

# Plant Mixed Asphalt Pavement – Design Guidelines

## Implementation

This guidance document supersedes [Technical Memorandum No. 17-SA-01 \(PDF\)](#). The guidelines contained in this document are effective immediately for all federal aid and state aid projects that contain specification 2360 - Plant Mixed Asphalt Pavement.

## Varying from guidance

State Aid understands the importance of having a consistent standard asphalt pavement specification across the local agencies in Minnesota. State Aid also understands the need to modify the standard specification from time to time to suit individual agency needs as they see fit. Modification(s) to specification 2360 - Plant Mixed Asphalt Pavement shall be requested by the local agency in a letter to the District State Aid Engineer (DSAE). The request for modification letter shall include justification for the specification deviation(s). The request for modification to the specification shall include at a minimum an explanation of the situation, why the modification is necessary and how this modification will provide a better product. A copy of the request for modification letter shall be retained in the respective local agency project file.

## Mix designs

To further standardize bituminous pavement specifications, all State Aid (including federal aid) projects should follow the most current criteria for asphalt pavement mix design and Performance Graded (PG) binder selection. The most current documents can be found on the [MnDOT Bituminous Engineering website](#).

Please visit the [State Aid Construction](#) and [State Aid Pavement](#) webpages before starting your pavement design to obtain the most current updates relevant to your design and current 2360 - Plant Mixed Asphalt Pavement specification.

## *Mixture type and binder oil usage*

- The top 3 inches should be considered wear, and mixture below that should be non-wear. (For project with more than 3 million Equivalent Single Axle Load (ESALS), use 4 inches).
- A PG 58H-34 binder (“C” oil) should be specified in the wear of new construction (reconstruction, reclamation, and Cold-Inplace Recycle) projects. MnDOT research has determined that this polymer modified oil may reduce thermal cracking up to 90 percent when used in the wear course, which should lead to longer pavement life.
- A PG 58S-28 binder (“B” oil) should be specified in the wear course of overlays on existing pavements with moderate or high degrees of thermal cracking. The use of the more expensive 58H-34 has shown little benefit in this case.

- For non-wear courses, only specify a PG 58S-28 oil. MnDOT research shows that since pavement does not typically reach -28 degrees Celsius at the non-wear depth, a more expensive binder is not beneficial to pavement life.

### ***Lift thickness and air void designation***

- Consider lift thickness when specifying the aggregate size (A, B, C, D). To optimize density and minimize the potential for segregation, the lift thickness to maximum aggregate size of the mix should have a ratio of 1 to 3 for fine mixtures and 1 to 4 for coarse mixes. Example: 1.5" minimum lift thickness for "A" gradation and 2" minimum lift thickness for "B" gradation.
  - Aggregate sizes **A** and **B** are specified most often. Aggregate size **A** is ½ inch minus and aggregate size **B** is ¾ inch minus. There has been a shift recently to aggregate size **A** as the aggregate specified most often in the wearing course mixtures. Although aggregate size **B** will accommodate RAP more readily than aggregate size **A**, splitting of RAP into two sizes appears to diminish this. See specification 2360.1 **A3** Mixture Designations for further clarification.
- Consider traffic volumes when specifying air voids in the mixture. A nonwear mixture will always have 3.0 percent air voids. Mainline wear mixtures have 4.0 percent air voids and shoulder wear mixes will have 3.0 percent air voids. The engineer should consider modifying mainline wear traffic level 2 mixtures to 3.0 percent air voids for low-volume local agency pavements having <0.3 million ESALS. Use 4.0 percent air voids on higher volume facilities.

### ***Incentive and disincentive provisions***

- The incentive/disincentive specification for density and ride should remain in project specifications as they do have a direct impact on pavement quality. Well compacted smooth pavements are desirable and last longer. However, if incentives are written out, so should the disincentives. If paying increased project costs for incentives is not in accordance with local policy, it is still possible to retain the incentive/disincentive specifications by including a statement informing bidders there will be no net increase in the line item as bid. By stating this, any disincentives incurred can be offset by incentives achieved up to, but not exceeding the line item unit bid price.
  - Density: Use the maximum density specification for bituminous compaction on the mainline of County State Aid Highways (CSAH). Achieving the required density is essential to constructing longer lasting pavements. The density specification should be included in its entirety (i.e. density incentive shouldn't be written out and disincentive retained).
  - Ride: It is highly recommended to include the ride specification in all projects as ride should not be sacrificed for density. Within Specification 2399 select the correct Ride Equation for your project based on number of pavement lifts placed; Ride Equation A is for 3 or more lifts of asphalt pavement, Ride Equation B is for 2 lifts, and Ride Equation C is for 1 lift.
  - Intelligent Compaction (IC)/Paver Mounted Thermal Profiling (PMTP)
  - Recommended Special Provisions for 2360 Plant Mixed Asphalt Pavement have been developed for specifically for local government units. These provisions are available from the [State Aid Electronic Proposal webpage](#).

### ***Other best practices***

- Ordinary compaction should be limited to layers identified in the typical sections with a minimum planned thickness of less than 1 ½ inches, thin lift leveling, wedging layers, patching layers, driveways and areas that cannot be compacted with standard highway construction equipment. See specification 2360.6C Ordinary Compaction Method for further information.
- Bikeway trail mixture designation should be SPWEA230B. See the [State Aid Bicycle Path Design webpage](#) for additional guidance.
- Recycled Asphalt Pavement (RAP) is successfully being used in MnDOT and local agency bituminous mixtures. The use of RAP is encouraged in both non-wear and wear courses.
- Warm mix asphalt use is permissible on State Aid projects (including federal aid) provided that the requirements of the 2360 specification are met. There may be economical and environmental incentives to use this type of bituminous mix.
- Minimize the number of mixtures and PG grades on any one project. Typically, it is not economical to specify more than one bituminous mixture for quantities less than 2,000 tons.

### **Questions**

For special or unique design considerations, please contact your DSAE for guidance.

For information on the technical contents of these guidelines, please contact the MnDOT Bituminous Engineer at <http://www.dot.state.mn.us/materials/bituminouscontacts-new.html> or the State Aid Project Engineer at <https://www.dot.state.mn.us/stateaid/construction.html>.