

Pavement Demonstration Program Status Report

Public Act 457 of 2016

June 2019

Background

Public Act 457 of 2016, Section 1i allows the Michigan Department of Transportation (MDOT) to construct demonstration projects that are not subject to a Life-Cycle Cost Analysis (LCCA). The LCCA process is a tool to select the lowest cost pavement design over the expected service life of the pavement. The LCCA process must include, by law, historical information for initial construction and maintenance costs, and performance (service life). This information is not available for new pavement design types and new pavement technologies and thus they cannot be used in the pavement selection process until the information has been obtained. The pavement demonstration legislation provides a means for trying new and innovative ideas.

Potential outcomes of pavement demonstration projects include increased service life, improved customer benefits and lower maintenance costs. Future LCCAs may utilize cost, performance, and maintenance information from the demonstration projects.

Project Selection

Selection of candidate projects is a collaborative effort among MDOT Construction Field Services pavement personnel, MDOT region personnel and pavement industry groups. Once these partners reach a consensus that a project would be a good candidate, the project goes to MDOT's Engineering Operations Committee for formal approval. Once approved, the project becomes part of the Pavement Demonstration Program.

All costs for the demonstration project are funded by the respective MDOT region's rehabilitation and reconstruction budget.

Project List

The table below contains a list of demonstration projects to date.

Table 1. Pavement Demonstration Project List							
FY Let/Built	Route/Road	Region	County	Location	Description	Pavement Costs*	
						HMA	Concrete
2003/2003	I-75 NB	North	Ogemaw	Ski Park Road to Roscommon County Line	Low volume unbonded overlay		\$1,980,000
2003/2005	M-84/Bay Road SB	Bay	Bay/Saginaw	Pierce Road to Delta Road	Perpetual pavement	\$700,000	
2004/2005	M-3/Gratiot Avenue	Metro	Wayne	St. Aubin Street to McClellan Street	Thin unbonded overlay		\$2,200,000
2005/2005	M-13/Euclid Avenue	Bay	Bay	Mary Drive to North Street	Low volume concrete		\$1,200,000
2005/2005	I-96 WB	Metro	Wayne	M-39 to Schaeffer Road	Perpetual pavement	\$4,800,000	

Table 1. Pavement Demonstration Project List

FY Let/Built	Route/Road	Region	County	Location	Description	Pavement Costs*	
						HMA	Concrete
2006/2006	M-99/Eaton Rapids Road	University	Jackson	Village of Springport	Low volume concrete		\$100,000
2008/2008	I-75 NB	North	Cheboygan	Topinabee Mail Route Road north for 2.37 miles	Perpetual pavement over rubblized concrete	\$781,000	
2009/2010	M-1/ Woodward Avenue	Metro	Wayne	Tuxedo Street to Chandler Street	Thin unbonded overlay		\$931,000
2018/2019	I-94	University	Jackson	M-60 to Elm Street	Continuously reinforced concrete pavement		\$3,488,000

* = estimated costs during design phase; NB = northbound; SB = southbound; WB = westbound; FY = fiscal year

Below is a brief description of the status or condition of each project based on field visits in April and May of 2019. Condition ratings for good/fair/poor have been assigned to each project based on a subjective evaluation of the condition at the time of the latest field visit. These are intended to provide the reader with a general sense of the performance of each project and may not reflect any future decisions about each project once enough information is obtained to make a final determination.

I-75 Northbound (Ski Park Rd. to Roscommon Co. Line, Ogemaw County, North Region):

This project, constructed in 2003, is a 6-inch unbonded concrete overlay on the northbound direction only, with a 20-year design life. It includes the following test sections:

- Section 1: 10-foot transverse joint spacing, unsealed joints, no load transfer bars, 0.25 miles
- Section 2: 10-foot transverse joint spacing, sealed joints, no load transfer bars, 0.25 miles
- Section 3: 12-foot transverse joint spacing, unsealed joints, no load transfer bars, 1.5 miles
- Section 4: 12-foot transverse joint spacing, sealed joints, no load transfer bars, 1.5 miles
- Section 5: 12-foot transverse joint spacing, sealed joints, load transfer bars, 0.5 miles

The southbound direction, constructed at the same time, was rubblized (existing concrete pavement broken into smaller pieces resembling gravel) and overlaid with 6.5-inches of hot mix asphalt (HMA).

