Matacryl® Waterproofing Membrane – Bridge # 2758, Palermo, Maine
# August 2018

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Transportation Research Division

Matacryl® Waterproofing Membrane
Project WIN 021739.00
Bridge # 2758 Palermo, Maine

**Project Description**

*Matacryl® WPM is a high technology, seamless liquid waterproofing membrane for bridges under asphalt overlays produced by RPM Belgium Vandex Group a subsidiary of RPM Inc. (since the time of the membrane application RPM Belgium has been incorporated into their US Division, TREMCO INC.)*

RESISTANCE Cold applied and does not require heating or conditioning

MANUAL & SPRAY APPLIABLE MEMBRANE Available in both hand and spray applied grades

CHEMICAL INERT Chemically inert and not requiring Hazmat precautions when disposing of.

REDUCED APPLICATION TIME Reduced application times between Coats and layers Rapid application and handover to Client / User

DIFFERENT PRIMER POSSIBILITIES Variety of Primers to suit each exposure

SOLVENTLESS VOC compliant and contains no solvent

RAIN RESISTANCE Rain resistant within 30 minutes of application Setting and Curing times may be adjusted to suit ambient and site conditions

LOW EQUIPMENT NEEDS Insignificant amount of equipment and plant required

* Above excerpt from Matacryl WPM literature

**Objective**

The objective of this study is to evaluate the viability of Matacryl WPM as a bridge deck waterproofing membrane for inclusion on the MaineDOT Qualified Products List (QPL) and to serve as a test deck for AASHTO’s Product Evaluation Program (APEL).

The State of Maine, Department of Transportation (MaineDOT) currently has a QPL for waterproofing membranes. In order for waterproofing membranes to be added to the QPL they must go through a product evaluation process (Appendix A). This process includes applying the membrane to a bridge deck and evaluating the membrane at the time of application and then annually for two years.
**Project Location**

The waterproofing membrane test deck is located in Palermo on Route 3, Bridge #2758. This bridge is also known as the Sheepscot Bridge and spans over a section of the Sheepscot River, the deck measures 46.7 ft. wide by 176 ft. long. The bridge was originally built in 1974 and reconstructed in 1995.

The project location is shown below.

![FIGURE 1 Project location map.](image)

**East and West Views**

![FIGURE 2 East Bound View.](image)
Matacryl WPM Product Descriptions

- Matacryl Primer CM: Low viscosity, colorless, 2-part reactive resin based on methyl methacrylate to enhance adhesion to the substrate.
- Matacryl Manual: Medium viscosity, urethane-modified pre-reacted, 100% solid membrane system based on acrylic monomers, a highly elastomeric liquid waterproofing membrane and coating.
- Matacryl Catalyst: Almost odorless, free-flowing, white powder consisting of 50% dibenzoyl peroxide to initiate polymerization.
- Matacryl Adcol: Clear, colorless liquid based on methyl methacrylate used as a thinner for manual methods and as a cleaner to clean contaminated areas of one layer before the next is put down for better adhesion.
- Matacryl Accelerator: Low viscosity, yellowish, resin solution to aid curing at temperatures between 32 – 68 °F (0 – 20 °C).
- Matacryl STC (first tack coat layer): Medium viscosity, elasticized, sealer based on acrylic resins, that is UV and acid rain resistant, to seal and protect the membrane.
- Matacryl Tack Coat No.1 (second tack coat layer): Modified, bonding, bituminous hot applied layer between Matacryl membrane and the wearing course of the bridge deck.

Construction

The bridge deck waterproofing membrane was installed in three phases to maintain two-way traffic. All three phases were completed using the same process.
Jerome Licata of RPM Belgium Vandex/Alteco Polymer Systems was on site directing the work. The installers were from Venture Construction and are experienced in waterproof membrane applications.

Matcryl WPM can be applied either using traditional spray application or through manual applications utilizing hand tools. For this project the waterproofing membrane was applies manually as the manufacturer requires this for training purposes. Each layer has specific mixing instructions, including the catalyst, based the environmental conditions at time of application. Mixing tables and Tack Coat specifics can be found in Appendix B.

