



# 2022 California Building Codes

Significant Changes

Structural, MEP & Fire/Life Safety

# University of California



# Introductions



**Casey Whitsett, SE, PE**  
Principal  
Structural Engineering  
619.321.0793  
casey.whitsett@coffman.com



**Louis Abbott, PE**  
Principal  
Mechanical Engineering  
760.717.0680  
louis.abbott@coffman.com



**Joe Dews, PE**  
Principal  
Electrical Engineering  
619.642.2229  
joe.dews@coffman.com



**Aman Shah, PE**  
Principal  
Fire Protection Engineering  
619.408.4119  
aman.shah@coffman.com



# Coffman Overview



Coffman Staff  
Companywide  
**700+**

Total Offices

**20**

Years in  
Business

**43**



# Services

## Structural Engineering

## Electrical Engineering

## Civil Engineering

## Fire Protection Engineering

## Mechanical Engineering

- Acoustical Consulting
- Alternative Energy
- Battery Energy Storage Systems

- Commissioning
- Energy Auditing
- Lighting Design

- Mass Timber
- Pedestrian Simulation Modeling
- Seismic Engineering



# AIA CES Provider Statement

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# AIA Learning Objectives

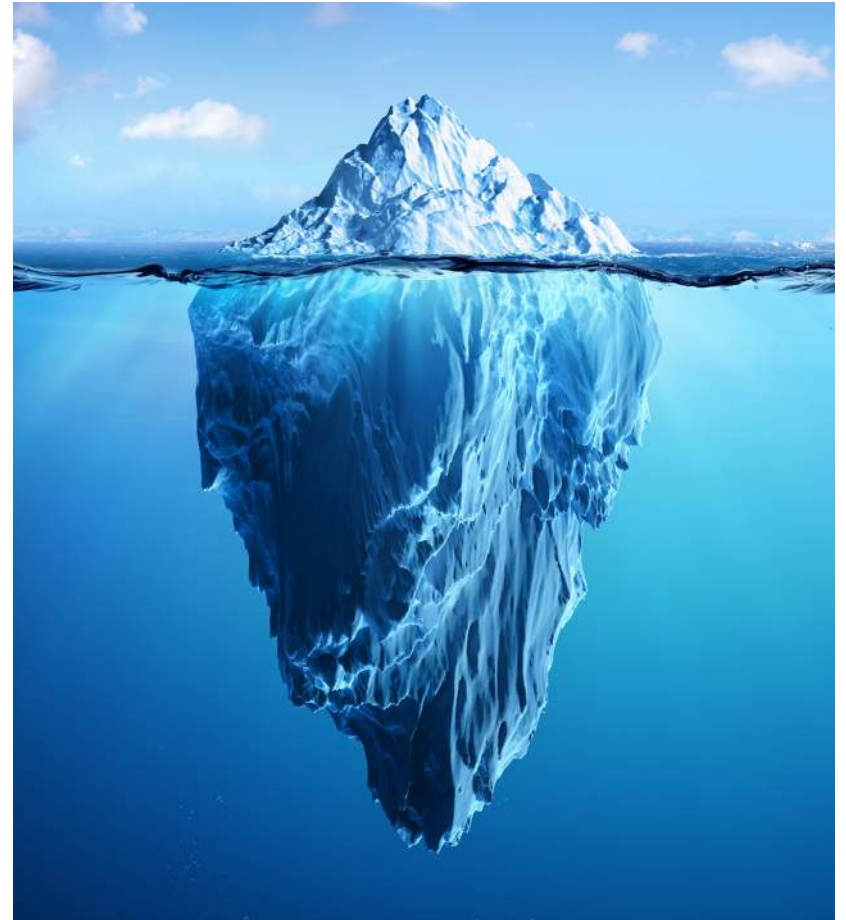
- Participants will receive a clearer understanding of the new code changes to the 2022 California Building codes for Structural, MEP (Power, lighting, and energy efficiency), and Fire/Life-safety and how those changes can affect design layout in buildings.
- Participants will gain a general understanding on how to meet the new code requirements and take advantage of new allowances in the 2022 California Building
- Participants will understand the purpose and intent behind the new requirements related to Structural, MEP and Fire/Life-Safety and how those requirements could potentially impact cost, as well as long term cost savings.
- Participants will be better able to explain the code updates to building owners and potential/current clients and help find solutions to challenges they may face with future designs or current facilities.





# Objectives

- Code Cycle Timeline
- Significant Implications
  - Structural
  - Mechanical, Plumbing, Energy
  - Electrical
  - Fire/Life Safety
- Questions?



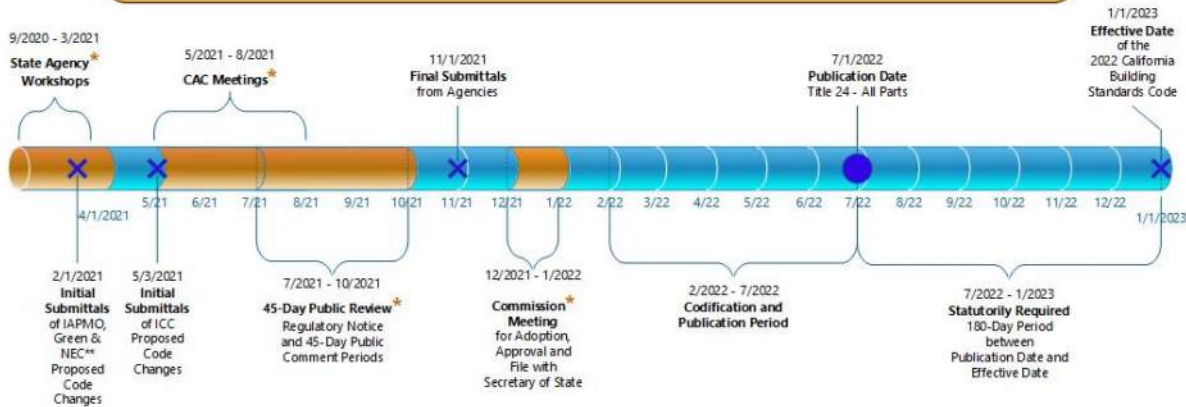
# Code Development Cycle



California Building Standards Commission

2022 California Building Standards Code, Title 24  
Effective January 1, 2023

## 2021 Triennial Code Adoption Cycle



### Code Advisory Committees (CAC):

- ACCESS – Accessibility
- BFO – Building, Fire & Other
- GREEN – Green Building
- HF – Health Facilities
- PEME – Plumbing, Electrical, Mechanical & Energy
- SDLF – Structural Design/Lateral Forces

### Model Code Publishers:

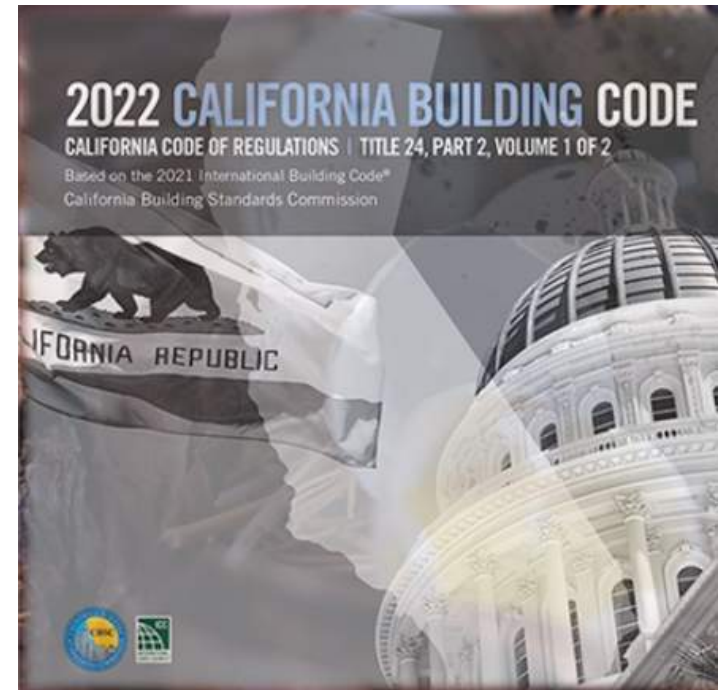
- ICC – International Code Council
- IAPMO – International Association of Plumbing and Mechanical Officials
- NFPA – National Fire Protection Association
- \*\*NEC resubmittal if necessary

