

MODOT Alternate Pavement Approach

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Cost Control in Missouri

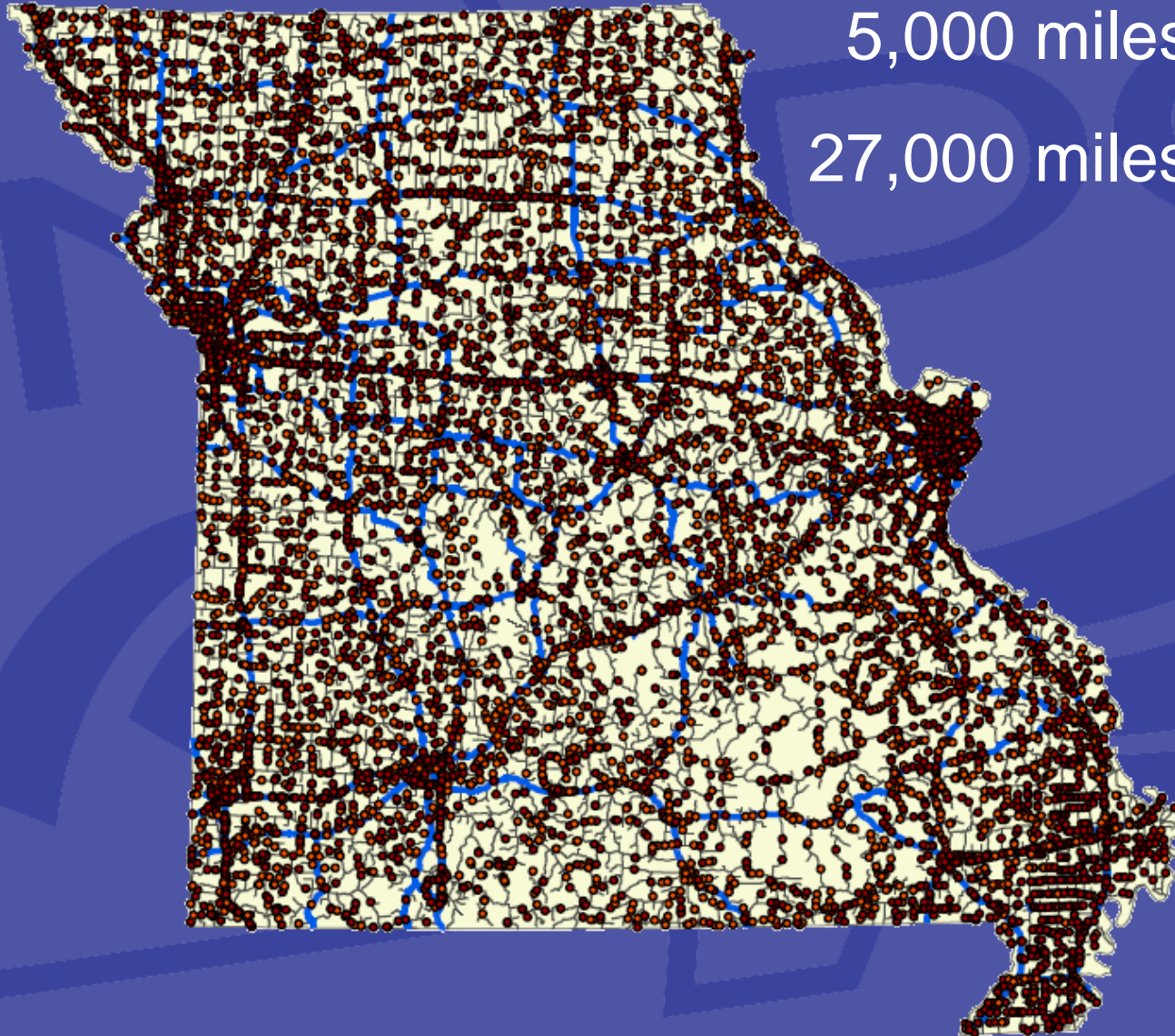
implementation - *the road to success*

- **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

Annual Pavement Quantities

Year	Asphalt		Concrete	
	Tons	\$\$	YD ³	\$\$
1992	4,950,706	106,542,443	599,575	30,760,634
1995	2,110,902	50,445,371	744,506	63,910,232
2000	5,115,218	200,192,172	1,141,790	108,794,341
2005	8,035,462	397,618,849	604,216	78,585,445
2006	2,467,655	134,679,642	573,052	77,422,513
2007	3,745,808	178,237,592	867,917	103,433,907
2008	2,087,204	122,035,246	667,354	90,891,896

