Pete Fowler
CONSTRUCTION
Services, Inc.

Introduction to Building Codes and Standards

Introduction to Building Codes and Standards is for anyone who needs to understand how codes and standards affect the construction, maintenance and alteration of buildings. This presentation deals with how codes and standards have evolved through the ages to provide for the health, welfare, and safety of the general public and how they continue to evolve today. Case studies will bring the words-on-paper to life, and model the path of analysis required in code interpretation.

Design professionals should design in compliance with codes and standards. General contractors should build to conform to codes and standards. Building officials are entrusted to interpret and enforce codes and standards. Some deviations from codes and standards can place the general welfare of the public at risk and can expose the design professional and construction professional to legal liability. Others don't require such a strict reading. So there is a lot to talk about.

Codes and standards today are more accessible than ever, and can be used in an effective quality control program that begins at project design or definition, is reinforced in the contracting phase, and performance compared to standard can be verified during the course of construction.

Pete Fowler Construction Services, Inc. is a general contracting, construction management and expert construction services provider. We specialize in getting or keeping our clients out of unpleasant construction related situations as quickly and as inexpensively as possible. Our team of construction professionals uses our unique, proven systems to develop and deliver the most accurate and comprehensive solutions that best serve the interests of our clients.

Summary Outline

1. *Introduction to Building Codes and Standards (10 Minutes)*
2. *History of Codes & Standards (20 Minutes)*
3. *Building Code Referenced Standards (20 Minutes)*

BREAK (5 Minutes)

4. *Trade Standards & Manufacturers Installation Instructions (20 Minutes)*
5. *Managing Construction Quality (10 Minutes)*
6. *Risk Management (15 Minutes)*
7. *Conclusions (5 Minutes)*

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Agenda

1. Introduction to Building Codes & Standards
- A. Who We Are
- B. Why Do We Care?
- C. Who Are You
- D. Program Outline
- E. Learning Objectives
- F. Using Building Codes

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- B. History of Building Standards
- C. Compare and Contrast
- D. Case Study: Stairs

3. Building Code Referenced Standards
- A. It's A Long List
- B. Case Study: GA 600-06
- C. Case Study: NFPA 13
- D. Case Study: ASTM E110

4. Introduction to Standards
- A. Trade Associations
- B. Manufacturer's Installation Instructions
- C. Building Information Modeling
- D. Case Study: Window Flashing

5. Managing Construction Quality
- A. The Good Old Days and The New World
- B. DBSKCV Construction Management Method
- C. Project Definition: Standards & Codes
- D. Definitions
- E. Managing Construction Quality
- F. Independent Quality Review
- G. Case Study

6. Risk Management
- A. The ABC's of Risk Management
- B. Risk Management Matrix
- C. Contracts
- D. Insurance

7. Conclusion
- A. Deep Thoughts
- B. Program Outline
- C. Learning Objectives
- D. Back-Up Materials
- E. Case Study

Introduction to Building Codes and Standards

Pete Fowler Construction Services, Inc.
November 2013

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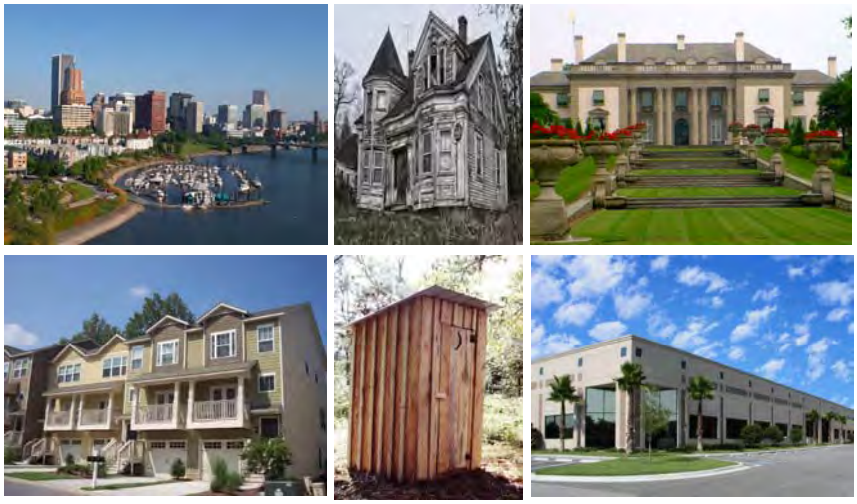
SOLUTIONS

Pete Fowler Construction Services (PFCS) specializes in creating REAL PRACTICAL SOLUTIONS for property owners & managers, builders & developers, construction contractors, product manufacturers & suppliers, lawyers and insurers.

PFCS: We Know Buildings



PFCS: We Know Buildings

CLIENTS

- Property Owners & Managers
- Builders & Developers
- Contractors
- Product Manufacturers
- Insurers
- Lawyers

PFCS: We Know Buildings

Building Life-Cycle Management

EVALUATION: We investigate building performance by inspecting, testing, interviewing and analyzing lots of documents and data.

SPECIFICATION: We consult with the Owners to maximize property value, specifying the right maintenance, repairs, and improvements.

QUALITY MANAGEMENT: Manage the scope, budget, schedule and contracts, and verify performance with quality control inspections.

Construction Claims & Litigation

EVALUATION: We investigate building problems by inspecting, testing, and analyzing lots of documents and data.

SPECIFICATION: We create real, practical solutions for how the problems should be fixed and how much they will cost.

ALLOCATION: We compare project performance to standards and our experience so we can explain what happened, what should have happened and who is responsible.

1. INTRODUCTION TO BUILDING CODES & STANDARDS

A. Who We Are: PFCS

Pete Fowler Construction Services, Inc. (PFCS)

Pete Fowler Construction Services, Inc. (PFCS) is a team of consultants with expertise in all phases of building construction including:

- Construction Claims
- Construction Defect
- Cost Estimating
- Construction Management
- Training & Education
- Expert Testimony

"We deliver solutions for building problems."

B. Why Do We Care?

C. Who You Are

D. Program Outline

1. Introduction to Building Codes & Standards
2. History of Building Codes & Standards
3. Building Code Referenced Standards
4. Trade Standards & Manufacturers Installation Instructions
5. Managing Construction Quality
6. Risk Management
7. Conclusion

E. Learning Objectives

1. Explain what codes and standards are and how they are used in the building industry.
2. Orient the participant to how critical codes and standards are to our modern economy.
3. Give the participant insight into how and why codes have evolved over time.
4. Conduct case studies on real buildings, referring to actual codes and standards in use today, analyzing how the applicable codes have evolved in the recent past, and discussing how decisions are made in practice.
5. Show the participants how to find applicable codes and standards.
6. Discuss where codes and standards are likely to go in the future.

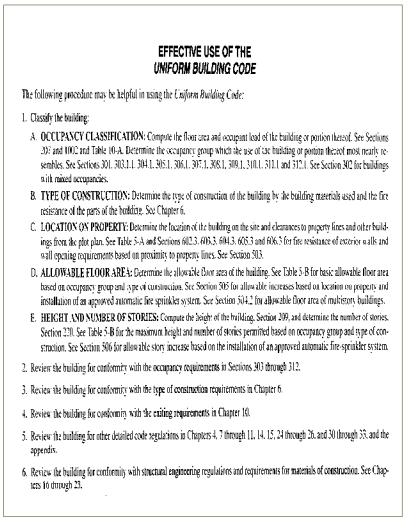
F. Using Building Codes

Codes set forth the requirements for the design and construction of buildings and influence how buildings are used and operated.

F. Using Building Codes

Effective Use Of The Uniform Building Code

The primary means of regulating and controlling design.



EFFECTIVE USE OF THE *UNIFORM BUILDING CODE*

The following procedure may be helpful in using the *Uniform Building Code*:

1. Classify the building.
   - A. **OCCUPANCY CLASSIFICATION:** Compute the floor area and occupant load of the building or portion thereof. See Sections 202 and 1002 and Table 10-A. Determine the occupancy group which the use of the building or portion thereof most nearly resembles. See Sections 301, 303.1.1, 304.1, 305.1, 306.1, 307.1, 308.1, 309.1, 310.1, 311.1 and 312.1. See Section 302 for buildings with mixed occupancies.
   - B. **TYPE OF CONSTRUCTION:** Determine the type of construction of the building by the building materials used and the fire resistance of the parts of the building. See Chapter 6.
   - C. **LOCATION ON PROPERTY:** Determine the location of the building on the site and clearances to property lines and other buildings from the plot plan. See Table 5-A and Sections 602.3, 603.3, 604.3, 605.3 and 606.3 for fire resistance of exterior walls and wall opening requirements based on proximity to property lines. See Section 503.
   - D. **ALLOWABLE FLOOR AREA:** Determine the allowable floor area of the building. See Table 5-B for basic allowable floor area based on occupancy group and type of construction. See Section 505 for allowable increases based on location on property and installation of an approved automatic fire sprinkler system. See Section 504.2 for allowable floor area of multistory buildings.
   - E. **HEIGHT AND NUMBER OF STORIES:** Compute the height of the building, Section 209, and determine the number of stories, Section 220. See Table 5-B for the maximum height and number of stories permitted based on occupancy group and type of construction. See Section 506 for allowable story increase based on the installation of an approved automatic fire-sprinkler system.
2. Review the building for conformity with the occupancy requirements in Sections 303 through 312.
3. Review the building for conformity with the type of construction requirements in Chapter 6.
4. Review the building for conformity with the exiting requirements in Chapter 10.
5. Review the building for other detailed code regulations in Chapters 4, 7 through 11, 14, 15, 24 through 26, and 30 through 33, and the appendix.
6. Review the building for conformity with structural engineering regulations and requirements for materials of construction. See Chapters 16 through 23.

F. Using Building Codes

1. INTRODUCTION

Effective Use Of The Uniform Building Code

Classify The Building:

- Occupancy Classification
  - A: Assembly
  - B: Offices
  - E: Educational
  - H: Hazardous
  - I: Nurseries, Health-care centers, Mental sanitariums
  - M: Merchandise
  - R: Hotels, apartments, dwellings
  - S: Low Hazardous, repair garages, open parking garages
  - U: Private garages, sheds, agricultural buildings

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F. Using Building Codes

Effective Use Of The Uniform Building Code

Classify The Building:
- Type of Construction
- Location on Property
- Allowable Floor Area
- Height and Number of Stories

1. INTRODUCTION

F. Using Building Codes

Effective Use Of The Uniform Building Code

Exiting Requirements
Structural Engineering / Materials of Construction

F. Using Building Codes

The purpose of codes is to provide the minimum standards to safeguard life and limb, health, property and public welfare.

F. Using Building Codes

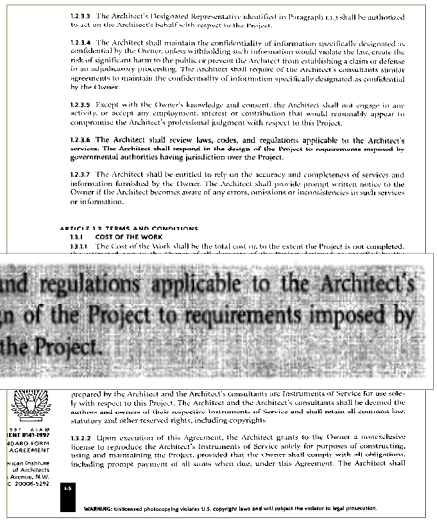
1. INTRODUCTION

Architects must respond in the design of the project to the requirements imposed by the code. General contractors must build to the code. Building officials are authorized and directed to enforce and interpret the code.

F. Using Building Codes

AIA Document: B141-1997

Standard form of agreement between owner and architect with standard form of architect's services



1.2.3.3 The Architect's Designated Representative identified in Paragraph 12.3 shall be authorized to act on the Architect's behalf with respect to the Project.

1.2.3.4 The Architect shall maintain the confidentiality of information specifically designated as confidential by the Owner, unless withholding such information would violate the law, create the risk of significant harm to the public or prevent the Architect from establishing a claim or defense in an adjudicatory proceeding. The Architect shall require of the Architect's consultants similar agreements to maintain the confidentiality of information specifically designated as confidential by the Owner.

1.2.3.5 Except with the Owner's knowledge and consent, the Architect shall not engage in any activity, or accept any employment, interest or contribution that would reasonably appear to compromise the Architect's professional judgment with respect to this Project.

1.2.3.6 The Architect shall review laws, codes, and regulations applicable to the Architect's services. The Architect shall respond in the design of the Project to requirements imposed by governmental authorities having jurisdiction over the Project.

1.2.3.7 The Architect shall be entitled to rely on the accuracy and completeness of services and information furnished by the Owner. The Architect shall provide prompt written notice to the Owner if the Architect becomes aware of any errors, omissions or inconsistencies in such services or information.

ARTICLE 1.3 TERMS AND CONDITIONS

1.3.1 COST OF THE WORK

1.3.1.1 The Cost of the Work shall be the total cost or, to the extent the Project is not completed,

1.2.3.6 The Architect shall review laws, codes, and regulations applicable to the Architect's services. The Architect shall respond in the design of the Project to requirements imposed by governmental authorities having jurisdiction over the Project.

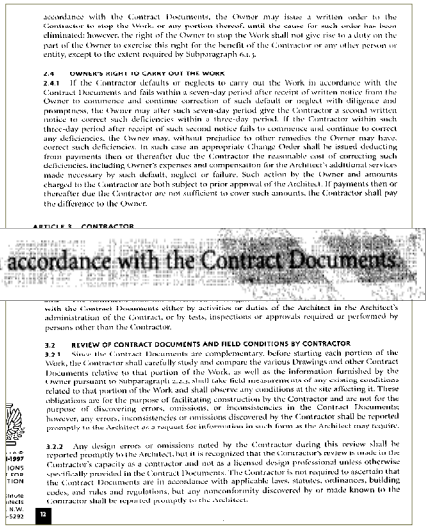
prepared by the Architect and the Architect's consultants are Instruments of Service for use solely with respect to this Project. The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service and shall retain all common law, statutory and other reserved rights, including copyrights.

1.3.2.2 Upon execution of this Agreement, the Architect grants to the Owner a nonexclusive license to reproduce the Architect's Instruments of Service solely for purposes of constructing, using and maintaining the Project, provided that the Owner shall comply with all obligations, including prompt payment of all sums when due, under this Agreement. The Architect shall

WARNING: Unlicensed photocopying violates U.S. copyright laws and will subject the violator to legal prosecution.

F. Using Building Codes

AIA Document: A201-1997
General conditions of the contract for construction



accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Subparagraph 6.1.3.

2.4 OWNER'S RIGHT TO CARRY OUT THE WORK

2.4.1 If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a seven-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may after such seven-day period give the Contractor a second written notice to correct such deficiencies within a three-day period. If the Contractor within such three-day period after receipt of such second notice fails to commence and continue to correct any deficiencies, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

ARTICLE 3 CONTRACTOR

3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons other than the Contractor.

3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

3.2.1 Since the Contract Documents are complementary, before starting each portion of the Work, the Contractor shall carefully study and compare the various Drawings and other Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Subparagraph 2.2.3, shall take field measurements of any existing conditions related to that portion of the Work and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, any errors, inconsistencies or omissions discovered by the Contractor shall be reported promptly to the Architect as a request for information in such form as the Architect may require.

3.2.2 Any design errors or omissions noted by the Contractor during this review shall be reported promptly to the Architect, but it is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional unless otherwise specifically provided in the Contract Documents. The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, building codes, and rules and regulations, but any nonconformity discovered by or made known to the Contractor shall be reported promptly to the Architect.

F. Using Building Codes

General Notes

Typical notes on plans referring to Uniform Building Code

GENERAL NOTES

NOTE:
THE GENERAL CONTRACTOR IS TO CONTACT THE DEPARTMENT OF BUILDING AND SAFETY, CITY OF LOS ANGELES, AND CERTIFY THAT THEY ARE NOW THE CONTRACTOR OF RECORD FOR THIS PROJECT. THEY SHALL PROVIDE THE DEPARTMENT OF BUILDING AND SAFETY WITH PROOF OF CURRENT WORKERS COMPENSATION INSURANCE AND SHALL ASSUME FULL RESPONSIBILITY FOR SUCH COVERAGE. THIS IS TO BE DONE BY THE GENERAL CONTRACTOR PRIOR TO THE START OF CONSTRUCTION.

NOTES:
1. THE GENERAL CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND CONDITIONS.

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NOTES:

1. THE GENERAL CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND CONDITIONS.
2. ALL WORKMANSHIP AND MATERIAL SHALL CONFORM TO THE UNIFORM BUILDING CODE, CURRENT EDITION.
3. ALL OMISSIONS AND/OR CONFLICTS BETWEEN THE VARIOUS ELEMENTS OF THE DRAWINGS AND/OR SPECIFICATIONS SHALL BE BROUGHT TO THE ATTENTION OF THE ARCHITECT BEFORE PROCEEDING WITH ANY WORK SO INVOLVED.
4. THE CONTRACTOR SHALL AT ALL TIMES KEEP THE PREMISES FREE FROM THE ACCUMULATION OF WASTE MATERIALS OR RUBBISH CAUSED BY HIS OPERATIONS.
5. CONTRACTOR IS NOT TO SCALE DRAWINGS.

F. Using Building Codes

City of Dana Point

Plan submittal with applicable codes

TENANT IMPROVEMENT PLAN REQUIREMENTS

I. Three complete sets of plans are required to be submitted and, when required by the State Business and Professions Code, shall be wet-stamped and signed by a California – Licensed architect or – registered engineer.
II. The following items shall appear on the first sheet of the drawings:
A. **Applicable codes:** 1997 Uniform Building, Plumbing and Mechanical Codes
1996 National Electrical Code
B. **Building code data:** Existing & proposed Group Occupancy(ies) and use(s)
Type(s) of construction, including fire sprinklers
Floor area per Occupancy Group/Type of Construction.
III. Plans shall consist of:
A. Plot Plan.
1. legal description or AP number
2. existing buildings
3. location of space

CITY OF DANA POINT

1 OF 1

Three complete sets of plans are required to be submitted and, when required by the State Business and Professions Code, shall be wet-stamped and signed by a California – Licensed architect or – registered engineer.
The following items shall appear on the first sheet of the drawings:

A. Applicable codes: 1997 Uniform Building, Plumbing and Mechanical Codes
1996 National Electrical Code

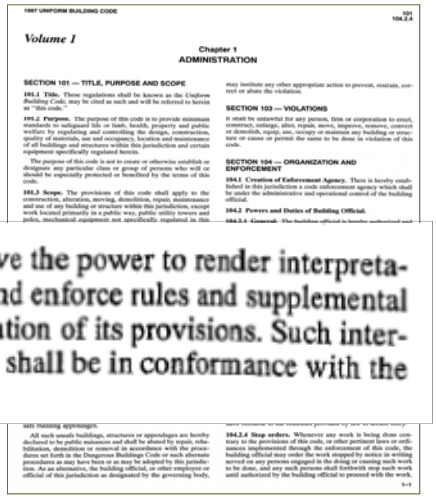
B. Building code data: Existing & proposed Group Occupancy(ies) and use(s)
Type(s) of construction, including fire sprinklers

Floor area per Occupancy Group/Type of Construction.

F. Using Building Codes

Chapter One: Administration
Section 104.2.1

Powers and duties of the building official



1997 UNIFORM BUILDING CODE 101 104.2.4

Volume 1

Chapter 1
ADMINISTRATION

SECTION 101 — TITLE, PURPOSE AND SCOPE

101.1 Title. These regulations shall be known as the Uniform Building Code, may be cited as such and will be referred to herein as "this code."

101.2 Purpose. The purpose of this code is to provide minimum standards to safeguard life or limb, health, property and public welfare by regulating and controlling the design, construction, quality of materials, use and occupancy, location and maintenance of all buildings and structures within this jurisdiction and certain equipment specifically regulated herein.

The purpose of this code is not to create or otherwise establish or designate any particular class or group of persons who will or should be especially protected or benefited by the terms of this code.

101.3 Scope. The provisions of this code shall apply to the construction, alteration, moving, demolition, repair, maintenance and use of any building or structure within this jurisdiction, except work located primarily in a public way, public utility towers and poles, mechanical equipment not specifically regulated in this

may institute any other appropriate action to prevent, restrain, correct or abate the violation.

SECTION 103 — VIOLATIONS

it shall be unlawful for any person, firm or corporation to erect, construct, enlarge, alter, repair, move, improve, remove, convert or demolish, equip, use, occupy or maintain any building or structure or cause or permit the same to be done in violation of this code.

SECTION 104 — ORGANIZATION AND ENFORCEMENT

104.1 Creation of Enforcement Agency. There is hereby established in this jurisdiction a code enforcement agency which shall be under the administrative and operational control of the building official.

104.2 Powers and Duties of Building Official.

104.2.4 Stop orders. Whenever any work is being done contrary to the provisions of this code, or other pertinent laws or ordinances implemented through the enforcement of this code, the building official may order the work stopped by notice in writing served on any persons engaged in the doing or causing such work to be done, and any such persons shall forthwith stop such work until authorized by the building official to proceed with the work.

The building official shall have the power to render interpretations of this code and to adopt and enforce rules and supplemental regulations to clarify the application of its provisions. Such interpretations, rules and regulations shall be in conformance with the intent and purpose of this code.

G. Case Study

Guard Rails

G. Case Study

Guard Rails

1. Multi-family complex in Oregon. Built in 1991.
2. A guest who was sitting on the guard rail of a 3rd floor private deck fell off.
3. The top of the guard rail is 36 ¼-inches above the deck.
4. The applicable building code is 1988.
5. The project is classified Group R, Division 1 (see back-up materials).
6. 1988 UBC Section 1711 calls for a 42-inch minimum height.

1. INTRODUCTION

G. Case Study

Guard Rails

7. 1988 UBC 1711. “Exceptions: 1. The top of guardrails for Group R, Division 3 and Group M, Division 1 Occupancies and interior guardrails within individual units and guest rooms of Group R, Division 1 Occupancies may be 36-inches in height.”
8. All private decks in the project have 36-inch guardrail height, suggesting the code official had accepted the condition.
9. Code Check with 1997 UBC / 2000 IRC referring explicitly to this language says “36-inches if only accessible from one unit.”
10. Current IBC / Oregon Structural exception applies only to locations “…whose top rail also serves as a handrail…”

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G. Case Study

Guard Rails: Code Check 2000 IRC / 1997 UBC

Guardrails

- ☐ Req'd for any walkoff >30in above floor or grade F52 [312.1] {509.1}
- ☐ Screened porches req guards if walkoff >30in .....[312.1] {509.1}
- ☐ {Min height 42in in multi-family} OR min height 36in if only accessible from one unit (34in if stair handrail) [312.1] {509.2X1}
- ☐ Max opening size <4in EXC .....F52 [312.2] {509.3}
- ☐ 6in opening OK at tread/riser/rail triangle .....[312.2X] {509.3X}
- ☐ Open risers on stairs must not allow 4in sphere to pass through .....[311.5.3.3] {509.3}
- ☐ Guardrail must be strong enough to resist 200 {50}pounds point load any direction .....[301.5] [1607.3.4]

Date:	January 29, 2008
To:	Mary Smith Underground Insurance PO BOX 55555, Portland, OR 95851-1108 T: (555) 852-5555 E: mary.smith@undergroundinsurance.com
From:	Pete Fowler Construction Services, Inc.
Project:	Bob's Properties – Nice Apartments PFCS # 07-373
Regarding:	Opinion Letter
Note:	Confidential Attorney-Client and Attorney Work Product. Protected under all applicable evidence codes.

Dear Ms. Smith:

As requested, PFCS performed a site inspection on January 9, 2008. At that time, we created diagrams and took photographs showing the current layout of the handrails. Our findings are set forth in this preliminary report.

Project Summary

The property in question is an apartment complex located at 12345 SE Main Road in Portland, Oregon. The Nice Apartments were constructed in 1991 and have a total of 200 units in 14 buildings, labeled A through N. The buildings are two- and three-stories in height. The walkways/staircases at the front elevation and private decks at the back elevation have guardrails composed of metal piping with horizontal intermediate members (See photos SM 01.009 and SM 01.014).

In May 2007, a woman was visiting Unit 29 in Building C and fell from the third level guardrail which she was sitting on. We were told the injured woman broke her pelvis but has since recovered. To this date, no lawsuit has been filed.

Observations

Upon arrival at the Nice Apartments, PFCS met with Bob Jones, the on-site manager. Bob directed us to the location of the accident, which was at the back deck of Unit 29.

Unit 29's deck is at the third level, is 10-feet by 6-feet, and positioned on the inside corner of the structure with a section of exterior wall approximately 27-inches wide on the east, outside corner (SM 01.028 & SM 01.029). There are two guardrails: the main rail at the back of the deck and a smaller side rail. The main guardrail is just over 9-feet long and the side guardrail is approximately 3-1/2-feet long. The horizontal railing members are 2-inch steel pipes and are welded to vertical support posts. Each support post is attached to the support beam below with two lag bolts through each welded plate

on the vertical posts. The main guardrail has three support posts and the side guardrail has two. The spacing between the horizontal guardrails is approximately 6-inches at the topmost space and approximately 5.5-inches in the remaining lower areas (SM 01.038).

In addition to the vertical support members, the side guardrail also has a single lag bolt attachment at the right end of the topmost horizontal member (SM 01.040). However, the main guardrail lacks any attachments at either end and is solely supported by the vertical posts (SM 01.043). The main guardrails at several units appeared to be leaning away from the buildings, though Unit 29's appeared to be aligned properly (SM 01.056).

The top of guardrails are approximately 36-1/4-inches above the deck surface. The deck surface is concrete with wood framing and is 18-feet from the ground. This would put the top of the guardrail at approximately 21-feet from the sidewalk below (SM 01.050).

Research

The 1988 Uniform Building Code (UBC), which likely prevailed when this project was constructed, requires a minimum height of 42-inches for guardrails. The 1988 UBC designates apartment buildings to be classified as Group R, Division 1. The code includes an exception allowing some guardrails to be only 36-inches in height. The wording is somewhat open to interpretation. Section 1711 Exception 1 reads "The top of guardrails for Group R, Division 3 and Group M, Division 1 Occupancies and interior guardrails within individual units and guest rooms of Group R, Division 1 Occupancies may be 36-inches in height." Excerpts from the 1988 UBC are attached. Since all the guardrails at these private decks have a uniform 36-inch height, is appears the building official considered the 36-inch requirement applied to these private decks. In addition, we have in our office third-party commentary (Code Check) related to this section that states "36-inch if only accessible from one unit." The 1997 UBC had the same language as 1988. The current prevailing code does not have this exception.

