SECTION 34 71 50

HIGHWAY-RAIL GRADE CROSSINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Constructing new highway-rail grade crossings.
2. Removing and reconstructing existing highway-rail grade crossings.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 01 - General Requirements.
2. Section 03 31 00 – Structural Concrete.
3. Section 26 05 43 – Electric: Exterior Underground.
4. Section 33 42 00 – Culvert and Drainage Pipe.
5. Section 34 11 10 – Continuous Welded Rail (CWR).
6. Section 34 11 23 - Other Track Materials (OTM).
7. Section 34 11 26 – Ballast.
8. Section 34 11 34 – Wood Railroad Tie
9. Section 34 11 40 – Precast Concrete Grade Crossing Panels
10. Section 34 72 00 - Trackwork.
11. Section 34 72 20 – Track Shifting, Relocation and Resurfacing.
12. Section 34 72 30 – Field Welding Rail.
13. Section 34 80 33 – Hot Mix Asphalt (HMA) for Bridges.
14. Section 34 80 43 – Precast and Prestressed Concrete for Railroad Bridges.

1.02 REFERENCES

A. SCRRA: Engineering Standards, and Track Maintenance and Engineering Instructions.

B. ASTM International (ASTM):

1. D3776 Standard Test Methods for Mass per Unit Area (Weight) of Fabric.

2. D4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

3. D4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile.

C. SSPWC: Latest Edition, Standard Specifications for Public Works Construction, “Greenbook”, Public Works Standards, Inc.

D. California Public Utilities Commission (CPUC): General Order(s) for road crossing(s) being newly constructed, removed or reset under the Project.

E. State of California Department of Transportation: California Manual on Uniform Traffic Control Devices (CA MUTCD), Latest Edition.

F. WATCH: Work Area Traffic Control Handbook, Latest Edition, WATCH BOOK, APWA Southern California Chapter.

G. Federal Railroad Administration (FRA): 49 CFR Part 213, Track Safety Standards.

H. Americans with Disabilities Act (ADA).

I. Materials not meeting the requirements of this Specification shall not be used in the Work.

1.03 SUBMITTALS

A. General

1. Submittals shall be made in accordance with Division 01 requirements.

B. Plans and Procedures:

1. Traffic Detour Plan signed by a Registered Professional Engineer and approved by the City of Anaheim. Detour Plan shall conform to the requirements of the City of Anaheim, SCRRA Engineering Standard ES4301, and provisions of the State of California MUTCD and the WATCH BOOK.

2. Site Specific Work Plan (SSWP) and Operating System Interface in accordance with Division 01 requirements.

C. Certificates:

1. Material Test Reports for products purchased and used in the Project.

D. Product Data and Shop Drawings:

1. Product technical data including:

a. Acknowledgement that products submitted meet requirements of standards referenced.

b. Manufacturer's installation instructions.

c. Shop Drawings detailing dimensions, reinforcement and lifting apparatus for precast crossing panels.

1) Precast concrete mix design in accordance with Section 03 31 00.

2) Structural calculations.

3) Manufacturing and curing procedures.

E. Miscellaneous Submittals:

1. Submit quality control test results for testing performed for precast concrete panels and other material. Testing shall be performed by a certified test laboratory hired by the Contactor or fabricator and approved by the Engineer.

2. Verification documentation that Contractor requested DigAlert field location of underground utilities and SCRRA clearance of underground railroad utilities prior to starting any excavation work in accordance with Division 01 requirements.

3. Contractor must submit qualifications and experience of installers of precast concrete grade crossings.

1.04 QUALITY ASSURANCE

A. Employ a skilled foreman for the Installation of grade crossings, having no less than 3 years experience in installation of the type of grade crossing panels used.

B. Trackwork shall be performed under the supervision of an FRA Part 213 Track Safety Qualified Foreman in accordance with requirements of Section 34 72 00.

C. The Engineer, will review test reports in accordance with the Specifications as applicable for the material item and may require additional testing to confirm requirements with the Specifications.

1.05 PROJECT SITE CONDITIONS

A. Prior to commencing Work, Contractor must examine the Contract Documents, inspect the site, obtain and review available Record Drawings of existing work and utilities and note conditions and limitations which may influence work required by this Section in accordance with Division 01 requirements.

B. Contractor must execute Work under this Specification in such a manner as to minimize impact to the daily operation of the railroad, vehicular and pedestrian traffic in accordance with Division 01 requirements and the approved Traffic Control Plans.

C. Contractor must maintain vehicular traffic and pedestrian walkways using barricades, warning signs and warning lights in accordance with Division 01 requirements.

1. Warning lights shall be set so they do not shine into the eyes of locomotive engineers in on-coming trains.

2. Temporary pedestrian walkways shall meet ADA standards.

1.06 ENVIRONMENTAL CONDITIONS

A. The Contractor must protect against erosion and uncontrolled run-off within and adjacent to right-of-way in accordance with the Project's Storm Water Pollution Prevention Plan (SWPPP) and the Contractor's Water Quality Management Plan (WQMP) and associated compliance with the requirements of the County of Orange NPDES Stormwater Program Drainage Area Management Plan (DAMP) in accordance with Division 01 requirements.

B. The Contractor must obtain all required permits for dewatering and legally dispose of water from dewatering operations in accordance with Division 01 requirements.

C. Contractor must provide for site cleanliness, sweeping and dust control in accordance with Division 01 requirements.

D. Contractor must provide noise abatement as required by environmental permits or local agency requirements in accordance with Division 01 requirements.

1.07 REGULATORY REQUIREMENTS

A. Furnish any required excavation drawings or traffic control plans to Engineer for review and approval by OCTA, SCRRA, and jurisdictional authorities.

1. Contractor to obtain permits for performing such work as required in accordance with Division 01 requirements.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Precast Concrete highway-rail grade crossing Panels shall be new and conform to Section SS 34 11 40:

B. Wood Ties: Ties shall be new 10 feet long and conform to Section SS 34 11 34.

C. Ballast: Ballast shall be new and conform to Section SS 34 11 26.

D. Rail: Rail size shall be 136# CWR and shall conform to Section SS 34 72 00.

E. Rail Fastening: Rail fastenings shall be new and shall conform to Section SS 34 72 00.

F. Geotextile:

1. Geotextile filter fabric used for grade crossings shall be nonwoven fabric. The filaments shall be polypropylene, polyester, or polyethylene. The filaments must be dimensionally stable (i.e., filaments must maintain their relative position with respect to each other) and resistant to delaminating. The filaments must be free from any chemical treatment or coating that might significantly reduce porosity and permeability. Nonwoven fabric may be needle-punched, heat-bonded, resin-bonded, or combinations thereof.

2. The physical properties for Geotextile shall conform to the following:

Test Method	Property	Requirement
ASTM D3776	Minimum Weight (oz./sq. yd.)	3.5
ASTM D4632	Minimum Wet Grab Tensile Strength (lbs.)	100
ASTM D4632	Minimum Grab Elongation at Break (%)	20
ASTM D4751	Apparent Opening Size(US Sieve)	30

G. Asphalt Concrete:

1. Asphalt concrete for crossing underlayment shall conform to Section 32 12 00.

2. Asphalt concrete for roadway shall conform to Section 32 12 00, Hot Mix Asphalt Concrete. Asphalt concrete for roadway approach paving shall conform to Section 32 12 00, Hot-Mix Asphalt Concrete and the Greenbook Section 203 – Bituminous Materials as noted in SCRRA Engineering Standards ES4201 for permanent crossings or ES4302 for temporary crossings or Agency requirements as specified in the Plans or Project Special Provisions.

   a. Contractor must submit the proposed pavement design to the Engineer for review and acceptance. Roadway approach paving will be reviewed and accepted by OCTA and the local agency governing the crossing.

H. Cast-in-Place Concrete

1. Cast-in-Place concrete for new or replacement sidewalks, curbs, gutters and other concrete items shall conform to Section 03 31 00 or as shown in the Plans.

   a. Minimum 28-day compressive strength shall be 3250 psi (560-C-3250 –SSPWC) unless otherwise shown in the Plans.

I. Perforated Drain Pipe:

1. Perforated drain pipe shall be Schedule 80 PVC pipe in accordance with Section 33 46 00.

J. Signal Conduit:

1. Signal conduits shall be Schedule 80 PVC electrical conduit in accordance with Section 34 42 18.

PART 3 - EXECUTION

3.01 GENERAL

A. Coordinate with SCRRA Signal Department forces in accordance with Division 01 requirements.

B. Demolish and dispose of existing grade crossing material including asphalt concrete pavement, sidewalks, curbs and gutters and other items as required in the Plans in accordance with Section 31 11 50.

C. Track subgrade, asphalt underlayment, and ballast shall be constructed to extend at each end, beyond the limits shown for each grade crossing in accordance with SCRRA Engineering Standards ES4201 or as shown in the Plans, whichever is greater.

3.02 SUBGRADE AND SITE PREPARATION

A. Prepare subgrade in accordance with the Contract Documents, Section 31 20 00 and SCRRA Engineering Standards ES4201.

B. Remove existing concrete foundations, curbs, sidewalks, storm drains, pavement and traffic striping as shown in the plans in conformance with Section 31 11 50.

C. Cut lines for asphalt and concrete shall be straight and neat in accordance with Section 31 11 50 and any damage to facilities to remain shall be repaired to the approval of the Engineer at no additional cost to OCTA.

3.03 DRAINAGE AND SUBDRAINAGE

A. Drainage and subdrainage work including placement of geotextile wrap of perforated drainage pipe, shall be performed as specified in the Contract Documents and in accordance with SCRRA Standard Plans ES4201.

3.04 HOT MIX ASPHALT (HMA) CROSSING UNDERLAYMENT

A. Hot Mix Asphalt (HMA) pavement for crossing underlayment shall be placed as indicated in the Contract Documents Section 32 12 00 and as shown in SCRRA Engineering Standards ES4201.

B. Hot Mix Asphalt (HMA) pavement end ramps shall be provided at all concrete grade crossing panel installations in accordance with SCRRA Engineering Standards ES4201 if the preapproved crossing panel is used. End ramps shall be per the manufacturer's recommendation if a substitute is approved, but shall not be less than five feet two inches (5'-2") in length.

3.05 SIDEWALKS, CURBS, GUTTERS AND OTHER ROADWAY ITEMS

A. Place new sidewalks, curbs, gutters and other roadway items as shown in the plans, the identified standards of the public agency identified in the Plans responsible for the roadway and SCRRA Engineering Standards ES4001 through ES4021.

B. Highway-Railroad Grade Crossing Crossbuck signs, when called for, shall be installed in accordance with SCRRA Standard Drawing ES4310.

C. Private, Pedestrian and Bicycle Railroad Grade Crossing Sign, when called for, shall be installed in accordance with SCRRA Engineering Standards ES4311.

D. Temporary construction crossing signs, when called for, shall be installed in accordance with SCRRA Engineering Standards ES4302.

3.06 PRECAST CONCRETE HIGHWAY-RAIL GRADE CROSSING PANELS

A. Install precast concrete grade crossing panels to the position and location shown in the Plans in accordance with manufacturer's recommendations, the approved procedures and SCRRA Engineering Standards ES4201.

1. Contractor must use SCRRA Engineering Standards ES4201 when using the preapproved crossing plank.

B. Contractor must clean dirt and debris from the flangeways before releasing the crossing for the passage of trains.

3.07 BALLAST

A. Place and spread ballast in accordance with the details indicated on the Contract Plans, SCRRA Engineering Standards ES4201 and Section 34 72 00.

3.08 TIES

A. Grade crossing ties shall be spaced per crossing plank manufacturer's recommendations if not the pre-approved crossing plank, and spacing per SCRRA Engineering Standards ES4201 if the pre-approved crossing plank. Other tie location and layout distances shall be per the SCRRA Engineering Standards ES4201.

B. Tops of all ties within the crossing limits shall lie in the same plane. Any tie with an irregular surface dimension shall be adzed or replaced.

3.09 HIGHWAY-RAIL GRADE CROSSING TRACK CONSTRUCTION

A. Construction and fastening of track through grade crossings shall be performed in accordance with details shown on the Contract Plans, SCRRA Engineering Standards ES4201 and Section 34 72 00.

B. Rail joints or thermite welds are not permitted within the limits of the grade crossing trackwork unless approved by the Engineer.

C. Rail joints consisting of field welds are permitted at the ends of rail strings placed for crossings. Welds shall conform to Section 34 72 30.

D. Contractor must use a dynamic stabilizer after initial tamping and surfacing followed by a second surfacing pass in accordance with Section 34 72 20, prior to the final installation of the grade crossing panels.

E. Every attempt needs to be made to close the roadway for the crossing construction so that the entire crossing can be completed continuously. If the roadway cannot be closed, extra efforts shall be utilized to ensure track surface profile is maintained during and after construction, including but not limited to an extra dynamic stabilizer pass.

3.10 FIELD QUALITY CONTROL/QUALITY ASSURANCE

A. Compaction testing for subgrade, trench backfill and sub-ballast shall conform to Section 31 20 00.

B. Compaction testing for asphalt concrete crossing underlayment shall conform to Section 32 12 00.

C. Contractor must coordinate with and provide 24 hours advance notice of crossing work to SCRRA Signal Inspectors and verify that testing of all crossing signal work has been completed and accepted by SCRRA prior to opening crossing to vehicular traffic.

D. Coordinate with SCRRA Engineer in Charge (EIC) and SCRRA Communications & Signal Inspection for release of “Protect Order” following completion of construction and inspection of crossing facility by the Contractor.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. Highway-rail grade crossings will be measured by the unit or fraction thereof furnished and completed in accordance with the Contract Documents and as measured by the Engineer. The quantities as contained on the Schedule of Quantities and Prices, or approved schedule of values, as applicable, as derived from the Plans will be used as the basis for this measurement.

B. All material, work and services included in Sections Section 32 12 00 Hot Mix Asphalt (HMA) Pavement (for full depth HMA Pavement, HMA End ramps, and HMA crossing underlayment); 34 11 10, Continuous Welded Rail (CWR); 34 11 15, Other Track Materials (OTM); 34 11 26, Ballast; 34 11 27, Sub-Ballast and Aggregate Base; 34 11 34, Wood Railroad Ties; 34 11 36, Elastic Rail Fasteners; and 34 11 40, Precast Concrete Grade Crossing Panels will be included in this Section and are considered incidental to work under this Section and will be measured by the unit or fraction thereof furnished and completed in accordance with the Contract Documents and as measured by the Engineer.

4.02 PAYMENT

A. Highway-rail grade crossings furnished and completed in accordance with the Contract Documents will be paid for at the Contract Unit Price, as listed on the Schedule of Quantities and Prices. This price shall include full compensation for furnishing all labor, Materials, tools, equipment, supplies, supervision, full depth (8” thick) HMA Pavement within 10 feet of centerline of track (within 5 feet of edge of crossing panel), Hot Mix Asphalt (HMA) pavement end ramps within 10 feet of centerline of track, HMA crossing underlayment, and incidentals, and doing all work, as shown on the Plans, and as specified in these Specifications, and as directed by the Engineer.

B. This price shall be full compensation for furnishing all labor, materials, tools, equipment, fees, supplies, supervision, and incidentals within the limits of highway-rail grade crossing work in accordance with SCRRA Engineering Standards ES4201 necessary for any highway-rail grade crossings described by the Contract Documents.

END OF SECTION

SECTION 34 72 00

TRACKWORK

PART 1 - GENERAL

1.01 SUMMARY

A. This Section consists of the Contractor, unless otherwise indicated, furnishing all labor, materials, equipment, tools, and incidentals necessary to remove, repair, modify, rehabilitate, or construct trackwork, turnouts, crossings and crossovers.

1. Work includes ballast, walkways, ties, rail, fastening systems, other track material (OTM), turnouts and other special trackwork.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.

2. Division 01 - General Requirements.

3. Section 34 11 10 – Continuous Welded Rail (CWR).

4. Section 34 11 15 - Other Track Materials (OTM).

5. Section 34 11 23 – Special Trackwork.

6. Section 34 11 26 - Ballast.

7. Section 34 11 27 - Sub-Ballast and Aggregate Base.

8. Section 34 11 33 - Concrete Railroad Ties.

9. Section 34 11 34 - Wood Railroad Ties.

10. Section 34 71 50 – Highway-Rail Grade Crossings.

11. Section 34 72 30 – Field Welding Rail.

1.02 REFERENCES

A. American Railroad Engineering and Maintenance of Way Association (AREMA):

1. Manual for Railway Engineering.

B. FRA: 49 CFR Part 213, Track Safety Standards, most current and addenda, Federal Railroad Administration.

C. SCRRA: Engineering Standards.

D. SCRRA: Current Track Maintenance, Right-of-Way and Structures, Engineering Instructions.

1.03 SUBMITTALS

A. Submit, under the provisions of Division 01:

1. Materials: Submit individual certifications that all materials furnished by the Contractor conform to the specified requirements.

