

**Indiana Department of Transportation
2010 Annual Report
For
Alternate Bid Process on Pavement Type Selection
March 11, 2011**

A. Introduction

On November 18, 2009 the Federal Highway Administration approved the innovative contracting process of the Indiana Department of Transportation (INDOT) for alternate bids on pavement type for multiple projects. This process involved one bid with both Portland Cement Concrete Pavement (PCCP) and Hot Mix Asphalt (HMA) pavement in an “alternate pay items option” format that requires only one set of plans with both PCCP and HMA typical pavement sections. A Present Worth (PW) cost was calculated for future maintenance costs of both pavement types using an established Life Cycle Cost Analysis (LCCA) Strategy. This PW cost was added to the respective pay items option after the bid was opened, but the PW cost was only used to determine the low bidder. See attached Work Plan for SEP 14 dated November 2, 2009.

The primary reasons INDOT implemented this innovative contracting practice for alternate pavement type bidding are:

1. Attract more bidders and competition.
2. Obtain true cost savings over similar conventional bid projects.
3. Provide a more competitive market, i.e. lower bid costs on paving items using this procedure versus the standard procedure where the pavement type is pre-determined.

INDOT let eleven (11) contracts from January 1, 2010 to December 31, 2010 with this process. Out of these eleven (11), Three (3) of them were design build and eight (8) were design bid build.

The Descriptions of the contracts are as follow:

Description of Contracts						
Route	Contract No.	Des. No.	Location	County	Letting Date	Length
PR 69	IR-30983	0800284	0.03 mi N of SR 68 to 1.54 mi N of SR 68	Gibson	2/10/2010	1.5 miles
US 31	IR-30108	0600339	0.5 mi S of SR 26 to 1.5 mi S of SR 22/US 35	Howard	4/14/2010	3.0 miles
SR 25	IR-30840	9802920	I-65 to 0.1 mi E of CR 750 E (Seg. 1, Ph-A)	Tippecanoe	5/26/2010	4.5 miles
US 31	IR-30889	0800234	0.5 mi S to 0.65 mi N of CR 200N	Howard	8/4/2010	2.0 mile
US 35		9706380	Goyer Rd to CR 300 E			1.5 miles
I-70	IR-31104	0200699	0.6 mile E of Post Rd to 0.5 mile E of Mt. Comfort Rd	Hancock/ Marion	9/1/2010	5.18 miles
US 24	IR-30162	0300291	0.5 mi E of I-469 to 0.5 mi E of Ryan/Bruick Rd Phase-1	Allen	10/6/2010	3.15 miles
PR 69	IR-33040	0902201	Patoka River to SR 57 (Segment 2)	Pike	11/30/2010	3.52 miles
		0500441	SR 57 to SR 61 (Segment 3)			4.49miles
PR 69	IR-31121	0800285	1.97 mile N of SR 68 to 0.6 mile N of SR 168 (Section 1, Package 4)	Gibson	12/8/10	3.37 miles
PR 69*	IR-33047	0500443	CSX RR to North Fork of Prairie Creek (Segment 8 & 9)	Daviess	4/29/2010	6.29 miles
		0902174				
PR 69*	IR-33049	0500444	CR 1000 N to 1400 N (Segment 11)	Daviess	6/9/2010	4.11 miles
PR 69*	IR-33051	0902176	CR 1400N to CR 700E (Segment 12)	Daviess	8/27/2010	3.73 miles
		0500445	CR 700E to 0.7 mile N of US 231 (Segment 13)	Daviess/ Green		6.06 miles
					Total 52.40 miles	

* Denote Design Build Contracts

B. Analysis

INDOT analyzed the three (3) design build contract bids using only the total bid amounts because these projects do not let as an itemized pay items format; therefore, the pavement item unit prices were not available. The estimated quantities were used to calculate PW costs for these design build contracts. And the PW costs were applied to the total bid amounts.

This report analyzed the eight (8) itemized pay items contract bids by:

1. Comparing the total bids before and after adding the PW costs.
2. Comparing some unit bid prices of unique pavement items against estimated costs, and
3. Comparing some common HMA items found in both PCCP and HMA options to check for unbalanced bids.

All eight (8) contract bids were below the engineer's estimate (both PCCP and HMA pay items). On these eight (8) contracts actual bid quantities were used to calculate PW costs. Bidding these contracts using one bid package (Plans, Specifications and Contract Documents with both PCCP and HMA pavement pay items options) allowed contractors who work with both types of pavements to bid on these contracts as either/or both.

Using the Mechanistic Empirical Pavement Design Guide (MEPDG) INDOT provided both PCCP and HMA pavement design thicknesses for the mainline on these projects. INDOT then utilized the FHWA real cost software to perform LCCA with an established strategy to calculate a PW cost for both pavement types over a service life of fifty (50) years. See attached Appendix A-K for individual project Alternate Bid PW Cost Calculations. Estimated costs used to calculate the PW cost are from the data base maintained by the INDOT Office of Pavement Engineering. This data base is populated with actual historic bid costs on pavement items. In the LCCA the data from the previous five (5) years was used, this is standard procedure for INDOT. INDOT does not use a User Cost in their LCCA. Future maintenance of traffic costs was included in the calculations. See Appendix A-H for individual project bid analysis summary for itemized pay items format contracts and I-K for Design Build project bid analysis.

INDOT is confident that enough data has been collected to compare how successful this alternate bidding for pavement type selection process is. INDOT compared this process with the conventional bidding practices where the pavement type was selected ahead of the bidding. The comparison is for work type of “New Road Construction”, “Added Travel lanes”, “Pavement Replacement”, and some major “Interchange Modification” projects. The results are as follow:

1. Traditionally INDOT would receive four or five bids for conventional bidding. INDOT received on average 4.32 bidders per contract for nineteen (19) contracts let between January 1, 2010 and December 31, 2010. By performing the alternate bid process on pavement type selection, INDOT received more bids than expected for both itemized pay items format (an average of 6.38 bidders per contract) and design build contracts format (an average of 5.33 bidders per contract). This proves that the alternate bidding for pavement type attracted more bidders.
2. The winning bid amounts on all eleven (11) alternate projects were substantially below the engineer’s estimate. The average percentage was 26.4 below the engineer’s estimate. The winning bid amounts on conventional bidding projects where the pavement type was selected ahead of the bidding were also below engineer’s estimate but the average percentage was 17.4 below the engineer’s estimate.

Number of and Type of Bids	Winning Bid Amounts \$	Engineer’s Estimate \$	% Below Engineer’s Estimate
19 Conventional	\$285,295,617.09	\$345,413,792.32	17.4
11 Alternate	\$422,698,033.04	\$574,204,558.37	26.4

The above comparison shows that INDOT attracted more bidders per contract for the alternate bidding process than the conventional bidding process. INDOT also received winning bid amounts that average nine (9) percent more below the engineer’s estimate for the alternate bidding process than the conventional bidding process. INDOT considered this alternate bid process to be very successful.

INDOT contacted both the Asphalt and Concrete industry representatives at the end of the year for their comments about this process. The Concrete industry provided no comments. The Asphalt industry provided the following comments and INDOT addressed these comments at a meeting with the industries held January 5, 2011:

1. INDOT has different smoothness acceptance criteria for the HMA and PCCP pavements.

INDOT response - As per INDOT current Standard Specification, smoothness acceptance is based on profilograph but INDOT is currently investigating for future accepting pavement smoothness utilizing IRI. The PCCP pavement tining for friction negatively influences the profilograph test method.

2. The current pavement designs are not equivalent for shoulders for both pavements types.

INDOT response - INDOT explained the design to both industries and they agreed that shoulder designs are equivalent for both pavement types. INDOT will entertain revised proposals based on supporting cost data.

3. The contractors desire an option to reduce the approved pavement thickness such as by proposing a stronger subgrade.

INDOT response - INDOT will investigate and if feasible will determine how it could be implemented into contract documents for bidding.

4. The pavement design thickness should be replicable by designers other than the INDOT.

INDOT response - INDOT utilizes the MEPDG and DARWin-ME 1.1. These are research grade tools that crash quite frequently. Performance is expected to improve with the release of DRAWin-2.0 in April, 2011.

5. FHWA needs to review its directives on the usage of material price indices. Some of the material current market fluctuations could have negative effects on receiving the competitive pricing.

INDOT response - Currently, material price indices are not included in alternate bid contracts since it would bias the comparison between the HMA and PCCP alternatives.

6. LCCA costs should include only pavement costs that actually occur, not an ideal preventive care situation that does not or will not occur. In other words some Contractors commented that there are far too many maintenance activities such as joint seals every 3 years on HMA pavement.

INDOT response - The pavement life strategies and subsequent life cycle costs calculated are based on typical maintenance performed by INDOT as defined in the

Work Management System. These have been verified through a review of maintenance records.

7. Contractors want the PW cost published before bid opening so they can factor in their bid amount.

INDOT response - With the success of this alternate bidding process INDOT is not considering publishing the PW cost prior to the bid opening at this time. The PW costs continue to be published just minutes before the bid opening.

8. LCCA and reconstruction projects should include current and future lane rental costs in the calculation.

INDOT response - INDOT will investigate the user costs and may consider in the future.

9. Some Contractors want to have alternate pavement options for Shoulders also.

INDOT response - INDOT is not considering this at this time but it may consider it in the future as the program develops further.

10. The Contractors believed that the process is open, transparent, and produces a competitive bid environment.

C. Conclusion

The primary reasons INDOT participated in this innovative contracting practice for alternate pavement type bidding was:

1. Attract more bidders and competition.
2. Obtain true cost savings over similar conventional bid projects.
3. Provide a more competitive market, i.e. lower bid costs on paving items using this procedure versus the standard procedure where the pavement type is pre-determined.

The process was successful:

1. INDOT data indicates that more bidders were attracted and the process promotes more competitive bid prices than traditional methods.
2. Lower costs were realized than the estimates used for evaluation.
3. INDOT also received winning bid amounts that averaged nine (9) percent more below engineer's estimate for the alternate bidding process than the conventional bidding process. This clearly indicates that INDOT saved a great deal more on the alternate pavement type bid process and it also indicates that this process is most economical.

The cost savings of the individual contracts are shown on the attached appendixes. INDOT saved the tax payers on the eleven (11) contracts approximately \$15M immediately, at the

bid openings, (HMA Low Bid – PCCP Low Bid). Using the Bid Analysis amounts (after PW costs applied); INDOT saved the tax payers approximately \$27M over the 50 year service life of the pavements.

If INDOT compares the average difference in percentage below the engineer's estimate for all eleven (11) alternate bid contracts versus the conventional bid contracts, then the savings would be a much greater amount. INDOT received winning bid amounts that averaged nine (9) percent more below the engineer's estimate for the alternate bidding process than the conventional bidding process. Reference the table in section B Analysis above. The winning bid amounts for all eleven (11) alternate bids were \$422,698,033.04 and the engineer's estimate amounts were \$574,204,558.37; therefore a nine (9) % difference between alternate and conventional bid for all items, INDOT saved the tax payers approximately **\$51,000,000.00**. This shows that INDOT not only saved on pavement pay items, but saved on all other pay items in the contracts also. INDOT believes that this greater percentage below the engineer's estimate phenomenon for Alternate Bidding versus Conventional Bidding was because INDOT does not publish the PW cost before the bids are opened. INDOT believes that this Alternate Bid process for Pavement Type Selection may affect all the bid items in the contract based on the percentage below the engineer's estimate phenomenon.

The PW cost factor for future maintenance did impact which contractor received the contract on two (2) itemized pay item contracts out of the eight (8) and one (1) design build contract out of the three (3). The comments received from the contractors are mostly positive and both industries support the process. Since, this process is more competitive and realizes cost savings, INDOT will continue to partner with the industries as questions and concerns develop.

ALTERNATE BIDDING for PAVEMENT TYPE SELECTION 2010

APPENDIX	CONTRACT #	BIDDERS ID (HMA-PCCP)	INITIAL BID DIFFERENCE (Δ) (HMA-PCCP)	BID ANALYSIS	CONSULTANT DESIGN SERVICES	INITIAL BID - CONSULTANT SERVICES	BID ANALYSIS - CONSULTANT SERVICES
A	IR-30983	C - A	\$ 92,162.90	\$ 481,831.80	\$ 16,500.00	\$ 75,662.90	\$ 465,331.80
B	IR-30108	F - A	\$ 1,595,211.70	\$ 2,327,620.70	\$ 24,300.00	\$ 1,570,911.70	\$ 2,303,320.70
C	IR-30840	B - A	\$ 910,048.88	\$ 2,250,786.88	\$ 43,540.00	\$ 866,508.88	\$ 2,207,246.88
D	IR-30889	E - B	\$ 2,020,912.18	\$ 3,091,798.18	\$ 69,000.00	\$ 1,951,912.18	\$ 3,022,798.18
E	IR-31104	A - A	\$ 1,263,199.49	\$ 2,817,785.24	\$ 25,000.00	\$ 1,238,199.49	\$ 2,792,785.24
F	IR-30162	A - A	\$ (431,966.77)	\$ 123,826.63	\$ 8,000.00	\$ (439,966.77)	\$ 115,826.63
G	IR-33040	C - A	\$ 5,645,985.58	\$ 6,914,730.81	\$ 16,800.00	\$ 5,629,185.58	\$ 6,897,930.81
H	IR-31121	A - A	\$ (135,344.71)	\$ 737,416.66	\$ 30,000.00	\$ (165,344.71)	\$ 707,416.66
I	IR-33047	A - A	\$ (650,000.00)	\$ 799,822.00	\$ 31,450.00	\$ (681,450.00)	\$ 768,372.00
J	IR-33049	C - A	\$ 2,966,406.52	\$ 4,035,194.52	\$ 20,550.00	\$ 2,945,856.52	\$ 4,014,644.52
K	IR-33051	A - A*	\$ 2,200,000.00	\$ 3,973,284.17	\$ 48,950.00	\$ 2,151,050.00	\$ 3,924,334.17
TOTALS			\$ 15,476,615.77	\$ 27,554,097.59	\$ 334,090.00	\$ 15,142,525.77	\$ 27,220,007.59

Initial Bid Δ = (HMA Low Bid - PCCP Low Bid)

Bid Analysis = [(HMA+PW)-(PCCP+PW)]

* Alternate PCCP design

Appendix A
PR 69 (IR-30983)

The six (6) Contractors participated in both pavement type pay options (see below Bid Analysis Summary). Out of these six (6), one (1) Contractors bid was irregular due to their bid amount exceeded their cumulative bonding limit.

INDOT provided the following pavement design thickness for this project:

1. PR 69 mainline
 - a. 12.5 inches of PCCP or
 - b. 16 inches of HMA.
2. SR 68 ramps
 - a. 9 inches of PCCP or
 - b. 12.5 inches of HMA.

Bid Analysis Summary

PCCP Pay item Options

<u>Bidders</u>	<u>Initial Bid</u>		<u>PW Cost for PCCP</u>	=	<u>Bid Analysis</u>
A	\$10,474,000.00	+	\$682,586.00	=	\$11,156,586.10
B	\$10,511,052.70	+	\$682,586.00	=	\$11,193,638.70
C	\$10,607,395.85	+	\$682,586.00	=	\$11,289,981.85
D	\$10,856,438.00	+	\$682,586.00	=	\$11,539,024.00
E	\$11,155,757.20	+	\$682,586.00	=	\$11,838,343.20

HMA Pay item Options

<u>Bidders</u>	<u>Initial Bid</u>		<u>PW Cost for HMA</u>	=	<u>Bid Analysis</u>
C	\$10,566,162.90	+	\$1,072,255.00	=	\$11,638,417.90
D	\$10,681,286.79	+	\$1,072,255.00	=	\$11,753,541.79
A	\$10,715,000.00	+	\$1,072,255.00	=	\$11,787,255.00
B	\$10,765,422.40	+	\$1,072,255.00	=	\$11,837,677.40
E	\$11,239,845.14	+	\$1,072,255.00	=	\$12,312,100.14

The low bid amount, out of all 5 bids, was for PCCP pay items option (Bidder A) and after adding PW cost of HMA and PCCP to the respective pavement type options, PCCP option was also the low bid (Bidder A). PCCP pay items option was awarded for this contract.

INDOT compared the estimated cost with actual low bid costs of both pavement types. The following table shows the cost comparison with low bid of those pavement items that were relative to the mainline pavements and relative to this alternate bid for pavement type. All other items in the bids were common to both types of pavement. Shoulders and “S” Lines are to be HMA.

