

Pavement Demonstration Project Annual Status Report
Public Act 51 of 1951, Section 247.651i
(as amended by Public Act 457 of 2016)
June 2024

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 a demonstration project is identified, it 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 Finalization Process

All active demonstration projects are continually 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. A separate technical report, Pavement Demonstration Program Project Evaluation, provides further details about final recommendations and is available upon request. Once a project is recommended for finalization, a final comprehensive report about the project and its findings will be published and its annual monitoring will end.

Project List

The following represents the list of pavement demonstration projects:

Pavement Demonstration Project List								
Built	Route/ Road	Status	Region	County	Location	Description	Pavement Costs*	
							Asphalt	Concrete
2003	I-75 NB	Final	North	Ogemaw	Ski Park Road to Roscommon County Line	Unbonded concrete overlay		\$1,980,000
2005	M-84/Bay Road SB	Active	Bay	Bay/Saginaw	Pierce Road to Delta Road	Asphalt perpetual pavement	\$700,000	
2005	M-3/ Gratiot Avenue	Active	Metro	Wayne	St. Aubin Street to McClellan Street	Thin unbonded concrete overlay		\$2,200,000
2005	M-13/ Euclid Avenue	Active	Bay	Bay	Mary Drive to North Street	Low volume concrete		\$1,200,000
2005	I-96 WB	Active	Metro	Wayne	M-39 to Schaeffer Road	Asphalt perpetual pavement	\$4,800,000	
2006	M-99/ Eaton Rapids Road	Active	University	Jackson	Village of Springport	Low volume concrete		\$100,000
2008	I-75 NB	Active	North	Cheboygan	Topinabee Mail Route Road north for 2.37 miles	Asphalt perpetual pavement over rubblized concrete	\$781,000	

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Built	Route/ Road	Status	Region	County	Location	Description	Pavement Costs*	
							Asphalt	Concrete
2010	M-1/ Woodward Avenue	Active	Metro	Wayne	Tuxedo Street to Chandler Street	Thin unbonded concrete overlay		\$931,000
2020	I-94	Active	University	Jackson	M-60 to Elm Street	Continuously reinforced concrete pavement		\$3,488,000**
2023	US-10 WB	Active	Bay	Bay	7 Mile Road to west of Gies Street	Asphalt reconstruction on reduced base and subbase	\$3,574,000**	
2024	US-24	Active	Metro	Wayne	Grand River to north of 8 Mile Road	Asphalt reconstruction modification per stabilized subgrade	\$3,190,500**	

* = estimated costs per construction year of the pavement during design phase

** = costs include pavement and engineered cross-section

NB = northbound; SB = southbound; WB = westbound

The following is a brief description of the status and/or condition of each active project based on field visits in April 2024. Condition ratings of 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. Ratings are intended to provide a general sense of the performance (in terms of anticipated distress and ride quality per the design type) of each project and may not reflect future decisions about performance after all relevant information is obtained to make a final determination.

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

This project is a 6.5-inch hot mix asphalt (HMA), 40-year design perpetual pavement reconstruction completed in fall 2005. This was a two-lane road 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) built in 2004. The southbound direction contains the perpetual pavement, which is a 40-year design. Polymerization of the asphalt binder used in the HMA, and a thicker unbound aggregate 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 initiated at the bottom of the asphalt pavement. This would leave only surface cracking to be maintained with mill and resurface preventive maintenance fixes at intervals up to 15 years. The initial costs of a perpetual pavement, however, can be significantly higher than a standard design.

Project Evaluation Recommendation: Per the February 2021 Pavement Demonstration Program Project Evaluation technical report, it is recommended that the annual status review monitoring of this perpetual pavement demonstration project conclude with its final report since

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it has reached a reasonable age with enough condition data points for project close out. Moreover, while cracking will likely increase, the relative annual increase of cracking is decreasing (slowing). Additional annual field reviews are unlikely to add benefit since cracking is unlikely to significantly change and/or alter conclusions. This is further supported by 2020 coring and falling-weight-deflectometer (FWD) testing (which is also summarized in the 2021 Evaluation report). Monitoring of this project will continue until the final report is officially approved by MDOT.