The environmental conditions were measured prior to the start of application. The temperature of the substrate must be higher than the dew point but, no higher than 130 °F (55 °C). The moisture of the bridge deck should be below 6%. Values of all measurements can be found in the testing section of this report.

Prior to application, the previous bridge deck membrane was completely removed by grinding the deck of the bridge. After grinding, all questionable areas of the bridge deck were repaired. Lastly, the deck was then shot blasted followed by mechanical sweeping and compressed air cleaning to remove any leftover loose material. The bridge deck preparation was performed the day prior to Phase 1 and the deck was recleaned using compressed air immediately prior to starting the waterproofing membrane application. Phases 2 and 3 were prepared the morning of application so the extra cleaning was not necessary (Figures 4-5).

Phase 1 of the application took several hours as each layer of the Matacryl WPM system has curing times (see Testing Section) and it was the first time installing this product for Venture Construction. Subsequent phases were quicker as the installers were more familiar with the process.

Step One: Primer
Matacryl Primer CM®, (membrane primer) was applied to the bridge deck at a rate of 80 – 130 ft²/gal (0.3 – 0.5 kg/m²). Prior to the application, sections were measured to indicated how far each batch should be spread and this was repeated for each layer of the membrane system. During the application, measurements were taken to insure the thickness was appropriate. Immediately after application, while still wet, a thin coat of fine quartz was broadcast over the primer (Figures 6-7). This was allowed to cure until the surface was no longer tacky. Any issues with the bridge deck were then filled with Matacryl Ready Rep® to create a level surface and allowed to dry (Figure 8).

Step Two: Membrane
Matacryl Manual Waterproofing Membrane was applied to the bridge deck at a rate of 20 ft²/gal (2.8 kg/m²) to a minimum thickness of 80 mils. The membrane was initially applied to the bridge joint header, curb and around the bridge drains using a paint brush and/or paint roller as these areas would be difficult to get with the steel tooth rake. (Figures 9-10). The membrane was then applied to the bridge deck using a steel tooth rake with care taken to avoid inducing air bubbles (Figures 11-12). Extra raking of the membrane in the opposite direction was performed during Phase One and found to be counterproductive as it was producing air bubbles. Measurements were again taken to verify that the membrane thickness was at least 80 mils thick (see Testing section & Figures 13-14). Once the membrane was application completed (Figures 16a-16c) and cured, any areas with air bubbles (Figure 15) were given a second coat of membrane to fill the voids. After the membrane had cured, pull off tests using ASTM D7234 were performed (see Testing section & Figures 17a-18).
During Phase Three the waterproofing membrane sub contractor did not have the proper equipment to obtain the moisture reading of the bridge deck. The deck was heated and dried by a torch blower and the Manufacturer’s representative gave the okay to proceed. It is recommended that both the contractor and the product manufacturer have the proper environmental gauges and testing equipment on hand to avoid situations such as this in the future.

Step Three: First Tack Coat:
Matacryl STC®, an elasticized acrylic based resin, is applied at a rate of 40 – 80 ft²/gal (05. – 1.0 kg/m²) with a paint roller. This layer is immediately broadcast with a full layer of quartz (1 – 3 mm) (Figures 19-20). In Phase 1 the catalyst was mistakenly left out when mixing one container of the tack coat. This area of tack coat was removed from the membrane and replaced with properly mixed tack coat. (This also demonstrated the importance of following the mixing procedures.)

Step Four: Second Tack Coat:
Matacryl Tack Coat No. 1, a bituminous material, was applied at a rate of 0.6 – 1.0 kg/m². This tack coat cannot be heated in excess of 428°F (220°C) so monitoring the temperature is extremely important. This tack coat is used in areas where an asphalt wearing surface will be used or in high stress areas. The tack dries to a non-tacky layer and the heat from the asphalt reactivates it to create a tacky surface for proper adherence to the asphalt layer being put on top of it (Figures 21-23).