\* Public Participation Opportunity

[dgs.ca.gov/BSC](http://dgs.ca.gov/BSC)  
(916) 263-0916

Rev. 09/2020

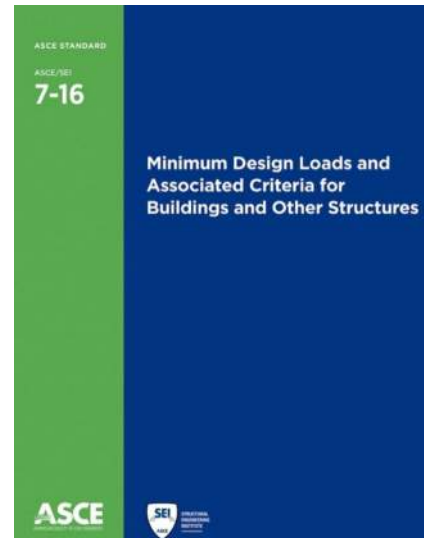
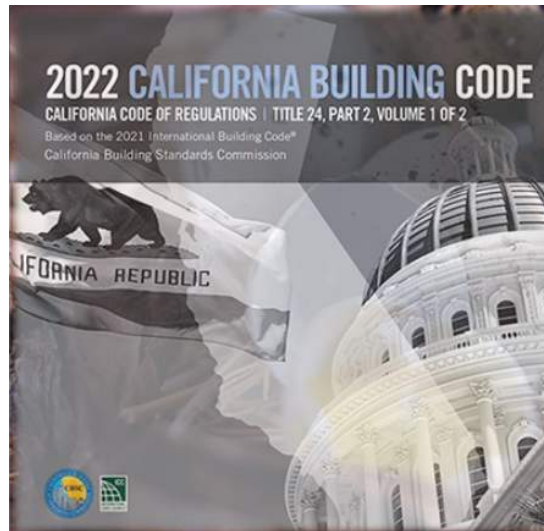
All dates are subject to change





# Code Overview

- **Model Code vs Referenced Standards**
- **Local Jurisdiction Amendments - City of SD, DSA, HCAI (formerly OSHPD), etc**
  - 2022 California Building Code  
(2021 International Building Code)
    - Referenced Standards



# Structural

# Code Overview - Referenced Standards

Gen Purpose	Old	New	Change?
Design Loads (EQ, Wind, Snow, etc)	ASCE 7-16	ASCE 7-16	None
Steel Design	AISC 360-16	AISC 360-16	None
Concrete Design	ACI 318-14	ACI 318-19	Major
CMU	TMS 402-2016	TMS 402-2016	None
Wood Design	AWC NDS-2018 SPDWS 15	AWC NDS-2018 SPDWS 21	Minor
Existing Buildings	2018 IEBC ASCE 41-13	2021 IEBC ASCE 41-17	Minor



# ACI 318-19 Major Updates

- High Strength Reinforcement
- Seismic Design of Concrete Shear walls
- Seismic Detailing of Concrete shear walls



# High Strength Reinforcement

- Applications for 80ksi and 100ksi reinforcement have been expanded including for seismic systems.
- Previously limited to non-seismic systems.
- Advantages:
  - Smaller bar sizes and fewer bars
  - Improved concrete placement and consolidation
  - Reduction in reinforcing bar congestion
- Disadvantages:
  - Limitations on Type 2 Mechanical Couplers





# High Strength Reinforcement

## SPECIAL SEISMIC SYSTEM

USAGE	ACI 318-14 LIMIT	ACI 318-19 LIMIT
MOMENT FRAME	60 ksi	80 ksi
SHEAR WALL	60 ksi	100 ksi

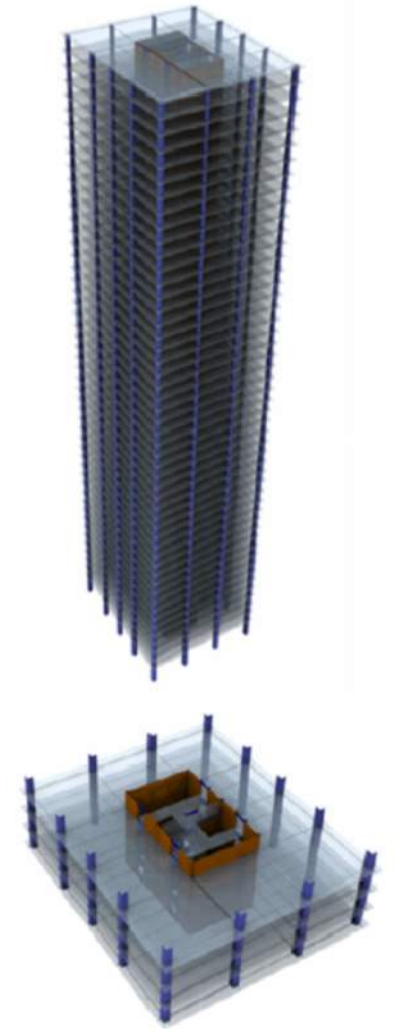
## OTHER SYSTEMS (Gravity Beams, Columns, etc)

USAGE	ACI 318-14 LIMIT	ACI 318-19 LIMIT
FLEXURAL	80 ksi	100 ksi
SHEAR	60 ksi	60 ksi
TORSION	60 ksi	60 ksi

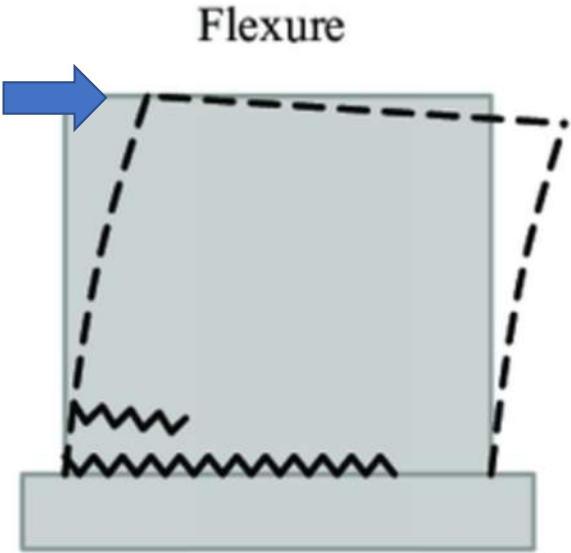


# Shear Wall – Seismic Design

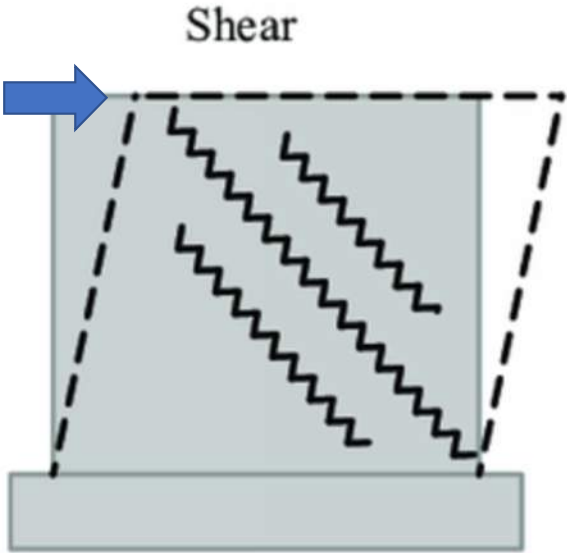
- Amplification of wall shear forces
  - Ensure flexural fuse at where wall yields
  - Increases design shear forces 1.5x to 3x
- Amplification only required for design of shear in wall
  - No impacts to:
    - Foundations
    - Diaphragms
    - Slabs, Beams
    - Etc...



