Cost Comparison of HMA and PCC for Kansas Rural Interstate Pavements
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Interstate/Kansas Turnpike
PCC Pavement (184 miles)
HMA Pavement (244 miles)
## Miles of Pavement

<table>
<thead>
<tr>
<th>Route</th>
<th>HMA</th>
<th>PCC</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-70</td>
<td>249.7</td>
<td>95.1</td>
</tr>
<tr>
<td>I-35</td>
<td>12.1</td>
<td>55.4</td>
</tr>
<tr>
<td>I-135</td>
<td>0</td>
<td>68.4</td>
</tr>
<tr>
<td>Totals</td>
<td>261.8</td>
<td>218.9</td>
</tr>
</tbody>
</table>
### Average 1-Way Traffic

<table>
<thead>
<tr>
<th></th>
<th>HMA</th>
<th>PCCP</th>
</tr>
</thead>
<tbody>
<tr>
<td>AADT</td>
<td>5,085</td>
<td>7,120</td>
</tr>
<tr>
<td>ESAL</td>
<td>1,140</td>
<td>1,230</td>
</tr>
<tr>
<td>Trucks</td>
<td>1,580</td>
<td>1,600</td>
</tr>
</tbody>
</table>
Basis of Analysis

• Expenditures per 4-Lane Mile of Mainline Paving
• Actual Dollar Basis
• Constant 2001 $ Basis
  –3.5% Annual Inflation Rate
Analysis by Section
Each Section has Discrete Beginning and Reconstruction or Rehabilitation Date

- HMA
  - 24 Sections
  - 4.0 - 23.2 miles

- PCCP
  - 32 Sections
  - 1.9 - 13.1 miles
Expenditures per 4-Lane Mile ($ millions)

- $-0.50
- $0.00
- $1.00
- $1.50
- $2.00
- $2.50
- $3.00
- $3.50
- $4.00
- $4.50
- $5.00

Pavement Age (Years)

OL

Reconst.
I-70 HMA

2001 $(Millions)

Pavement Age (Years)

Whitetopped

$5.00

$4.00

$3.00

$2.00

$1.00

$0.00
## Total Expenditures (Millions)

<table>
<thead>
<tr>
<th></th>
<th>HMA</th>
<th>PCCP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual</td>
<td>$279.5</td>
<td>$481.6</td>
</tr>
<tr>
<td>2001 $</td>
<td>$489.2</td>
<td>$693.6</td>
</tr>
<tr>
<td>Miles</td>
<td>262</td>
<td>219</td>
</tr>
</tbody>
</table>
Why The Difference?
Major Distress:

- HMA
- Thermal Cracking
- PCCP
- Joint Deterioration
I-70 HMA

HMA Original

- 14" HMA
- 3" PSC

HMA Rehabilitation

- 2" HMA
- 10.5" HMA
- 4" CIR
- 4" HR
- 1.5" HMA
Recycle
Reconstruct
Total Expenditures per 4-Lane Mile ($ millions)

- $1.32
- $2.04
- $1.82
- $0.66
- $0.50
- $1.00
- $1.50
- $2.00
- $2.50

HMA
PCC

$0.66
$1.32
$1.82
$2.04
Cost per 4-Lane Mile ($2001 millions)

<table>
<thead>
<tr>
<th>Pavement Type</th>
<th>$0.58</th>
<th>$0.74</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PCC</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Original Cost
Life-Cycle Cost

Performance / Cost History

Minimum Life-Cycle Recommendations*

*The opinions presented are those of the authors and do not necessarily reflect the position of KDOT
Reconstruction / Rehabilitation

Miles in Service

Age (Years)

Reconst. PCC $2.04
Rehab. HMA $0.66

HMA

PCC
Rehabilitation / Reconstruction

- **HMA**
  - 33 Years
  - 15-40 Range
  - $0.66 M per 4-Lane Mile

- **PCCP**
  - 34 Years
  - 22-42 Range
  - $2.04 M per 4-Lane Mile
Structural Overlays

- PCC-1
- PCC-2
- HMA-2

Miles in Service vs. Age (Years)
Structural HMA Overlays

- **HMA**
  - PSC at 10 Yrs. 7-13 Range
  - HMA at 27 Yrs. 17-37 Range

- **PCCP**
  - HMA at 18 Yrs. 13-42 Range
  - HMA at 31 Yrs. 17-42 Range
Minor Maintenance Treatment

The graph illustrates the percentage of minor maintenance treatments over time, categorized by different materials:

- **PCC** (Plain Concrete): Shows a consistent decrease over age, with a higher percentage remaining in service for a longer period.
- **HMA** (Hot-Mix Asphalt): Demonstrates a quicker decline, with a significant drop in serviceability as age increases.
- **PSC** (Portland Stone Concrete): Exhibits a moderate decline, retaining a notable percentage of serviceability compared to HMA.

The x-axis represents age in years, ranging from 0 to 50, while the y-axis indicates the percentage of miles in service, ranging from 0% to 100%. The graph visually compares the durability and serviceability of these materials over time.
1st Minor Maintenance Treatment

**HMA**
- at 10 Years PSC
- at 18 Years:
  - Cold Milling
  - Seals
  - Surface Recycle
  - 5-27 Yr Range

**PCCP**
- at 9 Years:
  - PCCP Patch
  - Mudjacking
  - Crack Seal
  - 1-29 Yr Range
Conclusions

• HMA Pavements:
• Similar Heavy Truck Traffic
• Lower Initial Costs
• Lower Rehabilitation Costs
• Lower Total Expenditures
Conclusions

• Expected Service Life HMA
  • at 10 Years PSC Overlay
  • at 18 Years Seal
  • at 27 Years HMA Overlay
  • at 33 Years Rehabilitation
Conclusions

• PCC Pavements
• Similar Heavy Truck Traffic
• Higher Initial Cost
• Higher Maintenance Cost
• Higher Total Expenditures
Conclusions

• Expected Service Life PCC
• at 9 Years Maintenance
• at 18 Years HMA Overlay
• at 31 Years 2nd Overlay
• at 34 Years Reconstruction
Lessons Learned

• Treatment Life has a Significant Effect on LCCA – Use Defendable, Reasonable, Values
Other Performance Studies

• Washington State
  – Eastern:
  – 12.4 years 1<sup>st</sup> OL, 12 years 2<sup>nd</sup> OL
  – Western: 18.4 years 1<sup>st</sup> OL

GPS-6 (FHWA-RD-00-165)

Most OL > 15 years, Many > 20 years
Lessons Learned

• Determine Your Own Input Values Based on: Performance/Cost Studies With Your Materials, Traffic and Climate
Questions ?
Life History of Actions on I-70 (KDOT)

Ave Cost/Mi/Yr
HMA $47,551
PCCP $88,089