



Illinois Department of Transportation

To: Mike Brand
From: Greg Jamerson By: Mark Daugherty District 7
Subject: Pavement Design
Date: February 16, 2017

I-70
Section (25-1,2)R
Altamont to Little Wabash River west of Effingham
Effingham County
74664

The pavement design for 11.5" of HMA over rubblized pavement was approved by your office on 7-9-15. The project is scheduled for the June 16, 2017 letting and will be constructed using temporary crossovers, allowing closure of one direction of I-70 per stage. After several meetings with District 7 Construction and Materials personnel, rubblized pavement is proposed for over 75% of the 8.9 mile project (one way), but certain sections are better suited for Full-Depth HMA pavement and CRC pavement.

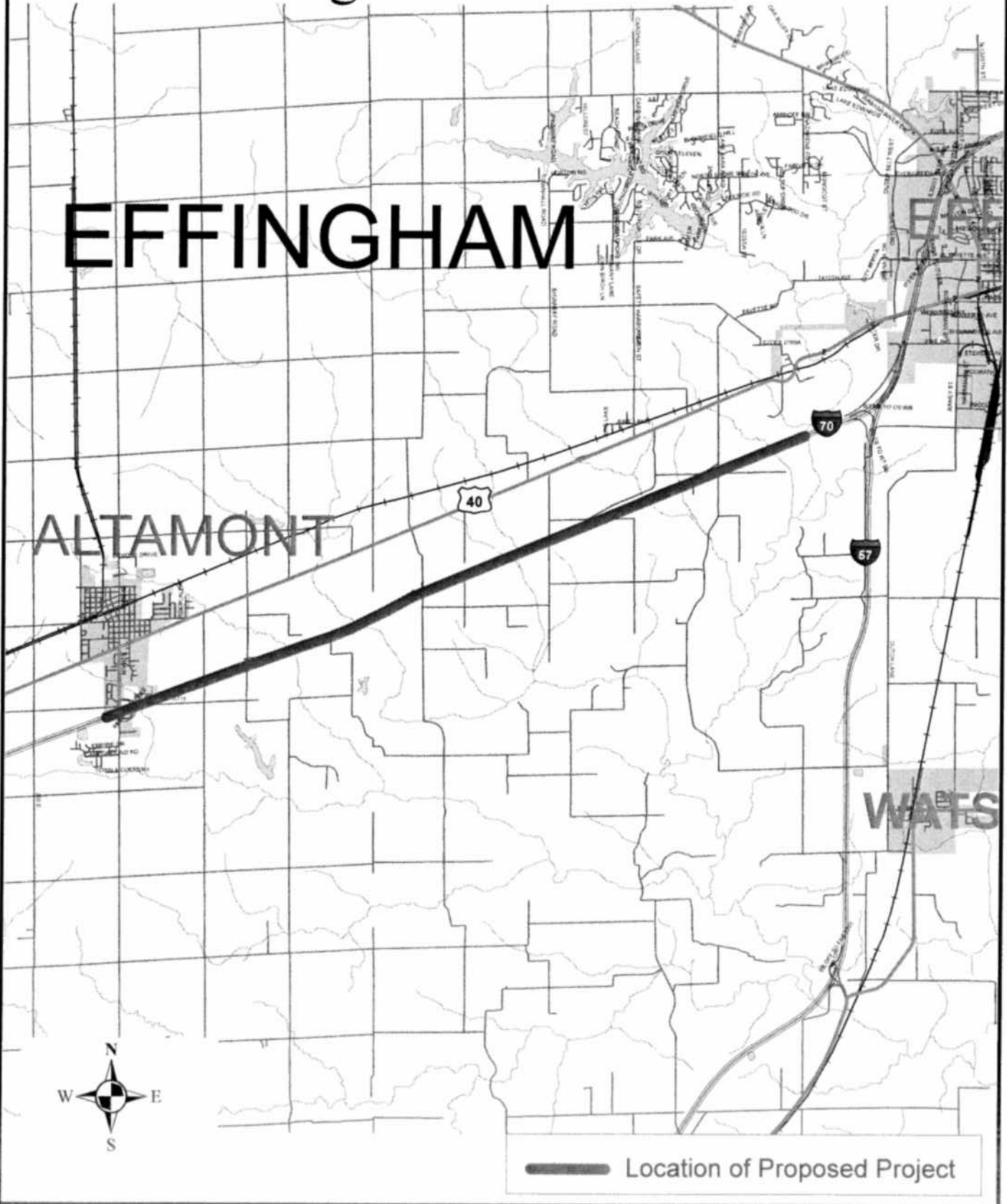
CRC PAVEMENT

We are proposing to construct 12" CRC pavement over 4" stabilized subbase over 12" lime modified soil from the west job limit throughout the Altamont interchange and easterly beyond the west temporary crossover, a total of approximately 0.8 miles (one way). Because the distance between SN 025-0005(EB)/0006(WB) - over the abandoned railroad, and SN 025-0007(EB)/0008(WB) - over IL 128, is only 800', it was decided to use CRC pavement for constructability and to match grade. HMA over rubblized pavement would require a 6" grade raise. Since the interchange ramps are located partially on SN 025-0007/0008, it made sense to match grade through the entire interchange. The west temporary crossover is within the job limits, located near the Altamont interchange. For staging considerations and constructability of the crossovers, it was decided to match grade and construct CRC pavement through the west temporary crossover.

FULL-DEPTH HMA PAVEMENT

We are proposing to use 16.5" Full-Depth HMA pavement over 12" lime modified soil under all overhead structures, a total of approximately 1.4 miles (one way). The new pavement elevation will be lowered to maintain proper clearance. CRC pavement was considered and the drainage issue was discussed, but the depth of pavement structure was the same for CRC as Full-Depth HMA and there was concern of eventually having a bump at CRC/HMA joints. We also considered CRC pavement with HMA overlay. We felt the contractor could construct Full-Depth HMA over lime modified soil cheaper, faster, and smoother than CRC pavement. In our opinion, the benefits of constructing CRC pavement at these locations did not exceed the benefits of Full-Depth HMA.

