

ITEM #0601219A – 4’X 2’ PRECAST CONCRETE BOX CULVERT

Description: Work under this item shall consist of designing, furnishing and installing a box culvert constructed of four-sided, steel reinforced, monolithically cast concrete culvert sections or two-piece (three-sided culvert bottom with concrete slab top) concrete culvert sections with open ends of the size and length shown on the plans. Precast concrete cut off and return wall, reinforcing steel dowels, reinforcing steel bars, threaded inserts, lifting and seating fixtures, non-shrink grout, and all other necessary materials and equipment to complete the work shall also be included.

Materials:

Concrete: The concrete shall conform to the requirements of Subarticle M.14.01-1, as applicable except that the entrained air content requirement shall be eliminated when zero-slump concrete is used.

Reinforcement: Welded wire fabric shall be uncoated and conform to the requirements of ASTM A185 or ASTM A497. Deformed steel bars shall be uncoated and conform to the requirements of ASTM A615, Grade 60.

Threaded Inserts, Lifting Fixtures and Miscellaneous Hardware: All inserts, fixtures and hardware cast into precast concrete components shall have a corrosion-resistant coating or be fabricated from a non-corrosive material suitable for the intended use. The coating shall be either an epoxy material or galvanization, applied mechanically or by the hot-dip process. All hardware shall be as specified on the working drawings.

Gaskets: Gaskets shall be flexible, expanded rubber conforming to ASTM D1056.

Non-shrink Grout: Non-shrink grout shall conform to Subarticle M.03.01-12.

Geotextile: Shall be “Separation (High Survivability)”, as listed in the Connecticut Department of Transportation’s Approved List for Geotextiles. Torn or punctured geotextiles shall not be used.

Construction Methods: The design and manufacture of the precast concrete box culvert shall conform to the requirements of the AASHTO LRFD Bridge Design Specifications, 5th Edition, with latest Interim Revisions, supplemented by ASTM C1433 with the following additions and revisions:

1. Working Drawings: Before fabrication, the Contractor shall submit working drawings to the Engineer for review in accordance with Article 1.05.02.

Working drawings for all box culverts shall include but not be limited to the following:

Layout plan of box culvert.

Plans and cross-sections showing length, width, height and thickness of walls and slabs.

Type, size, location and spacing of steel reinforcing and inserts for anchoring threaded deformed steel bars. Bending diagrams, material lists and catalog cuts for inserts shall be provided.

Type, size and location of lifting holes and seating fixtures. All fixtures (inserts, etc.) cast permanently into the sections shall be recessed a minimum of $\frac{3}{4}$ ". No more than four lifting holes or fixtures shall be located in each box section.

Location and size of all holes cast for grouting deformed steel bars or other reasons as noted on the plans.

Complete details of the lap joints at the end of the box sections, which shall include the type, size and location of gaskets and additional steel reinforcement. Except where shown otherwise, the ends of the box sections shall have lap joints with not less than $1\frac{1}{2}$ " of concrete overlap. Each joint shall be provided with a preplaced gasket.

Material designations.

Working drawings for all box sections shall be stamped by a Professional Engineer licensed in the State of Connecticut. Each sheet of the working drawings shall be stamped.

After the working drawings have been reviewed and the Engineer's comments have been appropriately taken into account and implemented, the Contractor shall submit a final submission of working drawings. The final submission shall include one set of full size (approximately 2' x 3') and two sets of half-scale paper copies. The two half-scale sets are intended for distribution to the Town.

Erection drawings shall also be prepared and submitted for review by the Department.

2. Design Computations: With the submission of working drawings, the Contractor shall also submit to the Engineer for review four sets of complete design computations for the box culvert. These computations shall be stamped by a Professional Engineer licensed in Connecticut.

The box culvert shall be designed in accordance with the Load and Resistance Factor Design Method (LRFD) described in the aforementioned AASHTO and ASTM specifications. The box culvert shall be designed to support an HL-93 live load for the applicable AASHTO Limit States.

Design, Legal and Permit Vehicle Load Ratings shall be prepared for the box culvert. The live load ratings shall conform to the LRFD method in accordance with the AASHTO Manual for Bridge Evaluation, 2nd Edition. Live Loads, Load Factor Criteria and Analysis Parameters are given in the Table in Appendix A.

Two sets of Inventory and Operating load ratings for the box culvert shall be submitted in summary form along with computations substantiating the load ratings. One set of Inventory and Operating load ratings will be provided to ConnDOT's Office of Bridge Safety & Evaluation.