Project Evaluation Recommendation: Per the 2018 Pavement Demonstration Program Project Evaluation technical report, it is recommended that monitoring of this demonstration project end because enough time has passed (14 years) to fully evaluate its experimental aspects (unsealed joints, no dowel bars, reduced joint spacing). This report concludes that unbonded concrete overlays should have sealed transverse and longitudinal joints. Additionally, transverse joints should be doweled along with tied longitudinal joints. Finally, 12-foot joint spacing should be maintained for 6-inch concrete pavement with adequate provisions to ensure proper drainage of the HMA open graded interlayer. Monitoring of this project will continue until this recommendation is officially approved by MDOT.

Latest Condition Survey: All sections were repaired with intermittent full-depth slabs after the review last year and before the review this year. Therefore, crack counts could not be directly compared. However, the number of slabs repaired were tracked as an indication of those slabs that had some type of distress in need of repair, which may include faulting, cracking or spalling. The repair project appears to be well done and should greatly benefit the location. Accordingly, **Section 3** had the most slabs repaired (39), which is consistent with past reviews, where it had the most distressed slabs. For **Section 4**, the number of repaired slabs (20) indicates that this section remained stable. For **Section 1**, the number of repaired slabs (22) may indicate a slight increase in distress. For **Section 5**, the number of repaired slabs (12) may indicate a slight increase in distress. **Section 2**, which was distress-free until 2016, had a fair number of slabs replaced (37), which may indicate a moderate increase in distress. The number of replaced/distressed concrete slabs for the entire project is approximately 7 percent. Overall, the performance of this pavement section is characterized as fair.

The rubblized project in the southbound direction continues to exhibit longitudinal and transverse cracking, with more new transverse cracks being noticed this year. There is also evidence of heaving at some transverse cracks. The joint at centerline continues to widen, indicating a potentially poor joint construction. The heaving of the cracks has been the most problematic condition of this pavement section. Initial investigations indicate that the concrete base may not have been fully rubblized, which may be inhibiting drainage, resulting in the surface heaving. Therefore, a rehab project is to be constructed in 2019 on this southbound section of I-75 that would mitigate the heaving observed at the transverse cracks, as well as the longitudinal joint quality issues. This project has underperformed as compared to other rubblize projects. Its performance is characterized as poor.

M-84/Bay Road Southbound (Pierce Road to Delta Road, Saginaw County, Bay Region):

This project is a 6.5-inch HMA 40-year design perpetual pavement completed in the fall of 2005. This was a two-lane road that was upgraded to a four-lane boulevard section and built over a two-year period. The northbound direction contains a standard 6.5-inch HMA cross-section (20-year design) that was built in 2004. The southbound direction contains the perpetual pavement, which is a 40-year design. Polymerization of the HMA and a thicker base are expected to increase the service life over the standard cross section. With the perpetual pavement concept, the cross section and materials used are designed to eliminate cracking that initiate at the bottom of the asphalt layer. This would leave only surface cracking that can be maintained with mill/resurface preventive maintenance fixes at intervals that could be as long as 15 years. The initial costs of a perpetual pavement, however, can be significantly higher than a standard design.

Latest Condition Survey: Transverse cracking for both directions continues to show significant increases, as northbound increased 269 feet/mile over last year, (an increase of 15 percent) and southbound increased 1,029 feet/mile over last year, (an increase of 50 percent). While the increase in southbound is greater than northbound, the cracks in southbound remain tight (approximately 1/16th of an inch) and those in northbound are widening (approximately 1 inch). The amount of longitudinal cracking in both directions continues to be minimal and stable. While the transverse cracking is high in both directions, it may be isolated to the surface course of the southbound perpetual pavement (as indicated by the narrow width of cracks), so this pavement may be a candidate for the first mill and resurface project. This project's performance to date is considered fair. However, this perpetual pavement section is exhibiting more surface cracking as compared to

the other two perpetual demonstration pavements (I-96 Metro Region and I-75 North Region). Therefore, additional investigation will have to be completed to ascertain any benefit in the performance and full-depth condition of the perpetual pavement section (southbound).

M-3/Gratiot Avenue (St. Aubin Street to McClellan Street, Wayne County, Metro Region):

This project is a 4-inch unbonded concrete overlay with a 15-year design that was constructed in the fall of 2005. Normal unbonded overlays are 6-inches or thicker. This project contains 4 test sections involving a combination of sealed and unsealed joints, with two different HMA bond breaking interlayer mixes. The HMA interlayer mixes are a normal dense-graded HMA and a more open-graded (drainable) HMA. The test sections are as follows:

- Section 1: Open-graded HMA interlayer, unsealed joints, 1 mile
- Section 2: Open-graded HMA interlayer, sealed joints, 0.85 miles
- Section 3: Dense-graded HMA interlayer, sealed joints, 0.75 miles
- Section 4: Dense-graded HMA interlayer, unsealed joints, 0.80 miles

