



# TRANSPORTATION RESEARCH SYNTHESIS

Minnesota Department of Transportation  
Office of Policy Analysis, Research & Innovation  
Research Services  
(651) 366-3780  
[www.dot.state.mn.us/research](http://www.dot.state.mn.us/research)

TRS 1212  
Published October 2012

## Ultra-Thin Polymer Concrete Overlays for Bridge Decks

*The purpose of this TRS is to serve as a synthesis of pertinent completed research to be used for further study and evaluation by MnDOT. This TRS does not represent the conclusions of either CTC & Associates or MnDOT.*



### **Introduction**

Minnesota DOT is currently conducting research on ultra-thin polymer concrete overlays for bridge decks. These overlays improve the friction and durability of bridge decks while sealing them against the

corrosive effects of deicing chemicals. However, there are concerns that these overlays may trap water in the concrete surface, accelerating deterioration due to freeze-thaw cycles. MnDOT needs more information on the effectiveness of thin overlays in extending the life of bridge structures, the effectiveness of overlays in reducing accidents by increasing friction, and the performance of overlays over time.

As a precursor to the development of a research project to monitor the performance of products in the field, MnDOT and its partner Minnesota State University requested information on other states' experiences with ultra-thin polymer overlay materials.

### **Summary**

CTC interviewed staff at 14 state departments of transportation by phone about their use of materials for ultra-thin polymer overlays ranging in thickness from 1/8 inch to 3/8 inch. Interviews focused on the following questions:

- What polymer materials is your state using? Do you have an approved materials list that you can provide?
- Have any polymer materials been removed from your approved materials list and if so, which? What materials have performed poorly?
- What is the rationale for including materials on the approved materials list or excluding them from it?

- Can you provide specifications, special provisions documents, or research reports that guide your use of ultra-thin polymer concrete overlays?
- At what point in the bridge deck life cycle (or at what condition) do you place overlays?
- Do you require the supplier of polymer materials to provide warranties? If so, what is their nature and length?
- Can you provide contact information for field maintenance supervisors or other personnel who have firsthand knowledge of the installation and performance of these overlays?

Of the 14 states contacted, 13 said they had experience with ultra-thin polymer overlays (Maine was the exception). Below is a summary of these 13 states' practices and experiences.

### **Polymer Materials**

Most states had an approved materials list (either separately or as part of their specification). Utah and Virginia do not have approved materials lists, but do have commonly used materials. The most commonly used materials among the 13 states (in order of frequency of use) are:

- Pro-Poxy Type III DOT, Unitex (California, Illinois, Kansas, Michigan, Missouri, New York, Oregon, Utah, Wisconsin, Wyoming).
- Mark-163 Flexogrid, Poly-Carb, Inc. (California, Illinois, Michigan, Missouri, Ohio, Utah, Washington, Wisconsin, Wyoming).
- Flexolith, Euclid Chemical Company (Illinois, Kansas, Michigan, Missouri, New York, Ohio, Virginia, Washington, Wisconsin).
- E-Bond 526, E-Bond Epoxies, Inc. (California, Illinois, Kansas, Michigan, Missouri, Virginia, Wisconsin).
- Mark-154, Poly-Carb, Inc. (Illinois, Kansas, Michigan, Missouri, Oregon, Wyoming).
- Sikadur 22 Lo-Mod, Sika Corp. (Illinois, Kansas, Missouri, Ohio, Washington, Wisconsin).
- Transpo T-48 Overlay System, Transpo Industries, Inc. (California, Illinois, Oregon, Wyoming).
- Trafficguard EP35, BASF (Missouri, New York, Oregon, Wisconsin).

### **Discontinued Materials**

Only Missouri has removed a product from its approved materials list: Transpo T-48 (MoDOT had problems with this material on a steel deck). Three products failed to make New York's approved materials based on field tests: SafeLane (Cargill), SmartLane (Cargill), and Transpo T-48. And WSDOT used SafeLane on a bridge in 2006 but had issues with a decrease in friction. Other reports of product performance issues include:

- Caltrans is replacing a worn-out Mark-163 Flexogrid overlay placed in 1995 (although this product has generally performed well).
- Illinois reports that a Sikadur overlay is coming apart under heavy traffic (although another installation is doing well and Illinois is generally happy with this product's performance).
- Michigan reports that E-Bond 120 (which no states reported using currently) had problems setting up, but has had no problems with E-Bond 526 Lo-Mod.
- Oregon tried Urefast PF60 liquid concrete and discontinued its use because of poor performance.
- UDOT and WYDOT have tried methyl methacrylate products without success.

### **Approval Rationale**

Before a product can be added to a state's approved materials list, state specifications require that the material pass laboratory tests or field tests (or both).

- Field tests: California, Michigan, New York, Oregon, Utah, Washington, Wisconsin, Wyoming.
- Laboratory tests: Illinois, Kansas, Missouri, Ohio, Oregon, Utah, Virginia, Wisconsin.

Wisconsin appears to have the most stringent requirements, with manufacturers required to submit five projects that they have completed in the Midwest using the material, including data sheets and manufacturer specifications, and certified test reports with results for all laboratory tests required by WisDOT's specification.