2. Shop Drawings:

a. Submit Shop Drawing and product data for trackwork items not specifically defined by engineering standards.

b. Shop Drawings for each size and direction of Turnout will be required.

c. Shop Drawings shall also be submitted in electronic media Microstation Intergraph DGN V8 compatible format on compact discs and shall conform to SCRRA's CADD Standards.

3. Equipment: Provide submittal for all construction equipment proposed to be used as identified in Division 01.

4. Procedure: Submit procedure for transporting, stockpiling and handling of trackwork Materials.

a. Submit proposed construction and installation procedure for new trackwork as part of the Site Specific Work Plan (SSWP) submitted under Division 01, Coordination with SCRRA.

b. Contractor may modify Installation procedure stated hereinafter, to produce the most efficient method for track construction, subject to approval by the Engineer.

5. Compliance Record: As-built compilation of actual track geometry produced in construction including curvature, length of reversing tangent, length of spirals, top of rail profile, and super elevation values.

6. Compliance Record: Rail temperature record taken during anchorage and de-stressing procedures as described in the Articles entitled "Procedures for Placement of CWR" and "Anchoring CWR" herein.

7. Compliance Record: Test results for insulated joints as described in Article entitled "Insulated Joints" in Part 3 of this Section.

8. Procedure: Quality Control / Quality Assurance Program.

9. Procedure: Submit rail end hardening procedure.

10. Procedure: Submit procedure and field welding material technical data for field welding rail.

11. Procedure: De-stressing of Rail.

12. Procedure: Installation of insulated joints.

13. Procedure: Plan for the coordinating and scheduling of a signal track support crew to protect and maintain the operating signal system.

1.04 QUALITY ASSURANCE

A. Quality Assurance:

1. Perform track construction under the supervision of Qualified personnel, as defined in Division 01.

2. Corrections by Contractor: During the Installation and testing period, Contractor must make available personnel, equipment, and Materials necessary to make required corrections to the track including such work as replacements, re-ballasting, resurfacing and realigning, or repair of constructed items, as the Engineer may require ensuring completion of the Work in accordance with the Contract.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Ties shall be lifted and supported during storage, transportation, and placing in such a manner as to prevent damage.

1. Ties shall not be dropped to the roadbed.

2. Wood ties shall be handled in accordance with AREMA Manual Volume 1, Chapter 30, Section 3.5 and Concrete Ties shall be handled in accordance with AREMA Manual Volume 1, Chapter 30, Section 4.11.

3. Refer to Sections 34 11 34 and Section 34 11 33 for on-site storage requirements.

B. Rail shall be unloaded and distributed in a manner that prevents damage to ties, rails and structures. Do not bump or strike rail.

PART 2 - PRODUCTS

2.01 CONSTRUCTION EQUIPMENT

A. If the Engineer determines that Contractor's equipment is not in good working condition or that the kind, size, capacity or quantity of equipment is incapable of contributing to the Work progress or to the requirements of the Contract Documents, Contractor must promptly replace the equipment with an improved kind, type, size, capacity, or quantity. Rejection of equipment shall not be considered justification for a delay Claim.

B. Track surfacing and alignment equipment shall be laser guided.

1. Track surfacing equipment must have all tamping tools in good repair and working order.

2. As a minimum, at least 70 percent of the original surface area of the tamping tool pad must be available and these tools must closely match adjacent and opposite tamping tool pads in the amount of wear.

C. Equipment shall be compatible with and shall be operated within the clearances indicated in SCRRA Engineering Standards.

D. Wheel contours of all rail-mounted equipment shall conform to the Association of American Railroads (AAR) wheel standards or AREMA maintenance of way equipment wheel standards.

E. All construction loads borne by equipment shall be applied between gage lines of running rails on each track unless approved by the Engineer.

F. Vibratory compaction equipment for compaction of base ballast shall be specifically manufactured for compaction purposes.

1. The self-propelled, pneumatic-tired roller shall have a gross weight of 10 to 15 tons, and the vibratory compactor shall have a weight of not less than 10 tons and shall be capable of applying a dynamic load of not less than 18,000 lbs. at 1300 to 1500 cycles per minute.

2. The proposed compaction equipment is subject to approval by the Engineer.

G. Ballast stabilizer and associated ballast stabilization will be furnished and performed by SCRRA.

2.02 TRACK TOOLS

A. Furnish tools and equipment necessary to construct the track.

B. Track gages, track levels, and other tools shall conform to the AREMA Volume 1, Chapter 5, Part 6, "Specifications and Plans for Tools."

C. Tools and equipment shall be maintained in such a condition as not to endanger personnel nor damage the Work and shall be subject to inspection by the Engineer.

D. Tools not conforming to standard shall be repaired to AREMA standards or shall be replaced.

1. Substitution of tools other than AREMA standard will be permitted only with approval of the Engineer.

E. Track levels and gages shall be checked for accuracy at the start of every work shift and at any time the tool is dropped or struck.

1. Adjustments shall be performed anytime it is found to have more than 0.050 inches deviation from the nominal measurement value.

2.03 SUB-BALLAST

A. Sub-Ballast shall conform to the requirements of Section 34 11 27.

2.04 BALLAST AND WALKWAY ROCK

A. Ballast shall conform to the requirements of Section 34 11 26.

B. Walkway rock shall conform to the requirements of Section 34 11 26.

2.05 TIES

A. Wood ties shall conform to the requirements of Section 34 11 34.

1. Cross ties and switch ties shall be of the lengths detailed on the Contract Documents or the designated SCRRA Engineering Standard.

2. Ties shall be new unless indicated otherwise in the Contract Documents.

B. Concrete ties, shall conform to the requirements of Section 34 11 33 and SCRRA Engineering Standard Plan ES2402 for Pre-stressed Concrete Track Tie or ES2403 and ES2407 (for bridge deck locations requiring a neoprene pad). Ties shall be new unless indicated otherwise in the Contract Documents.

2.06 RAIL

A. Rail shall conform to the requirements of Section 34 11 10.

2.07 OTHER TRACK MATERIAL (OTM)

A. OTM shall be new and conform to requirements of Section 34 11 15 and SCRRA Engineering Standards.

2.08 TURNOUTS

A. Special Trackwork shall conform to the requirements of Section 34 11 23.

B. Turnouts shall be as indicated on the Contract Plans, fabricated with all new Material, and in conformance with SCRRA Engineering Standards.

C. Derails shall be of constructed using new Material and conform to SCRRA Engineering Standards with type (double switch point derail or sliding derail with crowder) as indicated in the Contract Documents.

2.09 GRADE CROSSING PANELS

A. Road Crossings shall be of new Material and conform to Section 34 11 40 and SCRRA ES4201 and as indicated on the Contract Plans.

2.10 LUBRICANTS

A. Lubricant for special trackwork shall be Whitmore's Railmaster Curve grease except that Dixon L-5550 graphite shall be used for switch plate lubricant. Approved equals shall be submitted for approval by the Engineer.

2.11 INSULATED JOINTS

A. Insulated Joints shall be new and conform to requirements of Section 34 11 15 and SCRRA Engineering Standards.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. Work shall be completed in accordance with SCRRA Engineering Standard Plans, SCRRA Track Maintenance and Engineering Instructions, AREMA Manual for Railway Engineering, and as specified herein.

1. Each fully completed segment of track, as approved in the SSWP, that is to be placed into operational service shall fully comply with the requirements of FRA 49 CFR 213 for the specific classification of train operation.

2. Track must have ballast section full to top of ties, have joints fully bolted or welded, have all anchors or elastic fasteners applied, and the rail shall be fully de-stressed.

B. Bottom of rail, fastener assemblies, and all bearing surfaces shall be broom cleaned before laying rail.

C. The low rail (inside rail of curves) on all superelevated track shall be designated as the profile rail.

D. Install track, OTM, turnouts, derails and road crossings in accordance with the Contract Plans, SCRRA Engineering Standards, Track Maintenance and Engineering Instructions and California Public Utilities Commission requirements.

3.02 SUB-BALLAST

A. Sub-ballast construction shall conform to typical cross sections as depicted in SCRRA Engineering Standards or as shown on Contract Plans and must also comply with the requirements of Specification Section 34 11 27.

3.03 CROSS TIES

A. Wood or concrete ties shall be used in special trackwork, grade crossings, turnouts, and crossing diamonds as shown on the Contract Plans.

1. Use of wood ties or concrete cross ties shall be designated on the Contract Plans for use in track construction as indicated.

B. Ties damaged as a result of improper handling or installation by Contractor and rejected by the Engineer must be removed and replaced with new ties at no additional cost to the OCTA.

C. Installation and placement of wood ties shall be as follows:

1. Place wood Crossties on 19-1/2” centers for mainline track, except through grade crossings.

2. Space cross ties for grade crossings in accordance with the applicable SCRRA Engineering Standard.

3. Space Crossties for turnouts in accordance with the applicable SCRRA Engineering Standard and the Contract Plans.

4. Obtain approval for any deviation in crossties spacing from the Engineer prior to Installation of spikes or hold down devices.

5. Place wood ties with heartwood face down and square to the rail, except as otherwise shown on the Contract Plans.

6. When handling or spacing ties, prevent damaging them with picks or spiking hammers. Tie tongs, lining bars, other suitable tools or tie spacing equipment shall be used.

7. Do not drive nails or spikes other than those called for into wood ties.

8. Do not re-spike new wood ties.

D. Place concrete Crossties as shown in the Contract Plans and SCRRA Engineering Standards.

1. Ensure that the proper rail cant is established.

2. Concrete Crosstie spacing shall be 24 inches centers.

E. Transition ties shall be installed where concrete ties abut timber track in accordance with SCRRA Track Maintenance and Engineering Instructions and SCRRA ES2351-03.

F. Bridge decks with less than 12 inches of ballast under the tie will require use of a concrete tie with embedded neoprene pad (SCRRA ES2403 or ES2407). When calculating the depth of ballast under the tie, include any HMA underlayment as a part of the ballast depth for determining the requirement for use of the concrete tie with embedded neoprene pad. Bridge decks with 12 inches or more of ballast under the ties will utilize standard concrete ties (SCRRA ES2402 or ES2406).

3.04 TIE PLATES

A. Plates shall be positioned so that the rail will cant inward towards track centerline and the plate shall be centered on tie and applied as to obtain full proper bearing on both the tie and rail.

B. Tie plates shall be installed as shown on the SCRRA Engineering Standards, in SCRRA Track Maintenance and Engineering Standards, and on approved Shop Plans.

3.05 RAIL FASTENING

A. OTM shall be installed in accordance with SCRRA Engineering Standards and where applicable, manufacturer’s recommendations.

B. Installation of screw spikes and specified resilient fasteners shall be in accordance with manufacturer's recommendations, and SCRRA Engineering Standards and SCRRA Track Maintenance and Engineering Instructions.

C. Spiking for standard cut spike fastening systems shall be performed using new cut spikes unless otherwise indicated in the Contract Plans and as follows:

1. Spiking pattern shall conform to SCRRA ES2460.

2. Spikes shall be started vertically, square to the base of rail and driven straight.

3. Shank of rail-holding spikes shall have full bearing against base of rail.

4. Do not strike rail or fastenings when driving spikes.

5. Bent spikes shall be removed and replaced with a new spike as approved by the Engineer.

6. Spikes shall not be over-driven.

D. Holes for the screw spikes shall be pre-drilled and applied perpendicular to the plane of the base of tie plate.

1. Sufficient torque shall be applied to bring the bearing face of the screw spike into flush bearing contact with the tie plate so no gap exists.

2. Not more than 2 each cut spikes per plate may be used to hold the elastic fastening system plates until the screw spikes are installed.

3. Cut spikes used in this manner as temporary fasteners may be salvaged or used material.

4. Cut spikes used as temporary fasteners in this manner shall not be removed; however, four (4) screw spikes per plate shall be provided if cut spikes are used in this manner.

3.06 RAIL ANCHOR INSTALLATION

A. Rail anchors shall be installed per SCRRA ES2351-01 through ES2351-04, as applicable.

1. In applying rail anchors, they shall be set with full bearing against the side of the tie.

2. Anchors shall not be over-driven.

3. Fractured or spread rail anchors will be rejected.

4. Rail anchors shall be applied prior to operation of trains.

5. If, in accordance with the Engineer-approved SSWP, a slow order will be required, the Contractor must submit proposed anchor pattern to the Engineer for approval prior to commencement of the rail anchor work.

6. Anchors shall be removed and re-applied at the time CWR is de-stressed.

B. Rail anchors shall be applied in accordance with manufacturer's recommendations.

3.07 INSTALLING TRACK

A. Installation, laying, raising, lining, tamping and dressing of track over ballast shall be performed as follows:

1. Ballast shall only be installed over sub-ballast, which has been prepared in accordance with Section 34 11 27 and approved by the Engineer.

2. Place base ballast in lifts not more than 6 inches in thickness before compaction.

a. Layers shall extend beyond the edge of the ties as shown on the Contract Plans before compaction.

b. Compact ballast thoroughly to form a stable section able to support the subsequent layers and loads.

3. Compaction of base ballast shall be by means of vibratory compaction equipment specified in Division 01.

a. Each lift of ballast within the initial layer shall be uniformly spread and compacted with not less than four passes of either a self-propelled, pneumatic-tired roller or vibratory compactor.

b. Ballast surface that exhibits ruts or crowns is not acceptable and shall be re-graded and re-compacted prior to the placement of the crossties.

4. Obtain the Engineer's verification of the compacted ballast prior to the installation of track and appurtenant Work over the ballast.

5. The track shall be assembled on the compacted ballast to permit placement of additional ballast for subsequent raising and tamping and to provide the full depth under the ties.

6. The ballast shall be tamped with a 16 tool vibrating squeeze-type mechanical tamper specified in Division 01, making a minimum of one full tamping insertion per tie for each inch of raise.

7. The final track raise shall not exceed 1 inch.

8. The ballast in the crib areas shall be mechanically stabilized by a ballast stabilizer approved by the Engineer in accordance with Division 01.

9. The track shall be raised, aligned and tamped to within the specified tolerances.

10. Ballast shall be thoroughly tamped within a space from 15 inches inside either rail to the ends of the ties.

a. In tamping ties within the above-described limits, simultaneous tamping shall be performed under each rail.

b. Tamping is not permitted at the center of the tie except within limits of turnouts and crossings where the center of the ties shall be tamped unless prevented by trackwork components.

11. Pneumatic or electric tamping tools, either hand held or machine mounted shall be used to perform tamping at portions of turnouts not accessible to a production tamper. Hand tamping with shovels or picks will not be permitted unless authorized by the Engineer.

12. Two tamping tools shall always be used opposite each other on the same tie.

a. Tampers shall be started from a nearly vertical position and worked downward past the bottom of the tie, after which the tool should be slanted downward to force ballast under the tie.

b. Double tamp every joint tie.

13. Ballast shall be mechanically dressed to provide the section as shown on the SCRRA Engineering Standards and the Contract Plans.

14. Excess ballast shall be removed.

    a. With the Engineer's permission, excess ballast may be placed as directed by the Engineer.

    b. Payment will not be made for ballast in excess of dimensions shown on the Contract Plans.

15. Ballast damaged by overwork or excessive tamping or fouled by dirt or other deleterious material as determined by the Engineer must be removed and replaced at no additional cost to the OCTA.

16. Where new track joins existing track, the existing track shall be surfaced for a minimum distance of 500 feet on mainline or siding tracks, or 200 feet on industrial tracks, from the point of connection.

    a. Existing track surfacing may be longer as needed to meet FRA requirements, or as shown of the Contract Plans.

17. After the track has been raised to its final elevation and super-elevation, ballast consolidation of all tracks shall be performed before the track is placed in service.

    a. Each segment of track may be placed in full service, as approved in the SSWP, if that segment fully complies with FRA 49 CFR 213 for specific classification of train operation, has ballast section full to top of ties, has joints fully bolted or welded, has all anchors or elastic fasteners applied, and has the rail fully de-stressed and ballast compacted.

