Illinois Department of Transportation

To:	Jeffrey Keirn	Attn: District Nine
From:	John Baranzelli	
Subject:	Pavement Design	
Date:	June 24, 2014	

FAI Route 57 (I-57)
Section (44-1-1, 44-1)R-2;(91-3)R-3
Union & Johnson Counties
From the Johnson CL to Lick Creek

We have reviewed the pavement selection for the above captioned section, which was submitted with your memorandum dated June 12, 2014. The Life Cycle Cost Analysis favored a rubblized design for the new pavement construction. Full depth HMA pavement will be provided at the overpass sections to maintain a 16' clearance. The approved pavement design is as follows:

I-57 [NB & SB][Pavement Rubblization]

11.75 inches Full Depth HMA with HMA Shoulders
- 2 inches of HMA Polymerized Surface Course, Mix "E", N105
- 2.25 inches of HMA Polymerized Binder Course, N105, IL-19.0
- 7.5 inches of HMA Binder Course, N90, IL-19.0

8.5 inches HMA Shoulders
On Rubblized Pavement

I-57 [NB & SB][Pavement Construction at Overpass Locations]

16.25 inches Full Depth HMA with HMA Shoulders
- 2 inches of HMA Polymerized Surface Course, Mix "E", N105
- 2.25 inches of HMA Polymerized Binder Course, N105, IL-19.0
- 12 inches of HMA Binder Course, N90, IL-19.0

8.5 inches HMA Shoulders
12 inches of Aggregate Subgrade Improvement

The existing pipe underdrain system will be replaced as part of the projects.

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

Illinois Department of Transportation

Memorandum

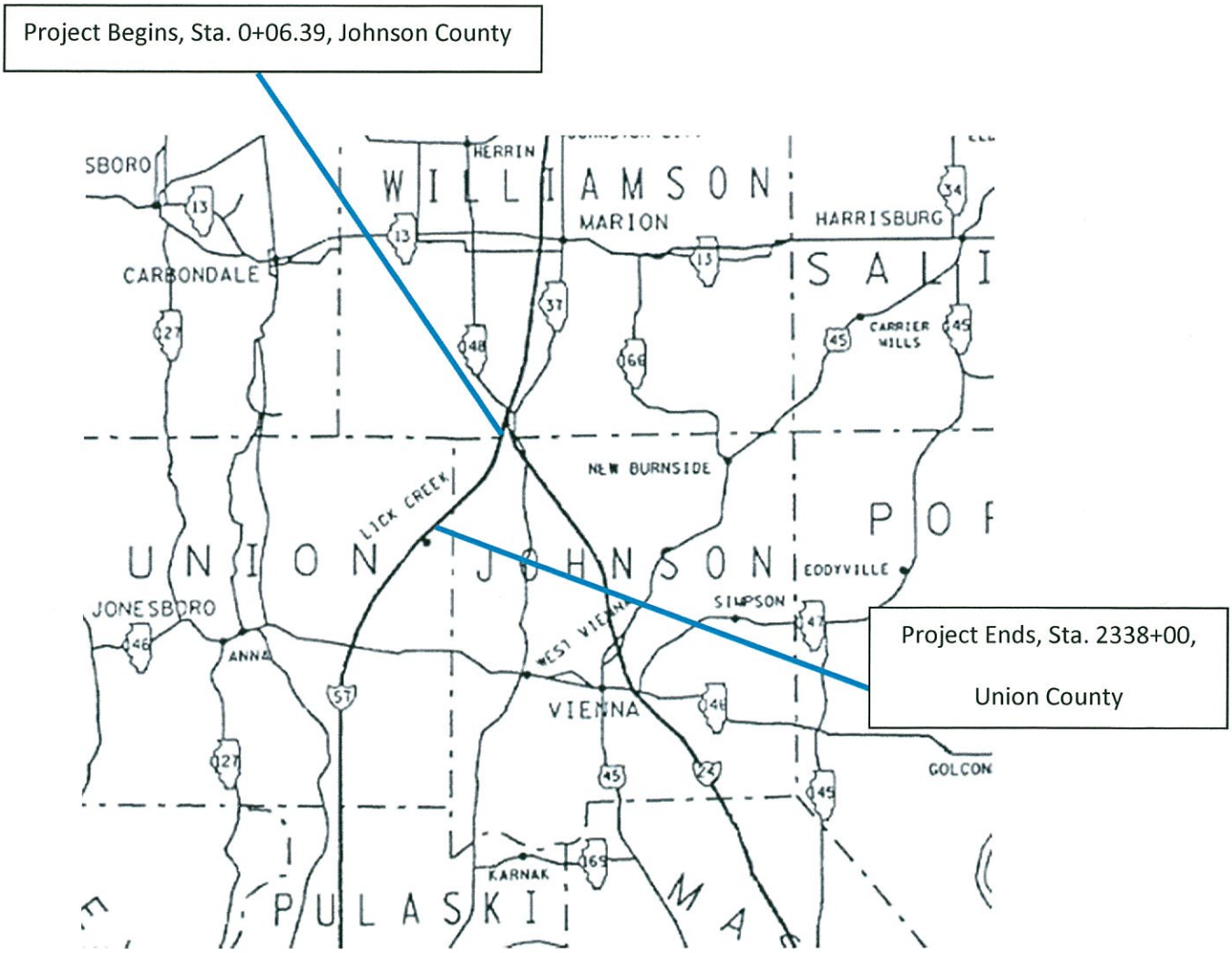
To:	Paul Niedernhofer
From:	Charles Stein
Subject:	Pavement Design
Date:	June 12, 2014

