

ITEM 18595.53 M - MEMBRANE WATERPROOFING SYSTEM FOR CULVERTS

DESCRIPTION.

This work shall consist of furnishing and applying a membrane waterproofing system where indicated on the Contract Plans. The work shall include the preparation of concrete surfaces. The Contractor shall select, furnish, and apply one of the membrane waterproofing systems included in this specification on each structure designated to receive Membrane Waterproofing System.

The Contractor has the option of using any one of the membrane waterproofing systems included in this specification, as desired. Also, substitution of one system for another may be done at will. However, only a single system may be used on any one structure, regardless of the length or design of that structure. No system may be substituted for any system which is already in any stage of installation.

MATERIALS

1. Bituthene Preformed System - shall consist of Bituthene P-3000 Primer, Bituthene 5000 Membrane, and Bituthene EM-3000 Mastic; all as manufactured by W. R. Grace and Company, Cambridge, Massachusetts.
Or
2. Royston Preformed System - shall consist of Royston Bridge Membrane No. 10-A, Royston Bridge Membrane Primer 713-A, and Royston 104CM Caulkable Mastic; all as manufactured by Royston Laboratories, Inc., Pittsburgh, Pennsylvania.
Or
3. Protecto-Wrap Preformed System - shall consist of Protecto-Wrap No. 80 Primer, Protecto-Wrap M-400A Membrane, and Protecto-Wrap 160H Mastic; all as manufactured by Protecto-Wrap Company, Denver, Colorado.
Or
4. Other sheet membrane system approved by the DCES.

CONSTRUCTION DETAILS

General. Waterproofing membrane shall be placed over the entire surface of precast units and over the vertical sides of precast units.

Work shall not be done during wet weather conditions. No work shall be done when the concrete slab surface temperature is below 10°C. The concrete culvert slab and sidewalls shall be surface dry at the time of application of the membrane waterproofing system.

To prevent stretching and possible damage to the membrane, prior to membrane application, the joints between precast culvert sections shall be filled flush to the culvert slab and sidewall surfaces with a grout conforming to 701-08 Vertical and Overhead Patching Material. In areas where the joints do not line up evenly, grout shall be tapered, with a maximum slope of 2:1, from the high side

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of the joint to the low side to provide a smooth transition from one unit to the next.

Cleaning. All surfaces against which the membrane waterproofing system is to be placed shall be cleaned as follows:

1. All loose material, including dirt, gravel, and concrete laitance, shall be removed by vacuuming or blowing with dry, oil-free compressed air.
2. Any excess laitance (surface film of concrete), road oil, other bituminous based materials, previous membrane treatments, and other foreign materials, including concrete curing compounds, shall be removed by sandblasting or wire brushing and washing with water or a combination of these methods. To confirm the adequacy of the cleaning, small test patches of primer and membrane shall be applied to any area(s) in question. These test patches shall then be evaluated by the Engineer. The Engineer may order additional cleaning where poor adhesion is found.
3. Immediately prior to application of the membrane system, surfaces to be coated shall be recleaned of dust and other loose material by vacuuming or blowing with dry, oil-free compressed air.

Application of Preformed Sheet Membrane Systems

1. **Primer Application:** After cleaning, all surfaces that will receive the membrane shall be primed with the primer required for the selected preformed system. The primer shall be thoroughly mixed prior to application. Mixing shall be done with mechanical mixers or by hand mixing using clean paddles or other suitable instruments.

The primer shall be applied, without dilution, using brushes, squeegees, rollers, or a combination of these methods. The primer shall be applied at the rate stated in the manufacturer's written instructions and shall uniformly cover the surface. Areas of concrete which are porous and appear dry shall be given a second coat of primer.

The primer shall be allowed to dry to a "tack free" condition prior to application of the preformed membrane. Excess primer, occurring as puddles or wet areas, shall be removed by brushes, or as directed by the Engineer. The appearance of bubbles in the primer is normal, due to outgassing of air and moisture in the concrete. After the primer has dried to a "tack free" condition, these bubbles shall be broken with squeegees or brooms. Unless otherwise directed by the Engineer, it shall not be necessary to repair the areas where bubbles have been broken.

Primed surfaces which the Engineer determines have become contaminated by dust

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or dirt shall be cleaned by vacuuming or blowing with dry, oil-free compressed air and reprimed. Primed areas which have not been covered with preformed membrane within 24 hours of primer application shall be cleaned and reprimed. All such cleaning and repriming work shall be done at no additional cost to the State.

