

To:

Jeff South

Attn: Greg Jamerson

From:

Maureen M. Addis

Subject:

Pavement Design Approval

Date:

March 7, 2017

Route:

I-70

Section: (25-1,2)R

County: Effingham

Contract: 74664

Limits:

Altamont to the Little Wabash River West of Effingham

We have reviewed the supplemental pavement design for the above referenced project which was submitted on February 16, 2017. The revised scope of the project is an 11.5" HMA overlay of rubblized pavement over approximately 75% of the project's 8.9 mile length (instead of the entire length) with the remaining portions now being either 12" CRC pavement or 16.5" Full-Depth HMA.

The 12" CRC pavement is proposed from the West end of the project through the Altamont interchange and easterly beyond the West temporary crossover (approximately 0.8 miles) due to the short distance between the structures over the abandoned railroad and at the interchange itself and to match the existing grade of those structures.

The 16.5" Full-Depth HMA pavement is proposed under each of the 4 overhead structures (approximately 1.4 miles in total) to maintain vertical clearance.

The supplemental pavement design is hereby approved. The original pavement design for the rubblized portion approved July 9, 2015, remains in effect as well.

If you have any questions, please contact Mike Brand at (217) 782-7651.



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

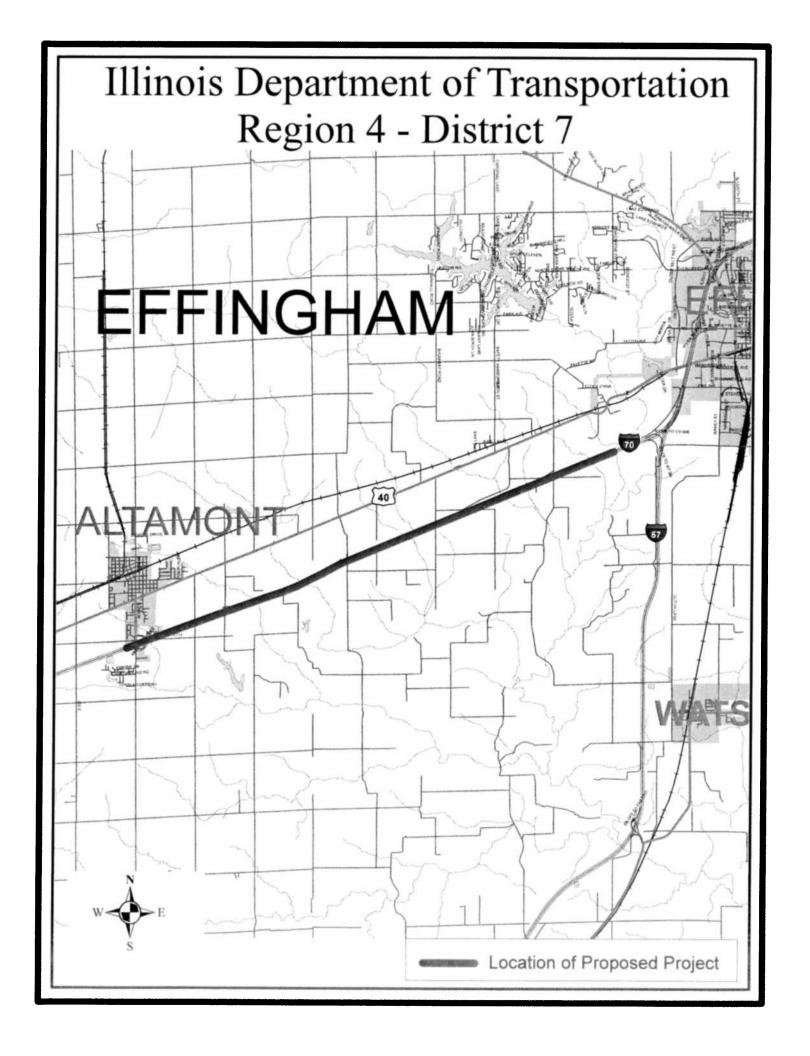
The pavement design for 11.5" of HMA over rubblized pavement was approved by your office on 7-9-15. The project is scheduled for the June 16, 2017 letting and will be constructed using temporary crossovers, allowing closure of one direction of I-70 per stage. After several meetings with District 7 Construction 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.



IDOT MECHANISTIC PAVEMENT DESIGN

Printed: 10/25/2017 PROJECT AND TRAFFIC INPUTS (Enter Data in Gray Shaded Cells) Route: I-70 Comments: Rubblization Section: (25-1,2)R County: Effingham Design Date: 03/17/2015 <-- BY ADT Location: Abandoned RR bridge in Altamont to Little Modify Date: <-- BY Year Current: 20,000 2014 Facility Type Interstate or Freeway Future: 31,000 # of Lanes = Structural Design Traffic Minimum Actual Actual %of % of ADT in Road Class: ADT ADT Total ADT Design Lane PV = 0 15,392 57.5% Subgrade Support Rating (SSR): SU = 500 S= 45% 1,205 45% Construction Year: 2020 MU = 1500 10,172 38.0% M = 26,769 Design Period (DP) = 20 Struct. Design ADT = (2030) years 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) = 45.63 (Actual ADT) TF rigid (Actual) = 65.33 (Actual ADT)

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.		
Goto Map	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)	C	RC Pave	ment		
	Full Depth HMA Design Thickness =	17.25	in. (Fig. 54-5.F)	Use TF rigid =	65.33			
Goto Map	Limiting Strain Criterion Thickness =	16.25	in. (Fig. 54-5.l)	IBR value =	3			
	Use Full-Depth HMA Thickness =	16.25	inches	CRCP Thickness =	11.75	in. (Fig. 54-4.M)		

(Min ADT Fig. 54-2.C)

TF rigid (Min) =

10.05

(Min ADT Fig. 54-2.C)

	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		
	HMA Overlay Design Thickness =	14.25	in. (Fig. 54-5.U)	special considerations.		
Goto Map	Limiting Strain Criterion Thickness =	11.50	in. (Fig. 54-5.V)	apostal contractations.		
	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

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

	Min. Str. Design Traffic (Fig 54-2.0				
Facility Type	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		

TF flexible (Min) =

7.11

	Traffic Factor ESAL Coefficients			
	Rigid (Fig. 54-4.C)	Flexible (F	ig. 54-5.B)
Class	Csu	Cmu	Csu	Cmu
	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				

