

Evaluation of Optional and/or Replacement Concrete Sealers

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This is an In-House evaluation of products performed by ODOT's Office of Materials Management. ODOT Spends about \$8M per year on coating concrete for esthetic purposes. Built into the coating is sealing capability to help protect the concrete and the steel within. The acceptance of sealers and coatings is done based on laboratory tests, but the tests do not show a true reflection of field performance, field application, etc. The ODOT Test Lab will compare the current coatings with some newer technology and recommendations from other states in an effort to find a more effective product.			
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and the U.S. Department of Transportation, Federal Highway Administration

The contents of this report reflect the views of the author(s) who is (are) responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Ohio Department of Transportation or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

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Evaluation of Concrete Sealer Products on LAK 2-7.60

Testing Plan

This item shall be in accordance with item 512 of the Ohio Department of Transportation Construction and Materials Specifications, 2010 Version, except as noted below. This work includes the evaluation of concrete sealer systems listed in Table 1 below. These systems will be applied to a concrete barrier wall that will be constructed in accordance with item 622 of the Ohio Department of Transportation Construction and Materials Specification (ODOTCMS), 2010 Version.

The Office of Materials Management shall be notified 72 hours prior to concrete sealer system application.

Table 1: Products to be evaluated:

System	Primer/finish coat		Manufacturer
1	EPX/ Duraguard 310 WB Primer	Primer	ChemMasters
	EPX/ Duraguard 310 CRU	Finish	ChemMasters
2	Mark 124 (Primer)	Primer	Poly-Carb
	Mark 73	Finish	Poly-Carb
3	Mark 58.6 A	Primer	Poly-Carb
	Mark 58.6 B	Finish	Poly-Carb
4	Si-Primer	Primer	Klaas Coatings
	Si-Rex03	Finish	Klaas Coatings
5	FX-460 Primer	Primer	Fox Industries
	FX-460	Finish	Fox Industries

Apply each concrete sealer system to eight hundred (1000) feet of the horizontal and vertical surfaces of a median barrier wall as shown below in Figure 1.

The median barrier wall shall be slip-formed and water cured, in accordance with item 511.17.A of the Ohio Department of Transportation Construction and Materials Specification, 2010 Version, with the exception of one 2000 feet section which shall be liquid membrane cured, in accordance with item 511.17.B of the Ohio Department of Transportation Construction and Materials Specification, 2010 Version.

The sealer color must be comparable to Federal color standard no. 17778.

Manufacturers shall provide technical data sheets of their respective products to the project, the Office of Materials Management staff, and the contractor prior to concrete sealer application.

A manufacturer's representative shall be present during the surface preparation processes and during the sealer systems application processes.

Surface Preparation

Surface preparation of the median barrier wall shall be in accordance with Section 512.03 of the Ohio Department of Transportation Construction and Materials Specification, 201 Version.

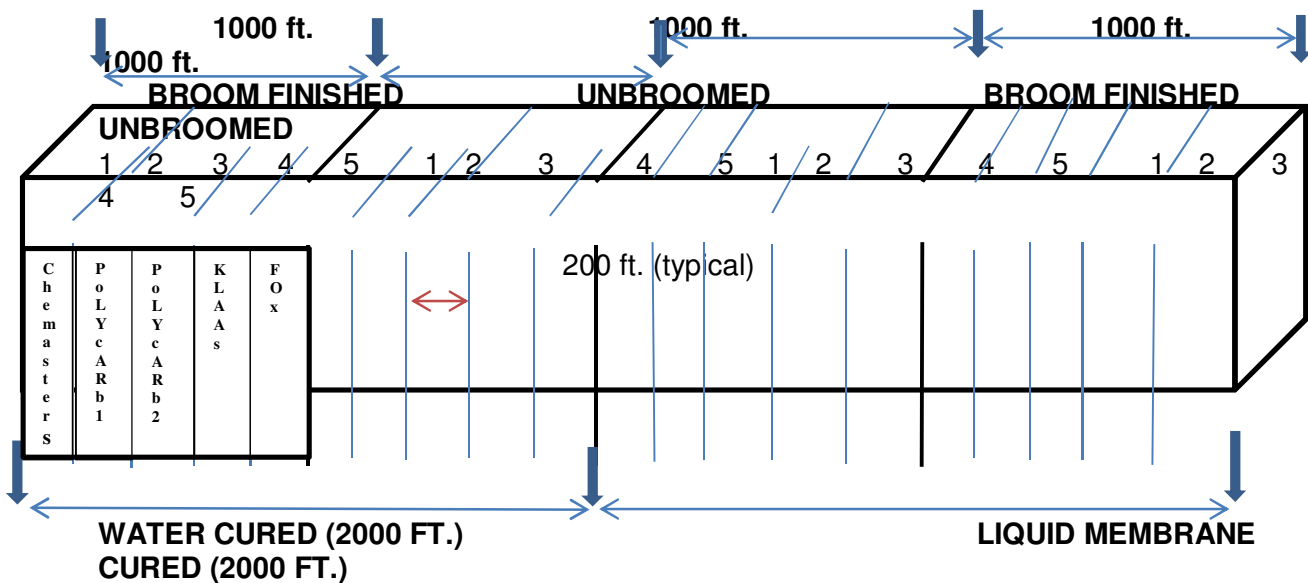
Ensure that all waste generated by the surface preparation operation are managed to prevent the direct or indirect discharge to the environment.

