

# MDOT PAVEMENT DESIGN PROCEDURE/POLICIES

Contained within this document are a description of the MDOT pavement design procedure and a list of MDOT policies regarding pavement design. An updated copy is kept at the following location: <http://www.gomdot.com> (LPA Area). Several other documents are located in this directory.

## Earthwork Recommendation:

During development of right-of-way plans, RWD will provide a set of plans to the District Office. The District is responsible for preparing a soil profile and making a recommendation on the earthwork related issues. This recommendation will:

- Identify limits of high-volume change soil (>60%) within the design soil prism;
- Propose the method of treatment of any high volume change soil (See [High volume change SOP](#));
- Identify limits of any required undercutting;
- Recommend the classes of borrow excavation to be required;
- Recommend the estimated design CBR;
- Recommend the estimated structure thickness.

If the removal of high volume change material is required, a 6:1 cut slope is required. Also, a recommendation should be made to use one of the two following options: A) waste the undercut material; or B) utilize the undercut material in embankments (in accordance with the high volume change SOP).

If high-volume change material is to be used in fill sections, a 5:1 fill slope is required, and a select borrow (classes listed in SOP) is to be placed over that material. In these cases, the earthwork recommendation should also specify areas for disposal of undercut material.

## Pavement Design Software (Flexible Pavement):

A computer program written in Excel shall be used to calculate structural requirements on new routes. A copy of the program is located in the following public directory ([structural requirements](#)). The program is routinely updated to keep up with changes in pavement design procedures.

## Design Life:

All asphalt pavements will be designed based on the following design life:

Interstate	20 years
Bridge approaches (100 feet from bridge end)	20 years
Urban projects	20 years
Temporary connections/detours	projected life, not less than 1 year
All other locations	10 years

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## Lift Thicknesses:

All layers of flexible pavement should meet the following lift thicknesses:

<u>Gradation</u>	<u>Minimum Layer Thickness</u>	<u>Maximum Layer Thickness</u>
Ultra-Thin MIXTURE*	0.5"	1.0"
4.75 mm MIXTURE	0.5"	0.75"
9.5 mm MIXTURE	1.0"	1.5"
12.5 mm MIXTURE	1.5"	2.5"**
19 mm MIXTURE	2.25"	3.5"
25 mm MIXTURE	3.0"	4.0"

\* To be used ONLY on ST routes (as shown on the [Mix Designation Map](#)) as a [Preventative Maintenance](#) treatment.

\*\* A 2.5-inch lift should not be used as the final riding surface on existing routes, due to the maximum allowable dropoff of 2.25 inches.

Example pavement design:

- 2" HMA or WMA, HT (12.5 mm MIXTURE) **Polymer Modified** (1 @ 2)
- 2.5" HMA or WMA, HT (19 mm MIXTURE) **Polymer Modified** (1 @ 2.5)
- 3" HMA or WMA, HT (19 mm MIXTURE) (1 @ 3)
- 6" Lime Fly Ash Treated Granular Material (9/C)
- 13.5" Structure Thickness
- 6" Chemically Treated Subgrade
- 7" Shoulder Granular Material (5/C)

Multiple lifts of 9.5 mm HMA/WMA should be avoided.

## Flexible Pavement:

More than 2 lifts of 12.5 mm HMA/WMA should be avoided if possible. Exceptions to this include a low volume route where the use of the larger mixes would result in an excessive amount of pavement, or where traffic is to be placed on an intermediate lift for more than one year.

All permanent pavement designs should include at least one lift of either 19 mm HMA/WMA or 25 mm HMA/WMA.

On pavement designs requiring multiple lifts of 19mm mix, it is recommended that the required additional thickness be in the bottom 19mm lift, as allowed by the lift thicknesses shown above.

The maximum allowable drop-off across a longitudinal construction joint that traffic is expected to temporarily cross is 2.25 inches.

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The maximum allowable overnight pavement edge drop-off without positive separation is 3 inches.

The minimum flexible pavement structure for a four-lane highway will consist of 6.5 inches of HMA/WMA over 6 inches of base (chemically treated granular material or crushed stone).

## Mix Type Designation/Polymer Modification:

The map titled “Mix Designation Map” has been distributed to each District and is posted at. The map shall be used to determine the type mix (ST, MT or HT) to be used on a particular project. The following guidelines were used in developing the map:

<u>Number of ESALs in the 10-Year Life</u>	<u>Type</u>
< 1 million	ST
1 million to 3 million	MT
> 3 million	HT*

\* Polymer modification required on the top two lifts of HMA/WMA

If a current traffic count shows the need for a higher mix designation than what is shown on the map, then that mix designation takes precedence over what the map requires.

For projects that include paved shoulders, ST mix shall be required on the shoulders which are to be placed in a separate operation from the travel lane.

For pavement designs requiring 4 or more lifts of HMA/WMA, the bottom lift shall be ST mix.

