



Illinois Department of Transportation

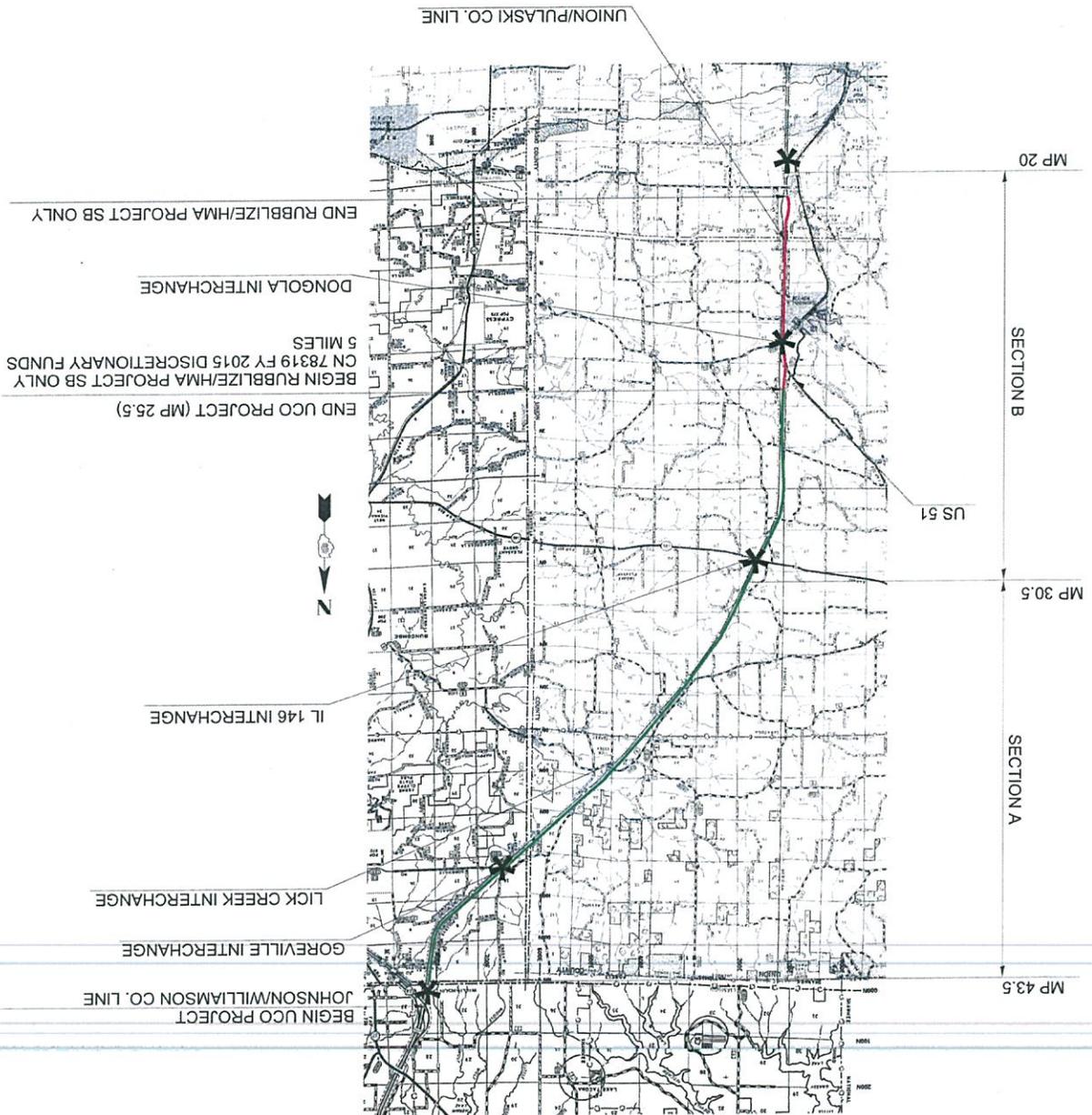
Memorandum

To: Paul Niedernhofer
From: Charles Stein
Subject: Pavement Design
Date: August 6, 2014

