



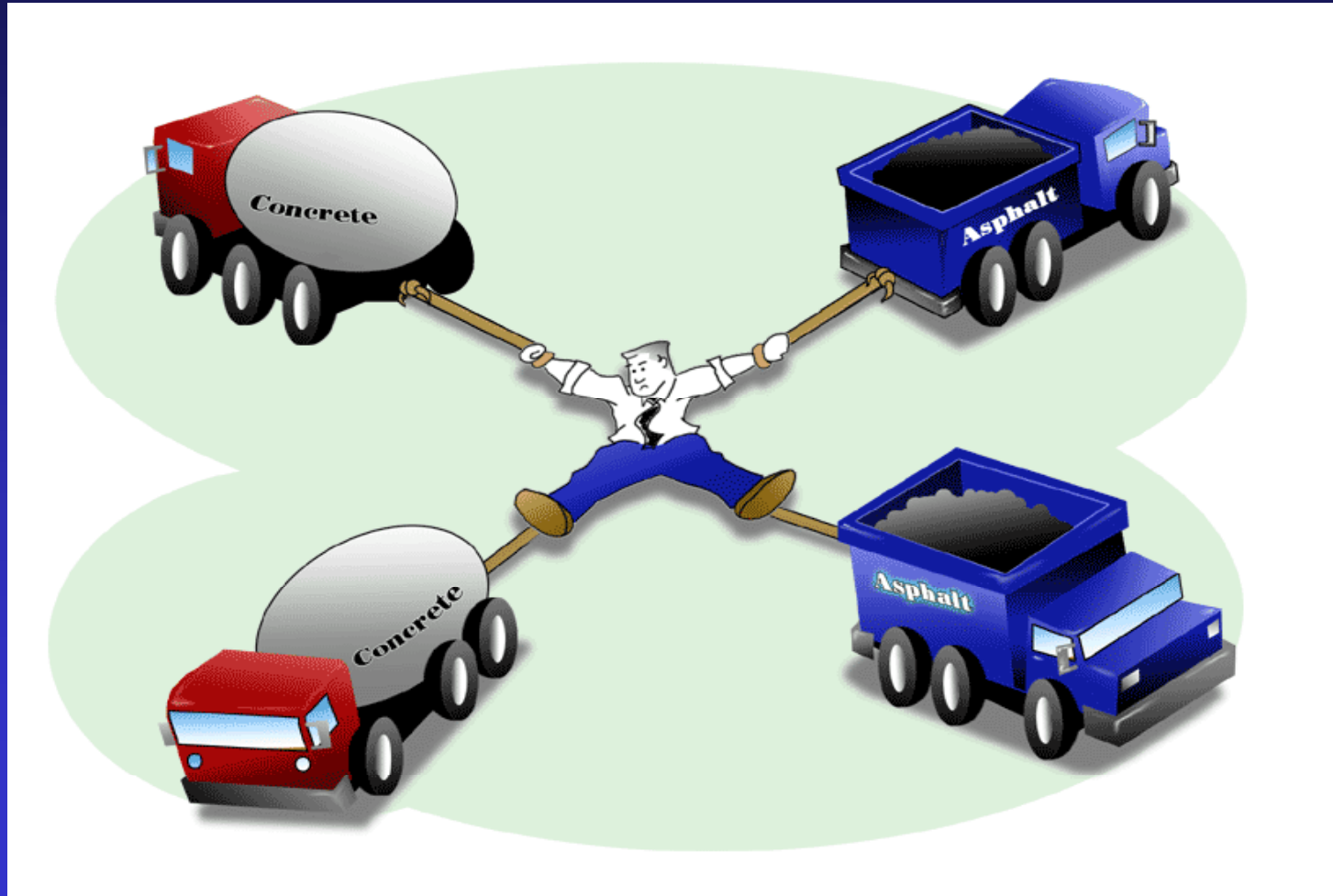
Kentucky Transportation Cabinet Alternate Pavement Bidding



Tennessee Concrete Pavement Conference
March 10, 2010

Paul Looney, P.E.
Kentucky Transportation Cabinet
Division of Highway Design

Pavement Type Selection Is One Large Tug-of-War



What were we doing?

