Evaluation of Feasibility of Using Composite Pavements in Florida By Means of HVS Testing

By

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Wasantha Kumara  Chung-Lung Wu
Acknowledgments

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### Research Need

<table>
<thead>
<tr>
<th>Increasing truck loads and tire pressure</th>
<th>Possible Solution: Whitetopping (WT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rutting and surface-initiated cracking in asphalt pavements</td>
<td>Advantages of WT</td>
</tr>
<tr>
<td>Increasing price of asphalt</td>
<td>- Resistant to rutting and surface-initiated cracking</td>
</tr>
<tr>
<td></td>
<td>- Better long-term performance</td>
</tr>
</tbody>
</table>

There is a need to effectively evaluate the feasibility and proper application of WT pavements in Florida.
Types of Whitetopping

- Conventional White-topping (CWT)  
  > 8"

- Thin White-topping (TWT)  
  5" - 8"

- Ultra-thin White-topping (UTW)  
  < 5"
How does un-bonded Whitetopping work?
How does bonded Whitetopping work?
Effects of joint spacing
Effects of temperature differential in the concrete slab
Objectives

- To develop analytical models for analysis of the behavior of UTW, TWT and CWT pavements. These models are to be verified and fine-tuned by experimental results.

- To evaluate the potential performance of the WT pavement test sections for use under Florida conditions.

- To assess the applicability of UTW, TWT and CWT techniques for rehabilitation of asphalt pavements in Florida.
Approach

- Run full scale experiments with proper instrumentation

- Develop a reliable model and methodology to analyze the behavior of WT pavements under the effects of load and temperature
  - calibrate and verify the analytical model
  - observe relationships between performance (distresses) and measured strains and calculated stresses
Approach

12 kip load
4-inch slab

Model Calibration

Analytical Tool to predict the behavior of WT pavements

Design recommendations
Analytical Model

3D Solid Element

Interface

AC Layer (4.5")

Longitudinal Joint

Transversal Joint

Wheel Load

Concrete

Base

Subgrade

Joints

Kt, Ks, Kn

3D Solid Element
Test Sections

- **Phase I: bonded**
  - Phase I-a: 6’ x 6’ Slabs
  - Phase I-b: 4’ x 4’ Slabs
  - 4, 5 and 6 inch slabs

- **Phase II: Un-bonded**
  - 6’ x 6’ Slabs
  - 6, 8 and 10 inch slabs
**Instrumentation**

**Gages locations**

Gauge 1

Gauge 2

Gauge 3

Locations 1, 2, 3, 4 and 5

**Thermocouples**

- Thermocouple
- Gauge

Wheel Path Direction
Construction & Testing of Test Sections
Material Characterization

- Characterization of the test sections by both laboratory and FWD testing, to obtain pavement parameters of the test sections.

<table>
<thead>
<tr>
<th>4 ft</th>
<th>4 ft</th>
<th>CENTER EDGE LOADING</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 2</td>
<td>6 5</td>
<td>4 3 2 1</td>
</tr>
<tr>
<td>7 2</td>
<td>6 5</td>
<td>4 3 2 1</td>
</tr>
<tr>
<td>7 2</td>
<td>6 5</td>
<td>4 3 2 1</td>
</tr>
<tr>
<td>7 2</td>
<td>6 5</td>
<td>4 3 2 1</td>
</tr>
</tbody>
</table>
### Material Characterization

#### Interface

<table>
<thead>
<tr>
<th>Intended Bond Condition</th>
<th>Slab Size</th>
<th>Shear Strength Before Loading (psi)</th>
<th>Shear Strength After Loading (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bonded (Phase I-a)</td>
<td>6’ x 6’</td>
<td>207.5</td>
<td>220</td>
</tr>
<tr>
<td>Bonded (Phase I-b)</td>
<td>4’ x 4’</td>
<td>-</td>
<td>194.5</td>
</tr>
<tr>
<td>Un-bonded (Phase II)</td>
<td>6’ x 6’</td>
<td>118.6</td>
<td>134.4</td>
</tr>
</tbody>
</table>