While the current codes require a maximum of 4-inches of space between each intermediate member, the 1988 UBC only required a 6-inch maximum, which these guardrails meet. Additionally, the 1988 UBC only requires a lateral load capacity of 20-pounds, whereas later code editions require a 200-pound lateral force capacity.

Conclusion

Although the guardrail height requirement is open to interpretation, we believe the guardrails met the code requirements as interpreted by the building official at the time of construction. Assuming no major renovations have been performed on the building, it is not necessary for the guardrails to meet current code requirements.

A separate issue unrelated to code requirements is the lack of lateral support at either end of the main guardrail. While this is not a code violation, we did observe leaning guardrails at various units. The leaning could be prevented by an attachment similar to that found at the top of the side guardrail.

Photographs

local.live.com – Aerial Image (Building C is outlined in red)

SM 01.056 Unit #29; Back elevation; Looking east, typical building.

SM 01.038 Unit #49; Back elevation; Deck. Main guardrail fastened to beam with large lag bolts.

SM 01.043 Unit #49; Back elevation; Deck railing. Side guardrail at left, main guardrail at right. Note attachment to wall at right side of left guardrail.

2. HISTORY OF BUILDING CODES & STANDARDS

"Man is the measure of all things"
-The Greek Philosopher, Protagoras

A. History of Building Codes

Egyptian Cubits
The "Royal Egyptian Cubit" was decreed to be equal to the length of the forearm from the bent elbow to the tip of the extended middle finger plus the width of the palm of the hand of the Pharaoh or King ruling at that time.
It varied between 17-21 inches.

A. History of Building Codes

Diamonds, Carats and Carob Seeds - Carob seeds were used as weights on precision scales because of their reputation for having a uniform weight. In past centuries, different countries each had their own carat unit, all roughly equivalent to the mass of a carob seed.

Saxon Yard - In England, the Saxon yard supposedly was based on the girth of a man, but King Henry I found the measure so variable that he decreed a yard would henceforth equal the length of his own arm.

Roman Mile - The unit of distance *mille passus* (literally "a thousand paces" in Latin, with one pace being equal to two steps) was first used by the Romans and denoted a distance of 1,000 paces or 5,000 Roman feet, and corresponded to about 1,480 meters, or 1,618 modern yards.

A. History of Building Codes

Ancient Code Of Hammurabi, Circa 1780 BC

A. History of Building Codes

Ancient Code Of Hammurabi, Circa 1780 BC

If a builder builds a house for someone and does not construct it properly, and the house which he built falls in and kills its owner, then that builder shall be put to death.

If it ruins goods, he shall make compensation for all that has been ruined, and inasmuch as he did not construct properly this house which he built and it fell, he shall re-erect the house from his own means.

If anyone bring an accusation of any crime before the Elders, and does not prove what he has charged, …he shall be put to death.

A. History of Building Codes

The Magna Carta, Circa 1215

"One measure for ale, one measure for wine, one measure for corn"

A. History of Building Codes

(Photograph: Some rights reserved by Hugh Llewelyn)

2. HISTORY OF CODES & STANDARDS

A. History of Building Codes

In their time Medieval cathedrals were some of the largest and costliest construction projects. Construction time was lengthy and evolutionary.

Principle construction of the Notre Dame was 87 years, other portions were 200 years.

Development of architectural and construction style was governed principally by trial and error and was often catastrophic and fatal.

A. History of Building Codes

Great Fire of London,1666

A. History of Building Codes

Impact Of The Fire

After the fire destroyed 13,000 houses, 89 churches and the original Saint Paul's Cathedral, six commissioners were appointed to redesign the city.

The city sets the most comprehensive town planning legislation ever seen in England.

Over 100 streets and lanes were widened, creating fire-breaks. Gradients were diminished and streets were added. Timber buildings were banned and the majority of new buildings were to be of red brick or white stone.

The fire also prompted the creation of the world's first fire brigade. Incidentally, after a London fire in 1212, King John decreed that thatch could not longer be used as a roofing material in the city.

A. History of Building Codes

Weights & Measures in the United States

The history of the United States as a nation may be considered to have begun with the Declaration of Independence in **1776**. The legislative history of our nation began with the ratification of The Articles of Confederation. From the beginning, the federal government recognized the problem of uniform weights and measures standards. The Continental Congress specified in the Articles of Confederation (article 9, paragraph 4) that one of its powers would be "fixing the standards of weights and measures throughout the United States." When the Constitution became effective in **1789**, the Congress was given powers in weights and measures (Section 8, Article 1) stating:
"The Congress shall have the power ... To regulate Commerce ... among the several States, ... To ... fix the Standard of Weights and Measures."
(Quoted from: http://www.azdwm.gov/)

A. History of Building Codes

1789: The Constitution charged congress with fixing standard weights and measures.

1790: President Washington urges Congress to act in his first annual address: ""Uniformity in currency, weights and measures of the United States, is an object of great importance, and will, I am persuaded, be duly attend to."

A. History of Building Codes

1819

Congress orders a study under the direction of Secretary of State John Quincy Adams who produces a report on the subject in 1821.

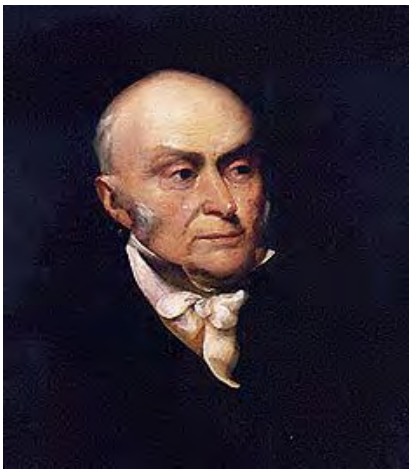
1856

In 1834 only a third of the states are using a standardized measurement of length. The remaining States do not adopt the standard until 1856.

A. History of Building Codes

"Weights & Measures may be ranked among the necessaries of life to every individual of human society."

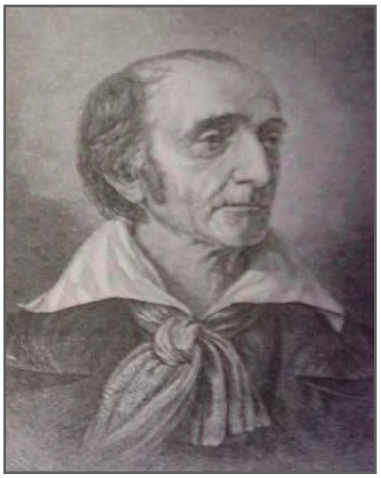
- John Quincy Adams, 1821



2. HISTORY OF CODES & STANDARDS

A. History of Building Codes

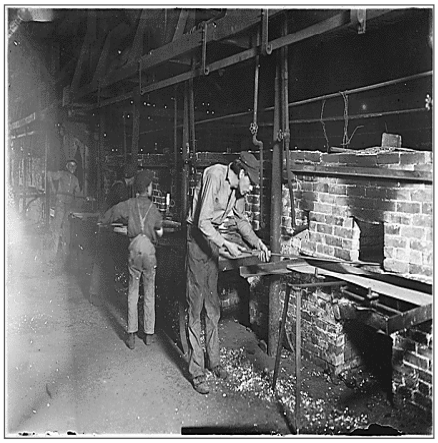
FERDINAND HASSLER, 1770-1843
1830, appointed by President Jackson to compare the weights and measures in use at the principal custom houses. Fixes the official yard as a national standard at 36 inches.



2. HISTORY OF CODES & STANDARDS

A. History of Building Codes

The Industrial Age (1862-1900)



A. History of Building Codes

The Industrial Age (1862-1900)

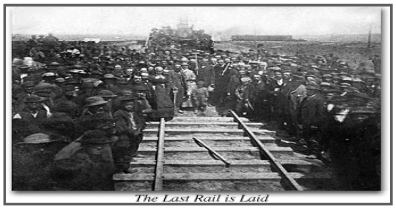
Rising progress of the Industrial Age creates unprecedented industrial innovation production and confusion.

The need for standardization becomes ever more apparent. If machines were to produce efficiently, all parts needed to be interchangeable.

1863 Secretary of the Navy establishes standard gauge for the diameter of bolts, nuts and screw threads for Naval Ship yard use only.

A. History of Building Codes

Railroad Standardization During The Civil War



A. History of Building Codes

Railroad Standardization During The Civil War

At the beginning of the war there are over 20 different railroad track gauges in the continental United States. The prevailing gauge of the north rolling stock was 4'-8-1/2". During the course of the war the north lays an additional 4,000 miles of this track.

PRESIDENT LINCOLN, 1862

The President calls for a railroad to link the nation from coast to coast. The resulting road known as the Union Pacific is specified a "standard" 4'-8 1/2" gauge track.

2. HISTORY OF CODES & STANDARDS

A. History of Building Codes

Railroad Standardization During The Civil War

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A. History of Building Codes

Railroad Standardization During The Civil War

1886

Southern railroads are moved to conform to the narrower gauge of the Pennsylvania railway line. Georgia moves 2413 miles on May 31, 1886.

A. History of Building Codes

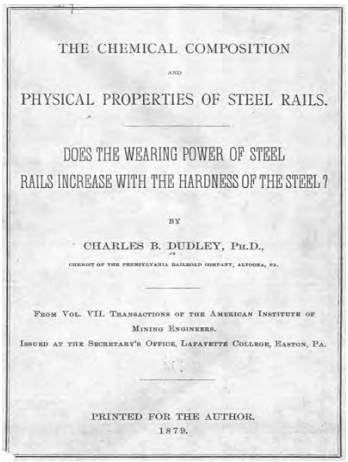
Charles B. Dudley (1842-1909)

1878 Publishes Physical Properties of Steel Rails.
1898 Founding member of the American Society for Testing and Materials.
1902-1909 First President of the American Society for Testing and Materials.

A. History of Building Codes

Charles B. Dudley (1842-1909)

Charles B. Dudley's first program was to research the chemical composition and physical properties of steel rails.
He published his initial results in 1878 and immediately meets with resistance from steel manufacturers, who view him as an outsider to their industry.



THE CHEMICAL COMPOSITION
AND
PHYSICAL PROPERTIES OF STEEL RAILS.

DOES THE WEARING POWER OF STEEL RAILS INCREASE WITH THE HARDNESS OF THE STEEL?

BY

CHARLES B. DUDLEY, PH.D.,
CHEMIST OF THE PENNSYLVANIA RAILROAD COMPANY, ALTOONA, PA.

FROM VOL. VII. TRANSACTIONS OF THE AMERICAN INSTITUTE OF MINING ENGINEERS.
ISSUED AT THE SECRETARY'S OFFICE, LAFAYETTE COLLEGE, EASTON, PA.

PRINTED FOR THE AUTHOR.
1879.

A. History of Building Codes

The Great Chicago Fire of 1871

A. History of Building Codes

The Great Chicago Fire of 1871

Prevalent wood framed construction fuels the fire that burns for two days and consumes four and a half square miles, 17,400 structures and leaves 200 dead.
Within a year more than eight miles of street frontage had started construction: 965 were brick, 200 were stone, 20 of iron and only 65 were wood frame construction.

A. History of Building Codes

Boiler Explosions 1870-1910

1865 the Mississippi riverboat Sultana explodes killing 1,455 Union Soldiers.
1894, 27 boilers explode simultaneously at the Henry Clay Mine of Pennsylvania.

A. History of Building Codes

Boiler Explosions 1870-1910

From 1870-1910 there are at least 10,000 boiler explosions.
1910 the American Society of Mechanical Engineers drafts a comprehensive boiler code, quickly adopted it virtually eliminates boiler explosions.

B. History of Building Standards

Established in 1901

It was established by Congress to assist industry in the development of technology, to improve product quality, to modernize manufacturing processes, to ensure product reliability, and to facilitate rapid commercialization of products based on new scientific discoveries.

B. History of Building Standards

Great Baltimore Fire of 1904

2. HISTORY OF CODES & STANDARDS

B. History of Building Standards

Great Baltimore Fire of 1904

Washington area firemen responding to the fire find that their hoses will not fit Baltimore hydrants.

Subsequent investigation by the Bureau of Standards find that there are 600 different sizes and varieties of hose couplings being used in the United States.

By 1905 a national standard for fire hoses is adopted.

1905 one of the earliest attempts to create a unified code on a national level was published by the National Board of Fire Underwriters to promote a “Recommended National Building Code”.

B. History of Building Standards

The Triangle Shirtwaist Fire of 1911

2. HISTORY OF CODES & STANDARDS

B. History of Building Standards

The Triangle Shirtwaist Fire of 1911

Overcrowded factory floors, inadequate fire escapes and locked exit doors contribute to the deaths of 146 workers, mostly Jewish immigrant women, in less than 15 minutes. Subsequent corrective acts mandate two exits per floor, fire proof stairways and limit the number of occupants per floor. In 1912, legislation was enacted requiring the installation of an automatic sprinkler system in factory buildings over seven stories high with more than 200 people employed above the seventh floor.

B. History of Building Standards

20th Century Codes & Standards

1905: One of the earliest attempts to unify codes on the national level was the National Board of Fire Underwriters successfully promoting a "Recommended National Building Code."

1909: The first public building law enacted in California was called the State Tenement Housing Act.

1913: State Division of Immigration and Housing and the State Division of Safety created. Each had separate regulatory authority that established the unfortunate precedent of having different state departments responding individually to specific building problems that had statewide impacts.

2. HISTORY OF CODES & STANDARDS

B. History of Building Standards

20th Century Codes & Standards

1915: Building Officials and Code Administrators (BOCA) founded in Country Club Hills, Illinois. Publishes the first BOCA code in 1950.

1922: The Pacific Coast Building Officials — now the International Conference of Building Officials (ICBO) is formed in Whittier, CA. Publishes the first Uniform Building Code (UBC) in 1927.

1940: Southern Building Code Congress (SBCC) – Birmingham, AL. Publishes the first code in 1946.

1994: 3 model codes combine to form International Code Council

2000: International Codes are Published including International Building Code (IBC) and International Residential Code (IRC)

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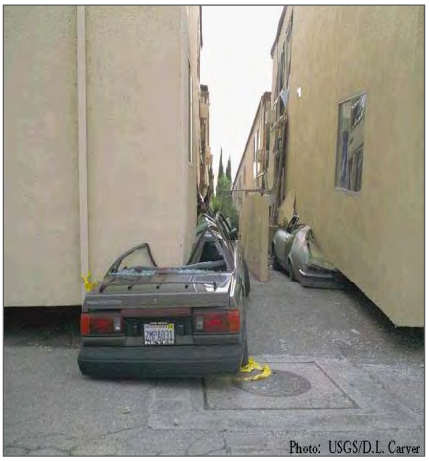
B. History of Building Standards

Northridge Earthquake, 1994

B. History of Building Standards

Northridge Earthquake, 1994



B. History of Building Standards

Northridge Earthquake, 1994

January 17, 1994 4:30 AM

On Monday, January 17, at 4:30 in the morning, a moderate but very damaging earthquake of 6.7 magnitude struck the densely populated San Fernando Valley in northern Los Angeles County.

Thousands of aftershocks, many in the magnitude 4.0 to 5.0 range, occurred during the next few weeks, further damaging already-affected structures.

The death toll was 57, and more than 1,500 people were seriously injured.

Days after the earthquake, 9,000 homes and businesses were still without electricity; 20,000 without gas; and more than 48,500 had little or no water.

About 12,500 structures were moderately to severely damaged, leaving thousands of people temporarily homeless.

2. HISTORY OF CODES & STANDARDS

B. History of Building Standards

Northridge Earthquake, 1994

Particularly vulnerable were low-rise, multi-story, wood-frame apartment structures with a soft (very flexible) first story and an absence of plywood shear walls.

The soft-first-story condition was most apparent in buildings with parking garages at the first-floor level.

Such buildings, with large, often continuous openings for parking, did not have enough wall area and strength to withstand the earthquake forces.

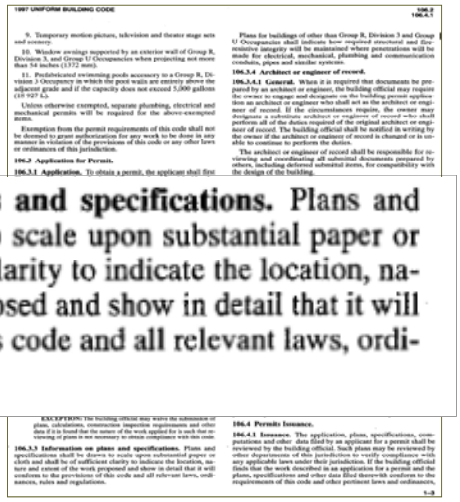
The lack of first-floor stiffness and strength led to collapse of the first floor of many structures throughout the valley.

C. Compare and Contrast

1997 Uniform Building Code

Chapter One: Administration

Section 106.3.3



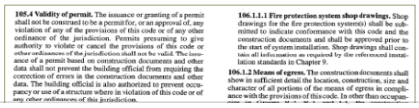
106.3.3 Information on plans and specifications. Plans and specifications shall be drawn to scale upon substantial paper or cloth and shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the provisions of this code and all relevant laws, ordinances, rules and regulations.

C. Compare and Contrast

2010 California Building Code

Chapter One: Administration

Section 106.1.3

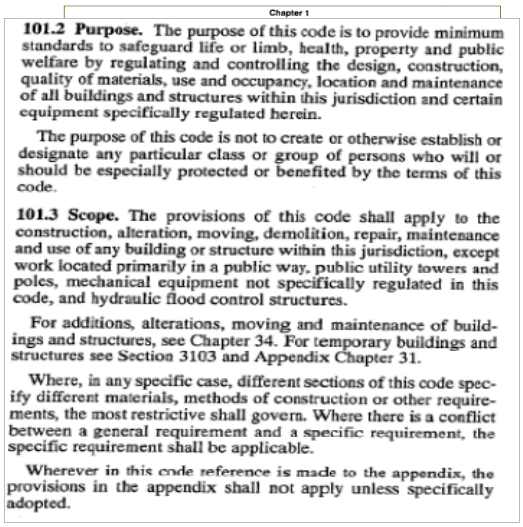


106.1.3 Exterior wall envelope. Construction documents for all buildings shall describe the exterior wall envelope in sufficient detail to determine compliance with this code. The construction documents shall provide details of the exterior wall envelope as required, including flashing, intersections with dissimilar materials, corners, end details, control joints, intersections at roof, eaves or parapets, means of drainage, water-resistive membrane and details around openings.

The construction documents shall include manufacturer's installation instructions that provide supporting documentation that the proposed penetration and opening details described in the construction documents maintain the weather resistance of the exterior wall envelope. The supporting documentation shall fully describe the exterior wall system which was tested, where applicable, as well as the test procedure used.

C. Compare and Contrast

1997 Uniform Building Code
Chapter 1: Administration
Section 101.2 and 101.3



Chapter 1

101.2 Purpose. The purpose of this code is to provide minimum standards to safeguard life or limb, health, property and public welfare by regulating and controlling the design, construction, quality of materials, use and occupancy, location and maintenance of all buildings and structures within this jurisdiction and certain equipment specifically regulated herein.

The purpose of this code is not to create or otherwise establish or designate any particular class or group of persons who will or should be especially protected or benefited by the terms of this code.

101.3 Scope. The provisions of this code shall apply to the construction, alteration, moving, demolition, repair, maintenance and use of any building or structure within this jurisdiction, except work located primarily in a public way, public utility towers and poles, mechanical equipment not specifically regulated in this code, and hydraulic flood control structures.

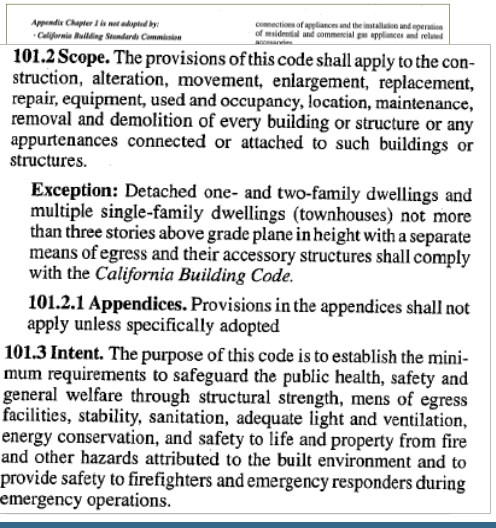
For additions, alterations, moving and maintenance of buildings and structures, see Chapter 34. For temporary buildings and structures see Section 3103 and Appendix Chapter 31.

Where, in any specific case, different sections of this code specify different materials, methods of construction or other requirements, the most restrictive shall govern. Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall be applicable.

Wherever in this code reference is made to the appendix, the provisions in the appendix shall not apply unless specifically adopted.

C. Compare and Contrast

2010 California Building Code
Chapter 1: Administration
Section 101.2 and 101.3



Appendix Chapter 1 is not adopted by:
· California Building Standards Commission

connections of appliances and the installation and operation of residential and commercial gas appliances and related accessories.

101.2 Scope. The provisions of this code shall apply to the construction, alteration, movement, enlargement, replacement, repair, equipment, used and occupancy, location, maintenance, removal and demolition of every building or structure or any appurtenances connected or attached to such buildings or structures.

Exception: Detached one- and two-family dwellings and multiple single-family dwellings (townhouses) not more than three stories above grade plane in height with a separate means of egress and their accessory structures shall comply with the *California Building Code.*

101.2.1 Appendices. Provisions in the appendices shall not apply unless specifically adopted

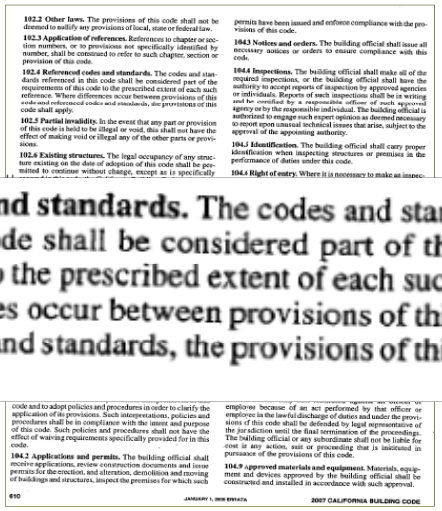
101.3 Intent. The purpose of this code is to establish the minimum requirements to safeguard the public health, safety and general welfare through structural strength, mens of egress facilities, stability, sanitation, adequate light and ventilation, energy conservation, and safety to life and property from fire and other hazards attributed to the built environment and to provide safety to firefighters and emergency responders during emergency operations.

C. Compare and Contrast

2010 California Building Code

Chapter 1: Administration

Section 102.4



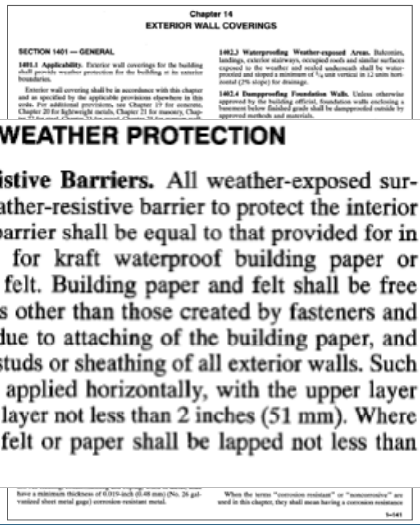
102.4 Referenced codes and standards. The codes and standards referenced in this code shall be considered part of the requirements of this code to the prescribed extent of each such reference. Where differences occur between provisions of this code and referenced codes and standards, the provisions of this code shall apply.

C. Compare and Contrast

1997 Uniform Building Code

Chapter 14: Exterior Wall Coverings

Section 1402.1



SECTION 1402 — WEATHER PROTECTION

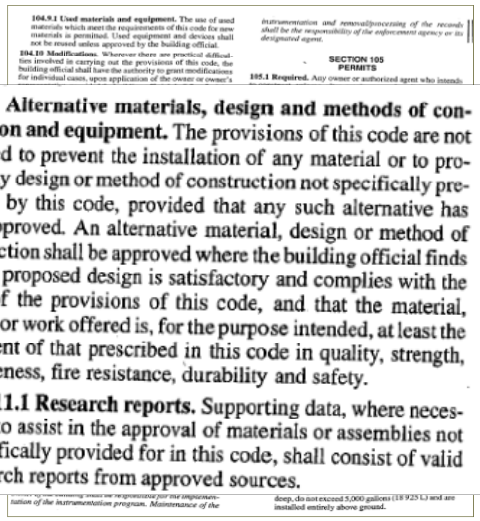
1402.1 Weather-resistive Barriers. All weather-exposed surfaces shall have a weather-resistive barrier to protect the interior wall covering. Such barrier shall be equal to that provided for in UBC Standard 14-1 for kraft waterproof building paper or asphalt-saturated rag felt. Building paper and felt shall be free from holes and breaks other than those created by fasteners and construction system due to attaching of the building paper, and shall be applied over studs or sheathing of all exterior walls. Such felt or paper shall be applied horizontally, with the upper layer lapped over the lower layer not less than 2 inches (51 mm). Where vertical joints occur, felt or paper shall be lapped not less than 6 inches (152 mm).

C. Compare and Contrast

2010 California Building Code

Chapter 1: Administration

Section 104.11



104.11 Alternative materials, design and methods of construction and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety.

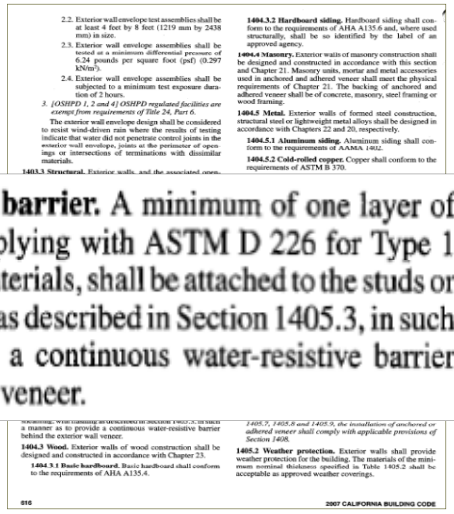
104.11.1 Research reports. Supporting data, where necessary to assist in the approval of materials or assemblies not specifically provided for in this code, shall consist of valid research reports from approved sources.

