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Introduction

About the EPC

The *Emerging Professional's Companion* (EPC) is an online resource for interns to gain IDP credit. The EPC can also be used by educators, ARE® candidates, young architects, firms, and AIA components to enhance or create new learning opportunities.

The EPC contains seventeen (17) chapters that align with IDP experience categories and areas. One EPC activity equals eight (8) hours of Supplemental Experience, designated as either “Supplemental Experience for Core hours” or “Supplemental Experience for Elective hours.” EPC activities are approved by NCARB as Supplemental Experience.

A History of the EPC

To support interns on the path to licensure, the AIA began publishing the *Supplementary Education Handbook: An Intern’s Companion to the Architect’s Handbook of Professional Practice* in 1977. Last published in 1992, the SuppEd Handbook provided a framework for comprehensive continuing education in professional practice issues through independent study. While the Supplementary Education Handbook was a useful and thorough publication, the need for a new resource became evident after the publication of the 13th edition of *The Architect’s Handbook of Professional Practice* in 2001.

Since 1992 changes in practice and internship called for the development of a new supplementary education handbook for interns. In 1996 the Carnegie Foundation released a report entitled *Building Community: A New Future for Architecture Education and Practice*, authored by Dr. Ernest Boyer and Lee Mitgang. This report incited a revolution in thinking about the path from architecture education to licensure. In response, the five collateral American architecture organizations—the American Institute of Architects (AIA), the American Institute of Architecture Students (AIAS), the Association of Collegiate Schools of Architecture (ACSA), the National Architectural Accrediting Board (NAAB), and the National Council of Architectural Registration Boards (NCARB)—organized an Internship Summit. Held in April 1999, this event brought together stakeholders to develop ideas that strengthen the bridge from academia to practice.

“Internships, before and after graduation, are the most essential link connecting students to the world of practice. Yet, by all accounts, internship is perhaps the most troubled phase of the continuing education of architects.

During this century, as architecture knowledge grew more complex, the apprenticeship system withered away and schools assumed much of the responsibility for preparing architects for practice. However, schools cannot do the whole job. It is widely acknowledged that certain kinds of technical and practical knowledge are best learned in the workplace itself, under the guidance of experienced professionals.”


Two committees, the Collateral Internship Task Force (CITF) and the Collateral Internship Management Group (CIMG), were created to study changes discussed at the 1999 gathering and to make recommendations to implement. In 2002 a second Internship Summit was hosted by ArchVoices at the University of Oklahoma to continue the conversation among interns and architecture professionals.
Beginning in the late 1990s, a number of studies and surveys on the architecture internship process yielded further information about the educational needs of today’s emerging professionals. In particular, findings from the 2003 Internship & Career Survey helped guide the development of a new resource that addresses a changing profession. A summary of the survey’s findings follows:

**Mentoring:** Nearly all respondents indicated an interest in mentoring, while only half indicated satisfaction with the mentoring they were currently receiving. Of the respondents, 39 percent said they would be most interested in a program coordinated by their local AIA component, while 34 percent would be most interested in one coordinated by their employers.

**Career/Work Experience:** The survey revealed a significant trend in which students acquire work experience while still in school. Between the 1999 AIA Survey on Internship and the 2003 survey, this statistic jumped from 19 percent to 42 percent of respondents. Nearly a quarter of non-registered respondents do not plan on pursuing a traditional architecture career, but most still plan on registration. Currently, 18 percent of those surveyed indicated they were employed in a non-traditional position.

**IDP:** For 59 percent of interns with professional degrees, the average time it took to complete NCARB’s IDP was longer than four years (the program is designed to take only three years). Half the interns who completed IDP indicated they were not able to fulfill all 16 IDP training areas at one firm. However, when this same half were asked why they left their previous jobs, only 11 percent indicated it was to complete their IDP requirements.

**Professional Service:** Both current members and non-members ranked networking (21%), access to resources (20%), career enrichment (15%), and continuing education (14%) as the most important AIA membership benefits for Associates and Young Architects.

A market research study was conducted to determine the strengths and weaknesses of the 1992 SuppEd Handbook, as well as to identify the training needs and delivery method desired by current interns. A number of issues emerged from this study that influenced the EPC’s format. User accessibility was important, which led to investigation of online delivery for the EPC. A web-based format allows portability for the user, and it also makes EPC updates easier as new trends in the profession take shape. A team of diverse and renowned authors, each an expert in a specific training area, was hired to write the EPC chapters. These individuals used the NCARB core competencies as a basis for their work, writing narrative sections for context and activities and scenarios to give interns a chance to apply their knowledge.

In 2010, NCARB sponsored a linking study to determine the extent to which the IDP core competencies were adequately covered by the various activities and exercises in the updated version of the EPC. The EPC Linking Task Force convened by NCARB completed the study and developed recommendations regarding the awarding of IDP Training Units (TU).

With NCARB’s transition to IDP 2.0, the EPC underwent an update. In 2012, all exercises and activities have transitioned to the “activity” title, designated as either “Supplemental Experience for Core hours” or “Supplemental Experience for Elective hours.” Each activity is worth eight (8) hours of IDP credit. The EPC’s refreshed, interactive PDF format builds upon the strengths of existing content, along with updated resources. AIA and NCARB will continue to improve the EPC for the future.
IDP Roles


Interns

Architecture students can also be interns. Take charge of your professional development. Review IDP eligibility criteria and establish a NCARB record when you intend to start tracking experience hours. IDP offers the flexibility to complete experience hours at your pace, in any order. Interns are encouraged to establish an NCARB record early and log experience hours frequently. Students can seek internships outside of the academic year or as part of their education requirement.

Use the Emerging Professional’s Companion to gain credit that may be difficult to obtain in one office environment. Interns are encouraged to report progress regularly to their IDP supervisors or mentors and identify specific areas where they need credit. EPC activities provide interns with the opportunity to augment their portfolio, demonstrating knowledge and competencies to advance their career. Be proactive; identify your potential supervisors, speak with local IDP Coordinators and find a mentor. While completing the IDP, interns may have multiple supervisors, and as many mentors as needed. Find more intern resources via the NCARB Experience Through Internships webpage.

ARE® Candidates

Interns can be ARE® Candidates. Following completion of the NCARB education requirement, the Architect Registration Examination® (ARE®) can be completed concurrently with IDP in most states. This allows interns the opportunity to shorten the time to complete their licensing requirements. The Emerging Professional’s Companion can be used to compliment an ARE® candidate’s study materials, or provide a discussion framework for group study.

Educators

EPC activities can be integrated into existing curriculum or introduced independently to underscore particular topics. Educators can present practice-based problems found in firms in the classroom. Educators can use the EPC while leading a studio course, in a professional practice lecture, or AIA Continuing Education session. However, for an intern to earn EPC activity hours, work must be completed outside the NCARB education requirement. Depending on circumstances, educators may be eligible to act as IDP supervisors, mentors, or coordinators.

IDP Supervisors & Mentors

IDP Supervisors oversee interns on a daily basis and regularly assess the quality of work performed. In most jurisdictions, for IDP experience settings A and O, supervisors must be licensed in a U.S. or Canadian jurisdiction, but not necessarily in the jurisdiction where the intern is located. In some experience settings, IDP supervisors can be professionals from other disciplines.

Supervisors meet with interns regularly to assess progress and approve the intern’s documentation of experience hours. At the same time, the supervisor can review any EPC completed work and provide feedback on final work product. The supervisor is not responsible for IDP record-keeping; documentation is the intern’s responsibility. However, the supervisor must digitally certify that activities submitted by the intern have been completed. To complete EPC activities, interns may request access to project documents and stakeholder contacts outside their project team or studio.

Mentors advise interns, discussing problems and aspirations. Ideally, the intern will select a mentor whom s/he knows well—perhaps a professor, seasoned colleague or former employer—who shares a professional
philosophy. Interns may reach out to mentors in person, by telephone or email. Interns meet with their mentors periodically to discuss IDP progress and career goals. During that time, the mentor can also review EPC activity work completed by the intern, and provide guidance on the final work product. The mentor, like a supervisor, can digitally certify that activities submitted to NCARB by the intern are completed. For this purpose, the mentor must be a licensed architect. Architects who serve as mentors do not have to be licensed in the state where the intern is located. To complete EPC activities, interns may ask for a mentor’s permission to attend project meetings, access to project documents, or consultant contacts. A mentor can help an intern gain IDP credit, even for just a day.

Firms
Whether your firm is starting in-house education, or supplementing an existing program, the EPC is a valuable resource for content. The EPC provides a means to help interns earn difficult-to-obtain IDP hours (consult your firm’s interns and supervisors). Parallel workshops and study groups are an excellent way to bring together those emerging professionals completing EPC activities. Experts from your firm can lead the sessions, or contact your local AIA component for experts who may be able to help develop a program. Don’t forget that related workshops can be offered as continuing education credit to architects if your firm is an AIA/CES Continuing Education provider.

IDP Coordinators: Educator, State, Auxiliary
NCARB administers the IDP Coordinator Program. For more information visit http://ncarb.org/en/Experience-Through-Internships/IDP-Coordinators.aspx.

**IDP Educator Coordinators** act as a liaison between schools of architecture, NCARB and AIA. The IDP Educator Coordinator must be familiar with how to use the EPC in the classroom and be willing to support colleagues within their school. The IDP Educator Coordinator is the contact for students seeking information about the IDP. NCARB provides up-to-date, credible presentations and resources to coordinators. The IDP Educator Coordinator position description and roster are available on the NCARB IDP Coordinators webpage.

**IDP State Coordinators** are appointed by the AIA and are the state-level contact for firms and interns. The State Coordinator must know how to include EPC in developing workshop series, study groups, and in-house firm education programs. The IDP State Coordinator is also the general contact for individual interns who may be seeking IDP information. The IDP State Coordinator position description and roster are available on the NCARB IDP Coordinators webpage.

**IDP Auxiliary Coordinators** are self-appointed individuals who volunteer to educate their firms and communities about IDP. To help those responsible for the administration of firm education programs, EPC narratives and activities can be used as program content. Any firm employee that supports interns can sign up as an IDP Auxiliary Coordinator by emailing idpcoordinators@ncarb.org. The IDP Auxiliary Coordinator position description is available on the NCARB IDP Coordinators webpage.

AIA Components
AIA Components play a significant role supporting firms with continuing education such as discussion/study groups, mentoring programs, and workshops addressing current practice issues. The *Emerging Professional’s Companion* narratives and activities can be used as content for continuing education programs. AIA Components can connect interns, supervisors, mentors, coordinators and act as a conduit supplying information and resources on the licensure process. Locate an AIA component near you.
How to Use the EPC

The *Emerging Professional's Companion* was developed in conjunction with *The Architecture Student’s Handbook of Professional Practice* and *The Architect’s Handbook of Professional Practice*. Each EPC chapter is aligned with IDP 2.0 experience areas. Work is self-guided by the intern, with support from IDP supervisors, mentors and IDP Coordinators. Interns do not have to be employed to complete EPC activities, but must have an IDP supervisor or mentor to approve completed activities through My NCARB Record.

Interns are encouraged discuss EPC chapters with peers and experts in related disciplines. Peer review and collaboration is encouraged, particularly between recent graduates and seasoned interns. However interns must maintain unique, individual documentation of their activities.

The new interactive PDF format allows users to quickly move between different chapters and resources. Chapter covers contain hyperlinks to each introduction, narrative, and all activities and exhibits. Titles on each page are hyperlinked to the chapter cover page. Most hyperlinks are visible by an underline style and may navigate to an outside website or to a page or location within the document. Bookmarks are also available within Adobe Acrobat. Use the “Ctrl+f” or “Command+f” function to search within the PDF document.

Introduction & Narrative
The introduction and narrative are the required reading to support the activities. The introduction highlights the IDP experience categories and areas and also the knowledge and skills expected to be gained in IDP. Many narratives were developed utilizing existing architecture resources, such as *The Architect’s Handbook of Professional Practice*. Within the narrative, the “Resources” column contains additional, credible reference materials to help you better understand the concepts presented.

Activities
The activities in each chapter are designated as either “Supplemental Experience for Core hours” or “Supplemental Experience for Elective hours” and will gain an intern eight IDP hours each. Activities present practice-based scenarios and instruct the intern to research, analyze, report, draft and document findings. Some activities may instruct the intern to reference additional resources to complete the activity. When an organization or authority having jurisdiction has updated or replaced any required reference materials (i.e. codes, standards, contract documents, etc.) the intern may substitute the current/superseding reference materials to complete the activity.

Exhibits
In each chapter, the exhibits section includes key diagrams, graphs, or reference materials to support the narrative or activities. Not every chapter contains exhibits.

Documenting Work
EPC activities may require the intern to create deliverables such as reports, diagrams, graphs, spreadsheets, and memorandums. Templates for these documentation methods may be found online from various credible organizations. In documenting your work, keep the presentation professional. Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF. Well-presented EPC activities can be used as part of your portfolio. Keep a digital PDF copy of all completed activities for a minimum of three years. While NCARB does not require you to submit PDF documentation of completed activities to receive credit, on occasion, they may audit your record and request a copy of work.
Use the EPC to satisfy a portion of your IDP hour requirements. Earn up to 1,624 IDP hours through the EPC. Each activity is worth eight hours. By completing EPC activities, you can earn up to 40 core hours in each experience area.

Please note: Interns can earn a maximum of 600 core minimum hours through EPC with no more than 40 core hours earned in any one IDP experience area. If an intern has already completed the maximum allowable 40 core minimum hours in a given experience area through any combination of supplemental experience, then EPC activities completed in that area will be credited as elective hours.

Step by Step

1. Complete an EPC core or elective activity and note the Chapter and Title.
2. Review your work with your IDP Supervisor or Mentor.
3. Log in to “My NCARB” at www.ncarb.org, then click “Go” to launch your NCARB Record.
4. Select the “IDP” tab in your NCARB Record.
5. Click the + NEW EXPERIENCE REPORT button.
7. Select “Emerging Professional’s Companion (EPC)” from the drop down menu and click ADD.
8. Provide your AIA member number (or temporary AIA number*) and identify a mentor/supervisor, then click CONTINUE.
9. In the drop-down menus next to “Add a Course:” select the Chapter and the Title for the activity you have completed.
10. Provide the date of completion and click ADD.
11. Verify that your activity and corresponding hours appear in the “Courses” tab.
12. Click SUBMIT FOR APPROVAL at the top of the window.

Your IDP Supervisor or Mentor will receive an email prompting him/her to certify your hours of EPC completion. Please remember to keep digital documentation (PDF) of completed core activities for three years following completion, should NCARB audit your file.

*The AIA provides interns in IDP a free temporary AIA number and AIA Transcript to track supplemental experience for IDP credit. Supplemental experience can also be gained through AIA Continuing Education courses. Request a free temporary AIA number at www.aia.org/FreeTranscriptsforInterns.
Mentoring Tools

Mentoring
Men-tor n. 1. A wise, loyal advisor. 2. A teacher or coach.

The AIA Code of Ethics and Professional Conduct encourages members to “nurture their fellow professionals as they progress through stages of their career, beginning with professional education in the academy, progressing through internship, and continuing throughout their career.” Mentors play a critical role in NCARB’s Intern Development Program (IDP), helping to review intern’s work. Additionally, architect mentors can certify completed EPC activities through “My NCARB Record.”

Mentoring is perhaps the best method of transferring knowledge gained through experience. Young architects make great mentors to interns, college students, and even high school or elementary school students. Being a mentor helps young architects hone their leadership skills. Young architects also want mentors to help them transition into leadership roles in firms and their communities.

Mentoring Resources

• www.aia.org/mentorship

• Mentoring Essentials for IDP Supervisors and Mentors (PDF)

• YAF Mentor Guidelines: A resource from the AIA Young Architects Forum

• AIA Components for local events and information

• EPC Resource Center from AIA.org

• AIA/NCARB Internship and Career Survey
The *Emerging Professional’s Companion* is result of the hard work of many people. Below are the primary groups and individuals who made this project a success. The AIA and NCARB wish to express gratitude for their contributions and commitment to emerging professionals.

### Authors & Editors

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<td>Andy Pressman</td>
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<td>16. Professional and Community Service</td>
<td>Gary Demele, AIA, NCARB</td>
<td>Gary E. Demele, AIA, NCARB and Maureen Steele Bellows, RA</td>
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Design and layout of 2012 interactive PDF format: Ashley Respecki, Assoc. AIA, & Kevin A. Fitzgerald, AIA.
Introduction

Reviewers and Content Experts

- Michael Alford, Assoc. AIA
- Larry Asaro, AIA
- F. Michael Ayles, AIA
- Scott Busby, AIA
- Marjorie Callahan
- John Cary, Assoc. AIA
- Kyle Davy
- Raymond Dehn, Assoc. AIA
- Steve Dent
- Duo Dickensen
- Betsey Dougherty, FAIA
- Bill DuBois
- Blake Elderkin, AIA
- Brenda Lee Emerick
- Kevin Fitzgerald, AIA
- Steve Fiskum
- Stephanie Garner, AIA
- Paul Guggenberger
- David Halivand
- Denis A. Henmi, AIA
- Jerry W. Herndon
- David Hinson, AIA
- Jay Isenberg
- Eric Jenkins
- Nancy Jenner
- Peter H. Jennings, AIA
- Karol Kaiser
- G. Daniel Knight, Jr., AIA
- Shannon Kraus, AIA
- Lexa Coury Lewis
- Rosemary McGonigal
- William Miller, FAIA
- Ed Mojica, AIA
- Erin Murphy, AIA
- Kurt Neubeck
- Wendy Ornelas, FAIA
- Chad Polk, AIA
- Kate Randolph, IIDA
- Chuck Redmon, FAIA
- Ashley Respecki, Assoc. AIA
- Brian Roeder, AIA
- Nick Serfass, AIA
- Scott Simpson, FAIA
- Holli Smith, Assoc. AIA
- Adrianne Steichen, Assoc AIA
- Alan Stover
- Brett Taylor, AIA
- Karol Williams
- Dan Wheeler
- Tim White
- Douglas Whiteaker, Assoc. AIA
- Jessica Zlotogura, AIA
Emerging Professional’s Companion Advisory Committee (2004)

- Laura Lee, FAIA
- John McRae, FAIA
- Jason Pettigrew, Assoc., AIA
- Andy Pressman, FAIA
- Rob Rosenfeld, Assoc., AIA
- Kenneth Schwartz, FAIA
- RK Stewart, FAIA
- Jean Valence, FSMPS
- Suzanna Wight, AIA

The EPC is dedicated to Jason Pettigrew, Assoc. AIA (1974-2004). He engaged the Emerging Professional’s Companion Advisory Committee with a passion for the intern’s journey. Jason’s legacy continues to be an inspiration, reminding us that we stand on the shoulders of giants.
# Programming

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*A maximum of 40 hours of core credit may be earned in this experience area.*

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Introduction

By completing the activities in this chapter, you will gain an understanding of the principles involved in programming. The following information is taken from the NCARB IDP Guidelines:

Programming
Minimum Programming Experience: 80 hours
Definition: The process of discovering the owner/client’s requirement and desires for a project and setting them down in written, numerical, and graphic form.

Tasks
At the completion of your internship, you should be able to:
- Assess the client’s needs, opportunities, and constraints
- Develop and/or review a program with the client
- Develop a vision and goals for the project
- Develop or review client’s design standards and guidelines
- Establish sustainability goals for the project
- Define the scope of the pre-design services

Knowledge Of/Skill In
- Architectural programming including working with clients to define their needs
- Facilities planning (e.g., building use; building conditions; systems conditions; infrastructure; space allocation)
- Space planning
- Sustainable design
- Contract negotiation (e.g., fees, scope, schedules)
- Oral and written communications
- Critical thinking (e.g., analysis, synthesis, and evaluation of information)
- Interpersonal skills (e.g., listening, diplomacy, responsiveness)
- Team building, leadership, participation
- Creativity and vision

resources

Download the current Intern Development Program (IDP) guidelines at www.ncarb.org/Experience-Through-Internships.aspx.

- Chapter 6.2 - Communicating with Clients
- Chapter 6.3 - Building Client Relationships
- Chapter 12.1 - Programming

- Chapter 1.2 - Understanding Client Values
- Chapter 2.3 - Managing Change in Client Facilities
- Chapter 5.1 - Meeting Client Needs
- Chapter 17.1 - Programming

- Chapter 6.1 - Defining Project Services
- Chapter 6.3 - Programming
Narrative

The programmer serves as a translator between the owner(s) and users, who generally are lay people regarding architecture, and the architects who will design a project. Put another way, the programmer separates the signal from the noise, culling crucial data from all the information available about a project. In particular, the programmer helps owners, users, and designers define the scope of work to be solved by the design effort.

How Does Programming Fit Into The Design Delivery Process?
Programming takes place before any design work begins. The level of detail included in the program should be suited to the designer’s task.

For example, programming for a master site plan project should address issues such as the overall image of the facility, its orientation, the gross square footage of built space, the impact of topography and the surrounding context, circulation patterns, parking, utility service to the site, the relationship of one building to another, and expected changes through time.

The program should address issues specific to the building and the site, such as the its scale, image, and functions; the climate; the interrelationship of interior spaces; the flow of goods and services through the building; and the affordability of the project.

For the space planning, interior design, or design development level of a building project, the program provides criteria for interior layouts, selection of furnishings, special lighting and power supply, detailed storage needs, and other issues at that level of detail.

Why Do Architectural Programming?
When executed well, the programming process makes it possible for the architect to focus the design effort on optimizing the form and plan of the project. Redesigning a project over and over as the requirements emerge, called “programming by design,” is very inefficient and takes away time that could be spent making a design more technically effective, functional, and beautiful. (Vitruvius’s definition of architecture: firmness, commodity, and delight.)

The programming phase is the best time to receive input from a wide variety of project stakeholders. Everyone who will be affected by the design should be given an opportunity to participate in programming. To ensure all relevant data is collected, the programmer has to be diligent in arranging for early input.

“If our artistic rhythms—a result—are to be significant, our prior meditations—the cause—must be so.”
—Louis H. Sullivan
Who Should Develop The Architectural Program?

Who the project stakeholders are depends on the type of project. For a small project in which the client is a sole proprietor, the client and the architect may be the only members of the programming team. For public sector projects, such as schools or libraries, a building committee can be set up involving a major decision-maker representing the client (the superintendent of schools, a school principal, or head librarian) and representatives of major groups affected by the project (teachers, parents, students for a school or staff, library patrons, and neighbors of a library). For a corporate client, representatives of each major department may contribute to the programming process.

Often the client is in the best position to recommend a list of participants/stakeholders. The programmer should request the participation of those who will be affected by the design. The more you learn from others who are affected by the design, the better the design will be able to serve those who use it.

It should be made clear at the beginning of the work if the programming committee has authority to approve the program or only to recommend approval to a higher authority. It is also important for the committee members to know how they will make their decisions. Will it be by consensus or majority vote, or will the boss dictate the end result?

How Is A Program Developed?

The programming process can be organized in many ways but, regardless of the format, several general topics must be addressed in order to achieve a comprehensive (qualitative and quantitative) program. There are six steps associated with the programming process:

1. **Research the project type.**
   What is the social, cultural, historical, and economic context of the facility type and the specific project?

2. **Identify project goals.**
   What do the clients (owners, users, general public) want the project to accomplish? What are the project goals?

3. **Gather and analyze information.**
   What information is needed to accomplish these goals?

4. **Diagram processes and relationships.**
   How will the goals be accomplished, given the information gathered in Step 3?

5. **Establish quantitative requirements.**
   What are the quantitative requirements; square footages, budget, schedule?

6. **Synthesize the program.**
   What does all of the above mean in terms of the designer’s task? How is the architectural program synthesized?

Each of these steps is described briefly in the following section on the programming process. The activities included in this chapter address the steps as well.

resources

Download the current Architect Registration Examination (ARE) guidelines at www.ncarb.org/ARE.aspx.

Steps in the Programming Process
No definitive process has been agreed upon by architects and others involved in programming for architectural projects. However, each programming effort will cover the steps outlined here:

**Step 1: Research the project type.**
Every project type has a characteristic history, vocabulary, and set of spatial relationships. The programmer has to be familiar with these aspects of the project type and be able to communicate them to the owners, users, and design architects. Sources of information include architectural literature, information produced by associations related to the functions of the project type, case studies, and post occupancy evaluations. For example, when developing a program for a fire station, you could search for articles online on that building type, study plans of fire stations to see what space types are included and how they are related, review literature from an association of firefighters, and visit local fire stations.

**Step 2: Identify project goals.**
Working with the project committee, establish the major goals of the project—the big ideas. Do not get involved at this point with details that can be addressed later.

**Step 3: Gather and analyze information.**
Using the project goals as a guide, gather information on activities, schedules, numbers of people, site characteristics, climate, zoning, space criteria, code information, and user profiles. Look for information relevant to the project type such as broad code issues that will affect the design task and the space requirements for each function (e.g., 25 square feet/student is a common space criteria for sizing classrooms).

**Step 4: Diagram processes and relationships.**
Given the information available, how can design strategies be created to reach the project goals? Take the information developed in Step 3 and place it in diagrammatic form to depict the processes and relationships the finished project must accommodate. Although not solutions themselves, these diagrams help to conceptualize design solutions and are abstract enough to be addressed by any number of physical solutions.
Flowcharts and relationship diagrams (often called bubble diagrams) are two of the ways you can illustrate information about the client’s needs for a project. For example, on page 5 is a sample flowchart for materials housed in a state records center. The idea of a flowchart is to show how goods, services, visitors, staff, information, and other important components of an organization will operate in a new facility. A sample relationship diagram for a university library is shown below. This type of diagram is a step toward laying out the spaces in a facility design.

**Step 5: Establish quantitative requirements.**
This step determines how big a facility will be, what it will cost, and when it will be completed.

The size of a facility is determined by using the space criteria developed in Step 3 to allocate space for all the activities identified in that step. Space requirements for the identified activities are called the net assignable square footage (NASF), net because this space is not the total amount required for the project and assignable because the area is assigned to an activity. The total area of the building is called the gross square footage (GSF). The difference between the GSF and the NASF is the space used for common areas such as corridors, public rest rooms, and open but covered space, as well as general support areas, which includes mechanical and electrical equipment space, custodial closets,
and wall thicknesses. The GSF is determined by assuming that the NASF is a percentage of the GSF. The percentage is determined by experience. For example, in a middle school classroom building, the NASF is expected to range between 64 and 68 percent of the GSF. See Exhibit 1A-1, 1A-2, and 1A-3 for sample space allocations.

Establishing the project budget is often a balancing act between the budget goals and the needs and desires of the client. The diagram on page 6 indicates that quantity and quality are in inverse proportion to each other. For a specific budget goal, a client can have a small amount of high-quality space, a large amount of low-quality space, or something in between. The program must find a balance acceptable to the client, which often requires several sessions with the project committee.

The importance of completing this part of the programming exercise cannot be overstated. The objective of the programming work is to define a meaningful scope of work for the design. If the size of the project and the budget are not reconciled, the scope of work will not be realistic. To proceed with design without a realistic scope of work is to invite serious problems later in the project.

Time, as reflected in the project schedule and completion date, also affects project cost. Therefore, cost estimates are adjusted to allow for inflation. Specifically, they frequently are inflated to the midpoint of construction because contractors allow for inflation during construction in their bids. If a project is delayed, the original budget may have to be increased or the project size decreased.

**Step 6: Synthesize the program.**
In the end, the program must summarize the information and identify the major issues revealed by the programming effort. This step is the most difficult and is best conducted with the designer’s input. (Note: Sometimes the programmer and the designer are the same person, and sometimes not.) The questions to be addressed include these: What are the major design issues? What are the major challenges to achieving the project goals? The purpose of the completed program is to focus the design effort and make it as effective as possible. This step also serves to educate the client about the major issues.

**Step 7: Document the program.**
When documenting an architectural program, value brevity over inclusiveness. The focus of the program document should be the definition of the scope of the work in qualitative and quantitative respects. If it is a program for schematic design of a building, the program should relate the criteria for the schematic design. It does not need to have information on location of electrical outlets and other details that can be resolved in design development. Details that have been discussed should be noted elsewhere, and the notes addressed in later project phases.

notes

Take brief notes while reading the narrative and list key resources you used to complete the activities. Note discussion outcomes from meetings with your supervisor, mentor, or consultants. When finalizing the activity documentation (PDF), include your notes and the Emerging Professional’s Companion activity description.
Skills and Tools For Architectural Programming

An architectural programmer needs good research skills. The programmer must answer questions such as: What information do we need? Where is that information? How much information is enough? What do we do if the information we have (e.g., projections) is unreliable?

Until about two decades ago, finding information could be a major problem. Today, with the Internet as a major research tool, information is easy to find. In fact, information overload can be a problem. In addition, since credentials are not required to place information on the Internet, the individual sifting through the quantities of available data must assess its reliability.

“The mere gathering of data should not be considered a substitute for thinking, any more than the gathering of seeds or fruit can be a substitute for nourishment.”
—Anonymous

Sometimes the client is the best source for project data. Even if such client information is flawed, it is the “book” they use, value, and work with, and it will help you see the world through the client’s eyes. However, you are obligated to inform clients about alternatives, as well. Architects always have the dual obligation of learning from and informing the client.

Interviewing

A programmer is like a cultural anthropologist trying to find out what makes a subculture (your clients) tick. A client organization has a governing system, a value system, an economic system, and folklore. Familiarizing yourself with this subculture will help your programming effort. To be a good interviewer, you need to:

• Plan your questions ahead of time and give the client a copy of them before the interview if possible.
• Be prepared to put your questions on the bottom of the pile while the clients tell you what they want you to know. Then get your list out and have your turn.
• Find a good way to document what you are told. You need to feed this information back to the client and your colleagues in the office.
• Be diplomatic if someone gives you information you do not need. Often, such information provides useful insights.
• Be an active listener.

“To listen is to surrender self-thoughts, impinging awareness, and judgments; to listen is to admit a stance, a vantage, a world other than our own.”
—Sven Birkerts

Documentation Skills

The programmer will want to document interviews used to gather information, as well as decisions made during the programming process. The programmer also must be able to compile the program for the owner’s approval and for the use of the design architects. Whenever possible, diagrams and room layouts should be sketched to assist the design architect.

resources

William Peña is often referred to as the “father of architectural programming.”


The Building Owners and Managers Association International (BOMA) has set standards for measuring buildings, including: office buildings, multi-unit residential, retail, and other building typologies. Learn more about these standards at www.boma.org/MeasurementStandards.
Analytical Skills
Before bringing a new person onto his programming team, William Peña would ask them, “Are you numerical?” To be a good programmer, you have to like people first and diagrams and numbers next. Today’s computer spreadsheet programs, like Excel, make managing the numbers much easier, making it possible to try more scenarios. In attempting to reconcile an owner’s space desires and budget, a programmer can test area (gross square footage) against quality (cost/square foot) at various levels. Most importantly, a programmer must be able to think clearly. This can be difficult, as we each have a personal thinking style that may not be shared by the rest of the world. We have to be analysts some of the time; idealists some of the time; synthesizers some of the time; and pragmatists some of the time. We have to be versatile thinkers, calling on the appropriate thinking style at the proper time.

A programmer also has to think critically, examining ideas as objectively as possible. This is helped by asking questions such as these: Where does this idea fit into the larger scheme of things? How does the value system of the person who suggested this idea affect its meaning? Why did that person say what he said? Why do I keep holding on to this idea when it seems to be weakly supported? How can we reconcile ideas that on the surface seem to be competing?

Finally, the architectural programmer should enjoy synthesizing, or bringing together, ideas. The programmer brings the client, user, and the designer together to agree on a scope of work, and in the process must synthesize ideas as diverse as a climate analysis and a strategy for achieving an image the client has in mind. The programmer provides a service that helps make the design effort more effective and focused, so that creativity has a chance to flourish in the design.

Written by Edith Cherry, FAIA
Edith Cherry is a partner in Cherry/See Architects in Albuquerque, New Mexico. She is professor emerita of architecture at the University of New Mexico, where she taught design and programming for 28 years. She is the author of Programming for Design, from Theory to Practice.
Many people go out to dinner to celebrate a special occasion. Typically the restaurant is chosen based on the type of celebration. Most restaurants have a similar basic program, but it is the additional services and function spaces provided that make them unique and more enjoyable for certain events.

Activity - Core

Compare the following programs: a pizza facility to host a child’s birthday party, a restaurant you would take your sweetheart to on Valentine’s Day, and a place suitable for a happy hour with coworkers.

Write a report describing what makes each of these places appropriate to celebrate the respective event. Assume that each place is located in the same town, and they have the same 3,000 square foot layout. Each restaurant has a dining room that is 60% of the total area and the kitchen, storage, and other areas make up the remaining 40%.

In your report, answer the following:
- How many square feet per person is necessary for the type of restaurant?
- What additions would be needed to make each space unique to its purpose?
- How are server and guests considered in the layout?

Produce plan seating and service diagrams to accompany the written report to explain your solutions.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
You are programming a community center for a city with a population of 500,000 that has fifteen other community centers. The activities vary from center to center. You analyzed the square footage for three recently built or expanded centers. Additionally, a budget review has shown that the construction cost allows for a total gross area of 20,000 square feet.

Data on the other community centers are provided in Exhibits 1A-1, 1A-2, and 1A-3.

**Activity - Core**

For the community center you are programming, develop a draft list of spaces and sizes, totaling 20,000 gross square feet (GSF). From the information shown in the exhibits, decide on an area multiplier to convert total net assignable square feet (NASF) to total gross square feet.

Write a report describing why you made space allocations and program decisions that are on your list. If a 5,000 GSF addition was part of phase two, what programmatic functions would be housed in that space?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Interviewing clients before the design process starts is an essential part of the programming process. Usually this is best accomplished one-on-one, without asking a client to fill out a questionnaire. However, when buildings include a large variety of users/occupants, a survey is an acceptable tool. Similarly, interviewing the building users after the project is completed and they have occupied it for several months is also important.

**Activity - Core**

Select two projects of similar building types completed by your firm or your mentor’s firm less than two years ago. Create a questionnaire for the occupants to complete. Write a summary of feedback you expect to receive from the occupants. Compare your summary to the post occupancy evaluations, if available.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
A post occupancy evaluation (POE) is used to determine user’s level of satisfaction with a building’s design and function after at least a year of occupancy. The purpose of this activity is to consider how building functions change over time. This information can be useful in determining the degree of flexibility that should be designed into a project.

Activity - Core

Select a project designed by your office or a mentor’s office that has been occupied for 5 to 7 years. If a documented program exists, review it. Review the construction documents to familiarize yourself with changes that may have occurred between the programming and construction documentation.

Make arrangements to visit the building and interview at least three people who have used the building for two years or more.

If the organization has a facility manager, be sure to interview him or her. Ask what changes have been requested and executed. Are there new needs for the current staff?

Write a report (with appropriate graphs or diagrams) on what design elements have proven successful and what aspects resulted in requested or executed change. Try to determine what caused changes. Did the user’s intentions change? Did the user’s operations require adjustments to the building? Did the designers miss something in the program? Did the programmer miss something? Was the budget sufficient to accomplish the original intentions? What new programmatic requirements are needed with the current staff?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
New Facility - Community Center

Supplemental Experience for eight (8) Core IDP Hours

In this scenario, you are programming a new community center that will replace an older building. In initial conversations with the director of community services, you learn that you are the second firm taking on this task. Apparently the pro-fitness staff thinks the questionnaire was “selectively distributed” because they did not agree with the results.

Through further discussion you discover factions within the community center staff. One faction supports the use of the center for weight training—a free gym of sorts. Another faction feels the clientele of a “free gym” would not be a good influence on adolescents. This group prefers fitness training, aerobics, and spinning bicycle classes. How could the architect reconcile the debate?

Activity - Core

Research community centers and write a report (maximum 250 words) that outlines your programmatic recommendations, and include a programming bubble diagram. In addition, prepare a questionnaire that is relevant to multiple users, to be distributed to all members.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Development of an Architectural Program
Supplemental Experience for eight (8) Core IDP Hours

Select a project designed by your firm or a mentor’s firm that has recently been occupied. If the project program was documented prior to design (as is recommended by all programmers), do not refer to that document until after completion of this exercise. Visit the facility and examine the plans and other drawings. Review the information in the programming narrative, the programming activities, and the references referred to in those sources.

Activity - Core

Reconstruct components of the architectural program as follows:

- Develop a set of goals that the completed project addressed.
- Develop a relationship diagram for the project.
- Calculate the square footage from the floor plan, and determine the efficiency ratio of the plan.
- Interview the project designer and determine the major design issues that were resolved. Relate these issues to the other program information. Determine what the role of the client played in the development of the program and the formulation of the design.
- If there was a documented program, compare the information you develop to the documented program prepared for the project. Explain the differences.
- Determine how programming is done in your office or your mentor’s office today. Is the process different from the process used on your “retroactive program”?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Assessment of Client Needs

Supplemental Experience for eight (8) Elective IDP Hours

In this scenario, a large corporation has hired your firm to design a new office building. You are the programmer for the project. The site is a lovely, located in a southwestern city in the U.S., where water is a precious resource. However, the city has not yet enacted any ordinances that limit water use.

The chief executive officer (CEO) has envisioned a sparkling white building on a green lawn. He is not from the Southwest and misses the greenery of other parts of the country. Some of the management directors are more sensitive to the water issues of the area.

Activity – Elective

On many issues, the programmer should act as a neutral party. Create a questionnaire that will pose unbiased questions to the entire management team assessing their functional needs, as well as meeting aesthetic desires. Include three office building precedents with differing strategies. Use diplomatic language.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Project Kick-Off Meeting
*Supplemental Experience for eight (8) Elective IDP Hours*

Initial client contact and interviews are key to a successful programming phase. Often you will find clients do not know what they want the first time around. A kick-off meeting is defined as the first meeting with the client and project team held in order to make introductions and discuss roles and responsibilities of stakeholders. Multiple meetings and conference calls may be necessary before programming can begin.

**Activity - Elective**

Ask to attend a project kick off meeting with your supervisor or IDP mentor for a new project. Be sure to take thoughtful notes, including who attended the meeting and why they are a project stakeholder. What materials or information was shared with the client? Write a report that summarizes your interpretation of client needs. Use any graphs or tables necessary to communicate your findings. Meet with your supervisor or mentor (or with whom you attended the meeting) and compare notes.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Impact of Code & Site Restrictions on Project Scope

Supplemental Experience for eight (8) Elective IDP Hours

Often project scope is affected by code and site restrictions. Codes may limit the number of floors and the size of the footprint of a building. Soil conditions may limit the building to one area of the lot because soil conditions are poor everywhere else or a portion of the site may be within a flood plain. Often these variables affect programmatic elements of a building.

Activity - Elective

Select a small recent project that was significantly impacted by code and site restrictions. Reference the applicable local building code of the project you have chosen. If the restrictions were lifted, or a variance approved, what programmatic changes would you recommend? Write a narrative describing the new building based on your new assessment. Include citations from the applicable codes or ordinances.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
New Facility - Children’s Museum
Supplemental Experience for eight (8) Elective IDP Hours

The Happy Valley Children’s Museum has been operating for more than eight years in “found space” at a local shopping center. The museum is very popular, with an active board of directors ready to raise funds for a permanent home.

In this scenario, your firm is asked to design a new facility for the Happy Valley Children’s Museum, with you as programmer. You asked the museum director for current literature and brochures on the museum, as well as the last eight years of annual reports. Exhibits 1A-4, 1A-5, and 1A-6 are excerpts from those materials.

Activity - Elective

Review the exhibits listed above and develop a draft set of goals for the project. It may help to have a list of organizational goals and a separate list of facility goals that implement them. The museum director recommends four considerations:

• Function (activities that require space)
• Form (aesthetics, psychological effect)
• Economy (attitude toward resources, amount of budget)
• Time (move-in date, expected changes over time)

Keep your list of goals concise. Take material that is a subset of a larger, more important goal out of this list, and move it to the part of the program that delineates strategies for accomplishing that goal. Make a list of questions you want to ask to address goals you think need to be added. For a real project, you would take this draft to the first building committee meeting to begin the discussion on goals.

A few days after you draft the goals, review them. Can you boil them down more? Are some of the ideas so closely related they could be combined? Or conversely, does one of the statements cover too many ideas? Make changes to your goals as necessary.

Once you have completed your goals, write a brief report (maximum 250 words) to the building committee. Be sure to explain the function, form, economy, and time.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
In this scenario, a popular motorcycle dealer has outgrown the tire store where he first began his business. Over the last ten years he has increased his revenue, number of customers, and expanded services. He has been very successful and wants a new building.

**Activity – Elective**

Determine the program for the project. Interviews have been held with the staff. As part of the programming, you will interpret the staff interviews (Exhibit 1A-7) and develop a flowchart showing how a motorcycle moves through the facility and a relationship (“bubble”) diagram for spaces needed in the new facility.

After making the diagrams, write a descriptive narrative (maximum 250 words). Do you have all the information needed for each diagram? What else would you ask the client?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
New Facility - Library
Supplemental Experience for eight (8) Elective IDP Hours

In this scenario, your community has decided to build a new library to replace the current outdated and inefficient facility. The community has decided to come to you for design assistance. As an architect that specializes in library design and a founder of a popular book club, you are flattered. The client has decided to give you freedom to develop the program as long as they agree with the direction of your ideas. But you realize that documenting client approval is important.

Activity - Elective

Research the program of a local public library and use this program as the older library you will replace. Through sketch quality bubble diagrams and a written narrative, communicate to the client your initial ideas for a new 50,000 gross square foot (GSF) library.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Law Office Addition to a 3,000 GSF Building
Supplemental Experience for eight (8) Elective IDP Hours

In this scenario, you are programming an addition to an existing 3,000 gross square foot (GSF) building. The existing building will be remodeled. An additional 2,000 gross square feet (GSF) will constitute the new quarters for an office of 20-25 lawyers. The original building was built in the late 1940’s and was used as optometrists’ offices. The long narrow shape of these offices will not be suitable for the lawyers, so the interior of the existing building will have to be gutted. You do all the interviews and attend all the user group meetings, and now you have to create a program for this building.

Activity - Elective

Prepare a report to the clients including a detailed scope of work, price per square foot (based on building requirements) and a list of design objectives that will be necessary to renovate the current building with the new client expectations. Interview a senior person in your firm or a mentor’s firm to find out what types of unforeseen conditions may arise during construction that may impact the program. Include a summary of findings in a client report, with any appropriate diagrams. Include what you believe to be the appropriate contingency for this project.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
A Dynamometer Room for a Motorcycle Dealership

Supplemental Experience for eight (8) Elective IDP Hours

In this scenario, Big Boss wants to add a dynamometer room to his dealership. He says that when new bikes with fuel injection get tuned, the mechanics need to run them to be sure everything is working right. They have been placing a laptop with the testing program on the handlebars and running the bikes down the interstate at 80 mph to test the tune up. Big Boss doesn’t think that is a good idea. His worker’s compensation insurance carrier agrees.

One of the chief mechanics, Jeff Smith, has run dynos in previous jobs and is the “main man” to operate the new addition. As you talk to Jeff about how this space should work, he tells you that the customers want to watch their bikes being tested. The dyno is usually sunk in the floor and the bike turns a big drum. The bike has to be running. The force on the drum and measurements on the bike controls indicate what is going on in the bike. He also points out that some of the bikes are air-cooled. “So, we have to have a big fan blowing on the bike while it’s running. Plus, we don’t want to be breathing all that exhaust.”

Activity - Elective

Research the applicable building code to see occupancy type for a dyno room. Big Boss has a total of 30 employees. Only the 12 mechanics will be authorized to use the dyno.

Write a report detailing the programmatic requirements for a dyno room. Include major elements of the design (with estimated square footages, adjacencies) that will have a large cost impact. List and explain the program requirements to protect the customers and those needed to protect the employees. Remember to include acoustical and exhaust requirements in your report. Synthesize the program issues succinctly.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
In this scenario, one lazy summer day, Johnny decides to climb a tall tree. Unfortunately he is not a good climber and quickly falls out of the tree, breaking his arm and leg. His mom was nearby and calls an ambulance which quickly arrives and takes him to the hospital. After running initial tests the doctor determines that Johnny needs routine surgery which requires a night in the hospital. The next day Johnny is released and returns home to recuperate.

Using the layout of a local hospital, create a diagram of Johnny’s patient experience in the hospital showing the medical services he receives from the time he enters until his departure the next day. Sequentially list all programmatic functions (with basic definitions, adjacencies and approximate square footages) that were required to make Johnny the patient better. Estimate how many hospital employees came into contact with the patient.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Addition to a University Science Facility

Supplemental Experience for eight (8) Elective IDP Hours

In this scenario, you are programming an addition to a science facility at Tankersly State University. The addition will house a new microbiology division in the biology department. The department uses two types of spaces: lecture/seminar rooms and labs. The enrollment data obtained from the university registrar is described in Exhibit 1A-8, column A. The university schedules courses in 39 time slots per week. Labs meet in four hour sessions. Lecture/seminars meet in 1-hour (MWF) or 1.5-hour (TTH) sessions.

University policy schedules labs at no more than 50% utilization and lecture/seminars at no more than 75% utilization. So, for example, the university is willing to have a lecture/seminar room be empty 25% of the time so the room can be used for meetings and other purposes. Labs are scheduled at 50% due to the difficulty of scheduling four-hour sessions and the required prep time between sessions.

Activity – Elective

Using the information provided above, determine how many of each type of teaching space (lecture/seminar and lab) is needed to accommodate the microbiology program at Tankersly. Place your results in the last three columns of Exhibit 1A-8. It may be difficult to achieve the desired percentage of utilization. If you propose one more classroom or lab, the utilization may fall below the desired percentage; propose one less, and the classroom or lab will be too heavily scheduled. Experiment with assuming one or more courses can be taught at different times in the same classroom or lab, but do not mix lecture/seminar and labs. These types of classes cannot be taught in the same rooms because equipment needs are very different. Can you come closer to the desired utilizations?

Write a report summarizing your findings. Include a copy of the Exhibit 1A-8 chart showing your recommended occupancy sequence. Include recommendations of support spaces needed in the addition. Provide diagrams when necessary to illustrate required adjacencies.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Partnering with a Contractor: Dealing with a Project Program that is Over Budget

Supplemental Experience for eight (8) Elective IDP Hours

In this scenario, your office wishes to pursue a design-build project with a contractor who is trusted by the partners in the office. The client, who knows both your firm and the contractor, is on board and wants to move on the project as soon as possible.

You all discuss the quality-versus-quantity issue and agree on a cost per square foot for the building. A contract is signed with all parties for a fixed construction price.

When programming begins, everyone understands that, if the budget remains unchanged, the agreed upon cost per square foot implies a limit on the gross square footage of the project. However, as programming progresses, the owner has a hard time agreeing to reductions in the response to his needs that are needed to stay within the budget. “Scope creep” is at work. A little more space is added here; a little more there. You keep adjusting your spreadsheet, illustrating that the bottom line is going up and up. The contractor thinks he can be very efficient.

Finally, everyone agrees that the project program is way over budget. The project has been delayed while these efforts were being made. Soon, the schedule will be the governing factor, since the owner’s lease for the existing location ends on a fixed date. All parties are getting nervous and defensive.

Activity - Elective

Write a narrative detailing how to prevent this situation as the programmer. Could there have been an agreement made in the beginning to establish the rules for programming? Explain and include any limitations and criteria that could have been set. Detail actions to take and the feasibility of this project. Create a questionnaire with that clearly addresses the conclusions in your narrative and that can be used to prevent this from happening in the future.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Project Where There is an Active Neighborhood Association (Historic District)

Supplemental Experience for eight (8) Elective IDP Hours

In this scenario, your client is a developer building an infill project in a historic district on two undeveloped lots. In order to develop a profitable project on the expensive lots, the developer is proposing multifamily housing that is denser than the surrounding neighborhood. The zoning on the site allows for development at the density the developer desires.

From experience, you are aware the historic district has an active neighborhood association. You propose to your client that you meet with the neighborhood association to discuss the project and listen to their concerns.

Activity - Elective

Prepare a questionnaire to distribute at the next neighborhood association meeting to allow you to establish the scope, design objectives and limitations of the public's needs for the proposed project. Knowing this project will most likely produce opposing points of view, describe in a narrative a programming technique to use with the developer and neighborhood association together so they feel they have participated in the design. Review and cite a local historic district code in your questionnaire, and if needed, include appropriate diagrams or graphics.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
### Exhibit 1A-1: Downtown Community Center (December 1999)

<table>
<thead>
<tr>
<th></th>
<th>Assignable Space</th>
<th>Area (sq.ft)</th>
<th>% GSF</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Downtown Community Center</td>
<td>19,312</td>
<td>61%</td>
</tr>
<tr>
<td>2</td>
<td>Non-Assignable Space</td>
<td>12,463</td>
<td>39%</td>
</tr>
<tr>
<td>3</td>
<td>Gross Square Footage (GSF)</td>
<td>31,772</td>
<td></td>
</tr>
</tbody>
</table>

**Assignable Space**

<table>
<thead>
<tr>
<th></th>
<th>Area (sq.ft)</th>
<th>% GSF</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Vestibule #5008</td>
<td>150</td>
</tr>
<tr>
<td>5</td>
<td>Vestibule #6008</td>
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<tr>
<td>6</td>
<td>Hallway #500C (lobby)</td>
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<td>7</td>
<td>Hallway #600C (lobby)</td>
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<td>8</td>
<td>Reception bU1</td>
<td>90</td>
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<tr>
<td>9</td>
<td>YDI Reception</td>
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<tr>
<td>10</td>
<td>YDI Office #1</td>
<td>224</td>
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<tr>
<td>11</td>
<td>YDI Office #2</td>
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<tr>
<td>12</td>
<td>YDI Office #3</td>
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<tr>
<td>13</td>
<td>Reception 600E</td>
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<tr>
<td>14</td>
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<tr>
<td>15</td>
<td>Storage for crafts 610</td>
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</tr>
<tr>
<td>16</td>
<td>Storage for crafts 619</td>
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<tr>
<td>17</td>
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<tr>
<td>18</td>
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<tr>
<td>19</td>
<td>Storage for fitness</td>
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</tr>
<tr>
<td>20</td>
<td>Office 614</td>
<td>127</td>
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<tr>
<td>21</td>
<td>Communications (office) 613</td>
<td>132</td>
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<tr>
<td>22</td>
<td>Office 615</td>
<td>163</td>
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<tr>
<td>23</td>
<td>Storage for office 615</td>
<td>44</td>
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<tr>
<td>24</td>
<td>Gym (showers in restrooms, no lockers)</td>
<td>7,140</td>
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<tr>
<td>25</td>
<td>Storage 611 for gym</td>
<td>261</td>
</tr>
<tr>
<td>26</td>
<td>Storage 612 for gym</td>
<td>219</td>
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<tr>
<td>27</td>
<td>Computer classroom</td>
<td>912</td>
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<tr>
<td>28</td>
<td>Server Room</td>
<td>120</td>
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<tr>
<td>29</td>
<td>Game Room</td>
<td>1,584</td>
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<tr>
<td>30</td>
<td>Storage for Game Room</td>
<td>174</td>
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<tr>
<td>31</td>
<td>Meeting Room (divisible into 2 sections)</td>
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<tr>
<td>32</td>
<td>Chair Storage #1</td>
<td>165</td>
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<tr>
<td>33</td>
<td>Chair Storage #2</td>
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<tr>
<td>34</td>
<td>Electrical Equipment Storage</td>
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<td>233</td>
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<td>36</td>
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**Non-Assignable Space**

<table>
<thead>
<tr>
<th></th>
<th>Area (sq.ft)</th>
<th>% GSF</th>
</tr>
</thead>
<tbody>
<tr>
<td>37</td>
<td>Men's Room, Women's Room</td>
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<tr>
<td>38</td>
<td>Walls, Hallways (except lobby)</td>
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<tr>
<td>39</td>
<td>Janitor, mechanical rooms, electrical rooms</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Total</td>
<td>12,463</td>
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</tbody>
</table>

### Back to Narrative
Back to “Programming a New Community Center”
<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
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<tbody>
<tr>
<td><strong>Midtown Community Center</strong></td>
<td><strong>Addition February 2003</strong></td>
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<td><strong>Assignable Space</strong></td>
<td><strong>Area (sq. ft)</strong></td>
<td><strong>Notes</strong></td>
<td><strong>% GSF</strong></td>
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<tr>
<td>4</td>
<td>Office/Reception</td>
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<td></td>
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<tr>
<td>5</td>
<td>Storage for Office/Reception</td>
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<td></td>
<td></td>
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<tr>
<td>6</td>
<td>Gymnasium</td>
<td>5,610</td>
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<tr>
<td>7</td>
<td>Gym Office</td>
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<tr>
<td>8</td>
<td>Lockers, Showers, Toilets</td>
<td>592</td>
<td></td>
<td></td>
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<tr>
<td>9</td>
<td>Weight Room</td>
<td>812</td>
<td>New Addition</td>
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<td>Computer Classroom</td>
<td>942</td>
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<td>94</td>
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<td>Indian Room (meeting room)</td>
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<td>Kitchen</td>
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<tr>
<td>23</td>
<td>Vending</td>
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<td></td>
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<td>Office #2</td>
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<td>open office?</td>
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<td>25</td>
<td>Game Room</td>
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<td></td>
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<td>Office #1</td>
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<td></td>
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<td>Reception</td>
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<td>Assignable Space Total</td>
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</tr>
<tr>
<td>30</td>
<td>Total gross square footage (GSF)</td>
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<td></td>
<td># # # #</td>
</tr>
<tr>
<td>31</td>
<td><strong>New Addition</strong></td>
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<tr>
<td>32</td>
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<td>64%</td>
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<td>33</td>
<td>Non-assignable Space</td>
<td>3,227</td>
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<td>34</td>
<td>New Addition gross square footage</td>
<td>9,035</td>
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<td>35</td>
<td></td>
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</tr>
<tr>
<td>36</td>
<td><strong>Sitework</strong></td>
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<td></td>
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</tr>
<tr>
<td>37</td>
<td>Parking</td>
<td></td>
<td></td>
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<tr>
<td>38</td>
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<td>39</td>
<td>Van-accessible</td>
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<tr>
<td>40</td>
<td>Regular</td>
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<td>41</td>
<td>Bicycle</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Basketball Courts</td>
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<tr>
<td>43</td>
<td>84x50</td>
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</tr>
<tr>
<td>44</td>
<td>74x42</td>
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</tr>
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<td>45</td>
<td>42x12 Half Court on Parking</td>
<td>3</td>
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Back to Narrative
Back to “Programming a New Community Center”
## Exhibit 1A-3

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<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taylor Ranch Community Center (1/03)</td>
<td>Taylor Ranch Community Center (1/03)</td>
<td>Taylor Ranch Community Center (1/03)</td>
<td>Taylor Ranch Community Center (1/03)</td>
</tr>
<tr>
<td>Assignable space</td>
<td>Area (sq ft)</td>
<td>% GSF</td>
<td></td>
</tr>
<tr>
<td>Fitness</td>
<td>1,391</td>
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<tr>
<td>Storage</td>
<td>117</td>
<td></td>
<td></td>
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<tr>
<td>Storage</td>
<td>109</td>
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<td></td>
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<tr>
<td>Computers Classroom</td>
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<tr>
<td>Chair storage</td>
<td>150</td>
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<td>Equipment storage</td>
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</tr>
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<td></td>
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<tr>
<td>Games</td>
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<tr>
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</tr>
<tr>
<td>AV</td>
<td>101</td>
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<td></td>
</tr>
<tr>
<td>Data/com</td>
<td>103</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chair storage</td>
<td>108</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Materials storage</td>
<td>115</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arts &amp; Crafts</td>
<td>1,201</td>
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</tr>
<tr>
<td>Meeting/Classroom</td>
<td>1,002</td>
<td></td>
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<tr>
<td>Kitchen</td>
<td>429</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage</td>
<td>116</td>
<td></td>
<td></td>
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<tr>
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<td>Storage</td>
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<tr>
<td>Chair storage</td>
<td>152</td>
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<td>Storage</td>
<td>310</td>
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<tr>
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<td>102</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chair storage</td>
<td>203</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting room</td>
<td>3,073</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vending</td>
<td>168</td>
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<tr>
<td>Total</td>
<td>13,079</td>
<td>63%</td>
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<tr>
<td>Non-assignable space</td>
<td>87</td>
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<td></td>
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<tr>
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<td>104</td>
<td></td>
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<tr>
<td>Electrical</td>
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<td></td>
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<tr>
<td>Mechanical</td>
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<tr>
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<tr>
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<td>Hallway (lobby)</td>
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<tr>
<td>Vestibule</td>
<td>113</td>
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<td>Hallway</td>
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<tr>
<td>Vestibule</td>
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<tr>
<td>Janitor room</td>
<td>213</td>
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<td></td>
</tr>
<tr>
<td>Men's toilet</td>
<td>926</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women's toilet</td>
<td>291</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accessible toilet</td>
<td>77</td>
<td></td>
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</tr>
<tr>
<td>Walls</td>
<td>1,320</td>
<td></td>
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</tr>
<tr>
<td>Total</td>
<td>8,371</td>
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<tr>
<td>Total gross square feet (GSF)</td>
<td>22,350</td>
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<td></td>
</tr>
</tbody>
</table>

[Back to Narrative](#)
[Back to “Programming a New Community Center”](#)
From a Happy Valley Children’s Museum’s general publicity brochure:

The Happy Valley Children’s Museum celebrates the child in all of us. We believe that learning is fun and fun is learning. Through play, we encourage children to expand their own learning. We accomplish these objectives by providing an environment that allows for exploration and interaction with that environment and the people, young and old, who are using it.

There are times when children hope to be stimulated by the environment. There are also times when they hope to be the stimulus. We offer opportunities to do both. The same reciprocity occurs between children and our staff.

We seek to be the place where the entire community comes to learn and play.

From the most recent annual report:

The following activities that took place this year illustrate the variety of experiences children have at the Happy Valley Children’s Museum:

- A ten-year-old played chimes in the garden.
- A class of third graders made costumes and put on a play they wrote.
- First graders built a playhouse out of cardboard boxes.
- A teenage intern conducted a workshop for intern candidates.
- A workshop was held for local third grade teachers.
- Children gave a musical concert in the amphitheater.
- The Museum on Wheels visited 18 schools.

Statistics:

- 64,000 individuals visited the museum during the year.
- 8,020 school children visited from local schools.
- 220 volunteers helped maintain exhibits, designed and built new exhibits, assisted on the exhibit floor, cleaned the museum, and helped in hundreds of other ways.
- 10,250 new members joined the museum.

From the collection of annual reports:

For the last eight years, the following visitor statistics emerged, beginning with the first year of operation:

- 6,000
- 8,000
- 9,000
- 12,000
- 20,000
- 32,000
- 40,000
- 64,000

The annual reports indicate that the exhibit floor and the “Birthday Room” are rented for private parties as a fund-raising activity.
Excerpts of interviews for the motorcycle dealership follow:

**Chucky, Warehouse Manager:** “Well, we get the bikes by semi-tractor trailer. You have to watch the drivers, ’cause none of them can back up a truck. Half the time they run over the curb or come close to wreckin’ somethin’. Bikes come crated in the worst to get off crates you ever saw. We use that hyster there to get them off the truck and into the warehouse. Course, there’s all kind of paperwork to do when they come to keep some truck jockey from ending up with a new bike by accident. Then, we’re left with all this wood from the crates.”

**Antonio, Bike Prep:** “Yeah, see, the bikes don’t get here ready to ride. No way. My guys have to put on the bars and a bunch of other stuff. They won’t put all that stuff on at the factory ’cause it makes the crate too big. Plus, there’s always something scuffed up or chipped paint or somethin’. We do some of it and then let the mechanics check it out.”

**Squid, Head Mechanic:** “We make sure all the parts got put on in the right place. Half the time the factory guys are dreaming instead of working. Plus we have to jet everything for this altitude. Once we get them runnin’ right, then the bikes get a bath. Be sure you put a drain in the wash bay. And be sure it doesn’t stop up every five minutes.”

**Danny, Parts Manager:** “If a bike was ordered with a special part, like a fancy muffler, we would have ordered that part. It gets delivered, and we have to check it into the inventory. We have to keep all the parts in a separate area kind of under lock and key, or they walk off. So, that’s why we have a window between the parts storage and the mechanics’ area, see, over there. We also have a window between parts storage and the parts counter in the display room. Also, we have to keep a good inventory and know where all the parts are when someone needs this gadget or that widget. Well, anyway, we have to have the muffler ready for the mechanic to put it on before we tell the customer to come get their new dream!”

**Beth, Bookkeeper:** “Before the bike gets to the floor, we have to be sure the inventory documents are all in order. I also have to record all the credit and payment information, since we finance about 40% of the bike sales.”

**Hollywood, Service Manager:** “Well, what happens at the service desk is customers bring their bikes in for tune-ups or repairs. They check in here, and we schedule the work. Usually, they call first, but sometimes we repair bikes for people who are on the road and break down nearby. The service desk needs to be near the mechanics, and it is probably best if we have our own door to the outside. The customers can park their bikes right outside, so we don’t have to push them so far into the holding area. They stay there ’til they get worked on. Oh, and we need a couch and a coffee pot, ’cause the travelers are here for quite awhile sometimes.”

**Lefty, Parts Sales Desk:** “We need to be handy to the customers, but close to the parts warehouse. Customers come and look at all the motor clothes and parts and stuff. They can order parts for their bikes here. We have all these catalogs with every part you can ever imagine.”

**Maggie, Motor Clothes:** “Well, most people think bikes are the hot sales item. But we make more on motor clothes than bikes. Course, I wouldn’t be able to get a bike salesperson to admit that. What we...”

Exhibit 1A-7 continued on page 34
Excerpts of interviews for the motorcycle dealership follow:

want is for customers to come in and have a good time, browse around, and buy something. Don’t make any straight lines to the parts desk. Make the customer come past all the clothes on the way to parts or service. Oh, and I need some storage for replacement stock. We get a great deal if we buy a ton of T-shirts, but I can’t display them all at once.”

Becky, Head Salesperson: “Look, on the sales floor there needs to be lots of lights so these babies sparkle. There is nothing as glorious as tons of chrome, all in one room! Give us enough room to spread the bikes out for folks to walk between them and take a good look. And we need some little offices to make the sales deals. They can be small, cause we’re always out on the floor selling those bikes.”

Boss Man, Dealership Owner: “Hey, all I need is a nice office with windows onto the sales floor. I like to be near the main entry ’cause I like to welcome the customers.”
### University Classroom/Lab Size Data

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- **A** | Projected total enrollment
- **B** | Number of hours attended per week
- **C** | Optimum class size
- **D** | Time slots available per week for scheduling
- **E** | Number of teaching stations required at 100% utilization (A/C x B/D = E). This number may be a fraction.
- **F** | Number of teaching stations proposed that approaches the desired percent utilization. It is important to remember that you cannot build a fraction of a teaching station.
- **G** | Percent utilization of proposed number of teaching stations (F/E = G)
notes

Take brief notes while reading the narrative and list key resources you used to complete the activities. Note discussion outcomes from meetings with your supervisor, mentor, or consultants. When finalizing the activity documentation (PDF), include your notes and the Emerging Professional’s Companion activity description.
Site & Building Analysis

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exhibits
Site & Building Analysis

Introduction

By completing the activities in this chapter, you will gain an understanding of the field activities involved in site and building analysis. The following information is taken from the NCARB IDP Guidelines:

Site and Building Analysis
Minimum Site and Building Analysis Experience: 80 Hours
Definition: Involves research and evaluation of a project’s context and may include site and building evaluation, land planning or design, and urban planning.

Tasks
At the completion of your internship, you should be able to:
• Develop or review master plan
• Establish requirements of site survey(s)
• Review site survey(s)
• Review geotechnical and hydrological conditions
• Evaluate and compare alternative sites
• Perform site analysis
• Assess environmental, social, and economic conditions related to project
• Document and evaluate existing conditions

Knowledge Of/Skill In
• Interpreting existing site/environmental conditions and data (e.g., topography, drainage, soils, local ecology environmental impact issues)
• Site planning (e.g., site selection, master planning)
• Regional impact on project (e.g., seismic, climate, transportation, economy, labor)
• Government and regulatory requirements (e.g., zoning, planning, design review)
• Community-based awareness (e.g., values, traditions, sociology, future objectives)
• Hazardous conditions and materials
• Facilities planning (e.g., building use, building conditions, systems conditions, infrastructure, space allocation)
• Site design
• Building design

resources
Download the current Intern Development Program (IDP) guidelines at www.ncarb.org/Experience-Through-Internships.aspx.


• Chapter 17.3 - Site Analysis

Site & Building Analysis

Narrative

A comprehensive site and environmental analysis is the foundation of good design. This is especially true in the twenty-first century, when energy scarcity and the transition to alternative energy sources offer prime design opportunities.

Site design begins with analysis of the site and environmental conditions, which yields information the architect can integrate into the project program and design solution. In many cases, when the natural attributes of a site are considered, the energy consumption of a building can be reduced considerably, the longevity of the building increased, and short-term and long-term facility costs reduced. To achieve these ideals is to approach sustainability in design.

A site reflects the environmental, economic, and social characteristics of its location within the natural and built landscape. The term “place-based design” refers to designs executed with an understanding of the site and the natural and built systems associated with it. The character of a site uniquely informs the function and expression of a building designed to stand on it. Put another way, the site analysis can be used to provide regional character and context to a design.

An in-depth and comprehensive site analysis helps the architect determine building footprint and form, building scale, building orientation, glazing location and size, and landscape design. It also makes possible development of a low maintenance/low energy use strategy for a project. Such a study begins with analyzing a larger area—the region in which the site is located. Regional environmental conditions, including ecology, biology, geologic history, anthropology, and climate, as well as legal and regulatory issues, provide information about the site that is essential to the building design process.

A building design informed by a rigorous site analysis has a number of advantages. Such a design is economically strong, works with nature, is unique to the region and neighborhood, takes advantage of the site’s microclimate, and addresses relevant legal and regulatory requirements.

Site Analysis Considerations

A project site is usually defined by a legal description furnished by the client. This description includes a survey fixing the size, legal corners, and existing conditions, such as vegetation, contours, existing infrastructure, and existing utilities of a property. A site, however, is much more than the legal description and project location. The survey, plat, and legal description describe the location of the property within the regulatory jurisdiction, but a tremendous amount of important information related to past use (or abuse) of the site is also critical to a site analysis.

notes

Take brief notes while reading the narrative and list key resources you used to complete the activities. Note discussion outcomes from meetings with your supervisor, mentor, or consultants. When finalizing the activity documentation (PDF), include your notes and the Emerging Professional’s Companion activity description.
A site analysis is always more than dirt on which to build. It is a three-dimensional space, including the airspace, watershed, and geological strata of a site. An environmental analysis is intended to establish and illustrate the climatic and natural conditions that affect this space. A historic look at a project site determines how it was formed over time by local environmental forces and reveals historic uses of the site and surrounding area. Site characteristics that could affect building design include factors such as prevailing winds, presence of wetlands, frequency of flooding or drought, and types of soil.

Along with the architect’s analysis of a site’s environmental conditions, it is critical to be aware of regional conditions that may affect the site, the project, and the community. The importance of this awareness lies in the potential for the architect to include in the design solution a regional or community issue while solving their client’s programmatic needs. An example of such opportunity would be an area that floods and the design could include an area set aside to alleviate damage from flooding while developing a community open space. In such a case, the designer is acting as a steward of the community and showing political savvy.

A site analysis that focuses on natural features can inform a design in ways that will improve energy efficiency and building longevity; reduce maintenance expenses; and improve the quality of life, sense of community, and health of the users and the environment. The knowledge gained from an in-depth environmental analysis of a site, when integrated into a building design, can help the architect solve the design program with lower mechanical and environmental costs. Building designs that work with natural site characteristics are typically less expensive to use and maintain and better for the environment. In addition, the increase in daylighting and natural ventilation provides better indoor air quality, which generally offers building occupants a better experience, increasing both their spirit and productivity.

The architect’s challenge, then, is to design a building that addresses the social, economic, and environmental considerations of the site at the same time it responds to the client’s program. To accomplish this requires the architect to understand these issues and create a solution that addresses them simultaneously. Pertinent considerations and their characteristics are explained in brief as follows:

**Building Location Options**
Identify possible locations on the site for entry and egress, parking, stormwater storage, sidewalks, and other necessary features early in the site design phase. Pedestrian and vehicular access points to the site, the context and scale of the existing neighborhood, view corridor protection; sense of entry/place, neighborhood character, connections to transit, and relation to civic amenities and open space can affect the location of a building on the site.

**Regulatory Restrictions**
Local, county, state, and federal requirements must be adhered to unless a variance is applied for and obtained. Such restrictive regulations typically
fix setbacks, height limits, lot coverage and landscaping, FARs (floor area ratios), parking, and fire protection requirements, as well as construction types and, in some cases, aesthetic issues. The architect, as an additional service, often applies for a variance to make it possible to fit a project better into the neighborhood or to address environmental issues such as solar access.

**Natural Conditions**

In sustainable design, the natural conditions of a site are an important factor in the project design. Natural conditions are the parts of the site and immediate surrounding that occur naturally, in other words, without human intervention. The natural site is a subset or microcosm of a region—biologically, ecologically, and climatically acting much like the region but with specific characteristics and microclimates. A regional environmental analysis shows long-term patterns of solar gain, wind, and precipitation, as well as soil and water movement, while a site-specific analysis reveals the context of a site and its specific connections to regional patterns. The regional climate informs a design about long-term issues, including natural dangers (high winds, seismic activity, drought and flooding, fire, insect infestation, etc.), sea level changes, air quality, water quality and quantity. Data about the microclimate, on the other hand, directly affects a project’s architectural form.

Other natural conditions of significance to the architect are existing and native vegetation and local soils and topography. Data on geology of the site and region is also useful. Learning and working with natural patterns is necessary for successful sustainable design.
Constructed Conditions

Two types of existing structures may affect building design. One is any infrastructure previously built on the site and the other is nearby structures that may affect a new building on the site.

Existing structures of concern include both those no longer in use and slated for demolition and those that will remain on the site, as in renovation or preservation of a historic structure. The architect can learn of past successful attempts at using the site from historic passively designed structures that have stood the test of time. By analyzing these, the architect can identify both successful and unsuccessful techniques and use them in working out the new design.

The urban scale or character of structures on adjoining sites can restrict what can be built on a site, as can the public nature of adjacent spaces such as a community square or other public amenity. Also important are not-yet-built structures that may affect the solar gain, view corridors, or air quality considerations on a site.

Utilities

The existence and location of utilities on a site greatly affect a site plan and ultimately the building design. The cost required to put utilities underground, move them out of view or away from site access, or comply with ordinances can significantly affect a project budget.

Environmental Hazards

If a site has been built on previously, it may be contaminated in some way. There are many levels of contamination, the worst being a toxic condition that must, by law, be cleaned up before any other activity is permitted on the site. Cleaning this type of site (a brownfield), whether toxic or nontoxic, before construction can greatly benefit the surrounding neighborhood and region. Constructing projects in previously built areas is a recommended strategy for reducing sprawl and improving the quality of urban life.

When the environmental hazards of a site are not addressed properly in the site design, it is more likely that a constructed project will have a negative effect on neighboring property. For instance, dangerous slopes and inadequately designed setbacks and stormwater controls could lead to flooding across property boundaries.

Natural disasters such as earthquakes, windstorms, flooding, drought, and fires should be addressed in the site plan analysis. The information and knowledge from the analysis carried into the design phase will inspire the design to contribute to the protection from and mitigation of such disasters.

Consultant Input

The complexity of building today often requires architects to bring consultants onto the design team early in the design process. Consultants who might contribute to site analysis would be soil engineers, ecologists, alternative energy specialists, waste management experts, green design professionals, landscape architects, and historic preservation architects, among others.
Community Interests
Today, establishing community consensus is part of virtually every architecture project. NIMBYism (Not In My BackYard) is a challenge that must be addressed with considerable creative thought in most projects today. Zoning and building codes stem from a desire to protect the community. Preservation of neighborhoods and environmental quality can be a critical concern in site and environmental analysis.

Jurisdictional Input
Determining which jurisdictions have responsibility for a project site may require considerable research, especially as this can vary depending on the scale of a project. Agencies representing local, state, and federal issues such as protection of the water supply, sewage management, air quality, aviation flight patterns, concurrency (requirement for supporting infrastructure to be in place concurrent with new development), traffic, and open space may all have some jurisdiction over the site plan and project design. Having their requirements overlaid on the site plan from the beginning of a project is an excellent way to ensure the regulations will be addressed.

Alternative Site Selection
As an additional service, a client may ask for analysis of an alternate site(s) for a project. The architect would prepare an in depth analysis of the alternate site(s) and a comparison evaluation of all the sites considered.

The Site Analysis Process
Although segments of a site and environmental analysis may become part of project demolition and site plan documents, acquiring information for these documents is not the main purpose of site analysis. Rather, the products of this process are intended to help designers become aware of legal and natural conditions and opportunities present on the site. This information is useful both for developing the design and illustrating present site considerations to clients.

Seven basic steps lead to the creation of this first sketch and analysis. (These can be added to or simplified through experience.)

1. Briefly review the design program and write down the most important project requirements. Next, answer questions about the size of the project, height restrictions, setbacks, parking requirements, and other regulations and restrictions that inform the design process. In this process, you may also question, “What does this project want to do; what are the opportunities and challenges?

2. Visit the site. Arrive by transit, bike, foot, and car, comparing what you learned about the site from each method of approach. Visit at different times of day. The site visit can reveal a uniqueness that will inspire expression in the design. Of all the site considerations, the characteristics of the site are the most important and basic to sustainable design.

3. Take considerations and characteristics previously listed, and research the specifics of the site.

4. Make a preliminary assessment of the site as it relates to the project. Answer questions: What opportunities present at the site match the human comfort needs of the occupants? What site characteristics may conflict with these needs, such as glare from other buildings, traffic congestion, excessive noise, heat or pollution from adjacent buildings or sites, opportunities for daylight and passive heating? Analysis of the character and context of the community helps set the project scale, entry and egress locations, and connection to the neighboring community, among others.

5. Analyze the site in more detail, and establish a site analysis plan if further research is necessary.
6. Evaluate the site in relationship to opportunities and conflicts. One way to organize this study would be through evaluation of the following relationships:

- **Building to site.** How does the climate relate to the comfort zones—temperature, air movement, humidity—of the building. How much precipitation is common? What types of vegetation does the soil easily support with the least maintenance? What is the relationship of the site geology to structural building issues? Does the thermal comfort required in the building correlate to the site’s thermal conditions; if so how can the site’s climate be used to reduce the cost of mechanically assisted comfort?

- **Site to site.** How does the site relate to its immediate surroundings? The context, scale, territorial view corridors, materials and construction methods, geometric relationships, neighborhood character, and proportion are all defined in the site and environmental analysis. Microclimates are also revealed in the “site-to-site” analysis. Existing and natural vegetation types, along with soil and water retention characteristics, affect temperature, air movement, and humidity on the site. Shading by vegetation and neighboring buildings affects solar gain, prevailing breezes, and daylighting.

- **Site to region.** The relationship between the site and its regional environment or climate, as well as the urban, agricultural, and natural character, is part of the site analysis. Cultural and economic considerations are determined in this analysis, as well as the climate characteristics of the bioregional system that have formed the general attributes of the place.

7. Prepare a report of findings that includes drawings and text discussing the criteria mentioned in Site Analysis Considerations. Once an architect has the results of site analysis in hand, he or she must determine how to incorporate this information into the design solution. Begin by considering this question: “How do these conditions affect the building program and how can design improve the site, the neighborhood, and the region in an economically and ecologically viable way?

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**Site Analysis & Research Tasks Continued**

Determine zoning and building regulations:
- Height limits
- Setbacks
- Maximum site coverage
- Floor area ratios
- Required landscape area
- Environmental regulations
- View corridors or other protected requirements
- Urban design criteria, if applicable


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Written by Daniel Williams, FAIA

Daniel Williams is principal of Daniel Williams ARCHITECT, an architecture and urban and regional design practice. He has degrees in architecture and urban and regional planning and is a national expert in sustainable design and planning. He is presently writing a book, *Sustainable Design: Ecology, Architecture and Planning* and has written and taught on the relationship between Energy, Environment, Architecture and Planning.
Architectural Examples
Design Responses Informed and Inspired By The Site Analysis

The projects on the following pages illustrate architecture that was informed by strong site and environmental analysis. These award-winning architecture projects include both building designs and regional planning designs. Listed for each project are design responses to these opportunities.
Architectural Example 1

**Edificio Malecon**
**Architect:** HOK
**Location:** Buenos Aires

This 125,000-square-foot office building was built on a reclaimed brownfield site (its garage within the foundations of a 19th century warehouse) at Puerto Madero, a redevelopment area in Buenos Aires, Argentina. The building was developed as a long narrow slab to minimize solar gain from the roof. The broad northern face, the primary solar exposure, is shaped to track the sun and is fully screened with deep sunshades that virtually eliminate direct solar radiation during peak cooling months. The south face, which reflects the geometry of the northern façade, is equipped with the same high-performance curtainwall system as the other facades, minimizing solar gain. A “green roof” helps insulate the 40,000-square-foot podium from solar radiation and manages stormwater runoff. Open floor plates and raised floors provide flexibility for multi-tenant office or alternative future uses.

Design elements attributable to the site and environmental analysis:
- Thin plate (narrow cross-section) for 100% daylighting
- Urban infill
- Urban design context
- Brownfield development
- Creation of urban edge
- Stormwater reclamation

resources

Browse the internet for more photos and information about Edificio Malecon.
Keywords: HOK, Edificio Malecon, brownfield site, redevelopment, solar gain, solar exposure, high-performance building, sunshades, open floor plan, urban infill, urban edge, stormwater reclamation.

HOK, Edificio Malecon: [www.hok.com/design/type/tall-buildings/edificio-malecon](www.hok.com/design/type/tall-buildings/edificio-malecon)
Architectural Example 2

Fisher Pavilion
**Architect:** Miller+Hull  
**Location:** City Center, Seattle, Washington

Fisher Pavilion is one of the first buildings in Seattle to be designed and constructed under the city policy requiring all public facilities costing more than $5 million to achieve a LEED Silver Rating. "Burying" the building and the use of a high mass (10 feet of concrete) roof decrease envelope loads on the building, resulting in extensive energy and heating savings.

Design opportunities resulting from site and environmental analysis:

- Thermal mass cooling and heating
- Rooftop plaza
- Daylighting for 85% of the building
- Creation of a new urban infill square as an amenity
- Natural ventilation
- Maximized solar heat gain
- Connected interior/exterior space
- Transit parking drop off

resources

Browse the internet for more photos and information about Fisher Pavilion. Keywords to consider: Fisher Pavilion, Miller+Hull, City Center, Seattle, LEED certification, city policy, building envelope, thermal mass, urban infill, natural ventilation.

Architectural Example 3

Kahn/Williams HAUS

Architect: Daniel Williams Architect
Location: Seattle, Washington

This urban infill site provides a working neighborhood, transit, civic amenities, walkable shopping, open space for recreation, and regional view corridors.

The site is a steep slope with a small area (4200 sf). Due to the site orientation, it was determined the structure should be open from the east to the southwest corner.

The requirement to build into the hill suggested use of a cube (the most static form), which also creates the most volume for the least exterior skin.

The site and environmental analysis established:

• Correct angles for seasonal light and heat penetration
• Required orientation of spaces in the plan to access daylight and territorial views
• Solar patterns to inform window design and detail
• Possibilities for earth cooling and heating (thermal mass 61º F)
• Maximize south (solar) yard.
• Possibilities for reuse of existing structure and demolition rubble
• Living roof recovery, cleanup, and storage of rainwater for irrigation and gravity-fed toilet flushing

resources

Browse the internet for more photos and information about Kahn/Williams HAUS.
Keywords to consider: Kahn/Williams HAUS, Daniel Williams Architect, DWA design, urban infill, walkable design, site orientation, daylight, solar patterns, thermal mass, building reuse, living roof, rainwater storage.

DWA Design, Kahn/Williams HAUS: www.dwa-design.com/architecture/KW_HAUS
Architectural Example 4

Steinhude Sea Recreation Facility
Architect: Randall Stout Architects of Los Angeles, CA
Location: Steinhude, Germany

Design objectives informed by the site and environmental analysis:
Energy self-sufficiency:
- photovoltaic panels
- solar hot water collectors
- a seed-oil fueled cogeneration micro turbine
- daylighting
- natural ventilation
- passive solar design
- building automation
- high-performance materials

These systems provide complete lighting and power needs for the building while recharging a fleet of eight photovoltaic-powered boats. They also produce excess electricity to sell back to the utility grid. Other sustainability practices incorporated into the design include graywater and harvested water systems, green materials, and waste reduction.

resources

Browse the internet for more photos and information about Steinhude Sea Recreation Facility.
Keywords to consider: Steinhude Sea Recreation Facility, Randall Stout Architects, photovoltaic panels, solar hot water collectors, passive solar design, high-performance buildings, sustainability practices, graywater, rainwater harvesting.

Randall Stout Architects, Steinhude Sea Recreation Facility: www.stoutarc.com
Sea Ranch Condos
Architect: Moore, Lyndon, Turnbull, Whitaker Architects
Landscape Architects: Halprin Associates
Location: Sea Ranch, California

Sea Ranch by Moore Turnbull Architects is a good example of a well-planned, well-designed project stemming from a well analyzed site with powerful environmental conditions.

Beach sand in wind shadow is an ecological example in this project. The energy organizes the sand (form/structure). Here, the massing of the small plant creates protection from the strong winds. This knowledge can inform the design of a coastal community that experiences gale force winds.

Elements informed by site analysis:
• High wind forces inspired a tight-knit urban form
• Architectural urban forms composed of exterior spaces
• Interconnected trails to protect the community from strong winds
• Use of local materials

resources

Browse the internet for more photos and information about Sea Ranch Condos.
Keywords to consider: Sea Ranch Condos, Turnbull Griffin Haesloop Architects, site analysis, wind shadow, massing, wind protection, local materials.

Turnbull Griffin Haesloop Architects, Sea Ranch Condos: www.tgharchitects.com/aboutus/history/condos/
Architectural/Urban Design Example 6

Bahama Village
Architect: Daniel Williams with Harrison Rue
Location: Key West, Florida

Bahama Village, the oldest African-American village in the U.S., located in Key West, Florida, was subjected to landfill that severely damaged the conch population, its economic base. A goal of this urban design solution was to reconnect the natural resources with the future of the village.

Ideas developed from information in the site analysis:

• Increase human comfort by improving orientation to prevailing breezes for passive cooling.
• Reconstitute the cisterns for irrigation and potable water use.
• Restore economic and environmental benefits of reclamation of conch farm.
• Reuse existing materials.
• Job incubation—train local residents as carpenters to protect and restore cultural and economic future of the community.
• Create land use zoning changes and tax breaks to preserve 150-year-old village.
• Increase density with rear cottage zoning, improving the value of the property while bringing income to residents.
• Re-create beach zone and habitat

resources

Browse the internet for more photos and information about Bahama Village.
Keywords to consider: Bahama Village, Daniel Williams Architect, Harrison Rue Architect, Key West, landfill development, natural resources, prevailing breezes, passive cooling, cistern irrigation, potable water, reclamation, land use zoning.
Architectural/Urban Design Example 7

Anacostia River

Architects and Planners: USGSA & Congress for the New Urbanism
Location: District of Columbia

The program for this design included the following:

- Develop affordable housing.
- Foster economic development.
- Improve environmental stewardship.

The site and environmental analysis suggested these possibilities:

- Reconstruct the creeks to manage storm water and create urban parks.
- Reclaim wetlands along river banks.
- Supports walkable neighborhoods by extending public transit to the riverfront.
- Create public recreational space where the urban space meets the river’s edge.
- Integrate demonstrations of water purification technology at the Navy Museum.
- Remove sewage–storm water combined outfall.

resources

Browse the internet for more photos and information about Anacostia River.
Keywords to consider: Anacostia River, USGSA, Congress for the New Urbanism, affordable housing, economic development, environmental stewardship, storm water management, wetlands, water purification.

Anacostia River: www.anacostia.net
notes

Take brief notes while reading the narrative and list key resources you used to complete the activities. Note discussion outcomes from meetings with your supervisor, mentor, or consultants. When finalizing the activity documentation (PDF), include your notes and the Emerging Professional’s Companion activity description.
“Long life - loose fit” refers to creating versatile designs in which the building is connected to the site in a symbiotic manner. Consider the following attributes of earth: The ability to support building loads, nutrient composition, ability to hold water, vegetation compatibility, and capability to support crops.

In this scenario, you are retrofitting an existing apartment building in an urban nontoxic brownfield neighborhood in San Diego, California. Your client wants to grow vegetables and edible crops on close to 100 percent of the site, including the building footprint.

**Activity - Core**

Write a proposal describing how you will accomplish your client’s goal. Use sketch site plan to illustrate proposal. Be sure to address:

- Where will potential cost arise/appear?
- How can costs be mitigated?
- Can gravity be used distribute water for irrigation and gravity water reuse?
- Is it possible for water be stored within the building and on the site?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Water Management - Before and After

Supplemental Experience for eight (8) Core IDP Hours

Parking lots can create huge heat islands and large areas of impervious surface, increasing flooding while decreasing groundwater recharge. What options can mitigate site impact?

Activity – Core

Identify a project that has a site of at least ten acres. If your office does not have any large-site projects, use a project from another firm. Using the topographic plan, sketch the natural gravity flow of water over the site. Then, using a site plan with the building intervention, sketch the new flow of water over the site. Respond to the following issues:

- Creating natural irrigation
- Creating surface and ground water storage areas
- Roof water collection
- Water system integration

Summarize the specific changes parking lots will create on the site, considering issues such as these:

- Increased erosion and flooding
- Increased impervious surface
- Degraded water runoff
- Microclimate heat gains and heat island effects
- Costly infrastructure for underground water storage

How would you combine parking requirements and storm water control? What can be done to accommodate a 100-year storm (10” in 24 hours)?

Describe any missed opportunities in the project plans for natural conservation or preservation. Using both economic and environmental criteria, explain in a narrative how you would convince the client that incorporating pervious pavement, water storage, parking, and open space on the site could be a win-win, environmentally and economically.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
In this scenario, your client wants to fill in wetlands on a site and put storm water treatment below grade in a concrete holding vault. “It’s easier and my engineer has done it before,” he says.

The county is in danger of losing its supply of groundwater, the regional storage for potable water, as well as the supply to the rivers. Local rivers are becoming contaminated with the polluted, reduced groundwater flow. You bring up the issue of retaining the wetlands to your client, and he again says, “No!”

Activity - Core

Use a project in your firm or your mentor’s firm involving wetlands on the site. Design a plan that provides two alternate locations for storm water management to discuss with your client. Indicate buildable area on each site scheme.

Write a narrative persuading your client on the new site plan’s benefits: mitigate major disturbances or leave the wetlands untouched.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Quality of Life

Supplemental Experience for eight (8) Elective IDP Hours

Consider attributes of quality of life: shelter, clean air, water, hygiene, security, human scale, thermal comfort, and food.

Activity - Elective

Write a description and illustrate (in plan, section, or diagram) your favorite “places:” one urban setting and one rural/natural setting. Describe similarities and differences using the following considerations:

- Sunlight
- Comfort
- Temperature
- Breezes
- Humidity
- Scale and proportion
- Color and material
- Orientation

Using a current project or other, prepare a short report demonstrating the natural characteristics of “place” as part of your design. Do site considerations in your design go beyond the feel of the “place” (e.g., comfort attained by passively heating or cooling)?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Precipitation Predicament

Supplemental Experience for eight (8) Elective IDP Hours

Water is the most critical of renewable resources. Supply comes from precipitation, such as rain and snow. A critical aspect of this limited resource is storage for use when the supply is reduced, as in drought. Designers can emulate natural conditions such as surface water (lakes, ponds, creeks), underground storage (aquifers, ground water), and soil mechanics.

In this scenario, a potential client wants to build a new town along an existing rail line in New Mexico. New Mexico is blessed with lots of sun but little precipitation. The site has many amenities and opportunities—beauty, views, clean air—but only seven inches of precipitation per year. The local water agency is about to stop all construction that consumes more water than falls on the site. This is key to getting the client to feel comfortable with your ability to understand and solve the water issue.

Activity - Elective

Geographic locations often effect the original design intent. For example, rainwater may not be an abundant resource in New Mexico, but sunlight is abundant. For your project sketch plans best orientation for maximizing passive and active solar use. Write a report on why you chose to adjust the project in this way, and explain the proposed methods of water storage and reuse. Are there other resources you recommend that can power the town?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Saving Wetlands

Supplemental Experience for eight (8) Elective IDP Hours

In this scenario, an analysis finds that wetlands make up twenty percent of a site in Madison, Wisconsin. You and a firm principal want to save this unique part of the site. The owner likes the idea but asks, “What about mosquitoes?”

Activity - Elective

Respond to the client’s concerns about mosquitoes and build a case for preserving the wetlands. Through plan sketch diagrams and a narrative address the following:

• What issue might arise if the wetlands are not saved? Is mitigation required?
• Outline three different approaches to the mosquito problem, while solving storm water storages.
• What is your firm’s liability if the client’s concern about mosquitoes turns out to be well-founded? Discuss a testing period, fixes if necessary, and additional consultant costs.
• What other site features could impact your design, are they positive or negative?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Several stakeholders are affected by every project. The neighborhood ecology and biology, the water quality and quantity, future residents, and the client and your future clients will all be affected by each project.

In any project, degradation of natural resources is often unnecessary. Degradation is usually caused by the belief that the structure can only be economical if every last square foot of a site is utilized. To paraphrase Buckminster Fuller, pollution is an artifact of bad design.

In this scenario, you have created a mission statement for your firm that encompasses good design, economics, and ecological stewardship. While explaining your mission statement to a new client, she commented, “Use it on your next project. We are filling in the wetlands—too much hassle for me.” This project is critical to your startup as a professional. How will you approach this dilemma?

Activity - Elective

Develop a mission statement mentioned in the scenario. Create a narrative responding to the client, keeping in mind this project will be a boost to your professional career. Explain the ethical dilemma you face and respond to the following:

- Are there any alternatives to suggest working with wetlands?
- How does filling in the wetlands affect neighborhood, ecology and biology, and future residents?
- Are there benefits to having wetlands near the property? What are the drawbacks?
- If her position does not change will you accept this job, why or why not?
- If you accept this job will your firm have to change its mission statement?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Sustainable Site Determination

Credit Option 1: Development Density -OR- Credit Option 2: Community Connectivity

Supplemental Experience for eight (8) Elective IDP Hours

Current thinking about sustainability design issues includes the practice of reducing “urban sprawl” by limiting greenfield development and focusing development in existing urban fabric or brownfields. Greenfields are defined as sites that have not been previously developed or built on and could support open space, habitat or agriculture. Brownfields are abandoned or underused sites available for reuse.

LEED 2009 Sustainable Sites Credit 2, “Development Density and Community Connectivity,” requires that one of two options (Density or Connectivity) be met by performing an analysis and calculations outlined in the USGBC LEED 2009 Reference Guide for Green Building Design and Construction.

Activity - Elective

Please reference the following source:

In sketch form, select a completed project that is located in an urban area. A multiple story building on an urban infill site is preferable. The area density (floor area to site area) is more important than the type of occupancy. Select one of the following two credit options to study and report on. Respond to all requirements listed in the LEED reference guide.

Provide a response to the following questions in your sketches: Which option did you choose and why? Will your project receive this LEED credit as a sustainable site? If not, what changes would have to be made to the project to receive the credit? Could your project meet the requirements of both options? If you picked option 2, community connectivity, how many of the required community services are present?

Credit Option 1: Development Density
- Provide a site vicinity plan showing the project site and the surrounding sites and buildings. Sketches, block diagrams, maps and aerial photos are all acceptable for this purpose. Draw the density boundary on the drawing or note the drawing scale.
- Record the project site area and building area in square feet.
- Within the density radius, list all buildings and include their respective site and building areas.

-OR-

Credit Option 2: Community Connectivity
- Provide a site vicinity plan showing the project site, the ½ mile community radius and the locations of the of the community services surrounding the project site. Sketches, block diagrams, maps and aerial photos are all acceptable for this purpose. Draw either the ½ mile radius on the drawing or note the drawing scale.
- Record the project site area and building area in square feet.
- Within the ½ mile radius, list all community services and include their name and type of business.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Machu Picchu survived as a working community for hundreds of years using only energy and resources found on or near the site. Research and find site plans, images, and other graphic documentation that will help you understand the theories behind the community form and design of Machu Picchu or other ancient cities.

**Activity – Elective**

Prepare a short summary of your findings. Answer following questions:

- What lessons about community design can be learned from ancient builders? (Before you research the answer, write down three ideas based on your intuition.)
- What design principles are at work in your city or town that parallel those of Machu Picchu?
- Describe three design principles in your city or hometown that are different from those used at Machu Picchu or other ancient cities.
- What site design principles do you see in a current project that parallel those of Machu Picchu and what benefits do they provide to the site and its users?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
notes

Take brief notes while reading the narrative and list key resources you used to complete the activities. Note discussion outcomes from meetings with your supervisor, mentor, or consultants. When finalizing the activity documentation (PDF), include your notes and the Emerging Professional’s Companion activity description.
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Project Cost & Feasibility

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Introduction

By completing the activities in this chapter, you will gain an understanding of the activities involved in project cost and feasibility. The following information is taken from the NCARB IDP Guidelines:

Project Cost and Feasibility
Minimum Project Cost and Feasibility Experience: 40 Hours
Definition: Analyze and/or establish project costs relative to project conditions and owner’s budget.

Tasks
At the completion of your internship, you should be able to:
• Perform or review a feasibility study to determine the cost and/or technical advisability of a proposed project
• Establish preliminary project scope, budget, and schedule

Knowledge Of/Skill In
• Project financing and funding
• Project delivery methods
• Construction sequencing
• Cost estimating
• Value engineering
• Life cycle analysis
• Project budget management
• Critical thinking (e.g., analysis, synthesis, and evaluation of information)

resources

Download the current Intern Development Program (IDP) guidelines at www.ncarb.org/Experience-Through-Internships.aspx.

• Chapter 13.5 - Construction Cost Management

• Chapter 14.4 - Construction Cost Management

• Chapter 9.4 - Construction Cost Management
Managing building costs is a challenging task for the design team as well as for construction managers, contractors, and consultants. Owners demand that their design and construction teams respect the owner’s financial and economic objectives and that they control costs during project delivery. This expectation is found in both the public and the private sectors in all client industries, locations, and financial situations. Owners expect that a budget prepared early in a project will be accurate and that the project will be completed to the required scope, quality, and performance within that budget. Owners invariably place a high priority on cost issues, regardless of the quality or other attributes of the project. They may even judge success or failure exclusively in terms of cost.

During the past decade, professional organizations, educational institutions, government and private entities have supported the development of building cost analysis methodologies and provided seminars and other educational programs on this subject. The success of these efforts has varied, but one issue has become clear: Achieving high-quality design and implementing effective cost analysis and management are not contradictory objectives.

Nearly every decision an architect makes during design and construction affects project costs. Some decisions are straightforward because they affect building quality or performance. Others are more subtle, affecting ease of construction, complexity of building elements, or availability of materials. Some decisions can profoundly affect other disciplines, such as plenum depths that may confine mechanical/electrical services or a building module that influences a structural grid.

Why is it so difficult to control building costs? Quite simply, the design decision-making process is subject to constant upward pressure on scope, quality, and performance and, therefore, on cost. Unless decisions are managed and expectations kept in check, costs may rise beyond budget limits.

Building cost analysis encompasses economics, cost estimating, and cost management, discussed below under the following heads:

- Understanding building economics
- Identifying factors that influence building costs
- Using standard formats
- Applying cost-estimating methods
- Dealing with escalation and contingencies
- Understanding value analysis
- Understanding life-cycle costing
- Integrating building cost analysis into the design process

Take brief notes while reading the narrative and list key resources you used to complete the activities. Note discussion outcomes from meetings with your supervisor, mentor, or consultants. When finalizing the activity documentation (PDF), include your notes and the Emerging Professional’s Companion activity description.
Understanding Building Economics

What determines how much buildings cost? We all understand the cost of buying a suit, an automobile, or even a house. By experience, we develop a sense for what something should cost. However, unless we fabricate an item from its basic parts, we may not develop a sense of what makes it cost a specific amount. Construction projects are complicated entities. To be able to estimate and manage building cost, an architect must first understand what costs are involved.

Capital Cost Components

Capital costs are normally subdivided into three major categories—site costs, hard costs, and soft costs. The accompanying diagram summarizes each of these categories.

Site Costs

Site costs normally cover the owner’s initial land acquisition and development costs for the project.

Soft Costs

Soft costs include a variety of costs incurred by the owner to move the project forward. Design fees, management fees, legal fees, taxes, insurance, owner’s administration costs, and a variety of financing costs fall into this category. Moving costs and other tenant-related costs may be placed in the soft cost category.

Hard Costs

Hard costs are those most directly affected by decisions of the architect. These include core and shell features, interior enclosures, basic building services, and fit-out costs for finishes and mechanical and electrical services. Major components of hard costs that are usually not incurred under the construction contract include furniture, fixtures, and equipment (FF&E) and specialized mechanical and electrical services. These costs are often incurred directly by the owner.

The breakdown of costs can vary widely according to building type. For instance, a standard office building is typically built for between $80 per square foot and $150 per square foot, depending on quality and performance requirements. A laboratory building, on the other hand, may cost from $150 per square foot to more than $400 per square foot, again depending on quality and performance requirements. The disparity between costs for these two building types is caused largely by laboratory mechanical costs, which alone can exceed $150 per square foot, especially when extreme requirements of control, filtration, and cleanliness are required. To control mechanical costs when they are expected to represent 40 to 50 percent of overall project cost, more attention must be given to initial budgeting and ongoing cost management activities for mechanical elements.
Construction Costs
Construction costs are the portion of hard costs normally associated with the construction contract, including the cost of materials and the labor and equipment costs necessary to put those materials in place. Added to this are overhead costs, which include both job site management and the contractor’s standard cost of doing business (office, staff, insurance, etc.).

Material Costs
Material costs cover purchase of materials, including local and regional taxes, and shipping and handling costs, which include transportation, warehousing, and in some cases security. In very remote areas or in overseas locations, shipping, handling and other overheads may exceed the cost of the material.

Installation Costs
Installation costs include the price of labor and equipment to put materials in place. Labor costs consists of base wages, taxes, insurance, and benefits, as well as premiums for overtime or for working in remote locations. Equipment costs include the direct cost of the equipment (whether it is a purchase amortization or a rental) and the cost of an equipment operator, which sometimes includes support staff.

Overhead costs associated with construction are usually referred to as general conditions. These costs include those for field supervisory staff, additional professional services staff, engineering consultants, as well as temporary facilities and utilities, small tools, and a variety of safety and security equipment. Also included in this category are bonds, permits, and insurance costs allocated to the project. Contractors and subcontractors also incur general conditions costs.

Additional overhead costs associated with the main office of each contractor include salaries of home office staff, certain insurance costs, various home office overhead costs (job procurement, marketing, advertising, etc.) and profit. Profit is a function of market and risk and may include a contingency for unknown or uncontrollable aspects of the work.

What makes construction costs vary?
The purchase price of building materials is directly affected by their availability and the demand for them in the marketplace. The timing of events on a project can significantly affect cost, especially if short lead times for products and materials challenge availability. Shipping and handling costs, particularly in remote areas, can be expensive. Procurement limitations such as the “Buy American Act” can substantially drive up cost by limiting competition. Sales taxes, import/export duties, and other special fees indirectly affect the cost of materials.
Installation costs are driven by geographic variations in labor costs and productivity. Certain trades, such as demolition, universally carry very high insurance premiums because of the risks associated with the work. The safety record of the contractor further affects insurance premiums. Conditions of the work, particularly for renovation projects, dramatically affect productivity because access, egress, laydown area, staging area, and general space available to conduct business may be restricted.

The nature of a project site, such as a remote location or site with poor access to utility services, also affects general conditions costs. Security for the construction site can be another cost factor. Owner requirements and limitations on site access may indirectly affect cost.

Other potential markups that contribute to a building’s cost are a function of market competition and project risk. Risk or the perception of risk is always a significant factor. In times of high competition, allocations for overhead and profit tend to be reduced to increase a firm’s competitive edge. When competition is poor, these costs tend to increase. Owner policies intended to reduce the owner’s risk can also increase cost. For example, some owners believe that employing extremely onerous bonding and default requirements protect them, but they may be unaware of the cost of such measures.

### Identifying Factors That Influence Building Cost

Building costs can only be controlled through effective control of the factors that influence them:

- Scope of work
- Geographic and site factors
- Programmatic factors
- Design factors
- Qualitative and performance factors
- Delivery process, legal, and administrative factors
- Market, competition, and economic influences
- Risk factors

### Scope of Work

This is the most basic factor driving building cost. If the scope increases, costs will almost invariably increase accordingly, thus scope management is an important part of cost management. Under extreme circumstances, it may be necessary to program a facility over again rather than rely on the design process to correct a scope problem.

### Geographic and Site Factors

Site location (e.g., urban vs. rural) affects labor rates, material costs, and a variety of other cost issues. Local climate has a major influence on selection of building materials and even on basic approaches to developing the building. The building site also determines access, egress, and utility provisions. In some instances, particularly large sites such as campuses and military bases, utility lines may need to be extended great distances to reach the building site, possibly resulting in costs that exceed those of the rest of the project.
# Factors Affecting the Cost of Building Elements

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<td>Site configuration and levels, paved areas, special features, demolition required, soil disposal and compaction, soil conditions, exterior lighting and utilities, extent of landscaping</td>
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</table>
Site conditions include basic topography, which dictates the amount of earth that must be moved to allow for development and provision of utilities. Environmental factors can affect costs directly if they require a response and indirectly if their mitigation requires adjustment in the project schedule. For example, wetlands mitigation can have major impact on cost and on how much of the site is available for use. The presence of rock or other difficult soils also directly affect site development costs as well as eventual choices for building foundations.

Programmatic Factors
Typical cost drivers related to a building program include space efficiency, security requirements, circulation requirements, ADA requirements, blocking and stacking, adjacency requirements, and the functional mix of spaces.

By far the most significant of these factors is the mix of space types required in a building. For example, laboratory space may cost $400 per square foot, while standard administrative or office space may cost $100-150 per square foot. An exact 50-50 program mix in this example would yield a building cost of $200-220 per square foot. If the same building comprised 70 percent laboratories and 30 percent office space, the building cost would exceed $300 per square foot.

Space efficiency is also an important cost driver. Achieving the levels of space efficiency defined in the program can be a design challenge. To ensure these efficiencies are achieved, care must be taken to establish realistic targets based on experience in comparable buildings.