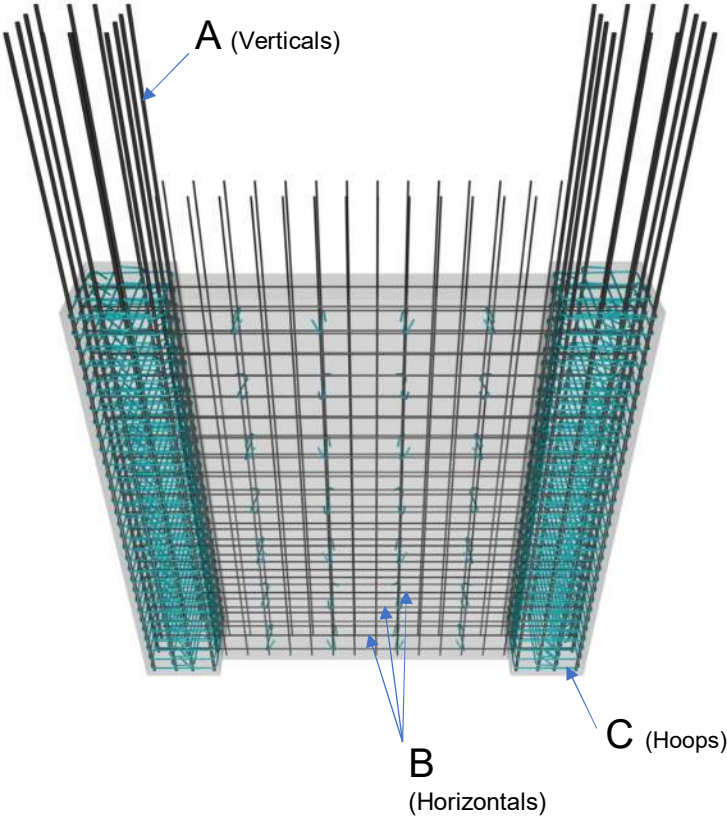
# Shear Wall – Seismic Design



**FLEXURE = GOOD FUSE**



**SHEAR = BAD FUSE**



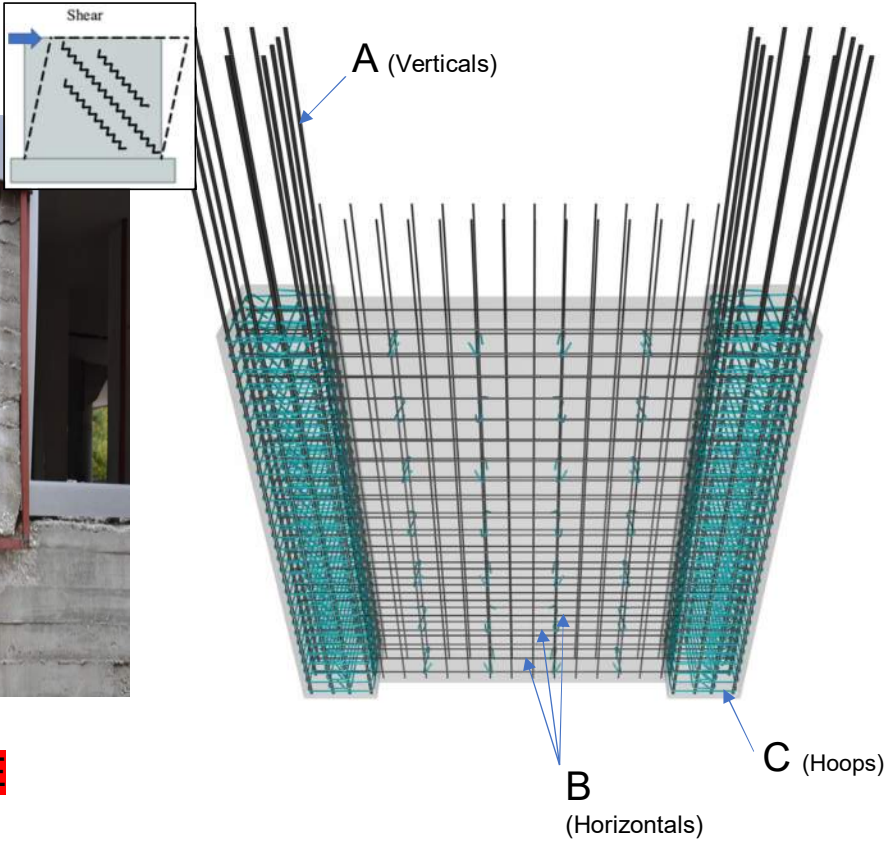
# Shear Wall – Seismic Design



**FLEXURE = GOOD FUSE**



**SHEAR = BAD FUSE**



# Shear Wall – Case Study

## SHEAR FORCE AMPLIFICATION COMPARISON



	Short/Squat	Slender 5 Story	Slender 10 Story	Slender 20 Story
Wall Height / Length	< 1.5	> 2.0	> 2.0	> 2.0
*Flexural Overstrength Amplification	NA	1.5 – 3.0	1.5 – 3.0	1.5 – 3.0
Dynamic Amplification	NA	~ 1.4	~ 1.63	~ 1.96
Total Amplification	None	~ 2x	~2.5x	~ 3x

\*Overstrength is greater of:

- $M_{pr}/M_u$
- 1.5





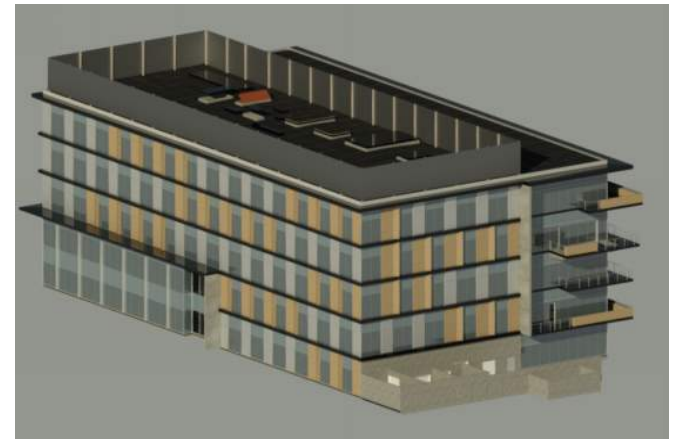
# Shear Wall – Case Study

## Building Description

- 5-story concrete lab/office building (140,000 sq. ft)
- Concrete shear wall

## Design Increase

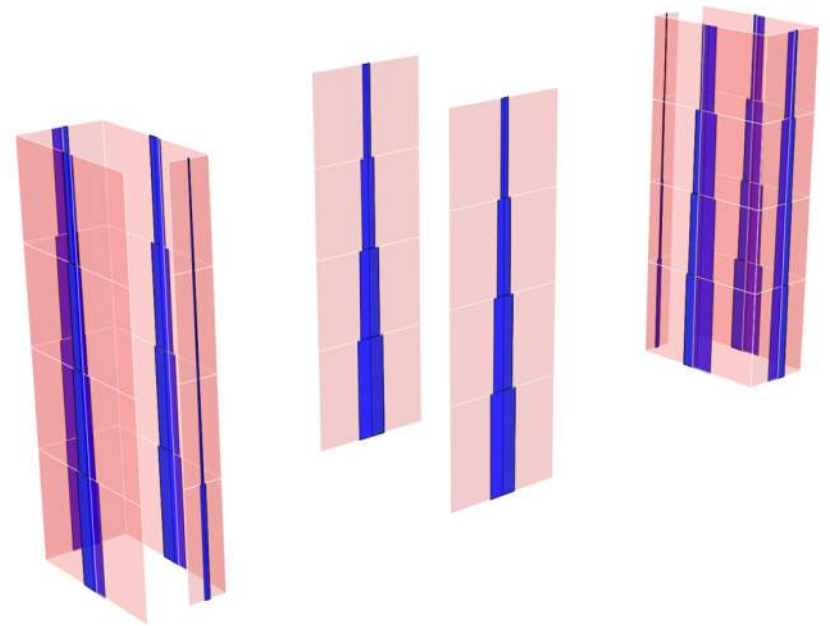
- Increase in wall horizontal reinforcement
  - ACI 318-14: #5@16" EA. FACE
  - ACI 318-19: #6@9" EA FACE
  - 2.5x increase in wall horizontal bars
  - Approx 5%-8% increase in overall building rebar



# Shear Wall – Case Study

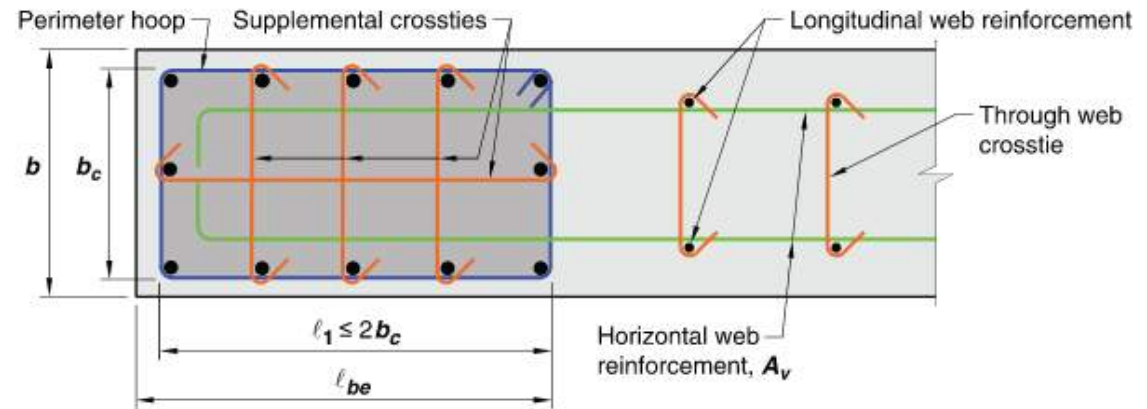
## Other Structural Options

- Increase in thickness of walls
- Increase wall length for walls
- Increase in quantity of walls
- Increase in wall horizontal reinforcement
- Utilize high-strength reinforcement to reduce bar size and quantity



