

SECTION 02650

PRECAST CONCRETE CULVERTS

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Section includes specifications for concrete three-sided arch culverts with headwalls and wingwalls. Headwalls and wingwalls may be precast or cast-in-place.

1.02 REFERENCE STANDARDS

- A. American Railroad Equipment and Maintenance-of-way Association (AREMA):
 - 1. Manual for Railway Engineering and Maintenance (Manual),
- B. American Society for Testing and Materials (ASTM International):
 - 1. C39 Test Method for Compressive Strength of Cylindrical Concrete Specimens
 - 2. C497 Test Methods for Concrete Pipe, Manhole Sections, or Tile
- C. Caltrain Standards for Design and Maintenance of Structures

1.03 DESIGN REQUIREMENTS

- A. Comply with requirements indicated in the Contract Documents.

1.04 SUBMITTALS

- A. Shop Drawings. Submit shop drawings for Engineer's approval including the following information for footings, culvert section, wingwalls, and headwalls, as applicable:
 - 1. Concrete dimensions, elevations, and reinforcing steel with bar size and spacing indicated. Include elevation, plan, and section views. Include anchorage details, as applicable.
 - 2. Details for pedestals.
 - 3. Note actual soil bearing pressure on the footing detail sheets.
 - 4. Structure backfill type and limits for culvert and wingwalls.
- B. Submit manufacturer's product data of the culvert system for approval. Include adhesive for securing plugs in handling holes.
- C. Submit sample showing proposed wingwall finish.
- D. Submit design computations for culverts including wingwalls and pedestals. Furnish a longhand example of the design methodology if the design calculations are in a computer printout format.

1.05 QUALITY ASSURANCE

- A. Design computations and shop drawings shall be signed and sealed by a professional engineer registered in the State of California.

PART 2 – PRODUCTS

2.01 GENERAL

- A. All products necessary to complete the work shall conform to the relevant sections of these technical specifications.
- B. Sealer and Waterproofing Membrane: As recommended by culvert manufacturer and approved by the Engineer.

2.02 FABRICATION

- A. Handling devices or holes will be permitted in each culvert or wingwall section. However, not more than four holes shall be cast or drilled in each section. Cast holes shall be tapered.
- B. Design and form section ends so that when the culvert sections are erected, they shall make a continuous line of culvert with a smooth interior free of irregularities.
- C. Joints: Provide keyway joints between culvert sections. Keyway joint shall be a minimum of 4 inches deep by 1-1/2 inches wide.
- D. The culvert sections and wingwalls shall be free of fractures. The ends of the culvert sections shall be normal to the walls and centerline, except where beveled ends are specified. The surface of the culvert section shall be a smooth steel form or troweled surface. Trapped air pockets causing defects which do not weaken or make sections more vulnerable to corrosion shall be considered as part of a smooth steel form finish.
- E. Provide smooth rubbed finish on wingwalls. Refer to Section 03170, Concrete Finishing.
- F. Do not store culvert units in an upright position until the designated handling and storage compressive strength, as shown on the shop drawings, has been achieved.
- G. Marking: Clearly mark each culvert section and wingwall with waterproof paint. The following information shall be shown on the inside face of each wingwall and on a vertical leg of each culvert section:
 - 1. Culvert span and rise (culvert sections only)
 - 2. Date of manufacture
 - 3. Name or trademark of manufacturer
 - 4. Design earth cover
 - 5. Location designator for use in field

