



Illinois Department of Transportation

To: Kensil Garnett Attn: District Four
From: John D. Baranzelli 
Subject: Pavement Design
Date: April 21, 2015

FAS Route 2401 (US 150)
Section (40V-1)BR
Knox County
Over the BNSF RR

We have reviewed the pavement selection for the above captioned section, which was submitted with by email dated March 13, 2015. The project will replace the structure over the railroad. The project is less than 2 lane-miles and is not subject to alternate bidding. The LCCA was within 10%, and required action by the Pavement Selection Committee. The flexible design was more economical by 4.5%. The Committee concurred with the district's request to use the flexible design. The approved pavement design is as follows:

US 150 (Pavement Reconstruction)

- 10.25 inches of HMA Pavement with HMA Shoulders
 - 2 inches of HMA Surface Course, Mix "D", N70
 - 2.25 inches of HMA Top Binder Course, IL-19.0, N70
 - 6 inches of HMA Lower Binder Course, IL-19.0, N70
- 12 inches of Aggregate Subgrade Improvement

If you have any questions, please contact Paul Niedernhofer at (217) 524-1651.

Niedernhofer, Paul R

From: Maushard, Christopher E
Sent: Friday, March 13, 2015 8:18 AM
To: Niedernhofer, Paul R
Cc: Dotson, Richard J; Horst, Kevin J
Subject: Pavement Design for US 150 over BNSF Railroad near Galesburg

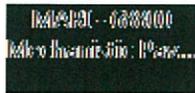
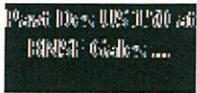
Paul –

Shown attached is a pavement design and excel spreadsheet for new pavement on US 150 near Galesburg for the reconstruction of the US 150 structure over the BNSF Railroad in Knox County. This pavement design is very similar to the IL 8 Edwards design I submitted yesterday.

The design is for a total of 6667 sy of new pavement. The recommendation is for Full-Depth HMA pavement, 10 ¼” total thickness based on LCCA. This project doesn’t meet the 2 lane mile minimum requirement for alternate bid.

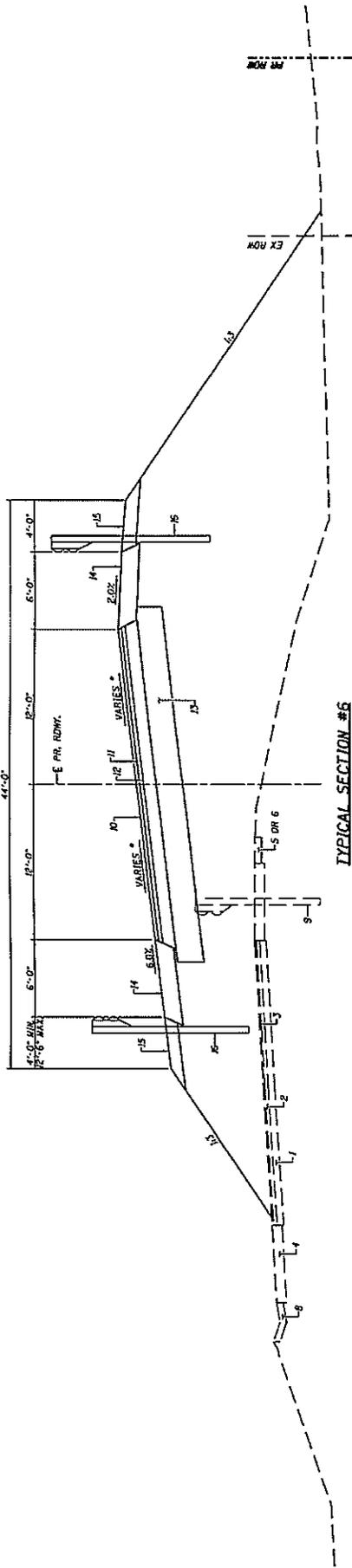
Please review and pass to the Statewide Pavement Selection Committee for their review and recommendation. If you have any questions please let me know.