18. When raising track, a spot board or other approved device shall be used to maintain grade, and a level shall be used to keep track to proper crosslevel.

    a. Laser guided alignment is required, and horizontal alignment must be maintained during the raising operation.

    b. Use of automated controls on tampers will satisfy this requirement.

19. In addition to the other requirements specified herein, all newly constructed mainline and mainline siding tracks, upon completion of final surfacing operations, shall be mechanically stabilized using a Ballast Stabilizer as specified in Division 01.

3.08 INSTALLING TURNOUTS

A. Installation of frog plates, switch plates, and plates under the closure rails shall conform to SCRRA Engineering Standards and AREMA trackwork standards.

1. Plates shall be secured by screw spikes except rehabilitation of existing turnouts with cut spikes, which shall be fully spiked.

B. Following the installation of turnouts on the initial layer of ballast, the turnouts shall be lifted, aligned and supported prior to placement of final ballast.

C. Ballast shall be uniformly placed and spread.

1. The turnout shall then be raised and the ballast tamped under both sides of each tie for the full length of the tie.

2. Tamp ballast thoroughly throughout the length of all ties in the turnout or other special trackwork.

3. Final top of ballast shall conform to the ballast section as indicated except in cribs wherein switch operating rods, locking rods or connecting rods are located and between point of switch and heel of switch where the crib ballast shall be 3 IN below the base of the rail.

D. When installing the various components of the turnout, particular attention shall be given to the following:

1. Check that alignment, gage, and surface meet Specifications.

2. Verify that bolts, nuts, cotter pins, and other fastenings are in place, in good condition, and properly tightened.

3. Verify that switch points are properly aligned and fit tightly against rail when switch is thrown in either position.

4. Verify that connecting rod and switch rod bolts are equipped with cotter pins properly applied.

5. Test-operate the switches for lost motion, difficult throw, or loose connections and adjust as necessary.

6. Examine the rod and fastenings that connect the switch point to the switch stand to see that they are in place and in good condition.

E. Joints within turnouts shall be welded.

F. Switch stands shall be so installed as to hold the switch point tightly against the stock rail when stand is in normal position, per the manufacturer’s instructions.

1. Switch rods shall be adjusted to hold the opposite point tightly against the rail when stand is in reverse position.

2. Switch stands, for both switches and derails, shall be mounted on two 16 feet ties.

G. Switch stands shall be kept securely fastened to the head block ties, use approved screw spike fasteners.

1. The head block ties shall be set square with the track and kept firmly tamped.

2. Correct any walkway deficiencies adjacent to the head block ties that would impact SCRRA employee or operating personnel access to the operating levers or controls for the switch stand.

H. Switch stand target colors shall conform to SCRRA ES2106 for Derail Switch Target or to SCRRA ES2703 for standard switch target.

I. At the time of Installation, sliding surfaces of special trackwork assemblies shall be lubricated with a dry film graphite lubricant in accordance with the manufacturer's recommendations.

J. Insulated joints for non-interlocked switches shall be installed as shown on the Contract Plans and in accordance with AREMA (Former AAR) Signal Manual.

1. Install joint using manufacturer's recommended procedure.

K. Signal System Point Protection:

1. No switch point shall be installed in the main track unless it has the proper signal system point protection in place and tested.

2. No switch protection shall be removed from any normally closed signaled switch point unless the switch point is replaced by a straight rail and signal circuits have been corrected and tested.

3. All rail bonding and fouling circuit protection must be intact at all times on all signaled switches.

4. SCRRA will perform installation and testing of signal devices.

5. Contractor must coordinate installation or removal of turnout with SCRRA Engineer for required signal testing.

3.09 INSTALLING DERAILS

A. Install derails per manufacturer’s instructions at locations designated in Contract Plans and in accordance with SCRRA Engineering Standards.

3.10 DRILLING

A. Rail ends for bolted joints shall be drilled in accordance with SCRRA Track Maintenance, Right-of-Way and Structures, Engineering Instructions Section 2.1.14.

1. Any additional holes in rail will be sufficient cause for rejection.

B. A variation of 1/32” in size and location of bolt holes will be allowed.

C. Holes shall be located with the proper size rail-drilling template and marked with a center punch prior to drilling.

D. Drilling through joint bars is prohibited.

3.11 RAIL ENDS

A. Rail shall be cut with rail saw to a tolerance of 1/32” from square.

1. All burrs shall be removed and ends made smooth.

2. Torch cut rails will be rejected.

B. Battered or mismatched ends shall be built up or ground off to conform to minimum tolerance of 1/16” on top and gage side to adjoining rail.

3.12 RAIL END HARDENING

A. At all rail end locations not eliminated by field welding, rail ends shall be field end hardened in accordance with the AREMA Manual, Volume 1, Chapter 4, Section 2.1.17.1, “Supplementary Requirements” including all insulated joints.

3.13 PROCEDURES FOR PLACEMENT OF CWR

A. Rail shall be laid or adjusted to the Preferred Rail Laying Temperature in accordance with SCRRA Track Maintenance and Engineering Instructions Section 2.2..

B. Tie cribs shall be filled with ballast immediately after laying rails and after each track raise.

1. Track shall be surfaced, stabilized, and lined and all ties tamped and anchored, prior to returning track to full service.

C. If the rail temperature exceeds 120˚ F, the Engineer reserves the right to suspend rail-laying operations, or direct that the rail be cooled.

1. These actions shall not entitle Contractor to any additional compensation or time.

D. Welded rails shall be positioned for installing in a manner to minimize handling and to prevent buckling.

E. The rail base and tie plate or concrete tie rail seat area shall be cleaned to remove foreign material that may interfere with the full bearing contact with the base of the rail.

1. Rails shall be placed base down, parallel with track, avoiding excessive bending or damage, using suitable mechanical equipment.

2. Do not place rails on signal equipment, manhole covers, electrical connections, or near any other installation that could be susceptible to damage.

F. An approved rail thermometer shall be used to determine rail temperature.

1. The thermometer shall be placed on the web or base of rail shaded from the sun and left long enough to record the rail temperature accurately.

2. The temperature shall be checked frequently.

3. All rail thermometers shall be calibrated.

G. Tools used for field cutting rails shall be approved rail saws.

1. Torch-cut rails shall not be installed in the track.

2. Any rail damaged by torches shall be rejected and removed before Installation in the track.

H. Rail shall be de-stressed in accordance with SCRRA Track Maintenance and Engineering Instructions Section 8.3 only after final track line and grade has been achieved and ballast stabilized, or as required by the Engineer.

1. Rail shall be re-anchored after de-stressing has been achieved.

2. Rail shall have adequate anchor patterns installed at all stages of construction.

3.14 ANCHORING CWR

A. As used in this Article the term “rail anchor” also refers to elastic rail fasteners. Install rail-anchoring devices when the rail is within the permissible anchoring temperature.

1. Anchor opposite rail only when its temperature is within 5˚ F of the previously anchored rail's temperature at the time of its anchoring.

2. Temperatures shall be measured in accordance with SCRRA Track Maintenance and Engineering Instructions Section 2.2.4, Instructions for Taking Rail Temperatures.

3. No train operation is permitted over rail that does not have a full complement of anchors per SCRRA ES2351-01 through ES2351-04.

4. If it is necessary to operate trains before de-stressing rail, following the movement of trains, anchors shall be removed for the de-stressing procedure and re-applied.

B. Prior to joining CWR strings, adjust the CWR strings to the Preferred Rail Laying temperature, vibrate to relieve internal rail stresses, and fully anchor.

C. Join CWR strings when the rail gap is at the specified gap.

1. If the rail gap is not within the recommended tolerances for joining CWR strings, and the remainder of the string has been adjusted, un-anchor the CWR strings for 400 feet on each side of the rail gap and readjust each CWR string to within the Preferred Rail Laying Temperature.

2. Re-anchor the CWR strings before installing the rail joint or weld.

3. If the recommended rail gap cannot be obtained in this manner, cut a section of rail from the end of one of the CWR strings and insert a rail plug not less than 19'-6" long on tangent track and curves less than 2˚; and not less than 30 feet long in curves of 2˚ or greater to provide the recommended rail gaps, or crop the rail as necessary to provide the recommended gap.

4. If the Contractor elects to use an artificial means of adjusting the rail for anchoring, submit the method and equipment proposed to the Engineer and obtain Engineer's acceptance.

5. A rail vibrator shall accompany the rail heating process to assure free expansion of the rail in advance of the heated area.

6. Witness marks shall be made at four (4) or more stations on unanchored rail across the base of the rail and tie plates to confirm actual expansion of the rail in accordance with the calculations.

D. Contractor must not make any joints or welds within the body of a curve unless approved by the Engineer.

3.15 ADJUSTMENT BY MECHANICAL HEATING

A. Rail shall be adjusted for temperature after it has been laid on tie plates but before it is anchored.

B. Rail gaps shall be provided at the end of each continuous welded rail equal to the amount of the expansion that is required for that rail.

C. Heating shall begin at the end of the rail and be steadily applied moving forward and without reversing direction until the required expansion has been obtained for that rail.

D. Complete anchoring application shall follow heating as closely as possible.

1. Any deviation or delay will require reheating the rail.

E. Prevent damage to other work during the heating process.

3.16 THERMAL ADJUSTMENT CALCULATION

A. The adjustment of the rail for thermal forces shall be done as per SCRRA's Procedures for Installation, Maintenance and Inspection of CWR.

B. When it is necessary to adjust the rail already in track, the required increase or decrease may be found by taking the difference between the Preferred Rail Laying Temperature and recorded rail temperatures at each string of CWR and calculating the amount of adjustment as specified herein.

C. The number of inches by which a CWR segment shall be increased or decreased to adjust its length for a temperature higher or lower than that at which it was anchored or adjusted may be calculated using the following formula:

1. Req. Adjustment (inches) = 0.0000067 x ΔT (°F) x L (Ft.) x 12

D. Example:

1. To adjust the length (L) of a 400 feet CWR, fastened at a rail temperature of 65 degrees, to correspond to the length of this rail at a Preferred Laying Temperature (PRLT) of 110 degrees, subtract 65 from 110 to obtain a difference of 45 degrees (ΔT) and multiply as follows:

Station 1, 100 X 12 X 0.0000067 x 45 = 0.36” = 3/8”

Station 2, 100 X 12 X 0.0000067 x 45 = 0.48” = 1/2”

Station 3, 100 X 12 X 0.0000067 x 45 = 0.96” = 1”

Station 4, 400 X 12 X 0.0000067 x 45 = 1.44” = 1 1/2”

3.17 RAIL ANCHORAGE RECORD

A. Compliance record shall be kept in the format similar to that shown in SCRRA Track Maintenance and Engineering Instructions Section 2.2.4 Instructions for Taking Rail Temperatures and provided to the Engineer in an acceptable, reproducible form.

1. It shall contain the following data for each end of a CWR and at each 400 FT interval during installation:

a. Date and time.

b. Track number and rail (East or West, North or South).

c. Station location.

d. Weather, air and base of rail temperature.

e. Type of fastener.

f. Length of rail being anchored.

3.18 PROCEDURES FOR PLACEMENT OF JOINTED RAIL

A. This Article covers both the permanent construction and rehabilitation of jointed rail and the temporary use of rail joints in the CWR pending field welding.

1. When laying jointed rail, each rail shall be carefully placed on the ties with ends square, using standard expansion shims placed between the ends of adjoining rails to ensure proper opening of joint.

2. Shims shall be removed after all joint bolts are tightened.

B. Using temperatures taken on the rails when they are being laid or adjusted; the thickness of the shim to be used for 39 feet rails will be determined by the following table:

Ranges (deg. F)	Shim (Inches)
-20 - 0	3/8
0 - 25	1/4
25 - 50	3/16
50 - 75	1/8
75 - 100	1/16
Over 100	Laid Tight

C. Joint Bars shall be well oiled and with full number and correct size of bolts, nuts and spring washers.

D. Joint bolts shall be tightened before spiking rail and the two center bolts shall be tightened in advance of the end bolts.

E. Bolts shall be placed with the nuts alternatively on the inside and outside of the rail.

1. Nuts shall be placed with the flat side toward the rail.

2. Track bolts, joint bars and finishing surfaces of rails at joint bars shall be swabbed with oil.

3. Use outer four bolt holes only when installing bolted joints that will be eliminated by field welding.

4. Do not drill inside holes (holes closest to rail ends) at future field weld locations.

3.19 TRACK CRITERIA AND TOLERANCES

A. Track shall be constructed to the alignment and grade prescribed.

1. Gage shall be 4’ - 8½”.

2. Deviation from established gage and cross- level shall not exceed 1/8”, and profile grade and horizontal alignment variation shall not exceed 1/8” measured at the center of a 62 feet chord.

B. Provide vertical and horizontal control stakes every 50 feet on curves and every 100 feet on tangents.

C. Tangent track shall be level and superelevation and runoff spirals shall be provided on all curves in conformance with SCRRA ES2201 through ES2204 unless otherwise indicated in the Contract Plans.

D. Contractor must not cut rail strings except as required to fit rail to turnouts, crossings or limits of work.

E. A thermometer designed to measure rail temperature shall be used in accordance with SCRRA Track Maintenance and Engineering Instructions during rail Installation to assure compliance with the SCRRA Preferred Rail Laying Temperature.

1. Final installed or Adjusted Rail Temperature shall be within 10 degrees below or 10 degrees over the Preferred Rail Laying Temperature.

3.20 WELDING OF CONTINUOUS WELDED RAIL

A. Rail welding shall be in accordance with the approved procedure and Section 34 11 16, Field Welding Rail.

3.21 WALKWAYS

A. CPUC walkways shall be provided within track work limits in accordance with the Contract Plans, SCRRA ES2105, SCRRA Track Maintenance and Engineering Instructions, CPUC General Order No. 118.

B. Installation of walkways are incidental to installation of track.

3.22 INSULATED JOINTS

A. Each insulated joint installed by the Contractor must be tested with an insulated joint tester, either the Harmon 1501A1JC or equal approved by the Engineer.

1. Test shall measure no less than 100 ohms across the joint.

2. Test results shall be uniquely identified with a specific joint and submitted to the Engineer in Compliance Record.

B. The rail ends at each insulated joint shall be beveled and hardened in accordance with the manufacturer’s procedures as approved by the Engineer.

1. Contractor must comply with rail end hardening and beveling requirements specified in this Section.

3.23 INNER GUARD RAILS

A. Inner Guard Rails will be required:

1. For all bridge spans where exposed structural steel is present above the top of rail.

2. Where individual spans are over 100 feet in length

3. Where entire structure is over 800 feet in length and at least one span crosses over a waterway that normally contains water which is at least 15 feet deep.

4. On any bridge as directed by the Engineer or the Contract Documents.

B. Inner Guard Rails shall extend 50 feet beyond the span or spans to be protected as required above. SCRRA ES2302 and ES2304 indicate details for construction of Inner Guard Rails. Inner Guard Rails require use of special Concrete Ties as shown in ES2406 and ES2407.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. Construct Track (type as shown on the Schedule of Quantities and Prices) will be measured by the unit or fraction thereof furnished and completed in accordance with the Contract Documents and as measured by the Engineer. The quantities as contained on the Schedule of Quantities and Prices, or approved schedule of values, as applicable, as derived from the Plans will be used as the basis for this measurement.

B. Remove and Salvage Existing Track will be measured by the unit or fraction thereof furnished and completed in accordance with the Contract Documents and as measured by the Engineer. The quantities as contained on the Schedule of Quantities and Prices, or approved schedule of values, as applicable, as derived from the Plans will be used as the basis for this measurement.

C. Furnish & Install Special Trackwork (type as shown on the Schedule of Quantities and Prices) will be measured by the unit or fraction thereof furnished and completed in accordance with the Contract Documents and as measured by the Engineer. The quantities as contained on the Schedule of Quantities and Prices, or approved schedule of values, as applicable, as derived from the Plans will be used as the basis for this measurement. The construction of special trackwork, from point of switch to last switch tie will be measured separately from Construct Track per complete special trackwork unit as designated in the Schedule of Quantities and Prices.

D. Remove Insulated Joints and Furnish and Install Insulated Joints (prefabricated plug rail) will be measured by the unit or fraction thereof furnished and completed in accordance with the Contract Documents and as measured by the Engineer. The quantities as contained on the Schedule of Quantities and Prices, or approved schedule of values, as applicable, as derived from the Plans will be used as the basis for this measurement.

