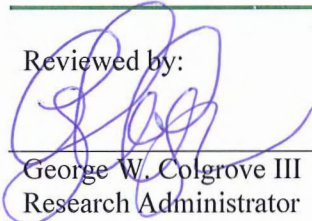

MATERIALS & RESEARCH SECTION

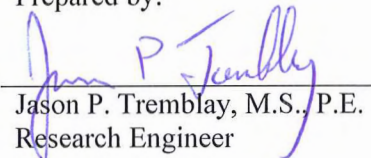
Research & Technology Implementation

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RESEARCH UPDATE

U2013-01

Assessment of the Bridge Preservation LLC's BDM Waterproofing Membrane System

References – Work Plan No. WP-2012-1

INTRODUCTION

The purpose of this study is to examine and evaluate the impacts of the constructability, overall performance, and life cycle cost of a spray applied polyurethane membrane waterproofing system produced by Bridge Preservation LLC called Bridge Deck Membrane (BDM). Reportedly, this product system may alleviate many of the drawbacks (limited placement conditions such as temperature and moisture constraints, some installation difficulties, and possible shoving of the hot mix asphalt overlay in some high-sloped applications) with respect to ease of application along with increased waterproofing capabilities. The system can be applied horizontally, vertically, and overhead and provides no seams to seal as are found with sheet membranes. Another important aspect of the finished membrane is that it is reported, by the manufacturer, to be resistant to damage from punctures and tearing.

The objective of this project is to assess the product's performance in a very specific bridge deck application. The bridge in which the system is to be installed is part of a rapid construction project, which will be performed during cold winter months. The bridge was damaged as part of the Hurricane Irene weather event during the summer of 2011 and needed to be repaired to serviceability during months where it is unfavorable to use a torch applied sheet membrane product as is typically specified by the Vermont Agency of Transportation.

The rationale behind using this product was based on two factors. First, the producer claimed the product can be applied in temperatures as low as -20°F without effect on set up time or curing. This can be very important for construction activities during Vermont's winter months. The manufacturer has affirmed the suitability of placement conditions at low temperatures, provided that the surface moisture content is below 5%. The second factor involved the timing of asphalt placement. Since this was a winter application, the bridge could not be paved over with asphalt immediately. The product provides for an aggregate to be placed over the surface to act as a wearing surface until pavement could be applied in warmer months later in the spring. According to the manufacturer, the membrane is able to withstand punctures from aggregate in this configuration, and if any were to occur, the membrane could be easily repaired with further spraying.

PRODUCT DESCRIPTION

BDM (Bridge Deck Membrane) is produced by Bridge Preservation LLC. According to product literature (1), the complete system consists of: the primer, used to penetrate and seal the substrate enhancing the system's bond to the deck and the membrane, and a polyurethane membrane that provides 100% effective waterproofing. Optional components could include a top coat, which would allow for the addition of an aggregate top coat or a tack coat which would provide adhesion of asphalt to an aggregated top coat (not utilized as part of this evaluation).

There are several reported benefits of this cold spray applied system as listed in the product literature. Of these, the major benefit to Vermont in this application is the product's ability to be applied in a wide range of temperatures and weather conditions; the recommended temperature range for application begins at -20°F. Due to its formulation it cures very rapidly, even in sub freezing temperatures. When applied to dry surfaces, even in the middle of winter, the membrane reportedly can be ready for surfacing after only one hour.

CONSTRUCTION

The BDM system was used on one bridge replacement project, Warren ER-STP 013-4(36), bridge no. 165 on VT 100 in the town of Warren, 50 feet north of the Warren and Granville town line. The bridge was completely replaced using rapid construction techniques. The bridge is 21 feet long by 34 wide, with a reported average annual daily traffic (AADT) of 980. The selected bridge structure was a precast rigid frame, provided by S. D. Ireland in an outdoor containment structure.

Traffic was detoured around the preexisting structure starting on February 1, 2012. New structure placement was conducted over the next six weeks. The BDM membrane was installed on March 12, 2012 by G. S. Bolton as the subcontractor, with manufacturer and Materials and Research representatives on hand to observe.

The temperature at the time of membrane placement ranged from approximately 50-55°F. This is important to note, as a primary reason that the use of this spray applied membrane was requested for the project was its ability to be placed in very cold conditions. Being a late winter project, it was expected that the temperature would be at or below freezing during installation. As temperatures were considerably higher than freezing, the product's ability to handle cold weather installation was not able to be observed or verified.

On the day of membrane application, the surfaces which it was to be applied to were shot blasted and cleaned thoroughly. Foam backer rods were wedged into any open joints. The primer was then rolled on all surfaces. The membrane was then sprayed onto all surfaces, using a mechanized spraying apparatus in a truck, hoses, and nozzles. The membrane is bright orange in color, which makes it easier to observe if all surfaces have been covered to a uniform nominal 80 mil thickness.

Once cured, gravel was placed on top of the membrane over the subsequent two days to act as the travel service until the bridge could be paved over during warmer weather months. The bridge was open to traffic on March 17, 2012. With the onset of warmer weather in May, the bridge was again closed to traffic to begin paving activities. Once the gravel was removed

from the bridge deck, GS Bolton performed an inspection of the membrane on May 23 to ensure the gravel did not puncture or cause any weak spots. It was deemed in good shape. Binder and base courses of asphalt were placed on the bridge and approaches on June 6, and the top course on June 18, 2012.



Figure 1 Installation of the BDM system, application of the primer



Figure 2 Spraying of the membrane

PERFORMANCE

To this point there have been no noticeable issues with the membrane, the asphalt applied on top, or the structure itself. In a couple brief field visits in 2013, Research found no indications of any membrane issues.

An outcome of this product evaluation project has been the addition of a spray applied membrane specification to the 2011 Standard Specifications for Construction, which requires the products to be on the Agency's Approved Products List, and the Bridge Preservation LLC's BDM membrane specifically being added to the list.

FOLLOW-UP

Site visits will be made on a yearly basis, to document the condition of the bridge. The duration of the study will be a minimum of five years of the structures initial life. Should any issues with the structure or asphalt be identified, Research will conduct a field evaluation to determine if the membrane is the root of the issue.

REFERENCES

1. "Bridge Preservation, Bridge Deck Membrane", Bridge Preservation LLC product advertisement, www.bridgepreservation.com and www.rjwatson.com.