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

	Design L	Design Lane Distribution Factors For Structural Design Traffic (Fig. 54-2.B)					
		Rural Urban					
Number of Lanes	P S M P S I						
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 SECTION COUNTY LOCATION ge in Altamont to Little Wabash Rive	I-70 (25-1,2)R Effingham r in Effingham		
FACILITY TYPE	INTERSTATE		
PROJECT LENGTH # OF CENTERLINES # OF LANES # OF EDGES LANE WIDTH - AVERAGE SHOULDER WIDTH HMA Inside HMA Outside Total Width of Paved Shoulders	47,784 FT ==> 2 CL 4 LANES 4 EP 12 FT 6 FT 10 FT 32 FT	9.05 Miles	
PAVEMENT THICKNESS (FLEXIBLE) SHOULDER THICKNESS POLICY OVERLAY THICKNESS	16.25 IN 8.00 IN 2.00 IN	16.25 IN MAX HMA_LSCD LSC Des	ign
FLEX PAVEMENT TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
	7.11	45.63	45.63
TUMA COOT DED TON		LINIT PRIOF	Read Me!
HMA COST PER TON HMA SURFACE HMA TOP BINDER HMA LOWER BINDER		\$111.65 / TON \$90.34 / TON \$73.74 / TON	
HMA BINDER (LEVELING) HMA SHOULDER		\$90.00 / TON \$68.93 / TON	
INITIAL COSTS ITEM THICKNESS 10	0% 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 HMA TOP BINDER COURSE (2.25") 1.0217	28,741 TONS 32,808 TONS	\$111.65 / TON \$90.34 / TON	\$0 \$0
HMA LOWER BINDER COURSE (12.00") 1.0712	183,448 TONS	\$73.74 / TON	\$0
HMA SHOULDER (8.00") 169899 CURB & GUTTER	76,115 TONS 0 LIN FT	\$68.93 / TON \$30.00 / LIN FT	\$5,246,580 ~ \$0
SUBBASE GRAN MATL TY C (TONS) IMPROVED SUBGRADE: Modified Soil Width = 87.	66,359 TONS	\$17.18 / TON \$3.12 / SQ YD	\$1,140,048 \$1,448,067
Reserved For User Supplied Item Reserved For User Supplied Item	0 UNITS 0 UNITS	\$0.00 / UNITS \$0.00 / UNITS	\$0 \$0
PAVEMENT REMOVAL SHOULDER REMOVAL	254,848 SQ YD 169,899 SQ YD	\$7.00 / SQ YD \$8.00 / SQ YD	\$1,783,936 \$1,359,192
	ELEXIBLE CONSTRUCTION INSTRUCTION ANNUAL		\$30,678,086 \$138,255
MAINTENANCE COSTS: ITEM THICKNESS	MATERIAL T	UNIT COST	
ROUTINE MAINTENANCE ACTIVITY	WAY EINIAE	\$0.00 LANE-MILE	E/YEAR
HMA OVERLAY PVMT SURF (2.00") 1.0069	Surface Mix 2.00	\$12.59 / SQ YD	
HMA OVERLAY PVMT (2.00") 1.0069 HMA SURFACE MIX (2.00") 1.0069	2.00 Surface Mix 2.00	\$12.59 / SQ YD \$12.59 / SQ YD	
HMA BINDER MIX (0.00") 1.0139	eling Binder Mix 0.00	\$0.00 / SQ YD	
HMA OVERLAY SHLD (Year 30) (2.00") HMA OVERLAY SHLD (2.00")	Shoulder Mix 2.00 Shoulder Mix 2.00	\$7.72 / SQ YD \$7.72 / SQ YD	
MILLING (2.00 IN)	2.00	\$3.00 / SQ YD	

Surface Mix 2.00

\$82.50 / SQ YD

PARTIAL DEPTH PVMT PATCH (Mill & Fill Surf)

PARTIAL DEPTH SHLD PATCH	(Mill & Fill Surf)	Shoulder Mix	2.00	\$77.72	/ SQ YD	
PARTIAL DEPTH PVMT PATCH PARTIAL DEPTH SHLD PATCH	(Mill & Fill +2.00 ") (Mill & Fill +2.00 ")	Leveling Binder Mix Shoulder Mix	2.00 2.00	\$80.08 \$77.72		
LONGITUDINAL SHOULDER JOINT CENTERLINE JOINT ROUT & SEAL RANDOM / THERMAL CRACK ROUT		(100% Rehab = 110.00' / Station	n / Lane)	\$2.00	/ LIN FT / LIN FT / LIN FT	
		FLEXIBLE T		E-CYCLE COST		\$39,922,423 \$179,916