C. Compare and Contrast

2010 California Building Code

Chapter 14: Exterior Walls

Section 1404.2



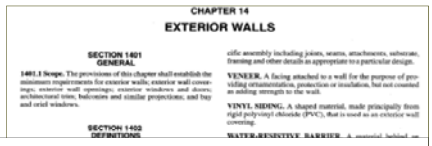
1404.2 Water-resistive barrier. A minimum of one layer of No.15 asphalt felt, complying with ASTM D 226 for Type 1 felt or other approved materials, shall be attached to the studs or sheathing, with flashing as described in Section 1405.3, in such a manner as to provide a continuous water-resistive barrier behind the exterior wall veneer.

C. Compare and Contrast

2007 California Building Code

Chapter 14: Exterior Walls

Section 1403.2



CHAPTER 14
EXTERIOR WALLS

SECTION 1401
GENERAL

SECTION 1402
DEFINITIONS

1403.2 Weather protection. Exterior walls shall provide the building with a weather-resistant exterior wall envelope. The exterior wall envelope shall include flashing, as described in Section 1405.3. The exterior wall envelope shall be designed and constructed in such a manner as to prevent the accumulation of water within the wall assembly by providing a water-resistive barrier behind the exterior veneer, as described in Section 1404.2, and a means for draining water that enters the assembly to the exterior. Protection against condensation in the exterior wall assembly shall be provided in accordance with the *California Energy Code, Section 150 of Title 24, Part 6.*

C. Compare and Contrast

2010 California Building Code

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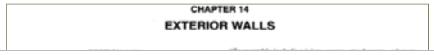


CHAPTER 14
EXTERIOR WALLS

SECTION 1403
PERFORMANCE REQUIREMENTS

1403.1 General. The provisions of this section shall apply to exterior walls, wall coverings and components thereof.

1403.2 Weather protection. Exterior walls shall provide the building with a weather-resistant *exterior wall envelope*. The *exterior wall envelope* shall include flashing, as described in Section 1405.4. The *exterior wall envelope* shall be designed and constructed in such a manner as to prevent the accumulation of water within the wall assembly by providing a *water-resistive barrier* behind the exterior veneer, as described in Section 1404.2, and a means for draining water that enters the assembly to the exterior. Protection against condensation in the *exterior wall* assembly shall be provided in accordance with Section 1405.3.

Exceptions:

1. A weather-resistant *exterior wall envelope* shall not be required over concrete or masonry walls designed in accordance with Chapters 19 and 21, respectively.
2. Compliance with the requirements for a means of drainage, and the requirements of Section 1404.2 and 1405.4, shall not be required for an *exterior wall envelope* that has been demonstrated through testing to resist wind-driven rain, including joints, penetrations and intersections with dissimilar materials, in accordance with ASTM E 331 under the following conditions:
   1. *Exterior wall envelope* test assemblies shall include at least one opening, one control joint, one wall/eave interface and one wall sill. All tested openings and penetrations shall be representative of the intended end-use configuration.
   2. *Exterior wall envelope* test assemblies shall be at least 4 feet by 8 feet (1219 mm by 2438 mm) in size.
   3. *Exterior wall envelope* assemblies shall be tested at a minimum differential pressure of 6.24 pounds per square foot (psf) (0.297 kN/m^2).
   4. *Exterior wall envelope* assemblies shall be subjected to a minimum test exposure duration of 2 hours.

   The *exterior wall envelope* design shall be considered to resist wind-driven rain where the results of testing indicate that water did not penetrate control joints in the *exterior wall envelope*, joints at the perimeter of openings or intersections of terminations with dissimilar materials.
3. Exterior insulation and finish systems (EIFS) complying with Section 1408.4.1.

663

C. Compare and Contrast

1997 Uniform Building Code

Chapter 14: Exterior Wall Coverings

Section 1404.1

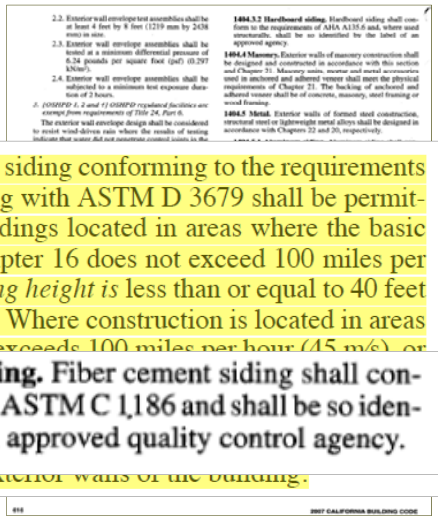
1404.1 General. Vinyl siding conforming to the requirements of this section and complying with UBC Standard 14-2 may be installed on exterior walls of buildings of Type V construction located in areas where the wind speed specified in Figure 16-1 does not exceed 80 miles per hour (129 km/h) and the building height is less than 40 feet (12 192 mm) in Exposure C. If construction is located in areas where wind speed exceeds 80 miles per hour (129 km/h) or building heights are in excess of 40 feet (12 192 mm), data indicating compliance with Chapter 16 must be submitted. Vinyl siding shall be secured to the building to provide weather protection for the exterior walls of the building.

C. Compare and Contrast

2010 California Building Code

Chapter 14: Exterior Walls

Section 1405.14 and 1404.10



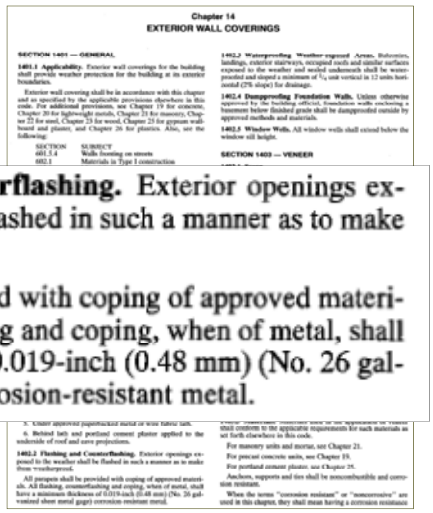
1405.14 Vinyl siding. Vinyl siding conforming to the requirements of this section and complying with ASTM D 3679 shall be permitted on exterior walls of buildings located in areas where the basic wind speed specified in Chapter 16 does not exceed 100 miles per hour (45 m/s) and the *building height is* less than or equal to 40 feet (12 192 mm) in Exposure C. Where construction is located in areas where the basic wind speed exceeds 100 miles per hour (45 m/s), or

1404.10 Fiber cement siding. Fiber cement siding shall conform to the requirements of ASTM C 1,186 and shall be so identified on labeling listing an approved quality control agency.

weather protection for the exterior walls of the building.

C. Compare and Contrast

1997 Uniform Building Code
Chapter 14: Exterior Wall Coverings
Section 1402.2



Chapter 14
EXTERIOR WALL COVERINGS

1402.2 Flashing and Counterflashing. Exterior openings exposed to the weather shall be flashed in such a manner as to make them weatherproof.

All parapets shall be provided with coping of approved materials. All flashing, counterflashing and coping, when of metal, shall have a minimum thickness of 0.019-inch (0.48 mm) (No. 26 galvanized sheet metal gage) corrosion-resistant metal.

C. Compare and Contrast

2010 California Building Code
Chapter 14: Exterior Walls
Section 1405.4

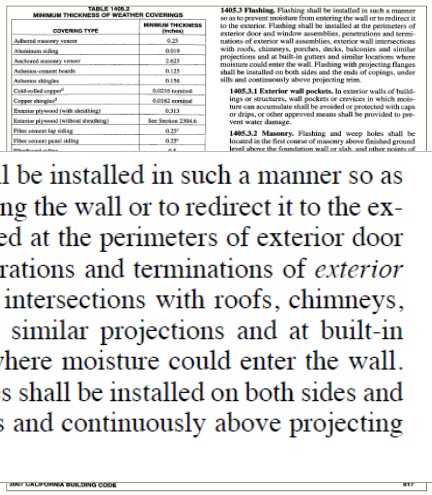


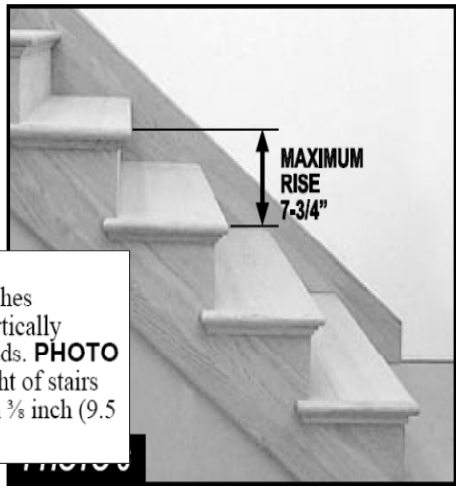
TABLE 1405.2
MINIMUM THICKNESS OF WEATHER COVERINGS

COVERING TYPE	MINIMUM THICKNESS (inches)
Adhered masonry veneer	0.25
Aluminum siding	0.019
Anchored masonry veneer	3.625
Asbestos-cement boards	0.125
Asbestos shingles	0.156
Cold-rolled copper[a]	0.0216 nominal
Copper shingles[a]	0.0162 nominal
Exterior plywood (with sheathing)	0.313
Exterior plywood (without sheathing)	See Section 2304.6
Fiber cement lap siding	0.25[f]
Fiber cement panel siding	0.25[f]

1405.4 Flashing. Flashing shall be installed in such a manner so as to prevent moisture from entering the wall or to redirect it to the exterior. Flashing shall be installed at the perimeters of exterior door and window assemblies, penetrations and terminations of *exterior wall* assemblies, *exterior wall* intersections with roofs, chimneys, porches, decks, balconies and similar projections and at built-in gutters and similar locations where moisture could enter the wall. Flashing with projecting flanges shall be installed on both sides and the ends of copings, under sills and continuously above projecting *trim*.

D. Case Study

Stairs: 1997 UBC vs. 2006 IRC

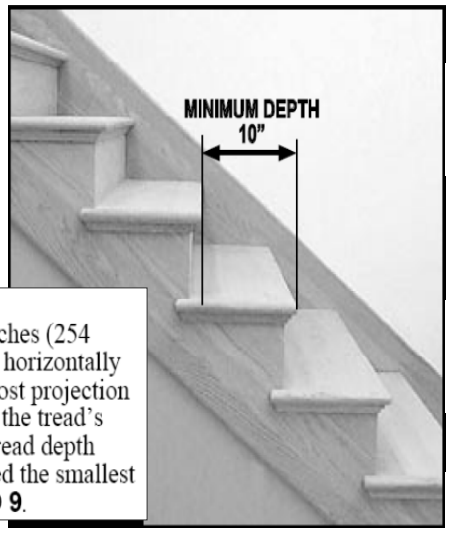


Stairway Manufacturers' Association Interpretation of IRC 2006 • www.stairways.org

R311.5.3.1 Riser height.
The maximum riser height shall be 7¾ inches (196 mm). The riser shall be measured vertically between leading edges of the adjacent treads. **PHOTO 6**. The greatest riser height within any flight of stairs shall not exceed the smallest by more than ⅜ inch (9.5 mm). **PHOTO 7**.

D. Case Study

Stairs: 1997 UBC vs. 2006 IRC



R311.5.3.2 Tread depth.
The minimum tread depth shall be 10 inches (254 mm). The tread depth shall be measured horizontally between the vertical planes of the foremost projection of adjacent treads and at a right angle to the tread's leading edge. **PHOTO 8**. The greatest tread depth within any flight of stairs shall not exceed the smallest by more than ⅜ inch (9.5 mm). **PHOTO 9**.

D. Case Study

Stairs: 1997 UBC vs. 2006 IRC

1003.3.3.3 Rise and run. The rise of steps and stairs shall not be less than 4 inches (102 mm) nor more than 7 inches (178 mm). The greatest riser height within any flight of stairs shall not exceed the smallest by more than $^3/_8$ inch (9.5 mm). Except as permitted in Sections 1003.3.3.8.1, 1003.3.3.8.2 and 1003.3.3.8.3, the run shall not be less than 11 inches (279 mm) as measured horizontally between the vertical planes of the furthermost projection of adjacent treads or nosings. Stair treads shall be of uniform size and shape, except the largest tread run within any flight of stairs shall not exceed the smallest by more than $^3/_8$ inch (9.5 mm).

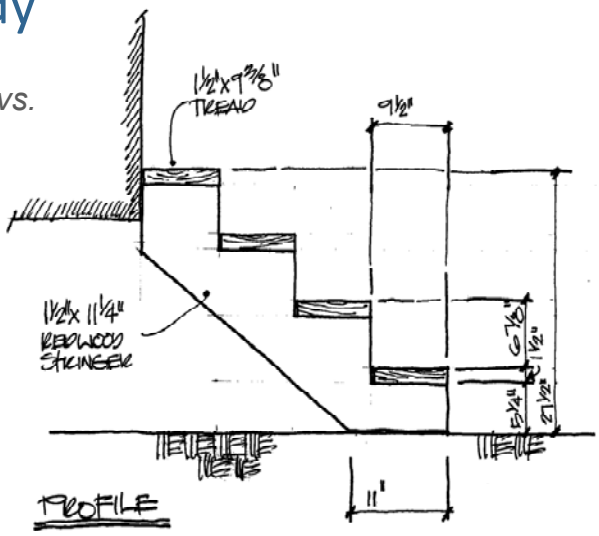
EXCEPTIONS: 1. Private steps and stairways serving an occupant load of less than 10 and stairways to unoccupied roofs may be constructed with an 8-inch-maximum (203 mm) rise and a 9-inch-minimum (229 mm) run.

2. Where the bottom or top riser adjoins a sloping public way, walk or driveway having an established grade (other than natural earth) and serving as a landing, the bottom or top riser may be reduced along the slope to less than 4 inches (102 mm) in height with the variation in height of the bottom or top riser not to exceed 1 unit vertical in 12 units horizontal (8.3% slope) of stairway width.

1997 UBC

D. Case Study

Stairs: 1997 UBC vs. 2006 IRC



Actual Project

Chapter 12
REQUIREMENTS FOR GROUP R OCCUPANCIES

Group R Occupancies Defined

Sec. 1201. Group R Occupancies shall be:

Division 1. Hotels and apartment houses.

Convents and monasteries (each accommodating more than 10 persons).

Division 2. Not used.

Division 3. Dwellings and lodging houses.

For occupancy separations, see Table No. 5-B.

A complete code for construction of detached one- and two-family dwellings is in Appendix Chapter 12 of this code. When adopted, as set forth in Section 103, it will take precedence over the requirements set forth in Parts I through X and Chapter 60 of this code.

Construction, Height and Allowable Area

Sec. 1202. (a) **General.** Buildings or parts of buildings classed in Group R because of the use or character of the occupancy shall be limited to the types of construction set forth in Tables No. 5-C and No. 5-D and shall not exceed, in area or height, the limits specified in Sections 505, 506 and 507.

(b) **Special Provisions.** Walls and floors separating dwelling units in the same building shall be of not less than one-hour fire-resistive construction.

Group R, Division 1 Occupancies more than two stories in height or having more than 3000 square feet of floor area above the first story shall be of not less than one-hour fire-resistive construction throughout except as provided in Section 1705 (b) 2.

Storage or laundry rooms that are within Group R, Division 1 Occupancies that are used in common by tenants shall be separated from the rest of the building by not less than one-hour fire-resistive occupancy separation.

For Group R, Division 1 Occupancies with a Group B, Division 1 parking garage in the basement or first floor, see Section 702 (a).

For attic space partitions and draft stops, see Section 2516 (f).

Location on Property

Sec. 1203. For fire-resistive protection of exterior walls and openings, as determined by location on property, see Section 504 and Part IV.

Exits and Emergency Escapes

Sec. 1204. Stairs, exits and smokeproof enclosures shall be as specified in Chapter 33.

Basements in dwelling units and every sleeping room below the fourth story shall have at least one operable window or door approved for emergency escape or rescue which shall open directly into a public street, public alley, yard or exit court. The units shall be operable from the inside to provide a full clear opening without the use of separate tools.

shall extend to the same height as any portion of the roof that is within the distance where protection of wall openings would be required, but in no case shall the height be less than 30 inches.

Projections

Sec. 1710. Cornices, eave overhangs, exterior balconies and similar architectural appendages extending beyond the floor area as defined in Section 407 shall conform to the requirements of this section. (See Sections 3305 and 3306 for additional requirements applicable to exterior exit balconies and stairways.)

Projections from walls of Type I or II construction shall be of noncombustible materials.

Projections from walls of Type III, IV or V construction may be of noncombustible or combustible materials.

Combustible projections located where openings are not permitted or where protection of openings is required shall be of one-hour fire-resistive or heavy-timber construction conforming to Section 2106.

Projections shall not extend more than 12 inches into the areas where openings are prohibited.

For projections extending over public property, see Chapter 45.

For combustible ornamentation, see Section 1705 (d).

Guardrails

Sec. 1711. All unenclosed floor and roof openings, open and glazed sides of stairways, landings and ramps, balconies or porches, which are more than 30 inches above grade or floor below, and roofs used for other than service of the building shall be protected by a guardrail.

EXCEPTION: Guardrails need not be provided at the following locations:

1. On the loading side of loading docks.
2. On the auditorium side of a stage or enclosed platform.

The top of guardrails shall be not less than 42 inches in height.

EXCEPTIONS: 1. The top of guardrails for Group R, Division 3 and Group M, Division 1 Occupancies and interior guardrails within individual dwelling units and guest rooms of Group R, Division 1 Occupancies may be 36 inches in height.

2. The top of guardrails on a balcony immediately in front of the first row of fixed seats and which are not at the end of an aisle may be 26 inches in height.

3. The top of guardrails for stairways, exclusive of their landings, may have a height as specified in Section 3306 (j) for handrails.

Open guardrails shall have intermediate rails or an ornamental pattern such that a sphere 6 inches in diameter cannot pass through.

EXCEPTION: The open space between the intermediate rails or ornamental pattern of guardrails in areas of commercial and industrial-type occupancies which are not accessible to the public may be such that a sphere 12 inches in diameter cannot pass through.

History of Codes

Source: http://www.bsc.ca.gov/abt_bsc/abt_hstry.htm

The following is a summary of key events related to building standards and the BSC.

This history helps to explain the development of the current processes by which building standards are adopted, approved, published, used as design and construction requirements, and enforced.

1905
One of the earliest attempts to unify codes on the national level was the National Board of Fire Underwriters successfully promoting a "Recommended National Building Code."

1909
The first public building law enacted in California was called the State Tenement Housing Act.

1913
The State Division of Immigration and Housing and the State Division of Safety were created. Each had separate regulatory authority that established the unfortunate precedent of having different state departments responding individually to specific building problems that had statewide impacts.

1927
The Pacific Coast Building Officials — now the International Conference of Building Officials (ICBO) — published the first Uniform Building Code (UBC). The ICBO family of Uniform Codes has been adopted by reference or has been used as a pattern by most local governments. The UBC established uniformity of building codes in California.

1933
The Field Act became law as a legislative response to the Long Beach earthquake. The Act assigned responsibility for the design and construction of public schools to the State Architect. This is an example of a separate regulatory authority adopting building standards in its own title - in this case, Title 21.

1949
House Resolution No. 183 established a panel to study the building code issue and report back to the Legislature.

One of the comments in that report was:

“The state has no one agency concerned principally with building regulations. There are at least ten state agencies having some degree of authority in this field, and not one of them is responsible for taking the lead in coordinating the activity of all of them. This produces two kinds of confusion — conflict between state agencies themselves and too many kinds of relationships between state and local agencies. There is no consistent pattern for defining the relative responsibility of the state and local agencies in enforcing state regulations.”

1953
The initial State Building Standards Law was enacted (Chapter 1500, Statutes of 1953). As originally enacted, the law established a California Building Standards Commission with limited powers to control the building standards regulatory process. The Commission could not question the substantive provisions of the code if it found technical defects or that the provisions would have a negative impact on the public.

Also, the Commission had no control over the filing of a building standard with the Secretary of State, and no appellant powers.

Because of its limited powers to control the building standard regulatory process, the Commission was unsuccessful in its attempts to resolve longstanding problems that made it almost impossible for users of the code to understand and comply with its requirements.

Building standards continued to be buried in different titles of the California Administrative Code: OSHA in Title 8, Health in Title 17, Fire Marshal in Title 19, Hospitals in Title 22, etc. There was no codification or indexing, with standards scattered through the 30,000 plus pages of the California Administrative Code. Enforcement was complicated, costly, and in some cases, nonexistent.

1957
The Senate Interim Committee on Governmental Organization reviewed building standards and reported:

“The handicaps under which the California Building Standards Commission operates emphasize the inadequacy of halfway measures. The promulgation of the State Building Standards Code would eliminate some of the confusion resulting from uncoordinated building regulations issued by the various state agencies, but would not be a substitute for an integrated department or agency with the responsibility for administration of the State's building laws activities.”

1970
SB 952 (Moscone) proposed to create a Board of Building and Safety with sole authority to adopt building standards. It was opposed by the state agencies who were adopting building standards. It was vetoed.

1972
The Hospital Seismic Safety Act was a legislative response to the San Fernando earthquake of 1971. The Act provided for state-regulated design and construction of certain emergency health facilities. The regulations were placed in Title 22.

1973
AB 2265 (Greene), an administration bill, would have abolished the Department and Commission of Housing and Community Development, and created a Department of Building and Safety. It did not pass.

1975
The Warren-Alquist State Energy Resources Conservation and Development Act was based on a legislative finding that the rapid growth rate in the demand for electric energy was in part due to wasteful, uneconomic, inefficient, and unnecessary uses of power. A continuation of this trend would have resulted in:

- The serious depletion or irreversible commitment of energy and land and water resources
- Potential threats to the state's environmental quality

The Legislature also found there was a pressing need to accelerate research and development of alternative sources of energy.

This policy resulted in a situation where more than 20 agencies, ranging from the Barbers' Licensing Board to the State Architect can adopt building standards and publish them in the separate titles of the California Code of Regulations.

1978
To correct the problems and confusion resulting from the uncoordinated proliferation of conflicting, duplicate, and overlapping state regulations, SB 331 (Robbins) (Chapter 1152, Statutes of 1979), effective January 1, 1980, provided the Commission with broader powers. As a result of SB 331, all proposed building regulations adopted by various state agencies must be reviewed and approved by the Commission before the regulations have any force or effect.

Further, the legislation called for all building standards to be removed from other titles of the California Code of Regulations and put into a single code — Title 24 — that the Commission is responsible for codifying and publishing.

In addition, since January 1980, the Commission is charged with reviewing proposed regulations to make sure they meet the following criteria — commonly called the nine-point criteria — found in Health and Safety Code Section 18930(a):

1. The regulation does not conflict, overlap, or duplicate other regulations.
2. The regulation is within parameters of enabling legislation.
3. The public interest requires the adoption of the regulation.
4. The regulation is not unreasonable, arbitrary, unfair, or capricious.
5. The cost to the public is reasonable, based on the overall benefit derived from the regulation.
6. The regulation is not necessarily ambiguous or vague.
7. Applicable national standards, published standards, and model codes have been incorporated.
8. The format of the regulation is consistent with the BSC's format.
9. The regulation, if it promotes fire and panic safety as determined by the State Fire Marshal, has their written approval.

In addition, the Administrative Procedure Act (APA) requirements related to the adoption of regulations (Government Code Section 11346 et al.) must be met.

1988
AB 4616 (Lancaster), effective January 1, 1989, provided that state agencies that adopt administrative regulations related to the implementation or enforcement of building standards must submit those regulations to the Commission for approval.

SB 2871 (Marks) provided that an amendment, addition, or deletion to the California Building Standards Code, adopted by a city, county, or city and county pursuant to provisions enacted by the bill (together with all applicable portions of the California Building Standards Code), shall become effective 180 days after its publication by the Commission.

The bill also required that the building standards contained in specified codes (model codes) published by the Commission apply, with certain exceptions, to all occupancies throughout the state.

1990
AB 4082 (Chandler) required the Commission, in conjunction with all state agencies involved in the adoption of building standards and the interested public, to conduct a comprehensive review of state building standards and statutes relating to state building standards, beginning January 1, 1991 and continuing through December 31, 1992.

1991
AB 47 (Eastin) transferred the adoption authority of the following state agencies to the Commission:

- Department of Housing and Community Development (HCD)
- Office of the State Fire Marshal (OFSM)
- Office of Statewide Health Planning and Development (OSHPD)
- Office (now Division) of the State Architect (DSA)

Several pieces of legislation were introduced at this time in response to the Loma Prieta earthquake. In particular, AB 204 (Cortese) increased the regulatory authority of the Commission to include, in general, existing buildings having at least one unreinforced masonry bearing wall.

Specifically, AB 204 required the Commission to adopt and publish by reference the Appendix Chapter I of the Uniform Code for Building Conservation (UCBC) to provide standards for buildings specified in that appendix.

1992
AB 2358 (Frazee) exempted local jurisdictions that, on or before January 1, 1993, adopted programs for mitigating potentially hazardous buildings, from the application of building standards contained in the Uniform Code for Building Conservation (UCBC) as adopted by the Commission.

AB 2963 (Hauser), effective January 1, 1993, specified that only the building standards approved by the Commission that are effective at the local level at the time an application for a building permit is submitted, apply to plans and specifications as well as to construction work performed under that building permit.

AB 3515 (Lancaster), signed in 1992, was primarily a "clean-up" bill to reorganize and clarify certain provisions in the State Building Standards Law. However, there were three substantive amendments:

- The bill mandated that the Office of the State Fire Marshal review proposed building standards which, in fact, affect fire and panic safety, regardless of a state agency's intent when the standards were written.
- The effective date of regulations that implement or enforce building standards was specified in the Law to be 30 days after filing with the Secretary of State.
- The effective date of building standards adopted by the California Occupational Safety and Health Standards Board (OSHSB) was also set at 30 days after filing with the Secretary of State.

SB 1588 (Kopp) required that the publication date established by the Commission for the

California Building Standards Code be no earlier than the date that the Code is available for purchase by the public.

1993
AB 1904 (W. Brown) expanded the exemption for local jurisdictions that, on or before January 1, 1993, adopted programs for mitigating potentially hazardous buildings, from the application of building standards contained in the Uniform Code for Building Conservation (UCBC) as adopted by the Commission.

AB 2351 (Committee on Ways and Means) deleted Health and Safety Code Subsection 18949.6(d), which had provided for the new annual building code advisory groups.

1994
AB 1780 (Hauser) directed the Commission to prepare a comprehensive listing of all state amendments developed for publication in the California Building Standards Code, Title 24, Part 2, referencing the 1994 Uniform Building Code, for the period beginning January 1, 1995 through December 31, 1995.

