Reviewed by:
George W. Colgrove III
Research Administrator

Prepared by:
Jason P. Tremblay, M.S., P.E.
Research Engineer

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Assessment of the Poly-Carb Flexogrid Bridge Deck Overlay System

References – Work Plan No. WP-2012-R-2

INTRODUCTION

Like other New England States, the weather in Vermont is highly variable with a large range of daily and annual temperatures. Wintertime temperatures fluctuate from day to day with an average daily temperature range of approximately 20°F. In addition to fluctuating ambient temperatures, Vermont receives an average annual snowfall amount of about 100 inches. These weather conditions pose an ongoing threat to local residents and tourists that may be unaware of the associated roadway hazards. In order to address this safety hazard, the Vermont Agency of Transportation (VTrans) applies road salt and sand to combat the formation and build up of ice and snow or to increase friction. While this is an extremely effective treatment, it often requires constant attention, especially in high vehicle incident locations.

The purpose of this study is to apply an experimental bridge overlay treatment manufactured by Poly-Carb known as Flexogrid, a high friction bridge deck overlay system. This system creates an anti skid surface for use on high crash locations while also creating a barrier to water and chloride intrusion into the concrete deck.

In support of the FHWA, "Get In, Get Out and Stay Out" initiative, the VTrans is undergoing developing a process to plan, design and construct bridges and preventative maintenance measures with shortened time frames (VTrans is developing an Accelerated Bridge Program) whereby the traveling public is less effected by construction impacts in both the short term and long term. To accomplish this, higher performing and more robust bridge membrane products need to be identified and made available as an option for use on our projects. Additionally, we do not currently allow vehicles to travel on a torch applied membrane prior to it being covered with asphalt to prevent damage. If more robust membrane systems that provide the ability to rapidly change the traffic phasing are identified, then the objective to minimize impacts to the traveling public will be realized. Products that provide for shorter bridge closures can be listed on the Approved Products List (APL) for regular use, much like the torch applied product.

PRODUCT DESCRIPTION

According to the manufacturer, Poly-Carb, the Mark-163 Flexogrid Overlay System:

- is a hybridized copolymer formulated through a unique chemical combination of epoxy and urethane molecules specially designed to provide a flexible, yet strong waterproofing and de-slicking system for highway bridge decks.
- is designed to accommodate slight movements of the concrete structure due to heavy traffic and extreme changes in weather conditions.
- consists of a 100% solids, two-part liquid polymer system to be mixed on the job site and a blend of specially selected aggregate to be broadcast on the spread liquid.
- can be applied at temperatures of 50°F and above.
- maintains skid number well above 50 for an extended period of time
- fast curing system allows traffic to be resumed within hours

All the manufacturer's recommendations were to be followed during surface preparation and system application. Further information can be found in Poly-Carb Technical Data Sheet for Mark-163, RW/HN 09-243.

CONSTRUCTION

The experimental feature was applied as part of IM MEMB(31) membrane replacement project on bridge 8 over I-93 in the town of Waterford on Town Highway 4, built in 1982. The estimated total deck area of the application is approximately 1000 square yards. The project description indicates that it involved removing and replacing the sheet membrane waterproofing and bituminous concrete pavement on the bridge and its approaches along with minor related work. There will be no asphalt overlay placed over the overlay system.

Construction began on the bridge on April 11, 2013 by JP Sicard, Inc. as the prime contractor with the removal of the existing bridge deck overlay. The condition of the existing overlay in 2012 can be seen in Figure 1. Once the overlay was removed, deck repair was completed and silane was applied to the exposed concrete. Poly-Carb along with Nicom as the subcontractor, installed the Flexo-grid on May 30th and 31st, 2013. The deck was opened to traffic as soon as each lane was completed. Figures 2 and 3 show the specialty application from Poly-Carb, which houses all of the materials and a special feeder system to broadcast the aggregate after the epoxy is applied.

PERFORMANCE

As per the original workplan, four specific locations were selected to be monitored in-depth with each site visit in addition to the condition of the deck as a whole. Two locations were chosen near the leading edge of each direction of traffic, with one being in the right wheel path and the other in the middle of the two wheelpaths. These four locations will be photographed extensively on each visit and friction testing performed with the use of a British pendulum tester (1). Figure 4 shows the layout of the skid testing locations, northbound lane, while Figure 5 shows the surface texture of the Flexogrid overlay. Table 1 displays the friction values at the four locations as taken on November 14th, 2013, approximately five and a half months of age.