PCC PAVEMENT			CRCP
ROUTE SECTION COUNTY	I-70 (25-1,2)R Effingham		
LOCATION je in Altamont to Little Wabash Rive	_		
FACILITY TYPE	INTERSTATE		
PROJECT LENGTH # OF CENTERLINES # OF LANES # OF EDGES LANE WIDTH - AVERAGE SHOULDER WIDTH PCC Inside	47784 FT ==> 2 CL 4 LANES 4 EP 12 FT 6 FT	9.05 Miles	
PCC Outside Total Width of Paved Shoulders	10 FT 32 FT		
PAVEMENT THICKNESS (RIGID) CRCP SHOULDER THICKNESS	11.75 IN 11.75 IN	TIED SHLD	
POLICY OVERLAY THICKNESS	3.75 IN		
RIGID PAVEMENT TRAFFIC FACTORS	MINIMUM 10.05	ACTUAL 65,33	USE 65.33
Worksheet Construction Type is Reconstruction		avement Type is	CRCP
INITIAL COSTS ITEM THICKNESS 10	00% QUANTITY UNIT	UNIT PRICE	COST
CRC PAVEMENT (11.75")	254,848 SQ YD	\$46.17 / SQ YD	\$11,766,332
PAVEMENT REINFORCEMENT STABILIZED SUBBASE (4.00")	254,848 SQ YD 286,704 SQ YD	\$23.00 / SQ YD \$17.68 / SQ YD	\$5,861,504 \$5,068,927
PCC SHOULDERS CURB & GUTTER	169,899 SQ YD 0 LIN FT	\$45.42 / SQ YD \$30.00 / LIN FT	\$7,716,813 \$0
SUBBASE GRAN MATL TY C IMPROVED SUBGRADE: (~ 3.48") Modified Soil Width = 82	19,991 TONS 435,365 SQ YD	\$20.34 / TON \$3.12 / SQ YD	\$406,617 \$1,358,339
Reserved For User Supplied Item Reserved For User Supplied Item	0 UNITS 0 UNITS	\$0.00 / UNITS \$0.00 / UNITS	\$0 \$0
PAVEMENT REMOVAL SHOULDER REMOVAL	254,848 SQ YD 169,899 SQ YD	\$7.00 / SQ YD \$8.00 / SQ YD	\$1,783,936 \$1,359,192
Note: * Denotes User Supplied Quantity RIGID Co	RIGID CONSTRUCTION		\$35,321,660 \$159,182
MAINTENANCE COSTS:			
ITEM THICKNESS	MATERIAL T	UNIT COST	
ROUTINE MAINTENANCE ACTIVITY		\$0.00 / LANE-MI	LE / YEAR
HMA POLICY OVERLAY (3.75") HMA POLICY OVERLAY PVMT (3.75") 1.0130	3.75 3.75	\$21.02 / SQ YD	
HMA SURFACE MIX (3.73) 1.0052	Surface Mix 1.50	\$9.43 / SQ YD	
HMA BINDER MIX (2.25") 1.0182	Top Binder Mix 2.25	\$11.59 / SQ YD	
HMA POLICY OVERLAY SHLD (3.75")	Shoulder Mix 3.75	\$14.48 / SQ YD	
CLASS A PAVEMENT PATCHING CLASS B PAVEMENT PATCHING		\$195.00 / SQ YD \$150.00 / SQ YD	
CLASS C SHOULDER PATCHING		\$145.00 / SQ YD	
PARTIAL DEPTH PVMT PATCH (Mill & Fill HMA Surf) PARTIAL DEPTH PVMT PATCH (Mill & Fill HMA 1.50")	Surface Mix 1.50 Surface Mix 1.50	\$79.38 / SQ YD \$79.38 / SQ YD	
LONGITUDINAL SHOULDER JOINT ROUT & SEAL		\$2.00 / LIN FT	
CENTERLINE JOINT ROUT & SEAL REFLECTIVE TRANSVERSE CRACK ROUT & SEAL		\$2.00 / LIN FT \$2.00 / LIN FT	
RANDOM CRACK ROUT & SEAL (100% Rehab = 100.0	00' / Station / Lane)	\$2.00 / LIN FT	

RECONSTRUCTION -	HMA OVE	R RUBBLIZED	PAVE	MENT_		
PAVEMENT OVERLAY THICKNESS (SHOULDER OVERLAY THICKNESS	FLEXIBLE)	11.50 5.50		11.50 IN MA	X HMA_LSCD	Maintenance Sched
INITIAL COSTS ITEM	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE	COST	
HMA OVERLAY REMOVAL RUBBLIZING PCC PAVEMENT	6.00	254,848 254,848		\$4.00 / SQ Y \$2.50 / SQ Y		
HMA OVERLAY (TOTAL)	11.50	254,848	SQ YD	\$55.80 / SQ Y	D \$14,219,805	~
HMA SURFACE COURSE HMA TOP BINDER COURSE HMA LOWER BINDER COURSE	2.00 2.25 7.25	1.0069 254,848 1.0217 254,848 1.0547 254,848	SQ YD	\$12.59 / SQ Y \$11.63 / SQ Y \$31.58 / SQ Y	D \$0	
HMA SHOULDER	5.50	52,329	TONS	\$68.93 / TON	\$3,607,023	~
nlet Adjustments Aggregate Shoulders, Type B		22 8,115	EACH TONS	* \$1,500.00 / EAC		
EARTHWORK		281,925	CU YD	* \$9.97 / CU Y	D \$2,810,792	
Note: * Denotes User Supplied Quanti		RUBBLIZED CON BLIZED CONSTRUCTION			\$22,550,132 \$101,626	
	RL	RUBBLIZED MAINTE BBLIZED MAINTENANCE			\$9,244,337 \$41,661	
RECONSTRUCTION -	PCC LINE	RUBBLIZED TOTAL	. ANNUAL	FE-CYCLE COST COST PER MILE	\$31,794,469 \$143,287	
PAVEMENT THICKNESS (PCC) HOULDER THICKNESS	PCC UND	10.75	IN	Pavement Type	is CRCP	
NITIAL COSTS TEM	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE	COST	
MILLING of EXISTING HMA OVERLAY	(Pvmt & Shld) (Pvmt & Shld)	424,747 424,747		\$3.00 / SQ Y \$4.00 / SQ Y		
CRC PAVEMENT PAVEMENT REINFORCEMENT	10.75	254,848 254,848		\$42.49 / SQ Y \$23.00 / SQ Y		
PCC SHOULDERS		169,899	SQ YD	\$41.75 / SQ Y	D \$7,093,283	
nlet Adjustments Aggregate Shoulders, Type B		22 12,950	EACH TON	* \$1,500.00 / EAC * \$27.17 / TON	\$33,000 \$351,852	
EARTHWORK		331,939	CU YD	* \$10.01 / CU Y	D \$3,322,709	
Note: * Denotes User Supplied Quanti		UNBONDED CON ONDED CONSTRUCTION			\$30,464,069 \$137,291	
	UN	UNBONDED MAINTE BONDED MAINTENANCE			\$5,348,703 \$24,105	
		UNBONDED UNBONDED TOTAL		FE-CYCLE COST COST PER MILE	\$35,812,772 \$161,396	

LIFE-CYCL	E COST ANALYSIS	: NEW DESIGN o	Calculated / Revised :	3/17/15 1:35 PM
CONSTRUCTION	INITIAL COST	PRESENT WORT	CRCP + \$35,321,660	HMA \$30,678,086
		ANNUAL COST PER MIL	E \$159,182	\$138,255
MAINTENANCE	LIFE-CYCLE COST	PRESENT WORT ANNUAL COST PER MIL	*-,,	\$9,244,337 \$41,661
TOTAL	LIFE-CYCLE COST	PRESENT WORT ANNUAL COST PER MIL	+ -,,	\$39,922,423 \$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
	0.01_000.	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	НМА	\$179,916	25.6%
	TYPE / PERCENTAGE	CRCP	\$183,287	27.9%