Prepare the median wall surface in accordance with Figure 1 below.

Apply the water cure to two thousand (2000) feet of the slip formed median barrier wall, in accordance with Section 511.17.A. of the Ohio Department of Transportation Construction and Materials Specification, 2010 Version. Apply a broom finish to one thousand (1000) feet of the water cured section of the median barrier wall, while leaving the other one thousand (1000) feet without a broom finish.

Apply a membrane cure to two thousand (2000) feet of the slip formed median barrier wall, in accordance with Section 511.17.B. of the Ohio Department of Transportation Construction and Materials Specifications, 2010 Version. Apply a broom finish to one thousand (1000) feet of the membrane cured section of the median barrier wall, while leaving the other one thousand (1000) feet without a broom finish.

Figure 1: Not Drawn to Scale



Application of Coverage

Apply the sealer systems between twelve (12) and forty eight (48) hours after surface preparation, if water blasting. The same crew shall apply all sealers on the same day.

Apply the individual sealer systems according to Figure 1 above.

In each designated 200 feet section, coat a two (2) feet long section on the top one foot wide horizontal surface of the median barrier wall with the first coat (primer) of the sealer system. In each designated 200 feet section, coat a two (2) feet by two (2) feet section on the vertical surface with primer only. Coat these sections with the second coat (finish) of the sealer systems after adhesion tests have been performed on these primed areas.

Testing

Adhesion Testing

The Office of Materials Management will perform adhesion testing of the designated sealed sections of the median barrier wall in the following manner:

1. After the primer is completely cured, adhesion tests will be performed on the two (2) feet long sections on the top one foot wide horizontal surface of the median barrier wall and the two (2) feet by two (2) feet sections on the vertical surface sections as specified above.
2. Ten days after the application of the sealer systems, initial adhesion tests will be performed.
3. In each designated section, five (5) adhesion tests will be taken on the top horizontal surface, five (5) adhesion tests will be taken on the top of the vertical surface, about six (6) to ten (10) inches from the edge of the top of the vertical wall, and five (5) adhesion tests will be taken on the bottom of the vertical surface, about six (6) to ten (10) inches from the bottom of the median wall.
4. Adhesion tests will be performed quarterly, for a year.

Film Thickness Testing

The Office of Materials Management will perform film thickness testing of the designated sealed sections of the median barrier wall in the following manner:

1. One hundred (100) measurements will be taken on each designated 200 feet section of the median barrier wall. Measurements will be taken on both horizontal and vertical surfaces.

Note:

1. The concrete sealer application contractor will be required to provide 1 quart of each component (primer and finish) to the Office of Materials Management staff.

Sealers will be evaluated comparatively, by the Department, on the basis of adhesion test results and overall durability and wear.

In the event that any sealer system fails to meet the satisfaction of the Department, the manufacturer shall perform the following items in order to be considered for future experimental construction feature projects:

1. Submit in writing the reason(s) why the product failed to perform and detail changes that will be made to eliminate the cause(s) of failure.
2. Propose changes to the product's specifications.
3. Demonstrate and provide documentation to the Department proving successful use of the product on at least one non-ODOT project.

