

Design Criteria 2360

Rev. 04/04/2014

Mixture Designation Code	
Mixture Course	Code Format
Non Wear (4" below pavement surface)**	SPNW <u>(1)</u> * <u>(2)</u> * 30 <u>(3)</u> *
Wear (Top 4" of pavement)**	SPWE <u>(1)</u> * <u>(2)</u> * 40 <u>(3)</u> *
Shoulder Wear	SPWE <u>(1)</u> * <u>(2)</u> * 30 <u>(3)</u> *
Stone Matrix Asphalt (SMA) – Spec 2365	SMWEE640H

* Select (1) Aggregate Size; (2) Traffic Level; and (3) Asphalt Binder Grade as shown below. See Mixture Designation Example. WE=wear; NW=non-wear

**May replace 4" with 3" for non-trunk highway with traffic levels < 3 million ESAL's.

(1) Aggregate size. Recommended minimum lift thickness is also shown:

Size A (-1/2") SP 9.5 – 1" minimum

Size B (-3/4") SP 12.5 – 1 1/2" minimum

Size C (-1") SP 19.0 – 2 1/2" minimum

Size D (-3/8") SP 4.75 – 3/4" minimum

*Specify size A or D when course/lift is less than 1 1/2".

- a. The **A** gradation provides a "finer" pavement surface. Select this aggregate size if you are concerned about coarseness of the driving surface. It is only necessary to specify **A** for the final wear lift, aggregate size **B** can be used for all underlying lifts. Except for SMA and unless otherwise designated in the Special Provisions, the Contractor has the option to supply recycled mixture. With the approval of the Engineer, the Contractor may supply a gradation with a smaller maximum aggregate size than that specified, i.e. size A in lieu of size B.

(2) Traffic Level: Select Levels 2-6 based on ESAL's as shown in example below.

- a. For slow traffic consider selecting a higher mix type (Traffic Level) and/or higher high temperature binder grade. For shoulders where traffic is allowed consider selecting a higher mixture type (Traffic Level).

(3) Asphalt Binder Grade:

- a. For mainline paving select the asphalt binder grade from the most current PG Guidelines (http://www.dot.state.mn.us/materials/bituminousdocs/Doc_Aids/PGGuide_2007_Dec.pdf).
- b. For shoulders where traffic is allowed, generally, use the same binder grade as the mainline.
- c. For shoulders where traffic is prohibited select either PG 52 - 34 or PG 58 - 28 by matching the mainline low PG number.
I.E. Mainline PG 64 - 28 => Shoulder PG 58 - 28
- d. For new construction including cold in place recycle (CIR), reclaiming, and reconstruction, specify, PG XX-34 in the wear (top 4") of the pavement structure.

- Notes: 1) Typical Sections should delineate individual lifts/courses and thicknesses.
2) Include mixture designation codes and ride equation in contract special provisions.
3) Use SMA on final wearing surface only (1.5"-2" lift). Specify minimum PG 70-28 (H) for SMA mixtures.

Mixture Designation Example: **SPWEB440E**

Type	Lift	Max Agg. Size	Traffic Level (ESAL's X 10 ⁶)	Air Voids	Standard Binder Grades
<i>SP</i>	<i>WE</i>	A (SP 9.5)	2 (<1.0 & Shld)	30 (3.0)	A = PG 52 - 34 H = PG 70 - 28
SM	NW	B (SP 12.5)	3 (1 - 3)	40 (4.0)	B = PG 58 - 28 L = PG 64 - 22
		C (SP 19.0)	4 (3 - 10)		C = PG 58 - 34 M = PG 49 - 34
		D (SP 4.75)	5 (10 - 30)		E = PG 64 - 28
		E (SMA)	6 (SMA)		F = PG 64 - 34

The format for 2360 Pay Items are as follows:

2360.501 Type SP Course Mixture (,).....English ton

An example of the pay item for the above mixture designation is:

2360.501 Type **SP12.5 Wearing** Course Mixture (**4, E**).....English ton

Note: Number in parenthesis denotes the traffic level and the letter denotes the PG grade.

State Aid for Local Transportation Design Guidelines

The following design information is from the “Guidelines” section of Julie Skallman’s Technical **Memorandum No. 10-SA-02** dated June 24, 2010, <http://www.dot.state.mn.us/stateaid/techmemo/10-SA-02.pdf>. Additional comments and corrections have been made by John Garrity as part of this updated Design Guidelines and are noted with [Comment – JAG].