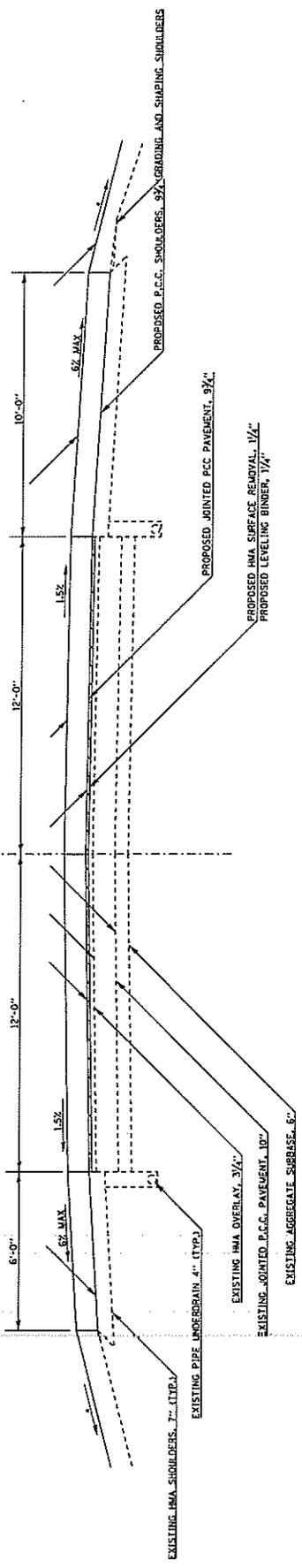
Route	FAI 57 (I-57)
Section	(93-3,91-1,44-1-1,44-1)RS-2
County	Union & Johnson
Contract	78286

This project involves placing a jointed PCC pavement overly on 18 miles of the existing HMA overlaid PCC pavement on I-57 from the Johnson County line to near the Dongola interchange (see attached map). The project is scheduled for the January 2015 letting. The original PCC pavement was built in the 1960's, and resurfaced in 1999. The district proposes to mill 1.25" off the existing HMA overlay and place a minimum 1.25" HMA overlay on the milled surface to correct profile irregularities and then place 9.75" jointed PCC pavement on the HMA. At the overpasses and at grade bridges, the existing pavement will be removed, a 12" aggregate sub-base, a 4" stabilized sub-base, and a 10.75" jointed PCC pavement will be built. The mechanistic pavement design and life cycle cost analysis are attached.

* CROSSOVER LOCATIONS



€ 10' & 6" LINES
APART
(LOOKING IN DIRECTION OF TRAVEL)



EXISTING IMA SHOULDERS, 7" ATPA
EXISTING PIPE UNDERDRAIN, 4" ATPA
EXISTING IMA OVERLAY, 3/4"
EXISTING JOINTED P.C.C. PAVEMENT, 10"
EXISTING AGGREGATE SUBBASE, 6"
PROPOSED JOINTED P.C.C. PAVEMENT, 3/4"
PROPOSED IMA SURFACE REMOVAL, 1/4"
PROPOSED LEVELING BINDER, 1/4"
PROPOSED IMA GRADING AND SHAPING SHOULDERS, 5/8" MAX

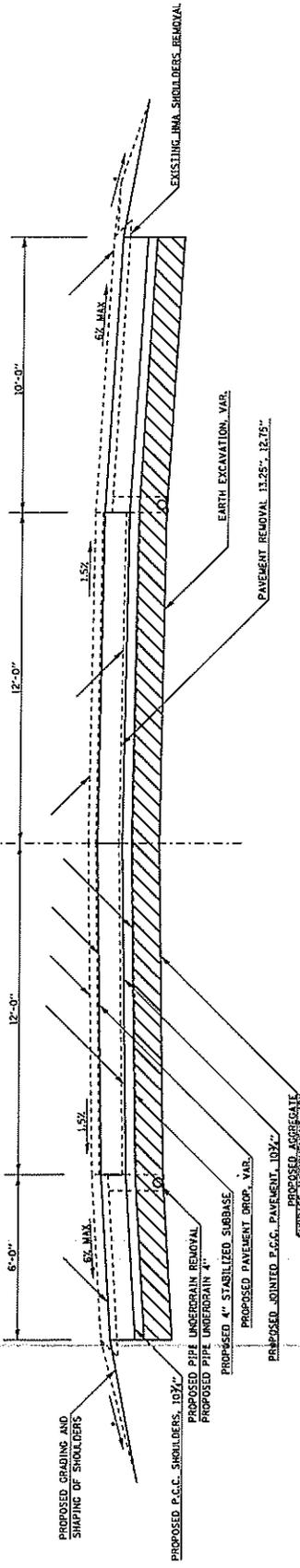
NOTES:
* GRADING AND SHAPING SHOULDERS, 4" OR FLATTER USE SPECIAL PROVISION

FILE NAME	DESIGNED	REVISION	SECTION	COUNTY	SHEET
PROJECT NO.	DRAWN	REVISION	DATE	SECTION	SHEET
DATE	CHECKED	REVISION	DATE	CONTRACT NO.	REVISION NO.
DATE	DATE	REVISION	DATE	CONTRACT NO.	REVISION NO.

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

TYPICAL
SCALE: SHEET OF SHEETS STA. TO STA.

