



# Two-Lift Concrete Paving & Use of Geotextiles as a Bond Breaker

**Suneel N. Vanikar, P.E.**  
*Concrete Team Leader*

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# Long Life Concrete Pavement International SCAN (2005) - Recommendations for Implementation

- **Two-Lift Construction**
- Design Features Catalog
- Construction of High-Quality Foundations
- Greater Attention to Mix Design Components
- **Geotextile Interlayer**
- Exposed Aggregate Surfaces

# What is Two-Lift Paving?

- Two-Lift paving consists of two layers of PCC placed wet on wet, with each layer consisting of a special mix.
- The top layer should be engineered to obtain surface characteristics of reduced noise, improved friction, and greater durability.
- The bottom layer may be engineered to reduce materials cost and recycle.

# Goals of Two-Lift Paving

- Improved Surface Durability
- Improved Safety (friction)
- Reduced Tire/Pavement Noise
- Improved Environment by Recycling
- Improved Pavement Performance

# European Experience

- Countries employing two lift paving
  - France, Germany, and Austria
- Lessons learned
  - 2 to 5.5-inch high quality surface courses
  - 8.5 to 9.5-inch low cost base courses
  - Use of local aggregates in the base and imported aggregates in the surface
  - Two-lift paving equipment built

# USA Experience

- 11 Projects Built (1970-1994)
  - Iowa, North Dakota, Florida, Kansas, Michigan
  - Wet on wet construction
  - Use of recycled materials in base layer
  - Capping of base layer
  - Use of econocrete in base layer
  - Use of durable aggregates in surface or employment of exposed aggregate surfaces for improved noise/durability
- All in service today

# USA Projects Characteristics

- Facility – Street, Road, Interstate
- Lower Lift – gravel or lower quality limestone
- Width – 24 to 36-feet
- Load Transfer – some
- Joint Spacing – 15 or 20-feet
- ADT > 4,800
- Paving Method – slipform and/or forms
- Time Between Lifts – 30-60 minutes minimum

# Two-Lift Paving Design and Construction Details

- Lower Layer
  - Materials
  - **Recycling**
  - Construction
- Surface Layer
  - Materials
  - Texture
  - Construction

# Two-Lift Paving Lower Layer

- Recycling
  - Sort out wood and sealants when crushing the old pavement.
  - Use impact type crusher and operate at less than maximum output.
  - Dowels and reinforcement are no problem for magnetic separator.
  - An old 2-lane pavement should provide all the coarse aggregate for a new 3-lane pavement.
  - Keep RCA wet and monitor its density.