### **Specifications and Reports**

Each state provided a specification or special provision, and eight states (Michigan, Missouri, New York, Ohio, Oregon, Utah, Virginia and Washington) provided research reports or field reviews (and in one case a white paper) on ultra-thin polymer overlays.

### **Bridge Deck Life Cycle**

States generally use ultra-thin polymer overlays on decks where friction needs to be restored or cracks sealed, but warn against using them when the deck is so damaged that serious repair is required. Because decks deteriorate at very different rates depending on traffic and other factors, the ages of decks when overlays are placed varies significantly. The median age range seems to be 15 to 20 years. Two states (Illinois and Utah) use them on new decks as a preventative measure. Ranges for the 13 states interviewed are:

- Caltrans: 7 to 15 years, once friction needs to be restored.
- Illinois: Typically after decks are 20 years old; sometimes on brand-new decks (as a sealer or when the contractor has made an error).
- Kansas: When the cracks are around 1 to 2 mm wide and the bridge is 2 percent delaminated or less; possibly on bridges with up to 10 percent delamination.
- Michigan: Fairly new decks with a rating of 7 or better, often 1 to 2 years old.
- Missouri: Bridges with a rating of 5 or 6 (15 percent delamination).
- New York: 15 to 20 years old—in pretty good shape but starting to show some wear.
- Ohio: Once friction needs to be restored.
- Oregon: Once a bridge begins to show cracks.
- Utah: All new decks.
- Virginia: Decks of around 20 years in age.
- Washington: Decks of 30 to 40 years in age.
- Wisconsin: Decks of 10 to 15 years in age.
- Wyoming: Decks rated 2 or 3 on the agency's 5-point rating scale—once they begin to show cracks or need friction restored.

### **Warranties**

Most states do not receive warranties from polymer material suppliers, since it is difficult to tell whether performance is due to the material or the way it was installed. Exceptions are Ohio, in which the supplier may be required to give a five-year guarantee (although the interviewee was skeptical about the practicality of the requirement), and Utah. Michigan has a warranty specification that applies not to the materials but to the deck preparation and material application.

### **Further Contacts**

The states provided contact information for field maintenance supervisors or other personnel who have firsthand knowledge of the installation and performance of the overlays.

## **State DOT Interviews**

This section details the results of the 14 interviews. For reference, we have included an abbreviated version of each question as a heading before the interviewee's response; for the full question text, please see the Summary on page 1 of this report.

### **California**

#### **Contacts (conference call)**

Dolores Valls, Structures Engineer, Division of Structures, (916) 227-8409, [dolores\\_valls@dot.ca.gov](mailto:dolores_valls@dot.ca.gov).

Michael Lee, Chairman of Caltrans Bridge Preservation Committee, Branch Chief for Structure Maintenance Design, [michael\\_j\\_lee@dot.ca.gov](mailto:michael_j_lee@dot.ca.gov).

#### **Polymer Materials**

The specification (Appendix A-1) contains the list of approved materials:

- POLY-CARB Mark-163 Flexogrid Overlay System, Poly-Carb, Inc.
- Low Modulus Polysulphide Epoxy Overlay (T-48), Transpo Industries, Inc.
- Low Modulus Multi-Layer Epoxy Overlay, E-Bond Epoxies, Inc.
- Pro-Poxy Type III DOT Epoxy Overlay System, Unitex.
- Tyregrip, Ennis Traffic Safety Solutions.

Caltrans does not use ultra-thin polymer overlays frequently. They're primarily used for heat resistance on three to four bridges a year. All materials on the approved list have performed well. For multilayer systems, each epoxy layer must be cured before the next layer is applied, which can be an issue. The specification requires that the system be compatible with the traffic control requirements of the contractor, supplier and vendor.

Caltrans has also tried a product not listed, a polyester multilayer system that cures much faster than epoxy and seems to have more promise for California.

#### **Discontinued Materials**

None. Caltrans' first use of an ultra-thin polymer overlay involved Mark-163 Flexogrid on a bridge deck in 1995, which the agency is currently replacing because it is worn out and peeling off.

#### **Approval/Removal Rationale**

Caltrans tests materials by trying them out and evaluating wear for a year. The interviewees noted that it's obvious pretty quickly when a system hasn't bonded well, or is polishing up or losing aggregate.

#### **Specifications and Reports**

See Appendix A-1 for the Multilayer Polymer Overlay specification that Caltrans has used for bridge decks since 1995. See Appendix A-2 for the High Friction Surface Treatment specification that was recently developed by Caltrans' pavement group for roadway applications. This specification emphasizes calcined bauxite. Eventually the two specifications will be merged.

#### **Bridge Deck Life Cycle**

Bridge decks are generally 7 to 15 years old before these systems are placed. Caltrans uses them to restore skid resistance and when the texture has worn off, not for rehabilitation.

#### **Warranties**

None.

## **Further Contacts**

Caltrans uses contractors for these systems, so it's best to contact interviewee Michael Lee at [michael\\_j\\_lee@dot.ca.gov](mailto:michael_j_lee@dot.ca.gov).

## **Illinois**

### **Contacts (separate interviews)**

Carl Pewsey, Bridge Office Bureau Chief, (217) 782-2125.

Gary M. Kowalski, Policies, Standards & Specifications Unit Chief, Bureau of Bridges and Structures, (217) 785-2914, [Gary.kowalski@illinois.gov](mailto:Gary.kowalski@illinois.gov).