E. The construction of track at grade crossings will be measured and paid under Section 34 71 50 Highway-Rail Grade Crossings. Track construction within the limits of measurement and payment limits for grade crossing construction will be considered included in measurement and payment for grade crossing work and will not be measured or paid under this Section.

F. Measurement limits for various trackwork items will not overlap unless otherwise specified under this Section.

G. Measurement for insulated joints may overlap with measurement for 34 72 00.02 Construct Track, 34 72 20.01 Shift Existing Wood Tie Track, and 34 72 20.02 Shift Existing Concrete Tie Track.

H. Removal of existing track will not be considered incidental to measurement and payment for track and special trackwork construction.

I. Wood Tie Transition (on existing track) will be measured by the unit or fraction thereof furnished and completed in accordance with the Contract Documents and as measured by the Engineer. The quantities as contained on the Schedule of Quantities and Prices, or approved schedule of values, as applicable, as derived from the Plans will be used as the basis for this measurement

4.02 PAYMENT

A. Trackwork furnished and completed in accordance with the Contract Documents will be paid for at the Contract Unit Price, as listed on the Schedule of Quantities and Prices. This price shall include full compensation for furnishing all labor, Materials, tools, equipment, supplies, supervision, and incidentals, and doing all work, as shown on the Plans, and as specified in these Specifications.

B. Remove and Salvage Existing Track completed in accordance with the Contract Documents will be paid for at the Contract Unit Price, as listed on the Schedule of Quantities and Prices. This price shall include full compensation for furnishing all labor, Materials, tools, equipment, supplies, supervision, and delivery of salvaged rail and track materials to SCRRA at Marine Way Yard in Irvine, removal and legal disposal of damaged/worn out wood ties, removal and legal disposal of ties, spikes, anchors, and other OTM, and incidentals, and doing all work, as shown on the Plans, and as specified in these Specifications.

C. Construct Track furnished and completed in accordance with the Contract Documents will be paid for at the Contract Unit Price, as listed on the Schedule of Quantities and Prices. This price shall include full compensation for furnishing all labor, Materials, tools, equipment, supplies, supervision, rail, welds, concrete ties, OTM, ballast, and incidentals, and doing all work, as shown on the Plans, and as specified in these Specifications, and as directed by the Engineer.

D. Furnish and Install Special Trackwork furnished and completed in accordance with the Contract Documents will be paid for at the Contract Unit Price, as listed on the Schedule of Quantities and Prices. This price shall include full compensation for furnishing all labor, Materials, tools, equipment, supplies, supervision, special trackwork components, turnout ties, switch machine ties, rail, welds, OTM, insulated joints, ballast, and incidentals, and doing all work, as shown on the Plans, and as specified in these Specifications. Track constructed within the limits of a crossover shall be considered incidental to special trackwork construction.

E. Insulated joints within turnouts and the insulated joints at the tie in points of the turnout shall be considered incidental to the Contract Unit Price paid for turnout.

F. Asphalt underlayment for track, special trackwork, and grade crossings shall be considered incidental to the Contract Unit Price paid for track, turnout or grade crossing construction

G. Remove Insulated Joints furnished and completed in accordance with the Contract Documents will be paid for at the Contract Unit Price, as listed on the Schedule of Quantities and Prices. This price shall include full compensation for furnishing all labor, Materials, tools, equipment, supplies, supervision, and incidentals, plug rail, welds, and doing all work, as shown on the Plans, and as specified in these Specifications.

H. Furnish and Install Insulated Joints (prefabricated plug rail) furnished and completed in accordance with the Contract Documents will be paid for at the Contract Unit Price, as listed on the Schedule of Quantities and Prices. This price shall include full compensation for furnishing all labor, Materials, tools, equipment, supplies, supervision, rail removal, welds, and incidentals, and doing all work, as shown on the Plans, and as specified in these Specifications.

I. Payment for Trackwork will be made only upon documentation of fully completed trackwork and full restoration of track speed to the design speed as shown in the Contract Plans. All work must be complete prior to payment being made, including but not limited to welding, distressing, final surfacing, and completion of punch list items related to track work

END OF SECTION

SECTION 34 72 20

TRACK SHIFTING, RELOCATION AND RESURFACING

PART 1 - GENERAL

1.01 SUMMARY

A. Furnish all supervision, labor, materials, equipment, transportation and incidentals necessary to shift, relocate or resurface railroad track as shown on the Contract Plans and specified herein. Railroad track as used herein is defined as "an assembly of rails, ties and fastenings over which cars, locomotives and trains are moved." This "track" assembly includes, the rail, ties, special trackwork, other track material (OTM), ballast, and walkways although not an exclusive listing.

B. Section 34 72 00 will govern track construction work associated with this Section.

C. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.

2. Division 01 - General Requirements.

3. Section 34 11 10 – Continuous Welded Rail (CWR).

4. Section 34 11 15 - Other Track Materials (OTM).

5. Section 34 11 23 – Special Trackwork.

6. Section 34 11 26 - Ballast.

7. Section 34 11 27 - Sub-Ballast and Aggregate Base.

8. Section 34 11 33 - Concrete Railroad Ties.

9. Section 34 11 34 - Wood Railroad Tie.

10. Section 34 71 50 – Highway-Rail Grade Crossings.

11. Section 34 72 00 - Trackwork.

12. Section 34 72 30 – Field Welding Rail.

1.02 REFERENCES

A. Full compliance with applicable rules, regulations, and General Orders of California Public Utilities Commission is required. Representatives of that State agency will inspect railroad related work for compliance with General Orders.

B. American Railway Engineering and Maintenance of Way Association (AREMA): Manual of Railway Engineering.

C. AREMA Portfolio, American Railway Engineering and Maintenance of Way Association, Portfolio of Trackwork Plans.

D. FRA:

1. 49 CFR Part 213, Track Safety Standards, most current and addenda, Federal Railroad Administration

2. 49 CFR Part 214, Railroad Workplace Safety, most current and addenda, Federal Railroad Administration

E. CPUC, California Public Utilities Commission General Orders.

F. SCRRA, Southern California Regional Rail Authority

1. Engineering Standards.

2. Track Maintenance and Engineering Instructions (Current Edition).

3. Maintenance of Way Safety Instructions.

G. GCOR, General Code of Operating Rules for Maintenance of Way employees.

1.03 SYSTEM DESCRIPTION

A. Perform all track shifting, relocation and resurfacing work as shown on the Contract Plans, and in accordance with this Section.

1. Prior to shifting or relocating track, all drainage structures and grading, including placement of Sub-Ballast as per Section 34 11 27 shall be completed and accepted by the Engineer.

2. In addition to the other requirements specified herein, shifted, relocated, and resurfaced track shall be stabilized using a Ballast Stabilizer in accordance with Division 01.

3. Following shifting, relocating, resurfacing and stabilizing of track, rail shall be destressed in accordance with SCRRA Track Maintenance and Engineering Instructions Section 8.3.

4. Track shifting shall include all work to shift existing track more than 1 foot and less than 10 feet and providing Ballast per Section 34 11 26, resurfacing and regulating track in its new location.

5. Track relocation shall include all work to relocate existing track a distance greater than 10 feet including installation of Ballast per Section 34 11 26, resurfacing and regulating track in its new location.

6. Resurfacing, shall include shifting of existing track up to 1 foot, and involves resurfacing indicated track and all special trackwork, including lining, raising, tamping, and regulating track in conformance with SCRRA engineering standards, provisions of this specification, and to the lines and grades shown on the Contract Plans. The Ballast per Section 34 11 26 required to fill cribs and provide adequate shoulders must be provided by the Contractor.

7. Rough and final surfacing of the entire track section shall be performed as required to provide minimal profile smoothing and adjustment. This surfacing may include providing and placing Ballast per Section 34 11 26, tamping, stabilizing and regulating ballast.

B. The Contractor, as with any Work within the OCTA Right of Way, must submit a SSWP for each track segment that requires shifting, relocating, or resurfacing the active track in accordance with Division 01, Coordination with SCRRA.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00, Submittal Procedures:

1. Refer to Division 01 for submittal of applicable SSWP.

2. Refer to Division 01 for submittal of personnel resumes and railroad equipment list.

1.05 QUALITY ASSURANCE

A. Quality Assurance:

1. Contractor must perform track shifting, relocating, and surfacing under supervision of a qualified Railroad Construction Project Manager, Railroad Track Construction Manager, and Track Foreman. Work shall be performed by personnel experienced in similar railroad track work, as required under Division 01. The surfacing crew shall include a ground man, with a minimum of six months experience, qualified to check profile and alignment behind the tamper.

1.06 PROJECT CONDITIONS

A. This work may occur on an active railroad track.

B. The Contractor must coordinate all phases of the Work to prevent undue interference with the SCRRA daily operations (which includes both Metrolink and BNSF), or with other phases of the Project, whether performed by SCRRA forces or another contractor’s forces.

PART 2 - PRODUCTS

2.01 GENERAL

A. Materials to be installed under this Contract must be provided by the Contractor unless indicated otherwise in the Contract Documents.

B. Materials damaged or broken prior to or during installation must be replaced at the Contractor's expense with no additional cost to OCTA.

C. Labor, material not furnished by SCRRA, or equipment required for track resurfacing but not expressly shown on the Contract Plans shall be as if shown on the Plans and included in the Contractor's bid price.

D. Material must be new, except as otherwise indicated herein, and meet the requirements stated herein and of the AREMA and SCRRA Standards.

PART 3 - EXECUTION

3.01 GENERAL

A. Contractor personnel and equipment shall meet the requirements set forth in Division 01.

B. Contractor must exercise care in his progression of work under this Contract to avoid and prevent damage to the track being shifted, relocated, or resurfaced, adjacent tracks, and structures and facilities, such as existing pavements, pavement bases, drainage structures, light poles, fire hydrants, signal facilities (track wires, bootlegs, signal masts, guy wires, signals, cables, conduits) utilities, signage and buildings. Contractor must repair or replace damaged structures or facilities to satisfaction of the owner at no cost to OCTA, except that SCRRA will repair and test signal facilities at the Contractor's sole expense. The Contractor must be responsible to coordinate his work with SCRRA to arrange for the timely and orderly removals or relocations of this signal equipment and facilities. Failure of the Contractor to provide reasonable and adequate coordination for timely removal and relocation of signal facilities will not allow for an extension of time or provide grounds for extra cost to OCTA.

C. Contractor must perform Work under this Section in accordance with these Specifications and consistent with track resurfacing standard industry practice.

D. Contractor must periodically review the supply of materials, labor and equipment to ensure a uniform flow of work. Contractor must keep the Engineer informed regarding material shortages or developing problems that require corrective action.

E. Shifted, relocated, and resurfaced track shall meet the following tolerances as well as the standards for FRA 49CFR213 class 5 track.

1. Except for pre-existing rail gauge corner rail wear,

a. Deviation from correct gage of 56-1/2” shall not exceed + or - 1/4 inch at any point.

b. Deviation measured in any section of 20 consecutive crossties shall not exceed 1/8 inches at 75 percent of the crossties, and 1/4” at the remaining 25 percent.

c. Newly installed or re-installed ties will be spiked not to exceed + or – 1/8” irrespective of pre-existing rail gauge corner wear.

TRACK SURFACE	TOLERANCE
Runoff in any 31 FT of rail at the end of a raise may not be more than	1/4”
Deviation from uniform profile on either rail at the mid-ordinate of a 62 feet chord may not be more than	3/8”
Deviation from designated elevation on spirals may not be more than	1/4”
Variations in cross levels on spirals in any 31 feet may not be more than	5/8”
Deviation from zero cross level at point on tangent or from designated elevation on curves between spirals may not be more than	3/16”
Difference in cross level between two points less than 62 feet apart on tangents and curves between spirals may not be more than	3/8”

2. Alignment - maximum deviation from uniformity measured in conformance FRA Safety Standards Section, 213.55.

a. Tangent Track 1/4” - at mid-ordinate on a 62 feet chord.

b. Curved Track 1/4” - from correct mid-ordinate on a 62 feet chord.

F. Elastic clips, rail anchors, and spikes shall be loosened prior to shifting track to prevent skewed ties. Rail, fasteners, or crossties damaged during track shifting must be replaced by the Contractor at Contractor’s expense. Rail anchors are not to be slid longitudinally along the base of the rail. They must be removed prior to shifting track and reapplied in the correct location after track is shifted to its final location.

3.02 RESURFACING, ALIGNMENT AND DRESS

A. Contractor must perform shifting and resurfacing within the stated project limit station areas as specified to bring the line and surface into compliance within the track geometry tolerances specified.

B. Contractor must resurface the track to zero crosslevel on tangent track and to the proper crosslevel elevation, with spirals, for the curves as shown on Contract Documents.

C. Ballast shall be spread and track raised in a series of lifts. No single lift shall be higher than 2 inches except in crossings and turnouts. In raising the track, jacks or equipment shall be regulated to avoid bending of angle bars or straining of joints. When jacks are used they shall be simultaneously used and properly spaced at not more than quarter points of the rail to avoid breaks or bends in the rail when the track is raised. Both rails shall be raised simultaneously and to proper crosslevel by utilizing automatic tampers or standard track level boards with each set of track raising jacks. Each tie shall be tamped from 15 inches inside the rail to the end of the tie. Tamping shall not be permitted at the middle of a tie. Both ends of a tie shall be tamped simultaneously and tamping inside and outside the rail shall be done at the same time.

D. Ties that become loose during track raise shall be placed in proper position, tie-plates properly placed, holes plugged with “Tight Spike” or approved tie plugs and spiked before tamping. During each track raise, track shall be uniformly tamped.

E. After ballasting is completed and the track is resurfaced and lined, according to the tolerances, ballast shall be mechanically stabilized using a track stabilizer and ballast shall be trimmed neatly and surplus material shall be spread evenly along the ballast shoulder.

F. After stabilizing is completed, rail shall be destressed in accordance with SCRRA Track Maintenance and Engineering Instructions Section 8.3.

G. Contractor must perform the necessary operations to ensure that all ties are at right angles to the track as practical with standard railroad procedures. Cribs between ties shall be fully ballasted and dressed.

H. Contractor must perform two tamping squeezes per tie up to two (2) inches of raise with one additional insertion and squeeze for each additional one (1) inch of raise. Joint ties shall be given one additional squeeze more than other ties. The Contractor must not cause a center-bound track condition.

I. In locations where squeeze tampers cannot fill and compact ballast, such as but not limited at frogs, guard rails, switch portions of turnouts and headblocks, mechanically tamp with approved hand-held air tools or other power tamping tools. Hand tamping shall be done simultaneously from both sides of the tie.

J. On curves, the high rail shall be used as the line rail and the low rail shall be used as the grade rail.

K. When surfacing turnouts, the straight side of the turnout shall be used as the line rail.

L. After ballast regulating in turnouts, cribs for switch points, switch rods, and guardrails shall be pocketed 3 inches and cleared of ballast to permit free operation of the switch and signal rods.

M. After the ballast is regulated, dressed and consolidated using a track stabilizer, Contractor must ensure that track bolts and rail anchors, or elastic track fasteners are tight and in proper alignment.

N. For track resurfacing the total track raise will be the minimum amount necessary to smooth the track profile. It shall be the responsibility of the Contractor to provide smooth transitions that meet the required surfacing tolerances as listed above to grade crossings and turnouts, using the ballast stockpiled near the worksite. In addition, the Contractor must maintain vertical overhead clearances under structures by limiting the amount of track raise. Adjustment of turnouts and connecting tracks to match profile and alignment adjustments on adjacent track must be provided by Contractor at no additional expense.

O. Any temporary surfacing runoffs made to accommodate interim rail traffic prior to completion of track surfacing must meet FRA Track Class 5 Standards.

3.03 WALKWAYS

A. Walkways shall conform to SCRRA Engineering Standards ES2109 and General Order No.118-Public Utilities Commission of the State of California.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. Shift Existing Track will be measured by the unit or fraction thereof furnished and completed in accordance with the Contract Documents and as measured by the Engineer. The quantities as contained on the Schedule of Quantities and Prices, or approved schedule of values, as applicable, as derived from the Plans will be used as the basis for this measurement.

B. Surface, Line, and Dress Track and Surface, Line and Dress #10 Turnout will be measured by the unit or fraction thereof furnished and completed in accordance with the Contract Documents and as measured by the Engineer. The quantities as contained on the Schedule of Quantities and Prices, or approved schedule of values, as applicable, as derived from the Plans will be used as the basis for this measurement. Surface, Line, and Dress Track will only be measured and paid in areas of existing track outside of performance of other trackwork items. Surfacing, lining, and dressing of track shall be considered incidental within the limits of measurement and payment for track construction, special trackwork construction, grade crossing construction, and shift existing track.