Major Projects (Interstates, Parkways, NHS)

- Central Office staff performed analysis and prepared pavement designs
- Assistant State Highway Engineer approved

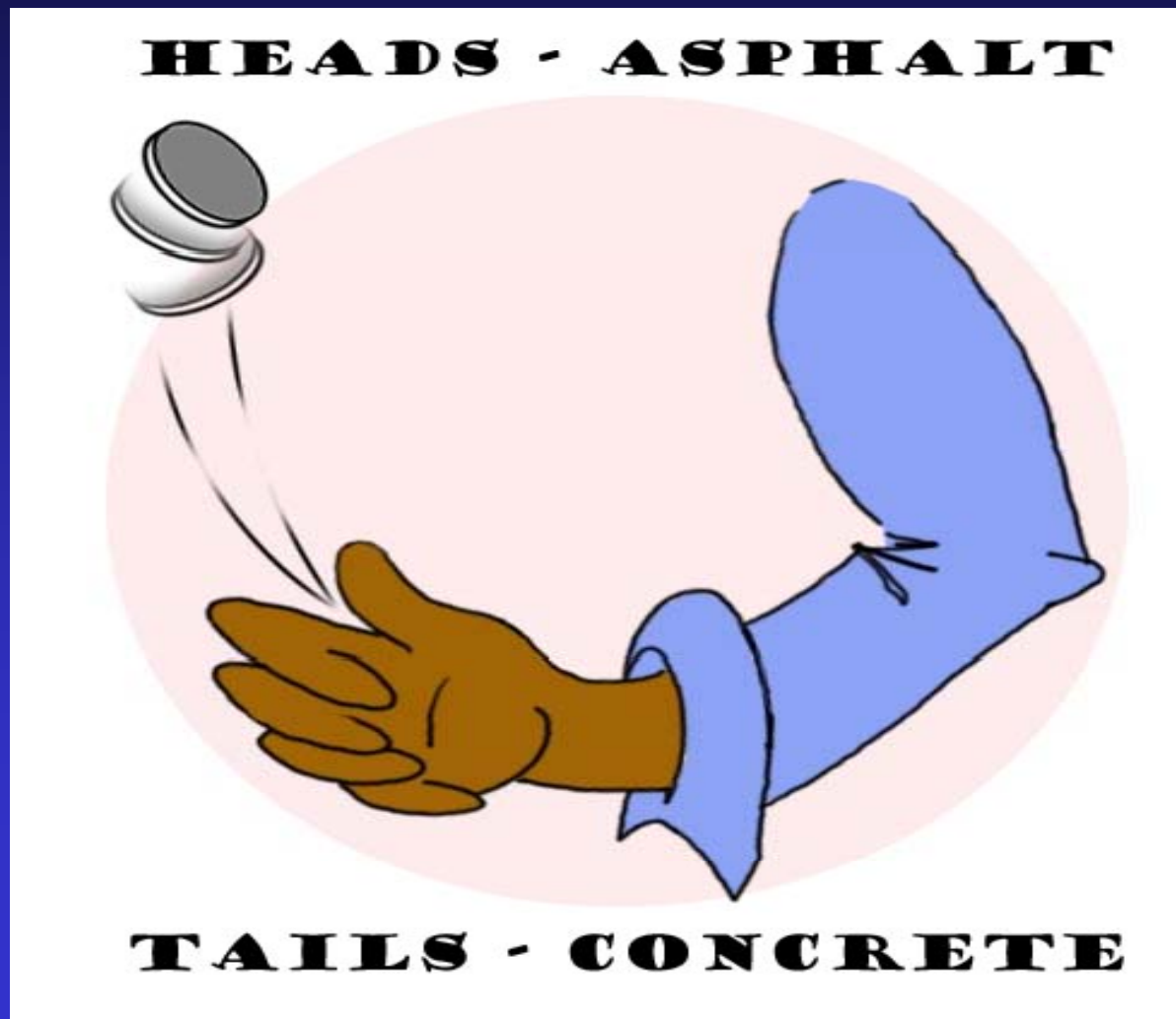
Minor Projects (Off NHS)

- Districts/Consultants performed analysis and prepared pavement designs
- TEBM for Pavements approved

The rest of the story....

- Plans prepared and sold
- Industries challenged design/type selection
- Central Office staff defended
- Sometimes Pavement Type was changed or Alternate pavement types were bid

“Is there a better way to decide?”



Pavement Working Group

- Formed in Spring 2002 at the request of the State Highway Engineer
- First meeting April 11, 2002
- Met with paving industries in August 2002
- Presented recommendations to State Highway Engineer in October 2003

Working Group Members

KYTC Members

Division of Design

Division of Maintenance

Division of Materials

Division of Construction

District Offices

Other Members

FHWA

Transportation Center



Group Consensus

It is in the best interest of the Cabinet and the taxpayers to maintain both the asphalt and concrete paving industries in Kentucky.

Why?

- Constructability
- Durability
- Economic Benefits

Primary Goals For Pavement Type Selection

- Provide Well Performing, Durable, Safe and Cost Effective Pavements
- Provide Fair And Equitable Treatment Between Industries
- Stimulate Competition

Why Competition?

- The Cabinet saves 15-20% on average on projects where there is more than 1 bidder
- Competition fuels innovation

Original KYTC Policy

- Effective October 2003
- Interstates, Parkways, NHS Routes
- Other routes
 - $\geq 5,000$ ADT
 - $\geq 5,000,000$ ESALs
- No stipulation for alternate bidding

2006 Update

- Added Type Selection Factors
- Added Specific LCCA Details
- Alternate Bidding Allowed

2009 Update

- Expanded Scope of Projects
 - 2,500 ADT
 - 1,000,000 ESALs

What Projects Apply?

