



BUREAU OF MATERIALS & RESEARCH

EXPERIMENTAL FEATURE 2004-2 and 2005-2 Poly-Carb Flexogrid Bridge Deck Overlay System and Stirling Lloyd SafeTrack HW

Interim Report

Introduction

Bridge decks are under constant attack from de-icing chlorides (salt) and other chemicals. Such contaminants are absorbed into the concrete, and eventually corrode the reinforcing steel within the structure. Corroding steel (rust) expands, causing the concrete to crack due to its weak tensile strength properties. Cracks are a direct path for moisture and chlorides to attack the steel and increase the rate of general deterioration of the structure.

A number of techniques are utilized by the Department to prevent or slow the deterioration process, including the use of barrier membranes, high performance concrete, corrosion inhibitors, and corrosion-resistant reinforcing materials. Thin overlay systems are also considered to be a viable alternative.

This report describes an evaluation of the performance of two thin overlay systems. The products that were evaluated were the Poly-Carb Mark-163 Flexogrid Bridge Deck Overlay System and Stirling Lloyd SafeTrack HW. The site for this field trial is a pair of bridges that carry NH Route 119 across the Connecticut River between Hinsdale, NH and Brattleboro, VT.

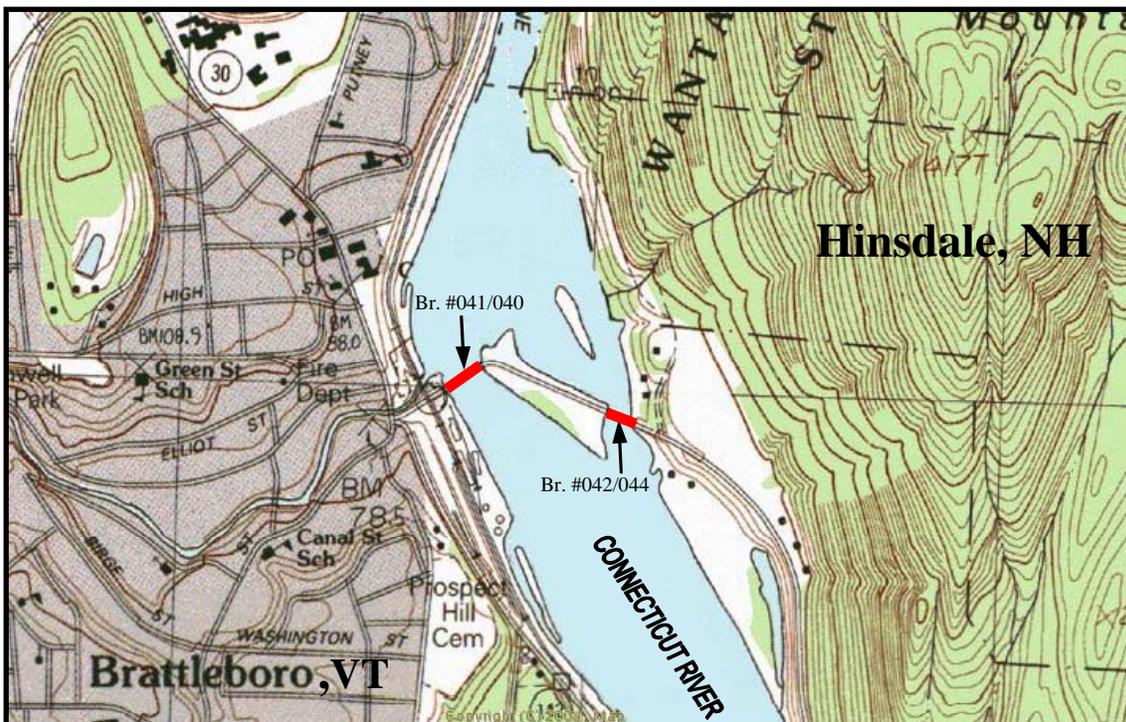


Figure 1 – Test Site Location

These two bridges were rehabilitated in 2003. The rehab consisted of replacing the existing concrete deck slab with full-width, precast concrete sections that are 21 ft wide and 8 ft long. The grouted joints between these concrete sections are visible in Figure 5. Figure 2 shows a typical deck slab section and Figure 3 shows the configuration of the precast sections.