Thanks.

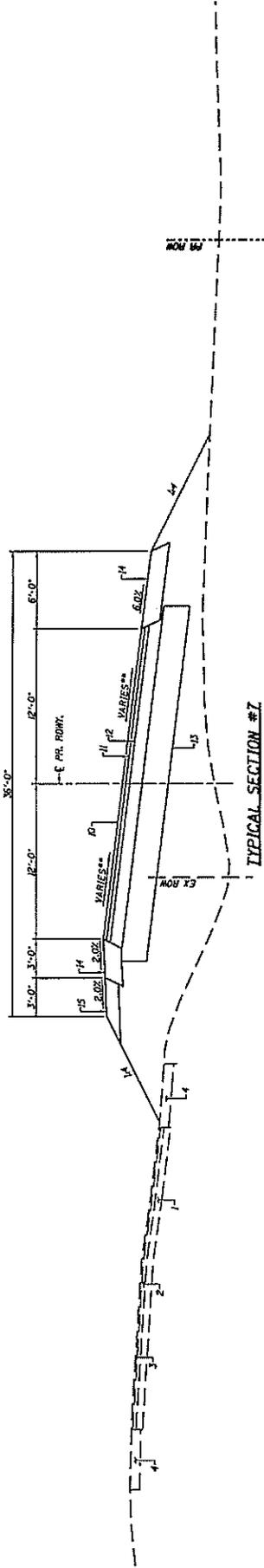


Christopher Maushard, P.E.
-Project Engineer-
Region 3 District 4
Program Development
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 Please consider the environment before printing this e-mail.



TYPICAL SECTION #6



TYPICAL SECTION #7

- LEGEND**
- 1 - EX CONCRETE PAVEMENT
 - 2 - EX BITUMINOUS OVERLAY, 1.5" THICK
 - 3 - EX BITUMINOUS OVERLAY, 1.5" THICK
 - 4 - EX BITUMINOUS SHOULDER, 6"
 - 5 - EX AGGREGATE SHOULDER, 6"
 - 6 - EX AGGREGATE SHOULDER, 6"
 - 7 - EX AGGREGATE SHOULDER, 6"
 - 8 - EX CONCRETE GUTTER, TYPE A
 - 9 - EX GUARDRAIL
 - 10 - EX 12" x 11" GUTTER
 - 11 - EX 12" x 12" GUTTER
 - 12 - EX 15" x 6" DRAIN
 - 13 - EX 15" x 6" DRAIN
 - 14 - EX 15" x 6" DRAIN
 - 15 - EX 15" x 6" DRAIN
 - 16 - EX 15" x 6" DRAIN

FILE NAME	DESIGNED	REVISION	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
DATE	DRAWN	REVISION	1007-088	ANK	240	240
SCALE	CHECKED	REVISION	TYPICAL SECTIONS - US 150			
DATE	DATE	REVISION	SHEETS 1 OF 2			
STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION			SCALE SHEET NO. OF SHEETS 1 OF 2			

PROJECT AND TRAFFIC INPUTS

(Enter Data in Gray Shaded Cells)

Route: FAS 2401 (US 150)	Comments:			
Section: (40V-1)BR	Design Date: 12/18/2014	L. Davis	<- BY	
County: KNOX	Modify Date:		<- BY	
Location: US ROUTE 150 OVER BNSF RR			ADT	Year
Facility Type: Other Marked State Route			Current: 4,450	2013
			Future: 5,650	2037
# of Lanes = 2 or 3			Structural Design Traffic	
Part of future 4 lanes or more? No			Minimum ADT	Actual ADT
One Way Street? No				Actual % of Total ADT
Road Class: II				% of ADT in Design Lane
Subgrade Support Rating (SSR): Poor			PV = 0	4,728
Construction Year: 2017			SU = 250	309
Design Period (DP) = 20 years			MU = 750	113
			Struct. Design ADT = 5,150	(2027)
				P = 50%
				S = 50%
				M = 50%