#### Concrete

<table>
<thead>
<tr>
<th>Curing Time, days</th>
<th>Compressive Strength, psi</th>
<th>Elastic Modulus, ksi</th>
<th>Flexural Strength, psi</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1,690</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>2,940</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>3,930</td>
<td>3,440</td>
<td>-</td>
</tr>
<tr>
<td>14</td>
<td>4,750</td>
<td>3,737</td>
<td>732</td>
</tr>
<tr>
<td>28</td>
<td>5,980</td>
<td>3,940</td>
<td>772</td>
</tr>
<tr>
<td>56</td>
<td>6,750</td>
<td>4,380</td>
<td>847</td>
</tr>
</tbody>
</table>

#### Phase I

<table>
<thead>
<tr>
<th>Curing Time, days</th>
<th>Compressive Strength, psi</th>
<th>Elastic Modulus, ksi</th>
<th>Flexural Strength, psi</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1,933</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>3,608</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>4,651</td>
<td>3,307</td>
<td>-</td>
</tr>
<tr>
<td>14</td>
<td>-</td>
<td>3,875</td>
<td>808</td>
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<tr>
<td>28</td>
<td>6,083</td>
<td>4,004</td>
<td>855</td>
</tr>
<tr>
<td>56</td>
<td>6,612</td>
<td>4,272</td>
<td>-</td>
</tr>
</tbody>
</table>

#### Phase II

<table>
<thead>
<tr>
<th>Curing Time, days</th>
<th>Compressive Strength, psi</th>
<th>Elastic Modulus, ksi</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1,933</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>3,608</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>4,651</td>
<td>3,307</td>
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<tr>
<td>14</td>
<td>-</td>
<td>3,875</td>
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<tr>
<td>28</td>
<td>6,083</td>
<td>4,004</td>
</tr>
<tr>
<td>56</td>
<td>6,612</td>
<td>4,272</td>
</tr>
</tbody>
</table>

#### Asphalt

<table>
<thead>
<tr>
<th>AC Properties</th>
<th>Temperature 5 °C</th>
<th>Temperature 15 °C</th>
<th>Temperature 25 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resilient Modulus (ksi)</td>
<td>1,787</td>
<td>1,193</td>
<td>750</td>
</tr>
<tr>
<td>Indirect Tensile Strength (psi)</td>
<td>-</td>
<td>272</td>
<td></td>
</tr>
</tbody>
</table>
Temperature Differential in Concrete

Temperature Differential - Phase I-a - 6" - 6'x6' slab
May 20th - May 25th

Temperature Diff (F)

Time (min)

Center
Corner
Temperature Differential in Concrete

Fall - Winter

Temperature Differential - Phase I-a - 5" - 6'x6' slab
November 1st 2004 - January 13th 2005

Temperature Diff. (F)

Time

Center  Corner
Temperature Differential in Concrete

Temperature Differential - Phase I-b - 6" - 4'x4' slab
June 17th - June 22nd

[Graph showing temperature differential over time for center and corner locations, with data points indicated at specific hours and times.]
Temperature Differential in Concrete

Temperature Differential - Phase II - 6" - 6'x6' slab
Jan 31st - Feb 15th, 2006

Winter
Temperature in the surface of the AC layer - Phase I-a - 6" - 6’x6’ slab

May 20\textsuperscript{th} - May 25\textsuperscript{th}, 2005

Temperature (C)

Time (min)
Temperature in AC Layer

Fall – Winter

Temperature on the surface of the AC layer - Phase I-a - 5" - 6'x6' slab

November 1st 2004 - January 13th 2005

Time

Temperature (C)

Center - Corner

0 5 10 15 20 25 30 35

Temperature in AC Layer

Temperature in the surface of AC - Phase I-b - 6" - 4'x4' slab
June 17th - June 22nd