Latest Condition Survey: The rate of transverse (thermal) cracking has continued to increase over the last 10 years. This year, 2,651-feet/lane-mile and 4,900-feet/lane-mile of transverse cracking were observed for northbound and southbound, respectively. While the amount of cracking on southbound is greater than on northbound, the cracks in southbound remain tight (approximately 1/16 inch) and those in northbound are much wider (approximately 1-inch). The amount of longitudinal and fatigue (structural) cracking in both directions continues to be very low. The perpetual design concept of this demonstration project appears to be effectively supporting the traffic loadings and preventing structural damage, but it is performing poorly in thermal cracking, which is not a structural related issue and is more likely due to the HMA mixture characteristics. As supported by the 2020 coring data, FWD testing, and narrow crack widths, most of the cracking is isolated to the surface course so this pavement would be a good candidate for its first mill and resurface project to renew the surface. If thermal cracks continue to develop and propagate, water can enter the pavement system and cause deterioration of pavement structure, such as raveling of the cracks and/or loss of base support. While this project is performing poorly in thermal cracking, the structural characteristic of this pavement is considered good.

M-3/Gratiot Avenue (St. Aubin Street to McClellan Street, Wayne County, Metro Region): This project is a 4-inch thin unbonded concrete overlay with a 15-year design constructed in fall 2005. Standard MDOT unbonded overlays are 6-inches or thicker. Transverse joints are spaced at 6-feet, while the longitudinal joints are spaced at 5.5-feet. This project contains four test sections involving a combination of sealed and unsealed joints, with two different HMA bond breaking interlayer mixes. The HMA interlayer mixes are a standard 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

Project Evaluation Recommendation: Per the February 2021 Pavement Demonstration Program Project Evaluation technical report, this fix type of thin unbonded concrete overlay has been standardized for MDOT use, so a final report will be composed for this project. Monitoring of this project will continue until the final report is officially approved by MDOT.

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Latest Condition Survey: Overall, 20 percent of the concrete slabs are cracked or repaired. This is an increase of approximately 4 percent from last year. Of the slabs cracked or repaired, 50 percent are on northbound, and 50 percent are on southbound. The sealed sections are exhibiting higher frequency of cracked or repaired slabs than the unsealed (23 percent vs. 17 percent). The open-graded HMA interlayer sections are exhibiting a slightly higher frequency of cracked or repaired slabs than the dense-graded HMA (23 percent vs. 16 percent). Test section performance has been variable from year-to-year, so their trends are inconsistent. This may suggest performance is indifferent to the type of interlayer or joint sealing. Alternatively, this may be due to variable materials and/or construction related issues influencing the results. This will be further examined during the final reporting of this project. In those areas not yet repaired, 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. To address these distresses, annual maintenance work has been conducted since 2015, including work conducted in 2023. Accordingly, locations in poor condition have been repaired and/or maintained and 80 percent of the remaining slabs exhibit no cracking. 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 used as an approximate comparison section. This section has had three contracted repair projects since being constructed (crack treatments in 2008 and 2019, and a single course HMA resurface in 2014). This location has sealed and unsealed cracking.

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 constructed in summer 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 (transversely and longitudinally) and are unsealed. A dense-graded unbound aggregate base was used instead of the standard open-graded aggregate base material.

Project Evaluation Recommendation: Per the February 2021 Pavement Demonstration Program Project Evaluation technical report, it is recommended low-volume concrete pavement be standardized for MDOT use, so a final report will be composed for this project. Monitoring of this project will continue until the final report is officially approved by MDOT.

Latest Condition Survey: A total of 228 of the concrete slabs were noted as being cracked or repaired which is 8 more than last year. The number of cracked or repaired slabs is minimal, representing approximately 2.7 percent of the total slabs for this pavement. These counts include approximately 42 slabs that are cracked or repaired 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 parked on the area during a 2009 bridge repair project. There is intermittent scaling and spalling at the joints, particularly within the first 550-feet of the south end of the project in the northbound lanes, where they were filled with a spray-on asphalt emulsion patching material (commonly referred to by its commercial name AMZ). This joint deterioration is

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commonly related to the timing of the sawing operation. The repairs continue to deteriorate, due to aging and further concrete spalling or slab movement. The mid-lane longitudinal joint of the rightmost lane, in both directions, is exhibiting some widening and low levels of faulting at various locations. The performance of this pavement section is characterized as good.

