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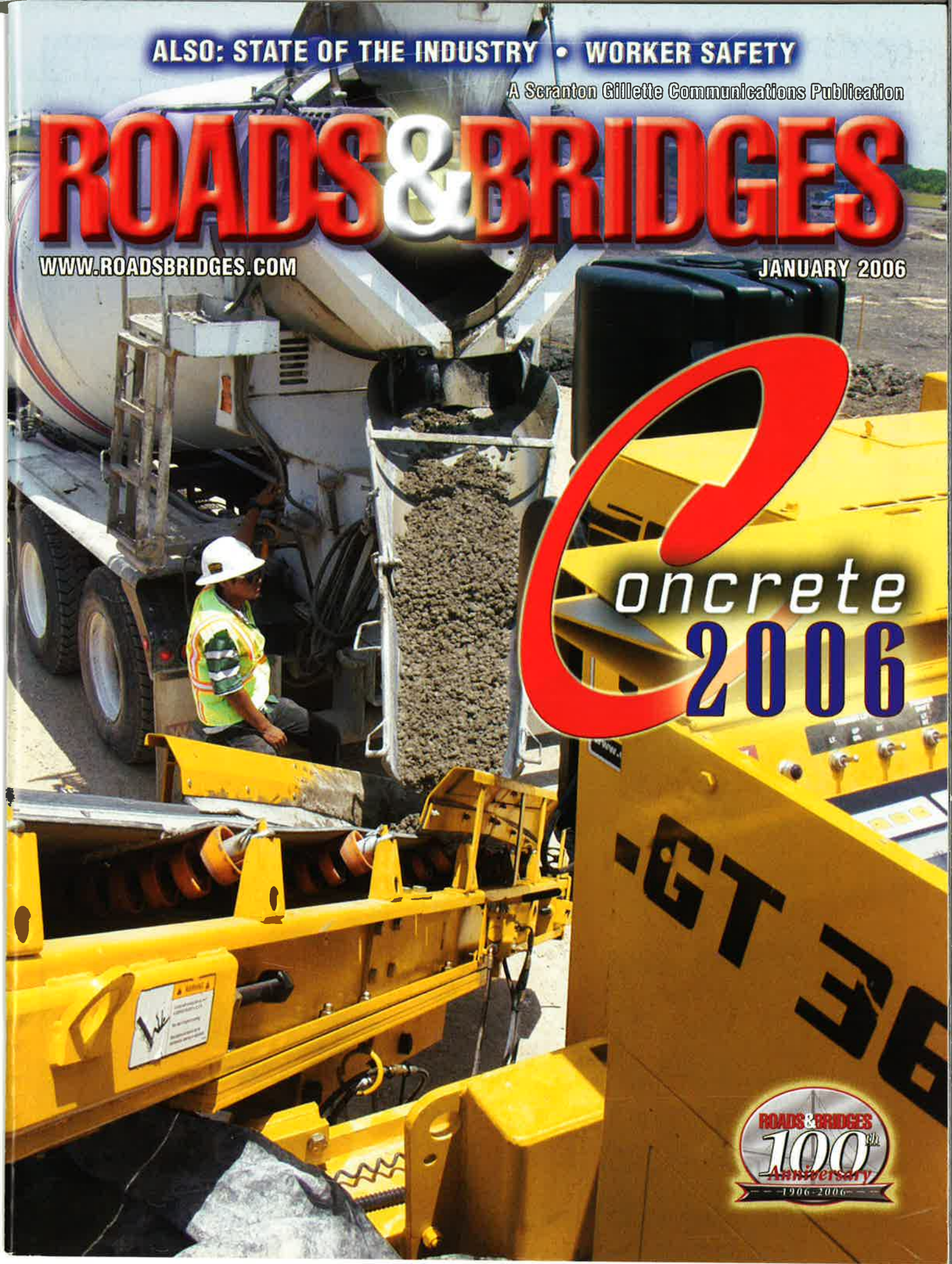