2.03 SOURCE QUALITY CONTROL

- A. Test Specimen: Determine concrete compressive strength from compression tests made on cylinders or cores. For cylinder testing, take a minimum of 4 cylinders during each production run. For core testing, cut one core from a culvert section selected at random from each group of 15 culvert sections or less of a particular size and production run. Cut one core from each group of four or fewer wingwalls. For each continuous production run, each group of 15 culvert sections of a single size or fraction thereof or four wingwalls shall be considered separately for the purpose of testing or acceptance. A production run shall be considered continuous if not interrupted for more than three consecutive days.
- B. Compression Testing: Make and test cylinders in accordance with ASTM C39. Obtain cores and test for compressive strength in accordance with ASTM C497.
- C. Acceptability of Cylinders Tests: Failure of one of the 28 day test cylinders to achieve 90 percent of the minimum compressive strength requirement may be cause for rejection.
- D. Acceptability of Core Tests: The compressive strength of the concrete in each group of sections as defined above will be acceptable when the core test strength is equal to or greater than the design concrete strength. The Engineer will randomly select and witness testing of the cores taken by the manufacturer.
- E. If compressive strength of a core is less than the design concrete strength, the culvert section or wingwalls from which that core was taken will be rejected. The Engineer will select two culvert sections or wingwalls from the remainder of the group at random, and one core shall be taken from each. If the compressive strength of both cores is equal to or greater than the design concrete strength, the remainder of the culvert sections or wingwalls in that group will be acceptable. If the compressive strength of either of the two cores tested is less than the design concrete strength, the remainder of the culvert sections or wingwalls in the group will be rejected. However, at the option of the manufacturer, each remaining culvert section or wingwall in the remainder of the group may be cored and accepted individually. The sections which have cores with less than the design concrete strength will be rejected.
- F. Plugging Core Holes in Accepted Units: Plug and cure core holes at place of manufacture in such a manner that the culvert will meet all the test requirements of the specifications. Culvert sections or wingwalls repaired accordingly will be considered satisfactory for use.
- G. Test Equipment: Furnish facilities and personnel necessary to conduct the quality control tests required.

2.04 INSPECTION

- A. Rejection: Culvert sections or wingwalls will also be rejected due to the following conditions.
 - 1. Fractures or cracks pass through the wall, except for a single end crack which does not exceed half of the thickness of the wall.
 - 2. Defects which indicate proportioning, mixing, or molding which are not in accordance with specifications.

3. Honeycombed or open texture.
4. Damaged section ends, where such damage prevents making a satisfactory joint.

2.05 REPAIRS

- A. Repair or replace culvert sections and wingwalls which have manufacturing imperfections or have been damaged. Repairs shall be sound, properly finished and cured, and repaired culvert section or wingwalls complies with the requirements specified herein.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Bottom of Trench Compaction: Compact soils in the bottom of the excavation to 95 percent of the maximum dry density. If 95 percent of the maximum dry density cannot be obtained in the bottom of the excavation or in other areas or if soft soils are encountered at depths that make removal impractical, contact the Engineer for additional requirements.
- B. Footings: Footings may be cast-in-place or precast. When a precast footing is utilized, a four (4) inch layer of pervious backfill shall be placed under the full width of the footing. Give footings a smooth form finish. The footing concrete shall reach a compressive strength indicated on the shop drawings before placement of the culvert sections or wingwalls.
- C. Pedestals: When a cast-in-place reinforced concrete pedestal is required between the base of the culvert leg and the top of the footing, either provide a culvert with longer legs or construct pedestals, at the Contractor's option.
- D. Placement of Culvert Sections and Wingwalls: Set culvert sections and wingwalls on masonite or steel shims. Provide a minimum gap of 1/2 inch between footing and bottom of each section or wingwall. Fill gap with a slurry cement backfill in accordance with Section 02300, Earthwork.
- E. Sealing: Apply sealer on the top surface of the culvert section. Such sealer shall extend 5 feet vertically down each vertical leg. Place no sealer material in keyway joints. Provide sealer for the full length of the structure. Prepare surface and apply sealer as recommended by sealer manufacturer.
- F. Keep waterproofing membrane in its proper location over joints and protect from damage during the backfilling operation.
- G. Prior to backfilling, treat handling holes as follows: Fill tapered holes for handling with Portland cement mortar or precast concrete plugs secured with Portland cement mortar or other adhesive, as approved. Fill drilled holes for handling filled with Portland cement mortar. Prior to backfilling the structure, cover holes with waterproofing membrane with a minimum width of 9 inches.
- H. Place and compact structure backfill as specified in Section 02300, Earthwork.

END OF SECTION