



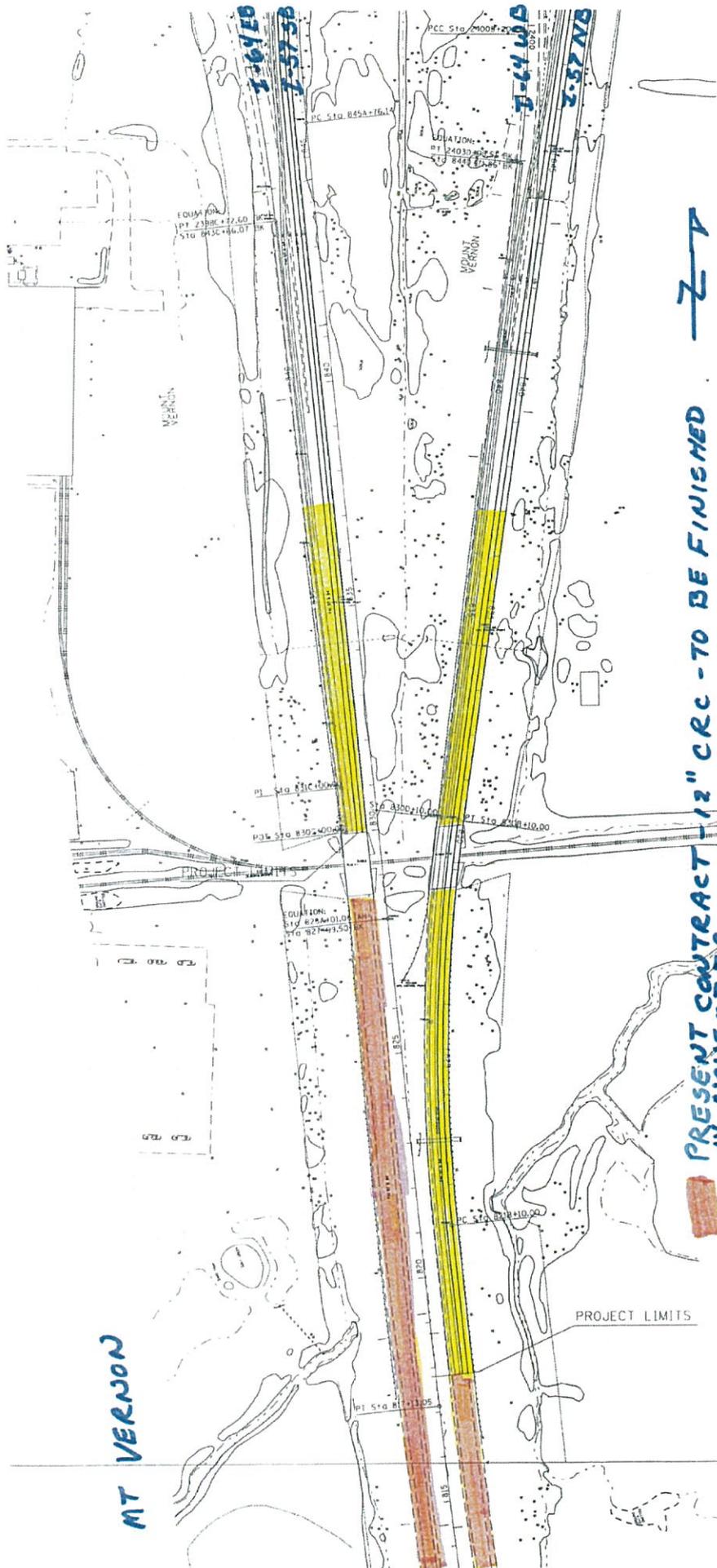
Illinois Department of Transportation

Memorandum

To: Paul Niedernhofer
From: Charles Stein
Subject: Pavement Design
Date: October 8, 2013

Route	I-57 (FAI 57) & I-64 (FAI 64)
Section	(41-3-1)RS-1;(41-8)RS-2
County	Jefferson
Contract	78276

This project involves the rehabilitation of the pavement of I-57/64 interchange north of Mt. Vernon. This project starts at the north limit of the existing CRC paving contract due to be completed December 1, 2013 and ends approximately 1 mile north and 1 mile west. The total equivalent 4 lane mileage is 2 miles. The life cycle cost analysis results in 11.75" of HMA over rubblized CRC pavement to be the most cost effective pavement. The District proposes to use the 11.75" of HMA over rubblized pavement except in the area adjacent to the existing contract. In this area the District proposes to use 12" CRC paving to match the existing project (see attached). The District wishes to use the CRC pavement for two reasons. One, existing pavement will have to be removed to meet the elevation of the existing bridges and ,two, the traffic in this stretch combines both I-64 and I-57.



