

## I-06.02 Investment Strategies

The North Dakota Department of Transportation, NDDOT, in conjunction with the Federal Highway Administration, FHWA, has developed a series of investment strategies outlined in the *DESIGN GUIDELINES* that will ensure the life expectancy of the roadway is met. These investment strategies are Preventive Maintenance, Minor Rehabilitation, Structural Improvement, Major Rehabilitation, and New/Reconstruction Projects. Below is a brief summary of each investment strategy:

**Preventive Maintenance** – The intended purpose of this strategy is to protect the pavement structure, slow the rate of pavement deterioration, and/or correct deficiencies in the pavement surface only; structural deficiencies cannot be corrected with this application. The surface defects may be caused by the environment, and by daily wear and tear of traffic. This type of project may occur on the same roadway as frequently as supported by a cost effectiveness determination. A detailed definition of Preventive Maintenance can be found in Section I-06.03.01, which also includes examples of projects that can be considered Preventive Maintenance. An overlay is considered to be Preventive Maintenance when the maximum thickness is two inches (no allowance for rut filling).

**Minor Rehabilitation** – This strategy aims to correct the structural integrity of the pavement without necessarily changing the existing geometrics. A detailed definition of Minor Rehabilitation can be found in Section I-06.03.02, which also includes examples of projects that can be considered Minor Rehabilitation. When an overlay is between two and three inches the project is considered to be Minor Rehabilitation.

**Structural Improvement** – A Structural Improvement restores the structural integrity of the pavement without necessarily changing the existing geometrics. In addition, the load carrying capacity should be increased to meet the HPCS guidelines. A detailed definition of Structural Improvement can be found in Section I-06.03.03. A Structural Improvement is either an HBP overlay in excess of three inches or a white top.

**Major Rehabilitation** – Major Rehabilitation requires a large amount of work to bring the condition of the highway up to a level that will extend the service life. This strategy also provides the opportunity to perform operational improvements. A detailed definition of Major Rehabilitation can be found in Section I-06.03.04, which also includes examples of projects that can be considered Major Rehabilitation.

**New/Reconstruction** – There may be extensive changes to the existing route such as relocating on a new alignment, or completely removing the roadway down to the subgrade and rebuild from the bottom up. Everything from ADA requirements to signing must be addressed when performing a new or reconstruction project. A detailed definition of New/Reconstruction can be found in Section I-06.03.05.

### I-06.03 Design Guidelines

1. The intent of the roadway width guidelines is not to reduce the roadway width to the minimum width shown in the guidelines, but rather to maintain the width as close as possible to the existing width.
2. If a District Corridor is on the NHS system the roadway will be designed to meet the minimum design guidelines for a State Corridor.
3. Design features that do not meet the minimum design guidelines, but are incorporated into a project will require a design exception.
4. Safe pavement sloughs will be maintained as described in the Departments shoulder/slough standards. If there is no shoulder the slough should have a minimum slough of 3:1.
5. The traffic volumes shown are general guidelines. A 10% tolerance in the volumes may be allowed without requiring the designer to move to the next level of standard or the need for a design exception.
6. The rail system is defined as both the bridge and roadway facility rail systems servicing as one entire rail system including all of the following items:
  - end treatments and end terminals
  - linear guardrail runs
  - transition sections
  - bridge rails

In cases where the roadway improvement strategy and bridge improvement strategy for the rail system are different, the investment strategy with the highest rail system requirement will be applied to the entire rail system. If the roadway strategy requires the bridge rail to be in compliance with MASH, the bridge rail at a minimum shall comply with MASH Test Level 3. However, if a portion of the bridge deck needs to be removed in order to upgrade the bridge rail to be in minimum compliance with MASH Test Level 3, the bridge rail will instead be required to be in minimum compliance with NCHRP Report 350 Test Level 3.

On Minor Rehabilitation and Structural Improvement roadway projects, the rail system may be left in place if the rail system was originally installed in compliance with NCHRP Report 350 or MASH performance criteria, and has been maintained in a condition that is in reasonably close conformity to NCHRP Report 350 or MASH performance criteria.

**I-06.03.01 Preventive Maintenance**

**Design Guidelines for Preventive Maintenance Projects**

Traffic Data	Use current ADT
Roadway Width	Use appropriate width to meet NDDOT guidelines.
Superelevations	Use existing.
Design Speed	Use posted speed limit.
Driving Lane Cross Slope	Use existing.
Horizontal Curvature	Use existing.
Vertical Curvature	Use existing.
Clear Zone	Use existing.
Foreslope	Use existing.
Roadway Shoulder/Slough Cross Slope	Use NDDOT shoulder/slough treatment methods.
Safety	Safety issues will be identified and addressed as part of the Statewide Safety Program. Safety features will remain as they exist unless a need is identified.

