

# Strategy Development for Roads and Bridges

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## Goal Redefinition

In the spring of 2007, Director Steudle and the Director's Executive Team (DET) requested the establishment of a team to redefine and broaden our department's goals. To that end, the Performance Measurement Team (formerly known as the Goal Redefinition and Measurement for Roadway (GRAMR) Team) was created. The Team created interim focus areas and identified goals, objectives and measures within them by utilizing the Goals, Objectives and Performance Measures Report from the MI Transportation Plan (also known as the State Long-Range Plan).

*Four goal areas* Four goal areas have been identified with objectives within each goal area.

- **Goal Area 1: Stewardship** - Preserve transportation system investments, protect the environment and utilize public resources in a responsible manner.
- **Goal Area 2: Safety and Security** - Continue to improve transportation safety and ensure the security of the transportation system.
- **Goal Area 3: System Improvement** - Modernize and enhance the transportation system to improve mobility and accessibility.
- **Goal Area 4: Efficient and Effective Operations** - Improve the efficiency and effectiveness of the transportation system and transportation services, and expand MDOT's coordination and collaboration with its partners.

## Road Network Strategy Development

### Rehabilitation and Reconstruction for Roads



The Rehabilitation and Reconstruction (R&R) Program, along with Capital Preventive Maintenance (CPM), are the major instruments used to preserve pavements along Michigan's trunkline system. Implementing a construction program with a balance of "Mix of Fixes", along with a focus on the freeway system, continues to be the major emphasis areas for this program. The intent of the R&R Program is to maintain the highest sustainable system health possible with available resources.

#### Road R&R Project Identification and Selection

R&R projects should be targeted for pavements that are no longer cost effective or feasible for improving with CPM fixes. These R&R projects should be targeted toward pavements that meet all of the following:

- Remaining Service Life (RSL) of 0-2 years, or Category I

- Locations with poor ride quality - International Roughness Index (IRI) greater than 170 inches/mile
- Sufficiency Surface Condition Rating equal to or greater than 4
- Distress Index (DI) equal to or greater than 50 is associated with RSL = 0. R&R can have RSL =2.
- Cost effective fix of less than \$70,000 per lane mile, in 2009 dollars (i.e. lane mile cost/project fix life value)
- Cost effective fix per Vehicle Miles Traveled (VMT) of less than 0.05 (i.e. total project cost/VMT/project fix life value)
- Cost effective fix per Commercial Vehicle Miles Traveled (CVMT) of less than 1.0 (i.e. total project cost/CVMT/project fix life value)
- Locations that benefit from coordination with safety enhancements, capacity improvement and/or expansion/local participation

*For more details on the condition factors listed above, see Chapter 4.*

In addition, locations that can be preserved for extended periods with cost effective rehabilitation, delaying the need for reconstruction, should be given priority.

### **Freeway R&R Projects**

As mentioned above, selecting appropriate locations for R&R will ensure that projects needing reconstruction will be cost effective and constructed at the appropriate time.

*Avoid putting HMA over concrete* When feasible, avoid creating new composite pavements (hot mix asphalt (HMA) over concrete). Composite pavements tend to deteriorate faster than non-composite pavements, requiring more maintenance and shorter pavement life in most cases.



A current MDOT goal, as defined by the Project Screening Committee and the Call For Projects Instructions, is to achieve an average annual rate of reconstruction (or long term major rehabilitation) of 1.5 percent of each region's freeway network lane miles. This recommended goal has been reduced from previous years in an effort to address the projected increase in Category I and II pavements, while still attempting to maintain the long term health of the system.



### **Non-Freeway R&R Projects**

The focus for the Non-Freeway system should be rehabilitation and CPM type projects, in order to improve the overall network condition. This concept is important to maintain, given the priority of the Freeway network strategy.

Currently, as defined by the Project Screening Committee and the Call For Projects Instructions, a region is limited to one small town (or less) of reconstruction per year. A small town is defined as an area outside of an

urbanized area boundary with population less than 50,000. The purpose of this requirement is to keep the limited available funds from being allocated in just a few areas, since MDOT has a significant statewide network to maintain.

*Avoid putting HMA over concrete*



Like with freeways, when feasible, avoid creating new composite pavements (HMA over concrete) and target locations to cost-effectively reduce the number of composite pavements.