Illinois Department of Transportation Region 4 - District 7



PROJECT AND TRAFFIC INPUTS

(Enter Data in Gray Shaded Cells)

Route: I-70	Comments: Rubblization		
Section: (25-1,2)R	Design Date: 03/17/2015	<-- BY	
County: Effingham	Modify Date:	ADT	Year
Location: Abandoned RR bridge in Altamont to Littl		Current: 20,000	2014
Facility Type: Interstate or Freeway	# of Lanes = 4	Future: 31,000	2040
Road Class: I	Subgrade Support Rating (SSR): Poor	Structural Design Traffic	
Construction Year: 2020	Design Period (DP) = 20 years	Minimum ADT	Actual ADT
		Actual % of Total ADT	% of ADT in Design Lane
		PV = 0	P = 32%
		SU = 500	S = 45%
		MU = 1500	M = 45%
		Struct. Design ADT = 26,769 (2030)	

TRAFFIC FACTOR CALCULATION

FLEXIBLE PAVEMENT

Cpv = 0.15
 Csu = **132.5**
 Cmu = **482.53**
 TF flexible (Actual) = 45.63 (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) = 65.33 (Actual ADT)
 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 = 45.63	Use TF rigid = 65.33
PG Grade Lower Binder Lifts = PG 64-22 (Fig. 53-4.R)	Edge Support = Tied Shoulder or C.&G.
HMA Mixture Temp. = 78.0 deg. F (Fig. 54-5.C)	Rigid Pavt Thick. = 11.50 in. (Fig. 54-4.E)
Design HMA Mixture Modulus (E _{HMA}) = 610 ksi (Fig. 54-5.D)	
Design HMA Strain (ε _{HMA}) = 40 (Fig. 54-5.E)	CRCP Pavement
Full Depth HMA Design Thickness = 17.25 in. (Fig. 54-5.F)	Use TF rigid = 65.33
Limiting Strain Criterion Thickness = 16.25 in. (Fig. 54-5.I)	IBR value = 3
Use Full-Depth HMA Thickness = 16.25 inches	CRCP Thickness = 11.75 in. (Fig. 54-4.M)

RECONSTRUCTION ONLY (SUPPLEMENTAL) PAVEMENT DESIGN CALCULATIONS

HMA Overlay of Rubblized PCC	Unbonded Concrete Overlay
Use TF flexible = 45.63	Review 54-4.03 for limitations and special considerations.
HMA Overlay Design Thickness = 14.25 in. (Fig. 54-5.U)	
Limiting Strain Criterion Thickness = 11.50 in. (Fig. 54-5.V)	
Use HMA Overlay Thickness = 11.50 inches	CRCP Thickness = 10.75 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 Unmarked State Route	0 No Min	250 No Min	750 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	

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

Design Lane Distribution Factors For Structural Design Traffic (Fig. 54-2.B)						
Number of Lanes	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

LSC Design

ROUTE I-70
 SECTION (25-1,2)R
 COUNTY Effingham
 LOCATION ge in Altamont to Little Wabash River in Effingham

FACILITY TYPE INTERSTATE

PROJECT LENGTH 47,784 FT == > 9.05 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 16.25 IN MAX
 SHOULDER THICKNESS 8.00 IN HMA_LSCD LSC Design
 POLICY OVERLAY THICKNESS 2.00 IN

FLEX PAVEMENT	TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
		7.11	45.63	45.63

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HMA COST PER TON	UNIT PRICE
HMA SURFACE	\$111.65 / TON
HMA TOP BINDER	\$90.34 / TON
HMA LOWER BINDER	\$73.74 / TON
HMA BINDER (LEVELING)	\$90.00 / TON
HMA SHOULDER	\$68.93 / TON

INITIAL COSTS

ITEM	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE	COST
HMA PAVEMENT (FULL-DEPTH)	(16.25")	254848	254,848 SQ YD	\$77.30 / SQ YD	\$19,700,263 ~
HMA SURFACE COURSE	(2.00")	1.0069	28,741 TONS	\$111.65 / TON	\$0
HMA TOP BINDER COURSE	(2.25")	1.0217	32,808 TONS	\$90.34 / TON	\$0
HMA LOWER BINDER COURSE	(12.00")	1.0712	183,448 TONS	\$73.74 / TON	\$0

HMA SHOULDER	(8.00")	169899	76,115 TONS	\$68.93 / TON	\$5,246,580 ~
CURB & GUTTER			0 LIN FT	\$30.00 / LIN FT	\$0

SUBBASE GRAN MATL TY C (TONS)			66,359 TONS	\$17.18 / TON	\$1,140,048
IMPROVED SUBGRADE:	Modified Soil Width = 87.4'		464,124 SQ YD	\$3.12 / SQ YD	\$1,448,067

Reserved For User Supplied Item			0 UNITS	\$0.00 / UNITS	\$0
Reserved For User Supplied Item			0 UNITS	\$0.00 / UNITS	\$0

PAVEMENT REMOVAL			254,848 SQ YD	\$7.00 / SQ YD	\$1,783,936
SHOULDER REMOVAL			169,899 SQ YD	\$8.00 / SQ YD	\$1,359,192

Note: * Denotes User Supplied Quantity

FLEXIBLE CONSTRUCTION INITIAL COST	\$30,678,086
FLEXIBLE CONSTRUCTION ANNUAL COST PER MILE	\$138,255

MAINTENANCE COSTS:

ITEM	THICKNESS	MATERIAL	T	UNIT COST
ROUTINE MAINTENANCE ACTIVITY				\$0.00 LANE-MILE / YEAR
HMA OVERLAY PVMT SURF	(2.00")	1.0069 Surface Mix	2.00	\$12.59 / SQ YD
HMA OVERLAY PVMT	(2.00")	1.0069 Surface Mix	2.00	\$12.59 / SQ YD
HMA SURFACE MIX	(2.00")	1.0069 Surface Mix	2.00	\$12.59 / SQ YD
HMA BINDER MIX	(0.00")	1.0139 aling Binder Mix	0.00	\$0.00 / SQ YD
HMA OVERLAY SHLD (Year 30)	(2.00")	Shoulder Mix	2.00	\$7.72 / SQ YD
HMA OVERLAY SHLD	(2.00")	Shoulder Mix	2.00	\$7.72 / SQ YD
MILLING (2.00 IN)			2.00	\$3.00 / SQ YD
PARTIAL DEPTH PVMT PATCH	(Mill & Fill Surf)	Surface Mix	2.00	\$82.50 / SQ YD

PARTIAL DEPTH SHLD PATCH	(Mill & Fill Surf)	Shoulder Mix	2.00	\$77.72 / SQ YD
PARTIAL DEPTH PVMT PATCH	(Mill & Fill +2.00 ")	Leveling Binder Mix	2.00	\$80.08 / SQ YD
PARTIAL DEPTH SHLD PATCH	(Mill & Fill +2.00 ")	Shoulder Mix	2.00	\$77.72 / 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	\$39,922,423
FLEXIBLE TOTAL ANNUAL COST PER MILE	\$179,916

PCC PAVEMENT

CRCP

ROUTE I-70
 SECTION (25-1,2)R
 COUNTY Effingham
 LOCATION je in Altamont to Little Wabash River in Effingham

FACILITY TYPE INTERSTATE

PROJECT LENGTH 47784 FT == > 9.05 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) CRCP 11.75 IN TIED SHLD
 SHOULDER THICKNESS 11.75 IN

POLICY OVERLAY THICKNESS 3.75 IN

RIGID PAVEMENT	TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
		10.05	65.33	65.33
Worksheet Construction Type is	Reconstruction	The Pavement Type is		CRCP

