MDOT
Michigan Department of Transportation

LOCAL AGENCY PROGRAMS
GUIDELINES FOR GEOMETRICS
ON
LOCAL AGENCY PROJECTS

2014 Edition

INCLUDING GUIDELINES FOR:

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

Approved: _____ 3-4-14
Development Services Division Administrator — Date
Michigan Department of Transportation

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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: 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.

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 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 which are listed on the National Highway System (NHS), shall be in accordance with applicable AASHTO guidelines and MDOT Non-Freeway NHS 3R guidelines.

Summary of Changes:

The following is a summary of the major changes from the LAP Guidelines for Geometrics on Local Agency Projects dated 08/28/08 to address changes in ADA requirements and how standards apply for a project with 3R and 4R work:

The changes in ADA ramps, is based on a joint briefing memo that FHWA and Department of Justice (DOJ) to address different interpretations of when ADA ramps are required for road projects that are considered alterations. The main change is certain Preventative Maintenance treatments will now be considered an alteration and will require ADA ramps to be upgraded. For multiple treatments, if more than one of those treatments contains aggregate and/or filler, the combination will be considered an alteration.

For a project that includes 3R and 4R work, the applicable standards will correspond individually to each work type (3R or 4R) within the limits of that work.

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 AASHTO guidelines.

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 fifty (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 fifty (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 AASHTO in A Policy on Geometric Design of Highways and Streets. Bridge widths in excess of minimum AASHTO guidelines must be justified.
- Bridges designed to a width less than the minimum recommended by AASHTO will require a design exception. However, 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 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 ft., then a minimum 4 ft. (3 ft. paved) shoulder is acceptable adjacent to right turn lanes.
- However, if AASHTO requirements are less than 4 ft., then the shoulder width adjacent to the right turn lane should 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. Bridge deck overlay and/or minor widening (no increase in the number of through lanes).
6. Roadside safety improvements.
7. Signing, pavement marking and traffic signals.
8. Intersection and railroad crossing upgrades.
9. Bridge painting, joint replacements, and pin and hanger replacements.
10. Pavement joint repair.
11. Crush and shape and resurfacing.
12. Rubblize and resurface.
13. Passing relief lanes.
14. Reconstruction of the roadway pavement, including <u>less</u> 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. 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.”

<u>Combined 3R and 4R Work</u>

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:

1. Design Speed
2. Shoulder Width
3. Lane Width
4. Bridge Width
5. Structural Capacity
6. Horizontal Alignment
7. Vertical Alignment
8. Stopping Sight Distance
9. Grade
10. Cross Slope
11. Superelevation
12. Vertical Clearance
13. Horizontal Clearance (not including clear zone)

When 3R guidelines are not met for any of these controlling elements, a formal request for an exception 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 should be accompanied by a justification explaining why non-freeway 3R minimum guidelines are not being met. It should include a crash history evaluation, the estimated total cost required to attain non-freeway 3R guidelines, and a simple cost benefit analysis. When requesting exceptions to design elements on Heritage Routes, it is important to address the fact that the requested exception is based on historic, economic, or environmental concerns for the preservation of the natural beauty or historic nature of the facility.

The design exception requests are to be submitted on MDOT form number FC26. See link: http://mdotcf.state.mi.us/public/webforms/public/FC26.pdf for further guidance on design exceptions. Refer to Section E, Guidance Exception, within this document.

<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" (Paved desired)

6'-0" (with 3'-0" Paved desired)</td></tr>
<tr><td>Multi-Lane
(Divided &
Undivided)</td><td>Inside
(Divided)</td><td>Outside
(Both sides for un-divided)</td></tr>
<tr><td></td><td>3'-0" Paved</td><td>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-6 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.

CRASH ANALYSIS

A safety review (3-year period) shall be performed on each 3R project before starting design work. This review should include an analysis of available crash data to determine where safety enhancements are warranted.

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.

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-3.

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 bridge width and structural capacity are not met, a design exception is required.

All approach guardrails must be properly anchored to the bridge.

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 a design exception.

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.

3R SAFETY CONSIDERATIONS

The designer should consider site specific conditions to determine the appropriateness for making improvements to side slopes and/or clear zones. 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 project file.

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 sharp 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.
- The 2% 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 (i.e., a uniform distance from the edge of pavement to the tree line, utility poles, etc.) 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 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 National Highway System (NHS). Refer to Michigan Design Manual Road Design Section 7.01.41B for upgrading guardrail terminal guidelines.

Refer to AASHTO Roadside Design Guide when determining if the installation of guardrail is warranted. Special consideration should be made to fill sections (AASHTO fig 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 design traffic volumes on either roadway exceed 1,500 vehicles per day or there is evidence of crashes related to existing conditions. 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 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*.

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. Some of these are:

Geometric Concern	Supplemental Safety Measure	
Narrow lanes and shoulders	Pavement edge lines Paved shoulders Permanent pavement markers Post delineators Warning signs	
Steep side slopes; roadside obstacles	Warning signs Round ditches Breakaway hardware Install guardrail	Slope flattening Obstacle removal Post delineators
Narrow bridge	Traffic control devices Approach guardrail Pavement markings Warning signs	
Poor sight distance at hill crest	Traffic control devices Shoulder widening Driveway relocation Warning signs	
Sharp horizontal curve	Traffic control devices Appropriate superelevation Slope flattening Pavement anti-skid treatment Permanent pavement markers	Shoulder widening Advisory signs Obstacle removal Post delineators
Problem intersections	Traffic control devices Fixed lighting Advisory signs Pavement anti-skid treatment	Traffic signalization Speed controls Rumble strips

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.

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 are not required and are not allowed for preventive maintenance projects.

Safety Review

A 3-year safety review is required for preventive maintenance projects. 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.

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.

All preventive maintenance projects should consider appropriate ways to maintain or enhance the current level of safety and accessibility. 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.

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 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 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.

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.

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	N
Double Chip Seal	4-7	3-6	N/A	5-7	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
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

* 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 = 3 when the sole reason for rating is rutting or severe raveling of the surface asphalt layer

Standard Capital Preventive Maintenance Treatments

The following table lists all standard allowable Preventive Maintenance treatments and indicates whether the treatment is a pavement seal or a functional enhancement.

Standard Capital Preventive Maintenance Treatments	
Pavement Seal	Functional Enhancement
• HMA Crack Treatment • Concrete Crack Treatment • Concrete Joint Resealing with Minor Spall Repair • Overband Crack Fill- Pretreatment • Chip Seals • Micro-surfacing • Ultra-Thin HMA Overlay-Low Volume • (<1" thick) • Paver Placed Surface Seal	• 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 • Concrete Pavement Restoration *# • Underdrain Outlet Clean Out and Repair

*# Includes: joint spall repair, surface spall repair, joint/crack sealing, full depth repairs, and diamond grinding.

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.

DESIGN EXCEPTIONS

(Section E)

DESIGN EXCEPTIONS

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 exceptions shall be submitted to MDOT Local Agency Programs by the project owner. A design exception must show the need for the exception and must demonstrate that it would not create or maintain a potential or existing crash situation.

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

MDOT Form FC26 can be obtained at: http://mdotcf.state.mi.us/public/webforms/public/FC26.pdf

The following information must be included in a design exception 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. 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 13 controlling design elements listed on page C-2 are not satisfied for the applicable standards, then a design exception must be submitted.

The design exception does not apply to preventive maintenance projects.