Design Factors
The building geometry and degree of articulation in the basic plan affect building cost. For example, from a cost perspective, a perfectly square footprint is the simplest to build and theoretically less expensive. Nonetheless, this geometry may be unacceptable and overly simplistic for most projects.

Plan geometry and exterior articulation are issues that require proper budgeting and oversight during the design process. Shadow lines, notches, and projections all may benefit the building form aesthetically, but their complexity represents additional costs for labor and possibly for materials. This relationship is especially true for buildings with high-quality envelope systems.

Building height and overall scale also influence building cost. For example, the cost of the structural system is likely to increase along with the building height.

Qualitative and Performance Factors
The owner’s quality and performance requirements need to be carefully considered in both budgeting and cost management. Owners generally set requirements with a bottom threshold in anticipation that delivered quality will at least meet stated minimums. Designers will almost certainly meet these minimums and often exceed the minimum because of their desire to provide better quality and performance.

resources
Legal and Administrative Factors
The delivery method chosen by the owner can affect the cost of a project in many ways. Whether the delivery method is design-bid-build, design-build, construction management at risk, or a variety of other construction management approaches, the initial budgeting process and the cost management process should reflect the delivery method chosen and account for any premiums or discounts anticipated, especially as they relate to the schedule.

The timing of a construction contract award is an extremely important consideration. A construction contract can be awarded at almost any point in the procurement process. However, if the contract is negotiated and awarded before the documents are complete, the owner and contractor often agree on a guaranteed maximum price (GMP). A GMP usually includes allowance for work not defined, and the degree and nature of these allowances requires scrutiny on the part of the owner and the architect.

The owner’s approach to cost management and cost management policies have a subtle but significant effect on the cost of a building. Brian Bowen, former president of Hanscomb Inc., observed, “Buildings cost what they’re allowed to cost.” If the owner’s attitude toward cost management is lax, it is reasonable to assume costs will increase over time. Conversely, if the owner demonstrates concern for cost then cost tends to be contained over time.

Market and Economic Influences
Market and economic conditions may overwhelm other cost factors. Market conditions tend to follow the overall economy, and in turbulent economic times the market has been known to affect building costs by 10 to 20 percent or more. In times of recession or slow economy, prices tend to drop because demand is down. Conversely, in times of economic boom, prices tend to rise because demand is up.

Competition also affects prices. As the number of bidders increases, the price goes down; when the number of bidders is reduced, the price goes up. Market factors are volatile, and great care must be taken when projecting the effects of competition and inflation. The delivery method chosen may also affect competition, directly through the number of prime contractors who are bidding the project and indirectly through the number of subcontractors included in the bids of the primes.

Risk Factors
Projects with more risk are likely to cost more, thus formalized risk-estimating methods may be appropriate in certain circumstances. Preparation of a risk-based cost estimate places more attention on major cost components when risk is a significant issue and variances in these components can be consequential. In some circumstances, it may be appropriate to consider alternate design choices that may have the benefit of minimizing some aspect of risk on a project. For example, a facility could be relocated to a different area of the site to minimize the chance of disturbing contaminated soils, or materials could be selected that are known to be readily available rather than materials that are in short supply.
Using Standard Formats

Use of a standard framework for classifying and managing information is essential for accurate building cost analysis. The most common framework in the construction industry today is the 16-division MasterFormat developed and managed by the Construction Specifications Institute (CSI). MasterFormat is extensively used throughout the industry as a format for project manuals, specifications, and other project data. Since the MasterFormat structure resembles the basic way projects are procured (subtrades and contract packages), it is often used as a framework for cost control, scheduling, and estimating.

UNIFORMAT is a classification system based on physical building elements, originally developed by the American Institute of Architects (AIA) and the U.S. General Services Administration (GSA) in the 1970s. The most recent version, UNIFORMAT II, refines certain aspects of the original system and has been designated ASTM Standard E1557-96. UNIFORMAT is best applied to conceptual and schematic estimating, while MasterFormat is more effectively used for detailed estimating and bidding. It is not difficult to cross reference the two systems.

Applying Cost-Estimating Methods

Any cost-estimating method used should be consistent with the level of information available and the time available to prepare the estimate. Cost estimating methods tend to fall into four major categories:

1. **Single-unit Rate Methods (SUR)**
2. **Parametric/Cost Modeling**
3. **System/Elemental Cost Analysis**
4. **Quantity Survey**

The figure on the opposite page shows when these estimating methods generally can be applied to overall delivery of a project.

Single-unit rate methods tend to be appropriate in the planning and programming phases of a project. Parametric and cost model estimates are generally used during schematic design and early design development. Systems and elemental estimates are best during design development and early construction documentation. Estimates based on a quantity survey can be used almost any time but are generally most appropriate when documents are reasonably detailed, such as during design development, construction documentation, and bidding and construction. At any time, these techniques may be used to cross-check overall costs.

1. **Single-Unit Rate (SUR) Estimating Methods**
   Single-unit rate estimating methods are subdivided into four major categories:
   - Accommodation method
   - Cubic foot method
   - Square foot method
   - Functional area method
Accommodation Method
For this method, an estimate of overall construction cost is calculated using the cost of selected units of the facility as a baseline. For example, parking garages can be measured per parking stall. Apartment buildings might be measured on cost per apartment. Performing arts facilities and auditoriums can be measured on cost per seat. Hospitals may be measured on cost per bed. The accommodation method is often used to provide very preliminary estimates or to provide a quick check and assessment of a current project estimate.

Cubic Foot Method
This method of analysis is not generally used in the United States except for volume-dependent facilities such as warehouses. Although it can be effective, the cubic foot method tends to be awkward for use in most facility types. Nonetheless, certain European countries, especially Germany, routinely use cubic measures as a means of budgeting facilities.

Square Foot Method
This is the most commonly used initial budgeting mechanism in the United States. It can be effective, but care must be taken to ensure the programmatic basis of each is comparable when costs of different facilities are considered. In addition, the method of measuring must be consistent for project comparisons to be valid. A number of published sources provide square foot costs. A commonly referenced one is the RSMeans, Building Construction Cost Data.

Functional Area Method
This approach to estimating is based on functional space types. A functional space type is defined as an area in a building that has a distinct functional purpose, for example, classrooms, a cafeteria, or a gymnasium in a school. The advantage of determining cost by functional area rather than pure square footage is that variations in space types and program can be considered in the basic estimate. Using the school example, classrooms might cost $100 per square foot to build, while the gymnasium might cost $200 per square foot. Overall proportions in a typical program of classrooms and gymnasium can be accommodated. The functional area method allows for sensitivity to program elements.

The functional area method can be applied in two ways, either by pure space type or by core and shell plus the functional space build-out. The first option assumes equal sharing of the core and shell costs among space types. The second derives the core and shell costs separately and then assesses the build out costs of each space type.

2. Parametric/Cost Modeling Method
These cost estimating methods use predetermined models based on statistical analyses used to predict facility costs. The process is most effective for repetitive facilities that have consistent programs, such as those with industrial applications. Statistics are gathered from in-place construction and can be used
to predict costs, especially for complicated systems that involve piping, manufacturing, and processing components. These approaches have less application in building construction.

Cost models can be prepared with computer models that project the form, shape, and composition of building types. In the last several years, computer based systems have been developed to help designers model form and shape and determine building size. These systems can also be used as a front-end device for cost modeling.

3. Systems/Elemental Cost Analysis
This approach to cost estimating provides a bridge between the conceptual estimating methods described above and estimates based on full, detailed quantity surveys, which are described below. The concept behind this approach is subdivision of a facility into its elemental components, generally using UNIFORMAT as a basis. The level of detail included is a function of the amount of design detail available when the cost estimate is prepared.

When very limited design information is available, a set of assumptions must be made from which to estimate costs. It is possible to base these estimates on historical information from similar facilities or historical information about building components and elements. At an early stage of design, before details have been defined, it may be desirable to develop what are generally referred to as “assemblies”—composite systems usually drawn from standard design details. These assemblies can be accurately priced and are especially useful for comparative purposes. Historical cost is an appropriate basis for estimates when facility types and programmatic components are similar. Adjustments to the historical cost information can be made if necessary.

Published sources of information can be used to prepare estimates and to cross-check estimates prepared using other methods. RSMeans produces a publication that contains cost models of various building types, including selections of walls, finishes, mechanical systems, etc.

A potentially more accurate estimate is one produced using an elemental format that represents specific conditions of the developing design. This approach requires a combination of pricing mechanisms, which could include historical costs, costs of systems and assemblies, and detail cost analysis for selected items.

4. Quantity Surveys
The quantity survey method of cost estimating is usually employed when detailed design information is available on the entire project or at least major components thereof. The actual pricing approach may include only total unit prices or labor, materials, and equipment. The level of detail in the estimate is intended to reflect individual units of work in the way it will be carried out.
Dealing With Escalation and Contingencies

Escalation and contingencies are cost factors that have not yet been identified when an estimate is prepared. All estimates, as estimates, potentially include escalation and contingency. These terms can be defined as follows:

Escalation is the inflationary cost growth anticipated between the time an estimate is prepared and the project bid is accepted. Pricing represents known costs at the time the estimate is prepared, and escalation is added to move the cost forward in time. This can be done in three ways:

1. Escalation that occurs during construction: For simplicity, 50 percent of the work is assumed to take place before the midpoint of construction and 50 percent after. Therefore, the cost estimate for construction is escalated to the midpoint to show what a potential bid might be. This is called a bid estimate.

2. Escalation that occurs from the time the estimate is calculated to a projected bid date: In order for an estimate to reflect a future bid date, the bid estimate would be escalated for the amount of time between the date of the bid estimate and the bid date.

3. Escalation calculated by the contractor and presented in a bid: Subcontractors preparing bids to submit to general contractors usually include escalation in their numbers and guarantee the numbers for a limited time. A contractor preparing a bid to present to the owner does the same.

Contingency is an allowance for work that is not completely defined when the construction estimate is made but is anticipated to be part of the project scope. Contingencies tend to be added as a single factor made up of several components:

- Design contingencies depend on the degree of completeness of the design when estimates are prepared and the degree of confidence the estimator has that the design will not change significantly.

- Estimating contingencies reflect the estimator’s confidence in the estimate. They can depend on the extent of design development at the time the estimate is prepared, but other factors may also affect the estimate, such as availability of materials, issues of site access/egress, and conditions of the work. The design and estimating contingencies are usually included together and generally approach zero as the documents are completed.

- Construction contingencies are intended to reflect cost increases that will occur after the construction contract has been awarded. These contingencies are meant to cover unknown site conditions, weather, and uncontrollable delays, as well as change orders due to inconsistencies/incompleteness in the construction documents.

- Owner’s contingencies are intended to cover the construction contingency but include an allowance for scope increases and owner-elected changes.

What are reasonable allowances for contingencies? There are no absolute standards, but experience teaches what figures are sensible. For example, a major architecture/engineering firm advocates using the following design/estimating contingencies:

- Program estimates: 10-15%
- Schematic cost estimates: 7.5-12.5%
- Design development estimates: 5-10%
- Construction documents estimates: 2-5%
- Pre-bid estimates: 0%
Understanding Value Analysis/Value Engineering

Value analysis (VA) is a cost optimization process that has been applied in numerous ways in the construction industry for more than 30 years, mostly under the term value engineering. The concept is also a problem-solving process, and when applied correctly to a problem can have excellent results. It is this aspect of the process that has led to the use of the term value analysis rather than value engineering. Unfortunately, VA has often been employed instead as a last minute cost reduction process, resulting in significantly reduced value for the owner.

The application of VA is not difficult but does require patience, concentration, and a certain amount of discipline. For best results, all parties involved must agree on the objectives and be willing to work toward common goals. When properly used, VA can be a useful tool for general problem-solving, cost optimization, and value enhancement.

Understanding Life-Cycle Costing

Life-cycle costing (LCC) is an economic assessment expressed in terms of equivalent costs. It is used to evaluate the significant costs of ownership over the life of a product, assembly, system, or facility and to compare the costs of various options.

Life-Cycle Costing Principles

In LCC analyses, both present and future costs need to be taken into account and related to one another. Today’s dollar is not equal to tomorrow’s dollar. Money invested in any form earns, or has the capacity to earn, interest. For example, $100 invested at 10 percent annual interest, compounded annually, will grow to $673 in 20 years. In other words, it can be said that $100 today is equivalent to $673 in 20 years time, providing the money is invested at the rate of 10 percent per year.

The terms “interest rate” and “discount rate” are generally used synonymously, and refer to the annual growth rate for the time value of money. The discount rate can be derived from the minimum acceptable rate of return for the client for investment purposes or from the current prime borrowing rate of interest.

Inflation also affects an economic analysis because its ability to reduce purchasing power over time must be factored in. This effect, more correctly termed “deflation,” means that more currency in the future will be required to purchase the same goods. Some costs may exceed inflation. For example, energy costs have tended to increase at a rate 1-2 percent above inflation over the last 10 years. Thus, future energy costs need to be inflated differentially (above the general inflation rate) by 1-2 percent. This is referred to in life-cycle cost analyses as escalation.

Life-Cycle Cost Analysis Period

The period used in comparing design alternatives is an important consideration. Generally, 25 to 40 years is long enough to predict future costs for economic purposes and to capture most significant costs, since 90 percent of the total equivalent cost is consumed in the first 25 years.

More information about value analysis can be found in topic 12.11 Value Analysis in The Architect’s Handbook of Professional Practice, 14th Edition.

(at a 10 percent discount rate). Consideration of periods longer than 40 years generally add no significant benefit to the analysis.

A time frame must also be assigned to each system under analysis. The useful life of each system, component, or item under study may be its physical, technological, or economic life. The useful life of any item depends on such things as the frequency with which it is used, its age when acquired, the policy for repairs and replacements, and the climate in which it is used. Component replacement may be scheduled several times in an overall facility cycle.

Categories of Cost
Typical facility costs for the owner over the life of a building can be subdivided as follows:

1. Initial costs
   • Construction
   • Fees
   • Other initial costs
2. Future facility one-time costs
   • Replacements
   • Alterations
   • Salvage
   • Other one-time costs
3. Future facility annual costs
   • Operations
   • Maintenance
   • Financing
   • Taxes
   • Insurance
   • Security
   • Other annual costs
4. Functional use costs
   • Staffing
   • Materials
   • Denial of use
   • Other functional use costs

Life-Cycle Costing Methods
Life-cycle costing requires adjustment of costs to a common point of time. Generally, one of two economic methods can be used. Costs may be converted into today’s cost by the present worth method, or they may be converted to an annual series of payments by the annualized method. Either approach will allow accurate comparison of construction alternatives.
Present Worth Method
The present worth method requires conversion of all present and future expenditures to a baseline of today’s cost. Initial (present) costs are already expressed in present worth. Future costs are converted to present value by applying the factors presented previously.

Annualized Method
The annualized method converts initial, recurring, and nonrecurring costs to an annual series of payments and may be used to express all life-cycle costs as an annual expenditure. Home mortgage payments are an example of this procedure; that is, a buyer opts to purchase a home for $1,050 a month (360 equal monthly payments at 10 percent yearly interest) rather than paying $150,000 all at once.

Other Economic Analysis Methods
Other methods of economic analysis can be used in a life-cycle study, depending on the client’s requirements and special needs. With additional rules and mechanics, it is possible to perform a sensitivity analysis, determine the payback period, establish a break-even point between alternatives, determine the rate of return and extra-investment and rate-of-return alternatives, perform a cash flow analysis, and review the benefits and costs of using different products, materials, and assemblies.

All life-cycle costing methods, correctly applied, will yield results pointing to the same conclusion—selection of the alternative with superior economic performance. Since the construction industry is capital cost intensive, however, the present worth method is recommended. In addition, this method tends to be easier to use and to produce easily understood results.

Integrating Building Cost Analysis Into The Design Process
Detailed cost estimating, value analysis, and life-cycle costing are all useful tools and are all services beyond the basic requirements specified in AIA Document B101™. Building cost analysis is the application of these tools within the overall design process. The objective of building cost analysis is to maintain balance and alignment between scope, user/owner expectations, and budget, both from the outset and over time in a way that makes clear the cost consequences of decisions.

The building cost analysis process has several key steps:

1. **Prepare a realistic budget.** Prepare a budget that properly reflects scope and expectations. This is the first and perhaps most important step in the process. The budget can be prepared using an estimating technique appropriate to the information available but, at least, it should have budgets for each discipline. In this way, the budget becomes a “cost model” for the facility. Adequate reserves for escalation, contingencies, and risk must also be included.

2. **Subject decision-making to ongoing cost input.** Design decisions should be reviewed for cost implications as decisions are made. This requires provision of cost input on an ongoing basis.
3. **Prepare comprehensive milestone estimates.** Periodic cost estimates, at a minimum, should be prepared at the conclusion of each major phase of the project and reviewed by all disciplines to ensure completeness and proper consideration of competition and market costs. Historical cost analysis and benchmarking can provide an additional measure of justification for the estimates.

4. **Focus on cost drivers.** Details are important, but focus on the key cost drivers associated with each discipline. The effort involves a balancing process and the recognition that to achieve overall cost targets trade-offs and adjustments between disciplines will be necessary.

5. **Revise design/objectives as necessary to maintain budget.** If the estimate, as well as a reasoned analysis of it, indicates budget problems, it will be necessary to revise the design itself and possibly the design objectives to maintain the budget. After any necessary adjustments have been made, the “cost model” should be revised to reflect redistribution and reassessment of the budget assigned to each discipline along with revised contingencies. This process continues to the next milestone and becomes progressively more detailed in each phase of design.

6. **Use value analysis as a cost management tool.** VA can be used as an optimization tool and a means of balancing competing design issues without compromising critical aspects of the design. VA focus should narrow as the design develops, adjusting from conceptual issues to details, materials, and systems.

7. **Maintain sensitivity to life-cycle costs and sustainability.** Life-cycle costing is a recognized method for objectively comparing alternatives during design development and is an important component of ongoing cost advice. Issues of energy efficiency, sustainability, and reliability require an organized approach and a proper economics-based analysis tool that can inform project decision-making.

8. **Learn from the process.** Last but not least, learn from the process. Gather and maintain information from past projects to use as input for current projects, and learn from the experience of others.

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Written by Michael D. Dell’Isola, PE, CVS, FRICS

Michael D. Dell’Isola is a senior vice president of the Orlando, Florida, office of Faithful+Gould. He has 30 years of experience in cost control, value engineering, technical facilitation and partnering, life-cycle costing, and project management.
Differences in the Cost of One-Story Versus Two-Story Schools

Supplemental Experience for eight (8) Core IDP Hours

In this scenario, your firm is experienced in designing elementary and middle schools. A key client from a local school system asks for help preparing for an upcoming school board meeting. There are several new elementary schools planned and their approach has always been based on a single story design. However, one of the school board members who is a developer of apartment buildings claims that two-story construction could save money. Your client asks you for assistance in clarifying the costs of one-story versus two-story construction for elementary schools.

Activity - Core

Solicit assistance from mentors or those in your firm experienced with school construction. Review the potential differences between one-story and two-story construction for the following:

• Site and site work
• Foundation
• Structural
• Roof construction and roofing
• Circulation square footage
• Vertical transportation
• Plumbing piping
• Air distribution
• Emergency power/backup
• Building security
• Building operations
• Child safety

Prepare a brief report that addresses the issues and compares the relative cost of two-story and one-story construction.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Preparing a Market Survey

Supplemental Experience for eight (8) Elective IDP Hours

For this activity, prepare a market survey of the local area.

A market survey explores the factors influencing construction costs in a location. Pertinent data can be gathered by interviewing local firms having knowledge of the construction activity in your area.

It will be necessary to contact firms/organizations in your area. Possible sources include: general and subcontractors, contractors and builders associations, local government officials, other architectural and engineering firms, builders’ exchange and construction-reporting firms, and bankers and commercial mortgage firms. Talk with your IDP supervisor or mentor about contacts they can provide to you.

Activity - Elective

Conduct a (partial) market survey. Select from the following list and address two or three categories:

- Availability of major materials to be in the project
- Capability of local fabricators, precast yards, concrete plants, etc.
- Availability of labor crafts necessary for the project
- Availability of special erection equipment
- Anticipated capacity of local contractors during bidding period
- Special conditions that might influence bidding
- Local escalation experience
- Site accessibility

Prepare a written report that includes:

- Who was contacted.
- Where they are located.
- When contact was made.
- Why they were contacted.
- What information was obtained.
- A summary assessment with specific recommendations.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
In this scenario, your firm is designing a headquarters for a company with 400 employees. The company’s master plan called for two, two-story buildings: each 50,000 GSF at a construction cost of $12,500,000.

Activity - Elective

The owner’s facility department is recommending the buildings be combined into one. Write a brief narrative answering the following questions:

- Will the single building be larger or smaller in total gross area?
- Will the single building be more or less costly?
- Are there other impacts on the building’s function?

The owner’s facility staff based their construction budget ($25,000,000 total) on expectations of a competitive market with 6-8 prime bidders and 3-4 subcontractors per trade. It is now apparent that the marketplace is much less competitive with 2-3 prime bidders and maybe, 1-2 subcontractors per trade. What is your suggestion for a revised construction budget considering this level of competition?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Initial Budget for a High School
*Supplemental Experience for eight (8) Elective IDP Hours*

Your firm has been selected to design a new high school. The school system has not constructed a new high school in many years and has requested that you prepare a preliminary budget.

They provided following program:

<table>
<thead>
<tr>
<th>Program</th>
<th>SF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classrooms</td>
<td>50,000 SF</td>
</tr>
<tr>
<td>Laboratories</td>
<td>8,000 SF</td>
</tr>
<tr>
<td>Gymnasium</td>
<td>12,000 SF</td>
</tr>
<tr>
<td>Auditorium</td>
<td>11,000 SF</td>
</tr>
</tbody>
</table>

The following provides a basis of budgeting (benchmark current year) using program spaces and overall building core and shell.

<table>
<thead>
<tr>
<th>Space Type</th>
<th>Unit Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF of Core &amp; Shell</td>
<td>x $</td>
</tr>
<tr>
<td>SF of Classrooms</td>
<td>x $</td>
</tr>
<tr>
<td>SF of Laboratories</td>
<td>x $</td>
</tr>
<tr>
<td>SF of Gymnasium</td>
<td>x $</td>
</tr>
<tr>
<td>SF of Auditorium</td>
<td>x $</td>
</tr>
</tbody>
</table>

**Activity - Elective**

Please reference the following source:
- RSMeans, Reed Construction Data, Inc.

Research the cost per square foot listed above by consulting RSMeans. Once all costs are known, prepare a draft budget using the revised unit costs.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
The Price of Sustainable Design
Supplemental Experience for eight (8) Elective IDP Hours

In this activity, you will assess the cost associated with sustainable initiatives, examine the benefits and seek to justify the expenditure.

In this scenario, Mr. Smith, the owner of a small retail store, has approached you to design a new location for his growing enterprise. The client does not have a large budget, and doubling his inventory and sales space to two locations is a risky venture for his small business. Your firm has a reputation in the local community for sustainable design. This client is not familiar with the LEED rating system but is receptive to improving sustainability and heard about your work when you won an AIA green design award last year. You believe that seeking a LEED rating for the project is a good idea and will benefit the owner. Achieving this rating may increase the cost of the project by approximately 3-5 percent.

Activity - Elective

Consider how to justify this additional expenditure to your client:
- Outline four sustainability changes to include in the project that would have modest cost but significant impact.
- Estimate the initial cost premiums associated the changes.
- Use life-cycle costing and value analysis to determine whether the higher LEED rating is actually cost-effective in the long run.
- Estimate the benefits of the sustainability changes to the design in both economic and non-economic terms.

With the data you find, write a brief memo to the client justifying this additional expenditure.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Initial Budget Overrun

*Supplemental Experience for eight (8) Elective IDP Hours*

In this scenario, your practice is invited in January to submit to a commercial client an expression of interest to build a 275,000 GSF distribution facility. The owner has stated that the approximate budget for construction is $10M. You respond and are short-listed. You are invited to an interview at which you submit a fee proposal based on a general description of the facility and its scope provided by the owner.

To prepare your submittal and calculate your fees, you estimate that the construction and site work will cost approximately $9.7 million, which correlates well to the owner’s budget. A week after the interviews, you receive the good news that you have been selected to design the project (see Exhibit 1C-1).

You complete an intensive two-week evaluation of the client's program and requirements, as requested by the client, and submit a pre-contract evaluation report. Working closely with a professional cost consultant, you conclude that the scope, performance, and quality requirements reflected in the program you developed will require a budget of $13.5 million. This includes the fact that your analysis indicates the facility will exceed 300,000 GSF. You are scheduled to meet with the client to discuss and defend your report and recommend actions.

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**Activity - Elective**

Prepare an outline agenda for the meeting. Consider the following questions:

- The client said a budget of $10 million was based on a previous project constructed about five years ago that the owner claims was similar to the current project.
- How will you defend projection of scope, quality and resulting estimate, while convincing the client your work is accurate?
- How do you explain it may not be affordable?
- The owner has expressed concern over the schedule. If the design phase takes longer than the client expected, how will you respond?
- What are the next steps you will recommend to the client?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Office Building Costs

**Supplemental Experience for eight (8) Elective IDP Hours**

In this scenario, your architectural practice has been retained to prepare the design for a headquarters building of a small regional textile company, which has outgrown its administrative space that is currently attached to one of the company’s plants. The gross floor area is 50,000 SF, on a single floor.

No budget has been set for the project. You proceed to develop a two-story conceptual design and prepare a cost estimate that predicts a construction cost of $8,000,000.

You meet with the company president and the reaction to your cost estimate is immediate and it is clear their company expected to spend less. The president focuses on the cost per square foot ($160.00). A board member contends that their company has just built an office building and it only cost $120.00 per square foot.

The president knows very little about design and construction. Decide how to explain why office buildings can vary a great deal in cost.

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**Activity - Elective**

Talk with colleagues experienced in office building design. Develop an outline presentation to the owner including:

- What are the major variables that affect the cost of office buildings?
- What are the assumptions on design approach, quality and other features that would be consistent with a $160/SF office facility? With a $120/SF office facility?
- Compare and contrast the above cost per square foot.
- How would you convince the owner to spend more money?
- If the owner remained fixed on $120/SF for the building, how would you proceed?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
ACME MANUFACTURING COMPANY

21 January 2008

Jones & Jones Architects
1021 Z Street
Washington, DC 20020

East Coast Distribution Facility, Baltimore, MD

Dear Sirs:

I am pleased to inform you that our Evaluation Committee has selected your firm as architect/engineers for this facility.

Prior to us entering into a contract for complete design and supervision, you are authorized to proceed with a pre-contract evaluation report of our proposed building program and user requirements, with particular concentration on cost and schedule. You should note that the company has established a budget for construction of $10.0million (hard and soft costs) and wishes to put the facility into complete operation before the end of 2009.

My staff is available to assist you in providing any information required, and we will be pleased to receive your report on or before February 14, 2008.

You are authorized to proceed on a time and material basis not to exceed $20,000.00.

We look forward to a long and rewarding association with your company on this project.

Yours sincerely,

Ralph Smith
Director of Facilities
# Planning & Zoning Regulations

## introduction

<table>
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<th>Activities - Core*</th>
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<tbody>
<tr>
<td>Same Floor Plans, Different Codes</td>
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<tr>
<td>ADA Compliance Checklist</td>
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</table>

*Maximum of 40 hours of core credit may be earned in this experience area.

## exhibits

### narrative

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<th>Activities - Elective</th>
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<tbody>
<tr>
<td>Egress Systems</td>
</tr>
<tr>
<td>Complex Zoning</td>
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</table>
Planning & Zoning Regulations

Introduction

By completing the activities in this chapter, you will gain an understanding of the activities involved in planning and zoning regulations. The following information is taken from the NCARB IDP Guidelines:

Planning and Zoning Regulations
Minimum Planning and Zoning Regulations Experience: 60 Hours
Definition: Evaluate, reconcile, and coordinate applicable regulatory requirements and professional design standards.

Tasks
At the completion of your internship, you should be able to:
• Identify requirements of regulatory agencies
• Prepare and present submittals for governmental approval

Knowledge Of/Skill In
• Government and regulatory requirements (e.g., zoning, planning, design review)
• Permit and approval processes
• Building codes, zoning codes, and ordinances
• Accessibility laws, codes, and guidelines
• Specialty codes and regulations (e.g., seismic, life safety, fair housing, historic preservation, energy)
• Universal design (environments usable by everyone regardless of limitations)
• Designing and delivering presentations

resources

Download the current Intern Development Program (IDP) guidelines at www.ncarb.org/Experience-Through-Internships.aspx.

• Chapter 15 - Building Codes and Regulations

• Chapter 15.4 - Building Codes and Regulations
• Chapter 17.5 - Zoning Process Assistance

• Chapter 10 - Building Codes and Regulations
Narrative

The practice of architecture, the rules of conduct of our professional societies, and the licensing laws of states and other jurisdictions all require protection of the public health, safety, and welfare. The AIA Code of Ethics and Professional Conduct Canon 1: General Obligations, Rule 1.101 states that, “In practicing architecture, members shall demonstrate a consistent pattern of reasonable care and competence, and shall apply the technical knowledge and skill which is ordinarily applied by architects of good standing practicing in the same locality.” In addition, under Canon III: Obligations to the Client, Rule 3.101 states the following: “In performing professional services, members shall take into account applicable laws and regulations. Members may rely on the advice of other qualified persons as to the intent and meaning of such regulations.”

Similarly, the NCARB Ethics and Professional Rules of Conduct state: “In designing a project, an architect shall take into account all applicable state and municipal building laws and regulations. While an architect may rely on the advice of other professionals (e.g., attorneys, engineers and other qualified persons) as to the intent and meaning of such regulations, once having obtained such advice, an architect shall not knowingly design a project in violation of such laws and regulations.”

Most, if not all, state licensing laws have rules prefaced with language such as, “In order to safeguard life, health, property and the public welfare...” As well, the International Code Council’s International Building Code begins, “The purpose of this code is to establish minimum requirements to safeguard the public health, safety and general welfare...”

The first step in complying with the charge to protect the public health, safety, and welfare is to gain a clear understanding of the intent and use of the building codes and other regulations applicable to the work of architects. This chapter of the Emerging Professional’s Companion offers readers a foundation for understanding and applying the codes and standards that influence a conventional architectural design.

Codes and Standards Differ

A building code is a set of regulations adopted by a jurisdiction to define the design, construction, and materials that may be used to construct buildings and facilities with the goal of protecting the health, safety, and welfare of the public. Codes generally are developed by nonprofit organizations through a process that brings interested and affected parties from the entire building community together in a public forum to determine the provisions of the code. In order to apply to construction in a particular location, the code must be adopted for that area by the pertinent legislative body (state legislature, city council, etc.). Compliance with the code is administered by the authority having jurisdiction (AHJ) in the area, which may vary according to building type. For instance, plans for hospitals often must be approved by the state health department, while plans for a residence are approved by the local planning and zoning department.

Notes

Take brief notes while reading the narrative and list key resources you used to complete the activities. Note discussion outcomes from meetings with your supervisor, mentor, or consultants. When finalizing the activity documentation (PDF), include your notes and the Emerging Professional’s Companion activity description.
While codes regulate what, where, and how buildings may be constructed, the standards referenced in them are intended to ensure that materials, engineering systems, and construction techniques meet safety requirements. A building code may refer to a variety of standards. For example, engineering standards relate to the design of a product and testing standards relate to methods of determining the performance of materials or assemblies. Standards cannot be applied to a project unless they have been adopted, usually by reference in the building code, by the jurisdiction where the project is located. Otherwise, standards are strictly “advisory in nature.”

When designing a project, it is important to remember that the contents of the building code are the minimum standards the project must comply with. Designing to these minimum standards is not only the ethical thing to do, it is required by law. Every member of the project team, from designer to project manager to drafter, must understand these minimum standards in order to meet the architecture profession’s licensing obligation to protect the public health, safety, and welfare.

**Prescriptive vs. Performance-Based Codes**

Most architectural projects can be fit into one or more of the “uses” defined in the building code, typically the International Building Code (IBC). However, a client may ask for a building design that simply does not fit the parameters of the code. This situation arises because the IBC and other building codes are “prescriptive” in nature. In other words, they prescribe what must be done for a building to be safely occupied for its intended purpose.

It may be difficult to make an unusual project (e.g., a casino building in Las Vegas) comply with the prescriptive measures of the IBC. In such a case, a performance code approach may better address relevant issues. To begin to address such situations, the IBC contains a section (104.11) that permits a designer to use “alternate materials, design, and methods of construction and equipment.” According to the International Building Code Commentary, the code “is not intended to inhibit innovative ideas or technological advances” unless the resulting design will be inherently unsafe. “The writers of a comprehensive regulatory document such as a building code,” the IBC Commentary continues, “cannot envision and then address all future innovations in the industry. As a result, a performance code must be applicable to and provide a basis for the approval of an increasing number of newly developed, innovative materials, systems, and methods for which no code text or referenced standards yet exists.” Section 104.11 of the IBC was taken and fully expanded into the International Performance Code.

The difference between a prescriptive code and a performance code is easily explained by using an ordinary automobile as an example. A prescriptive code would tell you that in order to stop an automobile traveling at 30 miles per hour on dry concrete pavement within 100 feet, you must install disc brakes with non-asbestos pads that are connected to all four wheels and simultaneously operate when you touch the brake pedal. A performance code simply identifies the task of stopping the same automobile, with all of the same parameters, in the same 100-foot distance, no matter what technological methods or procedures are used.
In the United States at this time, a performance code is viewed as a relatively new approach to protecting public safety. Therefore, some architects and authorities having jurisdiction (AHJs) are less comfortable designing to a performance standard. However, from a common sense point of view, the performance concept makes more sense than a prescriptive code.

**Design Begins With Code Analysis**

A code analysis is a systematic review and compilation of the specific provisions of the locally adopted building code that will affect the design and construction of a building or facility. It is one of the most important tasks during the course of any architectural project. An incomplete analysis can have serious implications on the degree to which a project meets the obligation to protect the public at the same time it achieves the architect’s design intent.

Codes are divided into many chapters defining minimum requirements for the design and construction of a building. The International Building Code (IBC) begins with a chapter devoted to the administrative and operational procedures adopted by jurisdictions to enforce the code.

In chapter 2 of the IBC, the majority of terms used in the code are defined. Definitions that are missing may be found in the chapters that pertain to the subjects you are researching. For example, the definition of “exit access” is not found in chapter 2 but in section 1002.1 of chapter 10, Means of Egress. The remaining chapters deal with subjects that are the technical “meat” of any code—the provisions that will govern the components or features of a design.

There are prescribed steps to follow in analyzing a code, but before we address those we will review some general rules every architect should keep in mind when working with building codes. Rule #1 requires your complete attention; it is the most important rule and may be the only one you need to remember. However, it is best to apply all of these rules to every project you design. In this chapter you will soon see that I caution you more than once about prudent use of building codes. Not only is this chapter intended to coach you in the use of codes; it is also intended to explain the pitfalls of applying codes halfheartedly.

**Rule #1: Do not memorize the code.**

The worst thing you can do is memorize what the codes say. Why? Because codes change. This is a good thing because codes are usually changed to reflect progress and technological advancement in the building industry.

The danger of committing codes to memory is the possibility that you will design to a code provision that has been changed, requiring costly “re-design” that risks budget, schedule, and client trust. Such errors, although unlikely, often are not discovered until bidding. The worst-case scenario is discovery during construction, when it is too late to alter the design.

You may become convinced you know what the code says, but don’t let that prevent you from reading the
code book every time you begin a new design. In addition, be sure to test your current design against your original code analysis as construction documents are being finalized. Relying upon your memory alone may mean missing something that was changed in the last code revision cycle or remembering a detail incorrectly.

The real danger is that a code error will affect your design in a way that is detrimental to both your in-house budget and the client’s construction budget. Your in-house budget may be exhausted, resulting in the redesign being done at a financial loss to your firm. Or, the cost of redesign to bring the project into code compliance may exceed the project budget, causing the project to be delayed or even cancelled. Either effect can be devastating.

As an example, the following is a true story involving the height of guardrails. Guardrails had been in the codes at the same height for years. The architect of a large two-story covered mall based the building design on a code that was no longer applicable. All of the guardrails that lined the second level of the open mall were of a custom design, rather than something taken from a manufacturer’s catalog. After the railing system had been installed, the building inspector issued a stop work order to halt construction of the building because the guardrails were too low. The AHJ refused to remove the stop work order, or “red tag,” jeopardizing the widely publicized grand opening of the project. Because the railing system was a custom design, retrofitting the installed railing did not appeal to the architects. They asked the owner to grant them time to redesign the guardrail system, which would delay the opening. With different priorities, the owner ordered the system retrofitted with anything that would ensure compliance with the height requirement and not endanger the opening date. For the architect, the result was a visual nightmare, but the project opened and was successful in the owner’s eye. The owner ultimately had the retrofitted system removed and replaced with a conventional system and sued the architect to recover the costs. All of that could have been avoided if the architect had checked the code provisions before creating the design and committing an inadequate design to the construction documents.

At this point you may ask why this was a problem for the architect. Why did the AHJ not identify the problem during the plan check? After all, the jurisdiction issued a building permit and surely that means the project, in its entirety, complies with the building code. WRONG! Codes contain a provision whereby the AHJ is immune from prosecution and another that says that nothing will forgive a violation of the code. The architect is the first interpreter of the building code, and some AHJs rely upon the architect’s seal to ensure a project complies with the code. After all, the architect is the person who sets the parameters of the design. Owners expect architects to design projects that will satisfy their program needs, and rely upon architects to produce projects that meet those needs, including compliance with all applicable rules, regulations, and standards. The AHJ is responsible for checking if the completed work of architects and builders complies with the rules and regulations the jurisdiction has adopted. Although AHJs review construction documents and inspect
Rule #2: Verify what codes will be applied to your design.

It is vital for architects to understand code implications before design work begins because the consequences of not designing to code are severe. Code compliance for each project is different, as it is based on building type and what has been adopted and enforced in the jurisdiction where the project will be constructed. Therefore, designers must make an exhaustive investigation of what codes, rules, and regulations will be applied to the design and construction of every project.

Do not just call the office of building inspection; rather, visit a responsible building official who can answer your questions. Before visiting the AHJ office, or even calling to make an appointment, prepare a list of questions that need to be answered before you begin the design process. Ask which building, mechanical, plumbing, fire, and electrical codes are being enforced by the jurisdiction, and ask whether any other codes or guidelines will be used to assess your project. In particular, find out which edition of each code the AHJ uses and whether there are any plans to switch to another code or edition; this information is critical, as significant changes can occur from one edition of a code to the next. Also ask whether the codes or other applicable documents have been modified in any way for local use or if they are enforced as they were published. This is important! Local officials may assume you know more about how they do business than you actually do; be sure to ask lots of questions.

Prudent designers not only ask the right building code questions, they also inquire as to any implications for their projects of other regulations, such as zoning ordinances, historic district ordinances, deed restrictions, or federal requirements, such as requirements of the Occupational Safety and Health Act, Environmental Protection Agency, Department of Energy, or Americans with Disabilities Act.

Rule #3: Review your design with the AHJ before you commit.

The person, or entity, that reviews your project documents for compliance with the applicable codes and standards has many names—the building official, the code official, the fire official, etc. No matter what their title, these officials are the authority having jurisdiction over your work, so we will generically refer to them as AHJs.

Before construction on your project can begin, the AHJ must issue a building permit. The issuance of a permit means your construction documents have been found in “general conformance” with the codes and standards enforced by the jurisdiction. In most locations, getting a building permit requires a very lengthy, labor-intensive process. To help move things along, a second visit to the AHJ (after the first visit discussed in Rule #2 above) is recommended to review the finalized schematic design. At that point, your code compliance investigation should be complete so you can explain to the AHJ how the codes will be applied in your design as illustrated in your construction documents. Make certain the AHJ understands your interpretation of the codes and agrees with it and how you will apply that interpretation.

One thing most architects do not understand is their role as the first, and often primary, interpreter of the codes. It is not the AHJs’ job to tell you how to apply the code. It is their job to confirm that your interpretation is correct and that you have correctly applied your interpretation to your construction documents. In view of the architect’s role, it is vital that you visit the AHJ when you have both an understanding of your design and of how the codes will affect it. Leave a copy of your code analysis with the AHJ and follow up with a letter that confirms your meeting, what was discussed, and any agreements or acknowledgments regarding interpretations of the code as applied to your project made by the AHJ.

It is prudent to visit the AHJ a third time when construction documents are near completion, just prior to submittal for permit review. Take a copy of the code analysis initially reviewed with the AHJ and the letter
confirming your prior meeting and its conclusions. Make certain the AHJ understands how you applied your analysis to the construction documents and how you have addressed each code issue. At this meeting you may ask how long it will take to get the building permit. Make certain the AHJ understands that these documents, when completed, will be the documents submitted for the building permit.

When is a Code Analysis Performed?
As mentioned above, it is a good idea to engage in more than one code analysis and review during the course of a project. The first is done before the design leaves the sketch paper and becomes an idea to be developed. At this point, some basic determinations have been made, such as general size, a general idea of materials, and proposed location on the site. The suitability of a site for a given use, building size, or location can quickly be determined through a preliminary code analysis. Since the feasibility of the basic project concept affects the overall cost of a project, it must be one of the first considerations.

As a project design develops beyond the sketch paper stage, a more detailed understanding of the code is required to ensure protection of those who occupy the building. The design team often develops a code analysis to be used at the transition between phases of a project and in discussions with building officials. Through a continual reference to this code analysis, unexpected surprises for the project design can be avoided.

What Does a Typical Code Analysis Encompass?
The code book itself can guide you through the steps recommended for completing a code analysis for your project; see the page titled “Effective Use of the Building Code.” Entire books are dedicated to this process and a copy of one of them may assist you.

The process recommended by each author will take you through issues regarding the use and size of a proposed project. Following are brief discussions of the issues that are most significant as you begin the design process.

Occupancy Classification
Select the category in chapter 3 of the International Building Code that describes the use or uses intended for the building you are designing. Most of the occupancy classifications are self-explanatory; for example, theaters are Assembly Occupancies (“A”). Select the appropriate occupancy based upon the features of your theater. If you are designing a multifamily dwelling, the occupancy classification will be found in the residential (“R”) classifications. However, and don’t let this confuse you, if you are designing a single-family dwelling you will not find your project in the IBC. Instead, if the local jurisdiction has adopted it you are likely to be using the International Residential Code, which also covers townhouses that do not exceed three stories in height. This is an instance in which Rule #2 is vital; confirm which code applies to single-family houses in the jurisdiction where the structure will be built.
Some projects will have more than one use and be classified as “mixed use” occupancy. This usually (not always) means the project will require the use of “separation walls” to divide the building into one or more separate “buildings” as defined by the code. The IBC, for example, reads, “Structures or portions of structures shall be classified with respect to occupancy in one or more of the groups listed. Where a structure is proposed for a purpose which is not specifically provided for in the code, such structure shall be classified in the group which the occupancy most nearly resembles, according to the fire safety and relative hazard involved.” In other words, the “hazards” contemplated by the occupancy groupings are broadly divided into those related to people and those related to contents. People-related hazards include number and density of occupants, their age or mobility, and their awareness of surrounding conditions. Content-related hazards include storage and use of hazardous materials, as well as the presence of large quantities of combustible materials.

Analysis of the occupancy classification, construction type, and height and area limitations must be carried out simultaneously. These three factors together make up the basic code compliance package, as well as the basic parameters of a project design. If they are not resolved in the early design stages of a project, they will have serious implications for the success of your project.

Construction Type
Your design may depend in some ways on a construction type, such as steel-frame, wood-frame, brick, or masonry construction. However, the code may limit the use of some building materials, possibly making it difficult to accomplish your design. Requirements for building height, area, and fire ratings depend on the type of construction chosen for a project. Construction type also influences construction costs, as costs rise in tandem with fire resistance and structural performance.

Height and Area Limitations
Buildings are permitted to be a certain height or area based on the materials used to build them. Determining height and area limitations for a project is one of the most important parts of a code analysis, and may be confusing if not carefully considered. See the accompanying information, “Applying the Height and Area Table of the International Building Code,” for more details about this topic.

Location on the Property
Determining where a project can be located on the site is another vital part of the code analysis. The location of the building relative to the property lines, which is determined by zoning regulations, will dictate much about the design of a building’s exterior walls. Placement of window or other wall openings, projections, and fire ratings of exterior walls are all defined by codes.

Fire Suppression Requirements
To determine whether your project must be fitted with a fire suppression system, carefully read the relevant portion of the applicable building code (chapter 9 in the IBC). You may choose to install an automatic fire sprinkler system required because of the building’s occupancy class or other code requirements to gain more height or area for your building.
Applying the Height and Area Table of the International Building Code

Table 503 of the 2003 edition of the International Building Code (IBC) —the height and area table— is used to establish the fire risk of a building. The fire-hazard level of different use groups (determined by fire load and/or occupant load) is weighed against the fire load and fire-resistive protections of a building construction type. The IBC makes certain assumptions regarding these two factors to determine the heights and areas shown in the table.

In addition to the type of construction, two other factors increase or decrease the fire hazard of a building: the proximity of adjoining structures and the fire suppression systems used. Equation 5-1 in the IBC is used to calculate increases in the allowable areas shown in table 503 due to these additional factors and to determine the largest single-floor area for a particular building. (See section 502 for the definition of “building area” to determine how to apply this figure.)

**Equation 5-1:**

\[ A_a = A_t + \left[ \frac{A_t I_f}{100} \right] + \left[ \frac{A_t I_s}{100} \right] \]

where:

- \( A_a \) = allowable area per floor (sq. ft.)
- \( A_t \) = tabular area per floor in accordance with table 503 (sq. ft.)
- \( I_f \) = area increase permitted due to frontage (%) as calculated in accordance with section 506.2
- \( I_s \) = area increase permitted due to sprinkler protection (%) as calculated in accordance with section 506.3

Before you can use equation 5-1, the frontage or open space allowance must be calculated using equation 5-2. An increase in the tabular area of a building is permitted when more than 25 percent of the total building perimeter is open to a public way (street), or when other open space on the same lot or equivalent open space is dedicated for public use with access to a street or approved fire lane. This access must provide fire service access to the structure, provide safety for evacuees, and reduce exposure of the new structure to and from adjacent buildings. Any space other than a public way must be at least 20 feet wide to qualify as open frontage. Note that the maximum value of \( I_f \) is 75 percent.

**Equation 5-2:**

\[ I_f = 100 + \left[ \frac{F - 0.25}{P - 0.25} \right] \frac{W}{30} \]

where:

- \( I_f \) = area increase permitted due to frontage (%)
- \( F \) = building perimeter that fronts on a public way or open space having 20 ft. open minimum width
- \( P \) = perimeter of entire building
- \( W \) = minimum width of public way or open space

Continued on page 101
Several conditions apply to the use of equation 5-2:

1. W is the minimum width of a public way or open space around a building for purposes of this equation. Therefore, the minimum value for W is 20. If the space is less than 20 feet in width, that portion of the perimeter does not qualify as open perimeter in determining the value of F.

2. Section 506.2.1 limits the value of W/30 to 1, making the practicable maximum value of W 30 regardless of the actual width available. The exception for unlimited-area buildings does not apply here because this equation is used to determine maximum areas permitted. The equation does apply to unlimited-area buildings when it is used elsewhere to determine the fire-resistive-rating requirement of an exterior wall.

3. In determining the value of P, the perimeter of any interior court must be included.

4. The value of F cannot include the perimeter of an interior court because that space is not accessible from the public way (see item 5 below).

5. Open frontage perimeter that is not accessible from a public way cannot be included in determining the value of F. For example, an open backyard may not be included if the access is only through side yards, neither of which is at least 20 feet in width.

None of the above is intended to require a building to have a minimum perimeter of 25 percent open to a public way or open space. This is only the minimum required to apply area modification equation 5-2. The second part of equation 5-1 is simpler to calculate. When a building is equipped throughout with an automatic sprinkler system designed and installed in accordance with referenced standard NFPA 13 as stipulated in section 903.3.1.1 or exceptions thereto, the area of table 503 is permitted to increase by 300 percent for single-story buildings or 200 percent for multistory buildings.

The maximum allowable area determined by using equation 5-1 is restricted in several ways. First, it is applied to the horizontal projection of the building (see the definition of “building area” in section 502) per floor to a maximum of three stories (section 503.3). Therefore, the maximum total area of a building is three times the maximum allowable area calculated by Equation 5-1. In buildings greater than three stories, this area must be distributed throughout (not necessarily equally), with no floor greater than the value calculated in equation 5-1. Note that the height modification provisions of section 504 do not change the three-story limit.

The other application restriction affects basements. When a single-story basement is not above grade (see definitions in Section 502), the basement is not included in the calculation of the total building area. Its area is, however, limited to the maximum allowable area for a single story as determined by equation 5-1. This permits a single-story basement that has a larger area than the stories above, particularly if the building exceeds three stories.

If there are multiple basement stories, only one is exempt from the total building area calculation, and the exempted basement area is still limited as noted above. The other basement stories are included in the total building area.

Written by Jerry R. Tepe, FAIA
In addition to checking the code, it is very important to check with the authority having jurisdiction to determine if a “sprinkler ordinance” has been enacted locally. Many jurisdictions have such ordinances, which are generally more restrictive (e.g., requiring installation of sprinklers when not otherwise indicated) than the provisions of the International Building Code or the International Fire Code. Because sprinkler protection is becoming a more widespread requirement, it is best to design a project as though a sprinkler system is required until you find out otherwise. Integrating sprinklers from the outset of design, using the standards that regulate their placement, can prevent interference with your design intent if sprinklers have to be added later.

Means of Egress

Because of its direct effect on public safety, the means of egress from a building—both everyday use and panic mode—demands careful review of the applicable building code. The occupant load for a building or portion(s) of a building is specified in the building code to determine the size and type of egress system required. These requirements have a great effect on the building design, making a careful check of the code doubly important.

The first step in designing an exiting system is to determine the occupant load of the building. This calculation specifies the maximum number of persons who may, according to the code, occupy a building, or a portion of it, at any one time. Certain occupancy classifications have special exit system requirements. The minimum number of occupants any exit must accommodate is established by the largest number of occupants calculated for a room or building floor. (The relevant portion of the IBC is sections 1003.2.2.1 through 1003.2.2.3.) The width of corridors, exit doors, and exit stairs is derived using formulas in the code after the occupant load has been determined for each room and floor in the building.

Accessibility

Accessibility has been a design consideration since 1958, when President Dwight D. Eisenhower created the President’s Committee for the Physically Handicapped. At that time, the American Standards Association (now NSI) was asked to develop “accessibility specifications” that would set the basis for designing buildings and facilities for access by the disabled. The resulting document has evolved into today’s standard for providing access to all sites and structures and the Americans with Disabilities Act Accessibility Guidelines.

Today, accessibility is mandated by federal, state, and local laws. Basically, everything you design is required to be accessible to disabled individuals. There are some exceptions, but they are limited. You must do careful code research if you feel a project is not required to follow accessible guidelines.

Coordinating the Work of Others

Architects often employ consultants to assist in designing a project. Architects do not perform the technical work of their consultants; rather, they coordinate that work with their architectural work. Look at it this way: The buildings you design are like a human being. Each building has a skin and “bones” (the structural system) and a “brain” (the M/E/P systems) that
GIVEN: Two-story office building
Type IIB construction
Fully sprinklered
Yards and streets as shown

DETERMINE: Maximum allowable area per floor \( A_a \)

\[
A_a = A_t + \left[ \frac{A_t I_f}{100} \right] + \left[ \frac{A_t I_s}{100} \right]
\]

\( A_t = 23,000 \text{ sq. ft. (Table 503)} \)

\[
I_f = 100 + \left[ \frac{220}{320} - 0.25 \right] \frac{25}{30} = 100 [0.69 - 0.25] 0.83 = 37\%
\]

\( I_s = 200\% \) (multistory building)

\[
A_a = 23,000 + \left[ \frac{23,000(37)}{100} \right] + \left[ \frac{23,000(200)}{100} \right]
\]

\[
= 23,000 + 8510 + 46,000 = 77,510\text{ sq. ft. per floor (155,020 sq. ft. for building)}
\]
go inside the skin. If the internal parts do not fit within the skin, then the design and the designer have failed the client. Therefore, while the architect may not be required to actually perform a code analysis for their consultants, they must coordinate and make certain the consultants’ work has been performed so nothing about their work will adversely affect the project.

As an example of the importance of coordinating engineered systems designs with the architect’s design, consider this: If the corridor walls and ceilings require a certain fire resistance rating, all of the ductwork that penetrates the walls and ceilings can be required to have “fire dampers” installed. Leaving these dampers out of a set of bid documents can add significant cost to a project in the form of a change order.

Accessibility Upfront

Accessibility standards for buildings and facilities are mandated by several laws, including the Americans with Disabilities Act (ADA), the Architectural Barriers Act (ABA), HUD and the Fair Housing Act, and, often, by one or more state or local building codes. Any one, or all, of these may be applicable to a single project. Today these requirements more than ever before affect a great many building features, components, and fixtures. They can also affect fundamental aspects of building design, including size and configuration of rooms, location of doors, and systems for vertical movement.

Accessibility standards and guidelines include, among others, the ADA Accessibility Guidelines (ADAAG), the Fair Housing Act Accessibility Guidelines (FHAG), the Uniform Federal Accessibility Standards (UFAS), ANSI A117.1, and the ICC International Building Code (IBC). In addition, many states have accessibility laws, some with their own unique provisions. Although much effort goes into making federal guidelines and model codes technically consistent, and many states and local jurisdictions adopt the model standards, differences remain. The U.S. Access Board has developed federal accessibility guidelines for children’s facilities and for recreation facilities such as fishing piers, boating facilities, miniature and full-size golf courses, exercise facilities, swimming pools, and playground surfaces and play equipment. While these guidelines have not yet been incorporated into federal law, they have been published and are readily available so they may be considered to serve as a standard of care for architectural design. The Access Board is also working on guidelines for public rights-of-way, passenger vessels, and outdoor developed areas.

Careful investigation of applicable codes, standards, and guidelines early in the design process is essential to minimize exposure to litigation and prevent the inconvenience and additional time and expense of redesigning and revising plans and specifications for compliance. The later changes occur in the design process, the greater the consequences. Certainly, integration of accessibility standards into a design should be accomplished before construction documents are prepared so that changes are less costly and take less time.

One way to ensure accessibility requirements are incorporated in every project is to adopt mainstreaming, an approach that has emerged in the development of accessibility standards. This concept involves incorporating accessibility compliance as an integral part of the design process, rather than an activity that is carried out separately. For example, the minimum clear width of 32 inches the model code requires for doors to accommodate people with disabilities would be incorporated in the chapter on means of egress, rather than in a separate accessibility requirement. Placing a provision that accommodates the disabled in the main text of a code is referred to as mainstreaming. Architects can similarly mainstream accessibility considerations into their design process. There are already enough issues that can complicate a design project; if accessibility considerations are main streamed, chances are accessibility compliance will not be one of them.

Written by Ken Schoonover, PE
A Code Research Example
This section will guide you through the development of a building code program, also referred to as a code analysis’’ for a hypothetical library project.

The Scenario
The project is intended to create an underground and above ground addition to a historic library structure at a major state university in western Pennsylvania. Additional space is needed to house the university’s growing book collection and to meet the need for private group study spaces and conference spaces both large and small. State-of-the-art technology for video conferencing and multimedia presentations must be accommodated. In addition, the project includes structural repair and total renovation of the M/E/P systems of the existing building.

The programmed intent of the client is for the addition to be a stand-alone building connected to the existing library with a lobby or similar element in order to exempt the existing building from compliance with the new code. Your firm would prefer to build the addition adjacent to, but not physically connected to, the existing building. This decision has important code implications in that if the addition is a totally separate building it must comply with all provisions of the 2000 International Building Code.

The renovation work that will be undertaken in the existing library building, on the other hand, need not fully comply with the IBC as long as the renovation work does not cause the building to become unsafe. This situation exists because of a practice called “grandfathering,” in which existing buildings are permitted to adhere to the provisions of prior editions of the code. The code does not address grandfathering, except by allowing an existing building to remain in its “original condition” if renovation work will not make it unsafe. The premise is that you must consider an existing building was safe when it was constructed and first occupied. If nothing has happened to appreciably change the building, it can remain as built even though it may not fully comply with the current edition of the building code.

Clarifying the Client’s Expectations
The scenario just described is a picture near the beginning of project delivery, and a lot of questions must be asked and answered before your firm can go forward with a design. Following are some questions you may need the client to answer in order to understand the project.

Q. Since this is an addition to an existing facility, do you want us to use the same interior and exterior materials in the new building? (This should not matter to the designer, but it is important to the code reviewer and the specification writers because it relates to the fire ratings assigned to construction assemblies by the code.)

A. The campus has an overall architectural style that includes the use of brick and cast stone on the exterior of buildings throughout the campus. We would like you to use the same materials in this new structure.
Q. How big should the addition be? (The designers will set the size of the floor plates and the height of the addition, and these dimensions are based on the needs of the project as determined during programming. Nonetheless, it is useful to know if a client has some ideas about size when you are researching the height and area tables and assigning construction types and assemblies to be studied during the code analysis.

A. The building program, developed by the university, has set the square footage required to house the book collection (allowing for future expansion) at 250,000 square feet. This does not include the square footage desired for meeting, study, and conference rooms, nor that needed for the building support functions. (The actual area of the building will not be known until the designers have completed their work.)

Q. Will the new design allow free pedestrian movement between the two buildings, or will there need to be a definite fire-resistant separation between the two? This is an important code issue.

A. This is strictly a design consideration and the architect is free to create the connection in a manner he or she considers the least damaging or imposing in relation to the existing historic façade.

Q. Will the new building’s mechanical and electrical systems support the existing building or will the old systems be totally revamped as stand-alone systems?

A. The systems in the existing building are to be removed and replaced with services that will be housed in the new building. This arrangement is desirable because of the water damage the old systems caused to the historic structure.

Q. Can we use conventional fire suppression systems, or must there be some systems that do not rely on water for fire suppression? Is there a requirement to use both water and waterless systems?

A. The university wants to make use of both types of fire suppression systems. As the project develops, the university staff will work with the architects and consultants to determine which portions of the building will have which system.

Q. To what extent are openings in the exterior envelope desired by the university?

A. This will be both a design consideration and a function of the building’s relationship to other existing buildings. The book stacks are to be located on the interior of the building and arranged so that direct...
sunlight does not reach the books. If the overall building design is enhanced by windows (or skylights), the architect must consider how these openings will affect the function of the spaces they are in, how to deal with any excessive energy losses, and what fire protection may be necessary because of the close proximity of other buildings.

Q. What types of conveyance systems are anticipated? Will open shafts house escalators, or will the conveyance systems be conventional elevators?

A. Again, this is a design issue and not specified by the building program. However, the university staff has not envisioned anything other than elevators. If the architect contemplates escalators or other people movers, those decisions will be made in the design presentation process.

Executing a Building Code Analysis
The AIA standard forms of agreement and the conditions of the contract for construction set out the responsibilities of all the parties involved in a project. Make certain you familiarize yourself with those agreements and govern yourself according to what is required of the architect. Understanding your contractual responsibilities is as important as performing an accurate code analysis.

Verifying that all aspects of your design comply with applicable building codes and guidelines is vital since the finished structure must comply with them. To help with this task, firms often devise their own building code analysis forms to use as a guide. A sample code analysis form appears on the following page to illustrate the basics of code review, but do not treat it as a complete or master form for use with every project. Code analysis forms should be unique to each project. You will be required to think through the code issues on all your projects as you begin the work of designing.

Even though the building program may identify certain code features, you must always verify what the code requires. In this example, the building occupancy/use for the project was established by the program, which states that the building will be used as a library (refer to A-3 in section 303.1 of the 2000 IBC). When you check the tables, you will find that “library” is not listed. Remember, what you are looking for is the building “use, rather than the building type. It takes some imagination, but what you have to do is think of what common action, or feature, will apply to people using the building.

In the case of a library, people assemble and make use of a facility that will house books. Libraries offer spaces for people to study and gather for meetings, lectures, and other public events, functions that are “assembly uses.” Offices and spaces that serve other support functions in the library are considered “auxiliary uses,” so do not require the building to be classified as “mixed use.”

The owner’s building program also indirectly sets the construction type for the project. The square footage needed to accommodate the building function requires Type I construction. The code provides for exceptions and other ways to increase the allowable square footage if a different construction type is employed. In this
case, however, those exceptions and allowances were exhausted because the existing building is a historic structure and over the years other buildings went up around it. Immediately to the north of the library was a much older building that was in worse condition, so the university decided to sacrifice that structure to gain a building pad for the new addition. Even with this space, the new building will be close enough to existing buildings that the code will require compliance with the most restrictive fire resistance requirements.

Fire suppression systems are always required for buildings with an assembly use. Therefore, conventional fire suppression systems will be used in most of the building, in accordance with NFPA-13 standards, but special fire suppression systems that do not employ water as the suppressant will be used in certain sections of the library.

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<thead>
<tr>
<th>Item</th>
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<tr>
<td></td>
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<td>Refer to Section 1003.2.1 &amp; Table 1003.2.2.2</td>
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<tr>
<td>Exit and Corridor Width</td>
<td>Refer to Section 1004.2.2.2</td>
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Narrative Written by Jim. W. Sealy, FAIA
Jimmy Sealy, an architect and consultant in Dallas, Texas, has participated in writing building codes and standards since the early 1970s. He most recently served as a member of the International Code Council drafting committees for the International Performance and International Residential codes. Sealy serves on building codes and standards committees for Underwriters Laboratories, the National Institute of Building Sciences, the National Institute of Science and Technology, the Applied Technology Council, and the American Institute of Architects.

Activities Written by Terry L. Patterson, NCARB
Terry Patterson is the W. Edwin Bryan, Jr., Professor of Architecture at the University of Oklahoma College of Architecture where he has taught architectural technology and design for 24 years. He is the author of Illustrated 2003 Building Code Handbook and other publications on building materials and technology.
Take brief notes while reading the narrative and list key resources you used to complete the activities. Note discussion outcomes from meetings with your supervisor, mentor, or consultants. When finalizing the activity documentation (PDF), include your notes and the Emerging Professional’s Companion activity description.
Same Floor Plans, Different Codes
Supplemental Experience for eight (8) Core IDP Hours

In this scenario, a repeat client has come back with another project. The first project was a suburban two-story, wood-framed, brick veneered condominium complex without sprinklers. It was a financial success in part because the design amenities attracted a large number of buyers. Given the success of that venture, the client wants your firm to design a ten-story version of the same project, to be located in the urban center of a large city in another state. The client expects the project can use the same floor plans on multiple levels. Consequently, he wants to negotiate a minimal fee for the design phase of the work.

Your firm must convince the client that a significant amount of design work will be required. Your supervisor has asked you to research the building code ramifications of the proposal—how the changes in size and location of the project will affect your firm’s work with regard to building code, zoning laws, and the Americans with Disabilities Act and the Fair Housing Act. Colleagues in your office are preparing studies on other aspects, so your focus is limited to code issues.

Activity - Core

Write a report to your client addressing three changes to the plans and elevations that might result. Base your responses on the following questions and suggested categories for examination:

1. What ordinance requirements related to location must be considered?
   - Building height
   - Fire zone versus building materials
   - Setbacks versus opening protection

2. What building code requirements related to building size must be considered?
   - Building height and floor area limitations
   - Construction type
   - Fire protection systems
   - Means of egress
   - Accessibility

3. Explain to the client how this project is affected by and local, state, or federal regulations between two-story and ten-story projects. Assume your jurisdiction is the local area.

4. Encourage the client to view sustainable design as a way to save money in a larger building.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
ADA Compliance Checklist
Supplemental Experience for eight (8) Core IDP Hours

Compliance with the Americans with Disabilities Act (ADA) is a challenge facing architects in every aspect of architectural practice. This act, which is a civil rights law as opposed to a “code”, asserts guidelines for assuring accessibility to the built environment for physically disabled citizens. Failure to comply with accessibility guidelines can cause an architect to incur risks for monetary damages to building owners, if the owners and their built works are found not to be in compliance and remedial construction is required. Worse yet, owners may be found to be liable for monetary damages to disabled citizens giving rise to potential claims against the architect. Errors and omissions involved in failing to comply with ADA requirements can be very serious for architects because the errors tend to be discovered only after construction is completed, a time when all costs to remediate are more likely to be assessed as the architect’s responsibility.

Only a few primary areas cause most of the problems for architects. As the project manager you are primarily responsible for organizing others to do work, but if you have a detailed understanding of accessibility issues, you will also be able to influence the outcome of the work of others with greater precision.

Activity - Core

Please reference the following documents:

- Common ADA Errors and Omissions in New Construction and Alterations; Department of Justice (PDF)
- ADA Standards for Accessible Design; July 1, 1994, Department of Justice (PDF)

To address ADA design issues on your projects create an ADA compliance checklist. Study the current edition of the ADA Standards for Accessible Design, and Common ADA Errors and Omissions in New Construction and Alterations. Create an outline of the major issues which affect architectural drawings. Using the errors and omissions studies as a guide, prepare a checklist of major requirements of the section of the design standards entitled, “Accessible Elements and Spaces: Scope and Technical Requirements.”

Differentiate between those items affecting the drawings and those affecting the specifications in your checklist. The ADA Standards for Accessible Design contains many drawings and sketches that explain layout and dimension requirements. In order to create your checklist as a visual guide, place reference copies of these drawings, where appropriate.

As you prepare your checklist pay attention to the following issues:

- Is it important to have an accessible route to an accessible entrance to accessible parking?
- What is the maximum slope of a ramp in an accessible route through the site?
- What kinds of handrail extensions are required at stairs?
- How many primary ways are there to access doors, and what maneuvering space is required?
- What protrusions are allowed in circulation paths?
- What are the circulation requirements into and through toilet rooms?
- What are the dimensions of accessible toilet stalls?
- What are the acceptable dimensions and details of accessible showers?

Take care to prepare the checklist and visual guide in a well-organized manner; it helps as a design and project management aid in the future.

Share your work with your IDP supervisor or mentor and make suggested changes.
Egress System

Supplemental Experience for eight (8) Elective IDP Hours

An overlay consists of egress and fire safety zones. Separation of different occupancy classes may require fire-rated partitions in a building, which means that all the doors, ducts, and other penetrations of the partitions are fire-rated as well. In this case, the HVAC system has to be designed to prevent the spread of smoke. In large buildings, HVAC fans may be involved in pressurizing compartmentalized zones adjacent to a fire and depressurizing the fire zone itself. Structural systems are fire-rated, interior finishes are flame retardant, and so on.

The egress system must allow for safe exit paths to unobstructed sky (or at least a safe place of refuge) in the event of emergency. Egress is a geometric overlay of routes and passages as well as a system of safe construction standards. Many occupancy-based building codes regulate dimensions such as the length of dead-end corridors, the maximum diagonal distance to an exit, the number and width of required doors, and the width of the egress path itself.

Activity - Elective

Prepare an ideal building plan that presents the best interior layout and circulation to idealize fire safety. They are to occupy ten intermediate floors of an office tower with a 100’ x 100’ footprint. Draw a typical layout for one floor. There will be clerical, staff, executive, conference, toilet, library, and utility areas. A 40’ x 40’ media center of 100 seats will be provided on select floors for teleconferencing and large meetings. Be sure to include sustainability features in the design.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Complex Zoning
*Supplemental Experience for eight (8) Elective IDP Hours*

Ask a colleague to refer you to a project that had a complex zoning circumstance. Carry out the following exercises related to that project:

- Review the zoning ordinance that governed the project.
- Reconstruct the volume that constitutes the allowable building envelope for the site.
- Develop a diagram illustrating the allowable building envelope.
- Develop an overlay on the allowable building envelope that represents the building that was actually constructed. Make note of the difference.

Browse through the zoning ordinance, or interview a zoning official in your city to learn about floor area ratios (FARs). How could the FAR be a determinant in a building program? Floor area ratio (FAR) equals the total covered area on all floors of all buildings on a certain plot, divided by the area of the plot.

**Activity - Elective**

Write a report that summarizes your findings on this project. Be sure to include any charts and diagrams used as well as the information learned from the zoning official. Review the zones described in the zoning ordinance, and speculate how a mixed-use building (residential and commercial, for example) could be dealt with in the architectural program.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
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## Schematic Design

### introduction

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### activities - core*

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*A maximum of 40 hours of core credit may be earned in this experience area.

### narrative

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### activities - elective

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By completing the activities in this chapter, you will gain an understanding of the activities involved in schematic design. The following information is taken from the NCARB IDP Guidelines:

**Schematic Design**

Minimum Schematic Design Experience: 320 Hours

Definition: Involves the development of graphic and written conceptual design solutions for owner/client's approval.

**Tasks**

At the completion of your internship, you should be able to:

- Develop design concepts, including site design
- Prepare schematic design documents
- Apply sustainable design principles
- Apply historic preservation principles
- Prepare presentation materials (e.g., models, renderings, drawings)
- Develop project phasing plans

**Knowledge Of/Skill In**

- 3-D modeling
- Adaptive reuse of buildings and/or materials
- Alternative energy systems and technologies
- Architectural history and theory
- Basic engineering principles
- Building design
- Building Information Modeling (BIM) technology
- Building systems and their integration
- Computer Aided Design and Drafting (CADD)
- Conflict resolution
- Construction sequencing
- Creativity and vision
- Critical thinking (e.g., analysis, synthesis, and evaluation of information)
- Design impact on human behavior
- Design principles
- Designing and delivering presentations
- Freehand drawing and design sketching
- Graphic communication
- Implications of design decisions (e.g., cost, engineering, schedule)
- Interpersonal skills (e.g., listening, diplomacy, responsiveness)
- Life safety
- Manual drafting
- Natural and electric lighting (e.g., daylight, solar control, energy consumption)
- Oral and written communications
- Problem solving
- Site design
- Space planning

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**resources**


- Chapter 12.2 - Design Phases

- Chapter 7.3 - Design Phases
Knowledge Of/Skill In Continued

- Spatial visualization and modeling
- Sustainable design
- Team building, leadership, participation
- Universal design (environments usable by everyone regardless of limitations)
- Vertical circulation

notes

Take brief notes while reading the narrative and list key resources you used to complete the activities. Note discussion outcomes from meetings with your supervisor, mentor, or consultants. When finalizing the activity documentation (PDF), include your notes and the Emerging Professional’s Companion activity description.
Schematic Design

Narrative

Schematic design is the first of the five increments of basic architectural services defined in most AIA standard forms of agreement between owner and architect. During schematic design (SD), the architect typically works with the client and other project team members to explore alternative concepts for addressing the client’s needs. A preferred design direction is selected for further exploration from these alternatives, and schematic design typically ends with a presentation of the proposed design including plans of each floor level, major elevations, outline specifications, a budget estimate, and other information needed to clearly describe how the design meets the client’s project program and goals. The language used to define this increment in the standard AIA contract form is quoted in the accompanying sidebar.

Most of the examples of this process provided in this chapter have been drawn from interviews with the design principals of firms that won the AIA’s Architecture Firm Award. This award is given annually to firms in which “the continuing collaboration among individuals has been the principal force in consistently producing distinguished architecture for a period of at least 10 years.”

Major Variables Affecting Design

The first step in schematic design is usually identification of major issues that must be addressed—at least at a conceptual level. Although every project is unique, the following factors generally are the basis for most project designs:

Program
The program sets out the core of the design problem—the project objectives and the spaces and functional requirements to be accommodated. Most programs are unique to a project and client and, therefore, call for unique solutions.

Codes and Regulations
Regulatory constraints on design have increased steadily. Beginning with simple safety requirements and minimal land use and light-and-air zoning, building codes and regulations have grown into a major determinant in design.

In addition to formal code requirements, a growing number of public agency approvals influence design in a more subjective, less structured way. Many owners and their architects must adjust designs to satisfy community groups, neighbors, and public officials. These design adjustments are often ad hoc efforts to meet objections or to gain support rather than direct responses to codified requirements.

Site
The building site, of course, has a major influence on building design. Physical characteristics (such as size, configuration, topography, and geotechnical

resources

See Chapter 1A - Programming for more information on programming.

See Chapter 2D - Codes and Regulations for more information on building codes.

See Chapter 1B - Site and Building Analysis for more information on site analysis.

See Chapter 2C - Construction Cost for more information on building cost analysis.
issues), existing structures, environmental factors (views, existing vegetation, climate, solar orientation, drainage), access, adjacent land uses, and many other site factors become considerations in the final design.

One site consideration that often has a significant effect on building design is the surrounding environment. Not only does the community context have obvious effects on building configuration, it also frequently influences the scale, detailing, color, and texture of the final design. A more direct influence on building design are existing structures to be incorporated into the project. A growing percentage of building design problems calls for working within the constraints of an existing structure.

AIA Contract Document, Description of Schematic Design
AIA B101™, Standard Form of Agreement Between Owner and Architect, describes schematic design as follows:

§3.2.1 The Architect shall review the program and other information furnished by the Owner, and shall review laws, codes, and regulations applicable to the Architect’s services.

§3.2.2 The Architect shall prepare a preliminary evaluation of the Owner’s program, schedule, budget for the Cost of the Work, Project site, and the proposed procurement or delivery method and other Initial Information, each in terms of the other, to ascertain the requirements of the Project. The Architect shall notify the Owner of (1) any inconsistencies discovered in the information, and (2) other information or consulting services that may be reasonably needed for the Project.

§3.2.3 The Architect shall present its preliminary evaluation to the Owner and shall discuss with the Owner alternative approaches to design and construction of the Project, including the feasibility of incorporating environmentally responsible design approaches. The Architect shall reach an understanding with the Owner regarding the requirements of the Project.

§3.2.4 Based on the Project’s requirements agreed upon with the Owner, the Architect shall prepare and present for the Owner’s approval a preliminary design illustrating the scale and relationship of the Project components.

§3.2.5 Based on the Owner’s approval of the preliminary design, the Architect shall prepare Schematic Design Documents for the Owner’s approval. The Schematic Design Documents shall consist of drawings and other documents including a site plan, if appropriate, and preliminary building plans, sections and elevations; and may include some combination of study models, perspective sketches, or digital modeling. Preliminary selections of major building systems and construction materials shall be noted on the drawings or described in writing.

Building Technology
Building proportions, as well as choice of materials and systems, are rarely determined arbitrarily and are only partially based on aesthetic criteria. For example, the floor-to-floor height required to accommodate structural, mechanical, lighting, and ceiling systems in a cost-effective manner varies significantly from an apartment house to an office building to a research facility. Similarly, horizontal modules are often set to achieve maximum layout efficiency; thus, the exterior fenestration of an office building may be based on the module of a typical office width, while the fenestration of a hotel is based on the module of a typical guest room. In other cases, the dimensions may be dictated largely by mechanical systems, the technical criteria of the exterior materials, or the knowledge and preferences of the local construction industry.
Schematic Design

Cost
The owner’s budget is often the most-discussed influence on building design. Since projects generally have limited budgets, cost considerations regulate almost all decisions, from building size and configuration to material selection and detailing.

Sustainability
In Chapter 1B - Site and Building Analysis, the study of the site and climate presented the design team with multiple opportunities for the incorporation of energy efficient building principles into the project. At the schematic design phase, the team must begin to formulate which of these principles should be developed to meet the goals of the owner. A protocol such as LEED requires certain energy strategies be initiated at this Phase in order to receive LEED Credits.

Ethics
What conflicts has the design created with the neighbors? With the community? Who bears the responsibility for researching valid design alternatives? These questions and other issues can potentially become significant ethical dilemmas for consideration by the architect and design team as the schematic design for the project is being developed.

Other Team Members
The design of few projects—and virtually none of any size and complexity—are carried out by a single individual. Many projects require a team of architects supported by as many as a dozen specialized consultants. Each of these team members will have some input on the final design.

The Client
A central ingredient in most successful design projects is a good client. Some clients have a clear idea of program, budget, and other project objectives, including the final appearance of a building. Others look to their architect to help them define the project objectives, as well as to design a building that meets their goals. In both cases, the effectiveness of the marriage between client and architect affects key design decisions made throughout the project. Eero Saarinen expressed the central importance of good architect-client relations in this suggestion: “Let’s see if we can make this guy into a great client.”

The above list of factors that affect the design process is far from complete. Almost every project has a unique set of factors that distinguish it.

Primary Steps In Schematic Design
Despite the range of design opportunities and constraints that architects face, the schematic design process used by most architects includes the following activities in one form or another:

1. Analysis
   Typically results in a definition of the design problem.

2. Synthesis
   Analysis is translated into a project concept.
3. **Refinement**  
The concept is worked into a design solution.

4. **Documentation**  
The design solution is graphically depicted.

**Step 1: Analysis**  
Design begins with analysis. The key objective of this initial step is to identify, analyze, confirm, and organize the factors that will influence the development of a design concept. Architects typically take the data gathered and developed during the economic feasibility, programming, and site analysis stages of a project and organize them for use in building design. These data may be provided by the owner or they may be developed by the architect in the course of providing pre-design or site analysis services.

Each architect has his or her own approach to analysis. Some of the more common ones are described here:

**Program analysis.** Many architects translate the words and numbers in a program statement into graphic terms, developing charts, bubble diagrams, sketches of design concepts, and even three dimensional models. These become design tools.

 Virtually all experienced architects stress the need to take time to familiarize yourself with the project program before design work begins. Most architects would prefer to be actively involved in programming, which they believe is a critical starting point for design. However, even when the owner has prepared a program before the architect is brought into the project, the architect needs to take time to review and understand the program and to undertake the series of tasks used to convert the program into understandable and usable design information.

For example, Charles Gwathmey and Robert Siegel of Gwathmey-Siegel & Associates usually work with a senior staff member to reach a full understanding of the program and other issues particular to a project. They diagram (to scale) all the program areas, noting adjacencies, mass, and other characteristics. Next, they overlay this drawing on the site plan to get a sense of the scale and size needed to accommodate the building as well as an understanding of its parts.

**Site analysis.** Important site data are typically diagrammed, organized, and drawn on one or more copies of the site survey. Some firms may build a site model as well. These efforts yield a common record of the physical, cultural, and regulatory factors discussed in Chapter 1B - Site and Building Analysis. When organized in a common scale and format, these data often begin to point the way to a design solution. No matter how well the data are documented, however, the architect needs to spend time walking the site. As Roy Solfisburg of Holabird and Root puts it, an important part of the process involves time for “tramping and photographing the site and surrounding community.”
The site is almost always a major influence on building design. Romaldo Giurgola’s statement that “a building should respond both to the order of the city and the order of the land” illustrates the importance of the site. His view is echoed by nearly all experienced architects.

Since many building design projects must work with or include existing structures in the final solution, it is essential to establish clear, accurate documentation of existing conditions, either by converting existing drawings into base sheets for use in design or by creating new measured base drawings. In addition to providing basic dimensional data for design, this step typically identifies existing physical and code problems.

**Zoning and code analysis.** Concurrent with the site analysis, many firms convert zoning and other code issues into graphic form. In the case of complex urban zoning codes, this may include graphic representations of the zoning envelope—the height, bulk, setbacks, and other limits imposed by the code.

When combined with parking and loading requirements, egress considerations, building area and height limitations, and other code requirements, this analysis can help the architect begin to shape the program into a building mass that fits the site. In many cities, zoning and other code constraints are a major architectural influence. Where land costs are high, the owner typically wants to fill the maximum allowable envelope. As Edward Larrabee Barnes noted, however, the architect is a professional: “There are times where maximum exploitation is not the right course, and the architect must argue for a smaller building.”

**Budget analysis.** The project budget should be analyzed to determine its implications for building design. Virtually all project budgets are limited. The architect must make careful use of funds, applying more funds to those elements of the building that appear most important to the success of the design solution. This attention to cost may appear limiting, but in commenting on cost and other constraints Robert Venturi has observed, “The best things happen [in the genesis of a design] when you have to deal with reality.”

The portion of a budget that is discretionary can usually be determined by an experienced analysis of the budget. Analysis of the budget can also establish clear guidelines for basic system selection during design.

**Consideration of local construction industry practices.** Concurrent with an analysis of the budget, most architects consider the aspects of local construction industry practice relevant to the design assignment. This can range from what materials and systems are commonly available to specific detailing frequently used in the area. Local choices are typically the most cost-effective for that region, and in many cases reflect climatic, code, and other local or regional considerations.

**Scheduling considerations.** The project schedule is more than a project management tool. At times, it can also be an important factor in
design. Major scheduling issues such as phasing, the time it takes to seek variances, and the sequencing of design decisions to accommodate fast-track delivery can all influence initial consideration of a design concept.

**Identification of architectural precedents.** In many firms, an important aspect of the analyses carried out at the beginning of schematic design is the study of relevant projects that faced similar or related project issues (e.g., program, site, context, cost, etc.). Architects often familiarize themselves with the design of such buildings to stimulate solutions for their own design problems. These analyses can also help a client visualize some design ideas, as long as the owner is reassured the evolving design will not be just a copy of the precedent.

**Step 2: Synthesis**
The architect's combination of analysis and understanding and response of the data collected above is the next step in schematic design. The combination of all this into a unified solution is the synthesis that is the core of concept design. There are many different approaches to this critical step. Lewis Davis of Davis Brody Bond believes it is very hard to define all the influences that lead to a design: “Very few architects—no matter how consistent their work—can trace all influences. Some are external, such as technology, available materials, code, etc. Some are internal, such as the architect’s own education and experience or the building just seen in Europe.”

Some firms—including Venturi, Scott Brown and Associates; Holabird & Root; CRS; and Hardy Holzman Pfeiffer—follow approaches that generate and test several alternatives at once. Hugh Hardy notes that “often one proposes extremes or opposite possibilities to test an idea and elicit a response. Many assert the need for an early idea.” “The strongest ideas are often the ones developed early,” according to Lewis Davis.

There is usually some logic to the process that produces the initial sketches. Edward Larrabee Barnes cites the evolutionary development of design concepts, “There should be no clash of gears between the analysis phase and design.” But there is more than logic at work. In their work and in their writings, nearly all the AIA Firm Award winners have commented on the importance of the non-rational, non-describable, and poetic in the creation of a successful building design. At key points, judgment, taste, intuition, and creative talent take over.

The particular design stimuli, organizing principles, areas of emphasis, and aesthetic vocabulary vary according to the architect or firm, and the way in which architects synthesize these vary as well. Underlying this diversity in the way architects approach schematic design, though, are some common tasks. Most firms begin with analysis of the base data and then work through sketches, talking and thinking until they reach the level of understanding necessary to form a concept.

**Establishing design goals.** The client and design team have goals, expressed formally or informally, for the project. Beyond the first conceptual steps involved in schematic design, the process becomes more complex. In all but the smallest and simplest projects, subsequent steps involve teamwork.
While it is true that most significant works of architecture are developed under the guidance of a single strong design leader, most projects have at least 10 team members involved in decision making (architects, engineers, interior designers, consultants, construction managers, public agencies, and, of course, clients). Thus, design excellence results in part from the effective management of a complex team, all of whose members contribute to the quality of the final result. (Learn more in Chapter 3D - General Project Management.) It is important to recognize and deal effectively with the many participants who play a role in building design. Walter Gropius, a founder of the Architect’s Collaborative, described the significance of a coordinated team effort this way:

“The essence . . . [is] . . . to emphasize individual freedom of initiative instead of authoritative direction by a boss. Synchronizing all individual efforts by a continuous give and take of its members, a team can raise its integrated work to a higher potential than the sum of the work of just as many individuals.”

As important as teamwork and leadership from the architect are, the client is an essential part of the design effort. As Charles Gwathmey puts it, “If you include the client in an understanding of the problem and how you are responding to it, it makes the solution understandable instead of a mysterious aesthetic proposition. Issues of taste go away.”

During the schematic design phase, the architect and the client usually meet regularly to evaluate the project concept and discuss design ideas.

**Design Teamwork.** Aesthetic guidelines for judging design decisions, and project objectives help establish priorities when tradeoffs must be made in the design solution. Compromises between budget and quality, appearance and energy efficiency, and sustainable design goals and budget limitations, and hundreds of other decisions have to be made within the context of an understanding of project goals and priorities. As Paul Kennon of CRS asserts, “It is important to have all of the cards on the table and all of the issues identified.”

**Developing a parti.** Since a design problem can usually be solved in several ways, another initial concept step is establishing a basic organization, or parti, for the project. This may be a plan concept, selection of a geometric form, a decision to mass the building vertically or horizontally, or use of an organizing element such as a central mall for the interior spaces. In thinking about this idea, you may want to note this observation of Edward Larrabee Barnes: “It is not just a case of form following function. Sometimes function follows form. The interaction is important.”

In some cases, a basic design concept may stem from a particular image or one of the partis commonly used in earlier periods of architecture. Whatever the underlying principle, it is common for architects to develop several partis prior to the testing and evaluation steps that lead to a final concept.
Selecting a design vocabulary. Complementing, or even integral to the development of, a parti is the articulation of a design vocabulary. Architects work from a set of formal or aesthetic ideas that govern how they synthesize their initial ideas into a complete building design concept. While few firms claim a specific unchanging vocabulary, architects, in Lewis Davis’s words, “like painters . . . we have a palette of design elements that we are comfortable with, know how to use, and have found can produce the best result.”

This does not necessarily imply consistency. Paul Kennon noted that “some architects develop a vocabulary and refine it on each project. Others approach each project as a unique problem. They evolve a vocabulary that may be cruder but which grows from the problem itself.”

Creating and evaluating alternatives. Clients and design teams may have slightly different definitions of what is accomplished in schematic design, and their definitions may vary from project to project. However, certain objectives and products are commonly agreed upon. The primary objective of schematic design is to arrive at a clearly defined, feasible concept and to present it in a form that the client can understand and accept. Secondary objectives are to clarify the project program, explore the most promising alternative design solutions, and provide a reliable basis for analyzing project cost.

Step 3: Refinement
Often the architect continues to explore two or more alternatives until a consensus is reached with the client about the preferred design direction. Once this has been set, the design team refines plans, sections, and elevations to work out the major functional and aesthetic features of the proposed design.

Step 4: Documentation
Communicating design ideas and decisions usually involves a variety of media. Most well-known architects make extensive use of models, but they also use other common study and presentation techniques. All stress the need to spend focused time sketching and testing potential ideas to be included in the recommended design. As Steven Izenour of the former firm Venturi, Rauch, and Scott Brown put it, “No matter how good an architect is, it takes a lot of time.” Typical documentation at the end of schematic design can include:

- A site plan created during programming or by the architect as a discrete service before schematic design begins
- An updated written and graphic building program
- Plans for each level
- Elevations
- Two or more sections
- Outline specifications
- A statistical summary of the areas included in the plans as well as a summary of other key characteristics in relation to the program
- A preliminary construction cost estimate
- Other illustrative materials—renderings, models, or drawings—needed to adequately present the concept
Drawings are typically presented at the smallest scale that can clearly illustrate the concept (perhaps 1/16” = 1’0” for larger buildings and 1/4” = 1’0” for smaller buildings and interiors). Outline specifications give a general description of the work, indicating the major systems and material choices for the project but usually providing little detailed product description. As part of the schematic design work, the architect may agree to provide energy studies, tenant-related design studies, life-cycle costs, or value analysis; special renderings; models; brochures; or promotional materials for the owner. It is also common for the architect to help the client complete initial land use and code reviews before the design proceeds to the next phase. Some of these reviews call for services beyond the architect’s basic services. Many of these are included as “additional services” in AIA Document B101™, Standard Form of Agreement Between Owner and Architect.

Final Approvals
The final step in schematic design is to obtain formal client approval. The importance of this step cannot be overemphasized. The schematic design presentation has to be clear enough to gain both the understanding and the approval of the client. Once this has been obtained, most architects recommend that each item in the presentation be signed and dated by the client before design development services begin. While the successful completion of this project increment typically sets the direction for design development, it is only the first step in the design process. The AIA’s standard description of the five increments in basic services implies that the process begins with a clear definition of the client’s program. It also implies that the process can progress in a linear fashion through a series of steps, each of which results in a more complete definition of design, until a project is sufficiently detailed to go into documentation for bidding (or negotiation) and construction.

The reality is not so orderly. Evolving program requirements, budget realities, increased knowledge of site considerations (such as subsoil problems), public agency reviews, and many other factors make it necessary to go back and modify previous steps. Design moves forward, but rarely in the linear fashion implied by the standard two-phase description of design—schematic design and design development. Moreover, design rarely ends with completion of design development. Most architects agree that design choices occur in every step of the process of planning, designing, and constructing a building.

Written by Bradford Perkins, FAIA, MRAIC, AICP
Bradford Perkins is the founding principal of New York-based Perkins Eastman Architects. He has been the principal in charge of more than 400 architecture and urban design projects throughout the United States as well as many others in 20 foreign countries.
notes

Take brief notes while reading the narrative and list key resources you used to complete the activities. Note discussion outcomes from meetings with your supervisor, mentor, or consultants. When finalizing the activity documentation (PDF), include your notes and the Emerging Professional’s Companion activity description.
Creating an Alternative System of Proportions

Supplemental Experience for eight (8) Core IDP Hours

In consultation with your supervisor or mentor, choose a completed project to analyze. This activity requires you to study the composition and proportioning of exterior building elevations elements. Some materials are a part of the building’s “skin” and provide shelter from the weather. Other materials are purely decorative and provide either visual or representational relief or pattern from the body of the building.

Suggested order of elements to study:
1. Focus on the use of materials and consider the relationship of that material with the exterior grade, various finish floor levels, the corner of the building, the centerline of the building, etc.
2. Study the transition of one material to the next. Why does it occur at that location in the facade?
3. Consider the reason for these materials to be used together in the composition. What factors—such as cost, manufacturers’ recommended or available sizes, codes, and aesthetics—led to the final composition of the elevations?
4. Now look at the form of the building. Is the building symmetrical? Is it organized in the classical manner of base-shaft-cap or is there some other organizing parti? What influences created the overall form? What is the “style” or history of the building (if applicable)?
5. Next look at how changes in the vertical plane are used to create shade and shadow. How is the elevation oriented to the sun and what are the reasons why the Architect oriented the building on the site?

Activity – Core

Using the final schematic design phase elevations, record in sketch form the factors that influenced the following design elements:
- Major exterior materials and their location
- Record the major exterior element proportions
- Measure window and door dimensions and placement in the elevations
- Record the masonry unit or other exterior cladding material sizes. Is it a jumbo size?
- Record any pattern used in the exterior materials

After analyzing the exterior elements, devise an alternative system of proportions for the front facade and one side. Explain in 400 to 500 words, the issues the alternative system would raise (e.g., cost, code, material availability, and so on). Write 100 to 200 words about what inspired the new solution.

Why do you consider your design to be an improvement over the original design? What changes would you make to the original material selections? How does this change the style of the original design? Does your design cost more or less to construct than the original design? How about availability of materials you have chosen? Would this design require the structure of the building to be altered? Is there an existing building or architect that provided the inspiration for your design?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Creating an Alternative Floor Plan

Supplemental Experience for eight (8) Core IDP Hours

Every floor plan is driven by the requirements of the building program, number of total occupants, the type of occupancy, intended use of a space or spaces, code requirements including circulation and exiting, and the creative nature of architectural design. Other considerations are structure, mechanical systems, furniture size and placement, and cost. All of these demands must be organized into a floor plan that is efficient, meets code, and satisfies the aesthetics of the design problem.

Activity - Core

In sketch form, analyze the schematic floor plans of the project you selected for the Activity Creating an Alternative System of Proportions OR select a different project to be studied. Respond to the following:

- Note the major design ideas incorporated in the plans.
- Make a list of the major project objectives and program goals.
- Determine how well the plans meet these goals.
- Calculate the occupant load of your floor plan.
- Speak to the original project architect or designer if possible about the program and design generators that were incorporated into the floor plan.
- Calculate the percentage of circulation space required compared to the overall gross square footage of your floor plan.
- Calculate the percentage of your floor area dedicated to the mechanical and electrical rooms. Consider the reason for their location.

If a single story building: How many exits are there and what is their relative location to the front entry and each other? How many spaces or rooms must a visitor travel through to arrive at the main space or room from the front entrance? Is this a single or mixed use building?

If a multi-story building: How many sets of stairs and their location relative to each other? Where is the elevator(s) located? Where are windows located? What are the fire safety features of the floor plan?

Also in sketch form, develop an alternative floor plan that fulfills the same goals. Evaluate the alternative against the same list of project objectives and program goals by considering the following:

- Did your alternate floor plan use more, less, or the same floor area as the original design?
- If less, what areas or functions were you able to make more efficient?
- If more, what issues required you to use more space?
- How does your plan improve the original design?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
A Design with a Potential Problem

Supplemental Experience for eight (8) Elective IDP Hours

In this scenario, you are working on the design of a new elementary school in upstate New York. Due to a tight budget, the client has directed that the exterior envelope be kept very simple. You use this directive to propose a very modern building with simple but attractive detailing. Two essential elements of the design are a flat roof (low slope roof) and skylights over the main entries and in several other spaces.

In the meeting where you present the first schematic concepts, a school board member asks, “Don’t flat roofs and skylights leak?” You answer, “If it’s properly detailed, installed, and maintained, a flat roof—even one with skylights—should perform as well as any other roof.”

After the meeting, one of the older members of the design team says to you, “No one will remember the ‘if properly detailed, installed, and maintained’ caveat. Flat roofs and skylights tend to leak more often than roofs with positive drainage and few penetrations. When a leak starts, it’s often very difficult to determine who’s at fault.”

You find this comment sobering. Except for this one question, the school board’s response to the design was positive. Should you change the design because something that should be avoidable might happen?

Consider the following questions: Are there materials in a standard skylight assembly that should be avoided in cold climates? Are there special features available to enhance the performance of the skylight? Does the type of flat roof membrane system affect the design and performance of the skylight with regards to expansion and contraction? Are there special flashings available for this situation? What type of alternate roof system will you consider? Is there a cost impact to the budget using this roof system?

Activity - Elective

Consult your supervisor, mentor or other experienced architects on their experience low-slope roofs and skylights. Record lessons learned in sketch format.

Review manufacturers’ literature and conduct an internet search for information on leaking related to low-slope roofs and skylights.

Based on your research, write a response to the school board member’s question. If you determine the proposed design solution is the correct approach for the project, prepare appropriate sketches and citations of articles to illustrate your conclusions and to demonstrate how the potential for leaks can be minimized. If you determine the proposed design may be too risky (be sure to include consideration of the local climate), prepare sketches of an alternate roof plan that will provide benefits similar to that of the original design.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
“Self-Sufficient” vs. Green Architecture

Supplemental Experience for eight (8) Elective IDP Hours

In this scenario, your client is a well-known and committed advocate for green design in the San Francisco Bay Area and an owner of a solar hot water and photovoltaic panel manufacturing company. Your firm is known for being able to design “state of the art,” self-sustaining houses that do not require power from the utility grid.

This client has invited you to design a house that will be 100% self-sufficient with regards to electrical power and hot water needs. The client is expecting you to showcase his panels by providing all or part of the energy needs in the design using the panels. He does realize that providing all of the energy using only these roof panels may be a very difficult goal to obtain and is willing to consider other forms of alternative energy generation technology to power the house as long as the outside power grid is not required.

Early calculations of the required power and hot water requirements for the project leads you to the idea that your design can rely solely on a mix of photovoltaic and solar panels that are to be roof mounted. The panels will have a low profile that will be integrated into the design and oriented to maximize the generation of power and hot water for the house.

The site has a moderate slope down of 6 to 8 percent from the north to the south. The prevailing wind is from the northwest.

You begin the design and while on-site checking some field conditions you notice that the entire west and southern property lines are covered with 8 to 10 foot high redwood trees. Within 10 years these trees will grow to a height of 25 to 30 feet and in the afternoon will shade most of the roof you had planned for the house. These trees will continue to grow and live well beyond the life of any house you plan.

Do you carry out the design knowing this? Do you cut down the trees knowing that they provide cooling in summer, absorb carbon dioxide, and are a habitat for wildlife? Or does the fact that the panels will provide a greater reduction of the carbon dioxide emissions govern? Are there other technologies available to help power the house? Is it possible to mitigate the potential impact the trees have on the house? How do you balance the self-sufficient requirements of the program with other issues of sustainability?

Activity - Elective

Write a letter to the client describing the reasons for your course of action using one of the following options:

• OPTION 1: You decide to proceed with the original design relying on the photovoltaic and hot water panels, as designed. At the end of 10 year growth period for the trees, determine what options you have to maintain the client’s requirement of a “self-sufficient” house.

• OPTION 2: You decide you cannot cut any of the trees but will rethink the basis of the design and plan for future tree growth now. Determine what options are available to you to meet the client’s original program.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Schematic Design

Reflections

Supplemental Experience for eight (8) Elective IDP Hours

In this scenario, you are working with one of the largest financial institutions in the country on a high rise building that will be the flagship for their banking operations on the West Coast. The site is located on a busy corner with heavy vehicle and pedestrian traffic in the financial area of downtown Los Angeles. Most of the neighbors are well known banks and other corporations and all have adopted the stylized architecture of southern California using reflective glass curtain wall that begins at ground level and is extruded vertically.

Your client has made it clear that the architecture of this building will also use this reflective glass curtain wall feature to create “the look” and blend in with the surrounding buildings.

You proceed with the design and as you study the site conditions and design of the building, you begin to understand that during certain times in the morning and afternoon, the reflective glass from the surrounding buildings create a bright crossfire of reflected sunlight at the intersection in front of the building. Your building design is only going to contribute to the problem and perhaps create a blinding and potentially dangerous condition for drivers and pedestrians in the area. You express these concerns to your client but they are indifferent to the problems you present and state “It’s public property anyway, and not our problem” and want you to continue with the development of the design, as is.

What are the options to using glass curtain wall? What is the potential liability if you proceed with the reflective glass? Is there a way to continue to use the reflective glass in the design without contributing to the reflected sunlight problem? How do change the attitude of your client?

Activity – Elective

Please reference the following source:

- Professional Liability and other insurance information from The AIA Trust, www.theaiatrust.org

Contact the insurance agent who provides professional liability coverage for your firm or if unavailable, work with someone knowledgeable about professional liability coverage. Discuss the potential claims from motorists or pedestrians who could be injured using the walks and streets in front of the building site. Record these answers.

Draw the building profile and show the geometry of the solar angles at summer and winter solstice for the latitude at Los Angeles. Show how you would redesign the exterior skin of the building at the first 5 stories to reduce the reflected sunlight onto the adjacent sidewalk and street intersection in front of the building.

Consider and record alternate optional design features, geometries or materials that could be used to filter, block or change the reflected sunlight of the building curtain wall to the surrounding area.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
In this scenario, one of your firm’s clients is interested in developing a LEED-certified project, incorporating sustainable design concepts. While the client discusses the matter with some degree of certainty, client representatives indicate they do not really know what is involved in the LEED certification process, nor are they sure exactly how sustainable design will affect the design, construction, or cost of their project. The client asks your firm to develop a checklist of what will be entailed if they decide to proceed with development of a “green” building.

Research what sustainability or building green means to an architect’s design process and prepare a summary report assessing what is involved in achieving LEED certification and how design and construction may be affected. Develop the checklist that has been requested by the client.

Start your study by downloading and assembling reference materials from the following resources or from links suggested by them:
- AIA Committee on the Environment: www.aia.org/cote
- U.S. Green Building Council: www.usgbc.org/LEED

In preparing your report, follow these steps:
- Develop an understanding of the basic philosophy of sustainable design, and summarize in the report.
- Research and note the different levels of LEED certification (Certified, Silver, Gold, and Platinum). Review the LEED project checklist available from the USGBC web site to put this information in perspective.
- Review each major area of sustainability espoused by the U.S. Green Building Council (e.g., site, water efficiency, materials and resources, etc.). In your report, cite examples of how these categories might influence an architect’s building design.

Your report should address the following questions:
- Why is sustainable design important in today’s society?
- How will the design of the building be affected by the level of certification the client chooses to pursue?
- Impact on construction of the building.
- Impact on the cost of the building.
- Address the cost/benefit equation related to sustainability or LEED certification.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Schematic Design

Evaluation of Context and Precedent

Supplemental Experience for eight (8) Elective IDP Hours

Use the same project you selected for the Activity *Creating an Alternative System of Proportions* OR choose a different project that is local to research the activities listed below.

Some projects are highly dependent on the surrounding community to help create a design vocabulary or palette from which the architect can use to create a design. Other architects may study this data and choose to reject the vocabulary and create a building that is developed on an entirely different set of values.

This activity is designed to study the site area and record the type of design vocabulary you find in the community and relate those values back to the building.

Activity - Elective

Study the site and prepare a photo essay that illustrates the features of the project site, the immediate area, and the community that have influenced the final design of the selected building.

Mount your photos on a board or develop a digital board presentation. Write a project report of 600 to 800 words that addresses what these issues are and why you think the architect was influenced by them. Select a minimum of the 3 most important influences. (Note: You may include more than 3 issues, if you deem it important to your thesis.)

If your building was influenced by the style of a historic or non-local prominent building, add this building to your photo essay and record your reasons for linking the building to your project.

Consider the following:

- Local structures used for comparable or related purposes.
- Materials commonly used in the area.
- Elements of the immediate area that could be incorporated or reflected in the final design, such as important site features (e.g., topography, views, adjacent structures, points of access, mature vegetation, etc.)

What is the height and density found on the site and in the surrounding area? Style of architecture? What is the average age of the buildings found here? What impact does the required property setbacks have on the building’s function or form? Does the project “fit in” with the surrounding community or does the building stand in contrast? What problem was the architect trying to solve?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
notes

Take brief notes while reading the narrative and list key resources you used to complete the activities. Note discussion outcomes from meetings with your supervisor, mentor, or consultants. When finalizing the activity documentation (PDF), include your notes and the Emerging Professional’s Companion activity description.
# Engineering Systems

## Introduction

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*A maximum of 40 hours of core credit may be earned in this experience area.

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Engineering Systems

Introduction

By completing the activities in this chapter, you will gain an understanding of the principles involved in engineering systems coordination. The following information is taken from the NCARB IDP Guidelines:

Engineering Systems
Minimum Engineering Systems Experience: 360 Hours
Definition: Involves selecting and specifying structural, mechanical, electrical, and other systems, and integrating them into the building design. These systems are normally designed by consultants in accordance with the client’s needs.

