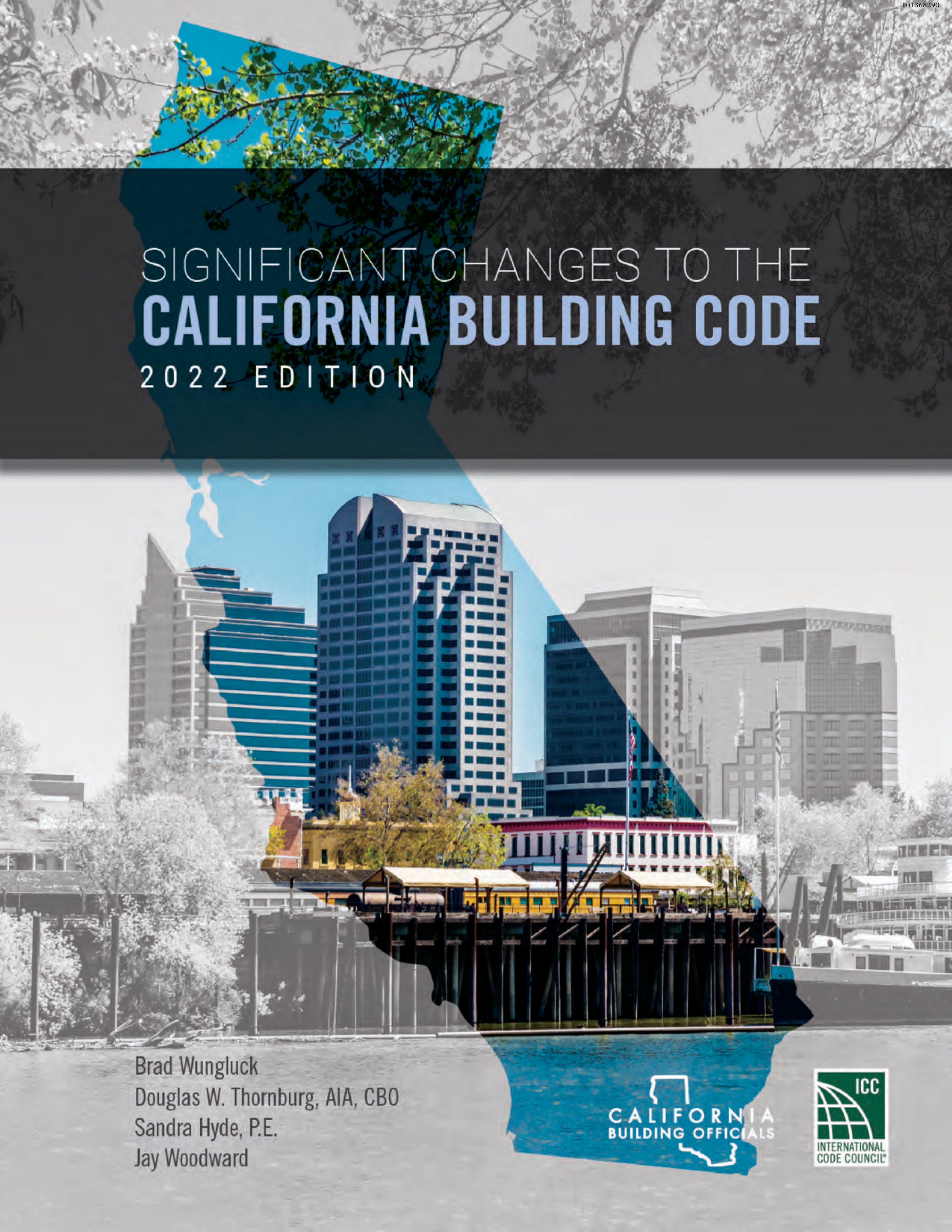

SIGNIFICANT CHANGES TO THE

CALIFORNIA BUILDING CODE

2022 EDITION

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CALIFORNIA BUILDING OFFICIALS

ICC INTERNATIONAL CODE COUNCIL

Significant Changes to the California Building Code 2022 Edition

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Preface

The purpose of *Significant Changes to the California Building Code, 2022 Edition* is to familiarize building officials, fire officials, plans examiners, inspectors, design professionals, contractors and others in the construction industry with many of the important changes in the 2022 *California Building Code* (CBC). This publication is designed to assist those code users in identifying the specific code changes that have occurred and, more importantly, understanding the reasons behind the changes. It is also a valuable resource for jurisdictions in their code-adoption process.

Only a portion of the total number of code changes to the CBC are discussed in this book. The changes selected were identified for a number of reasons, including the frequency of application, special significance or change in application. However, the importance of those changes not included is not to be diminished. Further information on all code changes can be found in the *Complete Revision History to the 2021 I-Codes*, available from the International Code Council® (ICC®) online store. The revision history provides the published documentation for each successful code change contained in the 2021 *International Building Code* (IBC) since the 2018 edition, which is the base model code for the CBC.

The CBC discussion in this publication addressing significant code changes is organized into eight general categories, each representing a distinct grouping of code topics. It is arranged to follow the general layout of the CBC, including code sections and section number format. The table of contents, in addition to providing guidance in the use of this publication, allows for the quick identification of the significant code changes that occur in the 2022 CBC.

This edition of *Significant Changes to the California Building Code* includes a ninth part that addresses a limited number of selected code changes that occur in the 2022 edition of the *California Existing Building Code* (CEBC). Applicable to all existing buildings, the CEBC is intended to provide flexibility to permit the use of alternative approaches to achieve compliance with minimum requirements to safeguard the public health, safety and welfare. Both structural and nonstructural changes are addressed in Part 9 of this publication.

Throughout the book, each change is accompanied by a photograph, an application example or an illustration to assist and enhance the reader's understanding of the specific change. A summary and a discussion of the significance of the changes are also provided. Each code change is identified by type, either an addition, modification, clarification or deletion.

The code change itself is presented in a format similar to the style utilized for code-change proposals. Deleted code language is shown with a strike-through, and new code text is indicated by underlining. As a result, the actual 2022 code language is provided as well as a comparison with the 2019 code language, so the user can easily determine changes to the specific code text.

As with any code-change text, *Significant Changes to the California Building Code, 2022 Edition* is best used as a study companion to the 2022 CBC. Because only a limited discussion of each change is provided, the code itself should always be referenced to gain a more comprehensive understanding of the code change and its application.

The commentary and opinions set forth in this text are those of the authors and do not necessarily represent the official position of the ICC or California state agencies. In addition, they may not represent the views of any enforcing agency, as such agencies have the sole authority to render interpretations of the CBC. In many cases, the explanatory material is derived from the reasoning expressed by the code-change proponent.

Comments concerning this publication are encouraged and may be directed to the ICC at significantchanges@iccsafe.org.

About the *California Building Code*

Building officials, design professionals and others involved in the building construction industry recognize the need for a modern, up-to-date building code addressing the design and installation of building systems through requirements emphasizing performance. The *California Building Code* (CBC), in the 2022 edition, is intended to meet these needs through code regulations that safeguard public health and safety in all communities, large and small.

This comprehensive building code establishes minimum regulations for buildings systems through prescriptive- and performance-related provisions. It is founded on broad-based principles that make possible the use of new materials and new building designs. The CBC is applicable throughout the state. However, a city, county, or city and county may establish more restrictive building standards reasonably necessary because of local climatic, geological or topographical conditions. Findings of the local condition(s) and the adopted local building standard(s) amendments must be filed with the California Building Standards Commission to become effective. Only the state's significant change amendments are included as part of this publication.

About the Authors

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Douglas W. Thornburg is currently Vice President and Technical Director of Products and Services for the International Code Council (ICC), where he provides administrative and technical leadership for the ICC product development activities. Prior to employment with ICC in 2004, he spent 9 years as a code consultant and educator on building codes. Doug also spent 10 years with the International Conference of Building Officials (ICBO), where he served as Vice President/Education. He began his career with the City of Wichita, Kansas, where he had inspection, plan review and building administration responsibilities.

In his current role, Doug also continues to create and present building code seminars nationally and has developed numerous educational texts and resource materials. He was presented with the ICC's inaugural Educator of the Year Award in 2008, recognizing his outstanding contributions in education and training.

A graduate of Kansas State University and a registered architect, Doug has over 40 years of experience in building code education and administration. He has authored a variety of other code-related support publications, including the *International Building Code Illustrated Handbook*.

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Sandra Hyde is a Senior Staff Engineer with the International Code Council. She develops technical resources in support of the structural provisions of the *International Building Code*, *International Existing Building Code* and *International Residential Code*. Sandra reviews publications authored by the ICC and engineering groups, while also developing publications and technical seminars on the structural provisions of the I-Codes for building departments, design engineers and special inspectors.

Prior to the ICC, Sandra worked for Weyerhaeuser in the research and development of engineered lumber products. She has a Master's degree in Structural Engineering from Portland State University and is a Registered Civil Engineer in Idaho and California. She has authored and reviewed many support publications, including *Significant Changes to the International Residential Code*, *Special Inspection Manual* and, in conjunction with the APA, *A Guide to the 2018 IRC Wood Wall Bracing Provisions*.

Jay Woodward
International Code Council
Senior Staff Architect

Jay Woodward is a Senior Staff Architect with the ICC's Business and Product Development department. With more than 38 years of experience in building design, construction, code enforcement and instruction, Jay's current position involves developing publications and seminars in support of the *International Building Code*. Jay has previously served as the Secretariat for the ICC A117.1 standard committee, the ICC's *International Energy Conservation Code*, and the *International Building Code* Fire Safety Code Development committees.

A graduate of the University of Kansas and a registered architect, Jay has previously worked as an architect for the Leo A. Daly Company in Omaha, Nebraska, as a building plans examiner for the City of Wichita, Kansas, and as a senior staff architect for the International Conference of Building Officials. He is also the author of two ICC publications, *Significant Changes to the A117.1 Accessibility Standard and Firestopping, Joint Systems and Dampers.*

Brad Wungluck, MPA, MCP, CBO
California Building Officials
First Vice President

With more than 15 years of building safety management experience, Brad currently serves on the Executive Board for California Building Officials (CALBO) as the First Vice President. In addition, he teaches regularly for CALBO, has developed a number of CALBO training courses, and serves on the committee responsible for all training and education, the CALBO Training Institute.

In addition, Brad serves the City of Manteca as a Deputy Director for Development Services and is responsible for all Building Safety functions. Serving as the Chief Building Official for the City, he manages building plan review, counter assistance and inspection services.

Brad earned his BS in Political Science from Loyola University Chicago and his Masters in Public Administration from San Diego State University. Brad has participated on various local, state-wide and national committees including the California Building Standards Code Advisory Committees on Accessibility; California Building Standards Code Advisory Committee on Plumbing, Electrical, Mechanical and Energy; the CALBO State Code Committee; the CALBO Energy Committee; and the ICC Plumbing, Mechanical and Fuel Gas Code Action Committee.

Brad is also a certified Master Code Professional, Building Official and Plans Examiner, holding certifications in several inspection categories.

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Kevin Scott is the President of KH Scott & Associates LLC. Kevin has extensive experience in the development of fire safety, building safety and hazardous materials regulations. He has actively worked for over 35 years in the development of fire code, building code and fire safety regulations at the local, state, national and international levels. Kevin previously worked as a Senior Regional Manager with the International Code Council, and before that, he was Deputy Chief for the Kern County Fire Department in California, where he worked for 30 years. Kevin provides consulting services regarding plan review, interpretation, application and enforcement of fire codes and building codes. He has authored several books and continues to work in the development of codes and standards. Kevin has developed and presented many training seminars on a variety of technical subjects, including means of egress, high-piled combustible storage, hazardous materials, plan review and inspection practices.

Kevin was a member of the original IFC Drafting Committee that worked to create the first edition of the IFC. He served for 7 years on the IFC Code Development Committee and was the chairperson of the committee from 2001 to 2004. Kevin has actively participated in numerous technical committees to evaluate specific hazards and technologies and to create regulations specific to those hazards.

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Buddy Showalter is a Senior Staff Engineer with the ICC's Product Development group. He develops technical resources in support of the structural provisions of the *International Building Code* and *International Residential Code*. Buddy reviews publications authored by the ICC and engineering groups, while also developing publications and technical seminars on the structural provisions of the I-Codes for building departments, design engineers and special inspectors. He was the project lead in the development of the publication *Mass Timber Buildings and the IBC* as well as associated education programs, jointly developed by the ICC and the American Wood Council (AWC).

A graduate of Virginia Tech, Buddy has been a member of the Editorial Board for *STRUCTURE* magazine for over 15 years. Prior to joining the ICC, he spent 26 years with the AWC where he oversaw its technology transfer program with oversight responsibility for publications, website, helpdesk, education and other technical media. Buddy has more than 34 years of experience in development and support of building codes and standards, publishing over 60 technical articles for industry-related trade journals.

Beth Tubbs, P.E., FSFPE
International Code Council
Senior Staff Engineer

Beth Tubbs is a Senior Staff Engineer with the ICC's Codes and Standards Development department. She has 25 years of experience in codes and standards development and the associated support documents such as the IBC and IFC commentary. Beth has also represented the ICC in various national and international activities such as the SFPE Design Fire Standard Development Committee and the ASME A17.1 Code Correlation Committee. She is the staff secretariat for the *International Existing Building Code* and the *International Fire Code*. In addition, Beth is currently the lead staff on the ICC Fire Code Action Committee, which works to develop technically relevant proposals to the I-Codes related to fire and life safety requirements.

Beth has a bachelor's in civil engineering from Worcester Polytechnic Institute (WPI) and a master's degree in Fire Protection Engineering from WPI. She is a Fellow of the Society of Fire Protection Engineers (SFPE) and a member of the Board of Directors for the Society. She holds a professional fire protection engineering license in the Commonwealth of Massachusetts and the State of California.

About California Building Officials

California Building Officials (CALBO) is a non-profit corporation dedicated to promoting public health and safety in building construction through responsible legislation, education and building code development. CALBO was founded in 1962 to promote and further the profession of the local California Building Official. With time and achievement, the organization has become the advocate and representative of not only the local California Building Official, but of local building departments, local government entities, and public safety and code enforcement officials.

About the International Code Council®

The International Code Council is the leading global source of model codes and standards and building safety solutions that include product evaluation, accreditation, technology, codification, training and certification. The Code Council's codes, standards and solutions are used to ensure safe, affordable and sustainable communities and buildings worldwide. The International Code Council family of solutions includes the ICC Evaluation Service, the International Accreditation Service, General Code, S. K. Ghosh Associates, NTA Inc., Progressive Engineering Inc., ICC Community Development Solutions and the Alliance for National & Community Resilience. The Code Council is the largest international association of building safety professionals and is the trusted source of model codes and standards, establishing the baseline for building safety globally and creating a level playing field for designers, builders and manufacturers.

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PART 1

Administration

Chapters 1 and 2

- **Chapter 1** Scope and Administration
- **Chapter 2** Definitions

The provisions of Chapter 1 address the application, enforcement and administration of subsequent requirements of the code. In addition to establishing the scope of the *California Building Code* (CBC), the chapter identifies which buildings and structures come under its purview. A building code, as with any other code, is intended to be adopted as a legally enforceable document to safeguard health, safety, property and public welfare. A building code cannot be effective without adequate provisions for its administration and enforcement. Chapter 2 provides definitions for terms used throughout the CBC. Codes, by their very nature, are technical documents, and as such, literally every word, term and punctuation mark can add to or change the meaning of the intended result. ■

CHAPTER 1

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Chapter 1

Format of Administrative Provisions

CHANGE TYPE: Clarification

CHANGE SUMMARY: Numerous revisions in format have occurred in *California Building Code* (CBC) Chapter 1 in order to provide for consistent language throughout the administrative provisions found in each of the California codes.

2022 CODE TEXT:

SECTION 103
~~DEPARTMENT OF BUILDING SAFETY~~ CODE COMPLIANCE AGENCY

103.1 Creation of enforcement agency. The ~~Department of Building Safety~~ [INSERT NAME OF DEPARTMENT] is hereby created and the official in charge thereof shall be known as the building official. The function of the agency shall be the implementation, administration and enforcement of the provisions of this code.

103.2 Appointment. The building official shall be appointed by the chief appointing authority of the jurisdiction.

103.3 Deputies. In accordance with the prescribed procedures of this jurisdiction and with the concurrence of the appointing authority, the building official shall have the authority to appoint a deputy building official, ~~the~~ other related technical officers, inspectors~~, plan reviewers~~ and other employees. Such employees shall have powers as delegated by the building official. ~~For the maintenance of existing properties, see the International Property Maintenance Code.~~

Photo courtesy of the City of Folsom, California, Building Services Department

Front counter at building department.

SECTION 107
~~SUBMITTAL~~ CONSTRUCTION DOCUMENTS

SECTION 113
~~BOARD~~ MEANS OF APPEALS

113.1 General. In order to hear and decide appeals of orders, decisions or determinations made by the building official relative to the application and interpretation of this code, there shall be and is hereby created a board of appeals. The board of appeals shall be appointed by the applicable governing authority and shall hold office at its pleasure. The board shall adopt rules of procedure for conducting its business and shall render all decisions and findings in writing to the appellant with a duplicate copy to the building official.

113.2 Limitations on authority. An application for appeal shall be based on a claim that the true intent of this code or the rules legally adopted thereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an ~~equally good~~ equivalent or better form of construction is proposed. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

113.3 Qualifications. The board of appeals shall consist of members who are qualified by experience and training to pass on matters pertaining to building construction and are not employees of the jurisdiction.

113.4 Administration. The building official shall take immediate action in accordance with the decision of the board.

(These are several examples of extensive format and text changes that establish consistent language throughout the administrative provisions of Chapter 1 in each of the California codes.)

CHANGE SIGNIFICANCE: Chapter 1 of the CBC, as well as the other California codes, provides guidance in both the administration of the code compliance agency and the application of the technical provisions found within the codes. Establishment of departmental duties and responsibilities includes those related to the issuance of permits, the review of submittal documents, the inspection of buildings and other activities that ensure compliance with the code. In addition, the application of the code requirements as related to scope and intent, interpretations and policies, alternate methods and materials, and the relationship of codes and referenced standards is set forth. Numerous revisions in format have occurred in the CBC in order to provide for consistent language throughout the Chapter 1 administrative provisions found in each of the California codes.

Although each of the California codes has unique provisions established in Chapter 1 to address the administration and application functions specific to the scope of the individual code, many other provisions are consistent throughout the various California codes. It is therefore appropriate to provide as much consistency as possible in the application of all of the California codes, as most administrative and enforcement matters are the same for any code. While those matters unique to a specific code have typically remained unchanged, a number of editorial and organizational changes have been made to the administrative chapter (Chapter 1) in each of the California codes.

In an effort to provide consistency in presentation, a template was developed for each of the areas being revised. As an example, in Section 103 the section title "Code Compliance Agency" has replaced various terms that have been used in California codes to identify the jurisdictional agency assigned to enforce the code. In the CBC, this agency was previously described as the Department of Building Safety; in the *California Fire Code* (CFC), it has been the Department of Fire Prevention; in the *California Mechanical Code* (CMC), it was the authority having jurisdiction; and so on. The new terminology is generic in nature to represent the inclusion of all aspects of the code administration function under one agency.

105.5.1

Permit Expirations

CHANGE TYPE: Addition

CHANGE SUMMARY: Section 105.5.1 has been added as a reflection of the language contained within Health and Safety Code 18938.5 and 18938.6 regarding permit expirations.

2022 CODE TEXT: ***105.5.1 Expiration. [BSC]*** *On or after January 1, 2019, every permit issued shall become invalid unless the work on the site authorized by such permit is commenced within 12 months after its issuance, or if the work authorized on the site by such permit is suspended or abandoned for a period of 12 months after the time the work is commenced. The building official is authorized to grant, in writing, one or more extensions of time, for periods not more than 180 days each. The extension shall be requested in writing and justifiable cause demonstrated. (See Health and Safety Code Section 18938.5 and 18938.6.)*

CHANGE SIGNIFICANCE: Building Standards Commission (BSC) has added Section 105.5.1, and the language mirrors that contained within the recently added sections of the Health and Safety Code. The language is intended to extend all building permits and their expirations from 180 days to 12 months. The Health and Safety Code language was a result of the natural disasters throughout the state and the impact on the construction industry and their timelines. This allows a permit to not be expired for 12 months after issuance, thereby alleviating some of those concerns moving forward.

Approved plans.

110.3.5

Type IV Connection Protection

CHANGE TYPE: Addition

CHANGE SUMMARY: A new inspection has been established, applicable only to Type IV-A, IV-B and IV-C construction, that deals with connections where fire-resistance is provided by wood cover.

2022 CODE TEXT: **110.3.5 Type IV-A, IV-B and IV-C connection protection inspection.** In buildings of Type IV-A, IV-B and IV-C construction, where connection fire-resistance ratings are provided by wood cover calculated to meet the requirements of Section 2304.10.1, inspection of the wood cover shall be made after the cover is installed, but before any other coverings or finishes are installed.

CHANGE SIGNIFICANCE: The inspection function is arguably the most critical aspect of building department operations. As the construction process moves forward, specified inspections of the work being done must be completed prior to such work becoming concealed and inaccessible for evaluation. A listing of the required inspections, where applicable, begins with a potential preliminary inspection and continues through various stages of the work, ending with a final inspection. The scope of each inspection is indicated and the extent of work to be available for inspection is provided. A new inspection has been established, applicable only to mass timber construction of Types IV-A, IV-B and IV-C, that deals with connections where fire-resistance is provided by wood cover.

Connections of structural members, and their protection to achieve a fire-resistance rating, represent a significant component of mass timber buildings' structural integrity, and therefore warrant a specific new

Photo courtesy of American Wood Council

Wood cover protection of structural member connections to achieve a fire-resistance rating.

requirement for building department inspections. Special inspections are not required for this aspect of construction as this field inspection process does not require any special expertise nor special tools for testing that are outside the day-to-day work of building inspectors. These new requirements are parallel to, and generally the same as, the inspection of fire-resistive protection for connections of traditional heavy timber that have been done in the course of building department inspections for more than 100 years. This mandate does not preclude the building official from requiring special inspections in special cases as established in Section 1705.1.1.

It is likely that designers will choose to overlay wood connections using additional wood cover that will protect the underlying wood and steel. This additional thickness of wood can be provided by oversizing the structural element or by adding a collar or other architectural embellishment at the connection. For oversized wood structural elements, the inspector will need to check the approved building plans to determine the required dimensions of the oversized structural element to be used to meet the fire-resistance rating. Where the plans indicate the addition of wood members to protect the connection, the inspector will need to verify that the additional wood members are in place and meet the minimum dimensions set forth in the approved construction documents.

Section 110.3.5, now reformatted as Section 110.3.6, has historically required the inspection of gypsum board when used as a component of fire-resistance-rated assemblies. The connection being protected may be steel-to-mass timber, concrete-to-mass timber, or any other combination of materials. Gypsum board is assigned a fire-resistance-rating time based on board thickness and other performance properties of the product, such as a Type X certification. When the connection protection calls for the addition of gypsum board to add fire-resistance time, the thickness, number of layers and other properties should be inspected.

It is also possible for additional material added at the connection location to be a combination of both gypsum board and wood. Architecturally, the designer may choose to add a ⅝-inch Type X gypsum board collar, which is equivalent to 40 minutes of protection, and cover it with a layer of wood trim equivalent to 20 minutes of protection, thus providing 1 hour of protection at the connection location.

110.3.7

Inspection of Weather-Exposed Balconies

CHANGE TYPE: Modification

CHANGE SUMMARY: The inspection currently required for certain weather-exposed balcony and walking surface waterproofing has been modified through the introduction of the defined term "weather-exposed surfaces."

2022 CODE TEXT: **~~110.3.6~~ 110.3.7 Weather-exposed balcony and walking surface waterproofing.** Where balconies or other elevated walking surfaces ~~are exposed to water from direct or blowing rain, snow or irrigation~~ have weather-exposed surfaces, and the structural framing is protected by an impervious moisture barrier, all elements of the impervious moisture barrier system shall not be concealed until inspected and approved.

> **Exception:** Where special inspections are provided in accordance with Section 1705.1.1, Item 3.

CHANGE SIGNIFICANCE: For most buildings, there are a number of inspections mandated by the code that are required to be made during the construction process. Starting with the footing/foundation inspection, followed by framing and other applicable inspections, and finishing with the final inspection, the work is evaluated for compliance with the code while visible and accessible. In some cases, additional inspections are required to address unique conditions where compliance is deemed critical. Examples include inspections of fire- and smoke-resistant penetrations, as well as a variety of special inspections set forth in Chapter 17. The scope of the inspection for weather-exposed balcony and walking surface waterproofing, mandated where applicable, has been modified through the introduction of the defined term "weather-exposed surfaces."

Photo courtesy of PPAMPicture

Balconies depicted are considered "weather-exposed".

The reference to a currently defined term accomplishes two things: (1) it allows for a more consistent application of the code through specified conditions under which exterior surfaces are not considered exposed to the weather, and (2) it deletes the inspection where the only water exposure concern is due to irrigation.

Balconies and similar elevated walking surfaces that are exposed to moisture from rain and snow are subject to potential structural damage where an impervious moisture barrier provides protection of the structural members. It is vitally important that the construction methods used in the protection of the members from such damage due to extended exposure to water be compliant with all applicable code provisions. Therefore, the code specifically mandates an inspection of the waterproofing that is provided for any elevated exterior walking surfaces. The extent of what constitutes an exterior condition that must be inspected has been modified to refer to only those surfaces that are considered by definition to be weather-exposed.

The regulation of weather-exposed surfaces has historically been focused on the use of gypsum construction in exterior applications. In fact, prior to the definition's move to Chapter 2 in the 2013 edition of the CBC, it was located in Chapter 25 dealing with gypsum board and plaster. The definition identifies those exterior locations where the potential exposure to weather is not likely to be an issue, such as ceilings, roof soffits and walls that are protected in some manner. The allowances recognized in the definition are now also applicable in the determination of whether an inspection is required for those exterior balconies and walking surfaces where the structural framing is protected by an impervious moisture barrier.

Per the definition, an exterior surface is considered as weather-exposed unless one of three conditions exist. Since these conditions only reference walls, ceilings and balconies, it will be necessary to provide a degree of equivalency when determining the protection potential of walking surfaces. For example, a wall beneath an unenclosed roof area is not considered as weather-exposed provided the wall is located a horizontal distance from an exterior opening equal to no less than twice the height of the opening. Thus, a balcony floor that is roofed above with a vertical clearance of 8 feet could be considered as weather-exposed unless it is located at least 16 feet inside the leading edge of the roof line.

The use of the definition for scoping purposes also modifies what water sources are subject to regulation. Because the definition specifically refers to surfaces exposed to the weather, the required inspection is no longer mandated where irrigation features, primarily lawn sprinkler systems, are the sole source of water exposure to the elevated surface. Only where rain, snow or a similar weather event impacts an exterior surface is the inspection required.

202

Definition of Access Aisle

CHANGE TYPE: Modification

CHANGE SUMMARY: The definition of Access Aisle has been modified in the CBC to provide greater clarity and reduce confusion that was an issue raised by agencies and jurisdictions throughout the state.

2022 CODE TEXT: ***202 Access aisle. [DSA-AC]*** *An accessible ~~pedestrian~~ space adjacent to or between ~~parking~~ <u>vehicle</u> spaces that provides clearances in compliance with this code.*

CHANGE SIGNIFICANCE: The Division of the State Architect proposed the amendment to the definition of "Access Aisle" for clarity by repealing the word "pedestrian" and replacing the word "parking" with "vehicle."

Comments received by the Division of the State Architect indicated the word "pedestrian" in the definition was confusing to code users and created questions about locating detectable warnings in compliance with Chapter 11B where access aisles are approached from walks or sidewalks via perpendicular curb ramps, parallel curb ramps or blended transitions. Despite existing code provisions that specify the location of detectable warnings at curb ramps and blended transitions, and that prohibit detectable warnings within access aisles and at driveway and drive aisle crossings, commenters question the need for detectable warnings where a pedestrian crosses from one pedestrian area (i.e., walks, sidewalks, curb ramps or blended transitions) to another pedestrian area (i.e., access aisles).

Handicap vehicle space.

Access aisles accommodate the needs of pedestrians—movement through the access aisle and as an approach to accessible parking, electric vehicle spaces, and accessible passenger drop-off and loading zones. Access aisles also accommodate the spatial requirements for the use of vehicle-mounted wheelchair lifts; in this regard, access aisles also serve as vehicle areas. In practical use, access aisles are both pedestrian and vehicle areas. The Division of the State Architect believed repealing the word "pedestrian" will alleviate this confusion.

The second change to the definition replaces the word "parking" with the word "vehicle." This change acknowledges that access aisles are required not only at accessible parking, but also at accessible electric vehicle spaces, and accessible passenger drop-off and loading zones.

202

Definition of Atrium

CHANGE TYPE: Modification

CHANGE SUMMARY: The revised definition of atrium is now limited to addressing only two conditions: 1) an atrium is a vertical space enclosed at the top, and 2) an atrium typically connects three or more stories.

2022 CODE TEXT: **202 Atrium.** ~~An opening~~ A vertical space that is closed at the top, connecting two or more stories ~~other than enclosed stairways, elevators, hoistways, escalators, plumbing, electrical, air-conditioning or other equipment, which is closed at the top and not defined as a mall. Stories, as used in this definition, do not include balconies within assembly groups or mezzanines that comply with Section 505~~ in Group I-2 and I-3 occupancies or three or more stories in all other occupancies.

CHANGE SIGNIFICANCE: The recognition of an atrium in the *California Building Code* (CBC) as more than just a design feature is due to the openings between stories that pose a significant hazard under fire conditions. In order to address this unique approach to vertical openness, special provisions were established in the 1980s to provide alternative protection through concepts applicable to open courts and shaft enclosures. Confusion has occurred over the years due to the format, in which Section 712 regulating vertical openings provides the scoping provisions for atriums. In addition, the relationship between the definition and its availability as an optional means to address vertical openings has caused misapplication of the code's intent. An effort has been made to better clarify the application of the atrium provisions by simplifying the definition.

The definition of atrium was significantly simplified through the elimination of some previous language and the relocation of other text to Section 712.1.7. The remaining terminology in Section 202 is limited to

Photo courtesy of Nikata

Atrium.

addressing two conditions: (1) an atrium is a vertical space enclosed at the top, and (2) an atrium typically connects three or more stories. The listing of those components that are not considered as atriums has been deleted, and the reference to balconies and mezzanines has been moved to Chapter 7. The primary significance of the modification to the definition is the increase in the threshold from two to three stories before an atrium condition is created in all occupancies except Group I-2 and I-3.

Significant confusion has always existed due to the "two-story" atrium condition that was previously expressed in the definition. Many code users assumed that where a floor opening connected only two stories, it was still required to be regulated as an atrium due to the definition's wording. Although it was possible for the designer to consider the two-story opening as an atrium, it was not required to do so as the designation of the vertical opening as an atrium is just one of several fire protection methods allowed by Section 712.1. In most cases where only two stories are open to each other, Section 712.1.9 can be applied provided the six conditions are met. In those instances, Section 712.1.7 addressing the use of an atrium will not be used, and the provisions of Section 404 regulating atriums are not applicable.

It is important to note that there may be limited circumstances where an open two-story condition exists and one or more of the requirements of Section 712.1.9 cannot be met. In such situations, by definition, an atrium condition cannot be considered due to the "three-story" threshold. However, if a complying atrium can be considered as an acceptable approach to addressing a vertical opening of three or more stories, it should also be acceptable where the opening connects only two stories.

202

Definition of Change of Occupancy

CHANGE TYPE: Modification

CHANGE SUMMARY: The scope of a change of occupancy has been narrowed where no classification change takes place.

2022 CODE TEXT: **202 Change of occupancy.** ~~A change in the use of a building or a portion of a building which results in one of the following:~~ Either of the following shall be considered as a change of occupancy where this code requires a greater degree of safety, accessibility, structural strength, fire protection, means of egress, ventilation or sanitation than is existing in the current building or structure:

1. Any change in the occupancy classification of a building or structure.
2. Any change in the purpose of, or a change in the level of activity within, a building or structure.

~~1. A change of occupancy classification.~~

~~2. A change from one group to another group within an occupancy classification.~~

~~3. Any change in use within a group for which there is a change in application of the requirements of this code.~~

CHANGE SIGNIFICANCE: Every building, or portion of a building, must be assigned an occupancy classification with respect to its use by placing it into one of the specific occupancy groups identified in Chapter 3. These groups are used throughout the code to address everything from allowable building size to required fire protection features. The occupancy

Photo courtesy of buzbuzzer

Multiple-tenant building.

classification process represents identifying a distinct hazard, or more typically a group of hazards, that must be specifically addressed throughout the applicable code requirements. For example, the classification of Group A recognizes those assembly-related concerns associated with theaters, night clubs, places of worship and other facilities where large numbers of people congregate in a concentrated manner. Where there is a change in the use of the building that modifies the type or extent of the hazards created by the new use, a change of occupancy occurs. The scope of a change of occupancy is now more specifically stated in order to identify when such a condition takes place.

Historically, a change of occupancy only occurred where there was a specific change of the building's occupancy category. This included both changes within an occupancy group, as well as changes from one occupancy group to another. This scope of a change of occupancy was modified in the 2016 CBC to include a change in use, and clarified in the 2018 edition to indicate that all such changes in use that result in a change in the code's application are considered as a change of occupancy, even if no change in classification occurs. The 2022 CBC has been further revised to narrow the scope of a change of occupancy where there is no change in classification.

Where no change in occupancy classification occurs, a change of occupancy now exists only in those buildings where (1) there is a change in a building's purpose or level of activity, (2) that functional change is such that the current CBC requires a greater degree of regulation than presently exists in the current building, and (3) the greater degree of regulation required by the current CBC occurs only in the areas of accessibility, structural strength, fire protection, means of egress, ventilation or sanitation. The intent is to limit the application of a change of occupancy where there is no change in classification to only those new uses that present a higher risk to the life safety or welfare of the occupants than was created by the previous use.

Due to the restructured scope of the definition, there is a question as to how to address a building that undergoes a change in occupancy classification where no greater degree of safety, accessibility, structural strength, fire protection, means of egress, ventilation or sanitation is required by the code. An example is the remodeling of a Group A-2 assembly space in a manner where it would be reclassified as Group B. Where the new use poses an equal or lesser hazard level, but such use is classified as a different occupancy, it would seem appropriate to also consider it as a change of occupancy even though no modifications would be required.

202

Definition of Child-Care

CHANGE TYPE: Addition

CHANGE SUMMARY: A definition of Child-Care has been added to the CBC.

2022 CODE TEXT: ***202 Child-care.*** *For the purposes of these regulations, means the care of children during any period of a 24-hour day where permanent sleeping accommodations are not provided. The time-period shall not be more than 24 hours.*

> ***Note:*** *"Child care" shall not be construed to preclude the use of cots or mats for napping purposes, provided all employees, attendants and staff personnel are awake and on duty in the area where napping occurs.*

CHANGE SIGNIFICANCE: The change is representative of current regulation as it is printed in California Code of Regulations (CCR) Title 22. For approximately 10 years, the Department of Social Services (DSS) has been transitioning from the term "Day-Care" to "Child-Care." The profession of child-care has evolved into a more inclusive type of care that can include early learning and child development. The caring aspect of the facilities are more emphasized. The State Fire Marshal work group is including the definition to be more consistent between regulations. CCR 22 Section 101152 c (7) "Child-Care Center" or "Day-Care Center" (or "center") means any child-care facility of any capacity, other than a family child-care home as defined in Section 102352f (1), in which less than 24-hour per day non-medical care and supervision are provided to children in a group setting. The term "Child-Care Center" supersedes the term "Day-Care Center" as used in previous regulations.

Child-care accommodation example.

202

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2022 CODE TEXT: ***202 Day-care.*** *For the purposes of these regulations, means the care of persons during any period of a 24-hour day where permanent sleeping accommodations are not provided. <u>The time-period shall not be more than 24 hours.</u>*

> ***Note:*** *"Day-care" shall not be construed to preclude the use of cots or mats for napping purposes, provided all employees, attendants and staff personnel are awake and on duty in the area where napping occurs.*

CHANGE SIGNIFICANCE: Similar to the change significance with the additional definition of Child-Care, this change is representative of current regulation as it is printed in California Code of Regulations (CCR) Title 22. For approximately 10 years, the Department of Social Services (DSS) has been transitioning from the term "Day-Care" to "Child-Care." The profession of child-care has evolved into a more inclusive type of care that can include early learning and child development. The caring aspect of the facilities are more emphasized. The State Fire Marshal work group is including the definition to be more consistent between regulations. CCR 22 Section 101152 c (7) "Child-Care Center" or "Day-Care Center" (or "center") means any child-care facility of any capacity, other than a family child-care home as defined in Section 102352f (1), in which less than 24-hour per day non-medical care and supervision are provided to children in a group setting. The term "Child-Care Center" supersedes the term "Day-Care Center" as used in previous regulations. This will allow the building and fire code officials to classify the occupancy of I-4 or E based on Social Services classifications for licensing. This will be determined by the age of the children within the child-care facility.

Day-care accommodation example.

202

Definition of Inflatable Amusement Device

CHANGE TYPE: Addition

CHANGE SUMMARY: A definition of Inflatable Amusement Device has been added to the CBC.

2022 CODE TEXT: **202 Inflatable amusement device.** A device made of flexible fabric or other combustible materials that is inflated by one or more air-blowers providing internal air pressure to maintain its shape. Such a device is designed for recreational activities that allow occupants to bounce, climb, slide, negotiate an obstacle course or participate in interactive play.

CHANGE SIGNIFICANCE: It is important to note that an amendment in the Referenced Standards was also made that now includes ASTM F2374, *Standard Practice for Design, Manufacture, Operation, and Maintenance of Inflatable Amusement Devices*. These devices are continuing to become more popular throughout the State of California. Similarly, the number of injuries related to these devices is significant; therefore, the State Fire Marshal proposed the language be included and the ASTM standard be referenced to provide a greater level of safety for the users of these devices and a tool for enforcement by local jurisdictions.

An inflatable amusement device as defined.

202

Definition of Mass Timber

CHANGE TYPE: Addition

CHANGE SUMMARY: Mass timber is now specifically defined as representative of both the large wood building elements historically recognized as Heavy Timber (now Type IV-HT) construction and the three new construction types of IV-A, IV-B and IV-C.

2022 CODE TEXT: <u>**202 Mass timber.** Structural elements of Type IV construction primarily of solid, built-up, panelized or engineered wood products that meet minimum cross-section dimensions of Type IV construction.</u>

CHANGE SIGNIFICANCE: Heavy timber has never been specifically defined in the CBC; its meaning derived partially from various code provisions addressing its application in regard to the regulation of building design and construction. Heavy timber members have large cross sections to achieve a slow burning characteristic, with minimum dimensions established in Table 2304.11 of the CBC. Although regulated in various forms when heavy timber structural elements are used on a limited basis throughout a building, the primary recognition of such materials is through the type of construction classification of Type IV. This construction type, similar to Type III, is made up of structural members that typically must meet the criteria for heavy timber members (exceptions include exterior and interior walls). A new definition recognizes that mass timber consists of Type IV structural elements that are primarily of solid, built-up, panelized or engineered wood products that meet minimum Type IV cross section dimensions.

Photo courtesy of naturallywood.com, KK Law

Mass timber construction with glulam and CLT.

Mass timber represents both the large wood building elements historically recognized as Heavy Timber (now Type IV-HT) construction and the three new construction types contained in the 2022 CBC (Types IV-A, IV-B and IV-C). A single term now represents the various sawn and engineered wood products referenced in Chapter 23 (Wood) of the CBC and in ANSI/APA PRG 320 *Standard for Performance-rated Cross-laminated Timber*.

Type IV-HT mass timber construction has exterior walls made of noncombustible materials, fire-retardant-treated wood (FRTW), or cross-laminated timber (CLT) protected in accordance with CBC Section 602.4.2. Interior building elements must be of solid or laminated wood. Columns, roof/floor beams, girders, flooring, roof decking and partitions must have minimum nominal dimensions per Table 2304.11. A key feature recognizes that Type IV-HT is deemed to meet an acceptable degree of fire resistance based solely on its required minimum dimensions. In contrast, mass timber used in construction Types IV-A, IV-B and IV-C is required to have a fire-resistance rating. The rating may be determined in accordance with Section 703.2.2 addressing various methods for determining fire-resistance, including calculations performed in accordance with Section 722.

Another new definition addresses the passive fire protection sometimes required for mass timber construction. Depending on the building's type of construction, mass timber is permitted to have its own fire-resistance rating, have a fire-resistance rating through a combination of the inherent mass timber fire-resistance plus protection with noncombustible insulating materials, or use the noncombustible protection to provide the entire fire-resistance rating. The definition of noncombustible protection also recognizes its value in delaying the combustion of mass timber members.

202

Definition of Nailable Substrate

CHANGE TYPE: Addition

CHANGE SUMMARY: Nailable substrate has been defined to clarify what materials should be expected to provide withdrawal resistance for roof or wall cladding assemblies.

2022 CODE TEXT: **202 Nailable substrate.** A product or material such as framing, sheathing or furring, composed of wood, wood-based materials or other materials providing equivalent fastener withdrawal resistance.

CHANGE SIGNIFICANCE: The addition of a definition of nailable substrate clarifies what products and materials are to be used for wind resistance in wall assemblies. Some siding materials have sufficient capacity on their own to resist wind loads, including wood panel sheathing and hardboard siding. Many other materials have limited resistance to wind loads; for example, vinyl siding and insulated vinyl siding need another material behind the siding to resist wind loads. Such wind resisting materials are typically wood framing, wood sheathing or cold-formed steel framing. For some siding and roof materials, furring is added specifically to provide an attachment surface. Adding the definition of nailable surface clarifies that these structural elements need to be used when attaching siding to the structure. Fasteners must be attached to wood or cold-formed steel. The definition also offers a performance approach, by referencing an option for calculating nailing equivalency in a material other than wood.

New Section 1404.14.1.1, addressing vinyl siding fasteners and fastener penetration for wood construction, directly references the new term.

Furring forms a nailable substrate over insulation and beneath vinyl siding.

202

Definition of Penthouse

CHANGE TYPE: Clarification

CHANGE SUMMARY: The definition of penthouse has been slightly revised to ensure that enclosures extended to the roof in order to house stairways are considered as penthouses.

2022 CODE TEXT: **202 Penthouse.** An enclosed, unoccupied rooftop structure used for sheltering mechanical and electrical equipment, tanks, elevators and related machinery, stairways and vertical shaft openings.

CHANGE SIGNIFICANCE: Penthouses are structures placed on the roofs of buildings to shelter various types of machinery and equipment, as well as provide an enclosure for vertical shaft openings. A key feature of penthouses is that they are enclosed, yet unoccupied, areas of a building. The scope of the portion of a building that would be considered as a penthouse is often critical in the evaluation of allowable building height and area, type of construction, means of egress, fire resistance, structural loading conditions, and other key areas of regulation. The definition of penthouse has been slightly revised to ensure that enclosures extended to the roof in order to house stairways will also be considered as penthouses.

Where applying the provisions of the CBC, penthouses that comply with Section 1511 do not contribute to the building's number of stories and building floor area. In addition, a penthouse is not to be included in the determination of any fire area in the building. Various required fire-resistive ratings may also be reduced for penthouse structures. As such, the scope of what type of structure is considered as a penthouse is critical for proper code application. In conjunction with the use limitations set forth in Section 1511.2.2, the definition of penthouse in Chapter 2 has historically provided the limitations of such rooftop structures. In addition to being enclosed and typically unoccupied, the scope of a penthouse's

Photo courtesy of Sergey Alimov

Penthouses.

use has been limited to only those structures used exclusively to shelter mechanical and electrical equipment, tanks, elevators and associated machinery, and vertical shaft openings. There has previously been some question whether its use to enclose the uppermost portion of a stairway qualifies as acceptable. The definition, as well as Section 1511.2.2, has been expanded to clarify that rooftop structures that enclose stairways may be considered as penthouses when in compliance with Section 1511.

202

Definition of Photovoltaic (PV) Panel System, Ground-Mounted

CHANGE TYPE: Addition

CHANGE SUMMARY: A definition of Photovoltaic (PV) Panel System, Ground-Mounted has been added to the CBC.

2022 CODE TEXT: ***202 Photovoltaic (PV) panel system, ground-mounted.*** *An independent photovoltaic (PV) panel system without useable space underneath, installed directly on the ground.*

CHANGE SIGNIFICANCE: The term now has a definition for jurisdictions to better apply ground-mounted photovoltaic panel system requirements as appropriate and differentiate those installations from elevated photovoltaic support structures.

Ground-mounted photovoltaic panel system.

202

Definition of Photovoltaic (PV) Support Structure, Elevated

CHANGE TYPE: Addition

CHANGE SUMMARY: A definition of Photovoltaic (PV) Support Structure, Elevated has been added to the CBC.

2022 CODE TEXT: ***202 Photovoltaic (PV) support structure, elevated.*** *An independent photovoltaic (PV) panel support structure designed with useable space underneath with minimum clear height of 7 feet 6 inches (2286 mm), intended for secondary use such as providing shade or parking of motor vehicles.*

CHANGE SIGNIFICANCE: This new definition clarifies the intent of how elevated photovoltaic panel systems and their supports are defined in the code and how the requirements for these structures are applied. Specifically, most PV panels in the marketplace have been fire tested and assigned a “type rating” in accordance with UL 1703. However, some PV panels might not have that fire testing, and could be marked “not fire rated.” PV panels marked “not fire rated” cannot be used on elevated/overhead PV structures that could have people or cars beneath them, with or without a full roof assembly. The definition as adopted helps code users to identify applications where these types of panels can or cannot be installed.

Elevated photovoltaic support structure.

202

Definition of Structural Members

CHANGE TYPE: Clarification

CHANGE SUMMARY: Definitions for primary structural frame and secondary structural members have been revised to better address new technologies, as well as remove archaic concepts and redundant language.

2022 CODE TEXT: **202 Primary structural frame.** The primary structural frame shall include all of the following structural members:

1. The columns.
2. Structural members having direct connections to the columns, including girders, beams, trusses and spandrels.
3. Members of the floor construction and roof construction having direct connections to the columns.
4. ~~Bracing~~ Members that are essential to the vertical stability of the primary structural frame under gravity loading ~~shall be considered part of the primary structural frame whether or not the bracing member carries gravity loads~~.

202 Secondary structural members. The following structural members shall be considered secondary members and not part of the primary structural frame:

1. Structural members not having direct connections to the columns.
2. Members of the floor construction and roof construction not having direct connections to the columns.
3. Bracing members ~~other than those~~ that are not designated as part of ~~the~~ a primary structural frame or bearing wall.

Columns and girder trusses form the primary structural frame in a roof; trusses are considered secondary structural members.

CHANGE SIGNIFICANCE: In the regulation of structural members for the purposes of required fire resistance, as well as for other reasons, such members are considered as either primary or secondary in nature. Provisions regulating primary structural frame members often rise to a higher level than those regulating secondary members due to the increased loading conditions and lack of redundancy involved. Definitions regarding both of these types of structural elements have been revised so as to update the terms to adequately address new technologies; remove parts of the definitions that could be considered archaic; and remove what was considered as redundant language. As such, the revised definitions better identify a component's status as primary or secondary.

The type and level of protection required for various structural elements varies in Table 601 and Section 704 depending on the member and the portion of the structural system where it is placed. Changes were also made to both Table 601 and Section 704.4 to incorporate the revised secondary structural member definition. On the whole this group of revisions may not seem significant, but these definitions are used frequently and have a great impact on determining the proper fire resistance of structural elements and how they are to be protected.

Any member or component that is essential to the vertical stability of the building under gravity loads is now to be classified and protected as part of the primary structural frame, clarifying a long-standing question of whether the definition was intended to apply to bearing walls, which are assemblies rather than single components.

For the primary structural frame, the following components qualify:

1. Columns.
2. Beams and girder trusses – directly supported by columns.
3. Roof and floor panels and slabs – monolithic concrete and timber construction.
4. Braced frames and moment frames – transfer gravity loads to the foundation.
5. Bearing walls – support gravity loads and transfer them to the foundation.

For secondary structural members, components that are built into an assembly that supports a portion of a floor, roof or only their own self-weight qualify:

1. Roof trusses connected to a girder truss.
2. Roof purlins and subpurlins connected to beams.
3. Floor joists and trusses.
4. Nonbearing walls.
5. Bracing in the roof, floor or walls that is specifically designed to resist wind or seismic loads and is redundant for gravity systems.

The revisions in the definitions help to address some of the newer structural systems, such as mass timber constructed only of cross-laminated floor and wall panels with no columns, as well as concrete slab floor systems without beams where the slabs connect directly to the columns.

202

Definition of Toddler

CHANGE TYPE: Addition

CHANGE SUMMARY: A definition of Toddler has been added to the CBC.

2022 CODE TEXT: ***202 Toddler.*** *Any child between 18 months and 36 months of age.*

CHANGE SIGNIFICANCE: Day-Care facilities are licensed by the Department of Social Services. The classifications of the children are infants: age 0 to 24 months; toddlers: 18 to 36 months; and preschool, etc. The intent of these regulations is to provide a level of safety to the children that are nonambulatory or unable to self-evacuate in an emergency. The conflict is that there is an overlap of the definition of infants and toddlers. The Office of the State Fire Marshal conducted a Day-Care Workgroup to address issues with the current regulations. The workgroup recommended the legal definition of toddlers be picked up from the Health & Safety Code Section 1596.55 and included in the regulations to remove the conflict in the definitions. This proposal will also remove the conflict with the Social Service's classification of day-cares. This will allow the building and fire code officials to classify the occupancy of I-4 or E based on Social Services classifications for licensing. This will be determined by the age of the children within the child-care facility.

A toddler that would require greater level of safety in accordance with the new definition.

PART 2

Building Planning

Chapters 3 through 6

- **Chapter 3** Occupancy Classification and Use
- **Chapter 4** Special Detailed Requirements Based on Occupancy and Use
- **Chapter 5** General Building Heights and Areas
- **Chapter 6** Types of Construction

The application of the *California Building Code* (CBC) to a structure is typically initiated through the provisions of Chapters 3, 5, and 6. Chapter 3 establishes one or more occupancy classifications based upon the anticipated uses of a building. The appropriate classifications are necessary to properly apply many of the code's non-structural provisions. The requirements of Chapter 6 deal with classification as to construction type, based on a building's materials of construction and the level of fire resistance provided by such materials. Limitations on a building's height and area, set forth in Chapter 5, are directly related to the occupancies it houses and its type of construction. Chapter 5 also provides the various methods available to address conditions in which multiple uses or occupancies occur within the same building. Chapter 4 contains special detailed requirements based on unique conditions or uses that are found in some buildings. ■

305.2
Group E, Child-Care Facilities

306.2
Group F-1 Occupancy Classification

307.1.1
Uses Not Classified as Group H

311.2, 311.3
Alcoholic Beverage Storage

404.1
Scope of Atrium Provisions

404.5
Smoke Control in Atriums

404.6
Horizontal Assemblies in Atriums

406.2.4
Floor Surfaces in Parking Garages

407.3.1.1
Group I-2 Corridor Doors

407.6.1
Automatic-Closing Doors in Group I-2

411.5

Puzzle Rooms

414.2.3

Fire Wall Use for Control Areas

422.7

Cooking in Ambulatory Care Facilities

424

Play Structures

455.2

Large Family Day-Cares

503.1.4

Occupied Roof Allowances

TABLE 504.3

Allowable Height in Feet

TABLE 504.4

Allowable Height in Stories

TABLE 506.2

Allowable Building Area

506.3.2

Allowable Area Frontage Increase

508.4.4

Separated Occupancies

508.4.4.1, 509.4.1.1

Fire Separations of Mass Timber

508.5

Live/Work Units

TABLE 509.1

Storage Battery Systems as Incidental Uses

510.2

Stairway Construction in Podium Buildings

TABLE 601

Type IV Fire-Resistance

602.4

Mass Timber Type IV Buildings

602.4.1 – 602.4.3

Type IV-A, IV-B and IV-C Buildings

602.4.4

Type IV-HT Buildings

603.1

Combustible Materials in Types I and II

305.2

Group E, Child-Care Facilities

CHANGE TYPE: Modification

CHANGE SUMMARY: Section 305.2 was amended to reflect the new definition of child-care and to state that Group E Child-Care is now for more than six children of 36 months, not 2 years as previously written.

2022 CODE TEXT: **305.2 Group E, ~~day~~ *child*-care facilities.** This group includes buildings and structures, or portions thereof occupied by more than *six* children ~~2 years~~ *36 months* of age *and older* who receive educational, supervision or personal care services for *fewer* than 24 hours per day.

> ***Exception: [SFM]*** *A ~~Day care~~ child-care facility not otherwise classified as ~~an~~ a Group R-3 occupancy, where occupants are not capable of responding to an emergency situation without physical assistance from the staff shall be classified as Group I-4. A maximum of five infants and toddlers are allowed in a Group E child care.*

305.2.1 Within places of religious worship. Rooms and spaces within places of worship providing such day-care during religious functions shall be classified as part of the primary occupancy *where not licensed for ~~day~~ child-care purposes by the Department of Social Services*.

CHANGE SIGNIFICANCE: The changes in the addition of definitions for Child-Care, Day-Care and Toddler as well as this amendment are made because the Department of Social Services (DSS) has been transitioning from the term “Day-Care” to “Child-Care” for approximately 10 years. The profession of child-care has evolved into a more inclusive type of care that can include early learning and child development. The caring aspect of the facilities are more emphasized. The State Fire Marshal work group is including the definition to be more consistent between regulations.

An example of a Group E, child-care facility.

CCR 22 Section 101152 c (7) "Child-Care Center" or "Day-Care Center" (or "center") means any child-care facility of any capacity, other than a family child-care home as defined in Section 102352f (1), in which less than 24-hour per day non-medical care and supervision are provided to children in a group setting. The term "Child-Care Center" supersedes the term "Day-Care Center" as used in previous regulations.

306.2

Group F-1 Occupancy Classification

CHANGE TYPE: Modification

CHANGE SUMMARY: Energy storage systems and water/sewer treatment activities have been added to the listing of Group F-1 occupancies.

2022 CODE TEXT: **306.2 Moderate-hazard factory industrial, Group F-1.** Factory industrial uses that are not classified as Factory Industrial F-2 Low Hazard shall be classified as F-1 Moderate Hazard and shall include, but not be limited to, the following:

Energy storage systems (ESS) in dedicated use buildings

Water/sewer treatment facilities

(no changes to other listed uses)

CHANGE SIGNIFICANCE: Although the potential hazard and fire severity of the multiple uses in the Group F occupancy classification is quite varied, these uses share common elements. The occupants are adults who are awake and generally have enough familiarity with the premises to be able to exit the building with reasonable efficiency. Public occupancy is usually quite limited, and most occupants are aware of the potential hazards the use creates. The Group F-1 classification is applied for those factory and industrial uses that pose a moderate degree of hazard, essentially any such use that would not be considered as a low-hazard Group F-2 occupancy. The Group F-1 designation typically recognizes the presence of materials that pose a risk due to their combustibility or flammability potential. Due to these anticipated hazards, two additional types of uses addressing energy storage systems and water/sewer treatment activities have been added to the listing of Group F-1 occupancies.

Photo courtesy of TerryJ

Group F-1 water treatment facility.

Electrical energy storage systems are regulated by Section 1207 of the *California Fire Code* (CFC). The purpose of these systems is to provide standby or emergency power, an uninterruptable power supply, load shedding, load sharing and similar capabilities. The CFC extensively regulates such facilities, including the obtaining of permits, submitting of construction documents and providing for a hazard mitigation analysis. A substantial number of safeguards have been established in the CFC to allow for recognition as a moderate-hazard condition in the determination of occupancy classification.

Where a single-occupancy building is used only for energy storage systems (ESSs), electrical energy generation and other electrical grid operations, the building is now to be considered as a Group F-1 occupancy. Although no other occupancies are permitted in the building, administrative and support areas that do not contain ESSs are allowed provided they do not exceed 10 percent of the building area on the story they are located. In the evaluation of the anticipated fuel load hazard, a moderate-hazard Group F-1 classification was deemed appropriate. For comparison purposes, electric generation plants have been historically classified as Group F-1 occupancies.

If an ESS is installed in a building having an occupancy other than Group F-1, the ESS is to be considered as part of that other occupancy. However, the provisions of CFC Section 1207 addressing an ESS will apply for the space the ESS occupies. The impact of the new Group F-1 classification may be significant for larger ESS installations in dedicated-use indoor locations, as classification as a Group H-2 occupancy will no longer be required.

Although nearly every community has a water/sewer treatment facility, there has been a lack of consistency in how such facilities should be viewed for occupancy classification purposes. Typically considered as a Group F industrial use, it has been unclear as to whether a moderate-hazard Group F-1 or a low-hazard Group F-2 classification is most appropriate. Such facilities are now specifically listed as one of the many Group F-1 occupancies due to the potential hazards that are typically present. There is a concern that some of the materials in use, especially in water treatment activities, are of a hazardous nature that would warrant a Group H classification should the maximum allowable quantities permitted in Section 307 be exceeded. Where the allowable quantities of hazardous materials do not rise to the level of a Group H classification, it was determined that a moderate hazard exists, resulting in an occupancy classification of Group F-1.

307.1.1

Uses Not Classified as Group H

CHANGE TYPE: Modification

CHANGE SUMMARY: The distilling or brewing of alcohol beverages, as well as the storage of beer, distilled spirits and wine, are now considered as conditions where the quantities of the beverages are not limited in a non-Group H occupancy provided compliance with the CFC is achieved.

2022 CODE TEXT: **307.1.1 Uses other than Group H.** An occupancy that stores, uses or handles hazardous materials as described in one or more of the following items shall not be classified as Group H, but shall be classified as the occupancy that it most nearly resembles.

18. Distilling or brewing of beverages conforming to the requirements of the *California Fire Code.*

19. The storage of beer, distilled spirits and wines in barrels and casks conforming to the requirements of the *California Fire Code.*

(no changes to other listed uses)

CHANGE SIGNIFICANCE: High-hazard Group H occupancies are characterized by an unusually high degree of explosion, fire or health hazard as compared to typical commercial and industrial uses. There is a single common feature about all Group H occupancies: They are designated as Group H based on excessive quantities of hazardous materials in use and/or in storage. A variety of conditions have historically been established under which a Group H classification is not required despite that the quantities of materials exceed the amounts set forth in Table 307.1(1) or 307.1(2). The distilling or brewing of alcohol beverages, as well as the storage of beer, distilled spirits and wine, are now considered as conditions where the quantities of the beverages are not limited in a non-Group H occupancy provided compliance with the CFC is achieved.

Photo courtesy of FocusEye

Whiskey distillery.

The addition of the two new uses regarding the manufacture and storage of alcoholic beverages is significant due to the elimination of any classification as a Group H occupancy. Distilling, brewing and the storage of alcohol beverages, regardless of alcohol content and the quantity of liquid, are not considered as Group H occupancies where in compliance with the CFC. This allowance in part takes into consideration the new automatic sprinkler requirements for the manufacture of distilled spirits, or the bulk storage of distilled spirits or wine. Where the alcoholic beverages being manufactured or stored exceed 16-percent alcohol content, regardless of the liquid quantity, a sprinkler system shall be provided throughout the fire area containing the Group F-1 or S-1 occupancy. See the discussion of new Sections 903.2.4.2 and 903.2.9.3. Due to the fire protection afforded by an automatic sprinkler system, along with other safeguards established in the CFC, the manufacture and storage of alcoholic beverages in any quantity is not ever to be considered as a Group H occupancy. Manufacturing activities will be classified as Group F-1 or Group F-2 based on the alcohol content, while the newly revised storage occupancy provisions will address the concerns associated with classification as Group S-1 or Group S-2.

311.2, 311.3

Alcoholic Beverage Storage

CHANGE TYPE: Clarification

CHANGE SUMMARY: The proper occupancy classification for the storage of beverages, specifically alcohol beverages, has been clarified for both the Group S-1 and S-2 categories.

2022 CODE TEXT: **311.2 Moderate-hazard storage, Group S-1.** Storage Group S-1 occupancies are buildings occupied for storage uses that are not classified as Group S-2, including, but not limited to, storage of the following:

Beverages over 16-percent alcohol content

(no changes to other listed uses)

311.3 Low-hazard storage, Group S-2. Storage Group S-2 occupancies include, among others, buildings used for the storage of noncombustible materials such as products on wood pallets or in paper cartons with or without single thickness divisions; or in paper wrappings. Such products are permitted to have a negligible amount of plastic trim, such as knobs, handles or film wrapping. Group S-2 storage uses shall include, but not be limited to, storage of the following:

Beverages up to and including 16-percent alcohol ~~in metal, glass or ceramic containers~~

(no changes to other listed uses)

CHANGE SIGNIFICANCE: In general, the Group S designation includes storage occupancies that are not highly hazardous. Such storage uses are classified into two divisions based on the hazard level involved.

Photo courtesy of John J Miller Photography

Bourbon whiskey warehouse.

Group S-1 includes those buildings used for moderate-hazard storage purposes, whereas low-hazard uses make up the Group S-2 classification. The proper occupancy classification for the storage of beverages, specifically alcohol beverages, has been clarified for both the Group S-1 and S-2 categories.

The storage of alcoholic beverages having a maximum alcohol content of 16 percent has historically been classified as a Group S-2 low-hazard occupancy provided the containers are composed of noncombustible materials. There has previously been a concern that such beverages stored in wooden barrels and casks pose a higher hazard than typically addressed by the Group S-2 classification. This concern has now been addressed through the inclusion of safeguards set forth in new CFC Chapter 40 relating to ignition sources, mechanical ventilation and spill containment. Therefore, the Group S-2 classification is now appropriate for the storage of alcohol beverages with no more than 16-percent alcohol content regardless of the types of containers in which the beverages are stored.

Where the alcohol content of beverages in a storage condition exceeds 16 percent, the occupancy classification for such storage use is now specifically identified as Group S-1. This classification is applicable for both bulk storage and retail packaging. Previously, there had been no specific entry in the *California Building Code* (CBC) for such a use; however, the Group S-1 classification was typically applied due to the mandate in Section 311.1 that storage uses that are not classified as Group S-2 shall be considered as Group S-1. Additionally, where the maximum allowable quantities of hazardous materials have been exceeded, a classification of Group H was often assigned. Due to an evaluation of the actual hazards involved with the storage of such materials, and the recognition that the CBC has always considered the manufacture of beverages with more than 16-percent alcohol content as a Group F-1 occupancy, the classification of such storage uses as Group S-1 now provides for consistency in application.

It should be noted that these revisions in the CBC were part of a series of changes in the CFC, including new Chapter 40 addressing the storage of alcoholic beverages.

404.1

Scope of Atrium Provisions

CHANGE TYPE: Clarification

CHANGE SUMMARY: Application of the atrium provisions have been clarified and several means of egress provisions have been relocated to Chapter 10.

2022 CODE TEXT: **404.1 General.** ~~In other than Group H occupancies, and where permitted by Section 712.1.7, the~~ The provisions of Sections 404.1 through 404.~~10~~11 shall apply to buildings containing atriums. Atriums are not permitted in buildings or structures ~~containing vertical openings defined as "Atriums."~~ classified as Group H.

> **Exception:** Vertical openings that comply with Sections 712.1.1 through 712.1.3, and Sections 712.1.9 through 712.1.14.

404.9 Exit access travel distance. Exit access travel distance for areas open to an atrium shall comply with the requirements of ~~this section~~ Section 1017.

1017.3.2 Atriums. Exit access travel distance for areas open to an atrium shall comply with the requirements of Sections 1017.3.2.1 through 1017.3.2.3.

~~404.9.1~~ 1017.3.2.1 Egress not through the atrium. Where required access to the exits is not through the atrium, exit access travel distance shall comply with Section 1017.2.

~~404.9.2~~ 1017.3.2.2 Exit access travel distance at the level of exit discharge. Where the path of egress travel is through an atrium space, exit access at the level of exit discharge shall be determined in accordance with Section 1017.2.

~~404.9.3~~ 1017.3.2.3 Exit access travel distance at other than the level of exit discharge. Where the path of egress travel is not at the level of exit discharge from the atrium, that portion of the total permitted exit access travel distance that occurs within the atrium shall be not greater than travel distance 200 feet (60 960 mm).

Photo courtesy of susib

Atrium.

404.~~10~~11 Interior exit ~~stairways~~ stairway discharge. ~~Not greater than 50 percent~~ Discharge of interior exit stairways ~~are permitted to egress~~ through an atrium ~~on the level of exit discharge~~ shall be in accordance with Section 1028.

CHANGE SIGNIFICANCE: Unprotected vertical openings are often identified as the factors responsible for fire spread in incidents involving fire fatalities or extensive property damage. Section 404 addresses one method for protection of these specific building features in lieu of providing a complete floor separation. Where an atrium is provided in conformance with this section, it is considered as an equivalent level of resistance to fire and smoke spread vertically from story to story. The application of the atrium provisions has been clarified, and several means of egress provisions applicable to atriums have been relocated to Chapter 10.

The atrium provisions of Section 404 are only one of the numerous options for addressing vertical openings as set forth in Sections 712.1.1 through 712.1.16. Atriums are identified in Section 712.1.7 and are considered acceptable when in compliance with the criteria of Section 404. Additionally, the code permits other types of vertical opening conditions that do not require compliance with the atrium provisions. For example, Section 712.1.1 continues to recognize the use of shaft enclosures for vertical opening protection. Section 712.1.2 permits openings within residential dwelling units to be unprotected. Other unprotected vertical openings that are permitted by the code include communicating spaces in buildings of Group I-3 (see Section 408.5); mezzanines (see Section 505); escalator openings (see Section 712.1.3); supplemental stairway openings (see Section 1019.3, Exception 4); open parking garages (see Section 406.5); enclosed parking garages (see Section 406.6); and other openings as detailed in Section 712.

Atriums in compliance with Section 404 are not to be considered unprotected vertical openings; rather, the vertical openings are protected by means other than enclosure by a shaft or a complete floor assembly. The provisions of Section 404 are not intended to apply to conditions that are addressed by Section 712.1 based on the itemized options, other than when Section 712.1.7 is the chosen method of compliance. In other words, if compliance with Section 712.1 is achieved by applying one of the options other than an atrium as permitted by Section 712.1.7, then the provisions of Section 404 are not applicable. Conversely, if the provisions of Section 404 have been complied with, then the other options listed in Section 712.1 do not need to be addressed. It is the intent that the revision to the scoping language of Section 404.1 will provide the needed clarity for when the atrium provisions are applied.

Regarding a related issue, a change in format has resulted in the special travel distance limitation provisions previously located in Section 404.9 being relocated to Chapter 10 in new Section 1017.3.2. Although the three potential exiting scenarios that are possible in an atrium situation may appear specific to atriums, they are not entirely self-contained. The limitations to travel must be evaluated as part of the general travel distance provisions of Section 1017, and thus have been relocated to that area of the code.

The acceptable use of interior exit stairways within an atrium for egress purposes has also been reformatted for reasons similar to that for the relocation of the atrium travel distance provisions and are now located in Section 1028.

404.5

Smoke Control in Atriums

CHANGE TYPE: Modification

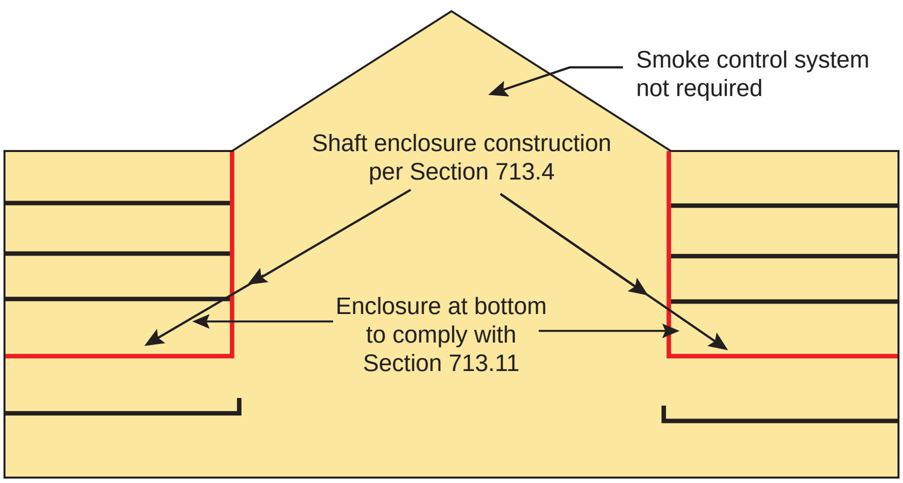
CHANGE SUMMARY: In the evaluation of whether a smoke control system is required for an atrium condition, vertical opening protection consisting of a combination of both the atrium and a shaft enclosure is now recognized.

2022 CODE TEXT: **404.5 Smoke control.** A smoke control system shall be installed in accordance with Section 909.

Exceptions:

1. In other than Group I-2 *and R-2.1*, Condition 2, smoke control is not required for atriums that connect only two stories.
2. A smoke control system is not required for atriums connecting more than two stories when all of the following are met:
   2.1 Only the two lowest stories shall be permitted to be open to the atrium.
   2.2 All stories above the lowest two stories shall be separated from the atrium in accordance with the provisions for a shaft in Section 713.4.

CHANGE SIGNIFICANCE: A major component of the life-safety system for a building containing an atrium is the required smoke control system. Intended to prevent the migration of smoke throughout interconnected stories of a building via the atrium, the design of the smoke control system is to be in accordance with Section 909. The smoke control system is to be installed in all atriums connecting more than two stories as well as those Group I-2 and Group I-1, Condition 2 buildings where atriums connect two or more stories. The extension of an atrium without smoke control beyond two stories has historically been prohibited; however, a new exception removes that limitation where two conditions are met. First, only the two lowest stories are permitted to be open to the atrium. Second, those stories located above the two lowest stories are required to



ATRIUM CONDITION

be separated from the atrium with shaft enclosures having a minimum fire-resistance rating in compliance with Section 713.4. The new allowance recognizes that a combination vertical opening condition consisting of both an atrium and a shaft enclosure provides the necessary degree of separation expected between multiple stories, eliminating the need for a smoke control system.

404.6

Horizontal Assemblies in Atriums

CHANGE TYPE: Modification

CHANGE SUMMARY: Horizontal assembly separation of the atrium from adjacent spaces is no longer required at those openings created for complying escalators and/or exit access stairways.

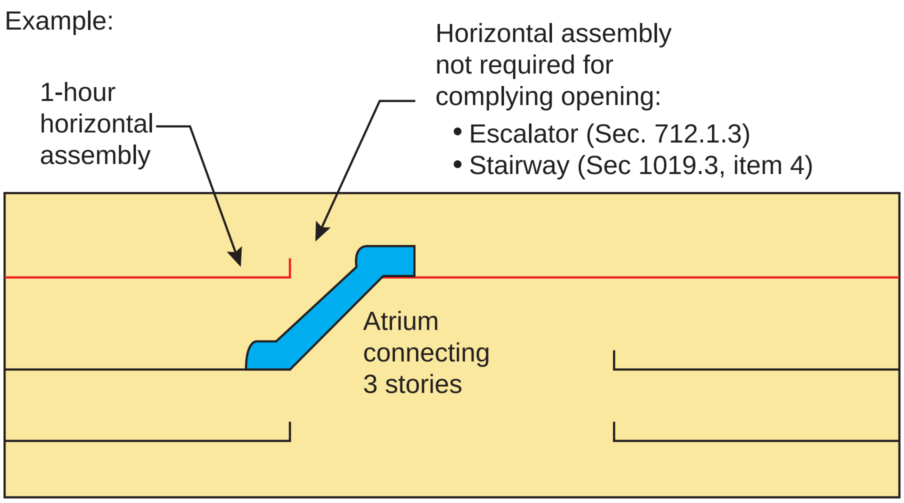
2022 CODE TEXT: **404.6 Enclosure of atriums.** Atrium spaces shall be separated from adjacent spaces by a 1-hour fire barrier constructed in accordance with Section 707 or a horizontal assembly constructed in accordance with Section 711, or both.

Exceptions:

(no changes to Exceptions 1-4)

5. A horizontal assembly is not required between the atrium and openings for escalators complying with Section 712.1.3.
6. A horizontal assembly is not required between the atrium and openings for exit access stairways and ramps complying with Item 4 of Section 1019.3.

CHANGE SIGNIFICANCE: One of the basic premises of the atrium requirements is that an engineered smoke control system combined with an automatic fire sprinkler system that is properly supervised provides an adequate alternative to the fire-resistance rating of a shaft enclosure. It is also recognized that some form of a boundary is required to assist the smoke control system in containing smoke to just the atrium area. The basic requirement, therefore, is that the atrium space be separated from adjacent areas by fire barriers and horizontal assemblies having a fire-resistance rating of at least 1 hour. Two new exceptions to the enclosure requirements address conditions where escalators and/or exit access stairways penetrate the required horizontal assembly. These exceptions recognize that no horizontal assembly separation of the atrium is required at those locations where openings are created for such escalators and/or stairways.



Unless specifically excepted, the boundary of an atrium must provide a full separation from surrounding spaces. Such separation would typically prohibit unprotected openings that pass through any horizontal assembly that creates a portion of the boundary. New Exception 5 now permits the omission of any required horizontal assembly where the floor opening contains an escalator and is in compliance with Section 712.1.3. A similar allowance has been established as Exception 6 for exit access stairways and ramps that comply with item 4 of Section 1019.3.

The allowance for such openings is based on the recognition that the floor openings are protected in a special manner through the use of draft curtains around the floor opening and additional sprinklers at the perimeter of the opening. The size of the floor opening is also limited based on the area devoted to the escalator or stairway. It is anticipated that the presence of the draft curtains and sprinklers limit the potential of smoke spread through the opening; thus, such areas that only communicate via these specific openings should not be considered as an extension of the atrium.

406.2.4

Floor Surfaces in Parking Garages

CHANGE TYPE: Modification

CHANGE SUMMARY: The mandate for a sloping floor in the vehicle areas of parking garages has been reinstated in the CBC for those garages classified as Group S-2 occupancies.

2022 CODE TEXT: **406.2.4 Floor surfaces.** Floor surfaces shall be of concrete or similar approved noncombustible and nonabsorbent materials. The area of floor used for the parking of automobiles or other vehicles shall be sloped to facilitate the movement of liquids to a drain or toward the main vehicle entry doorway. The surface of vehicle fueling pads in motor fuel-dispensing facilities shall be in accordance with Section 406.7.1.

Exceptions:

1. *(no change to exception)*

~~**2.** Floors of Group S-2 parking garages shall not be required to have a sloped surface.~~

~~**3.**~~**2.** *(no change to exception)*

CHANGE SIGNIFICANCE: Motor-vehicle-related uses are regulated in a detailed manner through the special provisions found in Section 406. Those requirements applicable to all types of such uses, including parking garages, motor-fuel dispensing facilities and repair garages, are set forth in Section 406.2. Floor surfaces of these varied uses are addressed for a variety of concerns, such as surface material and floor slope. The need for a sloping floor in the vehicle areas, mandated in the CBC until the 2010 edition, has been reinstated for those parking garages classified as Group S-2 occupancies.

Photo courtesy of Jonas Ahrentorp/EyeEm

Enclosed parking garage.

A sloped floor in parking garage vehicle areas provides a means to move liquids from the parking surface. Such liquids often include deleterious oils and de-icing salts that could potentially cause damage to the concrete surface and the reinforcement within the floor system. Although the base requirement in Section 406.2.4 mandates all such floors be sloped to address such concerns, Exception 2 has previously exempted Group S-2 public garages, both enclosed and open, from having sloped surfaces. The intent of the exception was to recognize that in some cases, such as large parking structures constructed of prefabricated materials, it may be difficult to design all vehicle surfaces to be sloped. However, it was determined that the need to provide proper drainage is a significant concern and thus the exception has now been deleted.

407.3.1.1

Group I-2 Corridor Doors

CHANGE TYPE: Clarification

CHANGE SUMMARY: Several specific conditions related to corridor doors have expanded the smoke-resistant criteria in order to address the various types of doors used in corridors of Group I-2 care facilities.

2022 CODE TEXT: **407.3.1.1 Door construction.** *Corridor doors* not required to have a fire protection rating shall comply with the following:

1. Solid doors shall have close-fitting operational tolerances, head and jamb stops.
2. Dutch-style doors shall have an astragal, rabbet or bevel at the meeting edges of the upper and lower door sections. Both the upper and lower door sections shall have latching hardware. Dutch-style doors shall have hardware that connects the upper and lower sections to function as a single leaf.

CHANGE SIGNIFICANCE: Health care facilities classified as Group I-2 occupancies have multiple unique characteristics that cannot be addressed under the general provisions of the CBC. Therefore, any special considerations must be recognized separately in Chapter 4, specifically Section 407. Corridors in such facilities are intended to provide a relatively smoke-free environment for the relocation of patients during a fire or other emergency condition. The corridor walls must be constructed in a manner to limit smoke transfer. Accordingly, the corridor doors must also assist in maintaining the smoke-protected environment. Several specific conditions related to corridor doors have expanded the criteria addressing the various types of doors used in corridors of care facilities.

Corridor doors in Group I-2.

Doors in corridor walls of Group I-2 occupancies are specifically regulated in Section 407.3.1. One of the provisions is performance in nature, requiring such corridor doors to "provide an effective barrier to limit the transfer of smoke." That performance statement has now been further expressed by allowing those necessary operational tolerances at the head and jamb stops, while continuing to be as close-fitting as possible. The smoke-resistant characteristics are further regulated in Condition 3, where louvers are permitted in doors. Or, as an alternative method of providing required make-up air for exhaust systems, a door undercut is acceptable up to a maximum of ⅔ inch.

In addition, Dutch-style doors are now specifically permitted in Group I-2 corridors where several conditions are met. A bevel, rabbet or astragal is required at the meeting edges of the upper and lower door sections. In addition, latching hardware is mandated on both the upper and lower sections. There must also be a means for connecting the upper and lower door sections in a manner that will allow the entire assembly to function as a single leaf.

Additional clarity and guidance has been provided for addressing an intended function for Group I-2 corridor doors. An effective barrier at the door openings limits the movement of smoke between the egress corridor and adjacent rooms. Additionally, their introduction into Section 407 provides for alignment with the Centers for Medicare & Medicaid Services (CMS) federal standard.

407.6.1

Automatic-Closing Doors in Group I-2

CHANGE TYPE: Modification

CHANGE SUMMARY: In Group I-2 occupancies, the closing of automatic-closing doors on hold-open devices must now also occur upon activation of the fire alarm system or automatic sprinkler system.

2022 CODE TEXT: **407.6.1 Activation of automatic-closing doors.** Automatic-closing doors on hold-open devices in accordance with Section 716.2.6.6 shall also close upon activation of a fire alarm system, an automatic sprinkler system, or both. The automatic release of the hold-open device on one door shall release all such doors within the same smoke compartment.

CHANGE SIGNIFICANCE: Automatic-closing doors with hold-open devices are mandated by the CBC in a very limited number of situations: those locations where it is critical that the doors will close automatically under smoke conditions. Two such locations are found in Group I-2 occupancies where 1) a pair of opposite-swinging doors in a smoke barrier wall are installed across a corridor, and 2) special purpose horizontal sliding, accordion or folding doors are installed in a smoke barrier. Historically, the CBC has only required such doors to close upon actuation of smoke detectors or loss of power to the smoke detector or hold-open device. Door closing must now also occur upon activation of the fire alarm system or automatic sprinkler system.

Section 407.6 addressing automatic-closing doors has previously been a simple reference statement leading to Sections 709.5 (openings in smoke barriers) and 716.2 (fire door assemblies). The reference to Section 709.5, including Section 709.5.1, identifies those specific locations where automatic-closing devices are required for cross-corridor doors with hold-open devices. Section 716.2, and more specifically Section 716.2.6.6, mandates that such automatic-closing doors with hold-open devices are to close

Photo courtesy of SDI Productions

Cross-corridor doors in hospital.

upon (1) actuation of smoke detectors, or (2) loss of electrical power to the hold-open device or smoke detector. New Section 407.6.1 mandates that in addition to the requirements of Section 716.2.6.6, automatic-closing doors with hold-open devices must also close upon activation of a fire alarm system or an automatic sprinkler system. If one or more of these four conditions occur within the Group I-2 occupancy, the doors shall automatically close.

As an additional requirement, all automatic-closing doors with hold-open devices that are located within the same smoke compartment shall be released upon the automatic release of the hold-open device on any one of such doors.

A higher level of life safety is now provided for residents and care recipients of these care facilities. In addition, the new requirements provide consistency between the CBC provisions addressing Group I-2 occupancies and the Federal Standards and CMS enforcement rules.

411.5

Puzzle Rooms

CHANGE TYPE: Addition

CHANGE SUMMARY: A new type of building use, the puzzle room, is now regulated in a manner consistent with traditional special amusement areas. In addition, special means of egress requirements have been established that are specific only to such puzzle rooms.

2022 CODE TEXT: **411.5 Puzzle room exiting.** Puzzle room exiting shall comply with one of the following:

1. Exiting in accordance with Chapter 10.
2. An alternative design approved by the *authority having jurisdiction.*
3. Exits shall be open and readily available upon activation by the automatic fire alarm system, automatic sprinkler system, and a manual control at a constantly attended location.

CHANGE SIGNIFICANCE: Special conditions are applicable to buildings, or portions of buildings, defined as special amusement areas. Previously identified in the CBC as special amusement buildings, these areas have typically been limited to walk-through and ride-through attractions at amusement parks, as well as haunted houses. Such buildings and areas have much in common with other assembly uses, and as such are classified as Group A occupancies where the occupant load is 50 or more. As expected, a Group B classification is assigned where the occupant load does not exceed 49. Except where modified by Section 411, the code requirements applicable to special amusement areas are those that are mandated for other types of assembly uses. However, Section 411 recognizes the unique characteristics of those buildings and areas defined as special amusement areas and establishes specific provisions to address the

Photo courtesy of Best View Stock

Escape room.

unique hazards that are created. A new type of building use, that of puzzle rooms, is now regulated by the code in a manner consistent with other traditional special amusement areas. In addition, unique means of egress requirements have been established that are applicable only to such puzzle rooms.

Puzzle rooms, often identified as escape rooms, are a relatively new business model where individuals enter a room and are required to solve a puzzle of some sort before they are able to exit the facility or travel to the next room in the puzzle. The rooms are typically small with a limited number of occupants within in each space. Puzzle rooms are designed in a manner to provide a unique and challenging experience for the customer. The intended design philosophy often incorporates a number of different features that are intended to disorient the occupants and/or disguise the egress route, resulting in a condition contrary to the foundation of code-specified means of egress provisions.

From a performance standpoint, three key assumptions should be taken into account regarding the regulation of puzzle rooms. One, occupants are awake, alert and predominantly able to exit without the assistance of others, but are also unfamiliar with the area. Two, the risk of injury assumed by occupants during their use of the area is potentially high and involuntary. Three, public expectations regarding the protection that is afforded to the occupants is also high.

The newly set forth definition of a puzzle room is that it is a "type of special amusement area in which occupants are encouraged to solve a challenge to escape from a room or series of rooms." Of primary importance is the recognition that a puzzle room is considered as a special amusement area, and as such is subject to all applicable code provisions set forth in Section 411. This would include requirements mandating an automatic sprinkler system, an automatic smoke detection system, an emergency voice/alarm communications system, special exit marking and Class A interior finishes. Of particular note is that these requirements are all applicable regardless of the occupancy classification of the puzzle room, as the special provisions of Section 411 apply in a consistent manner to both Group A and Group B puzzle rooms.

In addition to compliance with all provisions applicable to other special amusement areas, puzzle rooms must also meet one of three exiting methodologies as set forth in Section 411.5. The means of egress system shall either 1) comply with the applicable provisions based upon occupancy classification as established in Chapter 10, 2) gain building official approval of an alternative means of egress design, or 3) meet the performance goal of the exit being open and readily available upon activation by the automatic sprinkler system, the automatic fire alarm system, as well as a manual control at a constantly attended location.

Through the regulation of puzzle rooms, this special type of building use can now be addressed in a manner specific to its hazards. Their recognition as special amusement buildings and the introduction of various means of egress solutions provides a very high level of protection for the occupants experiencing such facilities.

414.2.3

Fire Wall Use for Control Areas

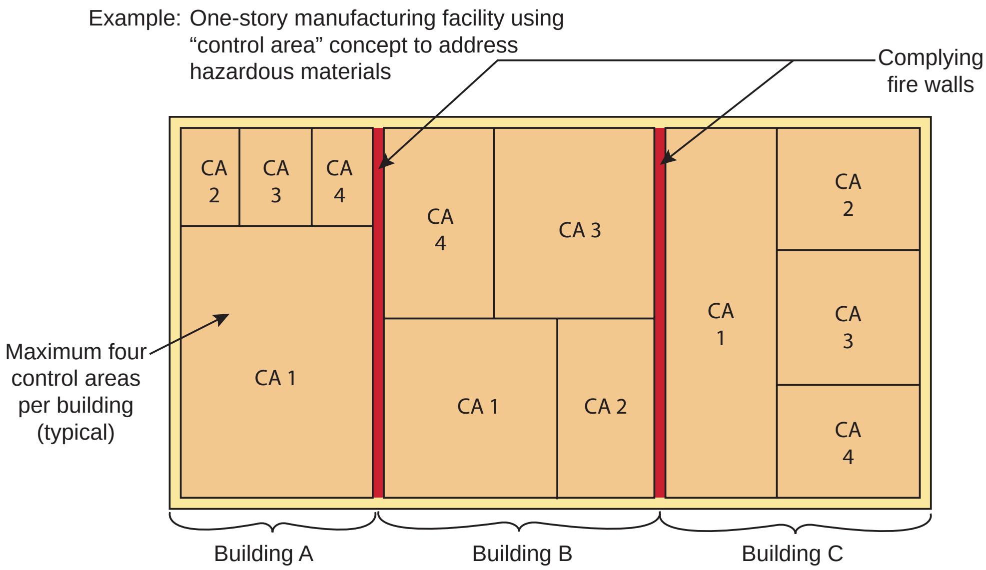
CHANGE TYPE: Addition

CHANGE SUMMARY: The scoping limitations of a fire wall's use to create separate buildings have been expanded through a new allowance for the number of control areas permitted.

2022 CODE TEXT: **414.2.3 Number.** The maximum number of control areas within a building shall be in accordance with Table 414.2.2. For the purposes of determining the number of control areas within a building, each portion of a building separated by one or more fire walls complying with Section 706 shall be considered a separate building.

CHANGE SIGNIFICANCE: Occupancy classifications of buildings containing hazardous materials are based on the maximum allowable quantities (MAQs) concept. As established in CBC Tables 307.1(1) and 307.1(2), the maximum amounts are identified for the various hazardous materials based on a variety of conditions. Where the MAQs are exceeded, the uses are to be classified as Group H occupancies. In those cases where the amounts do not exceed the MAQs, a classification other than Group H that best represents the building's use is assigned. It is often quite desirable to the designer that an occupancy classification of other than Group H be assigned due to the restrictive nature of the code when it regulates high-hazard uses. A fundamental method of maintaining a non-Group H condition is the creation of control areas.

Control areas are portions of a building that contain hazardous materials in amounts that do not exceed the MAQs and that are separated from other areas containing hazardous materials by fire-resistant construction. Any combination of hazardous materials, up to the MAQs, is permitted in a control area. The intent is that each control area is regulated for MAQs rather than the building as a whole, thereby increasing the amounts of hazardous materials that can be present without triggering a Group H classification. However, there is a limit to the number of control areas that can be created in a building as set forth in Table 414.2.2. For example, in



a single-story building no more than four control areas can be provided. Therefore, a Group H classification will be mandated where the quantities of hazardous materials require the creation of more than four control areas. The use of one or more fire walls to create separate buildings is now applicable to the control area concept, allowing the permissible number of control areas to be increased. Where a structure is divided into separate buildings through the use of complying fire walls, each such separate building may now contain the maximum number of control areas permitted by Table 414.2.2.

The primary purpose of fire walls as regulated by Section 706 is to create separate buildings under one roof, providing an opportunity for the designer to regulate each of these buildings independently rather than as the entire structure. This highly regulated fire-resistance-rated vertical separation provides the necessary independence so that the portion of the structure on each side of the fire wall can be regulated individually. However, the application of the separate building concept is very limited. Section 503.1 mandates that a fire wall only creates separate buildings for the purposes of determining area limitations, height limitations and type of construction. This very short list, which reflects the scoping limitations of a fire wall's use to create separate buildings, has been expanded through a new allowance applicable to the limitation on the number of control areas permitted. As a result, an increased amount of hazardous materials may now be present without classification as a Group H occupancy where fire walls divide a structure into separate buildings.

422.7

Cooking in Ambulatory Care Facilities

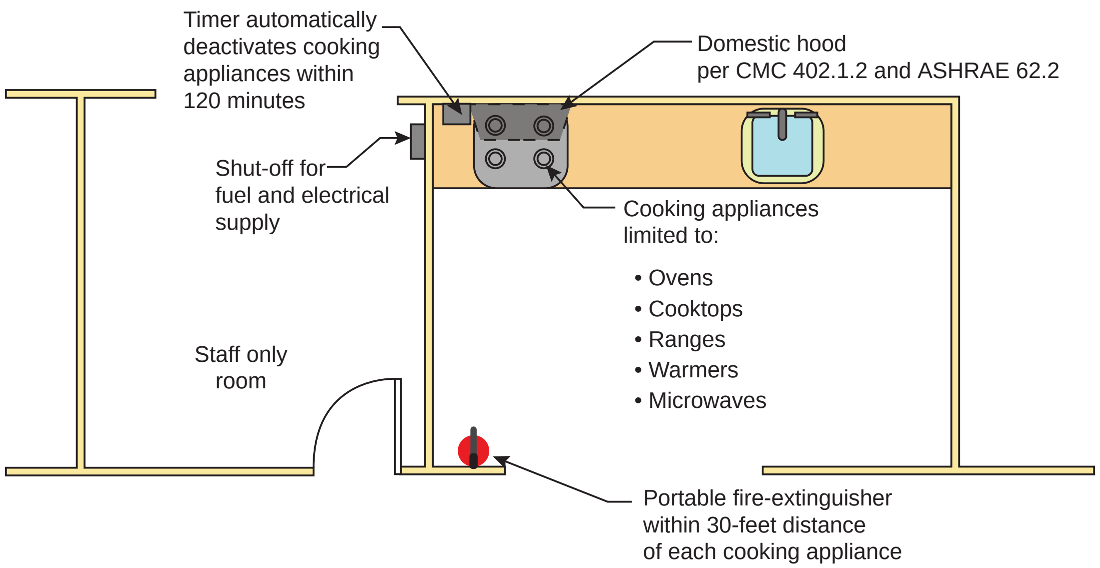
CHANGE TYPE: Modification

CHANGE SUMMARY: Where domestic cooking facilities are provided in ambulatory care facilities, conditions addressing the installation of the cooking appliances have now been established to address any fire concerns.