Route	FAI 57 (I-57)
Section	(44-1-1, 44-1) R-2;(91-3)R-3
County	Johnson and Union
Contract	78439

This project involves rubblizing 6.25 miles of the existing HMA overlaid PCC pavement on I 57 from the Johnson County line to the Lick Creek interchange (see attached map). The project is scheduled for the September 2015 letting. The original PCC pavement was built in the 1960's, and resurfaced in 1999. The existing pipe underdrain system will be replaced as part of the project. The district proposes to rubblize the existing PCC pavement and place 11.75" of HMA pavement on the rubblized pavement, as well as inlay 16.25" of full depth HMA pavement in the overpass sections in order to maintain a 16' clearance. The mechanistic pavement design and life cycle cost analysis are attached.

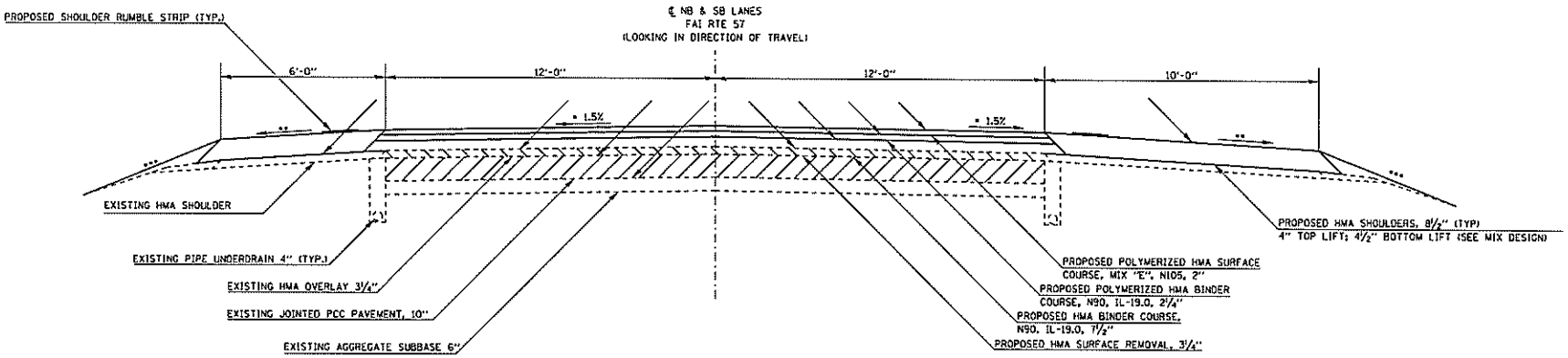
Location Map

I-57 Rubblization



TYPICAL SECTION #1
MILL AND RUBBLIZE

UNION/JOHNSON COUNTIES
NORTHBOUND AND SOUTHBOUND LANES
FAI ROUTE 57



TO BE USED:

JOHNSON COUNTY: STA 0+06.39 TO 224+40.74 NB LANES
STA 0+06.39 TO 224+40.74 SB LANES

UNION COUNTY: STA 2232+74.28 TO 2308+91.78 NB LANES
STA 2311+29.90 TO 2338+00 NB LANES
STA 2232+74.28 TO 2308+91.78 SB LANES
STA 2311+29.90 TO 2338+00 SB LANES

PROPOSED RUBBLIZATION OF PORTLAND CEMENT CONCRETE PAVEMENT, METHOD 1

PROPOSED HOT-MIX ASPHALT SURFACE REMOVAL, 3¼"

NOTES:

- * 1.5% PAVEMENT CROSS SLOPE TO BE ACHIEVED WITH HOT-MIX ASPHALT BINDER COURSE
- ** MATCH EXISTING SHOULDR SLOPE UP TO 6% MAXIMUM
- *** GRADING AND SHAPING SHOULDERS
  POLYMERIZED PRIME COAT MUST BE USED BETWEEN ALL LIFTS OF HOT-MIX ASPHALT BINDER SHALL BE PLACED IN THREE LIFTS: 4" - 3½" - 2¼"

FILE NAME :	USER NAME = Dehmerje	DESIGNED -	REVISED -	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION	TYPICAL SECTION	F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS / SHEET NO.
		DRAWN -	REVISED -						
	PLOT SCALE = 4.0000 ' / in.	CHECKED -	REVISED -					CONTRACT NO. 78439	
Default	PLOT DATE = 6/12/2014	DATE -	REVISED -		SCALE: SHEET OF SHEETS STA. TO STA.			ILLINOIS FED. AID PROJECT	

BDE 5401 Template (Rev. 09/05/2013)

IDOT MECHANISTIC PAVEMENT DESIGN

Printed: 08/12/2014

PROJECT AND TRAFFIC INPUTS

(Enter Data in Gray Shaded Cells)