Tasks
At the completion of your internship, you should be able to:
• Analyze and design basic structural elements and systems
• Coordinate building systems (e.g., structural, mechanical, electrical, fire safety, security, telecommunications/data) and reconcile systems’ conflicts
• Apply sustainable design principles

Knowledge Of/Skill In
• Adaptive reuse of buildings and/or materials
• Alternative energy systems and technologies
• Basic engineering principles
• Building envelope
• Building Information Modeling (BIM) technology
• Building systems and their integration
• Characteristics and properties of construction materials
• Conflict resolution
• Critical thinking (e.g., analysis, synthesis, and evaluation of information)
• Design impact on human behavior
• Design principles
• Engineering load calculations
• Hazardous materials mitigation
• Implications of design decisions (e.g., cost, engineering, schedule)
• Indoor air quality
• Interpersonal skills (e.g., listening, diplomacy, responsiveness)
• Life safety
• Life cycle analysis
• Natural and electric lighting (e.g., daylight, solar control, energy consumption)
• Oral and written communications
• Problem solving
• Product evaluation, selection, and availability
• Sustainable design
• Team building, leadership, participation
• Technological advances and innovative building products
• Vertical circulation
From the everyday perspective, an “engineered system” is any technical building component specialized enough to require the services of an expert consultant. More precisely, such a system is a discrete array of components that plays a vital functional role in the building and relates to other building systems and components.

The structural system, the building envelope, and the HVAC system are three readily identifiable engineered systems. Along with the site and the interior, these are characteristically the main components of a building project. Many subsystems can be identified, as well: The electrical system, lighting, furniture, glazing, foundation, storm water management, and so forth. While it would be just as valid to categorize building systems in other ways, such as circulation, signage, and life safety, naming the topic “engineering systems coordination” suggests the hardware approach.

This chapter will focus on systems that generally require professional engineering consultants as part of the project team. From it, interns can learn both about the building systems discussed and about the relationship between architects and engineers working on a project together. Some issues that may come up include the following:

- Architects and engineers tend to approach a project from different points of view, as the architect is generally more familiar with project particulars and the engineer with system standards.
- Different perspectives may mean that the architect and engineer prioritize their objectives differently for a project, the architect more focused on design intentions and the engineer on the function of systems design and equipment.
- The engineer’s design work must be coordinated with the architectural management of the project, including the work of other consultants.
- In project scheduling, the team must anticipate the effects of details regarding engineered systems that will affect project construction, including lead time, work sequence, and technical criteria such as required environmental conditions or temporary bracing.
- Long-term perspectives on commissioning, controls, operation, maintenance, and obsolescence of engineered systems—considerations of life-cycle costing—are important factors in the selection of engineered systems for a project.

Embracing these issues as architectural opportunities rather than shunning them as technical problems to be solved by others can help architects achieve a smooth working relationship with building system consultants. The engineer plays a vital role, but the architect leads the coordination of all building systems and controls the final decisions, giving the architect the opportunity to promote innovation regarding the use of building systems.

notes

Take brief notes while reading the narrative and list key resources you used to complete the activities. Note discussion outcomes from meetings with your supervisor, mentor, or consultants. When finalizing the activity documentation (PDF), include your notes and the Emerging Professional’s Companion activity description.
Recognizing Technical Aspects of Building Design

Engineered systems vary according to the functional requirements of a building project. Every building type has a number of technical aspects that are generally the same in that category. For example, the technical considerations inherent in library design include task lighting, a circulation and storage system for library media, acoustics for quiet study spaces, structural loads imposed by book stacks, and strict humidity control for proper storage of printed works. Life safety code issues include egress and fire suppression. To address all of these concerns well requires recognizing them early and formulating appropriate design strategies even at the most conceptual levels of project delivery. Selecting suitable systems early in the design response is much easier than imposing them on a final design that was not intended to accommodate them.

Another set of technical considerations is introduced by an architectural design concept developed within the parameters of the building type. Although an architect’s concept is based on an essential understanding of the functional requirements of a building project, it is not uncommon for a design to introduce atypical requirements. For example, irregular forms may require structural gymnastics, or exposed elements may have unusual finishes that require special maintenance.

Another source of technical concerns can be introduced by the context of the project: Conditions particular to the site, the climate, or surrounding buildings or restrictions imposed by the historical situation or local codes, and so on.

Selecting Appropriate Systems

The types of building systems chosen to address the critical issues of a building project should simultaneously satisfy the challenges inherent in that building type, the parameters of the project setting, and the architectural concept. Failure in any one of these mandates will ultimately derail a design. How then are these requirements translated into appropriate selections?

One factor used to select building systems is performance specifications, which are often based on laboratory ratings, which make it possible to engage in qualitative and quantitative comparisons. Understand the available options and the rating techniques used to evaluate them can help in product selection as well as in writing specifications. A window system offers a good example of performance specifications because it has so many ratings. Following are some of the major ones:

- Solar heat gain coefficient (SHGC)—the rate of heat gain from solar radiation and temperature difference (NFRC 200)
- Visible light transmittance (VLT or Tv)—percentage and color of light in the visible spectrum that is transmitted to the interior (NFRC 300 & 301)
- Light-to-solar gain ratio (LSG)—the “cooltth” rating factor of VLT ÷ SHGC
- U-value—thermal conductance of combined glazing and window frame (NFRC 100)

resources

Institutions that promulgate performance specification standards include the following:

- National Fenestration Rating Council (NFRC)
- American Architectural Manufacturers Association (AAMA)
- Window and Door Manufacturers Association (WDMA)
- U. S. Department of Energy (DOE)
- National Institute of Standards and Technology (NIST)
- American Society for Testing and Materials (ASTM)
- Underwriters Laboratories (UL)
- National Institute of Justice (NIJ)
- National Fire Protection Association (NFPA)

These institutions may have free resources and tools to aid the designer.
• Air leakage—the volume of air passing through a square foot of window area and resulting in heat loss and gain through cracks in the window assembly (NFRC 400)
• Condensation resistance—the ability to resist the formation of condensation on the interior surface (NFRC 500)
• Energy Star Windows Rating Program—(USDOE)
• Design pressure—the pressure withstood by closed window, which in turn establishes the structural pressure, water penetration, and air infiltration (AAMA/WDMA 101/I.S.2-97 and NAFS F-C90)
• Forced entry—the attempted penetration of a door or window using a variety of tools (ASTM F588). Blast and ballistic standards are also available (UL 752 and NIJ 0801.01).
• Sound transmission class (STC) and transmission loss (TL)—the decibel rating of noise attenuation, ASTM Classification E90 and E413 (NIST).
• Fire rating—where required to restrict the spread of fire and smoke within buildings from internal or external fire (NFPA 257)

The ratings the organizations (listed on the opposite page) assign to various products are meant to be interpreted rather than used for absolute comparisons. Laboratory rating standards are rather like the EPA ratings of automobile gas mileage in that actual performance will vary with use and application in the real world. In addition, details of project or site can also influence the selection of products. For example, in window selection the different sides of a building will have different solar exposures, thus, windows for the different facades should be considered separately. In the final analysis, the numerical ratings of a particular window should be balanced against project-specific qualitative issues. The same principle applies to other building systems and their performance ratings.

In addition to these performance specifications, some “rules of thumb” can be applied to selection of building systems. Derived from the proven experience of engineering consultants, these rules can be used by architects in the conceptual and schematic design stages. In the window system example, a preliminary selection of glazing type and placement could be made based on the rough daylighting rule that suggests natural light will penetrate to 2.5 times the window head. Similar rules of thumb specify tons per square foot of air conditioning capacity, span-to-depth ratios for floor systems, and watts per square foot for lighting. Such information can be carefully applied to developing appropriate systems in other stages of the project.

Practical Application
In the architect’s office, coordination of engineered systems affects every stage of project delivery. It requires the architect to synthesize the owner’s requirements and the consultant’s recommendations on alternatives into a solution that considers both what the design could be and what it practically should be. To achieve this, the architect must engage in accurate, concise, and ongoing communication with the owner and consultants, including continuous feedback that fosters collaboration.

Coordination of building system choices is communicated in many ways, from submittals, shop drawings, specifications, schematics, change orders, technical memos, requests for production lead time, cost and performance comparisons, warranty agreements, and the like, to finished construction documents for...
Engineering Systems

eering seal. Any single transaction can produce a ripple of change in the network of time, cost, size, and image, thereby causing reconsideration of many other decisions. Changing from low performance glazing to high performance glazing, for example, can radically affect the thermal load and thus the engineering design and architectural requirements affecting duct size, vertical duct space, spandrel size, floor-to-floor heights, column loads, and foundation sizing, not to mention HVAC capacity, fan room size requirements, connected electrical loads, transformer vault design, and service feeder size. Beyond all this, there is the detailing of the alternative window wall system itself to consider.

Obviously, decisions with impacts so widespread have to be communicated effectively because they affect the work and time investment of numerous team members. Coordination ensures that client, architect, and engineering consultants are all progressing from a common set of shared information.

Building System Relationships

Building systems are related in physical, visual, and functional ways. Components that are physically connected share space, either literally or where they intersect. For example, detailing marks the site of physical connections between dissimilar materials, such as where two systems meet, such as a curtain wall at the structural frame or a window frame at a brick veneer wall surface. Visual integration is managed by size, proportion, color, shape, and other compositional techniques. The development of a building elevation is a classic example, with roofline, fenestration, and structural framing serving as geometric cues against the façade.

The functional relationships between building systems and their components are guided by performance requirements. Passive thermal design, for example, involves coordinating the building envelope design with HVAC requirements so that these systems work together to provide a satisfactory level of thermal comfort. Similarly, daylighting requires the coordination of envelope glazing and interior luminaire layout. If these systems are functionally coordinated, the resources of both are economized and a more elegant lighting scheme is possible. As is true throughout a project, if systems are designed with no relation to each other, both will be oversized and neither will achieve optimal performance.

The most basic building system coordination addresses only potential interference among systems at a practical level. In other words, light fixtures must physically fit into the ceiling space, ductwork has to be routed around major beams, the formal composition should be inoffensive, and the building must meet functional program criteria. This level of coordination, though minimal, can result in functional buildings. At the opposite end of the spectrum is a level of coordination that results in well-integrated buildings, those with systems that fully reinforce the design intention. In these buildings, systems have been selected, coordinated, and deployed not only to satisfy programmatic requirements but also to support the architectural design. This higher level of integration explains a great deal about exemplary works such as the John Deere headquarters, which Eero Saarinen designed with CorTen steel.

resources

ULtimate Fire Wizard


Programming and Building Systems
As stated by Michael Stanton, FAIA in The Discipline of Architecture, architecture is granted the status of a profession because it nurtures and employs a large and sophisticated body of knowledge to the betterment of society. One of the most distinct and evident aspects of this service to society is the translation of a client’s vision for their project into an architectural program. It is part of the architect’s magic, entailing as it does the principles and tacit understandings that underlie the entire discipline.

The architect develops a building program by beginning with a statement from the client and using good communication and careful listening to reach an intimate understanding of the project. What begins as an inventory of spaces, adjacencies, budgets, and perceptions in the client’s descriptions becomes an inclusive and complex ambition that cannot be described in terms of art or science. The design program is a uniquely architectural artifact. It becomes the managing principle that manages all other factors of a project.

This emphasis on program is a reminder of the distinction between goals and objectives. The program is meant to capture the ultimate goals of a project in a way that includes all the requirements and opportunities from which it evolved. It is vital for engineering coordination objectives to be formulated with this big idea in mind.

Early Project Development
Engineered systems coordination begins with selecting consultants well-suited to the project and establishing a working rapport. Initial decisions should identify the contact individuals for each party and a method for handling the flow of information.

Communication during the early phases of a project typically includes drawings and memos circulated among the team. The architect should expect to receive written and graphic descriptions of recommended standards at appropriate phases of the project. An initial meeting with an acoustician on a hotel project, for example, might be summarized by that consultant in with a technical memo that includes recommended STC ratings for separation of sleeping rooms from corridors, lobbies, and other spaces. Some generic drawings of typical acoustical separations might be included, as well as details of critical connections, appropriate door types to complement the noise reduction level of the wall, and suggested strategies for handling HVAC noise. The consultant is likely to know that the designer is looking for a range of reasonable options at this stage. Later technical memos from the same consultant would contain more detail and involve more professional judgment on final details and specifications.

To the extent merited by project size and complexity, all members of the project team should be kept abreast of major evolutions in all building systems to prevent system compatibility problems. Changes and mistakes cost increasingly more throughout a project, as it is obviously a great deal more work to undo things later than to plan for them in the first place. For example, the cost of correcting poor wall detailing selections adapted earlier in the process could be compounded by the cost of correcting how the details associated with a revised wall affect trim and finish selections.
Early in project development is also the best time to consider the physical, visual, and functional aspects of building systems, as outlined above:

- **Ease of coordination due to physical compatibility.** This relationship validates product submittals, shop drawings, and change orders. A more comprehensive example is the layering of CAD drawings to identify spatial relationships and potential interferences, such as when a duct crosses a beam in cramped space.

- **Resolved composition of visual relationships.** All engineering systems have technical criteria that affect where they are placed in a building. To avoid having such technical concerns unduly affect the building design, architects must take engineered systems coordination into account from the beginning of a project. For example, HVAC systems need outside air for ventilation, exhaust to the outdoors for polluted air, and combustion air along with an exhaust flue if gas heating is used. Fan rooms have to be located with concern for noise and access but be central enough to minimize duct runs. Outdoor compressors need a few feet of free air around them and an electrical disconnect within direct line of sight. All of these requirements limit the location of HVAC equipment, but an architect who knows these limitations from the outset can plan around them.

- **Economy, elegance, and sophistication of functional relationships.** Multipurpose, versatile building systems are more easily combined into a unified building system. Automated and intelligent systems can add further direct benefit. Buckminster Fuller termed this sort of thinking through technology as “ephemeralizing” the problem, increasing benefit while using fewer resources.

In practice it is usually not necessary, and sometimes not really possible, to classify the exact nature of the relationships between building systems and their components. Whether something has a physical, visual, or functional relationship is not important. As an example, consider the common 2’x 4’ air-handling light fixture. It physically incorporates a return air path, thus combining elements of the HVAC system and the lighting system. The light fixture also fits snugly into the ceiling hardware grid, making it possible to omit return air registers from the reflected ceiling plan. On the performance side, the lamp’s operation will be cooler and cleaner, making the fixture last longer and provide higher efficacy and reducing the need for additional supply air flow to capture the lamp. In the end, 10% fewer fixtures might be needed than for a standard fixture, and air conditioning loads and electrical circuits are reduced to match. Clearly, it is not important how such relationships are labeled, but it is good to have a framework for considering them.

To enumerate some of the major system-to-system integration opportunities more vividly, consider the matrix on the opposite page of ten possible two-system combinations and three types of relationship.
## Sample Building System Integration Matrix

<table>
<thead>
<tr>
<th>Building Systems</th>
<th>Physical Integration</th>
<th>Visual Integration</th>
<th>Functional Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site and Structure</td>
<td>Bearing and retaining</td>
<td>Sight lines; ground-figure massing as cave, slab, terraced or elevated</td>
<td>Solar orientation, aerodynamic form, setbacks</td>
</tr>
<tr>
<td>Site and envelope</td>
<td>Earth-sheltered or underground construction</td>
<td>View in, out, of, and from building; elevations; landscaping</td>
<td>Green roofs</td>
</tr>
<tr>
<td>Site and services</td>
<td>Cooling towers, utility entry, maintenance facilities, access</td>
<td>Screens, landscape buffers, pond as storm water retention feature</td>
<td>Cooling ponds</td>
</tr>
<tr>
<td>Site and interior</td>
<td>Entry, pedestrian routes, hardscape</td>
<td>Relation to landscape, visual contact with outdoors</td>
<td>Glare, contrast, shading</td>
</tr>
<tr>
<td>Structure and envelope</td>
<td>Hung cladding, in-filled frame or monolithic form</td>
<td>Detailing connections, expressing structure</td>
<td>Load-bearing walls, waterproofing</td>
</tr>
<tr>
<td>Structure and services</td>
<td>Interstitial spaces, interference, service layers in floor/ceiling</td>
<td>Exposed or finished over together</td>
<td>Thermal mass, cavity as air duct or conduit</td>
</tr>
<tr>
<td>Structure and interior</td>
<td>Fire protection of structure</td>
<td>Modular order in bay size units, visual expression of structure</td>
<td>Load bearing walls, columns, pilasters</td>
</tr>
<tr>
<td>Envelope and services</td>
<td>Perimeter services</td>
<td>High Tech, serviceability meets constructability as a path to meaning</td>
<td>Passive heating and cooling</td>
</tr>
<tr>
<td>Envelope and interior</td>
<td>The window as interface</td>
<td>Proportion, fenestration, enclosure, security, privacy</td>
<td>Daylighting, noise control, and mean radiant temperature</td>
</tr>
<tr>
<td>Services and interior</td>
<td>Lighting and plumbing fixtures, registers, vents, controls</td>
<td>Deployment and treatment of fixtures</td>
<td>Comfort, control, and economy</td>
</tr>
</tbody>
</table>

### Incorporating Engineered Systems into the Building Design

As a project progresses through design development and construction documentation, coordination of the engineered systems shifts from selection and general alignment to refinement, sizing, specification, deployment, and commissioning. At later stages in project delivery, the architect works more closely with manufacturers and contractors to select and specify equipment and materials, then to assure that they are
properly installed and, in the case of operating equipment, correctly started up. Advances in post occupancy evaluation (POE) and total building commissioning (TBC) techniques are extending opportunities for architects to be involved in the coordination of building systems. POE studies are beginning to create case study data that both verify how satisfied occupants are with the constructed building and validates that the design intention was on target.

TBC has grown out of the increasing realization that complex buildings seldom operate as intended right out of the box. Commissioning, which formerly entailed little more than balancing air flow and aiming light fixtures, now has a comprehensive goal: the assurance of a good match between how the building is actually used to the way it performs. For example, when the first generation of energy-efficient buildings realized only half their predicted savings, further analysis revealed faulty equipment, poor controls, and a host of other problems. After corrections were made, most of the potential savings began to be realized. Commissioning practices are growing in sophistication and scope and include everything from pre-commissioning in the programming phase to periodic commissioning throughout the life of the building. It is no accident that LEED standards (Leadership in Energy and Environmental Design) require consideration of commissioning from start to finish, design through occupancy.

Written by Leonard R. Bachman
Leonard Bachman is an architect and associate professor at the Gerald D. Hines College of Architecture at the University of Houston. He is the author of two books: Spreadsheets for Architects (with David Thaddeus) and Integrated Buildings: The Systems Basis of Architecture.
notes

Take brief notes while reading the narrative and list key resources you used to complete the activities. Note discussion outcomes from meetings with your supervisor, mentor, or consultants. When finalizing the activity documentation (PDF), include your notes and the Emerging Professional’s Companion activity description.
Technical Criteria Characteristic of Different Building Types

Performance specifications, rules of thumb, and other numerical ratings were discussed in the Engineered Systems Coordination narrative as quantitative and qualitative guides for developing and integrating building systems. Technical criteria characteristic of different building types, required by the context of a project, and created by the architectural design agenda were also addressed. All three types of technical criteria affect the architect’s design and should be embodied in the programming stage of a project and refined as work progresses.

Activity - Core

Using a project from your firm or your mentor’s firm that is completed through construction documentation, prepare a list of numerical standards that could have influenced the design team. Consult Architectural Graphic Standards and other references. Use sources such as Allen and Iano’s Studio Companion as a quick reference for occupancy, fire protection, egress, and mechanical equipment. See Fuller Moore’s Understanding Structures or other references for depth to span guidelines and Mechanical and Electrical Equipment for Buildings for electrical, mechanical, acoustical, and illumination standards. Consult any publications that deal specifically with the building type. Look for things such as foot candle levels, electrical power allowances (perhaps including an allowance for expansion), cooling ratios, dead loads and live loads, masking RC sound levels, recommended STC separations, along with other design considerations you can put numbers to.

The goal of this activity is to identify as many limitations and requirements as possible. Collect all of the planning standards you can for the project and construct a large data table to organize them. A spreadsheet would simplify this task. Apply the ratios and guidelines to the size and specifics of the completed project, multiplying recommended square foot ratios by the actual areas in your project and adjusting all the recommendations to fit the particulars. Finally, compare your projected sizes and ratings to the actual building systems and enter these as-built figures in a separate column.

Once you have compiled all your data, use it to answer the following questions in a narrative:

- How well do the values you projected match up with the as-built numbers? Can you explain or account for any major differences between the two sets of data?
- As design determinants, do you feel the set of initial guidelines you’ve identified promotes or inhibits design creativity? Explain both sides of the issue.
- What were some of the most important technical standards related to characteristics of the building type, project context, and design intention? How do your preliminary and the as-built numerical ratings reflect these priorities?
- Use sketches to create your version of the projected sizes and compare it to the final product, how are they different?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Impact of Other Disciplines on Schematic Design

Supplemental Experience for eight (8) Core IDP Hours

This activity illustrates the importance of other design disciplines in the development of the schematic design. An architect must take a leadership role by learning the engineer’s technical language and basic concepts of systems design. From these concepts come options which will begin to integrate with the other systems accepted into the project and inform the design early in the process.

Activity - Core

Please review the following source:

• The Architect’s Studio Companion - Technical Guidelines for Preliminary Design; Edward Allen. Chapters “Designing the Structure” and “Designing Spaces for Mechanical and Electrical Services”.

Select a project that your firm or your mentor’s firm has designed. It may be a completed project or a current building in the office. It must have completed the Schematic Design Phase and have licensed engineers that are available to consult with.

With your IDP supervisor or mentor, arrange to meet with the structural and mechanical/electrical engineering consultants on the selected project. Discuss the process and criteria these consultants use to consider and incorporate their preliminary design ideas and systems into the project.

In sketch form, review and record the schematic design decisions that were significantly influenced by the choice of structural system. For example, if bearing walls were used instead of a structural steel framing system, what were the implications? Did the floor-to-floor height change? Did the proportions of the openings in the exterior walls or interior partitions change? How did the choice of mechanical/electrical systems affect the structure? Analyze how the building could have evolved differently if an alternative structural system had been selected.

Repeat this exercise with the mechanical/electrical system. What mechanical system elements had to be accommodated on the exteriors (e.g., louvers, rooftop equipment, etc.)? How was the rooftop equipment screened? Did the choice of mechanical system affect the floor-to-floor height? How was the size and location of the mechanical/electrical room(s) determined? How did the structural system affect the choice of mechanical/electrical systems?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Value Analysis

**Supplemental Experience for eight (8) Core IDP Hours**

In this scenario, your firm has been retained to design a 10-story vision and spandrel glass curtain wall office building in the Chicago suburbs. It will be the new corporate headquarters of Life Insurance. This building has been identified in the long range plan to serve Life for 30 to 50 years. The company is also interested in sustainable practices and would like to see any practices incorporated into the project only if it can be included in the budget provided. Life also wants the building to have a strong corporate and green image.

Life has hired a construction manager to work with the design team. The construction manager, your firm, and the engineers agree on the major systems: The structural system will be steel columns with steel girders and beams framing a 30 x 30 foot bay spacing; heating and air conditioning will be a variable air volume induction system serving 1500 square feet of floor area; and the office areas will be lit with fixtures that provides indirect lighting suspended from a hung ceiling. The ceiling height must be a minimum of 9 feet above finish floor.

The construction manager has just completed an update of the initial budget and reports the project is over budget. He makes a number of value analysis suggestions to bring the project within budget. Among the suggestions is a reduction in the floor-to-floor height from 13 feet to 12 feet. Over the 10 floors, this will save 10 feet of exterior skin, steel columns, plumbing risers, sheetrock, and many other materials.

Your team views this recommendation with concern. On several recent projects, this kind of reduction led to serious problems in coordinating engineered systems in the ceiling and caused problems for maintenance and efficiency of these systems when the building was in use. However, the construction manager estimates the change will save $400,000, and the client representative has directed you to make the change in the schematic design.

Is there enough space to fit the structure and engineered systems into the ceiling space provided and perform efficiently? How will this proposed revision affect the architectural design of the building’s skin? How will the eventual operation of the building be affected? What issues of sustainability come into play? What other design and/or material changes should be considered to bring the project into budget?

**Activity - Core**

Please review the following source:

- *The Architect’s Studio Companion - Technical Guidelines for Preliminary Design*; Edward Allen. Review the requirements of preliminary design for structural and engineered systems.

Using the source above, in sketch format:

1. Draw a building section sketch at a minimum scale of ½” = 1’-0” through a typical floor illustrating how a reduction in floor-to-floor height would affect placement and efficiency of the necessary engineered systems.
2. Using the sketch analysis as an illustration, write a memo to the client representative and the construction manager explaining why this change is or is not a good idea.
3. If it is not a good idea, explain any options you have considered to bring the project into budget that would be more suitable to meet the program and budget requirements.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Reconciling Conflicting Client Demands

Supplemental Experience for eight (8) Core IDP Hours

In this scenario, your client group on a recent small medical clinic has been a dream to work with. From the first day they had every intention of investing in quality and expect high standards of environmental stewardship embodied in their new building. They repeatedly express their belief that energy efficiency will pay back the increased initial investment required to incorporate green standards in the project.

Reality sets in and halfway through design development and the project is estimated to be running far beyond the expected budget. Your firm has invested a great deal of research and design work in sorting through products and technologies the clients requested as part of their basic ethical approach to the project. Now they want to retain as many of the energy and green features as possible, but not at the kinds of construction costs current estimates suggest. By now they have also identified several aesthetic features of the design they are unwilling to relinquish, features that are basically optional to the project but will cost enough to prohibit inclusion of several sustainable design and energy conservation measures.

The client insists that your firm rework the design to reconcile all of the issues above. A meeting has been called to discuss the implications of their demands.

Activity - Core

In preparation for the client meeting, using small project under construction in your area as the project, assume you have been asked to create a presentation considering the following terms and prepare to discuss them with the client and the design team. Describe how you would handle this situation in a narrative and include the following:

• What implications will cost cutting have on the coordination of engineered systems at this point?
• Create a map to show how the engineered systems are all interconnected and the effect changing one has on the other. Could the change in systems affect the overall design of the building?
• Who should be responsible for the time and resources needed to redesign and re-integrate the technical aspects of the project?
• In the long term, what ways would sustainable design and energy conservation save the client money? How could the engineered systems be made more sustainable to save money in the future?
• How do cost control strategies in design practice work to balance initial construction costs, ongoing operational costs, and future costs for upgrading and replacing parts of the building that become worn out or obsolete?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
In this scenario, your firm’s residential client from Seattle met a consultant at a party who told him about a high-tech heating and ventilation system that pays for itself in three years and runs on methane. You and the principal in charge are sure this elaborate system is overkill for the climate conditions in Seattle and may not be possible, but you are willing to review the system and other similar systems on the market while working on the design of the home.

**Activity - Elective**

Prepare an analysis that compares the Seattle climate with passive and active heating and ventilation systems. Illustrate which system is more appropriate for Seattle. If the client insists on the less efficient of the two, how can you acquiesce and still protect the firm from exposure to liability in the future?

If passive design were used, draw the ideal site plan for maximum efficiency. Then draw the ideal site plan using active heating plan for maximum efficiency.

Write a report explaining to the client which design is more efficient for the region.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Solutions for Water Collection and Distribution
Supplemental Experience for eight (8) Elective IDP Hours

Using a project recently completed in your office or your mentor’s office, create plan and section drawings to show the changes necessary in order to store enough rainwater to provide potable water to all the users of the building (use 200 gallons/person/day for sizing storage).

Activity – Elective

In addition to the plan and section drawings, write a narrative to describing the following:

- Distribution of water throughout the building.
- Additional uses for this new water source.
- Possible amenities developed from the need to store water.
- A way to provide a failsafe in your design in the event of a regional drought.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Coordinating Engineering Services
Supplemental Experience for eight (8) Elective IDP Hours

Use the activity below to document the responsibilities of key individuals at your firm or your mentor’s firm who regularly interact with engineering consultants.

Activity - Elective

Review a project your firm or your mentor’s firm has completed and write a narrative on the engineering services coordination using the documents provided.

Start by sitting down with experienced individuals who routinely handle project coordination with engineering consultants. Prepare a good list of questions and discussion topics to make the most of your time together.

- **Attitudes and inclinations.** Are there any notable differences in background experience or personal inclination that makes an architect more comfortable and confident in dealing with engineering consultants? Can these attitudes and inclinations be adopted willingly or are they learned skills?
- **Time allocation.** How much time is typically invested in coordinating the work of engineering consultants in each phase of the project from conception to completion? How is this time spent, and how is it dispersed among the various tasks involved?
- **Milieu.** How is this coordination effort similar to and different from the role of designer?
- **Caught between.** What special considerations or challenges arise in communicating the work, thought, and language of the architect’s team to the engineer’s team and vice versa? Does the coordinator get “both barrels from both sides” when things go amiss?
- **Scope.** In building system coordination, which tasks are engineering consultants most positive about and which are they indifferent or opposed to assuming? How is the task of systems integration shared?
- **Time and money.** How are the production of drawings, specifications, submittals, and other instruments of service for engineering coordination kept in line with the project schedule and budget, as well as with the firm’s project management objectives?
- **IPD.** How could integrated project delivery be used in this project?

Use the answers from your interview and the information provided in the construction documents to write your narrative. Address all of the questions above.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Who Makes the Decisions and How?

Supplemental Experience for eight (8) Elective IDP Hours

A concept map will let you delineate the paths and nodes of relevant decision making. Architects frequently use this technique to construct adjacency or “bubble” diagrams to illustrate the relationship of plan elements. You can choose from a variety of formats for creating this map: flowcharts, Gantt charts, fishbone charts, Venn diagrams, and so forth.

These methods are used for brainstorming and process documentation in a variety of professions. Try using shapes and colors to differentiate the items on your map in some meaningful way. Shapes usually represent entities (ideas, decisions, questions), while lines usually represent flow or connections between the entities. See the resource section on mind mapping at the end of this chapter for examples and more ideas.

Concept maps can present complex relationships in graphics that communicate information quickly and intuitively. The maps are also easy to work on collaboratively in brainstorming exercises such as design charrettes. A mapping technique for the early organizational stage is to use sticky notes to position and reposition entities on a larger notepad, drawing page, or whiteboard. As your map evolves, however, try formalizing it in increasingly sophisticated ways that capture and communicate what occurred in the project you are documenting.

Activity - Elective

Select a project in your firm or your mentor’s firm and interview someone who worked on it about the sequence, logic, and interconnected decisions regarding selection of engineering systems. Create a map/diagram of the project using the notes from your interview.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Passive or Active HVAC? Consultants Disagree

Supplemental Experience for eight (8) Elective IDP Hours

In this scenario, your firm has considerable expertise in earth-cooled structures, utilizing ground temperature in concert with passive solar design. Your analysis of the client’s site in Santa Fe, New Mexico, shows high potential for using site energies to heat and cool the house. The client’s brother-in-law is a mechanical engineer in Florida. He has told your client she should not use passive methods and that ground temperature is inconsistent. “The only way to go is electric HVAC,” he says. Your client wants to do what works. She is open-minded but does not want to offend her brother-in-law.

Activity - Elective

Illustrate in a geologic/watershed/airshed drawing how the regional New Mexico climatic systems work and how, through passive design, the home will be comfortable at low cost.

Write a cover letter to the client, describing your drawing and outlining why electric HVAC is unnecessary. Explain that in south Florida her brother-in-law may be correct, and use a side-by-side analysis of climatic conditions and comfort levels to illustrate your point. (Review and use Victor Olgyay’s comfort charts or information from the chapter on “Energy and Environmental Design” in Architectural Graphic Standards.)

The client decides to use electric HVAC, even though you have proved the passive approach will work and is cheaper. Write a narrative where you explain to the client the environmental benefits of passive HVAC and why or why not you will accept this job.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
In The Building Systems Integration Handbook, Richard Rush, AIA, describes a “design engine” in which aesthetics, function, and cost are arranged as a wheel with a circle of arrows connecting them. This method of diagramming is meant to imply that a change in any factor will cause a change in the others.

Activity - Elective

Ask a mechanical engineer that your company has worked with to specify two different heating/cooling systems for a high school auditorium that seats 1,000 people.

Write a narrative detailing the differences between the two systems and describe the design impact on the space that each system would have. Include the recommendations of the engineer and a minimum of three sketches of the space that would support your recommendation to the client.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
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Construction Costs

Introduction

By completing the activities in this chapter, you will gain an understanding of the office activities involved in construction cost estimating. The following information is taken from the NCARB IDP Guidelines:

Construction Cost
Minimum Construction Cost Experience: 120 Hours
Definition: Involves estimating the probable construction cost of a project.

Tasks
At the completion of your internship, you should be able to:
• Perform value engineering of selected building elements
• Perform life cycle cost analysis of selected building elements

Knowledge Of/Skill In
• Alternative energy systems and technologies
• Building Information Modeling (BIM) technology
• Construction sequencing
• Cost estimating
• Critical thinking (e.g., analysis, synthesis, and evaluation of information)
• Hazardous materials mitigation
• Implications of design decisions (e.g., cost, engineering, schedule)
• Life cycle analysis
• Product evaluation, selection, and availability
• Value engineering

resources

Download the current Intern Development Program (IDP) guidelines at www.ncarb.org/Experience-Through-Internships.aspx.

• Chapter 13.5 - Construction Cost Management

• Chapter 14.4 - Construction Cost Management

• Chapter 9.4 - Construction Cost Management
Narrative

Managing building costs is a challenging task for the design team as well as for construction managers, contractors, and consultants. Owners demand that their design and construction teams respect the owner’s financial and economic objectives and that they control costs during project delivery. This expectation is found in both the public and the private sectors in all client industries, locations, and financial situations.

Owners expect that a budget prepared early in a project will be accurate and that the project will be completed to the required scope, quality, and performance within that budget. Owners invariably place a high priority on cost issues, regardless of the quality or other attributes of the project. They may even judge success or failure exclusively in terms of cost.

During the past decade, professional organizations, educational institutions, government and private entities have supported the development of building cost analysis methodologies and provided seminars and other educational programs on this subject. The success of these efforts has varied, but one issue has become clear: Achieving high-quality design and implementing effective cost analysis and management are not contradictory objectives.

Nearly every decision an architect makes during design and construction affects project costs. Some decisions are straightforward because they affect building quality or performance. Others are more subtle, affecting ease of construction, complexity of building elements, or availability of materials. Some decisions can profoundly affect other disciplines, such as plenum depths that may confine mechanical/electrical services or a building module that influences a structural grid.

Why is it so difficult to control building costs? Quite simply, the design decision-making process is subject to constant upward pressure on scope, quality, and performance and, therefore, on cost. Unless decisions are managed and expectations kept in check, costs may rise beyond budget limits.

Building cost analysis encompasses economics, cost estimating, and cost management, discussed below under the following heads:

- Understanding building economics
- Identifying factors that influence building costs
- Using standard formats
- Applying cost-estimating methods
- Dealing with escalation and contingencies
- Understanding value analysis
- Understanding life-cycle costing

notes

Take brief notes while reading the narrative and list key resources you used to complete the activities. Note discussion outcomes from meetings with your supervisor, mentor, or consultants. When finalizing the activity documentation (PDF), include your notes and the Emerging Professional’s Companion activity description.
Understanding Building Economics

What determines how much buildings cost? We all understand the cost of buying a suit, an automobile, or even a house. By experience, we develop a sense for what something should cost. However, unless we fabricate an item from its basic parts, we may not develop a sense of what makes it cost a specific amount. Construction projects are complicated entities. To be able to estimate and manage building cost, an architect must first understand what costs are involved.

Capital Cost Components

Capital costs are normally subdivided into three major categories—site costs, hard costs, and soft costs. The accompanying diagram summarizes each of these categories.

Site Costs

Site costs normally cover the owner’s initial land acquisition and development costs for the project.

Soft Costs

Soft costs include a variety of costs incurred by the owner to move the project forward. Design fees, management fees, legal fees, taxes, insurance, owner’s administration costs, and a variety of financing costs fall into this category. Moving costs and other tenant-related costs may be placed in the soft cost category.

Hard Costs

Hard costs are those most directly affected by decisions of the architect. These include core and shell features, interior enclosures, basic building services, and fit-out costs for finishes and mechanical and electrical services. Major components of hard costs that are usually not incurred under the construction contract include furniture, fixtures, and equipment (FF&E) and specialized mechanical and electrical services. These costs are often incurred directly by the owner.

The breakdown of costs can vary widely according to building type. For instance, a standard office building is typically built for between $80 per square foot and $150 per square foot, depending on quality and performance requirements. A laboratory building, on the other hand, may cost from $150 per square foot to more than $400 per square foot, again depending on quality and performance requirements. The disparity between costs for these two building types is caused largely by laboratory mechanical costs, which alone can exceed $150 per square foot, especially when extreme requirements of control, filtration, and cleanliness are required. To control mechanical costs when they are expected to represent 40 to 50 percent of overall project cost, more attention must be given to initial budgeting and ongoing cost management activities for mechanical elements.
Construction Costs

Construction costs are the portion of hard costs normally associated with the construction contract, including the cost of materials and the labor and equipment costs necessary to put those materials in place. Added to this are overhead costs, which include both job site management and the contractor’s standard cost of doing business (office, staff, insurance, etc.).

Material Costs

Material costs cover purchase of materials, including local and regional taxes, and shipping and handling costs, which include transportation, warehousing, and in some cases security. In very remote areas or in overseas locations, shipping, handling and other overheads may exceed the cost of the material.

Installation Costs

Installation costs include the price of labor and equipment to put materials in place. Labor costs consists of base wages, taxes, insurance, and benefits, as well as premiums for overtime or for working in remote locations. Equipment costs include the direct cost of the equipment (whether it is a purchase amortization or a rental) and the cost of an equipment operator, which sometimes includes support staff.

Overhead costs associated with construction are usually referred to as general conditions. These costs include those for field supervisory staff, additional professional services staff, engineering consultants, as well as temporary facilities and utilities, small tools, and a variety of safety and security equipment. Also included in this category are bonds, permits, and insurance costs allocated to the project. Contractors and subcontractors also incur general conditions costs.

Additional overhead costs associated with the main office of each contractor include salaries of home office staff, certain insurance costs, various home office overhead costs (job procurement, marketing, advertising, etc.) and profit. Profit is a function of market and risk and may include a contingency for unknown or uncontrollable aspects of the work.

What makes construction costs vary?

The purchase price of building materials is directly affected by their availability and the demand for them in the marketplace. The timing of events on a project can significantly affect cost, especially if short lead times for products and materials challenge availability. Shipping and handling costs, particularly in remote areas, can be expensive. Procurement limitations such as the “Buy American Act” can substantially drive up cost by limiting competition. Sales taxes, import/export duties, and other special fees indirectly affect the cost of materials.
Installation costs are driven by geographic variations in labor costs and productivity. Certain trades, such as demolition, universally carry very high insurance premiums because of the risks associated with the work. The safety record of the contractor further affects insurance premiums. Conditions of the work, particularly for renovation projects, dramatically affect productivity because access, egress, laydown area, staging area, and general space available to conduct business may be restricted.

The nature of a project site, such as a remote location or site with poor access to utility services, also affects general conditions costs. Security for the construction site can be another cost factor. Owner requirements and limitations on site access may indirectly affect cost.

Other potential markups that contribute to a building’s cost are a function of market competition and project risk. Risk or the perception of risk is always a significant factor. In times of high competition, allocations for overhead and profit tend to be reduced to increase a firm’s competitive edge. When competition is poor, these costs tend to increase. Owner policies intended to reduce the owner’s risk can also increase cost. For example, some owners believe that employing extremely onerous bonding and default requirements protect them, but they may be unaware of the cost of such measures.

Identifying Factors That Influence Building Cost
Building costs can only be controlled through effective control of the factors that influence them:

- Scope of work
- Geographic and site factors
- Programmatic factors
- Design factors
- Qualitative and performance factors
- Delivery process, legal, and administrative factors
- Market, competition, and economic influences
- Risk factors

Scope of Work
This is the most basic factor driving building cost. If the scope increases, costs will almost invariably increase accordingly, thus scope management is an important part of cost management. Under extreme circumstances, it may be necessary to program a facility over again rather than rely on the design process to correct a scope problem.

Geographic and Site Factors
Site location (e.g., urban vs. rural) affects labor rates, material costs, and a variety of other cost issues. Local climate has a major influence on selection of building materials and even on basic approaches to developing the building. The building site also determines access, egress, and utility provisions. In some instances, particularly large sites such as campuses and military bases, utility lines may need to be extended great distances to reach the building site, possibly resulting in costs that exceed those of the rest of the project.

resources
## Factors Affecting the Cost of Building Elements

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<td>Site configuration and levels, paved areas, special features, demolition required, soil disposal and compaction, soil conditions, exterior lighting and utilities, extent of landscaping</td>
</tr>
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</table>
Site conditions include basic topography, which dictates the amount of earth that must be moved to allow for development and provision of utilities. Environmental factors can affect costs directly if they require a response and indirectly if their mitigation requires adjustment in the project schedule. For example, wetlands mitigation can have major impact on cost and on how much of the site is available for use. The presence of rock or other difficult soils also directly affect site development costs as well as eventual choices for building foundations.

**Programmatic Factors**
Typical cost drivers related to a building program include space efficiency, security requirements, circulation requirements, ADA requirements, blocking and stacking, adjacency requirements, and the functional mix of spaces.

By far the most significant of these factors is the mix of space types required in a building. For example, laboratory space may cost $400 per square foot, while standard administrative or office space may cost $100-150 per square foot. An exact 50-50 program mix in this example would yield a building cost of $200-220 per square foot. If the same building comprised 70 percent laboratories and 30 percent office space, the building cost would exceed $300 per square foot.

Space efficiency is also an important cost driver. Achieving the levels of space efficiency defined in the program can be a design challenge. To ensure these efficiencies are achieved, care must be taken to establish realistic targets based on experience in comparable buildings.

**Design Factors**
The building geometry and degree of articulation in the basic plan affect building cost. For example, from a cost perspective, a perfectly square footprint is the simplest to build and theoretically less expensive. Nonetheless, this geometry may be unacceptable and overly simplistic for most projects.

Plan geometry and exterior articulation are issues that require proper budgeting and oversight during the design process. Shadow lines, notches, and projections all may benefit the building form aesthetically, but their complexity represents additional costs for labor and possibly for materials. This relationship is especially true for buildings with high-quality envelope systems.

Building height and overall scale also influence building cost. For example, the cost of the structural system is likely to increase along with the building height.

**Qualitative and Performance Factors**
The owner’s quality and performance requirements need to be carefully considered in both budgeting and cost management. Owners generally set requirements with a bottom threshold in anticipation that delivered quality will at least meet stated minimums. Designers will almost certainly meet these minimums and often exceed the minimum because of their desire to provide better quality and performance.

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Legal and Administrative Factors
The delivery method chosen by the owner can affect the cost of a project in many ways. Whether the delivery method is design-bid-build, design-build, construction management at risk, or a variety of other construction management approaches, the initial budgeting process and the cost management process should reflect the delivery method chosen and account for any premiums or discounts anticipated, especially as they relate to the schedule.

The timing of a construction contract award is an extremely important consideration. A construction contract can be awarded at almost any point in the procurement process. However, if the contract is negotiated and awarded before the documents are complete, the owner and contractor often agree on a guaranteed maximum price (GMP). A GMP usually includes allowance for work not defined, and the degree and nature of these allowances requires scrutiny on the part of the owner and the architect.

The owner’s approach to cost management and cost management policies have a subtle but significant effect on the cost of a building. Brian Bowen, former president of Hanscomb Inc., observed, “Buildings cost what they’re allowed to cost.” If the owner’s attitude toward cost management is lax, it is reasonable to assume costs will increase over time. Conversely, if the owner demonstrates concern for cost then cost tends to be contained over time.

Market and Economic Influences
Market and economic conditions may overwhelm other cost factors. Market conditions tend to follow the overall economy, and in turbulent economic times the market has been known to affect building costs by 10 to 20 percent or more. In times of recession or slow economy, prices tend to drop because demand is down. Conversely, in times of economic boom, prices tend to rise because demand is up.

Competition also affects prices. As the number of bidders increases, the price goes down; when the number of bidders is reduced, the price goes up. Market factors are volatile, and great care must be taken when projecting the effects of competition and inflation. The delivery method chosen may also affect competition, directly through the number of prime contractors who are bidding the project and indirectly through the number of subcontractors included in the bids of the primes.

Risk Factors
Projects with more risk are likely to cost more, thus formalized risk-estimating methods may be appropriate in certain circumstances. Preparation of a risk-based cost estimate places more attention on major cost components when risk is a significant issue and variances in these components can be consequential. In some circumstances, it may be appropriate to consider alternate design choices that may have the benefit of minimizing some aspect of risk on a project. For example, a facility could be relocated to a different area of the site to minimize the chance of disturbing contaminated soils, or materials could be selected that are known to be readily available rather than materials that are in short supply.
Using Standard Formats
Use of a standard framework for classifying and managing information is essential for accurate building cost analysis. The most common framework in the construction industry today is the 16-division MasterFormat developed and managed by the Construction Specifications Institute (CSI). MasterFormat is extensively used throughout the industry as a format for project manuals, specifications, and other project data. Since the MasterFormat structure resembles the basic way projects are procured (subtrades and contract packages), it is often used as a framework for cost control, scheduling, and estimating.

UNIFORMAT is a classification system based on physical building elements, originally developed by the American Institute of Architects (AIA) and the U.S. General Services Administration (GSA) in the 1970s. The most recent version, UNIFORMAT II, refines certain aspects of the original system and has been designated ASTM Standard E1557-96. UNIFORMAT is best applied to conceptual and schematic estimating, while MasterFormat is more effectively used for detailed estimating and bidding. It is not difficult to cross reference the two systems.

Applying Cost-Estimating Methods
Any cost-estimating method used should be consistent with the level of information available and the time available to prepare the estimate. Cost estimating methods tend to fall into four major categories:

1. **Single-unit Rate Methods (SUR)**
2. **Parametric/Cost Modeling**
3. **System/Elemental Cost Analysis**
4. **Quantity Survey**

The figure on the opposite page shows when these estimating methods generally can be applied to overall delivery of a project.

Single-unit rate methods tend to be appropriate in the planning and programming phases of a project. Parametric and cost model estimates are generally used during schematic design and early design development. Systems and elemental estimates are best during design development and early construction documentation. Estimates based on a quantity survey can be used almost any time but are generally most appropriate when documents are reasonably detailed, such as during design development, construction documentation, and bidding and construction. At any time, these techniques may be used to cross-check overall costs.

1. **Single-Unit Rate (SUR) Estimating Methods**
   Single-unit rate estimating methods are subdivided into four major categories:
   - Accommodation method
   - Cubic foot method
   - Square foot method
   - Functional area method
Accommodation Method
For this method, an estimate of overall construction cost is calculated using the cost of selected units of the facility as a baseline. For example, parking garages can be measured per parking stall. Apartment buildings might be measured on cost per apartment. Performing arts facilities and auditoriums can be measured on cost per seat. Hospitals may be measured on cost per bed. The accommodation method is often used to provide very preliminary estimates or to provide a quick check and assessment of a current project estimate.

Cubic Foot Method
This method of analysis is not generally used in the United States except for volume-dependent facilities such as warehouses. Although it can be effective, the cubic foot method tends to be awkward for use in most facility types. Nonetheless, certain European countries, especially Germany, routinely use cubic measures as a means of budgeting facilities.

Square Foot Method
This is the most commonly used initial budgeting mechanism in the United States. It can be effective, but care must be taken to ensure the programmatic basis of each is comparable when costs of different facilities are considered. In addition, the method of measuring must be consistent for project comparisons to be valid. A number of published sources provide square foot costs. A commonly referenced one is the R. S. Means Company’s Building Construction Cost Data.

Functional Area Method
This approach to estimating is based on functional space types. A functional space type is defined as an area in a building that has a distinct functional purpose, for example, classrooms, a cafeteria, or a gymnasium in a school. The advantage of determining cost by functional area rather than pure square footage is that variations in space types and program can be considered in the basic estimate. Using the school example, classrooms might cost $100 per square foot to build, while the gymnasium might cost $200 per square foot. Overall proportions in a typical program of classrooms and gymnasium can be accommodated. The functional area method allows for sensitivity to program elements.

The functional area method can be applied in two ways, either by pure space type or by core and shell plus the functional space build-out. The first option assumes equal sharing of the core and shell costs among space types. The second derives the core and shell costs separately and then assesses the build out costs of each space type.

2. Parametric/Cost Modeling Method
These cost estimating methods use predetermined models based on statistical analyses used to predict facility costs. The process is most effective for repetitive facilities that have consistent programs, such as those with industrial applications. Statistics are gathered from in-place construction and can be used...
to predict costs, especially for complicated systems that involve piping, manufacturing, and processing components. These approaches have less application in building construction.

Cost models can be prepared with computer models that project the form, shape, and composition of building types. In the last several years, computer based systems have been developed to help designers model form and shape and determine building size. These systems can also be used as a front-end device for cost modeling.

3. Systems/Elemental Cost Analysis
   This approach to cost estimating provides a bridge between the conceptual estimating methods described above and estimates based on full, detailed quantity surveys, which are described below. The concept behind this approach is subdivision of a facility into its elemental components, generally using UNIFORMAT as a basis. The level of detail included is a function of the amount of design detail available when the cost estimate is prepared.

   When very limited design information is available, a set of assumptions must be made from which to estimate costs. It is possible to base these estimates on historical information from similar facilities or historical information about building components and elements. At an early stage of design, before details have been defined, it may be desirable to develop what are generally referred to as “assemblies” — composite systems usually drawn from standard design details. These assemblies can be accurately priced and are especially useful for comparative purposes. Historical cost is an appropriate basis for estimates when facility types and programmatic components are similar. Adjustments to the historical cost information can be made if necessary.

   Published sources of information can be used to prepare estimates and to cross-check estimates prepared using other methods. The R. S. Means Company produces a publication that contains cost models of various building types, including selections of walls, finishes, mechanical systems, etc.

   A potentially more accurate estimate is one produced using an elemental format that represents specific conditions of the developing design. This approach requires a combination of pricing mechanisms, which could include historical costs, costs of systems and assemblies, and detail cost analysis for selected items.

4. Quantity Surveys
   The quantity survey method of cost estimating is usually employed when detailed design information is available on the entire project or at least major components thereof. The actual pricing approach may include only total unit prices or labor, materials, and equipment. The level of detail in the estimate is intended to reflect individual units of work in the way it will be carried out.
Dealing With Escalation and Contingencies

Escalation and contingencies are cost factors that have not yet been identified when an estimate is prepared. All estimates, as estimates, potentially include escalation and contingency. These terms can be defined as follows:

Escalation is the inflationary cost growth anticipated between the time an estimate is prepared and the project bid is accepted. Pricing represents known costs at the time the estimate is prepared, and escalation is added to move the cost forward in time. This can be done in three ways:

1. Escalation that occurs during construction: For simplicity, 50 percent of the work is assumed to take place before the midpoint of construction and 50 percent after. Therefore, the cost estimate for construction is escalated to the midpoint to show what a potential bid might be. This is called a bid estimate.

2. Escalation that occurs from the time the estimate is calculated to a projected bid date: In order for an estimate to reflect a future bid date, the bid estimate would be escalated for the amount of time between the date of the bid estimate and the bid date.

3. Escalation calculated by the contractor and presented in a bid: Subcontractors preparing bids to submit to general contractors usually include escalation in their numbers and guarantee the numbers for a limited time. A contractor preparing a bid to present to the owner does the same.

Contingency is an allowance for work that is not completely defined when the construction estimate is made but is anticipated to be part of the project scope. Contingencies tend to be added as a single factor made up of several components:

- Design contingencies depend on the degree of completeness of the design when estimates are prepared and the degree of confidence the estimator has that the design will not change significantly.

- Estimating contingencies reflect the estimator’s confidence in the estimate. They can depend on the extent of design development at the time the estimate is prepared, but other factors may also affect the estimate, such as availability of materials, issues of site access/egress, and conditions of the work. The design and estimating contingencies are usually included together and generally approach zero as the documents are completed.

- Construction contingencies are intended to reflect cost increases that will occur after the construction contract has been awarded. These contingencies are meant to cover unknown site conditions, weather, and uncontrollable delays, as well as change orders due to inconsistencies/incompleteness in the construction documents.

- Owner’s contingencies are intended to cover the construction contingency but include an allowance for scope increases and owner-elected changes.

What are reasonable allowances for contingencies? There are no absolute standards, but experience teaches what figures are sensible. For example, a major architecture/engineering firm advocates using the following design/estimating contingencies:

- Program estimates: 10-15%
- Schematic cost estimates: 7.5-12.5%
- Design development estimates: 5-10%
- Construction documents estimates: 2-5%
- Pre-bid estimates: 0%
Understanding Value Analysis/Value Engineering

Value analysis (VA) is a cost optimization process that has been applied in numerous ways in the construction industry for more than 30 years, mostly under the term value engineering. The concept is also a problem-solving process, and when applied correctly to a problem can have excellent results. It is this aspect of the process that has led to use of the term value analysis rather than value engineering. Unfortunately, VA has often been employed instead as a last minute cost reduction process, resulting in significantly reduced value for the owner.

The application of VA is not difficult but does require patience, concentration, and a certain amount of discipline. For best results, all parties involved must agree on the objectives and be willing to work toward common goals. When properly used, VA can be a useful tool for general problem-solving, cost optimization, and value enhancement.

Understanding Life-Cycle Costing

Life-cycle costing (LCC) is an economic assessment expressed in terms of equivalent costs. It is used to evaluate the significant costs of ownership over the life of a product, assembly, system, or facility and to compare the costs of various options.

Life-Cycle Costing Principles

In LCC analyses, both present and future costs need to be taken into account and related to one another. Today’s dollar is not equal to tomorrow’s dollar. Money invested in any form earns, or has the capacity to earn, interest. For example, $100 invested at 10 percent annual interest, compounded annually, will grow to $673 in 20 years. In other words, it can be said that $100 today is equivalent to $673 in 20 years time, providing the money is invested at the rate of 10 percent per year.

The terms “interest rate” and “discount rate” are generally used synonymously, and refer to the annual growth rate for the time value of money. The discount rate can be derived from the minimum acceptable rate of return for the client for investment purposes or from the current prime borrowing rate of interest.

Inflation also affects an economic analysis because its ability to reduce purchasing power over time must be factored in. This effect, more correctly termed “deflation,” means that more currency in the future will be required to purchase the same goods. Some costs may exceed inflation. For example, energy costs have tended to increase at a rate 1-2 percent above inflation over the last 10 years. Thus, future energy costs need to be inflated differentially (above the general inflation rate) by 1-2 percent. This is referred to in life-cycle cost analyses as escalation.

Life-Cycle Cost Analysis Period

The period used in comparing design alternatives is an important consideration. Generally, 25 to 40 years is long enough to predict future costs for economic purposes and to capture most significant costs, since 90 percent of the total equivalent cost is consumed in the first 25 years.

More information about value analysis can be found in topic 12.11 Value Analysis in The Architect’s Handbook of Professional Practice, 14th Edition.

(at a 10 percent discount rate). Consideration of periods longer than 40 years generally add no significant benefit to the analysis.

A time frame must also be assigned to each system under analysis. The useful life of each system, component, or item under study may be its physical, technological, or economic life. The useful life of any item depends on such things as the frequency with which it is used, its age when acquired, the policy for repairs and replacements, and the climate in which it is used. Component replacement may be scheduled several times in an overall facility cycle.

Categories of Cost
Typical facility costs for the owner over the life of a building can be subdivided as follows:

1. Initial costs
   • Construction
   • Fees
   • Other initial costs
2. Future facility one-time costs
   • Replacements
   • Alterations
   • Salvage
   • Other one-time costs
3. Future facility annual costs
   • Operations
   • Maintenance
   • Financing
   • Taxes
   • Insurance
   • Security
   • Other annual costs
4. Functional use costs
   • Staffing
   • Materials
   • Denial of use
   • Other functional use costs

Life-Cycle Costing Methods
Life-cycle costing requires adjustment of costs to a common point of time. Generally, one of two economic methods can be used. Costs may be converted into today’s cost by the present worth method, or they may be converted to an annual series of payments by the annualized method. Either approach will allow accurate comparison of construction alternatives.
Construction Costs

Present Worth Method
The present worth method requires conversion of all present and future expenditures to a baseline of today’s cost. Initial (present) costs are already expressed in present worth. Future costs are converted to present value by applying the factors presented previously.

Annualized Method
The annualized method converts initial, recurring, and nonrecurring costs to an annual series of payments and may be used to express all life-cycle costs as an annual expenditure. Home mortgage payments are an example of this procedure; that is, a buyer opts to purchase a home for $1,050 a month (360 equal monthly payments at 10 percent yearly interest) rather than paying $150,000 all at once.

Other Economic Analysis Methods
Other methods of economic analysis can be used in a life-cycle study, depending on the client’s requirements and special needs. With additional rules and mechanics, it is possible to perform a sensitivity analysis, determine the payback period, establish a break-even point between alternatives, determine the rate of return and extra-investment and rate-of-return alternatives, perform a cash flow analysis, and review the benefits and costs of using different products, materials, and assemblies.

All life-cycle costing methods, correctly applied, will yield results pointing to the same conclusion—selection of the alternative with superior economic performance. Since the construction industry is capital cost intensive, however, the present worth method is recommended. In addition, this method tends to be easier to use and to produce easily understood results.

Integrating Building Cost Analysis Into The Design Process
Detailed cost estimating, value analysis, and life-cycle costing are all useful tools and are all services beyond the basic requirements specified in AIA Document B101™. Building cost analysis is the application of these tools within the overall design process. The objective of building cost analysis is to maintain balance and alignment between scope, user/owner expectations, and budget, both from the outset and over time in a way that makes clear the cost consequences of decisions.

The building cost analysis process has several key steps:

1. **Prepare a realistic budget.** Prepare a budget that properly reflects scope and expectations. This is the first and perhaps most important step in the process. The budget can be prepared using an estimating technique appropriate to the information available but, at the least, it should have budgets for each discipline. In this way, the budget becomes a “cost model” for the facility. Adequate reserves for escalation, contingencies, and risk must also be included.

2. **Subject decision-making to ongoing cost input.** Design decisions should be reviewed for cost implications as decisions are made. This requires provision of cost input on an ongoing basis.

resources


3. **Prepare comprehensive milestone estimates.** Periodic cost estimates, at a minimum, should be prepared at the conclusion of each major phase of the project and reviewed by all disciplines to ensure completeness and proper consideration of competition and market costs. Historical cost analysis and benchmarking can provide an additional measure of justification for the estimates.

4. **Focus on cost drivers.** Details are important, but focus on the key cost drivers associated with each discipline. The effort involves a balancing process and the recognition that to achieve overall cost targets trade-offs and adjustments between disciplines will be necessary.

5. **Revise design/objectives as necessary to maintain budget.** If the estimate, as well as a reasoned analysis of it, indicates budget problems, it will be necessary to revise the design itself and possibly the design objectives to maintain the budget. After any necessary adjustments have been made, the “cost model” should be revised to reflect redistribution and reassessment of the budget assigned to each discipline along with revised contingencies. This process continues to the next milestone and becomes progressively more detailed in each phase of design.

6. **Use value analysis as a cost management tool.** VA can be used as an optimization tool and a means of balancing competing design issues without compromising critical aspects of the design. VA focus should narrow as the design develops, adjusting from conceptual issues to details, materials, and systems.

7. **Maintain sensitivity to life-cycle costs and sustainability.** Life-cycle costing is a recognized method for objectively comparing alternatives during design development and is an important component of ongoing cost advice. Issues of energy efficiency, sustainability, and reliability require an organized approach and a proper economics-based analysis tool that can inform project decision-making.

8. **Learn from the process.** Last but not least, learn from the process. Gather and maintain information from past projects to use as input for current projects, and learn from the experience of others.

Written by Michael D. Dell’Isola, PE, CVS, FRICS

Michael D. Dell’Isola is a senior vice president of the Orlando, Florida, office of Faithful+Gould. He has 30 years of experience in cost control, value engineering, technical facilitation and partnering, life-cycle costing, and project management.
Reconciling Estimates
Supplemental Experience for eight (8) Core IDP Hours

In this scenario, the estimator consultant on your project, a 35,000 SF medical clinic has prepared an estimate at design development that indicates you are approximately 1 percent under budget. The client, a group of doctors, has indicated that their funding is finite and the project must remain within budget or it will not be financially viable. The doctors have also made it clear that several other projects will follow if this one is successful.

Activity - Core

As an added precaution your firm commissions an additional independent estimate by another firm. The second estimate comes in at 12 percent over budget (a difference of 13% between estimates). You review both estimates and note the following significant differences:

• The first estimator has a contingency of 5%, while the second estimate has a contingency of 10%.
• General contractor overhead and profit (OH&P) is 15% for the first estimator and 18% for the second
• Both estimators are using a projected bid date about one year from the estimate date and a construction time at 12 months. This means the mid-point of construction is 18 months out. However, the first estimator is adding 6% escalation and the second 8%.
• Mechanical/Electrical costs are about 15% higher in the second estimate (adding about 5% to the total cost)
• Other differences are not individually significant
• Both firms have excellent reputations.

Based on the estimates outlined above, prepare a client report advising that your initial estimate is reasonable, or suggesting adjustments to the project contingency, schedule or escalation.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Life-Cycle Costing for a Project

Supplemental Experience for eight (8) Core IDP Hours

With advice from your supervisor or mentor, find a project underway in your community for which you can access detailed project information. Choosing a project in your firm will be simpler, but if your firm has no ongoing local project you can use a project from another firm.

Begin by reviewing the information in the narrative on life-cycle costing. Meet with the client and building manager (if available) to determine their parameters for the economic success of the building.

Specifically, work with the client to understand and learn:
- Their initial cost budget
- Projected building life (25, 30 or 40 years)
- Their discount (interest) rate to establish a time value for money (at least 6% and as much as 15%)
- Expectations for energy performance
- Expectations for maintainability
- Expectations for system/component life
- Special feature of the building that contributes to the owner’s product or service

Activity - Core

Select a building system and compare two construction alternatives for that system and project. Prepare a life cycle cost analysis using the present worth approach comparing the two alternatives.

Address the following life-cycle costing questions:
- Determine the useful life of the materials specified in each alternative. Consider factors such as the frequency with which the material is used, the climate, and maintenance requirements.
- Prepare a spreadsheet with each of the following categories of cost, filling in information as you find it in your research: Initial costs, Future facility one-time costs (replacement and alteration), Future facility annual costs (energy, maintenance, and other applicable costs), Functional use costs (if appropriate)
- Consider non-economic impacts of the two alternatives that could affect a final choice.

Prepare a client report, outlining your conclusions and explaining recommended alternatives. Review findings with your supervisor. If possible, share the report with the client. Catalog research of each material alternative in the report’s appendix.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Construction Costs

Conduct a Value Analysis Workshop
Supplemental Experience for eight (8) Core IDP Hours

In this activity, you will conduct a “mini” value analysis (VA) workshop on a project active in your office. The “mini” workshop will be a condensed form of a full VA workshop.

Activity - Core

Select an active project in your office or mentor’s office, preferably one recently completed schematic design or in early design development, with a cost estimate available. The objective is to assemble a team and conduct an independent VA workshop on the project to identify potential changes in the design that could improve value. Value can be improved by maintaining function and reducing cost or by spending more but with a proportionally larger improvement in function.

Preliminary efforts (two to three calendar days):
• Sit down with the current design team to review the program, design documents and cost estimate and discuss what they consider key objectives, issues and limitations.
• Select a multi-discipline team of your colleagues not associated with the design to be the peer review VA team. The team should be 3-5 people.
• Prepare a brief (one page or less) summary of the project and an agenda for the workshop, following the steps below.
• Distribute the agenda and report to your team. Make available a copy of the project documentation to your team to review ahead of time.

VA Workshop (1/2 Day):
• Schedule a meeting for your team to spend ½ day in the workshop. Secure a meeting space.
• Invite the project principal or manager provide a brief project overview (20 minutes) and, if possible, participate as an observer for the session.
• Conduct the workshop.
• Spend 30 minutes discussing the objectives of the workshop and identifying two or three key functional study areas. Because of the time limit, it is important to focus on a limited number of opportunities.
• Spend 45 minutes brainstorming changes to improve value through reduced cost or improved function. Record the ideas.
• After brainstorming, spend about 45 minutes evaluating ideas and consider the most promising for further review. Select 5-7 ideas and assign ideas to team members to complete an analysis.
• Spend the balance of the time developing the ideas assigned to each team member including advantages/disadvantages, a cost assessment and a recommended approach.
• Allow team members one or two days to complete their work and submit to team leader.

Prepare a report that summarizes the impacts, benefits and overall economic consequences of the ideas. Each idea developed should be captured as an exhibit. Review your recommendations with the design team and record their feedback.

Ask to observe upcoming project meetings. You can help by taking notes or the meeting minutes.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Gather Historical Project Costs
Supplemental Experience for eight (8) Elective IDP Hours

In this activity, you will gather and examine historical construction cost information on completed projects. To do this, request access to files and have conversations with the project’s manager. If possible, talk with the cost consultant who prepared the estimate and the building contractor.

Activity - Elective

Review two completed projects to determine the history of cost estimates prepared during the project and the final actual bid/offer price for the project. Examine the accuracy and completeness of the estimates and develop a rationale for any significant difference from the bid/offer. Interview at least one project manager and one cost consultant.

- Locate project files and obtain copies (digital preferred) of estimates prepared at project milestones.
- Examine format, content and level of detail. Was the date of the estimate and the schedule for the project clearly stated? Were inflation/escalation, markups and overhead and profit assumptions documented? Document the history of the estimates. Did any changes to project scope or quality result?
- Examine bid/offer information. If not available, follow-up with the project manager, cost consultant and/or construction contractor may be necessary. Once obtained, compare the bid/offer with the final estimate. What was the general result?
- Obtain a Schedule of Values (SV) for the project. This may also require follow-up if not available in the files. Compare the SV with the bid/offer and the final estimate. Can you determine where in building components or trades variations occurred?
- Write a brief 2-3 page report documenting your observations and conclusions.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Assessing the Current Status of a Budget

Supplemental Experience for eight (8) Elective IDP Hours

In this activity, you will review a current project active in your office and review and assess its status.

Activity - Elective

In consultation with your IDP supervisor or mentor, select an active project in your office or a mentor’s. Carry out the following steps:

1. Verify the budget for the project and assess its current status—within budget or over budget.
2. Gather information, if available, on a current cost estimate being prepared and review previous estimates prepared for the project. Review previous actions taken to keep the project in budget.
3. Whether the project is over or under budget, prepare a summary based on the following parameters:
   • Areas of the project that have exceeded, met, and come in under the client’s budget
   • Decisions that added costs to the project and who made them
   • Other external factors that may be adding costs to the project
   • Steps that can bring the project back within budget

Present your findings to your supervisor/mentor and the project manager for this project. Discuss what lessons can be learned to ensure that the project remains within budget and future projects can stay within their budget.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Time and Materials Estimate

Supplemental Experience for eight (8) Elective IDP Hours

Prepare an estimate of the cost of laying 6” x 6” x ½” quarry tile flooring and a 6” covered base in the room illustrated below.

Activity - Elective

Research the unit and labor costs listed in Exhibit 2C-1 by consulting RSMeans or by calling a local supplier. Once all costs are known, prepare your cost estimate by using the accompanying form, Exhibit 2C-2.

Find:
- Total cost
- Total cost per square foot (based on the tile area).
- Consider alternate tile sizes or types that come under total cost of the original.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Exhibit 2C-3 is an excerpt of a Schedule of Values from a high school. The excerpt includes MasterFormat Divisions 3 - Concrete, 4 - Masonry and 7 - Thermal and Moisture Protection.

**Activity – Elective**

Your task is to extract the cost of those items associated with Exterior Closure. In the column provided in Exhibit 2C-3, indicate which items apply to Exterior Closure. If a partial amount is appropriate indicate why in the comments. Calculate a total cost for all three divisions.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Storm Windows and LEED Points  
*Supplemental Experience for eight (8) Elective IDP Hours*

In this scenario, your firm is designing a renovation to a historic building on a college campus nearby in Northern New York State. Part of the expectations for the project involves attaining a LEED Silver rating and doing so is proving difficult, especially in conjunction with maintaining the historic character of the building.

Your area of responsibility is the building’s exterior closure including the original windows that have been deemed historic. Currently the building is extremely energy intensive due in part to extensive infiltration of outside air through the windows. The owner wants to retain the windows if possible and replacing the windows is prohibitively expensive. You propose adding exterior storm windows designed in such a way as to not obscure the historic windows. You are also applying for LEED points based on energy savings.

Your client favors the approach and wants to reduce the energy consumption in the building but is concerned about initial cost. He has asked you to help justify the added cost of the storm windows.

The following provides cost/economic information on the project:

- Added cost of Storm Windows $227,000
- Mechanical Equipment Saved $156,500
- Annual Energy Savings $12,570
- Discount Rate = 8%
- Life Cycle = 30 Years
- Present value of annual cost factor = 15.631

### Activity – Elective

Calculate the simple payback period for the added initial investment. Calculate the net present value of the savings in energy. Compare the savings to the added initial investment.

Are these results desirable to the owner and if so, how would you convince the owner to proceed with your recommended design? What would you present to a local Architecture Review Board or Historic District Review Board?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
**Project Data:**

- **6” x 6” x 1/2” quarry tile** .................................................. $ ______ per carton of 100
- **6” x 6” quarry tile base (straight)** .................................................. $ ______ each
- **6” x 6” quarry tile base (angles/corners)** .................................................. $ ______ each
- **Cement setting mix (3 bags required per 100 SF)** .................................................. $ ______ per bag
- **Tax on all materials** .......................................................... 5%
- **Allow for waste on tile** .......................................................... 5%
- **Allow for waste on base** .......................................................... 2%
- **Tile setter (setting 120 SF or 100 linear ft. of base per 8-hr. day)** .................................................. $ ______ per hour
- **Helper (one for each setter)** .......................................................... $ ______ per hour
- **Burden/fringe benefits** .......................................................... 35% on labor Cost
- **Job overhead** .......................................................... 5% on labor and Materials
- **Head office overhead** .......................................................... 2% on labor, materials, and job overhead
- **Profit** .......................................................... 10% on labor, materials, and job overhead
### Construction Costs

#### Exhibit 2C-2

**Estimate:**

**a) Materials:**

<table>
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<th>Item</th>
<th>Quantity</th>
<th>Rate</th>
<th>Cost</th>
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<tr>
<td>6&quot; x 6&quot; x ½&quot; quarry tile</td>
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<td></td>
</tr>
<tr>
<td>6&quot; x 6&quot; base (straight)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6&quot; x 6&quot; base (angles/corners)</td>
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<tr>
<td>Cement setting mix</td>
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**Tax**:%

**b) Labor:**

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<td></td>
</tr>
<tr>
<td>Helper</td>
<td></td>
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**Burden**:%

**Labor and Materials**:

**c) Job overhead**:%

**d) Head office overhead**:

<table>
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<th>Head office overhead</th>
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<tbody>
<tr>
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**Total Estimated Cost**: $  

**Area of Room**: __________SF 

**Cost per SF**: $ ________
## Exhibit 2C-3

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Total: $5,593,349

[Back to “Working with a Schedule of Values”]
notes

Take brief notes while reading the narrative and list key resources you used to complete the activities. Note discussion outcomes from meetings with your supervisor, mentor, or consultants. When finalizing the activity documentation (PDF), include your notes and the Emerging Professional’s Companion activity description.
# Codes & Regulations

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*A maximum of 40 hours of core credit may be earned in this experience area.

## exhibits

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Introduction

By completing the activities in this chapter, you will gain an understanding of the activities involved with codes and regulations. The following information is taken from the NCARB IDP Guidelines:

Codes And Regulations
Minimum Codes and Regulations Experience: 120 Hours
Definition: Involves evaluating a specific project in the context of relevant local, state, and federal regulations that protect public health, safety, and welfare.

Tasks
At the completion of your internship, you should be able to:
• Perform code analyses (e.g., building, energy, accessibility)
• Review project with code officials
• Submit documents to approval agencies and obtain approvals

Knowledge Of/Skill In
• Accessibility laws, codes, and guidelines
• Building codes, zoning codes, and ordinances
• Conflict resolution
• Critical thinking (e.g., analysis, synthesis, and evaluation of information)
• Designing and delivering presentations
• Government and regulatory requirements (e.g., zoning, planning, design review)
• Interpersonal skills (e.g., listening, diplomacy, responsiveness)
• Life safety
• Permit and approval processes
• Problem solving
• Specialty codes and regulations (e.g., seismic, life safety, fair housing, historic preservation, energy)

resources

Download the current Intern Development Program (IDP) guidelines at www.ncarb.org/Experience-Through-Internships.aspx.

• Chapter 15 - Building Codes and Regulations

• Chapter 15.4 - Building Codes and Regulations
• Chapter 17.5 - Zoning Process Assistance

• Chapter 10 - Building Codes and Regulations
Narrative

The practice of architecture, the rules of conduct of our professional societies, and the licensing laws of states and other jurisdictions all require protection of the public health, safety, and welfare. The AIA Code of Ethics and Professional Conduct Canon 1: General Obligations, Rule 1.101 states that, “In practicing architecture, members shall demonstrate a consistent pattern of reasonable care and competence, and shall apply the technical knowledge and skill which is ordinarily applied by architects of good standing practicing in the same locality.” In addition, under Canon III: Obligations to the Client, Rule 3.101 states the following: “In performing professional services, members shall take into account applicable laws and regulations. Members may rely on the advice of other qualified persons as to the intent and meaning of such regulations.”

Similarly, the NCARB Ethics and Professional Rules of Conduct state: “In designing a project, an architect shall take into account all applicable state and municipal building laws and regulations. While an architect may rely on the advice of other professionals (e.g., attorneys, engineers and other qualified persons) as to the intent and meaning of such regulations, once having obtained such advice, an architect shall not knowingly design a project in violation of such laws and regulations.”

Most, if not all, state licensing laws have rules prefaced with language such as, “In order to safeguard life, health, property and the public welfare...” As well, the International Code Council’s International Building Code begins, “The purpose of this code is to establish minimum requirements to safeguard the public health, safety and general welfare...”

The first step in complying with the charge to protect the public health, safety, and welfare is to gain a clear understanding of the intent and use of the building codes and other regulations applicable to the work of architects. This chapter of the Emerging Professional’s Companion offers readers a foundation for understanding and applying the codes and standards that influence a conventional architectural design.

Codes and Standards Differ

A building code is a set of regulations adopted by a jurisdiction to define the design, construction, and materials that may be used to construct buildings and facilities with the goal of protecting the health, safety, and welfare of the public. Codes generally are developed by nonprofit organizations through a process that brings interested and affected parties from the entire building community together in a public forum to determine the provisions of the code. In order to apply to construction in a particular location, the code must be adopted for that area by the pertinent legislative body (state legislature, city council, etc.). Compliance with the code is administered by the authority having jurisdiction (AHJ) in the area, which may vary according to building type. For instance, plans for hospitals often must be approved by the state health department, while plans for a residence are approved by the local planning and zoning department.

notes

Take brief notes while reading the narrative and list key resources you used to complete the activities. Note discussion outcomes from meetings with your supervisor, mentor, or consultants. When finalizing the activity documentation (PDF), include your notes and the Emerging Professional’s Companion activity description.
While codes regulate what, where, and how buildings may be constructed, the standards referenced in them are intended to ensure that materials, engineering systems, and construction techniques meet safety requirements. A building code may refer to a variety of standards. For example, engineering standards relate to the design of a product and testing standards relate to methods of determining the performance of materials or assemblies. Standards cannot be applied to a project unless they have been adopted, usually by reference in the building code, by the jurisdiction where the project is located. Otherwise, standards are strictly “advisory in nature.”

When designing a project, it is important to remember that the contents of the building code are the minimum standards the project must comply with. Designing to these minimum standards is not only the ethical thing to do, it is required by law. Every member of the project team, from designer to project manager to drafter, must understand these minimum standards in order to meet the architecture profession’s licensing obligation to protect the public health, safety, and welfare.

Prescriptive vs. Performance-Based Codes
Most architectural projects can be fit into one or more of the “uses” defined in the building code, typically the International Building Code (IBC). However, a client may ask for a building design that simply does not fit the parameters of the code. This situation arises because the IBC and other building codes are “prescriptive” in nature. In other words, they prescribe what must be done for a building to be safely occupied for its intended purpose.

It may be difficult to make an unusual project (e.g., a casino building in Las Vegas) comply with the prescriptive measures of the IBC. In such a case, a performance code approach may better address relevant issues. To begin to address such situations, the IBC contains a section (104.11) that permits a designer to use “alternate materials, design, and methods of construction and equipment.” According to the International Building Code Commentary, the code “is not intended to inhibit innovative ideas or technological advances” unless the resulting design will be inherently unsafe. “The writers of a comprehensive regulatory document such as a building code,” the IBC Commentary continues, “cannot envision and then address all future innovations in the industry. As a result, a performance code must be applicable to and provide a basis for the approval of an increasing number of newly developed, innovative materials, systems, and methods for which no code text or referenced standards yet exists.” Section 104.11 of the IBC was taken and fully expanded into the International Performance Code.

The difference between a prescriptive code and a performance code is easily explained by using an ordinary automobile as an example. A prescriptive code would tell you that in order to stop an automobile traveling at 30 miles per hour on dry concrete pavement within 100 feet, you must install disc brakes with non-asbestos pads that are connected to all four wheels and simultaneously operate when you touch the brake pedal. A performance code simply identifies the task of stopping the same automobile, with all of the same parameters, in the same 100-foot distance, no matter what technological methods or procedures are used.
In the United States at this time, a performance code is viewed as a relatively new approach to protecting public safety. Therefore, some architects and authorities having jurisdiction (AHJs) are less comfortable designing to a performance standard. However, from a common sense point of view, the performance concept makes more sense than a prescriptive code.

**Design Begins With Code Analysis**

A code analysis is a systematic review and compilation of the specific provisions of the locally adopted building code that will affect the design and construction of a building or facility. It is one of the most important tasks during the course of any architectural project. An incomplete analysis can have serious implications on the degree to which a project meets the obligation to protect the public at the same time it achieves the architect’s design intent.

Codes are divided into many chapters defining minimum requirements for the design and construction of a building. The International Building Code (IBC) begins with a chapter devoted to the administrative and operational procedures adopted by jurisdictions to enforce the code.

In chapter 2 of the IBC, the majority of terms used in the code are defined. Definitions that are missing may be found in the chapters that pertain to the subjects you are researching. For example, the definition of “exit access” is not found in chapter 2 but in section 1002.1 of chapter 10, Means of Egress. The remaining chapters deal with subjects that are the technical “meat” of any code—the provisions that will govern the components or features of a design.

There are prescribed steps to follow in analyzing a code, but before we address those we will review some general rules every architect should keep in mind when working with building codes. Rule #1 requires your complete attention; it is the most important rule and may be the only one you need to remember. However, it is best to apply all of these rules to every project you design. In this chapter you will soon see that I caution you more than once about prudent use of building codes. Not only is this chapter intended to coach you in the use of codes; it is also intended to explain the pitfalls of applying codes halfheartedly.

**Rule #1: Do not memorize the code.**

The worst thing you can do is memorize what the codes say. Why? Because codes change. This is a good thing because codes are usually changed to reflect progress and technological advancement in the building industry.

The danger of committing codes to memory is the possibility that you will design to a code provision that has been changed, requiring costly “re-design” that risks budget, schedule, and client trust. Such errors, although unlikely, often are not discovered until bidding. The worst-case scenario is discovery during construction, when it is too late to alter the design.

You may become convinced you know what the code says, but don’t let that prevent you from reading the
code book every time you begin a new design. In addition, be sure to test your current design against your original code analysis as construction documents are being finalized. Relying upon your memory alone may mean missing something that was changed in the last code revision cycle or remembering a detail incorrectly.

The real danger is that a code error will affect your design in a way that is detrimental to both your in-house budget and the client’s construction budget. Your in-house budget may be exhausted, resulting in the redesign being done at a financial loss to your firm. Or, the cost of redesign to bring the project into code compliance may exceed the project budget, causing the project to be delayed or even cancelled. Either effect can be devastating.

As an example, the following is a true story involving the height of guardrails. Guardrails had been in the codes at the same height for years. The architect of a large two-story covered mall based the building design on a code that was no longer applicable. All of the guardrails that lined the second level of the open mall were of a custom design, rather than something taken from a manufacturer’s catalog. After the railing system had been installed, the building inspector issued a stop work order to halt construction of the building because the guardrails were too low. The AHJ refused to remove the stop work order, or “red tag,” jeopardizing the widely publicized grand opening of the project. Because the railing system was a custom design, retrofitting the installed railing did not appeal to the architects. They asked the owner to grant them time to redesign the guardrail system, which would delay the opening. With different priorities, the owner ordered the system retrofitted with anything that would ensure compliance with the height requirement and not endanger the opening date. For the architect, the result was a visual nightmare, but the project opened and was successful in the owner’s eye. The owner ultimately had the retrofitted system removed and replaced with a conventional system and sued the architect to recover the costs. All of that could have been avoided if the architect had checked the code provisions before creating the design and committing an inadequate design to the construction documents.

At this point you may ask why this was a problem for the architect. Why did the AHJ not identify the problem during the plan check? After all, the jurisdiction issued a building permit and surely that means the project, in its entirety, complies with the building code. WRONG! Codes contain a provision whereby the AHJ is immune from prosecution and another that says that nothing will forgive a violation of the code. The architect is the first interpreter of the building code, and some AHJs rely upon the architect’s seal to ensure a project complies with the code. After all, the architect is the person who sets the parameters of the design. Owners expect architects to design projects that will satisfy their program needs, and rely upon architects to produce projects that meet those needs, including compliance with all applicable rules, regulations, and standards. The AHJ is responsible for checking if the completed work of architects and builders complies with the rules and regulations the jurisdiction has adopted. Although AHJs review construction documents and inspect
projects under construction, such reviews and inspections do not ensure a project complies with codes in every instance. Section 109.1 of the IBC states, “Approval as a result of an inspection shall not be construed to be an approval of a violation of the provisions of this code or of other ordinances of the jurisdiction.”

**Rule #2: Verify what codes will be applied to your design.**
It is vital for architects to understand code implications before design work begins because the consequences of not designing to code are severe. Code compliance for each project is different, as it is based on building type and what has been adopted and enforced in the jurisdiction where the project will be constructed. Therefore, designers must make an exhaustive investigation of what codes, rules, and regulations will be applied to the design and construction of every project.

Do not just call the office of building inspection; rather, visit a responsible building official who can answer your questions. Before visiting the AHJ office, or even calling to make an appointment, prepare a list of questions that need to be answered before you begin the design process. Ask which building, mechanical, plumbing, fire, and electrical codes are being enforced by the jurisdiction, and ask whether any other codes or guidelines will be used to assess your project. In particular, find out which edition of each code the AHJ uses and whether there are any plans to switch to another code or edition; this information is critical, as significant changes can occur from one edition of a code to the next. Also ask whether the codes or other applicable documents have been modified in any way for local use or if they are enforced as they were published. This is important! Local officials may assume you know more about how they do business than you actually do; be sure to ask lots of questions.

Prudent designers not only ask the right building code questions, they also inquire as to any implications for their projects of other regulations, such as zoning ordinances, historic district ordinances, deed restrictions, or federal requirements, such as requirements of the Occupational Safety and Health Act, Environmental Protection Agency, Department of Energy, or Americans with Disabilities Act.

**Rule #3: Review your design with the AHJ before you commit.**
The person, or entity, that reviews your project documents for compliance with the applicable codes and standards has many names—the building official, the code official, the fire official, etc. No matter what their title, these officials are the authority having jurisdiction over your work, so we will generically refer to them as AHJs.

Before construction on your project can begin, the AHJ must issue a building permit. The issuance of a permit means your construction documents have been found in “general conformance” with the codes and standards enforced by the jurisdiction. In most locations, getting a building permit requires a very lengthy, labor-intensive process. To help move things along, a second visit to the AHJ (after the first visit discussed in Rule #2 above) is recommended to review the finalized schematic design. At that point, your code compliance investigation should be complete so you can explain to the AHJ how the codes will be applied in your design as illustrated in your construction documents. Make certain the AHJ understands your interpretation of the codes and agrees with it and how you will apply that interpretation.

One thing most architects do not understand is their role as the first, and often primary, interpreter of the codes. It is not the AHJs’ job to tell you how to apply the code. It is their job to confirm that your interpretation is correct and that you have correctly applied your interpretation to your construction documents. In view of the architect’s role, it is vital that you visit the AHJ when you have both an understanding of your design and of how the codes will affect it. Leave a copy of your code analysis with the AHJ and follow up with a letter that confirms your meeting, what was discussed, and any agreements or acknowledgments regarding interpretations of the code as applied to your project made by the AHJ.

It is prudent to visit the AHJ a third time when construction documents are near completion, just prior to submittal for permit review. Take a copy of the code analysis initially reviewed with the AHJ and the letter
confirming your prior meeting and its conclusions. Make certain the AHJ understands how you applied your analysis to the construction documents and how you have addressed each code issue. At this meeting you may ask how long it will take to get the building permit. Make certain the AHJ understands that these documents, when completed, will be the documents submitted for the building permit.

When is a Code Analysis Performed?

As mentioned above, it is a good idea to engage in more than one code analysis and review during the course of a project. The first is done before the design leaves the sketch paper and becomes an idea to be developed. At this point, some basic determinations have been made, such as general size, a general idea of materials, and proposed location on the site. The suitability of a site for a given use, building size, or location can quickly be determined through a preliminary code analysis. Since the feasibility of the basic project concept affects the overall cost of a project, it must be one of the first considerations.

As a project design develops beyond the sketch paper stage, a more detailed understanding of the code is required to ensure protection of those who occupy the building. The design team often develops a code analysis to be used at the transition between phases of a project and in discussions with building officials. Through a continual reference to this code analysis, unexpected surprises for the project design can be avoided.

What Does a Typical Code Analysis Encompass?

The code book itself can guide you through the steps recommended for completing a code analysis for your project; see the page titled “Effective Use of the Building Code.” Entire books are dedicated to this process and a copy of one of them may assist you.

The process recommended by each author will take you through issues regarding the use and size of a proposed project. Following are brief discussions of the issues that are most significant as you begin the design process.

Occupancy Classification

Select the category in chapter 3 of the International Building Code that describes the use or uses intended for the building you are designing. Most of the occupancy classifications are self-explanatory; for example, theaters are Assembly Occupancies (“A”). Select the appropriate occupancy based upon the features of your theater. If you are designing a multifamily dwelling, the occupancy classification will be found in the residential (“R”) classifications. However, and don’t let this confuse you, if you are designing a single-family dwelling you will not find your project in the IBC. Instead, if the local jurisdiction has adopted it you are likely to be using the International Residential Code, which also covers townhouses that do not exceed three stories in height. This is an instance in which Rule #2 is vital; confirm which code applies to single-family houses in the jurisdiction where the structure will be built.
Some projects will have more than one use and be classified as “mixed use” occupancy. This usually (not always) means the project will require the use of “separation walls” to divide the building into one or more separate “buildings” as defined by the code. The IBC, for example, reads, “Structures or portions of structures shall be classified with respect to occupancy in one or more of the groups listed. Where a structure is proposed for a purpose which is not specifically provided for in the code, such structure shall be classified in the group which the occupancy most nearly resembles, according to the fire safety and relative hazard involved.” In other words, the “hazards” contemplated by the occupancy groupings are broadly divided into those related to people and those related to contents. People-related hazards include number and density of occupants, their age or mobility, and their awareness of surrounding conditions. Content-related hazards include storage and use of hazardous materials, as well as the presence of large quantities of combustible materials.

Analysis of the occupancy classification, construction type, and height and area limitations must be carried out simultaneously. These three factors together make up the basic code compliance package, as well as the basic parameters of a project design. If they are not resolved in the early design stages of a project, they will have serious implications for the success of your project.

**Construction Type**
Your design may depend in some ways on a construction type, such as steel-frame, wood-frame, brick, or masonry construction. However, the code may limit the use of some building materials, possibly making it difficult to accomplish your design. Requirements for building height, area, and fire ratings depend on the type of construction chosen for a project. Construction type also influences construction costs, as costs rise in tandem with fire resistance and structural performance.

**Height and Area Limitations**
Buildings are permitted to be a certain height or area based on the materials used to build them. Determining height and area limitations for a project is one of the most important parts of a code analysis, and may be confusing if not carefully considered. See the accompanying information, “Applying the Height and Area Table of the International Building Code,” for more details about this topic.

**Location on the Property**
Determining where a project can be located on the site is another vital part of the code analysis. The location of the building relative to the property lines, which is determined by zoning regulations, will dictate much about the design of a building’s exterior walls. Placement of window or other wall openings, projections, and fire ratings of exterior walls are all defined by codes.

**Fire Suppression Requirements**
To determine whether your project must be fitted with a fire suppression system, carefully read the relevant portion of the applicable building code (chapter 9 in the IBC). You may choose to install an automatic fire sprinkler system required because of the building’s occupancy class or other code requirements to gain more height or area for your building.
Applying the Height and Area Table of the International Building Code

Table 503 of the 2003 edition of the International Building Code (IBC) —the height and area table— is used to establish the fire risk of a building. The fire-hazard level of different use groups (determined by fire load and/or occupant load) is weighed against the fire load and fire-resistive protections of a building construction type. The IBC makes certain assumptions regarding these two factors to determine the heights and areas shown in the table.

In addition to the type of construction, two other factors increase or decrease the fire hazard of a building: The proximity of adjoining structures and the fire suppression systems used. Equation 5-1 in the IBC is used to calculate increases in the allowable areas shown in table 503 due to these additional factors and to determine the largest single-floor area for a particular building. (See section 502 for the definition of “building area” to determine how to apply this figure.)

Equation 5-1:

\[ A_a = A_t \left[ I_f + \frac{I_s}{100} \right] \]

where:
- \( A_a \) = allowable area per floor (sq. ft.)
- \( A_t \) = tabular area per floor in accordance with table 503 (sq. ft.)
- \( I_f \) = area increase permitted due to frontage (%) as calculated in accordance with section 506.2
- \( I_s \) = area increase permitted due to sprinkler protection (%) as calculated in accordance with section 506.3

Before you can use equation 5-1, the frontage or open space allowance must be calculated using equation 5-2. An increase in the tabular area of a building is permitted when more than 25 percent of the total building perimeter is open to a public way (street), or when other open space on the same lot or equivalent open space is dedicated for public use with access to a street or approved fire lane. This access must provide fire service access to the structure, provide safety for evacuees, and reduce exposure of the new structure to and from adjacent buildings. Any space other than a public way must be at least 20 feet wide to qualify as open frontage. Note that the maximum value of \( I_f \) is 75 percent.

Equation 5-2:

\[ I_f = 100 + \frac{F}{P - 0.25} \times \frac{W}{30} \]

where:
- \( I_f \) = area increase permitted due to frontage (%)
- \( F \) = building perimeter that fronts on a public way or open space having 20 ft. open minimum width
- \( P \) = perimeter of entire building
- \( W \) = minimum width of public way or open space

Continued on page 199
Several conditions apply to the use of equation 5-2:

1. W is the minimum width of a public way or open space around a building for purposes of this equation. Therefore, the minimum value for W is 20. If the space is less than 20 feet in width, that portion of the perimeter does not qualify as open perimeter in determining the value of F.

2. Section 506.2.1 limits the value of W/30 to 1, making the practicable maximum value of W 30 regardless of the actual width available. The exception for unlimited-area buildings does not apply here because this equation is used to determine maximum areas permitted. The equation does apply to unlimited-area buildings when it is used elsewhere to determine the fire-resistive-rating requirement of an exterior wall.

3. In determining the value of P, the perimeter of any interior court must be included.

4. The value of F cannot include the perimeter of an interior court because that space is not accessible from the public way (see item 5 below).

5. Open frontage perimeter that is not accessible from a public way cannot be included in determining the value of F. For example, an open backyard may not be included if the access is only through side yards, neither of which is at least 20 feet in width.

None of the above is intended to require a building to have a minimum perimeter of 25 percent open to a public way or open space. This is only the minimum required to apply area modification equation 5-2. The second part of equation 5-1 is simpler to calculate. When a building is equipped throughout with an automatic sprinkler system designed and installed in accordance with referenced standard NFPA 13 as stipulated in section 903.3.1.1 or exceptions thereto, the area of table 503 is permitted to increase by 300 percent for single-story buildings or 200 percent for multistory buildings.

The maximum allowable area determined by using equation 5-1 is restricted in several ways. First, it is applied to the horizontal projection of the building (see the definition of “building area” in section 502) per floor to a maximum of three stories (section 503.3). Therefore, the maximum total area of a building is three times the maximum allowable area calculated by Equation 5-1. In buildings greater than three stories, this area must be distributed throughout (not necessarily equally), with no floor greater than the value calculated in equation 5-1. Note that the height modification provisions of section 504 do not change the three-story limit.

The other application restriction affects basements. When a single-story basement is not above grade (see definitions in Section 502), the basement is not included in the calculation of the total building area. Its area is, however, limited to the maximum allowable area for a single story as determined by equation 5-1. This permits a single-story basement that has a larger area than the stories above, particularly if the building exceeds three stories.

If there are multiple basement stories, only one is exempt from the total building area calculation, and the exempted basement area is still limited as noted above. The other basement stories are included in the total building area.

*Written by Jerry R. Tepe, FAIA*
In addition to checking the code, it is very important to check with the authority having jurisdiction to determine if a “sprinkler ordinance” has been enacted locally. Many jurisdictions have such ordinances, which are generally more restrictive (e.g., requiring installation of sprinklers when not otherwise indicated) than the provisions of the International Building Code or the International Fire Code. Because sprinkler protection is becoming a more widespread requirement, it is best to design a project as though a sprinkler system is required until you find out otherwise. Integrating sprinklers from the outset of design, using the standards that regulate their placement, can prevent interference with your design intent if sprinklers have to be added later.

**Means of Egress**

Because of its direct effect on public safety, the means of egress from a building—both everyday use and panic mode—demands careful review of the applicable building code. The occupant load for a building or portion(s) of a building is specified in the building code to determine the size and type of egress system required. These requirements have a great effect on the building design, making a careful check of the code doubly important.

The first step in designing an exiting system is to determine the occupant load of the building. This calculation specifies the maximum number of persons who may, according to the code, occupy a building, or a portion of it, at any one time. Certain occupancy classifications have special exit system requirements. The minimum number of occupants any exit must accommodate is established by the largest number of occupants calculated for a room or building floor. (The relevant portion of the IBC is sections 1003.2.2.1 through 1003.2.2.3.) The width of corridors, exit doors, and exit stairs is derived using formulas in the code after the occupant load has been determined for each room and floor in the building.

**Accessibility**

Accessibility has been a design consideration since 1958, when President Dwight D. Eisenhower created the President’s Committee for the Physically Handicapped. At that time, the American Standards Association (now NSI) was asked to develop “accessibility specifications” that would set the basis for designing buildings and facilities for access by the disabled. The resulting document has evolved into today’s standard for providing access to all sites and structures and the Americans with Disabilities Act Accessibility Guidelines.

Today, accessibility is mandated by federal, state, and local laws. Basically, everything you design is required to be accessible to disabled individuals. There are some exceptions, but they are limited. You must do careful code research if you feel a project is not required to follow accessible guidelines.

**Coordinating the Work of Others**

Architects often employ consultants to assist in designing a project. Architects do not perform the technical work of their consultants; rather, they coordinate that work with their architectural work. Look at it this way: The buildings you design are like a human being. Each building has a skin and “bones” (the structural system) and a “brain” (the M/E/P systems) that
**GIVEN:** Two-story office building  
Type IIB construction  
Fully sprinklered  
Yards and streets as shown  

**DETERMINE:** Maximum allowable area per floor ($A_a$)

\[
A_a = A_t + \left( \frac{A_t I_f}{100} \right) + \left( \frac{A_t I_s}{100} \right)
\]

\[
\begin{align*}
A_t &= 23,000 \text{ sq. ft. (Table 503)} \\
I_f &= 100 + \left( \frac{220}{320} - 0.25 \right) \left( \frac{25}{30} \right) = 100 \times \left( 0.69 - 0.25 \right) \times 0.83 = 37\% \\
I_s &= 200\% \text{ (multistory building)} \\
A_a &= 23,000 + \left( \frac{23,000(37)}{100} \right) + \left( \frac{23,000(200)}{100} \right) \\
&= 23,000 + 8,510 + 46,000 \\
&= 77,510 \text{ sq. ft. per floor (155,020 sq. ft. for building)}
\end{align*}
\]

go inside the skin. If the internal parts do not fit within the skin, then the design and the designer have failed the client. Therefore, while the architect may not be required to actually perform a code analysis for their consultants, they must coordinate and make certain the consultants’ work has been performed so nothing about their work will adversely affect the project.

As an example of the importance of coordinating engineered systems designs with the architect’s design, consider this: If the corridor walls and ceilings require a certain fire resistance rating, all of the ductwork that penetrates the walls and ceilings can be required to have “fire dampers” installed. Leaving these dampers out of a set of bid documents can add significant cost to a project in the form of a change order.

### Accessibility Upfront

Accessibility standards for buildings and facilities are mandated by several laws, including the Americans with Disabilities Act (ADA), the Architectural Barriers Act (ABA), HUD and the Fair Housing Act, and, often, by one or more state or local building codes. Any one, or all, of these may be applicable to a single project. Today these requirements more than ever before affect a great many building features, components, and fixtures. They can also affect fundamental aspects of building design, including size and configuration of rooms, location of doors, and systems for vertical movement.

Accessibility standards and guidelines include, among others, the ADA Accessibility Guidelines (ADAAG), the Fair Housing Act Accessibility Guidelines (FHAG), the Uniform Federal Accessibility Standards (UFAS), ANSI A117.1, and the ICC International Building Code (IBC). In addition, many states have accessibility laws, some with their own unique provisions. Although much effort goes into making federal guidelines and model codes technically consistent, and many states and local jurisdictions adopt the model standards, differences remain. The U.S. Access Board has developed federal accessibility guidelines for children’s facilities and for recreation facilities such as fishing piers, boating facilities, miniature and full-size golf courses, exercise facilities, swimming pools, and playground surfaces and play equipment. While these guidelines have not yet been incorporated into federal law, they have been published and are readily available so they may be considered to serve as a standard of care for architectural design. The Access Board is also working on guidelines for public rights-of-way, passenger vessels, and outdoor developed areas.

Careful investigation of applicable codes, standards, and guidelines early in the design process is essential to minimize exposure to litigation and prevent the inconvenience and additional time and expense of redesigning and revising plans and specifications for compliance. The later changes occur in the design process, the greater the consequences. Certainly, integration of accessibility standards into a design should be accomplished before construction documents are prepared so that changes are less costly and take less time.

One way to ensure accessibility requirements are incorporated in every project is to adopt mainstreaming, an approach that has emerged in the development of accessibility standards. This concept involves incorporating accessibility compliance as an integral part of the design process, rather than an activity that is carried out separately. For example, the minimum clear width of 32 inches the model code requires for doors to accommodate people with disabilities would be incorporated in the chapter on means of egress, rather than in a separate accessibility requirement. Placing a provision that accommodates the disabled in the main text of a code is referred to as mainstreaming. Architects can similarly mainstream accessibility considerations into their design process. There are already enough issues that can complicate a design project; if accessibility considerations are main streamed, chances are accessibility compliance will not be one of them.

*Written by Ken Schoonover, PE*
A Code Research Example

This section will guide you through the development of a building code program, also referred to as a “code analysis” for a hypothetical library project.

The Scenario

The project is intended to create an underground and above ground addition to a historic library structure at a major state university in western Pennsylvania. Additional space is needed to house the university’s growing book collection and to meet the need for private group study spaces and conference spaces both large and small. State-of-the-art technology for video conferencing and multimedia presentations must be accommodated. In addition, the project includes structural repair and total renovation of the M/E/P systems of the existing building.

The programmed intent of the client is for the addition to be a stand-alone building connected to the existing library with a lobby or similar element in order to exempt the existing building from compliance with the new code. Your firm would prefer to build the addition adjacent to, but not physically connected to, the existing building. This decision has important code implications in that if the addition is a totally separate building it must comply with all provisions of the 2000 International Building Code.

The renovation work that will be undertaken in the existing library building, on the other hand, need not fully comply with the IBC as long as the renovation work does not cause the building to become unsafe. This situation exists because of a practice called “grandfathering,” in which existing buildings are permitted to adhere to the provisions of prior editions of the code. The code does not address grandfathering, except by allowing an existing building to remain in its “original condition” if renovation work will not make it unsafe. The premise is that you must consider an existing building was safe when it was constructed and first occupied. If nothing has happened to appreciably change the building, it can remain as built even though it may not fully comply with the current edition of the building code.

Clarifying the Client’s Expectations

The scenario just described is a picture near the beginning of project delivery, and a lot of questions must be asked and answered before your firm can go forward with a design. Following are some questions you may need the client to answer in order to understand the project.

Q. Since this is an addition to an existing facility, do you want us to use the same interior and exterior materials in the new building? (This should not matter to the designer, but it is important to the code reviewer and the specification writers because it relates to the fire ratings assigned to construction assemblies by the code.)

A. The campus has an overall architectural style that includes the use of brick and cast stone on the exterior of buildings throughout the campus. We would like you to use the same materials in this new structure.
Q. How big should the addition be? The designers will set the size of the floor plates and the height of the addition, and these dimensions are based on the needs of the project as determined during programming. Nonetheless, it is useful to know if a client has some ideas about size when you are researching the height and area tables and assigning construction types and assemblies to be studied during the code analysis.

A. The building program, developed by the university, has set the square footage required to house the book collection (allowing for future expansion) at 250,000 square feet. This does not include the square footage desired for meeting, study, and conference rooms, nor that needed for the building support functions. (The actual area of the building will not be known until the designers have completed their work.)

Q. Will the new design allow free pedestrian movement between the two buildings, or will there need to be a definite fire-resistant separation between the two? This is an important code issue.

A. This is strictly a design consideration and the architect is free to create the connection in a manner he or she considers the least damaging or imposing in relation to the existing historic façade.

Q. Will the new building’s mechanical and electrical systems support the existing building or will the old systems be totally revamped as stand-alone systems?

A. The systems in the existing building are to be removed and replaced with services that will be housed in the new building. This arrangement is desirable because of the water damage the old systems caused to the historic structure.

Q. Can we use conventional fire suppression systems, or must there be some systems that do not rely on water for fire suppression? Is there a requirement to use both water and waterless systems?

A. The university wants to make use of both types of fire suppression systems. As the project develops, the university staff will work with the architects and consultants to determine which portions of the building will have which system.

Q. To what extent are openings in the exterior envelope desired by the university?

A. This will be both a design consideration and a function of the building’s relationship to other existing buildings. The book stacks are to be located on the interior of the building and arranged so that direct...
sunlight does not reach the books. If the overall building design is enhanced by windows (or skylights), the architect must consider how these openings will affect the function of the spaces they are in, how to deal with any excessive energy losses, and what fire protection may be necessary because of the close proximity of other buildings.

Q. What types of conveyance systems are anticipated? Will open shafts house escalators, or will the conveyance systems be conventional elevators?

A. Again, this is a design issue and not specified by the building program. However, the university staff has not envisioned anything other than elevators. If the architect contemplates escalators or other people movers, those decisions will be made in the design presentation process.

