Hot-Mixed, Hot-Laid Asphalt Mixtures

Items 340, 341, 344

These Items require PG binders.

Select the grade by climate and confidence levels for high and low temperatures. Then determine if there is cause for increasing the high temperature designation for increased rutting protection because of high traffic loads or low speeds. PG binders with a temperature span of 92 and above require an elastic recovery test and, therefore, will be polymer modified. Polymer modified binders will cost more than unmodified binders.

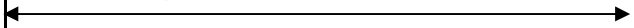
Binder Grade	ER Test / Higher Cost	Binder Grade	ER Test / Higher Cost
PG 58-22		PG 70-28	X
PG 58-28		PG 70-34	X
PG 58-34	X	PG 76-16	X
PG 64-16		PG 76-22	X
PG 64-22		PG 76-28	X
PG 64-28	X	PG 76-34	X
PG 64-34	X	PG 82-16	X
PG 70-16		PG 82-22	X
PG 70-22	X	PG 82-28	X

Items 342 and 346

These Items require PG 76-YY binder or Type I or Type II Asphalt Rubber Binder. The PG binders all require the ER test and, therefore, will be polymer modified. The A-R binders require a minimum of 15% Crumb Rubber Modifier. A-R Type I is stiffer than Type II and is used in hotter climates.

Binder Grade	Relative Cost
PG 76-16	high
PG 76-22	high
PG 76-28	high
PG 76-34	higher
A-R Type I	higher
A-R Type II	higher

Lowest to Highest Scale



lowest <- lower <- low - medium - high -> higher -> highest

Surface Treatments - Hot Weather

Item 316

Hot Applied Binders	Polymer Modified	Relative Cost
AC-5	none	low
AC-10	none	low
AC-5 w/2% SBR	SBR	higher
AC-10 w/2% SBR	SBR	higher
AC-15P	SBS	higher
AC-20XP	SBS	highest
AC-20-5TR	TR	highest

Emulsions	Polymer Modified	Relative Cost	Relative Break and Cure Speed
MS-2	none	low	slow
HFRS-2	none	low	medium
CRS-2	none	low	fast
CRS-2H	none	low	fast
HFRS-2P	yes	higher	medium
CRS-2P	yes	higher	fast

Item 318

Asphalt-Rubber Binders	Polymer Modified	Relative Cost
A-R Type II	TR	highest
A-R Type III	TR	highest

Note: There is not a significant cost difference between A-R Type II and Type III.

Lowest to Highest Scale

lowest <- lower <- low - medium - high -> higher -> highest

Surface Treatments - Cool Weather

Material	Type	Polymer Modified	Relative Cost	Relative Break and/or Cure Speed	Fire Hazard
RS-1P	Emulsion	yes	higher	medium	low
CRS-1P	Emulsion	yes	higher	fast	low
RC-250	Cutback	no	high	fast	highest
RC-800	Cutback	no	high	fast	highest
RC-3000	Cutback	no	high	fast	highest
MC-250	Cutback	no	high	slow	high
MC-800	Cutback	no	high	slow	high
MC-3000	Cutback	no	high	slow	high
MC-2400L	Cutback	yes	higher	slow	high

Notes:
1) Adding polymer generally means higher cost.
2) Cutbacks are high cost and high fire hazard because of solvent used in manufacturing.

Lowest to Highest Scale

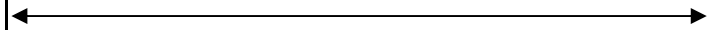
lowest <- lower <- low - medium - high -> higher -> highest

Precoating

Material	Type	Relative Cost	Relative Break and/or Cure Speed
AC-5	Hot Applied	low	fast
AC-10	Hot Applied	low	fast
PG 64-22	Hot Applied	moderate	fast
SS-1	Emulsion	low	slower
SS-1H	Emulsion	low	slower
CSS-1	Emulsion	low	fast
CSS-1H	Emulsion	low	fast

Note: None of these materials is polymer modified.
Most precoating is done in a HMA plant; break and cure speed are not a concern.
Using too much asphalt with softer materials may produce aggregate clumping.

Lowest to Highest Scale



lowest <- lower <- low - medium - high -> higher -> highest

Tack Coat

Material	Application Temp	Relative Cost	Relative Break and/or Cure Speed
PG Binders	high	low	n/a
SS-1H	low	low	slower
CSS-1H	low	low	faster
EAP&T	low	low	slower

Notes: None of these materials needs to be polymer modified. PG binders may require rolling to distribute the binder over the surface resulting in higher application cost.

Lowest to Highest Scale

lowest <- lower <- low - medium - high -> higher -> highest

Fog Seal

Material	Stiffness*	Relative Cost	Relative Break and Cure Speed	Stability**
SS-1	3	low	slower	high
SS-1H	4	low	slower	high
CSS-1	3	low	faster	high
CSS-1H	4	low	faster	high

Notes: *The rating scale is 1 to 5. Materials with higher numeric ratings may be used in hotter climates or higher traffic areas.
**Material rated "high" may be stored and diluted with water. If the material is rated "low," do not store or dilute material with water.