### **Polymer Materials**

IDOT uses 3/8-inch overlays (but no thinner) in a two-lift application. For approved materials, see <http://www.dot.il.gov/materials/polymeroverlaysystems.pdf>. Materials include:

- E-Bond 526, E-Bond Epoxies, Inc.
- Flexolith, Euclid Chemical Company.
- Mark-163 Flexogrid, Poly-Carb, Inc.
- Mark-154, Poly-Carb, Inc.
- Sikadur 22 Lo-Mod, Sika Corp.
- Transpo T-48 Overlay System, Transpo Industries, Inc.
- Pro-Poxy Type III DOT, Unitex.

Sikadur 22 Lo-Mod is the material most commonly used by IDOT.

### **Discontinued Materials**

No materials have been removed from IDOT's list, and the agency hasn't had any problems with any of these materials. Sikadur is most commonly used because of price. One of IDOT's first installations used Mark-154, and Transpo T-48 was used on a deck in the 1990s. These survived for a long time. The oldest Sikadur bridge is doing well at 15 years of age. There is a Sikadur overlay on I-55 that is coming apart under heavy traffic, but that's because the underlying deck has a lot of distress. The interviewees noted that the overlays are only as good as what you put them over. For aggregates, IDOT uses crushed basalt or trap rock, but does not like Black Beauty (which is commonly used in Missouri and with Sikadur). IDOT went to Missouri to review its systems and found that Black Beauty tends to have pockets of wear.

### **Approval/Removal Rationale**

A material is submitted to the bureau of materials for comparison to the specification via laboratory testing. The specification was written using an experimental project (no reports are available). IDOT has been approached by suppliers of other technologies, such as ethyl methacrylate, but these cannot be evaluated using the current specification; they would require an experimental project and their own specification.

### **Specifications and Reports**

See the specification at <http://www.dot.il.gov/bridges/gbsp45.pdf>.

### **Bridge Deck Life Cycle**

IDOT stated that it is best for overlays to be placed as early as possible in the bridge deck life cycle. The agency uses them as sealers and on brand-new bridges when the contractor has done something wrong. The bridge deck condition cannot be too poor when an overlay is placed; if the cost of patching the deck before placing the overlay is more than 50 percent of the cost of a brand-new deck, IDOT will replace the deck instead. IDOT often considers overlays after 20 years, but the age of the deck varies, since some decks last longer than others. Illinois

has problems with deck cracking in general because it is an all-composite state. Sometimes decks crack before they're open to traffic.

### **Warranties**

There are no warranties on materials; IDOT noted that a warranty would be difficult to enforce because it's hard to tell whether performance is due to the material itself, the way it was installed by the contractor, or some other factor. In Illinois law there is an implied warranty of 10 years for contractors, but again these are hard to enforce because it's hard to pinpoint who's at fault.

### **Further Contacts**

District Bridge Maintenance Engineers:

District 1: Sarah Wilson, (847) 705-4181, [Sarah.Wilson@illinois.gov](mailto:Sarah.Wilson@illinois.gov).  
District 3: Christian McCarter, (815) 434-8444, [Christian.McCarter@illinois.gov](mailto:Christian.McCarter@illinois.gov).  
District 4: Mark Eckhoff, (309) 671-4463, [Mark.Eckhoff@illinois.gov](mailto:Mark.Eckhoff@illinois.gov).  
District 6: Steve Beran, (217) 785-9290, [Steve.Beran@illinois.gov](mailto:Steve.Beran@illinois.gov).  
District 7: Christopher Smith, (217) 342-8378, [Christopher.Smith@illinois.gov](mailto:Christopher.Smith@illinois.gov).  
District 8: Timothy Krumm, (618) 346-3258, [Timothy.Krumm@illinois.gov](mailto:Timothy.Krumm@illinois.gov).

## **Kansas**

### **Contact**

Tony Menke, Field Construction Engineer, Bureau of Construction and Maintenance, (785) 296-7137, [amenke@ksdot.org](mailto:amenke@ksdot.org).

### **Polymer Materials**

See <http://www.ksdot.org/burmatres/pql/pql-10-06.pdf> for the list of approved materials:

- E-Bond 526, E-Bond Epoxies.
- Flexolith, Euclid Chemical Company.
- Mark-154, Poly-Carb, Inc.
- Sikadur 22 Lo Mod, Sika Corp.
- Pro-Poxy Type III DOT, Unitex Chemicals.

### **Discontinued Materials**

KSDOT has not removed anything from the list.

### **Approval/Removal Rationale**

For a product to be included on the list, the manufacturer must submit various test reports as described in KSDOT's material specification:

- Materials Specification: <http://www.ksdot.org/burconsmain/specprov/2007/1705.pdf>.
- Specification Update: <http://www.ksdot.org/burconsmain/specprov/2007/pdf/07-17002-r01.pdf>.

Poor test results or poor field performance would result in the removal of the material from the list.

### **Specifications and Reports**

For the overlay specification, see <http://www.ksdot.org/burConsMain/specprov/2007/729.pdf>, and for the special provision to revise the specification, see <http://www.ksdot.org/burConsMain/specprov/2007/pdf/07-07013-r01.pdf>.