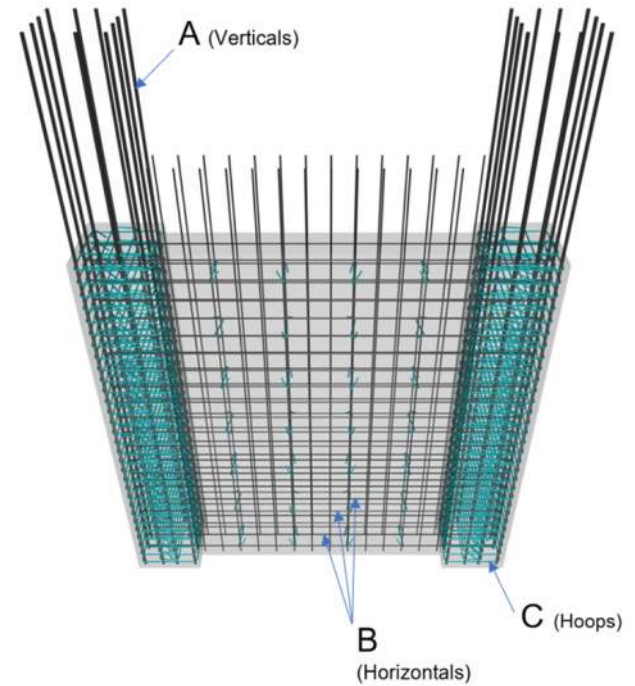
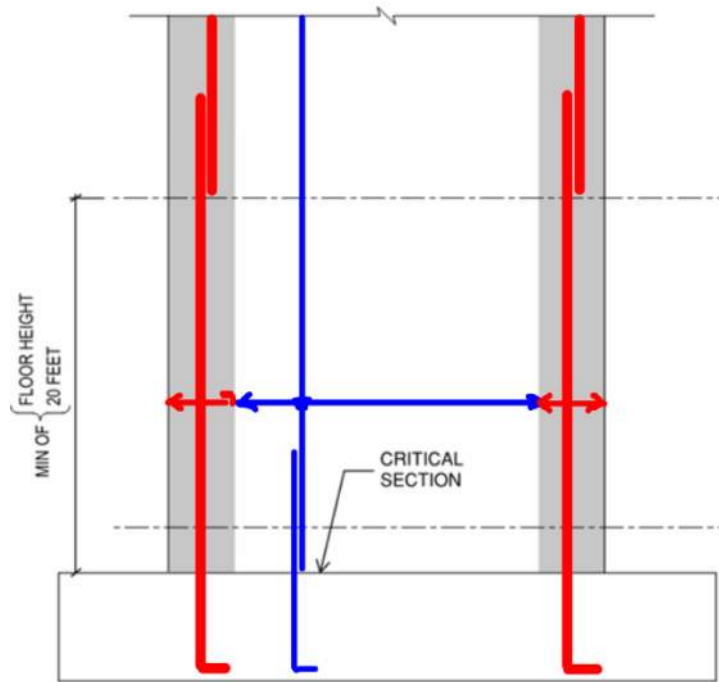
# Shear Wall – Seismic Detailing

- Seismic hooks or hoops required in boundary zones
- Seismic ties required for longitudinal reinforcement near critical section



# Shear Wall – Seismic Detailing

- Lap splices of vertical bars in boundary zones not permitted at wall critical section



# Mechanical, Plumbing, Energy



# Plumbing



- Temperature Limiting Device (Water Heater)

- CPC 407.3 (*Lavatory*), CPC 408.3 (*Shower*), CPC 409.4 (*Bath*), CPC 410.3 (*Bidet*), & CPC 416.2 (*Emergency Eyewash*)



- Minimum Plumbing Facilities Occupancy Load Factor

- CPC Table 4A (*Eliminated*)

- Pipe Insulation

- CPC Table 609.12.3 (*Modified*)

- Up to x8 Public Lavatory Installed on 1-1/2” Waste Line

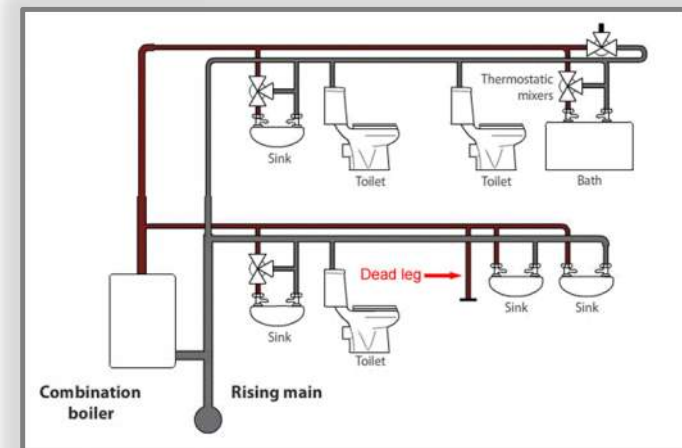
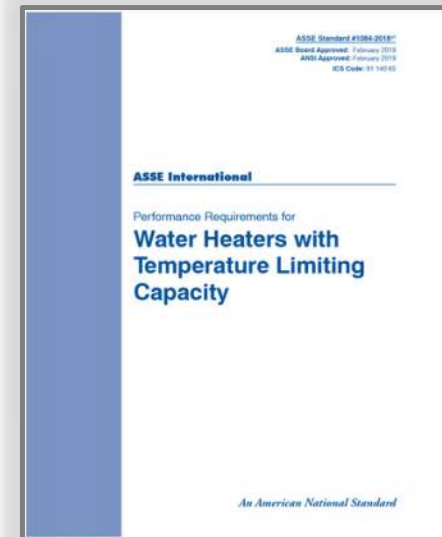
- CPC Table 703.2 Footnote #7 (*New*)

- Dead Leg Flushing

- CPC 309.6 (*New*)

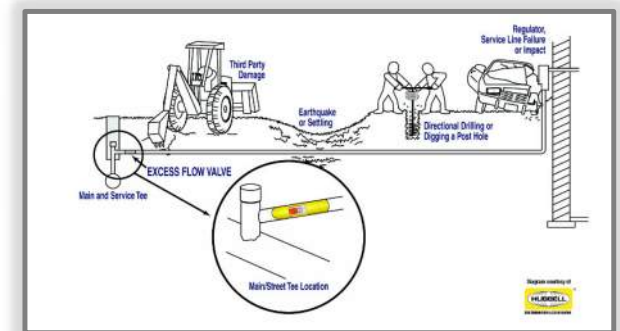
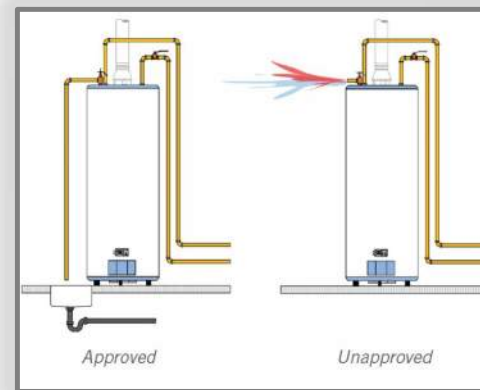
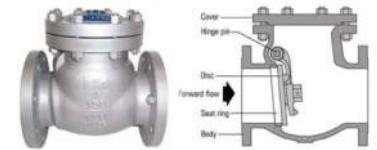
- Drinking Water Treatment Units

- CPC Table 611.1 (*New*)



# Plumbing

- Pumped Water Systems (Check Valve Required)
  - CPC 606.9 (New)
- P&T Discharge Piping
  - CPC 608.5 (Modified)
- Gas Overprotection Devices
  - CPC 1208.10 (New)
- Gas Sizing
  - CPC 1215.2 (Modified)
- Chapter 13 Code Organization (Medical Gas)



# Mechanical



- Rooftop Guard Rails
  - CMC 303.8.4.1 (New)
- Energy Code Ventilation Supersedes
  - CMC 401.1 (New)
- Residential Ventilation
  - CMC 405.0 (New)
- Environmental Exhaust Termination
  - CMC 502.2.1 (Modified)
- Parking Garage Exhaust System Exception
  - CMC 403.7.2 Exception #2 (Modified)
  - NO2 Sensors
- Product Conveying Minimum Duct Velocities
  - CMC Table 505.9 (Modified)
- General Duct Limitations
  - CMC 603.1 (Modified)

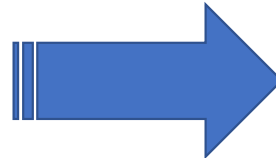


# Energy- New Code Layout

2019

Nonresidential, High-rise  
Residential, Hotel & Motel  
*(Sections 120.0-141.1)*