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

This project is a 14-inch HMA perpetual pavement reconstruction completed in fall 2005 in the westbound local and express lane sections. The eastbound local and express lanes were reconstructed using standard MDOT concrete design. The concrete is a 20-year design, while the perpetual pavement is a 40-year design, so this is not a direct comparison.

Project Evaluation Recommendation: Per the February 2022 Pavement Demonstration Program Project Evaluation technical report, it is recommended that the annual status review monitoring of this perpetual pavement demonstration project conclude with its final report since it has reached a reasonable age with enough condition data points for project close out. Monitoring of this project will continue until the final report is officially approved by MDOT.

Latest Condition Survey: Intermittent repair patches were conducted in 2021 in both the local and express lane sections. This comprises about 7.6 and 10.6 percent of the surface area of the local and express sections, respectively. Almost all patching was within the longitudinal joints (between lanes and the shoulders) to repair joint raveling and separation (1- to 2-foot wide). Longitudinal joint problems are typically a construction-related issue; therefore, not considered a problem of the perpetual pavement design and its structural characteristics. The observed pavement distress increased since last year, particularly in the express lanes, where it has now reached a moderate level. However, most of this distress appears to be confined to the surface HMA layer due to the narrow widths of cracks and shallow potholes. As a result, this pavement would be a good candidate for its first mill and resurface project to renew the surface. For the local lanes, 628-feet/lane-mile of longitudinal cracking, 185-feet/lane-mile of transverse cracking, and 5 potholes/lane-mile were observed. For the express lanes, 1,506-feet/lane-mile of longitudinal cracking, 539-feet/lane-mile of transverse cracking, and 21 potholes/lane-mile were observed. While there is a moderate increase in surface cracking, the structural integrity of both pavement sections 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 2006 and is approximately 800-feet in length. Like M-13, a dense-graded unbound aggregate base was used instead of the standard open-graded aggregate base material.

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Project Evaluation Recommendation: Per the February 2021 Pavement Demonstration Program Project Evaluation technical report, it is recommended low-volume concrete pavement be standardized for MDOT use, so a final report will be composed for this project. Monitoring of this project will continue until the final report is officially approved by MDOT.

Latest Condition Survey: No additional cracked concrete slabs were observed within the project limits. Only 12 additional slabs had spalling as compared to last year. Severity of existing distresses, including cracks, spalls, and corner breaks remained mostly unchanged from last year. Approximately 7.9 percent of all slabs are cracked or repaired and approximately 15.7 percent of all slabs have some amount of spalling. Therefore, in total, about 23.6 percent of all slabs are cracked, repaired, or have some spalling. While this percentage is elevated, construction related issues are at least in part contributing to this, including construction warranty repairs and initial spalling due to late sawing of the joints. This spalling is consistent with observations of the first annual review in 2007, where early cracking within inches of the joint was observed. There is some faulting, but it is isolated and minimal. Similar to previous surveys, the progression of distress (number and severity of distresses) is steady. Performance of this pavement section is characterized as fair.

I-75 Northbound (Topinabee Mail Route Road north for 2.37 miles, Cheboygan County, North Region):

This is a 40-year HMA perpetual pavement design over rubblized concrete constructed in fall 2008. Concrete rubblization is a process which pulverizes and crushes the existing concrete pavement into small fragments, similar to an aggregate base. HMA over rubblized concrete is a standard fix type; however, the HMA resurfacing is normally a 20-year design.

Project Evaluation Recommendation: Per the February 2022 Pavement Demonstration Program Project Evaluation technical report, it is recommended that the annual status review monitoring of this perpetual pavement demonstration project conclude with its final report since it has reached a reasonable age with enough condition data points for project close out. Monitoring of this project will continue until its final report is officially approved by MDOT.