Executing a Building Code Analysis

The AIA standard forms of agreement and the conditions of the contract for construction set out the responsibilities of all the parties involved in a project. Make certain you familiarize yourself with those agreements and govern yourself according to what is required of the architect. Understanding your contractual responsibilities is as important as performing an accurate code analysis.

Verifying that all aspects of your design comply with applicable building codes and guidelines is vital since the finished structure must comply with them. To help with this task, firms often devise their own building code analysis forms to use as a guide. A sample code analysis form appears on the following page to illustrate the basics of code review, but do not treat it as a complete or master form for use with every project. Code analysis forms should be unique to each project. You will be required to think through the code issues on all your projects as you begin the work of designing.

Even though the building program may identify certain code features, you must always verify what the code requires. In this example, the building occupancy/use for the project was established by the program, which states that the building will be used as a library (refer to A-3 in section 303.1 of the 2000 IBC). When you check the tables, you will find that “library” is not listed. Remember, what you are looking for is the building “use, rather than the building type. It takes some imagination, but what you have to do is think of what common action, or feature, will apply to people using the building.

In the case of a library, people assemble and make use of a facility that will house books. Libraries offer spaces for people to study and gather for meetings, lectures, and other public events, functions that are “assembly uses.” Offices and spaces that serve other support functions in the library are considered “auxiliary uses,” so do not require the building to be classified as “mixed use.”

The owner’s building program also indirectly sets the construction type for the project. The square footage needed to accommodate the building function requires Type I construction. The code provides for exceptions and other ways to increase the allowable square footage if a different construction type is employed. In this
case, however, those exceptions and allowances were exhausted because the existing building is a historic structure and over the years other buildings went up around it. Immediately to the north of the library was a much older building that was in worse condition, so the university decided to sacrifice that structure to gain a building pad for the new addition. Even with this space, the new building will be close enough to existing buildings that the code will require compliance with the most restrictive fire resistance requirements.

Fire suppression systems are always required for buildings with an assembly use. Therefore, conventional fire suppression systems will be used in most of the building, in accordance with NFPA-13 standards, but special fire suppression systems that do not employ water as the suppressant will be used in certain sections of the library.

<table>
<thead>
<tr>
<th>Item</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Edition International Plumbing Code</td>
</tr>
<tr>
<td></td>
<td>Edition International Mechanical Code</td>
</tr>
<tr>
<td></td>
<td>Edition International Fire Code</td>
</tr>
<tr>
<td></td>
<td>Edition NFPA National Electric Code</td>
</tr>
<tr>
<td></td>
<td>NFPA 13</td>
</tr>
<tr>
<td>Building Occupancy Classification</td>
<td>A-3 Library. Established by the Owner’s Program. Refer to Section 302.1</td>
</tr>
<tr>
<td>Construction Type</td>
<td>Type I (Required, based upon Program S.F.)</td>
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<tr>
<td></td>
<td>Refer to Table 503</td>
</tr>
<tr>
<td>Building Area</td>
<td>Unlimited (Based upon Construction Type)</td>
</tr>
<tr>
<td></td>
<td>Refer to Table 503</td>
</tr>
<tr>
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<td>Unlimited (Based upon Construction Type)</td>
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<td>Refer to Table 503</td>
</tr>
<tr>
<td>Table 503 Analysis</td>
<td>Refer to Height &amp; Area Sidebar</td>
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<td>Fire Suppression System</td>
<td>Required by Section 903.2.1.3</td>
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<tr>
<td>Allowable Occupant Load</td>
<td>Refer to Section 1003.2.1 &amp; Table 1003.2.2.2</td>
</tr>
<tr>
<td>Number of Exits Required</td>
<td>4 - Refer to Sections 1004.2 &amp; 1005.2.1</td>
</tr>
<tr>
<td>Corridors Construction</td>
<td>Refer to Section 1004.3.2</td>
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<tr>
<td>Maximum Allowable Travel Distance</td>
<td>250 Feet, Refer to Table 1004.2.4</td>
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<tr>
<td>Exit Locations</td>
<td>Refer to Section 1004.3.2.2</td>
</tr>
<tr>
<td>Exit and Corridor Width</td>
<td>Refer to Section 1004.2.2.2</td>
</tr>
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</table>

Narrative Written by Jim. W. Sealy, FAIA
Jimmy Sealy, an architect and consultant in Dallas, Texas, has participated in writing building codes and standards since the early 1970s. He most recently served as a member of the International Code Council drafting committees for the International Performance and International Residential codes. Sealy serves on building codes and standards committees for Underwriters Laboratories, the National Institute of Building Sciences, the National Institute of Science and Technology, the Applied Technology Council, and the American Institute of Architects.

Activities Written by Terry L. Patterson, NCARB
Terry Patterson is the W. Edwin Bryan, Jr., Professor of Architecture at the University of Oklahoma College of Architecture where he has taught architectural technology and design for 24 years. He is the author of Illustrated 2003 Building Code Handbook and other publications on building materials and technology.
notes

Take brief notes while reading the narrative and list key resources you used to complete the activities. Note discussion outcomes from meetings with your supervisor, mentor, or consultants. When finalizing the activity documentation (PDF), include your notes and the Emerging Professional’s Companion activity description.
Egress Systems for Safely Exiting a Building During an Emergency

Supplemental Experience for eight (8) Core IDP Hours

A central requirement of all model building codes is that egress systems must be designed to enable users to safely exit a building during an emergency. These requirements are generally based on the specific type and use of the building or space. Architects must take emergency egress into account in all projects they design. No other aspect of a design produced by an architect has a more direct effect on the health, safety, and welfare of the public than egress, or exiting, systems. Examples of tragic incidents that involved emergency exit design are the fire at the MGM Grand Hotel and Casino in Las Vegas, Nevada, in 1980; the DuPont Plaza Hotel and Casino fire in San Juan, Puerto Rico, in 1986; and the attack on the World Trade Center in New York in 2001.

In this scenario, your firm has been commissioned to design a mixed use complex that will include:

• A large hotel with ballrooms on the lower level and a five-star restaurant on the top floor overlooking the city
• An office building adjacent to the hotel, designed to be connected by a retail concourse
• A large parking garage serving the hotel, office building, and retail facilities

This project has many components, all of which lend complexity to the design of egress systems. As a member of the project team, you are assigned to create a guideline and checklist for monitoring compliance of egress system designs with building code requirements for the project.

Activity - Core

Using the instructions below, create a tool to help an architect design to the egress requirements of the building code:

• Study the egress requirements of the 2000 or 2003 International Building Code. (If you practice where the IBC has not been adopted, check with your local building official to determine when or if it will be adopted. If it will not be adopted in your area, use the current building code for this study.)
• Create an outline of the major egress issues that will affect the architectural designs and drawings. Include requirements for location and width of egress, doorways, stairs, and other major components and design issues related to egress issues.
• Prepare a checklist of the major egress requirements. Prepare vignette drawings and sketches that explain configuration and dimension requirements to augment your checklist. Where appropriate, place copies of tables and charts from the building code in your checklist.

Prepare a well-organized checklist to serve as both a design aid and a tool for checking project documents.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
ADA Compliance in an Existing Building
Supplemental Experience for eight (8) Core IDP Hours

In this scenario, you are the project architect for an addition to a performing arts center, and your work includes minor renovations to the existing building. The design for the addition is in full compliance with the Americans with Disabilities Act (ADA), but there is very little money in the budget to bring the existing building into compliance. The ambiguity of the act regarding compliance for existing buildings means you need an interpretation of what is required from the local authority having jurisdiction (AHJ). You were unable to meet with the official during schematic design, so full compliance for the existing building was not addressed.

Schematic design for the project has been approved, and the job is in design development. You have begun meeting with the local AHJ so that ADA issues can be resolved before construction documentation. At your first meeting, you learn the AHJ wants the entire building to comply with the ADA.

Activity - Core

Prepare a letter to the authority having jurisdiction to request this reinterpretation of the ADA. Cite sections in the act that support your position.

Identify at least two alternatives to your schematic design approach that might satisfy the AHJ and still be affordable for your client. Prepare a memo to your client explaining these new options, and make a recommendation.

• Look for examples in your city or in other parts of the country that might support your letter to the AHJ.
• Check to see if your office has some relevant projects you could refer to.
• Explain cost associated with change at this stage of development.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
ADA Design Compliance
Supplemental Experience for eight (8) Core IDP Hours

Architects have been guided by code requirements for many years. But the Americans with Disabilities Act of 1990 (ADA) set a national standard for building accessibility and caused this aspect of design to be unilaterally enforced by all relevant governing agencies. Congress passed the ADA to place a clear and comprehensive prohibition on discrimination on the basis of disability. Today, ADA-related design mistakes, when discovered after the construction is complete, are typically the architect’s responsibility because they result in impact costs rather than betterment to the project.

In this scenario, you are providing services as a construction administrator on a small office building, handling both office responsibilities and site visits. Construction is well underway and the owner has just informed you of their desire to add another toilet room to the building. The room must be ADA compliant. The design includes four water closets and two lavatories in the women’s toilet room and two water closets, two urinals, and two lavatories in the men’s toilet room. Each room is to have a vestibule with doors.

Activity - Core

Please reference the following documents:
- ADA Accessibility Guidelines for Buildings and Facilities
- Your state accessibility requirements

View and download the following sample document for reference:
- AIA G709™, Work Changes Proposal Request

Familiarize yourself with national standards for ADA compliance, as well as those of your state. Determine the appropriate space requirements and handicap accommodations. Pay close attention to specified clearances and mounting heights.

Draw up a generic plan that accommodates the scope described above. Follow ADA requirements for clearances and accessibility. Indicate critical dimensions, and select appropriate toilet fixtures and hardware.

When developing your design, answer the following questions:
- What is the minimum required floor area?
- Where are the handrails to be located?
- Which direction will the doors swing?
- What are the required fixture mounting heights?
- What are the required hardware mounting heights?
- What is the minimum size of the vestibules?

Using someone knowledgeable in MEP as the consultant, prepare a narrative to explain the changes to your MEP consultant and request appropriate revisions to the mechanical and electrical drawings. Ask them to determine the overall impact to the mechanical and electrical systems in the event additional work is needed to support the added toilet. Then create a communication flow chart and time line showing all contacts, for what reasons, and in which order.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Code Check

Supplemental Experience for eight (8) Core IDP Hours

In this scenario, your firm has designed a five-story classroom building for a college campus. It has 76,000 square feet, evenly divided among the floors. The building is intended to be Type III B construction. Its structural frame and exterior bearing walls have no fire resistance rating, and the building is not sprinklered. There will be 750 occupants, divided evenly among the floors. The building has two exits, each a single 36-inch-wide door.

The project manager believes that the design and detailing contain code violations. Before completion of the design development phase, you are assigned to check several aspects of the drawings for compliance with the 2000 International Building Code. Others are checking other aspects.

Activity - Core

Respond to the following questions:

1. What is the occupancy group of this building?
   - Identify the code section that covers this building’s occupancy group.

2. Does the building meet the requirements of Type III B construction?
   - Identify the code table that can be used to verify that the building has the fire resistance ratings required by Type III B construction.
   - Cite the required fire-resistance ratings for the structural frame and exterior bearing walls and determine whether these two building elements in your firm's design comply with the code.

3. Does the building meet code limitations for height and area?
   - Identify the code table that can be used to verify that the building meets height and area limitations.
   - Cite the limitations for this building and determine whether the design is in compliance. If it is not in compliance, create a new code plan.

4. Are the number and width of exits in compliance with the code?
   - Identify the code table that lists the minimum number of exits based on occupant load.
   - Cite the number and determine whether the design is in compliance.
   - Identify the code table that provides data with which to calculate the required exit width.
   - Calculate the required width of exits for this building and determine whether the exits are in compliance with the code.

5. Where the building design fails to meet code requirements, write recommendations to bring it into compliance.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Fire-Rated Wall Systems

**Supplemental Experience for eight (8) Core IDP Hours**

In this scenario, your firm has designed a multistory office building of Type I B construction. The building has masonry exterior bearing walls, interior wide-flange columns, wide-flange steel beams, open web steel joists, and steel stud partitions.

You are assigned to detail selected fire-resistance rated components for the building.

**Activity - Core**

Using the prescriptive fire-resistance-rated elements in the 2000 International Building Code, draw the following details in a convenient scale and format (e.g., freehand on grid paper, or by computer). Meet the fire-resistance rating required by the construction type. Identify all materials, sizes, thicknesses, and dimensions.

- A section through the exterior wall.
- A section in plan of the steel column fireproofing system. Use a steel column that is about 8 inches in each dimension.
- A section of the steel beam fireproofing system. Use a steel beam that has flanges of about 8 inches and a depth of about 12 inches.
- A section of the open web steel joist fireproofing system. Use a steel joist that is about 16 inches deep.
- A section of the steel stud interior partitions.

Provide the following information for each drawing:

- The code table in which the required fire resistance ratings are listed.
- The code table and item number that describe the selected fireproofing detail. The required fire-resistance rating for each component.

Provide a written summary for your choice of material, size, thickness, and dimension.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Simply reading a building code does not always lead to understanding it. A good way to make sure you understand the code is to draw an illustration of each code requirement. This method of study will show you quickly whether you understand the section you are illustrating. It will also help you measure your progress toward understanding the entire code.

Activity - Core

Prepare illustrations to approximate scale (freehand on grid paper is recommended) of the 2000 International Building Code sections listed below:

- 1003.2.3 Egress width
- 1003.2.3.1 Door encroachment
- 1003.2.4 Ceiling height
- 1003.2.5 Protruding objects
- 1003.2.5.1 Head room
- 1003.2.5.2 Freestanding objects
- 1003.2.5.3 Horizontal projections
- 1003.2.5.4 Clear width
- 1003.2.6 Floor surface
- 1003.2.7 Elevation change

Place each illustration on a separate 8-1/2” x 11” sheet. Although sections with dimensions are fairly easy to understand and illustrate, sections without dimensional requirements can be illustrated with a little thought and creative effort. If you do not have access to the 2000 IBC, choose a series of ten sections in another code that address similar subjects. (Note that these sections are sequential, with none omitted between the first and last.) Restrict your illustrations to a single occupancy, such as business, education, or mercantile. Do not include the exceptions. Use orthographic and/or pictorial views. If two sections can be illustrated by the same drawing, photocopy the drawing and enter the different section requirements on each copy. Enter your name, the name of the code, and the section number at the top of the sheet.

Write a narrative of how the drawings are IBC compliant how they are interpreted within your jurisdiction.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
As buildings have become increasingly complex, meeting life safety requirements has become more specialized. Life safety plans have a number of components, usually shown through diagrams, specifications, and schedules, and often coordinated with mechanical, electrical, and plumbing (M/E/P) consultants. Depending on the scope and character of a project, this aspect of building design and documentation may require special consultants.

Most components of life safety plans are enumerated in the International Building Code and NFPA 101. Although the issues may vary from project to project, the primary concern is building egress.

In this scenario, your office has essentially completed the design of a new, 30,000-square-foot school, and the owner has approved it. Your firm reviewed the design for compliance with building and life safety codes during design development. Now, at the start of the construction documents phase, you are assigned to create a life safety plan for the building and to review it with the local code official.

To begin your work, you verify the occupancy classification, building and construction type, and egress requirements as determined in the schematic and design development phases. You check the approved drawings for compliance with all relevant codes. You find that, in principle, the project complies with all the elements of a sound life safety plan. However, you discover that, since the life safety check completed during design development, the dimensions of the building have changed enough that some aspects of the project no longer meet code.

In its present configuration, the project fails to meet the required travel distance maximums for space without sprinklers. However, neither the construction budget nor the construction documents budget includes design and installation of a fire sprinkler system. The CD schedule is tight, and it is late in the game to redesign the building.

You voice your concerns to your supervisor, who tells you to suggest alternative solutions to the problem and make a drawing of each to review with the project manager. One of your solutions (or some variation of one) will ultimately be selected for implementation. You will document the solution and review it with the building code official.

Activity - Elective

Analyze the above scenario, writing a narrative to address the following:

- Ignoring codes is not an alternative, and retrofitting a building that is not yet built seems counter intuitive. Assess the possibilities and consequences available to the architect at this juncture. Describe each possibility, accompanied with sketches, in your narrative.

- Verification and coordination throughout each stage of project development and delivery might have avoided this problem. What was the optimal point in the process to address this issue? Explain your reasoning in the narrative.

After completing your narrative, prepare a cover letter addressed to the building code official to accompany drawings solutions. In your letter, outline the issues and the changes that must be made.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Last Minute Code Problem

Supplemental Experience for eight (8) Elective IDP Hours

In this scenario, a conference center building designed by your firm is scheduled to receive a certificate of occupancy in two weeks. The owner, who has existing motel facilities on the site, has scheduled the conference center for use in 30 days. About 200 motel rooms have been booked by conference attendees, who will use all the large multipurpose conference rooms in the center. Once the conference center is put into use, it will be continuously occupied, with only a day or two break between conferences. Bookings are scheduled more than a year in advance.

You have just discovered that the steel roof trusses that span the width of the large conference rooms were designed for a deflection of L/240, according to table 1604.3 of the 2000 International Building Code. The engineers understood that the ceilings were to be acoustical board, which qualifies for the deflection limit used. The ceilings actually installed were plaster, which requires a deflection limit of L/360. Until now, this mismatch of deflection to ceiling material has been overlooked by the building department, the structural engineers, and your firm.

The owner originally wanted plaster ceilings, as shown in the construction documents. The bids were high, so the ceiling material was changed to acoustical board, which brought down the cost. The structural engineer redesigned the trusses for the greater deflection permitted (saving more money), and they were fabricated. Before construction began, the owner came up with the extra money required for plaster ceilings and requested that they be installed as originally planned. They were added back into the project, but the trusses were not changed.

Two problems must be addressed. First, a code violation exists that could affect the occupancy permit if the building department gets involved. Second, although no cracks are apparent in the plaster ceilings now, it is probable that they will eventually appear, and plaster might crack or fall. You are charged with recommending appropriate action.

Activity - Elective

Prepare recommended actions to the questions below. You have a 30-day window before disruption of occupancy for repairs will cause a financial hardship to the owner.

- What paperwork should you examine to identify the party responsible for any error that might have occurred? What are the paperwork scenarios that would place fault, if any, with the architect or with the engineer?
- Do you have any local or state regulations that have an effect on this scenario?
- What should be done with regard to the building department? (It can refuse to issue a certificate of occupancy, so a good faith notification might be wise.)

What is your remedy? Most likely, if corrective action is not taken, cracks will appear and plaster will fall from the ceilings after the rooms are occupied. Will your recommendation vary depending on who is responsible for the oversight? If so, why?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Change in Code

Supplemental Experience for eight (8) Elective IDP Hours

Search for a design that was built under a previous model code by your firm. Compare a building element (e.g., exit, stair, etc.) that was designed according to the previous code and investigate how the building element could be upgraded to the current IBC guidelines.

Activity - Elective

Prepare sketches to scale (freehand on grid paper is recommended) illustrating how the building element would be designed under current IBC guidelines. Take notes of the differences between the two designs.

Write a summary of the advantages and disadvantages of the code change in terms of safety, function, and aesthetics. Also make note of any possible advantages in sustainability.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Compare and Contrast

Supplemental Experience for eight (8) Elective IDP Hours

Select a code change from one of two editions of the IBC or a model code that replaced it.

Activity - Elective

Write a summary that explains the change in code; be sure to illustrate this code change with diagrams.

Remember to keep in mind:
• What is the reason for this particular change in code?
• How does this affect the rest of the building?
• What advantages does the change in code bring?
• What disadvantages are presented from this change?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Specification Alteration
Supplemental Experience for eight (8) Elective IDP Hours

Interview a specification writer to identify a code change that affected the specifications for a building.

Activity - Elective

Using the above example, perform the following:

- Compare a material, detail, or process in the building that was specified using the older code.
- Summarize the advantages of the code change.
- In the new material, detail, or process lends itself to illustration, prepare two sketches.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
How to Change the Code

Supplemental Experience for eight (8) Elective IDP Hours

Every three years, a new edition of the International Building Code is issued. The International Code Council (ICC) provides opportunities during each three-year period for any interested party to submit changes to be considered and voted on. Proponents and opponents can challenge or defend the proposed changes at public hearings. Most changes are proposed by manufacturers of building materials and products, usually through code consultants, but changes also are proposed by professional organizations such as the American Institute of Architects and others who represent those concerned about the safety of buildings, such as fire service engineers, interior designers, and code officials.

Activity – Elective

For this activity, keep in mind that the ICC website and categories occasionally change format. Be resourceful.

Prepare a proposal for a change to the International Building Code using the following procedure:

1. Interview several people in your firm to collect opinions on how a specific section of the building code could be improved. Select the strongest idea for further development.
2. Download (from the ICC website) previous proposals for changes in the code category of your choice. Review several change proposals submitted in the past to learn the nature and style of the proposals.
3. Prepare a code change proposal on the idea you selected from your interviews, using the style on the Web site. Solicit comments on your proposal from those who gave you code change ideas, and refine the draft.
4. Download from the ICC Web site the file titled “Code Development Process” and study it, paying particular attention to the section titled “Submittal of Code Change Proposals.”
5. Download the Public Proposal Form. Fill out the form, using the narrative you completed in step 3 above and following the guidelines in the “Submittal of Code Change Proposals.”
6. Ask your supervisor or mentor for feedback on your completed Public Proposal Form and make any recommended changes. If your supervisor approves, submit your change proposal to the ICC.
7. Using a project you are working on write a narrative detailing how your change would affect the project. Make any necessary alterations to drawings and plans.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Drawings that require building permits must be reviewed by local building officials. This review will reveal how carefully your firm has checked the project documents with respect to code requirements. To learn more about this process, you can interview a project manager at your firm.

**Activity - Elective**

Interview a project manager/project team in your firm or a mentor’s firm who has had experience submitting projects for building permits. Consider the following questions:

- **What is the permitting submittal process in your jurisdiction?** Obtain copies of building permit application forms and instructions and study them before attending the meeting. These may be available online.
- **What kind and size of projects require a formal building permit review, as opposed to an over-the-counter building permit?** (For example, in some jurisdictions small projects such as swimming pools, fences, or even residences may require a fee and minimal documentation, which is reviewed while the applicant waits.)
- **What time frame should be anticipated for building permit review?** Does the size of the project figure into the time required?
- **What construction documents and specifications should be included with the building permit submittal?** Is there a formal list? Does the building code address documentation requirements?
- **Has the project manager observed problems when architectural drawings are submitted for permit review?**
- **Are the drawings frequently judged to be incomplete?**
- **Do they adequately address building code issues?**
- **Is the project manager generally concerned about any issues relative to review of architectural and engineering drawings by the building official?**

Prepare a written report describing the building permit submittal process. Address any problems or concerns raised by the project manager. Include in your report a checklist designed to guide an architect through the building permit submittal process in your city, including items that address the issues you have identified.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
notes

Take brief notes while reading the narrative and list key resources you used to complete the activities. Note discussion outcomes from meetings with your supervisor, mentor, or consultants. When finalizing the activity documentation (PDF), include your notes and the Emerging Professional’s Companion activity description.
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* A maximum of 40 hours of core credit may be earned in this experience area.

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Design Development

Introduction

By completing the activities in this chapter, you will gain an understanding of the activities involved in design development. The following information is taken from the NCARB IDP Guidelines:

Design Development
Minimum Design Development Experience: 320 Hours
Definition: During design development, a project’s schematic design is refined, including designing details and selecting materials. This step occurs after the owner/client has approved the schematic design.

Tasks
At the completion of your internship, you should be able to:
• Prepare design development documents
• Investigate and select building systems and materials
• Meet with client to refine design and obtain approvals
• Conduct or respond to a constructability review
• Apply sustainable design principles

Knowledge Of/Skill In
• 3-D modeling
• Adaptive reuse of buildings and/or materials
• Alternative energy systems and technologies
• Applied mathematics (e.g., algebra, geometry, trigonometry)
• Basic engineering principles
• Building design
• Building envelope
• Building Information Modeling (BIM) technology
• Building systems and their integration
• Characteristics and properties of construction materials
• Computer Aided Design and Drafting (CADD)
• Conflict resolution
• Constructability
• Construction details
• Construction sequencing
• Creativity and vision
• Critical thinking (e.g., analysis, synthesis, and evaluation of information)
• Design impact on human behavior
• Design principles
• Designing and delivering presentations
• Engineering load calculations
• Freehand drawing and design sketching
• Furnishings, fixtures, and equipment
• Graphic communication
• Hazardous materials mitigation
• Implications of design decisions (e.g., cost, engineering, schedule)
• Indoor air quality
• Interior materials and finishes

resources

Download the current Intern Development Program (IDP) guidelines at www.ncarb.org/Experience-Through-Internships.aspx.

• Chapter 12.2 - Design Phases


• Chapter 7.3 - Design Phases
Knowledge Of/Skill In Continued

- Interpersonal skills (e.g., listening, diplomacy, responsiveness)
- Life safety
- Managing quality through best practices
- Manual drafting
- Natural and electric lighting (e.g., daylight, solar control, energy consumption)
- Oral and written communications
- Problem solving
- Product evaluation, selection, and availability
- Project scheduling (e.g., construction document setup, storyboarding, staffing projections)
- Site design
- Space planning
- Spatial visualization and modeling
- Specifications
- Sustainable design
- Team building, leadership, participation
- Technological advances and innovative building products
- Universal design (environments usable by everyone regardless of limitations)
- Vertical circulation

**notes**

*Take brief notes while reading the narrative and list key resources you used to complete the activities. Note discussion outcomes from meetings with your supervisor, mentor, or consultants. When finalizing the activity documentation (PDF), include your notes and the Emerging Professional’s Companion activity description.*
Narrative

The beginning of design development (DD) is a logical extension of schematic design. DD tasks build on the approved schematic design to reach a level of completeness that demonstrates the project can be built. The schematic design is overlaid with more detailed information obtained from an array of multidisciplinary consultants and team members. Throughout DD, it is important to evaluate how systems, material selection, and detailing reflect the schematic design concept. The design team works out detailed coordination issues, while enhancing the project, so that major revisions are not needed during construction documentation or, worse, during construction.

Depiction of all aspects of the design, including architectural, structural, HVAC, electrical, plumbing, and fire protection systems are essential. Depending on the building type, acoustic and vibration considerations, lighting concepts, landscaping design, and other specialized factors also need to be integrated into the design. Design development may rely on extensive three-dimensional representations (models, perspectives, animations, full-size mockups, etc.) to communicate both the overall design and details to the design team, the client, and the construction team.

Historically, schematic design, design development, and construction documentation were distinct phases of project delivery. In a continuous process of evolution, refinement, and integration, digital developments have blurred these phases. Add to this the emergence of project delivery methods beyond traditional design-bid build to methods emphasizing multiple packages and sequential issuance of design information, and the crisp lines between traditional project delivery phases are often gone.

Design development documents are often similar to those in schematic design, but contain more detail in the drawings and specifications and may—depending on the contract—be accompanied by an updated cost estimate. The client reviews these documents and, upon the client’s written approval, construction documentation begins. In some project delivery methods, the issuance of production information and even commencement of construction overlap the design development phase. In these instances, the architect must focus sooner on systems that affect early stages in the work.

Architects must be proficient in preparing design development documents that detail project scope, quality, and cost, providing details about materials, systems, and compliance with life safety requirements. Meetings during this phase are critical to an understanding of why design decisions are made. Ideally, interns seeking licensure should participate in discussions with the client regarding scope, quality, and cost and in technical coordination meetings with the engineering disciplines. Identifying conflicts between building systems, collaborating with design team consultants to resolve these problems, and ensuring that specifications and drawings conform to applicable codes are important activities during design development.
The Design Development Process
Design development in the architecture profession is continually evolving, responding to changes in technology, project delivery methods, and computer-aided design (CAD) systems. As a result of changes in computer technology over the past several decades, the distinction between schematic design (SD), design development, and construction document (CD) phases has blurred. When DD documents are hand-drawn, SD drawings are often discarded and larger scale plans and sections begun. Commencement of the CD phase also included creation of new drawings. Creating drawings in CAD is a different process. As the project delivery process moves ahead, information is continuously added to the drawings, allowing them to be viewed in multiple scales, and more recently, explored in multiple viewpoints with three dimensional CAD.

Another cause of this blurring of phases stems from the adoption of project delivery methods that seek to build faster and with more input from contractors and manufacturers. Some contracts actually delete design development, going from concept design to construction documents. Others require creation of bid packages for foundations and structural frames in the middle of design development. Despite these changes in technology and delivery, the tasks that make up the DD phase are still necessary for a successful project, even if they are performed in different phases or out of sequence.

Design Development Tasks
The main task that must be accomplished in design development is preparation of drawings and documents for your client that detail project scope, quality, and design. Specifications and details of selected materials and systems are part of the DD package, with more technical detail provided by consultants. The DD products make possible a more refined cost estimate and a better understanding of how different building systems are integrated and how the building is likely to perform. Ultimately, the DD documents allow a client to make an informed decision whether to continue a project into the CD phase and construction itself. The skills needed to accomplish DD tasks vary.

Architects must have the technical skills to take the approved schematic design and incorporate appropriate levels of detail in drawings and specifications, coordinate and integrate the systems, and comply with code requirements. Necessary management skills include the ability to participate actively in meetings with clients and consultants and to keep a project moving forward. Problem-solving skills are needed throughout the DD phase, as architects resolve conflicts between systems or consultants, reinforce and support the initial design intent with selection of materials and details, and explore important portions of the building at a larger scale.

Design Development Team
The project team gets bigger during design development. The core design team of architects and engineers is augmented with a number of consultants in specialties such as geotechnical issues, wind tunnel testing, security, sustainability, acoustics, lighting, vertical transportation, landscape design, and so on. While some of these consultants may have been brought into the project during SD, all of them have more work to do in DD. Today construction managers and cost estimators are included earlier in the design process, so they often participate in DD meetings. The cost control team works closely with the architecture/engineering team.
during so everyone understands the cost implications of design decisions. (For more information about cost issues, see Chapter 1C - Project Cost and Feasibility.) Subcontractors and suppliers are also brought in early for their valuable input into construction feasibility and construction and materials cost. While many architecture firms “do it all” in-house, many other firms specialize in technical aspects of architecture. The latter offer services in specifications writing, code and life safety issues, exterior wall design, theaters, sport venues, laboratories and hospitals, and physical model building as well as new virtual model building. Depending on the scale and complexity of a building, many of these consultants are assembled for design development.

Effects of New Technologies
The traditional role of design development is as a step in a continuously increasing effort that leads to construction documentation, which is the climax of the design effort. A by-product of the new technologies used in architecture practice is the alteration of this process, as described above. In response to this change, Patrick MacLeamy, FAIA, CEO of HOK, proposed an alternate effort chart that makes DD the peak effort in the design process (see the accompanying diagram below). This view of design development coincides with its position on the design effort curve in MacLeamy’s graph, which shows the design team’s ability to affect cost and quality diminishing over the life of a project.

Prescriptive vs. Performance-Based Codes

When DD is seen as the peak effort in the design process, more final work occurs during this phase, requiring more effort. For example, construction of 3-D building information models (BIMs) and other means of achieving interdisciplinary coordination during design development require greater effort than traditional...
2-D drawings. However, expending this effort during DD reduces the effort required during construction documentation. The Construction Users Roundtable (CURT) is presently considering this approach to DD as a way to increase A/E productivity, while improving the quality of construction documents.

Architects and their consultants use a variety of techniques to explore the design of a building throughout the DD phase. These techniques range from traditional hand sketching and physical model building to computer modeling and animation borrowed from the aerospace and entertainment industries. New technologies make it possible to take information from physical models of buildings and mockups of portions of a design and enter them into computer programs for use in design development.

The expansion of CAD into the third dimension has increased the number of tools available to explore design issues. In addition to placing 2-D design information into 3-D computer programs, it is now possible to export 3-D information. Rapid prototyping machines “print” 3-D model buildings and mockups. Even the physical models used in wind tunnel analysis often begin with 3-D models of the building and surroundings created by computer numerical control (CNC) machines. Other ways of assessing building performance during design by using 3-D models exported to other programs include computational fluid dynamic (CFD) analysis, lighting studies, timed exit analysis, and energy analysis.

Using the technology available today gives architects quantities of information to help them analyze designs in ways that were not affordable or even possible a few years ago. Examples of how several well-known firms are making use of this new technology are shown at the end of the narrative.

**DD Deliverables and Products**

Refinement of the schematic design approved by the owner, including design of details and selection of materials, is the primary goal of design development. However, drawing content varies according to project size, type, location, and local practice, making it impossible to develop a single list of DD deliverables appropriate for every project. Following is a list of items frequently considered for inclusion in DD documents, along with some particulars that might be included in each:

- **Site plan:** Zoning and site development requirements, property lines, elevations, pavement and sidewalks, walls and curbs, landscaping, utilities, typical site details
- **Floor plans:** Rooms, corridors, and other spaces; windows and doors; fire ratings and compartments; expansion joints; reflected ceilings; structural grid; major dimensions
- **Building elevations:** Materials and features, major dimensions and elevations, typical windows and doors
- **Building sections:** Materials, fire ratings and compartments, expansion joints, major dimensions and elevations, outline specifications
- **Typical wall sections:** Partition types, fire-rated assemblies
- **Integrated sections/plans:** Architectural, structural, mechanical, electrical, and plumbing systems depicted on the same drawings to show how they fit together
- **Schedules:** Room finishes, doors, windows, vertical transportation
- **Structural:** Foundation plan, floor framing, roof framing, typical notes and details, outline specifications
Design Development

- **Mechanical**: Equipment rooms and distribution zones, riser diagrams, equipment rooms, outline specifications
- **Electrical**: Equipment rooms and distribution zones, riser diagrams, equipment schedule, outline specifications
- **Plumbing**: Equipment rooms and distribution zones, riser diagrams, equipment rooms, outline specifications
- **Outline specifications**: Brief description of the project, architectural materials and systems, engineering specifications
- **Visualization**: Models, mockups, material samples, renderings, computer models, animations, sketches, lighting studies
- **Other material**: Code and zoning analysis, floor area summaries, LEED rating summary

**Approvals**
The architect submits DD drawings and specifications to the client for review and comment. Some architects (or clients) prefer a design development presentation, with plans and sections put up on the wall or projected from a computer. Some clients prefer to study the drawings and specifications carefully while a cost estimate is prepared, and then have a meeting to discuss comments. If a project budget is not on target, the architect and client discuss ways to achieve the client’s objectives. Sometimes, the DD documents need to be revised before the client will approve them. In any event, the architect should not commence construction documentation before written approval has been received. In fast-track delivery, however, work often begins on the CDs during the client review period. The owner-architect contract should address the approval process for a particular project.

**Standards for Drawings and Computerized Design**
Standards for the graphics that depict building plans and details have evolved along with the transition from drawings created with pen and pencil on paper to those created using CAD. In the past, individual architecture firms often developed their own standards, leading to many variations on the commonly agreed plans and sections that make up a DD set. Today paper standards have given way to CAD standards because the CAD files themselves have become deliverables.

CAD standards to be used for a project are commonly identified in the owner-architect agreement. The Construction Specification Institute (CSI), the National Institute of Building Sciences (NIBS), and the American Institute of Architects (AIA) have joined their efforts to publish and promulgate the National CAD Standard. In addition to this standard, some architecture firms have established their own standards, which are often a variation of the national standard altered to fit the way the firm works. Clients can be another source of standards, such as the General Services Administration (GSA), which has the GSA CAD standard available as a PDF on its website. See “Resources” side bar for more information.

New ways to deliver architecture products are on the horizon. An example is building information models (BIM), which store information in 3-D graphic databases. Organizations such as the International Alliance for Interoperability (IAI) are working on standards for building construction.
Design Development

objects in these databases to improve efficiency and productivity in the design and construction industry. The BIM standards are beginning to evolve in a way similar to the development of CAD standards. The promise of these standards for building products and their use in BIMs is that the development of software applications will dramatically improve productivity in building design and construction. The automobile and aerospace industries have shown this is possible, without sacrificing design and performance.

Multidisciplinary Design Issues
Many issues in building design require coordination and collaboration among team members from different disciplines. Attention to these interdisciplinary efforts begins during schematic design, but responses to such concerns are refined during design development. In particular, the revived emphasis on energy conscious design and the emergence of sustainable design objectives have introduced increased intersections in the work of architects, engineers, and specialty consultants.

Attention is given to the following multidisciplinary design areas at many points in the project delivery process. By necessity, none can be considered independently by practitioners of just one discipline. As mentioned above, detailed coordination may wait until construction documentation; however, an integrated approach to addressing these issues during design development yields better results.

Energy-Conscious Design
Decisions about building systems, the exterior envelope, daylighting, and the indoor environment all influence the design and affect the energy use of a building. During DD, refining the enclosure strategies established in schematic design includes evaluating window size and location, shading, and glass type with the goal of minimizing heating, cooling, and lighting loads. The heating and cooling systems chosen for a building are an important part of energy-conscious design, but these systems also influence the structural systems and service spaces of a building. M/E/P engineers, lighting designers, exterior wall consultants, and structural engineers are all needed to study these aspects of the design.

Sustainable Design
During design development, sustainable strategies can be introduced to refine energy-conscious designs and to influence product selection. For example, lighting and HVAC systems can respond to passive energy and ventilation strategies, and dimming ballasts and photo-sensor lighting controls can be used to dim electric lights when daylighting is available. Other building materials can also be selected for their environmental characteristics. Structural engineers, geotechnical engineers, and mechanical engineers are often involved in developing these strategies.

Achieving a LEED rating is sometimes a project goal. To accomplish this, the architect must pursue the rating throughout the design process, using measures to verify performance. The process involved in achieving sustainable design goals is illustrated in the sidebar.

Acoustic Design
Architects working on acoustically sensitive buildings often hire specialized consultants to determine the characteristics of sound quality and sound isolation appropriate to the project. Criteria are established that affect door, window, and enclosure design, as well as structural and HVAC design. In addition, interior design of critical spaces may be affected by the need for absorptive or reflective materials. Acoustic and vibration consultants lead the effort to evaluate design options and make recommendations. However, the architect must coordinate a number of interdisciplinary issues, including those introduced by M/E/P and structural engineers and exterior wall consultants. A number of ways are available to simulate sound qualities in buildings, including specialized consultants who build and test physical and computer models that help the architect evaluate alternatives.
Design Development

Lighting Design
Good lighting design can enhance the physical form and structure of a building. In addition to the technical aspects of lighting levels and functionality, design decisions about lighting systems can reinforce ideas imbedded in the schematic design. Lighting consultants work with the architectural design team and the electrical engineer on computational fluid dynamic (CFD) analysis, lighting studies, timed exit analysis, and energy analysis to establish design concepts for various project conditions. For example, lighting simulations can be run in 3-D CAD, giving the architect an unprecedented ability to study lighting during design development. Sophisticated modeling programs are now a standard part of rendering programs available to architects.

Envelope Design
Designs that incorporate large glass walls, curtainwall systems, and skylights often require the expertise of specialists, who work with the architectural design team during design development. In particular, decisions about the building envelope affect structural and mechanical systems. Information about window washing and skylight maintenance/cleaning should also be considered during design development.

Site Design and Geotechnical Issues
For many projects, a site investigation and geotechnical recommendations are needed. Evaluation of foundation options, suggestions for controlling groundwater, and recommended designs for basements and other earth retention structures will provide information helpful for refining a foundation design. For large site development schemes, recommendations are needed for the design of pavements and retaining walls, as well as for dealing with utility and transportation issues. Architects lead the effort in advancing site issues during design development, with the help of civil, geotechnical and structural engineers.

Life Safety Design
Life safety and other code specialists are commonly hired to assist on large, complex projects. Fire ratings and separations affect mechanical and structural engineering systems and must be coordinated among the disciplines. A building code analysis will reveal many of the issues related to egress, fire separations, and structural protection, which generally have prescriptive code requirements.

Performance-based design concepts developed in Europe and Australia are coming into use in the United States. Techniques such as timed-exit analysis, computational fluid dynamics (CFD) analysis, and structural analysis with fire design load cases require specialized consulting services. Design development is the time to explore these options, particularly if a project falls outside the typical building types addressed in building codes.

Indoor Environment
Many buildings, including hospitals, schools, libraries, laboratories, and residential buildings, have critical indoor environment requirements. Indoor air quality (IAQ) issues, including release of volatile organic compounds (VOCs) and effects of hazardous materials, affect the choice of interior

resources
Acronyms to Remember
- DD - Design development
- IAQ - Indoor air quality
- BIM - Building information modeling
- M/E/P - Mechanical, Electrical, Plumbing
- CFD - Computational fluid dynamic
- VOCs - Volatile organic compounds
- CNC - Computer numerical control
Design Development

finishes and engineering systems. Indoor air quality consultants help architects in these areas, especially in evaluating existing buildings, and mechanical engineers play an important role in addressing any concerns raised.

Seismic Design
In many parts of the country, designs must accommodate the level of seismic force expected in that region. While the structural engineer takes the lead in design to resist earthquakes, the seismic design process includes consideration of the design of nonstructural elements and mechanical systems, as well. State-of-the-art earthquake resistant systems may include active and passive damping systems and base isolation systems. All of these have an impact on detailing of expansion joints and access requirements as well as mechanical systems.

Integration of Systems
The often-conflicting requirements and restrictions of technical building systems require engineering systems coordination during design development. The more complex the project, the larger the design team is likely to be, making collaboration skills key to successful project development and completion.

Structural Systems
Structural engineering aspects of building design can have a significant effect on an architect’s overall design concepts. For example, a wide range of system alternatives can be developed for the foundations and superstructure of most buildings. Structural concepts also influence the development of details such as cladding, skylights, stairs, and guardrails, elements that may have been identified during schematic design but now require more in depth design.

Architects explore foundation and basement alternatives with structural and geotechnical engineers. Geotechnical site investigations and analysis are used to determine how to protect basements from groundwater and earth pressure. Usually, a foundation system is selected during design development to meet performance, cost, and construction requirements.

Tall buildings and long-span buildings, as well as complex urban environments, may be effectively modeled in wind tunnels to assess a number of critical design considerations. The structural engineer often takes the lead in working with the wind tunnel consultant; however, a number of other disciplines receive valuable information from the wind tunnel tests. Wind pressures on cladding and at the pedestrian level are estimated. The effectiveness of exhaust and air intake locations may be assessed, and snow drifting and sliding and ice buildup may be estimated. The primary reason for wind tunnel testing, however, is to assess the aerodynamic properties of the building, that is, the probable movement of the building in wind.

Wind tunnel testing often occurs just before or during design development as it is essential for the building form to be determined before testing. The exception to this are buildings, such as super-tall towers, where the building form contributes to the building’s aerodynamic performance. For these projects, early testing assists with the evaluation of optimal schemes. Although uncommon, when wind tunnel testing reveals
the need for supplemental damping systems, as in seismic design, these systems are designed during the DD phase. In addition to the cost of such systems, the building program must be stretched to accommodate them. Design to resist seismic forces is becoming more common in the United States. The primary concern of earthquake-resistant design is stability and safety, making the structural system of particular concern. Nonetheless, significant secondary concerns include life safety, mechanical/electrical system design, and choice of cladding systems, particularly in essential facilities such as hospitals, police and fire stations, and emergency response facilities intended to be operational after extreme events. Building codes define additional requirements for these facilities.

**Mechanical/Electrical/Plumbing (M/E/P) Systems**

The evaluation of alternative systems for mechanical, electrical, and plumbing aspects of a building is a critical activity in design development. By the end of DD, the optimal systems should be selected and incorporated into the building design and the documents. Alternate systems often have different space requirements, quality, costs (initial and life cycle), and implications on the structural systems, and their selection is often a design issue. Design decisions about sustainability, lighting, energy use, and indoor environment all affect selection of these systems. While it is true that much detailed engineering coordination occurs during construction documentation, it is important for overall engineered system concepts to be achieved during design development. Mechanical rooms, exhaust shafts, ventilation louvers, and penthouses may support or conflict with the architectural design. When these elements appear late in the design, it can be difficult to insert them unobtrusively into the design.

**Sitework and Landscaping**

The scope of civil engineering varies widely from project to project, from tight urban sites to wide open rural settings. Where utilities enter a building affects the location of mechanical and electrical rooms. Grading and drainage for a project affects the ground floor elevations. Again, detailed coordination is not necessary at this stage; however, overall concepts for utilities, site drainage, earth retention, and water retention should be resolved by the end of design development.

Although the approved schematic design often incorporates landscape concepts, more detailed studies are needed in design development. The goal is to integrate the landscape design with civil, structural, and plumbing design. With more and more buildings incorporating atria, and green roofs, landscape decisions affect engineering coordination as well as sustainability and energy conscious design.

**Security Design**

Acts of terror perpetrated in the United States have instigated new analysis and design requirements for many public facilities. Public buildings owned by the General Services Administration (GSA) and other government agencies require compliance with federal security guidelines, including those set by the GSA, the State Department, and the Department of Defense. Corporate and institutional owners are also evaluating security risks. Integrating solutions to security requirements into an architectural
design can be a challenge, with a number of conflicting issues. One of the biggest challenges in the design of public buildings is balancing the desire for openness and transparency with requirements for security and blast resistance.

Security consultants have a wide range of specialties, and very often owners employ them directly. While they may have provided initial concepts during schematic design, a more detailed analysis is performed during design development. If design for blast loading is a requirement, a specialist in blast analysis is needed to define the structural design criteria for the project, including loading requirements, which structural engineer project then incorporates into the analysis and design. Security consultants may also be asked to analyze security requirements for access to a building.

**Preliminary Regulatory Review**
The DD phase is an excellent time to schedule a preliminary review with regulatory agencies such as the local building department, fire marshal, health department, education agency, planning and zoning office, and/or design review board. Often an in-progress set of drawings is used to present the building to the officials. A zoning and building code analysis should be performed (or updated from schematic design), as well as an energy code analysis, as required. Although consultants can be hired to address code issues, architects often perform the zoning and code review and M/E/P engineers the energy code analysis. Again, an early meeting with officials is helpful, especially for designs with issues open to interpretation or requirements for variances.

**The Evolution of Design Development**
Design development is a central part of the design process, and it continues to evolve. It is more complex today than ever before, yet a number of new computer tools and consultants are available to help architects evaluate these complexities. For each project, what must not be lost during DD are the important concepts imbedded in the schematic design. Design development should enhance these features, while finding ways to weave in the technical demands outlined in this chapter.

Written by Joseph G. Burns, FAIA, RIBA, PE, CEng
Joseph Burns is a managing principal of Thornton-Tomasetti Group in Chicago. He is an advocate for the deeper integration of architecture and engineering, which he promotes through technical innovations in the design of structural systems, collaboration in practice, and participation in building science education.
Sample DD Applications of Computer Technology

A sample of the range of tools used in design development today is illustrated in the brief descriptions that accompany the sample drawings on the following pages. Each paragraph outlines how an architecture firm—small, medium, or large—practices design development today.

This is by no means an exhaustive list of examples; rather, it shows how broad choices are today, as the building industry continues to develop new technology and to adapt technology from other industries for use in architectural design.

resources

As you research and look for more information on topics presented in the Emerging Professional’s Companion, remember that a quick internet search of keywords can be incredibly useful to completing your Activities.
Garofalo Architects
Location: Chicago

Garofalo Architects uses a wide range of computer software to study buildings throughout the design process. They mix physical models and computer models and make use of animation software. In particular, they use Maya, computer animation software borrowed from the entertainment industry, which allows for assembly of 3-D objects and rapid exploration of space and time. In design development, assemblies of structural systems and other building systems can be coordinated in three dimensions. MicroStation is also used for 3-D modeling and for plan and section construction. Visit www.garofaloarchitects.com for more information about Garofalo Architects.
DD Example #2

Gehry Partners
Location: Los Angeles, California

Gehry Partners employs a mix of physical models at various scales and sophisticated 3-D software to model complex surfaces. Spatial digitizers are used to input complex surfaces from the physical models, and rapid prototyping equipment is used to reverse the process and verify the contents of the computer models. Architects and engineers use 3-D object programs to model systems and their integration. Two-dimensional plan and section information is exported from the 3-D software for traditional documentation. Gehry Technologies is a separate company that conducts research on building practice and develops software products for the building industry.

An important part of the firm’s success in realizing its projects has been to use building systems that can accommodate substantial geometric variations while minimizing engineering and shop drawing effort for individual pieces. Recent advances in parametric modeling allow the firm to efficiently reuse material developed for systematic design, engineering, and modeling strategies across the project. Information such as geometry, materials, system assembles, and so on are available to everyone on the project team.

In the project illustrated here, a glazed atrium roof system makes it possible to construct certain types of curved surface forms using flat, quadrilateral sheets of glass. Gehry Partners has developed a parametric description of the geometry required to support this construction. A set of curves initially defines the object in the parametric modeling program, allowing designers to modify the surface shape while preserving construction requirements. For instance, construction details such as mullions and connection geometry, created as parametric objects, respond automatically to changes in the overall form of the glazing system.

A physical model
A parametric model of glazing systems
A parametric model of mullions and connections
DD Example #3

Wheeler Kearns Architects

Location: Chicago, Illinois

Wheeler Kearns employs a range of sketches, perspectives, models, renderings, plans, and sections throughout design development. A high degree of coordination between the architectural design and building technology is sought through integrated section and plan details. AutoCAD is used to create plans and sections. Visit www.wkarch.com for more information about Wheeler Kearns Architects.

Illustrated here is the design development study of a bookcase in a private residence.
Design Development

DD Example #4

Populous
Location: Kansas City, Missouri

Populous, formerly HOK Sport + Venue + Event, uses the full three-dimensional capabilities of AutoCad Architectural Desktop (ADT) throughout the design process. In design development, a building is constructed in three dimensions, as is the consulting engineers’ work, easing integration and technical coordination of engineered systems and the building design. Specialized software is used for interference (clash) checks. See the accompanying sidebar for examples of these documents. For more information about Populous, visit www.populous.com.

3-D renderings made during design development, from which plans and sections can be “extracted”
notes

Take brief notes while reading the narrative and list key resources you used to complete the activities. Note discussion outcomes from meetings with your supervisor, mentor, or consultants. When finalizing the activity documentation (PDF), include your notes and the Emerging Professional’s Companion activity description.
Energy Code Compliance

*Supplemental Experience for eight (8) Core IDP Hours*

In this scenario, you are the project architect remodeling an older office building in the design development phase. Your mechanical consultant has just issued a report indicating the project will not meet the city-mandated energy code. Among other problems, the type of glass selected for the project and the size of openings shown on the approved schematic design drawings, the energy uses are too great.

You have reviewed the options with the principal in charge of design in your office. If possible, the project architect does not want to make changes/revisions to the size, location, or glass type of the windows.

**Activity - Core**

You are tasked with creating alternative solutions. Using an older office building project in your area that no longer meets current energy codes as an example, write a report for the principal detailing what changes you suggest.

- Research the energy codes for your state and see what has to be done to the project in order to bring it up to code.
- Since you are not allowed to make revisions to the size, locations, or glass type of the windows, what else are you able to change? What changes would you make?
- Be sure to include a cost analysis for any proposed changes.
- How does your regional environment complicate this project? How can you environment be used to your advantage?
- How does the project being in the design development phase affect your decision making? Explain.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Lessons Learned in Check Sets

Supplemental Experience for eight (8) Core IDP Hours

In this scenario, you are the project architect for a new downtown retail and office building that includes a parking garage in the basement. You are reviewing the design development drawings, specifications, and other project records to check compliance with the code analysis performed by your team. During your review, you have discovered several omissions.

One omission is the absence of four-hour rated construction separating the parking area in the basement from the retail space on the first floor. This separation is not shown on design development drawings, and the structural engineering drawings indicate steel floor framing with a metal deck concrete slab, which appears to provide a two-hour separation. Although both steel and concrete structural frames were evaluated in schematic design, steel was selected for cost and speed of construction.

You discover another omission in one of the exterior walls, where four-hour rated construction is required along a property line. Your design shows several windows in this wall; closing them will require revising the schematic design for some of the spaces. In addition, it appears to you that only a two-hour separation is provided at this location on the design development drawings.

The design team is happy to receive your comments before they have completed design development. They have asked you for ideas on how to revise the construction to comply with the code.

Activity - Core

Research and describe various options for resolving these two omissions. Write your findings in narrative form and include illustrations. Discuss with your supervisor or mentor. Then, outline the lessons learned from this experience that would inform your approach to future projects.

Consider these questions:

• Do any of the identified solutions involve requests for a variance from the local building authority? Are there any trade-offs in the design that would make it possible to use the assemblies as intended in the DD drawings?
• Should the decision to select a steel frame be revisited? How would the project team evaluate this option? What is the best way to approach the client with this option?
• Are there any options for the wall openings that include alternate window types or fire suppression systems?
• Be sure to include any change to building systems and components. Detail how these solutions would affect the schematic design, time and cost of the project.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Observing the Work of Others

Supplemental Experience for eight (8) Core IDP Hours

Observing projects you are not working on is a key component of learning for architects. Choose a project at your firm or your mentor’s firm and perform a brief design and/or technical review of the drawings and specifications near the end of design development. If your office has a checklist for project reviews, utilize it in your evaluation.

Activity - Core

Follow these steps in preparing your evaluation:

• Compare the design development documents with the approved schematic design. Is it consistent or have there been some major revisions? If so, why? Point out the reason for the change and the positives and negatives.
• Look at the documents prepared by the engineering disciplines. Are they consistent with the architectural documents? If not, how could this be rectified?
• Review the specifications prepared for the project. How do these sections support the design concepts?
• Perform your own evaluation of the code analysis and accessibility report. Does the building comply with these requirements? Make note of any place it does not and explain why.
• In what ways could integrated project delivery help this project?
• Review the DD deliverables and make note of which are applicable to this project.

Write a summary of your review.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Value Engineering the Exterior Wall

Supplemental Experience for eight (8) Core IDP Hours

Value Engineering (VE), also referred to as Value Analysis (VA) is an area of practice where architects are frequently pushed around, and which can be the source of trouble on a project. All participants must realize that value engineering is an often necessary though extremely disruptive process that usually subverts coordination and leads to measurable errors in drawings and specifications. VE can also lead to quality reductions that were not within the realm of the owner’s expectations.

A less commonly discussed problem is that VE changes to drawings take time, and usually occur during the beginning of the construction phase when coordination oversights and drawing mistakes are more costly. Architects can participate to some extent in the VE process, but are usually under the control of the owner’s or contractor’s desire to reduce costs.

Activity - Core

Please reference the following documents:
- The Architect’s Handbook of Professional Practice, 14th ed. Chapters 12.5, 12.11 and 14.2
- Other EIFS information such as; Dryvit Systems, Inc., Sto Corp., Teifs
- The Portland Cement Association
- Gimme Shelter, February 2006, AIArchitect article by Grant A. Simspson, FAIA and James B. Atkins, FAIA.

In an effort to understand what an architect is faced with when building systems and materials change, you will research two different materials and make note of the differences. The objective will be to create a list of pros and cons to discuss with the owner. Answer the following questions:
- Is it really any of your business if the owner and/or contractor choose to change the design of the building?
- If the owner or the contractor changes the design of the building, aren’t they going to be responsible for the design?
- Do you have any responsibility to explain the advantages and disadvantages of decisions they have made about the building design?

EIFS (Exterior Insulation and Finish Systems): Your owner has elected to change a large portion of the exterior wall of the building you’ve designed from brick masonry veneer on metal studs to EIFS on sheathing on metal studs. You’ve heard stories that concern you about the quality of the EIFS product. You start your research and discover there are several grades of EIFS, including drainable systems and barrier systems. Answer the following questions:
- What are the advantages of brick masonry veneer on metal studs?
- What are the advantages of EIFS cladding systems?
- Is cement plaster stucco a viable alternative to EIFS that you might propose to the owner?

Prepare a report that compares the advantages and disadvantages of brick masonry, drainable EIFS, Barrier EIFS and ¾” cement plaster stucco. Consider the following:
- Remember that the EIFS manufacturer website present information on the comparison of EIFS with other materials.
- As does the Portland Cement Plaster Website.
- Be neutral toward each system until you are convinced that one or more are better systems.

Share your work with your IDP supervisor or mentor and make suggested changes.
Research a Multi-Disciplinary Design Issue

Supplemental Experience for eight (8) Core IDP Hours

Choose one or more of the multidisciplinary design issues listed in the narrative, and prepare a detailed evaluation of one that interests you. Research alternative solutions to the issue you have chosen, and evaluate some of the reasons (cost, aesthetics, technical) for choosing among them. Choose challenging design issue(s) on a familiar project you are familiar with, one you have read about in a magazine, or one you are interested in learning about.

Activity - Core

Prepare a memo to a client explaining at least two alternatives you have explored that are appropriate to work during DD, and explain your recommendation for one of them. Be sure to include the following:

- A few sketches to illustrate the alternatives.
- The approximate cost of each alternative based on the use specific materials.
- How the alternatives affect the rest of the design.

In researching the issue(s) you have chosen, consider these points:

- What disciplines are needed to address the issue? Speak with a consultant from each area of expertise to understand the issue from different perspectives. These could be with experts within your firm, consultants who regularly work with your firm, or an expert you have read about and are willing to approach.
- Research precedents that have solved these issues. If you find any less than successful examples, explain why they were not successful.
- What are alternative ways to consider this issue?
- Prepare a summary memo for your “client” and include illustrations or reference materials if needed to explain the issue.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Change-of-Use Dilemma
Supplemental Experience for eight (8) Core IDP Hours

In this scenario, you are the project architect for the conversion of an existing four-story office building into an arts center. No drawings of the existing building are available. Your structural engineer told you the change of use will result in an increase in live loading, and he recommended a structural survey to determine the size and strength of the beams and columns in the building. Because the building is currently occupied, the client did not want to disturb the tenants so did not approve a structural survey. As a result, you completed schematic design without the structural information for existing building.

The project is now in design development, and you have convinced the client to proceed with a limited survey. At selected locations, the engineer was able to access the ceiling areas and measure some beams. Assuming some reasonable material strength, your structural engineer evaluates portions of the building and concludes insufficient structural capacity for public assembly is likely on all but the ground floor. As you had positioned the most heavily loaded gallery spaces on the second floor during schematic design, this is a problem.

**Activity – Core**

List the questions to explore with your structural engineer in evaluating options for increasing the capacity of the other floors. What other steps could be taken to confirm what the engineer suspects about existing building conditions?

Write a narrative to your client explaining the results of the limited structural survey and what suggestions you have for dealing with the situation.

Make your recommendation and include sketches illustrating your ideas.

Ideas for approaching this assignment follow:

- What will you need to document existing conditions in order to obtain a building permit from your local building department?
- How would this affect the time, cost, and quality of the project?
- What changes to materials or components would you make?
- Speak with a structural engineer that is working on one of your projects, and ask his/her opinion about how to approach this problem.
- Should schematic design be revisited? Would this be an additional service under a standard AIA owner-architect agreement? If so, should you mention it to the client if reworking the SD drawings is one of your options for moving forward?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Understanding Building System Selection

Supplemental Experience for eight (8) Elective IDP Hours

During design development, major building systems are selected. For this assignment you will study a building system on a recent project in your office or a mentor’s office. Choose a structural, mechanical, enclosure, lighting, or other building system.

Address the following in a narrative:

• Speak with a representative of the technical discipline involved with this building system to understand the design issues from their perspective.
• Review the schematic design documents, and compare them with the design development set. Does the system selected support or weaken the design concepts?
• What are the major design considerations for this building system? Did the design team take all of them into account?
• What other disciplines have an impact on your case study system? Were these considered in the selection of the building system you are studying?
• Are there any design alterations that you would recommend for these systems? Incorporate specific changes in materials, components, and possible cost.
• Are there any multi-disciplinary design issues you must consider?

Prepare a presentation explaining the research results and your suggestions. Explain why the selected system was chosen and any changes proposed.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Buildable Entities

Supplemental Experience for eight (8) Elective IDP Hours

The design development phase when architects begin to turn single line sketches into buildable entities. If you are not careful you may mislead the client by under or over estimating moulding profiles, window mullion or muntin size, or eave profiles.

Activity - Elective

Using schematic design sketches showing windows, research a popular window manufacturer’s details for head, jamb, sill, mullion, and muntin size. Redraw the sketch with appropriately sized members. Write a narrative describing the differences. If the difference is significant, what other options do you recommend to be explored in order to achieve the original design intent?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Errors in Survey of Existing Building

Supplemental Experience for eight (8) Elective IDP Hours

In this scenario, your architecture firm has been hired to design an industrial building with offices in an old manufacturing district of your city. The client wants to demolish much of an existing building on the site, but she wants you to reuse its foundations for the new facility. The footprint of the existing building is very large, 400 ft. x 600 ft., and the existing column grid is typically 40 ft. x 40 ft.

Because no drawings of the existing building could be found, your firm surveyed and documented it. The work was needed to accurately represent the existing column grid because the client intends to build a new superstructure on the existing foundation. The survey of existing conditions was performed during schematic design, and all the team members for the development of engineering systems and architectural design have used the results.

This is a fast-track project, and the contractor must order steel midway through design development to meet the project schedule. Your firm is nearly finished with design development, and the contractor has discovered a number of inaccuracies in the existing conditions survey. It turns out that one of the exterior bays is skewed and follows a rail siding; it varies in width from 38 ft to 42 ft. The structural engineer will have to revise the drawings before the steel can be ordered.

Activity - Elective

Compose a draft letter on behalf of the partner in charge of the project to the client, who has blamed your firm for the delays. Explain how to address the needed changes without further delaying the project. Use the Design Effort Curve, defined in the narrative, to explain the benefits of catching the setback now. Include effects on cost, functional capabilities, and effort. In addition, explain how this will affect building components, systems, and overall design.

Review your responses for this assignment with one of the following: (1) an insurance agent or broker who specializes in professional liability insurance for architects, (2) an attorney who practices primarily in the field of construction law, or (3) legal counsel or the claims staff representative from one of the major insurance companies for design firms.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
notes

Take brief notes while reading the narrative and list key resources you used to complete the activities. Note discussion outcomes from meetings with your supervisor, mentor, or consultants. When finalizing the activity documentation (PDF), include your notes and the Emerging Professional’s Companion activity description.
Construction Documents

activities - core*

- Mock-Ups 272
- Window Installation 273
- Comparison of Documents 274
- Compliance with ADA 275
- Feedback on the Usefulness, or Quality, of Drawings from Contractors/Subcontractors Who Build Architect’s Design 276
- Checking & Coordinating Documents 277
- Construction Document Coordination 278

* A maximum of 40 hours of core credit may be earned in this experience area.

activities - elective

- LEED Checklist 279
- Attending an In-Office Product Presentation 280
- Developing a LEED-Certified Project, Incorporating Sustainable Design Concepts 281
- Changes Required In Order to Meet Code 282
- Creation of CAD Standard 283
- Prepare a Consultant Coordination Plan 284
- Preparation of Traditional Redlined Check Set 285
- Preparation of Green-Light Check Set 286
- Development of a Tool for Preventive Document Checking and Coordination 287
- Critical Review of Checking and Coordination Procedures 288
- Preparation of a Check Set Error Analysis 289

exhibits
Introduction

By completing the activities in this chapter, you will gain an understanding of the activities involved in developing construction documents. The following information is taken from the NCARB IDP Guidelines:

Construction Documents
Minimum Construction Documents Experience: 1,200 Hours
Definition: Includes the written and graphic instructions used for construction of the project. These documents must be accurate, consistent, complete, and understandable.

Tasks
At the completion of your internship, you should be able to:
  • Prepare construction documents
  • Coordinate construction documents (e.g., architectural, structural, mechanical, civil, electrical)
  • Conduct quality control review of project documents
  • Apply sustainable design principles

Knowledge Of/Skill In
  • 3-D modeling
  • Adaptive reuse of buildings and/or materials
  • Alternative energy systems and technologies
  • Basic engineering principles
  • Building design
  • Building envelope
  • Building Information Modeling (BIM) technology
  • Building systems and their integration
  • Characteristics and properties of construction materials
  • Computer Aided Design and Drafting (CADD)
  • Conflict resolution
  • Constructability
  • Construction details
  • Construction sequencing
  • Creativity and vision
  • Critical thinking (e.g., analysis, synthesis, and evaluation of information)
  • Design impact on human behavior
  • Design principles
  • Designing and delivering presentations
  • Engineering load calculations
  • Freehand drawing and design sketching
  • Furnishings, fixtures, and equipment
  • Graphic communication
  • Hazardous materials mitigation
  • Implications of design decisions (e.g., cost, engineering, schedule)
  • Indoor air quality
  • Interior materials and finishes
  • Interpersonal skills (e.g., listening, diplomacy, responsiveness)
Knowledge Of/Skill In Continued

- Life safety
- Managing quality through best practices
- Manual drafting
- Natural and electric lighting (e.g., daylight, solar control, energy consumption)
- Oral and written communications
- Problem solving
- Product evaluation, selection, and availability
- Project scheduling (e.g., construction document setup, storyboarding, staffing projections)
- Site design
- Space planning
- Spatial visualization and modeling
- Specifications
- Sustainable design
- Team building, leadership, participation
- Technological advances and innovative building products
- Vertical circulation

notes

Take brief notes while reading the narrative and list key resources you used to complete the activities. Note discussion outcomes from meetings with your supervisor, mentor, or consultants. When finalizing the activity documentation (PDF), include your notes and the Emerging Professional’s Companion activity description.
Construction Documents

Narrative

First and foremost, construction documents (CDs) are a vital, creative, even exquisite instrument of communication: Following the definition of the overall design in the design development phase and its approval by the owner, construction documentation is a natural continuation of the design process—one that sets the parameters for the building process. Comprising legal, procedural, and construction information, CDs outline the key interrelationships, rights, responsibilities, and dynamics that bring a building into being.

In a combination of written and graphic formats, construction documents translate the design of a project from the realm of ideas to physical form. CDs are at once descriptive and prescriptive: They describe, in detail, the components of a project that need to be fabricated and assembled in order for it to be built. To that end, the contributions of myriad consultants are assembled into a coherent, artful whole.

It is essential for clarity, specificity, and completeness of construction documents. Accordingly, they demand thought, time, research, coordination, organization, clear communication and, above all, infinite care: The health, safety and welfare of the public is bound up in the successful completion of this phase of a project.

Context

Long before they come to occupy physical space, buildings are “built” many times over. The act of producing CDs is itself an act of construction. The unique combination of words and drawings that are construction documents is the last iteration of the virtual building—and the first that most nearly approximates its final shape.

The heart of any project resides in its construction drawings and specifications. This is the place where the building succeeds or fails: In the construction drawings, it is possible to express the possibilities of materials, the lyricism of their assembly, and the potential of each to articulate and support the ideas of the larger whole. At their best, construction document drawings balance the architect’s instinct for innovation with the tempering voice of experience.

The Big Picture

Construction document drawings present distinct design challenges, as well as unique potential. The architect is tasked with developing CDs that interpret the client-approved project concept and present it so the building that results is one we safely inhabit and remember. Although many elements of the building are partially defined in the phases that precede construction documentation, it is in the CDs that these take their final form. Construction documents are prepared at a more focused, detailed scale than either the schematic design or design development phases of a project, yet they are the clear next step in that design continuum. In the CDs, every aspect of the larger building is subjected to careful scrutiny:

Continued on page 258
It is tested, explored, and depicted to ensure it will be constructed correctly on the site. Construction documents describe the products, systems, quantities, configuration, and performance specifications that deliver the overall design intent of the project. It is important to keep in mind, however, that the CDs are not a set of instructions for building. Construction means and methods, coordination among construction trades, construction sequencing, and site safety compliance are the responsibilities of the contractor in charge of building the project.

Among the benefits of working on the construction documents phase of a project is the opportunity for close collaboration with consultants in a broad range of professions and disciplines—including architects who may be employed by outside firms associated with the project.

The Task at Hand
While a series of contractual agreements and project specifications are also considered part of construction documentation, this chapter focuses on the production of construction document drawings and specifications. That said, it is important to understand that once a contract between owner and contractor has been executed, the construction drawings acquire the status of legal documents: They are instruments of the contract, as well as the focal point of the construction process.

Every project has distinctive characteristics that demand unique expression. Nonetheless, each requires its project manager and/or project architect to revisit the industry-wide standards for assembling CDs at the start of construction documentation: Their professional assessment, based on their thorough familiarity with every aspect of the project, will establish the best means for planning and describing the work at hand.

With some exceptions, the architect takes the lead in overseeing and coordinating the work of the full project team during the construction document phase of project delivery. Consultant teams that collaborate to assemble CDs are sometimes large, with members in scattered locations and with different areas of expertise as diverse as landscape architecture; civil, structural, mechanical, electrical, and environmental engineering; acoustics; lighting; interior design; and so on. To guide this complex process successfully, the architect must have a clear understanding of the full project scope, as well as of the responsibilities and contributions of each team member. A thoroughly organized approach to the work, aided by an effective system of communication among project participants, is imperative.

In large and small firms alike, clear standards and procedures for collaboration and communication among team members are vital. These vary depending on the size of the firm and the number of participants, and they also will change from project to project, according to the individual characteristics and requirements of each. For large firms, some sample procedures could include the following:

- Compile project-specific organizational charts with contact information for key participants
- Keep accurate minutes for meetings and conference calls and distribute them in a timely manner
- Collaborate via a project extranet or web based project management system to ease the exchange of project information. (This provides a central clearinghouse in which all up-to-date project data resides, and indicates who did what and when.)
For smaller firms (and smaller projects), the process is, in effect, the same: Here, too, the identification of key project personnel and their regular inclusion in all relevant communications (and, as appropriate, meetings) are essential. Mechanisms that enable excellent communications are vital if the project team is to achieve an excellent end-product: a thoroughly documented, meticulously coordinated set of construction drawings and specifications that clearly and faithfully communicate the project design while enabling construction to proceed within budget and on schedule.

## Construction Drawings

Just as your studies in architecture school prepared you to engage in schematic design and design development, much of what you learned as a student will apply toward your internship experiences in developing, managing and producing construction drawings. As explained by the authors of “Construction Documents Production” in *The Architect’s Handbook of Professional Practice*, construction drawings “show, in graphic and quantitative form, the extent, configuration, location, relationships, and dimensions of the work to be done. They generally contain site and building plans, elevations, sections, details, diagrams, and schedules. In addition to drawn information, they may include photographs, other imported graphics, and printed schedules.” Thus, the proficiency you have acquired in describing projects graphically at a range of scales—from context and site plans to detailed floor plans, sections, elevations, perspectives, axonometrics and digital models—all apply directly to the skills required to generate construction drawings.

However, as an intern working toward professional license, it is important to keep in mind that construction drawings are more than a series of graphics and schedules that describe a project. Termed “instruments of service,” CDs are legal documents that become part of the contract between the owner and the contractor. Errors, conflicting information, or omissions in these legal documents can result in costly change orders and should be avoided if at all possible.

### Elements of Construction Drawings

Most two-dimensional construction drawings contain elements with which you are very familiar:

- Plan, section, elevation, and detail drawings produced at different scales
- Dimensions
- Symbols and targets (or “keys”)
- Drawing annotations and abbreviations

They may also contain:

- Schedules
- Information available to bidders, including site or contextual photographs and reference drawings (documentation of existing structures, site surveys)

Although the specifics of proper project documentation may vary from project to project, building type to building type, and office to office, the fundamentals remain largely the same. Principal elements are the scale at which the drawings are produced, the information they convey, and the legal nature of the documents they represent.
which the drawing appears on the sheet; the method in which the drawing is dimensioned; and the targets, or “keys,” that reference drawings on other sheets. Symbols, notes, keynotes, and abbreviations also help describe a project with the greatest accuracy, efficiency, and economy.

**Drawing Scale**

Choose the scale that is optimal for the information you are presenting. For example, overall building floor plans might be presented at 1/16”=1′-0” (1/8″=1′-0″ in smaller projects), while enlargements of sections of the floor plan containing a higher level of detail (such as toilet rooms with their accessories and fixtures), might be presented at 1/4″=1′-0″. Construction details, because they show a great deal of information about a very small element, might be presented at 1-1/2″=1′0″ or even larger. In the CAD environment, the scale at which the drawings will be plotted must be taken into consideration so the line weight and text size for drawing annotations appear in the correct size on the plotted sheets.

**Drawing Dimensions**

Proper dimensioning is vital to achieving an accurate representation of the project in the drawings and to avoiding discrepancies and conflicts between drawings. Many professionals consider dimensioning an art form. Architects aim to show only the dimensions required by each particular drawing and to avoid duplication of information in a set of construction drawings.

Firms often establish an in-house set of guidelines for dimensioning drawings. One example is the following set developed by Booth/Hansen & Associates in Chicago and adapted somewhat from how they appear in the 13th edition of the *The Architect’s Handbook of Professional Practice*.

- Dimension only from a fixed reference point, such as a column centerline or foundation wall.
- Dimension only those things that really matter
- Do not repeat dimensions, either within a drawing or on more than one drawing
- In general, do not close dimension strings. In a string of dimensions, leave tolerance by omitting the dimension for a non-critical space or assembly. When a dimension is omitted, delete the dimension line as well. Final decision concerning the method of dimensioning resides with the project architect.
- The thicknesses of tile, wood base, wainscoting, trim, and similar applied finishes are not included in room dimensions.
- Vertical dimensioning appears on elevations or wall sections. Dimensions should be to the top of significant structural elements and to window and door heads (rather than sills). They should be from the top of the foundation, finish floor level, or similar fixed reference. Masonry is dimensioned to the top of the masonry unit, not to the joint centerline.
- Ends of dimensions are indicated by short, bold, diagonal slashes. No dots, arrows, or crosses.
- Specific dimensions are not always the best choice. The simple notes “ALIGN” and “4 EQUAL SPACES” are often more appropriate if they relate clearly to information already present.
- Dimensioning and checking dimensions are the responsibility of the job captain alone. The work should not be delegated. All dimensions are to be double-checked by an architect not directly involved with the project.
Construction Documents

CAD software provides automatic dimensioning tools that can be great time savers for the architect. Remember, however, that accurate dimensions in the CAD environment depend on the accuracy with which the drawing was generated. Inaccurate drawings result in inaccurate dimension strings.

Targets
Also referred to as “keys,” targets are used to identify relationships between drawings in the full construction document set. They can interconnect building sections, enlarged floor plans, interior and exterior elevations, wall partition types, and plan and section details.

Symbols and abbreviations. To avoid confusion, symbols and abbreviations used on project drawings are usually defined ahead of time so they can be used consistently throughout the documents (and across disciplines). They save architects time and make it possible to provide more information on a drawing in less space.

Annotations
In most cases, project specifications provide a detailed description of a material or system referenced on a drawing. Drawing notes can thus be kept short and concise to convey design intent, while the specifications provide further information about the system or material.

Schedules
The most common schedules to appear in architectural construction drawings are door, hardware, finish, window, fixture, and equipment schedules. Module 3 of the Uniform Drawing System (part of the United States National CAD Standard) contains a section of standard formats for the numerous schedules used in construction documents. Once formatted, a schedule may be imported into a CAD drawing, where it may be dynamically linked to the original word processing document so that updates to it will be reflected on the CAD drawing.

A Note on CAD and CAD Standards
Odds are that your firm will use a set of drawing standards that includes specific formats for different types of drawings, drawing sizes, and sheet layouts. Firms also usually have a standard title block that should appear on each sheet.

If construction drawings will be generated using CAD software, the entire project team should agree to adopt a specific drawing standard at the outset of the project. This is especially important for projects in which several different firms may collaborate on and exchange drawings. Many in-house CAD standards are based on the U.S. National CAD Standard, which has been widely adopted by much of the industry. Nonetheless, a project may require you to adopt another CAD standard: The Chicago Department of Aviation, for instance, has its own CAD drafting standard, and all DOA project participants must adopt this, regardless of whether they have a standard of their own.

Using a CAD standard ensures that all team members know how to access project information and everyone will use the same language. Other major...
benefits of adopting and adhering to a CAD standard include improved communications and graphic quality, reduced time required for review and reworking, and increased coordination among drawings in a set. In short, regardless of what CAD standard is chosen or assigned, it is important for the entire team to agree on a single standard and to enforce its use throughout the project. This saves time and energy that can then be devoted to the real work of the construction documents phase—documenting the project design in an excellent set of construction drawings and specifications. Enforcing use of a standard also makes it possible to share CAD template files, ensuring consistency among project drawings.

Construction Specifications
The relationship between construction drawings and construction specifications is vital, especially the need for close coordination between them, which can enhance their descriptive potential and lessen any possible conflicts between them.

What are construction specifications? The Architect’s Handbook of Professional Practice, 13th edition, defines them as presenting the “written requirements for materials, equipment, and construction systems, as well as standards for products, workmanship, and the construction services required to produce the work.” Project specifications are usually included in the project manual, along with bidding requirements, contract forms, and conditions of the contract.

Because of the magnitude and complexity of construction specifications—especially for large, intricate projects—many architecture firms employ one or more in-house experts. These individuals specialize in the art and science of specification writing and assist the architects in outlining and developing specifications that best describe each project. Some firms procure the services of an outside consultant for this purpose, while the project architect takes this task on at other firms.

Development of project specifications typically begins during the schematic design phase, with the creation of an “outline spec” for the project. As the design evolves through the design development phase, the specifications are revised and updated to reflect changes in the project. Writing specifications for buildings is important and time consuming work. In them, the architect is asked to stipulate, in full detail, the range of acceptable construction materials, manufacturers, and systems for virtually every aspect of a building project. The project specifications also communicate the architect’s requests for shop drawings and for other submittals from the building contractor.

Specification Programs
How are specifications organized? In the 1970s the Construction Specifications Institute (CSI) developed MasterFormat®, a specification program to encourage the consistent arrangement of all project specifications. In adopting this program, the industry took a major step toward achieving a uniform approach to organizing information in construction project manuals. CSI revises MasterFormat® every five to seven years as construction methods and materials evolve.
CSI’s widely used MasterFormat® has been incorporated into ARCOM’s MasterSpec, which is produced by the American Institute of Architects. Both MasterFormat® and MasterSpec establish a master list of section titles and numbers and a format for the organization of individual specification sections.

As an example, Division 1 of MasterFormat®/MasterSpec contains the general procedural and administrative requirements applicable to an entire construction project. Each division is broken down into sections identified by five-digit numbers that relate to specific portions of the work required on a project. Each of these, in turn, is organized into a three-part format: general, products, and execution. This standard format provides a predictable framework for the consultant, the owner, and the contractor. This predictability allows for the easy organization of an often-complex array of information. For more comprehensive information on project specifications, see Chapter 2G - Material Selection & Specification.

Coordinating Drawings and Specifications

Thorough coordination between construction drawings and specifications is critical to ensuring a sound set of construction documents. This aspect of document coordination consists primarily of ascertaining consistency and clarity across the drawings and specifications, particularly in the language used to describe the assemblies, products, and materials of the project. Uniformity and lack of ambiguity in drawings and specifications facilitate the construction process, making requests for interpretation and change orders less frequent.

In smaller or simpler projects, it is not unusual to find that specifications are incorporated directly on the drawings. For larger or more complex work—projects in which materials and assemblies are more voluminous or intricate—the specifications are typically included as part of a separate project manual. No matter where the specifications are found, the need for consistency between the drawn and written descriptions of the component elements of the project remains the same.

Mechanisms for coordination vary. They can be enhanced by an architect’s production techniques, as well as use of CAD and other programs for automated drawing assembly. Among the techniques that have been employed with great success is numerical keynoting. Here, the architect generates a standardized, numerical drawing key that includes all the components of a given project. These numbers take the place of descriptive notes on all the project drawings and are cross-referenced in the specifications. The process ensures consistency from drawing to drawing and facilitates coordination throughout development of the project, making in-progress updates easier to complete: The architect need only revise the drawing key to remain abreast of changes in a project.

Automation tools such as CAD can be used to coordinate drawings and specifications in other ways as well, integrating these two sources of construction information for the contractor. For example, standard drawing components can be modified to include project-specific information and links to the specifications document. These, in turn, can be used to check
whether all project components are covered in the specifications and all specifications referenced in the
drawings. The use of these tools for document production can be used for many other tasks, such as
materials quantification for cost estimating.

Tools for Drawing Production
As a result of significant advances in the capabilities of computer drawing programs, as well as the
widespread adoption of computer drafting by the construction industry, the manual production of
construction drawings has become increasingly rare. Although the improvement in quality and productivity
introduced by CAD technology is partly offset by its own demands, the benefits provided by using it far
outweigh its drawbacks. Notwithstanding, some firms continue to produce construction drawings by hand,
primarily using ink and plastic lead on pre-cut sheets of Mylar.

CAD systems provide the architect with tools that make production of construction drawings faster, easier,
and more accurate—but also more complicated, especially if a project is not carefully planned in advance.
Typical advantages of using CAD technology include the ability to:

• Copy, mirror, and array repetitive elements very quickly
• Scale drawings simply
• Make drawing changes and revisions quickly
• Coordinate drawings more accurately by referencing or overlaying drawings from other disciplines to
  check for interference
• Automate area takeoffs and quantity takeoffs and create window, door, hardware, and equipment
  schedules using “out-of-the-box” CAD tools
• Easily exchange CAD files electronically via tape/CD/DVD media or over the Internet via email, a file
  transfer protocol (FTP) site, or project extranet
• Customize CAD systems with approved custom menus, toolbars, and libraries that provide
  automated production tools to all CAD users in a firm to ensure compliance with CAD drafting
  standards. This minimizes inconsistencies and ensures a high level of quality throughout a set of
  documents.
• Integrate other software applications with CAD systems via custom application program interfaces
  (APIs)
• Automate production of printed/plotted sets of drawings

The CAD environment has some differences from the manual one. As noted above, careful planning is
essential for managing production of CAD drawings. In addition, a CAD drafting standard and must be
adopted and a common CAD software platform agreed to at the beginning of the construction document
phase to ensure consistency among drawings and consultants throughout the project. If CAD file translation
cannot be avoided, project participants must establish translation specifications that can be mapped to
agreed-upon CAD standards at the outset of the project. This will allow the team to automate the translation
process, running batch translations (in many cases overnight), and ensure the highest level of document
quality.
For today’s architect, much of the work regarding CAD drafting standards, drawing set organization, sheet organization, CAD layering and attributes, drafting conventions, terms and abbreviations, symbols, code conventions, and notations has been done by other organizations. The U.S. National CAD Standard, first published in 2001, incorporates four different documents:

- **Introduction and Amendments to Industry Publications**, published by the National Institute of Building Sciences
- **CAD Layer Guidelines**, published by the American Institute of Architects
- **Uniform Drawing System (UDS)—Modules 1-8**, published by the Construction Specifications Institute
- **Tri-Service Plotting Guidelines**, published by the U.S. Coast Guard and the U.S. Department of Defense Tri-Service CADD/GIS Technology Center

Many architecture firms using CAD systems today have adopted a firm-wide CAD standard based on the National CAD Standard. According to the National Institute of Building Sciences (NIBS), major benefits to the architect in adopting and adhering to the National CAD Standard are these:

- Consistent classification, organization, and representation of all CAD data for all projects, regardless of project type or client
- Seamless transfer of information between architects, engineers, and other design team members
- Reduced preparation time for translation of electronic data files between different proprietary software file formats and predictable file translation results
- Reduced training time for teaching staff to use multiple “office standards”
- Streamlined process for document checking drawing
- Automated updating of data files as the standard evolves
- New opportunities for expanded services and revenue beyond building design
- Opportunity to market compliance with the standard as a benefit to prospective clients

Whatever the tool selected to produce construction drawings, adoption of a common drawing standard among all project participants is essential to avoiding drawing rework, conflicts, errors, and omissions. Consistency across the project team will make the production process efficient and comprehensive, and yield results of the highest quality.

**Planning And Production Of Drawings**

Typically, the project manager or project architect takes the lead in developing a timeline for construction document production and delivery and identifying staffing and other resources required to complete the construction documents.

**Production Management and Planning**

The capabilities made possible by CAD technology are blurring the distinction between design and documents production. In this environment, most offices find it best to assign a single individual to coordinate production of construction drawings for a project. This task can be assigned to...
numerous individuals, in larger firms and on larger projects, a technical architect, job captain, or other individual may be assigned this responsibility.

As a project nears the construction documents phase, the production coordinator determines the time, staff, and other resources needed to produce the project documents. He or she plans the needed drawings, details what must be done to develop the outline specifications, and lists the remaining documents to include in the project manual. In some cases, some or all of these decisions will have been made and acted upon, at least in a preliminary way, earlier in the project. Further information about this responsibility can be found in Chapter 3D General Project Management.

An architecture firm may use the same production approach for all of its projects or vary it according to the needs of the project at hand. Similarly, a firm must decide how specifications will be produced, whether separate systems will be used for outline and final specifications, and the extent to which specifications will be integrated with the drawings.

Regardless of the system used, it is especially important for the project manager or production coordinator to plan the organization of the data, as well as the number of drawings, scales, sheet layouts, and so on. Typically, for example, a firm's CAD standards provide guidance on these topics, but almost every project will present certain unique requirements. Sharing CAD data with outside consultants or the client requires additional planning to ensure that all parties can use the data without extensive editing.

In short, many benefits accrue when a project manager thinks ahead, planning carefully from the outset to ensure optimal use of available tools and technology. Adopting a common CAD standard and tweaking it to your project’s needs within established guidelines is a critical factor in ensuring consistency and accuracy throughout the construction document phase.

Mockup Sets
A good mockup or cartoon set of the drawings needed for a project assists the team in visualizing the full construction document process from the outset and to anticipate the requirements of the project. A mockup set can be created using CAD or paper or a combination of both. The set should show all required site, plan, section, elevation, and detail drawings, with notations of the scales required for each; pages with general notes; schedules; and any other special drawings required to fully describe the design intent of the project. The title sheet and table of contents can also be generated from this mock-up set. Most important, the set provides the team with a tangible guide to the completion of the work ahead.

Exchanging Data
Before data is exchanged among different organizations, some planning must be done. Addressing the following questions, originally published in The Architect’s Handbook of Professional Practice, is a good place to start:

- Which organizations are exchanging data?
- What information does each organization need from the other(s)?
Construction Documents

- What format data is required (AutoCAD native, .dxf)?
- What are the project drafting and CAD standards?
- What is the frequency of data exchange?
- How will the data be exchanged (project website, bulletin board, e-mail, CD)?
- How much data preparation is required for each exchange and how long does the transfer take?
- Who is the person in each organization responsible for sending and receiving data?
- Who is authorized to request and release electronic data?
- How will data transfers be logged?

Project Web Sites
Many owners and architects are adopting the use of project-specific websites where project participants may exchange electronic information via a central clearinghouse. One of the simplest ways to do this is to create a password-protected FTP (file transfer protocol) site on a server connected to the Internet. Project data, such as large CAD and specification files, can be uploaded or downloaded from an FTP site using an Internet browser or FTP software.

Increasingly, Web-based project management systems are being implemented on large, complex projects with many participants in many places to facilitate communication and exchange of project data among team members. Whether the system is custom designed or off the shelf, its overall goal should be to provide the following:

- Access (real-time access to all project data and information, typically via the Internet)
- Accountability (tools for specifying and determining who is responsible for what and when it is due)
- Auditability (tools for determining who did what and when they did it)
- Document management (tools for managing data that is uploaded and downloaded from the system—especially CAD data)
- Document viewing (viewers capable of displaying multiple file formats regardless of whether the user has the native application installed on his or her computer)

These robust tools can improve communication, coordination, and productivity when available to and used by the entire team.

Milestone Coordination and Archiving
An important goal of the construction documents phase is a fully coordinated set of documents that are internally consistent within and across disciplines. This goal has its challenges: Plans, sections, elevations, details, and schedules must agree with one another. Materials shown on drawings must be specified, mechanical and electrical systems must fit within the chases and plenums designed for them, etc.

The coordination task is complicated by the reality that more than one person or firm will work on the construction documents of all but the smallest projects. Staff may be in different groups within a firm or in consultant organizations. For CAD systems, it is necessary to develop

resources

Acronyms to Remember

- CD - Construction documentation
- CAD - Computer-aided design
- FTP - file transfer protocol
- .DWG - standard filename extension for most CAD programs
- .PDF - Portable document format
- BIM - Building information modeling
- CATIA - computer aided three-dimensional interactive application
protocols for who has access to what layer or drawings, the exchange of updated files, and regular and frequent backups of all of the work.

As you can see, it is imperative to be organized when working in any environment. Several suggestions for accomplishing this follow:

- If possible, establish a common CAD software application for the project.
- Make sure the entire team conforms to CAD standards, including these:
  - Layering guidelines
  - File naming conventions
  - Folder organization (and access permissions if applicable)
  - Symbology libraries
  - Drawing templates
  - Annotation
- Establish hard deadlines for both in-house and outside team members for completion and exchange of CAD and specification data prior to a milestone issue.
- Especially for larger projects and firms, provide each discipline or consultant with a staging area to which they may copy or upload their sheet files (CAD drawings that will be plotted).
- Establish the file format in which drawings will be submitted, reproduced, and archived (e.g., AutoCAD .DWG, .PLT or Adobe .PDF).

No matter what the firm size, delivery mode, or project scale, it is important to communicate, communicate, communicate! Make sure every member of the project team is aware of his or her responsibilities with respect to quality of work and milestone deliverables.

A key aspect of production planning is recognizing potential bottlenecks that may slow down a project and endanger the schedule. Coordination points, milestone dates when all drawings and specifications are brought to a common level of development for checking, are one common bottleneck. Another is the dates marked for plotting CAD drawings and preparing, translating, and transferring CAD files to outside consultants.

Like all other stages of project development, construction drawings and specifications are typically issued for checking and coordination at major contract milestone intervals (e.g., 30 percent completion, 60 percent completion, 90 percent completion, 100 percent completion, issued for permit, issued for bid, issued for construction), as well as when any construction document changes are issued as addenda or bulletins.

Archiving procedures are important but frequently overlooked. Archiving is distinguished from data backup in that it refers to the production of a complete, unalterable copy (hard or electronic and frequently both) of the project data at a defined point in time. Deciding what and when to archive is a project management responsibility. The archived documents provide a history of the work in a series of snapshots of the delivery process. These can be useful to both the architect and the owner, and they acquire a certain legal standing as the official record of progress in a project.
An accurate electronic archive of milestone issues ensures that everyone is literally “on the same page.” If a milestone issue is to be plotted for distribution (in hard-copy or electronic format such as Adobe PDF), the plotted drawings should be generated from the archive, not from the live CAD environment. The archive should never be altered and should serve as a record of the project milestone.

**Drawing Review and Checking**

Drawing review, coordination, and verification—within and across the various disciplines included in a project team—are of the utmost importance during the construction documents phase of project delivery. The complexity of projects, the number of contributors to the development and documentation process, the disparate locations of project consultants, as well as the significant time constraints under which construction documents are often produced, are among the many elements that combine to make review and checking a crucial aspect of the documentation process. Thorough review by an individual who is intimately acquainted with all aspects of the project is absolutely essential to the production of a good set of construction documents.

As are the mechanisms developed by firms to coordinate drawings and specifications, checklists are both generally available and individually generated by professional offices. In addition to supporting the necessary procedures of meticulous review, checklists inform the process of generating and developing project drawings. The following steps may be included among the typical practices developed by professional offices to ensure the quality of the documents they produce:

- Full review takes place at regular intervals throughout the construction documents phase, typically at project milestones.
- Documents are checked by senior professionals not directly connected with the project.
- All important dimensions are verified by a single individual.
- Specifications writers review the drawings, and those responsible for drawings review the specifications.
- Coordination efforts include interdisciplinary review by project consultants.
- The owner contributes a substantive review of the work before construction documents are issued.

Review and approval of the construction documents by the project owner is a key part of this phase of project delivery, as it is the owner who officially issues construction documents and signs all construction contracts. AIA forms of agreement mandate that the owner approve the construction documents.

The architect is the hub around which all project activity rotates. Through careful organization and open communication with all project participants, the business of checking drawings and specifications for completeness, accuracy, and coordination among disciplines can be streamlined: Make sure all team members understand their contractual responsibilities with respect to milestone deliverables. Establish regular meetings for drawing reviews prior to milestone issues. Getting everyone in one room for a face-
to-face meeting, when possible, can save hours of back and forth time among project participants. Keep logs of all review comments and copies of drawing markups. Distribute these to all project participants after meeting(s), especially if they are spread out geographically and using a project-specific Web site or extranet to exchange information.

The Future
The traditions and conventions of document production are revisited with each new development in the tools we use to generate design and construction drawings. Computer programs and methodologies such as building information modeling and computer aided three-dimensional interactive application (or CATIA) are quickly changing the face of construction documents production. By extension, they are changing the construction process itself.

Building Information Modeling (BIM)
Already in use is what has come to be known in the CAD software industry as building information modeling, or BIM. BIM, which is a significant departure from traditional two- and three dimensional CAD drawings, holds great promise for the architecture/engineering/construction and facility management communities. BIM CAD applications based on parametric modeling, such as Autodesk Revit, among others, are already on the market and available to architects and engineers. The functionality of these programs becomes more robust with each release.

Building information modeling is not a technology but an approach to organizing and connecting data. It is based on a technique known as parametric modeling, which allows CAD software to store and manipulate detailed parameters of building elements, rather than simple graphic representations of them. This approach is also sometimes called object-oriented modeling because the project information is created and defined as a collection of objects rather than a series of lines and planes. The greatest advantages of using BIM include these:

- **Ease of collaboration:** All project participants collaborate on a single building information model, which is essentially a central database that can be translated into a graphic or tabular representation of the project.
- **Flexibility:** Project participants may view the model in ways applicable to their responsibilities. An architect may want to view the model as a drawing, while an estimator might want to view it as a bill of materials in tabular format.
- **Better coordination:** Portions of the model can be “checked in” and “checked out” by the responsible project participants to avoid duplication of effort and creation of conflicting information. Since all project participants collaborate on a single building information model, coordination among disciplines is easier. The entire team has access to the latest information available in the model across all disciplines.
- **Increased speed of delivery:** As portions of the model are updated, linked elements are updated automatically; maintaining consistency among references and reducing the time it takes to update them.
• Greater productivity: Since the building information model is a database, information can be extracted from it for use in other computer applications, such as scheduling and estimating software.

All of these advantages can increase the overall efficiency of the documents production process and the comprehensiveness and quality of the work produced. BIM has the potential to revolutionize the design, construction, and facility management industries.

CATIA

Like BIM, computer aided three-dimensional interactive application, or CATIA, is a modeling tool. Originating in the aeronautics industry, it is a methodology that scans three-dimensional physical models and builds numerically controlled virtual models using descriptive geometry. The methodology for generating the virtual model translates directly to manufacturing: Through computer-controlled milling tools, complex forms can be fabricated with an astonishing degree of accuracy and at relatively low cost —directly from the model generated by the architect. The methodology eliminates intermediary steps between designer and builder. The primacy of the relationship between designer and manufacturer also serves to control the costs of manufacturing; without the middle man, costs can be kept down.

CATIA is used in conjunction with conventional CAD drawings to render complex designs for which traditional two-dimensional drawings are insufficiently agile and descriptive. It can be used to achieve repetition of elaborate forms in a cost effective way, making daring proposals feasible. To the extent that—to echo Marshall McLuhan—the medium is, in fact, [a large part of] the message, then tools such as these allow for creativity, freedom, and expansiveness on the part of the architect.

Written by Marilys R. Nepomechie, AIA, NCARB
Marilys Nepomechie is associate professor of architecture at the Florida International University School of Architecture and an architect in private practice in Coconut Grove, Florida.

Written by Michael J. Poynton, AIA
Michael Poynton, has been applying information technology to architecture, engineering, and construction management since the mid-1990’s. He is an architect and technology consultant specializing in Web-based project management system implementation for Kristine Fallon Associates, Inc., in Chicago, Illinois
notes

Take brief notes while reading the narrative and list key resources you used to complete the activities. Note discussion outcomes from meetings with your supervisor, mentor, or consultants. When finalizing the activity documentation (PDF), include your notes and the Emerging Professional’s Companion activity description.
Mock-Ups

*Supplemental Experience for eight (8) Core IDP Hours*

Producing a mock-up set of the drawings that comprise the construction documents phase (i.e., cartooning) is an excellent way to understand the full scope of a project and the level of effort required for its documentation. A mock-up set allows the project manager to think through the full CD process at the outset and anticipate what is needed to produce all the documents. Mock-up drawings can inform the creation and organization of a construction drawing set.

The mock-up set should include all the drawings required for a comprehensive description of the design intent of a project, including drawings for all the relevant disciplines and specializations. The set should also indicate the appropriate scale for each drawing.

Activity - Core

Produce a mock-up set of the drawings that will be required to describe the project fully. For the mock-up sets use 8” x 11” or 11” x 17” sheets in landscape orientation.

Be sure to complete the following steps:

- Make a list of the drawings, details, and schedules that will be necessary. Refer to similar projects in the office archive, being careful to note the ways in which your project differs from them.
- Determine the most appropriate scale for executing and understanding each drawing, and plan how the drawings should be laid out on each sheet and within the set.
- Speak to the project consultants to ascertain the number of sheets they will need to execute their work, and the content and scale of each of their sheets.
- Devise a preliminary table of contents (TOC) for the set of construction drawings.

Write a narrative that describes how you would explain to a client the importance of construction documents. Be sure to include in the narrative why it is necessary to have the type and number of drawings included in the mock up for their projects.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Window Installation
**Supplemental Experience for eight (8) Core IDP Hours**

In this scenario, a contractor calls after noticing a large pool of water on the floor after a recent storm passes. He tells you that the pool is located near a window that he just installed. You immediately suspect something was left out or done incorrectly during the window installation the day before.

**Activity - Core**

Using a set of completed construction drawings in your office, review the window details. Create a set of drawings detailing the correct construction system to ensure that the windows will be waterproof.

Write a narrative (500 words minimum) explaining the step by step construction process. Meet with your supervisor or mentor to review your drawings and explain why window details are an important part of the construction documents.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Comparison of Documents

Supplemental Experience for eight (8) Core IDP Hours

Understanding the components that make up a set of construction documents is important for the entire design team and the client. The potential for and severity of professional liability for errors and omissions are often tied to when they are discovered. An error discovered during the bidding phase can be corrected with an addendum to the construction documents. As the owner has not yet entered into a contractual relationship with the contractor, corrections to errors at this point typically involve limited costs to the project or its consultants. Depending on the amount of documentation affected by the error, the corrected drawing set may be reissued in part or in full. (Less commonly, the addendum may result in an extension of the bidding period or a redefinition of the scope of the project.) Any revisions to the documents after they are sent out for bid could potentially mean more cost to the owner and/or design team.

Activity - Core

Using a set of design development documents from a built project, create a cartoon set of construction documents, including drawings you feel are essential to receive from the M/E/P consultants. Be thorough when creating the cartoon set.

Compare your cartoon set to the actual construction document set that was issued, what did you miss? What did you include that was not in the original set of drawings? How many drawings did you include compared to the original construction document set? Prepare a narrative that explains why you included more construction drawings or fewer construction drawings.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Compliance with ADA
Supplemental Experience for eight (8) Core IDP Hours

Compliance with the Americans with Disabilities Act (ADA) is a challenge facing architects in every aspect of architecture practice. This act, which is a civil rights law rather than a code, asserts guidelines for assuring accessibility to building facilities for physically disabled citizens. Architects who fail to comply with accessibility guidelines risk their reputations and their pocketbooks. If a built work is found not to be in compliance and remedial construction is required, the owner may incur fines. Worse yet, owners may be found liable for monetary damages to disabled citizens. Either situation could give rise to potential claims against the architect. Errors and omissions involved with ADA compliance can be serious for architects because the errors tend to be discovered only after construction is complete, a time when costs for remediation are more likely to be assessed as the architect's responsibility.

In this scenario, you are part of a project team designing a large municipal building that contains city offices, a library, and a small museum. After construction is completed and the project is occupied, a local organization of disabled persons visits the building to ascertain accessibility and finds several major areas in which the building is not in compliance. The group has filed a complaint with the city, and the city is looking to the designers for a response to the complaint, including proposed solutions.

Activity - Core

Please reference the following source:
- ADA Accessibility Guidelines for Buildings and Facilities (ADAAG), Department of Justice.

Considering the scenario above, create an ADA compliance checklist that could be used to help ensure that these important design requirements would not be overlooked during design:

- Create an outline of the major issues that affect architectural drawings from the ADAAG section entitled “Accessible Elements and Spaces: Scope and Technical Requirements.”
- Prepare a checklist incorporating the major requirements you have identified, differentiating between items that affect drawings and those that affect specifications. ADAAG contains many drawings and sketches that explain layout and dimension requirements. Where appropriate, place reference copies of these in your checklist.
- Using an existing set of construction drawings, review the documents for the items listed on your checklist. Prepare a memo to your supervisors outlining your findings and attach sketches if necessary to communicate any needed design solutions.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Feedback on the Usefulness, or Quality, of Drawings from Contractors/Subcontractors Who Build Architect’s Design

Supplemental Experience for eight (8) Core IDP Hours

The primary users of an architect’s construction drawings are the contractors and subcontractors who build the architect’s design. Talking to people in the field—job superintendents and engineers—can help architects understand the usefulness, or quality, of their drawings.

Choose a project recently completed by your firm or your mentor’s firm. To help you remain objective, choose a project you didn’t work on. Make an appointment with the job superintendent or one of the engineers who worked for the contractor to meet with you and any other interested interns. This will be a more rewarding experience if several interns join in the exercise and meet with the contractor’s representative as a group.

Activity - Core

Before the interview, talk to the project architect or construction administrator who led the project for your office about his or her perception of how the project went during the construction phase. Make notes about any problems that were experienced, including any thoughts the project leader(s) may have about the source of the problems. Discuss the attitude of the owner and contractor toward the architect during the project.

Before the meeting, you may want to provide the contractor with a copy of this assignment and of the narrative for this chapter. At the interview, preface your discussions with several important thoughts:

• You are an intern(s) who arranged the interview to learn about the profession, and you are not an authorized spokesman for your firm.
• You hope to learn from the builder’s information that may help you become a better architect.
• Encourage the builders to be candid in communicating their thoughts about the architectural documents so that you can learn from their opinions.

The purpose of these introductory comments, which you may wish to document in writing, is that errors in architecture practice have become the object of conflict and litigation, and many people are reluctant to openly discuss their thoughts about “problems.” Your supervisor can help moderate the meeting.

Talk to the contractors about their thoughts regarding the drawings and other aspects of architectural service. Ask questions, and take notes. Do not be defensive. Enjoy the opportunity to learn what others think of the work provided by architects, even if the views seem harsh. Think about how you might use what you learn to be an effective architect. Take advantage of this exercise to frankly discuss errors with the builders.