Low-rise Residential  
*(Sections 150.0-150.2)*



2022

Nonresidential, Hotel & Motel  
*(Sections 120.0-141.1)*

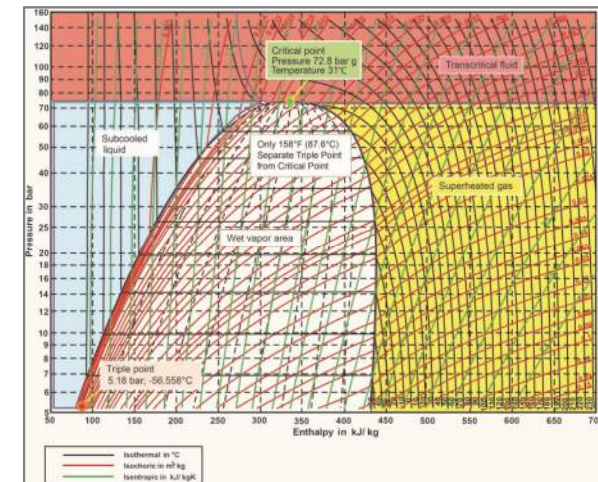
Single Family Residential  
*(Sections 150.0-150.2)*

Multi-Family Residential  
*(Sections 160.0-180.2)*



# Energy- Mandatory

- Envelope
  - Section 110.6(a) (*Modified*)
- Controlled Environmental Horticulture
  - Section 120.6(h) (*New*)
- Computer Rooms
  - Section 120.6(j) (*New*)
- Commercial Refrigeration
  - Sections 120.6(a)8 & 120.6(b)5 (*New*)
- Compressed Air
  - Sections 120.6(e)4 & 120.6(e)5 (*New*)
- Outside Air Ventilation
  - Section 120.1(c)3 (*Modified*)
- Fan Energy Index (FEI)
  - Section 120.10 (*New*)



# Energy- Prescriptive

- HVAC Selections
  - Section 140.4(a)2 (*New*)
- Economizers
  - Section 140.4(e) (*Modified*)
- Fan Power
  - Section 140.4(c) (*Modified*)
- DOAS
  - Section 140.4(p) (*New*)
- Exhaust Heat Recovery
  - Section 140.4(q) (*New*)
- Boilers
  - Section 140.4(k)8 (*New*)
- Domestic Hot Water
  - Sections 140.5 (*Modified*), 150.1(c)8 (*Modified*) & 170.2(d) (*New*)



# Electrical



# Electrical

- Photovoltaic (PV) Systems are required on **nonresidential** buildings:
  - Grocery
  - Office, Financial Institutions, Unleased Tenant Space
  - Retail
  - School
  - Warehouse
  - Auditorium
  - Convention Centers
  - Restaurants
  - Theaters
  - Library
  - Medical Office Buildings and Clinics
  - Hotel/Motels



# Electrical

- Exceptions:
  - Total SARA (Solar Access Roof Area) is less than three percent of the conditioned floor area
  - Minimum PV system is less than 4 kWDC
  - SARA is less than 80 contiguous SF
  - Buildings with enforcement-authority-approved roof designs where authority determines it **is not possible** for the PV system to meet the snow load requirements of Ch.7 in the ASCE standard 7-16
  - Multi-tenant buildings in areas where the utility does not provide either virtual net metering (VNEM) or community solar program



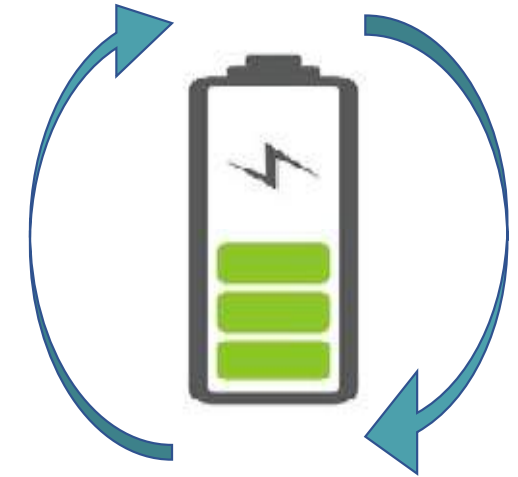
# Electrical

- SARA
  - Area of building roof space capable of structurally supporting a PV system AND
  - The area of all roof space on covered parking areas, carports, and other new structures on site that are capable of supporting a PV system
  - Exceptions:
    - Any roof area that has <70% annual solar access
    - Occupied roof areas
    - Roof area that is not available due to other building code requirements
- 2 PV System Sizing Methods – whichever is smaller
  - Conditioned floor area multiplied by an occupancy-based capacity factor
  - $SARA * 14W/sqft$



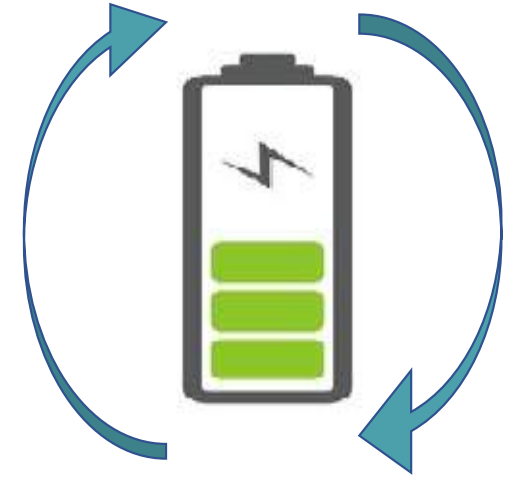
# Electrical

- Got PV? Let's charge some batteries!
- Required where PV is required
- Grid harmonization –
  - Charge batteries during the day (low rates)
  - Discharge during later afternoon and early evening hours (peak rates)



# Electrical

- Exceptions
  - Installed PV system size is <15% of the size determined by 140.10-A equation
  - Buildings with battery storage system requirements with < 10kwh rating
  - Offices, schools and warehouses in climate zone 1
  - Single tenant buildings <5,000 SF of conditioned floor area
  - Multi tenant buildings: Capacity and power of BESS shall be based on tenant spaces with more than 5,000 SF conditioned floor area



# Electrical

- Case Study - 50,000 SF conditioned Office
  - San Diego – Climate zone 7
    - 145kW DC minimum photovoltaic system
      - ~7,000 SF
    - 60KW , 251 kWh minimum Battery Energy Storage System
      - 8' x 12' exterior pad





# Electrical

- University of California Facilities Manual, Resource Directory RD 4.6
- Consideration of entire campus energy production and storage

<p>University of California Facilities Manual, Resource Directory RD 4.6</p> <p><b>2022 Energy Code Updates – Solar and Storage Requirements for New Buildings</b></p> <p>Background: Updates to the 2022 Title 24 Energy Code include solar and battery storage requirements for new building construction. Based on the unique site characteristics of many UC campuses, interpretation of these requirements is necessary.</p> <p><b>SECTION 160.10. PRESCRIPTIVE REQUIREMENTS FOR PHOTOVOLTAIC AND BATTERY STORAGE SYSTEMS</b> outlines a compliance path focused on solar and battery storage resources physically located within or adjacent to new buildings based on standard sizing equations.</p> <p>UC's alternative position is that because of the unique design of many campuses with owned electrical distribution systems located behind a single utility meter, the entire campus is included as the project site. Using a whole-campus site approach has precedent in achieving compliance for state environmental regulatory requirements, certification programs such as LEED, along with UC's Sustainable Practices Policy. This would allow existing or new solar and battery storage resources connected anywhere on the same campus-owned utility distribution grid to satisfy the code requirement using the same standard sizing equations.</p> <p>For a campus to utilize this approach to meet code requirements, clear documentation and accounting of the campus distribution grid connected solar and battery resources are necessary (see below). This record keeping would be overseen by the campus Energy Manager or other appropriate facilities staff and would include a comprehensive accounting of all solar and battery storage resource capacities connected to the campus-owned utility distribution grid, updated annually at a minimum.</p> <p>To ensure energy resources are not double counted, an allocation of how the capacity of these connected solar and battery storage resources have been assigned to specific buildings and/or loads on the campus distribution grid shall be documented and made available to stakeholders, including the designated campus Building Official.</p> <p><b>Documentation Requirements</b> The Campus Energy Manager or appropriate designated staff will maintain a comprehensive accounting of all solar and battery storage resources connected to the campus-owned utility distribution grid. This data will be reviewed and updated annually at minimum, and will include at least the following system data for each solar and battery storage resource:</p> <ul style="list-style-type: none"><li>• Name/description of resource</li><li>• Type (solar or battery storage, if system includes both create separate entries)</li><li>• Physical location description, address</li><li>• On campus distribution grid? (y/n)</li><li>• Total rated capacity (kW for solar, kW and kWh for battery)</li><li>• Portion of capacity that has been assigned to one or more buildings/loads (kW for solar, kW and kWh for battery).</li><li>• For each building/load that is assigned capacity from this resource please list:<ul style="list-style-type: none"><li>o Name/description</li><li>o Location</li></ul></li></ul>	<ul style="list-style-type: none"><li>o On campus distribution grid? (y/n)</li><li>o Capacity assigned (kW for solar, kW and kWh for battery)</li><li>o Start date of assignment</li><li>o Duration of assignment</li><li>o Reason for assignment (building code, LEED requirement, etc)</li></ul> <p>Version 1, March 24, 2023</p>
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# Electrical