MT VERNON

PRESENT CONTRACT - 12" CRC - TO BE FINISHED IN NOVEMBER

PROPOSED CONTRACT PAVEMENT REMOVAL

Z-A

PROJECT LIMITS

PROJECT AND TRAFFIC INPUTS

(Enter Data in Gray Shaded Cells)

Route: I-57	Comments:			
Section: (41-3-1)RS-1;(41-8)RS-2	Design Date: 10/07/2013	Charles Steir		
County: Jefferson	Modify Date:			
Location: Mt Vernon - CN 78276				
Facility Type: Interstate or Freeway	# of Lanes = 6 or more			
Road Class: I	Rural or Urban ? Rural			
Subgrade Support Rating (SSR): Poor	Construction Year: 2014			
Design Period (DP) = 20 years				

	ADT	Year
Current:	-	-
Future:	-	-

Structural Design Traffic			
Minimum ADT	Actual ADT	Actual % of Total ADT	% of ADT in Design Lane
PV = 0	28,950	61.1%	P = 20%
SU = 500	1,195	2.5%	S = 40%
MU = 1500	17,205	36.3%	M = 40%
Struct. Design ADT = 47,350		(2024)	

TRAFFIC FACTOR CALCULATION

FLEXIBLE PAVEMENT		RIGID PAVEMENT	
C _{pv} = 0.15	C _{su} = 132.5	C _{pv} = 0.15	C _{su} = 143.81
C _{mu} = 482.53	TF flexible (Actual) = 67.70 (Actual ADT)	C _{mu} = 696.42	TF rigid (Actual) = 97.25 (Actual ADT)
TF flexible (Min) = 6.32 (Min ADT Fig. 54-2.C)		TF rigid (Min) = 8.93 (Min ADT Fig. 54-2.C)	

NEW CONSTRUCTION / RECONSTRUCTION PAVEMENT DESIGN CALCULATIONS

Full-Depth HMA Pavement	JPC Pavement
Use TF flexible = 67.70	Use TF rigid = 97.25
PG Grade Lower Binder Lifts = PG 64-22 (Fig. 53-4.R)	Edge Support = Tied Shoulder or C.&G.
HMA Mixture Temp. = 80.0 deg. F (Fig. 54-5.C)	Rigid Pavt Thick. = 11.50 in. (Fig. 54-4.E)
Design HMA Mixture Modulus (E _{HMA}) = 560 ksi (Fig. 54-5.D)	
Design HMA Strain (ε _{HMA}) = 36 (Fig. 54-5.E)	CRC Pavement
Full Depth HMA Design Thickness = 19.25 in. (Fig. 54-5.F)	Use TF rigid = 97.25
Limiting Strain Criterion Thickness = 16.75 in. (Fig. 54-5.I)	IBR value = 3
Use Full-Depth HMA Thickness = 16.75 inches	CRCP Thickness = 12.50 in. (Fig. 54-4.M)

RECONSTRUCTION ONLY (SUPPLEMENTAL) PAVEMENT DESIGN CALCULATIONS

HMA Overlay of Rubblized PCC	Unbonded Concrete Overlay
Use TF flexible = 67.70	Review 54-4.03 for limitations and special considerations.
HMA Overlay Design Thickness = 15.00 in. (Fig. 54-5.U)	
Limiting Strain Criterion Thickness = 11.75 in. (Fig. 54-5.V)	
Use HMA Overlay Thickness = 11.75 inches	CRCP Thickness = 11.50 inches

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 ESAL Coefficients			
	Rigid (Fig. 54-4.C)		Flexible (Fig. 54-5.B)	
	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

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%

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

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

LIFE-CYCLE COST ANALYSIS: NEW CONSTRUCTION / RECONSTRUCTION

FULL-DEPTH HMA PAVEMENT

Standard Design

ROUTE I-57
 SECTION (41-3-1)RS-1;(41-8)RS-2
 COUNTY Jefferson
 LOCATION Mt Vernon - CN 78276