FLEXIBLE PAVEMENT		RIGID PAVEMENT	
Cpv =	0.15	Cpv =	0.15
Csu =	112.06	Csu =	135.78
Cmu =	385.44	Cmu =	567.21
TF flexible (Actual) =	0.79 (Actual ADT)	TF rigid (Actual) =	1.07 (Actual ADT)
TF flexible (Min) =	3.17 (Min ADT Fig. 54-2.C)	TF rigid (Min) =	4.59 (Min ADT Fig. 54-2.C)

TRAFFIC FACTOR CALCULATION

NEW CONSTRUCTION / RECONSTRUCTION PAVEMENT DESIGN CALCULATIONS

Full-Depth HMA Pavement		JPC Pavement	
Use TF flexible =	3.17	Use TF rigid =	4.59
PG Grade Lower Binder Lifts =	PG 64-22 (Fig. 53-4.R)	Edge Support =	Tied Shoulder or C.&G.
HMA Mixture Temp. =	76.0 deg. F (Fig. 54-5.C)	Rigid Pavt Thick. =	9.00 in. (Fig. 54-4.E)
Design HMA Mixture Modulus (E _{HMA}) =	660 ksi (Fig. 54-5.D)		
Design HMA Strain (ε _{HMA}) =	86 (Fig. 54-5.E)	CRC Pavement	
Full Depth HMA Design Thickness =	10.25 in. (Fig. 54-5.F)	Use TF rigid =	4.59
Limiting Strain Criterion Thickness =	15.25 in. (Fig. 54-5.I)	IBR value =	3
Use Full-Depth HMA Thickness =	10.25 inches	CRCP Thickness =	7.75 in. (Fig. 54-4.N)

TF MUST BE > 60 FOR CRCP

RECONSTRUCTION ONLY (SUPPLEMENTAL) PAVEMENT DESIGN CALCULATIONS

HMA Overlay of Rubblized PCC		Unbonded Concrete Overlay	
Use TF flexible =	3.17	Review 54-4.03 for limitations and special considerations.	
HMA Overlay Design Thickness =	7.50 in. (Fig. 54-5.U)	JPCP Thickness =	NA inches
Limiting Strain Criterion Thickness =	11.00 in. (Fig. 54-5.V)		
Use HMA Overlay Thickness =	7.50 inches		

CONTACT BMPR FOR ASSISTANCE

DESIGN TABLES FROM BDE MANUAL CHAPTER 54 - PAVEMENT DESIGN

Class I Roads	Class II Roads	Class III Roads	Class IV Roads
4 lanes or more Part of a future 4 lanes or more One-way Streets with ADT > 3500	2 lanes with ADT > 2000 One way Street with ADT <= 3500	2 Lanes (ADT 750 -2000)	2 Lanes (ADT < 750)

	Min. Str. Design Traffic (Fig 54-2.C)		
Facility Type	PV	SU	MU
Interstate or Freeway	0	500	1500
Other Marked State Route	0	250	750
Unmarked State Route	No Min	No Min	No Min

Class Table for One-Way Streets	
ADT	Class
0 - 3500	II
>3501	I

	Traffic Factor ESAL Coefficients			
	Rigid (Fig. 54-4.C)		Flexible (Fig. 54-5.B)	
Class	Csu	Cmu	Csu	Cmu
I	143.81	696.42	132.50	482.53
II	135.78	567.21	112.06	385.44
III	129.58	562.47	109.14	384.35
IV	129.58	562.47	109.14	384.35

Class Table for 2 or 3 lanes (not future 4 lane & not one-way street)	
ADT	Class
0 - 749	IV
750 - 2000	III
>2000	II