- Ground Fault Circuit Interruption (GFCI) – Expanded
  - In all Kitchens and all areas where food is prepared:
    - Coffee shops
    - Ice cream shops
    - Smoothie stores, etc.
    - Areas with a sink and permanent provisions for either food preparation or cooking
- All 120V, 240V single phase 50A and less
- All 208V, 3-phase 100A and less



# Electrical

- Identification of disconnecting means
  - Now required to identify the source of the branch circuit or feeder



# Fire/Life Safety

# CFC §1207 Energy Storage Systems

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- 2019 CBC, July 1 2021 Intervening Supplement.
- 2021 IFC had significant revisions to Energy Storage Systems to align with NFPA 855, Standard for the Installation of Stationary Energy Storage Systems.

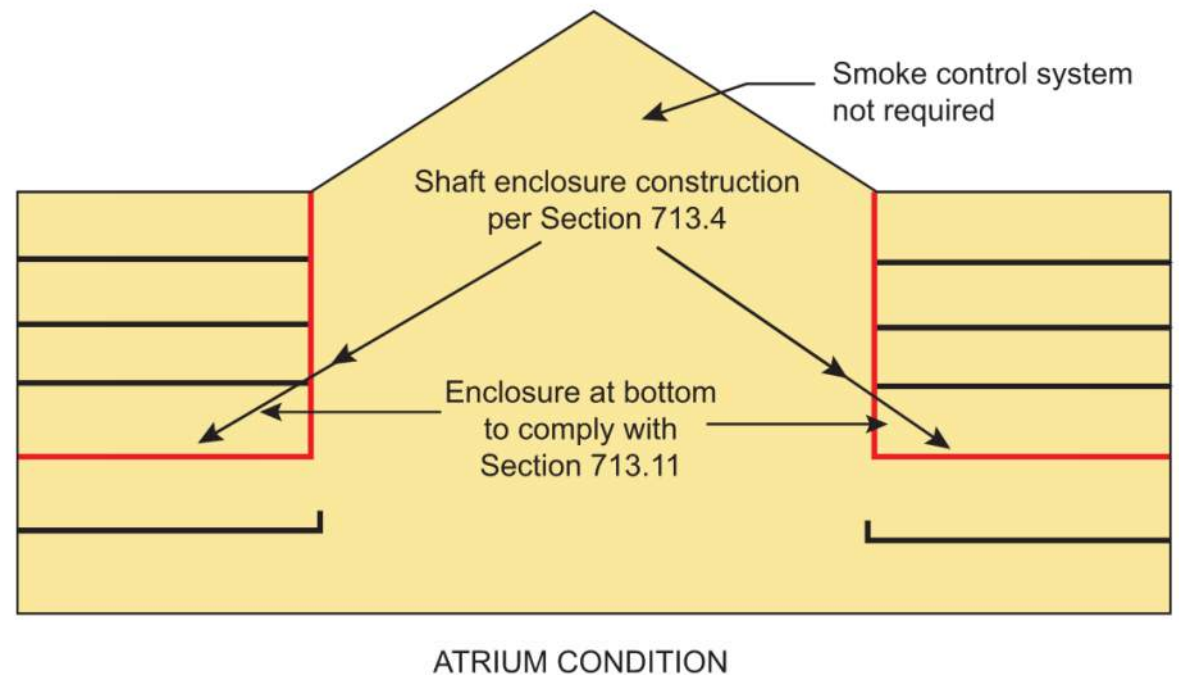


Modification



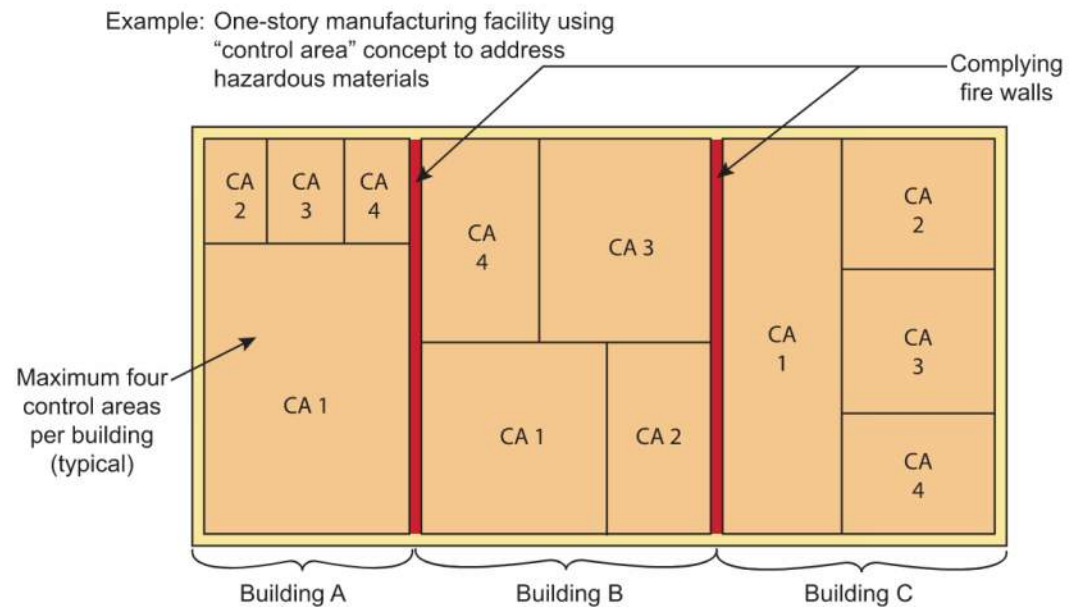
# CBC §404.5 Smoke Control in Atriums

- New exception allows atriums greater than two stories without a smoke control system.
- All levels above the 2<sup>nd</sup> level of the atrium must be separated by shaft enclosure construction.



## CBC §414.2.3 Fire Wall Use for Control Areas

- Allows the use of fire walls to increase the number of control areas provided in a building.
  - Previously, §503.1 only allowed fire walls to create separate buildings
- Each “building” separated by the fire wall must comply with the maximum number of control areas prescribed by Table 414.2.2.
- Helps designers to avoid a Group H occupancy.





# CBC §406.6.4 – Mechanical-Access Parking Garages

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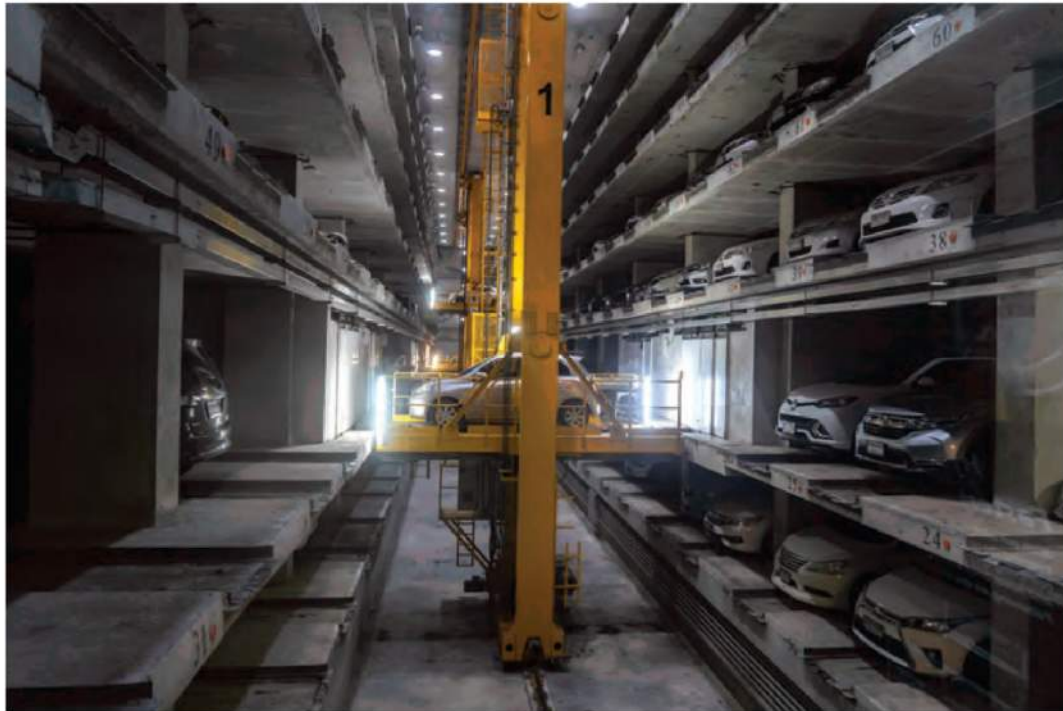