INITIAL COSTS

ITEM	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE	COST
CRC PAVEMENT	(11.75")	254,848	SQ YD	\$46.17 / SQ YD	\$11,766,332
PAVEMENT REINFORCEMENT		254,848	SQ YD	\$23.00 / SQ YD	\$5,861,504
STABILIZED SUBBASE	(4.00")	286,704	SQ YD	\$17.68 / SQ YD	\$5,068,927
PCC SHOULDERS		169,899	SQ YD	\$45.42 / SQ YD	\$7,716,813
CURB & GUTTER		0	LIN FT	\$30.00 / LIN FT	\$0
SUBBASE GRAN MATL TY C	(~ 3.48")	19,991	TONS	\$20.34 / TON	\$406,617
IMPROVED SUBGRADE:	Modified Soil Width = 82.0'	435,365	SQ YD	\$3.12 / SQ YD	\$1,358,339
Reserved For User Supplied Item		0	UNITS	\$0.00 / UNITS	\$0
Reserved For User Supplied Item		0	UNITS	\$0.00 / UNITS	\$0
PAVEMENT REMOVAL		254,848	SQ YD	\$7.00 / SQ YD	\$1,783,936
SHOULDER REMOVAL		169,899	SQ YD	\$8.00 / SQ YD	\$1,359,192

Note: * Denotes User Supplied Quantity
 RIGID CONSTRUCTION INITIAL COST \$35,321,660
 RIGID CONSTRUCTION ANNUAL COST PER MILE \$159,182

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")	1.0130	3.75	\$21.02 / SQ YD
HMA SURFACE MIX	(1.50")	1.0052	1.50	\$9.43 / SQ YD
HMA BINDER MIX	(2.25")	1.0182	2.25	\$11.59 / SQ YD
HMA POLICY OVERLAY SHLD	(3.75")	Shoulder Mix	3.75	\$14.48 / 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	\$79.38 / SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill HMA 1.50")		Surface Mix	1.50	\$79.38 / 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 \$40,670,363
 RIGID TOTAL ANNUAL COST PER MILE \$183,287

RECONSTRUCTION - HMA OVER RUBBLIZED PAVEMENT

PAVEMENT OVERLAY THICKNESS (FLEXIBLE) **11.50** IN **11.50** IN MAX **HMA_LSCD** Maintenance Schedule
 SHOULDER OVERLAY THICKNESS **5.50** IN

INITIAL COSTS

ITEM	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE	COST
HMA OVERLAY REMOVAL	6.00	254,848	SQ YD	\$4.00 / SQ YD	\$1,019,392
RUBBLIZING PCC PAVEMENT		254,848	SQ YD	\$2.50 / SQ YD	\$637,120
HMA OVERLAY (TOTAL)	11.50	254,848	SQ YD	\$55.80 / SQ YD	\$14,219,805 ~
HMA SURFACE COURSE	2.00	1.0069 254,848	SQ YD	\$12.59 / SQ YD	\$0
HMA TOP BINDER COURSE	2.25	1.0217 254,848	SQ YD	\$11.63 / SQ YD	\$0
HMA LOWER BINDER COURSE	7.25	1.0547 254,848	SQ YD	\$31.58 / SQ YD	\$0
HMA SHOULDER	5.50	52,329	TONS	\$68.93 / TON	\$3,607,023 ~
Inlet Adjustments		22	EACH *	\$1,500.00 / EACH	\$33,000
Aggregate Shoulders, Type B		8,115	TONS *	\$27.48 / TONS	\$223,000
EARTHWORK		281,925	CU YD *	\$9.97 / CU YD	\$2,810,792
Note: * Denotes User Supplied Quantity					
				RUBBLIZED CONSTRUCTION INITIAL COST	\$22,550,132
				RUBBLIZED CONSTRUCTION ANNUAL COST PER MILE	\$101,626
				RUBBLIZED MAINTENANCE LIFE-CYCLE COST	\$9,244,337
				RUBBLIZED MAINTENANCE ANNUAL COST PER MILE	\$41,661
				RUBBLIZED TOTAL LIFE-CYCLE COST	\$31,794,469
				RUBBLIZED TOTAL ANNUAL COST PER MILE	\$143,287

RECONSTRUCTION - PCC UNBONDED OVERLAY

PAVEMENT THICKNESS (PCC) **10.75** IN Pavement Type is **CRCP**
 SHOULDER THICKNESS **10.75** IN

INITIAL COSTS

ITEM	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE	COST
MILLING of EXISTING HMA OVERLAY (Pvmt & Shld)		424,747	SQ YD	\$3.00 / SQ YD	\$1,274,241
HMA BINDER COURSE (Pvmt & Shld)		424,747	SQ YD	\$4.00 / SQ YD	\$1,698,988
CRC PAVEMENT	10.75	254,848	SQ YD	\$42.49 / SQ YD	\$10,828,492
PAVEMENT REINFORCEMENT		254,848	SQ YD	\$23.00 / SQ YD	\$5,861,504
PCC SHOULDERS		169,899	SQ YD	\$41.75 / SQ YD	\$7,093,283
Inlet Adjustments		22	EACH *	\$1,500.00 / EACH	\$33,000
Aggregate Shoulders, Type B		12,950	TON *	\$27.17 / TON	\$351,852
EARTHWORK		331,939	CU YD *	\$10.01 / CU YD	\$3,322,709
Note: * Denotes User Supplied Quantity					
				UNBONDED CONSTRUCTION INITIAL COST	\$30,464,069
				UNBONDED CONSTRUCTION ANNUAL COST PER MILE	\$137,291
				UNBONDED MAINTENANCE LIFE-CYCLE COST	\$5,348,703
				UNBONDED MAINTENANCE ANNUAL COST PER MILE	\$24,105
				UNBONDED TOTAL LIFE-CYCLE COST	\$35,812,772
				UNBONDED TOTAL ANNUAL COST PER MILE	\$161,396

LIFE-CYCLE COST ANALYSIS: NEW DESIGN

Calculated / Revised : **3/17/15 1:35 PM**

			CRCP	HMA
CONSTRUCTION	INITIAL COST	PRESENT WORTH	\$35,321,660	\$30,678,086
		ANNUAL COST PER MILE	\$159,182	\$138,255
MAINTENANCE	LIFE-CYCLE COST	PRESENT WORTH	\$5,348,703	\$9,244,337
		ANNUAL COST PER MILE	\$24,105	\$41,661
TOTAL	LIFE-CYCLE COST	PRESENT WORTH	\$40,670,363	\$39,922,423
		ANNUAL COST PER MILE	\$183,287	\$179,916

LIFE-CYCLE COST ANALYSIS: SUPPLEMENTAL DESIGNS

			PCC Unbonded	Rubblized
CONSTRUCTION	INITIAL COST	PRESENT WORTH	\$30,464,069	\$22,550,132
		ANNUAL COST PER MILE	\$137,291	\$101,626
MAINTENANCE	LIFE-CYCLE COST	PRESENT WORTH	\$5,348,703	\$9,244,337
		ANNUAL COST PER MILE	\$24,105	\$41,661
TOTAL	LIFE-CYCLE COST	PRESENT WORTH	\$35,812,772	\$31,794,469
		ANNUAL COST PER MILE	\$161,396	\$143,287