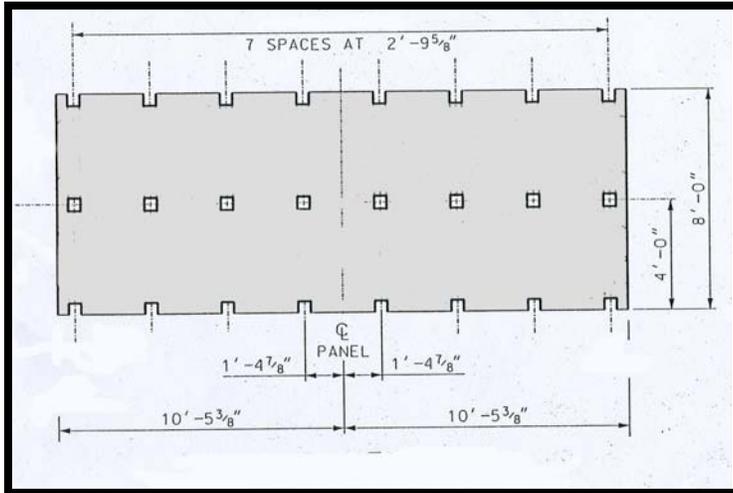


Figure 2 - Typical deck slab section

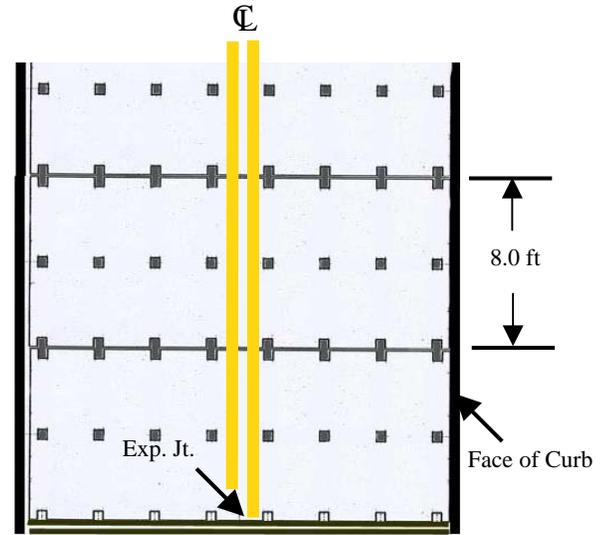


Figure 3 - Deck slab configuration

Product Descriptions

Poly-Carb Mark-163 Flexogrid Bridge Deck Overlay System

The Poly-Carb Mark-163 Flexogrid Bridge Deck Overlay system is a solventless, 100% solids combination of urethane and epoxy molecules. It is a two-part liquid system that is mixed on the jobsite. The system includes a pretreatment application that penetrates and seals existing cracks in the concrete deck. The manufacturer claims that the tensile elongation of the pretreatment resin will enhance the systems ability to tolerate movements from traffic loading and temperature variations. The Flexogrid system also includes an aggregate that is broadcast into the freshly applied liquid. The system is placed in two coats for a minimum thickness of 1/4" - 3/8". The manufacturer states that the primary use of this product is for waterproofing and skid proofing the deck. The minimum recommended application temperature for this system is 50 degrees F.

The Poly-Carb system was applied to the more easterly bridge, Br. # 042/044, in August 2005. The deck was shot blasted prior to application of the overlay. The design thickness of this installation was 3/8". The manufacturer placed the product using a specialized distribution unit of the type shown in Figure 4.



