Michigan Department of Transportation

LOCAL AGENCY PROGRAMS
GUIDELINES FOR GEOMETRICS
ON
LOCAL AGENCY PROJECTS

2017 Edition

INCLUDING GUIDELINES FOR:

New Construction/Reconstruction (4R)
Resurfacing, Restoration, and Rehabilitation (3R)
Preventive Maintenance (PM)
and
Design Exceptions/Design Variances

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Development Services Division Administrator — Date
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Section

GENERAL

(Section A)

GENERAL

This manual provides information and guidelines upon which to base the design of federal and state funded local agency road and bridge projects administered through Local Agency Programs (LAP) of the Michigan Department of Transportation (MDOT). Depending upon the type of project work, these guidelines allow some latitude from the road and bridge geometrics required by the American Association of State Highway and Transportation Officials (AASHTO).

A project may be designed based upon one of two different guidelines which have been adopted and approved by the Michigan Division of the Federal Highway Administration: 1) The AASHTO current edition of *A Policy on Geometric Design of Highways and Streets*, or applicable MDOT guidelines for new construction/reconstruction; or 2) this document, *Michigan Department of Transportation Local Agency Programs Guidelines for Geometrics*. The latter includes guidelines for New Construction/Reconstruction (4R); Resurfacing, Restoration and Rehabilitation (3R); Preventive Maintenance; and Design Exceptions/Design Variances.

The National Association of City Transportation Officials (NACTO) also provides helpful recommendations. The NACTO Urban Street Design Guide, and Urban Bikeway Design Guide are useful tools and resources for consideration in the development of context sensitive multi-modal facilities. However, AASHTO national guides remain the standard for planning and designing Michigan roadways and multi-modal facilities.

The guidance supplied by AASHTO's *A Policy on Geometric Design of Highways and Streets* is based on established practices supplemented by recent and continuing research. The intent of this publication is to provide a reference manual for assisting in the design of roads and bridges. As stated in the foreword to 2011 AASHTO's *A Policy on Geometric Design of Highways and Streets:*

> "The intent of this policy is to provide guidance to the designer by referencing a recommended range of values for critical dimensions. Sufficient flexibility is permitted to encourage independent designs tailored to particular situations. Minimum values are either given or implied by the lower value in a given range of values. The larger values within the ranges will normally be used where the social, economic, and environmental (S.E.E.) impacts are not critical."

TRB Special Report 214, *Designing Safer Roads: Practices for Resurfacing, Restoration, and Rehabilitation, 1987* is the basis of the 3R guidelines in this document.

Design of projects on roads, streets, and bridges under local jurisdiction, regardless of funding, which are listed on the National Highway System (NHS), shall be in accordance with applicable AASHTO guidelines and MDOT Non-Freeway NHS 3R Guidelines, available at link:
http://mdotcf.state.mi.us/public/design/englishroadmanual/ section 3.09.)

Local Agency projects non-NHS	Local Agency projects on NHS
Use AASHTO or this document	Use AASHTO or MDOT Non-Freeway NHS 3R Guidelines (see link above)

Summary of Changes:

The following is a summary of the major changes from the LAP Guidelines for Geometrics on Local Agency Projects dated 03/04/14.

- ..... The Controlling Criteria for which Design Exceptions are required have been updated to reflect new FHWA Guidance. This reduces the number of design elements for which a Design Exception would be required, especially on projects for which design speed is less than 50 mph. In addition, MDOT has chosen to continue documentation of these dropped design elements by creating a Design Variance process that will essentially mimic the design exception process in intent, but may allow for less stringent documentation procedures. This will limit the use of Design Exceptions and allow the use of Design Variances, which will determine the level of review required by MDOT.

- ..... Safety Funded projects will no longer be required to prepare a 3-year crash analysis as previously required under 3R, due to the Safety project selection process utilizing safety analysis.

- ..... Paved shoulders under 3R have become increasingly more required versus desired at higher ADT, due to safety concerns and the increased use of shoulders by the non-motoring community.

- ..... Preventative Maintenance approved road treatments have been expanded to include additional treatments.

- ..... A new section on Bridge Preventive Maintenance approved treatments was included in the Preventive Maintenance.

- ..... Existing bridge railings may be retained with Preventive Maintenance treatments up to 1.5 inch HMA, either as an initial overlay on original deck, or as a mill and fill treatment.

- ..... Parabolic Crowns are no longer able to remain under 3R work, and must now be corrected.

- ..... Intersections where Preventative Maintenance concrete patches exceed 50% of the intersection area, ADA sidewalk compliance must now be completed.

NEW CONSTRUCTION / RECONSTRUCTION (4R)

(Section B)

NEW CONSTRUCTION/RECONSTRUCTION (4R)

The design of any federal or state funded new construction or reconstruction project on a road or bridge under local jurisdiction shall, at a minimum, be designed using the FHWA approved current AASHTO guidelines.

Definition of Work Type:

Projects that are mainly comprised of the following types of work are considered new construction or reconstruction:

1. Complete removal and replacement of pavement.
2. Major alignment improvements.
3. Adding lanes for through traffic.
4. New roadways and/or bridges.
5. Complete bridge deck or superstructure replacement.
6. Reconstruction of the roadway pavement, including more than 50 percent of the subbase or subgrade, exclusive of such work as rubblizing, crushing and shaping.
7. On aggregate surface roadways, reconstruction is defined as involving more than 50 percent of the subbase.

The above list is not all inclusive, but is intended to give typical examples of new construction or reconstruction work.

Refer to Michigan Design Manual, Road Design Section 3.08.01.B for current definition of 4R projects. If any discrepancies exist between these guides and Section 3.08.01.B, then Section 3.08.01.B shall prevail except for Items 6 and 7 listed above. The following type of work found in Section 3.08.01.B is exempt from these 4R guidelines, "Intermittent grade lifts that leave the existing pavement in service for less than 50% of the total project length."

Bridge Widths:

For new construction or reconstruction, bridges should be designed to the minimum clear roadway width recommended by the current AASHTO in *A Policy on Geometric Design of Highways and Streets*. Bridge widths designed in excess of the maximum AASHTO guidelines must be justified in writing (but will not require a design exception or design variance). In no case may the approach roadway width used to determine the clear bridge width, be less than the corresponding lane/shoulder widths in the 3R guidelines.

The "traveled way" in the AASHTO bridge width tables refers to the minimum width of traveled way (i.e., total lane width) for new or reconstructed roadways, as shown in the appropriate AASHTO table. Approach roadway width is the width of traveled way plus graded shoulders, also as shown in AASHTO.

New construction or reconstruction for road or bridge projects on the NHS must be designed, at a minimum, to applicable AASHTO guidelines.

