Protection for Concrete Bridge Decks by Membrane Waterproofing

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ABRIDGMENT

•IT IS standard practice in the Commonwealth of Massachusetts to use a membrane waterproofing on all new construction of concrete bridge decks that are to be covered by bituminous concrete. This is not new as it has been used back as far as the late 1940's. All restoration of concrete bridge decks that have deteriorated to the point of requiring repairs, include membrane waterproofing as a part of the restoration project. The first use of this method was tried in 1949.

Massachusetts has many bridges built prior to 1940 without adequate deck waterproofing that have a bituminous-concrete riding surface of various thicknesses. These are the decks that are presently reaching a state of deterioration requiring necessary repairs. In every instance there is considerable cracking in the bituminous concrete, and severe disintegration along the curb lines where the water collects between the concrete and the bituminous-concrete covering.

At first, 3 plys of impregnated cotton fabric were used between layers of a waterproofing asphalt or a coal tar pitch emulsion. In 1958 the Department revised the Specifications for membrane waterproofing and called for a 2-ply coated woven-glass fabric placed between five moppings of a coal tar pitch emulsion.

It is interesting to note that over the years the average contract bid price for this work has remained constant at approximately $3.00 per square yard.

Before placing of the membrane waterproofing all concrete surfaces are brought to a true cross section, free of rough spots, projections and other defects which might rupture or puncture the membrane. No waterproofing is allowed to be applied in wet or foggy weather and when the temperature is below 40 F.

The emulsion must be thoroughly agitated in its container and no adulterants of any nature may be added. All applications of the coal tar pitch emulsion are applied at a minimum rate of $\frac{1}{8}$ gal per sq yd. Each of the five applications must thoroughly dry before the next is applied. The first application of the emulsion is applied to a dampened concrete surface free of puddles. When the application is thoroughly dry the second coat is applied and the first ply of the coated glass fabric is laid. It must be brushed flat, free of wrinkles and bumps. This is followed by the third and fourth applications of the emulsion. The second ply of the coated glass fabric is laid on the fourth application of the emulsion at right angles to the first ply. This is followed by the application of the fifth and final coat of emulsion.

Where membrane waterproofing will be placed at steel expansion joints, scuppers, manholes or other metal projecting through the concrete, the membrane is turned up about $1\frac{1}{2}$ inches and sealed to the metal. When it is necessary to keep a section of the roadway open to traffic during the work, a 6-in. lap is left at the edge of each section of roadway to allow the joining of the adjacent section.

Bleeders, 2 in. in diameter, are installed at the curb lines, prior to the placing of the membrane waterproofing.

It is important that the membrane waterproofing be protected throughout all operations of placing the bituminous-concrete base course. No vehicles, including mechan-

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ical spreaders, are permitted on the bare waterproofing. The first course of bituminous concrete must be spread by hand.

Membrane waterproofing is paid for at the contract unit price per square yard of deck surface covered, complete in place. The contract costs for membrane waterproofing over the past five years has varied from a $1.80 per sq yd to $6.00 per sq yd, with the average cost being slightly under $3.00 per sq yd.

Observations during the past 20 years show satisfactory results from this method of waterproofing. No other method or materials have been found that will produce comparable results at such a reasonable cost.