± NO. 3 SB LANS
 ± AT RATE 57
 (LOOKING IN DIRECTION OF TRAVEL)



PROPOSED AGGREGATE SUBBASE IMPROVEMENT, 12"

NOTES:
 * GRADING AND SHAPING SHOULDERS, 41 OR FLATTER (SEE SPECIAL PROVISION)

FILE NAME	DESIGNED BY	REUSED BY	SHEET NO.	COUNTY	SECTION	PROJECT NO.
DATE	DRAWN BY	REUSED BY				
DATE	CHECKED BY	REUSED BY	SHEET NO.	CONTRACT NO.	REVISIONS	PROJECT
DATE	DATE	DATE				

STATE OF ILLINOIS
 DEPARTMENT OF TRANSPORTATION

TYPICAL

SCALE

SHEET

OF

SHEETS

314

TO 314

PROJECT AND TRAFFIC INPUTS

(Enter Data in Gray Shaded Cells)

Route: **I-57 (FAI 57)** Comments: _____

Section: **(44-1-1, 44-1)R-2;(91-3)R-3**

County: **Union & Johnson** Design Date: **06/10/2014** CWS

Location: **I-24 to Lick Creek interchange** Modify Date: _____

Facility Type: **Interstate or Freeway** # of Lanes = **4**

Road Class: **I**

Subgrade Support Rating (SSR): **Poor**

Construction Year: **2015**

Design Period (DP) = **20** years

	<-- BY		
	<-- BY	ADT	Year
Current:		-	-
Future:		-	-

	Minimum ADT	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		RIGID PAVEMENT	
Cpv =	0.15	Cpv =	0.15
Csu =	132.5	Csu =	143.81
Cmu =	482.53	Cmu =	696.42
TF flexible (Actual) =	22.90 (Actual ADT)	TF rigid (Actual) =	32.82 (Actual ADT)
TF flexible (Min) =	7.11 (Min ADT Fig. 54-2.C)	TF rigid (Min) =	10.05 (Min ADT Fig. 54-2.C)

NEW CONSTRUCTION / RECONSTRUCTION PAVEMENT DESIGN CALCULATIONS

Full-Depth HMA Pavement	JPC Pavement
Use TF flexible = 22.90	Use TF rigid = 32.82
PG Grade Lower Binder Lifts = PG 64-22 (Fig. 53-4.R)	Edge Support = Tied Shoulder or C.&G.
HMA Mixture Temp. = 81.0 deg. F (Fig. 54-5.C)	Rigid Pavt Thick. = 10.75 in. (Fig. 54-4.E)
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)	CRC Pavement
Limiting Strain Criterion Thickness = 17.00 in. (Fig. 54-5.I)	Use TF rigid = 32.82
Use Full-Depth HMA Thickness = 16.25 inches	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	Unbonded Concrete Overlay
Use TF flexible = 22.90	Review 54-4.03 for limitations and special considerations.
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	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)

Facility Type	Min. Str. Design Traffic (Fig 54-2.C)		
	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	Traffic Factor EGAL Coefficients			
	Rigid (Fig. 54-4.C)		Flexible (Fig. 54-5.B)	
I	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

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

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

Number of Lanes	Design Lane Distribution Factors For Structural Design Traffic (Fig. 54-2.B)					
	Rural			Urban		
	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 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 5280 FT ==> 1.00 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 10 FT
 Total Width of Paved Shoulders 16 FT

PAVEMENT THICKNESS (FLEXIBLE) 16.25 IN 17.00 IN MAX
 SHOULDER THICKNESS 8.00 IN HMA_SHLD 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	\$94.00 / TON
HMA TOP BINDER	\$73.00 / TON
HMA LOWER BINDER	\$72.00 / TON
HMA BINDER (LEVELING)	\$0.00 / TON
HMA SHOULDER	\$74.00 / TON

INITIAL COSTS

ITEM	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE	COST
HMA PAVEMENT (FULL-DEPTH)	(16.25")	14,080	SQ YD	\$71.83 /sq YD	\$1,011,320 ~
HMA SURFACE COURSE	(2.00")	1,588	TONS	\$94.00 / TON	\$0
HMA TOP BINDER COURSE	(2.25")	1,813	TONS	\$73.00 / TON	\$0
HMA LOWER BINDER COURSE	(12.00")	10,135	TONS	\$72.00 / TON	\$0
HMA SHOULDER	(8.00")	4,205	TONS	\$74.00 / TON	\$311,187 ~
CURB & GUTTER		0	LIN FT	/LIN FT	\$0
SUBBASE GRAN MATL TY C (TONS)		3,666	TONS	\$29.00 / TON	\$106,314
IMPROVED SUBGRADE:	Modified Soil	25,642	SQ YD	\$3.00 /sq YD	\$76,926
Reserved For User Supplied Item		0	UNITS	/UNITS	\$0
Reserved For User Supplied Item		0	UNITS	/UNITS	\$0
PAVEMENT REMOVAL		14,080	SQ YD	\$8.00 /sq YD	\$112,640
SHOULDER REMOVAL		9,387	SQ YD	\$5.00 /sq YD	\$46,935
Note: * Denotes User Supplied Quantity					
FLEXIBLE CONSTRUCTION INITIAL COST					\$1,665,322
FLEXIBLE CONSTRUCTION ANNUAL COST PER MILE					\$67,920