### **Approved Road R&R Fixes**

Potential R&R fixes include, but are not limited to, the following:

#### **Rigid (Concrete) Pavement**

- Patching concrete pavement and repairing joints
- Restoring concrete pavement through full-depth pavement patching, joint and surface spall repair, joint/crack resealing and/or diamond grinding
- Rubblizing concrete pavement and applying a multiple-course HMA overlay
- Applying an unbonded concrete overlay
- Placing aggregate course 6" to 8" and applying a multiple-course HMA overlay
- Repairing existing pavement and applying a multiple-course HMA overlay
- Removing pavement and inserting a concrete inlay
- Reconstructing concrete pavement

#### **Flexible (HMA) Pavement**

- Repairing existing pavement and applying a multiple-course HMA overlay
- Milling existing pavement and applying a multiple-course HMA overlay
- Crushing and shaping pavement and applying a multiple-course HMA overlay
- Placing aggregate course 6" to 8" and applying a multiple-course HMA overlay
- Milling and/or removing pavement and inserting a HMA/concrete inlay
- Reconstructing HMA pavement

#### **Composite (HMA over Concrete) Pavement**

- Repairing and/or milling existing pavement and applying a multiple-course HMA overlay
- Placing aggregate course of 6" to 8" and applying a multiple-course HMA overlay

- Milling HMA and placing an HMA bond breaker and an unbonded concrete overlay
- Milling and removing pavement and inserting a HMA/concrete inlay
- Reconstructing pavement

### **Capital Preventive Maintenance for Roads**

The performance of a highway depends upon the type of material, age of pavement and the quality of the preventive maintenance it receives during the lifetime of the pavement.

#### **Types of Pavement Maintenance**

Pavement maintenance are classified into three groups: Capital Preventive, Reactive and Routine.

**Capital Preventive Maintenance** is the planned strategy of cost effective treatments to an existing roadway system and its appurtenances that preserves the system, retards the future deterioration, and maintains or improves the functional condition of the system without (significantly) increasing structural capacity. In essence, preventive maintenance activities protect the pavement and decrease the rate of deterioration. Examples of preventive maintenance include crack sealing, surface and joint seals, thin asphalt overlays, diamond grinding and concrete patching.


**Reactive Maintenance** consists of activities that must be done in response to events beyond the control of the Department. Some events require response as soon as possible to avoid serious consequences because a present or imminent danger exists. Reactive maintenance cannot be scheduled because some problems occur without warning and often must be immediately addressed. Examples of reactive maintenance activities include pothole patching, removing and patching pavement blowups, joint failures, unplugging drainage facilities or repairing washouts.

**Routine Maintenance** is the day-to-day maintenance activities that are scheduled or whose timing is within the control of maintenance personnel. Examples of routine maintenance include filling cracks in pavement, painting pavement markings and cleaning ditches.

**Road CPM Project Identification and Selection** (revised 3-17-14)

Delays in performing CPM work allow the quantity of pavement defects and their severity to increase, which in turn leads to an increase in cost to perform the fix. Consequently, this causes considerable increases in the life-cycle costs of the pavement (i.e. the cost of maintaining the pavement throughout its service life).

Emphasis should be placed on life cycle work (the effort to extend a pavement's service life), for both rigid and flexible pavement.

-  Appropriate CPM should be done until repair costs exceed the benefits derived from such activities or until the pavement structure needs to be reconstructed. This may require that CPM is performed on pavements at a more frequent interval. The basis of CPM should be consistent with the Region's overall preservation strategy.

*CPM Guidelines*



Selection for CPM projects can be assisted by using pavement condition data. Recommended pavement condition levels, for each preventive maintenance treatment, are listed in MDOT's CPM Program Guidelines and are shown in the Appendix. The condition levels listed have been identified to aid the engineer in determining the cost effectiveness for specific preventive maintenance treatments given an existing pavement condition.

On CPM mill and overlay/inlay projects the need for ADA improvements shall be considered when scoping the project (refer to Chapter 6 for sidewalk ramp upgrade warrants).

**Timing for CPM Activities**

CPM should be performed on pavements with:

- RSL of greater than or equal to 3 years — RSL categories II, III, IV, V and VI
- DI of less than 40

Routine maintenance should be performed on all pavements, including those which may require rehabilitation or reconstruction.