Reporting

1. The Office of Materials Management will generate a final report detailing the results of the evaluation, the conclusions, and recommendations. This report will include:
Comparative Analysis of Various Concrete Sealer Systems
 - Cost
 - Ease of Application
 - Durability of products
 - Aesthetics
2. Effects of various concrete curing techniques on concrete sealer performance
3. Effects of concrete broomed and unbroomed surface preparation on concrete sealer performance

Evaluation Results

In 2014 the Concrete Sealer Demo, in District 12 at project LAK 2-7.60, had completed the proposed two year evaluation term. All the participating sealer products were performing well. They were all intact, showing no signs of delamination.

The basis of the Ohio DOT QPL (Qualified Product List) acceptance of the participating sealers was based on how they performed in comparison to the ODOT approved epoxy-urethane sealers.

In 2014 all of the sealers were acceptable. Yet considering the expected performance life of all the sealer products, 2 years of evaluation did not seem sufficient to judge if the new sealers were comparable to the already approved epoxy-urethanes. The Demo evaluation period was extended.

A final visual inspection was done on May 15, 2017.

Final Visual Inspection

Fox Industries – Unbroomed,(UB) Liquid membrane cured (LM). Coating intact. Looks good.



Klaas Coatings – (UB), (LM) Delamination on the horizontal. Vertical intact.



PolyCarb 58.6 – (UB), (LM) Delamination on horizontal



PolyCarb 124/73 – (UB), (LM) Coating intact. Looks very good.



ChemMaster – (UB), (LM). No delamination. Coating intact. Looks very good.



Fox Industries – Broomed (B), Liquid Membrane cured (LM) Very little delamination.



Klaas Coatings – (B), (LM) Delamination on horizontal. Vertical intact.



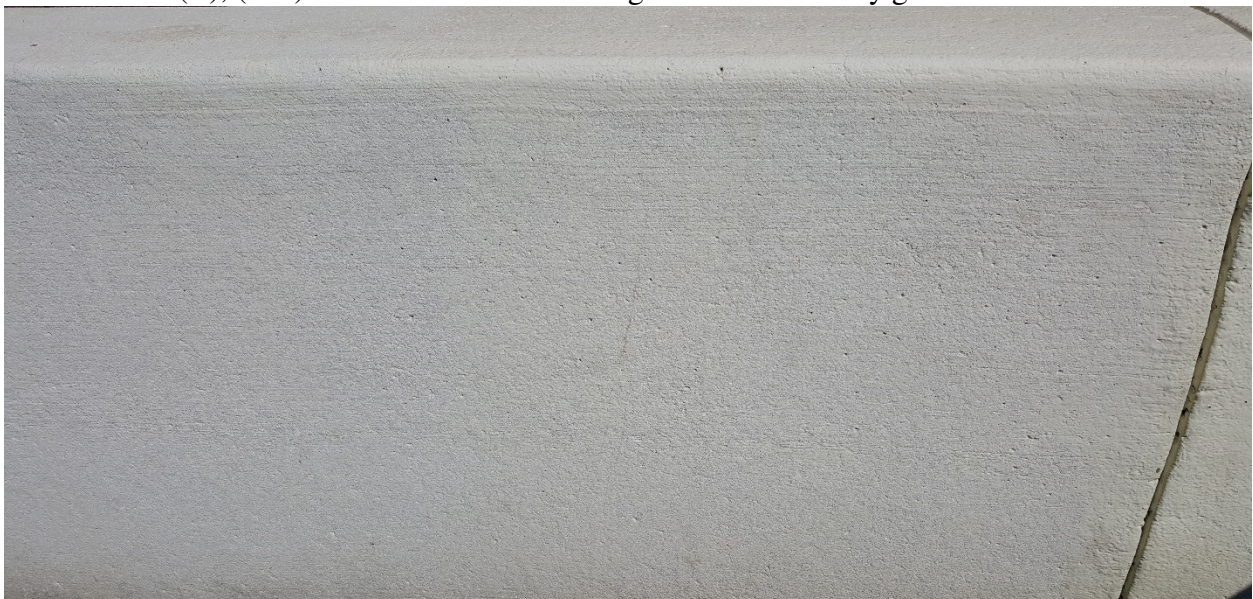
PolyCarb 58.6 – (B), (LM) Delamination on horizontal. Vertical intact.