MAINTENANCE COSTS:

ITEM	THICKNESS	MATERIAL	UNIT COST
ROUTINE MAINTENANCE ACTIVITY			\$0.00 LANE-MILE / YEAR
HMA OVERLAY PVMT SURF	(2.00")	Surface Mix	\$10.60 /SQ YD
HMA OVERLAY PVMT	(3.75")	Surface Mix	\$17.30 /SQ YD
HMA SURFACE MIX	(1.50")	Surface Mix	\$7.94 /SQ YD
HMA BINDER MIX	(2.25")	Top Binder Mix	\$9.37 /SQ YD
HMA OVERLAY SHLD (Year 30)	(1.75")	Shoulder Mix	\$7.25 /SQ YD
HMA OVERLAY SHLD	(2.00")	Shoulder Mix	\$8.29 /SQ YD
MILLING (2.00 IN)			\$3.00 /SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill Surf)		Surface Mix	\$80.53 /SQ YD
PARTIAL DEPTH SHLD PATCH (Mill & Fill Surf)		Shoulder Mix	\$78.29 /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	\$78.29 /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 \$2,173,054
 FLEXIBLE TOTAL ANNUAL COST PER MILE \$88,628

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%	10,560	LIN FT	\$2.00	\$21,120	
	CNTR LINE JOINT R&S	100.00%	5,280	LIN FT	\$2.00	\$10,560	
	RNDM / THRM CRACK R&S	50.00%	5,808	LIN FT	\$2.00	\$11,616	
	PD PVMT PATCH M&F SURF	0.10%	14	SQ YD	\$80.53	\$1,127	
	PWFn =	0.8626		PW =	0.8626 X	\$44,423	\$38,320
YEAR 10							
	LONG SHLD JT R&S	100.00%	10,560	LIN FT	\$2.00	\$21,120	
	CNTR LINE JOINT R&S	100.00%	5,280	LIN FT	\$2.00	\$10,560	
	RNDM / THRM CRACK R&S	50.00%	5,808	LIN FT	\$2.00	\$11,616	
	PD PVMT PATCH M&F SURF	0.50%	70	SQ YD	\$80.53	\$5,637	
	PWFn =	0.7441		PW =	0.7441 X	\$48,933	\$36,411
YEAR 15							
	MILL PVMT & SHLD 2.00"	100.00%	23,467	SQ YD	\$3.00	\$70,401	
	PD PVMT PATCH M&F ADD'L 2.00"	1.00%	141	SQ YD	\$70.00	\$9,870	
	HMA OVERLAY PVMT 2.00"	100.00%	14,080	SQ YD	\$10.60	\$149,264	
	HMA OVERLAY SHLD 2.00"	100.00%	9,387	SQ YD	\$8.29	\$77,797	
	PWFn =	0.6419		PW =	0.6419 X	\$307,332	\$197,265
YEAR 20							
	LONG SHLD JT R&S	100.00%	10,560	LIN FT	\$2.00	\$21,120	
	CNTR LINE JOINT R&S	100.00%	5,280	LIN FT	\$2.00	\$10,560	
	RNDM / THRM CRACK R&S	50.00%	5,808	LIN FT	\$2.00	\$11,616	
	PD PVMT PATCH M&F SURF	0.10%	14	SQ YD	\$80.53	\$1,127	
	PWFn =	0.5537		PW =	0.5537 X	\$44,423	\$24,596
YEAR 25							
	LONG SHLD JT R&S	100.00%	10,560	LIN FT	\$2.00	\$21,120	
	CNTR LINE JOINT R&S	100.00%	5,280	LIN FT	\$2.00	\$10,560	
	RNDM / THRM CRACK R&S	50.00%	5,808	LIN FT	\$2.00	\$11,616	
	PD PVMT PATCH M&F SURF	0.50%	70	SQ YD	\$80.53	\$5,637	
	PWFn =	0.4776		PW =	0.4776 X	\$48,933	\$23,371
HMA_SD							
YEAR 30 INTERSTATE							
	MILL PVMT ONLY 2.00"	100.00%	14,080	SQ YD	\$3.00	\$42,240	
	PD PVMT PATCH M&F ADD'L 2.00"	2.00%	282	SQ YD	\$70.00	\$19,740	
	PD SHLD PATCH M&F SURF 2.00"	1.00%	94	SQ YD	\$78.29	\$7,359	
	HMA OVERLAY PVMT 3.75 "	100.00%	14,080	SQ YD	\$17.30	\$243,623	
	HMA OVERLAY SHLD 1.75 "	100.00%	9,387	SQ YD	\$7.25	\$68,072	
	PWFn =	0.4120		PW =	0.4120 X	\$381,034	\$156,981
YEAR 35							
	LONG SHLD JT R&S	100.00%	10,560	LIN FT	\$2.00	\$21,120	
	CNTR LINE JOINT R&S	100.00%	5,280	LIN FT	\$2.00	\$10,560	
	RNDM / THRM CRACK R&S	50.00%	5,808	LIN FT	\$2.00	\$11,616	
	PD PVMT PATCH M&F SURF	0.10%	14	SQ YD	\$80.53	\$1,127	
	PWFn =	0.3554		PW =	0.3554 X	\$44,423	\$15,787
YEAR 40							
	LONG SHLD JT R&S	100.00%	10,560	LIN FT	\$2.00	\$21,120	
	CNTR LINE JOINT R&S	100.00%	5,280	LIN FT	\$2.00	\$10,560	
	RNDM / THRM CRACK R&S	50.00%	5,808	LIN FT	\$2.00	\$11,616	
	PD PVMT PATCH M&F SURF	0.50%	70	SQ YD	\$80.53	\$5,637	
	PWFn =	0.3066		PW =	0.3066 X	\$48,933	\$15,001
							\$507,732
ROUTINE MAINTENANCE ACTIVITY				2.00	lane Miles	0.00	\$0
							\$0
						MAINTENANCE LIFE-CYCLE COST	\$507,732
45	YEAR LIFE CYCLE	CRFn = 0.0407852	MAINTENANCE ANNUAL COST PER MILE				\$20,708

