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 including Supplement No.1 (ASCE7), 2021 Special Design Provisions for Wind and Seismic (SDPWS), 2016 Building Code Requirements and Specification for Masonry Structures TMS 402-16 & TMS 602-16

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 ASCE7 Section 2.3 or Allowable Stress Design specified in ASCE7 Section 2.4 (1605.1)
2. Provide structural calculations and details of reinforcement for piers, columns, beams, and for the distribution of concentrated vertical loads at walls.
3. Provide structural calculations for the design of masonry columns and walls considering the effects of combined axial and bending stresses due to eccentricity and lateral loading. (TMS 402 § 8.3.4, 8.3.5 & 9.3.5)
4. Provide calculations for the design of anchor bolts in masonry considering edge distance and effective embedment depth in accordance with TMS 402 § 8.1.3.3 for allowable stress design or TMS 402 § 9.1.6.3 for strength design.
5. Only the net area of hollow masonry units shall be used in the design of shear walls. (TMS 402 § 4.3.1.1)
6. The design of masonry structures shall comply with the working stress design provisions of 2107, or strength design provisions of 2108 of LACBC, and with the "General Design and Construction Requirements" of 2101 through 2104 and 2106 of LACBC. (2101.2)
7. Special reinforced masonry shear walls shall be designed to resist 1.5 times the shear or diagonal tension stresses resulting from in-plane seismic forces. The 1.5 multiplier need not be applied to the overturning moment. (TMS 402 § 7.3.2.6.1.2)
8. Allowable axial compressive force shall be in accordance with the formulas in TMS 402 § 8.3.4.2.1.
9. Allowable flexural compressive stresses or combined flexural compressive stresses with axial load shall not exceed Fb = 0.45 f'm, per TMS 402 § 8.3.4.2.2.
10. Allowable shear stress, F_{vm}, resisted by special reinforced masonry shear wall shall be computed by TMS 402 Eq. 8-25:

$$F_{vm} = \frac{1}{4}\left[\left(4.0 - 1.75\left(\frac{M}{Vd_v}\right)\right)\sqrt{f'_m}\right] + 0.25\frac{P}{A_n} \geq 0$$

11. Allowable shear stress resisted by the steel reinforcement, F_{vs}, shall be computed by $F_{vs} = 0.5(A_v F_s d/A_{nv} s)$
12. Calculated shear stress $f_v = V/A_{nv}$ shall not exceed the allowable shear stress $F_v = (F_{vm}+F_{vs})\Upsilon_g$ and maximum values of:

    a) $F_v \leq \left(3\sqrt{f'_m}\right)\Upsilon_g$ for $M/(Vd_v) \leq 0.25$

    b) $F_v \leq \left(2\sqrt{f'_m}\right)\Upsilon_g$ for $M/(Vd_v) \geq 1.0$

    The maximum value of Fv for M/(Vdv) between 0.25 and 1.0 shall be permitted to be linearly interpolated. (TMS 402 § 8.3.5.1.2 (c))
13. Allowable stresses in reinforcement shall conform to TMS 402 § 8.3.3. Grade 40 or 50, F_s = 20,000 psi. Grade 60, F_s = 32,000 psi.
14. Reinforcement in special reinforced masonry shear walls with M/(Vdv) equal to or greater than 1 and having an axial load greater than 0.05(f'm)(An) shall not exceed the max. reinforcement ratio determined by Equation 8-20. The reinforcement ratio is not applicable for the out-of-plane direction. (TMS 402 § 8.3.4.4)

15. Shear reinforcement shall be provided parallel to the direction of applied shear force. Spacing of shear reinforcement shall not exceed the lesser of d/2 or 48". (TMS 402 § 8.3.5.2.1)
16. Development length of reinforcing bars in tension or compression shall be determined in accordance with Equation (6-1) but shall not be less than 12". (TMS 402 § 6.1.5.1.1)
17. Lap splices of reinforcing steel shall be determined in accordance with Equation (21-1) of LACBC but not less than 12". Reinforcement larger than No. 9 bars shall be approved mechanical connections in accordance with LACBC § 2107.2.1 & 2107.3 and TMS 402 § 6.1.6.1.3.