FACILITY TYPE INTERSTATE

PROJECT LENGTH 7800 FT ==> 1.48 Miles
 # OF CENTERLINES 4 CL
 # OF LANES 6 LANES
 # OF EDGES 4 EP
 LANE WIDTH - AVERAGE 12 FT
 SHOULDER WIDTH HMA Inside 10 FT
 HMA Outside 12 FT
 Total Width of Paved Shoulders 44 FT

PAVEMENT THICKNESS (FLEXIBLE) 11.75 IN 16.75 IN MAX
 SHOULDER THICKNESS 11.75 IN
 POLICY OVERLAY THICKNESS 3.75 IN
 Standard Design

FLEX PAVEMENT	TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
		6.32	67.70	67.70

HMA COST PER TON	UNIT PRICE
HMA SURFACE	\$95.00 / TON
HMA TOP BINDER	\$84.00 / TON
HMA LOWER BINDER	\$78.00 / TON
HMA BINDER (LEVELING)	\$0.00 / TON
HMA SHOULDER	\$77.00 / TON

INITIAL COSTS	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE	COST
HMA PAVEMENT (FULL-DEPTH)	(11.75")	62,400	SQ YD	\$78.68 / SQ YD	\$4,909,632 ~
HMA SURFACE COURSE	(2.00")	7,021	TONS	\$95.00 / TON	\$0
HMA TOP BINDER COURSE	(2.25")	7,976	TONS	\$84.00 / TON	\$0
HMA LOWER BINDER COURSE	(7.50")	27,179	TONS	\$78.00 / TON	\$0
HMA SHOULDER	(11.75")	25,092	TONS	\$77.00 / TON	\$1,932,063 ~
CURB & GUTTER		0	LIN FT	\$0.00 / LIN FT	\$0
SUBBASE GRAN MATL TY C (TONS)		0	TONS	\$0.00 / TON	\$0
IMPROVED SUBGRADE: Modified Soil		105,661	SQ YD	\$2.75 / SQ YD	\$290,568
Reserved For User Supplied Item		0	UNITS	\$0.00 / UNITS	\$0
Reserved For User Supplied Item		0	UNITS	\$0.00 / UNITS	\$0
PAVEMENT REMOVAL		62,400	SQ YD	\$6.00 / SQ YD	\$374,400
SHOULDER REMOVAL		38,133	SQ YD	\$5.00 / SQ YD	\$190,665

Note: * Denotes User Supplied Quantity
 FLEXIBLE CONSTRUCTION INITIAL COST \$7,697,328
 FLEXIBLE CONSTRUCTION ANNUAL COST PER MILE \$212,511

MAINTENANCE COSTS:	THICKNESS	MATERIAL	UNIT COST
ROUTINE MAINTENANCE ACTIVITY			\$0.00 LANE-MILE / YEAR
HMA OVERLAY PVMT SURF	(2.00")	Surface Mix	\$10.69 / SQ YD
HMA OVERLAY PVMT	(3.75")	Surface Mix	\$10.69 / SQ YD
HMA SURFACE MIX	(1.50")	Surface Mix	\$10.69 / SQ YD
HMA BINDER MIX	(2.25")	Top Binder Mix	\$0.00 / SQ YD
HMA OVERLAY SHLD (Year 30)	(1.75")	Shoulder Mix	\$8.62 / SQ YD
HMA OVERLAY SHLD	(2.00")	Shoulder Mix	\$8.62 / SQ YD
MILLING (2.00 IN)			\$2.00 / SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill Surf)		Surface Mix	\$79.64 / SQ YD
PARTIAL DEPTH SHLD PATCH (Mill & Fill Surf)		Shoulder Mix	\$77.62 / SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill +2.00")		Leveling Binder Mix	\$69.00 / SQ YD
PARTIAL DEPTH SHLD PATCH (Mill & Fill +2.00")		Shoulder Mix	\$77.62 / 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 \$9,630,887
 FLEXIBLE TOTAL ANNUAL COST PER MILE \$265,894