Cost Comparison of Unique Items						
Bid Item	Bid Quantities	Estimated Cost of Item Per Unit	Low Bid Cost of Item Per Unit	Range of Bid Costs of Item Per Unit	Average Bid Cost of Item Per Unit	HMA or PCCP Option
QC/QA PCCP, 12.5 IN.	46,296 yd ²	\$39.18	\$29.00	\$29.00 - \$30.25	\$29.78	PCCP
QC/QA PCCP, 9 IN.	11,474 yd ²	\$33.45	\$23.00	\$23.00 - \$24.25	\$23.78	PCCP
Subbase for PCCP	17,580 yd ³	\$34.29	\$35.00	\$33.11 - \$47.80	\$38.73	PCCP
D-1 Contraction Joint	34,050 ft	\$9.59	\$8.25	\$8.25 - \$9.01	\$8.59	PCCP
QC/QA-HMA, 5, 76, Surface	4,570 TON	\$75.70	\$85.00	\$84.00 - \$86.50*	\$84.70	HMA
QC/QA-HMA, 1, 64, Surface	946 TON	\$57.68	\$61.00	\$60.00 - \$64.00	\$61.36	HMA
QC/QA-HMA, 5, 76, Intermediate	7,618 TON	\$57.30	\$60.00	\$56.00 - \$60.15	\$58.91	HMA
QC/QA-HMA, 1, 64, Intermediate	1,577 TON	\$51.10	\$50.50	\$50.00 - \$54.50	\$51.81	HMA
QC/QA-HMA, 5, 64, Base	24,385 TON	\$47.90	\$49.00	\$47.00 - \$52.00	\$49.63	HMA
QC/QA-HMA, 1, 64, Base	3,786 TON	\$60.49	\$53.00	\$52.00 - \$54.80*	\$53.49	HMA
QC/QA-HMA, 5, 76, Intermediate, OG	12,518 TON	\$53.40	\$50.00	\$46.00 - \$50.70*	\$48.94	HMA

* Bidder E was higher on almost all HMA items.

The above table shows that pavement item bids on PCCP are lower than the estimates used in evaluation but on HMA the majority of the items are higher than the estimates. This indicates that a true cost savings was realized by INDOT in this process.

The table below compares some common HMA items found in both PCCP and HMA options to check for unbalanced bids. These bids appear to be consistent and no anomalies were found.

Cost Comparison of Some Common Items Used in Both PCCP and HMA					
Bid Item	Bid Quantities	Low Bid Cost of Item Per Unit	Range of Bid Costs of Item Per Unit	Average Bid Cost of Item Per Unit	HMA or PCCP Bid
HMA Surface, Type A	518 TON	\$64.00	\$62.25 - \$67.49	\$64.47	PCCP
HMA Surface, Type A	628 TON	\$68.00	\$62.00 - \$68.00	\$64.88	HMA
HMA Intermediate, Type A	1,554 TON	\$54.00	\$54.00 - \$57.90	\$55.83	PCCP
HMA Intermediate, Type A	1,884 TON	\$52.00	\$52.00 - \$55.80	\$53.58	HMA

Conclusion

INDOT saved the tax payers approximately \$75,662.90 immediately, at the bid opening, (HMA Low Bid – PCCP Low Bid). Using the Bid Analysis amounts (after PW costs applied); INDOT saved the tax payers approximately \$465,331.80 over the 50 year service life of the pavement. These savings include the reduction of INDOT’s consultant cost of \$16,500.00 for producing two sets of typical plan sheets and quantities. The in-house costs for INDOT were determined negligible.

The PW cost for future maintenance did not impact the bid and which contractor received the contract. INDOT believes using this process of alternate bids for pavement type selection on this project was very successful.

PW of Future Maintenance of the Pavement

I-69 (IR-30983)

PW of HMA Option = \$1,072,255.00

PW of PCCP Option = \$682,586.00

HMA PW for Future Rehabilitation Work			
Age in Years	Rehab.	Cost \$	Present Worth Cost \$
3	Joint Seal	57,377.00	51,008.00
6	Joint Seal	57,377.00	45,346.00
9	Joint Seal	57,377.00	40,312.00
12	Joint Seal	57,377.00	35,837.00
15	Joint Seal	57,377.00	31,859.00
18	Joint Seal	57,377.00	28,323.00
20	Mill and Functional Overlay	1,244,790.00	568,106.00
23	Joint Seal	57,377.00	23,279.00
26	Joint Seal	57,377.00	20,695.00
29	Joint Seal	57,377.00	18,398.00
32	Joint Seal	57,377.00	16,356.00
35	Mill and Resurface	588,051.00	149,021.00
38	Joint Seal	57,377.00	12,926.00
41	Joint Seal	57,377.00	11,491.00
44	Joint Seal	57,377.00	10,216.00
47	Joint Seal	57,377.00	9,082.00
Total HMA PW Cost			\$1,072,255.00

PCCP PW for Future Rehabilitation Work			
Age in Years	Rehab.	Cost \$	Present Worth Cost \$
8	Reseal the Joint	71,502.00	52,246.00
16	Reseal the Joint	71,502.00	38,175.00
24	Reseal the Joint	71,502.00	27,894.00
30	Mill and Functional Overlay	1,256,840.00	387,507.00
33	Joint Seal	57,377.00	15,727.00
36	Joint Seal	57,377.00	13,981.00
39	Joint Seal	57,377.00	12,429.00
42	Mill and Resurface	602,736.00	116,072.00
45	Joint Seal	57,377.00	9,823.00
48	Joint Seal	57,377.00	8,732.00
Total PCCP PW Cost			\$682,586.00

$$PW = F [1/(1+i)^n]$$

Where: F = Future Construction Cost
i = Discount rate (4%)
n = Number of years from year zero

Total Cost	Alternative 1: 12.5 inches PCCP		Alternative 2: 16 inches HMA	
	Agency Cost (\$1000)	User Cost (\$1000)	Agency Cost (\$1000)	User Cost (\$1000)
Undiscounted Sum	\$2,360.97	\$0.00	\$2,636.12	\$0.00
Present Value	\$682.59	\$0.00	\$1,072.26	\$0.00
EUAC	\$31.77	\$0.00	\$49.91	\$0.00
Lowest Present Value Agency Cost	Alternative 1: 12.5 inches PCCP			
Lowest Present Value User Cost	Alternative 1: 12.5 inches PCCP			

Expenditure Stream				
Year	Alternative 1: 12.5 inches PCCP		Alternative 2: 16 inches HMA	
	Agency Cost (\$1000)	User Cost (\$1000)	Agency Cost (\$1000)	User Cost (\$1000)
0				
1				
2				
3			\$57.38	
4				
5				
6			\$57.38	
7				
8	\$71.50			
9			\$57.38	
10				
11				
12			\$57.38	
13				
14				
15			\$57.38	
16	\$71.50			
17				
18			\$57.38	
19				
20			\$1,244.79	
21				
22				
23			\$57.38	
24	\$71.50			
25				
26			\$57.38	
27				
28				
29			\$57.38	
30	\$1,256.84			
31				
32			\$57.38	
33	\$57.38			
34				
35			\$588.05	
36	\$57.38			
37				
38			\$57.38	
39	\$57.38			
40				
41			\$57.38	
42	\$602.74			
43				
44			\$57.38	
45	\$57.38			
46				
47			\$57.38	
48	\$57.38			
49				
50				

Appendix B US 31 (IR-30108)

Six (6) Contractors participated in the bidding (5 PCCP options and 4 HMA options were bid) and all bids were substantially below the engineer's estimate. Three (3) Contractors participated in both pavement type pay options (see Bidder B, C, & E below in Bid Analysis Summary).

INDOT provided the following pavement design thickness for this project:

1. US 31 mainline
 - a. 10 inches of PCCP or
 - b. 14 inches of HMA
2. SR 26 ramps
 - a. 9 inches of PCCP or
 - b. 12.5 inches of HMA
3. SR 26 mainline
 - a. 9 inches of PCCP or
 - b. 11 inches of HMA

Bid Analysis Summary

PCCP Pay item Options

<u>Bidders</u>	<u>Initial Bid</u>		<u>PW Cost for PCCP</u>		<u>Bid Analysis</u>
A	\$21,868,350.18	+	\$1,203,300.00	=	\$23,071,650.18
B	\$23,168,039.74	+	\$1,203,300.00	=	\$24,371,339.74
C	\$23,506,302.81	+	\$1,203,300.00	=	\$24,709,602.81
D	\$24,051,719.58	+	\$1,203,300.00	=	\$25,255,019.58
E	\$24,196,458.38	+	\$1,203,300.00	=	\$25,399,758.38

HMA Pay item Options

<u>Bidders</u>	<u>Initial Bid</u>		<u>PW Cost for HMA</u>		<u>Bid Analysis</u>
F	\$23,463,561.88	+	\$1,935,709.00	=	\$25,399,270.88
B	\$23,707,889.43	+	\$1,935,709.00	=	\$25,643,598.43
C	\$23,777,638.89	+	\$1,935,709.00	=	\$25,713,347.89
E	\$25,014,219.30	+	\$1,935,709.00	=	\$26,949,928.30

The low bid amount, out of all 6 bids, was for PCCP pay items option (Bidder A) and after adding PW cost of HMA and PCCP to the respective pavement type options, PCCP option was also the low bid (Bidder A). PCCP pay items option was awarded for this contract.

INDOT compared the estimated cost with actual low bid costs of both pavement types. The following table shows the cost comparison with low bid of those pavement items that were relative to the mainline pavements and relative to this alternate bid for pavement type. All other items in the bids were common to both types of pavement. Shoulders and “S” Lines are to be HMA.

Cost Comparison of Unique Items						
Bid Item	Bid Quantities	Estimated Cost of Item Per Unit	Low Bid Cost of Item Per Unit	Range of Bid Costs of Item Per Unit	Average Bid Cost of Item Per Unit	HMA or PCCP Option
QC/QA PCCP, 10 IN.	71,608 yd ²	\$28.58	\$22.85	\$22.85 - \$25.54*	\$24.56	PCCP
QC/QA PCCP, 9 IN.	41,995 yd ²	\$27.35	\$25.85	\$23.18 - \$26.27*	\$24.47	PCCP
Subbase for PCCP	30,728 yd ³	\$30.59	\$26.75	\$25.76 - \$37.59*	\$28.56	PCCP
D-1 Contraction Joint	61,865 ft	\$8.64	\$7.85	\$7.85 - \$10.12*	\$8.66	PCCP
QC/QA-HMA, 4, 70, Surface	6,733 TON	\$70.50	\$65.04	\$65.04 - \$73.35*	\$69.68	HMA
QC/QA-HMA, 3, 70, Surface	3,482 TON	\$67.69	\$69.69	\$69.69 - \$77.48*	\$73.28	HMA
QC/QA-HMA, 4, 70, Intermediate	11,221 TON	\$49.40	\$53.15	\$48.00 - \$58.60	\$52.33	HMA
QC/QA-HMA, 3, 70, Intermediate	5,805 TON	\$53.2	\$57.68	\$55.00 - \$61.08	\$57.64	HMA
QC/QA-HMA, 4, 64, Base	31,419 TON	\$48.10	\$51.74	\$42.00 - \$51.74	\$47.09	HMA
QC/QA-HMA, 3, 64, Base	9,612 TON	\$47.90	\$36.28	\$36.28 - \$50.62*	\$42.54	HMA
QC/QA-HMA, 5, 76, Intermediate, OG	14,398 TON	\$54.20	\$60.21	\$46.50 - \$60.21	\$52.72	HMA

* Bidder D was higher on all PCCP items and bidder C was higher on almost all HMA items.

The above table shows that pavement item bids on PCCP are all lower than the estimates used in evaluation but on HMA the majority of the items are higher than the estimates. This indicates that a true cost savings was realized by INDOT in this process.

The table below compares some common HMA items found in both PCCP and HMA options to check for unbalanced bids. Bidder D of PCCP option was significantly higher on common HMA items and appeared not to be consistent, but no other anomalies were found among the rest of the bidders.

Cost Comparison of Some Common Items Used in Both PCCP and HMA					
Bid Item	Bid Quantities	Low Bid Cost of Item Per Unit	Range of Bid Costs of Item Per Unit	Average Bid Cost of Item Per Unit	HMA or PCCP Bid
HMA Surface, Type B	596 TON	\$69.00	\$56.64 - \$87.45	\$70.67	PCCP
HMA Surface, Type B	596 TON	\$54.48	\$54.48 - \$76.76	\$65.49	HMA
QC/QA-HMA, 2, 64, Intermediate	1,059 TON	\$51.60	\$46.94 - \$62.35	\$53.16	PCCP
QC/QA-HMA, 2, 64, Intermediate	1,059 TON	\$45.15	\$45.15 - \$53.20	\$49.15	HMA
HMA Intermediate, Type B	452 TON	\$53.50	\$51.21 - \$84.67	\$58.48	PCCP
HMA Intermediate, Type B	452 TON	\$49.27	\$49.27 - \$60.85	\$55.01	HMA
HMA Base, Type B	363 TON	\$51.05	\$50.88 - \$71.50	\$55.35	PCCP
HMA Base, Type B	363 TON	\$48.96	\$48.96 - \$57.85	\$53.38	HMA

Conclusion

INDOT saved the tax payers approximately \$1,570,911.70 immediately, at the bid opening, (HMA Low Bid – PCCP Low Bid). Using the Bid Analysis amounts (after PW costs applied); INDOT saved the tax payers approximately \$2,303,320.70 over the 50 year service life of the pavement. These savings include the reduction of INDOT’s consultant cost of \$24,300.00 for producing two sets of typical plan sheets and quantities. The in-house costs for INDOT were determined negligible.

The PW cost for future maintenance did not impact the bid and which contractor received the contract. INDOT believes using this process of alternate bids for pavement type selection on this project was very successful.

PW of Future Maintenance of the Pavement

US 31 (IR-30108)

PW of HMA Option = \$1,935,709.00

PW of PCCP Option = \$1,203,300.00

HMA PW for Future Rehabilitation Work			
Age in Years	Rehab.	Cost \$	Present Worth Cost \$
3	Joint Seal	111,501.00	99,124.00
6	Joint Seal	111,501.00	88,121.00
9	Joint Seal	111,501.00	78,339.00
12	Joint Seal	111,501.00	69,643.00
15	Joint Seal	111,501.00	61,912.00
18	Joint Seal	111,501.00	55,040.00
20	Mill and Functional Overlay	2,152,245.00	982,256.00
23	Joint Seal	111,501.00	45,239.00
26	Joint Seal	111,501.00	40,217.00
29	Joint Seal	111,501.00	35,753.00
32	Joint Seal	111,501.00	31,784.00
35	Mill and Resurface	1,039,119.00	263,329.00
38	Joint Seal	111,501.00	25,120.00
41	Joint Seal	111,501.00	22,331.00
44	Joint Seal	111,501.00	19,852.00
47	Joint Seal	111,501.00	17,649.00
Total HMA PW Cost			\$1,935,709.00

PCCP PW for Future Rehabilitation Work			
Age in Years	Rehab.	Cost \$	Present Worth Cost \$
8	Reseal the Joint	127,491.00	93,156.00
16	Reseal the Joint	127,491.00	68,068.00
24	Reseal the Joint	127,491.00	49,737.00
30	Mill and Functional Overlay	2,170,496.00	669,204.00
33	Joint Seal	111,501.00	30,562.00
36	Joint Seal	111,501.00	27,169.00
39	Joint Seal	111,501.00	24,153.00
42	Mill and Resurface	1,065,520.00	205,192.00
45	Joint Seal	111,501.00	19,089.00
48	Joint Seal	111,501.00	16,970.00
Total PCCP PW Cost			\$1,203,300.00

$$PW = F [1/(1+i)^n]$$

Where: F = Future Construction Cost
i = Discount rate (4%)
n = Number of years from year zero

Total Cost				
Total Cost	Alternative 1: 10 inches PCCP		Alternative 2: 14 inches HMA	
	Agency Cost (\$1000)	User Cost (\$1000)	Agency Cost (\$1000)	User Cost (\$1000)
<i>Undiscounted Sum</i>	\$4,175.99	\$0.00	\$4,752.36	\$0.00
Present Value	\$1,203.30	\$0.00	\$1,935.70	\$0.00
EUAC	\$56.01	\$0.00	\$90.11	\$0.00
Lowest Present Value Agency Cost		Alternative 1: 10 inches PCCP		
Lowest Present Value User Cost		Alternative 1: 10 inches PCCP		
Expenditure Stream				
Year	Alternative 1: 10 inches PCCP		Alternative 2: 14 inches HMA	
	Agency Cost (\$1000)	User Cost (\$1000)	Agency Cost (\$1000)	User Cost (\$1000)
0				
1				
2				
3			\$111.50	
4				
5				
6			\$111.50	
7				
8	\$127.49			
9			\$111.50	
10				
11				
12			\$111.50	
13				
14				
15			\$111.50	
16	\$127.49			
17				
18			\$111.50	
19				
20			\$2,152.25	
21				
22				
23			\$111.50	
24	\$127.49			
25				
26			\$111.50	
27				
28				
29			\$111.50	
30	\$2,170.50			
31				
32			\$111.50	
33	\$111.50			
34				
35			\$1,039.12	
36	\$111.50			
37				
38			\$111.50	
39	\$111.50			
40				
41			\$111.50	
42	\$1,065.52			
43				
44			\$111.50	
45	\$111.50			
46				
47			\$111.50	
48	\$111.50			
49				
50				

Appendix C

SR 25 (IR-30840)

Seven (7) Contractors participated in the bidding (7 PCCP options and 5 HMA options were bid) and all bids were below the engineer's estimate. Five (5) Contractors participated in both pavement type pay options.