PolyCarb 124/73 - (B), (LM) No delamination. Coating intact. Looks very good.



ChemMaster (B), (LM) No delamination. Coating intact. Looks very good.



Fox Industries – Unbroomed (UB), Water cured (W) More delamination on horizontal compared to (UB), (LM).



Klaas Coatings – (UB), (W) Delamination on horizontal.



PolyCarb 58.6 – (UB), (W) Lots of delamination on horizontal compared to (UB), (LM).



PolyCarb 124/73 – (UB), (W) No delamination. Coating intact. Looks very good.



ChemMaster – (UB), (W) No delamination. Coating intact. Looks very good.



Fox Industries – Broomed (B), Water cured (W) Delamination on horizontal, not as much compared to (UB), (W).



Klaas Coatings – (B), (W) Delamination, but much less compared to (UB), (W)



PolyCarb 58.6 - (B), (W) Delamination on horizontal.



PolyCarb 124/73 – (B), (W) No delamination. Coating intact. Looks very good.



ChemMaster – (B), (W) No delamination. Coating intact. Looks very good.



Evaluation of Sealers

Laboratory test results showed differences in the performance of participating sealers, while field testing and observation showed all the participating sealers performing equally well during the first 3 to 4 years. However, after 5-6 years, differences in field performance appeared. In the final outcome, the laboratory testing results paralleled the field testing results. Laboratory testing, in this case, was a tool that could have been used to predict the durability performance of the participating sealers in the field.

Application Issues

Both liquid membrane and water cures were used to make the concrete walls in the District 12 Concrete Sealer Demo. The walls had both broomed and non-broomed finished sections. Neither concrete cure, nor surface finish, had an effect on the performance of the epoxy-urethane sealers. For the sealers that showed delamination in the final inspection, the water cured, non-broomed section had the most delamination of these sealers.

Field Demos – New Sealer Acceptance

It took 6 years to complete the Concrete Sealer Demo in District 12. While field evaluations are the most direct way to observe product performance, in the case of concrete sealers, laboratory testing would have presented similar performance information in less time. Although the correlation between laboratory test results and field testing results are never perfect, laboratory testing may be the best method of new product acceptance for concrete sealers.

Product Evaluation Results

Fox Industries' FX 460 Primer/FX 460

The final inspection showed the performance of Fox Industries' FX 460 Primer/FX 460 Sealer.

This product is not comparable to the Ohio DOT's approved epoxy-urethane sealer participants, and thus not accepted for inclusion on the ODOT Qualified Product List (QPL), as part of this Demo.

Klaas Coatings' Si-Primer/Si-Rex03

The final inspection showed the performance of Klaas Coatings' Si-Primer/Si-Rex03.

This product is not comparable to the Ohio DOT's approved epoxy-urethane sealer participants, and thus not accepted for inclusion on the ODOT Qualified Product List (QPL), as part of this Demo.

PolyCarb's Mark 58.6A/B

The final inspection showed the performance of PolyCarb's Mark 58.6A/B.

This product is not comparable to the Ohio DOT's approved epoxy-urethane sealer participants, and thus not accepted for inclusion on the ODOT Qualified Product List (QPL), as part of this Demo.

The Ohio DOT Approved Epoxy-Urethane Concrete Sealers:

PolyCarb's 124/73

The final inspection showed the performance of PolyCarb's 124/73 Epoxy-Urethane Sealer exceeding the performance of Fox Industries' FX 460 Primer/FX 460, Klaas Coatings' Si-Primer/Si-Rex03, and PolyCarb's Mark 58.6A/B.

All sections coated with PolyCarb's 124/73 showed very little to no delamination.

ChemMaster's EPX Duregard 310WB/310CRU

The final inspection showed the performance of ChemMaster's EPX Duregard 310WB/ Duregard 310CRU Epoxy-Urethane Sealer exceeding the performance of Fox Industries' FX 460 Primer/FX 460, Klaas Coatings' Si-Primer/Si-Rex03, and PolyCarb's Mark 58.6A/B.

All sections coated with ChemMaster's EPX Duregard 310WB/ Duregard 310CRU showed very little to no delamination.