STRENGTH DESIGN (LRFD)

18. The design strength is the nominal strength multiplied by the strength reduction factor φ as specified in TMS 402 Section 9.1.4.
19. Walls shall be designed for out of plane loads in accordance with TMS 402 Section 9.3.5:
    a. Factored axial stress (P_u/A_g) shall not exceed $0.20(f'_m)$ (TMS 402 Equation 9-22)
    b. When the ratio of effective height to nominal thickness exceeds 30, factored axial stress shall not exceed $0.05(f'_m)$. (TMS 402 § 9.3.5.4.2)
    c. The mid-height, out-of-plane wall deflection subject to lateral and vertical loads (without load factors) shall be limited to $0.007h$. (TMS 402 § 9.3.5.5)
    d. Check stress at mid-height of wall in accordance with TMS 402 9.3.5.4.2.
    e. The factored moment and axial force at the mid-height of the wall shall be computed using the method of either Section 9.3.5.4.2, or Section 9.3.5.4.3.
    f. The nominal moment shall be calculated by formula $Mn= (P_u/\varphi + A_s f_y)(d-a/2)$ if the reinforcing steel is placed in the center of the wall.
    g. The design strength shall satisfy the following equation $Mu=\varphi Mn$
20. Walls shall be designed for in-plane loads in accordance with TMS 402 § 9.3.6:
    a. Reinforcement shall be provided perpendicular to the shear reinforcement and shall be at least equal to one-third A_v. The reinforcement shall be uniformly distributed and shall not exceed a spacing of 8 ft. (TMS Section 9.3.6.2). Nominal flexural and axial strength shall be determined in accordance with TMS 9.3.4.1.1.
    b. Nominal shear strength shall be determined in accordance with TMS 402 § 9.3.4.1.2.
    c. The maximum reinforcement requirements of Section 9.3.3.2 shall not apply if shear wall is designed satisfy the requirements of Section 9.3.6.6.1 thru 9.3.6.6.5.
21. Development length of reinforcing bars in tension or compression shall be determined in accordance with TMS 402 Equation (6-1), but shall not be less than 12" and not greater than $72\mathbf{d_b}$ (2108.2)
22. Splices of reinforcement shall be determined by TMS 402 Equation (6-1) and shall not be less than 12". Splices shall also comply with TMS 402 §6.1.6.

OUT OF PLANE WALL ANCHORAGE

23. Provide calculations and details on the plans for the sub-diaphragm and continuous crosstie system required for all wood diaphragms providing lateral support to masonry walls. The spacing of continuous ties shall not exceed 40'. (LACBC 1613.5.2)
24. Provide details, properly referenced, of the anchorage system between the wood roof and floor diaphragms to the masonry walls per ASCE7 § 12.11.
25. 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 walls: (ASCE7 § 12.11.2.2)
    a. The wall anchorage shall provide a positive direct connection between the wall and floor or roof construction, capable of resisting the horizontal force specified in ASCE7 § 12.11.2.1. 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.
    b. Elements of the wall anchorage system shall be designed for the forces specified in ASCE7 §12.11.2.1. The value of F_p used for the design of the elements of the wall anchorage system shall not be less than $Fp=0.2k_a I_e W_p$ of wall substituted for E.
    c. When elements of the wall anchorage system are not loaded concentrically or are not perpendicular to the wall, the system shall be designed to resist all components of the forces induced by the eccentricity. (ASCE7 12.11.2.2.6)
    d. When 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 not be reduced. (ASCE7 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. (ASCE7 § 12.11.2.2.2)
    f. Floor and roof diaphragms shall be designed to resist the forces per ASCE7 § 12.10.1. A maximum aspect ratio of 3:1 is to be used for unblocked diaphragms. (SDPWS 4.2.4)
    g. The maximum diaphragm shear used to determine the depth of the sub-diaphragm shall not exceed 75% of the diaphragm shear. (LACBC § 1613.5.2)

h. The maximum length-to-width ratio of the wood structural sub-diaphragm shall be 2.5:1 per ASCE7 § 12.11.2.2.1.