INDOT provided the following pavement design thickness for mainline of this project:

1. 10 inches of PCCP or
2. 13.5 inches of HMA

Bid Analysis Summary

PCCP Pay item Options

<u>Bidders</u>	<u>Initial Bid</u>		<u>PW Cost for PCCP</u>		<u>Bid Analysis</u>
A	\$26,695,938.17	+	\$2,108,515.00	=	\$28,804,453.17
B	\$26,950,326.93	+	\$2,108,515.00	=	\$29,058,841.93
C	\$26,994,088.85	+	\$2,108,515.00	=	\$29,102,603.85
D	\$28,217,279.05	+	\$2,108,515.00	=	\$30,325,794.05
E	\$28,372,604.40	+	\$2,108,515.00	=	\$30,481,119.40
F	\$30,007,418.05	+	\$2,108,515.00	=	\$32,115,933.05
G	\$30,827,332.05	+	\$2,108,515.00	=	\$32,935,847.05

HMA Pay item Options

<u>Bidders</u>	<u>Initial Bid</u>		<u>PW Cost for HMA</u>		<u>Bid Analysis</u>
B	\$27,605,987.05	+	\$3,449,253.00	=	\$31,055,240.05
A	\$27,671,360.16	+	\$3,449,253.00	=	\$31,120,613.16
C	\$27,876,127.63	+	\$3,449,253.00	=	\$31,325,380.63
F	\$28,191,983.79	+	\$3,449,253.00	=	\$31,641,236.79
D	\$29,117,275.82	+	\$3,449,253.00	=	\$32,566,528.82

The low bid amount, out of all 7 bids, was for PCCP pay items option (Bidder A) and after adding PW cost of HMA and PCCP to the respective pavement type options, PCCP option was also the low bid (Bidder A). PCCP pay items option of Bidder A was awarded for this contract.

INDOT compared the estimated cost with actual low bid costs of both pavement types. The following table shows the cost comparison with low bid of those pavement items that were relative to the mainline pavements and relative to this alternate bid for pavement type. All other items in the bids were common to both types of pavement. Shoulders and "S" Lines are to be HMA.

Cost Comparison of Unique Items						
Bid Item	Bid Quantities	Estimated Cost of Item Per Unit	Low Bid Cost of Item Per Unit	Range of Bid Costs of Item Per Unit	Average Bid Cost of Item Per Unit	HMA or PCCP Option
QC/QA PCCP, 10 IN.	199,445 yd ²	\$28.58	\$23.66	\$22.99 - \$26.00*	\$24.40	PCCP
Subbase for PCCP	51,490 yd ³	\$30.59	\$26.00	\$26.00 - \$52.00*	\$34.45	PCCP
D-1 Contraction Joint	97,990 ft	\$8.64	\$8.48	\$7.64 - \$15.00*	\$9.39	PCCP
QC/QA-HMA, 4, 70, Surface	18,179 TON	\$70.50	\$67.97	\$66.50 - \$71.95	\$67.88	HMA
QC/QA-HMA, 4, 70, Intermediate	30,340 TON	\$49.40	\$52.12	\$48.43 - \$52.12	\$50.71	HMA
QC/QA-HMA, 4, 64, Base	48,570 TON	\$48.10	\$49.57	\$48.39 - \$49.57	\$48.69	HMA
QC/QA-HMA, 5, 76, Intermediate, OG	31,370 TON	\$54.20	\$45.99	\$45.00 - \$47.44	\$45.68	HMA

* Bidder F was significantly and consistently higher on all the PCCP option items.

The above table shows that pavement item bids on PCCP are consistently lower than the estimates used in evaluation, overall the HMA items were lower than the estimates with only a few HMA items higher. This indicates that a true cost savings was realized by INDOT in this process.

The table below compares some common HMA items found in both PCCP and HMA options to check for unbalanced bids. These bids appear to be consistent and no anomalies were found.

Cost Comparison of Some Common Items Used in Both PCCP and HMA					
Bid Item	Bid Quantities	Low Bid Cost of Item Per Unit	Range of Bid Costs of Item Per Unit	Average Bid Cost of Item Per Unit	HMA or PCCP Bid
QC/QA-HMA, 2, 64, Surface	2,119 TON	\$64.00	\$64.00 - \$67.20	\$65.37	PCCP
QC/QA-HMA, 2, 64, Surface	1,855 TON	\$65.92	\$64.50 - \$65.92	\$65.00	HMA
QC/QA-HMA, 2, 64, Intermediate	3,375 TON	\$52.00	\$52.00 - \$56.21	\$54.46	PCCP
QC/QA-HMA, 2, 64, Intermediate	12,410 TON	\$55.19	\$52.39 - \$55.19	\$53.92	HMA
QC/QA-HMA, 2, 64, Base	7,617 TON	\$52.00	\$52.00 - \$54.48	\$52.51	PCCP
QC/QA-HMA, 2, 64, Base	7,617 TON	\$53.15	\$52.00 - \$53.16	\$52.46	HMA

Conclusion

INDOT saved the tax payers approximately \$866,508.88 immediately, at the bid opening, (HMA Low Bid – PCCP Low Bid). Using the Bid Analysis amounts (after PW costs applied); INDOT saved the tax payers approximately \$2,207,246.88 over the 50 year service life of the pavement. These savings include the reduction of INDOT's consultant cost of \$43,540.00 for producing two sets of typical plan sheets and quantities. The in-house costs for INDOT were determined negligible.

The PW cost for future maintenance did not impact the bid and which contractor received the contract. INDOT believes using this process of alternate bids for pavement type selection on this project was very successful.

PW of Future Maintenance of the Pavement

SR 25 (IR-30840)

PW of HMA Option = \$3,449,253.00

PW of PCCP Option = \$2,108,515.00

HMA PW for Future Rehabilitation Work			
Age in Years	Rehab.	Cost \$	Present Worth Cost \$
3	Joint Seal	182,952.00	\$162,643.66
6	Joint Seal	182,952.00	\$144,589.62
9	Joint Seal	182,952.00	\$128,539.65
12	Joint Seal	182,952.00	\$114,271.28
15	Joint Seal	182,952.00	\$101,586.75
18	Joint Seal	182,952.00	\$90,310.25
20	Mill and Functional Overlay	3,995,007.00	\$1,823,269.04
23	Joint Seal	182,952.00	\$74,228.44
26	Joint Seal	182,952.00	\$65,988.82
29	Joint Seal	182,952.00	\$58,663.82
32	Joint Seal	182,952.00	\$52,151.92
35	Mill and Resurface	1,947,871.00	\$493,620.65
38	Joint Seal	182,952.00	\$41,216.42
41	Joint Seal	182,952.00	\$36,641.25
44	Joint Seal	182,952.00	\$32,573.94
47	Joint Seal	182,952.00	\$28,958.11
Total HMA PW Cost			\$3,449,253.62

PCCP PW for Future Rehabilitation Work			
Age in Years	Rehab.	Cost \$	Present Worth Cost \$
8	Reseal the Joint	176,176.00	\$128,730.08
16	Reseal the Joint	176,176.00	\$94,061.81
24	Reseal the Joint	176,176.00	\$68,730.04
30	Mill and Functional Overlay	4,022,890.00	\$1,240,332.09
33	Joint Seal	182,952.00	\$50,146.08
36	Joint Seal	182,952.00	\$44,579.68
39	Joint Seal	182,952.00	\$39,631.17
42	Mill and Resurface	1,989,558.00	\$383,138.99
45	Joint Seal	182,952.00	\$31,321.09
48	Joint Seal	182,952.00	\$27,844.34
Total PCCP PW Cost			\$2,108,515.36

$$PW = F [1/(1+i)^n]$$

Where: F = Future Construction Cost
i = Discount rate (4%)
n = Number of years from year zero

Total Cost				
Total Cost	Alternative 1: 10 inches PCCP		Alternative 2: 13.5 inches HMA	
	Agency Cost (\$1000)	User Cost (\$1000)	Agency Cost (\$1000)	User Cost (\$1000)
Undiscounted Sum	\$7,455.74	\$0.00	\$8,504.21	\$0.00
Present Value	\$2,108.52	\$0.00	\$3,449.25	\$0.00
EUAC	\$98.15	\$0.00	\$160.56	\$0.00
Lowest Present Value Agency Cost	Alternative 1: 10 inches PCCP			
Lowest Present Value User Cost	Alternative 1: 10 inches PCCP			

Expenditure Stream				
Year	Alternative 1: 10 inches PCCP		Alternative 2: 13.5 inches HMA	
	Agency Cost (\$1000)	User Cost (\$1000)	Agency Cost (\$1000)	User Cost (\$1000)
0				
1				
2				
3			\$182.95	
4				
5				
6			\$182.95	
7				
8	\$176.18			
9			\$182.95	
10				
11				
12			\$182.95	
13				
14				
15			\$182.95	
16	\$176.18			
17				
18			\$182.95	
19				
20			\$3,995.01	
21				
22				
23			\$182.95	
24	\$176.18			
25				
26			\$182.95	
27				
28				
29			\$182.95	
30	\$4,022.89			
31				
32			\$182.95	
33	\$182.95			
34				
35			\$1,947.87	
36	\$182.95			
37				
38			\$182.95	
39	\$182.95			
40				
41			\$182.95	
42	\$1,989.56			
43				
44			\$182.95	
45	\$182.95			
46				
47			\$182.95	
48	\$182.95			
49				
50				

Appendix D US 31 (IR-30889)

Eight (8) Contractors participated in the bidding (7 PCCP options and 2 HMA options were bid) and all bids were below the engineer's estimate. One (1) Contractor participated in both pavement types pay options. In this contract, there were four pay item options as follows:

1. PCCP option on US 31 mainline, shoulders and ramps.
2. HMA option on US 31 mainline, shoulders and ramps.
3. PCCP option on US 35/SR 22/Markland Avenue.
4. HMA option on US 35/SR 22/Markland Avenue.

The Contractor could bid on the following combinations:

- a. Section 1 & 3
- b. Section 1 & 4
- c. Section 2 & 3
- d. Section 2 & 4

All bids were either a and/or d.

INDOT provided the following pavement design thickness for this project:

1. US 31 mainline and shoulders
 - a. 10 inches of PCCP with Composite HMA shoulder (4.5 inches HMA on 6 inches of Compacted Aggregate) or
 - b. 14 inches of HMA with Composite HMA shoulder (6 inches HMA on 8 inches of Compacted Aggregate)
2. US 35/SR 22 ramps
 - a. 8 inches of PCCP or
 - b. 12.5 inches of HMA
3. US 35/SR 22/Markland Avenue
 - a. 9 inches of PCCP or
 - b. 13.5 inches of HMA

Bid Analysis Summary

PCCP Pay item Options (US 31)

<u>Bidders</u>	<u>Initial Bid</u>	<u>PW Cost for PCCP</u>	<u>Bid Analysis</u>
A	\$31,505,064.88	+ \$1,271,495.00	= \$32,776,559.88
B	\$31,551,160.94	+ \$1,271,495.00	= \$32,822,655.94
C	\$31,701,584.64	+ \$1,271,495.00	= \$32,973,079.64
D	\$32,811,312.88	+ \$1,271,495.00	= \$34,082,807.88
F	\$33,528,027.23	+ \$1,271,495.00	= \$34,799,522.23
G	\$34,923,621.84	+ \$1,271,495.00	= \$36,195,116.84
H	\$35,988,069.42	+ \$1,271,495.00	= \$37,259,564.42

HMA Pay item Options (US 31)

<u>Bidders</u>	<u>Initial Bid</u>		<u>PW Cost for HMA</u>		<u>Bid Analysis</u>
E	\$32,639,521.93	+	\$2,060,540.00	=	\$34,700,061.93
F	\$33,868,397.42	+	\$2,060,540.00	=	\$35,928,937.42

PCCP Pay item Options (US 35/SR 22/Markland Ave.)

<u>Bidders</u>	<u>Initial Bid</u>		<u>PW Cost for PCCP</u>		<u>Bid Analysis</u>
B	\$7,387,466.06	+	\$515,677.00	=	\$7,903,143.06
C	\$7,452,787.84	+	\$515,677.00	=	\$7,968,464.84
A	\$7,804,387.66	+	\$515,677.00	=	\$8,320,064.66
H	\$7,906,937.29	+	\$515,677.00	=	\$8,422,614.29
G	\$7,969,370.16	+	\$515,677.00	=	\$8,485,047.16
F	\$8,152,610.83	+	\$515,677.00	=	\$8,668,287.83
D	\$8,167,795.12	+	\$515,677.00	=	\$8,683,472.12

HMA Pay item Options (US 35/SR 22/Markland Ave.)

<u>Bidders</u>	<u>Initial Bid</u>		<u>PW Cost for HMA</u>		<u>Bid Analysis</u>
F	\$8,005,183.04	+	\$797,518.00	=	\$8,802,701.04
E	\$8,320,017.25	+	\$797,518.00	=	\$9,117,535.25

PCCP Pay item Options (Whole Contract)

<u>Bidders</u>	<u>US 31</u>		<u>US 35/SR 22</u>		<u>Bid Analysis</u>
B	\$32,822,655.94	+	\$7,903,143.06	=	\$40,725,799.00
C	\$32,973,079.64	+	\$7,968,464.84	=	\$40,941,544.48
A	\$32,776,559.88	+	\$8,320,064.66	=	\$41,096,624.54
D	\$34,082,807.88	+	\$8,683,472.12	=	\$42,766,280.00
G	\$36,195,116.84	+	\$8,485,047.16	=	\$44,680,164.00
H	\$37,259,564.42	+	\$8,422,614.29	=	\$45,682,178.71
F	\$34,799,522.23	+	\$8,668,287.83	=	\$43,467,810.06

HMA Pay item Options (Whole Contract)

<u>Bidders</u>	<u>US 31</u>		<u>US 35/SR 22</u>		<u>Bid Analysis</u>
E	\$34,700,061.93	+	\$9,117,535.25	=	\$43,817,597.18
F	\$35,928,937.42	+	\$8,802,701.04	=	\$44,731,638.46

The low bid amount for this contract was decided after adding respective combinations of US 31 and US 35/SR 22 pay items options. The low bid amount, out of all 8 bids, was for PCCP pay items option (Bidder B) and after adding PW cost of PCCP and HMA of US 31 and US 35/SR 22 to the respective combinations of pavement type options, PCCP option was also the low bid (Bidder B). PCCP pay items option was awarded for this contract.

INDOT compared the estimated cost with actual low bid costs of both pavement types. The following table shows the cost comparison with low bid of those pavement items that were relative to the mainline pavements and relative to this alternate bid for pavement type. All other items in the bids were common to both types of pavement. Shoulders and other “S” Lines are to be HMA.

Cost Comparison of Unique Items						
Bid Item	Bid Quantities	Estimated Cost of Item Per Unit	Low Bid Cost of Item Per Unit	Range of Bid Costs of Item Per Unit	Average Bid Cost of Item Per Unit	HMA or PCCP Option
QC/QA PCCP, 10 IN.	91,709 yd ²	\$28.51	\$23.47	\$23.11 - \$29.88	\$25.03	PCCP
QC/QA PCCP, 9 IN.	55,145 yd ²	\$27.34	\$25.10	\$23.25 - \$30.00	\$26.12	PCCP
QC/QA PCCP, 8 IN.	25,511 yd ²	\$26.29	\$20.40	\$20.40 - \$29.00	\$23.93	PCCP
Subbase for PCCP	50,518 yd ³	\$30.63	\$21.39	\$21.00 - \$35.00	\$27.03	PCCP
D-1 Contraction Joint	91,499 ft	\$8.65	\$8.08	\$6.70 - \$10.70	\$8.12	PCCP
QC/QA-HMA, 4, 70, Surface	8,696 TON	\$70.51	\$82.91	\$67.50 - \$82.91*	\$75.20	HMA
QC/QA-HMA, 3, 70, Surface	6,506 TON	\$67.54	\$63.82	\$63.82 - \$70.00	\$66.33	HMA
QC/QA-HMA, 4, 70, Intermediate	14,586 TON	\$49.40	\$73.45	\$48.50 - \$73.45*	\$60.97	HMA
QC/QA-HMA, 3, 70, Intermediate	10,834 TON	\$53.10	\$48.84	\$48.84 - \$62.45	\$53.32	HMA
QC/QA-HMA, 4, 64, Base	41,319 TON	\$48.10	\$71.45	\$43.00 - \$71.45*	\$57.22	HMA
QC/QA-HMA, 3, 64, Base	29,061 TON	\$47.90	\$37.28	\$37.28 - \$49.00	\$43.65	HMA
QC/QA-HMA, 5, 76, Intermediate, OG	28,709 TON	\$54.00	\$56.48	\$43.00 - \$56.48*	\$50.02	HMA

* Bidder E was significantly and consistently higher on almost all HMA items.

The above table shows that pavement item bids are lower than the estimates used in the evaluation. This indicates that a true cost saving was realized by INDOT in this process.

The table below compares some common HMA items found in both PCCP and HMA options to check for unbalanced bids. These bids appear to be consistent and no anomalies were found.

