Pavement Research
Outline

• Uretek process
• CRCP
• JCP
• Bridge approach slabs
Uretek Process

• Level depressions on:
• Bridge approach slabs
• CRCP
• Drainage structures
• Parking lots

• Since 1994 36 Projects > 400,000 lbs
Uretek Process

- On JCP
- Reduce faulting (longitudinal and transverse)
- Undersealing
- Filling Voids
- Depressions
Uretek Process

• Polyurethane $\rightarrow$ 5/8” holes

• Between the slab and base course
• Beneath the base course
• Deep foundations
$X = \text{Horizontal distance (ft)}$

$Y = \text{Vertical distance (ft)}$
Assessment Tools

• FWD (deflections and voids)
• Dynaflect (Structural Number)
• High speed profiler (Profile, IRI, Faulting)
• AARB Walking Profiler (Profile and IRI)
• Core rig (Concrete cores)
Void detection (FWD)

![Graph showing load vs. deflection for different Commercial Drive types.](image-url)
CRCP depression leveling

- 35 years old
- 8” CRC
- 5” AC base course
- 12” Sand shell base course
- Pavement depression 2.3” (edge line)
- Length of depression 70 ft
- Test area 90 ft
Base line (BL) 1, 2, 3 is 2', 6', 10' from inside lane edge, respectively.

Base line (BL) 6, 5, 4 is 2', 6', 10' from outside lane edge, respectively.
DANGER: FLAMMABLE CONTENTS
UNDER PRESSURE
HARMFUL OR FATAL IF SWALLOWED
KEEP OUT OF REACH OF CHILDREN.
SEE OTHER CAUTIONS ON BACK.
NET WEIGHT 6.6 OZ./272G
(before injection)
<table>
<thead>
<tr>
<th></th>
<th>ICC HIGH SPEED PROFILER</th>
<th></th>
<th>ARRB WALKING PROFILER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>INSIDE LANE (IRI)</td>
<td>OUTSIDE LANE (IRI)</td>
<td>INSIDE LANE (IRI)</td>
</tr>
<tr>
<td></td>
<td>WHEELPATH</td>
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<tr>
<td></td>
<td>LEFT</td>
<td>RIGHT</td>
<td>LEFT</td>
</tr>
<tr>
<td>BEFORE</td>
<td>192</td>
<td>198</td>
<td>BEFORE</td>
</tr>
<tr>
<td>AFTER</td>
<td>106</td>
<td>86</td>
<td>AFTER</td>
</tr>
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<tr>
<td></td>
<td>121</td>
<td>111</td>
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</table>
Dynaflect

![Graph showing Dynaflect with Structural Number on the y-axis and Base line 2 on the x-axis. The graph compares 'Before' and 'After' with a legend indicating blue for 'Before' and pink for 'After'.]
Discussion

• Deflections were higher
• Y intercepts were higher
• 2 out of 50 test points were slightly above 2.0

• The overall structure of the pavement was not adversely impacted
Core Hole 2 (inside lane)
JCP

• 38 years old
• 9” PCC
• 12” soil cement
• Silty clay subgrade
• Failed load transfer devices (Star lug)
• Severe faulting (Long & Trans.)
• Heavy truck traffic (>100,000 lb)
Test areas

• Area 1 (Faults of approximately 1 inch)

• Area 2 (Slabs rehabilitated with Uretek in April 2002 (18 months of service))

• Area 3 (Slabs moving under traffic)
Treatments targeted

• Raising

• Undersealing

• Injection depths (Between slab and base course or beneath base course into subgrade)
Trenching
Uretek stiffness
Trench inspection

- Did underseal slab (layer about 0.25 inches observed)
- Voids were filled
- Layers of varying stiffness were observed in the Uretek

- Does not appear to waterproof pavement nor limit deflections at the joint
Injection depths

• Only 2 out of the 10 targeted locations for injection between the slab and base course
The graph shows the deflection (mils) of Area 1 Base line 3 (ft) for both 'Before' and 'After' conditions. The deflection values range from 0 to 25 mils. The graph compares the deflection at various points along the base line, indicating differences between the 'Before' and 'After' states.
Discussion

- Reduced or maintained deflections
- Significantly decreased the number of voids
- Did not adversely impact the pavement structure
Discussion

• Most of the joints locked up during the lifting process

• 18 of the 21 slabs replaced after 18 months of service
Bridge approach slab leveling