The bill also required the Commission to determine whether or not existing state amendments in Part 2 continued to be justified under the criteria set forth in the State Building Standards Law, specifically Health and Safety Code Section 18930.

3. BUILDING CODE REFERENCED STANDARDS

The explosion of referenced documentation!

A. It's A LONG List

640

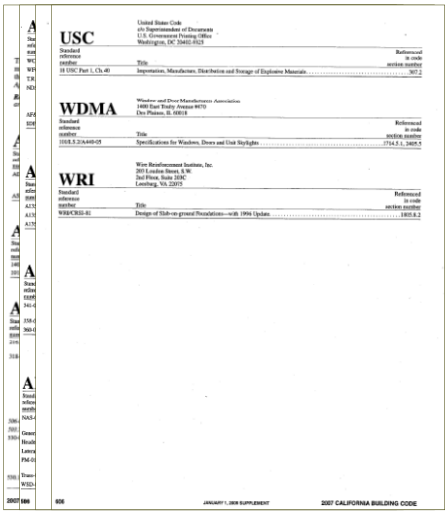
CHAPTER 35
REFERENCED STANDARDS

This chapter lists the standards that are referenced in various sections of this document. The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title, and the section or sections of this document that reference the standard. The application of the referenced standards shall be as specified in *Chapter 1, Administration, Division 1, Sections 1.1.5 and 1.1.7, and in Chapter 1, Administration, Division II,* Section 102.4.

[DSA-SS, DSA-SS-CC & OSHPD 1 & 4] Reference to other chapters. *In addition to the code sections referenced, the standards listed in this chapter are applicable to the respective code sections in Chapters 16A, 17A, 18A, 19A, 21A, 22A and 34A.*

AA	Aluminum Association 1525 Wilson Boulevard, Suite 600 Arlington, VA 22209	
Standard reference number	Title	Referenced in code section number
ADM1—05	Aluminum Design Manual: Part 1-A Specification for Aluminum Structures, Allowable Stress Design; and Part 1-B—Aluminum Structures, Load and Resistance Factor Design	1604.3.5. 2002.1
ASM 35—00	Aluminum Sheet Metal Work in Building Construction (Fourth Edition)	2002.1
AAMA	American Architectural Manufacturers Association 1827 Waldon Office Square, Suite 550 Schaumburg, IL 60173	

A. It's A LONG List



22 Pages 48 Agencies

Approximately 300 References

AA	ASME	FEMA	SJI
AAMA	ASTM	FM	SPRI
ACI	AWCI	GA	TIA
AF&PA	AWPA	HPVA	TMS
AHA	AWS	ICC	TPI
AISC	BHMA	ISO	UL
AISI	CSA	NAAMM	ULC
AITC	CPSC	NCMA	WDMA
ALI	CSSB	NFPA	WRI
ANSI	DASMA	PCI	
APA	DOC	PTI	
ASAE	DOL	RMI	
ASCE/SEI	DOTn	SFM	

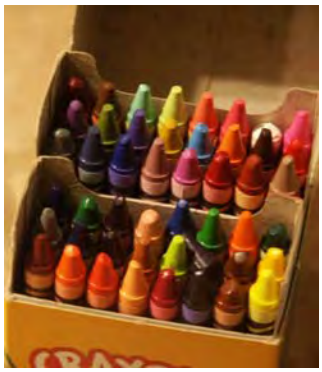
A. It's A LONG List

Standards are specifications, practices or test methods based on technical research and testing conducted by industry experts.

"An industry standard is a published document or detail that helps define the minimum levels of design, materials, and workmanship that currently are recognized via consensus by regional or national industry associations." – Interface magazine, January 2010

A. It's A LONG List

The adherence to voluntary standards helps to promote public health and safety and overall quality of life by contributing to the reliability of materials, products, systems, services and testing procedures.



Crayola Crayons conform to ASTM Standard D-4236 - 94(2005) Standard Practice for Labeling Art Materials for Chronic Health Hazards

3. BUILDING CODE REFERENCED STANDARDS

A. It's A LONG List

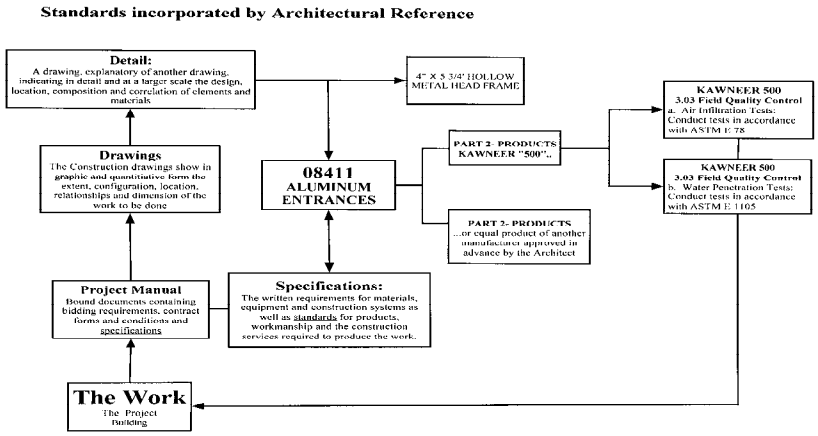
Who Writes Standards?

Public and private organizations, trade groups, professional societies, government departments and agencies develop standards

B. Case Study: GA 600-06

C. Case Study: NFPA 13

D. Case Study: ASTM E1105



3. BUILDING CODE REFERENCED STANDARDS

D. Case Study: ASTM E1105

Detail showing Head / Jamb of a storefront window assembly.
Material called out as hollow metal head frame.

D. Case Study: ASTM E1105

Same Detail but with SPEC 08411 for the material.

D. Case Study: ASTM E1105

CSI Formatted Specification
Section 08411

ALUMINUM ENTRANCES
(5 pages total)

D. Case Study: ASTM E1105

Kawneer IR 500/501

Part V Execution

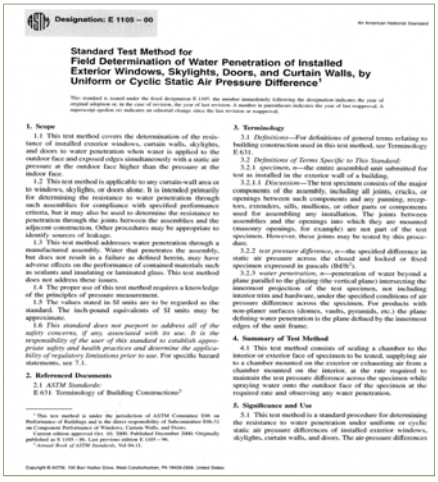
3.03 Field quality control

3. BUILDING CODE REFERENCED STANDARDS

D. Case Study: ASTM E1105

ASTM E1105

Standard test method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain walls, by Uniform or Cyclic Static Air Pressure Difference.



Designation: E 1105 – 00

Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference[1]

1. Scope

2. Referenced Documents

3. Terminology

4. Summary of Test Method

5. Significance and Use

www.petefowler.com

CALIFORNIA BUILDING CODE-MATRIX ADOPTION TABLE

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				CSA	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1-AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter	X								X	X	X	X								
Adopt entire chapter as amended (amended sections listed below)		X	X	X	X		X	X												
Adopt only those sections that are listed below						X														
Chapter/Section																				
ACI							X	X												
AISC							X	X												
AITC							X	X												
ANSI						X														
ASCE/SEI							X	X												
ASME						X														
ASME A17.1/CSA B44-07		X																		
ASME BPE-2009		X																		
ASTM							X	X												
ASTM E648-04		X																		
ASTM E662-09		X																		
AWS							X	X												
BHMA						X														
CPSC						X														
FM3260-00		X																		
FM3011-99		X																		
FM4430-80		X																		
ICC							X	X												
ICC ES AC 331		X																		
ICC ES AC 77		X																		
NFPA						X	X	X												
NFPA 720			X	X	X															
NFPA 13-10		X																		
NFPA 13D-10		X																		
NFPA 13R-10		X																		
NFPA 14-07		X																		
NFPA 15-01		X																		
NFPA 22-03		X																		
NFPA 24-10		X																		
NFPA 37-06		X																		
NFPA 50-01		X																		
NFPA 54-09		X																		
NFPA 57-02		X																		
NFPA 72-10		X																		
NFPA 92a-09		X																		

(continued)

CALIFORNIA BUILDING CODE-MATRIX ADOPTION TABLE CHAPTER 35 – REFERENCED STANDARDS—continued

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				CSA	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1-AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter	X								X	X	X	X								
Adopt entire chapter as amended (amended sections listed below)		X	X	X	X		X	X												
Adopt only those sections that are listed below																				
Chapter/Section		X																		
NFPA 170-06		X																		
PCI							X	X												
PTI							X	X												
SFM 12-3		X																		
SFM 12-7-3		X																		
SFM 12-7A-1		X																		
SFM 12-7A-2		X																		
SFM 12-7A-3		X																		
SFM 12-7A-4		X																		
SFM 12-7A-4A		X																		
SFM 12-7A-5		X																		
SFM 12-8-100		X																		
SFM 12-10-1		X																		
SFM 12-10-2		X																		
SFM 12-10-3		X																		
UBC 15-2		X																		
UBC 15-3		X																		
UBC 15-4		X																		
UL 13-96		X																		
UL 38-99		X																		
UL 193-04		X																		
UL 199-95		X																		
UL 228-97		X																		
UL 260-04		X																		
UL 262-04		X																		
UL 268A-98		X																		
UL 312-04		X																		
UL 346-05		X																		
UL 464-03		X																		
UL 497B-04		X																		
UL 521-99		X																		
UL 539-00		X																		
UL 632-00		X																		
UL 753-04		X																		
UL 813-96		X																		
UL 864-03		X																		
UL 2034			X	X	X															

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 35 REFERENCED STANDARDS

This chapter lists the standards that are referenced in various sections of this document. The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title, and the section or sections of this document that reference the standard. The application of the referenced standards shall be as specified in *Chapter 1, Administration, Division 1,* Sections *1.1.5 and 1.1.7, and in Chapter 1, Administration, Division II,* Section 102.4.

[DSA-SS, DSA-SS-CC & OSHPD 1 & 4] Reference to other chapters. *In addition to the code sections referenced, the standards listed in this chapter are applicable to the respective code sections in Chapters 16A, 17A, 18A, 19A, 21A, 22A and 34A.*

AA Aluminum Association
1525 Wilson Boulevard, Suite 600
Arlington, VA 22209

Standard reference | Referenced in code

number	Title	section number
ADM1-05	Aluminum Design Manual: Part 1-A Specification for Aluminum Structures, Allowable Stress Design; and Part 1-B-Aluminum Structures, Load and Resistance Factor Design	1604.3.5, 2002.1
ASM 35-00	Aluminum Sheet Metal Work in Building Construction (Fourth Edition)	2002.1

AAMA

American Architectural Manufacturers Association
1827 Waldon Office Square, Suite 550
Schaumburg, IL 60173

Standard Reference Number	Title	Referenced in code section number
1402-86	Standard Specifications for Aluminum Siding, Soffit and Fascia	1404.5.1
AAMA/WDMA/CSA 101/I.S.2/A440-08	North American Fenestration Standard/Specifications for Windows, Doors and Skylights	1715.5.1, 2405.5

ACI

American Concrete Institute
38800 Country Club Drive
Farmington Hills, MI 48331

Standard Reference Number	Title	Referenced in code section number
216.1-07	Standard Method for Determining Fire Resistance of Concrete and Masonry Construction Assemblies	Table 720.1(2), 721.1
318-08	Building Code Requirements for Structural Concrete	1604.3.2, 1614.3.1, 1614.4.1, 1704.3.1.3, Table 1704.3, 1704.4.1, Table 1704.4, 1708. 2,,1808.8.2, Table 1808.8.2, 1808.8.5, 1808.8.6, 1810.2.4.1, 1810.3.2.1.1, 1810.3.2.1.2, 1810.3.8.3.1, 1810.3.8.3.3, 1810.3.9.4.2.1, 1810.3.9.4.2.2, 1810.3.11.1, 1901.2, 1901.3, 1901.4, 1902.1, 1903.1, 1904.1, 1904.2, 1904.3, 1904.4.1, 1904.4.2, 1904.5, 1905.1.1, 1905.2, 1905.3, 1905.4, 1905.5, 1905.6.2, 1905.6.3, 1905.6.4, 1905.6.5, 1905.7, 1905.8, 1905.9, 1905.10, 1905.11, 1905.12, 1905.13, 1906.1, 1906.2, 1906.3, 1906.4, 1907.1, 1907.2, 1907.3, 1907.4, 1907.5, 1907.6, 1907.7.1, 1907.7.2, 1907.7.3, 1907.7.4, 1907.7.5, 1907.7.6, 1907.8, 1907.9, 1907.10, 1907.11, 1907.12, 1907.13, 1908.1, 1908.1.1, 1908.1.2, 1908.1.3, 1908.1.4, 1908.1.5, 1908.1.6, 1908.1.7, 1908.1.8, 1908.1.9, 1908.1.10, 1909.1, 1909.3, 1909.4, 1909.5, 1909.6, 1912.1, 2108.3, 2205.3
440.2R-08	*Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Concrete Structures*	*1917A.3*
503.7-07	*Specification for Crack Repair by Epoxy Injection*	*1917A.2*
506-05	*Guide to Shotcrete*	*1913A*
530-08	Building Code Requirements for Masonry Structures	1405.5, 1405.5.2, 1405.9, 1604.3.4, 1704.5, 1704.5.1, Table 1704.5.1, 1704.5.2, 1704.5.3, Table 1704.5.3, 1807.1.6.3.2, 1808.9, 2101.2.2, 2101.2.3, 2101.2.4, 2101.2.5, 2101.2.6, 2103.1.3.6, 2106.1, 2107.1, 2107.2, 2107.3, 2107.4, 2107.5, 2108.1, 2108.2, 2108.3, 2109.1, 2109.1.1, 2109.2, 2109.2.1, 2109.3, 2110.1
530.1-08	Specifications for Masonry Structures	1405.5.1, Table 1704.5.1, Table 1704.5.3, 1807.1.6.3, 2103.8, 2103.11, 2103.12, 2103.13, 2104.1, 2104.1.1, 2104.1.2, 2104.1.3, 2104.2, 2104.3, 2104.4, 2105.2.2.1.1, 2105.2.2.1.2, 2105.2.2.1.3

AF&PA

American Forest & Paper Association
1111 19th St, NW Suite 800
Washington, DC 20036

Standard Reference Number	Title	Referenced in code section number
WCD No. 4-89	Wood Construction Data-Plank and Beam Framing for Residential Buildings	2306.1.2
WFCM-01	Wood Frame Construction Manual for One- and Two-family Dwellings	1609.1.1, 1609.1.1.1, 2301.2, 2308.1, 2308.2.1
NDS-05	National Design Specification (NDS) for Wood Construction with 2005 Supplement	721.6.3.2, 1716.1.1, 1716.1.4, 1809.12, 1810.3.2.4, Table 1810.3.2.6, 2302.1, 2304.12, 2306.1, Table 2306.2.1(1), Table 2306.2.1(2), Table 2306.3, Table 2306.6, 2307.1, 2307.1.1
AF&PA-93	Span Tables for Joists and Rafters	2306.1.1, 2308.8, 2308.10.2, 2308.10.3
ANSI/AF&PA PWF-07	Permanent Wood Foundation Design Specification	1805.2, 1807.1.4, 2304.9.5.2
ANSI/AF&PA SDPWS-08	Special Design Provisions for Wind and Seismic	1613.6.1, 2305.1, 2306.1, 2306.2.1, 2306.2.2, 2306.2.3, 2306.3, Table 2306.3, 2306.4, 2306.5, 2306.6, 2306.7, Table 2306.7, 2307.1, 2307.1.1

AISC

American Institute of Steel Construction
One East Wacker Drive, Suite 700
Chicago, IL 60601-18021

Standard Reference Number	Title	Referenced in code section number
341-05	Seismic Provisions for Structural Steel Buildings, including Supplement No. 1 dated 2005	1613.6.2, 1707.2, 1708.3, 2205.2.1, 2205.2.2, 2205.3, 2205.3.1
358-05	*Prequalified Connections for Special and Intermediate Steel Moment Frames* for Seismic Applications including Supplement No. 1	2205A, 3413A
360-05	Specification for Structural Steel Buildings	1604.3.3, Table 1704.3, 1704.3.3, 2203.1, 2203.2, 2205.1, 2205.3

AISI

American Iron and Steel Institute
1140 Connecticut Avenue, 705
Suite 705
Washington, DC 20036

Standard Reference Number	Title	Referenced in code section number
S100-07	North American Specification for the Design of Cold-formed Steel Structural Members	1604.3.3, 2203.1, 2203.2, 2209.1, 2210.2, 2210.4, 2210.5
S200-07	North American Standard for Cold-formed Steel Framing-General Provisions	2203.1, 2203.2, 2210.1
S210-07	North American Standard for Cold-formed Steel Framing-Floor and Roof System Design	2210.5
S211-07	North American Standard for Cold-formed Steel Framing-Wall Stud Design	2210.4
S212-07	North American Standard for Cold-formed Steel Framing-Header Design	2210.2
S213-07	North American Standard for Cold-formed Steel Framing-Lateral Design	2210.6
S214-07	North American Standard for Cold-formed Steel Framing-Truss Design, with Supplement 2, dated 2008	2210.3.11
S230-07	Standard for Cold-formed Steel Framing-Prescriptive Method for One- and Two-family Dwellings, with Supplement 2, dated 2008	1609.1.1, 1609.1.1.1, 2210.7

AITC

American Institute of Timber Construction
Suite 140
7012 S. Revere Parkway
Englewood, CO 80112

Standard Reference Number	Title	Referenced in code section number
AITC Technical Note 7-96	Calculation of Fire Resistance of Glued Laminated Timbers	721.6.3.3
AITC 104-03	Typical Construction Details	2306.1
AITC 110-01	Standard Appearance Grades for Structural Glued Laminated Timber	2306.1
AITC 111-05	*Recommended Practice for Protection of Structural Glued Laminated Timber* During Transit, Storage and Erection	2303.1.3.1
AITC 113-01	Standard for Dimensions of Structural Glued Laminated Timber	2306.1
AITC 117-04	Standard Specifications for Structural Glued Laminated Timber of Softwood Species	2306.1
AITC 119-96	Standard Specifications for Structural Glued Laminated Timber of Hardwood Species	2306.1
AITC 200-04	Manufacturing Quality Control Systems Manual for Structural Glued Laminated Timber	2306.1
AITC 404-05	*Standard for Radially Reinforcing Curved Glued Laminate Timber Members to Resist Radial Tension*	*2303.1.3.1*
ANSI/AITC A 190.1-07	Structural Glued Laminated Timber	2303.1.3, 2306.1

ALI

Automotive Lift Institute
P.O. Box 85
Courtland, NY 13045

Standard Reference Number	Title	Referenced in code section number
ALI ALCTV-2006	Standard for Automobile Lifts-Safety Requirements for Construction, Testing and Validation (ANSI)	3001.2

ANSI

American National Standards Institute
25 West 43rd Street, Fourth Floor
New York, NY 10036

Standard Reference Number	Title	Referenced in code section number
A13.1-96 (Reaffirmed 2002)	Scheme for the Identification of Piping Systems	415.8.6.4
A108.1A-99	Installation of Ceramic Tile in the Wet-set Method, with Portland Cement Mortar	2103.10
A108.1B-99	Installation of Ceramic Tile, quarry Tile on a Cured Portland Cement Mortar Setting Bed with Dry-set or Latex-portland Mortar	2103.10

A108.4-99	Installation of Ceramic Tile with Organic Adhesives or Water-cleanable Tile-setting Epoxy Adhesive	2103.10.6
A108.5-99	Installation of Ceramic Tile with Dry-set Portland Cement Mortar or Latex-portland Cement Mortar	2103.10.1, 2103.10.2
A108.6-99	Installation of Ceramic Tile with Chemical-resistant,Water Cleanable Tile-setting and -grouting Epoxy	2103.10.3
A108.8-99	Installation of Ceramic Tile with Chemical-resistant Furan Resin Mortar and Grout	2103.10.4
A108.9-99	Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout	2103.10.5
A108.10-99	Installation of Grout in Tilework	2103.10.7
A118.1-99	American National Standard Specifications for Dry-set Portland Cement Mortar	2103.10.1
A118.3-99	American National Standard Specifications for Chemical-resistant, Water-cleanable Tile-setting and -grouting Epoxy and Water Cleanable Tile-setting Epoxy Adhesive	2103.10.3
A118.4-99	American National Standard Specifications for Latex-portland Cement Mortar	2103.10.2
A118.5-99	American National Standard Specifications for Chemical Resistant Furan Mortar and Grouts for Tile Installation	2103.10.4
A118.6-99	American National Standard Specifications for Cement Grouts for Tile Installation	2103.10.7
A118.8-99	American National Standard Specifications for Modified Epoxy Emulsion Mortar/Grout	2103.10.5
A136.1-99	American National Standard Specifications for Organic Adhesives for Installation of Ceramic Tile	2103.10.6
A137.1-88	American National Standard Specifications for Ceramic Tile	2103.5
A208.1-99	Particleboard	2303.1.7, 2303.1.7.1
S3.41	*American National Standard Specifications for Audible Emergency Evacuation Signal*	*907.5.2.1.3*
Z 97.1-04	Safety Glazing Materials Used in Buildings-Safety Performance Specifications and Methods of Test	2406.1.2, 2406.2, Table 2406.2(2), 2406.3.1, 2407.1, 2407.1.4.1, 2408.2.1, 2408.3, 2409.1, 2409.2, 2409.3.1

APA

APA - Engineered Wood Association
7011 South 19th
Tacoma, WA 98466

Standard Reference Number	Title	Referenced in code section number
APA PDS-04	Panel Design Specification	2306.1
APA PDS Supplement 1-90	Design and Fabrication of Plywood Curved Panels (revised 1995)	2306.1
APA PDS Supplement 2-92	Design and Fabrication of Plywood-lumber Beams (revised 1998)	2306.1
APA PDS Supplement 3-90	Design and Fabrication of Plywood Stressed-skin Panels (revised 1996)	2306.1
APA PDS Supplement 4-90	Design and Fabrication of Plywood Sandwich Panels (revised 1993)	2306.1
APA PDS Supplement 5-95	Design and Fabrication of All-plywood Beams (revised 1995)	2306.1
EWS R540-02	Builders Tips: Proper Storage and Handling of Glulam Beams	2306.1
EWS S475-01	Glued Laminated Beam Design Tables	2306.1
EWS S560-03	Field Notching and Drilling of Glued Laminated Timber Beams	2306.1
EWS T300-05	Glulam Connection Details	2306.1
EWS X440-03	Product Guide-Glulam	2306.1
EWS X450-01	Glulam in Residential Construction-Western Edition	2306.1

APSP

The Association of Pool & Spa Professionals
2111 Eisenhower Avenue
Alexandria, VA 22314

Standard Reference Number	Title	Referenced in code section number
ANSI/APSP 7-06	Standard for Suction Entrapment Avoidance in Swimming Pools, Wading Pools, Spas, Hot Tubs and Catch Basins	3109.5

ASABE

American Society of Agricultural and Biological Engineers
2950 Niles Road
St. Joseph, MI 49085

Standard Reference Number	Title	Referenced in code section number
EP 484.2 (2003)	Diaphragm Design of Metal-clad, Post-frame Rectangular Buildings	2306.1
EP 486.1 (2000)	Shallow-post Foundation Design	2306.1
EP 559 (1997)	Design Requirements and Bending Properties for Mechanically Laminated Columns	2306.1

ASCE/SEI

American Society of Civil Engineers
Structural Engineering Institute
1801 Alexander Bell Drive
Reston, VA 20191-4400

Standard Reference Number	Title	Referenced in code section number

3-91	Structural Design of Composite Slabs	1604.3.3, 2209.2.1
5-08	Building Code Requirements for Masonry Structures	1405.6, 1405.6.2, 1405.10, 1604.3.4, 1704.5, 1704.5.1, Table 1704.5.1, 1704.5.2, 1704.5.3, Table 1704.5.3, 1807.1.6.3.2, 1808.9, 2101.2.2, 2101.2.3, 2101.2.4, 2101.2.5, 2101.2.6, 2103.1.3.6, 2106.1, 2107.1, 2107.2, 2107.3, 2107.4, 2107.5, 2108.1, 2108.2, 2108.3, 2109.1, 2109.1.1, 2109.2, 2109.2.1, 2109.3, 2110.1
6-08	Specification for Masonry Structures	1405.6.1, Table 1704.5.1, Table 1704.5.3, 1807.1.6.3, 2103.8, 2103.11, 2103.12, 2103.13, 2104.1, 2104.1.1, 2104.1.2, 2104.1.3, 2104.2, 2104.3, 2104.4, 2105.2.2.1.1, 2105.2.2.1.2, 2105.2.2.1.3
7-05	Minimum Design Loads for Buildings and Other Structures including Supplements No. 1 and 2, excluding Chapter 14 and Appendix 11A	Table 1504.8, 1602.1, 1604.3, 1604.8.2, 1604.10, 1605.1, 1605.2.2, 1605.3.1.2, 1605.3.2, 1607.11.1, 1608.1, 1608.2, 1609.1.1, 1609.1.1.2.1, 1609.1.1.2.2, 1609.1.2, 1609.3, 1609.4.4, 1609.5.1, 1609.5.3, 1609.6, 1609.6.1, 1609.6.1.1, 1609.6.2, Table 1609.6.2(2), 1609.6.3, 1609.6.4.1, 1609.6.4.2, 1611.2, 1612.2, 1612.4, 1613.1, 1613.2, Table 1613.5.3(1), Table 1613.5.3(2), 1613.5.6, 1613.5.6.1, 1613.5.6.2, 1613.6, 1613.6.1, 1613.6.2, 1613.6.3, 1613.6.4, 1613.6.5, 1613.6.6, 1613.6.7, 1613.7, 1702.1, 1705.3.4, 1708.1, 1708.5, 1808.3.1, 1810.3.6.1, 1810.3.9.4, 1810.3.11.2, 1810.3.12, 1908.1.1, 1908.1.2, 1908.1.9, 2205.2.1, 2205.3, 2205.3.1, 2208.1, Table 2304.6.1, Table 2306.7, Table 2308.10.1, 2404.1, 2505.1, 2505.2, 3404.4, 3404.5
8-02	Standard Specification for the Design of Cold-formed Stainless Steel Structural Members	1604.3.3, 2209.1
19-96	Structural Applications of Steel Cables for Buildings	2207.1, 2207.2
24-05	Flood Resistant Design and Construction	1203.3.2, 1612.4, 1612.5, 3001.2, G103.1, G401.3, G401.4
29-05	Standard Calculation Methods for Structural Fire Protection	721.1
32-01	Design and Construction of Frost Protected Shallow Foundations	1809.5
41-06	*Seismic Rehabilitation of Existing Buildings including Supplement No. 1*	3401.5, 3412A, 3413A, 3417.5, 3417.8, 3418, 3419.1,3419.2, 3419.5, 3419.7, 3419.8, 3419.9, 3420, 3421