*When NOT to perform CPM* Normally, CPM should not be performed:

- On RSL Category I pavement
- On severely distressed pavement structures or pavements with a severely rutted cross section
- Beyond the outside edges of the shoulders or curbs

*Limitations of CPM* Minor safety work can be included in CPM projects, but such work should not be extensive. Examples of minor safety work include:

- Modification of pavement cross sections, by either milling or placing a HMA wedge course

- Replacement of non-standard, blunt and turned-down guardrail endings with standard guardrail endings
- Connection of guardrail to bridge rails and/or bridge piers
- Rumble strip placement and railroad crossing pavement markings

### **Approved Road CPM Fixes**

Potential CPM fixes include, but are not limited to:

#### **Flexible and Composite Pavement**

- Applying a single course of 1 ½ inch (165 lbs/syd) non-structural hot mix asphalt (HMA) overlay
- Milling the pavement surface and applying a single course of 1 ½ inch (165 lbs/syd) non-structural HMA overlay (Concrete Joint Repair and/or Detail 8 Joint repair as needed)
- Chip sealing (spraying the surface with asphalt then immediately covering with aggregate and rolling)
- Micro-surfacing (applying a mixture of polymer modified asphalt emulsion, mineral aggregate, mineral filler, water and other additives)
- Overband crack filling (overfilling a crack such that a thin layer of sealant is spread onto the pavement)
- Applying HMA shoulder ribbons (if existing shoulder is gravel)
- Applying an ultra-thin HMA overlay (an overlay of less than 1 inch in thickness)
- Applying a paver-placed surface seal
- Cleaning and repairing underdrain outlets

#### **Rigid (Concrete) Pavement**

- Full-depth patching (removal and replacement of a segment of pavement to the level of the subgrade in order to restore areas of deterioration)
- Resealing joints
- Repairing spalls
- Sealing cracks
- Diamond grinding (shaving the pavement surface with diamond-tipped saw blades to remove bumps, improve rideability and surface friction)
- Retrofitting dowel bars (placing dowel bars across joints and/or cracks that exhibit poor load transfer)
- Concrete pavement restoration
- Applying HMA shoulder ribbons (if existing shoulder is gravel)
- Cleaning and repairing underdrain outlets

## Safety Programs for Roads (revised 6-24-2019)

*How MDOT supports Michigan's Strategic Highway Safety Plan, and the goals of that plan*

The safety program is a major component in MDOT's emphasis of addressing locations with safety concerns as part of the Transportation Program. More importantly, the Safety Program is a means by which MDOT can support the goals of Michigan's Strategic Highway Safety Plan (SHSP). The purpose of a SHSP is to identify the key safety needs in the state and guide investment decisions to achieve significant reductions in highway fatalities and serious injuries on all public roadways. The Emphasis Areas in Michigan's SHSP include:

*The Safety Template and Safety focus areas*

- Alcohol/Drug Impaired Driving
- Commercial Vehicle Safety
- Drivers Age 24 and Younger
- Driver Behavior and Awareness
- Emergency Medical Services
- Intersection Safety
- Lane Departure
- Motorcycle Safety
- Occupant Protection
- Pedestrian and Bicycle Safety
- Senior Mobility and Safety
- Traffic Records and Information Systems

Michigan's SHSP was adopted in June 2008 by the Governor's Traffic Safety Advisory Commission and endorsed by the Governor in 2008.

For MDOT, the SHSP provides guidance in the allocation of the annual Safety Template to reduce crashes and fatalities, and to improve the safety and operational efficiency of the state trunkline system. Emphasis areas that are predominately addressed by the Safety Program are intersection safety and lane departure.

Toward Zero Deaths (TZD) is a statewide safety campaign based on the National Strategy on Highway Safety intended to influence driver behavior and improve safety. With more than 37,000 fatalities occurring on U.S. highways each year, roadway safety remains one of the most challenging issues facing Michigan and the nation. In 2013, Toward Zero Deaths: A National Strategy on Highway Safety (TZD National Strategy) was released, laying out a national vision of eliminating fatal crashes. It's a vision in which all U.S. highway safety stakeholders work collaboratively on a single initiative to save lives. The TZD National Strategy is meant to unify the many diverse efforts occurring around the nation to reduce and eventually eliminate fatal and serious-injury highway crashes. The national strategy outlines strategies and tactics that any group, organization or agency can use to reduce roadway fatalities for six emphasis areas: Drivers and Passengers, Vulnerable Users, Vehicles, Infrastructure, Emergency Medical Services and Safety Management. For MDOT it is the incorporation of safety into all of our projects as part of the Infrastructure emphasis area. In addition, we contribute to the remaining five areas by our efforts on projects and interactions with our partners. This is accomplished though using the state's Strategic Highway Safety Plan (SHSP) as our guide.