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 5280 FT ==> 1.00 Miles
 # OF CENTERLINES 1 CL
 # OF LANES 2 LANES
 # OF EDGES 2 EP
 LANE WIDTH - AVERAGE 12 FT
 SHOULDER WIDTH PCC Left 6 FT
 PCC Right 10 FT
 Total Width of Paved Shoulders 16 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
Worksheet Construction Type is	Reconstruction	10.05	32.82	32.82
			The Pavement Type is	JPCP

INITIAL COSTS

ITEM	THICKNESS	100% QUANTITY UNIT	UNIT PRICE	COST
JPC PAVEMENT	(10.75")	14,080 SQ YD	\$44.00 /SQ YD	\$619,520
PAVEMENT REINFORCEMENT - STABILIZED SUBBASE	(4.00")	0 SQ YD 15,840 SQ YD	/SQ YD \$17.00 /SQ YD	\$0 \$269,280
PCC SHOULDERS CURB & GUTTER	(10.75" to 10.75")	9,387 SQ YD 0 LIN FT	\$41.00 /SQ YD /LIN FT	\$384,867 \$0
SUBBASE GRAN MATL TY C IMPROVED SUBGRADE:	(~ 1.74") Modified Soil Depth = 41.0'	1,104 TONS 24,053 SQ YD	\$29.00 /TON \$3.00 /SQ YD	\$32,016 \$72,159
Reserved For User Supplied Item		0 UNITS	/UNITS	\$0
Reserved For User Supplied Item		0 UNITS	/UNITS	\$0
PAVEMENT REMOVAL		14,080 SQ YD	\$8.00 /SQ YD	\$112,640
SHOULDER REMOVAL		9,387 SQ YD	\$5.00 /SQ YD	\$46,935

Note: * Denotes User Supplied Quantity

RIGID CONSTRUCTION INITIAL COST \$1,537,417
 RIGID CONSTRUCTION ANNUAL COST PER MILE \$62,704

MAINTENANCE COSTS:

ITEM	THICKNESS	MATERIAL	UNIT COST
ROUTINE MAINTENANCE ACTIVITY			\$0.00 /LANE-MILE /YEAR
HMA POLICY OVERLAY	(3.75")		\$7.75 /SQ YD
HMA POLICY OVERLAY PVMT	(3.75")		\$17.30 /SQ YD
HMA SURFACE MIX	(1.50")	Surface Mix	\$7.94 /SQ YD
HMA BINDER MIX	(2.25")	Top Binder Mix	\$9.37 /SQ YD
HMA POLICY OVERLAY SHLD	(3.75")	Shoulder Mix	\$15.54 /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	\$77.90 /SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill HMA 1.50")		Surface Mix	\$77.90 /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 \$1,865,581
 RIGID TOTAL ANNUAL COST PER MILE \$76,088