The purpose of the Preventive Maintenance program is to protect the pavement structure, slow the rate of pavement deterioration and/or correct pavement surface deficiencies. Surface treatments used for preventive maintenance are targeted at pavement surface defects primarily caused by the environment and by the daily wear and tear of traffic. Structural deficiencies caused by traffic loading are not corrected by using these treatments.

Preventive Maintenance treatments may be applied as frequently as supported by a cost effectiveness determination. Improvements for ADA requirements will be considered and be addressed in the environmental document. Most preventive maintenance projects will be conducted on the top of the existing roadway and will have no impact to wetlands or cultural resources. Miscellaneous features such as mailboxes, signing, delineators and others will not be required to be upgraded as part of these projects unless identified by the Statewide Safety Program. Signage not in compliance with the MUTCD will be updated if engineering judgment indicates that:

- One compliant device in the midst of a series of adjacent non-compliant devices could potentially be confusing to road user.
- The anticipated schedule for replacement of the whole series of non-compliant devices will result in achieving timely compliance with the MUTCD.

All railroad crossings will have adequate warning/protective devices in place or be otherwise addressed in the State Railroad Crossing Improvement Program.

Examples of Preventive Maintenance treatments are: Crack Pouring/Sealing, Route and Seal, Seal Coats, Micro-Surfacing, Pavement Patching, Milling and Asphalt Overlay 2” Maximum with or without subcut repair\*, Asphalt Overlay 2” Maximum with or without subcut repair\*, Repair of depressed cracks, Minor Concrete Pavement Repair (less than 10% of the pavement surface area per mile), Dowel Bar Retrofit, Diamond Grinding, Rumble Strips, Pavement Marking, Signals, Slope Protection Repair, Joint Repair, Painting Structures, Scour Repair, Abutment Repair, Pier Repair, Damaged Railing Repair, etc.

\*Milling and Asphalt Overlay 2” Maximum with or without subcut repair, and

\*Asphalt Overlay 2” Maximum with or without subcut repair shall be limited to:

- The subcut repair shall be limited to a maximum of 2% of the total square yards of the project, and a maximum of 1000 square yards per mile.
- The subcut repair shall be limited to 12” maximum depth of subcut below the bottom of existing asphalt layer.
- The subcut repair will not be allowed at reoccurring frost heaves or in areas with an existing pipe.
- The subcut repair work shall have nearly vertical cuts on all sides, be performed from on top of the roadway, the adjacent foreslope topsoil shall not be disturbed, and no construction equipment or traffic is allowed in the ditch bottom.
- No allowance for rut filling. If rut filling is needed, the quantity shall be taken from the overall mainline quantity.

**I-06.03.02 Minor Rehabilitation**

**Design Guidelines for Minor Rehabilitation Projects**

Traffic Data	Use current ADT
Roadway Width	Use appropriate width to meet NDDOT guidelines.
Superelevations	Use existing.
Design Speed	Use posted speed limit
Driving Lane Cross Slope	Use existing.
Horizontal Curvature	Use existing.
Vertical Curvature	Use existing.
Clear Zone	Use existing.
Foreslope	If the proposed foreslope is less than 3:1 consider cost effective treatment. In fill sections where the foreslope breaks to less than 3:1 outside the clear zone a 4:1 foreslope should be used in the clear zone.
Roadway Shoulder/Slough Cross Slope	Use Department Shoulder Guidelines.
Safety	Safety issues will be identified and addressed as part of the Statewide Safety Program. Safety features will remain as they exist unless a need is identified. Safety hardware that is not in compliance with NCHRP Report 350 performance criteria will be upgraded to be in compliance with MASH* performance criteria. Existing guardrail that is in compliance with NCHRP Report 350 except for rail height, may be reset to correct rail height for compliance with NCHRP Report 350.

\* If safety hardware is not available for MASH performance criteria, safety hardware shall instead be required to be in compliance with NCHRP Report 350 performance criteria.

*Minor Rehabilitation* is a planned strategy to extend the useful life of a highway by restoring the pavement structure without necessarily improving existing geometrics. The minor rehabilitation of roadways will use repair techniques designed to repair pavement distress areas primarily caused by the environment and by the daily wear and tear of traffic. A minor rehabilitation strategy will restore the load carrying capacity to its original condition. During the scoping process the department will determine if the foreslope criteria is being met. The appropriate NEPA process will be followed to address any environmental impacts. Improvements for ADA requirements will be considered and be addressed in the environmental document. Miscellaneous features such as mailboxes, signing, delineators and others will not be required to be upgraded as part of these projects unless identified by the Statewide Safety Program. Signage not in compliance with the MUTCD will be updated if engineering judgment indicates that:

- One compliant device in the midst of a series of adjacent non-compliant devices could potentially be confusing to road user.