C. All material, work and services included in Sections 34 11 15 Other Track Materials (OTM) and 34 11 26 Ballast will be included in this Section and are considered incidental to work under this Section and will be measured by the unit or fraction thereof furnished and completed in accordance with the Contract Documents.

D. Work of shifting, relocating and resurfacing existing track will include furnishing all labor, materials, tools, equipment, supplies, supervision, installation of Contractor provided ballast and walkway rock, laser aligned tamping, resurfacing, regulating, stabilizing and de-stressing to SCRRA standard cross section and any other incidental work necessary for shifting, relocating and resurfacing existing track as described in the Contract Documents.

4.02 PAYMENT

A. Shift Existing Track furnished and completed in accordance with the Contract Documents will be paid for at the Contract Unit Price, as listed on the Schedule of Quantities and Prices. This price shall include full compensation for furnishing all labor, Materials, tools, equipment, supplies, supervision, replacement of up to 15% of wood ties, restoration of shifted track, OTM, ballast, and incidentals, and doing all work, as shown on the Plans, and as specified in these Specifications.

B. Surface, Line, and Dress Track, and Surface, Line, and Dress #10 Turnout completed in accordance with the Contract Documents will be paid for at the Contract Unit Price, as listed on the Schedule of Quantities and Prices. This price shall include full compensation for furnishing all labor, Materials, tools, equipment, supplies, supervision, OTM, ballast, and incidentals, and doing all work, as shown on the Plans, and as specified in these Specifications.

END OF SECTION

SECTION 34 72 30

FIELD WELDING RAIL

PART 1 - GENERAL

1.01 SUMMARY

A. This Section consists of the Contractor performing field welding of continuous welded rail (CWR) strings using the flash butt welding process or approved thermite-welding method.

B. The Contractor must make assessment as to the number of welds, including the method of welding for each weld, to be performed under this Contract.

C. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.

2. Division 01 - General Requirements.

3. Section 34 72 00 - Trackwork.

4. Section 34 72 20 - Track Shifting, Relocating and Resurfacing.

1.02 REFERENCES

A. SCRRA: Engineering Standards, and Track Maintenance and Engineering Instructions.

B. American Railway Engineering and Maintenance of Way Association (AREMA):

1. Manual for Railway Engineering

C. FRA: 49 CFR Part 213, Track Safety Standards, most current and addenda, Federal Railroad Administration.

D. ASTM International (ASTM):

1. ASTM E164 Standard Practice for Ultrasonic Contact Examination of Weldments.

1.03 SUBMITTALS

A. Submit under the provisions of Division 01:

1. Procedure: Submit proposed materials, methods and procedures to be used for mobile flash butt field welding of CWR, including:

a. Manufacturer's trade name and technical data for the welding process, including welding machine performance standards.

b. Method of welding high strength rail if different from requirements for standard rail.

c. Methods of transporting material and mobile equipment to the site and duration of welding operations.

d. Method used for cutting and cleaning to parent metal of the rail ends.

e. Minimum and maximum spacing between rail ends.

f. Method used for maintaining the rails in alignment during welding.

g. Method used for grinding and contouring rail removing weld upset following the welding process.

2. Procedure: Submit proposed methods and procedures to be used for thermite welding of CWR, including:

a. Manufacturer’s trade name and technical data for the welding process.

b. Method used for cutting and cleaning of the rail ends.

c. Minimum and maximum spacing between rail ends.

d. Method used for maintaining the rails in alignment during welding.

e. Method used for preheating the rail ends including time and temperature.

f. Tapping procedure including the minimum time required to cool the weld under the mold insulation.

g. Method used, including a description of special tools and equipment for removing the gates and risers and finishing the weld to the final contour.

3. Refer to Division 01 for submittal of resumes for individual(s) directly supervising, inspecting, and performing field welding of rail.

4. Procedure: Submit rail end hardening procedure.

5. Testing: Submit testing company qualified in use of the Ultrasonic testing method in accordance with ASTM E164.

6. Field Weld Record: Submit as specified herein.

1.04 QUALITY ASSURANCE

A. Provide qualified personnel for supervision and performance of work in accordance with Division 01.

B. Perform certification testing of all welds to ensure that Work is performed in accordance with the Contract Documents, and within the tolerances provided herein.

PART 2 - PRODUCTS

2.01 MATERIALS

A. For electric flash butt welding, materials, equipment and process shall be as provided by Holland L.P. or other approved equivalent.

B. For thermite welding, Materials and equipment shall be as manufactured by "Boutet," "Orgotherm," "Elektro-Thermite," or other approved equivalent for standard or high strength (alloy or heat treated) rail, as appropriate.

PART 3 - EXECUTION

3.01 GENERAL

A. Electric flash butt welding, methods and procedures shall comply with the AREMA Manual, Volume 1, Chapter 4, Section 2.3, Specifications for the Quality Assurance of Electric-Flash Butt Welding of Rail.

B. Thermite welding, methods and procedures shall comply with the AREMA Manual, Volume 1, Chapter 4, Section 2.5 Specification for the Quality Assurance of Thermite Welding Rail, with the welding kit manufacturer's recommendations, and as specified herein.

C. Rail ends for thermite welding shall be prepared in accordance with the recommendations of the welding kit manufacturer.

D. For thermite welding, the rail ends shall be preheated prior to welding to a sufficient temperature and for sufficient time to ensure full fusion of the weld metal to the rail ends without cracking of the rail or weld.

E. The completed weld shall be finished by mechanically controlled grinding to conform to the same requirements specified for shop welding.

F. Thermite welds shall not be made at the following locations:

1. Within 5 inches of the edge of any bolt hole in the rail.

2. Within 2 inches of a Cadweld or copper bond wire (If this type of bond exists, remove any presence of copper by grinding. The rail ends must be inspected and cleaned after grinding is complete).

3. Closer than 2 feet from an existing plant weld.

4. Closer than 6 feet to an existing thermite weld.

5. On both ends of a rail plug simultaneously unless the rail is 15 feet or longer on tangent track and 24 feet long or longer on curved track.

G. Follow Manufacturer recommendations for compromise welds.

H. Follow recommendations of rail manufacturer for welding high strength (alloy or heat-treated) rails.

I. Thermite welds shall be located in cribs between ties. The edge of the weld must be no closer than 3 inches from the edge of the nearest tie.

J. Electric Flash Butt welds with the base of the rail smoothly ground may be located anywhere.

3.02 FIELD WELDING RECORD AND RAIL MARKINGS

A. Field welding record shall be continuously maintained and furnished to the Engineer within seven (7) workdays of completing the weld. The record shall include the following minimum details, noting that a different recording and marking procedure will be required for free end welds or for destress welds used to close up openings in rail:

1. Date and time of weld(s).

2. Location by station, specifying track and rail.

3. Contractor foreman initials.

4. Weather, air and rail temperature for destress welds (welds made to close up rail).

5. Track condition, anchorage and rail stress for destress welds, or the word “FREE” for free end welds.

B. Rail shall be permanently marked on the web of rail in legible characters at least 1-1/2 inches high at each field weld with the above information in accordance with Section 3.1.15, Marking Thermite Welds of the SCRRA Track Maintenance and Engineering Instructions. If an existing destress weld is located within 400 feet of a new destress weld, lines shall be marked through the old weld’s marking and an arrow marked indicating the direction towards the new destressed weld.

3.03 TOLERANCES OF FIELD WELDS

A. A straight edge 36 inches in length, applied to finished welded joint area shall be used to check for the following maximum variations (measurements shall be taken with a 6 inches steel taper gauge):

1. Rail Head:

a. Vertical Offset: 0.020 inches.

b. Horizontal Offset: 0.040 inches.

c. Vertical Crown: 0.030 - 0.045 inches.

d. Horizontal Kink: 0.020 inches.

2. Rail Base:

a. Horizontal Offset: 0.060 inches.

b. Offset Bending: 0.010 inches per inch.

3.04 FINISHING OF FIELD WELDS

A. Sharp edges and burrs shall be removed, including chimneys from thermite welds. Top of base of rail shall be ground smooth at chimney locations.

B. Weld joints shall be smooth on top and sides of head and straight in line. No over grinding is permitted. Web of rail at thermite welds shall not be ground. All mold residues shall be removed from the weld area and properly discarded.

C. Finishing of welds shall be sufficient to allow testing using the Ultrasonic test method as described below. Welds rejected because of insufficient or unsatisfactory finishing of welds shall be refinished, repaired, or replaced at the Contractor's expense until the weld meets the testing criteria.

3.05 FIELD WELD TESTING

A. Fabricate CWR strings so that the branding of all individual rail section appears on the field side of installed track.

B. Rail welds must be tested by the Contractor through the use of a testing agency that has been approved by the Engineer. Testing shall be performed using the Ultrasonic testing method in accordance with ASTM E164, using the Two-Search-Unit Technique 4.

C. Each completed weld shall have full penetration and complete fusion and be entirely free of cracks. Total area of internal defects such as porosity and slag inclusions shall not exceed 0.060 sq in and the largest single porosity or slag defect permitted shall not exceed 1/8 inches dia.

D. Other causes for rejection of welds shall be:

1. Cracks that show in the finished weld.

2. Pit holes that show in web and base of weld after finish grinding. Pit holes in head not exceeding 1/4 inches in depth may, if approved by the Engineer, be repaired by gas welding.

3. Over-grinding of weld.

E. Welded joints not meeting these Specifications and tolerances will be replaced at no additional cost to the OCTA. The defective weld shall be cut out, and a new section of rail of a length described in Article 3.06 herein shall be inserted, welded into place as described in this Section, and retested.

3.06 CUTTING IN SHORT SECTION RAIL AND THERMITE WELDING THE ENDS

A. A short section of rail shall be cut in the CWR, when required by the Engineer, for the following reasons:

1. To repair defective rail(s).

2. To repair defective weld(s).

3. To destress rail.

4. To make a connection between rail strings or adjust rail to meet a specific point (i.e. to connect CWR to stock rail or frog).

B. The short section of rail to be cut in shall be at least 19 feet-6 inches long on tangents and curves less than 2 degrees; and 30 feet long on curves 2 degrees or greater and rail to be cut in shall be of the same weight, size, section, and class of rail being replaced or joined.

C. Before cutting out rail in CWR and inadvertently losing all thermal control, prevent remaining CWR from further movement by applying full box anchors for at least 200 feet each way from the proposed cut. After cutting CWR, a rail expander/puller or other means shall be used to prevent rail movement until a weld or temporary joint is installed.

D. The ends of the short rail section and the CWR shall be saw cut.

E. Follow manufacturer’s recommended procedures specified for completing field welding by thermite process.

F. Repair of rail due to damage by Contractor shall be at Contractor's expense.

G. When repairing a defective rail or weld, the new rail shall be the same length as rail being replaced, or as required to achieve thermal adjustment.

H. When performing field welding, rail temperature adjustments shall be made in accordance with Section 34 72 00 using either heating of rail or mechanical rail pullers. The first weld of a replacement plug may be at ambient temperature, but the second (destress weld or rail closure weld) shall be installed in accordance with Section 34 72 00.

PART 4 - MEASUREMENT AND PAYMENT

A. Work of this Section is considered incidental to work under other payment items and no separate measurement and payment will be made to the Contractor for Work of this Section.

B. Work of this section shall include furnishing all labor, materials, tools, equipment, supplies, supervision, and incidentals necessary for Field Welding Rail as described by the Contract Documents.

END OF SECTION

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SECTION 34 80 11

STONE REVETMENT (RIPRAP)

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Stone revetment (riprap) for protection of slopes against erosion.

a. Drainage outflow area.

b. Slope riprap.

c. Geotextile and sand cushion base.

d. Other areas indicated and shown on the Drawings.

B. Related Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.

2. Division 01 - General Requirements.

3. Section 31 20 00 - Earthwork.

1.02 REFERENCES

A. Reference Standards:

1. American Association of State Highway and Transportation Officials (AASHTO):

a. M228, Standard Specification for Geotextile Specification for Highway Applications.

b. T103, Soundness of Aggregates by Freezing and Thawing.

2. ASTM International (ASTM):

a. C88, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.

b. C127, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.

c. C1116, Standard Specification for Fiber-Reinforced Concrete and Shotcrete.

3. Corps of Engineers (COE):

a. CRD-C100, Method of Sampling Concrete Aggregate and Aggregate Sources, and Selection of Material for Testing.

1.03 SUBMITTALS

A. Shop Drawings:

1. See Division 01 for requirements for the mechanics and administration of the submittal process.

2. Product technical data including:

a. Acknowledgement that products submitted meet requirements of standards referenced.

3. Certifications.

4. Test reports.

5. Submit all tests and certification in a single coordinated submittal. Partial submittals will not be accepted.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Stone:

1. Durable broken quarry run stone Apparent Specific Gravity minimum 2.50 ASTM C127.

2. Does not disintegrate on exposure to water or weathering.

3. Free from structural fractures and defects.

4. Not containing shale, unsound sandstone, or other material which will disintegrate.

5. Graded within limits specified.

6. Breadth and thickness of any stone: Not less than one-third of its length.

7. Ensure that dirt and fines accumulated from interledge layers or from blasting or handling operation is less than 2 percent by weight.

8. Gradation of the material:

   a. Ungrouted riprap to be loaded and quarried shall conform to the following limitations unless otherwise specified:

RIPRAP CLASS	AVERAGE WEIGHT PER STONE (LBS)	DIMENSION (IN)	MINIMUM LAYER THICKNESS
I	50 to 200	9 to 14	1' - 6 "
II	200 to 1000	14 to 24	2' - 0"
III	1000 to 4000	24 to 38	3' - 0"
IV	> 4000	> 38	4' - 0"

   b. Grouted riprap shall have the following gradation:

NOMINAL STONE SIZE (INCHES)	% OF MIX SMALLER THAN GIVEN SIZE (BY WEIGHT)
21	70 to 100
18	50 to 70
12	0 to 5

9. The following allowances shall be acceptable to produce the required ungrouted riprap protection:

   a. Riprap Class I - No allowances permitted.

   b. Riprap Class II - 15 percent of riprap Class I.

   c. Riprap Class III - 15 percent of riprap Class I and 15 percent of Class II.

   d. Riprap Class IV - 15 percent of riprap Class I, 15 percent of Class II, and 15 percent of Class III.

10. Grouted riprap:

   a. Riprap shall be angular (not rounded), each rock having its greatest dimension not greater than 3 times its least dimension. Elongated rocks shall be hand adjusted to a vertical verses horizontal position.

   b. The specific gravity of the riprap rock shall be 2.5 or greater.

   c. Broken concrete or asphalt pavement shall not be acceptable for use in the work.

d. Riprap and grout colors may be limited by local flood control districts or other regulatory entities. Contractor is responsible for ascertaining and complying with any such requirements.

B. Geotextile:

1. Geotextile shall be Class 2 Non-Woven in accordance with AASHTO M288 with an AOS of 70.

C. Sand Cushion:

1. Sand cushion shall be clean sand, free of angular gravel.

D. Grout:

1. Concrete for the grout shall be an approved batch meeting the following requirements:

a. All concrete shall develop 3,000 psi compressive strength within 28 days, the cement shall be Type II modified or Type V, the stone aggregate shall have a maximum diameter of ½", and the slump shall be within a range of 3 to 6 inches.

b. The water/cement ratio shall not exceed 0.48.

c. Add 1.5 lbs of synthetic fiber-reinforcing per cy of grout per manufacturer's instructions.

E. Synthetic Fiber-Reinforcing:

1. 100 percent virgin polypropylene, fibrillated fibers containing no reprocessed olefin materials and specifically manufactured for use in concrete.

2. Physical characteristics:

a. Specific gravity: 0.91.

b. Fiber length: ¾".

c. Provide in accordance with ASTM C1116.

d. Acceptable manufacturers:

1) Fibermesh.

2) Grace Construction Products.

2.02 SOURCE QUALITY CONTROL

A. Perform all tests at an approved independent laboratory.

B. Obtain samples in conformance with COE CRD-C100.

C. Source Tests:

1. Supply certified tests and service records to determine acceptability and application of stone materials.

2. In event suitable test reports or a service record that is satisfactory are not available, as in case of newly operated sources, subject material to tests necessary to determine its acceptability for use.

3. Tests to which materials to be subjected include:

a. Specific gravity.

b. Soundness in magnesium sulfate.

c. Soundness in freezing and thawing.