Cost Comparison of Some Common Items Used in Both PCCP and HMA					
Bid Item	Bid Quantities	Low Bid Cost of Item Per Unit	Range of Bid Costs of Item Per Unit	Average Bid Cost of Item Per Unit	HMA or PCCP Bid
HMA Surface, Type A	75 TON	\$85.00	\$70.00 - \$85.00	\$82.85	PCCP
HMA Surface, Type A	75 TON	\$84.41	\$84.41 - \$85.00	\$84.70	HMA
HMA Surface, Type C	565 TON	\$84.00	\$82.00 - \$84.00	\$83.71	PCCP
HMA Surface, Type C	565 TON	\$79.76	\$79.76 - \$84.00	\$81.88	HMA
HMA Intermediate, Type A	124 TON	\$65.00	\$64.00 - \$65.00	\$64.85	PCCP
HMA Intermediate, Type A	124 TON	\$61.30	\$61.30 - \$65.00	\$63.15	HMA
HMA Intermediate, Type C	503 TON	\$65.00	\$65.00 - \$66.00	\$65.14	PCCP
HMA Intermediate, Type C	503 TON	\$51.96	\$51.00 - \$65.00	\$58.48	HMA
HMA Base, Type C	265 TON	\$50.00	\$50.00 - \$73.00	\$53.28	PCCP
HMA Base, Type C	265 TON	\$51.55	\$50.00 - \$51.55	\$50.77	HMA

Conclusion

INDOT saved the tax payers approximately \$1,951,912.18 immediately, at the bid opening, (HMA Low Bid – PCCP Low Bid). Using the Bid Analysis amounts (after PW costs applied); INDOT saved the tax payers approximately \$3,022,798.18 over the 50 year service life of the pavement. These savings include the reduction of INDOT’s consultant cost of \$69,000.00 for producing two sets of typical plan sheets and quantities. The in-house costs for INDOT were determined negligible.

The PW cost for future maintenance did not impact the bid and which contractor received the contract. INDOT believes using this process of alternate bids for pavement type selection on this project was very successful.

PW of Future Maintenance of the Pavement

IR-30889 (US 31)

PW of PCCP Option (US 31 & Ramps, Section 1) = \$1,271,495.00

PW of HMA Option (US 31 & Ramps, Section 2) = \$2,060,540.00

PW of PCCP Option (US 35, Section 3) = \$515,677.00

PW of HMA Option (US 35, Section 4) = \$797,518.00

HMA PW for Future Rehab. Work (US 31 & Ramps)

Age in Years	Rehab.	Cost \$	Present Worth Cost \$
3	Joint Seal	115,061.00	\$102,288.81
6	Joint Seal	115,061.00	\$90,934.38
9	Joint Seal	115,061.00	\$80,840.33
12	Joint Seal	115,061.00	\$71,866.76
15	Joint Seal	115,061.00	\$63,889.29
18	Joint Seal	115,061.00	\$56,797.35
20	Mill and Functional Overlay	2,331,065.00	\$1,063,867.64
23	Joint Seal	115,061.00	\$46,683.28
26	Joint Seal	115,061.00	\$41,501.26
29	Joint Seal	115,061.00	\$36,894.47
32	Joint Seal	115,061.00	\$32,799.05
35	Mill and Resurface	1,122,717.00	\$284,513.86
38	Joint Seal	115,061.00	\$25,921.57
41	Joint Seal	115,061.00	\$23,044.18
44	Joint Seal	115,061.00	\$20,486.19
47	Joint Seal	115,061.00	\$18,212.15
Total HMA PW Cost			\$2,060,540.56

PCCP PW for Future Rehab. Work (US 31 & Ramps)

Age in Years	Rehab.	Cost \$	Present Worth Cost \$
8	Reseal the Joint	123,171.00	\$89,999.84
16	Reseal the Joint	123,171.00	\$65,762.00
24	Reseal the Joint	123,171.00	\$48,051.65
30	Mill and Functional Overlay	2,350,638.00	\$724,745.58
33	Joint Seal	115,061.00	\$31,537.55
36	Joint Seal	115,061.00	\$28,036.77
39	Joint Seal	115,061.00	\$24,924.58
42	Mill and Resurface	1,148,787.00	\$221,227.58
45	Joint Seal	115,061.00	\$19,698.26
48	Joint Seal	115,061.00	\$17,511.68
Total PCCP PW Cost			\$1,271,495.50

$$PW = F [1/(1+i)^n]$$

Where: F = Future Construction Cost
i = Discount rate (4%)
n = Number of years from year zero

HMA PW for Future Rehab. Work (US 35)			
Age in Years	Rehab.	Cost \$	Present Worth Cost \$
3	Joint Seal	49,782.00	\$44,256.02
6	Joint Seal	49,782.00	\$39,343.44
9	Joint Seal	49,782.00	\$34,976.17
12	Joint Seal	49,782.00	\$31,093.69
15	Joint Seal	49,782.00	\$27,642.18
18	Joint Seal	49,782.00	\$24,573.80
20	Mill and Functional Overlay	849,266.00	\$387,593.92
23	Joint Seal	49,782.00	\$20,197.87
26	Joint Seal	49,782.00	\$17,955.83
29	Joint Seal	49,782.00	\$15,962.67
32	Joint Seal	49,782.00	\$14,190.75
35	Mill and Resurface	401,726.00	\$101,803.58
38	Joint Seal	49,782.00	\$11,215.16
41	Joint Seal	49,782.00	\$9,970.24
44	Joint Seal	49,782.00	\$8,863.50
47	Joint Seal	49,782.00	\$7,879.62
Total HMA PW Cost			\$797,518.43

PCCP PW for Future Rehab. Work (US 35)			
Age in Years	Rehab.	Cost \$	Present Worth Cost \$
8	Reseal the Joint	68,976.00	\$50,400.09
16	Reseal the Joint	68,976.00	\$36,826.85
24	Reseal the Joint	68,976.00	\$26,909.02
30	Mill and Functional Overlay	870,391.00	\$268,357.79
33	Joint Seal	49,782.00	\$13,644.96
36	Joint Seal	49,782.00	\$12,130.32
39	Joint Seal	49,782.00	\$10,783.81
42	Mill and Resurface	418,152.00	\$80,525.59
45	Joint Seal	49,782.00	\$8,522.60
48	Joint Seal	49,782.00	\$7,576.56
Total PCCP PW Cost			\$515,677.58

$$PW = F [1/(1+i)^n]$$

Where: F = Future Construction Cost
i = Discount rate (4%)
n = Number of years from year zero

Total Cost (US 31 & Ramps)				
Total Cost	Alternative 1: 10 inches PCCP		Alternative 2: 14 inches HMA	
	Agency Cost (\$1000)	User Cost (\$1000)	Agency Cost (\$1000)	User Cost (\$1000)
<i>Undiscounted Sum</i>	\$4,444.24	\$0.00	\$5,064.64	\$0.00
Present Value	\$1,271.50	\$0.00	\$2,060.54	\$0.00
EUAC	\$59.19	\$0.00	\$95.92	\$0.00
Lowest Present Value Agency Cost	Alternative 1: 10 inches PCCP			
Lowest Present Value User Cost	Alternative 1: 10 inches PCCP			
Expenditure Stream				
Year	Alternative 1: 10 inches PCCP		Alternative 2: 14 inches HMA	
	Agency Cost (\$1000)	User Cost (\$1000)	Agency Cost (\$1000)	User Cost (\$1000)
0				
1				
2				
3			\$115.06	
4				
5				
6			\$115.06	
7				
8	\$123.17			
9			\$115.06	
10				
11				
12			\$115.06	
13				
14				
15			\$115.06	
16	\$123.17			
17				
18			\$115.06	
19				
20			\$2,331.06	
21				
22				
23			\$115.06	
24	\$123.17			
25				
26			\$115.06	
27				
28				
29			\$115.06	
30	\$2,350.64			
31				
32			\$115.06	
33	\$115.06			
34				
35			\$1,122.72	
36	\$115.06			
37				
38			\$115.06	
39	\$115.06			
40				
41			\$115.06	
42	\$1,148.79			
43				
44			\$115.06	
45	\$115.06			
46				
47			\$115.06	
48	\$115.06			
49				
50				

Total Cost (US 35)				
Total Cost	Alternative 1: 9 inches PCCP		Alternative 2: 13.5 inches HMA	
	Agency Cost (\$1000)	User Cost (\$1000)	Agency Cost (\$1000)	User Cost (\$1000)
<i>Undiscounted Sum</i>	\$1,744.38	\$0.00	\$1,947.94	\$0.00
Present Value	\$515.68	\$0.00	\$797.52	\$0.00
EUAC	\$24.00	\$0.00	\$37.12	\$0.00
Lowest Present Value Agency Cost	Alternative 1: 9 inches PCCP			
Lowest Present Value User Cost	Alternative 1: 9 inches PCCP			
Expenditure Stream				
Year	Alternative 1: 9 inches PCCP		Alternative 2: 13.5 inches HMA	
	Agency Cost (\$1000)	User Cost (\$1000)	Agency Cost (\$1000)	User Cost (\$1000)
0				
1				
2				
3			\$49.78	
4				
5				
6			\$49.78	
7				
8	\$68.98			
9			\$49.78	
10				
11				
12			\$49.78	
13				
14				
15			\$49.78	
16	\$68.98			
17				
18			\$49.78	
19				
20			\$849.27	
21				
22				
23			\$49.78	
24	\$68.98			
25				
26			\$49.78	
27				
28				
29			\$49.78	
30	\$870.39			
31				
32			\$49.78	
33	\$49.78			
34				
35			\$401.73	
36	\$49.78			
37				
38			\$49.78	
39	\$49.78			
40				
41			\$49.78	
42	\$418.15			
43				
44			\$49.78	
45	\$49.78			
46				
47			\$49.78	
48	\$49.78			
49				
50				

Appendix E

I-70 (IR-31104)

Six (6) Contractors participated in the bidding (5 PCCP options and 2 HMA options were bid) and all bids were below the engineer's estimate. One (1) Contractor participated in both pavement type pay options.

INDOT provided the following pavement design thickness for mainline of this project:

1. 12 inches of PCCP or
2. 15.5 inches of HMA

Bid Analysis Summary

PCCP Pay item Options

<u>Bidders</u>	<u>Initial Bid</u>		<u>PW Cost for PCCP</u>		<u>Bid Analysis</u>
A	\$32,332,908.93	+	\$3,539,454.84	=	\$35,872,363.77
B	\$33,846,852.49	+	\$3,539,454.84	=	\$37,386,307.33
C	\$36,335,804.34	+	\$3,539,454.84	=	\$39,875,259.18
D	\$37,974,271.64	+	\$3,539,454.84	=	\$41,513,726.48
E	\$38,708,192.73	+	\$3,539,454.84	=	\$42,247,647.57

HMA Pay item Options

<u>Bidders</u>	<u>Initial Bid</u>		<u>PW Cost for HMA</u>		<u>Bid Analysis</u>
A	\$33,596,108.42	+	\$5,094,040.59	=	\$38,690,149.01
F	\$36,694,492.07	+	\$5,094,040.59	=	\$41,788,532.66

The low bid amount, out of all 6 bids, was for PCCP pay items option (Bidder A) and after adding PW cost of HMA and PCCP to the respective pavement type options, PCCP option was also the low bid (Bidder A). PCCP pay items option of Bidder A was awarded for this contract.

INDOT compared the estimated cost with actual low bid costs of both pavement types. The following table shows the cost comparison with low bid of those pavement items that were relative to the mainline pavements and relative to this alternate bid for pavement type. All other items in the bids were common to both types of pavement.

Cost Comparison of Unique Items						
Bid Item	Bid Quantities	Estimated Cost of Item Per Unit	Low Bid Cost of Item Per Unit	Range of Bid Costs of Item Per Unit	Average Bid Cost of Item Per Unit	HMA or PCCP Option
QC/QA PCCP, 12 IN.	408,293 yd ²	\$31.29	\$23.00	\$23.00 - \$29.38*	\$26.27	PCCP
Subbase for PCCP	103,293 yd ³	\$30.63	\$26.50	\$25.00 - \$32.50*	\$27.63	PCCP
D-1 Contraction Joint	229,667 ft	\$8.65	\$7.95	\$6.99 - \$8.50*	\$7.88	PCCP
QC/QA-HMA, 5, 76, Surface	20,457 TON	\$76.00	\$69.75	\$69.75 - \$80.00	\$75.12	HMA
QC/QA-HMA, 5, 76, Intermediate	34,094 TON	\$58.60	\$48.00	\$48.00 - \$54.00	\$51.00	HMA
QC/QA-HMA, 5, 64, Base	109,102 TON	\$48.90	\$39.00	\$39.00 - \$44.00	\$41.50	HMA
QC/QA-HMA, 5, 76, Intermediate, OG	72,804 TON	\$54.00	\$37.75	\$37.75 - \$49.00	\$43.37	HMA
QC/QA-HMA, 1, 64, Surface	13,277 TON	\$53.11	\$50.00	\$50.00 - \$63.75	\$56.87	HMA
QC/QA-HMA, 1, 64, Intermediate	22,347 TON	\$50.16	\$40.80	\$40.80 - \$52.80	\$46.80	HMA
QC/QA-HMA, 1, 64, Base	73,947 TON	\$52.36	\$37.60	\$37.60 - \$45.75	\$41.67	HMA

* Bidder E was higher on all the PCCP option items among PCCP bidders.

The above table shows that pavement item bids are consistently lower than the estimates used in the evaluation. This indicates that a true cost saving was realized by INDOT in this process.

The table below compares some common HMA items found in both PCCP and HMA options to check for unbalanced bids. These bids appear to be consistent and no anomalies were found.

Cost Comparison of Some Common Items Used in Both PCCP and HMA					
Bid Item	Bid Quantities	Low Bid Cost of Item Per Unit	Range of Bid Costs of Item Per Unit	Average Bid Cost of Item Per Unit	HMA or PCCP Bid
HMA Surface, Type A	146 TON	\$97.00	\$97.00 - \$160.00	\$111.92	PCCP
HMA Surface, Type A	146 TON	\$97.00	\$97.00 - \$120.00	\$108.50	HMA
HMA Intermediate, Type A	439 TON	\$58.00	\$58.00 - \$85.00	\$64.91	PCCP
HMA Intermediate, Type A	439 TON	\$58.00	\$58.00 - \$67.00	\$62.50	HMA
HMA for Temp. Pavement	36,624 TON	\$49.45	\$23.95 - \$59.00	\$46.65	PCCP
HMA for Temp. Pavement	36,624 TON	\$56.50	\$56.50 - \$59.00	\$57.75	HMA

Conclusion

INDOT saved the tax payers approximately \$1,238,199.49 immediately, at the bid opening, (HMA Low Bid – PCCP Low Bid). Using the Bid Analysis amounts (after PW costs applied); INDOT saved the tax payers approximately \$2,792,785.24 over the 50 year service life of the pavement. These savings include the reduction of INDOT’s consultant cost of \$25,000.00 for producing two sets of typical plan sheets and quantities. The in-house costs for INDOT were determined negligible.

The PW cost for future maintenance did not impact the bid and which contractor received the contract. INDOT believes using this process of alternate bids for pavement type selection on this project was very successful.

PW of Future Maintenance of the Pavement

IR-31104 (I-70)

PW of HMA Option = \$5,094,040.59

PW of PCCP Option = \$3,539,454.84

HMA PW for Future Rehabilitation Work			
Age in Years	Rehab.	Cost \$	Present Worth Cost \$
3	Joint Seal	245,280.00	\$218,053.03
6	Joint Seal	245,280.00	\$193,848.35
9	Joint Seal	245,280.00	\$172,330.47
12	Joint Seal	245,280.00	\$153,201.16
15	Joint Seal	245,280.00	\$136,195.28
18	Joint Seal	245,280.00	\$121,077.11
20	Mill and Functional Overlay	6,239,162.00	\$2,847,472.09
23	Joint Seal	245,280.00	\$99,516.56
26	Joint Seal	245,280.00	\$88,469.86
29	Joint Seal	245,280.00	\$78,649.38
32	Joint Seal	245,280.00	\$69,919.01
35	Mill and Resurface	2,874,455.00	\$728,431.37
38	Joint Seal	245,280.00	\$55,258.01
41	Joint Seal	245,280.00	\$49,124.17
44	Joint Seal	245,280.00	\$43,671.21
47	Joint Seal	245,280.00	\$38,823.55
Total HMA PW Cost			\$5,094,040.59

PCCP PW for Future Rehabilitation Work			
Age in Years	Rehab.	Cost \$	Present Worth Cost \$
8	Reseal the Joint	482,300.00	\$352,411.89
16	Reseal the Joint	482,300.00	\$257,503.91
24	Reseal the Joint	482,300.00	\$188,155.59
30	Mill and Functional Overlay	6,215,077.00	\$1,916,224.26
33	Joint Seal	245,280.00	\$67,229.82
36	Joint Seal	245,280.00	\$59,767.06
39	Joint Seal	245,280.00	\$53,132.70
42	Mill and Resurface	2,937,598.00	\$565,707.73
45	Joint Seal	245,280.00	\$41,991.55
48	Joint Seal	245,280.00	\$37,330.33
Total PCCP PW Cost			\$3,539,454.84

$$PW = F [1/(1+i)^n]$$

Where: F = Future Construction Cost

i = Discount rate (4%)

n = Number of years from year zero

Total Cost				
Total Cost	Alternative 1: 12 inches PCCP		Alternative 2: 15.5 inches HMA	
	Agency Cost (\$1000)	User Cost (\$1000)	Agency Cost (\$1000)	User Cost (\$1000)
Undiscounted Sum	\$11,825.97	\$0.00	\$12,547.54	\$0.00
Present Value	\$3,539.45	\$0.00	\$5,094.04	\$0.00
EUAC	\$164.76	\$0.00	\$237.13	\$0.00
Lowest Present Value Agency Cost	Alternative 1: 12 inches PCCP			
Lowest Present Value User Cost	Alternative 1: 12 inches PCCP			
Expenditure Stream				
Year	Alternative 1: 12 inches PCCP		Alternative 2: 15.5 inches HMA	
	Agency Cost (\$1000)	User Cost (\$1000)	Agency Cost (\$1000)	User Cost (\$1000)
0				
1				
2				
3			\$245.28	
4				
5				
6			\$245.28	
7				
8	\$482.30			
9			\$245.28	
10				
11				
12			\$245.28	
13				
14				
15			\$245.28	
16	\$482.30			
17				
18			\$245.28	
19				
20			\$6,239.16	
21				
22				
23			\$245.28	
24	\$482.30			
25				
26			\$245.28	
27				
28				
29			\$245.28	
30	\$6,215.08			
31				
32			\$245.28	
33	\$245.28			
34				
35			\$2,874.46	
36	\$245.28			
37				
38			\$245.28	
39	\$245.28			
40				
41			\$245.28	
42	\$2,937.60			
43				
44			\$245.28	
45	\$245.28			
46				
47			\$245.28	
48	\$245.28			
49				
50				

Appendix F

US 24 (IR-30162)

Seven (7) Contractors participated in the bidding (6 PCCP options and 4 HMA options were bid) and all bids were below the engineer's estimate. Three (3) Contractors participated in both pavement type pay options.