LIFE-CYCLE COST ANALYSIS: FINAL SUMMARY

LOWEST COST OPTION	=====>		Rubblized	\$143,287	
OTHER OPTIONS (LOWEST TO HIGHEST):		TYPE / PERCENTAGE	PCC Unbonded	\$161,396	12.6%
		TYPE / PERCENTAGE	HMA	\$179,916	25.6%
		TYPE / PERCENTAGE	CRCP	\$183,287	27.9%

S:\GENWPDOCS\Pavement Designs\D-71-70 - Altamont to the Little Wabash River - 746641-70 Altamont to the Little Wabash River - 3rd Submittal\pavement design

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%	191,136	LIN FT	\$2.00	\$382,272	
	CNTR LINE JOINT R&S	100.00%	95,568	LIN FT	\$2.00	\$191,136	
	RNDM / THRM CRACK R&S	50.00%	105,125	LIN FT	\$2.00	\$210,250	
	PD PVMT PATCH M&F SURF	0.10%	255	SQ YD	\$82.50	\$21,039	
	PWFn =	0.8626		PW =	0.8626 X	\$804,697	\$694,139
YEAR 10							
	LONG SHLD JT R&S	100.00%	191,136	LIN FT	\$2.00	\$382,272	
	CNTR LINE JOINT R&S	100.00%	95,568	LIN FT	\$2.00	\$191,136	
	RNDM / THRM CRACK R&S	50.00%	105,125	LIN FT	\$2.00	\$210,250	
	PD PVMT PATCH M&F SURF	0.50%	1,274	SQ YD	\$82.50	\$105,111	
	PWFn =	0.7441		PW =	0.7441 X	\$888,769	\$661,328
YEAR 15							
	MILL PVMT & SHLD 2.00"	100.00%	424,747	SQ YD	\$3.00	\$1,274,241	
	PD PVMT PATCH M&F ADD'L 2.00"	1.00%	2,548	SQ YD	\$80.08	\$204,044	
	HMA OVERLAY PVMT 2.00"	100.00%	254,848	SQ YD	\$12.59	\$3,208,954	
	HMA OVERLAY SHLD 2.00 "	100.00%	169,899	SQ YD	\$7.72	\$1,311,645	
	PWFn =	0.6419		PW =	0.6419 X	\$5,998,884	\$3,850,455
YEAR 20							
	LONG SHLD JT R&S	100.00%	191,136	LIN FT	\$2.00	\$382,272	
	CNTR LINE JOINT R&S	100.00%	95,568	LIN FT	\$2.00	\$191,136	
	RNDM / THRM CRACK R&S	50.00%	105,125	LIN FT	\$2.00	\$210,250	
	PD PVMT PATCH M&F SURF	0.10%	255	SQ YD	\$82.50	\$21,039	
	PWFn =	0.5537		PW =	0.5537 X	\$804,697	\$445,541
YEAR 25							
	LONG SHLD JT R&S	100.00%	191,136	LIN FT	\$2.00	\$382,272	
	CNTR LINE JOINT R&S	100.00%	95,568	LIN FT	\$2.00	\$191,136	
	RNDM / THRM CRACK R&S	50.00%	105,125	LIN FT	\$2.00	\$210,250	
	PD PVMT PATCH M&F SURF	0.50%	1,274	SQ YD	\$82.50	\$105,111	
	PWFn =	0.4776		PW =	0.4776 X	\$888,769	\$424,481
HMA_LSCD							
YEAR 30							
	INTERSTATE						
	MILL PVMT & SHLD 2.00"	100.00%	424,747	SQ YD	\$3.00	\$1,274,241	
	PD PVMT PATCH M&F ADD'L 2.00"	2.00%	5,097	SQ YD	\$80.08	\$408,168	
	PD SHLD PATCH M&F ADD'L 2.00"	1.00%	1,699	SQ YD	\$77.72	\$132,047	
	HMA OVERLAY PVMT 2.00"	100.00%	254,848	SQ YD	\$12.59	\$3,208,954	
	HMA OVERLAY SHLD 2.00 "	100.00%	169,899	SQ YD	\$7.72	\$1,311,645	
	PWFn =	0.4120		PW =	0.4120 X	\$6,335,055	\$2,609,959
YEAR 35							
	LONG SHLD JT R&S	100.00%	191,136	LIN FT	\$2.00	\$382,272	
	CNTR LINE JOINT R&S	100.00%	95,568	LIN FT	\$2.00	\$191,136	
	RNDM / THRM CRACK R&S	50.00%	105,125	LIN FT	\$2.00	\$210,250	
	PD PVMT PATCH M&F SURF	0.10%	255	SQ YD	\$82.50	\$21,039	
	PWFn =	0.3554		PW =	0.3554 X	\$804,697	\$285,976
YEAR 40							
	LONG SHLD JT R&S	100.00%	191,136	LIN FT	\$2.00	\$382,272	
	CNTR LINE JOINT R&S	100.00%	95,568	LIN FT	\$2.00	\$191,136	
	RNDM / THRM CRACK R&S	50.00%	105,125	LIN FT	\$2.00	\$210,250	
	PD PVMT PATCH M&F SURF	0.50%	1,274	SQ YD	\$82.50	\$105,111	
	PWFn =	0.3066		PW =	0.3066 X	\$888,769	\$272,458
							\$9,244,337
ROUTINE MAINTENANCE ACTIVITY			36.20	Lane Miles	0.00	0	\$0
							\$9,244,337
45	YEAR LIFE CYCLE	CRFn = 0.0407852	MAINTENANCE LIFE-CYCLE COST				\$41,661
							\$41,661