D. Material Acceptability Tests:

1. Initial test: On material from each ledge sampled prior to start of construction.

a. Specific gravity.

b. Soundness in magnesium sulfate.

c. Soundness in freezing and thawing.

2. Control tests:

a. Perform control tests including one specific gravity, one soundness in magnesium sulfate, and one soundness in freezing and thawing for each type of stone revetment material for every 100 tons of material.

E. Specific Gravity Test:

1. Conform with ASTM C127.

2. Not less than 2.40 minimum.

F. Soundness in Magnesium Sulfate:

1. Conform with ASTM C88, except maintain samples immersed in solution at a temperature of 80˚ F (26˚ C) +2˚ F.

2. Not more than 12 percent loss at five cycles.

G. Soundness of Aggregates in Freezing and Thawing:

1. Conform with AASHTO T103 method as modified herein.

2. Ensure loss at 12 cycles of not more than 10 percent.

3. Maintain temperature of cold liquid in range of -5 to 0 deg. F (-20 to -18 deg. C).

4. Maintain thaw fluid temperature in range of 45 to 50 deg. F (7 to 10 deg. C).

5. Permit length of freezing and of thawing cycles of 2 hours with 1 hour of freezing following by 1 hour of thawing.

6. Perform thawing by circulating thaw fluid around pan containing stone immersed in a depth of ¼" rather than by total immersion.

PART 3 - EXECUTION

3.01 PREPARATION

A. Trim and dress all areas to required cross sections.

B. Bring areas that are below allowable minus tolerance limit to grade by filling with material similar to adjacent material.

C. Compact base to density specified for backfill in accordance with Section 31 20 00.

D. Do not place any stone material on prepared base prior to inspection by Engineer.

3.02 PLACING

A. Ungrouted Riprap:

1. Where indicated on Drawings, place geotextile on prepared foundation within limits indicated.

   a. Geotextile overlaps shall be a minimum of 1' – 0".

   b. Geotextile shall be secured to slope per the manufacturer's recommendation.

2. Where indicated on Drawings, place sand cushion on geotextile within limits indicated.

   a. Sand cushion shall have a minimum thickness of 4 inches.

3. Place stone revetment material on prepared base within limits indicated.

4. Place on prepared base to produce a well-graded mass of stone with minimum percentage of voids.

5. Place to required thickness and grades.

6. Place to full thickness in a single operation to avoid displacing the underlying material.

7. Distribute entire mass to conform to gradation specified.

   a. Do not place stone by dumping into chutes or by similar method likely to cause segregation.

8. Keep finished stone revetment free from objectionable pockets of small stones or clusters of larger stone.

   a. Hand place as necessary to obtain a well-graded distribution.

9. Ensure a final tolerance of within 3 inches from indicated slope and grade lines.

10. Place stone revetment in conjunction with embankment construction to prevent mixture of embankment and stone revetment materials.

11. Maintain stone revetment until accepted.

12. Replace any displaced material to lines and grades shown.

B. Grouted Riprap:

1. The Contractor must notify the OCTA a minimum of two working days of his intent to perform any grouting activities prior to placement of any grout to allow scheduling of inspection activities. Grout operation shall not proceed without the approval of the OCTA.

2. Contractor must clean with a water blast operation faces and edges of any existing to-remain structural elements such as wingwalls or abutments to which the grouted riprap will come in contact.

3. Riprap shall be placed prior to grouting. It is desirable that elongated stones along the top layer of riprap have a vertical orientation.

4. Dewatering shall be implemented to guarantee that the grout will not be placed in water or be exposed to stream flows for a period of 24 hours after the grout has been placed.

5. Contractor must keep riprap, boulders and concrete walls that are to receive grout wet at all times prior to injecting grout.

6. The concrete grout shall be placed by injection methods by pumping under low pressure, positive displacement methods, through a 2 inches maximum diameter hose to ensure complete penetration of the grout into the rock layer.

7. The voids at the surface of the riprap will not be grouted. The depth of grout measured from the prepared subgrade bed shall be 18 inches. Operator shall be able to stop the flow of grout when required, and will place grout in the voids and not on the surface of the riprap.

8. A "pencil" vibrator will be used to make sure all voids are filled between and under the riprap. The intent is to fill all voids from the subgrade level around the riprap for a minimum depth of 18 inches. In all cases, grout must penetrate to the subgrade of the riprap. The pencil vibrator may be used to smooth the appearance of the surface, but the Contractor must use a wood float to smooth and grade the grout to drain. When placing grout, it shall be placed between the riprap and against earth, rock, or concrete excavated sidewalls.

9. Contractor must clean and wash any spillage before the grout sets. The visible surfaces of the riprap will be free of grout to provide a clean natural appearance.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. Ungrouted Riprap:

1. Ungrouted riprap of the various classifications will be measured by the unit or fraction thereof furnished and completed in accordance with the Contract Documents and as measured by the Engineer. The quantities as contained on the Schedule of Quantities and Prices, or approved schedule of values, as applicable, as derived from the Plans will be used as the basis for this measurement.

4.02 PAYMENT

A. Ungrouted Riprap:

1. Ungrouted riprap furnished and completed in accordance with the Contract Documents will be paid for at the Contract Unit Price, as listed on the Schedule of Quantities and Prices. This price shall include full compensation for furnishing all labor, Materials, tools, equipment, supplies, supervision, and incidentals, and doing all work, as shown on the Plans, and as specified in these Specifications.

2. The contract price paid unit of ungrouted riprap for each classification shall include compensation to the Contractor for furnishing riprap, all labor, materials, equipment and any other incidentals to place riprap complete-in-place, including haul from the suppliers source, necessary stockpiling at the job site, reloading for placement, placement, overestimates of salvageable boulders, disposing of any rejected riprap, excavation and removal of material, over-excavation for construction, backfilling, and any other miscellaneous items and work shown or reasonable implied on the Plans, in the Specifications for this work, and elsewhere in the Contract Documents.

3. Geotextile and sand base and other associated materials and incidentals and installation thereof shall be considered part of the riprap and full compensation therefore shall be considered as included in the contract unit price paid for ungrouted riprap.

END OF SECTION

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SECTION 34 80 22

CAST-IN-DRILLED-HOLE (CIDH) PILES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Construction of CIDH pile foundations.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.

2. Division 01 - General Requirements.

3. Section 03 21 00 – Reinforcing Steel

4. Section 03 31 00 - Structural Concrete.

C. CIDH Pile construction shall be in accordance with the most current edition of The American Railway Engineering and Maintenance-of-Way Association (AREMA) Manual of Railway Engineering, Chapter 8: Concrete Structures and Foundations, Part 24: Drilled Shaft Foundations.

1.02 REFERENCES

A. ADSC West Coast Chapter, Standard CIDH Pile Anomaly Mitigation Plan “A” and Plan “B”.

B. American Railway Engineering and Maintenance-of-Way Association (AREMA).

1. Manual for Railway Engineering.

C. American National Standards Institute (ANSI):

1. A135.4 – Basic Hardboard Standards

D. ASTM International (ASTM):

1. A36, Standard Specification for Carbon Structural Steel.

2. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

3. A252, Standard Specification for welded and Seamless Steal Pipe Piles.

4. A283, Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.

5. A929, Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process for Corrugated Steel Pipe.

6. C203, Standard Test Method for Breaking Load and Flexural Properties of Block-Type Thermal Insulation.

7. D1751, Standard Specifications for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

8. D4380, Standard Test Method for Density of Bentonitic Slurries.

9. D4381, Standard Test Method for Sand Content by Volume of Bentonitic Slurries.

10. D4972, Standard Test Method for pH of Soils.

E. American Petroleum Institute (API):

1. RP 138-1, Standard Procedure for Field Testing Water-Based Drilling Fluids.

F. American Welding Society (AWS):

1. D1.1, Structural Welding Code - Steel.

G. California Department of Transportation (Caltrans):

1. Soil and Rock Logging, Classification, and Presentation Manula (2010 Edition).

2. California Test 233, Method of Ascertaining the Homogeneity of Concrete in Cast-In-Drilled-Hole (CIDH) Piles Using the Gamma-Gamma Test Method.

1.03 SUBMITTALS

A. See Division 01 for requirements for the mechanics and administration of the submittal process.

B. Log of installation of all CIDH Piles.

C. Shop Drawings of all reinforcing and accessories required for the CIDH Piles.

D. Product Technical Data including:

1. Acknowledgement that products meet the requirements of the standards referenced.

2. Proposed concrete mix design for the CIDH Piles:

a. See Section 03 31 00 for information to be included in the mix design submittal.

E. Test Reports:

1. Copies of concrete strength tests for concrete placed in the CIDH Piles.

F. Contractors qualifications as specified in Article 1.02.B. in this Specification Section.

G. CIDH Pile installation plan as specified in Article 3.02.A. in this Specification Section.

H. Slurry test results as specified in Article 2.01.A. in this Specification Section.

I. AWS Welder Certification.

1.04 QUALITY ASSURANCE

A. Qualifications:

1. Contractor Qualifications:

a. Two (2) weeks prior to the pre-construction conference, the Contractor must submit the contractor's qualification as specified in the following to Engineer.

b. Unless otherwise indicated, the minimum Contractor's experience shall consist of successful installation of at least 5 CIDH Pile Projects of similar or greater size, and similar geotechnical conditions installed within the past 3 years.

1) The mentioned documentation shall reference and detail the size of the CIDH piles, methods used during installation, methods used for stabilizing the CIDH pile wall excavations, local soil conditions, actual construction time, contract time, names and phone numbers of owner's representatives who can verify the Contractor's participation on those projects.

2) The Contractor must provide documentation of their superintendent's qualifications, record experience, and prior project references demonstrating that they can handle unusual site conditions and equipment breakdowns.

c. The CIDH pile work shall be performed under the supervision of the Contractor's superintendent, who shall be fully knowledgeable and experienced in construction of CIDH pile foundations of similar size and geotechnical conditions as those shown on the plans.

1) In addition, the Contractor's superintendent performing the work shall have at least 5 years of experience installing similar size CIDH piles within the last 8 years.

2) The Engineer may accept or reject the Contractor's CIDH Pile Subcontractor and its superintendent based on their qualifications and previous field performance.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Slurry:

1. Only mineral or polymer slurries shall be used in the drilling process unless other drilling fluids are approved in writing by the Engineer.

2. The percentage and specific gravity of the material used to make the suspension shall be sufficient to maintain the stability of the excavation and to allow proper concrete placement.

3. In the event of a sudden significant loss of slurry to the excavation, the construction of the foundation shall be stopped until either methods to stop slurry loss or an alternate construction procedure has been approved by the Engineer.

4. All tests specified below shall be performed when the slurry temperature is above 40˚ F.

5. Mineral slurry or polymer slurry shall be premixed thoroughly with clean, fresh water, and adequate time (as prescribed by the manufacturer) allotted for hydration in slurry tanks.

a. Slurry tanks of adequate capacity will be required for slurry circulation, storage, treatment, and disposal.

b. No excavated slurry pits will be allowed.

c. The Contractor must draw sample sets from the slurry tanks and test the samples for conformance with the specified material properties prior to introduction into the shaft excavation.

d. A sample set shall be composed of samples taken at mid-height and within 2 feet of the bottom of the slurry tanks.

6. The Contractor must sample and test all slurry in the presence of the Engineer, unless otherwise directed.

    a. The date, time, names of the persons sampling and testing the slurry, and the results of the tests shall be recorded.

    b. A copy of the recorded slurry test results shall be submitted to the Engineer at the completion of each pile, and during construction of each pile when requested by the Engineer.

7. Sample sets of all slurry, composed of samples taken at mid-height and within 2 feet of the bottom of the pile, shall be taken and tested during shaft excavation as necessary to verify the control of the properties of the slurry.

    a. As a minimum, sample sets shall be taken and tested at least once every 2 hours after beginning slurry use.

    b. When the test results show consistent specified properties, sample sets shall be taken and tested at least once every 4 hours of slurry use.

    c. Slurry shall be recirculated, or agitated with the drilling equipment, when tests show that the sample sets do not have consistent specified properties.

8. When samples are found to be unacceptable, the Contractor must clean, recirculate, desand, or replace the slurry to maintain the required slurry properties.

    a. Cleaning of the bottom of the excavation and placement of the concrete shall not begin until tests show that the sample sets have consistent specified properties.

9. The Contractor must demonstrate to the satisfaction of the Engineer that stable conditions are being maintained.

    a. If the Engineer determines that stable conditions are not being maintained, the Contractor must immediately take action to stabilize the shaft.

    b. The Contractor must submit a revised installation plan, which corrects the problem and prevents future instability.

    c. The Contractor shall not continue with pile construction until receiving the Engineer’s approval of the revised pile installation plan.

10. Controlled Slurry:

a. Slurry shall consist of a stable colloidal suspension of various pulverized clays or polymers thoroughly mixed with water with the properties given in the Required Slurry Property Table below.

b. Water used to mix slurry shall be potable.

REQUIRED SLURRY PROPERTIES TABLE		
Items to be measured	Range of results at 60˚ F	Test Methods
1. Density before concrete placement, lb/ft^3 for slurry 1 foot from shaft bottom		(Mud Balance) ASTM D4380
Mineral slurries (bentonite/attopulgite)		
a. No end bearing	85 maximum	
b. With end bearing	70 maximum	
Polymer slurry		
a. No end bearing	64 maximum	
b. With end bearing	64 maximum	
2. Marsh funnel viscosity, sec/qt, for entry		(Marsh funnel and CUP American Petroleum Institute (API - RP138-1), Section 2.2.
a. Mineral slurries (bentonite/attopulgite)	26 to 50	
b. Polymer slurry	40 to 90*	Standard Procedure for Field Testing Water-Based Drilling Fluids
	* or as recommended by manufacturer and approved by OCTA	
3. Sand content be volume, percent, before concrete placement for slurry 1 foot from shaft bottom		(Sand screen set) ASTM D4381
Mineral slurries (bentonite/attopulgite)		
a. No end bearing	4 maximum	
b. With end bearing	20 maximum	
Polymer slurry		
a. No end bearing	1 maximum	
b. With end bearing	1 maximum	

REQUIRED SLURRY PROPERTIES TABLE		
4. pH, during excavation	7 to 12	ASTM D4972

c. The Contractor must wait 30 minutes, after the last drilling and scouring, to allow contaminants to settle out before taking and testing a sample set of slurry.

1) After the reinforcing steel cage is placed in the excavation, a sample set of slurry shall be taken and tested immediately prior to concrete placement.

B. Concrete:

1. All materials, proportioning, air entraining, mixing, slump, and transporting of PCC shall be in accordance with Section 03 31 00 except as modified herein.

2. The water/cement ratio shall not exceed 0.45.

3. The concrete for construction of drilled shafts shall have a slump of 8 inches ±1.5 inches.

4. Concrete admixtures:

a. Comply with Section 03 31 00.

C. Reinforcing Steel:

1. Provide reinforcing steel conforming to requirements of Section 03 21 00.

a. Reinforcing sizes, number, configuration, spacing and lengths to be as indicated on Plans.

D. Steel Casing (Permanent and Temporary):

1. Permanent steel casing shall have sufficient strength to withstand handling stresses, drilling and installation stresses, concrete pressures, and surrounding earth and water pressures, if required.

a. Steel for permanent casing shall conform to the requirements of ASTM A283: Grade C, ASTM A36, or ASTM A929.

b. Submit size, wall thickness, type of steel, and length of permanent casing to the OCTA for acceptance.

2. Temporary steel casing shall have sufficient strength to withstand handling stresses, drilling and installation stresses, concrete pressures, and surrounding earth and water pressures, or if required, for protection of personnel or to permit advancement of shaft through caving ground.

    a. Submit size, wall thickness, type of steel, and length of permanent casing to the OCTA for acceptance.

3. Furnish full-penetration welds meeting the requirements of "Structural Welding Code - Steel" (ANSI/AWS D1.1) of the American Welding Society requirements for joints in non-corrugated permanent steel casings.

    a. Welders shall be AWS certified.

4. Deliver casing to site in undamaged condition.

    a. Handle and protect casing to maintain diameter within 2 percent.

E. Expanded Polystyrene:

1. Expanded polystyrene must be commercially available polystyrene board with (1) a flexural strength of at least 35 psi when tested under ASTM C203 and (2) a compressive yield strength from 16 to 40 psi at 5 percent compression. Face the surfaces of expanded polystyrene that concrete is placed against with 1/8 IN thick hardboard complying with ANSI A135.4. Other facing materials may be used that provide equivalent protection. Secure the hardboard using nails, waterproof adhesive, or other authorized means.