2. Preformed Sheet Membrane Installation:

a. General.

Rolls of preformed sheet membrane may be applied by hand or mechanical means. The sheet shall be placed on the culvert with the sticky side against the concrete. Rolls of sheet membrane shall be placed in such a manner as to minimize wrinkles and bubbles.

No overlaps shall be made on vertical surfaces and overlaps on horizontal surfaces shall be a minimum of 600 mm from the edge of the horizontal surface. Unless otherwise noted herein, adjacent rolls of sheet shall overlap a minimum of 50 mm on transverse laps and 200 mm on longitudinal laps.

Stiff bristled brooms shall be used at the time of application to smooth the sheet at its point of contact with the culvert.

The completed membrane shall be free of wrinkles larger than 50 mm, air bubbles, and other placement defects. These shall be corrected in a manner satisfactory to the Engineer. Where patches are used, the area shall be coated with mastic sealer and pieces of membrane pressed into the sealer over the defective area. The patches shall extend at least 150 mm in every direction beyond the edge of the defect.

Bubbles of 25 mm diameter and greater shall be vented by piercing with an ice pick, or other suitable instrument, and expelling the air. Vented bubbles shall be coated with mastic sealer.

To insure adhesion to the horizontal culvert surfaces, the preformed membrane shall be rolled with a 45-91 kg hand roller. On vertical surfaces, the preformed membrane shall be pressed with a stiff bristled broom. Laps which have not been thoroughly sealed by rolling operations shall be sealed with mastic.

When only a portion of the membrane application is completed in one day, the exposed edge of the membrane shall be sealed with mastic. The termination edge of the membrane at slab ends and expansion joints constructed without headers shall be sealed with mastic sealer.

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- b. Bituthene System: Rolls of preformed membrane shall be placed on the culvert, sticky side down, by removing the release paper as the work progresses. The membrane shall not be stretched or otherwise placed in tension during the installation.
- c. Royston System: Rolls of membrane shall be placed on the culvert, sticky side down, by removing the release paper as the work progresses. The polyester film on the surface of the membrane need not be removed.

Adjacent rolls of sheet shall overlap a minimum of 100 mm on transverse laps. End laps shall be sealed by heating the membrane surface to be covered with a propane torch, melting the polyester film and fusing the melted surface to the underside of the covering roll. Caution should be taken to avoid overheating or entrapping air.

Wrinkles in the membrane may be repaired by slitting the membrane and heat-fusing the overlapping pieces. Mastic shall be used to seal the edges of the repair areas.

- d. Protecto-Wrap System. Rolls of preformed membrane shall be placed sticky side down, by removing the release sheet as the work progresses. To minimize wrinkles and bubbles, the rolls of membrane shall be slightly pulled into place. The membrane is interwound with polyethylene release film on the top surface. Except for the perforated edge strip, the film shall be left-in-place until the day the bituminous overlay is placed or backfilling occurs. The perforated edge strip of the polyethylene film shall be removed at the time of placement of an overlapping roll of membrane. Spliced rolls of membrane have release film on the bottom (sticky) side, so care shall be taken to ensure removal of the release film from spliced areas at the time of membrane application

Membrane Protection. To protect the membrane waterproofing system from punctures, the following procedures shall be used:

- 1. On vertical surfaces, the waterproofing membrane shall be covered with material conforming to Item 705-07 Premoulded Resilient Joint Filler.
- 2. On horizontal surfaces,
 - a. If select granular fill is specified over the culvert, a 0.15 m thick protective layer of concrete sand meeting the requirements of Standard Specification

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703-07 Concrete Sand shall be placed on the membrane.

or

- b. If asphalt pavement using aggregate larger than 9.5 mm is specified directly above the membrane, or if clearances don't allow for 0.15 m of concrete sand, a 25 mm thick (minimum) course of 9.5 mm Superpave HMA (maximum aggregate size of 9.5 mm) shall be placed on top of the membrane. The hot mix asphalt shall be thoroughly compacted with mechanical tampers as directed by the Engineer.

METHOD OF MEASUREMENT

The work shall be measured as the number of square meters of culvert surface area shown on the plans as requiring coverage by the complete membrane waterproofing system.

BASIS OF PAYMENT

The unit price bid per square meter for this item shall include the cost of furnishing all labor, materials, (including 705-07 Premoulded Resilient Joint Filler, concrete sand, or 9.5 mm Superpave HMA), and equipment necessary to complete the work.