ASME

American Society of Mechanical Engineers
Three Park Avenue
New York, NY 10016-5990

Standard reference number	Title	Referenced in code section number
A17.1/CSA B44—2007	Safety Code for Elevators and Escalators	1607.8.1, 1613.6.5
A18.1—2005	Safety Standard for Platform Lifts and Stairway Chairlifts	*1116B.2.1*, 2702.2.6, 3411.8.3
A90.1—03	Safety Standard for Belt Manlifts	3001.2
B16.18—2001 (Reaffirmed 2005)	Cast Copper Alloy Solder Joint Pressure Fittings	909.13.1
B16.22—2001 (Reaffirmed 2005)	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings	909.13.1
B20.1—2006	Safety Standard for Conveyors and Related Equipment	3001.2, 3005.3
BPE—2009	*Bio-processing Equipment Standard*	
B31.3—2004	Process Piping	415.8.6.1

ASTM

ASTM International
100 Barr Harbor Drive
West Conshohocken, PA 19428-2959

Standard reference number	Title	Referenced in code section number
A 36/A 36M—05	Specification for Carbon Structural Steel	1810.3.2.3
A 153/A 153M—05	Specification for Zinc Coating (Hot-dip) on Iron and Steel Hardware	2304.9.5
A 240/A 240M—07	Standard Specification for Chromium and Chromium-nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications	Table 1507.4.3(1)
A 252—98 (2002)	Specification for Welded and Seamless Steel Pipe Piles	1810.3.2.3
A 283/A 283M—03	Specification for Low and Intermediate Tensile Strength Carbon Steel Plates	1810.3.2.3
A 307—04e01	Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength	1911.1
A 416/A 416M—06	Specification for Steel Strand, Uncoated Seven-wire for Prestressed Concrete	1810.3.2.2
A 463/A 463M—05	Standard Specification for Steel Sheet, Aluminum-coated, by the Hot-dip Process	Table 1507.4.3(2)
A 572/A 572M—07	Specification for High-strength Low-alloy Columbium-vanadium Structural Steel	1810.3.2.3
A 588/A 588M—05	Specification for High-strength Low-alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4 inches (100 mm) Thick	1810.3.2.3
A 615/A 615M—04a	Specification for Deformed and Plain Billet-steel Bars for Concrete Reinforcement	1708.2, 1810.3.10.2
A 653/A 653M—07	Specification for Steel Sheet, Zinc-coated Galvanized or Zinc-iron Alloy-coated Galvannealed by the Hot-dip Process	Table 1507.4.3(1), Table 1507.4.3(2), 2304.9.5.1
A 690/A 690M—07	Standard Specification for High-strength Low-alloy Nickel, Copper, Phosphorus Steel	

	H-piles and Sheet Piling with Atmospheric Corrosion Resistance for Use in Marine Environments	1810.3.2.3
A 706/A 706M—05a	Specification for Low-alloy Steel Deformed and Plain Bars for Concrete Reinforcement	Table 1704.3, 1704.4.1, 2107.4, 2108.3
A 722/A 722M—07	Specification for Uncoated High-strength Steel Bar for Prestressing Concrete	1810.3.10.2
A 755/A 755M—03	Specification for Steel Sheet, Metallic-coated by the Hot-dip Process and Prepainted by the Coil-coating Process for Exterior Exposed Building Products	Table 1507.4.3(1), Table 1507.4.3(2)
A 792/A 792M—06a	Specification for Steel Sheet, 55% Aluminum-zinc Alloy-coated by the Hot-dip Process	Table 1507.4.3(1), Table 1507.4.3(2)
A 875/A 875M—06	Standard Specification for Steel Sheet Zinc-5 percent, Aluminum Alloy-coated by the Hot-dip Process	Table 1507.4.3(2)
A 913/A 913M—04	Specification for High-strength Low-alloy Steel Shapes of Structural Quality, Produced by Quenching and Self-tempering Process (QST)	1810.3.2.3
A 924/A 924M—07	Standard Specification for General Requirements for Steel Sheet, Metallic-coated by the Hot-dip Process	Table 1507.4.3(1)
A 992/A 992M—06a	Standard Specification for Structural Shapes	1810.3.2.3
B 42—02e01	Specification for Seamless Copper Pipe, Standard Sizes	909.13.1
B 43—98(2004)	Specification for Seamless Red Brass Pipe, Standard Sizes	909.13.1
B 68—02	Specification for Seamless Copper Tube, Bright Annealed (Metric)	909.13.1
B 88—03	Specification for Seamless Copper Water Tube	909.13.1
B 101—02	Specification for Lead-coated Copper Sheet and Strip for Building Construction	Table 1404.5.3, Table 1507.2.9.2, Table 1507.4.3(1)
B 209—06	Specification for Aluminum and Aluminum Alloy Steel and Plate	Table 1507.4.3(1)
B 251—02e01	Specification for General Requirements for Wrought Seamless Copper and Copper-alloy Tube	909.13.1

ASTM—continued

B 280—03	Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service	909.13.1
B 370—03	Specification for Cold-rolled Copper Sheet and Strip for Building Construction	1404.5.2, Table 1507.2.9.2, Table 1507.4.3(1)
B 695—04	Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel	2304.9.5.1, 2304.9.5.3
C 5—03	Specification for Quicklime for Structural Purposes	Table 2507.2
C 22/C 22M—00 (2005)e01	Specification for Gypsum	Table 2506.2
C 27—98 (2002)	Specification for Standard Classification of Fireclay and High-alumina Refractory Brick	2111.5
C 28/C 28M—00 (2005)	Specification for Gypsum Plasters	Table 2507.2
C 31/C 31M—06	Practice for Making and Curing Concrete Test Specimens in the Field	Table 1704.4
C 33—03	Specification for Concrete Aggregates	721.3.1.4, 721.4.1.1.3
C 34—03	Specification for Structural Clay Load-bearing Wall Tile	2103.2
C 35—01(2005)	Specification for Inorganic Aggregates for Use in Gypsum Plaster	Table 2507.2
C 36/C 36M—03	Specification for Gypsum Wallboard	Figure 721.5.1(2), Figure 721.5.1(3), Table 2506.2
C 37/C 37M—01	Specification for Gypsum Lath	Table 2507.2
C 55—06e01	Specification for Concrete Building Brick	Table 721.3.2, 2103.1, 2105.2.2.1.2
C 56—05	Specification for Structural Clay Nonload Bearing Tile	2103.2
C 59/C 59M—00 (2006)	Specification for Gypsum Casting and Molding Plaster	Table 2507.2
C 61/C 61M—00 (2006)	Specification for Gypsum Keene's Cement	Table 2507.2
C 62—05	Specification for Building Brick (Solid Masonry Units Made from Clay or Shale)	1807.1.6.3, 2103.2, 2105.2.2.1.1
C 67—07	Test Methods of Sampling and Testing Brick and Structural Clay Tile	721.4.1.1.1, 2109.3.1.1
C 73—05	Specification for Calcium Silicate Face Brick (Sand-lime Brick)	Table 721.3.2, 2103.1
C 79—04a	Specification for Treated Core and Nontreated Core Gypsum Sheathing Board	Table 2506.2
C 90—06b	Specification for Loadbearing Concrete Masonry Units	Table 721.3.2, 1807.1.6.3, 2103.1
C 91—05	Specification for Masonry Cement	Table 2507.2
C 94/C 94M—07	Specification for Ready-mixed Concrete	110.3.1
C 126—99 (2005)	Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick and Solid Masonry Units	2103.2
C 140—07	Test Method Sampling and Testing Concrete Masonry Units and Related Units	721.3.1.2
C 144-04	*Standard Specification for Aggregate for Masonry Mortar*	*2103A.8*
C 150—07	Specification for Portland Cement	Table 2507.2
C 172—04	Practice for Sampling Freshly Mixed Concrete	Table 1704.4
C 199—84 (2005)	Test Method for Pier Test for Refractory Mortars	2111.5, 2111.8, 2113.12
C 206—03	Specification for Finishing Hydrated Lime	Table 2507.2
C 208—95 (2001)	Specification for Cellulosic Fiber Insulating Board	Table 1508.2, 2303.1.5
C 212—00 (2006)	Specification for Structural Clay Facing Tile	2103.2
C 216—07	Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)	1807.1.6.3, 2103.2, 2105.2.2.1.1
C 270—07	Specification for Mortar for Unit Masonry	2103.8
C 289—07	*Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates*	*1916.1.3, 1903A.3*
C 315—07	Specification for Clay Flue Liners and Chimney Pots	2111.8, 2113.11, Table 2113.16(1)
C 317/C 317M—00 (2005)	Specification for Gypsum Concrete	1914.1
C 330—05	Specification for Lightweight Aggregates for Structural Concrete	721.1.1
C 331—05	Specification for Lightweight Aggregates for Concrete Masonry Units	721.3.1.4, 721.4.1.1.3
C 406—06e01	Specification for Roofing Slate	1507.7.5
C 442/C 442M—04	Specification for Gypsum Backing Board and Coreboard and Gypsum Shaftliner Board	Table 2506.2
C 472—99 (2004)	Specification for Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete	Table 2506.2
C 473—06a	Test Method for Physical Testing of Gypsum Panel Products	Table 2506.2

C 474—05	Test Methods for Joint Treatment Materials for Gypsum Board Construction	Table 2506.2
C 475—05	Specification for Joint Compound and Joint Tape for Finishing Gypsum Wallboard	Table 2506.2
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D 6380—03	Standard Specification for Asphalt Roll Roofing (Organic) Felt	1507.2.9.2, 1507.3.3, 1507.6.5
D 6509—00	Standard Specification for Atactic Polypropylene (APP) Modified Bituminous base Sheet Materials Using Glass Fiber Reinforcements	1507.11.2
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E 96/E 96M—05	Test Method for Water Vapor Transmission of Materials	202, 1203.2
E 108—07a	Test Methods for Fire Tests of Roof Coverings	1505.1, 2603.6, 2610.2, 2610.3
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E662–09	*Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials*	*804.4.1, 804.4.2*
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E 1592—01	Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference	1504.3.2
E 1602—03	Guide for Construction of Solid Fuel-burning Masonry Heaters	2112.2
E 1886—05	Test Method for Performance of Exterior Windows, Curtain Walls, Doors and Storm Shutters Impacted by Missiles and Exposed to Cyclic Pressure Differentials	1609.1.2
E 1966—01	Test Method for Fire-resistant Joint Systems	702.1, 714.3
E 1996—06	Specification for Performance of Exterior Windows, Glazed Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes	1609.1.2, 1609.1.2.1
E 2072—04	Standard Specification for Photoluminescent (Phosphorescent) Safety Markings	1024.4

E 2273—03	Standard Test Method for Determining the Drainage Efficiency of Exterior Insulation and Finish Systems (EIFS) Clad Wall Assemblies	1408.4.1
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F 2090-01a (2007)	Specification for Window Fall Prevention Devices with Emergency Escape (Egress) Release Mechanisms	1405.13.2
F 2200-05	Standard Specification for Automated Vehicular Gate Construction	3110.3
G 152-06	Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials	1504.6
G 154-05	Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials	1504.6
G 155-05a	Practice for Operating Xenon Arc Light Apparatus for Exposure of Nonmetallic Materials	1504.6

AWCI

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Standard Reference Number	Title	Referenced in code section number
12-B-98	Technical Manual 12-B Standard Practice for the Testing and Inspection of Field Applied Thin Film Intumescent Fire-resistive Materials; an Annotated Guide, First Edition	1704.13

AWPA

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Standard Reference Number	Title	Referenced in code section number
C1-03	All Timber Products-Preservative Treatment by Pressure Processes	1505.6
M4-06	Standard for the Care of Preservative-treated Wood Products	1810.3.2.4.1, 2303.1.8
U1-07	USE CATEGORY SYSTEM: User Specification for Treated Wood Except Section 6, Commodity Specification H	1403.5, Table 1507.9.6, 1807.1.4, 1807.3.1, 1809.12, 1810.3.2.4.1, 2303.1.8, 2304.11.2, 2304.11.4, 2304.11.6, 2304.11.7

AWS

American Welding Society
550 N.W. LeJeune Road
Miami, FL 33126

Standard Reference Number	Title	Referenced in code section number
D1.1-*08*	Structural Welding Code-Steel	Table 1704.3, *1704.3.1.1, 1704A.3.1.4*
D1.3-*08*	Structural Welding Code-Sheet Steel	Table 1704.3, 1704.3.1.2
D1.4-*05*	Structural Welding Code-Reinforcing Steel	Table 1704.3, 1704.3.1.3, Table 1704.4, *2107A.4, 2107A.7*
D1.8-09	*Structural Welding Code - Seismic Supplement*	*1704A.3.1.4, 2204A.1.1, 2204A.1.3, 2211.1*
QC1-06	*Standard for AWS Certification of Welding Inspectors*	*1704A.3.1.4*

Builders Hardware Manufacturers' Association

BHMA

355 Lexington Avenue, 17th Floor
New York, NY 10017-6603

Standard Reference Number	Title	Referenced in code section number
A 156.10-06	Power Operated Pedestrian Doors	1008.1.4.2, *1133B.2.3.2, 1133B.2.5*
A 156.19-02	Standard for Power Assist and Low Energy Operated Doors	1008.1.4.2, *1133B.2.3.2, 1133B.2.5*

CGSB

Canadian General Standards Board
Place du Portage 111, 6B1
11 Laurier Street
Gatineau, Quebec, Canada KIA 1G6

Standard Reference Number	Title	Referenced in code section number
37-GP-52M (1984)	Roofing and Waterproofing Membrane, Sheet Applied, Elastomeric	1504.7, 1507.12.2
37-GP-56M (1980)	Membrane, Modified, Bituminous, Prefabricated and Reinforced for Roofing-with December 1985 Amendment	1507.11.2
CAN/CGSB 37.54-95	Polyvinyl Chloride Roofing and Waterproofing Membrane	1507.13.2

CPA

Composite Panel Association
19465 Deerfield Avenue, Suite 306
Leesburg, VA 20176

Standard Reference Number	Title	Referenced in code section number
ANSI A135.4-2004	Basic Hardboard	1404.3.1, 2303.1.6
ANSI A135.5-2004	Prefinished Hardboard Paneling	2303.1.6, 2304.6.2
ANSI A135.6-1998	Hardboard Siding	1404.3.2, 2303.1.6

CPSC

Consumer Product Safety Commission
4330 East West Highway
Bethesda, MD 20814-4408

Standard Reference Number	Title	Referenced in code section number
16 CFR Part 1201(1977)	Safety Standard for Architectural Glazing Material	2406.2, Table 2406.2(1), 2406.3.1, 2407.1, 2407.1.4.1, 2408.2.1, 2408.3, 2409.1, 2409.2, 2409.3.1
16 CFR Part 1209 (1979)	Interim Safety Standard for Cellulose Insulation	719.6
16 CFR Part 1404 (1979)	Cellulose Insulation	719.6
16 CFR Part 1500 (1991)	Hazardous Substances and Articles; Administration and Enforcement Regulations	307.2
16 CFR Part 1500.44 (2001)	Method for Determining Extremely Flammable and Flammable Solids	307.2
16 CFR Part 1507 (2001)	Fireworks Devices	307.2
16 CFR Part 1630 (2000)	Standard for the Surface Flammability of Carpets and Rugs	804.4.1

CSA

Canadian Standards Association
5060 Spectrum Way
Mississauga, Ontario Canada L4W 5N6

Standard Reference Number	Title	Referenced in code section number
101/I.S.2/A440-08	Specifications for Windows, Doors and Unit Skylights	1715.5.1, 2405.5

CSSB

Cedar Shake and Shingle Bureau
P. O. Box 1178
Sumas, WA 98295-1178

Standard Reference Number	Title	Referenced in code section number
CSSB-97	Grading and Packing Rules for Western Red Cedar Shakes and Western Red Shingles of the Cedar Shake and Shingle Bureau	Table 1507.8.5, Table 1507.9.6

DASMA

Door and Access Systems Manufacturers Association International
1300 Summer Avenue
Cleveland, OH 44115-2851

Standard Reference Number	Title	Referenced in code section number
ANSI/DASMA 107-1997 (R2004)	Room Fire Test Standard for Garage Doors Using Foam Plastic Insulation	2603.4.1.9
108-05	Standard Method for Testing Sectional Garage Doors and Rolling Doors: Determination of Structural Performance Under Uniform Static Air Pressure Difference	1715.5.2
115-05	Standard Method for Testing Sectional Garage Doors and Rolling Doors:	

	Determination of Structural Performance Under Missile Impact and Cyclic Wind Pressure	1609.1.2.2

DOC

U.S. Department of Commerce
National Institute of Standards and Technology
1401 Constitution Avenue NW
Washington, DC 20230

Standard Reference Number	Title	Referenced in code section number
PS-1-07	Structural Plywood	2303.1.4, 2304.6.2, Table 2304.7(4), Table 2304.7(5), Table 2306.2.1(1), Table 2306.2.1(2)
PS-2-04	Performance Standard for Wood-based Structural-use Panels	2303.1.4, 2304.6.2, Table 2304.7(5), Table 2306.2.1(1), Table 2306.2.1(2)
PS 20-05	American Softwood Lumber Standard	1810.3.2.4, 2302.1, 2303.1.1

DOJ

U.S. Department of Justice
950 Pennsylvania Avenue, NW
Civil Rights Division, Disability Rights Section-NYA
Washington, DC 20530

Standard Reference Number	Title	Referenced in code section number
DOJ 36 CFR Part 1192	American with Disabilities Act (ADA) Accessibility Guidelines for Transportation Vehicles (ADAAG) Department of Justice, 1991	E109.2.4

DOL

U.S. Department of Labor
c/o Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402-9325

Standard Reference Number	Title	Referenced in code section number
29 CFR Part 1910.1000 (1974)	Air Contaminants	902.1

DOTn

U.S. Department of Transportation
c/o Superintendent of Documents
1200 New Jersey Avenue, SE
Washington, DC 20402-9325

Standard Reference Number	Title	Referenced in code section number
49 CFR Parts 100-185-2005	Hazardous Materials Regulations	307.2
49 CFR Parts 173.137 (2005)	Shippers-General Requirements for Shipments and Packaging-Class 8-Assignment of Packing Group	307.2
49 CFR-1998	Specification of Transportation of Explosive and Other Dangerous Articles, UN 0335, UN 0336 Shipping Containers	307.2

EN

European Committee for Standardization (EN)
Central Secretariat
Rue de Stassart 36
B-10 50 Brussels

Standard Reference Number	Title	Referenced in code section number
EN 1081-98	Resilient Floor Coverings-Determination of the Electrical Resistance	406.5.2

FEMA

Federal Emergency Management Agency
Federal Center Plaza
500 C Street S.W.
Washington, DC 20472

Standard Reference Number	Title	Referenced in code section number
FIA-TB11-01	Crawlspace Construction for Buildings Located in Special Flood Hazard Areas	1805.1.2.1

FM

Factory Mutual Global Research
Standards Laboratories Department
1301 Atwood Avenue, P.O. Box 7500
Johnston, RI 02919

Standard Reference		Referenced in code

Number	Title	section number
3260-00	*Radiant Energy-Sensing Fire Detectors for Automatic Fire Alarm Signaling.*	
3011-99	*Approval Standard for Central Station Service for Fire Alarm and Protective Equipment Supervision*	
4430-80	*Acceptance Criteria for Smoke and Heat Vents*	*910.3.1*
4450 (1989)	Approval Standard for Class 1 Insulated Steel Deck Roofs-with Supplements through July 1992	1508.1, 2603.3, 2603.4.1.5
4470 (1992)	Approval Standard for Class 1 Roof Covers	1504.7
4474 (04)	Evaluating the Simulated Wind Uplift Resistance of Roof Assemblies Using Static Positive and/or Negative Differential Pressures	1504.3.1
4880 (2005)	American National Standard for Evaluating Insulated Wall or Wall and Roof/Ceiling Assemblies, Plastic Interior Finish Materials, Plastic Exterior Building Panels, Wall/Ceiling Coating Systems, Interior and Exterior Finish Systems	2603.4, 2603.9

GA

Gypsum Association
810 First Street N.E. #510
Washington, DC 20002-4268

Standard Reference Number	Title	Referenced in code section number
GA 216-07	Application and Finishing of Gypsum Panel Products .	Table 2508.1, 2509.2
GA 600-06	Fire-resistance Design Manual, 18th Edition	Table 720.1(1), Table 720.1(2), Table 720.1(3)

HPVA

Hardwood Plywood Veneer Association
1825 Michael Faraday Drive
Reston, VA 20190

Standard Reference Number	Title	Referenced in code section number
HP-1-2004	Standard for Hardwood and Decorative Plywood	2303.3, 2304.6.2

HUD

U.S. Department of Housing and Urban Development
451 7th Street, SW
Washington, DC 20410

Standard reference number	Title	Referenced in code section number
HUD 24 CFR Part 3280 (1994)	Manufactured Home Construction and Safety Standards	G201

ICC

International Code Council, Inc.
500 New Jersey Ave, NW
6th Floor
Washington, DC 20001

Standard reference number	Title	Referenced in code section number
ICC 300—07	ICC Standard on Bleachers, Folding and Telescopic Seating and Grandstands	1028.1.1, Table 1607.1, 3401.1
ICC 400—07	Standard on Design and Construction of Log Structures	2301.2
ICC 500—08	ICC/NSSA Standard on the Design and Construction of Storm Shelters	423.1, 423.2
ICC 600—08	Standard for Residential Construction in High Wind Regions	1609.1.1, 1609.1.1.1, 2308.2.1
ICC ES AC 331	*Acceptance Criteria for Smoke and Heat Vents*	*910.3.1*
ICC ES AC77	*Acceptance Criteria for Smoke Containment Systems Used with Fire-resistance-rated Elevator Hoistway Doors and Frames*	*707.14.1*
*ICC-ES AC 01—09**	*Acceptance Criteria for Expansion Anchors in Masonry Elements*	*1615A.1.14*
*ICC-ES AC 43—09**	*Acceptance Criteria for Steel Deck Roof and Floor Systems*	*2209A.3*
*ICC-ES AC 58—09**	*Acceptance Criteria for Adhesive Anchors in Masonry Elements*	*1615A.1.14*
*ICC-ES AC 70—09**	*Acceptance Criteria for Fasteners Power-Driven into Concrete, Steel and Masonry Elements*	*1911A.1.1*
*ICC-ES AC 106—09**	*Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry*	*1615A.1.14*
*ICC-ES AC 125—09**	*Acceptance Criteria for Concrete, and Reinforced and Unreinforced Masonry Strengthening Using Externally Bonded Fiber-Reinforced Polymer (FRP) Composite Systems*	*1917A.3*
*ICC-ES AC 178—09**	*Acceptance Criteria for Inspection and Verification of Concrete, and Reinforced and Unreinforced Masonry Strengthening Using Fiber-Reinforced Polymer (FRP) Composite Systems*	*1917A.3*
*ICC-ES AC 193—09**	*Acceptance Criteria for Mechanical Anchors in Concrete Elements*	*1615A.1.14, 1912A.1.1*
ICC-ES AC 308—09	*Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements*	*1615A.1.14, 1912A.1.1*
*ICC-ES AC 358-09**	*Acceptance Criteria for Helical Foundation Systems and Devices*	*1810A.3.1.5.1*
SBCCI SSTD 11—97	Test Standard for Determining Wind Resistance of Concrete or Clay Roof Tiles	1716.2.1, 1716.2.2

** Refers to International Building Code, 2009 as a reference standard.*

International Organization for Standardization
ISO Central Secretariat
1 ch, de la Voie-Creuse, Case Postale 56

ISO

CH-1211 Geneva 20, Switzerland

Standard reference number	Title	Referenced in code section number
ISO 8115—86	Cotton Bales–Dimensions and Density	Table 415.8.2.1.1

NAAMM

National Association of Architectural Metal Manufacturers
800 Roosevelt Road, Bldg. C, Suite 312
Glen Ellyn, IL 60137

Standard reference number	Title	Referenced in code section number
FP 1001—97	Guide Specifications for Design of Metal Flag Poles	1609.1.1

NCMA

National Concrete Masonry Association
13750 Sunrise Valley
Herndon, VA 22071-4662

Standard reference number	Title	Referenced in code section number
TEK 5-84 (1996)	Details for Concrete Masonry Fire Walls	Table 720.1(2)

NFPA

National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169-7471

Standard reference number	Title	Referenced in code section number
10—07	Portable Fire Extinguishers	906.2, 906.3.2, 906.3.4, Table 906.3(1), Table 906.3(2)
11—05	Low Expansion Foam	904.7
12—05	Carbon Dioxide Extinguishing Systems	904.8, 904.11
12A—04 Halon 1301	Halon 1301 Fire Extinguishing Systems	904.9
13—*10*	Installation of Sprinkler Systems, *as amended**	708.2, 903.3.1.1, 903.3.2, 903.3.5.1.1, 903.3.5.2, 904.11, 905.3.4, 907.6.3, 1613.6.3

NFPA 13, Amended Sections as follows:

Add a new definition as 3.4.1.1 to read as follows:

3.4.1.1 Premixed Antifreeze Solution. A mixture of an antifreeze material with water that is prepared by the manufacturer with a quality control procedure in place that ensures that the antifreeze solution remains homogeneous.

Revise 7.6.1.5 to read as follows:

7.6.1.5 A placard shall be placed on the antifreeze system main valve that indicates the manufacture type and brand of the antifreeze solution, the concentration by volume of the antifreeze solution used, and the volume of the antifreeze solution used in the system.

Revise 7.6.2.1 to read as follows:

7.6.2.1* Antifreeze solutions shall be limited to premixed antifreeze solutions of glycerin (chemically pure or United States Pharmacopoeia 96.5 percent) at a maximum concentration of 50 percent by volume, or propylene glycol at a maximum concentration of 40 percent by volume.

