



PRC-006  
**Plan Review Checklist  
Structural Design**

<b>INFORMATION</b>	PROJECT NO.:		EXPIRATION DATE:		STATUS: <b>1<sup>st</sup> Review</b>	
	PROJECT ADDRESS:			VALUATION: \$		
	WORK DESCRIPTION:					
	APPLICANT'S NAME:			TEL. NO.:		
	USE	OCCUPANCY GROUP	FLOOR AREA	OCCUPANT LOAD	TYPE OF CONSTR.	NO. OF STORIES
						FIRE SPRINKLER
<b>INSTRUCTIONS</b>	<p>Your application for a permit, together with plans and specifications, has been examined and you are advised that the issuance of a permit is withheld for the reasons herein after set forth. The approval of plans and specifications does not permit the violation of any sections of the Building Code or other local ordinances or state laws.</p> <p>In an effort to streamline the plan review process, please follow the steps outlined below to ensure that there is no delay in processing your application and reviewing your responses to these plan check comments.</p> <ul style="list-style-type: none"> <li>All items on this checklist with circled item numbers apply to this plan review. This is not a complete list of the building comments and corrections, please see the marked plans, calculations, reports, etc. for all remaining comment items.</li> <li>The revised plans, reports, and calculations shall incorporate or address all comments marked on the original checked set of plans, calculations, and this plan review checklist.</li> <li>Provide a written response to each comment, stating where and how it has been addressed on the plans. Identify the sheet number, detail number or reference note on the revised plans where the corrections are made. When all comments on the plans, calculations, and this checklist have been addressed, resubmit the updated plans, calculations and reports via email directly to the plan reviewer listed below.</li> </ul>					
	PLAN REVIEWER: _____ TEL. NO.: <u>562-570-</u>					
	ADDRESS: <u>411 W. OCEAN BLVD., 2nd FLOOR, LONG BEACH, CA 90802</u>					
	EMAIL: _____@longbeach.gov WEBSITE: <u>www.longbeach.gov/lbcd</u>					
<b>NOTE</b>	Numbers within the parenthesis ( ) refer to the section or table (T) of the applicable code: 2022 Edition of the California Building Code (CBC). Minimum Design Loads and Associated Criteria for Buildings and Other Structures (ASCE 7-16). Seismic Provisions for Structural Steel Buildings (ANSI/AISC 341-16). Specification for Structural Steel Buildings (ANSI/AISC 360-16). Building Code Requirements for Structural Concrete (ACI 318-19). Building Code Requirements and Specification for Masonry Structures (TMS 402-16, 602-16). National Design Specification for Wood Construction with 2018 Supplement (ANSI/AWC NDS-18). Special Design Provisions for Wind and Seismic (ANSI/AWC SDPWS-2021).					

## CHAPTER 16 STRUCTURAL DESIGN

### A. GENERAL

1. The following design loads and other information pertinent to the structural design required by CBC 1603.1.1 through 1603.1.9 shall be indicated on the construction documents: (CBC 1603.1)
  - a. Floor dead load and live load.
  - b. Roof dead load and live load.
  - c. Wind design data:
    - i. Basic wind speed in M.P.H.
    - ii. Wind importance factor, I, and risk category.
    - iii. Wind exposure.
    - iv. Internal pressure coefficient.
    - v. Design wind pressures.
  - d. Earthquake design data:
    - i. Seismic importance factor, I, and risk category.
    - ii. Mapped spectral response accelerations,  $S_s$  and  $S_1$ .
    - iii. Site class.
    - iv. Spectral response coefficients,  $S_{Ds}$  and  $S_{D1}$ .
    - v. Seismic design category.
    - vi. Basic seismic-force-resisting system(s).
    - vii. Design base shear.
    - viii. Seismic response coefficient(s),  $C_s$ .
    - ix. Response modification factor(s), R.
    - x. Analysis procedure used.
    - xi. Redundancy factor used.
  - e. Flood/Tsunami Design Data
  - f. Geotechnical Information
  - g. Special loads
  - h. System or components requiring special inspections for seismic resistance.
2. Designate on the plans a registered design professional in responsible charge. The jurisdiction having authority shall be notified in writing of any changes. The registered design professional shall review and coordinate all submitted documents prepared by others, including deferred submittal items. The registered design professional shall submit deferred documents to the jurisdiction having authority in a timely manner. The owner shall notify the Building Official in writing if the registered design professional in responsible charge is changed.
3. Deferred submittal documents shall be listed on the plans and shall have prior approval of the Building Official.
4. When submitted by the registered design professional in responsible charge, deferred documents shall bear a notation indicating the documents have been reviewed by the registered design professional and have been found to be in general conformance with the design of the building. This statement should be made adjacent to where the deferred item or item submitted “by others” is noted on the plans.
5. Provide details of anchorage of roof and ceiling mounted mechanical, electrical and plumbing equipment as applicable. Include the weight in the calculations as necessary. (CBC 1603.1 and 1606.2, ASCE 7 Section 13.1)

