

## **ITEM 15595.50 M - MEMBRANE WATERPROOFING SYSTEM**

**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.** Membrane Waterproofing System. The membrane waterproofing system shall consist of one of the proprietary sheet systems plus wire mesh. No substitutions of the proprietary portions of the applied system shall be allowed.

Membrane Waterproofing Materials. The membrane waterproofing shall be one of the following:

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.
2. 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.
3. Royston Preformed System - shall consist of Royston Bridge Membrane No. 10-A, Royston Bridge Membrane Primer 713-A; and Royston 104 CM Caulkable Mastic; all as manufactured by Royston Laboratories, Inc., Pittsburgh, Pennsylvania.

**Wire Mesh.** Wire mesh for use over subdrainage opening shall be 6 mm mesh, 23 gauge hot-dipped galvanized cloth.

**CONSTRUCTION DETAILS.** General. Work shall not begin on existing structural concrete until seven (7) days have passed subsequent to the placement of portland cement concrete, portland cement mortar or epoxy mortar for structural concrete repair. The Engineer may waive the seven day requirement if the areas of repair can sustain loads without damage or deformation. There are various other types of concrete repair materials which have different required periods of waiting prior to safe loading. If one of these is used, the Manufacturer's instructions for allowable loading shall be followed subject to the concurrence of the Engineer.

On new structural concrete, the provisions of Subsection 557-3.12, Curing shall be met prior to membrane system placement. Work shall not be done during wet weather conditions nor when atmospheric conditions are such that unsatisfactory results will be produced. The Engineer shall be the sole determiner of favorable atmospheric conditions. No work shall be done when the concrete structural slab surface temperature is below 10°C, or ambient temperatures are below 10°C. The structural concrete

## ITEM 15595.50 M - MEMBRANE WATERPROOFING SYSTEM

shall be surface dry at the time of application of the membrane waterproofing system.

Structural Concrete Cleaning. All structural concrete 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 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 compressed air.

### Application Membrane Systems.

#### A. Primer Application.

After cleaning, all surfaces to be waterproofed 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. Hand mixing shall be required for the Royston Primer.

The primer shall be applied, without dilution, using brushes, squeegees, rollers, or a combination of these methods. Spray application of the primer shall not be allowed. The primer shall be applied at the rate given in the following table so as to thoroughly and uniformly cover the surface. Areas of concrete which are porous and appear dry shall be given a second coat of primer.

<u>Membrane System</u>	<u>Primer Application Rate</u>
Bituthene System	5 - 10 m <sup>2</sup> /l.
Protecto-Wrap System	2 - 3.7 m <sup>2</sup> /l.
Royston System (Approx)	7.3 m <sup>2</sup> /l.

## ITEM 15595.50 M - MEMBRANE WATERPROOFING SYSTEM

On vertical curb, concrete barrier, and header surfaces, the primer shall be applied and finished off, in a neat line, to a height that will be 25 mm higher than the height of the completed asphalt overlay. The outside face of metal scuppers shall not be primed. The inside surfaces of subdrainage outlets (weep tubes) shall be primed to a depth of at least 75 mm.

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 or dirt shall be reprimed. Primed areas which have not been covered with preformed membrane within 24 hours of primer application shall be reprimed. All such repriming work shall be done at no additional cost to the State.

### B. Preformed Sheet Installation.

1. General. The preformed membrane sheets and "flashing strips" shall be placed longitudinally on the structural slab so that both the longitudinal and transverse overlaps are formed in the direction of water drainage (See attached drawings). "Flashing strips" shall be defined to mean sections of membrane which are used to waterproof vertical surfaces and seal the intersection of the vertical surface with the structural slab. At those locations where no cross slope exists on the structural slab, the transverse water drainage shall be assumed to be from the center of the roadway toward the curbs.

Rolls of preformed sheet membrane may be applied by hand or mechanical means. The sheet shall be placed on the structural slab or other surfaces, sticky side down. Preformed sheet membrane flashing strips shall be placed and turned up the vertical faces of curbs, headers, scuppers, joints, and concrete barriers to a height equal to the thickness of bituminous overlay. Rolls of sheet membrane shall be placed in such a manner as to minimize wrinkles and bubbles. Stiff bristled brooms shall be used at the time of application to smooth the sheet at its point of contact with the structural slab. Unless otherwise noted herein, adjacent rolls of sheet shall overlap a minimum of 50 mm on transverse laps and 200 mm on longitudinal laps.