- Greater than 1-mile in length
- New Construction
- Reconstruction
- Major Widening
- Pavement Rehabilitation

What Projects Apply?

- Interstates
 - Greater than 1 ½” grade change or 2” milling
- Parkways and other NHS Routes
 - Greater than 4” of new pavement
- Other Routes
 - Greater than 4” of new pavement
 - 2,500 ADT or 1,000,000 ESALs

Type Selection Factors

Primary Factors

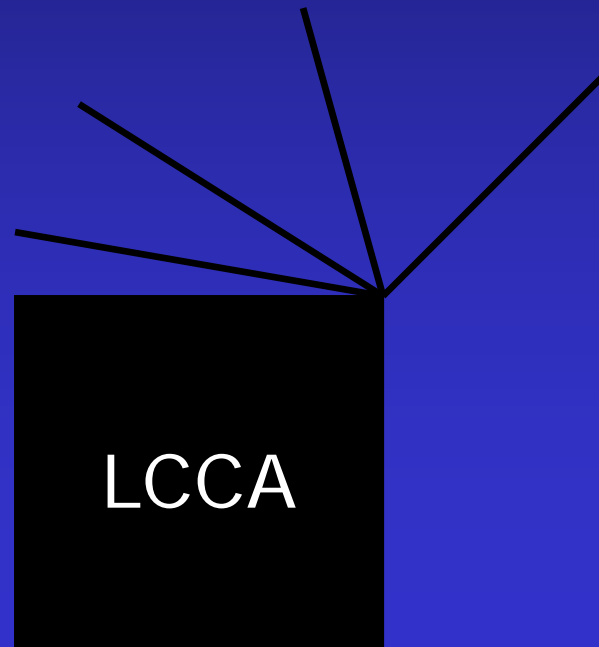
- **Traffic**
- Soil Characteristics
- Weather
- **Construction considerations**
- Recycling
- **Cost comparison**
 - Initial
 - Life Cycle

Secondary Factors

- **Performance of similar pavements in the area**
- **Adjacent existing pavements**
- Conservation of materials & energy
- Availability of local materials/contractors
- Traffic safety
- Experimental features
- Stimulation of competition
- Municipal preference

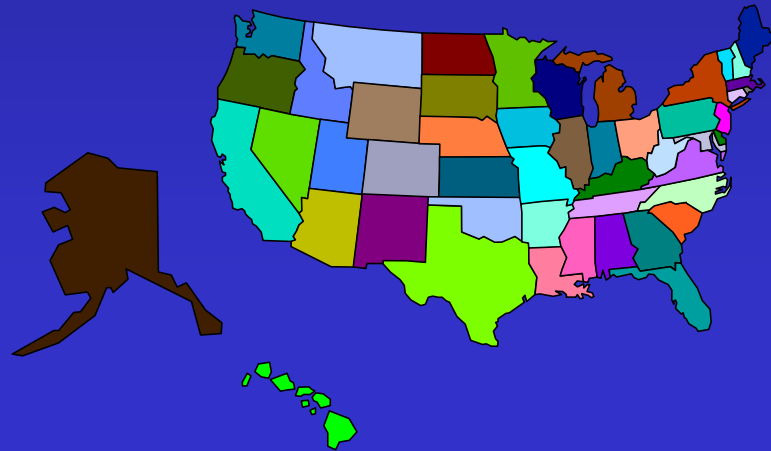
Life Cycle Cost Analysis

What's in the box?



What are other states doing?

Life Cycle Cost Analysis



Experiences In Other States

- Initial Design Period
 - 20-40 Years (20/40 years)
- Analysis Period for LCCA
 - 35-50 Years (40 years)
- Discount Rates for LCCA
 - 4% Typical; Range 0-7% (4%)
- Asphalt Rehabilitation Cycles
 - 10-15 Years (10/15)

Experiences In Other States (cont.)

