TPAD with Loading Rollers and Rolling Sensors in Retracted Position
TPAD Transportation System

Tractor

TPAD

Trailer
Case 1
Is this JCP a candidate for a Thin Overlay
Yes good for thin Overlay
90% of project looked like this
Very poor support

Very poor joints
IH 02, West Bound, Radar Scan w/ 400MHz

D

S

06° 12° 18° 24° 30° 36° 42° 48° 54° 60° 66° 72° 78° 84°
US385
Hartley County, Amarillo District
### FWD and Ground Coupled Radar Testing

#### FWD (W1) - After Repair (Air Temp. 42°F)

<table>
<thead>
<tr>
<th>Shoulder</th>
<th>Center Stripe</th>
<th>Shoulder</th>
</tr>
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<tbody>
<tr>
<td>1.1</td>
<td>9.2</td>
<td>1.3</td>
</tr>
<tr>
<td>8.3</td>
<td>9.5</td>
<td>9.9</td>
</tr>
<tr>
<td>10.9</td>
<td>10.2</td>
<td>10.2</td>
</tr>
<tr>
<td>4.6</td>
<td>4.9</td>
<td>5.2</td>
</tr>
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#### FWD (W1) - After Repair (Air Temp. 42°F)

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<tr>
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<tr>
<td>4.1</td>
<td>4.4</td>
<td>4.1</td>
</tr>
<tr>
<td>3.2</td>
<td>4.1</td>
<td>4.5</td>
</tr>
<tr>
<td>2.9</td>
<td>3.3</td>
<td>4.7</td>
</tr>
<tr>
<td>1.0</td>
<td>4.1</td>
<td>4.7</td>
</tr>
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</table>

### Center Stripe Shoulder Shoulder

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<th>Before Repair</th>
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<tr>
<td>4.6 4.6 4.5 4.4 3.7 3.7 4.2 4.7 5.7 6.2 4.6 4.9 4.6</td>
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**FWD and Ground Coupled Radar Testing**

**Center Stripe Shoulder Shoulder**

**Before Repair After Repair**
IH35W-SB-Fort Worth
17 inch overlay = settlement
Contractor encountered issues during boring.
District decided to fix the shoulder.
IH45 Pavement Depression

Current Google Earth view with sewer line
IH45 Pavement Depression

Aug 10, 2017
IH45 Pavement Depression

Lidar Aug 10, 2017
IH45 Pavement Depression

Lidar Aug 10, 2017
IH45 Pavement Depression

Volume
[ft³]
60.0685
Moving objects will not show up clearly as with a camera. (top)
Distress on the roads appear more visible with minimal light.
Request made by the District to check the settlement.

Dip has been observed about 10 yr ago
Google map also showed dip in 2011
IH45 Pavement Depression

26' UMID OF PAVING (1.26"")

ADDITIONAL PAVING AT RAMP LOCATIONS
WIDTH VARIES

12" E
12' LANES
10' SHLD (USUAL)
VARIES IN SOME LOCATIONS

1.25" PFG
4.25" AVG HMA
11" CONCRETE PAVEMENT
(JOINTED CONCRETE)

EXISTING TYPICAL SECTION (NB & SB MAINLANES)
IH45 Pavement Depression

SB Lane looking South

June 2013
IH45 Pavement Depression

Sewer SE-1 Relocation Plan

Approximate depth 30'
IH45 Pavement Depression
IH45 Pavement Depression

SB Lane looking South
June 2013
IH45 Pavement Depression

NB Lane looking South

June 2013
IH45 Pavement Depression

Current Google Earth view with sewer line
IH45 Pavement Depression

FWD scan pattern
IH45 Pavement Depression

IH45 SBOL OWP
IH45 Pavement Depression

IH45 SBOL Center

Distance (ft)

Distance (ft)
0 50 100 150 200 250 300 350 400

WTD Deflection (mils)

28’
IH45 Pavement Depression

IH45 SBIL Center

Deflections Increased 4 times

FWD
IH45 Pavement Depression

Deflections Increased 4 times

28’
IH45 Pavement Depression

IH-45 FWD

FWD

IH45 Pavement Depression
IH45 Pavement Depression

Sewer Line Depression

SBC

SH

400 MHz Radar

5.75" 15.25"
Location of Anomaly
Starts at 9 -10' from edge of shoulder
15" - 18" down
Radar Data at +/- 18 inches

Location “C”

Location “D”

IH-10 East

0 ft

100 ft

Culvert
The normal signal is shown on the left (C). The anomaly found, (D), shows a positive signal. The reflection, possibly moisture or metal, will not allow us to get a true reading below this point.
Layers are not consistent with the above scan. Possible settling still occurring below the view of the radar.
When water enters flex base, the strength will reduce drastically.
The 4in design (from 2005). The traffic data is way out of date. Traffic is far greater than they estimated in 2005. Design ESALs were 1.596M (Ralph used 1.7M) but number is now 3.898M. At that level, the design does not pass unless you drop the confidence to 90%, have an uncracked 4in of 500ksi AC present at reopening, and assume the wet springy base is still 40ksi. And then it fails the mechanistic check by cracking.
Number of Load Repetitions