Concrete 2006

ROADS & BRIDGES 100th Anniversary 1906-2006

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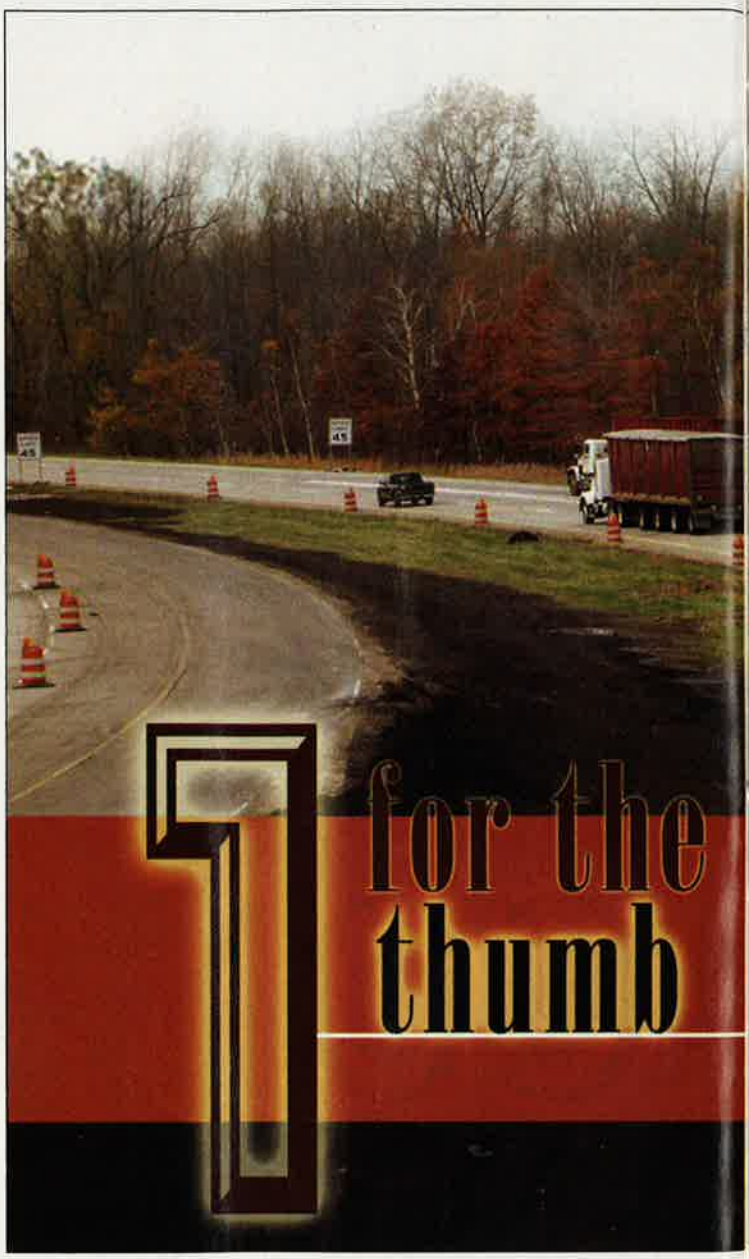


The I-94 freeway between Port Huron and Detroit, Mich., serves as a critical commercial traffic link to several areas within southeastern Michigan. Not only is it a portion of the North American Free Trade Agreement (NAFTA) Corridor No. 18, it also serves as the primary route between two of the busiest U.S.-Canadian border crossings: the Blue Water Bridge in Port Huron and the Ambassador Bridge in Detroit. Originally constructed in 1964, the four-lane segment of I-94 southwest of Port Huron had begun showing substantial wear and tear throughout the 1990s as increasing commercial traffic (in the neighborhood of 15% of total ADT) was leaving its mark on the aging pavement.

