

*P3*

*Pavement Performance Prediction Symposium 2005*

# ***Adhesion and Cohesion of Asphalt in Pavement***

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# Introduction

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Statement of the Problem

Direction of the Symposium

Desired Outcome

# Steps to a Quality Road

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## Critically Important Factors

Design – Mix, Pavement, Geometric

Material Selection – **Asphalt**, Aggregate,  
Additive(s)

Proper Construction

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This Symposium is to Focus on  
Material Selection

ASPHALT – the 30 million tons of “black glue” used to build and maintain 90+ percent of the 2 million miles of U.S. public roads.

This is roughly a rail tank car load per minute – around the clock, around the calendar

ASPHALT – A generic name for a wide variety of materials that come from hundreds of different crude oil sources and mixtures of crudes

# Asphalt Selection Process

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High-, mid- and low-temperature, and oxidative aging properties are specified by Superpave

THE PROBLEM – Asphalts from various sources differ from each other with respect to Adhesive and Cohesive properties, and therefore with respect to performance

WE HAVE – Numerous test methods for asphalts

THE NEED – Rapid test methods that differentiate among asphalts with respect to adhesive and cohesive properties and hence to long-term pavement performance

## Today's Binder Selection Process

Superpave<sup>®</sup> Binder Specification

Superpave Plus

State-to-State Additional Specifications

Examples: While the AASHTO Standard for moisture susceptibility is T-283,

Nevada requires a full Lottman test

Kansas uses an improved T-283 test

Texas (most districts) requires a Hamburg test

## Today's Binder Selection Process (cont.)

### State-to-State Additive Requirements

Examples:

Georgia, Arizona and Wyoming have a universal lime requirement

Kansas requires an anti-strip, but it is contractor's choice

Many states have polymer requirements, but are job specific

**Point:** It sounds as if states aren't comfortable with Superpave as being complete

## Question:

- Do the Superpave Binder Specifications, Plus Specs and other current tests distinguish asphalt behavior in pavement?
- Are the current specifications sensitive to long term performance?

The Superpave Binder Specification is silent on adhesion and minimal on cohesion.

Numerous states, therefore, as previously stated, have additional state-specific specifications.

## Do Mixture Tests Evaluate Adhesion and Cohesion Adequately?

- Apparently not because, again, many states invent/employ unique tests and specifications.

Does “Lock Down” of Asphalt Source Help?

- Not really

Why?

- Specifying a particular supplier does not guarantee that the test asphalt and job asphalt are the same

In addition to specifying high-, mid-, and low-temperature, and oxidative aging properties, there is a need to also assure adhesive and cohesive properties of the binder as it is produced.

Question:

What is the cost of selecting a poor combination of asphalt, aggregate and additive(s), i.e., the cost of early failure?

**BALLPARK: \$1-4 million per mile**

# Cost of Early Failure

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## Question:

How many miles of highway per year fail prematurely?

This question is complex and has several answers:

- First, define failure that requires replacement.
- How early is the failure?
- What can be done to rehab the road?
- What kind of road – how many lanes?
- What is the cause of failure?

## Consider Some Very Minimal Numbers

If there are two miles of road per state per year that fail early (that is 0.005 percent of the total road, or one mile in 20,000),

Presume the replacement cost is 1.5M \$ per mile

That totals \$150,000,000 per year

**Point:** A trivial percentage of early failure equals a huge cost

# Symposium Agenda

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- Research to Specification
- Examples of State DOT Early Failures
  - What does “the state” have to evaluate adhesion and cohesion?
  - What would “the state” like to have?
- Values of Common Additives
- Basic Research on Adhesion & Cohesion
- **Development of a Research Needs Statement**