## B. GENERAL LOADS

1. The live loads used in the design of buildings and other structures shall be the maximum load expected by the intended use or occupancy but shall in no case be less than the minimum uniformly distributed unit loads required by CBC T-1607.1.
2. Floor live load, where less than 80 psf, must include a minimum 15 psf partition load, in addition to other loads per CBC 1607.5.
3. Exit facilities must be designed for a 100 psf live load. (CBC T-1607.1)
4. The minimum uniform distributed live load for balconies and decks is 1.5 times the live load for the area served. Not required to exceed 100 psf. (CBC T-1607.1)
5. Floors supporting vehicles accommodating less than 9 passengers shall be designed for either a live load of 40 psf or a 3,000 lb. concentrated load acting on a 4.5" by 4.5" area, whichever produces the greater load effect per CBC T-1607.1 Item 14. Concrete slabs supporting fire trucks shall be designed per CBC 1607.7.2.
6. The (uniform) (concentrated) (special) loads for \_\_\_\_\_ must be used in accordance with CBC T-1607.1.
7. Ceiling joists shall be designed for 20 psf live load. Attic without storage and less than 42" of headroom may be designed for 10 psf live load. (CBC T-1607.1 Item 25)
8. Suspended ceilings shall be designed per ASCE 7 Section 13.5.6. Provide details. See Information Bulletin IB BU-011 for additional design requirements.
9. Where the minimum 1/4" per foot roof or deck slope for drainage is not provided, a design to support accumulated water per CBC 1611.3 is required.
10. Provide deflection calculations for all horizontal gravity members and walls to show compliance with CBC T-1604.3 and CBC 1604.3.2 through 1604.3.5 for the more restrictive limitations. (CBC 1604.3)
11. Provide connection details of guards and/or handrail, including connections of posts or panels to deck or floor framing, capable of withstanding a load of at least 200 lbs applied in any direction at any point of the rail. Assemblies and guards, including connection of posts or panels to deck framing, shall be designed to resist a load of 50 plf applied in any direction and intermediate rails shall be designed to withstand a horizontally applied normal load of 50 pounds. Provide calculations to verify the above. (CBC 1607.8.1)
12. Vehicle barrier systems shall be designed to resist loadings specified in CBC 1607.9.
13. Roof live loads shall be considered where surface mounted photovoltaic panels or modules occur (CBC 1607.13.5.1)

## C. LATERAL LOADS

1. Seismic Design Category (SDC) shall be based on CBC T-1613.2.5(1) and T-1613.2.5(2). When  $S_1$  is greater than or equal to 0.75, the building shall be assigned to SDC E for Occupancy Category I, II, or III and assigned to SDC F for Occupancy Category IV. (CBC 1613.2.5)
2. The value of R used for design in a specific direction shall not exceed the lowest value of R for any of the lateral force resisting systems utilized in that same direction per ASCE 7 Section 12.2.3 (Except where the conditions of ASCE 7 Sections 12.2.3.1 and 12.2.3.2 are met for 1 & 2 family dwellings constructed of light frame construction).
3. Provide calculations and details to show that collector elements, splices, and connections to resisting elements have the strength to resist the combined loads resulting from the special seismic load of ASCE 7 Sections 12.4.3.1 and 12.14.3.1.
4. Calculate seismic drift based on deflections of each level with  $C_d$  and I factors using strength level forces in accordance with ASCE 7 Section 12.8.6.
5. Provide separation from property line or adjacent building(s) of not less than the building drift in accordance with ASCE 7 Section 12.12.3 amended by LBMC 18.40.320.
6. Cantilevered column systems resisting seismic forces shall be designed with an R and  $C_d$  factor per ASCE 7 T-12.2-1 and shall be limited to a maximum inelastic response displacement per ASCE 7 T-12.12-1. Foundation and other elements used to provide overturning resistance at the base of cantilever column elements shall have the strength to resist the load combinations with over strength factor of ASCE 7 Section 12.4.3.1. Use an effective length factor  $K = 2.1$

7. Submit structural calculations and connection details for the structural members that provide support for the seismic forces generated by elevators. The seismic forces must be determined in accordance with ASCE 7 Section 13.3. The calculations and details provided must show the complete load path from the rail supports to the building's lateral-force-resisting system. (ASCE 7 Section 13.6.11.1 & CBC 1607.10.1)
8. The lateral design shall be based on the most restrictive of either the wind or seismic forces per CBC 1609 and 1613 respectively.
9. Wind analysis that does not comply with the conditions of simplified procedure of ASCE 7 Section 28.5 (Part 2) shall comply with the envelope procedure of ASCE 7 Section 28.2 (Part 2). Alternately, ASCE 7 Chapter 27 may be used.
10. Seismic analysis that does not comply with the conditions of simplified base shear design of ASCE 7 Section 12.14 must comply with equivalent lateral force procedure per ASCE 7 Section 12.8 or linear dynamic analysis per ASCE 7 Section 12.9.
11. Provide mapped spectral acceleration for short periods  $S_s = \underline{\hspace{1cm}}$  and at one second  $S_1 = \underline{\hspace{1cm}}$ , as determined in accordance with ASCE 7 Section 11.4.
12. The site coefficients are  $F_a = \underline{\hspace{1cm}}$  and  $F_v = \underline{\hspace{1cm}}$  per ASCE 7 Section 11.4-1 & T-11.4-2.  
***Site specific ground motion procedures per ASCE 7 Section 11.4.8 are required unless exceptions apply.***
13. The redundancy factor,  $p$ , shall be 1.3, except where the conditions of ASCE 7 Section 12.3.4.2 are met.
14. Provide detail to show that the interior shear walls are connected to the roof diaphragm.
15. Check the shear wall overturning reactions on the beams/columns per ASCE 7 Section 12.3.3.3. Also see ASCE 7 Section 12.4.3.
16. Wood elements designed primarily as flexural members shall be provided with lateral bracing or solid blocking at each end and at connection location(s) of the discontinuous system.
17. Where applicable, provide pre-engineered wall manufacturer's detail sheets on the plan.
18. Provide calculations for wind loading on the building showing compliance with ASCE 7 Chapter 26. Indicate in the calculations which method is being used. (CBC 1609)
19. Deflection of framing members supporting glass subjected to 0.6 times the "component and cladding" wind loads shall not exceed the deflection limits of CBC 1604.3.7.
20. When determining the maximum uplift force for hold-down design, multiply the dead load resisting moment by 0.9 for seismic or wind forces for LRFD combination. For ASD load combinations, 0.6 shall be used for basic load combination per CBC 1605.3.1, or 0.9 shall be used for alternate load combination per CBC 1605.3.2. (CBC 1605.2 & 1605.3)
21. The values of  $C_s$  and  $E_v$  are permitted to be calculated using a value of  $S_{DS}$  equal to 1.0 but not less than 70-percent of  $S_{DS}$  where all criteria of ASCE 7 Section 12.8.1.3 are met. (ASCE 7 Section 12.8.1.3)
22. Basement, foundation, and retaining walls shall be designed for soil lateral loads per CBC 1610. For walls retaining 6 feet or more soil and occurring in SDC d through F, lateral seismic earth pressures shall be considered (CBC 1803.5.12)