Design Speed

The design speed selected for new construction or reconstruction projects shall be in accordance with the following criteria:

- The recommended design speed is 5 miles per hour (mph) over the posted or regulatory speed.
- The minimum design speed without a design exception is the posted or regulatory speed, or 55 mph if the road is not posted in rural areas, or 25 mph if the road is not posted in urban areas.

Shoulder Width

The shoulder width for new construction or reconstruction should be in accordance with AASHTO and the following criteria:

- If the approach roadway shoulder exceeds 4 feet, then a minimum 4 feet (3 feet paved) shoulder is acceptable adjacent to right turn lanes.
- However, if AASHTO requirements are less than 4 feet, then the shoulder width adjacent to the right turn lane should, at a minimum, meet the AASHTO requirements.

NON-NHS

RESURFACING, RESTORATION AND REHABILITATION (3R)

(Section C)

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Non-NHS
Resurfacing, Restoration, and Rehabilitation (3R)

APPLICATION OF THE 3R GUIDELINES

These guidelines for Resurfacing, Restoration, and Rehabilitation (3R) are applicable to federal or state funded projects on roads and bridges under local agency jurisdiction which are NOT on the National Highway System (NHS) in Michigan. For features not addressed in these 3R guidelines, the requirements of AASHTO's current guide entitled *A Policy on Geometric Design of Highways and Streets* or applicable Michigan Department of Transportation guidelines will govern.

The 3R work is defined in 23 CFR (Code of Federal Regulations) as "*work undertaken to extend the service life of an existing highway and enhance highway safety. This includes placement of additional surface material and/or other work necessary to return an existing roadway, including shoulders, the roadside and appurtenances to a condition of structural or functional adequacy. This work may include upgrading of geometric features, such as widening, flattening curves or improving sight distances*."

Examples of this type of work include:

1. Resurfacing, milling or profiling.
2. Lane and/or shoulder widening (no increase in number of through lanes).
3. Roadway base correction.
4. Minor alignment improvements.
5. Roadside safety improvements.
6. Signing, pavement marking and traffic signals.
7. Intersection and railroad crossing upgrades.
8. Pavement joint repair.
9. Crush and shape and resurfacing.
10. Rubblize and resurface.
11. Passing relief lanes.
12. Reconstruction of the roadway pavement, including less than fifty (50) percent of the subbase or subgrade.

Refer to the Michigan Department of Transportation Road Design Manual, Section 3.08.01.A for current definition of 3R projects.
See Link: http://mdotcf.state.mi.us/public/design/englishroadmanual/

If any discrepancies exist between these guides and Section 3.08.01.A then Section 3.08.01.A shall prevail except for Item 14 listed above. The following type of work found in Section 3.08.01.A is exempt from these 3R guidelines, "*Intermittent grade lifts that leave the existing pavement in service for more than 50% of the total project length.*"

Combined 3R and 4R Work

If a project includes 3R and 4R work, the applicable standards are governed by the standards that correspond individually to each work type (3R or 4R). Identify the logical limits of each work type on the project information sheet to distinguish where 3R guidelines and 4R standards are separately applied. Work type overlap between separation limits may cause a default to 4R standards within the overlap. When other work types are combined with 3R or 4R projects, they are also governed separately and identified as such on the project information sheet.
See Section 3.08.01D.

Controlling Elements Subject to Formal Design Exception or Design Variance:

The following ten design elements are subject to a formal Design Exception request if the Design Speed is 50 mph or greater. If the project has a Design Speed of 45 mph or below, the following elements would require a Design Variance, with the exception being Design Speed, Design Loading Structural Capacity, and Vertical Clearance which always requires a Design Exception.

1. Design Speed
2. Shoulder Width
3. Lane Width
4. Design Loading Structural Capacity
5. Horizontal Curve Radius
6. Stopping Sight Distance
7. Maximum Grade
8. Cross Slope
9. Superelevation Rate
10. Vertical Clearance

Non-Standard Design Element (NHS & Non-NHS)	Applicability of Design Exception (DE) or Design Variance (DV)	
	Design Speed	
	≥50 mph	< 50 mph
Design Speed < Posted Speed	DE	DE
Shoulder Width	DE	DV
Lane Width*	DE	DV
Horizontal Curve Radius*	DE	DV
Superelevation Rate*	DE	DV
Vertical Clearance	DE	DE
Maximum Grade*	DE	DV
Stopping Sight Distance (HSO & K-value horizontal & vertical)*	DE	DV
Cross Slope	DE	DV
Design Loading Structural Capacity	DE	DE

**Values based on design speeds less than posted.*

When 3R guidelines are not met for any one of these controlling elements, a formal request for a Design Exception, or a Design Variance should be prepared during the scoping process by the local agency representative preparing the scope and sent to the appropriate Local Agency Programs Staff Engineer for approval. Each request for a Design Exception, or Design Variance should be accompanied by a justification explaining why non-NHS 3R minimum guidelines are not being met. It should include a crash history evaluation, the estimated total cost required to attain non-NHS 3R guidelines, and a simple cost/benefit analysis. When requesting exceptions, or variances to design elements on Heritage Routes, it is important to address the fact that the requested exception, or variance is based on historic, economic, or environmental concerns for the preservation of the natural beauty or historic nature of the facility.

The design exception/variance requests are to be submitted on the following MDOT forms:

Design Exception: MDOT Form DE26-LA can be obtained at:
http://mdotjboss.state.mi.us/webforms/GetDocument.htm?fileName=DE26-LA.pdf

Design Variance: MDOT Form DV26-LA can be obtained at:
http://mdotjboss.state.mi.us/webforms/GetDocument.htm?fileName=DV26-LA.pdf

See Section E for more details.

<table>
<tr><th>Geometric Elements</th><th colspan="3">3R Minimum Guidelines: Non-NHS</th></tr>
<tr><td rowspan="4">Design Speed

Shoulder Width
NOTE: Minimum shoulder widths apply for posted speeds greater than 45 mph. Restrictions such as right of way and roadside context sensitivity issues may preclude the use of minimum shoulders within city, village or township limits with posted speeds of 45 mph and less.</td><td colspan="3">Posted Speed Minimum</td></tr>
<tr><td>Current ADT
Two-Way</td><td colspan="2">Inside and Outside Shoulder Width</td></tr>
<tr><td>≤750

750-2000

>2000</td><td colspan="2">2'-0" (Gravel)

3'-0" (with 1’-0” Paved required when a 3R Safety review shows a pattern of lane departure crashes.)