- 10” reinforced concrete
- 12” stone base course
- 6” treated soil
- 21 years old
- 40 feet long
- Two approach slabs tested
US 167 NB

US 167 BASELINE 4 (ft)

PROFILE (in)

BEFORE
AFTER
Linear (AFTER)
Linear (BEFORE)
Bayou Duplente SB

Bayou Duplente BASELINE 3 (ft)

PROFILE (in)

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40

BEFORE  AFTER  Linear (AFTER)  Linear (BEFORE)
Approach slab profile

40' approach slab

Ideal profile

Existing profile

X1

X2

X3

Y1

10' to 20'

10' to 15'
<table>
<thead>
<tr>
<th>WHEELPATH</th>
<th>INSIDE LANE (IRI)</th>
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<td>LEFT</td>
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<td></td>
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<tr>
<td>BEFORE</td>
<td>440</td>
<td>365</td>
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<tr>
<td>AFTER</td>
<td>291</td>
<td>217</td>
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<td>RIGHT</td>
<td></td>
</tr>
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<td>BEFORE</td>
<td>195</td>
<td>134</td>
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<tr>
<td>AFTER</td>
<td>130</td>
<td>87</td>
</tr>
</tbody>
</table>

**ICC HIGH SPEED PROFILER**

**NORTH BOUND AT US 167**

**SOUTH BOUND AT BAYOU DUPLENTIE**
FWD voids

US 167 Base line 3 Distance (ft)

Y intercept (mils)

Before

After

0 2 5 10 15 20 25 30 35 40 42 49 50 51
Dynaflect

US 167 Base line 3 Distance (ft)

Structural Number

Before

After

15 20 25 30 35 40 42 49 57 59
<table>
<thead>
<tr>
<th>Core location</th>
<th>Concrete Thick. (in)</th>
<th>Poly. Thick. (in)</th>
<th>Comments (Conditions found at field inspection)</th>
<th>Poly. Density (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>US 167</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N1</td>
<td>11.5</td>
<td>N/A</td>
<td>Polyurethane was not found. However, there was a five inch void</td>
<td>N/A</td>
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<tr>
<td>N2</td>
<td>9.5</td>
<td>0.5</td>
<td>0.5” of polyurethane found on one side of the core</td>
<td>Dense</td>
</tr>
<tr>
<td>N3</td>
<td>11.0</td>
<td>12</td>
<td>12” of polyurethane found. 5” was polyurethane and 7” was gravel/polyurethane mixture.</td>
<td>Dense</td>
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<tr>
<td>N4</td>
<td>10.0</td>
<td>N/A</td>
<td>Polyurethane was not found. 6” soil cement core extracted.</td>
<td>N/A</td>
</tr>
<tr>
<td>Bayou Duplente</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>S1</td>
<td>12</td>
<td>N/A</td>
<td>Polyurethane was not found.</td>
<td>N/A</td>
</tr>
<tr>
<td>S2</td>
<td>9</td>
<td>2.5</td>
<td>2.5” of polyurethane found</td>
<td>Dense</td>
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<tr>
<td>S3</td>
<td>10</td>
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<td>Polyurethane was not found.</td>
<td>N/A</td>
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<tr>
<td>S4</td>
<td>9.5</td>
<td>N/A</td>
<td>Polyurethane was not found.</td>
<td>N/A</td>
</tr>
</tbody>
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(1) Dense means that the head of an ink pen could not be pushed into the polyurethane.
Discussion

- Maintained or lowered deflections
- Generally maintained Y intercepts
- Reduced number of points with voids by 50%
- Maintained structural number
Discussion (cont)

- Readings from 0 to 10 ft (invalid)
- FWD can be used to predict voids
- Slab prior to or following the approach slab should be injected also.
Conclusions

- Uretek method is effective for leveling CRCP and bridge approach slabs
- IRI values reduced from 38 to 68%
- As much as 2 inches of depression removed
Conclusions (cont)

• Pavement voids are filled

• Pavement is undersealed

• In CRCP & approach slabs, Uretek is dense

• JCP, varying layers of density
Conclusions (cont)

• Amount of support provided needs further investigation

• Does not appear to waterproof the pavement or stop pavement deflections
Recommendations

• Use as an alternate on CRCP and bridge approach slabs for leveling

• Use to repair depressions on any pavement type (unless failed)

• Emergency repairs only for JCP pavements
Recommendations

• Further research is needed

• Long term effects (all pavements)

• Varying layers of stiffness

• Joint strength and durability (JCP)