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%	31,200	LIN FT	\$2.00	\$62,400	
	CNTR LINE JOINT R&S	100.00%	31,200	LIN FT	\$2.00	\$62,400	
	RNDM / THRM CRACK R&S	50.00%	25,740	LIN FT	\$2.00	\$51,480	
	PD PVMT PATCH M&F SURF	0.10%	62	SQ YD	\$79.64	\$4,938	
		PWFn = 0.8626			PW = 0.8626 X	\$181,218	\$156,320
YEAR 10							
	LONG SHLD JT R&S	100.00%	31,200	LIN FT	\$2.00	\$62,400	
	CNTR LINE JOINT R&S	100.00%	31,200	LIN FT	\$2.00	\$62,400	
	RNDM / THRM CRACK R&S	50.00%	25,740	LIN FT	\$2.00	\$51,480	
	PD PVMT PATCH M&F SURF	0.50%	312	SQ YD	\$79.64	\$24,848	
		PWFn = 0.7441			PW = 0.7441 X	\$201,128	\$149,658
YEAR 15							
	MILL PVMT & SHLD 2.00"	100.00%	100,533	SQ YD	\$2.00	\$201,066	
	PD PVMT PATCH M&F ADD'L 2.00"	1.00%	624	SQ YD	\$69.00	\$43,056	
	HMA OVERLAY PVMT 2.00"	100.00%	62,400	SQ YD	\$10.69	\$667,010	
	HMA OVERLAY SHLD 2.00 "	100.00%	38,133	SQ YD	\$8.62	\$328,709	
		PWFn = 0.6419			PW = 0.6419 X	\$1,239,841	\$795,807
YEAR 20							
	LONG SHLD JT R&S	100.00%	31,200	LIN FT	\$2.00	\$62,400	
	CNTR LINE JOINT R&S	100.00%	31,200	LIN FT	\$2.00	\$62,400	
	RNDM / THRM CRACK R&S	50.00%	25,740	LIN FT	\$2.00	\$51,480	
	PD PVMT PATCH M&F SURF	0.10%	62	SQ YD	\$79.64	\$4,938	
		PWFn = 0.5537			PW = 0.5537 X	\$181,218	\$100,336
YEAR 25							
	LONG SHLD JT R&S	100.00%	31,200	LIN FT	\$2.00	\$62,400	
	CNTR LINE JOINT R&S	100.00%	31,200	LIN FT	\$2.00	\$62,400	
	RNDM / THRM CRACK R&S	50.00%	25,740	LIN FT	\$2.00	\$51,480	
	PD PVMT PATCH M&F SURF	0.50%	312	SQ YD	\$79.64	\$24,848	
		PWFn = 0.4776			PW = 0.4776 X	\$201,128	\$96,060
HMA SD							
YEAR 30 INTERSTATE							
	MILL PVMT ONLY 2.00"	100.00%	62,400	SQ YD	\$2.00	\$124,800	
	PD PVMT PATCH M&F ADD'L 2.00"	2.00%	1,248	SQ YD	\$69.00	\$86,112	
	PD SHLD PATCH M&F SURF 2.00"	1.00%	381	SQ YD	\$77.62	\$29,575	
	HMA OVERLAY PVMT 3.75 "	100.00%	62,400	SQ YD	\$10.69	\$667,056	
	HMA OVERLAY SHLD 1.75 "	100.00%	38,133	SQ YD	\$8.62	\$328,709	
		PWFn = 0.4120			PW = 0.4120 X	\$1,236,252	\$509,319
YEAR 35							
	LONG SHLD JT R&S	100.00%	31,200	LIN FT	\$2.00	\$62,400	
	CNTR LINE JOINT R&S	100.00%	31,200	LIN FT	\$2.00	\$62,400	
	RNDM / THRM CRACK R&S	50.00%	25,740	LIN FT	\$2.00	\$51,480	
	PD PVMT PATCH M&F SURF	0.10%	62	SQ YD	\$79.64	\$4,938	
		PWFn = 0.3554			PW = 0.3554 X	\$181,218	\$64,402
YEAR 40							
	LONG SHLD JT R&S	100.00%	31,200	LIN FT	\$2.00	\$62,400	
	CNTR LINE JOINT R&S	100.00%	31,200	LIN FT	\$2.00	\$62,400	
	RNDM / THRM CRACK R&S	50.00%	25,740	LIN FT	\$2.00	\$51,480	
	PD PVMT PATCH M&F SURF	0.50%	312	SQ YD	\$79.64	\$24,848	
		PWFn = 0.3066			PW = 0.3066 X	\$201,128	\$61,657
							\$1,933,559
ROUTINE MAINTENANCE ACTIVITY				8.86 Lane Miles	0.00	\$0	\$0
							MAINTENANCE LIFE-CYCLE COST \$1,933,559
45	YEAR LIFE CYCLE	CRFn = 0.0407852				MAINTENANCE ANNUAL COST PER MILE	\$53,383