Center
Corner
# Temperature in AC Layer

**Winter**

## Temperature in the surface of AC layer - Phase II - 6" - 6'x6' slab

Jan 31<sup>st</sup> - Feb 15<sup>th</sup>, 2006

<table>
<thead>
<tr>
<th>Time</th>
<th>TC 1</th>
<th>TC 2</th>
<th>TC 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>12:00:00 AM</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>12:05:00 AM</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>12:10:00 AM</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>12:15:00 AM</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>12:20:00 AM</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>12:25:00 AM</td>
<td>25</td>
<td>25</td>
<td>25</td>
</tr>
</tbody>
</table>

![Graph showing temperature changes over time](chart.png)
Deflection-based calibration

Determination of Elastic Modulus - Phase I-a
FWD test run on the center of the 4" - 12' x 18' slab, sensors in the longitudinal direction

- Concrete: 4,350,000 psi
- AC: 700,000 psi
- Base: 160,000 psi
- Subgrade: 30,000 psi

Distance (in)

Deflection (mils)
Deflection-based calibration

Determination of Elastic modulus - Phase I-b

FWD test run on the center of the 6" - 12' x 18' slab, sensors in the transversal direction

Case 1:
Concrete: 4,350,000 psi
AC: 1,100,000 psi
Base: 160,000 psi
Subgrade: 27,000 psi

Case 2:
Concrete: 4,350,000 psi
AC: 1,100,000 psi
Base: 100,000 psi
Subgrade: 27,000 psi

Case 3:
Concrete: 4,350,000 psi
AC: 850,000 psi
Base: 160,000 psi
Subgrade: 27,000 psi

Distance (in)

Deflection (mils)
Deflection-based calibration

Calibration of Springs at joints - Phase I-b
FWD test run on 5" - 4' x 4' slab, drops at the corner, sensors along the edge of the loaded slab

Distance (in)

Deflection (mils)

Case 1:
Concrete: 4,350,000 psi
AC: 850,000 psi
Base: 100,000 psi
Subgrade: 28,000 psi
K-spring: 100,000 lb/in

Case 2:
Concrete: 4,350,000 psi
AC: 1,100,000 psi
Base: 100,000 psi
Subgrade: 28,000 psi
K-spring: 1,000 lb/in

FWD-1  -  Case 1  -  Case 2
Deflection-based calibration

Calibration of vertical springs - Phase II
FWD test run on 8" slab, drops at the corner, sensors along the edge of the loaded slab

Case 1:
- Interface Z: $5.0 \times 10^8$ lb/in
- Interface X: 500,000 lb/in
- Interface Y: 500,000 lb/in
- Longitudinal Joint Z: 100,000 lb/in
- Transversal Joint Z: 100,000 lb/in

Case 2:
- Interface Z: $1.0 \times 10^9$ lb/in
- Interface X: 500,000 lb/in
- Interface Y: 500,000 lb/in
- Longitudinal Joint Z: 100,000 lb/in
- Transversal Joint Z: 100,000 lb/in
Strain-based Calibration

Strain comparison - 4" - 6'x6' slab - Phase I-a
Location 1, Gage 2 (bottom), 12 kips load

Case 1 (Best Match):
Concrete: 4,350,000 psi
AC: 300,000 psi
Base: 160,000 psi
Subgrade: 30,000 psi
K-joint: 100,000 lb/In

Case 2:
Concrete: 4,350,000 psi
AC: 500,000 psi
Base: 160,000 psi
Subgrade: 30,000 psi
K-joint: 100,000 lb/In

Strain (me) vs Time (sec)
Strain-based Calibration

Strain comparison - 6" - 4'x4' slab - Phase I-b
Location 1 - Gage 1 (top, depth 1.25"), 12 kips load

Time (sec)

Case 1:
Concrete: 4,350,000 psi
AC: 700,000 psi
Base: 130,000 psi
Subgrade: 28,000 psi
K-joint: 100,000 lb/lin

Case 2 (Best Match):
Concrete: 4,350,000 psi
AC: 300,000 psi
Base: 130,000 psi
Subgrade: 28,000 psi
K-joint: 100,000 lb/lin
Strain-based Calibration

Strain comparison - 6" - 4'x4' slab - Phase I-b
Location2 - Gage 3 (bottom, depth 5.3''), 12 kips load