- The anticipated schedule for replacement of the whole series of non-compliant devices will result in achieving timely compliance with the MUTCD.

All railroad crossings will have adequate warning/protective devices in place or be otherwise addressed in the State Railroad Crossing Improvement Program.

Examples of Minor Rehabilitation treatments are: Asphalt Overlay up to 3", Distress Area Repairs and Asphalt Overlay, Mill & Overlay up to 3", Cold In-Place Recycling (CIR), Sliver Grading to correct foreslope or re-establish the original traveled-way-plus-shoulders width, Bridge Approach Repair, Bridge Rail Repair, Deck Overlay, Guardrail, etc.

Sliver Grading is defined as minor grading required to correct foreslope, or re-establish the original traveled-way-plus-shoulders width. Where re-establishing the original traveled-way-plus-shoulders width is triggered to accommodate an overlay, Minor Rehabilitation may include: up to 2' of widening on each side of the roadway or widening to provide 12' driving lanes with 2' shoulders on each side of narrow roadways, even if the total resulting width exceeds the original roadway width. Sliver Grading is required to provide 4:1 foreslopes or flatter within the clear zone, and the installation of rumble strips. Examples of Sliver Grading are shown in the Department Shoulder/Slough Guidelines.

**I-06.03.03 Structural Improvements**

**Design Guidelines for Structural Improvements Projects**

Traffic Data	Use 20 year projected
Roadway Width	Use appropriate width to meet NDDOT guidelines.
Superelevations	Attempt to correct to AASHTO Standards. (6% max superelevation) Request design exception if not cost effective.
Design Speed	Use posted speed limit
Driving Lane Cross Slope	HBP Over Asphalt Roadways: 2.1% HBP Over Non Interstate Concrete Roadways: 1.5-2.5 % HBP Over Interstate Concrete Roadways: 1.5-2.5 %
Horizontal Curvature	Use existing, sign when less than posted speed.
Vertical Curvature	Use existing.
Clear Zone	20 foot clear zone.
Foreslope	If the proposed inslope is less than 3:1 consider cost effective treatment. In fill sections where the inslope breaks to less than 3:1 outside the clear zone a 4:1 inslope should be used in the clear zone.
Roadway Slough	Use Department Guidelines for sloughs.
Roadway Shoulder Cross Slope	HBP Over Asphalt Roadways: 8.0 % Max. HBP Over Non Interstate Concrete Roadways: 8.0 % Max HBP Over Interstate Concrete Roadways: 6.0% Max
Safety	Safety issues will be identified and addressed as part of the Statewide Safety Program. Safety features will remain as they exist unless a need is identified. Safety hardware that is not in compliance with NCHRP Report 350 performance criteria will be upgraded to be in compliance with MASH* performance criteria. Existing guardrail that is in compliance with NCHRP Report 350 except for rail height, may be reset to correct rail height for compliance with NCHRP Report 350. Replace mailbox supports where necessary.

\* If safety hardware is not available for MASH performance criteria, safety hardware shall instead be required to be in compliance with NCHRP Report 350 performance criteria.

*Structural improvement* is a planned strategy to extend the useful life of a highway by restoring the pavement structure without necessarily improving existing geometrics. Examples of Structural Improvements include: white topping, full depth reclamation, crack and seat or break and seat and HBP overlay or an HBP overlay in excess of 3” and is designed based on an engineering analysis. A structural improvement will increase the load carrying capacity to meet the HPCS guidelines. The appropriate NEPA process will be followed to address any environmental impacts. Improvements for ADA requirements will be considered and be addressed in the environmental document. All regulatory and warning signs and pavement markings will be verified to comply with current MUTCD standards or brought up to MUTCD standards if necessary, and all railroad crossings will have adequate warning/protective devices in place or be otherwise addressed in the State Railroad Crossing Improvement Program.