6'-0" (with 3'-0" Paved required)</td></tr>
<tr><td>Multi-Lane
(Divided &
Undivided)</td><td>Inside
(Divided)
3'-0" Paved</td><td>Outside
(Both sides for un-divided)
6'-0" (3'-0" Paved)</td></tr>
<tr><td rowspan="2">Lane Width</td><td>Current ADT
Two-Way</td><td colspan="2">Lane Width*
(excluding curb and gutter or shy distance from face of curb)</td></tr>
<tr><td>≤750

>750</td><td colspan="2">10'-0"
(Lane width may be 9' where design speed ≤ 35 mph and ADT ≤250)
11'-0"
10'-0" lanes with curb and gutter may be retained in urban areas for multi-lane un-divided (regardless of ADT) and multi-lane divided (ADT < 10,000) without crash concentration.

12'-0" lanes are desirable on designated truck routes and the Priority Commercial Network (PCN) or where truck traffic ≥10%</td></tr>
<tr><td rowspan="6">Bridge Width, Structural Capacity & Horizontal Clearances

(Existing Bridges to remain in place)</td><td>ADT
Two-Way
(Design Year)</td><td>Minimum
Design
Loading</td><td>Usable Width</td></tr>
<tr><td>0-750</td><td>H15</td><td>Width of approach lanes.</td></tr>
<tr><td>751-1500</td><td>HS 15</td><td>Width of approach lanes.</td></tr>
<tr><td>1501-2000</td><td>HS15</td><td>Width of approach lanes plus 1' each side.</td></tr>
<tr><td>2001-4000</td><td>HS15</td><td>Width of approach lanes plus 2' each side.</td></tr>
<tr><td>>4000</td><td>HS15</td><td>Width of approach lanes plus 3' each side.</td></tr>
<tr><td rowspan="2">Horizontal/Vertical Alignment and Stopping Sight Distance</td><td>Vertical</td><td colspan="2">0-20 mph less than project design speed may be retained without crash concentration.</td></tr>
<tr><td>Horizontal</td><td colspan="2">0-15 mph less than project design speed may be retained without crash concentration.</td></tr>
<tr><td>Grade</td><td colspan="3">Review crash data. Existing grade may be retained without crash concentration.</td></tr>
<tr><td>Cross Slopes</td><td colspan="3">1.5% Minimum – 2% Maximum (refer to page C-9 for further guidance)</td></tr>
<tr><td>Superelevation</td><td colspan="3">MDOT Standard Plan R-107-Series; reduced maximum (6%) Straight Line Superelevation chart; or AASHTO requirements with max e=6%.</td></tr>
<tr><td>Vertical Clearance</td><td colspan="3">Maintain 14'-0” minimum.</td></tr>
</table>

*Outside lanes: Lane width for outside lanes are measured to the edge of metal of the curb and gutter, or in the case of concrete pavement with integral curb, a 1 foot minimum shy distance from face of curb will be maintained and may not be considered as lane width.

SAFETY REVIEW AND CRASH ANALYSIS

A safety review (3-year period) shall be performed on each 3R project before starting design work. Including a review of future crash potential is recommended utilizing HSM (Highway Safety Manual) or other predictive analysis. This safety review should include an analysis of available crash data to determine where safety enhancements are warranted. Safety Projects which are selected for Safety Funding, will not be required to do a crash analysis, as they have already undergone a comprehensive safety review during the application process.

The 3R project should incorporate features that alleviate any excessive crash patterns identified during the review. This should be considered regardless of other minimum requirements shown elsewhere in this guideline.

The designer should consider site specific conditions related to all users, to determine the appropriateness for making safety improvements. Considerations include an evaluation of the costs as well as the impacts of improvement alterations. Documentation of the decision-making process should be placed in the local agency's project file.

DESIGN TRAFFIC VOLUME (ADT)

According to Special Report 214 (recommendation 14, page 204), "The design traffic volume for a given highway feature should match the average traffic anticipated over the expected performance period of that feature". Therefore, the design ADT for a given feature should match the average ADT anticipated over the service life of the affected feature such as alignment and widths. However, based on the type of proposed work, the ADT may range from the present design life to the anticipated design life.

DESIGN SPEED

There are two methods that can be used to select the design speed for 3R projects. These may be used alone or in combination.

- Select an overall design speed greater than or equal to the posted regulatory or prima facie speed on the section being improved.
- Determine the 85th percentile speed for the feature being designed, such as horizontal curves or vertical curves. (Documented speed study is required to apply this method.)

BRIDGES TO REMAIN

If lane widening is planned as part of the 3R project, the usable bridge width should be compared to the approach width after widening.

- These values do not apply to bridges greater than 100 feet in length. These structures should be evaluated individually according to clear width provided, traffic volume,

remaining life of the structure, pedestrian volume, snow storage, design speed, crash record, and other pertinent factors.

The designer should evaluate retention of an existing bridge if the bridge is less than 100 feet long and the usable width or structural loading of the bridge is less than shown in the table on page C-6.

When evaluating the replacement or widening, consider the following:

- Cost of replacing the existing bridge with a wider bridge designed to AASHTO guidelines for new bridges.
- Cost of widening the existing bridge (if practical).
- Review of available crash data.
- Structural condition of the existing bridge.

If the guidelines for Design Loading Structural Capacity are not met, a design exception is required.

All approach guardrails must be anchored to the bridge, meeting current standards.

BRIDGE RAILINGS

Evaluation of all existing bridge railings to be left in service that have not been successfully crash-tested should be made. Retro-fitting the existing bridge railing to provide additional strength and safety characteristics in lieu of replacement of the entire rail system with a crash-tested rail may be cost effective and feasible.

Existing bridge rail may remain in place if it meets AASHTO static load requirements. Otherwise, the bridge rail shall be replaced or retrofitted to meet current AASHTO guidelines.

HORIZONTAL/VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

Horizontal Curves

Without crash concentrations that warrant revision, existing horizontal curves with a design speed which is 0-15 mph less than the posted speed may be retained without further documentation. However, the operation and safety should be improved to the extent feasible through such elements as superelevation modifications, removing crown, and removal of sight obstructions to improve stopping sight distance. When the horizontal alignment does not meet the posted speed, applicable traffic control devices should be installed according to the current Michigan Manual of Uniform Traffic Control Devices.

A decision not to reconstruct an existing horizontal curve where the curve design speed is more than 15 mph below the posted speed shall be supported with the applicable design exception or design variance.

Vertical Curves

CREST - Without crash concentration and/or other geometric features such as:

- intersections
- lane drops
- horizontal curves warranting consideration,

existing vertical curves with a design speed 0-20 mph less than the posted speed do not require a design exception. However, designers should examine the nature of potential hazards in relation to sight distance and provide warning signs when appropriate.

SAG - In general, all sag vertical curves may be retained unless a safety review indicates a problem with crashes.