During each phase, the bridge remained closed until after the the asphalt wearing surface was paved. During paving some waterproof membranes “bubble up” because the heat from the hot asphalt causes any moisture trapped beneath it to change to steam. The Matacryl WPM did not have any steam pockets (bubbles) during the paving of each phase. The paving team stated that the Matacryl WPM was easier to pave over when compared to other types of waterproofing membranes. The rollers and wheels were treated to be sure they did not stick during paving and this was adequate to prevent this from occurring.

Costs
Matacryl WPM® costs $7 to 15 per square foot installed. This can vary depending on experience of the installers, whether it is spray applied or manually applied, location, deck condition, and weather conditions that may impacts the application.
Figure 4
Bridge Deck Preparation

Figure 5
Bridge Deck Preparation

Figure 6
Application of Matacryl Primer CM

Figure 7
Application of quartz on primer

Figure 8
Application of Matacryl Ready Rep

Figure 9
Application membrane along edge

Figure 10
Application around bridge drain

Figure 11
Application of membrane

Figure 12
Application of membrane

Figure 13
Measuring for membrane thickness

Figure 14
Membrane thickness > 80 mils
FIGURE 15
Example of air bubbles

FIGURE 16a
Completed membrane layer phase 1

FIGURE 16b
Completed membrane layer phase 2

FIGURE 16c
Completed membrane layer phase 3

FIGURE 17a
Performing a pull-off test

FIGURE 17b
Pull-off test

FIGURE 18
Pull-off test

FIGURE 19
First tack coat

FIGURE 20
First tack coat
MaineDOT’s Transportation Research Division will monitor this application for signs of degradation and/or delamination for at least two years. The treated portion inspected after each winter for two winters and will include brief inspection reports with photographic documentation.

### Environmental Conditions

<table>
<thead>
<tr>
<th>Phase</th>
<th>Date</th>
<th>Moisture Content of Deck (Max. = 6%)</th>
<th>Temperature of Deck</th>
<th>Relative Humidity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9/7/18</td>
<td>1.5 %</td>
<td>69 °F</td>
<td>50 °F</td>
</tr>
<tr>
<td>2</td>
<td>9/20/18</td>
<td>3 %</td>
<td>58 °F</td>
<td>51 °F</td>
</tr>
<tr>
<td>3</td>
<td>10/3/2018</td>
<td>Equipment Issue</td>
<td>58 °F</td>
<td>49 °F</td>
</tr>
</tbody>
</table>

### Thickness Measurements

<table>
<thead>
<tr>
<th>Phase (# of measurements)</th>
<th>Thickness Range (mils)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (&gt;5)</td>
<td>90-98</td>
</tr>
<tr>
<td>2 (&gt;8)</td>
<td>88-94</td>
</tr>
<tr>
<td>3 (&gt;5)</td>
<td>92-100</td>
</tr>
</tbody>
</table>

### Cure Times

<table>
<thead>
<tr>
<th>Layer</th>
<th>Minutes*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primer</td>
<td>60</td>
</tr>
<tr>
<td>Matacryl WPM</td>
<td>120</td>
</tr>
<tr>
<td>Tack Coat I</td>
<td>60</td>
</tr>
<tr>
<td>Bituminous Tack Coat</td>
<td>As it cools</td>
</tr>
</tbody>
</table>

*Cure times are approximate as each is environmentally dependent.

### Pull-Off Tests

<table>
<thead>
<tr>
<th>Test #</th>
<th>Pull-Off (Min. = 100 psi)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>244 psi</td>
<td>Pull of test pulled some of concrete off</td>
</tr>
<tr>
<td>2</td>
<td>262 psi</td>
<td>Pull of test pulled some of concrete off</td>
</tr>
<tr>
<td>3</td>
<td>252 psi</td>
<td>Pull of test pulled some of concrete off</td>
</tr>
<tr>
<td>4</td>
<td>254 psi</td>
<td>Pull of test pulled some of concrete off.</td>
</tr>
<tr>
<td>5</td>
<td>246 psi</td>
<td>Pull of test pulled some of concrete off. Test patch was done on repaired area of bridge deck prior to application.</td>
</tr>
</tbody>
</table>

### Initial Observations

The Matacryl WPM® seemed to be somewhat time consuming to apply by the manual method. Some of the additional time to apply the product was due to the subcontractor not having experience with this particular system. Phases 2 and 3 went smoother and quicker with less problems encountered. All phases encountered some weather issues which had to be worked around, this is a common issue or construction projects in general and proved to be the biggest obstacle for this project. The pull-off tests were well above the minimum requirement of 100 psi and the heat from the hot mix asphalt did not produce air “bubbles” to contend with during the paving process. It was noted that the fumes from this
product were quite strong however, it was alleviated by standing upwind. The manufacturer is currently testing a low odor variation of the product.