	Design Lane Distribution Factors For Structural Design Traffic (Fig. 54-2.B)					
	Rural			Urban		
Number of Lanes	P	S	M	P	S	M
1 Lane Ramp	100%	100%	100%	100%	100%	100%
2 or 3	50%	50%	50%	50%	50%	50%
4	32%	45%	45%	32%	45%	45%
6 or more	20%	40%	40%	8%	37%	37%

LIFE-CYCLE COST ANALYSIS: NEW CONSTRUCTION / RECONSTRUCTION

FULL-DEPTH HMA PAVEMENT

Standard Design

ROUTE **FAS 2401 (US 150)**
 SECTION **(40V-1)BR**
 COUNTY **KNOX**
 LOCATION **US ROUTE 150 OVER BNSF RR**

FACILITY TYPE **NON-INTERSTATE**

PROJECT LENGTH **2500 FT == > 0.47 Miles**
 # OF CENTERLINES **1 CL**
 # OF LANES **2 LANES**
 # OF EDGES **2 EP**
 LANE WIDTH - AVERAGE **12 FT**
 SHOULDER WIDTH HMA Left **6 FT**
 HMA Right **6 FT**
 Total Width of Paved Shoulders **12 FT**

PAVEMENT THICKNESS (FLEXIBLE) **10.25 IN** **15.25 IN MAX**
 SHOULDER THICKNESS **8.00 IN** **HMA_CK Standard Design**
 POLICY OVERLAY THICKNESS **2.25 IN**

FLEX PAVEMENT	TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
		3.17	0.76	3.17

Read Me!

HMA	COST PER TON	UNIT PRICE
HMA SURFACE		\$101.49 / TON
HMA TOP BINDER		\$93.45 / TON
HMA LOWER BINDER		\$84.21 / TON
HMA BINDER (LEVELING)		\$85.00 / TON
HMA SHOULDER		\$79.04 / TON

INITIAL COSTS	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE	COST
HMA PAVEMENT (FULL-DEPTH)	(10.25")	6,667	SQ YD	\$53.20 / SQ YD	\$0
HMA SURFACE COURSE	(2.00")	752	TONS	\$101.49 / TON	\$76,305 ~
HMA TOP BINDER COURSE	(2.25")	858	TONS	\$93.45 / TON	\$80,202 ~
HMA LOWER BINDER COURSE	(6.00")	2,353	TONS	\$84.21 / TON	\$198,127 ~
HMA SHOULDER	(8.00")	1,493	TONS	\$79.04 / TON	\$118,033 ~
CURB & GUTTER		0	LIN FT	\$30.00 / LIN FT	\$0
SUBBASE GRAN MATL TY C (TONS)		204	TONS	\$18.92 / TON	\$3,860
IMPROVED SUBGRADE: Modified Soil		10,752	SQ YD	\$14.50 / SQ YD	\$155,904
Reserved For User Supplied Item		0	UNITS	\$0.00 / UNITS	\$0
Reserved For User Supplied Item		0	UNITS	\$0.00 / UNITS	\$0
PAVEMENT REMOVAL		6,667	SQ YD	\$0.00 / SQ YD	\$0
SHOULDER REMOVAL		3,333	SQ YD	\$0.00 / SQ YD	\$0
				FLEXIBLE CONSTRUCTION INITIAL COST	\$632,431
				FLEXIBLE CONSTRUCTION ANNUAL COST PER MILE	\$54,477