The application of the sheet membrane shall proceed as follows:

- a. Before the rolls of sheet membrane are applied to the slab, flashing strips shall be applied to the vertical faces where the direction of water drainage is toward the vertical face. The "flashing strips" shall be placed so that their overlaps are formed in the direction of water drainage. The flashing strips shall extend up the vertical face to the depth of the bituminous overlay and a minimum of 150 mm

## ITEM 15595.50 M - MEMBRANE WATERPROOFING SYSTEM

onto the structural slab. Where required, the vertical faces shall be coated with mastic to ensure adhesion of the flashing strip (See Plate 5).

- b. At subdrainage openings (weeps), mastic shall be applied to that area of the structural slab within 150 mm of the drain opening.
- c. Rolls of preformed sheet membrane shall then be aligned parallel to and applied on the structural slab. The preformed sheet shall be placed within 25 mm of abutting vertical faces. At subdrainage openings, the membrane shall be pierced and the edges turned down and adhered to the inside of the drain. If necessary, mastic shall be used to ensure adhesion and to prevent seepage under the membrane (See Plate 4).
- d. After the rolls of sheet membrane have been applied to the slab, flashing strips shall be applied to the vertical faces where the direction of water drainage is away from the vertical face, so the flashing strip is on top of the sheet membrane.
- e. The vertical termination of the flashing strips shall be sealed with a bead of mastic (see attached drawings). The completed membrane shall be free of large wrinkles, "fishmouths", 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 need not be repaired.

To insure adhesion to the structural slab, the preformed membrane shall be rolled with the required roller. Laps which have not been thoroughly sealed by rolling operations shall be sealed with mastic.

A 125 mm square piece of wire mesh shall be pressed into mastic applied to the membrane at each subdrainage opening.

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.

2. Bituthene System. Rolls of preformed membrane shall be placed on the structural concrete surfaces, 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.

## ITEM 15595.50 M - MEMBRANE WATERPROOFING SYSTEM

On granite and other rough vertical faces, mastic shall be applied to the vertical face to ensure bonding of the flashing strips.

Rolling shall be done with a 45 - 90 kg hand roller.

3. Protecto-Wrap System. Rolls of preformed membrane shall be placed on the structural concrete surface, sticky side down. To minimize wrinkles and bubbles, the rolls of membrane shall be stretched 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.

All vertical surfaces shall be coated with mastic, to the depth of the asphalt overlay, before placement of the flashing strips.

Rolling shall be done with a pneumatic tired roller.

4. Royston System. Rolls of membrane shall be placed on the structural concrete surface 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.

Flashing strips shall be adhered to vertical surfaces By the heat-fusion method: by heating the sticky side of the membrane and pressing the heated. surface into contact with the vertical face. The heat-fusion method shall be used to adhere the membrane to the inside of subdrainage outlets.

Mastic shall not be used to adhere the flashing strips to the membrane sheets.

Rolling shall be done with a 45 - 90 kg hand roller.

4. 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.

**METHOD OF MEASUREMENT.** The work shall be measured as the number of square meters of surface area of the structural concrete, as shown on the plans covered with the complete membrane waterproofing system. No separate measurement of the vertical faces of curbs, joints, concrete barriers,

## ITEM 15595.50 M - MEMBRANE WATERPROOFING SYSTEM

headers, and scuppers, or for the inside surfaces of subdrainage outlets, shall be made. No deductions will be made for holes less than 0.1 square meter in area.

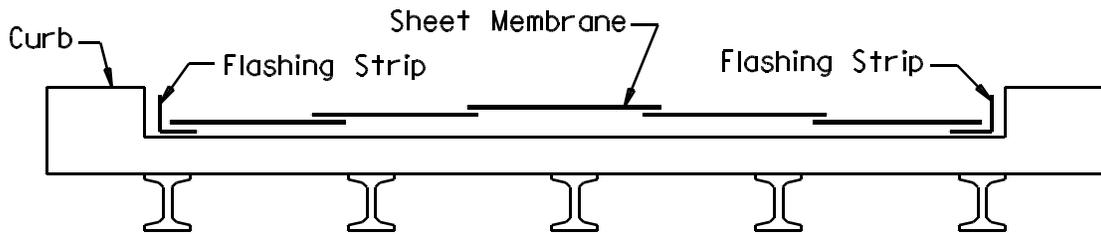
**BASIS OF PAYMENT.** The unit price bid per square meter include the cost of furnishing all labor, materials, (including wire mesh), and equipment necessary to complete the work.