Figure 4 – Poly-Carb distribution unit



Figure 5 – NHDOT Bridge Maintenance installing Stirling Lloyd product

Stirling Lloyd Safetrack® HW Bridge Deck Overlay System

The Safetrack® HW overlay system, manufactured by Stirling Lloyd, is a high performance polymer concrete overlay that is based on methyl methacrylate resins. The overlay consists of one or two coats of resin binder with an aggregate broadcast into the liquid surface. In addition to providing a protective wearing course, the manufacturer claims that the overlay

protects against water, chlorides and other contaminants. It is also intended to provide skid resistance. Product literature states that this product can be installed “all year round”, however there is a caution that Stirling Lloyd Technical Services should be contacted if the application temperature will be below 32 degrees F.

This system was applied to the more westerly bridge, Br. # 041/040 in May 2006. Prior to application, the deck was shot blasted by a subcontractor of Stirling Lloyd. The NHDOT Bureau of Bridge Maintenance applied the two-coat system that was specified for this project with technical oversight provided by Stirling Lloyd. The total applied thickness of the product varied between 1/8” and 3/16”.

Observations

An inspection of both the Poly-Carb and Stirling Lloyd deck overlay systems was conducted on June 3, 2008. At this point the Poly-Carb system had been in place for 34 months and had been subjected to the maintenance activities of 3 winters. The Stirling Lloyd system had been in place for 25 months and had been through 2 winters.

Poly-Carb Mark-163 Flexogrid Bridge Deck Overlay System

Although it appears that the majority of the Poly-Carb product is still in good condition, there has been some snowplow damage at expansion joints (see Figures 6 and 7). This loss is most likely due to the fact that the overlay was not inset at the joint but rather was applied over the existing deck surface and onto the top surface of the expansion joint as shown in Figure 8. Efforts were made to prevent the overlay material from running into the opening of the expansion joint. This left an unprotected edge of overlay material that could be snagged by snowplows.

