See the *DESIGN GUIDELINES* in Section I-06 for requirements for cross slope of the roadway.

For New/Reconstruction projects:

- The cross slope of the driving lanes range from 1.5% to 2.5%. Typically, the driving lanes have a cross slope of 2.1%.

- The maximum cross slope on the shoulders is 6%. The cross slope on shoulders for the Interstate is typically 2.9%. As a cost saving measure, the shoulder thickness should be reduced to provide shoulder cross slope.

The Materials and Research Division develops the design for the entire pavement section. Materials and Research Division will only submit a design recommendation if the project investment strategy is a Structural Improvement, Major Rehabilitation, or New/Reconstruction. The design recommendations include:

- Thickness and type of base (dense, blended, or permeable).

- Thickness of surfacing (asphalt and concrete).

- Class of HBP to be used.

- Type and percentage of asphalt cement for asphalt pavements.

When centerline profile elevations are shown in the plans, the elevations shall be to the top of the pavement. If there is an additional surfacing project scheduled for the following year to place the final lifts of pavement, the signing plans should provide adequate vertical clearance so that when the final lift(s) of pavement are placed, the signs will have the correct vertical clearance.

III-06.01 Asphalt Pavements

III-06.01.01 Overlays Greater than Three Inches

Investment strategies included with asphalt overlays greater than 3 inches are: Structural Improvement, Major Rehabilitation, and New/Reconstruction. Asphalt overlays greater than three inches are intended to extend the useful life of a highway by restoring the pavement structure. The thickness of the overlay is determined by Materials and Research Division.

III-06.01.02 Overlays Three Inches or Less

Investment strategies included with asphalt overlays 3 inches or less are Preventive Maintenance and Minor Rehabilitation as follows:

- Preventive Maintenance are asphalt overlays 2" maximum thickness. There is no allowance for rut filling on Preventive Maintenance projects (2" max overlay). If rut filling is needed, the quantity should be taken from the overall mainline quantity.

- Minor Rehabilitation are asphalt overlays up to 3" maximum.

These strategies are intended to slow the deterioration of the pavement and improve ride quality. The overlay thickness will be determined by the District Engineer. Materials and Research Division will not submit thickness recommendations for Preventive Maintenance and Minor Rehabilitation strategies.

III-06.01.03 Milling

Milling is a process where some of the surfacing is removed to correct the typical section or make adequate room for an overlay without widening.

III-06.01.04 Overlay Transition Tapers

To reduce the chances of the thin sections (ends of bridges, railroad tracks, ends of the project, away from curbs, etc.) from raveling, the designer should require that the transitions be milled. Paving transitions placed in the late fall may not adhere to the existing pavement surface and this treatment allows for a thickened transition section. A plan note may be used to cover this work requirement. A sample note can be found on the web at: http://www.dot.nd.gov/manuals/design/designmanual/designmanual.htm under "Plan Preparation Guide", "Plan Notes"

Generally, a detail is included in the plan sheets.

III-06.01.05 Slough/Shoulder Treatments

See the appropriate Department Slough/Shoulder Guidelines shown in the *DESIGN GUIDELINES* in Section I-06 of the Design Manual for slough/shoulder treatment method requirements for various project investment strategies.

III-06.02 Portland Cement Concrete (PCC) Pavement

III-06.02.01 New/Reconstruction

This process is used when the PCC has reached a condition where it is no longer cost effective to repair. The surfacing is removed, the subgrade reworked, the roadway may need widening, the vertical and horizontal alignment may need to be changed, and new base and surfacing is placed.

The existing surfacing, be it asphalt, PCC, or aggregate, is salvaged and recycled into the base. Generally, salvaged material is not used in the surfacing.

Concrete pavements could be plain jointed with dowels or continuously reinforced. Materials and Research will recommend if continuously reinforced concrete pavement should be used.

III-06.02.02 White Topping

White topping is a Structural Improvement where a layer of PCC is placed over an existing pavement. This can be done as either a bonded or unbonded overlay.

III-06.02.03 Concrete Pavement Repair (CPR)

This work consists of repairing spalled joints, broken slabs, stitching, installing dowel bars in existing joints to re-establish load transfer, and grinding the surface to improve the ride. There are two strategies for CPR:

- Minor CPR – Preventive Maintenance: Less than 10% of the pavement surface area per mile is repaired.

- Major CPR – Major Rehabilitation: Greater than 10% of the pavement surface area per mile is repaired.

When making repairs to continuously reinforced concrete, the continuity of the reinforcing should be re-established.