Route: I-57 (FAI 57)
Section: (44-1-1, 44-1)R-2;(91-3)R-3
County: Union & Johnson
Location: I-24 to Lick Creek interchange

Comments:

Design Date: 06/10/2014 CWS <-- BY
Modify Date: <-- BY

	ADT	Year
Current:	-	-
Future:	-	-

Facility Type: Interstate or Freeway

# of Lanes = 4

Road Class: I

Subgrade Support Rating (SSR): Poor
Construction Year: 2015
Design Period (DP) = 20 years

	Minimum ADT	Structural Design Traffic: Actual ADT	Actual %of Total ADT	% of ADT in Design Lane	
PV =	0	8,650	60.4%	P =	32%
SU =	500	535	3.7%	S =	45%
MU =	1500	5,125	35.8%	M =	45%
Struct. Design ADT =		14,310	(2025)		

TRAFFIC FACTOR CALCULATION

FLEXIBLE PAVEMENT

Cpv =	0.15	
Csu =	132.5	
Cmu =	482.53	
TF flexible (Actual) =	22.90	(Actual ADT)
TF flexible (Min) =	7.11	(Min ADT Fig. 54-2.C)

RIGID PAVEMENT

Cpv =	0.15	
Csu =	143.81	
Cmu =	696.42	
TF rigid (Actual) =	32.82	(Actual ADT)
TF rigid (Min) =	10.05	(Min ADT Fig. 54-2.C)

NEW CONSTRUCTION / RECONSTRUCTION PAVEMENT DESIGN CALCULATIONS

Full-Depth HMA Pavement

Use TF flexible =	22.90	
PG Grade Lower Binder Lifts =	PG 64-22	(Fig. 53-4.R)
HMA Mixture Temp. =	81.0	deg. F (Fig. 54-5.C)
Design HMA Mixture Modulus (E_{HMA}) =	530	ksi (Fig. 54-5.D)
Design HMA Strain (ε_{HMA}) =	49	(Fig. 54-5.E)
Full Depth HMA Design Thickness =	16.25	in. (Fig. 54-5.F)
Limiting Strain Criterion Thickness =	17.00	in. (Fig. 54-5.I)
Use Full-Depth HMA Thickness =	**16.25**	**inches**

Goto Map

Goto Map

JPC Pavement

Use TF rigid =	32.82	
Edge Support =	Tied	Shoulder or C.&G.
Rigid Pavt Thick. =	**10.75**	**in. (Fig. 54-4.E)**

CRC Pavement

Use TF rigid =	32.82	
IBR value =	3	
CRCP Thickness =	**10.75**	**in. (Fig. 54-4.M)**

TF MUST BE > 60 FOR CRCP

RECONSTRUCTION ONLY (SUPPLEMENTAL) PAVEMENT DESIGN CALCULATIONS

HMA Overlay of Rubblized PCC

Use TF flexible =	22.90	
HMA Overlay Design Thickness =	12.75	in. (Fig. 54-5.U)
Limiting Strain Criterion Thickness =	11.75	in. (Fig. 54-5.V)
Use HMA Overlay Thickness =	**11.75**	**inches**

Goto Map

Unbonded Concrete Overlay

Review 54-4.03 for limitations and special considerations.

JPCP Thickness = NA 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%

BDE 5401 Template (Rev. 09/05/2013) Printed: 08/12/2014

LIFE-CYCLE COST ANALYSIS: NEW CONSTRUCTION / RECONSTRUCTION

FULL-DEPTH HMA PAVEMENT

Standard Design

ROUTE	I-57 (FAI 57)
SECTION	(44-1-1, 44-1)R-2;(91-3)R-3
COUNTY	Union & Johnson
LOCATION	I-24 to Lick Creek interchange

FACILITY TYPE: INTERSTATE

PROJECT LENGTH		33000 FT	==> 6.25 Miles
# OF CENTERLINES		2 CL	
# OF LANES		4 LANES	
# OF EDGES		4 EP	
LANE WIDTH - AVERAGE		12 FT	
SHOULDER WIDTH	HMA Inside	6 FT	
	HMA Outside	10 FT	
	Total Width of Paved Shoulders	32 FT	

PAVEMENT THICKNESS (FLEXIBLE)	16.25 IN	17.00 IN MAX
SHOULDER THICKNESS	8.00 IN	HMA_SD Standard Design
POLICY OVERLAY THICKNESS	3.75 IN	

FLEX PAVEMENT TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
	7.11	22.90	22.90

Read Me!