Latest Condition Survey: A chip seal with fog coat capital preventive maintenance project (Contract ID 16091-204267) occurred in 2020. The following summary of observed distresses will be different from reviews conducted prior to 2021 and may not be directly comparable. Since last year, the number of transverse cracks minimally increased from 22 to 24 (236-feet to 250-feet total). All cracks are unsealed, and most are full width. The cracking remains tight, and the amount of transverse cracking was very low at approximately 53-feet/lane-mile. Longitudinal cracking had been mitigated by the maintenance project and had not been observed since 2020. However, it has returned this year, albeit at a minimal amount, with a total extent of 42-feet. The longitudinal joint between the right lane and right shoulder had some raveling and was widening in some locations, by up to 2-inches. This was improved by the chip seal project, so only a few locations are raveling at the shoulder. Potholes and delamination at the southern and northern transitions to and from the project are still present (mostly in the right lane). This

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distress is typically due to construction related issues. 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 thin unbonded concrete overlay with a 15-year design like the M-3 project. It was constructed in 2010 and contains a single uniform test section (unlike M-3, which has four different sections). All joints were sealed and the same dense-graded HMA interlayer was used throughout. Transverse joints are spaced at 6-feet, while the longitudinal joints are spaced at 5-feet.

Project Evaluation Recommendation: Per the February 2021 Pavement Demonstration Program Project Evaluation technical report, this fix type of thin unbonded concrete overlay has been standardized for MDOT use, so a final report will be composed for this project. Monitoring of this project will continue until its final report is officially approved by MDOT.

Latest Condition Survey: Annual maintenance work has occurred over the last six years, including intermittent full-depth concrete slab replacement in 2023. A total of 1,176 concrete slabs are cracked or repaired, which is 211 more than last year (an increase of 22 percent). This represents about 11 percent of the total survey area. Most joints remain in fair to good condition. While not tracked in the counts due to parking, most of the slabs in the outside parking lanes have been repaired. As noted in past reviews, prior to being repaired, many of these slabs were shattered and faulted. Similarly, the outermost travel lanes (next to the parking lanes) have more distressed or repaired slabs than the inner travel lanes, consisting of about 66 percent of the noted cracked or repaired slabs. Locations in poor condition have been repaired and/or maintained. 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 (three lanes in each direction) reconstruction project using a 13-inch thick continuously reinforced concrete pavement (CRCP). The CRCP pavement type is designed to have tight transverse cracks, spaced from 1.5-feet to 6.0-feet apart to maximize load-transfer efficiency and minimize flexural stresses. Due to the existence of underground abandoned mineshafts within the right-of-way of this roadway, CRCP was selected to provide additional safety against the risk of subsidence. This is the first use of CRCP by MDOT since the late-1970s. Construction began in spring of 2019, with the eastbound direction completed in the same year. The westbound direction was completed during 2020.

Latest Condition Survey: Thus far, for both bounds, tight transverse cracks continue to appear as expected. Some are in groups spaced 3-feet to 6-feet apart and others appear as single cracks, spaced more than 10-feet from the next crack. Transverse cracks should continue to appear as the pavement ages and crack spacing is expected to reduce (as new transverse cracks appear and reduce isolated cracks). This crack spacing is adequate, but some intersecting cracks continue to be observed in both bounds, occurring intermittently every 20- to 200-feet. This cracking may be of concern since cracks should be relatively straight and not intersect. These will continue to be monitored for future progression and potential distress.