No payment will be made for any work necessitated by damage or defacement attributable to the Contractor's operations.

No additional payment will be made for any repriming done in conformance with the requirements of the Primer Application subsection. No additional payment will be made for patching damaged areas of a membrane system.

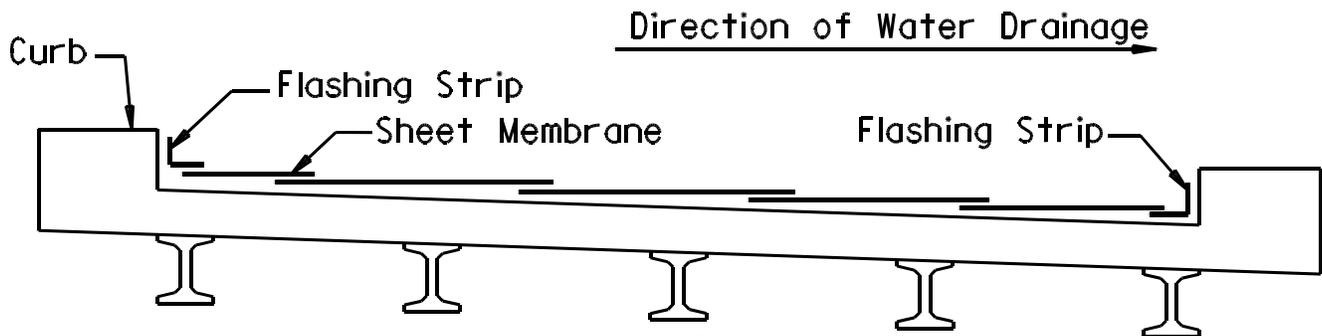
**DISAPPROVED BY**  
**EI 05-046**

**ITEM 15595.50 M - MEMBRANE WATERPROOFING SYSTEM**



1. Flashing strips installed first along both curbs.
2. Sheet membrane is installed from each curb toward the center with 50 mm minimum transverse overlap for the Bituthene and Protecto-Wrap Systems, and a 100 mm minimum transverse overlap for the Royston System.

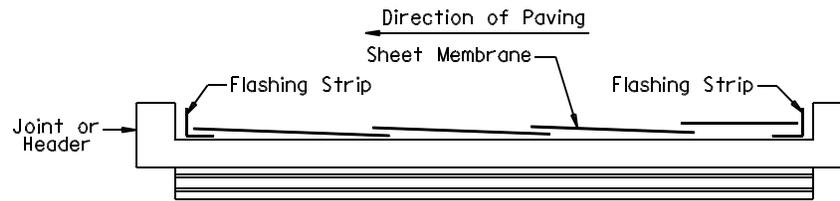
**DISAPPROVED BY**  
**TRANSVERSE BRIDGE SECTION**  
**(LEVEL DECK OR NORMAL CROWN)**  
**EI 05-046**



1. Flashing strips installed along low curb first.
2. Sheet membrane is installed from the low curb to the high curb with 50 mm minimum transverse overlap for the Bituthene and Protecto-Wrap Systems, and a 100 mm minimum transverse overlap for the Royston System.
3. Flashing strip installed along high curb last.

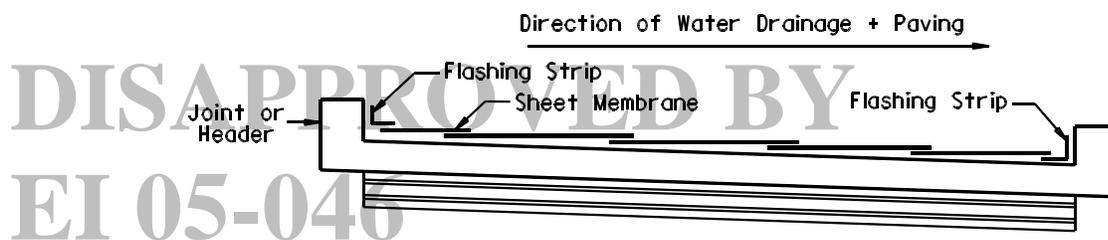
**TRANSVERSE BRIDGE SECTION**  
**(SUPERELEVATED)**