## **Bridge Deck Life Cycle**

KSDOT places polymer overlays on bridge decks when the cracks are about 1 to 2 mm wide and the bridge is 2 percent or less delaminated to minimize the amount of patching required. KSDOT will consider polymer overlays on decks that are up to 10 percent delaminated, but the agency uses a silica fume overlay for anything beyond that level.

## **Warranties**

None; material providers are just required to meet material specifications. If there were an early failure, Menke said KSDOT might push the contractor to fix it.

## **Further Contacts**

KSDOT's Wamego office has had several projects with polymer overlays. Mark Karolevitz is the area engineer and can be reached at (785) 456-2353.

The Kansas Turnpike Authority has a crew that installs all of the agency's polymer bridge deck overlays, and Director of Maintenance Eric Becker is a good contact to share that agency's experiences. He can be reached at (317) 652-2604 or [ebecker@ksturnpike.com](mailto:ebecker@ksturnpike.com).

## **Maine**

### **Contact**

John Buxton, (207) 624-3580, [john.buxton@maine.gov](mailto:john.buxton@maine.gov).

### **Polymer Materials**

MaineDOT has no experience with ultra-thin polymer overlays.

## **Michigan**

### **Contact**

Corey Rogers, Bridge Construction Engineer, (517) 322-3320, [rogersc5@michigan.gov](mailto:rogersc5@michigan.gov).

### **Polymer Materials**

The approved materials list is part of the specification (Appendix B-1):

- Flexolith 216, Euclid Chemical Company.
- Pro-Poxy Type III DOT, Unitex, Inc.
- Flexogrid Mark-163, Poly-Carb, Inc.
- Flexogrid Mark-154, Poly-Carb, Inc.
- 526 Lo-Mod, E-Bond.
- Akabond 811, Axson.

### **Discontinued Materials**

One product (E-Bond 120) had issues with setting up. After reports that it was successful in West Virginia, MDOT tried it numerous times in small areas, but it wouldn't set up to their standards. MDOT has had no issues with E-Bond 526 Lo-Mod.

### **Approval/Removal Rationale**

Materials are evaluated through experimentation and field analysis by maintenance crews for at least one year through a full temperature cycle. After a year, the undersides of decks are checked for moisture on a rainy day, and the deck is reviewed for delamination and cracking. If a new material is successful, it is added to the list. MDOT periodically tests new products from the larger, more reliable companies at their request.

## **Specifications and Reports**

For the special provision, see Appendix B-1. See also a white paper on thin epoxy overlays, Appendix B-2.

## **Bridge Deck Life Cycle**

MDOT places ultra-thin polymer overlays on fairly new decks with a rating of 7 or better, consistent with manufacturers' recommendations. They see this as a preventative treatment, not a fix. Often the overlays are placed on decks that are 1 or 2 years old. MDOT doesn't place them right after construction, but waits for cracks to appear.

## **Warranties**

None. MDOT recently created a performance warranty specification that applies not to the materials but to deck preparation and material application. This is a five-year warranty that falls on the contractor. If there is a failure within five years, the contractor must repair it. Most failures for ultra-thin polymer overlays occur within the first few years, and are usually the result of poor deck preparation so that the epoxy doesn't stick.

## **Further Contacts**

Scott Stilson, Transportation Maintenance Supervisor, University Region Special Crews, (517) 783-3852, [stilsons@michigan.gov](mailto:stilsons@michigan.gov).

Andrew Bouvy, Structures Maintenance Engineer, Region Bridge Support, (517) 322-3325, [bouvy@michigan.gov](mailto:bouvy@michigan.gov).

## **Missouri**

### **Contacts (conference call)**

Bryan Hartnagel, Structural Resource Manager, Bridge Division, (573) 751-0267, [bryan.hartnagel@modot.mo.gov](mailto:bryan.hartnagel@modot.mo.gov).

Scott Stotlemeyer, State Bridge Maintenance Engineer, (573) 526-1759, [Scott.Stotlemeyer@modot.mo.gov](mailto:Scott.Stotlemeyer@modot.mo.gov).

### **Polymer Materials**

MoDOT's approved materials list is available at [http://modot.org/business/materials/pdf/vol\\_1/FS1039T4.pdf](http://modot.org/business/materials/pdf/vol_1/FS1039T4.pdf).  
Materials include:

- E-Bond 526, E-Bond Epoxies, Inc.
- Flexolith, Tamms.
- HIT-HY 150 MAX, Hilti, Inc.
- Mark-163 Flexogrid, Poly-Carb, Inc.
- Mark-154 System, Poly-Carb, Inc.
- Pro-Poxy Type III DOT, Unitex.
- Sikadur 22 Lo-Mod, Sika Corp.
- Spec Binder, Conspec.
- Sure-Level Epoxy (J-57), Dayton Superior.
- ThoRoc Trafficguard EP-35, Chemrex.

### **Discontinued Materials**

The Transpo T-48 Overlay System is no longer on the list. MoDOT had problems with it coming off, though they noted that this was on a steel deck bridge. The interviewees reported that it is difficult to track materials' performance because contractors select products from the approved materials list, but the products used are not recorded in the bridge management database.



## **Approval/Removal Rationale**

Products have to meet the specification laboratory tests to be added to the approved materials list.