SIDE SLOPES

Side slopes should be flattened as much as cost considerations and conditions permit. Review crash history for improvement needs. Special consideration should be given to the following:

- Where run-off road crashes are likely to occur (i.e., outside of horizontal curves), side slopes steeper than 1:3 within existing right-of-way should be flattened as much as conditions permit.
- Retain the current rate of side slopes when widening lanes and/or shoulders, unless steeper slopes are warranted by special circumstances. This often requires new ditches; however, the fore-slopes should not be steepened beyond the existing fore-slope rate (existing rates flatter than 1:4, may be steepened to 1:4).

CROSS-SLOPES AND SUPERELEVATION

- 3R projects that include resurfacing pavement, cross-slopes should be restored to new construction standards. Parabolic crowns will not be allowed.
- The 2 percent maximum cross-slope can vary if supported by AASHTO requirements based on roadway classification.
- Superelevation rates on horizontal curves should be increased if necessary, to the appropriate rate for new construction for the design speed.

CLEAR ZONE

A uniform clear zone for all users is desirable for the project length. Special consideration should be given to the following:

- Removing, relocating, and/or shielding isolated roadside obstacles on the fore-slope or roadside ditches, particularly in target areas and non-recoverable fore-slopes.
- Removing, relocating and/or shielding roadside obstacles with recorded crash concentrations.
- If run-off road crashes are not concentrated in any location, but there is a significant number distributed throughout the project, consider widening the average clear zone for the length of the project.

TREE REMOVAL

Tree removal will be selective and generally "fit" conditions within the existing right-of-way and character of the road. The AASHTO *Roadside Design Guide* presents ideal clear zone distance criteria; however, these distances are not always practical in Michigan. Consequently, trees within the clear zone should be considered for removal subject to the following criteria:

- **Crash Frequency** - Where there is evidence of vehicle-tree crashes either from actual crash reports or scarring of the trees.
- **Outside of Horizontal Curves** - Trees in target position on the outside of curves with a radius of 3000 feet or less.
- **Intersections and Railroad** - Trees that are obstructing adequate sight distance or are particularly vulnerable to being hit.
- **Volunteer Tree Growth** - Consider removal of volunteer trees within the originally intended tree line. Volunteer trees are those that have naturally occurred since original construction of the road.
- **Maintain Consistent Tree Line** - Where a generally established tree line exists, consider removing trees that break the continuity of this line within the clear zone.
- **Clear Zone –** Refer to Michigan Design Manual Road Design Section 7.01.11B for treatment/consideration of obstacles inside the calculated project clear zone. Review crash history for need for spot improvements.

ROADSIDE OBSTACLES

Roadside improvements should be considered to enhance safety. Improvements may include removal, relocation, redesign, or shielding of obstacles such as culvert headwalls, utility poles, and bridge supports that are within the clear zone as referenced in Michigan Design Manual Road Design Section 3.09.03C.

A review of crash history, or future crash potential will provide guidance for possible treatments. However, treatment of some obstacles such as large culverts can add significantly, perhaps prohibitively, to the cost of a project. This means that in most instances only those obstacles that

can be cited as specifically related to crashes or can be improved at low-cost should be included in the project. Ends of culverts that are within the clear zone should be considered for blending into the slope.

GUARDRAIL

An analysis (including an onsite inspection of height, length and overall condition) should be made of all existing guardrail installations to determine if continued existence or removal is appropriate. Refer to MDOT Road Design Manual for further guidance on guardrail requirements. The allowable variation from standard height is detailed in Michigan Design Manual Road Design Section 7.01.41B.

Evaluation of Guardrail and Bridge Rail

- Onsite inspection of height, length, and overall condition should be done to determine guardrail upgrading needs
- Type A guardrail may be retained on cul-de-sacs or "T" intersections. Type A guardrail and two cable guardrail will be replaced at other locations
- Blunt ends and turned down endings shall be upgraded to current standard terminals.
- Unconnected guardrail to bridge rail transitions shall be connected or upgraded to current standards.
- Existing bridge rail may remain in place if it meets AASHTO static load requirements. Otherwise, the bridge rail shall be replaced or retrofitted to meet current AASHTO guidelines.
- By Federal mandate, existing Breakaway Cable Terminals (BCT) must be removed on 3R projects on the NHS. Refer to Michigan Design Manual Road Design Section 7.01.41B for upgrading guardrail terminal guidelines.
- If a non-motorized path or bike facility (existing or proposed) runs behind the face of the guardrail, the addition of a "rub-rail" and sufficient clear zone for the path should be included.

Refer to AASHTO Roadside Design Guide when determining if the installation of guardrail is warranted. Special consideration should be made to fill sections (AASHTO figure 5.1), clear zone is not free of obstacles, slopes are non-recoverable with hazards at the landing zone, or at any location that requires guardrail based on the traffic crash history analysis.

INTERSECTION DESIGN

Designers should evaluate existing intersections when there is evidence of crashes related to existing conditions, or future crash potential. Such intersections should be reviewed during design and safety improvements and should be included in the project where practical and feasible. All available crash data for all users should be utilized in the field review of the intersection.

Safety measures, as discussed in the Supplemental Safety Measures herein, can be utilized to mitigate safety concerns at intersections. Warning panels/signs should be installed where appropriate.

TRAFFIC CONTROL DEVICES

Signs, pavement markings, and traffic signal controls shall be installed in accordance with the current *Michigan Manual of Uniform Traffic Control Devices* (MMUTCD).

SIGNING

Consideration should be given to upgrading sign reflectivity, supports, and locations.

SUPPLEMENTAL SAFETY MEASURES

The design of highways provides a range of supplemental measures that can be utilized alone or in combination with others to mitigate deficiencies in controlling elements to provide for safer roadways. Where reconstruction of a roadway feature, such as a horizontal curve, vertical curve, intersection or bridge, is not feasible or prudent because of economic, social or environmental concerns, alternative safety measures should be considered. Treatments can be, but are not limited to:

Concern	Supplemental Safety Measure	
Narrow lanes and shoulders	Pavement edge lines Paved shoulders Permanent pavement markers Post delineators Warning signs	Safety Edge Rumble Strips/Stripes
Steep side slopes; roadside obstacles	Warning signs Round ditches Breakaway hardware Install guardrail	Slope flattening Obstacle removal Post delineators Rumble Strips/Stripes Safety Edge
Narrow bridge	Traffic control devices Pavement markings	Approach guardrail Warning signs
Poor sight distance at hill crest	Traffic control devices Driveway relocation	Shoulder widening Warning signs
Horizontal curve	Traffic control devices Appropriate superelevation Slope flattening Post delineators Permanent pavement markers	Shoulder widening Advisory signs Obstacle removal High Friction Surface

Intersections	Traffic control devices	Traffic signalization
	Fixed lighting	Speed controls
	Advisory signs	Rumble strips
	High Friction Surface	

PREVENTIVE MAINTENANCE (PM)

(Section D)

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Non-NHS
Preventive Maintenance (PM)
(Section D)

PREVENTIVE MAINTENANCE

Preventive maintenance projects are defined as cost-effective projects designed to preserve the existing pavement and base, and give extended life to a roadway without undertaking reconstruction or major rehabilitation. The intent of a preventive maintenance program is to implement a planned strategy of cost effective treatments to an existing roadway system and its appurtenances that preserve the system, retards future deterioration, and maintains or improves the functional condition of the system without increasing structural capacity.