PART 3 - EXECUTION

3.01 CONSTRUCTION TOLERANCES:

A. The CIDH Pile shall be within 3 inches of plan position at the top of shaft.

B. The vertical alignment of pile excavation shall not vary from the plan alignment by more than 1/4 inches/feet.

C. Full depth reinforcing steel cages shall be set at no less than 6 inches above the bottom of the excavated shaft prior to placement of concrete.

D. After all the concrete is placed, the top of the reinforcing steel cage shall be no more than six (6) Inch above and no more than 2-3/4 inches below plan position.

E. The top elevation of the shaft may have a tolerance of up to +1 inches or -3 inches from the plan top of pile elevation.

1. Sufficient reinforcement bar splice length for splices above the shaft shall be attained.

F. Excavation equipment and methods shall be designed so that the completed shaft excavation will have a planar bottom.

1. The cutting edges of excavation equipment shall be normal to the vertical axis of the equipment within a tolerance of 3/8 in/ft of diameter.

G. CIDH Pile excavations and completed shafts not constructed within the required tolerances are unacceptable.

1. The Contractor shall be responsible for correcting all unacceptable pile excavations and completed shafts to the satisfaction of the Engineer.

2. Materials and work necessary, including engineering analysis and redesign, to complete corrections for out of tolerance CIDH pile excavations shall be furnished without either cost to the Contracting Authority or an extension of the completion dates of the project.

H. The elevations, dimensions, and depth of the CIDH Piles shall be as specified on the Plans.

I. The dimensions of casings are subject to American Pipe Institute tolerances applicable to regular steel pipe.

3.02 INSTALLATION

A. The installation of the CIDH pile must be done in a continuous operation with no unplanned interruptions. If an unplanned interruption cannot be avoided, the engineer shall be notified immediately and the contractor must submit remedial measures for approval.

B. CIDH Pile Installation Plan:

1. The Contractor must submit a signed statement that they have inspected the project site and all the subsurface information made available in the contract documents.

2. No later than 1 month prior to constructing CIDH Piles, the Contractor must submit a CIDH Pile installation plan for review by the Engineer.

a. This plan shall provide information on the following:

1) Name and experience record of firm(s) and associated personnel for the following:

a) Driller.

b) Drilled shaft superintendent.

2) List of proposed equipment to be used including cranes, drills, augers, bailing buckets, grooving equipment, scouring equipment, final cleaning equipment, core sampling equipment, confirmation boring equipment, tremies or concrete pumps, casing, slurry equipment, airlift pumps, etc.

3) Details of overall construction operation sequence, the sequence of pile construction in bents or groups and pile construction.

4) Details of pile excavation methods.

5) Details of steel casing and forms, including installation and extraction methods.

6) Details of the type and methods to mix, circulate, desand, test, and dispose of slurry (if applicable).

   a) If polymer slurry is proposed, submit data on load transfer and manufacturers requirements for slurry control.

7) Details of methods to clean the pile excavation, including air lift methods and spin bucket methods as applicable.

8) Details of reinforcement placement including support and cage centering methods.

9) Reinforcing steel cage splicing method, if proposed, including details of dimensions, installation, splice location, support and cage centering methods, and estimated time required for splicing.

10) Details of concrete placement including procedures for tremie or pumping methods and method to prevent slurry intrusion at the discharge end.

11) Details of methods to control cuttings, water and slurry. with adjacent traffic conditions (vehicular or railroad if applicable).

12) Details of final discharge of concrete at top of pile, of removing contaminated concrete, and verifying concrete uniformity for site specific conditions.

13) Details on casing to be used, including specific length/depth of all casing proposed, and specific evaluation and determination of casing (size, depth, etc.) required to prevent any shaft installation procedure from having an effect or impact on adjacent structures, railroads, etc.

14) Details of casing being seated into rock to seal groundwater from entering the drill hole.

3. The Engineer will evaluate the CIDH pile installation plan for conformance with the Contract Documents.

a. Within 14 calendar days after receipt of the plan, the Engineer will notify the Contractor of additional information required and changes necessary to meet the Contract requirements.

b. All procedural approvals given by the Engineer shall be subject to trial in the field and shall not relieve the Contractor of the responsibility to satisfactorily complete the work as detailed in the Contract Documents.

4. A pre-drilling conference will be required for this work prior to the start of pile excavation. The Engineer and OCTA will set up the conference.

a. The Engineer, Contractor, and drilling staff shall discuss the anticipated pile installation process.

C. Pile Excavation:

1. Protection of Existing Structures:

a. Precautions shall be taken to prevent damage to existing structures and utilities.

b. These measures shall include but are not limited to vibration monitoring, or subsidence control during driving of casings, sheets, or drilling.

2. Construction Method:

a. If the concrete is to be placed under the wet condition as defined in this Specification, the Contractor must construct CIDH piles in such a manner that the elevation of the water or slurry inside the pile will be equal to or higher than the ground water elevation at the time of concrete placement.

b. The CIDH Piles may be constructed by casing method to produce sound, durable concrete foundation shafts free of defects.

1) Wet method may be combined with casing method with approval from the Engineer only if the excavation can not be dewatered and concrete placed in the dry, as defined elsewhere in this Specification Section.

2) Wet Method:

a) The wet method consists of keeping the shaft filled with slurry a minimum of 4 feet above the highest expected water table during drilling and excavation, desanding of the slurry when required, final cleaning of the excavation by means of a bailing bucket, air lift, pump or other approved device and placing shaft concrete which displaces the slurry.

3) Casing Method:

a) The casing method is used to advance the hole through unstable material.

(1) Undercutting to the outside diameter of the casing may be required.

b) The purpose of the steel casing is to stabilize the side walls during drilling to prevent cave-ins from unstable material and vibrations. The purpose of the casing is also to prevent any pile installation procedure from having an impact on adjacent structures and railroads.

c) If voids exist between the permanent casing and the drill hole, lean grout or a sand/gravel mix shall be placed as directed by the Engineer.

c. Surface and subsurface obstructions shall be removed by the Contractor.

1) Special tools and/or procedures may be required.

2) No separate payment will be made for removing obstructions.

d. Excavations required for the CIDH Piles shall be performed through whatever materials encountered, of the dimensions, and to the elevations shown in the Plans.

1) The excavation and installation method shall be suitable for the intended results and materials are encountered.

2) Blasting is not permitted.

3. Excavation in rock is defined as the excavation that cannot be drilled or accomplished with conventional augers designated to excavate hard soil or soft rock and that requires special tools and procedures to make the excavation advance.

a. Rock drilling tools such as augers with fitted rock teeth, core barrel, buckets with significant down crowding, or roller bits combined with extra drilling pressure by a hydraulic or percussion system are used for the rock drilling excavation.

4. The Contractor shall anticipate and make available at the job site all equipment necessary and essential to penetrate soft and hard rock during the construction of the drilled shafts.

   a. The equipment for excavation, drilling, and cleaning operations shall have adequate capacity; including power, torque, and down thrust to excavate a hole to an elevation equal to the lowest tip elevation of the production drilled shafts installed from the equipment operation elevation at the time of drilled shaft construction, plus 25 feet or plus 25 percent of the maximum length of the production drilled shafts, whichever is greater.

      1) The Contractor must have drilling tools available to increase diameter of shaft should initial drilled hole be out of vertical tolerances stated in this Specification.

5. CIDH piles shall be installed in such a manner that no voids shall exist between the overburden and the casings.

6. The drilling sequence shall be such that for every pile drilled, at least two piles are skipped. The piles adjacent to the freshly poured pile may only be drilled a minimum of 24 hours after placement of concrete.

7. The Contractor must extend CIDH pile tip elevations if the Engineer determines that the material encountered during excavation or present at tip elevation is unsuitable and/or differs from that anticipated in the design of the CIDH pile.

8. After the pile excavation has been completed, the Contractor shall immediately proceed with shaft construction.

9. Safety:

   a. The Contractor shall not permit any worker to enter the CIDH pile excavation for any reason unless; a suitable casing has been installed, the water level has been lowered and stabilized below the level to be occupied, and an adequate safety equipment and procedures have been provided to the personnel entering the excavation which includes OSHA certification for confined-entry-space.

10. Record Information:

a. For each CIDH pile construction, the Contractor must provide the Engineer with an excavation record including but not limited to the following: the location; dimensions; verticality; description of the materials encountered at all elevations; drilling time in each of the various strata; elevation of the water table during excavation; description of any change in excavated material; elevation of top and bottom of the finished pile; depth to the steel casing; condition of the bottom of the excavation and deviation from plan location.

1) All unusual observations shall be reported to the Engineer within 8 hours of discovery.

2) Two (2) copies of the excavation records, signed by a responsible representative of the Contractor and cosigned by a representative of the Engineer, shall be furnished to the Engineer within one (1) day after the pile excavation is completed.

b. The Contractor must retain additional CIDH pile installation records including, but not limited to the following: Concrete volume, concrete pouring rate, and other pertinent data to the CIDH pile operations.

1) Copies of these installation records shall be submitted to the Engineer within one (1) day after the finish of the installation.

D. Steel Casing (Temporary and Permanent):

1. The procedure and methods to install and seal the steel casings shall not produce stresses in excess of 25 percent over the design allowable for the type of steel used.

a. The Contractor must submit computations of critical stresses imposed on the steel casing during installation.

b. The casing shall not be more than one inch out of round before and after installation.

2. Welding of steel casings shall be by a semi-automatic or automatic welding process to fully develop the casing.

a. All welding shall be in accordance with ANSI/AWS D1.1.

3. Nondestructive testing of the welds will not be required; however, the Contractor shall be responsible for placing a sound, watertight casing.

4. After installation but prior to excavation of the rock socket, the casings shall be inspected for location, alignment and condition.

a. Any casing that shows bends or kinks or other deformations that would impair the strength or efficiency of the complete shaft shall be either removed and replaced or repaired by the Contractor in a manner satisfactory to the Engineer.

b. Repairing or replacing casing when ordered by the Engineer shall be done at no additional cost to the Contracting Authority.

5. Temporary casing, if approved for use as part of the Contractor's means and methods, may require the casing to be cut ("lost") or damaged by the Contractor during the construction process. Temporary casing and any associated lost or damaged temporary casing shall be considered incidental to CIDH Pile construction; and no separate measurement or payment shall be made therefor.

E. Dewatering and Rock Socket:

1. The Contractor shall determine the elevation of the top of the rock and at the bottom of the casing at each drilled shaft location.

a. The method shall be approved by the Engineer, and the elevation determined during the presence of Engineer or the Engineer's representative.

2. Prior to excavation of the rock socket, the Contractor shall seat the casing in the sound rock for a minimum depth of 1 foot and attempt to dewater the shaft.

a. If the shaft cannot be dewatered to the dry condition or the satisfaction of the Engineer, the Contractor shall attempt to seal the shaft by carrying the casing further into the rock.

b. This procedure shall be followed for each drilled shaft.

c. The Contractor will not be required to carry the casing more than an additional 3 feet (a total of 4 feet) into the sound rock. The casing may be advanced four feet into the sound rock during initial placement.

d. The preliminary tip elevations of the casings are shown in the plans based on available borings.

e. The actual elevation shall be determined based on actual rock elevation and conditions encountered during excavation as determined by the Contractor using the method(s) approved by and in the presence of the Engineer.

f. After the casing has been seated sufficiently to allow dewatering to achieve the dry condition or the satisfaction of the Engineer or to the maximum depth specified above, the Contractor shall excavate the rock socket.

1) The aforementioned dry condition is defined as less than 12 inches of water accumulation above the base over a 1 hour period.

g. Additionally, less than 3 inches of water will be permitted in the bottom of the excavation at the time of concrete placement in dry condition.

3. The method of excavating the rock socket shall be capable of providing a cylindrical opening of the specified diameter and to the full depth shown on the plans or to the depth directed by the Engineer.

a. Excavation shall be along the axis of the shaft and over breakage at the rock surface shall be avoided so as not to destroy the seal of the bottom of the steel casing.

b. The methods of excavating the rock socket shall have proper control to prevent undercutting of the steel casing.

4. No rock projections shall extend inside the rock socket diameter.

a. All overburden, loose rock fragments, and other debris shall be removed from the rock socket and shaft prior to placing the shaft concrete.

b. The inside surface of the casing shall be clean and free of extraneous material prior to placing of concrete.

F. Final Cleaning:

1. If a slurry cake builds up on the sidewalls of the drill hole, the Contractor shall remove it prior to concrete placement at no additional cost.

a. If mineral slurry is used, the sidewalls shall be reamed prior to placement of reinforcement.

b. The Contractor must adjust operations so that the maximum time that the slurry is allowed to remain in the shaft is 24 hours.

2. The Contractor must clean the base of each pile so that a minimum of 50 percent of the base will have less than ½" of sediment at the time of concrete placement.

a. The maximum depth of sediment or debris at the base of the pile shall not exceed 1 inch.

3. For dry piles, visual inspection will be performed by the Engineer.

4. For slurry piles, the Contractor must use an air lift to clean the bottom of the pile.

a. After a wait period equal to the time to set the reinforcing steel cage and concrete placement setup, the Contractor shall measure the amount of sediment in the bottom of the pile.

b. If the amount of sediment meets the above requirements, the Contractor shall clean the base of the pile a second time with the air lift and immediately proceed with shaft construction.

c. If after the described wait period the amount of sediment exceeds the requirements, the Contractor shall clean the pile by air lift and repeat the above procedure until the sediment accumulation meets the requirements.

d. The Engineer may approve, at no additional cost to the SCRRA, an alternate method to clean the bottom of the pile.

G. Inspection of Shaft and Rock Socket

1. The Contractor must provide suitable means of access and lighting facilities for the Engineer to check locations, dimensions, and alignment of the casings, inspect conditions of the casings, and inspect and determine that the rock sockets are satisfactory.

a. Final shaft depths will be measured with a suitable weighted tape or other approved methods after final cleaning.

2. At all times when a person is in a dewatered casing, provision shall be made for pumping fresh air to said person; and any required lighting shall be by electric lights.

a. Any mechanical equipment used inside the casing shall be operated by air or electricity.

b. The use of gasoline engines or other types of equipment producing fumes placed in the excavation for pumping or drilling are not permitted.

3. If the shaft cannot be dewatered, the Contractor must provide a method for visual inspection to confirm that the shaft is in an acceptable condition and that rock socket cleanliness requirements are met.

H. Reinforcing Steel Cage Construction and Placement:

1. The reinforcing steel cage consisting of longitudinal bars, ties, cage stiffener bars, spacers, cage centering devices, and other necessary appurtenances, shall be completely assembled and placed immediately after the pile excavation is inspected and accepted, and prior to concrete placement.

2. The reinforcing steel in the pile shall be tied and supported so that the reinforcing steel will remain within allowable tolerances given in this Specification Section.

    a. Reinforcing added to stiffen a reinforcing cage will be at the Contractor's expense and as approved by the Engineer.

    b. Concrete spacers or other approved non-corrosive spacing devices shall be used at sufficient intervals, near the top and bottom and at intervals not exceeding 10 feet along the shaft, to ensure concentric spacing for the entire cage length.

    c. Spacers shall be constructed of approved material equal in quality and durability to the concrete specified for the pile.

    d. The spacers shall be of adequate dimension to ensure a minimum distance of 3 inches or as shown in the plan which ever is greater between the cage and the excavated hole.

    e. When a full depth reinforcing steel cage is used, it shall be supported at the bottom by approved cylindrical feet to ensure that the bottom of the cage is maintained at the proper distance above the base.

3. The elevation of the top of the steel cage shall be checked before and after the concrete is placed.

    a. If the reinforcing cage is not maintained within the specified tolerances, corrections shall be made by the Contractor to the satisfaction of the Engineer.

    b. No additional piles shall be constructed until the Contractor has modified the reinforcing cage support in a manner satisfactory to the Engineer.

4. At no time shall the reinforcing cage be allowed to rest at the bottom of the drill hole.

I. Concrete Placement:

1. Placement of concrete pile:

    a. Concrete shall be placed as soon as possible after reinforcing steel placement.

    b. The Contractor shall coordinate batching and delivery of the concrete with the batch plant so that the time limits, as stated in the Standard Specifications, between batching and delivery are not exceeded.

    c. Concrete placement shall be continuous.

d. Concrete placement shall continue after the pile excavation is full until good quality concrete is evident at the top of shaft.

e. Remove a sufficient volume of concrete to ensure elimination of all contaminated concrete at the top of shaft using small pumps.

f. Concrete shall be placed either through a tremie or concrete pump.