- Concrete Rehabilitation Cycles
 - 10-30 Years (15/25)
- Salvage Value
- User Costs
- When Is LCCA Not Determinate?
 - 5% to 20% Variation (20%)

KYTC Life Cycle Cost Analysis

- Design Life
 - Interstates/Parkways: 40 years
 - Other Routes: 20 years
- Analysis Period
 - 40 years

KTC Report on Pavement Conditions and Ages When Treatments Were Applied in KY

Maintenance or Rehabilitation Types	Interstate or Parkway	Average RI	Average Rut Depth (1/16 inch)	Average Condition Points	Surface Age
Resurfacing of Original AC	Interstate	3.51	6.31	38.07	10.59
	Parkway	3.30	7.16	44.66	12.86
Rehabilitation of Original PCC	Interstate	2.92	N/A	51.43	21.13
	Parkway	2.79	N/A	56.16	26.94
Resurfacing of AC Overlay	Interstate	3.72	5.76	29.96	9.64
	Parkway	3.42	5.16	39.16	9.43
PCC Grinding		2.56	N/A	44.48	17.7

Table 2.9 Average Pavement Conditions and Pavement Ages before Treatments

Life Cycle Cost Analysis

(Rehabilitation Cycles)

All Interstates, Parkways (>15,000ADT)

Asphalt: Years 10, 20, 30 - (Mill 1 1/2" & resurface)

Concrete: Year 15 - Repair 2% of area and grind

Year 30 - Repair 5% of area and grind

All Other Routes

Asphalt: Year 15 – Mill 1 1/2" & resurface 1 1/2"

Year 30 – Mill 1 1/2" & repave 3 1/2"

Concrete: Year 25 – Repair 5% of area and grind

Life Cycle Cost Analysis

- User Costs
 - Calculated but not included in LCCA
- Unit Costs
 - Provided by Engineering Estimator
- Discount Rate
 - 4%

LCCA Examples

Project 1

- 2-mile, 4-lane Interstate
- New Construction
- CBR=3; 40,000,000 ESALs

Project 2

- 2-mile, 4-lane bypass
- New Construction
- CBR=3; 5,000,000 ESALs

Project 1 (Interstate)

Asphalt Alternate

8" Lime

4" DGA

4" Drainage Blanket

11.75" Asph Base

1.5" Asph Surf

Concrete Alternate

8" Lime

4" DGA

4" Drainage Blanket

11" JPC

Project 1 (Interstate)

Asphalt Alternate

Initial Cost = \$4,100,000

Rehab 1 = \$285,000

Rehab 2 = \$190,000

Rehab 3 = \$130,000

LCC = \$4,705,000

Bid Adj = \$605,000

Concrete Alternate

Initial Cost = \$3,950,000

Rehab 1 = \$305,000

Rehab 2 = \$195,000

LCC = \$4,450,000

Bid Adj = \$500,000

LCC Diff. = 5.4%

Costs are Present Worth based on 4% discount rate

Alternate Bidding

- A+B format
 - A is materials and labor
 - B is pavement bid adjustment
- Asphalt Bids ($A + \$605,000$)
- Concrete Bids ($A + \$500,000$)

Project 2 (Bypass)

Asphalt Alternate

8" Lime

4" DGA

9" Asph Base

1.25" Asph Surf

Concrete Alternate

8" Lime

4" DGA

9" JPC

Project 2 (Bypass)

Asphalt Alternate

Initial Cost = \$3,383,000

Rehab 1 = \$210,000

Rehab 2 = \$195,000

LCC = \$3,788,000

Bid Adj = \$405,000

Concrete Alternate

Initial Cost = \$3,710,000

Rehab 1 = \$203,000

LCC = \$3,913,000

Bid Adj = \$203,000

LCC Diff. = 3.3%

Costs are Present Worth based on 4% discount rate

KYTC Alternate Bid Projects

2006-2010



When are Alternate Pavements bid?

- If LCCA For Alternates are within specified range (20%)
- No Other Overriding Considerations

Update for Jobs Thru January 2010 with LCCA Bid Adjustment Factor

- 17 Alternate Projects to Date (\$381.3M)
 - 16 Full Depth (\$331,872,686)
 - 1 Widening/Rehab (\$49,451,314)
- Full Depth
 - 14 Asphalt Awards (\$293,925,923)
 - 2 Concrete Awards (\$37,946,765)
- Widening/Rehab
 - 1 Asphalt Award (\$49,451,314)