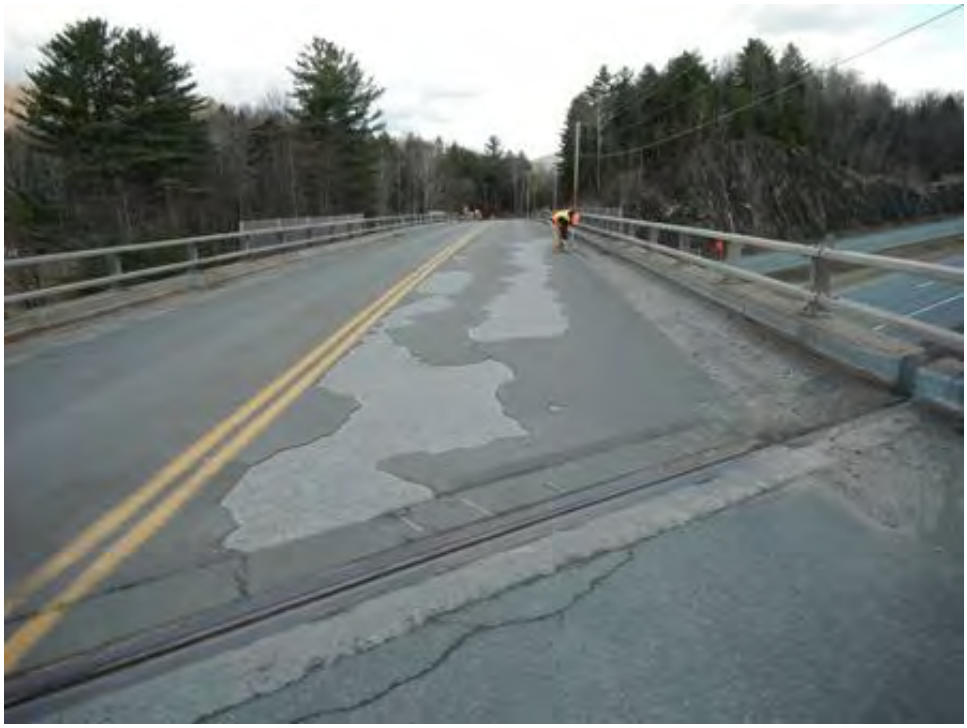

Figure 1. Condition of the previous overlay (unknown product) in 2012.

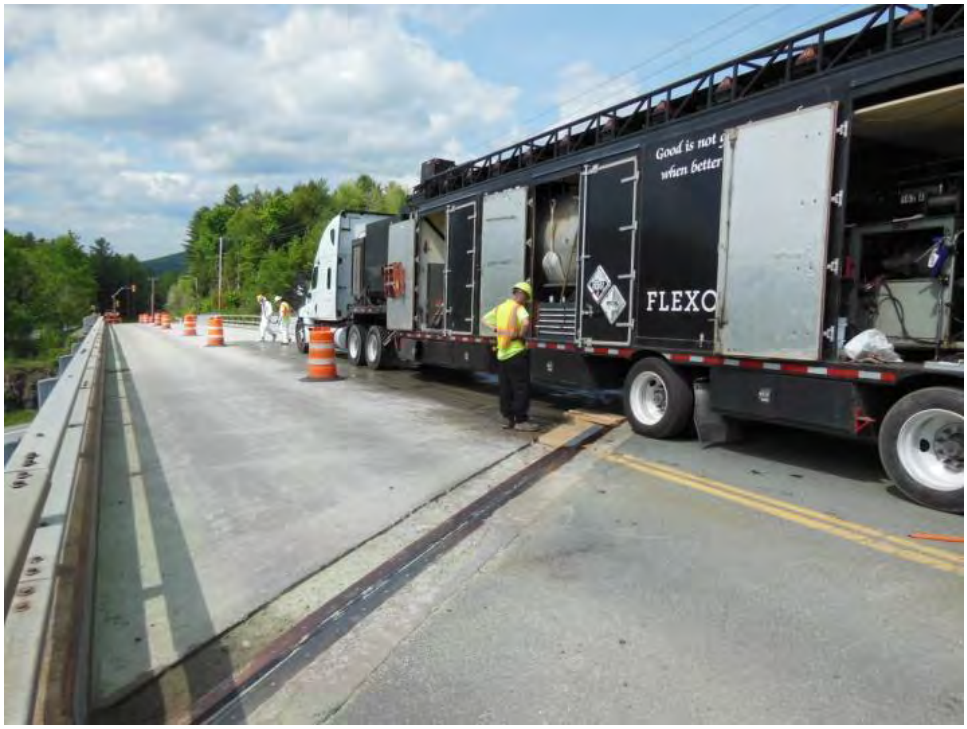

Figure 2. Poly-Carb installation vehicle, and the prepared condition of the concrete bridge deck.