3. Length of Sections: The length of each precast box section shall be determined by the Contractor. When laid together, the culvert sections shall satisfy the total length of the box culvert shown on the plans.

4. Forms and Forming Material: Forms shall be mortar-tight and sufficiently strong to prevent misalignment of adjacent box sections. Forms shall be constructed to allow their removal without damage to the concrete. A positive means of supporting reinforcing cages in place during forming shall be required.

The forms shall not be removed until the concrete is sufficiently strong to avoid possible damage to the concrete. Forms shall not be removed without approval being granted by the Engineer.

All forming materials used for casting cylindrical openings for lifting holes or holes for grouting deformed steel bars shall be removed. All non-plastic material used as forms for casting weepholes shall also be removed.

5. Mixture: The Contractor shall design and submit to the Engineer for review a concrete mix that shall attain a minimum 28-day strength (f'c) as shown on the plans.

6. Placing Concrete: Concrete shall not be deposited in the forms until the Engineer has verified the presence and proper location of the reinforcing steel and other cast-in-place components, and has given his approval thereof.

Concrete shall not be deposited into the forms when the ambient temperature is below 40° F or above 100° F, unless adequate heating or cooling procedures are provided and have been previously approved by the Engineer. The concrete temperature shall be within the range of 60° F to 90° F at the time of placement.

Production during the winter season, from November 15 to March 15 inclusive, will be permitted only on beds located in a completely enclosed structure of suitable size and dimension that provides a controlled atmosphere for the protection of both the casting operation and the product.

Outside concreting operations will not be permitted during rainfall unless the operation is completely under cover.

Void forms shall be held in place against uplift or lateral displacement during the pouring and vibrating of the concrete by substantial wire ties or other satisfactory means as approved by the Engineer.

The concrete shall be vibrated internally, or externally, or both, as ordered by the Engineer. The vibrating shall be done with care in such a manner as to avoid displacement of reinforcing steel,

voids, forms, or other components. There shall be no interruption in the pouring of any of the sections. Concrete shall be carefully placed in the forms and sufficiently vibrated to produce a surface that is free from imperfections such as honeycombing, segregation, cracking, or checking. Any deficiencies noted in the sections may be cause for rejection.

7. Test Cylinders: During the casting of the sections, the Contractor shall make test cylinders under the supervision of a representative of the Department. A minimum of 4 cylinders shall be taken during each production run or as ordered by the Engineer. The dimensions and type of cylinder mold shall be as specified by the Engineer. Cylinders shall be cured under the requirements of ASTM C31 and shall be used to determine the 28-day compressive strength requirements ($f'c$). Failure of any of the 28-day tests cylinders to meet 90% of the minimum compressive strength requirement may be cause for rejection. The Engineer also reserves the right to request and test core specimens from the sections to determine their adequacy.

8. Repairs: The Engineer shall evaluate the acceptability and the cause of the defects and the service condition of the box section. No repairs shall be done by the Contractor unless permission has been granted by the Engineer. The Contractor shall submit to the Engineer, for review, the proposed methods and materials to be used in the repair operation. All repairs shall be sound and properly finished and cured before the box section is delivered to the job site. The Contractor shall bear the costs of all repair work.

9. Finishing: All exposed, outside surfaces of end sections shall be given a grout clean-down finish in accordance with Subarticle 6.01.03-21 except where concrete will be field cast against the section. Other formed surfaces need not be finished in any specific manner. All fins, runs, or mortar shall be removed from surfaces that will remain exposed. Form marks on exposed surfaces shall be smoothed by grinding.

10. Handling and Storage: Care shall be taken during storage, transporting, hoisting and handling of all box sections to prevent damage. Sections damaged by improper storing, transporting or handling shall be repaired or replaced by the Contractor, as directed by the Engineer and at no cost to the State of Connecticut. All storage and handling operations shall be as directed by the Engineer.

The box sections shall not be removed from their casting beds until the concrete has attained a minimum compressive strength of 75% of the 28-day strength. The box sections shall not be shipped to the job site until the 28-day strength ($f'c$) has been attained.

11. Installation: The installation of the precast concrete box culver shall conform to the following requirements:

The installation of the precast concrete box culvert shall proceed as required by the sequence of construction, stage construction plans, and the special provisions entitled "Prosecution and Progress" and "Maintenance and Protection of Traffic."

The box sections shall be placed in a manner to best accommodate and facilitate the construction of the cast-in-place concrete headwalls, cut-off walls, wingwalls, etc. No box sections shall be set on cast-in-place concrete without the approval of the Engineer.

