

SECTION DESIGN, MIXTURE DESIGNS AND QUALITY CONTROL

APWA

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STEVEN R. MARVIN



Pavement Design Components

- Material Type
 - Asphalt Concrete
 - Aggregate Base
 - Cement Treated Base/Recycled CTS
- Traffic Use
- Subgrade Soil Support
 - R-value
 - CBR
 - Modulus
- Design period

Terms

- Subgrade
- Aggregate Subbase (ASB)
- Aggregate Base (AB)
- Asphalt Concrete (AC)
- Full Depth Reclamation (FDR)
- Cement Treated Soil/Base (CTS/CTB)
- Lime Treated Soil (LTS)

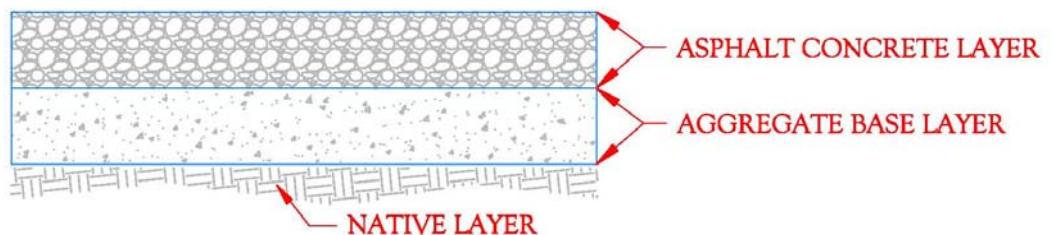
Full Depth Reclamation Mix Design

- Proportional Blend
- Variable Application Rates
- Measure design parameters including R-value, compressive strength, appearance, density



Proportion Blend

- Determine existing pavement section
 - Asphalt concrete thickness
 - Aggregate base thickness
 - Subgrade soil conditions
- Develop preliminary section requirements
 - Subgrade R-value



Proportion Blend (cont'd)

- Determine site preparation method
 - Asphalt concrete removal/pulverization
 - Aggregate base thickness
- Determine site export requirements
 - Asphalt concrete thickness
 - Aggregate base thickness

Proportion Blend (cont'd)

- Duplicate site blend
 - Mix with various Portland Cement application rates (probable 4% to 8%)
 - Observe mixing characteristics
 - Compact and determine treated maximum density
 - Determine 7 day compressive strengths

TYPICAL ACCEPTANCE CRITERIA

- 7 Day Compressive Strength
 - 400 psi to 1100 psi
 - 750 psi typical

Section Design - Conventional

- Total Section
 - $T=0.0032(100-R)TI$
- Asphalt Concrete
 - $(0.0032(100-22) + SF)/Gf$

Where R = Subgrade R-Value and TI is Traffic Index

Section Design – Stabilized Layer

- Total Section
 - R-Value + Traffic Index
- Asphalt Concrete
 - $(40\% \text{ Total Section} + \text{SF})/\text{Gf}$

Section Design Example

- Subgrade R-value 5
- Traffic Index 5.0 & 7.0
- Conventional Design
- Full Depth Reclamation

Section Design Example

- Full Depth Reclamation
 - Conventional Design Procedures
 - Asphalt Concrete = 40% Total Section+ SF
 - Asphalt Concrete based on limiting FDR R-value

Section Design Example- Conventional Section

$$\begin{aligned}T_{\text{Total}} &= 0.0032(100-5)5.0 \\&= 1.52' (18.24")\end{aligned}$$

$$T_{\text{AC}} = 2.64" \quad \text{use 3"}$$

$$T_{\text{AB}} = 9.76" \quad \text{use 10"}$$

Section Design Example- 40% Procedure

$$\begin{aligned} T_{\text{Total}} &= 0.0032(100-5)5.0 \\ &= 1.52' (18.24") \end{aligned}$$

$$T_{\text{AC}} = 3.87" \quad \text{use 4"}$$

$$T_{\text{FDR}} = 6.87" \quad \text{use 8"}$$

Section Design Example- Conventional Section

Limit FDR R-value to 50 maximum

$$\begin{aligned} T_{\text{Total}} &= 0.0032(100-5)5.0 \\ &= 1.52' (18.24") \end{aligned}$$

$$T_{\text{AC}} = 4.80" \quad \text{use 5"}$$

$$T_{\text{AB}} = 4.78" \quad \text{use 8"}$$

Section Design Summary – TI 5.0

• Asphalt Concrete	3"	4"	5"
• Aggregate Base	10"	-	-
• FDR	-	8"	8"
• Subgrade Compaction	90%	N/A	N/A

Section Design Summary – TI 7.0

• Asphalt Concrete	4"	6"	4"	7 1/2"
• Aggregate Base	15 1/2"	-	7"	-
• FDR	-	11"	8"	8"
• Subgrade Compaction	90%	N/A	N/A	N/A

Asphalt Concrete Material Selection

- Enhance Tensile Strength
- Enhance durability
- Recommend Use of
 - Type B AR8000
 - Type III B3 AR8000
 - Type A $\frac{3}{4}$ " Maximum AR8000
 - Type B $\frac{3}{4}$ " Maximum AR8000



What is Quality Control?

- Any combination of documentation, inspection, observations or sampling that increases the understanding of the final product, individual components, and production variability



Construction Controls

- Thickness control
 - Grade tolerances
 - Prior to treatment
 - After treatment

Construction Controls

- Spread Rate
 - Pan weights
 - Truck yield
 - Daily yield
- Mixing Depth
 - Test holes
- Mixing Uniformity
 - Test holes/observations/pH indicator

Construction Controls

- Mixture Characteristics
 - Maximum Density
 - Optimum Moisture
 - 7 Day Compressive Strengths

Construction Controls

- Fine Grading
 - Timeliness
 - Compaction

Construction Controls

- Curing
 - Moist Cure
 - Curing Seal
 - Traffic Limits

Critical Elements

- Grade tolerances
 - Impacts thickness of completed layer
- Spread Rate/Mixing Depth
 - Impacts effective application rate
 - Impacts thickness of completed layer
- Mixture Uniformity
 - Impacts effective application rate
 - Impacts thickness of completed layer
 - Impacts short and long term performance

Why Quality Control ?

- Increase probability of contract compliance
- Protect City, Contractor and Material Supplier
- Better understand performance issues over time
- Provide improved basis for future project design



Proactive Production Control

- Construction Documentation
 - Material source confirmation
 - Material quantities
 - Mixture proportions
 - Spread rate
 - Material qualities
 - Mixture proportions
 - Spread rate
 - Layer strength



Proactive Production Control

- Date and Location of work (street and limits)
- Construction equipment
 - Size
 - Number
 - Operating condition
- Weather conditions
- Existing surface conditions
- Set/cure time
- Rolling patterns (where applicable)



Proactive Production Control

- Post construction inspection
 - Initial Performance review
 - Identify required corrective action
 - Comparison with quality control information
 - Long term performance review
 - Provide input relative to material or construction changes for future work



ALTERNATIVE TO QC

- TRUST EVERYTHING WILL BE ALL RIGHT
- ACCEPT VARIABLE PERFORMANCE WITHOUT EXPLANATION
- ACCEPT VARIABLE PERFORMANCE WITHOUT POTENTIAL FOR IMPROVEMENT OF FUTURE PERFORMANCE