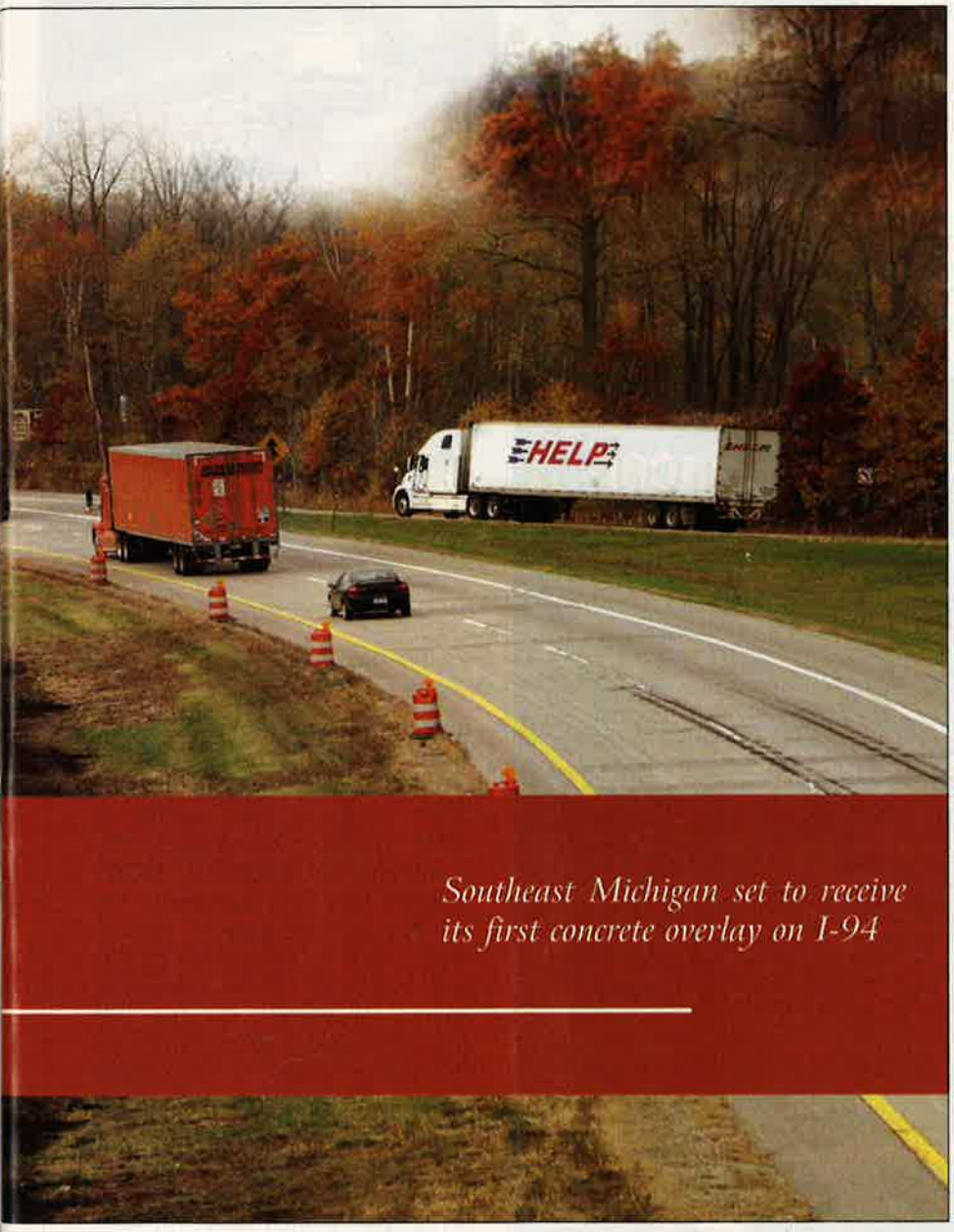
The existing pavement section consisted of parabolic-crowned 9-in. reinforced concrete on top of a 4-in. aggregate base with a 12-in. sand sub-base. Much of the land surrounding this area is rather flat and impedes drainage. In the 1990s an extensive concrete patching project repaired most of the deteriorating areas of the roadway, but rideability continued to suffer. Most of this deterioration is attributable to the fact that the Blue Water Bridge, only about four miles to the northeast of the project, is the second-busiest commercial border crossing in North America.

In January 2004, the Michigan Department of Transportation (MDOT) selected Spalding DeDecker Associates, a Rochester Hills, Mich.-based consultant, to develop plans for the first unbonded concrete overlay on an interstate freeway in southeastern Michigan. The location of the proposed work covers a 3.7-mile section of I-94 south of the I-69 interchange toward the town of Marysville, Mich. MDOT had initiated or completed a few different concrete overlay projects on freeways in western and central Lower Michigan in the previous few years, and was ready to implement this repair method on a freeway on the outskirts of the metro Detroit region.

Natural course

Before the concrete overlay could be placed, the existing 9-in. reinforced concrete pavement needed to be repaired. Partial-depth hot-mix asphalt (HMA) patching was used for longitudinal and transverse joint, crack and spall repairs. Full-depth concrete patching was required for slab and previous pavement

repair failures. To improve the subgrade drainage of the original pavement section, the proposed pavement design includes installing 6-in. open-graded underdrains below the existing HMA shoulders. Additionally, all existing culverts crossing the freeway within the project limits need to be removed and upgraded to improve drainage, resulting in additional full-depth pavement patching. The existing HMA shoulders require widening to meet current MDOT and FHWA standards.