Case 1:
Concrete: 4,350,000 psi
AC: 700,000 psi
Base: 130,000 psi
Subgrade: 28,000 psi
K-joint: 100,000 lb/in

Case 2 (Best Match):
Concrete: 4,350,000 psi
AC: 300,000 psi
Base: 130,000 psi
Subgrade: 28,000 psi
K-joint: 100,000 lb/in
Strain-based Calibration

Strain comparison - 10" - 6'x6' slab - Phase II

Location 1 - Bottom, 12 kips load

CASE 1 (Best Match)
Material properties:
Concrete: 4,350,000 psi
AC: 1,000,000 psi
Base: 100,000 psi
Subgrade: 30,000 psi

CASE 1 (Best Match)
Spring constants:
Interface X: 3,000,000 lb/in
Interface Y: 3,000,000 lb/in
Interface Z: 10^6 lb/in
Transv. Joint X: 10,000 lb/in
Transv. Joint Y: 10,000 lb/in
Transv. Joint Z: 100,000 lb/in
Long. Joint X: 10,000 lb/in
Long. Joint Y: 10,000 lb/in
Long. Joint Z: 100,000 lb/in

CASE 2
Spring constants:
Interface X: 3,000,000 lb/in
Interface Y: 3,000,000 lb/in
Interface Z: 10^6 lb/in
Transv. Joint X: 10,000 lb/in
Transv. Joint Y: 1,000,000 lb/in
Transv. Joint Z: 100,000 lb/in
Long. Joint X: 10,000 lb/in
Long. Joint Y: 100,000 lb/in
Long. Joint Z: 3,000,000 lb/in

CASE 2
Material properties:
Concrete: 4,350,000 psi
AC: 1,000,000 psi
Base: 150,000 psi
Subgrade: 30,000 psi

Gage 2  —  3D Model (Case 1) —  3D Model (Case 2)
Strain-based Calibration

CASE 1
Material properties:
Concrete: 4,350,000 psi
AC: 1000,000 psi
Base: 150,000 psi
Subgrade: 30,000 psi

CASE 2 (Best Match)
Material properties:
Concrete: 4,350,000 psi
AC: 800,000 psi
Base: 180,000 psi
Subgrade: 30,000 psi

Strain comparison - 10" - 6'x6' slab - Phase II
Location 5 - Bottom (depth 1.25"), 12 kips load

CASE 1
Spring constants:
Interface X: 1,000,000 lbin
Interface Y: 1,000,000 lbin
Interface Z: 100 lbin
Transv. Joint X: 0 lbin
Transv. Joint Y: 0 lbin
Transv. Joint Z: 100,000 lbin
Long. Joint X: 10,000,000 lbin
Long. Joint Y: 0 lbin
Long. Joint Z: 5,000,000 lbin

CASE 2 (Best Match)
Spring constants:
Interface X: 1,000,000 lbin
Interface Y: 1,000,000 lbin
Interface Z: 100 lbin
Transv. Joint X: 0 lbin
Transv. Joint Y: 0 lbin
Transv. Joint Z: 100,000 lbin
Long. Joint X: 10,000,000 lbin
Long. Joint Y: 0 lbin
Long. Joint Z: 3,000,000 lbin

Time (sec)

Gage 13  3D Model (Case 1)  3D Model (Case 2)
Strain-based Calibration

Strain comparison - 8" - 6'x6' slab - Phase II

Location 1 - Top (depth 0.8"), 12 kips load

CASE 1 (Best Match)
Material properties:
Concrete: 4,350,000 psi
AC: 1,000,000 psi
Base: 160,000 psi
Subgrade: 30,000 psi

CASE 1 (Best Match)
Spring constants:
Interface X: 3,000,000 lbf/in
Interface Y: 3,000,000 lbf/in
Interface Z: 10^6 lbf/in
Transv. Joint X: 0 lbf/in
Transv. Joint Y: 0 lbf/in
Transv. Joint Z: 100,000 lbf/in
Long. Joint X: 10,000 lbf/in
Long. Joint Y: 0 lbf/in
Long. Joint Z: 100,000 lbf/in