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So far, these intersecting cracks have not exhibited discernable excess spalling or pop-outs. For the eastbound section, some cracks have developed intermittent very minor, chip spalls (approximately ½-inch by 1-inch), particularly west of the Cooper Street overpass. Notably, larger minor spalls (approximately 1-inch by 2-inches) were observed in the right lane at stations 2131+30 and 2138+80. For westbound, only 5 chip spalls were observed throughout its entire length. Very straight transverse cracking was observed at eastbound stations 2147+20 and 2152+20 and westbound stations 2149+00 and 2145+20. These can indicate a stopped paving sequence or sympathy cracking from the shoulder transverse joint. These locations will continue to be monitored for future potential distress, but to date, there are no observed problems at these locations. No longitudinal cracks were observed in either bound. Minimal faulting was observed for the longitudinal joint between the rightmost lane and center lane for eastbound station 2135+00. The jointed plain concrete pavement shoulders and ramp lanes mostly continue to have straight and tight joints, but minor spalling was observed for some of the transverse joints on the eastbound Cooper Street on ramp to I-94. It should be noted, during the I-94 eastbound construction, the concrete supply to the paver was intermittent from stations 2153+00 to 2154+50; therefore, extra hand finishing was required in this area. Additionally, the middle lane had a full-depth patch at station 2132+10 because of construction damage to the newly paved CRCP. To date, there are no observed problems at these locations. For westbound construction, there are several areas where diamond grinding was required to achieve initial ride quality tolerance, particularly west of the Cooper Street off ramp. This may indicate concrete material delivery quality and finishing issues and/or poor uniformity of the base, so these locations will be monitored for ongoing performance. The performance of this pavement section is currently characterized as good.

US-10 Westbound (7 Mile Road to west of Gies Street, Bay County, Bay Region):

This is a divided freeway that has two lanes in each direction with two interchanges at Mackinaw Road and I-75. Construction started and completed in 2023. The standard (control) cross-section (from bottom to top) will be 18-inches of sand subbase, 6-inches of dense-graded aggregate base, and 8-inches of HMA pavement. However, the demonstration cross-section (reduced subbase) will reduce the subbase thickness to 10-inches, subsequently requiring an increase to the HMA thickness so that its thickness is 10-inches. Therefore, this demonstration project will be split into four sections with descriptions and locations defined by the following test sections (from west to east along project length):

- Section 1: Standard section (control) with reuse of existing subbase, 1.51 miles
- Section 2: Reduced subbase with new and partial reuse of existing subbase, 1.38 miles
- Section 3: Reduced subbase with reuse of existing subbase, 0.65 miles
- Section 4: Standard section (control) with new subbase, 1.85 miles

This pavement demonstration project will provide information on whether the thickness of unbound base and/or subbase can be reduced and continue to provide adequate performance (frost resistance) as compared to the current standard total thickness of base and subbase, and if so, for what conditions (climate, subgrade, etc.) this may be acceptable.

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Latest Condition Survey: This pavement is in as-constructed condition with no observed distresses, except for a distinct transverse cold joint located between 7 Mile Road and Mackinaw Road. This indicates a stopped construction sequence. This location has been identified for post construction grinding to occur later this year, which should improve the joint's surface condition and ride. This joint will be monitored for potential subsequent distress issues that may occur as the pavement ages. Otherwise, the longitudinal centerline construction joint is very tight.

US-24 (Grand River Avenue to 8 Mile Road, Wayne County, Metro Region):

This is an HMA reconstruction project that started construction in 2023 and is to be completed in 2024. Within the project limits, US-24 is a boulevard with four lanes in each direction and additional intermittent inside and outside turn lanes. The cross-section (from bottom to top) will be 8-inches of sand subbase, 16-inches of open-graded drainage course, and 7-inches of HMA pavement. Two sections will stabilize the subgrade, with one of those sections eliminating the 8-inches of sand subbase. This project will be split into three sections with descriptions and locations defined by the following test sections:

- Section 1: Stabilized subgrade and no sand subbase, 0.37 miles
- Section 2: Stabilized subgrade with sand subbase, 0.34 miles
- Section 3: Standard section (control without stabilization), 0.27 miles

This pavement demonstration project should provide MDOT with information regarding the benefits to HMA reconstruction projects due to stabilizing subgrade. The three sections will help MDOT understand the influence of stabilized subgrade on the performance, and if the engineered cross-section can be reduced due to the improved subgrade (test section 1). In accordance with the anticipated end of construction, the annual reviews for this demonstration project are expected to begin in 2025 and will be first reported in the 2025 Pavement Demonstration Program Status Report.