Preventive maintenance projects have the following characteristics:

- Do NOT increase lane widths.
- Do extend pavement life (typically 1-7 years).
- Do NOT exceed an application thickness of more than 1.5 inches of hot mix asphalt (HMA) material; however, in certain cases the use of 2 inch overlays may be approved.
- Have base courses in good condition. If base or sub-grade rutting appears to be present, preventive maintenance projects should not be applied until the structural deficiency is corrected.

Approved Preventive Maintenance Treatments

There are many acceptable ways to effectively extend the service life of a roadway, and a list of the currently approved treatments is included as Appendix D-1. Distress guidelines are provided for the application of each approved treatment utilizing the Pavement Surface Evaluation and Rating (PASER) system. In order to qualify as an approved preventive maintenance treatment, the majority of the pavement which the treatment is applied to, shall be within the PASER guidelines outlined in Appendix D-1 or as an alternative preventative maintenance treatment outlined below.

PASER ratings that are acceptable for the evaluation of guidelines include ratings from the Transportation Asset Management Council's annual statewide data collection effort or from a PASER data collection effort by the local agency, at the discretion of the agency that has jurisdictional ownership of the pavement in question.

Brief descriptions of the approved preventive maintenance treatments are included in Appendix D-2.

Approved CPM Treatments for Economic Development Category C funding

These treatments are defined as those that provide "Functional Enhancement" to the pavement. They are:

Non-Structural HMA Overlay (1.5")
Surface Milling with Non-Structural HMA Overlay (1.5")
HMA Shoulder Ribbons
Full Depth Concrete Pavement Repairs
Diamond Grinding

Dowel Bar Retrofit
Underdrain Outlet Clean Out and Repair
Concrete Pavement Restoration
Including the use of: joint spall repair, surface spall repair, joint/crack sealing, full depth repairs, and diamond grinding.

Complementary Treatments

The use of two or more preventive maintenance treatments is acceptable when they serve a complimentary purpose. For example, crack filling or repair of a pavement prior to applying a chip seal is an acceptable practice and will extend the life of the chip seal. Where complementary treatments are planned to be utilized, the less restrictive PASER range of the two treatments as shown in Appendix D-1 shall apply.

Approval of Alternative Preventive Maintenance Treatments

A local agency can request to use an alternate treatment not included in Appendix D-1. The local agency will need to provide information to demonstrate that the alternative treatment will extend the service life of the roadway in a cost-effective manner and has benefits (financial, operational, or otherwise) exceeding existing approved treatments. Proposed treatments may not be accepted by MDOT if adequate information is not supplied on the proposed treatment. The information provided to MDOT must indicate why the alternative treatment is desired and the expected results of the treatment. The information must include supporting documentation to substantiate the anticipated benefit of the treatment and the anticipated life extending benefit to the pavement. If the alternative treatment has not been widely used in Michigan, information must also be submitted that demonstrates it is a suitable treatment when Michigan's climate is considered.

Design Exceptions

Design Exceptions, or Design Variances, are not required and are not allowed for preventive maintenance projects.

Safety Review and Crash Analysis

A 3-year safety review is required for preventive maintenance projects, unless utilizing Safety Funding. At a minimum, the safety review should contain the most recent 3 years of crash data and a letter signed by a licensed engineer that describes the crash history and determines if there is a correctable crash pattern in areas that the project could reasonably address. A review of future crash potential is recommended utilizing HSM (Highway Safety Manual) or other predictive analysis.

Where the safety review indicates an existing problem, area the project shall be modified in accordance with 3R, AASHTO, or applicable MDOT guidelines; however, geometric changes will not be required on preventive maintenance projects. At a minimum, pavement markings shall be applied to the roadway as part of the preventive maintenance project, existing guardrail conditions along the route shall meet the criteria detailed in Section C (3R) of these guidelines, and signs that are damaged or are without reflectivity must be replaced with new signs with reflective sheeting. Signs required by the Michigan Manual of Uniform Traffic Control Devices

that are not currently installed must be installed as part of a preventive maintenance project. Existing bridge railings may be retained with Preventive Maintenance treatments up to 1.5 inch HMA, either as an initial overlay over the original deck, or as a mill and fill treatment.

All preventive maintenance projects should consider appropriate ways to maintain or enhance the current level of safety and accessibility for all users. Isolated or obvious deficiencies should always be addressed. Safety enhancements such as the removal or shielding of roadside obstacles, mitigation of edge drop-offs, addition of paved or stabilization of unpaved shoulders, or installation of milled rumble strips, should be encouraged and included in projects where they are determined to be a cost-effective way to improve safety. MDOT may require these safety features to be added to a project at the time of the grade inspection meeting. To maintain preservation program flexibility and in accordance with 23 U.S.C. 109(q), safety enhancements can be deferred and included within an operative safety management system or included in a future project in the STIP. In no way shall preventive maintenance type projects adversely impact the safety of the traveled way or its users.

Pavement Warranties

Pavement warranties shall not be used on preventive maintenance projects (unless otherwise legislatively required.)

Testing and Material Certification

Quality control provisions, quality assurance provisions, material certifications, material testing requirements, and construction engineering requirements cannot be waived or lowered on preventive maintenance projects. This requirement applies on projects that are competitively bid or constructed. For projects completed under a force account authorization, standard force account requirements apply. FHWA and/or MDOT will review all preventive maintenance projects to ensure such measures are in place.

Federal Highway Compliance

The majority of preventative maintenance projects are deemed “alterations” and must meet the Americans with Disability Act (ADA) requirements (for public rights of way) by including sidewalk ramps and all other ADA compliance within the scope of the project. The only exception for ADA compliance would be those projects that meet the definition of “maintenance” as defined by the US Department of Justice (DOJ). DOJ defines “maintenance” projects as projects that are exempt from ADA.

