Supplemental Structural Correction Sheet
Flexible Diaphragm with Rigid Wall
(2011 LABC)

Plan Check / PCIS Application number: ____________________________

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PLAN DETAILS

1. Expansion anchors shall not be used in concrete or masonry where they will be subjected to cyclic loads.
2. Anchor bolts with epoxy. Provide Research Department Approval Letter and specify LARR # on the plans. Special Inspection may be required per Research Report.

   Note: Epoxy anchor is not approved for gravity loads, or for high pre-tension loads that may be experienced by over-torqueing hold down anchors.
3. Provide 3x wood members to develop anchorage forces to the diaphragm for new construction and replacement. All such members must be checked for combined gravity and earthquake loads, as part of the wall anchorage.
4. Provide continuous ties or struts between diaphragm chords to distribute the anchorage forces specified in LABC 1613.8.2. The spacing of the continuous ties shall not exceed 40 feet. Added chords and crossties may be used to form sub-diaphragms to transmit the anchorage forces to the main continuous wall-to-wall crossties. LABC 1613.8.2.
5. Interior reinforced concrete or masonry walls anchored to the roof diaphragm shall be considered as part of the lateral load resisting system or be detailed for seismic isolation . The same requirements for out-of-plane anchorage per LABC 1613.8.2 shall apply.
6. Limit anchor spacing to 4 feet or provide bending and deflection compatibility analysis for masonry or concrete walls and diaphragm between the wall anchors. LABC 1604.8.2
7. Provide positive out-of-plan anchorage system from the reinforced concrete or masonry wall to sub-purlins and from the sub-purlins across the purlins including the LADBS approved connections by testing or by design, and the nailing schedules from the diaphragm sheathing to the sub-purlins as the continuous ties for the required depth of the sub-diaphragm design per LABC 1613.8.2.
8. Provide positive out-of-plan anchorage system from the reinforced concrete or masonry wall to the purlins and from the purlins across the girders including LADBS approved connections by testing or by design, and the nailing schedules from the diaphragm sheathing to the purlins as the continuous ties for the required depth of the sub-diaphragm design or for the requirement of the continuous cross ties for the entire diaphragm per LABC 1613.8.2.
9. Show sub-diaphragm width and depth with the design per LABC 1613.8.2.
10. Provide chords and drag strut members in diaphragms having horizontal structural irregularities in ASCE Table 12.3-1 with the design force required in ASCE 12.3.3.4 per LABC 1613.8.2
11. In wood diaphragms, the continuous ties shall be in addition to the diaphragm sheathing. Anchorage shall not be accomplished by use of toe nails or nails subject to withdrawal nor shall wood ledgers or framing be used in cross-grain bending or cross-grain tension. The diaphragm sheathing shall not be considered effective as providing the ties or struts required by Section 12.11. ASCE 12.11.2.2.3.

12. Diaphragm to structural wall anchorage using embedded straps shall be attached to, or hooked around, the reinforcing steel or otherwise terminated so as to effectively transfer forces to the reinforcing steel.

CALCULATIONS

Diaphragm

1. Design continuity ties at maximum 40' o.c. LABC 1613.8.2.
2. The deflection in the plane of the diaphragm shall not exceed the permissible deflection of the attached elements. Permissible deflection shall be that deflection which will permit the attached element to maintain its structural integrity under the individual loading and continue to support the prescribed loads. ASCE 12.12.2.
3. Limit diaphragm shear to 75 percent of the maximum diaphragm shear per LABC 1613.8.2. in determining the required depth of the sub-diaphragm.
4. The maximum length-to-width ratio of the wood structural sub-diaphragm shall be 2.5 to 1. ASCE 12.11.2.2.1.
5. Provide complete structural calculations for design of diaphragm and sub-diaphragm. Diaphragms shall be provided with continuous ties or struts between diaphragm chords to distribute these anchorage forces into the diaphragms. Diaphragm connections shall be positive, mechanical, or welded. Added chords are permitted to be used to form sub-diaphragms to transit the anchorage forces to the main continuous cross-ties. Connections and anchorages capable of resisting the prescribed forces shall be provided between the diaphragm and the attached components. Connections shall be extended into the diaphragm a sufficient distance to develop the force transferred into the diaphragm. ASCE 12.11.2.2.1.
6. Connections of diaphragms to the vertical elements and to collectors and connections of collectors to the vertical elements in structures assigned to Seismic Design Category D, E, or F, and having a horizontal irregularity of Type 1a, 1b, 2, 3 or 4 in ASCE Table 12.3-1, or a vertical structural irregularity of Type 4 in Table 12.3-2, shall be designed with increased design force of 25 percent unless they are designed for the load combinations with an over-strength factor of Section 12.4.3.2, in accordance with Section 12.10.2.1. ASCE 12.3.3.4.
7. Design drag struts. For structures with a reentrant corner plan irregularity of Type 2 in ASCE Table 12.3-1, diaphragm chords and drag members shall be designed per ASCE 12.3.3.4. and 12.10.2.1.
8. Provide structural calculations and details for drag strut members, boundary members and their connections.
9. The spacing of continuous ties shall not exceed 40 feet. Added chords of diaphragms may be used to form sub-diaphragms to transmit the anchorage forces to the main continuous crossties. LABC 1613.8.2.
10. Chords and drag struts members in diaphragms having horizontal structural irregularities in ASCE Table 12.3-1 shall be designed for forces in ASCE Section 12.3.3.4.

