

CORRUGATED STRUCTURAL PLATE STRUCTURES

Effective: April 22, 2016

Revised: April 13, 2018

Description. This work shall consist of Designing, furnishing and installing the corrugated structural plate structures according to applicable portions of Sections 503 and 542 of the Standard Specifications and as specified herein. The design of corrugated structural plate structures, headwalls, wingwalls and footings shall be to the lines and grades shown on the contract plans and shall be the responsibility of the Contractor.

Materials. Materials shall be according to the following.

Item	Article/Section
(a) Corrugated Structural Plate Pipe, Pipe Arches, Arches and Boxes (Note 1) (Note 2)	1006.02
(b) Fine Aggregate	1003.04
(c) Coarse Aggregate	1004.05
(d) Portland Cement Concrete	1020

Note 1: The Department reserves the right to specify either steel or aluminum alloy. When a particular material is specified, no other material will be permitted.

Note 2: All steel channels, angles, bolts, washers, or other hardware shall be hot dip galvanized according to ASTM A123 or A153 as applicable after fabrication.

Design requirements. The corrugated structural plate structure shall be designed according to Section 12 of the AASHTO LRFD Bridge Design Specifications, and as a minimum shall be sized to meet the minimum diameter, or span and rise, specified and shall be designed for the design fill height, and out to out length shown on the plans. Unless otherwise specified the minimum design life of the structure shall be 75 years.

The Contractor shall be responsible for diverting the water from the construction area using a method meeting the approval of the Engineer. The cost of diverting the water shall be considered as included in the contract unit price bid for the corrugated structural plate structure being constructed and no additional compensation will be allowed.

The longitudinal and circumferential seams shall be designed to be connected by bolts with seams staggered to minimize the chances of more than three plates coming together at any one point.

The design shall also address the backfilling sequence to minimize unbalanced loading between multiple, closely spaced barrels, and the backfilling options allowed to address the placement and compaction of fill in the relatively tight annular space between the barrels.

Shop drawings for the corrugated structural plate structures shall be submitted according to Article 505.03 and Article 105.04 of the Standard Specifications. The supplier selected by the

Contractor shall submit complete design calculations and shop drawings, prepared and sealed by an Illinois Licensed Structural Engineer, for approval by the Engineer. An initial Structure Load Rating Summary (SLRS- see form BBS 2795) and analysis file(s) shall be submitted. The calculations, SLRS, and drawings shall be submitted a minimum of 45 days prior to construction.

Construction Requirements. The excavation, erection and backfill for corrugated structural plate structures shall be according to Section 502 of the Standard Specifications and the following. If there are any additional backfilling requirements based on the approved design, all construction inspection and material certification necessary to verify these additional backfilling requirements in the field shall be the responsibility of the Contractor. Bearing surfaces for corrugated plate arches shall be according to the approved design requirements and shop drawings.

The Contractor shall obtain technical assistance from the supplier of the corrugated structural plate in the form of onsite attendance of qualified support staff to ensure proper assembly and installation of all components. In addition, if any issues related to fabrication and/or assembly arises during installation, the Contractor in conjunction with the supplier of the system shall be responsible for any remedial action required to remedy the situation subject to the approval of the Engineer and at no additional cost to the Department.

The corrugated structural plate structure shall be placed according to applicable requirements of Article 542.04(d) of the Standard Specifications. When multi-spans are used the backfilling procedures shall be as required by the approved design. When permitted by design, in lieu of compacting the fill between multi barrel structures, the space between adjacent units may be filled with Class SI concrete. The Class SI concrete shall be according to Section 1020, except the maximum size of the aggregate shall be 3/8 in. (9.5 mm). For structures requiring temporary bracing to maintain the structure shape, the supports shall not be removed until the structure backfill is placed to an elevation to provide the necessary support. In no case shall internal braces be left in place when backfilling reaches the top quadrant of the pipe or top radius arc portion of the structure.

(a) Corrugated Structural Plate Pipe Culverts, Pipe Arches and boxes. When a plate structure is to be erected in a trench, the width of the trench shall be sufficient to permit thorough tamping of the earth backfill against every plate. Trench width will also depend on the relative stiffness of the trench wall soils to the stiffness of the backfill soils. The required minimum trench width shall be as specified by the structure designer and according to AASHTO design requirements. The structure shall be bedded on an earth foundation of uniform density shaped to fit the lower plate at the proper grade. Any soil below the foundation grade which has been disturbed by the Contractor's operations shall be removed. If the foundation excavation has been made deeper than necessary, the foundation shall be brought to proper grade by the addition of well-compacted aggregate.