MAINTENANCE COSTS:	THICKNESS	MATERIAL	T	UNIT COST
ROUTINE MAINTENANCE ACTIVITY				\$0.00 LANE-MILE / YEAR
HMA OVERLAY PVMT SURF	(2.00")	Surface Mix	2.00	\$11.45 / SQ YD
HMA OVERLAY PVMT	(2.25")	Surface Mix	2.25	\$12.19 / SQ YD
HMA SURFACE MIX	(1.50")	Surface Mix	1.50	\$8.57 / SQ YD
HMA BINDER MIX	(0.75")	Leveling Binder Mix	0.75	\$3.62 / SQ YD
HMA OVERLAY SHLD (Year 30)	(2.25")	Shoulder Mix	2.25	\$9.96 / SQ YD
HMA OVERLAY SHLD	(2.00")	Shoulder Mix	2.00	\$8.85 / SQ YD
MILLING (2.00 IN)			2.00	\$3.00 / SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill Surf)		Surface Mix	2.00	\$81.37 / SQ YD
PARTIAL DEPTH SHLD PATCH (Mill & Fill Surf)		Shoulder Mix	2.00	\$78.85 / SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill +2.00")		Leveling Binder Mix	2.00	\$79.52 / SQ YD
PARTIAL DEPTH SHLD PATCH (Mill & Fill +2.00")		Shoulder Mix	2.00	\$78.85 / SQ YD
LONGITUDINAL SHOULDER JOINT ROUT & SEAL				\$2.00 / LIN FT
CENTERLINE JOINT ROUT & SEAL				\$2.00 / LIN FT
RANDOM / THERMAL CRACK ROUT & SEAL (100% Rehab = 110.00' / Station / Lane)				\$2.00 / LIN FT