Photo courtesy of Getty Images/Prasit Photo

- Mechanical-access parking garages are now specifically addressed and require the following:
  - A specially engineered automatic sprinkler system
  - 2-hour separation from other occupancies
  - Fire department access doors at the ground level
  - Mechanical smoke removal system
  - Manual emergency shutdown switch
  - Fire control equipment room with exterior access (where fire command center is not already provided for the building)

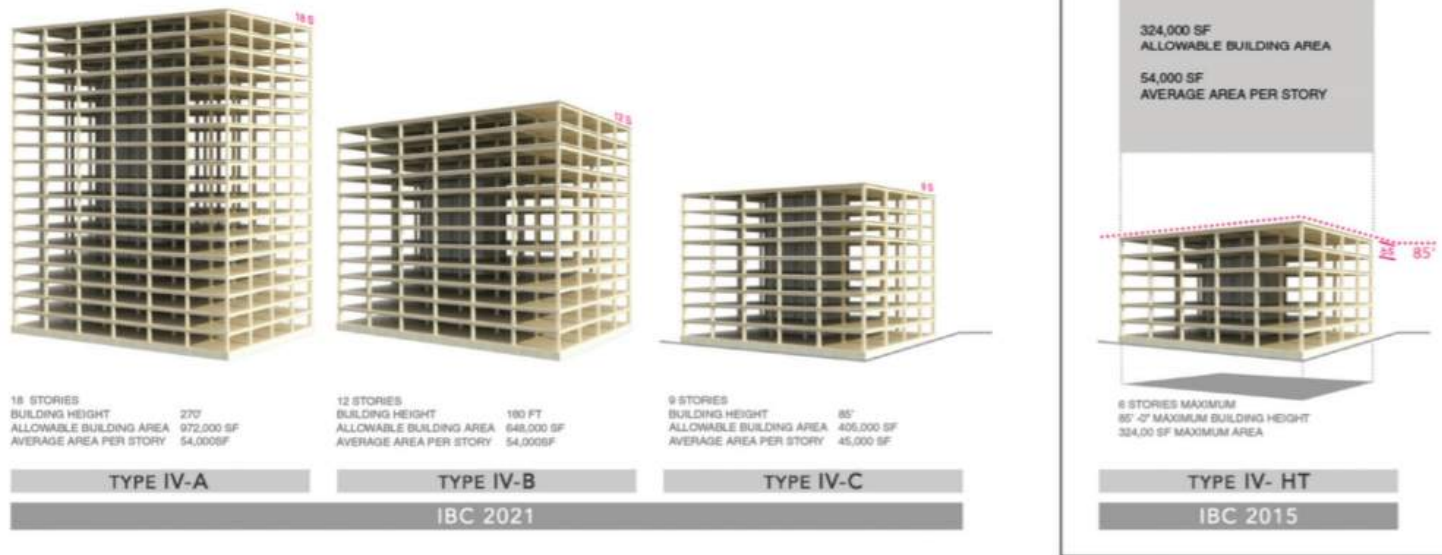
Addition





# CBC Ch. 5 New Mass Timber Construction Types

- CBC Tables 504.3, 504.4, and 506.2: Height and area limitations have been added for the three new mass timber construction types: IV-A, IV-B and IV-C



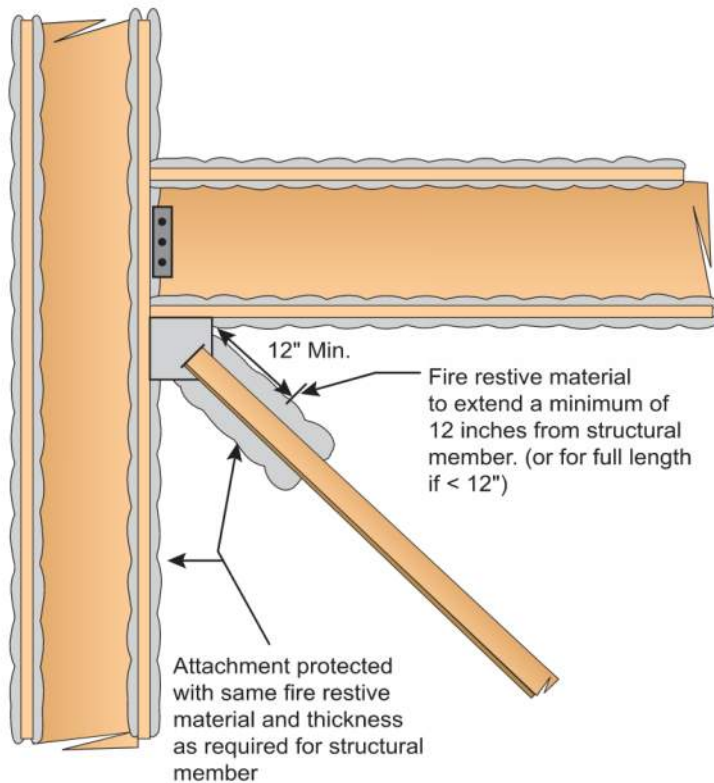
BUSINESS OCCUPANCY [GROUP B]

\*BUILDING FLOOR-TO-FLOOR HEIGHTS ARE SHOWN AT 12'-0" FOR ALL EXAMPLES FOR CLARITY IN COMPARISON BETWEEN 2015 TO 2021 IBC CODES.

Addition



# CBC §704.6.1 Secondary attachments to structural members



- Where primary and secondary structural members require fire resistance protection, any additional structural steel members w/direct connection to these member (i.e., seismic bracing or steel angles) must be protected.
- Same thickness of fire resistive material for at least 12 inches.
- Hollow attachments to structural members must be provided with protection on both the exterior and interior.

Modification



# CBC Chapter 7A – Wildland Urban Interface Requirements

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- Many changes to Chapter 7A.
- Ongoing developments of WUI code development effort by state.



Modification

## **SECTION 701A** **SCOPE, PURPOSE AND APPLICATION**

**701A.1 Scope.** *This chapter applies to building materials, systems and/or assemblies used in the exterior design and construction of new buildings located within a Wildland-Urban Interface Fire Area as defined in Section 702A.*

**701A.2 Purpose.** *The purpose of this chapter is to establish minimum standards for the protection of life and property by increasing the ability of a building located in any Fire Hazard Severity Zone within State Responsibility Areas or any Wildland-Urban Interface Fire Area to resist the intrusion of flames or burning embers projected by a vegetation fire and contributes to a systematic reduction in conflagration losses.*

**701A.3 Application.** *New buildings located in any Fire Hazard Severity Zone or any Wildland-Urban Interface Fire Area designated by the enforcing agency constructed after the application date shall comply with the provisions of this chapter.*



## CBC §903.2.10 – Sprinklers in Open Parking Garages

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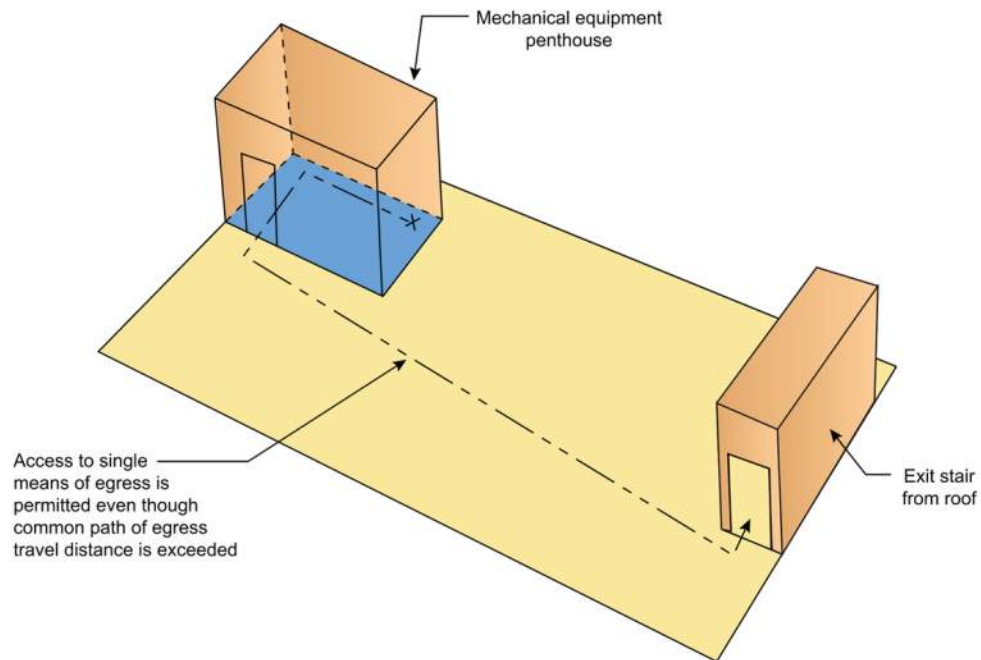
- Sprinklers are now required in open parking garages with a *fire area* exceeding 48,000 sf or a height exceeding 55 ft.
- Open parking garages that are part of high-rise buildings also require sprinkler protection.