Latest Condition Survey: Overall, 1,322 of the 6-foot by 5.5-foot concrete slabs are cracked or repaired (5.6 percent of the total in the survey area). This is an increase of 130 slabs (or 11 percent) over last year. Of the 1,322 total, 599 are on northbound and 723 on southbound. The sealed sections are exhibiting fewer cracks/repairs than the unsealed (507 vs. 815 or 4.6 percent vs. 6.5 percent), while the dense-graded HMA interlayer is exhibiting fewer cracks/repairs than the open-graded HMA (507 vs. 815 or 4.7 percent vs. 6.4 percent). From last year to this year, the unsealed category saw the largest increase in cracking (676 to 815). The pavement continues to show increases in cracking, raveling, and spalling throughout the project. Most of the distresses are concentrated in and around intersections, transitions, bus lanes, and manholes. It appears that annual maintenance work has been used to address continued distress. Additionally, the concrete section had one maintenance project (full depth repairs) in 2010. While there are isolated spots in poor condition, the rest of the pavement remains in good condition. Therefore, the overall performance of this pavement section is characterized as fair.

A 2004 HMA multicourse resurface on the composite section, directly adjacent to the north end of this project (north of I-94) was being used as a comparison section. This section has had two repair projects since being constructed (crack treatment in 2008 and single course resurface in 2014). This project and the demonstration project are performing at a similar rate.

M-13/Euclid Avenue (Mary Drive to North Street, Bay County, Bay Region):

This project is a low-volume concrete pavement with a 20-year design that was constructed in the summer of 2005. The concrete is 6-inches thick, compared to a minimum concrete thickness of 8-inches on non-freeway routes. Joints are spaced 5.5-feet in both directions and are unsealed. A dense-graded base was used instead of the normal open-graded base material.

Project Evaluation Recommendation: Per the 2018 Pavement Demonstration Program Project Evaluation technical report, it is recommended that a performance curve for life-cycle purposes be developed based on the data from the M-13 project with a maximum traffic restriction (and/or other design restrictions) per this new pavement fix type. At the time of this recommendation, this project and the other M-99 project were approximately 13 years old and performing as good or better than standard concrete reconstruction projects. Since initial construction costs of this design

type are generally lower than the standard 8-inch minimum design and their performance is at least equivalent, it was concluded (based on qualitative and quantitative evaluation of available data) that they are a cost-effective alternative for low-volume roadways. Monitoring of this project will continue until this fix is officially approved by MDOT as a standard fix.

Latest Condition Survey: 90 of the 5.5-foot by 5.5-foot slabs were noted as being cracked or repaired this year. This is stable as compared to last year. The number of cracked or repaired slabs represent approximately 1 percent of the total slabs for this pavement. Note that these counts include the 34 slabs that are cracked at the south side of the Pinconning River Bridge. The probable cause for the higher distress levels at the south side of the bridge is heavy equipment (large crane, etc.) that was parked on the area during a 2009 bridge repair project. Otherwise, there is a significant amount of scaling and spalling at the joints, particularly at the south end of the project, where they were filled with a spray-on patching material commonly referred to by its commercial name AMZ. This joint deterioration is commonly related to the equipment used to saw the joints and the timing of the sawing operation. The repairs seem to be wearing out and segregating, possibly due to further concrete spalling or slab movement. The right lane, mid-lane longitudinal joint in both directions is exhibiting some widening and low levels of faulting at various locations along both north and southbound. This appears to have impacted the lane cross slope. Overall, the performance of this pavement section is characterized as good.

I-96 Westbound (M-39/Southfield Freeway to Schaefer Rd., Wayne County, Metro Region):

This project is a 14-inch HMA perpetual pavement constructed in the fall of 2005 in the westbound local and express lanes. The eastbound local and express lanes were reconstructed with concrete. The concrete is a 20-year design, while the perpetual pavement is a 40-year design, so this is not a direct comparison.

Latest Condition Survey: The pavement condition was similar to that observed during the previous annual assessment. The longitudinal construction joints show widening along the joint between the outside lane and the on/off ramps along the project length. However, this does not appear any worse than previous years. As noted in previous reports, the longitudinal joint problems are typically a construction-related issue and are, therefore, not considered a problem of the perpetual pavement design. No change was observed in the condition of the two transverse cracks that developed around the edges of a culvert along the westbound local lanes. Otherwise, the local lanes had approximately 2 potholes, while the express lanes had approximately 10 intermittent potholes. Most of these were in shaded locations under bridge overpasses. This may suggest that these areas are blocking sun light and preventing evaporation of water, so they are retaining water longer, which in turn, is causing damage to those lanes. The express lanes had approximately 3 full width transverse cracks. Overall, the performance of this pavement section is characterized as good.