By agreement with FHWA, “Maintenance” projects that are exempt from ADA are limited to only the following: crack filling and sealing, surface sealing, single chip seals, slurry seal, fog seals, scrub sealing, joint crack seals, joint repairs, dowel retrofit, spot high-friction treatments, diamond grinding, pavement patching, and pavement markings. Any combination of the above treatments in one project that cause the use of any two or more treatments that contain aggregate or filler of any kind will constitute an “alteration” and must be ADA compliant. All other preventative maintenance projects must comply with ADA requirements. All existing ADA or safety features which are relocated or reconstructed must be brought up to the current governing standard. (See Appendix D-1.)

The USDOT policy for bicycle and pedestrian accommodation in all federally funded projects should be considered in addition to ADA.

Transportation Improvement Plan Listing

Preventative maintenance projects must be listed on the Statewide Transportation Plan (STIP) (or Transportation Improvement Plan (TIP) in urbanized areas). Such projects may be included in a group or listed individually. The TIP description must indicate that the project is a preventive maintenance project. Metropolitan Planning Organizations (MPOs), the MPO's Federal Aid Committees, and Rural Task Forces are encouraged to develop programmatic guidelines for their member agencies to follow in order to have preventive maintenance projects selected by the agency's respective committees.

Federal funds can be used on preventive maintenance projects unless the funding source would prohibit maintenance type work.

Routine Maintenance

Operations such as filling potholes, mowing, plowing, etc., are considered reactive or routine maintenance and are not eligible for federal or state aid.

Bridge Preventive Maintenance

Preventive Maintenance activities are eligible under the Local Bridge Program.

Examples of preventive maintenance include:

- Hot mix asphalt (HMA) overlay with waterproofing membrane
- Epoxy deck overlay (Concrete)
- Shallow deck overlay (removing and replacing concrete surface above the top mat of steel reinforcement)
- Deep deck overlay (removing and replacing the concrete surface below the top mat of steel reinforcement)
- Painting only (full, zone, or spot painting)
- Pin and hanger replacement
- Slope paving repair
- Joint replacement and repair
- Drainage system repair (bridge deck drains and bridge approach downspouts)
- Scour countermeasures
- Concrete crack sealing
- Concrete patching and repair
- Approach pavement relief joint installation
- Temporary supports
- Expansion or construction joint repair
- Guard rail beam retrofit or installation
- Substructure repairs

Appendix D-1:

Approved Preventive Maintenance Treatments

Fix Type	Life Extension (in years) *	Life Extension (in years)	Life Extension (in years)	PASER Rating	ADA Required (Yes/No)
	Flexible	Composite	Rigid		
HMA Crack Treatment	1-3	1-3	N/A	6-7	N
Overband Crack Filling	1-2	1-2	N/A	6-7	N
One Course Non-Structural HMA Overlay	5-7	4-7	N/A	4-5****	Y
Mill and One Course Non-Structural HMA Overlay	5-7	4-7	N/A	3-5	Y
Single Course Chip Seal	3-6	N/A	N/A	5-7[1]	N
Double Chip Seal	4-7	3-6	N/A	5-7[1]	Y
Single Course Micro-Surface	3-5	**	N/A	5-6	Y
Multiple Course Micro-Surface	4-6	**	N/A	4-6****	Y
Ultra-Thin HMA Overlay	3-6	3-6	N/A	4-6****	Y
Paver Placed Surface Seal	4-6	**	N/A	5-7	Y
Full Depth Concrete Repair	N/A	N/A	3-10	4-5 ***	N[2]
Concrete Joint Resealing	N/A	N/A	1-3	5-8	N
Concrete Spall Repair	N/A	N/A	1-3	5-7	N
Concrete Crack Sealing	N/A	N/A	1-3	4-7	N
Diamond Grinding	N/A	N/A	3-5	4-6	N
Dowel Bar Retrofit	N/A	N/A	2-3	3-5 ***	N
Longitudinal HMA Wedge/Scratch Coat with Surface Treatment	3-7	N/A	N/A	3-5****	Y
Flexible Patching	**	**	N/A	N/A	N
Mastic Joint Repair	1-3	1-3	N/A	4-7	N
Cape Seal	4-7	4-7	N/A	4-7	Y
Flexible Interlayer “A”	4-7	4-7	N/A	4-7	Y
Flexible Interlayer “B” (SAMI)	4-7	4-7	N/A	3-7	Y
Flexible Interlayer “C”	4-7	4-7	N/A	3-7	Y
Fiber Reinforced Flexible Membrane	4-7	4-7	N/A	3-7	N
Fog Seal	**	**	N/A	7-10	N
GSB 88	**	**	N/A	7-10	N
Mastic Surface Treatment	**	**	N/A	7-10	N
Scrub Seal	**	**	N/A	4-8	N

* The time range is the expected life extending benefit given to the pavement, not the anticipated longevity of the treatment.

** Data is not available to quantify the life extension.

*** The concrete slabs must be in fair to good condition.

**** Can be used on a pavement with a PASER rating equal to three when the sole reason for rating is rutting or severe raveling of the surface asphalt layer.

[1] For PASER ratings of four or below; providing structural soundness exists, and that additional pre-treatment will be required; for example, wedging, bar seals, spot double chip seals, injection spray patching or other pre-treatments.

[2] Full depth concrete repair or replacement that exceeds 50% of the paved area of any road intersection (defined as spring point to spring point) will require ADA compliance at that intersection.

Appendix D-2:

Definitions of Preventive Maintenance Treatments

HMA Crack Treatment and Overband Crack Filling

This is a generalized treatment category including crack sealing, crack filling, and crack repair. This crack seal treatment is used on all types of cracks. It involves using a hot air lance or compressed air to blow out the debris in the crack, then filling with a sealant. This class of treatments is intended to seal the cracks from water infiltration and incompressible material entering the pavement system.

Non Structural HMA Overlays:

Non-structural overlays are considered to have an application thickness of 1.5 inches or less of hot mix asphalt HMA material; however, in certain cases the use of 2 inch overlays may be approved. Pre-approved cases include the use of 2 inch overlays for crown correction, the use of superpave mixes that require 2 inch lifts, the use of a scratch course prior to a 1.5 inch overlay in areas where there is a concern with crack sealing materials, and where it is necessary to mill 2 inches to address distress (such as rutting). Use of 2 inch overlays is still the exception to the rule and the use of 2 inches of HMA in the preventive maintenance program for any reason other than the pre-approved reasons listed above will require approval from the MDOT Local Agency Staff Engineer, the MDOT Local Agency Engineer, and the Development Services Division Administrator. Approval will be on a case by case basis. Preventive maintenance projects should not be applied to a roadway that has a significant level of distress that should be addressed by a 3R or reconstruction type project.