## ITEM 15595.50 M - MEMBRANE WATERPROOFING SYSTEM



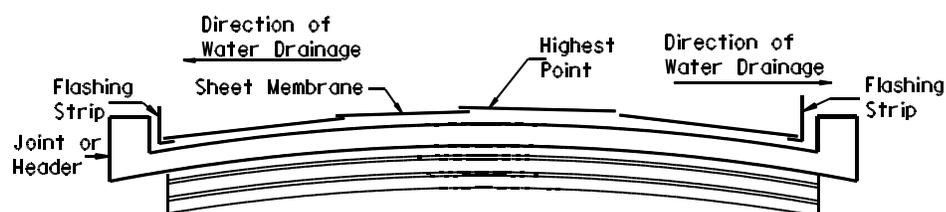
1. Flashing strips installed first along joints or header.
2. Sheet membrane is installed opposite the direction of paving with 200 mm minimum longitudinal overlaps.

### LONGITUDINAL BRIDGE SECTION - 0% GRADE



1. Flashing strips installed along low joint first.
2. Sheet membrane is installed from the low end of the slab to the high end with 200 mm minimum longitudinal overlaps.
3. Flashing strip installed along high joint last.

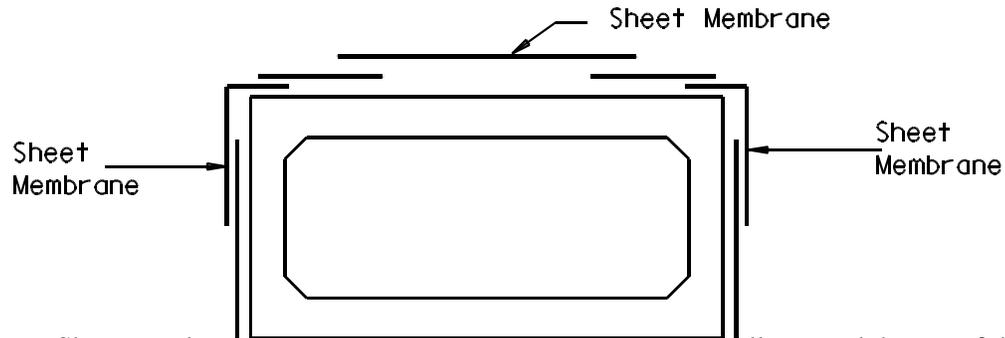
### LONGITUDINAL BRIDGE SECTION - WITH GRADE



1. Flashing strips installed first along both joints or headers.
2. Sheet membrane is installed from each joint toward the highest point of the vertical curve with 200 mm min. longitudinal overlaps.

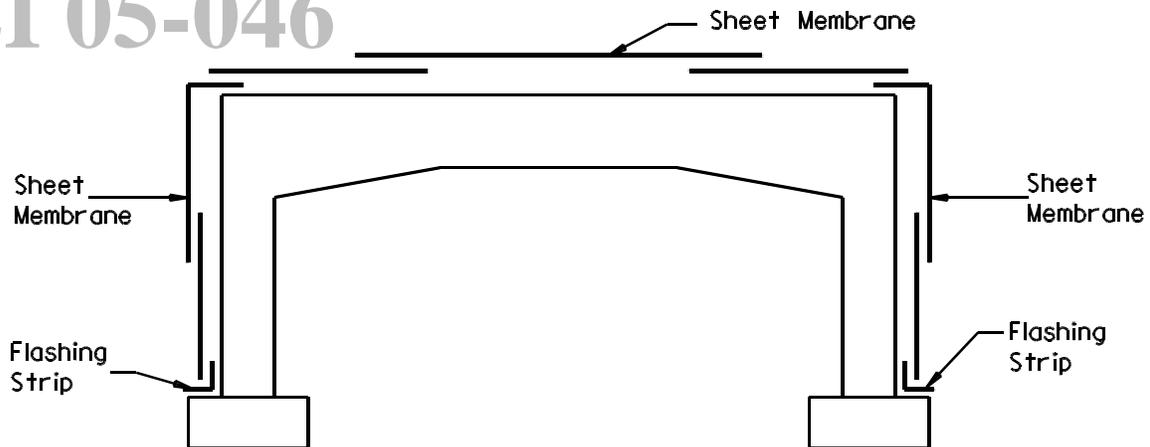
### LONGITUDINAL SECTION - VERTICAL CURVE

