A Tour of European Practices for Two-Lift Paving

Thanks to:
- Dr. Dipl. Ing. Hermann Sommer
- E. Thomas Cackler, PE (IA)
- Andrew J. Gisi, PE (KS)
- Gary J. Fick

National Open House for Two-Lift Concrete Paving
Chesterfield, Missouri – 27-28 October 2010

Dr. Robert Otto Rasmussen, INCE, PE (TX)
Defining Performance

- **Structural**
  - Faulting, cracking

- **Material**
  - ASR, D-cracking

- **Functional**
  - Friction, noise, smoothness
Optimization through Two-Lift Paving

The potential for...

- Improved durability (longer life)
- Low noise, high friction
- Reduced fuel consumption
- Reduced tire and vehicle wear

Using two mix designs allows for optimization of structural, material, and functional Performance
Sustainability and Surface Characteristics Tracks
FHWA-AASHTO-NCHRP Scan Tour on Long-Life Concrete Pavements

- Canada
- Germany
- Austria
- Belgium
- The Netherlands
- United Kingdom

May 2006
LLCP Scan Team

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Austria in 1990: The Problem

Traffic noise
- Ban on concrete surfaces imminent
- Coarse aggregate exposed by studded tires
- Increasing (transit) traffic
→ fine-grained exposed aggregate concrete

Reconstruction
- 186-mile motorway A1 (Vienna to Salzburg)
- Thick overlays not feasible (too many bridges)
- Landfill space and virgin aggregates scarce
→ recycling
Austria since 1990: The Solution

Something old...
- 8.5-in. thick bottom lift
- 1.25 in. RCA or gravel aggregate
- Flexural strength $\geq 800$ psi

Something new...
- 1.5-in. exposed aggregate concrete top lift
- 3/8” maximum aggregate size, very durable
- Flexural strength $\geq 1000$ psi
Concrete Pavements in Austria

before

4 cm
22 cm
8 cm

after

4 cm exposed aggregate concrete MA 8 or MA 11
21 cm recycling concrete MA 32
5 cm bit. subbase
25 cm cement-bound material

crushed material
(max. 10 % asphalt)

70 % 4/32
30 % 0/4
tar-bound
Two-Lift Recycling Operation
Two-Lift Recycling Operation

- **RCA is strong**
  - 10,000 to 15,000 psi compressive!!
  - As good as many natural aggregates

- **RCA bonds well**
  - Strength higher and better than with many virgin aggregates.

- **RCA is high value**
  - Should be used for concrete and not wasted for subbases.

- Some HMA (RAP) can be included in the new concrete (up to 10%)
Coarse Aggregate for Exposed Aggregate
Batching

Mobile continuous mixing plant
For bottom lift
260 cu.yd. / hour
Batching

Mobile continuous mixing plant
For top lift
130 cu.yd. / hour
Paving Train
2008 New construction, A5 Vienna-Brno
41 ft. (12.5 m) wide, 0.5 mi. (800 m) per day
2008 New construction, A5 Vienna-Brno
41 ft. (12.5 m) wide, 0.5 mi. (800 m) per day
Paving Train
Placing Top Lift
Placing Top Lift
Placing Top Lift
Retarder/Cure Application
Retarder/Cure Application
Brushing (and curing again!)
Noise Intensity Testing in Europe: NITE II

- Sponsored by National CP Technology Center
- Concrete Pavement Construction Techniques
- “Rodeo” US and European Measurement Techniques
- October 2007
- Austria, Belgium, The Netherlands, Germany
- 68 Unique Test Sections
  - 16 Exposed Aggregate Concrete (6 AT, 3 BE, 1 NL, 6 GE)
  - 2 Porous Concrete (1 BE, 1 NL)
  - 1 Grinding (GE)
  - 2 Drag (GE)
  - Asphalt, chip seal (mostly at IPG test track)
- 20 km of Test Section Length
- OBSI for Tire-Pavement Noise, RoboTex for Texture
Measuring Texture using RoboTex
Measuring Noise using OBSI
CP Tech Center OBSI Noise Catalog

A-weighted Overall OBSI Level, 60 mph, SRTT (dB ref 1 pW/m²)

- Diamond Grinding
- Drag
- Longitudinal Tining
- Transverse Tining

Probability Density
20 mm Aggregate

106 dBA
The Netherlands
The Netherlands versus Belgium

96 dBA

104 dBA
German Practice

U.S. “Half-Ass” Practice
Germany

A-weighted Total L(EBL) Level, 60 mph, SRTT, dB ref 1 pW/m²

<table>
<thead>
<tr>
<th>Material Type</th>
<th>Level (dB)</th>
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<tbody>
<tr>
<td>Exposed Agg. (5mm)</td>
<td>106.1</td>
</tr>
<tr>
<td>Exposed Agg. (8mm)</td>
<td>105.2</td>
</tr>
<tr>
<td>Burlap Drag</td>
<td>103.8</td>
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</tbody>
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A4 Röhre (Site BE05) Test Section
Germany
Back in the U.S.A.
Let’s Build one like they do in Europe
... why not in Kansas?
Two-lift concrete paving provides opportunity to optimize structural, functional, and material performance.

Exposed aggregate surfaces can be used, but are not necessary.

Both the US and Europe can learn from our recent experiences together.
For more on this collaboration, please visit...

www.CPTechCenter.org

and...

Thank You !!!