2022 CODE TEXT: **422.7 Domestic cooking.** Installation of cooking appliances used in domestic cooking facilities shall comply with all of the following:

1. The types of cooking appliances permitted are limited to ovens, cooktops, ranges, warmers and microwaves.
2. Domestic cooking hoods installed and constructed in accordance with the *California Mechanical Code* shall be provided over cooktops or ranges.
3. A shutoff for the fuel and electrical supply to the cooking equipment shall be provided in a location to which only staff has access.
4. A timer shall be provided that automatically deactivates the cooking appliances within a period of not more than 120 minutes.
5. A portable fire extinguisher shall be provided. Installation shall be in accordance with Section 906 and the extinguisher shall be located within a 30-foot (9144 mm) distance of travel from each domestic cooking appliance.

CHANGE SIGNIFICANCE: Ambulatory care facilities, while classified as moderate-hazard Group B occupancies, pose life safety concerns due to the ongoing presence of individuals receiving care. Although such individuals are only in the facility for a limited period of time, they may be incapable of self-preservation and unable to egress. Therefore, such occupants must rely on staff to assist them under emergency conditions. Special conditions are placed on such facilities to create a protect-in-place environment, as well as to minimize the potential of a fire incident.



Where domestic cooking facilities are provided in ambulatory care facilities, conditions addressing the installation of the cooking appliances have now been established to address any fire concerns.

Although not very common, there are times where physical therapy areas of ambulatory care facilities contain kitchens to educate patients in the safe operation of cooking equipment. Such training may be helpful to the patients for when they are cooking at home, or it may be a portion of nutrition counseling. The scope of the new provisions would also include domestic cooking facilities used for other purposes, such as where the cooking appliances are installed in an employee break room. Shared domestic cooking facilities in Group I-1 and I-2 facilities have been addressed in the CBC for several editions and provide a basis for extending similar regulations to Group B ambulatory care facilities.

There are five fundamental conditions of compliance that must be met to allow the installation of domestic cooking appliances in ambulatory care facilities. First, the only cooking appliances permitted are ovens, cooktops, ranges, warmers and microwaves. Second, ranges and cooktops must be provided with domestic cooking hoods constructed and installed in accordance with the *California Mechanical Code,* which regulates the exhaust equipment, exhaust ducts and required make-up air.

A third condition mandates that a shut-off be provided for the fuel and electrical supply to the cooking equipment. Such shut-off must be located in an area that is only accessible to staff. Fourth, a timer shall be provided to automatically shut down the cooking appliances within two hours. And fifth, a complying portable fire extinguisher shall be installed within 30 feet of travel of each cooking appliance.

Although ambulatory care facilities share many similarities with high-hazard Group I-1 and I-2 occupancies, it should be remembered that they are classified as moderate-hazard Group B occupancies. As such, the requirements applicable to cooking facilities in ambulatory care facilities are not as restrictive as those that apply to nursing homes, assisted living facilities, and other similar uses. For example, the domestic cooktop or range permitted in an ambulatory care facility is not required to be provided with an automatic fire-extinguishing system. However, the hazards presented by the installation of domestic cooking appliances do warrant some degree of regulation when such appliances are in a facility where individuals may be incapable of self-preservation for some limited time.

424

Play Structures

CHANGE TYPE: Modification

CHANGE SUMMARY: The interior finish materials of play structures are now regulated for flame spread purposes. In addition, the scoping provisions have been modified to include larger structures, and the requirements are no longer limited to play structures for children's use.

2022 CODE TEXT:

SECTION 424
~~CHILDREN'S~~ PLAY STRUCTURES

424.2 Materials. ~~Children's play~~ Play structures shall be constructed of noncombustible materials or of combustible materials that comply with the following:

(no changes to Conditions 1 through 9)

10. Interior finishes for structures exceeding 600 square feet (56 m^2) in area or 10 feet (3048 mm) in height shall have a flame spread index not greater than that specified in Table 803.13 for the occupancy group and location designated. Interior wall and ceiling finish materials tested in accordance with NFPA 286 and meeting the acceptance criteria of Section 803.1.1.1 shall be permitted to be used where a Class A classification in accordance with ASTM E84 or UL 723 is required.

424.5 Area limits. ~~Children's play~~ Play structures shall not be greater than ~~300~~ 600 square feet (~~28~~ 56 m^2) in area, unless a special investigation, acceptable to the building official, has demonstrated adequate fire safety.

Photo courtesy of SolStock

Rock climbing wall.

424.5.1 Design. Play structures exceeding 600 square feet (56 m^2) in area or 10 feet (3048 mm) in height shall be designed in accordance with Chapter 16.

CHANGE SIGNIFICANCE: Play structures for children's use were initially regulated by the CBC only where located within a covered mall building. As the use of such structures became more popular due to their presence in other types of buildings, such as fast-food restaurants and day care centers, the provisions were modified to regulate children's play structures regardless of the occupancy in which they are located. The code's primary concern related to these structures is the combustibility and flammability of its structure and contents. An additional condition of compliance has now been established as interior finish materials are now regulated for flame spread purposes. In addition, the scoping provisions have been modified to include larger structures, and the requirements are no longer limited to play structures for children's use.

Indoor structures used for recreational activities are not limited to use only by children. Rock climbing walls, laser tag arenas, skydiving facilities and many other types of indoor spaces are used by people of all ages. Obviously, the concerns relating to potential fire hazards are present regardless of the ages of the participants. It was deemed that the limitations on the materials used in such play structures should be applicable in all such structures, and not limited only to those designed for children's use. Therefore, all indoor play structures that fall within the scope of Section 424 are now regulated with no regard to the ages of those individuals participating in the play activity.

Unless constructed of noncombustible materials, the construction components of a play structure must comply with a number of specific conditions to address fire concerns. Another condition has been introduced that regulates the interior finishes of any play structure that exceeds 600 square feet in area or 10 feet in height. New Condition 10 references Table 803.13 addressing the flame spread index limit based on the occupancy classification of that portion of the building where the play structure is located.

Sole compliance with the conditions of Section 424.2 has previously been satisfactory regarding the regulation of combustible materials used in play structures provided the size of the structure was limited to 300 square feet in area. Where the area exceeded 300 square feet, a special investigation has been required to demonstrate adequate fire safety to the building official. That threshold at which a special investigation is required has been increased to 600 square feet in recognition of the adequacy of Section 424.2 in addressing the hazards involved with combustible play structure materials.

The threshold of 600 square feet in area, along with that for a maximum height of 10 feet, is also utilized in a new requirement that mandates the design of play structures in accordance with Chapter 16. It is increasingly common for play structures to be sizeable in area, height or both. Their structural systems should be designed in accordance with the provisions of Chapter 16 to address any special design considerations that may exist. There are often unique structural stability and anchorage requirements that must be considered. Therefore, where the play structure exceeds 10 feet in height, or where it exceeds 600 square feet in area, the structural requirements of Chapter 16 are applicable.

455.2

Large Family Day-Cares

CHANGE TYPE: Modification

CHANGE SUMMARY: The contents of Section 455.2 were repealed and replaced with the language as required by Senate Bill 234 as contained within Health and Safety Code 1597.45 and 1597.46.

2022 CODE TEXT: **455.2.** *For purposes of clarification, Health and Safety Code Section 1597.45 and 1597.46 is repeated.*

~~*(a) A city, county, or city and county shall not prohibit large family day care homes on lots zoned for single-family dwellings, but shall do one of the following:*~~

~~*(1) Classify these homes as a permitted use of residential property for zoning purposes.*~~

~~*(2) Grant a nondiscretionary permit to use a lot zoned for a single-family dwelling to any large family daycare home that complies with local ordinances prescribing reasonable standards, restrictions and requirements concerning spacing and concentration, traffic control, parking and noise control relating to such homes, and complies with subdivision (d) and any regulations adopted by the state fire marshal pursuant to that subdivision. Any noise standards shall be consistent with local noise ordinances implementing the noise element of the general plan and shall take into consideration the noise level generated by children. The permit issued pursuant to this paragraph shall be granted by the zoning administrator, if any, or if there is no zoning administrator by the person or persons designated by the planning agency to grant such permits, upon the certification without a hearing.*~~

Example of a large family day-care.

~~(3) Require any large family day-care home to apply for a permit to use a lot zoned for single-family dwellings. The zoning administrator, if any, or if there is no zoning administrator, the person or persons designated by the planning agency to handle the use permits shall review and decide the applications. The use permit shall be granted if the large family day care home complies with local ordinances, if any, prescribing reasonable standards, restrictions and requirements concerning spacing and concentration, traffic control, parking and noise control relating to such homes, and complies with subdivision (d) and any regulations adopted by the state fire marshal pursuant to that subdivision.~~

~~Any noise standards shall be consistent with local noise ordinances implementing the noise element of the general plan and shall take into consideration the noise levels generated by children.~~

~~The local government shall process any required permit as economically as possible, and fees charged for review shall not exceed the costs of the review and permit process. Not less than 10 days prior to the date on which the decision will be made on the application, the zoning administrator or person designated to handle such use permits shall give notice of the proposed use by mail or delivery to all owners shown on the last equalized assessment roll as owning real property within a 100-foot radius of the exterior boundaries of the proposed large family day care home. No hearing on the application for a permit issued pursuant to this paragraph shall be held before a decision is made unless a hearing is requested by the applicant or other affected person. The applicant or other affected person may appeal the decision. The appellant shall pay the cost, if any of the appeal.~~

~~(b) A large family day-care home shall not be subject to the provisions of Division 13 (commencing with Section 21000) of the Public Resources Code.~~

~~(c) Use of a single-family dwelling for the purposes of a large family day-care home shall not constitute a change of occupancy for purposes of Part 1.5 (commencing with Section 17910) of Division 13 (State Housing Law), or for purposes of local building and fire codes.~~

~~(d) Large family day-care homes shall be considered as single-family residences for the purposes of the State Uniform Building Standards Code and local building and fire codes, except with respect to any additional standards specifically designed to promote the fire and life safety of the children in these homes adopted by the State Fire Marshal pursuant to this subdivision.~~

1597.45.

(a) The use of a home as a small or large family day-care home shall be considered a residential use of property and a use by right for the purposes of all local ordinances, including, but not limited to, zoning ordinances.

(b) *A local jurisdiction shall not impose a business license, fee or tax for the privilege of operating a small or large family day-care home.*

(c) *Use of a home as a small or large family day-care home shall not constitute a change of occupancy for purposes of Part 1.5 (commencing with Section 17910) of Division 13 (State Housing Law) or for purposes of local building codes.*

(d) *A small or large family day-care home shall not be subject to the provisions of Division 13 (commencing with Section 21000) of the Public Resources Code.*

(e) *The provisions of this chapter do not preclude a city, county or other local public entity from placing restrictions on building heights, setback or lot dimensions of a family day-care home, as long as those restrictions are identical to those applied to all other residences with the same zoning designation as the family day-care home. This chapter does not preclude a local ordinance that deals with health and safety, building standards, environmental impact standards or any other matter within the jurisdiction of a local public entity, as long as the local ordinance is identical to those applied to all other residences with the same zoning designation as the family day-care home. This chapter also does not prohibit or restrict the abatement of nuisances by a city, county, or city and county. However, the ordinance or nuisance abatement shall not distinguish family day-care homes from other homes with the same zoning designation, except as otherwise provided in this chapter.*

(f) *For purposes of this chapter, "small family day-care home or large family day-care home" includes a detached single-family dwelling, a townhouse, a dwelling unit within a dwelling or a dwelling unit within a covered multifamily dwelling in which the underlying zoning allows for residential uses. A small family day-care home or large family day-care home is where the family day-care provider resides and includes a dwelling or dwelling unit that is rented, leased or owned.*

(Amended by Stats. 2019, Ch. 244, Sec. 9. (SB 234) Effective January 1, 2020.)

1597.46.

(a) *A large family day-care home shall abide by all standards, in addition to the requirements of the State Uniform Building Standards Code, that are specifically designed to promote fire and life safety in large family day-care homes. The State Fire Marshal shall adopt separate building standards specifically relating to the subject of fire and life safety in family day-care homes, which shall be published in Title 24 of the California Code of Regulations. These standards shall apply uniformly throughout the state and shall include, but not be limited to, all of the following:*

(1) *The requirement that a large family day-care home contain a fire extinguisher or smoke detector device, or both, that meets child-care standards established by the State Fire Marshal.*

(2) Specification as to the number of required exits from the home.

(3) Specification as to the floor or floors on which child care may be provided and the number of required exits on each floor.

(b) A large family day-care home for children shall have one or more carbon monoxide detectors in the facility that meet the standards established in Chapter 8 (commencing with Section 13260) of Part 2 of Division 12. The department shall account for the presence of these detectors during inspections.

(c) Enforcement of this section shall be in accordance with Sections 13145 and 13146. A city, county, city and county, or district shall not adopt or enforce a building ordinance or local rule or regulation relating to the subject of fire and life safety in large family day-care homes that is inconsistent with those standards adopted by the State Fire Marshal, except to the extent the building ordinance or local rule or regulation applies to all residences with the same zoning designation in which child care is provided.

(Repealed and added by Stats. 2019, Ch. 244, Sec. 12. (SB 234) Effective January 1, 2020.)

CHANGE SIGNIFICANCE: Health and Safety Code 1597.45 and 1597.45 as repeated in this section require that large family day-care homes, providing care for up to 14 children, be treated as a residential use of the property. Further, a city or property owner may not restrict the ability for a large family day-care to operate through conveyances, leases, mortgages or even business license payments. The State Fire Marshal was required, as part of the bill, to update the Large Family Day-Care requirements as contained within Section 455 to comply with the bill. The repeated language satisfies that requirement.

503.1.4

Occupied Roof Allowances

CHANGE TYPE: Clarification

CHANGE SUMMARY: The proper approach to dealing with occupied roofs from the perspectives of building height, number of stories and installation of occupant notification features has been further clarified for a more consistent application of the code's intent.

2022 CODE TEXT: **503.1.4 Occupied roofs.** A roof level or portion thereof shall be permitted to be used as an occupied roof provided the occupancy of the roof is an occupancy that is permitted by Table 504.4 for the story immediately below the roof. The area of the occupied roofs shall not be included in the building area as regulated by Section 506. An occupied roof shall not be included in the building height or number of stories as regulated by Section 504, provided that the penthouses and other enclosed roof structures comply with Section 1511.

Exceptions:

1. The occupancy located on an occupied roof shall not be limited to the occupancies allowed on the story immediately below the roof where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 and occupant notification in accordance with ~~Section 907.5~~ Sections 907.5.2.1 and 907.5.2.3 is provided in the area of the occupied roof. Emergency voice/alarm communication system notification per Section 907.5.2.2 shall also be provided in the area of the occupied roof where such system is required elsewhere in the building.
2. *(no change to this exception)*

Photo courtesy of vgajic

Hotel rooftop cafe.

CHANGE SIGNIFICANCE: The allowable building height in stories as limited by Table 504.4 is based on a combination of factors. A primary consideration is the building's type of construction, consistent with the application of Table 504.3 for allowable building height in feet. However, a significant difference between the two tables is the impact of the building's use on its maximum allowable height. The limits on stories above grade plane set forth in Table 504.4 vary widely based on the building's occupancy classification(s). New criteria were added to the 2019 CBC in order to establish the appropriate methodology for the determination of the allowable number of stories where one or more occupancies are located on the roof of the building. The proper approach to dealing with occupied roofs from an allowable height and an allowable number of stories perspective have been further clarified for a more consistent application of the code's intent.

The provisions now specifically state that in the determination of a building's allowable height and number of stories, an occupied roof is not to be considered as an additional story. In addition, it has also been clarified that compliance with Section 1511 for penthouses and other enclosed roof structures is necessary. The base requirement for allowing a roof level to be occupied remains unchanged, as the occupancy of the roof is limited to only those occupancies permitted by Table 504.4 to be located on the story directly below the roof. Only where the conditions of Exception 1 are met is an occupancy not in compliance with the base requirement allowed to be located on the roof.

An additional clarification addresses the conditions of Exception 1 recognizing there is no story limitation to be applied on rooftop occupancies where specified fire protection features are provided. In the application of the exception, the building must be provided with an automatic sprinkler system. In addition, occupant notification shall be extended to the occupiable area of the roof where a fire alarm system is required. The new provisions specifically reference Sections 907.5.2.1, 907.5.2.2 and 905.5.2.3 addressing audible alarms, emergency voice/alarm communication systems and visual alarms, respectively. However, due to the absence of scoping language mandating a fire alarm system be installed, occupant notification at the roof level is only applicable where an alarm system is already required elsewhere in the building.

CHANGE TYPE: Addition

CHANGE SUMMARY: Height limits in feet above grade plane have now been established for the three new construction types addressing mass timber construction: IV-A, IV-B and I-VC.

2022 CODE TEXT: **504.3 Height in feet.** The maximum height, in feet, of a building shall not exceed the limits specified in Table 504.3.

Table 504.3

Allowable Height in Feet

TABLE 504.3 Allowable Building Height in Feet Above Grade Plane[a,i]

Occupancy Classification	See Footnotes	Type I A	Type I B	Type II A	Type II B	Type III A	Type III B	Type IV A	Type IV B	Type IV C	Type IV HT	Type V A	Type V B
B, F, M, S, U	NS[b]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85	75	85	75	270	180	85	85	70	60
A, E	*NS[b]*	*UL*	*160*	*65*	*55*	*65*	*55*	*65*	*65*	*65*	*65*	*50*	*40*
	S (without area increase)	*UL*	*180*	*85*	*75*	*85*	*75*	*270*	*180*	*85*	*85*	*70*	*60*
	S (with area increase)	*UL*	*160*	*65*	*55*	*65*	*55*	*250*	*160*	*65*	*65*	*50*	*40*
H-1, H-2, H-3, H-5, *L*	NS[c,d]	UL	160	65	55	65	55				65	50	40
	S (without area increase)							120	90	*85*			
	S (with area increase)	*UL*	*160*	*65*	*55*	*65*	*55*				*65*	*50*	*40*
H-4	NS[c,d]	UL	160	65	55	65	55	65	65	65	65	50	40
	S (without area increase)	UL	180	85	75	85	75	140	100	85	85	70	60
	S (with area increase)	*UL*	*160*	*65*	*55*	*65*	*55*	*250*	*160*	*65*	*65*	*50*	*40*
I-3	NS[d,e]	UL	160	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*
	S (without area increase)	UL	180	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*
	S (with area increase)	*UL*	*160*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*
I-2, *I-2.1*	NS[d,e,f]	UL	160	65				*NP*	*NP*	*NP*			
	S (without area increase)	UL	180	85	55	65	55	*NP*	*NP*	*NP*	65	50	40
	S (with area increase)	*UL*	*160*	*65*				*NP*	*NP*	*NP*			
I-4	NS[d,g]	UL	160	65	55	65	55	*65*	*65*	*65*	65	50	40
	S (without area increase)	UL	180	85	75	85	75	*180*	*120*	*85*	85	70	60
	S (with area increase)	*UL*	*160*	*65*	*55*	*65*	*55*	*160*	*100*	*65*	*65*	*50*	*50*
R-1[h]	NS[d]	UL	160	65	55	65	55	65	65	65	65	50	40
	S13D	60	60	60	60	60	60	60	60	60	60	50	40
	S13R	60	60	60	*55*	60	*55*	60	60	60	60	60	60
	S (without area increase)	UL	180	85	75	85	75	270	180	85	85	70	60
	S (with area increase)	*UL*	*160*	*65*	*55*	*65*	*55*	*250*	*160*	*65*	*65*	*50*	*40*
R-2[h]	*NS[d]*	UL	160	65	55	65	55	65	*65*	*65*	*65*	50	40
	S13R	60	60	60	*55*	60	55	*60*	*60*	*60*	*60*	*50*	*40*
	S (without area increase)	UL	180	85	75	85	75	*270*	*180*	*85*	85	70	60
	S (with area increase)	*UL*	*160*	*65*	*55*	*65*	*55*	*250*	*160*	*65*	*65*	*60[j]*	*40*

continues

TABLE 504.3 (*continued*)

Occupancy Classification	See Footnotes	Type of Construction											
		Type I		Type II		Type III		Type IV				Type V	
		A	B	A	B	A	B	A	B	C	HT	A	B
R-2.1[h]	*NS*[d]	*UL*	*160*	*65*	*55*	*65*	*55*	*65*	*NP*	*NP*	*NP*	*50*	*40*
	S13D	*60*	*60*	*60*	*55*	*60*	*55*	*60*	*NP*	*NP*	*NP*	*50*	*40*
	S13R	*60*	*60*	*60*	*55*	*60*	*55*	*60*	*NP*	*NP*	*NP*	*50*	*40*
	S	*UL*	*160*	*65*	*55*	*65*	*55*	*270*	*NP*	*NP*	*NP*	*50*	*40*
R-2.2[h]	*NS*[d]	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*
	S (without area increase)	*UL*	*180*	*85*	*NP*	*85*	*NP*	*270*	*180*	*85*	*85*	*70*	*NP*
	S (with area increase)	*UL*	*160*	*65*	*NP*	*65*	*NP*	*250*	*160*	*65*	*65*	*60*[i]	*NP*
R-3, R-3.1[h]	*NS*[d]	*UL*	*160*	*65*	*55*	*65*	*55*	*65*	*65*	*65*	*65*	*50*	*40*
	S13D	*60*	*60*	*60*	*60*	*60*	*60*	*60*	*60*	*60*	*60*	*50*	*40*
	S13R	*60*	*60*	*60*	*55*	*60*	*55*	*60*	*60*	*60*	*60*	*60*	*60*
	S	*UL*	*160*	*65*	*55*	*65*	*55*	*270*	*180*	*85*	*65*	*70*	*60*
R-4[h]	*NS*[d]	*UL*	*160*	*65*	*55*	*65*	*55*	*65*	*65*	*65*	*65*	*50*	*40*
	S13D	*60*	*60*	*60*	*55*	*60*	*55*	*60*	*60*	*60*	*60*	*50*	*40*
	S13R	*60*	*60*	*60*	*55*	*60*	*55*	*60*	*60*	*60*	*60*	*50*	*40*
	S	*UL*	*160*	*65*	*55*	*65*	*55*	*270*	*180*	*85*	*65*	*50*	*40*

For SI: 1 foot = 304.8 mm.

UL = Unlimited; *NP = Not Permitted*; NS = Buildings not equipped throughout with an automatic sprinkler system; S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1; S13R = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2; S13D = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.3.

a. See Chapters 4 and 5 for specific exceptions to the allowable height in this chapter.
b. See Section 903.2 for the minimum thresholds for protection by an automatic sprinkler system for specific occupancies.
c. New Group H *and all Group L* occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.5.
d. The NS value is only for use in evaluation of existing building height in accordance with the *California Existing Building Code*.
e. New Group I-3 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6.
f. New and existing Group I-2 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6.
g. For new Group I-4 occupancies, see Exceptions 2 and 3 of Section 903.2.6.
h. New Group R occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.8.
i. In other than Group A, E, H, I, L and R occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, the S increases for height and stories in Tables 504.3 and 504.4 are permitted in addition to the S area increase in accordance with Table 506.2.
j. For Group R-2 buildings of Type VA construction equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1, S area increase is permitted in addition to the height and story increase provided the height shall not exceed 60 feet and 4 stories.

CHANGE SIGNIFICANCE: Compliance with the limitations on a building's height in feet is one of three conditions in assigning a building's type of construction. Unlike the methodology for determining a building's allowable height in stories, the maximum permissible height in feet for each of the types of construction does not vary based on the building's occupancy groups. A building's allowable height in feet is typically determined based on only two conditions: the building's construction type and whether the building is sprinklered. Height limits in feet above grade plane have now been established for the three new construction types included in mass timber construction: IV-A, IV-B and IV-C.

During development of the allowable number of stories criteria for the new mass timber construction types, each individual type of construction was examined for its safety and efficacy in protecting occupants and the structure against risks associated with height above grade. Type IV-B limits were established to provide the same base fire-resistance requirements as Type IB construction, which sets forth requirements for 2-hour structural elements. Because of this comparison, and based on a review of the fire safety and structural integrity performance of protected mass timber that was verified by fire testing, the establishment of allowable height for the three new construction types started with setting Type IV-B story allowances equivalent to Type IB. However, note that the allowance for high-rise buildings in Section 403.2.1.1 to reduce IB construction to 1-hour structural elements is not allowed for Type IV-B construction. Essentially, where a high-rise building is permitted to be constructed of IB construction and has 1-hour fire protection, that same building will require 2-hour structural elements for Type IV-B construction. It was decided to take the more conservative approach in addressing the required fire-resistance for mass timber buildings.

It was also determined that Type IV-A should be permitted to be somewhat taller than Type IV-B since Type IV-A construction is entirely protected (no exposed mass timber permitted) and the required fire-resistance rating (FRR) of the structure is equivalent to requirements for Type IA construction (3-hour FRR for the structural frame). However, by continuing to take the more conservative approach, it was deemed unacceptable to allow the unlimited heights of Type IA to be applied to Type IV-A. For most occupancies in fully sprinklered buildings, a multiplier of 1.5 was applied to the heights developed for Type IV-B construction to develop reasonable height allowances for Type IV-A construction.

Type IV-C was viewed as similar to Type IV-HT construction, with the exception that Type IV-C has a 2-hour FRR where HT is accepted as fire resistant based on the large sizes of the members. As such, the height in feet for Type IV-C is consistently equal to the height in feet of Type IV-HT.

Of major importance is the intent that buildings of the three new types of mass timber construction should be protected by automatic sprinkler systems. Relying on Section 903.2.11.3 as a guide, which requires an automatic sprinkler system to be installed for most buildings with one or more stories located more than 55 feet above the lowest level of fire department vehicle access, the intent to have fully sprinklered buildings for the three new construction types has, in all practical terms, been met. However, the calculation of allowable area increase for open perimeter is based on the nonsprinklered building area (tabulated as NS in Table 506.2), so it was incumbent to provide tabulated NS values as well.

Of particular note is that no additional heights over what is permitted for Type IV-HT are permitted for nonsprinklered buildings of the new construction types. As such, where separate rows in Table 504.3 are provided for heights for the NS situation, the heights for Types IV-A, IV-B, and IV-C are consistent with those heights historically permitted for Type IV-HT. A similar approach is used for the allowable number of stories in Table 504.4. The historical recognition that nonsprinklered buildings of a specified construction type are limited to a height of 20 feet less than that permitted for a similar sprinklered building does not apply to the three new mass timber types of construction.

For occupancy groups A, B, E, F, M, R, S and U, the methodology described above reflects the development of the height in feet limits. After using this methodology to develop initial allowable building heights, professional judgment was applied (from both a fire safety and a structural perspective), cell by cell, for all occupancy types. A more thorough examination of the reasoning applied in the assignment of allowable building height is available in the publication *Mass Timber Buildings and the IBC*. It is important to note that this section is not adopted by the State Fire Marshal.

CHANGE TYPE: Addition

CHANGE SUMMARY: Height limits in stories above grade plane have now been established for the three new construction types included in mass timber construction, and increases in allowable height for Group S-1 occupancies in sprinklered buildings of Type IIB and IIIB construction have been made.

2022 CODE TEXT: **504.4 Number of stories.** The maximum number of stories above grade plane of a building shall not exceed the limits specified in Table 504.4.

Table 504.4

Allowable Height in Stories

TABLE 504.4 Allowable Number of Stories Above Grade Plane[a,b,n]

Occupancy Classification	See Footnotes	Type of Construction											
		Type I		Type II		Type III		Type IV				Type V	
		A	B	A	B	A	B	A	B	C	HT	A	B
A-1	NS	UL	5	3	2	3	2	3	3	3	3	2	1
	S *(without area increase)*	UL	6	4	3	4	3	9	6	4	4	3	2
	S (with area increase)	*UL*	*5*	*3*	*2*	*3*	*2*	*8*	*5*	*3*	*3*	*2*	*1*
A-2	NS	UL	11	3	2	3	2	3	3	3	3	2	1
	S *(without area increase)*	UL	12	4	3	4	3	18	12	6	4	3	2
	S (with area increase)	*UL*	*11*	*3*	*2*	*3*	*2*	*17*	*11*	*5*	*3*	*2*	*1*
A-3	NS	UL	11	3	2	3	2	3	3	3	3	2	1
	S *(without area increase)*	UL	12	4	3	4	3	18	12	6	4	3	2
	S (with area increase)	*UL*	*11*	*3*	*2*	*3*	*2*	*17*	*11*	*5*	*3*	*2*	*1*
A-4	NS	UL	11	3	2	3	2	3	3	3	3	2	1
	S *(without area increase)*	UL	12	4	3	4	3	18	12	6	4	3	2
	S (with area increase)	*UL*	*11*	*3*	*2*	*3*	*2*	*17*	*11*	*5*	*3*	*2*	*1*
A-5	NS	UL	UL	UL	UL	UL	UL	1	1	1	UL	UL	UL
	S	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL
B	NS	UL	11	5	3	5	3	5	5	5	5	3	2
	S	UL	12	6	4	6	4	18	12	9	6	4	3
E	NS	UL	5	3	2	3	2	3	3	3	3	1	1
	S *(without area increase)*	UL	6	4	3	4	3	9	6	4	4	2	2
	S (with area increase)	*UL*	*5*	*3*	*2*	*3*	*2*	*8*	*7*	*3*	*3*	*1*	*1*
F-1	NS	UL	11	4	2	3	2	3	3	3	4	2	1
	S	UL	12	5	3	4	3	10	7	5	5	3	2
F-2	NS	UL	11	5	3	4	3	5	5	5	5	3	2
	S	UL	12	6	4	5	4	12	8	6	6	4	3
H-1	NS[c,d]	1	1	1	1	1	1	NP	NP	NP	1	1	NP
	S							1	1	1			
H-2	NS[c,d]	*20*	3	2	1	2	1	1	1	1	2	1	1
	S							2	2	2			
H-3	NS[c,d]	*20*	6	4	2	4	2	3	3	3	4	2	1
	S							4	4	4			

continues

TABLE 504.4 (*continued*)

Occupancy Classification	See Footnotes	Type I A	Type I B	Type II A	Type II B	Type III A	Type III B	Type IV A	Type IV B	Type IV C	Type IV HT	Type V A	Type V B
H-4	NS[c,d]	20	7	5	3	5	3	5	5	5	5	3	2
	S (without area increase)	20	8	6	4	6	4	8	7	6	6	4	3
	S (with area increase)	20	7	5	3	5	3	7	6	5	5	3	2
H-5	NS[c,d]	4	4	3	3	3	3	2	2	2	3	3	2
	S							3	3	3			
I-2, I-2.1[j,i]	NS[d,f]	UL	4	2				NP	NP	NP			
	S (without area increase)	UL	5	3	1	1	NP	NP	NP	NP	1	1	NP
	S (with area increase)	UL	4	2				NP	NP	NP			
I-3	NS[d,e]	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
	S (without area increase)	UL	3	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
	S (with area increase)	UL	2	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
I-4[p]	NS[d,g]	UL	5	3	2	3	2	3	3	3	3	1	1
	S (without area increase)	UL	6	4	3	4	3	9	6	4	4	2	2
	S (with area increase)	UL	5	3	2	3	2	8	5	3	3	1	1
L	NS	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
	S	20	6	5	3	5	3	8	6	5	5	3	2
M	NS	UL	11	4	2	4	2	4	4	4	4	3	1
	S	UL	12	5	3	5	3	12	8	6	5	4	2
R-1[h]	NS[d]	UL	11	4	4	4	4	4	4	4	4	3	2
	S13R	4	4									3	2
	S (without area increase)	UL	12	5	5	5	5	18	12	8	5	4	3
	S (with area increase)	UL	11	4	4	4	4	17	11	7	4	3	2
R-2[h]	NS[d]	UL	11	4	4	4	4	4	4	4	4	3	2
	S13R	4	4	4								4	3
	S (without area increase)	UL	12	5	5	5	5	18	12	8	5	4	3
	S (with area increase)	UL	11	4	4	4	4	17	11	7	4	4[o]	2
R-2.1[h]	NS[d]	UL	6[l]	3[k]	NP	3[k]	NP	4	NP	NP	NP	3[k]	NP
	S13R	UL	4[l]	3[k]	NP	3[k]	NP	4	NP	NP	NP	3[k]	NP
	S	UL	6[l]	3[k]	NP	3[k]	NP	10	NP	NP	NP	3[k]	NP
R-2.2[h]	NS[d]	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
	S (without area increase)	UL	12	5	NP	5	NP	18	12	8	5	4	NP
	S (with area increase)	UL	11	4	NP	4	NP	17	11	7	4	4[o]	NP
R-3, R 3-1[h]	NS[d]	UL	11									3	3
	S13D	4	4	4	4	4	4	4	4	4	4	3	3
	S13R	4	4									4	
	S	UL	12	5	5	5	5	18	12	5	5	4	4
R-4[h]	NS[d]	UL	11[l]									3[k]	2[m]
	S13D	4	4[l]	4[k]	4[m]	4[k]	4[m]	4[m]	4[m]	4[m]	4[m]	3[k]	2[m]
	S13R	4	4[l]									4	3
	S	UL	11[l]	5	5	5	5	11[l]	5	5	5	4	3
S-1	NS	UL	11	4	2	3	2	4	4	4	4	3	1
	S	UL	12	5	4	4	4	10	7	5	5	4	2

continues

TABLE 504.4 (*continued*)

Occupancy Classification	See Footnotes	Type of Construction											
		Type I		Type II		Type III		Type IV				Type V	
		A	B	A	B	A	B	A	B	C	HT	A	B
S-2[i]	NS	UL	11	5	3	4	3	4	4	4	5	4	2
	S	UL	12	6	4	5	4	12	8	5	6	5	3
U	NS	UL	5	4	2	3	2	4	4	4	4	2	1
	S	UL	6	5	3	4	3	9	6	5	5	3	2

UL = Unlimited; NP = Not Permitted; NS = Buildings not equipped throughout with an automatic sprinkler system; S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1; S13R = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2; S13D = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.3.

a. See Chapters 4 and 5 for specific exceptions to the allowable height in this chapter.
b. See Section 903.2 for the minimum thresholds for protection by an automatic sprinkler system for specific occupancies.
c. New Group H occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.5.
d. The NS value is only for use in evaluation of existing building height in accordance with the *California Existing Building Code*.
e. Group I-3 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6.
f. New and existing Group I-2 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6.
g. For new Group I-4 occupancies, see Exceptions 2 and 3 of Section 903.2.6.
h. New Group R occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.8.
i. See Sections 407.1.1 and 408.1.2 for specific exceptions to construction type, allowable building areas and allowable heights.
j. Restraint shall not be permitted in any building except in Group I-3 occupancies constructed for such use (see Section 408.1.2).
k. Nonambulatory persons shall be limited to the first 2 stories.
l. Nonambulatory persons shall be limited to the first 5 stories.
m. Nonambulatory elderly clients are not permitted in buildings of these types of construction. See Sections 435.3.3 and 435.3.4.
n. In other than Group A, E, H, I, L and R occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, the S increases for height and stories in Tables 504.3 and 504.4 are permitted in addition to the S area increase in accordance with Table 506.2.
o. For Group R-2 buildings of Type VA construction equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1, S area increase is permitted in addition to the height and story increase provided the height shall not exceed 60 feet and 4 stories.
p. See Section 436.1 for additional regulations for child-care centers and adult day care.

CHANGE SIGNIFICANCE: Along with allowable height in feet and allowable building areas, compliance with the limitations on a building's height in stories is one of three conditions in assigning a building's type of construction. Unlike the methodology for determining a building's allowable height in feet, the maximum permissible height in stories for each of the types of construction can vary considerably based on the building's occupancy classification(s). Height limits in stories above grade plane have now been established for the three new construction types included in mass timber construction. In addition, increases in allowable height have been made for Group S-1 occupancies in sprinklered buildings of Type IIB and IIIB construction.

Much of the rationale established in the development of the allowable height in feet limitations for new construction types (Types IV-A, IV-B and IV-C) is also applicable to the determination of a mass timber building's allowable number of stories. The allowable number of stories assigned to sprinklered Type IB buildings is also applied to buildings of Type IV-B construction for Group A, B, E, H-1, I-2, I-3, I-4, R and U occupancies. The allowable number of stories permitted for the remaining occupancies in a Type IV-B building has been selectively reduced below those permitted for Group I-B for various reasons. Tabular entries for Type IV-A and IV-C construction were also derived in a manner similar to that used for allowable height in feet limitations. Type IV-A limits are typically increased by a modifier of 1.5 applied to buildings of Type IV-B, and Type IV-C limits are generally consistent with those of Type IV-HT buildings. Consistent with the development of the limits on building height in feet and building area, each occupancy was reviewed individually to address any specific hazards that would warrant a variance from the established process.

Consistent with the limits placed on the allowable height in feet for Type IV-A, IV-B and IV-C buildings, no additional stories over those permitted for Type IV-HT are allowed for nonsprinklered buildings. As such, where separate rows in Table 504.4 are provided for the number of stories for the NS situation, the limits for Types IV-A, IV-B and IV-C are typically consistent with those historically permitted for Type IV-HT. A similar approach was used for the allowable height in feet in Table 504.3. The historical recognition that nonsprinklered buildings of a specified construction type are limited to a height in stories above grade plane of one fewer story than that permitted for a similar sprinklered building does not apply to the three new mass timber types of construction.

An additional change is specific only to moderate-hazard Group S-1 storage occupancies in sprinklered buildings of Type IIB and IIIB construction. The new allowance of up to four stories above grade plane is now consistent with the allowable height in stories permitted in the 2007 CBC and previous editions. For the 2010 edition of the CBC, several inconsistencies in the original allowable height thresholds were identified and reductions were made in the allowable number of stories for Group B, M, S-1 and S-2 occupancies in both sprinklered and nonsprinklered Type IIB and IIB buildings. Although the latest modification restores the allowable height to four stories per the 2007 CBC story limit for sprinklered Group S-1 occupancies in buildings of Type IIB and IIIB construction, it does not modify the maximum allowable height in stories above grade plane for Group B, M and S-2 occupancies. There is also no change in the story limit for nonsprinklered Group S-1 occupancies.

The allowable story heights have also been modified for Group S-2 occupancies in buildings of Type IV-HT construction. The limits of 4 stories in nonsprinklered buildings and five stories in sprinklered buildings have been increased to five stories and six stories, respectively. This modification corrects two tabular value errors that went undetected in the transition from Table 503 in the 2013 CBC to Table 504.4 in the 2015 edition. There was no intent at the time of the transition to make any technical changes to allowable building height from what was previously allowed. It is important to note that this section is not adopted by the State Fire Marshal.

Table 506.2

Allowable Building Area

CHANGE TYPE: Addition

CHANGE SUMMARY: Building area limitations have now been established for the three new construction types included in mass timber construction, and an increase has occurred in allowable single-story floor area for Group I-3 occupancies in sprinklered buildings of Type IIA construction.

2022 CODE TEXT: **506.2 Allowable area determination.** The allowable area of a building shall be determined in accordance with the applicable provisions of Sections 506.2.1, 506.2.2 and 506.3.

TABLE 506.2 **Allowable Area Factor (A_t = NS, S1, S13R, S13D or SM, as Applicable) in Square Feet[a,b,j]**

Occupancy Classification	See Footnotes	Type I A	Type I B	Type II A	Type II B	Type III A	Type III B	Type IV A	Type IV B	Type IV C	Type IV HT	Type V A	Type V B
A-1	NS	UL	UL	15,500	8,500	14,000	8,500	45,000	30,000	18,750	15,000	11,500	5,500
	S1	UL	UL	62,000	34,000	56,000	34,000	180,000	120,000	75,000	60,000	46,000	22,000
	SM *(without height increase)*	UL	UL	46,500	25,500	42,000	25,500	135,000	90,000	56,250	45,000	34,500	16,500
	SM (with height increase)	*UL*	*UL*	*15,500*	*8,500*	*14,000*	*8,500*	*45,000*	*30,000*	*18,750*	*15,000*	*11,500*	*5,500*
A-2	NS	UL	UL	15,500	9,500	14,000	9,500	45,000	30,000	18,750	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	180,000	120,000	75,000	60,000	46,000	24,000
	SM *(without height increase)*	UL	UL	46,500	28,500	42,000	28,500	135,000	90,000	56,250	45,000	34,500	18,000
	SM (with height increase)	*UL*	*UL*	*15,500*	*9,500*	*14,000*	*9,500*	*45,000*	*30,000*	*18,750*	*15,000*	*11,500*	*6,000*
A-3	NS	UL	UL	15,500	9,500	14,000	9,500	45,000	30,000	18,750	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	180,000	120,000	75,000	60,000	46,000	24,000
	SM *(without height increase)*	UL	UL	46,500	28,500	42,000	28,500	135,000	90,000	56,250	45,000	34,500	18,000
	SM (with height increase)	*UL*	*UL*	*15,500*	*9,500*	*14,000*	*9,500*	*45,000*	*30,000*	*18,750*	*15,000*	*11,500*	*6,000*
A-4	NS	UL	UL	15,500	9,500	14,000	9,500	45,000	30,000	18,750	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	180,000	120,000	75,000	60,000	46,000	24,000
	SM *(without height increase)*	UL	UL	46,500	28,500	42,000	28,500	135,000	90,000	56,250	45,000	34,500	18,000
	SM (with height increase)	*UL*	*UL*	*15,500*	*9,500*	*14,000*	*9,500*	*45,000*	*30,000*	*18,750*	*15,000*	*11,500*	*6,000*
A-5	NS S1 SM	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL
B	NS	UL	UL	37,500	23,000	28,500	19,000	108,000	72,000	45,000	36,000	18,000	9,000
	S1	UL	UL	150,000	92,000	114,000	76,000	432,000	288,000	180,000	144,000	72,000	36,000
	SM	UL	UL	112,500	69,000	85,500	57,000	324,000	216,000	135,000	108,000	54,000	27,000
E	NS	UL	UL	26,500	14,500	23,500	14,500	76,500	51,000	31,875	25,500	18,500	9,500
	S1	UL	UL	106,000	58,000	94,000	58,000	306,000	204,000	127,500	102,000	74,000	38,000
	SM *(without height increase)*	UL	UL	79,500	43,500	70,500	43,500	229,500	153,000	95,625	76,500	55,500	28,500
	SM (with height increase)	*UL*	*UL*	*26,500*	*14,500*	*23,500*	*14,500*	*76,500*	*51,000*	*31,875*	*25,500*	*18,500*	*9.500*

table continued

TABLE 506.2 *continued*

Occupancy Classification	See Footnotes	Type I A	Type I B	Type II A	Type II B	Type III A	Type III B	Type IV A	Type IV B	Type IV C	Type IV HT	Type V A	Type V B
F-1	NS	UL	UL	25,000	15,500	19,000	12,000	100,500	67,000	41,875	33,500	14,000	8,500
	S1	UL	UL	100,000	62,000	76,000	48,000	402,000	268,000	167,500	134,000	56,000	34,000
	SM	UL	UL	75,000	46,500	57,000	36,000	301,500	201,000	125,625	100,500	42,000	25,500
F-2	NS	UL	UL	37,500	23,000	28,500	18,000	151,500	101,000	63,125	50,500	21,000	13,000
	S1	UL	UL	150,000	92,000	114,000	72,000	606,000	404,000	252,500	202,000	84,000	52,000
	SM	UL	UL	112,500	69,000	85,500	54,000	454,500	303,000	189,375	151,500	63,000	39,000
H-1	NS[c] S1	21,000	16,500	11,000	7,000	9,500	7,000	10,500	10,500	10,500	10,500	7,500	NP
H-2	NS[c] S1 SM	21,000	16,500	11,000	7,000	9,500	7,000	10,500	10,500	10,500	10,500	7,500	3,000
H-3	NS[c] S1 SM	UL	60,000	26,500	14,000	17,500	13,000	25,500	25,500	25,500	25,500	10,000	5,000
H-4	NS[c,d]	UL	UL	37,500	17,500	28,500	17,500	72,000	54,000	40,500	36,000	18,000	6,500
	S1	UL	UL	150,000	70,000	114,000	70,000	288,000	216,000	162,000	144,000	72,000	26,000
	SM *(without height increase)*	UL	UL	112,500	52,500	85,500	52,500	216,000	162,000	121,500	108,000	54,000	19,500
	SM (with height increase)	*UL*	*UL*	*37,500*	*17,500*	*28,500*	*17,500*	*72,000*	*54,000*	*40,500*	*36,000*	*18,000*	*6,500*
H-5	NS[c,d]	UL	UL	37,500	23,000	28,500	19,000	72,000	54,000	40,500	36,000	18,000	9,000
	S1	UL	UL	150,000	92,000	114,000	76,000	288,000	216,000	162,000	144,000	72,000	36,000
	SM *(without height increase)*	UL	UL	112,500	69,000	85,500	57,000	216,000	162,000	121,500	108,000	54,000	27,000
	SM (with height increase)	*UL*	*UL*	*37,500*	*23,000*	*28,500*	*19,000*	*72,000*	*54,000*	*40,500*	*36,000*	*18,000*	*9,000*
I-2, *I-2.1*	NS[d,f]	UL	UL	15,000	11,000	12,000	NP	36,000	24,000	12,000	12,000	9,500	NP
	S1	UL	UL	60,000	44,000	48,000	NP	144,000	96,000	48,000	48,000	38,000	NP
	SM *(without height increase)*	UL	UL	45,000	33,000	36,000	NP	108,000	72,000	36,000	36,000	28,500	NP
	SM (with height increase)	*UL*	*UL*	*15,000*	*11,000*	*12,000*	*NP*	*NP*	*NP*	*NP*	*12,000*	*9,500*	*NP*
I-3	NS[d,e]	UL	*15,100*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*
	S1	UL	*45,300*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*
	SM *(without height increase)*	UL	*30,200*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*
	SM (with height increase)	*UL*	*15,100*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*
I-4	NS[d,g]	UL	60,500	26,500	13,000	23,500	13,000	76,500	51,000	25,500	25,500	18,500	9,000
	S1	UL	121,000	106,000	52,000	94,000	52,000	306,000	204,000	102,000	102,000	74,000	36,000
	SM *(without height increase)*	UL	181,500	79,500	39,000	70,500	39,000	229,500	153,000	76,500	76,500	55,500	27,000
	SM (with height increase)	*UL*	*60,500*	*26,500*	*13,000*	*23,500*	*13,000*	*76,500*	*51,000*	*25,500*	*25,500*	*18,500*	*9,000*
L	*NS[c]* *S1* *SM*	*UL*	*60,000*	*37,500*	*17,500*	*28,500*	*17,500*	*60,000*	*37,500*	*36,000*	*36,000*	*18,000*	*6,500*
M	NS	UL	UL	21,500	12,500	18,500	12,500	61,500	41,000	26,625	20,500	14,000	9,000
	S1	UL	UL	86,000	50,000	74,000	50,000	246,000	164,000	102,500	82,000	56,000	36,000
	SM	UL	UL	64,500	37,500	55,500	37,500	184,500	123,000	76,875	61,500	42,000	27,000

table continued

TABLE 506.2 ***continued***

Occupancy Classification	See Footnotes	Type I A	Type I B	Type II A	Type II B	Type III A	Type III B	Type IV A	Type IV B	Type IV C	Type IV HT	Type V A	Type V B
R-1[h]	NS[d] S13R	UL	UL	24,000	16,000	24,000	16,000	61,500	41,000	25,625	20,500	12,000	7,000
	S1	UL	UL	96,000	64,000	96,000	64,000	246,000	164,000	102,500	82,000	48,000	28,000
	SM *(without height increase)*	UL	UL	72,000	48,000	72,000	48,000	184,500	123,000	76,875	61,500	36,000	21,000
	SM (with height increase)	*UL*	*UL*	*24,000*	*16,000*	*24,000*	*16,000*	*61,500*	*41,000*	*25,625*	*20,500*	*12,000*	*7,000*
R-2[h]	NS[d] S13R	UL	UL	24,000	16,000	24,000	16,000	61,500	41,000	25,625	20,500	12,000	7,000
	S1	UL	UL	96,000	64,000	96,000	64,000	246,000	164,000	102,500	82,000	48,000	28,000
	SM *(without height increase)*	UL	UL	72,000	48,000	72,000	48,000	184,500	123,000	76,875	61,500	36,000	21,000
	SM (with height increase)	*UL*	*UL*	*24,000*	*16,000*	*24,000*	*16,000*	*61,500*	*41,000*	*25,625*	*20,500*	*12,000*	*7,000*
R-2 Type VA construction[k]	*NS[d]*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*12,000*	*NP*
	S13R	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*12,000*	*NP*
	S1	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*48,000*	*NP*
	SM (without height increase)	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*36,000*	*NP*
	SM (with height increase)	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*NP*	*36,000[j]*	*NP*
R-2.1[h]	*NS[d]*	*UL*	*55,000*	*19,000*	*NP*	*16,500*	*NP*	*54,000*	*NP*	*NP*	*NP*	*10,500*	*NP*
	S13R	*UL*	*55,000*	*19,000*	*NP*	*16,500*	*NP*					*10,500*	*NP*
	S1	*UL*	*220,000*	*76,000*	*NP*	*66,000*	*NP*	*216,000*	*NP*	*NP*	*NP*	*42,000*	*NP*
	SM (without height increase)	*UL*	*165,000*	*57,000*	*NP*	*49,500*	*NP*	*162,000*	*NP*	*NP*	*NP*	*31,500*	*NP*
	SM (with height increase)	*UL*	*55,000*	*19,000*	*NP*	*16,500*	*NP*	*54,000*	*NP*	*NP*	*NP*	*10,500*	*NP*
R-2.2[h]	*NS[l]*	*UL*	*UL*	*24,000*	*NP*	*24,000*	*NP*	*61,500*	*41,000*	*25,625*	*20,500*	*12,000*	*NP*
	S1	*UL*	*UL*	*96,000*	*NP*	*96,000*	*NP*	*246,000*	*164,000*	*102,500*	*82,000*	*48,000*	*NP*
	SM (without height increase)	*UL*	*UL*	*72,000*	*NP*	*72,000*	*NP*	*184,500*	*123,000*	*76,875*	*61,500*	*36,000*	*NP*
	SM (with height increase)	*UL*	*UL*	*24,000*	*NP*	*24,000*	*NP*	*61,500*	*41,000*	*25,625*	*20,500*	*12,000*	*NP*
R-3, *R-3-1[h]*	NS[d] S13D S13R S1 SM	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL
R-4[h]	NS[d] S13D S13R	UL	UL	24,000	16,000	24,000	16,000	61,500	41,000	25,625	20,500	12,000	7,000
	S1	UL	UL	96,000	64,000	96,000	64,000	246,000	164,000	102,500	82,000	48,000	28,000
	SM *(without height increase)*	UL	UL	72,000	48,000	72,000	48,000	184,500	123,000	76,875	61,500	36,000	21,000
	SM (with height increase)	*UL*	*UL*	*24,000*	*16,000*	*24,000*	*16,000*	*61,500*	*41,000*	*25,625*	*20,500*	*12,000*	*7,000*
S-1	NS	UL	48,000	26,000	17,500	26,000	17,500	76,500	51,000	31,875	25,500	14,000	9,000
	S1	UL	192,000	104,000	70,000	104,000	70,000	306,000	204,000	127,500	102,000	56,000	36,000
	SM	UL	144,000	78,000	52,500	78,000	52,500	229,500	153,000	95,625	76,500	42,000	27,000

table continued

TABLE 506.2 *continued*

Occupancy Classification	See Footnotes	Type of Construction											
		Type I		Type II		Type III		Type IV				Type V	
		A	B	A	B	A	B	A	B	C	HT	A	B
S-2	NS	UL	79,000	39,000	26,000	39,000	26,000	115,500	77,000	48,125	38,500	21,000	13,500
	S1	UL	316,000	156,000	104,000	156,000	104,000	462,000	308,000	192,500	154,000	84,000	54,000
	SM	UL	237,000	117,000	78,000	117,000	78,000	346,500	231,000	144,375	115,500	63,000	40,500
U	NS[i]	UL	35,500	19,000	8,500	14,000	8,500	54,000	36,000	22,500	18,000	9,000	5,500
	S1	UL	142,000	76,000	34,000	56,000	34,000	216,000	144,000	90,000	72,000	36,000	22,000
	SM	UL	106,500	57,000	25,500	42,000	25,500	162,000	108,000	67,500	54,000	27,000	16,500

For SI: 1 square foot = 0.0929 m^2.
UL = Unlimited; NP = Not Permitted; NS = Buildings not equipped throughout with an automatic sprinkler system; S1 = Buildings a maximum of one story above grade plane equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1; SM = Buildings two or more stories above grade plane equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1; S13R = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2; S13D = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.3.

a. See Chapters 4 and 5 for specific exceptions to the allowable area in this chapter.
b. See Section 903.2 for the minimum thresholds for protection by an automatic sprinkler system for specific occupancies.
c. New Group H *and all Group L* occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.5.
d. The NS value is only for use in evaluation of existing building area in accordance with the *California Existing Building Code*.
e. Group I-3 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6.
f. New and existing Group I-2 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6.
g. New Group I-4 occupancies see Exceptions 2 and 3 of Section 903.2.6.
h. New Group R occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.8.
i. The maximum allowable area for a single-story nonsprinklered Group U greenhouse is permitted to be 9,000 square feet, or the allowable area shall be permitted to comply with Table C102.1 of Appendix C.
j. In other than Group A, E, H, I, L and R occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, the S increases for height and stories in Tables 504.3 and 504.4 are permitted in addition to the S area increase in accordance with Table 506.2.
k. For Group R-2 buildings of Type VA construction equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1, S area increase is permitted in addition to the height and story increase provided the height shall not exceed 60 feet and 4 stories.
l. The NS value is only for use in evaluation of single-occupancy, multistory buildings per the formula in Section 506.2.3.

CHANGE SIGNIFICANCE: Allowable building area, as established in part by Table 506.2, limits the size of buildings in order to limit to a reasonable level the magnitude of a fire that potentially may develop. Whereas floor-area limitations are concerned primarily with property damage, life safety is enhanced as well by the fact that in the larger buildings there are typically more people at risk during a fire. The essential ingredients in the determination of allowable areas are 1) the amount of combustibles attributable to the use, and 2) the amount of combustibles in the construction of the building, both of which contribute to the potential fire severity. Building area limitations have now been established for the three new construction types included in mass timber construction. In addition, an increase in allowable floor area for Group I-3 occupancies in one-story sprinklered buildings of Type IIA construction has occurred.

Because the allowable size of a building is directly related to its materials of construction, as well as the fire-resistance-rated protection of such materials, the assignment of allowable area factors for each of the three new mass timber construction types is an important decision. Recognizing the additional impact to the factors in Table 506.2 by the occupancy classification(s) involved, the allowable area factors for the new mass timber construction types also vary based on the hazards involved due to the building's use. The determination of appropriate allowable area factors was made in a rigorous fashion consistent with the efforts addressing allowable building height. Each of the three new construction types was examined for its fire safety characteristics. A multiplier was then assigned to each of the new construction types to be applied to the current factors applicable to Type IV-HT construction. The intended result was to reflect the additional passive fire protection provided by the new construction types (Types IV-A, IV-B and IV-C).

The allowable area factors of Table 506.2 for buildings of Type IV-HT construction were initially increased by the following multipliers:

- Type IV-C is 1.25 times the Type IV-HT allowable area factor.
- Type IV-B is 2.00 times the Type IV-HT allowable area factor.
- Type IV-A is 3.00 times the Type IV-HT allowable area factor.

The resulting allowable area factors were then reexamined on a case-by-case basis regarding their relative hazard and occupancy classification. Maintaining a conservative approach, some hazards were perceived to be of a greater concern, and the allowable area factors were adjusted downward. The two occupancy classifications considered as representing the most hazardous conditions, Group I and Group H, were ultimately assigned reduced factors from those determined solely by using the multipliers. Additionally, the allowable area factors for each occupancy were considered in conjunction with each occupancy's allowable height to conservatively address risks associated with allowable floor areas at specific heights.

The allowable area limits have also been modified for Group I-3 occupancies in one-story buildings of Type IIA construction. The limit of 45,000 square feet in single-story sprinklered buildings has been increased to 60,000 square feet. This modification corrects a tabular value error that went undetected in the transition from Table 503 in the 2013 CBC to Table 506.2 in the 2016 edition. There was no intent at the time of the transition to make any technical changes to allowable building area from what was previously allowed.

506.3.2

Allowable Area Frontage Increase

CHANGE TYPE: Modification

CHANGE SUMMARY: The methodology for establishing the permissible allowable area increase for frontage has been simplified through the use of a tabular format to make for a more efficient approach to allowable area determination.

2022 CODE TEXT: **506.3.2 Minimum frontage distance.** To qualify for an area factor increase based on frontage, the public way or open space adjacent to the building perimeter shall have a minimum distance (*W*) of 20 feet (6096 mm) measured at right angles from the building face to any of the following:

1. The closest interior lot line.
2. The entire width of a street, alley or public way.
3. The exterior face of an adjacent building on the same property.

~~Where the value of *W* is greater than 30 feet (9144 mm), a value of 30 feet (9144 mm) shall be used in calculating the building area increase based on frontage, regardless of the actual width of the public way or open space. Where the value of *W* varies along the perimeter of the building, the calculation performed in accordance with Equation 5-5 shall be based on the weighted average calculated in accordance with Equation 5-4.~~

$$\cancel{W = (L_1 \times w_1 + L_2 \times w_2 + L_3 \times w_3 \ldots)/F} \quad \textbf{\cancel{(Equation 5-4)}}$$

~~where:~~

~~*W* (Width: weighted average) = Calculated width of public way or open space (feet).~~

~~L_n = Length of a portion of the exterior perimeter wall.~~

~~w_n = Width (≥ 20 feet) of a public way or open space associated with that portion of the exterior perimeter wall.~~

~~*F* = Building perimeter that fronts on a public way or open space having a width of 20 feet (6096 mm) or more.~~

<u>The frontage increase shall be based on the smallest public way or open space that is 20 feet (6096 mm) or greater, and the percentage of building perimeter having a minimum 20 feet (6096 mm) public way or open space.</u>

506.3.3 Amount of increase. The area factor increase based on frontage shall be determined in accordance with ~~Equation 5-5:~~ <u>Table 506.3.3.</u>

$$\cancel{I_f = [F/P - 0.25]W/30} \quad \textbf{\cancel{(Equation 5-5)}}$$

~~where:~~

~~I_f = Area factor increase due to frontage.~~

~~*F* = Building perimeter that fronts on a public way or open space having minimum distance of 20 feet (6096 mm).~~

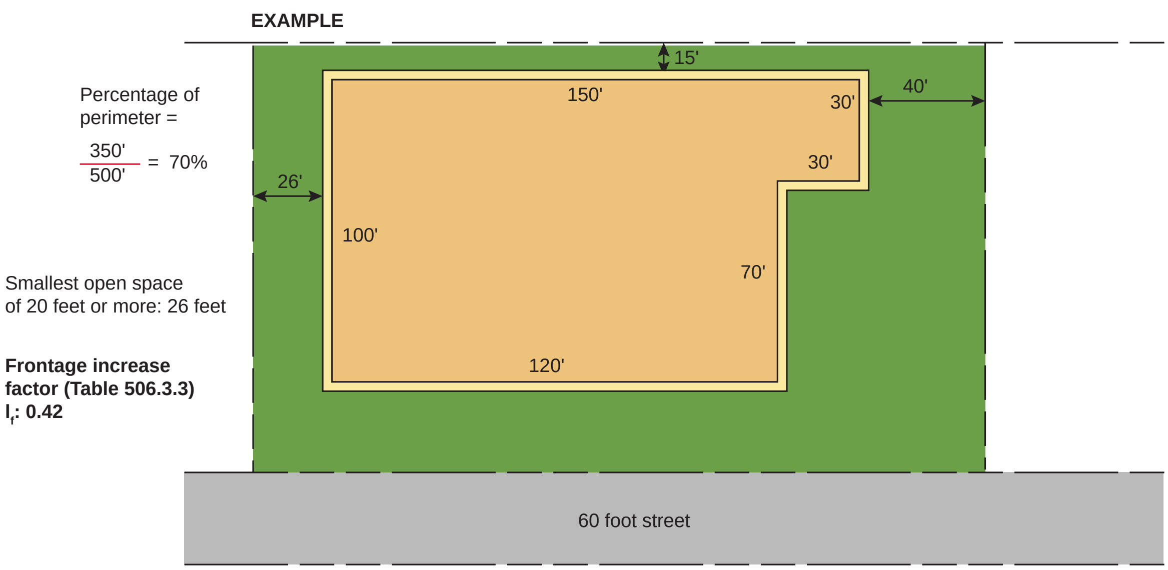
~~*P* = Perimeter of entire building (feet).~~

~~*W* = Width of public way or open space (feet) in accordance with Section 506.3.2.~~

TABLE 506.3.3 Frontage Increase Factor[a]

Percentage of Building Perimeter	Open Space: 0 to less than 20 feet	20 to less than 25 feet	25 to less than 30 feet	30 feet or greater
0 to less than 25	0	0	0	0
25 to less than 50	0	0.17	0.21	0.25
50 to less than 75	0	0.33	0.42	0.50
75 to 100	0	0.50	0.63	0.75

a. Interpolation is permitted.



~~**Exception (to Section 506.3.2):**~~ **506.3.3.1 Section 507 buildings.** Where a building meets the requirements of Section 507, as applicable, except for compliance with the minimum 60-foot (18 288 mm) public way or yard requirement~~, and the value of W is greater than 30 feet, the value of W shall not exceed 60 feet~~ the area factor increase based on frontage shall be determined in accordance with Table 506.3.3.1.

TABLE 506.3.3.1 Section 507 Buildings[a]

Percentage of Building Perimeter	Open Space: 30 to less than 35 feet	35 to less than 40 feet	40 to less than 45 feet	45 to less than 50 feet	50 to less than 55 feet	55 to less than 60 feet
0 to less than 25	0	0	0	0	0	0
25 to less than 50	0.29	0.33	0.38	0.42	0.46	0.50
50 to less than 75	0.58	0.67	0.75	0.83	0.92	1.00
75 to 100	0.88	1.00	1.13	1.25	1.38	1.50

a. Interpolation is permitted.

CHANGE SIGNIFICANCE: If a building is provided with frontage consisting of public ways and/or open space for a sizable portion of the perimeter of the building, some benefit will accrue based on better access for the fire department. Also, if the yards or public ways are wide enough, there will be a benefit due to the decreased exposure from adjoining hazards. Because of the beneficial aspects of open space adjacent to a building, the CBC permits increases in the tabular areas established from Table 506.2 based on the amount of open perimeter and width of the open space and public ways surrounding the building. The methodology for establishing the permissible allowable area increase for frontage has been simplified to make for a more efficient approach to allowable area determination.

Calculating the allowable area increase based on frontage has historically been a very confusing and time-consuming process with a relatively limited benefit, particularly as compared to the automatic sprinkler system increase. Two significant modifications were made in the effort to simplify the concept of allowing an increase in allowable floor area for those buildings that have a specified degree of open space surrounding the building. First, the allowance for "weighting" the open space area increase (Equation 5-4) has been eliminated and replaced with recognition of the smallest yard of 20 feet or more in width. Second, the calculation of the area factor increase due to frontage (Equation 5-5) has been deleted in favor of new Table 506.3.3, which provides a limited number of frontage increase factors based on percentage of perimeter open and width of open space ranges. The values in Table 506.3.3 have been based on the calculation process as previously established in Equation 5-5.

The use of a "weighted average" approach in determining the allowable frontage increase was first established in the 2007 CBC. Applicable only to those situations where the open space adjacent to a building's exterior wall was at least 20 feet in width, but less than 30 feet in width, the weighting of open space has been viewed by many as confusing and, as a result, has been seldom applied. Although the elimination of this concept may result in a slight reduction in the available frontage increase as determined by new Table 506.3.3, the impact of its deletion is relatively small due to the limited scope of its application. In addition, it removes a significant amount of the confusion related to the frontage increase determination.

The code will continue to recognize that no frontage increase is provided where an open space and/or public way is less than 20 feet in width. In addition, there is no change in the recognition that no additional credit is given for those open spaces greater than 30 feet in width. However, the methodology of "weighting" (a form of averaging) those open spaces that have a width between 20 feet and 30 feet is no longer utilized. In the new evaluation of the frontage increase, the smallest open space width that is 20 feet or greater is to be used in the application of new Table 506.3.3.

As mentioned, new Table 506.3.3 is based on the factors established in the now deleted Equation 5-5. The area increase factor I_f has previously been determined due to 1) the amount of building perimeter fronting on a minimum 20-foot open space or public way, 2) the building's entire perimeter, and 3) the width of the public way or open space as determined by the weighted average method. Items 1 and 2 will continue to be represented in the new table by a limited number of ranges representing the amount of perimeter considered to be open, while Item 3 is now represented by only the smallest open space that is 20 feet or more.

The streamlined process is simply a matter of 1) determining the percentage of perimeter considered to be open, 2) identifying the smallest open space or public way that is at least 20 feet in width, and 3) applying the applicable row and column in the table to identify the allowable frontage increase I_f for the building under consideration. In applying the factors established in Table 506.3.3, it is acceptable to interpolate both the percentage of perimeter and the width of the open space if necessary to gain an additional limited increase for frontage; however, such interpolation will typically not be necessary.

A related revision occurs with the replacement of the exception to Section 506.3.2 with new Table 506.3.3.1 for those buildings that comply with the conditions of Section 507 (unlimited area buildings) except for compliance with the minimum 60-foot public way or yard requirement. This new table is to be applied in the same manner as Table 506.3.3 in the determination of the frontage increase factor I_f.

508.4.4

Separated Occupancies

CHANGE TYPE: Clarification

CHANGE SUMMARY: The clarity and functionality provided by a format change to Table 508.4.4 addressing separated occupancies is intended to eliminate any confusion as to the table's proper use.

2022 CODE TEXT: **508.4.4 Separation.** Individual occupancies shall be separated from adjacent occupancies in accordance with Table 508.4.

TABLE 508.4 Required Separation of Occupancies (Hours)[h]

	A, E		I-4[i], R-2.1		I-2[j], I-2.1		I-3		R-1[a], R-2[a], R2-2[a], R-3[a], R-3.1[a], R-4[a]		F-2, S-2[b], U		B[e], F-1[g,h], M, S-1		L		H-1		H-2		H-3, H-4		H-5	
Occupancy	**S**	**NS**	**S**	**NS**	**S**	**NS**	**S**	**NS**	**S**	**NS**	**S**	**NS**	**S**	**NS**	**S**	**NS**	**S**	**NS**	**S**	**NS**	**S**	**NS**	**S**	**NS**
A, E	N	N	2	2	2	NP	2	NP	1	2	N	1	1	2	2	NP	NP	NP	3	4	2	3	2	NP
I-4[i], R-2.1	2	2	1[e]	NP	2	NP	2	NP	1	NP	1	2	1	2	2	NP	NP	NP	4	NP	2	NP	2	NP
I-2[j], I-2.1	2	NP	2	NP	N	NP	2	NP	2	NP	2	NP	2	NP	2	NP	NP	NP	4	NP	2	NP	2	NP
I-3	2	NP	2	NP	2	NP	N	NP	2	NP	2	2	2	2	2	NP	NP	NP	4	NP				
R-1[a], R-2[a], R-2-2[a], R-3[a], R-3.1[a], R-4[a]	1	2	1	NP	2	NP	2	NP	N	N	1[c]	2[c]	1	2	4	NP	NP	NP	3	NP	2	NP	2	NP
F-2, S-2[b], U	N	1	1	2	2	NP	2	2	1[c]	2[c]	N	N	1	2	1	NP	NP	NP	3	4	2	3	2	NP
B[e], F-1[g,h], M, S-1	1	2	1	2	2	NP	2	2	1	2	1	2	N	N	1	NP	NP	NP	2	3	1	2	1	NP
L	2	NP	2	NP	2	NP	2	NP	4	NP	1	NP	1	NP	1	NP	NP	NP	2	NP	1	NP	1	NP
H-1	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	N	NP	NP	NP	NP	NP	NP	NP
H-2	3	4	4	NP	4	NP	4	NP	3	NP	3	4	2	3	2	NP	NP	NP	N	NP	1	NP	1	NP
H-3, H-4	2	3	2	NP	2	NP			2	NP	2	3	1	2	1	NP	NP	NP	1	NP	1[d]	NP	1	NP
H-5	2	NP	2	NP	2	NP			2	NP	2	NP	1	NP	1	NP	NP	NP	1	NP	1	NP	N	NP

S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.
NS = Buildings not equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.
N = No separation requirement.
NP = Not Permitted.

a. See Section 420.
b. The required separation from areas used only for private or pleasure vehicles shall be reduced by 1 hour but not to less than 1 hour.
c. See Sections 406.3.2 and 406.6.4.
d. Separation is not required between occupancies of the same classification.
e. See Section 422.2 for ambulatory care facilities.
f. Occupancy separations that serve to define fire area limits established in Chapter 9 for requiring fire protection systems shall also comply with Section 707.3.10 and Table 707.3.10 in accordance with Section 901.7.
g. *[SFM] Group I and F1 occupancies and Group R-2.1 and F-1 occupancies shall have a 3 hour separation.*
h. *[SFM] Commercial kitchens not associated with cafeterias and similar dining facilities in Group I-2 and Group R-2.1 shall have a 2-hour separation and shall be protected by an automatic sprinkler system.*
i. *[SFM] Group E child-care separation with I-4 child care can be reduced to 1 hour with the installation of automatic fire sprinklers in accordance with Section 903.3.1.1.*
j. *When not considered an accessory use in accordance with Section 508.2.4, the required separation between Group I-2 and required covers for accessible entrances and emergency vehicle entrances, when in accordance with Section 406.5.2 and protected by an automatic sprinkler system, shall be reduced by 1 hour but not to less than 1 hour. See Section 903.2.21.*

CHANGE SIGNIFICANCE: Where a building contains multiple occupancy classifications, Section 508 requires that at least one of three established methodologies be applied to address the varied hazards. Separated occupancies, one of the three available methods, is based upon the similarities, or dissimilarities, of hazards posed by the adjacent occupancies being regulated. Where the hazards are deemed to be sufficiently dissimilar, some degree of fire-resistance-rated separation is required by Table 508.4. However, no fire-resistive separation is required by the table where the occupancies pose hazards that are somewhat similar. The table's format has been revised in a manner to help limit confusion in its application.

The use of Table 508.4 is dependent upon identifying the two occupancies being evaluated under the separated occupancies approach to mixed occupancy evaluation. One of the occupancies is selected from the horizontal row at the top of the table, the other from the vertical column along the table's left-hand side. The intersection of the applicable row and column is intended to provide the minimum hourly fire-resistance rating required for the fire barrier and/or horizontal assembly needed to provide the required separation. However, this methodology often appeared to indicate no requirement, as the intersecting row and column resulted in a dashed mark rather than a required hourly rating. This unintended application has been addressed by completing the balance of Table 508.4. The revision is simply editorial in nature, as no technical requirements have been modified. The clarity and functionality provided by the format change should eliminate any previous confusion as to the table's proper use.

508.4.4.1, 509.4.1.1

Fire Separations of Mass Timber

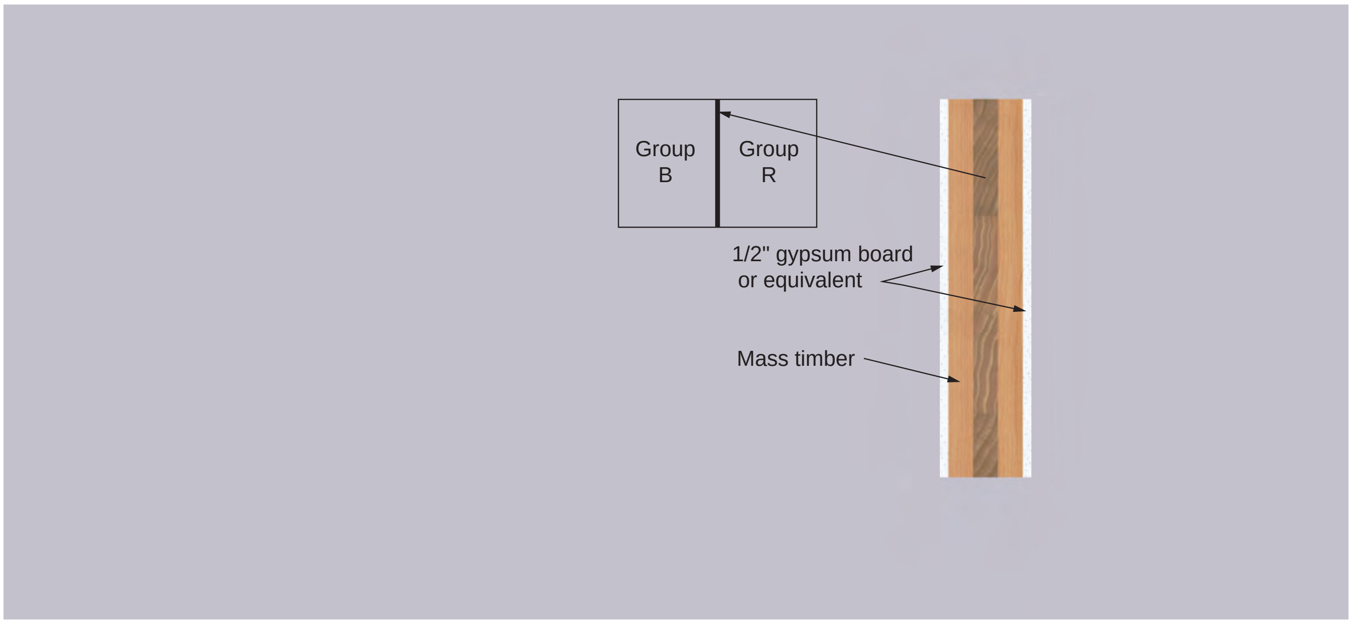
CHANGE TYPE: Addition

CHANGE SUMMARY: Additional criteria for the use of mass timber elements serving as fire barriers and horizontal assemblies in mass timber buildings include the installation of a thermal barrier as part of any required incidental use and occupancy separations.

2022 CODE TEXT: **508.4.4.1 Construction.** Required separations shall be fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both, so as to completely separate adjacent occupancies. <u>Mass timber elements serving as fire barriers or horizontal assemblies to separate occupancies in Type IV-B or IV-C construction shall be separated from the interior of the building with an approved thermal barrier consisting of gypsum board that is not less than ½ inch (12.7 mm) in thickness or a material that is tested in accordance with and meets the acceptance criteria of both the Temperature Transmission Fire Test and the Integrity Fire Test of NFPA 275.</u>

<u>**509.4.1.1 Type IV-B and IV-C construction.** Where Table 509.1 specifies a fire-resistance-rated separation, mass timber elements serving as fire barriers or horizontal assemblies in Type IV-B or IV-C construction shall be separated from the interior of the incidental use with an approved thermal barrier consisting of gypsum board that is not less than ½ inch (12.7 mm) in thickness or a material that is tested in accordance with and meets the acceptance criteria of both the Temperature Transmission Fire Test and the Integrity Fire Test of NFPA 275.</u>

CHANGE SIGNIFICANCE: Fire barriers and horizontal assemblies are referenced in both Sections 508.4.4 and 509.4.1 as the means to create a substantial fire separation where mandated for occupancy separations



Example: Type IV-C construction with mixed occupancy consisting of business and residential uses.

and incidental use separations. The use of such fire-resistance-rated assemblies allows for the creation of a compartment that will, through containment, impede the spread of a fire to other areas outside of the compartment. Where the separated occupancies method is applied in a mixed-occupancy building, the fire barrier and/or horizontal assembly separation isolates dissimilar hazards to regulate each occupancy independently from other occupancies in the building. The use of fire barriers and/or horizontal assemblies provides a means to contain a fire in an incidental use area for an established period of time so it does not spread to surrounding areas. Additional criteria for such fire assemblies in Type IV-B and IV-C construction now include the installation of a thermal barrier as part of any required incidental use and occupancy separations.

The thermal protection of exposed mass timber elements used as occupancy separations or incidental use separations is only applicable to those buildings classified as Type IV-B or IV-C. There is no need to regulate Type IV-A construction due to the mandatory noncombustible protection of all mass timber elements. The requirements are generally consistent for both types of separation. Exposed mass timber in fire barriers and horizontal assemblies used as occupancy separations must be provided with a complying thermal barrier. For incidental use separations, the thermal barrier need only be installed on the side where the hazard occurs, that is, the side within the incidental use.

The installation of a thermal barrier delays or prevents ignition of the mass timber member, thus delaying or preventing its contribution to the fuel load. As a result, additional time is available for occupants to evacuate and fire personnel to respond. The thermal barrier may consist of gypsum board at least ½-inch in thickness or any material tested to and meeting the acceptance criteria of the Temperature Fire Test and the Integrity Fire Test established in the National Fire Protection Association standard NFPA 275, *Standard Method of Fire Tests for the Evaluation of Thermal Barriers*.

It is important to note that the thermal barrier requirements are only established to address the possible contribution of exposed mass timber surfaces to the fuel load. The thermal barrier is not intended to increase the fire-resistance ratings of mass timber fire barriers and/or horizontal assemblies used as occupancy separations or incidental use separations.

508.5

Live/Work Units

CHANGE TYPE: Clarification

CHANGE SUMMARY: The criteria for live/work units has been relocated from the special use provisions of Chapter 4 to the mixed occupancy provisions of Section 508, with no change to the technical requirements.

2022 CODE TEXT:

~~SECTION 419~~
~~LIVE/WORK UNITS~~

508.1 General. Each portion of a building shall be individually classified in accordance with Section 302.1. Where a building contains more than one occupancy group, the building or portion thereof shall comply with the applicable provisions of Section 508.2, 508.3 ~~or~~, 508.4 or 508.5, or a combination of these sections.

Exceptions:

(no changes to Exceptions 1 and 2)

3. ~~Uses within live/work units, complying with Section 419, are not considered separate occupancies.~~

Photo courtesy of kaceyb

Live/work unit.

~~419.1 General~~ 508.5 Live/work units. A live/work unit shall comply with Sections ~~419.1~~ 508.5 through ~~419.9~~ 508.5.11.

(no change to Exception)

~~419.1~~ 508.5.1 through ~~419.9~~ 508.5.11. *(no changes to provisions)*

CHANGE SIGNIFICANCE: The concept of live/work units typically combines a residential unit with a small business activity. Residential live/work units often include a dwelling unit along with some public service business, such as an artist's studio, coffee shop or chiropractor's office. There may be a small number of employees working within the unit, and the public is able to enter the work area of the unit to acquire service. Live/work units are a throwback to the 1900-era where residents could walk to all the needed services within their neighborhood. Provisions specifically addressing live/work units recognize the uniqueness of this type of use. By definition, such a unit is primarily residential in nature but has a sizable portion of the space devoted to nonresidential activities. The recognition of live/work units has been relocated from the special use provisions of Chapter 4 to the mixed occupancy provisions of Section 508, with no change to the technical requirements.

The singular benefit of buildings, or portions of buildings, that are in compliance with the live/work unit provisions is that such units are not considered as being a mixed occupancy condition. Classified solely as Group R-2 occupancies, live/work units need only comply with those code requirements applicable to the Group R-2 classification, unless specifically addressed in Sections 508.5.3 through 508.5.11. Within the unit, the mixed occupancy requirements of Section 508 are not applicable because the entire unit is considered as only one occupancy, Group R-2. The inclusion of the live/work provisions in Section 508 is actually more of an exception than a general requirement, as a live/work unit does not create a mixed occupancy condition. The change is simply a relocation of existing requirements, as no technical modifications have occurred.

Table 509.1

Storage Battery Systems as Incidental Uses

CHANGE TYPE: Modification

CHANGE SUMMARY: The identification of stationary storage battery systems as incidental uses, and the corresponding fire separations required for such uses, have been deleted from Table 509.1 and are now more comprehensively regulated by Section 1207 of the CFC.

2022 CODE TEXT:

TABLE 509.1 **Incidental Uses**

Room or Area	Separation and/or Protection
Furnace room where any piece of equipment is over 400,000 Btu per hour input	1 hour or provide automatic sprinkler system
Rooms with boilers where the largest piece of equipment is over 15 psi and 10 horsepower	1 hour or provide automatic sprinkler system
Refrigerant machinery room	1 hour or provide automatic sprinkler system
Hydrogen fuel gas rooms, not classified as Group H	1 hour in Group B, F, M, S and U occupancies; 2 hours in Group A, E, I and R occupancies.
Incinerator rooms	2 hours and provide automatic sprinkler system
Paint shops, not classified as Group H, located in occupancies other than Group F	2 hours; or 1 hour and provide automatic sprinkler system
In Group E occupancies, laboratories and vocational shops not classified as Group H	1 hour or provide automatic sprinkler system
[SFM] *Rooms or areas with special hazards such as laboratories, vocational shops and other such areas not classified as Group H, located in Group E occupancies where hazardous materials in quantities not exceeding the maximum allowable quantity are used or stored.*	*1 hour*
In Group I-2 *and I-2.1* occupancies, laboratories not classified as Group H	1 hour[a]
In ambulatory care facilities, laboratories not classified as Group H	1 hour or provide automatic sprinkler system
Laundry rooms over 100 square feet	1 hour or provide automatic sprinkler system
In Group I-2 *and I-2.1* laundry rooms over 100 square feet	1 hour[a]
Group I-3 cells and Group I-2 *and I-2.1* patient rooms equipped with padded surfaces	1 hour[a]
In Group I-2 *and I-2.1* physical plant maintenance shops	1 hour[a]
In ambulatory care facilities or Group I-2 *and I-2.1* occupancies, waste and linen collection rooms with containers that have an aggregate volume of 10 cubic feet or greater	1 hour[a]
In other than ambulatory care facilities and Group I-2 *and I-2.1* occupancies, waste and linen collection rooms over 100 square feet	1 hour or provide automatic sprinkler system
In ambulatory care facilities or Group I-2 *and I-2.1* occupancies, storage rooms greater than 100 square feet	1 hour[a]
Electrical installations and transformers	See Sections 110.26 through 110.34 and Sections 450.8 through 450.48 of the *California Electrical Code* for protection and separation requirements.

For SI: 1 square foot = 0.0929 m^2, 1 pound per square inch (psi) = 6.9 kPa, 1 British thermal unit (Btu) per hour = 0.293 watts, 1 horsepower = 746 watts, 1 gallon = 3.785 L, 1 cubic foot = 0.0283 m^3.

a. ***[SFM]*** *Fire barrier protection and automatic sprinkler protection required throughout the fire area in I-2 and I-2.1 occupancies as indicated.*

CHANGE SIGNIFICANCE: Incidental uses are limited to those uses listed in Table 509.1. The listed uses have been selected for inclusion because of the increased hazard they present to the other areas of the building. However, it is also recognized that the degree of hazard is such that a separate occupancy classification is not warranted. Through fire separation and/or fire protection requirements, the code provides safeguards to address the potential hazard these uses may pose. The requirements of Table 509.1 identifying stationary storage battery systems as incidental uses, and the corresponding fire separations required for such uses, have been deleted and are now more comprehensively regulated by Section 1207 of the CFC.

Section 1207 of the CFC, Electrical Energy Storage Systems, has added extensive protection features to such installations, including detection, suppression, fire separation and explosion control, along with large scale testing to document the effectiveness of chosen protection levels. With the increased level of protection mandated by the IFC, there is no longer a need to address areas containing stationary storage battery systems under the incidental use provisions.

For more information of the changes to CFC Section 1207 regarding electrical energy storage systems, see the ICC publication *Significant Changes to the California Fire Code, 2022 Edition*.

Photo courtesy of Mischa Keirjser

Storage battery system.

510.2

Stairway Construction in Podium Buildings

CHANGE TYPE: Modification

CHANGE SUMMARY: Where a combustible building (Type III, IV or V) is located above the lower noncombustible (Type IA) building when applying the horizontal building separation allowance, interior exit stairways located within the Type IA building may be constructed of combustible materials where specified conditions are met.

2022 CODE TEXT: **510.2 Horizontal building separation allowance.** A building shall be considered as separate and distinct buildings for the purpose of determining area limitations, continuity of fire walls, limitation of number of stories and type of construction where the following conditions are met:

(no changes to Conditions 1-3)

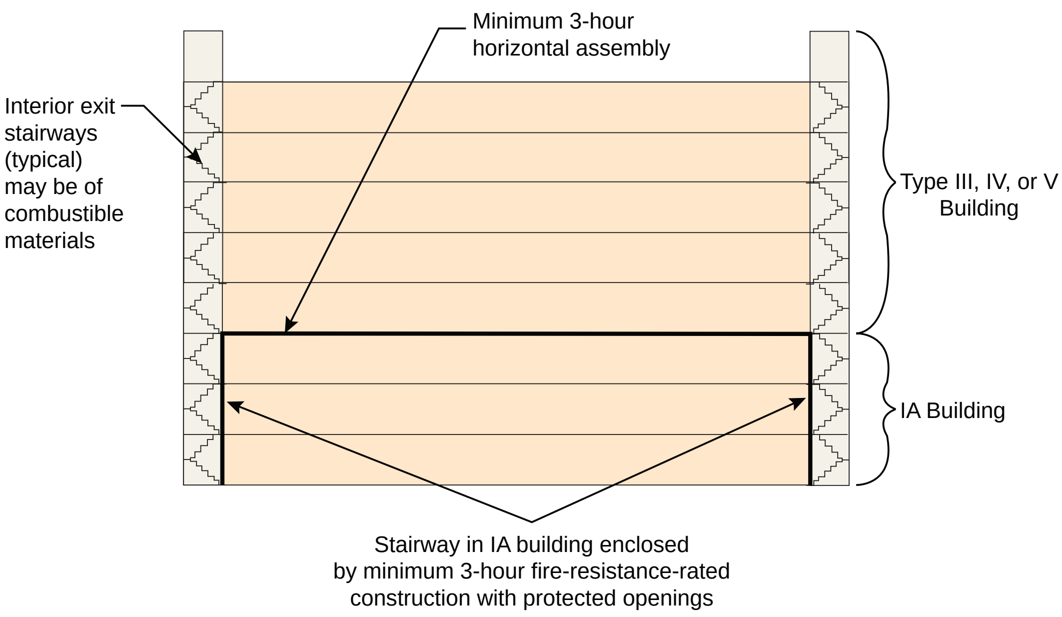
4. Interior exit stairways located within the Type IA building are permitted to be of combustible materials where the following requirements are met:

4.1 The building above the Type IA building is of Type III, IV, or V construction.

4.2 The stairway located in the Type IA building is enclosed by 3-hour fire-resistance-rated construction with opening protectives in accordance with Section 716.

(no changes to renumbered Conditions 5-7)

CHANGE SIGNIFICANCE: The provisions set forth in Section 510 allow for modifications or exceptions to the general provisions of Chapter 5 for allowable building heights and areas. These special provisions are viewed as specific in nature and take precedence over any general provisions that may apply. Section 510.2, addressing the horizontal building separation allowance, is one of the most common applications in use today. This methodology is often referred to as a "podium" or pedestal"



building. Limited in application, the provisions create, in effect, an exception that allows those stories below a 3-hour horizontal fire separation to be considered portions of a separate building from the "building" above the horizontal fire separation. Multiple conditions must be met in order to take advantage of these provisions. A new allowance addresses the permissible materials of stairway construction where a combustible building (Type III, IV or V) is located above the lower noncombustible (Type IA) building.

Section 1011.7 indicates that stairways are to be built of materials consistent with those materials permitted for the building's type of construction. This mandate is easily addressed in most buildings, as the code requires a building to be classified as a single construction type. However, in those buildings designed and built under the special provisions of Section 510.2 allowing for a horizontal building separation, two types of construction are permitted. The lower building must be of Type IA construction; however, the upper building may be of any complying construction type. Where the upper buildings is built of combustible construction (Type III, IV or V), a conflict has existed regarding how the stairway that extends through both types of construction should be regulated. Noncombustible stairway construction would be required in the Type IA building, while combustible stairway construction would be permitted in the Type III, IV or V building.

Where an interior exit stairway is located in a building utilizing the horizontal building separation allowance, it is now permissible for the stairways to be constructed of combustible materials throughout, including in the Type IA portion of the building, provided two conditions are met. One, the upper building is classified as Type III, IV or V construction, and two, the stairway located in the lower building is enclosed by a minimum 3-hour fire-resistance-rated shaft enclosure. Where the upper building is of noncombustible construction (Type I or II), the entire stairway must be constructed of noncombustible materials.

Where new Condition 4 is applied, the minimum 3-hour fire-resistance-rated horizontal separation is extended vertically downward adjacent to the stairway enclosure, in effect isolating the exit stairway in the upper building. As a result, the interior exit stairways can be considered as located only in the upper building where combustible stairway construction is permitted.

Table 601

Type IV Fire-Resistance

CHANGE TYPE: Addition

CHANGE SUMMARY: The minimum required fire-resistance ratings for the building elements of those structures classified as one of the new construction types (Types IV-A, IV-B and IV-C) have been established as set forth in Table 601.

2022 CODE TEXT:

TABLE 601 Fire-Resistance Rating Requirements for Building Elements (Hours)

Building Element	Type I A	Type I B	Type II A	Type II B	Type III A	Type III B	Type IV A	Type IV B	Type IV C	Type IV HT	Type V A	Type V B
Primary structural frame[f]	3[a,b]	2[a,b,c]	1[b,c]	0[c]	1[b,c]	0	3[a]	2[a]	2[a]	HT	1[b,c]	0
Bearing walls												
Exterior[e,f]	3	2	1	0	2	2	3	2	2	2	1	0
Interior	3[a]	2[a]	1	0	1	0	3	2	2	1/HT[g]	1	0
Nonbearing walls and partitions Exterior	See Table ~~602~~ 705.5											
Nonbearing walls and partitions Interior[d]	0	0	0	0	0	0	0	0	0	See Section 2304.11.2	0	0
Floor construction and associated secondary structural members (see Section 202)	2	2	1	0	1	0	2	2	2	HT	1	0
Roof construction and associated secondary structural members (see Section 202)	1½[b]	1[b,c]	1[b,c]	0[c]	1[b,c]	0	1½	1	1	HT	1[b,c]	0

a. Roof supports: Fire-resistance ratings of primary structural frame and bearing walls are permitted to be reduced by 1 hour where supporting a roof only.
b. Except in Group F-1, H, M and S-1 occupancies, fire protection of structural members in roof construction shall not be required, including protection of primary structural frame member, floor framing and decking where every part of the roof construction is 20 feet or more above any floor immediately below. Fire-retardant-treated wood members shall be allowed to be used for such unprotected members.
c. In all occupancies, heavy timber complying with Section 2304.11 shall be allowed for roof construction, including primary structural frame members, where a 1-hour or less fire-resistance rating is required.
d. Not less than the fire-resistance rating required by other sections of the code.
e. Not less than the fire-resistance rating based on fire separation distance (see Table 705.5).
f. Not less than the fire-resistance rating as referenced in Section 704.10.
g. Heavy timber bearing walls supporting more than two floors or more than a floor and a roof shall have a fire-resistance rating of not less than 1 hour.