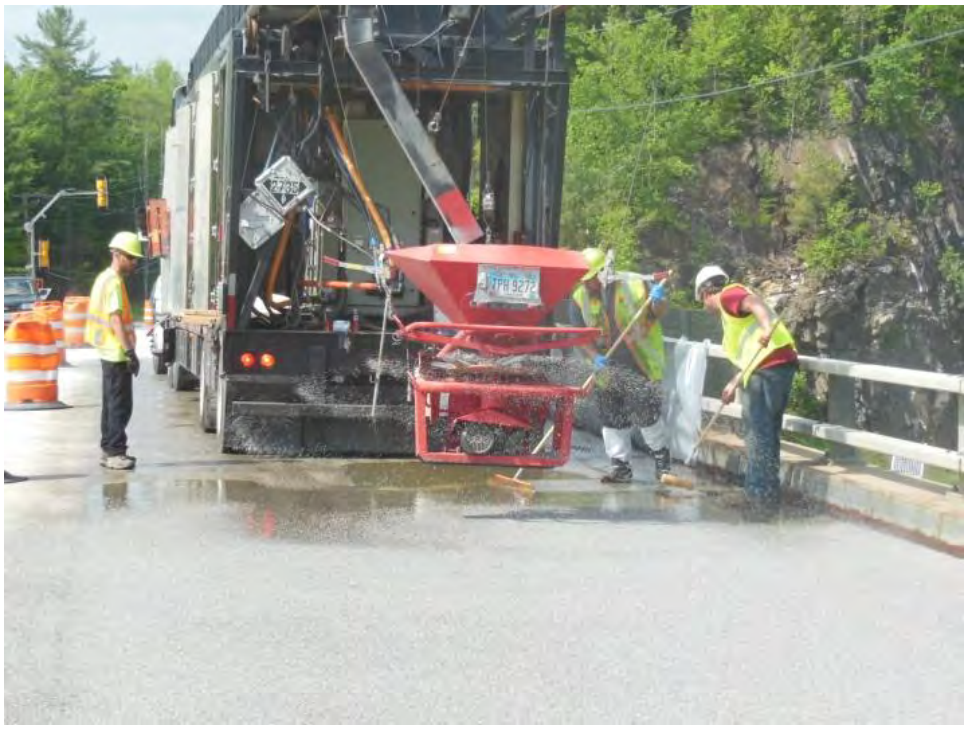

Figure 3. Installation of Flexogrid. Epoxy has been squeegeed on and the aggregate is being spread on the surface.