## ITEM 15595.50 M - MEMBRANE WATERPROOFING SYSTEM



1. Sheet membrane is installed from bottom of the vertical walls toward the top of the box culvert with 50 mm minimum overlap for the Bituthene and Protecto - Wrap systems, and a 100 mm minimum transverse overlap for the Royston System.
2. Sheet membrane is installed on the top of the box culvert with 50 mm minimum overlap for the Bituthene and Proto-Wrap systems, and a 100 mm minimum transverse overlap for the Royston system.

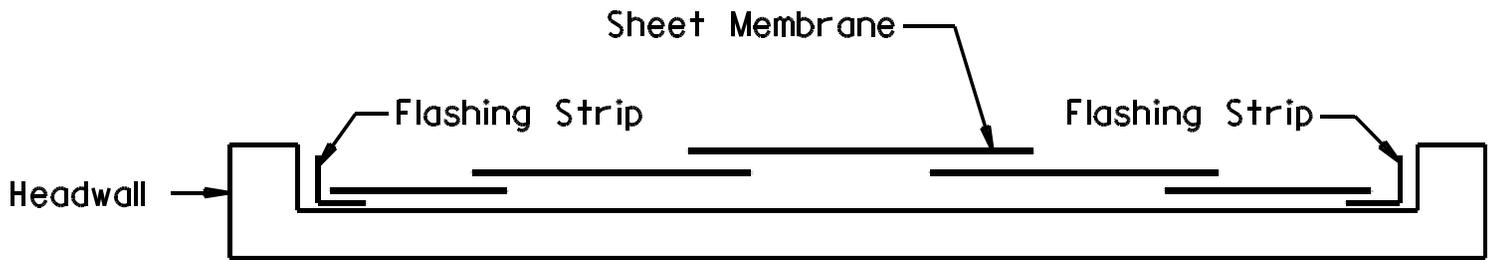
### TRANSVERSE BOX CULVERT SECTION



1. Flashing strip installed first along both footings.
2. Sheet membrane is installed from bottom of the vertical walls toward the top of box culvert with 50 mm minimum overlap for the Bituthene and Protecto-Wrap Systems, and a 100 mm minimum transverse overlap for the Royston System.
3. Sheet membrane is installed on the top of the box culvert with 50 mm minimum overlap for the Bituthene and Proto-Wrap Systems, and a 100 mm minimum transverse overlap for the Royston System.

### TRANSVERSE CULVERT SECTION

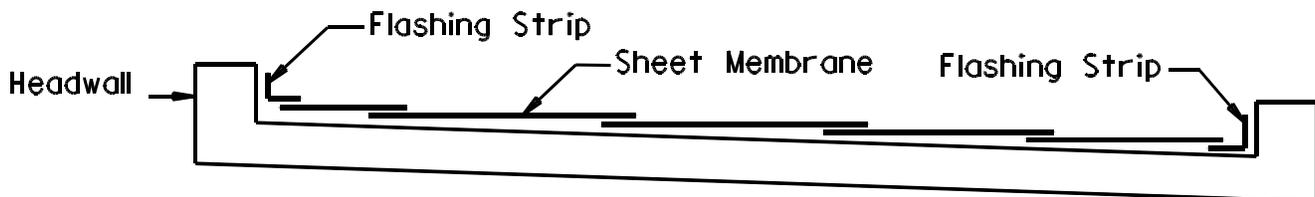
ITEM 15595.50 M - MEMBRANE WATERPROOFING SYSTEM



1. Flashing strips installed first along joints or headwall.
2. Sheet membrane is installed with 200 mm minimum longitudinal overlaps.

