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RESEARCH UPDATE U95-1

THIN POLYMER OVERLAY - GEORGIA VT.

INTRODUCTION:

Bridge number 10 in Georgia was identified as in need of protection because of premature and extensive cracking of the deck. Vermont's customary protection method of choice for bridge decks is waterproofing with sheet membrane and bituminous concrete overlay. The standard treatment was not deemed appropriate in this case because of the elevation of the existing bridge joints and the considered wisdom of preserving them intact. Thus, in lieu of the ordinary bridge deck protective procedure, a thin polymer overlay, utilizing a product manufactured by Tamms (formerly Dural) was selected.

PRODUCT INFORMATION:

Tamms Flexolith polymer concrete bridge deck overlay consists of an epoxy type polymer binder combined with an aggregate containing aluminum oxide to form a bridge deck overlay system which has a high resistance to fracture and polishing. The product is designed to provide protection from corrosion by de-icing chemicals, a skid resistant surface and reduced noise. The Flexolith binder is a two component 100% solids epoxy resin compound having high elongation and flexibility properties.

PROJECT LOCATION & DESCRIPTION:

TH#1 in Georgia is a short north-south oriented highway connecting VT 104A and TH #36. The intersection of the town highway with VT 104A is located at km 2.708 (MM 1.728) of VT 104A. The total length of BR#1 over the Lamoille river is approximately 98 m (320 ft) and comprises most of the total 146 m (480 ft) length of TH#1. The scope of project TH2 9335 consisted of rehabilitation of BR#1 with a thin polymer overlay and minor approach work. The 1995 average daily traffic (ADT) on TH #1 has been estimated to be 500.

CONSTRUCTION:

Project work began on 08/03/94 and was completed on 08/25/94. Preparation of the existing concrete deck included shot blasting, thorough broom cleaning and blown hot air to eliminate the possibility of any surface moisture . The application of the required three coats of the polymer overlay began on 08/08/94.

The material was mixed in two parts, the composition being two volumes of component A (the base) to one part of component B (the hardener). Mixing

must be thorough but time is very critical because initial set-up begins almost immediately and the blend begins to gel within four to eight minutes. The polymerization process is extremely exothermic, even to the point of ignition if the overlay is not spread in a reasonable time. The overlay was applied to one lane and over one span at a time. It was poured at the high end of the span and spread as it drained downstream with rollers. A basalt aggregate was broadcast over each coat of the two component epoxy polymer.

The recommended and actual application rates of the two part epoxy polymer are shown below:

	SUGGESTED APPLICATION RATE	ACTUAL APPLICATION RATE
First coat	1.02 l /m^2 (.025 Gal./SF)	1.06 l/m^2 (.0259 gal/SF)
Second Coat	2.04-1.34 l/m^2 (.05-.033 Gal./SF)	1.8331/m^2 (.045 gal/SF)
Third Coat	2.04-1.34 l/m^2 (.05-.033gal/SF)	1.87 l/m^2 (.046 gal/SF)

The total application of the basalt aggregate over the 785 m^2 8450 SF bridge area was 17.3 t (19 tn) or a rate of 22 kg/m^2 (4.5 lb/SF). The resident checked the thickness profile between each of the three overlay lifts and was confident that the 10 mm (3/8)" contract thickness was achieved.

COST:

The original low bid price for the thin polymer overlay was \$108.72/m^2 (\$90.90/SY). Deeming this cost to be excessive, Agency personnel met with the contractor and Tamms staff to explore possible measures for cost reduction. It was decided at that conference that since TH #1 in Georgia carries a relatively light traffic load, the thickness of the overlay could be reduced from the originally designed 13 mm (0.5 in) to 10 mm (3/8 in). This resulted in a renegotiated price of \$94.73/m^2 (\$79.20/SY). Even at the lower price, this is extremely expensive compared to the average weighted low bid price of \$12.06/m^2 (\$10.08/SY) to construct a deck section with sheet waterproofing membrane and a 38.1 mm (2.5 in) standard overlay of bituminous concrete pavement. The state of New York, which has extensive experience with thin polymer overlays, has noted their high price and has suggested that they should only be utilized under two conditions: 1) Bridges where weight of the overlay or overhead clearance is critical. 2) Where extended traffic disruptions are intolerable, as in urban areas.

Based on Vermont's decision to utilize the thin polymer overlay, one other criterion for justifying its use could be added, i.e. where it is a necessary procedure to preserve a design feature of the existing structure.

DISCUSSION:

This technology is relatively new. The first application of this product to a bridge deck occurred in Michigan during 1976. The state of New York began using thin polymer overlays on structures in 1983 on the Brooklyn Bridge and have used the technique nine times since then. The conclusions and recommendations made in the NYDOT research report entitled "POLYMER-CONCRETE BRIDGE DECK OVERLAYS", by Michael Doody and Rick Morgan, published in June of 1993, are summarized as follows:

1. Testing to date suggests optimism for a developing technology. There is no way to predict long term performance at this time.

2. System performance is dependent on existing deck soundness and proper preparation.

3. Principal long term concerns are for the ability of the system to retain adequate bond and resist wear under high traffic volumes

Vermont's previous experience with thin polymer overlays included 3 applications on bridge decks in Maintenance District 2. These overlays involved a different product (Poly Carb Flexogrid) and were applied by district forces under close supervision by a technical representative of the manufacturer. Overall performance of this product was poor. Two of the applications demonstrated significant debonding almost immediately, while a third was marginally successful.

CONCLUSIONS:

1. The thin polymer overlay was placed without any significant problems.

2. This technology (but a different product) has been tried previously in Vermont with marginal success. The experiences of both Vermont and New York suggest that the thin polymer overlay is a high risk treatment. An additional disincentive for its use is its high cost (see the "cost" section of this report).

FOLLOW UP:

The polymer overlay of this bridge will be checked annually for cracking and debonded areas. Inspections will continue until the effectiveness of the treatment can be documented.

Thin polymer overlay is applied with rollers while basalt aggregate is broadcast over the surface.