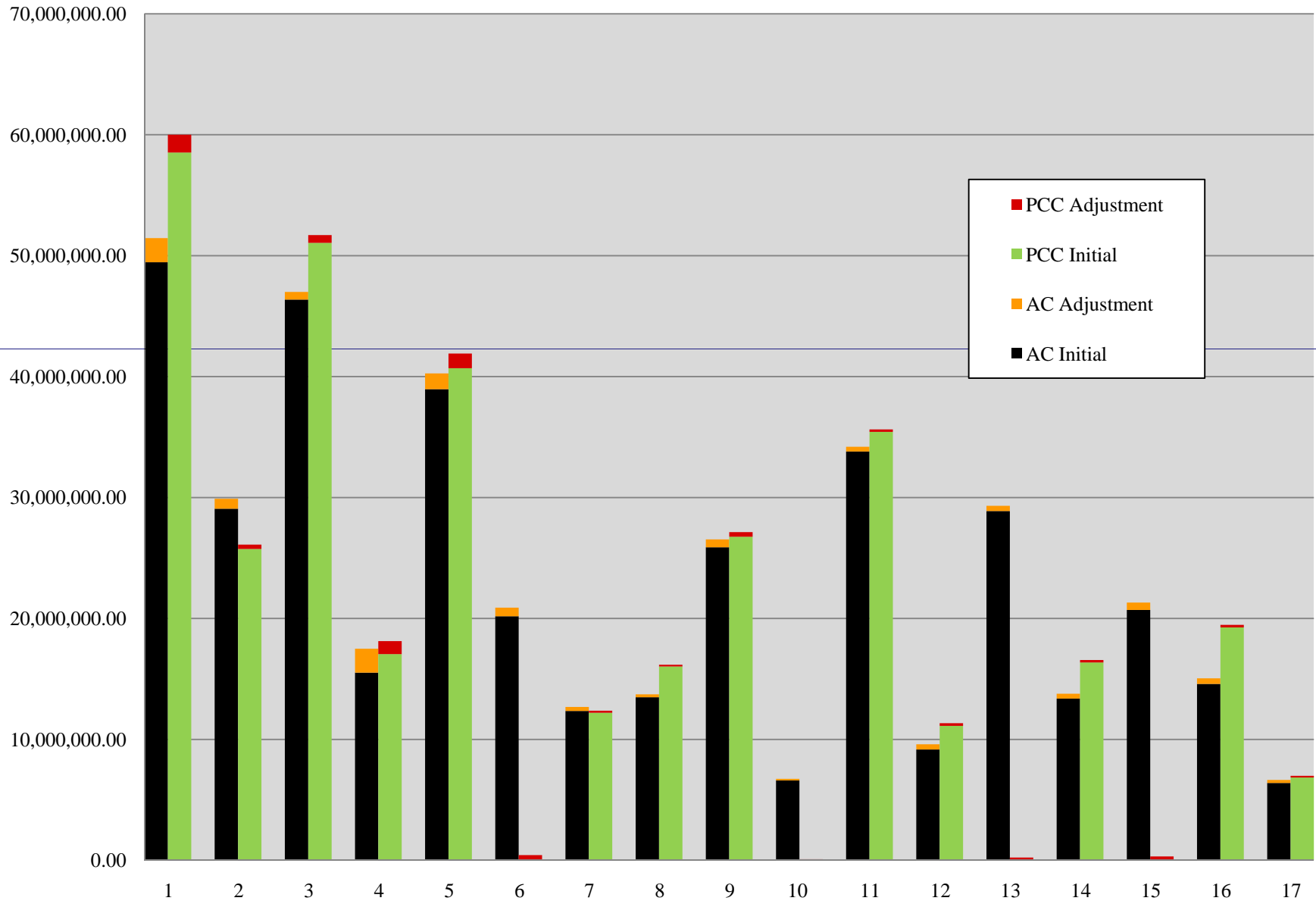
Alternate Bidding

- Project Construction Estimates Range
 - \$8 Million to \$50 Million
- Bid Adjustment Range
 - \$95,000 to \$2,000,000
 - 1.12% to 3.98% of total project estimate

Alternate Bid Results

- 13 of 17 projects had AC and PCC bidder(s)
- Bid Adjustment Factor did not determine low bid in any of the 17 projects

KYTC Alternate Bids 2006-2010



KYTC Alternate Bids

- Average 4.7 bidders per project
 - All Paving Projects Average 2 bidders (2009)
- Minimum 2 bidders (2 projects)
- Maximum 8 bidders

Low Bid vs. Engineer's Estimate

Alternate Bids(2009)

- Average Difference:
-20.5%
- Maximum Difference:
-30.7%
- Minimum Difference:
-9.7%

All Bids* (2009)

- Average Difference:
-8.9%
- Avg. Diff. Single Bid:
-1.5%
- Avg. Diff. Multi Bid:
-18.4%

*Awarded Projects (Inc. Alt. Bid)

KYTC Paving Projects 2009

- 56% Single Bid (226 of 401)
- 52% Single Bid > Engineer's Estimate (117)
- 96% Multi Bid < Engineer's Estimate (167 of 175)

KYTC Paving Projects 2009

- Single Bid Projects
 - \$363,000 less than Estimates (\$151M)
- Multiple Bid Projects
 - \$114M less than Estimates (\$567M)

What Next?

- Continue Alternate Bidding in 2010
 - 10 to 15 projects identified
- Meet with Industries
 - Feedback on pros/cons of alternate bidding
 - Ways to improve
- Continue to evaluate process
 - LCCA (Bid Adjustment)
 - Competition



PAVEMENT DESIGN GUIDANCE

Document Name	FileType
Pavement Design Guide(2007Update)	PDF
Appendix A.Examples	PDF
Appendix B. Special Notes and Special Provisions	PDF
Appendix C. General Pavement Design Notes	PDF
Appendix D. Warrants for Selecting Asphalt Mixtures	PDF
Appendix E. Pavement Type Selection Policy	PDF
Pavement Design Spreadsheet (V5.03--Updated 4/2/08)	Excel



The Pavement Branch in the Division of Highway Design is responsible for overseeing the development of pavement structural designs for all Kentucky Transportation Cabinet projects. The Pavement Branch staff is available to assist District Offices and Consultant Engineers in developing pavement designs.