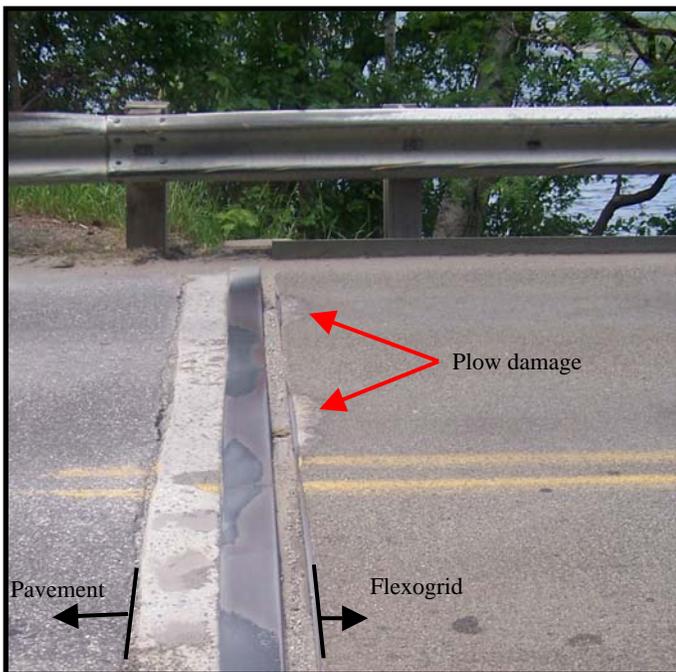


Figure 6 – Flexogrid snowplow damage

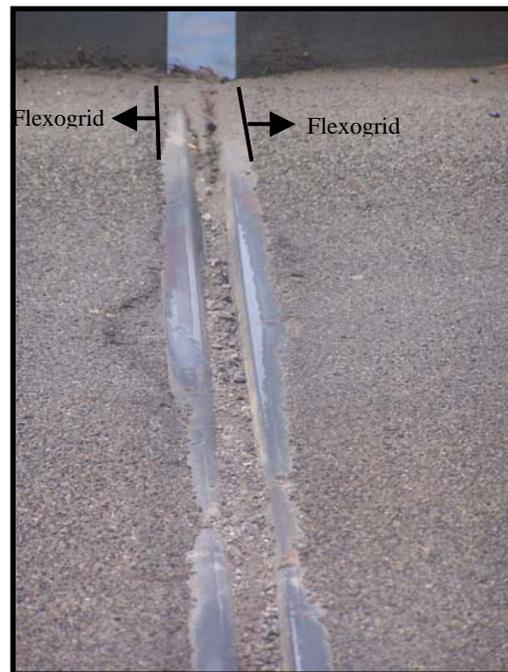


Figure 7 – Flexogrid snowplow damage

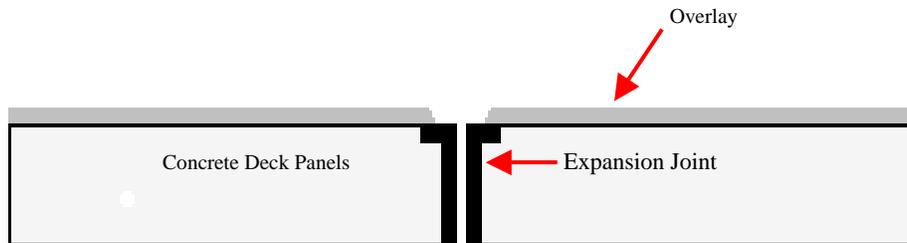


Figure 8 – Overlay at expansion joint

Between expansion joints, the overlay aggregate shows some signs of wear in that the surface appears to be discolored in the wheel paths (see Figure 9). Although this wear may indicate some loss of skid resistance, it did not seem to be slippery under foot or when subjected to normal driving actions.



Figure 9 – Flexogrid aggregate wear in wheel path



Figure 10 – Flexogrid cracking

There are several fine cracks in the overlay as shown in Figure 10. It is not clear if these cracks are reflective cracks over the joints in the bridge deck system, but this may be the case. The cracks are tight and there does not appear to be any loss of overlay material at these locations.

There is no indication of lost bond between the concrete deck and the overlay. There did not appear to be any rutting, shoving, or shifting of the overlay material.

Stirling Lloyd Safetrack® HW Bridge Deck Overlay System

The Stirling Lloyd product has experienced significant areas of bond failure. Areas of missing overlay material can be seen in Figure 11. Pieces of separated overlay were lying in the roadway as seen in Figure 12.

In addition, it appears that the remaining overlay material has suffered damage from wear. There are areas where aggregate and binder appear to have been scraped off as indicated by the light colored areas of the overlay surface in Figure 12.



Figure 11 - Failed Stirling Lloyd overlay



Figure 12 – Separated pieces of Stirling Lloyd

Conclusions/Recommendations

Poly-Carb Mark-163 Flexogrid Bridge Deck Overlay system

Visual inspection of the Poly-Carb Mark-163 Flexogrid Bridge Deck Overlay system revealed that the overlay has been damaged by snowplows at the expansion joints. The overlay was placed over the edge of the expansion joint as shown in Figure 8, and it is expected that this type of damage could be avoided by inseting the overlay at the expansion joint to obtain a flush finish.

Fine, widely spaced cracks were observed in the overlay. These cracks may have reflected up from the joints between precast deck slabs. An underside inspection is recommended to determine if the cracks align with the panel joints or if any leakage is occurring in these areas.

The surface of the Poly-Carb overlay shows some wear in the wheel paths, but no apparent loss of traction.

At the time of this inspection, it appears that the product has not suffered any significant deterioration. Yearly inspections of this product are recommended.

Stirling Lloyd SafeTrack HW

It is readily apparent that the Stirling Lloyd Safe Track HW overlay has suffered significant loss of bond with the underlying deck surface. Significant areas of overlay are missing and loose pieces of overlay material are evident.

Areas of the remaining overlay have experienced significant wear, presumably from traffic and/or snowplows. These areas appear to have lost aggregate and a portion of the binder material.

As this product has not fared well over the 2-year evaluation period, further use is not recommended.

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