2. Placement of Concrete by Tremie:

a. The tremie used to deposit concrete shall be constructed so that it is watertight and will readily discharge concrete.

b. The tremie shall not be less than 10 in dia., and there shall be no aluminum parts in contact with concrete.

c. The discharge end of the tremie shall be constructed to prevent water or slurry intrusion and permit the free flow of concrete during placement operations.

d. The tremie shall have sufficient mass that it will rest on the pile bottom before start of concrete placement.

e. The length of the tremie shall be sufficient to extend to the bottom of the pile.

f. The discharge orifice shall be maintained between 5 feet and 10 feet below the surface of the fluid concrete.

g. The tremie shall be supported so that it can be raised to increase the discharge of concrete and lowered to reduce the discharge of concrete.

h. The flow of the concrete shall be continuous and the concrete in the tremie shall maintain a positive pressure differential at all times to prevent introduction of air pockets or contaminants into the concrete.

3. Placement of Concrete by Pump:

a. Concrete pumps and lines may be used for concrete placement.

b. All pump lines shall have a minimum 4 inches dia. and be constructed with watertight joints.

1) Concrete placement shall not begin until the pump line discharge orifice is at the pile base elevation.

c. A plug or similar device shall be used to separate the concrete from the fluid in the hole until pumping begins.

1) The plug shall either be removed from the excavation or be of a material, approved by the Engineer, which will not be a detriment to the pile if not removed.

d. The discharge orifice shall be maintained between 5 feet and 10 feet below the surface of the fluid concrete.

1) When lifting the pump line during concreting, the Contractor shall temporarily reduce the line pressure until the orifice has been repositioned at a higher level in the excavation.

e. The pumping operation shall be performed in a manner that prevents introduction of air pockets into the concrete.

1) If breaking of the pump line is required, the discharge orifice shall be temporarily positioned 3 feet to 5 feet below the surface of the fluid concrete in the hole.

2) Additional methods to eliminate introduction of air into the concrete may be proposed by the Contractor.

4. The elapsed time from the beginning of concrete placement in the pile to the completion of the placement shall not exceed 3 hours.

a. All admixtures, when approved for use, shall be adjusted for the conditions encountered on the job so the concrete remains in a workable plastic state throughout the 3 hours placement limit.

b. The Contractor may propose placement time over 3 hours provided the Contractor submits trial mix documentation that all concrete in the pile will retain a minimum 4 inches slump for the entire placement period.

J. The concrete in the rock socket shall be, if at all possible, placed in the dry.

1. The Contractor will be required to make a diligent effort to dewater the rock socket.

2. If, after making such effort, it is determined by the Engineer that it is not possible to dewater the socket sufficiently to allow the concrete to be placed in the dry; the Contractor, with the Engineer's written approval, shall proceed with the placement of the concrete under water.

K. The casing segment above the top elevation of the drilled shaft shall be left empty.

L. Installation of Expanded Polystyrene

1. Place expanded polystyrene in position before placing concrete.

3.03 TEMPORARY CASING WITHDRAWAL

A. Provide means and opportunity for the Engineer to inspect the operation during the withdrawal of casing and placing of concrete.

B. Coordinate casing withdrawal carefully with concrete placement.

1. Maintain head of concrete to exceed the anticipated outside soil and water pressure above the bottom of the casing at all times during casing withdrawal.

2. Withdrawal of temporary casing may require the casing to be cut (“lost”) or damaged by the Contractor during the construction process. This shall be considered part of the Contractor’s means and methods, and must be approved by the Engineer prior to construction of CIDH Piles.

C. Check concrete level prior to, during, and after withdrawing casing to confirm that separation of shaft concrete has not occurred.

1. Do not vibrate concrete internally before the casing is withdrawn.

2. A casing vibratory extractor is permitted.

3. Do not withdraw casing after concrete has attained initial set as determined by the Engineer.

3.04 FIELD QUALITY CONTROL

A. Inspection of Pile:

1. For piles that have been dewatered, or constructed in the “Dry”, the Contractor shall provide a method for visual inspection to confirm that the pile is acceptable.

B. Acceptance Testing of Pile:

1. For piles constructed by the “wet” or “slurry-displacement” method, the contractor shall provide acceptance testing by a qualified independent testing firm.

a. Contractor must submit qualifications of proposed testing firm for review and approval by the Engineer at least 14 days prior to the planned start of construction.

b. Testing firm shall have conducted acceptance testing of CIDH piles in similar circumstances and using the same test methods on at least 5 projects in the last 3 years.

2. Vertical inspection pipes for acceptance testing shall be provided in all CIDH concrete piling constructed by the “wet” or “slurry displacement” methods.

3. The furnishing and placing of inspection pipes shall conform to the following:

   a. Inspection pipes shall be Schedule 40 PVC pipe with a nominal inside diameter of 2 IN. Watertight PVC couplers are permitted to facilitate pipe lengths in excess of those which are commercially available. The Contractor shall log the location of the inspection pipe couplers with respect to the plane of pile cut off, and these logs shall be delivered to the Engineer upon completion of the placement of concrete in the drilled hole.

   b. Each inspection pipe shall be capped at the bottom and shall extend from 3 FT above the pile cutoff down to the bottom of the reinforcing cage. A temporary top cap or similar means shall be provided to keep the pipes clean before testing. If pile cutoff is below the ground surface or working platform, inspection pipes shall be extended to 3 FT above the ground surface or working platform. Approved covers or railings shall be provided and inspection pipes shall be located as necessary to minimize exposure of testing personnel to potential falling hazards.

   c. Inspection pipes shall be completely clean, dry, and unobstructed at the time of testing providing a 2 IN DIA clear opening.

   d. The inspection pipes shall be installed in straight vertical alignment, parallel to the main reinforcement, and securely fastened in place to prevent misalignment during installation of the reinforcement and placing of concrete in the hole. The CIDH concrete piling shall be constructed so that the relative distance of inspection pipes to vertical steel reinforcement shall remain constant.

   e. When any changes are made to the tip of CIDH concrete piling, the Contractor shall also extend the inspection pipes to the bottom of the reinforcing cage.

   f. Inspection pipes shall be placed radially around the pile, inside the outermost spiral or hoop reinforcement and no more than 1 IN clear of the outermost spiral or hoop reinforcement.

   g. Inspection pipes shall be placed around the pile at a uniform spacing not exceeding 33 IN measured along the circle passing through the centers of inspection pipes. A minimum of four (4) inspection pipes per pile shall be used. Inspection pipes shall be placed to provide the maximum diameter circle that passes through the centers of the inspection pipes while maintaining the spacing required herein.

h. Inspection pipes shall be placed a minimum of 1-1/2 inch clear of the vertical reinforcement. When the vertical reinforcement configuration does not permit this clearance while achieving radial location requirements, distance to vertical rebar shall be maximized while still maintaining the requirement for radial location.

i. Where the dimensions of the pile reinforcement do not permit inspection pipes to be placed per these requirements, a plan for tube placement shall be submitted to the Engineer for approval in the CIDH Pile Installation Plan with a request for deviation before fabricating pile reinforcement.

4. After placing concrete and before requesting acceptance tests, each inspection pipe shall be tested by the Contractor in the presence of the Engineer by passing a 1-1/4 inch diameter rigid cylinder 4.5 feet long through the length of pipe. If an inspection pipe fails to pass the 1-1/4 inch diameter cylinder, the Contractor shall immediately fill all inspection pipes in the pile with water.

5. For each inspection pipe that does not pass the 1-1/4 IN DIA cylinder, the Contractor shall core a nominal 2 inch diameter hole through the concrete for the entire length of the pile. Cored holes shall be located as close as possible to the inspection pipes they are replacing and shall be no more than 5 IN clear from the reinforcement.

a. Coring shall not damage the pile reinforcement. Cored holes shall be made with a double wall core barrel system utilizing a split tube type inner barrel. Coring with a solid type inner barrel will not be allowed. Coring methods and equipment shall provide intact cores for the entire length of the pile. The coring operation shall be logged by an Engineering Geologist or Civil Engineer licensed in the State of California and experienced in core logging. Coring logs shall be in conformance with the Caltrans "Soil and Rock Logging, Classification, and Presentation Manual." Coring logs shall include Core Recovery (REC), Rock Quality Designation (RQD), locations of breaks, and complete descriptions of inclusions and voids encountered during coring, and shall be delivered to the Engineer upon completion. Concrete cores shall be preserved, identified with the exact location the core was recovered from within the pile, and delivered to the Engineer upon completion. The Engineer will evaluate the portion of the pile represented by the cored hole based on the submitted core logs.

6. Acceptance tests of the concrete shall be made by a qualified technician employed by the approved testing firm. Acceptance tests will evaluate the homogeneity of the placed concrete. Tests will include gamma-gamma logging (GGL) conducted in conformance with California Test 233. The Contractor shall not conduct operations within 25 FT of the gamma-gamma logging operations. The Contractor shall separate reinforcing steel as necessary to allow the technician access to the inspection pipes to perform gamma-gamma logging or other acceptance testing. After requesting acceptance tests and providing access to the piles, the Contractor shall allow 7 days for the technician to conduct these tests. The testing firm shall submit acceptance test results and interpretations to the Engineer no later than 7 days after completion of testing for each shaft.

7. The Engineer will make determination of acceptance after receiving test results. No superimposed construction shall proceed without acceptance of the CIDH pile by the Engineer.

8. The Engineer may elect to require additional tests to further evaluate a pile. These tests may include cross-hole sonic logging (CSL) and other means of inspection selected by the Engineer. When the Engineer elects to require additional tests to further evaluate anomalies for a rejected pile, no time requirement exists for performing these tests. The Contractor may progress with the mitigation plan process without waiting for these supplemental results.

9. Inspection pipes and cored holes shall be dewatered and filled with grout after notification by the Engineer that the pile is acceptable. Inspection pipes and holes shall be filled using grout tubes that extend to the bottom of the pipe or hole or into the grout already placed.

10. If the Engineer determines that a pile does not meet the requirements of the specifications and California Test 233, Part 5C, then that pile will be rejected and all depositing of concrete under slurry or concrete placed using temporary casing for the purpose of controlling groundwater shall be suspended until written changes to the methods of pile construction are approved in writing by the Engineer.

C. Mitigation of Rejected Pile:

1. The Engineer will determine whether the rejected pile requires mitigation due to structural, geotechnical, or corrosion concerns. The Engineer will consider the estimated size and location of the anomaly and potential effects upon the design. The Engineer will provide the conclusions of this analysis to the Contractor for development of a mitigation plan, if required. The Contractor shall allow 35 days for the Engineer to determine whether the pile requires mitigation and provide information to the Contractor. Day 1 of the 35 days shall be the 1st day after results of acceptance testing have been provided to the Engineer. If additional information is submitted to the Engineer that modifies the size, shape, or nature of the anomaly, the Contractor shall allow 15 additional days for the subsequent analysis.

2. If the Engineer determines that a rejected pile requires mitigation, the Contractor shall submit to the Engineer for approval a mitigation plan for repair, supplementation, or replacement for each rejected CIDH concrete pile. If the Engineer determines that it is not feasible to repair the rejected pile, the Contractor shall not include repair as a means of mitigation and shall proceed with the submittal of a mitigation plan for replacement or supplementation of the rejected pile.

3. Pile mitigation plans shall include the following:

   a. The designation and location of the pile addressed by the mitigation plan.

   b. A review of the structural, geotechnical, and corrosion design requirements of the rejected pile.

   c. A step by step description of the mitigation work to be performed, including plans if necessary.

   d. An assessment of how the proposed mitigation work will address the structural, geotechnical, and corrosion design requirements of the rejected pile.

   e. Methods for preservation or restoration of existing earthen materials.

   f. A list of affected facilities, if any, with methods and equipment for protection of these facilities during mitigation.

   g. The assigned contract number, full name of the structure as shown on the contract plans, and the Contractor's (and Subcontractor's if applicable) name on each sheet.

   h. A list of materials, with quantity estimates, and personnel, with qualifications, to be used to perform the mitigation work.

   i. The seal and signature of an engineer who is licensed as a Civil Engineer by the State of California. This requirement is waived for approved mitigation plans when either of the following conditions are present:

      1) The proposed mitigation will be performed in conformance with the most recent version of "ADSC Standard Mitigation Plan 'A' - Basic Repair" without exception or modification.

      2) The Engineer has determined that the rejected pile does not require mitigation due to structural, geotechnical, or corrosion concerns, and the Contractor elects to repair the pile using the most recent version of the "ADSC Standard Mitigation Plan 'B' - Grouting Repair" without exception or modification.

D. The most recent version of the "ADSC Standard Mitigation Plan" is available at: http://www.dot.ca.gov/hq/esc/geotech/ft/adscmitplan.htm

1. For rejected piles to be repaired, the Contractor shall submit a pile mitigation plan that contains the following additional information:

a. An assessment of the nature and size of the anomalies in the rejected pile.

b. Provisions for additional pile testing if required by the Engineer.

2. For rejected piles to be replaced or supplemented, the Contractor shall submit a pile mitigation plan that contains the following additional information:

a. The proposed location and size of additional piles.

b. Structural details and calculations for any modification to the structure to accommodate the replacement or supplemental piles.

3. All provisions for CIDH concrete piling shall apply to replacement piles.

4. The Contractor shall allow the Engineer 20 days to review the mitigation plan after a complete submittal has been received.

5. When repairs are performed, the Contractor shall submit a mitigation report to the Engineer within 10 days of completion of the repair. This report shall state exactly what repair work was performed and quantify the success of the repairs relative to the submitted mitigation plan. The mitigation report shall be stamped and signed by an engineer that is licensed as a Civil Engineer by the State of California. The mitigation report shall show the assigned contract number, full name of the structure as shown on the contract plans, and the Contractor (and subcontractor if applicable) name on each sheet. The Engineer will be the sole judge as to whether a mitigation proposal is acceptable, the mitigation efforts are successful, and to whether additional repairs, removal and replacement, or construction of a supplemental foundation is required.

3.05 CLEANING

A. Control and Disposal of Materials:

1. Disposal of excavated material, as well as slurry and/or water removed from the shaft excavation, shall be the responsibility of the Contractor.

2. All slurry and water, displaced during final cleaning and concrete placement, shall be collected and properly disposed off site.

3. Open pits for collection of materials will not be allowed.

4. All excavated material, slurry, water, and other matter shall be controlled by the Contractor so that at no time it enters or encroaches upon the adjacent travel lanes, railroad and water ways.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. CIDH Piles will be measured by the unit or fraction thereof furnished and completed in accordance with the Contract Documents and as measured by the Engineer. The quantities as contained on the Schedule of Quantities and Prices, or approved schedule of values, as applicable, as derived from the Plans will be used as the basis for this measurement.

B. The length of each CIDH Piles to be paid for shall be the length, measured along the longest side, from the tip elevation shown on the plans, or the tip elevation ordered by the Engineer for the diameter of the pile shown on the plans, to the plane of the pile cut-off. No reduction in the length for payment will be made for any CIDH pile where the tip elevation is revised in conjunction with a request by the Contractor to increase the pile diameter.

C. Reinforcing Steel of this Section is considered incidental to work under other payment items and no separate measurement and payment will be made to the Contractor for Reinforcing Steel.

D. Foundations and footings required for work items other than station canopies and station light poles shall be considered incidental to the Contract price measured and paid the work items. No measurement or payment will be made under this Section for items other than other than station canopy and station light pole CIDH Piles

E. Square footings integral to retaining wall are not considered CIDH Piles.

4.02 PAYMENT

A. CIDH Piles will be paid the contract unit price, as listed in the Schedule of Quantities and Prices.

B. The contract unit price shall include full compensation for all equipment, labor and materials necessary to satisfactorily construct the shafts; including drilling and excavation of shaft and rock socket, furnishing, installing and removing temporary casing, furnishing and placing concrete, confirmation boring and lab testing, reporting boring logs and lab test results, CSL (steel pipe) or gamma-gamma (PVC pipe) non-destructive testing and reporting, shaft inspection, disposal of excavated materials and water, and all other materials.

C. Full compensation for furnishing all reinforcing steel in piles and pile extensions, including reinforcement required to extend beyond the pile or extension as shown on the Plans, shall be considered as included in the Contract price per unit for

furnishing piling of the type or class shown in the Schedule of Quantities and Prices, and no additional compensation will be allowed therefor.

END OF SECTION