MAINTENANCE AND REHABILITATION ACTIVITY SCHEDULE

02/04/15

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%	14	SQ YD	\$150.00	\$2,100	
		PWFn = 0.7441			PW = 0.7441 X	\$2,100	\$1,563
YEAR 15							
	PAVEMENT PATCH CLASS B	0.20%	28	SQ YD	\$150.00	\$4,200	
		PWFn = 0.6419			PW = 0.6419 X	\$4,200	\$2,696
YEAR 20							
	PAVEMENT PATCH CLASS B	2.00%	282	SQ YD	\$150.00	\$42,300	
	SHOULDER PATCH CLASS C	0.50%	47	SQ YD	\$145.00	\$6,815	
	LONGITUDINAL SHLD JT R&S	100.00%	10,560	LIN FT	\$2.00	\$21,120	
	CENTERLINE JT R&S	100.00%	5,280	LIN FT	\$2.00	\$10,560	
		PWFn = 0.5537			PW = 0.5537 X	\$80,795	\$44,734
YEAR 25							
	PAVEMENT PATCH CLASS B	3.00%	422	SQ YD	\$150.00	\$63,300	
	SHOULDER PATCH CLASS C	1.00%	94	SQ YD	\$145.00	\$13,630	
		PWFn = 0.4776			PW = 0.4776 X	\$76,930	\$36,742
YEAR 30							
	INTERSTATE						
	PAVEMENT PATCH CLASS B	4.00%	563	SQ YD	\$150.00	\$84,450	
	SHOULDER PATCH CLASS C	1.50%	141	SQ YD	\$145.00	\$20,445	
	HMA POLICY OVERLAY 3.75" (PVMT)	100.00%	14,080	SQ YD	\$17.30	\$243,623	
	HMA POLICY OVERLAY 3.75" (SHLD)	100.00%	9,387	SQ YD	\$15.54	\$145,869	
		PWFn = 0.4120			PW = 0.4120 X	\$494,387	\$203,681
YEAR 35							
	INTERSTATE						
	LONGITUDINAL SHLD JT R&S	100.00%	10,560	LIN FT	\$2.00	\$21,120	
	CENTERLINE JT R&S	100.00%	5,280	LIN FT	\$2.00	\$10,560	
	RANDOM CRACK R&S	50.00%	5,280	LIN FT	\$2.00	\$10,560	
	REFLECTIVE TRANSVERSE CRACK R&S	40.00%	3,379	LIN FT	\$2.00	\$6,758	
	PD PVMT PATCH M&F HMA SURF 1.50"	0.10%	14	SQ YD	\$77.90	\$1,091	
		PWFn = 0.3554			PW = 0.3554 X	\$50,089	\$17,801
YEAR 40							
	INTERSTATE						
	PAVEMENT PATCH CLASS B	0.50%	70	SQ YD	\$150.00	\$10,500	
	LONGITUDINAL SHLD JT R&S	100.00%	10,560	LIN FT	\$2.00	\$21,120	
	CENTERLINE JT R&S	100.00%	5,280	LIN FT	\$2.00	\$10,560	
	REFLECTIVE TRANSVERSE CRACK R&S	60.00%	5,069	LIN FT	\$2.00	\$10,138	
	RANDOM CRACK R&S	50.00%	5,280	LIN FT	\$2.00	\$10,560	
	PD PVMT PATCH M&F HMA SURF 1.50"	0.50%	70	SQ YD	\$77.90	\$5,453	
		PWFn = 0.3066			PW = 0.3066 X	\$68,331	\$20,947
							\$328,164
	ROUTINE MAINTENANCE ACTIVITY		2.00	Lane Miles	\$0.00	\$0	\$0
							MAINTENANCE LIFE-CYCLE COST \$328,164
45	YEAR LIFE CYCLE	CRFn = 0.0407852					MAINTENANCE ANNUAL COST PER MILE \$13,384

RECONSTRUCTION - HMA OVER RUBBLIZED PAVEMENT

PAVEMENT OVERLAY THICKNESS (FLEXIBLE) **11.75 IN** **11.75 IN** MAX HMA_LSCD Maintenance Schedule
 SHOULDER OVERLAY THICKNESS **8.00 IN**

INITIAL COSTS

ITEM	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE	COST
HMA OVERLAY REMOVAL	3.75	14,080	SQ YD	\$2.25 /SQ YD	\$31,680
RUBBLIZING PCC PAVEMENT		14,080	SQ YD	\$2.10 /SQ YD	\$29,568
HMA OVERLAY (TOTAL)	11.75	14,080	SQ YD	\$51.92 /SQ YD	\$731,016 ~
HMA SURFACE COURSE	2.00	1,588	TONS	\$94.00 /TON	\$0
HMA TOP BINDER COURSE	2.25	1,813	TONS	\$73.00 /TON	\$0
HMA LOWER BINDER COURSE	7.50	6,242	TONS	\$72.00 /TON	\$0
HMA SHOULDER	8.00	4,205	TONS	\$74.00 /TON	\$311,187 ~
Reserved For User Supplied Item		0	UNITS	/UNITS	\$0
Reserved For User Supplied Item		0	UNITS	/UNITS	\$0
EARTHWORK		0	CU YD	/CU YD	\$0