i. In wood diaphragms, 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. (ASCE7 § 12.11.2.2.3)

j. For structures assigned to SDC D, E, or F and having a horizontal structural irregularity of Type 1a, 1b, 2, 3, or 4 in Table 12.3-1 or a vertical structural irregularity of Type 4 in Table 12.3-2, the diaphragm design force determined from Section 12.10.1.1 shall be increased 25% for the following elements of the seismic force resisting system: (1) Connections of diaphragms to vertical elements and to collectors and (2) Collectors and their connections, including connections to vertical elements, of the seismic force resisting system.

k. Structures having a horizontal structural irregularity of Type 2 in ASCE7 § 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 projecting wings in opposing directions.

l. When designing the diaphragm to comply with the requirements of ASCE7 T-12.3-1 as stated above, the return walls and fins/canopies at entrances shall be considered. Seismic compatibility is to be achieved with the diaphragm by either seismically isolating the element or by attaching the element and integrating its load into the diaphragm.

STRUCTURAL DETAIL

REINFORCEMENT

26. Vertical reinforcement in masonry walls shall comply with the following: (TMS 7.3.2.3.1 and 7.3.2.6)
    a. Provide at least 0.20 sq. inches in area:
       i. At corners
       ii. Within 16” of each side of an opening.
       iii. Within 8” of the ends of walls or movement joints,
       iv. Spacing shall not exceed 1/3 the length of the shear wall, 1/3 the height of the shear wall, nor 48” for masonry laid in running bond.
    b. A minimum area of 1/3 of the required shear reinforcement.
27. Horizontal reinforcement in masonry walls shall comply with the following: (TMS 7.3.2.3.1 and 7.3.2.6)
    a. Provide at least 0.20 sq. in. in area spaced no more than 48” O.C for masonry laid in running bond & 24” O.C not laid in running bond.
    b. Spacing of horizontal reinforcement shall not exceed 1/3 the length of the shear wall, 1/3 the height of the shear wall, nor 48”.
    c. Horizontal reinforcement shall be provided at the bottom and top of wall openings and shall extend a minimum of 24” or 40 bar diameters past the opening, whichever is greater.
    d. Continuous horizontal reinforcement shall be provided at structurally connected roof and floor levels and be provided within 16” of the top of walls.
28. Shear reinforcement shall be anchored around vertical reinforcing bars with a standard hook complying with TMS 402 § 7.3.2.6(d).
29. Provide minimum reinforcement for masonry walls as follows: (TMS 7.3.2.6(c))
    a. The sum of horizontal and vertical reinforcement shall not be less than 0.002 times the gross cross-sectional area of the wall.
    b. For masonry laid in running bond, minimum reinforcement in each direction shall not be less than 0.0007 times the gross cross sectional area of the wall.
    c. For masonry laid in other than running bond, minimum reinforcement in vertical/horizontal direction shall not be less than 0.0007 / 0.0015 times the gross cross-sectional area of the wall, respectively.
30. Columns and pilasters that are part of the seismic-force-resisting system and beams supporting reactions from discontinuous stiff elements such as walls shall have transverse reinforcement ratio not less than 0.0015. Reinforcement spacing for columns and pilasters shall not exceed one-fourth of the least dimension of the column or pilaster and for beam transvers reinforcement shall be spaced no more than one-half of the nominal depth of the beam. (TMS Section 7.4.3.2.5)
31. For ASD, the bar diameter shall not exceed 1/8 of the nominal wall thickness and 1/4 of the least dimension of the cell, course, or collar joint in which it is placed.

WALLS AND COLUMNS

32. Masonry partition walls, screen walls and other elements that are not part of the seismic-force- resisting system shall be isolated from the structure in accordance with TMS 402 § 7.3.1. Isolation joints and connectors between these elements and the structure shall be designed to accommodate the design story drift.
33. Masonry shear walls in Seismic Design Category D, E or F shall be designed for the requirements of special reinforced masonry shear walls per TMS 402 §7.3.2.6 and ASCE7 T-12.2-1. Intermediate & Ordinary shear wall types are not permitted in seismic design category D, E, or F.