Southeast Michigan set to receive its first concrete overlay on I-94

Once the original pavement is repaired and shoulders are widened, a nominally 1-in.-thick HMA separator layer is applied across the full width of the travel lanes and HMA shoulders. Once this step is completed, the nominally thick 7-in. nonreinforced concrete overlay is placed. The concrete overlay thickness will vary from 7 in. at the edges to nearly 8.5 in. at the center in order to modify the existing parabolic crown into a 2% cross-slope. Each side of the finished freeway overlay pavement will consist of two 12-ft traffic lanes, a 12-ft paved outer shoulder and a 5-ft paved inside shoulder.

Pursuant to more stringent FHWA materials requirements, MDOT specifications for the portland cement concrete (PCC) overlay mixture called for using coarse aggregates originating "only from natural geological sources." Additionally, MDOT materials specifications required that Michigan Class 6AAA coarse aggregates used in the concrete mixture must meet higher freeze-thaw durability requirements with the commercial ADT levels exceeding 5,000. The 6AAA coarse aggregate in the concrete mixture allows a maximum freeze-thaw dilation of 0.04 necessary for this level of commercial traffic loading. The allowable content of portland cement specified for the overlay mixtures ranges from 470 to 564 lb per cu yd.

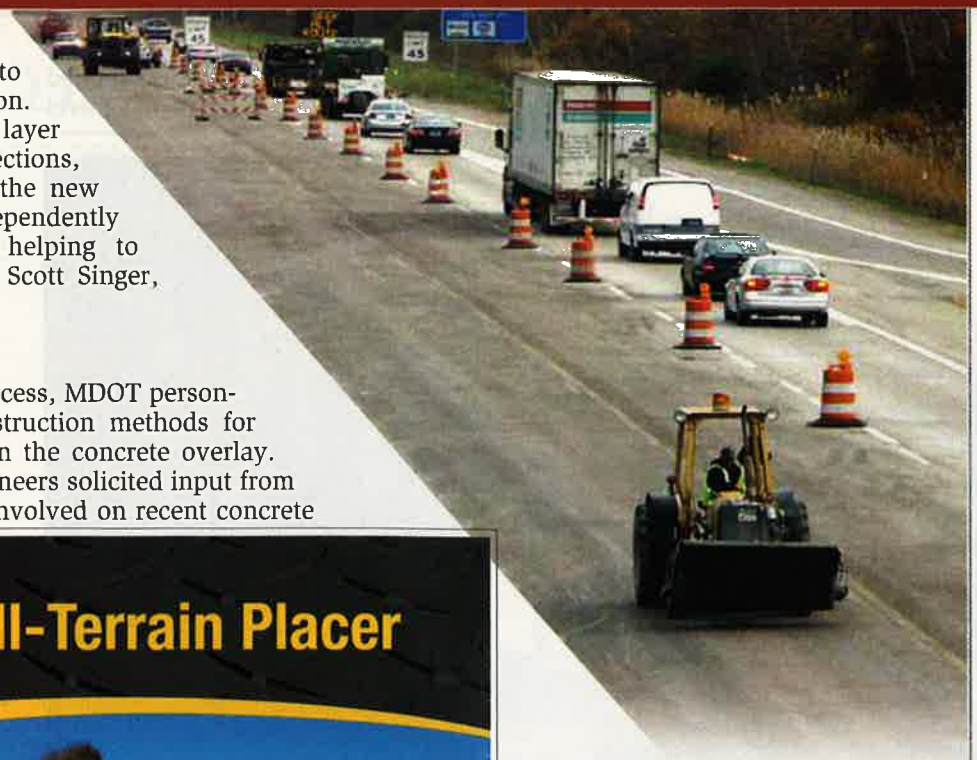
An MDOT special provision for "high performance" PCC also requires the use of natural coarse aggregates within the reconstructed pavement areas.

