VEHICLE-PAVEMENT INTERACTION

• Workshop on Super-Single Tires

• Mixture Design to Enhance Safety and Reduce Noise of HMA

• Pavement Response Model to Dynamic Loads
WORKSHOP

• Review of progress on the use and impact of super single tires on pavements

• Plan future activities in this area

• October 24-25, 2007

• Turner Fairbank Highway Research Center

• 12-15 U.S. and International participants
PAVEMENT MODEL

• Develop a fundamental model to predict the response of flexible pavements to traffic loads moving at a certain speed.

• To be used as an advanced analysis model for
  – Intersections
  – Heavy loads
  – Off-road equipments
PAVEMENT MODEL

I. Dynamic Load
   - Truck suspension
   - Road roughness
   - Braking/Acceleration
   - Speed

II. Tire-Pavement Interface
   - Inflation pressure
   - Tire type
   - Tire load
   - Speed

III. Pavement Response
   - Inertia
   - Material characteristics
PAVEMENT MODEL
III. Pavement Response

Material Characterization

• HMA Layer: viscoelastic properties
  – Dynamic modulus master curve
  – Inertia
  – Internal damping (phase angle)

Unbound material: linear elastic properties
  – Modulus
  – Inertia
  – Internal damping
III. Pavement Response

Material Characterization

• HMA Layer: Variation of Dynamic Complex modulus with loading frequency

\[ E^* = E' + i E'' \]

where \( E' = \) Storage Modulus
\( E'' = \) Loss Modulus

For every loading frequency select \( E' \) and \( E'' \)
# COMPARISON OF MODELS

<table>
<thead>
<tr>
<th>Condition</th>
<th>Current Practice</th>
<th>Proposed Practice</th>
<th>Future Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMA</td>
<td>L-E</td>
<td>L-V-E</td>
<td>N-L-V-E</td>
</tr>
<tr>
<td>Base/SG</td>
<td>L-E</td>
<td>L-E</td>
<td>N-L-E</td>
</tr>
<tr>
<td>Loads</td>
<td>Static</td>
<td>Moving</td>
<td>Static</td>
</tr>
<tr>
<td>Pressure</td>
<td>Uniform</td>
<td>Any Dist.</td>
<td>Any Dist.?</td>
</tr>
<tr>
<td>Application</td>
<td>Simple</td>
<td>Moderate</td>
<td>Complicated</td>
</tr>
</tbody>
</table>
PAVEMENT MODEL

- Is it a Comprehensive Model: No
- Public Domain
- Time Efficient
- Short Term Delivery: 2-3 years
PAVEMENT MODEL

• Applicable to a Wide Range of Cases

• Improvements:
  - dynamic loads
  - dynamic behavior of pavement
  - non-uniform stress distributions
  - two-dimensional stress distributions
  - incorporates pavement roughness