

Superpave Binder Materials Selection Procedures

Superpave criteria for choosing a binder is a process which includes project location (climate), confidence level selections for both high and low temperatures, and possible up-grades for traffic speed (fast, slow or standing) and traffic volume. The recommendation is to use this process and add one more consideration for possible performance up-grades, that of mixture type.

Phase I - Base Binder Grade

The beginning binder should be selected based on the climate and confidence levels. This involves using a computer program (PGEXCEL3.XLS) or maps showing climate grades.

Computer Program

The computer program uses input of longitude, latitude, high and low temperature confidence to calculate the binder grade required. The computer program allows individual entry of the high and low temperature confidence levels from 50% to 99.99%. These confidence limits are the percent chance that the design temperatures will not be exceeded. The program output is the PG binder that meets the defined minimum confidence limits for the closest three weather data base stations. These are the standard climate grades for the three locations and represent the binder required for fast moving traffic.

Determining the base binder grade should include studying the effect of the confidence limit on the high and low temperature portions of the grade. In general, the high temperature part of the grade will not change unless one reduces the confidence significantly. This will probably result in unacceptable confidence levels. The low temperature part of the grade might be changed with modest decreases in confidence levels. The confidence levels ultimately chosen should be those the districts are comfortable with.

Maps

Maps can be used to select the base binder grade. Maps inherently are developed at specific confidence levels. CST-M&P can supply maps which were generated using the computer program. These maps are color coded according to PG binder grade by county.

Phase II - Possible High Temperature Designation Increases

In theory, the low temperature performance (resistance to thermal cracking) is affected only by temperature (how cold does it get). This parameter is not affected by the traffic levels or mixture type.

Speed and Volume

The high temperature performance, resistance to rutting, is affected by several traffic related factors. The Superpave system allows one to increase the high temperature grade for traffic speed and volume.

Slow moving traffic may warrant an increase of one temperature grade on the high side. Standing traffic may warrant increasing the high temperature grade by two increments over the base climate grade.

There are also recommendations for increasing the high temperature designation for traffic volumes. The recommendations are: 1) If the design life of the pavement will see more than 10 million ESAL's, consider increasing the high temperature designation by one (1) grade, and 2) If the design life of the pavement will see more than 30 million ESAL's, increase the high temperature designation by one grade. Notice that this is not a two grade increase for over 30 million ESAL's. The guidance is: above 10 million consider an increase; above 30 million you should definitely increase the grade one increment.

Mixture Type

There may be additional reasons to increase the high temperature side of the binder grade. Mixture type may be another consideration for increasing the high temperature portion of the binder grade. Some districts have used stiffer binders (higher high temperature designation) to address flushing of CMHB mixture.

Engineering Judgment

When determining the appropriate base binder grade and considering possible increases to the high temperature grade, there are some economic consideration as well.

There is a general rule that if the spread between the low and high temperature portions of the grade is more than 90 degrees, there is more chance that polymer modifiers will be used in the binder production. The higher the spread, the greater the chance for polymer modifiers. Polymer modifiers generally result in increased cost.

Increases to the high temperature portion of the binder due to non-climate related factors increase the likelihood of modifiers and increase the cost of the binder. Judgment should be used in the number of high temperature “bump-ups.” One could come up with a scenario in which a base climate grade of PG 64-22 is bumped three or four times resulting in a PG 82-22 to be specified for a project. This would probably be overkill and would result in a very expensive binder which also may be difficult to place.

Additionally, there is great concern on the part of contractors that it is difficult to manage a large variety of binder grades. Their tankage is usually limited and during this transition period where there are old projects which specify AC binders, new projects which specify PG binders, and now the possibility of Modified PG binders, they have voiced a desire to keep the number of different grades to a minimum.

Additional Clarification

The general rule to follow is that if the material is used hot through a hot mix plant it should be specified as a PG binder. Materials for surface treatments need not be PG binders (the original research did not address surface treatments). Some special case situations have been identified which may need additional clarification.