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%	255	SQ YD	\$195.00	\$49,725	
		PWFn = 0.7441			PW = 0.7441 X	\$49,725	\$37,000
YEAR 15							
	PAVEMENT PATCH CLASS A	0.20%	510	SQ YD	\$195.00	\$99,450	
		PWFn = 0.6419			PW = 0.6419 X	\$99,450	\$63,833
YEAR 20							
	PAVEMENT PATCH CLASS A	0.50%	1,274	SQ YD	\$195.00	\$248,430	
	LONGITUDINAL SHLD JT R&S	100.00%	191,136	LIN FT	\$2.00	\$382,272	
	CENTERLINE JT R&S	100.00%	95,568	LIN FT	\$2.00	\$191,136	
		PWFn = 0.5537			PW = 0.5537 X	\$821,838	\$455,032
YEAR 25							
	PAVEMENT PATCH CLASS A	0.75%	1,911	SQ YD	\$195.00	\$372,645	
	SHOULDER PATCH CLASS C	0.50%	849	SQ YD	\$145.00	\$123,105	
		PWFn = 0.4776			PW = 0.4776 X	\$495,750	\$236,773
YEAR 30 INTERSTATE							
	PAVEMENT PATCH CLASS A	3.00%	7,645	SQ YD	\$195.00	\$1,490,775	
	SHOULDER PATCH CLASS C	1.00%	1,699	SQ YD	\$145.00	\$246,355	
	HMA POLICY OVERLAY 3.75" (PVMT)	100.00%	254,848	SQ YD	\$21.02	\$5,356,341	
	HMA POLICY OVERLAY 3.75" (SHLD)	100.00%	169,899	SQ YD	\$14.48	\$2,459,334	
		PWFn = 0.4120			PW = 0.4120 X	\$9,552,805	\$3,935,629
YEAR 35							
	LONGITUDINAL SHLD JT R&S	100.00%	191,136	LIN FT	\$2.00	\$382,272	
	CENTERLINE JT R&S	100.00%	95,568	LIN FT	\$2.00	\$191,136	
	RANDOM CRACK R&S	50.00%	95,568	LIN FT	\$2.00	\$191,136	
	PD PVMT PATCH M&F HMA SURF	0.10%	255	SQ YD	\$79.38	\$20,242	
		PWFn = 0.3554			PW = 0.3554 X	\$784,786	\$278,900
YEAR 40							
	LONGITUDINAL SHLD JT R&S	100.00%	191,136	LIN FT	\$2.00	\$382,272	
	CENTERLINE JT R&S	100.00%	95,568	LIN FT	\$2.00	\$191,136	
	RANDOM CRACK R&S	50.00%	95,568	LIN FT	\$2.00	\$191,136	
	PAVEMENT PATCH CLASS A	0.50%	1,274	SQ YD	\$195.00	\$248,430	
	PD PVMT PATCH M&F HMA SURF	0.50%	1,274	SQ YD	\$79.38	\$101,128	
		PWFn = 0.3066			PW = 0.3066 X	\$1,114,102	\$341,536
							\$5,348,703
	ROUTINE MAINTENANCE ACTIVITY		36.20	Lane Miles	\$0.00	\$0	\$0
							MAINTANANCE LIFE-CYCLE COST \$5,348,703
	45 YEAR LIFE CYCLE	CRFn = 0.0407852					MAINTANANCE ANNUAL COST PER MILE \$24,105



Illinois Department of Transportation

To: Roger Driskell Attn: District Seven
From: John D. Baranzelli 
Subject: Pavement Design
Date: July 9, 2015

FAI 70 (I-70)
Section (25-1,2)R
Effingham County
From Altamont to the Little Wabash River

We have reviewed the pavement design for the above captioned section, which was submitted to BDE on June 19, 2015. The LCCA supported a rubblized pavement as the most economical design. The project will rubblize the existing pavement and construct 11.5 inches of HMA as new pavement.

The approved pavement design is as follows:

I-70 [Pavement Rubblization]

11.5 inches Full Depth HMA with 5.5 inches of HMA Shoulders
 2 inches of HMA Surface Course, SMA, N80
 2.25 inches of Polymerized HMA Top Binder Course, N90, IL-19.0
 7.25 inches of HMA Lower Binder Course, N90, IL-19.0
On Rubblized Pavement

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



Illinois Department of Transportation

To: Paul Niedernhofer
From: Mark Daugherty District 7
Subject: Pavement Design - resubmittal
Date: June 19, 2015

I-70
Section (25-1,2)R
Effingham County
74664

Paul:

Enclosed for your review and approval are the resubmitted pavement design & life cycle costs, location map, typical section, and pro-heavy task detail reports for I-70 from Altamont to the Little Wabash River. The pavement design and life cycle cost analysis shows the lowest cost construction option to be 11.5" HMA over rubblized pavement.

The life cycle cost analysis includes pay items required to meet reconstruction design criteria for freeways per figure 44-5.A of the BDE Manual.

Please contact me at 217-342-8341 if you have any questions.

Thank you.

PROJECT AND TRAFFIC INPUTS

(Enter Data in Gray Shaded Cells)

Route: I-70	Comments: Rubblization		
Section: (25-1,2)R	Design Date: 03/17/2015	<-- BY	
County: Effingham	Modify Date:	ADT	Year
Location: Abandoned RR bridge in Altamont to Littl		Current: 20,000	2014
Facility Type: Interstate or Freeway	# of Lanes = 4	Future: 31,000	2040
Road Class: I	Subgrade Support Rating (SSR): Poor	Structural Design Traffic	
Construction Year: 2020	Design Period (DP) = 20 years	Minimum ADT	Actual ADT
		Actual % of Total ADT	% of ADT in Design Lane
		PV = 0	15,392
		SU = 500	1,205
		MU = 1500	10,172
		Struct. Design ADT = 26,769	(2030)
		P = 32%	S = 45%
		M = 45%	

TRAFFIC FACTOR CALCULATION

FLEXIBLE PAVEMENT

Cpv = 0.15
 Csu = **132.5**
 Cmu = **482.53**
 TF flexible (Actual) = 45.63 (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) = 65.33 (Actual ADT)
 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 = 45.63	Use TF rigid = 65.33
PG Grade Lower Binder Lifts = PG 64-22 (Fig. 53-4.R)	Edge Support = Tied Shoulder or C.&G.
HMA Mixture Temp. = 78.0 deg. F (Fig. 54-5.C)	Rigid Pavt Thick. = 11.50 in. (Fig. 54-4.E)
Design HMA Mixture Modulus (E _{HMA}) = 610 ksi (Fig. 54-5.D)	CRCP Pavement
Design HMA Strain (ε _{HMA}) = 40 (Fig. 54-5.E)	Use TF rigid = 65.33
Full Depth HMA Design Thickness = 17.25 in. (Fig. 54-5.F)	IBR value = 3
Limiting Strain Criterion Thickness = 16.25 in. (Fig. 54-5.I)	CRCP Thickness = 11.75 in. (Fig. 54-4.M)
Use Full-Depth HMA Thickness = 16.25 inches	

RECONSTRUCTION ONLY (SUPPLEMENTAL) PAVEMENT DESIGN CALCULATIONS

HMA Overlay of Rubblized PCC	Unbonded Concrete Overlay
Use TF flexible = 45.63	Review 54-4.03 for limitations and special considerations.
HMA Overlay Design Thickness = 14.25 in. (Fig. 54-5.U)	
Limiting Strain Criterion Thickness = 11.50 in. (Fig. 54-5.V)	
Use HMA Overlay Thickness = 11.50 inches	CRCP Thickness = 10.75 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

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

Design Lane Distribution Factors For Structural Design Traffic (Fig. 54-2.B)						
Number of Lanes	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

LSC Design

ROUTE I-70
 SECTION (25-1,2)R
 COUNTY Effingham
 LOCATION ge in Altamont to Little Wabash River in Effingham