I-06.03.04 Major Rehabilitation

Design Guidelines for Major Rehabilitation Projects

Traffic Data	Use 20 year projected
Roadway Width	Use appropriate width to meet NDDOT guidelines.
Superelevations	Correct to AASHTO Standards. (6% max superelevation)
Design Speed	Use posted speed limit.
Cross Slope	Driving lanes 1.5 – 2.5%, Shoulder 6% max.
Horizontal Curvature	Use existing, sign when less than posted speed. On State and Interregional Corridors with ADT >750, if existing horizontal curvature is designed for less than 15 mph less than the posted speed make cost effective improvement or sign accordingly.
Vertical Curvature	<p><b>Interregional System:</b> ADT &lt; 2000 maintain existing. ADT &gt; 2000 use stopping sight distance for crest curve design and comfort curve design for sag curves. Decision sight distance should be considered in areas where complex driver decisions are required such as intersections with major collectors or higher, interchanges, lane drops or additions, etc. Passing areas should be provided at reasonable intervals based on terrain and traffic volumes. A rule of thumb would be a passing area every 3 to 5 miles when the ADT &lt;2000 and every 3 miles when the ADT &gt;2000.</p> <p><b>State Corridors, District Corridors &amp; Collectors:</b> ADT &lt; 2000, existing vertical curves should meet a design speed of no less than 20 mph below the overall project design speed. ADT &gt; 2000 use stopping sight distance for crest curve design and comfort curve design for sag curves. Passing areas should be provided at reasonable intervals based on terrain and traffic volumes. A rule of thumb would be a passing area every 3 to 5 miles when the ADT &lt;2000 and every 3 miles when the ADT &gt;2000.</p>
Clear Zone	Upgrade safety work to 20' clear zone except when ADT >2000 use AASHTO roadside design clear zone.
Foreslope	4:1 minimum, on Interregional system > 2000 ADT a 6:1 inslope is desirable where grading or roadway widening is required.
Pavement Slough	Use NDDOT shoulder treatment methods.
Safety	A 90-1 survey will be completed and areas needing safety improvements will be addressed. Upgrade safety hardware to be in compliance with MASH* performance criteria.

\* If safety hardware is not available for MASH performance criteria, safety hardware shall instead be required to be in compliance with NCHRP Report 350 performance criteria.



*Major Rehabilitation* is a planned strategy in which major work is performed to bring a highway up to an acceptable condition to extend the service life and provide operational improvements (i.e. adding turn lanes). Improvements for ADA requirements will be addressed in the environmental document.

Major rehabilitation projects may include reclaiming the existing surface material and base along with the placement of additional surface material and/or other work necessary to return an existing roadway, including shoulders, bridges, the roadside, and appurtenances to a condition of structural or functional adequacy. On these projects the roadway elevation may change, shoulders may be added, and foreslope corrections may be made. The roadway will be resurfaced and safety improvements will be completed as required. A crash analysis will be completed and cost effective enhancements will be addressed. All regulatory and warning signs and pavement markings will be verified to comply with current MUTCD standards or brought up to MUTCD standards if necessary, and all railroad crossings will have adequate warning/protective devices in place or be otherwise addressed in the State Railroad Crossing Improvement Program.

Examples of Major Rehabilitation treatments are: Mine and Blend and HBP, Full depth Reclamation, Major Concrete Pavement Repair (greater than 10% of the surface area per mile), etc.

I-06.03.05 New/Reconstruction Projects

**Design Guidelines for New/Reconstruction Projects**

Traffic Data	Use 20 year projected
Roadway Width	Use AASHTO Standards.
Superelevations	Use AASHTO Standards. (6% max superelevation)
Design Speed	Use posted speed limit.
Cross Slope	Driving lanes 1.5 – 2.5%, Shoulder 6% max.
Horizontal Curvature	Use AASHTO Standards.
Vertical Curvature	<b>Interregional System:</b> Use stopping sight distance for crest curve design and comfort curve design for sag curves. Decision sight distance should be considered in areas where complex driver decisions are required such as intersections with major collectors or higher, interchanges, lane drops or additions, etc. Passing areas should be provided at reasonable intervals based on terrain and traffic volumes. A rule of thumb would be a passing area every 3 to 5 miles when the ADT <2000 and every 3 miles when the ADT >2000. <b>State Corridors, District Corridors &amp; Collectors:</b> Use stopping sight distance for crest curve design and comfort curve design for sag curves. Passing areas should be provided at reasonable intervals based on terrain and traffic volumes. A rule of thumb would be a passing area every 3 to 5 miles when the ADT <2000 and every 3 miles when the ADT >2000.
Clear Zone	Use AASHTO roadside design clear zone.
Foreslope	Use 4:1 except Interregional system > 2000 ADT and Interstate use 6:1
Pavement Slough	Use AASHTO Standards.
Safety	Safety hardware will be in compliance with MASH* performance criteria.

\* If safety hardware is not available for MASH performance criteria, safety hardware shall instead be required to be in compliance with NCHRP Report 350 performance criteria.

Is defined as a planned strategy in which a new road is constructed. This work may include work items such as relocating an existing route on new alignment, or completely removing the old pavement structure and restoring the roadbed and surfacing, or major widening on an existing roadway to increase traffic capacity (excludes realigning horizontal curves).

On New/Reconstruction projects a crash analysis will be completed and cost effective enhancements will be addressed. All safety hardware will be in compliance with MASH\* performance criteria. ADA requirements will be addressed. All regulatory and warning signs and pavement markings will be verified to comply with current MUTCD standards or brought up to MUTCD standards if necessary, and all railroad crossings will have adequate warning/protective devices in place or be otherwise addressed in the State Railroad Crossing Improvement Program.