Write a narrative on the role coordination and document checking played in this project. Be sure to answer:

• Were there any communication problems from what you observed? How were they avoided or what caused them?
• What role did checklists play?
• How would you have improved the coordination of this project between all parties on this project?
• Review the checklists for this project and make changes to them where you think they are needed.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Checking & Coordinating Documents

Supplemental Experience for eight (8) Core IDP Hours

Checking and coordinating documents includes many fundamentals that are not project specific and can be applied repeatedly. This portion of the review process often comes last minute and quite often has items that are quickly overlooked. For instance, did you include a north arrow on every plan that you have drawn on the last set of construction documents you worked on? Developing tools to help with this process such as checklists often cut down on the time it takes to review a construction drawing set.

Activity – Core

Using an existing set of construction documents that were recently completed, review and coordinate the document set to ensure consistency and coordination throughout. Redline all changes that need to be made and note any drawings that may need to be added. Check and coordinate the drawings from the consultants, as well.

Create a checklist of items to look for when reviewing each type of drawing/sheet, plan, section, elevation, and detail. Also, create a checklist to use when coordinating consultants’ drawings. Review your redlines with your supervisor or mentor and see if they can add any items to your checklist.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Construction Document Coordination

Supplemental Experience for eight (8) Core IDP Hours

Coordination is essential to produce a comprehensive and well-integrated set of construction drawings. The process of coordination also presents a unique opportunity to understand the scope of a project, including the contributions of various members of the project team and the multiple, complex interrelationships among project components. Visualizing and understanding these relationships is one of the most challenging and rewarding aspects of the CD phase.

Coordination must take place in a variety of contexts. For example, the work of project participants must be coordinated both within each discipline and among the disciplines. It is also important to coordinate construction drawings with the specifications.

The construction industry has generated drawing coordination checklists to help professionals assemble construction drawings. Many offices have their own checklists as well. Companies that specialize in professional liability insurance are strong advocates for the use of such checklists because they can help architects avoid errors and omissions.

Activity - Core

Just before the 90 percent milestone review, coordinate a set of construction documents for your office or your firm’s office if possible (working from hard copy and using CAD). To help you, use a checklist developed by your office for reviewing project documents. Be sure to include the work of all consulting disciplines.

Write a summary of your findings, noting items you missed.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
LEED Checklist

Supplemental Experience for eight (8) Elective IDP Hours

In this scenario, one of your firm’s clients is interested in developing a LEED-certified project, incorporating sustainable design concepts. While the client discusses the matter with some degree of certainty, client representatives indicate they do not really know what is involved in the LEED certification process, nor are they sure exactly how sustainable design will affect the design, construction, or cost of their project. The client asks your firm to develop a checklist of what will be entailed if they decide to proceed with development of a green building.

Activity - Elective

Research what sustainability or green building means and prepare a short summary assessing what is involved in achieving the different levels of LEED certification and how design and construction may be affected. You are also asked to develop the checklist that has been requested by the client.

Once you have created a checklist use it to go over a set of construction drawings from a LEED certified building in your area. Create a report of how your checklist worked with the construction drawings. Where is your checklist different from the building? What changes would you make to the building drawings? To the checklist?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Attending an In-Office Product Presentation

Supplemental Experience for eight (8) Elective IDP Hours

One of the easiest ways to learn about new architectural building products and systems is to contact a manufacturer’s product representative and schedule an in-office presentation. Invite other architects, interior designers, and engineers in your office to attend. You may want to find out about masonry or paving products; pre-cast stone and concrete; curtainwall, storefront, or commercial/residential glazing systems; plastic laminate or ceramic tile; membrane waterproofing and roofing systems; door hardware; textiles, the list goes on.

Once the presentation concludes, sit down with the product representative and review your set of construction drawings that will include their product.

As you review, redline all drawings that need to be updated to reflect the product that was presented. Are there any new drawings that need to be added to your set of construction documents to make them complete? Review all redlines and additional drawings with your supervisor prior to making changes to the construction set.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Developing a LEED-Certified Project, Incorporating Sustainable Design Concepts

Supplemental Experience for eight (8) Elective IDP Hours

Today there are many clients interested in sustainable design, but they may not know what that means for their building. Helping the client understand how sustainability is integrated into the building design adds value to their facility—even if the client does not pursue LEED certification.

Activity - Elective

Select a non-LEED-certified project completed by your firm or a mentor’s firm. Review the project’s design development (DD) set, construction documents (CDs), and specifications book, if available. Assess the design’s potential for LEED certification and select the appropriate USGBC LEED rating system (i.e., LEED for Homes, LEED for New Construction & Major Renovations) under which the project could qualify.

In a report (500 word minimum) identify at least eight key design opportunities to revise the design and make it eligible for LEED certification. Identify relevant LEED credits the project could obtain for the rating system selected and provide sketches to support your proposed rating system and certification level.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Changes Required In Order to Meet Code
Supplemental Experience for eight (8) Elective IDP Hours

In this scenario, a project is almost ready to be released for bid. The work is slightly behind schedule, but everyone is reasonably certain that final deadlines and commitments to the owner will be met. You have been asked to help give the construction drawings a final check. In reviewing the drawings, you note a series of problems that were missed in previous reviews. The emergency egress path must have a certain fire rating to meet the requirements of the code; however, the floor plan you are examining indicates regular drywall rather than Type X. Moreover, the composite thickness of the wall is insufficient to meet the code requirement: The code requires two layers of wallboard, but the drawings indicate only one. In addition, the walls in question do not reach to the underside of the floor structure above them. Changes—some quite time consuming and affecting multiple drawings and details—must be made to meet the code requirements. You give your project manager the bad news.

Activity - Elective

In preparation for your discussion with the project manager and client, respond to the following questions in a memo addressed to the client:

- How do you weigh the necessity to meet project deadlines against the need to revise multiple drawings to meet the code requirements?
- Can you suggest an alternative approach to accomplish the necessary changes without affecting the project schedule or opening the firm to liability?
- Explain the purpose and need for the construction documents to reflect this change. Why is it important that they do?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Creation of CAD Standard

Supplemental Experience for eight (8) Elective IDP Hours

Adherence by all project participants to a common computer-aided design (CAD) standard is critical to the efficient and transparent exchange of information among team members, especially on projects that involve multiple consultants. Standards ensure high graphic quality, less review and rework, and consistency among drawings in the set.

The increasingly common production of schematics, design development, and construction drawings in the CAD environment has resulted in a greater carryover of drawing information from design development into the CD phase. By the time a project reaches CDs, it is likely that folder organization and file naming conventions have already been established and are being used by the team. However, this is a good time to take inventory and make sure your project complies with the chosen CAD standard.

In this scenario, you just started working for a new office, and note that they do not follow a CAD standard. You decide to raise the issue with the project manager or principal and decide to volunteer your services to create one.

Activity - Elective

Create a recommendation for the following items in your proposal for office wide CAD standards:

- Directory structure for organizing drawing files
- Drawing set organization
- Sheet sizes, layouts, and title block information
- File naming conventions
- Data organization such as cross-references, layers, levels, and blocks
- Drawing templates
- Line weights
- Layer/level naming conventions

Prepare a report that explains construction drawings, the efforts needed to coordinate drawings among project team members and how your proposed system will make this easier.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Prepare a Consultant Coordination Plan

Supplemental Experience for eight (8) Elective IDP Hours

Managing coordination of the architect’s work with the work of consultants is one of the most important, yet most difficult tasks faced by the project manager. It is not the responsibility of the architect to coordinate the internal work of the consultants. That is the consultants’ professional responsibility. The consultants are hired because of their ability to provide specialized services to augment the services provided by the architect when designing a building.

It is, however, the responsibility of the architect to coordinate the architect’s designs with the designs provided by the consultants and engineers. This means that the architect is to determine that the consultants’ designs fit with, and are compatible with, the architect’s designs.

Poor coordination between the consultants and the architect is the source of great consternation and many claims during the construction phase when it is discovered that not all of the work will fit together. Poor coordination can also occur when the contractor fails to coordinate the sequence which the subcontractors will follow when putting the work in place.

Activity - Elective

Please reference the following source:

- The Architect’s Handbook of Professional Practice, 14th ed. Chapters 12.3 and 14.1

Working with your supervisor, select a project that is in the construction documents phase that will be issued for either bidding or construction in one to two months. Meet with the actual project manager for the project and discuss the manager’s current plan for coordinating with the consultants. Review the latest progress prints for the construction documents.

Independent of the project manager; prepare a plan for coordinating with the consultants from the present time through the planned date of issuance for bidding or construction. As you prepare your coordination plan answer the following questions:

- Is it really necessary for a project to be in the final stages of coordinating the designs when it will only be issued for bidding and not for construction?
- Who are the primary consultants and what design disciplines do they represent?
- What meetings might be necessary to facilitate the coordination process?
- What are effective ways to compare the architect’s construction documents with the consultant’s construction documents?
- Should architects review the consultant’s specifications or may the architect rely on the consultant to do so?
- Is software available to augment the architect’s efforts?
- How much time should be allowed for consultant coordination?
- What should the project manager be concerned with coordination when the PM does not usually actually prepare the drawings?

Prepare a written report on your views of means and methods of effective coordination with the consultants.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Preparation of Traditional Redlined Check Set  
*Supplemental Experience for eight (8) Elective IDP Hours*

Obtain a set of working drawings for a small project from an architecture firm, preferably the office where you work or your mentor’s firm. Optimally, the set of drawings should comprise at least eight to ten architectural sheets, plus drawings from related disciplines such as mechanical, electrical, plumbing, and civil engineering and landscape design. As an alternative, if you are employed by a larger firm that does not work on smaller projects, ask your supervisor or mentor to help you select one or two floors or portions of floors of a larger project, plus related ceiling and interior sheets, and organize a package of 8 to 10 architectural sheets plus the consultant’s sheets.

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**Activity - Elective**

Work with your supervisor or mentor to select a construction document phase checklist. Options include checklists used by your firm and those available from web sites and other sources mentioned as resources in this chapter.

Prepare a traditional redlined check set. Work your way through the checklist you’ve selected, assessing and editing each item for applicability to the project you selected. Then, work your way through the drawings and specifications, reviewing the drawings for errors and coordination issues and redlining them to address each item in the checklist.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Preparation of Green-Light Check Set

Supplemental Experience for eight (8) Elective IDP Hours

Obtain a set of working drawings for a small project from an architecture firm, preferably the office where you work. Optimally, the set of drawings should comprise at least eight to ten architectural sheets, plus drawings from related disciplines such as mechanical, electrical, plumbing, and civil engineering and landscape design. As an alternative, if you are employed by a larger firm that does not work on smaller projects, ask your supervisor or mentor to help you select one or two floors or portions of floors of a larger project, plus related ceiling and interior sheets, and organize a package of eight to ten architectural sheets plus the consultant’s sheets.

Activity - Elective

Work with your supervisor or mentor to select a construction document phase checklist. Options include checklists used by your firm or your mentor’s firm and those available from Web sites and other sources mentioned as resources in this chapter.

Prepare a green-light check set. Apply the green light technique to the floor plan and wall section sheets (or at least two other sheets selected in consultation with your supervisor).

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Development of a Tool for Preventive Document Checking and Coordination

Supplemental Experience for eight (8) Elective IDP Hours

Develop a checklist to be used in preventive document checking and coordination for a small project.

Activity - Elective

Develop a “work zone” diagram of clearances required for lights (7”), sprinklers (4”), ductwork (14”), and other items that must be located above the ceiling in the plenum in a small medical office building. The diagram should be configured as a conceptual section through the plenum with structural system members drawn to scale. This diagram will be used to communicate to your consultants your expectations for the location of their designs within the plenum. Consider these issues:

• What building elements other than lights, sprinklers, and ductwork might you expect to find above the ceiling?
• Is it appropriate to plan for future building elements above the ceiling in the absence of a program requiring such elements?
• What is the relationship between elements in the plenum, the floor-to-floor height, and the finished interior ceiling height?
• What logical sequence of construction of the various elements will the design disciplines need to coordinate? (Your supervisor might introduce you to a contractor or consultants so you can ask their advice). Should your drawing reflect your assumptions regarding the sequence of construction (i.e., should ductwork be above or below the sprinkler piping)?

Make a list of the potential consequences of failing to properly establish a work zone regimen for the plenum. Be sure to answer the following questions:

• Where will building elements be located if a design professional fails to leave adequate room above the ceiling?
• Who should pay for the costs of moving building elements if it is determined they will not fit in their intended place above the ceiling?

Write a memorandum to transmit the proposed work zone diagram to hypothetical project consultants. Explain to them why you believe the diagram is useful. Tell them of your logic in arranging the zones for the different disciplines the way you have. Solicit their comments and advice concerning the arrangement.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Critical Review of Checking and Coordination Procedures

Supplemental Experience for eight (8) Elective IDP Hours

Critically review the checking and coordination procedures used in your office or your mentor’s office. Consider several questions:

• What are the basic elements of an effective document checking system?
• How can you tell if a document checking system is effective?
• How does your firm’s document checking system measure up?
• What recommendations can you make for improving your firm’s checking system?

Many offices may not have formal document checking and coordination procedures. These tasks may simply be practiced by the “seat-of-the-pants” method, as it has been learned by many practicing architects. Other firms may have well-defined procedure descriptions, methodology narratives, and checklists.

If your office or your mentor’s office has a plan-checking process such as a peer review system, or a quality management group, meet with a plan checker and discuss how they check a set of drawings.

Activity - Elective

Using what you have learned, and any changes you made use your plan checking process on a copy of a document your office is working on currently. Write a summary off your findings showing what changes need to be made to the document? Compare your checklist to another checklist used on a previous project, how effective was your checklist?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Preparation of a Check Set Error Analysis

Supplemental Experience for eight (8) Elective IDP Hours

Architects commonly create check sets, but preparing an error analysis for the mistakes found in a check set is less frequently done. This exercise involves both recording the errors and forming an opinion of what caused them and how they could have been prevented.

Activity - Elective

Using the check set you prepared in the earlier exercises, do the following:

- Make a list of each mistake or coordination problem you discovered. (You should have not fewer than 40 or 50 items in your list. (If you have fewer, either you have checked an exceptional set of drawings, or you should go back through your checklist again.) A slang term for an error in architectural drawings is a “bust.”
- Describe each “bust,” and write a comment about what kind of problem the error might have caused during construction. Write a comment about what might have been done to prevent the error from creeping into the drawings in the first place.
- Create a written report to be presented to the architects and engineers who prepared the drawings. (What you are creating is essentially a peer review).

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Material Selection & Specification

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Material Selection & Specification

Introduction

By completing the activities in this chapter, you will gain an understanding of materials selection and specification. The following information is taken from the NCARB IDP Guidelines:

Material Selection And Specification

Minimum Material Selection and Specification Experience: 160 Hours

Definition: The analysis and selection of building materials and systems for a project. The materials specified for a particular project communicate the requirements and quality expected during construction. Specifications are included in a project manual that is used during bidding and construction.

Tasks

At the completion of your internship, you should be able to:

• Prepare specifications based on performance criteria
• Research, select, and specify materials

Knowledge Of/Skill In

• Adaptive reuse of buildings and/or materials
• Alternative energy systems and technologies
• Basic engineering principles
• Building design
• Building envelope
• Building Information Modeling (BIM) technology
• Building systems and their integration
• Characteristics and properties of construction materials
• Constructability
• Construction details
• Construction sequencing
• Critical thinking (e.g., analysis, synthesis, and evaluation of information)
• Design principles
• Furnishings, fixtures, and equipment
• Hazardous materials mitigation
• Implications of design decisions (e.g., cost, engineering, schedule)
• Indoor air quality
• Interior materials and finishes
• Interpersonal skills (e.g., listening, diplomacy, responsiveness)
• Life safety
• Managing quality through best practices
• Oral and written communications
• Problem solving
• Product evaluation, selection, and availability
• Project scheduling (e.g., construction document setup, storyboarding, staffing projections)
• Site design
• Specifications
• Sustainable design
• Technological advances and innovative building products
• Vertical circulation

resources

Download the current Intern Development Program (IDP) guidelines at www.ncarb.org/Experience-Through-Internships.aspx.


• Chapter 12.8 - Environmentally Preferable Product Selection


• Chapter 18.6 - Construction Document: Specifications


• Chapter 7.2 - Environmentally Preferable Product Selection
Material Selection & Specification

Narrative

As the art and science of building developed and the responsibility for construction shifted from the designer to a separate contractor, the need for explanatory information in the form of written notes arose. Then, as the complexity of the construction process grew, so did the volume of written notes needed to fully communicate the design intent to the constructor. Ultimately, the notes were removed from the drawings, organized, and placed in a document of their own. Thus, specifications evolved as a way to supplement drawing notations, eliminating the need for large amounts of text on the drawings, which tended to clutter what should be a clear image of the intended construction.

The following discussion examines the relationship between drawings, specifications, and the other documents that, combined with the specifications, make up the project manual. It also considers the importance of evaluating materials, products, and building systems and assemblies before incorporating them in a specification.

A Complementary Relationship

One of the primary concepts in the organization of construction information is that drawings and specifications support one another with neither having priority over the other. This concept is clearly defined in AIA Document A201™ General Conditions of the Contract for Construction, as quoted here:

§1.1.5 The Drawings
The drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams.

§1.1.6 The Specifications
The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§1.1.7 The Project Manual
The Project Manual is a volume assembled for the Work which may include the bidding requirements, sample forms, Conditions of the Contract and Specifications.

The next statement in A201™, §1.2 Correlation and Intent of the Contract Documents, addresses the complementary relationship between drawings and specifications:

§1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by

notes

Take brief notes while reading the narrative and list key resources you used to complete the activities. Note discussion outcomes from meetings with your supervisor, mentor, or consultants. When finalizing the activity documentation (PDF), include your notes and the Emerging Professional’s Companion activity description.
the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

Because the documents are complementary, it is important for specific types of information to be located in the correct place. As stated in the Construction Specifications Institute’s The Project Resource Manual—CSI Manual of Practice, the primary rule of specification writing is that “each requirement should be stated only one time and in the right place.” Adherence to this concept simplifies retrieval of information and reduces the possibility of discrepancies, conflicts, and errors and omissions.

To paraphrase The Project Resource Manual—CSI Manual of Practice (PRM), “Both the drawings and specifications are needed to fully describe a construction project. The drawings show size, form, quantity, relationship, generic type, and graphic representation of construction materials. Specifications define the qualitative requirements for products, materials, and workmanship upon which the construction contract is based. The specifications also describe administrative procedures that relate to both drawings and specifications.” Many resources help define what information should be located in the specifications or drawings. Among these are the United States National CAD Standard, published by the National Institute of Building Sciences (NIBS), and The Project Resource Manual—CSI Manual of Practice.

Project Manual Concept

The project manual, commonly referred to as specifications, is actually a bundling of procurement requirements, contracting requirements, and specifications into a unified document. Procurement and contracting requirements are not specifications and, in most cases, are prepared by or in coordination with the owner and the owner’s legal counsel, not the architect. As stated in The Project Resource Manual—CSI Manual of Practice, “the project manual concept provides an organizational format and standard location for all the various documents involved.”

The organization of the project manual is based on MasterFormat®, the familiar industry standard for organizing written construction information published by the Construction Specifications Institute and Construction Specifications Canada. In 2004, a new Division 00–Procurement and Contracting Requirements was added to cover documents other than specifications. It includes procurement requirements; contracting forms; project forms; conditions of the contract; and revisions, clarifications, and modifications. Division 01–General Requirements contains procedural and administrative requirements that apply to the rest of the divisions, which contain the product specifications. For additional information on the use of MasterFormat® and the organization of the project manual, refer to the MasterFormat® application guide, The Project Resource Manual—CSI Manual of Practice and The Architect’s Handbook of Professional Practice.
MasterFormat®, a product of the Construction Specifications Institute and Construction Specifications Canada, is a master list of numbers and titles for organizing information about construction requirements, products, and activities into a standard sequence. The 2012 master list of numbers and titles can be downloaded from CSI’s website for free via the following webpage: www.csinet.org/mfnumber.

The way in which the six-digit MasterFormat® 2004* numbers work is explained using the following example:

03 20 00 Concrete Reinforcing

The three pairs of numbers represent three levels of classification. Because each level is represented by two digits, up to 99 subjects can be addressed at each level. The numbers and titles in MasterFormat® are grouped under the following general headings:

- Procurement and Contracting Requirements Group (Division 00 containing documents)
- Specifications Group (Divisions 01-49 containing sections)

The Procurement and Contracting Requirements Group indexes administrative and procedural subjects that deal with introductory material, procurement and contracting requirements. The subjects in this group are defined by a document number and title. The Specifications Group describes the physical aspects of construction. Subjects in this group are defined by a section number and title. The Specifications Group is made up of several specialty subgroups of divisions.

MasterFormat® arranges related construction practices, or “work results,” into a series of level 1 titles, called divisions. Several of these divisions lack content and titles and are reserved for future expansion.

Central to the use of MasterFormat® is the notion that all types of construction should be addressed equally. Thus, the more basic, or common, divisions are generally placed near the beginning of the document. These contain work results likely to be specified in all types of construction. For example, most projects have contractual requirements, common requirements, and some type of structural materials. Subsequent divisions contain sections applicable only to specific types of projects (building construction, heavy civil work, process plant construction, etc.) come later in the specifications document. In addition, there is a space in Division 01–General Requirements for specifying performance requirements for all or part of a project. A list of MasterFormat® division numbers and names is provided with this sidebar.

For more information on MasterFormat® and its use in the construction industry, visit www.csinet.org/MasterFormat.

* The Construction Specifications Institute has since released a 2012 version of MasterFormat®.
Please note: In 2012, the Construction Specifications Institute released MasterFormat® 2012. Changes to the above Division Numbers and Titles consists of an edit to the name of Division 44, now “Pollution and Waste Control Equipment,” and the addition of Division 46 Water and Wastewater Equipment.
Relationship of Construction Documents
Excerpted with permission from The Project Resource Manual—CSI Manual of Practice, Module 5
Construction Documents, Figure 5.1A.
Purpose Of Specifications

As specifications are developed, it is important to remember their purpose. The goal of construction documents is to communicate the needs of the owner, as represented by the design, in a form easily understood by those responsible for construction. In an ideal world, the development of specifications would be linked to the development of the drawings, and both would reflect a consistent level of detail. All too often, however, project drawings are nearly complete before they are turned over to the person or persons responsible for developing specifications. Preferably, drawings and specifications would be developed in tandem, each to the same level of detail at the same time, throughout the project.

The information provided in specifications may be used in many ways during project delivery, and the form or structure in which information is presented should reflect its purpose. For example, at the end of the schematic design (SD) phase, a client may use the SD documents to explain the project to its staff or for fund-raising. In this case, a narrative description of the building systems may be easier to understand and still contain enough detail to document the design decisions made to that point. Such a narrative, called a preliminary project description, is organized around a system of building elements called UniFormat (a publication of CSI and CSC). This narrative does not need to be static but can grow and reflect an increasing level of detail until a natural transition to preliminary specification format is made.

During the design development (DD) phase, project documents may be used to provide a more accurate estimate of probable construction cost as well as a checklist for development of the final construction documents. At this time, more detailed information is required about individual building materials, products, systems, and assemblies that will be incorporated in the project. For this purpose, an outline specification may be most appropriate. Based on MasterFormat®, an outline specification should include the sections that will be needed for the final project manual. Outline specifications contain information that typically would be included in Part 2–Products of a typical three-part final specification section. See pages 300 and 301 for more information on SectionFormat, another publication of CSI and CSC.

Final construction documents are used for bidding or negotiating, and for construction of the project. The specifications included at this stage of project delivery contain detailed requirements for the materials, products, equipment, and systems to be incorporated into the project.

The three parts of a final specifications package begin with Part 1–General, which includes administrative, procedural, and quality assurance requirements. Part 2–Products includes specific product attributes, while Part 3–Execution includes special installation requirements. Refer to The Project Resource Manual—CSI Manual of Practice or resources in the bibliography for additional information about these three formats.

Material And Product Research

Material and product research begins with analysis of the project program and a statement of performance requirements and desired results in the selection of specific products.

This process involves simple problem solving, which begins with defining the problem. Each product, system, and assembly incorporated into a project is intended to satisfy certain criteria, and each product has a set of attributes that should match these criteria. The first step is to establish the desired criteria for a specific product or system.

Next, the criteria are ranked by priority. Product selection would be difficult and client expectations might not be met if products were evaluated with all criteria considered to be equivalent in importance. What is most important about a particular product? Is it technical performance, aesthetics, cost, environmental impact, or something else? It is important for all members of a project team to agree on the priority ranking so there is no misunderstanding about why a particular product is selected.
UniFormat

According to *The Project Resource Manual—CSI Manual of Practice*, UniFormat, a product of the Construction Specifications Institute and Construction Specifications Canada, is a “uniform classification system for organizing preliminary construction information into a standard order or sequence on the basis of elements or systems.” Like MasterFormat®, UniFormat is organized in levels, each with a different level of detail. This format can be used throughout project delivery to document the decisions made at each phase. It can be used to document selected construction materials in narrative form, identify performance of a specific building element, and organize preliminary cost estimates.

The first level of UniFormat organizes information into the following categories, which are identified with letter designations:
- A–Substructure
- B–Shell
- C–Interiors
- D–Services
- E–Equipment and Furnishings
- F–Special Construction and Demolition
- G–Building Sitework
- Z–General

At level 2, UniFormat classifies 25 basic building elements and systems. This level uses an alphanumeric designation as an identifier. For example, category B, Shell, includes the following building elements:
- B10, Superstructure
- B20, Exterior Enclosure
- B30, Roofing

UniFormat level 3 is designated by adding two more digits to the number. At this level, each building element is expressed in further detail by its specific type. For example, B20, Exterior Enclosure, includes the following:
- B2010, Exterior Walls
- B2020, Exterior Windows
- B2030, Exterior Doors

UniFormat can be used to organize preliminary project descriptions, preliminary cost estimates, and drawing detail filing.

notes
SectionFormat

SectionFormat, a product of the Construction Specifications Institute and Construction Specifications Canada provides a structure for organizing specifications information into three parts: General, Products, and Execution. Each part is organized in a hierarchical fashion into articles and paragraphs. SectionFormat includes suggested titles for article headings as well as a suggested order for presenting information. This flexible format makes it possible to demote or promote articles and paragraphs according to the importance and detail of the information being specified. A partial listing of SectionFormat article headings provided by CSI appears on the next page.

Part 1–General, provides a location for administrative, procedural, and quality assurance information. It expands upon the general information included in the general conditions of the contract and Division 01–General Requirements.

The relationship between the general section and the more detailed sections is illustrated in about the following example, using the topic of submittals. AIA Document A201™, §4.2.7, states, “The Architect will review and approve or take other appropriate action upon the Contractor’s submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.” The Division 01 section on submittals states that the contractor submits “one reproducible (shop drawing) and two blue line prints” and that “the Architect (after review) will return one reproducible sepia after making copies required for Architect’s use.” Part 1–General, of a wood door specification may include the following requirement: “Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, factory machining criteria, factory finishing criteria.” As you can see from this example, the submittal requirements are related but it is in the specification section that specific requirements for the specified material or product are identified.

Part 2–Products, as the title suggests, provides the location for the information describing a specified material or product. Part 3–Execution, is where product-specific preparation and installation requirements are located. Refer to the partial listing of SectionFormat article and paragraph headings for examples of the type of information included in these headings. Refer to the resources listed in this chapter for more detailed explanations of SectionFormat and its use in the construction industry.
# Section Format Outline

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<td><strong>Verification of Performance</strong></td>
<td><strong>Field Quality Control</strong></td>
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<td><strong>Manufacturers’ Instructions,</strong></td>
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<td><strong>Site Tests, Inspection</strong></td>
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<td><strong>Manufacturers’ Field Reports,</strong></td>
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<td><strong>Manufacturers’ Field Services</strong></td>
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<td><strong>Qualification Statements</strong></td>
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<td><strong>Adjusting</strong></td>
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<td><strong>Closeout Submittals</strong></td>
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<td><strong>Cleaning</strong></td>
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<td><strong>Demonstration</strong></td>
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<td><strong>Protection</strong></td>
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<td><strong>Schedules</strong></td>
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</tbody>
</table>

**Quality Assurance**
- Qualifications
- Regulatory Requirements
- Certifications
- Field Samples
- Mock-ups
- Pre-installation Meetings

**Delivery, Storage, and Handling**
- Packing, Shipping, Handling, and Unloading
- Acceptance at Site
- Storage and Protection
- Waste Management and Disposal

**Project/Site* Conditions**
- Project/Site* Environmental Requirements
- Existing Conditions

**Sequencing**

**Scheduling**

**Warranty**
- Special Warranty

**System Startup**

**Owner’s Instructions**

**Commissioning**

**Maintenance**
- Extra Materials
- Maintenance Service

---

*Project Conditions is the preferred term in the U.S. Site Conditions is the preferred term in Canada.*
A list of possible solutions or acceptable products is assembled. Information is gathered about these based on the established performance criteria. The possible solutions are then tested against the criteria to determine which product best meets the project requirements. Product or products that best satisfy the criteria are selected for use on the project.

**Establishing Criteria**

To evaluate the performance of various design alternatives, project-specific evaluation criteria must be defined. Each material has many characteristics or attributes that contribute to its overall performance and its applicability to a particular project. These attributes can be grouped by category. As an example, the list of categories below was distilled from *Construction Materials Evaluation and Selection: A Systematic Approach*, by Harold J. Rosen and Philip M. Bennett, and from a list of attributes in *The Project Resource Manual—CSI Manual of Practice*. Sample material attributes are provided for each category. Consult the above publications for more detailed lists and discussions of the material attributes that would be included in these groups:

- **Structural serviceability**: natural forces, strength properties
- **Fire safety**: fire resistance, flame spread, smoke development, toxicity, fuel load, combustibility
- **Habitability**: thermal properties, acoustic properties, water permeability, optical properties, hygiene, comfort, safety
- **Durability**: resistance to wear, weathering adhesion of coatings, dimensional stability, mechanical properties, rheological properties
- **Practicability**: transport, storage on site, handling at installation, field tolerances, connections
- **Compatibility**: jointing materials, coatings, galvanic interaction or corrosion resistance
- **Maintainability**: compatibility of coatings, indention and puncture (patching), chemical or graffiti attack
- **Environmental impact**: resource consumption at production, life-cycle impact, LEED points
- **Cost**: installed cost, maintenance cost
- **Aesthetics**: visual impact, customizing options, color selection

It can be helpful to use a *product evaluation matrix* such as the one shown on page 303 to record the established criteria and tested performance of products and systems, along with salient qualities or product attributes. The general categories of performance criteria listed above can be included in the matrix as the default and then customized to meet project requirements. Another column can be used to identify specific tests and results that demonstrate a product’s performance. Not all product analysis is objective, however, so a column for noting subjective comments is useful. Finally, include a column for other comments. Using such a matrix serves as an especially helpful tool when critical products and systems or new products and systems are being evaluated.

**Prioritizing Criteria**

After the project-specific evaluation criteria have been determined, a priority is established for each of these criteria. This may be the most difficult step.
**Material Selection & Specification**

**Product Evaluation Matrix**

<table>
<thead>
<tr>
<th>SECTION NUMBER:</th>
<th>PRODUCT EVALUATION SUMMARY SHEET</th>
<th>PROJECT</th>
<th>DATE:</th>
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</table>

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<tr>
<th>CRITERIA</th>
<th>TEST RESULTS</th>
<th>SUBJECTIVE EVALUATION</th>
<th>COMMENTS</th>
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<tbody>
<tr>
<td>Structural Serviceability</td>
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<tr>
<td>Fire Safety</td>
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<td>Habitability</td>
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<td>Cost</td>
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<td>Aesthetics</td>
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</table>

**Criteria**

- **Structural Serviceability**: Natural forces, Strength properties.
- **Fire Safety**: Fire resistance, Flame spread, Smoke development.
- **Toxicity**: Total toxicity, Combustibility.
- **Habitability**: Thermal properties.
- **Practicability**: Transport.

- **Acoustic properties**: Water permeability, Optical properties, Hygiene, comfort, safety.
- **Durability**: Resistance to wear, Weathering, Adhesion of coatings, Dimensional stability, Mechanical properties, Rheological properties.
- **Compatibility**: Jointing materials, Coatings, Corrosion interaction or corrosion resistance.
- **Maintainability**: Compatibility of coatings, Fusion and puncture (pinching), Chemical or graffiti attack.
- **Environmental Impact**: Resource consumption at production, Life-cycle impact.
- **Cost**: Installed cost, Maintenance costs.
- **Aesthetics**: Visual impact.

Criteria from "Construction Materials Evaluation & Selection" by Harold Kronen and Philip Rosenberg.
Questions considered in determining the importance of the criteria include these: What is most important to the success of the project? Is it the technical performance of the product, or is it appearance or cost? Members of the project team may not agree. To the technical architect, durability characteristics may be most important. To the designer, aesthetics may be more important. The owner may feel cost is the most important characteristic. Who ultimately makes the decision?

This task provides a great opportunity to involve the owner in what can be viewed as an extension of programming process. For critical facility systems, it is important for project team members to reach agreement on the criteria and their importance to diminish the chance for unmet expectations.

Identifying Options
Once product attributes have been identified and prioritized, it is possible to begin assembling product options. Information about specific products is collected and organized. Possible sources for such information include Internet search engines such as Sweets.com, SmartBIM.com, and ReedConstructionData.com. These sites, among others, allow product searches based on product attributes. Product representatives can also be a valuable source of information. However, if a manufacturer cannot provide information about a specific performance characteristic of a product or material, the product or material should not be considered unless the manufacturer or a testing authority will conduct the required tests and provide the missing information.

Product literature may include criteria that are not relevant to the intended application. It is important to focus on the qualities of a product that will affect its intended performance in the project. The evaluation of the product is based only on such pertinent qualities, and these characteristics are that which is included in the project specifications.

Evaluation And Selection Of Products And Materials
Each possible product is evaluated against the criteria established for it and rated by how well it would satisfy project requirements. The scores thus calculated are multiplied by a weighting factor based on the priority given to the criteria and then added to get the total score. For example, consider a project that requires a coating for existing elevator doors. After discussions with the owner, you determine that although color selection and compliance with Environmental Protection Agency (EPA) VOC requirements are important attributes, durability has top priority. Thus, coating durability gets a weighting factor of 10, color selection gets an 8, and VOC content gets a 6. Possible products are evaluated, and their compliance with the evaluation criteria established for the project is rated based on test results. One of the products being evaluated has test results that indicate it has a pencil hardness of 2H, the highest of all the products being evaluated, and it is assigned an 8 for compliance with the requirement for durability. The score of 8 times the priority factor of 10 would give the product a score of 80 for that category. After all the scores have been totaled, the product with the highest score would be considered the best match to the specified performance criteria.
In some cases, it may be helpful to change the priority ratings and go through the evaluation again to see how this affects the possible solutions. Note that products are not rated against each other, but against the established criteria. This is important because some products may have attributes that outperform those of other products but are not relevant to the ultimate performance or success of the product when incorporated in the project. A detailed explanation of this process is contained in ASTM E1765, Standard Practice for Applying Analytical Hierarchy Process, which offers a standard method for “performing multi-attribute decision analysis in the evaluation of buildings and building systems.”

Documentation
As mentioned at the beginning of this narrative, it is best to develop drawings and specifications concurrently and to a similar level of detail. This is also true for the product evaluation process. At schematic design, the narrative description or preliminary project description may contain descriptions of the project’s major elements, as well as performance and other criteria identified during the process of establishing criteria for project materials, products, and systems. At design development, the outline specification may contain generic descriptions of materials and products to be incorporated into the project as part of the process of identifying options. Finally, at completion of construction documents, the detailed specifications include descriptions of specific products and procedural, administrative, and quality assurance requirements and special installation instructions.

In most architecture firms, the process of creating specifications involves editing master guide specifications. The process usually begins with the table of contents of the master set of specifications, from which sections needed for the project are selected. Many firms have their own in house master specification system, but a number of commercial systems are also available. With a few exceptions, the editing process for these systems is similar. Text is selected and organized to produce the desired level of detail. The sections can also be customized with project-specific text added by the editor.

A master specification section may include one or a combination of specification methods, which are reviewed below. When editing, it is important to review the specifications to determine whether more than one method of specifying has been used to define the product requirements. If more than one method has been used, the specification must be coordinated carefully to eliminate any contradictory requirements.

After each section of the specifications is complete, evaluation criteria should be reviewed again to ensure that the pertinent qualities of the products have been correctly identified. The sections should then be reviewed for any relationship to other sections and to resolve possible conflicts or contradictions.

Methods Of Specifying
There are four basic types of specifications—descriptive, performance, proprietary, and reference standards. The first three can be used to specify the essential qualities of materials for a project. Reference standard specifications are published by standards organizations such as the American Society for Testing and Materials (ASTM) or organizations that represent manufacturers of specific building elements, such as
the Steel Door Institute (SDI), and are typically referenced without customization. The Project Resource Manual—CSI Manual of Practice notes that more than one specifying method is used in most project specifications, although all four methods may be used in a single specification section. PRM cautions, though, that “the A/E should be careful about combining methods in the specification of a single product.”

Descriptive specifications include a detailed written description of the required properties of a product. They are often lengthy and tedious. Their preparation involves researching products and critical features, determining which features to specify, describing critical features, and providing information about submittals, tests, etc.

Performance specifications identify the performance characteristics that must be met by a product or system. Writing performance specifications is a two-part process that includes preparation of a statement of required results and identification of a method for verifying compliance. Avoid use of both descriptive and performance specifications for a single requirement; the resulting specifications are redundant and open to conflicts.

Performance must be technically possible.

Proprietary specifications identify desired products by manufacturer’s name, model number, or unique characteristics. There are two types of proprietary specification, open and closed. Closed proprietary specifications do not allow substitutions. Open proprietary specifications provide for requested alternates, often proposed by the contractor proposed. Avoid combining the use of descriptive, proprietary, and performance requirements for a single requirement, as this multiplies the opportunities for conflicts.

Reference standard specifications are published standard specifications that can be incorporated into project specifications by reference. According to The Project Resource Manual—CSI Manual of Practice, reference standards are “documents established by a consensus that provides rules, guidelines, or characteristics for activities, and their results . . . .” They are published by trade associations, professional societies, standards organizations, governments, and institutions.

Beyond The Basics

As its title suggests, this narrative concentrates on a basic two-step process of selecting and documenting materials, products, and systems for construction projects. For this purpose, the development of an individual section has been the primary topic. Assembling sections into a project manual, development and coordination of Division–01 sections, and general and supplementary conditions have not been discussed in detail. For additional information on these topics, refer to the resources listed in this chapter.

Written by Garry Betts, AIA, FCSI, CCS
Garry Betts, principal and director of specifications at Chicago-based Loebl Schlossman & Hackl, is a nationally recognized expert in the field of specifications.

As you research and look for more information on topics presented in the Emerging Professional’s Companion, remember that a quick internet search of keywords can be incredibly useful to completing your Activities.
notes

Take brief notes while reading the narrative and list key resources you used to complete the activities. Note discussion outcomes from meetings with your supervisor, mentor, or consultants. When finalizing the activity documentation (PDF), include your notes and the Emerging Professional’s Companion activity description.
Develop One Section of an Outline Specification

Supplemental Experience for eight (8) Core IDP Hours

For this activity, select a small project in your office or a mentor’s office that has been completed at least through design development (DD). It may be best if this is a project that you have not worked on; however, any project will suffice.

Activity - Core

First, review the drawings (preferably DD drawings) in preparation for developing an outline specification. Take note of various key elements of the design. Speak with the project architect or project designer if appropriate to gain additional insight into the goals for the project. Then, using the table of contents from the office master specification system (or MasterFormat®), develop a table of contents for the project.

After consulting with your supervisor, select one of these divisions:

• Division 07 Thermal and Moisture Protection
• Division 08 Openings
• Division 10 Specialties

Take the material from the office master specification system for the division you have chosen, and edit it to create an outline specification for the division. Next, research the materials and products to include in your outline specification section. Identify important characteristics of each material and product. (Note: Refer to the criteria discussed in the narrative regarding material and product research.) Finalize the outline specification for the division that you have selected.

Consider the following:

• How does the product fulfill project requirements?
• What priorities might you have to place on the material or product criteria if your project is 20% over budget?
• What challenges did you encounter in developing an outline specification at the design development stage?
• If available, compare your work to the project’s actual outline specification. How do they differ? Why?
• What did you learn that you might apply to future projects?

Be prepared to discuss why you chose the products and how you incorporated them into the outline specification.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Material Selection & Specification

Product Evaluation and Selection
Supplemental Experience for eight (8) Core IDP Hours

Select a small or medium sized base building project in your or your mentor’s office that has recently been completed and for which you have access to drawings and specifications. This assignment will be most effective if you select a project you did not work on previously.

Activity – Core

Document the process used by the project design team to evaluate exterior building enclosure systems for the project. Review the final drawings and specifications and gain access to earlier iterations, if possible. It will be useful to interview members of the project team who can share their insights to the project. Conduct your own independent research of exterior systems.

Consider the following questions:
- How were the performance criteria established?
- How are compatibility issues addressed?
- Are there coordination issues where different components meet?
- Does the selected product’s performance meet or exceed project requirements?
- Is the product adequately documented, and is the documentation consistent between drawings and specifications?
- Based on your independent research, would you have done anything differently in the specification of the system(s)?

Prepare a 2-3 page resource for your office that can be used by future project teams, especially interns, defining an office standard operating procedure for researching, selecting and documenting exterior systems.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Learning Through Comparison

Supplemental Experience for eight (8) Core IDP Hours

For this assignment, choose a project outside your studio or office for which you have access to detailed information. The project can be of any size and should be substantially complete.

Activity - Core

First, review the drawings for the project you have selected. Note the design concept and how the building systems that are specified for the project will impact the design. Speak with the project architect or project designer if appropriate to gain additional insight into the goals for the project.

Next, select one of the following building systems:
- Roofing system
- Below-grade waterproofing
- Windows
- Wood doors

Use the appropriate section from the office master specification system (or MasterFormat®) to develop one specification section for the project you have chosen.

Consider the following:
- What are the project requirements for the specifications section you have selected?
- Document the products you have selected to be used in this project.
- Analyze the characteristics of each product that meet the requirements for the project. Note the reasons why you selected one product over another (e.g., cost, lead time, aesthetics, etc.).
- Compare the information in Part 1 General of the specification section you have written and the information in Division 01 General Requirements of the office master specification system. What is the relationship of these two sets of information?
- Using the narrative as a reference, are there any suggestions you could make to your office to improve these general requirements sections. Why?

Share the specifications section you have developed with your supervisor or IDP mentor and provide a written explanation of your product selection decisions. Also document in writing your analysis of the relationship between Part 1-General and Division 01–General Requirements as well as any improvements that may be considered.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Observe a Building Element
Supplemental Experience for eight (8) Core IDP Hours

With your IDP supervisor or mentor, choose a building element to research, for example, a window wall system or revolving doors. Tour your local business district, strip retail centers, and school and hospital campuses, observing the installation conditions for the element you chose. Also, spend time in the library or online researching manufacturers, standard details and specifications for the building element you have chosen.

Activity - Core

Keep a notebook and document from your tour at least fifteen (15) applications in different building types. Take photos of each application. Also keep in your notebook cut sheets, references and other research you conduct on the building element.

Consider the following:

- For each application, note the differences in detail and quality and whether the quality is adequate for the installation.
- Concentrate on the interface between the selected building element and adjacent elements, and follow the transition around the perimeter.
- Consider whether the quality of each installation is consistent with the quality of the building type and of individual building elements.
- Do your findings out in the field match your impressions of the desired level of quality for the building and the chosen element?
- How do your findings in the field compare to the standard specifications and details you found in the library and/or online?

Prepare a report outlining your findings and research. Share this with your office or mentor as a research for others who may consider using this building element in the future.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Material Selection & Specification

Applying LEED for Homes to Materials Research

Supplemental Experience for eight (8) Core IDP Hours

Become familiar with the LEED for Homes requirements. It may be helpful to print out the checklist for this assignment. Next, locate a residential showroom (such as in Lowes or Home Depot) in your local area. Make at least one visit to the showroom to research materials and appliances that may be used for a kitchen design in a new home.

Activity - Core

Write a set of specifications for a residential kitchen. The residential project must meet quality for LEED Certification.

Consider the following:

- Which materials are prohibited by the LEED criteria? Are you able to locate sustainable alternatives for your project in the showroom?
- Consider the appliance options. What opportunities and challenges arise when selecting a refrigerator, dishwasher and oven for the project?
- Assuming the client is not a wealthy millionaire, what budget considerations are there when selecting materials and appliances for a residential kitchen in a LEED certified home?
- What trade-offs have you considered in your selection process? Energy vs. aesthetics? Others?
- Assume for that you can salvage 3 items from the original kitchen. Which would those be and why? Note carefully the salvage requirements in the specifications.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Specifications Table of Contents Comparison

*Supplemental Experience for eight (8) Elective IDP Hours*

For this activity, work with the project architect and with a spec writer, if your office or your mentor’s office has one.

During the construction document (CD) process, drawings are periodically reviewed and coordinated with specifications. Milestone reviews typically occur at 30 percent, 60 percent, and 90 percent completion and before the documents are issued for bid and construction. Reread the sidebar “What Constitutes CDs” in the chapter 8 narrative. Understanding the relationship between drawings and specifications is essential to executing a fully coordinated set of construction documents of the highest quality.

During the CD phase, components of the building design are developed and documented in detail, and materials and systems are identified and specified. Although the owner has approved the overall building design in the design development phase, interior finishes and roofing, cladding, waterproofing, glazing, and curtain wall systems require detailed exploration and development. During this process, many things can change, and it is important to keep track of drawing changes that affect specifications.

A good way to become familiar with the relationship between construction drawings and specifications is to review a set of drawings and the project specifications table of contents (TOC) side-by-side. Make sure that all materials and systems on the drawings appear in the specifications, and vice versa.

**Activity - Elective**

Choose a project in the CD phase then create your own specifications TOC for this project. Compare your TOC with the one used for the project and make note of any changes that need to be made. Compare your revised TOC with the drawings for the project. Write a report detailing your comparison and answering the following:

- Identify any materials and systems that appear on the drawings but not in the specifications TOC; add them to the specifications.
- Identify any items in the specifications TOC that no longer appear in the drawings; delete them from the specifications.
- Identify systems and materials that have changed, making it necessary to update certain specification sections; note these on the specifications TOC.

This kind of comparison can be tedious, especially on large projects. However, the task is essential to achieving comprehensiveness and quality. If you have questions, ask the project architect or spec writer. When you have finished the review, you will have identified items in the drawings and specifications that require attention to ensure the documents are fully coordinated. Review your additions and deletions with the project architect and, if your firm employs one, with the specifications writer for the project.

Discuss your findings by sharing a redlined set of the specifications and drawings.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Security Versus Life Safety

In this scenario, you have been assigned to a project team that is designing a renovation for the Uptown Hospital in your local community. One of your responsibilities is to evaluate and select architectural doors, frames, and finish hardware. The hospital intends to update its labor-delivery-recovery (LDR) rooms and nursery in a space currently occupied by administrative and patient treatment functions. The hospital’s security consultant has provided information on high-tech security and monitoring systems. His recommendations include leg bracelets for the babies and sensing devices around the nursery unit that close and lock doors leading away from the nursery when a device senses a signal from a bracelet. Security measures also include door monitors, keycard access control systems, and cameras—all designed to limit and monitor access to the nursery.

The code search indicates that no major changes are needed to the existing construction because there has been no change in occupancy classification. However, the original construction included a smoke barrier separating the floor into two smoke compartments. This barrier runs through the center of the area designated for the new nursery. A number of corridors run from one side of the existing space to the other to provide access to emergency exits. The smoke barrier and access to the exits have to be conserved or replaced.

Because of the movement patterns of patients, four of the cross-corridor doors will be on automatic operators. Two of these doors are part of the smoke barrier and must be self-closing and positive latching; all four are in exit access corridors; and all four have been identified by the security consultant as needing the lockdown feature.

There is a conflict between program requirements and code requirements, between the desire for security and the need for life safety.

Activity - Elective

Prepare a letter to your client describing the type and extent of the conflict between security and life safety requirements in this project. Provide an attachment to the letter that provides specifications on the products you have chosen and lists the reasons why you made those selections. Address the following in your response:

- Research technology options that might allow the doors to meet all code and program requirements. What alternatives might be available to your client?
- Review the local building code. What exceptions might allow the need for security to be held above the need for life safety? How would you make the case to the building code official?
- Describe how you could work with the design team and the security consultant to revise the design in a way that would eliminate or reduce the conflict.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Substitutions That Don’t Work

*Supplemental Experience for eight (8) Elective IDP Hours*

In this scenario, you are the project architect working closely with the client over the past few months, designing an addition for a historic church in your home town of Springfield, Ill. The entire design team has been very sensitive to the issues involved in designing an addition to a historic structure. The client is adamant that materials and finishes for the project be true to the historic context of the existing structure.

As you conduct research for this project, the windows become a significant area of focus. You recognize that because of the historic nature of the addition, the requirements for the windows must be very specific.

As the project architect, you will be following this project through to completion. On a recent project, a historic renovation of a commercial building in the downtown area, you had a negative experience with a contractor who submitted substitutions for windows because of claims that the manufacturers cannot deliver windows fast enough to meet the project schedule. You were concerned the product the contractor proposes would not meet all the project requirements. There were many heated exchanges about the issue resulting in the client blowing up at a project meeting because the architect and the contractor were not working together to resolve the issue. You don’t want to have this situation happen again.

**Activity - Elective**

Prepare a specification section for Division 08 Openings. Research three manufacturers and list them in the specification section. Consider the following:

- What are the critical performance criteria for the window specification for this project?
- For which materials might you accept a substitution from the contractor other than those specified in the project manual?
- What criteria will you use for approving substitutions during the submittal process in construction administration?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Drawings Versus Specs
Supplemental Experience for eight (8) Elective IDP Hours

In this scenario, you are a project architect in a Northwestern U.S. firm of about 75 people. Projects are diverse ranging from institutional to commercial base building work; however, your firm does not do any residential projects. The office has had a quality assurance (QA) process for years and you are one of five architects who are available to project teams to perform a QA prior to issuing a set of project documents. An important step in the QA process is to ensure coordination between the drawings and specifications. According to office policies, sets are not to be issued unless QA is complete.

On Monday, you were given a set of drawings for a new computer science building at the local community college. It appears that in an attempt to “make things easier” the project architect has tried to eliminate the spec book by putting as much of the specifications information into the drawings. Not only is this not the office standard, but the drawings are difficult to read. You have concerns that during the bidding/construction process, contractors will complain, the office will be flooded with RFIs and the firm’s reputation will be damaged.

Activity - Elective

Develop criteria for what type of specification information is appropriate to list on drawings versus in a specifications manual. Consider the following:

- What is the purpose of specifications? Purpose of drawings?
- How do specifications and drawings complement each other?
- How might you, as the project architect, avoid conflicts or duplication between the specifications and drawings?

You decide to give him a head start on the specifications book that must be prepared. Prepare an outline specification for this project using MasterFormat®. Consider the following:

- Which divisions are likely to be needed for a project and location such as this?
- For those divisions that you have excluded, provide a brief paragraph explaining why you do not think it is needed?

Speak with the project architect immediately to get this issue resolved. With the criteria and the table of contents in hand, you set off across the office to find him/her and have this difficult conversation.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Using a New or Untried Product

*Supplemental Experience for eight (8) Elective IDP Hours*

In this scenario, your firm is designing a two-story addition to the local middle school. It is a concrete structure with the first floor slab on grade. Your research indicates a vapor retarder will be required under the slab.

During the process of selecting finish materials for the floor, you discover that different types of flooring have specific requirements for the dryness of the slab and the alkalinity of the slab surface. You carefully record this information in preparation for developing the specification for the vapor retarder and defining the substrate conditions required before installation of the finish flooring.

Before the bidding documents are issued, a product representative calls you about a product he says is perfect for this project. It is a new product and (in advertised performance only) is a match to the products you were planning to specify.

When the principal in charge gave you this assignment, she also gave you an article to read about a school in a neighboring district that was closed for more than six months because of an outbreak of mold. It was determined the under-slab vapor retarder had failed, allowing moisture to migrate through the concrete slab and provide the moisture source the mold needed to feed on the organic compounds in the adhesive and in the flooring itself.

**Activity - Elective**

First, prepare a matrix or worksheet that allows you to evaluate the attributes of possible products against project requirements and to determine which products are the best match. Consider the following:

- What criteria will you use to evaluate the products?
- What are the project requirements that should be considered?
- What steps would you take to ensure the new product will meet project requirements?

Second, demonstrate in a report how you would specify two products using different technologies that both meet the project requirements.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Value Analysis by the Contractor

Supplemental Experience for eight (8) Elective IDP Hours

In this scenario, you are working on the documentation of a new neighborhood retail development in Fort Worth, TX. This is a developer client with whom your firm has done a number of projects. You have heard through the office grapevine that the client is going to be looking for bids that are under budget, and that he will try to increase the project scope with add-alternates that provide additional amenities in the retail space for hardware, finishes, and the window wall system.

Of course, you want the client to be happy. Reluctantly, you agree to develop these three add-alternates. This means that the drawings and specifications will include baseline specifications for the three systems as well as a second upgraded set of specs for the add-alternate selection. Your gut tells you that both should be written as proprietary specifications to reduce the chances of value analysis suggestions from the contractor.

Upon reviewing the contractor’s suggestions, you do not think the suggested products meet the performance criteria used to select the products included in the original bidding documents. If these changes are implemented, the suggested products would lower the quality level of the project.

Activity - Elective

Research and select baseline products for door hardware, entrance lobby flooring and a window wall system. Develop proprietary specifications for each appropriate division. Then, select upgraded products for each of the three systems add alternates. Develop proprietary specifications for each appropriate division. Consider the following for your final report:

- What are the benefits of using a proprietary specification in this instance?
- Compare the two specifications for each system. What are the distinguishing characteristics between the baseline and upgraded systems?
- If value analysis suggestions are made by the contractor, how will you support your decision for the materials and systems selected in the original drawing set?
- How else can you ensure during the design process that the client’s expectations for the desired level of quality and performance are clearly understood and integrated into the specifications?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Translate Project Requirements into Product Options

Supplemental Experience for eight (8) Elective IDP Hours

In this scenario, you are the project architect for a seven-story, 70,000 square foot commercial office building located in Washington, DC. The client is a developer who is looking to maximize his return on investment by keeping costs low and offering a Class A office building that will attract long term tenants. The potential tenants include government contractors and technology companies who work closely with the Pentagon, CIA, and other high security divisions of the government. To deliver the project on time and on budget is to ensure a happy client. And, the District of Columbia has recently adopted a Green Building Act which will require this building to achieve at minimum rating of LEED Silver. (Note: U.S. Green Building Council’s program Leadership in Energy and Environmental Design and commonly referred to as LEED.)

The developer says to you in an early meeting: “I’ve done lots of these buildings before. We need to spend our money on the exterior finishes and the lobby. I don’t want to waste money on things no one will see like the roof.”

Back at the office, you are reviewing the LEED checklist and have some reservations about being able to make the Silver rating. You begin to review the project’s design development drawings for ideas. The roof design immediately jumps out at you as a perfect opportunity for some points. If you could just convince your client to consider a green roof or other products that reduce heat island effect, perhaps the project could qualify for the Sustainable Sites; Heat Island Effect, roof credit.

Activity - Elective

Develop criteria for evaluating different roofing products or systems for a generic commercial building with a flat roof. Research products or systems that meet these criteria. Which products are the best choice for this project and client? Why? List your criteria and describe the selection process, giving specific reasons for the choices you made.

Then, using the U.S. Green Building Council’s LEED evaluation criteria, revise the project criteria so the roof system will meet the requirements under the category Sustainable Sites; Heat Island Effect, roof.

- How did the criteria change?
- How will the application of the LEED criteria would affect your selection of roofing products or systems?

Write a memorandum (250 words minimum) to the client. List the pros and cons of each system and make a recommendation regarding the best choice for the roof design and product selection for this project.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Dysfunctional Drainage System

Supplemental Experience for eight (8) Elective IDP Hours

In this scenario, you are asked to take over the completion of a project after the project manager, who has worked on the project for the past two years, resigns. This is a five-story poured-in-place concrete parking garage in Poughkeepsie, NY.

The project is the first your office is doing with integrated project delivery. The team of engineers, contractors, architects and subcontractors has been assembled since the inception of the project. The project has been designed using BIM.

You are about three weeks from having to deliver the set for permit. You know that once the permit is pulled, the project is going into high gear. You want the set to be in good shape to ensure a good project start for the client and to be a best practice for the firm with this new project delivery method.

Soon after getting up to speed with the project team, you become aware that the foundation drainage system that was selected for the perimeter of the garage is not adequate. There are opportunities for waterproofing failures that will compromise the system. You have to go back to the drawing board on this system and want to make minimal changes to the design in the process. It took you a week to identify this issue, now you only have two weeks to solve it before the deadline.

Activity - Elective

Please reference the following sources:


First, research foundation drainage systems to be used in this scenario. Select three alternatives that may be effective in this application. Consider the following:

- What criteria did you use to select the systems?
- What are the project requirements that should be considered?
- How might the constructor team be of use to you in evaluating products?
- What information can you gather from product manufacturers and representatives? How will you evaluate the information they share with you?

Second, write an outline specification for Division 07 Thermal and Moisture Protection for the one system you selected as best for this project. Consider the following:

- How is the approach to this problem different in Integrated Project Delivery than it would have been if the project was Design-Bid-Build?
- What advantages and disadvantages did you see in addressing the problem with the team?
- How would you share lessons learned with your office to ensure that other teams don’t run into the same issues with future projects?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
notes

Take brief notes while reading the narrative and list key resources you used to complete the activities. Note discussion outcomes from meetings with your supervisor, mentor, or consultants. When finalizing the activity documentation (PDF), include your notes and the Emerging Professional’s Companion activity description.
Bidding & Contract Negotiation

activities - core*

☐ Learning from AIA Bidding Documents 338
☐ Completion of Bid Forms for a Project 339
☐ Attendance at a Pre-Bid Meeting 340
☐ Attendance at a Public Bid Opening 341

*A maximum of 40 hours of core credit may be earned in this experience area.

exhibits

Exhibit 3A-1 351
Exhibit 3A-2 352

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Bidding & Contract Negotiation

Introduction

By completing the activities in this chapter, you will gain an understanding of the field activities involved in bidding and contract negotiation. The following information is taken from the NCARB IDP Guidelines:

Bidding and Contract Negotiation
Minimum Bidding and Contract Negotiation Experience: 120 Hours
Definition: Involves the establishment and administration of the bidding process, issuance of addenda, evaluation of proposed substitutions, review of bidder qualifications, analysis of bids, and selection of the contractor(s).

Tasks
At the completion of your internship, you should be able to:
- Conduct or participate in bidding/negotiating phase
- Evaluate product and material substitutions
- Prepare bid documents including addenda

Knowledge Of/Skill In
- Conflict resolution
- Construction procurement (e.g., bidding, negotiating)
- Contracts (e.g., professional services and construction)
- Interpreting construction documents
- Oral and written communications
- Product and material substitutions
- Project delivery methods

resources

Download the current Intern Development Program (IDP) guidelines at www.ncarb.org/Experience-Through-Internships.aspx.

- Part 4 - Contracts and Agreements

- Chapter 11 - Contracts and Agreements

- Part 4 - Contracts and Agreements
Narrative

The architect’s duties in contractor selection may appear relatively minor in comparison to the architect’s role in design and construction. However, the architect’s role in contractor selection is pivotal in terms of establishing sound working relationships, limiting liability to the owner and the architect, and treating contractors fairly.

An increasingly complex design and construction environment necessitates consideration of modes of project delivery that differ from the traditional design-bid-build approach. Certainly, the recent advances in integrated project delivery provide powerful new alternatives to the traditional construction process. No matter what project delivery approach is used, however, contractor selection criteria and procedures should be clear, sound, and strictly adhered to, particularly in publicly bid work. In addition, the owner needs to be informed of the implications of straying from the rules. Attention to detail and the importance of communication should enable a smooth transition from design to the construction phase, or merging of the two project increments, and optimize the chances of achieving a successful project.

Bidding and contract negotiation are two distinct steps in traditional contractor selection. While these may constitute only a small portion of an architect’s overall services, they are a critical bridge between design and construction. Even the best design and most accurate and complete construction documentation cannot ensure success. After all, someone needs to turn the ideas represented in the construction documents into a three-dimensional physical reality. Ultimately, it is the quality of the contractor(s) and the quality of the working relationships among the owner, contractor, architect, and their subcontractors and consultants that will determine just how successful a project will be. Thus, the means used to select a contractor is a critical issue that needs to be addressed as early as possible with the client. The selection process lays the groundwork for the realization of the project and the relationships among the parties involved in the construction process.

Traditionally, contractor selection has followed a design-bid-build strategy, which separates design and construction into distinct increments and limits the choice of a contractor on the basis of lowest cost. Design-bid-build works well for a wide variety of projects of all sizes and is still widely used in the construction industry. In this project delivery method, the owner establishes one contract with the architect for design services and another with a builder (or perhaps several separate contractors each with prime contracts with the owner) for construction. The architect’s role during construction is limited to administration of the construction contract between owner and builder. Having developed a set of contract documents that establish a scope of construction work, the architect releases them to competing contractors who propose a price for completing the work. In most cases, the job is awarded to the lowest responsible bidder.

The bulk of this chapter details how the bidding process works in the context of traditional design-bid-build. Special attention is given to procedural issues and limiting liability. The remaining portion of the chapter...
provides an overview of contractor selection in alternative approaches to project delivery, including design-negotiation-build, design-build, and construction management. In contemporary design and construction, such approaches are often worth considering for economic, schedule, technical complexity, and project coordination reasons and thus are increasingly common. However, such project delivery methods have very different implications for project coordination and liability, and for the architect’s roles and responsibilities, than does the design-bid-build approach.

The following discussion of competitively bid contracts outlines many of the issues generally associated with contractor selection and project delivery, no matter what delivery method is employed. Following it is a detailed description of bidding procedures, followed by a review of practical and legal pitfalls in bidding and contract negotiation.

**Preparation**

Competitive bidding involves sending complete sets of contract documents to two or more contractors who bid against each other. Usually, the lowest bidder is awarded the contract. The initial tasks in a competitive bidding process include: determining whether the pool of bidders should be open or selective, qualifying contractors, and preparing and issuing the bid package.

**Choosing Open or Selective Bidding**

The architect and the owner decide whether they will get better results for a project by choosing from a large or a small pool of bidders. Their decision determines whether the bidding process is open or selective.

When attracting a large number of bidders is considered desirable, as is often the case in public sector work, open bidding is used. An “advertisement to bid” is published in trade or government publications or professional journals, inviting any interested contractors to participate. When a limited number of bidders are preferred, a selective bidding process is implemented. An “invitation to bid” is sent to a selected group of contractors based on reputation, recommendation, prior work, or previous relationship with the owner or the architect.

**Qualifying Bidders**

Prospective bidders are identified based on their ability to successfully undertake a project. In some cases, the contractor’s reputation or relationship with the owner is sufficient, but sometimes it is necessary to establish the qualifications of contractors before bidding documents are issued. This is particularly important in the open bidding process, so unsuitable bidders are eliminated and the administration effort involved in competing a high number of bidders is reduced. AIA Document A305™, Contractor’s Qualification Statement, may be used in the pre-qualification stage of the open bidding process to help the architect and the owner assess a contractor’s suitability for the project. When completed, the document provides full details of the contractor’s business record, including business history, organization and scope of operations, past record of construction work (type, range of experience, etc.), trade and bank references, bonding company, and details of assets and liabilities.
Preparing the Bid Package
To facilitate contractor selection, the owner may fill out AIA Document G612™, Owner’s Instructions to the Architect Regarding the Construction Contract. The information in this document is intended to provide information to the architect that will clarify the owner’s requirements and preferences. Once bidders have been identified, a package of information concerning the proposed project is issued. The package includes the following:

- Invitation or advertisement to bid
- Drawings and specifications
- Bid form
- Notice to Bidders
- Instructions to Bidders
- Proposed contract documents
- Bid security details (if required)

Invitation or Advertisement to Bid
The original invitation or advertisement provides a concise summary of the project. The law usually requires public work to be advertised in generally available publications. Private clients may choose to advertise in trade publications or other venues, depending on the nature of the project.

Drawings and Specifications
These documents should be as complete and unambiguous as possible to make it possible for the contractor to bid accurately. They are sent free of charge to bidders. To ensure that unsuccessful bidders return the bidding documents, a deposit is usually required; this is returned upon receipt of outstanding documents. The number of sets for each bidder varies; two may be appropriate for smaller work, while larger projects may require three or more. Projects that are more complex or under time constraints may require extra sets. The architect can require additional payment for the extra work necessary to produce multiple sets. Similarly, if any of the bidders ask for extra copies, these may be provided at the bidder’s expense.

Pre-Bid Conference
Depending on the nature of the project and client preferences, a conference for potential bidders may be useful. Walter Rosenfeld, AIA, CSI, offers the following advice in the 13th edition of The Architect’s Handbook of Professional Practice:

A pre-bid conference, held two or three weeks before bids are due, may be valuable for several reasons. It focuses potential bidders on the project, allows the architect to reiterate key points in the documents, and (if held at the site) gives bidders an opportunity to visit the site. An agenda might include the following items:

- Project background
- Confirmation of bid date and procedures
- Further explanation of alternates
- Identification of special issues or working conditions
- Any update on the post-bid schedule
- Questions and observations about the project

For the owner and architect, such a meeting provides an indication of contractor interest in the project. It may disclose questions or issues that require clarification or additional information, which results in an addendum to the bid documents. (Many architects report that they do not answer any such questions at the pre-bid conference, both to provide time for a full answer and to be sure that all bidders receive the same answer.) On occasion the pre-bid conference may uncover a significant gap in the documents or bidding procedure—a gap that is much easier to address during bidding than after all the proposals have been received.
Bidder’s Representations

According to AIA Document A701™, Instructions to Bidders, the act of making a bid represents the following:

- **Alternates.** An alternate bid may be required or accepted for a specified section of the work, and this should be included in the calculation of the base bid. This procedure can help keep costs within budget but should be used sparingly. It should not be employed to give one bidder preference over the others.
- **Unit prices.** Unit prices supply a price per unit for materials and/or services. They offer the architect and owner a comparable means of measurement to use in comparing bids. Unit prices also provide an idea of price calculation for unknown quantities or variable factors. Use of this approach should be limited if the overall budget needs to be controlled.

**Bid Form**

This form is sent to all bidders and contains relevant information concerning the project. Each bidder returns the document complete with the price of the work, or base bid, and any other figures that may be appropriate (e.g., alternate bids, substitutions for specified materials or services, etc.).

**Notice to Bidders**

This notice, which may be included in the bidding documents, informs prospective bidders of their opportunity to bid and of the conditions and requirements involved.

**Instructions to Bidders**

AIA Document A701™, Instructions to Bidders, provides relevant information concerning the detailed requirements of the bidding process. Included are the following items:

- Definitions
- Bidding documents
- Consideration of bids
- Owner-contractor agreement
- Supplementary instructions
- Bidder’s representations
- Bidding procedures
- Post-bid information
- Performance/labor and material payment bonds (see bid security below)

**Proposed contract documents**

All documents intended for use in the proposed project should be sent to each bidder for examination, including the general conditions (e.g., AIA Document A201™, General Conditions of the Contract for Construction) and any other applicable addendums or supplementary conditions. A new edition of the contract was published in 2007 with changes to contractor and client responsibilities, which should be checked carefully.
Bid security
In order to ensure each bidder’s commitment to their base bid and willingness to fulfill their obligation to sign the contract if they are selected, the owner may require some form of security, which should be submitted along with the returned bid form. The security might take the form of cash, a certified check, or a bid bond (AIA Document A310™, Bid Bond).

The bid security could be expressed either in a lump sum or as a percentage of the base bid. Bidders usually prefer the former, as it does not reveal their bid before opening. This amount is usually not less than ten percent of the bid amount. A successful bidder that refuses to undertake the work for the bid specified may forfeit all or part of the security. The penalty amount is usually determined as the difference between the selected bid and the next lowest bidder, although the penalty cannot exceed the amount of the security.

During Bidding
AIA Document A701™, Instructions to Bidders, sets forth some commonly used bidding procedures, including the provision of information for use by contractors in preparing and submitting their bids. The summary below reflects these bidding procedures, although of course other procedures may be used to reflect a project’s unique requirements. After the bidding documents have been mailed, it may be necessary for the architect to modify the bidding documents before bids are due. Once bids have been submitted, a bid opening is held and the final selection of the contractor is made.

Modification of Bidding Documents
The owner if necessary may request certain adjustments to the documents before the closing date for bid submission. These are usually in the form of interpretations or substitutions.

Interpretations
If any bidders discover errors or ambiguities in the documentation, they must inform the architect in writing at least seven days prior to the submission date. The architect issues any changes or addenda that result from the inquiry to all bidders.

Substitutions
Should any of the bidders wish to substitute materials or services otherwise specified in the bidding documents, the architect must receive a request for approval in writing at least 10 days before the submission date. If the architect determines the substitution is acceptable, all parties are notified by addendum, although no addendum can be made within four days of the final receipt date except a notice canceling or postponing the request for bids.

Submission of Bids
Bids must be received in writing, contained in sealed, opaque envelopes prior to the time and date specified in the advertisement/invitation to bid. Oral bids are not acceptable, and any bids received after the specified time should be returned unopened.
Bid Opening
If the bids are opened in public they are often read aloud. When bids are opened in private, the bidding information may be sent to all bidders at the owner’s discretion. The owner need not accept any of the bids if they appear too high and may reject any bid not in conformance with the stated requirements. However, the bidding documents do provide that if a contractor is chosen, it will be on the basis of the lowest responsible bid. A decision is usually made within 10 days of the bid opening.

In publicly bid work, the owner is often constrained by law to accept the lowest responsible bidder and thus may be held liable if the selection does not conform to that requirement (i.e., the lowest monetary bid, coupled with the owner’s satisfaction that the contractor can successfully undertake the work). In privately bid work, the owner’s obligation to accept one of the bids is not as clear, particularly when an owner has specifically reserved the right, in its sole discretion, to accept or reject bids. However, even when there is no legal obligation to accept a certain bid, owners may feel compelled from a business standpoint to select the lowest bidder to prevent suspicion of favoritism and avoid ill feeling among contractors with whom they may want to work in the future.

Contractor Selection
Prior to the bid opening, any bidders may withdraw or modify their bids. However, once the bids have been opened, bidders cannot make changes or withdraw from the process for a period stipulated in the bidding documents (e.g., 30 days). Once selected, the successful bidder must undertake the work for the agreed price or risk forfeiting the bid bond (if any). Exceptions to this are sometimes made if a bidder can prove substantial error in the bid calculation, in which case withdrawal might be appropriate, with award of the contract to the next lowest bidder. Alternatively, the contract may be re-bid. Defaulting bidders should be disqualified from any further bidding on the same project, and no bid correction should be permitted, except for minor clerical errors and alterations.

After Bidding
When a contractor has been selected (usually within 10 days of bid opening), all bidding parties should be informed of the decision. Unsuccessful bidders are often given a list of the bid figures, and the bid deposits are returned once the contract documents have been returned. The successful bidder should be informed of the decision in a way that does not form a legally binding agreement before the contract documents are signed. Usually, the bids of the next two or three lowest bidders are retained for a specified period as a contingency measure.

At this stage, each party to the proposed building contract may provide further information and/or assurances to the other parties. For example, the owner may, upon request, demonstrate to the contractor that sufficient financial arrangements have been made to undertake the project. The contractor, typically within seven days of the contract award, should furnish names of proposed suppliers of materials and equipment, details of the amount of work to be undertaken by the contractor’s forces, and a list of

resources
Owner-Architect and Owner-Contractor Agreements
For more information about owner-architect and owner-contractor agreements, consult the following resources:

- Chapter 16 Types of Agreements

- Chapter 11 Contracts and Agreements

- Chapter 11 Types of Agreements
intended subcontractors for the architect’s approval. The contractor may also be asked for a qualification statement (if appropriate and not required prior to selection), evidence of the responsibility and reliability of the work force, and bonds in accordance with the owner’s requirements as expressed in the instructions to bidders.

When these and any other preliminary matters have been dealt with and the contracts prepared, the owner and contractor are ready to enter into the contractual agreement.

**After the Agreement**

As soon as practical after the owner-contractor agreement has been signed, the contractor should submit a list of proposed subcontractors and suppliers to the architect. Under the single contract system, it is not unusual for prime contractors to sublet parts of the work to other contractors, either because of the size of a project or to take advantage of special skills and expertise the subcontractors have to offer. The contractor may select suitable subcontractors, and the owner typically cannot require a contractor to work with anyone about whom the contractor raises reasonable objections.

The architect or the owner may lodge reasonable objections to any of the names on the contractor’s list of subcontractors, but such objections should be made promptly so the contractor may submit a substitute. If the substitution is acceptable, the contract sum can be adjusted by change order to accommodate alterations in cost caused by the substitution. The contractor should not change any subcontractors for a project without the knowledge and approval of the architect and the owner.

If AIA owner-contractor agreements are being used and subcontracting is expected, it may be advisable to use a standard form of subcontractor agreement. AIA Document A401™, Contractor-Subcontractor Agreement Form, can be used in conjunction with other AIA documents.

Subcontractors may, in turn, engage other contractors, termed sub-subcontractors to work on a project. The relationship between these parties is similar to the relationship between the contractor and subcontractor, although the prime contractor still has overall responsibility to the owner for the project.

**Practical and Legal Safeguards**

What practical and legal issues are associated with bidding? On the whole, comparatively few legal cases provide guidance about an architect’s liability originating from errors in bidding. Despite this relative dearth of legal authority, architects can take at least some steps to protect themselves from claims by clients, contractors, or subcontractors and to protect the owner’s interests during the construction phase.

**Quality Documentation**

Court cases involving contractors’ claims based on misinterpretation or inadequate documentation highlight some of the problems an architect may cause or otherwise encounter. Hazy documentation, for example, may induce bidders to build substantial contingencies into their base bids. This could leave an architect...
open to claims for inadequately estimating project construction costs. Some courts have ruled against architects when bids exceeded estimates by as little as fifteen percent, or even less. This is worrisome considering that professional liability insurance often does not cover errors in cost estimating.

When there is limited preparation time, or when owner requirements are uncertain, clarity in documentation may be difficult to achieve. However, clear and carefully produced construction documentation allows for greater precision in bidding and thus a more realistic construction cost.

Other aspects of bidding that can affect cost include requests for alternate design bids and for unit pricing. Architects should exercise special care whenever these optional bidding devices are under consideration.

**Clear Rules**

Courts have ruled on a number of occasions that owners do not act in good faith when they make what may appear to be arbitrary selection decisions. In one example, an owner decided to award a contract to the second lowest bidder because it was a local corporation. A court ruled this decision invalid because locale was not initially listed as a criterion.

To avoid this type of situation, your notice to bidders and instructions to bidders should be stated very clearly. Be sure to mention every factor you and the owner will use to select the winning bid. In addition, exactly the same data should be sent to all bidders, including any clarification requested by one of the bidders prior to bid opening.

**Strict Adherence to Procedures**

Once the bid package has been released with its clear requirements, strict adherence to selection procedures will also often help the owner and architect avoid the appearance of unfairness or competitive advantage. Any action that smacks of collusion between the owner or the architect and one of the bidders invites suspicion and perhaps a lawsuit, especially in publicly bid work.

The procedures for bidding laid out in AIA Document A701™ offer a series of orderly steps and safeguards that protect the owner and, by implication, the architect from unqualified contractors. At the same time, they provide bidders with an even playing field. Public sector procurement procedures are often similarly designed, and are usually quite specific to help ensure fair and open competition.

To demonstrate fairness, valid bids can be opened in public and late bids returned unopened. The question of what constitutes a late bid has been the focus of a number of court cases brought by disgruntled bidders who felt a late bid gave a competitor an unfair edge. In one case involving a federal project, acceptance of a bid 30 seconds after the time of bid opening was held to be invalid. While some flexibility may be acceptable in special circumstances—mail delivery problems, perhaps—the architect should advise the owner of problems that may result from accepting late bids.
Cautious Rejection of Bidders
Some suits have been brought against design professionals who counseled against hiring particular contractors. In one case, an engineer’s opinion rendered in good faith helped fend off a suit from a bidder the engineer felt lacked sufficient experience to do the work. However, courts have ruled against an owner who decided the lowest bidder was insufficiently responsible based solely on rumors of poor performance or who did not solicit sufficient information on a hitherto unknown contractor. These decisions were based on the concept that the owner exercised insubstantial reasoning in rejecting the contractor. Owners are expected to consider a contractor’s recent performance to verify if earlier problems have been addressed.

An architect who chooses to advise an owner to reject a contractor with the lowest bid should do this with great care, especially in publicly bid work. Architects’ advice on hiring will be most defensible if it is based only on objective, factual considerations and is free of any conflict of interest. When an architect recommends rejection, it is best to record in writing the data and reasoning that led to this decision. Avoid sweeping personal statements and slander. Also make it a point not to record statements that, however innocently intended, may come back to haunt you.

A similar approach should be adopted when an architect demands substitution of a subcontractor. It is estimated that very few architects actually take advantage of their contractual ability to object to subcontractors or suppliers proposed by a contractor. If this power is invoked, however, the rationale for substitution should be clearly and objectively articulated to limit the possibility of a claim from a disgruntled rejected subcontractor.

Contractor Selection and Alternate Delivery Methods
Design-bid-build is just one of many project delivery approaches used today. Following are brief descriptions of the major alternatives:

Design-Negotiation-Build
An owner may choose to select a contractor on the basis of reputation, specialized expertise, or a past working relationship. In this arrangement, the owner negotiates the terms of the agreement and payment for the work, forgoing the advantage of having the project competitively bid.

Owners choose this delivery method when project requirements justify it, for example, when quality rather than economy is a major determinant. In other circumstances, it may be advantageous to skip the bidding process to get construction underway more quickly. Negotiation can also make it possible to bring a contractor on board before contract documents are complete, which may provide benefits in terms of coordination and communication among the owner, architect, and builder. Usually, a cost plus fee contract, in which the contractor is reimbursed for the cost of doing the work, with a separate fee for overhead and profit, is used for this project delivery method.

Design-Build
The design-build approach, where the owner contracts with a design-builder to provide both the design
and construction of the project, is becoming more popular. Architects and contractors may join forces, perhaps through a strategic alliance, to compete for a specific project, or they may establish a design-build firm. A design-build team may be led by the architect or the contractor, although the latter arrangement is more common. The design-build entity may also be a design-build company with architects and contractors under one roof.

Depending on how the agreement is written, professional liability exposure for an architect in design-build delivery may be greater than, the same as, or less than in traditional design-bid-build delivery. The onus is typically on the owner to select and manage the design-build team. In design-build, the design-builder cannot make a claim to the owner for defects in the plans and specifications, since the design-builder is responsible for creating them with its own architect. Thus, the architect is not liable to the owner for errors and omissions in its design, but may be liable to the design-builder.

In design-build, the architect and builder work together from the beginning of the project, allowing them to work out constructability issues early and more easily fast-track the project. The advantages of design-build: time-savings, efficiency, and reduced risk of claims to the owner, are not guaranteed; but, if the design-builder and the architect have a good working relationship, it will be more likely to attain these advantages.

**Construction Management**
As construction projects have become larger and more intricate, and the design and construction industry has fragmented into ever-greater specialization, new roles have emerged simply to cope with all that complexity. A construction management (CM) approach to project delivery is designed to address these issues. In it, the architect can serve the owner in one of three distinct roles:

- **CM-adviser:** Under a separate and distinct contract with the owner (but not with the architect or contractor), a CM-adviser provides expertise to owners on issues of project scope, constructability, and procurement and management of design and construction services, including contractor selection. The owner gains impartial advice, but must now manage three distinct contracts instead of one or two.

  The addition of a CM-adviser works well with the separate design and construction increments of the design-bid-build and design-negotiation-build approaches. On the other hand, it creates potential redundancies and conflicts with the role of the architect in a variety of matters, including contractor selection. It is critical, therefore, to carefully define the CM-adviser’s roles and responsibilities in the contract formulation stage. The CM-adviser may incur liability for input affecting building design and construction.

- **CM-agent:** A CM-agent provides a single point of contact for the owner with an entity that is empowered to act on the owner’s behalf, including having the fiscal authority to contract directly with an architect and builder. An owner who is unusually distant from a
Five Factors to Reduce Risk in Project Delivery

Useful guidance for establishing a sound contractual basis for effective working relationships and overall risk management can be found in Ava Abramowitz’s book *Architect’s Essentials of Contract Negotiation*. Her advice covers working with savvy clients and other experienced parties to the contract and “front-end alignment” of goals and processes among project participants. Her analysis of a two-year study of risk management factors for A/E firms, carried out by Victor O. Schinnerer & Company, highlights key risk factors specifically associated with project delivery and contractor selection. Risk management in the transition from design to construction requires thinking about more than which mode of contractor selection and project delivery to choose. According to Abramowitz, five “claims preventers” are more important than the project delivery method chosen:

1. **Experience with the Project Delivery Approach**
   Experienced people succeed, more often than not, because they can anticipate and address problems faster and better than those who are new to a situation. This is one reason everyone should think twice before proposing delivery systems (or contracts) with which few people are familiar.

2. **Architect Involvement in Selection of Contractor or CM**
   Since construction contract documents are never complete, construction will go more smoothly if the contractor, or construction manager (CM) if there is to be one, can work effectively with the architect to bring the construction documents to life. This is why so many claims-free firms volunteer a list of good contractors or CMs from which the owner may invite bids. Some of these firms charge a lower fee for construction contract administration services when the contractor or CM is selected from their “recommended” list. Alternatively, they may add a surcharge for construction contract administration when the owner selects a contractor not on their list.

3. **Qualifications-Based Contractor Selection**
   The data suggest that contractors selected on the basis of qualifications, rather than bid price alone, perform better. The federal government and some states are beginning to recognize the value of qualifications in the contractor selection process. The U.S. Army Corps of Engineers, for example, increasingly uses a “best value” approach to contractor selection. The Corps decides which contractor skills and qualifications are necessary, assigns a weight to each of these, and make its selection accordingly. Cost is invariably a measure in contractor selection, but it no longer needs to be the controlling one.

4. **Early or No CM Involvement**
   Data show that the presence of a CM increased the number of claims for the firms studied and, albeit to a lesser extent, increased the losses from those claims. This is not an anti-CM statement. Often, having a CM can make all the difference; however, in many projects, CMs are brought in too late to have their ideas and expertise incorporated into the A/E’s thinking. When that happens, all the CM can do is “undo” the design that was bid on, under the guise of value analysis. In fact, according to Schinnerer data, the later in the process value analysis is introduced, the more likely it will cause a claim. Even when CMs are brought into the process early, they are other parties who add their own ideas and objectives to the project, adding one more set of risks to be managed.

5. **Adequate Schedule**
   Undue speed can cause problems. There is nothing inherently wrong with fast-tracking a project, but fast-tracking without the careful detailing of an agreed-upon program and scope of work can be dangerous. Designs implemented at one stage may prove insufficient later. This is especially true if the parties’ understanding of the project objectives or design parameters change over time.
project, such as a corporation building in a foreign country, might use this approach. The approach is used infrequently in the public sector because of the granting of fiscal authority.

In terms of contractor selection, the role and responsibilities of the CM-agent and those of the project architect need to be clearly defined to avoid potential conflict. Insofar as a CM-agent acts on behalf of the owner’s interests, he or she may incur liability in addition to that for design and construction decisions.

- **CM-constructor:** The construction-manager-as-constructor delivery method enables the construction manager to assume all the responsibilities and liabilities of a general contractor. The approach is similar to traditional project delivery in that it maintains a contractual relationship between the owner and architect. It also offers some of the benefits of the CM-adviser approach by bringing advice on cost containment and constructability early on in the process. The architect works separately with the owner to develop documentation that delineates the scope, functional requirements, and aesthetics of a project. These scope-of-work documents can then be used either to competitively bid or to negotiate the selection of the CM-constructor, and the CM-constructor architect assists the owner in this process. The CM-constructor’s and the architect’s responsibilities for design and construction decisions must be carefully delineated in the contract documents.

**Integrated Project Delivery**

In recent years, Integrated Project Delivery (IPD), which is made possible by sophisticated Building Information Management (BIM) has become the focus of much discussion. With IPD, the architect, consultants, contractor, owner, fabricator, and subcontractors joint own a 3-D computer model of the project. Everyone shares in the liability, and collaboration among all parties begins from the inception of the project. Each party shares its expertise as well as the risks and rewards. The IPD approach lends itself to design-negotiate-build and design-build delivery, but as defined above, is less practicable for traditional design-bid-build projects.

Written by Brian K. Schermer, PhD, RA  
Brian Schermer is an associate professor of architecture at the Department of Architecture at the University of Wisconsin-Milwaukee.

Written by Robert Greenstreet, Int. Assoc. AIA, RIBA  
Robert Greenstreet is an architect currently serving as dean of the School of Architecture and Urban Planning at the University of Wisconsin-Milwaukee.
notes

Take brief notes while reading the narrative and list key resources you used to complete the activities. Note discussion outcomes from meetings with your supervisor, mentor, or consultants. When finalizing the activity documentation (PDF), include your notes and the Emerging Professional’s Companion activity description.
Learning from AIA Bidding Documents
Supplemental Experience for eight (8) Core IDP Hours

AIA Contract Documents provide a detailed, generally accepted procedure for contractor selection with which all entrants should become familiar.

Download sample copies of the following AIA Contract Documents associated with the bidding process and review them for consistency with the concepts presented in the narrative.

- A305™, Contractor’s Qualification Statement
- A310™, Bid Bond
- G612™, Owner’s Instructions to the Architect Regarding the Construction Contract
- A701™, Instructions to Bidders

Activity - Core

Take a look at file copies of as many of these documents as you can for a project that your firm or a mentor’s firm has completed recently. Write a summary answering the following questions:

- Which documents were utilized?
- Were there any changes that your firm has made in following standard bidding and contract negotiation procedures as detailed in the documents and described in the narrative?
- What was the purpose behind those changes, and did they positively or negatively affect the outcome of the bidding process in terms of minimizing your firm’s liability or the overall success of the project?

Write a report summarizing your conclusions. Be sure to note any potential pitfalls, problems or challenges you feel a project manager should be aware of, based on your analysis of both the documents and the file copies.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Completion of Bid Forms for a Project
*Supplemental Experience for eight (8) Core IDP Hours*

With the help of the project manager in your firm or an IDP mentor, find a set of drawings that were issued for bid, completed bid forms, and any addenda that were issued in your firm’s archives. Do not review the addenda or forms just yet.

**Activity – Core**

With the bid drawings you found as the basis, complete your own set of bid forms for the project. Review the drawings carefully and decide what, if anything you should include in an addendum to be issued to the bidders.

Compare what you have to what was done for the original project. Make any necessary adjustments to what you have prepared.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Prior to contractor selection, potential bidders may attend a pre-bid conference to ask specific questions about the project. Their perspectives are useful in gauging their concern about the procedures that will involve them in considering their bids.

**Activity - Core**

Arrange to attend a pre-bid meeting in your area and take notes on the proceedings.
- What kinds of questions come up?
- How do the participants behave?
- Do they appear to use their questions to posture and jockey for advantage, or do they simply want to get their questions clarified?
- Does the process appear to follow to the steps, suggestions, and requirements described in the narrative of this chapter?
- If the process strays from what is described in this chapter, does it put the project and the participants at risk?

Write a memo to the individual conducting the pre-bid meeting summarizing your observations and outlining five questions asked by the contractors with your proposed responses. Include recommendations on how to make the next meeting for a similar project better.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Attendance at a Public Bid Opening

Supplemental Experience for eight (8) Core IDP Hours

After all of the proceedings have been put into place and the bidding contractors have proposed their bids, the bid opening brings the process to an abrupt, and hopefully productive, conclusion. Obviously, stakes can be high, so the procedures must be followed carefully.

Activity – Core

Attend a public bid opening in your area and take notes on the proceedings. Be sure to arrive 30 to 60 minutes early so you see the process from start to finish.

• How many people arrived early? How early did they arrive?
• Were any questions asked?
• How did the bidders behave?
• Was the opening what you expected? How did it differ and why?

After the meeting concludes be sure to observe any side conversations amongst both the high and low bidders. Prepare a report that summarizes your observations. Include overall comments from the bidders and any obvious reasons for their comments. Also include aspects of the bid opening that were handled well and which were not. Make any recommendations for improvement.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Project Delivery Approaches

*Supplemental Experience for eight (8) Elective IDP Hours*

Every project will exhibit its own characteristics and challenges and it is important to become familiar with as many examples as you can.

For this activity, gather information about completed building projects or projects in progress from several supervisors and project managers at your firm or your mentor’s firm. Choose at least three projects (preferably using three different project delivery methods, if possible).

**Activity - Elective**

Record information on how contractors were selected for each project using the following suggestions as a basis for your research:

- Identify the strategies used to select contractors for each project.
- Characteristics of the projects associated with each project delivery method, including project type, size, complexity, and client experience.
- Find out what you can about the bidding and negotiation processes. For example, find out how many bidders there were, what they bid, and which contractor was selected.
- How did the bids compare to the original estimates?
- Try to determine how the selection process set the stage for the successful completion of the project or for subsequent difficulties.
- Would the project outcome have been dramatically different if another mode of delivery had been used?
- Did any ethical dilemmas arise? Any issues of legal liability?
- What did your firm do well in the process? Did the firm do anything questionable or worth rethinking?

Write a report summarizing your review of the three case studies. Create a chart or matrix for quick reference for later use.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Design Without Compromise & the Bid Package
Supplemental Experience for eight (8) Elective IDP Hours

In this scenario, you are working with a private foundation to design offices for its national headquarters. The board of directors agrees in principle with your vision of an environmentally sustainable building, although board members voice some concern about additional up-front costs related to certain features. You believe it is better to send the project out for bid with the sustainability design concepts fully intact and to deal with the inevitable compromises and value engineering later. The bids arrive and they are, to your client’s dismay, much higher than anticipated. In a letter, the board expresses profound disappointment in your leadership and professional advice. The letter contains the veiled threat of a lawsuit. You learned in school that a project needs a strong design concept to withstand the inevitable erosion that is part of getting a building built. In this case, though, your strategy for getting the project past the bidding stage without compromise seems to have backfired.

Activity - Elective

In a letter to your client, communicate what you can do to salvage the project and your relationship with the client. Does AIA Document B101™, Standard Form of Agreement Between Owner and Architect, offer any guidance? Download a sample copy of AIA Document B101™.

Consider questions such as these:
• Should you revise the drawings at your own expense?
• How might you have structured the contractor selection and/or bid package to deal with what you now realize is a very unpredictable bidding environment?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Rebar Construction Revokes its Bid

Supplemental Experience for eight (8) Elective IDP Hours

In this scenario, three weeks after the public bid opening for a public parking garage project, Rebar Construction informs you and your client that its bid contains an error significant enough to raise the price above that of the next lowest bidder. Based on your previous experience with the contractor, you suspect that Rebar has obtained another, more lucrative contract, and that it is concocting the error to get out of the parking garage job. Rebar insists that it made an honest mistake and cannot be held to the bid.

Activity - Elective

Download a sample copy of AIA Document A701™, Instructions to Bidders. Review the document and prepare a memorandum to the client addressing the following questions, and explain the reasoning behind your answers:

• Should Rebar be held to its original bid?
• Does Rebar need to prove that they made an honest error?
• Should the contractor be allowed to adjust the bid?
• Should Rebar be liable for the cost of the difference between its original bid and the next lowest?
• How would you frame the options for the client, and what are the potential consequences of each course of action?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
In this scenario, your practice was retained to design a new elementary school for the local school board. A budget of $7,000,000 was set at the outset of the project, and you followed through with a comprehensive cost control program during design. You are confident a bid or bids will be received below budget. Two days ago, you attended the bid opening at the school board’s offices. You analyze the bid results in Exhibit 3A-1 and prepare a report for your client.

In the meantime, however, you have received a letter from the chairman of the school board (see Exhibit 3A-2).

Activity - Elective

All you have to work with is the bid tabulation summary as the detailed analysis has not yet arrived from the client. You are under pressure to respond immediately. Write a response to this letter containing the following:

- Your explanation of the gap between the low bidder and the remaining bidders
- A recommendation of whether to accept or reject the low bid
- If the low bidder is accepted, special precautions the owner should take
- If that low bidder is not accepted, address how you would deal with a likely protest from the low bidder
- Additional steps you would recommend and the time necessary to make a final recommendation to the owner.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
In this scenario, your client, Green Valley Center for the Performing Arts, has been planning a new facility for nearly ten years. The budget has always been tight, and the scope of the building program ambitious. It includes a theater, recital hall, dance studios, classrooms, and numerous ancillary facilities that will combine to make this the premier performing arts institution in the region. Unfortunately, about 24 months ago fundraising began to lag because of a slow regional economy, and you had to place the project on the shelf. But now Green Valley is back—they have achieved their fundraising goals and are ready to put the project out to bid. You are impressed by their perseverance, but you have to tell them that the local construction market is now bustling, and the bidding climate does not look favorable. You expect the bids to come in high, perhaps as much as 20 percent higher than you would have anticipated two years ago.

Determine how the bidding package could be structured to help the clients realize their dream. Explain in a memorandum to the client how the bid package might be restructured using alternates to successfully select a contractor. What are the major strategies you would suggest to your client? What other cost savings could you recommend to them?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
During the bidding process there are procedures that must be adhered to strictly. These procedures are often very clear and somewhat scripted for public works.

Activity - Elective

Research the public bidding process within your jurisdiction. Interview a project manager within your firm or your mentor’s firm about bidding procedures for private sector work. Write a report comparing and contrasting the two types of procedures. Be sure to note what procedures are consistent across both areas of bidding. Include which process you believe is better and why.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
In this scenario, the contractor for a publicly bid state correctional facility project has submitted a list of subcontractors for the job. You feel compelled to object to one of them, Flicker Electric. In your experience, Flicker bids low and tries to make up the difference in change orders. The company often complains about lack of coordination among the architectural and engineering drawings and specifications. They have delayed more than one job because of their unreliability, and they have a penchant for damaging the work of other subcontractors and then denying responsibility. The owner, Will Flicker, is unpleasant, and you would like to avoid working with him. The problem is that eliminating Flicker will almost certainly raise the base bid above that of the next bidder.

Activity - Elective

Write a memorandum to the contractor that rejects Flicker Electric, while protecting your firm from liability and preserving the integrity of the public bidding process. Be mindful of specific pitfalls you must avoid in discussing your objection, specifically, inaccuracy, subjectivity, and hyperbole.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
**Bidding Error on the Up and Up?**

*Supplemental Experience for eight (8) Elective IDP Hours*

The following case was adapted from Barry Wasserman, et al., Ethics and the Practice of Architecture (John Wiley & Sons, 2000).

In this scenario, you are hired by a small city to provide design and construction administration services for a new elementary school building. Knowing that the $1.2 million budget for the project is tight, you work with the client to provide maximum flexibility to adjust the scope of the project by including two additive alternates and five deductive alternates. Five contractors bid on the project, and the bids are announced in public at your office. Representatives from all five bidders are present. The lowest bidder is Sound Construction. It is awarded the contract on the basis of its base bid; even with the additive alternates, Sound Construction is the lowest bidder.

The next day, Sound Construction calls to inform you that its electrical subcontractor has made a serious error, omitting the cost of light fixtures. The total error is $20,000, enough for Sound Construction to seek to add the amount to its original bid. Without the addition, Sound will have to withdraw its bid entirely. Even with the additional $20,000, Sound Construction’s bid is still be the lowest. Your firm has worked with Sound Construction before, and you believe the company is honest. You have never worked with the second lowest bidder.

Prepare a recommendation letter to the client summarizing the situation and answering the following questions. Be sure to explain the reasoning behind your answers:

- Should Sound Construction be allowed to adjust its bid? Provide reasons.
- Should you tell Sound Construction that its bid cannot be changed or withdrawn?
- Should you declare the lowest bid invalid and force the owner to accept the second lowest bid which would obligate the owner to pay more for the project?
- What ethical considerations, if any, are due to the bidders?
- How does the fact that this is a publicly bid project complicate the decision?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
The Late Bid

*Supplemental Experience for eight (8) Elective IDP Hours*

In this scenario, at precisely 12:01pm, the municipality of River City, Iowa commenced with the opening of bids for the construction of a new library. All bids were due exactly one minute earlier at noon that day. At 12:10pm, one of the local contractors, Harold Hill of Hill Construction, burst into the hearing. Apologizing for his tardiness, Mr. Hill handed his sealed, opaque envelope to the city official who was opening the bids and reading them aloud. “There was a rehearsal of the marching band blocking Main Street, just as I was approaching City Hall,” he explained. The city officials and Marian, the librarian, look to you for guidance. You sense an impending lawsuit from Hill if you recommend disqualifying his bid, or from the other contractors if you do not.

**Activity - Elective**

What is your advice to River City, and what specific legal and contractual points support your position? Write your answer in the form of a pre-emptive letter to your attorney.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
### Exhibit 3A-1

#### Bid Record
New Elementary School—Record of Bids Opened

**Date:** 11 May 2007  **Time:** 3:00 pm  **Prepared by:** O. Jones  **Package No.:** 1

**Location:** Fairfax County  **Contract Title:** R. Ramsey Elementary School

<table>
<thead>
<tr>
<th>Contractor</th>
<th>Bid Amount</th>
<th>Rank</th>
<th>Bid Bond Amount</th>
<th>Bid Bond Type</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yardstick Contractors</td>
<td>7,276,000</td>
<td>4</td>
<td>5%</td>
<td>X</td>
<td>See Bid Analysis form for record of addenda received, alternates, unit prices, list of subs.</td>
</tr>
<tr>
<td>The Griffin Construction Co.</td>
<td>7,200,000</td>
<td>3</td>
<td>5%</td>
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</tr>
<tr>
<td>Cook-Richards Co.</td>
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<td>5%</td>
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</tr>
<tr>
<td>Prince Builders</td>
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<td>X</td>
<td></td>
</tr>
<tr>
<td>Bucknall-Austin Co.</td>
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<td>5%</td>
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<td>Jones &amp; Jones Estimate</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School Board Budget</td>
<td>7,000,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Bid opening committee:**

O. Jones (Jones & Jones)  
R. Smith (School Board)  
B. Lang (School Board)
FAIRFAX COUNTY SCHOOL BOARD

11 May 2007

Mr. O. Jones
Jones & Jones Architects
1021 Z Street
Washington, DC 20020

Re: R. Ramsey Elementary School

Dear Mr. Jones:

I have been instructed by the School Board pursuant to the receipt of bids on this project on 11 May 2007, to request that you to carefully analyze the situation and recommend to the Board the action that we should now take.

While we are of course pleased that the low bidder is below your estimate and our budget for the project, we are very concerned that the second bidder is 14% higher and appears to be in a bracket with two other bidders. This might indicate the inability of the low bidder to complete the work for the price quoted.

We have no need to remind you of the seriousness of our budget situation in the event that the low bidder is not acceptable. On the other hand, we have no wish to contract with a party incapable of completing their side of the bargain. We look forward to your recommendations.

Yours sincerely,

Chairman of the Board
notes
Take brief notes while reading the narrative and list key resources you used to complete the activities. Note discussion outcomes from meetings with your supervisor, mentor, or consultants. When finalizing the activity documentation (PDF), include your notes and the Emerging Professional’s Companion activity description.
Construction Administration

introduction

activities - core*

- Understanding Procedures of the Change Process

*A maximum of 40 hours of core credit may be earned in this experience area.

activities - elective

- Understanding Construction Phase Activities & Project Communications
- Questionable Stored Materials
- Tracking the RFI Process On-Site
- Impartial Determination of Substantial Completion
- Determining Construction Phase Workload
- Determining Construction Phase LEED Certification Responsibilities
- Negative Results from Late Wind Tunnel Test
- Saved by a Scope Change?
- Solutions for a One-Inch Code Violation
- Processing an Unacceptable Substitution Request
- Certification of Nonconforming Work
- Design Not Suitable for Use
- Forced Substitution of Skylights

exhibits

narrative
Introduction

By completing the activities in this chapter, you will gain an understanding of the activities involved in construction administration. The following information is taken from the NCARB IDP Guidelines:

Construction Administration
Minimum Construction Administration Experience: 240 Hours
Definition: Tasks carried out in the architect’s office include facilitating project communication, maintaining project records, reviewing and certifying amounts due contractors, and preparing change orders.

Tasks
At the completion of your internship, you should be able to:
- Respond to Requests for Information (RFI)
- Issue Architect’s Supplemental Instructions (ASI)
- Process shop drawings and submittals
- Process Change Orders
- Review and certify contractor’s application for payment
- Review material test reports
- Record changes to the contract documents
- Provide substantial and final completion services

Knowledge Of/Skill In
- Change order process
- Conflict resolution
- Construction conflict resolution
- Contractor application for payment
- Contracts (e.g., professional services and construction)
- Interpersonal skills (e.g., listening, diplomacy, responsiveness)
- Interpreting construction documents
- Managing quality through best practices
- Problem solving
- Product and material substitutions
- Project budget management
- Project closeout procedures
- Project records management
- Shop drawing review
- Site observation
- Team building, leadership, participation

Download the current Intern Development Program (IDP) guidelines at www.ncarb.org/Experience-Through-Internships.aspx.

- Chapter 12.5 - Construction Contract Administration
- Chapter 13.5 - Construction Cost Management

- Chapter 14.4 - Construction Cost Management
- Chapter 18.7 - Construction Management
- Chapter 18.9 - Construction Administration

- Chapter 8.5 - Construction Contract Administration
- Chapter 9.4 - Construction Cost Management
Construction contract administration services are the most time-consuming and record-intensive of all professional design services and delivering them requires patience and experience. Activities are time sensitive and carry increased legal ramifications. Efficient organization, timely execution, and thorough documentation are paramount for successful delivery.

Architects direct the exchange of project information and communications during construction and coordinate any architecture work to be executed at this stage in the project. They provide information to the contractor that cannot be fully discerned from the drawings and specifications, including information from other team members. In addition, the architect observes the work to determine that it conforms to the project design and reviews submittals, acting on them within a reasonable time to avoid causing project delays. Although architects tend to think of construction phase services as those provided on the project site, the majority of this work is performed in the architect’s office. Proficiency in and knowledge of the skills and responsibilities required to manage the architect’s construction responsibilities are as much a part of construction administration as walking the job site and interacting with the contractor.

For the individual practitioner, construction administration activities offer a chance to get out of the office. At the same time, many of these tasks must be performed in the office along with other projects that may be incubating in the computer. Among larger firms, a project may be transferred from the project management team to architects who specialize in construction administration when this phase is reached. Firms without dedicated construction administration departments typically rely on the project manager or project architect to execute these duties.