LONGITUDINAL CULVERT SECTION  
(NO GRADE)

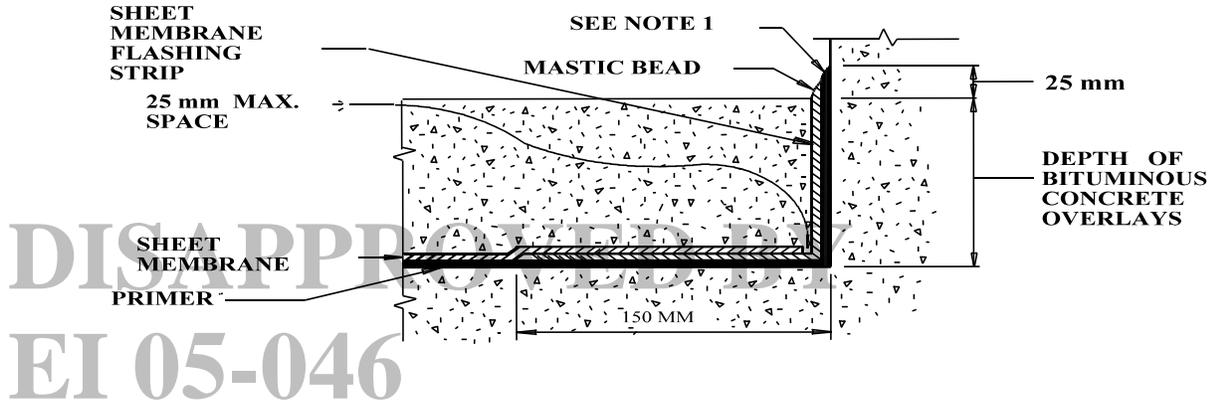
DISAPPROVED BY  
EI 05-046



1. Flashing strips installed along low headwall first.
2. Sheet membrane is installed from the low end of the top slab to the high end with 200 mm minimum longitudinal overlaps.
3. Flashing strip installed along high joint last.

LONGITUDINAL CULVERT SECTION  
(WITH GRADE)

**ITEM 15595.50 M - MEMBRANE WATERPROOFING SYSTEM**



**Figure 10**

Notes:

1. Bituthene flashing strips shall be adhered to rough vertical surfaces such as granite curb with Bituthene EM-3000 mastic. No additional treatment is required for smooth surfaces.

Protecto-Wrap ME-400 A flashing strip shall be adhered to all vertical surfaces with  
 Protecto-Wrap 150-H mastic. A flashing strip shall be adhered to all vertical  
 surfaces using the heat fusion method.

**TYPICAL SHEET MEMBRANE DETAIL**

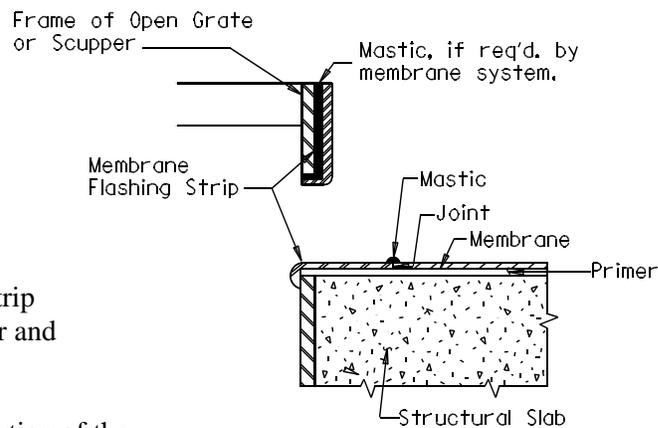
## ITEM 15595.50 M - MEMBRANE WATERPROOFING SYSTEM

### Construction Sequence

1. Primer extends down outlet 75 mm.
2. Apply mastic within 150 mm of outlet.
3. Pierce membrane at center of outlet and turn edges down.
4. Apply mastic within 75 mm of outlet.
5. Press 125 mm x 125 mm piece of wire mesh into mastic.

### SHEET MEMBRANE DETAIL (TYPE I) SUBDRAINAGE OUTLET

DISAPPROVED BY  
EI 05-046



### Construction Sequence

1. Apply primer and flashing strip
2. Pierce flashing strip at center and turn edges into opening.
3. Apply membrane sheet.
4. At the opening, remove a portion of the membrane sheet to make a butt joint.
5. Seal the butt joint with mastic.

### SHEET MEMBRANE DETAIL (TYPE II) SUBDRAINAGE OUTLET

Used where drainage of the membrane is accomplished through slots out in grates in the structural slab.