INDOT provided the following pavement design thickness for mainline of this project:

1. 10.5 inches of PCCP or
2. 13.5 inches of HMA.

Bid Analysis Summary

PCCP Pay Items Option

<u>Bidders</u>	<u>Initial Bid</u>		<u>PW Cost for PCCP</u>		<u>Bid Analysis</u>
A	\$16,452,359.85	+	\$919,579.74	=	\$17,371,939.59
B	\$16,596,965.57	+	\$919,579.74	=	\$17,516,545.31
C	\$16,843,565.39	+	\$919,579.74	=	\$17,763,145.13
D	\$16,883,604.60	+	\$919,579.74	=	\$17,803,184.34
E	\$17,046,415.82	+	\$919,579.74	=	\$17,965,995.56
F	\$17,126,951.39	+	\$919,579.74	=	\$18,046,531.13

HMA Pay Item Option

<u>Bidders</u>	<u>Initial Bid</u>		<u>PW Cost for HMA</u>		<u>Bid Analysis</u>
A	\$16,020,393.08	+	\$1,475,368.14	=	\$17,495,766.22
D	\$16,055,178.49	+	\$1,475,368.14	=	\$17,530,546.63
F	\$16,593,462.83	+	\$1,475,368.14	=	\$18,068,830.97
G	\$17,912,365.98	+	\$1,475,368.14	=	\$19,387,734.12

The low bid amount, out of all 7 bids, was for HMA pay items option (Bidder A) and after adding PW cost of HMA and PCCP to the respective pavement type options, PCCP pay items option was the low bid (Bidder A). PCCP pay items option of Bidder A was awarded for this contract. The PW cost factor affected the outcome of the bidding.

INDOT compared the estimated cost with actual low bid costs of both pavement types. The following table shows the cost comparison with low bid of those pavement items that were relative to the mainline pavements and relative to this alternate bid for pavement type. All other items in the bids were common to both types of pavement option.

Cost Comparison of Unique Items						
Bid Item	Bid Quantities	Estimated Cost of Item Per Unit	Low Bid Cost of Item Per Unit	Range of Bid Costs of Item Per Unit	Average Bid Cost of Item Per Unit	HMA or PCCP Option
QC/QA PCCP, 10.5 IN.	79,893 yd ²	\$29.21	\$24.89	\$24.15 - \$25.25	\$24.82	PCCP
Subbase for PCCP	24,492 yd ³	\$30.63	\$26.63	\$23.10 - \$27.00	\$25.55	PCCP
D-1 Contraction Joint	40,522 ft	\$8.65	\$8.65	\$8.00 - \$9.64	\$8.82	PCCP
QC/QA-HMA, 4, 70, Surface	7,503 TON	\$70.50	\$66.00	\$50.70 - \$66.0	\$54.52	HMA
QC/QA-HMA, 4, 70, Intermediate	12,600 TON	\$49.40	\$53.00	\$38.00 - \$53.00	\$41.75	HMA
QC/QA-HMA, 4, 64, Base, 25.0mm	20,412 TON	\$48.10	\$51.00	\$35.00 - \$51.00	\$39.00	HMA
QC/QA-HMA, 4, 64, Base, 19.0mm	14,739 TON	\$48.10	\$51.00	\$35.40 - \$51.00	\$39.30	HMA
QC/QA-HMA, 5, 76, Intermediate, OG	12,788 TON	\$54.00	\$51.00	\$44.05 - \$51.00	\$45.78	HMA

The above table shows that pavement item bids are all lower than or equal to the estimates used in evaluation, but on HMA the majority of the items are higher than the estimates. This indicates that a true cost saving was realized by INDOT in this process.

The table below compares some common HMA items found in both PCCP and HMA options to check for unbalanced bids. These bids appear to be consistent and no anomalies were found.

Cost Comparison of Some Common Items Used in Both PCCP and HMA					
Bid Item	Bid Quantities	Low Bid Cost of Item Per Unit	Range of Bid Costs of Item Per Unit	Average Bid Cost of Item Per Unit	HMA or PCCP Bid
HMA Surface, Type B	428 TON	\$47.00	\$47.00 - \$60.00	\$53.67	PCCP
HMA Surface, Type B	428 TON	\$47.00	\$47.00 - \$55.00	\$53.00	HMA
HMA Intermediate, Type B	925 TON	\$47.00	\$47.00 - \$60.00	\$53.67	PCCP
HMA Intermediate, Type B	925 TON	\$47.00	\$47.00 - \$60.00	\$53.00	HMA

Conclusion

INDOT did not realize a saving immediately, at the bid opening, (HMA Low Bid – PCCP Low Bid = -\$439,966.77). However after using the Bid Analysis amounts (after PW costs applied), INDOT saved the tax payers approximately \$115,826.63 over the 50 year service life of the pavement. These savings include the reduction of INDOT's in-house cost of approximately \$8,000.00 for approximately 80 hours of additional time spend by designer to developed two typical section sheets, design work, quantity calculation, and two cost estimates. The time spend by INDOT Contract Section were determined negligible.

The PW cost for future maintenance **did** impact the bids and which contractor received the contract. INDOT believes using this process of alternate bids for pavement type selection on this project was very successful.

PW of Future Maintenance of the Pavement

IR-30162 (US 24)

PW of HMA Option = \$1,475,368.14

PW of PCCP Option = \$919,579.74

HMA PW for Future Rehabilitation Work			
Age in Years	Rehab.	Cost \$	Present Worth Cost \$
3	Joint Seal	77,968.00	\$69,313.27
6	Joint Seal	77,968.00	\$61,619.24
9	Joint Seal	77,968.00	\$54,779.28
12	Joint Seal	77,968.00	\$48,698.58
15	Joint Seal	77,968.00	\$43,292.86
18	Joint Seal	77,968.00	\$38,487.20
20	Mill and Functional Overlay	1,715,050.00	\$782,726.43
23	Joint Seal	77,968.00	\$31,633.67
26	Joint Seal	77,968.00	\$28,122.22
29	Joint Seal	77,968.00	\$25,000.55
32	Joint Seal	77,968.00	\$22,225.40
35	Mill and Resurface	828,940.00	\$210,066.22
38	Joint Seal	77,968.00	\$17,565.05
41	Joint Seal	77,968.00	\$15,615.27
44	Joint Seal	77,968.00	\$13,881.92
47	Joint Seal	77,968.00	\$12,340.97
Total HMA PW Cost			\$1,475,368.14

PCCP PW for Future Rehabilitation Work			
Age in Years	Rehab.	Cost \$	Present Worth Cost \$
8	Reseal the Joint	83,937.00	\$61,331.94
16	Reseal the Joint	83,937.00	\$44,814.65
24	Reseal the Joint	83,937.00	\$32,745.63
30	Mill and Functional Overlay	1,734,427.00	\$534,756.22
33	Joint Seal	77,968.00	\$21,370.57
36	Joint Seal	77,968.00	\$18,998.36
39	Joint Seal	77,968.00	\$16,889.48
42	Mill and Resurface	848,805.00	\$163,458.56
45	Joint Seal	77,968.00	\$13,348.00
48	Joint Seal	77,968.00	\$11,866.32
Total PCCP PW Cost			\$919,579.74

$$PW = F [1/(1+i)^n]$$

Where: F = Future Construction Cost
i = Discount rate (4%)
n = Number of years from year zero

Total Cost				
Total Cost	Alternative 1: 10.5 inches PCCP		Alternative 2: 13.5 inches HMA	
	Agency Cost (\$1000)	User Cost (\$1000)	Agency Cost (\$1000)	User Cost (\$1000)
Undiscounted Sum	\$3,224.88	\$0.00	\$3,635.54	\$0.00
Present Value	\$919.58	\$0.00	\$1,475.37	\$0.00
EUAC	\$42.81	\$0.00	\$68.68	\$0.00
Lowest Present Value Agency Cost		Alternative 1: 10.5 inches PCCP		
Lowest Present Value User Cost		Alternative 1: 10.5 inches PCCP		
Expenditure Stream				
Year	Alternative 1: 10.5 inches PCCP		Alternative 2: 13.5 inches HMA	
	Agency Cost (\$1000)	User Cost (\$1000)	Agency Cost (\$1000)	User Cost (\$1000)
0				
1				
2				
3			\$77.97	
4				
5				
6			\$77.97	
7				
8	\$83.94			
9			\$77.97	
10				
11				
12			\$77.97	
13				
14				
15			\$77.97	
16	\$83.94			
17				
18			\$77.97	
19				
20			\$1,715.05	
21				
22				
23			\$77.97	
24	\$83.94			
25				
26			\$77.97	
27				
28				
29			\$77.97	
30	\$1,734.43			
31				
32			\$77.97	
33	\$77.97			
34				
35			\$828.94	
36	\$77.97			
37				
38			\$77.97	
39	\$77.97			
40				
41			\$77.97	
42	\$848.80			
43				
44			\$77.97	
45	\$77.97			
46				
47			\$77.97	
48	\$77.97			
49				
50				

Appendix G PR 69 (IR-33040)

Five (5) contractors participated in the bidding (5 PCCP options and 1 HMA option were bid) and all bids were substantially below the engineer's estimate. One (1) Contractor participated in both pavement type pay options. All contractors had the option to bid either HMA pay items section or PCCP pay items section or both. There was a third section in this bid was that comprised all the common items for the contract. The low bidder was determined from:

1. Bid of HMA pay items section + PW cost of HMA, + Bid of common items section or
2. Bid of PCCP pay items section + PW cost of PCCP, + Bid of common items section.

INDOT provided the following pavement design thickness for this project:

1. PR 69 mainline
 - a. 11 inches of PCCP or
 - b. 13.5 inches of HMA

2. SR 61 Ramps
 - a. 9.5 inches of PCCP or
 - b. 10 inches of HMA.

Bid Analysis Summary

PCCP Pay item Options

<u>Bidders</u>	<u>PCCP Section</u>	<u>PW Cost for PCCP</u>	<u>Common Section</u>	<u>Bid Analysis</u>
A	\$17,293,621.24	+ \$2,165,255.83	+ \$53,328,966.64	= \$72,787,843.71
B	\$16,950,357.18	+ \$2,165,255.83	+ \$55,723,131.57	= \$74,838,744.58
C	\$17,127,655.76	+ \$2,165,255.83	+ \$59,170,951.94	= \$78,463,863.53
D	\$16,962,560.17	+ \$2,165,255.83	+ \$61,630,589.86	= \$80,758,405.86
E	\$19,023,097.63	+ \$2,165,255.83	+ \$63,521,205.13	= \$84,709,558.59

HMA Pay item Options

<u>Bidder</u>	<u>HMA Section</u>	<u>PW Cost for HMA</u>	<u>Common Section</u>	<u>Bid Analysis</u>
C	\$17,097,621.52	+ \$3,434,001.06	+ \$59,170,951.94	= \$79,702,574.52

The low bid amount, out of all 5 bids, was for PCCP pay items option (Bidder A) and after adding PW cost of HMA and PCCP to the respective pavement type options, PCCP option was also the low bid (Bidder A). PCCP pay items option was awarded for this contract.

INDOT compared the estimated cost with actual low bid costs of both pavement types. The following table shows the cost comparison with low bid of those pavement items that were relative to the mainline pavements and relative to this alternate bid for pavement type.

All other items in the bids were common to both types of pavement. Shoulders and “S” Lines are to be HMA.

Cost Comparison of Unique Items						
Bid Item	Bid Quantities	Estimated Cost of Item Per Unit	Low Bid Cost of Item Per Unit	Range of Bid Costs of Item Per Unit	Average Bid Cost of Item Per Unit	HMA or PCCP Option
QC/QA PCCP, 11 IN.	162,570 yd ²	\$29.88	\$26.75	\$24.50 - \$32.00*	\$27.11	PCCP
QC/QA PCCP, 9.5 IN.	25,013 yd ²	\$27.87	\$27.50	\$23.60 - \$30.00*	\$26.54	PCCP
Subbase for PCCP	51,336 yd ³	\$30.64	\$36.00	\$36.00 - \$45.00*	\$40.31	PCCP
D-1 Contraction Joint	100,268 ft	\$8.71	\$8.00	\$8.00 - \$10.00*	\$8.87	PCCP
QC/QA-HMA, 4, 76, Surface	22,927 TON	\$77.10	\$77.00	\$77.00	\$77.00	HMA
QC/QA-HMA, 2, 64, Surface	2,072 TON	\$49.99	\$63.00	\$63.00	\$63.00	HMA
QC/QA-HMA, 4, 76, Intermediate	38,417 TON	\$55.70	\$56.00	\$56.00	\$56.00	HMA
QC/QA-HMA, 2, 64, Intermediate	3,475 TON	\$49.65	\$52.00	\$52.00	\$52.00	HMA
QC/QA-HMA, 4, 64, Base	108,045 TON	\$47.80	\$51.45	\$51.45	\$51.45	HMA
QC/QA-HMA, 2, 64, Base	4,873 TON	\$49.57	\$50.00	\$50.00	\$50.00	HMA
QC/QA-HMA, 5, 76, Intermediate, OG	38,107 TON	\$53.80	\$52.00	\$52.00	\$52.00	HMA

* Bidder E was higher on all PCCP items.

The above table shows that pavement item bids on PCCP are lower than the estimates used in evaluation but on HMA a few items are higher than the estimates. This indicates that a true cost savings was realized by INDOT in this process.

The table below compares some of the HMA items on the common section for the contract to check for unbalanced bids. All five bidders bid the same price for these items so these bids appear to be consistent and no anomalies were found.

Cost Comparison of Some Common Items Used in Both PCCP and HMA					
Bid Item	Bid Quantities	Low Bid Cost of Item Per Unit	Range of Bid Costs of Item Per Unit	Average Bid Cost of Item Per Unit	HMA or PCCP Bid
HMA Surface, Type A	1278 TON	\$74.00	\$74.00 - \$74.00	\$74.00	Both
HMA Surface, Type B	1,424 TON	\$74.00	\$74.00 - \$74.00	\$74.00	Both
HMA Intermediate, Type A	2,010 TON	\$68.00	\$68.00 - \$68.00	\$68.00	Both
HMA Intermediate, Type B	2,250 TON	\$68.00	\$68.00 - \$68.00	\$68.00	Both

Conclusion

INDOT saved the tax payers approximately \$5,629,185.58 immediately, at the bid opening, (HMA Low Bid – PCCP Low Bid). Using the Bid Analysis amounts (after PW costs applied); INDOT saved the tax payers approximately \$6,897,930.81 over the 50 year service life of the pavement. These savings include the reduction of INDOT's consultant cost of \$16,800.00 for producing two sets of typical plan sheets and quantities. The in-house costs for INDOT were determined negligible.

The PW cost for future maintenance did not impact the bid and which contractor received the contract. INDOT believes using this process of alternate bids for pavement type selection on this project was very successful.