PCC PAVEMENT

CRCP

ROUTE **I-57**
 SECTION **(41-3-1)RS-1;(41-8)RS-2**
 COUNTY **Jefferson**
 LOCATION **Mt Vernon - CN 78276**

FACILITY TYPE **INTERSTATE**

PROJECT LENGTH **7800 FT ==> 1.48 Miles**
 # OF CENTERLINES **4 CL**
 # OF LANES **6 LANES**
 # OF EDGES **4 EP**
 LANE WIDTH - AVERAGE **12 FT**
 SHOULDER WIDTH PCC Inside **10 FT**
 PCC Outside **12 FT**
 Total Width of Paved Shoulders **44 FT**

PAVEMENT THICKNESS (RIGID) **CRCP 12.50 IN TIED SHLD**
 SHOULDER THICKNESS **12.50 IN**

POLICY OVERLAY THICKNESS **3.75 IN**

RIGID PAVEMENT	TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
Worksheet Construction Type is	Reconstruction	8.93	97.25	97.25
The Pavement Type is				CRCP

INITIAL COSTS

ITEM	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE	COST
CRCP PAVEMENT	(12.50")	62,400	SQ YD	\$47.00 /SQ YD	\$2,932,800
PAVEMENT REINFORCEMENT		62,400	SQ YD	\$22.00 /SQ YD	\$1,372,800
STABILIZED SUBBASE	(4.00")	67,600	SQ YD	\$18.00 /SQ YD	\$1,216,800
PCC SHOULDERS	(12.50" to 12.50")	38,133	SQ YD	\$44.00 /SQ YD	\$1,677,852
CURB & GUTTER		0	LIN FT	\$0.00 /LIN FT	\$0
SUBBASE GRAN MATL TY C	(~ 3.13")	3,858	TONS	\$24.00 /TON	\$92,592
IMPROVED SUBGRADE:	Modified Soil (K ₂₀ = 412.0)	102,267	SQ YD	\$2.75 /SQ YD	\$281,234
Reserved For User Supplied Item		0	UNITS	\$0.00 /UNITS	\$0
Reserved For User Supplied Item		0	UNITS	\$0.00 /UNITS	\$0
PAVEMENT REMOVAL		62,400	SQ YD	\$6.00 /SQ YD	\$374,400
SHOULDER REMOVAL		38,133	SQ YD	\$5.00 /SQ YD	\$190,665

Note: * Denotes User Supplied Quantity

RIGID CONSTRUCTION INITIAL COST	\$8,139,143
RIGID CONSTRUCTION ANNUAL COST PER MILE	\$224,709

MAINTENANCE COSTS:

ITEM	THICKNESS	MATERIAL	UNIT COST
ROUTINE MAINTENANCE ACTIVITY			\$0.00 /LANE-MILE / YEAR
HMA POLICY OVERLAY	(3.75")		3.75
HMA POLICY OVERLAY PVMT	(3.75")	1.0007	\$18.72 /SQ YD
HMA SURFACE MIX	(1.50")	1.0005	\$8.01 /SQ YD
HMA BINDER MIX	(2.25")	1.0122	\$10.71 /SQ YD
HMA POLICY OVERLAY SHLD	(3.75")	Shoulder Mix	\$16.17 /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	\$76.98 /SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill HMA 1.50")		Surface Mix	\$76.98 /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	\$9,373,132
RIGID TOTAL ANNUAL COST PER MILE	\$258,777