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

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 J2P0187
 County Randolph
 Route 63
 Call 040716-201
 Letting Date 07/18/04

Total Area of Paving 415518 SY
 Area of Traveled Way 256781 SY

SP125 Weight Factor 1.97 Tons/CY

Estimated Unit Price for SP125 \$38.78 /Ton
 Estimated Unit Price for Cold Milling \$1.47 /SY
 Estimated Unit Price for Diamond Grinding \$1.81 /SY
 Estimated Unit Price for Pavement Repair** \$100.00 /SY

This Documentation should be filed with all other Final Engineer's Estimate Documentation. Also include a copy along with the pavement estimation worksheet in the Alternate Pavements Notebook.

Spreadsheets use OMB Real Interest Rates March 2004
 5-Year 10-Year 20-Year* 25-Year*
 2.100% 2.800% 3.160% 3.325%
 *Straight Line Interpolation From Published Rates

**Includes all related Pavement Repair Items

Total LCCA Adjustment Factor **\$1,469,204** Use \$1,469,200
 For Job Special Provision

MoDOT AC Projection							2003 Present Worth
	% or Thick. (in.)	Year	Quantity	Unit	Unit Price	Cost	
20 Year Maintenance							
Discount Rate: 3.160%							
Mill Surface Lift Traveled Way	1	20	256,781 SY		\$1.47	\$377,468	\$203,000
AC Resurfacing Traveled Way	1.75	20	24,590 TON		\$38.78	\$953,614	\$512,847
Miscellaneous	20%	20	1 Price		\$266,216.35	\$266,216	\$143,169
Mobilization	5%	20	1 Price		\$79,864.90	\$79,865	\$42,951
Construction added costs	12.9%	20	1 Price		\$216,354.02	\$216,354	\$116,364
33 Year Maintenance							
Discount Rate: 3.500%							
Mill Surface Lift - all	1	33	415,518 SY		\$1.47	\$610,811	\$196,280
AC Resurfacing (100%) - all	1.75	33	39,792 TON		\$38.78	\$1,543,119	\$495,870
Miscellaneous	20%	33	1 Price		\$430,786.09	\$430,786	\$138,430
Mobilization	5%	33	1 Price		\$129,235.83	\$129,236	\$41,529
Construction added costs	12.9%	33	1 Price		\$350,099.86	\$350,100	\$112,502
Years in analysis:	Total Cost:					\$4,967,569	\$2,002,932
Discount Rate:	45	Equivalent Uniform Annual Cost:					\$89,037

MoDOT PCC Projection							2003 Present Worth
	% or Thick. (in.)	Year	Quantity	Unit	Unit Price	Cost	
25 Year Maintenance							
Discount Rate: 3.325%							
Traveled Way Slab Replacements	1.5%	25	3,852 SY		\$100.00	\$385,172	\$170,027
Diamond Grinding of Traveled Way		25	256,781 SY		\$1.81	\$464,774	\$205,166
Miscellaneous	20%	25	1 Price		\$169,989.02	\$169,989	\$75,039
Mobilization	5%	25	1 Price		\$60,996.71	\$60,997	\$22,512
Construction added costs	12.9%	25	1 Price		\$138,150.08	\$138,150	\$60,984
Years in analysis:	Total Cost:					\$1,209,061	\$533,726
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