*How to identify unsafe locations*



Locations are identified where safety improvements can be made in support of key focus areas in Michigan's SHSP. Safety improvements include adding a center left turn lane, right turn lane, median protection and low cost safety improvements. These locations can be identified through a review of the current High Crash List, 3R/4R Safety Reviews, customer concerns and Pavement Friction Analyses.

*How to qualify for safety funding*



To qualify for safety funding, proposed projects must meet a Time-of-Return (TOR) as stated in the current Call For Projects instructions. For proposals in conjunction with another construction project, a separate job number is needed to fund the proposed safety improvement.

Safety projects are included in an MDOT region's pavement strategy analysis and condition goals where applicable.

## Bridge Network Strategy Development

### Rehabilitation and Replacement for Bridges

The purpose of the bridge program is to preserve MDOT's trunkline bridges. It is a balanced strategy made up of Replacement, Rehabilitation, CPM and Capital Scheduled Maintenance (CSM). The emphasis area of this program is to address the needs of all structures of critical concern, and maintain the freeway and non-freeway bridges in good or fair condition.

*MBRS*



As a priority on the network, MDOT must identify all the structures of critical concern. MDOT must continue to provide long-term fixes for these structures, removing them from the poor category when possible. The Michigan Bridge Reporting System (MBRS) can be used to download a spread sheet identifying serious and critical bridges.

An additional priority is to improve the overall condition of the bridge network to meet and sustain MDOT's current condition goal. Emphasis should be placed on targeting poor rated elements of freeway bridges when utilizing replacement and rehabilitation funds.

The Bridge Deck Preservation Matrix, in Appendix A-6, should be used when determining repair options for structures, and the average daily traffic (ADT) of the route carried by the bridge should be considered when determining the type of fix.

An additional priority is to provide sound long term management of MDOT's designated Big Bridges\*. At present, there are 29 Big Bridges identified in the network. These structures are managed centrally by the

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\* "Big Bridges" are defined as: those with a deck area greater than 100,000 square feet (there are 13); moveable bridges (there are 12); or those with segmental concrete girders or other unique construction (there are 4).

Bridge Operations Unit of Construction and Technology in Lansing, with input from Regions.

As with roads, MDOT follows the “Mix of Fixes” strategy for bridges. Implementing a balanced mixture of CPM, CSM and R&R projects will increase the number of bridges improved each year and preserve the overall health of the bridge network.

The condition of the bridge network varies among MDOT regions. Each region has developed a strategy tailored to meet the network needs. The Bridge Operations Unit is available to assist in the development of region bridge strategies. The R&R and CPM targets are based upon the number of bridges each region has that are candidates for that type of work. As each region nears or exceeds the bridge network goal, the region strategy is adjusted to focus more on bridge CPM in order to maintain the good condition of the network.

### **Bridge R&R Project Identification and Selection**

Rehabilitation (3R) is defined as work undertaken to extend the service life of an existing bridge. The intent of this work is to return a bridge to a condition of structural or functional adequacy. This work may include upgrading geometric features such as bridge widening (no increase in number of through lanes). Examples of this work are shallow and deep concrete overlays, superstructure repairs, extensive substructure repairs and substructure replacement.


Replacement (4R) involves substantial changes to the existing structure, such as bridge deck replacement, superstructure replacement or complete structure replacement. Bridge Projects with proposed work of 3R & 4R, on the NHS network, may require a meeting with the FHWA to discuss oversight requirements. Early coordination with FHWA is recommended to avoid changes to the scope during the design phase. FHWA oversight is generally determined by the Region System Managers in the fall of every year. This is accomplished by meeting together with the FHWA area engineer and discussing the Five Year Program and following the guidelines in the FHWA Oversight Matrix.