HMA COST PER TON	UNIT PRICE
HMA SURFACE	$82.00 / TON
HMA TOP BINDER	$71.00 / TON
HMA LOWER BINDER	$66.00 / TON
HMA BINDER (LEVELING)	$0.00 / TON
HMA SHOULDER	$73.00 / TON

INITIAL COSTS

ITEM	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE		COST	
HMA PAVEMENT (FULL-DEPTH)	(16.25")	176,000	SQ YD	$65.90	/ SQ YD	$11,597,858	~
HMA SURFACE COURSE	(2.00")	19,849	TONS	$82.00	/ TON	$0	
HMA TOP BINDER COURSE	(2.25")	22,657	TONS	$71.00	/ TON	$0	
HMA LOWER BINDER COURSE	(12.00")	126,691	TONS	$66.00	/ TON	$0	
HMA SHOULDER	(8.00")	52,565	TONS	$73.00	/ TON	$3,837,269	~
CURB & GUTTER		0	LIN FT	$0.00	/ LIN FT	$0	
SUBBASE GRAN MATL TY C (TONS)		45,828	TONS	$28.00	/ TON	$1,283,184	
IMPROVED SUBGRADE:	Modified Soil	320,528	SQ YD	$3.00	/ SQ YD	$961,584	
Reserved For User Supplied Item		0	UNITS	$0.00	/ UNITS	$0	
Reserved For User Supplied Item		0	UNITS	$0.00	/ UNITS	$0	
PAVEMENT REMOVAL		176,000	SQ YD	$8.00	/ SQ YD	$1,408,000	
SHOULDER REMOVAL		117,333	SQ YD	$5.00	/ SQ YD	$586,665	

Note: * Denotes User Supplied Quantity

FLEXIBLE CONSTRUCTION INITIAL COST	$19,674,560
FLEXIBLE CONSTRUCTION ANNUAL COST PER MILE	$128,389

MAINTENANCE COSTS:

ITEM	THICKNESS	MATERIAL	UNIT COST	
ROUTINE MAINTENANCE ACTIVITY			$0.00	LANE-MILE / YEAR
HMA OVERLAY PVMT SURF	(2.00")	Surface Mix	$9.25	/ SQ YD
HMA OVERLAY PVMT	(3.75")		$16.03	/ SQ YD
HMA SURFACE MIX	(1.50")	Surface Mix	$6.92	/ SQ YD
HMA BINDER MIX	(2.25")	Top Binder Mix	$9.11	/ SQ YD
HMA OVERLAY SHLD (Year 30)	(1.75")	Shoulder Mix	$7.15	/ SQ YD
HMA OVERLAY SHLD	(2.00")	Shoulder Mix	$8.18	/ SQ YD
MILLING (2.00 IN)			$3.00	/ SQ YD
PARTIAL DEPTH PVMT PATCH	(Mill & Fill Surf)	Surface Mix	$79.18	/ SQ YD
PARTIAL DEPTH SHLD PATCH	(Mill & Fill Surf)	Shoulder Mix	$78.18	/ SQ YD
PARTIAL DEPTH PVMT PATCH	(Mill & Fill +2.00 ")	Leveling Binder Mix	$70.00	/ SQ YD
PARTIAL DEPTH SHLD PATCH	(Mill & Fill +2.00 ")	Shoulder Mix	$78.18	/ 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	$25,761,215
FLEXIBLE TOTAL ANNUAL COST PER MILE	$168,108