#### **D. HORIZONTAL DIAPHRAGM**

1. Provide a diaphragm analysis to show diaphragm adequacy per ASCE 7 Section 12.10.
2. Provide details, properly referenced, of the anchorage system between the wood roof and floor diaphragms to the concrete or masonry walls per ASCE 7 Section 12.11.
3. Provide calculations and details on the plans for the sub-diaphragm and continuous cross tie system required for all wood diaphragms, providing lateral support to masonry or concrete walls. (CBC 1604.8, ASCE 7 Section 12.11.2.2)
  - a. The wall anchorage shall provide a positive direction connection between the wall and floor or roof construction, capable of resisting a horizontal force specified in CBC 1604.8 & ASCE 7 Section 12.11.2. In addition, a diaphragm to wall anchorage using embedded straps shall have the straps attached to or hooked around the reinforcing steel or otherwise terminated to effectively transfer forces to the reinforcing steel. (ASCE 7 Section 12.11.2.2.5)

- b. Elements of the wall anchorage system shall be designed for the forces specified in CBC 1604.8. The value of  $F_p$  used for the design of the elements of the wall anchorage system shall not be less than required per ASCE 7 Section 12.11.2.1.
  - c. Where elements of the wall anchorage system are loaded eccentrically or are not perpendicular to the wall, the system shall be designed to resist all components of the forces induced by the eccentricity.
  - d. Where pilasters are present in the wall, the anchorage force at the pilasters shall be calculated considering the additional load transferred from the wall panels to the pilasters. However, the minimum anchorage force at a floor or roof shall be that specified in “b” above. (ASCE 7 Section 12.11.2.2.7)
  - e. The strength design forces for steel elements of the wall anchorage system shall be 1.4 times the forces otherwise required above. (ASCE 7 Section 12.11.2.2.2)
  - f. Floor and roof diaphragms shall be designed to resist the forces per ASCE 7 Section 12.10.1. The maximum aspect ratio is 3:1 for unblocked diaphragm.
  - g. The maximum diaphragm shears used to determine the depth of the sub-diaphragm shall not exceed 75% of the diaphragm shear. (LBMC18.40.310)
  - h. The maximum length-to-width ratio of the wood, wood structural panel, or untopped steel deck sheathed structural sub-diaphragm shall be 2.5:1 per ASCE 7 Section 12.11.2.2.1.
  - i. The spacing of continuous ties shall not exceed 40' (LBMC 18.40.310).
  - j. The wall anchorage shall not be accomplished by use of toenails or nails subject to withdrawal. Wood ledgers or framing shall not be used in cross-grain bending or cross-grain tension.
  - k. Connection of a diaphragm to the vertical elements in structures having vertical irregularities identified in ASCE 7 T-12.3-2 shall be designed per the section referenced for the seismic design category specified in the table.
  - l. Structures having a horizontal structural irregularity of Type 2 in ASCE 7 T-12.3-1 for diaphragm chords and drag members shall be designed considering independent movement of the projecting wings of the structure. Each of these diaphragm elements shall be designed for the more severe of the following two assumptions:
    - i. Motion of the projecting wings in the same direction.
    - ii. Motion of the projection wings in opposing directions.
  - m. When designing the diaphragm to comply with the requirements stated above, the return walls, and fins/canopies at entrances shall be considered. Seismic compatibility with the diaphragm by either seismically isolating the element or by attaching the element and integrating its load into the diaphragm.
4. Provide a rigid diaphragm analysis if the building does not meet the conditional criteria under which a diaphragm can be idealized as flexible. (ASCE 7 Section 12.3.1.1)

## CHAPTER 17 STRUCTURAL TESTS AND SPECIAL INSPECTIONS

### E. STRUCTURAL OBSERVATION

- 1. Structural Observation is required per CBC 1704.6. Photocopy/blueprint the attached Structural Observation Program form on the plans.
- 2. Structural observations for seismic resistance: Structural observations shall be provided for those structures included in Seismic Design Category D, E or F, as determined in CBC 1613, where one or more of the following conditions exist: (CBC 1704)
  - a. The structure is classified as Risk Category III or IV in accordance with CBC 1604.5.
  - b. The height of the structure is greater than 75' above the base.
  - c. The structure is assigned to SDC E, is classified as Risk Category I or II in accordance with CBC 1604.5, and a lateral design is required for the structure or portion thereof.
  - d. When so designated by the registered design professional in responsible charge of the design.
  - e. When such observation is specifically required by the Building Official.

