9. SOIL AND ROCK ANCHOR SYSTEMS

Soil and rock anchors typically consist of steel bar-type tendons or strand-type tendons and anchor assemblies that are grouted in cored or drilled holes. Soil or rock anchors are classified as Ground Anchors, or Soil Nails. The following information is intended to give some brief background regarding these systems. Additional detailed information can be found in the Department's ***Foundation Manual, Memo to Designers 5-12*** and the ***Caltrans Geotechnical Manual*** (see References).

9.1 Sub-Horizontal and Vertical Ground Anchors

Sub-horizontal ground anchors (tieback anchors) are used in both temporary and permanent structures. These types of anchors are typically associated with retaining walls and may contain either bar-type or strand-type tendons that are grouted into drilled holes of on-site foundation materials (either soil or rock).

Vertical ground anchors (tiedown anchors) are typically foundation anchors for bridge footings that are grouted into cored, formed or drilled holes. They are used to provide additional restraint against rotation of the footings and can be installed in both soil and rock. Components of both sub-horizontal and vertical ground anchors are similar.

Corrosion mitigation measures for ground anchors are specified in the ***Standard Specifications Section 46***, the recommendations of the Post-Tensioning Institute (PTI) ***Specification for Unbonded Single Strand Tendons*** and ***Recommendation for Prestressed Rock and Soil Anchors***. They include the use of PVC, HDPE, or polypropylene sheathing, corrosion inhibiting grease and cementitious grout.

9.2 Soil Nails

Soil nailing is a technique that is used to reinforce and strengthen an existing embankment. It is an effective technique used for large excavations. The basic concept is that soil is reinforced with closely spaced, grouted soil anchors or "nails" that are inserted (drilled) into the existing foundation material. Unlike sub-horizontal and vertical ground anchors, Soil Nails are not post-tensioned. They are forced into tension as the ground deforms laterally in response to the loss of support caused by continued excavation. Corrosion mitigation measures are provided based on the corrosivity of the site, and are included in the contract special provisions and ***Standard Specifications Section 46***. Depending on the site conditions, corrosion mitigation measures may include sheathing with HDPE, epoxy- coated reinforcement and cementitious grout.

9.3 Rockfall Mitigation

Rockfall protection facilities in corrosive environments should be protected against corrosion. In accordance with the plans, special provisions and type of system specified, galvanizing and epoxy coating are typical acceptable protective measures. Where wire or cable may be subjected to damage by rockfall, stainless steel should be considered. For assistance regarding the corrosion evaluation and mitigation, contact the Corrosion Branch.

9.4 Gabions

Section 72-16 Gabions of the ***Standard Specifications*** details the requirements for Gabions. For assistance regarding the corrosion evaluation and mitigation measures for gabions, refer to the 2001 ***Gabion Mesh Corrosion*** publication and the ***Caltrans Geotechnical Manual*** (see References).