CHANGE SIGNIFICANCE: Table 601 provides the basic fire-resistance rating requirements for the various types of construction, as well as delineating those fire-resistance ratings required to qualify for a specific construction type. These designations, as further described in Sections 602.2 through 602.5 and used throughout the code to describe a specific type of construction, are not specifically defined in the CBC. Rather, their definitions can only be determined through the combination of the provisions of Chapter 6 along with those set forth in Table 601. A building's permissible types of construction are based primarily on the intended building size and anticipated use of the building. The minimum required fire-resistance ratings for the building elements of those structures classified as one of the new construction types (Types IV-A, IV-B and IV-C) have been established as set forth in Table 601.

The minimum required fire-resistance ratings set forth in the table for Type IV-A, IV-B and IV-C buildings were established in a manner consistent with the development of height and area limits for these new construction types. Correlations between the maximum building sizes and the various types of construction were established, then further evaluation addressed any unique conditions that needed to be addressed. As a point of comparison, the minimum required building element ratings for Type IB construction were also applied to Type IV-B buildings. In order to maintain a significant level of fire-resistance for all mass timber construction, the minimum required ratings for Type IV-C construction are the same as those of Type IV-B. See the discussion of Sections 603.4.1 through 602.4.3 for the distinction between Type IV-B and IV-C construction. For the highest level of mass timber construction, Type IV-A, an equivalency with Type IA was made. No modifications were made to the minimum required ratings for Type IV-HT construction.

The only differences involve interior bearing walls, where the fire-resistance ratings of interior bearing walls in Types IV-A, IV-B and IV-C construction are not allowed to be reduced by 1 hour where only supporting a roof (in accordance with Note a), as is permitted for Type IA and IB. While not specific to Table 601, it should also be noted that the reductions in fire-resistance ratings permitted by Section 403.2.1.1 for Type IA and IB high-rise buildings are not applicable to buildings of Type IV-A or IV-B construction.

Footnote c in Table 601 has historically allowed the use of heavy timber in lieu of the 1-hour rated roof construction that is required for many construction types. Because there is a separate row in the table addressing primary structural frame elements, its application to such elements has been in question. The footnote has been modified such that all components of the roof construction, including any structural frame members, may consist of heavy timber.

The addition of footnote g, applicable only to Type IV-HT construction, now requires heavy timber interior bearing walls supporting more than two floors, or a floor and a roof, to be fire-resistance-rated for at least 1 hour. With its application typically utilized for vertical elements in midrise buildings, this mandate may result in an increase in wall thickness in exposed heavy timber interior bearing walls supporting multiple stories in order to provide the minimum 1-hour rating. It is important to note that this section is not adopted by the State Fire Marshal.

602.4

Mass Timber Type IV Buildings

CHANGE TYPE: Addition

CHANGE SUMMARY: While the past allowances for Type IV buildings have been maintained as Type IV-HT construction, three new construction types have been introduced to recognize other forms of mass timber construction.

2022 CODE TEXT: **602.4 Type IV.** ~~Type IV construction is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of solid wood, laminated wood, heavy timber (HT) or structural composite lumber (SCL) without concealed spaces. The minimum dimensions for permitted materials including solid timber, glued-laminated timber, structural composite lumber (SCL), and cross-laminated timber and details of Type IV construction shall comply with the provisions of this section and Section 2304.11. Exterior walls complying with Section 602.4.4.1 or 602.4.4.2 shall be permitted. Interior walls and partitions not less than 1-hour fire-resistance rating or heavy timber complying with Section 2304.11.2.2 shall be permitted.~~ Type IV construction is that type of construction in which the building elements are mass timber or noncombustible materials and have fire-resistance ratings in accordance with Table 601. Mass timber elements shall meet the fire-resistance-rating requirements of this section based on either the fire-resistance rating of the noncombustible protection, the mass timber, or a combination of both and shall be determined in accordance with Section 703.2. The minimum dimensions and permitted materials for building elements shall comply with the provisions of this section and Section 2304.11. Mass timber elements of Types IV-A, IV-B and IV-C construction shall be protected with noncombustible protection applied directly to the mass timber in accordance with Sections 602.4.1 through 602.4.3. The time assigned to the noncombustible protection shall be determined in accordance with Section 703.6 and comply with Section 722.7.

Photo courtesy of naturallywood.com, KK Law

Mass timber construction.

Cross-laminated timber shall be labeled as conforming to ANSI/APA PRG 320 as referenced in Section 2303.1.4.

Exterior load-bearing walls and nonload-bearing walls shall be mass timber construction, or shall be of noncombustible construction.

> **Exception:** Exterior load-bearing walls and nonload-bearing walls of Type IV-HT construction in accordance with Section 602.4.4.

The interior building elements, including nonload-bearing walls and partitions, shall be mass timber construction or of noncombustible construction.

> **Exception:** Interior building elements and nonload-bearing walls and partitions of Type IV-HT construction in accordance with Section 602.4.4.

Combustible concealed spaces are not permitted except as otherwise indicated in Sections 602.4.1 through 602.4.4. Combustible stud spaces within light frame walls of Type IV-HT construction shall not be considered concealed spaces, but shall comply with Section 718.

In buildings of Type IV-A, IV-B, and IV-C construction with an occupied floor located more than 75 feet (22 860 mm) above the lowest level of fire department access, up to and including 12 stories or 180 feet (54 864 mm) above grade plane, mass timber interior exit and elevator hoistway enclosures shall be protected in accordance with Section 602.4.1.2. In buildings greater than 12 stories or 180 feet (54 864 mm) above grade plane, interior exit and elevator hoistway enclosures shall be constructed of noncombustible materials.

CHANGE SIGNIFICANCE: Type IV construction has traditionally been designated as heavy timber, based upon the minimum required cross-sectional dimensions of the wood members. This type of construction derived its fire-resistive protection solely from the size of the building elements, recognizing the slow-burning characteristics of the individual wood members. Very similar to Type III construction, Type IV buildings have been recognized for the inherent fire-resistance achieved independent of any additional protection afforded by gypsum board or other noncombustible insulating material. While the past allowances for Type IV buildings have been maintained as Type IV-HT construction, three new construction types have been introduced to recognize other forms of mass timber construction.

In the construction of Type IV buildings, both noncombustible assemblies and heavy timber members are permitted, with their fire-resistance capabilities continuing to be regulated by Table 601. For Type IV-HT buildings, compliance for fire-resistive purposes is typically based solely upon the cross-sectional dimension of the timber members as established by Table 2304.11. For the three new construction types, the required fire-resistance ratings may be met by 1) the rating of the mass timber member, 2) the rating of the noncombustible protection applied directly to the mass timber member, or 3) a rating based on a combination of both the timber member and its protective material. Reference is made to Chapter 7 regarding the length of time assigned to the noncombustible protection.

Only two types of materials are typically permitted in buildings of Type IV-A, IV-B and IV-C construction: mass timber and noncombustible. However, the use of fire-retardant-treated wood continues to be acceptable for framing and sheathing components within exterior walls of Type IV-HT buildings. In addition, Type IV-HT permits interior walls and partitions of solid wood construction as set forth in Section 2304.11.2.2.

As a general rule, combustible concealed spaces are not permitted due to the potential for a fire to smolder and spread undetected. However, from a design standpoint it is desirable to provide such concealed areas to accommodate piping, ductwork and similar building components. As a result, each of the four mass timber classifications provides guidance as to the necessary protection and limitations where concealed spaces are created.

The enclosure of interior exit stairways and elevator hoistways is also regulated in a specific manner in those high-rise buildings of Type IV-A, IV-B and IV-C construction. Where such enclosures do not exceed 12 stories above grade plane and are no more than 180 feet in height, they may be constructed of mass timber covered with the necessary noncombustible protection. Where 12 stories or 180 feet are exceeded, the enclosures must be constructed of noncombustible materials for the entire building height.

602.4.1–602.4.3

Type IV-A, IV-B and IV-C Buildings

CHANGE TYPE: Addition

CHANGE SUMMARY: New construction types (Types IV-A, IV-B and IV-C) are defined based upon the varying percentages of mass timber surfaces that are permitted to be unprotected.

2022 CODE TEXT: **602.4.1 Type IV-A.** Building elements in Type IV-A construction shall be protected in accordance with Sections 602.4.1.1 through 602.4.1.6. The required fire-resistance rating of noncombustible elements and protected mass timber elements shall be determined in accordance with Section 703.2.

602.4.1.1 Exterior protection. The outside face of exterior walls of mass timber construction shall be protected with noncombustible protection with a minimum assigned time of 40 minutes, as specified in Section 722.7.1(1). Components of the exterior wall covering shall be of noncombustible material except water-resistive barriers having a peak heat release rate of less than 150 kW/m^2, a total heat release of less than 20 MJ/m^2 and an effective heat of combustion of less than 18 MJ/kg as determined in accordance with ASTM E1354 and having a flame spread index of 25 or less and a smoke-developed index of 450 or less as determined in accordance with ASTM E84 or UL 723. The ASTM E1354 test shall be conducted on specimens at the thickness intended for use, in the horizontal orientation and at an incident radiant heat flux of 50 kW/m^2.

602.4.1.2 Interior protection. Interior faces of all mass timber elements, including the inside faces of exterior mass timber walls and mass timber roofs, shall be protected with materials complying with Section 703.3.

Photo courtesy of ATF Fire Research Laboratory

Mass timber construction fire test.

602.4.1.2.1 Protection time. Noncombustible protection shall contribute a time equal to or greater than times assigned in Table 722.7.1(1), but not less than 80 minutes. The use of materials and their respective protection contributions specified in Table 722.7.1(2) shall be permitted to be used for compliance with Section 722.7.1.

602.4.1.3 Floors. The floor assembly shall contain a noncombustible material not less than 1 inch (25 mm) in thickness above the mass timber. Floor finishes in accordance with Section 804 shall be permitted on top of the noncombustible material. The underside of floor assemblies shall be protected in accordance with Section 602.4.1.2.

602.4.1.4 Roofs. The interior surfaces of roof assemblies shall be protected in accordance with Section 602.4.1.2. Roof coverings in accordance with Chapter 15 shall be permitted on the outside surface of the roof assembly.

602.4.1.5 Concealed spaces. Concealed spaces shall not contain combustibles other than electrical, mechanical, fire protection, or plumbing materials and equipment permitted in plenums in accordance with the *California Mechanical Code*, and shall comply with all applicable provisions of Section 718. Combustible construction forming concealed spaces shall be protected in accordance with Sections 602.4.1.2.

602.4.1.6 Shafts. Shafts shall be permitted in accordance with Sections 713 and Section 718. Both the shaft side and room side of mass timber elements shall be protected in accordance with Section 602.4.1.2.

602.4.2 Type IV-B. Building elements in Type IV-B construction shall be protected in accordance with Sections 602.4.2.1 through 602.4.2.6. The required fire resistance rating of noncombustible elements or mass timber elements shall be determined in accordance with Section 703.2.

602.4.2.1 Exterior protection. The outside face of exterior walls of mass timber construction shall be protected with noncombustible protection with a minimum assigned time of 40 minutes, as specified in Table 722.7.1(1). Components of the exterior wall covering shall be of noncombustible material except water-resistive barriers having a peak heat release rate of less than 150 kW/m^2, a total heat release of less than 20 MJ/m^2 and an effective heat of combustion of less than 18 MJ/kg as determined in accordance with ASTM E1354, and having a flame spread index of 25 or less and a smoke-developed index of 450 or less as determined in accordance with ASTM E84 or UL 723. The ASTM E1354 test shall be conducted on specimens at the thickness intended for use, in the horizontal orientation and at an incident radiant heat flux of 50 kW/m^2.

602.4.2.2 Interior protection. Interior faces of all mass timber elements, including the inside face of exterior mass timber walls and mass timber roofs, shall be protected, as required by this section, with materials complying with Section 707.3.

602.4.2.2.1 Protection time. Noncombustible protection shall contribute a time equal to or greater than times assigned in Table 722.7.1(1), but not less than 80 minutes. The use of materials and their respective protection contributions specified in Table 722.7.1(2) shall be permitted to be used for compliance with Section 722.7.1.

602.4.2.2.2 Protected area. Interior faces of mass timber elements, including the inside face of exterior mass timber walls and mass timber roofs, shall be protected in accordance with Section 602.4.2.2.1.

Exceptions: Unprotected portions of mass timber ceilings and walls complying with Section 602.4.2.2.4 and the following:

1. Unprotected portions of mass timber ceilings and walls complying with one of the following:
   - 1.1 Unprotected portions of mass timber ceilings, including attached beams, shall be permitted and shall be limited to an area equal to 20 percent of the floor area in any dwelling unit or fire area.
   - 1.2 Unprotected portions of mass timber walls, including attached columns, shall be permitted and shall be limited to an area equal to 40 percent of the floor area in any dwelling unit or fire area.
   - 1.3 Unprotected portions of both walls and ceilings of mass timber, including attached columns and beams, in any dwelling unit or fire area shall be permitted in accordance with Section 602.4.2.2.3.
2. Mass timber columns and beams that are not an integral portion of walls or ceilings, respectively, shall be permitted to be unprotected without restriction of either aggregate area or separation from one another.

602.4.2.2.3 Mixed unprotected areas. In each dwelling unit or fire area, where both portions of ceilings and portions of walls are unprotected, the total allowable unprotected area shall be determined in accordance with Equation 6-1.

$$(U_{tc}/U_{ac}) + (U_{tw}/U_{aw}) \leq 1 \qquad \textbf{(Equation 6-1)}$$

where:

U_{tc} = Total unprotected mass timber ceiling areas

U_{ac} = Allowable unprotected mass timber ceiling area conforming to Exception 1.1 of Section 602.4.2.2.2

U_{tw} = Total unprotected mass timber wall areas

U_{aw} = Allowable unprotected mass timber wall area conforming to Exception 1.2 of Section 602.4.2.2.2

602.4.2.2.4 Separation distance between unprotected mass timber elements. In each dwelling unit or fire area, unprotected portions of mass timber walls and ceilings shall be not less than 15 feet (4572 mm) from unprotected portions of other walls and ceilings, measured horizontally along the ceiling and from other unprotected portions of walls measured horizontally along the floor.

602.4.2.3 Floors. The floor assembly shall contain a noncombustible material not less than 1 inch (25 mm) in thickness above the mass timber. Floor finishes in accordance with Section 804 shall be permitted on top of the noncombustible material. The underside of floor assemblies shall be protected in accordance with Section 602.4.1.2.

602.4.2.4 Roofs. The interior surfaces of roof assemblies shall be protected in accordance with 602.4.2.2 except, in nonoccupiable spaces, they shall be treated as a concealed space with no portion left unprotected. Roof coverings in accordance with Chapter 15 shall be permitted on the outside surface of the roof assembly.

602.4.2.5 Concealed spaces. Concealed spaces shall not contain combustibles other than electrical, mechanical, fire protection, or plumbing materials and equipment permitted in plenums in accordance with the *California Mechanical Code*, and shall comply with all applicable provisions of Section 718. Combustible construction forming concealed spaces shall be protected in accordance with Section 602.4.1.2.

602.4.2.6 Shafts. Shafts shall be permitted in accordance with Sections 713 and 718. Both the shaft side and room side of mass timber elements shall be protected in accordance with Section 602.4.1.2.

602.4.3 Type IV-C. Building elements in Type IV-C construction shall be protected in accordance with Sections 602.4.3.1 through 602.4.3.6. The required fire-resistance rating of building elements shall be determined in accordance with Section 703.2.

602.4.3.1 Exterior protection. The exterior side of walls of combustible construction shall be protected with noncombustible protection with a minimum assigned time of 40 minutes, as determined in Table 722.7.1(1). Components of the exterior wall covering shall be of noncombustible material except water-resistive barriers having a peak heat release rate of less than 150 kW/m^2, a total heat release of less than 20 MJ/m^2 and an effective heat of combustion of less than 18 MJ/kg as determined in accordance with ASTM E1354 and having a flame spread index of 25 or less and a smoke-developed index of 450 or less as determined in accordance with ASTM E84 or UL 723. The ASTM E1354 test shall be conducted on specimens at the thickness intended for use, in the horizontal orientation and at an incident radiant heat flux of 50 kW/m^2.

602.4.3.2 Interior protection. Mass timber elements are permitted to be unprotected.

602.4.3.3 Floors. Floor finishes in accordance with Section 804 shall be permitted on top of the floor construction.

602.4.3.4 Roof coverings. Roof coverings in accordance with Chapter 15 shall be permitted on the outside surface of the roof assembly.

602.4.3.5 Concealed spaces. Concealed spaces shall not contain combustibles other than electrical, mechanical, fire protection, or plumbing materials and equipment permitted in plenums in accordance with the *California Mechanical Code*, and shall comply with all applicable provisions of Section 718. Combustible construction forming concealed spaces shall be protected with noncombustible protection with a minimum assigned time of 40 minutes, as specified in Table 722.7.1(1).

602.4.3.6 Shafts. Shafts shall be permitted in accordance with Sections 713 and 718. Shafts and elevator hoistway and interior exit stairway enclosures shall be protected with noncombustible protection with a minimum assigned time of 40 minutes, as specified in Table 722.7.1(1), on both the inside of the shaft and the outside of the shaft.

CHANGE SIGNIFICANCE: The primary purposes of providing three unique types of mass timber construction are to recognize and accommodate the use of solid timber structural elements in buildings of considerable height and area. The three new types vary based upon the percentage of mass timber surfaces that can be unprotected. The three established levels of protection include complete noncombustible protection of the mass timber members (Type IV-A), partial protection of such members (Type IV-B), and no required noncombustible protection of the mass timber (Type IV-C). An important consideration was the extent of any required protection, based on the degree to which noncombustible protection limits fuel contribution of mass timber to a fire. As such, it was determined that the conditions, materials and assemblies associated with Types IV-A, IV-B and IV-C construction be limited only to those that had been tested. See the discussion on Sections 703.6 and 722.7. This differs significantly from Type IV-HT construction where the fire-resistance is almost solely achieved through an evaluation of the cross-sectional dimensions of the mass timber members.

By definition, mass timber includes structural elements that primarily consist of solid, built-up, panelized or engineered wood products that meet the minimum dimensional criteria for Type IV construction. Combustible light-frame materials are specifically and totally excluded from these three new types of construction. In the three new types of construction, those materials of construction that do not qualify as mass timber must be noncombustible.

The three new types of construction are all defined by the specific requirements established in Sections 602.4.1 through 602.4.3. There is one major commonality, that the buildings are composed wholly, or in part, of heavy timber elements. The details of each individual construction type may differ when it comes to fire-resistive protection and other issues; however, the recognition of mass timber as a viable construction material for buildings of a significant size has been established.

The defining characteristic of Type IV-A construction is the mandate of completely protected mass timber structural elements. The details of the noncombustible protection are established in Section 602.4. Noncombustible assemblies are also permitted, such as light-gage steel framing, but combustible assemblies are specifically excluded. In addition, the minimum fire protection ratings required by Table 601 for construction type and Section 705.5 for exterior walls must be applied regardless of the materials of construction.

Type IV-B construction is unique in that some degree of exposed interior wood surfaces of walls, ceilings, columns and beams are allowed. However, a significant amount of the mass timber elements must be protected in the same manner as applicable to Type IV-A buildings. The details identifying those elements that may be protected, and the allowable percentages of unprotected mass timber elements, are set forth in Sections 602.4.2.1 through 602.4.2.6. The allowance for unprotected building elements does not eliminate the need for any fire-resistance rating that may be mandated by the code. Mass timber structural elements permitted without noncombustible protection must still be evaluated for compliance with any required fire-resistance rating. Consistent with the limits on Type IV-A buildings, combustible light-frame construction, including the use of fire-retardant-treated wood, is not permitted.

Type IV-C construction differs significantly from Types IV-A and IV-B in that the mass timber located on the interior of the building can be fully exposed, with limited exceptions. No noncombustible protection is mandated except for components such as concealed spaces, shaft enclosures and interior exit stairways. Type IV-C differs from the traditional Type IV-HT construction when it comes to required fire-resistance-rated protection of the building elements. Minimum 2-hour ratings must be achieved by the bearing walls, floors and primary structural frame elements; however, such rated elements are not required to be covered with noncombustible protection.

Additional areas of commonality and differences among the new construction types include those related to exterior wall protection, floor and roof construction, concealed spaces and shaft enclosures. A comprehensive discussion regarding all of the 2022 code provisions related to the regulation of mass timber buildings can be found in the publication *Mass Timber Buildings and the IBC*, jointly published by ICC and the American Wood Council.

602.4.4

Type IV-HT Buildings

CHANGE TYPE: Modification

CHANGE SUMMARY: The Type IV-HT designation has been introduced to differentiate the historical Type IV "heavy timber" construction type from the three new mass timber types of construction.

2022 CODE TEXT: **~~602.4~~ 602.4.4 Type IV-HT.** Type IV-HT (Heavy Timber) construction is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of solid wood, laminated ~~wood,~~ heavy timber ~~(HT)~~ or structural composite lumber (SCL) without concealed spaces or with concealed spaces complying with Section 602.4.4.3. The minimum dimensions for permitted materials including solid timber, glued-laminated timber, SCL and cross laminated timber (CLT) and the details of Type IV construction shall comply with the provisions of this section and Section 2304.11. Exterior walls complying with Section ~~602.4.1 or 602.4.2~~ 602.4.4.1 or 602.4.4.2 shall be permitted. Interior walls and partitions not less than 1-hour fire-resistance ~~rating~~ rated or heavy timber ~~complying~~ conforming with Section 2304.11.2.2 shall be permitted.

~~602.4.1~~ 602.4.4.1 Fire-retardant-treated wood in exterior walls. Fire-retardant-treated wood framing and sheathing complying with Section 2303.2 shall be permitted within exterior wall assemblies ~~not less than 6 inches (152 mm) in thickness~~ with a 2-hour rating or less.

Photo courtesy of WoodWorks

Traditional heavy timber construction.

101368290

~~602.4.2~~ 602.4.4.2 Cross-laminated timber in exterior walls. Cross-laminated timber (CLT) not less than 4 inches (102 mm) in thickness complying with Section 2303.1.4 shall be permitted within exterior wall assemblies ~~not less than 6 inches (152 mm) in thickness~~ with a 2-hour rating or less. Heavy timber structural members appurtenant to the CLT exterior wall shall meet the requirements of Table 2304.11 and be fire-resistance rated as required for the exterior wall. ~~provided the~~ The exterior surface of the cross-laminated timber ~~is~~ and heavy timber elements shall be protected by one the following:

1. Fire-retardant-treated wood sheathing complying with Section 2303.2 and not less than $^{15}/_{32}$ inch (12 mm) thick.
2. Gypsum board not less than $^{1}/_{2}$ inch (12.7 mm) thick.
3. A noncombustible material.

602.4.4.3. Concealed spaces. Concealed spaces shall not contain combustible materials other than building elements and electrical, mechanical, fire protection, or plumbing materials and equipment permitted in plenums in accordance with the *California Mechanical Code*. Concealed spaces shall comply with applicable provisions of Section 718. Concealed spaces shall be protected in accordance with one or more of the following:

1. The building shall be sprinklered throughout in accordance with Section 903.3.1.1 and automatic sprinklers shall also be provided in the concealed space.
2. The concealed space shall be completely filled with noncombustible insulation.
3. Surfaces within the concealed space shall be fully sheathed with not less than $^{5}/_{8}$-inch Type X gypsum board.

Exception: Concealed spaces within interior walls and partitions with a 1-hour or greater fire-resistance rating complying with Section 2304.11.2.2 shall not require additional protection.

~~602.4.3~~ 602.4.4.4 Exterior structural members. Where a horizontal separation of 20 feet (6096 mm) or more is provided, wood columns and arches conforming to heavy timber sizes complying with Section 2304.11 shall be permitted to be used externally.

CHANGE SIGNIFICANCE: Type IV construction has traditionally identified buildings that have characteristics much different than those of the other construction types. Relying almost solely on the minimum required cross-sectional dimensions of the wood members for fire-resistive protection, Type IV buildings have been regulated in a prescriptive manner rather than through performance-based criteria. Such structures are similar to those classified as Type III, as exterior walls are required to be composed of noncombustible materials or fire-retardant-treated wood, and interior building elements are permitted to be of combustible materials. This traditional construction type has been maintained and is now recognized as Type IV-HT in order to distinguish it from the three new mass timber construction types. In addition, limited modifications have been made to the Type IV-HT provisions addressing exterior wall construction and the creation of concealed spaces.

The allowance for the use of fire-retardant-treated wood framing and sheathing in wall assemblies of Type IV-HT buildings has been modified by removing the mandate that the wall assembly be at least 6 inches in minimum thickness. A minimum thickness requirement for the exterior wall assembly was deemed unnecessary since the required fire-resistance rating is a much more significant factor than the assembly thickness.

Two modifications related to the use of cross-laminated timber (CLT) in exterior walls have also occurred. A minimum overall thickness of 6 inches for the entire CLT wall assembly was previously mandated. However, a minimum actual thickness for just the CLT is a better parameter for structural integrity than an overall wall thickness, as the overall thickness could include exterior sheathing, cladding and insulation. Accordingly, the change provides for the minimum thickness of CLT itself: 4 inches. A second modification clarifies that other heavy timber elements, such as headers and boundary elements made of glulam, structural composite lumber or solid sawn lumber, are permitted to be within the CLT wall without fire-retardant treatment provided they meet the same rating, required thickness and protection that is required for the CLT in the wall.

Another change of significance now allows for concealed spaces in Type IV-HT construction. Historically not permitted in traditional heavy timber construction, such spaces are now allowed when specified protection of the concealed space includes at least one of the following:

- Automatic sprinkler protection throughout the building including installation within the concealed space.
- Filling of the entire space with noncombustible insulation.
- Covering all combustible surfaces with not less than ⅝-inch Type X gypsum board.

The new allowance for protected concealed spaces in Type IV-HT buildings is important to encourage adaptive reuse of existing heavy timber buildings, as well as to provide for the installation of mechanical, electrical and plumbing systems.

603.1

Combustible Materials in Types I and II

CHANGE TYPE: Modification

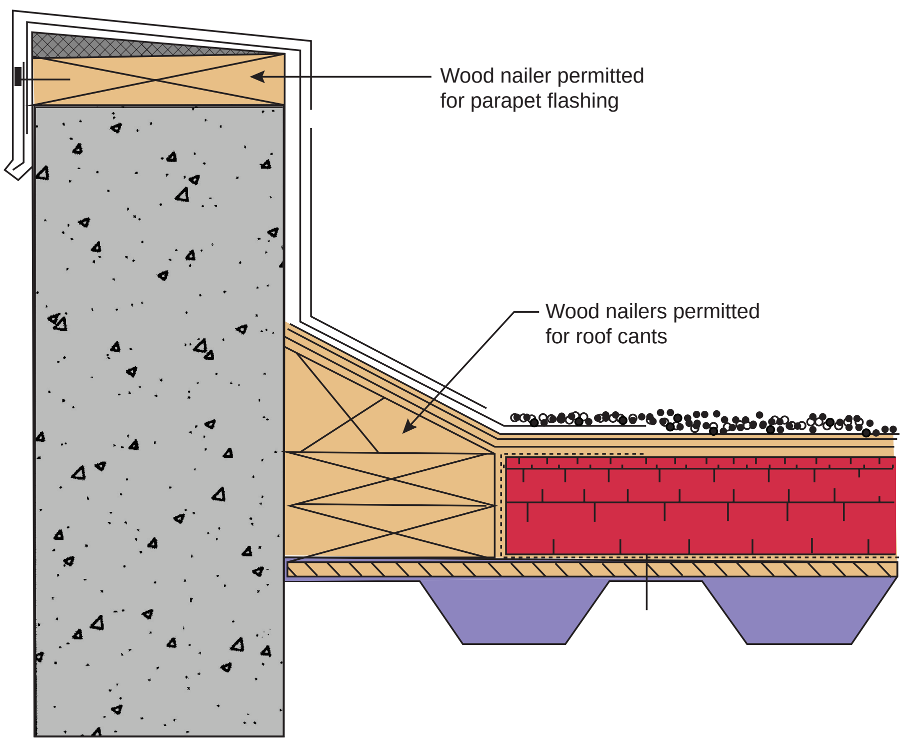
CHANGE SUMMARY: In buildings of Type I and II construction, the allowance for the use of fire-retardant-treated wood in shaft enclosure and roof construction has been modified for Group I-2 buildings. In addition, the use of wood nailers for parapet flashing and roof cants is permitted in all buildings.

2022 CODE TEXT: **603.1 Allowable materials.** Combustible materials shall be permitted in buildings of Type I or II construction in the following applications and in accordance with Sections 603.1.1 through 603.1.3:

1. Fire-retardant-treated wood shall be permitted in:
   - 1.1. Nonbearing partitions where the required fire-resistance rating is 2 hours or less except in shaft enclosures within Group I-2 occupancies and ambulatory care facilities.
   - 1.2. Nonbearing exterior walls where fire-resistance-rated construction is not required.
   - 1.3. Roof construction, including girders, trusses, framing and decking.

Exceptions:

1. In buildings of Type IA construction exceeding two stories above grade plane, fire-retardant-treated wood is not permitted in roof construction where the vertical distance from the upper floor to the roof is less than 20 feet (6096 mm).



Example of wood nailers for parapet flashing and roof cants.

2. Group I-2 roof construction containing fire-retardant-treated wood shall be covered by not less than a Class A roof covering or roof assembly, and the roof assembly shall have a fire-resistance rating where required by the construction type.

1.4. Balconies, porches, decks and exterior stairways not used as required exits on buildings three stories or less above grade plane.

(no change to applications 2 through 26)

27. Wood nailers for parapet flashing and roof cants.

CHANGE SIGNIFICANCE: Buildings of Type I and II construction are considered noncombustible structures. As such, all of the building elements, including walls, floors and roofs, are to be constructed of noncombustible materials. There are, however, a variety of exceptions to the general rule that allow a limited amount of combustibles to be used in the building's construction. It has been determined that the level of combustibles permitted by Section 603.1, as well as their control, does not adversely impact the fire severity caused by the materials of construction. In Type I and II buildings, the allowance for the use of fire-retardant-treated wood (FRTW) in shaft enclosure and roof construction has been modified for Group I-2 buildings, while a new entry specifically permits the use of wood nailers for parapet flashing and roof cants in all buildings.

Although FRTW does not meet the CBC criteria for a noncombustible material, it is permitted as an alternative to noncombustible materials in specific locations in Type I and II construction. One of those locations is nonbearing partitions having a fire-resistance rating of 2 hours or less. However, the use of FRTW is no longer permitted for such partitions that create shaft enclosures in Type I and II buildings housing Group I-2 occupancies or Group B ambulatory care facilities. The new limitations now provide conformity with the applicable Federal Standards and CMS enforcement rules. An additional modification addresses FRTW roof construction of buildings housing Group I-2 occupancies. In such buildings, the intent is to provide for a Class A roof covering or roof assembly where FRTW is used. This new mandate now provides consistency with the applicable federal certification requirements.

The new allowance permitting the use of wood nailers for parapet flashing and roof cants in buildings of Type I and II construction recognizes how they are necessary for the proper fastening of roofing materials. Much like the rationale for the use of wood in other limited applications such as blocking and millwork, the amount of combustible materials due to the use of wood nailers in roof construction is relatively insignificant.

PART 3

Fire Protection

Chapters 7 through 9

- **Chapter 7** Fire and Smoke Protection Features
- **Chapter 8** Interior FinishesMaterials and Furnishings
- **Chapter 9** Fire Protection and Life Safety Systems

The fire protection provisions of the *California Building Code* (CBC) are found primarily in Chapters 7 through 9. There are two general categories of fire protection: active and passive. Chapter 7 details the use of fire and smoke resistance to protect building elements in a passive manner. Chapter 9 contains requirements for various active systems often utilized in the creation of a safe building environment, including automatic sprinkler systems, standpipe systems and fire alarm systems. To further address the rapid spread of fire, the provisions of Chapter 8 are intended to regulate interior finish materials, such as wall and floor coverings. ■

702A
Definition of Exterior Wall Assembly

702A
Definition of Exterior Wall Covering

702A
Definition of Fire-Resistant Vegetation

703.6, 703.7
Noncombustible Protection for Mass Timber

704.6.1
Secondary Attachments and Fireproofing

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Group I-4

907.2.10

Manual Alarms in Group S Buildings

907.2.11.8

Specific Location Requirements (Smoke Alarms and Detectors)

907.5.2.1.3

Fire Alarm Occupant Notification

909.20

Smokeproof Enclosures

911

Fire Command Centers in Groups F-1 and S-1

702A

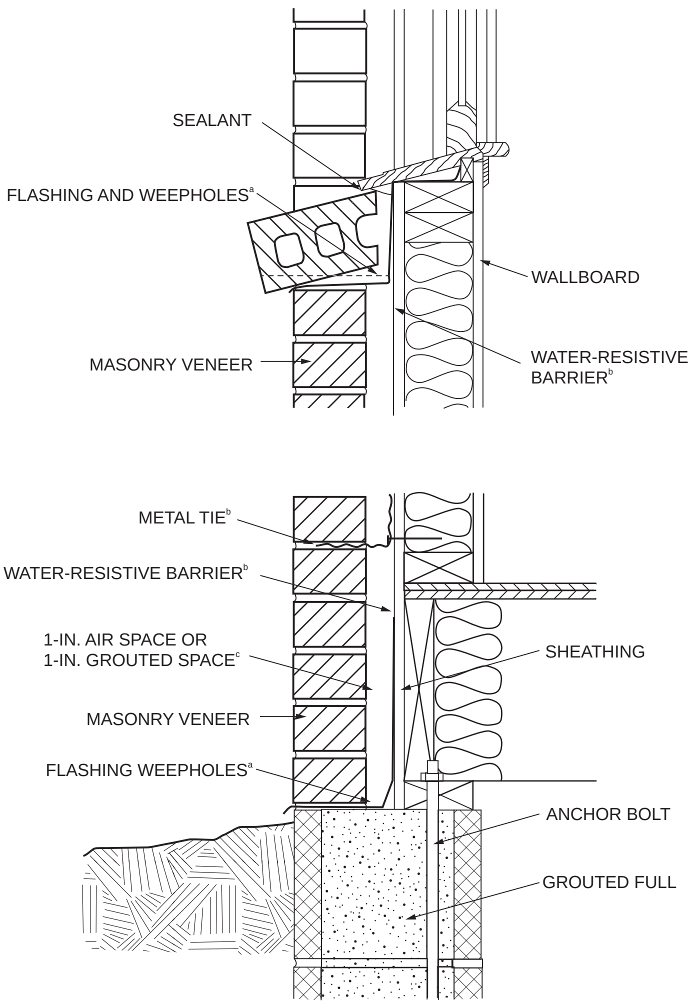
Definition of Exterior Wall Assembly

CHANGE TYPE: Addition

CHANGE SUMMARY: A definition of Exterior Wall Assembly has been added to the CBC.

2022 CODE TEXT: ***702A Exterior wall assembly.*** *A system or assembly of exterior wall components, including exterior wall covering materials, that provides protection of the building structural members, including framing and sheathing materials, and conditioned interior space, from the detrimental effects of the exterior environment.*

CHANGE SIGNIFICANCE: The definition of exterior wall assembly has been added because it was needed to distinguish between different exterior wall products in Section 707 of the *California Building Code*. Further, the term "exterior wall assembly" was added to the code due to the use of the term previously, especially in Chapter 7A, without definition. For example, 707A.2, 707A.3 and 707A.4 utilize the term to describe the requirements for exterior wildfire exposure. This added definition helps clarify the intent and the requirement of Chapter 7A and Section 707A specifically.



Example of an exterior wall assembly diagram.

702A

Definition of Exterior Wall Covering

CHANGE TYPE: Addition

CHANGE SUMMARY: A definition of Exterior Wall Covering has been added to the CBC.

2022 CODE TEXT: ***702A Exterior wall covering.*** *A material or assembly of materials applied on the exterior side of exterior walls for the purpose of providing a weather-resisting barrier, insulation or for aesthetics, including but not limited to, veneers, siding, exterior insulation and finish systems, architectural trim, and embellishments such as cornices, soffits, facias, gutters and leaders.*

CHANGE SIGNIFICANCE: The definition of exterior wall covering has been added because it was needed to distinguish between different exterior wall products in Section 707 of the *California Building Code*. Further, the term "exterior wall covering" was added to the code due to the use of the term previously, especially in Chapter 7A, without definition. For example, 707A.2 and 707A.3 both utilize the term to describe the requirements for exterior wildfire exposure. This added definition helps clarify the intent and the requirement of Chapter 7A and Section 707A specifically.

Exterior wall covering example.

702A

Definition of Fire-Resistant Vegetation

CHANGE TYPE: Addition

CHANGE SUMMARY: The State Fire Marshal added a definition of "Fire-Resistant Vegetation" as the term had previously been used but not defined in the code.

2022 CODE TEXT: ***702A Fire-resistant vegetation.*** *Plants, shrubs, trees and other vegetation that exhibit properties, such as high moisture content, little accumulation of dead vegetation, and low sap or resin content, that make them less likely to ignite or contribute heat or spread flame in a fire than native vegetation typically found in the region.*

> ***Note:*** *The following sources contain examples of types of vegetation that can be considered as fire-resistant vegetation. (Fire-resistant Plants for Home Landscapes, A Pacific Northwest Extension publication; Home Landscaping for Fire, University of California Division of Agriculture and Natural Resources; Sunset Western Garden Book)*

California lilac, an example of fire-resistant vegetation.

CHANGE SIGNIFICANCE: The State Fire Marshall proposed the addition of the definition of Fire-Resistant Vegetation in Section 702A in order to correlate to the changes made in Chapter 49 of the *California Fire Code*. Both *California Building Code* Chapter 7A and *California Fire Code* Chapter 49 include mitigation strategies to reduce the hazards of fire originating within a structure and spreading to wildland in addition to fire originating in wildland and spreading to structures. Those mitigation strategies include requirements about landscape and vegetation management. The intent of these sections is to balance the aesthetic beauty of our area, protect our resources, and reduce the risk associated with wildfire and habitat resources.

The term fire-resistant vegetation, which is referenced in Chapter 49 of the *California Fire Code*, was not previously defined. Chapter 49 has been significantly revised, and the definition adds clarification to the term used throughout the revised code language. Realizing that vegetation can never be completely fire resistant, the definition was composed to describe the beneficial characteristics that determine when vegetation is less likely to be a significant contributing factor in a wildfire.

While all burning vegetation will contribute some heat to a fire, the amount of heat is variable. For instance, dry grasses and other light fuels will initially contribute heat and proceed to burn out quickly compared to thick branches of a tree which take more energy to ignite but will contribute significantly more heat once ignited than a light fuel. The definition also reflects the requirements in Public Resources Code, Division 4, Part 2, Chapter 3, Section 4291 which stipulates the Department of Forestry and Fire Protection to provide guidance on fuel management ensuring "regionally appropriate vegetation suggestions that preserve and restore native species that are fire resistant and/or drought tolerant." It is also important as this definition and listed plants will provide greater opportunities for residents to select vegetation that is fire resistant in the widely variable climatic regions within California. The newly added definition and note help in this effort.

703.6, 703.7

Noncombustible Protection for Mass Timber

CHANGE TYPE: Addition

CHANGE SUMMARY: A test method has been provided to determine the contribution time of noncombustible protection to mass timber fire-resistance. In addition, edges and intersections between adjacent elements are to be sealed to limit smoke and air movement within a building.

2022 CODE TEXT: **703.6 Determination of noncombustible protection time contribution.** The time, in minutes, contributed to the fire-resistance rating by the noncombustible protection of mass timber building elements, components, or assemblies, shall be established through a comparison of assemblies tested using procedures set forth in ASTM E119 or UL 263. The test assemblies shall be identical in construction, loading, and materials, other than the noncombustible protection. The two test assemblies shall be tested to the same criteria of structural failure with the following conditions:

1. Test Assembly 1 shall be without protection.
2. Test Assembly 2 shall include the representative noncombustible protection. The protection shall be fully defined in terms of configuration details, attachment details, joint sealing details, accessories and all other relevant details.

The noncombustible protection time contribution shall be determined by subtracting the fire resistance time, in minutes, of Test Assembly 1 from the fire resistance time, in minutes, of Test Assembly 2.

Photo courtesy of ATF Fire Research Laboratory

Sealing of mass timber.

Photo courtesy of ATF Fire Research Laboratory

Mass timber and noncombustible protection.

703.7 Sealing of adjacent mass timber elements. In buildings of Type IV-A, IV-B and IV-C construction, sealant or adhesive shall be provided to resist the passage of air in the following locations:

1. At abutting edges and intersections of mass timber building elements required to be fire-resistance rated.
2. At abutting intersections of mass timber building elements and building elements of other materials where both are required to be fire-resistance rated.

Sealants shall meet the requirements of ASTM C920. Adhesives shall meet the requirements of ASTM D3498.

Exception: Sealants or adhesives need not be provided where they are not a required component of a tested fire-resistance-rated assembly.

CHANGE SIGNIFICANCE: Materials and methods used for fire-resistance purposes are to be limited to those specified in Chapter 7, specifically Section 703. The new Section 703.6 provides the means to determine the contribution the noncombustible protection material makes to the fire-resistance rating. The impact, in minutes, that the protection material has on the mass timber building elements, components and assemblies is established using the performance method in this section. The protection time is established by conducting two fire tests, the first solely with the mass timber itself and the second with added protection provided by any applied noncombustible protection. Once the two tests are conducted, the noncombustible protection contribution can be determined by subtracting the time that was achieved by the unprotected mass timber assembly or structural element from the tested time of the protected assembly. During the establishment of fire-resistance requirements for new mass timber construction types (IV-A, IV-B and IV-C), it was determined that at least two-thirds of the required fire-resistance rating should come from noncombustible protection. The new provisions of Section 602.4 require the use of noncombustible protection on specified mass timber elements in Types IV-A and IV-B construction (and certain elements of Type IV-C such as egress and hoistway shafts).

Both a prescriptive and a performance path to determine the noncombustible protection material contribution have been provided. The prescriptive path is outlined in Section 722.7, and Section 703.6 provides the performance path by which the contribution of noncombustible materials that are not included in Table 722.7.1(2) can be determined.

The concept of determining fire resistance by evaluating and adding membrane contribution has historically been recognized in the code and has been confirmed by testing. Often recognized as the Component Additive Method (CAM) for wood construction, this approach is included in the calculated fire-resistance requirements of the *California Building Code* (CBC) Section 722.6 along with the times assigned to various membranes by Section 722.6.2.2 and Table 722.6.2(1). Testing by the American Wood Council (AWC) confirmed the values derived from historic testing, and the results of those and other tests are summarized in *Technical Report 10—Calculating the Fire Resistance of Wood Members and Assemblies.*

The new Section 703.7 mandates that abutting edges and intersections between mass timber building elements (e.g. panels, beams or columns) be sealed where such elements are connected. This requirement for sealing applies to fire-resistant-rated assemblies whether the connected rated elements are mass timber building elements (Item 1 in 703.7) or mass timber elements connected to building elements of other materials (Item 2 in 703.7). Sealing these intersections helps limit the spread of fire, smoke and hot gasses. Periodic special inspection under the provisions of Section 1705.20 is also required to ensure compliance with these code provisions. Where fire-resistance-rated mass timber assemblies are successfully tested without sealants and adhesives at these intersections, an exception removes the sealing requirement.

704.6.1

Secondary Attachments and Fireproofing

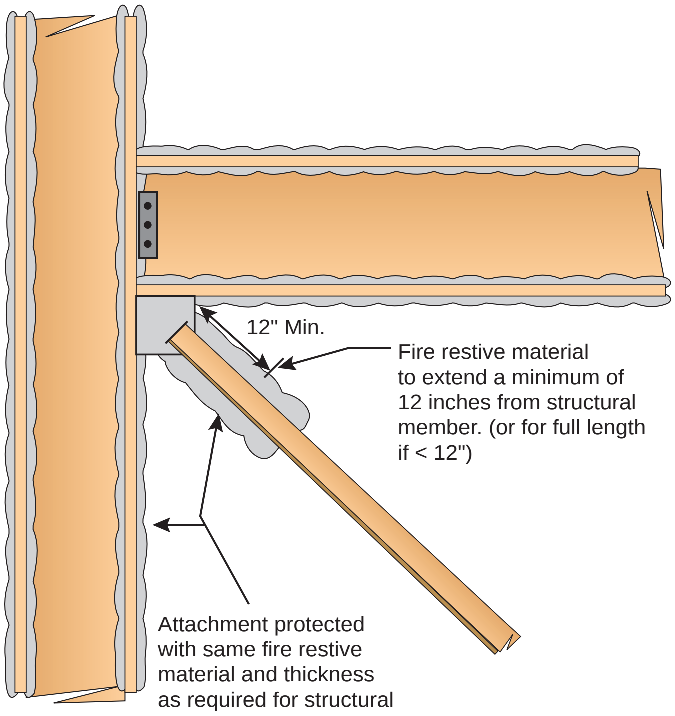
CHANGE TYPE: Modification

CHANGE SUMMARY: Guidance has been provided to ensure continuity of fire-resistive protection where secondary steel attaches to either primary or secondary fire-resistance-rated structural members.

2022 CODE TEXT: **704.6.1 Secondary attachments to structural members.** Where primary and secondary structural steel members require fire protection, *any additional structural steel members having direct connection to the primary structural frame or secondary structural members* shall be protected with the same fire resistive material and thickness as required for the structural member. The protection shall extend away from the structural member a distance of not less than 12 inches (305 mm), or shall be applied to the entire length where the attachment is less than 12 inches (305 mm) long. Where an attachment is hollow and the ends are open, the fire-resistive material and thickness shall be applied to both the exterior and interior of the hollow steel attachment.

Hollow attachment with open ends.

CHANGE SIGNIFICANCE: Structural frame members such as columns, beams and girders are typically regulated for fire resistance based on a building's type of construction. While Section 704.6 addressed protection for certain items that may be attached to a structural member, there was not enough detail to determine how the provisions would be applied to other elements. In many buildings, various items that do not require a fire-resistance rating end up being attached to structural elements that require protection. Examples of non-rated elements include lateral bracing



Protection of secondary attachments.

elements for wind or seismic loads, or steel angles or tubes that are used to support an exterior curtainwall system. Where these nonrated and rated elements connect, the code has not clearly identified how much of the attached element needs to be protected. Where steel attachments connect to the structural system, heat transfer from the unprotected element into the structure can occur and compromise the fire-resistance rating of the member or assembly. Under this new provision, an attached steel element must be protected for a minimum distance of 12 inches from the point of contact with the structural member, or, if it is less than 12 inches long, then it must be protected for its entire length. This 12-inch dimension was selected because it has traditionally been used in the general notes portion of UL 263 (UL's *BXUV General Information for Fire-resistance Ratings*) and as a written policy of some jurisdictions.

One added aspect of this new provision addresses the protection of attached hollow members with open ends. Because heat can impact both the interior and exterior of a hollow member, the fire-resistive protection must be installed on both the interior and exterior of the attached element for the required 12-inch distance.

Table 705.5

Exterior Wall Ratings

CHANGE TYPE: Modification

CHANGE SUMMARY: The previous Table 602 dealing with exterior wall fire-resistance ratings based on fire separation distance has been relocated to Section 705 for inclusion with the general exterior wall requirements. The table was also revised to include the new mass timber construction types.

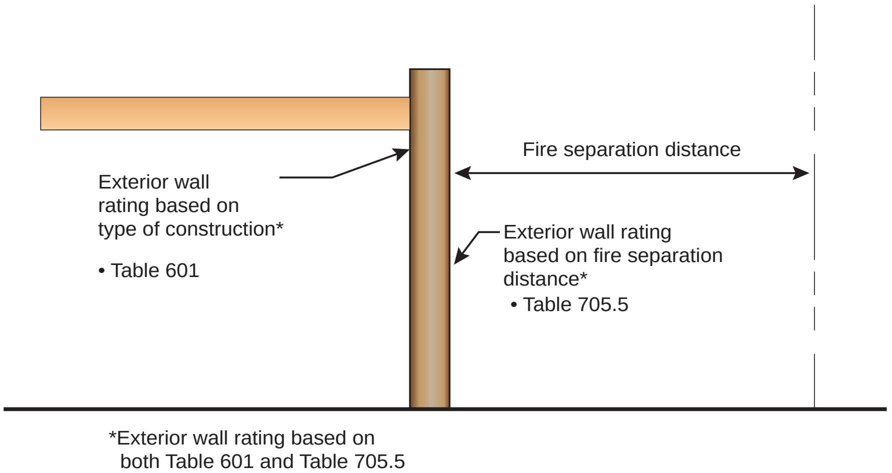
2022 CODE TEXT: **705.5 Fire-resistance ratings.** *For other than Group A, E, H, I, L and R occupancies, high-rise buildings, and other applications listed in Section 1.11* exterior walls shall be fire-resistance rated in accordance with ~~Tables~~ Table 601, ~~and 602 and this section~~ based on the type of construction, and Table 705.5 based on the fire separation distance. The required fire-resistance rating of exterior walls with a fire separation distance of greater than 10 feet (3048 mm) shall be rated for exposure to fire from the inside. The required fire-resistance rating of exterior walls with a fire separation distance of less than or equal to 10 feet (3048 mm) shall be rated for exposure to fire from both sides.

TABLE ~~602~~ 705.5 Fire-Resistance Rating Requirements for Exterior Walls Based on Fire Separation Distance[a,d,g]

Fire Separation Distance = X (feet)	Type Of Construction	Occupancy Group H[e]	Occupancy Group F-1, M, S-1[f]	Occupancy Group A, B, E, F-2, I, R[i], S-2, U[h]
X < 5[b]	All	3	2	1
5 ≤ X < 10	IA, IV-A	3	2	1
	Others	2	1	1
10 ≤ X < 30	IA, IB, IV-A, IV-B	2	1	1[c]
	IIB, VB	1	0	0
	Others	1	1	1[c]
X ≥ 30	All	0	0	0

For SI: 1 foot = 304.8 mm.

(No change to footnotes)



Rating of exterior wall.

CHANGE SIGNIFICANCE: Table 602 from previous editions of the CBC has been relocated to Section 705 that addresses exterior walls. This table regulates fire-resistance ratings for exterior walls based on the fire separation distance for each wall. Relocating the table was deemed appropriate because Section 705 is the primary location for establishing exterior wall requirements. The move from Chapter 6 to Chapter 7 will not create any technical changes or result in any change of application.

The only true technical changes that have been made in the table are simply to include the new mass timber types of construction. The Type IV-A requirements are consistent with those currently established for Type IA construction, and the exterior walls of Type IV-B buildings will be regulated in the same manner as those in Type IB buildings. Additionally, the Type IV-C requirements are consistent with those regulated as "others" (Type IIA, III, IV-HT and VA construction).

707.4, 716

Separations of Energy Storage Systems

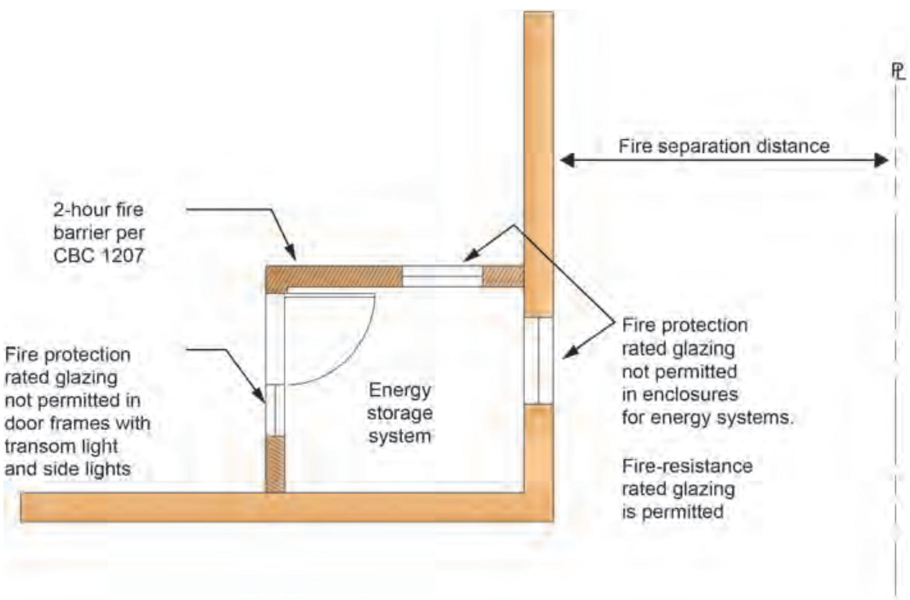
CHANGE TYPE: Modification

CHANGE SUMMARY: To both adequately isolate and protect energy storage systems from potential thermal runaway, the use of glazing with only a fire-protection rating is prohibited in fire-resistance-rated walls that are a portion of the enclosure of energy storage systems.

2022 CODE TEXT: **707.4 Exterior walls.** Where exterior walls serve as a part of a required fire-resistance-rated shaft, or ~~stairway~~ separation or ~~ramp~~ enclosure for a stairway, ramp or ~~separation,~~ exit passageway, such walls shall comply with the requirements of Section 705 for exterior walls and the fire-resistance-rated enclosure or separation requirements shall not apply.

Exceptions:

1. Exterior walls required to be fire-resistance rated in accordance with Section 1021 for exterior egress balconies, Section 1023.7 for interior exit stairways and ramps, Section 1024.8 for exit passageways and Section 1027.6 for exterior exit stairways and ramps.
2. Exterior walls required to be fire-resistance rated in accordance with Section 1207 of the *California Fire Code* for enclosure of energy storage systems.



Energy storage system separation.

SECTION 716
OPENING PROTECTIVES

716.2 Fire door assemblies. Fire door assemblies required by other sections of this code shall comply with the provisions of this section. Fire door frames with transom lights, sidelights or both shall be permitted in accordance with Section 716.2.5.4.

716.2.5 Glazing in fire door assemblies. Fire-rated glazing conforming to the opening protection requirements in Section 716.2.1 shall be permitted in fire door assemblies.

716.2.5.4 Fire door frames with transom lights and sidelights. Fire-protection-rated glazing shall be permitted in door frames with transom lights, sidelights or both, where a ¾-hour fire protection rating or less is required and in 2-hour fire-resistance-rated exterior walls in accordance with Table 716.1(2). Fire door frames with transom lights, sidelights or both, installed with fire-resistance-rated glazing tested as an assembly in accordance with ASTM E119 or UL 263 shall be permitted where a fire protection rating exceeding ¾ hour is required in accordance with Table 716.1(2).

716.2.5.4.1 Energy storage system separation. Fire-protection-rated glazing shall not be permitted in fire door frames with transom lights and sidelights in fire barriers required by Section 1207 of the *California Fire Code* to enclose energy storage systems.

716.3 Fire window assemblies. Fire window assemblies required by other sections of this code shall comply with the provisions of this section.

716.3.2.1 Interior fire window assemblies. Fire-protection-rated glazing used in fire window assemblies located in fire partitions and fire barriers shall be limited to use in assemblies with a maximum fire-resistance rating of 1 hour in accordance with this section.

716.3.2.1.1 Where ¾-hour-fire-protection window assemblies permitted. Fire-protection-rated glazing requiring 45-minute opening protection in accordance with Table 716.1(3) shall be limited to fire partitions designed in accordance with Section 708 and fire barriers utilized in the applications set forth in Sections 707.3.6, 707.3.7 and 707.3.9 where the fire-resistance rating does not exceed 1 hour. Fire-resistance-rated glazing assemblies tested in accordance with ASTM E119 or UL 263 shall not be subject to the limitations of this section.

716.3.2.1.1.1 Energy storage system separation. Fire-protection-rated glazing is not permitted for use in fire window assemblies in fire barriers required by Section 1207 of the *California Fire Code* to enclose energy storage systems.

TABLE 716.1(2) Opening Fire Protection Assemblies, Ratings And Markings

Type of Assembly	Required Wall Assembly Rating (Hours)	Minimum Fire Door and Fire Shutter Assembly Rating (Hours)	Door Vision Panel Size[a]	Fire-Rated Glazing Marking Door Vision Panel[b,c]	Minimum Sidelight/ Transom Assembly Rating (Hours)		Fire-Rated Glazing Marking Sidelight/ Transom Panel	
					Fire Protection	Fire Resistance	Fire Protection	Fire Resistance
Exterior walls	3	1½	100 sq. in.[a]	≤ 100 sq. in. = D-H-90 > 100 sq. in = D-H-W-90	Not Permitted	3	Not Permitted	W-180
	2	1½	Maximum size tested	D-H 90 or D-H-W-90	1½[h]	2	D-H-OH-90[h]	W-120
					Fire protection			
	1	¾	Maximum size tested	D-H-45	¾[h]		D-H-45[h]	

(Portions of table are not shown)

h. Fire-protection-rated glazing is not permitted for fire barriers required by Section 1207 of the California Fire Code to enclose energy storage systems. Fire-resistance-rated glazing assemblies tested to ASTM E119 or UL 263, as specified in Section 716.1.2.3, shall be permitted.

(Other footnotes not shown)

CHANGE SIGNIFICANCE: Additional new construction parameters related to enclosures for energy storage systems have been introduced in the CBC to supplement the *California Fire Code* (CFC) operational requirements for these systems. As the provisions are intended to ensure the enclosures for such systems are properly constructed and provide the CFC's intended protection, it is important to provide details and references within the CBC.

Energy storage systems (ESS), historically called battery storage systems, have traditionally required a separation to isolate them from the remainder of the building. These enclosure provisions applied when the systems reached certain sizes (See Table 1207.1 of the CFC) and required either a 1- or 2-hour fire-resistance-rated separation from other areas of the building in accordance with the incidental use provisions of CBC Section 509. It should be noted that in the 2022 CFC, the separation is required to be not less than a 2-hour fire barrier. One energy storage system hazard is thermal runaway leading to a fire event that can be significant and enduring. An ESS is required to prevent thermal runaway internally, however, in some cases, it can be induced by an exterior event such as a damaging impact or fire exposure. Although the CFC requires fire suppression of the space occupied by the ESS (CFC Section 1207.5.5), the remainder of the building and occupancy may not be protected.

The revisions reflect the concern that while fire-protection-rated glazing may help stop the spread of fire and smoke, it will not stop heat flow through the glazing. The concern is that radiant heat flow through the glazing could produce significant heat to cause a fire on the other side of the rated assembly. In a situation where energy storage systems are involved, this could cause a thermal runaway of the ESS. Therefore, the use of fire-protection-rated glazing is now prohibited such that any glazing must have a fire-resistance rating.

While a new footnote "h" in Table 716.1(2) will prohibit fire-protection-rated glazing in exterior wall openings, it should be noted that Section 705.8 and Table 705.8 will continue to allow limited amounts of "unprotected" openings for both sprinklered and unsprinklered buildings. In addition, Section 705.8.2 includes an exception that would permit the use of a water curtain system instead of protected openings in fully sprinklered buildings. Both the limited amounts of unprotected openings and the water-curtain-protected openings would be allowed even though they are seemingly contrary to the new provisions' intended application. And, despite the addition of Exception 2 in Section 707.4, the requirements of CFC Section 1207.7.4 only require the 2-hour separation "from other areas in the building." Therefore, exterior wall ratings, including those enclosing energy storage systems, are regulated by the building's construction type and the adjacent fire separation distance.

707.5

Enclosure of Exit Passageways

CHANGE TYPE: Modification

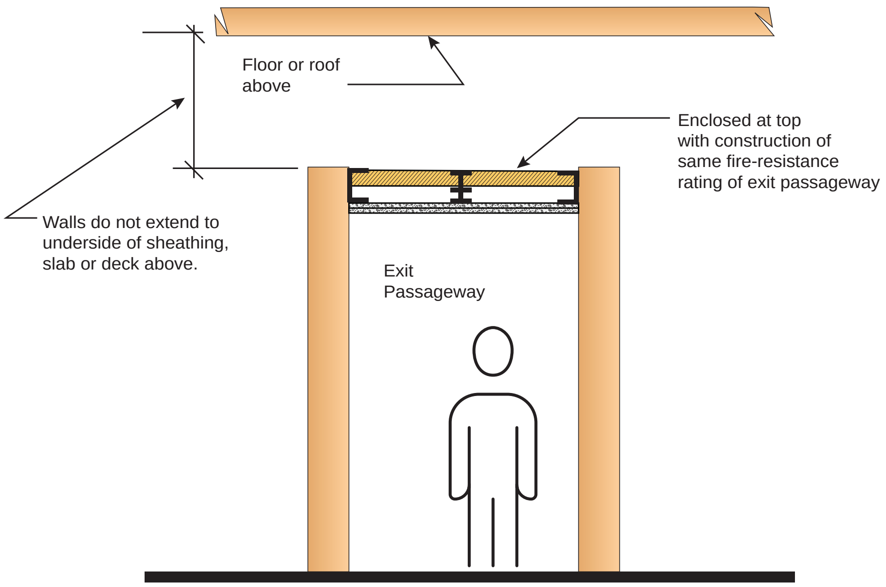
CHANGE SUMMARY: Fire barriers creating an exit passageway may now terminate at a fire-resistance-rated top (lid) instead of continuing to the underside of the roof slab above.

2022 CODE TEXT: **707.5 Continuity.** Fire barriers shall extend from the top of the foundation or floor/ceiling assembly below to the underside of the floor or roof sheathing, slab or deck above and shall be securely attached thereto. Such fire barriers shall be continuous through concealed space, such as the space above a suspended ceiling. Joints and voids at intersections shall comply with Sections 707.8 and 707.9.

Exceptions:

1. Shaft enclosures shall be permitted to terminate at a top enclosure complying with Section 713.12.
2. Interior exit stairway and ramp enclosures required by Section 1023 and exit access stairway and ramp enclosures required by Section 1019 shall be permitted to terminate at a top enclosure complying with Section 713.12.
3. <u>An exit passageway enclosure required by Section 1024.3 that does not extend to the underside of the roof sheathing, slab or deck above shall be enclosed at the top with construction of the same fire-resistance rating as required for the exit passageway.</u>

CHANGE SIGNIFICANCE: As fire barriers, walls forming an exit passageway enclosure must extend from the floor or foundation below to the underside of the floor or roof sheathing, slab or deck above. This continuity requirement essentially creates separate compartments by completely



Continuity at the top of an exit passageway.

dividing a floor from deck to deck. A new exception recognizes that exit passageways only require the egress path to be isolated and protected from adjacent spaces, and that they are not intended to compartmentalize the entire story of the building as the general continuity provisions would impose. An example of where this exception may be useful is where an exit stair enclosure terminates within a building, and the exit path must be extended to the exterior wall.

Previously, fire barrier walls enclosing an exit passageway were required to extend up to the floor or roof deck above. Under the new exception, the fire-resistance-rated walls are permitted to terminate at a lower height and therefore allow mechanical, electrical or plumbing systems to pass above the passageway. This concept of stopping the walls at an equivalently-rated horizontal assembly has historically been allowed by Exception 2 for interior exit stairway and interior exit ramp enclosures.

While this concept is somewhat similar to the "tunnel corridor" system that is permitted for fire partitions by Exception 3 of Section 708.4, it is somewhat different because the horizontal assembly that serves as the passageway lid and the termination point for the fire barriers is required to be constructed with "the same fire-resistance rating as required for the exit passageway." Therefore, these horizontal assemblies would need to comply as 1- or 2-hour rated horizontal assemblies per Section 1024.3 and be constructed to comply with Sections 711 and 1024. It is important to recognize that the fire-resistance-rated horizontal assembly requirement ensures a higher level of protection than what is required for tunnel corridors. In addition, limitations are placed on openings, penetrations and ventilation systems related to an exit passageway.

One aspect that needs to be discussed with the code official is whether the exception is applicable where a floor occurs above the level with the passageway. The code text in the exception only mentions terminating at the "roof" sheathing, slab or deck. Therefore, while fire barriers are generally allowed to terminate at a "floor or roof…" above, the new exception appears much more limited. Whether this limitation was intentional was never discussed or mentioned during the code change process or in the proponent's reason statement. The exception probably should be applicable to both "floor and roof" systems but since the approved code text only mentions the roof, it needs to be discussed with the code official before applying it to passageways where a "floor" and additional story occur above.

708.1, 708.4.1

Supporting Construction for Fire Partitions

CHANGE TYPE: Modification

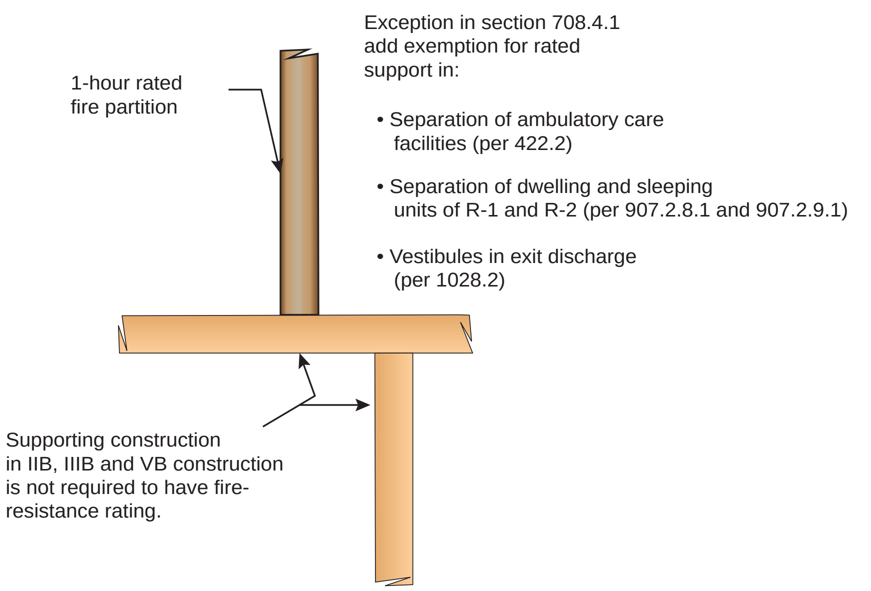
CHANGE SUMMARY: A more complete list of wall assemblies required to be constructed as fire partitions has been provided, and additional locations have been identified where fire partitions are permitted to be supported by non-rated construction.

2022 CODE TEXT:

SECTION 708
FIRE PARTITIONS

708.1 General. The following wall assemblies shall comply with this section:

1. Separation walls as required by Section 420.2 for Group R occupancies.
2. Walls separating tenant spaces in covered and open mall buildings as required by Section 402.4.2.1.
3. Corridor walls as required by Section 1020.3 and in *Group I-2 and I-2.1 as required by Section 407.3.*
4. Enclosed elevator lobby separation as required by Section ~~3006.2.~~ 3006.3.
5. Egress balconies as required by Section 1021.2.
6. Walls separating ambulatory care facilities from adjacent spaces, corridors or tenant as required by Section 422.2.
7. Walls separating dwelling and sleeping units in Groups R-1 and R-2 in accordance with Sections 907.2.8.1 and 907.2.9.1.
8. Vestibules in accordance with Section 1028.2.



Exemption for rating supporting construction.

9. *Walls separating enclosed tenant spaces in high-rise buildings and in buildings of Types I, IIA, IIIA, IV or VA construction of Group A, E, H, I, L and R-2.1 occupancies and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal.*

708.4.1 Supporting construction. The supporting construction for a fire partition shall have a fire-resistance rating that is equal to or greater than the required fire-resistance rating of the supported fire partition.

> **Exception:** In buildings of Types IIB, IIIB and VB construction, the supporting construction requirement shall not apply to fire partitions separating tenant spaces in covered and open mall buildings, fire partitions separating dwelling units, fire partitions separating sleeping units, ~~and~~ fire partitions serving as corridor walls, fire partitions separating ambulatory care facilities from adjacent spaces or corridors, fire partitions separating dwelling and sleeping units from Groups R-1 and R-2 occupancies and fire partitions separating vestibules from the level of exit discharge.

CHANGE SIGNIFICANCE: Two separate changes related to fire partitions have occurred. Section 708.1 has been corrected by completing the listing of locations where fire partitions are already recognized. Additionally, the Section 708.4.1 exception that allows certain fire partitions to be supported by non-rated floors in Types IIB, IIIB and VB construction has been expanded.

Generally, a fire partition is required to be supported by construction that has the same fire-resistance rating as the fire partition itself. The exception allows certain fire partitions in Types IIB, IIIB and VB construction to be erected on non-rated floors. Applications included in the exception comprise situations where a fire partition establishes protection on a floor level as a priority over separation from adjacent stories. The exception has been modified to include fire partitions that create separations in ambulatory care facilities, those in Groups R-1 and R-2 that are installed to modify required fire alarm provisions, and those creating a vestibule regulated as an interior exit discharge element.

709.4.1

Smoke Barrier Continuity

CHANGE TYPE: Modification

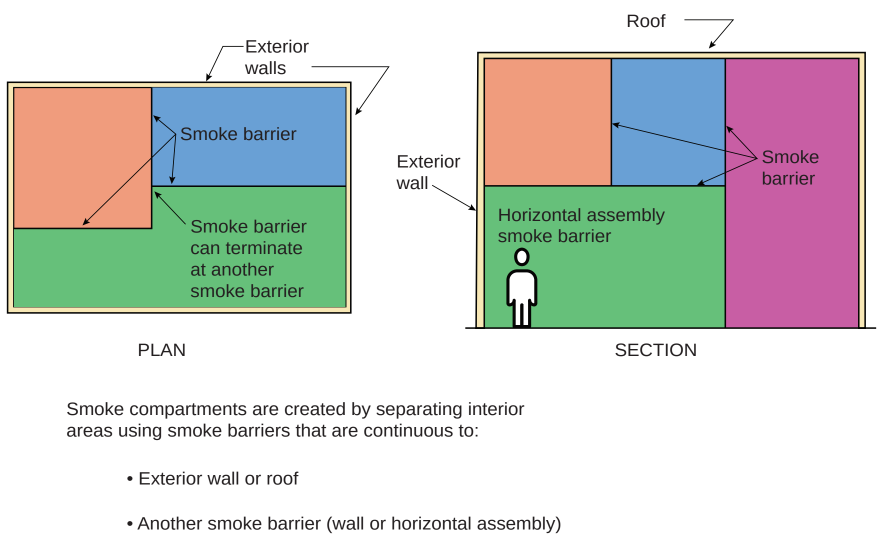
CHANGE SUMMARY: Smoke barrier and smoke compartment continuity needed to effectively serve their intended purposes have been clarified through revisions to the definition and enclosure provisions.

2022 CODE TEXT: **709.4.1 Smoke-barrier ~~walls~~ assemblies separating smoke compartments.** Smoke-barrier ~~walls~~ assemblies used to separate smoke compartments shall form an effective membrane enclosure that is continuous from an outside wall or smoke barrier wall to an outside wall or another smoke barrier wall and to the horizontal assemblies.

202 Smoke compartment. A space within a building ~~enclosed by smoke barriers on all sides, including the top and bottom~~ separated from other interior areas of the building by smoke barriers, including interior walls and horizontal assemblies.

CHANGE SIGNIFICANCE: The intent of smoke barriers is to separate interior building areas to create separate compartments. The previous definition stating that the compartments were to be enclosed "on all sides, including the top" was occasionally viewed as requiring roofs or exterior walls to be constructed as smoke barriers. Expecting a roof or exterior wall to be constructed as a smoke barrier—to prevent smoke from reaching the building exterior and potentially coming back into an adjacent compartment—was never the intent of the smoke compartment requirements. The definition now focuses on separations isolating "interior areas of the building" and clarifies that both walls and horizontal assemblies can create these separate compartments.

Section 709.4.1 provisions addressing smoke barrier continuity have also been revised to address several issues. First, the separation between adjacent smoke compartments may include both walls and horizontal



Smoke barrier continuity.

assemblies. While both Sections 709.1 and 711.2.4.4 specifically reference horizontal smoke barriers, the continuity provisions only mentioned "walls" even though the general requirements call for an effective continuous separation. While designers may designate smoke compartments at various horizontal assemblies, the Group I-2 provisions of Section 407.5 and, specifically, Section 407.5.5 are perhaps the most common location where floors between levels are required to create smoke compartments on adjacent stories.

The second revision recognizes that smoke barriers are permitted to terminate at other smoke barriers and are not always required to extend to an exterior wall. Separation requirements in Section 709.4.2 already permit this for smoke barriers that create areas of refuge or elevator lobbies by stating that they may stop at "another smoke barrier wall or an outside wall." The important thing is that the smoke compartments are "separated from other interior areas ... by smoke barriers" (per the definition of smoke compartment) and that the separation between compartments "form an effective membrane enclosure." Therefore, where a smoke barrier adjoins another smoke barrier, it will adequately isolate adjacent compartments and would not need to continue to an exterior wall. This additional option provides design flexibility for compartment layout and will continue to provide the intended separation between adjacent smoke compartments.

710.5.2.1, 710.5.3

Smoke Partition Openings

CHANGE TYPE: Modification

CHANGE SUMMARY: Specific allowances are now provided for louvered doors and pass-through openings in smoke partitions that serve specified locations of a Group I-2 occupancy.

2022 CODE TEXT: **710.5.2 Doors.** Doors in smoke partitions shall comply with Sections 710.5.2.1 through 710.5.2.3.

710.5.2.1 Louvers. Doors in smoke partitions shall not include louvers.

Exception: Where permitted in accordance with Section 407.3.1.1.

710.5.2.2 Smoke and draft control doors. *(No changes)*

710.5.2.2.1 Smoke and draft control door labeling. *(No changes)*

710.5.2.3 Self- or automatic-closing doors. *(No changes)*

710.5.3 Pass-through openings in Group I-2, Condition 2. Where pass-through openings are provided in smoke partitions in Group I-2, Condition 2 occupancies, such openings shall comply with all of the following:

1. The smoke compartment in which the pass-through openings occur does not contain a patient care suite or sleeping room.
2. Pass-through openings are installed in a wall, door or vision panel that is not required to have a fire-resistance rating.
3. The top of the pass-through opening is located a maximum of 48 inches (1219 mm) above the floor.
4. The aggregate area of all such pass-through openings within a single room shall not exceed 80 square inches (0.05 m^2).

Pass-through opening.

CHANGE SIGNIFICANCE: Smoke partition requirements are commonly applied to hospital corridors under Section 407.3. Group I-2 hospital provisions within Section 407 often differ from general CBC provisions due to an ongoing effort to be generally consistent with federal regulations imposed by other codes and agencies as well as allowances for other protection and operational features common in such facilities. The new Section 710.5.2.1 exception and the added Section 710.5.3 are examples of specific modifications applicable to Group I-2 occupancies.

The new exception in Section 710.5.2.1 allows louvers within certain hospital corridor doors and is related to changes made in Section 407.3.1.1. While louvers would generally make a door ineffective at resisting smoke passage, the federal regulations from the Centers for Medicare and Medicaid Services (CMS) do allow transfer grilles or louvers in walls or doors serving auxiliary spaces that do not contain flammable or combustible materials and are not used to protect shaft enclosures or exitways. Where louvers are provided to allow makeup air for an exhaust system to enter the room as permitted by Section 1020.6, Exception 1, the use of louvers in the smoke partition doors is permitted.

The limited allowance for pass-through openings in Section 710.5.3 is also based on CMS regulations and the *National Fire Protection Association (NFPA) 101 Life Safety Code®* that serves as one of the primary regulatory documents for hospitals. Pass-throughs help accomplish several important functions such as maintaining security at pharmacy or payment counters or helping prevent the spread of contaminants, diseases or smoke because of air pressure differences. Where pass-throughs are installed in sprinklered buildings under the limitations established in Section 710.5.3, the limited pass-through sizes and locations of the pass-throughs are in keeping with the intended performance. These allowances have been proven effective under the federal regulations on which they are based.

713.12

Top of Shaft Enclosure

CHANGE TYPE: Clarification

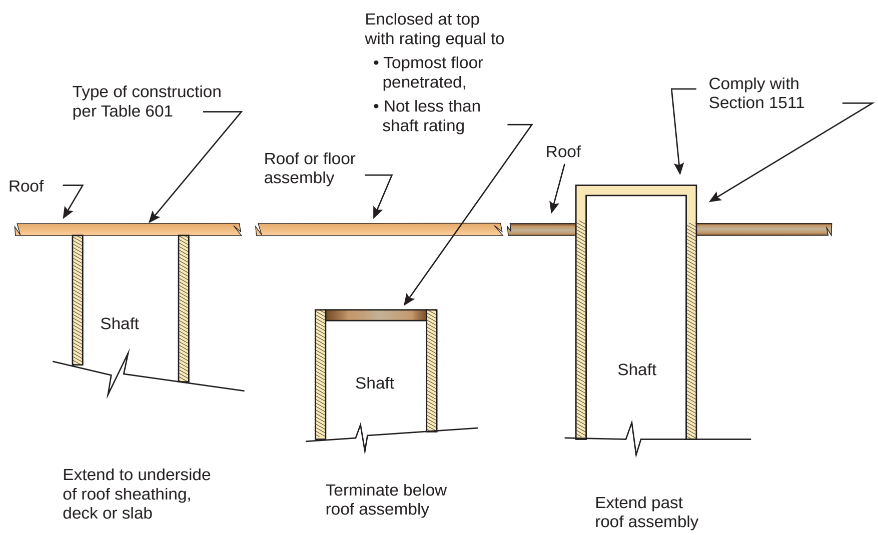
CHANGE SUMMARY: The three options for termination at the top of a shaft enclosure have been clarified.

2022 CODE TEXT: **713.12 Enclosure at top.** ~~A shaft enclosure that does not~~ The top of shaft enclosures shall comply with one of the following:

1. Extend to the underside of the roof sheathing, deck or slab of the building, and the roof assembly shall comply with the requirements for the type of construction as specified in Table 601.
2. Terminate below the roof assembly and ~~shall~~ be enclosed at the top with construction of the same fire-resistance rating as the topmost floor penetrated by the shaft, but not less than the fire-resistance rating required for the shaft enclosure.
3. Extend past the roof assembly and comply with the requirements of Section 1511.

713.12.1 Penthouse mechanical rooms. A fire/smoke damper shall not be required at the penetration of the rooftop structure where shaft enclosures extend up through the roof assembly into a rooftop structure conforming to Section 1511. Ductwork in the shaft shall be connected directly to HVAC equipment.

CHANGE SIGNIFICANCE: Revisions shown in Section 713.12 help clarify how the top of a shaft is permitted to be terminated. The format is intended to mirror Section 713.11 for the bottom of the shaft and identify the common termination conditions and their requirements. These three termination conditions already exist in the code, therefore, this revision does not create any technical change to the code requirements. While conditions 1 and 2 are clearly created from existing text, Item 1 now references the Table 601 roof construction provisions. Item 3 points



Enclosure options at the top of a shaft.

to penthouse provisions in Section 1511. The definition for a penthouse indicates it is "an enclosed, unoccupied rooftop structure used for sheltering…vertical shaft openings." Adding this third condition provides details for the top of the shaft whether it terminates at, below, or above the roof.

The new Section 713.12.1 recognizes that not every penetration or opening that pierces a roof requires protection. The CBC typically does not address conditions where a fire spreads from the interior of the building to the exterior as illustrated in the acceptance of unprotected roof openings for penetrations (Section 714.5), ducts (Section 717.6), and skylights (Section 712.1.15). Where a mechanical penthouse provides an extension of a shaft enclosure from below, it has been clarified that neither a fire nor smoke damper is required at such penetrations provided all ductwork in the shaft enclosure is directly connected to heating, ventilation and air-conditioning (HVAC) equipment.

715

Protection of Joints and Voids

CHANGE TYPE: Modification

CHANGE SUMMARY: The provisions for joints and voids have been reformatted and clarified to provide for more consistent application.

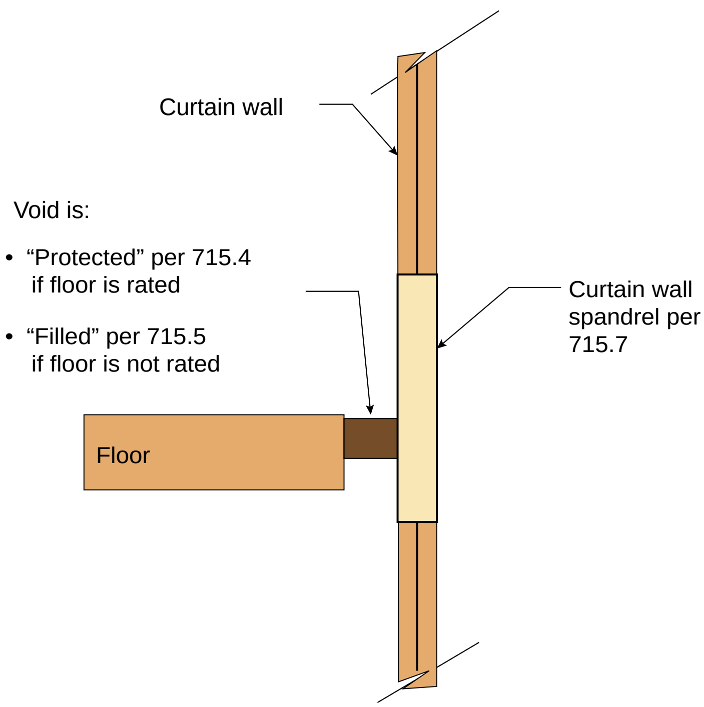
2022 CODE TEXT:

SECTION 715
~~FIRE-RESISTANT JOINT SYSTEMS~~
JOINTS AND VOIDS

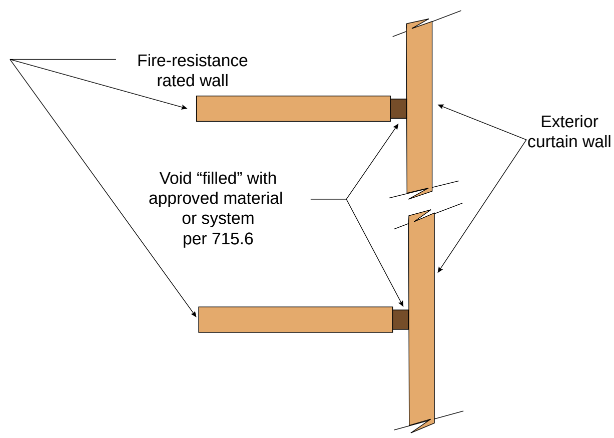
715.1 General. The provisions of this section shall govern the materials and methods of construction used to protect joints and voids in or between horizontal and vertical assemblies.

~~**715.1.1 Curtain wall assembly.** The void created at the intersection of a floor/ceiling assembly and an exterior curtain wall assembly shall be protected in accordance with Section 715.4.~~

715.2 Installation. ~~A fire-resistant joint system~~ Systems or materials protecting joints and voids shall be securely installed in accordance with the manufacturer's installation instructions ~~and the listing criteria~~ in or on the joint or void for its entire length so as not to dislodge, loosen or otherwise impair its ability to accommodate expected building movements and to resist the passage of fire and hot gases. Fire-resistant joint systems or systems used to protect voids at exterior curtain walls and fire-resistance-rated floor intersections shall also be installed in accordance with the listing criteria.



Sealing joints and voids - Section view.



Sealing joints and voids - Plan view.

~~715.1 General~~. 715.3 Fire-resistance-rated assembly intersections. Joints installed in or between fire-resistance-rated walls, floor or floor/ceiling assemblies and roofs or roof/ceiling assemblies shall be protected by an approved fire-resistant joint system designed to resist the passage of fire for a time period not less than the required fire-resistance rating of the wall, floor or roof in or between which the system is installed. ~~Fire-resistant joint systems shall be tested in accordance with Section 715.3.~~

> **Exception:** Fire-resistant joint systems shall not be required for joints in all of the following locations:
>
> *(No changes in Exceptions 1 through 10)*

~~715.3~~ 715.3.1 Fire test criteria. *(No changes)*

715.4 Exterior curtain wall/fire-resistance-rated floor intersections. ~~Where fire-resistance-rated floor or floor/ceiling assemblies are required,~~ Voids created at the intersection of ~~the~~ exterior curtain wall assemblies and fire-resistance-rated floor or floor/ceiling assemblies shall be ~~sealed~~ protected with an approved perimeter fire containment system to prevent the interior spread of fire. Such systems shall ~~be securely installed and tested in accordance with ASTM E2307 to~~ provide an F rating for a time period not less than the fire-resistance rating of the floor or floor/ceiling assembly. ~~Height and fire-resistance requirements for curtain wall spandrels shall comply with Section 705.8.5.~~

> ~~**Exception:** Voids created at the intersection of the exterior curtain wall assemblies and such floor assemblies where the vision glass extends to the finished floor level shall be permitted to be sealed with an approved material to prevent the interior spread of fire. Such material shall be securely installed and capable of preventing the passage of flame and hot gases sufficient to ignite cotton waste where subjected to ASTM E119 time-temperature fire conditions under a minimum positive pressure differential of 0.01 inch (0.254 mm) of water column (2.5 Pa) for the time period not less than the fire-resistance rating of the floor assembly.~~

715.4.1 Fire test criteria. Perimeter fire containment systems shall be tested in accordance with the requirements of ASTM E2307.

> **Exception:** Voids created at the intersection of the exterior curtain wall assemblies and floor assemblies where the vision glass extends to the finished floor level shall be permitted to be protected with an approved material to prevent the interior spread of fire. Such material shall be securely installed and capable of preventing the passage of flame and hot gases sufficient to ignite cotton waste where subjected to ASTM E119 time-temperature fire conditions under a minimum positive pressure differential of 0.01 inch (0.254 mm) of water column (2.5 Pa) for the time period not less than the fire-resistance rating of the floor assembly.

~~715.4.1~~ 715.5 Exterior curtain wall/nonfire-resistance-rated floor assembly intersections. Voids created at the intersection of exterior curtain wall assemblies and nonfire-resistance-rated floor or floor/ceiling assemblies shall be ~~sealed~~ filled with an approved material or system to retard the interior spread of fire and hot gases between stories.

~~715.4.2~~ 715.6 Exterior curtain wall/vertical fire barrier intersections. Voids created at the intersection of nonfire-resistance-rated exterior curtain wall assemblies and vertical fire barriers shall be filled~~.~~ ~~An~~ with an approved material or system ~~shall be used to fill the void and shall be securely installed in or on the intersection for its entire length so as not to dislodge, loosen or otherwise impair its ability to accommodate expected building movements and~~ to retard the ~~passage~~ interior spread of fire and hot gases.

~~715.5~~ 715.7 ~~Spandrel wall.~~ Curtain wall spandrels. Height and fire-resistance requirements for curtain wall spandrels shall comply with Section 705.8.5. Where Section 705.8.5 does not require ~~a~~ fire-resistance-rated curtain wall spandrels, the requirements of ~~Section~~ Sections 715.4 and 715.5 shall still apply to the intersection between the curtain wall spandrels and the floor.

~~715.6~~ 715.8 ~~Fire-resistant joint systems~~ Joints and voids in smoke barriers. Fire-resistant joint systems protecting joints in smoke barriers, and ~~joints~~ perimeter fire containment systems protecting voids at the intersection of a horizontal smoke barrier and an exterior curtain wall, shall be tested in accordance with the requirements of UL 2079 for air leakage. The L rating of the joint system shall not exceed 5 cubic feet per minute per linear foot (0.00775 m^3/s m) of joint at 0.30 inch (74.7 Pa) of water for both the ambient temperature and elevated temperature tests.

CHANGE SIGNIFICANCE: Provisions for joints and voids have been reformatted and clarified to provide more consistent application. Most of the revisions are editorial in nature and will not impact the application of the requirements. Other changes clarify the provisions by using more consistent terminology and more descriptive section titles. An example of reformatting is the creation of a new Section 715.1 to provide charging language similar to Section 714.1 for penetrations as well as expanding Section 715.2 to address the installation of all of joints and voids included in Section 715. A joint or void is to be “protected” where the protection method is required to be tested to a specific test standard. Where a void is only required to be “filled,” there is no specific test standard or listing requirement.

716.2.2.1.1

Prohibited Use of Terminated Stops

CHANGE TYPE: Modification

CHANGE SUMMARY: The use of "terminated stops" on door frames of doors providing smoke and draft control protection at elevator lobbies is now prohibited.

2022 CODE TEXT: **716.2.2.1.1 Smoke and draft control.** The air leakage rate of the door assembly shall not exceed 3.0 cubic feet per minute per square foot ($0.01524\ m^3/s \times m^2$) of door opening at 0.10 inch (24.9 Pa) of water for both the ambient temperature and elevated temperature tests. Louvers shall be prohibited. Terminated stops shall be prohibited on doors required by Section 405.4.3 to comply with Section 716.2.2.1 and prohibited on doors required by Item 3 of Section 3006.3 or Section 3007.6.3 or 3008.6.3 to comply with this section.

202 Terminated stops. Factory feature of a door frame where the stops of the door frame are terminated not more than 6 inches (152 mm) from the bottom of the door frame. Terminated stops are also known as "hospital stops" or "sanitary stops."

CHANGE SIGNIFICANCE: Due to inconsistent interpretations and applications, terminated stops are now specifically defined and regulated. A terminated stop is simply a door frame stop that terminates a limited distance above the floor level. Removal of the stop for a limited height eliminates floor obstructions that can accumulate debris and are difficult to clean. Terminated stops are often used in hospitals and other occupancies to improve floor cleaning.

Photo courtesy of John Woestman

Door frame with terminated stop.

The use of terminated stops is now specifically prohibited at four locations where the movement of equipment and floor cleaning are not considered as important as maintaining the required smoke and draft protection. Prohibited locations are all related to protecting elevator hoistways and limiting the potential for smoke movement to other parts of the building. Locations where terminated stops cannot be used include (a) an elevator serving multiple smoke compartments in an underground building, (b) additional doors providing smoke and draft control for elevator hoistway openings, (c) lobby doors serving a fire service access elevator, and (d) lobby doors serving occupant evacuation elevators. In all of these locations, the code specifically requires the doors to be tested to the UL 1784 standard "without an artificial bottom seal." The new prohibition will ensure that a terminated stop is not used on these door assemblies and that the assembly is installed as it was actually tested.

In all other locations, door assemblies that are required to meet smoke and draft control requirements are permitted to use a terminated stop. Any smoke and draft control doors using terminated stops must still be tested and installed in accordance with their listing. Smoke and draft control doors with terminated stops are to be tested using the UL 1784 test standard and allowed to have an artificial bottom seal installed during the testing. However, that type of seal is not required for the actual installation. Door assemblies with terminated stops would need to meet the 3.0 cubic feet per minute per square foot air leakage limit, but if they are installed in accordance with their listing, they are permitted. Due to the dynamics of positive pressure door testing, the bottom of the door is at a negative pressure and there is generally little concern with smoke movement through the door at that level. However, where the doors are protecting the four listed elevator hoistway locations, the pressure differences within the building and within the elevator hoistway cause greater concern.

716.4

Fire-Protective Curtain Assemblies

CHANGE TYPE: Addition

CHANGE SUMMARY: Labeling and performance requirements for fabric fire-protective curtain assemblies have been established.

2022 CODE TEXT: **202 Fire protective curtain assembly.** An assembly consisting of a fabric curtain, a bottom bar, guides, a coil, and an operating and closing system.

716.4 Fire protective curtain assembly. Approved fire protective curtain assemblies shall be constructed of any materials or assembly of component materials tested without hose stream in accordance with UL 10D, and shall comply with the Sections 716.4.1 through 716.4.3

716.4.1 Label. Fire protective curtain assemblies used as opening protectives in fire-rated walls and smoke partitions shall be labeled in accordance with Section 716.2.9.