## F. SPECIAL INSPECTION

1. Where special inspection or testing is required, the registered design professional in responsible charge shall include a “Statement of Special Inspections” on the plans. (CBC 1704.3)
2. (Continuous) (Periodic) Special Inspection is required for \_\_\_\_\_ per CBC 1705. (CBC T-1705.2 steel, T-1705.3 concrete, 1705.4 masonry, 1705.5 wood, T-1705.6 soils, T-1705.7 driven deep foundations, or T-1705.8 cast-in-place deep foundations).
3. Special inspection of concrete elements in buildings and structures and concreting operations shall be as required by CBC 1705.3 and CBC T-1705.3.
4. Specify the required minimum level of Quality Assurance for masonry per TMS 402 Section 3.1.
5. Periodic Special Inspection is required for wood shear walls, shear panels, and diaphragms, including nailing, bolting, anchoring, and other fastening of components of the seismic force resisting system. Special inspection by a registered deputy inspector is not required where the fastener spacing of the sheathing is more than 4” on center. (CBC 1705.12.2)
6. Add the following notes to the plans:
  - a. Contractors responsible for the construction of a wind or seismic force resisting system/component listed in the “Statement of Special Inspection” shall submit a written statement of responsibility to the Building Official and the owner prior to the commencement of work on such system or component per CBC 1704.3.
  - b. Continuous Special Inspection by a registered deputy inspector is required for field welding, concrete strength  $f'c > 2500$  psi, high strength bolting, sprayed-on fireproofing, engineered masonry, high-lift grouting, pre-stressed concrete, high load diaphragms and special moment-resisting concrete frames. (CBC 1705).
  - c. Field Welding to be done by welders certified by an approved agency for (structural steel) (reinforcing steel) (light gauge steel). Continuous inspection by a registered deputy inspector is required.
  - d. Shop welds must be performed in a fabricator’s shop licensed by an approved agency.
  - e. (Trusses) (Structural Steel) (Glulam Beams) (Engineered Joist) (\_\_\_\_\_) shall be made by a fabricator licensed by an approved agency.

## CHAPTER 18 SOILS AND FOUNDATIONS

### G. SOIL INVESTIGATION

1. Provide a geological/soil investigation report to satisfy CBC 1803.3 through 1803.5. (CBC 1803.2)
2. Provide soils investigation to evaluate potential hazards due to earthquake including lateral pressure on basement walls, slope instability, liquefaction and soil strength loss, surface rupture, mitigating measures, and site-specific ground motions. (CBC 1803.5.11 and 1803.5.12)
3. Soil bearing pressure is limited to 1500 lbs./sq. ft. unless soil is classified per CBC 1806.2, or a soils report recommends otherwise. (CBC T-1806.2)

### H. EXCAVATION, GRADING AND FILL

1. Backfill with soil shall be free from organic material, debris, cobbles and boulders, place in lifts and compacted. (CBC 1804.3)
2. Slope ground immediately adjacent to foundation away from building at a slope of not less than 1:20 (5%), or at a 2% slope when a swale is provided. (CBC 1804.4)
3. The soils report requires foundation excavations to be reviewed by the soils engineer. Note on the foundation plan “Prior to requesting a foundation inspection, the soils engineer/geotechnical consultant shall inspect and approve the foundation excavations”.

### I. FOOTINGS AND FOUNDATIONS

1. Minimum depth of footings below the undisturbed ground surface shall be 12”. (CBC 1809.4)
2. Footings on or adjacent to slopes shall comply with CBC 1808.7.1 through 1808.7.5. (CBC 1808.7)

3. Footings shall comply with CBC T-1809.7 for light-framed construction unless specifically designed. All construction exceeding 1 story shall have specific design provided. (CBC 1809.7& LBMC 18.40.440)
4. Provide grade beam ties to interconnect individual pile caps and caissons. Ties shall be capable of resisting, in tension or compression, a minimum horizontal force of the lesser of 10% of the larger column vertical load multiplied by  $S_{Ds}$  and 25% of the smaller pile or column design gravity load. (CBC 1810.3.13)
5. The soils/geotechnical engineer shall review and approve the foundation plans and details for general conformance with the recommendations in the geotechnical/soils report, if one is provided or required, and shall bear the seal and signature of the soils/geotechnical engineer.
6. Deep foundations shall be designed and installed in accordance with recommendations of foundation investigation. (CBC 1810.1.1)
7. Retaining wall shall be designed for a minimum factor of safety of 1.5 against lateral sliding and overturning. (CBC 1807.2.3)
8. Provide complete shoring plans for the subterranean excavation or provide plans and sections showing cut slopes as recommended per approved soils report. Before commencing the excavation, proof of notification to adjoining property owners shall be submitted. (CBC 3307)
9. Concrete and masonry foundation walls shall be designed in accordance with Chapter 19 or 21. (LBMC 18.40.400)

## **CHAPTER 19 CONCRETE**

### **J. GENERAL**

1. Construction documents shall include the following information as applicable to the project:
  - a. Specified concrete compressive strength at the stated ages or stages of construction.
  - b. Specified grade of reinforcement.
  - c. Size and location of structural elements, reinforcement and anchors.
  - d. Reinforcement anchorage length, location and length of lap splice.
  - e. Type and location of mechanical and/or welded splices of reinforcement.
2. The allowable service loads of headed bolts and headed stud anchors cast in concrete for shear and tension, shall not be permitted.
3. Strength design of anchors installed in concrete shall be designed in accordance with Chapter 17 of ACI 318.
4. Connections between concrete members shall comply with ACI 318 Section 4.10 for structural integrity.
5. IMF columns supporting reactions from discontinuous stiff members shall be designed and detailed in accordance with ACI 318 Section 18.4.3.6. SMF columns supporting reactions from discontinuous stiff members shall be designed and detailed in accordance with ACI 318 Section 18.7.5.6.
6. Provide details, properly referenced, of the anchorage system between the wood roof and floor diaphragms and the concrete or masonry walls. The connections shall be Capable of resisting horizontal forces specified in ASCE 7 Section 12.11.2.
7. Non-structural components (precast panels, exterior non-bearing, non-shear wall panels, or elements) that are attached to or enclose the exterior shall be designed to resist the forces and connections shall be in compliance with ASCE 7 Sections 13.4.1, 13.4.2, and 13.5.3.
8. Alternate slender wall design for out-of-plane bending must satisfy deflection limitation in accordance with ACI 318 Section 11.8.4.