**Credits**

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Guy Hews, MaineDOT


Venture Construction

Videos of application and further information can be requested via Dawn Bickford, MaineDOT.

Special thanks to everyone that worked on this project to make it a success.

**References**

RPM Belgium Vandex/Alteco Polymer Systems – [www.rpmbelgiumvandex.com](http://www.rpmbelgiumvandex.com)
ITEM 508.13 - MEMBRANE WATERPROOFING
ITEM 508.14 - HIGH PERFORMANCE WATERPROOFING MEMBRANE

-- Specification
When high performance membrane is specified, the materials shall meet the requirements of the Manufacturer and shall be one of the prequalified products listed on the Department’s Qualified Products List (QPL) of Waterproofing Membrane. All other membrane shall consist of an adhesive primer, preformed sheet waterproofing membrane, and a mastic with all components being as recommended by the Manufacturer and prequalified by the Department as described above.

--Required Submissions and Demonstrations

**PHASE 1**

1. Manufacturer shall submit a completed Preliminary Information for Product Evaluation (QPL Product Submittal) Form, applicable MSDS(s), and other pertinent literature, including its Quality Control Plan for production of membrane, a detailed summary of its Applicator Training & Certification Program, and its Field Process Quality Control Plan.

2. Manufacturer shall submit a detailed summary of successful applications that have occurred in the United States, including owner contact information, design and construction details (substrate type & condition, membrane system components, bituminous overlay thickness and mix details, etc.), year constructed, tests performed, performance monitoring and/or testing, and any other additional information requested by the Department.

3. In the absence of successful U.S. applications, information from applications occurring in Canada may be submitted. The Department reserves the right to delay consideration of membrane systems that have not established a successful track record in the U.S., until such time as successful applications have been documented to the satisfaction of the Department.

4. Manufacturer shall make a presentation of their system to appropriate Department personnel. This presentation shall be scheduled through MaineDOT’s Product Evaluation Program. At the discretion of the Department, Phase 2 may be omitted, proceeding directly to Phase 3.

**PHASE 2**

5. Manufacturer shall set up and perform a demonstration on a test slab in the field, in the presence of Department personnel set up through MaineDOT’s Product Evaluation Program. It is the Manufacturer’s responsibility to locate or place a suitable slab within reasonable travel distance from Augusta, Maine. At the Department’s option, out-of-state locations within a reasonable distance from the Maine State line may be acceptable provided that sufficient notice is given to allow Department personnel sufficient time to obtain proper out-of-state travel authorization.

During the demonstration, the intended applicator must demonstrate proficiency in applying the membrane, including overlap technique. A minimum of 16 square feet must be applied per applicator. The purpose of this requirement is for the Manufacturer to demonstrate the effectiveness of its Applicator Training & Certification Program. The Manufacturer shall perform testing consistent with the applicable specification requirements.

6. The Department will evaluate the membrane and application, and may request additional testing such as bond, crack-bridging, and freeze-thaw stability.
PHASE 3

7. A demonstration bridge deck application will be required. The Department will allow the membrane to be applied on a small (approximately 2000 square feet) bridge project as an alternative to a system already on the QPL. It is recommended that this application occur on a bridge project that is presently under development, but not yet advertised for bids.

The Department shall be responsible for preparation of the bridge deck surface to the manufacturer's specification. The Department shall also be responsible for any required work zone traffic control.

The manufacturer shall provide all necessary products for the test application including primers and actual membrane material as well as all labor to perform the application. After the application of the membrane, the bridge deck shall be ready for the hot-mix asphalt overlay.