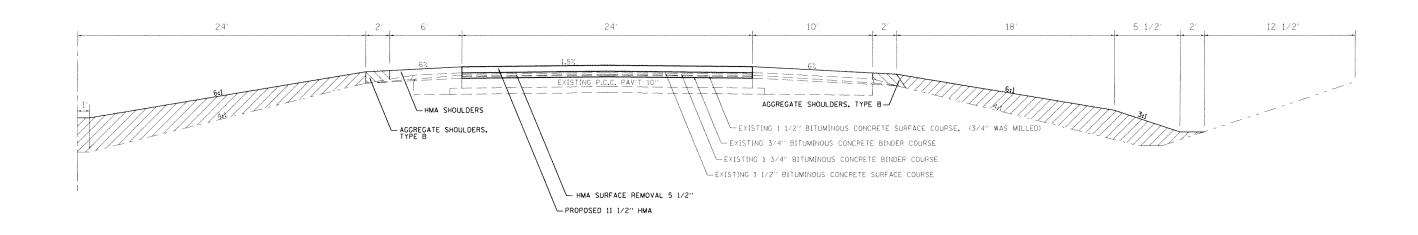
S:\GEN\WPDOCS\Pavement Designs\D-7\I-70 - Altamont to the Little Wabash River - 74664\I-70 Altamont to the Little Wabash River - 3rd Submittal\[pavement designs \text{ | 1.70 - Altamont to the Little Wabash River | 1.70 - 1.70

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

	LIMITI	NG STR	AIN CRITER	ION DESIGN				
MAINTENANCE COSTS: IT	ГЕМ		0/_	QUANTITY	LINIT	UNIT COST	COST	PRESENT WORTH
WAINTENANCE COSTS.	I CIVI		/0	QUANTITI	UNII	UNIT COST	CO31	WORTH
YEAR 5								
L	ONG SHLD JT R&S		100.00%	191,136	LIN FT	\$2.00	\$382,272	
C	NTR LINE JOINT R&S		100.00%	95,568		\$2.00	\$191,136	
R	NDM / THRM CRACK R&S		50.00%	105,125		\$2.00	\$210,250	
P	D PVMT PATCH M&F SURF		0.10%	255	SQ YD	\$82.50	\$21,039	
	PW	/Fn =	0.8626		PW =	0.8626 X	\$804,697	\$694,139
VEAD 40								
YEAR 10	ONC CUI D IT DOC		100.000/	101 120	LINIET	#2.00	#202 272	
	ONG SHLD JT R&S NTR LINE JOINT R&S		100.00%	191,136		\$2.00	\$382,272	
			100.00%	95,568		\$2.00	\$191,136	
	NDM / THRM CRACK R&S D PVMT PATCH M&F SURF		50.00%	105,125	SQ YD	\$2.00	\$210,250	
<u> </u>		/Fn =	0.50% 0.7441	1,214	PW =	\$82.50 0.7441 X	\$105,111 \$888,769	\$661,328
	FVV		0.7441		rvv =	0.7441 X	φοσο,709	φ001,320
YEAR 15								
	IILL PVMT & SHLD 2.00"		100.00%	424,747	SQ YD	\$3.00	\$1,274,241	
P	D PVMT PATCH M&F ADD'L 2.00"		1.00%	2,548	SQ YD	\$80.08	\$204,044	
Н	IMA OVERLAY PVMT 2.00"		100.00%	254,848	SQ YD	\$12.59	\$3,208,954	
H	MA OVERLAY SHLD 2.00 "		100.00%	169,899		\$7.72	\$1,311,645	
	PW	/Fn =	0.6419		PW =	0.6419 X	\$5,998,884	\$3,850,455
YEAR 20	ONO OUR DUT DOG		100.000	10: :==		AC	0000	
	ONG SHLD JT R&S		100.00%	191,136		\$2.00	\$382,272	
	NTR LINE JOINT R&S		100.00%	95,568		\$2.00	\$191,136	
	NDM / THRM CRACK R&S		50.00%	105,125		\$2.00	\$210,250	
P	D PVMT PATCH M&F SURF	·	0.10%	255	SQ YD	\$82.50	\$21,039	0445 544
	PW	/Fn =	0.5537		PW =	0.5537 X	\$804,697	\$445,541
YEAR 25								
	ONG SHLD JT R&S		100.00%	191,136	LIN FT	\$2.00	\$382,272	
	NTR LINE JOINT R&S		100.00%	95,568		\$2.00	\$191,136	
R	NDM / THRM CRACK R&S		50.00%	105,125		\$2.00	\$210,250	
	D PVMT PATCH M&F SURF		0.50%		SQ YD	\$82.50	\$105,111	
_	PW	/Fn =	0.4776		PW =	0.4776 X	\$888,769	\$424,481
	HMA_LSCD							
YEAR 30	INTERSTATE							
	IILL PVMT & SHLD 2.00"		100.00%	424,747		\$3.00	\$1,274,241	
P	D PVMT PATCH M&F ADD'L 2.00"		2.00%	5,097	SQ YD	\$80.08	\$408,168	
	D SHLD PATCH M&F ADD'L 2.00"		1.00%	,	SQ YD	\$77.72	\$132,047	
	IMA OVERLAY PVMT 2.00"		100.00%	254,848		\$12.59	\$3,208,954	
H	IMA OVERLAY SHLD 2.00 "		100.00%	169,899		\$7.72	\$1,311,645	
	PW	/Fn =	0.4120		PW =	0.4120 X	\$6,335,055	\$2,609,959
VEAD OF								
YEAR 35	ONG SHI D. IT D&S		100.009/	101 126	LINIET	\$2.00	\$202.272	
	ONG SHLD JT R&S :NTR LINE JOINT R&S		100.00% 100.00%	191,136 95,568		\$2.00 \$2.00	\$382,272	
	NTR LINE JOINT R&S NDM / THRM CRACK R&S		50.00%	105,125		\$2.00 \$2.00	\$191,136 \$210,250	
	D PVMT PATCH M&F SURF		0.10%		SQ YD	\$2.50 \$82.50	\$21,039	
<u> </u>		/Fn =	0.3554	200	PW =	0.3554 X	\$804,697	\$285,976
			3.3001		–	2.300 · A		+=30,0.0
YEAR 40								
	ONG SHLD JT R&S		100.00%	191,136		\$2.00	\$382,272	
	NTR LINE JOINT R&S		100.00%	95,568		\$2.00	\$191,136	
	NDM / THRM CRACK R&S		50.00%	105,125		\$2.00	\$210,250	
P	D PVMT PATCH M&F SURF	/F.,	0.50%	1,274	SQ YD	\$82.50	\$105,111	#070 450
	PW	/Fn =	0.3066		PW =	0.3066 X	\$888,769	\$272,458
							_	\$9,244,337
								ψυ, Σ ττ, υυ ι
R	OUTINE MAINTENANCE ACTIVITY			36.20	Lane Miles	0.00	0	\$0
					MA	INTENANCE LIFE-	CYCLE COST	\$9,244,337
45 Y	YEAR LIFE CYCLE CRFn =	0.0407	852		MAINTENA	ANCE ANNUAL CO	OST PER MILE	\$41,661