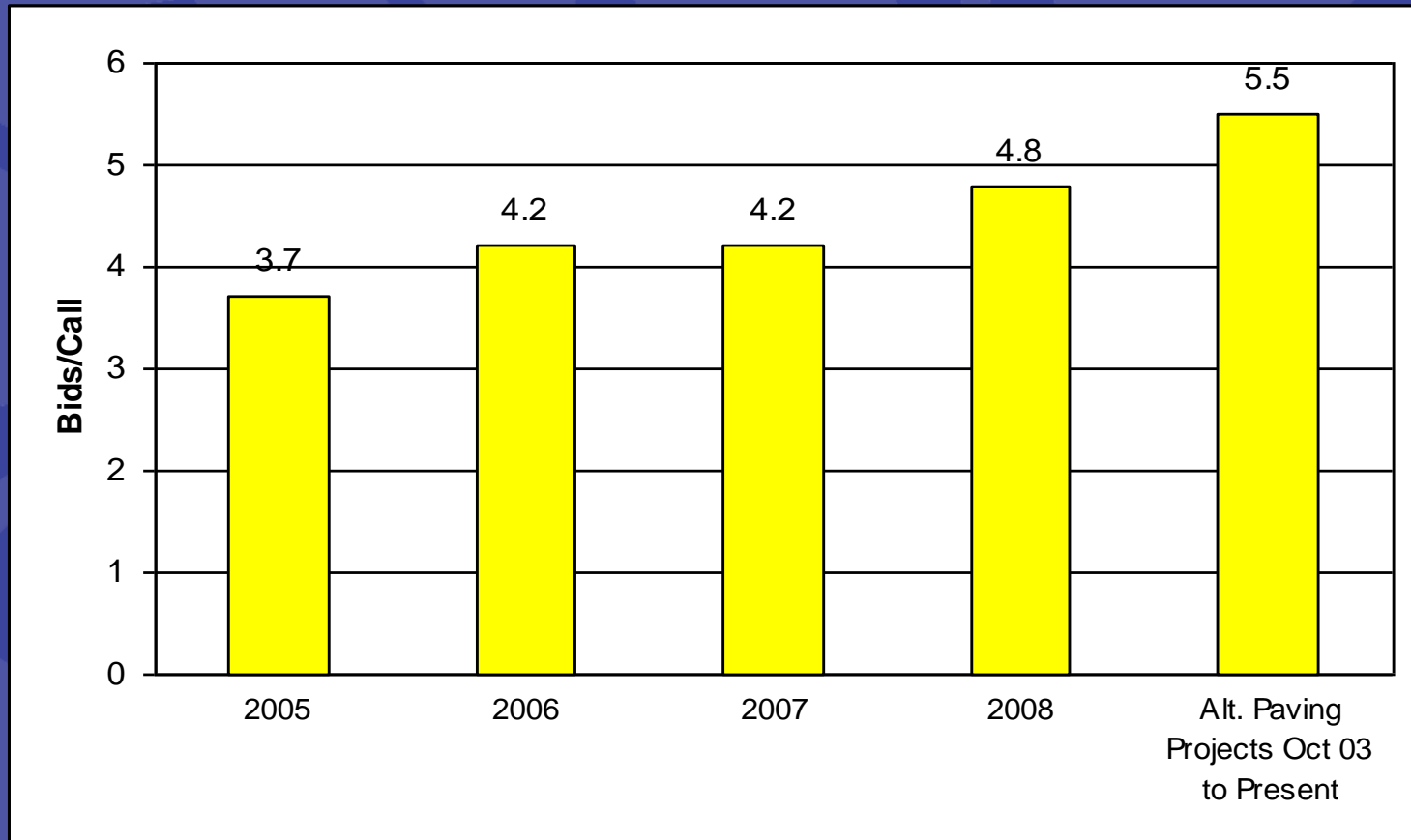
- ◆ 124 Alternate Projects to Date (\$1.645 bil)
 - 118 Full Depth (\$1.562 bil)
 - 6 Rehabilitation (\$82.6 mil)
- ◆ Full Depth
 - 40 Asphalt Awards (\$451.7 mil)
 - 78 Concrete Awards (\$1.111 bil)
- ◆ Rehabilitation
 - 1 Asphalt Award (\$2.6 mil)
 - 5 Concrete Awards (\$80 mil)

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



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 ¾" HMA vs.
- 1" HIR plus surface treatment

and

- 3 ¾" 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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