FLEXIBLE TOTAL LIFE-CYCLE COST **\$860,721**
 FLEXIBLE TOTAL ANNUAL COST PER MILE **\$74,141**

FULL-DEPTH HMA PAVEMENT
HMA OVERLAY OF RUBBLIZED PCC PAVEMENT
Figure 54-7.C
STANDARD DESIGN

MAINTENANCE COSTS:	ITEM	%	QUANTITY	UNIT	UNIT COST	COST	PRESENT WORTH
YEAR 5							
	LONG SHLD JT R&S	100.00%	5,000	LIN FT	\$2.00	\$10,000	
	CNTR LINE JOINT R&S	100.00%	2,500	LIN FT	\$2.00	\$5,000	
	RNDM / THRM CRACK R&S	50.00%	2,750	LIN FT	\$2.00	\$5,500	
	PD PVMT PATCH M&F SURF	0.10%	7	SQ YD	\$81.37	\$570	
		PWF _n = 0.8626			PW = 0.8626 X	\$21,070	\$18,175
YEAR 10							
	LONG SHLD JT R&S	100.00%	5,000	LIN FT	\$2.00	\$10,000	
	CNTR LINE JOINT R&S	100.00%	2,500	LIN FT	\$2.00	\$5,000	
	RNDM / THRM CRACK R&S	50.00%	2,750	LIN FT	\$2.00	\$5,500	
	PD PVMT PATCH M&F SURF	0.50%	33	SQ YD	\$81.37	\$2,685	
		PWF _n = 0.7441			PW = 0.7441 X	\$23,185	\$17,252
YEAR 15							
	MILL PVMT & SHLD 2.00"	100.00%	10,000	SQ YD	\$3.00	\$30,000	
	PD PVMT PATCH M&F ADD'L 2.00"	1.00%	67	SQ YD	\$79.52	\$5,328	
	HMA OVERLAY PVMT 2.00"	100.00%	6,667	SQ YD	\$11.45	\$76,305	
	HMA OVERLAY SHLD 2.00 "	100.00%	3,333	SQ YD	\$8.85	\$29,508	
		PWF _n = 0.6419			PW = 0.6419 X	\$141,141	\$90,593
YEAR 20							
	LONG SHLD JT R&S	100.00%	5,000	LIN FT	\$2.00	\$10,000	
	CNTR LINE JOINT R&S	100.00%	2,500	LIN FT	\$2.00	\$5,000	
	RNDM / THRM CRACK R&S	50.00%	2,750	LIN FT	\$2.00	\$5,500	
	PD PVMT PATCH M&F SURF	0.10%	7	SQ YD	\$81.37	\$570	
		PWF _n = 0.5537			PW = 0.5537 X	\$21,070	\$11,666
YEAR 25							
	LONG SHLD JT R&S	100.00%	5,000	LIN FT	\$2.00	\$10,000	
	CNTR LINE JOINT R&S	100.00%	2,500	LIN FT	\$2.00	\$5,000	
	RNDM / THRM CRACK R&S	50.00%	2,750	LIN FT	\$2.00	\$5,500	
	PD PVMT PATCH M&F SURF	0.50%	33	SQ YD	\$81.37	\$2,685	
		PWF _n = 0.4776			PW = 0.4776 X	\$23,185	\$11,073
HMA SD							
YEAR 30 NON-INTERSTATE							
	MILL PVMT & SHLD 2.00"	100.00%	10,000	SQ YD	\$3.00	\$30,000	
	PD PVMT PATCH M&F ADD'L 2.00"	2.00%	133	SQ YD	\$79.52	\$10,576	
	PD SHLD PATCH M&F ADD'L 2.00"	1.00%	33	SQ YD	\$78.85	\$2,602	
	HMA OVERLAY PVMT 2.25 "	100.00%	6,667	SQ YD	\$12.19	\$81,240	
	HMA OVERLAY SHLD 2.25 "	100.00%	3,333	SQ YD	\$9.96	\$33,197	
		PWF _n = 0.4120			PW = 0.4120 X	\$157,615	\$64,935
YEAR 35							
	LONG SHLD JT R&S	100.00%	5,000	LIN FT	\$2.00	\$10,000	
	CNTR LINE JOINT R&S	100.00%	2,500	LIN FT	\$2.00	\$5,000	
	RNDM / THRM CRACK R&S	50.00%	2,750	LIN FT	\$2.00	\$5,500	
	PD PVMT PATCH M&F SURF	0.10%	7	SQ YD	\$81.37	\$570	
		PWF _n = 0.3554			PW = 0.3554 X	\$21,070	\$7,488
YEAR 40							
	LONG SHLD JT R&S	100.00%	5,000	LIN FT	\$2.00	\$10,000	
	CNTR LINE JOINT R&S	100.00%	2,500	LIN FT	\$2.00	\$5,000	
	RNDM / THRM CRACK R&S	50.00%	2,750	LIN FT	\$2.00	\$5,500	
	PD PVMT PATCH M&F SURF	0.50%	33	SQ YD	\$81.37	\$2,685	
		PWF _n = 0.3066			PW = 0.3066 X	\$23,185	\$7,108
							\$228,290
ROUTINE MAINTENANCE ACTIVITY				0.95 Lane Miles	0.00	\$0	\$0
							\$228,290
45	YEAR LIFE CYCLE	CRF _n = 0.0407852	MAINTENANCE LIFE-CYCLE COST				\$228,290
							\$19,665
							MAINTENANCE ANNUAL COST PER MILE