CONTINUOUSLY REINFORCED CONCRETE PAVEMENT
 UNBONDED CONTINUOUSLY REINFORCED CONCRETE OVERLAY
 Figure 54-7.B

MAINTENANCE COSTS:	ITEM	%	QUANTITY	UNIT	UNIT COST	COST	PRESENT WORTH
YEAR 10							
	PAVEMENT PATCH CLASS A	0.10%	62	SQ YD	\$195.00	\$12,090	
		PWF _n = 0.7441			PW = 0.7441 X	\$12,090	\$8,996
YEAR 15							
	PAVEMENT PATCH CLASS A	0.20%	125	SQ YD	\$195.00	\$24,375	
		PWF _n = 0.6419			PW = 0.6419 X	\$24,375	\$15,645
YEAR 20							
	PAVEMENT PATCH CLASS A	0.50%	312	SQ YD	\$195.00	\$60,840	
	LONGITUDINAL SHLD JT R&S	100.00%	31,200	LIN FT	\$2.00	\$62,400	
	CENTERLINE JT R&S	100.00%	31,200	LIN FT	\$2.00	\$62,400	
		PWF _n = 0.5537			PW = 0.5537 X	\$185,640	\$102,784
YEAR 25							
	PAVEMENT PATCH CLASS A	0.75%	468	SQ YD	\$195.00	\$91,260	
	SHOULDER PATCH CLASS C	0.50%	191	SQ YD	\$145.00	\$27,695	
		PWF _n = 0.4776			PW = 0.4776 X	\$118,955	\$56,814
YEAR 30	INTERSTATE						
	PAVEMENT PATCH CLASS A	3.00%	1,872	SQ YD	\$195.00	\$365,040	
	SHOULDER PATCH CLASS C	1.00%	381	SQ YD	\$145.00	\$55,245	
	HMA POLICY OVERLAY 3.75" (PVMT)	100.00%	62,400	SQ YD	\$18.72	\$1,168,149	
	HMA POLICY OVERLAY 3.75" (SHLD)	100.00%	38,133	SQ YD	\$16.17	\$616,616	
		PWF _n = 0.4120			PW = 0.4120 X	\$2,205,050	\$908,451
YEAR 35							
	LONGITUDINAL SHLD JT R&S	100.00%	31,200	LIN FT	\$2.00	\$62,400	
	CENTERLINE JT R&S	100.00%	31,200	LIN FT	\$2.00	\$62,400	
	RANDOM CRACK R&S	50.00%	23,400	LIN FT	\$2.00	\$46,800	
	PD PVMT PATCH M&F HMA SURF	0.10%	62	SQ YD	\$76.98	\$4,773	
		PWF _n = 0.3554			PW = 0.3554 X	\$176,373	\$62,680
YEAR 40							
	LONGITUDINAL SHLD JT R&S	100.00%	31,200	LIN FT	\$2.00	\$62,400	
	CENTERLINE JT R&S	100.00%	31,200	LIN FT	\$2.00	\$62,400	
	RANDOM CRACK R&S	50.00%	23,400	LIN FT	\$2.00	\$46,800	
	PAVEMENT PATCH CLASS A	0.50%	312	SQ YD	\$195.00	\$60,840	
	PD PVMT PATCH M&F HMA SURF	0.50%	312	SQ YD	\$76.98	\$24,018	
		PWF _n = 0.3066			PW = 0.3066 X	\$256,458	\$78,619
							\$1,233,989
	ROUTINE MAINTENANCE ACTIVITY		8.86	Lane Miles	\$0.00	\$0	\$0
							MAINTANANCE LIFE-CYCLE COST \$1,233,989
45	YEAR LIFE CYCLE	CRF _n = 0.0407852					MAINTANANCE ANNUAL COST PER MILE \$34,068

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	62,400	SQ YD	\$5.00 /SQ YD	\$312,000
RUBBLIZING PCC PAVEMENT		62,400	SQ YD	\$2.50 /SQ YD	\$156,000
HMA OVERLAY (TOTAL)	11.75	62,400	SQ YD	\$78.68 /SQ YD	\$4,909,632 ~
HMA SURFACE COURSE	2.00	62,400	SQ YD	\$10.69 /SQ YD	\$0
HMA TOP BINDER COURSE	2.25	62,400	SQ YD	\$10.74 /SQ YD	\$0
HMA LOWER BINDER COURSE	7.50	62,400	SQ YD	\$57.25 /SQ YD	\$0
HMA SHOULDER	5.75	12,279	TONS	\$77.00 /TON	\$945,478 ~
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 \$6,323,110
 RUBBLIZED CONSTRUCTION ANNUAL COST PER MILE \$174,571

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")	1.0048	2.00	\$88.38 /TON
HMA SURFACE MIX	(2.00")	1.0048	Surface Mix 2.00	\$95.00 /TON
HMA BINDER MIX	(0.00")	1.0048	Top Binder Mix 2.00	\$84.00 /TON
HMA OVERLAY SHLD (Year 30)	(2.00")		Shoulder Mix 2.00	\$77.00 /TON