Add a new 7.6.2.1.1 to read:

7.6.2.1.1 Premixed antifreeze solutions of propylene glycol exceeding 40 percent concentration by volume shall be permitted for use with ESFR sprinklers where the ESFR sprinklers are listed for such use in a specific application.

Add new 7.6.2.1.2 to read as follows:

7.6.2.1.2 Premixed antifreeze solutions other than those described in 7.6.2.1 that are listed for use in sprinkler systems shall be permitted to be used.

Add a new 7.6.2.1.3 to read as follows:

7.6.2.1.3 All premixed antifreeze solutions shall be provided with a certificate from the manufacturer indicating the type of antifreeze, concentration by volume, and freezing point.

Delete current Table 7.6.2.2 and replace it with the following table in the annex renumbered as Table A.7.6.2.1

A.7.6.2.1 See Table A.7.6.2.1.

TABLE A.7.6.2.1 PROPERTIES OF GLYCERIN AND PROPYLENE GLYCOL

MATERIAL	SOLUTION (by volume)	SPECIFIC GRAVITY AT 77ºF (25ºC)	FREEZING POINT	
			ºF	ºC
Glycerin (C.P. or U.S.P. grade)	0%	1.000	32	0
	5	1.014	31	-0.5
	10	1.029	28	-2.2
	15	1.043	25	-3.9
	20	1.059	20	-6.7
	25	1.071	16	-8.9
	30	1.087	10	-12
	35	1.100	4	-15.5

	40	1.114	-2	-19
	45	1.130	-11	-24
	50%	1.141	-19	-28
Propylene glycol	0%	1.000	32	0
	5	1.004	26	-3
	10	1.008	25	-4
	15	1.012	22	-6
	20	1.016	19	-7
	25	1.020	15	-10
	30	1.024	11	-12
	35	1.028	2	-17
	40%	1.032	-6	-21

C.P.: Chemically Pure; U.S.P.: United States Pharmacopoeia 96.5%.

NFPA—continued

Delete 7.6.2.3 and Table 7.6.2.3.

Revise 7.6.2.4 to read as follows:

7.6.2.4 A premix antifreeze solution with a freezing point below the expected minimum temperature for the locality shall be provided.

Delete existing 7.6.2.5 as well as the Figures 7.6.2.5(a), 7.6.2.5(b), and 7.6.2.5(c) and Annex A.7.6.2.5.

Delete 7.6.2.6.

Add an asterisk to Section 7.6 and a new Annex A.7.6 to read as follows:

A.7.6 In cold climates and areas where the potential for freezing of pipes is a concern, options other than antifreeze are available. Such options include installing the pipe in warm spaces, tenting insulation over the piping (as illustrated in NFPA 13D), listed heat tracing, and the use of dry pipe systems and preaction systems.

In A.7.6.2, delete the second paragraph.

A.7.6.2 Listed CPVC sprinkler pipe and fittings should be protected from freezing with glycerine only. The use of diethylene, ethylene, or propylene glycols is specifically prohibited. Laboratory testing shows that glycol-based antifreeze solutions present a chemical environment detrimental to CPVC.

Delete existing A.7.6.2.4 and Figure A.7.6.2.4.

Revise Section 2.2 and add publications as follows:

2.2 NFPA Publications.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems, 2006 California* edition.

Revise Section 8.15.1.2.15 as follows:

8.15.1.2.15 Exterior columns under 10 ft^2 (0.93 m^2) in *total* area, formed by studs or wood joist, *with no sources of ignition within the column,* supporting exterior canopies that are fully protected with a sprinkler system, shall not require sprinkler protection.

8.15.5.7 *The sprinkler required at the top and bottom of the elevator hoistway by 8.15.5.6 shall not be required where permitted by Chapter 30 of the California Building Code.*

Revise Section 8.15.7.1* as follows:

8.15.7.1* Unless the requirements of 8.15.7.2 or 8.15.7.3 are met, sprinklers shall be installed under exterior roofs, canopies, porte- cochere, balconies, decks, or similar projections exceeding 4 ft (1.2 m) in width.

Revise Section 8.15.7.2* as follows:

8.15.7.2* Sprinklers shall be permitted to be omitted where the canopies, roofs, balconies, decks, or similar projections are constructed with materials that are noncombustible, limited-combustible, or fire retardant treated wood as defined in NFPA 703, *Standard for Fire Retardant-Treated Wood and Fire-Retardant Coatings for Building Materials*.

Delete Section A.8.15.7.2 of Annex

Revise Section 8.15.7.3

8.15.7.3 Sprinklers shall be permitted to be omitted from below the canopies, roofs, balconies, decks, or similar projections are combustible construction, provided the exposed finish material on the roof, *or* canopy, is noncombustible, limited-combustible, or fire retardant treated wood as defined in NFPA 703, *Standard for Fire Retardant-Treated Wood and Fire-Retardant Coatings for Building Materials,* and the roofs, *or* canopies contain only sprinklered concealed spaces or any of the following unsprinklered combustible concealed spaces:

(1) Combustible concealed spaces filled entirely with noncombustible insulation

(2) Light or ordinary hazard occupancies where noncombustible or limited-combustible ceilings are directly attached to the bottom of solid wood joists so as to create enclosed joist spaces 160 ft^3 (4.5 m^3) or less in volume, including space below insulation that is laid directly on top or within the ceiling joists in an otherwise sprinklered attic *[See 11.2.3.1.4(4)(d)].*

(3) Concealed spaces over isolated small roofs, *or* canopies not exceeding 55 ft^2 (5.1 m^2)

Delete language to section 8.15.7.4 and reserve section number.

8.15.7.4

Revise Annex Section A.8.15.7.5 as follows:

A.8.15.7.5 The presence of planters, newspaper machines and *similar items* should not be considered storage.

Add new Sections 8.16.1.1.1.4 and 8.16.1.1.1.5 as follows:

8.16.1.1.1.4 *Where a system includes floor control valves, a hydraulic design information sign containing information for the floor shall be provided at each floor control valve. A hydraulic design information sign shall be provided for each area calculated. The installing contractor shall identify a hydraulically designed sprinkler system with a permanently marked weatherproof metal or rigid plastic sign secured with corrosion resistant wire, chain or other approved means. Such signs shall*

be placed at the alarm valve, dry pipe valve, preaction valve or deluge valve supplying the corresponding hydraulically designed area.

8.16.1.1.1.5 *Control valves, check valves, drain valves and antifreeze valves shall be readily accessible for inspection, testing and maintenance. Valves located more than 7 feet above the finished floor shall be provided with a means of opening and closing the valve from the floor level.*

NFPA—continued

Revise Section 8.16.1.5.1 as follows:

8.16.1.5.1 *Private* fire service main systems shall have sectional control valves at appropriate points in order to permit sectionalizing the system in the event of a break or for the making of repairs or extensions.

Add new Sections 8.16.1.5.1.1, 8.16.1.5.1.2 and 8.16.1.5.1.3 as follows:

8.16.1.5.1.1 *Sectional control valves are not required when the fire service main system serves less than six fire appurtenances.*

8.16.1.5.1.2 *Sectional control valves shall be indicating valves in accordance with Section 6.7.1.3.*

8.16.1.5.1.3 *Sectional control valves shall be located so that no more than five fire appurtenances are affected by shut-down of any single portion of the fire service main. Each fire hydrant, fire sprinkler system riser and standpipe riser shall be considered a separate fire appurtenance. In-rack sprinkler systems shall not be considered as a separate appurtenance.*

8.16.1.5.1.4 *The number of fire appurtenances between sectional control valves is allowed to be modified by the authority having jurisdiction.*

Revise Section 8.16.1.5.2 as follows:

8.16.1.5.2 A valve shall be provided on each bank where a main crosses *a body of* water *or* outside the building foundation(s) where the main or section of main runs under a building.

Add new Section 9.1.3.9.1.1 as follows:

9.1.3.9.1.1 *Powder-driven studs used for attaching hangers to the building structure are prohibited in Seismic Design Categories C, D, E and F.*

Revise Section 9.3.5.8.3 as follows:

9.3.5.8.3 *Where threaded pipe is used for sway bracing, it shall have a wall thickness of not less than Schedule 40.*

Replace Section 9.3.5.9.4 as follows:

Lag screws or power-driven fasteners shall not be used to attach braces to the building structure.

Add language to the beginning of Section 9.3.5.9.6 as follows:

9.3.5.9.6 *Fastening methods other than those identified in Section 9.3.5.9* shall not apply to other fastening methods, which shall be acceptable for use if certified by a registered professional engineer to support the loads determined in accordance with the criteria in 9.3.5.6. Calculations shall be submitted *to* the authority having jurisdiction.

Revise Section 9.3.5.9.7.2* as follows:

9.3.5.9.7.2* Concrete anchors other than those shown in Figure 9.3.5.9.1 *and identified in Section 9.3.5.8.10* shall be acceptable for use where designed in accordance with the requirements of the building code and certified by a registered professional engineer.

Revise Section 9.3.6.1(3) as follows:

9.3.6.1*(3) *No. 12, 440 lb (200Kg) wire installed at least 45 degrees from the vertical plane and anchored on both sides of the pipe. Powder-driven fasteners for attaching restraint is allowed to be used provided that the restraint component does not support the dead load.*

Revise Section 10.6.5 as follows:

10.6.5 Pipe joints shall not be located under foundation footings. *The pipe under the building or building foundation shall not contain mechanical joints.*

Exceptions:

1. Where allowed in accordance with Section 10.6.2

2. Alternate designs may be utilized where designed by a registered professional engineer and approved by the enforcing agency.

Revise Section 11.2.3.1.4(4)(i) as follows:

11.2.3.1.4(4)(i) Exterior columns under 10 ft^2 (0.93 m^2) in *total* area, formed by studs or wood joist, *with no sources of ignition within the column,* supporting exterior canopies that are fully protected with a sprinkler system.

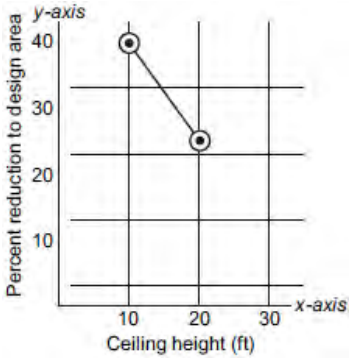
Revise Section 11.2.3.2.3.1 as follows:

11.2.3.2.3.1 Where listed quick-response sprinklers, *excluding* extended coverage quick-response sprinklers, are used throughout a system or portion of a system having the same hydraulic design basis, the system area of operation shall be permitted to be reduced without revising the density as indicated in Figure 11.2.3.2.3.1 when all of the following conditions are satisfied:

(1) Wet pipe system

(2) Light hazard occupancy

NFPA—continued



(3) 20 ft (6.1 m) maximum ceiling height

(4) There are no unprotected ceiling pockets as allowed by 8.6.7 and 8.8.7 exceeding 32 ft^2 (3 m^2)

Note: $y = \frac{-3x}{2} + 55$

For ceiling height ≥ 10 ft and ≤ 20 ft, $y = \frac{-3x}{2} + 55$

For ceiling height < 10 ft, $y = 40$

For ceiling height > 20 ft, $y = 0$

For SI units, 1 ft = 0.31 m.

FIGURE 11.2.3.2.3.1 Design Area Reduction for Quick-Response Sprinklers.

Revise Section 11.2.3.2.3.2 as follows:

11.2.3.2.3.2 The number of sprinklers in the design area shall never be less than *seven*.

12.1.1.2 Early suppression fast-response (ESFR) sprinklers shall not be used in buildings with automatic heat or smoke vents unless the vents use a standard-response operating mechanism *with a minimum temperature rating of 360ºF (182ºC) or 100ºF (56ºC) above the operating temperature of the sprinklers, whichever is higher.*

Add Section 24.1(5)

24.1 Approval of Sprinkler Systems and Private Fire Service Mains.

The installing contractor shall do the following:

(1) Notify the authority having jurisdiction and the property owner or property owner's authorized representative of the time and date testing will be performed.

(2) Perform all required testing *(see Section 24.2)*

(3) Complete and sign the appropriate contractor's material and test certificate(s) *(see Figure 24.1)*

(4) Remove all caps and straps prior to placing the sprinkler system in service

(5) Upon system acceptance by the authority having jurisdiction a label prescribed by Title 19 California Code of Regulations, Chapter 5 shall be affixed to each system riser.

Revise Section 24.4(2) and add Section 24.4(3) as follows:

24.4 Instructions.

The installing contractor shall provide the property owner or the property owner's authorized representative with the following:

(1) All literature and instructions provided by the manufacturer describing proper operation and maintenance of any equipment and devices installed

(2) *NFPA 25, Standard for the Inspection, testing, and maintenance of Water-Based Fire Protection Systems, 2006 California Edition*

(3) Title 19, California Code of Regulations, Chapter 5, "Fire Extinguishing Systems."

Add sentence at the end of Section 24.5.1 as follows:

24.5.1 *"Pipe schedule systems shall be provided with a sign indicating that the system was designed and installed as a pipe schedule system and the hazard classification(s) included in the design."*

Revise Section 24.5.2(3) and add Sections 24.5.2(7) to (14) as follows:

24.5.2 The sign shall include the following information:

(3) Required flow and pressure of the system at the base of the riser

(7) Required flow and pressure of the system at the water supply source.

(8) Required flow and pressure of the system at the discharge side of the fire pump where a fire pump is installed.

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(9) Type or types and number of sprinklers or nozzles installed including the orifice size, temperature rating, orientation, K-Factor, sprinkler identification number (SIN) for sprinkler heads when applicable, and response type.

(10) The minimum discharge flow rate and pressure required from the hydraulically most demanding sprinkler.

(11) The required pressure settings for pressure reducing valves.

(12) For deluge sprinkler systems, the required flow and pressure at the hydraulically most demanding sprinkler or nozzle.

(13) The protection area per sprinkler based on the hydraulic calculations.

(14) The edition of NFPA 13 to which the system was designed and installed.

Revise Section 24.6.1 as follows:

24.6.1 *California Edition* NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*.

13D—*10*	Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes *as amended**	*R313.1.1, R313.2.1, R313.3.1, R313.3.2, R313.3.2.3.1, R313.3.2.4.2, R313.3.6*

****NFPA 13D, Amended Sections as follows:***

Add a new definition as 3.3.9.1.1 and related annex note to read as follows:

3.3.9.1.1* Premixed Antifreeze Solution. A mixture of an antifreeze material with water that is prepared and factory-mixed by the manufacturer with a quality control procedure in place that ensures that the antifreeze solution remains homogeneous.

A.3.3.9.1.1 Where a tank is used as the water supply for the sprinkler system, the tank is not permitted to be filled with antifreeze.

Revise 4.1.4 and related annex note to read as follows:

4.1.4* Antifreeze Systems.

A.4.1.4 Sampling from the top and bottom of the system helps to determine if the solution has settled. Antifreeze solutions are heavier than water. If the antifreeze compound is separating from the water due to poor mixing, it will exhibit a higher concentration in the lower portion of the system than in the upper portions of the system. If the concentration is acceptable near the top, but too low near the water connection, it may mean that the system is becoming diluted near the water supply. If the concentration is either too high or too low in both the samples, it may mean that the wrong concentration was added to the system.

On an annual basis, test samples should be drawn from test valve B as shown in Figure 8.3.3.2.1(1), especially if the water portion of the system has been drained for maintenance or repairs. A small hydrometer can be used so that a small sample is sufficient. Where water appears at valve B, or where the sample indicates that the solution has become weakened, the entire system should be emptied and refilled with acceptable solution as previously described.

Where systems are drained in order to be refilled, it is not typically necessary to drain drops that are less than 36 inches in length. Most systems with drops have insufficient volume to cause a problem, even if slightly higher concentration solutions collect in the drops. For long drops with significant volume, consideration should be given to draining drops if there is evidence that unacceptably high concentrations of antifreeze have collected in these long drops.

When emptying and refilling antifreeze solutions, every attempt should be made to recycle the old solution with the antifreeze manufacturer rather than discarding it.

4.1.4.1 Annual Antifreeze Solution Test and Replacement Procedure.

4.1.4.1.1 Samples of antifreeze solution should be collected by qualified individuals in accordance with 4.1.4.1.1.1 or 4.1.4.1.1.2 on an annual basis.

4.1.4.1.1.1 The system shall be drained to verify that (a) the solution is in compliance with 8.3.3, and (b) the solution provides the necessary freeze protection. Solution samples shall be taken near the beginning and near the end of the draining process.

4.1.4.1.1.2* Solution samples shall be taken at the highest practical elevation and the lowest practical elevation of the system.

A.4.1.4.1.1.2 If not already present, test connections (valves) for collection of solution samples should be installed at the highest and lowest practical locations of the system or portion of the system containing antifreeze solution.

4.1.4.1.2 The two samples collected in accordance with the procedures specified in 4.1.4.1.1.1 or 4.1.4.1.1.2 shall be tested to verify that the specific gravity of both samples is similar and that the solution is in compliance with 8.3.3. The specific gravity of each solution shall be checked using a hydrometer with a suitable scale or a refractometer having a scale calibrated for the antifreeze solution.

4.1.4.1.3* If concentrations of the two samples collected in accordance with the procedures above are similar and in compliance with 8.3.3, then (a) the solution drained in accordance with 4.1.4.1.1.1 can be used to refill the system, or (b) the existing undrained solution tested in accordance with 4.1.4.1.1.2 shall be permitted to continue to be used. If the two samples are not similar and not in compliance with 8.3.3, then a solution in compliance with 8.3.3 shall be used to refill the system.

A.4.1.4.1.3 In the past, for some existing systems subject to extremely low temperatures, antifreeze solutions with concentrations greater than what is now permitted by NFPA 13D were used. Such high concentrations of antifreeze are no longer permitted. In situations where extremely low temperatures are anticipated, refilling the fire sprinkler system with a concentration of antifreeze solution currently permitted by the standard might not provide sufficient freeze protection without additional measures. Such measures might include converting the antifreeze system to another type of sprinkler system.

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4.1.4.1.4 A tag shall be attached to the riser indicating the date the antifreeze solution was tested. The tag shall also indicate the type and concentration of antifreeze solution (by volume) with which the system is filled, the date the antifreeze was replaced (if applicable), the name of the contractor that tested and/or replaced the antifreeze solution, the contractor's license number, a statement indicating if the entire system was drained and replaced with antifreeze, and a warning to test the concentration of the antifreeze solutions at yearly intervals per NFPA 13D.

6.2* Water Supply Sources. *When the requirements of Section 6.2.2 are met,* the following water supply sources shall be considered to be acceptable by this standard:

(1) A connection to a reliable waterworks system with or without an automatically operated pump

(2) An elevated tank

(3) A pressure tank designed to American Society of Mechanical Engineers (ASME) standards for a pressure vessel with a reliable pressure source

(4) A stored water source with an automatically operated pump

(5) A well with a pump of sufficient capacity and pressure to meet the sprinkler system demand. The stored water requirement of 6.1.2 or 6.1.3 shall be permitted to be a combination of the water in the well (including the refill rate) plus the water in the holding tank if such tank can supply the sprinkler system.

6.2.2 Where a *well*, pump, tank *or combination thereof* is the source of supply for a fire sprinkler system, *the water supply shall serve both domestic and fire sprinkler systems, and* the following shall be met:

(1) A test connection shall be provided downstream of the pump that creates a flow of water equal to the smallest sprinkler on the system. The connection shall return water to the tank.

(2) Any disconnecting means for the pump shall be approved.

(3) A method for refilling the tank shall be piped to the tank.

(4) A method of seeing the water level in the tank shall be provided without having to open the tank.

(5) The pump shall not be permitted to sit directly on the floor.

6.2.2.1 *Where a fire sprinkler system is supplied by a stored water source with an automatically operated means of pressurizing the system other than an electric pump, the water supply may serve the sprinkler system only.*

6.2.4 *Where a water supply serves both domestic and fire sprinkler systems, 5 gpm (19 L/min) shall be added to the sprinkler system demand at the point where the systems are connected, to determine the size of common piping and the size of the total water supply requirements where no provision is made to prevent flow into the domestic water system upon operation of a sprinkler.*

Add an asterisk to 8.3.3 and add a new A.8.3.3 to read as follows:

8.3.3* Antifreeze Systems.

A.8.3.3 Where protection of pipes from freezing is a concern, options other than antifreeze are available. Such alternatives include running the piping in warm spaces, tenting insulation over pipe, dry-pipe systems, and preaction systems.

Revise 8.3.3.2.1 to read as follows:

8.3.3.2.1* Unless permitted by 8.3.3.2.1.1, antifreeze solutions shall be limited to premixed antifreeze solutions of glycerine (chemically pure or United States Pharmacopoeia 96.5 percent) at a maximum concentration of 50 percent by volume, propylene glycol at a maximum concentration of 40 percent by volume, or other solutions listed specifically for use in fire protection systems.

Add a new 8.3.3.2.1.1 to read as follows:

8.3.3.2.1.1 For existing systems, antifreeze solutions shall be limited to premixed antifreeze solutions of glycerine (chemically pure or United States Pharmacopoeia 96.5 percent) at a maximum concentration of 50 percent by volume, propylene glycol at a maximum concentration of 40 percent by volume, or other solutions listed specifically for use in fire protection systems.

Delete 8.3.3.2.2 and 8.3.3.2.3 and related Annex material A.8.3.3.2.3.

TABLE A.8.3.3.2.1 PROPERTIES OF GLYCERINE AND PROPYLENE GLYCOL

MATERIAL	SOLUTION (by volume)	SPECIFIC GRAVITY AT 60ºF (15.6ºC)	FREEZING POINT	
			ºF	ºC
Glycerine (C.P. or U.S.P. grade)	50% water	1.145	-20.9	-29.4
Hydrometer scale 1.000 to 1.200				
Propylene glycol	60% water	1.034	-6	-21.1
Hydrometer scale 1.000 to 1.200 (subdivisions 0.002)				

C.P.: Chemically Pure; U.S.P.: United States Pharmacopoeia 96.5%.

NFPA—continued

Move Table 8.3.3.2.3 to the annex and renumber as Table A.8.3.3.2.1 while deleting the rows in the table dealing with glycerine and 40 percent water, glycerine and 30 percent water, propylene glycol and 50 percent water and propylene glycol and 40 percent water. Add an annex note so that the annex and Table would appear as follows:

A.8.3.3.2.1 See Table A.8.3.3.2.1.

Renumber 8.3.3.2.3.1 to 8.3.3.2.2.

8.3.3.2.2 The concentration of antifreeze solutions shall be limited to the minimum necessary for the anticipated minimum temperature.

Delete 8.3.3.2.4, 8.3.3.2.5 and Table 8.3.3.2.5.

Renumber 8.3.3.2.6 as 8.3.3.2.3 and renumber A.8.3.3.2.6 as A.8.3.3.2.3. Also renumber Figure A.8.3.3.2.6 as Figure A.8.3.3.2.3.

8.3.3.2.3* An antifreeze solution with a freezing point below the expected minimum temperature for the locality shall be installed.

A.8.3.3.2.3 Beyond certain limits, an increased proportion of antifreeze does not lower the freezing point of the solution (*see Figure A.8.3.3.2.3*). Glycerine, diethylene glycol, ethylene glycol, and propylene glycol never should be used without mixing with water in the proper proportions, because these materials tend to thicken near 32°F (0°C).

Renumber 8.3.3.2.7 as 8.3.3.2.4 and revise to read as follows:

8.3.3.2.4 The specific gravity of the antifreeze shall be checked by a hydrometer with a scale having 0.002 subdivisions in accordance with Figure 8.3.3.2.4(a) and 8.3.3.2.4(b).

Renumber Figure 8.3.3.2.3(a) as Figure 8.3.3.2.4(a) and delete the 50 percent curve.

Renumber Figure 8.3.3.2.3(b) as Figure 8.3.3.2.4(b) and delete the 60 percent and 70 percent curves.

8.6.4* Sprinklers shall not be required in *detached* garages, open attached porches, carports *with no habitable space above,* and similar structures.

13R—*10* Installation of Sprinkler Systems in Residential Occupancies Up to and Including Four Stories in Height *as amended** 903.3.1.2, 903.3.5.1.1, 903.3.5.1.2, 903.4

***NFPA 13R, Amended Sections as follows:**

Revise Section 2.2 and add publications as follows:

2.2 NFPA Publications.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems, 2006 California* edition.

Add Section 6.3.5 as follows:

6.3.5 Instructions.

The installing contractor shall provide the property owner or the property owner's authorized representative with the following:

(1) All literature and instructions provided by the manufacturer describing proper operation and maintenance of any equipment and devices installed

(2) NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems 2006 California Edition and Title 19, California Code of Regulations, Chapter 5.

(3) Once the system is accepted by the authority having jurisdiction a label as prescribed by Title 19, California Code of Regulations, Chapter 5, shall be affixed to each system riser.

14—07	Installation of Standpipe and Hose System, *as amended**	905.2, 905.3.4, 905.4.2, 905.6.2, 905.8

NFPA 14, Amended Sections as follows:

Replace Section 6.3.7.1

6.3.7.1 *System water supply valves, isolation control valves, and other valves in fire mains shall be supervised in an approved manner in the open position by one of the following methods:*

(1) Where a building has a fire alarm system or a sprinkler monitoring system installed, the valve shall be supervised by:

(a) a central station, proprietary, or remote supervising station, or

(b) a local signaling service that initiates an audible signal at a constantly attended location.

(2) Where a building does not have a fire alarm system or a sprinkler monitoring system installed, the valve shall be supervised by:

(a) Locking the valves in the open position, or

(b) Sealing of valves and a approved weekly recorded inspection where valves are located within fenced enclosures under the control of the owner.

15—01	*Water Spray Fixed Systems for Fire Protection*	
16—07	Installation of Foam-water Sprinkler and Foam-water Spray Systems	904.7, 904.11

NFPA—continued

17—02	Dry Chemical Extinguishing Systems	904.6, 904.11
17A—02	Wet Chemical Extinguishing Systems	904.5, 904.11
20—07	Installation of Stationary Pumps for Fire Protection	913.1, 913.2.1, 913.5
22—03	*Water Tanks for Private Fire Protection*	
24—10	*Installation of Private Fire Service Mains and Their Appurtenances, as amended**	

NFPA 24, Amended Sections as follows:

Amend Section 4.2.1

Section 4.2.1. Installation work shall be done by fully experienced and responsible *contractors. Contractors shall be appropriately licensed in the State of California to install private fire service mains and their appurtenances.*

Revise Section 4.2.2 as follows:

4.2.2 *Installation or modification of private fire service mains shall not begin until plans are approved and appropriate permits secured from* the authority having jurisdiction.

