USH 16
Oconomowoc Bypass
Report of Early Distress
Portland Concrete Pavement and
Glomark Pavement Marking

Field Review by Jim Parry and Peter Kemp

March 2007
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Investigation of early failure of pavement marking Glomark, in addition an investigation of reported soft aggregate in the pavement exposed on the surface. It was concluded that the Pavement is experiencing aggregate pop outs due to an expansive aggregat.
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Introduction:

The Quality Assurance Unit of the Bureau of Technical Services was contacted by the Bureau of Highway Operations to investigate reported soft sandstone like aggregates in the surface of the pavement of USH 16 on the Oconomowoc bypass. This is one-year old warranted Portland Concrete pavement constructed by Michael’s Construction in the SE Region as part of project 1371-06-74 and 1371-07-77.

The pavement distress was discovered as part of a review of a pavement marking study conducted by the Bureau of Project Development, Highway Operations Section. The study is looking at alternative pavement marking Glomark 90. The markings are a system inserted into a milled or ground groove in which the centerline pavement marking is either flush or slightly lower than the surrounding pavement. The experimental pavement marking was failing. Large sections of the product were missing or debonded from the concrete pavement.

Evaluation:

The Site was field reviewed on March 9, 2007. Present were department representative Peter Kemp (BTS), Jim Parry (BTS), Deborah Kozol (BPD), Jim Emmons (BPD), Tom Heydel (SE Region) and the construction Engineer Josh Johnson (DAAR Engineering). Century Fence, the subcontractor who applied the material, and the company representatives were present onsite.

A visual scoping was done to determine the extent of the distress both on the pavement marking and the pavement surface. Destructive testing by means of impact with a pick hammer was done on exposed suspect aggregate on the surface of the pavement.

Review of the department’s verification testing record of the course aggregate source revealed:

- High absorption value as compared to other gravel deposits from the same region of the state (AASHTO T-85) at 2.39%.
- A soundness value (AASHTO T-103) of 12% at the upper limit for weighted loss as specified in 501.2.4.5.3 of the department’s standard specifications.

See appendix B for the complete testing record.

Conclusion:

It is the opinion of the Bureau of Technical Services that the concrete pavement itself has a coarse aggregate durability problem, which varies from light to moderate severity along the length of the project. The coarse aggregate comes from a gravel source, which contains rock from various geological origins. Unfortunately, in this instance, a small percentage of the rock appears to be a highly absorptive shaly material from the Sinnippi group of the Ordovician System, which is known for breaking down quickly and expanding when exposed to moisture and freeze-thaw cycles. This problem is manifested by a light to moderate frequency of aggregate "popouts" on the surface of the pavement.

In areas with the highest frequency of popouts, the expansive pressure from the failing aggregate particles may have contributed significantly to the debonding of the pavement marking material.
However, also observed were areas with relatively low frequency of the aggregate distress where significant portions of the pavement marking material still debonded. In these areas, it appeared that the diamond ground surface of the slot where the centerline stripes were placed was quite smooth compared to the 2005 paving installation of a pavement marking tape, refer to Figure 4 and 5 in Appendix A. Samples of the pavement marking material from areas that were in the process of failure could be peeled up. Some of the area on the bottom of these samples had little or no concrete material attached to the pavement marking material. This would indicate that adequate bond was NOT achieved between the concrete and the pavement marking material in some areas.

In conclusion, although the concrete aggregate distress may have been a partial cause of the failure of the pavement marking material, it appears that other problems with installation or product durability of the pavement marking material itself may have also contributed to the failure.

The pavement has expansive aggregate incorporated into it which is the cause of the surface distress.

**Implementation:**

Recommend initiating a specification change to section 501 of the standard specifications requiring freeze thaw testing of pit aggregates that show a high soundness value. Will recommend to the SE Region to request a review of the surface distress of this warranted pavement.

Recommend to the Bureau of Highway Operations to not approve Glomark based on this review.
Appendix A:

**Figure 1:** Typical Aggregate “pop outs” on USH 16 Pavement Surface – 2006 Construction

**Figure 2:** Typical Aggregate “pop outs” on USH 16 Pavement Surface – 2006 Construction
Figure 3: Glomark in service with a close up of surface showing embedded beads

Figure 4: Example of Typical Milling Profile on the Subject 2006 Project
Figure 5: Example of Typical Milling Profile on the Adjacent 2005 Project, Note the Rougher Profile

Figure 6: Close up of the Underside of a Section of the Pavement Marking, Note the Lack of Bonding Demonstrated by the Absence of Concrete Paste Over the Majority of the Surface
Test Number: 0 - 225 - 0140 - 2006

Materials Laboratory Testing System Tests On:
Aggregate Quality
Type: V - VERIFICATION

Main Project ID: 0617-02-00
District 2 General Testing

Labsite: Wisconsin Department of Transportation
Bureau of Technical Services-Central Lab
Truax Center, 3502 Kinsman Blvd.
Madison, WI 53704

Date Sampled: 05/15/06
Date Requested / Received: 05/24/06
Date Tested: 06/07/06

By: S. SORBY
By: SER
By: R. TRACY

Source: MICHELS NEFT
PIT

Legal Description: SE, NW, Section: 18, T: 8 N, R: 17, E
County: WAUKESHA

Material:
Aggregate Source:
Name:
Type: PIT
Location:

County: WAUKESHA

Sieve Analysis (AASHTO T-11, T-27 & T248)

<table>
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<th>Sieve Size</th>
<th>Percent Passing</th>
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Allowed Usage:
HMA<E-3, HMA>=E-3, CONCRETE, OGBC, Base Aggregate

Liquid Limit (AASHTO T-89):
Non-Coh NP

Plasticity Index (AASHTO T-90):
Crushed Particles (%): 49

Lightweight Particles (%): (AASHTO T-113)

LA Wear (AASHTO T-96)

Soundness (AASHTO T-104) (%): 12.0
Freeze-Thaw (AASHTO T-103) (%):

Specific Gravity and Absorption

Coarse Aggregate (AASHTO T-85)
Specific Gravity: 2.624
Absorption: 2.392%

Remarks: Satisfactory

Verified Date: 06/07/2006
Verified By: Wayne Kleist
References:
