



5-14 REVIEW OF SHOP DRAWINGS FOR GROUND ANCHORS

The 2010 Standard Specifications allow the contractor to propose a ground anchor system that provides the required anchor loads at the locations shown on the contract plans. In addition, the Standard Special Provisions have the option of allowing the contractor to furnish a fewer number of greater capacity ground anchors or a greater number of lesser capacity ground anchors than those shown on the contract plans.

The Standard Specifications require the submittal of shop drawings that identify the ground anchor system the contractor proposes to use.

When reviewing shop drawings for ground anchors, all applicable portions of Memo to Designers 11-1, *Prestressed Concrete-Working Drawing Review* apply.

In addition, verify shop drawings include:

1. Specified minimum tensile strength of steel, f_{pu} .

Bars - ASTM Designation:	A722 Type II	150 ksi
Strands - ASTM Designation:	A416	270 ksi

Maximum permissible tensile stresses when the maximum test load is applied.

Bars - ASTM Designation:	A722 Type II	120 ksi (0.80 f_{pu})
Strands - ASTM Designation:	A416	202 ksi (0.75 f_{pu})

2. The design and details of the anchoring devices at the end of the tendons. A list of pre-approved anchoring devices is maintained by Materials Engineering and Testing Services (METS). The reviewer can access the list on the METS website:

http://www.dot.ca.gov/hq/esc/approved_products_list/

3. The design and details of the anchorage systems used to distribute the ground anchor design loads to the structure that complies with the contract. The anchorage system is generally composed of one or more of the following elements: bearing plate, trumpet tube, waler, side plates, support bars, and associated welding. The reference to ASTM for all components of the anchorage system must be shown. When electrical isolation is required, the elements providing the electrical isolation must also be shown. If the contractor proposes to use a material for an element of the anchorage



system for which permissible stresses are not specified in the special provisions, the reviewer must evaluate the permissible stresses used in the contractor's calculations to determine if they are acceptable.

4. A typical longitudinal section of the anchor with all its components. This includes dimensions and the connection to the wall or footing.
5. Corrosion protection that complies with the contract. Specifically, the sheathing must include inside and outside diameters, wall thickness, and type of material.
6. The limits and stages of grouting/pregrouting inside and outside the corrugated sheathing.
7. The proposed installation procedures, including the method to drill, place the ground anchor tendon, and grout the drilled hole.
8. The placement and spacing of anchor centralizers. Centralizers must be placed throughout the entire length of all ground anchors regardless of the drilling method or anchor inclination. Also, for anchors with tendons the placement and spacing of tendon spacers.
9. Anchor stressing calculations for each anchor load group.
10. Instructions to repair corrugated PVC and HDPE sheathing.
11. A ground anchor schedule for each wall.
12. The minimum size of the drilled hole to be used that provides the minimum grout cover (1 inch) for the tendon.
13. Performance and proof testing schedules.
14. When shims are used to lock off strand tendons against the structure, the estimated thickness of the shims required and supporting calculations.
15. When bars are used and a coupler is required, the coupler detail.
16. The design of the admixture, if proposed by the contractor to be added to the grout for the drilled hole. The admixture must comply with the Standard Specifications.



17. Calculations supporting the bonded length shown for the ground anchor are not required. If calculations supporting the proposed bonded length are furnished, they should be evaluated.
18. The proposed bonded and un-bonded lengths in all cases where there is a conflict with the Right of Way or underground obstructions. If the proposed bonded length is shorter than calculated by the designer the difference should be reconciled. The bonded length calculations should be based on the maximum Factored Test Load (FTL) of the anchor. The estimated bond strength between grout and drilled hole should be evaluated. Consult with Geotechnical Services for geotechnical evaluation of the bond strength used. If no sufficient information is provided to verify the proposed bonded lengths, the shop drawings must include the following statement:

“The bonded length calculations have not been evaluated. The contractor is responsible for providing ground anchors that satisfy the contract.”

If the bonded length calculations indicate a length longer than that shown on the shop drawings, the shop drawings must include the following statement:

“The contractor is responsible for providing ground anchors that satisfy the contract.”

Special applications of ground anchors may require additional information to be included on the shop drawings.



Changes to the Number of Anchors on the Contract Plans

When the contract allows a different number of ground anchors, the submittal must include calculations and details demonstrating that the redesign is equivalent to the design in the contract plans. Items to be considered are:

- Total horizontal and vertical components of the ground anchor design loads are equivalent and equally distributed.
- The un-bonded lengths of the ground anchors extend more than five feet beyond the limit of interpreted active zone.
- Any affected structural component is redesigned and adequate details are provided if the original structural component is not adequate.
- Adequate redesign for all construction stages.
- Impact on aesthetics of the redesigned structure.

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