## **Specifications and Reports**

Specification on Epoxy Polymer Overlay: [http://www.modot.mo.gov/business/standards\\_and\\_specs/Sec0623.pdf](http://www.modot.mo.gov/business/standards_and_specs/Sec0623.pdf).

Also see specification 1039.60, Epoxy Polymer Concrete Overlay:  
[http://www.modot.mo.gov/business/standards\\_and\\_specs/Sec1039.pdf](http://www.modot.mo.gov/business/standards_and_specs/Sec1039.pdf).

MoDOT conducted a research project on epoxy polymer overlays, and found that there are many occasions in which they were applied too late. See the 2007 report *Investigations of Failures of Epoxy Polymer Overlays in Missouri*: <http://library.modot.mo.gov/RDT/reports/Ri06020/or08010.pdf>.

MoDOT also has two draft documents on when to use epoxy polymer overlays (see Appendices C-1 and C-2).

## **Bridge Deck Life Cycle**

MoDOT uses these overlays when the bridge condition is a 5 or 6 (15 percent delamination). As mentioned above, MoDOT's research shows that sometimes they have waited too long to place these overlays. Interviewees noted that if they wait for a condition 6, it may be worse by the time crews get to construction and not suitable for an ultra-thin polymer overlay.

## **Warranties**

None.

## **Further Contacts**

Patrick Martens, Supervising Bridge Engineer, (573) 751-2856, [Patrick.Martens@modot.mo.gov](mailto:Patrick.Martens@modot.mo.gov). Martens is in charge of bridge inspection staff and looks at many bridges every year.

## **New York**

### **Contact**

Guy Hildreth, Materials Bureau, (518) 485-5431, [Guy.Hildreth@dot.ny.gov](mailto:Guy.Hildreth@dot.ny.gov).

### **Polymer Materials**

NYSDOT uses at minimum a 3/8-inch-thick overlay using two coats of epoxy polymer materials. The agency has not had good results with just one coat.

For the approved materials list, see [https://www.dot.ny.gov/divisions/engineering/technical-services/technical-services-repository/alme/pages/thn\\_ovr-1.html](https://www.dot.ny.gov/divisions/engineering/technical-services/technical-services-repository/alme/pages/thn_ovr-1.html). Materials include:

- Flexolith/Flexolith Summer Grade (SG), Euclid Chemical Company.
- Pro-Poxy Type III DOT, Unitex Chemicals.
- SSI RE-DECK, C.S. Behler, Inc.
- Trafficguard EP35, BASF Building Systems.

This list was established in 2009. All materials on the approved list have performed well.

### **Discontinued Materials**

No products have been removed from the approved materials list. Several products failed to get on the list based on field evaluations: SafeLane (Cargill), SmartLane (Cargill), and Transpo T-48.

### **Approval/Removal Rationale**

Products have their field performance evaluated for two years before they are added to the list.

### **Specifications and Reports**

See Appendix D-1 for the specification. It is required that an overlay be a two-coat system with a minimum of 3/8-inch thickness with preapproved aggregates. NYSDOT does not use thinner systems for bridge decks, although it uses them for crosswalks and bus stops—contact Jim Patnaude at (518) 485-7056 for more information on these applications.

NYSDOT has conducted a field performance review of these systems. See Appendix D-2 for photographs that detail the review’s findings.

### **Bridge Deck Life Cycle**

NYSDOT uses these overlays to restore friction, and does not use them on bridge decks with extreme problems. Once a deck becomes too slick and polished and accidents are an issue, an ultra-thin overlay is used. Typically this type of overlay is placed on a bridge deck that is 15 to 20 years old that is in pretty good shape but starting to show some wear, but this can vary quite a bit—some bridge decks are falling apart after five years and some are still in good shape after 30 years. NYSDOT also sometimes uses these overlays to seal brand-new bridge decks to prevent salt and oxygen penetration. The agency began using these products 10 years ago; they were used on regular pavements before bridge decks.

### **Warranties**

NYSDOT does not have warranties. If there is a problem with a product, it will be removed from the approved materials list. Hildreth noted that it is difficult to warranty a product when it’s unclear whether the product or the contractor installation led to the problem.

### **Further Contacts**

See Appendix D-3.

## **Ohio**

### **Contact**

Sean Meddles, Assistant Administrator, Office of Structural Engineering, (614) 466-2464, [sean.meddles@dot.state.oh.us](mailto:sean.meddles@dot.state.oh.us).

### **Polymer Materials**

ODOT does not use polymer overlays very often. In the last 10 construction seasons, the agency has conducted eight projects totaling 37,436 square yards. One of those eight projects accounted for 58 percent of the total square yardage (21,718 square yards).

Approved materials are contained in the specification, which dates to 2002 (Appendix E-1):

- Flexogrid, Poly-Carb, Inc.
- Flexolith, Tamms Industries.
- Sikadur Epoxy Broadcast Overlay System, Sika Corp.

### **Discontinued Materials**

The specification hasn’t changed in the 10 years it’s been in existence, and no materials have been removed.

### **Approval/Removal Rationale**

Products have to meet the specification via independent laboratory testing.

## **Specifications and Reports**

See Appendix E-1 for the specification.