Add Section 4.2.2.1 as follows:

4.2.2.1 *As approved by the authority having jurisdiction, emergency repair of existing system may start immediately, with plans being submitted to the authority having jurisdiction within 96 hours from the start of the repair work.*

Revise Section 5.9.1.2 as follows:

Section 5.9.1.2 Fire department connections shall be properly supported *and protected from mechanical damage.*

Revise Section 5.9.5.1 as follows:

5.9.5.1 Fire department connections shall be on the street side of buildings and *as approved by the authority having jurisdiction.*

Revise Section 6..5.1 as follows:

6.5.1 *Private* fire service main systems shall have sectional control valves at appropriate points in order to permit sectionalizing the system in the event of a break or for the making of repairs or extensions.

Add Sections 6.5.2.1 – 6.5.2.3

6.5.2.1 *Sectional control valves are not required when the fire service main system serves less than six fire appurtenances.*

6.5.2.2 *Sectional control valves shall be indicating valves in accordance with Section 6.7.1.3.*

6.5.2.3 *Sectional control valves shall be located so that no more than five fire appurtenances are affected by shut-down of any single portion of the fire service main. Each fire hydrant, fire sprinkler system riser, and standpipe riser shall be considered a separate fire appurtenance. In-rack sprinkler systems shall not be considered as a separate appurtenance.*

6.5.2.4 *The number of fire appurtenances between sectional control valves is allowed to be modified by the authority having jurisdiction.*

Revise Section 6.6.2 as follows:

6.6.2 A sectional valve shall be provided at the following locations:

(1) On each bank where a main crosses *a body of* water

(2) Outside the building foundation(s) where a main or a section of a main runs under a building

Revise Section 10.6.5 as follows:

10.6.5 Pipe joints shall not be located under foundation footings. *The pipe under the building or building foundation shall not contain mechanical joints*.

Exceptions:

1. Where allowed in accordance with Section 10.6.2

2. Alternate designs may be utilized where designed by a registered professional engineer and approved by the enforcing agency.

Revise Section 10.9.1 as follows:

10.9.1 *Backfill shall be well tamped in layers or puddle under and around pipes to prevent settlement or lateral movement.* Backfill shall consist of clean fill sand or pea gravel to a minimum 6" below and to a minimum of 12" above the pipe *and shall*

	contain no ashes, cinders, refuse, organic matter, or other corrosive materials. Other backfill materials and methods are permitted where designed by a registered professional engineer and approved by the enforcing agency.	
30—08	Flammable and Combustible Liquids Code	415.3
31—06	Installation of Oil-burning Equipment	2113.15
32—07	Dry Cleaning Plants	415.6.4
37—06	*Installation and Use of Stationary Combustion Engines and Gas Turbines*	
	NFPA—continued	
40—07	Storage and Handling of Cellulose Nitrate Film	409.1
52—06	*Compressed Natural Gas (CNG) Vehicular Fuel Systems Code*	
54—09	*National Fuel Gas Code*	
58—08	Liquefied Petroleum Gas Code	415.6.3
61—08	Prevention of Fires and Dust Explosions in Agricultural and Food Product Facilities	415.6.1
70—08	National Electrical Code	108.3, 415.8.2.8.2, 904.3.1, 907.6.1, 909.12.1, 909.16.3, 1205.4.1, 2701.1, 3401.3, H106.1, H106.2, K101, K111.1
72—*10*	National Fire Alarm Code, *as amended**	901.6, 903.4.1, 904.3.5, 907.2, 907.2.5, 907.2.11, 907.2.13.2, 907.3, 907.3.3, 907.3.4, 907.5.2.1.2, 907.5.2.2, 907.6, 907.6.1, 907.6.5, 907.7, 907.7.1, 907.7.2, 911.1.5, 3006.5, 3007.6

NFPA 72, Amended Sections as follows:

10.3.1 Equipment constructed and installed in conformity with this code shall be listed for the purpose for which it is used. *Fire alarm systems and components shall be California State Fire Marshal approved and listed in accordance with California Code of Regulations, Title 19, Division 1.*

10.3.3 All devices and appliances that receive their power from the initiating device circuit or signaling line circuit of a control unit shall be *California State Fire Marshal* listed for use with the control unit.

10.6.1 *Where approved by the authority having jurisdiction,* ECS priority signals when evaluated by stakeholders through risk analysis in accordance with 24.4.2.2 shall be permitted to take precedence over all other signals.

14.4.7.1 Testing. Household fire alarm systems shall be tested *in accordance with the manufacturer's published instructions* according to the methods of Table 14.4.2.2.

17.15 Fire Extinguisher Monitoring Device. A fire extinguisher monitoring device shall indicate those conditions for a specific fire extinguisher required by *California Code of Regulations, Title 19, Division 1, Chapter 1, Section 574.2(c) and California Fire Code to a fire alarm control unit.*

21.3.6 Smoke detectors shall not be installed in unsprinklered elevator hoistways unless they are installed to activate the elevator hoistway smoke relief equipment *or where required by Chapter 30 of the California Building Code*.

23.4.2.2 (4) Where the vertically run conductors are contained in a 2-hour rated cable assembly, or enclosed (installed) in a 2-hour rated enclosure or a listed circuit integrity (C.I.) cable, which meets or exceeds a 2-hour fire resistive rating.

23.8.5.1.2 Where connected to a supervising station, fire alarm systems employing automatic fire detectors or waterflow detection devices shall include a manual fire alarm box to initiate a signal to the supervising station.

Exception: Fire alarm systems dedicated to elevator recall control, supervisory service *and fire sprinkler monitoring.*

23.8.5.4.1 Systems equipped with alarm verification features shall be permitted under the following conditions:

(1) The alarm verification feature is not initially enabled unless conditions or occupant activities that are expected to cause nuisance alarms are anticipated in the area that is protected by the smoke detectors. Enabling of the alarm verification feature shall be protected by password or limited access.

(2) A smoke detector that is continuously subjected to a smoke concentration above alarm threshold does not delay the system functions of Sections 10.6 through 10.13, 23.8.1.1, or 21.2.1 by more than *30 seconds*.

(3) Actuation of an alarm-initiating device other than a smoke detector causes the system functions of 4.4.3, 6.8.1.1, or 6.16.2.1 without additional delay.

(4) The current status of the alarm verification feature is shown on the record of completion *(see Figure 4.5.2.1, item 10).*

(5) Operation of a patient room smoke detector in I-2 and R-2.1 Occupancies shall not include an alarm verification feature.

29.3.1 All devices, combinations of devices, and equipment to be installed in conformity with this chapter shall be approved or listed *by the California State Fire Marshal* the for the purposes for which they are intended.

29.5.2.1.1* Smoke and Heat Alarms. Unless exempted by applicable laws, codes, or standards, smoke or heat alarms used to provide a fire-warning function, and when two or more alarms are installed within a dwelling unit, suite of rooms, or similar area, shall be arranged so that the operation of any smoke or heat alarm causes all alarms within these locations to sound.

29.7.2.1 *The alarm verification feature shall not be used for household fire warning equipment.*

29.7.5.7.1 *The alarm verification feature shall not be used for household fire warning equipment.*

80—07	Fire Doors and Other Opening Protectives	410.3.5, 508.2.5.2, 715.4, 715.4.5, 715.4.6, 715.4.7.1, 715.4.8.2, 715.5, 715.5.5, 1008.1.4.3
85—07	Boiler and Combustion System Hazards Code	415.6.1
	(Note: NFPA 8503 has been incorporated into NFPA 85)	
92A—09	*Standard for Smoke-Control Systems Utilizing Barriers and Pressure Differences*	
92B—05	Smoke Management Systems in Malls, Atria and Large Spaces	909.8
99—05	Standard for Health Care Facilities	407.9
101—06	Life Safety Code	1028.6.2
105—07	Standard for the Installation of Smoke Door Assemblies	405.4.2, 715.4.3.1, 909.20.4.1

110—05	Emergency and Standby Power Systems	2702.1
	NFPA—continued	
111—05	Stored Electrical Energy Emergency and Standby Power Systems	2702.1
120—04	Coal Preparation Plants	415.6.1
170—06	*Standard for Fire Safety and Emergency Symbols*	*907.1.2*
211—06	Chimneys, Fireplaces, Vents and Solid Fuel-burning Appliances	2112.5
252—03	Standard Methods of Fire Tests of Door Assemblies	715.3, 715.4.1, 715.4.2, 715.4.3, 715.4.7.3.1
253—06	Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source	402.12.1, 406.6.4, 804.2, 804.3
257—07	Standard for Fire Test for Window and Glass Block Assemblies	715.3, 715.4.3.2, 715.5, 715.5.1, 715.5.2, 715.5.9.1
259—03	Test Method for Potential Heat of Building Materials	2603.4.1.10, 2603.5.3
265—07	Method of Fire Tests for Evaluating Room Fire Growth Contribution of Textile Wall Coverings on Full Height Panels and Walls	803.1.3, 803.1.3.1
268—07	Standard Test Method for Determining Ignitibility of Exterior Wall Assemblies Using a Radiant Heat Energy Source	1406.2.1, 1406.2.1.1, 1406.2.1.2, 2603.5.7, D105.1
285—06	Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Nonload-bearing Wall Assemblies Containing Combustible Components	1407.10.4, 2603.5.5
286—06	Standard Method of Fire Test for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth	402.16.4, 803.1.2, 803.1.2.1, 803.9, 2603.4, 2603.9
288—07	Standard Method of Fire Tests of Floor Fire Door Assemblies Installed Horizontally in Fire-resistance-rated Floor Systems	712.8
409—04	Aircraft Hangars	412.4.6, Table 412.4.6, 412.4.6.1, 412.6.5
418—06	Standard for Heliports	412.7.4
484—06	Combustible Metals	415.6.1
654—06	Prevention of Fire & Dust Explosions from the Manufacturing, Processing and Handling of Combustible Particulate Solids	415.6.1
655—07	Prevention of Sulfur Fires and Explosions	415.6.1
664—07	Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities	415.6.1
701—04	Standard Methods of Fire Tests for Flame-propagation of Textiles and Films	402.12.1, 410.3.6, 801.1.4, 806.1, 806.1.2, 806.2, 3102.3, 3102.3.1, 3102.6.1.1, 3105.4, D102.2.8, H106.1.1
704—07	Standard System for the Identification of the Hazards of Materials for Emergency Response	414.7.2, 415.2
720	*Standard for the Installation of Carbon Monoxide (CO) Detection and Warning Equipment 2009 Edition*	*420.4*
1124—06	Manufacture, Transportation and Storage of Fireworks and Pyrotechnic Articles	415.3.1
2001—08	Clean Agent Fire Extinguishing Systems, *as amended**	Table 901.6.1, 904.10
	***NFPA 2001, Amended Sections as follows:**	
	***4.3.5.1.1** Alarms signals from the fire extinguishing system shall not interfere with the building fire alarm signal.*	
	***4.3.5.2.1** The lens on visual appliances shall be "red" in color.*	
	Exception: Other lens colors are permitted where approved by the enforcing agency.	

Exception: Other lens colors are permitted where approved by the enforcing agency.

PCI

Precast Prestressed Concrete Institute
209 W. Jackson Boulevard, Suite 500
Chicago, IL 60606-6938

Standard Reference Number	Title	Referenced in code section number
MNL 124-89	Design for Fire Resistance of Precast Prestressed Concrete	721.2.3.1
MNL 128-01	Recommended Practice for Glass Fiber Reinforced Concrete Panels	1903.2
PCI 120-10	*PCI Design Handbook 7th Edition*	*1908A.1*

PTI

Post-Tensioning Institute
8601 North Black Canyon Highway, Suite 103
Phoenix, AZ 85021

Standard Reference Number	Title	Referenced in code section number
PTI-2004	*Recommendations for Prestressed Rock and Soil Anchors (4th Edition)*	1811A.2, 1810A.3.10.4, J106.2.5
PTI-2007	Standard Requirements for Analysis of Shallow Concrete Foundations on Expansive Soils, Third Edition	1808.6.2
PTI-2007	Standard Requirements for Design of Shallow Post-tensioned Concrete Foundation on Expansive Soils, Second Edition	1808.6.2

SFM

State of California
Department of Forestry and Fire Protection
Office of the State Fire Marshal
P.O. Box 944246
Sacramento, CA 94246-2460

Standard Reference Number	Title	Referenced in code section number
12-3	*Releasing Systems for Security Bars in Dwellings*	1029.4
12-7-3	*Fire-testing Furnaces*	NA
12-7A-1	*Exterior Wall Siding and Sheathing*	703A.7, 707A.2
12-7A-2	*Exterior Window*	703A.7, 708A.2.1
12-7A-3	*Under Eave*	703A.7, 707A.8
12-7A-4	*Decking*	703A.7, 709A.3
SFM 12-7A-4A	*Decking Alternate Method A*	703A.7, 709A.3
SFM 12-7A-5	*Ignition Resistant Building Material*	703A.7, 709A.3
12-8-100	*Room Fire Tests for Wall and Ceiling Materials*	NA
12-10-1	*Power Operated Exit Doors*	NA
12-10-2	*Single Point Latching or Locking Devices*	NA
12-10-3	*Emergency Exit and Panic Hardware*	NA

(The Office of the State Fire Marshal standards referred to above are found in the California Code of Regulations, Title 24, Part 12.)

RMI

Rack Manufacturers Institute
8720 Red Oak Boulevard, Suite 201
Charlotte, NC 28217

Standard Reference Number	Title	Referenced in code section number
ANSI/MH16.1-08	Specification for Design, Testing and Utilization of Industrial Steel Storage Racks	2208.1

SDI

Steel Deck Institute
P. O. Box 25
Fox River Grove, IL 60021

Standard Reference Number	Title	Referenced in code section number
ANSI/NC1.0-06	Standard for Noncomposite Steel Floor Deck	2209.2.2, 2209.2.2.1
ANSI/RD1.0-06	Standard for Steel Roof Deck	2209.2.3

SJI

Steel Joist Institute
1173B London Links Drive
Forest, VA 24551

Standard Reference Number	Title	Referenced in code section number
CJ-1.0-06	Standard Specification for Composite Steel Joists, CJ-series	1604.3.3, 2203.2, 2206.1
JG-1.1-05	Standard Specification for Joist Girders	1604.3.3, 2203.2, 2206.1
K-1.1-05	Standard Specification for Open Web Steel Joists, K-series	1604.3.3, 2203.2, 2206.1
LH/DLH-1.1-05	Standard Specification for Longspan Steel Joists, LH-series and Deep Longspan Steel Joists, DLH-series	1604.3.3, 2203.2, 2206.1

SPRI

Single-Ply Roofing Institute
411 Waverly Oaks Road, Suite 331B
Waltham, MA 02452

Standard Reference Number	Title	Referenced in code section number
SPRI/ANSI/ES-1-03	Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems	1504.5
RP-4-02	Wind Design Guide for Ballasted Single-ply Roofing Systems	1504.4

TIA

Telecommunications Industry Association
2500 Wilson Boulevard
Arlington, VA 22201-3834

Standard Reference Number	Title	Referenced in code section number
TIA-222-G-05	Structural Standards for Steel Antenna Towers and Antenna Supporting Structures including-Addendum 1, 222-G-1, Dated 2007	1609.1.1, 3108.1, 3108.2

TMS

The Masonry Society
3970 Broadway, Unit 201-D
Boulder, CO 80304-1135

Standard		Referenced

Reference Number	Title	in code section number
0216-97	Standard Method for Determining Fire Resistance of Concrete and Masonry Construction Assemblies	Table 720.1(2), 721.1
0302-07	Standard Method for Determining the Sound Transmission Class Rating for Masonry Walls	1207.2.1
402-08	Building Code Requirements for Masonry Structures	1405.6, 1405.6.2, 1405.10, 1604.3.4, Table 1703.4.5.3, 1704.5, 1704.5.1, Table 1704.5.1, 1704.5.2, 1704.5.3, 1807.1.6.3.2, 1808.9, 2101.2.2, 2101.2.3, 2101.2.4, 2101.2.5, 2101.2.6, 2103.1.3.6, 2106.1, 2107.1, 2107.2, 2107.3, 2107.4, 2107.5, 2108.1, 2108.2, 2108.3, 2109.1, 2109.1.1, 2109.2, 2109.2.1, 2109.3, 2110.1
602-08	Specification for Masonry Structures	1405.6.1, Table 1704.5.1, Table 1704.5.3, 1807.1.6.3, 2103.8, 2103.11, 2103.12, 2103.13, 2104.1, 2104.1.1, 2104.1.2 2104.1.3, 2104.2, 2104.3, 2104.4, 2105.2.2.1.1, 2105.2.2.1.2, 2105.2.2.1.3

TPI

Truss Plate Institute
218 N. Lee Street, Suite 312
Alexandria, VA 22314

Standard Reference Number	Title	Referenced in code section number
TPI 1-2007	National Design Standards for Metal-plate-connected Wood Truss Construction	2303.4.6, 2306.1

UBC

International Code Council, Inc.
500 New Jersey Avenue, NW 6th Floor
Washington, DC 20001

Standard reference number	*Title*	*Referenced in code section number*
UBC Standard 15-2	*Test Standard for Determining the Fire Retardancy of Roof-Covering Materials*	*1505.6*
UBC Standard 15-3	*Wood Shakes*	*1505.6*
UBC Standard 15-4	*Wood Shingles*	*1505.6*

UL

Underwriters Laboratories, Inc.
333 Pfingsten Road
Northbrook, IL 60062-2096

Standard reference number	Title	Referenced in code section number
9—2000	Fire Tests of Window Assemblies—with Revisions through April 2005	715.3, 715.4.3.2, 715.5, 715.5.1, 715.5.2, 715.5.9.1
10A—98	Tin Clad Fire Doors—with Revisions through March 2003	715.4
10B—97	Fire Tests of Door Assemblies—with Revisions through October 2001	715.4.2
10C—98	Positive Pressure Fire Tests of Door Assemblies—with Revisions through November 2001	715.4.1, 715.4.3
13—96	*Power-limited Circuit Cables*	
14B—98	Sliding Hardware for Standard Horizontally-mounted Tin Clad Fire Doors—with Revisions through July 2000	715.4
14C—06	Swinging Hardware for Standard Tin Clad Fire Doors Mounted Singly and in Pairs	715.4
38—99	*Manually Actuated Signaling Boxes—with revisions through February 2, 2005 as amended.**	

Amend Section 14.1.5 as follows:

14.1.5 *A signaling box having a glass panel, disc, rod or similar part that must be broken to operate it for a signal or for access to its actuating means shall satisfactorily complete five part-breaking operations using the means provided with the box, without jamming of the mechanism or other interference by broken particles. It shall be practicable to remove and replace the broken parts. A signaling box shall not have a glass panel, disc, rod or similar part requiring a striking action by grasping a tool to operate it for a signal. The force required to activate controls shall be no greater than 5 pounds (22 N) of force.*

Add Appendix B chapter to UL 38 (1999) as follows:

	Appendix B,	
	14.1.5 Operation. *Controls and operating mechanisms shall be operable with one hand and shall not require tight grasping, pinching or twisting of the wrist.*	
103—01	Factory-built Chimneys, for Residential Type and Building Heating Appliances —with Revisions through June 2006	717.2.5.1
127—96	Factory-built Fireplaces—with Revisions through November 2006	717.2.5.1, 2111.11
193—04	*Alarm Valves for Fire-Protection Service*	
199—95	*Automatic Sprinklers for Fire Protection Service—with revisions through August 19, 2005*	
199E—04	Outline of Investigation for Fire Testing of Sprinklers and Water Spray Nozzles for Protection of Deep Fat Fryers	904.11.4.1
217—06	Single and Multiple Station Smoke Alarms—with Revisions through August 2005	907.2.11
228—97	*Door Closers/Holders, with or without Integral Smoke Detectors—with revisions through January 26, 2006*	
260—04	*Dry Pipe and Deluge Valves for Fire Protection Service*	
262—04	*Gate Valves for Fire Protection Service*	
263—03	Standard for Fire Test of Building Construction and Materials	703.2, 703.2.1, 703.2.3, 703.3, 703.5, 704.12, 705.7, 707.7, 712.3.2, 713.3.1, 713.4.1.1, 714.1, 715.2, 716.5.2, 716.5.3, 716.6.1, Table 716.6.2(1), Table 720.1(1), 1407.10.2, 2103.2, 2603.4, 2603.5.1
268—06	Smoke Detectors for Fire Protective Signaling Systems—with Revisions through January 1999	407.7, 907.2.6.2
268A—98	*Smoke Detectors for Duct Application—with revisions through October 22, 2003*	
300—05	Fire Testing of Fire Extinguishing Systems for Protection of Restaurant Cooking Areas	904.11
305—07	Panic Hardware	1008.1.10
312—04	*Check Valves for Fire-Protection Service*	
325—02	Door, Drapery, Gate, Louver and Window Operations and Systems—with Revisions through February 2006	406.1.5, 3110.4
346—05	*Waterflow Indicators for Fire Protective Signaling Systems*	
464—03	*Audible Signal Appliances—with revisions through October 10, 2003*	
497B—04	*Protectors for Data Communication and Fire Alarm Circuits*	
	UL—continued	
521—99	*Heat Detectors for Fire Protective Signaling Systems—with Revisions through July 20, 2005*	
539—00	*Single- and Multiple-Station Heat Detectors—with Revisions through August 15, 2005*	
555—2006	Fire Dampers	716.3
555C—2006	Ceiling Dampers	716.3, 716.6.2
555S—99	Smoke Dampers—with Revisions through July 2006	716.3, 716.3.1.1
580—2006	Test for Uplift Resistance of Roof Assemblies	1504.3.1, 1504.3.2
632—00	*Electrically Actuated Transmitters*	
641—95	Type L Low-temperature Venting Systems—with Revisions through August 2005	2113.11.1.4
710B—04	Recirculating Systems—with Revisions through April 2006	904.11
723—03	Standard for Test for Surface Burning Characteristics of Building Materials—with Revisions through May 2005	402.11, 402.16.4, 406.5.3, 703.4.2, 719.1, 719.4, 802.1, 803.1.1, 803.9, 806.5, 1407.9, 1407.10.1, 2303.2, 2603.3, 2603.4.1.13, 2603.5.4, 2604.2.4, 2606.4, 3105.4, D102.2.8
753—04	*Alarm Accessories for Automatic Water Supply Valves for Fire Protection Service*	
790—04	Standard Test Methods for Fire Tests of Roof Coverings	1505.1, 2603.6, 2610.2, 2610.3
793—03	Standards for Automatically Operated Roof Vents for Smoke and Heat—with Revisions through April 2004	910.3.1
813—96	*Commercial Audio Equipment—with revisions through December 7, 1999*	
864—03	*Control Units for Fire Protective Signaling Systems, as amended*—with*	909.12

	revisions through July 14, 2005 ***Amend No. 55.1 as follows:*** ***RETARD-RESET-RESTART PERIOD – MAXIMUM 30 SECONDS**—No alarm obtained from control unit. Maximum permissible time is 30 seconds.* ***Amend Section 55.2.2 as follows:*** *Where an alarm verification feature is provided, the maximum retard-reset-restart period before an alarm signal can be confirmed and indicated at the control unit, including any control unit reset time and the power-up time for the detector to become operational for alarm, shall not exceed 30 seconds. (The balance of the section text is to remain unchanged).* **Add Section 55.2.9 as follows:** *Smoke detectors connected to an alarm verification feature shall not be used as releasing devices.* ***Exception:** Smoke detectors which operate their releasing function immediately upon alarm actuation independent of alarm verification feature.* ***Amend Section 89.1.10 as follows:*** The existing text of this section is to remain as printed with one editorial amendment as follows: ***THE TOTAL DELAY (CONTROL UNIT PLUS SMOKE DETECTORS) SHALL NOT EXCEED 30 SECONDS.*** (The balance of the section text is to remain unchanged).	
924—06	Standard for Safety Emergency Lighting and Power Equipment	1011.4
1040—96	Fire Test of Insulated Wall Construction—with Revisions through June 2001	1407.10.3, 2603.4, 2603.9
1256—02	Fire Test of Roof Deck Construction—with Revisions through January 2007	1508.1, 2603.3, 2603.4.1.5
1479—03	Fire Tests of Through-penetration Firestops—with Revisions through April 2007	702.1, 713.3.1.2, 713.3.2, 713.4.1.1.2
1482—96	Solid-fuel-type Room Heater—with Revisions through November 2006	2112.2, 2112.5
1715—97	Fire Test of Interior Finish Material—with Revisions through March 2004	1407.10.2, 1407.10.3, 2603.4, 2603.9
1777—04	Chimney Liners	2113.11.1, 2113.19
1784—01	Air Leakage Tests of Door Assemblies—with Revisions through December 2004	708.14.1, 711.5.2, 715.4.3.1, 715.4.6.1, 715.4.6.3, 3007.4.3
1897—04	Uplift Tests for Roof Covering Systems	1504.3.1
1975—06	Fire Test of Foamed Plastics Used for Decorative Purposes	402.11, 402.12.1, 402.16.5
1994—04	Standard for Luminous Egress Path Marking Systems—with Revisions through February 2005	411.7, 1024.2.1, 1024.2.3, 1024.2.4, 1024.4
2017—2000	Standards for General-purpose Signaling Devices and Systems—with Revisions through August 2005	3109.4.1.8
2034	*Single and Multiple Station Carbon Monoxide Alarms Effective August 1, 2009*	*420.4*
2075	*Gas and Vapor Detectors and Sensors Effective September 1, 2009*	*420.4*
2075—2007	Standard for Gas and Vapor Detectors and Sensors	406.6.6.1
2079—04	Tests for Fire Resistance of Building Joint Systems—with Revisions through March 2006	702.1, 714.3, 714.6
2200—04	Stationary Engine Generator Assemblies—with Revisions through July 2004	2702.1.1

ULC

Underwriters Laboratories of Canada
7 Underwriters Road
Toronto, Ontario, Canada M1R3B4

Standard Reference Number	Title	Referenced in code section number
CAN/ULC S102.2-1988	Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies-with 2000 Revisions	719.4

USC

United States Code
c/o Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402-9325

Standard Reference Number	Title	Referenced in code section number
18 USC Part 1, Ch.40	Importation, Manufacture, Distribution and Storage of Explosive Materials	307.2

Window and Door Manufacturers Association
1400 East Touhy Avenue #470

WDMA

Des Plaines, IL 60018

Standard Reference Number	Title	Referenced in code section number
AAMA/WDMA/CSA 101/I.S.2/A440-08	Specifications for Windows, Doors and Unit Skylights	1715.5.1, 2405.5

WRI

Wire Reinforcement Institute, Inc.
942 Main Street, Suite 300
Hartford, CT 06103

Standard Reference Number	Title	Referenced in code section number
WRI/CRSI-81	Design of Slab-on-ground Foundations-with 1996 Update	1808.6.2

Top Previous Section Next Section To view the next subsection please select the Next Section option.