MAINTENANCE AND REHABILITATION ACTIVITY SCHEDULE

04/21/15

JOINTED PLAIN CONCRETE PAVEMENT
UNBONDED JOINTED PLAIN CONCRETE OVERLAY
Figure 54-7.A

MAINTENANCE COSTS:	ITEM	%	QUANTITY	UNIT	UNIT COST	COST	PRESENT WORTH
YEAR 10							
	PAVEMENT PATCH CLASS B	0.10%	7	SQ YD	\$150.00	\$1,050	
		PWFn = 0.7441			PW = 0.7441 X	\$1,050	\$781
YEAR 15							
	PAVEMENT PATCH CLASS B	0.20%	13	SQ YD	\$150.00	\$1,950	
		PWFn = 0.6419			PW = 0.6419 X	\$1,950	\$1,252
YEAR 20							
	PAVEMENT PATCH CLASS B	2.00%	133	SQ YD	\$150.00	\$19,950	
	SHOULDER PATCH CLASS C	0.50%	17	SQ YD	\$145.00	\$2,465	
	LONGITUDINAL SHLD JT R&S	100.00%	5,000	LIN FT	\$2.00	\$10,000	
	CENTERLINE JT R&S	100.00%	2,500	LIN FT	\$2.00	\$5,000	
		PWFn = 0.5537			PW = 0.5537 X	\$37,415	\$20,716
YEAR 25							
	PAVEMENT PATCH CLASS B	3.00%	200	SQ YD	\$150.00	\$30,000	
	SHOULDER PATCH CLASS C	1.00%	33	SQ YD	\$145.00	\$4,785	
		PWFn = 0.4776			PW = 0.4776 X	\$34,785	\$16,614
YEAR 30							
	NON-INTERSTATE						
	PAVEMENT PATCH CLASS B	4.00%	267	SQ YD	\$150.00	\$40,050	
	SHOULDER PATCH CLASS C	1.50%	50	SQ YD	\$145.00	\$7,250	
	HMA POLICY OVERLAY 2.5" (PVMT)	100.00%	6,667	SQ YD	\$13.40	\$89,305	
	HMA POLICY OVERLAY 2.5" (SHLD)	100.00%	3,333	SQ YD	\$11.07	\$36,885	
		PWFn = 0.4120			PW = 0.4120 X	\$173,490	\$71,476
YEAR 35							
	NON-INTERSTATE						
	LONGITUDINAL SHLD JT R&S	100.00%	5,000	LIN FT	\$2.00	\$10,000	
	CENTERLINE JT R&S	100.00%	2,500	LIN FT	\$2.00	\$5,000	
	RANDOM CRACK R&S	50.00%	2,500	LIN FT	\$2.00	\$5,000	
	REFLECTIVE TRANSVERSE CRACK R&S	40.00%	1,603	LIN FT	\$2.00	\$3,206	
	PD PVMT PATCH M&F HMA 2.50"	0.10%	7	SQ YD	\$84.21	\$589	
		PWFn = 0.3554			PW = 0.3554 X	\$23,795	\$8,456
YEAR 40							
	NON-INTERSTATE						
	PAVEMENT PATCH CLASS B	0.50%	33	SQ YD	\$150.00	\$4,950	
	LONGITUDINAL SHLD JT R&S	100.00%	5,000	LIN FT	\$2.00	\$10,000	
	CENTERLINE JT R&S	100.00%	2,500	LIN FT	\$2.00	\$5,000	
	REFLECTIVE TRANSVERSE CRACK R&S	60.00%	2,405	LIN FT	\$2.00	\$4,810	
	RANDOM CRACK R&S	50.00%	2,500	LIN FT	\$2.00	\$5,000	
	PD PVMT PATCH M&F HMA 2.50"	0.50%	33	SQ YD	\$84.21	\$2,779	
		PWFn = 0.3066			PW = 0.3066 X	\$32,539	\$9,975
							\$129,270
	ROUTINE MAINTENANCE ACTIVITY		0.95	Lane Miles	\$0.00	\$0	\$0
							MAINTENANCE LIFE-CYCLE COST \$129,270
45	YEAR LIFE CYCLE	CRFn = 0.0407852					MAINTENANCE ANNUAL COST PER MILE \$11,135

LIFE-CYCLE COST ANALYSIS: NEW DESIGN

Calculated / Revised : 12/18/14 8:49 AM

			JPCP	HMA
CONSTRUCTION	INITIAL COST	PRESENT WORTH	\$769,981	\$632,431
		ANNUAL COST PER MILE	\$66,325	\$54,477
MAINTENANCE	LIFE-CYCLE COST	PRESENT WORTH	\$129,270	\$228,290
		ANNUAL COST PER MILE	\$11,135	\$19,665
TOTAL	LIFE-CYCLE COST	PRESENT WORTH	\$899,251	\$860,721
		ANNUAL COST PER MILE	\$77,460	\$74,141

LIFE-CYCLE COST ANALYSIS: FINAL SUMMARY

LOWEST COST OPTION	=====>	HMA	\$74,141	
OTHER OPTIONS (LOWEST TO HIGHEST):	TYPE / PERCENTAGE	JPCP	\$77,460	4.5%