See Appendix E-2 for field review photos of ultra-thin polymer overlays with commentary by Structures Planning Engineer Brandon Collett.

## **Bridge Deck Life Cycle**

ODOT uses these overlays to restore friction, or as short-term measures pending a complete deck replacement. It does not use these overlays often because other overlays show better durability. ODOT's preferred system is a microsilica overlay 1.5 inches in thickness, or dense concrete overlays of 1.5 to 1.75 inches in thickness.

## **Warranties**

The contractor and/or the epoxy manufacturer are required to furnish the state with a written five-year guarantee on the completed epoxy overlay. Meddles noted that it's unclear if this has been enforced or is really enforceable. He added that if overlays fail, they do so quickly (sections peel up).

## **Further Contacts**

Brandon Collett, Structures Planning Engineer, District 8, (513) 933-6643,  
[brandon.collett@dot.state.oh.us](mailto:brandon.collett@dot.state.oh.us).

Robert Taylor, District Bridge Engineer, District Pavement Supervisor, (740) 833-8354,  
[robert.taylor@dot.state.oh.us](mailto:robert.taylor@dot.state.oh.us).

## **Oregon**

### **Contact**

Bill Bennett, Assistant Structural Quality Engineer, (503) 986-6628, [William.F.BENNETT@odot.state.or.us](mailto:William.F.BENNETT@odot.state.or.us).

### **Polymer Materials**

For the approved materials list, see <http://www.oregon.gov/ODOT/HWY/CONSTRUCTION/qpl/docs/qpl.pdf>.

Flexolith is currently the only material on this list, and this is the material most commonly used in Oregon (Unitex Pro-Poxy Type III DOT is also commonly used).

### **Discontinued Materials**

No products have been taken off the approved materials list. In the past, ODOT tried Urefast PF60 liquid concrete, and discontinued its use because of poor performance.

### **Approval/Removal Rationale**

Products are evaluated in the laboratory and the field. ODOT has several products on its Conditional List, which is not publicized. As the products on the Conditional List are used, staff evaluate the systems and either completely reject them or move them to the approved materials list. The thin overlay products on the Conditional List performed adequately during an ODOT research project (see below) but have not yet been proven on a construction project.

The following products are on the Conditional List:

- MBT Trafficguard EP35
- Poly-Carb Mark-154
- Pro-Poxy Type III DOT
- SafeLane HDX
- Transpo T-48

- Tyregrip
- MBT Degadeck Bridge Overlay
- Safetrack HW
- Transpo T-18

### **Specifications and Reports**

See Appendix F for the specification.

ODOT has conducted research on thin polymer overlays in which various products were tested side by side. See the report at [http://www.oregon.gov/ODOT/TD/TP\\_RES/docs/reports/2010/thinoverlayforbridges.pdf](http://www.oregon.gov/ODOT/TD/TP_RES/docs/reports/2010/thinoverlayforbridges.pdf). Abstract:

Eight thin polymer overlay systems were evaluated in the laboratory and on two bridge decks exposed to trucks and passenger vehicles including those with studded tires. The products were Mark-154, Flex-O-Lith, Safetrack HW, Kwik Bond PPC MLS, Tyregrip, SafeLane HDX, Urefast PF60, and Unitex ProPoxyType III DOT. None of the overlay systems showed superior performance under moderate average daily traffic from the standpoint of maintaining good skid resistance and resisting wear through. Tyregrip and Safetrack HW started to wear through to the concrete after exposure of approximately 1.3 million vehicles, and Urefast PF60 wore through much sooner. For the five products that did not wear through, empirical equations predicted the friction number of the best of these five products would decrease to 40 (equivalent to the friction number of the concrete) within five months at a traffic level of 10,000 vehicles per lane per day. Delamination from the concrete was not a major problem with the products. Laboratory tests were not able to predict performance.

### **Bridge Deck Life Cycle**

ODOT does not have a set time for placing these overlays; a bridge deck might be quite old or new. Generally, once a bridge deck begins to show cracks, it is a candidate for an overlay.

### **Warranties**

None.

### **Further Contacts**

Ron Beatty, Maintenance Crew Coordinator, (541) 563-6400, [Ronald.J.BEATTY@odot.state.or.us](mailto:Ronald.J.BEATTY@odot.state.or.us).

Rich Stinson, Bridge Supervisor, (541) 757-4195, [Richard.T.STINSON@odot.state.or.us](mailto:Richard.T.STINSON@odot.state.or.us).

## **Utah**

### **Contacts (conference call)**

Barry Sharp, New Products Coordinator, Research Division, (801) 965-4859, [rsharp@utah.gov](mailto:rsharp@utah.gov).

Scott Andrus, State Materials Engineer, (801) 965-4859, [SCOTTANDRUS@utah.gov](mailto:SCOTTANDRUS@utah.gov).

### **Polymer Materials**

There is no approved materials list. UDOT most commonly uses Poly-Carb's Mark-163 Flexogrid and also uses Unitex Pro-Poxy Type III DOT.

### **Discontinued Materials**

UDOT tried methyl methacrylate without success, but plans to try it again, noting that the problem may have been in the way it was installed.

### **Approval/Removal Rationale**

There is no approved materials list. A supplier can have its product certified by getting independent laboratory tests, after which UDOT would conduct a trial.