HMA_SD

MAINTENANCE AND REHABILITATION ACTIVITY SCHEDULE

08/12/14

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%	132,000	LIN FT	$2.00		$264,000	
	CNTR LINE JOINT R&S	100.00%	66,000	LIN FT	$2.00		$132,000	
	RNDM / THRM CRACK R&S	50.00%	72,600	LIN FT	$2.00		$145,200	
	PD PVMT PATCH M&F SURF	0.10%	176	SQ YD	$79.18		$13,936	
	PWFn =	0.8626		PW =	0.8626	X	$555,136	$478,865
YEAR 10								
	LONG SHLD JT R&S	100.00%	132,000	LIN FT	$2.00		$264,000	
	CNTR LINE JOINT R&S	100.00%	66,000	LIN FT	$2.00		$132,000	
	RNDM / THRM CRACK R&S	50.00%	72,600	LIN FT	$2.00		$145,200	
	PD PVMT PATCH M&F SURF	0.50%	880	SQ YD	$79.18		$69,682	
	PWFn =	0.7441		PW =	0.7441	X	$610,882	$454,554
YEAR 15								
	MILL PVMT & SHLD 2.00"	100.00%	293,333	SQ YD	$3.00		$879,999	
	PD PVMT PATCH M&F ADD'L 2.00"	1.00%	1,760	SQ YD	$70.00		$123,200	
	HMA OVERLAY PVMT 2.00"	100.00%	176,000	SQ YD	$9.25		$1,627,609	
	HMA OVERLAY SHLD 2.00 "	100.00%	117,333	SQ YD	$8.18		$959,317	
	PWFn =	0.6419		PW =	0.6419	X	$3,590,125	$2,304,365
YEAR 20								
	LONG SHLD JT R&S	100.00%	132,000	LIN FT	$2.00		$264,000	
	CNTR LINE JOINT R&S	100.00%	66,000	LIN FT	$2.00		$132,000	
	RNDM / THRM CRACK R&S	50.00%	72,600	LIN FT	$2.00		$145,200	
	PD PVMT PATCH M&F SURF	0.10%	176	SQ YD	$79.18		$13,936	
	PWFn =	0.5537		PW =	0.5537	X	$555,136	$307,365
YEAR 25								
	LONG SHLD JT R&S	100.00%	132,000	LIN FT	$2.00		$264,000	
	CNTR LINE JOINT R&S	100.00%	66,000	LIN FT	$2.00		$132,000	
	RNDM / THRM CRACK R&S	50.00%	72,600	LIN FT	$2.00		$145,200	
	PD PVMT PATCH M&F SURF	0.50%	880	SQ YD	$79.18		$69,682	
	PWFn =	0.4776		PW =	0.4776	X	$610,882	$291,761
	HMA_SD							
YEAR 30	INTERSTATE							
	MILL PVMT ONLY 2.00"	100.00%	176,000	SQ YD	$3.00		$528,000	
	PD PVMT PATCH M&F ADD'L 2.00"	2.00%	3,520	SQ YD	$70.00		$246,400	
	PD SHLD PATCH M&F SURF 2.00"	1.00%	1,173	SQ YD	$78.18		$91,700	
	HMA OVERLAY PVMT 3.75 "	100.00%	176,000	SQ YD	$16.03		$2,821,800	
	HMA OVERLAY SHLD 1.75 "	100.00%	117,333	SQ YD	$7.15		$839,403	
	PWFn =	0.4120		PW =	0.4120	X	$4,527,303	$1,865,189
YEAR 35								
	LONG SHLD JT R&S	100.00%	132,000	LIN FT	$2.00		$264,000	
	CNTR LINE JOINT R&S	100.00%	66,000	LIN FT	$2.00		$132,000	
	RNDM / THRM CRACK R&S	50.00%	72,600	LIN FT	$2.00		$145,200	
	PD PVMT PATCH M&F SURF	0.10%	176	SQ YD	$79.18		$13,936	
	PWFn =	0.3554		PW =	0.3554	X	$555,136	$197,286
YEAR 40								
	LONG SHLD JT R&S	100.00%	132,000	LIN FT	$2.00		$264,000	
	CNTR LINE JOINT R&S	100.00%	66,000	LIN FT	$2.00		$132,000	
	RNDM / THRM CRACK R&S	50.00%	72,600	LIN FT	$2.00		$145,200	
	PD PVMT PATCH M&F SURF	0.50%	880	SQ YD	$79.18		$69,682	
	PWFn =	0.3066		PW =	0.3066	X	$610,882	$187,270
								$6,086,655
	ROUTINE MAINTENANCE ACTIVITY		25.00	Lane Miles	0.00		$0	$0
					MAINTENANCE LIFE-CYCLE COST			$6,086,655
45	YEAR LIFE CYCLE	CRFn = 0.0407852			MAINTENANCE ANNUAL COST PER MILE			$39,719

PCC PAVEMENT

JPCP

ROUTE	I-57 (FAI 57)
SECTION	(44-1-1, 44-1)R-2;(91-3)R-3
COUNTY	Union & Johnson
LOCATION	I-24 to Lick Creek interchange
FACILITY TYPE	INTERSTATE

PROJECT LENGTH		33000 FT	= = >	6.25 Miles
# OF CENTERLINES		2 CL		
# OF LANES		4 LANES		
# OF EDGES		4 EP		
LANE WIDTH - AVERAGE		12 FT		
SHOULDER WIDTH	PCC Inside	6 FT		
	PCC Outside	10 FT		
	Total Width of Paved Shoulders	32 FT		

PAVEMENT THICKNESS (RIGID)	JPCP	10.75 IN	TIED SHLD
SHOULDER THICKNESS		10.75 IN	
POLICY OVERLAY THICKNESS		3.75 IN	

RIGID PAVEMENT TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
	10.05	32.82	32.82
Worksheet Construction Type is Reconstruction		The Pavement Type is	JPCP

INITIAL COSTS

ITEM	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE		COST
JPC PAVEMENT	(10.75")	176,000	SQ YD	$43.00	/ SQ YD	$7,568,000
PAVEMENT REINFORCEMENT		0	SQ YD	$30.00	/ SQ YD	$0
STABILIZED SUBBASE	(4.00")	198,000	SQ YD	$21.00	/ SQ YD	$4,158,000
PCC SHOULDERS	(10.75" to 10.75")	117,333	SQ YD	$40.00	/ SQ YD	$4,693,320
CURB & GUTTER		0	LIN FT	$0.00	/ LIN FT	$0
SUBBASE GRAN MATL TY C	(~ 3.46")	13,806	TONS	$28.00	/ TON	$386,568
IMPROVED SUBGRADE:	Modified Soil Width = 52.0'	300,667	SQ YD	$3.00	/ SQ YD	$902,001
Reserved For User Supplied Item		0	UNITS	$0.00	/ UNITS	$0
Reserved For User Supplied Item		0	UNITS	$0.00	/ UNITS	$0
PAVEMENT REMOVAL		176,000	SQ YD	$8.00	/ SQ YD	$1,408,000
SHOULDER REMOVAL		117,333	SQ YD	$5.00	/ SQ YD	$586,665

Note: * Denotes User Supplied Quantity

RIGID CONSTRUCTION INITIAL COST	$19,702,554
RIGID CONSTRUCTION ANNUAL COST PER MILE	$128,572

MAINTENANCE COSTS:

