

**GENERAL PROJECT INFORMATION**

PLAN CHECK NO. \_\_\_\_\_ DISTRICT NO \_\_\_\_\_

JOB ADDRESS \_\_\_\_\_ CITY \_\_\_\_\_ ZIP \_\_\_\_\_

NOTE: Numbers in the parenthesis ( ) refer to sections of the 2023 edition of the Los Angeles County Building Code (LACBC), Table (T), Building Code Manual (BCM), Residential Code Manual (RCM), 2016 Minimum Design Loads and Associated Criteria for Buildings and Other Structures (ASCE7-16), 2019 Building Code Requirements for Structural Concrete (ACI 318-19)

**INSTRUCTIONS**

- Corrections with circled item numbers apply to this plan check.
- In the left-hand margin of the circled corrections, please indicate the sheet number and detail or note number on the plans where the corrections are made. Resubmit marked original plans and two corrected sets of plans, calculations and this plan review list.
- Incomplete, unclear, or faded drawings or calculations will not be accepted.
- Incorporate all comments as marked on checked set of plans and calculations and these correction sheets.

**STRUCTURAL CALCULATION**

**GENERAL**

1. Design forces shall be in accordance with the Load and Resistance Factor Design specified in LACBC 1605 and ASCE7 § 2.3
2. The R value used in determining the base shear for bearing wall systems shall not exceed 5.0 for special reinforced concrete shear walls and 4.0 for intermediate precast concrete shear walls. (ASCE7 T12.2-1)
3. The R value used in determining the base shear for building frame systems shall not exceed 6.0 for special reinforced concrete shear walls and 5.0 for intermediate precast concrete shear walls. (ASCE7 T-12.2-1)
4. In storage and warehouse occupancies, include a minimum 25% of the floor live load for the seismic dead load, W. (ASCE7 12.7.2.1)
5. The shear strength reduction factor, "Φ", shall be per ACI318 §21.2.4. Use Φ = 0.60 unless nominal shear strength of the member is greater than shear corresponding to the development of nominal flexural strength. (ACI 318 21.2.4.1)

**SHEAR**

6. Walls shall have nominal shear strength per the following formula: (ACI Eq 18.10.4.1)

$$V_n = A_{cv}(\alpha_c \lambda \sqrt{f'_c} + \rho_t f_y)$$

Where  $\alpha_c = 3.0$  for  $h_w / \ell_w \leq 1.5$

$\alpha_c = 2.0$  for  $h_w / \ell_w \leq 1.5$

$\alpha_c$  varies linearly between 3.0 and 2.0 for  $h_w / \ell_w$  between 1.5 and 2.0

7.  $h_w / \ell_w$  used in determining  $V_n$  for segments of a wall shall be the larger of the ratios for the entire wall and the segment of wall considered. (ACI318 18.10.4.2)
8. For  $h_w / \ell_w$  ratios < 2.0, the reinforcement ratio shall be  $\rho_t \geq \rho_{t1}$  (ACI318 18.10.4.3)
9. Nominal shear strength,  $V_n$ , of all wall segments shall not exceed  $8A_{cv}\sqrt{f'_c}$  for the entire wall and  $10A_{cv}\sqrt{f'_c}$  for individual wall piers. (ACI 318 18.10.4.4)

**FLEXURE AND AXIAL LOADS**

10. Shear walls subject to combined flexural and axial loads shall be designed in accordance with ACI318 §22.4. The effects of openings shall be considered. (ACI318 18.10.5.1)
11. Effective flange widths of flanged sections shall extend from the face of the web to a distance equal to the smaller of 1/2 the distance to an adjacent wall web and 25% of the total wall height. (ACI318 18.10.5.2)
12. Special boundary elements at the edges of structural walls are required per ACI318 § 18.10.6.2 and 18.10.6.3. (ACI 318 18.10.6.1)