716.4.2 Smoke and draft control. Fire protective curtain assemblies used to protect openings where smoke and draft control assemblies are required shall comply with Section 716.2.1.4.

716.4.3 Installation. Fire protective curtain assemblies shall be installed in accordance with NFPA 80.

Photo courtesy of Smoke Guard Inc.

Vertically deploying fire protective curtain.

CHANGE SIGNIFICANCE: The establishment of provisions addressing fire-protective curtain assemblies is the first step in the specific regulation of these systems and provides building officials with guidance on how they are to be tested, labeled and installed. These systems are to be evaluated using the UL 10D *Standard for Fire Tests of Fire Protective Curtain Assemblies* standard. This test is similar to UL 10C *Positive Pressure Fire Tests of Door Assemblies*, but without the hose stream test. Though not required by the standard, opening protection tested to this standard can be evaluated to verify whether smoke and draft leakage through the opening complies with UL 1784, and some manufacturers have products that provide egress options. In addition, UL 10D provides for testing of both horizontal and vertical assemblies. Fire-protective curtain assemblies are required to meet the testing, labeling and installation requirements specified in Section 716.4 as appropriate, depending on assembly location and use.

The 2022 CBC doesn't specifically reference when or where these fire protective curtain assemblies can be used or accepted. It simply provides the code official with the standard to evaluate their performance. Therefore, their use, whether vertical or horizontal, will need to be reviewed and approved by the building official using the alternate methods provisions of Section 104.11. Because the code does not address where these protective curtain assemblies can be used, the limitation will really come based on the approval of the code official under the alternate methods provisions. These fire-protective curtain assemblies would be usable any place that Table 716.1(2) accepts a 20 minute or less rating or they could be used to supplement an opening protective and provide smoke and draft leakage or to establish a smoke reservoir at an upper floor or to close off a convenience stair. Potential uses, if accepted, would be as a supplemental means of protecting an opening at an atrium or a corridor as part of an engineered fire protection system. Another example of possible use is between two spaces with a cased opening between them but that would be viewed as separate areas for the purposes of a smoke control system. In this situation, the opening would allow the movement of both people and air between the spaces under normal circumstances, but, when needed, the fire protective curtain assembly would divide the spaces into separate smoke compartments. One important item of note is that, based on the limitations of the UL 10D and NFPA 80 standards, this fire-protective curtain assembly is not intended to be used as the proscenium curtain required by Section 410.2.5.

The scope of the UL 10D standard helps explain the intent of these systems when it states "These requirements cover the evaluation of fire protective curtain assemblies intended to provide supplemental passive fire protection as part of an engineered fire protection system. Fire protective curtain assemblies provide nonstructural separation only and are not intended to be substituted for structural hourly rated partitions or opening protectives that have been tested for fire endurance and hose stream performance." The standard includes several of these restrictions since the curtains do not limit the temperature rise on the unexposed side.

CHANGE TYPE: Modification

CHANGE SUMMARY: Appropriate opening protection is now addressed where two doors are used to protect a single opening, such as between adjacent hotel rooms or where a double fire wall is constructed.

Table 716.1(2)

Doors in Double Fire Walls

2022 CODE TEXT:

(Partial view of Table 716.1(2))

TABLE 716.1(2) Opening Fire Protection Assemblies, Ratings and Markings

Type Of Assembly	Required Wall Assembly Rating (Hours)		Minimum Fire Door And Fire Shutter Assembly Rating (Hours)	Door Vision Panel Size[a]	Fire-Rated Glazing Marking Door Vision Panel[b,c]	Minimum Sidelight/ Transom Assembly Rating (Hours)		Fire-Rated Glazing Marking Sidelight/ Transom Panel	
						Fire Protection	Fire Resistance	Fire Protection	Fire Resistance
Fire walls and fire barriers having a required fire-resistance rating greater than 1 hour	4 3 2 1½		No changes in this portion of the table						
	Single-wall assembly rating (hours)[e]	Each wall of the double-wall assembly (hours)[f]							
Double fire walls constructed in accordance with NFPA 221	4	3	3	See note a	D-H-W-180	Not permitted	3	Not permitted	W-180
	3	2	1½	100 sq. in	≤100 sq. in. = D-H-90 >100 sq. in. = D-H-W-90	Not permitted	2	Not permitted	W-120
	2	1	1	100 sq. in.	≤100 sq. in. = D-H-60 >100 sq. in. = D-H-W-60	Not permitted	1	Not permitted	W-60
						Fire protection			
Other fire barriers	1		¾	Maximum size tested	D-H	¾[h]		D-H[h]	
Other fire partitions	1		¾[i]	Maximum size tested	D-H-45	¾		D-H-45	
	0.5		⅓	Maximum size tested	D-H-20	⅓		D-H-20	

table continued

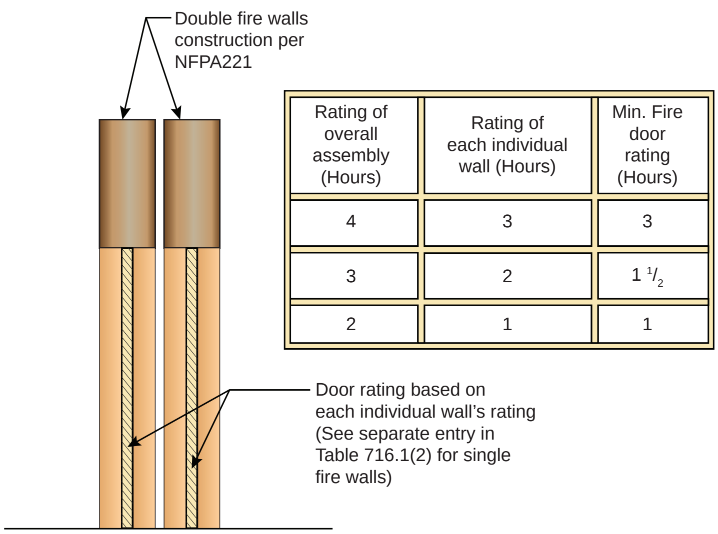
TABLE 716.1(2) *continued*

Type Of Assembly	Required Wall Assembly Rating (Hours)	Minimum Fire Door And Fire Shutter Assembly Rating (Hours)	Door Vision Panel Size[a]	Fire-Rated Glazing Marking Door Vision Panel[b,c]	Minimum Sidelight/ Transom Assembly Rating (Hours)		Fire-Rated Glazing Marking Sidelight/ Transom Panel	
					Fire Protection	Fire Resistance	Fire Protection	Fire Resistance
Exterior walls	2	1½	Maximum size tested	D-H 90 or D-H-W-90	1½[h]	2	D-H-OH-90[h]	W-120
					Fire protection			
	1	¾	Maximum size tested	D-H-45	¾[h]		D-H-45[h]	

For SI: 1 square inch = 645.2 mm.

a. ~~b.~~ Fire-resistance-rated glazing tested to ASTM E119 in accordance with Section 716.1.2.3 shall be permitted, in the maximum size tested.
b. ~~c.~~ Under the column heading “Fire-rated glazing marking door vision panel,” W refers to the fire-resistance rating of the glazing, not the frame.
c. ~~e.~~ See Section 716.1.2.2.1 and Table 716.1(1) for additional permitted markings.
d. Two doors, each with a fire protection rating of 1½ hours, installed on opposite sides of the same opening in a fire wall, shall be deemed equivalent in fire protection rating to one 3-hour fire door.
e. As required in Section 706.4.
f. As allowed in Section 4.6 of NFPA 221.
g. ~~d.~~ See Section 716.2.5.1.2.1.
h. Fire-protection-rated glazing is not permitted for fire barriers required by Section 1207 of the *California Fire Code* to enclose energy storage systems. Fire-resistance-rated glazing assemblies tested to ASTM E119 or UL 263, as specified in Section 716.1.2.3 shall be permitted.
i. ~~a.~~ Two doors, each with a fire rating of 20 minutes, installed on opposite sides of the same opening in a fire partition, shall be deemed equivalent in fire protection rating to one 45-minute fire door.

(No changes to other portions of Table 716.1(2))



Doors in double fire walls using NFPA 221.

Photo courtesy of Gerri Kielhofner

Fire partition with two 20-minute doors.

CHANGE SIGNIFICANCE: Two changes occurred to Table 716.1(2) addressing conditions where two doors are used to protect a single opening. Door protection requirements have been introduced when a double fire wall designed and constructed in accordance with NFPA 221 is provided instead of a single fire wall. This option of using two doors is also applicable to certain fire partitions. An additional change is the inclusion of footnote "h" dealing with glazing in the enclosures for energy storage systems, which was discussed previously in Section 707.4.

Section 706.2 requires that a fire wall be constructed to allow the collapse of the structure on either side without causing a collapse of the fire wall. One solution the code permits is the use of NFPA 221 for construction of two adjacent walls instead of a single wall. Table 716.1(2) clearly addresses the required door rating for a single fire wall but did not previously provide specific guidance where two walls were constructed directly adjacent to each other. Although designers and building officials could generally determine the appropriate rating where each of the double walls had either a 3-hour or 2-hour fire-resistance rating, there was no entry to address where a 1-hour wall is used for creating a double fire wall. It is important that code users recognize the unique requirements in the table for "double fire walls constructed in accordance with NFPA 221." One column now addresses a "single wall assembly rating" and the other column is for "each wall of the double wall assembly." If misapplied, it might be determined that a 3-hour single wall assembly only requires a 1-1/2 hour fire protection rating for the door and not recognize that it is the rating needed for the door in each of the two adjacent fire walls.

A second change is the inclusion of footnote "i" that will most likely be applied at the separation between adjacent sleeping units where Section 420.2 and Section 708.3 require a 1-hour rating between adjacent rooms. This footnote is referenced for "other fire partitions" where a wall requires a 1-hour fire-resistance rating and the door assembly requires a minimum 3/4-hour fire-protection rating. While one door with a 3/4-hour rating is required to be installed in this separation, it is common to install one door for each of the connecting rooms to allow occupants on either side of the wall to lock their door for security. The addition of this footnote will allow the installation of two 20-minute doors on each side of the opening, providing a general equivalency to the 45-minute rating mandated as the minimum fire-protection rating for a single door.

717.2.3, 717.6.2.1

Ceiling Radiation Dampers

CHANGE TYPE: Modification

CHANGE SUMMARY: The use of static ceiling radiation dampers are now permitted where controls are used to shut down the airflow.

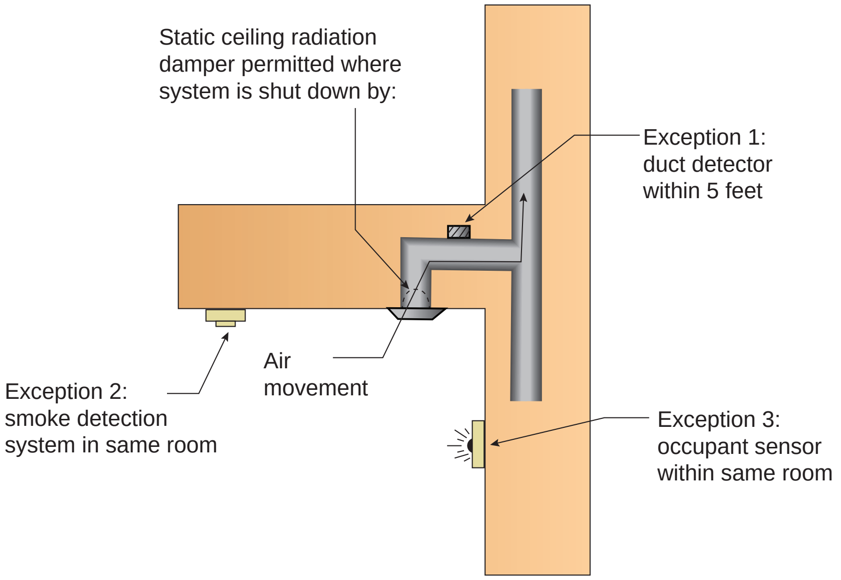
2022 CODE TEXT: **717.2 Installation.** Fire dampers, smoke dampers, combination fire/smoke dampers and ceiling radiation dampers located within air distribution and smoke control systems shall be installed in accordance with the ~~requirements of this section,~~ the manufacturer's instructions ~~and~~ , the dampers' listing and Sections 717.2.1 through 717.2.3.

717.2.3 Static dampers. Fire dampers and ceiling radiation dampers that are listed for use in static systems shall only be installed in heating, ventilation and air-conditioning systems that are automatically shut down in the event of a fire.

717.3 Damper testing, ratings and actuation. Damper testing, ratings and actuation shall be in accordance with Sections 717.3.1 through 717.3.3.

717.3.1 Damper testing. Dampers shall be listed and labeled in accordance with the standards in this section.

1. Fire dampers shall comply with the requirements of UL 555. ~~Only fire dampers labeled for use in dynamic systems shall be installed in heating, ventilation and air-conditioning systems designed to operate with fans on during a fire.~~
2. Smoke dampers shall comply with the requirements of UL 555S.
3. Combination fire/smoke dampers shall comply with the requirements of both UL 555 and UL 555S.



Exceptions permitting static ceiling radiation damper.

4. Ceiling radiation dampers shall comply with the requirements of UL 555C or shall be tested as part of a fire-resistance-rated floor/ceiling or roof/ceiling assembly in accordance with ASTM E119 or UL 263. ~~Only ceiling radiation dampers labeled for use in dynamic systems shall be installed in heating, ventilation and air-conditioning systems designed to operate with fans on during a fire.~~
5. Corridor dampers shall comply with requirements of both UL 555 and UL 555S. Corridor dampers shall demonstrate acceptable closure performance when subjected to 150 feet per minute (0.76 mps) velocity across the face of the damper during the UL 555 fire exposure test.

717.6.2.1 Ceiling radiation dampers testing and installation. *(No changes)*

717.6.2.1.1 Dynamic systems. Only ceiling radiation dampers labeled for use in dynamic systems shall be installed in heating, ventilation and air-conditioning systems designed to operate with fans on during a fire.

717.6.2.1.2 Static systems. Static ceiling radiation dampers shall be provided with systems which are not designed to operate during a fire.

Exceptions:

1. Where a static ceiling radiation damper is installed at the opening of a duct, a smoke detector shall be installed inside the duct or outside the duct with sampling tubes protruding into the duct. The detector or tubes within the duct shall be within 5 feet (1524 mm) of the damper. Air outlets and inlets shall not be located between the detector or tubes and the damper. The detector shall be listed for the air velocity, temperature and humidity anticipated at the point where it is installed. Other than in mechanical smoke control systems, dampers shall be closed upon fan shutdown where local smoke detectors require a minimum velocity to operate.
2. Where a static ceiling radiation damper is installed in a ceiling, the ceiling radiation damper shall be permitted to be controlled by a smoke detection system installed in the same room or area as the ceiling radiation damper.
3. A static ceiling radiation damper shall be permitted to be installed in a room where an occupant sensor is provided within the room that will shut down the system.

CHANGE SIGNIFICANCE: UL 555C now has requirements to test ceiling radiation dampers (CRD) for closure under either dynamic or static conditions. Static-type fire dampers and ceiling radiation dampers are evaluated only for use where air movement is effectively stopped at the start of a fire. Dynamic-type dampers have been evaluated for use in mechanical systems where the airflow is operational during a fire, such as in a smoke control system or in situations where a fan system is operating at the time of a fire. Static damper installation limitations are appropriately relocated to a subsection of installation requirements rather than being addressed with each separate damper testing item.

Additionally, provisions have been added to specifically address how static CRDs can be installed within mechanical systems that have air movement during a fire. Because the UL CRD dynamic testing requirement is relatively new, all currently listed CRDs are essentially viewed as being static dampers. There are several situations where an exhaust system or fresh air make-up system can be operating during a fire and create conditions where dampers technically should be considered as dynamic systems. The Section 717.6.2.1.2 exceptions allow currently listed CRDs (and those listed in the future as static dampers) to be installed in locations where a dynamic damper should be used, provided that the damper is controlled as required by one of the exceptions. For example, many Group R-1 hotels have an exhaust fan in the bathroom of each unit. If the exhaust duct goes through a wall, there are dynamic fire dampers that can be used in this location. However, if the exhaust duct exits through the ceiling, then there currently are no listed CRDs that can be installed as listed when the exhaust system is operating. The three exceptions allow either a duct-mounted smoke detector, an area smoke detector installed within the room or an occupant sensor as a means of shutting down the air movement. For an occupant sensor, when the bathroom is vacant, the exhaust fan is assumed not to be running and the system can be considered static.

717.4

Access to Dampers

CHANGE TYPE: Modification

CHANGE SUMMARY: Specific damper access requirements have been established, including an allowance for remote inspection where access cannot be provided.

2022 CODE TEXT: **717.3.3.1 Fire damper actuation device.** ~~The fire damper actuation device~~ Primary heat responsive devices used to actuate fire dampers shall meet one of the following requirements:

1. The operating temperature shall be approximately 50°F (10°C) above the normal temperature within the duct system, but not less than 160°F (71°C).
2. The operating temperature shall be not more than 350°F (177°C) where located in a smoke control system complying with Section 909.

717.4 Access and identification. Access and identification of fire and smoke dampers shall comply with Sections 717.4.1 and 717.4.2.

717.4.1 Access. Fire and smoke dampers shall be provided with an approved means of access that is large enough to permit inspection and maintenance of the damper and its operating parts. Dampers equipped with fusible links, internal operators, or both shall be provided with an access door that is not less than 12 inches (305 mm) square or provided with a removable duct section.

Photo courtesy of Dave Nelsen, Norton and Schmidt Consulting Engineers

Damper access opening.

717.4.1.1 Access openings. The access shall not affect the integrity of fire-resistance-rated assemblies. The access openings shall not reduce the fire-resistance rating of the assembly. Access doors in ducts shall be tight fitting and suitable for the required duct construction.

717.4.1.2 Restricted access. Where space constraints or physical barriers restrict access to a damper for periodic inspection and testing, the damper shall be a single- or multi-blade type damper and shall comply with the remote inspection requirements of NFPA 80 or NFPA 105

717.4.2 Identification. Access points shall be permanently identified on the exterior by a label having letters not less than ½ inch (12.7 mm) in height reading: "FIRE/SMOKE DAMPER," "SMOKE DAMPER" or "FIRE DAMPER."

CHANGE SIGNIFICANCE: While at first glance the revisions of Section 717.4 appear quite substantial, they are primarily an editorial reformatting of the existing provisions. Sections 717.4.1, 717.4.1.1 and 717.4.2 address three distinct topics: the need for access, the access opening itself and the identification of the access point. The only technical change is that a specific size requirement of a minimum 12-inch by 12-inch opening now provides an enforceable size requirement for the access opening. Previously an "approved" means of damper access was required that was adequate in size and location "to permit inspection and maintenance of the damper and its operating parts."

Recognizing that a 12-inch square access opening may not always be possible, especially when located in smaller ducts or in locations that have some type of barrier or obstruction, an option allows for "remote inspection." A remote testing and inspection alternative is recognized by the two referenced NFPA standards, NFPA 80 and NFPA 105, that are applicable to fire dampers and smoke dampers, respectively. These two standards address remote inspection, which is becoming more common, especially for larger facilities with numerous dampers, or for more efficient periodic inspections after the dampers have been in service for some time. Requirements for maintenance and periodic inspection are found in Section 706.1 of the CFC which references the provisions of the two NFPA standards.

Also of note is the terminology revision where "fire damper actuation device" is now identified as a "primary heat responsive device." This new terminology is consistent with the UL 555 standard.

717.5.2

Flex Connectors

CHANGE TYPE: Modification

CHANGE SUMMARY: An allowance to eliminate fire dampers where a fully ducted HVAC system is provided has been modified to permit the use of flexible connections.

2022 CODE TEXT: **717.5.2 Fire barriers.** *In other than Group A, E, H, I, L and R occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal.* Ducts and air transfer openings of fire barriers shall be protected with listed fire dampers installed in accordance with their listing. Ducts and air transfer openings shall not penetrate enclosures for interior exit stairways and ramps and exit passageways, except as permitted by Sections 1023.5 and 1024.6, respectively.

Exceptions: Fire dampers are not required at penetrations of fire barriers where any of the following apply:

1. Penetrations are tested in accordance with ASTM E119 or UL 263 as part of the fire-resistance-rated assembly.
2. Ducts are used as part of an approved smoke control system in accordance with Section 909 and where the use of a fire damper would interfere with the operation of a smoke control system.
3. Such walls are penetrated by <u>fully</u> ducted HVAC systems, have a required fire-resistance rating of 1 hour or less, are in areas of other than Group H and are in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2. For the purposes of this

Flex connector to ceiling diffuser.

exception, a fully ducted HVAC system shall be a duct system for conveying supply, return or exhaust air as part of the structure's HVAC system. Such a duct system shall be constructed of sheet steel not less than No. 26 gage thickness and shall be continuous from the air-handling appliance or equipment to the air outlet and inlet terminals. Nonmetal flexible air connectors shall be permitted at the following locations *in accordance with Section 603 of the California Mechanical Code*:

3.1. At the duct connection to the air handling unit or equipment located within the mechanical room.

3.2. From an overhead metal duct to a ceiling diffuser within the same room.

CHANGE SIGNIFICANCE: Elimination of a fire damper in a 1-hour fire barrier penetration was previously not permitted if any portion of the ducted system was constructed of a material other than No. 26 gage sheet steel. Thus, any type of isolation connection between HVAC equipment and a duct system or to air diffusers located remotely from a duct penetration of a fire barrier was prohibited.

Flexible air connectors are now permitted at the two locations addressed by Items 3.1 and 3.2 when following appropriate provisions in the *California Mechanical Code* (CMC). Unprotected openings into the duct on both sides of the fire barrier have always been acceptable, therefore, the use of flexible air connectors at the locations specified is not deemed to constitute any greater hazard. Flexible air connectors are regulated by several provisions of both the CMC and CBC that address their performance, length, location, connections and sealing. See CMC Section 603 as well as CBC Section 717.7 for more information.

The exception continues to be permitted only in a fully sprinklered building in an occupancy other than a Group H and for a maximum 1-hour rated assembly. By limiting allowable locations in the two new provisions, the flexible connectors will only occur at the end of the hard ductwork system. A steel duct, protected as a penetration (see Section 717.1.2), will continue to be required where a duct passes through a fire barrier.

722.7

Fire-Resistance Rating of Mass Timber

CHANGE TYPE: Addition

CHANGE SUMMARY: A prescriptive approach has been provided to achieve the required fire-resistance ratings for new mass timber construction type members and assemblies.

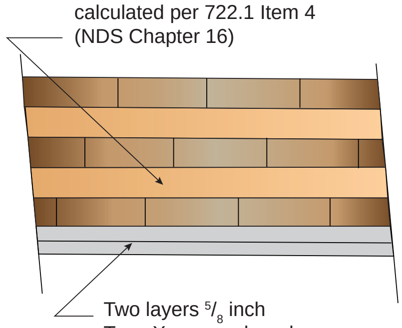
2022 CODE TEXT: **722.7 Fire-resistance for mass timber.** The required fire resistance of mass timber elements in Section 602.4 shall be determined in accordance with Section 703.2 *or Section 703.3*. The fire-resistance rating of building elements shall be as required in Tables 601 and 705.5 and as specified elsewhere in this code. The fire-resistance rating of the mass timber elements shall consist of the fire resistance of the unprotected element added to the protection time of the noncombustible protection.

722.7.1 Minimum required protection. Where required by Sections 602.4.1 through 602.4.3, noncombustible protection shall be provided for mass timber building elements in accordance with Table 722.7.1(1). The rating, in minutes, contributed by the noncombustible protection of mass timber building elements, components or assemblies, shall be established in accordance with Section 703.6. The protection contributions indicated in Table 722.7.1(2) shall be deemed to comply with this requirement where installed and fastened in accordance with Section 722.7.2.

722.7.2 Installation of gypsum board noncombustible protection. Gypsum board complying with Table 722.7.1(2) shall be installed in accordance with this section.

722.7.2.1 Interior surfaces. Layers of Type X gypsum board serving as noncombustible protection for interior surfaces of wall and ceiling assemblies determined in accordance with Table 722.7.1(1) shall be installed in accordance with the following:

1. Each layer shall be attached with Type S drywall screws of sufficient length to penetrate the mass timber at least 1 inch (25 mm) when driven flush with the paper surface of the gypsum board.



Example – calculating fire-resistance.

Exception: The third layer, where determined necessary by Section 722.7, shall be permitted to be attached with 1-inch (25 mm) No. 6 Type S drywall screws to furring channels in accordance with AISI S220.

2. Screws for attaching the base layer shall be 12 inches (305 mm) on center in both directions.
3. Screws for each layer after the base layer shall be 12 inches (305 mm) on center in both directions and offset from the screws of the previous layers by 4 inches (102 mm) in both directions.
4. All panel edges of any layer shall be offset 18 inches (457 mm) from those of the previous layer.
5. All panel edges shall be attached with screws sized and offset as in Items 1 through 4 above and placed at least 1 inch (25 mm) but not more than 2 inches (51 mm) from the panel edge.
6. All panels installed at wall-to-ceiling intersections shall be installed such that ceiling panels are installed first and the wall panels are installed after the ceiling panel has been installed and is fitted tight to the ceiling panel. Where multiple layers are required, each layer shall repeat this process.
7. All panels installed at a wall-to-wall intersection shall be installed such that the panels covering an exterior wall or a wall with a greater fire-resistance rating shall be installed first and the panels covering the other wall shall be fitted tight to the panel covering the first wall. Where multiple layers are required, each layer shall repeat this process.
8. Panel edges of the face layer shall be taped and finished with joint compound. Fastener heads shall be covered with joint compound.
9. Panel edges protecting mass timber elements adjacent to unprotected mass timber elements in accordance with Section 602.4.2.2 shall be covered with 1¼-inch (32 mm) metal corner bead and finished with joint compound.

722.7.2.2 Exterior surfaces. Layers of Type X gypsum board serving as noncombustible protection for the outside of the exterior mass timber walls determined in accordance with Table 722.7.1(1) shall be fastened 12 inches (305 mm) on center each way and 6 inches (152 mm) on center at all joints or ends. All panel edges shall be attached with fasteners located at least 1 inch (25 mm) but not more than 2 inches (51 mm) from the panel edge. Fasteners shall comply with one of the following:

1. Galvanized nails of minimum 12 gage with a $^{7}/_{16}$-inch (11 mm) head of sufficient length to penetrate the mass timber a minimum of 1 inch (25 mm).
2. Screws that comply with ASTM C1002 (Type S, W or G) of sufficient length to penetrate the mass timber a minimum of 1 inch (25 mm).

TABLE 722.7.1(1) Protection Required from Noncombustible Covering Material

Required Fire-Resistance Rating of Building Element per Tables 601 and 705.5 (hours)	Minimum Protection Required from Noncombustible Protection (minutes)
1	40
2	80
3 or more	120

TABLE 722.7.1(2) Protection Provided by Noncombustible Covering Material

Noncombustible Protection	Protection Contribution (minutes)
$^1/_2$-inch Type X gypsum board	25
$^5/_8$-inch Type X gypsum board	40

CHANGE SIGNIFICANCE: A prescriptive method has been established for achieving the fire resistance required to protect mass timber elements in new construction types IV-A, IV-B and IV-C. As an alternative to the tested assemblies established by Section 703.6, specific attachment and protection ratings are also provided. Section 703.6 addresses the performance method by which the fire-resistance rating of mass timber structural elements is to be determined. Section 722.7 is the prescriptive equivalent of Section 703.6 and provides a method to achieve fire resistance for mass timber buildings.

As stated in the last sentence of Section 722.7, "The fire-resistance rating of the mass timber elements shall consist of the fire-resistance rating of the unprotected element added to the protection time of the noncombustible protection." A calculated fire-resistance rating for an unprotected wood structural element is established using provisions found in Section 722.1 by applying Chapter 16 of the AWC National Design Specification for Wood Construction (NDS). Where required by Sections 602.4.1 through 602.4.3 for new construction types IV-A, IV-B and IV-C, provisions of Section 722.7.1 and Tables 722.7.1(1) and 722.7.1(2) are used to determine the required contribution of noncombustible protection needed for a wood structural member or assembly. Data from the broad testing of beams, columns, wall and ceiling panels was used to establish the values in Table 722.7.1(2).

When establishing the fire-resistance requirements for mass timber used in new construction types IV-A, IV-B and IV-C, it was determined that at least two-thirds of the required fire-resistance rating should come from noncombustible protection. When using the calculation (prescriptive) method, the protection required is set forth in Table 722.7.1(1), with Table 722.7.1(2) then establishing the protection provided by each layer of noncombustible material. For example, if an element required a minimum 2-hour fire-resistance rating, Table 722.7.1(1) would mandate a minimum contribution from the noncombustible covering of 80 minutes. Table 722.7.1(2) indicates that two layers of ⅝-inch Type X gypsum board would provide the needed 80 minutes of protection. The calculated fire-resistance of an exposed wood member is then determined from

NDS Chapter 16 (a minimum of 40 minutes) and added to the 80-minute noncombustible protection. Where the total is no less than 120 minutes, with at least 80 minutes being provided by gypsum board, the 2-hour fire-resistance requirement is satisfied.

Because 722.7 is a prescriptive methodology, the gypsum board protection must be installed as indicated in Section 722.7.2. While an assembly tested in accordance with Section 703.6 would require the non-combustible protection to be installed as it was for the actually tested assembly, Section 722.7.2 provides specific details that must be followed when the prescriptive provisions are used. These prescriptive installation provisions must be followed just as those in Tables 721.1(1), 721.1(2) or 721.1(3) are used when constructing a rated assembly with those systems.

806.9

Combustible Lockers as Interior Finish

CHANGE TYPE: Addition

CHANGE SUMMARY: Combustible lockers are now regulated for interior finish purposes.

2022 CODE TEXT: **806.9 Combustible lockers.** Where lockers constructed of combustible materials are used, the lockers shall be considered to be interior finish and shall comply with Section 803.

> **Exception:** Lockers constructed entirely of wood and noncombustible materials shall be permitted to be used wherever interior finish materials are required to meet a Class C classification in accordance with Section 803.1.2.

CHANGE SIGNIFICANCE: The regulation of combustible lockers, previously limited to Section 808.4 of the CFC, is now also addressed in the CBC. This allows for regulation before and during construction rather than only after occupancy during a fire service inspection.

Traditionally, lockers in schools, health clubs and similar facilities were primarily constructed of steel. In recent years, lockers constructed of combustible materials have become prevalent. These lockers typically line an entire wall (for example, a corridor in a school) and are generally not regulated by the CBC. They are not usually addressed for interior finish purposes and yet they also do not fall under the CBC's decorative materials and trim provisions. While CFC Chapter 8 does address other topics such as upholstered furniture, decorations, decorative vegetation, wastebaskets, linen containers and signs, lockers do not fall into any of those categories. Therefore, a specific provision was previously added to

Combustible lockers.

the "furnishings" section of the CFC. To ensure these requirements are not overlooked during design and construction, they are now also being added to the CBC.

Combustible lockers can present a significant fire load and, if ignited, are likely to spread fire in a manner similar to other materials with comparable interior finish conditions. Plastic lockers have the benefit of being more immune to the effects of water from wet clothing and are generally very durable, but with these benefits comes a fire hazard. One type of locker is constructed of ⅜-inch-thick (9.52 mm) solid plastic bodies with heavy-duty ½-inch-thick (12.7 mm) doors. Typically, the "solid plastic" used is either high-density polyethylene or polypropylene. Polypropylene is a thermoplastic that generates considerable energy and produces a pooling flammable liquid fire as it burns. Because of this potential hazard, compliance with general testing and flame spread limitations used for other wall and ceiling finishes in Section 803 is required.

The exception recognizes lockers that are constructed of wood as being acceptable in any application permitting Class C flame spread finish material. This is reasonable since most wood materials generally fall within either the Class B or Class C flame spread categories. Where a locker is constructed of noncombustible materials, it is not impacted due to the scoping limit statement of "constructed of combustible materials."

903.2.4, 903.2.7, 903.2.9

Upholstered Furniture and Mattresses

CHANGE TYPE: Modification

CHANGE SUMMARY: The sprinkler provisions for upholstered furniture and mattresses have been modified to clearly indicate the scope of the required protection.

2022 CODE TEXT: **903.2.4 Group F-1.** An automatic sprinkler system shall be provided throughout all buildings containing a Group F-1 occupancy where one of the following conditions exists:

1. A Group F-1 fire area exceeds 12,000 square feet (1115 m^2).
2. A Group F-1 fire area is located more than three stories above grade plane.
3. The combined area of all Group F-1 fire areas on all floors, including any mezzanines, exceeds 24,000 square feet (2230 m^2).
4. ~~A Group F-1 occupancy used for the manufacture of upholstered furniture or mattresses exceeds 2,500 square feet (232 m^2).~~

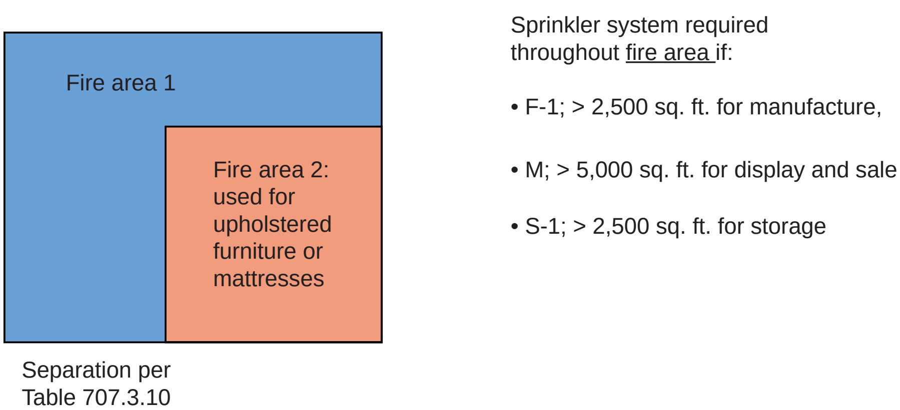
903.2.4.1 Woodworking operations. *(No change)*

903.2.4.2 Group F-1 distilled spirits. *(New)*

903.2.4.3 Group F-1 upholstered furniture or mattresses. An automatic sprinkler system shall be provided throughout a Group F-1 fire area that exceeds 2,500 square feet (232 m^2) used for the manufacture of upholstered furniture or mattresses.

903.2.7 Group M. An automatic sprinkler system shall be provided throughout buildings containing a Group M occupancy where one of the following conditions exists:

1. A Group M fire area exceeds 12,000 square feet (1115 m^2).
2. A Group M fire area is located more than three stories above grade plane.



Fire area sprinkler requirement.

3. The combined area of all Group M fire areas on all floors, including any mezzanines, exceeds 24,000 square feet (2230 m²).
4. ~~A Group M occupancy used for the display and sale of upholstered furniture or mattresses exceeds 5,000 square feet (464 m²).~~
4. *The structure exceeds 24,000 square feet (465 m²), contains more than one fire area containing a Group M occupancy, and is separated into two or more buildings by fire walls of less than 4-hour fire resistance rating without openings.*

903.2.7.1 High-piled storage. *(No change)*

<u>**903.2.7.2 Group M upholstered furniture or mattresses.** An automatic sprinkler system shall be provided throughout a Group M fire area where the area used for the display and sale of upholstered furniture or mattresses exceeds 5,000 square feet (464 m²).</u>

903.2.9 Group S-1. An automatic sprinkler system shall be provided throughout all buildings containing a Group S-1 occupancy where one of the following conditions exists:

1. A Group S-1 fire area exceeds 12,000 square feet (1115 m²).
2. A Group S-1 fire area is located more than three stories above grade plane.
3. The combined area of all Group S-1 fire areas on all floors, including any mezzanines, exceeds 24,000 square feet (2230 m²).
4. A Group S-1 fire area used for the storage of commercial motor vehicles where the fire area exceeds 5,000 square feet (464 m²).
5. ~~A Group S-1 occupancy used for the storage of upholstered furniture or mattresses exceeds 2,500 square feet (232 m²).~~

903.2.9.1 Repair garages. *(No change)*

903.2.9.2 Bulk storage of tires. *(No change)*

903.2.9.3 Group S-1 Distilled spirits or wine. *(New)*

<u>**903.2.9.4 Group S-1 upholstered furniture and mattresses.** An automatic sprinkler system shall be provided throughout a Group S-1 fire area where the area used for the storage of upholstered furniture or mattresses exceeds 2,500 square feet (232 m²).</u>

> <u>**Exception:** Self-service storage facilities no greater than one story above grade plane where all storage spaces can be accessed directly from the exterior.</u>

CHANGE SIGNIFICANCE: Since the sprinkler requirements specific to upholstered furniture and mattresses were first introduced into the CBC, there has been debate and discussion on exactly how the provisions are to be applied. Vague language has led to inconsistent application and, in some situations, to sprinklers being required where many people felt there was not a great enough hazard to justify the need for the protection. The sprinkler requirements for these special hazards that occur in Groups

F-1, M and S-1 occupancies have been modified to help clarify not only when the requirements apply, but also where the sprinkler protection is required.

Previously, if a business involved in the manufacture of upholstered furniture was 6,000 square feet in size, but the area "used for the manufacture" of the furniture was only 1,000 square feet, it was difficult to determine if the provision was to be applied. It was often deemed that the sprinkler protection was required not only in the area to address the unique hazard the upholstered furniture creates, but also throughout the entire building.

The new upholstered furniture and mattress provisions have been relocated into a separate section for each of the three occupancies. The revised scoping will not only limit the floor area thresholds to the "fire area" instead of to the occupancy, but will also only require the sprinkler protection to be installed in that fire area instead of "throughout the building." For the Group M and S-1 occupancies, the provisions also clarify it is the actual area used for the upholstered furniture and mattresses that is the trigger and not the overall size of the fire area. Although it is now permissible to subdivide a building with multiple fire areas to avoid the sprinkler requirement, each of the three occupancy types would ultimately still face the general sprinkler limitations of having a 12,000 square foot fire area, being more than three stories above grade or having an aggregate area of 24,000 square feet for all the fire areas. While the option to subdivide with a 3-hour (Groups F-1 and S-1) or a 2-hour (Group M) separation can be used to eliminate the sprinklers in smaller facilities with upholstered furniture and mattresses, the overall building provisions would still ultimately trigger the sprinkler protection requirement for larger facilities. The unique hazard potential these products create is now directly addressed rather than possibly relating the protection threshold to portions of the occupancy that do not present that same level of risk.

A new exception applies specifically to Group S-1 self-service storage facilities that are a single story above grade plane and have all storage spaces accessed directly from the exterior. Under such conditions, the 2,500 square foot fire area limitation based on the storage of upholstered furniture or mattresses in a nonsprinklered building does not apply. However, this exception only eliminates the sprinkler requirement for upholstered furniture and mattress storage and does not eliminate the general Group S-1 sprinkler thresholds. Since these are low-rise structures with adequate exterior access for fire personnel, there is a reduced level of hazard compared to a multistory structure or one with central corridor access to the upholstered furniture or mattress storage areas.

903.2.4.2, 903.2.9.3

Distilled Spirits

CHANGE TYPE: Addition

CHANGE SUMMARY: Imposes a sprinkler requirement for both the manufacturing and bulk storage of distilled spirits.

2022 CODE TEXT: **903.2.4.2 Group F-1 distilled spirits.** An automatic sprinkler system shall be provided throughout a Group F-1 fire area used for the manufacture of distilled spirits.

903.2.9.3 Group S-1 Distilled spirits or wine. An automatic sprinkler system shall be provided throughout a Group S-1 fire area used for the bulk storage of distilled spirits or wine.

CHANGE SIGNIFICANCE: A series of changes has been made throughout both the CBC and the CFC to eliminate confusion in the regulation of buildings that manufacture or store distilled spirits and wines. Distilled spirits have the properties of flammable liquids and proper safeguards must be provided for the occupancies and structures that house such activities.

With the changes to (a) clarify the proper occupancy classification of both manufacturing and storage, (b) deal with the different types of containers, (c) provide specific exclusions to indicate such facilities can be a "use other than Group H", and (d) add a new chapter in the CFC to address the "storage of distilled spirits and wines", it should now be easier to determine how these uses are to be regulated and should lead to more consistent enforcement. The new sprinkler requirements, along with all the other changes, will help reduce the hazard from these uses and coordinate with all the other important protection systems and controls.

F-1 distilled spirits manufacturing.

903.2.10

Sprinklers in Parking Garages

CHANGE TYPE: Modification

CHANGE SUMMARY: An automatic sprinkler system must now be installed in an open parking garage where a specific fire area or height threshold is exceeded.

2022 CODE TEXT: 903.2.10 Group S-2 ~~enclosed~~ parking garages. An automatic sprinkler system shall be provided throughout buildings classified as ~~enclosed~~ parking garages ~~in accordance with Section 406.6 where either~~ where any of the following conditions exists:

1. Where the fire area of the enclosed parking garage in accordance with Section 406.6 exceeds 12,000 square feet (1115 m^2).
2. Where the enclosed parking garage in accordance with Section 406.6 is located beneath other groups.

   Exception: Enclosed parking garages located beneath Group R-3 occupancies.
3. Where the fire area of the open parking garage in accordance with Section 406.5 exceeds 48,000 square feet (4460 m^2).

403.3 Automatic sprinkler system. Buildings and structures shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 and a secondary water supply where required by Section 403.3.3. *A sprinkler water-flow alarm-initiating device and a control valve with a supervisory signal-initiating device shall be provided at the lateral connection to the riser for each floor.*

> **Exception:** An automatic sprinkler system shall not be required in spaces or areas of telecommunications equipment buildings used exclusively for telecommunications equipment, associated electrical

Sprinklered open parking garage.

power distribution equipment, batteries and standby engines, provided that those spaces or areas are equipped throughout with an automatic fire detection system in accordance with Section 907.2 and are separated from the remainder of the building by not less than 1-hour fire barriers constructed in accordance with Section 707 or not less than 2-hour horizontal assemblies constructed in accordance with Section 711, or both.

903.2.11.3 Buildings 55 feet or more in height. An automatic sprinkler system shall be installed throughout buildings that have one or more stories with an occupant load of 30 or more located 55 feet (16 764 mm) or more above the lowest level of fire department vehicle access, measured to the finished floor.

~~Exceptions:~~ Exception

~~1.~~ ~~Open parking structures.~~

~~2.~~ Occupancies in Group F-2.

CHANGE SIGNIFICANCE: Open parking garages have historically been exempted from the sprinkler system requirements due to both a relatively good fire record and previous fire test data. However, with the change in the construction of automobiles, there is an increased use of plastics and lightweight materials as opposed to the metals that were previously used. In addition, the types of fuels being used to power the vehicles are also different. Based on the greater hazards due to a vehicle's fire fuel loading and on a fire that occurred in a parking garage in Liverpool, England on December 31, 2017, it was determined that sprinkler protection should be provided at an established threshold.

The 48,000 square-foot fire area threshold was selected predominately because it was four times the general 12,000 square foot limit and thus would lessen the impact of the new sprinkler requirement. This seemed like a reasonable step that would only impact larger garages. An additional justification for the area limit selected was its approximate equivalency to a 200-foot by 200-foot area and the limit of preconnected fire hoses. It should be noted that where any parking garage fire area exceeds 48,000 square feet, the entire building must be protected with an automatic sprinkler system.

Within the high-rise provisions of Section 403.3, there has historically been an exemption to eliminate sprinklers in open parking garages in high-rise buildings. That exemption has been removed, resulting in the required sprinkler protection of a high-rise building extending to any open parking garage in a high-rise building regardless of the size of the garage fire area.

A similar exception deletion occurred in Section 903.2.11.3 addressing buildings having one or more stories with an occupant load of 30 or more located 55 feet or more above the lowest level of fire department vehicle access. In those buildings containing an open parking garage where the occupant load and height thresholds are exceeded, the entire building, including the parking garage, is required to be sprinklered. Again, the sprinkler protection of the open garage is mandated regardless of the garage's fire area size. It is important to note that the provisions apply to both single-occupancy open parking garages as well as to mixed-occupancy conditions where a Group S-2 open parking garage is not the only occupancy in the building.

903.2.10.2

Mechanical-Access Parking Garages

CHANGE TYPE: Addition

CHANGE SUMMARY: Mechanical-access enclosed parking garages are now defined and require an automatic sprinkler system.

2022 CODE TEXT: **903.2.10.2 Mechanical-access enclosed parking garages.** An approved automatic sprinkler system shall be provided throughout buildings used for the storage of motor vehicles in a mechanical-access enclosed parking garage. The portion of the building that contains the mechanical-access enclosed parking garage shall be protected with a specially engineered automatic sprinkler system.

CHANGE SIGNIFICANCE: Enclosed mechanical-access parking garages are being constructed in the United States on an increasing basis. Classified as Group S-2, these occupancies are distinct from the traditional ramp-access parking garages in that there are very limited floor openings, sometimes there are no floors at all. Comparable to automated high rack storage systems, some of these facilities have no floors, no stairwells and no above-ground level access other than maintenance walkways and ladders.

An enclosed mechanical-access parking garage offers many fire-fighting challenges; i.e. most are constructed within a building shell, and there is no floor access to the upper levels. The vehicles are parked in a rack system with no safe elevated access to the interior of the structure. The construction components of newer vehicles and the new fuel sources being used create a substantial fire problem. Because of all these features and concerns, a specifically engineered automatic sprinkler system is required to be installed in these types of buildings.

Enclosed mechanical-access parking garage.

In addition to the fire sprinkler requirement, the new Section 406.6.4 requires mechanical-access enclosed parking garages to provide the following:

- Separation from other occupancies by minimum 2-hour fire barriers or horizontal assemblies.
- Fire department access doors at the ground level as required for high-piled combustible storage.
- Mechanical smoke removal system.
- Manual emergency shutdown switch for use by emergency personnel.
- Fire control equipment room with exterior access housing the fire alarm control unit, mechanical ventilation controls and emergency shut down switch.

903.3.1.2

NFPA 13R Sprinkler Protection

CHANGE TYPE: Modification

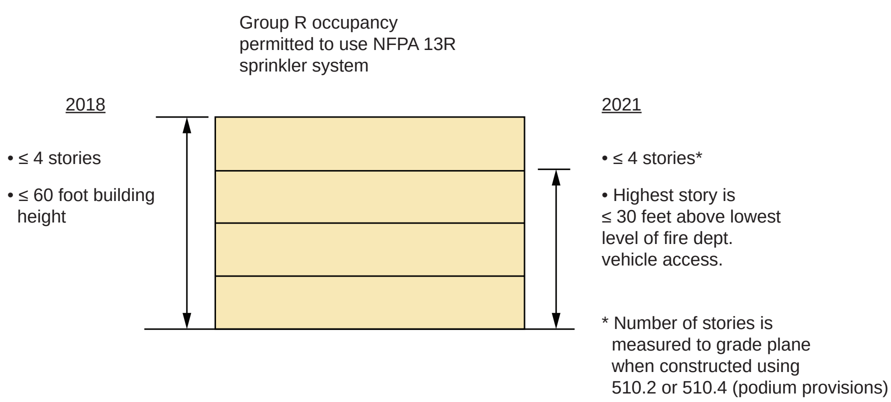
CHANGE SUMMARY: The maximum building height where an NFPA 13R sprinkler system is permitted has been reduced. In addition, where the podium provisions of Section 510 are applied, the story height measuring point has been changed to grade plane.

2022 CODE TEXT: **903.3.1.2 NFPA 13R sprinkler systems.** Automatic sprinkler systems in Group R occupancies ~~up to and including four stories in height in buildings not exceeding 60 feet (18 288 mm) in height above grade plane~~ shall be permitted to be installed throughout in accordance with NFPA 13R *as amended in Chapter 35.*

1. Four stories or fewer above grade plane.
2. The floor level of the highest story is 30 feet (9114 mm) or less above the lowest level of fire department vehicle access.
3. The floor level of the lowest story is 30 feet (9114 mm) or less below the lowest level of fire department vehicle access.

The number of stories of Group R occupancies constructed in accordance with Sections 510.2 and 510.4 shall be measured from ~~the horizontal assembly creating separate buildings~~ grade plane.

CHANGE SIGNIFICANCE: An NFPA 13R sprinkler system is intended as a life safety system and is not expected to address all of the property protection concerns. As such, the sprinklers are allowed to be installed only in the occupied areas of the building and are not required to be installed within the attic or other concealed combustible spaces. While the CBC and the NFPA 13R standard both generally allow these systems to be installed in buildings "up to…four stories in height," the CBC has historically allowed measurement from the podium building's "horizontal assembly creating separate buildings." Although the overall height in feet remains consistent, counting the permitted number of stories starting at the podium deck has essentially made the residential sprinkler system now applicable to what is seen from the ground as being a five- or



Limits for using a 13R sprinkler system.

six-story building. This allowance places the unsprinklered attic area of combustible construction at a higher and more difficult level for the fire department to reach or defend. Because of these concerns, the permissible use of an NFPA 13R sprinkler system has been modified to require the story height limit for podium buildings to be made from grade plane instead of from the horizontal assembly separating the upper and lower buildings.

In addition, the 60-foot building height limitation that was measured from “grade plane,” has been replaced with a 30-foot maximum height measured to the floor level of the highest story from the lowest level of fire department vehicle access. This modification will be more restrictive than what has been previously allowed. The 30-foot floor level height and other triggers were selected based on the standpipe requirements found within Section 905.3.1. Using a single scoping limit for both the standpipe and the NFPA13 sprinkler systems makes for a logical point at which additional fire protection is warranted.

903.3.1.2.2

Corridor and Balcony Sprinklers

CHANGE TYPE: Modification

CHANGE SUMMARY: Sprinkler protection must now be extended into corridors and balconies used in the means of egress, even though the location may be exempt based upon the NFPA 13R standard.

2022 CODE TEXT: **903.3.1.2.2 ~~Open-ended corridors~~ Corridors and balconies in the means of egress.** Sprinkler protection shall be provided in corridors and for balconies in the means of egress where any of the following conditions apply:

1. Corridors with combustible floor or walls.
2. Corridors with an interior change of direction exceeding 45 degrees (0.79 rad).
3. Corridors that are less than 50 percent open to the outside atmosphere at the ends.
4. Open-ended corridors and associated exterior stairways and ramps as specified in Section 1027.6, Exception 3.
5. Egress balconies not complying with Sections 1021.2 and 1021.3.

CHANGE SIGNIFICANCE: To fully understand the intent of this code change, it is important to review the way that reference standards are applied with the CBC and how it dictates which document takes precedence. A review of Section 102.4 indicates (a) that if there is a conflict, the code takes precedence, and (b) that where a subject is addressed both within the code and the standard, the scope from the code is the controlling provision. In this case, the CBC scopes where sprinkler systems are required, but then indicates that they follow the technical provisions

Egress balconies.

of the standard by stating the systems are to be "installed throughout in accordance with NFPA 13R." Under the technical requirements of that standard, any space "open" to outside temperature is allowed to eliminate the sprinkler protection in that unconditioned/open area. At issue is whether a space is interior and needs sprinkler protection or is exterior (read as "open" from the NFPA perspective) and does not need the sprinklers. While the CBC has historically addressed the requirement in some cases (see Item 3.1 in Exception 3 of CBC Section 1027.6 for open-ended corridors), where specific guidance is not provided, the provisions of the standard could be used to eliminate the sprinklers even though the egress element is essentially enclosed with only something minor leaving it "open" and unconditioned. The added scoping establishes priority over the standard and thus mandates that the sprinkler protection is required in these situations even though it may generally be exempt under the standard itself.

Code users should not view these changes as modifications to the CBC provisions such as Exception 3 in Section 1027.6, but instead view it as limiting the exemptions that the NFPA 13R standard would otherwise allow. Where a building is not required to be sprinklered, it is not the intent that this section would require a sprinkler system to be installed in these listed locations. This subsection of Section 903.3.1.2 is only applicable where some other provision (such as Section 903.2.8) has already required the sprinkler system to be installed, and once that occurs, Section 903.3.1.2.2 mandates that the required system also be extended into these elements of the means of egress even though the NFPA 13R standard indicates that the protection is not needed due to being "open" and unconditioned.

Another point to emphasize is that while Section 903.3.1.2.1 does require the NFPA 13R sprinkler protection to be extended onto the balconies and decks, it is important to recognize the difference in the scoping of that section compared to egress balconies addressed by Item 5 of the new text. While Section 903.3.1.2.1 regulates the balconies and decks "of dwelling units and sleeping units" under two conditions, the new text in Section 903.3.1.2.2 applies to "egress balconies" that serve as a part of the means of egress system and may serve the overall building or areas that are not a part of a dwelling unit or sleeping unit. Therefore, the spaces regulated by this Item 5 are different than the spaces regulated by Section 903.3.1.2.1.

905.3.1

Standpipes in Parking Garages

CHANGE TYPE: Modification

CHANGE SUMMARY: The standpipe requirements for both open and enclosed parking garages have been modified impacting the type of system, the threshold heights, and the necessary water supply.

2022 CODE TEXT: **905.3.1 Height.** *In other than Group R-3 and R-3.1 occupancies*, Class III standpipe systems shall be installed throughout *each floor where any of the following occur*:

1. *Buildings where the floor level of the highest story is located more than 30 feet (9144 mm) above the lowest level of fire department vehicle access.*
2. *Buildings that are four or more stories in height.*
3. *Buildings where the floor level of the lowest story is located more than 30 feet (9144 mm) below the highest level of fire department vehicle access.*
4. *Buildings that are two or more stories below the highest level of fire department vehicle access.*

Exceptions:

1. *(No changes)*
2. *(No changes)*
3. Class I ~~manual~~ standpipes are allowed in ~~open~~ parking garages ~~where the highest floor is located not more than 150 feet (45 720 mm) above the lowest level of fire department vehicle access~~.

Class I standpipe in parking garage.

4. ~~Class I manual dry standpipes are allowed in open parking garages that are subject to freezing temperatures, provided that the hose connections are located as required for Class II standpipes in accordance with Section 905.5.~~

~~5~~4. *(No changes)*

~~6~~5. *(No changes)*

~~7~~6. *(No changes)*

~~7.1~~6.1. *(No changes)*

~~7.2~~6.2. *(No changes).*

CHANGE SIGNIFICANCE: Consistent with revisions to Section 903.2.10 mandating sprinkler systems in larger open parking garages, it has also been recognized that both the materials and fuel types used in vehicles have changed. Therefore, it is important that fire fighters have a water supply available where open parking garages require sprinkler protection. As with any multiple-story building, it is important that quick action is taken to get water onto a fire to limit its growth and potentially extinguish it, thereby protecting both life and property. Where buildings exceed the threshold limits, a Class III standpipe system must typically be installed. These systems are established not only for use by the fire department but are also provided with smaller hose connections that allow for the building occupants to fight the fire during its incipient stages. With the use of lighter weight and thinner metals, along with more synthetic combustible materials being used in the construction of the vehicles and a wider variety of fuel types, there is now a greater potential for larger multiple-vehicle fires within parking garages. Thus, the exceptions have been modified to provide the necessary water supply for the parking garage and accelerate the fire department's response to any vehicle fire.

Exception 3 previously provided an important exemption for open parking garages. Instead of a Class III standpipe system, a Class I could be installed under specified conditions. Class I systems are intended for fire fighter operations and are not intended for occupant use. These Class I systems could have been "manual" systems that either did not have their own water supply or had an inadequate water supply to meet the anticipated demand. The Class I manual systems were limited to a maximum of 150 feet, at which point a compliant water supply was required. All aspects of the exception were in recognition of the lower hazard level that open parking garages were viewed as having. With the revisions, the exception is now applicable to both open and enclosed parking garages, but, perhaps more importantly, once the standpipe system is required, the exception will no longer address the type of water supply that is required.

The deletion of Exception 4 will result in applying the exception in Section 905.8 to determine the type of water supply to be used for the standpipe system in open parking garages where freezing is a concern. Section 905.3.1 addresses the class of standpipe system to be used, and Section 905.8 will address the type of water supply for the system. The combined impact of revising the two exceptions results in allowing a designer to select which type of water supply can be used for the standpipe system in an open parking garage. This could include automatic, semi-automatic or even a manual system, and those automatic or manual systems could also be either wet or dry pipe systems.

CHANGE TYPE: Addition

907.2.6.4
Group I-4

CHANGE SUMMARY: The State Fire Marshal has added automatic smoke detection throughout Group I-4 occupancies.

2022 CODE TEXT: ***907.2.6.4 Group I-4.*** *An automatic smoke detection system shall be installed throughout the Group I-4, including contiguous day rooms, group activity spaces and other common spaces normally occupied by the clients. Group I-4 facilities located above the first story shall comply with the provisions of Section 436.1.*

CHANGE SIGNIFICANCE: The language now requires automatic smoke detection throughout the Group I-4 to include day rooms, group activity spaces and other common spaces in these large family day-cares. These changes were made in conjunction with the changes previously referenced for the definition of day-care in Section 202. Previously, the section for Fire Alarm and Detection of I-4 Occupancies only required one manual fire alarm box and the actuation of a fire alarm signal; however, this requirement now adds smoke detection to these occupancy groups and increases the fire and life safety based on the additional level of protection for the occupants.

A ceiling-mounted automatic smoke detector.

907.2.10

Manual Alarms in Group S Buildings

CHANGE TYPE: Addition

CHANGE SUMMARY: A manual fire alarm system is now required in self-storage facilities that are three stories or more in height and have interior corridors.

2022 CODE TEXT: **907.2.10 Group S.** A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group S public- and self-storage occupancies three stories or greater in height for interior corridors and interior common areas. Visible notification appliances are not required within storage units.

> **Exception:** Manual fire alarm boxes are not required where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1, and the occupant notification appliances will activate throughout the notification zones upon sprinkler water flow.

CHANGE SIGNIFICANCE: Manual fire alarm systems are now required in self-storage facilities that consist of three or more stories and have interior corridors or interior common areas. A multiple-story self-storage building often has dozens, if not hundreds, of storage units, each with a different owner or renter. The users know how to access their unit, but typically are not familiar with the entire facility. It is important that notification to the various occupants who could be inside the building at any one time be provided by a fire alarm system.

Storage building requiring a fire alarm.

Visible notification appliances are not required within the storage units. Thus the visual alarm appliances are only required in the interior corridors and common areas. In addition, manual fire alarm boxes are not required if the building is sprinklered. Section 903.4.2 mandates that where a fire alarm system is installed, the sprinkler system shall be monitored by the fire alarm system and shall activate the fire alarm system when the sprinkler operates. Therefore, this exception results in the elimination of the manual fire alarm boxes (pull stations) but retains the audible and visible notification devices. Section 907.2 states that when the code allows the elimination of manual fire alarm boxes due to the installation of fire sprinklers, at least one manual fire alarm box must be installed at an approved location.

907.2.11.8

Specific Location Requirements (Smoke Alarms and Detectors)

Ceiling-mounted smoke alarm.

CHANGE TYPE: Modification

CHANGE SUMMARY: The State Fire Marshal has revised the required locations of smoke detectors in R-2, R-2.1, R-2.2, R-3, R-3.1, R-4 and R-4.1.

2022 CODE TEXT: ***~~907.2.10.8~~ 907.2.11.8 Specific location requirements.*** *Extract from NFPA 72 Section ~~29.8.3.4~~ 29.11.3.4 Specific Location Requirements.* This extract has been provided by NFPA ~~as amended by~~ for the Office of the State Fire Marshal ~~and adopted~~ adoption by reference as follows:*

> ***~~29.8.3.4~~ 29.11.3.4 Specific location requirements.*** *The installation of smoke alarms and smoke detectors shall comply with the following requirements:*
>
> *(1) Smoke alarms and smoke detectors shall not be located where ambient conditions, including humidity and temperature, are outside the limits specified by the manufacturer's published instructions.*
>
> *(2) Smoke alarms and smoke detectors shall not be located within unfinished attics or garages or in other spaces where temperatures can fall below 40°F (4°C) or exceed 100°F (38°C).*
>
> *(3) Where the mounting surface could become considerably warmer or cooler than the room, such as a poorly insulated ceiling below an unfinished attic or an exterior wall, smoke alarms and smoke detectors shall be mounted on an inside wall.*
>
> *(4) Smoke alarms ~~or~~ and smoke detectors shall not be installed within an area of exclusion determined by a 10-foot (3.0 m) radial distance along a horizontal flow path from a stationary or fixed cooking appliance, unless listed for installation in close proximity to cooking appliances. Smoke alarms and smoke detectors installed between 10 feet (3.0 m) and 20 feet (6.1 m) along a horizontal flow path from a stationary or fixed appliance shall be equipped with an alarm-silencing means or use photoelectric detection. ~~be installed a minimum of 20 feet horizontal distance from a permanently installed cooking appliance.~~*

**For additional requirements or clarification, see NFPA 72.*

~~***Exceptions:***~~

~~*1. Ionization smoke alarms with an alarm silencing switch or Photoelectric smoke alarms shall be permitted to be installed 10 feet (3 m) or greater from a permanently installed cooking appliance.*~~

~~*2. Photoelectric smoke alarms shall be permitted to be installed greater than 6 feet (1.8 m) from a permanently installed cooking appliance where the kitchen or cooking area and adjacent spaces have no clear interior partitions and the 10-foot distances would prohibit the placement of a smoke alarm or smoke detector required by other sections of the code.*~~

~~*3. Smoke alarms listed for use in close proximity to a permanently installed cooking appliance.*~~

(5) Smoke alarms or smoke detectors that use photoelectric detection shall be permitted for installation at a radial distance greater than 6 feet (1.8 m) from any stationary or fixed cooking appliance when both of the following conditions are met:

(a) The kitchen or cooking area and adjacent spaces have no clear partitions or headers.

(b) The 10-foot (3.0 m) area of exclusion would prohibit the placement of a smoke alarm or smoke detector required by other sections of this code.

~~*Installation near bathrooms. Smoke alarms shall be installed not less than a 3-foot (0.91 m) horizontal distance from the door or opening of a bathroom that contains a bathtub or shower unless this would prevent placement of a smoke alarm required by other sections of the code.*~~

(6) Effective January 1, 2022, smoke alarms and smoke detectors installed between 6 feet (1.8 m) and 20 feet (6.1 m) along a horizontal flow path from a stationary or fixed cooking appliance shall be listed for resistance to common nuisance sources from cooking. ~~*1Smoke alarms and smoke detectors shall not be installed within a 36 in. (910 mm) horizontal path from the supply registers of a forced air heating or cooling system and shall be installed outside of the direct airflow from those registers.*~~

(7) Smoke alarms and smoke detectors shall not be installed within a 36-inch (910 mm) horizontal path from a door to a bathroom containing a shower or tub unless listed for installation in close proximity to such locations. ~~*the tip of the blade of a ceiling-suspended (paddle) fan.*~~

(8) Smoke alarms and smoke detectors shall not be installed within a 36-inch (910 mm) horizontal path from the supply registers of a forced air heating or cooling system and shall be installed outside of the direct airflow from those registers. ~~*Where stairs lead to other occupied levels, a smoke alarm or smoke detector shall be located so that smoke rising in the stairway cannot be prevented from reaching the smoke alarm or smoke detector by an intervening door or obstruction.*~~

(9) Smoke alarms and smoke detectors shall not be installed within a 36-inch (910 mm) horizontal path from the tip of the blade of a ceiling-suspended (paddle) fan unless the room configuration restricts meeting this requirement. ~~*For stairways leading up from a basement, smoke alarms or smoke detectors shall be located on the basement ceiling near the entry to the stairs.*~~

(10) Where stairs lead to other occupied levels, a smoke alarm or smoke detector shall be located so that smoke rising in the stairway cannot be prevented from reaching the smoke alarm or smoke detector by an intervening door or obstruction. ~~*For tray-shaped ceilings (coffered ceilings), smoke alarms and smoke detectors shall be installed on the highest portion of the ceiling or on the sloped portion of the ceiling within 12 in. (300 mm) vertically down from the highest point.*~~

(11) For stairways leading up from a basement, smoke alarms or smoke detectors shall be located on the basement ceiling near the entry to the stairs. ~~*Smoke alarms and detectors installed in rooms with joists or beams shall comply with the requirements of 17.7.3.2.4.*~~

(12) For tray-shaped ceilings (coffered ceilings), smoke alarms and smoke detectors shall be installed on the highest portion of the ceiling or on the sloped portion of the ceiling within 12 inches (300 mm) vertically down from the highest point. ~~*Heat alarms and detectors installed in rooms with joists or beams shall comply with the requirements of 17.6.3.*~~

(13) Smoke alarms and detectors installed in rooms with joists or beams shall comply with the requirements of 17.7.3.2.4 of NFPA 72.

(14) Heat alarms and detectors installed in rooms with joists or beams shall comply with the requirements of 17.6.3 of NFPA 72.

CHANGE SIGNIFICANCE: Section 907.2.11 requires that single- or multiple-station smoke alarms shall be installed and maintained in Groups R-2, R-2.1, R-2.2, R-3, R-3.1 and R-4 regardless of occupant load at the specific locations contained within Section 907.2.11.8. The language contained within the section is an extract from NFPA 72 that was amended by the State Fire Marshal. The language was amended to include additional language and options for smoke alarm and smoke detector locations near fixed cooking appliances based upon the type of alarm and its listing.

907.5.2.1.3

Fire Alarm Occupant Notification

CHANGE TYPE: Modification

CHANGE SUMMARY: Where a fire alarm system is required in Group R-1 and R-2 occupancies, a low-frequency signal shall be used in the sleeping rooms to improve the waking effectiveness of the occupant notification devices.

2022 CODE TEXT: **907.4 Initiating devices.** Where ~~manual or automatic alarm initiation is required as part of a fire alarm system, the initiating~~ a fire alarm system is required by another section of this code, occupant notification in accordance with Section 907.5 shall be initiated by one or more of the following. Initiating devices shall be installed in accordance with Sections 907.4.1 through 907.4.3.1.

1. Manual fire alarm boxes.
2. Automatic fire detectors.
3. Automatic sprinkler system waterflow devices.
4. Automatic fire-extinguishing systems.

907.5 Occupant notification ~~systems~~. ~~A fire alarm system shall annunciate at the fire alarm control unit and shall initiate occupant notification upon activation,~~ Occupant notification by fire alarms shall be in accordance with Sections 907.5.1 through 907.5.2.3.3. ~~Where a fire alarm system is required by another section of this code, it shall be activated by:~~ Occupant notification by smoke alarms in Groups R-1 and R-2 occupancies shall comply with Section 907.5.2.1.3.2.

~~1. Automatic fire detectors.~~

~~2. Automatic sprinkler system waterflow devices.~~

~~3. Manual fire alarm boxes.~~

~~4. Automatic fire-extinguishing systems.~~

Sleeping room in R-1 hotel.

~~Exception:~~ ~~Where notification systems are allowed elsewhere in Section 907 to annunciate at a constantly attended location.~~

907.5.1 Alarm activation and annunciation. Upon activation, fire alarm systems shall initiate occupant notification and shall annunciate at the fire alarm control unit, or where allowed elsewhere by Section 907, at a constantly attended location.

~~907.5.1~~ 907.5.1.1 Presignal feature. A presignal feature shall ~~not~~ be ~~installed unless~~ provided only where approved ~~by the fire code official~~. ~~Where a~~ The presignal ~~feature is provided, a signal~~ shall be annunciated at an approved constantly attended location, ~~approved by the fire code official, so that occupant notification can be activated~~ having the capability to activate the occupant notification system in the event of a fire or other emergency.

Exception: *A presignal feature shall not be permitted to be installed in a Group I-2, I-2.1 or R-2.1 occupancy.*

907.5.2 Alarm notification appliances. *(No change)*

907.5.2.1 Audible alarms. *(No change)*

907.5.2.1.1 Average sound pressure. *(No change)*

907.5.2.1.2 Maximum sound pressure. The ~~maximum~~ total sound pressure level ~~for audible alarm~~ produced by combining the ambient sound pressure level with all audible notification appliances operating shall ~~be~~ not exceed 110 dBA at the minimum hearing distance from the audible appliance. Where the average ambient noise is greater than ~~95~~ 105 dBA, visible alarm notification appliances shall be provided in accordance with NFPA 72 and audible alarm notification appliances shall not be required.

907.5.2.1.3 Audible signal frequency in Group R-1 and R-2 sleeping rooms. Audible signal frequency in Group R-1 and R-2 occupancies shall be in accordance with Sections 907.5.2.1.3.1 and 907.5.2.1.3.2.

907.5.2.1.3.1 Fire alarm system signal. In sleeping rooms of Group R-1 and R-2 occupancies, the audible alarm activated by a fire alarm system shall be a 520-Hz low-frequency signal complying with NFPA 72.

907.5.2.1.3.2 Smoke alarm signal in sleeping rooms. In sleeping rooms of Group R-1 and R-2 occupancies that are required by Section 907.2.8 or 907.2.9 to have a fire alarm system, the audible alarm signal activated by single- or multiple-station smoke alarms in the dwelling unit or sleeping unit shall be a 520-Hz signal complying with NFPA 72. Where a sleeping room smoke alarm is unable to produce a 520-Hz signal, the 520-Hz alarm signal shall be provided by a listed notification appliance or a smoke detector with an integral 520-Hz sounder.

CHANGE SIGNIFICANCE: Where a fire alarm system is required in Group R-1 and R-2 occupancies, the fire alarm system signal in the sleeping area must be a 520 Hz low-frequency signal that complies with NFPA 72. In addition, where a fire alarm system is mandated, all single- or multiple-station smoke alarms that are located within the sleeping rooms are to also provide a 520 Hz signal. It is important to note that the low-frequency signal for the smoke alarms is only required if the Group R-1 or R-2 occupancy is required to have a fire alarm system. This limitation is due to the limited number of smoke alarms that are currently available and capable of meeting the low-frequency requirement.

The low-frequency (520 Hz) audible fire alarm signal has been shown to improve the waking effectiveness for several high-risk segments of the population. Research has shown that the low frequency is six times more effective than the standard 3 kHz signal at waking the high-risk occupants (such as people over 65 who are hard of hearing, school-age children and people who are alcohol impaired). While NFPA 72 does recognize the effectiveness of the low-frequency alarm signal by requiring it in sleeping rooms of hotels, dormitories and apartment buildings with a fire alarm system, it is only required for smoke alarm systems on a voluntary basis or as the need is identified for persons with hearing loss. This difference in the audible signal requirement between a fire alarm and smoke alarm system has caused confusion and inconsistent application. Therefore, in the case of smoke alarms, Section 907.5.2.1.3.2 will provide the scoping for the low-frequency alarm signal and take precedence over the scoping provisions in Chapter 29 of NFPA 72.

As previously addressed, it is important to review and understand the provisions in Section 907.5.2.1.3.2 since there are currently very few smoke alarms capable of providing the 520 Hz alarm signal, especially when operating in the battery backup mode. However, there are several product solutions that are currently available and capable of providing the 520 Hz signal. These include (a) fire alarm system horns and horn/strobes, (b) smoke detectors with integral sounder bases, and (c) speakers connected to an Emergency Voice Alarm Communication (EVAC) system.

The remaining changes, particularly those in Section 907.4 and 907.5, are primarily an editorial reformatting with Section 907.4 focusing on the initiating devices and Section 907.5 addressing the occupant notification aspects of the system.

909.20

Smokeproof Enclosures

CHANGE TYPE: Modification

CHANGE SUMMARY: A new alternative method of pressurizing both the stair enclosure and the vestibule relative to the fire floor has been established for smokeproof enclosures.

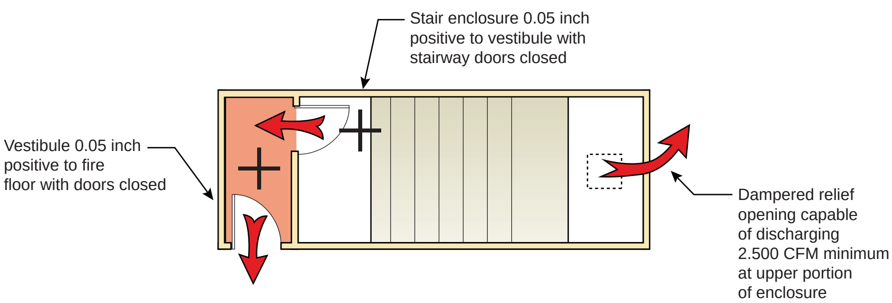
2022 CODE TEXT: **909.20 Smokeproof enclosures.** Where required by Section 1023.12, a smokeproof enclosure shall be constructed in accordance with this section. A smokeproof enclosure shall consist of an interior exit stairway or ramp that is enclosed in accordance with the applicable provisions of Section 1023 and an open exterior balcony ~~or~~, ventilated vestibule or pressurized stair and pressurized entrance vestibule meeting the requirements of this section. Where access to the roof is required by the *California Fire Code*, such access shall be from the smokeproof enclosure where a smokeproof enclosure is required.

909.20.6 Pressurized stair and vestibule alternative. The provisions of Sections 909.20.6.1 through 909.20.6.3 shall apply to smokeproof enclosures using a pressurized stair and pressurized entrance vestibule.

909.20.6.1 Vestibule doors. The door assembly from the building into the vestibule shall be a fire door assembly complying with Section 716.2.2.1. The door assembly from the vestibule to the stairway shall not have less than a 20-minute fire protection rating and meet the requirements for a smoke door assembly in accordance with Section 716.2.2.1. The door shall be installed in accordance with NFPA 105.

909.20.6.2 Pressure difference. The stair enclosure shall be pressurized to not less than 0.05 inch of water gage (12.44 Pa) positive pressure relative to the vestibule with all stairway doors closed under the maximum anticipated stack pressures. The vestibule, with doors closed, shall have not less than 0.05 inch of water gage (12.44 Pa) positive pressure relative to the fire floor. The pressure difference across doors shall not exceed 30 pounds (133-N) maximum force to begin opening the door.

909.20.6.3 Dampered relief opening. A controlled relief vent having the capacity to discharge not less than 2,500 cubic feet per minute (1180 L/s) of air at the design pressure difference shall be located in the upper portion of the pressurized exit enclosure.



Smokeproof enclosure – alternative option.

~~909.20.6~~ 909.20.7 *Pressurization* equipment. The activation of *pressurization* equipment required by the alternatives in Sections 909.20.4, 909.20.5 and ~~909.20.5~~ 909.20.6 shall be by smoke detectors installed at each floor level at an approved location at the entrance to the smokeproof enclosure *and upon activation of the automatic controls required by Section 909.12.4*. When the closing device for the stairway and ramp shaft and vestibule doors is activated by smoke detection or power failure, the mechanical equipment shall activate and operate at the required performance levels. Smoke detectors shall be installed in accordance with Section 907.3.

CHANGE SIGNIFICANCE: Another means of creating and protecting smokeproof enclosures has been added to ensure that smoke entry is limited and will not impact the means of egress. Currently, a smokeproof enclosure is permitted to be constructed using either a naturally- or mechanically-ventilated vestibule, or, alternatively, without a vestibule by pressurizing the enclosure itself relative to the fire floor. This new option allows for a combination of the existing methods by including a vestibule and using the pressurization between the vestibule and the fire floor, as well as the pressure difference between the exit enclosure and the vestibule, to minimize or prevent smoke from entering into the enclosure. Essentially, the smoke would need to "swim upstream" by first overcoming the pressure to enter the vestibule, and then overcoming the additional pressure that comes from the exit enclosure itself.

An arrangement very similar to this was previously allowed by one of the CBC legacy codes and has been used effectively for several decades. Perhaps the easiest way to conceptually think about the difference between this new option and Section 909.20.4 (Mechanical Ventilation Alternative) is that instead of the vestibule inviting the smoke to enter and then capturing and exhausting the smoke out, as Section 909.20.4.2 would do, the new method attempts to discourage the smoke from even entering the vestibule by placing a positive pressure differential in the vestibule to force the smoke away from it. Therefore, the goal is to not allow the smoke to enter into the vestibule in the first place.

This new fourth option for constructing smokeproof enclosures will work well for high-rise buildings where the height of the building and outdoor air temperatures cause stack effect conditions. In taller buildings where these pressure differences caused by the stack effect get larger, it can make the pressurization option of Section 909.20.5 more difficult to design, implement and properly control so that it is effective. By using a vestibule that is pressurized, it essentially creates an "airlock" between the stairway and the remainder of the building and thus makes it easier to maintain the pressure difference of 0.10 inch of water (25 Pa) within the exit without over pressurizing the stair. Depending on the design and the required pressures, this new option may be less expensive to design, construct and maintain than the ventilated vestibule option that is allowed by Section 909.20.4.2. In some situations, leakage under or around the door separating the stairway from the vestibule may be sufficient to pressurize the vestibule without the need for additional ductwork or fans as would be needed for the vestibules required by Section 909.20.4.2 and the long-standing mechanical ventilation alternative.

911

Fire Command Centers in Groups F-1 and S-1

CHANGE TYPE: Modification

CHANGE SUMMARY: A fire command center is now required in buildings housing Group F-1 or S-1 occupancies where the building footprint is over 500,000 square feet in size.

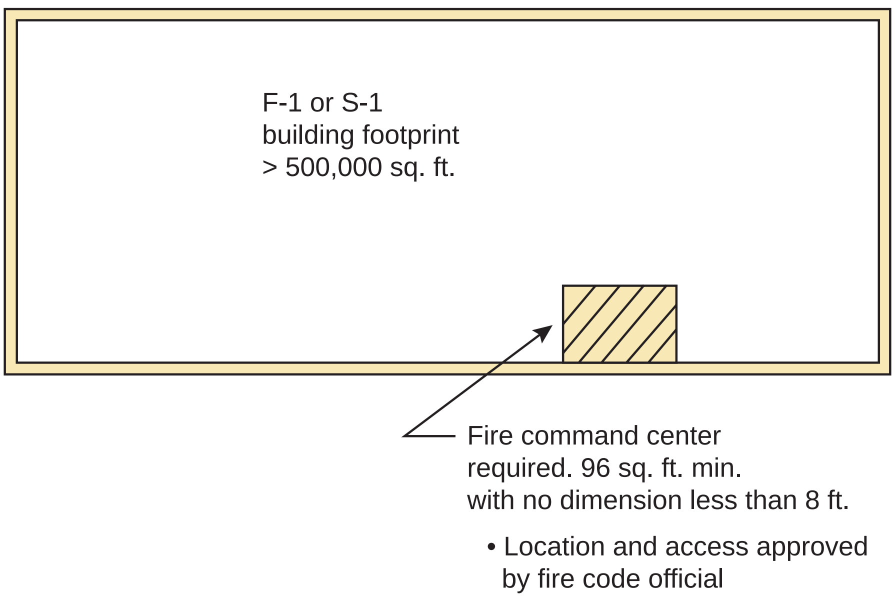
2022 CODE TEXT: **911.1 General.** Where required by other sections of this code, and in buildings classified as high-rise buildings by this code <u>and in all F-1 and S-1 occupancies with a building footprint of over 500,000 square feet (46 452 m^2)</u> *and Group I-2 occupancies having occupied floors located more than 75 feet above the lowest level of fire department vehicle access*, a fire command center for fire department operations shall be provided and shall comply with Sections 911.1.1 through ~~911.1.6~~ <u>911.1.7</u>.

911.1.1 Location and access. The location and <u>access</u> ~~accessibility of~~ <u>to</u> the fire command center shall be approved by the fire code official.

911.1.2 Separation. *(No changes)*

911.1.3 Size. The fire command center shall be not less than 0.015 percent of the total building area of the facility served or 200 square feet (19 m^2) in area, whichever is greater, with a minimum dimension of 0.7 times the square root of the room area or 10 feet (3048 mm), whichever is greater. <u>Where a fire command is required for Group F-1 and S-1 occupancies with a building footprint greater than 500,000 square feet (46 452 m^2) in area, the fire command center shall have a minimum size of 96 square feet (9 m^2) with a minimum dimension of 8 feet (2348 mm) where approved by the fire code official.</u>

911.1.4 Layout approval. *(No changes)*



Required fire command center in F-1 and S-1.

911.1.5 Storage. *(No changes)*

911.1.6 Required features. *(No changes)*

911.1.7 Fire command center identification. The fire command center shall be identified by a permanent easily visible sign stating "FIRE COMMAND CENTER" located on the door to the fire command center.

CHANGE SIGNIFICANCE: Buildings with a large footprint can present many challenges to fire department access to fight a fire. Providing a protected fire command center in these types of large buildings will allow the fire department's incident commander to see at a glance where the fire is, the building layout and the status of any active fire protection so they can quickly see the problem and develop a strategy to address and control it. The fire command center criteria for these large and complex buildings essentially remain unchanged, except for a clarification regarding access and a mandate for identification of the space. The more significant change is the mandate that extremely large manufacturing and storage buildings must now also be provided with a complying fire command center.

In Section 911.1.1, the term "accessibility" was replaced with "access" to avoid confusion with the requirements related to disability access set forth in Chapter 11. As a side note, Exception 3 to Section 1110.15 provides a reference to ICC A117.1 standard that eliminates the accessibility requirements for devices that are "used only for emergencies by emergency personnel acting in their official capacity." In addition, the new Section 911.7 now requires that a fire command center be identified with a sign located on the door.

High-rise buildings have historically been the only building type where fire command centers are required. Now, buildings housing Group F-1 manufacturing occupancies and/or Group S-1 storage occupancies must be provided with a fire command center where the building exceeds 500,000 square feet in floor area. The floor area threshold and applicable occupancies were selected based on the complexity of operations for fighting a fire in such a large building that does not always allow for a quick assessment of the tactical situation. In addition, the fire loading conditions can be significant. Providing a fire command center will allow the incident commander to identify at a glance, from a protected location, the building layout, the fire location and any active fire protection to establish the best strategy to mitigate the problem.

The criteria for central control centers are essentially consistent regardless of building type. As the only departure from the general requirements, the minimum required room size has been reduced for Group F-1 and S-1 buildings to a minimum 96 square-foot floor area with no dimension less than 8 feet. However, this reduced size can only be applied "where approved by the fire code official."

Although the features set forth in Sections 911.1.6 are required, it is apparent that a number of them may not be present in Group F-1 or S-1 buildings. It is intended that only those features that exist in the building are to be addressed, not necessarily all 18 items. As an example, the building may not include an elevator, and, thus, the recall feature in Item 17 would not be applicable.

PART 4

Means of Egress

Chapter 10

- **Chapter 10** Means of Egress

The criteria set forth in Chapter 10 regulating the design of means of egress are established as the primary method for protection of people in buildings. Both prescriptive and performance language is utilized in the chapter to provide for a basic approach in the determination of a safe exiting system for all occupancies. Chapter 10 addresses all portions of the egress system and includes design requirements as well as provisions regulating individual components. A zonal approach to egress provides a general basis for the chapter's format through the regulation of the exit access, exit, and exit discharge portions of the means of egress. ■

1006.2.1
Egress from Mechanical Rooms and Penthouses

1006.3
Egress from Occupied Roofs

1006.3.4
Single Exit Stories

1008.2.1
Stairway Illumination

1009.2.1
Accessible Elevators to Occupied Roofs

1009.6.2
Areas of Refuge

1009.6.3, 3008.6.4
Area of Refuge Floor Space

1010.1.1
Door Widths

1010.1.1.1
Projections into Door Openings

1010.1.3
Door Opening Forces

1010.2.4
Locks and Latches

1010.2.8

Locking Arrangements in Group I-4

1011.6

Stairway Landings

1016.2

Egress Through Intervening Spaces

1019.3

Exit Access Stairways

1020.5

Dead-End Corridors

1030.16

Handrails at Social Stairs

1031

Emergency Escape and Rescue Openings

1006.2.1

Egress from Mechanical Rooms and Penthouses

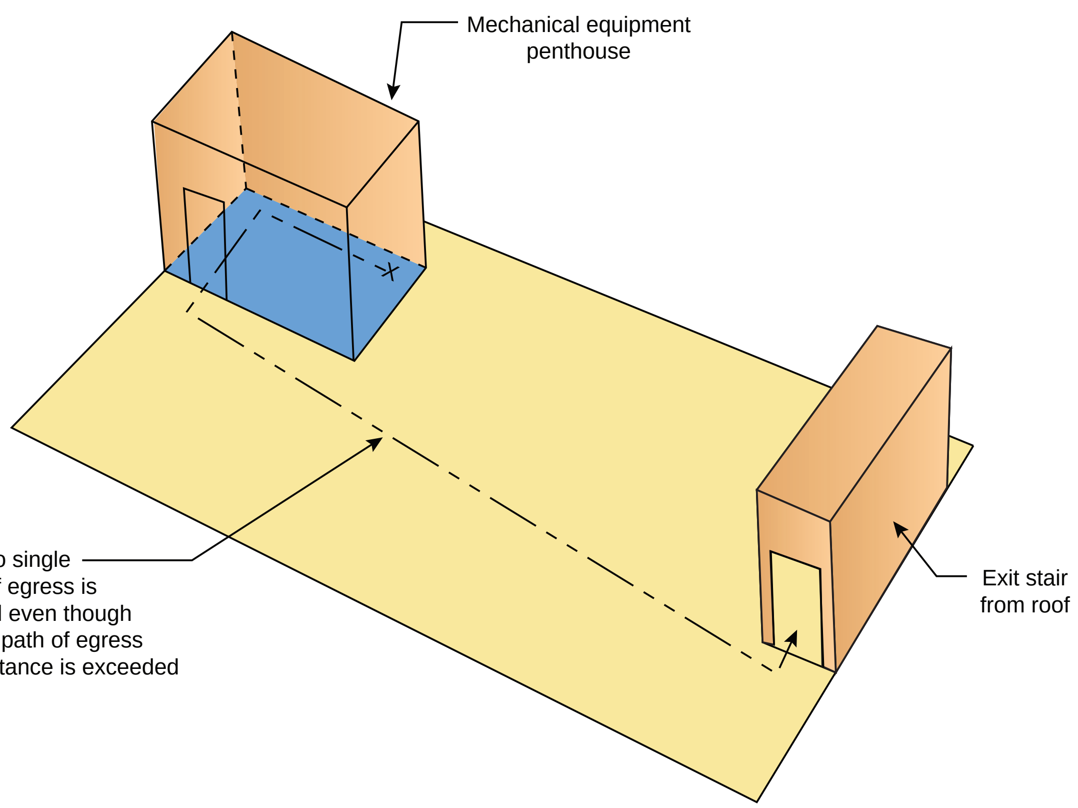
CHANGE TYPE: Modification

CHANGE SUMMARY: The common path of travel distance limitations for unoccupied mechanical rooms and penthouses have been eliminated.

2022 CODE TEXT: **1006.2.1 Egress based on occupant load and common path of egress travel distance.** Two exits or exit access doorways from any space shall be provided where the design occupant load or the common path of egress travel distance exceeds the values listed in Table 1006.2.1. The cumulative occupant load from adjacent rooms, areas or spaces shall be determined in accordance with Section 1004.2.

Exceptions:

1. The number of exits from foyers, lobbies, vestibules or similar spaces need not be based on cumulative occupant loads for areas discharging through such spaces, but the capacity of the exits from such spaces shall be based on applicable cumulative occupant loads.
2. *Rooms and* care suites in Group I-2 *and I-2.1* occupancies complying with Section 407.4.

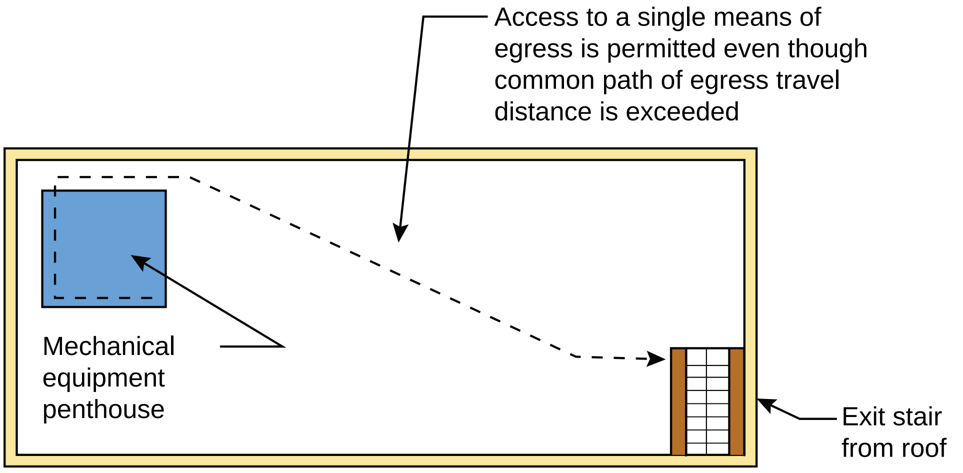


Egress from penthouse.

3. Unoccupied mechanical rooms and penthouses are not required to comply with the common path of egress travel distance measurement.
4. *In detention and correctional facilities and holding cells, such as are found in courthouse buildings, when the occupant load is more than 20 see Section 408.3.11.*

CHANGE SIGNIFICANCE: Generally, spaces with only a single means of egress are limited to both a small occupant load and travel distance by Table 1006.2.1. In areas like unoccupied mechanical rooms and penthouses, this limitation on the travel distance to reach the exit within the "common path of travel" distance would occasionally result in the need for an additional means of egress. This mandate could apply even though the rooms might have a very low occupant load or typically only be occupied during the periods when technicians were performing routine maintenance or during the replacement of the equipment. While some jurisdictions may have viewed these as unoccupied spaces and used the *California Mechanical Code's* (CMC's) access provisions instead of the *California Building Code's* (CBC's) egress requirements, others did view even a limited occupancy of the space as a trigger for the CBC's egress requirements.

The new exception will continue to regulate these limited use spaces based on the occupant load (Table 1006.2.1) and the exit access travel distance (Table 1017.2) to determine if adequate egress is being provided. The occupants within these spaces will not need to reach the single exit within the travel limitations that are established in Table 1006.2.1.



Roof top plan

1006.3

Egress from Occupied Roofs

CHANGE TYPE: Modification

CHANGE SUMMARY: The means of egress provisions applicable to occupied roofs have been clarified.

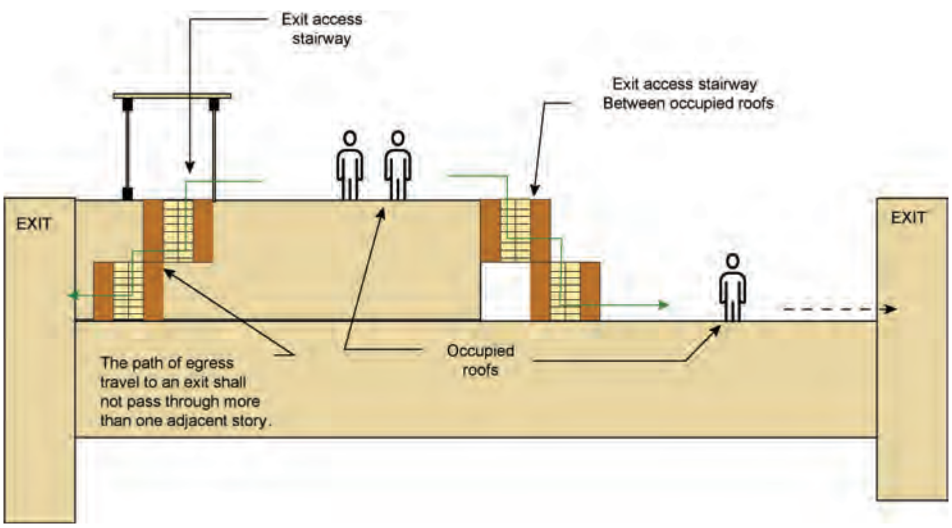
2022 CODE TEXT: **1006.3 Egress from stories or occupied roofs.** The means of egress system serving any story or occupied roof shall be provided with the number of separate and distinct exits or access to exits based on the aggregate occupant load served in accordance with this section. ~~Where stairways serve more than one story, only the occupant load of each story considered individually shall be used in calculating the required number of exits or access to exits serving that story.~~

1006.3.1 Occupant load. Where stairways serve more than one story, or more than one story and an occupied roof, only the occupant load of each story or occupied roof, considered individually, shall be used when calculating the required number of exits or access to exits serving that story.