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

										PRESENT
MAINTENANCE	= COSTS:	ITEM		%	QUANTITY	UNII	UNIT COST		COST	WORTH
	\/EAD 40	1								
	YEAR 10			0.400/	055	00.1/D	£405.00		£40.705	
		PAVEMENT PATCH CLASS A	DW/En	0.10%	255	SQ YD	\$195.00	V	\$49,725	¢27.000
			PWFn =	0.7441		PW =	0.7441	Х	\$49,725	\$37,000
	YEAR 15	Т								
	TEAR 13	PAVEMENT PATCH CLASS A		0.20%	510	SQ YD	\$195.00		\$99,450	
		TAVEMENTTATON CLASS A	PWFn =	0.6419	310	PW =	0.6419	X	\$99,450	\$63,833
				0.0413			0.0413	^	ψ55,450	ψ00,000
	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	Χ	\$821,838	\$455,032
	YEAR 25			0.750/	4.044	00.1/0	#405.00		#070.045	
		PAVEMENT PATCH CLASS A		0.75%		SQ YD	\$195.00		\$372,645	
		SHOULDER PATCH CLASS C	DW/E	0.50%	849	SQ YD	\$145.00	V	\$123,105	#000 770
			PWFn =	0.4776		PW =	0.4776	Х	\$495,750	\$236,773
	YEAR 30	INTERSTATE								
	12/11 30	PAVEMENT PATCH CLASS A		3.00%	7.645	SQ YD	\$195.00		\$1,490,775	
		SHOULDER PATCH CLASS C		1.00%		SQ YD	\$145.00		\$246,355	
		HMA POLICY OVERLAY 3.75"	(PVMT)	100.00%	254,848		\$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	Χ	\$9,552,805	\$3,935,629
	YEAR 35									
		LONGITUDINAL SHLD JT R&S		100.00%	191,136		\$2.00		\$382,272	
		CENTERLINE JT R&S		100.00%	95,568		\$2.00		\$191,136	
		RANDOM CRACK R&S	UDE	50.00%	95,568		\$2.00		\$191,136	
		PD PVMT PATCH M&F HMA SI	PWFn =	0.10%	255	SQ YD PW =	\$79.38 0.3554		\$20,242 \$784,786	\$278,900
			F VVFII =	0.3334		- vv =	0.3334	^	\$704,700	\$270,900
	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 SI	-	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 ACTIV	VITY		36.20	Lane Miles	\$0.00		\$0	\$0
	-								CYCLE COST	\$5,348,703
	45	YEAR LIFE CYCLE	CRFn = 0.0407	7852		MAINTANA	ANCE ANNUA	L CO	ST PER MILE	\$24,105



I-70 EASTBOUND & WESTBOUND

				harmanina variante a come a come e come	-
	Default	PLOT DATE : 5/1/2015	DATE -	REVISED -	1
		PLOT SCALE = 8.0000 17 in.	CHECKED -	REVISED -	1
	pws\\IL084EBIDINTEC.slltnoss.gov:PWIDDT\Do	cuments\1001 Offices\District 7\Projects\746	-ORAWN ta\CA8shests\D?74664-sht-typical.	REVISED -	
-	FILE NAME =	USER NAME : teasleyck	DESIGNED -	REVISED -	

SCALE:

TYPICAL SECTIONS				F.A.I. RTE.	SECTION	COUNTY	TOTAL	SHEE NO.		
					70	(25-1,2)R	EFFINGHAM			
								CONTRACT	NO.	74664
	SHEET	OF	SHEETS	STA.	TO STA.		ILLINOIS FED. A	D PROJECT		



To:

Roger Driskell

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.

Attn: District Seven

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.

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.

IDOT MECHANISTIC PAVEMENT DESIGN

Printed: 10/25/2017 PROJECT AND TRAFFIC INPUTS (Enter Data in Gray Shaded Cells) Route: I-70 Comments: Rubblization Section: (25-1,2)R County: Effingham Design Date: 03/17/2015 <-- BY Location: Abandoned RR bridge in Altamont to Little Modify Date: <-- BY ADT Year 2014 Current: 20,000 Facility Type Interstate or Freeway Future: 31,000 2040 # of Lanes = Structural Design Traffic Minimum Actual Actual %of % of ADT in Road Class: ADT ADT Total ADT Design Lane PV = 0 15,392 57.5% Subgrade Support Rating (SSR): 500 S= SU = 1,205 45% 38.0% 2020 MU = 1500 10,172 M = 45% Construction Year: Design Period (DP) = 20 Struct. Design ADT = 26,769 (2030) years TRAFFIC FACTOR CALCULATION **FLEXIBLE PAVEMENT RIGID PAVEMENT** 0.15 Cpv = 0.15 Cpv = Csu = 132.5 Csu = 143.81 Cmu = 482.53 Cmu = 696.42

	NEW CONSTRUCTION / RECONSTRUCTION PAVEMENT DESIGN CALCULATIONS						
	Full-De	JPC	C Paveme	ent			
	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.	
Goto Map	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)	C	RC Pave	ment	
	Full Depth HMA Design Thickness =	17.25	in. (Fig. 54-5.F)	Use TF rigid =	65.33		
Goto Map	Limiting Strain Criterion Thickness =	16.25	in. (Fig. 54-5.l)	IBR value =	3		
	Use Full-Depth HMA Thickness =	16.25	inches	CRCP Thickness =	11.75	in. (Fig. 54-4.M)	