Out-Of-Plane Wall Anchorage to Flexible Diaphragm

1. Anchorage of concrete or masonry structural walls to flexible diaphragms in structures assigned to Seismic Design Category C, D, E, or F shall have strength to develop the out-of-plane force given by ASCE Equation 12.11-1:

   $Fp = 0.8\ S_{DS}\ I\ Wp$ ASCE 12.11.2.1.

2. The anchorage of concrete or masonry structural walls to supporting construction shall provide a direct connection capable of resisting the design force from ASCE Equation 12.11-1 or as a minimum of the greater of the following:

   A force of 400 $S_{DS}\ I$ lb/linear ft of wall or 280 lb/linear ft of wall. Show the nailing pattern. ASCE 12.11.2.

3. Provide symmetry of connectors in the anchorage system. 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. ASCE 12.11.2.2.6.

4. At Pilasters. 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 not be reduced. ASCE 12.11.2.2.7.

5. Connector design.

   a) If L.A. City approved anchors and connectors are used, the steel elements of the wall anchorage system shall be designed for 1.4 x Fp at strength design level (LRFD) (Information Bulletin P/BC 2008-071) or 1.7 x ASD anchorage force when designing per LABC Chapters 91 and 96 (9108.2, 9604.2).

      No 1/3 stress increase is permitted of allowable stress design of wall anchorage when designing per LABC Chapter 91 or 96 (9108.2, 9604.2) or when designing the steel elements of the wall anchorage system using 75% of F_p for retrofit.

   b) If connectors are custom designed, then need to consider both deformation and strength design using 1.4 load factor. Deflection of custom anchorage or holdowns shall not exceed 1/8" at a design force as specified per the code design force with the 1.4 load factor.

      No 1/3 stress increase is permitted of allowable stress design of wall when designing per Chapter 91 or 96 (9108.2, 9604.2) or when designing the steel elements of the wall anchorage system using 75% of F_p for retrofit.

6. Bolts-Allowable Tension in Masonry. Provide structural calculations for the anchor bolt embedded in masonry per TMS 402/ACI 530/ASCE 5, Section 3.1.6.2 ????? . LABC 2107 and 2108.

7. Bolts-Allowable Tension in Concrete. Anchor bolt embedment in concrete shall be designed in accordance with ACI 318-08 Appendix D as modified by Section 1908.1.9. LABC 1912.

8. Metal Deck Diaphragms. In metal deck diaphragms, the metal deck shall not be used as the continuous ties required for out-of-plane anchorage system in the direction perpendicular to the deck span. ASCE 12.11.2.2.4.

9. Provide design analysis.
   A metal deck without concrete fill shall be considered as a flexible diaphragm. Such construction is required to comply with the flexible diaphragm criteria. Metal decks with light weight concrete may also be flexible. The flexible diaphragm wall anchorage provisions will apply unless the calculations shows that the diaphragm is rigid. Metal decks must be approved by tests and must have a L.A. Research Report Number. These decks are tested only for shear loads in plane with the lateral force resisting elements. The metal decks cannot be used as sub-diaphragms since the decks have not been tested for out of plane forces, and thus have no approval for bi-axial loads.

10. <u>TJI Truss Joists</u>

    Design and Detail Connection of the TJI to the wall. The TJI's have not been tested or designed to take tensile or compressive loads.

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ADDITIONAL CORRECTIONS	**Code Sec. No.**

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