ITEM	THICKNESS	MATERIAL	T	UNIT COST	
ROUTINE MAINTENANCE ACTIVITY				$0.00	/ LANE-MILE / YEAR
HMA POLICY OVERLAY	(3.75")		3.75		
HMA POLICY OVERLAY PVMT	(3.75")	1.9130	3.75	$16.03	/ SQ YD
HMA SURFACE MIX	(1.50")	1.0052	1.50	$6.92	/ SQ YD
HMA BINDER MIX	(2.25")	1.0182	2.25	$9.11	/ SQ YD
HMA POLICY OVERLAY SHLD	(3.75")	Shoulder Mix	3.75	$15.33	/ SQ YD
CLASS A PAVEMENT PATCHING				$195.00	/ SQ YD
CLASS B PAVEMENT PATCHING				$150.00	/ SQ YD
CLASS C SHOULDER PATCHING				$145.00	/ SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill HMA Surf)		Surface Mix	1.50	$76.89	/ SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill HMA 1.50")		Surface Mix	1.50	$76.89	/ SQ YD
LONGITUDINAL SHOULDER JOINT ROUT & SEAL				$2.00	/ LIN FT
CENTERLINE JOINT ROUT & SEAL				$2.00	/ LIN FT
REFLECTIVE TRANSVERSE CRACK ROUT & SEAL				$2.00	/ LIN FT
RANDOM CRACK ROUT & SEAL	(100% Rehab = 100.00' / Station / Lane)			$2.00	/ LIN FT

RIGID TOTAL LIFE-CYCLE COST	$23,702,488
RIGID TOTAL ANNUAL COST PER MILE	$154,674

MAINTENANCE AND REHABILITATION ACTIVITY SCHEDULE 08/12/14

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%	176	SQ YD	$150.00		$26,400	
	PWFn =	0.7441		PW =	0.7441	X	$26,400	$19,644
YEAR 15								
	PAVEMENT PATCH CLASS B	0.20%	352	SQ YD	$150.00		$52,800	
	PWFn =	0.6419		PW =	0.6419	X	$52,800	$33,890
YEAR 20								
	PAVEMENT PATCH CLASS B	2.00%	3,520	SQ YD	$150.00		$528,000	
	SHOULDER PATCH CLASS C	0.50%	587	SQ YD	$145.00		$85,115	
	LONGITUDINAL SHLD JT R&S	100.00%	132,000	LIN FT	$2.00		$264,000	
	CENTERLINE JT R&S	100.00%	66,000	LIN FT	$2.00		$132,000	
	PWFn =	0.5537		PW =	0.5537	X	$1,009,115	$558,723
YEAR 25								
	PAVEMENT PATCH CLASS B	3.00%	5,280	SQ YD	$150.00		$792,000	
	SHOULDER PATCH CLASS C	1.00%	1,173	SQ YD	$145.00		$170,085	
	PWFn =	0.4776		PW =	0.4776	X	$962,085	$459,497
YEAR 30	INTERSTATE							
	PAVEMENT PATCH CLASS B	4.00%	7,040	SQ YD	$150.00		$1,056,000	
	SHOULDER PATCH CLASS C	1.50%	1,760	SQ YD	$145.00		$255,200	
	HMA POLICY OVERLAY 3.75" (PVMT)	100.00%	176,000	SQ YD	$16.03		$2,821,800	
	HMA POLICY OVERLAY 3.75" (SHLD)	100.00%	117,333	SQ YD	$15.33		$1,798,720	
	PWFn =	0.4120		PW =	0.4120	X	$5,931,720	$2,443,790
YEAR 35	INTERSTATE							
	LONGITUDINAL SHLD JT R&S	100.00%	132,000	LIN FT	$2.00		$264,000	
	CENTERLINE JT R&S	100.00%	66,000	LIN FT	$2.00		$132,000	
	RANDOM CRACK R&S	50.00%	66,000	LIN FT	$2.00		$132,000	
	REFLECTIVE TRANSVERSE CRACK R&S	40.00%	42,240	LIN FT	$2.00		$84,480	
	PD PVMT PATCH M&F HMA SURF 1.50"	0.10%	176	SQ YD	$76.89		$13,532	
	PWFn =	0.3554		PW =	0.3554	X	$626,012	$222,474
YEAR 40	INTERSTATE							
	PAVEMENT PATCH CLASS B	0.50%	880	SQ YD	$150.00		$132,000	
	LONGITUDINAL SHLD JT R&S	100.00%	132,000	LIN FT	$2.00		$264,000	
	CENTERLINE JT R&S	100.00%	66,000	LIN FT	$2.00		$132,000	
	REFLECTIVE TRANSVERSE CRACK R&S	60.00%	63,360	LIN FT	$2.00		$126,720	
	RANDOM CRACK R&S	50.00%	66,000	LIN FT	$2.00		$132,000	
	PD PVMT PATCH M&F HMA SURF 1.50"	0.50%	880	SQ YD	$76.89		$67,661	
	PWFn =	0.3066		PW =	0.3066	X	$854,381	$261,916
								$3,999,934
	ROUTINE MAINTENANCE ACTIVITY		25.00	Lane Miles	$0.00		$0	$0
					MAINTENANCE LIFE-CYCLE COST			$3,999,934
45	YEAR LIFE CYCLE	CRFn = 0.0407852			MAINTENANCE ANNUAL COST PER MILE			$26,102