The Emerging Professional’s Companion presents construction administration services from the design-bid-build viewpoint, since this is the most commonly used method of project delivery. In this approach, the architect performs construction administration services directly for the owner. In the design-build delivery approach, on the other hand, the architect is typically a consultant to the contractor and communications and lines of authority align with this contractual relationship. Fast-track construction scheduling requires the architect to perform construction administration tasks more rapidly because of the compression and overlap of project time lines. More information on delivery approaches is available in The Architect’s Handbook of Professional Practice.

Team Relationships
The working relationship of the project team contributes to the effectiveness of construction administration services, both in the office and at the project site.

notes
Take brief notes while reading the narrative and list key resources you used to complete the activities. Note discussion outcomes from meetings with your supervisor, mentor, or consultants. When finalizing the activity documentation (PDF), include your notes and the Emerging Professional’s Companion activity description.
Within the Office

Project team makeup can be influenced by the size and organization of the architect’s office. An office without a construction administration department may realize fewer internal team changes during the construction phase because project staff assignments simply shift to accommodate the required services. While the project manager begins a regimen of trips to the project site, the team in the office provides support by helping with submittal reviews, document changes, and responses to requests for information (RFIs). The project designer, who also may be working on a new project, continues to play an essential role in design issues and the review of design-related submittals.

Before construction commences, make sure your contract with the owner includes required special services, such as a full-time project representative or special consultants. Services required in the owner-architect agreement that involve the architect’s consultants must be specifically called for in your architect-consultant contracts. The AIA documents family provides this pass-through of services in companion contracts such as B101™, Standard Form of Agreement Between Owner and Architect, and C401™, Standard Form of Agreement Between Architect and Consultant.

Although they are not project team members, staff members responsible for maintaining an architecture firm’s library of information on specifications and materials may also contribute to construction administration tasks. In particular, their cooperation is vital to the project team that must undertake research when the contractor needs a quick response.

Outside the Office

Friendly relationships that are beneficial both the architecture team and other project team members make for a smoother construction administration process. If owner, architect, and contractor forge a collaborative relationship, this attitude is likely to extend throughout the project team. The emergence of integrated project delivery is increasing the opportunities for a more collaborative management initiative.

Integrated project delivery involves early participation by the contractor in design development which allows the documents to progress more rapidly. Submittals can be prepared sooner, and documents can contain more information, requiring fewer clarifications. The end result is fewer RFIs, timelier submittal review and approval, and often an earlier construction start.

Another popular approach for achieving a collaborative relationship between the owner, architect, and contractor is “partnering,” this is a process in which the parties jointly confront and manage project risks and establish and promote a nurturing project environment. This relationship is established through structured meetings designed to define project issues and goals, team responsibilities, and other essential project concerns. Partnering sessions are typically managed by an outside facilitator experienced in the process.
A variety of additional owner-retained participants may be involved in work at the construction site. For example, some owners retain an in-house project manager, while others contract with a construction manager-adviser who specializes in construction. The banking or lending institution may want to monitor a project’s financial aspects. The owner may have contracts with contractors or vendors who are not administered under the owner-architect agreement. All of these participants may have full interaction on the project as it is constructed, and the architect’s job will be simpler if he or she develops good relationships with them.

**Project Communications**

Effective communications are necessary for project success because representatives of three entities (owner, architect, and contractor) are working together during construction. Multiple decision-makers can cause unnecessary work and frustration, not to mention potential miscommunication and delay. To keep things running smoothly, it is important to establish a protocol for communications, document routing, and lines of authority and review these procedures with all team members during the preconstruction conference.

The AIA documents require the owner and the contractor to communicate with each other through the architect about matters related to the contract for construction to ensure the architect is aware of all project communications. This requirement provides the architect with the information needed to fulfill his or her contractual responsibility to administer the contract between the owner and the contractor. It also alerts the architecture firm to actions or decisions that could adversely affect delivery of its professional services. The architect is required to certify that the construction, when complete, is in general conformance with the contract documents. If actions are taken or decisions made that would compromise the architect’s ability to fulfill this charge, it is important to be aware of this as early as possible and to notify the owner promptly.

In design-bid-build projects, the architect’s project manager is typically the primary project team contact with the contractor. Architecture firm staff members communicate with the project manager regarding their areas of specific responsibility, and the project manager passes information on to the contractor. Any consultants who work for the architect also communicate with the project manager rather than the contractor.

To clarify communications, the project manager usually asks the owner to designate a single contact for communications and approvals during construction. Other owner’s representatives assigned to the project and consultants working for the owner then communicate with the project manager. Nonetheless, the architect copies the owner’s team members on communications and correspondence in case they have authority that could affect the owner’s approval process.

The contractor also typically has a single representative who communicates with the architect about the project. Any subcontractors working for the contractor ask questions or provide information to this individual, who then confers with the architect’s project manager.
Interaction between the project designer and the project manager is essential when submittals arrive and critical decisions are required. Therefore, these team members are typically copied on site observation reports and key correspondence, and they may also attend project meetings. Other team members in the office who are knowledgeable about specific building components and designs may also be included in the submittal review process.

The accompanying flowchart illustrates the traditional communications protocol in design-bid-build project delivery. Although the owner has a contract directly with the contractor, communications between the owner and contractor are conducted through the architect to facilitate the architect’s responsibility to determine if the work is in accordance with the contract documents. Subcontractors and consultants, on the other hand, communicate through the holders of their contracts when passing information to other team members. This procedure allows the owner, architect, and contractor to be aware of and control their subcontracted work.

**Preparation**

Preparation in the architect’s office for construction administration activities includes compiling a complete set of construction documents, updating the office filing system and project team directory, and marshalling firm resources to support the project team.

An important management tool is the project database. This body of information contains the electronic history of the project to date. These systems can save much time when searching for historical data. Some company databases contain financial and labor data, which can be used to estimate service needs on future projects and to monitor profit status. A variety of management software is available, and the effectiveness and cost of these programs continues to improve.

The construction documents define the project scope, and the owner-contractor agreement requires that the finished work conform to the design. Errors or omissions in your documents convey a risk that could affect financial and professional stability. Therefore, it is vital that project documents be kept current and maintained in a safe and accessible location.

Project documents are only useful if you can easily locate the ones you need. It is wise to have a company filing protocol that is simple and adaptable so that all projects can be accessed uniformly. This will allow for
easy retrieval of documents in the future and make it easy to add documents relevant to the construction phase. Chapter 13.2 - Managing Architectural Projects, of The Architect’s Handbook of Professional Practice provides sample categories for use in naming files. At a minimum, you should have project files close by and be familiar with them. If a construction administrator will lead the project team instead of the project manager, hard-copy project files may be transferred to the construction administrator’s office.

Since documents today consist primarily of electronic data on a server, necessary safeguards must be imposed to back up the data and keep it safe. Many firms have developed a business continuity plan for this purpose. However, from a practical standpoint, the hard-copy set remains a useful tool. This is typically made up of all drawing sheets that have been published on the project since the contract for construction was signed.

AIA Document G807™, Project Team Directory, can be used to record contact information for project team members. When construction begins, add new participants to your project database. It is helpful to establish a list in your e-mail address file for distribution of project-related information. To make sure all project participants are included, check the owner-architect agreement for requirements regarding specific personnel. Also add any new owner representatives or consultants who will join the owner’s team during construction. The contractor’s team members should be introduced during the preconstruction conference. (Activities planned for the preconstruction conference are addressed in Chapter 3C - Construction Phase Observation, on page 388.)

Architecture firm staff members who become involved at the construction phase should also be added to the team directory. Internal communications and participation should be defined early. Firm activities could include special submittal routing, design review, and progress reporting.

When the contractor’s submittal schedule has been received, the architect reviews it for conformance with contract requirements and to determine if the sequencing and timing is reasonable for review by the design team, including its consultants. Be sure to determine if consultants in any outside specialties, such as curtain wall or roofing, should be involved in these reviews.

A list of project objectives and parameters should be maintained throughout all phases of service to enable the project team to focus on the owner’s program. This can be manually documented or maintained in a database. Either way, a list of basic project information will help you provide consistent construction administration. AIA Document G806™, Project Parameters Worksheet, is a form designed to help maintain a single standard list of project parameters, including project objectives, the owner’s program, project delivery method, legal parameters, and financial parameters.

The most important resource during construction is the project team. For the most part, they have been involved since the beginning of the project, and their collective knowledge can help maintain consistency in services. It is important to keep the team involved as much as possible until project completion. This is more difficult in larger firms, where team members may be assigned to other projects. The construction phase of
a project lasts longer than the design phase, and reassignment of team members is a normal part of business. Because smaller projects require smaller teams, group fragmentation is less of a problem for them.

Office resources support the project team during construction administration. These can include a products library, a specifications library, a company project database, and in larger firms, specialists within the office. The sole practitioner must look outside for assistance, and a phone file on experts, specialists, and friends in the business can be a valuable resource.

Construction Start-Up

When the owner-contractor agreement has been signed and the construction phase begins, certain tasks are required to get things started. If the owner-contractor agreement does not stipulate a date when the work will begin, the owner may direct the architect to issue a notice to proceed. This directive establishes the date of commencement of the work. From this milestone, the date of substantial completion can be determined by adding the total construction time specified in the owner-contractor agreement.

The owner-contractor agreement defines the scope of work for construction. To avoid confusion and prevent disagreement, the general conditions of the contract for construction require the architect to provide the contractor with a hard copy reference set of the construction documents. This set should consist of three copies of the documents issued for construction, noted as the “contract set,” with signature lines provided for the owner and contractor. After the sets have been signed, the owner, contractor, and architect each retain a copy for reference. Be aware that any additions to this set of documents in the form of detail sheets or reissued drawings may result in a change order.

An effective alternative consistent with today’s technology is a digital copy of the contract set. The hard copy signature confirmation is replaced by the requirement that the recipient acknowledge the validity of the documents with a mouse click before the file can open.

The contractor is typically provided, free of charge, copies of drawings and project manuals as are reasonably necessary for execution of the work. The project manual is a volume assembled for the project, which may include the bidding requirements, sample forms, conditions of the contract, and specifications, among other documents.

A preconstruction conference is held to introduce project team members, establish communications protocols, and review relevant project matters. The architect prepares the draft agenda for the meeting and sends it to the owner and contractor for their input. Since construction activities are generally the same from project to project, a standard draft agenda can be edited for project specific requirements. Review the owner-contractor agreement and make additions or changes to the draft agenda as required. A sample agenda is shown in the Chapter 12.5 - Construction Contract Administration in The Architect’s Handbook of Professional Practice, Fourteenth Edition.

AIA Contract Documents

View the list of sample contract documents and resources for interns.

AIA Document G709™, Work Changes Proposal Request, is a form used to obtain price quotations required in the negotiation of change orders.

AIA Document G701™, Change Order, is used for implementing changes in the work agreed to by the owner, contractor, and architect.

AIA Document G714™, Construction Change Directive, is a directive for changes in the work for use where the owner and contractor have not reached an agreement on proposed changes in the contract sum or time.
Construction Administration Activities
The architect’s construction contract administration responsibilities fall into three categories: Document control, submittal review, and design clarification.

Maintaining Document Control
The architect is typically responsible for production of the construction documents. Part of this responsibility is controlling the content and distribution of these documents to prevent disruption and miscommunication among the project team. Construction documents continue to evolve during the construction process because of imposed changes. Changes can result from owner preferences, proposed contractor substitutions, material availability, or design errors and omissions. No matter their source, it is imperative that document changes be executed in a timely manner to avoid delays. Keeping up with the status of the construction documents and responding quickly to proposed changes will help to protect the architect from liability arising from project delay.

If permitted by the contract, the contractor may propose substitutions of the architect’s specified products and systems. These proposals are typically submitted to reduce the cost of the work. To avoid compromise in the quality of the work, the architect should include a specification provision requiring substitutions to provide performance equal to or better than the product or system they supplant. Otherwise, a credit should be given when a lesser performing product is accepted unless an appropriate deductive change order is proposed along with the substitution. Remember, your specifications were developed after much research and trial. Consider proposed replacement products or systems carefully, and require the contractor prove to you that the substitution is worthwhile.

Changes in the work typically require changes in the construction documents. Ideally, the architect describes the scope of the change and its effects on adjacent work so the contractor can quote a price for the work. The architect initiates the change process by issuing a proposal request with attached drawings, specifications, and instructions as required to adequately describe the change. This process is undertaken to obtain price quotations required for negotiation of change orders.

When the contractor has prepared a quotation for the proposed change, a meeting is held to discuss the change and review the pricing. On larger projects, multiple proposals for change may be reviewed at one time. When the price for the change is agreed upon, the architect prepares and issues a change order. The proposal request and related pricing are usually attached along with a description of the change. A change order may include multiple work changes and/or proposal requests.

A change order is not effective until it has been signed by the architect, the contractor, and the owner. The architect’s signature on the change order signifies the change in the project and in the documents is acceptable to the design team. Since the design professionals are responsible for the scope defined by the construction documents, the drawings and specifications should not be changed without their knowledge and consent. The design professional’s signature also indicates a change conforms to the accepted standard of practice.
Changes to the construction documents can be made in the form of a descriptive narrative, a modified drawing, or a modified section of the specifications. Any document that is changed and reissued must conform to the appropriate state statutes governing use of the design professional’s seal.

Changes in the construction contract sum or completion date can be made without the contractor’s consent by using a construction change directive (CCD). This document is used when the owner and contractor have not agreed on proposed changes in the contract sum or time. It was developed to address changes in the work that, if not expeditiously implemented, may delay a project. Upon receipt of the completed CCD, the contractor must promptly proceed with the change in the work described. It is recommended that a CCD be converted to a change order after the change in the contract sum or time has been determined.

Managing and Reviewing Submittals
Construction project submittals are prepared by the contractor and reviewed by the architect or an appropriate consultant. They include shop drawings, product literature, product samples, test reports, operating instructions and maintenance manuals, warranties from product suppliers and manufacturers, and designs or design calculations prepared in response to a performance specification. These materials are used to demonstrate how the contractor proposes to conform to the project design requirements.

As the holder of the prime design contract the architect is responsible for managing the distribution of submittals to all his or her consultants. This includes managing the routing of submittals and staying on top of time sensitive review schedules.

It is important that the contractor be required to provide a submittal schedule along with the construction schedule early in the project. On some projects, providing this information is a prerequisite for processing the first application for payment. The architect reviews the submittal schedule to determine if the sequences and time allowed for review are reasonable. A maximum time for submittal review is often stipulated in the owner-contractor agreement, and it is important to determine if the time allowed is sufficient. For example, receiving a large number of submittals at one time could make effective review impossible within the contracted time constraints. Also, if submittals for project detailing such as doors, frames, and hardware are not submitted at the same time, review will take much longer. A time period commonly stipulated for submittal review is 10 business days.

Submittals must be logged and tracked when they arrive in the architect’s office. Untimely submittal review is a popular basis for claims for delay, and a submittal log can become the architect’s best source for verification of submittal activities. Such a log can be maintained in hard copy or with a software management program. If a program is provided by the contractor, make sure the activities and tracking protocols of all participants are included in the log. Be sure to keep an up-to-date copy of the submittal log in a secure location as a backup.
Assignment of document control numbers is necessary for effective management of submittals. You can use simple ascending numbers or a more elaborate numbering system. The contractor should affix the control number to the submittal upon receipt from a subcontractor or vendor and prior to submission to the architect. All submittals, along with all other correspondence received by the architect, should be stamped received and recorded immediately in the architect’s submittal log so the dates in the log and on the document correspond.

The owner-contractor agreement and the general conditions of the contract for construction require the contractor to review each submittal prior to submission to the architect and mark them up with corrections and coordination notations prior to submission to the architect. Prior to the 2007 AIA Contract Documents revisions, a contractor’s review stamp was required, however current AIA documents state that submission is a representation that the appropriate review has taken place.

When the architect has reviewed a submittal, it should be stamped with the appropriate review stamp. Such stamps typically indicate actions such as approved, approved as noted, revise and resubmit, or rejected. Wording on the stamp can vary, but should reflect the language of the owner-contractor agreement and the general conditions of the contract for construction.

Make sure team members familiar with specific building components and designs, such as the curtain wall system or doors and hardware, are included in the submittal review process. It is especially important to include the project designer, if different from the project manager, in the review of finish materials. To avoid taking on increased risk, architects should review only the submittals required in the specifications. However, the architect may review as-built drawings or designs by a professional hired by the contractor. In such instances, the submittals are reviewed with respect to their effect on the design intent and not for accuracy.

Clarifying Construction Documents

Construction documents can never be complete enough to answer every question a contractor or subcontractor may have. Thus, contractors often ask the architect to clarify what is expected when, for example, they are selecting products. The architect must provide these design clarifications in a timely and efficient manner. Whether you are answering requests for information or issuing supplemental instructions, your response timing may affect the construction schedule.

Requests for clarification usually come from the contractor in the form of a request for information (RFI), and e-mail is the popular medium for submitting them. RFIs are typically included in electronic document management software programs such as Buzzsaw™, although they can be managed manually. Documents the architect may request from the contractor include the submittal schedule or a pricing response to a work change proposal. RFIs should be logged and tracked like submittals. Since the RFI process is the most popular basis for claims by contractors, timely management and accurate tracking are essential. In the architect’s response to an RFI, there is often a fine line between clarifying project requirements and adding scope to the contractor’s work in the architect’s review comments. When architects set out to clarify
documents, they have to take care not to increase the scope of work. Contractors often claim scope has been added when an architect marks up shop drawings because it is tempting for the architect to “fill in” information that should have been included originally. Ideally, the architect will provide a clarification that includes no added scope when issuing supplemental information to the contractor. In the event the contractor believes a change in contract sum or time is involved and the architect agrees, the contract for construction should be amended to reflect the change.

**Documentation**

Construction administration services consist of many intangible activities, such as making decisions, giving directions, and taking actions, and the participants are judged by the timeliness as well as the accuracy of their performance. Accordingly, such activities are recorded in logs, confirmed in letters and memoranda, or recorded in a meeting report. This documentation is then available to support the quality of services rendered should anyone’s actions be called into question later.

All important conversations in which critical information is discussed and all important actions should be documented in writing. The architect’s documentation can include:

- Reports (meeting, site observation)
- Certifications (payment, substantial completion)
- Requests for information
- Additional services agreements
- Work change documents (change orders, construction change directives, architect’s supplemental instructions)
- Notices (to owner, contractor, surety)
- Miscellaneous communications

Documentation generated and maintained by the contractor can include:

- Submittals (shop drawings)
- Schedules (construction, submittal)
- Requests for information
- Certifications (work compliance, payment application)
- Design calculations (if required by specifications)
- Approvals (changes)
- Notices (to owner, architect)
- Punch lists
- Miscellaneous communications

Owner documentation can include:

- Approvals, authorizations (changes, notice to proceed, nonconforming work)
- Site civil information
- Requests for information
- Miscellaneous communications

A record of meetings, discussions, decisions, and approvals, if not recorded by the documents listed above, should be recorded in a meeting report, document log, transmittal letter, or memorandum. Finally, the architect may choose to keep a journal to record important project communications.
Meeting Reports
The meeting report is the most common method used to record actions taken and decisions made. If a meeting is not recorded, it is difficult to justify why it was held, as apparently no important decisions were made. A meeting report should include the following information, at a minimum:

- Project name
- Purpose of meeting
- Project number
- Issues discussed
- Date
- Decisions made
- Attendees
- Deadlines

The report should be compiled and distributed as soon as possible after the meeting. For repetitive meetings such as scheduled project meetings, the meeting report can be used as the agenda for the next meeting.

Document Logs
Repetitive tasks are best tracked by logging. A log should have all relevant information, including critical dates for initiation, receipt, and transmittal; action taken; and final disposition. Logs typically used by architects during construction administration include these:

- Construction documents issue log (usually cover sheet on drawings)
- Supplemental drawing log
- Request for information (RFI) log
- Submittal log (AIA Document G712™, Shop Drawing and Sample Record, can be used for recording submittal review data such as number of copies and dates received and transmitted.)
- Architect’s supplemental instructions (ASI) log
- Construction change directive (CCD) log
- Work changes proposal request log
- Change order log

Related documents such as proposals for change and change orders should be cross-referenced in each log. All documents should be numbered for efficient identification and to avoid confusion.

Transmittal Letters
The most efficient method of recording the flow of information between parties is a transmittal letter. Transmittals document the exchange of project information and act as a checklist reminding the sender to tell the recipient what exactly is being sent, how the material is being sent, and why. For example, AIA Document G810™, Transmittal Letter, is designed to serve as a written record of the exchange of project information.

A transmittal letter should contain the following information:

- Project name
- Project number (if applicable)
- Date
- Sender’s name and company
- Receiver’s name and company (can be multiple)
- Complete description of transmitted material
- Method of delivery (courier, U.S. mail, etc.)
- Reason for sending
- Copies to others

Standard forms do not require a transmittal letter if they are tracked by a log because the forms contain the basic project information and the document and reason for sending it are obvious. Approved methods for delivering transmittal letters and standard forms between project team members should be discussed at the preconstruction conference.
Memoranda
A memorandum can be written to another person or to your file. While a memorandum can be presented in many graphic formats, the primary objective is to capture the information for future reference. At minimum, the following should be included in a memorandum:

- Date
- Project name
- Project number
- Subject
- Recipient (if appropriate)
- Author
- Subject matter
- Persons copied

The text of a memorandum can include discussions, conclusions, facts, or observations relevant to the subject. Sending the document to the participants and allowing them to respond with corrections or clarifications will give credibility to your written record.

Journal
Another documentation tool available to the project manager or construction administrator is the journal. This can take the form of a bound book, a ring binder, loose papers in a file, or data in a computer. Whatever its form, a journal can be used by the design professional for personal organization and documentation and as a place to prioritize daily activities. If the journal is kept chronologically in a book or binder, it will provide ready reference to historic events. The architect can maintain a separate journal for each project or a single journal that contains records of multiple projects.

Project Closeout
The project closeout activities administered in the architect’s office are addressed in the owner-architect agreement. They include production of punch list modifications and additions, review of the contractor’s closeout submittals, and preparation and issuance of the certificate of substantial completion and the final change order. More detailed requirements may be included in the specifications in Section 1 of MASTERSPEC.

Punch List
On large projects, preparation of punch list modifications and additions can be a big job. When multiple project team members review the contractor’s punch list, the influx of revisions may require many hours to publish. It is wise to discuss project completion sequencing with the contractor before project completion is reached to anticipate punch list administrative needs.

Pre-punch items encountered on site visits can be discussed with the contractor and subcontractors to make them aware of areas of concern and to establish the expected level of quality. This should help streamline the punch list process.

Closeout Documents
The contractor’s closeout submittals typically include warranties and guarantees, record drawings, as-built construction drawings, specifications and submittals, operations manuals, maintenance schedules, operations videos, and attic stock (extra materials). These items are usually submitted at once, filling up the project manager’s office space. They must be reviewed to determine if the contractor has fulfilled its contractual requirements for closeout submission before delivery to the owner. The design professional does not review this information for accuracy, as that is the contractor’s responsibility.
Final Change Order
When it has been determined that the work is completed under the construction contract, a final change order must be issued to reconcile outstanding contract issues. These may include the following:

- Allowance balances
- Contingency balances
- Unresolved unit prices
- Contract savings
- Reimbursement for owner accepted non-conforming work
- Reimbursement for scope reductions
- Contractor bonuses
- Contractor penalties
- Liquidated damages
- Deductions for additional design services
- Additional contractor general conditions costs
- Weather related time extensions
- Delay related time extensions

The final change order must be executed and included in the final application for payment before final completion can be achieved.

The construction phase brings the owner’s project to reality, and its challenges and problems often linger in their mind longer than design phase experiences. The actions taken by the construction contract administrator during construction can become good memories or bad ones. Relationships can be built or lost by how well the architect administers and resolves the issues.

Written by James B. Atkins, FAIA
Jim is a senior vice president/principal with HKS Architects in Dallas, where he is involved with the firm’s quality management and education program, DoubleCheck®. He serves on the AIA Documents Committee and the AIA Risk Management Committee.
Changes are made on almost all projects. They can be caused by owner decisions, errors or omissions, or unforeseen circumstances such as differing soil conditions. Most projects require a final change order to reconcile allowances, unit prices or contingencies.

Changes in the contract tend to be questioned because they usually increase the contract price. Owners often do not understand or accept the causes and circumstances surrounding a change. The construction contract administrator must know the change process, manage it effectively, and take appropriate action so that the process itself does not penalize the project.

In this scenario, you are providing construction phase services on a four story office building. The project delivery is design/bid/build with a fixed fee construction contract. The building frame has been topped out, and the roof and exterior skin has been completed. The project was designed for a single tenant with the reception area immediately off the main entrance. Each floor is open with no circulation corridors.

The client calls you up and informs you that the prime tenant deal has fallen through. He now wants the building changed to accommodate multiple tenants. This will be the third change order on the project.

Prepare the appropriate change documents for administering the owner’s requested change. The first document that you will prepare is the Work Changes Proposal Request. If possible, review change documents from an existing project and consult with your IDP supervisor, mentor or a senior construction administrator. When you are preparing the document, answer the following questions:

- How soon should I request the contractor to submit the price?
- Should I send a notice alerting the contractor of the change so that demolition can be minimized?
- What fee should I charge for this significant change in project scope?

You receive the contractor’s quotation for the change, and it is time to meet with the owner and contractor to review the costs. Prepare a memorandum requesting a change order review meeting. As you prepare the memorandum, answer the following questions:

- Who should attend the meeting?
- Where should the meeting take place?
- What documents should I take to the meeting?

The owner approves the change in the meeting, and it is time to prepare the change order. As you do your work, answer the following questions:

- Which documents will be referenced in the change order?
- To whom is the change order sent to first for signature?
- What is the distribution of the change order?
- How will the change order be tracked on the contractor’s application for payment?

Prepare a flow chart illustrating the change process and the documents involved including the meeting notice. Share your work with your IDP supervisor or mentor and make suggested changes.
Understanding Construction Phase Activities & Project Communications

**Supplemental Experience for eight (8) Elective IDP Hours**

In this scenario, the client is a private company, the delivery mode is design/bid/build, the project is a 10-story office building, and the owner has retained your architectural firm to provide contract administration services. You are planning your work to be performed during the construction phase – which meetings to attend and the routine tasks to be performed. The project team includes the following:

- Owner
- Owner’s equipment contractor
- Architect
- Structural engineer
- M/E/P engineer
- Architect’s site representative
- Contractor’s project manager
- Two contractor superintendents
- Four contractor site foreman
- Mechanical subcontractor
- Electrical subcontractor
- Plumbing subcontractor
- Contractor’s scheduling consultant
- Test lab representative

### Activity - Elective

Please reference the following sources:

- MASTERSPEC, Section 1

View and download the following sample documents for reference:

- AIA Document A101™, Standard Form of Agreement Between Owner and Contractor
- AIA Document A201™, General Conditions of the Contract for Construction
- AIA Document B214™, Standard Form of Architect’s Services: LEED® Certification

Read the reference documents listed above thoroughly and prepare the following lists. (You may wish to consult meeting reports and communication documents from an existing project.) List the activities typically performed by the architect and the contractor during the construction phase. Categorize your listing based on contractor—subcontractor interaction, contractor-architect interaction, and architect—consultant interaction. Prepare a flow chart representing the lines of communication. Prepare a weekly schedule of the architect’s activities. Answer the following questions:

- Which tasks will be ongoing?
- Which tasks will be intermittent?
- How often will the architect visit the site?
- What meetings will be held?
- Who will attend each meeting?
- How will payment applications affect the timing of site visits?
- How often should a field observation report be issued?

List the types of communications that will occur between the following parties during the construction phase:

- Architect – Owner
- Architect – Contractor
- Architect – LEED facilitator
- Owner – Contractor
- Owner – Architect – Contractor

Most of these activities will be repetitive, such as the architect reporting the work status to the owner, but some will be task driven, such as a construction detail resolution.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Questionable Stored Materials

Supplemental Experience for eight (8) Elective IDP Hours

Some ethical dilemmas may actually be illegal acts. In this exercise, you must determine whether an unlawful condition exists.

In this scenario, you are providing construction contract administration services for the interior of a small office building. The construction contract is based on the cost of the work plus a fee. The shell has been completed, and your contract is approximately 80 percent complete. You visit the project to review an application for payment and to determine whether the work completed is accurately reflected in the document.

The floor covering is carpet, and you are directed to a warehouse on site where it has been stored. You check the tags and find that 3,000 square yards of carpet is stored. You look at the application for payment, and it matches the information on the tags.

You return to your office and are checking a change that was made on the drawings when you see a handwritten note on the corner of the drawing. It says, “2,500 square yards total.” You ask the interior design manager about the note, and she says that the carpet supplier was in the office, and they did the takeoff and left the note. It is a cost-of-the-work contract, and the owner pays for all materials. It appears that more carpet was ordered than necessary, and someone will end up with the extra carpet. Could the amount be the overage required by the contract for stored material, or is the contractor intending to keep the excess?

You call the contractor about the extra carpet. He says, “Don’t be concerned, it’s none of your business.” But it is your business. You are required to determine if the stored materials are appropriate for the work. Although you are not responsible for measurements, you must explore the variation.

Activity - Elective

Please reference the following source:
- AIA Code of Ethics and Professional Conduct

Write out a plan for resolving the situation. There may be a legitimate explanation for the additional carpet, but what must first be determined? As you prepare your plan, answer the following questions:
- Does the owner want the extra carpet for attic stock?
- Could there be a separate contract in the works outside your contract?
- Could the overage be anticipated waste?

Remember that title to the product transfers to the owner upon payment, and the owner may not wish to purchase the extra carpet.

Your plan will include communication with the owner. Prepare a memorandum to the owner and contractor advising of your findings and requesting an explanation. Advise them that if none can be given, you will approve for payment only the yardage needed including reasonable waste.

Request that the carpet subcontractor provide his layout sheets for carpet cuts to substantiate the yardage.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Tracking the RFI Process On-Site

Supplemental Experience for eight (8) Elective IDP Hours

The RFI is the primary method for contractors to obtain clarifications from the architect regarding the intent of the contract documents. In recent years, the RFI has become a universal tool for obtaining information by the architect and owner as well.

Activity - Elective

Please reference the following sources:
- MASTERSPEC, Section 013100
- Other files such as change orders, meeting reports, ASIs, CCDs, and journal entries, if available.

View and download the following sample documents for reference:
- AIA Document G716™, Request for Information

Track the full path of three contractor RFIs on an existing project in your office. Review the files and select RFIs that include drawing details provided by the architect.

RFIs that involve a supplementary detail from the architect often result in a change to the contract. In this case, the change should be administered through the prescribed change process using appropriate AIA documents. As you review the RFIs, answer the following questions:
- Did the sender also propose the fix?
- Did the RFI result in a change to the contract?
- What change documents were used to effect the change?
- Was there a dispute over the resolution of the change?
- Were consultants involved with the issue?

Locate the supplementary details provided by the architect and any revised contract documents reflecting the change. Answer the following:
- Did the architect revise the contract documents to reflect the change?
- Did the contractor include the change in their contractor marked-up drawings?

Prepare a report on the three RFIs describing how they were administered. Include copies of all supporting documentation. List everyone that was involved and their method of communicating. If the issue resulted in a change to the contract, list the documents used to administer the change. If meetings were held to discuss resolution of the issue, list the purpose of the meeting, the attendees and the resolution.

As a final step, answer the following questions:
- Was the RFI detail really necessary to express the design concept expressed in the contract documents?
- Should the contractor have generated the detail as a “clarification” drawing and part of the contractor’s work plan?
- Should the appropriate subcontractor have generated the detail as part of their shop drawings for that portion of the work?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Impartial Determination of Substantial Completion

Supplemental Experience for eight (8) Elective IDP Hours

AIA Document A201™, General Conditions of the Contract for Construction, and AIA Document G704™, Certificate of Substantial Completion, require the architect to render decisions impartially. This requirement is without exception, and it requires open, candid communication and disclosure.

In this scenario, you are providing construction contract administration services on a project that has substantial liquidated damage provisions for late completion as well as a generous bonus of $10,000 to the contractor for each day of early completion.

The contractor has informed you in writing that the project is substantially complete, and you have conducted the appropriate inspection. You find that the project is substantially complete and available for the use intended on July 11, 2013, ten days before the contracted substantial completion date.

The owner calls you up and tells you that the punch list items will not be completed or corrected until five days after the contracted date, and you are to certify substantial completion at that time.

Activity - Elective

View and download the following sample documents for reference:
- AIA Document A201™, General Conditions of the Contract for Construction
- AIA Document G704™, Certificate of Substantial Completion

Review A201™ to determine the requirements for impartiality in providing professional services. Quote the section with a written description of its meaning in practice.

Write a memorandum to the owner and copy the contractor citing these provisions and advise of the accurate date of substantial completion. In the memo, advise the owner, based on the contracted bonus clause, the total bonus amount payable to the contractor.

Prepare a Certificate of Substantial Completion that indicates the date of substantial completion. Remember that the certificate will require two dates, the determined date of substantial completion, and the date of issuance. As you prepare your memorandum, answer the following questions:

- How can the memorandum be written to help the owner understand the requirements for substantial completion?
- What examples can be given to show that the completed work is available for the use intended?
- Should the bonus amount be added to the construction contract by change order?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Determining Construction Phase Workload

Supplemental Experience for eight (8) Elective IDP Hours

A thorough understanding of the activities involved in the construction phase is necessary in order to effectively plan and administer construction services. Knowing when activities occur will allow for load shifting and increased staffing to accommodate project demands.

This exercise will provide an overview of the construction phase work activities of a project based on the documents generated during the work process.

Activity - Elective

View and download the following sample documents for reference:

- AIA Document G702™, Application and Certificate for Payment
- AIA Document G704™, Certificate of Substantial Completion

Examine the files of a completed project in your firm to determine workload requirements based on the records listed below. Establish a graphic timeline for the duration of construction in monthly increments, and record the activities accordingly. As you begin your research, answer the following questions:

- What was the level of complexity of the project?
- Was project completion timely or late?
- Were owner scope changes reasonable or extensive?
- Was the project location local or out of town?
- Was the overall office workload heavy or average?

Examine the following project documents:

- **RFIs**: Review the RFI log and chart the number of RFIs processed each month during construction.
- **Submittals**: Review the submittal log and record the number of submittals processed each month. Determine if a submittal schedule was provided.
- **Meeting reports**: Review all meeting reports and record issues that required additional labor to accomplish or resolve.
- **Payment applications**: Review all application and certificate for payment forms (G702™ & G703™). Track the inclusion of approved change orders to determine the final contract amount, completion duration, and date of substantial completion.
- **Punch lists**: Review all punch lists to determine the amount of work remaining for completion or correction after substantial completion.
- **Certificate(s) of substantial completion**: Review all certificates to determine if the originally scheduled date was met.
- **Change orders**: Review all change orders and related change documents to identify issues and events that required additional labor. Record these on the timeline.
- **Site visits**: Review the field observation reports, and record the number of site visits conducted each month.
- **Staffing**: Query personnel assigned to the project to establish the amount of labor required during construction. Review timesheets if available. Determine the workload by total hours expended each month.
- **Personal journal/notes**: Review available journals and notes to identify issues that affected work requirements. Record significant issues on the timeline.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Determining Construction Phase LEED Certification Responsibilities

Supplemental Experience for eight (8) Elective IDP Hours

LEED is becoming widely accepted as the standard by which high-performance buildings are measured. This exercise will address the responsibilities of the project team’s office responsibilities for LEED certification services during the construction phase.

Use documents from a completed project that has been LEED certified or is pursuing LEED certification as a case study.

Activity - Elective

Please reference the following sources:
- Completed LEED project documents
- MASTERSPEC, Section 018113

Examine the files of a completed project in your firm to determine the construction phase – office responsibilities of the project team. Project documents from the completed LEED project include:
- Drawings
- Specifications
- LEED submittals
- Project materials cost data
- LEED action plans
- LEED progress reports

As you begin your research, answer the following questions:
- What is the LEED certification rating?
- Did the project achieve the certification level that was originally pursued?
- How were LEED submittals processed compared to typical project submittals?
- What was the total number of LEED submittals?
- What was the total cost of LEED related project materials?

Examine the following project documents:
- RFIs: Review the RFI log for LEED related questions.
- Submittals: Review the submittal log and record the number of LEED submittals processed.
- Meeting reports: Review all meeting reports for LEED related communications and activities.
- Change orders: Review all change orders and related change documents to identify LEED issues.
- Site visits: Review the field observation reports for observations related to LEED.
- Staffing: Query personnel assigned to the project to determine the amount of time that was required to administer LEED related activities and responsibilities.
- Personal journal/notes: Review available journals and notes to identify LEED issues that affected work requirements.

Assemble your findings in a report and categorize the findings based on typical construction phase office activities. Determine the premium in hours and costs to administer the construction phase—office portion of a LEED certified project.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Building construction is not always performed in an orderly, sequential manner. In delivery variations such as fast-track, the design and construction activities are compressed and supplementary activities such as testing are not always performed in a timely manner. This scenario explores a complication in a building design introduced by untimely testing.

In this scenario, you are administering the construction contract on a fast-track schedule for a 20-story office building. The building floor plate is rectangular with rounded corners. The curtain wall system is segmented at the corners, forming sleek, curvilinear shapes.

The preparation of construction documents was accelerated; as a result, the building was not wind tunnel tested until after construction had begun. (For more information on wind engineering and wind hazard mitigation, see the American Association for Wind Engineering website.)

By the time the wind tunnel test results are made available, the building frame is at the eighth floor level and the unitized curtain wall system is at the sixth floor level. Test results indicate negative pressures on the building of 115 psf at the rounded corners caused by an “airplane wing effect.” The original curtain wall design allows a maximum of 90 psf negative pressure. If the corners are not reinforced, wind pressure will overstress the curtain wall attachment to the building frame.

The structural engineer evaluates the impact on the increased pressures at the corners of the building and determines that braces must be placed above the ceiling at those locations. The braces are large, and they encroach on the perimeter slot air diffuser boots and ductwork.

**Activity - Elective**

Prepare an agenda for a meeting with the contractor, structural engineer, MEP engineer, curtain wall consultant, curtain wall subcontractor, and the owner. List the topics to be discussed and the decisions that must be made for designing and implementing the change while construction continues. As you prepare your agenda, answer the following questions:

- How will the mechanical and electrical systems be affected?
- Is involvement required by the curtain wall consultant?
- What elements of the building may need to be revised in the construction schedule, ceiling grid and tiles, interior framing?
- What other systems may be affected?

The meeting must address the impact of the change on existing building systems, as well as the contractor’s construction sequencing. The overall objective is to add the required additional bracing without negatively impacting the construction schedule. Ask yourself; what measures can be taken to complete the task as quickly as possible? How should the results be documented? What AIA documents should be used to implement the resulting change in the contract?

Prepare a schedule for developing a corrective design, issuing scope change documents, pricing the change, and issuing the change order. Include a request that the contractor be prepared to discuss time frames for implementing the change and coordinating it with the ongoing work.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Saved by a Scope Change?

*Supplemental Experience for eight (8) Elective IDP Hours*

Architects have both an ethical and a contractual duty to design projects that conform to applicable codes. In some cases, issues of nonconformance may become moot as the result of changes in scope. In this activity a mistake was made, but the scope was revised before construction. However, complications involving allocation of cost lead to an ethical dilemma.

In this scenario, you have been commissioned to design an addition to a junior high school. The addition consists of a basketball gymnasium with a weight room, locker rooms, and toilets. Your complete your drawings and issue them for bidding. The bids are opened, and a contractor is selected. The successful bidder’s price is significantly below the budget. A construction contract is executed, and a “Notice to Proceed” is issued.

As you prepare for the preconstruction conference, you realize that the toilet rooms do not meet ADA requirements. The changes required to make them compliant will add scope to the project and increase the cost. Although you have found the problem before the toilets are constructed, the additional costs for bringing them into compliance will exceed the budget.

The next day, the owner informs you that the school board has decided to allow the nearby high school to use the new gym. She asks you to give her a fee quote for revising the drawings to make the toilet rooms larger. You realize that you can correct the AIA noncompliance as you redesign the toilet rooms, and no one will be the wiser. No harm done or is there?

The owner mentions that the change in scope is possible because the bids came in under budget. She believes the extra money will allow her to enlarge the toilet rooms to accommodate the high school students.

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**Activity - Elective**

View and download the following sample documents for reference:
- AIA Document B101™, Standard Form of Agreement Between Owner and Architect
- AIA Document G701™, Change Order
- AIA Document G709™, Work Changes Proposal Request

Prepare a narrative outlining action you should take in this scenario. Include an explanation to the owner regarding the ADA noncompliance and its potential impact on the completed construction. List each step in order of priority. Assume that the cost of enlarging the toilet rooms to accommodate the high school students will cost less than enlarging them to meet ADA requirements.

As you prepare your work, answer the following questions:
- Are substitutions available that could reduce the overall cost?
- What can you do to attempt to keep the project on schedule?
- What can you ask the contractor to do to help you with the changes?
- If the origin of the non-compliant design was the architect’s error, should the architect absorb the cost to re-design?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Solutions for a One-Inch Code Violation
Supplemental Experience for eight (8) Elective IDP Hours

In this scenario, your firm has designed and detailed a vocational tech school building on which construction is nearing completion. The building inspector has discovered that the ceiling in a hallway serving as a means of egress is 1 inch lower than the 7-foot minimum height dictated by 2000 International Building Code Section 1003.2.4. It appears that the various subcontractors could not get all the utilities (e.g., structure, ducts, drains, sprinkler piping, conduits) into the space provided in the architectural working drawings. They are packed as tight as possible. There is no way to get a higher ceiling with all the utilities shown in the various engineering drawings. The bottom element is a duct that occupies 60 percent of the width of the hallway and runs its full length (45 feet), with branch ducts into adjacent rooms. Although the architectural drawings show a 7’6” ceiling (well above the minimum), the contractor installed the highest acoustical board suspended ceiling possible at 6’11” without consulting the architect.

You have been directed to investigate the circumstances and make recommendations for action that will eliminate this situation as an obstacle to getting a certificate of occupancy.

Activity - Elective

Answer the questions below as part of your investigation:

- Will your recommendation vary depending on who (if anyone) is responsible for the impasse? If so, why? If so, recommend a solution for each party that might ultimately be assigned responsibility for the error. To do this, you will have to identify all the types of firms associated with the design and installation of utilities typically located above a hallway ceiling.
- What documents would you examine to identify the responsible party (if any)?
- What should the documents say or show that would help identify any party that might be responsible? Suggest statements and types of drawings that would have been appropriate to include in the various documents to avoid this situation. Who should prepare such drawings or statements?
- Develop three solutions to physically solve the problem. Ask colleagues how tight space above hallway ceilings has been addressed in the past during the design phase. Past strategies might suggest a retrofit solution. Which of your three solutions do you prefer and why?

Write a narrative of the findings from your investigation and include the recommendation you would give to your supervisor.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Processing an Unacceptable Substitution Request

**Supplemental Experience for eight (8) Elective IDP Hours**

It has become somewhat common practice for owners to solicit substitution requests beyond contract award in an effort to further reduce project costs. These requested changes do not always take into consideration quality or impact on adjacent materials. The architect may determine that the proposed substitution is unacceptable for use in the project.

Although the owner may elect to accept it, the architect is not required to change their drawings or specifications and take on the increased risk for a product they did not specify. If the architect revises their drawings and specifications and the product or system fails to perform, the architect can be held responsible.

In this scenario, you are providing construction phase services on a small retail center. The budget is tight, and the owner has solicited substitutions from the contractor after the construction has begun. The contractor has requested a substitution for the aluminum and glass storefront system. It is a brand that does not conform to your specifications, and you have experienced problems with it in the past. You have determined that it is not acceptable for use on the project.

**Activity - Elective**

Please reference the following source:

- **MASTERSPEC, Section 1**

View and download the following sample document for reference:

- **AIA Document A201™, General Conditions of the Contract for Construction**

Prepare a memorandum to the contractor and owner explaining your position. In 500 to 800 words, explain why you do not want the product used on the project and recommend an alternate system that conforms to your specifications. Contact an approved manufacturer listed in your firm’s specifications to obtain supporting information to include with the memorandum. As you prepare the memorandum, answer the following questions:

- How can the benefits of the specified system be best explained?
- What other storefront system can be identified that will reduce project costs?
- How can I style my memorandum to be helpful instead of combative?
- What other building components could be substituted to reduce costs?
- Should you offer to allow the rejected substitution if the owner agrees to indemnify you?

Assume the owner is persistent in accepting the substitution and directs you to include it in the project.

*Note*: Be mindful that you are not obligated to change your drawings as that would increase your risk for the substituted system. If this approach is taken, the system will become owner accepted nonconforming work. As such you should note it as an exception to the Certificate of Substantial Completion. These actions will require a detailed explanation to the owner.

Prepare a memorandum to the owner explaining why you cannot accept the product and explain that a qualification to the Certificate of Substantial Completion will be required. Base your narrative on factual information; refrain from emotional statements. Approach the memorandum as a chance to educate and enlighten the owner, and focus on performance and life-cycle benefits. Review and discuss your work with specialists such as a specifications writer or a senior construction administrator.

Share your work with your IDP supervisor or mentor and make suggested changes.
Certification of Nonconforming Work

Supplemental Experience for eight (8) Elective IDP Hours

The Certificate of Substantial Completion is an important legal document. It is a representation that the architect has determined that the work or designated portion is sufficiently complete in accordance with the contract documents so that the owner can use it for its intended use.

If work is certified by the architect that is later determined to be nonconforming, the architect may be determined to be in breach of their contractual responsibilities. It is therefore important that the architect documents all observed nonconforming work.

Typically, such work will be on the attached punch list, and the contractor will correct or complete it. Should the owner elect to accept the nonconforming work, it must be excluded from the certificate on an attached list.

In this scenario, you are providing construction phase services on an office building tenant finish out. You have issued a Certificate of Substantial Completion for the project. The certificate includes an attach punch list of items remaining for completion or correction and an attached list of owner accepted nonconforming work that has been excluded from the certificate.

The contractor has notified you in writing that the project is finally complete, and you are performing the inspection for final completion. When reviewing the work, you notice that the wrong type of wood trim has been used in the reception area. The area is complete and ready for occupancy.

Activity - Elective

Please reference the following source:

- The Architect's Handbook of Professional Practice, 14th ed. Chapter 12.5 - Construction Contract Administration

View and download the following sample documents for reference:

- AIA Document A201™, General Conditions of the Contract for Construction
- AIA Document G704™, Certificate of Substantial Completion

Review AIA Document G704™ to understand the definition of substantial completion. Review the section in A201™ on the owner’s acceptance of nonconforming work. Prepare a memorandum to the owner explaining your subsequent discovery of the nonconforming work. Explain the condition thoroughly. As you prepare the memorandum, answer the following questions:

- Will the replacement of the work delay owner occupancy? If so, the project is not substantially complete.
- Is the work of a quality and appearance that it could be accepted?
- Should you recommend acceptance of the nonconforming work to the owner?
- Is the nonconforming work of such scope that re-issuance of the certificate is necessary?

Then,

- Assume the Owner rejects the work. Prepare a memorandum to the owner and contractor amending the attached punch list, adding the nonconforming work.
- Assume the Owner accepts the work. Prepare a memorandum to the owner and contractor amending the attached exclusions of owner accepted nonconforming work.
- Assume the Owner rejects it and remediation will delay occupancy. Prepare a memorandum to the owner and contractor advising that the work is not substantially complete and rescinding the issued certificate. Wait for the contractor’s written notice that the work is substantially complete.

Share your work with your IDP supervisor or mentor and make suggested changes.
Design Not Suitable for Use

Supplemental Experience for eight (8) Elective IDP Hours

This exercise involves a design that complies with code but is not suitable for the intended use. Unlike designs that can be checked in a code book, the adequacy of this design must be measured by anticipating how it will be used. This activity underscores the importance of continuous scrutiny of the documents to determine if the design meets the functional needs of the user. It also emphasizes the importance of having the appropriate qualifications and experience to work on your design.

In this scenario, you are administering a construction contract on an emergency room addition to a hospital. The scope of the contract includes a covered emergency entrance with automatic biparting entry doors allowing a 5-foot clearance, a 10-foot wide entry corridor, and six emergency treatment rooms.

Project construction is nearing completion, and the contractor is ahead of schedule. You are getting an early start on our substantial completion inspection and have invited the owner to accompany you. As you inspect the entry doors, the owner informs you that the 5-foot width is inadequate to allow easy passage of a gurney with attendants. The owner demands that you correct the problem and expects you to pay for the change.

Activity - Elective

Develop a plan for addressing this design error. Consider the construction schedule, delay costs, occupancy of the building, city approval of the correction, space limitations, possible modifications to the existing door, your staff time for drawing changes, the change order to the contractor, and educating your staff for future designs. As you approach this problem you must ask yourself the following questions:

- How can this issue be approached with the least impact to ongoing construction activities?
- How can the submittal approval process be accelerated?
- How can the fabrication and delivery process be accelerated?
- If a temporary door is required, what type is most suitable?
- What will be the city requirements for a temporary certificate of occupancy?
- What actions are required to preserve the owner’s confidence in my firm?

Prepare the following:

- List the steps involved in replacing the door with one that will suit the purpose.
- Prepare an agenda for a meeting with the contractor, and determine who should attend the meeting.
- Find out if approval is required in this jurisdiction to install a temporary door if another door cannot be delivered by the occupancy date.
- Write a letter to the city requesting a temporary certificate of occupancy until the new door can be installed.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Forced Substitution of Skylights
Supplemental Experience for eight (8) Elective IDP Hours

Substitutions have become a popular means of reducing the project cost after the construction contract has been executed. Many owners allow substitution proposals until project buyout has been completed. Substitutions during construction almost always result in a reduction in quality as well as cost. Owners are often enticed by lower costs, and they are not always as concerned about the reduction in quality – that is, until the substitution fails to perform as expected. Then it often becomes the architect’s problem.

In this scenario, you are providing shell and core construction contract administration services on a corporate headquarters building for a top 100 corporation. The budget is large, and the project was hard bid. The successful contractor was almost two million dollars lower than the budget, and the talk around the job site is they “left most of it on the table.” This means they underbid the project significantly.

The elated owner relished in the found money and gave the interiors architect an open ticket. Finished was upgraded to Italian stone and exotic wood paneling. The desperate contractor began a vicious substitution assault to lower the project cost, with very little credit given back to the owner.

The building has an elaborate skylight system that is a central feature. The skylight has a custom profile, which is fitting for the overall budget. As the building enclosure is completing, the contractor submits shop drawings for the skylights. The submitted profile is an off-the-shelf model with many compromises in features and quality. You immediately reject the submittal.

The contractor responds that if he is required to submit the custom profile, he will miss the fabrication window and the project will be delayed. He offers a modest credit for the custom profile, and the owner accepts it.

Activity - Elective

Please reference the following sources:
• MASTERSPEC, Section 013300

View and download the following sample documents for reference:
• AIA Document A201™, General Conditions of the Contract for Construction

Prepare a memorandum to the owner and contractor rejecting the proposed skylight system. Cite the requirements from A201™ and MASTERSPEC for adhering to the specifications and coordinating submittals with other activities such as fabrication and construction.

Advise the owner that you will not accept the substitution or change your drawings. Advise that the Certificate of Substantial Completion will list the substituted skylight as exclusion, and it will be designated as, “owner-accepted nonconforming work.”

Prepare a summary of the events that led up to the event, and list the actions that your construction administration group will take to avoid such an incident in the future. As you prepare the summary, answer the following questions:
• What contract requirements were not followed or enforced?
• What indications were apparent that would warn of such an incident?
• What actions could you have taken to avert the incident?
• How can you tactfully explain to the owner that they did not receive full value for money spent?

Share your work with your IDP supervisor or mentor and make suggested changes.
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exhibits
Construction Phase: Observation

Introduction

By completing the activities in this chapter, you will gain an understanding of the field activities involved in construction phase observation. The following information is taken from the NCARB IDP Guidelines:

Construction Phase: Observation
Minimum Construction Phase Observation Experience: 120 Hours
Definition: Tasks carried out in the field include observing construction for conformance with drawings and specifications and reviewing and certifying amounts due to contractors.

Tasks
At the completion of your internship, you should be able to:
- Conduct on-site observations
- Document and communicate status to owner and constructor
- Resolve constructability issues

Knowledge Of/Skill In
- Constructability
- Construction procurement
- Contract negotiation
- Contracts (e.g., professional services and construction)
- Electronic communications (e.g., virtual offices, video-conferencing, web-based networking)
- Interpersonal skills (e.g., listening, diplomacy, responsiveness)
- Invoicing for services
- Oral and written communications
- Permit and approval processes
- Project budget management
- Project delivery methods
- Project records management
- Risk management (e.g., professional and general liability)
- Team building, leadership, participation
- Attend, conduct, and record meetings
- Document project status and progress

resources

Download the current Intern Development Program (IDP) guidelines at www.ncarb.org/Experience-Through-Internships.aspx.


Construction Phase: Observation

Narrative

The architect’s services during construction begin on the date established in the owner-contractor agreement or set out in the notice-to-proceed. From this point forward, project meetings are normally conducted at the construction site rather than in the owner’s conference room, and many new team members participate. Each meeting agenda includes the status of construction phase activities, and the contractor and primary subcontractors report on the progress of construction in their areas. Requests for information, project change documents, submittals, and payment applications are among the items architects monitor and track as part of their services. The architect’s primary goal is to protect the owner’s interest at a time when great amounts of the owner’s money are being spent in a short amount of time. You are required to report on the progress and quality of the work while keeping the submittal review flowing and maintaining control of the contract documents.

It can be exciting to travel to a job site and represent the owner during construction, but it is also challenging to juggle paperwork and site responsibilities. Issuing site observation reports, reviewing submittals, and documenting changes in a timely manner requires careful planning, an organized schedule, and efficient execution.

This chapter addresses tasks generally carried out by the architect at the project site during the construction phase of project delivery. The material presented here duplicates to some degree that in Chapter 3B - Construction Administration, which stresses construction increment services provided from the architect’s office. It is suggested that you review both chapters to gain a full perspective on the scope of the architect’s services during construction.

Team Relationships

Team relationships during the construction increment of traditional design-bid-build project delivery center on the three primary players—the owner, the architect, and the contractor. The architect and the contractor have a direct contractual relationship with the owner but no contractual relationship with each other. Nonetheless, the architect serves as a direct line of communication between the owner and contractor, and the contractor must perform largely to the architect’s satisfaction. The owner holds a contract that requires a specific performance from the contractor, and the architect is the judge of that performance. The owner looks to the architect to determine if the contractor has met his contractual obligations. That is why the owner must provide the architect with a copy of the owner-contractor agreement if you are expected to administer that contract.

In addition, all three players may have contracts with consultants or subcontractors who are actively involved in construction activities. Because of the contractual structure, the architect does not communicate directly with the contractor’s subs, and the contractor does not communicate directly with the architect’s consultants.

notes

Take brief notes while reading the narrative and list key resources you used to complete the activities. Note discussion outcomes from meetings with your supervisor, mentor, or consultants. When finalizing the activity documentation (PDF), include your notes and the Emerging Professional’s Companion activity description.
Preconstruction Conference
The preconstruction conference is used to introduce the project team, review the timeline, establish communication channels, and organize the activities that will take place during construction. In the design-bid-build method of project delivery, this meeting is typically scheduled and chaired by the architect, who uses it to establish project procedures for an orderly construction administration process.

“Suggested Agenda Topics for a Preconstruction Conference,” in the Resources sidebar, can be used as a reminder of topics that may be covered during the preconstruction conference.

Construction Observation Activities
The architect’s responsibilities for observing construction and determining if the contractor is supporting the design intent fall into six categories: construction observation, document clarification, submittal review, payments to the contractor, certification of completion, and project closeout.

Observing Construction
The architect is typically required by contract to keep the owner apprised of construction progress and quality. The owner relies on these reports to keep up with the progress and quality of the work, and a close owner-architect relationship can result from this direct form of communication. To document what the architect has observed in the field and enable the delivery of this information to the client, the architect can use AIA Document G711™, Architect’s Field Report. As with all document types issued repeatedly during a project, each report should be dated and sequentially numbered.

Clarifying Construction Documents
Construction documents typically have not been drawn to indicate specific product dimensions and characteristics. This may change as integrated project delivery gains greater status in the profession. In any case, they can never be detailed enough to answer every question a contractor or subcontractor may have, thus a primary activity of the architect during construction is to provide clarifications and interpretations. The primary vehicle for conveying the contractor’s questions to the architect has become the request for information (RFI). AIA Document G716™, Request for Information (RFI), is a convenient form to use in that it is generic and can be used by any member of the project team.

The architect responds in an appropriate manner, perhaps by simply answering the RFI or by issuing supplemental instructions that do not change the contract sum or time. AIA Document G710™, Architect’s Supplemental Instructions, is available for this purpose. Should a document clarification result in a change in the contract scope or a change in the construction schedule, a change order will be required to make the proper adjustment in the contract.

Construction is not an exact science, and project participants may propose
different resolutions to an issue. The contractor’s plan for constructing portions of a project may not be consistent with the architect’s response to an RFI. AIA Document G716™ provides for the sender to propose a solution to the question, thus allowing the contractor, who usually has the best solution to the problem, to provide the architect with a viable alternative.

This frequently speeds up the RFI review process when the architect agrees with the proposed solution. The caution that the architect must take is to determine if the contractor’s proposed solution adds to the contract sum or time.

With some RFIs, a meeting may be required to discuss the issues and determine a solution that is acceptable to all parties. The architect must therefore be ready to go to the site on short notice and stay until the issue is resolved. Activities can involve walking the site to review the built condition and discuss alternatives. If the site is not near the architect’s office, digital images can be emailed for discussion. The architect’s objective in responding to a challenging RFI is to research the condition, provide the necessary information and assistance, and bring the issue to closure as quickly as possible. Suggested steps for resolving difficult issues brought up by the contractor include the following:

1. Identify the problem
2. Gather relevant information
3. Consult appropriate resources for information required for resolution
4. Involve appropriate participants
5. Require representation from authoritative participants
6. Develop possible solutions
7. Analyze options
8. Recommend a solution
9. Execute the owner’s decision

This seems like a lot of steps to cover in a short period of time, and it usually is. That is why effective construction administration should be proactive instead of reactive. The more involved the architect is in the construction administration process, the more quickly questions can be answered. A very important requirement for the efficient resolution of issues is to have people with decision-making authority involved in the resolution process. If authorized decision-makers are not involved, the process will not move as quickly. In addition to the ongoing tasks of interpreting the design documents and issuing clarifications, the architect must manage a number of routine tasks during construction. These are outlined in the following text.

Managing and Reviewing Submittals

Although the submittal review process is typically administered in the architect’s office, as discussed in Chapter 3B - Construction Administration, some submittal-related tasks must be undertaken on the project site. Since submittals are detailed depictions of how the contractor will execute the work, they are essential to reviewing the work for conformance to the construction contract. The contractor typically is required to keep an up-to-date set of approved submittals on the job site, and the architect can reference these when performing site observations and duties. If a full-time project representative has been employed, a complete
set of approved submittals is usually maintained in the architect’s on-site office.

AIA Document A201™, General Conditions of the Contract for Construction, requires the contractor to review and coordinate the various submittals of its subcontractors. General conditions documents preceding A201™ required the contractor to provide a signed approval stamp on the documents before the architect was obligated to review it. The 2007 revisions do not require the stamp and signature, but instead state that the submission of a submittal by the contractor is a representation that he or she has reviewed or taken appropriate action on the document.

Contractor’s stamp or no stamp, the true indication of the contractor’s review of the submittal is marks and notations. Remember that one of the contractor’s primary duties is to coordinate the subcontractors and prepare a plan for the work. It is only logical that submittals prepared by separate subcontractors will require coordinating marks and notations.

Accordingly, pristine submittals should be viewed with caution, and if the contractor’s review is not taking place, the documents should be returned for proper review as required by A201™. However, care should be used to avoid delaying the review process with these actions. A more expedient response would be to take the submittal to the site and confront the contractor face to face.

Since the submittal process typically does not end until well into construction, the status of submittals should be a standard agenda item during project meetings. The requirement for the contractor to provide a submittal schedule should be strictly enforced, and the architect should stay on top of outstanding submittals and endeavor to avoid delays in reviewing and processing them.

Delinquent and poorly prepared submittal schedules are more common these days than we all would like, and immediate action should be taken to enforce this important contract requirement. The architects will be held accountable for the RFI review and response status, which will likely be advertised in the project meeting, so it is only proper that the contractors are held accountable for the submittal schedule as well.

One approach to enforcement is to send an RFI to the contractor requesting the submittal schedule. Remember that A201™ requires that the schedule be acceptable to the architect, and an unacceptable schedule is as much in default as a nonexistent one. RFIs originating from the architect are still somewhat new to many owners and contractors, so establishing this process in the preconstruction conference is recommended.

**Reviewing and Approving Applications for Payment**

Payment for the contractor’s work must be timely to avoid disrupting the labor force or supply of materials and to enable payment to the contractor in accordance with contract terms. The payment process has many participants and takes time to administer. The architect is required
to be aware of the general progress and quality of the work and act timely in reviewing and approving the contractor’s applications for payment.

The AIA standard documents provide two forms for certification of the contractor’s application for payment—G702™, Application and Certificate for Payment, and G703™, Continuation Sheet. The contractor fills out G703™ to show the status of the work to date, broken into portions in accordance with the schedule of values (costs) submitted in accordance with the requirements of the general conditions of the contract for construction. A summary of these figures, as well as a statement of previous payments, is then entered on G702™ to serve as the contractor’s application for payment. The contractor certifies under a notary’s seal that the document is correct and the work has progressed as represented. The architect’s approval (or certification) of this application is also made on the G702™.

The payment process takes time, and delays in processing the contractor’s payment can result in protective actions by the contractor in the form of liens or a work stoppage. AIA Document A201™, General Conditions of the Contract for Construction, requires the architect to respond to the application for payment within seven days of receiving it from the contractor. The architect’s certification represents that the architect has evaluated the work and the data comprising the application for payment and determined, to the best of the architect’s knowledge, information and belief, that the work has progressed to the point indicated by the contractor, and that the quality of the work is substantially in accordance with the contract documents. An effective way to handle this task is to schedule a site visit just before the application is submitted. This will allow the architect to walk the site with the contractor using a draft, or “pencil” copy of the application to compare to the work in place. Any revisions the architect requires to more accurately reflect work conditions can then be made by the contractor, avoiding subsequent reviews or challenges after the application is submitted.

Certification of the application for payment allows the contractor to be paid for stored materials that have not been installed on the project. These materials are often stored off site in an approved bonded warehouse. The architect should schedule time during a site visit to observe the stored materials indicated on the application. Evidence is typically required from the contractor that the warehouse is bonded and that the listed materials are stored there.

If the size of the project site allows, the materials may be stored on-site. In this case, the architect should conduct a review to determine if the materials are present and properly stored. It is not the architect’s responsibility to count rebar or metal studs, so written confirmation by the contractor evidencing the materials may be required.

Work performed under the construction contract that is the design responsibility of licensed engineers must be reviewed and certified for payment by these design professionals for completion and quality. Consultants such as structural and M/E/P engineers must visit the site and review the progress and quality of the work at payment time just like the architect does.
Some State licensing boards have ruled that certification of payment for the engineering design scope by the architect constitutes the practice of engineering. Accordingly, the architect must require these engineers of record to provide independent certifications for payment for their portion of the work. This can be accomplished with a letter or a memorandum. It is recommended that all design professionals reviewing the work coordinate their visitation schedules for this purpose.

**Sustainable Design and LEED Certification**
Sustainable design and construction practices are gaining in popularity and frequency. When a project is pursuing a LEED certification, there are opportunities for the contractor to achieve certification credit through sustainable practices and the use of sustainable materials during construction. It is important that the construction administrator be aware of related sustainable activities when administering the construction contract on a LEED certified project. It is also important that the architect reviews and observes that the sustainable aspects of the design, particularly those required for LEED certification, are being executed as called for in the construction documents.

**Integrated Project Delivery**
Integrated project delivery (IPD), is quickly becoming the rule rather than the exception. For many years, related components of IPD such as design/build and fast-track scheduling have been practiced. When IPD is fully developed, the architect’s activities during the construction phase may vary significantly from those practiced in today’s market.

**Project Completion And Closeout**

**Determining Completion**
During the construction phase, the architect is responsible for determining two types of project completion—substantial completion and final completion.

Substantial completion is the stage in a project when the owner can occupy or use a building for its intended use, as defined in the general conditions (A201™, §9.8). AIA Document G704™, Certificate of Substantial Completion, is a standard form for recording the date of substantial completion.

The certificate establishes the date of substantial completion and the responsibilities of the owner and contractor for security, maintenance, heat, utilities, damage to the work, and insurance requirements. It also establishes a date by which the contractor must complete all items on the punch list that relates to the certificate. Warranties required by the contract commence on the date of substantial completion of the work or designated portion thereof unless otherwise agreed.

On larger projects, several substantial completion certificates may be used to cover designated portions of the work. In this case, the project is typically certified substantially complete by defined areas, such as individual floors in multi-level buildings or separate wings of a single-story building. The contractor and the architect typically agree on a schedule...
for the substantial completion inspections. Although the contractor is contractually responsible for preparing the list of items for completion or correction, the architect and architect’s consultants must review the list for completeness and add any missing information. The architect is not responsible for the completeness of the list, however, and subsequent discoveries of incomplete or incorrect work can be added.

The list of items for completion or correction, also known as the “punch list”, can take a variety of forms. The most popular is the narrative, and it is typically prepared initially on a hand-held voice recorder. The information is transcribed on site or at the architect’s office and published to the contractor.

Other methods of preparing punch lists include the plan method, where a copy of the floor plan is used in conjunction with a numbered or lettered key indicating repetitive conditions. Yet another method is the room data sheet, where a list or enlarged room plan is prepared on a single page for each room or area. A numbered or lettered key, a list, or a narrative of conditions is entered on the page and affixed in the room or on the door. As the contractor and his subcontractors complete or correct the items on the list, they sign off on the room data sheet. This is a popular approach with contractors.

Nonconforming Work
Completed projects almost always contain nonconforming work that has been accepted by the owner, as permitted in the general conditions (A201™, §12.3). Although these conditions may be minor in nature, they should be documented in the certificate if known by the architect. Lenders and purchasers typically rely on certificates of substantial completion as accurate representations of the status of the work, and omitting information about non-conforming work accepted by the owner can increase the architect’s risk should the certificate be challenged.

The nonconforming work can be documented by listing it on a separate page that is attached to the certificate of substantial completion. Owners and lenders typically do not realize that the nonconforming work must be documented, so advance discussions are recommended, preferably in the preconstruction conference.

As in review of applications for payment, consultants who work under the architect’s contract must review the work that is their responsibility for substantial completion. These consultants should review the project at substantial completion and certify to the architect that their portion of the work is substantially complete. This review includes going over the contractor’s punch list and comparing it to the work in place. Since AIA Document G704™, Certificate of Substantial Completion, has no place for consultants to sign, a separate letter or memorandum attesting to this condition is acceptable.

The inspection of the work to determine substantial completion is different from scheduled reviews of the work by the architect, which are considered to be “observations.” This distinction is made because, according to Black’s Law Dictionary, the term “inspection” means more than just observation. To inspect is to examine carefully or critically, or investigate and test officially, especially in a critical investigation or scrutiny.
Undertaking Project Closeout
The owner’s needs increase with occupancy of a project. Building sophistication and complexity require that necessary records and easy-to-use documentation be available when a building is ready to be occupied. A smooth transition to building occupancy will strengthen the relationship between architect and owner because ultimately the owner will remember more about building start-up and initial operations than the issues that were argued and debated during construction.

Upon written notice from the contractor that the work is ready for final inspection and acceptance, and upon receipt of a final application for payment, the architect and appropriate consultants inspect their respective portions of the work. When the work is found acceptable under the contract documents and it has been determined that the contract was fully performed, the architect issues a final certificate for payment supported by the respective consultants’ payment certifications. Both the inspection and the issuance of the certificate are to be carried out promptly.

The conditions for final completion and final payment are defined in §9.10 of A201™, General Conditions of the Contract for Construction. The architect does not issue a certificate of final completion but only a final certificate for payment. This is because certifying final completion would legally represent that the architect has more than general familiarity with the work completed, which is a services limitation explicitly stated in §4.2.2 of A201™. Only the contractor is responsible for the completion and conformance of the work.

Before the owner makes the final payment to the contractor, §9.10.2 of the general conditions requires submittal of specific documents and representations. These include a certificate from the contractor’s insurance provider that insurance required by the contract documents will remain in force after final payment and will not be cancelled or allowed to expire without 30 days prior written notice to the owner. A written document is also required stating that the contractor knows of no substantial reason the insurance will not be renewable to cover the periods required by the contract documents. AIA Document G707™, Consent of Surety to Final Payment, is also typically required for final payment.

The owner may require other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests, or other encumbrances arising out of the contract. AIA documents G706™, Contractor’s Affidavit of Payment of Debts and Claims, and G706A™, Contractor’s Affidavit of Release of Liens, may be used for these purposes.

The architect cannot find the contract to be fully performed until all required closeout documents and services have been completed. The specifications typically set out the requirements for closeout. Closeout documents include record copies of the contract documents, as well as required markups made by the contractor to indicate the as-built conditions and warranties.

Substantial completion certificates and the final certification for payment are critical documents for the owner and the contractor. The owner assumes control and responsibility for the building at substantial completion, including the cost of insurance, maintenance and utilities. The owner’s loan may be affected, and lenders are naturally very interested in the certificates. Contractors often receive their profit for the project with the final certificate for payment as well as make final payment to their subcontractors.

Considering these significant documents that are finalized by the architect, it is an opportune time for the architect to settle any outstanding accounts. If the architect or its consultants has a fee outstanding for additional services, or if there is a balance remaining in the basic services fee, this is a good time to resolve these issues while everyone has cards on the table.

Documents And Tools For Construction Observation
Construction administration services consist of many intangible activities—making decisions, communicating instructions, observing the work—and participants are judged by the timeliness and the accuracy of their
performance. Accordingly, these activities are recorded in writing or in digital form, even if they have first taken place orally. This record is then available to support the quality of services rendered should anyone’s actions later be called into question.

Meetings, discussions, decisions, and approvals can be recorded in meeting reports, document logs, transmittal letters, memoranda, or a personal journal. A number of AIA documents are available for use in important communications between the architect and the contractor. Today, the architect in the field often has a laptop, a mobile phone and/or a tablet to help him or her stay on top of the details involved in construction contract administration.

Reference Contracts
The architect has a contract with the owner that requires him or her to administer the owner’s contract for construction according to established general conditions. Accordingly, the architect must be knowledgeable about these key documents.

The architect should become completely familiar with the owner-architect agreement before becoming involved with the project. How can the architect administer duties if they do not know what those duties are? Next, the architect should become completely familiar with the owner-contractor agreement and the general conditions of the contract for construction if he or she expects to know how and what to do during the construction phase.

To facilitate this objective it is recommended that the construction contract administrator keep copies of these key documents with their journal or in their laptop. Issues can and usually do arise that require reference to these documents. Should the requirements of these documents differ from the language of the AIA documents, it is suggested that the construction administrator note the differences for easy reference. Owners may not understand the importance of the architect having a copy of the owner-contractor agreement, and they may be reluctant to provide it. AIA Document B101™, Standard Form of Agreement Between Owner and Architect, §5.11, requires the owner to provide a copy of the owner-architect agreement to the architect including the general conditions. If the general conditions agreed upon between the owner and the contractor differ from A201™, the construction administrator should become familiar with the differing requirements and determine if architectural services consistent with the standard of care can still be provided. If not, negotiated revisions in the owner-contractor general conditions is advisable. In any case, the owner should be advised of this discrepancy.

Reference Set of Contract Documents
The architect who visits the project site during construction will want to have a personal set of drawings and specifications for reference. This can be a hard copy set of drawings, or it can be digital media stored on the laptop hard drive. When a sheet is re-issued in a hard copy set, the new sheet is placed in the set on top of the old sheet, and the old sheet is marked to indicate that it is no longer valid. This set of documents provides a complete record of revisions so the architect can quickly reference old details and conditions.
Construction Phase: Observation

Transmittal Letters
Because architects are judged on how quickly they act and react during the construction increment of project delivery, the transmittal letter is a valuable tool for documenting time sensitive administrative activities.

Memoranda
Memoranda are used to record instructions, notices, decisions, conversations, or other important information. If you do not have a standardized format, a blank sheet of paper or an email will suffice to document a message or event.

Personal Journal
To keep a personal record of project communications, architects may choose a sketchbook, binder, or some form of digital documentation. As long as the information is organized and accessible, the format is less important. Such a journal is used to keep track of critical topics or activities, and it becomes a log of events and decisions.

Request for Information
AIA Document G716™, Request for information (RFI), used to ask for information on a project, can be initiated by the owner, architect, or contractor. The contractor is typically the most active sender, and since contractor questions are often time sensitive, it is important that all RFIs be responded to in a timely manner. A frequently required turnaround time for reviewing RFIs is two business days.

RFIs are discussed in more detail in Chapter 3B - Construction, Administration as they are typically administered from the architect’s office. However, if the architect has an on-site project representative, that person should receive copies of all RFIs in the event a physical observation is needed to resolve an issue.

Architect’s Field Report
An effective way of maintaining uniform site observation reports is to use AIA Document G711™, Architect’s Field Report. This form can also be used by an on-site project representative to maintain a daily log of construction activities. Each report should be dated and sequentially numbered. A report should be easy to follow and have appropriate references to project areas; photographs are often included. A field observation report should be filed after each visit to the site.

Architect’s Supplemental Instructions
The architect can issue additional instructions or interpretations or minor changes in the work that do not change the contract sum or time by using AIA Document G710™, Architect’s Supplemental Instructions. This document is intended to help the architect perform its obligations as interpreter of the contract documents in accordance with the owner-architect agreement and the general conditions. Like all recorded project information, it should be numbered, tracked, and logged.
Documents for Changes in the Work
The documents required for changes in the work are addressed in detail in Chapter 3B - Construction Administration. Activities related to changes that occur on site can include:
- Observation and research of change issues
- Delivery of change documents to the owner and contractor
- Contractor pricing review meetings
- Observation of change-related construction
- Review of constructed changes for payment certification

Managing the change process is one of the architect’s most important tasks because of the effect changes can have on the contract sum or time. Any change initiated after the start of construction has a potential for extending time and increasing general conditions costs. Unanticipated changes can increase the construction cost beyond the owner’s established budget.

The most traumatic contract change for the architect is one that is caused by an error or omission in the drawings. The best recourse is to respond quickly and keep communication open, with the goal of avoiding delay or demolition costs. Many errors and omissions, if acted upon quickly, can be resolved without affecting the contract sum or time.

The construction phase is the time in the project when critical activities are time-driven and the owner’s money is being spent at a high rate. Proactive construction administration allows the architect to better fulfill construction phase responsibilities and it demonstrates to the owner that the architect is actively involved with contracted construction phase responsibilities.

Written by James B. Atkins, FAIA
Jim is a senior vice president/principal with HKS Architects in Dallas, where he is involved with project management, construction services and risk management. He chaired The Architect’s Handbook of Professional Practice, 14th Edition Task Group, and he has served on the AIA Risk Management Committee and the AIA Documents Committee.
A primary characteristic of effective construction contract administration (CCA) is the ability to identify, take action, and resolve problematic issues during construction. This characteristic marks the difference between just getting the job done and being a truly effective CCA.

This activity will track the identification and resolution of problematic issues that arise during construction.

Resolution requires specific steps to be efficient and to move the process toward conclusion.

1. Identify the problem
2. Gather information
3. Assemble relevant participants
4. Develop options
5. Determine solution
6. Implement

Activity - Core

Select a project your firm or your mentor’s firm completed with records that document issue resolution. The documents can include meeting reports, action item lists, journal entries, RFIs, and field observation reports. Prepare reports on three issues that were resolved during the construction phase. Use a chronological, timeline approach that addresses meetings held, details generated, documents used, changes made to the contract and the resolution of the issue.

As you prepare your timelines, answer the following questions:

- What caused the problem?
- Was the problem avoidable?
- How long did it take to resolve?
- Who were the parties involved?
- Did it cost the owner money?
- Did it cost the architect money?

The objective of this exercise is to identify similar trends or actions in how the issues were resolved. Necessary components for achieving resolution are:

- Involvement of relevant parties
- Participants must have authority
- Everyone must have a desire to resolve the issue

Evaluate the three reports for anomalies such as missing participants or missing steps. Summarize your findings.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Tracking the Change Process on Site

Supplemental Experience for eight (8) Core IDP Hours

The change order is the primary method of making changes in the work after the owner-contractor agreement has been executed. AIA Document A201™, General Conditions of the Contractor for Construction states, “The Architect will prepare Change Orders and Construction Change Directives, and may authorize minor changes in the Work…”

The administrative tasks for preparing a change order with related construction documents are typically done in the architect’s office. However, the cause of the change and the change itself typically occurs on the site. There is also follow-up required on the application for payment.

This exercise involves tracking the change process on the project site. This process will be a confirmation that the change was fully administered and the owner received full benefit.

Activity - Core

Please reference the following source:
• MASTERSPEC, Section 012600

View and download the following sample documents for reference:
• AIA Document A201™, General Conditions of the Contract for Construction
• AIA Document G701™, Change Order
• AIA Document G702™, Application and Certificate for Payment
• AIA Document G709™, Work Changes Proposal Request
• AIA Document G711™, Architect’s Field Report

Select a project in your firm that is under construction and has experienced change orders. Review the change order log, and select two areas where the project scope has been changed. Assemble all documents related to the two changes. These can include emails or notifications of the need for the changes, the work changes proposal requests, the change orders, field observation reports noting the construction of the changes, and the application for payment that includes the change order summary.

Prepare a summary of the two changes following the path of the changes from their origin through the certificate for payment. Give complete information including nature of the changes, trades involved, and include all related documents.

Establish a time line noting the time required for the following activities:
• Time to prepare the change orders and related contract documents
• Time for the contractor to price the change
• Time for the change to be approved in a change order review session
• Time for the change to be constructed
• Time for the owner to pay for the change

As you prepare your summary, answer the following questions:
• Did the changes add to the contract time as well as the sum?
• Did they originate from an RFI?
• Did they originate from an ASI?
• Were allowances or contingencies involved?

Share your work with your IDP supervisor or mentor and make suggested changes.
Performing a Payment Application Site Review

Supplemental Experience for eight (8) Core IDP Hours

AIA Document A201™, General Conditions of the Contractor for Construction states, “...the Architect will review and certify amounts due the Contractor and will issue Certificates for Payment in such amounts.” Review is accomplished by visiting the site at appropriate intervals to, “...determine in general if the Work observed is being performed...in accordance with the Contract Documents.”

The accepted interval for applications for payment is monthly, so on at least one site visit each month the architect observes the overall work to compare it to the amount represented in the application as being at a specific stage of completion. The contractor may accompany the architect in the review in the event the architect requires substantiation or has questions about portions of the work.

The contractor often provides the architect with a “pencil” copy of the payment application to use in the review. This is a draft copy on which the architect can make changes if the status of work completion does not match the application. This activity involves the preparation and execution of a payment application site review.

Activity - Core

Please reference the following source:
- MASTERSPEC, Sections 012900, 012100, 012200, and 012300

View and download the following sample documents for reference:
- AIA Document A201™, General Conditions of the Contract for Construction
- AIA Document G702™, Application and Certificate for Payment
- AIA Document G703™, Continuation Sheet

Select a project in your firm or your mentor’s firm that is in construction. It is preferred that the project is far enough along so that the applications for payment include architecture. If possible, accompany the construction contract administrator on the site visit to conduct the payment application site review. As you conduct the review, answer the following questions:
- What is the status of work completion?
- What is the represented status reflected on the application?
- Are stored materials involved?
- Is the contractor’s application signed and notarized?
- Is the Schedule of Values in order?
- Are allowances involved?
- Are contingencies involved?
- Are Waivers of Mechanic’s Lien forms attached?
- Is the Change Order Summary accurate and up to date?

When observing the work, make notes as to the completion status and whether or not it aligns with the application. Take note of items in the application that are represented to be complete. If stored materials are listed, ask where they are stored, and if they are off-site, check to see if documentation is included that confirms storage in a bonded warehouse. Write a report summarizing your findings. If you have found that the work represented to be complete is not accurate, list the request amount that you feel is reasonable for the work actually completed. If you reduce the certified amount, write an explanation for those actions to the contractor. Check the retainage amounts to determine if they are being administered properly. When early work has been completed, such as pier drilling or concrete reinforcing, the retainage for that work is often released early. Check the application for such conditions.

Share your work with your IDP supervisor or mentor and make suggested changes.
Preparing a Certificate of Substantial Completion with Amended Punch List

Supplemental Experience for eight (8) Core IDP Hours

Substantial completion is a significant contractual milestone in that it determines if the contractor has met contract completion requirements, it allows the owner to occupy that portion of the project, and it begins the tolling of legal statutes for the architect.

View and download the following sample documents for reference:
- AIA Document G704™, Certificate of Substantial Completion
- AIA Document G810™, Transmittal Letter

Choose a project your firm or your mentor’s firm is close to completing and ask to accompany the team members when they perform their inspection to determine substantial completion. Observe carefully and take notes as you walk through the project, and listen carefully to the observations of others.

After the inspection, use your notes to prepare a punch list by room. Sequence the rooms geographically so you can move through the building in a linear fashion. As you review each room, note any deficiencies. Use active statements; for example, “Touch up paint on door at east wall” instead of “Paint on door at east wall should be touched up.” Put the project name and the date of the inspection at the top of the list. As you prepare your punch list, answer the following questions:
- Is this portion of the project ready for substantial completion inspection?
- Has the contractor prepared a punch list to review during the inspection?
- Should I use narrative, floor plan, or individual room plan as the format?
- Are some discrepancies repetitive, and if so, should I use a key with a symbol?
- How many certificates of substantial completion are appropriate on this project?

Complete AIA Document G704™, Certificate of Substantial Completion. There should be two dates on the form—one indicating the date of substantial completion, and the other indicating the date the certificate is issued. An entire project can be certified as substantially complete, or multiple certificates can be issued covering designated portions. The decision should be based on the size of the project, the sequence of completion, or the stages of owner occupancy. If multiple certificates are issued, the designated area on the final certificate should include the wording, “all remaining portions of the project,” to avoid the possibility that an area was not specifically described.

The certificate in this assignment applies only to the building interior, and the designated area described on the form should indicate as such. The building shell in this case is covered by another contract and will require a separate certificate.

A section at the bottom of the form indicates the time period within which the contractor agrees to resolve the punch list items. Mark a time limit of two weeks. There is also a section where the owner can indicate specific conditions for assuming the costs for operating the building. When all parties sign the certificate, they are agreeing to the conditions set forth in it.

Draft a transmittal letter for sending the certificate and punch list to the contractor for signature. Provide instructions to forward the signed certificate to the owner. If possible, compare your work with the certificate and punch list actually prepared for the project.

Share your work with your IDP supervisor or mentor and make suggested changes.
Evaluating Project Closeout in Preparation for Final Completion
Supplemental Experience for eight (8) Core IDP Hours

Project closeout is a critical step in the ultimate success of a project. The owner will remember more about this stage of the project than most others because it is the fulfillment of their investment of time and money. At this time the architect must determine whether unfinished punch list items are completed and whether the client has all of the project documentation required by the construction contract.

This activity is intended to help you determine if a project has been constructed as it was designed and if the client is satisfied with the final result. The level of completeness of project closeout will influence the extent to which you will be able to make your evaluation because accurate and complete records are necessary for comparing as-built conditions to as-designed plans.

Activity – Core

Please reference the following sources:
- MASTERSPEC, Section 017700
- AIA Document A201™, General Conditions of the Contract for Construction

View and download the following sample documents for reference:
- View and download the following sample documents for reference:
- AIA Document A201™, General Conditions of the Contract for Construction

With the guidance of your supervisor or mentor, select an appropriate completed project for a project closeout evaluation. Assemble all project records and review them thoroughly. In particular, include the following in your study:

- Meeting reports
- Field observation reports
- Change order log
- Record drawings
- Certificate(s) of substantial completion
- Punch lists
- Correspondence related to closeout
- Warranties and guarantees
- Field observation reports and correspondence after project completion
- Final application for payment
- Final change order

Note significant scope changes, problematic issues, and late arrival or completion of products or systems. Read the requirements for project closeout in A201™ and in MASTERSPEC, Section 1. Review the contractor’s closeout documents and compare them to the requirements of the project specifications. Has the contractor met these requirements? Review the punch lists and certificates of substantial completion to determine the amount of work required to inspect for final completion. Prepare a schedule for walking the building to review punch list items. Will the review take more than one site visit?

If your firm or your mentor’s firm agrees, contact the building operator and schedule a visit to the project to review completed conditions. Your firm or mentor may wish to have the project manager make the contact and accompany you. As you review the project, answer the following questions:

- Have the punch list items been resolved?
- Is warranty information available for the owner?
- Is the contractor’s closeout information neatly assembled and easy to follow?
- Was a final change order issued?
- Was a final certificate for payment issued?

Prepare a written report and submit it to the project manager or principal in charge. Note how the research you prepared before your visit did or did not correspond to what you encountered on site or was noted by the building operator. Retain the report in your personal portfolio for use in future project closeout evaluations. Share your work with your IDP supervisor or mentor and make suggested changes.
The Owner-Architect-Contractor (OAC) Meeting

Supplemental Experience for eight (8) Elective IDP Hours

The Owner-Architect-Contractor meeting, also known as the project meeting, is the primary means of communicating between the three parties during the construction phase. It is typically conducted based on a standard agenda, and it usually contains actions items assigned to specific team members with set completion dates. It is typically held on the project site at the same time of the week or month. Attendees typically include the owner’s representative, the architect, the architect’s consultants, owner consultants, and the contractor.

In the meeting, project issues and activities relating to project completion are discussed. These issues are typically critical and time driven. Tasks are assigned to specific parties with defined completion dates. In this scenario, you are providing contract administration services on a retail strip center. The contractor has been selected through a negotiated contract, and the first OAC meeting is scheduled for next week. The meeting will be held weekly, and it will follow a set agenda. You will conduct and report on the meeting. Your objective should be to generate the meeting report as soon as possible after the meeting so that team members can act upon their assigned tasks.

Typical attendees at the meeting will include the following: Owner’s designated representatives, Architect’s designated representatives, Architect’s consultants, Architect’s site representative, Contractor’s designated representatives, and Contractor’s prime subcontractors. Others may attend such as the owner’s separate contractors, testing lab representatives or special consultants.

Activity - Elective

Please reference the following sources:

- The Architect’s Handbook of Professional Practice, 14th ed. Chapter 12.5 - Construction Contract Administration
- MASTERSPEC, Section 1

View and download the following sample documents for reference:

- AIA Document A101™, Standard Form of Agreement Between Owner and Contractor
- AIA Document A201™, General Conditions of the Contract for Construction
- AIA Document B101™, Standard Form of Agreement Between Owner and Architect

Read the reference documents thoroughly; you may wish to consult relevant documents from an existing project as a guide. Prepare a standard agenda for the OAC meeting. In preparation, answer the following questions:

- What are the owner’s typical issues?
- What are the ongoing issues, such as submittal status, RFI status, and change status?
- What are the contractor’s issues, such as project schedule and quality control testing?
- What special issues may arise, and how can they be accommodated by the agenda?

There will be ongoing issues that require attention by specific team members and required resolution dates. Include a means of tracking these issues until resolution. This is called the “action item” format, and they include specific responsibility, assigned party, and date to complete.

Prepare the meeting report format that will be used throughout the project. Determine the copy distribution for the report and the content format. As you prepare the report, answer the following questions:

- Will images be included?
- What will be the format, action item or narrative?
- What others in addition to the owner and contractor will be on the distribution list?

Share your work with your IDP supervisor or mentor and make suggested changes.
Architect’s Field Report

Supplemental Experience for eight (8) Elective IDP Hours

The architect’s field report is the document commonly used for keeping the owner informed about the progress and quality of the work. Preparation of a field report requires knowledge of the contract documents, knowledge of construction, and access to the work.

A field report may contain brief statements addressing the work status and work conformance. Images can be included in the report to give the reader a visual point of reference on the project. Images can also be used to indicate a nonconforming condition.

Field reports should be succinct and factual, without emotional commentary. The information should be logical and progressive with clear subheadings. It should be easy for the reader to identify the portion of the project being addressed.

Reports should be numbered, dated, and indicate the project name and number. Distribution should include all primary participants on the project unless otherwise directed by the owner.

In this scenario, you are visiting a project site to perform site observations and prepare a field observation report for the owner. The project is United Development, and the project number is 1400.

Activity - Elective

View and download the following sample document for reference:
• AIA Document G711™, Architect’s Field Report

Note: If a project under construction is not available, use a completed building such as your office or your home.

Prepare a field report addressing the status of construction, and list discrepancies in construction and finishes. Format the report with subheadings for each room, building façade, or exterior area.

As you prepare your report, answer the following questions:
• Who will be reading the report?
• Will images be included?
• To whom will it be distributed?
• Are there areas that were not observed on the last visit?
• Should consultant field observation reports be attached?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Understanding Construction Activity Pollution Prevention

Supplemental Experience for eight (8) Elective IDP Hours

The prerequisite for sustainable site credit in LEED certification is construction activity pollution prevention. The intent is to reduce pollution from construction activities by controlling soil erosion, water sedimentation and airborne dust generation.

This is achieved by implementing an Erosion and Sedimentation Control (ESC) plan for all construction activities associated with the project.

The Plan describes the measures implemented to accomplish the following objectives:

• Prevent loss of soil during construction by storm water runoff and/or wind erosion, including protecting topsoil by stockpiling for reuse.
• Prevent sedimentation of storm sewer or receiving system.
• Prevent polluting the air with dust and particulate matter.

ESC plans are created during the design phase of a project, and they are implemented during the construction phase.

Activity – Elective

Please reference the following sources:

• An example Erosion and Sedimentation Control plan

Review an ESC plan from an existing project pursuing LEED certification. The plan is submitted as a construction submittal during the construction phase. Review the plan and check for the following documentation:

• Copies of project drawings documenting the erosion and sediment control measures implemented on the site.
• Confirmation of the compliance path taken by the project.
• A narrative describing the erosion and sedimentation control measures implemented on the project.

Review the civil engineering documents for notations and instructions regarding the plan.

Prepare a report on your findings. Include discussions with the project team members regarding the additional efforts required to administer the ESC along with typical construction phase activities.

As you prepare your report answer the following questions:

• Did the contractor meet all of the LEED requirements?
• Did the civil engineer give the ESC plan a favorable review?
• Did the project achieve its LEED certification objective?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Omitted Fireproofing on Structural Steel

Supplemental Experience for eight (8) Elective IDP Hours

The work you design as an architect must conform to code. If the design is not in conformance, occupancy certificates could be withheld until corrections are made. In this exercise, a nonconforming condition is discovered late in the construction process. The exercise illustrates the need for timely, decisive action.

In this scenario, you are providing construction administration services for the renovation of a historic building. The renovation includes the addition of structural steel columns and beams to support a concrete deck balcony around the perimeter of the lobby. The steel frame is wrapped with a high-finish Venetian plaster. The underside has a gypsum board ceiling with recessed light fixtures and sprinkler heads.

The project is on schedule and nearing completion. You are visiting the site to prepare an architect’s field report when you discover that the required fireproofing on the steel frame was omitted on the drawings. The plaster is in place, along with the rough-in of the lights and sprinklers. The only work remaining is the gypsum ceiling and the lighting and sprinkler trim.

The city’s code review apparently missed the absence of fireproofing, but the city’s failure to find the problem will not exonerate you from your errors or omissions.

Activity - Elective

Prepare an outline for a plan to correct the problem. It will be necessary to inform the owner and the contractor of the problem. List the steps required to evaluate the problem and develop a solution. As you prepare the plan, answer the following questions:

• What are the options for achieving an approved solution?
• Who should be involved in the resolution?
• What consultants are needed?
• What subcontractors will be affected?
• What will be the impact on the construction schedule and project completion?
• What temporary work may be required to avoid a delay in the project opening?

Write a memorandum to the owner and contractor describing the problem. Explain that you have developed a plan for correction and request a meeting to review and discuss.

The solution will be implemented by the contractor and must be approved by the city. Develop agendas for the required meetings.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Owner Decision Affecting Public Safety

Supplemental Experience for eight (8) Elective IDP Hours

Owner accepted nonconforming work exists on almost all projects, and the AIA documents allow for the owner to accept such work. However, nonconforming work that affects health, safety and welfare is another matter. The architect must reject such work and insist that it be brought into conformance.

In this scenario, you are providing construction contract administration services in a retail center for a 10,000 square foot stand-alone shoe store. The client has elected to provide some of the building products for contractor installation. One such product is the building door hardware; however, it was included in your contract.

As the project nears substantial completion, the client informs you that you are not to inspect owner-furnished, contractor-installed items for substantial completion. The owner advises that he will do that with his own forces.

Your certificate of substantial completion covers all portions of the construction contract, including owner-furnished, contractor-installed items. You think about how you will explain to the owner that you must inspect all of the work under the contract.

As you are preparing your punch list, you notice that the exit door from the stock room to the building exterior does not have panic hardware, an obvious code violation. Instead, it has been fitted with a less expensive lockset.

Activity - Elective

Please reference the following source:
- AIA Code of Ethics and Professional Conduct
- View and download the following sample document for reference:
  - AIA Document A201™, General Conditions of the Contract for Construction

Review A201™ to determine the requirements for the work to conform to applicable codes. Review the architect’s responsibilities for inspecting for substantial completion and citing all nonconforming conditions. Prepare a memorandum to the owner rejecting the condition as nonconforming work and informing her of the requirements for code compliance. Cite the AIA Code of Ethics requirement for you to contact local building officials if the condition is not remediated.

Prepare a memorandum to the local code official to send in the event the owner does not cooperate. As you are preparing your work, answer the following questions:
- What type of documentation is required for the nonconforming work?
- If a change order had been written deducting the panic hardware, what actions would be required to correct the construction contract?
- Can the correct hardware be installed on the rated door without violating the rating?
- How can you best explain to the owner that this situation is not a matter of choice for either of you?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
ADA Noncompliant Doors
Supplemental Experience for eight (8) Elective IDP Hours

One of the most important aspects of architecture services is their impact on the health, safety, and welfare of building occupants. These exercises illustrate the importance of your professional design responsibilities as they affect use by the general public.

In this scenario, you are providing construction contract administration services on a health care facility. The fire separation in the building is achieved in part by rated doors in the hallways. The hallways are 5'-0" in clear width and the door width is 3'-0". In order to comply with ADA, the latch side of the door must be at least 15 inches from the hallway wall. This will leave a balance of less than one foot on the hinge side.

You are walking the project performing a site observation, and the light-gauge interior metal framing has just begun. As you move through the hallways, you notice that the framed opening for the rated hallway doors is centered in the hallway.

You return to the job trailer and check the contract documents. They indicate that the doors are centered. This condition will not result in the 15 inch offset required by the ADA. You sit back in your chair and think about the appropriate actions to take.

Activity - Elective

Review the documents in a similar project to determine which drawing sheets are affected by such a discrepancy. List the affected sheets.

Write a memorandum to the owner and contractor identifying the discrepancy. Provide a time line for revising and reissuing the documents. Request that the contractor provide a cost for re-framing the hallway doors as well as an assessment of the impact on the construction schedule. As you prepare your memorandum, answer the following questions:

• Which change document is appropriate to use in this instance?
• How do you best explain to the owner how the mistake occurred?
• Should you mention in the memorandum that you are not charging fee for the correction?

When preparing your memorandum, answer the following questions:

• Should you avoid referencing the project in the communication to keep from creating risky documentation?
• How can you present your critique in a non-threatening accusatory way?
• Should you suggest hiring an ADA consultant on future projects?
• What quality control (QC) approach should you recommend on future projects?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Mold Discovered at Site

Supplemental Experience for eight (8) Elective IDP Hours

This activity involves the discovery of a sensitive environmental condition and the actions required for mitigation.

In this scenario, you are walking the site, observing the work and preparing your field report. It has rained heavily over the past week. Although the contractor has taken measures to protect the building with plastic sheeting, water has pooled in some areas on the building slab.

You walk through the stacks of drywall and metal studs stored on the floor, to the northeast corner, where drywall already has been installed. As you move toward the stair at the edge of the building slab, you see wet drywall with black mold two feet up from the slab.

Activity - Elective

View and download the following sample documents for reference:
- AIA Document A201™, General Conditions of the Contract for Construction
- AIA Document G711™, Architect’s Field Report
- AIA Document G716™, Request for Information (RFI)

Prepare an architect’s field report noting the mold on the drywall at the northeast stair tower. Cite specific locations and reject the work where the mold is present. Note that the drywall containing the mold will have to be removed and replaced, and the metal studs at the mold location will require antimicrobial treatment. As you prepare the report, answer the following questions:
- How will you format the report for clarity?
- What article(s) of the general conditions should you reference?
- What wording should be used to reject the work so that it is consistent with contract requirements?
- Should you recommend that an environmental consultant be retained to manage the remediation?

Prepare an RFI to send to the contractor, requesting a complete description of locations where mold is present. Set a time limit of one week for receipt of a response. Request a plan for drying in the building and remediating the wet drywall and mold. The contractor’s Plan of Action must address the following:
- Extent of mold contamination
- Source(s) of water intrusion
- Method of cleanup and decontamination
- Future preventive efforts
- Construction phasing (dry-in/work sequencing)
- Collateral damage to work
- Time line for accomplishing the work

Write a memorandum to the contractor rejecting the damaged area. Advise that the areas in question may require destructive investigation to determine whether mold is inside the walls.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Nonconforming Ceiling Grid

Supplemental Experience for eight (8) Elective IDP Hours

The purpose of site observations is to report the progress and quality of the work to the owner. Sometimes the work may appear to be correct, but on closer review discrepancies may be observed. The nonconforming condition may function as well as the original design, but unless the owner chooses to accept the nonconforming work, it must be corrected or replaced.

In this scenario, you are providing construction contract administration services on a medical office building. The job is a little behind schedule, and the contractor is working extra hours to complete on time. The contractor has informed you that the ceiling grid has been installed, and if you want to do an above-ceiling punch, you should do it before the ceiling tiles are installed.

The project has a reception area with a 2'-0" x 2'-0" suspended acoustical ceiling that has a higher ceiling height than the remaining areas of the building. The grid has been installed, but not the ceiling tiles. No shop drawings were submitted for the ceiling grid layout. The contractor informed you that the grid would conform to the reflected ceiling plans.

As you observe the grid you notice that it is installed with a full tile against one wall and a 6 inch wide tile on the other. You remember that the specifications call for centering the grid so that the partial tiles on each opposing wall will be equal. You pull out your half-size set of drawings, and you note that the grid is centered.

Activity - Elective

Please reference the following source:
- MASTERSPEC, Section 095123

View and download the following sample document for reference:
- AIA Document A201™, General Conditions of the Contract for Construction

Write a field observation report noting the nonconforming condition. Reference the location of the work in the building.

Prepare a memorandum to your MEP consultant requesting they confirm that the lights and mechanical grills will function properly with the nonconforming grid in the event the owner chooses to accept it.

Prepare a memorandum to the owner and contractor rejecting the nonconforming work and requesting a meeting to discuss the condition. The owner can decide in the meeting if she wants to accept the nonconforming work.

As you prepare the report, answer the following questions:
- What section of MASTERSPEC should be cited for enforcement of the nonconforming work?
- What article in the general conditions should be cited for the contractor’s requirement to correct nonconforming work?
- What article in the general conditions should be cited relative to the owner’s acceptance of nonconforming work?
- How can I best present the options to the owner for acceptance or rejection?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Because contractors have specialized knowledge about their products and systems, designers sometimes use them as consultants. A common example is the hardware supplier who may assist in preparing the hardware specification only to appear later as the installing subcontractor. As both consultant and subcontractor, he prepares his own shop drawings and answers his own requests for information.

In this scenario, you are providing construction contract administration services on an office building on the Florida coast. In this locale, wind loads are much greater than in inland areas. There is a requirement for hurricane shutters on all windows, and you have designed a large ornamental window at the building entrance. You have researched available markets, and you can find only one company that has built a hurricane shutter of this size, so you are compelled to use this company as a design consultant. You obtain approval from the owner, cautioning her that this supplier may inevitably be the installing subcontractor.

Construction progresses and soon it is time for the hurricane shutters to be installed. The window supplier has submitted shop drawings through the general contractor, and you have routed them back to the supplier for review and approval. When your office reviewed the supplier’s comments on the drawings, no one notices the note in the corner of the sheet that read, “Attachment as required.”

Soon after the window installation begins, the general contractor informs you that larger metal clips are required to install the large window due to the wind loads. She says that no clips were shown on the drawings, and they will be an addition to the contract. The owner, who is already unhappy about the cost of the large window and the shutters, refuses to consider an add change order. She asks why you used the supplier to design the window in the first place.

**Activity - Elective**

Please reference the following source:
- MASTERSPEC, Section 1
- AIA Document A201™, General Conditions of the Contract for Construction

List the conflicting issues that can arise when a subcontractor is also the design consultant. Consider conflict of interest, contract status, communications, approvals, and design quality. Review the documents for requirements for subcontractors. Prepare a memorandum to the general contractor and owner summarizing the development of the shutter design, and request a meeting to resolve the issue.

Prepare a meeting agenda for the resolution meeting with relevant topics listed in the order of importance. Prepare a narrative for presenting this issue at the meeting. Be mindful that the owner does not work in construction and your terminology and jargon must be understandable. Explain thoroughly for those that may not easily understand. As you prepare your work, answer the following questions:
- Who should attend the meeting?
- The contract anticipated a complete system, and the designer is also the contractor. Shouldn’t the clips already be in the price? How do I express this at the meeting?
- Shouldn’t the contractor have coordinated the shutter attachment?
- What documents should be cited for contractor coordination requirements?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Late Glass Installation Results in Water Intrusion
Supplemental Experience for eight (8) Elective IDP Hours

The contractor is responsible for the sequencing and procedures used to put the work in place. However, if the sequencing is such that the work is damaged, or may become damaged, the architect may question the contractor’s means and methods.

In this scenario, you are administering the construction contract of an eight-story office building. The contract has a bonus clause for the contractor for every day the project is completed in advance of the contractually scheduled date. The building frame has been topped out, and the roof has been installed. The work is several days ahead of schedule, and the contractor vows to finish a month early.

The contractor allowed the curtain wall subcontractor to start early, and the curtain wall frame has been installed to the sixth level. The glass delivery is not scheduled for three more weeks.

The day is overcast, and you want to get your building walk-through completed before it starts to rain. As you enter the building, you hear the buzz of an electric screw gun. You remember that metal studs were already in place on your last walk-through. You wonder if they are finishing up the stud framing or if they are correcting a problem.

