MODOT Alternate Pavement Approach

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2009 AASHTO Subcommittee on Construction
Cost Control in Missouri
implementation - *the road to success*

- **Past Decade** – Letting schedules optimized
  - **Spring 2002** – Performance Spec.s written
  - **Fall 2003** – Alternate bidding pavements required
  - **December 2004** – Practical Design concept pitched to Commission
  - **Spring 2005** – Districts challenged to cut STIP 10%
  - **Fall 2005** – First Practical Design Policy written
  - **2006** – First Design/Build Projects
  - **Fall 2007** – *First ATC Project*
Alternate Pavement Bidding
Responsibility

- 5,000 miles of Major Roads
- 27,000 miles of Minor Roads
- 10,000 Bridges
First Alternate Bidding Experiment

- Missouri let five pilot projects in 1996 under the auspices of FHWA SEP-14
- Project conditions included
  - Design costs within 15% of each other
  - At least one mile of paving
  - Primary work was paving
  - Minimal grade change impact
  - Area unit prices
- An LCCA adjustment factor was used
## Annual Pavement Quantities

<table>
<thead>
<tr>
<th>Year</th>
<th>Asphalt</th>
<th>Concrete</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tons</td>
<td>$$</td>
</tr>
<tr>
<td>1992</td>
<td>4,950,706</td>
<td>106,542,443</td>
</tr>
<tr>
<td>2000</td>
<td>5,115,218</td>
<td>200,192,172</td>
</tr>
<tr>
<td>2005</td>
<td>8,035,462</td>
<td>397,618,849</td>
</tr>
<tr>
<td>2006</td>
<td>2,467,655</td>
<td>134,679,642</td>
</tr>
<tr>
<td>2007</td>
<td>3,745,808</td>
<td>178,237,592</td>
</tr>
<tr>
<td>2008</td>
<td>2,087,204</td>
<td>122,035,246</td>
</tr>
</tbody>
</table>
Alternate Bidding Restart

- Pavement Team; composed of MoDOT, PCC and HMA paving industry, and FHWA representatives; recommended in 2003 to restart alternate pavement design bidding
- Open, Transparent Process
- LCCA assumptions difficult to reach consensus on
Alternate Bidding Pavement Design

• From 1993 – 2004 a simple catalogue design, derived from the 1986 AASHTO Guide for the Design of Pavement Structures, was used for new Jointed Plain Concrete pavements.

• The Pavement Team recommended adopting a mechanistic-empirical (M-E) design approach for pavements in Missouri.
Alternate Pavement Design Bidding

maximizing competition

‘Structurally Equivalent’ PCC and HMA bid competitively by using life cycle cost analysis correction factors.
Alternate Pavements - Policy

- Alternate pavement design with a LCCA factor for projects with 7500 sq yd in a continuous area
- Optional pavement designs without a LCCA factor for smaller paving quantities
- New full depth and major rehabilitation
M-E Design Implementation

• Started using nationally-calibrated MEPDG program at the beginning of 2005 for JPCP and HMA designs.

• Average JPCP thicknesses reduced by
  – ~ 2” for high truck volume routes
  – ~ 1” for low to medium truck volume routes

• Average HMA thicknesses reduced by
  – ~ 3-4” for high truck volume routes
  – ~ 1-2” for low to medium truck volume routes
Reasons for Selecting NCHRP M-E Pavement Design Guide

• Common traffic and climatic module platforms are provided for both PCC and HMA analysis
• Distress models were calibrated and validated with largest pavement database ever
• New materials in designs could be evaluated
• Probably will become most defensible method because of AASHTO adoption
Alternate Pavement Designs

• New construction (based on M-E Design Guide)
  – JPCP
  – Conventional HMA

• Rehabilitation (default thickness derived partly from M-E and empirical data)
  – 8” Unbonded PCC overlay (UBOL)
  – Rubblization w/ 12“ HMA overlay
Method of Measurement

• New JPCP and HMA measured in square yards
• Unbonded overlays measured in cubic yards for furnishing and square yards for placing
• HMA overlay (on rubblized PCC) measured in wet tons
Alternate Pavement Bidding
seeking innovation

Performance specifications
Eliminate method specifications where possible.
Alternate Design Life Cycle Costs

• LCCA used solely to determine adjustment factor for 45-year design life
• Life cycle costs considered
  – Initial construction
  – Maintenance
  – Rehabilitation
  – Salvage value
  – User costs
Rehabilitation Assumptions

• HMA
  – Mill and fill wearing course **at 20 years** in driving lanes
  – Mill and fill wearing course **at 33 years** across whole surface

• PCC
  – Diamond grind whole surface and perform full-depth repairs on **1 ½ % of surface area at 25 years**
Adjustment Factor

Adjustment factor = PW (future HMA rehab) – PW (future PCC rehab)
Adjustment factor calculated by Estimating Section using current market unit prices

Present worth (PW) values of future rehabilitation determined using OMB discount rates.