34. Masonry columns shall comply with the following:
    a. The nominal width of a column shall not be less than 8". (TMS 402 § 5.3.1.1)
    b. Columns shall be designed to resist loads with a minimum eccentricity equal to 0.1 times each side dimension, considering each axis independently.
    c. Vertical column reinforcement shall not be less than 0.0025An nor exceed 0.04An. The minimum number of vertical bars is 4. (TMS 402 § 5.3.1.3)
    d. Vertical reinforcement shall be enclosed by lateral ties at least ¼" in diameter spaced no more than:
        i. 16 longitudinal bar diameters
        ii. 48 lateral tie diameters
        iii. The least cross-sectional dimension of the member. (TMS 402 § 5.3.1.4)
    e. Lateral ties shall be arranged so that every corner and alternate longitudinal bar shall have lateral support provided by the corner of a lateral tie with an included angle of not more than 135 degrees. (TMS 402 § 5.3.1.4 (c))
    f. Lateral ties shall be located vertically not more than 1/2 lateral tie spacing above the top of footing or slab in any story and not more than 1/2 lateral tie spacing below the lowest horizontal reinforcement in beam, girder, slab, or drop panel above. (TMS 402 § 5.3.1.4 (d))
35. Masonry columns and piers meeting the following requirements may be used to resist seismic load:
    a. Seismic response modification factor R not greater than 1.5 (TMS 7.4.3.2.4)
    b. Transverse reinforcement shall meet the requirements of TMS Section 7.4.3.2.5.
36. Additional ties shall be provided around anchor bolts which are set in the top of columns. Such ties shall enclose both the vertical bars in the column and the anchor bolts. There shall be a minimum of two No. 4 lateral ties provided in the top 5" of the column. (TMS 402 § 7.4.3.2.1)

STRUCTURAL NOTES

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

37. Identify the following masonry material specifications and add as notes to the structural plans: (LACBC § 2103)
    a. Concrete masonry units – ASTM C90.
    b. Grout – ASTM C476. Specify grout proportions to conform to ASTM C476.
    c. Mortar – ASTM C270. Specify mortar proportions per T-SC-1 or the mortar properties per T-SC-2 of TMS 602
    d. Compressive strength. Specify strength per TMS 602 § 1.4B.
38. Continuous Special Inspection by a registered deputy inspector is required for (engineered masonry)/(high-lift grouting). (1705.4)
39. (Continuous) / (Periodic) Special Inspection is required for masonry construction per TMS 402 Section 3.1, and TMS 602 Table 4.
40. Where Special Inspection or testing is required, the registered design professional in responsible charge shall include a "Statement of Special Inspections" on the plans. (LACBC 1704.3)
41. Quality assurance measures shall comply with LACBC § 2105 and TMS 402 & 602.
42. Type N mortar or masonry cement shall not be used as part of the lateral force resisting system. (TMS 402 § 7.4.4.2.2)
43. Cleanouts shall be provided for all grout pours over 5'-4" high. (TMS 602 § 3.2F)
44. Grout lifts shall not exceed 12.67' when the masonry has cured for 4-hrs., the grout slump is maintained between 10" and 11", and no intermediate reinforced bond beams are placed between the top and bottom of the pour height. Otherwise, lifts shall not exceed 5'-4".
45. All cells and spaces containing reinforcement shall be filled with grout.
46. Pipes and conduits embedded in masonry shall comply with the requirements of TMS 402 § 3.2.2.
47. Reinforcement shall be supported and fastened together to prevent displacements beyond the tolerances allowed by TMS 602 § 3.4B prior to grouting.
48. Joint reinforcement used in masonry shall be fully embedded in mortar or grout and if exposed to earth or weather shall be stainless steel or protected from corrosion by hot-dipped galvanized coating, or epoxy coating. (TMS 402 § 6.1.4.2)

ADDITIONAL COMMENTS