### **K. DETAILS OF REINFORCEMENT**

1. Foundations with stem walls shall be reinforced with a minimum of one No. 4 bar at the top of the wall and one No. 4 bar at the bottom of the footing. (CBC 1905.1.7, ACI 318 Section 14.1.4(c))
2. Concrete cover for reinforcement shall comply with ACI 318 Section 20.6.1.

3. Provide minimum thickness of 3-1/2" concrete on-grade slab and identify reinforcement and moisture barrier. (CBC 1907.1)
4. Slabs-on-grade with turndown footings shall be reinforced with a minimum of one No. 4 bar at the top and one No. 4 bar at the bottom. (CBC 1905.1.7, ACI 318 Section 14.1.4(a))
5. Transverse reinforcement for compression members shall comply with ACI 318 Section 10.7.6.
6. Transverse reinforcement for compression reinforcement in flexural members shall comply with ACI 318 Section 9.7.6.4.
7. Provide shrinkage and temperature reinforcement to comply with ACI 318 Section 24.4.
8. Provide an analysis of all tilt up panels with openings. Show that the reinforcing in the panels, on each side of the openings is adequate for in-plane and out-of-plane forces combined with axial loads. (ACI 318 Sections 18.2.1.5 and 18.10)
9. Provide confinement reinforcement in wall piers in accordance with ACI 318 Section 18.10.8.
10. Concrete structural wall reinforcement shall be terminated with required development length beyond the boundary reinforcing at the vertical and horizontal end faces of wall sections. (ACI 318 Section 18.10.2)

## CHAPTER 21 MASONRY

### L. GENERAL

1. Identify the following masonry material specifications and add as notes to the structural plans: (TMS 402 Section 1.2)
  - a. Concrete masonry units – ASTM C90
  - b. Mortar – ASTM C270. Specify mortar proportions per ASTM C270.
  - c. Grout – ASTM C476. Specify grout proportions per ASTM C476.
  - d. Compressive strength. Specify strength per TMS 602 T-2.
2. Glass unit masonry having an installed weight > 40 psf or a height > 12' shall not be permitted to be supported on wood construction. (TMS 402 Section 13.3.2.2)
3. Masonry and concrete chimneys shall be anchored at each floor, ceiling or roof line more than 6' above grade. Two 3/16" x 1" straps shall be embedded a minimum of 12" into the chimney.
4. The use of 1/2 the allowable stress in the masonry wall design in lieu of providing special inspections required by CBC 1705.4 is not permitted.
5. Loads for special reinforced masonry shear designed by the allowable stress design method shall be designed to resist 1.5 times the seismic forces required by CBC Chapter 16. (TMS 402 Section 7.3.2.6.1.2)
6. Masonry shear wall shall be designed as a "special reinforced masonry shear wall" per ASCE 7 T-12.2-1. Other masonry shear wall types are not permitted in seismic design category D and higher.
7. Masonry walls, unless isolated from the seismic force-resisting system, shall be considered participating elements per TMS 402 Section 7.3.2

## CHAPTER 22 STEEL

### M. GENERAL

1. Identify the following steel material specifications and add as notes to the structural plans: (ANSI/AISC 360 Section A3) (ANSI/AISC 341 Sections A3 & D2)
  - a. Hot rolled structural shape – ASTM (A36) (A992)
  - b. Hollow structural sections (HSS) – ASTM (A500 Grade B or C) (A501)
  - c. Pipe – ASTM A53 Grade B
  - d. Plates – ASTM (A36) (A572 Grade 50) (A588)
  - e. Bars – ASTM (A36) (A572 Grade 50)



- f. Bolts – ASTM (A307) (A325) (A490)
  - g. Nuts – ASTM A563
  - h. Washers – ASTM F436
  - i. Anchor or threaded rods – ASTM F1554
  - j. Filler metal and flux for welding – AWS (A5.1) (A5.5)
2. Identify on the structural plans the inspection points and frequencies required for the following (ANSI/AISC 360 Chapter N and ANSI/AISC 341 Chapter J):
    - a. Visual Welding Inspection
    - b. Nondestructive Testing (NDT) of Welds
    - c. Inspection of Bolting
    - d. Other Inspections
  3. The registered design professional in responsible charge shall indicate the following QA/QC information in accordance with ANSI/AISC 341 Chapter J on the structural plans:
    - a. Referenced documents.
    - b. Material specifications.
    - c. Welding processes.
    - d. Inspection & nondestructive testing.
  4. Column base plate shall be designed in accordance with ANSI/AISC 341 Section D2.6 and ANSI/AISC 360 Section J8.
  5. Column splices when column is not part of the seismic load resisting system shall be detailed in accordance ANSI/AISC 341 Section D2.5.
  6. Beams and columns shall meet the width-thickness ratio limitations of ANSI/AISC 360 T-B4.1a and T-B4.1b.
  7. Bolts and welds shall not be designed to share force in a joint or the same force component in a connection. (ANSI/AISC 341 Section D2.2)
  8. The design, manufacture and use of open web steel joists and joist girders shall be as follows: (CBC 2207)
    - a. The registered design professional in responsible charge shall indicate on the structural plans the steel joist and/or steel joist girder designations and indicate the requirements for joist and joist girder design, layout, end supports, anchorage, non-SJI standard bridging, bridging termination connections and bearing connection design to resist uplift and lateral loads.
    - b. Submission of the steel joist and joist girder calculations is required and shall bear the seal and signature of the registered design professional in responsible charge.
    - c. Location of steel joist placement shall be clearly identified on the structural plans including connection for joist and joist girder supports, field splices, bridging attachment and joist headers. List all applicable loads used in the design of the steel joists and joist girders.
  9. Add the following notes to the plans:
    - a. Individual structural members and assembled panels of cold-formed steel construction shall be protected against corrosion with an approved coat of paint, enamel or other approved protection. (CBC 2203.1)
    - b. Anchor rods shall be set accurately to the pattern and dimensions called for on the plans. The protrusion of the threaded ends through the connected material shall be sufficient to fully engage the threads of the nuts, but shall not be greater than the length of the threads on the bolts.(CBC 2204.3)
    - c. Contractor documents shall be submitted to and reviewed by the registered design professional in responsible charge, including but not limited to, shop drawings, erection drawings, welding procedure specifications (WPS), manufacturer certificate of conformance for all electrodes, fluxes and shielding gases, and manufacturer product data sheets or catalog for SMAW, FCAW and GMAW process. (ANSI/AISC 341 Section J2)