III-06.02.04 Expansion, Contraction, WT Terminal, and Tied Longitudinal Joints

Generally:

- Expansion joints should not be used except at bridges.

- Contraction joints are used on all non-reinforced concrete pavements.

- The maximum width of concrete that is tied together is 40 feet.

- Terminal joints are used where continuously reinforced concrete pavement abuts non-reinforced concrete pavement or a bridge.

III-06.03 Driveway and Guardrail Surfacing Policy

The following driveway and guardrail surfacing policy applies to paving projects, and does not apply to seal coats and microsurfacing projects.

III-06.03.01 Rural Projects

Generally, the following will govern the surfacing of driveways and under guardrail. There may be exceptions that can be handled on a case-by-case basis:

- For Structural Improvement, Major Rehabilitation, or New/Reconstruction projects:
    - Pave to the ROW for paved section lines, paved county roads, paved street approaches, or paved private drives.
    - Pave to the radius for gravel section lines, gravel county roads, gravel street approaches, and gravel private drives.
    - Pave a 5’ area of pavement from the edge of driving lane to provide a transition into field drive approaches.

- For Preventive Maintenance and Minor Rehabilitation projects:
    - Pave to the ROW for paved section lines, paved county roads, or paved street approaches.
    - Pave a 5’ area of pavement from the edge of driving lane to provide a transition into gravel section lines, gravel county roads, gravel street approaches, paved private drives, gravel private drives, or field drive approaches.

- If the drive was previously paved and is disturbed during the construction, it will be paved.

- Surfacing is to be provided under guardrail to a point 3 feet beyond the back of the face of the guardrail.

III-06.03.02 Urban Projects

- Generally, the driveway will be paved to the R/W line or to the limit of the construction easement that is needed to blend the drive into the adjacent property or connect with existing surfacing.

- The design used for driveways should be the same as the respective cities use. Driveways may need to be thickened or reinforced in industrial areas.

III-06.04 Rumble Strips

The purpose of rumble strips is to save lives by reducing head-on and run off the road (ROR) crashes. Rumble strips are used to effectively reduce shallow angle ROR crashes. These types of crashes are usually caused by distracted, drowsy, or fatigued driving. The noise and vibrations caused by driving on rumble strips alert the driver of a near lane departure, allowing time to make corrections. Rumble strips are not effective for ROR crashes caused be excessive speed, loss of control, sudden turns to avoid on-road collisions, high-angle encroachments.

Rumble strips will be installed in conjunction with rural highway projects where paved shoulders are constructed, reconstructed, or overlaid as part of a highway construction contract.

Rumble strips will not be installed across bridge decks and approach slabs, adjacent to guardrail, and ½ mile on either side of:

- Highways with posted speeds 45 mph or less
- All urban areas*
- Areas with curb and gutter

*Urban areas are areas within city limits, or reduced speed zones near towns and cities.

III-06.04.01 Bicycle Travel Considerations

The shoulder and edgeline rumble strip pattern for undivided roadways with shoulders 1’ or greater in width shall provide an intermittent pattern of 40’ length of rumble strips with 10’ gaps of no rumble strips to accommodate bicycle maneuvers from one side of the rumble strips to the other without having to encounter the indentations/grooves.

If the roadway is identified on the United States Bicycle Route System (USBRS), an executive decision for the installation of rumble strips will be determined during the Environmental Documentation process.

III-06.04.02 Maintenance Considerations

Rumble strips must be reinstalled if covered during patching and overlay activities.

The rumble strips may be covered during chip and sand sealing activities. The District Engineer may limit chips to the travel lanes only and sand the shoulders, or eliminate the chips or sand on the shoulders altogether.

III-06.04.03 Installation

Installations for rumble strips include shoulder rumble strips, edgeline rumble strips, centerline rumble strips, and saw slotted rumble strips at intersections. Installations for rumble strips are shown for various roadway types on the following Standard Drawings:

- Standard Drawing D-960-1
  RUMBLE STRIPS INTERSTATE HIGHWAYS

- Standard Drawing D-960-2
  RUMBLE STRIPS DIVIDED HIGHWAYS (NON-INTERSTATE)

- Standard Drawing D-960-3
  RUMBLE STRIPS UNDIVIDED HIGHWAYS (SHOULDERS 4' OR GREATER)

- Standard Drawing D-960-4
  RUMBLE STRIPS UNDIVIDED HIGHWAYS (SHOULDERS LESS THAN 4')

- Standard Drawing D-960-5
  SAW SLOTTED RUMBLE STRIPS AT INTERSECTIONS

Shoulder rumble strips may also be installed on the right shoulder of Interstate loop ramps.