~~**1006.3.1**~~ **1006.3.2** ~~**Adjacent story.**~~ **Path of egress travel.** The path of egress travel to an exit shall not pass through more than one adjacent story.

Exception: The path of egress travel to an exit shall be permitted to pass through more than one adjacent story in any of the following:

1. In Group R-1, R-2 or R-3 occupancies, exit access stairways and ramps connecting four stories or less serving and contained within an individual dwelling unit, sleeping unit or live/work unit.
2. Exit access stairways serving and contained within a Group R-3 congregate residence or a Group R-4 facility.
3. Exit access stairways and ramps within an atrium complying with Section 404.



Egress from occupied roofs.

<u>4</u>.~~3.~~ Exit access stairways and ramps in open parking garages that serve only the parking garage.

<u>5</u>.~~4.~~ Exit access stairways and ramps serving open-air assembly seating complying with the exit access travel distance requirements of Section ~~1029.7~~ <u>1030.7</u>.

<u>6</u>.~~5.~~ Exit access stairways and ramps between the balcony, gallery or press box and the main assembly floor in occupancies such as theaters, places of religious worship, auditoriums and sports facilities.

<u>7. Exterior exit access stairways and ramps between occupied roofs.</u>

CHANGE SIGNIFICANCE: The trend of clarifying how various code provisions should be applied to occupied roofs continues through these revisions. For years, the only code requirements specific to occupied roofs were that they meet the increased structural loading and that they needed to be provided with a means of egress in the same manner as stories; even though they did not meet the definition for being a story. This caused confusion in the application of other provisions that are now starting to be addressed.

Previously, it was clearly stated that only the occupant load of a single story was to be used for calculating the egress requirements. However, that statement began with the limitation that it applied “where stairways serve more than one story.” As an occupied roof does not meet the definition of a story, an argument could be made that a combined occupant load was intended to be used where a story and an occupied roof were the levels under consideration. Although the change may not seem significant, the simple fact that the code specifically addresses this issue should provide more consistency in application and make understanding the intent easier for code users.

The intent of Exception 3 is to recognize that, although an exit access stairway can generally serve as a portion of the required egress path for travel through only one adjacent story, it is permissible that the egress stairway be unenclosed and connect to multiple stories within an atrium. This coordinates with Exception 5 of Section 1019.3 allowing the exit access stairway to be in the atrium instead of being in a shaft enclosure. Therefore, a traditional open exit access stairway (or a convenience stairway) in an atrium may pass through multiple stories, and, based on this new exception, it could be used for travel through multiple floors before it would need to provide access to a compliant exit element. Because this is an exit access stairway, the travel distance would be limited by both the general requirements of Section 1017 as well as the limits applicable to atriums as established in Section 1017.3.2.

Since an occupied roof does not qualify as a story, the new Exception 7 is simply providing guidance regarding exit access stairways that serve or connect to occupied roofs and allowing a connection to adjacent roof levels. This exception addresses that vertical travel connecting occupied roofs may be provided by exterior exit access stairways, permitted to be unenclosed while serving as a part of the required egress path. Where the egress travel is “between occupied roofs,” as stated in Exception 7, travel is permitted to more than one level; however, if the egress is from an enclosed story, the egress path is only permitted to pass through one adjacent story.

1006.3.4

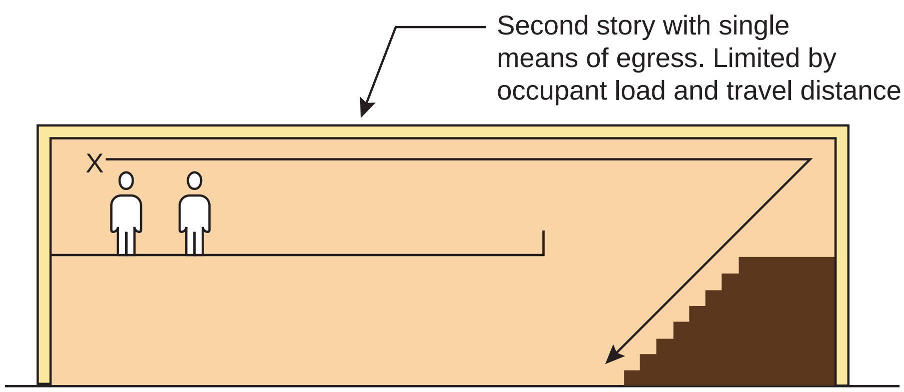
Single Exit Stories

CHANGE TYPE: Modification

CHANGE SUMMARY: For single-exit stories, the travel distance limits are now based on the exit access travel distance as opposed to the common path of egress travel.

2022 CODE TEXT: **~~1006.3.3~~ 1006.3.4 Single exits.** A single exit or access to a single exit shall be permitted from any story or occupied roof where one of the following conditions exists:

1. The occupant load, number of dwelling units and ~~common path of egress~~ exit access travel distance do not exceed the values in Table ~~1006.3.3(1) or 1006.3.3(2)~~ 1006.3.4(1) or 1006.3.4(2).
2. Rooms, areas and spaces complying with Section 1006.2.1 with exits that discharge directly to the exterior at the level of exit discharge, are permitted to have one exit or access to a single exit.



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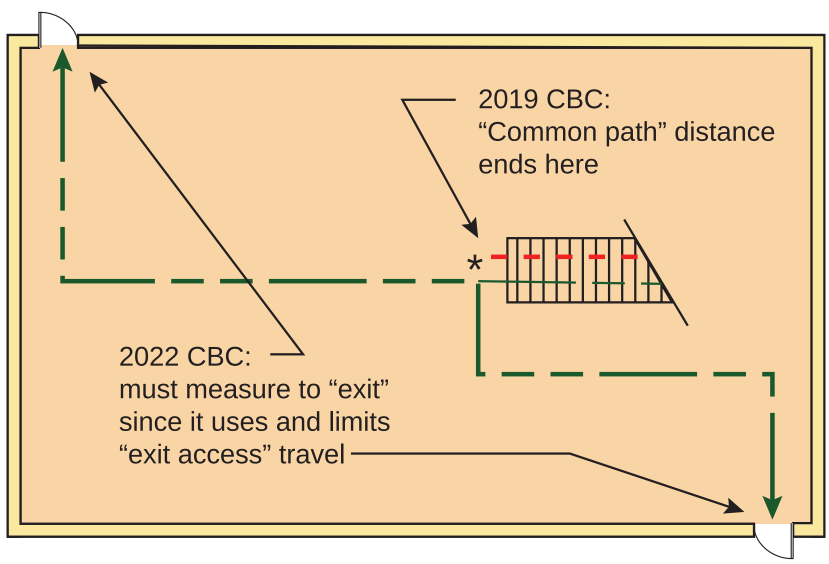


Plan

Example: 2019 "common path" vs. 2022 "exit access".

TABLE ~~1006.3.3(1)~~ 1006.3.4(1) Stories with One Exit or Access to One Exit for R-2 Occupancies

Story	Occupancy	Maximum Number of Dwelling Units	Maximum ~~Common Path of Egress~~ Exit Access Travel Distance
Basement, first, second or third story above grade plane	R-2[a,b]	4 dwelling units	125 feet
Fourth story above grade plane and higher	NP	NA	NA

For SI: 1 foot = 3048 mm.
NP = Not Permitted.
NA = Not Applicable.
a. Buildings classified as Group R-2 equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 and provided with emergency escape and rescue openings in accordance with Section ~~1030~~ 1031.
b. This table is used for R-2 occupancies consisting of dwelling units. For R-2 occupancies consisting of sleeping units, use Table ~~1006.3.3(2)~~ 1006.3.4(2).

TABLE ~~1006.3.3(2)~~ 1006.3.4(2) Stories with One Exit or Access to One Exit for Other Occupancies

Story	Occupancy	Maximum Occupant Load per Story	Maximum ~~Common Path of Egress~~ Exit Access Travel Distance (Feet)
First story above or below grade plane	A, B[b], E, F[b], M, U	49	75
	H-2, H-3	3	25
	H-4, H-5, I, R-1, R-2[a,c]	10	75
	S[b,d]	29	75
Second story above grade plane	B, F, M, S[d]	29	75
Third story above grade plane and higher	NP	NA	NA

For SI: 1 foot = 304.8 mm.
NP = Not Permitted.
NA = Not Applicable.
a. Buildings classified as Group R-2 equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 and provided with emergency escape and rescue openings in accordance with Section ~~1030~~ 1031.
b. Group B, F and S occupancies in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 shall have a maximum exit access travel distance of 100 feet.
c. This table is used for R-2 occupancies consisting of sleeping units. For R-2 occupancies consisting of dwelling units, use Table ~~1006.3.3(1)~~ 1006.3.4(1).
d. The length of exit access travel distance in a Group S-2 open parking garage shall be not more than 100 feet.

3. Parking garages where vehicles are mechanically parked shall be permitted to have one exit or access to a single exit.

4. Group R-3 and R-4 occupancies shall be permitted to have one exit or access to a single exit.

5. Individual single-story or multistory dwelling units shall be permitted to have a single exit or access to a single exit from the dwelling unit provided that both of the following criteria are met:

5.1. The dwelling unit complies with Section 1006.2.1 as a space **with one means of egress.**

5.2. Either the exit from the dwelling unit discharges directly to the exterior at the level of exit discharge, or the exit access outside the dwelling unit's entrance door provides access to not less than two approved independent exits.

CHANGE SIGNIFICANCE: "Common path of egress travel" is generally only applied to locations where a single means of egress is available. It is used as a second condition, along with the occupant load, to determine when a second means of egress is needed from an area. Tables 1006.3.4(1) and 1006.3.4(2) are applicable to stories with a single means of egress and also as an exception for the minimum of two means of egress that are typically required from a story by Table 1006.3.3. At issue was whether it was appropriate to use "common path of egress travel" in a compliant single means of egress space or whether it should be "exit access travel" distance. Although the tabular distances will remain unchanged, the revision will impact the end point of the travel measurement.

Since the "common path" measurement is allowed to end either at the door of an exit, or at the "point where the occupants have separate and distinct access to two exits or exit access doorways", the revision to "exit access travel distance" will mean that the occupants must actually be able to reach the door of an exit within that distance. The travel limit is no longer measured to the point where the egress path can split to lead to two separate exits. Although this difference may not seem significant, it will mean that the occupants must be able to reach the door of an exit within that travel distance limitation and that simply having a divergent path to two means of egress will not be adequate.

Code users will want to remember that the common path of travel continues to be a valid concept and its other applications have been maintained. Section 1006.2 and Table 1006.2.1 regulating single means of egress spaces will continue to use the "common path of egress travel" as the distance measurement, and spaces with a small occupant load and limited travel can be provided with a single means of egress where they can reach a point where they have egress options within that distance limitation. The change is limited to the application of egress from stories as set forth in Section 1006.3, such that a story having a single egress path must comply with the more limited and restrictive "exit access travel distance."

1008.2.1

Stairway Illumination

CHANGE TYPE: Modification

CHANGE SUMMARY: The minimum illumination level for both exit and exit access stairways has been increased from 1 foot-candle to 10 foot-candles.

2022 CODE TEXT: **1008.2.1 Illumination level under normal power.** The means of egress illumination level shall be not less than 1 footcandle (11 lux) at the walking surface. Along exit access stairways, exit stairways and at their required landings, the illumination level shall not be less than 10 footcandles (108 lux) at the walking surface when the stairway is in use.

> **Exception:** For auditoriums, theaters, concert or opera halls and similar assembly occupancies, the illumination at the walking surface is permitted to be reduced during performances by one of the following methods provided that the required illumination is automatically restored upon activation of a premises' fire alarm system:
>
> 1. Externally illuminated walking surfaces shall be permitted to be illuminated to not less than 0.2 footcandle (2.15 lux).
> 2. Steps, landings and the sides of ramps shall be permitted to be marked with self-luminous materials in accordance with Sections 1025.2.1, 1025.2.2 and 1025.2.4 by systems listed in accordance with UL 1994.

CHANGE SIGNIFICANCE: Adequately illuminating the stairways and landings that serve as a part of either the exit or exit access is one of the easiest ways to help improve stairway safety. Increasing the required illumination level will help not only people with low vision and the elderly, but also will allow all stair users to better perceive the location of

Increased illumination required on stairway.

the steps and level changes on the stairways. The 10 foot-candle level has been recognized as an illumination minimum in the ICC A117.1 standard since the 2003 edition. By placing this requirement directly within the CBC, the application of the higher illumination provisions has been expanded.

It is important to note the scoping of the revised provisions:

a. The minimum illumination of 10 foot-candles does not apply to stairs or steps located in the exit discharge due to being limited to "exit access" and "exit" stairways.

b. The stairways are not expected to be continuously illuminated to the 10 foot-candle level, as the increased illumination is only applicable "when the stairway is in use", thus allowing for occupant sensor controls, daylight-responsive controls or other energy saving techniques.

c. The exception for lower lighting levels during performances in assembly occupancies is still applicable.

The general means of egress will continue to use the 1 foot-candle minimum as only the stairways within the exit and exit access portion of the egress path must be illuminated to this higher level "when the stairway is in use."

1009.2.1

Accessible Elevators to Occupied Roofs

CHANGE TYPE: Modification

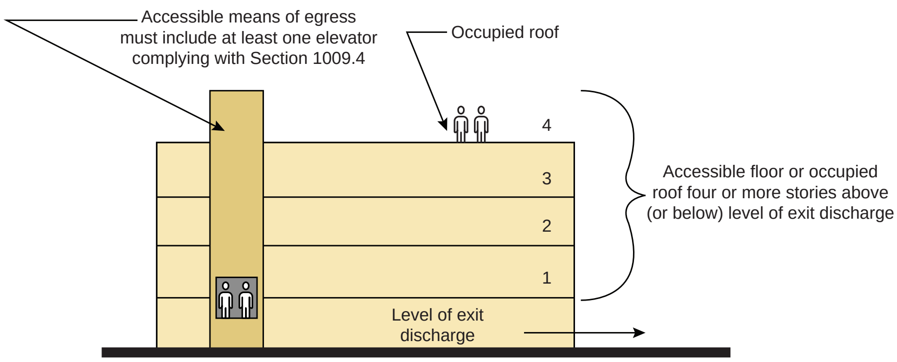
CHANGE SUMMARY: An elevator serving an occupied roof must now be considered as one of the required accessible means of egress where the roof is located directly above the third story above the level of exit discharge.

2022 CODE TEXT: **1009.2.1 Elevators required.** In buildings where a required accessible floor <u>or occupied roof</u> is four or more stories above or below a level of exit discharge, not less than one required accessible means of egress shall be an elevator complying with Section 1009.4.

Exceptions:

1. In buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2, the elevator shall not be required on floors provided with a horizontal exit and located at or above the levels of exit discharge.
2. In buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2, the elevator shall not be required on floors provided with a ramp conforming to the provisions of Section 1012.

CHANGE SIGNIFICANCE: In the 2018 edition, CBC Section 1104.4 was modified to specifically include occupied roofs as also needing to be served by an accessible route similar to how accessible stories in a multiple-story building are addressed. However, even though an accessible route was required to the occupied roof, there was some debate as to how the Accessible Means of Egress (AMOE) provisions applied. The AMOE was clearly applicable to the occupied roof because it is an accessible space and based on the requirements in CBC Section 1009.1. Whether an elevator was required as one of the AMOE was arguable because the provisions of Section 1009.2.1 applied where an accessible floor was four or more stories above a level of exit discharge. For example, if there was an occupied roof on a four-story building, that roof level had only three "stories" between it and the level of exit discharge, and the roof itself did not qualify as a story under the definition of the code. Therefore, there



Accessible means of egress from occupied roof.

were not "four or more stories" above the level of exit discharge and it seemingly would allow stairways or other components to be used for the AMOE. This issue was generally viewed as being adequately addressed since the code had required occupied roofs to be provided with exits as required for stories (see Section 1021.1 in 2009 CBC), but with occupied roofs becoming more common and there being some confusion, it was deemed important to clarify the code's intent.

An occupied roof on a four-story or taller building will now typically impose the requirements of Section 1009.2.1 that an elevator provide "not less than one" of the required accessible means of egress. Having the elevator available for independent or possibly assisted rescue will help emergency responders who would help people from the occupied roof. This will also limit the number of floor levels where people must be carried or assisted down the stairways, as well as generally ensure that people who use wheelchairs will be able to be brought down from above with their chair. Addressing the occupied roof level, even though it is not a "story," should lead to greater consistency when applying the elevator requirement.

1009.6.2

Areas of Refuge

CHANGE TYPE: Modification

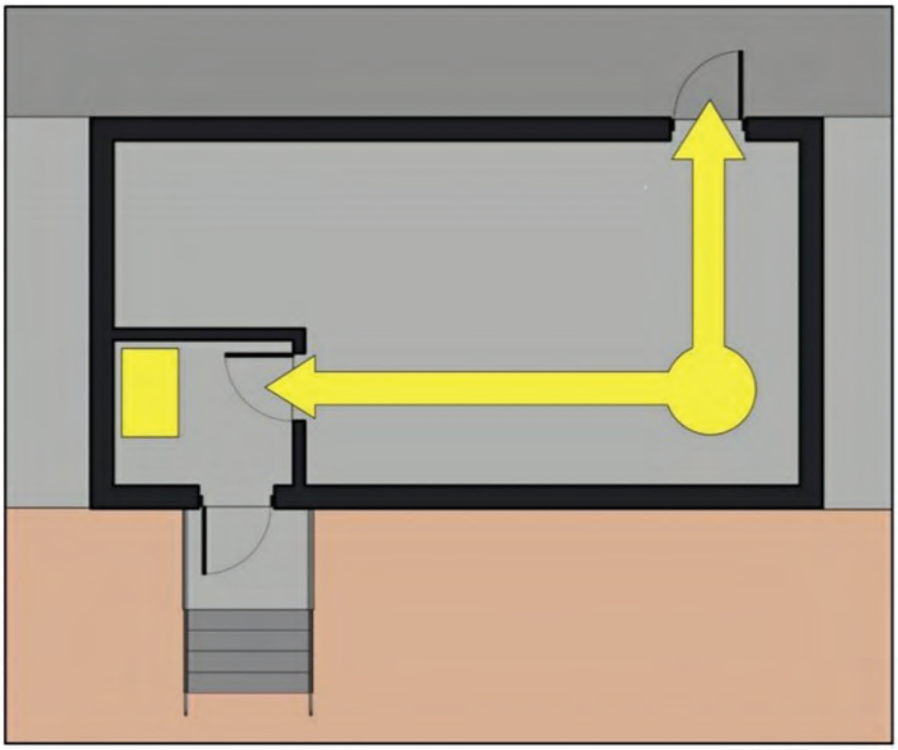
CHANGE SUMMARY: The use of an interior area of refuge at the level of exit discharge instead of an exterior area for assisted rescue is now permitted.

2022 CODE TEXT: **1009.6.2 Stairway or elevator access.** Every required area of refuge shall have direct access to a stairway complying with Sections 1009.3 and 1023 or an elevator complying with Section 1009.4.

> **Exception:** An interior area of refuge at the level of exit discharge that provides direct access to an exterior exit door.

CHANGE SIGNIFICANCE: In general, to consider an area of refuge as a safe location for awaiting assistance, the area of refuge needs to have access to a stairway that is compliant with CBC Section 1009.3 and runs between stories or to an exit stairway complying with Section 1023. In situations like single-story buildings, the safe location was typically put on the exterior of the building in compliance with the provisions for exterior areas for assisted rescue in Section 1009.7. In some situations, due to either location, climate or other factors, an exterior area for assisted rescue may not be possible or desirable.

An example would be a building with different grade elevations on the front and the back of the building. While the front of the building provides for one accessible means of egress at grade level, the second route out the rear of the building is at a level approximately loading dock height with a stairway to grade. With no ability to provide an exterior area for



International Code Council; conceptual credit to U.S. Access Board

Interior area of refuge on level of exit discharge.

assisted rescue at the rear of the building that meant either (1) doing without any protection, ignoring the need for a second accessible means of egress, or (2) locating a second means of egress along the front with what was considered as an inadequate spatial separation. Providing an interior area of refuge was considered to be a reasonable alternative even though it was not technically permitted due to the limitations in Section 1009.3 and 1023.

Although there were concerns regarding the perceived reduction in safety of having a less obvious interior area of refuge instead of an exterior area for assisted rescue at the rear exit, it was recognized that the area of refuge would need to comply with all the applicable provisions and would be permitted on other levels. When using this option for an area of refuge, it is important to remember that many other provisions will still apply. The area of refuge must comply with all the requirements of Section 1009.6, including the need for adequate separation (1009.6.4) and two-way communication (1009.6.5). Signage and instructions as regulated by Sections 1009.9, 1009.10, 1009.11, 1112.1 Item 8 and 1112.4 Items 2 and 3 would be required, making the occupants aware of this area of refuge and its features. In addition, where fire safety or evacuation plans are required by the California Fire Code Section 403, the provisions of Item 4 in CFC Section 404.2.1 and Items 2.3 and 4.4.1 in CFC Section 404.2.2 will ensure the fire department knows the location of these areas of refuge and will check them for people who may need assistance. The applicable CFC requirements along with the two-way communication requirements for all areas of refuge will ensure that people who use these areas of refuge will have a means of requesting and expecting assistance.

1009.6.3, 3008.6.4

Area of Refuge Floor Space

CHANGE TYPE: Modification

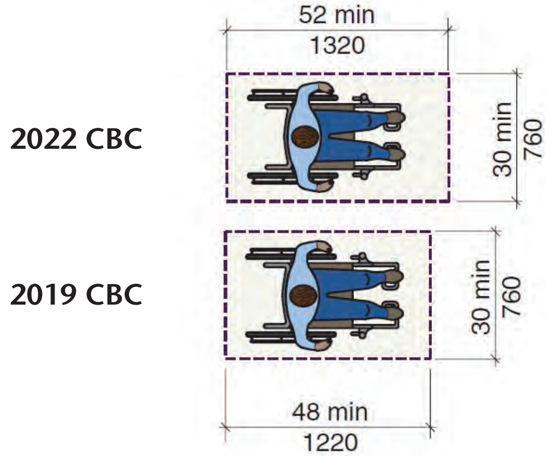
CHANGE SUMMARY: The minimum required size of the clear floor space for a wheelchair has been increased to 30 inches in width by 52 inches in length to coordinate with the 2017 edition of the ICC A117.1 Standard.

2022 CODE TEXT: **1009.6.3 Size.** Each area of refuge shall be sized to accommodate *two* wheelchair spaces *that are not less than* 30 inches by ~~48~~ 52 inches (762 mm by ~~1219~~ 1320 mm). *The total number of such 30-inch by ~~48~~ 52-inch (762 mm by ~~1219~~ 1320 mm) spaces per story shall be not less than one for every 200 persons of calculated occupant load served by the area of refuge.* Such wheelchair spaces shall not reduce the means of egress minimum width or required capacity. Access to any of the required wheelchair spaces in an area of refuge shall not be obstructed by more than one adjoining wheelchair space.

3008.6.4 Lobby size. Each occupant evacuation elevator lobby shall have minimum floor area as follows:

1. The occupant evacuation elevator lobby floor area shall accommodate, at 3 square feet (0.28 m^2) per person, not less than 25 percent of the occupant load of the floor area served by the lobby.
2. The occupant evacuation elevator lobby floor area shall accommodate one wheelchair space of 30 inches by ~~48~~ 52 inches (760 mm by ~~1220~~ 1320 mm) for each 50 persons, or portion thereof, of the occupant load of the floor area served by the lobby.

Exception: The size of lobbies serving multiple banks of elevators shall have the minimum floor area approved on an individual basis and shall be consistent with the building's fire safety and evacuation plan.



Increased size of clear floor space.

CHANGE SIGNIFICANCE: In the 2017 edition of the ICC A117.1 Standard, the minimum required length of a clear floor space for a wheelchair was increased from 48 inches to 52 inches. The standard was revised due to research focusing on "wheeled mobility devices" including manual and power wheelchairs as well as scooters that are used for accessibility. The research indicated that the previous 48-inch length would accommodate the occupied length of approximately 75 percent of the manual chair users and about 50 percent of the occupied powered chair and scooter users. By increasing the length of the clear floor space to at least 52 inches, it is expected that the new length will accommodate approximately 95 percent of the occupied manual chair users and 90 percent of powered chair users.

Although this change to the clear floor space occurred in the 2017 edition of ICC A117.1, it is important to note that the standard will only impose this increased size requirement in new construction. Existing buildings will continue to be regulated based on the previous 48-inch length. When dealing with the accessible means of egress, the CBC provides the scoping and many of the details that are needed for areas of refuge including the construction protection and size requirements for areas of refuge. Therefore, it is important that the minimum required size of the wheelchair clear floor space be increased in locations where building occupants in wheeled mobility devices are expected to wait for assistance, such as in an area of refuge (CBC Section 1009.6) or in a lobby serving an occupant evacuation elevator (CBC Section 3008.6.4). Because many users of power-operated wheelchairs are also the people with the greatest accessibility challenges and a more vulnerable part of the population, it was important that the spaces where they are expected to await assistance would be adequately sized to allow them to enter into the protected space and wait.

Additional information related to this size increase is available in the ICC publication *Significant Changes to the ICC A117.1 Accessibility Standard*, as well as at the University of Buffalo's Center for Inclusive Design and Environmental Access website at http://idea.ap.buffalo.edu/projects/anthropometry/. It is important to recognize that although the recommendations of the report suggest even larger clear floor spaces, the A117.1 standard committee elected to modify the recommendations. As the Americans with Disabilities Act (ADA) references the CBC for accessible means of egress, these increased size clear floor spaces are to be applied within an area of refuge.

California has added additional requirements to this modified code section by requiring two wheelchair spaces in each area of refuge. Further, the California amendments also require one space for every two hundred persons of calculated occupant load that serve the area of refuge thereby potentially requiring a greater number of wheelchair spaces in these locations.

1010.1.1

Door Widths

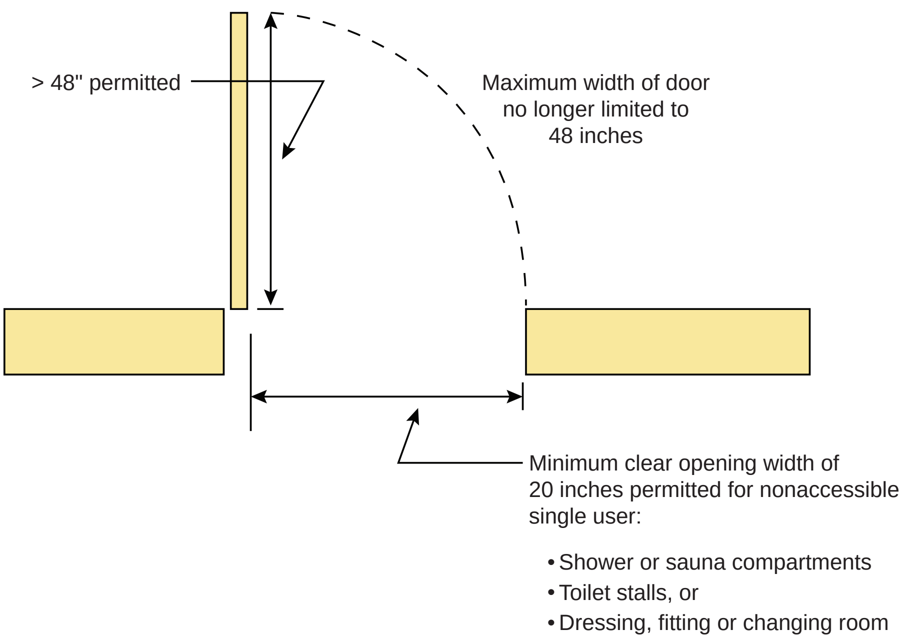
CHANGE TYPE: Modification

CHANGE SUMMARY: The maximum width for a swinging door is no longer regulated and a consolidated exception now allows for reduced door sizes where serving single-user showers, saunas and toilet compartments, as well as dressing, fitting and changing rooms.

2022 CODE TEXT: **1010.1.1 Size of doors.** The required capacity of each door opening shall be sufficient for the occupant load thereof and shall provide a minimum clear opening width of 32 inches (813 mm). The clear opening width of doorways with swinging doors shall be measured between the face of the door and the stop, with the door open 90 degrees (1.57 rad). Where this section requires a minimum clear opening width of 32 inches (813 mm) and a door opening includes two door leaves without a mullion, one leaf shall provide a minimum clear opening width of 32 inches (813 mm). In Group I-2 *or I-2.1*, doors serving as means of egress doors where used for the movement of beds *and stretcher patients* shall provide a minimum clear opening width of *44 inches (1118 mm).* *Where this section requires a minimum clear opening width of 44 inches (1118 mm) and a door opening includes two door leaves without a mullion, one leaf shall provide a minimum clear opening width of 44 inches (1118 mm).* ~~The maximum width of a swinging door leaf shall be 48 inches (1219 mm) nominal.~~ The minimum clear opening height of doors shall be not less than 80 inches (2032 mm).

Exceptions:

1. In Group R-2 and R-3 dwelling and sleeping units that are not required to be *adaptable or accessible as specified in Chapter 11A*, the minimum ~~and maximum~~ width shall not apply to door openings that are not part of the required means of egress.



Door width.

2. *(No change)*
3. *(No change)*
4. The maximum width of door leaves in revolving doors that comply with Section ~~1010.1.4.1~~ 1010.3.1 shall not be limited.
5. The maximum width of door leaves in power-operated doors that comply with Section ~~1010.1.4.2~~ 1010.3.2 shall not be limited
6. *(No change)*
7. *(No change)*
8. In Groups R-2, R-3 and R-4, in dwelling and sleeping units that are not required to be *adaptable or accessible as specified in Chapter 11A*, the minimum clear opening widths shall not apply to interior egress doors.
9. Doors to walk-in freezers and coolers less than 1,000 square feet (93 m^2) in area shall have a maximum width of 60 inches (1524 mm) nominal.
10. The minimum clear opening width shall not apply to doors for *nonadaptable or nonaccessible* shower or sauna compartments, *as specified in Chapter 11A.*
11. Doors serving *nonadaptable or* nonaccessible single-user shower or sauna compartments, toilet stalls or dressing, fitting or changing rooms shall have a minimum clear opening width of 20 inches (508 mm).

CHANGE SIGNIFICANCE: Historically, the maximum allowable width of a swinging door used for egress has been limited to 48 inches. The limitation was based principally on the weight of the door and tendency for wider/heavier doors to require greater maintenance to assure proper functioning and reasonable opening effort. The elimination of the width limitation is based on several factors, including 1) Section 1010.1.3 will continue to limit the door opening force regardless of the height, width or weight of the door; and 2) the need for wider doors in locations such as hospitals and other occupancies where the movement of patient beds, merchandise or equipment may create the need for a wider door. Although a pair of doors has been the typical solution, that approach was not always effective as it could require the person moving through the door or moving the equipment through the door to operate both doors at the same time to gain passage. Exceptions 1 and 4 were also revised to coordinate with the deletion of the maximum door width requirement.

Exception 10 was recently added to address nonaccessible shower, sauna or toilet compartments. Unfortunately, once a list of exceptions is created, it begins to make the items that are not on the list more apparent. For example, small dressing, fitting and changing rooms at many retail stores were required to provide 32-inch minimum width doors simply because there was no specific exception. From a format perspective, these two previous exceptions were also consolidated as Exception 11.

A minimum door width of 20 inches was also included in the revised exception. The width of 20 inches was selected to maintain compliance with historical door widths of 24 inches for most single-user toilet compartments and individual saunas, 32 inches for fitting rooms, and 22 inches for commercial showers. As such, the 20-inch minimum width selection continues to allow all of these commonly accepted door sizes.

1010.1.1.1

Projections into Door Openings

CHANGE TYPE: Modification

CHANGE SUMMARY: Additional components are now specifically permitted to project into the minimum required door opening height.

2022 CODE TEXT: **1010.1.1.1 Projections into clear ~~width~~ opening.** There shall not be projections into the required clear opening width lower than 34 inches (864 mm) above the floor or ground. Projections into the clear opening width between 34 inches (864 mm) and 80 inches (2032 mm) above the floor or ground shall not exceed 4 inches (102 mm).

Exceptions:

1. Door closers, overhead door stops, power door operators, and electromagnetic door ~~stops~~ locks shall be permitted to be 78 inches (1980 mm) minimum above the floor.
2. *In a Group I-2 or I-2.1 occupancy, there shall be no projections into the clear width of doors used for the movement of beds and stretcher patients in the means of egress.*

CHANGE SIGNIFICANCE: Previously, the only items that were specifically permitted to project into the minimum required clear door height were a door closer and a door stop. Power door operators and electromagnetic locks are now also permitted to extend down into the clear opening height. It has also been clarified that the door stops that were previously addressed are the overhead stops that are a part of the door frame and not some other type of device mounted on the wall, ceiling or other part of the egress path that in some manner restricts how far the door can open.

Door closer and electromagnetic lock projecting into door height.

1010.1.3

Door Opening Forces

CHANGE TYPE: Modification

CHANGE SUMMARY: The requirements for releasing the latching hardware and the force to open the door have been divided into separate subsections to provide coordination with the 2017 edition of the ICC A117.1.

2022 CODE TEXT: ~~**1010.1.3 Door opening force.** The force for pushing or pulling open interior swinging egress doors, other than fire doors, shall not exceed 5 pounds (22 N). These forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door in a closed position. For other swinging doors, as well as sliding and folding doors, the door latch shall release when subjected to a 15-pound (67 N) force. The door shall be set in motion when subjected to a 30-pound (133 N) force. The door shall swing to a full-open position when subjected to a 15-pound (67 N) force.~~

1010.1.3 Forces to unlatch and open doors. The forces to unlatch doors shall comply with the following:

1. Where door hardware operates by push or pull, the operational force to unlatch the door shall not exceed 15 pounds (67 N).
2. Where door hardware operates by rotation, the operational force to unlatch the door shall not exceed 28 inch-pounds (315 N-cm).

Operational force for door hardware.

The force to open doors shall comply with the following:

1. For interior swinging egress doors that are manually operated, other than doors required to be fire rated, the force for pushing or pulling open the door shall not exceed 5 pounds (22 N).
2. For other swinging doors, sliding doors, or folding doors, and doors required to be fire rated, the door shall require not more than a 30-pound (133 N) force to be set in motion and shall move to a full-open position when subjected to not more than a 15-pound (67 N) force.

CHANGE SIGNIFICANCE: Door opening force provisions have been modified to 1) coordinate with the requirements found in ICC A117.1, and 2) help clarify the intent by dividing the requirements into separate areas. As divided, one provision now addresses the operating force to release the door latching hardware and the second addresses the force needed to move the door leaf to an open position. Previously, misapplication occurred where efforts were made to apply the limits to both the door itself and to the operating hardware.

A technical revision recognizes that the door hardware provisions now address "rotation" and establishes a 28 inch-pound force instead of the 15-pound force that is referenced for pushing or pulling the hardware. This coordinates with Section 404.2.6 of the ICC A117.1 standard. Depending on the type of hardware involved (pushing, pulling, rotational), appropriate force levels have been established so compliance may be determined. Providing these values and distinctions helps to clarify how the forces are applied and determined, leading to more consistent interpretations related to the forces that are appropriate for each type of operation. As an example, where the operational force for the hardware relies on a rotational movement, a maximum of 28 inch-pounds is specified. Because this is essentially the torque, a rotational force, it was considered inappropriate to simply specify a force such as 5 pounds. The amount of force required to operate the hardware will be dependent on the length of the lever arm to which the force is applied. The amount of force would differ greatly depending on the distance from the pivot point where the force is applied.

1010.2.4

Locks and Latches

CHANGE TYPE: Modification

CHANGE SUMMARY: The general locking provisions have been expanded to allow locked doors in the egress system when desired due to the clinical needs of care recipients or where exterior areas egress back through the building.

2022 CODE TEXT: ~~**1010.1.9.4**~~ **1010.2.4 Locks and latches.** Locks and latches shall be permitted to prevent operation of doors where any of the following exist:

1. *(No change)*
2. In Group I-1, Condition 2 and Group I-2 occupancies where the clinical needs of persons receiving care require containment or where persons receiving care pose a security threat, provided that all clinical staff can readily unlock doors at all times, and all such locks are keyed to keys carried by all clinical staff at all times or all clinical staff have the codes or other means necessary to operate the locks at all times.

~~2.~~3. *(No change)*

~~3.~~4. *(No change)*

~~4.~~5. *(No change)*

~~5.~~6. *(No change)*

~~6.~~7. *(No change)*

Courtyard egressing through building.

8. Other than egress courts, where occupants must egress from an exterior space through the building for means of egress, exit access doors shall be permitted to be equipped with an approved locking device where installed and operated in accordance with all of the following:
   - 8.1. The maximum occupant load shall be posted where required by Section 1004.9. Such sign shall be permanently affixed inside the building and shall be posted in a conspicuous space near all the exit access doorways.
   - 8.2. A weatherproof telephone or two-way communication system installed in accordance with Sections 1009.8.1 and 1009.8.2 shall be located adjacent to not less than one required exit access door on the exterior side.
   - 8.3. The egress door locking device is readily distinguishable as locked and shall be a key-operated locking device.
   - 8.4. A clear window or glazed door opening, not less than 5 square feet (0.46 m^2) in area, shall be provided at each exit access door to determine if there are occupants using the outdoor area.
   - 8.5. A readily visible, durable sign shall be posted on the interior side on or adjacent to each locked required exit access door serving the exterior area stating, "THIS DOOR TO REMAIN UNLOCKED WHEN THE OUTDOOR AREA IS OCCUPIED." The letters on the sign shall be not less than 1 inch (25.4 mm) high on a contrasting background.
   - 8.6. The occupant load of the occupied exterior area shall not exceed 300 occupants in accordance with Section 1004.
9. Locking devices are permitted on doors to balconies, decks or other exterior spaces serving individual dwelling or sleeping units.
10. Locking devices are permitted on doors to balconies, decks or other exterior spaces of 250 square feet (23.23 m^2) or less serving a private office space.

CHANGE SIGNIFICANCE: Although four new items have been added to the general locking provisions, they fundamentally address two basic situations. Item 2 will address certain institutional occupancies where the needs of the care recipients are better addressed by containment. Items 8, 9 and 10 address exterior areas that must enter back into the building as a portion of their required egress path.

Item 2 now coordinates with provisions that are accepted by the federal regulations used for healthcare facilities. This exception will allow locked egress doors, and thus restricted movement, for the safety of the patient and/or public in certain assisted living facilities, hospitals and nursing facilities. This type of restricted egress is often used where additional security, elopement prevention or dementia wandering need to be addressed. While Section 1010.2.14 can be used to address electric locking systems, this new exemption can be applied where the use of manual locking systems having keys or codes may not be addressed. An important aspect of this requirement is that all clinical staff are capable of unlocking these egress doors should a need arise.

Items 8, 9 and 10 try to strike a balance between egress safety and building security that has been left unaddressed in previous editions of the code. Section 1004.7 mandates an unobstructed path of egress—including the prohibition of locking devices on means of egress doors—where egress travel from exterior spaces is required to pass back through the building. However, for security purposes, building owners and tenants want to install locks on these doors to prevent people from being able to enter the building through these doors. Building owners and building officials have long recognized this conflict between security and safety and generally had to accept locks being installed by using either the modification or alternative allowances of Chapter 1. The new exemptions will provide guidance to directly address how these exterior doors can be provided with locking devices and still be considered for required egress purposes from the exterior spaces.

While Items 9 and 10 will be somewhat self-limiting due to the occupancy involved, a maximum occupant load limit of 300 was established in Item 8 for consistency with Item 3, which has allowed a lockable main egress door in assembly uses under somewhat similar restrictions.

1010.2.8

Locking Arrangements in Group I-4

CHANGE TYPE: Modification

CHANGE SUMMARY: Group I-4 occupancies are now regulated under the special locking arrangements allowed for other “educational occupancies.”

2022 CODE TEXT: **~~1010.1.4.4~~ 1010.2.8 Locking arrangements in educational occupancies.** In Group E ~~and~~ occupancies, Group B educational occupancies and Group I-4 occupancies, egress doors from classrooms, offices and other occupied rooms ~~shall be permitted to be provided~~ with locking arrangements designed to keep intruders from entering the room ~~where~~ shall comply with all of the following conditions ~~are met~~:

1. The door shall be capable of being unlocked from outside the room with a key or other approved means.
2. The door shall be openable from within the room in accordance with Section ~~1010.1.9~~ 1010.2.
3. Modifications shall not be made to listed panic hardware, fire door hardware or door closers.
4. Modifications to fire door assemblies shall be in accordance with NFPA 80.

~~**1010.1.4.4.1 Remote operation of locks.** Remote operation of locks complying with Section 1010.1.4.4 shall be permitted.~~

Remote locking or unlocking of doors from an approved location shall be permitted in addition to the unlocking operation in Item 1.

Photo courtesy of Schlage Lock Co., LLC (Part of Allegion plc)

Door security hardware.

CHANGE SIGNIFICANCE: Facilities used for day-care operations are often classified as Group I-4 occupancies. Such occupancies provide custodial care for fewer than 24 hours per day and include both adult day care and child day care. Although Group E day-care facilities and other similar uses have previously been addressed, Group I-4 occupancies have not been included in the CBC but have previously been addressed in the CFC for existing buildings. The need for lockdown plans in day-care facilities, both Group E and Group I-4, is important, and as such has been included with the other educational related occupies covered by this provision.

The remote operation requirement has also been relocated and clarified to recognize that it can be used for both locking and/or unlocking operations. It is important to note that this remote operation provision must be in addition to the outside the room unlocking option addressed by Item 1. In addition, it does not modify or remove the egress capabilities established in Items 2 and 3. These remote locking/unlocking operations can be set up to occur from locations including the main office or a security office, or even by a remote fob given to school staff or emergency responders. The intent of Item 1 and the remote operation requirement is to ensure that authorized entry can be made into the room and to prohibit the installation of slide bolts or dead bolts that would only be openable from within the room, limiting the ability of emergency responders to enter a room from outside the space.

It should be noted that the code does not require the installation of these locking arrangements to keep people from entering a room. However, if that type of security is desired, then compliance with the four items is required.

1011.6

Stairway Landings

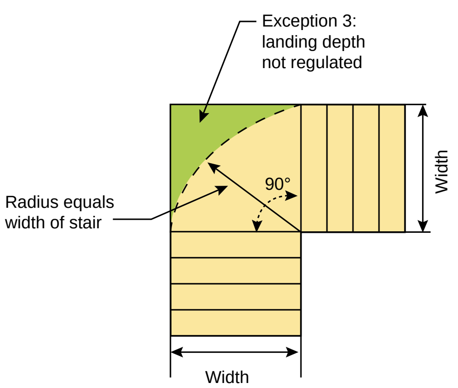
CHANGE TYPE: Modification

CHANGE SUMMARY: Requirements addressing the layout and configuration of landings, both curved and those that exceed the minimum size, have been revised.

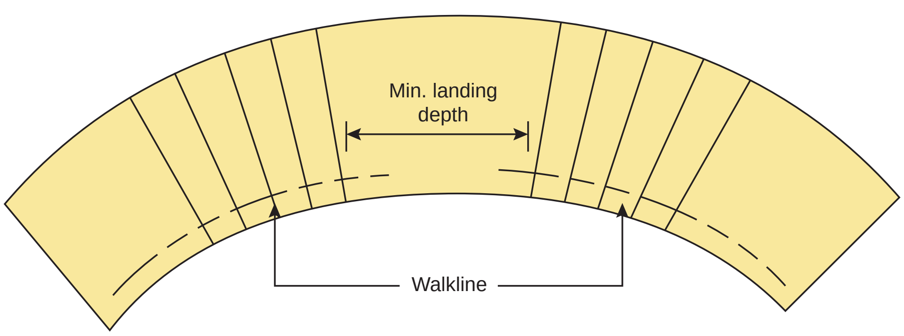
2022 CODE TEXT: **1011.6 Stairway landings.** There shall be a floor or landing at the top and bottom of each stairway. The width of landings, measured perpendicularly to the direction of travel, shall be not less than the width of stairways served. Every landing shall have a minimum depth, measured parallel to the direction of travel, equal to the width of the stairway or 48 inches (1219 mm), whichever is less. Doors opening onto a landing shall not reduce the landing to less than one-half the required width. When fully open, the door shall not project more than 7 inches (178 mm) into <u>the required width of</u> a landing. Where wheelchair spaces are required on the stairway landing in accordance with Section 1009.6.3, the wheelchair space shall not be located in the required width of the landing and doors shall not swing over the wheelchair spaces.

~~Exception~~ <u>Exceptions:</u>

1. Where stairways connect stepped aisles to cross aisles or concourses, stairway landings are not required at the transition between stairways and stepped aisles constructed in accordance with Section ~~1029~~ <u>1030</u>.
2. <u>Where curved stairways of constant radius have intermediate landings, the landing depth shall be measured horizontally between the intersection of the walkline of the lower flight at the landing nosing and the intersection of the walkline of the upper flight at the nosing of the lowest tread of the upper flight.</u>
3. <u>Where a landing turns 90 degrees (1.57 rad) or more, the minimum landing depth in accordance with this section shall not be required where the landing provided is not less than that described by an arc with a radius equal to the width of the flight served.</u>
4. *In Group R-3 occupancies a floor or landing is not required at the top of an interior flight of stairs, including stairs in an enclosed garage, provided a door does not swing over the stairs.*



Landing at 90-degree turn.



Landing depth at curved stairway.

CHANGE SIGNIFICANCE: Doors protruding into the width of the landing more than 7 inches should only be considered a problem when that projection is into the required width. While doors projecting into egress elements and over landings are generally handled in a similar manner – both at any point in their swing and when fully opened – the provisions for landings did differ from those in Section 1005.7.1 that were directly related to the required width. This caused some confusion on the application due to the provisions of Section 102.1 dealing with specific versus general provisions. As the scope of the provision is now the required width, confusion should be eliminated and the door swing projection requirements will be consistent.

The new Exception 2 provides specific guidance as to how the measurement of the landing depth is to be made when the landing and adjacent stair runs are curved. For those curved stairways with a constant and consistent radius, the measurement of the landing depth is to be taken at the walkline, which is established in Section 1011.4. Because the measurement of the tread depth of the adjacent stairs is measured at the walkline of those flights, it made sense to regulate the depth of the landing in a similar manner.

The intent of Exception 3 is to maintain the minimum width and required capacity of the stairway as it turns at the landing between adjacent flights. By swinging an arc that uses the stairway width as the radius, it will establish the area of the landing that is required to maintain the minimum egress width without mandating a square or rectangular landing. This methodology has been generally accepted for years and has been common where semicircular landings were designed or to allow for standpipes to be placed in these corners. It should be noted that Exception 3 does not apply where the stairway's turn at the landing is less than 90 degrees.

1016.2

Egress Through Intervening Spaces

CHANGE TYPE: Modification

CHANGE SUMMARY: Egress through an enclosed elevator lobby area is now permitted for spaces requiring only one means of egress.

2022 CODE TEXT: **1016.2 Egress through intervening spaces.** Egress through intervening spaces shall comply with this section.

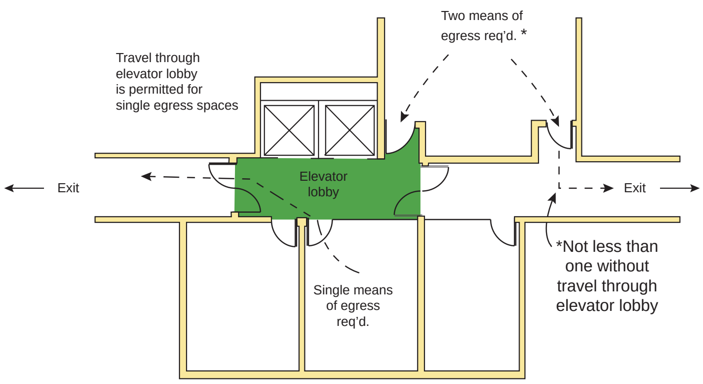
1. Exit access through an enclosed elevator lobby is permitted *in other than a Group I-2 and I-2.1.* Where access to two or more exits or exit access doorways is required in Section 1006.2.1, access ~~Access~~ to not less than one of the required exits shall be provided without travel through the enclosed elevator lobbies required by Section 3006. Where the path of exit access travel passes through an enclosed elevator lobby, the level of protection required for the enclosed elevator lobby is not required to be extended to the exit unless direct access to an exit is required by other sections of this code.
2. *(No change)*
3. *(No change)*
4. *(No change)*
5. *(No change)*

Exceptions:

1. *(No change)*
2. *(No change)*

CHANGE SIGNIFICANCE: Egress travel through intervening spaces, including enclosed elevator lobbies, is permitted where specific conditions are met. Historically, all spaces required access to at least one of the required exits without passing through an enclosed elevator lobby. Therefore, if a space had only a single means of egress, such egress was not permitted to go directly through an elevator lobby before travel to an exit. Only when an area had multiple egress paths available could one pass through the elevator lobby to reach an exit.

Although spaces that required two means of egress could have one path go through the elevator lobby—because there was one option available that did not require travel through the lobby—a small space without an available secondary option was not permitted to go through the lobby.



Egress through elevator lobby.

CHANGE TYPE: Clarification

1019.3

Exit Access Stairways

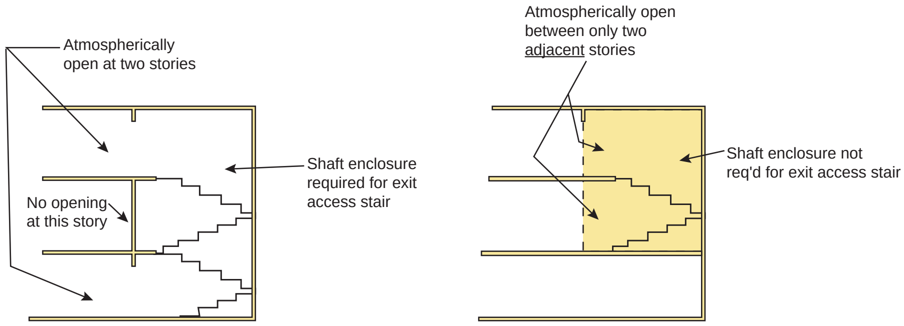
CHANGE SUMMARY: The allowance exempting the enclosure of exit access stairways that only serve two stories has been clarified by mandating that the stories be adjacent.

2022 CODE TEXT: **1019.3 Occupancies other than Groups I-2, *I-2.1*, I-3 and *R-2.1*.** In other than Group I-2, *I-2.1*, I-3 and *R-2.1* occupancies, floor openings containing exit access stairways or ramps ~~that do not comply with one of the conditions listed in this section~~ shall be enclosed with a shaft enclosure constructed in accordance with Section 713.

Exceptions:

1. Exit access stairways and ramps that serve or atmospherically communicate between only two adjacent stories. Such interconnected stories shall not be open to other stories.
2. *(No change)*
3. *(No change)*
4. *(No change)*
5. *(No change)*
6. *(No change)*
7. Exit access stairways and ramps serving smoke-protected or open-air assembly seating complying with the exit access travel distance requirements of Section ~~1029~~ 1030.7.
8. *(No change)*
9. Exterior exit access stairways or ramps between occupied roofs.
10. *Fixed-guideway transit stations, constructed in accordance with Section 443.*

CHANGE SIGNIFICANCE: In a format revision, the charging paragraph of Section 1019.3 has been revised such that the conditions that previously existed are now exceptions rather than conditions. As revised, the general scoping will mandate that exit access stairways are required to be enclosed within a compliant shaft, and the various exceptions will provide exemptions to that shaft enclosure requirement.



Exit access stair connecting stories.

Exception 1 has also been modified so the term "adjacent" has been inserted, limiting the two atmospherically connected levels to being two adjacent stories. Limiting the exception to adjacent stories is intended to clarify the exception and to prohibit the possibility of using an enclosure to skip intermediate levels and interconnect two remote floors. For example, if the stairway was left open to the first story and perhaps the third story, but partitioned off from the second story, it would still potentially allow smoke or a fire to spread greater distances through the building. Even in buildings where floors are nonrated, they provide a level of separation and the code has traditionally only allowed two adjacent floors to be interconnected. However, the previous code language was not clear enough to limit the exception to being "adjacent" stories.

When applying the new Exception 9, exterior exit access stairways between different levels of occupied roofs are also permitted to be exempt from the shaft enclosure requirement. This allowance is applicable to the stairway between an elevated deck that is on the roof itself, or a condition where a stairway connects the roofs on different levels of the building.

1020.5

Dead-End Corridors

CHANGE TYPE: Modification

CHANGE SUMMARY: In hospitals, a corridor that does not serve patient rooms or treatment spaces is now allowed a maximum 30-foot dead end.

2022 CODE TEXT: ~~**1020.4**~~ **1020.5 Dead ends.** Where more than one exit or exit access doorway is required, the exit access shall be arranged such that dead-end corridors do not exceed 20 feet (6096 mm) in length.

Exceptions:

1. In Group I-3, Condition 2, 3 or 4, occupancies, the dead end in a corridor shall not exceed 50 feet (15 240 mm).
2. In occupancies in Groups B, E, F, M, R-1, R-2, *R-2.1*, *R-2.2*, S and U, where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, the length of the dead-end corridors shall not exceed 50 feet (15 240 mm).
3. A dead-end corridor shall not be limited in length where the length of the dead-end corridor is less than 2.5 times the least width of the dead-end corridor.
4. In Group I-2 *and I-2.1* occupancies, *where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1*, the length of dead-end corridors that do not serve patient rooms or patient treatment spaces shall not exceed 30 feet (9144 mm).

Corridor serving patient treatment space.

CHANGE SIGNIFICANCE: To keep egress travel direct and efficient, the length of a dead-end corridor is typically limited to a maximum of 20 feet. While several exceptions allow for longer dead-ends, the increase did not apply to Group I-2 occupancies such as hospitals. Maintaining the dead end limit in hospitals was generally viewed as being appropriate for areas where patients might not be easily or rapidly moved. Although the CBC has previously placed a 20-foot maximum limit on such dead-end corridors, the National Fire Protection Association in NFPA 101 permits a 30-foot maximum limit for healthcare occupancies.

Because most hospitals are regulated by the federal Centers for Medicare and Medicaid Services (CMS), the difference between the CBC and NFPA 101 has caused confusion and resulted in the more restrictive 20-foot limitation being applied throughout the area of the hospital classified as a Group I-2 occupancy. Many areas within a hospital, such as staff areas, waiting areas or other non-patient areas are functionally similar to Group B occupancies where a longer dead end has been deemed to be reasonable and appropriate. Balance has been achieved by now permitting a 30-foot limit in dead-end corridors "that do not serve patient rooms or patient treatment spaces" while still maintaining the general 20-foot limitation where patients would be served. Because the 30-foot limitation aligns with the requirements established by CMS and NFPA 101, it was viewed as being reasonable and safe to change the limit in the CBC.

1030.16

Handrails at Social Stairs

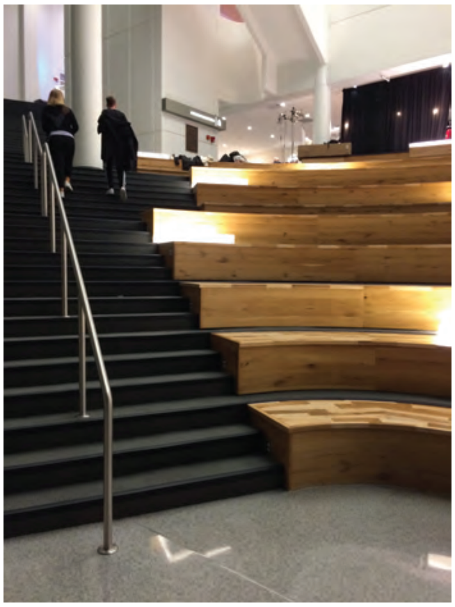
CHANGE TYPE: Modification

CHANGE SUMMARY: Guidance is now provided to address what are often called "social stairs," which are regulated by a combination of the general stairway provisions and those for assembly seating.

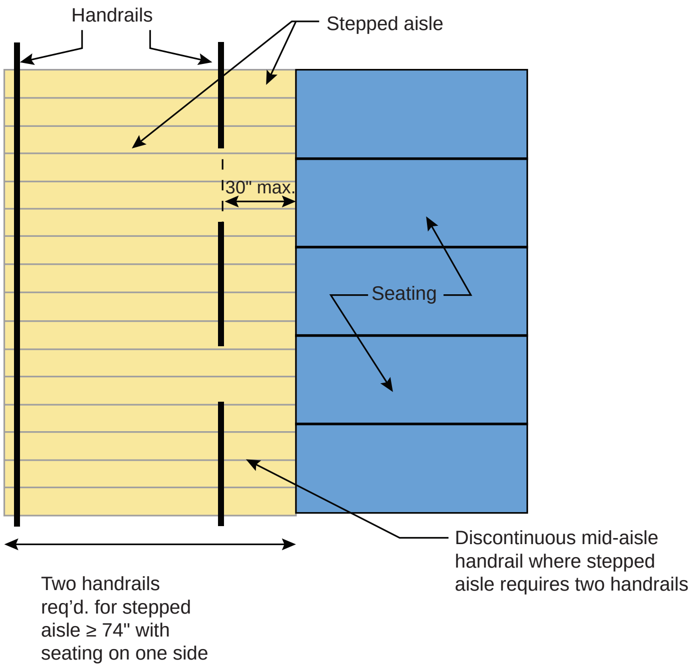
2022 CODE TEXT: ~~**1029.16**~~ **1030.16 Handrails.** Ramped aisles having a slope exceeding one unit vertical in 15 units horizontal (6.7-percent slope) and stepped aisles shall be provided with handrails in compliance with Section 1014 located either at one or both sides of the aisle or within the aisle width. Where stepped aisles have seating on one side and the aisle width is 74 inches (1880 mm) or greater, two handrails are required. Where two handrails are required, one of the handrails shall be within 30 inches (762 mm) horizontally of the stepped aisle.

Exceptions:

1. Handrails are not required for ramped aisles with seating on both sides.
2. Handrails are not required where, at the side of the aisle, there is a guard with a top surface that complies with the graspability requirements of handrails in accordance with Section 1014.3.
3. Handrail extensions are not required at the top and bottom of stepped aisles and ramped aisles to permit crossovers within the aisles.



Social stairway.



Handrail requirements for social stairway.

~~1029.16.1~~ 1030.16.1 Discontinuous mid-aisle handrails. Where there is seating on both sides of the aisle, the mid-aisle handrails shall be discontinuous. ~~with~~ Where a stepped aisle is required to have two handrails, the mid-aisle handrails shall be discontinuous. Gaps or breaks shall be provided at intervals not exceeding five rows to facilitate access to seating and to permit crossing from one side of the aisle to the other. These gaps or breaks shall have a clear width of not less than 22 inches (559 mm) and not greater than 36 inches (914 mm), measured horizontally, and the mid-aisle handrail shall have rounded terminations or bends.

CHANGE SIGNIFICANCE: Social stairs have become common as gathering areas, especially in educational and assembly occupancies. In the meantime, they have not been clearly classified or regulated by the code. Because of the different designs and the lack of any clear means of regulation, it has led to inconsistent regulation. Depending on the design and jurisdiction, the provisions for bleachers, stairways, stepped aisles, or some other alternate system have been applied. In some cases, the effort to make them comply with the CBC's existing provisions have made some of them seemingly less safe by locating handrails where the users must either climb over or under the rail to reach the seating platforms.

The new regulations are a variation of the assembly stepped aisle provisions of Section 1030. The rationale is based on essentially having an assembly seating area with the seating platforms, without seats, located to the side of the stepped aisle. This approach will help guide the aisle width requirements (per Section 1030.9.1) as well as address the placement of handrails serving the adjacent stepped aisle or, if also included, a stairway adjacent to the stepped aisle.

Section 1030.16 requires handrails either at one or both sides of the aisle or allows a handrail to be in the middle of the aisle. In situations where there is seating to one side, Section 1030.16 now requires two handrails where the aisle width exceeds 74 inches. The 74-inch width was selected to create a width that will keep the steps usable. In this case, that dimension was selected by the 30-inch measurement from the seating platform, which also ensures the handrail is within the 30-inch reach dimension addressed in Section 1014.9, plus the normal 44-inch stairway width required by Section 1011.2. Using these two dimensions to establish the 74-inch requirement and the need for having two handrails ensures that the handrails will be provided where needed and not be required on narrower stepped aisles where the second handrail may impede movement in the aisle.

Where two handrails are required, Section 1030.16.1 requires any handrail located other than at the side of the aisle to be a discontinuous handrail. The discontinuous handrail provisions are consistent with what historically has been required for center aisle handrails in assembly seating. Using these discontinuous handrails will allow for a stepped aisle adjacent to the seating platforms but also allow people to move from that aisle to any adjacent stepped aisle without having to climb over or under the rail or needing to go to the top or bottom to get to the other side. This will allow people to use an actual stepped aisle to access the platforms of the social stairway instead of requiring them to walk on the platforms that may have larger riser heights and varying depths.

Several good examples of both acceptable and unacceptable designs can be found in a review of code change submittal E106-18.

1031

Emergency Escape and Rescue Openings

CHANGE TYPE: Modification

CHANGE SUMMARY: Although predominately a reorganization of the emergency escape and rescue opening provisions to coordinate the CBC and the *California Residential Code* (CRC) provisions have also been added to address the size of steps from an area well and the use of a door.

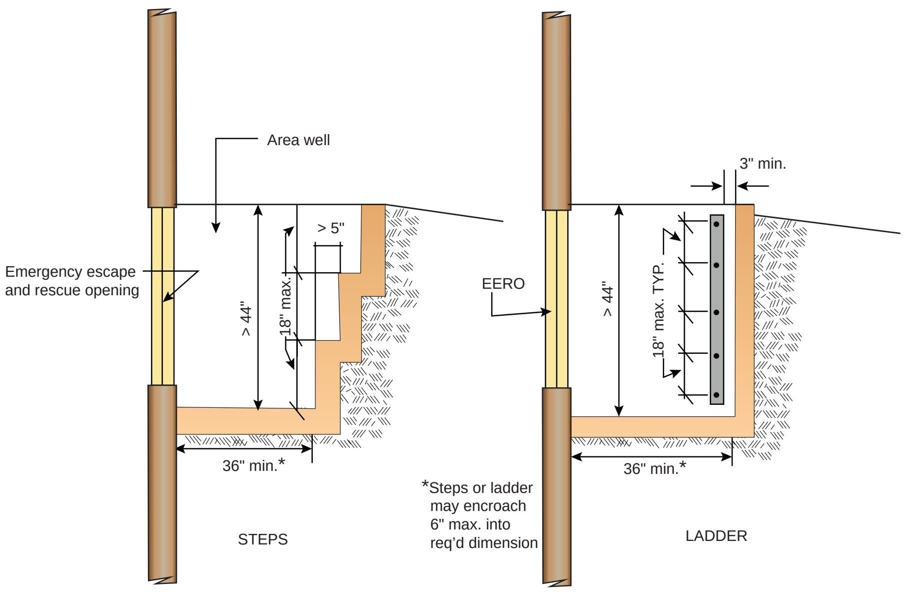
2022 CODE TEXT: **202 Emergency escape and rescue opening.** An operable exterior window, door or other similar device that provides for a means of escape and access for rescue in the event of an emergency.

SECTION ~~1030~~ 1031
EMERGENCY ESCAPE AND RESCUE

1031.1 General. Emergency escape and rescue openings shall comply with the requirements of this section.

~~1030.1~~ 1031.2 ~~General~~ Where required. In addition to the means of egress required by this chapter, emergency escape and rescue openings shall be provided in *Group R* occupancies.

Basements and sleeping rooms below the fourth story above grade plane shall have not fewer than one ~~exterior~~ emergency escape and rescue opening in accordance with this section. Where basements contain one or more sleeping rooms, an emergency escape and rescue ~~openings~~ opening shall be required in each sleeping room, but shall not be required in adjoining areas of the basement. Such openings shall open directly into a public way or to a yard or court that opens to a public way.



Area well requirement for EERO.

Exceptions:

1. *In Groups R-1 and R-2 occupancies constructed of Type I, Type IIA, Type IIIA or Type IV construction equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1.*
2. *Group R-2.1 occupancies meeting the requirements for delayed egress in accordance with Section 1010.2.13 may have operable windows that are breakable in sleeping rooms permanently restricted to a maximum of 4-inch open position.*
3. Basements with a ceiling height of less than 80 inches (2032 mm) shall not be required to have emergency escape and rescue openings.
4. Emergency escape and rescue openings are not required from basements or sleeping rooms that have an exit door or exit access door that opens directly into a public way or to a yard, court or exterior *egress* balcony that opens to a public way.
5. Basements without habitable spaces and having not more than 200 square feet (18.6 m^2) in floor area shall not be required to have emergency escape and rescue openings.
6. Storm shelters are not required to comply with this section where the shelter is constructed in accordance with ICC 500.
7. Within individual dwelling and sleeping units in Groups R-2 and R-3, where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1, 903.3.1.2 or 903.3.1.3, sleeping rooms in basements shall not be required to have emergency escape and rescue openings provided that the basement has one of the following:
   - **7.1.** One means of egress and one emergency escape and rescue opening.
   - **7.2.** Two means of egress.
8. *In Group R-2.2 occupancies a certified fire escape is acceptable as a secondary means of egress for existing buildings for this section of the code.*

~~1030.1.1~~ 1031.2.1 Operational constraints and opening control devices. *(No changes)*

1031.3 Emergency escape and rescue openings. Emergency escape and rescue openings shall comply with Sections 1031.3.1 through 103.3.3.

~~1030.2~~ 1031.3.1 Minimum size. *(No changes)*

~~1030.2.1~~ 1031.3.2 Minimum dimensions. *(No changes)*

~~1030.3~~ 1031.3.3 Maximum height from floor. *(No changes)*

~~1030.3~~ 1031.4 Emergency escape and rescue doors. Where a door is provided as the required emergency escape and rescue opening, it shall be a swinging door or a sliding door.

~~1030.4~~ 1031.5 ~~Window~~ Area wells. An emergency escape and rescue opening with ~~a finished sill height~~ the bottom of the clear opening below the adjacent grade ~~ground level~~ shall be provided with ~~a window~~ an area well in accordance with Sections ~~1030.4.1 and 1030.4.2~~ 1031.5.1 through 1031.5.3.

~~1030.4.1~~ 1031.5.1 Minimum size. The minimum horizontal area of the ~~window~~ area well shall be 9 square feet (0.84 m^2), with a ~~minimum dimension of~~ horizontal projection and width of not less than 36 inches (914 mm). The area ~~of the window~~ well shall allow the emergency escape and rescue opening to be fully opened.

> **Exception:** The ladder or steps required by Section 1031.5.2 shall be permitted to encroach not more than 6 inches (152 mm) into the required dimensions of the area well.

~~1030.4.2~~ 1031.5.2 Ladders or steps. ~~Window~~ Area wells with a vertical depth of more than 44 inches (1118 mm) shall be equipped with an approved permanently affixed ladder or steps. ~~Ladders or rungs shall have an inside width of not less than 12 inches (305 mm), shall project not less than 3 inches (76 mm) from the wall and shall be spaced not more than 18 inches (457 mm) on center (o.c.) vertically for the full height of the window well. The ladder or steps shall not encroach into the required dimensions of the window well by more than 6 inches (152 mm).~~ The ladder or steps shall not be obstructed by the emergency escape and rescue opening when the window or door is in the open position. Ladders or steps required by this section ~~are exempt from the stairway requirements of~~ shall not be required to comply with Section 1011.

~~1030.4.2.1~~ 1031.5.2.1 Ladders. Ladders or rungs shall have an inside width of at least 12 inches (305 mm), shall project at least 3 inches (76 mm) from the wall and shall be spaced not more than 18 inches (457 mm) on center (o.c.) vertically for the full height of the area well.

~~1030.4.2.2~~ 1031.5.2.2 Steps. Steps shall have an inside width of not less than 12 inches (305 mm), shall have treads greater than 5 inches (127 mm) in depth and a riser height not greater than 18 inches (457 mm) for the full height of the area well.

1031.5.3 Drainage. Area wells shall be designed for proper drainage by connecting to the building's foundation drainage system required by Section 1805.

> **Exception:** A drainage system for area wells is not required where the foundation is on well-drained soil or sand-gravel mixture soils in accordance with the United Soil Classification System, Group I Soils, in accordance with Section 1803.5.1.

~~1030.5~~ 1031.6 Bars, grilles, covers and screens. ~~Bars~~ Where bars, grilles, covers, screens or similar devices ~~are permitted to be~~ placed over emergency escape and rescue openings~~, bulkhead enclosures~~ or ~~window~~ area wells that serve such openings, ~~provided that~~ the minimum net clear opening size ~~complies~~ shall comply with Sections 1031.3 and 1031.5 ~~1030.1.1 through 1030.4.2 and such~~. Such devices shall be releasable or removable from the inside without the use of a key, tool or force greater than that which is required for normal operation of the emergency escape and rescue opening. ~~Where such bars, grilles, covers, screens or similar devices are installed in existing buildings, they shall not reduce the net clear opening of the emergency escape and rescue opening and smoke alarms shall be installed in accordance with Section 907.2.10 regardless of the valuation of the alteration~~.

CHANGE SIGNIFICANCE: On the whole, the revisions to the provisions addressing emergency escape and rescue openings (EEROs) result in relatively few technical changes but do provide more coordination between the CRC and the CBC regarding the requirements for EEROs. For example, the ladder requirements that are shown as new text in Section 1031.5.2.1 are merely being relocated from Section 1031.5.2. This will allow Section 1031.5.2 to serve as a base paragraph dealing with the way that ladders or steps impact an area well, while the specific ladder and step provisions are addressed in the subsections of 1031.5.2.1 and 1031.5.2.2, respectively. The following is a list of the more important technical changes found within this section.

- **Section 1031.2:** The word "exterior" has been deleted because it is now included in the definition. A new Exception 4 references the ICC 500 standard for storm shelters. Although many of the dimensional requirements are consistent, Section 501.4 of that standard contains requirements for an emergency opening in spaces that have only a single means of egress. Since the ICC 500 standard contains specific requirements for the emergency opening, it is appropriate to use those requirements for storm shelters instead of those found in the CBC.
- **Section 1031.4:** The new EERO text intends to use substantially the same criteria for both doors and windows rather than separate requirements for each. This new requirement will be a bit more restrictive than before by limiting EERO doors to a swinging door or a sliding door.
- **Section 1031.5:** The primary changes in the area well provisions are editorial revisions to provide clearer language and wording that is consistent with other sections. For example, the term is changed from "window wells" since doors are also allowed to serve as the EERO. The term "finished sill height" is changed to "the bottom of the clear opening" to coordinate with the location the measurement in Section 1031.3.3 is made to.

- **Section 1031.5.2:** A significant change provides technical guidelines for steps from an area well. While the code previously excluded these steps from needing to comply with the stairway requirements of Section 1011, it provided no details regarding what sizing or spacing was appropriate. The established dimensions allow the width and spacing between the steps to be 18 inches as is currently allowed for the ladder and a 5-inch minimum tread depth that is currently allowed for alternating tread devices and ships' ladders in Sections 1011.14 and 1011.15. Having a specific set of requirements will provide consistency where steps are installed.
- **Section 1031.5.3:** Provisions regarding drainage have been added consistent with the provisions from the CRC to address the concern of water accumulation in the area well.
- **Section 1031.6:** The requirements related to alterations of existing buildings have been relocated to the *California Existing Building Code* (CEBC) since that is the appropriate document for such buildings.

PART 5

Accessibility

Chapters 11A and 11B

■ **Chapters 11A and 11B** Accessibility

Chapters 11A and 11B are intended to address the accessibility and usability of buildings and their elements for people with physical disabilities. The provisions within the chapters are generally considered as scoping requirements that state what and where accessibility is required or how many accessible features or elements must be provided. ■

11B-206.4, 11B-207

Accessible Means of Egress

11B-206.4, 11B-207

Accessible Means of Egress

CHANGE TYPE: Modification

CHANGE SUMMARY: This is a two-part amendment in Sections 11B-206.4 and 11B-207 and addresses that the provisions for exits is being moved under accessible means of egress rather than the code section for entrances.

2022 CODE TEXT: **11B-206.4, 11B-207**

11B-206.4 Entrances. Entrances shall be provided in accordance with Section 11B-206.4. Entrance doors, doorways, and gates shall comply with Section 11B-404 and shall be on an accessible route complying with Section 11B-402.

Exceptions:

1. Reserved.
2. Reserved.

11B-206.4.1 Entrances ~~and exterior ground floor exits~~. All entrances ~~and exterior ground-floor exits to buildings and facilities~~ shall comply with Section 11B-404.

~~**Exceptions:**~~

1. ~~Exterior ground floor exits serving smoke-proof enclosures, stairwells, and exit doors serving stairs only shall not be required to comply with Section 11B-404.~~
2. ~~Exits in excess of those required by Chapter 10, and which are more than 24 inches (610 mm) above grade shall not be required to comply with Section 11B-404. Directional signs shall comply with Chapter 10, Section 1009.10.~~

An accessible means of egress being utilized by the disabled.

11B-207 Accessible means of egress

11B-207.1 General. Means of egress shall comply with *Chapter 10, Section 1009* and Section 11B-207.

Exceptions:

1. Where means of egress are permitted by local building or life safety codes to share a common path of egress travel, accessible means of egress shall be permitted to share a common path of egress travel.
2. Areas of refuge shall not be required in detention and correctional facilities.
3. *Accessible means of egress are not required to be provided in existing buildings.*
4. *Doors that provide access only to interior or exterior stairways shall not be required to comply with Section 11B-404.*
5. *Exits in excess of those required by Chapter 10, and which are more than 24 inches (610 mm) above grade shall not be required to comply with Section 11B-404 or be on an accessible route. Directional signs shall be provided in compliance with Chapter 10, Section 1009.10.*

CHANGE SIGNIFICANCE: The Division of the State Architect proposed the amendment to this section to relocate provisions from Section 11B-206.4 to Section 11B-207. This amendment includes exits under accessible means of egress rather than inclusion in the section for entrances.

The amendment is in response to code users who stated that the requirements for exits are overlooked because of the current provisions that place exits in the scoping sections for accessible routes and entrances.

PART 6

Building Envelope, Structural Systems and Construction Materials

Chapters 12 through 26

- **Chapter 12** Interior Environment
- **Chapter 14** Exterior Walls
- **Chapter 15** Roof Assemblies and Rooftop Structures
- **Chapter 16** Structural Design
- **Chapter 17** Special Inspections and Tests
- **Chapter 18** Soils and Foundations
- **Chapter 19** Concrete
- **Chapter 20** Aluminum
  No changes addressed
- **Chapter 21** Masonry
- **Chapter 22** Steel
- **Chapter 23** Wood
- **Chapter 24** Glass and Glazing
  No changes addressed
- **Chapter 25** Gypsum Board, Gypsum Panel Products, and Plaster
- **Chapter 26** Plastic
  No changes addressed

The interior environment provisions of Chapter 12 include requirements for lighting, ventilation and sound transmission. Regulations governing the building envelope are located in Chapters 14 and 15, addressing exterior wall coverings and roof coverings, respectively. Structural systems are regulated through the structural design provisions of Chapter 16, while structural testing and special inspections are addressed in Chapter 17. The provisions of Chapter 18 apply to soils and foundation systems. The requirements for materials of construction, both structural and non-structural, are located in Chapters 19 through 26. Structural materials regulated by the code include concrete, lightweight metals, masonry, steel and wood. Glass and glazing, gypsum board, plaster and plastics are included as regulated non-structural materials. ■

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1202.3

Insulation of Unvented Attics

CHANGE TYPE: Modification

CHANGE SUMMARY: A new option is available for the regulation of unvented attics with air-permeable insulation and vapor diffusion ports in warmer climates.

2022 CODE TEXT: **1202.3 Unvented attic and unvented enclosed rafter assemblies.** Unvented attics and unvented enclosed roof framing assemblies created by ceilings applied directly to the underside of the roof framing members/rafters and the structural roof sheathing at the top of the roof framing members shall be permitted where all of the following conditions are met:

1-4. *(no significant changes)*

5. Insulation shall ~~be located in accordance with the following:~~ <u>comply with either Item 5.1 or 5.2, and additionally Item 5.3.</u>

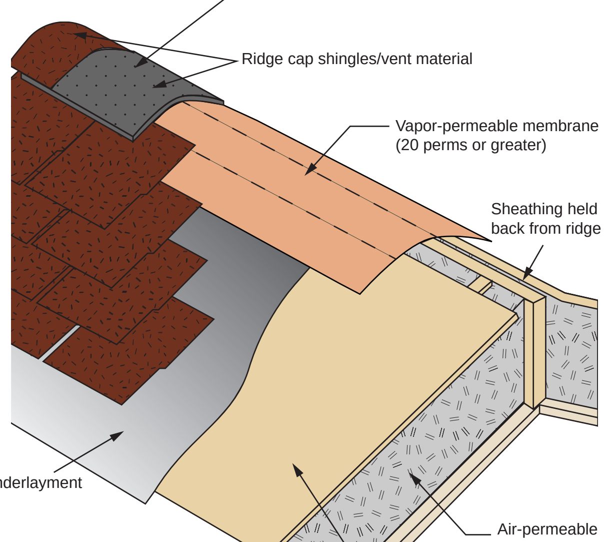
5.1. *(no significant changes)*

<u>**5.2.** In Climate Zones 1, 2 and 3, air-permeable insulation installed in unvented attics shall meet the following requirements:</u>

<u>**5.2.1.** A vapor diffusion port shall be installed not more than 12 inches (305 mm) from the highest point of the roof, measured vertically from the highest point of the roof to the lower edge of the port.</u>

<u>**5.2.2.** The port area shall be greater than or equal to 1/600 of the ceiling area. Where there are multiple ports in the attic, the sum of the port areas shall be greater than or equal to the area requirement.</u>

<u>**5.2.3.** The vapor-permeable membrane in the vapor diffusion port shall have a vapor permeance rating of greater than or equal to 20 perms when tested in accordance with Procedure A of ASTM E96.</u>



Vapor diffusion ports above an unvented attic.

5.2.4. The vapor diffusion port shall serve as an air barrier between the attic and the exterior of the building.

5.2.5. The vapor diffusion port shall protect the attic against the entrance of rain and snow.

5.2.6. Framing members and blocking shall not block the free flow of water vapor to the port. Not less than a 2-inch (50 mm) space shall be provided between any blocking and the roof sheathing. Air-permeable insulation shall be permitted within that space.

5.2.7. The roof slope shall be greater than or equal to 3 units vertical in 12 units horizontal (3:12).

5.2.8. Where only air-permeable insulation is used, it shall be installed directly below the structural roof sheathing, on top of the attic floor, or on top of the ceiling.

5.2.9. Where only air-permeable insulation is used and is installed directly below the structural roof sheathing, air shall be supplied at a flow rate greater than or equal to 50 cubic feet per minute (23.6 L/s) per 1000 square feet (93 m^2) of ceiling.

~~5.2~~5.3. The air shall be supplied from ductwork providing supply air to the occupiable space when the conditioning system is operating. Alternatively, the air shall be supplied by a supply fan when the conditioning system is operating. Where preformed insulation board is used as the air-impermeable insulation layer, it shall be sealed at the perimeter of each individual sheet interior surface to form a continuous layer.

202 Vapor diffusion port. An assembly constructed or installed within a roof assembly at an opening in the roof deck to convey water vapor from an unvented attic to the outside atmosphere.

CHANGE SIGNIFICANCE: To assist with energy efficiency, unvented attic assemblies are an alternative to ventilated attic spaces. The assemblies are typically constructed with spray polyurethane foam applied directly to the underside of the roof deck, or they may be insulated over the top of the roof deck with rigid insulation boards. In regions at risk from wildfires, the elimination of eave vents and air sealing of the vents at ridges reduces the entry of embers into the attic. The elimination of roof vents in hurricane-prone regions reduces the entry of rainwater during hurricanes.

Blown cellulose, fiberglass batts and blown fiberglass have been added as options for insulating unvented attic assemblies. This new assembly is limited to warmer areas, specifically Climate Zones 1, 2 and 3, and requires a vapor diffusion port. The port acts as a moisture control measure, allowing moisture in the attic to be removed by vapor diffusion rather than by air change. Moisture laden air is more buoyant than dry air and accumulates at the ridge, then exits via the vapor diffusion ports, allowing the attic assembly to remain airtight while providing a path for moisture reduction.

The use of this method also allows insulation to be installed directly to the underside of the roof deck or at the floor/ceiling level of the attic assembly. Section 1202.3 provides guidance on the location of vapor diffusion ports within the roof assembly and clarifies that the vapor diffusion port contains a membrane material that is both vapor-permeable and water-resistive. The definition of a vapor diffusion port has also been added to Chapter 2 to clarify that the port is an element of the attic space and installed within the roof deck.

1207

Enhanced Classroom Acoustics

CHANGE TYPE: Addition

CHANGE SUMMARY: Educational occupancies are now required to meet the enhanced classroom acoustic requirements of Section 808 of ICC A117.1.

2022 CODE TEXT:

SECTION 1207 ENHANCED CLASSROOM ACOUSTICS

1207.1 General. Enhanced classroom acoustics, where required in this section, shall comply with Section 808 of ICC A117.1.

1207.2 Where required. In Group E occupancies, enhanced classroom acoustics shall be provided in all classrooms with a volume of 20,000 cubic feet (566 m^3) or less.

CHANGE SIGNIFICANCE: Good classroom acoustics are essential to support language acquisition and learning for all children, particularly younger children. There are three primary styles of learning in a classroom: visual, auditory and kinesthetic or tactile. Visual learning is a teaching and learning style in which ideas, concepts, data and other information are associated with images. This style highlights the importance of good lighting in classrooms, so students can read or see different images.

Auditory learning is a learning style in which a person learns through listening. An auditory learner depends on hearing and speaking. In the instruction of auditory learners, teachers use techniques such as verbal direction, group discussions, verbal reinforcement, group activities, reading aloud and putting information into a rhythmic pattern such as a rap, poem or song. The third style, kinesthetic or tactile learning, is learning while carrying out a physical activity, such as physical manipulation or experiments. Learning modality strengths can occur independently or in combination, they can change over time and they become ingrained with age. It is estimated that auditory learners make up about 30 percent of the population.

Photo courtesy of skynesher

Classroom acoustics are based on ceiling, wall and floor materials.

For children who have hearing loss and those who use cochlear implants, there is no substitute for a good acoustic environment. Assistive technologies typically only amplify the teacher and do not amplify discussions among children or between the teacher and individual child. Additionally, children with disabilities not related to hearing, such as autism and learning disabilities, may be adversely affected by high ambient-noise levels, while students learning English also benefit from clear speech and low background noise.

The new enhanced acoustic requirements only apply to those rooms where the volume doesn't exceed 20,000 cubic feet. Assuming a 10-foot ceiling height, classrooms of up to 2000 square feet are required to meet these requirements. The criteria in ICC A117.1, Section 808 are intended to be applicable to standard-sized self-contained classrooms, while not including larger spaces used for activities such as band and choir. The criteria are not intended to apply to ancillary learning spaces, such as individual tutoring spaces, corridors or a cafeteria.

A classroom is limited to a maximum reverberation time for classroom acoustics, determined through the measurement of room performance or by a calculation based on materials on the floor, ceiling and walls. Performance in a fully furnished, unoccupied classroom should include a maximum reverberation time of 0.6-0.7 seconds, depending upon the size of the classroom, and a maximum background noise of either 35 dBA (A-weighted sound pressure level) or 55 dBC (C-weighted sound pressure level). The ambient sound levels must be measured in both dBA and dBC. The dBA filter measures mid-range frequencies, while the dBC filter measures low and high frequencies.

Reverberation time measures how quickly sound decays in a room. The volume of the space and the surfaces in the room will affect the reverberation time. The intent of the 0.6 to 0.7 second reverberation time is to increase the sound level from the teacher throughout the room while maintaining clarity. ASTM E2235, *Standard Test Method for Determination of Decay Rates for Use in Sound Insulation Test Methods*, is used for testing sound decay rates.

The prescriptive calculation requires noise reduction coefficient (NRC) ratings for every surface finish, including finishes on the floor, ceiling and all walls. Ratings range from zero to one, with one indicating the surface absorbs most of the speech sound energy and zero indicating the surface reflects most of the speech sound energy. The NRC for each material is multiplied by the square footage of that material. The surface area of these materials are to be subtracted from the area of the mounting surface – for example, if a wall is 10 feet in length by 10 feet in height, and two 2-foot by 10-foot panels are attached to the wall, the calculation would be based on 60 square feet of uncovered wall and 40 square feet of panels.

The ICC A117.1 criterion also considers other sound sources including ambient sound sources outside the classrooms. These sources may include playground noises, airplane or traffic sources and student movement in hallways. There are multiple ways to mitigate these issues. Some outdoor environment sources can be addressed by careful placement of the classrooms on the site or through the choice of the exterior materials for walls and roofs. Building noises can be mitigated by the proper selection of wall systems, location of doors and placement of mechanical systems.

1208.4

Efficiency Dwelling Units

CHANGE TYPE: Modification

CHANGE SUMMARY: The minimum required floor area of an efficiency dwelling unit has been reduced to 190 square feet, and a definition of an efficiency dwelling unit has been added.

2022 CODE TEXT: **~~1207.4~~ 1208.4 Efficiency dwelling units.** ***[HCD 1]*** ~~An efficiency living unit~~ *Unless modified by local ordinance pursuant to Health and Safety Code Section 17958.1, efficiency dwelling units shall comply with the following:*

1. The unit shall have a living room of not less than ~~220~~ 190 square feet (~~20.4 m^2~~ 17.7 m^2) of floor area. ~~An additional 100 square feet (9.3 m^2) of floor area shall be provided for each occupant of such unit in excess of two.~~
2. The unit shall be provided with a separate closet.
3. ~~The~~ For other than Accessible, *adaptable* dwelling units, the unit shall be provided with a kitchen sink, cooking appliance and ~~refrigeration facilities~~ refrigerator, each having a clear working space of not less than 30 inches (762 mm) in front. Light and ventilation conforming to this code shall be provided.
4. The unit shall be provided with a separate bathroom containing a water closet, lavatory and bathtub or shower

202 Dwelling unit, efficiency. A dwelling unit where all permanent provisions for living, sleeping, eating and cooking are contained in a single room.

Photo courtesy of Paul Vinten

Studio apartment with a single primary living space.

CHANGE SIGNIFICANCE: Efficiency dwelling units are better known as studio apartments, where a single room is utilized for all living, sleeping, dining and cooking activities. A new definition reflects this single-space concept. It has also been clarified that an efficiency unit is a specific type of dwelling unit and would be regulated as such where scoped throughout the CBC. In prior codes, it was represented as an undefined living unit.

Previously, the approach to occupant load determination was inconsistent with the general method established in Chapter 10 "Means of Egress." Rather than basing the design occupant load on the floor area of the unit, the size of the unit varied based on the actual occupant load. No code path was available for an occupant load exceeding two occupants unless the gross square footage of the efficiency dwelling unit exceeded 320 square feet. This methodology has been deleted, based in part on the assumption that no more than two people occupy the unit. The minimum required living room floor area for an efficiency dwelling unit has been decreased from 220 square feet to 190 square feet of floor area, aligned and consistent with Section 1208.3 for a dwelling unit's minimum required floor area (equal to two rooms, one of 120 square feet and a second of 70 square feet).

Comparison of Dwelling Units

Dwelling Unit	Standard	Efficiency
Primary Room – Minimum Size	120 ft^2	190 ft^2
Other Rooms – Minimum Size	70 ft^2	Not Applicable
Cooking Facilities?	Yes	Yes
Sanitation Facilities?	Yes	Yes
Closet?	Not required in primary room	Yes

Note that a standard dwelling unit assumes multiple rooms within the unit.

1210.3

Restroom Privacy

CHANGE TYPE: Addition

CHANGE SUMMARY: Concerns regarding privacy within public restrooms have been addressed by requiring a screening element at the entry to the restroom.

2022 CODE TEXT: ~~**1209.3**~~ **1210.3 Privacy.** Public restrooms shall be visually screened from outside entry or exit doorways to ensure user privacy within the restroom. This provision shall also apply where mirrors would compromise personal privacy. Privacy at water closets and urinals shall be provided in accordance with Sections 1210.3.1 and 1210.3.2.

> **Exception:** Visual screening shall not be required for single-occupant toilet rooms with a lockable door.

CHANGE SIGNIFICANCE: For some time, Section 1210.3 has required sidewall or partition urinal privacy in restrooms but has not previously addressed privacy from passersby outside restroom facilities. A requirement for a screening wall or other obscuring measure in the entry to the facilities has been added. The placement of mirrors within the facility has also been addressed to deal with reflections from within the room to the outside area.

See Chapter 29 of the 2021 CBC for additional changes to public restrooms addressing installation of fixtures and water closets.

Photo courtesy of baona

Screen at restroom entry.

CHANGE TYPE: Modification

1404.3

Vapor Retarders

CHANGE SUMMARY: Vapor retarder provisions have been reorganized and thresholds clarified for when a vapor retarder is required and which retarder is required as well as location and climate zone requirements.