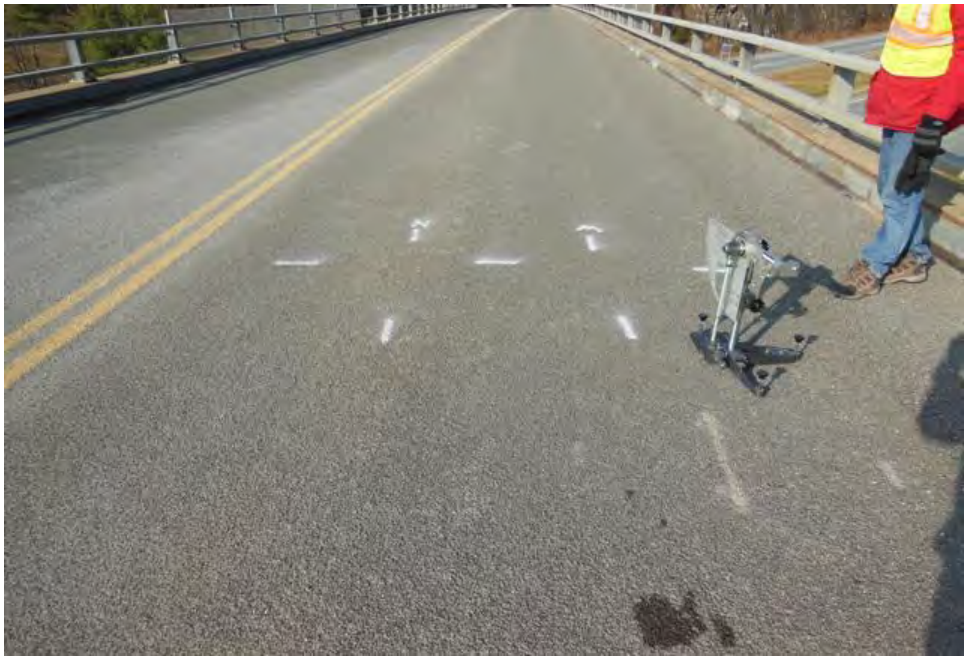

Figure 4. Layout of skid testing locations, wheelpath (right) and non-wheelpath (left). The British pendulum tester can also be seen.

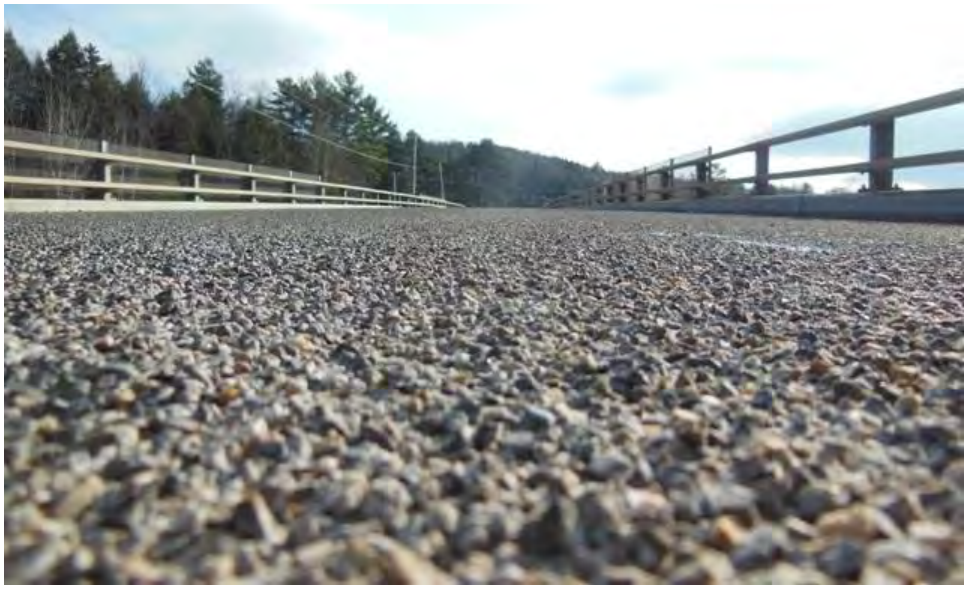

Figure 5. Surface texture of Flexogrid.

Table 1. British pendulum numbers for the friction values.

Test Number	Northbound		Southbound	
	Wheelpath	Non-wheelpath	Wheelpath	Non-wheelpath
1	100	113	93	100
2	105	112	91	100
3	103	114	95	97
4	105	117	88	101
5	106	104	88	103
Average	**104**	**112**	**91**	**100**

British pendulum skid testing resulted in very high values for the overlay, as would be expected at an early age, ranging from 88 to 117 British pendulum number (BPN) overall. As a method of comparison, a VTrans' research project that was recently performed detailing skid resistances of bare concrete bridge decks with various surface finishes and ages yielded British pendulum results between 50 and 80. After a little over five months of service there is a slight measurable decrease in friction within the wheelpath of about 8 BPN in each direction. This difference will continue to be monitored over the next few years.

FOLLOW-UP

Site visits will be made on a yearly basis to document the condition of the bridge and to monitor the quality of the surface. Site visits will be made for a minimum of five years of the overlay system's initial life. Site visits will also be made should any issues with the structure or overlay arise, to determine if the overlay system is an issue. Four one foot by one foot areas have been identified, two in a wheel path and two not in a wheel path (one set in each lane) to take pictures and British pendulum friction testing at during each site visit to observe the wear in specific locations.

REFERENCES

1. “Standard Method of Test for Surface Frictional Properties Using the British Pendulum Tester”, AASHTO T 278-90 (1999).