RUBBLIZED MAINTENANCE LIFE-CYCLE COST \$1,945,875
 RUBBLIZED MAINTENANCE ANNUAL COST PER MILE \$53,723

RUBBLIZED TOTAL LIFE-CYCLE COST \$8,268,985
 RUBBLIZED TOTAL ANNUAL COST PER MILE \$228,294

RECONSTRUCTION - PCC UNBONDED OVERLAY

PAVEMENT THICKNESS (PCC) **11.50 IN** Pavement Type is **CRCP**
 SHOULDER THICKNESS **11.50 IN**

INITIAL COSTS

ITEM	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE	COST
MILLING of EXISTING HMA OVERLAY (Pvmt & Shld)		100,533	SQ YD	\$4.50 /SQ YD	\$452,399
HMA BINDER COURSE (Pvmt & Shld)		100,533	SQ YD	\$18.00 /SQ YD	\$1,809,594
CRC PAVEMENT	11.50	62,400	SQ YD	\$44.00 /SQ YD	\$2,745,600
PAVEMENT REINFORCEMENT		62,400	SQ YD	\$22.00 /SQ YD	\$1,372,800
PCC SHOULDERS	11.50 11.50	38,133	SQ YD	\$41.00 /SQ YD	\$1,563,453
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

UNBONDED CONSTRUCTION INITIAL COST \$7,943,846
 UNBONDED CONSTRUCTION ANNUAL COST PER MILE \$219,317

UNBONDED MAINTENANCE LIFE-CYCLE COST \$1,233,989
 UNBONDED MAINTENANCE ANNUAL COST PER MILE \$34,068

UNBONDED TOTAL LIFE-CYCLE COST \$9,177,835
 UNBONDED TOTAL ANNUAL COST PER MILE \$253,385

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%	31,200	LIN FT	\$2.00	\$62,400	
	CNTR LINE JOINT R&S	100.00%	31,200	LIN FT	\$2.00	\$62,400	
	RNDM / THRM CRACK R&S	50.00%	25,740	LIN FT	\$2.00	\$51,480	
	PD PVMT PATCH M&F SURF	0.10%	62	SQ YD	\$79.64	\$4,938	
	PWFn =	0.8626		PW =	0.8626 X	\$181,218	\$156,320
YEAR 10							
	LONG SHLD JT R&S	100.00%	31,200	LIN FT	\$2.00	\$62,400	
	CNTR LINE JOINT R&S	100.00%	31,200	LIN FT	\$2.00	\$62,400	
	RNDM / THRM CRACK R&S	50.00%	25,740	LIN FT	\$2.00	\$51,480	
	PD PVMT PATCH M&F SURF	0.50%	312	SQ YD	\$79.64	\$24,848	
	PWFn =	0.7441		PW =	0.7441 X	\$201,128	\$149,658
YEAR 15							
	MILL PVMT & SHLD 2.00"	100.00%	100,533	SQ YD	\$2.00	\$201,066	
	PD PVMT PATCH M&F ADD'L 2.00"	1.00%	624	SQ YD	\$69.00	\$43,056	
	HMA OVERLAY PVMT 2.00"	100.00%	62,400	SQ YD	\$10.69	\$667,010	
	HMA OVERLAY SHLD 2.00 "	100.00%	38,133	SQ YD	\$8.62	\$328,709	
	PWFn =	0.6419		PW =	0.6419 X	\$1,239,841	\$795,807
YEAR 20							
	LONG SHLD JT R&S	100.00%	31,200	LIN FT	\$2.00	\$62,400	
	CNTR LINE JOINT R&S	100.00%	31,200	LIN FT	\$2.00	\$62,400	
	RNDM / THRM CRACK R&S	50.00%	25,740	LIN FT	\$2.00	\$51,480	
	PD PVMT PATCH M&F SURF	0.10%	62	SQ YD	\$79.64	\$4,938	
	PWFn =	0.5537		PW =	0.5537 X	\$181,218	\$100,336
YEAR 25							
	LONG SHLD JT R&S	100.00%	31,200	LIN FT	\$2.00	\$62,400	
	CNTR LINE JOINT R&S	100.00%	31,200	LIN FT	\$2.00	\$62,400	