2022 CODE TEXT: **1404.3 Vapor retarders.** Vapor retarder materials shall be classified in accordance with Table 1404.3(1). A vapor retarder shall be provided on the interior side of frame walls in accordance with Tables 1404.3(2) and 1404.3(3), or an approved design using accepted engineering practice for hygrothermal analysis. The appropriate zone shall be selected in accordance with Chapter 3 of the *California Energy Code*. ~~Vapor retarders as described in Section 1404.3.3 shall be provided in accordance with Sections 1404.3.1 and 1404.3.2, or an approved design using accepted engineering practice for hygrothermal analysis.~~

TABLE 1404.3(1) Vapor Retarder Materials and Classes

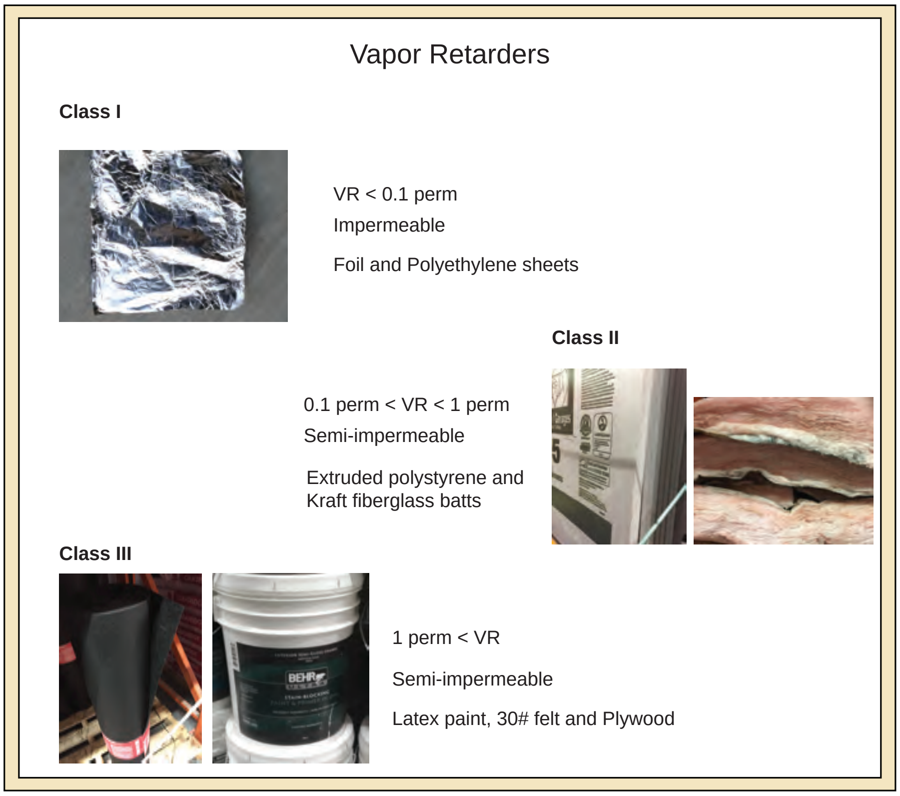
Vapor Retarder Class	Acceptable Materials
I	Sheet polyethylene, nonperforated aluminum foil, or other approved materials with a perm rating of less than or equal to 0.1
II	Kraft-faced fiberglass batts or vapor retarder paint or other approved materials, applied in accordance with the manufacturer's instructions for a perm rating greater than 0.1 and less than or equal to 1.0
III	Latex paint, enamel paint, or other approved materials, applied in accordance with the manufacturer's instructions for a perm rating of greater than 1.0 and less than or equal to 10

TABLE 1404.3(2) Vapor Retarder Options

	Vapor Retarder Class		
Climate Zone	I	II	III[a]
1, 2	Not permitted	Not permitted	Permitted
3	Not permitted	Permitted	Permitted
4 (except Marine 4)	Not permitted	Permitted	See Table 1404.3(3)
Marine 4, 5, 6, 7, 8	Permitted	Permitted	See Table 1404.3(3)

a. See also Sections 1404.3.1 and 1404.3.2.

CHANGE SIGNIFICANCE: Vapor retarder provisions have been reorganized to make them more user-friendly, utilizing new tables and text to assist the designer in selecting appropriate vapor retarders for the climatic conditions and desired vapor retarder class.



Class I, II and III vapor retarders.

Some vapor retarders do not fit neatly into categories defined by vapor permeability measurements alone. Prohibition of certain vapor retarder classes in specific climate zones is based on the need to provide assemblies the ability to dry to the interior. However, if a vapor retarder has vapor permeability that increases with relative humidity to a Class III level, it will allow drying and should not be prohibited.

While there is adequate experience in cold climates in the U.S. and Canada to justify the use of a Class I interior vapor retarder, for example, a 4-mil polyethylene, with foam plastic insulating sheathing on the exterior side of an assembly, a design for the double vapor barrier assembly must be submitted for approval. Due to concerns with a low drying potential, walls using a double vapor barrier, in other words, a Class I vapor retarder on both sides, must be accompanied by air sealing details and a drainage plane to minimize the potential for water leakage or moisture accumulation. Thus, the use of a double vapor barrier assembly may require some additional considerations to ensure performance.

Table 1404.3(4)

Class II Vapor Retarders

Kraft-paper-backed fiberglass. Insulation is a Class II vapor retarder.

CHANGE TYPE: Modification

CHANGE SUMMARY: New Table 1404.3.1 assigns minimum continuous insulation *R*-values where Class II vapor retarders are installed.

2022 CODE TEXT: **1404.3 *[HCD 1 & HCD 2]*** *Class I or II vapor retarders shall be provided on the interior side of frame walls of low-rise residential buildings in California Climate Zones 14 and 16, as required in the California Energy Code (see definition of "Low-rise residential building").*

Exceptions:

1. Basement walls.
2. Below-grade portion of any wall.
3. Construction where accumulation, condensation or freezing of moisture will not damage the materials.
4. ~~Conditions where Class III vapor retarders are required in Section 1404.3.2.~~
4. Class I and II vapor retarders with vapor permeance greater than 1 perm when measured by ASTM E96 water method (Procedure B) shall be allowed on the interior side of any frame wall in all climate zones.

CHANGE SIGNIFICANCE: Section 1404.3 now allows the use of a Class II interior vapor retarder where foam plastic insulating sheathing is used as continuous insulation on the exterior of buildings where appropriate for climate and use. This modified provision coordinates requirements for vapor retarders with typical insulation requirements found in the *California Energy Code* for wood-framed wall assemblies, assuring that an adequate amount of continuous insulation is used together with a Class II interior vapor retarder to keep wall interiors sufficiently warm to control condensation and moisture accumulation.

TABLE 1404.3(4) Continuous Insulation with Class II Vapor Retarder

Climate Zone	Permitted Conditions[a]
3	Continuous insulation with *R*-value ≥ *R*-2
4, 5, 6	Continuous insulation with *R*-value ≥ *R*-3 over 2 × 4 wall
	Continuous insulation with *R*-value ≥ *R*-5 over 2 × 6 wall
7	Continuous insulation with *R*-value ≥ *R*-5 over 2 × 4 wall
	Continuous insulation with *R*-value ≥ *R*-7.5 over 2 × 6 wall
8	Continuous insulation with *R*-value ≥ *R*-7.5 over 2 × 4 wall
	Continuous insulation with *R*-value ≥ *R*-10 over 2 × 6 wall

a. In addition to the vapor retarder, spray foam with a maximum permeance of 1.5 perms at the installed thickness, applied to the interior cavity side of wood structural panels, fiberboard, insulating sheathing or gypsum is deemed to comply with the continuous insulation requirement only for the moisture control purposes of this table where the spray foam *R*-value plus any continuous insulation *R*-value provided equals or exceeds the specified continuous insulation *R*-value.

The use of a Class II interior vapor retarder with foam sheathing on the exterior provides a stable and dry wall assembly. Using Class II vapor retarders, research has found stable moisture content levels, and their use does not seem to alter the ability of walls with exterior foam sheathing to dry out. Consequently, a combination of exterior insulation and a Class II vapor retarder is allowed, increasing the R-value with minimal changes in construction practice. Spray foam used to satisfy continuous insulation requirements is intended to be used for moisture control.

1404.3.2

Class III Vapor Retarders

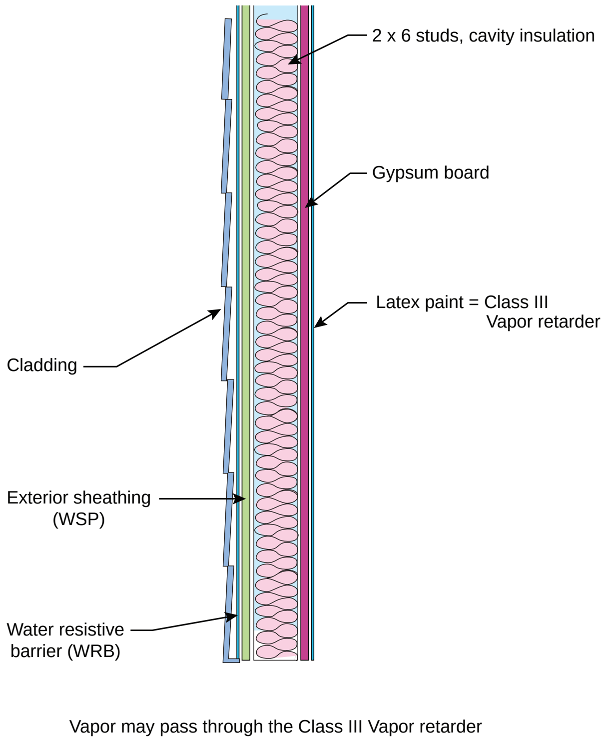
CHANGE TYPE: Modification

CHANGE SUMMARY: The appropriate use of Class III vapor retarders with spray foam insulation has been clarified.

2022 CODE TEXT: **1404.3.2 Class III vapor retarders.** ~~Class III vapor retarders shall be permitted where for any one of the conditions in Table 1404.3.2 is met.~~ Only Class III vapor retarders shall be used on the interior side of frame walls where foam plastic insulating sheathing with a perm rating of less than 1 is applied in accordance with Table ~~1404.3.2~~ 1404.3(3) on the exterior side of the frame wall.

[HCD 1 & HCD 2] *Class III vapor retarders shall be permitted where any one of the conditions in Items 1, 2 or 3 below are met. This section shall apply to "Low-rise residential buildings" as defined in the California Energy Code.*

1. *Vented cladding over fiberboard*
2. *Vented cladding over gypsum*
3. *Insulated sheathing with R-value ≥ R4 Spray foam with a minimum density of 2 lbs/ft^3 applied to the interior cavity side of OSB, plywood, fiberboard, insulating sheathing or gypsum is deemed to meet the insulating sheathing requirement where the spray foam R-value meets or exceeds the specified insulating sheathing R-value.*



Wall with Class III vapor retarder.

TABLE ~~1404.3.2~~ 1404.3(3) Class III Vapor Retarders

Zone	Class III Vapor Retarders Permitted for:[a,b]
~~Marine~~ 4	Vented cladding over wood structural panels
	Vented cladding over fiberboard
	Vented cladding over gypsum
	Continuous insulation with *R*-value ≥ *R*-2.5 over 2 × 4 wall
	Continuous insulation with *R*-value ≥ *R*-3.75 over 2 × 6 wall
7 ~~and 8~~	Continuous insulation with *R*-value ≥ *R*-10 over 2 × 4 wall
	Continuous insulation with *R*-value ≥ *R*-15 over 2 × 6 wall
8	Continuous insulation with *R*-value ≥ *R*-12.5 over 2 × 4 wall
	Continuous insulation with *R*-value ≥ *R*-20 over 2 × 6 wall

a. ~~Spray foam with a maximum permanence of 1.5 perms at the installed thickness applied to the interior cavity side of wood structural panels, fiberboard, insulating sheathing or gypsum is deemed to meet the continuous insulation requirement where the spray foam *R*-value meets or exceeds the specified insulating sheathing *R*-value.~~ Vented cladding shall include vinyl lap siding, polypropylene, or horizontal aluminum siding, brick veneer with airspace as specified in this code, and other approved vented claddings.

b. The requirements in this table apply only to insulation used to control moisture in order to permit the use of Class III vapor retarders. The insulation materials used to satisfy this option also contribute to but do not supersede the thermal envelope requirements of the *International Energy Conservation Code.*

(No changes to portions of table not shown)

1404.3.2.1 Spray foam plastic insulation for moisture control with Class III vapor retarders. For purposes of compliance with Table 1404.3(3), spray foam with a maximum permeance of 1.5 perms at the installed thickness applied to the interior cavity side of wood structural panels, fiberboard, insulating sheathing or gypsum shall be deemed to meet the continuous insulation *R*-value requirement where the spray foam *R*-value meets or exceeds the specified continuous insulation *R*-value.

1404.3.2.1.1 Hybrid insulation for moisture control with Class III vapor retarders. For the purposes of compliance with Table 1404.3(3), the combined *R*-values of spray foam plastic insulation and continuous insulation shall be permitted to be counted towards the continuous *R*-value requirement.

CHANGE SIGNIFICANCE: A revised table and new text are provided to assist designers in selecting appropriate vapor retarders for the climatic conditions and desired vapor retarder class. Class III vapor retarders with foam sheathing are now addressed in a manner consistent with provisions in the *California Residential Code*. Table 1404.3(3) mandates continuous insulation for moisture control but provides an exception for spray foam in the cavity. Charging language has been added for the combination of insulating methods to provide moisture control where the total required *R*-value is achieved by continuous, cavity or a combination of insulation strategies.

Modifications to Table 1404.3(3) include the use of Zone 4, rather than Marine 4, for the first category. The Marine 4 climate zone is a warmer-in-winter climate zone than the rest of Climate Zone 4. When conditions are necessary to control water vapor in Marine 4, they should also be required in all of Climate Zone 4, especially in the moist (A) regions of Climate Zone 4. Climate Zone 8 was not intended to be included with Climate Zone 7. Climate Zone 8 is a colder climate and requires additional continuous insulation to maintain proper moisture control and equivalent performance. Climate Zone 8 now requires a higher degree of insulation.

Class III vapor retarders are also permitted in Climate Zones 1-3 without necessary compliance with the conditions in Table 1404.3(3) intended for colder climates. Latex paint often complies as a Class III vapor retarder and is commonly used in all climate zones for an interior finish, even if not declared to be a Class III vapor retarder. Where paints are used as vapor retarders, they must be applied in accordance with the manufacturer's instructions to achieve the required perm rating for the vapor retarder class. Misuse or misapplication of paints that are not specifically recommended for use as vapor retarders has been shown to increase the risk of moisture problems in walls requiring Class III vapor retarders. Some paint applications may have a water vapor permeance of more than three times the maximum limit for Class III vapor retarders. As a result, walls designed with Class III vapor retarders can experience an increased risk of moisture accumulation problems. Paints should be verified to be acceptable Class III barriers when intended to be used as a vapor barrier.

1406.10

Metal Composite Material Cladding

CHANGE TYPE: Modification

CHANGE SUMMARY: From an application perspective, requirements for metal composite materials installed on exterior walls of buildings of Type I, II, III and IV construction have been significantly simplified and limited by the deletion of the alternate conditions previously set forth in Section 1406.11.

2022 CODE TEXT: **1406.10 Type I, II, III and IV construction.** Where installed on buildings of Type I, II, III and IV construction, metal composite material (MCM) ~~MCM systems~~ shall comply with Sections 1406.10.1 and ~~1406.10.4, or Section 1406.11.~~ 1406.10.2 for installations up to 40 feet (12 192 mm) above grade plane. Where installed on buildings of Type I, II, III and IV construction, MCMs and MCM systems shall comply with Sections 1406.10.1 through 1406.10.3, for installations greater than 40 feet (12 192 mm) above grade plane.

1406.10.1 Surface-burning characteristics. MCM shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 450 when tested ~~as an assembly~~ in the maximum thickness intended for use in accordance with ASTM E84 or UL 723.

1406.10.2 Thermal barriers. MCM shall be separated from the interior of a building by an approved thermal barrier consisting of ½-inch (12.7 mm) gypsum wallboard or material that is tested in accordance with and meets the acceptance criteria of both the Temperature Transmission Fire Test and the Integrity Fire Test of NFPA 275.

MCM use for cladding of an urban building.

~~**1406.10.3 Thermal barrier not required.**~~

Exceptions:

1. The MCM system is specifically approved based on tests conducted in accordance with NFPA 286 and with the acceptance criteria of Section 803.1.1.1, UL 1040 or UL 1715. Such testing shall be performed with the MCM in the maximum thickness intended for use. The MCM system shall include seams, joints and other typical details used in the installation and shall be tested in the manner intended for use.
2. The MCM is used as elements of balconies and similar projections, architectural trim or embellishments.

~~**1406.10.4**~~ **1406.10.3 Full-scale tests.** The MCM system shall be tested in accordance with, and comply with, the acceptance criteria of NFPA 285. Such testing shall be performed on the MCM system with the MCM in the maximum thickness intended for use.

(The deleted text of Section 1406.11 providing for alternate conditions is not included for clarity.)

CHANGE SIGNIFICANCE: A metal composite material (MCM) is a factory manufactured panel consisting of metal skins bonded to both sides of a solid plastic core. Recent global fire events have raised multiple questions regarding the use of MCM panels on exterior walls of Type I, II, III and IV construction. Although many, if not all, of the fires have involved wall assemblies that did not comply with provisions of the CBC, it was deemed necessary to evaluate the current regulation of such assemblies and revise the provisions to address current thinking. From an application perspective, the requirements have been significantly simplified and limited by the deletion of alternate conditions previously set forth in Section 1406.11. In other than Type V construction, the installation of MCM panels and MCM systems are now regulated based on one of two thresholds: 1) those applications where MCMs are installed no more than 40 feet above grade plane, and 2) those conditions where MCM panels and systems are installed at heights more than 40 feet above grade plane.

Where the MCM or MCM systems are installed at a height greater than 40 feet above grade plane, the three previous criteria continue to be applicable regarding surface-burning characteristics, thermal barriers and full-scale tests based on NFPA 285. Where the installation height is 40 feet or less, full-scale testing is not mandated. Testing for flame spread of the MCM when installed in buildings of Type I, II, III and IV construction needs to be of the MCM itself, in other words, of the sandwich panel alone and not of the system that includes a series of other components.

The recognition of alternate conditions dealing with fire separation distance, self-ignition temperature, panel size, occupancy limitations and automatic sprinkler system protection has been deleted. MCMs were the only system in Chapter 14 where the presence of sprinklers inside the building was the reason to eliminate height and coverage limitations associated with fires along the exterior wall envelope. However, interior sprinkler systems for high-rise buildings are not intended to control outside exposure fires. The presence of sprinklers inside the building should not provide a full exception from testing to NFPA 285 or from height limitations considered necessary to ensure a minimum level of safety.

1503.3

Parapet Walls

CHANGE TYPE: Modification

CHANGE SUMMARY: Parapet walls now require moisture resistance in a manner similar to the remainder of the building.

2022 CODE TEXT: **1503.3 ~~Coping.~~ Parapet walls.** Parapet walls shall be ~~properly coped with noncombustible, weatherproof materials of a width not less than the thickness of the parapet wall.~~ coped or covered in accordance with Sections 1503.3.1 and 1503.3.2. The top surface of the parapet wall shall provide positive drainage.

1503.3.1 Fire-resistance-rated parapet walls. Parapet walls required by Section 705.11 shall be coped or covered with weatherproof materials of a width not less than the thickness of the parapet wall such that the fire-resistance rating of the wall is not decreased.

1503.3.2 Other parapet walls. Parapet walls meeting one of the exceptions in Section 705.11 shall be coped or covered with weatherproof materials of a width not less than the thickness of the parapet wall.

CHANGE SIGNIFICANCE: By definition, a parapet wall is the part of any wall entirely above the roof line. Depending on the type of roofing system designed, traditional metal or masonry copings may not cap or cover a parapet wall. Section 1503.3 now provides requirements for when and how parapet walls are to be properly coped or covered by having requirements for two different types of parapet walls. Additionally, the mandate that parapet walls be coped with noncombustible materials has been deleted.

Photo courtesy of Patrick Wong

Short parapet wall on roof.

Section 1503.3.1 is applicable to parapet walls required to comply with Section 705.11 regulating the fire resistance and related features of such walls. Parapet walls shall be coped or covered with materials that are both weatherproof and maintain the required fire-resistance rating. Section 1503.3.2 addresses parapet walls that are exempt from the parapet wall requirements of Section 705.11, such as those parapets intended to conceal the roof slope or rooftop equipment. With no fire resistance mandated, the only requirement is that parapet walls be coped or covered with weatherproof materials. In both cases, coping materials are to extend the full thickness of the parapet wall.

1504.5

Ballasted Roofs

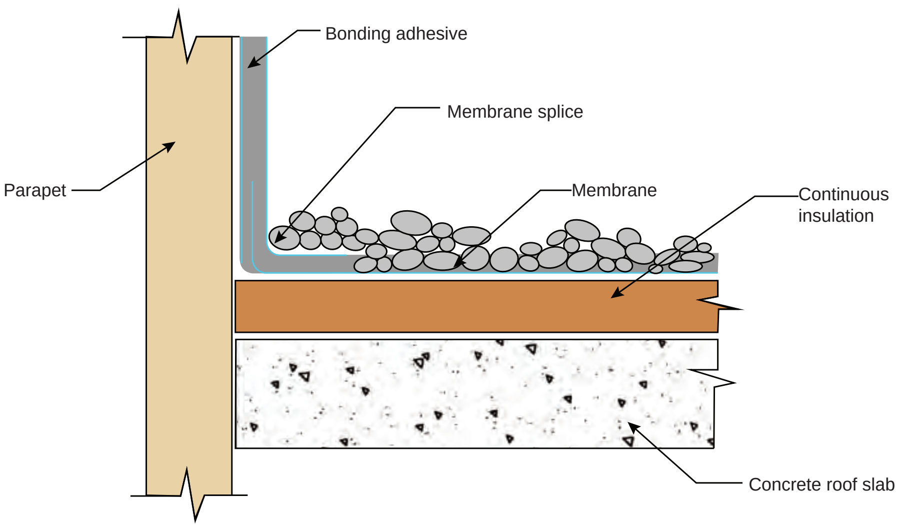
CHANGE TYPE: Modification

CHANGE SUMMARY: All requirements applicable to the design and construction of ballasted low-slope roofs are now contained in the ANSI/SPRI RP-4 standard.

2022 CODE TEXT: **~~1504.4~~ 1504.5 Ballasted low-slope single-ply roof systems.** Ballasted low-slope (roof slope < 2:12) single-ply roof system coverings installed in accordance with Section~~s~~ 1507.12 ~~and 1507.13~~ shall be designed in accordance with ~~Section 1504.8 and~~ ANSI/SPRI RP-4.

CHANGE SIGNIFICANCE: Ballasted roofs must now solely comply with American National Standards Institute (ANSI)/Single Ply Roofing Industry (SPRI) RP-4, *Wind Design Standard for Ballasted Single-ply Roofing Systems*, and as such are no longer regulated by Section 1504.9. Requirements in the SPRI RP-4 standard were developed for ballasted roofs with the intent to prevent ballast scour for this single-ply ballasted system. The scour wind speed is below the wind speed at which blow-off occurs. Therefore, rock does not become airborne and damage glazing in adjacent buildings.

SPRI RP-4 requires stone ballast sized according to ASTM D7655, *Standard Classification for Size of Stone Used as Ballast for Membrane Roof Systems*. Stone is sized into one of four categories. No. 4 ballast, the smallest diameter stone, must be at least 1¼ inches in diameter. In comparison, No. 2 ballast must be at least 2½ inches in diameter. Alternatively, stone pavers may be used as ballast. A No. 4 paver must weigh at least 18 pounds per square foot. This ballast stone is much larger than stone used for aggregate surfaced roofing, as described in CBC Section 1504.9.



Ballasted single-ply roof with large aggregate.

The requirements in SPRI RP-4 are based on a complete set of wind tunnel tests. In this test series, variables that impact the wind performance of ballasted single-ply roof assemblies were evaluated, including stone size and distribution as specified in ASTM D7655. In the series of tests, three critical wind speeds were identified for each condition of parapet height and stone size:

Wind speed 1 – speed at which stone first begins to move

Wind speed 2 – speed, if maintained, that results in stone scouring

Wind speed 3 – speed at which stone blow-off occurs

Requirements in the design tables of SPRI RP-4 are based on Wind speed 2, the wind speed at which stone scour occurs. The requirements of the standard have recently been updated based on field performance of ballasted single-ply roofs. The most recent edition's design tables reflect the current methodology for the interpretation of wind tunnel data.

1504.9

Aggregate-Surfaced Roofs

CHANGE TYPE: Modification

CHANGE SUMMARY: Parapets of a minimum height are now required for aggregate-surfaced roofs to prevent blow-off.

2022 CODE TEXT: **1504.9 Wind resistance of aggregate-surfaced roofs.** Parapets shall be provided for aggregate-surfaced roofs and shall comply with Table 1504.9.

~~**1504.8 Surfacing and ballast materials in hurricane-prone regions.** For a building located in a hurricane-prone region as defined in Section 202, or on any other building with a mean roof height exceeding that permitted by Table 1504.8 based on the exposure category and basic wind speed at the site, the following materials shall not be used on the roof:~~

1. ~~Aggregate used as surfacing for roof coverings.~~
2. ~~Aggregate, gravel or stone used as ballast.~~

~~**TABLE 1504.8** Maximum Allowable Mean Roof Height Permitted for Buildings with Aggregate on the Roof in Areas Outside A Hurricane-Prone Region~~

TABLE 1504.9 Minimum Required Parapet Height (inches) for Aggregate Surfaced Roofs[a,b,c]

Aggregate Size	Mean Roof Height (ft)	Wind Exposure and Basic Design Wind Speed (mph)																	
		Exposure B									Exposure C[d]								
		≤95	100	105	110	115	120	130	140	150	≤95	100	105	110	115	120	130	140	150
ASTM D1863 (No.7 or No.67)	15	2	2	2	2	12	12	16	20	24	2	13	15	18	20	23	27	32	37
	20	2	2	2	2	12	14	18	22	26	12	15	17	19	22	24	29	34	39
	30	2	2	2	13	15	17	21	25	30	14	17	19	22	24	27	32	37	42
	50	12	12	14	16	18	21	25	30	35	17	19	22	25	28	30	36	41	47
	100	14	16	19	21	24	27	32	37	42	21	24	26	29	32	35	41	47	53
	150	17	19	22	25	27	30	36	41	46	23	26	29	32	35	38	44	50	56
ASTM D1863 (No.6)	15	2	2	2	2	12	12	12	15	18	2	2	2	13	15	17	22	26	30
	20	2	2	2	2	12	12	13	17	21	2	2	12	15	17	19	23	28	32
	30	2	2	2	2	12	12	16	20	24	2	12	14	17	19	21	26	31	35
	50	12	12	12	12	14	16	20	24	28	12	15	17	19	22	24	29	34	39
	100	12	12	14	16	19	21	26	30	35	16	18	21	24	26	29	34	39	45
	150	12	14	17	19	22	24	29	34	39	18	21	23	26	29	32	37	43	48

For SI: 1 inch = 25.4 mm; 1 foot = 304.8 mm; 1 mile per hour = 0.447 m/s.

a. Interpolation shall be permitted for mean roof height and parapet height.

b. Basic design wind speed, *V*, and wind exposure shall be determined in accordance with Section 1609.

c. Where the minimum required parapet height is indicated to be 2 inches (51 mm), a gravel stop shall be permitted and shall extend not less than 2 inches (51 mm) from the roof surface and not less than the height of the aggregate.

d. For Exposure D, add 8 inches (203 mm) to the parapet height required for Exposure C and the parapet height shall not be less than 12 inches (305 mm).


Photo courtesy of Baloncici

Aggregate-surfaced roof with parapet.

CHANGE SIGNIFICANCE: Past provisions regulating aggregate blow-off from aggregate-surfaced roofs were not based on a quantitative analysis of observed roofing system performances in real wind events. Rather, the requirements were based on variations in surface pressure with building height, which is known to be an inaccurate predictor of aggregate blow-off due to pressure equalization effects.

Fully revised Section 1504.9 is now based on wind speeds for blow-off and only deals with smaller aggregate used for the surfacing of built-up roofs (BUR) and sprayed polyurethane foam (SPUF) roofs, both of which are different systems than ballasted roofs.

Table 1504.9 considers aggregate size, roof height and wind speed to determine the minimum required parapet height. The table provides an engineering and scientific basis for roof design to prevent aggregate blow-off that is based on wind tunnel tests and subsequent field studies of hurricane damage. Unsafe conditions where no parapets are provided to retain aggregates are no longer allowed.

Critical parameters, such as aggregate size and parapet height, will now govern performance. The use of aggregate-surfaced roofing systems is a viable option in high-wind areas with appropriate aggregate sizing and parapet height.

Note: ASTM D1863 maintains an aggregate size No. 67 that is sized between aggregates No. 7 and No. 6.

1603.1.4

Construction Document Wind Zones

CHANGE TYPE: Modification

CHANGE SUMMARY: Component and cladding wind zones must now be identified in the construction documents.

2022 CODE TEXT: **1603.1.4 Wind design data.** The following information related to wind loads shall be shown, regardless of whether wind loads govern the design of the lateral force-resisting system of the structure:

1. Basic design wind speed, V, miles per hour and allowable stress design wind speed, V_{asd}, as determined in accordance with Section 1609.3.1.
2. Risk category.
3. Wind exposure. Applicable wind direction if more than one wind exposure is utilized.
4. Applicable internal pressure coefficient.
5. Design wind pressures <u>and their applicable zones with dimensions</u> to be used for exterior component and cladding materials not specifically designed by the registered design professional responsible for the design of the structure, pounds per square foot (kN/m^2).

CHANGE SIGNIFICANCE: There has been some confusion as to how the 2016 edition of the American Society of Civil Engineers (ASCE) standard ASCE 7, *Minimum Design Loads and Associated Criteria for Buildings and Other Structures,* component and cladding (C&C) wind pressure zones are to be applied—specifically, what dimensions various zones should be for individual buildings. A description of C&C pressure zones in the construction documents should assist in correctly applying requirements for roof and wall assemblies and covering applications.

Adding the zones to the submittal information is intended to improve guidance for locating tighter nailing zones and other changes in construction requirements on a roof or wall surface. As ASCE 7-16 updated C&C roof zones, changing the shape, length and wind intensity of the zones, notice of changing nailing patterns in designs, especially along roof edges and ridges, is important. C&C wall pressures did not change in ASCE 7-16.

To provide a sense of how these changes affect building nailing patterns, consider Figure 16-1 where four examples of a flat roof on low- and mid-rise buildings are outlined. Note that corner areas have higher wind pressures than edge areas, while interior areas have the lowest wind pressures. Therefore, the tightest nailing patterns occur in corner zones and more widely-spaced nail patterns occur in the center of a roof.

For the low-rise building in Layout 1, the large footprint means the high-pressure corner areas look small. The length and depth of a corner area are determined by the building height. When a building's length (L) and width (W) are much larger than its height, in a warehouse, for example, the higher-pressure corner areas (Zone 3) become a very small portion of the total roof area. Edge areas typically fall into the Zone 2 category, unless Zone 3 extends around the perimeter as shown in Layout 4. The width of these Zone 2 areas is 60 percent of the building height. For a warehouse, this is a narrow strip along the four sides of the building. This

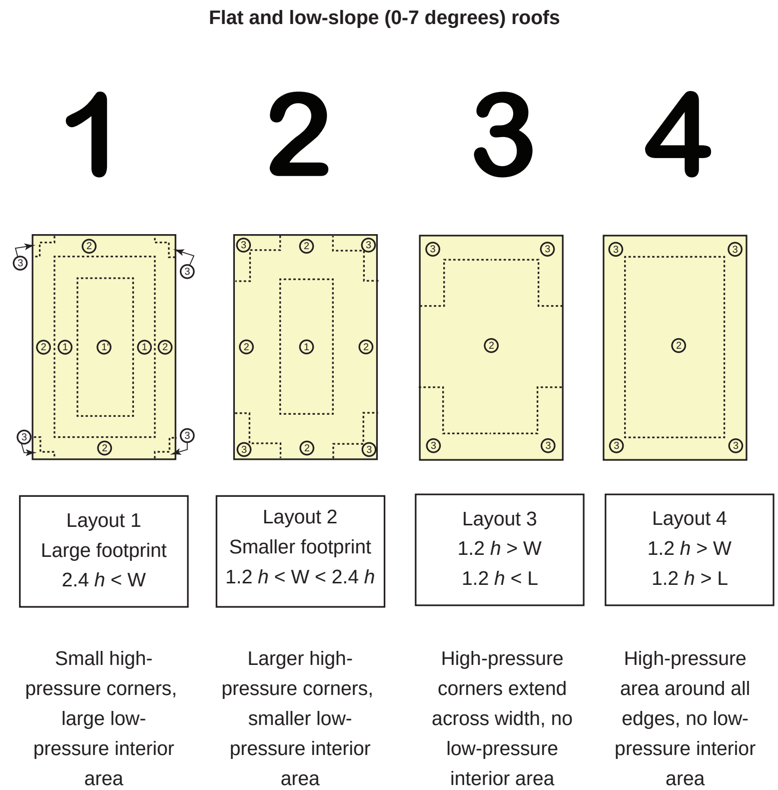


Figure 16-1 Component and cladding wind zone sizes may change significantly with building shape.

area will have increased nailing requirements compared to ASCE 7-10, but only in a relatively narrow strip. The interior is divided into Zone 1 and Zone 1′. Wind pressures in Zone 1 are lower than the edge and corner zones. Zone 1′ has a further reduced wind pressure. This zone only exists for buildings with a large footprint and low height. A building with a smaller footprint, such as Layout 2 or Layout 3, does not have a Zone 1′.

Layout 2 is an example of a typical low-rise 1- to 3-story building potentially used for office or mercantile space. Its footprint is significantly smaller than the warehouse. The edge areas extend further into the center of the roof. More of this roof will have tight nailing patterns. Zone 1 does still occur in the center of the roof along with its less restrictive nailing patterns.

Layout 3 is a mid-rise building with a height approximately equal to its width. In this example, the corner areas extend across the width of the building creating tighter nail spacing along the entire edge. Along the length of the building, the corner nailing ends and the edge nailing begins near the center of the building length. The entire center of the roof requires edge (Zone 2) nailing rather than a reduction to interior (Zone 1) nail spacing.

Layout 4 is a mid-rise building where the building is taller than it is long. In this case, the entire edge of the roof requires corner (Zone 3) nailing and the interior requires edge (Zone 2) nailing, creating a much tighter nail schedule for the entire roof.

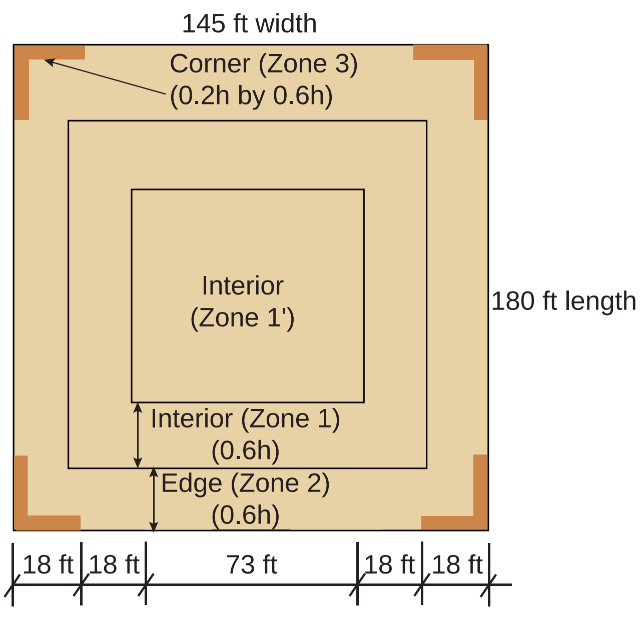
A more detailed example of the nailing patterns:
In the following examples, the roof C&C zones using the simplified method for low-rise buildings (ASCE 7-16, Chapter 30, Part 2) are shown for (1) a flat roof and (2) a 10:12 hip roof. Both have significant changes to nail spacing due to increased loads compared to ASCE 7-10, which was referenced by the 2013 and 2016 editions of the *California Building Code* (CBC).

Example 1: Flat Roof

Building Height ~ Mean Roof Height = 30 ft

0.2h = 0.2 × 30 ft = 6 ft (corner zone depth)

0.6h = 0.6 × 30 ft = 18 ft (corner zone length, edge zone depth)



Example 2: High-Slope Hip Roof

4-story building

10:12 pitch roof

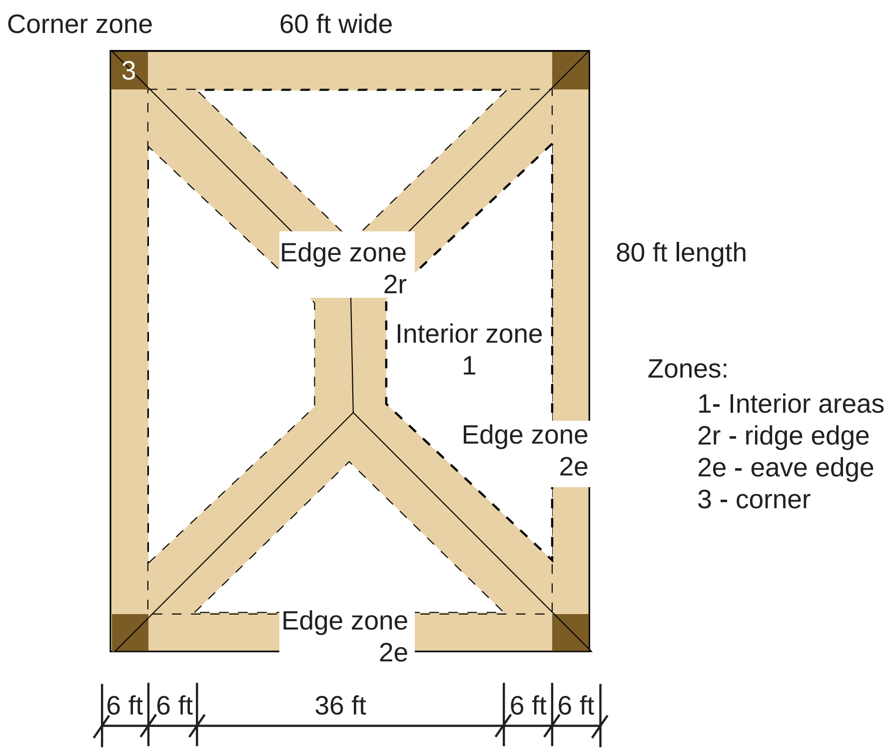
Mean Roof Height = 55 ft

a = 10% of the least roof dimension or 0.4h

0.1w = 0.1 × 60 ft = 6 ft   6 ft < 22 ft, a = 6 ft

0.4h = 0.4 × 55 ft = 22 ft

When designing hip roofs, the use of the variable a to determine the length and depth of corner, ridge and eave edge zones continues. The value is either 10 percent of the roof width or 40 percent of the building height, whichever is smaller.



Roof Pressures

In addition to larger corner and edge areas on roofs, ASCE 7-16 also includes increased roof pressures for low-rise (simplified) buildings with h ≤ 60 ft and buildings taller than 60 feet with hip, gable or flat roofs. In the case of a flat roof on a low-rise building using the simplified method, pressures for corner, edge and interior areas increased from 13 percent to 81 percent with an average increase of over 40 percent. For other roof slopes, Table 16-1 shows a comparison of C&C loads for ASCE 7-16 versus ASCE 7-10. Between the increase of roof area assigned to corner and edge regions and the increase in roof pressures, nail schedules are likely to change across the entire roof with nail spacing cut in half in some cases.

TABLE 16-1 Comparison of Component and Cladding Coefficients in ASCE 7[a]

	Ratio of ASCE 7–16/ASCE 7–10											
	Roof $GC_p - GC_{pi}$						Roof Overhang $GC_p - GC_{pi}$					
Roof Slope	3r	3e	2r	2n	2e	1	3r	3e	2r	2n	2e	1
$7 < \Theta \leq 20$	1.36	1.14	1.69	1.69	1.16	2.02	1.27	1.11	1.59	1.59	1.14	–
$20 < \Theta \leq 27$	1.36	0.96	1.43	1.43	0.89	1.56	1.27	0.97	1.36	1.36	0.91	–
$27 < \Theta \leq 45$	1.58	2.45	1.43	1.58	1.43	1.68	1.40	2.00	1.30	140	1.30	–

a. Low-rise building (simplified) Part 2 method for gable roofs.

(Courtesy of American Wood Council.)

Table 1604.5

Risk Categories of Assembly Spaces

CHANGE TYPE: Modification

CHANGE SUMMARY: Mixed occupancy buildings with assembly spaces are now designated as Risk Category III when the total public assembly occupant load is greater than 2,500 people.

2022 CODE TEXT:

TABLE 1604.5 Risk Category of Buildings and Other Structures

Risk Category	Nature of Occupancy
III	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to: • Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300. • Buildings and other structures containing one or more public assembly spaces, each having an occupant load greater than 300 and a cumulative occupant load of the public assembly spaces of greater than 2,500. • Buildings and other structures containing Group E or Group I-4 occupancies or combination thereof, with an occupant load greater than 250. *(Other Risk Category III criteria remain unchanged)*

Photo courtesy of Mad Circles

A movie theater is an example of an assembly occupancy.

CHANGE SIGNIFICANCE: Group R-1 hotels often have convention center facilities with multiple large ballrooms and other assembly spaces, but public assembly is not the primary occupancy of the building. These buildings have historically been classified as Risk Category II. Conversely, there are smaller buildings consisting solely of one or more assembly rooms where the primary occupancy is public assembly with a cumulative occupant load of over 300 that must be designed to the higher Risk Category III requirements although the total assembly occupant load is much lower when compared to a hotel.

To deal with this imbalance, Table 1604.5 includes a new condition under Risk Category III for those buildings containing at least one assembly space with an occupant load greater than 300 while also having a cumulative occupant load for all assembly spaces of more than 2,500. Buildings that meet these criteria are now assigned to Risk Category III rather than Risk Category II.

To illustrate the revised provisions, the following example is based on a hotel with an adjoining convention area. The primary use of the building is considered to be Group R-1; however, there are also a number of assembly spaces having a significant occupant load. The building housing the hotel and convention facilities is now considered to be Risk Category III due to the new criteria.

Example: Hotel Conference Center

Photo courtesy of mustafagull

5-story hotel with conference center

440 guest rooms

2 ballrooms with 1,200 occupants each

3 meeting rooms with 90 occupants each

Total assembly occupants: 2,670 people **Risk Category III**

The new threshold requires the existence of two conditions for the establishment of a Risk Category III classification. First, at least one of the assembly spaces must have an occupant load that exceeds 300, and second, the cumulative occupant load of all assembly spaces must exceed 2,500. In the example shown, both conditions have been met, and the building is to be assigned to Risk Category III.

An additional revision addresses day-care facilities classified as Group I-4 occupancies. These occupancies have not previously been specifically identified in Table 1604.5; however, the threshold at which a Risk Category III is to be assigned to such day-care facilities has now been established. Consistent with the application for when a Group E occupancy is present, a building used for day-care purposes is considered Risk Category III when the total occupant load for the Group I-4 occupancy, or the combination of Group E and Group I-4 occupancies, exceeds 250.

Photo courtesy of kievith

Group I-4 in an apartment complex.

1605

Load Combinations

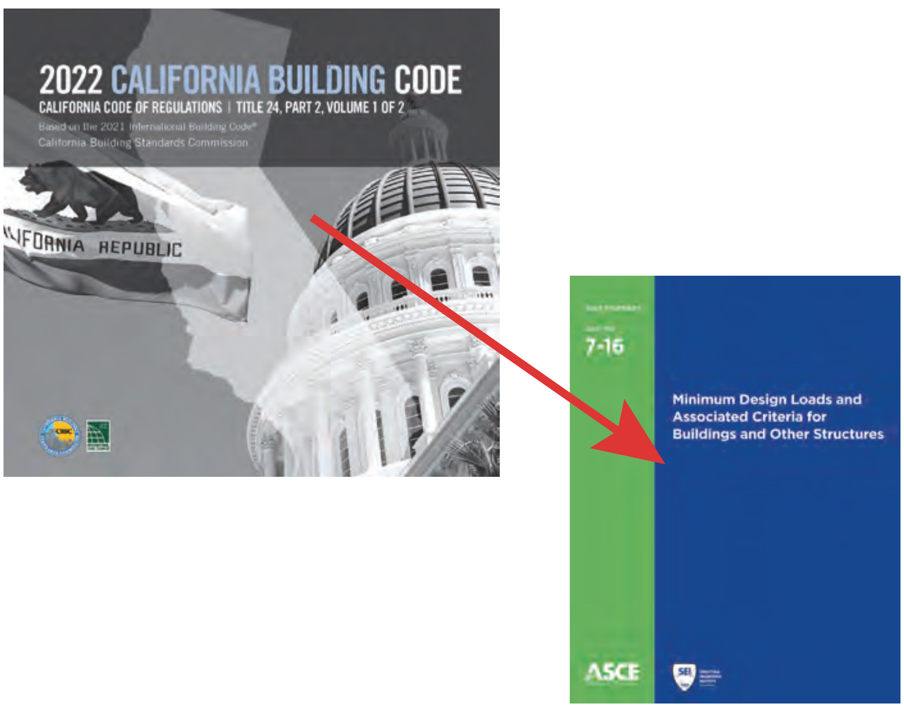
CHANGE TYPE: Modification

CHANGE SUMMARY: The strength design and allowable stress design load combinations have been deleted while direct reference to Chapter 2 of ASCE 7 has been added to Section 1605.

2022 CODE TEXT: **1605.1 General.** Buildings and other structures and portions thereof shall be designed to resist the strength load combinations specified in ASCE 7, Section 2.3, the allowable stress design load combinations specified in ASCE 7, Section 2.4, or the alternative allowable stress design load combinations of Section 1605.2.

Exceptions:

1. The modifications to load combinations of ASCE 7 Section 2.3, ASCE 7 Section 2.4, and Section 1605.2 specified in ASCE 7 Chapters 18 and 19 shall apply.
2. Where the allowable stress design load combinations of ASCE 7 Section 2.4 are used, flat roof snow loads of 30 pounds per square foot (1.44 kN/m^2) and roof live loads of 30 pounds per square foot (1.44 kN/m^2) or less need not be combined with seismic load. Where flat roof snow loads exceed 30 pounds per square foot (1.44 kN/m^2), 20 percent shall be combined with seismic loads.
3. Where the allowable stress design load combinations of ASCE 7 Section 2.4 are used, crane hook loads need not be combined with roof live loads or with more than three-fourths of the snow load or one-half of the wind loads.



International Code Council and American Society of Civil Engineers

2022 CBC directly references ASCE 7-16 for load combinations.

~~1605.3.2~~ 1605.2 Alternative allowable stress design load combinations. In lieu of the ~~basic load combinations specified in Section 1605.3.1~~ load combinations in ASCE 7, Section 2.4, structures and portions thereof shall be permitted to be designed for the most critical effects resulting from the following combinations. Where using these alternative allowable stress load combinations that include wind or seismic loads, allowable stresses are permitted to be increased or load combinations reduced where permitted by the material chapter of this code or the referenced standards. For load combinations that include the counteracting effects of dead and wind loads, only two-thirds of the minimum dead load likely to be in place during a design wind event shall be used. Where using these alternative load combinations to evaluate sliding, overturning and soil bearing at the soil-structure interface, the reduction of foundation overturning from Section 12.13.4 in ASCE 7 shall not be used. Where using these alternative basic load combinations for proportioning foundations for loadings, which include seismic loads, the vertical seismic load effect, E_v, in Equation 12.4-4 of ASCE 7 is permitted to be taken equal to zero. Where required by ASCE 7, Chapters 12, 13, and 15, the load combinations including overstrength of ASCE 7, Sections 2.3.6 shall be used. ***[OSHPD 1R, 2B & 5]*** *Each load combination shall be investigated with one or more of the variable loads set to zero.*

$D + L + (L_r \text{ or } S \text{ or } R)$ **(Equation ~~16-17~~ 16-1)**

$\cancel{D + L + 0.6\omega W}$ $D + L + 0.6W$ **(Equation ~~16-18~~ 16-2)**

$\cancel{D + L + 0.6\omega W + S/2}$ $D + L + 0.6W + S/2$ **(Equation ~~16-19~~ 16-3)**

$\cancel{D + L + S + 0.6\omega W/2}$ $D + L + S + 0.6W/2$ **(Equation ~~16-20~~ 16-4)**

$D + L + S + E/1.4$ **(Equation ~~16-21~~ 16-5)**

$0.9D + E/1.4$ **(Equation ~~16-22~~ 16-6)**

Exceptions:

1. Crane hook loads need not be combined with roof live loads or with more than three-fourths of the snow load or one-half of the wind load.
2. Flat roof snow loads of 30 pounds per square foot (1.44 kN/m^2) or less and roof live loads of 30 pounds per square foot (1.44 kN/m^2) or less need not be combined with seismic loads. Where flat roof snow loads exceed 30 pounds per square foot (1.44 kN/m^2), 20 percent shall be combined with seismic loads.

(Additional deleted text not shown for brevity and clarity)

CHANGE SIGNIFICANCE: For five editions, the CBC has contained three separate groups of load combinations:

1. Strength (Section 1605.2)
2. Basic Allowable Stress (Section 1605.3.1)
3. Alternative Allowable Stress (Section 1605.3.2)

Two combinations, the strength load combinations and basic allowable stress load combinations, are replicated directly from ASCE 7-16, *Minimum Design Loads and Associated Criteria for Buildings and Other Structures*. Deletion of the CBC load combinations removes minor variations in the requirements between the CBC and ASCE 7 by eliminating the duplication of the equations.

The third set of load combinations are a legacy set from the codes that predate the CBC. In the 2007 CBC through the 2019 CBC, the alternative allowable stress design load combinations permitted the use of a 1/3 increase in allowable stresses when evaluating load combinations containing short-term transient loads including wind and seismic loads. The basic allowable stress combinations did not permit the reduction in loads, but applied a factor of 0.75 to transient loads, including live, snow, wind and seismic loads, when more than one of these loads was considered simultaneously.

The ASCE 7 load combinations have further permitted an increase in allowable stresses when the material, such as wood, has increased available strength under short-term loading, i.e. loads due to snow, rain, wind or earthquakes. This increase is not intended to be used for the design of masonry, concrete or steel structures, because the strength of these materials does not vary significantly with the duration of the load. Unfortunately, the one-third stress increase has routinely been applied incorrectly. To limit misuse of the stress increase, the omega factor, ω, has been deleted from the alternative allowable stress design load combinations.

1606

Dead Loads

CHANGE TYPE: Modification

CHANGE SUMMARY: Dead loads at the roof level have been clarified as well as fixed service equipment concentrated loads.

2022 CODE TEXT: **1606.2** ~~**Design dead load.**~~ **Weights of materials of construction.** For purposes of design, the actual weights of materials of construction ~~and fixed service equipment~~ shall be used. In the absence of definite information, values used shall be subject to the approval of the building official.

1606.3 Weight of fixed service equipment. In determining dead loads for purposes of design, the weight of fixed service equipment, including the maximum weight of the contents of fixed service equipment, shall be included. The components of fixed service equipment that are variable, such as liquid contents and movable trays, shall not be used to counteract forces causing overturning, sliding, and uplift conditions in accordance with Section 1.3.6 of ASCE 7.

Exceptions:

1. Where force effects are the result of the presence of the variable components, the components are permitted to be used to counter those load effects. In such cases, the structure shall be designed for force effects with the variable components present and with them absent.
2. For the calculation of seismic force effects, the components of fixed service equipment that are variable, such as liquid contents and movable trays, need not exceed those expected during normal operation.

1606.4 Photovoltaic panel systems. The weight of photovoltaic panel systems, their support system, and ballast shall be considered as dead load.

1606.5 Vegetative and landscaped roofs. The weight of all landscaping and hardscaping materials for vegetative and landscaped roofs shall be considered as dead load. The weight shall be computed considering both fully saturated soil and drainage layer materials and fully dry soil and drainage layer materials to determine the most severe load effects on the structure.



Examples of roof dead loads – HVAC equipment, solar panels and vegetative roofs.

CHANGE SIGNIFICANCE: Historically, the code has not addressed variable content weight in dead loads nor explicitly described certain loads. The weights of vegetative roofs, solar panels and fixed service equipment have been clarified to provide consistency between the CBC and ASCE 7. A dead load, as defined in Section 202, has two parts: the weight of materials that constitute the building and the weight of fixed service equipment. The weight of fixed service equipment includes both the empty weight of the equipment and the maximum weight of the contents. For example, the weight of liquids is to be included in the dead load of piping and tanks, and the weight of conduit and wiring is to be included in the dead load of cable trays. In addition, as content weight may be variable, it cannot be counted upon to counteract the effects of overturning, sliding and uplift forces. Exceptions in Section 1606 specifically address the calculation of variable loads for liquids and moveable equipment.

Exception 1 indicates that when the variable content weight is the source of the force causing overturning, sliding or uplift, it can be used to counteract the force. For example, in a tank, a liquid is the primary source of the seismic mass for the tank and, therefore, can be used to resist seismic uplift. However, the liquid cannot be used to resist overturning, sliding and uplift forces from wind loads.

Exception 2 indicates that the maximum weight of the contents does not have to be used when calculating seismic forces, but rather the weight that typically exists during normal operation. This is consistent with methodologies for the determination of seismic weight when including components that may not be in place during an earthquake.

The worst-case design load is used for each aspect of seismic design. If a fully loaded tank is the worst design load case for drift calculations or forces on tank anchorage, then a fully loaded tank is assumed in design. If an empty tank is the worst potential load case for determining uplift or walking of a tank during an earthquake, then that loading scheme is to be used for design.

1607.11.4

Rope Descent Systems

Photo courtesy of Den Boma

Fall arrest and lifeline cables must be designed to stop falls.

CHANGE TYPE: Modification

CHANGE SUMMARY: Rope descent system anchorage has been added to the section on fall arrest and lifeline anchorage.

2022 CODE TEXT: **~~1607.10.4~~ 1607.11.4 Fall arrest, ~~and~~ lifeline, and rope descent system anchorages.** In addition to any other applicable live loads, fall arrest, ~~and~~ lifeline, and rope descent system anchorages and structural elements that support these anchorages shall be designed for a live load of not less than 3,100 pounds (13.8 kN) for each attached ~~lifeline~~ line, in ~~every~~ any direction that ~~a fall arrest~~ the load can be applied.

Anchorages of horizontal lifelines and the structural elements that support these anchorages shall be designed for the maximum tension that develops in the horizontal lifeline from these live loads.

CHANGE SIGNIFICANCE: In 2017, the Occupational Safety and Health Administration (OSHA) adopted new regulations in Section 1910.27 that specifically require all anchorages of rope descent systems (such as boatswain's chairs) to be able to support 5,000 pounds in any direction for each attached worker. Since OSHA has added specific language addressing rope descent systems, and because the systems and loads are basically identical to those for other fall arrest lines, Section 1607.11.4 has been updated to mirror OSHA's requirements and includes minimum design loads for rope descent systems.

Requirements for the design of a horizontal lifeline anchorage and its support have been added to ensure that the anchorage design correctly considers increases in forces associated with the horizontal lifeline geometry.

Photo courtesy of cat-scape

Rope descent systems.

1607.17

Fixed Ladder Live Load

CHANGE TYPE: Addition

CHANGE SUMMARY: Live loads for fixed and ship's ladders have been added to the CBC.

2022 CODE TEXT: **1607.17 Fixed ladders.** Fixed ladders with rungs shall be designed to resist a single concentrated load of 300 pounds (1.33 kN) in accordance with Section 4.5.4 of ASCE 7. Where rails of fixed ladders extend above a floor or platform at the top of the ladder, each side rail extension shall be designed to resist a single concentrated load of 100 pounds (0.445 kN) in accordance with Section 4.5.4 of ASCE 7. Ship's ladders shall be designed to resist the stair loads given in Table 1607.1.

CHANGE SIGNIFICANCE: Live loads to be used in the design of ladders have not previously been specified in the CBC; however, requirements for fixed ladders are now coordinated between the CBC and ASCE 7. Ladder live loads contained in ASCE 7 have been added to the CBC. The addition of live load values provides the necessary load values in the CBC but maintains the accompanying design information within ASCE 7.

Ship's ladder live loads are listed by a reference to stair loads set forth in Table 1607.1. The table requires a uniform live load for stairs of 100 pounds per square foot and a concentrated live load of 300 pounds. One- and two-family dwellings may use a lower uniform live load for stairs, which also applies to ship's ladders.

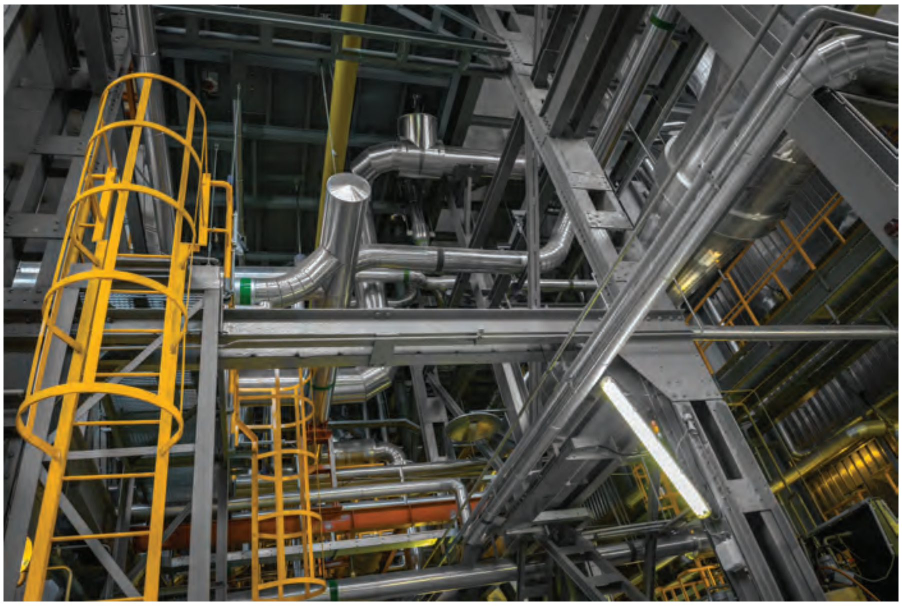


Photo courtesy of svedoliver

Fixed ladder loads are assigned by ASCE 7.

1608.2

Snow Maps

CHANGE TYPE: Modification

CHANGE SUMMARY: The ground snow load map has been updated to provide consistency with ASCE 7-16 snow maps by adding a reference to ASCE 7 snow tables in states with large case study areas.

2022 CODE TEXT: **1608.2 Ground snow loads.** The ground snow loads to be used in determining the design snow loads for roofs shall be determined in accordance with ASCE 7 or Figures 1608.2(1) and 1608.2(2) for the contiguous United States and Table 1608.2 for Alaska.

(Additional text in section not shown for brevity.)

CHANGE SIGNIFICANCE: Updating Section 1608 harmonizes snow load provisions with the 2016 edition of ASCE 7, which is the reference standard for snow loads used in building design.

ASCE 7 has a ground snow map that contains new ground-snow load tables; these include tables for seven states: Colorado, Idaho, Montana, Washington, New Mexico, Oregon and New Hampshire. The state tables list ground snow loads and maximum elevations for major cities and towns in each region of a given state. The tables are based on state ground snow reports by regional experts and include specialized knowledge of local climatic conditions. Table 7.2-5, Ground Snow Loads for Selected Locations in Washington [State] is an excerpt from ASCE 7-16.

CBC Figures 1608.2(1) and 1608.2(2) indicate which states have supplemental data within the ASCE 7 standard.

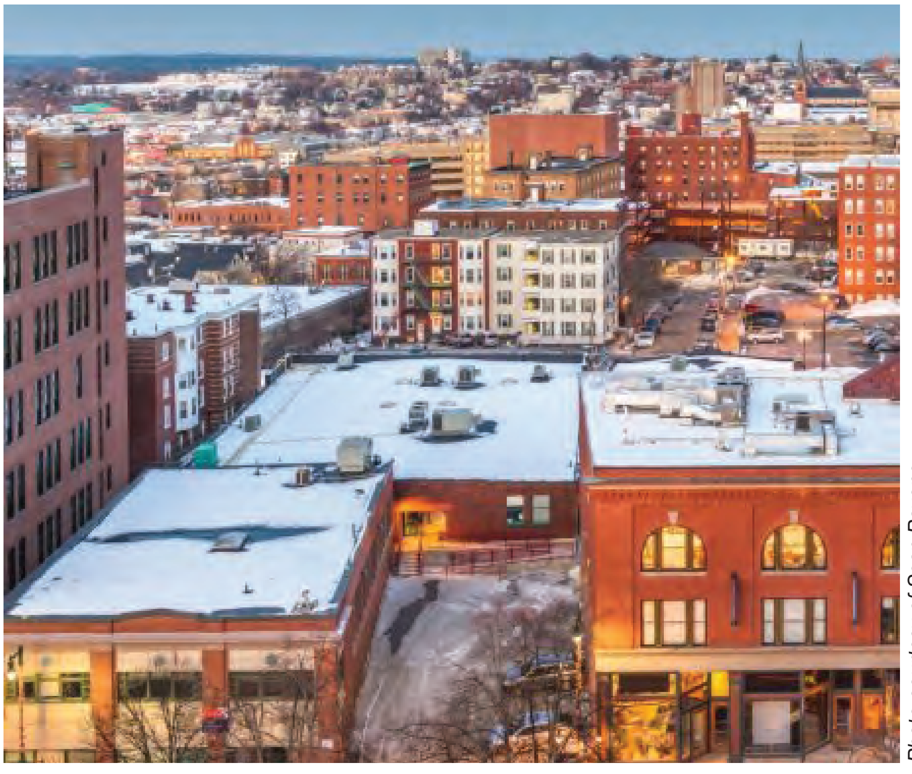


Photo courtesy of Sean Pavone

Many western towns have snow loads updated in the 2022 CBC.

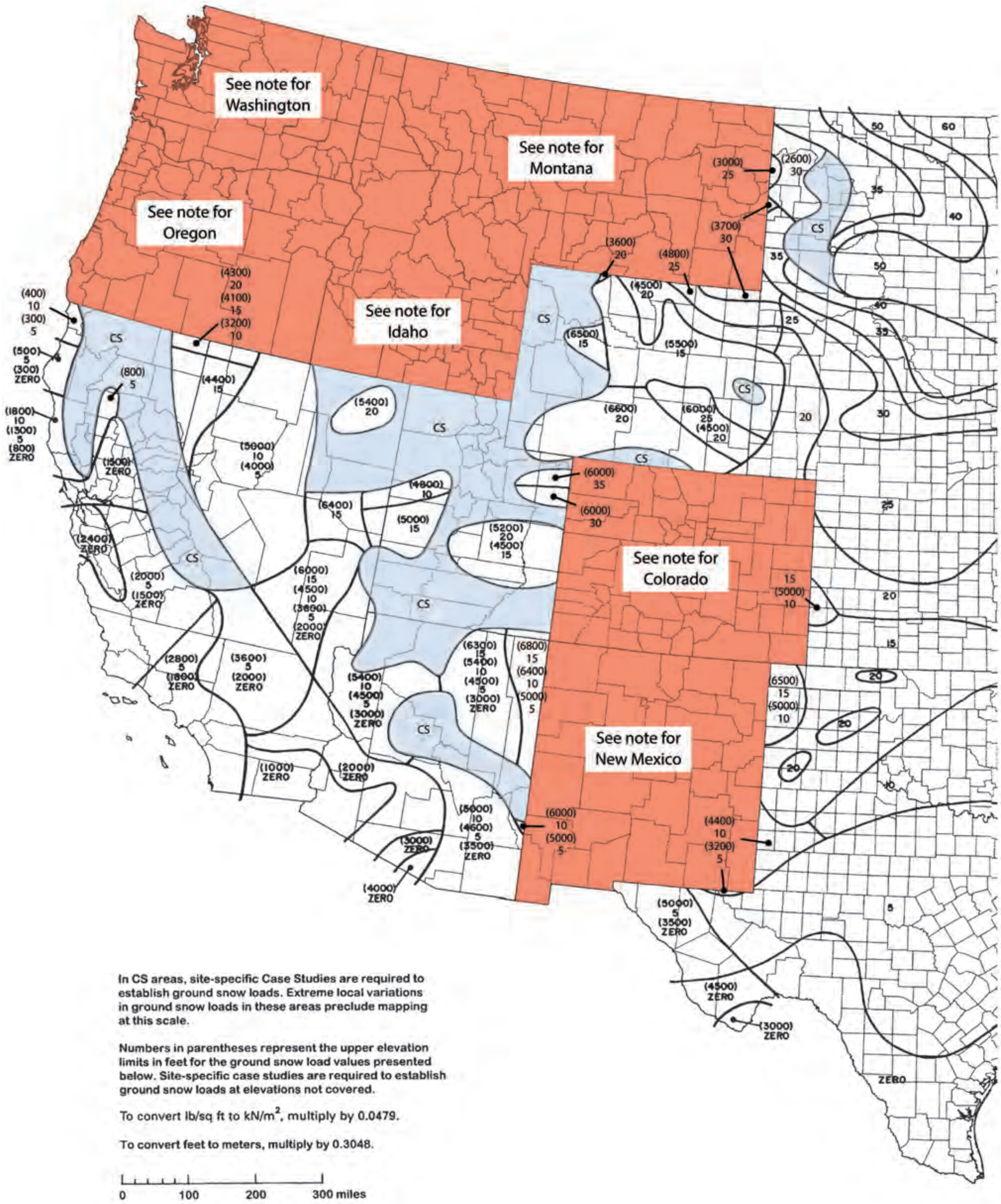


Figure 1608.2(1) Ground Snow Loads, p_g, for the United States (psf).

1610.2

Soil-Caused Uplift

CHANGE TYPE: Addition

CHANGE SUMMARY: Concrete slabs on ground must now be designed for uplift due to soil expansion and water pressure in areas prone to soil movement or a shallow water table.

2022 CODE TEXT: **1610.1** **~~General.~~** **Lateral pressures.** Foundation walls and retaining walls shall be designed to resist lateral soil loads from adjacent soil. Soil loads specified in Table 1610.1 shall be used as the minimum design lateral soil loads unless determined otherwise by a geotechnical investigation in accordance with Section 1803. Foundation walls and other walls in which horizontal movement is restricted at the top shall be designed for at-rest pressure. Retaining walls free to move and rotate at the top shall be permitted to be designed for active pressure. ~~Design~~ ~~l~~Lateral pressure from surcharge loads shall be added to the lateral ~~earth pressure~~ soil load. ~~Design~~ ~~l~~Lateral pressure shall be increased if expansive soils are present at the site ~~are expansive~~. Foundation walls shall be designed to support the weight of the full hydrostatic pressure of undrained backfill unless a drainage system is installed in accordance with Sections 1805.4.2 and 1805.4.3.

> **Exception:** Foundation walls extending not more than 8 feet (2438 mm) below grade and laterally supported at the top by flexible diaphragms shall be permitted to be designed for active pressure.

1610.2 Uplift loads on floor and foundations. Basement floors, slabs on ground, foundations, and similar approximately horizontal elements below grade shall be designed to resist uplift loads where applicable. The upward pressure of water shall be taken as the full hydrostatic pressure applied over the entire area. The hydrostatic load shall be measured from the underside of the element being evaluated. The design for upward loads caused by expansive soils shall comply with Section 1808.6.

Photo courtesy of Mark Winfrey

Slab foundations require design for soil heave.

CHANGE SIGNIFICANCE: Section 1610 has not previously addressed uplift loads from hydrostatic pressure or expansive soils. Requirements addressing uplift forces are now to be applied when appropriate and included in the design. The hydrostatic pressure provisions include a required determination of loads based on measuring to the underside of the construction per ASCE 7, Section 3.2.2. While this is a straightforward provision of fluid mechanics, the new provisions are intended to prevent the use of common elevations shown on construction drawings, such as floor elevations or the top of foundation construction, as the elevation at which to apply hydrostatic forces. The new language explicitly states that hydrostatic pressures should be applied to the underside of a foundation's lowest horizontal element.

A pointer has been added to Section 1808.6, Design for Expansive Soils, to help in determining the minimum required uplift or upward load due to the movement of soils below a building when expansive soils are present.

1611
Rain Loads

Secondary drainage system outflow.

CHANGE TYPE: Modification

CHANGE SUMMARY: Secondary drainage system rain loads have been updated to be consistent with ASCE 7.

2022 CODE TEXT: **1611.1 Design rain loads.** Each portion of a roof shall be designed to sustain the load of rainwater ~~that will accumulate on it if the primary drainage system for that portion is blocked plus the uniform load caused by water that rises above the inlet of the secondary drainage system at its design flow.~~ as per the requirements of Chapter 8 of ASCE 7. The design rainfall shall be based on the 100-year ~~hourly rainfall rate indicated in Figure 1611.1~~ 15-minute duration event, or on other rainfall rates determined from approved local weather data. Alternatively, a design rainfall of twice the 100-year hourly rainfall rate indicated in Figures 1611.1(1) through 1611.1(5) shall be permitted.

$$R = 5.2(d_s + d_h) \qquad \textbf{(Equation 16-19)}$$

For SI: $R = 0.0098(d_s + d_h)$

where:

d_h = Additional depth of water on the undeflected roof above the inlet of secondary drainage system at its design flow (in other words, the hydraulic head), in inches (mm).

d_s = Depth of water on the undeflected roof up to the inlet of secondary drainage system when the primary drainage system is blocked (in other words, the static head), in inches (mm).

R = Rain load on the undeflected roof, in psf (kN/m^2). Where the phrase "undeflected roof" is used, deflections from loads (including dead loads) shall not be considered when determining the amount of rain on the roof.

Photo courtesy of Onfokus

Frequently flooded roof.

1611.2 Ponding instability. Susceptible bays of roofs shall be evaluated for ponding instability in accordance with ~~Section 8.4~~ Chapters 7 and Chapter 8 of ASCE 7.

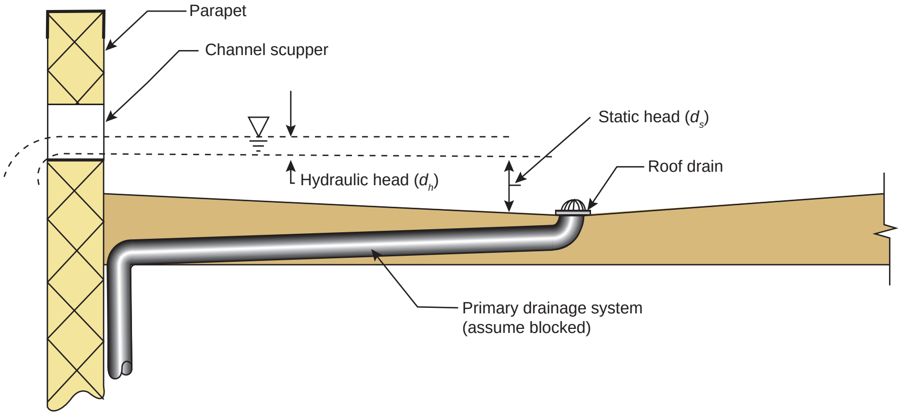
CHANGE SIGNIFICANCE: Secondary (overflow) system design has been harmonized with roof rain load provisions for a structure to provide realistic expectations of the roof drainage system and potential roof loading by rainfall. The CBC is now consistent with ASCE 7 provisions. Calculations for the design mean recurrence interval and duration for determining the hydraulic head, d_h, are available in both ASCE 7 and the CBC.

Legacy ASCE load standards' design rainfall durations for plumbing systems were between 15- and 60-minutes for a 100-year mean recurrence interval. The 1995 *Standard Plumbing Code* used the 100-year/60-minute duration for primary drainage system design and a 100-year/15-minute duration storm for the secondary drainage system. In the 2019 *California Building Code* (CBC) a 100-year/60-minute duration is used for both the primary and secondary systems. Note that the use of twice the 60-minute duration is close to the 15-minute duration rainfall rate. Also note that 2022 CBC rainfall maps (Figures 1106.1(1-5) and 1611.1(1-5), respectively) both include a 60-minute duration rather than the 15-minute storm duration. However, the 2022 CBC, by giving two options – the 15-minute duration or twice the 60-minute duration – results in values similar to ASCE 7.

The best source for rainfall data is the National Oceanic and Atmospheric Administration (NOAA) National Weather Service Precipitation Frequency Data Server – Hydrometeorological Design Studies Center (hdsc.nws.noaa.gov/hdsc/pfds/index.html) for precipitation intensity (inches per hour) based on the 100-year mean recurrence interval. NOAA's data lists both 15-minute and 60-minute duration data.

Details of load and drain size calculations:
To understand why this makes a difference, the following examples show how to determine rain load, *R*, assuming rainfall for the city of Cedar Rapids, Iowa. The first example uses the 2019 CBC requirements and the second uses the 2022 CBC requirements.

Secondary drain sizes and geometries affect the structural engineer's determination of a maximum height of water above the roof surface by the use of variables d_s and d_h for static and hydraulic head. Secondary drains should be specified, if possible, to keep rain loads reasonable. Engineers should be aware of different secondary drain options available to plumbers and clearly communicate how changes, especially to secondary drain geometry, can impact design rain loads on a building. Important parameters to communicate include the assumed static head, hydraulic head associated with the secondary drain or scupper size and geometry, rain load and rainfall rate.



Secondary drainage design assumptions.

Example 1: 60-minute rainfall total for primary and secondary systems (2019 CBC).

Design rainfall: 3.30 inches for 100-year mean recurrence, Cedar Rapids Station No. 1.

Calculate primary and secondary drain size and resulting rain load, *R*.

Primary Drain

Depth of water (in 1 hr): 3.30 inches (NOAA)
Tributary area (primary drain): 100 ft by 50 ft = 5,000 ft^2
Flow rate (volume) to maintain roof drainage:

$$Q = 0.0104 \times A \times i \qquad \textbf{(ASCE 7-16 Equation C8.3-1*)}$$

where:

Q = flow rate to maintain drainage rate equal to rainfall rate
A = tributary area
i = water depth in inches per hour

*The 0.0104 factor in the equation converts area, which is in square feet, and rainfall rate, which is in inches per hour, to gallons per minute.

$A = 50 \text{ ft} \times 100 \text{ ft} = 5{,}000 \text{ ft}^2$
$i = 3.30$ inches/hr
$Q = 0.0104 \times 5{,}000 \text{ ft}^2 \times 3.30 \text{ inches/hr} = 172$ gal/min*

From Table 1103.1 of the 2019 CPC, the minimum drain size is …

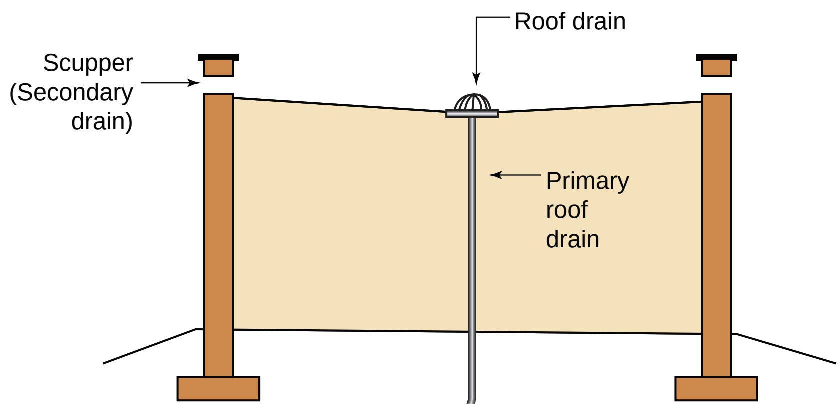
4-inch vertical pipe

Secondary Drain and Rain Load (*R*) Calculation

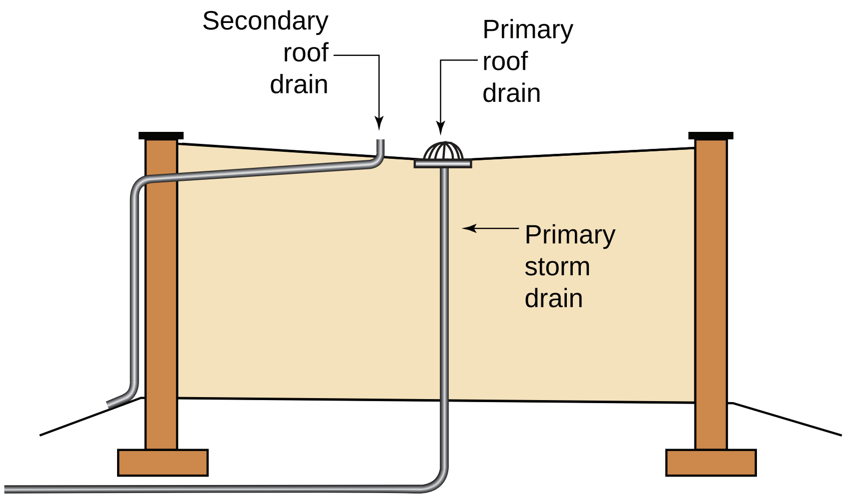
Given:

d_s = specified distance from the roof surface to the bottom of scupper
d_h = calculated (tabulated) height of water above base of scupper or secondary drain based on drain geometry

Flow rate (volume) to maintain roof drainage through a scupper or secondary drain is calculated for the secondary drain since the primary drain is assumed to be completely blocked. The secondary system's design rainfall is 3.30 inches per hour per the 2019 CBC. The flow rate, Q, will be 172 gal/min, identical to the primary drain system. This rain load must leave the roof at least at the same rate it is falling. Typically, once the structural engineer determines the rainfall, static head, hydraulic head, d_h, and rain load on a roof, a plumber can size the secondary system pipes or scuppers to a flow rate of 172 gal/min or greater. The structural engineer does this check as an iterative process to keep rain loads on the roof reasonable by limiting the hydraulic head to a reasonable value. Engineers should be aware of different secondary drain options available to plumbers and clearly communicate how changes, especially to secondary drain geometry, can impact design rain loads on a building.



Secondary drainage using scuppers.



Secondary drainage using pipe with visible outlet.

To calculate R:

d_h (hydraulic head) = 5 inches for a 6-inch-wide, 6-inch-high, closed-top scupper which corresponds to a flow rate of 194 gpm (per 2018 IBC Commentary Figure 1611.1(2)), which is sufficient for the calculated flow rate of 172 gpm.

d_s (static head) = 6 inches (specified distance from the roof surface to the bottom of the scupper)

$R = 5.2(d_s + d_h) = 5.2(6 \text{ in.} + 5 \text{ in.}) = 57.2 \text{ psf}$

(CBC Equation 16-19)

As a second iteration, a 24-inch-wide scupper (open- or closed-top of any height) handles 200 gpm with a corresponding 2-inch hydraulic head. This would reduce the rain load to a more reasonable 41.6 psf.

Note: The 5.2 value in the equation converts the depth of water, which is in inches, to pressure in pounds/square foot (psf) using the density of water of 62.5 pounds per cubic foot (pcf) and the conversion of inches to feet (12 inches per foot); therefore, (62.5 pcf)/(12 in./ft) = 5.2 psf per inch of water depth.

Example 2: 60-minute rainfall duration for the primary system, 15-minute rainfall duration for the secondary system (2022 CBC). Design rainfall for Cedar Rapids Station No. 1:

3.30 inches for 100-year mean recurrence (60-minute)

1.72 inches for 100-year mean recurrence (15-minute)

Calculate primary and secondary drain size and resulting rain load, R.

Primary Drain

Using the parameters from Example 1, calculation of the primary drain diameter per Table 1103.1 of the 2022 CPC requires a minimum:

4-inch vertical pipe

Secondary Drain and Rain Load (R) Calculation

Flow rate (volume) to maintain roof drainage through a scupper or secondary drain is the flow rate calculated for the secondary drain. The primary drain is assumed to be completely blocked.

Flow rate (volume) to maintain roof drainage rate equal to rainfall rate:

$$Q = 0.0104 \times A \times i$$ **(ASCE 7-16 Equation C8.3-1*)**

where:

Q = flow rate to maintain drainage rate equal to rainfall rate
A = tributary area
i = water depth in inches per hour (must convert 15 min interval to equivalent hour interval)

*The 0.0104 factor in the equation converts area, which is in square feet, and rainfall rate, which is in inches per hour, to gallons per minute.

$A = 50 \text{ ft} \times 100 \text{ ft} = 5{,}000 \text{ ft}^2$
$i = 1.72$ inches/15 minutes $\times$ 60 minutes/hour = 6.88 inches/hour
$Q = 0.0104(5{,}000 \text{ ft}^2)$ (6.88 inches/hr) = 358 gal/min

Note that a 15-minute design rainfall has a flow rate approximately 2 times the flow rate of the 2019 CBC 60-minute design rainfall. This is true for much of the United States, but check each location to make sure it is true in that region rather than assuming a fixed 100-percent increase in flow rate.

To calculate R:

d_h (hydraulic head) = 3 inches for a 24-inch-wide, open- or closed-top scupper corresponding to a flow rate of 360 gpm (2018 IBC Commentary Figure 1611.1(2)) which is sufficient for the calculated flow rate of 358 gpm.

d_s (static head) = 6 inches (specified distance from the roof surface to the bottom of the scupper)

$R = 5.2(d_s + d_h) = 5.2(6 \text{ in.} + 3 \text{ in.}) = 46.8$ psf

(CBC Equation 16-19)

Note: The 5.2 value in the equation converts the depth of water, which is in inches, to pressure in pounds/square foot (psf) using the density of water of 62.5 pounds per cubic foot (pcf) and the conversion of inches to feet (12 inches per foot); therefore, (62.5 pcf)/(12 in/ft) = 5.2 psf per inch of water depth.

Notes:

Not only does secondary drain size impact flow rate, but drain size and geometry impacts hydraulic head levels. To keep the rain load to reasonable design levels, larger secondary drains and geometries should be explored to minimize hydraulic head levels. As shown in the examples, flow rates in the 2022 CBC are approximately double for secondary drain design, 2022 CBC flow rate to 2019 CBC flow rate = 358/171 = 2.08. However, for comparably sized roofs and secondary drains (24-inch scuppers), the difference in the hydraulic head is only 1 inch, which only increases the rain load by about 5 psf.

Discussion must occur for the plumber to be aware of the change in the CBC and ASCE 7 to a 15-minute per 100-year rainfall duration. Engineers should clearly communicate how changes, especially to secondary drain geometry, can impact design rain loads on a roof.

1612.4

Flood Hazard Documents

CHANGE TYPE: Modification

CHANGE SUMMARY: The design of hydrostatic loads on breakaway walls is required when the walls do not meet the requirements of ASCE 24.

2022 CODE TEXT: **1612.4 Flood hazard documentation.** The following documentation shall be prepared and sealed by a registered design professional and submitted to the building official:

1. For construction in flood hazard areas other than coastal high hazard areas or coastal A zones:

(no changes to items 1.1-1.2)

1.3. For dry floodproofed nonresidential buildings, construction documents shall include a statement that the dry floodproofing is designed in accordance with ASCE 24 <u>and shall include the flood emergency plan specified in Chapter 6 of ASCE 24.</u>

2. For construction in coastal high hazard areas and coastal A zones:

(no changes to items 2.1-2.3)

<u>**2.4.** For breakaway walls where provisions to allow for the automatic entry and exit of floodwaters do not meet the minimum requirements in Section 2.7.2.1 of ASCE 24, construction documents shall include a statement that the design will provide for equalization of hydrostatic flood forces in accordance with Section 2.7.2.2 of ASCE 24.</u>

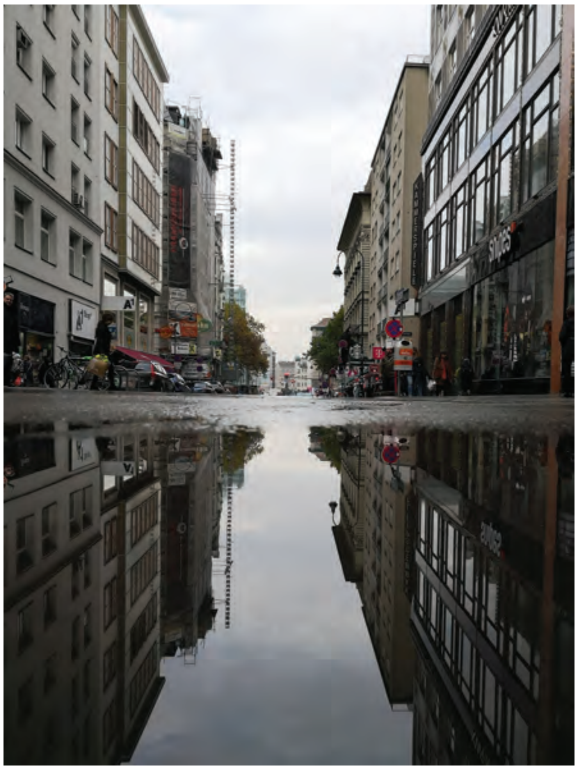


Photo courtesy of David Crunelle / EyeEm

Flooded commercial area.

CHANGE SIGNIFICANCE: A flood emergency plan needs to be consistent with ASCE 24, *Flood Resistant Design and Construction*. ASCE 24 requires the submittal and approval of a flood emergency plan where dry floodproofing measures require human intervention, for example, where deployable flood shields are used. Flood emergency plans must specify:

- Storage location of shields
- Method of installation
- Conditions activating installation
- Maintenance of shields and attachment devices
- Periodic practice of installing shields
- Testing of sump pumps and other drainage measures
- Inspection of necessary material and equipment to activate or implement floodproofing

The design professional developing dry floodproofing measures that require human intervention should take into consideration the effort needed to effectively deploy such measures. Preparation of a flood emergency plan ensures that the methods specified by the design professional can be installed and implemented within the given warning time. If a design requires more warning time than reasonably available before the onset of flooding, then the designer should interpret that to mean the contemplated dry floodproofing measures must be redesigned or that dry floodproofing may not be appropriate for the building.

Additionally, maintenance, testing and inspection are critical to ensuring system performance. The possible inability of owners or occupants to implement dry floodproofing due to lack of preparation or maintenance is regarded as an unacceptable risk. After Hurricanes Harvey and Irma, FEMA mitigation assessment teams observed dry floodproofing measures that failed due to inadequate deployment or improper maintenance. Challenges included:

- Systems requiring sizeable crews with heavy and specialized equipment to be mobilized over a period of several days in advance of the storm to install a system.
- Lack of maintenance of gaskets around doors and flood shields that allowed water intrusion.
- Lack of inspection and owner awareness of components integral to dry floodproofing meant inadvertent mis-installation.

Breakaway walls are defined in ASCE 24 as:

> any type of wall subject to flooding that is not required to provide structural support to a building … and is designed and constructed such that … it will collapse … [to] (1) allow free passage of floodwaters, and (2) it does not damage the structure or supporting foundation system.

The walls may be designed using a prescriptive approach following ASCE 24, Section 2.7.2.1 for non-engineered openings or use engineering to design openings following the minimum requirements of Section 2.7.2.2. Per the new Section 1612.4, Item 2.4, when ASCE 24, Section 2.7.2.2 is applied, a statement must be included in the construction documents stating that equalization of hydrostatic flood forces was considered in the design of the openings.

1704.6

Structural Observations

CHANGE TYPE: Modification

CHANGE SUMMARY: A structural observer must now visually observe the construction of structural systems for general design conformance for all buildings assigned to Risk Category III or IV.

2022 CODE TEXT: **1704.6 Structural observations.** Where required by the provisions of Section 1704.6.1, ~~1704.6.2 or 1704.6.3,~~ the owner or the owner's authorized agent shall employ a registered design professional to perform structural observations. <u>The structural observer shall visually observe representative locations of structural systems, details and load paths for general conformance to the approved construction documents.</u> Structural observation does not include or waive the responsibility for the inspections in Section 110 or the special inspections in Section 1705 or other sections of this code. Prior to the commencement of observations, the structural observer shall submit to the building official a written statement identifying the frequency and extent of structural observations. At the conclusion of the work included in the permit, the structural observer shall submit to the building official a written statement that the site visits have been made and identify any reported deficiencies that, to the best of the structural observer's knowledge, have not been resolved.

Photo courtesy of espion

Visual observation of construction of structural systems.

1704.6.1 Structural observations for structures. Structural observations shall be provided for those structures where one or more of the following conditions exist:

1. The structure is classified as Risk Category III or IV.
2. The structure is a high-rise building.
3. The structure is assigned to Seismic Design Category E and is greater than two stories above the grade plane.

~~3.~~4. Such observation is required by the registered design professional responsible for the structural design.

~~4.~~5. Such observation is specifically required by the building official.

~~**1704.6.2 Structural observations for seismic resistance.**~~

~~**1704.6.3 Structural observations for wind resistance.**~~

CHANGE SIGNIFICANCE: Because the definition of structural observations in the *2019 California Building Code* (CBC), Chapter 2 was considered vague and disconnected from the Chapter 17 requirements, a new description in Section 1704.6 provides clearer direction for the structural observer duties. The structural observer is expected to observe, in person, gravity and lateral force resisting systems, connection details and gravity and lateral load paths. The clarification is also intended to address a widespread perception of overlap between special inspections and structural observation. Special inspections are very detailed inspections of components and materials within structural systems. Special inspections require specialized training, but they do not necessarily require an understanding of how systems are designed to function as part of the overall building.

Structural observations are general, visual overviews of all structural systems and load paths. Broad knowledge of structural design issues and specific knowledge of their application to the project are necessary. Observations of seismic or wind resisting systems and load paths are to be performed by the same registered design professional that observes gravity systems and load paths. Observations do not strictly adhere to a standard's written procedures in the same manner as special inspections, but rather they focus on whether the construction is consistent with the plans and specifications. An observation answers the question, is the building's structural frame being constructed as directed within the construction documents?

Construction site observations by a structural engineer to verify that as-built construction generally conforms to the structural design intent have historically not been required for certain facilities assigned to Seismic Design Categories A, B or C, and with design wind speeds less than 130 mph (fundamentally, Risk Category III buildings located in areas with low or moderate seismic and wind risk). Examples include schools, colleges, arenas, health care facilities, structures that contain a significant amount of hazardous materials and water treatment plants. Risk Category III includes categories of buildings that represent a substantial hazard to human life in the event of failure. Given the relative risk and hazard, it is deemed appropriate to require that a structural engineer conduct site visits to verify general conformance to the design intent for these structures.

It should be noted that there are no longer separate categories for wind and seismic structural observations as the requirements were incorporated into the updated Section 1704.6. Various requirements for the structural observation of Risk Category III and IV buildings in high wind regions ($V \geq 130$ mph) now fall under the general requirements of Section 1704.6 for all buildings. Requirements for structural observation of all buildings over two stories above grade plane assigned to Seismic Design Category E have also been relocated to Section 1704.6. Since all buildings in Seismic Design Category F are, by definition, Risk Category IV buildings, they are also addressed within the general provisions of Section 1704.6.

Table 1705.3

Special Inspection of Precast Concrete

CHANGE TYPE: Addition

CHANGE SUMMARY: Special inspection requirements for precast concrete diaphragm connections have been added to the list of general concrete special inspections and tests.

2022 CODE TEXT:

TABLE 1705.3 Required Special Inspections and Tests of Concrete Construction

Type	Continuous Special Inspection	Periodic Special Inspection	Referenced Standard	CBC Reference
10. Inspect erection of precast concrete members.	–	×	ACI 318: 26.9	–
11. For precast concrete diaphragm connections or reinforcement at joints classified as moderate or high deformability elements (MDE or HDE) in structures assigned to Seismic Design Category C, D, E or F, inspect such connections and reinforcement in the field for:				
a. Installation of the embedded parts	×	–	ACI 318: 26.13.1.3	–
b. Completion of the continuity of reinforcement across joints.	×	–		
c. Completion of connections in the field.	×	–	ACI 550.5	
12. Inspect installation tolerances of precast concrete diaphragm connections for compliance with ACI 550.5.	–	×	ACI 318: 26.13.1.3	–

(Full table not shown for clarity and brevity.)