### **Specifications and Reports**

See Appendix G-1 for the specification.

UDOT evaluated Mark-163 Flexogrid by Poly-Carb for five years on a bridge on one of its secondary main highways. The product did its job well; it provided friction and sealed cracks so that chlorides stayed constant for five years. UDOT found that it did not stick well on older concrete, as opposed to decks not older than four or five years. See Appendix G-2 for the full report.

### **Bridge Deck Life Cycle**

UDOT currently uses these overlays on all new bridge decks. They have had mixed experiences when using them on older decks; one deck had to be redone twice within the five-year warranty period.

### **Warranties**

There is a manufacturer's warranty bond for the bid price of the installed material; the time of the warranty varies. Details are provided in the specification; see Appendix G-1.

### **Further Contacts**

Contractor Protech Corp. has experience installing polymer overlays for UDOT. Protech can be reached at (801) 563-9898 or at 9911 South Gateway, Sandy, UT 84070.

## **Virginia**

### **Contact**

Michael M. Sprinkel, Associate Director, Virginia Center for Transportation Innovation and Research, (434) 293-1941, [Michael.Sprinkel@VDOT.Virginia.gov](mailto:Michael.Sprinkel@VDOT.Virginia.gov).

### **Polymer Materials**

VDOT does not have an approved materials list, but rather a general specification for materials (see Appendix H-1). It most commonly uses E-Bond 526 and Flexolith.

Sprinkel did the research and development for thin polymer overlays for VDOT in the early 1980s. After trying several systems in the 1980s, VDOT decided the thin epoxy overlay was the most cost-effective system, and use has increased over the years. From 1992 to 1995 Sprinkel chaired the AASHTO task force that prepared and published the AASHTO TF34 Guide Specification that is in use today.

### **Discontinued Materials**

VDOT has also tried Sikadur, Thermaflex, and Poly-Carb products. The agency doesn't currently use these materials solely because of price; VDOT uses E-Bond 526 and Flexolith most often because they have the lowest price.

In the early 1980s, VDOT tried every material on the market, including methacrylic slurry overlays, multiple-layer polyester, premix polyester, and epoxy overlays. VDOT had mixed results with the methacrylic slurry—two installations failed completely after five years. One was in mint condition after five years, and lasted more than 15 years (before the bridge was demolished for highway improvements). These were discontinued primarily due to expense; it couldn't be determined that they were worth the cost. VDOT has had good experience with polyester overlays, but in the 1980s decided to go with epoxy because it is similar in cost to polyester and better suited to Virginia's high humidity. Polyester is affected more by moisture, and in Virginia there is a higher risk of problems when it is put on bridges during damp conditions.

### **Approval/Removal Rationale**

VDOT conducts laboratory tests of a sample of the material to make sure it meets specifications.

### **Specifications and Reports**

See Appendix H-1 for VDOT's special provision. The specification is based on data for suppliers with a reasonable track record.

VDOT has been using thin polymer overlays for more than 25 years. See Appendix H-2 for the research report *Twenty Five Year Experience with Polymer Concrete Overlays on Bridge Decks*, published in 2001. From the abstract:

Evaluations indicate that these overlays can provide skid resistance and protection against intrusion by chloride ions for 25 years and are an economical technique for extending the life of hydraulic cement concrete decks. Polymer concrete overlays have recently been used as the wearing surface on fiber reinforced plastic bridge decks and performance similar to that on concrete decks is anticipated.

### **Bridge Deck Life Cycle**

VDOT believes that the optimum time for application of these overlays to Virginia bridge decks is at an age of around 20 years. VDOT does not use polymer overlays on decks that have corrosion-induced deterioration where concrete removal and patching needs to be done. Such decks require rehabilitation with concrete overlays. VDOT views epoxy as the best deck preservation system in existence, and overlays performed in the 1980s on decks built in the 1960s have performed very well, providing two more decades without deterioration. While some states use these overlays on new decks for preservation, VDOT only does this when something has gone wrong with construction. For example, if the deck has higher permeability than normal, the contractor must install the overlay at their expense.

### **Warranties**

None on products. All contract work in Virginia is subject to a one-year warranty. Sprinkel noted that it's rare that construction would be so poor as to cause problems, and said VDOT would not pay for a job that doesn't meet its specification. If done correctly, the overlays should last 20 years or more.

### **Further Contacts**

Hampton Roads District: James Long, [Jim.Long@vdot.virginia.gov](mailto:Jim.Long@vdot.virginia.gov).

Staunton District: Marc Stecker, [Marc.Stecker@vdot.virginia.gov](mailto:Marc.Stecker@vdot.virginia.gov)

Culpeper District: David Pearce, [David.Pearce@vdot.virginia.gov](mailto:David.Pearce@vdot.virginia.gov).

## **Washington**

### **Contact**

DeWayne Wilson, Bridge and Structures Office, (360) 705-7214, [WilsonD@wsdot.wa.gov](mailto:WilsonD@wsdot.wa.gov).

### **Polymer Materials**

WSDOT has used both epoxy and methyl methacrylate. Approved materials are contained within the specification; see page 89 of Appendix I-1. Epoxy materials include:

- Flexolith, Dural International Corp.
- Flexogrid, Poly-Carb.
- Sikadur 22, Sika Corp.