PW of Future Maintenance of the Pavement

I-69 (IR-33040)

PW of HMA Section = \$3,434,001.06

PW of PCCP Section = \$2,165,255.83

HMA PW for Future Rehabilitation Work
--

Age in Years	Rehab.	Cost \$	Present Worth Cost \$
3	Joint Seal	181,975.00	\$161,775.11
6	Joint Seal	181,975.00	\$143,817.49
9	Joint Seal	181,975.00	\$127,853.22
12	Joint Seal	181,975.00	\$113,661.05
15	Joint Seal	181,975.00	\$101,044.26
18	Joint Seal	181,975.00	\$89,827.98
20	Mill and Functional Overlay	4,002,878.00	\$1,826,861.27
23	Joint Seal	181,975.00	\$73,832.05
26	Joint Seal	181,975.00	\$65,636.42
29	Joint Seal	181,975.00	\$58,350.54
32	Joint Seal	181,975.00	\$51,873.42
35	Mill and Resurface	1,897,370.00	\$480,822.91
38	Joint Seal	181,975.00	\$40,996.32
41	Joint Seal	181,975.00	\$36,445.58
44	Joint Seal	181,975.00	\$32,399.98
47	Joint Seal	181,975.00	\$28,803.47
Total HMA PW Cost			\$3,434,001.06

PCCP PW for Future Rehabilitation Work			
Age in Years	Rehab.	Cost \$	Present Worth Cost \$
8	Reseal the Joint	210,562.00	\$153,855.59
16	Reseal the Joint	210,562.00	\$112,420.77
24	Reseal the Joint	210,562.00	\$82,144.76
30	Mill and Functional Overlay	4,052,150.00	\$1,249,353.49
33	Joint Seal	181,975.00	\$49,878.29
36	Joint Seal	181,975.00	\$44,341.62
39	Joint Seal	181,975.00	\$39,419.53
42	Mill and Resurface	1,947,254.00	\$374,992.30
45	Joint Seal	181,975.00	\$31,153.83
48	Joint Seal	181,975.00	\$27,695.64
Total PCCP PW Cost			\$2,165,255.83

$$PW = F [1/(1+i)^n]$$

Where: F = Future Construction Cost

i = Discount rate (4%)

n = Number of years from year zero

Total Cost

Total Cost	Alternative 1: 11 inches PCCP		Alternative 2: 13.5 inches HMA	
	Agency Cost (\$1000)	User Cost (\$1000)	Agency Cost (\$1000)	User Cost (\$1000)
<i>Undiscounted Sum</i>	\$7,540.97	\$0.00	\$8,447.90	\$0.00
Present Value	\$2,165.26	\$0.00	\$3,434.00	\$0.00
EUAC	\$100.79	\$0.00	\$159.85	\$0.00
Lowest Present Value Agency Cost	Alternative 1: 11 inches PCCP			
Lowest Present Value User Cost	Alternative 1: 11 inches PCCP			

Expenditure Stream				
Year	Alternative 1: 11 inches PCCP		Alternative 2: 13.5 inches HMA	
	Agency Cost (\$1000)	User Cost (\$1000)	Agency Cost (\$1000)	User Cost (\$1000)
0				
1				
2				
3			\$181.98	
4				
5				
6			\$181.98	
7				
8	\$210.56			
9			\$181.98	
10				
11				
12			\$181.98	
13				
14				
15			\$181.98	
16	\$210.56			
17				
18			\$181.98	
19				
20			\$4,002.88	
21				
22				
23			\$181.98	
24	\$210.56			
25				
26			\$181.98	
27				
28				
29			\$181.98	
30	\$4,052.15			
31				
32			\$181.98	
33	\$181.98			
34				
35			\$1,897.37	
36	\$181.98			
37				
38			\$181.98	
39	\$181.98			
40				
41			\$181.98	
42	\$1,947.25			
43				
44			\$181.98	
45	\$181.98			
46				
47			\$181.98	
48	\$181.98			
49				
50				

Appendix H

PR 69 (IR-31121)

Six (6) contractors participated in the bidding (6 PCCP options and 4 HMA option were bid) and all bids were substantially below the engineer's estimate. One (1) Contractor participated in both pavement type pay options. All contractors had the option to bid either HMA pay items section or PCCP pay items section or both. There was a third section in this bid was that comprised all the common items for the contract. The low bidder was determined from:

1. Bid of HMA pay items section + PW cost of HMA, + Bid of common items section or
2. Bid of PCCP pay items section + PW cost of PCCP, + Bid of common items section.

INDOT provided the following pavement design thickness for this project:

1. PR 69 mainline
 - a. 11 inches of PCCP or
 - b. 13.5 inches of HMA
2. SR 168 Ramps
 - a. 9 inches of PCCP or
 - b. 10 inches of HMA.

Bid Analysis Summary

PCCP Pay item Options

<u>Bidders</u>	<u>PCCP Section</u>	<u>PW Cost for PCCP</u>	<u>Common Section</u>	<u>Bid Analysis</u>
A	\$10,827,777.86	+ \$1,480,742.91	+ \$11,462,530.17	= \$23,771,050.94
B	\$10,893,212.51	+ \$1,480,742.91	+ \$11,852,906.82	= \$24,226,862.24
C	\$10,811,918.05	+ \$1,480,742.91	+ \$12,866,562.56	= \$25,159,223.52
D	\$10,385,506.50	+ \$1,480,742.91	+ \$13,377,752.26	= \$25,244,001.67
E	\$10,730,801.60	+ \$1,480,742.91	+ \$13,409,247.85	= \$25,620,792.36
F	\$10,021,549.70	+ \$1,480,742.91	+ \$14,500,954.02	= \$26,003,246.63

HMA Pay item Options

<u>Bidder</u>	<u>HMA Section</u>	<u>PW Cost for HMA</u>	<u>Common Section</u>	<u>Bid Analysis</u>
A	\$10,692,433.15	+ \$2,353,504.28	+ \$11,462,530.17	= \$24,508,467.60
B	\$10,992,127.95	+ \$2,353,504.28	+ \$11,852,906.82	= \$25,198,539.05
C	\$10,777,604.90	+ \$2,353,504.28	+ \$12,866,562.56	= \$25,997,671.74
E	\$11,039,122.07	+ \$2,353,504.28	+ \$13,409,247.85	= \$26,801,874.20

The low bid amount, out of all 6 bids, was for HMA pay items option (Bidder A) and after adding PW cost of HMA and PCCP to the respective pavement type options, PCCP option was the low bid (Bidder A). PCCP pay items option was awarded for this contract. The PW cost factor affected the outcome of the bidding.

INDOT compared the estimated cost with actual low bid costs of both pavement types. The following table shows the cost comparison with low bid of those pavement items that were relative to the mainline pavements and relative to this alternate bid for pavement type.

All other items in the bids were common to both types of pavement. Shoulders and “S” Lines are to be HMA.

Cost Comparison of Unique Items						
Bid Item	Bid Quantities	Estimated Cost of Item Per Unit	Low Bid Cost of Item Per Unit	Range of Bid Costs of Item Per Unit	Average Bid Cost of Item Per Unit	HMA or PCCP Option
QC/QA PCCP, 11 IN.	111,292 yd ²	\$29.88	\$27.26	\$25.00 - \$28.00	\$26.37	PCCP
QC/QA PCCP, 9 IN.	17,778 yd ²	\$27.31	\$22.48	\$22.00 - \$29.00	\$23.92	PCCP
Subbase for PCCP	36,993 yd ³	\$30.64	\$37.15	\$26.00 - \$41.00	\$36.09	PCCP
D-1 Contraction Joint	68,270 ft	\$8.71	\$9.50	\$8.57 - \$9.75	\$9.28	PCCP
QC/QA-HMA, 4, 76, Surface	10,581 TON	\$77.10	\$75.50	\$75.50 - \$75.50	\$75.50	HMA
QC/QA-HMA, 2, 64, Surface	2,184 TON	\$49.99	\$64.00	\$64.00 - \$64.00	\$64.00*	HMA
QC/QA-HMA, 4, 76, Intermediate	17,625 TON	\$55.70	\$56.00	\$56.00 - \$56.00	\$56.00*	HMA
QC/QA-HMA, 2, 64, Intermediate	4,212 TON	\$49.65	\$53.00	\$53.00 - \$53.00	\$53.00*	HMA
QC/QA-HMA, 4, 64, Base	49,481 TON	\$47.80	\$50.55	\$50.55 - \$50.55	\$50.55*	HMA
QC/QA-HMA, 2, 64, Base	3,422 TON	\$49.57	\$51.50	\$51.50 - \$51.50	\$51.50*	HMA
QC/QA-HMA, 5, 76, Intermediate, OG	19,348 TON	\$53.80	\$48.25	\$48.25 - \$48.25	\$48.25	HMA

* All Bidders were higher on HMA items.

The above table shows that pavement item bids on PCCP are lower than the estimates used in evaluation but on HMA all items are higher than the estimates except few. This indicates that a true cost savings was realized by INDOT in this process.

The table below compares some of the HMA items on the common section for the contract to check for unbalanced bids. These bids appear to be consistent and no anomalies were found.

Cost Comparison of Some Common Items Used in Both PCCP and HMA					
Bid Item	Bid Quantities	Low Bid Cost of Item Per Unit	Range of Bid Costs of Item Per Unit	Average Bid Cost of Item Per Unit	HMA or PCCP Bid
QC/QA-HMA, 2, 64, Surface	718 TON	62.10	\$61.85 - \$74.00	\$63.94	PCCP
QC/QA-HMA, 2, 64, Surface	718 TON	\$64.00	\$64.00 - \$64.00	\$64.00	HMA
QC/QA-HMA, 2, 64, Intermediate	1,679 TON	\$51.25	\$51.00 - \$57.00	\$52.04	PCCP
QC/QA-HMA, 2, 64, Intermediate	1,679 TON	\$53.00	\$53.00 - \$53.00	\$53.00	HMA
QC/QA-HMA, 2, 64, Base	2,423 TON	\$49.75	\$49.50 - \$55.00	\$50.87	PCCP
QC/QA-HMA, 2, 64, Base	2,423 TON	\$50.10	\$50.10 - \$50.10	\$50.10	HMA

Conclusion

INDOT did not realize a saving immediately, at the bid opening, (HMA Low Bid – PCCP Low Bid = -\$165,344.71). However after using the Bid Analysis amounts (after PW costs applied), INDOT saved the tax payers approximately \$707,416.66 over the 50 year service life of the pavement. These savings include the reduction of INDOT’s consultant cost of \$30,000.00 for producing two sets of typical plan sheets and quantities. The in-house costs for INDOT were determined negligible.

The PW cost for future maintenance **did** impact the bid and which contractor received the contract. INDOT believes using this process of alternate bids for pavement type selection on this project was very successful.

PW of Future Maintenance of the Pavement

I-69 (IR-31121)

PW of HMA Section = \$2,353,504.28

PW of PCCP Section = \$1,480,742.91

HMA PW for Future Rehabilitation Work			
Age in Years	Rehab.	Cost \$	Present Worth Cost \$
3	Joint Seal	123,618.00	\$109,895.95
6	Joint Seal	123,618.00	\$97,697.10
9	Joint Seal	123,618.00	\$86,852.37
12	Joint Seal	123,618.00	\$77,211.44
15	Joint Seal	123,618.00	\$68,640.69
18	Joint Seal	123,618.00	\$61,021.32
20	Mill and Functional Overlay	2,755,501.00	\$1,257,574.69
23	Joint Seal	123,618.00	\$50,155.08
26	Joint Seal	123,618.00	\$44,587.68
29	Joint Seal	123,618.00	\$39,638.29
32	Joint Seal	123,618.00	\$35,238.29
35	Mill and Resurface	1,305,397.00	\$330,807.80
38	Joint Seal	123,618.00	\$27,849.33
41	Joint Seal	123,618.00	\$24,757.96
44	Joint Seal	123,618.00	\$22,009.73
47	Joint Seal	123,618.00	\$19,566.57
Total HMA PW Cost			\$2,353,504.28

PCCP PW for Future Rehabilitation Work			
Age in Years	Rehab.	Cost \$	Present Worth Cost \$
8	Reseal the Joint	143,367.00	\$104,756.86
16	Reseal the Joint	143,367.00	\$76,544.81
24	Reseal the Joint	143,367.00	\$55,930.55
30	Mill and Functional Overlay	2,775,977.00	\$855,885.53
33	Joint Seal	123,618.00	\$33,882.97
36	Joint Seal	123,618.00	\$30,121.84
39	Joint Seal	123,618.00	\$26,778.21
42	Mill and Resurface	1,333,844.00	\$256,864.92
45	Joint Seal	123,618.00	\$21,163.21
48	Joint Seal	123,618.00	\$18,814.01
Total PCCP PW Cost			\$1,480,742.91

$$PW = F [1/(1+i)^n]$$

Where: F = Future Construction Cost

i = Discount rate (4%)

n = Number of years from year zero

Total Cost				
Total Cost	Alternative 1: 11 inches PCCP		Alternative 2: 13.5 inches HMA	
	Agency Cost (\$1000)	User Cost (\$1000)	Agency Cost (\$1000)	User Cost (\$1000)
<i>Undiscounted Sum</i>	\$5,158.01	\$0.00	\$5,791.55	\$0.00
Present Value	\$1,480.74	\$0.00	\$2,353.50	\$0.00
EUAC	\$68.93	\$0.00	\$109.56	\$0.00
Lowest Present Value Agency Cost		Alternative 1: 11 inches PCCP		
Lowest Present Value User Cost		Alternative 1: 11 inches PCCP		

Expenditure Stream				
Year	Alternative 1: 11 inches PCCP		Alternative 2: 13.5 inches HMA	
	Agency Cost (\$1000)	User Cost (\$1000)	Agency Cost (\$1000)	User Cost (\$1000)
0				
1				
2				
3			\$123.62	
4				
5				
6			\$123.62	
7				
8	\$143.37			
9			\$123.62	
10				
11				
12			\$123.62	
13				
14				
15			\$123.62	
16	\$143.37			
17				
18			\$123.62	
19				
20			\$2,755.50	
21				
22				
23			\$123.62	
24	\$143.37			
25				
26			\$123.62	
27				
28				
29			\$123.62	
30	\$2,775.98			
31				
32			\$123.62	
33	\$123.62			
34				
35			\$1,305.40	
36	\$123.62			
37				
38			\$123.62	
39	\$123.62			
40				
41			\$123.62	
42	\$1,333.84			
43				
44			\$123.62	
45	\$123.62			
46				
47			\$123.62	
48	\$123.62			
49				
50				

Appendix I

PR 69 (IR-33047)

This project was bid as a design build contract. INDOT let this project on mainline as an optional pavement section (HMA or PCCP) or the Contractor's alternate pavement section. INDOT received seven (7) bids (7 PCCP options, 5 HMA options, and 1 Contractor's alternate section). Five (5) Contractors participated in both HMA and PCCP pavement type options and one (1) Contractor participated in all three: HMA, PCCP, and the alternate pavement section.

INDOT provided the following pavement design thickness for mainline of this project:

1. 11 inches of PCCP or
2. 13 inches of HMA

The Contractor's alternate pavement section was 10 inches of HMA with a modified subgrade treatment (32 inches Lime Modification).

Bid Analysis Summary

PCCP Option

<u>Bidders</u>	<u>Initial Bid</u>		<u>PW Cost for PCCP</u>		<u>Bid Analysis</u>
A	\$40,595,100.00	+	\$2,098,552.00	=	\$42,693,652.00
B	\$44,165,292.00	+	\$2,098,552.00	=	\$46,263,844.00
C	\$46,484,140.00	+	\$2,098,552.00	=	\$48,582,692.00
D	\$48,726,600.00	+	\$2,098,552.00	=	\$50,825,152.00
E	\$49,395,116.00	+	\$2,098,552.00	=	\$51,493,668.00
F	\$58,998,545.04	+	\$2,098,552.00	=	\$61,097,097.04
G	\$66,463,060.00	+	\$2,098,552.00	=	\$68,561,612.00

HMA Option

<u>Bidders</u>	<u>Initial Bid</u>		<u>PW Cost for HMA</u>		<u>Bid Analysis</u>
A	\$39,945,100.00	+	\$3,449,374.00	=	\$43,394,474.00
E	\$49,014,706.00	+	\$3,449,374.00	=	\$52,464,080.00
D	\$49,111,100.00	+	\$3,449,374.00	=	\$52,560,474.00
F	\$60,328,545.04	+	\$3,449,374.00	=	\$63,777,919.04
G	\$64,727,205.00	+	\$3,449,374.00	=	\$68,176,579.00

Contractor's Alternate HMA Pavement

<u>Bidders</u>	<u>Initial Bid</u>		<u>PW Cost for Alt. HMA</u>		<u>Bid Analysis</u>
F	\$60,206,545.04	+	\$4,628,327.00	=	\$64,834,872.04

The low bid amount, out of all 7 bids, was for HMA option (Bidder A) and after adding PW cost of HMA, PCCP, and Contractor's Alternate HMA to the respective pavement type

options, PCCP option was the low bid (Bidder A). PCCP option of Bidder A was awarded for this contract. The PW cost factor affected the outcome of the bidding.

INDOT is unable to compare the estimated cost of pavement pay items with actual low bid costs of all three pavement types since this contract was not let as an itemized proposal. All other pavement types such as S-lines in the bids were common to all pavement options.

Conclusion

INDOT did not realize a saving immediately, at the bid opening, (HMA Low Bid – PCCP Low Bid = -\$681,450.00). However after using the Bid Analysis amounts (after PW costs applied), INDOT saved the tax payers approximately \$768,372.00 over the 50 year service life of the pavement. These savings include the reduction of INDOT's consultant cost of \$31,450.00 for producing two sets of typical plan sheets and quantities. The in-house costs for INDOT were determined negligible.

The PW cost for future maintenance **did** impact the bids and which contractor received the contract. INDOT believes using this process of alternate bids for pavement type selection on this project was very successful.