CHANGE SIGNIFICANCE: Special inspection requirements have been added for precast concrete diaphragms. The American Concrete Institute's (ACI) updated standard ACI 318-19, *Building Code Requirements for Structural Concrete and Commentary*, has new provisions for the design of precast concrete diaphragms in Section 18.12.11. The new ACI 318, Section 26.13.1.3 requires the inspection of concrete panel placement and reinforcement in precast concrete diaphragms assigned to Seismic Design Categories (SDC) C, D, E or F using moderate or high-deformability connections. These diaphragms are also required to comply with the requirements of ACI 550.5-18, *Code Requirements for the Design of Precast Concrete Diaphragms for Earthquake Motions and Commentary*. ACI 550.5 has special inspection requirements for precast concrete diaphragm connections or reinforcement at joints classified as high deformability elements (HDE).

A special inspector observes the installation of embedded parts, checks for the completion of reinforcement continuity across joints and the completion of field connections when structures are assigned to SDC C, D, E and F. ACI 318 Section, 26.13.1.3 also requires that installation tolerances of precast concrete diaphragm connections be inspected for compliance with ACI 550.5.

Precast concrete diaphragm construction.

To incorporate the new requirements, two new items have been added to Table 1705.3. Item 11 is a conservative synthesis of the two requirements from ACI 318 and ACI 550.5. A continuous special inspection is required onsite for precast concrete diaphragm connections or reinforcement at joints classified as moderate or high deformability elements in structures assigned to SDC C, D, E or F with a focus on the reinforcement continuity across the joint, embedded parts installation and onsite connections completion. Item 12 mirrors the ACI 318 requirement to check diaphragm connections against the installation tolerance requirements of ACI 550.5.

1705.4.1

Empirically Designed Masonry

CHANGE TYPE: Deletion

CHANGE SUMMARY: Empirically designed masonry is no longer allowed in Risk Category IV buildings.

2022 CODE TEXT: **1705.4.1 ~~Empirically designed masonry, glass~~ Glass unit masonry and masonry veneer in Risk Category IV.** Special inspections and tests for ~~empirically designed masonry,~~ glass unit masonry or masonry veneer designed in accordance with Section ~~2109,~~ 2110 or Chapter 14, respectively, where they are part of a structure classified as Risk Category IV shall be performed in accordance with TMS 602 Level 2 ~~402, Level B Quality Assurance~~.

CHANGE SIGNIFICANCE: Special inspection of empirically designed masonry in Risk Category IV buildings is no longer required because the masonry standard, TMS 402, *Building Code Requirements and Specification for Masonry Structures*, does not allow Risk Category IV buildings to be designed following the empirical design method. TMS 402, Section A.1.2.4 (empirical design of masonry) specifically prohibits the use of empirical design in structures assigned to Risk Category IV. Fire stations, hospitals, police stations, emergency operation centers and other Risk Category IV structures all require engineered design.

Glass unit masonry and masonry veneer continue to be allowed in the construction of Risk Category IV buildings, and the installation of veneer or glass masonry will continue to require special inspection.

Photo courtesy of Papa Bear

Glass block masonry in a Risk Category IV building.

1705.5.3, 1705.20

Mass Timber Special Inspection

CHANGE TYPE: Addition

CHANGE SUMMARY: Special inspection requirements have been added to address the anchorage and connection of mass timber structural elements.

2022 CODE TEXT: **1705.5.3 Mass timber construction.** Special inspections of mass timber elements in Types IV-A, IV-B and IV-C construction shall be in accordance with Table 1705.5.3.

TABLE 1705.5.3 Required Special Inspections of Mass Timber Construction

Type	Continuous Special Inspection	Periodic Special Inspection
1. Inspection of anchorage and connections of mass timber construction to timber deep foundation systems.		X
2. Inspect erection of mass timber construction.		X
3. Inspection of connections where installation methods are required to meet design loads.		
Threaded fasteners.		
Verify use of proper installation equipment.		X
Verify use of pre-drilled holes where required.		X
Inspect screws, including diameter, length, head type, spacing, installation angle, and depth.		X
Adhesive anchors installed in horizontal or upwardly inclined orientation to resist sustained tension loads.	X	
Adhesive anchors not defined in the preceding cell.		X
Bolted connections.		X
Concealed connections.		X

1705.20 Sealing of mass timber. Periodic special inspections of sealants or adhesives shall be conducted where sealant or adhesive required by Section 703.7 is applied to mass timber building elements as designated in the approved construction documents.

CHANGE SIGNIFICANCE: Special inspection provisions have been added to Section 1705 for mass timber elements in Types IV-A, IV-B and IV-C construction. This unique type of construction requires a level of inspection consistent with other large buildings and applications. The special inspections are similar to requirements for other prefabricated systems such as precast concrete and structural steel.

The specific elements requiring special inspection for construction Types IV-A, IV-B and IV-C include:

1. The connection of mass timber elements to timber deep foundation elements. These connections are critical to transfer loads from the mass timber elements to the piles, particularly for lateral loading. Connections to concrete foundations are addressed in CBC Table 1705.3 for concrete special inspections.

Photo courtesy of ATF Fire Research Laboratory

Connections between mass timber products that utilize threaded, bolted or concealed connections require special inspection.

Photo courtesy of ATF Fire Research Laboratory

Sealants and adhesives specified to resist the passage of air require special inspection.

2. Erection of mass timber elements. Similar to precast concrete, tall wood buildings utilizing prefabricated elements need verification that the correct elements are placed in the correct location in accordance with the design drawings.
3. Specialized connections between mass timber products that utilize threaded, bolted or concealed connections. Similar to concrete connections, the strength of many connections is predicated on specific screw lengths and installation angles. Bolted connections require specific diameters, and for lag screws, specific lengths and diameters. Concealed connectors, many of which are proprietary, must be installed correctly for structural performance.
4. Adhesive anchorage installed in horizontal or upwardly inclined positions resisting sustained tension loads. A continuous special inspection is necessary because of issues with adhesive creep under long-term tension loading. All other adhesive anchors need only be inspected periodically.

If, in the judgment of the building official, there are other unusual connections or assemblies not covered in Table 1705.5.3, special inspection per Section 1705.1.1 will be required. The building official can require special inspections where a manufacturer's installation instructions prescribe requirements not contained in the code. For example, field-glued mass timber beam or panel splices, while currently rare in North America, may become more prevalent in the future. Section 1705.1.1 would allow the building official to require special inspection for either proprietary or non-proprietary field-glued splices. Additionally, many design engineers will specify special inspections for unusual conditions in both their structural notes within the construction documents and in the statement of special inspections.

The new Section 1705.20 requires periodic special inspection of sealants or adhesives where the sealant or adhesive required by CBC Section 703.7 is applied to mass timber building elements as designated in the approved construction documents. Additionally, the new Section 703.7 requires sealing between mass timber elements in Type IV-A, IV-B and IV-C construction to resist the passage of air at the following locations:

1. At abutting edges and intersections of mass timber building elements required to be fire-resistance rated.
2. At abutting intersections of mass timber building elements and building elements of other materials where both are required to be fire-resistance rated.

Sealants must meet the requirements of the ASTM International standard ASTM C920, *Standard Specification for Elastomeric Joint Sealants*, and adhesives must meet the requirements of ASTM D3498, *Standard Specification for Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems*.

Special inspection of mass timber sealing does not apply to "joints" as defined in Section 202 since these fire-resistant joint systems have their own requirements for placement and inspection in Section 715 and special inspections in Section 1705.18. Joints are defined as having an opening that is designed to accommodate building tolerances or to allow independent movement. Panels and members that are connected do not meet the definition of a joint since they are rigidly connected and do not have an opening. It should be noted that some mass timber panels are manufactured under proprietary processes to ensure there are no voids at intersections. Where this proprietary process is incorporated and tested, there is no requirement for a sealant or adhesive.

1705.10

Structural Integrity of Deep Foundations

CHANGE TYPE: Addition

CHANGE SUMMARY: When installed deep foundation elements appear to be understrength due to quality, location or alignment, an engineering assessment must now be done.

2022 CODE TEXT: **1705.10 Structural integrity of deep foundation elements.** Whenever there is a reasonable doubt as to the structural integrity of a deep foundation element, an engineering assessment shall be required. The engineering assessment shall include tests for defects performed in accordance with ASTM D4945, ASTM D5882, ASTM D6760 or ASTM D7949, or other approved method.

Chapter 35

ASTM D5882—16: Standard Test Method for Low Strain Impact Integrity Testing of Deep Foundations

ASTM D6760—16: Standard Test Method for Integrity Testing of Concrete Deep Foundations by Ultrasonic Crosshole Testing

ASTM D7949—14: Standard Test Methods for Thermal Integrity Profiling of Concrete Deep Foundations

CHANGE SIGNIFICANCE: Most foundation failures are caused by inadequate soil bearing or lateral capacity. The new Section 1705.10 addresses a less common failure, a lack of structural integrity in a deep foundation element due to material defects. Significant defects may affect the structural strength of deep foundation elements; therefore, the defects need to be detected and corrected prior to further construction above.

Photo courtesy of Chaiyaporn1144

Verification of deep foundation element strength.

For example, when the integrity of a deep foundation element is in doubt due to issues in alignment during installation, problematic soil conditions or the inadequacy of construction procedures, a deep foundation element should be load-tested during installation to assure that there are no material defects. The visual special inspection provisions addressing deep foundations in Sections 1705.7, 1705.8 and 1705.9 are unchanged. However, tests have been added in the new Section 1705.10 to provide a means to assess portions of deep foundation elements that cannot be visually inspected. Testing may be done by impact, thermal imaging or UT tests. The applicable ASTM standard is used to define appropriate test procedures.

1705.13.7

Special Inspection of Storage Racks

CHANGE TYPE: Addition

CHANGE SUMMARY: Steel storage rack special inspection duties have been clarified with the addition of special inspection tasks.

2022 CODE TEXT: ~~**1705.12.7**~~ **1705.13.7** **Storage racks.** ~~Periodic special inspection is required for the anchorage of storage racks that are 8 feet (2438 mm) or greater in height in structures assigned to Seismic Design Category D, E or F.~~ Steel storage racks and steel cantilevered storage racks that are 8 feet (2438 mm) in height or greater and assigned to Seismic Design Category D, E or F shall be provided with periodic special inspection as required by Table 1705.13.7.

TABLE 1705.13.7 Required Inspections of Storage Rack Systems

Type	Periodic Inspection	Referenced Standard	CBC Reference
1. Materials used, to verify compliance with one or more of the material test reports in accordance with the approved construction documents.	X		
2. Fabricated storage rack elements.	X		1704.2.5
3. Storage rack anchorage installation.	X	ANSI/MH16.1 Section 7.3.2	
4. Completed storage rack system, to indicate compliance with the approved construction documents.	X		

CHANGE SIGNIFICANCE: The design of storage rack components is based on a minimum steel thickness and minimum yield strength. It is imperative that these minimum properties be included in the design for component fabrication and considered in storage rack installation. Storage rack systems may have complex load paths. Installation must comply with approved drawings to create the necessary load paths. Verification must be made of material minimum quality requirements during fabrication and correct anchorage during installation.

It has been clarified that periodic special inspection is required for steel storage racks, regular or cantilevered, that are eight feet or more in height in Seismic Design Category D, E or F locations. In addition, a definition of cantilevered steel storage racks has been added for clarity. Additional commentary on the storage rack definitions can be found in the significant changes discussion of Section 2209.

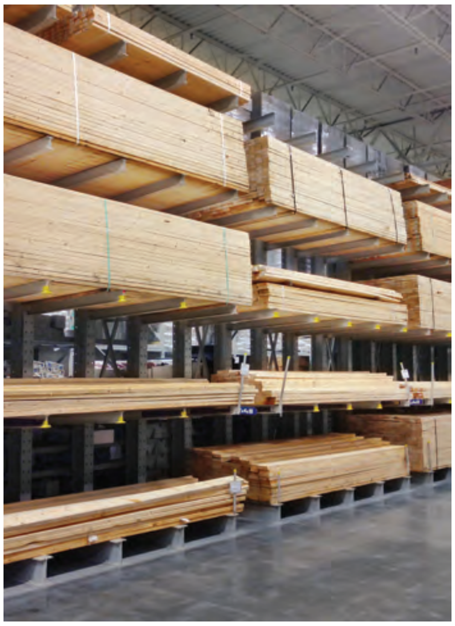


Photo courtesy of Michael Krinke

Cantilevered storage racks.

1705.18

Firestop Inspections in Group R

CHANGE TYPE: Modification

CHANGE SUMMARY: The installation of firestops, fire-resistant joint systems and perimeter fire barrier systems in residential-use buildings now requires special inspection in those Group R fire areas having an occupant load exceeding 250.

2022 CODE TEXT: **~~1705.17~~ 1705.18 Fire-resistant penetrations and joints.** In high-rise buildings ~~or~~, in buildings assigned to Risk Category III or IV, or in fire areas containing Group R occupancies with an occupant load greater than 250, special inspections for through-penetrations, membrane penetration firestops, fire-resistant joint systems and perimeter fire ~~barrier~~ containment systems that are tested and listed in accordance with Sections 714.4.1.2, 714.5.1.2, 715.3.1 and 715.4 shall be in accordance with Section 1705.18.1 or 1705.18.2.

CHANGE SIGNIFICANCE: Firestop, fire-resistant joint system and perimeter fire containment system special inspections are required for buildings in Risk Categories III and IV, as well as in high-rise buildings. However, fire-resistance-rated compartmentation is a critical fire protection feature in many Risk Category II Group R buildings as well. When through-penetration firestop systems and fire-resistant joint systems are not properly installed, the integrity of the fire-rated separations is compromised. To adequately protect people where they live, the requirement for special inspection of firestop, fire-resistant joints and perimeter containment systems has been expanded to include larger buildings containing residential occupancies.

The scope of the special inspection requirement is limited to Group R fire areas containing an occupant load of more than 250 people within the fire area. Unless a high-rise condition exists, such special inspection is not required provided the Group R building has an occupant load of 250 or less, or where the building has been subdivided into complying fire areas so that no Group R fire area occupant load exceeds 250.

Photo courtesy of buzbuzzer

Hotels may require special inspection of firestop systems.

1709.5

Window and Door Assemblies

CHANGE TYPE: Modification

CHANGE SUMMARY: Testing standards and analysis procedures have been clarified for exterior door and window assemblies, including garage door assemblies.

2022 CODE TEXT: **1709.5 Exterior window and door assemblies.** The design pressure rating of exterior windows and doors in buildings shall be determined in accordance with Section 1709.5.1 or 1709.5.2. For exterior windows and doors tested in accordance with Sections 1709.5.1 or 1709.5.2, required design wind pressures determined from ASCE 7 shall be permitted to be converted to allowable stress design by multiplying by 0.6.

> **Exception:** Structural wind load design pressures for window ~~units smaller~~ or door assemblies other than the size tested in accordance with Section 1709.5.1 or 1709.5.2 shall be permitted to be ~~higher~~ different than the design value of the tested ~~unit~~ assembly, provided that such ~~higher~~ pressures are determined by accepted engineering analysis~~.~~ or validated by an additional test of the window or door assembly to the alternative allowable design pressure in accordance with Section 1709.5.2. Components of the ~~small unit~~ alternate size assembly shall be the same as the tested ~~unit. Where such calculated design pressures are~~ or labeled assembly. Where engineering analysis is used, ~~they~~ it shall be ~~validated by an additional test of the window unit having the highest allowable design pressure.~~ performed in accordance with the analysis procedures of AAMA 2502.

Photo courtesy of vaximilian

Garage doors must be tested by the manufacturer and labeled.

1709.5.1 Exterior windows and doors. Exterior windows and sliding doors shall be tested and labeled as conforming to AAMA/WDMA/CSA 101/I.S.2/A440. The label shall state the name of the manufacturer, the approved labeling agency and the product designation as specified in AAMA/WDMA/CSA 101/I.S.2/A440. Exterior side-hinged doors shall be tested and labeled as conforming to AAMA/WDMA/CSA 101/I.S.2/A440 or comply with Section 1709.5.2. Products tested and labeled as conforming to AAMA/WDMA/CSA 101/I.S.2/A440 shall not be subject to the requirements of Sections 2403.2 and 2403.3.

1709.5.2 Exterior window and door assemblies not provided for in Section 1709.5.1. Exterior window and door assemblies shall be tested in accordance with ASTM E330. ~~Structural performance of garage doors and rolling doors shall be determined in accordance with either ASTM E330 or ANSI/DASMA 108, and shall meet the acceptance criteria of ANSI/DASMA 108.~~ <u>Exterior</u> window and door assemblies containing glass shall comply with Section 2403. The design pressure for testing shall be calculated in accordance with Chapter 16. Each assembly shall be tested for 10 seconds at a load equal to 1.5 times the design pressure.

<u>**1709.5.2.1 Garage doors and rolling doors.** Garage doors and rolling doors shall be tested in accordance with either ASTM E330 or ANSI/DASMA 108, and shall meet the pass/fail criteria of ANSI/DASMA 108. Garage doors and rolling doors shall be labeled with a permanent label identifying the door manufacturer, the door model/series number, the positive and negative design wind pressure rating, the installation instruction drawing reference number, and the applicable test standard.</u>

CHANGE SIGNIFICANCE: Historically, the CBC has not required any type of label for garage doors. For products that do not have permanent labels, it is nearly impossible for an owner to determine the structural wind load resistance of a building's garage doors. For the past decade, there has been a movement to consider resilience in buildings. As a result, building owners and occupants increasingly want more information about the resilience of the buildings they occupy. Consequently, methods to determine critical components and their performance have been needed. Garage doors are important components of the building envelope, and their performance is critical in preventing wind and water infiltration as well as to maintaining overall structural integrity. Some manufacturers already include permanent labels on their products that provide traceability of manufacture and basic product characteristics.

In response to these issues, garage doors are now required to have a permanent label that provides a way for building owners, homeowners and code officials to be able to determine the performance characteristics of the door after the building has been occupied. The new Section 1709.5.2.1 requires a permanent marking on the garage door indicating the manufacturer, the model/series number and basic performance characteristics regardless of whether the building is in a hurricane-prone region or another geographical area.

1809.5.1

Frost Protection at Required Exits

CHANGE TYPE: Addition

CHANGE SUMMARY: Frost protection for egress doors has been added to the foundation requirements.

2022 CODE TEXT: **1809.5.1 Frost protection at required exits.** Frost protection shall be provided at exterior landings for all required exits with outward-swinging doors. Frost protection shall only be required to the extent necessary to ensure the unobstructed opening of the required exit doors.

CHANGE SIGNIFICANCE: Frost protection must now be provided for exterior landings at all required means of egress doors. Where frost protection is required, landing areas immediately adjacent to egress doors must be provided with the same frost protection systems as that of the building being served by the exits. This protection is designed to prevent concrete landings from heaving, thereby compromising normal operation of required egress doors. Such heaving actions can render an egress door entirely unusable, creating an untenable situation.

There are multiple conditions that contribute to concrete heaving, making it impossible to predict when and where such heaving may occur. Section 1809.5.1 is intended to provide heave protection only for the area of a landing immediately adjacent to exit doors and only for the area required to allow the door to swing open at least 90 degrees from a closed position. The remaining portions of a larger patio or sidewalk need not be provided with frost protection. Doors that do not swing—for example, a revolving door at a lobby entrance—do not require frost protection.

Photo courtesy of Bim

Frost protection is required in front of a swinging door only.

Table 1810.3.2.6

Allowable Stresses in Deep Foundations

CHANGE TYPE: Modification

CHANGE SUMMARY: The maximum allowable stress for materials in deep foundation elements has been updated to be consistent with the capacity of materials used today.

2022 CODE TEXT:

TABLE 1810.3.2.6 Allowable Stresses for Materials Used in Deep Foundation Elements

Material Type and Condition	Maximum Allowable Stress[a]
1. Concrete or grout in compression[b]	
Cast-in-place with a permanent casing in accordance with Section 1810.3.2.7 or Section 1810.3.5.3.4	$0.4\ f'_c$
Cast-in-place in ~~a pipe, tube,~~ other permanent casing or rock	$0.33\ f'_c$
Cast-in-place without a permanent casing	$0.3\ f'_c$
Precast nonprestressed	$0.33\ f'_c$
Precast prestressed	$0.33\ f'_c - 0.27\ f_{pc}$
2. Nonprestressed reinforcement in compression	$0.4\ f_y \leq 30{,}000$ psi
3. Steel in compression	
Cores within concrete-filled pipes or tubes	$0.5\ F_y \leq 32{,}000$ psi
Pipes, tubes or H-piles, where justified in accordance with Section 1810.3.2.8	$0.5\ F_y \leq 32{,}000$ psi
Pipes or tubes for micropiles	$0.4\ F_y \leq 32{,}000$ psi
Other pipes, tubes or H-piles	$0.35\ F_y \leq$ ~~16,000 psi~~ 24,000 psi
Helical piles	$0.6\ F_y \leq 0.5\ F_u$
4. Nonprestressed reinforcement in tension	
Within micropiles	$0.6\ f_y$
Other conditions	
For load combinations that do not include wind or seismic loads	$0.5\ f_y \leq$ ~~24,000 psi~~ 30,000 psi
For load combinations that include wind or seismic loads	$0.5\ f_y \leq 40{,}000$ psi
5. Steel in tension	
Pipes, tubes or H-piles, where justified in accordance with Section 1810.3.2.8	$0.5\ F_y \leq 32{,}000$ psi
Other pipes, tubes or H-piles	$0.35\ F_y \leq$ ~~16,000 psi~~ 24,000 psi
Helical piles	$0.6\ F_y \leq 0.5\ F_u$
6. Timber	In accordance with the ANSI/AWC NDS

a. f'_c is the specified compressive strength of the concrete or grout; f_{pc} is the compressive stress on the gross concrete section due to effective prestress forces only; f_y is the specified yield strength of reinforcement; F_y is the specified minimum yield stress of steel; F_u is the specified minimum tensile stress of structural steel.

b. The stresses specified apply to the gross cross-sectional area ~~within~~ of the concrete ~~surface~~ for precast prestressed piles and to the net cross-sectional area for all other piles. Where a temporary or permanent casing is used, the inside face of the casing shall be considered ~~to be~~ the outer edge of the concrete ~~surface~~ cross-section.

Photo courtesy of PJ66431470

Deep foundation elements.

CHANGE SIGNIFICANCE: Table 1810.3.2.6, Item 1 previously only allowed a maximum allowable stress of 0.40 f'_c for thin-wall casing in deep foundation piles because the concrete is confined. Section 1810.3.2.7 allows cased mandrel-driven cast-in-place elements, a legacy material typically referring to corrugated shell piles, the higher allowable stress of 0.40 f'_c when the piles are much weaker than the steel pipes or tubes following the provisions of Section 1810.3.5.3.4 for steel pipes and tubes. It is reasonable to allow the same maximum allowable stress of 0.40 f'_c when the concrete is confined by a thicker-walled pipe or tube. Therefore, Item 1 now allows the limit of 40 percent of the concrete strength of tubes and pipes referenced in either Section 1810.3.2.7 or Section 1810.3.5.3.4. For other permanent casing or rock, the maximum allowable stress limit is not increased due to variation in the type of permanent casing in this category and because rock as a casing is inherently variable in strength and quality.

For Item 3 in Table 1810.3.2.6 regarding steel in compression, the maximum allowable stress of 0.35 F_y for other steel pipes, tubes and helical piles does not change, but the allowable upper limit has been increased to 24,000 psi because the yield strength for commonly available steel pilings has increased significantly. When the 16,000 psi upper limit was first established, the common steel yield was perhaps 36,000 psi. In the *2022 California Building Code*, yield strengths are normally 50,000 to 60,000 psi. Yields above 70,000 psi are now available and in common use for piling.

Regarding Table 1810.3.2.6, Item 4 dealing with reinforcement in tension, Section 1901.2 states that structural concrete shall be designed and constructed in accordance with the requirements of CBC Chapter 19 and the American Concrete Institute's (ACI) standard ACI 318, *Building Code Requirements for Structural Concrete*. ACI 318 establishes an upper limit of maximum yield strength, F_y, of 80,000 psi for non-prestressed reinforcement; therefore, setting an upper limit of 40,000 psi (50 percent of 80,000 psi) for steel provides consistency between the CBC and ACI 318. Using this upper limit for temporary loading conditions, including wind or earthquake loads, is appropriate. Additionally, in Item 4, limiting stresses to 30,000 psi will reduce cracking and the potential for corrosion with permanent load conditions.

Notes for clarity:

1. Stresses should be applied to the net area (gross area minus steel reinforcement area) not to the gross sectional area.
2. Item 1 precast prestressed concrete states a minimum allowable stress of $0.33f'_c - 0.27f_{pc}$. That is an allowable stress obtained by subtracting the applied prestresses from the concrete compressive stress.

1810.3.3.1.9

Helical Piles

CHANGE TYPE: Clarification

CHANGE SUMMARY: Calculation of the allowable axial design load, P_a, has been clarified.

2022 CODE TEXT: **1810.3.3.1.9 Helical piles.** The allowable axial design load, P_a, of helical piles shall be determined as follows:

$$P_a = 0.5P_u \qquad \textbf{(Equation 18-4)}$$

where P is the least value of:

1. <u>Base capacity plus shaft resistance of the helical pile. The base capacity is equal to the sum</u> ~~Sum~~ of the areas of the helical bearing plates times the ultimate bearing capacity of the soil or rock comprising the bearing stratum. <u>The shaft resistance is equal to the area of the shaft above the uppermost helical bearing plate times the ultimate skin resistance.</u>
2. Ultimate capacity determined from well-documented correlations with installation torque.
3. Ultimate capacity determined from load tests <u>where required by Section 1810.3.3.1.2.</u> <u>***[OSHPD 1R, 2B & 5]*** *Load tests are required to determine the ultimate capacity.*</u>

Photo courtesy of Artboy Animation

Helical piles.

4. Ultimate axial capacity of pile shaft.
5. Ultimate axial capacity of pile shaft couplings.
6. Sum of the ultimate axial capacity of helical bearing plates affixed to pile.

CHANGE SIGNIFICANCE: Larger helical pile elements are now common and shaft friction can play an important role for larger shaft diameters. When determining the allowable axial load, P_a, the base capacity plus the shaft resistance may now be used. Shaft resistance is the shaft area multiplied by the shaft's ultimate skin resistance for the length above the shallowest bearing plate. Base capacity is the soil or rock ultimate bearing capacity in the bearing layer multiplied by the total number of bearing plates multiplied by the plate area for all plates in that layer of soil or rock. The term shaft resistance is used to be consistent with Section 1810.3.3.1.4, addressing allowable shaft resistance.

The determination of ultimate capacity by load testing has never been intended to be a requirement for all piles. Adding the reference to Section 1810.3.3.1.2 for load tests clarifies when a load test for ultimate capacity must be made available. Details for the load test are covered in the load test provisions. Load tests are first required when design compressive loads are greater than those determined for the soils using the allowable stresses specified in Table 1810.3.2.6. A load test is required on one pile within every section of consistent subsoil conditions. When the design load for any deep foundation element is in doubt, a load test of one element in each section with consistent subsoil conditions is required. When cast-in-place deep foundation elements have an enlarged base formed from compacting concrete or by driving a precast base, control test elements shall be tested. The testing protocol must follow either ASTM D 1143, *Standard Test Methods for Deep Foundations Under Static Axial Compressive Load*, or ASTM D4945, *Standard Test Method for High-Strain Dynamic Testing of Deep Foundations*.

1810.3.5.3.1

Structural Steel H-piles

CHANGE TYPE: Modification

CHANGE SUMMARY: The design and detailing of H-piles must now conform with AISC 341 requirements for a structure assigned to Seismic Design Category D, E or F.

2022 CODE TEXT: **1810.3.5.3.1 Structural steel H-piles.** Sections of structural steel H-piles shall comply with the requirements for HP shapes in ASTM A6, or the following:

1. The flange projections shall not exceed 14 times the minimum thickness of metal in either the flange or the web and the flange widths shall be not less than 80 percent of the depth of the section.
2. The nominal depth in the direction of the web shall be not less than 8 inches (203 mm).
3. Flanges and web shall have a minimum nominal thickness of $^3/_8$ inch (9.5 mm).

For structures assigned to Seismic Design Category D, E or F, design and detailing of H-piles shall also conform to the requirements of AISC 341.

Installation of H-piles.

CHANGE SIGNIFICANCE: Steel H-piles used in higher seismic design categories are expected to yield just under the pile cap or foundation from a combined bending and axial load. Design and detailing requirements for H-piles in American Institute of Steel Construction's AISC 341, *Seismic Provisions for Structural Steel Buildings,* are intended to produce stable plastic hinge formation in the piles. A plastic hinge is the area along the pile length that yields or stretches with permanent deformation during an earthquake.

Because piles can be subjected to tension caused by an overturning moment during an earthquake, mechanical means to transfer the tension to the pile cap must be designed for the required tension force and not less than 10 percent of the pile compression capacity. This requirement focuses on attachment of a pile to the pile cap with enough strength in the connection that the pile steel will not pull out of the pile cap. See Section 1810.3.11 for more information on changes to the pile cap requirements.

Piles located on site class E or F soils (poor, liquefiable and expansive soils) must satisfy the requirements for moderately ductile members in AISC 341, Section D1.1.

1810.3.6

Deep Foundation Element Splicing

CHANGE TYPE: Modification

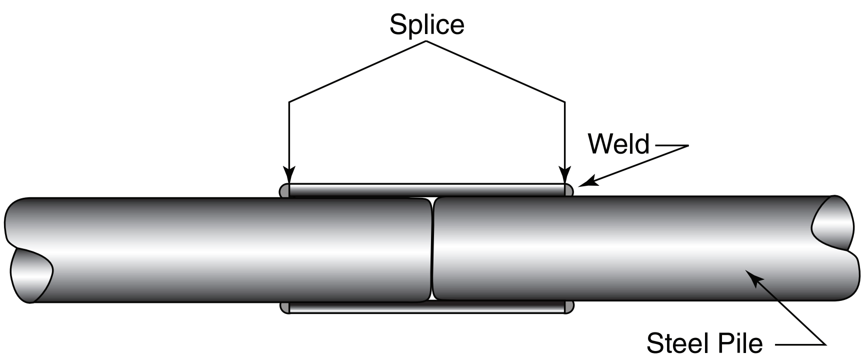
CHANGE SUMMARY: Deep foundation element splices for buildings in Seismic Design Category A and B regions designed by general engineering practices do not have to meet the 50 percent tension and bending capacity requirements.

2022 CODE TEXT: **1810.3.6 Splices.** Splices shall be constructed so as to provide and maintain true alignment and position of the component parts of the deep foundation element during installation and subsequent thereto and shall be designed to resist the axial and shear forces and moments occurring at the location of the splice during driving and for design load combinations. Where deep foundation elements of the same type are being spliced, splices shall develop not less than 50 percent of the bending strength of the weaker section. Where deep foundation elements of different materials or different types are being spliced, splices shall develop the full compressive strength and not less than 50 percent of the tension and bending strength of the weaker section. Where structural steel cores are to be spliced, the ends shall be milled or ground to provide full contact and shall be full-depth welded.

> **Exception:** For buildings assigned to Seismic Design Category A or B, splices need not comply with the 50 percent tension and bending strength requirements where justified by supporting data.

Splices occurring in the upper 10 feet (3048 mm) of the embedded portion of an element shall be designed to resist at allowable stresses the moment and shear that would result from an assumed eccentricity of the axial load of 3 inches (76 mm), or the element shall be braced in accordance with Section 1810.2.2 to other deep foundation elements that do not have splices in the upper 10 feet (3048 mm) of embedment.

CHANGE SIGNIFICANCE: Splices must be designed to resist axial and shear forces as well as moments occurring at a splice location. Conformance with this requirement ensures the structural integrity of the splice. Section 1810.3.6.1 contains restrictive splice requirements for structures assigned to Seismic Design Categories C through F. For low seismic areas, commonly available splices are acceptable in many design situations,



Steel pile splice.

such as a splice located deep enough that significant tension or bending demands are not expected or possible. Load requirements at the splice diminish due to soil resistance above the splice when the splice is located at depth.

Splices in low seismic design categories are exempt from having to be designed to 50 percent of the tension and bending strength of the pile material. For example, if friction piles are driven to 240 feet, the splice between the two 120 foot sections is 120 feet below grade. These piles do not need to be checked for a capacity of 50 percent of the pile tension and bending capacity. The pile is braced at the splice by the surrounding soil.

All other requirements of Section 1810.3.6 continue to apply for pile splices in areas assigned as Seismic Design Categories A and B.

1810.3.8

Precast Concrete Piles

CHANGE TYPE: Modification

CHANGE SUMMARY: Precast concrete piles are now to be designed in accordance with ACI 318 rather than CBC provisions.

2022 CODE TEXT: **1810.3.8 Precast concrete piles.** Precast concrete piles shall be designed and detailed in accordance with ~~Sections 1810.3.8.1 through 1810.3.8.3~~ ACI 318.

Exceptions:

1. For precast prestressed piles in Seismic Design Category C, the minimum volumetric ratio of spirals or circular hoops required by Section 18.13.5.10.4 of ACI 318 shall not apply in cases where the design includes full consideration of load combinations specified in ASCE 7, Section 2.3.6 or Section 2.4.5 and the applicable overstrength factor, Ω_0. In such cases, minimum transverse reinforcement index shall be as specified in Section 13.4.5.6 of ACI 318. ***[OSHPD 1R, 2B & 5]*** *not permitted by OSHPD.*
2. For precast prestressed piles in Seismic Design Categories D through F, the minimum volumetric ratio of spirals or circular hoops required by Section 18.13.5.10.5(c) of ACI 318 shall not apply in cases where the design includes full consideration of load combinations specified in ASCE 7, Section 2.3.6 or Section 2.4.5 and the applicable overstrength factor, Ω_0. In such cases, the minimum transverse reinforcement shall be as specified in Section 13.4.5.6 of ACI 318. ***[OSHPD 1R, 2B & 5]*** *not permitted by OSHPD.*

   [OSHPD 1R, 2B & 5] Exception: *Where the axial load from seismic forces is amplified by the applicable overstrength factor, Ω_0, the axial load limits in Section 18.13.5.10.6 of ACI 318 may be increased by two times.*

Photo courtesy of Chaiyaporn1144

Precast piles.

~~1810.3.8.1 Reinforcement.~~

~~1810.3.8.2 Precast nonprestressed piles.~~

~~1810.3.8.3 Precast prestressed piles.~~

~~1810.3.8.3.4 Axial load limit in Seismic Design Categories C through F.~~

(Sections 1810.3.8.1 Reinforcement through 1810.3.8.3.4 Axial load limit in SDC C-F deleted without replacement)

CHANGE SIGNIFICANCE: Sections 1810.3.8.1 through 1810.3.8.3.4 of the CBC have been deleted as similar provisions are included in Chapter 18 of the 2019 edition of ACI 318, *Building Code Requirements for Structural Concrete*. Two exceptions for precast prestressed piles are retained in the 2022 CBC.

Section 1810.3.8.3.2 and Section 1810.3.8.3.3, Item 5 of the 2019 CBC form exception Items 1 and 2 in the 2022 CBC allowing the use of the overstrength factor of ASCE 7 by applying the factor to the load equations with seismic loads included to replace a design following ACI 318. These provisions were not included in ACI 318-19 and thus remain in the CBC.

Exceptions 1 and 2 recognize that the volumetric ratio of spiral reinforcement need not be greater than that required for driving and handling stresses when a pile foundation system is designed for load combinations including overstrength. The minimum spiral reinforcement required per ACI 318, Section 13.4.5.6 for driving and handling stresses is the minimum spiral reinforcement required in Seismic Design Categories A and B.

Increased axial forces, shear forces and bending moments provide a large factor of safety against nonlinear pile behavior when the design includes overstrength effects.

1810.3.11

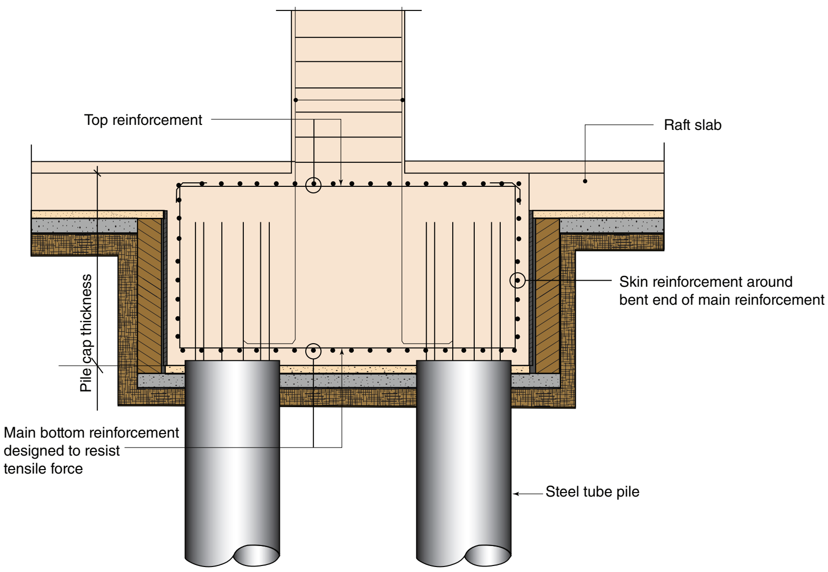
Pile Caps

CHANGE TYPE: Modification

CHANGE SUMMARY: Pile cap requirements have been updated to align with the 2019 edition of ACI 318.

2022 CODE TEXT: **1810.3.11 Pile caps.** Pile caps shall conform with ACI 318 and this section. Pile caps shall be of reinforced concrete and shall include all elements to which vertical deep foundation elements are connected, including grade beams and mats. The soil immediately below the pile cap shall not be considered as carrying any vertical load, with the exception of a combined pile raft. ***[OSHPD 1R, 2 & 5]*** *A combined pile raft foundation shall be an alternative system.* The tops of vertical deep foundation elements shall be embedded not less than 3 inches (76 mm) into pile caps and the caps shall extend not less than 4 inches (102 mm) beyond the edges of the elements. The tops of elements shall be cut or chipped back to sound material before capping.

1810.3.11.1 Seismic Design Categories C through F. For structures assigned to Seismic Design Category C, D, E or F, concrete deep foundation elements shall be connected to the pile cap ~~by embedding the element reinforcement or field-placed dowels anchored in the element into the pile cap for a distance equal to their development length~~ in accordance with ACI 318. ~~It shall be permitted to connect precast prestressed piles to the pile cap by developing the element prestressing strands into the pile cap provided that the connection is ductile. For deformed bars, the development length is the full development length for compression, or tension in the case of uplift, without reduction for excess reinforcement in accordance with Section 25.4.10 of ACI 318. Alternative measures for laterally confining concrete and maintaining toughness and ductile-like behavior at the top of the element shall be permitted provided that the design is such that any hinging occurs in the confined region. The minimum transverse steel ratio for confinement shall be not less than one-half of that required for columns.~~



Pile cap connecting two foundation piles.

For resistance to uplift forces, anchorage of steel pipes, tubes or H-piles to the pile cap shall be made by means other than concrete bond to the bare steel section. Concrete-filled steel pipes or tubes shall have reinforcement of not less than 0.01 times the cross-sectional area of the concrete fill developed into the cap and extending into the fill a length equal to two times the required cap embedment, but not less than the development length in tension of the reinforcement.

1810.3.11.2 Seismic Design Categories D through F. For structures assigned to Seismic Design Category D, E or F, deep foundation element resistance to uplift forces or rotational restraint shall be provided by anchorage into the pile cap, designed considering the combined effect of axial forces due to uplift and bending moments due to fixity to the pile cap. Anchorage shall develop not less than 25 percent of the strength of the element in tension. Anchorage into the pile cap shall comply with the following:

(No changes to Items 1 and 2)

3. The connection between the pile cap and the steel H-piles or unfilled steel pipe piles in structures assigned to Seismic Design Category D, E or F shall be designed for a tensile force of not less than 10 percent of the pile compression capacity.

Exceptions:

1. Connection tensile capacity need not exceed the strength required to resist seismic load effects including overstrength of ASCE 7 Section 12.4.3 or 12.14.3.2.
2. Connections need not be provided where the foundation or supported structure does not rely on the tensile capacity of the piles for stability under the design seismic force. ***[OSHPD 1R, 2B & 5]*** *Not permitted by OSHPD.*

Where the vertical lateral-force-resisting elements are columns, the pile cap flexural strengths shall exceed the column flexural strength. The connection between batter piles and pile caps shall be designed to resist the nominal strength of the pile acting as a short column. Batter piles and their connection shall be designed to resist forces and moments that result from the application of seismic load effects including overstrength factor in accordance with Section 2.3.6 or 2.4.5 of ASCE 7.

CHANGE SIGNIFICANCE: Steel piles used in higher seismic design categories are expected to yield just under the pile cap or foundation because of combined bending and axial loads. The design and detailing requirements of AISC 341 for piles are intended to produce a stable plastic hinge formation in steel piles. Requirements within ACI 318 are similarly intended to produce stable plastic hinges in concrete piles. Because piles can be subjected to tension caused by an overturning moment, mechanical means to transfer such tension must be designed for the required tension force, but not less than 10 percent of the pile compression capacity.

1810.4.5

Vibratory Drivers

CHANGE TYPE: Modification

CHANGE SUMMARY: Where vibratory drivers are used to install piles, load tests are no longer required when pile installation is completed with an impact hammer or when a pile is only used for lateral resistance.

2022 CODE TEXT: **1810.4.5 Vibratory driving.** Vibratory drivers shall only be used to install deep foundation elements where the element load capacity is verified by load tests in accordance with Section 1810.3.3.1.2. The installation of production elements shall be controlled according to power consumption, rate of penetration or other approved means that ensure element capacities equal or exceed those of the test elements.

Exceptions:

1. The pile installation is completed by driving with an impact hammer in accordance with Section 1810.3.3.1.1.
2. The pile is to be used only for lateral resistance.

Photo courtesy of Geoquip, Inc.

Vibratory hammer.

CHANGE SIGNIFICANCE: Axial load tests are only needed when there are axial loads and the pile capacity is in doubt. Piles that are started using a vibratory hammer but completed using an impact hammer should be regulated as piles that are installed by an impact hammer, thus no load tests are required. An impact hammer can be used to assure that the minimum required axial capacity has been achieved or exceeded. The driving criteria of Section 1810.3.3.1.1 require the use of approved driving formulas when allowable loads are less than 40 tons if using an impact hammer. For allowable loads greater than 40 tons, the wave equation analysis method must be utilized to estimate the allowable compressive load.

The exception for piles used only for lateral resistance is applicable because a load test for axial capacity, as required by Section 1810.3.3.1.2, is not appropriate for piles providing lateral resistance only. Lateral load capacity requirements are addressed in Section 1810.3.3.2, requiring calculation of the lateral loads through an approved analysis method or lateral load tests to a minimum of twice the proposed design load.

CHANGE TYPE: Modification

1901.2
Concrete Design and Construction

CHANGE SUMMARY: ACI 318 has been updated to the 2019 edition and includes changes addressing deep foundations, materials and seismic design.

2022 CODE TEXT: **1901.2 Plain and reinforced concrete.** Structural concrete shall be designed and constructed in accordance with the requirements of this chapter and ACI 318 as amended in Section 1905 of this code. *(Additional text in section not shown for brevity.)*

Chapter 35

ACI 318—~~14~~19: Building Code Requirements for Structural Concrete

CHANGE SIGNIFICANCE: The American Concrete Institute's *Building Code Requirements for Structural Concrete* (ACI 318) includes requirements for the design and construction of structural concrete necessary to ensure public health and safety. The 2019 edition is now referenced, with changes responding to new developments in materials, structural systems and seismic design. Not only have the structural design provisions changed, materials advancement and placement techniques are addressed resulting in procedural changes.

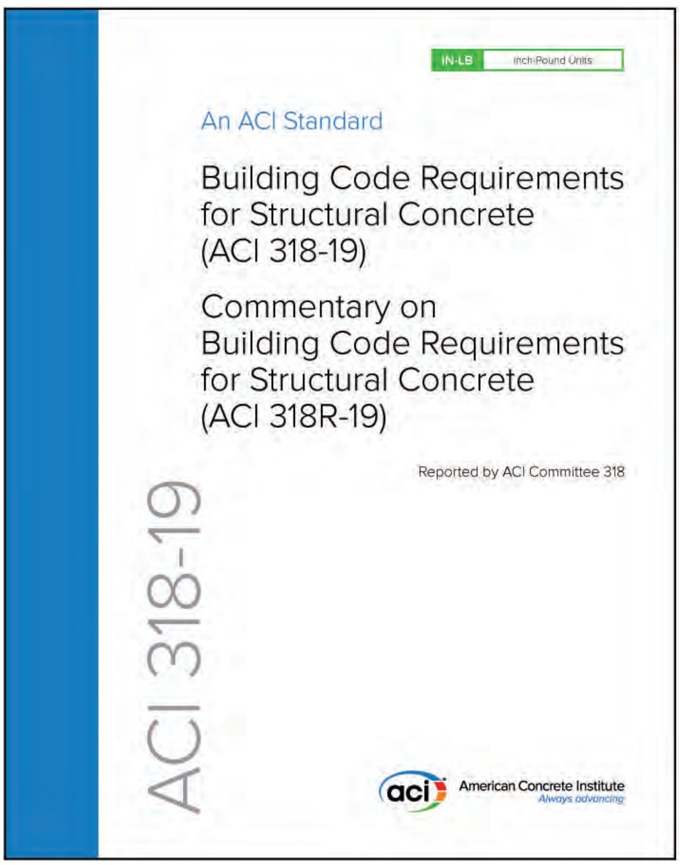


Photo courtesy of American Concrete Institute

ACI 318-19 Requirements for Structural Concrete.

Changes include:

- For the seismic design of structural walls, ACI 318 introduces several new design requirements. New provisions require cross ties with 135-degree hooks, vertical lap splice location restrictions near plastic hinge zones and wall design shear amplification based on flexural overstrength.
- The precast concrete diaphragm design procedure of ACI 550.5, *Code Requirements for the Design of Precast Concrete Diaphragms for Earthquake Motions,* has been adopted. The design method in ACI 550.5 gives designers connection options for selecting a precast concrete diaphragm's target performance when subject to seismic forces.
- Chapter 17, Anchoring to Concrete, has been reorganized and Chapter 26, Construction Documents and Inspection, has been updated.
- Shear provisions have been updated to deal with concerns that requirements were inadequate for the design of thick slabs or deep beams. Provisions addressing one-way shear and two-way punching shear have been consolidated from what was previously a wide range of equations. A method has been added to include size effect in shear design to avoid issues wherein increasing a member's size can reduce its design unit shear strength. The new shear equations also allow a design engineer to consider the reinforcement ratio.
- Structural concrete materials, quality control measures and construction methods are continually evolving, resulting in revisions to ACI 318 provisions. Changes include a new variable for lightweight concrete in design equations, a modified definition for the modulus of elasticity and updated provisions for higher strength reinforcement.

1901.7

Structural Concrete Tolerances

CHANGE TYPE: Addition

CHANGE SUMMARY: American Concrete Institute standards ACI 117 and ITG-7 have been added to the CBC by reference to provide acceptable tolerances for concrete construction.

2022 CODE TEXT: **1901.7 Tolerances for structural concrete.** Where not indicated in construction documents, structural tolerances for concrete structural elements shall be in accordance with this section.

1901.7.1 Cast-in-place concrete tolerances. Structural tolerances for cast-in-place concrete structural elements shall be in accordance with ACI 117.

Exceptions:

1. Group R-3 detached one- or two-family dwellings are not required to comply with this section.
2. Shotcrete is not required to comply with this section.

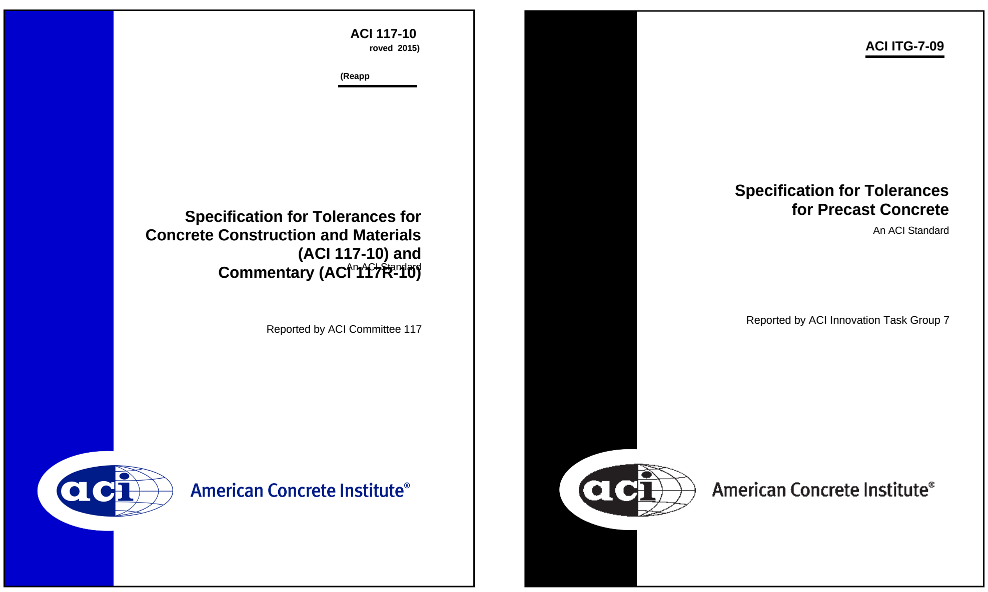
1901.7.2 Precast concrete tolerances. Structural tolerances for precast concrete structural elements shall be in accordance with ACI ITG-7.

Exception: Group R-3 detached one- or two-family dwellings are not required to comply with this section.

Chapter 35

ACI 117—10: Specification for Tolerances for Concrete Construction and Materials

ACI ITG-7—09: Specification for Tolerances for Precast Concrete



Images courtesy of American Concrete Institute

ACI 117 and ACI ITG-7.

CHANGE SIGNIFICANCE: Two standards are now referenced regarding the allowable tolerances of structural concrete elements when such tolerances have not been indicated in construction documents, providing building departments, designers, contractors and special inspectors with information necessary for concrete design and construction within appropriate tolerances.

ACI 117-10, *Specification for Tolerances for Concrete Construction and Materials,* designates standard tolerances for concrete construction. Applicable to exposed concrete and architectural concrete, tolerances in the specification are for typical concrete construction and construction procedures. Materials that interface with, or connect to, concrete elements may have tolerance requirements that are not compatible with those contained in ACI 117. Care should be taken to verify that concrete tolerances work with the steel or wood tolerances of each structural assembly. This specification does not apply to precast concrete or to shotcrete.

As a best practice, a series of preconstruction tolerance coordination meetings should be scheduled and held before the commencement of concrete work. The contractor, subcontractors, material suppliers and other key parties should all attend. At the meeting, all parties should be given an opportunity to identify any tolerance questions and conflicts applicable to the work with materials, prefabricated elements and work to be assembled or installed in the field by the contractor.

ACI ITG 7-09, *Specification for Tolerances for Precast Concrete*, provides standard tolerances for precast concrete construction, deals with dimensional tolerances for precast concrete members used in building construction, and addresses erection tolerances for the individual members. A specifier can supplement the provisions of ITG-7 as needed by including project-specific requirements in the contract documents.

2109.2.4.8

Exterior Finish of Adobe Masonry

CHANGE TYPE: Addition

CHANGE SUMMARY: The use of plaster as an exterior finish for adobe construction has been clarified, with cement-lime, lime and clay plaster minimum requirements now addressed.

2022 CODE TEXT: ~~**2109.2.4.8 Exterior finish.** Exterior walls constructed of unstabilized adobe units shall have their exterior surface covered with not fewer than two coats of Portland cement plaster having a minimum thickness of ¾ inch (19.1 mm) and conforming to ASTM C 926. Lathing shall comply with ASTM C 1063. Fasteners shall be spaced at 16 inches (406 mm) on center maximum. Exposed wood surfaces shall be treated with an approved wood preservative or other protective coating prior to lath application.~~

2109.2.4.8 Exterior finish. Exterior finishes applied to adobe masonry walls shall be of any type permitted by this section or Chapter 14, except where stated otherwise in this section.

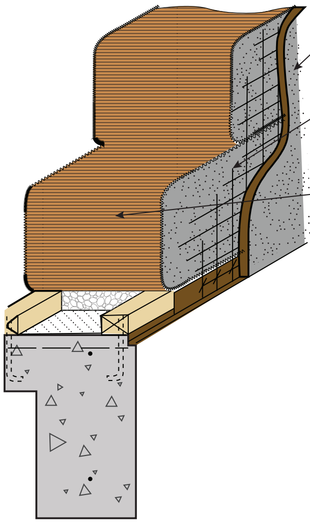
2109.2.4.8.1 Where required. Unstabilized adobe masonry walls shall receive a weather protective exterior finish in accordance with Section 2109.2.4.8.

2109.2.4.8.2 Vapor permeance. Plaster and finish assemblies shall have a vapor permeance of not less than 5 perms.

> **Exception:** Insulation products applied to the exterior of stabilized adobe masonry walls in Climate Zones 2B, 3B, 4B and 5B shall not have a vapor permeance requirement. *Comparison of IECC and California Energy Code climate zones is shown in Chapter 12, Table 1202.3.1.*


Photo courtesy of BCFC

Exterior finish in adobe construction.



Details of adobe construction.

2109.2.4.8.3 Plaster thickness and coats. Plaster applied to adobe masonry shall be not less than ⅞ inches (22 mm) and not greater than 2 inches (51 mm) thick. Plaster shall be applied in not less than two coats.

2109.2.4.8.4 Plaster application. Where plaster is applied directly to adobe masonry walls, no intermediate membrane shall be used.

2109.2.4.8.5 Lath for plaster. Lath shall be provided for all plasters, except where not required elsewhere in Section 2019.2.4.8. Fasteners shall be corrosion resistant and spaced at a maximum of 16 inches (406 mm) on center with a minimum 1½-inches (38 mm) penetration into the adobe wall. Metal lath shall comply with ASTM C1063, as modified by this section, and shall be corrosion resistant. Plastic lath shall comply with ASTM C1788, as modified by this section. Wood substrates shall be protected with No. 15 asphalt felt, an approved wood preservative or other protective coating prior to lath application.

2109.2.4.8.6 Cement plaster. Cement plaster shall conform to ASTM C926 and shall comply with Chapter 25, except that the proportion of lime in plaster coats shall be not less than 1 part lime to 4 parts cement. The combined thickness of plaster coats shall not exceed 1 inch (25 mm).

2109.2.4.8.7 Lime Plaster. Lime plaster is any plaster with a binder composed of calcium hydroxide, including Type N or S hydrated lime, hydraulic lime, natural hydraulic lime, or slaked quicklime. Hydrated lime shall comply with ASTM C206. Hydraulic lime shall comply with ASTM C1707. Natural hydraulic lime shall comply with ASTM C141 and EN 459. Quicklime shall comply with ASTM C5.

2109.2.4.8.8 Cement-lime plaster. Cement-lime plaster shall be any plaster mix type CL, F or FL, as described in ASTM C926.

2109.2.4.8.9 Clay Plaster. Clay plaster shall comply with this section.

2109.2.4.8.9.1 General. Clay plaster shall be any plaster having a clay or clay subsoil binder. Such plaster shall contain sufficient clay to fully bind the aggregate and shall be permitted to contain reinforcing fibers. Acceptable reinforcing fibers include chopped straw, sisal, and animal hair.

2109.2.4.8.9.2 Clay subsoil requirements. The suitability of clay subsoil shall be determined in accordance with the Figure 2 Ribbon Test and the Figure 3 Ball Test in the appendix of ASTM E2392/E2392M.

2109.2.4.8.9.3 Weather-exposed locations. Clay plaster exposed to water from direct or wind-driven rain or snow shall be finished with an approved erosion-resistant finish. The use of clay plasters shall not be permitted on weather-exposed parapets.

2109.2.4.8.9.4 Prohibited finish coat. Plaster containing Portland cement shall not be permitted as a finish over clay plaster.

2109.2.4.8.9.5 Conditions where lathing is not required. For unstabilized adobe walls finished with unstabilized clay plaster, lathing shall not be required.

CHANGE SIGNIFICANCE: Adobe walls require vapor-permeable finishes to ensure appropriate performance and service life. Moisture that is trapped within adobe wall assemblies can cause failures due to finish separation, salt attack, coving and freeze-thaw related spalling. Although it is accepted that earthen walls require vapor-permeable finishes to adequately manage moisture in the assembly, previous code text has been based on legacy requirements that predate current building science. To maintain vapor permeance, Class I and II vapor retarders are prohibited as they are effectively impermeable, having perm ratings of less than 1.

While stabilized adobe does not require any exterior finishes, unstabilized adobe masonry walls are subject to erosion from precipitation. Unstabilized adobe is required to be finished with conventional cement stucco, a finishing system that without modification has been shown to have insufficient permeability. Lime plasters, frequently recommended for use on earthen and other monolithic masonry systems, are now addressed in Section 2109.2.4.8.7.

Clay plasters are a desirable finishing system and are readily available, low cost, have low-embodied carbon and are vapor-permeable. Due to the susceptibility of clay plasters to erosion, specific requirements for the material are necessary. Reinforcing fibers are frequently added to inhibit and control cracking. As clay plasters may be successfully installed without reinforcing fiber (dependent on the material qualities of the clay/sand/aggregate mix), fiber use is not required.

A few types of clay are not suitable for use in clay plasters as they are too expansive or do not provide sufficient binding characteristics. ASTM E2392 is to be referenced to assess the material suitability. The ⅞-inch minimum thickness is required to provide the desired weather protection benefits and to match industry practice. Lime plasters and linseed oil surface applications have also been successfully used to inhibit erosion of rain-exposed clay plasters. Limits on the maximum thickness of applied plasters are required to ensure that they securely bond to the substrate. The 2-inch thickness limitation is consistent with the limit in CRC Appendix S for strawbale construction.

Metallic laths are conventionally used for Portland cement-based plasters. Requirements and conditions for their use are provided by reference to ASTM standards. ASTM C1063, *Standard Specification for the Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster,* and ASTM C926, *Standard Specification for the Application of Portland Cement-Based Plaster,* contain information on metallic lath use with cement plaster.

Requirements for exterior finishes of adobe masonry walls were primarily based on CRC Appendix S, Strawbale Construction, the 2015 *New Mexico Earthen Building Materials Code*, and ASTM E2392, *Standard Guide for Design of Earthen Wall Building Systems*.

2205.2.1

AISC 358 for Prequalified Connections

CHANGE TYPE: Modification

CHANGE SUMMARY: Beam-column moment connections in Seismic Design Category B and C buildings are now required to be prequalified where the response modification coefficient exception is not applied.

2022 CODE TEXT: **2205.2.1.1 Seismic Design Category B or C.** Structures assigned to Seismic Design Category B or C shall be of any construction permitted in Section 2205. Where a response modification coefficient, R, in accordance with ASCE 7, Table 12.2-1, is used for the design of structures assigned to Seismic Design Category B or C, the structures shall be designed and detailed in accordance with the requirements of AISC 341. <u>Beam-to-column moment connections in special moment frames and intermediate moment frames shall be prequalified in accordance with AISC 341, Section K1, qualified by testing in accordance with AISC 341, Section K2, or shall be prequalified in accordance with AISC 358.</u>

> **Exception:** The response modification coefficient, *R*, designated for “Steel systems not specifically detailed for seismic resistance, excluding cantilever column systems” in ASCE 7, Table 12.2-1, shall be permitted for systems designed and detailed in accordance with AISC 360, and need not be designed and detailed in accordance with AISC 341.

2205.2.1.2 Seismic Design Category D, E or F. Structures assigned to Seismic Design Category D, E or F shall be designed and detailed in accordance with AISC 341, except as permitted in ASCE 7, Table 15.4-1.

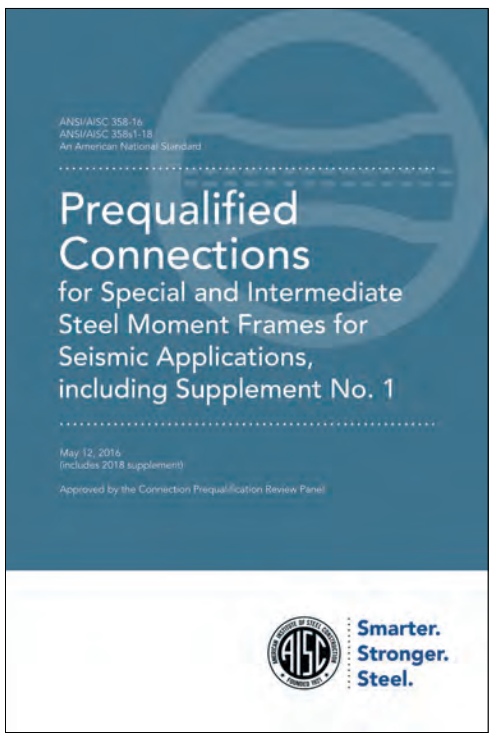


Image courtesy of American Institute of Steel Construction

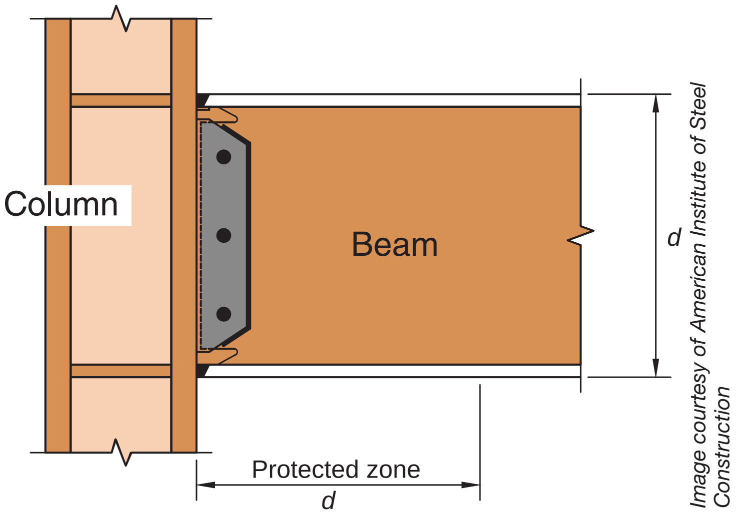
AISC 358-Prequalified Connections.

Beam-to-column moment connections in special moment frames and intermediate moment frames shall be prequalified in accordance with AISC 341, Section K1, qualified by testing in accordance with AISC 341, Section K2, or shall be prequalified in accordance with AISC 358. ***[OSHPD 1R, 2 & 5]*** *All structural steel seismic force-resisting systems in ASCE 7 Table 15.4-1 shall be designed in accordance with AISC 341.*

CHANGE SIGNIFICANCE: AISC 358, *Prequalified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications*, includes requirements for the design, detailing, fabrication and quality control of tested connections for use with intermediate and special moment frames. In the past, AISC 358 was directly referenced in AISC 341, *Seismic Provisions for Structural Steel Buildings*, which is referenced in the *California Building Code*. However, supplements to AISC 358 are now produced more frequently than new editions of AISC 341, with the net effect of not recognizing these newer steel provisions in the code, which leads to confusion among building officials, registered design professionals and manufacturers regarding prequalified connections.

By directly referencing AISC 358 in the CBC, the most up-to-date standard is accommodated. AISC 358 is just one approach for the design of structural steel connections for seismic loads. Section K1 or K2 of AISC 341 may also be used. Section K1 offers minimum requirements for the process of prequalifying a beam-to-column connection used in a special or intermediate moment frame. The intent is to allow the use of a few connection configurations that have been tested to the point where typical performance is understood for a narrow set of construction tolerances. Both Section K1 and AISC 358 are based on the premise of a pre-tested connection for a moment frame. Section K2 of AISC 341, addressing testing requirements for both beam-to-column moment frame connections and link-to-column braced frame connections, includes a simplified list of requirements that can be used to create a specific beam-column connection test protocol.

Examples of prequalified moment frame connections are a Welded Unreinforced Flange-Welded Web (WUF-W) connection and a Bolted Flange Plate (BFP) connection. Each structural steel connection ties a beam to a column.



Welded Unreinforced Flange-Welded Web (WUF-W) connection.

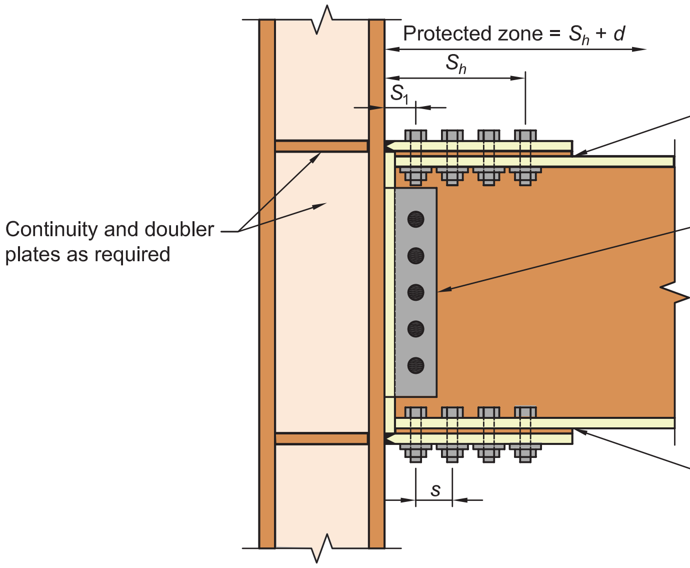


Image courtesy of American Institute of Steel Construction

Bolted Flange Plate (BFP) connection.

2209

Steel Storage Racks

CHANGE TYPE: Modification

CHANGE SUMMARY: Requirements for steel storage racks and their anchorage qualification continue to be clarified.

2022 CODE TEXT: **2209.1** ~~**Storage**~~ **Steel storage racks.** The design, testing and utilization of steel storage racks made of cold-formed or hot-rolled steel structural members shall be in accordance with RMI ANSI/MH 16.1. Where required by ASCE 7, the seismic design of steel storage racks shall be in accordance with Section 15.5.3 of ASCE 7.

2209.2 ~~**Cantilevered steel**~~ **Steel cantilevered storage racks.** The design, testing and utilization of steel cantilevered storage racks made of cold-formed or hot-rolled steel structural members shall be in accordance with RMI ANSI/MH 16.3. Where required by ASCE 7, the seismic design of steel cantilevered ~~steel~~ storage racks shall be in accordance with Section 15.5.3 of ASCE 7.

2209.3 Certification. For rack storage structures that are 8 feet (2438 mm) in height or greater to the top load level and assigned to Seismic Design Category D, E, or F at completion of the storage rack installation, a certificate of compliance shall be submitted to the owner or the owner's authorized agent stating that the work was performed in accordance with approved construction documents.

202 Storage racks, steel. Cold-formed or hot-rolled steel structural members which are formed into steel storage racks, including pallet storage racks, movable-shelf racks, rack-supported systems, automated storage and retrieval systems (stacker racks), push-back racks, pallet-flow racks, case-flow racks, pick modules and rack-supported platforms. Other types of racks, such as drive-in or drive-through racks, cantilever racks, portable racks or racks made of materials other than steel, are not considered storage racks for the purpose of this code.

202 Storage racks, steel cantilevered. A framework or assemblage composed of cold-formed or hot-rolled steel structural members, primarily in the form of vertical columns, extended bases, horizontal arms projecting from the faces of the columns, and longitudinal (down-aisle) bracing between columns. There may be shelf beams between the arms, depending on the products being stored; this definition does not include other types of racks such as pallet storage racks, drive-in racks, drive-through racks, or racks made of materials other than steel.

CHANGE SIGNIFICANCE: The addition of a steel cantilevered storage rack definition acknowledges that this common type of storage rack has different load and design requirements than a standard steel storage rack. The definition of a steel cantilevered storage rack is consistent with that found in ASCE 7, Section 11.2 and specifically states that the racks will be made of structural steel, that the arms cantilever and that the definition is not applicable to other types of steel storage racks.

Photo courtesy of Michael Krinke

Cantilevered storage rack.

The design of the components utilized in steel storage racks are based on minimum thicknesses and minimum yield strength. Storage rack systems can be complex, and their fabrication and installation must comply with the approved drawings. The installation and anchorage of storage racks in high seismic regions require special inspection. In addition, a certificate of compliance is to be provided to the owner stating that the rack was installed following the approved construction documents.

2303.2

Fire-Retardant-Treated Wood

CHANGE TYPE: Modification

CHANGE SUMMARY: ASTM E84 has been updated to now include requirements previously only addressed in the CBC; accordingly, the code language has been deleted.

2022 CODE TEXT: **2303.2 Fire-retardant-treated wood.** Fire-retardant-treated wood is any wood product that, when impregnated with chemicals by a pressure process or other means during manufacture, shall have, when tested in accordance with ASTM E84 or UL 723, a listed flame spread index of 25 or less<u>.</u> ~~and show no evidence of significant progressive combustion when the test is continued~~ <u>Additionally, the ASTM E84 or UL 723 test shall be continued</u> for a 20-minute period~~. Additionally,~~ <u>and</u> the flame front shall not progress more than 10½ feet (3200 mm) beyond the centerline of the burners at any time during the test.

2303.2.1 Pressure process. *(No changes)*

2303.2.2 Other means during manufacture. *(No changes)*

~~**2303.2.3 Testing.** For wood products produced by other means during manufacture, other than a pressure process, all sides of the wood product shall be tested in accordance with and produce the results required in Section 2303.2. Wood structural panels shall be permitted to test only the front and back faces.~~

<u>**2303.2.3 Fire testing of wood structural panels.** Wood structural panels shall be tested with a ripped or cut longitudinal gap of ⅛ inch.</u>

Photo courtesy of American Wood Council

FRT Plywood.

Photo courtesy of American Wood Council

FRT Lumber.

CHANGE SIGNIFICANCE: How to test fire-retardant-treated wood has been a discussion point for several years. Surveyed fire test labs indicate that there are only two applicable fire test requirements from ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*:

1. Flame spread index of not more than 25.
2. Flame front that does not progress more than 10½ feet beyond the burners' centerline when the ASTM E84 test is extended by 20 minutes for a total test time of 30 minutes.

The referenced 2019 edition of ASTM E84 incorporates requirements for conducting an extended 30-minute test. Previously, ASTM E84 did not specify any time frame beyond its 10-minute test. Consequently, ASTM E84 did not provide details on how to assess either "no evidence of significant progressive combustion" or "the flame front shall not progress more than 10½ feet beyond the centerline of the burners." Information for how to determine both of those characteristics is contained in ASTM E2768, *Standard Test Method for Extended Duration Surface Burning Characteristics of Building Materials (30 min Tunnel Test),* and is now directly referenced by ASTM E84.

2303.4.1.2

Wood Truss Bracing

CHANGE TYPE: Addition

CHANGE SUMMARY: Specific requirements have been added to address wood truss member diagonal bracing and restraint.

2022 CODE TEXT: **2303.4.1.2 Permanent individual truss member restraint (PITMR) and permanent individual truss member diagonal bracing (PITMDB).** Where the truss design drawings designate the need for permanent individual truss member restraint, it shall be accomplished by one of the following methods:

1. PITMR and PITMDB installed using standard industry lateral restraint and diagonal bracing details in accordance with TPI 1, Section 2.3.3.1.1, accepted engineering practice, or Figures 2303.4.1.2(1), (3), and (5).
2. Individual truss member reinforcement in place of the specified lateral restraints (i.e., buckling reinforcement such as T-reinforcement, L-reinforcement, proprietary reinforcement, etc.) such that the buckling of any individual truss member is resisted internally by the individual truss. The buckling reinforcement of individual truss members shall be installed as shown on the truss design drawing, on supplemental truss member buckling reinforcement details provided by the truss designer or in accordance with Figures 2303.4.1.2 (2) and (4).
3. A project-specific PITMR and PITMDB design provided by any registered design professional.

2303.4.1.2.1 Trusses installed without a diaphragm. Trusses installed without a diaphragm on the top or bottom chord shall require a project specific PITMR and PITMDB design prepared by a registered design professional.

Exception: Group U occupancies.

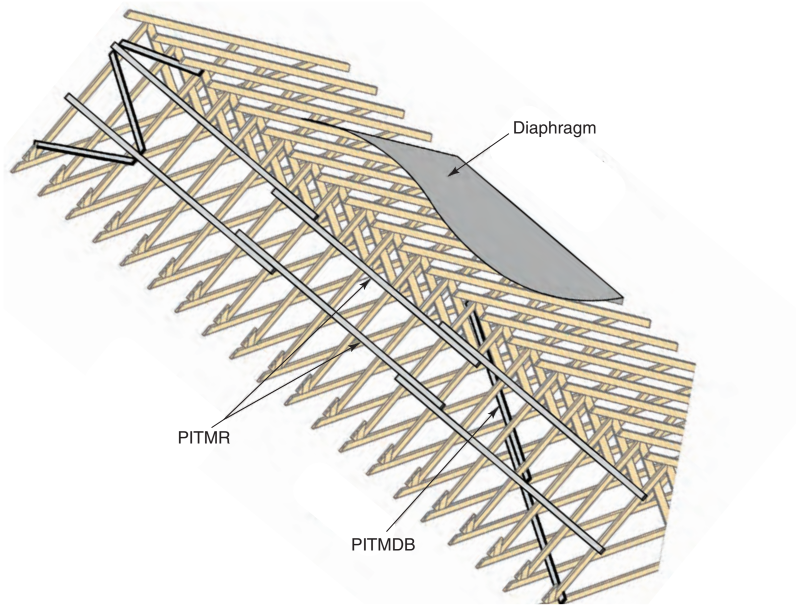
2303.4.1.3 Trusses spanning 60 feet or greater. The owner or the owner's authorized agent shall contract with any qualified registered design professional for the design of the temporary installation restraint and diagonal bracing and the PITMR and PITMDB for all trusses with clear spans 60 feet (18 288 mm) or greater.

(Deleted text not shown for clarity)

202 Permanent individual truss member restraint (PITMR). Restraint that is used to prevent local buckling of an individual truss chord or web member because of the axial forces in the individual truss member.

202 Permanent individual truss member diagonal bracing (PITMDB). Structural member or assembly intended to permanently stabilize the PITMRs.

202 Individual truss member. A truss chord or truss web.



PITMR and PITMDB for truss web members requiring two rows of PITMR.

(Only a portion of Figure 2303.4.1.2(3) is shown for brevity)

CHANGE SIGNIFICANCE: Revised Section 2303.4.1 now provides clarity on the installation of permanent truss member restraint and permanent diagonal bracing of individual wood truss members. The current industry standard of care for the installation of permanent truss member restraint and diagonal bracing is to require that a truss installer (framer) rely on standard industry details. Such details are found in the document *Building Component Safety Information (BCSI) – B3: Permanent Restraint/Bracing of Chords & Web Members* as referenced in *ANSI/TPI 1 National Design Standard for Metal Plate Connected Wood Truss Construction* Section 2.3.3.1.1. The reality in the field, however, is that framers are often not familiar with BCSI-B3 and not provided a copy of that document with the trusses. Owners, building designers, truss designers, truss manufacturers and building officials typically rely on framers to accurately and completely interpret when, where and how to install required restraint and diagonal bracing for pre-engineered wood trusses.

The new Section 2303.4.1.2 requirements are intended to clarify truss bracing needs. Definitions for an Individual Truss Member, a Permanent Individual Truss Member Restraint (PITMR) and Permanent Individual Truss Member Diagonal Bracing (PITMDB) have been added to Section 202. These definitions should eliminate some confusion in the design community and on the job site with respect to what specific bracing members are required and their intended purpose. Terms such as bracing, bridging, continuous lateral brace and x-bracing are often used but do not necessarily mean the same thing to everyone.

Figures have been added to Section 2303.4.1.2 to assist both framers and building inspectors in understanding when and how permanent restraint and bracing should be installed. The figures and associated connections are prescriptive; however, the following engineering assumptions were used during their development:

1. Some amount of lateral restraint force is required to brace a web member that is in compression. Opinions on how much restraint is needed vary from the traditional and conservative 2 percent of axial compression force in the member to 1 percent of the axial compression force, which is currently used by AISI in light gage steel truss design. Even less than 1 percent of axial compression is sometimes assumed depending on the end fixity provided by the top and bottom chords and associated diaphragms. To more accurately determine the actual lateral restraint force, testing and further analysis is required.
2. Utilizing a minimum of four 0.131-inch × 3-inch nails connecting PITMDB ends to blocking, which is similar to connections framers are currently installing, creates considerable lateral capacity, about 375 pounds assuming SPF framing and a load duration factor of 1.15.
3. Most projects utilizing wood trusses will have both a wood structural panel roof diaphragm and a gypsum board ceiling diaphragm. Since diaphragms brace the top and bottom chords, these provisions address truss web members only.
4. For less common projects where there is no diaphragm on the top or bottom chords, a project-specific restraint and bracing design is required. This is critical for trusses with spans of less than 60 feet and dropped ceilings with no ceiling diaphragm.

2304.10.1

Mass Timber Connection Protection

CHANGE TYPE: Addition

CHANGE SUMMARY: In Type IV-A, IV-B and IV-C construction, both a testing option for connections that are part of a fire-resistance-rated assembly and a calculation option for connections that are required to be protected for the fire-resistance rating time of the connected elements have been provided.

2022 CODE TEXT: **2304.10.1 Connection fire-resistance rating.** Fire-resistance ratings for connections in Type IV-A, IV-B or IV-C construction shall be determined by one of the following:

1. Testing in accordance with Section 703.2 where the connection is part of the fire-resistance test.
2. Engineering analysis that demonstrates that the temperature rise at any portion of the connection is limited to an average temperature rise of 250°F (139°C), and a maximum temperature rise of 325°F (181°C), for a time corresponding to the required fire-resistance rating of the structural element being connected. For the purposes of this analysis, the connection includes connectors, fasteners and portions of wood members included in the structural design of the connection.

CHANGE SIGNIFICANCE: Sections 704.2 and 704.3 require connections of columns and other primary structural members to be protected with materials that have the required fire-resistance rating. The new Section 2304.10.1 provides two options for demonstrating such compliance for connections in Types IV-A, IV-B and IV-C construction: a testing option and a calculation option. The provisions are not applicable to connections in heavy timber (IV-HT) construction, because heavy timber structural members do not have a prescribed fire-resistance rating.

Photo courtesy of ATF Fire Research Laboratory

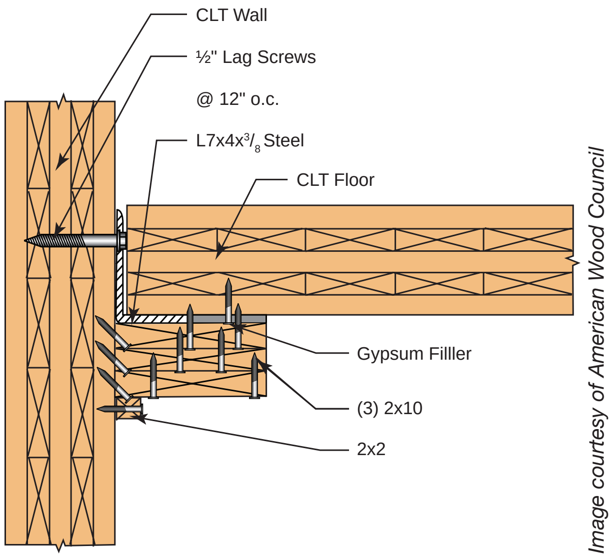
Glulam beam-to-column connection as part of an assembly fire test.

Sections 704.2 and 704.3 do not require connections that join elements of the structural frame to be tested in accordance with ASTM E119. The connections must only be protected with material having the fire-resistance rating required for the structural members that they connect. It is neither practical nor possible to test connections in a standard fire test furnace since there is no capability to test large connections used to transfer gravity loads. In addition, ASTM E119 does not include any provisions on how to test connections and assess their performance. Section 4.4.4 of ASTM E119-18c clearly states that the test standard does not simulate the fire behavior between building elements such as connections. While the testing of large gravity load connections is not contemplated by ASTM E119, the fasteners that are used to connect elements of an assembly are considered part of the test and critical to the assembly's fire performance. For example, the fastening system used to connect multiple pieces of abutting nail-laminated timber that form a floor assembly is considered to be part of the tested assembly. Proper detailing of the system used to connect abutting segments is a primary factor in meeting the thermal pass/fail criteria established in ASTM E119. The connection system has little bearing on the structural performance but is necessary to prevent the passage of hot gases at the abutting edges.

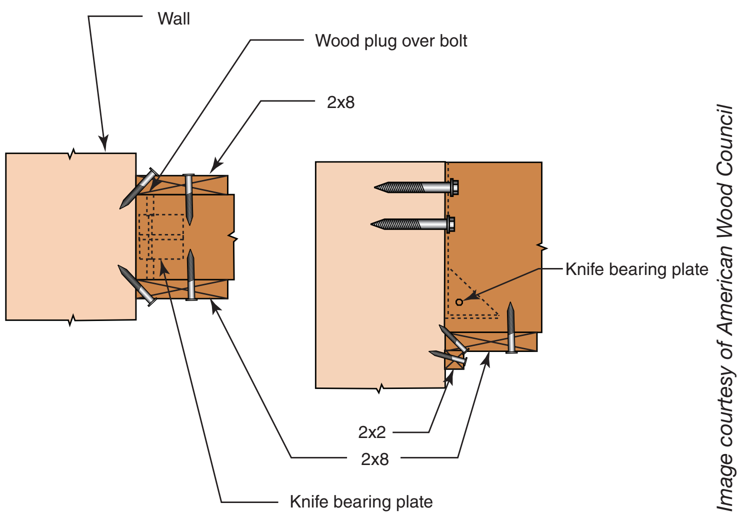
Option 1, described in Section 2304.10.1, Item 1, is consistent with ASTM E119 because the connection is included as part of the overall assembly being tested. In other words, the connection itself is not being tested; rather, the assembly is being tested with the connection included within it, and, therefore, subject to the ASTM E119 pass/fail criteria that are applicable to that assembly.

Some connections used in Types IV-A, IV-B and IV-C construction are not part of the mass timber element or assembly testing. For those connections, Option 2, an engineering analysis, is required by Section 2304.10.1, Item 2. Potential options for engineering analysis include:

- CBC Section 722 permits structural fire-resistance ratings of wood members to be determined using Chapter 16 of the American Wood Council's (AWC) *National Design Specification® (NDS®) for Wood Construction*.
- Where a wood connection is required to be fire-resistance-rated, NDS Section 16.3 requires all components of the wood connection, including the steel connector, the connection fasteners and the wood needed in the connection's structural design, to be protected for the minimum required fire-resistance time. The connection is permitted to be protected by wood, gypsum board or other approved materials.
- Analysis procedures have been developed that allow the protection of these connections to be designed based on test results of ASTM E119 fire tests from protection configurations using the wood member outside the connection, additional wood cover and gypsum board.
    - Analysis procedures must demonstrate that the protection will limit temperature rise at any portion of the connection, including metal connectors, connection fasteners and portions of the wood member that are necessary for the connection's structural design.



CLT floor-to-wall example from AWC TR10.



Glulam beam-to-column example from AWC TR10.

- The AWC *Technical Report 10 (TR10): Calculating the Fire Resistance of Wood Members and Assemblies*, which is referenced in the NDS Chapter 16 Commentary, provides examples of connection designs meeting the requirements of CBC Section 704 and NDS Section 16.3.

Limiting the level of heat allowed to transfer to connections is unique to mass timber and is intended to prevent excessive heating of any portion of the connection. Design guidance for the protection of connections is provided in AWC TR10. The design criteria for protecting a connection is based on thermal separation, which is measured as the distance between the closest surface of the connection and a temperature rise of 250°F within the added protection. Although the code allows for a temperature of 325°F at any single point, determining this is impractical and will not control the thickness of the required cover. Designing for a temperature rise of 250°F above the ambient temperature will always be the more severe case. TR10 provides a method for determining the additional thickness of wood or gypsum board necessary to provide the thermal separation to satisfy this requirement.

There are two common approaches to protecting a connection for the required fire-resistance rating. One method is to entirely embed a connection within the structural member. However, it is unlikely that a beam or column designed for a specified fire-resistance rating will have a sufficiently oversized cross-section to also provide the protection required for the connection. This approach also adds considerable cost to a project as the entire beam or column must be oversized.

The other approach is to use a cover to provide thermal separation by protecting the connection. TR10 specifies that the thermal separation time provided by wood protection can be determined by multiplying the calculated protection time, t_p, by a factor of 0.85. For example, assuming the NDS-specified nominal char rate of 1.5 inch[hour, if a single layer of wood having a thickness of 3.0 inches is used to provide fire protection to a wood member, the protection time, t_p, provided by this layer would be calculated as follows:

$$t_p = 60\left(\frac{3.0}{1.5}\right)^{1.23} = 141 \text{ minutes}$$

where

t_p – calculated protection time (in minutes)

However, if this 3.0-inch thick layer of wood is used to protect a connection, then it must also provide thermal protection to limit the average temperature rise at the interface between the protection and the connection to 250°F or less. As noted above, the thermal separation time provided by this wood protection can be determined by multiplying the protection time, t_p, by 0.85 as follows:

$$0.85\ t_p = (0.85)\ 141 \text{ minutes} = 120 \text{ minutes}$$

where

t_p – calculated protection time (in minutes)

Gypsum board can also be used to provide both fire protection and thermal separation. The time assigned to gypsum board for thermal separation is different from the time assigned for use as noncombustible protection in CBC Table 722.7.1(2). Finish rating is explained in the *UL Fire Resistance Directory* as the time it takes the wood surface nearest the fire, but beneath the cover, to reach a temperature rise of 250°F. When protected in this manner, it is commonly referred to as the finish rating and can be provided by the gypsum board manufacturer for a specific product and thickness. It may also be possible to find finish ratings that are provided in listings of certified assemblies.

UL Design No. U332 assigns a finish rating of 23 minutes to any fire resistance classified ⅝-inch Type X gypsum board. Similarly, it is possible to find finish ratings for two-layers of ⅝-inch Type X that are between 55 and 59 minutes. TR10 provides a slightly conservative approach for determining the thermal separation time of gypsum board; specifically, the thermal separation time is taken as the noncombustible protection time multiplied by a factor of 0.50. Thus, a single layer of


Photo courtesy of American Wood Council

Wood cover protection of structural member connections to achieve a fire-resistance rating.

⅝-inch Type X gypsum board, which has an assigned noncombustible protection time of 40 minutes, would be conservatively assumed to provide a thermal separation time of 20 minutes.

Regardless of whether the thermal separation is being provided by wood protection, gypsum board or a combination of both; where multiple layers of protection are used, the 0.85 or 0.50 factor should only be applied to the layer that is adjacent to the connection itself. For example, if a 1-hour fire-resistance rating is required for a connection, and ⅝-inch Type X gypsum board is to be used for protection of the connection, the layer adjacent to the connection would be assumed to have a thermal separation time of 20 minutes. Therefore, a second outer layer of ⅝-inch Type X gypsum board provides the additional 40 minutes of thermal separation since it is not adjusted by the 0.5 factor.

TR10 also provides guidance on the detailing of wood members and protection to account for char contraction. Where the edges of wood elements abut, such as at the edge of a beam and column interface, the potential effects of char contraction should be evaluated. Char depth is the distance between the location of the original wood surface prior to fire exposure and the char front location (furthest extent of charring into the wood on that face). As wood chars, its volume decreases such that the char layer thickness is less than the char depth. This difference between char depth and the char layer thickness is approximately 0.3 times the char depth at any given time. This phenomenon can result in a wedge-shaped gap formation that propagates along the interface between two wood members. Ignition extends into such gaps a distance that is approximately twice the char depth. As a result, additional wood cover or blocking is required to protect the area around abutting edges. Fasteners used to attach protection are not required to be protected.

It should be noted that Section 110.3.5 establishes new inspection requirements where wood cover is specified to provide fire-resistance protection of connections in Types IV-A, IV-B and IV-C construction.

Table 2304.10.2
Sheathing Fasteners

CHANGE TYPE: Modification

CHANGE SUMMARY: Additional fastener options have been added to the sheathing fastening schedule and nail patterns have been updated to current industry standards and the new ASCE 7 wind loads.

2022 CODE TEXT:

TABLE 2304.10.2 Fastening Schedule – Sheathing

Description of Building Elements	Number and Type of Fastener[g]	Spacing and Location	
Wood structural panels (WSP), subfloor, roof and interior wall sheathing to framing and particleboard wall sheathing to framing[a]			
		Edges (inches)	Intermediate supports (inches)
30. ⅜″ – ½″	6d common or deformed (2″ × 0.113″) or 2⅜″ × 0.113″ nail (subfloor and wall)	6	12
	8d common or deformed (2½″ × 0.131″ × 0.281″ head) (roof) or RSRS-01 (2⅜″ × 0.113″) nail (roof)[d]	6[e]	~~12~~ 6[e]
	2⅜″ × 0.113″ × 0.266″ head nail (roof)	~~4~~ 3[f]	~~8~~ 3[f]
	1¾″ 16 gage staple, 7/16″ crown (subfloor and wall)	4	8
	1¾″ 16 gage staple, 7/16″ crown (roof)	3[f]	~~6~~ 3[f]
31. 19/32″ – ¾″	8d common (2½″ × 0.131″); or ~~6d~~ deformed (2″ × 0.113″) (subfloor and wall)	6	12
	8d common or deformed (2½″ × 0.131″ × 0.281″ head) (roof) or RSRS-01 (2⅜″ × 0.113″) nail (roof)[d]	6[e]	~~12~~ 6[e]
	2⅜″ × 0.113″ × 0.266″ head nail; or 2″ 16 gage staple, 7/16″ crown	4	8

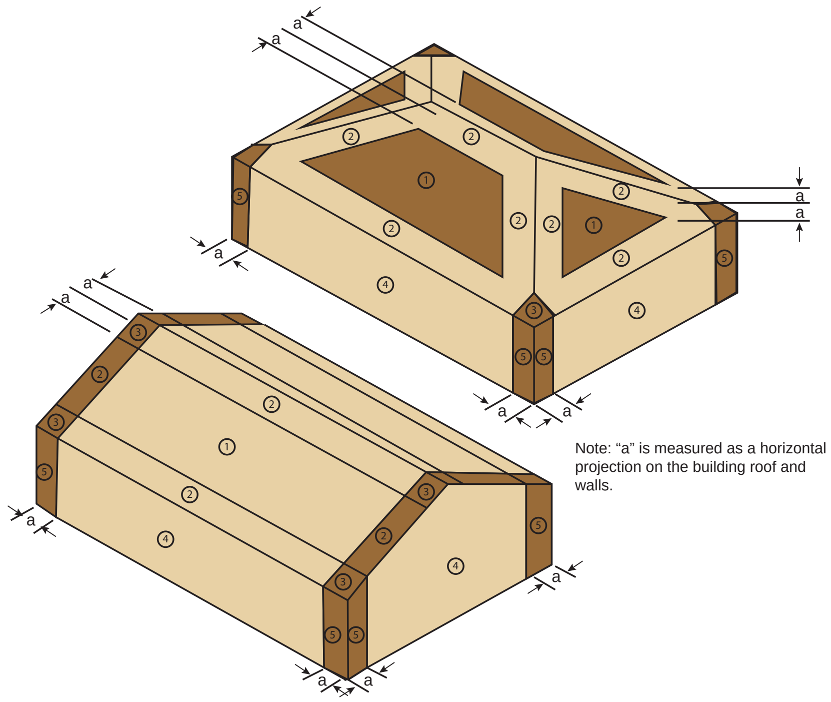
(no changes to footnotes a-d)

e. Tabulated fastener requirements apply where the ultimate design wind speed is less than 140 mph. For wood structural panel roof sheathing attached to gable-end roof framing and to intermediate supports within 48 inches of roof edges and ridges, nails shall be spaced at 4 inches on center where the ultimate design wind speed is greater than 130 mph in Exposure B or greater than 110 mph in Exposure C. Spacing exceeding 6 inches on center at intermediate supports shall be permitted where the fastening is designed per the AWC NDS.

f. Fastening is only permitted where the ultimate design wind speed is less than or equal to 110 mph.

g. Nails and staples are carbon steel meeting the specifications of ASTM F1667. Connections using nails and staples of other materials, such as stainless steel, shall be designed by acceptable engineering practice or approved under Section 104.11.