As you walk through the door, you see the drywall subcontractor installing drywall in the perimeter offices. The sound of thunder can be heard in the distance.

Activity - Elective

Please reference the following source:
- MASTERSPEC, Section 1

View and download the following sample document for reference:
- AIA Document A201™, General Conditions of the Contract for Construction

Compose an email to send immediately to the contractor, with copy to the owner, citing the contractor’s responsibility for protecting the work. Advise the contractor of the consequences if drywall is damaged.

To prepare for this notice, review AIA Document A201™ for the contractor’s responsibilities for protecting the work. Also review MASTERSPEC, Section 1 for contractor responsibilities for sequencing and protecting. As you prepare to send the notice, answer the following questions:
- What language in MASTERSPEC should be cited?
- What language in A201™ should be cited?
- What will be required to document damaged drywall?
- Should inclement weather be accepted as an offset for lost time in remediating damages work?

Assume that the weather damaged the perimeter drywall.

Prepare a memorandum to the contractor rejecting the damaged work and requesting an action plan and schedule for remediation. Advise the contractor on your decision as to whether the rain constitutes a weather delay. Remember that if the building had been protected, the damage would not have occurred.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Work Installed Without Approved Shop Drawings

Supplemental Experience for eight (8) Elective IDP Hours

Shop drawings are the means by which the architect determines if the contractor’s interpretation of the design concept is acceptable. Accordingly, A201™ prohibits the contractor from performing work that requires a shop drawing until the shop drawing is approved by the architect or its consultants. When the contractor installs work without an approved shop drawing, he is in breach of his contract and he performs the work at his own risk.

In this scenario, you are providing construction contract administration services on a replacement hospital, and the building structural frame has just been topped out. The contractor has begun installation of light gauge metal framing at the lower level. You have received and approved the shop drawings for the metal framing, but you have not yet received the submittals for the hollow metal door frames.

You are performing a site visit to observe job progress to review an application for payment. You notice that the contractor is requesting payment for hollow metal door frames. You remember reviewing a substitution request for component knocked down (KD) hollow metal door frames, but you rejected it because your specification requires full profile welded frames.

As you walk through the first floor you see workmen installing component metal door frames. The contractor has not only purchased nonconforming materials, but he is installing the work without approved shop drawings.

Activity - Elective

Please reference the following sources:
- MASTERSPEC, Section 013300
- MASTERSPEC, Section 081113

View and download the following sample document for reference:
- AIA Document A201™, General Conditions of the Contract for Construction

Prepare a memorandum to send to the owner and contractor rejecting the nonconforming work and advising that no payments will be certified for the hollow metal frames. Cite language from A201™ that prohibits the contractor from installing work without approved shop drawings. Cite language from MASTERSPEC, Section 013300 that sets out the requirements for submittal procedures and a submittal schedule. Cite language from MASTERSPEC, Section 081113 requiring “full profile welded” frames.

Request a submittal schedule and a schedule for removing the nonconforming frames from the site and submitting complying shop drawings for frames that meet all specification requirements. The schedule must address the impact to the overall construction schedule. As you prepare your work, answer the following questions:
- What actions can be recommended to expedite the review of the hollow metal submittal?
- Should the next payment certification be contingent on the contractor providing a submittal schedule?
- How do I best explain to the owner the quality difference between the two types of frames?
- What actions need to be taken if the owner elects to accept the nonconforming hollow metal door frames?
- How would the credit for the cheaper frames be determined should the owner accept them?

Share your work with your IDP supervisor or mentor and make suggested changes.
In this scenario, you are a member of the Our Town Planning Commission. The Town Council has appointed you to lead a Task Force of Commission and Design Review Board members (and with the assistance of certain staff members) to revise and update the town’s Design Review Board (DRB) Standards and Zoning Code for new housing. The Council is particularly interested in the Standards and Zoning Code as they relate to the design, density and massing for projects where the property is zoned for multiple housing units. The reason for the rewriting of the Standards and Code is that there is a lack of affordable housing in the community. As the value of property increases it has become harder and harder for the town to create new affordable housing without increasing the density. The Council would like you to study the problem and report back with your task force’s recommendations.

Some civic groups in Our Town are backed by developers and residential contractors that are pushing to allow greater density. In addition, they would like to see the DRB reduce or eliminate most of the visual and design requirements presently in place because this just “adds money to the project”. They are calling for “25% Design”. A project that utilizes 25% Design has the front or street facing elevation meet the DRB standards for detailing, materials and colors. The other 3 elevations are “stripped” of the detailing and use materials not currently allowed by the Standards such as stucco. In most of these projects, there is a lack of screening and so these views are highly visible from the street and to the neighbors of the development.

The staff is not convinced that the DRB Standards are helping to create better design. They tend to agree with the 25% Design approach outlined by the developers and contractors but think that heavy landscape grading and planting to screen the sides and rear elevation is the most appropriate solution for these projects.

Your neighbors and friends who live in the community are very concerned about the effect that the increased density and lowered design standards would have on their property values. They are also concerned about traffic, noise, increased infrastructure costs and the impact to an already burdened school district that this density will bring to the neighborhood.

How will you organize the Task Force and assign priorities? What types of issues will you deal with as you review the Standards? How do you achieve the goals of affordable housing and address the concerns of the existing neighborhood? How will you respond to staff’s attempts to influence the writing of the new Standards? How will you respond to local housing developers and the public’s influence?

Study the design review board standards and zoning codes in a local city or town. Make an appointment with a DRB member and/or zoning official to discuss the issues of this scenario. Use this opportunity to discuss some of the local politics of the town. Write a 400-500 word analysis of how you would approach this task. In addition, provide a written response to the following questions:

- As a professional, where do you draw the line between the best interests of the property owner and the needs of the overall community
- As a Task Force Leader, what recommendations would you make to City Council
- Describe what other pressures you anticipate will be brought to bear on your Task Force and by whom.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
notes

Take brief notes while reading the narrative and list key resources you used to complete the activities. Note discussion outcomes from meetings with your supervisor, mentor, or consultants. When finalizing the activity documentation (PDF), include your notes and the Emerging Professional’s Companion activity description.
General Project Management

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exhibits

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General Project Management

Introduction

By completing the activities in this chapter, you will gain an understanding of the activities involved in general project management. The following information is taken from the NCARB IDP Guidelines:

General Project Management
Minimum General Project Management Experience: 240 Hours
Definition: Includes planning, organizing, and staffing; budgeting and scheduling; leading and managing the project team; documenting key project information; and monitoring quality assurance.

Tasks
At the completion of your internship, you should be able to:

• Prepare and manage design contracts (owner/architect)
• Prepare and execute professional services contracts (architect/consultant)
• Attend, conduct, and record meetings throughout all phases
• Select, manage, and coordinate consultants
• Partner with the owner’s project delivery team
• Prepare and manage design team schedule and budget (consultant and staff costs)
• Obtain client authorization to proceed per contract phases
• Present at public hearings
• Document project status and progress
• Monitor project construction costs
• Prepare owner/contractor agreement
• Conduct post-occupancy evaluation
• Identify the project design team members and their required scope of services, roles, and responsibilities (e.g., architects, engineers, specialty consultants)
• Identify the project delivery team’s roles and responsibilities (e.g., owner, architect, contractor, program manager)
• Identify project delivery method

Knowledge Of/Skill In

• Construction procurement (e.g., bidding, negotiating)
• Contract negotiation (e.g., fees, scope, schedules)
• Contracts (e.g., professional services and construction)
• Designing and delivering presentations
• Electronic communications (e.g., virtual offices, video-conferencing, web-based networking)
• Interpersonal skills (e.g., listening, diplomacy, responsiveness)
• Invoicing for services
• Oral and written communications
• Permit and approval processes
• Post-occupancy evaluations
• Project budget management
• Project delivery methods
• Project records management

resources

Download the current Intern Development Program (IDP) guidelines at www.ncarb.org/Experience-Through-Internships.aspx.

  • Chapter 13 - Project Management

  • Chapter 14 - Project Management

  • Chapter 9 - Project Management
Knowledge Of/Skill In *Continued*

- Project scheduling (e.g., construction document setup, storyboarding, staffing projections)
- Risk management (e.g., professional and general liability)
- Team building, leadership, participation

*notes*

Take brief notes while reading the narrative and list key resources you used to complete the activities. Note discussion outcomes from meetings with your supervisor, mentor, or consultants. When finalizing the activity documentation (PDF), include your notes and the Emerging Professional’s Companion activity description.
Narrative

Most building design and construction projects involve multiple firms and many people. In these endeavors some people do the work and others direct the work. The latter role—that of project manager—can be a principal of the firm, director, designer, project architect, or job captain. Regardless of who takes on this role, however, the responsibilities of the project manager must be directed toward accomplishing the goals and objectives of the project. The design and construction industry is a project-based world. As such, project management is a key component for any architect or architecture firm.

Project management involves assigning, overseeing, directing, coordinating and monitoring the work of members of the project design team. It also involves managing employee, client, consultant, and contractor relationships. Although exact duties may vary all of these tasks depend on effective communication.

Some project management responsibilities spring from what is objectively defined by the architect’s contract for services. These include issuing notices; providing certifications; and reporting findings, decisions, and observations. Other objective responsibilities may be viewed as industry standards, including such things as attending project meetings, preparing meeting agendas, writing meeting reports, and generally attending to correspondence and documentation.

Subjective and more intangible responsibilities often require a broader application of judgment than objectively identified responsibilities. This side of project management relies on attitude, personality, behavior, and even personal habits. It involves people skills, such as being a good listener, motivating team members, and leading conflict resolution.

What Makes an Effective Project Manager?

Attitude

Project managers must have not only the skills to accomplish activities and responsibilities but also the willingness to bring an appropriate attitude to their role. Most important is dedication to being a strong leader. The effective project manager must be willing to make decisions and take action. The project manager cannot do all of the work personally, and must delegate tasks and rely on others to do much of it. A willingness to believe in others is necessary, as well mentor colleagues and clients on how to view and participate in the project. Many project managers see the work being accomplished exactly as he or she would do it. Yet successful delegation of tasks involves understanding when the work being done is good enough.

In overseeing the work of others as the project evolves, it is often necessary for the project manager to be a coach or motivator. This calls for laying the work out in a clear way and setting reasonable goals for what is to be accomplished. If the tasks or time frame are not reasonable, the
manager must either revise the work plan until the tasks are more achievable or motivate the team to rise to the occasion. A project manager must realize that most teams can stretch to meet the demands of difficult assignments, but that such assignments should be an exception and not the rule.

Project managers must be willing to see project circumstances from multiple points of view and to maintain a neutral attitude when conflicts arise. Nearly every aspect of project management requires give-and-take; it should be anticipated and embraced. The project manager who finds conflict threatening or frustrating will find successful outcomes difficult when disagreements arise.

Problem Solving
Unexpected issues arise as a part of every project. This makes problem solving a critical part of the management process. Coupled with this is the need for project managers to successfully negotiate solutions to problems, with either the client or the contractor. Problems can be viewed as meat and potatoes for the project manager, served in great helpings on a daily basis.

Problems cannot be avoided, nor are they evidence that someone has done something wrong. For the most part, design, schedule, cost, and quality problems are opportunities to improve the project along the way. Intuition and the ability to research, understand, and resolve problems are important attributes for a project manager.

Communication
Communication is the glue that holds all aspects of project delivery together. While the project manager is a distributor of information, a much more important responsibility is facilitating communication among the project participants. Since the project manager is in a position to oversee most of what is happening on a project, he or she is often in the best position to moderate discussions between the client and the design team or between the client and the contractor.

Client Expectations and Project Management
A significant ingredient in project success involves understanding and meeting client expectations. The foundation of the client’s experience is the client’s expectation of how the architect is to perform. The project manager who understands the client’s expectations has a better chance of successfully guiding the project team’s effort to meet them. If client expectations are unreasonably high, the architect may not be able to meet them even if they are fully understood. In such cases, the architect may need to help the client understand the capabilities of the firm and set more relevant and reasonable expectations.

Setting Expectations
An effective way to meet client expectations is to help set them. This is most often accomplished through frank discussion of potentially tough issues, before they become problems.

Tackling Difficult Issues Head On: Architects do not always talk effectively with clients about the services they provide. Often they try to sugarcoat tough issues in an effort to be viewed as non-confrontational.
For example, although errors and omissions are a normal part of professional life, many architects avoid bringing up the subject. However, it is best to discuss difficult issues associated with project expectations directly with the client and other project participants. Determine what each participant believes is true and what is reality. With an understanding of any different perceptions, the issues can be debated in the best interest of both the client and the project. If this communication does not take place, conflicts are definitely on the horizon.

**Explaining consequences:** Discussing the potential consequences of a decision or a change is important. Clients may not always want to believe what the project manager has to say and, in fact, may disagree. Nonetheless, they usually want to hear the project manager’s opinion because it is part of the service they expect. For example, if a client decides to eliminate waterproofing on the basement walls, it is not enough for the architect to simply disagree with the decision. The project manager should go a step further and explain that the decision could result in water leaking into the basement, causing damaged finishes and expensive repair costs. While such consequences may seem obvious to the experienced project manager, they might not be so obvious to the owner. Other client decisions may have less obvious consequences. For instance, a decision to save money on a building system may be likely to increase maintenance expenses. The project manager should share this with the client in plain language.

In all cases, however, the architect’s belief should be discussed with the client when a change is requested and not after the change has been completed. Even if the architect is overruled, the owner is likely to remember that such concerns were expressed.

**“Absolute” Expectations:** Architects tend to state things in absolutes because they want to explain things clearly and without ambiguity. This use of absolute terms may stem from the fact that most owner-architect agreements delineate payment of professional fees in accordance with the percentage of work completed. Thus, the architect may label a set of construction drawings “100% complete” in order to qualify for payment. However, in fact, a single set of construction drawings is unlikely to be 100 percent complete, and labeling them as such can create an expectation of performance that is unintended and even unachievable.

**Risk Management in Project Management**
The project manager must always be an advocate for the project design team. This may include standing by firm employees or the consultants working on the project. However, at times, the project manager is called upon to advocate for the client or for the contractor. Loyalty from clients usually grows from their perception that the architect is doing a good job. The project manager can build this loyalty by understanding that the client, not the project, is the firm’s valuable asset. Delivering the project through dedicated service, and taking care to understand and advocate for the client’s goals throughout, can help win the client’s loyalty. When
clients consistently feel the project manager is on their side and has their best interests at heart, success is closer at hand. The project manager also may need to advocate for the contractor. For example, contractors frequently make suggestions for improving a project or reducing costs but may require the project manager’s assistance to explain these suggestions to the owner.

A Word of Caution: If a project manager becomes an overt advocate only for the architect, he or she risks abandoning and alienating the client. The best approach is to adopt the objective attitude that a good project is a successful project, with ordinary problems and a satisfied client.

Project Management Activities
In carrying out day-to-day duties and responsibilities, project managers marshal and apply their knowledge and skills to lead, solve problems, motivate others, advocate, measure, document, and communicate. The management of architectural projects consists of activities that can be grouped into several broad categories for which the project manager is responsible:

- Planning, organizing, and staffing the project
- Facilitating the work
- Monitoring progress
- Concluding the project

These groups of activities essentially embody the full range of tasks and responsibilities that project managers will encounter in their assignments.

Planning, Organizing, and Staffing
The project manager usually takes charge of planning, organizing, and staffing a project. This simply means the project manager develops a primary understanding of how and when the project will be worked on and what leadership and staff will be needed to perform the work. The project manager usually interacts with firm leaders, and perhaps with other project managers, as this understanding becomes documented in a work plan.

Development of a work plan for the project begins with consideration of schedules, ways to organize relationships between the parties, the firm’s available resources, and perhaps fees. In addition, how the leadership for the project will be organized and what experience and specialty levels will be required are identified.

The Work Plan
The work plan is a key part of effective project management. To be useful, a work plan need not be complicated or lengthy. For most projects, it need only include the elements listed on the following pages. Even on large projects, this information may take up no more than a few pages.
Maintaining a work plan is an ongoing process. Projections for staffing, schedules, and budgets must be revisited and adjusted as new information becomes available. When carefully prepared, items one (1) through seven (7) can be presented to clients to illustrate how you plan to approach their projects. The work plan should include the following:

1. **Project description and client requirements.** The work plan includes a description of the project, including its scope and the client’s budget, as well as a record of what work the client has authorized. The client’s primary goals for the scope and quality of the project should also be incorporated into the project description.

   Depending on the project phase, client authorizations may be represented in the work plan by a simple checklist of authorized work keyed to copies of signed owner-architect agreements. Client authorizations can include various kinds of documentation, ranging from letters of agreement to formal contracts to phase-completion sign-offs. The project manager tracks and monitors all of these authorizations.

2. **Statement of deliverables.** Projects normally include a work product or deliverable produced by the architect. Such deliverables may include reports, sketches and drawings, specifications, virtual or physical models, and other items. The work plan should include estimates for the types and quantities of deliverables required to complete the work. The format of this estimate can be a simple list or a storyboard or cartoon depiction of the deliverables for each phase of the architect’s services. This description and estimate provides a basis for developing the project schedule, staffing needs, and budget for the architect’s work.

3. **Team organization.** Owners want information on how the architect will organize project staff, and how that staff will relate to other parties involved in the project. A chart is helpful for communicating the relationships between the project team participants.

   A team chart typically reflects who the primary project leaders will be, such as the principal-in-charge, the project manager, designers, project architects, and job captains. While there can be many position titles in an architect’s office, the basic intent of the team chart is to define the hierarchy of the architect’s team, reflect who will be responsible for what assignments, and show primary relationships between members of the project team.

4. **Responsibility matrix.** A companion task to defining deliverables is determining who will do what on the project. When a project requires consultants, it is important to have an explicit understanding of what each consultant will do. For example, it is not enough to have a seat-of-the-pants understanding that the M/E/P engineer will “do the M/E/P engineering.” A more detailed understanding would distinguish responsibilities such as these: “The electrical engineer will wire and circuit the landscape...”
architect’s lighting design,” or “the M/E/P engineer will coordinate HVAC equipment selections with the acoustical engineer.”

5. **Preliminary schedule.** Most requests for proposals (RFPs) received or tendered by the architect relate in some manner to the project schedule. This means the work plan should delineate the preliminary project schedule as clearly and as accurately as possible. Whether the objective is to complete a retail project in time for the fall shopping season or to open a sports facility for the opening home game, the owner’s goals for the project often dictate its major milestones. Into this mix, the architect must project the team’s ability to perform the work within the owner’s set of key dates. The preliminary schedule is one of the primary drivers of the architect’s assessment of staffing needs.

Project managers must also learn that a project schedule is more than a simple bar chart that represents time periods. A project schedule is the graphic representation of an organized series of promises and commitments. It cannot be developed in a vacuum. It must be developed through collaboration and coordination.

6. **Preliminary staffing needs.**

Preliminary staffing requirements can be estimated once the project scope has been delineated, the deliverables understood, the consultant’s responsibilities defined, and a preliminary schedule developed. The project manager may work with upper management (in a larger firm) to determine what key personnel will be available and what support staff will be required. If available staffing becomes a greater constraint on the firm’s ability to deliver the project than the client’s scheduling goals, the firm may need to revisit the preliminary schedule with the client and perhaps revise it.

When project leaders and staff positions have been identified, the project manager reviews the project organization chart and the required tasks to verify that assigned staff members have the needed skills and experience for the work they will be doing. In fact, staff experience is rarely evenly matched to the project assignments, so the project manager will always need to make adjustments to effectively use the talents of everyone assigned to a project.
7. **Project directory.** A project directory with current listings for all project entities and their key personnel should be included in the work plan. This can be prepared in a format the firm normally uses, or the entries can be printed from an e-mail management program such as Microsoft Outlook. More simply, organized copies of business cards can be used to develop a directory.

8. **Project budget and profit plan.** The project manager may sometimes be assigned the duty of apportioning the project fee to the various tasks required to produce the work to help estimate and plan for the firm’s profit. Often referred to as a job cost budget or a project budget, a copy of this should be included in the work plan.

9. **Code information.** Code information is optional.

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**Facilitating the Project**

As the role of the project manager has evolved, what was once thought of as “controlling” the project has come to be more a role of “facilitating” the project. The delivery of design services is facilitated through communicating effectively; developing good working relationships with the client, contractor, and consultants; providing assistance to parties whose decisions are necessary to keep the design services moving forward; and developing and using effective documentation.

**Managing the Project Team**

Managing the project team? This sounds like an overwhelming responsibility. However, the basic requirement boils down to a few key ideals. The first calls for understanding what the team is to accomplish. The second requires an understanding of who on the team has the skills to do what tasks, and where additional resources may be needed. The third is fostering a communications environment in which all parties are kept informed of what is expected of them and when their assignments are due. The key tools and techniques for accomplishing this are the work plan, effective management of project meetings, and reasonably thorough documentation of key project decisions and actions.

**Managing Project Meetings**

Successful project managers must learn to orchestrate and administrate project meetings. All project managers have faced the frustration of disruptions, lack of preparation on someone’s part, or disruptive—even angry—people while trying to run a meeting. It is possible to take an analytical view of managing meetings and look at some ways a project manager can be more effective. A first step is to first understand the obstacles to a successful meeting, which include the following:

- Too many people in attendance
- A disruptive participant
- People who don’t pay attention
- Unprepared attendees
- Sidebar conversations
- Cell phone or PDA interruptions
You will have to find a way around such obstacles, even if it means bringing a gavel to the meeting. You don’t want the meeting so out of control that you have to raise your voice to get attendees to pay attention.

*Meetings Schedule:* Arguably, for any project—but particularly for projects with more than three or four participants—it is important to hold regular meetings. Setting a routine by conducting the meetings on the same day of the week at the same time is advisable. Personal schedules tend to fall into a groove, and the participants will adapt more effectively to regularly set meetings. On smaller projects, it will save time and expense to organize the meeting via conference call if the agenda is short. Remember, it is important not to skip meetings. Missed meetings erode communication, and lack of communication is at the root of most problems on architecture projects.

*Effective Agendas:* Many project managers commonly arrive at a meeting with a single sheet of paper titled an agenda. This approach reflects a misunderstanding of what is to be accomplished by using an agenda. The actual purpose of an agenda is to facilitate discussion rather than to remind attendees of what is to be discussed. Therefore, in addition to the typical list of discussion topics, the agenda should be attached to additional pertinent information, such as e-mails, memoranda, schedules, budgets, reports, and the like. While this consumes more paper, attaching pertinent backup information to the agenda removes the risk that an important discussion item will be tabled because a particular attendee cannot recall the details to be discussed.

The list of agenda topics should be distributed a day or two in advance of the meeting, along with a request for comments. Although some recipients won’t bother to read them, at least everyone will have an opportunity to influence the structure of the meeting.

*Reporting on Project Meetings:* Meeting reports, sometimes called minutes, are a record of the general discussion, decisions made, directions given, and assignments accepted during the course of a project meeting. With time-driven assignments, it is advisable to publish meeting reports as soon as possible after the meeting. A copy of the agenda and any meaningful handouts presented during the meeting, along with copies of drawings or sketches, should be attached to the meeting report. With the advent of digital files and sheet-fed scanners, the entire information package can be distributed quickly and inexpensively via e-mail. Meeting reports may be prepared by the project manager or a team leader appointed by the manager.

Although some managers believe meeting reports are primarily prepared for risk management purposes, the effective project manager understands the primary purpose of minutes is to facilitate communication among project participants. Meeting reports should be distributed to all pertinent persons—whether in attendance or not—so they can stay up-to-date on the project status, recent decisions, and what is expected from members of the project team. Reports should record discussions in enough detail so that decisions and directions given—even if not expressed verbatim—can be reconstructed.
Managing Information
The project manager must be the driving force behind creation of the documentary record while the project is ongoing. Documentation includes preparing proposals and agreements, meeting agendas and reports, phase sign-offs, memoranda, and other correspondence that facilitates and explains communications between and among project participants. If a project manager has poor documentation habits, the rest of the team will tend to mimic those habits.

Managing and directing the flow of project information and saving that information in an orderly manner is perhaps the most important responsibility of the project manager. Of course, not all project information is created internally. As information is received from outside sources, such as the owner, consultants, or contractors, it must be processed. Processing includes noting the date the material is received, determining who requires copies, and deciding how the information will be preserved and filed.

Monitoring Progress
The project manager’s best efforts will not be sufficient if he or she does not monitor the progress of the project against project goals and objectives, the responsibilities established in the owner-architect agreement, and what is required by the standard of care.

When monitoring the progress of a project, the project manager must gauge and measure how well the client, contractor, consultants, and staff are accomplishing the goals established in the work plan. Here, more than in any other activity, the project manager must not adopt a passive stance. If monitoring the progress of the project against the work plan reveals inconsistencies, adjustments in course must be made. The project manager’s lines of communication must be energized, and appropriate decisions put in place to bring the project back in line.

Tracking Required Services
Project managers should be actively involved in the development of proposals and agreements. Both small and large offices require a certain discipline when developing these documents, since they set forth the foundation for project success or failure. Ideally, the project manager will be included in both the initial preparation of proposals and agreements as well as in the negotiation of final agreements. Participating in this process will give the project manager an intimate knowledge of both the firm’s and the client’s goals, and his or her familiarity with the issues will help the firm maintain continuity throughout the delivery process. Encouraging involvement of the project manager during this crucial stage of relationship building with the client also demonstrates the firm’s confidence in the leadership and authority of the project manager.

The Agreement: Project managers should keep a copy of the owner-architect agreement in a notebook at their desks at all times. As questions about services arise, the manager can refer to the contract to see if the issue is addressed. The manager should make a checklist of any contract-mandated reports or notices, schedule them, and monitor whether they are being implemented. For example, the contract may

resources
As you research and look for more information on topics presented in the Emerging Professional’s Companion, remember that a quick internet search of keywords can be incredibly useful to completing your Activities.
require written notice of the architect’s awareness of a schedule delay. Effective project managers understand that compliance with contract requirements is not optional. Monitoring whether contract provisions are being met is a serious responsibility. For this reason, the project manager should have a copy of the agreement at the ready, and read it often enough that it is dog-eared and annotated to excess when the project is concluded.

Standard of Care: Not all activities the architect carries out on a project are described in a contract. Things not described might include, for example, making a subjective judgment as to how complete a set of drawings must be or how often the architect should visit the job site during construction. Such matters relate to the “standard of care” concept, which can be stated in many different ways but essentially boils down to the notion that the architect is required to do what a reasonably prudent architect would do in the same community, in the same time frame, given the same or similar facts and circumstances.

Monitoring Client Objectives
The architect designs a building to accomplish as many of the client’s stated goals and objectives as possible. Those objectives are generally focused on the scope of the project, its cost, and its desired quality. Careful attention must therefore be given to how closely the design accommodates these objectives. The project manager should make frequent comparisons of the current design to the client’s objectives. If gaps or differences between the design and the client’s objectives are found, the manager must take corrective action. This could mean reviewing the differences with the client to determine if the design, the construction budget, or the level of quality should be revised. Small corrective measures could simply require minor revisions to designs or candid discussions with the client.

Construction budget targets: Although most architects are not construction cost estimators, the project manager should understand the relationship between scope, quality, and cost. The manager should have a good enough grasp of all aspects of the project to be able to make appropriate recommendations for scope or quality adjustments in the event cost estimates or bids exceed target construction budgets.

By far, the best approach to meeting client expectations for construction budgets is to carefully monitor the relationship between scope, quality, and cost as a design is being developed. Architects and clients alike are frequently tempted to look past a potential conflict between budget and estimated construction costs, hoping the conflict will be resolved in competitive bidding or subsequent events.

The best practical way to resolve such conflicts—although it may be a painful experience—is to sit with the client and review and adjust one or more of the project parameters of quality, time, and cost before proceeding to the next step in the design process.

Internal Budget Tracking and Management
Most project managers are asked to allocate portions of the fee to the various project phases in a proportion that matches the anticipated workload for each phase. Referred to as a job cost budget or a project budget, the purpose of these estimates is to budget for the firm’s labor and other expenses and profit.
General Project Management

Expenses include basic service consultants, unreimbursed expenses, and reimbursable expenses. Producing a realistic project budget requires an understanding of the firm’s labor rates and project delivery and staffing practices. As the work progresses, the project manager periodically checks actual costs against the budget plan.

Some firms develop their labor budgets using worker-hour estimates only. When dollar-based estimates are preferred, firms may use actual employee hourly costs or average hourly costs. The advantage of worker-hour only or average hourly cost methods is that they remove any incentive to reduce costs by choosing only low-priced and/or potentially less experienced staff for the project. Considering that most firms calculate profit for distribution at the end of the year based on the firm’s total income and expenses, even when employee-specific costs are used, everything averages out by the end of the year. However, for the firm’s senior management, having access to and reviewing actual employee-specific costs means the exact financial position of each project can be determined at any time.

*Tracking employee time records:* Project managers in most firms check the time records of the employees they supervise on an ongoing basis. The time records are approved and sent to the accountants. If corrections are required, they are first returned to the employee.

*Consultant invoices:* The project manager also reviews invoices from consultants to determine whether the consultant’s progress matches the amount invoiced. To simplify this process, some firms pay their primary consultants—such as structural and M/E/P engineers—on the same percentage complete basis as the invoice the architect submits to the client. In this approach, only reimbursable expense invoices are required from these consultants. However, some adjustment of payments is usually required when the consultant’s work progress doesn’t match the architect’s progress, as would be the case with contract administration fees for the structural engineer, who is usually finished before the architect.

*Reimbursable expenses:* Most architects pass on certain expenses to the client, such as those for out-of-town travel and living, reproduction and printing, photography, postage and shipping, and renderings and models. The way reimbursable expenses will be handled or marked up is typically defined in the owner-architect agreement and must be coordinated and tracked to match the contract requirements.

*Client invoices:* Invoices should be reviewed before they are sent to the client to determine that the amount billed represents the status of the work that has been completed. This should involve making sure the work being invoiced matches current client work authorizations. Reimbursable expenses should be checked against contract provisions—particularly if there is a limit on the amount to be reimbursed. Some firms believe the close working relationship that project managers have with clients puts them in an ideal position to discuss any overdue invoices. Other firms prefer not to put managers in an adversarial position with clients if there are disputes about amounts due.
Maintaining Project Quality

Managing Consultants
The way to “do better work” for many projects involves finding a better solution to coordinating with the work of consultants. Architects and consultants face similar problems in project delivery, such as:

- Reaching the finish line at about the same time to avoid disruption when documents are issued for bidding or construction
- Making sure all parties are using the same versions of the plan backgrounds
- Uncovering and coordinating conflicts between the work of different disciplines

Project managers must allot time and resources to attend to challenges such as these.

Quality Management
Some project managers believe that quality management and quality control are relegated to the technical guys in the back room. Nothing could be further from the truth. In managing and controlling quality at the project level, quality must be a daily concern of the project manager. As with other management responsibilities, this does not necessarily mean holding a red pencil and constantly marking up the efforts of the people producing the work, any more than the project manager is required to actually prepare the drawings and specifications, although some project managers may choose to do so. It does mean the project manager must know the status of the work at all times and must oversee and direct quality management controls as they are performed.

Responsibility for Document Reviews
The project manager should consider document reviews as an opportunity to uncover mistakes and other conditions before they create problems during construction. However, many managers are reluctant to invite the criticism that results when documents are reviewed, possibly fearing they will be perceived as a poor manager when scrutiny reveals deficiencies in the work they are directing. The irony of this thinking is that the contractor and subcontractors—through requests for information and change orders—will surely discover deficiencies that make their way into the construction drawings and specifications.

The project manager should schedule both time and resources for internal reviews of the project construction documents, if possible before the project is issued for bidding or negotiation. In small firms, the review might be made directly by the project manager. In large firms, the manager may select a reviewer, often a leader from another project. Specification writers can provide valuable internal peer reviews as their familiarity with the project helps them coordinate terminology between drawings and specifications and identify areas in the drawings where materials or systems have not been correctly represented.

External review of the project documents can also be useful. The project manager should welcome such reviews, whether they are provided by owners, contractors or subcontractors, agencies to which application have been made for building permits, or architects or engineers specializing in plan checking. Most external reviews provide an excellent opportunity for the project manager to improve the quality of drawings and specifications.
Concluding the Project

This management activity encompasses closeout tasks, such as delivering warranties and operating manuals to the owner, and housekeeping activities such as archiving project files. This activity should also include investigations to determine the quality of the services that were provided and efforts to obtain opinions from the owner, and possibly the contractor, about those services.

Post-Construction Evaluation

The most valuable insight into the effectiveness of the architect’s services can come from discussing those services with the owner and contractor immediately after occupancy of the project. At this time, minor irritations and recollection of bumps in the road are still fresh in their minds. While no architect wants to be beat up over minor issues, all want to improve the quality of their services. If a project is successful, the client and contractor may later decide not to mention the little things. The reality of professional service is that what the clients and contractors experience—as users of the architect’s services—counts a great deal in determining the quality of the experience. Following are several ways to carry out post-construction evaluation:

- **Team roundtable and project debriefing.** When construction is complete and the architect’s services are concluded, the project team may be scattered to the winds. Still, the project manager should gather the remaining troops and share insights gained from discussions with the owner and contractor, as well as detail the degree to which the firm’s quality and financial goals were met. An equally important objective of a project debriefing is to allow members of the project team to discuss their experiences, and to offer suggestions and ideas for improving work on future projects.

- **Year-end review with the client.** While it is ordinarily an additional service, many architects make a post-occupancy evaluation part of their normal services, especially with repeat clients. A walk-through, or even an inspection is conducted approximately a year after occupancy. This is done with the owner, supervisory personnel, and operations and/or maintenance staff to compare programmed use with actual use, the effectiveness of the design, and the performance of materials and systems. The year-end review allows the architect to reinforce the positive aspects of the relationship with the client. It also provides a heads-up on any problems the owner may be having with the project. While no one enjoys learning of problems that may be brewing, it is certain that bad news—if it is present—does not get better with age.

- **Mistakes are reality.** Although no one likes reliving the mistakes they have made, mistakes are a reality. Architects rarely prepare perfect sets of drawings or provide perfect services. As the project team explores what they did wrong or what they can do differently next time, the project manager should remind them that the purpose of revisiting project experiences is to improve
the architect’s services—not to castigate participants. Nonetheless, when discussing mistakes, particularly with the owner, an attitude of contrition is preferable to one of defensiveness.

Conclusion

Good project management is critical to any architecture firm committed to providing excellent services. While the expansive nature of project management can be challenging to describe, its basic tasks include determining who, when, and how the work will be done; directing and leading those who will do the work; tracking how progress compares to what was planned; taking action to make course adjustments when deviation from the plan is required; and evaluating and communicating how well the work was performed. Yet project management is more than just a series of tasks. The project manager embodies professionalism, accountability, and integrity. In line with these more subtle and less apparent qualities, project management can also be viewed as an attitude and a way of going about one’s work. For these reasons, a wise architect or other design professional will remain a student of project management throughout his or her career.

Written by Grant A. Simpson, AIA

Grant A. Simpson has served as a project delivery leader for several firms, including RTKL Associates and HKS, where his responsibilities included construction documentation, project management, and loss prevention activities. Simpson served as chair of the 2006 AIA Practice Management Knowledge Community advisory group and currently serves on the AIA Risk Management Committee.
Technical Coordination Meetings

Supplemental Experience for eight (8) Core IDP Hours

Participate in a technical coordination meeting during or just following design development, at your firm or your mentor’s firm. The meeting should include at least one of the engineering team members, preferably more. Prepare for the meeting, actively participate in it, and afterwards prepare meeting minutes.

Activity - Core

Prepare for the meeting by reviewing “in progress” drawings for the engineering disciplines along with the architectural drawings. Are the engineering systems supporting the architectural design ideas put forth in the schematic design? Are adjustments to the overall design agreed upon?

During the meeting, listen to the discussion and take notes. Be sure to ask questions if you don’t understand an issue.

After the meeting use your notes and prepare a presentation for the project as if you were giving the meeting for the client, be sure to include in your presentation:

- Project’s scope, quality, and cost.
- Any alterations to systems or designs.
- Any other issues that the client may need to know
- Explain details for specific components.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Attend a Project Meeting & Write a Meeting Report
Supplemental Experience for eight (8) Core IDP Hours

Interaction with design team members, clients and contractors during project meetings is one of the most common activities of the project manager’s daily professional life. Sometimes it seems that meetings will never end. Meetings are generally scheduled because there are important project issues to be discussed. Whenever important project issues are discussed, it is important to document those discussions.

Preparing accurate and detailed reports of meeting discussions is one of the most important aspects of managing and monitoring the flow of assignments and approvals on a project. The meeting report is one of the project manager’s most important tools.

Some managers tend to put off the tedium of preparing reports. Your goal is to begin to develop an attitude that the report is an important and useful tool that should not be considered tedious or be put off to another day.

Activity - Core

Please reference the following source:
- The Architect’s Handbook of Professional Practice, 14th ed. Chapter 13.2 - Managing Architectural Projects

Meet with your supervisor to make arrangements to attend a project meeting for a project in your firm or a mentor’s firm. Ideally the meeting would involve 8 to 10, or more attendees, and take place during the design development or construction documents phase.

Before the meeting, meet with the project manager to discuss the project background. If possible, read the manager’s meeting reports from the previous two or three meetings. Discuss the project manager’s preferred meeting report format.

Attend the meeting, and as an endeavor separate from the formal report prepared by others, prepare a report recording your impressions of the events of the meeting. Afterwards compare your report with the formal report and note the differences.

As you prepare your report answer the following questions:
- Is it necessary to record every statement made by attendees?
- Is it possible to keep track of the important issues without actually taking down issues verbatim?
- Was the meeting well organized and easily followed?
- Was the agenda effective in stimulating conversation?
- Were the attendees prepared to discuss the issues?
- Did the issues that were important to be recorded in the report the subject of sufficient focus during the meeting?
- Were you able to identify report items that would help the team accomplish project management goals?
- Were the next steps agreed upon by attendees?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Study a Firm’s Job Cost Budget Process

Supplemental Experience for eight (8) Core IDP Hours

Most firms require their project managers to monitor the financial performance of their projects. Some firms assess the project manager’s performance on the basis of the profitability of their projects. However, there is no hard and fast set of rules for monitoring project profitability. Nonetheless, in most firms the project manager must understand the relationship of project delivery within the culture of the firm to the firm’s profitability.

The architect’s labor—the project staff—is the most expensive cost that the project manager can directly control. The project labor is further qualified by the professional knowledge and ability of each team member. Finally, there is no perfect project team, for the project manager’s planning purposes; there are only average project teams.

Activity - Core

Please reference the following source:

Meet with your supervisor or mentor to discuss how their firm allocates expertise, time and expenses to its projects. Discuss the project manager’s role in developing performance budgets for its projects. Discuss the firm’s accounting system and how costs are allocated and tracked. Discuss how the firm accounts for indirect expenses and overhead. The firm may have learning tools to help you understand these issues.

Working with your supervisor or mentor, select an example project from their office, in any service phase, for which you will hypothetically plan the job cost budget. This will be an iterative process. Meet and review your work with your supervisor several times to develop an understanding of how time and resources are consumed as the project is delivered.

Using available forms and processes, prepare a job cost budget and summary that addresses the questions listed:
- How many employees are required to produce the architectural work during each phase of service?
- Building upon the “work plan” concept, how long will each phase of service last?
- What hourly billing rate does your firm budget for each category of employee?
- Does your firm have a profit target budget, or is profit budgeted as what remains after expenses?
- What is the difference between a profit target and what remains?
- How does your firm budget the cost of consultants?
- What is the difference between “direct” expenses and “indirect” expenses?
- How does your firm budget for reimbursed expenses?
- How does your firm budget for non-reimbursed expenses?
- How often are project management reviews held? Every two weeks?

Compare your completed job cost budget with the firm’s actual job cost budget and make notes about the differences in your summary.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Prepare a Proposal  
*Supplemental Experience for eight (8) Core IDP Hours*

Most architectural firms submit a proposal for architectural services to prospective clients before they are awarded a new project commission. The proposal is usually proprietary to the firm, with different firms having different proposal philosophies. Some firms prefer very brief forms of proposal, while other firms prefer more detailed proposals that reflect lessons learned the hard way. The AIA helps architects with their proposals through the use of AIA 305™, Architect’s Qualification Statement.

Proposals should have some fundamental components, including:

1. Description of the project
2. Scope of services to be performed
3. The fee quote
4. Payment terms
5. Discussion of schedule
6. Terms and conditions

Activity - Core

Please reference the following source:

- *The Architect’s Handbook of Professional Practice*, 14th ed. Chapter 11 - Project Definition

View and download the following sample documents for reference:

- AIA B101™, Owner-Architect Agreement
- AIA A201™, General Conditions of the Contract for Construction
- AIA 305™, Architect’s Qualification Statement

Working with your supervisor or mentor, select a project in their office that is in the proposal phase, or a recently awarded project for which a proposal was recently prepared. Obtain a copy of the firm’s current AIA 305™, Architect’s Qualification Statement. If the firm does not use the Architect’s Qualification Statement, then obtain a copy of their current marketing material that lists the firm’s qualifications. Also obtain a copy of the firm’s form of proposal that will be used on this project, or a copy of a recent proposal from a different but similar project.

Discuss the following questions, and any others about the proposal process, with your supervisor or mentor.

- How will fees be quoted (percent of construction cost, lump sum, $ per square foot, etc.)
- How will the services to be provided be described?
- Who will pay for consultant’s services?
- Who will pay for routine expenses, like travel, lodging, or postage?
- What terms and conditions will be proposed?
- What will be the payment terms?

Independent of the firm’s actual proposal preparation, you are to prepare a draft proposal for the project. As you work through the proposal draft include the following information:

- What kind of project is it?
- How does the project complexity or schedule affect services and fees?
- What services are required?
- What fees are appropriate?

The first time you prepare proposal may be a confusing, possibly intimidating experience. Consult your supervisor frequently. Compare your draft proposal with the firm’s actual proposal and mark up the differences. Share your work with your IDP supervisor or mentor and make suggested changes.
Prepare a Draft Work Plan

Supplemental Experience for eight (8) Core IDP Hours

The very mention of preparing a work plan to show a client how a project will be delivered strikes fear in the hearts of most project managers. This chapter narrative and the corresponding narrative in Chapter 13.2 - Managing Architectural Projects in *The Architect’s Handbook of Professional Practice* describe the fundamentals of a work plan. More information or less information can be compiled at the project manager’s option. Preparing a work plan is not particularly tedious, nor is it a burdensome process, but it does require attention to detail to organize all of the components.

The work plan concept revolves around how you will manage a project. Components can be suggested, but final decisions about the components and their content will be a reflection of your own project management approach.

**Activity - Core**

Please reference the following source:


Work with your supervisor or mentor to select a project in their office that is in the proposal stage to serve as a working exercise in developing a work plan.

Your work plan is to include, at a minimum, a preliminary draft at least 5 of the following components:

- Project description and client requirements
- Statement of deliverables
- Team organization chart
- Responsibility matrix
- Preliminary project schedule
- Preliminary staffing needs
- Project directory

As you prepare your work plan, answer the following questions:

- Who are the core players from the various companies who will be involved?
- What form of contract is contemplated?
- What kind of project is it?
- What are the owner’s schedule goals and requirements?
- What consultants are required to assemble an appropriate project team?
- How many employees, and at what skill levels are required?
- What work is to be done, explained in terms of services and deliverables?
- What is an appropriate fee for the professional services you will manage and provide?

Compare your draft work plan with the firm’s actual work plan in place for the project, if there is one, and mark up the differences.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Devising a Schedule for the Production of Construction Drawings

Supplemental Experience for eight (8) Elective IDP Hours

Devising an efficient but realistic schedule for production of construction drawings takes considerable experience. The following are among the key factors in creating a production schedule for construction drawings:

- Total quantity of drawings to be produced (from assessments made while generating the mock-up set)
- Complexity of the work
- Clarity and consistency of decisions made during the DD phase
- Division of the work among members of the project team
- Number and relative experience of the individuals available to do the work
- Other work in progress at the office to which team members might occasionally be assigned
- Proper sequencing (some drawings can only be done after others have been completed)
- An understanding of the potential of your working tools and methods. (For example: CAD systems provide the architect with a range of tools to facilitate the drawing, review, and coordination of documents.)
- Document review, coordination, and approval processes by internal and external team members
- Consultants’ working processes and efficiency
- Mode of project delivery (e.g., fast track or conventional)

Activity - Elective

At the beginning of the CD phase of a project in your office, use a mock-up set of drawings to devise a schedule for the production of construction drawings. Ask your mentor and/or the project manager for help. Consider the issues enumerated above. Ask senior colleagues in the office to review your work.

Update the schedule periodically, keeping track of the changes, until the end of the CD phase to reflect changes in the work and in your understanding of the project scope. Assess your ability to foresee the progression of the work.

Write a brief report on the schedule you created and be sure to answer the following questions:

- How similar is your initial schedule to the final schedule?
- What did you successfully account for in your schedule?
- What were you not able to account for initially?
- What would you have done differently with your schedule?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Observing Contractor Selection
Supplemental Experience for eight (8) Elective IDP Hours

While contractor selection procedures are well documented in AIA publications, architectural observation and judgment is a necessary component in choosing the right company for the job.

Activity - Elective

Set up a meeting to interview one of the senior members of your firm or your mentor’s firm about their contractor selection and negotiation process. Look for answers to questions such as these:

- Is this contractor selection approach typical for your firm, or are different strategies used for different kinds of clients and projects?
- Does the process unfold smoothly, or are there bumps in the road?
- When does the discussion about the mode of contractor selection take place?
- Are any other options for project delivery considered, or is the choice obvious?
- Now, arrange to attend a meeting where contractor selection will take place. Write a narrative summarizing the selection process. Was it the same as your original interview revealed? Why or why not?

Prepare a report summarizing your observations on the process and its overall effectiveness.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Understanding Integrated Project Delivery Terminology in the Construction Phase

Supplemental Experience for eight (8) Elective IDP Hours

In this scenario, you have a repeat client who is very interested in integrated project delivery. The client is aware that your firm has transitioned over to Building Information Modeling capability. The client’s favorite contractor has purchased 3-D CAD software, and he has indicated that he would like to be part of an IPD team.

The client calls and asks you to set up a meeting to discuss the possibility of everyone working together in an IPD scenario. She is aware that everyone is not familiar with IPD terminology, and she suggests that the first meeting would be a good time to review the IPD process and terminology. She requests that you send out a memorandum calling for the meeting and to also research an attached list of IPD terms in preparation for the meeting. The list includes the following terms:

- Building information modeling
- Collaborative estimating
- Collocation
- Concurrency
- Continuous design
- Design-assist contracting
- Design structure matrix (DSM)
- Early downstream information user input
- Information dependencies
- Integrated practice
- Integrated project planning
- Integrated project schedule
- Intersection criteria
- Project extranet
- Teaming agreement
- 4-D Modeling
- 5-D Modeling

Activity - Elective

Please reference the following source:

View and download the following sample document for reference:
- AIA Document A195™, Standard Form of Agreement Between Owner and Contractor for Integrated Project Delivery

Research the list and prepare a short narrative explaining each term. Realizing that IPD is a developing process, attempt to explain each term by relating it as much as possible to existing processes and terminology.

As you prepare your research, answer the following questions:
- What IPD terms are not on the list?
- What format can I use to make the presentation simple and easy to understand?
- Should I send out the list early for owner and contractor input prior to the meeting?

Prepare a memorandum requesting the meeting and list an agenda for discussion. As you prepare the memorandum, answer the following questions:
- What are the primary topics to be discussed?
- In what order should each attendee speak?
- How can I separate the topics under the categories of owner, architect and contractor?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Trying to Understand the Contractor’s Point of View
Supplemental Experience for eight (8) Elective IDP Hours

Relationships between the owner, the design team, and the contractor are especially important in sustainable projects. Unfortunately these relationships can become adversarial. Efforts by the contractor can make or break project certification.

The sustainable design process used by the USGBC can be a vehicle for developing relationships based on shared problem solving that can resolve many issues before they fester. Jody Gittell, in her book The Southwest Airlines Way, describes how Southwest Airlines, the most unionized workforce in the airline industry, has developed productive relationships with the unions while other companies have suffered. In this scenario, early in the design process, before the contractor has been selected, the owner and PM are looking at the LEED for New construction checklist. The owner asks the PM about the feasibility of some of the credits that are primarily contractor responsibility.

Would selecting a contractor early help facilitate the LEED process? What can the PM say to support the importance of the owner selecting a contractor early in the process?

Activity - Elective

Please reference the following sources:
- AIA Sustainability webpage: [www.aia.org/sustainability](http://www.aia.org/sustainability)
- AIA 50to50: [www.aia.org/about/initiatives/AIAS076530](http://www.aia.org/about/initiatives/AIAS076530)
- LEED Reference Guide for Green Building Design and Construction. U.S. Green Building Council, 2009. If your company does not have a copy it can be ordered at [www.usgbc.org](http://www.usgbc.org). (Note: the Reference Guide for Public Use and Display that is free to download on their web site does not have the tables you will be using for this exercise.)

Working with your supervisor or mentor select a local LEED accredited contractor to interview. Interview the contractor to identify processes used to achieve the credits. Use the interview process to learn what contractors bring to the design of sustainable construction projects.

Identify all of the prerequisites and credits that are primarily the responsibility of the contractor by reviewing the “Table 1: Credit Characteristics” in the LEED Reference Guide for Green Building Design and Construction (there are 6 total listed on page 2 of the overview of each major category).

Questions you should answer:
- When is best for the contractor to become involved in the project?
- Are any points lost if contractor selection doesn’t happen until Construction Documents phase or later?
- How is documentation different from non-LEED projects?
- How does LEED certification affect the value engineering process?
- What outcomes did the contractor like versus ones they didn’t like?
- Do they have any lessons learned to share with the design team?

Write a report identifying successful contractor strategies for dealing with sustainable projects, and how the Contractor can help facilitate the design and construction of LEED certified projects.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Matching Delivery Mode to Client Needs

Supplemental Experience for eight (8) Elective IDP Hours

Client #1
Stratocaster School of Music is a small educational institution. It is governed by an executive director and a board of directors for major decisions and an administrative staff for day-to-day operations. Faculty, staff, students, alumni, and community members are the school’s major constituent groups, and each has its own needs and agenda. The school plans to build a performance facility on a prominent site that will have an impact on both the campus and the surrounding neighborhood. The budget, funded by a private gift and alumni contributions, is fixed and too small to accommodate all of Stratocaster’s needs, but the board values building function and aesthetics. Nonetheless, the executive director is under pressure from the board to get the facility built as quickly as possible. At the same time, the board is risk averse and thus unlikely to agree to begin construction before overall costs have been determined.

Client #2
Ivana Profit is a real estate developer who seeks the highest return on her real estate investments in the shortest possible time frame. Currently, she has an option to buy a site on which she plans to build an office building. The design will be determined by well-established criteria for commercial real estate development. Aesthetic requirements call for a moderately high level of finish and materials but mostly straightforward detailing. Tenant fit-out will be handled under separate contracts. Profit’s finances must be in order before she can close on the property, but she is currently negotiating with a major tenant and has not determined a fixed construction cost. Consequently, Profit is paying for design services with speculative, out-of-pocket funds. As soon as the financing is set, the squeeze will be on for design time and money because Profit will want to get construction under way as quickly as possible.

Client #3
Magneto Systems is a growing automotive parts manufacturer with extensive operations in North America. It maintains a fairly lean in-house facilities engineering division that manages real estate, design, and construction services for manufacturing, administration, and research and development in North America. Magneto plans to build a large manufacturing facility in Malaysia, its first foray into overseas manufacturing. The company is under enormous pressure to get the facility built quickly and to get products manufactured and shipped to its Asian customers. The facilities engineering staff can provide detailed information about their needs, including preliminary drawings and specifications, but they do not have the expertise to manage design and construction overseas.

Activity - Elective

Consider the preceding client types and projects. For each client, determine which mode of project delivery seems most appropriate, and then write a memo describing the most suitable option to the client. Include a discussion of which type of project would be best suited for integrative project delivery. Be sure to include specific reasons the delivery method is best for the client’s situation.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
In this scenario, your firm has been selected to join a design and construction team that will use Integrated Project Delivery (IPD). The owner has asked you to be the Integrated Project Coordinator and the prime designer. The construction team will have a prime constructor and trade contractors that will provide cost, schedule and constructability information for the team during the criteria design (expanded schematic design) phase.

The project is a 15-story office tower you have designed in a downtown urban zoning district. To date, you as the prime designer, your engineering consultants and the prime constructor have formed an effective team working through the conceptualization (expanded programming) phase together and staying on the demanding budget and schedule the client has set out for you.

You have just completed a preliminary BIM (Building Information Model) showing the design with a bank of 4 elevators to service all floors of the building. The prime constructor has designated a local elevator trade contractor to provide the team with cost and scheduling information for the proposed design. Upon reviewing the model with the team, the elevator trade contractor hesitates when asked about the current elevator design. He does not agree with the choice of elevator manufacturer you have shown in the model because of the lead times required to deliver the elevator from that manufacturer. The elevator he proposes has a larger cab than the cab you have chosen and requires a larger shaft size. You start to wonder if there is some other issue that is affecting his decision making process about the elevator. If you enlarge the area to accommodate this new cab it will affect other programmed spaces that in turn will force a rethinking of the structural system. This, in turn, will impact the net rentable area negatively.

Ultimately, the team becomes very concerned about how this will impact the owner’s financial model and the project in general. In short, you realize this is an issue of money versus time.

Who is right? Which issue should take priority? When do scheduling and constructability issues trump the concerns of the design? What do you say to the client as a team? How does the team resolve this conflict and set priorities for the review process as a team? Should the team replace the trade contractor? Who is going to make the final decision in this type of project delivery environment?

Activity - Elective

Please reference the following source:

Review the above source for IPD principles as the relate to “Criteria Design” (Expanded Schematic Design). Review the outcomes and primary responsibilities for criteria design phase. List the differences between this type of project delivery and traditional design-bid-build during this phase of the project.

List the additional team members that are involved in the project during criteria design and would not be present during a typical schematic design phase.

Outline in memo form how you (as the prime designer) propose to resolve this dilemma regarding the elevators and address the questions posed above.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Prepare a Staffing Plan

Supplemental Experience for eight (8) Elective IDP Hours

An integral part of the project managers “work plan” is determination of which employees are available to work on the project, what are their capabilities and qualifications, and when and how long are they available. The capabilities and qualifications of the people available to work on the project rarely match the project manager’s exact assessment of the needs of the project. An effective project manager will often have to work with the employees that are available, matching their personalities and skills to the assignment at hand, as best they can.

Accordingly, assessing the needs of the project, and arranging for appropriate staff is no simple matter. It is an issue imbued with availability, subjectivity, opinion and sometimes second guessing.

Activity - Elective

Please reference the following source:

Work with your supervisor or mentor to select a project that will serve as a working exercise in learning to develop a staffing plan. For purposes of this application, much like actual practice, you will prepare an ideal staffing plan without regard to each employee’s actual availability. Your primary focus will be to estimate the number and skill set of the ideal project team required to produce the work on your project.

In order to begin preparation of a staffing plan, obtain a copy the staffing/organizational chart template or form used by the firm (or you may use the chart in the The Architect’s Handbook of Professional Practice, 14th edition, page 705, as a guide). Discuss how the form works in everyday practice at the firm.

Discuss the following questions with the actual project manager:
• What positions are required (draftsperson, job captain, project architect?)
• What levels of experience are necessary for each position?
• What actual employees are ideal for each required position and why?
• Is it appropriate to assign employees to positions requiring more than their current level of experience so they are continuously challenged?

Obtain the firm’s resumes for each employee to be considered. As you prepare your staffing plan, answer the following questions on your own:
• Do you agree that they are the right person for your assignment?
• Is the employee’s experience commensurate with the experience required?

Compare your draft staffing plan with the firm’s actual in place staffing for the project and mark up the differences.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
In this scenario, you serve as a Member of the Board of Directors for a community based non-profit corporation named Housing for Sale. The Charter for the Corporation includes language that describes the goals for “Housing”. Among these goals is a promise to deliver good quality projects that creates below market housing to the community. Also included in the delivery of a project is a promise to bring fair wages to the construction workers and others involved with the project.

The Board has authorized the start of a new 15 story housing project. “Housing” has been considering a particular Architect and General Contractor to team up to deliver the project. They are unsure how the team should be formed and want more information before a decision is made. In the past, Housing has used the Traditional Design-Bid-Build method and on more recent projects, Design-Build. The Board likes that single team approach and quickness of delivery of Design-Build but do not like the lack of control over any of the project aesthetics and detailing once most of the budget is committed and the construction of the project intensifies.

Housing for Sale is a very progressive organization and your friend, the Executive Director, has heard about Integrated Project Delivery or IPD. In fact, the interest in learning more about this has generated much conversation among members of the Board of Directors. They are hoping that this type of project delivery can improve the team aspect of design and construction while allowing the Board to have control over some of the aesthetic decisions that come up later in the project.

The Board has decided that before the Team can be selected, that you and the Executive Director make a presentation to review your understanding of the project, explain to the Board how this type of project delivery would be used for this project, discuss the advantages and disadvantages, and answer any questions they may have. The Executive Director shows his concern about how some of the Board policies could be enacted with IPD being used.

There are three concerns that almost all Board Members share about the project. The first is that Board policy requires open and competitive bidding for all trades. The second is that the project must embrace Fair Labor practices and in particular meet local union wage scales for all work performed. The last item relates to the Board being very proactive at the project level. Since it is a community-based corporation, they are very sensitive to how the overall community receives the project. As a result, the Board is interested in having control over the outcomes of the project.

Is IPD a good method of project delivery for this type of client and project? Or would another mode of delivery suit this project better? How will IPD benefit the project? How does the Owner control the outcomes of the project? How do you add good design to the list of desired outcomes? What is your obligation as a Board Member?

Activity - Elective

Please reference the following source:


Review the principles of IPD in the above source as they relate to this situation and project type. Write a report to the Board of Directors with a minimum of 500 words that explains three specific advantages of using IPD for this project. Write a second report (400 words minimum) that addresses the following concerns that the Board has regarding the use of IPD: Competitive Bidding Practices, Fair Labor practices and local union wages, and How the Board will retain control of the outcomes of the project. Share your work with your IDP supervisor or mentor and make suggested changes.
While AIA documents provide a solid foundation in traditional project delivery procedures, new alternatives should be explored.

Activity – Elective

Conduct research on recent trends in alternative project delivery approaches, including integrated project delivery. Then interview principals and others to find out what these approaches may mean for the firm’s future work. How might alternative delivery strategies affect the firm’s:

- alliances and partnerships,
- client base and marketing,
- technologies and quality control,
- hiring and human resource management,
- and liability and insurance needs?

Create a short presentation on the range of project delivery alternatives available, highlighting their usefulness and particular characteristics. Discuss with your project manager if this would make a useful firm-wide lunchtime presentation.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Understanding Design Development
Supplemental Experience for eight (8) Elective IDP Hours

As an emerging professional, you should have the experience of preparing a set of design development documents, with all the related activities. This process typically includes the following tasks, which often overlap:

- Attend consultant coordination meetings and client meetings.
- Establish final program verification and cost documentation.
- Participate in cost control and value analysis exercises.
- Coordinate and cross-reference documents.
- Identify conflicts between building systems, and coordinate the work of consultants to resolve those problems.
- Ensure that specifications and drawings conform to applicable codes.
- Overall, advance the design of the building, as approved from the schematic design phase.

Activity - Elective

Choose a project in your office or your mentor’s office that has recently completed design development and prepare a case study of the activities performed. Speak with the team members, including the project designer, project architect, and project manager. Your overall job in this assignment is to illustrate in graphic format the timeline of this project for the DD phase, showing the various overlapping tasks. Follow the steps below and make a narrative of your findings. The narrative should be a more detailed look at specific changes to systems and functional abilities.

Download a sample copy of AIA Document B101™, Standard Form of Agreement Between Owner and Architect. Review the scope-of-work tasks outlined in AIA contract documents between owner and architect as well as the contract for the project. Do they differ with respect to the scope of services for design development? If so, why?

Speak with one or more technical consultants on the project. How was their work synchronized with that of the architectural team? See if you can add the tasks of some of these team members to the timeline.

Evaluate the timeline, as well as the design development documents. Was there sufficient time to address all of the design development issues, or were some of them addressed during construction documentation?

- What would be the ideal timeline for this project?
- What changes would you have done in DD?
- Keep track of the approximate cost for each design task

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Understanding the Contractor’s Involvement in Integrated Project Delivery

Supplemental Experience for eight (8) Elective IDP Hours

The elements of integrated project delivery (IPD) have been evolving for many years. Collaboration between team members has been effectively demonstrated in design/build, fast-track and currently with the building information model.

The contractor’s participation in integrated project delivery varies significantly from that in traditional project delivery methods. In order for the architect to effectively utilize IPD he or she must fully understand how and when the contractor is involved as well as their role in the overall process.

The purpose of this exercise is to understand the resources and the benefits that the contractor brings to IPD and how the owner and the architect interact, collaborate, and work as a team to deliver the project.

In this scenario, your supervisor has informed you that your firm has agreed to participate in an integrated project delivery on a small project with a repeat client and a well-known local contractor. You will be providing construction administration services, and you have been directed to become familiar with the contractor’s involvement in IPD so that you can eventually set up office policies for the construction phase on IPD projects.

Activity - Elective

Please reference the following source:

View and download the following sample document for reference:
- AIA Document A201™, General Conditions of the Contract for Construction

Review the reference documents to understand the relationships between the owner, contractor and architect in integrated project delivery and the differences from a traditional project delivery. Prepare a description of responsibilities of the owner, architect and contractor during the project phases: conceptualization, criteria design, detailed design, implementation documents, agency coordination/final buyout, construction and closeout. As you prepare your work, answer the following questions:
- How does the architect’s relationship with the owner differ from traditional project deliveries?
- How does the contractor’s involvement with the building design differ from traditional project deliveries?
- What types of collaboration occur between the owner, contractor and architect during the conceptualization phase?

Describe in detail the development of the following contractor issues and prepare a comparative timeline to the overall project delivery:
- Project cost
- Contractor submittals
- Project schedule
- Project buyout

As you address the four items above, answer the following questions:
- How are project costs affected by IPD?
- How is the project time affected?
- How will the architect’s submittal review time be affected?

Share your work with your IDP supervisor or mentor and make suggested changes.
Management of the project construction cost budget is complicated, involves many different parties, is an area over which the architect often has little control, and can be intimidating. It is also an area of practice where the architect’s opportunities and obligations may be heavily controlled by the owner architect agreement.

Meet with your supervisor or mentor to select a medium sized project from your office that has already been constructed and closed out. Obtain PDF files of a completed set of drawings and specifications for study and review. Assume that the following hypothetical events have now occurred on the project:

- Your owner architect agreement is an AIA B101™ that has not been modified.
- The owner has appropriately maintained the budget as required by § 6.2.
- The owner has elected to proceed on the basis of § 6.6.4 and 6.7.
- Construction documents have been issued for bids.
- The project has been bid by several contractors, and the client has identified one contractor with whom to negotiate a final construction cost.
- The lowest bona fide bid is 20% over budget.

As you move to the next step of project management answer the following questions:

- What is the definition of construction cost applicable to this circumstance?
- Which owner’s budget is the lowest bona fide bid to be compared with?
- What are your responsibilities for revising the design to meet the budget?
- What are your responsibilities for the construction cost?
- Are there options other than § 6.6.4 that the owner could consider?

Prepare a summary of your obligations as the architect for making adjustments to the design in order to comply with the requirements of B101™. Review the plans and specifications and begin preparing a list of design modifications (sometimes called value engineering or value analysis) that could be considered to reduce costs. After you prepare your summary of contract obligations and review the documents, outline a plan of action that addresses the following issues:

- Is it possible to modify the project scope to reduce costs?
- Will it be necessary to reduce the project quality to reduce costs?
- Is the contractor’s bid reasonable? Is the architect the appropriate party to determine if the contractor’s bid is reasonable?
- What is an effective way to present your suggestions to the client?
- How will redesigning at your own expense affect the firm’s profits?

Prepare a report that enumerates your findings. Include a concluding discussion on the challenges of managing a project that is determined to be over budget late in the process.

Share your work with your IDP supervisor or mentor and make suggested changes.
Examine Estimating Fees & Consider In-House Estimating Capabilities

Supplemental Experience for eight (8) Elective IDP Hours

In this activity, you will examine how your current firm or your mentor’s firm handles cost estimating services and the potential benefits and risks associated with cost estimating services through a consultant and as an in-house service. To do this, have conversations with the firm’s principals and managers. Since the vast majority of firms use outside consultants to provide cost estimating services, a cost consultant should also be interviewed. Explain to them that this is an IDP activity to examine issues and not necessarily to recommend a firm wide approach.

Activity - Elective

Begin this activity by interviewing experienced individuals in your firm or your mentor’s firm who routinely handle cost estimating services and coordination with cost estimating consultants. Follow up with a cost consultant with experience with the firm. Develop a list of questions and discussion topics in advance so you make the most of your time together. Interview at least one principal, one senior manager and one current cost consultant on the following topics:

- **Experiences:** What has been the general experience working with cost estimating consultants? Has anyone internally prepared a cost estimate for a project? If so, at which stage(s) of the project?
- **Attitudes and inclinations:** What are the attitudes and characteristics of successful cost consultants? What are their attitudes toward working with your firm? Are they more or less comfortable and confident in dealing with specific people? What are the opinions of your firm’s staff to cost consultants?
- **Coordination:** How much time is typically invested in coordinating the work of cost consultants in each phase of the project from conception to completion? How is this time spent, by whom and how is it spread throughout internal disciplines and engineering consultants?
- **Communications:** What special considerations or challenges arise in communicating the work, thought, and language of the design team to the cost consultant and vice versa – especially during early project stages? How are work product requirements and schedule communicated?
- **Scope of work:** Which tasks and work scope do cost consultants accept most and which do they tend to oppose? How are unanticipated changes handled?
- **Fees:** How much of the overall fee is typically allocated to cost estimating? Is there interest in your firm to hiring a cost consultant directly and/or conducting some of the work internally?

Examine the files from two projects completed by your firm, and summarize the preparation of estimates, particularly the flow and exchange of information. Review emails, memos, letters, agreements, and other written communications directly involving cost estimates. Examine the actual cost estimate work products for consistency, accuracy and format. Check for end client satisfaction.

Ask to attend several project meetings with cost estimating consultants on a project you are working on. Take notes and ask questions after the meeting.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
In this scenario, your firm has been retained to design a large apartment complex. The developer wants to use the same engineers he uses on all his projects. They are not firms with which you have a relationship. The developer wants these firms to be consultants to you, so he can hold you responsible for a completed, coordinated design.

There are problems from the beginning. The consultants have regular, direct design discussions with the client that do not include you or the architecture team. In addition, they are accustomed to providing much less analysis and documentation than you expect from other consultants you work with regularly.

The latest issue is the selection of the structural system. Based on experience with other projects you assumed that the building would use a flat plate concrete slab system with columns and shear walls. Instead, the structural engineer and the owner have decided to use a masonry bearing-wall system with a proprietary concrete plank floor structure. You are convinced that they have not thought through all the implications of using this system. The building will be 10 stories tall, and local contractors rarely use masonry bearing-wall systems for buildings of this height.

This system choice was made between the engineer and the developer before the architects were brought into the discussion. It is early in the design phase, but you can see a pattern developing that will lead to more serious problems in later phases.

Please reference the following sources:

View and download the following sample document for reference:
- AIA B101™, Standard Form of Agreement Between Owner and Architect

Ask your supervisor or mentor to help you arrange an exploratory discussion of the issues with a structural engineer and/or a major masonry contractor. Make notes of your discussions. Answer the following questions:
- What critical issues are involved in building a bearing-wall structure of 10 stories in height?
- Are there likely to be issues about the proposed bearing wall system that will be particularly problematic for the proposed apartment use?
- Is the concrete plank floor structure appropriate for apartment use?

Write a memo to the client outlining your concerns related to the proposed bearing-wall structural system.

As you prepare your studies, answer the following related questions:
- Why shouldn’t the structural engineer have private meetings with his client about the project?
- Why should you be concerned that the developer and the other consultants are making design decisions without including you?
- Are their potential liability issues inherent in this scenario?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Being the Client’s Advocate: Advising of Fast-Track Risks

Supplemental Experience for eight (8) Elective IDP Hours

Architects tend to be and must be advocates for the design team. It is also a tenet of modern practice that architects can benefit in their relationships with their clients if they are advocates for their clients.

Some clients are pleasant to work with and make it easy to advocate on their behalf. Other clients like to point fingers and are more difficult. Nonetheless, all clients are more likely to appreciate your efforts if they believe you are looking out for their interests and concerns.

In this scenario, you are the project manager on a new $30 million lifestyle retail center for one of your firm’s best clients. As the project has developed, the client has signed up major new retail tenants. The tenants require certain changes that will take time to make, but they also must be open for business by the major end of summer shopping cycle. These changes will push the project into a fast track design and construction schedule.

Even though this is a repeat client, they are traditionally design-bid-build oriented, and your firm has no fast track experience with them. You’ve heard war stories of clients asking the architect to pay for mistakes that are virtually inevitable in a fast-track scenario. You resolve to try to educate the client about risks inherent to fast-track.

Activity - Elective

Please reference the following source:
- The Architect’s Handbook of Professional Practice, 14th ed. Chapter 13.4 - Managing Fast-Track Projects

After reviewing the above source, prepare a report comparing options for discussing the issue of fast-track with the client. Prepare a memo or a letter to the client explaining the risks inherent to fast-track.

As you prepare your report and letter, answer the following questions:
- Can an architect who prepares designs based on assumptions about future issues, ever be entirely accurate?
- How would you respond to an owner who demanded that each fast-track package be complete and completely coordinated with all future packages?
- Should an owner budget the contingency funds to cover the risks inherent to fast-track?
- Can an error, made solely to support the owner’s quest for speed, be considered betterment?
- Who benefits most from the owner’s quest for speed?
- How does the architect’s service as an advocate for her client benefit the architect in this scenario?
- Does the letter or memo help set the client’s expectations for the architect’s services?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Construction administration is one of the most complex and risk intensive areas of architectural practice for the project manager. Duties and responsibilities are defined by contract during this phase of service more so than in any other phase. Some firms augment the project manager with a dedicated construction contract administrator during this phase. Some firms assign the originating project manager to provide the services during this phase.

Many questions about the services to be provided by the architect arise during construction. These questions can generally be answered by a thorough review of the owner-architect agreement and the general conditions of the contract for construction. These documents are not always AIA documents. For this activity we will assume that they are.

Please reference the following sources:
- View and download the following sample documents for reference:
  - AIA B101™, Standard Form of Agreement Between Owner and Architect
  - AIA A201™, General Conditions of the Contract for Construction
  - AIA G702™, Application and Certificate for Payment

After reviewing the sources above, prepare an outline report delineating the architect’s primary responsibilities during the construction phase as related to means and methods, answering questions about the architect’s documents, shop drawings and certification that the work is being constructed in accordance with the contract documents.

As you prepare your report, answer the following questions, and cite the AIA document section that addresses the issue:

- Who is responsible for means and methods of construction?
- Who is responsible for deciding how the Work will be apportioned among the bidders?
- Who is responsible for scheduling and sequencing the Work?
- Is the Contractor responsible for attempting to answer RFIs before they are sent to the Architect?
- Who is responsible for initially checking shop drawings and submittals?
- Who supervises the Work?
- Who sequences the Work?
- Who inspects the Work to determine that subsequent Work can proceed?
- Who initially certifies that the Work is in accordance with the contract documents?
- Who warrants the Work, and to whom is the Work warranted?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Understanding your contractual responsibilities is paramount to initiating a successful project. There are numerous variations of the services to be provided. Additionally, how a consultant’s work is incorporated and how a consultant is contractually obligated to a project can be established in various ways. This activity is to determine what to include in the preparation of a proposal, and most importantly, which consultants will share your liability. Consider the following critical questions:

- Who is the client—who is paying the architectural fee to my firm?
- Is the site location confirmed? Are documents available that legally describe the project site dimensions, elevations, setbacks, right of ways, zoning regulations, and any other restrictions which may apply to the site or the project?
- Has the client contracted with a civil engineer?
- Has the client provided you with a zoning report prepared by a zoning attorney?
- Has the client provided a space program for the project?
- Has a geotechnical investigation been provided for the project site? Has the client contracted a geotechnical consultant?
- What consultants will be required for the project? Will they be contracted to the client or the architect?
- Do I have sufficient information to prepare my proposal, or how must I clearly identify my contractual responsibilities for my work and my consultants’ work?

There are many additional questions that apply, but for our purposes we will limit the list to the items above. Consult with peers who have experience in this area, and be sure to consult your legal counsel prior to signing any contract. Gain as much information as possible about a project prior to finalizing your proposal. Be unambiguous about your duties and responsibilities and of your consultants.

Activity – Elective

The client has provided you with a draft of his typical contract for architectural services, used on similar projects and modified for this project. You have received and reviewed the draft contract with your legal counsel and you will meet with the client to review the draft contract. The following contract clauses are presented for your use in the proposed contract for this project:

- The contract has the standard wording related to project schedule, which says the architect will deliver the project by a certain reasonable date. There is also wording which states the architect is responsible for managing all of the consultants on the project, and for the accurateness of their work, and for their work being properly coordinated in the construction documents.
- The architect is responsible for the accurateness of the construction documents for the project in a manner consistent with the degree and skill ordinarily exercised by design professionals practicing in this state.
- The architect is responsible for receiving the shop drawings submissions from the contractor, logging and tracking and distributing the shop drawings to all of the consultants, also for all of the consultant’s timely and accurate review of the shop drawings, and for receiving the reviewed shop drawings and returning them to the contractor and other parties.

Write a letter to the owner’s attorney identifying the above problem clauses and include the reason why it is a problem for you and a suggest alternate clauses for each.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
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## Business Operations 4A

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- Firm Organization 481
- Financial Operations 482
- Ownership & Transition 483
- Human Resources 484
- Marketing Strategy 485

*A maximum of 40 hours of core credit may be earned in this experience area.

### Activities - Elective 486

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- Compensation 488
- Legal Issues for Architects 489
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- Lack of Experience Affects Credibility 491
- All in the Family 492
- Design Excellence vs. the Client’s Best Interest 493

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By completing the activities in this chapter, you will gain an understanding of business operations. The following information is taken from the NCARB IDP Guidelines:

**Business Operations**
Minimum Business Operations Experience: 80 Hours
Definition: Involves allocation and administration of office resources to support the goals of the firm.

**Tasks**
At the completion of your internship, you should be able to:
- Obtain and maintain professional and business licenses
- Manage project revenues and expenses
- Calculate hourly billing rates
- Negotiate and establish fees for basic and additional services and reimbursable expenses
- Invoice for services rendered and reimbursable expenses
- Develop and manage positive client relationships
- At the completion of your internship, you should be able to actively participate in the following tasks: (“Actively participate” is the expectation that you will collaborate with your supervisor in learning how to perform the task.)
  - Business Operations
  - Maintain record management systems
  - Develop and manage firm’s strategic and business plans
  - Develop firm’s financial plan
  - Develop, implement, and manage marketing and communications plans
  - Obtain and update computer technology, including security systems and licenses
  - Investigate and use new digital technologies
  - Human Resources
  - Develop and manage human resource/office policies and operations
  - Conduct performance appraisal, career development, and compensation reviews
  - Recruit, retain, and manage staff
  - Develop training and professional development plans, including IDP and continuing education requirements
  - Legal & Insurance
  - Establish firm’s legal structure
  - Consult legal counsel
  - Secure liability and other insurance

**Knowledge Of/Skill In**
- Business Operations
- Business planning
- Contract negotiation (e.g., fees, scope, schedules)
Knowledge Of/Skill In Continued

- Current software applications
- Designing and delivering presentations
- Electronic communications (e.g., virtual offices, video-conferencing, web-based networking)
- Entrepreneurship
- Ethics and integrity
- Financial management
- Information management (e.g., hardware and software maintenance, office standards)
- Interpersonal skills (e.g., listening, diplomacy, responsiveness)
- Invoicing for services
- Legal and ethical issues pertaining to contracts
- Legal and ethical issues pertaining to practice (e.g., liens, taxation, licensure)
- Managing quality through best practices
- Marketing and communications
- Oral and written communications
- Project budget management
- Recognized ethical standards of the profession
- Requests for Qualifications (RFQ) and Requests for Proposal (RFP)
- Risk management (e.g., professional and general liability)
- Strategic planning
- Team building, leadership, participation
- Human Resources
- Human resources management
- IDP mentoring and supervising
- Oral and written communications
- Managing quality through best practices
- Interpersonal skills (e.g., listening, diplomacy, responsiveness)
- Team building, leadership, participation
- Mentoring and teaching others
- Personal time management
- Ethics and integrity
- Supervising

**notes**

Take brief notes while reading the narrative and list key resources you used to complete the activities. Note discussion outcomes from meetings with your supervisor, mentor, or consultants. When finalizing the activity documentation (PDF), include your notes and the Emerging Professional’s Companion activity description.
The business management of an architecture firm, or the ability to make a profit, is not an optional task. Even if you are the best designer the world has ever seen, if you lose money practicing architecture you won’t be designing for long, or you will be working for someone else who can run an office profitably. According to the annual AIA Firm Survey, only 10% of U.S. firms make a profit of less than 5% of annual revenues. Does this prove that 90% of all firms make a decent profit, so you should hurry and open your own firm? No. It shows that you will cease to exist if you don’t make a profit.

The intent of this chapter is to help you to prepare to open your own firm, be promoted to a management position in your existing firm, or, gain an appreciation for what it takes for the principals of your firm to manage it. This chapter will cover the following topics:

- General firm types
- Firm organization
- Marketing and business development
- Collaboration and partnering
- Financial operations and management
- Project planning
- Human resources
- Risk management and professional liability insurance
- Legal issues for architects

**Firm Types**

The principals of a firm must decide what services they want to offer and what type of firm they want to establish. An architecture firm can’t be all things to all clients, so it must focus on providing a limited range of services. Business experts, who agree that this century will be the era of the expert, promote the scattershot vs. focused approach. With scattershot, you fire hundreds of shots, but only a few will hit something. With a focused approach, firms can generate more work by concentrating on areas of relative advantage. Firms that don’t focus will find they spend a lot of time and money generating a little work.

Your organizational framework must be clear to you and to others outside of your firm. In her topic “Firm Identity and Expertise” in *The Architect’s Handbook of Professional Practice*, Ellen Flynn-Heaples explains her adaptation of Carl Jung’s six heroic archetypes to the design professions. Each archetype, or firm type, has a distinct personality and distinctive core values and underlying driving forces define the firm. The archetypes as applied to firms are briefly described here:

- **Einstein Archetype**: These are high-profile idea firms with an original styles or philosophies like Frank Gehry and Buckminster Fuller.
- **Niche Expert Archetype**: These firms are specialists dedicated to a specific project type or service in a broad market like Populous and Duany Plater-Zyberk. Both have cornered an impressive portion of the market for their type of work.
• **Market Partner Archetype:** A Market Partner firm is a leader in one or more markets, such as airports, or higher education, or hospitals.

• **Community Leaders Archetype:** These are firms whose owners have leadership roles in their city or town such as Carde Ten Architects in Santa Monica.

• **Orchestrator Archetype:** Project Management is the focus of Orchestrator firms. Askew Nixon Ferguson Architects is a good example.

• **Efficiency Expert Archetype:** These are firms that pride themselves on rapid and efficient solutions. Home Depot, BestBuy, and Wal-Mart look for these types of firms.

Early in firm planning, principals must identify a focus, that market sector, idea, process, or style that will set you apart. The driving force should be something you love doing. It should be something you can clearly articulate and are passionate about. One newly founded firm I know struggled early with focus. They did any project they could get their hands on, and they had to pursue twenty projects to get one. Some of their projects had challenging ADA issues to solve, and they found they had become expert at it. So, rather than continuing to pursue a scattershot marketing approach, they decided to focus on ADA renovations and retrofits. Their firm has expanded nicely, and they now spend little time on marketing because they are known nationally as ADA experts.

**Firm Organization**

The types of legal organization architecture firms can establish are limited to four basic types: Sole proprietorships, partnerships, corporations, and limited liability companies. Each type has different requirements relating to ownership, liability, and taxes.

**Sole Proprietorship**

A sole proprietor is an individual conducting business without incorporation. Because the individual and the firm are legally one entity, there are no firm tax returns to file. All financial information about the firm is included with the owner’s tax return.

A sole proprietor has unlimited liability for business debts and for professional or other liabilities. Anyone making a claim against a sole proprietorship, for non-payment of a debt or for an error or an omission, can obtain any assets of the firm and of the individual owner. A sole proprietor can, and should, obtain Professional Liability Insurance, which will help if such a situation arises.

**Partnership**

A partnership is similar to a proprietorship in that it is unincorporated; however, it allows for two or more individuals to operate the business. Determining the respective payments, liabilities, and debts of each partner is much more complex in this arrangement. The partnership files an informational tax return with the IRS but does not pay taxes on any profits. The return, a copy of which is filed with each individual’s personal tax return is a schedule that shows each partner’s share of the profits or losses.

Each partner becomes jointly and severally liable for the business and professional liability of the firm.
Should anyone make a claim against the partnership, the personal assets of each partner may be at stake if the partnership is found to be liable. Again, professional liability insurance is highly recommended.

Corporations
Corporations are separate and distinct legal entities that can conduct business on their own, a fact that makes them more stable than partnerships and proprietorships. A corporation has a separate existence from the individuals who own and manage it.

Corporations can be general business corporations or professional corporations. Professional corporations are established specifically for professional service firms, providing professional services like architecture. In some states, architecture cannot legally be the primary business of a general corporation. Most states require ownership of professional corporations to be held or controlled by a professional licensed to practice in that state.

A corporation is a separate taxable entity. Owners who are also employees pay personal taxes on their salaries. The corporation files a tax return, and it pays taxes on the gross income, which includes deductions for salaries and other expenses.

Unlike an unincorporated entity, a corporation protects the shareholders’ personal assets from general liability, such as for the purchase of goods and services.

Limited Liability Companies
Limited liability companies are hybrid entities with characteristics of corporations and partnerships. Specifically, they are separate entities with many of the characteristics of a corporation but are classified as partnerships for tax purposes.

LLCs are unique in that they do not need to be managed by employees of the firm. Often, professional managers are hired to run this type of company. LLCs are often useful for one-time projects involving numerous players and investors. The managers are afforded limited liability for their acts on behalf of the company.

Marketing and Business Development
By far the greatest challenge for any practicing architect is to consistently, year after year, bring in enough work to keep a firm going at its present size, even if that size is one. By comparison, starting a firm is easy. All you have to do is fill out some papers and start working in your basement. Designing great buildings is easy, too; you were taught to do that in architecture school. Chances are, though, you were taught little, if at all, about marketing in school. Not only that, most interns get very little opportunity to participate in or learn about marketing and strategic planning for the firms for which they work.

Marketing is the term for the process by which work is brought into the firm. If you are lucky, or extremely good, you won’t have to market the
services of your firm. You will receive enough requests for your services to keep you busy. But only a small percentage of firms can operate that way, and even they did not start out so lucky. Firms generally earn a reputation over time, so most firms have to engage in a marketing process.

The process of marketing for design firms is primarily carried out in three ways: increasing awareness of the firm by engaging in public relations or pre-contract activities, responding to requests for proposals (RFPs), and maintaining good relationships with existing clients who may hire the firm again. Some firms succeed using just one or two of these techniques, but for consistent growth, firms should consider all of these broad marketing categories.

Excellent marketing requires an understanding of and a strident focus on the uniqueness of the best qualities of the firm. It also requires early identification of projects suited to your firm. In communicating the strengths of your firm, however, you must also communicate that the firm is trustworthy. In a 1988 survey of clients performed by MRS/Pickar, 88 percent of the respondents reported that trust was by far the most desired quality considered when they selected architects.

Another Pickar survey of design firms showed that 82 percent of projects lost were lost to another firm who “got there first”. Employing a proactive marketing effort can minimize the number of times a firm encounters this situation.

The following steps will help you plan your firm’s proactive marketing efforts. They are excerpted from Roger L. Pickar’s book *Marketing for Design Firms in the 1990’s*, published by the AIA Press in 1991, with summary explanations added.

1. **Determine the firm’s mission.** Establish a statement of purpose that reflects why your firm is in business and gives broad parameters for the future and basic guidelines for further planning.
2. **Set company goals.** Determine the overall results your firm wishes to achieve. These will guide the marketing plan.
3. **Perform internal analyses.** Determine the strengths and weaknesses of your firm to determine what needs to be changed and what should be further encouraged. Conduct a survey of existing clients to help you with your analysis.
4. **Perform external analyses.** Research trends in your marketplace. Develop an understanding of market needs and trends.
5. **Establish marketing goals.** Plan for your accomplishments. Write a description of your firm, including size, income, etc., in three-, five- and 10-year visions.
6. **Generate strategies to accomplish these goals.** Create plans for activities that will help the firm reach its goals. They can include pursuing a new building type, expanding geographically, or adding a specialty.
7. **Research and refine strategies.** Focus, focus, focus. Select only those strategies that will help you attain your goals.
8. **Create and refine promotional and sales tactics.** Tactics are immediate, short-term actions designed to implement your strategies. Limit tactics to those that will most effectively accomplish your marketing goals.
9. **Implement the plan.** Act, publish, make phone calls, and give speeches. Do whatever it takes to get your message out all day, every day.

10. **Evaluate the plan in action.** The entire marketing process must be continuously evaluated and updated. Continue to survey your clients, and potential clients, and record successes.

Making good on your promises also contributes to your marketing effort. When you promise to deliver a project on time and on budget, make sure you do.

**Collaboration and Partnering**

Another way to get new business is by collaborating, or partnering, with other firms. In this way, a firm can receive commissions it might not get on its own. This approach is particularly helpful when a firm plans to move into a building type it has little or no experience with, or when a firm wants to obtain projects of a familiar type but on a larger scale. Often a firm considering a relationship with another firm looks for one in a different geographic region.

The two basic types of the project collaboration used by architects are joint ventures and associations.

A joint venture is a collaboration in which a separate company is established to pursue a particular project. If a project is awarded to a joint venture, the participating firms lend their employees to the new company so they can pursue and complete the project. This type of association may be most useful for two firms of similar size but different experience that can be meshed into a formidable team.

In associations, one of the firms is the prime architect, while the other acts as a consultant under contract to the former. The decision as to which firm will be the prime architect can be based on a number of factors, including the various abilities of the firms, the perceived strength of the team compared to the competition, and the desires of the client.

In both types of partnership, it is crucial to identify the roles and responsibilities of each party. The scope of work should be divided not by the desires of the parties but according to the skills and resources of the firms. The goal is to present a team that looks strong to a prospective client and has the best chance of obtaining the commission. The firms must determine their roles early and be able to explain them clearly to a client. If the client is confused about which firm is doing what tasks, the chance of the partnership getting the job are decreased.

One way to delineate the roles of firms in a partnership is to use a chart that shows the division of responsibilities for architectural services such as that used by Ayers Saint Gross. The **Division of Responsibilities chart on page 465** outlines the scope of work by phase and lists the responsibilities of each firm.
## THE ABC OFFICE BUILDING

### DIVISION OF RESPONSIBILITY FOR ARCHITECTURAL SERVICES

<table>
<thead>
<tr>
<th>Big &amp; Hot Architects (BHA)</th>
<th>Local &amp; Little Architects (LLA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symbols:</td>
<td></td>
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<tr>
<td>●</td>
<td>○</td>
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<tr>
<td>○</td>
<td>●</td>
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<tr>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Major Activity</td>
<td>Minor Activity</td>
</tr>
<tr>
<td>Minor Activity</td>
<td>None</td>
</tr>
</tbody>
</table>

### SCHEMATIC DESIGN

<table>
<thead>
<tr>
<th></th>
<th>BHA</th>
<th>LLA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schedule and coordinate meetings &amp; workshops</td>
<td>●</td>
<td>○</td>
</tr>
<tr>
<td>Provide meeting reports</td>
<td>●</td>
<td>○</td>
</tr>
<tr>
<td>Develop detailed project schedule</td>
<td>-</td>
<td>●</td>
</tr>
<tr>
<td>Coordinate design work during this phase</td>
<td>●</td>
<td>○</td>
</tr>
<tr>
<td>Coordinate submissions to all applicable agencies</td>
<td>○</td>
<td>●</td>
</tr>
</tbody>
</table>

### PROJECT ADMINISTRATION

- Develop basic blocking & stacking diagrams
- Develop schematic plans, building sections, and building elevations
- Develop materials & finishes in narrative format
- Develop schematic site plan concepts
- Provide code review

### ARCHITECTURE

- Review and confirm engineering program
- Determine applicable environmental regulations
- Analyze existing utility systems (water, sewer, fire protection, electric, gas)
- Determine preliminary engineering space requirements
- Determine preliminary engineering loads
- Coordinate Stormwater management requirements
- Coordinate Geotechnical evaluation of the site
- Coordinate topographic survey
- Develop schematic engineering plans
- Develop engineering systems’ narratives

### ENGINEERING (M/E/P, CIVIL, STRUCTURAL)

- Develop cost model
- Review schematic cost estimate

### COST & BUDGET CONTROL

### PRESENTATIONS AND REVIEWS

- Tenants
- Developers
- City Approval Agencies

2/20/04
Prospective clients want a well-managed team of experienced people to design and manage their projects. One way for a joint venture or an association to offer such a team is the 80/20 method used by Ayers Saint Gross. This method assumes one firm serves as the “design” firm and one as the “production” firm, although this may not always be the case. Often, the out-of-town firm is the design firm and the local firm is the production firm. The 80/20 split refers to the percentage of effort and associated fees of the two firms. For instance, the design firm will receive 80 percent of the fees for the schematic and design development phases, while the production firm receives 80 percent of the fees for the construction document, bidding, and construction administration.

In this manner, the production firm becomes familiar with the design process and design decisions, and the design firm maintains continuity during the production phases to ensure the design is implemented as planned. The client is pleased because this arrangement presents a team committed throughout the project for the client’s benefit.

Once a joint venture project has been successfully completed, each firm will have taken a step toward improving their marketing position. The large firm will have a new project, perhaps in a new area of the country, to use in marketing. The small firm will have gained experience in a new building type or size. After performing two or three projects of similar type in association with another firm, the small firm may be ready to compete effectively on their own.

Financial Operations and Management
If you don’t want to manage your firm’s finances, hire an MBA. Someone has to do this work, and it must be done effectively. The day-to-day management of income and expenses, project by project, is the basis on which profits are made. Architecture firms often have too many “loss leaders,” projects that don’t bring in a profit. Many other businesses would never operate this way. Get in the habit of making a profit on every one of your projects.

Profitability in the form of retained earnings or reinvested earnings is required for the firm to prosper. Profits can be used to maintain growth, bridge down cycles, and invest in the firm. An important element of profit-making is keeping those who produce the profit happy and employed at your firm rather than somewhere else. Investment in employees, however, must provide a return on the investment of the owners or they will invest their money elsewhere. Profit is used for retirement or profit-sharing funds, to fund stock purchases for new owners, to convince the bank that you are capable of borrowing for operations, to manage cash flow, and for staff bonuses.

Sources of Design Firm Revenue and Expense
To understand firm finances, begin with the source of a design firm’s revenue. A typical firm receives revenue from project fees, other business ventures like printing and plotting, interest payments on invested cash, and from miscellaneous sources. Most revenue (usually more than 90 percent)
comes from project fees, however, so projects cannot be run at a loss with the expectation that other capital and interest will make up for it.
The other side of the financial picture is firm expenses, which can be divided into direct and indirect expenses. For most design firms, indirect expenses are likely to be more than 50 percent of all expenses. Fortunately, to some extent the firm can control most direct and indirect expenses.

Direct expenses include the items listed just below. Of these, most firms are likely to spend the majority of their direct expenses on consultants' and engineers' fees, with the remaining firm-controlled direct expenses largely going toward salaries.

- Salaries
- Consultants
- Engineers
- Travel
- Reproductions
- Telephone
- Payroll Taxes
- Postage and overnight delivery
- Supplies
- Photography
- Project-related insurance premiums
- Project-related meals
- Other items purchased on the client's behalf, such as permit fees, bid advertising, etc.
- Models and renderings

Indirect expenses are sometimes called general and administrative expenses, or overhead. The following items are often included in this figure:

- Salaries not related to projects, such as for marketing or administration
- Payroll burden (fringe benefits)
- Data processing
- Depreciation
- Professional and other dues
- Insurance - liability, general and health
- Rent
- Supplies
- Printing for internal use or for consultants
- Maintenance
- Taxes
- Telephone
- Travel
- Utilities
- Computer expenses
- Interest payments
- Public relations
- Marketing

For most design firms, salaries for administrative and marketing personnel are the greatest single indirect expense. If you are having trouble controlling expenses, look there first. Rent probably will be the next largest indirect expense.
So, how do you make a profit? It’s simple in concept. Bring in more than you spend. The remainder of this section will give you the tools to control expenses.

Controlling Expenses

Businesses generally account for their finances on a cash basis or an accrual basis. An architect will need to understand both, and you will probably use a little of both to understand your finances completely. You may already understand cash-basis accounting, as it is what you use to keep track of your checking account. Money comes in, money goes out. If you are doing it properly, you don’t write checks until you have enough in the account to cover them. The same should be true for your firm.

An architecture firm accountant or bookkeeper should maintain a cash flow forecast. Your monthly revenue will fluctuate, but your expenses will be regular. This type of report gives a glimpse of the future by estimating receivables. Below is a sample cash flow projection for your reference.

<table>
<thead>
<tr>
<th>PROJECT</th>
<th>CASH FLOW MANAGEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>2040.00 SMITH SPORTS COMPLEX</td>
<td>GROSS FEE (CONSULTANTS)</td>
</tr>
<tr>
<td>2040.00 SMITH SPORTS COMPLEX</td>
<td>PRIOR PAYMENTS</td>
</tr>
<tr>
<td>2040.00 SMITH SPORTS COMPLEX</td>
<td>Nov-04</td>
</tr>
<tr>
<td>2040.00 SMITH SPORTS COMPLEX</td>
<td>331,600</td>
</tr>
<tr>
<td>2040.00 SMITH SPORTS COMPLEX</td>
<td>(12,340)</td>
</tr>
<tr>
<td>2040.00 SMITH SPORTS COMPLEX</td>
<td>319,260</td>
</tr>
</tbody>
</table>

Monthly revenue fluctuates, but expenses are regular. So your forecast will be reasonably accurate, but you should still obtain a commitment from each client about the time you can expect between their receipt of your invoices and your receipt of their payments. The cash flow report will compare your expected monthly actual income with your regular expenses. Keeping an eye on this chart far in advance will alert you to potential cash flow problems. With enough warning, you can make decisions to decrease or delay expenses, obtain bank credit, or whatever it takes to meet your financial obligations.

A more accurate, but more complicated, way of looking at the financial health of a firm is to understand it on an accrual basis. Instead of watching your cash-in/cash-out, the accrual method tracks the amount of revenue that you have earned, or the amount that you are able to invoice to your clients. If you track your
finances with cash-basis accounting, your monthly statement might look like the accompanying chart. It shows that during the month of July you received payments from clients of $25,000 relating to April invoices, $80,000 for May invoices, and $175,000 for June invoices. Compared to your July expenses of $220,000, this month looks like a winner, right? However, looking at the same month on an accrual basis presents a slightly different picture.

Your expenses for July are the same $220,000, but the work you and your employees accomplished during the month allowed you to invoice a total of $200,000. In other words, the firm is operating at a loss. Instead of rejoicing over your July cash, you should be making adjustments in August to prevent another accrual loss.

When trying to control firm expenses, another issue to consider is how to charge for services. Design firms use numerous methods including the following:

- **Hourly Billing Rates:** The more clients who agree to this fee structure, the better a firm’s chances of making a profit. With this method, you take the hourly rate you pay employees; add the payroll burden, overhead, and profit; and develop a billing rate for each employee.

  Often, however, clients insist on an upset, or not-to-exceed, limit to this type of billing so they can anticipate expenses. Before agreeing to this, the firm must carefully analyze the risks vs. rewards of doing so. If the firm does agree to such a limit, the hours must be developed and managed carefully to ensure the limit is not exceeded.

- **Stipulated sum:** Sometimes called lump sum, this is by far the most common method of payment for professional design services. It is a negotiated agreement for a fixed sum related to an agreed-upon scope of services. A clear description of the proposed scope of services is required, and an understanding of exactly how many hours the firm will need to complete that scope of services. Normally, it also includes the services of a number of consultants.

- **Professional fee plus expenses:** This method is similar to the stipulated sum, except it includes expenses in addition to the lump sum fee. This method should be used when it is difficult to estimate the amount of total expenses on a project, such as when you and your client are a long distance from each other, requiring extensive travel, or when there will be a complex process of obtaining approval for a project or a design.

- **Percentage of the cost of the work:** With this type of fee structure, the professional fee is a negotiated percentage of the cost of construction. For example, you may agree on an 8 percent fee for a proposed $6 million project. Your total fee would then be $480,000. This fee type works well for projects with fixed funding in place. Some clients are wary of this type of fee structure because they feel architects may realize a benefit from “over-designing” a project so there is no incentive for the architect to keep the construction costs down. Also, many clients and architects use this method to develop a stipulated sum because it makes fee comparisons easier.
Any firm, large or small, would be wise to invest in some type of accounting software. Software designed for small businesses can produce meaningful reports that will assist in the proper management of staff and expenses. These reports allow for the insertion of a budget by phase and real-time tracking of expenses as a project proceeds. They will compare actual expenditures with your budget and show the differences.

Note in the sample project progress report, Exhibit 4A-1, the four major columns of information, given in both man-hours and dollars. The first column tracks current expenses for the reporting period. In the second are cumulative job-to-date (JTD) totals, and the third shows budgeted hours and amounts. The figures in columns 2 and 3 are compared with the shown in the fourth column.

Another helpful tool is a weekly tracking chart, which shows the progress of a project by task. The chart is updated weekly to show percent completion of each task. See the example chart in Exhibit 4A-2.

Project Planning for Profit

The heart and soul of making a profit at the end of the year is in a firm’s projects. Each should be able to stand on its own as a profit-maker. To achieve this requires an understanding of how the negotiated fee breaks down, which is demonstrated using the following fictitious example.

Paradigm University plans to build a philosophy building. The program includes 50,000 gross square feet and has a $10 million construction budget. The architect was successful in negotiating a stipulated sum fee of $1 million. She starts shopping for a new Mercedes, but then looks at where all that money has to go.

First, she realizes that approximately 40 percent of the $1 million must go to the engineers and consultants, leaving her with only $600,000. Seeing how fast the fee is being reduced, she decides she had better scoop out a profit first. She decides she would like to make a 20 percent profit on this job, so she sets aside $120,000, leaving $480,000 to do the work. Then she realizes that this amount must cover an overhead factor of 62.5 percent to pay for rent, insurance, and other administrative expense, which leaves 37.5 percent for direct salaries for her staff (known as raw labor). The result is only $180,000 of the $1 million fee to do the work!

Saying goodbye to her Mercedes, she also realizes she has to further breakdown the $180,000 into the project’s five phases. Using the AIA-suggested breakdowns by phase (although many firms alter these percentages to suit their own practices), the raw labor is as follows on page 471:

- **Square footage:** Real estate developers and others who make their living on a square foot basis are the primary users of this method of determining a fee. A developer who is constructing a spec office building will sell his product by the square foot, obtain his funding by the square foot, and want to pay the architect by the square foot. This is a fair way to develop fees, but be aware that fluctuations in the size of the project, and thus in fees, can be expected. For example, you may agree to a fee of $3 per square foot for architecture only, or $5 per square foot for architecture and structural and mechanical/electrical engineering.

- **Unit Cost:** This method makes sense when the program for a project involves the repetition of similar units, such as hotel rooms, apartments, condominiums, or parking spaces. Often when this type of project is begun, the final size or unit count is unknown although the goal will be to maximize use of the site. A fair method in this case would be to base the fee on the unit count, such as $500 per car for a parking garage.

Whatever method of charging for your services is agreed upon by firm and client, you should understand how the choice affects your costs and man-hours. Each method may require a different type of record-keeping, control of expenses, and method of invoicing your client. In each case, however, the goal is to make a profit by spending less than you receive.
<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Schematic design</td>
<td>15%</td>
<td>$27,000</td>
</tr>
<tr>
<td>Design development</td>
<td>20%</td>
<td>$36,000</td>
</tr>
<tr>
<td>Construction documents</td>
<td>40%</td>
<td>$72,000</td>
</tr>
<tr>
<td>Bidding</td>
<td>5%</td>
<td>$9,000</td>
</tr>
<tr>
<td>Construction administration</td>
<td>20%</td>
<td>$36,000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>100%</td>
<td>$180,000</td>
</tr>
</tbody>
</table>

The next step is to break down each phase by week and by employee. The architect quickly realizes the project schedule is crucial. She feels the project needs a principal, of course, a project manager, a project architect, an architect 1, and an intern to complete the work. If each worked full-time on the project, she would run out of money quickly. So, she develops a work plan chart for the schematic design phase.

**SCHEMATIC DESIGN PHASE: ESTIMATED STAFFING - 8 WEEK SCHEDULE**

<table>
<thead>
<tr>
<th>Week Number</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>Total</th>
<th>Hourly Rate</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principal</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>32</td>
<td></td>
<td>48</td>
<td>$1536</td>
<td></td>
</tr>
<tr>
<td>Project Manager</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>192</td>
<td>36</td>
<td></td>
<td>$6912</td>
<td></td>
</tr>
<tr>
<td>Project Architect</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>320</td>
<td>28</td>
<td></td>
<td>$8960</td>
<td></td>
</tr>
<tr>
<td>Architect 1</td>
<td>18</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>258</td>
<td>24</td>
<td></td>
<td>$6192</td>
<td></td>
</tr>
<tr>
<td>Intern</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>200</td>
<td>17</td>
<td></td>
<td>$3400</td>
<td></td>
</tr>
<tr>
<td>Fee Required</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$27,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The work plan shows the firm can complete schematic design within this raw labor budget in eight weeks if the principal spends eight hours per week on it and the project manager works 24 hours per week. This becomes her plan, and she completes the other phase charts in the same manner.

This looks great, you say, so why don’t architects make more money? The answer is that the fees often run out before the work is complete. If this happens in a firm, it is important to carefully examine why. Each firm is different, but there are some common problems. Many redesign their projects until they are satisfied, only to find later that they exhausted the fee in the process. In some cases, schematic design is not completed until the project is in design development, and design development is not completed until construction documentation, and so on. Also many firms do more work than the contract requires in an effort to please the client. You may choose to do this, but be aware of its effect on your fees.