# Recent Implementation of Two-Lift Paving



Kansas DOT  
Two-Lift Paving Project

Completed Summer 2008

I-70  
Saline County

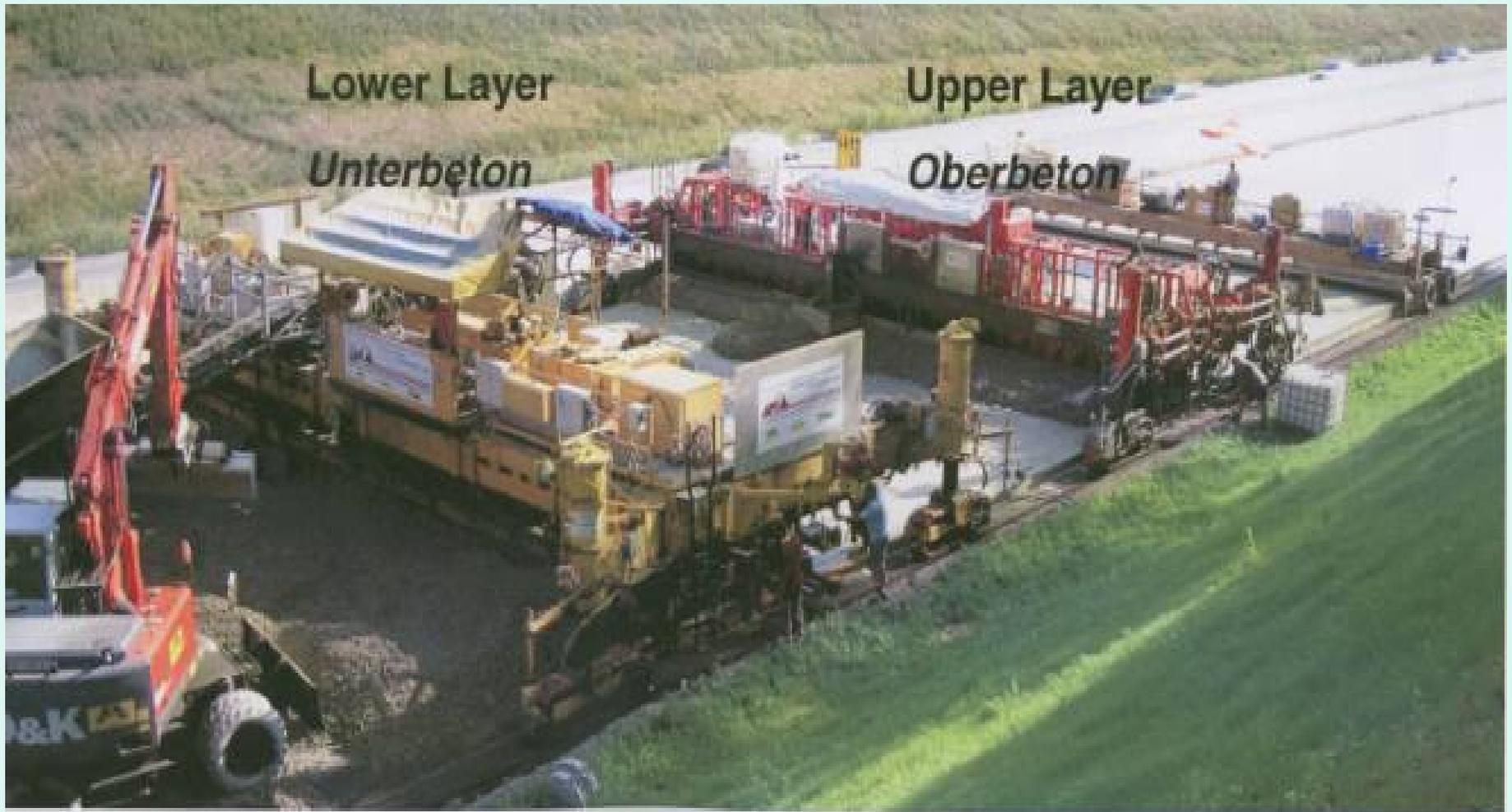
# Scope of Kansas Two-Lift Paving Project

- Construct 24-foot pavement with 6-foot inside and 10-foot outside shoulders
- Use non-"D" cracking aggregates in surface
- Construct several surface textures for noise reduction, improve friction, and reduce splash and spray
- Form centerline plastic joint

# KS DOT Mix Design

	<b>Bottom Lift</b>	<b>Top Lift (Textured Sections)</b>	<b>Top Lift (Exposed Aggregate Section)</b>
<b>PCC Type I/II(lb/yd<sup>3</sup>)</b>	<b>548</b>	<b>438</b>	<b>526</b>
<b>Fly Ash Class F (lb/yd<sup>3</sup>)</b>		<b>110</b>	<b>132</b>
<b>Water (lb/yd<sup>3</sup>)</b>	<b>236</b>	<b>236</b>	<b>270</b>
<b>Coarse Aggregate: Fine Aggregate Ratio</b>	<b>60 : 40</b>	<b>50 : 50</b>	<b>70 : 30</b>
<b>W/CM</b>	<b>0.43</b>	<b>0.43</b>	<b>0.41</b>
<b>Design Air Content</b>	<b>6.5%</b>	<b>6.5%</b>	<b>6.5%</b>
<b>Air Entraining Admixture (oz/yd<sup>3</sup>)</b>	<b>14</b>	<b>20</b>	<b>20</b>
<b>Mid-Range Water Reducer (oz/yd<sup>3</sup>)</b>	<b>5</b>		
<b>Anti-Bleed/Ant- Segregate Admixture (oz/yd<sup>3</sup>)</b>	<b>5.5</b>		
<b>Type A Water Reducer (oz/cwt)</b>		<b>5</b>	<b>5</b>