LINKS OF INTREST

- **Kentucky Transportation Center**
- **FHWA Pavement**
- **Traffic Forecasting**
- **Geotechnical Reports**

Staff in the Pavement Branch manages pavement rehabilitation and reconstruction projects on all Interstate, Parkway and National Highway System routes.

PAVEMENT DESIGN REFERENCES

Kentucky Transportation Center Reports:

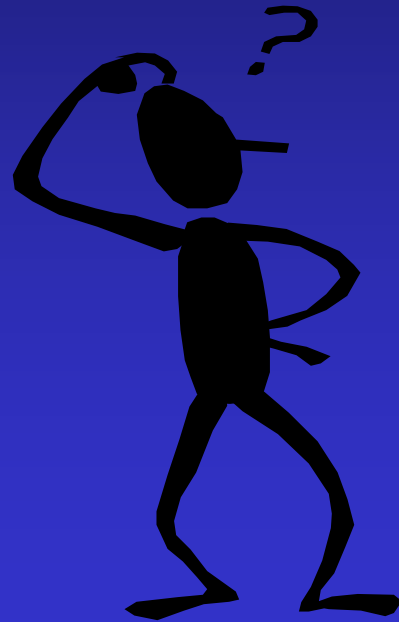
- UKTRP-81-17** "Design Guide for Bituminous Pavement Structures"
- UKTRP-84-3** "Thickness Design Curves for Portland Cement Concrete Pavements"
- UKTRP-87-26** "Breaking and Seating of Rigid Pavements"
- UKTRP-87-29** "Pavement Designs Based on Work"

Applicable Special Notes:

- Special Note 10B "Special Note for Geogrid Used for Reinforcement of Subgrade and Aggregate Base Courses"
- "Special Note for Perforated Pipe-4 Inch for Aggregate Backfilled Trench"
- "Special note for Pavement Surface drainage Outlet"

<http://www.transportation.ky.gov/design/design.asp>

Questions?



KYTC Mission Statement

“To provide a safe, secure, and reliable highway system that ensures the efficient mobility of people and goods, thereby enhancing both the quality of life and the economic vitality of the Commonwealth.”



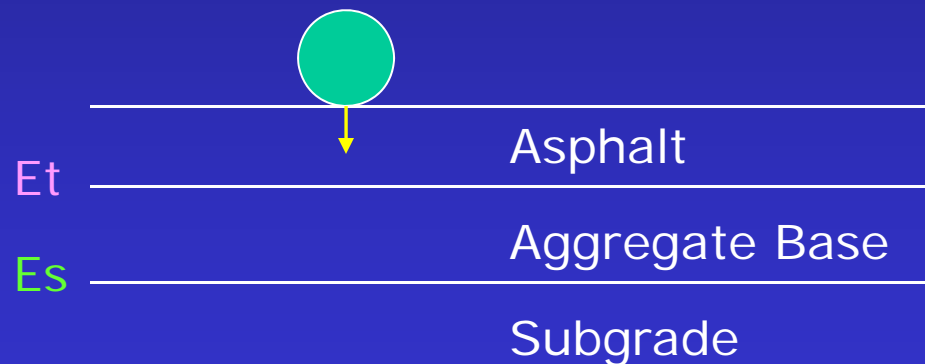
Pavement Design

Current KYTC Procedures



New Asphalt Pavement

- Mechanistic-Empirical Procedure
- Approved by FHWA in 1981
- 3-layer limiting strain procedure



New PCC Pavement

- Modified Catalog (Based on 1986 and 1993 AASHTO Pavement Guides)
- Tempered by mechanistic analysis performed by UK Transportation Center

Overlay Designs

PCC Pavement

- 1993 AASHTO Procedure

Asphalt

- 1993 AASHTO for overlay on concrete
- 1987 KTC Curves for Break, Seat & Overlay (Energy based procedure)
- 1981 KTC Mechanistic-Empirical procedure for Asphalt on Asphalt

Future Plans

- Currently analyzing designs in parallel with AASHTO M-E Guide
- Select Calibration sections for M-E Guide