TF rigid (Actual) =

TF rigid (Min) =

65.33

10.05

(Actual ADT)

(Min ADT Fig. 54-2.C)

(Actual ADT)

(Min ADT Fig. 54-2.C)

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		
	HMA Overlay Design Thickness =	14.25	in. (Fig. 54-5.U)	special considerations.		
Goto Map	Limiting Strain Criterion Thickness =	11.50	in. (Fig. 54-5.V)	opodal odiloladiano.		
	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 2 lanes with ADT > 2000 4 lanes or more 2 Lanes 2 Lanes One way Street with ADT <= 3500 Part of a future 4 lanes or more (ADT 750 -2000) (ADT < 750)One-way Streets with ADT > 3500

	Min. Str. Design Traffic (Fig 54-2.C)				
Facility Type	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		

TF flexible (Actual) =

TF flexible (Min) =

45.63

7.11

	-	Γraffic Factor ESAL	Coefficients	
	Rigid (Fig. 54-4.C)	Flexible (F	ig. 54-5.B)
Class	Csu	Cmu	Csu	Cmu
	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		
0 - 3500	ll l		
>3501	1		
Class Table for			
2 or 3 lanes			
,	41 0		

Class Table for One-Way Streets

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

	Design Lane Distribution Factors For Structural Design Traffic (Fig. 54-2.B)					
	Rural Urban					
Number of Lanes	Р	S	М	Р	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 SECTION COUNTY LOCATION ge in Altamont to Little Wabash River	I-70 (25-1,2)R Effingham in Effingham		
FACILITY TYPE	INTERSTATE		
PROJECT LENGTH # OF CENTERLINES # OF LANES # OF EDGES LANE WIDTH - AVERAGE SHOULDER WIDTH HMA Inside HMA Outside Total Width of Paved Shoulders	47,784 FT ==> 2 CL 4 LANES 4 EP 12 FT 6 FT 10 FT 32 FT	9.05 Miles	
PAVEMENT THICKNESS (FLEXIBLE) SHOULDER THICKNESS POLICY OVERLAY THICKNESS	16.25 IN 8.00 IN 2.00 IN	16.25 IN MAX HMA_LSCD LSC Desi	ign
FLEX PAVEMENT TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
	7.11	45.63	45.63
HMA COST PER TON		UNIT PRICE	Read Me!
HMA SURFACE HMA TOP BINDER HMA LOWER BINDER HMA BINDER (LEVELING) HMA SHOULDER		\$111.65 / TON \$90.34 / TON \$73.74 / TON \$90.00 / TON \$68.93 / TON	
INITIAL COSTS ITEM THICKNESS 100	0% 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 HMA TOP BINDER COURSE (2.25") 1.0217 HMA LOWER BINDER COURSE (12.00") 1.0712	28,741 TONS 32,808 TONS 183,448 TONS	\$111.65 /TON \$90.34 /TON \$73.74 /TON	\$0 \$0 \$0
HMA SHOULDER (8.00") 169899 CURB & GUTTER	76,115 TONS 0 LIN FT	\$68.93 / TON \$30.00 / LIN FT	\$5,246,580 ~ \$0
SUBBASE GRAN MATL TY C (TONS) IMPROVED SUBGRADE: Modified Soil Width = 87.	66,359 TONS	\$17.18 /TON \$3.12 /SQ YD	\$1,140,048 \$1,448,067
Reserved For User Supplied Item Reserved For User Supplied Item	0 UNITS 0 UNITS	\$0.00 / UNITS \$0.00 / UNITS	\$0 \$0
PAVEMENT REMOVAL SHOULDER REMOVAL	254,848 SQ YD 169,899 SQ YD	\$7.00 / SQ YD \$8.00 / SQ YD	\$1,783,936 \$1,359,192
	LEXIBLE CONSTRUCTION		\$30,678,086 \$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	2.00	\$12.59 / SQ YD	
HMA SURFACE MIX (2.00") 1.0069 HMA BINDER MIX (0.00") 1.0139	Surface Mix 2.00 sling Binder Mix 0.00	\$12.59 / SQ YD \$0.00 / SQ YD	
HMA OVERLAY SHLD (Year 30) (2.00") HMA OVERLAY SHLD (2.00")	Shoulder Mix 2.00 Shoulder Mix 2.00	\$7.72 / SQ YD \$7.72 / SQ YD	
MILLING (2.00 IN)	2.00	\$3.00 / SQ YD	

Surface Mix 2.00

\$82.50 / SQ YD

PARTIAL DEPTH PVMT PATCH (Mill & Fill Surf)

PARTIAL DEPTH SHLD PATCH	(Mill & Fill Surf)	Shoulder Mix	2.00	\$77.72	/ SQ YD		
PARTIAL DEPTH PVMT PATCH PARTIAL DEPTH SHLD PATCH	(Mill & Fill +2.00 ") (Mill & Fill +2.00 ")	Leveling Binder Mix Shoulder Mix	2.00 2.00	\$80.08 \$77.72			
LONGITUDINAL SHOULDER JOINT CENTERLINE JOINT ROUT & SEAL RANDOM / THERMAL CRACK ROU		(100% Rehab = 110.00' / Station	ı / Lane)	*	/ LIN FT / LIN FT / LIN FT		
FLEXIBLE TOTAL LIFE-CYCLE COST \$39,922,423 FLEXIBLE TOTAL ANNUAL COST PER MILE \$179,916							