RECONSTRUCTION - HMA OVER RUBBLIZED PAVEMENT

PAVEMENT OVERLAY THICKNESS (FLEXIBLE)	11.75 IN	11.75 IN MAX	HMA_LSCD	Maintenance Schedule
SHOULDER OVERLAY THICKNESS	5.75 IN			

INITIAL COSTS

ITEM	THICKNESS		100% QUANTITY	UNIT	UNIT PRICE		COST	
HMA OVERLAY REMOVAL	6.00		176,000	SQ YD	$8.00	/ SQ YD	$1,408,000	
RUBBLIZING PCC PAVEMENT			176,000	SQ YD	$2.10	/ SQ YD	$369,600	
HMA OVERLAY (TOTAL)	11.75		176,000	SQ YD	$47.65	/ SQ YD	$8,386,034	~
HMA SURFACE COURSE	2.00	1.0069	176,000	SQ YD	$9.25	/ SQ YD	$0	
HMA TOP BINDER COURSE	2.25	1.0217	176,000	SQ YD	$9.14	/ SQ YD	$0	
HMA LOWER BINDER COURSE	7.50	1.0586	176,000	SQ YD	$29.26	/ SQ YD	$0	
HMA SHOULDER	5.75		37,781	TONS	$73.00	/ TON	$2,758,037	~
Reserved For User Supplied Item			0	UNITS	$0.00	/ UNITS	$0	
Reserved For User Supplied Item			0	UNITS	$0.00	/ UNITS	$0	
EARTHWORK			0	CU YD	$0.00	/ CU YD	$0	

Note: * Denotes User Supplied Quantity

RUBBLIZED CONSTRUCTION INITIAL COST	$12,921,671
RUBBLIZED CONSTRUCTION ANNUAL COST PER MILE	$84,322

MAINTENANCE COSTS:

If the maintenance schedule used here (HMA_LSCD) is different than the maintenance schedule used above (HMA_SD), additional information may be needed. Please supply the additional maintenance costs below if different than the default costs supplied.

HMA OVERLAY PVMT		(2.00")	1.0069		2.00	$82.00	/ TON
HMA SURFACE MIX		(2.00")	1.0069	Surface Mix	2.00	$82.00	/ TON
HMA BINDER MIX		(0.00")	1.0139	Top Binder Mix	0.00	$71.00	/ TON
HMA OVERLAY SHLD	(Year 30)	(2.00")		Shoulder Mix	2.00	$73.00	/ TON