CASE 2
Material properties:
Concrete: 4,200,000 psi
AC: 1,000,000 psi
Base: 160,000 psi
Subgrade: 30,000 psi

CASE 2
Spring constants:
Interface X: 1,000,000 lbf/in
Interface Y: 1,000,000 lbf/in
Interface Z: 10^6 lbf/in
Transv. Joint X: 0 lbf/in
Transv. Joint Y: 0 lbf/in
Transv. Joint Z: 100,000 lbf/in
Long. Joint X: 10,000 lbf/in
Long. Joint Y: 0 lbf/in
Long. Joint Z: 1,000,000 lbf/in

Gage 1  3D Model (Case 1)  ▲  3D Model (Case 2)
Strain-based Calibration

Strain comparison - 8" - 6'x6' slab - Phase II
Location 1 - AC surface, 12 kips load

CASE 1 (Best Match)
Spring constants:
- Interface X: 3,000,000 lb/ft
- Interface Y: 3,000,000 lb/ft
- Interface Z: 10^9 lb/ft
- Transv. Joint X: 0 lb/ft
- Transv. Joint Y: 0 lb/ft
- Transv. Joint Z: 100,000 lb/ft
- Long. Joint X: 10,000 lb/ft
- Long. Joint Y: 0 lb/ft
- Long. Joint Z: 100,000 lb/ft

Material properties:
- Concrete: 4,350,000 psi
- AC: 1,000,000 psi
- Base: 160,000 psi
- Subgrade: 30,000 psi

CASE 2
Spring constants:
- Interface X: 1,000,000 lb/ft
- Interface Y: 1,000,000 lb/ft
- Interface Z: 10^9 lb/ft
- Transv. Joint X: 0 lb/ft
- Transv. Joint Y: 0 lb/ft
- Transv. Joint Z: 100,000 lb/ft
- Long. Joint X: 10,000 lb/ft
- Long. Joint Y: 0 lb/ft
- Long. Joint Z: 1,000,000 lb/ft

Material properties:
- Concrete: 4,200,000 psi
- AC: 1,000,000 psi
- Base: 160,000 psi
- Subgrade: 30,000 psi

Graph showing strain over time with blue line for Gage 3, red squares for 3D Model (Case 1), and green triangles for 3D Model (Case 2).
Critical Stress Analysis:

24-kip single axle load placed at mid edge and at slab corner

Axle Load Positioned on Slabs with 4-ft Joint Spacing
24-kip single axle load placed at mid edge and at slab corner

Axle Load Positioned on Slabs with 6-ft Joint Spacing
Effect of AC Elastic Modulus

Stress Comparison - Effect of the AC Elastic Modulus
5"- 4'x4' slab - Bonded condition - Load at the mid-edge

Stress (psi)

300,000  700,000  1,100,000
MR (psi)

dT=-10  dT=0  dT=+20
Effect of Temperature Differential

Stress Comparison - Effect of Temperature Differential
Bonded condition - 6' x 6' slab - Load at the corner

<table>
<thead>
<tr>
<th>Slab Thickness</th>
<th>-10 F</th>
<th>0 F</th>
<th>+20 F</th>
</tr>
</thead>
<tbody>
<tr>
<td>4&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Effect of Temperature Differential

Stress Comparison - Effect of Temperature Differential
Unbonded condition - 6’ x 6’ slab - Load at the mid-edge

<table>
<thead>
<tr>
<th>Slab Thickness</th>
<th>Stress (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6”</td>
<td>-10 F</td>
</tr>
<tr>
<td>8”</td>
<td>0 F</td>
</tr>
<tr>
<td>10”</td>
<td>+20 F</td>
</tr>
</tbody>
</table>
Effect of the Slab Size

Stress comparison - Effect of Slab Size
Bonded Condition - Load at the mid-edge

Stress (psi)

Slab Thickness (in)

- 6'x6', T=-10
- 6'x6', T=0
- 6'x6', T=20
- 4'x4', T=-10
- 4'x4', T=0
- 4'x4', T=20
Effect of the bond in the interface