PCC PAVEMENT			CRCP
ROUTE SECTION COUNTY	I-70 (25-1,2)R Effingham		
LOCATION je in Altamont to Little Wabash Rive			
FACILITY TYPE	INTERSTATE		
PROJECT LENGTH # OF CENTERLINES # OF LANES # OF EDGES LANE WIDTH - AVERAGE SHOULDER WIDTH PCC Inside	47784 FT === 2 2 CL 4 LANES 4 EP 12 FT 6 FT	9.05 Miles	
PCC Outside Total Width of Paved Shoulders	10 FT 32 FT		
PAVEMENT THICKNESS (RIGID) CRCP SHOULDER THICKNESS	11.75 IN 11.75 IN	TIED SHLD	
POLICY OVERLAY THICKNESS	3.75 IN		
RIGID PAVEMENT TRAFFIC FACTORS	MINIMUM 10.05	ACTUAL 65,33	USE 65.33
Worksheet Construction Type is Reconstruction		avement Type is	CRCP
INITIAL COSTS ITEM THICKNESS 10	0% QUANTITY UNIT	UNIT PRICE	COST
CRC PAVEMENT (11.75")	254,848 SQ YD	\$46.17 / SQ YD	\$11,766,332
PAVEMENT REINFORCEMENT STABILIZED SUBBASE (4.00")	254,848 SQ YD 286,704 SQ YD	\$23.00 / SQ YD \$17.68 / SQ YD	\$5,861,504 \$5,068,927
PCC SHOULDERS CURB & GUTTER	169,899 SQ YD 0 LIN FT	\$45.42 / SQ YD \$30.00 / LIN FT	\$7,716,813 \$0
SUBBASE GRAN MATL TY C (~3.48") IMPROVED SUBGRADE: Modified Soil Width = 82	19,991 TONS .0' 435,365 SQ YD	\$20.34 / TON \$3.12 / SQ YD	\$406,617 \$1,358,339
Reserved For User Supplied Item Reserved For User Supplied Item	0 UNITS 0 UNITS	\$0.00 / UNITS \$0.00 / UNITS	\$0 \$0
PAVEMENT REMOVAL SHOULDER REMOVAL	254,848 SQ YD 169,899 SQ YD	\$7.00 / SQ YD \$8.00 / SQ YD	\$1,783,936 \$1,359,192
Note: * Denotes User Supplied Quantity RIGID CO	RIGID CONSTRUCTION		\$35,321,660 \$159,182
MAINTENANCE COSTS:			
ITEM THICKNESS	MATERIAL T	UNIT COST	
ROUTINE MAINTENANCE ACTIVITY		\$0.00 / LANE-MI	LE / YEAR
HMA POLICY OVERLAY (3.75") HMA POLICY OVERLAY PVMT (3.75") 1.0130	3.75 3.75	\$21.02 / SQ YD	
HMA SURFACE MIX (3.73) 1.0052	Surface Mix 1.50	\$9.43 / SQ YD	
HMA BINDER MIX (2.25") 1.0182	Top Binder Mix 2.25	\$11.59 / SQ YD	
HMA POLICY OVERLAY SHLD (3.75")	Shoulder Mix 3.75	\$14.48 / SQ YD	
CLASS A PAVEMENT PATCHING CLASS B PAVEMENT PATCHING CLASS C SHOULDER PATCHING		\$195.00 / SQ YD \$150.00 / SQ YD \$145.00 / SQ YD	
PARTIAL DEPTH PVMT PATCH (Mill & Fill HMA Surf) PARTIAL DEPTH PVMT PATCH (Mill & Fill HMA 1.50")	Surface Mix 1.50 Surface Mix 1.50	\$79.38 / SQ YD \$79.38 / SQ YD	
LONGITUDINAL SHOULDER JOINT ROUT & SEAL		\$2.00 / LIN FT	
CENTERLINE JOINT ROUT & SEAL REFLECTIVE TRANSVERSE CRACK ROUT & SEAL		\$2.00 / LIN FT	
RANDOM CRACK ROUT & SEAL (100% Rehab = 100.0	0' / Station / Lane)	\$2.00 / LIN FT \$2.00 / LIN FT	

RECONSTRUCTION -	HMA OVE	RUBBLIZED	PAVEN	<u>//ENT</u>			
PAVEMENT OVERLAY THICKNESS SHOULDER OVERLAY THICKNESS	(FLEXIBLE)	11.50 5.50		11.50 IN MAX	HMA_LSCD	Maintenance Sched	
INITIAL COSTS ITEM	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE	COST		
HMA OVERLAY REMOVAL RUBBLIZING PCC PAVEMENT	6.00	254,848 254,848		\$4.00 / SQ YD \$2.50 / SQ YD	\$1,019,392 \$637,120		
HMA OVERLAY (TOTAL)	11.50	254,848	SQ YD	\$55.80 / SQ YD	\$14,219,805	~	
HMA SURFACE COURSE HMA TOP BINDER COURSE HMA LOWER BINDER COURSE	2.00 2.25 7.25	1.0069 254,848 1.0217 254,848 1.0547 254,848	SQ YD	\$12.59 / SQ YD \$11.63 / SQ YD \$31.58 / SQ YD	\$0 \$0 \$0		
HMA SHOULDER	5.50	52,329	TONS	\$68.93 / TON	\$3,607,023	3	
nlet Adjustments Aggregate Shoulders, Type B		22 8,115	EACH * TONS *	\$1,500.00 / EACH \$27.48 / TONS	\$33,000 \$223,000		
EARTHWORK		281,925	CU YD *	\$9.97 / CU YD	\$2,810,792		
Note: * Denotes User Supplied Quant		RUBBLIZED CONS LIZED CONSTRUCTION			\$22,550,132 \$101,626		
	RUE	RUBBLIZED MAINTEN BLIZED MAINTENANCE			\$9,244,337 \$41,661		
DECONSTRUCTION	DOC LINDO	RUBBLIZED TOTAL	ANNUAL C	E-CYCLE COST COST PER MILE	\$31,794,469 \$143,287		
PAVEMENT THICKNESS (PCC) CHOULDER THICKNESS	PCC UNBC	10.75 10.75	IN	Pavement Type is	CRCP		
NITIAL COSTS TEM	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE	COST		
MILLING of EXISTING HMA OVERLAY	(Pvmt & Shld) (Pvmt & Shld)	424,747 424,747		\$3.00 / SQ YD \$4.00 / SQ YD	\$1,274,241 \$1,698,988		
CRC PAVEMENT PAVEMENT REINFORCEMENT	10.75	254,848 254,848		\$42.49 / SQ YD \$23.00 / SQ YD	\$10,828,492 \$5,861,504		
PCC SHOULDERS		169,899	SQ YD	\$41.75 / SQ YD	\$7,093,283		
nlet Adjustments Aggregate Shoulders, Type B		22 12,950	EACH * TON *	\$1,500.00 / EACH \$27.17 / TON	\$33,000 \$351,852		
EARTHWORK		331,939	CU YD *	\$10.01 / CU YD	\$3,322,709		
Note: * Denotes User Supplied Quant		UNBONDED CONS			\$30,464,069 \$137,291		
	UNB	UNBONDED MAINTEN ONDED MAINTENANCE			\$5,348,703 \$24,105		
UNBONDED TOTAL LIFE-CYCLE COST \$35,812,772 UNBONDED TOTAL ANNUAL COST PER MILE \$161,396							