FACILITY TYPE INTERSTATE

PROJECT LENGTH 47,784 FT == > 9.05 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 16.25 IN MAX
 SHOULDER THICKNESS 8.00 IN HMA_LSCD LSC Design
 POLICY OVERLAY THICKNESS 2.00 IN

FLEX PAVEMENT	TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
		7.11	45.63	45.63

[Read Me!](#)

HMA COST PER TON	UNIT PRICE
HMA SURFACE	\$111.65 / TON
HMA TOP BINDER	\$90.34 / TON
HMA LOWER BINDER	\$73.74 / TON
HMA BINDER (LEVELING)	\$90.00 / TON
HMA SHOULDER	\$68.93 / TON

INITIAL COSTS

ITEM	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE	COST
HMA PAVEMENT (FULL-DEPTH)	(16.25")	254848	254,848 SQ YD	\$77.30 / SQ YD	\$19,700,263 ~
HMA SURFACE COURSE	(2.00")	1.0069	28,741 TONS	\$111.65 / TON	\$0
HMA TOP BINDER COURSE	(2.25")	1.0217	32,808 TONS	\$90.34 / TON	\$0
HMA LOWER BINDER COURSE	(12.00")	1.0712	183,448 TONS	\$73.74 / TON	\$0

HMA SHOULDER	(8.00")	169899	76,115 TONS	\$68.93 / TON	\$5,246,580 ~
CURB & GUTTER			0 LIN FT	\$30.00 / LIN FT	\$0

SUBBASE GRAN MATL TY C (TONS)			66,359 TONS	\$17.18 / TON	\$1,140,048
IMPROVED SUBGRADE:	Modified Soil Width = 87.4'		464,124 SQ YD	\$3.12 / SQ YD	\$1,448,067

Reserved For User Supplied Item			0 UNITS	\$0.00 / UNITS	\$0
Reserved For User Supplied Item			0 UNITS	\$0.00 / UNITS	\$0

PAVEMENT REMOVAL			254,848 SQ YD	\$7.00 / SQ YD	\$1,783,936
SHOULDER REMOVAL			169,899 SQ YD	\$8.00 / SQ YD	\$1,359,192

Note: * Denotes User Supplied Quantity
 FLEXIBLE CONSTRUCTION INITIAL COST \$30,678,086
 FLEXIBLE CONSTRUCTION ANNUAL COST PER MILE \$138,255

MAINTENANCE COSTS:

ITEM	THICKNESS	MATERIAL	T	UNIT COST
ROUTINE MAINTENANCE ACTIVITY				\$0.00 LANE-MILE / YEAR
HMA OVERLAY PVMT SURF	(2.00")	1.0069 Surface Mix	2.00	\$12.59 / SQ YD
HMA OVERLAY PVMT	(2.00")	1.0069 Surface Mix	2.00	\$12.59 / SQ YD
HMA SURFACE MIX	(2.00")	1.0069 Surface Mix	2.00	\$12.59 / SQ YD
HMA BINDER MIX	(0.00")	1.0139 Binding Binder Mix	0.00	\$0.00 / SQ YD
HMA OVERLAY SHLD (Year 30)	(2.00")	Shoulder Mix	2.00	\$7.72 / SQ YD
HMA OVERLAY SHLD	(2.00")	Shoulder Mix	2.00	\$7.72 / SQ YD
MILLING (2.00 IN)			2.00	\$3.00 / SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill Surf)		Surface Mix	2.00	\$82.50 / SQ YD

PARTIAL DEPTH SHLD PATCH	(Mill & Fill Surf)	Shoulder Mix	2.00	\$77.72 / SQ YD
PARTIAL DEPTH PVMT PATCH	(Mill & Fill +2.00 ")	Leveling Binder Mix	2.00	\$80.08 / SQ YD
PARTIAL DEPTH SHLD PATCH	(Mill & Fill +2.00 ")	Shoulder Mix	2.00	\$77.72 / 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	\$39,922,423
FLEXIBLE TOTAL ANNUAL COST PER MILE	\$179,916

PCC PAVEMENT

CRCP

ROUTE I-70
 SECTION (25-1,2)R
 COUNTY Effingham
 LOCATION je in Altamont to Little Wabash River in Effingham

FACILITY TYPE INTERSTATE

PROJECT LENGTH 47784 FT == > 9.05 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) CRCP 11.75 IN TIED SHLD
 SHOULDER THICKNESS 11.75 IN

POLICY OVERLAY THICKNESS 3.75 IN

RIGID PAVEMENT	TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
		10.05	65.33	65.33
Worksheet Construction Type is	Reconstruction	The Pavement Type is		CRCP

INITIAL COSTS

ITEM	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE	COST
CRC PAVEMENT	(11.75")	254,848	SQ YD	\$46.17 / SQ YD	\$11,766,332
PAVEMENT REINFORCEMENT		254,848	SQ YD	\$23.00 / SQ YD	\$5,861,504
STABILIZED SUBBASE	(4.00")	286,704	SQ YD	\$17.68 / SQ YD	\$5,068,927
PCC SHOULDERS		169,899	SQ YD	\$45.42 / SQ YD	\$7,716,813
CURB & GUTTER		0	LIN FT	\$30.00 / LIN FT	\$0
SUBBASE GRAN MATL TY C	(~ 3.48")	19,991	TONS	\$20.34 / TON	\$406,617
IMPROVED SUBGRADE:	Modified Soil Width = 82.0'	435,365	SQ YD	\$3.12 / SQ YD	\$1,358,339
Reserved For User Supplied Item		0	UNITS	\$0.00 / UNITS	\$0
Reserved For User Supplied Item		0	UNITS	\$0.00 / UNITS	\$0
PAVEMENT REMOVAL		254,848	SQ YD	\$7.00 / SQ YD	\$1,783,936
SHOULDER REMOVAL		169,899	SQ YD	\$8.00 / SQ YD	\$1,359,192

Note: * Denotes User Supplied Quantity
 RIGID CONSTRUCTION INITIAL COST \$35,321,660
 RIGID CONSTRUCTION ANNUAL COST PER MILE \$159,182

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")	1.0130	3.75	\$21.02 / SQ YD
HMA SURFACE MIX	(1.50")	1.0052	1.50	\$9.43 / SQ YD
HMA BINDER MIX	(2.25")	1.0182	2.25	\$11.59 / SQ YD
HMA POLICY OVERLAY SHLD	(3.75")	Shoulder Mix	3.75	\$14.48 / 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	\$79.38 / SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill HMA 1.50")		Surface Mix	1.50	\$79.38 / 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 \$40,670,363
 RIGID TOTAL ANNUAL COST PER MILE \$183,287

RECONSTRUCTION - HMA OVER RUBBLIZED PAVEMENT

PAVEMENT OVERLAY THICKNESS (FLEXIBLE) **11.50** IN **11.50** IN MAX **HMA_LSCD** Maintenance Schedule
 SHOULDER OVERLAY THICKNESS **5.50** IN