Note: * Denotes User Supplied Quantity

RUBBLIZED CONSTRUCTION INITIAL COST \$1,103,451
 RUBBLIZED CONSTRUCTION ANNUAL COST PER MILE \$45,004

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")	1.0000	2.00	\$94.00 /TON
HMA SURFACE MIX	(2.00")	1.0000	Surface Mix 2.00	\$94.00 /TON
HMA BINDER MIX	(0.00")	1.5133	Top Binder Mix 0.00	\$73.00 /TON
HMA OVERLAY SHLD	(Year 30) (2.00")		Shoulder Mix 2.00	\$74.00 /TON

RUBBLIZED MAINTENANCE LIFE-CYCLE COST \$484,466
 RUBBLIZED MAINTENANCE ANNUAL COST PER MILE \$19,759

RUBBLIZED TOTAL LIFE-CYCLE COST \$1,587,917
 RUBBLIZED TOTAL ANNUAL COST PER MILE \$64,763

RECONSTRUCTION - PCC UNBONDED OVERLAY

PAVEMENT THICKNESS (PCC) **9.75 IN** Pavement Type is JPCP
 SHOULDER THICKNESS **9.75 IN**

INITIAL COSTS

ITEM	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE	COST
MILLING of EXISTING HMA OVERLAY (Pvmt & Shld)		23,467	SQ YD	\$0.95 /SQ YD	\$22,294
HMA BINDER COURSE (Pvmt & Shld)		23,467	SQ YD	\$5.00 /SQ YD	\$117,335
JPC PAVEMENT	9.75	14,080	SQ YD	\$41.00 /SQ YD	\$577,280
PAVEMENT REINFORCEMENT		0	SQ YD	\$0.00 /SQ YD	\$0
PCC SHOULDERS	9.75	9,387	SQ YD	\$35.00 /SQ YD	\$328,545
Class B Patching		40	SQ YD	\$200.00 /SQ YD	\$8,000
Reserved For User Supplied Item		0	UNITS	/UNITS	\$0
EARTHWORK		0	CU YD	/CU YD	\$0