PW of Future Maintenance of the Pavement

I-69 (IR-33047)

1) Optional Pavement Section (INDOT)

PW of HMA Section = \$3,449,374.00

PW of PCCP Section = \$2,098,552.00

2) Alternate HMA Pavement Section (Contractor)

PW of Alternate Pavement Type (HMA) = \$4,628,327.00

HMA PW for Future Rehabilitation Work (INDOT)			
Age in Years	Rehab.	Cost \$	Present Worth Cost \$
3	Joint Seal	191,375.00	\$170,131.68
6	Joint Seal	191,375.00	\$151,246.44
9	Joint Seal	191,375.00	\$134,457.54
12	Joint Seal	191,375.00	\$119,532.26
15	Joint Seal	191,375.00	\$106,263.74
18	Joint Seal	191,375.00	\$94,468.08
20	Mill and Functional Overlay	3,927,083.00	\$1,792,269.42
23	Joint Seal	191,375.00	\$77,645.88
26	Joint Seal	191,375.00	\$69,026.90
29	Joint Seal	191,375.00	\$61,364.66
32	Joint Seal	191,375.00	\$54,552.96
35	Mill and Resurface	1,864,953.00	\$472,607.94
38	Joint Seal	191,375.00	\$43,114.00
41	Joint Seal	191,375.00	\$38,328.19
44	Joint Seal	191,375.00	\$34,073.62
47	Joint Seal	191,375.00	\$30,291.32
Total HMA PW Cost			\$3,449,374.64

PCCP PW for Future Rehabilitation Work (INDOT)			
Age in Years	Rehab.	Cost \$	Present Worth Cost \$
8	Reseal the Joint	184,287.00	\$134,656.71
16	Reseal the Joint	184,287.00	\$98,392.34
24	Reseal the Joint	184,287.00	\$71,894.32
30	Mill and Functional Overlay	3,968,741.00	\$1,223,636.94
33	Joint Seal	191,375.00	\$52,454.77
36	Joint Seal	191,375.00	\$46,632.10
39	Joint Seal	191,375.00	\$41,455.77
42	Mill and Resurface	1,908,559.00	\$367,540.62
45	Joint Seal	191,375.00	\$32,763.10
48	Joint Seal	191,375.00	\$29,126.27
Total PCCP PW Cost			\$2,098,552.92

$$PW = F [1/(1+i)^n]$$

Where: F = Future Construction Cost

i = Discount rate (4%)

n = Number of years from year zero

HMA PW for Future Rehabilitation Work (Contractor)			
Age in Years	Rehab.	Cost \$	Present Worth Cost \$
3	Joint Seal	191,375.00	\$170,131.68
6	Joint Seal	191,375.00	\$151,246.44
9	Joint Seal	191,375.00	\$134,457.54
10	Profile Mill and Functional Overlay	3,659,857.00	\$2,472,468.25
13	Joint Seal	191,375.00	\$114,934.87
16	Joint Seal	191,375.00	\$102,176.68
19	Joint Seal	191,375.00	\$90,834.69
22	Joint Seal	191,375.00	\$80,751.71
25	Mill and Resurface	1,864,953.00	\$699,575.21
28	Joint Seal	191,375.00	\$63,819.25
31	Joint Seal	191,375.00	\$56,735.08
34	Joint Seal	191,375.00	\$50,437.28
37	Joint Seal	191,375.00	\$44,838.56
40	Mill and Resurface	1,864,953.00	\$388,449.28
43	Joint Seal	191,375.00	\$35,436.56
46	Joint Seal	191,375.00	\$31,502.98
49	Joint Seal	191,375.00	\$28,006.03
50	Salvage Value	-621,651.00	-\$87,474.14
Total HMA PW Cost			\$4,628,327.95

$$PW = F [1/(1+i)^n]$$

Where: F = Future Construction Cost
i = Discount rate (4%)
n = Number of years from year zero

Total Cost (INDOT)				
Total Cost	Alternative 1: 11 inches PCCP		Alternative 2: 13 inches HMA	
	Agency Cost (\$1000)	User Cost (\$1000)	Agency Cost (\$1000)	User Cost (\$1000)
<i>Undiscounted Sum</i>	\$7,387.04	\$0.00	\$8,471.29	\$0.00
Present Value	\$2,098.55	\$0.00	\$3,449.37	\$0.00
EUAC	\$97.69	\$0.00	\$160.57	\$0.00
Lowest Present Value Agency Cost		Alternative 1: 11 inches PCCP		
Lowest Present Value User Cost		Alternative 1: 11 inches PCCP		

Expenditure Stream				
Year	Alternative 1: 11 inches PCCP		Alternative 2: 13 inches HMA	
	Agency Cost (\$1000)	User Cost (\$1000)	Agency Cost (\$1000)	User Cost (\$1000)
0				
1				
2				
3			\$191.38	
4				
5				
6			\$191.38	
7				
8	\$184.29			
9			\$191.38	
10				
11				
12			\$191.38	
13				
14				
15			\$191.38	
16	\$184.29			
17				
18			\$191.38	
19				
20			\$3,927.08	
21				
22				
23			\$191.38	
24	\$184.29			
25				
26			\$191.38	
27				
28				
29			\$191.38	
30	\$3,968.74			
31				
32			\$191.38	
33	\$191.38			
34				
35			\$1,864.95	
36	\$191.38			
37				
38			\$191.38	
39	\$191.38			
40				
41			\$191.38	
42	\$1,908.56			
43				
44			\$191.38	
45	\$191.38			
46				
47			\$191.38	
48	\$191.38			
49				
50				

Total Cost (Contractor's HMA Section)				
Total Cost	Alternative 1:		Alternative 2: 10 inches HMA	
	Agency Cost (\$1000)	User Cost (\$1000)	Agency Cost (\$1000)	User Cost (\$1000)
<i>Undiscounted Sum</i>	\$0.00	\$0.00	\$9,447.36	\$0.00
Present Value	\$0.00	\$0.00	\$4,628.33	\$0.00
EUAC	\$0.00	\$0.00	\$215.45	\$0.00
Lowest Present Value Agency Cost	Alternative 1:			
Lowest Present Value User Cost	Alternative 1:			
Expenditure Stream				
Year	Alternative 1:		Alternative 2: 10 inches HMA	
	Agency Cost (\$1000)	User Cost (\$1000)	Agency Cost (\$1000)	User Cost (\$1000)
0				
1				
2				
3			\$191.38	
4				
5				
6			\$191.38	
7				
8				
9			\$191.38	
10			\$3,659.86	
11				
12				
13			\$191.38	
14				
15				
16			\$191.38	
17				
18				
19			\$191.38	
20				
21				
22			\$191.38	
23				
24				
25			\$1,864.95	
26				
27				
28			\$191.38	
29				
30				
31			\$191.38	
32				
33				
34			\$191.38	
35				
36				
37			\$191.38	
38				
39				
40			\$1,864.95	
41				
42				
43			\$191.38	
44				
45				
46			\$191.38	
47				
48				
49			\$191.38	
50			(\$621.65)	

Appendix J

PR 69 (IR-33049)

This project was bid as a design build contract. INDOT let this project on mainline as an optional pavement section (HMA or PCCP) or the Contractor's alternate pavement section. INDOT received five (5) bids (5 PCCP options, 3 HMA options, and 2 Contractor's alternate pavement section) and all bids were substantially below the engineer's estimate. One (1) Contractor participated in both HMA and PCCP pavement type options and two (2) Contractors participated in all three: HMA, PCCP, and the alternate pavement section.

INDOT provided the following pavement design thickness for this project:

1. PR 69 mainline
 - a. 11 inches of PCCP or
 - b. 13 inches of HMA
2. SR 58 ramps
 - a. 9 inches of PCCP or
 - b. 10 inches of HMA

The Contractor's alternate pavement sections for mainline of this project were as follow:

1. 13 inches of HMA with a modified subgrade treatment.
2. 11 inches of PCCP mainline and inside shoulder.

Bid Analysis Summary

PCCP Option

<u>Bidders</u>	<u>Initial Bid</u>	<u>PW Cost for PCCP</u>	<u>Bid Analysis</u>
A	\$58,527,869.00	+ \$1,724,911.00	= \$60,252,780.00
B	\$59,806,080.00	+ \$1,724,911.00	= \$61,530,991.00
C	\$61,311,094.52	+ \$1,724,911.00	= \$63,036,005.52
D	\$62,230,560.00	+ \$1,724,911.00	= \$63,955,471.00
E	\$65,171,050.00	+ \$1,724,911.00	= \$66,895,961.00

HMA Option

<u>Bidders</u>	<u>Initial Bid</u>	<u>PW Cost for HMA</u>	<u>Bid Analysis</u>
C	\$61,494,275.52	+ \$2,793,699.00	= \$64,287,974.52
D	\$61,830,560.00	+ \$2,793,699.00	= \$64,624,259.00
E	\$65,798,918.00	+ \$2,793,699.00	= \$68,592,617.00

Contractor's Alternate HMA Pavement

<u>Bidders</u>	<u>Initial Bid</u>	<u>PW Cost for Alt. HMA</u>	<u>Bid Analysis</u>
E	\$64,847,287.00	+ \$2,793,699.00	= \$67,640,986.00

Contractor's Alternate PCCP Pavement

<u>Bidders</u>	<u>Initial Bid</u>	<u>PW Cost for Alt. PCCP</u>	<u>Bid Analysis</u>
C	\$61,072,476.52	+ \$1,753,859.00	= \$62,826,335.52

The low bid amount, out of all 5 bids, was for PCCP option (Bidder A) and after adding PW cost of HMA, PCCP, and Contractor's Alternate HMA and PCCP section to the respective pavement type, PCCP option was the low bid (Bidder A). PCCP option of Bidder A was awarded for this contract. The PW cost factor did not affected the outcome of the bidding.

INDOT is unable to compared the estimated cost of pavement pay items with actual low bid costs of all three pavement types since this contract was not let as an itemized proposal. All other pavement types such as S-lines in the bids were common to all pavement options.

Conclusion

INDOT saved the tax payers approximately \$2,945,856.52 immediately, at the bid opening, (HMA Low Bid – PCCP Low Bid). Using the Bid Analysis amounts (after PW costs applied); INDOT saved the tax payers approximately \$4,014,644.52 over the 50 year service life of the pavement. These savings include the reduction of INDOT's consultant cost of \$20,550.00 for producing two sets of typical plan sheets and quantities. The in-house costs for INDOT were determined negligible.

The PW cost for future maintenance did not impact the bids and which contractor received the contract. INDOT believes using this process of alternate bids for pavement type selection on this project was very successful.

PW of Future Maintenance of the Pavement

I-69 (IR-33049)

1) Optional Pavement Section (INDOT)

PW of HMA Section = \$2,793,699.00

PW of PCCP Section = \$1,724,911.00

2) PCCP Alternate Pavement Section (Contractor)

PW of Alternate Pavement Type (PCCP) = \$1,753,859.00

3) HMA Alternate Pavement Section (Contractor)

PW of Alternate Pavement Type (HMA) = \$2,793,699.00

HMA PW for Future Rehabilitation Work (INDOT)			
Age in Years	Rehab.	Cost \$	Present Worth Cost \$
3	Joint Seal	150,817.00	\$134,075.76
6	Joint Seal	150,817.00	\$119,192.87
9	Joint Seal	150,817.00	\$105,962.02
12	Joint Seal	150,817.00	\$94,199.85
15	Joint Seal	150,817.00	\$83,743.33
18	Joint Seal	150,817.00	\$74,447.51
20	Mill and Functional Overlay	3,225,836.00	\$1,472,229.44
23	Joint Seal	150,817.00	\$61,190.43
26	Joint Seal	150,817.00	\$54,398.07
29	Joint Seal	150,817.00	\$48,359.68
32	Joint Seal	150,817.00	\$42,991.58
35	Mill and Resurface	1,531,091.00	\$388,002.15
38	Joint Seal	150,817.00	\$33,976.87
41	Joint Seal	150,817.00	\$30,205.32
44	Joint Seal	150,817.00	\$26,852.42
47	Joint Seal	150,817.00	\$23,871.70
Total HMA PW Cost			\$2,793,699.00

PCCP PW for Future Rehabilitation Work (INDOT)			
Age in Years	Rehab.	Cost \$	Present Worth Cost \$
8	Reseal the Joint	157,861.00	\$115,347.49
16	Reseal the Joint	157,861.00	\$84,283.28
24	Reseal the Joint	157,861.00	\$61,584.97
30	Mill and Functional Overlay	3,251,932.00	\$1,002,631.34
33	Joint Seal	150,817.00	\$41,338.06
36	Joint Seal	150,817.00	\$36,749.39
39	Joint Seal	150,817.00	\$32,670.07
42	Mill and Resurface	1,565,798.00	\$301,533.44
45	Joint Seal	150,817.00	\$25,819.63
48	Joint Seal	150,817.00	\$22,953.56
Total PCCP PW Cost			\$1,724,911.22

$$PW = F [1/(1+i)^n]$$

Where: F = Future Construction Cost

i = Discount rate (4%)

n = Number of years from year zero

PCCP PW for Future Rehabilitation Work (Contractor)			
Age in Years	Rehab.	Cost \$	Present Worth Cost \$
8	Reseal the Joint	178,134.00	\$130,160.77
16	Reseal the Joint	178,134.00	\$95,107.20
24	Reseal the Joint	178,134.00	\$69,493.90
30	Mill and Functional Overlay	3,237,018.00	\$998,033.08
33	Joint Seal	150,817.00	\$41,338.06
36	Joint Seal	150,817.00	\$36,749.39
39	Joint Seal	150,817.00	\$32,670.07
42	Mill and Resurface	1,565,798.00	\$301,533.44
45	Joint Seal	150,817.00	\$25,819.63
48	Joint Seal	150,817.00	\$22,953.56
Total PCCP PW Cost			\$1,753,859.09

$$PW = F [1/(1+i)^n]$$

Where: F = Future Construction Cost
i = Discount rate (4%)
n = Number of years from year zero

HMA PW for Future Rehabilitation Work (Contractor)			
Age in Years	Rehab.	Cost \$	Present Worth Cost \$
3	Joint Seal	150,817.00	\$134,075.76
6	Joint Seal	150,817.00	\$119,192.87
9	Joint Seal	150,817.00	\$105,962.02
12	Joint Seal	150,817.00	\$94,199.85
15	Joint Seal	150,817.00	\$83,743.33
18	Joint Seal	150,817.00	\$74,447.51
20	Mill and Functional Overlay	3,225,836.00	\$1,472,229.44
23	Joint Seal	150,817.00	\$61,190.43
26	Joint Seal	150,817.00	\$54,398.07
29	Joint Seal	150,817.00	\$48,359.68
32	Joint Seal	150,817.00	\$42,991.58
35	Mill and Resurface	1,531,091.00	\$388,002.15
38	Joint Seal	150,817.00	\$33,976.87
41	Joint Seal	150,817.00	\$30,205.32
44	Joint Seal	150,817.00	\$26,852.42
47	Joint Seal	150,817.00	\$23,871.70
Total HMA PW Cost			\$2,793,699.00

$$PW = F [1/(1+i)^n]$$

Where: F = Future Construction Cost
i = Discount rate (4%)
n = Number of years from year zero

Total Cost (INDOT)				
Total Cost	Alternative 1: 11 inches PCCP		Alternative 2: 13 inches HMA	
	Agency Cost (\$1000)	User Cost (\$1000)	Agency Cost (\$1000)	User Cost (\$1000)
<i>Undiscounted Sum</i>	\$6,045.40	\$0.00	\$6,868.36	\$0.00
Present Value	\$1,724.91	\$0.00	\$2,793.70	\$0.00
EUAC	\$80.29	\$0.00	\$130.05	\$0.00
Lowest Present Value Agency Cost		Alternative 1: 11 inches PCCP		
Lowest Present Value User Cost		Alternative 1: 11 inches PCCP		
Expenditure Stream				
Year	Alternative 1: 11 inches PCCP		Alternative 2: 13 inches HMA	
	Agency Cost (\$1000)	User Cost (\$1000)	Agency Cost (\$1000)	User Cost (\$1000)
0				
1				
2				
3			\$150.82	
4				
5				
6			\$150.82	
7				
8	\$157.86			
9			\$150.82	
10				
11				
12			\$150.82	
13				
14				
15			\$150.82	
16	\$157.86			
17				
18			\$150.82	
19				
20			\$3,225.84	
21				
22				
23			\$150.82	
24	\$157.86			
25				
26			\$150.82	
27				
28				
29			\$150.82	
30	\$3,251.93			
31				
32			\$150.82	
33	\$150.82			
34				
35			\$1,531.09	
36	\$150.82			
37				
38			\$150.82	
39	\$150.82			
40				
41			\$150.82	
42	\$1,565.80			
43				
44			\$150.82	
45	\$150.82			
46				
47			\$150.82	
48	\$150.82			
49				
50				

Total Cost (Contractor's PCCP)				
Total Cost	Alternative 1: 11 inches PCCP		Alternative 2:	
	Agency Cost (\$1000)	User Cost (\$1000)	Agency Cost (\$1000)	User Cost (\$1000)
<i>Undiscounted Sum</i>	\$6,091.30	\$0.00	\$0.00	\$0.00
Present Value	\$1,753.86	\$0.00	\$0.00	\$0.00
EUAC	\$81.64	\$0.00	\$0.00	\$0.00
Lowest Present Value Agency Cost		Alternative 2:		
Lowest Present Value User Cost		Alternative 1: 11 inches PCCP		
Expenditure Stream				
Year	Alternative 1: 11 inches PCCP		Alternative 2:	
	Agency Cost (\$1000)	User Cost (\$1000)	Agency Cost (\$1000)	User Cost (\$1000)
0				
1				
2				
3				
4				
5				
6				
7				
8	\$178.13			
9				
10				
11				
12				
13				
14				
15				
16	\$178.13			
17				
18				
19				
20				
21				
22				
23				
24	\$178.13			
25				
26				
27				
28				
29				
30	\$3,237.02			
31				
32				
33	\$150.82			
34				
35				
36	\$150.82			
37				
38				
39	\$150.82			
40				
41				
42	\$1,565.80			
43				
44				
45	\$150.82			
46				
47				
48	\$150.82			
49				
50				

Total Cost (Contractor's HMA)				
Total Cost	Alternative 1:		Alternative 2: 13 inches HMA	
	Agency Cost (\$1000)	User Cost (\$1000)	Agency Cost (\$1000)	User Cost (\$1000)
<i>Undiscounted Sum</i>	\$0.00	\$0.00	\$6,868.36	\$0.00
Present Value	\$0.00	\$0.00	\$2,793.70	\$0.00
EUAC	\$0.00	\$0.00	\$130.05	\$0.00
Lowest Present Value Agency Cost		Alternative 1:		
Lowest Present Value User Cost		Alternative 1:		
Expenditure Stream				
Year	Alternative 1:		Alternative 2: 13 inches HMA	
	Agency Cost (\$1000)	User Cost (\$1000)	Agency Cost (\$1000)	User Cost (\$1000)
0				
1				
2				
3			\$150.82	
4				
5				
6			\$150.82	
7				
8				
9			\$150.82	
10				
11				
12			\$150.82	
13				
14				
15			\$150.82	
16				
17				
18			\$150.82	
19				
20			\$3,225.84	
21				
22				
23			\$150.82	
24				
25				
26			\$150.82	
27				
28				
29			\$150.82	
30				
31				
32			\$150.82	
33				
34				
35			\$1,531.09	
36				
37				
38			\$150.82	
39				
40				
41			\$150.82	
42				
43				
44			\$150.82	
45				
46				
47			\$150.82	
48				
49				
50				

Appendix K

PR 69 (IR-33051)

This project was bid as a design build contract. INDOT let this project on mainline as an optional pavement section (HMA or PCCP) or the Contractor's alternate pavement section. INDOT received four (4) bids (4 PCCP options, 1 HMA option, and 3 Contractor's alternate pavement section) and all bids were substantially below the engineer's estimate. One (1) Contractor participated in all three: HMA, PCCP, and the alternate pavement section.