M-99/Eaton Rapids Road (Village of Springport, Jackson County, University Region):

This is the second low-volume roadway concrete pavement with a 20-year design similar to the M-13 project (5.5-foot joint spacing in both directions), except the joints for this project are spaced at 6-feet in both directions. It was constructed in summer/fall of 2006 and is approximately 800-feet in length.

Project Evaluation Recommendation: As stated previously, per the 2018 Pavement Demonstration Program Project Evaluation technical report, it is recommended that a performance curve for life-cycle purposes be developed with a maximum traffic restriction (and/or other design restrictions)

per this new pavement fix type. Monitoring of this project will continue until this fix is officially approved by MDOT as a standard fix.

Latest Condition Survey: Only 2 new cracked concrete slabs were noted this year within the project limits. However, existing distresses (cracks and corner breaks) were showing increases in severity levels. Approximately 7 percent of all slabs are cracked or repaired. While this percentage is elevated, it is not yet considered poor. There is some faulting, but it is isolated and minimal. Similar to previous surveys, the progression of distress (number and severity of distresses) continues to be stable. Overall, performance of this pavement section is characterized as fair.

I-75 Northbound (Topinabee Mail Rte. Rd. north for 2.37 mi, Cheboygan Co, North Region):

This is another 40-year HMA perpetual pavement design constructed in the fall of 2008. For this project, the existing concrete pavement was rubblized prior to the paving of the HMA. Rubblization is a standard fix, however, the HMA resurfacing is normally a 20-year design.

Latest Condition Survey: Overall, the pavement continues to be in sound condition. There were approximately 7 transverse cracks per lane that were reported last year. This year, approximately 14 transverse cracks per lane were observed. While this number doubled, this is still considered minimal and the cracking per mile is very low at approximately 50 feet/mile. The longitudinal joint between the right lane and right shoulder is separating in certain areas. Also, some localized areas on the pavement surface exhibited low levels of segregation. At the southern limit of the project, some potholes were observed in the right lane due to raveling in a segregated area. These are typically construction related issues. Overall, the performance of this pavement section is characterized as good.

M-1/Woodward Avenue (Tuxedo Street to Chandler Street, Wayne County, Metro Region):

This project is a 4-inch unbonded concrete overlay with a 15-year design similar to the M-3 project. It was constructed in 2010 and does not contain test sections. All joints were sealed and the same HMA interlayer (drainable open-graded HMA) was used throughout. Transverse joints are spaced at 6-feet, while the longitudinal joints are spaced at 5-feet.

Latest Condition Survey: The pavement was noted to be in similar condition as observed during last year's evaluation. A total of 414 of the 6-foot by 5-foot slabs are cracked, which is 147 more than last year (an increase of 55 percent). This, however, still represents less than 4 percent of the total survey area. Similar to last year, intermittent black staining was again noted on either side of some longitudinal and transverse joints. Further investigation will be needed to determine its cause. This may be due to pumping of water at the HMA interlayer. However, the associated slabs of this staining do not show much distress. While not tracked in the counts due to parking, the outside parking lanes are extremely distressed. They have several cracks, faults and failing slabs. The outermost travel lanes, (next to the parking lanes) have more distressed slabs than the inner travel lanes. This may be due to a water drainage issue (as the water travels to the outside of the roadway and gets trapped in the base). Alternatively, this may be due to the parking lanes' poor condition and spread of their distresses. The parking lanes appear to be constructed at different times than the rest of the travel lanes and may be made of different material (due to their color difference in comparison to the rest of the travel lanes), so their distresses may be material related. Further investigation will be needed to determine the observed performance differences. Overall, the performance of this pavement section is characterized as fair.

I-94 (M-60 to Elm Street, Jackson County, University Region):

This is a 6-lane (3 lanes in each direction) reconstruction project using a 13-inch thick continuously reinforced concrete pavement (CRCP). The decision to utilize CRCP was made to provide additional safety against subsidence risk within the right-of-way due to the existence of underground abandoned mineshafts. This will be the first use of CRCP by MDOT since the mid-1980s. Construction began in spring of 2019. The annual reviews for this demonstration project will begin in 2020 and will be first reported in the 2020 status report.

Project Finalization Process

All demonstration projects are continually being evaluated to determine if there is enough information to create appropriate performance curves and make a final determination as to their applicability to standard MDOT practice. Final recommendations will be outlined in this Pavement Demonstration Program Status Report. A separate technical report, Pavement Demonstration Program Project Evaluation, will be made available to provide further details about final recommendations. Additionally, a final comprehensive report on each project will be made available once final recommendations are officially approved by MDOT.

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