## Rigid Pavement:

Concrete pavement will be designed on a 35-year design life.

All rigid designs will consist of a minimum of 10 inches plain concrete and a minimum 2-inch layer of flexible pavement over a base course.

## Base Course:

Chemical treatment of all base granular material prior to the placement of pavement is required. The requirement of chemical treatment may be waived for clay gravel (granular material with classes 1-6, group "D") in short sections of new pavement (less than 300 feet).

Chemical treatment (LFA or SC) of the granular material is to be depicted in the typical sections and quantities calculated for the roadway; interchange ramps; local roads that require an interchange with the mainline; and any new construction or reconstruction. Chemical treatment

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of the granular material is not required for crossovers, driveways, or local roads and streets that do not require interchanges with the mainline.

If a crushed stone base is required, and the subgrade will not be chemically treated, geotextile (Type V, non-woven) is required between the subgrade and the crushed stone.

## Rates for Treatment of Base:

LFA - 3% Lime; 12% Fly Ash (by weight)\*

Soil Cement - 5.5% Cement (by volume)\*

\* These rates are for the plan quantities only. The actual rates to be used will be determined during construction.

## Treatment of Subgrade:

To provide increased integrity of the subgrade, all paving projects shall include chemical treatment of the subgrade prior to the placement of the pavement structure, unless a crushed stone base and geotextile fabric is used. This requirement may be waived in the case of short lengths of new pavement, or local road relocation. Normally, based on soil conditions, the plans will include a combination of A) lime treatment (6 inch depth, 6% lime, class "C" application) and B) a selection of either lime fly ash treatment (6 inch depth, 3% lime, and 12% fly ash); or soil cement (5.5% cement) treatment. Plan quantities will be based on an estimated percentage of each of the treatment methods. Each District will be required to recommend the type treatment to be used (example: 50 percent lime treatment and 50 percent either lime fly ash treatment or soil cement treatment).

The treatment of the subgrade will not affect the pavement design or the design CBR.

Either a treated subgrade or fabric is required under all crushed stone bases.

## Rates for Treatment of Subgrade:

Lime Treatment - 6% Lime (by weight)\*

Soil Cement - 4% Cement (by volume)\*

LFA - 3% Lime; 12% Fly Ash (by weight)\*

\* These rates are for the plan quantities only. The actual rates to be used will be set during construction.

## Multi-Phase Paving:

On projects which involve construction of added lanes, and the reconstruction of existing lanes, placement of the required 1.5" HMA/WMA (9.5 mm) lift in the initial paving operation (added lanes) will be delayed. This means that less than the full structure will be placed in the initial paving operation, and will allow traffic to utilize this partial pavement structure for a period of up to 2 years. When traffic is opened up to the ultimate configuration, the final lift will be placed. In these situations, it is required that the top intermediate lift will be 12.5 mm

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HMA/WMA, and the final lift will be 9.5 mm HMA/WMA. On such projects which also require polymer, 3 lifts of polymer modified mix will be required.

## **Rehabilitation Policy:**

The District Office is required to submit pavement recommendations on all projects including pavement rehabilitation. The recommendation should be consistent with the [MDOT Pavement Rehabilitation Policy](#), which was signed by the Chief Engineer December 14, 2000. This policy requires:

- construction, rehabilitation and maintenance history;
- condition survey;
- pavement safety issues;
- structural evaluation with deflection measurements;
- analysis of pavement cores; and
- alternative rehabilitation strategies considered;
- FWD survey on full depth HMA/WMA pavement.

This recommendation will be reviewed by the MDOT Pavement Committee, and will be submitted to the Chief Engineer or FHWA as applicable for approval.

On projects requiring only a single lift overlay (or milling and replacing one lift), a pavement recommendation is not required provided all other policies contained in this document are followed\*. This includes using the mix designation type shown on the [Mix Designation Map](#).

On projects requiring only a single lift overlay (or milling and replacing one lift), a FWD survey is not required\*.

\* If a non-structural lift, such as leveling is used in addition to the one lift, a FWD and a pavement recommendation is not required.

The surface course of HMA/WMA pavements on Interstate highways shall require that the centerline joint and transverse joint be treated with a sealant between the placement of adjacent lanes (included paved shoulders). The sealant will be applied against the vertical face of the completed lane prior to the placement of the subsequent lane.

On all HMA/WMA overlays of jointed concrete pavement that have not previously been overlaid, new joints must be sawed and sealed in the new HMA/WMA overlay. Special attention must be taken to ensure that the new joints in the HMA/WMA overlay line up with the joints in the existing concrete pavement. This procedure is also required if all existing HMA/WMA overlay is to be removed from a section of jointed concrete pavement.

If the jointed concrete pavement is to be rubblized, the saw and seal will not be included.

No saw and seal will be allowed in an open graded friction course (OGFC).

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The placement of an OGFC over a jointed concrete pavement (which is to be overlaid) will be evaluated on a case-by-case basis.