A manufacturer's representative shall be on site at all times during membrane application and the first paving course of the asphalt overlay.

It is the responsibility of the Manufacturer to work closely with the Contractor to coordinate this application, and to inform MaineDOT's Transportation Research Division in order that proper monitoring and evaluation of the test deck may take place.

8. During this and any subsequent applications, only Certified Applicators will be allowed to apply the membrane. The Field Process Quality Control Plan is expected to be followed at all times during construction. It is the responsibility of the Manufacturer and its field representative to ensure that applicators have received proper training and certification prior to placing membrane on a MaineDOT bridge (i.e. on-the-job training on this test deck is not acceptable). Written proof of the Applicator's certification to install the Manufacturer's membrane system shall be provided to the Resident for inclusion in the project records.

--Qualification Criteria

9. The Department will evaluate and monitor the performance of the membrane application. The minimum evaluation period will span two winter seasons with normal traffic loads and conditions. During this time, the membrane will be classified as being "Under Evaluation." Any further use during this period will be at the discretion of the Department. This evaluation period may be extended beyond two winter seasons if required by the Bridge Program.

10. Providing no negative issues arise during this evaluation period, the membrane will be granted pre-qualified status and added to the QPL for consideration alongside other pre-qualified membranes for use on Department projects.

Following the Department’s evaluation of the membrane, the Manufacturer will be notified in writing of the qualification status of the membrane system.

11. The Department will continue to evaluate its qualification criteria as well as products that have been previously qualified against them, and reserves the right to revise the criteria and/or withdraw product prequalification status at any time, for any reason, and without prior notice.

ALL products must be recertified by the manufacturer every five (5) years from date of acceptance.
Appendix B – Mixing of Matacryl

Primer:

<table>
<thead>
<tr>
<th>Temperature °C / °F</th>
<th>% By Weight of Resin</th>
<th>Catalyst in Grams. For 10 kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>-5°C / 23°F</td>
<td>6% + Accelerator</td>
<td>600</td>
</tr>
<tr>
<td>0°C / 32°F</td>
<td>6%</td>
<td>600</td>
</tr>
<tr>
<td>+10°C / 50°F</td>
<td>4%</td>
<td>400</td>
</tr>
<tr>
<td>+20°C / 68°F</td>
<td>2%</td>
<td>200</td>
</tr>
<tr>
<td>+30°C / 86°F</td>
<td>1%</td>
<td>100</td>
</tr>
</tbody>
</table>

Membrane:

<table>
<thead>
<tr>
<th>Temperature °C / °F</th>
<th>Catalyst % by weight of Matacryl Manual</th>
</tr>
</thead>
<tbody>
<tr>
<td>-5°C / 23°F</td>
<td>3.6% + accelerator</td>
</tr>
<tr>
<td>0°C / 32°F</td>
<td>3.6%</td>
</tr>
<tr>
<td>+10°C / 50°F</td>
<td>2.1%</td>
</tr>
<tr>
<td>+20°C / 68°F</td>
<td>1.4%</td>
</tr>
<tr>
<td>+30°C / 86°F</td>
<td>1.1%</td>
</tr>
</tbody>
</table>

Tack Coat #1:

<table>
<thead>
<tr>
<th>Temperature °C / °F</th>
<th>% by Weight of Resin</th>
<th>For 10 kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>-5°C / 23°F</td>
<td>6%</td>
<td>500g</td>
</tr>
<tr>
<td>0°C / 32°F</td>
<td>6%</td>
<td>300g</td>
</tr>
<tr>
<td>+10°C / 50°F</td>
<td>4%</td>
<td>200g</td>
</tr>
<tr>
<td>+20°C / 68°F</td>
<td>2%</td>
<td>100g</td>
</tr>
<tr>
<td>+30°C / 86°F</td>
<td>1%</td>
<td>80g</td>
</tr>
</tbody>
</table>

Tack Coat #2
Hot Melt Tack Coat- Heated using a standard boiler to melt the polymer tack coat to a temperature between 180°C (355°F) - 200°C (390°F) and should not be heated above 220°C (428°F).