0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000

Permanent Strain

Optimum +1%

Optimum

Optimum-1%
2016, US 277, South Bound, Outside Lane, Right Wheel Path: CORE LOCATIONS

**February**

- US 277 S. Outside Lane
- US 277 S. Inside Lane
- US 277 N. Inside Lane
- US 277 N. Outside Lane

**March**

- Core 1
- Core 2
- Core 3

**April**

- US 277 S. Outside Lane
- US 277 S. Inside Lane

North

South
New distress

US 277 S. Inside Lane

US 277 N. Inside Lane

US 277 N. Outside Lane

South

North
Few locations, flex base comes with in...
2016

- February;  - March;  - April;  - June;

The repairs below are color coded. Sealcoat was done after the April testing.
<table>
<thead>
<tr>
<th>Month</th>
<th>CORE LOCATIONS</th>
</tr>
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<tbody>
<tr>
<td>February</td>
<td>5.67 7.49 7.64 6.26</td>
</tr>
<tr>
<td>March</td>
<td>9.39 27.00 26.31 11.62</td>
</tr>
<tr>
<td>April</td>
<td>8.72 8.34 6.56</td>
</tr>
</tbody>
</table>

New distress
- US 277 S. Inside Lane
- US 277 N. Inside Lane
- US 277 N. Outside Lane

2016, US 277, South Bound, Outside Lane, Right Wheel Path: CORE LOCATIONS

February
- 5.67 7.49 7.64 6.26

March
- 9.39 27.00 26.31 11.62

April
- 8.72 8.34 6.56
Sealcoat was done after the April testing.
The graph shows the dielectric from the first layer – South Bound, Outside Ln., Right WP

Sealcoat was done after the April testing.
The graph shows the dielectric from the second layer South Bound, Outside Ln., Right WP.
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The graph shows the dielectric from the second layer South Bound, Outside Ln., Right WP.
The graph shows the dielectric from the second layer:

South Bound, Outside Ln., Right WP
The graph shows the dielectric from the second layer South Bound, Outside Ln., Right WP.
Patches did not lower FWD data.

Water entered Flex Base that caused continuous failures

Seal Coat solved the problem by preventing water from entering the base. First, seal coat was used in the south bound and the failure stopped. Similarly, seal coat was used in the north bound.

The final 2 inch surface was placed. No distress was observed.

Final/Completed

<table>
<thead>
<tr>
<th></th>
<th>2&quot; Hot Mix</th>
<th>2&quot; AC</th>
<th>10&quot; Flex Base</th>
<th>Subgrade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seal coat</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</table>
Chronic Pavement Distress

Rehabs: 1996, 2001 (top 2 inch AC)

1. Total AC 4.5-8.5 inch
2. 11 inch sand shell base
3. 8" select material
4. 6" lime treated subgrade

Condition in 2004
Problem Area at 2''
Problem Area at 4''
Severe surface distress
No Surface Distress

US69S-Outside Lane
Chronic Pavement Distress

Rehabs: 1996, 2001 (top 2 inch AC)

1. Total AC 4.5-8.5 inch
2. 11 inch sand shell base
3. 8" select material
4. 6" lime treated subgrade

Condition in 2004
Porous layer that lead to debonding
Porous layer that lead to debonding
Debonded at 2.75 inch
Stripping on US 175
Annotated results for US 175
Core Location

1. 1500ft West of MP105
2. 1500ft East of MP105
3. 200ft West of MP104
4. 2300ft West of MP104

MP105
IH30West
AC
JCP
Use of GPR to detect Segregation

Changes > 0.4 out of spec on air voids for Dense Texas mixes
> 0.8 for Open graded mixes
GPR Detection of HMA

Segregation Sensors Dielectric Plots

Dielectric Plots

Surface Dielectric

Distance (feet)

Ideal Case

Distance (feet)

SegrAc
GPR data from thick HMA section with subsurface damage
US 290 Condition after 5 years

INITIAL DEFECTS

- Segregation all layers
- Burnt binder
- Poor tack

Continued subsurface deterioration

Surface de-bonding
US 82 King Co.

Westbound
Fly Ash Treated Base

Eastbound
Cement Treated Base
US 82 King Co.
US 82 East CTB - weave over joint

Dielectric spikes over inside wheel path outside lane
US 82 East CTB – Bad 1

Blue – Outside Lane
Red – Inside Lane
US 82 West Fly Ash – Bad 1

Blue – Outside Lane
Red – Inside Lane