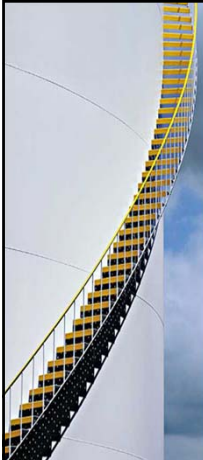


# Substitute Binders in Texas


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## What Do We Mean By Binder Substitution?



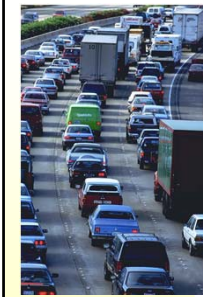
- The ability to use a lower grade binder than originally specified in the plans while meeting the performance requirements of the originally specified binder.

## Why The Change?



- Concern of over-stiffening our mixes
  - ◆ Pre-mature cracking
  - ◆ Shortened pavement life
- Make more effective use of recycled materials
  - ◆ Save money


## Typical Scenario – Past



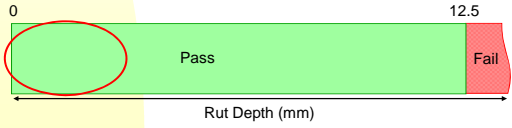
- Overlay on IH-35
- Plans specify a PG 76-22
- Specs. allow up to 20% recycled material (RAP)
- Contractor designs with 20% RAP
- HWT < 2mm rut depth @ 20,000 passes

**The Question: Did we over-stiffen the mix?**

## HWT and Tensile Strength



- Very low rut depths and high tensile strengths can indicate an over-stiff mix



Rut Depth (mm)

## New Specification

Table 1A  
Maximum Allowable Amounts of Recycled Binder, RAP & RAS

| Mixture Description & Location                                   | Maximum Ratio of Recycled Binder <sup>1</sup> to Total Binder (%) | Maximum Allowable % (Percentage by Weight of Total Mixture) |                               |                  |
|--|---|---|-------------------------------|------------------|
|  |   | Unfractionated RAP <sup>2</sup>                             | Fractionated RAP <sup>3</sup> | RAS <sup>4</sup> |
| Surface Mixes <sup>5</sup>                                       | 35  | 10  | 20                            | 5                |
| Non-Surface Mixes <sup>6</sup> < 8 in. From Final Riding Surface | 40  | 15  | 30                            | 5                |
| Non-Surface Mixes <sup>6</sup> > 8 in. From Final Riding Surface | 45  | 20  | 40                            | 5                |

### Allowable Substitutions (Table 3A)

| PG Binder Originally Specified | Allowable Substitute PG Binders |
|--------------------------------|---------------------------------|
| PG 76-22                       | PG 70-22 or PG 64-22            |
| PG 70-22                       | PG 64-22 or PG 58-22            |
| PG 64-22                       | PG 58-22                        |
| PG 76-28                       | PG 70-28 or PG 64-28            |
| PG 70-28                       | PG 64-28 or PG 58-28            |
| PG 64-28                       | PG 58-28                        |

### SP 341-024

- The contractor may substitute PG binder listed in Table 3A in lieu of the PG binder originally specified, if the substitute PG binder and mixture made with the substitute PG binder meet the following:



### SP 341-024

- the substitute binder must meet the specification requirements for the substitute binder grade in accordance with Section 300.2.J, "Performance-Graded Binders;"
  - The substitute binder used in a mix design will be tested at the temperature grade you tell us it is. (i.e. a PG 64-22 will be tested as and must meet the requirements of a PG 64-22)
  - We are not going to test the combined binder (virgin binder + recycled binder) for specification compliance

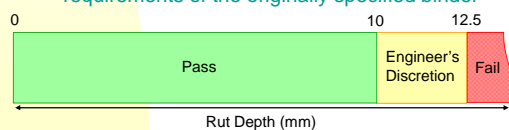
### SP 341-024

- the substitute binder has an un-aged dynamic shear value less than or equal to 2.00 kPa and an RTFO aged dynamic shear value less than or equal to 5.00 kPa at the PG test temperature; and
  - There is an upper limit for the DSR test
  - A PG 70-22 used to meet the requirements of a PG 64-22; not necessarily true now.



### SP 341-024

- the mixture has less than 10.0 mm of rutting on the Hamburg Wheel test (Tex-242-F) after the number of passes required for the originally specified binder. Use of the substitute PG binders may only be allowed at the discretion of the Engineer if the Hamburg Wheel test results are between 10.0 mm and 12.5 mm.
  - Mixtures are tested and must meet the requirements of the originally specified binder



### Same Scenario – Under New Specs



- Overlay on IH-35
- Plans specify a PG 76-22
- Specs. allow up to 20% recycled material
- Contractor designs with a PG 70-22, 15% RAP and 5% RAS
- HWT ~ 7mm rut depth @ 20,000 passes



### How Do I Get There

(Ability to Use Substitute Binders)



- RAP
- RAS
- Higher Quality Materials
  - ◆ Aggregate
  - ◆ Asphalt
- Other Additives
  - ◆ Lime
  - ◆ Liquid Anti-Strip

### Rule of Thumb

An addition of **5% RAS** or **20% RAP** in the mix gives roughly one grade bump in the binder as shown by the DSR.


| High Temp Grade    |            |                |
|--------------------|------------|----------------|
| Type D<br>PG 64-22 | 20%<br>RAP | 5%<br>Shingles |
| 67                 | 71         | 74             |

That same addition of **5% RAS** or **20% RAP** in the mix shows the stiffness doubling as shown by the Hamburg


### Rule of Thumb

- The addition of about 20% RAP stiffens the combined binder one grade
- The addition of about 5% RAS has the same effect
- This is a good starting point and only a rule of thumb



### Implications

- Shifts the importance of mix design responsibility to the Level II "Mix Design Specialist"
- Production temperatures should be adjusted to reflect the anticipated final PG grade
- Concerns when WMA is used in addition to RAP & RAS
  - ◆ WMA has less oxidizing effect
  - ◆ RAP & RAS has more oxidizing effect on binder
  - ◆ Are we getting proper blending?



### Questions ?