- d. All bolts used in a seismic load force resisting system shall be pretensioned high strength bolts and shall meet the requirements for slip critical faying surfaces in accordance with ANSI/AISC 360 Section J3.8 with a Class A surface. (ANSI/AISC 341 Section D2.2)
- e. All welds used in members and connections in the seismic load force resisting shall be made with a filler metal per ANSI/AISC 341 Section A3.4a.
- f. Welds designated as “demand critical” shall be made of filler metals meeting the Charpy V-Notch toughness per ANSI/AISC 341 Section A3.4b.

**N. CANTILEVERED COLUMN**

- 1. Where HSS or pipe sections are used as cantilever column, the following shall apply:
  - a. Design as an ordinary frame using an  $R = 1-1/4$  (may be used in SDC “D”). (ASCE 7 T-12.2-1)
  - b. The use of grade beam is required (i.e., flag pole formula per CBC 1807.3 is not allowed).
  - c. Extend member into grade beam (i.e., use of base plate designed as moment connection is not allowed).
  - d. Apply over-strength factor to grade beam design per ASCE 7 Section 12.2.5.2.
  - e. Limit height and weight applied to frame per ASCE 7 Section 12.2.5.6.
- 2. Where wide flange sections are used as cantilever column, the following shall apply:
  - a. Design as a special frame using an  $R = 2.5$  and comply with ANSI/AISC 341 T-D1.1.
  - b. The use of grade beam is required (i.e., flag pole formula per CBC 1807.3 is not allowed).
  - c. Extend member into grade beam (i.e., use of base plate designed as moment connection is not allowed).
  - d. Apply over-strength factor to grade beam design per ASCE 7 Section 12.2.5.2.
  - e. Maximum 35’ height limit per ASCE 7 T-12.2-1.
- 3. Where light or flag poles are designed as cantilever column conforming to ASCE 7 Chapter 15, flag pole formula per CBC 1807.3 may be used.

**CHAPTER 23 WOOD**

**O. GENERAL**

- 1. The allowable values used in the structural design shall be per the 2022 CBC and 2018 NDS Supplement.
- 2. Identify the following wood material specifications and add as notes to the structural plans: (CBC 2303 & ANSI/AWC NDS)
  - a. Sawn lumber – DOC PS 20. Specify grade and species.
  - b. Prefabricated wood I-joists – ASTM D5055.
  - c. Structural glued laminated timbers – ANSI/AITC A190.1 and ASTM D3737. Specify grade and lamination species.
  - d. Structural glued cross-laminated timbers – ANSI/APA PRG320
  - d. Wood structural panels – DOC PS 1, PS 2, or ANSI/APA PRP210. Specify grade, construction and glue type.
  - e. Preservative-treated wood – AWWA U1 and M4. Specify identification of treating manufacturer, type of preservative used, and minimum preservative retention (pcf).
  - f. Nails and staples – ASTM F1667. Specify nail length and shank diameter; staple gage, crown width, and leg length.
- 3. Cross-reference all calculations for joists, beams, shear walls, etc, to the structural framing/floor plans.
- 4. Submit structural calculations and or design details for the following: \_\_\_\_\_  
\_\_\_\_\_.