# Typical Two-Lift Paving Train



# Kansas Test Section



Courtesy Koss Construction Company

# Aggregate Management

- Plant
  - Dual Drum
  - Two Silos
    - Split
  - Aggregate Bins
    - Four



Courtesy Koss Construction Company

# Paving



Courtesy Koss Construction Company

# Kansas Test Section



Courtesy Koss Construction Company

# Paving



Courtesy Koss Construction Company

# Finished Surface



Courtesy Koss Construction Company

# Cores



Courtesy Kansas DOT

# Kansas Two-Lift Texturing

- 7 Surfaces

- Longitudinal Tining + Burlap Drag (Surf A, 500m)
- Burlap Drag + Longitudinal Grooving (Surf B, 800m)
  - Measured pre- and post-grooving
- Turf Drag + Longitudinal Grooving (Surf C, 800m)
  - Measured pre- and post-grooving
- Turf Drag (Surf D, 600m)
- Conventional Diamond Grinding (Surf E, 800m)
  - Measured pre- and post-grinding
- “Next Generation” Diamond Grinding (Surf F, 800m)
  - Measured pre- and post-grinding
- Exposed Aggregate Concrete (Surf G, 1000m)

# Exposed Aggregate Concrete



Courtesy CP Tech Center

# Construction Considerations

- Extra Equipment – plants, placers, pavers
- Definition of Low Quality Layer and a durable economical mixture – strength, durability, cost, etc.?
- Construction - site management, trucks, etc.
- Thermal coefficient differences between lifts

# Kansas DOT Conclusions

- Two-lift paving is possible and practical
- Economic paving sections can be achieved
- Exposed aggregate surface is possible and practical
- There are many choices for surface texture; their use may be condition dependant

# Contractor Conclusions (Koss Construction Company)

- Two-lift paving is a practical application
- There is limited production impact
- Economical
  - Economical bottom lift
  - Extended pavement life
- Team effort needed

# More Resources on Two-Lift Paving

- ISU- National Concrete Pavement Technology Center

- <http://www.cptechcenter.org/projects/two-lift-paving/index.cfm>

- Presentations from the open house held in Kansas
    - FHWA video conference
    - Kansas DOT workshop
    - 2006 International SCAN final report
    - Research reports

# Geotextile Interlayer

- A key detail recently introduced in Germany for cement-treated bases
- Thick geotextile interlayer prevents the concrete slab from bonding to the cement treated base
- Geotextile material is thicker than the materials commonly used for layer separation in the USA

# Geotextile Interlayer



# Geotextile Interlayer

- Geotextile is sufficiently porous and mortar from fresh concrete can permeate the geotextile
- Mortar provides a good mechanical bond to the concrete layer while achieving separation from the base layer

# Advantages

- Geotextile may provide a suitable alternate to the asphalt interlayer used in many States
- Ease of construction
- Cost savings?

# More Resources on the Geotextile Interlayer

- Draft Final Report
  - “Non-woven Geotextile Interlayer for Separating Cementitious Pavement Layers: A Report on European Practices and US Field Trials”
    - Prepared for: FHWA Office of International Programs
    - By: Robert Otto Rasmussen and Ms. Sabrina I. Garber (The Transtec Group)

# Questions?

Suneel Vanikar

[Suneel.vanikar@dot.gov](mailto:Suneel.vanikar@dot.gov)

202-366-0120