13. Walls that are effectively continuous from the base of the structure to the top of the wall and are designed to have a single critical section for flexure and axial loads shall meet the following: (ACI 318 18.10.6.2)
- Compression zones shall be reinforced with special boundary elements where:
 
$$\frac{1.5\delta_u}{h_{wcs}} \geq \frac{l_w}{600c} \quad \text{where} \quad \frac{\delta_u}{h_{wcs}} \geq 0.005 \quad (\text{Eq 18.10.6.2a})$$
  - Boundary reinforcement shall extend vertically above and below the critical section a distance not less than the larger of  $l_w$  or  $M_u/4V_u$
14. Structural walls not designed to the provisions of ACI 18.10.6.2 shall have special boundary elements at boundaries and edges around the openings of the wall where the maximum extreme fiber compressive stress exceeds  $0.2f'_c$ . The special boundary element could be discontinued where compressive stress is less than  $0.15f'_c$ . (ACI 18.10.6.3)

### WALL PIER

15. Wall piers not designated as part of the seismic force resisting system shall satisfy the requirements of 18.10.8. (ACI318 18.14.6.1)
16. Wall pier with a horizontal length-to-thickness ratio less than 2.5 shall be designed as columns. (ACI R18.10.8)

### STRUCTURAL DETAIL

17. Longitudinal and transverse reinforcement ratios  $\rho_l$  and  $\rho_t$  for shear walls shall not be less than 0.0025, except when  $V_u \leq \lambda\sqrt{f'_c}A_{cv}$ ,  $\rho_t$  shall be permitted to be reduced to the values of ACI Section 11.6.
18. Reinforcement spacing each way in shear walls shall not exceed 18". (ACI318 18.10.2.1)
19. Two curtains of reinforcement shall be used if the in-plane factored shear force,  $V_u \geq 2\lambda\sqrt{f'_c}A_{cv}$  or  $h_w/l_w \geq 2.0$
20. All continuous reinforcements in shear walls shall be anchored or spliced for  $f_y$  in tension in accordance with Chapter 25.4, 25.5 of ACI318 and (a) through (c): (ACI 18.10.2.3)
- Longitudinal reinforcement shall extend at least 12 feet above the point at which is no longer required to resist flexure by at least  $0.8l_w$ , except at the top of the wall.
  - At locations where yielding of longitudinal reinforcement is likely to occur as a result of lateral displacements, development lengths of longitudinal reinforcement shall be 1.25 times the values calculated for  $f_y$  in tension.

- Lap splices longitudinal reinforcement within boundary regions shall not be permitted over a height equal to  $h_x$  above, and  $l_d$  below, critical sections where yielding of longitudinal reinforcement is likely to occur as a result of lateral displacements. The value of  $h_{sx}$  need not exceed 20 feet. Boundary regions include those within lengths specified in 18.10.6.4(a) and within a length equal to the wall thickness measured beyond the intersecting regions of the connected walls.
  - Mechanical splices of reinforcement shall conform to ACI318 § 18.2.7 and welded splices of reinforcement shall conform to ACI318 § 18.2.8.
21. Two #5 bars shall be provided around all window and door opening (in walls having two layers of reinforcement in both directions). Such bars shall be anchored to develop  $f_y$  in tension at the corners of openings extended or extended of the corners of the openings not less than 24". (ACI318 11.7.5.1)
22. For wall piers and wall segments, spacing of transverse reinforcement with seismic hooks shall not exceed 6" and shall be extended beyond the pier clear height for at least 12". (ACI318 18.10.8.1 (d) and (e))
23. Reinforcing bars used in shear walls shall comply with ACI318 § 20.2.1 and 20.2.2
24. Columns supporting discontinuous shear wall elements shall be reinforced in accordance with ACI318 § 18.7.5.6
25. Tilt-up panels shall be detailed to conform to requirements of intermediate precast special structural walls. (LACBC 1905.4)

### SPECIAL BOUNDARY ELEMENTS

26. Where special boundary elements are required, the following shall be satisfied: (ACI318 18.10.6.4)
- The boundary elements shall extend horizontally from the extreme compression fiber minimum ( $c - 0.1l_w$ ) or  $c/2$ , whichever is larger.
  - Width of the flexural compression zone,  $b$ , over the horizontal distance calculated by 18.10.6.4(a), including flange if present, shall be at least  $h_w/16$ .
  - For walls or wall piers with  $h_w/l_w \geq 2.0$  that are effectively continuous from the base of structure to top of wall, designed to have a single critical section for flexure and axial loads, and with  $c/l_w \geq 3/8$ , width of the flexural compression zone  $b$  over the length calculated in 18.10.6.4(a) shall be greater than or equal to 12 in.
  - In flanged sections, the boundary element shall include the effective flange width in compression and shall extend at least 12" into the web.