Lowest to Highest Scale

lowest <- lower <- low - medium - high -> higher -> highest

Hot-Mix, Cold-Laid Asphalt Mixtures
Item 334

Material	Type	Stockpile Life	Relative Cost
AC-0.6	AC	high	low
AC-1.5	AC	lower	low
AC-3	AC	lower	low
AES-300	Emulsion	high	low
AES-300P	Emulsion	high	higher
CMS-2	Emulsion	lower	low
CMS-2S	Emulsion	high	low

Notes:
1) AES-300P has a higher cost because it is polymer modified.
2) The emulsions contain some solvent to increase stockpile life (amounts vary).
3) The AC binders are soft binders and contain no volatiles.

Lowest to Highest Scale

lowest <- lower <- low - medium - high -> higher -> highest

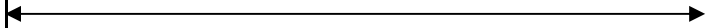
Patching Mixes

DMS-9202, “Asphaltic Concrete Patching Material (Stockpile Storage)”

Material	Type	Stockpile Life	Relative Cost
MC-800	Cutback	high	low
SCM I	Cutback	higher	higher
SCM II	Cutback	higher	higher
AES-300S	Emulsion	high	higher

Notes:
1) These materials all have volatiles.
2) AES-300S is an emulsion with solvent and polymer additives.
3) SCM I and SCM II usually contain antistripping additives.

Lowest to Highest Scale



lowest <- lower <- low - medium - high -> higher -> highest

Recycling

Material	Type	Relative Volume Needed to Restore Binder Properties	Relative Cost
AC-0.6	Soft AC	medium	low
AC-1.5	Soft AC	medium	low
AC-3	Soft AC	high	low
AES-150P	Emulsified AC with additives	medium	high
AES-300P	Emulsified AC with additives	medium	high
Recycling Agent	Recycling Oil	low	high
Emulsified Recycling Agent	Emulsified Recycling Oil	low	high

Notes: Soft AC binders will generally require the highest volume to bring the properties of the old binder back to a specification material. AES-150P and AES-300P contain polymer additives that increase the cost. Be aware that the mixture may not be able to tolerate the volume required to rejuvenate the old binder.

Lowest to Highest Scale

lowest <- lower <- low - medium - high -> higher -> highest

Crack Sealing

Material	Type	Width of Crack for Optimum Benefits	Application Temp	Flows in Crack or Sets on Top	Relative Cost	Crack Sealing Effectiveness (Short-term or Long-term)	Bleeds through Surface Treatments
SS-1P	Emulsion	less than 1/8 inch	low	in	low	Short-term	no
Polymer Modified Asphalt Emulsion Crack Sealant	Emulsion	less than 1/8 inch	low	in	medium	Short-term	no
Class A Rubber Asphalt Crack Sealer	Hot Applied	greater than 1/8 inch	high	top	high	Long-Term	yes
Class B Rubber Asphalt Crack Sealer	Hot Applied	greater than 1/8 inch	high	top	high	Long-Term	yes

Notes: SS-1P and Polymer Modified Asphalt Emulsion Crack Sealant contain polymer additives.
Class A Rubber Asphalt Crack Sealer contains recycled tire rubber.
Class B Rubber Asphalt Crack Sealer contains recycled tire rubber and additional polymer additives.

Lowest to Highest Scale

lowest <- lower <- low - medium - high -> higher -> highest

Microsurfacing

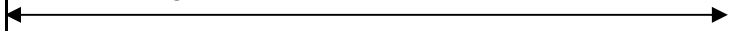
CSS-1P is the only asphalt material used for microsurfacing.
All the microsurfacing materials must be formulated to produce the desired properties of the microsurfacing mixture.
All CSS-1P does not work the same and any change in supply will require a redesign.

Prime

Material	Type	Contains Volatiles	Penetration Efficiency	Relative Cost
MC-30	Cutback	yes	high	low
AE-P	Emulsion	yes	medium	higher
EAP&T	Emulsion	no	med-low	higher
PCE	Emulsion	no	med-low	higher
SS-1	Emulsion	no	none	low
SS-1H	Emulsion	no	none	low
CSS-1	Emulsion	no	none	low
CSS-1H	Emulsion	no	none	low

Notes:
1) MC-30 penetrates almost universally, but contains a high percentage of volatiles.
2) AE-P is best described as an emulsified MC-30 and therefore contains substantial volatiles.
3) AE-P, EAP&T, and PCE should be tried in the field on actual field materials to determine if they penetrate the base adequately.
4) SS-1, SS-1H, CSS-1, and CSS-1H have no penetration efficiency and must be worked into the top of the base.

Lowest to Highest Scale



lowest <- lower <- low - medium - high -> higher -> highest

Curing Membrane and Erosion Control

Material	Type	Cure Rate	Availability	Relative Cost
SS-1	Asphalt Emulsion	slow	high	low
SS-1H	Asphalt Emulsion	slow	high	low
CSS-1	Asphalt Emulsion	higher	high	low
CSS-1H	Asphalt Emulsion	higher	high	low
PCE	Resin Emulsion	slow	limited	higher

Notes:
1) PCE may be able to endure light construction traffic as the residue is not as tacky as the rest.
2) For all the asphalt emulsions, any construction traffic will destroy the membrane.

Lowest to Highest Scale

lowest <- lower <- low - medium - high -> higher -> highest