4. TRADE STANDARDS AND MANUFACTURERS INSTALLATION INSTRUCTIONS

A. Trade Associations

B. Manufacturer's Installation Instructions

C. Building Information Modeling (BIM)

D. Case Study: Window Flashing

Window Flashing: PFCS CM Project

D. Case Study

Window Flashing

Manufacturers
Installation Instructions

D. Case Study

Window Flashing

UBC Standard 14-1

Kraft waterproof building paper, Volume 3

Material, Testing and Installation Standards

Shown in Volume 3 of the Uniform Building Code which contains material, testing and installation standards.

D. Case Study

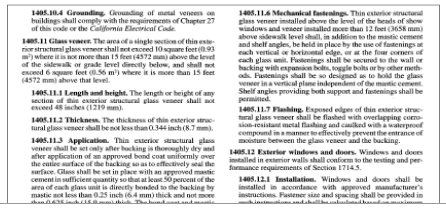
Window Flashing

60 Minute Super Jumbo Tex

Manufacturer's propriety specification for Kraft Waterproof Building Paper

D. Case Study

2010 California Building Code
Chapter 14: Exterior Walls
Section 1405.13



1405.13 Exterior windows and doors. Windows and doors installed in exterior walls shall conform to the testing and performance requirements of Section 1715.5.

1405.13.1 Installation. Windows and doors shall be installed in accordance with *approved* manufacturer's instructions. Fastener size and spacing shall be provided in such instructions and shall be calculated based on maximum loads and spacing used in the tests.

5. MANAGING CONSTRUCTION QUALITY

A. The Good Old Days and The New World

Successful construction projects used to go something like this: Owners would hire experienced, hard working Architects and Engineers who developed plans and specifications that were not perfect, but good enough that experienced, hard working General Contractors could hire experienced, hard working Trade Contractors to do the work of making a project happen. We worked through the inherent difficulties of construction by working long hours, keeping our word and understanding that “stuff happens”. We accepted that no project was perfect, that people screw up, and knew that
there was little use in crying over spilled milk. The satisfaction of a job well done carried us through the toughest days.

A. The Good Old Days and The New World

Construction professionals are living in a new world:

- Consumers expect increasing quality and decreasing prices in all products.
- The building industry is not keeping pace with the quality and price advances many industries are making.
- Consumers are more litigious than ever and there is a proliferation of attorneys.
- The building industry is not attracting the best and brightest young people.
- The built-environment has been altered in the last 20 years, including increased complexity, less fault-tolerant materials, and tighter, slower drying buildings.
- Consumers are more conscious of building-related health issues than ever.
- In some areas, a lack of skilled construction labor makes the construction professional's job even more critical

B. DBSKCV Construction Management Method

Pete Fowler CONSTRUCTION Services, Inc.

B. DBSKCV Construction Management Method

Define the Scope of Work (this includes the design phase).

Budget: identify how much the project will cost the contractor and owner.

Schedule when the construction will happen (and share this information).

Contract (K): Who is doing what? Everyone should know what to expect.

Coordinate the construction.

Verify, document and communicate that everyone is doing what they should.

C. Project Definition: Standards & Codes

The “Define” phase of construction management consists of documenting the work to be performed. This is usually graphic and written with plans, specs, references to codes and standards, and detailed “Scope of Work” documents.

Getting a clear, specific and detailed project scope is the first step in the construction project management process and it is where a project’s “quality” is established.

D. Definitions

• Plans and Details: Graphic representation of construction.
• Specifications: Specs are the written representation of construction, which usually includes a greater level of detail regarding construction performance, process, products, and quality.
• Construction Contract: Agreement between two or more parties for the delivery of construction; plans and specifications are used as the definition of what is being bought and sold.
• Standards: Documents, with graphic and written information, referenced by plans, specifications and construction contracts, which specify performance criteria and/or methods in greater detail than typical plans or specifications. Standards are created by standards setting bodies like ASTM, product manufactures, and industry trade groups.

5. MANAGING CONSTRUCTION QUALITY

D. Definitions

• Scope of Work: The written representation of all labor, materials and equipment required to complete the project described in the contract documents. A list or description of the responsibilities for various categories of work plus exclusions; serves to memorialize a meeting of the minds as to what is being bought and sold. It should conform to the fundamentals of a 2 or 3 level "Work Breakdown Structure" collectively representing 100% of the project scope.
• Hold-Point: Critical time in the construction process where construction should stop for verification of conformance with plans, specifications, standards (including performance) and contracts. Verification can include inspection, testing, recording, and reporting.

E. Managing Construction Quality

F. Quality Management Plan

ISO 9001 There are 9 essential steps to be followed through in order to implement ISO 9000 successfully.

Step 1: Top Management Commitment
Step 2: Establish Implementation Team
Step 3: Assess Current Quality System Status
Step 4: Create a Documented Implementation Plan
Step 5: Provide Training
Step 6: Create Documentation
Step 7: Document Control
Step 8: Monitor Progress
Step 9: Review -- Pitfalls to Effective Implementation

G. Independent Quality Review

www.petefowler.com

Independent Quality Review

5/15/2006

Line	Description of Potential Services	Service Level																Typical Durations	
		1A	1B	1C	2A	2B	2C	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	6C	Low	High
1	Evaluation of plans and specifications	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	8	40
2	Evaluation of referenced standards		x	x		x	x		x	x		x	x		x	x		x	x	4	40
3	Evaluation of contracts (scope of work)			x			x			x			x			x			x	4	40
4	Hold Point Development							x	x	x	x	x	x	x	x	x	x	x	x	4	40
5	Mock-Up of Assemblies and Testing										?	?	?	?	?	x	x	x		16	80
6	Recommendations (final)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	8	80
7	Meetings or Teleconferences	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	2	40
8	Review of Updated Design	?	?	?	?	?	?	?	?	?	?	?	?	x	x	x	x	x	x	4	40
9	Visual Inspection				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	4	160
10	Testing							x	x	x	x	x	x	x	x	x	x	x	x	8	80
11	Final Report										x	x	x	x	x	x	x	x	x	8	40
12																					
13	Potential Deliverables																				
14	Opinion Letter re: Evaluation	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
15	Issues List with Recommendations	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
16	Inspection Summary				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
17	Inspection Report										x	x	x	x	x	x	x	x	x		
18	Location Matrix				?	?	?	?	?	?	?	?	?	x	x	x	x	x	x	1	16
19	Hold Points				?	?	?	x	x	x	x	x	x	x	x	x	x	x	x		
20	Testing Protocol							x	x	x	x	x	x	x	x	x	x	x	x		
21	Testing Summary Report							x	x	x	x	x	x	x	x	x	x	x	x		
22	Project Close Report							?	?	?	?	?	?	x	x	x	x	x	x		

H. Case Study: Reroofing of a Condominium Project

Pete Fowler
CONSTRUCTION
Services, Inc.

Managing Construction Quality

The Good Old Days

Successful construction projects used to go something like this: Owners would hire experienced, hard working Architects and Engineers who developed plans and specifications that were not perfect, but good enough that experienced, hard working General Contractors could hire experienced, hard working Trade Contractors to do the work of making a project happen. We worked through the inherent difficulties of construction by working long hours, keeping our word and understanding that "stuff happens". We accepted that no project was perfect, that people screw up, and knew that there was little use in crying over spilled milk. The satisfaction of a job well done carried us through the toughest days.

We didn't spend much time telling specialists, like trade contractors, how to do their job. They had skilled tradesmen, the construction was relatively simple, and most contractors did things pretty much the same. If we had a contract, it was something the "suits" put together, and copies might not be sent to the job site since they had little or no connection to "getting the job done".

The New World

Construction professionals are living in a new world:

- Consumers expect increasing quality and decreasing prices in all products.
- The building industry is not keeping pace with the quality and price advances many industries are making.
- Consumers are more litigious than ever and there is a proliferation of attorneys.
- The building industry is not attracting the best and brightest young people.
- The built-environment has been altered in the last 20 years, including increased complexity, less fault-tolerant materials, and tighter, slower drying buildings.
- Consumers are more conscious of building-related health issues than ever.
- In some areas, a lack of skilled construction labor makes the construction professional's job even more critical.

Construction Management

Our company delivers training in construction management and we have categorized the phases of project planning and management in a framework we call "The DBSKCV™ (pronounced "dib-skiv" - DiB-SKCiV) Method."

Summary of the DBSKCV™ Method

- Define the Scope of Work (this includes the design phase).
- Budget: Identify how much the project will cost the contractors and owner.
- Schedule when the construction will happen and share this information.
- Contract (K): Who is doing what? Everyone should know what to expect.
- Coordinate the construction.
- Verify, document and communicate that everyone is doing what they should.

For details, please read *The DBSKCV™ Construction Management Method*.

Construction Risk Management

Growing legal risks, administrative issues, sky-rocketing workers' compensation costs, increasing fees and taxation, and complicated insurance issues are only a few of the reasons why the price of construction is higher today than ever before. Managing construction risk is a full time vocation for many professionals and beyond the scope of this article (we do training on this too).

THE ABC'S OF RISK MANAGEMENT

- A = Avoid Potentially Dangerous Situations (impossible in construction)
- B = Be Really Good At What You Do
- C = Cover Your Assets

The ABC's apply to Managing Construction Quality because (A.) we must face the fact that "risk avoidance" as a construction professional is impossible, (B.) being good at what you do means doing all you can to make sure a project succeeds, and doing a little bit of someone else's job will sometimes become necessary, and (C.) the best "coverage" is avoiding problems by delivering work that meets expectations. Just accept that buyers expect quality *and* performance, even when they pay rock-bottom prices, and lawyers expect perfection; the former is hard, but easier than the latter.

Project Definition

The "Define" phase of construction management consists of documenting the work to be performed. This is usually graphic and written with plans, specs, references to codes and standards, and detailed "Scope of Work" documents. Getting a clear, specific and detailed project scope is the first step in the construction project management process and it is where a project's "quality" is established.

SOME QUICK DEFINITIONS

- Plans and Details: Graphic representation of construction.
- Specifications: Specs are the written representation of construction, which usually includes a greater level of detail regarding construction performance, process, products, and quality.
- Construction Contract: Agreement between two or more parties for the delivery of construction; plans and specifications are used as the definition of what is being bought and sold.
- Standards: Documents, with graphic and written information, referenced by plans, specifications and construction contracts, which specify performance criteria and/or methods in greater detail than typical plans or specifications. Standards are created by standards setting bodies like ASTM, product manufactures, and industry trade groups.
- Scope of Work: Written documents, usually based on the plans and specs, which identify or clarify the project definition. These documents are attached to prime and trade contracts to establish who is doing what. In theory, the "Scope" for the prime contractor should include everything being sold to the owner, and all the trade contractor "scopes" in aggregate should include everything in the prime scope, less the GC's self-performed work.
- Hold-Point: Critical time in the construction process where construction should stop for verification of conformance with plans, specifications, standards (including performance) and contracts. Verification can include inspection, testing, recording, and reporting.

In "the good old days" we left the details of "how to" to the trade contractors. After all, they are the specialists. But for the reasons stated above, leaving the details to trade

contractors to work out among themselves has left a lot of projects in a less than enviable position: lack of integration, quality problems, re-work, leaks, lack of durability, and on and on.

Owners or their representatives should no longer sign a one or two page "Proposal" from a contractor which serves as the "Scope of Work." Such documents are not likely to contain information specific enough to ensure the scope is complete, they don't ensure that the parties are on the same page for quality or performance, and they lack adequate contractual protections.

Specification writers making obscure references to documents that are difficult to obtain is not new. But acquiring these documents is now much easier due to the internet. It is now possible to "define" (design) our projects using readily accessible documents that we can use during the building process to make sure the on-site work is being installed and integrated correctly. This information needs to be integrated throughout the plans, specifications, standards and contracts. In practice, these documents should be created or referenced in the *Define* phase, referenced in the *Contract* phase, and used to compare the actual work in the field to the plan during *Coordination* and *Verification.*

Managing Construction Quality

There is no way to 100% guarantee project success and performance; the closest I have found is the use of a proven system.

Think of it this way: *Construction plans and specifications are a hypothesis, and a hypothesis should always be verified*. The hypothesis is that the designers and specialty consultants have composed a set of documents that are appropriate to build a project that will meet the *performance expectations* of the owners and applicable codes. The contractors on the project then work under the hypothesis that the design is functional, and that the work they do will also meet *performance expectations.*

Question: How do we verify our construction projects are going to perform? Answer: (1.) During the define phase, we make sure our design hypothesis is reasonable by having someone with experience in building performance issues review, comment and recommend improvements; (2.) We make sure the plans, specifications, standards, and contracts are consistent in describing "what good performance looks like"; (3.) We establish a procedure to "verify" at specified *Hold-Points* during construction; (4.) During construction we inspect to verify conformance with the design (plans, specs, standards, and contracts). (5.) After the initial assemblies are installed, we test them to verify performance, or build a mock-up and test it before construction (whichever is more cost effective).

Remember: We must be willing to administer consequences to project team members who don't do what they promise. You will get resistance. If a contractor has signed a contract to perform consistent with a specified standard, it will sometimes take a strong will to make some of them perform.

ATTACHMENT: The attached *Independent Quality Review* spreadsheet is a matrix of optional services one might purchase from a consultant. The minimum activities required for a third party to be of assistance in ensuring project quality are identified; higher levels of service are like buying more insurance. Remember, this does not include *doing* the actual design. At a minimum, this is making sure the project definition is close to complete, and helping assure that proper installation and integration of the assemblies

will lead to appropriate performance. Further work can ensure a connection between the plans, specifications, standards and contract scope of work documents.

Quality Management Plan

Here is the system, organized in the context of The DBSKCV Method. Remember, the DBSKCV Method is iterative, meaning we walk through all steps many times throughout the life of a project. We should go through the "D-B Loop" (e.g Define-Budget-Repeat) many times before getting to the Coordinate phase.

DEFINE
- Architectural, Structural, and Specialty Design
- Specification Writing
- Referenced Standards

QUALITY PLANNING (Often by Independent Quality Review Consultant)
- Evaluation of plans and specs
- Evaluation of referenced standards, and contract / scope of work language review (Optional)
- Hold Point Development and performance verification planning (Optional)
- Mock-Up of assemblies and testing (Optional)
- Recommendations (final) from Quality Review Consultant
- Meetings or teleconferences between Quality Review Consultant and Owner, Designers and/or Contractors (Optional).
- Review of updated design, specification, referenced standards and contracts made in response to Recommendations from Independent Quality Review Consultant (Optional).

BUDGET: Update as necessary throughout the process. Make active decisions about "how much insurance to buy".

SCHEDULE:
- Establish Hold Points
- Be prepared to stop the project if acceptable performance cannot be achieved

CONTRACT
- Connect the Plans, Specifications, and Standards, Quality Management Plan, including Hold Points, to the prime and trade Contracts and Scope of Work documents so that Quality does not "cost extra" (in change orders) during construction.

COORDINATE
- Make sure prime and trade contractors know the standards they will be held to during the Verify phase.
- Coordinate actions at Hold Points in the construction schedule to verify quality of installations.

VERIFY
- Visual Inspection at Hold Points to verify conformance with project definition (plans, specs, standards and contract scope of work documents) and to evaluate any on-site changes (Optional)
- Testing to verify performance (Optional)
- Final Report that might include: Quality control process, design summary, evaluation process, inspection summary, testing summary and on-going maintenance recommendations (Optional)

Independent Quality Review

Line	Description of Potential Services	Service Level																	Typical Durations	
		1A	1B	1C	2A	2B	2C	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	6C	Low	High
1	Evaluation of plans and specifications	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	8	40
2	Evaluation of referenced standards		x	x		x	x		x	x		x	x		x	x		x	x	4	40
3	Evaluation of contracts (scope of work)			x			x			x			x			x			x	4	40
4	Hold Point Development							x	x	x	x	x	x	x	x	x	x	x	x	4	40
5	Mock-Up of Assemblies and Testing										?	?	?	?	?	?	x	x	x	16	80
6	Recommendations (final)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	8	80
7	Meetings or Teleconferences	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	2	40
8	Review of Updated Design	?	?	?	?	?	?	?	?	?	?	?	?	x	x	x	x	x	x	4	40
9	Visual Inspection				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	4	160
10	Testing							x	x	x	x	x	x	x	x	x	x	x	x	8	80
11	Final Report										x	x	x	x	x	x	x	x	x	8	40
12																					
13	Potential Deliverables																				
14	Opinion Letter re: Evaluation	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
15	Issues List with Recommendations	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
16	Inspection Summary				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
17	Inspection Report										x	x	x	x	x	x	x	x	x		
18	Location Matrix				?	?	?	?	?	?	?	?	?	x	x	x	x	x	x	1	16
19	Hold Points				?	?	?	x	x	x	x	x	x	x	x	x	x	x	x		
20	Testing Protocol							x	x	x	x	x	x	x	x	x	x	x	x		
21	Testing Summary Report							x	x	x	x	x	x	x	x	x	x	x	x		
22	Project Close Report							?	?	?	?	?	?	x	x	x	x	x	x		

Explanation of Service Levels

- L1: No Inspection
- L2: Limited Visual Inspection
- L3: Limited Visual, Limited Testing
- L4: Periodic Inspection, Limited Testing
- L5: Extensive Inspection, Limited Testing
- L6: Extensive Inspection, Extensive Testing

Document Review Levels

- A: Plans and Specs only
- B: Plans, Specs, and Standards
- C: Plans, Specs, and Standards and Contracts

6. RISK MANAGEMENT

A. The ABC's of Risk Management

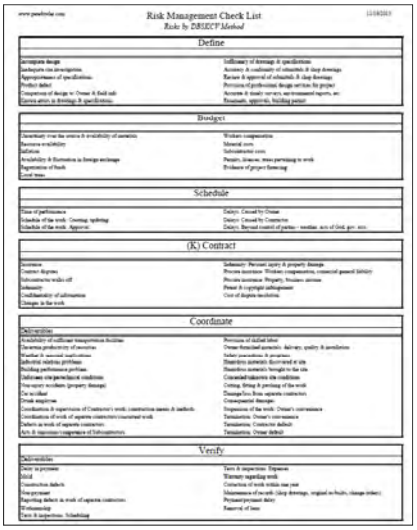
THE ABC'S OF RISK MANAGEMENT

- A = Avoid Potentially Dangerous Situations (Impossible in construction)
- B = Be Really Good At What You Do
- C = Cover Your Assets

A. The ABC's of Risk Management

The ABC's apply to Managing Construction Quality because
(A.) we must face the fact that "risk avoidance" as a construction professional is impossible,
(B.) being good at what you do means doing all you can to make sure a project succeeds, and doing a
little bit of someone else's job will sometimes become necessary, and
(C.) the best "coverage" is avoiding problems by delivering work that meets expectations. Just accept buyers expect high quality *and* performance, even when they pay rockbottom prices, and lawyers expect perfection; the former is hard, but easier
than the latter.

B. Risk Management Matrix


Risk Management Check List
Risk by DBIEPT Method
Define
Budget
Schedule
(K) Contract
Coordinate
Verify

C. Contracts

Prime Contracts

- Contracting Directly with the Owner. A prime construction contract is an agreement between the owner and a contractor
- AIA Forms
- Instructions
- Who is doing what?

C. Contracts

Subcontracts

- A subcontract is an agreement between a prime contractor and some other contractor who will perform all or a portion of the work covered in the prime contract. Thus, if an owner contracts directly with a subcontractor, like a painter, this is not a subcontract; it is a prime contract. Prime and subcontractors have different rights and responsibilities.
- AGC and other industry standard forms. See Standard Contract Forms and Suppliers (PDF).

D. Insurance

1. Workers Compensation
2. Commercial General Liability
   - Coverage: Premises / Operations, Completed Operations
   - Exclusions: Mold, Work Product ("Business Risk"), Types of Work
3. Builder's Risk
4. Umbrella Liability Coverage
5. Errors & Omissions
6. Wrap-Ups / Owner Controlled Insurance Programs
7. Bonds

Risk Management Check List

Risks by DBSKCV Method

Define

Incomplete design	Sufficiency of drawings & specifications
Inadequate site investigation	Accuracy & conformity of submittals & shop drawings
Appropriateness of specifications	Review & approval of submittals & shop drawings
Product defect	Provision of professional design services for project
Comparison of design w/ Owner & field info	Accurate & timely surveys, environmental reports, etc.
Known errors in drawings & specifications	Easements, approvals, building permit

Budget

Uncertainty over the source & availability of materials	Workers compensation
Resource availability	Material costs
Inflation	Subcontractor costs
Availability & fluctuation in foreign exchange	Permits, licenses, taxes pertaining to work
Repatriation of funds	Evidence of project financing
Local taxes	

Schedule

Time of performance	Delays: Caused by Owner
Schedule of the work: Creating, updating	Delays: Caused by Contractor
Schedule of the work: Approval	Delays: Beyond control of parties - weather, acts of God, gov. acts

(K) Contract

Insurance	Indemnity: Personal injury & property damage
Contract disputes	Procure insurance: Workers compensation, comercial general liability
Subcontractor walks off	Procure insurance: Property, business income
Indemnity	Patent & copyright infringement
Confidentiality of information	Cost of dispute resolution
Changes in the work	

Coordinate

Deliverables

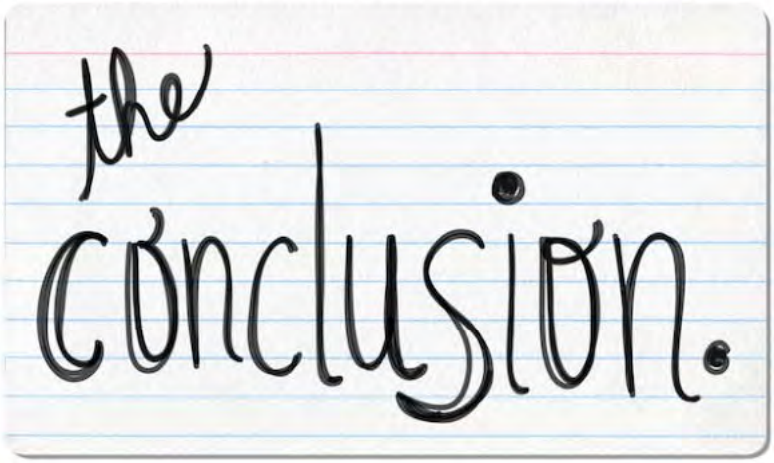
Availability of sufficient transportation facilities	Provision of skilled labor
Uncertain productivity of resources	Owner-furnished materials: delivery, quality & installation
Weather & seasonal implications	Safety precautions & programs
Industrial relations problems	Hazardous materials discovered at site
Building performance problem	Hazardous materials brought to the site
Unforseen site/geotechnical conditions	Concealed/unknown site conditions
Non-injury accidents (property damage)	Cutting, fitting & patching of the work
Car accident	Damage/loss from separate contractors
Drunk employee	Consequential damages
Coordination & supervision of Contractor's work; construction means & methods	Suspension of the work: Owner's convenience
Coordination of work of separate contractors/concurrent work	Termination: Owner's convenience
Defects in work of separate contractors	Termination: Contractor default
Acts & omissions/competence of Subcontractors	Termination: Owner default

Verify

Deliverables

Delay in payment	Tests & inspections: Expenses
Mold	Warranty regarding work
Construction defects	Correction of work within one year
Non-payment	Maintenance of records (shop drawings, original as-builts, change orders)
Reporting defects in work of separate contractors	Payment/payment delay
Workmanship	Removal of liens
Tests & inspections: Scheduling	

7. CONCLUSION



A. Deep Thoughts

B. Program Outline

1. Introduction to Building Codes & Standards
2. History of Building Codes & Standards
3. Building Code Referenced Standards
4. Trade Standards & Manufacturers Installation Instructions
5. Managing Construction Quality
6. Risk Management
7. Conclusion

C. Learning Objectives

1. Explain what codes and standards are and how they are used in the building industry.
2. Orient the participant to how critical codes and standards are to our modern economy.
3. Give the participant insight into how and why codes have evolved over time.
4. Conduct case studies on real buildings, referring to actual codes and standards in use today, analyzing how the applicable codes have evolved in the recent past, and discussing how decisions are made in practice.
5. Show the participants how to find applicable codes and standards.
6. Discuss where codes and standards are likely to go in the future.

D. Back-Up Materials

1. Opinion Letter with Back-up
2. History of Codes
3. ICC 2010 Chapter 35
4. PFCS Managing Construction Quality
5. PFCS Risk Management Matrix
6. PFCS Building Life-Cycle Management Flyer

End

We know buildings

EXPERTISE

PROJECT MANAGEMENT

TECHNOLOGY

STANDARDS

RESULTS

Maintaining your property is hard. We can help.

Building Life-Cycle Management Services for Owners, Associations and Managers

EVALUATION

Property Condition Assessment (per ASTM E2018)
Leak Investigation and Testing (per ASTM E2128)
Information Management (Incl. Document Storage and Access per ASTM E2166)

SPECIFICATION

Consultation
Maintenance Plan
Maintenance Manual
Reserve Study (In close coordination with a Reserve Study specialist)
Budget
Life-Cycle Cost Analysis
Specifications for Maintenance, Repair and Improvement

QUALITY MANAGEMENT

Progress Schedule
Request for Proposal
Proposal / Bid Analysis
Contracts
Construction Management including invoice and change order processing
Quality Control Inspections
Warranty Management

Pete Fowler Construction Services (PFCS) specializes in creating REAL PRACTICAL SOLUTIONS for property owners & managers, builders & developers, construction contractors, product manufacturers, lawyers and insurers.

PROJECT MANAGEMENT: To deliver valuable work with measurable return on investment (ROI), we have to manage the Scope, Budget and Schedule of our work and yours.

TECHNOLOGY: We use proprietary technology to create valuable work faster, better and cheaper, to make the information available to all applicable stakeholders, and to create a permanent digital record at no extra cost.

STANDARDS: To help clients manage building lifecycle performance and costs, we compare each project to industry standards and best practices, then apply professional judgement to develop strategies and stepbystep plans for maximizing ROI for maintenance and repair expenditures.

RESULTS: Our work allows our clients to make informed, effective decisions.

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