	RNDM / THRM CRACK R&S	50.00%	25,740	LIN FT	\$2.00	\$51,480	
	PD PVMT PATCH M&F SURF	0.50%	312	SQ YD	\$79.64	\$24,848	
	PWFn =	0.4776		PW =	0.4776 X	\$201,128	\$96,060
HMA SD INTERSTATE							
YEAR 30							
	MILL PVMT & SHLD 2.00"	100.00%	100,533	SQ YD	\$2.00	\$201,066	
	PD PVMT PATCH M&F ADD'L 2.00"	2.00%	1,248	SQ YD	\$69.00	\$86,112	
	PD SHLD PATCH M&F ADD'L 2.00"	1.00%	381	SQ YD	\$77.62	\$29,575	
	HMA OVERLAY PVMT 2.00"	100.00%	7,021	TON	\$88.38	\$620,530	
	HMA OVERLAY SHLD 2.00 "	100.00%	4,271	TON	\$77.00	\$328,862	
	PWFn =	0.4120		PW =	0.4120 X	\$1,266,145	\$521,635
YEAR 35							
	LONG SHLD JT R&S	100.00%	31,200	LIN FT	\$2.00	\$62,400	
	CNTR LINE JOINT R&S	100.00%	31,200	LIN FT	\$2.00	\$62,400	
	RNDM / THRM CRACK R&S	50.00%	25,740	LIN FT	\$2.00	\$51,480	
	PD PVMT PATCH M&F SURF	0.10%	62	SQ YD	\$79.64	\$4,938	
	PWFn =	0.3554		PW =	0.3554 X	\$181,218	\$64,402
YEAR 40							
	LONG SHLD JT R&S	100.00%	31,200	LIN FT	\$2.00	\$62,400	
	CNTR LINE JOINT R&S	100.00%	31,200	LIN FT	\$2.00	\$62,400	
	RNDM / THRM CRACK R&S	50.00%	25,740	LIN FT	\$2.00	\$51,480	
	PD PVMT PATCH M&F SURF	0.50%	312	SQ YD	\$79.64	\$24,848	
	PWFn =	0.3066		PW =	0.3066 X	\$201,128	\$61,657
							\$1,945,875
ROUTINE MAINTENANCE ACTIVITY				8.86 Lane Miles	0.00	0	\$0
							MAINTENANCE LIFE-CYCLE COST \$1,945,875
45	YEAR LIFE CYCLE	CRFn = 0.0407852				MAINTENANCE ANNUAL COST PER MILE	\$53,723

LIFE-CYCLE COST ANALYSIS: NEW DESIGN

Calculated / Revised : 10/7/13 8:11 AM

			CRCP	HMA
CONSTRUCTION	INITIAL COST	PRESENT WORTH	\$8,139,143	\$7,697,328
		ANNUAL COST PER MILE	\$224,709	\$212,511
MAINTENANCE	LIFE-CYCLE COST	PRESENT WORTH	\$1,233,989	\$1,933,559
		ANNUAL COST PER MILE	\$34,068	\$53,383
TOTAL	LIFE-CYCLE COST	PRESENT WORTH	\$9,373,132	\$9,630,887
		ANNUAL COST PER MILE	\$258,777	\$265,894

LIFE-CYCLE COST ANALYSIS: SUPPLEMENTAL DESIGNS

			PCC Unbonded	Rubblized
CONSTRUCTION	INITIAL COST	PRESENT WORTH	\$7,943,846	\$6,323,110
		ANNUAL COST PER MILE	\$219,317	\$174,571
MAINTENANCE	LIFE-CYCLE COST	PRESENT WORTH	\$1,233,989	\$1,945,875
		ANNUAL COST PER MILE	\$34,068	\$53,723
TOTAL	LIFE-CYCLE COST	PRESENT WORTH	\$9,177,835	\$8,268,985
		ANNUAL COST PER MILE	\$253,385	\$228,294

LIFE-CYCLE COST ANALYSIS: FINAL SUMMARY

LOWEST COST OPTION	=====>		Rubblized	\$228,294	
OTHER OPTIONS (LOWEST TO HIGHEST):		TYPE / PERCENTAGE	PCC Unbonded	\$253,385	11.0%
		TYPE / PERCENTAGE	CRCP	\$258,777	13.4%
		TYPE / PERCENTAGE	HMA	\$265,894	16.5%