COMPARISON OF LIFE CYCLE COST

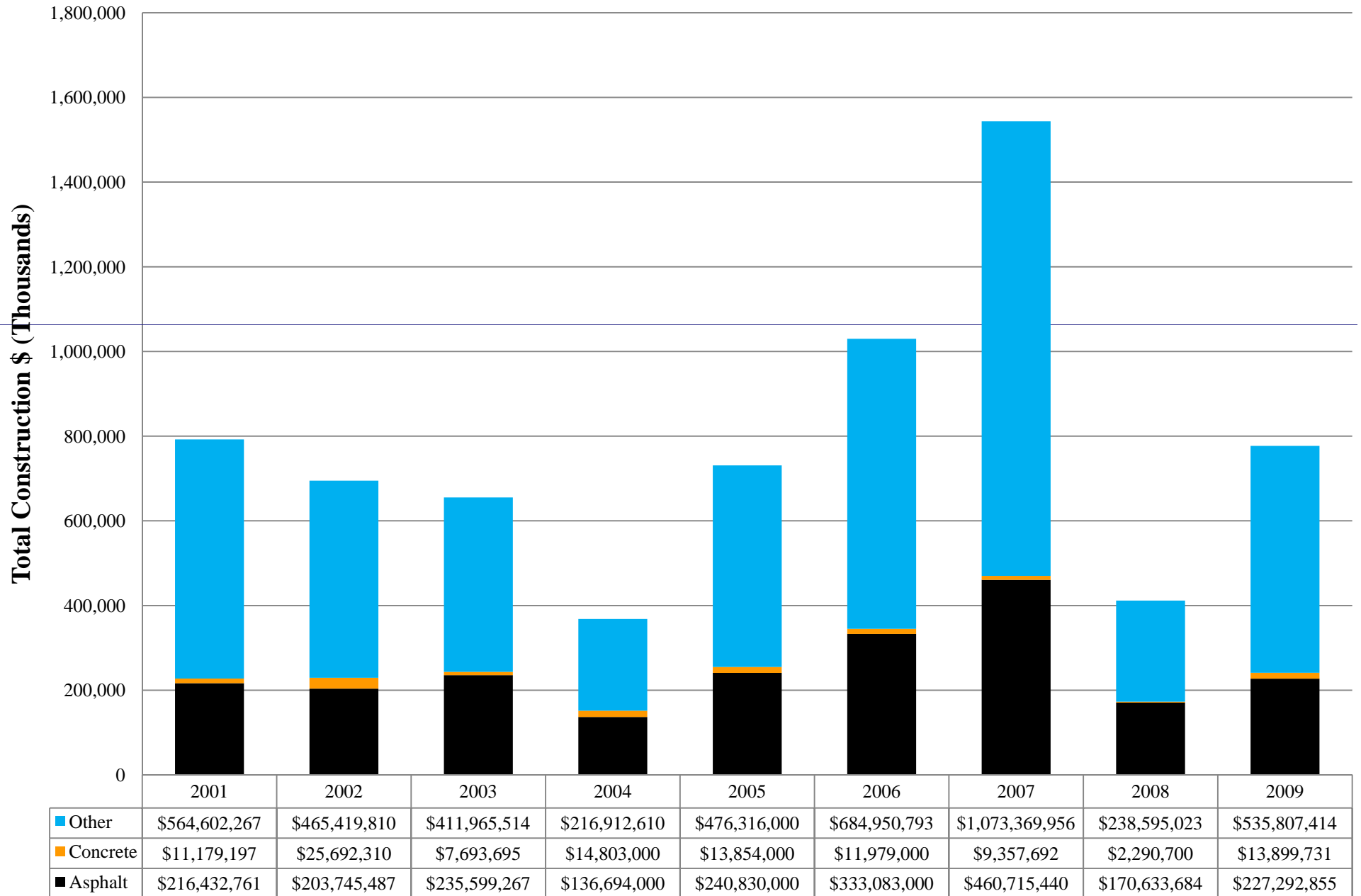
Factors	KYTC	MDOT	VDOT	FDOT	ODOT	LDOT
Initial Design Period	20/40	35	30	20	20	20-40
Analysis Period	40	35	50	40	35	30(overlay) 40 (new)
Discount Rate	4%	4%	4%	7%	0,1,2,3,4,5,6 %	4%
Asphalt Rehab Cycles	10 yr.	15 yr./ 25 yr.	10 yr.	14 yr./ 28 yr.*	New 10-15 Thin 18-25 Thick 28-32 Thick ***	15 yr./30 yr.
PCC Rehab Cycles	15 yr.	25 yr.	10 yr.	20yr./30 yr.**	New 18-25 28-32 ****	20
Salvage Value	No	No	Yes	No	No	No
User Cost	Yes	?	No	No	Yes	Yes
Alternate Bids	Yes	Yes	?	?	Yes	Yes
LCCA Not Determinate	20%		10%			20%
Alternate Bid Adjustment	Yes	Yes	No	No	No	Yes