Modification



# CBC §1006.2.1 – Egress from Mechanical Rooms and Penthouses



**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:

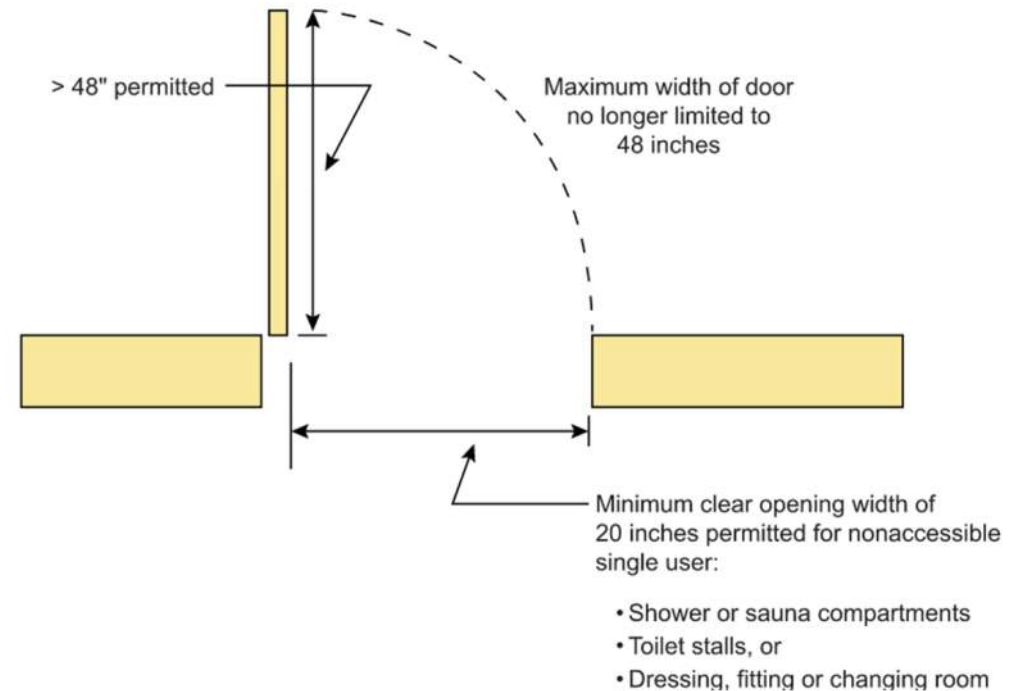
1. The number of *exits* from foyers, lobbies, vestibules or similar spaces need not be based on cumulative *occupant loads* for areas discharging through such spaces, but the capacity of the *exits* from such spaces shall be based on applicable cumulative *occupant loads*.
2. *Care suites* in Group I-2 occupancies complying with Section 407.4.
3. Unoccupied mechanical rooms and *penthouses* are not required to comply with the common path of egress travel distance measurement.

Modification



# CBC §1010.1.1 – Door Widths

- There is no longer a maximum door width
  - Previously, largest permitted door size was 48 inches
  - [Door opening force requirements still apply](#)
- Non-accessible single user spaces (bathroom stalls, dressing rooms, etc.) require a minimum clear door opening of 20 inches
- Group I-2: Where two door leaves are provided in a door opening without a center mullion, at least one of the door leaves must provide a clear width of 44-inches.
  - Example: 6 ft. opening – uneven pair 48-inch and 24-inch door leaves

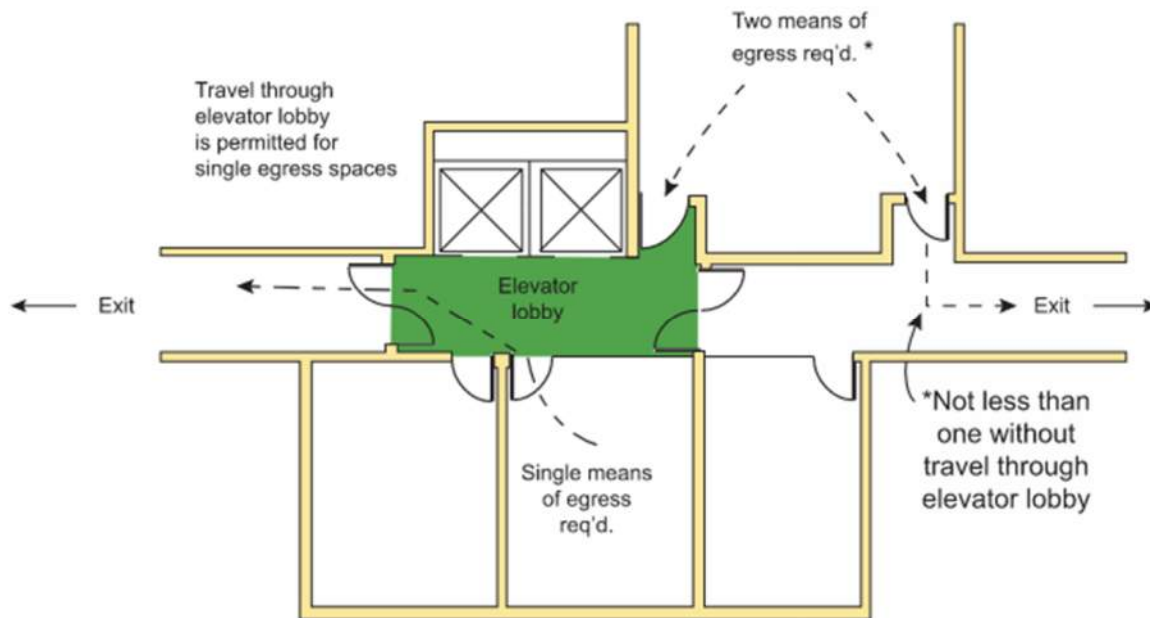


Modification





## CBC §1016.2 – Egress Through Elevator Lobbies



- Requirement for access to at least one exit without passing through the elevator lobby has been revised to apply only to spaces that require two means of egress.
- Allows small spaces adjacent to the lobby to pass through the lobby if within common path of travel.
- N/A in Group I-2

Modification





# CBC §1406.10 – Metal Composite Material Cladding

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International Code Council

Modification

- Due to recent global fire events, the requirements for MCM panels have become more stringent and limited.
- Alternate conditions section deleted.
- The presence of sprinklers inside the building no longer exempts the requirements of NFPA 285 or height limitations.



# CBC §Table 1604.5 – Risk Categories of Assembly Spaces

- Risk Category 3 updated to include:
- Mixed use buildings that have assembly spaces and a total assembly occupant load exceeding 2,500 occupants.
- Mixed use buildings with group I-4 occupancies that have an occupant load greater than 250.

**TABLE 1604.5 Risk Category of Buildings and Other Structures**

Risk Category	Nature of Occupancy
III	<p>Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to:</p> <ul style="list-style-type: none"><li>• Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300.</li><li>• <u>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.</u></li><li>• Buildings and other structures containing Group E <u>or Group I-4 occupancies or combination thereof</u>, with an occupant load greater than 250.</li></ul> <p><i>(Other Risk Category III criteria remain unchanged)</i></p>



# Elevators – 2019 CBC July 1, 2021 Supplement

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- 2019 CBC, July 1 2021 Intervening
- **CBC 3003.4 Emergency Hoistway Venting:** Elevator hoistways containing the driving machine shall be provided with a means for venting smoke and hot gases to the outer air in case of fire.
  - Operated by smoke detection in hoistway



**CBC 3005.4.1:** Elevator motor and motion control equipment shall be installed in a dedicated elevator machine room or control room located outside of the hoistway. The machine room or control room shall be of sufficient size to accommodate the elevator equipment and required minimum electrical clearances in accordance with the California Electrical Code.

Modification





# QUESTIONS?

## Thank You For Your Time

The presentation has highlighted many of the 2022 CBC Code amendments but is not meant to be all-inclusive.