5. The registered design professional in responsible charge shall be designated on the building permit application and plans.
6. Provide a detailed schedule of "Statement of Special Inspections" on the plans in accordance with CBC 1704.3.
7. Provide a framing nailing schedule on the plans meeting the requirements of CBC T-2304.10.1.
8. Add the following notes to plans:
  - a. Foundation sills shall be naturally durable or preservative-treated wood. (CBC 2304.12.1.4)
  - b. Glulam beams must be fabricated in an approved shop. Identify grade symbol and lamination species per ANSI/AWC NDS Supplement T-5-A.
  - c. Provide lead hole 40% to 70% of threaded shank diameter and full diameter for smooth shank portion. (ANSI/AWC NDS)
  - d. All bolt holes shall be drilled 1/32" to 1/16" oversized. (ANSI/AWC NDS Section 12.1.3.2)
  - e. Hold-down connector bolts into wood framing require approved plate washers; and hold-downs shall be tightened just prior to covering the wall framing. (LBMC 18.40.520)
  - f. Hold-down hardware must be secured in place prior to foundation inspection.
  - g. Roof diaphragm nailing to be inspected before covering. Strength axis of wood structural panel shall be perpendicular to supports. Floor diaphragms shall be tongue and groove or have blocked panel edges. Wood structural panel spans shall conform to CBC T-2304.8(1).
  - h. All diaphragm and shear wall nailing shall utilize common nails with full heads unless otherwise approved. (CBC 2306.2)
  - i. Fasteners in preservative treated wood or fire-retardant treated wood shall be in accordance with CBC 2304.10.5.
  - j. Mechanically driven nails used in wood structural panel shear walls shall meet the same dimensions as that required for hand-driven nails, including diameter, minimum length, and minimum head diameter. Clipped head or box nails are not acceptable. (LBMC 18.40.500)
  - k. Engineered wood products such as prefabricated wood I-joists, structural glued-laminated timber, structural composite lumber and design trusses shall not be notched or drilled except where permitted by the manufacturers' recommendations or where the effects of such alterations are specifically considered in the design of the member by a registered design professional in responsible charge.
  - l. The quality mark shall be on the stamp or label affixed to preservative-treated wood and shall include the following information: identification of treating manufacturer, type of preservative used, minimum preservative retention (pcf), end use for which the product is treated, AWPA standard to which the product was treated, and identity of the accredited inspection agency. (CBC 2303.1.9.1)
  - m. Moisture content of preservative-treated wood shall be 19% or less before being covered with insulation, interior wall finish, and floor covering of other materials (CBC 2303.1.9.2).
  - n. Moisture content of fire-retardant-treated wood shall be 19% or less for lumber and 15% or less for wood structural panels before use. (CBC 2303.2.8)
  - o. Sheathing nails or other approved sheathing connectors shall be driven so that their head or crown is flush with the surface of the sheathing. (CBC 2304.10.2)
  - p. Weather-exposed beams or posts supporting balconies, porches shall be naturally durable or preservative-treated wood per CBC 2304.12.2.3.
  - q. Weather-exposed wood structural members supporting moisture-permeable floors or roofs, shall be of naturally durable or preservative-treated wood unless separated from such floors or roofs by an impervious moisture barrier. The impervious moisture barrier system shall provide positive drainage of water that infiltrates the moisture-permeable floor topping per CBC 2304.12.2.5.
  - r. The construction documents shall include details for all elements of the impervious moisture barrier system. The construction documents shall include manufacturer's installation instructions. All elements of the impervious moisture barrier system shall not be concealed until inspected and approved per CBC 107.2.7 & 110.3.8.1.

- s. Enclosed framing in exterior balconies and elevated walking surfaces that are exposed to the weather shall be provided with openings that provide a net free cross ventilation area not less than 1/150 of the area of each separate space per CBC 2304.12.2.6.
- t. The hole in the plate washer is permitted to be diagonally slotted with a width of up to 3/16" larger than the bolt diameter and a slot length not to exceed 1-3/4", provided a standard cut washer is placed between the plate washer and the nut. (ANSI/AWC SDPWS Section 4.3.6.4.3 and CBC 2308.3.2)
- u. Fire-retardant-treated lumber and wood structural panels shall be labeled. The label shall contain the following items: the identification mark of an approved agency in accordance with CBC 1703.5, identification of the treating manufacturer, the name of the fire-retardant treatment, the species of wood treated, flame spread and smoke-developed index, method of drying after treatment, conformance with appropriate standards in accordance with CBC 2303.2.1 through 2303.2.5.
- v. Labeling for fire-treated wood exposed to weather, damp or wet locations, must include the words "no increase in the listed classification when subjected to the Standard Rain Test." (ASTM D 2898).

## **P. FOUNDATION**

1. Call out foundation bolt size and spacing on foundation plan. Unless otherwise required by design, foundation bolts shall have a minimum 1/2" diameter for SDC D or a minimum 5/8" diameter for SDC E or F, a minimum embedment of 7" into the concrete or masonry foundation, spaced not more than 6' spacing, 2 anchors minimum per section, located 4" to 12" from each end of that section, and 0.229" x 3" x 3" plate washers.
2. Braced wall lines shall be supported by continuous foundations unless an alternate load path is specifically detailed and justified by design.
3. Show a minimum 18" under floor clearance from grade to bottom of floor joists and minimum 12" clearance to bottom of girders. (CBC 2304.12.1.1)
4. A foundation cripple wall over 14" in height shall be framed of studs having the size required for an additional story; cripple walls shall be framed and sheathed as required by design.
5. Wood sill plate shall be a minimum 8" above adjacent grade. (CBC 2304.12.1.2)

## **Q. WOOD FRAMING**

1. Specify the size, spacing and direction of rafters.

Provide designed ridge beams (4x minimum) for open beam vaulted ceilings, or when ceiling joists or rafter ties are not provided.

2. Ridge / hip / valley members shall be designed as vertical load carrying members when the roof slope is less than 3:12. Provide calculations.
3. Show ceiling joist size, spacing, and direction on plans.
4. For wood structural panel roof diaphragms, specify thickness, grade, panel span rating, and nailing schedule. As a minimum, 8d common nails shall be used. (ANSI/AWC SDPWS T4.2A, T4.2B, T4.2C, CBC T-2306.2(2))
5. Show blocking at ends of rafters and trusses at exterior walls, and at supports of floor joists
6. Show size, spacing and direction of floor joists.
7. Beams, girders, doubled joists, walls or other bearing partitions are required under parallel bearing partitions.
8. For wood structural panel floor diaphragm specify thickness, grade, T&G edges, panel span rating, nailing schedule, and panel layout pattern. (ANSI/AWC SDPWS, T4.2A, T4.2B, T4.2C, CBC T-2306.2(2))
9. Headers shall be provided over each opening in exterior and interior bearing walls.
10. Detail is required for header support at the corner window(s) at \_\_\_\_\_.
11. Studs in bearing walls are limited to 10' in height unless an approved design is submitted.
12. Provide shrinkage analysis for wood stud walls and bearing partitions supporting more than two floors and a roof. (CBC 2304.3.3)