The following is a list of items that designers should watch closely for to ensure these items are correct in the plan.

1. Superpave (gyratory design) considers the top 4 inches (top 3” for local agencies with traffic levels < 3 million ESAL’s) to be wear. Bituminous mixture placed below the top 4” (top 3” for local agencies with traffic levels < 3 million ESAL’s) is considered nonwear.
2. A PGxx-34 should be specified in the top 4 inches (top 3” for local agencies with traffic levels < 3 million ESAL’s) for new construction, reclaiming and cold in-place recycling projects. Pavement Management data shows that thermal cracking may be reduced up to 90% when a PG xx-34 is used in the top four inches of the pavement structure. Reduced thermal cracking should lead to longer pavement life.
3. Do not specify a PG xx-34 below four inches (3” for local agencies with traffic levels < 3 million ESAL’s) in the pavement structure [Unless it makes economic sense—JAG]. Typically, specify a PG xx-28 below 4” (3” for local agencies with traffic levels < 3 million ESAL’s) in the pavement structure. Research at MnROAD has shown that the pavement typically does not reach temperatures below -28 Celsius at these depths. The use of a more expensive asphalt binder below these depths is usually not warranted.
4. Be careful when specifying the aggregate size (A, B, C, D). Aggregate sizes **A** and **B** are specified most often. Aggregate size “A” is ½” minus and aggregate size “B” is ¾ minus. Aggregate size **B** seems to be the aggregate specified most often and will accommodate RAP more readily than aggregate size **A**. See specification 2360.1A3 **Mixture Designations** for further clarification. [The **A** gradation was modified in 2012 to provide a “fine” pavement surface. Select this aggregate size if you are concerned about coarseness of the driving surface. It is only necessary to specify **A** for the final wear lift, aggregate size **B** can be used for all underlying lifts. – JAG]
5. Be careful when specifying air voids in the mixture. A nonwear mixture will always have 3.0% air voids (SPNWXX30X). Mainline wear mixtures have 4.0% air voids and shoulder wear will have 3.0% air voids.
6. Use maximum density for bituminous compaction on the mainline of County State Aid Highways. Achieving the required density is essential to constructing longer lasting pavements. Do not write-out the ride specification as we do not want to sacrifice ride for density. We desire well compacted roads with good ride quality. [

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, driveways [bike paths, walking paths, and other similar non-traffic paving areas – JAG] and areas that cannot be compacted with standard highway construction equipment. See specification ~~2360.6C~~ [2360.3 D.2 – JAG] **Ordinary Compaction Method** for further information.

7. Bikeway trail mixture designation should be **SPWEA230B**. See the [Bicycle Path Design](#) State Aid web page for additional guidance. [Consider using aggregate size **A** for all bikeway and trails (**SPWEA230B**). – JAG]
8. Recycled asphalt pavement (RAP) shall be used in the nonwear courses of bituminous mixtures and is encouraged in the wear courses.
9. Warm mix asphalt use is permissible on both Federal Aid and State Aid projects provided the requirements of the 2360 specification are met. There may be economical and environmental incentives to use this type of asphalt.

Rules of Thumb

- Minimize the number of mixtures and PG grades on any one project. Typically, it is not economical to specify another bituminous mixture less than 2000 tons.
- The top 4 inches (3” for local agencies < 3 million ESAL’s) of bituminous mixture should have the same PG grade. Typically in the top four inches, (3” for local agencies) specify PG xx-34 for new construction, reclaiming, and cold in-place recycling.
- Bituminous mixture below 4 inches from the surface (3” for local agencies < 3 million ESAL’s) should be the same PG grade, typically, specify PG 58-28.

Miscellaneous Design Considerations

Asphalt Binder:

Minimize the number of PG grades on any one project.

- The top 4" (top 3" for local agencies) should be the same PG grade. Typically, specify PG xx-34 for new construction. Typically, specify PG xx-28 for overlay construction.
- Below 4" (3" for local agencies) from the surface should be the same PG grade, typically, specify PG 58-28.
- For temporary construction and cross-overs that will be removed use PG xx-28 or PG 64-22.

Typical Section:

More lifts vs. fewer lifts – Should more lifts be paved or should fewer, thicker lifts be paved? The greatest benefit of paving thicker lifts is improved density. The greatest benefit of paving more lifts is the ability to improve ride. However, it has been shown that ride improvement from 2 to 3 lifts is not as great as from 1 to 2 lifts. In some situations it may make more sense to pave fewer lifts.