- e. The boundary element transverse reinforcement shall satisfy 18.7.5.2(a) through (d) and 18.7.5.3, except the transverse reinforcement spacing limit of 18.7.5.3(a) shall be one-third of the least dimension of the boundary element. The maximum vertical spacing of transverse reinforcement in the boundary element shall also not exceed that in Table 18.10.6.5(b).
- f. Transverse reinforcement shall be arranged such that the spacing  $h_x$  between laterally supported longitudinal bars around the perimeter of the boundary element shall not exceed the lesser of 14 in. and two-thirds of the boundary element thickness. Lateral support shall be provided by a seismic hook of a crosstie or corner of a hoop.
- g. The amount of transverse reinforcement shall be in accordance Table 18.10.6.4(g)
- i. For spiral or circular hoops, it's the greater of
- $$\rho_s \geq \begin{cases} 0.45(A_g/A_{ch} - 1) f'_c/f_{yt} \\ 0.12(f'_c/f_{yt}) \end{cases}$$
- ii. For rectilinear hoops, it's the greater of
- $$A_{sh} \geq \begin{cases} 0.09 f'_c/f_{yt} \\ 0.3(A_s/A_{sb} - 1) f'_c/f_{yt} \end{cases}$$
- h. Concrete within the thickness of the floor system at the special boundary element location shall have specified compressive strength at least  $0.7f'_c$  of the wall.
- i. For a distance above and below the critical section specified in 18.10.6.2(b), web vertical reinforcement shall have lateral support provided by the corner of a hoop or by a crosstie with seismic hooks at each end. Transverse reinforcement shall have a vertical spacing not to exceed 12 in. and diameter satisfying 25.7.2.2.
- j. Where the critical section occurs at the wall base, the boundary element transverse reinforcement at the wall base shall extend into the support at least  $l_d$  in accordance with 18.10.2.3, of the largest longitudinal reinforcement in the special boundary element. Where the special boundary element terminates on a footing, mat, or pile cap, special boundary transverse reinforcement shall extend at least 12 in. into the footing, mat, or pile cap, unless a greater extension is required 18.13.2.4.
- k. Horizontal reinforcement in the wall web shall extend to within 6 in. of the end of the wall. Reinforcement shall be anchored to develop  $f_y$  within the confined core of the boundary element using standard hooks or heads.
27. Where special boundary elements are not required by ACI318 § 18.10.6.2 or 18.10.6.3, the following shall be satisfied:
- a. If longitudinal reinforcement ratio at wall boundary exceeds  $400/f_y$ , the boundary transverse reinforcement shall satisfy ACI318 § 18.7.5.2 (a) through (e) over the distance calculated in accordance with 18.10.6.4(a)
- b. Except when  $V_u$  is less than  $\lambda\sqrt{f'_c}A_{cv}$  horizontal reinforcement terminating at the edges of structural walls without boundary elements shall have a standard hook engaging the edge reinforcement or "U" stirrup of the same size and spacing as, and spliced to, the horizontal reinforcement. (ACI 18.10.6.5(a))

## STRUCTURAL NOTES

### GENERAL NOTES

The following general structural notes shall be made part of the construction documents.

28. Construction documents shall include the following information as applicable to the project:
- Specify concrete compressive strength.
  - Specify grade of reinforcement.
  - Size and location of structural elements, reinforcement and anchors.
  - Reinforcement anchorage length, location, and length of lap splice.
  - Type and location of mechanical and/or welded splices of reinforcement.
29. Minimum compressive strength for concrete shear walls is  $f'_c = 3000$  psi. (ACI318 19.2.1.1)
30. Continuous Special Inspection by a registered deputy inspector is required for concrete with strength  $f'_c > 2500$  psi. (1705.3)

