10 Planning & Zoning Regulations

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

exhibits

Planning & Zoning Regulations

1D

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.

The American Institute of Architects. Demkin, Joseph A., ed. *The Architect's Handbook of Professional Practice.* 14th ed. Hoboken: John Wiley & Sons, 2008.

- Chapter 15 - Building Codes and Regulations

The American Institute of Architects. Demkin, Joseph A., ed. *The Architect's Handbook of Professional Practice.* 13th ed. New York: John Wiley & Sons, 2001.

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

The American Institute of Architects, *The Architecture Student's Handbook of Professional Practice.* 14th ed. Hoboken: John Wiley & Sons, 2009.

- 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.*

Planning & Zoning Regulations

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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.

resources

AIA Code of Ethics and Professionals Conduct

- Canon I: General Obligations
- Canon III: Obligations to the Client

Download a copy of the NCARB *Ethics and Professional Rules of Conduct: Distinction and Clarification* at www.ncarb.org/Publications/Mini-Monographs/Ethics-and-Professional-Rules-of-Conduct.aspx.

Learn more about the International Building Code (IBC) and the International Code Council (ICC) via the following website: www.iccsafe.org

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

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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

resources

Steiner, Frederick R., Kent S. Butler, and the American Planning Association. *Planning and Urban Design Standards.* Hoboken, NJ: J. Wiley, 2007.

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.

resources

Building Codes Illustrated: A Guide to Understanding the 2012 International Building Code, 4th Edition. Francis D. K. Ching, Steven R. Winkel

Architect’s Handbook of Professional Practice, 14th Edition, topic 15.2, Building Codes and Standards

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.

notes

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:

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

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:

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

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

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Continued from page 100

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

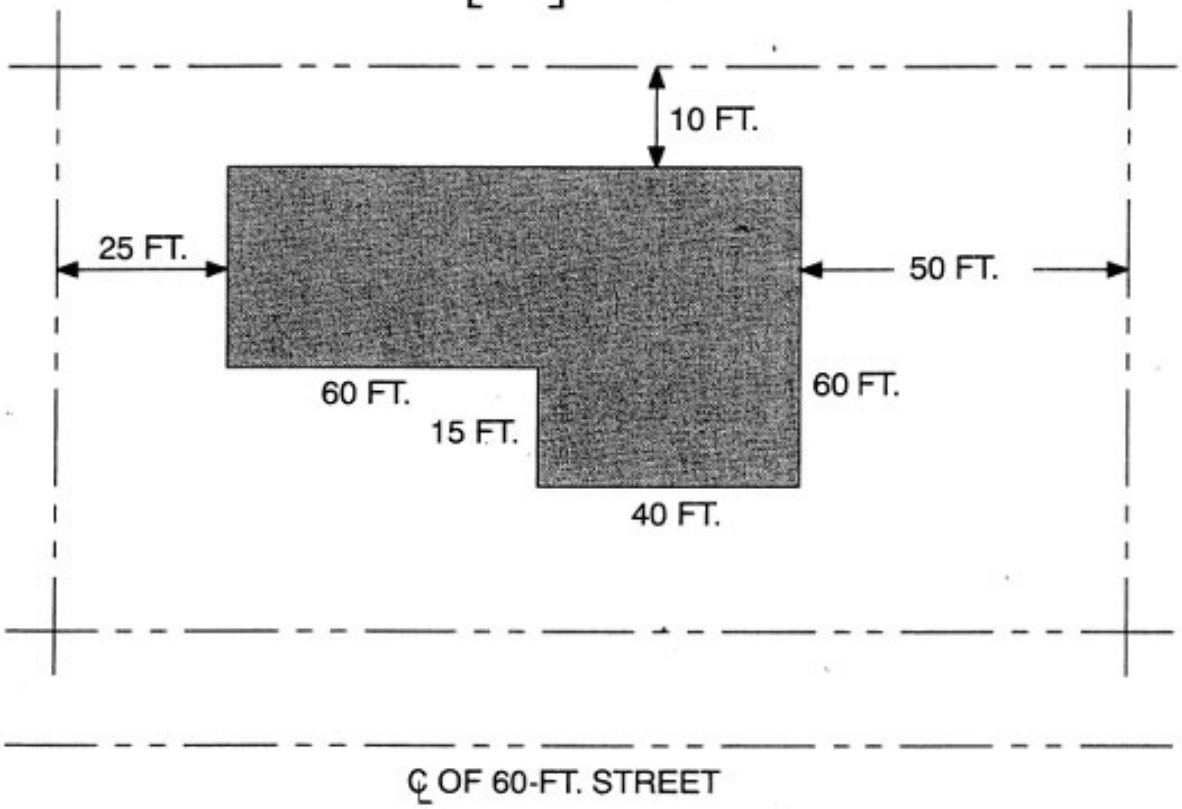
resources

Ching, Frank, and Steven R. Winkel. *Building Codes Illustrated: A Guide to Understanding the 2012 International Building Code.* Hoboken, NJ: John Wiley & Sons, 2012.

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 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.

1D

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.

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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

resources

To become a serious code user, invest in the following ICC publications:

- *2000 IBC Workbook: A Study Companion*
- *Architect's Guide to the 2000 IBC*

These books will provide practical learning assignments for independent study of the International Building Code. Some of the exercises provided with this chapter of the *Emerging Professional's Companion* have been extracted from these books (all with the permission of ICC).

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

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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.

Building Code Analysis Form

Item	Remarks
The Design Codes	2000 Edition International Building Code Edition International Plumbing Code Edition International Mechanical Code Edition International Fire Code Edition NFPA National Electric Code NFPA 13
Building Occupancy Classification	A-3 Library. Established by the Owner's Program. Refer to Section 302.1
Construction Type	Type I (Required, based upon Program S.F.) Refer to Table 503
Building Area	Unlimited (Based upon Construction Type) Refer to Table 503
Building Height	Unlimited (Based upon Construction Type) Refer to Table 503
Table 503 Analysis	Refer to Height & Area Sidebar
Fire Suppression System	Required by Section 903.2.1.3
Allowable Occupant Load	Refer to Section 1003.2.1 & Table 1003.2.2.2
Number of Exits Required	4 - Refer to Sections 1004.2 & 1005.2.1
Corridors Construction	Refer to Section 1004.3.2
Maximum Allowable Travel Distance	250 Feet, Refer to Table 1004.2.4
Exit Locations	Refer to Section 1004.3.2.2
Exit and Corridor Width	Refer to Section 1004.2.2.2

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.

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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.

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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.

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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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