Results-Difference in Low Bids

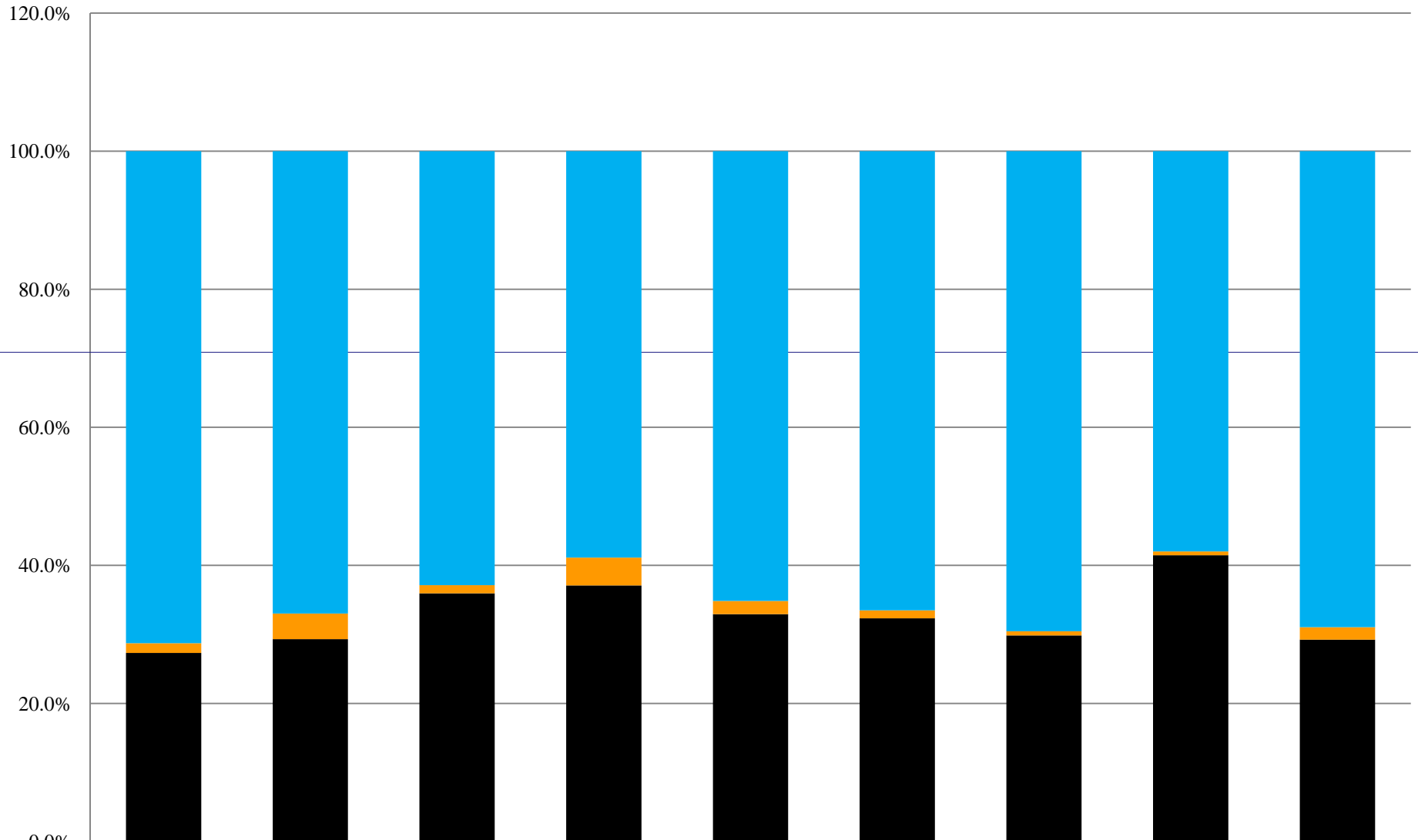
(Only Projects with AC and PCC Bids)

- Low PCC Bids vs. Low AC Bids LCCA Factor Not Applied
 - PCC Total - \$337,101,059
 - AC Total - \$308,434,556
 - Difference - \$28,666,503(8.5%)
- Low PCC Bids vs. Low AC Bids LCCA Factor Applied
 - PCC Total - \$344,596,000
 - AC Total - \$318,319,469
 - Difference - \$26,276,531 (6.8%)
- LCCA Adjustment Factor has not determined low bid in any of the 17 projects.

Total \$ Asphalt and Concrete Pavement 2001-2009



Percent of Total Construction \$ AC & PCC (2001-2009)



	2001	2002	2003	2004	2005	2006	2007	2008	2009
■ Other	71.3%	67.0%	62.9%	58.9%	65.2%	66.5%	69.5%	58.0%	69.0%
■ Concrete	1.4%	3.7%	1.2%	4.0%	1.9%	1.2%	0.6%	0.6%	1.8%
■ Asphalt	27.3%	29.3%	36.0%	37.1%	32.9%	32.3%	29.8%	41.5%	29.3%