### **Approved Bridge R&R Fixes**

- Applying a shallow overlay on the deck (hydro-demolishing the deck surface to a depth of  $\frac{3}{4}$  inch, then applying a latex-modified concrete that is typically 1  $\frac{1}{2}$  inch thick)
- Applying a deep overlay on the deck (hydro-demolishing to remove the deck concrete below the top reinforcement, replacing deficient rebar, and placing a Grade 45 D Modified concrete such that a depth of 3 inches covers the top transverse reinforcement)
- Repairing the bridge superstructure (the part of the bridge above the piers and abutments, typically steel or concrete beams, girders and stringers that support the deck)

- Repairing the bridge substructure (the piers and abutments which carry the superimposed load of the superstructure to the underlying soil or rock)
- Replacing the deck
- Replacing the bridge rail
- Replacing and widening the superstructure (to maintain same number of lanes)
- Replacing the entire bridge
- Replacing a culvert (10-20 feet)
- Adding lanes to the bridge via one or more of the following:
  - Widening the bridge
  - Replacing and widening the deck
  - Replacing and widening the superstructure
  - Replacing the bridge

### **Capital Preventive Maintenance for Bridges**

 CPM work is defined as bridge activities that will repair and preserve the bridge. CPM is performed with the understanding that future rehabilitation or replacement projects contain appropriate safety and geometric enhancements. Design Exceptions are not required for CPM or CSM work.

#### **CPM Project Identification and Selection**

Bridge CPM projects are identified as bridges with elements that are rated in fair condition with the intent of the project as improving these elements to a good rating. CPM projects deal with limited bridge elements, as indicated below with the list of CPM fixes for bridges.

#### **Approved Bridge CPM Fixes**

CPM bridge activities include:

- Replacing pins and hangers
- Painting zones of the bridge beams
- Complete painting of beams
- Patching the deck
- Patching the bridge substructure (minor)
- Applying a hot mix asphalt (HMA) cap (with no waterproofing membrane)
- Applying an HMA overlay (with waterproofing membrane)
- Installing scour countermeasures

- Replacing joints
- Applying an epoxy overlay

### Capital Scheduled Maintenance for Bridges

*MDOT's Bridge Capital Scheduled Maintenance Manual*



The Capital Scheduled Maintenance (CSM) program is part of the development of MDOT's Strategic Investment Plan for Trunkline Bridges. A portion of the overall budget within the Bridge Preservation template was set aside to establish resources for preserving bridges in their current condition for a longer period of time. More information about the CSM program can be found in MDOT's Bridge Capital Scheduled Maintenance Manual, online at

[www.michigan.gov/documents/mdot\\_CSM\\_Manual04\\_89342\\_7.pdf](http://www.michigan.gov/documents/mdot_CSM_Manual04_89342_7.pdf)

### Bridge CSM Project Identification and Selection

*What to consider when choosing a CSM project*

When identifying and selecting a CSM project the following general concepts should be considered:



- The anticipated work should have little or no impact to traffic and have very little maintaining traffic costs
- The work should be of short duration, typically completed within one working day
- The work should be focused on activities that if left unattended will cause deterioration of the structure leading to more expensive repairs
- Priority should be given to corridors where the same small task can be performed on many bridges

Bridges that are good candidates for CSM work activities should be fairly close together so they may be grouped into one project. There are two ways to bundle projects for these work activities: set up a project to do one work activity on a group of bridges, or take a group of bridges and do all of the work activities that are necessary to that group. The Region Bridge Engineer may package the contract as it best suits the bridge network.

### Approved Bridge CSM Fixes

CSM activities include:

- Washing the superstructure
- Removing vegetation
- Cleaning and/or repairing the drain system
- Spot-painting
- Resealing bridge construction joints
- Sealing concrete

- Sealing deck cracks
- Minor concrete patching
- Repairing bridge deck spalls
- Provide pressure relief joints in the concrete bridge approach
- Repairing or replacing spot locations of failed or damaged slope paving

## Other Strategies

The Department has strategies for public transportation, aviation and bike/pedestrian safety and accessibility included in the MDOT State Long Range Transportation Plan.

### **Road Diet**

This is a strategy employing a reduction in existing lanes or lane widths to accommodate evolved transportation needs within or along the roadway. These needs may include among other features, center turn lanes, bicycle lanes, sidewalks or to induce traffic speed reduction (traffic Calming) within a corridor. Use of road diet techniques must be presented to the Engineering Operations Committee for information only. Support for the road diet must be locally supported in the form of a city council resolution. Also see “Geometric Considerations” in Chapter 6.

### **Roundabouts**

This should be considered as a potential intersection option within MDOT-sponsored or funded planning studies/design projects since they offer improved safety, cost savings, and enhanced traffic operations in many situations. The option to include the roundabout requires Engineering Operations Committee approval.

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