Note: * Denotes User Supplied Quantity

UNBONDED CONSTRUCTION INITIAL COST \$1,053,454
 UNBONDED CONSTRUCTION ANNUAL COST PER MILE \$42,965

UNBONDED MAINTENANCE LIFE-CYCLE COST \$328,164
 UNBONDED MAINTENANCE ANNUAL COST PER MILE \$13,384

UNBONDED TOTAL LIFE-CYCLE COST \$1,381,618
 UNBONDED TOTAL ANNUAL COST PER MILE \$56,349

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%	10,560	LIN FT	\$2.00	\$21,120	
	CNTR LINE JOINT R&S	100.00%	5,280	LIN FT	\$2.00	\$10,560	
	RNDM / THRM CRACK R&S	50.00%	5,808	LIN FT	\$2.00	\$11,616	
	PD PVMT PATCH M&F SURF	0.10%	14	SQ YD	\$80.53	\$1,127	
	PWFn =	0.8626		PW =	0.8626 X	\$44,423	\$38,320
YEAR 10							
	LONG SHLD JT R&S	100.00%	10,560	LIN FT	\$2.00	\$21,120	
	CNTR LINE JOINT R&S	100.00%	5,280	LIN FT	\$2.00	\$10,560	
	RNDM / THRM CRACK R&S	50.00%	5,808	LIN FT	\$2.00	\$11,616	
	PD PVMT PATCH M&F SURF	0.50%	70	SQ YD	\$80.53	\$5,637	
	PWFn =	0.7441		PW =	0.7441 X	\$48,933	\$36,411
YEAR 15							
	MILL PVMT & SHLD 2.00"	100.00%	23,467	SQ YD	\$3.00	\$70,401	
	PD PVMT PATCH M&F ADD'L 2.00"	1.00%	141	SQ YD	\$70.00	\$9,870	
	HMA OVERLAY PVMT 2.00"	100.00%	14,080	SQ YD	\$10.60	\$149,264	
	HMA OVERLAY SHLD 2.00"	100.00%	9,387	SQ YD	\$8.29	\$77,797	
	PWFn =	0.6419		PW =	0.6419 X	\$307,332	\$197,265
YEAR 20							
	LONG SHLD JT R&S	100.00%	10,560	LIN FT	\$2.00	\$21,120	
	CNTR LINE JOINT R&S	100.00%	5,280	LIN FT	\$2.00	\$10,560	
	RNDM / THRM CRACK R&S	50.00%	5,808	LIN FT	\$2.00	\$11,616	
	PD PVMT PATCH M&F SURF	0.10%	14	SQ YD	\$80.53	\$1,127	
	PWFn =	0.5537		PW =	0.5537 X	\$44,423	\$24,596
YEAR 25							
	LONG SHLD JT R&S	100.00%	10,560	LIN FT	\$2.00	\$21,120	
	CNTR LINE JOINT R&S	100.00%	5,280	LIN FT	\$2.00	\$10,560	
	RNDM / THRM CRACK R&S	50.00%	5,808	LIN FT	\$2.00	\$11,616	
	PD PVMT PATCH M&F SURF	0.50%	70	SQ YD	\$80.53	\$5,637	
	PWFn =	0.4776		PW =	0.4776 X	\$48,933	\$23,371
HMA SD							
YEAR 30 INTERSTATE							
	MILL PVMT & SHLD 2.00"	100.00%	23,467	SQ YD	\$3.00	\$70,401	
	PD PVMT PATCH M&F ADD'L 2.00"	2.00%	282	SQ YD	\$70.00	\$19,740	
	PD SHLD PATCH M&F ADD'L 2.00"	1.00%	94	SQ YD	\$78.29	\$7,359	
	HMA OVERLAY PVMT 2.00"	100.00%	1,588	TON	\$94.00	\$149,264	
	HMA OVERLAY SHLD 2.00"	100.00%	1,051	TON	\$74.00	\$77,797	
	PWFn =	0.4120		PW =	0.4120 X	\$324,561	\$133,715
YEAR 35							
	LONG SHLD JT R&S	100.00%	10,560	LIN FT	\$2.00	\$21,120	
	CNTR LINE JOINT R&S	100.00%	5,280	LIN FT	\$2.00	\$10,560	
	RNDM / THRM CRACK R&S	50.00%	5,808	LIN FT	\$2.00	\$11,616	
	PD PVMT PATCH M&F SURF	0.10%	14	SQ YD	\$80.53	\$1,127	
	PWFn =	0.3554		PW =	0.3554 X	\$44,423	\$15,787
YEAR 40							
	LONG SHLD JT R&S	100.00%	10,560	LIN FT	\$2.00	\$21,120	
	CNTR LINE JOINT R&S	100.00%	5,280	LIN FT	\$2.00	\$10,560	
	RNDM / THRM CRACK R&S	50.00%	5,808	LIN FT	\$2.00	\$11,616	
	PD PVMT PATCH M&F SURF	0.50%	70	SQ YD	\$80.53	\$5,637	
	PWFn =	0.3066		PW =	0.3066 X	\$48,933	\$15,001
							\$484,466
ROUTINE MAINTENANCE ACTIVITY			2.00 Lane Miles	0.00	0	\$0	
						MAINTENANCE LIFE-CYCLE COST	\$484,466
45	YEAR LIFE CYCLE	CRFn = 0.0407852				MAINTENANCE ANNUAL COST PER MILE	\$19,759

LIFE-CYCLE COST ANALYSIS: NEW DESIGN

Calculated / Revised : 8/1/14 2:06 PM

			JPCP	HMA
CONSTRUCTION	INITIAL COST	PRESENT WORTH	\$1,537,417	\$1,665,322
		ANNUAL COST PER MILE	\$62,704	\$67,920
MAINTENANCE	LIFE-CYCLE COST	PRESENT WORTH	\$328,164	\$507,732
		ANNUAL COST PER MILE	\$13,384	\$20,708
TOTAL	LIFE-CYCLE COST	PRESENT WORTH	\$1,865,581	\$2,173,054
		ANNUAL COST PER MILE	\$76,088	\$88,628

LIFE-CYCLE COST ANALYSIS: SUPPLEMENTAL DESIGNS

			PCC Unbonded	Rubblized
CONSTRUCTION	INITIAL COST	PRESENT WORTH	\$1,053,454	\$1,103,451
		ANNUAL COST PER MILE	\$42,965	\$45,004
MAINTENANCE	LIFE-CYCLE COST	PRESENT WORTH	\$328,164	\$484,466
		ANNUAL COST PER MILE	\$13,384	\$19,759
TOTAL	LIFE-CYCLE COST	PRESENT WORTH	\$1,381,618	\$1,587,917
		ANNUAL COST PER MILE	\$56,349	\$64,763

LIFE-CYCLE COST ANALYSIS: FINAL SUMMARY

LOWEST COST OPTION	=====>	PCC Unbonded	\$56,349	
OTHER OPTIONS (LOWEST TO HIGHEST):		Rubblized	\$64,763	14.9%
		JPCP	\$76,088	35.0%
		HMA	\$88,628	57.3%