- ◆ Precoating aggregates for surface treatments. These materials will be going through a hot mix plant. Many times AC-20 or AC-10 is used for this purpose. AC-10 is still available in Item 300 because it is predominantly used for surface treatments. If you would normally selected AC-10 for precoating, you should specify PG 58-22 instead. If you would normally select AC-20, you should specify PG 64-22 instead. The specifications for other materials, such as AC-3, AC-5 or Asphalt Emulsions are not changing and these materials will still be available.
- ◆ Open Graded Friction Course or Plant Mix Seal. These are materials which go through a hot mix plant and consequently should use a PG binder unless you would normally choose one of the surface treatment binders which are not being eliminated.
- ◆ Special Specifications for ACrumb Rubber Modified Hot Mix Asphaltic Concrete Pavement \cong should use a PG binder to mix with the rubber. In this respect we will be specifying the PG binder to mix with the rubber as opposed to specifying the Performance Grade of the final asphalt-rubber product. Superpave testing does not presently apply to asphalt-rubber blends. The rubber particles are on the same order of size as the sample dimensions in some of the tests and therefore give false readings.
- ◆ Item 318, Hot Asphalt-Rubber Surface Treatments, or any Special Provisions to Item 318 do not call for a particular asphalt binder. In keeping with the general rule that surface treatment binders do not have to be PG binders AC-5 and AC-10 may be used, but AC-20 will not be available since the specification has been removed. If a stiffer binder than AC-10 is desired, a PG binder would need to be used. (Example: AC-20 -> PG 64-22.)

Special Needs

The Superpave Performance Grading System for binders is blind to polymers. This means that we are specifying the performance we need and not a recipe. If we ask for a certain binder the manufacturer is free to manufacture that binder in any way they can get the required performance. They are free to use better asphalt, better processing techniques, any polymer available, or any combination of these factors to achieve the required performance.

If you have a situation in which you believe you must have a polymer modifier, a special provision exists to allow you to specify a PG binder which has been manufactured with either an SBR latex rubber, SBS rubber, Tire rubber or gelling agent. Please see the appropriate special provision for the grade selection.

If there are any questions about the use of PG binders or their applicability in other situations not addressed, please contact Darren Hazlett (512-232-1902) or Gerald Peterson (512-232-1913).

Superpave Binder Maps

Several Superpave Binder Climate Maps are attached. These maps are described below.

Each map shows Texas with TxDOT district boundaries and color coded by county. Each color represents a different PG binder. A key to the PG coloring system is shown on each map. All colors (PG Binders) are not used on all maps. Performance Grades were calculated for all SHRP weather stations according to the selected confidence levels. These calculations were performed using the Excel program PGEXCEL.XLS. One grade was assigned each county based on an analysis of all stations in each county. If there were multiple weather stations in a county (which was usually the case), the highest performing grade in the county was chosen to represent the whole county.

These maps strictly show PG binder based on climate and do not take into account any high temperature “bump-up’s” for traffic speed, traffic volume, or mixture type.

MAP #1 98% Confidence Data

This map shows PG binders as calculated using 98% confidence levels for high and low pavement temperatures. The map shows ten (10) different PG binders.

MAP #2 95% Confidence Data

This map shows PG binders as calculated using 95% confidence levels for high and low pavement temperatures. The map shows ten (10) different PG binders, although they are not all the same ten shown in map #1. The tendency is toward slightly lesser performing binders, which is expected since the confidence levels are slightly less.

MAP #3 98% Practical Map

This map uses the 98% Confidence Data map as a base, but adjusts some of the grades recognizing that some high performing grades also fulfill the requirements of lesser performing grades and that the current asphalt supply may already give us grades which are higher performing than some calculated grades. For example: all PG 58-10 and PG 64-10 were changed to PG 64-16 all PG 58-22 was changed to PG 64-22, and all PG 70-10 was changed to PG 70-16. Changes always were made to give higher performing binder grades and the numbers of counties affected were few. The map shows only seven (7) climate grades for the state.

MAP #4 95% Practical Map

This map uses the 95% Confidence Data map as a basis, but adjusts the grades using the same criteria as for map #3; however, grades were not always adjusted the same. This map also shows seven (7) grades. There could be more adjustments made, such as eliminating PG 70-10 in favor of PG 70-16.