RUBBLIZED MAINTENANCE LIFE-CYCLE COST	$5,789,086
RUBBLIZED MAINTENANCE ANNUAL COST PER MILE	$37,777

RUBBLIZED TOTAL LIFE-CYCLE COST	$18,710,757
RUBBLIZED TOTAL ANNUAL COST PER MILE	$122,099

RECONSTRUCTION - PCC UNBONDED OVERLAY

HMA_LSCD

MAINTENANCE AND REHABILITATION ACTIVITY SCHEDULE

08/12/14

FULL-DEPTH HMA PAVEMENT
HMA OVERLAY OF RUBBLIZED PCC PAVEMENT
Figure 54-7.C
LIMITING STRAIN CRITERION DESIGN

MAINTENANCE COSTS:	ITEM	%	QUANTITY	UNIT	UNIT COST		COST	PRESENT WORTH
YEAR 5								
	LONG SHLD JT R&S	100.00%	132,000	LIN FT	$2.00		$264,000	
	CNTR LINE JOINT R&S	100.00%	66,000	LIN FT	$2.00		$132,000	
	RNDM / THRM CRACK R&S	50.00%	72,600	LIN FT	$2.00		$145,200	
	PD PVMT PATCH M&F SURF	0.10%	176	SQ YD	$79.18		$13,936	
	PWFn =	0.8626		PW =	0.8626	X	$555,136	$478,865
YEAR 10								
	LONG SHLD JT R&S	100.00%	132,000	LIN FT	$2.00		$264,000	
	CNTR LINE JOINT R&S	100.00%	66,000	LIN FT	$2.00		$132,000	
	RNDM / THRM CRACK R&S	50.00%	72,600	LIN FT	$2.00		$145,200	
	PD PVMT PATCH M&F SURF	0.50%	880	SQ YD	$79.18		$69,682	
	PWFn =	0.7441		PW =	0.7441	X	$610,882	$454,554
YEAR 15								
	MILL PVMT & SHLD 2.00"	100.00%	293,333	SQ YD	$3.00		$879,999	
	PD PVMT PATCH M&F ADD'L 2.00"	1.00%	1,760	SQ YD	$70.00		$123,200	
	HMA OVERLAY PVMT 2.00"	100.00%	176,000	SQ YD	$9.25		$1,627,609	
	HMA OVERLAY SHLD 2.00 "	100.00%	117,333	SQ YD	$8.18		$959,317	
	PWFn =	0.6419		PW =	0.6419	X	$3,590,125	$2,304,365
YEAR 20								
	LONG SHLD JT R&S	100.00%	132,000	LIN FT	$2.00		$264,000	
	CNTR LINE JOINT R&S	100.00%	66,000	LIN FT	$2.00		$132,000	
	RNDM / THRM CRACK R&S	50.00%	72,600	LIN FT	$2.00		$145,200	
	PD PVMT PATCH M&F SURF	0.10%	176	SQ YD	$79.18		$13,936	
	PWFn =	0.5537		PW =	0.5537	X	$555,136	$307,365
YEAR 25								
	LONG SHLD JT R&S	100.00%	132,000	LIN FT	$2.00		$264,000	
	CNTR LINE JOINT R&S	100.00%	66,000	LIN FT	$2.00		$132,000	
	RNDM / THRM CRACK R&S	50.00%	72,600	LIN FT	$2.00		$145,200	
	PD PVMT PATCH M&F SURF	0.50%	880	SQ YD	$79.18		$69,682	
	PWFn =	0.4776		PW =	0.4776	X	$610,882	$291,761
	HMA_SD							
YEAR 30	INTERSTATE							
	MILL PVMT & SHLD 2.00"	100.00%	293,333	SQ YD	$3.00		$879,999	
	PD PVMT PATCH M&F ADD'L 2.00"	2.00%	3,520	SQ YD	$70.00		$246,400	
	PD SHLD PATCH M&F ADD'L 2.00"	1.00%	1,173	SQ YD	$78.18		$91,700	
	HMA OVERLAY PVMT 2.00"	100.00%	19,849	TON	$82.00		$1,627,609	
	HMA OVERLAY SHLD 2.00 "	100.00%	13,141	TON	$73.00		$959,317	
	PWFn =	0.4120		PW =	0.4120	X	$3,805,025	$1,567,620
YEAR 35								
	LONG SHLD JT R&S	100.00%	132,000	LIN FT	$2.00		$264,000	
	CNTR LINE JOINT R&S	100.00%	66,000	LIN FT	$2.00		$132,000	
	RNDM / THRM CRACK R&S	50.00%	72,600	LIN FT	$2.00		$145,200	
	PD PVMT PATCH M&F SURF	0.10%	176	SQ YD	$79.18		$13,936	
	PWFn =	0.3554		PW =	0.3554	X	$555,136	$197,286
YEAR 40								
	LONG SHLD JT R&S	100.00%	132,000	LIN FT	$2.00		$264,000	
	CNTR LINE JOINT R&S	100.00%	66,000	LIN FT	$2.00		$132,000	
	RNDM / THRM CRACK R&S	50.00%	72,600	LIN FT	$2.00		$145,200	
	PD PVMT PATCH M&F SURF	0.50%	880	SQ YD	$79.18		$69,682	
	PWFn =	0.3066		PW =	0.3066	X	$610,882	$187,270
								$5,789,086
	ROUTINE MAINTENANCE ACTIVITY		25.00	Lane Miles	0.00		0	$0
					MAINTENANCE LIFE-CYCLE COST			$5,789,086
45	YEAR LIFE CYCLE	CRFn = 0.0407852			MAINTENANCE ANNUAL COST PER MILE			$37,777

LIFE-CYCLE COST ANALYSIS: NEW DESIGN

Calculated / Revised : 6/10/14 8:04 AM

			JPCP	HMA
CONSTRUCTION	INITIAL COST	PRESENT WORTH	$19,702,554	$19,674,560
		ANNUAL COST PER MILE	$128,572	$128,389
MAINTENANCE	LIFE-CYCLE COST	PRESENT WORTH	$3,999,934	$6,086,655
		ANNUAL COST PER MILE	$26,102	$39,719
TOTAL	LIFE-CYCLE COST	PRESENT WORTH	$23,702,488	$25,761,215
		ANNUAL COST PER MILE	$154,674	$168,108

LIFE-CYCLE COST ANALYSIS: SUPPLEMENTAL DESIGNS

			PCC Unbonded	Rubblized
CONSTRUCTION	INITIAL COST	PRESENT WORTH	$14,666,652	$12,921,671
		ANNUAL COST PER MILE	$95,709	$84,322
MAINTENANCE	LIFE-CYCLE COST	PRESENT WORTH	$3,999,934	$5,789,086
		ANNUAL COST PER MILE	$26,102	$37,777
TOTAL	LIFE-CYCLE COST	PRESENT WORTH	$18,666,586	$18,710,757
		ANNUAL COST PER MILE	$99,999,999	$122,099

LIFE-CYCLE COST ANALYSIS: FINAL SUMMARY

LOWEST COST OPTION	==========>	**Rubblized**	**$122,099**	
OTHER OPTIONS (LOWEST TO HIGHEST):	TYPE / PERCENTAGE	**JPCP**	**$154,674**	**26.7%**
	TYPE / PERCENTAGE	**HMA**	**$168,108**	**37.7%**

P:\Pavement Design Stuff\D-9\I-57 from Johnson CL to Lick Creek\[I-57 from Johnson CL to Lick Creek Life Cycle Cost Sheet.xlsm]LifeCycleCost