Longitudinal HMA Wedge/Scratch Coat with Surface Treatment:

Longitudinal HMA wedge/scratch coat with surface treatment consists of a paver-placed HMA material to correct the cross section of the roadway often done on lower volume roads in combination with a chip seal, but can also be used in combination with a micro-surface, ultra-thin overlay, and conventional overlay. This is not to be used in small isolated areas such as a pothole repair. This is to be used for the majority of the length of the project (using engineering judgment) so that the proper increase in ride quality can be achieved.

Chip Seal

A chip seal is the application of an asphalt emulsion with a cover aggregate. A chip seal will seal and/or retard the oxidation of an existing pavement surface, improve skid resistance of the pavement surface; seal fine surface cracks in the pavement, thus reducing the intrusion of water into the pavement structure; and retard the raveling of aggregate from a weathered pavement surface. Chip seals may be constructed using a single or multiple layers of asphalt emulsion and aggregate cover. Chip seals may be applied in conjunction with crack sealing.

Micro-Surface

Micro-surfacing is a mixture of polymer modified asphalt emulsion, mineral aggregate, mineral filler, water, and other additives placed on a paved surface. A single course micro-surfacing will retard oxidation and improve skid resistance in the pavement surface. A multiple course micro-surfacing is used to correct certain pavement surface deficiencies including severe rutting, minor surface profile irregularities, polished aggregate or low skid resistance and light to moderate raveling. Micro-surfacing is typically used on flexible or composite pavements and can perform under all traffic volumes.

Ultra-Thin HMA Overlay

Ultra-Thin HMA Overlay is a dense graded bituminous mixture limited to an application rate of 72lbs/syd, and a maximum average thickness of 0.75 inches which is applied to retard oxidation and improve skid resistance in the pavement surface.

Full Depth Concrete Repair

The work consists of complete removal and replacement of the concrete pavement at the deteriorated joint or open crack. The new concrete repair should include load transfer (dowel bars), pavement reinforcement if the pavement is a joint reinforce concrete pavement, contraction and/or expansion joints with joint seals. Repairs adjacent to ADA ramps will be reviewed on a case by case basis to determine if the fix is an "alteration" or "maintenance" with regard to ADA compliance.

Concrete Joint Resealing

The purpose of resealing the concrete pavement joints is to prevent water and incompressibles from entering the pavement structure, thus slowing the rate of deterioration of the concrete pavement. Concrete joint resealing includes the removal of the existing joint seals and resealing the transverse and longitudinal joint with preformed neoprene, silicones, or low-modulus hot-poured rubber.

Concrete Spall Repair

Spall repair is done to remove distress from the pavement and to increase the life of the repair versus typical reactive methods that use temporary asphaltic filler or cover materials. The work repairs spalled concrete by removing all unsound concrete, cleaning the area, and placing a filler material consisting of a fast-set mortar or a rapid setting polymer concrete. Spalling may occur along transverse or longitudinal joints or cracks, or be located somewhere on the pavement surface. Filler materials are typically pre-packaged and are placed according to recommendations from the supplier.

Concrete Crack Sealing

The purpose of sealing the cracks in the concrete pavement is to reduce the water and incompressible from entering the pavement structure and thus slowing the deterioration rate of the pavement. This treatment is can be used in conjunction with other treatments of rigid pavements such as joint resealing and minor spall repair and /or full depth concrete joint repair.

Diamond Grinding

Diamond grinding is used to restore the surface longitudinal profile and crown of a concrete pavement that provides an improved ride quality. Benefits from diamond grinding include the removal of joint and crack faults, the removal of wheel ruts caused by tire wear, the restoration of transverse drainage, and the improvement of skid resistance. Often other repairs should be performed prior to diamond grinding.

Dowel Bar Retrofit

A dowel bar retrofit treatment restores the effective load transfer at faulted joints and cracks, significantly reduces the recurrence of faulting, and increases the structural capacity of the pavement. Dowel bar retrofit is an operation in which slots are cut into the concrete pavement across faulted joints and cracks, and dowel bars are placed in the slots to restore the load transfer. The work consists of five operations:

- cutting the slots
- preparing the slots
- placing the dowel bars
- backfilling the slots
- opening the pavement to traffic

Paver Placed Surface Seal

A special paver places a polymer modified asphalt emulsion followed immediately by a gap-graded, ultra-thin HMA surface course. A paver placed surface seal is a non-structural HMA overlay in combination with a bonding/sealing polymer modified asphalt emulsion. It assists in sealing the existing pavement surface to reduce the intrusion of water into the pavement structure; improve friction; slow the rate of pavement deterioration; correct minor pavement surface deficiencies; and improve the ride, noise, and skid qualities of the pavement.

Flexible Patching

Flexible patching is a process that can be used for repairing alligator cracking, cupped joints, and compound cracking. Flexible patching can be used on asphalt or concrete surfaces. Cracks are cleaned and dried using compressed air or a heat lance. This ensures that sealant properly adheres to the pavement. The sealant is applied through a wand or gravity and is hand squeegeed to ensure proper coverage of the affected area. An approximately 1/8 inch base of sealant is ideal to hold the cover material in place. In some cases an aggregate cover material is placed on top of the sealant with other products to assist the aggregate as part of the mix. This improves not only the durability of the treatment, but also makes for a smoother riding surface. Allow for the flexible patching to fully cure before opening to traffic.

Mastic Joint Repair

Mastic Joint Repair involves removing old expansion joint material in concrete roadways and applying a mastic joint between the slabs. Depending on the product used, it may need to be sanded prior to traffic resuming.

Fog Seal

Fog Seal is the process of using a pressure distributor to apply an asphalt emulsion typically over a chip sealed road. The distributor is required to have a computerized application rate. This will ensure that the fog seal is applied properly to coat the void areas of the chip seal. This will help with stone retention in a chip seal as well as keep the water from getting underneath the chip seal. Fog Seal is also an effective method to provide asphalt binders with UV protection and the degradation caused by UV exposure. Alternatively, Fog Seal may be a candidate for protecting shoulder pavements or other HMA pavements (i.e. non-chip seal surface treatments) as long as skid resistance is not diminished or creates a safety hazard as a result of the fog seal application. Traffic should be kept off the freshly applied fog seal until it has fully cured.

GSB-88

GSB-88 is a process that is applied similarly to that of a fog seal. GSB-88 is used early in the life cycle of a road. Product is best used on roads that have little deterioration occurring. The product has gilsonite mixed into the product which is a naturally made asphalt. The asphaltenes, maltenes, and light oils penetrate the existing asphalt and introduce gilsonite to the pavement. This helps rejuvenate the asphalt characteristics that were initially lost due to UV rays, oxidization, and other natural elements. The gilsonite sets in pores and actually holds the asphalt fines in the asphalt matrix. GSB-88 is sprayed with a computerized distributor. The distributor may also have a sand spreading mechanism on the back to spread sand to help with traction and also decrease cure times. Traffic should be kept off the product until it has had time to fully cure.