Stress comparison - Effect of bond in the interface
Load applied at the mid-edge

Maximum Stress (psi)

Slab Thickness

-10 F - Phase II
0 F - Phase II
+20 F - Phase II

-10 F - Fully bonded
0 F - Fully bonded
+20 F - Fully bonded
Effect of the bond in the interface

Stress comparison for the 6" slab
Load applied at the mid-edge

Stress (psi)

Temperature Differential (°F)

- 6" - 6' x 6' - Bonded
- 6" - 6' x 6' - Unbonded
Shear stress in the interface

Bonded Condition - 6' x 6' slabs

Shear Stress in the interface

Shear stress (psi)

Slab Thickness (in)

E=300,000 psi, Load at the edge
E=1,100,000 psi, Load at the edge
E=300,000 psi, Load at the corner
E=1,100,000 psi, Load at the corner
Shear stress in the interface

Shear Stress in the interface
Bonded Condition - 4' x 4' slabs

Shear stress (psi)

Slab Thickness (in)

- $E=300,000$ psi, Load at the edge
- $E=1,100,000$ psi, Load at the edge
- $E=300,000$ psi, Load at the corner
- $E=1,100,000$ psi, Load at the corner
Tensile Stress in the AC layer

Bonded Condition - 6’ x 6’ slabs - +20 F Temp diff.

Stress (psi)

Slab Thickness (in)

- E=300,000 psi, Load at the edge
- E=1,100,000 psi, Load at the edge
- E=300,000 psi, Load at the corner
- E=1,100,000 psi, Load at the corner
Tensile Stress in the AC layer

Bonded Condition - 4' x 4' slabs - +20 F Temp diff.

Stress (psi)

<table>
<thead>
<tr>
<th>Slab Thickness (in)</th>
<th>E=300,000 psi, Load at the edge</th>
<th>E=1,100,000 psi, Load at the edge</th>
</tr>
</thead>
<tbody>
<tr>
<td>4''</td>
<td>▲</td>
<td>■</td>
</tr>
<tr>
<td>5''</td>
<td>▲</td>
<td>■</td>
</tr>
<tr>
<td>6''</td>
<td>▲</td>
<td>■</td>
</tr>
</tbody>
</table>

E=300,000 psi, Load at the corner

E=1,100,000 psi, Load at the corner
## Findings - Potential Performance

<table>
<thead>
<tr>
<th>Phase</th>
<th>Slab Thickness</th>
<th>Stress (psi)</th>
<th>Stress-strength Ratio</th>
<th># of Repetitions of 24-kip Axle Loads to Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-a</td>
<td>4”</td>
<td>568.3</td>
<td>0.675</td>
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Summary of Findings

- The method of milling and cleaning the asphalt surface and spraying it with water before the placement of concrete was found to produce excellent bonding at the interface, with a shear strength of 195 to 220 psi.

- When a white-pigmented curing compound was sprayed on the surface of the asphalt before the placement of concrete to intend to produce an unbonded interface, partial bonding was found to exist, with an average shear strength of 119 psi before the HVS loading and 135 psi after the HVS loading.
Summary of Findings (continued)

- With a relatively thin AC layer of 4.5 inches as typical for Florida conditions, a WT pavement with a 4-inch concrete layer can be used for low volume roads with heavy (24-kip single axle) loads.

- The allowable traffic volume increases as the concrete slab thickness increases.

- In order to be able to withstand the critical load without fear of fatigue failure (for an infinite number of critical load repetitions), a minimum slab thickness of 6 inches would be needed for a joint spacing of 4 ft, and a minimum slab thickness of 8 inches would be needed for a joint spacing of 6 ft.
Recommendations

- The developed 3-D finite element model is recommended for use for analysis of WT pavements subjected to load and temperature effects.

- It is recommended that experimental WT pavement test sections of various designs be constructed on actual roadways in Florida to evaluate their behavior and performance under actual environmental and traffic conditions. The experimental pavement sections will be instrumented for monitoring of temperature and strains on a long-term basis. This will enable the monitoring of the behavior of the WT pavements under critical load and temperature conditions.
Thank you!

Any Questions?