**Human Resources**

Architecture firms have material assets. Typically, all a design firm owns that has any tangible, capital value is computers and furniture, and these depreciate rapidly. Architecture firms sell very little actual products, so
they have no inventory. What they sell are professional design services, which are measured and billed as
time, or man-hours. Therefore, the most important assets of any firm are its staff, and their expertise.

Properly managing human resources requires knowledge and skill in three key areas:

- Recruiting and Hiring
- Compensation and Benefits
- Legal Issues and Termination

Recruiting and Hiring

Accurately predicting the future staffing needs of a firm is extremely difficult if not flat-out impossible;
nonetheless, it must be attempted on a regular basis. Many variables beyond the direct control of the firm
will influence the future workload, including economic conditions, changing project schedules, results of
competitions for projects, and staff turnover. The firm must at least have a look into the future so educated
decisions can be made about hiring and layoffs.

Assessing the need for more (or less) staff begins with the project work plans described in the section above
on financial operations and management. The work plan (see graphic below), based on the negotiated fee, is
a plan to complete the work, within a budget that allows the firm to make a certain profit, making this plan the
best look into the future of the firm.

To help you look at the big picture, work plans for all projects currently under contract should be assembled
and compiled into an office-wide staffing chart. At the bottom of the chart add any potential projects that
seem promising. Update this chart and review it on a regular basis.

If the firm needs more help, you can consider other options besides hiring a full-time, permanent employee,
especially if you consider the need to be short-term. Many architecture schools have co-op internship
programs for a semester, or longer, and a student may be able to fill your short-term need. Firms also may
consider hiring someone on a contractual basis, with the length of employment is determined at time of
hiring.
When you decide to hire a full-time, permanent employee, the issue becomes one of recruitment. Several proven methods of recruiting new staff are used by many architecture firms. Employee referrals are generally a very effective way of finding good people. Some firms offer bonuses to current employees for referring their friends to the firm. Advertising in local, regional or national newspapers or publications has worked well in the past, although advertising on Web sites is becoming more and more common. Many firms benefit from a relationship with an architecture school, either a local one or one or more schools with alumni at the firm. A relationship like this can bring in a steady stream of good interns. Firms may also consider hiring search firms, or recruiters for certain positions. Search firms require a fee, usually a percentage of the negotiated salary, which can be as much as 25-33 percent.

When a pool of applicants has been identified, it is time for the interview process. A job interview is not only the way for you to obtain information about the applicant; it is also a way for the applicant to find out about you and your firm. If you are even a little bit interested in the applicant, you must remember that you have a little selling to do also. If you are very interested in an applicant, move quickly into your best salesmanship mode.

When you are ready to make an offer, it is imperative for you to be crystal clear about its details. State the pay and whether it is an hourly, weekly, or yearly rate. Clarify details of your benefits package. The offer should include information on the proposed roles and responsibilities of the position and establish a starting date. It should state if any bonuses are possible. Finally, the offer should be made in writing. The offer letter should have a signature line for the applicant to indicate acceptance of the offer and a signature line for a representative of the firm, to confirm you both agree with the terms of the offer.

Plan an orientation process for each new employee. Introduce the new employee to all current staff, review the employee handbook, explain office procedures and the use of office equipment such as copiers, fax machines and plotters; convey the firm’s mission, goals and objectives; and so on. Consider an office lunch to welcome him or her.

Compensation and Benefits

Today compensation and benefits have now come to be known as the “total compensation” package. Prospective employees carefully consider offers, and benefits are becoming increasingly important in their decisions. To attract good people, a total compensation package needs to be competitive in the market in which the firm recruits. If the firm recruits locally, its compensation must be competitive with the local market. If the firm recruits nationally, its compensation must be competitive with other firms nationwide, accounting for regional differences. The employer must be acutely aware of the range of salaries in its competing marketplace. For example, see the accompanying excerpts from Compensation at U. S. Architecture Firms: 1999 AIA Report, Exhibit 4A-3.

Base salary rates are often very close for new graduates and interns in a geographic area. However, as an employee gains experience, develop areas of expertise, and make varying contributions to the firm’s success, the salary range widens. The salary rate for the most experienced architects in the firm is usually
based directly on the value the employee is perceived as contributing to the firm’s success and thus can vary greatly.

Benefit packages are becoming increasingly complex and creative, and it is often difficult to compare benefit packages from one firm to the next. However, in order to attract top talent, a firm must have a competitive benefits package. The basic package usually consists of health insurance, life insurance, paid time off, and a retirement savings plan. The cost of these benefits can be paid in full by the employer or shared in some manner with the employee. Other common benefits include dental and vision plans, short- and long-term disability insurance, health and dependent care reimbursement accounts, 401k plans, tuition reimbursement, continuing education reimbursement, payment for professional dues and licenses, and other benefits. Some firms have employee stock ownership plans (ESOPs) which allow staff to purchase shares of company stock. Some firms provide a flexible benefits package, in which a certain amount of money is offered for benefits, and the employees choose the benefits most useful to their personal situation.

Legal Issues and Termination
Staff changes occur for a variety of reasons. During your career, chances are you will have to fire one or more employees and you will lose employees whom you treasure. No matter how they come about, situations must be handled professionally, and legally.

Terminating a problem employee is never easy. In certain situations, however, this may be the best course of action. Except for gross misconduct, termination should not come as a surprise to the employee. There should be a mound of paperwork documenting the problem behavior, including warnings given with a period for correction. Make these time periods short, and don’t let the situation drag out. In most cases, the terminated employee should be asked to leave immediately.

Necessary reductions in staff are another difficult part of the human resource management. The architecture industry has a history of periodic slowdowns. If you sense one coming, try the following to avoid or postpone letting staff members go:

- Attempt to alter project schedules so as to keep staff working
- Eliminate overtime
- Allow natural attrition to occur
- Consider reducing overhead or benefits
- Encourage the use of vacation or other time off
- Encourage early retirement
- Contact other firms to see if they would like to borrow any employees
- Consider pay reductions, starting with the partners
- Reduce working hours

No matter what you may choose to do, you must communicate clearly and often with your employees. You don’t want good people to leave out of panic. If you must release good employees, promise them that you will give them a good reference and give them a letter explaining that they were laid off based on the value they provided to the firm. Other resources mentioned include the Architect’s Knowledge Resource (AKR) and the AIA Research Resource Center.
off due to lack of work, not for any performance reason. And indicate a willingness to hire them back when and if conditions improve.

**Risk Management and Professional Liability Insurance**

All businesses are subject to risk, which is defined as the probability of an unfavorable outcome. Risks common to all businesses are the destruction or theft of business property, accidental injury to workers, damages caused by business operations and, of course, the financial risk of business failure. Architects and other design professionals, however, are subject to additional risks because they practice a profession that affects the health, safety, and welfare of the public; their projects cannot be tested before being put to use; and their work is usually performed under changing conditions and is affected by clients, contractors, public authorities and others whose actions they cannot control.

**Managing Firm and Project Risk**

Risk management is a process that includes analysis of potential risk and development of responses that can control it. Sources of risk in a design firm may include the following:

- **Nature of the project:** The program, site, schedule, and budget all affect your risk.
- **Architect’s experience:** The experience of the firm and its staff with the project type.
- **Client:** Whether public or private, the client’s experience with the building type, the fees they are willing to pay the architect, and their claims history all affect risk.
- **Method of project delivery:** Risk differs according to the type of project – open bid, selected list, a general contractor or construction manager, or a fast-track.
- **Type of contract:** Risk varies from a standard contract, like AIA Document B102–2007™, Standard Form of Agreement Between Owner and Architect, and an owner-produced contract.
- **Industry influences:** The current bidding climate and the familiarity of contractors with the building type affect project risk.
- **Time and cost restraints:** An adequate design and construction schedule decreases project risk.

The magnitude of project risk is a function of the probability of an unfavorable outcome and the severity of the consequences of that outcome. Determine if you have the contractual authority to control the sources of risk. For example, if you are required to observe the progress of construction, are you being paid appropriately to do so, and do you have the authority to access the work?

After you have assessed and understood your firm’s risk for a project, the next step is developing your response. You have three choices: retain and mitigate the risk, transfer the risk to another party or avoid it completely.

If you choose to retain and mitigate the risk, look for a satisfactory risk vs. reward balance. Make sure your compensation covers the value of your services in addition to the risk. Understand what standards will be used to judge your performance. If your performance is not tied to the standard of care (see definition below), your risk is much greater. Watch for overlaps in responsibility, and determine the worst-case risk if disaster occurs.
Risk can be transferred in two basic ways: via insurance and via contract language. Professional liability insurance is the most common and most highly recommended way of transferring risk, but it should not be considered the only solution. With professional liability insurance, most of your risk is transferred to the insurance company, in exchange for premium payments. Your risk is then limited to your deductible and anything over and above your coverage limits.

Risk can be transferred via contract in two ways: By indemnification and by agreed-upon limits of liability. Indemnification is a tricky and complex subject, generally means that one party agrees to pay for the liabilities incurred by another party. It is advisable to consult with your attorney or insurance carrier if confronted by this issue. A limitation on liability is an agreement in which a cap on the liability value is determined. This can be limited to the total amount of compensation, the amount of insurance coverage, or a specific dollar amount.

A perfectly reasonable method of responding to risk is to avoid it as much as possible. Look for problem clients, complex projects outside of your or your client’s experience, and for confusing areas of responsibility. If you receive any warning signals, consider saying “no” and passing up on the project. It may be the best decision your firm can make.

Following are some basic risk management principles adapted from the Understanding and Managing Risk voluntary education program developed by CNA/Schinnerer, a professional liability insurance carrier:

- Select projects your firm’s experience and staffing qualify you. If you branch out into new areas, do so slowly while gaining valuable experience.
- Carefully select clients and research any new clients. Find out their history of claims against architects.
- Provide regular training on contractual and risk management topics, for all staff, not just principals.
- Provide timely and effective problem identification and resolution. Catching potential problems early can greatly reduce risk.
- Use indemnifications and limits on liability, but do not rely solely on them to reduce project risk.
- Recognize that insurance is not a substitute for a comprehensive risk management program.

If you practice architecture for any length of time, you will no doubt eventually have to face a liability claim. Don’t worry too much – you are not the first. Your professional liability insurance carrier will help you through it, and they have a lot of experience with which to help you.

Professional Liability Insurance Basics
Although professional liability insurance (PLI) policies are a risk-transfer method, they do not transfer all risk to the insurer. These policies have clauses that describe the scope of coverage and any exclusion from it. PLI policies cover negligent performance of professional services, but they typically do not cover the late review of shop drawings, or failure to live up to the terms of an express warranty or guarantee.
PLI policies also typically include a deductible. Like any insurance, the architect must satisfy the deductible before the insurer will pay, and the amount of the deductible affects the cost of the premiums. Generally, the higher the deductible you pay on the policy, the lower the premium. PLI policies also have a limit of liability, such as $100,000 or $1 million or $5 million. This usually applies to the aggregate limits of the policy per calendar year. If you have two claims against you during the term of one policy, and the first one exhausts the limit of the coverage, then you will have no insurance coverage for the second claim.

Professional liability insurance comes in two basic types: practice policies and project policies. Practice policies are written on a yearly or multi-yearly basis and cover claims made during the policy term for all projects within the firm’s practice. Project policies cover only a specific project but may be written to cover the entire design team on the project. The policy term covered by a project policy usually includes design, construction, and a discovery period following construction completion. Practice policies can be expensive and may not always be available.

Legal Issues for Architects
There has never been a set of construction documents in the history of the world that were completed without an error or omission. No fee can guarantee a perfect set of drawings.

The law, then, also does not require drawings to be perfect. Rather, it sets a reasonable standard of care for the performance of design professionals, and is roughly defined as “services provided by the design professional are to be performed in a manner consistent with that degree of skill and care ordinarily exercised by members of the same profession currently practicing under similar circumstances in a similar location.”

The law grants architects the same leeway it provides doctors, lawyers and other professionals. They are free to exercise their judgment and skill reasonably and prudently, with the comfort of knowing the law will support them as long as they act reasonably and prudently.

For an architect is to be found liable, it must be proven that he or she failed to meet the reasonable standard of care and injury or damage resulted from that failure. For a negligence action against an architect to succeed, the law requires proof of four things:

- **Duty:** There must be a legal obligation to do something, or to refrain from doing something. This is often contract language.
- **Breach:** There must be an established failure to perform some required duty.
- **Cause:** The established breach must be the actual cause of the harm to the party making the claim.
- **Damage:** Actual harm or damage must result from the breach. If there is no harm or damage, there can be no negligence.

Finally, architects must decide when to bring in legal counsel. Often the first call upon learning of a suit should be made to your insurance carrier. Your policy probably allows for the carrier to bring in an attorney, at their cost rather than yours. Do not hesitate to call the insurance company for fear of increased premiums.
Your policy may have a defense clause, and the carrier will usually find that it is cheaper to be brought in before a problem mushrooms into a major fight.

Architects must be proficient at design to convince building owners to hire them. They must be technically proficient to stay out of trouble and protect the public health, safety, and welfare. But, if they want to do either of these for very long, they must pay special attention to management of the firm. Making a profit is essential to any business, including architecture firms.

Written by Glenn W. Bix, AIA
Glenn Bix is a principal with Ayers Saint Gross Architects in Baltimore, where he heads the firm’s office and quality management, educational programs, and delivery of technical services. He is a LEED-certified professional and past president of both AIA Baltimore and the Maryland Society of Architects.

As you research and look for more information on topics presented in the Emerging Professional's Companion, remember that a quick internet search of keywords can be incredibly useful to completing your Activities.
Take brief notes while reading the narrative and list key resources you used to complete the activities. Note discussion outcomes from meetings with your supervisor, mentor, or consultants. When finalizing the activity documentation (PDF), include your notes and the Emerging Professional’s Companion activity description.
Positive publicity for a local architect is unusual. Often the only time an architect is mentioned in the local paper is when the project is over budget or construction is delayed, and then the architect usually gets the blame. Proactive media relations are not highlighted in architecture schools and are rarely a priority in most architecture firms. Yet positive publicity is important in obtaining commissions.

Positive media relations begin with a dialogue with the reporters and editors at your local media outlets who may share an interest in good stories about the built environment, or have written stories about architecture. Some larger city papers may have an architecture writer or critic. The first step toward positive publicity is to identify that person(s) and begin a dialogue.

It is important to understand that media outlets are looking for attention-grabbing stories. That is why stories about cost overruns and construction delays get a lot of attention. They affect a lot of people and taxpayer’s money. Stories about good design solutions for the local fire station don’t have the same appeal. To get a writer or editor interested, you must have a unique and interesting story. Stories about the first “green” building in your area, or about a unique public or private partnership, have a chance for coverage. Sometimes the best publicity is not directly about the architecture or architect, but a human interest story indirectly about the building where your firm’s name is mentioned. The story may be about the local philanthropist who donated a large sum of money for the project that you are designing. The trick is to get your name published as the architect.

Activity - Core

Please reference the following sources:

- Defining Public Relations and Developing A Plan: AIA Leaders, Media Center webpage

Research local newspaper, television stations, and applicable webpages to find stories about buildings. Do they mention the architect’s name? Determine the type of story that gets printed or aired by local media.

Your second task is to get published or broadcast. (But please obtain permission from your firm first prior to using their name and releasing any information.) Think about the projects on which you have been working. Find a unique and interesting stories. Using the example of a news release, write your own about your project. Keep it short and focused. Provide quotes from the owner or from a local dignitary involved in the project. Include quotes from yourself or the principal in charge. Submit a color rendering, color photograph, or a black and white drawing or photograph of the project. Send it to as many local reporters, editors, or respected bloggers as you can. Follow up with phone calls to answer any questions. Then, wait for publication or broadcast and save it for your scrapbook! The following are some critical questions to consider:

- What is the unique and human-interest story about one of your projects?
- How do you get the reporter to mention the firm’s name (in a positive light)?
- Which type of media (newspapers, magazines, radio, TV, blog, etc.) would be most likely to report on your unique story?
- What built environment stories have been published in the past by each type of media in your area?

Share your work with your IDP supervisor or mentor and make suggested changes.
Firm Organization

Supplemental Experience for eight (8) Core IDP Hours

In this scenario, you have worked at your current firm for ten years, ever since you graduated from Architecture school. Believing you have learned everything that you can from those that you worked for, you feel you are ready to “hang your own shingle.” You, Jennifer Ever, and your spouse, Thomas Best, also an architect, decide to quit your jobs and form a new firm, Best Ever Architects. Your dreams have always been to be Partners in your own firm, so you set up a Partnership, and register it legally in your state. Filing the registration papers requires that you state the percentage of ownership so you decide that since you are already married anyway, that it makes most sense to split the company 50% for each of you. Since you have no money yet, you decide to set up your office in the spare bedroom of your apartment, buy some cheap office furniture, and do not yet purchase professional liability insurance, until you need it, and can afford it.

Working with some contacts made while working at previous firms, you are able to get enough work to scrape out a living for a year. Since you have little overhead expenses, you were able to pay yourselves an amount that works out to approximately $30 per hour, so you feel pretty good about your first year. You learn that the firm made a profit of $20,000, after paying yourself the $30 per hour, and you and your spouse start talking about the new house. Nearing the end of the first year, you receive the following news:

• You did not get the commission on several projects that you pursued, due mostly to not satisfying the Minority and Women-Owned business requirements of your state.
• Your accountant states that you owe $18,000 to the Federal Government and $6,000 to the state government, in personal taxes, for each of you. But the good news is that you don’t owe any corporate taxes for the firm.
• You receive notice that your firm is being sued by both of your previous firms for interference with their business operations.
• You receive a letter from one of your clients saying that they will be holding up a $50,000 payment to you, to pay for errors and omissions on the drawings of the project.

Activity – Core

Please reference the following source:


Using the narrative section on firm organization, and other sections, answer the following questions:

• Was the Partnership the best legal entity for this new firm?
• If a partnership made sense, what could Jennifer and Thomas have done differently to avoid some of the above problems?
• How does the percentage of ownership matter?
• How could Jennifer and Thomas have avoided the huge end-of-year tax bills?
• How would things have been different if they had set up a professional corporation? A sole proprietorship? A limited liability company?

Prepare a brief business plan that would have worked better for Jennifer and Thomas. The plan should define the creation of a proper organization, and should address taxes, profit, and insurance.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Understanding the operating cost of an office involves layers of detail that are not evident to most employees. When you receive your pay check you must understand the total cost of employment and operation of an architect’s office.

As the office manager, you are responsible for all aspects of the operation of your firm. Your responsibility does not stop at staffing assignments and marketing, but includes everything necessary for day-to-day operations. These can be broken down into three categories. Some examples of things to consider are available in Exhibit 4A-4, but you must also determine what other items should be added to the list.

For this activity, you will focus on the hard cost of operating your firm for one year. Do basic research to determine a salary structure for your firm and benefits cost (based on a percentage of salary). The final product will include several exercises to help you understand how you must plan for change and growth. They can be accomplished using research and a spreadsheet. Each exercise will use information from the first exercise and make adjustments to the summary of fees required to operate the firm.

**Activity - Core**

Review the activities noted below and set-up your spreadsheet to accommodate the growth of the firm and the additional furnishings and equipment needed. (Remember that you provide a bonus to your employees if there is profit.)

The first exercise is to develop a spreadsheet covering the cost of operation of your architectural firm. From this information, you will determine the amount of fee required to make your firm successful. Calculate the annual fee, and then break it down on the basis of the average fee per month. To estimate your staff salaries, download the summary of the most recent AIA Compensation Report via the AIA Research and Reports webpage.

For the second exercise, you must determine the additional fee necessary to provide a bonus to each employee at the end of the year. Assume staff will receive 10% and each level above staff will receive an additional 5%. You should include the bonus in your annual budget planning for this exercise.

Prior to starting, schedule a meeting with one of your firm’s partners, office manager, etc., to discuss the items considered in the operation of an architectural practice. You may receive more accurate information for some of the items from this meeting. Prepare your evaluation material in a spreadsheet format.

The following are some critical questions to consider:

- How much does your firm need to invoice on a monthly basis to break even? To give out the bonuses described above?
- What is the proper amount of salaries and other costs to devote to marketing activities (as a percentage)?
- How can you fund technology and computer improvements as necessary?
- How will you plan for growth of your firm? Do you need additional projects first? Or do you need the staff and office space first?
- How do you plan for unexpected or unforeseen office costs?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Ownership & Transition
Supplemental Experience for eight (8) Core IDP Hours

For this activity, you are to learn about the ownership of your current firm or your mentor’s firm in detail. To do this, have conversations with the principals or owners of the firm. They may be reluctant to give you detailed information, but explain to them that it is an IDP task for your education. Tell them that they may alter the information and numbers so they are not factual, as long as the concepts and methods are accurate.

Activity - Core

First, how is the firm organized? Most likely it will be one of the four legal entities: A sole proprietorship, a partnership, a corporation (either general or professional), or a limited liability company. Ask the principals or owners why they selected that type of organization. Then ask about the number of current owners and percentage of stock that each owns. They may respond without names and with adjusted percentages if they wish. Ask about the history of stock sales over the life of the organization, if applicable. Find out why any stock sales occurred over the years. You might be surprised by this answer. Determine if any deaths of owners have occurred and how the stock was handled. See if there have been any divorces that affected ownership. Did any owners quit the firm, and then how was the stock transferred, if at all?

The next line of questions should be about the valuation of the stock. Find out how many shares exist, how many are outstanding, and how many the firm holds. There are many methods of determining the value of stock in a private organization. Ask your principal or owner what method they use what the current value of the stock is, and what the history of the value over the past few years. Ask him/her to share the calculations that the firm is using to value the stock.

Then ask about how stock transfers have been funded. Did the new owners bring in cash from their own sources? Were there any mergers or purchases of other firms or parts of firms? Did the firm fund any new owners from within through bonuses? If so, how long was the payback period? Ask about any interest charges and tax payments if this is the case. Ask if they will share with you copies of any offering memorandums, stock purchase agreements, promissory notes, stockholder agreements, deferred compensation agreements or employment agreements, with confidential information deleted. Was spousal consent required for any of these documents?

Finally, ask him/her if there are plans for future stock transfers. Don’t ask for names, but find out the conceptual plan. Does he/she plan to keep all of his/her stock until retiring at age seventy? Is there a plan to cash out gradually? If so, starting when? Is it his/her intention to keep the firm viable and growing after retirement, or to shut the firm down? Has s/he thought about it at all?

Record the information in memorandum format, entitled “Summary and History of the Ownership of (name of firm)”.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Understanding the physical relationships between the office environment, the safety of the work space and the employees is something to be considered in the selection and location of an office. A manager must be open minded in considering numerous situations which could manifest themselves on the work place, and the employees, in the decision to lease or purchase space for the business operation.

In this scenario, you are the office manager of your firm. As the office manager you are responsible for the physical environment in which the firm performs its daily business. Your firm has been successful over the last 15 years and moved into an old industrial building space on the waterfront in a Mid-Atlantic coastal city. While your office is not directly on the ocean, it is in a location susceptible to the effects of major weather anomalies such as a 100-year storm, and the waterfront flooding that accompanies this type of unpredictable event.

A storm of substantial magnitude is heading in the direction of your city, and storm surge warnings are being issued in areas adjacent to the waterfront. Your office is in an historic structure and a portion of the office area is at an elevation below the 100-year flood plain, but the majority of the space is level with the flood plain line. You closely follow the changing weather conditions and hope for the best, but the storm continues to head in your direction and it becomes apparent that your office space may be in peril of flooding. It is Thursday morning and you must make decisions about the pending disaster. While there is no guarantee, it appears that you have about 16 hours before the moment of truth arrives with the high tide.

For this activity you will focus on the employees and how to maintain safe working conditions, a functioning office, and continue to operate the business with minimal loss. You will need to determine how to prepare for the possibility of flooding and the issues it presents. There are several areas of concern, including: the work space, the employees, the equipment, files and intellectual data for which you are responsible.

Activity - Core

Please reference the following source:
- Human Resources Best Practices, AIA Architect’s Knowledge Resource (AKR)

Your assignment is to prepare a memo to your staff outlining the steps you will take in preparation for the storm. Provide a summary for each decision you make.

This activity will require research, information gathering, evaluation, and common sense. Use your office manager as a resource as well as local municipal agencies in the preparation of your report.

The following are some critical questions to consider:
- How will you prepare and protect your computers, network, and servers?
- How much work can your employees do to assist in the preparations? Do you need to hire any professionals and if so, what type?
- How will you complete the work under your contracts, invoice your clients and pay your employees if you are forced to move out of the office?
- How will you make plans for rebuilding if it becomes necessary?
- How will you contact your insurance companies and learn what is covered and what is not?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Marketing Strategy

Supplemental Experience for eight (8) Core IDP Hours

Read the book *Marketing for Design Firms in the 1990s* by Roger L. Pickar, or a similar title, and develop a formal Marketing Strategy for a firm. Assume that the current owners of the firm have suddenly decided to retire, and that they have decided to appoint you as the new President and CEO. Therefore, develop the marketing strategy as you would have it, using the historical experience and past clients of a firm your are familiar with as the foundation. You may choose to do this on your own as a fictitious exercise, or you may discuss this with the current partners to make this a real plan for the firm.

Activity - Core

As you prepare your marketing plan, it should include the following elements, from Pickar’s book:

1. **Determine the company mission.** Create a mission statement as to the purpose of your firm. It should be clear and concise, based on the project history of the firm, and it should contain a vision that is easily understood by your employees and prospective clients.

2. **Set company goals.** Based on the mission statement, define a set of goals that you wish to achieve for the future direction of the firm. These goals should be broad and will be used to guide the marketing plan.

3. **Perform internal analysis.** Prepare and send out a survey in order to determine the strengths, weaknesses and other perceptions of your firm. The survey should go to both clients, consultants, and your own employees. The answers to its questions should give you a good picture of how you are perceived, so that you can form your detailed marketing plan with that knowledge.

4. **Perform external analysis.** Perform a research analysis of your planned market and related markets. Develop an understanding of future trends anticipated for that market.

5. **Establish marketing goals.** This is the place to develop your specific marketing goals. They should be detailed, and should include things such as amount of fees per year, number of employees, specific clients or client types should be named, number of each type of projects, etc. Specific goals should be set as targets to work towards. They can be in yearly, or three or five year plans.

6. **Generate strategies to accomplish these goals.** Develop a plan for activities that will help the firm reach its goals. For new markets, it may include research and teaming; for an expanded geography it may involve a new office or partnering; for increased market share, it may include additional employees and space, etc.

7. **Research and refine strategies.** Take time to go back and review your strategies. Decide which are most likely to accomplish your goals, and are cost-effective. Focus on those, and consider deleting other loftier or costlier strategies. For now.

8. **Create and refine promotional and sales tactics.** Create a concrete, actionable series of tactics that can be implemented in a short amount of time. These tactics may include promotional material, a new image or logo or name, creating a new mailing list of potential clients, a series of informational emails, etc. Limit the series of tactics to those that will most effectively accomplish your strategy.

9. **Implement the plan.** Create a plan to implement your plan! Describe how, exactly, will you roll out and deliver your tactics. If you need to hire a graphic designer to create a new marketing piece, define how and when you will accomplish that. If your tactics include the creation of a new mailing list, how will you go about doing that, etc.

10. **Evaluate the plan in action.** Finally, develop a survey for completion by existing clients, potential clients, employees, consultants, community figures, etc., designed to give you feedback on the results of your plan and strategy. Also develop a plan to track measurable results, such as the amount of new clients, new market share, fees, profit, etc. Review the data often and make changes as necessary. Don’t forget this important step.

Share your work with your IDP supervisor or mentor and make suggested changes.
In this scenario, you have been working at a medium-sized firm for about five years. Your firm, DIA (Do it All) Architects, has about 25 people and designs K-12 schools, fire stations, libraries, speculative office buildings, strip shopping centers, and anything else that they can get their hands on. You started with the firm right after graduate school as a CAD draftsman, gradually gaining experience with design and project management on several building types. You are tired of the stodgy designs your firm produces and the fact that the principals insist on their own way, even though your ideas are much better. You notice they take home all of the profits on your projects, while you do all the real work. So, you have had enough, and you begin to plan to start your own firm.

Your first step will be to complete market research. You decide that you like working on K-12 schools, fire stations and libraries, and you feel your potential clients immediately will be attracted to your obvious skills and experience with these building types. Be sure there is a future market for these buildings before you leave. Complete research in your immediate area. For at least three local governments (state, county, or municipal), find out who would have information on future funding for these three building types. Place phone calls, do internet research, and visit the planning departments and compile a list of each type of project planned for the next three years. Also research the other architectural firms in your area to determine those able to compete with your new firm. Compile a list of those firms along with a list of their experience with these building types. Make a determination as to the ability of your new firm to obtain this future work, taking into consideration the potential new projects and your competition.

Your second step will be to prepare a strategic plan. After determining which of the above three building types you will pursue based on research, make plans to get that work. Come up with a plan to convince those hiring the architects that you are the best one to do the job. You may be unable to compete for the larger, more prestigious commissions with the larger, established firms in your area. From the list of projects that you developed during the market research, select smaller projects that larger firms may not pursue. Compile a list of your direct experience related to those small projects. Determine a percentage of those projects for which you feel your new firm could effectively compete. Include in your strategic plan the number of staff needed to complete that work and the amount of fees necessary to support them. Show a gradual plan so that by the end of the third year, you will have enough experience to compete effectively with established firms for these building types. Your strategic plan should be in narrative form, with charts showing projects and staffing for the duration of the three years.

The following are some critical questions to consider:

- Will there be enough projects in your target market to support your firm in the near future?
- How will you be able to convince an owner that hiring you will be the best solution to his needs?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Human Resources/Staff Planning
Supplemental Experience for eight (8) Elective IDP Hours

In this scenario, you have risen rapidly and now find yourself the managing principal of your 15-person (architectural staff) firm. One of your responsibilities is staff planning. In Exhibit 4A-5, you will find a list of staff members your firm employs as well as a list of current projects with their respective phase of completion.

Activity - Elective

Using the techniques and examples described in the narrative of this section, prepare a fictitious office-wide staffing plan for the next six months. Determine if you have enough staff to complete the work or if hiring more staff is required.

The following are some critical questions to consider:

- Each project must have a principal, a project manager, and other staff assigned to it.
- No single person should be committed to a project load that results in more than 40 hours per week.
- Each project must be planned to be completed on schedule.
- Each project must be planned to make a profit.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
In this scenario, you are responsible for hiring new employees at your firm. You have interviewed a series of candidates for an Intern Architect position. During the course of the interviews, you began to learn that the market value in your area of Intern Architects is higher than what you pay your current interns. This is confirmed when you decide to make an offer to the top candidate, who won’t make a move without a salary that is $5,000 higher than your highest intern’s salary. This is a common occurrence when the market for Architects is good, resulting in a “buyer’s market”. You have no choice but to hire this intern, in order to satisfy the requirements of your current contracts, and the other candidates are not less expensive.

Your selected candidate has an existing annual total compensation package that can be found in Exhibit 4A-6. He is receiving offers of a $50,000 salary from other firms.

Your assignment is to come up with an attractive offer to your selected candidate, and to be sensitive to the existing interns in your office.

Be sure to consider the following questions:

- Put yourself in your employer’s shoes. Increasing all salaries across the board is not a viable business option. What would be a creative plan that would be enough to lure this candidate to your firm, but that does not alienate your existing staff or “break the bank”?
- Which benefits listed in Exhibit 4A-6 are variable, and which are not, to the extent that changes will affect all employees?
- Which benefits will have the most impact on a young intern?

Prepare an offer letter showing the total compensation package as above. Be aware that policies such as health, life and dental insurance premiums, paid time off, and 401k plans are usually applied to all employees, so any changes to that will have other financial affects to the firm as a whole. In addition, come up with a plan that you can present to your other interns.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Legal Issues for Architects
Supplemental Experience for eight (8) Elective IDP Hours

In this scenario, your firm has been doing well, and reached the point where the existing staff cannot handle all of the work under contract. You decide to hire an additional intern to fill the staffing needs.

Resumes have been reviewed and narrowed down to two candidates. Based on the interviews and materials provided, decide who to hire.

This activity is geared toward understanding appropriate interview questions and the basis upon which you can make a decision.

Activity – Elective

Please reference the following sources:
- *Society for Human Resource Management, Sample Interview Questions*

Review the notes for two different candidates in Exhibit 4A-7. Prepare a memo to the hiring manager/partner which summarizes the interview process, gives your recommendation for which candidate to hire, and provides reasons why you have made that selection. Research state labor laws, including maternity leave, and include that in your memo.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Understanding the financial responsibilities associated with the operation of a business includes the complexities related to employee benefits and their impact on the operating cost and the bottom line. In this scenario, you are the office manager at your firm and you are responsible for the selection of the benefits package available to the employees as well as the basic insurance coverage the firm provides for worker health and safety.

All of these programs have a cost associated with them, which is typically shared between the employer and the employee. Determining which percentage each party must contribute to these programs is important to the operation of the firm. Its leadership must make the final decision on which vendor to use, which programs to make available to the employees and the associated costs to be covered.

If you are employed with a firm that provides a choice of the type of insurance programs available, or if your firm has only one choice available, you will begin to understand the reasons when you complete this activity.

You will focus on the health insurance benefits available to employees. Also, disability and life insurance benefits are usually available and you should list these along with the health insurance since they are a part of the total benefits cost exposure to a firm. Schedule a meeting with your benefits director, partner, office manager, etc., to learn the basics of the insurance program and the options that are considered and offered. Understand the office you work for has invested a substantial sum in the evaluation of the programs from the standpoint of diversity, availability in your working area, flexibility to meet the needs of all of the employees, and the cost of the program. Typically, a firm uses specialty consultants to prepare the preliminary information for evaluation, but the firm is responsible for the final selection of the benefits offered.

Research the current program(s) offered, and if possible, previous ones. Using these for comparison purposes should provide information that is readily available. Prepare a simple chart listing the benefits offered, but focus on the health insurance program in depth. List the positive and negative points compared side by side. You should consider all aspects of the program(s) including a minimum of:

- Benefits offered – health, vision, dental, etc.
- Levels of coverage (variety of programs available)
- Selection of primary and specialty doctors
- Emergency service considerations
- Range of service availability (geographical boundaries)
- Location of doctors to employees (convenience)
- Arranging for visits to specialist (Are referrals required? Does it vary with the program available?)
- Deductible (co-pay) cost
- Maximum benefit amount per employee
- Annual cost of each program, to the employee and to the firm
- How does the firm pay for the benefit?
- Can the cost be a pre-tax expense? What does this mean to your bottom line?
- Cost for a single employee
- Cost for a couple
- Cost for a family
- Option out – What benefit is realized if you do not enroll in the program
- Add other topics you discover as you prepare your research
- Conclusion and selection of the program you would recommend.

Share your work with your IDP supervisor or mentor and make suggested changes.
Lack of Experience Affects Credibility
Supplemental Experience for eight (8) Elective IDP Hours

In this scenario, you graduated from architecture school a few months ago and were hired by a firm that is designing a building for construction in another state. This is the first project the firm has done in that state. The project architect is a competent person with many years of experience; he does not have much time for “schoolies,” as he refers to recent graduates. In your work on the construction drawings, you notice a design condition that does not violate the building code in your state but does violate an amendment to the code in the state where the building will be built. You are aware of this amendment because you went to school in that state and are familiar with the building code.

You bring this violation to the attention of the project architect. He shows interest until you tell him that you learned about this particular violation in school, at which point he dismisses it. If the drawings go out for bid and the violation is discovered during the review for a building permit, the resulting delay would cause additional costs to your firm. If a permit is issued and the violation is discovered during construction (which it surely would be), there would be more delays and more costs to your firm and to others.

Consider the following circumstances:

• Your office does not have a copy of the amendments to the code of the state in question. The amendments have been ordered but have not arrived.
• If you report the violation to a senior partner, you will offend the project architect, whose evaluation at the end of your trial period will affect your future in this office. The firm stresses using the chain of command to enhance the efficiency of its operations. Going over someone’s head is not looked upon with favor.
• If you persist with your objection to the project architect, you run the risk of annoying him. Your relationship with him is already shaky.
• Your failure to do anything beyond making your original observation to the project architect will likely result in delays in the project and additional costs that would otherwise be unnecessary. You could be faulted for failing to pursue the issue. The client is considering your firm for other projects; glitches in this project would not impress him.

Please reference the following source:
• AIA Code of Ethics and Professional Conduct

In a narrative, explain whether there are ethical considerations in this situation or it is simply a case of protecting yourself versus protecting the firm. If issues are involved that are addressed in the AIA Code of Ethics and Professional Conduct, what are they? What action you would take at this point and why. Explain how a redesign would affect the project.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
In this scenario, the bids are in for a high-end condominium project for which you have provided architectural services. The selected contractor identifies the landscape irrigation system supplier for the project—it is your sister-in-law’s firm. “Not such a big deal,” you think at first, as her company has over 15 years of experience in the field, but it is a large contract.

Please reference the following source:
- The Architect’s Handbook of Professional Practice, 14th ed. Chapter 12.4 - Bidding or Negotiation Phase

View and download the following sample document for reference:
- AIA 701™, Instructions to Bidders

Review the above source. Write a report to share with your firm principal that answers the following questions and explains your reasoning:
- Is there a potential conflict of interest?
- The appearance of a conflict of interest?
- Should you disclose your relationship to the subcontractor?
- Should you formally object to your sister-in-law’s firm as the supplier? Or is it better to say nothing?
- What legal, ethical, and practical issues should you address and how should you record them?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
In this scenario, you are working on the design of a new art museum for a long-time client and friend who is the executive director for the museum. The client has placed responsibility for the project team in your hands and made it clear the client will be guided by your judgment about what is best. The entire project team, including the cost estimator, reports to your firm, and all information from the team to the client goes through you.

The executive director is answerable to the board of directors. Some of the board members are particularly sensitive to issues that affect the community at large. They insist that they be kept current with any issues that may cause a controversy or generate headlines in the newspaper, good or bad. The executive director has asked you to keep her in the loop regarding any issues that may impact the community. She can then present them to the board and be able to address any controversy. The board will have full knowledge of the situation beforehand.

During schematic design you develop a concept for the building envelope that includes a dramatic roof form and extensive use of a curtain wall system. You recognize there are significant costs associated with these ideas, but you can stay within budget by shrinking the galleries to the program minimum, stripping the interior finishes and millwork (including storage), and minimizing landscaping and other parts of the budget.

You are aware these cuts will mean the completed museum will not be as good a space to present the art in the short term, but some members of the architecture team argue that most of the cuts can be added back over time. Moreover, you know the client will be very pleased if the project is published or wins design awards.

Does allocating a significant part of the project budget to creation of an attractive building envelope violate the professional code of ethics? Do you owe your client a clear discussion of the costs and benefits of each major design decision? As a professional, where do you draw the line between the best interests of the end user and creating a structure that will be an important architectural asset in the community? What other program options are available to you and your client at this stage of the design?

Please reference the following source:
- AIA Code of Ethics and Professional Conduct

Write a memo to the executive director of a minimum of 400 words, outlining the situation and include the following:
- The reasons for your approach to the design of the museum.
- If any design options are available that might better fit the program requirements of the board.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Exhibit 4A-1

Project Progress Report

Ayers/Saint/Gross Incorporated
For the period 12/1/02 - 12/31/02
Friday, January 03, 2003
8:27:30 AM

Description | Hours | Amount | JTD | Amount | Budget | Amount | % Exp | % Rpt | % Balances
---|---|---|---|---|---|---|---|---|---
2000.00 PARADIGM UNIVERSITY PHILOSOPHY BUILDING | 198.05 | 2,500.00 | 1.25 | 2,500.00 | 1.25 | 2,500.00 | 1.25 | 2,500.00 | 1.25

Labor | | | | | | | | |
3 SCHEMATIC DESIGN | 11.50 | 270.06 | 1.37 | 270.06 | 1.37 | 270.06 | 1.37 | 270.06 | 1.37
4 DESIGN DEVELOPMENT | 11.00 | 270.00 | 1.35 | 270.00 | 1.35 | 270.00 | 1.35 | 270.00 | 1.35
5 CONSTRUCT DOCUMENTATION | 3.00 | 75.00 | 0.38 | 75.00 | 0.38 | 75.00 | 0.38 | 75.00 | 0.38
6 BID/EQUIPMENT | 7.00 | 1,600.00 | 0.85 | 1,600.00 | 0.85 | 1,600.00 | 0.85 | 1,600.00 | 0.85
7 CONSTRUCT ADMIN | | | | | | | | |

Labor Total | 28.00 | 699.07 | 3.74 | 699.07 | 3.74 | 699.07 | 3.74 | 699.07 | 3.74

Overhead Allocation (Estimated) | 1,994.81 | 162,440.96 | 8.92 | 162,440.96 | 8.92 | 162,440.96 | 8.92 | 162,440.96 | 8.92
Total Labor and Overhead | 29.00 | 2,693.88 | 12.66 | 2,693.88 | 12.66 | 2,693.88 | 12.66 | 2,693.88 | 12.66

Direct Expenses | | | | | | | | |
612.10 LIGHTING CONSULTANT | 14.20 | 2,000.00 | 1.07 | 2,000.00 | 1.07 | 2,000.00 | 1.07 | 2,000.00 | 1.07
616.10 INTERIOR DESIGN | 2.00 | 500.00 | 0.27 | 500.00 | 0.27 | 500.00 | 0.27 | 500.00 | 0.27
652.10 TRAVEL/DD | 879.49 | 11,957.75 | 6.72 | 11,957.75 | 6.72 | 11,957.75 | 6.72 | 11,957.75 | 6.72
652.20 PHOTOGRAPHY | 14.07 | 195.00 | 0.12 | 195.00 | 0.12 | 195.00 | 0.12 | 195.00 | 0.12
652.30 FAX/COPY | 14.07 | 195.00 | 0.12 | 195.00 | 0.12 | 195.00 | 0.12 | 195.00 | 0.12
652.40 PHOTOCOPY | 14.07 | 195.00 | 0.12 | 195.00 | 0.12 | 195.00 | 0.12 | 195.00 | 0.12
652.50 PHOTOCOPY | 14.07 | 195.00 | 0.12 | 195.00 | 0.12 | 195.00 | 0.12 | 195.00 | 0.12
652.60 POSTAGE/DD | 10.82 | 152.00 | 0.09 | 152.00 | 0.09 | 152.00 | 0.09 | 152.00 | 0.09
652.70 REIMBURSEABLE | 70.00 | 1,000.00 | 0.62 | 1,000.00 | 0.62 | 1,000.00 | 0.62 | 1,000.00 | 0.62
652.90 REIMBURSEABLE | 70.00 | 1,000.00 | 0.62 | 1,000.00 | 0.62 | 1,000.00 | 0.62 | 1,000.00 | 0.62

Reimbursable Expenses | 915.00 | 14,400.38 | 8.75 | 14,400.38 | 8.75 | 14,400.38 | 8.75 | 14,400.38 | 8.75

Project Totals | 29.00 | 2,929.11 | 16.23 | 2,929.11 | 16.23 | 2,929.11 | 16.23 | 2,929.11 | 16.23

Exhibit 4A-2

Weekly Tracking Chart

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
<th>L</th>
<th>M</th>
<th>N</th>
<th>O</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 PHASE</td>
<td>6 Date</td>
<td>7 DWG NO</td>
<td>8 TITLE</td>
<td>9 RESP</td>
<td>10 BUDD HRS</td>
<td>11 CUR HRS</td>
<td>12 % COMP</td>
<td>13 10</td>
<td>14 20</td>
<td>15 30</td>
<td>16 40</td>
<td>17 50</td>
<td>18 60</td>
<td>19 70</td>
<td>20 80</td>
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<tr>
<td>9</td>
<td>30.01 Floor Plans</td>
<td>FLW</td>
<td>80</td>
<td>40</td>
<td>50%</td>
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</tr>
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<td>31.01 Building Elevations</td>
<td>ES</td>
<td>60</td>
<td>40</td>
<td>67%</td>
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<td></td>
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</tr>
<tr>
<td>13</td>
<td>32.01 Building Sections</td>
<td>AA</td>
<td>40</td>
<td>10</td>
<td>25%</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>15</td>
<td>33.01 Wall Sections and Details</td>
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<td>80</td>
<td>20</td>
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<tr>
<td>17</td>
<td>34.01 Stair Plans and Details</td>
<td>EOM</td>
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<td>20</td>
<td>25%</td>
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<tr>
<td>19</td>
<td>35.01 Schedules</td>
<td>AF</td>
<td>40</td>
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<tr>
<td>21</td>
<td>36.01 Large Scale Plans and Elevations</td>
<td>GIG</td>
<td>80</td>
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<td>13%</td>
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<td></td>
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<td>23</td>
<td>Specifications</td>
<td>SMH</td>
<td>200</td>
<td>20</td>
<td>10%</td>
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<td></td>
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<tr>
<td>25</td>
<td>Administration</td>
<td>MLL</td>
<td>140</td>
<td>40</td>
<td>28%</td>
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<td>27</td>
<td>Quality Control Reviews</td>
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Back to Narrative
### Compensation by Position in the Firm

<table>
<thead>
<tr>
<th>Position</th>
<th>Mean</th>
<th>1st Q.</th>
<th>Median</th>
<th>3rd Q.</th>
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<tbody>
<tr>
<td>Associate</td>
<td>$71,900</td>
<td>$60,000</td>
<td>$69,000</td>
<td>$80,000</td>
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<tr>
<td>Manager</td>
<td>63,300</td>
<td>53,100</td>
<td>60,200</td>
<td>70,000</td>
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<tr>
<td>Architect III</td>
<td>54,700</td>
<td>46,800</td>
<td>53,800</td>
<td>61,000</td>
</tr>
<tr>
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<td>48,100</td>
<td>42,000</td>
<td>47,000</td>
<td>54,300</td>
</tr>
<tr>
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<td>41,100</td>
<td>36,000</td>
<td>40,000</td>
<td>45,000</td>
</tr>
<tr>
<td>Intern III</td>
<td>40,700</td>
<td>36,000</td>
<td>40,000</td>
<td>45,000</td>
</tr>
<tr>
<td>Intern II</td>
<td>33,500</td>
<td>30,000</td>
<td>33,000</td>
<td>36,700</td>
</tr>
<tr>
<td>Intern I</td>
<td>22,300</td>
<td>25,000</td>
<td>20,000</td>
<td>31,300</td>
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<tr>
<td>Engineer</td>
<td>58,700</td>
<td>53,000</td>
<td>57,700</td>
<td>65,000</td>
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<tr>
<td>Planner</td>
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<td>43,100</td>
<td>52,000</td>
<td>65,000</td>
</tr>
<tr>
<td>Landscape Architect</td>
<td>45,300</td>
<td>37,700</td>
<td>44,000</td>
<td>51,000</td>
</tr>
<tr>
<td>Interior Designer</td>
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<td>36,000</td>
<td>44,400</td>
<td>50,000</td>
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<tr>
<td>Construction Administrator</td>
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<td>50,000</td>
<td>60,000</td>
</tr>
<tr>
<td>CAD Manager</td>
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<td>35,000</td>
<td>41,000</td>
<td>50,000</td>
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<tr>
<td>Drafter</td>
<td>32,600</td>
<td>28,000</td>
<td>32,000</td>
<td>37,500</td>
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<td>60,000</td>
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<tr>
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<td>Office Manager</td>
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<td>35,000</td>
<td>44,000</td>
</tr>
<tr>
<td>Administrative Assistant</td>
<td>29,700</td>
<td>25,200</td>
<td>30,000</td>
<td>33,400</td>
</tr>
</tbody>
</table>

*First quartile. One fourth of salaries fall under this figure.

*Third quartile. Three-fourths of salaries fall under this figure, one-fourth above it.

The data in these tables provide three views of architects' compensation from the 1999 AIA compensation survey. The compensation figures include salaries, bonuses, and profit sharing.

These data represent a cross section response from 1,770 AIA member-owned architecture firms. The results are reported in Compensation at U.S. Architecture Firms: 1999 AIA Report. The purpose of the report is to provide information to AIA members and architecture firm management on prevailing salary scales within the profession. It is the policy of The American Institute of Architects that members are to make all decisions on matters of compensation and fees on an individual basis or within their own firms.

### Average Compensation by Position and Firm Size

<table>
<thead>
<tr>
<th>Position</th>
<th>5-9</th>
<th>10-19</th>
<th>20-49</th>
<th>50+</th>
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<tr>
<td>Associate</td>
<td>$56,900</td>
<td>$63,300</td>
<td>$69,300</td>
<td>$80,000</td>
</tr>
<tr>
<td>Manager</td>
<td>54,900</td>
<td>66,500</td>
<td>61,600</td>
<td>68,500</td>
</tr>
<tr>
<td>Architect III</td>
<td>49,100</td>
<td>53,500</td>
<td>51,300</td>
<td>58,700</td>
</tr>
<tr>
<td>Architect II</td>
<td>42,400</td>
<td>44,700</td>
<td>45,800</td>
<td>50,600</td>
</tr>
<tr>
<td>Architect I</td>
<td>37,600</td>
<td>39,900</td>
<td>40,000</td>
<td>42,300</td>
</tr>
<tr>
<td>Intern III</td>
<td>37,100</td>
<td>39,400</td>
<td>41,100</td>
<td>42,200</td>
</tr>
<tr>
<td>Intern II</td>
<td>31,100</td>
<td>32,800</td>
<td>33,700</td>
<td>34,700</td>
</tr>
<tr>
<td>Intern I</td>
<td>26,800</td>
<td>27,400</td>
<td>28,400</td>
<td>29,100</td>
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</table>

### Average Compensation by Position and Region

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<th>Position</th>
<th>New England</th>
<th>Atlantic</th>
<th>Central</th>
<th>South</th>
<th>West North</th>
<th>Central</th>
<th>Central</th>
<th>Central</th>
<th>South</th>
<th>South</th>
<th>South</th>
<th>Pacific North</th>
<th>Pacific South</th>
<th>Pacific West</th>
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<td>$75,700</td>
<td>$11,400</td>
<td>$71,800</td>
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<td>$68,400</td>
<td>$69,800</td>
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<td>$59,800</td>
<td>$76,400</td>
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<td></td>
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<tr>
<td>Manager</td>
<td>62,800</td>
<td>63,400</td>
<td>66,100</td>
<td>64,900</td>
<td>62,900</td>
<td>59,000</td>
<td>64,100</td>
<td>54,400</td>
<td>54,400</td>
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</tr>
<tr>
<td>Architect III</td>
<td>55,700</td>
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<td>58,800</td>
<td>52,900</td>
<td>52,300</td>
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<td>46,100</td>
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<td>39,300</td>
<td>40,100</td>
<td>41,100</td>
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<td>39,400</td>
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<td>41,000</td>
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</table>
### Exhibit 4A-4

<table>
<thead>
<tr>
<th>Salary Cost (Use AIA Information)</th>
<th>Salary Cost (28% of salary)</th>
<th>Operation Cost for Rent, Supplies, Etc.</th>
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</thead>
<tbody>
<tr>
<td>Partner / Owner</td>
<td>Health Insurance</td>
<td>Professional Liability Ins. (3.5%)</td>
</tr>
<tr>
<td>Senior Staff</td>
<td>Life Insurance</td>
<td>Office Rent ($22 per sf / year)</td>
</tr>
<tr>
<td>Staff</td>
<td>Dental Insurance</td>
<td>Utilities ($5 per sf/year)</td>
</tr>
<tr>
<td>IS Staff</td>
<td>Vision Insurance</td>
<td>Computer Hardware - ea workstation $650 /yr</td>
</tr>
<tr>
<td>Receptionist</td>
<td>Prescription Plan</td>
<td>Computer main eqpt. - $200 per workstation</td>
</tr>
<tr>
<td>Administrative Staff</td>
<td>Disability Insurance</td>
<td>Computer Software - $900 each workstation /yr</td>
</tr>
<tr>
<td>Accounting Staff</td>
<td>Vacation</td>
<td>Drafting Supplies - $80 / person</td>
</tr>
<tr>
<td>Support Staff</td>
<td>Holidays</td>
<td>Plotter ($8000 ea) and Printers ($1200 ea)</td>
</tr>
<tr>
<td>Maintenance Staff</td>
<td>Sick Leave</td>
<td>Office Furniture - $2500 each, $600 /year</td>
</tr>
<tr>
<td>Marketing Staff time</td>
<td>Personal Leave</td>
<td>Office Supplies - paper, etc $250 per emp./year</td>
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<tr>
<td></td>
<td>401K</td>
<td>Phone System - $10000 annual cost</td>
</tr>
<tr>
<td></td>
<td>Education / Exam</td>
<td>Internet - monthly $200</td>
</tr>
<tr>
<td></td>
<td>Other Leave – jury, etc.</td>
<td>Marketing Cost - travel, supplies (5%)</td>
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<tr>
<td>FICA, etc.</td>
<td>Accounting &amp; Tax Preparation Cost (2%)</td>
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</tr>
<tr>
<td></td>
<td>Professional Registration Fees for each state:</td>
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</tr>
<tr>
<td></td>
<td>Estimate at $100 per person/state</td>
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<tr>
<td></td>
<td>Professional Society Fees (AIA, CSI, etc.):</td>
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</tr>
<tr>
<td></td>
<td>Estimate at $450 per person registered</td>
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</tr>
<tr>
<td></td>
<td>Estimate at $250 per person non-registered</td>
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</tr>
<tr>
<td></td>
<td>Training cost – computer, etc.:</td>
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</tr>
<tr>
<td></td>
<td>Estimate $150 per person</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CEU training cost - $150 per person</td>
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</tr>
<tr>
<td></td>
<td>Office functions – holiday party, etc.:</td>
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</tr>
<tr>
<td></td>
<td>Estimate at $75 per person per event</td>
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<tr>
<td></td>
<td>Professional Meetings (AIA, CSI):</td>
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<tr>
<td></td>
<td>Estimate $20 per person per event</td>
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<tr>
<td></td>
<td>Professional Society Functions, etc.:</td>
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</tr>
<tr>
<td></td>
<td>Estimate at $150 per person per event</td>
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</tr>
<tr>
<td></td>
<td>Bonus (optional if profit exists)</td>
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<tr>
<td></td>
<td>Taxes (on profit) assume 35%*</td>
<td></td>
</tr>
</tbody>
</table>

*Assume taxes will be paid on total income remaining after all salaries, benefit, and operating expenses are deducted. If a bonus is paid from the profits, it will reduce the profits upon which taxes must be paid.
## Current Employees

<table>
<thead>
<tr>
<th>Name</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>De Shaun</td>
<td>Intern I</td>
</tr>
<tr>
<td>Jennifer</td>
<td>Intern I</td>
</tr>
<tr>
<td>Jay</td>
<td>Intern II</td>
</tr>
<tr>
<td>Louis</td>
<td>Intern III</td>
</tr>
<tr>
<td>Juan</td>
<td>CAD Drafter</td>
</tr>
<tr>
<td>Julius</td>
<td>CAD Drafter</td>
</tr>
<tr>
<td>TC</td>
<td>Architect I</td>
</tr>
<tr>
<td>Charles</td>
<td>Architect II</td>
</tr>
<tr>
<td>Victoria</td>
<td>Architect III</td>
</tr>
<tr>
<td>Jayne</td>
<td>Project Manager</td>
</tr>
<tr>
<td>Trey</td>
<td>Project Manager</td>
</tr>
<tr>
<td>Emily</td>
<td>Associate</td>
</tr>
<tr>
<td>Laura</td>
<td>Associate</td>
</tr>
<tr>
<td>Mies</td>
<td>Principal</td>
</tr>
<tr>
<td>IM</td>
<td>Principal</td>
</tr>
</tbody>
</table>

## Current Projects

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Current Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Longshoreman’s Bank</td>
<td>Construction Administration</td>
</tr>
<tr>
<td>French National Fry Factory</td>
<td>Construction Administration</td>
</tr>
<tr>
<td>Nicholson County Office Building</td>
<td>Bidding</td>
</tr>
<tr>
<td>Gulf War Veteran’s Memorial</td>
<td>Construction Documents</td>
</tr>
<tr>
<td>State Road Maintenance Storage Building</td>
<td>Construction Documents</td>
</tr>
<tr>
<td>Bauhaus University Student Union</td>
<td>Construction Documents</td>
</tr>
<tr>
<td>Gramps Retirement Community</td>
<td>Construction Documents</td>
</tr>
<tr>
<td>St. Georges Catholic Church</td>
<td>Design Development</td>
</tr>
<tr>
<td>Vacation Inn Motel</td>
<td>Design Development</td>
</tr>
<tr>
<td>Edward’s Residence</td>
<td>Schematic Design</td>
</tr>
<tr>
<td>St. Alice’s Medical Center</td>
<td>Programming</td>
</tr>
</tbody>
</table>

Back to “Human Resources/Staff Planning”
### Exhibit 4A-6

**Candidate’s Current Compensation Package**

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salary</td>
<td>$45,000</td>
</tr>
<tr>
<td>Health Insurance (paid by firm)</td>
<td>$2,500</td>
</tr>
<tr>
<td>Paid Time Off</td>
<td>15 days/year</td>
</tr>
<tr>
<td>Christmas Bonus (at discretion of firm)</td>
<td>$2,000</td>
</tr>
<tr>
<td>Life Insurance (paid by firm)</td>
<td>$500</td>
</tr>
<tr>
<td>401K plan (match up to $1,000)</td>
<td>$1,000</td>
</tr>
<tr>
<td>Dental Plan (paid by firm)</td>
<td>$750</td>
</tr>
<tr>
<td><strong>Total Annual Value</strong></td>
<td>$51,750 + Paid Time Off</td>
</tr>
<tr>
<td><strong>Candidate A</strong></td>
<td><strong>Candidate B</strong></td>
</tr>
<tr>
<td>----------------</td>
<td>----------------</td>
</tr>
<tr>
<td>She arrives on time, appropriately dressed, and appears to be expecting a baby.</td>
<td>She arrives 15 minutes early, appropriately dressed, and rather nervous.</td>
</tr>
<tr>
<td>You ask her about her experience, and from her answers and work examples it is obvious she has a level of skill that is acceptable.</td>
<td>You ask her about her experience, and from her answers and work examples it is obvious you would prefer a little more architectural office experience. Her portfolio shows moderately creative ideas and excellent drawing ability to express her concepts.</td>
</tr>
<tr>
<td>You ask her about career goals and she says she would like to pass her registration exam and continue working. She would like to have her own small firm at some point. She is comfortable during the interview and is not nervous when discussing her experience and goals.</td>
<td>She takes time to explain how she worked as a clerk for a contractor when she graduated from college. She handled the shop drawing process, coordinated the subcontractor’s submissions by checking them against the architect’s drawings and specifications. You are pleased with the experience she describes and her answers indicate she has a good understanding for the shop drawing phase of architecture and construction.</td>
</tr>
<tr>
<td>You explain the position and the need for someone to start working with the firm soon and to be available to share the workload in the office.</td>
<td>You ask her about her career goals and she says she would like to pass her registration exam and continue working as she considers architecture her career. The initial nervousness has given way to a conversational and respectful discussion.</td>
</tr>
<tr>
<td>She says she doesn’t see any problem and that her experience has provided her with the skills necessary to perform the job. She is planning on taking sections of the registration exam during the next six months.</td>
<td>You explain the position and the need for someone to start working with the firm soon and to be available to share the workload in the office.</td>
</tr>
<tr>
<td>She asks about vacation accrual and time off to take the registration exam.</td>
<td>She says she doesn’t see any problem in fulfilling the needs of the position, and her work experience has provided her with understanding of the skills necessary to perform the job.</td>
</tr>
<tr>
<td>You explain vacation accrual and the firm provides 24 hours per year for registration exam. Anything else is on the employee’s time.</td>
<td>She says she is getting married in four months. She realizes the work load of the firm, but her date is set and she will need one week off for the wedding and honeymoon. She offers to put in extra time before the wedding to share the load.</td>
</tr>
<tr>
<td>You thank her and let her know you will contact her with a decision after the other interviews are completed and after you contact her references.</td>
<td>You explain you will take that into consideration in making your decision.</td>
</tr>
<tr>
<td></td>
<td>You explain the company benefits package to her and ask if she has any questions.</td>
</tr>
<tr>
<td></td>
<td>You thank her and let her know you will contact her with a decision after the other interviews are completed, and after you contact her references.</td>
</tr>
</tbody>
</table>
Leadership & Service

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- Non-Profit Housing Corporations 515
- Teaching “Architecture in Schools” 516
- Sustainability of a Historic Structure 517
- Ethical Standards for a Public Official 518

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* A maximum of 40 hours of core credit may be earned in this experience area.

exhibits
Leadership & Service

Introduction

This chapter contains expanded opportunities for professional development related to the field of architecture. It addresses the ever-shifting nature of practice, the diverse abilities and roles of architects and, most important, the potential for interns to assume leadership. This chapter is also characterized by the freedom to choose how you as an individual can make contributions in the world as an emerging architecture professional. The following information is taken from the NCARB IDP Guidelines:

Leadership And Service
Minimum Leadership and Service Experience: 80 Hours
(Maximum Allowed: 320 hours)
Definition: These tasks will increase your understanding of the people and forces that shape society, as well as augment your professional knowledge and leadership skills. Interns will find that voluntary participation in professional and community activities enhances their professional development. Community service does not have to be limited to architecture-related activities for you to receive these benefits.

Tasks
At the completion of your internship, you should be able to:

- Develop leadership skills to enable successful practice
- Identify and articulate leadership traits required to maintain a successful and healthy office environment in an architecture firm
- Contribute your talents in a community-based organization to improve the quality of life

Knowledge Of/Skill In

- Community leadership/civic involvement
- Creativity and vision
- Entrepreneurship
- Ethics and integrity
- Interpersonal skills (e.g., listening, diplomacy, responsiveness)
- Managing quality through best practices
- Mentoring – teaching others
- Personal time management
- Service to the profession (e.g., AIA, NCARB)
- Supervising
- Team building, leadership, participation

resources

Download the current Intern Development Program (IDP) guidelines at www.ncarb.org/Experience-Through-Internships.aspx.


Leadership and service opportunities allow you to contribute your talents responsibly to community-based organizations with the goal of helping to improve the quality of life in the community. Some opportunities will be design oriented, some not. This is a beginning, not an exhaustive list, to initiate thoughts and ignite your passion that will make service worthwhile to you and the community you serve.

Leadership and service are vital components of the architect’s education in the near term and for lifelong development. What is not easily understood by the practitioner are the mutually beneficial aspects of community service that do not tie to project procurement, but those that increase ones skills at leadership, collaboration, networking and mediation. These skills enhance one’s abilities to effectively practice architecture, lead a firm and be seen as a credible leader on professional and community matters. These skills may well help you to generate more business, by your visibility as a catalyst for new projects. Service length can vary from a day to months, to several years. Helping others can be extremely gratifying.

As you do service work remember that in most states the title “Architect” is protected and reserved for those licensed to practice. Be certain to check with your state’s Registration Board before going out in the community and calling yourself an architect or even an intern architect. The Board should have a term that is used in your state to designate those with degrees in architecture who have yet to pass the licensure examination.

Understanding the Term “Professional”
The term professional may not have been a part of your architecture school education, or you may have received a partial picture. Classes in “professional practice” tend to focus on business management or even more narrowly on contracts and legal concerns. It is of vital importance that you understand the rights and responsibilities of an architect. Our society has loosely used the term professional. While a professional athlete may be distinguished from an amateur by the money they receive by playing their sport, there are fundamental criteria for defining professionals. As stated by Wasserman, et al., in *Ethics and the Practice of Architecture*, to be a professional all of the following criteria must be met:

- University level education in a special area of knowledge that is central to the profession being discussed
- Internship and supervised entry level performance in order to master application of that knowledge in practice
- Knowledge and practices that require the unique exercise of learned judgment for each new situation (rather than applied technical knowledge)
- Establishment of disciplinary identity and uniqueness of the professional group through the establishment of professional organizations, journals, systems of education, and standards for licensing
- Autonomy, earned by the profession and recognized and granted by society through state licensing,
Leadership & Service

in defining and mastering the knowledge and practice of the profession, resulting in self-policing with regard to the standards of practice and ethical conduct having the knowledge and expertise necessary for the well-being of persons in Society.

By this definition, the number of professions is reduced to a handful. Contemporary standards list law, medicine, architecture and engineering as professions. Traditionally university professors, ministers and members of the military have been included in this tightly defined group.

In the Carnegie Foundation’s Boyer and Mitgang report, *Building Community: A New Future for Architecture Education and Practice*, says that beyond this definition lie the two cornerstones of professional standing—the duty to provide public service and to merit trustworthiness. These are based on three conditions:

- The complexity of the knowledge and expertise that professionals hold
- The complex practices that are requisite for research and knowledge application
- The expectation of provision by the profession of necessary services and access to them by society and individuals who do not hold that knowledge

**Code of Ethics**

The NCARB Core Values pertain to the protection of life safety and public welfare and the architect is legally bound by the individual state licensing laws. For example, in Minnesota they include:

- Personal conduct
- Conflict of interest
- Improper solicitation of employment
- False or malicious statements
- Knowledge of improper conduct of others
- Action by another jurisdiction
- Employment on the basis of merit
- Misconduct
- Registration
- Responsible charge and direct supervision

Within these categories are laws concerning moral turpitude, plan and document stamping, gifts from contractors, receiving compensation from multiple parties on one project, and regulations concerning a firm’s practice of landscape engineering, engineering, or the like without having a licensed partner or employee in the field.

The AIA, *Code of Ethics and Professional Conduct* also concerns life safety and public welfare and professional interactions between architects and colleagues but it goes on to discuss broad issues such as seeking aesthetic excellence and respecting the environment. The Code was first written in 1909 and went through several revisions. In the early 1980s it was suspended following a Supreme Court Ruling, a revised Code was issued in 1986. The very first version forbade design build, paid advertising and entering in design competitions not based on the AIA principles.

**resources**


Trustworthiness is often tested in the area of service. Not only must you be diligent in meeting commitments, be it appearing on time and well prepared, but you must also avoid any fiduciary conflicts, real or perceived. Your ethical behavior is at the root of your trustworthiness and it needs to be upheld in every one of your actions.

The NCARB Rules of Conduct might be of value on your reading list. While they do not directly apply to service to the profession or the community, they do lay out rules that will apply to your professional life as soon as you become registered. Some states have adopted these Rules as “Model Law” and use them “as is” other states have added or incorporated them into their own regulations and statutes. Check your state’s code of ethics or code of conduct.

With that background, professional service takes on an entirely new meaning. The professional should exhibit the benefits of architecture at its highest and best.

In professional service you will be volunteering in situations where you promote or enhance the profession. You may be working with others who are interested in the field, working toward their licensure, or those who are already architects. In this type of service you might be covering some of the same broad areas as in public service, but there will always be an architectural aspect.

Even though you may not be a member, AIA is an invaluable resource to guide your professional behavior. As stated in the AIA Code of Ethics and Professional Conduct in Canon II, Obligations to the Public, “Members should be involved in civic activities as citizens and professionals, and should strive to improve public appreciation and understanding of architecture and the functions and responsibilities of architects.”

Below are listed some types professional and community services available to you in most regions. These are categorized as mentoring, education, politics, civic organizations, affiliations with allied fields, and continuing education. Professional service activities are first, community service opportunities follow.

**Professional Service**

**Mentoring**
Mentoring involves individuals willing to help others to reach their full potential through teaching, coaching and nurturing. The AIA Code of Ethics encourages members to “nurture their fellow professionals as they progress through all stages of their career, beginning with professional education in the academy, progressing through internship, and continuing throughout their career.” (Canon V).

Mentoring was practiced most often in the tradition of apprenticeship, now best illustrated by the medical profession’s internship and residency requirements. There are two positions, the mentor who guides, teaches and encourages the protégé who benefits from this interest and care.

**Apprenticeship**
Mr. Demele’s grandfather was an “indentured apprentice” to an Architect in late 19th century England. While today’s interns may object to the regimen of the IDP requirements these pale when contrasted to indenture.
The formal letter of indenture can be paraphrased as follows: (the then seventeen year old) of his own free will and with the consent of these parents is placed and bound as apprentice to...for four years...shall faithfully and diligently serve...and willingly obey the lawful directives...said apprentice shall not nor will at any time...absent himself from the employment of...nor will waste, misspend injure or destroy any of the monies, goods, books, papers, writings, or other properties or effects of the said...and that (apprentice) shall and will during the said term demean, conduct and behave himself as a honest, diligent and faithful apprentice...and that (parents) shall and will...provide the said apprentice with all apparel proper for one in his station and with good and sufficient meat, drink, washing and lodging and in case of his illness shall and will from time to time pay and discharge all bills and expenses attending such illness in anywise...and in consideration for such service the said...doth hereby covenant that he shall and will...according to the best of skill and knowledge teach and instruct the said apprentice in the profession of an Architect and Surveyor.

Mr. Demele’s grandfather traveled to Canada in 1911 and immigrated to the United States in 1913. He went on to work with Burnham in Chicago as an engineer on the famous Park and Boulevard system and then as a Planning Consultant for the Golden Gate Bridge in San Francisco. Later work brought him to Minneapolis and St. Paul, Minnesota. He eventually settled in San Francisco, where he was known for his skills as a planner.

Unlike in the 19th and early 20th centuries where a career in one office was the norm, in today’s job market it is more common to have multiple jobs over the course of one’s career. The more static career allowed for the tradition of having a senior mentor who stayed above the protégé until the senior professional retired. During the tenure of the relationship more junior members would find a mentor who might still be a protégé themselves. Today, multiple job situations are common and a new mentor is usually sought at each new work environment.

The result is the same, knowledge and experience is passed from one generation to the next. In today’s ever changing technological world there is a real chance that the mentoring will actually flow in two directions, down from the mentor and up from the protégé. The term for this “up and down” exchange of information is called ladder mentoring. This creates a virtual chain of mentors and protégés with multiple levels of experience. This is one example in which the mentor and protégé benefit from the experience. Other benefits include the improvement of communication and leadership skills, as well as a satisfaction from the experience that provides energy and enthusiasm to both participants.

Peer Mentoring
The structuring of the mentoring may be formal or casual, often dictated by the situation in which the relationship is established. A new “learning group” model has appeared in response to the dearth of mentors. In these relationships a single mentor works with a group of three to five protégés. Optimum success with these groups has been achieved where the mentor becomes a partner in the learning as opposed to a teacher. This situation also allows the protégés to begin a peer network.
Peer mentoring is another type of mentoring where you might:
• Work with others not yet at your experience level. (Students, other interns, etc.)
• Help those that practiced architecture abroad to acquaint them with U.S. practices.
• Organize around a common goal in a study or networking group. Studying for the Architect Registration Examination (ARE®), preparing IDP credits, or simply meeting on a regular basis to discuss current topics in architecture.

Education
Utilizing your architecture education outside the profession is also an good way to reinforce your skills, and help the general public learn what an architect does. Architect, much like professional, has been used more broadly than its true definition. Whether in the computer field, where it is used to describe the process of developing a new software or as a designation for one who develops a plan for diplomacy, education or legislation, misuse of the title is common.

The educational system appreciates the benefits of introducing the younger generation to architecture. In elementary schools it is used to teach basic principles of map reading, observation, interpretation and sketching as well as basic math skills. At the middle school level there are more complex lessons to be learned. Architecture involves a combination of disciplines sought by teachers striving to instruct students through integrated learning. The teaching of history, cultures, math, science, and communication are all brought together at this level. Within high schools more advanced lessons, as well as the linkage with college career counseling is appreciated.

There are also many books in the marketplace that will help you develop your own curriculum. A few titles to whet your appetite are Beginning with the simple What it Feels Like to Be a Building, How Things Were Built, Incredible Cross Sections, Round buildings, Square Buildings and Buildings that Wiggle Like a Fish, Old House, New House, and The Visual Dictionary of Buildings. Typing in the name of any one of these into Amazon.com will yield an extensive list of other titles available.

Volunteer to teach at any level about the profession’s impact on the environment, historic preservation, history of building or art/architectural history. This might happen in a school or art center venue. You might participate in Shadow an Architect Days where students follow you through the workday.

Professional Organizations/Boards Requiring Architectural Positions
There are a number of professional organizations as well as Boards with positions for Architects. (Remember, you are not an architect yet but these boards also have associate and public member positions.)

• Local AIA or AIAS chapter: Running for leadership in these organizations will give you a look at future positions in politics as well as giving you a perspective of how and why your professional organization serves it members and society.

• National AIA or AIAS: This takes the above responsibilities to the national level, with its added scope.
Leadership & Service

- **Chapter Committees**: Your local AIA Chapter is the source of a wide variety of committees, such as Building Codes, Design, the Environment, Government Affairs, Historic Resources, Housing Advocacy, Public Awareness, residential Architecture, and Small Firm Practice. There will also be groups covering their magazine, e-magazine, and convention as well as IDP, Professional Development, Emerging Professionals and Membership.

- **State Registration Board**: Typically these positions require years of licensure but almost all offer spots to public members. Learning about the working of your local board will bring understanding of licensure, and an opportunity to influence.

- **State Designer Selection Board**: Some states use this format to award state financed projects over a minimum dollar value. These boards are typically compromised of engineers, public members and architects. This would be a “public member” position for the architecture school graduate. It offers a valuable insight to firms, their presentation techniques (both written and verbal), as well as the number of projects in your state.

Boards often require a great deal of time; especially in years called “Bonding Years” when the legislatures pass bills and bonds funding state projects. Typically a Request for Proposals (RFPs) is released and firms submit in a prescribed format. One project, depending upon the economy and other projects available, each project may attract twenty-five to thirty-five proposals. Each must be read carefully in preparation for the short listing meeting, which usually entails a vote or series of votes to reduce the list to three to five. These firms are notified and requested to submit a presentation to the Board. These presentations are usually limited to a strict duration with a question period to follow. In heavily bonded years there may be as many as fifty buildings funded. Take the time to attend these meetings and carefully and thoughtfully make your decisions as a board member.

You will be exposed to a variety of building types and many of your state’s best firms, small and large. There are often out of state specialty consultants involved as well. Be prepared, however, for the occasional unhappy presenter that you may run into socially; often they are not reticent about expressing their opinion about your decision.

Make contacts to influence and advise local zoning boards, planning committees, fine arts review board or similar community based organizations.

**Civic Organizations**

Take the profession to your community in a wider setting. In addition to the activities listed below, consider writing a column for a community newspaper or website emphasizing architecture’s impact or soliciting comments on recent buildings or development projects. When considering others works, be thoughtful and fair.

**resources**

AIA Component programs vary. Locate a component near you: www.aia.org/about/structure/ components/AIAS078541.

Learn more about the Heritage Documentation Programs the National Parks Services administers, such as HABS (Historic American Buildings Survey), HAER (Historic American Engineering Record), and HALS (Historic American Landscapes Survey): www.nps.gov/history/hdp/

The American Institute of Architects, Institute Guidelines to Assist AIA Members, Firms, and Components in Undertaking Pro Bono Service Activities.
Leadership & Service

• **Planning Commission:** Positions are most often appointments. Serving provides an excellent way to share your design acumen. Depending upon your town or city’s governance the commission may have full authority or serve as a recommending body to the council or administrator.

• **Design Review Board:** Appearing more frequently as suburbs deal with increasing development, both commercial and residential. This position is well served by your talents and level of experience.

• **Historic Preservation Group or Association:** Are growing in stature as they act beyond preservation of individual buildings to neighborhoods, parks and the landscape. They potentially take part in the Sustainability Initiative by the National Trust for Historic Preservation as well as defend the character of community. The Sustainability Initiative emphasizes the importance of adaptive reuse as an essential part of sustainability. NTHPS President Roger Moe asked the question of recycling tin cans, newspapers and glass bottles when we throw away entire buildings.

Your ability to record buildings is an asset to these groups. With additional study and help from architects you might also be asked to assess and offer renovation advice on important buildings, neighborhoods or landscapes.

• **Pro Bono Work:** Ethics is a cornerstone of practice and service to your profession. These two merge the undertaking of pro bono work. Remember that pro bono work must be distinguished from “performing free services.” In pro bono work you expect nothing in return for your services rendered. Implicit in “free services” is the expectation that you are performing them in anticipation of a future commission. This is an important distinction. “Free services” occur where work for an organization is done to promote your firm; examples include free sketches of solutions or programming work. “Free services” may be unethical or illegal in your state.

You may require the assistance of an architect to complete this work (also performed Pro Bono). There is great satisfaction in helping a crisis nursery, senior daycare or other group facility improve their facility. Included in this work might be work after disasters or other emergencies.

• **Civic Improvement Groups:** Taking on projects to emphasize community, like place-making. This might be as simple as designing or building park benches, creating a living arch into a park, planters or decorating unsightly gas or electric utilities. Topiary can celebrate the local importance of a geological feature or species. Consider developing a farmer’s market or sidewalk art show. See Al Zelinka and Susan Jackson Harden’s, *Placemaking on a Budget: Improving Small Towns, Neighborhoods and Downtowns Without Spending a Lot of Money*, for inspiration.

• **The Environment:** Another charge to the profession is included in the AIA Code of Ethics is Canon VI, Obligations to the Environment. Opportunities include advocacy for the design, construction, and operation of sustainable buildings and communities, as well as the use of sustainable practices within your firm. Use any of the public forums mentioned above.

notes
Affiliations
These are opportunities to work with other fields, learning about them or contributing your combined talents to the community through a professional organization. Such associations might be landscape architects, interior designers, engineers or other design professionals. Activities may include teaching a course in the interdependence of the fields, participating on juries, or regularly contributing to newsletters or websites.

Here is your chance to develop your strengths as well as satisfy your curiosity about topics of interest. It is a good idea to stretch beyond architecture and learn about allied fields as well as areas of general interest. Once you have mastered a new topic, share your knowledge with others.

Community Service
Community service can be more complex than professional service. Communities have a range of needs. From infants to the elderly, animals to forests, and ice caps to the tropics, our world is in need. Service can be as simple as creating a group to provide meals to seniors, maintaining boulevard trees, or giving lectures to community groups on ways to green their environment. There are more complex ways to meet these needs that extend to governing a city or town, or bringing health organizations to rural area.

Needs exist: some are professional others provide basic volunteer power. Emphasis should be given to your commitment to service. Being absent or not finding a substitute may have an enormous impact on those expecting you. Matters which seem insignificant to you can be of great import to those who are less fortunate. Remember that their time is valuable too.

Mentoring
In the Community Service setting your role as mentor will have the same structure and definition as in Professional Service but you will be mentoring protégés who may be from a completely different educational or cultural setting. You will also draw upon a wider set of capabilities and skills.

Here are areas you might consider:
- Helping students, young or old, with academic subjects. This may occur either within a school or within a wider community context. Tutors in math, science, and English as a Second Language (ESL) are in high demand.
- Aiding immigrants in their adaptation to life in this country, as well as their efforts to learn the language. These activities would cover such basic skills as shopping, learning the medical system, and seeking housing.
- Assisting seniors in programs of music or even Wii programs for exercise.

Education
Your willingness and ability to commit and prove trustworthy is emphasized in this activity. In addition you should practice standing up before others and making your points in an articulate and engaging manner. While participating in this activity...
in juries at school may seem like preparation enough, you should remember that in those situations you were addressing peers. In most situations you will be speaking to those who are not well versed in the vocabulary of design. Practice before you present to your class. Becoming a comprehensible, articulate and concise presenter is essential to a career in architecture.

In this instance, you will be providing educational experiences that draw upon skills from your architectural education such as sketching or computer skills. An Art Center or Community Education program would be a place to lend your skills.

Politics
Your personal and professional ethics meet their highest and most frequent tests in the area of politics and/or governance. At no point should there be perception of impropriety. Your firm may have to pass up projects that they might have otherwise sought if you are in a position to influence the selection of the firms. While abstention is common during voting, it is best if you also abstain from any discussion of the project as well. Less obvious issues of ethics might include decisions, roadways or projects that might add value to property or otherwise benefit a current client.

The AIA Code of Ethics and Professional Conduct is a good source for guidance Canon II, Obligations to the Public, Rule 2.103 is clear, “Members serving in a public capacity shall not accept payments or gifts which are intended to influence their judgment “.

• City Council/Selectmen: These positions are important and should be taken with seriousness of purpose, preferably by those who bring more than one talent or interest to the table. Your presence will be valuable to most communities as they rarely have anyone with a design background serving. Development projects are often the most important items appearing on the agenda.

• Mayor: Mayoral positions are a higher goal in community politics and one that demands a significant amount of time. It is rare that less experienced people are elected, but this is happening more and more. Seek experienced counsel before running for political office.

Civic Organizations
This is the broadest category in Community Service. Habitat for Humanity, the YM(W)CA, Boy and Girl Scouts, and other such well know groups are the tip of the iceberg. There is a website (www.communityservice.org) that lists opportunities conveniently organized by distances in which you are willing to donate your time. Broad categories include human rights, the environment, conservation and wildlife as well as peace, firearms, drunk driving and drug abuse. Donate Blood, run in a race for cancer cure, write grant proposals for the arts board, staff the shop at the children’s museum, rake leaves or paint the house of a senior, clean up a neighborhood eyesore…the list is endless.

A few groups to consider are listed on the following page:
Leadership & Service

- **Park Board:** Park Boards see to the construction and maintenance of parks, playgrounds and hiking and biking trails. This is a good spot for the playful and nature loving personality.

- **Emergency Preparedness Organizations:** Hurricanes, floods, tornadoes, fires, etc., call for an organized group to prepare for them. This may involve your talents as an organizer of people or goods. You may even be asked to do some preparatory design work on temporary shelters or other structures should disaster strike.

- **Volunteer Fire Department:** Another under-staffed segment of our society. You might also take a course in EMT or the operation of a cardiac defibrillator.

Also look to these areas to contribute:
- Become a research associate
- Develop your skills as a graphic recorder or facilitator, with or without a computer
- Gain the skills to practice architectural photography
- Explore housing prototypes for the indigent, storm victims or sustainable living in remote locations
- Shadow a leader in another profession
- Sit on a jury for allied professions
- Develop a new software product or application
- Start a gallery specializing in architecture or a local architecture foundation
- Design and present a program for an AIA convention or an AIA chapter/component meeting
- Write a book on an area of interest or one that was neglected in your education or within the community

Written by Gary E. Demele, AIA, NCARB and Maureen Steele Bellows, RA
Gary E. Demele and Maureen Steele Bellows are Minnesota architects with practices that include local community based design and completed projects nationwide. Their service to the profession includes “Architecture in the Schools”, State IDP Coordinator, local and national AIA committee work and Master Grader for the NCARB ARE exam. Community service includes sitting on the state licensing board, state designer selection board, local planning commission, providing professional pro-bono work to non-profit groups and over 20 years of mentoring emerging professionals.

resources

Learn more about AIA advocacy efforts at the local, state, and federal level:
www.aia.org/advocacy

Learn more about assisting on disaster response teams:
www.aia.org/disasterresponse


The AIA is always in need of volunteers at the local, state, and national level. Volunteering can provide opportunities to lead teams and manage projects, network with your peers, and improve the architectural profession as a whole. Learn more about volunteering with AIA at www.aia.org/volunteer.
notes

Take brief notes while reading the narrative and list key resources you used to complete the activities. Note discussion outcomes from meetings with your supervisor, mentor, or consultants. When finalizing the activity documentation (PDF), include your notes and the Emerging Professional’s Companion activity description.
Wii for Seniors

Supplemental Experience for eight (8) Core IDP Hours

In this scenario, a local Senior Citizens Council is developing a program to enhance the lives of local seniors, whether they are living in nursing homes, assisted living or private homes. They feel strongly that a physical activity component be included for those who are able, even if assistance is necessary. The Wii activity seems to be an ideal means to achieve this goal. The council has a modest budget of fifteen hundred ($1,500.00) dollars to execute the program.

You have heard the Nintendo Wii game system has been used in similar situations. The games are used as a means of providing physical exercise to engage those who are less able and increase the heart rate of the viewers. The gentle motion, balance and coordination are credited with strengthening bones, loosening joints and decreasing cellular aging in the brain. Most importantly, the games are considered an impetus to socialization. Bowling, golf and even doubles tennis are popular. There are even bowling leagues and tournaments in some retirement homes. Providing a means of active participation between the generations, much as board games have in the past. There are games that can be enjoyed by all three generations.

As an involved citizen you are intrigued and find the idea worthy of consideration by the Citizens’ Council. When you bring this to the council they have not heard of its use by seniors and they look puzzled. They ask for concrete evidence of successful use of the product. Internet searches arm you with successful examples and increase your interests. The assignment set by the Council appears easy until you acknowledge the reality of the budget. With the knowledge that the Wii system is not inexpensive and several would be required to accommodate the nursing homes, and three assisted living complexes as well as taking the game to individual homes, you begin to think about how to overcome this hurdle. In addition, scarcity of the hardware concerns you.

You realize it’s necessary to find an ally that will help. You know of a “Santa for Seniors” project in town; a holiday activity that helps seniors and you wonder if this will conflict with efforts to provide Wii units. Now you are convinced that physical activity is important for citizens and want to have this program in your town.

Activity - Core

What games would be appropriate in your program? How do you convince the Council this is a viable idea? Would there be a better group to train and/or oversee the seniors? Are there additional funding sources you could include?

Write a maximum 600 word proposal to the Senior Citizens’ Council advocating for the Wii program. Write a funding request (minimum 300 words) aimed at a local big box vendor asking for a donation of game hardware or software. Produce a list of volunteer groups that would be suitable to assist the seniors with the games.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Non-Profit Housing Corporation

Supplemental Experience for eight (8) Core IDP Hours

In this scenario, you decide to invest your time and carpentry skills constructing housing units for a not-for-profit community based housing corporation this summer. Before you donate time, you would like to learn more about non-profit housing organizations.

Many housing organizations operate similarly to for-profit businesses. Usually they have an Executive Director, a Board of Directors setting the direction, goals and vision, and paid staff responsible for running the daily operations. Most non-profits receive grants from private and public sources. The public sources may include money from local, county, state or federal government programs. Private foundations may also provide funding for the general operations, or special projects identified in the original grant request.

Due to the size and complexity of many housing projects a non-profit corporation must also secure a temporary construction loan from a bank (if the project is to be sold) or a long term mortgage (if the units are to be rented). These loans are similar to a loan on your home. They can be adjustable or fixed rate loans, with 15 or 30 year term mortgages.

Often a non-profit will initiate co-venture projects with government in low income neighborhoods with the intention of revitalization by providing new housing or infrastructure. A project may be replacing housing stock destroyed in a natural disaster. The project may be housing components of a larger for-profit, mixed-use venture. It may include retail, institutional or religious facilities. The corporation then sells units at below market rates to those eligible. If the project is rental property, low cost or subsidized rental units will be provided. Qualifications often include income, a minimum age, and/or disability.

Where does the money come from to finance such a venture? What other ways are housing projects financed? Are members of the non-profit paid for their efforts? Who hires the architect, contractors, attorneys and construction team for the project? How does one obtain a position with a non-profit organization like this?

Activity - Core

Research a local non-profit corporation, or select a national community group, such as Habitat for Humanity. Review the mission of the corporation and its philosophy. How is their leadership organized? Review available organizational charts online. How long have they been serving the community and what is the annual volume of housing projects?

Write a report (500 words maximum) documenting how the group is organized, how a typical project is financed and how many units they have built in the last ten years. Visit a project completed or under construction sponsored by the non-profit group.

Prepare a photo essay (minimum of 10 photos) showing project’s scope. Include available drawings such as floor plans and building elevations.

If possible, interview a prospective unit’s buyer or lessee. Interview non-profit members involved in the construction, and discuss any special features; sustainable materials, energy-saving or creative solutions to typical housing problems.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Teaching “Architecture in Schools”

Supplemental Experience for eight (8) Core IDP Hours

Teaching the basics of architecture or exploring design with elementary, middle or high school children is an excellent way to serve and reinforce your knowledge about architecture in a rewarding way. It also offers a low pressure environment to practice public speaking and leadership skills with groups of young people.

The American Architectural Foundation and AIA Components offer resources for teaching a program known as “Architecture in Schools”. These programs come from local initiatives and volunteers ready to make their community a better place. Each program must take into account the location and school age groups. Students will be using local environments as a laboratory to test their knowledge.

Architecture is rarely part of curriculum for most children. Topics vary; looking at street maps, learning about architectural history, or working with a design team building a model. Others lessons to consider:

- Examine or draw a map of the neighborhood and discuss street patterns, parks, pedestrian paths, zoning, and other restrictions.
- Learning about materials, measurements, scale and shapes.
- Take a field trip to learn about utilities, infrastructure, street furniture.
- Learn the vocabulary of building elements.
- Learn basic structural principles and engineering systems.
- Read plan, elevation and section views.
- Understand the concepts of environmental preservation and green building.
- Visit construction sites or an architecture office.
- Learn how architecture is responsive by engaging families of students to design a new home.

Consider your experiences learning about architecture. Reflect on the classes and studios that have taught the basics of design, theory, planning and construction techniques. What students learn will help them to become better citizens. What do these children know that can be applied to architecture and design? What skills are they lacking? What can you teach them? Why does a child’s sense of play inform their creativity and potential to be designers?

Activity - Core

Starting with local architecture foundations, search the internet for prominent architecture in schools programs. Review the program basics, noting differences based on age of students. Contact your local AIA Chapter about their programs.

Select one of the topics above—or a topic of your choice—and prepare a presentation to be delivered to a class. Decide on an age group and level. Present the topic in a single class period (35 to 55 minutes in length depending on the age of your students).

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Sustainability of a Historic Structure
Supplemental Experience for eight (8) Core IDP Hours

In this scenario, you are a member of the Massachusetts State Historical Society called upon to select one of the ten “most endangered” buildings listed to renovate and help direct the renovation. Because of your interest in sustainability, you wish to help the Historical Society’s visibility by turning the property into a “green building.”

Knowing that only 6% of the current nonresidential building stock has been considered worthy of “historic” designation, you want to demonstrate that there is a larger opportunity for preservation. You view the expansion of the designation into neighborhoods will achieve the goals of “The New Urbanism” and “Intelligent Urbanism” without destroying existing stock. For now, prove the greenest building is one that is already built, even if it is a hundred years old.

When receiving the Vincent Scully prize Roger Moe was adamant that historic preservation has a role to play in fighting climate change. Recall the National Historic Trust’s Sustainability Initiative. This initiative centers on revitalization of buildings and neighborhoods as the highest form of sustainability. The initiative states demolishing an old building, hauling its remains to a landfill, and constructing a new building is an enormous waste of energy and resources. This process of energy consumption, from the start of construction is called “embodied energy;” it’s wasted if the building is demolished. The process is started again with the construction of a replacement building.

Carl Enfante, AIA, of Quinn Evans Architects, called accumulated building stock “the elephant in the room” and noted that of the over 65 billion square feet of nonresidential building stock in the United States, four out of five existing buildings will be renovated over the next generation while two more are added. Many say the most “green” buildings we have today are those built before 1920 and those built after 2000. Older buildings often have thicker walls, natural ventilation, large windows allowing natural daylight to penetrate the structure, porches, vestibules, as well as landscaping that shades. Many of these buildings were sited to take advantage of natural breezes to help cooling. Many employed sophisticated methods of natural ventilation creating virtual “chimneys” of the entire building, with cool basement air brought up through the structure, taking advantage of transoms, cupolas and clerestory windows to move the air.

Many buildings are retrofitted to green status through variety of means. Some are fitted with new mechanical systems employing solar panels or photovoltaic panels, others by new windows and improving natural ventilation. Since the Historical Society is opposed to mounting panels on the building (and likely prevented from doing so while retaining the building’s historical designation) you must be creative. Solutions may lie in (say) geothermal heating and cooling systems, which require minimal electricity to operate. You may find other solutions.

Activity - Core

Visit the National Trust website and read President Roger Moe’s acceptance speech for the Graham Gund/Award. Select one of your state’s ten most endangered historic buildings and create a plan to recycle the historic building using the initiative as a guideline. Why is this historic building considered to be a good candidate for applying sustainable principles to renovate the building? Present your plan in a 500 word report.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Ethical Standards for a Public Official

Supplemental Experience for eight (8) Core IDP Hours

Architects that choose to become public officials find the constellation of ethical standards must be considered before entering the public arena. What professional ethic rules should apply?

For example, an licensed architect, a member of the AIA, a NCARB certificate holder, and a city council member. In addition to the obligations to the public, an architect must follow obligations of the professional rules of conduct. These situations can create ethical responses in conflict with other considerations. How do you sort through the issues?

In *Ethics and the Practice of Architecture* by Barry Wasserman, et al, Wasserman addresses the problem of competing ethics with a method to examine complex problems. Wasserman describes this condition as “The Architecture/Ethics Nexus”. It’s a theoretical and practical framework for critical examination of this nexus. The authors propose the “5 Lenses of Inquiry” or Framing Lens:

- Architecture’s Purposefulness and Social Benefit: the social purpose to improve life and support communal construction.
- Material Production: includes the use of resources, the understanding of material properties to support best resource use and design vision.
- Aesthetics: architecture’s relationship to art and beauty.
- Architecture’s Rhetoric and Ideologies: to consider the intentions of say, the Modern Movement of architecture or other historical periods when a new ideology emerges.
- Praxis; Ethics that Emerge in Architectural Practices: mastery of the discipline required in the everyday practice of architecture.

From these “Framing Lenses” we can begin to apply the Four Principal Ethical Theories to the problem at hand. Finally, we examine the problem using the 5 Steps in Ethical Reasoning: Definition, Assessment, Speculation, Deliberation, Resolution.

Guiding us through the process to achieve resolution to prepare an ethical path, the 5 Steps in Ethical Reasoning can inform future decisions. What standard is the public official held to by the local citizens? By the State Registration Board? By the AIA? By NCARB? What is the correct path when one set of ethics overlaps another? What are the consequences if this person is convicted of an illegal act outside of professional services? Can this person lose his/her license?

### Activity - Core

Please reference the following sources:
- AIA Code of Ethics and Professional Conduct
- Your state’s Professional Conduct standards for Architects
- NCARB Rules of Conduct

Create a spreadsheet matrix comparing the various ethical codes in *Wii for Seniors*, with Ethical Code Names on the rows and Ethical Topics as columns. Write a 400 word memorandum describing which conduct requirements are similar in the codes and which requirements are only mentioned in one code. Compare the professional ethical requirements with the standards expected from a public official such as a city council member. Apply the 5 Framing Lenses outlined above to *Teaching “Architecture in Schools”* and write a 200 word memo explaining changes to the examination completed in that activity.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Becoming a Mayor

Supplemental Experience for eight (8) Elective IDP Hours

A leader must be organized, have a vision and enjoy working with the public, community leaders, and municipal staff. A leader must also be a good strategic thinker and public speaker with the ability to articulate a vision for the city or local government. Gaining these skills and knowledge typically requires years in public service. During a tenure on public or city boards, a prospective candidate can learn the basics of civic government; how the city is run, important community problems, and how to build a successful network of financial and issues-based supporters. For an architect in a public role, some supporters may be current clients of the firm and others will become clients in the future.

Within the city government, a citizen may serve on a number of boards or commissions including the Parks and Recreation Board, Emergency Preparedness, Planning Commission, Historic Preservation Board, Design Review Board, or Special Task Forces initiated by City or Town Council. Most of the work of these boards requires a knowledge of planning, architecture and design that architects possess. All of these activities require a term commitment to your city or community. The role of mayor is particularly demanding. Unlike a planning commissioner or DRB member, the mayor is elected rather than appointed. This requires the ability and money to campaign successfully and have the personality that most people can relate to the position the candidate has taken on the issues. Once elected, the mayor is in demand by various interest groups and the public at large.

The demand on one’s time may overshadow personal and professional obligations. In addition to supporters, the mayor will also have voters, members of civic groups, like the Lion’s Club or Chamber of Commerce and others that will not support certain mayoral programs for political reasons. The mayor should be ready to approach opposition with a clear sense of purpose.

In this scenario, you have decided that a career goal is to become the mayor of your city or town. What is the process for becoming mayor? What is the role of the mayor and how does the mayor impact the public policy of the city? How many years can a mayor serve? What requirements are necessary for the position? What other public positions do candidates usually hold before running for mayor? Is it necessary to be a member of a political party?

Activity - Elective

Research the questions above relative to a position in your local city government. Draw an organizational chart or diagram showing the different civic boards in your city or town. Determine which boards, in what order would lead to becoming mayor. Determine the minimum number of years in public service before becoming mayor. A conversation with a sitting commissioner or board chair may help you answer these questions.

Based on your research, write a campaign letter of 400-500 words to the community members expressing your political ideas and your platform improving the city as Mayor.

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
Mentoring an Architecture Student
Supplemental Experience for eight (8) Elective IDP Hours

In this scenario, you are an architect. An accredited architecture program at a local public university invites you to become a mentor in their respected mentoring program. They are expecting you to help develop a student with an understanding of the requirements for licensure as an architect.

You are matched with an undergraduate architecture student currently in a pre-professional degree program. S/he has not made a commitment to graduate school yet or to becoming a licensed architect. Your protege is interested in the practice of architecture and designing buildings. Your realize s/he has potential and seems suited for a career in architecture.

At your first meeting, you perform the “Core Values Activity,” where you both select four (4) important core values from a list. Your protege has selected Security, Balanced Life, Quality and Design as her/his core values. Do these values suggest certain activities or goals that would be mutually satisfying? How do these core values relate to your chosen career path?

Your protege’s short term goal is to finish school and work for an architectural firm. S/he seems interested but is tired of going to school and suggests that after a few years working for an architect, s/he will decide whether he will return to graduate school and determine his real career goals. You find her/his choice of security not in keeping with his other values and inquire. After a more detailed conversation with your protege, you find out that the issue of money has turned her/him heavily towards this current career approach. S/he confides that her/his accrued student debt is $60,000 and that once s/he completes a M.Arch degree, student debt will be over $100,000. Your protege is clearly at a loss as to how to deal with this financial situation and gain some financial peace of mind.

Discuss your protege’s choice of “Balanced Life” as a Core Value. S/he is interested in architecture but has many other interests to pursue in life. S/he loves sports, music and for now, architecture is just another interest.

Activity - Elective

What is your role as Mentor? How much time is involved to make the mentorship a success? What do you tell your protege about the profession? How do you discuss their career goals? What is your response if asked about your salary and the prospective opportunities for an architectural graduate? If you are an AIA member, do ethical obligations include finding a job for this student?

Write a response (minimum 200 words) considering the questions above. List four Core Values and address how they may influence the relationship with your protege’s situation and aspirations. List at least ten appropriate learning experiences to share with your protege based on your combined Core Values. Consider the following activities: becoming acquainted, career conversations, career observations, resume/interview exercises, attending school or professional lectures or activities, networking with professionals, personal finances.

In a report of 200 words minimum, describe what is required by the AIA Code of Ethics in regards to mentoring. Explain your obligation to the professional development of your protege in light of her/his lack of professional goals. Do you advise your protege to go to graduate school? Get licensed?

Share your work with your IDP supervisor or mentor and make suggested changes. Document the final version as a PDF.
notes
Take brief notes while reading the narrative and list key resources you used to complete the activities. Note discussion outcomes from meetings with your supervisor, mentor, or consultants. When finalizing the activity documentation (PDF), include your notes and the Emerging Professional’s Companion activity description.
Suggested resources from the editors and authors.
1A - Programming


Rowe, Peter G. Design Thinking. MIT Press, 1991.

Additional References


National Academic & Licensing Study Aids, PASS the ARE: www.nalsa.com

National Council of Architectural Registration Boards (NCARB), ARE Guidelines: www.ncarb.org/ARE.aspx


**Additional References**

The American Institute of Architects, Committee on the Environment, Top Ten Green Projects: [www.aia.org/cote](http://www.aia.org/cote)

*Environmental Building News*: [www.buildinggreen.com](http://www.buildinggreen.com)

NCARB ARE Prep Materials, Site Planning & Design: [www.ncarb.org/ARE/Taking-the-ARE/ARE4-Divisions/Site-Planning.aspx](http://www.ncarb.org/ARE/Taking-the-ARE/ARE4-Divisions/Site-Planning.aspx)
1C - Project Cost & Feasibility


Additional References
Building Commissioning Association (BCXA): www.bcxa.org

Construction Industry Institute, Best Practices Series: www.construction-institute.org

Construction Management Association of America Publications: www.cmaanet.org/cmaa-bookstore-browse


**Additional References**


The American National Standards Institute: [http://web.ansi.org](http://web.ansi.org)

The American Society of Heating, Refrigerating and Air-Conditioning Engineers: [www.ashrae.org](http://www.ashrae.org)

ASTM International: [www.astm.org](http://www.astm.org)


National Fire Protection Association: [www.nfpa.org](http://www.nfpa.org)

National Institute of Standards and Technology, Building and Fire Research Laboratory: [www.bfrl.nist.gov](http://www.bfrl.nist.gov)

National Multi-Housing Council: [www.nmhc.org](http://www.nmhc.org)

Occupational Safety and Health Administration (OSHA): [www.osha.gov](http://www.osha.gov)

Underwriters Laboratories Inc. (UL): [www.ul.com](http://www.ul.com)

United States Access Board: [www.access-board.gov](http://www.access-board.gov)
2A - Schematic Design


**Additional References**
The American Institute of Architects: AIA Code of Ethics and Professional Conduct


2C - Construction Costs


Additional References


Resources

2D - Codes & Regulations


Additional References


The American National Standards Institute: http://web.ansi.org

The American Society of Heating, Refrigerating and Air-Conditioning Engineers: www.ashrae.org

ASTM International: www.astm.org

Department of Housing and Urban Development: http://portal.hud.gov/hudportal/HUD

National Fire Protection Association: www.nfpa.org

National Institute of Standards and Technology, Building and Fire Research Laboratory: www.bfrl.nist.gov

National Multi-Housing Council: www.nmhc.org

Occupational Safety and Health Administration (OSHA): www.osha.gov

Underwriters Laboratories Inc. (UL): www.ul.com

United States Access Board: www.access-board.gov
2E - Design Development


**Additional References**


National Council of Architectural Registration Boards. [Professional Development Monograph Series](https://www.ncarb.org/professional-development/)

U.S. National CAD Standard: [www.nationalcadstandard.org/ncs5](http://www.nationalcadstandard.org/ncs5)
2G - Material Selection & Specifications


Additional References

4specs: www.4specs.com


ASTM International: www.astm.org


Construction Specifications Institute (CSI): www.csinet.org

ICC Evaluation Service, Inc.: www.icc-es.org

MasterSpec®: www.masterspec.com


REED Construction Data, Smart Building Index: www.reedconstructiondata.com/smartbuildingindex

SpecText® Master Guide Specifications: www.spectext.com
3A - Bidding & Contract Negotiations


Additional References
Resources

3B - Construction Administration


Additional References


**Additional References**


3D - General Project Management


**Additional References**

The American Institute of Architects: *AIA Code of Ethics and Professional Conduct*


**Resources**

**4B - Leadership & Service**