INITIAL COSTS

ITEM	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE	COST
HMA OVERLAY REMOVAL	6.00	254,848	SQ YD	\$4.00 / SQ YD	\$1,019,392
RUBBLIZING PCC PAVEMENT		254,848	SQ YD	\$2.50 / SQ YD	\$637,120
HMA OVERLAY (TOTAL)	11.50	254,848	SQ YD	\$55.80 / SQ YD	\$14,219,805 ~
HMA SURFACE COURSE	2.00	1.0069 254,848	SQ YD	\$12.59 / SQ YD	\$0
HMA TOP BINDER COURSE	2.25	1.0217 254,848	SQ YD	\$11.63 / SQ YD	\$0
HMA LOWER BINDER COURSE	7.25	1.0547 254,848	SQ YD	\$31.58 / SQ YD	\$0
HMA SHOULDER	5.50	52,329	TONS	\$68.93 / TON	\$3,607,023 ~
Inlet Adjustments		22	EACH *	\$1,500.00 / EACH	\$33,000
Aggregate Shoulders, Type B		8,115	TONS *	\$27.48 / TONS	\$223,000
EARTHWORK		281,925	CU YD *	\$9.97 / CU YD	\$2,810,792
Note: * Denotes User Supplied Quantity					
				RUBBLIZED CONSTRUCTION INITIAL COST	\$22,550,132
				RUBBLIZED CONSTRUCTION ANNUAL COST PER MILE	\$101,626
				RUBBLIZED MAINTENANCE LIFE-CYCLE COST	\$9,244,337
				RUBBLIZED MAINTENANCE ANNUAL COST PER MILE	\$41,661
				RUBBLIZED TOTAL LIFE-CYCLE COST	\$31,794,469
				RUBBLIZED TOTAL ANNUAL COST PER MILE	\$143,287

RECONSTRUCTION - PCC UNBONDED OVERLAY

PAVEMENT THICKNESS (PCC) **10.75** IN Pavement Type is **CRCP**
 SHOULDER THICKNESS **10.75** IN

INITIAL COSTS

ITEM	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE	COST
MILLING of EXISTING HMA OVERLAY (Pvmt & Shld)		424,747	SQ YD	\$3.00 / SQ YD	\$1,274,241
HMA BINDER COURSE (Pvmt & Shld)		424,747	SQ YD	\$4.00 / SQ YD	\$1,698,988
CRC PAVEMENT	10.75	254,848	SQ YD	\$42.49 / SQ YD	\$10,828,492
PAVEMENT REINFORCEMENT		254,848	SQ YD	\$23.00 / SQ YD	\$5,861,504
PCC SHOULDERS		169,899	SQ YD	\$41.75 / SQ YD	\$7,093,283
Inlet Adjustments		22	EACH *	\$1,500.00 / EACH	\$33,000
Aggregate Shoulders, Type B		12,950	TON *	\$27.17 / TON	\$351,852
EARTHWORK		331,939	CU YD *	\$10.01 / CU YD	\$3,322,709
Note: * Denotes User Supplied Quantity					
				UNBONDED CONSTRUCTION INITIAL COST	\$30,464,069
				UNBONDED CONSTRUCTION ANNUAL COST PER MILE	\$137,291
				UNBONDED MAINTENANCE LIFE-CYCLE COST	\$5,348,703
				UNBONDED MAINTENANCE ANNUAL COST PER MILE	\$24,105
				UNBONDED TOTAL LIFE-CYCLE COST	\$35,812,772
				UNBONDED TOTAL ANNUAL COST PER MILE	\$161,396

LIFE-CYCLE COST ANALYSIS: NEW DESIGN

Calculated / Revised : 3/17/15 1:35 PM

			CRCP	HMA
CONSTRUCTION	INITIAL COST	PRESENT WORTH	\$35,321,660	\$30,678,086
		ANNUAL COST PER MILE	\$159,182	\$138,255
MAINTENANCE	LIFE-CYCLE COST	PRESENT WORTH	\$5,348,703	\$9,244,337
		ANNUAL COST PER MILE	\$24,105	\$41,661
TOTAL	LIFE-CYCLE COST	PRESENT WORTH	\$40,670,363	\$39,922,423
		ANNUAL COST PER MILE	\$183,287	\$179,916

LIFE-CYCLE COST ANALYSIS: SUPPLEMENTAL DESIGNS

			PCC Unbonded	Rubblized
CONSTRUCTION	INITIAL COST	PRESENT WORTH	\$30,464,069	\$22,550,132
		ANNUAL COST PER MILE	\$137,291	\$101,626
MAINTENANCE	LIFE-CYCLE COST	PRESENT WORTH	\$5,348,703	\$9,244,337
		ANNUAL COST PER MILE	\$24,105	\$41,661
TOTAL	LIFE-CYCLE COST	PRESENT WORTH	\$35,812,772	\$31,794,469
		ANNUAL COST PER MILE	\$161,396	\$143,287

LIFE-CYCLE COST ANALYSIS: FINAL SUMMARY

LOWEST COST OPTION	=====>		Rubblized	\$143,287	
OTHER OPTIONS (LOWEST TO HIGHEST):		TYPE / PERCENTAGE	PCC Unbonded	\$161,396	12.6%
		TYPE / PERCENTAGE	HMA	\$179,916	25.6%
		TYPE / PERCENTAGE	CRCP	\$183,287	27.9%

S:\GENWPDOCS\Pavement Designs\D-71-70 - Altamont to the Little Wabash River - 74664\I-70 Altamont to the Little Wabash River - 2nd Submittal\I-70 from Altamont