13. Unless otherwise demonstrated as acceptable by design, studs supporting two floors, ceiling, and roof must be 3x4 or 2x6 at 16" o.c.
14. Note the use of full-length studs (balloon frame) on exterior walls of rooms with vaulted ceiling.
15. Call out all post sizes. Elements supporting concentrated loads which transfer forces to members below should be shown as "Post Above" on the second story framing plan and foundation plan. Call out their locations, connection hardware, and provide applicable details.
16. Provide axial plus bending column calculations to justify required number of studs/posts adjacent to windows and corners per CBC 1605, ASCE 7 Chapter 26, and ANSI/AWC NDS Section 3.7. Calculations shall address elements at areas of discontinuity.
17. Detail lateral support for the top of interior non-bearing walls when manufactured trusses are used. (CBC 1607.15)
18. Shear wall height shall be defined as the maximum clear height from the top of the foundation to the bottom of the diaphragm framing above OR the maximum clear height from the top of the diaphragm to the bottom of the diaphragm framing above. (ANSI/AWC SDPWS)

## R. WOOD TRUSSES

1. Provide calculations and specific details, for the proposed roof trusses, signed and stamped by the manufacturing engineer. The registered design professional in responsible charge shall review, approve and stamp truss design for loads, location, and suitability of intended use. (CBC 2303.4)
2. Panel point at bottom chord of trussed roof that occurs over uses such as manufacturing, storage warehouses and repair garages shall be designed for concentrated live load of 2,000 lbs. Revise plans and/or calculations to show compliance. (CBC T-1607.1)
3. Where permanent bracing is required, it shall comply with CBC 2303.4.1.2. Truss submittal package shall include the truss member permanent bracing specification. Revise truss placement diagram to show all required permanent bracings in accordance with CBC 2303.4.1.1.
4. Revise truss submittal package to specify all required anchorage/hangers to transfer load(s); including uplift forces of each truss to the supporting structures. (CBC 2303.4.1.1)
5. Revise framing and foundation plans to show load paths of all uplift forces shown at ends of designed trusses supported by bearing walls or beams. (CBC 2303.4.1.1)
6. The justification of the transfer of loads and anchorage details of each truss to the supporting structure is the responsibility of the registered design professional in responsible charge. Justify transfer of loads at \_\_\_\_\_, provide anchorage details at \_\_\_\_\_.

## S. LATERAL DESIGN

1. Provide a diaphragm analysis to show diaphragm adequacy. (CBC 2305.2, ASCE 7 Section 12.10)
2. When assuming flexible horizontal diaphragms for lateral force distribution, the base shear and lateral design shall meet the requirements of CBC 1613.6 and ASCE 7 Sections 12.3.1.1 and 12.11.2.2.
3. Wood structural panel diaphragms and shear walls using staples as fasteners are not permitted. (LBMC18.40.490)
4. Walls braced to resist wind and seismic forces shall not exceed the following height to width ratios: 2:1 for wood structural panels; 1.5:1 for gypsum wallboard and Portland cement plaster (stucco). 3.5:1 ratio may be used for wood structural panels provided the allowable shear values in ANSI/AWC SDPWS T-4.3A are multiplied by  $2b_s/h$ , 2:1 ratio is allowed for gypsum wallboard or Portland cement plaster if blocked. (ANSI/AWC SDPWS Section 4.3.4 & T-4.3A)
5. Wood structural panel shear walls shall meet the story drift limitation of ASCE 7 Section 12.12.1. Conformance shall be determined by testing or calculations. Calculated deflection shall be determined according to CBC 2305.3. (ASCE 7 Section 12.12.1 & T-12.12-1)
6. A common framing member at adjoining panel edges shall be at least 2" nominal thickness.
7. Common framing member or blocking shall be 3" nominal or greater with staggered nailing where nail spacing of 2" on center is specified, nail spacing of 3" on center at 10d common nails, or nominal unit shear capacity exceeds 700 plf. Alternately, two 2" nominal members fastened together per SDPWS-2015 Section 4.3.6.1.1 are acceptable. Where fasteners connecting the two members together are spaced less than 4" on center, they shall be staggered.



8. Portland cement plaster (stucco), gypsum lath and gypsum wallboard shear walls are not permitted below the top level of wood construction in a multilevel building.
9. When a diaphragm and or shear wall framing is not DFL or SP, the allowable shear values shall be adjusted per footnote 3 of ANSI/AWC SDPWS T-4.3A.
10. Provide calculation showing the overturning moments in all shear wall segments. Specify the hold-down connector model at each location on the foundation plan.
11. The capacity of hold-down connectors that do not consider cyclic loading of the product shall be reduced to 75% of the allowable earthquake load values. (LBMC 18.40.520)
12. Detail the shear transfer connections that transfer lateral forces from horizontal diaphragms through intermediate elements and shear walls to the foundation.
13. Specify on the framing plans the shear wall material and thickness and the size and spacing of fasteners and sole plate nailing. Call out anchor bolt spacing that is compatible with the shear wall capacity.
14. The maximum nominal shear for 3/8" wood structural panel resisting seismic forces is 400 plf. (LBMC 18.40.540)
15. Wood structural panels in shear walls shall be at least 3/8" thick and studs spaced no more than 16" o.c. (LBMC 18.40.540)
16. Detail how the interior shear walls or lateral force resisting elements are connected to the roof/floor diaphragm(s).
17. Provide a drag strut at \_\_\_\_\_ . Show details of strut and top plate connections.
18. Provide complete calculations, including deflection, and details for shear wall with openings, perforated or force transfer around openings method. (ANSI/AWC SDPWS Section 4.3)

**ADDITIONAL WRITTEN COMMENTS**

No.	Comment	Code Sec. No.

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