### Life-Cycle Cost Adjustment Worksheet

| Job Number | 22F 487 |
| County     | Rancho |
| Route      | 03 |
| Call       | 040176-201 |
| Letting Date | 07/11/04 |

| Total Area of Paving | 415,518 SY |
| Area of Traveled Way | 256,781 SY |

| SP125 Weight Factor | 1.97 Tons/CY |

| Estimated Unit Price for SP125 | $3.78 /Ton |
| Estimated Unit Price for Cost Milling | $1.27 /CY |
| Estimated Unit Price for Diamond Grinding | $1.31 /SY |
| Estimated Unit Price for Pavement Repair** | $100.00 /SY |

**Includes all related Pavement Repair Items

Total LCCA Adjustment Factor For Job Special Provision: $1,469,204

### MoDOT AC Projection

<table>
<thead>
<tr>
<th>Year</th>
<th>Quantity</th>
<th>Unit Price</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 Year Maintenance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discount Rate: 3.00%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mill Surface Lift Traveled Way</td>
<td>1</td>
<td>20</td>
<td>256,781 SY</td>
</tr>
<tr>
<td>AC Resurfacing Traveled Way</td>
<td>1.75</td>
<td>20</td>
<td>24,590 TON</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>20%</td>
<td>20</td>
<td>$296,271.30</td>
</tr>
<tr>
<td>Mobilization</td>
<td>5%</td>
<td>20</td>
<td>1 Price</td>
</tr>
<tr>
<td>Construction added costs</td>
<td>12.9%</td>
<td>20</td>
<td>1 Price</td>
</tr>
</tbody>
</table>

| 33 Year Maintenance |          |            |      |
| Discount Rate: 3.50% |          |            |      |
| Mill Surface Lift - all | 1 | 33 | 415,518 SY | $1.47 | $610,811 | $196,280 |
| AC Resurfacing (100%) - all | 1.75 | 33 | 39,702 TON | $38.78 | $1,543,119 | $49,870 |
| Miscellaneous | 20% | 33 | 1 Price | $430,796.09 | $430,796.09 | $138,430 |
| Mobilization | 5% | 33 | 1 Price | $129,236.83 | $129,236 | $41,629 |
| Construction added costs | 12.9% | 33 | 1 Price | $350,599.86 | $350,599.86 | $112,602 |

**Years of analysis: 45

**Total Cost:** $4,967,569, 2002,932

**Discount Rate: 45%

Equivalent Uniform Annual Cost: 89,037

### MoDOT PCC Projection

<table>
<thead>
<tr>
<th>Year</th>
<th>Quantity</th>
<th>Unit Price</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 Year Maintenance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discount Rate: 3.00%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traveled Way Slab Replacements</td>
<td>1.5%</td>
<td>25</td>
<td>3,852 SY</td>
</tr>
<tr>
<td>Diamond Grinding of Traveled Way</td>
<td>25%</td>
<td>25</td>
<td>256,781 SY</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>20%</td>
<td>25</td>
<td>1 Price</td>
</tr>
<tr>
<td>Mobilization</td>
<td>25%</td>
<td>25</td>
<td>1 Price</td>
</tr>
<tr>
<td>Construction added costs</td>
<td>12.9%</td>
<td>25</td>
<td>1 Price</td>
</tr>
</tbody>
</table>

**Years of analysis: 45

**Total Cost:** $1,209,081, 603,728

**Discount Rate: 45%

Equivalent Uniform Annual Cost: 23,726
Alternate Bid Selection

Low bidder = lower of
(PCC bid price) vs. (HMA bid price + adjustment factor)
Alt. Pavement Update for Jobs Thru July 2009 with LCCA Factor

- 124 Alternate Projects to Date ($1.645 bil)
  - 118 Full Depth ($1.562 bil)
  - 6 Rehabilitation ($82.6 mil)
- Full Depth
  - 40 Asphalt Awards ($451.7 mil)
  - 78 Concrete Awards ($1.111 bil)
- Rehabilitation
  - 1 Asphalt Award ($2.6 mil)
  - 5 Concrete Awards ($80 mil)
Results – Difference in Low Bids

– Low PC Bids vs. Low AC Bids w/o LCCA Factor
  • PC Total – $645,054,399
  • AC Total - $666,875,468
  • Difference - $21,821,069 (3.4%)

– Low PC Bids vs. Low AC Bids w/ LCCA Factor
  • PC Total – $645,054,399
  • AC Total - $691,278,469
  • Difference - $46,224,069 (7.2%)

LCCA Factor has Determined Low Bid 3 Times since October 2003.
Number of Bidders

<table>
<thead>
<tr>
<th>Year</th>
<th>Bids/Call</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>3.7</td>
</tr>
<tr>
<td>2006</td>
<td>4.2</td>
</tr>
<tr>
<td>2007</td>
<td>4.2</td>
</tr>
<tr>
<td>2008</td>
<td>4.8</td>
</tr>
<tr>
<td>Alt. Paving Projects Oct 03 to Present</td>
<td>5.5</td>
</tr>
</tbody>
</table>
Price Summaries

- 3-year average asphalt price/ton for alternate paving projects is 5.1% below that for non-alternate projects and 4.8% below the 3-year average for all projects.

- 3-year average concrete price/CY for alternate paving projects is 8.6% below that for non-alternate projects and 2.8% below the 3-year average for all projects.
Other Optional Bidding

- Intermediate overlays
  - 5 ¾” HMA vs.
  - 5” ‘big block’ PCC
- Thinner overlays
  - 3 ¾” HMA vs.
  - 4” ultrathin PCC or 5” ‘big block’ PCC
Other Optional Bidding

- Thin overlays
  - 1 ³⁄₄” HMA vs.
  - 1” HIR plus surface treatment
  and
  - 3 ³⁄₄” HMA vs.
  - 4” CIR plus surface treatment
Optional Shoulder Designs

- A2 design
  - 5 3/4” HMA
  - 5 3/4” PCC

- A3 design
  - 3 3/4” HMA
  - 4” PCC (also roller compacted concrete pavement option)
An independent third party peer review was performed in late 2005 by a respected national consultant on MoDOT’s alternate pavement bidding process.

“It appears that MoDOT has developed a balanced, innovative program that could serve as a national model for other highway agencies throughout the nation and beyond.”
Thank You!

Questions?

For more information including example plans and specifications go to:
http://epg.modot.mo.gov

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