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%	191,136	LIN FT	\$2.00	\$382,272	
	CNTR LINE JOINT R&S	100.00%	95,568	LIN FT	\$2.00	\$191,136	
	RNDM / THRM CRACK R&S	50.00%	105,125	LIN FT	\$2.00	\$210,250	
	PD PVMT PATCH M&F SURF	0.10%	255	SQ YD	\$82.50	\$21,039	
	PWFn =	0.8626		PW =	0.8626 X	\$804,697	\$694,139
YEAR 10							
	LONG SHLD JT R&S	100.00%	191,136	LIN FT	\$2.00	\$382,272	
	CNTR LINE JOINT R&S	100.00%	95,568	LIN FT	\$2.00	\$191,136	
	RNDM / THRM CRACK R&S	50.00%	105,125	LIN FT	\$2.00	\$210,250	
	PD PVMT PATCH M&F SURF	0.50%	1,274	SQ YD	\$82.50	\$105,111	
	PWFn =	0.7441		PW =	0.7441 X	\$888,769	\$661,328
YEAR 15							
	MILL PVMT & SHLD 2.00"	100.00%	424,747	SQ YD	\$3.00	\$1,274,241	
	PD PVMT PATCH M&F ADD'L 2.00"	1.00%	2,548	SQ YD	\$80.08	\$204,044	
	HMA OVERLAY PVMT 2.00"	100.00%	254,848	SQ YD	\$12.59	\$3,208,954	
	HMA OVERLAY SHLD 2.00 "	100.00%	169,899	SQ YD	\$7.72	\$1,311,645	
	PWFn =	0.6419		PW =	0.6419 X	\$5,998,884	\$3,850,455
YEAR 20							
	LONG SHLD JT R&S	100.00%	191,136	LIN FT	\$2.00	\$382,272	
	CNTR LINE JOINT R&S	100.00%	95,568	LIN FT	\$2.00	\$191,136	
	RNDM / THRM CRACK R&S	50.00%	105,125	LIN FT	\$2.00	\$210,250	
	PD PVMT PATCH M&F SURF	0.10%	255	SQ YD	\$82.50	\$21,039	
	PWFn =	0.5537		PW =	0.5537 X	\$804,697	\$445,541
YEAR 25							
	LONG SHLD JT R&S	100.00%	191,136	LIN FT	\$2.00	\$382,272	
	CNTR LINE JOINT R&S	100.00%	95,568	LIN FT	\$2.00	\$191,136	
	RNDM / THRM CRACK R&S	50.00%	105,125	LIN FT	\$2.00	\$210,250	
	PD PVMT PATCH M&F SURF	0.50%	1,274	SQ YD	\$82.50	\$105,111	
	PWFn =	0.4776		PW =	0.4776 X	\$888,769	\$424,481
HMA_LSCD							
YEAR 30							
	INTERSTATE						
	MILL PVMT & SHLD 2.00"	100.00%	424,747	SQ YD	\$3.00	\$1,274,241	
	PD PVMT PATCH M&F ADD'L 2.00"	2.00%	5,097	SQ YD	\$80.08	\$408,168	
	PD SHLD PATCH M&F ADD'L 2.00"	1.00%	1,699	SQ YD	\$77.72	\$132,047	
	HMA OVERLAY PVMT 2.00"	100.00%	254,848	SQ YD	\$12.59	\$3,208,954	
	HMA OVERLAY SHLD 2.00 "	100.00%	169,899	SQ YD	\$7.72	\$1,311,645	
	PWFn =	0.4120		PW =	0.4120 X	\$6,335,055	\$2,609,959
YEAR 35							
	LONG SHLD JT R&S	100.00%	191,136	LIN FT	\$2.00	\$382,272	
	CNTR LINE JOINT R&S	100.00%	95,568	LIN FT	\$2.00	\$191,136	
	RNDM / THRM CRACK R&S	50.00%	105,125	LIN FT	\$2.00	\$210,250	
	PD PVMT PATCH M&F SURF	0.10%	255	SQ YD	\$82.50	\$21,039	
	PWFn =	0.3554		PW =	0.3554 X	\$804,697	\$285,976
YEAR 40							
	LONG SHLD JT R&S	100.00%	191,136	LIN FT	\$2.00	\$382,272	
	CNTR LINE JOINT R&S	100.00%	95,568	LIN FT	\$2.00	\$191,136	
	RNDM / THRM CRACK R&S	50.00%	105,125	LIN FT	\$2.00	\$210,250	
	PD PVMT PATCH M&F SURF	0.50%	1,274	SQ YD	\$82.50	\$105,111	
	PWFn =	0.3066		PW =	0.3066 X	\$888,769	\$272,458
							\$9,244,337
ROUTINE MAINTENANCE ACTIVITY			36.20	Lane Miles	0.00	0	\$0
							\$9,244,337
45	YEAR LIFE CYCLE	CRFn = 0.0407852	MAINTENANCE LIFE-CYCLE COST				\$41,661
							\$41,661

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%	255	SQ YD	\$195.00	\$49,725	
		PWFn = 0.7441			PW = 0.7441 X	\$49,725	\$37,000
YEAR 15							
	PAVEMENT PATCH CLASS A	0.20%	510	SQ YD	\$195.00	\$99,450	
		PWFn = 0.6419			PW = 0.6419 X	\$99,450	\$63,833
YEAR 20							
	PAVEMENT PATCH CLASS A	0.50%	1,274	SQ YD	\$195.00	\$248,430	
	LONGITUDINAL SHLD JT R&S	100.00%	191,136	LIN FT	\$2.00	\$382,272	
	CENTERLINE JT R&S	100.00%	95,568	LIN FT	\$2.00	\$191,136	
		PWFn = 0.5537			PW = 0.5537 X	\$821,838	\$455,032
YEAR 25							
	PAVEMENT PATCH CLASS A	0.75%	1,911	SQ YD	\$195.00	\$372,645	
	SHOULDER PATCH CLASS C	0.50%	849	SQ YD	\$145.00	\$123,105	
		PWFn = 0.4776			PW = 0.4776 X	\$495,750	\$236,773
YEAR 30 INTERSTATE							
	PAVEMENT PATCH CLASS A	3.00%	7,645	SQ YD	\$195.00	\$1,490,775	
	SHOULDER PATCH CLASS C	1.00%	1,699	SQ YD	\$145.00	\$246,355	
	HMA POLICY OVERLAY 3.75" (PVMT)	100.00%	254,848	SQ YD	\$21.02	\$5,356,341	
	HMA POLICY OVERLAY 3.75" (SHLD)	100.00%	169,899	SQ YD	\$14.48	\$2,459,334	
		PWFn = 0.4120			PW = 0.4120 X	\$9,552,805	\$3,935,629
YEAR 35							
	LONGITUDINAL SHLD JT R&S	100.00%	191,136	LIN FT	\$2.00	\$382,272	
	CENTERLINE JT R&S	100.00%	95,568	LIN FT	\$2.00	\$191,136	
	RANDOM CRACK R&S	50.00%	95,568	LIN FT	\$2.00	\$191,136	
	PD PVMT PATCH M&F HMA SURF	0.10%	255	SQ YD	\$79.38	\$20,242	
		PWFn = 0.3554			PW = 0.3554 X	\$784,786	\$278,900
YEAR 40							
	LONGITUDINAL SHLD JT R&S	100.00%	191,136	LIN FT	\$2.00	\$382,272	
	CENTERLINE JT R&S	100.00%	95,568	LIN FT	\$2.00	\$191,136	
	RANDOM CRACK R&S	50.00%	95,568	LIN FT	\$2.00	\$191,136	
	PAVEMENT PATCH CLASS A	0.50%	1,274	SQ YD	\$195.00	\$248,430	
	PD PVMT PATCH M&F HMA SURF	0.50%	1,274	SQ YD	\$79.38	\$101,128	
		PWFn = 0.3066			PW = 0.3066 X	\$1,114,102	\$341,536
							\$5,348,703
	ROUTINE MAINTENANCE ACTIVITY		36.20	Lane Miles	\$0.00	\$0	\$0
							MAINTANANCE LIFE-CYCLE COST \$5,348,703
	45 YEAR LIFE CYCLE	CRFn = 0.0407852					MAINTANANCE ANNUAL COST PER MILE \$24,105