A loose, uncompacted layer of granular bedding shall be provided on the prepared soil foundation to allow the granular material to settle into the corrugations of the invert plates to achieve full bearing of the plates on the soil. The thickness of the loose bedding layer shall

be specified by the structural designer but will generally be between 1.5 and 2 times the corrugation profile depth. Where a firm foundation is not encountered at the grade established, due to soft, spongy, or other unsuitable soil, all such unsuitable soil under the plate structure and for a width of at least one diameter or span on each side of the structure, shall be removed and replaced with suitable structural fill material as directed by the Engineer.

Where rock, in either ledge or boulder formation is encountered, it shall be removed and replaced with a cushion of compacted aggregate fill to a depth below the structure as determined by the structural designer, but not less than 1/2 in./ft (40 mm/m) of height of fill over the top of the structure, with a minimum thickness of 8 in. (200 mm).

All excavated material not needed on the work shall be disposed of according to Article 202.03.

When a corrugated structural plate pipe, pipe arch, or box has been completely erected in place, moist aggregate shall be placed alongside the structure in lifts not to exceed 8 in. (200 mm) in depth, loose measurement, and compacted for the full width of the trench, or so that on each side of the structure there shall be a berm of compacted or undisturbed soil at least as wide as the greatest external dimension of the structure. The aggregate shall be placed longitudinally along the structure, except at the outer 3 ft (1 m) at each end of the structure, impervious material shall be used. The elevation of the backfill material on each side of the structure shall be the same. Special care shall be taken to compact the aggregate and impervious material under the haunches of the pipe. The backfill material, aggregate and impervious material shall be compacted to the satisfaction of the Engineer by mechanical means. This method of placement shall be continued until the top of the structure is covered with backfill material to a minimum depth defined as the greater of that as required by the design or 1 ft (300 mm).

- (b) Headwalls for Corrugated Structural Plate Structures. When backfilling a structure before headwalls are placed, the first material shall be placed midway between the ends of the structure forming as narrow a ramp as possible until the top of the structure is reached. The ramp shall be built evenly from both sides, and the backfilling material shall be thoroughly compacted as it is placed. After the ramps have been built to the top of the structure, the remainder of the backfill shall be deposited from the top of the structure, both ways from the center to the ends, and as evenly as possible on both sides of the structure.

If the headwalls are built before the structure is backfilled, the filling material shall first be placed adjacent to one headwall until the top of the structure is reached, after which the fill shall be dumped from the top of the structure toward the other headwall, with care being taken to deposit the material evenly on both sides of the structure.

In multiple installations, the procedure specified above shall be followed, but extreme care shall be used to bring the backfill up evenly on each side of each arch so that unequal pressure will be avoided.

In all cases, the filling material shall be thoroughly but not excessively tamped. Puddling the backfill will not be permitted.

After the structure has been covered with the minimum backfill required, additional embankment shall be constructed according to Article 542.04(h). The height of the additional embankment shall be that specified.

Workmanship. In addition to compliance with the required details of construction, the completed structural plate structure shall show careful, finished workmanship in all particulars. The following defects are specified as constituting poor workmanship and the presence of any or all of them in any individual plate or in any shipment may be cause for rejection of the plate or shipment as determined by the Engineer:

- (1) Uneven laps.
- (2) Distorted shaping (unless specified).
- (3) Variation from a straight centerline.
- (4) Ragged edges.
- (5) Bruised, scaled, or broken zinc coating.
- (6) Dents or bends in the metal.

Method of Measurement. Corrugated structural plate structures will be measured in feet (meters). The overall length shall be measured from out to out of headwalls along the centerline of each span of the structure. Class SI concrete placed between adjacent spans, wingwalls headwalls, footing and if required thrust beams or reinforcing ribs will not be measured for payment.

Rock excavation for all corrugated steel plate drainage structures will be measured for payment according to Article 502.12.

Basis of Payment. This work will be paid for at the contract unit price per foot (meter) for CORRUGATED STRUCTURAL PLATE PIPE CULVERTS, of the diameter specified; CORRUGATED STRUCTURAL PLATE PIPE ARCHES, CORRUGATED STRUCTURAL PLATE ARCHES, and CORRUGATED STRUCTURAL PLATE BOXES, of the span and rise specified.

Rock excavation for all corrugated steel plate drainage structures will be paid for according to Article 502.13.

The removal of unstable or unsuitable material or rock below foundation grade and the replacement thereof with the specified material, including additional excavation required to widen the trench, if required, will be paid for according to Article 109.04, unless the contract contains unit prices for the work included.