Mastic Surface Treatment:

This process seeks to improve micro-texture on a variety of Asphalt Surfaces or by locking down loose aggregate and eliminating dust associated with Chip Seal Surfaces. It is a mixture of polymer modified asphalt emulsion, quality "fine" aggregate, dark color enhancers, recycled materials and catalysts. This treatment is designed to protect your investment from UV damage, maintain frictional characteristics, minimize the costs of future maintenance treatments and return the roadways to traffic more quickly.

Fiber Reinforced Flexible Membrane Surface Treatment

This treatment is a crack inhibiting, waterproofing and sealing membrane. Fiberized Reinforced Surface treatment can be utilized to address two distinct distress application needs. **Type A** is applied as a superior wearing course for stand-alone surface treatment applications. This process consists of a combination of polymer-modified asphalt emulsion, chopped fiberglass strands and quality crushed aggregate. The benefit of the fiberglass is the superior tensile strength which absorbs and bridges pavement distresses, as well as helping to reduce

reflective cracking.

Cape Seal

A Cape seal is a two layered surface treatment in which the first layer is comprised of a chip seal followed by a second layer of Micro surface. Alternately, some situations may require or allow for reversal of the first and second layers. A cape seal helps to retard reflective cracking by combining a rather flexible seal to the original pavement, provide a hard frictional riding surface, and to repair minor pavement profile deficiencies. It can be a cost effective method for treatment of 'higher' stressed pavement surfaces that would not be possible with a single surface of chip seal or micro surface treatment alone. It can be used on gravel surfaces to construct a paved roadway buit is typically used on flexible or composite pavements and can perform under all traffic volumes.

Flexible Interlayers

Similar to Cape Seal philosophy several pavement preservation tools are used as flexible interlayers under new hot mix paving layer(s). Flexible interlayers are frequently used with mill and fill applications to help retard or redirect vertical reflective cracking horizontally to increase the service life of the new pavement and/or to defer requirement for crack sealing.

Flexible Interlayer "A" (Single Chip Seal)

A single layer of chip seal using commonly approved asphalt emulsion, polymer modified or non-polymer modified, can be placed under a Micro Surfacing or Hot Mix Asphalt surface. This treatment is a crack inhibiting, waterproofing and sealing membrane. The single chip seal application helps extend the life of the subsequent overlay by delaying reflective cracking or "bottom up" cracking by dissipating crack propagation energy and deflecting most of the "top down" pavement strain from vehicle loading. It is typically used on highly distressed milled or unmilled surfaces and can perform under all traffic volumes. It may not perform as well as Flexible Interlayer "B" (SAMI) dependent on the polymer concentration in the emulsion.

Flexible Interlayer "B" (SAMI (Stress **A**bsorbing **M**embrane **I**nterlayer))
A combination of highly polymerized asphalt emulsion and quality crushed aggregate. Installed much like a Chip Seal. This treatment is a crack inhibiting, waterproofing and sealing membrane. An excellent bonding agent that acts as a flexible waterproofing membrane installed prior to either a Micro Surfacing or Hot Mix Asphalt. **SAMI** helps extend the life of the subsequent overlay by delaying reflective cracking or "bottom up" cracking by dissipating crack propagation energy and deflecting most of the "top down" pavement strain from vehicle loading. It is typically used on highly distressed milled or unmilled surfaces and can perform under all traffic volumes.

Flexible Interlayer "C" (Fiber Reinforced Flexible Membrane Interlayer)
This treatment is a crack inhibiting, waterproofing and sealing membrane. Fiberized **Type B** is a Stress Absorbing Membrane Interlayer (SAMI) used to reduce reflective cracking in pavement system overlays. This process consists of a combination of polymer-modified asphalt emulsion, chopped fiberglass strands and quality crushed aggregate. The benefit of the

fiberglass is the superior tensile strength which absorbs and bridges pavement distresses, as well as helping to reduce reflective cracking better than Flexible Interlayers A or B.

Scrub Seal

Scrub Seal is the application of a chip surface placed over polymer modified asphalt rejuvenating emulsion surface sealer. The asphalt emulsion surface sealer is a polymer modified rejuvenating emulsion that is scrubbed with a scrub broom device immediately following application of the emulsion by a distributor. The scrub broom is used to force emulsion sealer into the existing surface and to distribute the rejuvenating emulsion sealer over variable road surface contours. Immediately after scrubbing the polymer modified asphalt rejuvenating emulsion it is covered with a surface aggregate.

Longitudinal Joint Repair

A process in which severely opened HMA or concrete joints are sealed by a chosen pre-treatment and/or then covered with a small width micro surfacing treatment to maintain a smooth ride quality while sealing the opened longitudinal joint and preventing further damage to the longitudinal joint from traffic and weather.

DESIGN EXCEPTIONS
AND
DESIGN VARIANCES

(Section E)

DESIGN EXCEPTIONS & DESIGN VARIANCES

Exceptions to particular design elements of AASHTO's *A Policy on Geometric Design of Highways and Streets* and Michigan's Local Agency 3R Guidelines may be warranted on projects at individual locations. These design deviances (which may Design Exceptions or Design Variances) shall be submitted to MDOT LAP by the project owner. A design deviance must show the need and must demonstrate that it would not create or maintain a potential or existing crash situation, for all users.

The need for a design deviance should be discussed with LAP during the early stages of the project's development. The design exception or design variance request form should be completed and submitted to LAP along with the project program application.

Design Exception: MDOT Form DE26-LA can be obtained at:
http://mdotjboss.state.mi.us/webforms/GetDocument.htm?fileName=DE26-LA.pdf

Design Variance: MDOT Form DV26-LA can be obtained at:
http://mdotjboss.state.mi.us/webforms/GetDocument.htm?fileName=DV26-LA.pdf

The following information must be included in a design exception or variance, request:

1. Feature and location not meeting the minimum design guideline.
2. Minimum design value that will be obtained.
3. Estimated cost of meeting the design guideline.
4. Environmental or physical constraints that prevent the design from meeting the design guideline.
5. All Design Exceptions/Variances must have site specific most recent 4-year Crash Analysis submitted, including past traffic crash analysis at the site-specific location that might be related to this design element. (If such crashes have occurred, further analysis will be required to show why upgrading is not cost effective.)
6. Discussion of whether some compromise design value could be used that would at least enhance the existing condition (include estimated cost of compromise solution).
7. Discussion of mitigation measures being utilized for the design exception. Safety Features and Supplemental Safety Measures discussed herein should be considered.

If any of the 10 controlling design elements listed on page C-4 are not satisfied for the applicable standards, then an applicable design exception, or design variance, must be submitted.

The design exception does not apply to preventive maintenance projects.