The box sections shall be set to the line and grade indicated on the plans or as directed by the Engineer. Placement of the sections shall not start until the Engineer has approved the depth of excavation and the suitability of the foundation material.

The lap joints shall be securely seated together to achieve a silt-tight joint all around. A silt-tight joint is defined as a joint in which the gasket is compressed to a minimum of one half of its uncompressed width. The gasket shall be uniformly compressed along all vertical and horizontal surfaces. A positive means, through the use of seating devices, shall be used for pulling one section against another to assure an adequate silt-tight joint.

Details for the seating method shall be submitted to the Engineer for review. The lap joints shall be seated such that they make a continuous line of sections with a smooth interior free from irregularities in the invert line.

The top portions of the horizontal lap joints for the roof and floor slabs and the outside face of the vertical lap joints (full height on each side) shall be neatly filled with non-shrink grout after seating the sections. The exposed portions of the lap joints within the haunches or fillets shall also be neatly filled with non-shrink grout. The finished surface shall be smooth and level with the adjacent concrete.

The box sections for multiple barrel culverts shall be placed as detailed on the plans. Slight mismatches along the 1" longitudinal joint may be tolerated by the Engineer provided that the vertical difference between the top surfaces of adjacent sections is 1" or less. The top 2" of the longitudinal joint shall be filled flush with non-shrink grout. The top surface of the non-shrink grout shall be sloped to form a smooth transition to correct any allowable mismatches.

Geotextile shall be placed over all vertical joints. Geotextile shall also be placed over the roof joints of culverts not receiving woven glass fabric. The geotextile shall extend 6" to each side of the joint and be attached to the culvert using silicone caulk.

After its installation, any box section or joint that is, as determined by the Engineer, not acceptable in vertical or horizontal alignment for any reason, including but not limited to settlement, displacement, excess camber or misfit, shall be removed by the Contractor and correctly installed, as directed by the Engineer and at no additional cost to the State.

All fixtures or holes cast into the sections for lifting or seating shall be neatly filled with non-shrink grout. The finished surface shall be smooth and level with the adjacent concrete.

The surface preparation, mixing, placing, curing, and finishing of the non-shrink grout shall conform to the written instructions provided by the manufacturer of the grout. The Contractor shall furnish the Engineer with copies of the instructions. The grout shall be cured at least 3 days unless determined otherwise by the Engineer.

Method of Measurement: This work will be measured for payment by the number of linear feet of precast concrete box culvert, of the size indicated, completed and accepted and measured in place along the floor at the centerline of culvert.

Basis of Payment: Payment for this work will be made at the contract unit price per linear foot for "4'x2' Precast Concrete Box Culvert", of the size indicated, complete and accepted, which price shall include threaded inserts, non-shrink grout, reinforcing steel bars, drilling and grouting of dowels, geotextile, gaskets, and all other materials, equipment, tools and labor incidental thereto. Cost for the precast concrete box culvert will include drilled and grouted bars, joint filler and waterstops.

The contract unit price per foot for "4'x2' Precast Concrete Box Culvert" shall also include the costs of preparing and furnishing design computations, working drawings, final drawings, and erection drawings.

Pay Item	Pay Unit
4'x2' Precast Concrete Box Culvert	l.f.

APPENDIX A
PERMIT VEHICLES AND RATING CRITERIA

Rating Procedure	Live Load Vehicle	Load factor criteria and analysis parameters	Minimum Acceptable Rating Factor (RF)
Design Load Rating	HL-93	Evaluation Level — Inventory	1.00
Design Load Rating	HL-93	Evaluation Level — Operating	Report value
Legal Load Rating	CT-L73.0	Load Factor = 1.80	1.00
Legal Load Rating	CT-L3S2	Load Factor = 1.80	1.00
Permit Load Rating	CT-P76.5	Permit Type: Routine or Annual Frequency: Unlimited Crossings Loading Condition: Mix with traffic Distribution Factor: Two or more lanes ADTT: > 5000	100
Permit Load Rating	CT-P204	Permit Type: Routine or Annual Frequency: Unlimited Crossings Loading Condition: Mix with traffic Distribution Factor: Two or more lanes ADTT: >5000 Minimum Load Factor: 1.35	1.00
Permit Load Rating	CT-TLC	Permit Type: Special or Limited Crossing Frequency: Single trip Loading Condition: Mix with traffic Distribution Factor: One lane ADTT: >5000 Dynamic Load Allowance: 0.00	1.00