(Only CBC Table 2304.10.2 Items 30 and 31 are shown here for brevity. All other modifications to this table reflect additional nail size equivalencies.)



Wind loads at roof edges require tighter sheathing nailing schedules.

CHANGE SIGNIFICANCE: The updated roof sheathing nailing criteria now found in Table 2304.10.2 are based on ASCE 7. The changes are also consistent with the roof sheathing nailing requirements in the *2018 Wood Frame Construction Manual* (WFCM). Wind uplift nailing requirements for common species of roof framing with specific gravities of 0.42 (based on SPF) are the basis of the nail spacing requirements in Table 2304.10.2 to meet the wind uplift loading requirements of ASCE 7 without being overly complex in the specification of wood structural panel roof sheathing nailing. The basic roof sheathing nailing schedule is 6 inches on-center at panel edges and 6 inches on-center at intermediate supports in the panel field. As shown in WFCM Table 3.10A for the common case of roof framing spaced at 24 inches on-center, nailing at intermediate supports in the interior portions of the roof is 6 inches on-center for wind speeds within the scope of CBC Section 2308. Six inches on-center spacing is also appropriate for edge zones except where ultimate wind speeds equal or exceed 130 mph in Exposure B and 110 mph in Exposure C where 4 inches on-center nail spacing is required. These special cases are addressed by modification to footnote e.

To update the alternative fastening schedule to uplift loading requirements of ASCE 7 without being overly complex in the specification of wood structural panel roof sheathing attachment, footnote f was added. The calculation leading to the use of 3 inches on-center spacing at all locations is based on a 0.113-inch diameter nail shank withdrawal capacity from wood framing with a specific gravity equal to 0.42 (SPF) and pre-calculated wind uplift loads in WFCM Table 3.10. The use of a single 3-inch spacing at all supports was extended to staples based on the assumption that the 2016 edition of ASCE 7 load increase would similarly require reduced spacing. This assumption was applied to staples because a withdrawal value is not available for staples in the NDS.

2304.11

Concealed Spaces in Type IV-HT

CHANGE TYPE: Modification

CHANGE SUMMARY: Concealed spaces are now permitted in floors and roof decks for Type IV-HT.

2022 CODE TEXT: **2304.11.3 Floors.** Floors shall be without concealed spaces <u>or with concealed spaces complying with Section 602.4.4.3</u>. Wood floors shall be constructed in accordance with Section 2304.11.3.1 or 2304.11.3.2.

2304.11.4 Roof decks. Roofs shall be without concealed spaces ~~and roof~~ <u>or with concealed spaces complying with Section 602.4.4.3. Roof</u> decks shall be constructed in accordance with Section 2304.11.4.1 or 2304.11.4.2. Other types of decking shall be an alternative that provides equivalent fire resistance and structural properties. Where supported by a wall, roof decks shall be anchored to walls to resist forces determined in accordance with Chapter 16. Such anchors shall consist of steel bolts, lags, screws or approved hardware of sufficient strength to resist prescribed forces.

CHANGE SIGNIFICANCE: Historically, concealed spaces have not been permitted in traditional heavy timber construction. Now, concealed spaces are permitted in traditional Type IV-HT construction, with specific requirements for their protection. New protection options include:

- In fully sprinklered buildings, installing automatic sprinkler protection in the concealed space.
- Filling the space with noncombustible insulation.
- Protecting combustible surfaces with not less than ⅝-inch Type X gypsum board.

Concealed spaces in new Types IV-A, IV-B and IV-C construction are addressed separately. The option of having protected concealed spaces in Type IV-HT buildings is important for encouraging adaptive re-use of existing heavy timber buildings as well as providing for the installation of mechanicals (MEP) in Type IV-HT cross-laminated timber construction.

Photo courtesy of ATF Fire Research Laboratory

Concealed spaces must be protected.

2305

Lateral Force-Resisting Systems

CHANGE TYPE: Modification

CHANGE SUMMARY: The 2021 edition of the SDPWS, which includes shear wall and diaphragm design provisions for cross-laminated timber, is now referenced in the CBC.

2022 CODE TEXT: **2305.1 General.** Structures using wood-frame shear walls or wood-frame diaphragms to resist wind, seismic or other lateral loads shall be designed and constructed in accordance with AWC SDPWS and the applicable provisions of Sections 2305, 2306 and 2307.

Chapter 35

ANSI/AWC SDPWS—2021~~2015~~: Special Design Provisions for Wind and Seismic

CHANGE SIGNIFICANCE: The American Wood Council's *Special Design Provisions for Wind and Seismic* (SDPWS) provides criteria for proportioning, designing and detailing engineered wood systems, members and connections in lateral force resisting systems. Nominal shear capacities of diaphragms and shear walls are provided for reference assemblies. The SDPWS has been updated to the 2021 edition and is now referenced in the CBC.

Changes to the standard include:

- Addition of cross-laminated timber (CLT) shear wall and diaphragm provisions. Using CLT components in seismic force-resisting systems is an area of considerable ongoing research. The referenced 2016 edition of ASCE 7, *Minimum Design Loads and Associated Criteria for Buildings and Other Structures*, does not

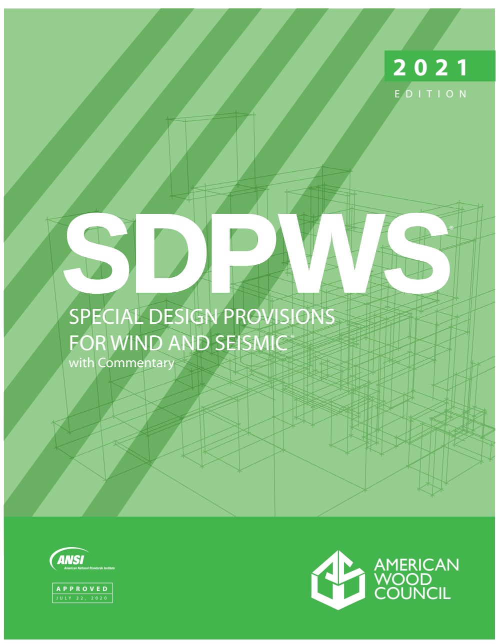


Photo courtesy of American Wood Council

2021 Special Design Provisions for Wind and Seismic (SDPWS).

contain seismic design coefficients for CLT shear wall systems; however, seismic design coefficients for CLT shear wall systems are expected to be provided in the 2022 edition of ASCE 7.

- Addition of deflection equations for cantilevered diaphragms.
- Revision of shear capacity adjustment factors for perforated shear wall design.
- Simplification of nominal unit shear capacity tables for diaphragms and shear walls and clarification of reference nail size and sawn lumber basis of tabulated values.

2308.5.6, 2308.6.6.2

Cripple Walls

CHANGE TYPE: Modification

CHANGE SUMMARY: Cripple wall requirements have been clarified to emphasize that, if only interior wood-framed cripple walls exist in a design, no sheathing or solid blocking is required.

2022 CODE TEXT: **2308.5.6 Cripple walls.** Foundation cripple walls shall be framed of studs that are not less than the size of the studding above ~~and~~. Exterior cripple wall studs shall be not less than 14 inches (356 mm) in length, or shall be framed of solid blocking. Where exceeding 4 feet (1219 mm) in height, such walls shall be framed of studs having the size required for an additional story. See Section 2308.6.6 for cripple wall bracing.

2308.6.6.2 Cripple wall bracing in Seismic Design Categories D and E. For the purposes of this section, cripple walls in Seismic Design Categories D and E ~~having~~ shall not have a stud height exceeding 14 inches (356 mm) ~~shall be considered to be a story and~~ , and studs shall be ~~braced~~ solid blocked in accordance with Section 2308.5.6 for the full dwelling perimeter and for the full length of interior braced wall lines supported on foundations, excepting ventilation and access openings. ~~Table 2308.6.1. Where interior braced wall lines occur without a continuous foundation below, the length of parallel exterior cripple wall bracing shall be one and one-half times the lengths required by Table 2308.6.1. Where the cripple wall sheathing type used is Method WSP or DWB and this additional length of bracing cannot be provided, the capacity of WSP or DWB sheathing shall be increased by reducing the spacing of fasteners along the perimeter of each piece of sheathing to 4 inches (102 mm) on center.~~

Interior cripple walls.

CHANGE SIGNIFICANCE: Section 2308.5.6 has been clarified through the addition of the term 'exterior' to the requirements. In addition, contradictory text has been deleted from Section 2308.6.6.2. Where cripple walls are exterior walls supporting one or more stories, the wall must be braced with either solid blocking or sheathing based on wall bracing requirements. These walls have been found to rack sideways and fail in moderate and large earthquakes. Adding sheathing or blocking stiffens the wall.

For buildings in Seismic Design Categories (SDC) A, B and C, where a cripple wall is part of an interior wall line, whether below an interior braced wall line or simply supporting the floor above, there is no requirement for bracing the wall line by blocking or sheathing. These walls are inside a much stiffer exterior foundation wall of concrete or concrete masonry unit (CMU) block and will not move independently of the floor and exterior walls during an earthquake.

Cripple wall bracing in SDC D and E is now limited to 14 inches in height and must be solidly blocked along both the interior and exterior walls. Therefore, buildings may only be one story with a slab on grade foundation or a crawlspace consisting of studs 14 inches or less in height with solid-blocked cripple walls per Table 2308.2.1. Because cripple walls over 14 inches in height are considered an additional story, a one-story building over cripple walls is considered a two-story building and prohibited in SDC D and E. The extent of solid blocking of cripple wall studs to allow for ventilation and access openings has also been clarified.

Table 2308.7.3.1

Rafter Tie Connections

CHANGE TYPE: Modification

CHANGE SUMMARY: Rafter tie connection requirements have been updated to reflect current standards.

2022 CODE TEXT:

TABLE 2308.7.3.1 Rafter Tie Connections[g,i]

Rafter Slope	Tie Spacing (inches)	Live Load Only[g]			Ground Snow Load 30 psf			Ground Snow Load 50 psf		
		Roof span (ft) 12	24	36	12	24	36	12	24	36
		Required number of 16d common (3½″ × 0.162″) nails per connection[a,b,c,d,e,f,h]								
3:12	12	3	5	8	3	6	9	5	9	13
	16	4	7	10	4	8	12	6	12	17
	19.2	4	8	12	5	10	14	7	14	21
	24	5	10	15	6	12	18	9	17	26
	32	7	13	20	8	16	24	12	23	34
	48	10	20	29	12	24	35	17	34	51
4:12	12	3	4	6	3	5	7	4	7	10
	16	3	5	8	3	6	9	5	9	13
	19.2	3	6	9	4	7	11	6	11	16
	24	4	8	11	5	9	13	7	13	19
	32	5	10	15	6	12	18	9	17	26
	48	8	15	22	9	18	26	13	26	38
5:12	12	3	3	5	3	4	6	3	6	8
	16	3	4	6	3	5	7	4	7	11
	19.2	3	5	7	3	6	9	5	9	13
	24	3	6	9	4	7	11	6	11	16
	32	4	8	12	5	10	14	7	14	21
	48	6	12	18	7	14	21	11	21	31
7:12	12	3	3	4	3	3	4	3	4	6
	16	3	3	5	3	4	5	3	5	8
	19.2	3	4	5	3	4	6	3	6	9
	24	3	5	7	3	5	8	4	8	11
	32	3	6	9	4	7	10	5	10	15
	48	5	9	13	5	10	15	8	15	22
9:12	12	3	3	3	3	3	3	3	3	5
	16	3	3	4	3	3	4	3	4	6
	19.2	3	3	4	3	4	5	3	5	7
	24	3	4	5	3	4	6	3	6	9
	32	3	5	7	3	6	8	4	8	12
	48	4	7	10	4	8	12	6	12	17

table continued

TABLE 2308.7.3.1 *continued*

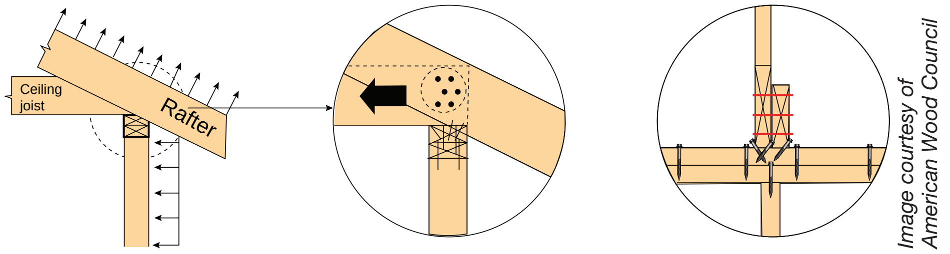
Rafter Slope	Tie Spacing (inches)	Live Load Only[g]			Ground Snow Load 30 psf			Ground Snow Load 50 psf		
		Roof span (ft)								
		12	24	36	12	24	36	12	24	36
		Required number of 16d common (3½″ × 0.162″) nails per connection[a,b,c,d,e,f,h]								
12:12	12	3	3	3	3	3	3	3	3	4
	16	3	3	3	3	3	3	3	3	5
	19.2	3	3	3	3	3	4	3	4	6
	24	3	3	4	3	3	5	3	5	7
	32	3	4	5	3	4	6	3	6	9
	48	3	5	8	3	6	9	5	9	13

a. ~~40d box (5″ × 0.162″) or 16d sinker (3¼″ × 0.148″) nails are~~ 10d common (3″ × 0.148″) nails shall be permitted to be substituted for 16d common (3½″ × ~~0.16~~″ 0.162″) nails where the required number of nails is taken as 1.2 times the required number of 16d common nails, rounded up to the next full nail.
~~b. Nailing requirements are permitted to be reduced 25 percent if nails are clinched.~~
~~c~~ b. Rafter tie heel joint connections are not required where the ridge is supported by a load-bearing wall, header or ridge beam.
~~d~~ c. Where intermediate support of the rafter is provided by vertical struts or purlins to a load-bearing wall, the tabulated heel joint connection requirements are permitted to be reduced proportionally to the reduction in span.
~~e~~ d. Equivalent nailing patterns are required for ceiling joist to ceiling joist lap splices.
~~f~~ e. Connected members shall be of sufficient size to prevent splitting due to nailing.
~~g~~ f. For snow loads less than 30 pounds per square foot, the required number of nails is permitted to be reduced by multiplying by the ratio of actual snow load plus 10 divided by 40, but not less than the number required for no snow load.
g. Applies to roof live load of 20 psf or less.
h. Tabulated heel joint connection requirements assume that ceiling joists or rafter ties are located at the bottom of the attic space. Where ceiling joists or rafter ties are located higher in the attic, heel joint connection requirements shall be increased by the adjustment factors in Table 2308.7.3.1(1).
i. Tabulated requirements are based on 10 psf roof dead load in combination with the specified roof snow load and roof live load.

TABLE 2308.7.3.1(1) Heel Joint Connection Adjustment Factors

H_C/H_R[a,b]	Heel Joist Connection Adjustment Factor
1/3	1.50
1/4	1.33
1/5	1.25
1/6	1.20
1/10 or less	1.11

a. H_C = Height of ceiling joists or rafter ties measured vertically from the top of the rafter support walls to the bottom of the ceiling joists or rafter ties.
H_R = Height of roof ridge measured vertically from the top of the rafter support walls to the bottom of the roof ridge.
b. Where H_C/H_R exceeds 1/3, connections shall be designed in accordance with accepted engineering practice.



Nail placement for rafter ties.

CHANGE SIGNIFICANCE: Table 2308.7.3.1 has been revised for consistency with the calculation basis of the American Wood Council's (AWC) *2018 Wood Frame Construction Manual (WFCM)* heel joint nailing requirements based on the AWC *2018 National Design Specification for Wood Construction (NDS)* provisions for nailed connections. The reduction in the required number of 16d common nails for rafter tie connections by approximately 15 percent is due to changes in the penetration factor and load duration assumptions used to develop the previous table. Previously, a reduction factor of 0.77 for penetration (based on the 1991 and 1997 NDS) was used for 16d common nails with less than 12d penetration in the main member and a load duration factor of 1.25.

The revised nailing requirements are based on a 1.15 load duration factor for snow load cases, a 1.25 load duration factor for roof live load cases, and an effective penetration factor equal to 1.0 per the current NDS where lateral design value calculations for nails are based on the actual penetration in the wood member. The ratio of nail design values for snow cases originally used to develop nailing requirements to the new nail design values for snow cases is $(Z \times 0.77 \times 1.25) / (Z \times 1.0 \times 1.15) = 0.84$ and explains the reduced number of nails now required in the table. Due to revised nail design provisions in the NDS, the benefit of a longer nail that is clinched is no longer recognized for this application and footnote b was deleted.

A 10d common nail option is added in new footnote a based on NDS lateral design value calculations for nails. The table heading clarifies the 10 pounds per square foot dead load basis of the nailing requirements. Also, adjustment factors for rafter tie height, consistent with WFCM and CRC, have been added in footnote h to increase connection requirements where the rafter tie, or ceiling joist, is not located at the bottom of the attic space. Generally, rafter ties located at the top of support walls are also ceiling joists.

2510.6

Water-Resistive Barriers for Stucco

CHANGE TYPE: Modification

CHANGE SUMMARY: Water-resistive barrier requirements for stucco have been divided into two categories based on whether the building is in a dry or moist climate.

2022 CODE TEXT: **2510.6 Water-resistive barriers.** Water-resistive barriers shall be installed as required in Section 1403.2 and, where applied over wood-based sheathing, shall comply with Section 2510.6.1 or Section 2510.6.2. ~~include a water-resistive vapor-permeable barrier with a performance at least equivalent to two layers of water-resistive barrier complying with ASTM E2556, Type I. The individual layers shall be installed independently such that each layer provides a separate continuous plane and any flashing (installed in accordance with Section 1404.4) intended to drain to the water-resistive barrier is directed between the layers.~~

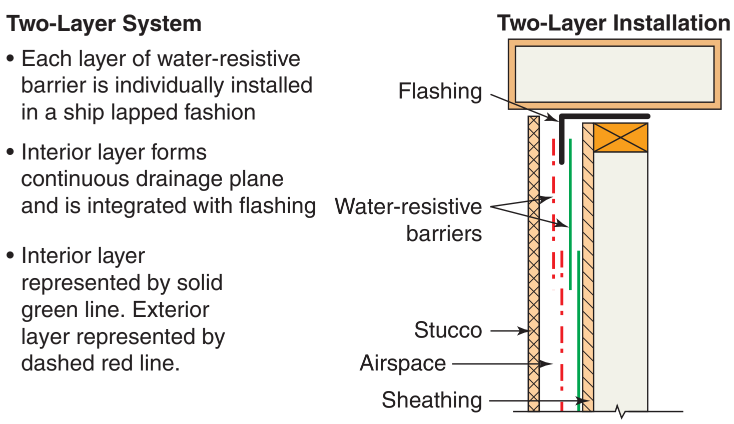
~~**Exceptions:**~~

~~1. Where the water-resistive barrier that is applied over wood-based sheathing has a water resistance equal to or greater than that of a water-resistive barrier complying with ASTM E2556, Type II and is separated from the stucco by an intervening, substantially nonwater-absorbing layer or drainage space.~~

~~2. Where the water-resistive barrier is applied over wood-based sheathing in Climate Zone 1A, 2A or 3A, a ventilated air space shall be provided between the stucco and water-resistive barrier.~~

2510.6.1 Dry climates. One of the following shall apply for dry (B) climate zones:

1. The water-resistive barrier shall be two layers of 10-minute Grade D paper or have a water resistance equal to or greater than two layers of water-resistive barrier complying with ASTM E2556, Type I.



Two-layer water-resistive barrier.

The individual layers shall be installed independently such that each layer provides a separate continuous plane and any flashing, installed in accordance with Section 1404.4 and intended to drain to the water-resistive barrier, is directed between the layers.

2. The water-resistive barrier shall be 60-minute Grade D paper or have a water resistance equal to or greater than one layer of water-resistive barrier complying with ASTM E2556, Type II. The water-resistive barrier shall be separated from the stucco by a layer of foam plastic insulating sheathing or other nonwater absorbing layer, or a drainage space.

2510.6.2 Moist or marine climates. In moist (A) or marine (C) climate zones, water-resistive barrier shall comply with of one of the following:

1. In addition to complying with Item 1 or 2 of Section 2510.6.1, a space or drainage material not less than 3⁄16-inch (4.8 mm) in depth shall be applied to the exterior side of the water-resistive barrier.
2. In addition to complying with Item 2 of Section 2510.6.1, drainage on the exterior side of the water-resistive barrier shall have a minimum drainage efficiency of 90 percent as measured in accordance with ASTM E2273 or Annex A2 of ASTM E2925.

CHANGE SIGNIFICANCE: Water-resistive barrier provisions for stucco have been reorganized by deleting the two exceptions. The exceptions have been replaced by subsections that indicate when an air gap is required by separating the requirements into dry and wet climate provisions. Additionally, a revised format recognizes two methods of compliance to the stucco water-resistive barrier provisions by requiring materials meet either ASTM E2556 Type I or Type II.

Requirements are now to be applied in relation to climate zones and are intended to abate potential moisture problems in climates that are moist or rainy. The change helps resolve problems with stucco performance due to moisture problems when placed over wood-based sheathing. Dry climates are also now exempt from meeting the more stringent requirements where stucco has a longstanding record of good performance without an installed air gap.

A reference to ASTM E2925, *Standard Specification for Manufactured Polymeric Drainage and Ventilation Materials Used to Provide a Rainscreen Function*, has been added to provide a second option when an air gap of 3/16-inch would be problematic for construction. An assembly can be checked by measuring drainage efficiency using the standard. If 90 percent of the water added above the space drains out, then the materials meet an equivalent drainage requirement. This method will require testing to determine sufficient drainage.111

PART 7

Building Services, Special Devices and Special Conditions

Chapters 27 through 33

Although building services such as electrical systems (Chapter 27), mechanical systems (Chapter 28) are regulated primarily through separate and distinct codes, limited provisions are set forth in the *California Building Code* (CBC). Chapter 30 regulates elevators and similar conveying systems to a limited degree, as most requirements are found in American Society of Mechanical Engineers (ASME) standards. The special construction provisions of Chapter 31 include those types of elements or structures that are not conveniently addressed in other portions of the code. By "special construction," the code is referring to membrane structures, pedestrian walkways, tunnels, awnings, canopies, marquees and similar building features that are unregulated elsewhere. Chapter 32 governs the encroachment of structures into the public right-of-way, and Chapter 33 addresses safety during construction and the protection of adjacent public and private properties. ■

3001.2

Emergency Elevator Communication Systems

CHANGE TYPE: Modification

CHANGE SUMMARY: Additional direction and clarity has been provided regarding the appropriate emergency two-way communication features that are mandated for accessible elevators.

2022 CODE TEXT: **3001.2 Emergency elevator communication systems for the deaf, hard of hearing and speech impaired.** An emergency two-way communication system shall be provided<u>. The system shall provide visible text and audible modes</u> that <u>meet all of the following requirements</u>:

1. ~~Is a visual and text-based 24/7 live interactive system.~~ <u>When operating in each mode, includes a live interactive system that allows back and forth conversation between the elevator occupants and emergency personnel.</u>
2. Is ~~fully accessible by the deaf, hard of hearing and speech impaired, and shall include voice-only options for hearing individuals.~~ <u>operational when the elevator is operational.</u>
3. ~~Has the ability to communicate with emergency personnel utilizing existing video conferencing technology, chat/text software or other approved technology.~~ <u>Allows elevator occupants to select the text-based or audible mode depending on their communication needs to interact with emergency personnel.</u>

CHANGE SIGNIFICANCE: In multistory buildings, passenger elevators are typically utilized as vertical accessible routes. In some cases, the elevators may also be considered a part of the accessible means of egress. The *California Building Code* (CBC) mandates than an emergency two-way communication system be provided for accessible elevators. In addition, the elevators and associated elevator landings must have accessible

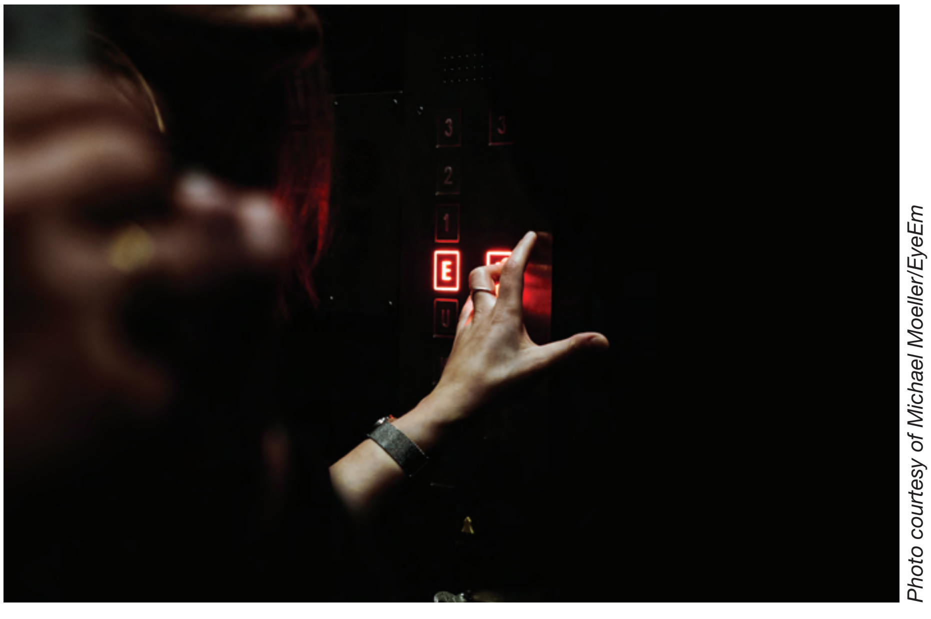


Photo courtesy of Michael Moeller/EyeEm

Elevator control panel.

features complying with ICC A117.1, the CBC-referenced technical standard for accessibility. Applicable to accessible elevators, the A117.1 standard requires an emergency two-way communication system between the elevator car and a point outside the hoistway. The system must also fully comply with the provisions in ASME A17.1/CSA B44, the *Safety Code for Elevators and Escalators* as published by the American Society of Mechanical Engineers.

The provisions of ICC A117.1 only address requirements regarding the height of operable parts, identification of the system and instructions for its use. Additional communication capabilities were introduced in the 2018 edition of the CBC to enhance the usability of the system by individuals with varying degrees of hearing or speech impairments. The criteria have now been further modified to provide additional direction and clarity in providing the appropriate accessible features.

To provide totally accessible communication between individuals in elevators who are deaf, hard of hearing or speech impaired with local governmental emergency services, additional communication features must be provided within the elevator. It has been clarified that the system must provide both a text mode and an audible mode that, during operation, allows for live interactive communication between those individuals within the elevator and emergency personnel. The system shall be operational during all times the elevator is operational, and it shall be designed to allow the selection of the appropriate communication mode by the elevator occupants. Such occupants may select either the text-based or audible mode based on their specific needs. Along with the necessary visual indicators and button indicators, the text-based mode would allow the use of a keyboard by those entrapped individuals who are deaf or hard-of-hearing.

3103.1

Special Event Structures

CHANGE TYPE: Clarification

CHANGE SUMMARY: Special event structures, newly defined in Section 202, are now included in the types of temporary structures that are regulated by both the *California Building Code* (CBC) and the *California Fire Code* (CFC).

2022 CODE TEXT: **3103.1 General.** The provisions of Sections 3103.1 through 3103.4 shall apply to structures erected for a period of less than 180 days. Special event structures, tents, umbrella structures and other membrane structures erected for a period of less than 180 days shall also comply with the *California Fire Code*. Those erected for a longer period of time shall comply with applicable sections of this code.

202 Special event structure. Any ground-supported structure, platform, stage, stage scaffolding or rigging, canopy, tower or similar structure supporting entertainment-related equipment or signage.

CHANGE SIGNIFICANCE: The special requirements that are applicable to temporary structures are set forth in Section 3103. For the purpose of applying the applicable code provisions, "temporary" is considered as being erected for a time period of less than 180 days. The CFC contains a significant number of provisions applicable to such structures. In addition, the CBC identifies some key criteria that must be applied to temporary structures, including conformity with the structural strength, fire safety, means of egress, accessibility, light, ventilation and sanitary requirements. Permits are typically required, as are construction documents. The scope of Section 3103 has previously been limited to tents, umbrella structures and other membrane structures. Special event structures, as defined in Section 202, are now included in the types of temporary structures that are regulated by the CBC and CFC.

Photo courtesy of Fish Scale

Special event structures at music festival.

The new definition in the CBC provides consistency with the CFC definition that was initially established in the 2018 edition. Because special event structures are temporary in nature, such structures are primarily regulated by the CFC for the purposes of approval, permitting, length of use, document submittal, location on lot and inspections. In addition to the provisions mandated by the CFC, limited requirements of the CBC must also be met. Where the structure is to remain in place for a period of 180 days or more, it is to be regulated in the same manner any other "permanent" building or structure by the applicable provisions of the CBC.

3111.3.5

Elevated Photovoltaic (PV) Support Structures

CHANGE TYPE: Addition

CHANGE SUMMARY: The State Fire Marshal has added new language to establish appropriate fire testing and listing criteria for overhead photovoltaic support structures that could have people or vehicles in the space beneath them.

2022 CODE TEXT: ***3111.3.5 Elevated photovoltaic (PV) support structures.*** *Elevated PV support structures shall comply with either 3111.3.5.1 or 3111.3.5.2.*

> ***Exception:*** *Elevated PV support structures that are installed over agricultural use.*

> ***3111.3.5.1 PV panels installed over open grid framing or noncombustible deck.*** *Elevated PV support structures with PV panels installed over open grid framing or over a noncombustible deck shall have PV panels tested, listed and labeled with a fire type rating in accordance with UL 1703 or with both UL 61730-1 and UL 61730-2. Photovoltaic panels marked "not fire rated" shall not be installed on elevated PV support structures.*

> ***3111.3.5.2 PV panels installed over a roof assembly.*** *Elevated PV support structures with a PV panel system installed over a roof assembly shall have a fire classification in accordance with Section 1505.9.*

An example of an elevated PV support structure.

CHANGE SIGNIFICANCE: The language of Section 3111.3.5 now specifies the appropriate fire testing and listing for elevated PV support structures. Elevated PV support structure is now defined as an independent support structure with a minimum clear height of 7 feet 6 inches intended for a secondary use like providing shade or parking. Now these types of structures, if solely used for an agricultural use, will be required to comply with UL 1703 or UL 61730-1 and UL 61730-2 for open grid framing or Section 1505.9 if installed over a roof assembly.

3114

Public-Use Restrooms in Flood Hazard Areas

CHANGE TYPE: Addition

CHANGE SUMMARY: Special criteria to be applied where public-use restrooms are located within designated flood hazard areas of publicly owned lands have been established to allow such restrooms to be at-grade or above-grade but below the base flood elevation.

2022 CODE TEXT:

SECTION 3114
PUBLIC-USE RESTROOM BUILDINGS IN FLOOD HAZARD AREAS

3114.1 General. For the purpose of this section, public restroom buildings are located on publicly owned lands in flood hazard areas and intended for public use. Public restroom buildings and portions of other buildings that contain public restrooms are limited to toilet rooms, bathrooms, showers and changing rooms. Public restroom buildings and portions of buildings that contain public restrooms shall comply with the requirements of this section. Public-use restrooms that are not elevated or dry floodproofed in accordance with Section 1612 shall comply with Section 3114.2. Portions of buildings that include uses other than public-use toilet rooms, bathrooms, showers and changing rooms shall comply with Section 1612.

3114.2 Flood resistance. Public-use restrooms on publicly owned lands in flood hazard areas shall comply with the requirements of ASCE 24, except for elevation requirements, and shall comply with all of the following criteria:

1. The building footprint is not more than 1,500 square feet (139 m^2).
2. Located, designed and constructed to resist the effects of flood hazards and flood loads to minimize flood damage from a combination of wind and water loads associated with the base flood.

Photo courtesy of Steve Martin, Florida Division of Emergency Management

Public restroom in coastal high hazard area (Zone V/VE).

3. Anchored to prevent flotation, collapse or lateral movement resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy during conditions of the base flood.
4. Constructed of flood-damage-resistant materials.
5. Where enclosed by walls, the walls have flood openings.
6. Mechanical and electrical systems are located above the base flood elevation.
7. Plumbing fixtures and plumbing connections are located above the base flood elevation.
8. An emergency plan, approved by the jurisdiction, is submitted to the building official and includes building design documents specifying implementation of protection measures prior to the onset of flooding conditions.

Exceptions:

1. Minimum necessary electric equipment required to address health, life safety and electric code requirements is permitted below the base flood elevation in accordance with ASCE 24 provisions for electric elements installed below the minimum elevations.
2. Plumbing fixtures and connections are permitted below the base flood elevation provided that the fixtures and connections are designed and installed to minimize or eliminate infiltration of floodwaters into the sanitary sewage system and discharges from sanitary sewage systems into floodwaters.

CHANGE SIGNIFICANCE: Chapter 31 provides regulations for unique buildings and building elements. Although many such buildings and elements are not considered as the typical structures regulated under the CBC, they nevertheless pose some degree of hazard or other concern that must be dealt with. Issues that arise in flood hazard areas are addressed in various locations throughout the code, including those related to administrative functions, exterior wall performance, accessibility and flood loads. New provisions established in Section 3114 now address the special criteria to be applied where public-use restrooms are located within designated flood hazard areas of publicly owned lands.

The Federal Emergency Management Agency (FEMA) develops Flood Insurance Rate Maps that identify the land area subject to inundation by the 1-percent annual chance flood. This land area is regulated in the CBC as the flood hazard area unless a state or local jurisdiction creates their own flood hazard areas that are more extensive than those identified by FEMA. In the application of the new provisions addressing public-use restrooms located within flood hazard areas of publicly owned lands, the requirements are applicable to the greater of the two delineated areas.

Public space and parks often occur along rivers and shorelines in communities and state-owned areas. Considerable economic value is derived by these communities from tourism and public access to areas having water features. Historically, the CBC, by reference to ASCE 24 *Flood Resistant Design and Construction*, has required that restrooms provided for public use located in flood hazard areas be in compliance with the same elevation or dry floodproofing requirements as commercial buildings.

Depending on site-specific conditions, this can result in situations where public restrooms must be constructed as high as 6 to 18 feet above grade, resulting in a variety of challenges including that of access. Although ramp construction is usually possible, extensive travel may be necessary due to significant elevation differences. Other issues include the possible conflict with the code requirement that elevated buildings in coastal high hazard areas (Zone V) and Coastal A Zone must be free of obstruction, as well as possible interference with the ability of enclosure walls to break away under flood conditions. In addition, ramps of extended length may provide no benefit to individuals with disabilities or limited mobility. Although the installation of elevators extending below the base flood elevation would be an acceptable solution, negative issues typically include expense, the extent of required maintenance, and the rate of operational failure.

The new provisions are limited in scope, applicable only where the following three conditions exist: 1) restroom buildings or portions of buildings containing restrooms are 2) located on publicly owned lands in flood hazard areas and 3) intended for public use. Where uses are present in addition to restroom facilities consisting of toilet rooms, bathrooms, showers and/or changing rooms, such uses must fully comply with the applicable elevation and flood-resistance requirements of the CBC.

It is important to emphasize that only the elevation requirements of ASCE 24 are affected. All other flood-resistant design and construction criteria must be met. In addition, other conditions have been established, including a limitation on the floor area of the building and the development of an emergency plan addressing the implementation of protection measures prior to the onset of flooding conditions.

CHANGE TYPE: Addition

CHANGE SUMMARY: The use of intermodal shipping containers as buildings and structures is now recognized in the CBC, and criteria have been established to address the minimum safety requirements without duplicating existing code provisions.

2022 CODE TEXT:

3115

Intermodal Shipping Containers

SECTION 3115
INTERMODAL SHIPPING CONTAINERS
Not permitted by OSHPD.

3115.1 General. The provisions of Section 3115 and other applicable sections of this code shall apply to intermodal shipping containers that are repurposed for use as buildings or structures, or as a part of buildings or structures.

Exceptions: ***[DSA-SS & DSA-SS/CC]*** *Not permitted by DSA.*

1. Intermodal shipping containers previously approved as existing relocatable buildings complying with Chapter 14 of the *California Existing Building Code.*
2. Stationary storage battery arrays located in intermodal shipping containers complying with Chapter 12 of the *California Fire Code.*
3. Intermodal shipping containers that are listed as equipment complying with the standard for equipment, such as air chillers, engine generators, modular data centers, and other similar equipment.

Photo courtesy of RADCO, a Twining Company

Multi-level structure of intermodal shipping containers.

4. Intermodal shipping containers housing or supporting experimental equipment are exempt from the requirements of Section 3115 provided they comply with all of the following:

4.1. Such units shall be single stand-alone units supported at grade level and used only for occupancies as specified under Risk Category I in Table 1604.5.

4.2. Such units are located a minimum of 8 feet (2438 mm) from adjacent structures, and are not connected to a fuel gas system or fuel gas utility.

4.3. In hurricane-prone regions and flood hazard areas, such units are designed in accordance with the applicable provisions of Chapter 16.

5. ***[HCD]*** *Shipping containers constructed or converted off-site that meet the definition of Factory-built Housing in Health and Safety Code Section 19971 or Commercial Modular(s) as defined in Health and Safety Code Section 18001.8 shall be approved by the Department of Housing and Community Development.*

(remainder of code text omitted for brevity purposes)

202 Intermodal shipping containers. A six-sided steel unit originally constructed as a general cargo container used for the transport of goods and materials.

CHANGE SIGNIFICANCE: A wide variety of structures are regulated throughout the CBC. In addition to those typical structures constructed of wood, masonry, concrete or steel, or a combination of such materials, other types of construction are also addressed. Chapter 31 addresses membrane structures, greenhouses and relocatable buildings. However, there are many other types of materials and methods being utilized in the design and construction of buildings that are not regulated by the CBC. As such, Section 104.11 allows for the use of alternative materials and methods of construction provided such methods and materials have been approved by the building official. The use of intermodal shipping containers as buildings and structures is now specifically recognized in the CBC and criteria have been established to address the minimum safety requirements without duplicating existing code provisions.

Over thirty million International Organization for Standardization (ISO) intermodal shipping containers are in use around the world today. These containers, both new and used, are being repurposed and converted to occupiable structures at a significant pace. The applications are widely diverse as is the extent to which the container is used as a structural building element. Before the introduction of the specific requirements now in the 2022 CBC, the lack of code provisions to address such structures had left state and local jurisdictions without appropriate regulations needed to apply and achieve a reasonable and consistent level of code compliance. Such construction practices and materials have required approval through the alternate methods and materials provisions of Section 104.11. ICC G5-2019 *Guideline for the Safe Use of ISO Shipping Containers Repurposed as Buildings and Building Components* was recently published to assist building officials in their evaluation. To provide consistency in design, construction and regulation, Section 3115 has now been introduced into the CBC to provide a consistent and comprehensive set of code provisions specific to such building materials and methods.

A number of key issues are addressed to supplement existing CBC requirements that are applicable to the use of shipping containers as part of a building's construction. A new definition has been developed to identify the scope of this particular type of building component and to avoid any confusion with other types of containers in the marketplace. The charging statement indicates the code's application to only intermodal shipping containers that are repurposed for use as buildings or structures. Four exceptions address conditions where such containers would be acceptable for use through the application of another code, such as the CFC or the *California Existing Building Code*, where the containers are listed as equipment, and where the containers house experimental equipment. As with any other building regulated by the CBC, construction documents must be provided and contain the necessary information required to ensure compliance with all applicable codes and standards.

Of utmost importance is the verification of the characteristics of the intermodal shipping container prior to it being repurposed as a building or structure. Key is the need for an inspection by an approved agency and verification of the data plate that is attached to the container. Specifics as to the qualifications of the approved agency are not provided to allow the building official and/or state law to apply the appropriate scope, and, further, to avoid dictating that jurisdictions must follow the international agreements that are employed by manufacturers worldwide.

References are made to current provisions of the CBC that are typically applicable to building construction practices using shipping containers. Such areas specifically addressed include protection against decay and termites, under-floor ventilation, roof assemblies, joints and voids. In addition, a number of specific structural considerations are set forth including those for foundations and anchorage. The structural design for the repurposed containers must comply with either the detailed design procedure set forth in Section 3115.8.4 or the simplified structural design method for single-unit containers outlined in Section 3115.8.5. Three ISO standards relevant to the construction of intermodal shipping containers have also been added to Chapter 35 as reference standards. These industry standards have policies and procedures for the inspection of containers throughout the world. Through the application of the new Section 3115, building officials and the business industry will no longer be faced with a patchwork of potentially conflicting or duplicative requirements regarding the use of shipping containers as buildings.

3313

Fire Protection During Construction

CHANGE TYPE: Modification

CHANGE SUMMARY: The scoping provisions addressing the timing and availability of the required water supply for buildings under construction have been expanded and specific fire flow requirements have now been established.

2022 CODE TEXT: **3313.1 Where required.** An approved water supply for fire protection, either temporary or permanent, shall be made available as soon as combustible building materials arrive~~s~~ on the site, on commencement of vertical combustible construction, and on installation of a standpipe system in buildings under construction, in accordance with Sections 3313.2 through 3313.5.

> **Exception:** The fire code official is authorized to reduce the fire-flow requirements for isolated buildings or a group of buildings in rural areas or small communities where the development of full fire-flow requirements is impractical.

3313.2 Combustible building materials. When combustible building materials of the building under construction are delivered to a site, a minimum fire flow of 500 gallons per minute (1893 L/m) shall be provided. The fire hydrant used to provide this fire flow supply shall be within 500 feet (152 m) of the combustible building materials, as measured along an approved fire apparatus access lane. Where the site configuration is such that one fire hydrant cannot be located within 500 feet (152 m) of all combustible building materials, additional fire hydrants shall be required to provide coverage in accordance with this section.

Photo courtesy of Matthew Morrison

Minimum water supply required during construction.

3313.3 Vertical construction of Types III, IV and V construction. Prior to commencement of vertical construction of Type III, IV or V buildings that utilize any combustible building materials, the fire flow required by Sections 3313.3.1 through 3313.3.3 shall be provided, accompanied by fire hydrants in sufficient quantity to deliver the required fire flow and proper coverage.

3313.3.1 Fire separation up to 30 feet. Where a building of Type III, IV or V construction has a fire separation distance of less than 30 feet (9144 mm) from property lot lines, and an adjacent property has an existing structure or otherwise can be built on, the water supply shall provide either a minimum of 500 gallons per minute (1893 L/m), or the entire fire flow required for the building when constructed, whichever is greater.

3313.3.2 Fire separation of 30 feet up to 60 feet. Where a building of Type III, IV or V construction has a fire separation distance of 30 feet (9144 mm) up to 60 feet (18 288 mm) from property lot lines, and an adjacent property has an existing structure or otherwise can be built on, the water supply shall provide a minimum of 500 gallons per minute (1893 L/m), or 50 percent of the fire flow required for the building when constructed, whichever is greater.

3313.3.3 Fire separation of 60 feet or greater. Where a building of Type III, IV or V construction has a fire separation of 60 feet (18 288 mm) or greater from a property lot line, a water supply of 500 gallons per minute (1893 L/m) shall be provided.

3313.4 Vertical construction, Type I and II construction. If combustible building materials are delivered to the construction site, water supply in accordance with Section 3313.2 shall be provided. Additional water supply for fire flow is not required prior to commencing vertical construction of Type I and II buildings.

3313.5 Standpipe supply. Regardless of the presence of combustible building materials, the construction type or the fire separation distance, where a standpipe is required in accordance with Section 3313, a water supply providing a minimum flow of 500 gallons per minute (1893 L/m) shall be provided. The fire hydrant used for this water supply shall be located within 100 feet (30 480 mm) of the fire department connection supplying the standpipe.

CHANGE SIGNIFICANCE: Some of the most hazardous conditions related to buildings often are present during the construction process. Over the past several years, there have been several significant fires in buildings under construction. One of the issues with construction fires is that water supply infrastructure is not always complete prior to vertical construction of a building. The lack of a reliable and sufficient water supply has contributed to significant loss during construction site fires. The fire service requires a dependable water supply to suppress fires of any significant size. Section 3313 has historically mandated that an approved water supply, either temporary or permanent, be available prior to the arrival of any combustible materials on the building site. The scoping provisions addressing the timing and availability of such water supply have been expanded and specific fire flow requirements have been established for buildings under construction.

The required timing of providing adequate fire flow has also been affected. Rather than allowing construction to start prior to establishing a water supply, as is often the case, the required fire flow, or a portion thereof, must now be provided as soon as combustible building materials arrive at the site and, further, must be provided prior to any vertical construction.

Only building materials are addressed in the scope of the provisions, as there is no intent to require fire flow water supply for elements such as construction trailers. It is also not the intent to require additional water supply during the construction of noncombustible Type I and II buildings merely due to presence of any combustibles, but rather to focus on combustible construction Types III, IV and V.

PART 8

Appendices

Appendices A through O

Appendix A	No changes addressed
Appendix B	Board of Appeals
Appendix C through N	No changes addressed
Appendix O	Application of ICC Performance Code

APPENDIX B

Board of Appeals

APPENDIX O

Application of ICC Performance Code

As stated in Chapter 1 of the *California Building Code* (CBC), provisions in the appendices do not apply unless specifically referenced in the adopting ordinance. The appendices are developed in much the same manner as the main body of the model code. However, the appendix information is judged to be outside the scope and purpose of the code at the time of code publication. Many times, an appendix offers supplemental information, alternative methods, or recommended procedures. The information may also be specialized and applicable or of interest to only a limited number of jurisdictions. Although an appendix may provide some guidelines or examples of recommended practices or assist in the determination of alternative materials or methods, it will have no legal status and cannot be enforced until it is specifically recognized in the adopting legislation. Appendix chapters or portions of such chapters that gain general acceptance over time can move into the main body of the model code through the code-development process. ■

Appendix B
Board of Appeals

CHANGE TYPE: Modification

CHANGE SUMMARY: Appendix B relating to the board of appeals has been expanded by establishing detailed provisions dealing with the application process, board membership, meetings and other areas.

2022 CODE TEXT:

APPENDIX B
BOARD OF APPEALS

B101.1 ~~Application~~ Scope. ~~Applications for appeal shall be obtained from the building official. Applications shall be filed within 20 days after notice has been served.~~ A board of appeals shall be established within the jurisdiction for the purpose of hearing applications for modification of the requirements of this code pursuant to the provisions of Section 113. The board shall be established and operated in accordance with this section, and shall be authorized to hear evidence from appellants and the building official pertaining to the application and intent of this code for the purpose of issuing orders pursuant to these provisions.

B101.2 ~~Membership of board.~~ Application for appeal. Any person shall have the right to appeal a decision of the building official to the board. An application for appeal shall be based on a claim that the intent of this code or the rules legally adopted hereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equally good or better form of construction is proposed. The application shall be filed on a form obtained from the building official within 20 days after the notice was served.

Photo courtesy of PeopleImages

Board of appeals meeting.

B101.2.1 Limitation of authority. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

B101.2.2 Stays of enforcement. Appeals of notice and orders, other than Imminent Danger notices, shall stay the enforcement of the notice and order until the appeal is heard by the board.

~~B101.2~~ B101.3 Membership of board. The board ~~of appeals~~ shall consist of ~~persons~~ five voting members appointed by the chief appointing authority of the jurisdiction. Each member shall serve for [INSERT NUMBER OF YEARS] years or until a successor has been appointed. The board members' terms shall be staggered at intervals, so as to provide continuity. The building official shall be an ex officio member of said board but shall not vote on any matter before the board. ~~as follows:~~

1. ~~One for 5 years; one for 4 years; one for 3 years; one for 2 years; and one for 1 year.~~
2. ~~Thereafter, each new member shall serve for 5 years or until a successor has been appointed.~~

~~The building official shall be an ex officio member of said board but shall have no vote on any matter before the board.~~

~~B101.2.2~~ B101.3.1 Qualifications. The board ~~of appeals~~ shall consist of five individuals, who are qualified by experience and training to pass on matters pertaining to building construction and are not employees of the jurisdiction. ~~one from each of the following professions or disciplines:~~

1. ~~Registered design professional with architectural experience or a builder or superintendent of building construction with not fewer than 10 years of experience, 5 of which shall have been in responsible charge of work.~~
2. ~~Registered design professional with structural engineering experience.~~
3. ~~Registered design professional with mechanical and plumbing engineering experience or a mechanical contractor with not fewer than 10 years of experience, 5 of which shall have been in responsible charge of work.~~
4. ~~Registered design professional with electrical engineering experience or an electrical contractor with not fewer than 10 years of experience, 5 of which shall have been in responsible charge of work.~~
5. ~~Registered design professional with fire protection engineering experience or a fire protection contractor with not fewer than 10 years of experience, 5 of which shall have been in responsible charge of work.~~

~~B101.2.1~~ B101.3.2 Alternate members. The chief appointing authority ~~shall~~ is authorized to appoint two alternate members who shall be called by the board chairperson to hear appeals during the absence or disqualification of a member. Alternate members shall possess the qualifications required for board membership, and shall be appointed for ~~5 years,~~ the same term or until a successor has been appointed.

B101.3.3 Vacancies. Vacancies shall be filled for an unexpired term in the same manner in which original appointments are required to be made.

~~B101.2.4~~ B101.3.4 Chairperson. The board shall annually select one of its members to serve as chairperson.

~~B101.2.6~~ B101.3.5 Secretary. The chief ~~administrative officer~~ appointing authority shall designate a qualified clerk to serve as secretary to the board. The secretary shall file a detailed record of all proceedings, ~~in the office of the chief administrative officer.~~ which shall set forth the reasons for the board's decision, the vote of each member, the absence of a member and any failure of a member to vote.

~~B101.2.5~~ B101.3.6 ~~Disqualification of member.~~ Conflict of interest. A member ~~shall not hear an appeal in which that member has a~~ with any personal, professional or financial interest in a matter before the board shall declare such interest and refrain from participating in discussions, deliberations and voting on such matters.

~~B101.2.7~~ B101.3.7 Compensation of members. Compensation of members shall be determined by law.

B101.3.8 Removal from the board. A member shall be removed from the board prior to the end of their term only for cause. Any member with continued absence from regular meeting of the board may be removed at the discretion of the chief appointing authority.

~~B101.2.3~~ B101.4 Rules and procedures. The board ~~is authorized to~~ shall establish policies and procedures necessary to carry out its duties consistent with the provisions of this code and applicable state law. The procedures shall not require compliance with strict rules of evidence, but shall mandate that only relevant information be presented.

~~B101.3~~ B101.5 Notice of meeting. The board shall meet upon notice from the chairperson, within 10 days of the filing of an appeal or at stated periodic meetings.

~~B101.3.1~~ B101.5.1 Open hearing. All hearings before the board shall be open to the public. The appellant, the appellant's representative, the building official and any person whose interests are affected shall be given an opportunity to be heard.

B101.5.2 Quorum. Three members of the board shall constitute a quorum.

~~**B101.3.2 Procedure.** The board shall adopt and make available to the public through the secretary procedures under which a hearing will be conducted. The procedures shall not require compliance with strict rules of evidence, but shall mandate that only relevant information be received.~~

~~B101.3.3~~ B101.5.3 Postponed hearing. When five members are not present to hear an appeal, either the appellant or the appellant's representative shall have the right to request a postponement of the hearing.

B101.6 Legal counsel. The jurisdiction shall furnish legal counsel to the board to provide members with general legal advice concerning matters before them for consideration. Members shall be represented by legal counsel at the jurisdiction's expense in all matters arising from service within the scope of their duties.

~~B101.4~~ B101.7 Board decision. The board shall only modify or reverse the decision of the building official by a concurring vote of ~~two-thirds of its~~ three or more members.

~~B101.4.1~~ B101.7.1 Resolution. The decision of the board shall be by resolution. ~~Certified copies shall be~~ Every decision shall be promptly filed in writing in the office of the building official within three days and shall be open to the public for inspection. A certified copy shall be furnished to the appellant or the appellant's representative and to the building official.

~~B101.4.2~~ B101.7.2 Administration. The building official shall take immediate action in accordance with the decision of the board.

B101.8 Court review. Any person, whether or not a previous party of the appeal, shall have the right to apply to the appropriate court for a writ of certiorari to correct errors of law. Application for review shall be made in the manner and time required by law following the filing of the decision in the office of the chief administrative officer.

CHANGE SIGNIFICANCE: The *California Building Code* (CBC) intends that the board of appeals have the authority to hear and decide appeals of orders and decisions of the building official relative to the application and interpretation of the code. The importance of a board of appeals should not be taken lightly. Its role is equivalent to that of a building official when it comes to the technical questions placed before it; thus, there is a need for highly qualified board members. The board is not merely advisory in its actions, but rather is granted the authority to overturn the decisions of the building official where the determination is within the scope described by the code. Appendix B expands on the scope of Section 113 relating to the board of appeals by establishing detailed provisions dealing with the applicationprocess, board membership, meetings and other areas.

Although this appendix chapter appears to have been extensively modified, many of the modifications are simply format changes. The fundamental right for an appeal is established in Section 113. The general workings of the board of appeals are set forth in Appendix B, allowing the jurisdiction to establish their own criteria or to use the appendix as a template. Significant modifications from the previous appendix text include the deletion of specific intervals for staggered appointments as well as the removal of specific qualifications and experience levels for service on the board. New provisions address the removal of members of the board prior to the expiration of their term, the number of members present for a quorum and how vacancies are to be filled.

Appendix O

Application of ICC Performance Code

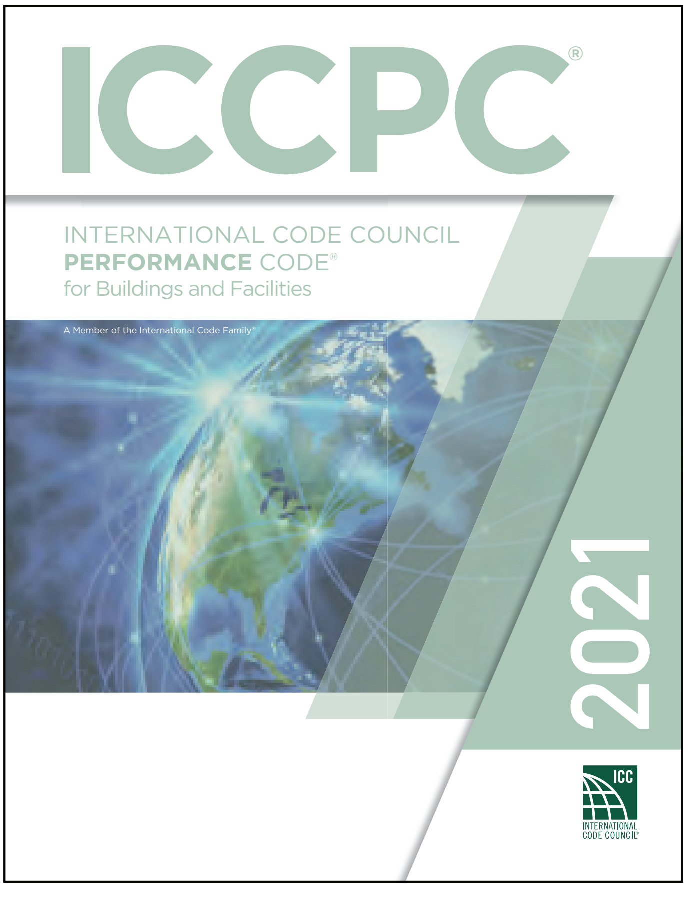
CHANGE TYPE: Addition

CHANGE SUMMARY: Appendix O, new to the CBC, contains administrative provisions excerpted from the *International Code Council Performance Code for Buildings and Facilities* (ICCPC). While this appendix is not adopted by any state agencies within the State of California, if adopted locally, it provides a starting point for the formulation of an effective submittal and review under the allowances of the CBC for alternative methods, materials, and design.

2022 CODE TEXT:

APPENDIX O
PERFORMANCE-BASED APPLICATION

O101.1 Introduction. The following administrative provisions are excerpted from the *ICC Performance Code for Buildings and Facilities* and can be used in conjunction with the Alternate Methods provisions in Chapter 1, or for a review of submittals requiring a rational analysis or performance-based design. These provisions provide an established framework for the building official in terms of the design expertise needed, the necessary submittals, a review framework and related items.



2021 ICC Performance Code for Buildings and Facilities.

O101.2 Qualifications. Registered design professionals shall possess the knowledge, skills and abilities necessary to demonstrate compliance with this code.

O101.3 Construction document preparation. Construction documents required by this code shall be prepared in adequate detail and submitted for review and approval in accordance with Section 107.

O101.3.1 Review. Construction documents submitted in accordance with this code shall be reviewed for code compliance with the appropriate code provisions in accordance with Section 107.

O101.4 Construction. Construction shall comply with the approved construction documents submitted in accordance with this code, and shall be verified and approved to demonstrate compliance with this code.

O101.4.1 Facility operating policies and procedures. Policies, operations, training and procedures shall comply with approved documents submitted in accordance with this code and shall be verified and approved to demonstrate compliance with this code.

O101.4.2 Maintenance. Maintenance of the performance-based design shall be ensured throughout the life of the building or portion thereof.

O101.4.3 Changes. The owner or the owner's authorized agent shall be responsible to ensure that any change to the facility, process, or system does not increase the hazard level beyond that originally designed without approval and that changes shall be documented in accordance with the code.

O101.5 Documentation. The registered design professional shall prepare appropriate documentation for the project, clearly detailing the approach and rationale for design submittal, the construction and the future use of the building, facility or process.

O101.5.1 Reports and manuals. The design report shall document the steps taken in the design analysis, clearly identifying the criteria, parameters, inputs, assumptions, sensitivities and limitations involved in the analysis. The design report shall clearly identify bounding conditions, assumptions and sensitivities that clarify the expected uses and limitations of the performance analysis. This report shall verify that the design approach is in compliance with the applicable codes and accepted methods and shall be submitted for concurrence by the building official prior to the construction documents being completed. The report shall document the design features to be incorporated based on the analysis.

The design report shall address the following:

1. Project scope.
2. Goals and objectives.
3. Performance criteria.
4. Hazard scenarios.
5. Design fire loads and hazards

6. Final design.
7. Evaluation.
8. Bounding conditions and critical design assumptions.
9. Critical design features.
10. System design and operational requirements.
11. Operational and maintenance requirements.
12. Commissioning testing requirements and acceptance criteria.
13. Frequency of certificate renewal.
14. Supporting documents and references.
15. Preliminary site and floor plans.

O101.5.2. Design submittal. Applicable construction documents shall be submitted to the building official for review. The documents shall be submitted in accordance with the jurisdiction's procedures and in sufficient detail to obtain appropriate permits.

O101.6 Review. Construction documents submitted in accordance with this code shall be reviewed for code compliance with the appropriate code provisions.

O101.6.1 Peer review. The owner or the owner's authorized agent shall be responsible for retaining and furnishing the services of a registered design professional or recognized expert, who will perform as a peer reviewer, where required and approved by the building official.

O101.6.2 Costs. The costs of special services, including contract review, where required by the building official, shall be borne by the owner or the owner's authorized agent.

O101.7 Permits. Prior to the start of construction, appropriate permits shall be obtained in accordance with the jurisdiction's procedures and applicable codes.

O101.8 Verification of compliance. Upon completion of the project, documentation shall be prepared that verifies performance and prescriptive code provisions have been met. Where required by the building official, the registered design professional shall file a report that verifies bounding conditions are met.

O101.9 Extent of documentation. Approved construction documents, the operations and maintenance manual, inspection and testing records, and certificates of occupancy with conditions shall be included in the project documentation of the building official's records.

O101.10 Analysis of change. The registered design professional shall evaluate the existing building, facilities, premises, processes, and contents, and the applicable documentation of the proposed change as it affects portions of the building, facility, premises, processes and contents that were previously designed for compliance under a performance-based code. Prior to any change that was not documented in a previously approved design, the registered design professional shall examine the applicable design documents, bounding conditions, operation and maintenance manuals, and deed restrictions.

CHANGE SIGNIFICANCE: The purpose of the ICC *Performance Code for Buildings and Facilities* (ICCPC) is to promote innovative, flexible and responsive solutions that optimize the expenditure and consumption of resources while preserving social and economic value. While a prescriptive-based code focuses on solutions that achieve a certain outcome, the methodology employed in a performance-based code focuses only on outcomes. The ICCPC creates a framework that both clearly defines the intent of the code and provides a process to understand quantitatively what the code is trying to achieve. Appendix O, new to the CBC, contains administrative provisions excerpted from the ICCPC to serve as a starting point for the formulation of an effective submittal and corresponding review under the allowances of CBC for alternative methods, materials and designs. It is also important to note that the previously adopted CBC Appendix O has been relocated under CBC Appendix P for 2022.

Appendix O does not contain any new code requirements, but rather provides an optional design, review and approval framework for use by the building official. Typical applications of the ICCPC would be where the use of Section 104.11 is proposed for an alternative material, design or method of construction, or where an area of the CBC requires a rational analysis such as Section 909 dealing with smoke control systems. Appendix O simply extracts the relevant administrative provisions from the ICCPC and presents them in a more concise, usable format for jurisdictional use.

As an appendix chapter, the provisions are only applicable where specifically adopted. The jurisdiction may adopt the appendix as written, adopt it with local modifications, or use it as a guideline on a case-by-case basis. Appendix O, when specifically adopted, is available as an additional tool for the jurisdiction to utilize as necessary when addressing alternate materials, designs and methods of construction.

PART **9**

2022 California Existing Building Code (CEBC)

Chapters 1 through 5

Applicable to all existing buildings, the CEBC is intended to provide flexibility to permit the use of alternative approaches to achieve compliance with minimum requirements to safeguard the public health, safety and welfare. Both structural and life safety changes are addressed. The CEBC covers existing buildings by creating three paths for compliance. Chapter 3 gives an overview of the paths.

The compliance paths include prescriptive compliance, classification of work and performance compliance. More focused topics on repairs, moved buildings and construction safeguards are found in Chapters 4, 14 and 15, respectively. The appendices supply additional requirements and information on seismic retrofits. ■

303

Storm Shelters

CHANGE TYPE: Modification

CHANGE SUMMARY: Storm shelter requirements have been relocated to Chapter 3. The required occupant capacity is now limited to the total occupant load of the classrooms, vocational rooms and offices in the school while the maximum distance of travel has been deleted.

2022 CODE TEXT:

SECTION 303
STORM SHELTERS

303.1 Storm shelters. This section applies to the construction of storm shelters constructed as rooms or spaces within existing buildings for the purpose of providing protection during storms that produce high winds, such as tornadoes and hurricanes. Such structures shall be designated to be hurricane shelters, tornado shelters, or combined hurricane and tornado shelters. Such structures shall be constructed in accordance with this code and ICC 500.

303.2 ~~1106.1~~ Addition to a Group E occupancy. Where an addition is added to an existing Group E occupancy located in an area where the shelter design wind speed for tornados is 250 mph in accordance with Figure 304.2(1) of ICC 500 and the occupant load in the addition is 50 or more, the addition shall have a storm shelter constructed in accordance with ICC 500.

Exceptions:

1. Group E day care facilities.
2. Group E occupancies accessory to places of religious worship.
3. Additions meeting the requirements for shelter design in ICC 500.

303.2.1 ~~1106.1.1~~ Required occupant capacity. The required occupant capacity of the storm shelter shall include all buildings on the site, and shall be the ~~greater of the following:~~

~~1. The~~ total occupant load of the classrooms, vocational rooms and offices in the Group E occupancy.

2. ~~The occupant load of any indoor assembly space that is associated with the Group E occupancy.~~

Photo courtesy of FEMA

School storm shelter with open and closed shutters.

Exceptions:

1. Where an addition is being added on an existing Group E site, and where the addition is not of sufficient size to accommodate the required occupant capacity of the storm shelter for all of the buildings on-site, the storm shelter shall at a minimum accommodate the required capacity for the addition.
2. Where approved by the code official, the required occupant capacity of the shelter shall be permitted to be reduced by the occupant capacity of any existing storm shelters on the site.

~~**1106.1.2 Location.** Storm shelters shall be located within the buildings they serve, or shall be located where the maximum distance of travel from not fewer than one exterior door of each building to a door of the shelter serving that building does not exceed 1,000 feet (305 m).~~

<u>**303.2.2**</u> ~~**1106.1.3**~~ <u>**Occupancy classification.** The occupancy classification for storm shelters shall be determined in accordance with Section 423.3 of the *California Building Code.*</u>

~~**502.8 Additions to Group E facilities.** For additions to Group E occupancies, storm shelters shall be provided in accordance with Section 1106.1.~~

~~**1301.2.3.1 Additions to Group E facilities.** For additions to Group E occupancies, storm shelters shall be provided in accordance with Section 1106.1.~~

CHANGE SIGNIFICANCE: Storm shelter requirements have been moved from the prescriptive and work area methods and relocated to Chapter 3 to apply generally to all compliance methods. In addition, a new Section 303.1 clarifies the difference between storm shelters used solely during a tornado or hurricane and emergency shelters used after such events, requiring that a storm shelter comply with the International Code Council's standard ICC 500. This language is now consistent with *California Building Code* (CBC) Section 423.

In the 2019 *California Existing Building Code* (CEBC), schools had to have a shelter suitable to house everyone who might be in a large assembly space on the site, such as a public library, football field, performing arts center, equestrian arena, natatorium, competition basketball arena or professional development center. Now, only the total occupant load of the students and staff need to be accommodated. The reasoning considers the fact that the code does not require storm shelters for the entire population that outdoor venues, such as outdoor football fields, can accommodate. It should not be necessary for schools to increase the size of the shelters based on their public assembly spaces. The assembly areas do not add to the normal population of students in school nor to the number of staff who are associated with those students. The additional people at the facility outside of school hours elect to be in those assembly areas, similar to any commercial or other public assembly area.

Section 1106.1.2 also previously required that storm shelters be within 1,000 feet of the buildings they serve. While the 1,000-foot maximum travel limit may be appropriate for new schools, it can be an undue hardship for existing buildings. The location of an addition may be limited by a variety of building and site constraints. Good disaster management practices will typically give schools a response time long enough to be able to move students to on-site shelters as appropriate.

A reference to CBC Section 423 has also been added, as it provides clarification of the occupancy classification of the storm shelter based upon whether it is a standalone structure or part of another occupancy.

306.7

Accessible Toilet and Bathing Rooms

CHANGE TYPE: Clarification

CHANGE SUMMARY: The requirements for accessible bathing rooms and toilet rooms have been clarified.

2022 CODE TEXT: **306.7.11 ~~305.8.10~~ Toilet rooms.** Where it is technically infeasible to alter existing toilet ~~and bathing~~ rooms to be accessible, ~~an~~ one accessible single user toilet room or one accessible family or assisted-use toilet ~~or bathing~~ room constructed in accordance with Section 1110.2.1 of the *California Building Code* is permitted. ~~The family or assisted use toilet or bathing~~ This toilet room shall be located on the same floor and in the same area as the existing toilet ~~or bathing~~ rooms. At the inaccessible toilet ~~and bathing~~ rooms, directional signs indicating the location of the nearest ~~family or assisted use~~ such toilet room ~~or bathing~~ room shall be provided. These directional signs shall include the International Symbol of Accessibility and sign characters shall meet the visual character requirements in accordance with ICC A117.1.

306.7.12 Bathing rooms. Where it is technically infeasible to alter existing bathing rooms to be accessible, one accessible single user bathing room or one accessible family or assisted-use bathing room constructed in accordance with Section 1110.2.1 of the *California Building Code* is permitted. This accessible bathing room shall be located on the same floor and in the same area as the existing bathing rooms. At the inaccessible bathing rooms, directional signs indicating the location of the nearest such bathing room shall be provided. These directional signs shall include the International Symbol of Accessibility and sign characters shall meet the visual character requirements in accordance with ICC A117.1.

Accessible toilet room.

CHANGE SIGNIFICANCE: Changes to Section 306.7.11 and the addition of the new Section 306.7.12 separate and clarify requirements for toilet and bathing rooms while coordinating with terminology in the *California Plumbing Code* (CPC). Historically, the requirement originally stated that 'unisex' toilet rooms were permitted, but revisions changed the term to 'family or assisted use' for consistency purposes.

In addition, the section title did not include "bathing rooms," although they were addressed in the text. Providing a separate section allows for consistency and also includes shower facilities for occupants. This issue has also been addressed for historic buildings in Sections 306.7.16.4 and 306.7.16.5.

307, 308
Smoke Alarms and CO Detection

CHANGE TYPE: Modification

CHANGE SUMMARY: The requirements for smoke alarms and CO alarms have been relocated to Chapter 3 to apply to all three methods. In addition, the CO requirements have been revised to recognize the use of both CO alarms and CO detection systems.

2022 CODE TEXT:

SECTION 307
SMOKE ALARMS

307.1 Smoke Alarms. Where an alteration, addition, change of occupancy or relocation of a building is made to an existing building or structure of a Group R and I-1 occupancies, the existing building shall be provided with smoke alarms in accordance with the *California Fire Code* or Section R314 of the *California Residential Code.*

> **Exception:** Work classified as Level 1 Alterations in accordance with Chapter 7.

SECTION 308
CARBON MONOXIDE DETECTION

308.1 Carbon monoxide detection. Where an addition, alteration, change of occupancy or relocation of a building is made to Group I-1, I-2, I-4 and R occupancies and classrooms of Group E occupancies, the existing building shall be provided with carbon monoxide detection in accordance with the *California Fire Code* or Section R315 of the *California Residential Code.*

Photo courtesy of Phonlamai Photo

Smoke alarm.

CO alarm.

Exceptions:

1. Work involving the exterior surfaces of buildings, such as the replacement of roofing or siding, the addition or replacement of windows or doors, or the addition of porches or decks.
2. Installation, alteration or repairs of plumbing or mechanical systems, other than fuel-burning appliances.
3. Work classified as Level 1 Alterations in accordance with Chapter 7.

(Deleted text is not shown for brevity and clarity)

CHANGE SIGNIFICANCE: The requirements for smoke alarms and carbon monoxide (CO) detection systems have been removed from the individual compliance methods and relocated to Chapter 3 to apply generally to all compliance methods. Intended to provide consistent requirements between methods, these requirements will also apply when the performance method is chosen.

The CO requirements have been revised to reflect "detection" versus "alarm" considerations to recognize that either CO alarms or a CO detection system may be used. Group E classrooms have also been added to the locations requiring CO detection to provide consistency with the requirements for existing buildings in Chapter 11 of the *California Fire Code* (CFC). Sections 307 and 308 maintain reference to the CFC and *California Residential Code* (CRC) for the details of the requirements.

Two new exceptions clarify that these provisions are only intended to apply to Level 2 and 3 alterations, changes of occupancy and additions mirroring the application of requirements in the 2019 CEBC.

309

Exterior Wall Coverings and Envelopes

CHANGE TYPE: Addition

CHANGE SUMMARY: When significant portions of a building's exterior wall coverings or exterior wall envelopes are added or replaced, they must comply with the requirements of Chapters 14 and 26 of the CBC.

2022 CODE TEXT:

SECTION 309

ADDITIONS AND REPLACEMENTS OF EXTERIOR WALL COVERINGS AND EXTERIOR WALL ENVELOPES

309.1 General. The provisions of Section 309 apply to all alterations, repairs, additions, relocations of structures and changes of occupancy regardless of compliance method.

309.2 Additions and replacements. Where an exterior wall covering or exterior wall envelope is added or replaced, the materials and methods used shall comply with the requirements for new construction in Chapter 14 and Chapter 26 of the *California Building Code* if the added or replaced exterior wall covering or exterior wall envelope involves two or more contiguous stories and comprises more than 15 percent of the total wall area on any side of the building.

Photo courtesy of Natalie Oxford

Grenfell fire.

202 Exterior wall covering. A material or assembly of materials applied on the exterior side of exterior walls for the purpose of providing a weather-resisting barrier, insulation or for aesthetics, including but not limited to, veneers, siding, exterior insulation and finish systems, architectural trim and embellishments such as cornices, soffits, facias, gutters and leaders.

202 Exterior wall envelope. A system or assembly of exterior wall components, including exterior wall finish materials, that provides protection of the building structural members, including framing and sheathing materials, and conditioned interior space, from the detrimental effects of the exterior environment.

CHANGE SIGNIFICANCE: Where either replacing an exterior wall covering or envelope, or where an exterior wall assembly or an exterior wall envelope is added, materials and systems must now meet the minimum performance and safety requirements in CBC Chapters 14 and 26 as applicable. This provision applies when the building owner voluntarily makes changes or when replacement is necessary due to damage or failure of the exterior wall covering or envelope.

Added in response to large intentional, and in some cases fatal, fires related to exterior wall envelope or exterior wall covering fires, the requirements will ensure the safety of existing buildings when replacement of the exterior wall covering or envelope is performed. Existing buildings, which may not have the same life safety features as a new building, are more at risk from non-code-compliant exterior wall envelopes and exterior wall coverings.

405.2.4

Snow Loads and Substantial Damage

CHANGE TYPE: Modification

CHANGE SUMMARY: Snow loads must be addressed for the repair of substantial structural damage regardless of whether the damage was a result of snow.

2022 CODE TEXT: **405.2.4 Substantial structural damage to gravity load-carrying components.** Gravity load-carrying components that have sustained substantial structural damage shall be rehabilitated to comply with the applicable provisions for dead, live and ~~live~~ snow loads in the *California Building Code*. ~~Snow loads shall be considered if the substantial structural damage was caused by or related to snow load effects.~~ Undamaged gravity load-carrying components that receive dead, live or snow loads from rehabilitated components shall also be rehabilitated if required to comply with the design loads of the rehabilitation design.

CHANGE SIGNIFICANCE: Previously, consideration of snow load effects was only required when substantial structural damage was caused by snow loads. Only dead and live loads were considered when rehabilitating the gravity load-carrying components of a building that had sustained substantial structural damage due to rain, wind or lack of maintenance. However, snow loads share the same load path as other gravity loads and it was determined that they should be considered when rehabilitating gravity load-carrying components.

Section 405.2.4 now requires the inclusion of snow load effects for all instances of the rehabilitation of gravity load-carrying components after sustaining substantial structural damage regardless of whether the cause of the substantial structural damage was related to snow loads.

Overloading the structural frame and gravity-carrying elements year after year with high snow loads causes damage that is often undetected. This damage weakens the structure, contributing to later substantial damage. Therefore, it is important to consider snow loads when determining load cases for the roof and other gravity elements of the building under the CBC loads.

Photo courtesy of catnap72

Roof snow load.

502.6, 503.16, 506.6

Classroom Acoustics

CHANGE TYPE: Addition

CHANGE SUMMARY: Additions, Level 3 alterations and changes of occupancy in educational occupancies are now required to meet the enhanced classroom acoustic requirements of Section 808 of ICC A117.1.

2022 CODE TEXT: **502.6 Enhanced classroom acoustics.** In Group E occupancies, enhanced classroom acoustics shall be provided in all classrooms in the addition with a volume of 20,000 cubic feet (565 m^3) or less. Enhanced classroom acoustics shall comply with the reverberation time in Section 808 of ICC A117.1.

503.16 Enhanced classroom acoustics. In Group E occupancies, where the work area exceeds 50 percent of the building area, enhanced classroom acoustics shall be provided in all classrooms with a volume of 20,000 cubic feet (565 m^3) or less. Enhanced classroom acoustics shall comply with the reverberation time in Section 808 of ICC A117.1.

506.6 Enhanced classroom acoustics. In Group E occupancies, where the work area exceeds 50 percent of the building area, enhanced classroom acoustics shall be provided in all classrooms with a volume of 20,000 cubic feet (565 m^3) or less. Enhanced classroom acoustics shall comply with the reverberation time in Section 808 of ICC A117.1.

CHANGE SIGNIFICANCE: Good classroom acoustics are essential to support language acquisition and learning for all children, particularly younger children. For children who have hearing loss and those who use cochlear implants, there is no substitute for a good acoustic environment. Assistive technologies typically only amplify the teacher and do not amplify discussions among children or between the teacher and an

Photo courtesy of skynesher

Typical classroom finishes.

individual child. Children with disabilities not related to hearing, such as autism and learning disabilities, may be adversely affected by high ambient noise levels.

Based on the scoping volume of 20,000 cubic feet and assuming a 10-foot ceiling height, classrooms up to 2,000 square feet are required to apply the enhanced acoustic requirements. The criteria in ICC A117.1, Section 808 are intended to be applicable to standard size self-contained classrooms while excluding larger spaces used for bands, choir and other large groups. The criteria are also not intended to apply to ancillary learning spaces, such as individual tutoring spaces, corridors or cafeterias.

The classroom is limited to a maximum reverberation time for classroom acoustics, determined through measurement of performance or a calculation based on the materials on the floor, ceiling and walls. Performance in a fully-furnished, unoccupied classroom should include a maximum reverberation time of 0.6 to 0.7 second, depending upon the size of the classroom and a maximum background noise of either 35 dBA or 55 dBC. The intent of the 0.6 to 0.7 second reverberation time is to increase the sound level from the teacher throughout the room while maintaining clarity. The prescriptive calculation requires noise reduction coefficient (NRC) ratings for every surface finish, including finishes on the floor, ceiling and all walls. Ratings range from zero to one, with one indicating the surface absorbs most of the speech sound energy and zero indicating the surface reflects most of the speech sound energy. The A117.1 criterion also considers other sound sources, including ambient sound sources outside the classrooms. These sources may include playground noises, airplane or traffic sources and student movement in halls.

Note that this requirement has been added to both the prescriptive method and the work area method. The new Sections within the work area method include Sections 903.4, 1011.4 and 1101.4. See additional background and commentary in the discussion of CBC Section 1207.

503.4

Rooftop Equipment Dead Load

CHANGE TYPE: Modification

CHANGE SUMMARY: The addition of equipment to the roof without a full structural analysis is now permitted when the equipment weighs less than 400 pounds and is less than 10 percent of the total roof dead load.

2022 CODE TEXT: **503.4 Existing structural elements carrying lateral load.** Except as permitted by Section 503.13, where the alteration increases design lateral loads, results in a prohibited structural irregularity as defined in ASCE 7, or decreases the capacity of any existing lateral load-carrying structural element, the structure of the altered building or structure shall meet the requirements of Sections 1609 and 1613 of the *California Building Code*. Reduced seismic forces shall be permitted.

Exceptions:

1. Any existing lateral load-carrying structural element whose demand-capacity ratio with the alteration considered is not more than 10 percent greater than its demand-capacity ratio with the alteration ignored shall be permitted to remain unaltered. For purposes of calculating demand-capacity ratios, the demand shall consider applicable load combinations with

Typical rooftop equipment.

design lateral loads or forces in accordance with Sections 1609 and 1613 of the *California Building Code*. Reduced seismic forces shall be permitted. For purposes of this exception, comparisons of demand-capacity ratios and calculation of design lateral loads, forces and capacities shall account for the cumulative effects of additions and alterations since original construction.

2. <u>Buildings in which the increase in the demand capacity ratio is due entirely to the addition of roof top supported mechanical equipment individually having an operating weight less than 400 pounds (181.4 kg) and when the total additional weight of all roof top equipment placed after initial construction of the building is less than 10 percent of the roof dead load. For purposes of this exception roof shall mean the "roof" level above a particular story.</u>

CHANGE SIGNIFICANCE: The new exception to Section 503.4 limits the need to hire a structural engineer for small modifications, which is recognized as a more reasonable allowance. Building owners and tenants frequently add or replace rooftop mechanical equipment as a part of an interior tenant improvement. Structural analysis for most projects only considers gravity load effects and ignores the contributions to roof dead load, thereby increasing the seismic weight resisted by the seismic force resisting system at the roof. However, engineers performing the structural design for new buildings determine the total accumulated operating weight of rooftop equipment and divide the load by the area of the roof and add the weight in pounds per square foot to the seismic dead weight. Therefore, new building designs do not account for the localized impacts of rooftop equipment. This code change merely codifies this current practice for existing buildings. The American Society of Civil Engineers standard ASCE 7 does not require that anchorage and bracing be determined for supported equipment having a weight of 400 pounds or less for new buildings.

503.12

Roof Diaphragm Wind Loads

CHANGE TYPE: Modification

CHANGE SUMMARY: The requirements of Section 503.12 have been relaxed so that the evaluation of wind loads is now only required when the ultimate design wind speed is greater than 130 mph.

2022 CODE TEXT: **503.12 Roof diaphragms resisting wind loads in high-wind regions.** Where the intended *alteration* requires a permit for reroofing and involves removal of roofing materials from more than 50 percent of the roof diaphragm of a building or section of a building located where the ultimate design wind speed is greater than 130 ~~115~~ mph (58 ~~51~~ m/s) in accordance with Figure 1609.3(1) of the *California Building Code* ~~or in a special wind region as defined in Section 1609 of the *International Building Code*~~, roof diaphragms, connections of the roof diaphragm to roof framing members, and roof-to-wall connections shall be evaluated for the wind loads specified in Section 1609 of the *California Building Code*, including wind uplift. If the diaphragms and connections in their current condition are not capable of resisting 75 percent of those wind loads, they shall be replaced or strengthened in accordance with the loads specified in Section 1609 of the *California Building Code*.

> **Exception:** Buildings that have been demonstrated to comply with the wind load provisions in ASCE 7-88 or later editions.

Photo courtesy of Kenneth Schulze

Hurricane winds uplifting roof.

CHANGE SIGNIFICANCE: Through the relaxation of requirements in Section 503.12, the evaluation of wind loads is now only required when the ultimate design wind speed exceeds 130 mph under both the prescriptive and work area compliance methods.

The revised wind speed threshold is based on a wind speed above which experience indicates there is a substantial risk of roof diaphragm damage or failure due to uplift in hurricane-prone regions. The value of 130 mph is consistent with windborne debris requirements. No historical data indicates that wind speeds of 115 to 130 mph pose any exceptional risk of building diaphragm damage or failure. Outside of hurricane-prone regions, wind speeds in special wind regions can vary widely from less than 115 mph to speeds much greater. There is no historical evidence indicating that diaphragm deficiencies pose any extraordinary threat outside of hurricane-prone regions. The requirement that a building undergo a diaphragm evaluation, involving a significant investigative and analytical effort by an engineer, must be regarded as an extraordinary burden that is justifiable based on an extraordinary hazard; in other words, the building is at risk of encountering a hurricane. Coordinating the threshold for attaching roof diaphragms to regions with a higher ultimate design windspeed limits the provision's scope to known areas of past vulnerability that are threatened by extraordinary winds.

Previously, the CEBC applied equally to the reroofing of all buildings that met the reroofing percentages and the location thresholds, regardless of when the buildings were constructed. A new exception now exempts buildings from complying with evaluation requirements for wind loads using CBC Section 1609 where the buildings were constructed in accordance with comprehensive wind design provisions. These provisions were first adopted in the 1988 edition of ANSI A58.1, *Minimum Design Loads for Buildings and Other Structures*, the document that would become ASCE 7. All editions since 1988 carry comprehensive provisions for wind design. These buildings comply with current wind development concepts; the roof diaphragms can be demonstrated to resist winds comparative to the current wind provisions.

503.17

Locking in Educational Occupancies

CHANGE TYPE: Addition

CHANGE SUMMARY: Requirements in the CBC have been referenced to provide special allowances for educational occupancies with regard to door lock mechanisms.

2022 CODE TEXT: **503.17 Locking arrangements in educational occupancies.** In Group E occupancies, Group B educational occupancies and Group I-4 occupancies, egress doors with locking arrangements designed to keep intruders from entering the room shall comply with Section 1010.2.8 of the *California Building Code*.

CHANGE SIGNIFICANCE: The new provisions within the prescriptive method and the work area method are intended to correlate with provisions found within the CBC and CEBC regarding locking arrangements in educational spaces. A high priority in educational facilities is the safety of occupants in classrooms and other occupied spaces during the event of a threatening situation. The CBC provides criteria that balance the challenges of providing protection for students and teachers in the classroom and, at the same time, providing for free and immediate egress. Guidance has now been provided to allow for enhanced security measures on educational classroom egress doors and that continue to comply with applicable means of egress requirements for fires and other emergencies. It is especially important to place these requirements in the CEBC to make sure where alterations are made that the locking arrangements are safe. Existing buildings are more likely to make use of unapproved devices that do not meet egress requirements. Oftentimes, locks or devices are added to doors to provide security, but they do not allow free egress or comply with the single operation requirement. The new provisions within

Photo courtesy of Wirachai

Door hardware in an educational occupancy.

the CEBC are consistent with Section 1010.2.8 of the CBC and CFC to provide guidance for combining security while maintaining safe egress capabilities.

Door locksets with some type of "classroom security function" are readily available at a comparable cost to the traditional "classroom function" door locksets. The most common configuration of a classroom security function lockset is the ability to lock the door from inside the classroom with a key preventing entry to the classroom; and for egress, the door may be easily opened from inside the classroom without a key by a single action on the lever handle. On the outside of the classroom, consistent with tradition, the door may also be locked and unlocked with a key. Many of the traditional locksets required the instructor to leave the classroom and lock the door with a key from the hallway or exterior side, then reenter the classroom for a defend-in-place strategy. This action placed instructors at risk by forcing them to leave the classroom and become exposed. The classroom security function eliminates the need to leave the classroom to lock the door and still allows unrestricted egress from inside the classroom.

Additionally, the CBC requires that the door be unlockable from outside the classroom. This allows for school personnel, law enforcement and emergency responders to obtain entry even after the door is locked from the inside. This can be accomplished at the door with a key or other approved means, including remotely as permitted by the CBC.

506.4

Emergency Escape and Rescue Openings

CHANGE TYPE: Addition

CHANGE SUMMARY: The new Sections 506.4 and 1011.4.6 add allowances during a change of occupancy to use replacement window requirements for the installation of emergency escape and rescue openings.

2022 CODE TEXT: **506.4 Existing emergency escape and rescue openings.** Where a change of occupancy would require an emergency escape and rescue opening in accordance with Section 1031.1 of the *California Building Code*, operable windows serving as the emergency escape and rescue opening shall comply with the following:

1. An existing operable window shall provide a minimum net clear opening of 4 square feet (0.38 m^2) with a minimum net clear opening height of 22 inches (559 mm) and a minimum net clear opening width of 20 inches (508 mm).
2. A replacement window where such window complies with both of the following:
   - **2.1.** The replacement window meets the size requirements in Item 1.
   - **2.2.** The replacement window is the manufacturer's largest standard size window that will fit within the existing frame or existing rough opening. The replacement window shall be permitted to be of the same operating style as the existing window or a style that provides for an equal or greater window opening area than the existing window.

Photo courtesy of Melissa Kopka

Typical emergency escape and rescue opening.

CHANGE SIGNIFICANCE: New provisions allow the use of existing and smaller replacement windows for emergency escape and rescue openings (EEROs) within a change of occupancy when applying both the prescriptive and work area methods, providing flexibility while still maintaining the level of safety for occupants and emergency responders.

Previously, Section 505 was not applicable to Change of Occupancy. The new provisions address occupancies that are converted to a Group R-3, R-4 or single exit R-2 occupancy. EEROs are required by CBC Section 1031 in Group R-3 and R-4 dwellings and for Group R-2 apartments in a single exit building (4 units per story, 3 stories above grade plane maximum).

506.5.3

Change of Occupancy from Group S or U

CHANGE TYPE: Modification

CHANGE SUMMARY: An upgrade threshold has been added when changing from a Group S or U occupancy to another occupancy.

2022 CODE TEXT: **~~506.4.3~~ 506.5.3 Seismic loads (seismic force-resisting system).** Where a change of occupancy results in a building being assigned to a higher risk category, or where the change is from a Group S or Group U occupancy to any occupancy other than Group S or Group U, the building shall satisfy the requirements of Section 1613 of the *California Building Code* for the new risk category using full seismic forces.

Exceptions:

1. Where the area of the new occupancy is less than 10 percent of the building area, the occupancy is not changing from a Group S or Group U occupancy, and the new occupancy is not assigned to Risk Category IV, compliance with this section is not required. The cumulative effect of occupancy changes over time shall be considered.
2. Where a change of use results in a building being reclassified from Risk Category I or II to Risk Category III and the seismic coefficient, S_{DS}, is less than 0.33, compliance with this section is not required.
3. Unreinforced masonry bearing wall buildings assigned to Risk Category III and to Seismic Design Category A or B, shall be permitted to use Appendix Chapter A1 of this code.
4. Where the change is from a Group S or Group U occupancy and there is no change of risk category, use of reduced seismic forces shall be permitted.

Photo courtesy of C. Mae Design

Change of occupancy from Group U to Group A-2.

CHANGE SIGNIFICANCE: Since the 2013 edition of the CEBC, a project with a change of occupancy triggers a seismic upgrade only when the change is so significant that it moves the building into a higher risk category. While this is preferable to the pre-2013 triggers, which were complex, an increasingly common case has been missed in which an unoccupied storage, parking, or utility area is converted to an occupied residential unit, leasable office or commercial space. In a seismically deficient building, such a change amounts to adding units to a substandard building, and often in the ground story of a soft-story building. This risk is equivalent to constructing new housing to obsolete seismic standards.

The growing interest in accessory dwelling units (ADUs) makes the problem more urgent when ADUs are proposed inside older storage buildings. Converting collapse-prone unoccupied space to new occupied space represents a significant increase in risk that the code has not previously addressed. Because Group S, U, R, B and M occupancies are generally assigned to Risk Category II, a change from a Group S or U occupancy to a Group R, B or M occupancy typically has not triggered any seismic work. In early editions of the CEBC's work area method, such a change would have triggered a full-building seismic upgrade with full code-level loads.

This change of occupancy now triggers an analysis of the need for seismic upgrade while allowing the use of reduced seismic loads from ASCE 41 for the analysis. This is an exception only for situations where the risk category does not change.

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