Methyl methacrylate materials include:

- Degadur, Degussa Corp.
- R66, Silikai

WSDOT found that all these materials worked well on bridges that were in good shape when the overlay was applied, but the agency stopped using thin polymer overlays because it found that after five years of service the decks become slick because of the studded tires commonly used in Washington. Further, bridges in Washington typically need a lot of repairs, making thin overlays a poor solution. WSDOT typically uses hydro-milling and modified concrete overlays, as well as 3/4-inch polyester overlays for rapid repairs. Wilson said WSDOT might use thin polymer overlays very selectively in the future.

### **Discontinued Materials**

None; the materials haven't changed since the specification was developed.

### **Approval/Removal Rationale**

WSDOT has conducted field tests of materials; see Appendix I-1 for a research report on WSDOT's experience with thin overlays.

### **Specifications and Reports**

Special provision: see pages 86 to 100 of Appendix I-1, a research report on thin polymer bridge deck overlays published by WSDOT in 1995.

WSDOT also provided research reports on SafeLane (Appendices I-2 to I-7) and Tyregrip (Appendix I-8). WSDOT used SafeLane on a bridge in 2006, but experienced issues with a decrease in friction.

### **Bridge Deck Life Cycle**

WSDOT has used thin overlays on bridges that were 30 to 40 years old, more as an experiment than to address a need or problem, but in some cases to prevent corrosion.

### **Warranties**

None.

### **Further Contacts**

Wilson is the best contact on this topic; he noted that regional staff would not have knowledge of these overlays.

## **Wisconsin**

### **Contact**

Dave Bohnsack, Region Structures Maintenance Engineer, (608) 785-9781, [david.bohnsack@dot.wi.gov](mailto:david.bohnsack@dot.wi.gov).

### **Polymer Materials**

See Appendix J-1 for approved materials, which include:

- Mark-163 Flexogrid, Poly-Carb, Inc.
- Sikadur 22 Lo-Mod, Sika Corp.
- E-Bond 526 Lo-Mod, E-Bond Epoxies, Inc.
- Pro-Poxy Type III DOT, Unitex.
- Sure Level Epoxy (J-57), Dayton Superior.
- Ico Flexi-Coat, International Coatings.
- Flexolith, Euclid Chemical Company.
- Trafficguard EP35, BASF.

The products that WisDOT uses most are Sikadur 22 Lo-Mod, Flexolith, and Mark-163 Flexogrid.

### **Discontinued Materials**

None. All materials have performed well.

### **Approval/Removal Rationale**

To get on the approved materials list, manufacturers are required to submit five projects that they've done in the Midwest using their material, with data sheets and specifications from the manufacturer and a certified test report with results for all laboratory tests required by WisDOT's specification (Appendix J-2).

### **Specifications and Reports**

See Appendix J-2 for the specification.

### **Bridge Deck Life Cycle**

Ultra-thin overlays are usually applied to bridge decks that are 10 to 15 years in age, depending on the inspected condition of the bridge. WisDOT is discussing putting overlays on bridges that are older than 12 years regardless of inspection. The agency is also considering using them on brand-new decks.

### **Warranties**

None for materials. WisDOT has not asked for warranties from contractors in the last five to six years, because this requires the contractor to get a bond, which small contractors can't afford.

### **Further Contacts**

Regional staff:

Tom Hardinger, (715) 421-8323, [thomas.hardinger@dot.wi.gov](mailto:thomas.hardinger@dot.wi.gov).

Dale Weber, (920) 492-7161, [dale.weber@dot.wi.gov](mailto:dale.weber@dot.wi.gov).

Greg Haig, (715) 577-6732, [gregory.haig@dot.wi.gov](mailto:gregory.haig@dot.wi.gov).

## **Wyoming**

### **Contact**

Keith R. Fulton, State Bridge Engineer, WYDOT Bridge Program, (307) 777-4427, [Keith.Fulton@wyo.gov](mailto:Keith.Fulton@wyo.gov).

### **Polymer Materials**

Approved materials are contained within the special provision (see Appendix K):

- Transpo T-48 Overlay System, Transpo Industries.
- Pro-Poxy Type III DOT, Unitex.
- Flexogrid Mark-163 or Mark-154, Poly-Carb.

### **Discontinued Materials**

No products have been removed from the approved materials list. Fulton said WYDOT used methyl methacrylates early on and had a lot of problems. Current materials are performing well.

### **Approval/Removal Rationale**

WYDOT does not currently have a rationale for approving materials; the materials currently on the list were added based on early trials. The agency is working on a rationale.

### **Specifications and Reports**

See Appendix K for the special provision.



**Bridge Deck Life Cycle**

WYDOT considers overlays when bridge decks have reached a condition of 2 or 3 on the department's 5-point rating scale, when there is cracking or the bridge deck needs more friction. The time it takes for decks to reach this condition varies widely.

**Warranties**

None.

**Further Contacts**

Tim McGary, District Maintenance Engineer, (307) 745-2100, [tim.mcgary@wyo.gov](mailto:tim.mcgary@wyo.gov).

Tom DeHoff, District Construction Engineer, (307) 745-2100, [tom.dehoff@wyo.gov](mailto:tom.dehoff@wyo.gov).