The concrete overlay section cannot be placed under the three existing overpasses along this section of the I-94 freeway due to underclearance constraints. In order to maintain a minimum 16 ft 3 in. underclearance at these structures, 834 ft of the existing pavement under each of the bridges will be removed and reconstructed. This allows room for placing 300 ft of new 11-in. nonreinforced concrete pavement under each of the structures, with 267-ft-long transitions before and after the reconstructed areas to meet the concrete overlay elevations. The reconstructed pavement sections also include a 6-in. open-graded drainage course (with 6-in. underdrains) and 10-in. sand sub-base. A similar transition section also will be placed at the end of the project to meet the existing pavement elevations.

Two curves near the northern end of the project had existing 6% superelevation and were required to be increased to 7% superelevation to meet current MDOT standards. Per MDOT's pavement design requirements, the 1-in. HMA separator layer was limited to a consistent 1-in. thickness to avoid "squashing out" on the high sides of the supers. To make up for this, the concrete overlay thickness needed to increase to approximately 12 in. on the outer edges of the

high sides of the curved areas to achieve a 7% finished superelevation.

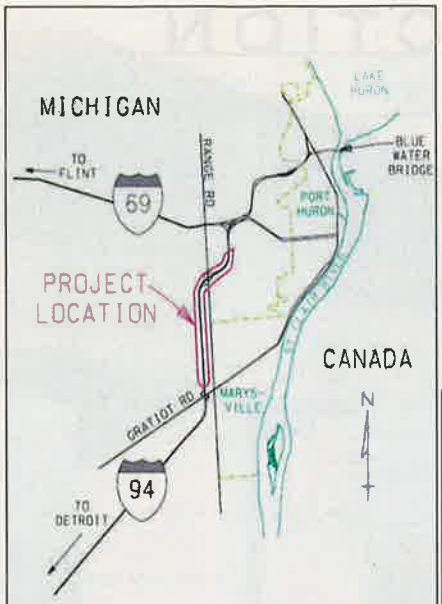
"By placing a thin HMA separator layer between two substantial concrete sections, MDOT's pavement design allows the new concrete overlay to function independently from the underlying pavement, helping to inhibit reflective cracking," stated Scott Singer, P.E., MDOT project manager.



Learning from others

At the beginning of the design process, MDOT personnel expressed concern about construction methods for placing load-transfer devices within the concrete overlay. MDOT and Spalding DeDecker engineers solicited input from other MDOT engineers who were involved on recent concrete overlay projects elsewhere in the state to see which methods worked and which ones did not. After observing the results of other recently completed concrete overlay projects, MDOT insisted that the placement and stability of load-transfer devices was critical to the overall quality and longevity of the pavement. Special provisions for the I-94 concrete overlay project included specifying using a dowel-bar inserter machine to achieve proper horizontal and vertical placement of load-transfer devices within the concrete overlay layer—particularly with variable-thickness concrete in the superelevated sections.

During the design process, MDOT took the opportunity to combine the concrete overlay project with an adjacent freeway interchange reconstruction project at the Marysville exit, including total reconstruction of two mainline I-94 bridges. The maintaining traffic scheme included building the freeway one half at a time by maintaining two-way traffic on one side of the freeway, while working on the other side. Additional provisions were incorporated for maintaining traffic for



I-94 CONCRETE OVERLAY PROJECT

both projects since the adjacent project now included coordination with bridge reconstruction.

Maintaining access at the two interchanges located within the project limits was necessary because of local traffic requirements. The maintaining traffic special provision was developed so that no more than two of the eight interchange ramps within the project limits would be closed at any one time. Temporary HMA crossovers were constructed in Fall 2005 in the median to carry traffic from one side of the freeway (where two-way traffic is maintained) to connect to the entrance and exit ramps on the other side.

In order to reduce the amount of time that the contractor could close the interchange ramps, MDOT set up "Lane Rental" and "Pavement Gapping" bid items. Lane rental includes assessing charges for each hour (or portion of an hour) for each lane closure on the ramps or portions of the trunk lines involved. For this project, assessments range from $40/hour to $200/hour depending on which lane or ramp is closed. Pavement gapping at the interchange ramps was set up to pay the contractor to interrupt through-paving operations to keep ramp traffic open, and then return later to place high-early concrete pavement in the gapped sections.

"MDOT believes this is an efficient way to significantly extend the life of the existing concrete pavement," stated Gregory Johnson, P.E., MDOT metro region engineer.

MDOT has scheduled the I-94 concrete overlay project (and the adjacent interchange reconstruction project) for letting in March 2006, with construction scheduled to be completed by October 2006.

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