INDOT provided the following pavement design thickness for mainline of this project:

1. 11 inches of PCCP at 18 feet Joint Spacing or
2. 13 inches of HMA

The Contractor's alternate pavement sections for this project were as follow:

1. The first Contractor's alternate pavement section was 11 inches PCCP at 18 feet Joint Spacing on mainline and inside shoulder with modified subgrade treatment.
2. The second Contractor's alternate pavement section was 10 inches PCCP at 18 feet Joint Spacing on cement treated open graded subbase with modified subgrade treatment.
3. The third Contractor's alternate pavement section was 10 inches PCCP at 16 feet Joint Spacing on mainline and inside shoulder. Contractor will control the Coefficient of Thermal Expansion (CTE) value not to exceed 5.4.

Bid Analysis Summary

PCCP Option

<u>Bidders</u>	<u>Initial Bid</u>	<u>PW Cost for PCCP</u>	<u>Bid Analysis</u>
A	\$84,750,000.00	+ \$3,219,678.88	= \$87,969,678.88
B	\$89,425,000.00	+ \$3,219,678.88	= \$92,644,678.88
C	\$93,175,880.00	+ \$3,219,678.88	= \$96,395,558.88
D	\$102,307,004.89	+ \$3,219,678.88	= \$105,526,683.77

HMA Option

<u>Bidders</u>	<u>Initial Bid</u>	<u>PW Cost for HMA</u>	<u>Bid Analysis</u>
A	\$86,100,000.00	+ \$5,276,981.59	= \$91,376,981.59

1st Contractor's Alternate PCCP Pavement

<u>Bidders</u>	<u>Initial Bid</u>	<u>PW Cost for Alt. PCCP</u>	<u>Bid Analysis</u>
D	\$101,937,004.89	+ \$3,180,575.78	= \$105,117,580.67

2nd Contractor's Alternate PCCP Pavement

<u>Bidders</u>	<u>Initial Bid</u>	<u>PW Cost for Alt. PCCP</u>	<u>Bid Analysis</u>
C	\$91,190,880.00	+ \$3,248,275.85	= \$94,439,155.85

3rd Contractor's Alternate PCCP Pavement

<u>Bidders</u>	<u>Initial Bid</u>	<u>PW Cost for Alt. PCCP</u>	<u>Bid Analysis</u>
A	\$83,900,000.00	+ \$3,503,697.42	= \$87,403,697.42

The low bid amount, out of all 4 bids, was for 3rd Contractor's Alternate PCCP section (Bidder A) and after adding PW cost of HMA, PCCP, and Contractor's Alternate PCCP to the respective pavement type, 3rd Contractor's **Alternate PCCP section was the low bid** (Bidder A). The 3rd Contractor's **Alternate PCCP section of Bidder A** was awarded for this contract. The PW cost factor did not affected the outcome of the bidding.

INDOT is unable to compared the estimated cost of pavement pay items with actual low bid costs of all three pavement types since this contract was not let as an itemized proposal. All other pavement types such as "S"-lines in the bids were common to all pavement options.

Conclusion

INDOT saved the tax payers approximately \$2,151,050.00 immediately, at the bid opening, (HMA Low Bid – PCCP Low Bid). Using the Bid Analysis amounts (after PW costs applied); INDOT saved the tax payers approximately \$3,924,334.17 over the 50 year service life of the pavement. These savings include the reduction of INDOT's consultant cost of \$48,950.00 for producing two sets of typical plan sheets and quantities. The in-house costs for INDOT were determined negligible.

The PW cost for future maintenance did not impact the bids and which contractor received the contract but the Contractor's alternate PCCP section **did** impact the overall outcome. INDOT believes using this process of alternate bids for pavement type selection on this project was very successful.

PW of Future Maintenance of the Pavement

I-69 (IR-33051)

1) Optional Pavement Section (INDOT)

PW of HMA Section = \$5,276,981.59

PW of PCCP Section = \$3,219,678.88

2) PCCP Alternate Pavement Section (1st Contractor)

PW of Alternate Pavement Type (PCCP) = \$3,180,575.78

3) PCCP Alternate Pavement Section (2nd Contractor)

PW of Alternate Pavement Type (PCCP) = \$3,248,275.85

4) PCCP Alternate Pavement Section (3rd Contractor)

PW of Alternate Pavement Type (PCCP) = \$3,503,697.42

HMA PW for Future Rehabilitation Work (INDOT)			
Age in	Rehab.	Cost	Present Worth

Years		\$	Cost \$
3	Joint Seal	287,204.00	\$255,323.31
6	Joint Seal	287,204.00	\$226,981.49
9	Joint Seal	287,204.00	\$201,785.72
12	Joint Seal	287,204.00	\$179,386.77
15	Joint Seal	287,204.00	\$159,474.19
18	Joint Seal	287,204.00	\$141,771.97
20	Mill and Functional Overlay	6,055,977.00	\$2,763,868.85
23	Joint Seal	287,204.00	\$116,526.23
26	Joint Seal	287,204.00	\$103,591.39
29	Joint Seal	287,204.00	\$92,092.37
32	Joint Seal	287,204.00	\$81,869.78
35	Mill and Resurface	2,902,313.00	\$735,491.02
38	Joint Seal	287,204.00	\$64,702.88
41	Joint Seal	287,204.00	\$57,520.62
44	Joint Seal	287,204.00	\$51,135.62
47	Joint Seal	287,204.00	\$45,459.38
Total HMA PW Cost			\$5,276,981.59

PCCP PW for Future Rehabilitation Work (INDOT)			
Age in Years	Rehab.	Cost \$	Present Worth Cost \$
8	Reseal the Joint	276,567.00	\$202,084.80
16	Reseal the Joint	276,567.00	\$147,661.38
24	Reseal the Joint	276,567.00	\$107,894.73
30	Mill and Functional Overlay	6,119,400.00	\$1,886,725.26
33	Joint Seal	287,204.00	\$78,720.94
36	Joint Seal	287,204.00	\$69,982.63
39	Joint Seal	287,204.00	\$62,214.30
42	Mill and Resurface	2,967,754.00	\$571,515.02
45	Joint Seal	287,204.00	\$49,168.87
48	Joint Seal	287,204.00	\$43,710.95
Total PCCP PW Cost			\$3,219,678.88

$$PW = F [1/(1+i)^n]$$

Where: F = Future Construction Cost

i = Discount rate (4%)

n = Number of years from year zero

PCCP PW for Future Rehabilitation Work (1 st Contractor)			
Age in Years	Rehab.	Cost \$	Present Worth Cost \$
8	Reseal the Joint	319,116.00	\$233,174.94
16	Reseal the Joint	319,116.00	\$170,378.64
24	Reseal the Joint	319,116.00	\$124,494.00
30	Mill and Functional Overlay	6,092,663.00	\$1,878,481.74
33	Joint/Crack Seal	191,469.00	\$52,480.54
36	Joint/Crack Seal	191,469.00	\$46,655.01
39	Joint/Crack Seal	191,469.00	\$41,476.13
42	Mill and Resurface	2,967,754.00	\$571,515.02
45	Joint/Crack Seal	191,469.00	\$32,779.19
48	Joint/Crack Seal	191,469.00	\$29,140.58
Total PCCP PW Cost			\$3,180,575.78

$$PW = F [1/(1+i)^n]$$

Where: F = Future Construction Cost
i = Discount rate (4%)
n = Number of years from year zero

PCCP PW for Future Rehabilitation Work (2 nd Contractor)

Age in Years	Rehab.	Cost \$	Present Worth Cost \$
8	Reseal the Joint	276,567.00	\$202,084.80
16	Reseal the Joint	276,567.00	\$147,661.38
24	Reseal the Joint	276,567.00	\$107,894.73
30	Mill and Functional Overlay	6,196,602.00	\$1,910,528.07
33	Joint/Crack Seal	287,204.00	\$78,720.94
36	Joint/Crack Seal	287,204.00	\$69,982.63
39	Joint/Crack Seal	287,204.00	\$62,214.30
42	Mill and Resurface	2,992,649.00	\$576,309.17
45	Joint/Crack Seal	287,204.00	\$49,168.87
48	Joint/Crack Seal	287,204.00	\$43,710.95
Total PCCP PW Cost			\$3,248,275.85

$$PW = F [1/(1+i)^n]$$

Where: F = Future Construction Cost
i = Discount rate (4%)
n = Number of years from year zero

PCCP PW for Future Rehabilitation Work (3rd Contractor)

Age in Years	Rehab.	Cost \$	Present Worth Cost \$
8	Reseal the Joint	454,740.00	\$332,274.06
16	Reseal the Joint	454,740.00	\$242,789.40
24	Reseal the Joint	454,740.00	\$177,403.84
30	Mill and Functional Overlay	6,079,236.00	\$1,874,341.95
33	Joint/Crack Seal	287,204.00	\$78,720.94
36	Joint/Crack Seal	287,204.00	\$69,982.63
39	Joint/Crack Seal	287,204.00	\$62,214.30
42	Mill and Resurface	2,975,935.00	\$573,090.48
45	Joint/Crack Seal	287,204.00	\$49,168.87
48	Joint/Crack Seal	287,204.00	\$43,710.95
Total PCCP PW Cost			\$3,503,697.42

$$PW = F [1/(1+i)^n]$$

Where: F = Future Construction Cost
i = Discount rate (4%)
n = Number of years from year zero

Total Cost (INDOT)				
Total Cost	Alternative 1: 11 inches PCCP		Alternative 2: 13 inches HMA	
	Agency Cost (\$1000)	User Cost (\$1000)	Agency Cost (\$1000)	User Cost (\$1000)

Undiscounted Sum	\$11,352.88	\$0.00	\$12,979.15	\$0.00
Present Value	\$3,219.68	\$0.00	\$5,276.98	\$0.00
EUAC	\$149.88	\$0.00	\$245.64	\$0.00
Lowest Present Value Agency Cost	Alternative 1: 11 inches PCCP			
Lowest Present Value User Cost	Alternative 1: 11 inches PCCP			

Expenditure Stream				
Year	Alternative 1: 11 inches PCCP		Alternative 2: 13 inches HMA	
	Agency Cost (\$1000)	User Cost (\$1000)	Agency Cost (\$1000)	User Cost (\$1000)
0				
1				
2				
3			\$287.20	
4				
5				
6			\$287.20	
7				
8	\$276.57			
9			\$287.20	
10				
11				
12			\$287.20	
13				
14				
15			\$287.20	
16	\$276.57			
17				
18			\$287.20	
19				
20			\$6,055.98	
21				
22				
23			\$287.20	
24	\$276.57			
25				
26			\$287.20	
27				
28				
29			\$287.20	
30	\$6,119.40			
31				
32			\$287.20	
33	\$287.20			
34				
35			\$2,902.31	
36	\$287.20			
37				
38			\$287.20	
39	\$287.20			
40				
41			\$287.20	
42	\$2,967.75			
43				
44			\$287.20	
45	\$287.20			
46				
47			\$287.20	
48	\$287.20			
49				
50				

Total Cost (1 st Contractor)				
Total Cost	Alternative 1: 11 inches PCCP		Alternative 2:	
	Agency Cost (\$1000)	User Cost (\$1000)	Agency Cost (\$1000)	User Cost (\$1000)

Undiscounted Sum	\$10,975.11	\$0.00	\$0.00	\$0.00
Present Value	\$3,180.58	\$0.00	\$0.00	\$0.00
EUAC	\$148.06	\$0.00	\$0.00	\$0.00
Lowest Present Value Agency Cost	Alternative 2:			
Lowest Present Value User Cost	Alternative 1: 11 inches PCCP			

Expenditure Stream				
Year	Alternative 1: 11 inches PCCP		Alternative 2:	
	Agency Cost (\$1000)	User Cost (\$1000)	Agency Cost (\$1000)	User Cost (\$1000)
0				
1				
2				
3				
4				
5				
6				
7				
8	\$319.12			
9				
10				
11				
12				
13				
14				
15				
16	\$319.12			
17				
18				
19				
20				
21				
22				
23				
24	\$319.12			
25				
26				
27				
28				
29				
30	\$6,092.66			
31				
32				
33	\$191.47			
34				
35				
36	\$191.47			
37				
38				
39	\$191.47			
40				
41				
42	\$2,967.75			
43				
44				
45	\$191.47			
46				
47				
48	\$191.47			
49				
50				

Total Cost (2 nd Contractor)				
Total Cost	Alternative 1: 10 inches PCCP		Alternative 2:	
	Agency Cost (\$1000)	User Cost (\$1000)	Agency Cost (\$1000)	User Cost (\$1000)

Undiscounted Sum	\$11,454.97	\$0.00	\$0.00	\$0.00
Present Value	\$3,248.28	\$0.00	\$0.00	\$0.00
EUAC	\$151.21	\$0.00	\$0.00	\$0.00
Lowest Present Value Agency Cost	Alternative 2:			
Lowest Present Value User Cost	Alternative 1: 10 inches PCCP			

Expenditure Stream				
Year	Alternative 1: 10 inches PCCP		Alternative 2:	
	Agency Cost (\$1000)	User Cost (\$1000)	Agency Cost (\$1000)	User Cost (\$1000)
0				
1				
2				
3				
4				
5				
6				
7				
8	\$276.57			
9				
10				
11				
12				
13				
14				
15				
16	\$276.57			
17				
18				
19				
20				
21				
22				
23				
24	\$276.57			
25				
26				
27				
28				
29				
30	\$6,196.60			
31				
32				
33	\$287.20			
34				
35				
36	\$287.20			
37				
38				
39	\$287.20			
40				
41				
42	\$2,992.65			
43				
44				
45	\$287.20			
46				
47				
48	\$287.20			
49				
50				

Total Cost (3 rd Contractor)				
Total Cost	Alternative 1: 10 inches PCCP		Alternative 2:	
	Agency Cost (\$1000)	User Cost (\$1000)	Agency Cost (\$1000)	User Cost (\$1000)

<i>Undiscounted Sum</i>	\$11,855.41	\$0.00	\$0.00	\$0.00
Present Value	\$3,503.70	\$0.00	\$0.00	\$0.00
EUAC	\$163.10	\$0.00	\$0.00	\$0.00
Lowest Present Value Agency Cost	Alternative 2:			
Lowest Present Value User Cost	Alternative 1: 10 inches PCCP			
Expenditure Stream				
Year	Alternative 1: 10 inches PCCP		Alternative 2:	
	Agency Cost (\$1000)	User Cost (\$1000)	Agency Cost (\$1000)	User Cost (\$1000)
0				
1				
2				
3				
4				
5				
6				
7				
8	\$454.74			
9				
10				
11				
12				
13				
14				
15				
16	\$454.74			
17				
18				
19				
20				
21				
22				
23				
24	\$454.74			
25				
26				
27				
28				
29				
30	\$6,079.24			
31				
32				
33	\$287.20			
34				
35				
36	\$287.20			
37				
38				
39	\$287.20			
40				
41				
42	\$2,975.94			
43				
44				
45	\$287.20			
46				
47				
48	\$287.20			
49				
50				