LIFE-CYCL	E COST ANALYSIS:	NEW DESIGN	Calculated / Revised :	3/17/15 1:35 PM
CONSTRUCTION	INITIAL COST	PRESENT WO ANNUAL COST PER I	* / - /	HMA \$30,678,086 \$138,255
MAINTENANCE	LIFE-CYCLE COST	PRESENT WO ANNUAL COST PER I	*-,,	\$9,244,337 \$41,661
TOTAL	LIFE-CYCLE COST	PRESENT WO ANNUAL COST PER I	,,	\$39,922,423 \$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	НМА	\$179,916	25.6%
	TYPE / PERCENTAGE	CRCP	\$183,287	27.9%

S:\GEN\WPDOCS\Pavement Designs\D-7\I-70 - Altamont to the Little Wabash River - 74664\I-70 Altamont to the Little Wabash River - 2nd Submittal\[I-70 from Al

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

	LIMITING	STRAIN CRITE	RION DESIGN				
MAINTENANCE COSTS: 17	TEM	0/_	QUANTITY	LINIT	UNIT COST	COST	PRESENT WORTH
WAINTENANCE COSTS.	I EW	/0	QUANTITI	UNIT	UNIT COST	0031	WORTH
YEAR 5							
L	ONG SHLD JT R&S	100.00%	191,136	LIN FT	\$2.00	\$382,272	
C	ONTR LINE JOINT R&S	100.00%		LIN FT	\$2.00	\$191,136	
R	RNDM / THRM CRACK R&S	50.00%			\$2.00	\$210,250	
P	PD PVMT PATCH M&F SURF	0.10%		SQ YD	\$82.50	\$21,039	
	PWFn	= 0.8626		PW =	0.8626 X	\$804,697	\$694,139
VEAD 40							
YEAR 10	ONC CUILD IT DOC	100.000/	101 100	LINIET	#2.00	¢202.272	
	ONG SHLD JT R&S ONTR LINE JOINT R&S	100.00%			\$2.00	\$382,272	
_		100.00%		LIN FT	\$2.00	\$191,136	
	RNDM / THRM CRACK R&S PD PVMT PATCH M&F SURF	50.00%		SQ YD	\$2.00	\$210,250	
<u> </u>	PWFn	0.50% = 0.7441	1,274	PW =	\$82.50 0.7441 X	\$105,111 \$888,769	\$661,328
	FWFII	= 0.7441		rvv =	0.7441 A	φοσο,709	φυσ1,320
YEAR 15							
	MILL PVMT & SHLD 2.00"	100.00%	424,747	SQ YD	\$3.00	\$1,274,241	
P	PD PVMT PATCH M&F ADD'L 2.00"	1.00%		SQ YD	\$80.08	\$204,044	
Н	HMA OVERLAY PVMT 2.00"	100.00%	254,848	SQ YD	\$12.59	\$3,208,954	
Н	HMA OVERLAY SHLD 2.00 "	100.00%			\$7.72	\$1,311,645	
	PWFn	= 0.6419		PW =	0.6419 X	\$5,998,884	\$3,850,455
YEAR 20	ONO OUR DUT DOO	100.000	10		00.00	00000000	
	ONG SHLD JT R&S	100.00%			\$2.00	\$382,272	
	CNTR LINE JOINT R&S	100.00%		LIN FT	\$2.00	\$191,136	
	RNDM / THRM CRACK R&S	50.00%	,		\$2.00	\$210,250	
<u> </u>	PD PVMT PATCH M&F SURF	0.10%		SQ YD	\$82.50	\$21,039	0.445 5.44
	PWFn	= 0.5537		PW =	0.5537 X	\$804,697	\$445,541
YEAR 25							
	ONG SHLD JT R&S	100.00%	191,136	LIN FT	\$2.00	\$382,272	
	CNTR LINE JOINT R&S	100.00%		LIN FT	\$2.00	\$191,136	
R	RNDM / THRM CRACK R&S	50.00%			\$2.00	\$210,250	
	PD PVMT PATCH M&F SURF	0.50%		SQ YD	\$82.50	\$105,111	
_	PWFn	= 0.4776		PW =	0.4776 X	\$888,769	\$424,481
<u> </u>	HMA_LSCD						
YEAR 30	INTERSTATE						
	MILL PVMT & SHLD 2.00"	100.00%			\$3.00	\$1,274,241	
P	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%		SQ YD	\$77.72	\$132,047	
	IMA OVERLAY PVMT 2.00"	100.00%			\$12.59	\$3,208,954	
H	IMA OVERLAY SHLD 2.00 "	100.00%	-		\$7.72	\$1,311,645	
	PWFn	= 0.4120		PW =	0.4120 X	\$6,335,055	\$2,609,959
VEAD OF							
YEAR 35	ONG SHI D. IT D&S	100.009/	101 126	LINET	\$2.00	\$202.272	
	ONG SHLD JT R&S ONTR LINE JOINT R&S	100.00% 100.00%		LIN FT	\$2.00 \$2.00	\$382,272	
	RNDM / THRM CRACK R&S	50.00%			\$2.00 \$2.00	\$191,136 \$210,250	
	PD PVMT PATCH M&F SURF	0.10%		SQ YD	\$2.00 \$82.50	\$21,039	
<u>.</u>	PWFn			PW =		\$804,697	\$285,976
		0.0001		–	1.000 . A	+ , 0 0.	1_00,0.0
YEAR 40							
	ONG SHLD JT R&S	100.00%			\$2.00	\$382,272	
	ENTR LINE JOINT R&S	100.00%		LIN FT	\$2.00	\$191,136	
	RNDM / THRM CRACK R&S	50.00%			\$2.00	\$210,250	
<u>P</u>	PD PVMT PATCH M&F SURF	0.50%		SQ YD	\$82.50	\$105,111	CO70 450
	PWFn	= 0.3066		PW =	0.3066 X	\$888,769	\$272,458
						_	\$9,244,337
							Ψ0,211,007
R	ROUTINE MAINTENANCE ACTIVITY		36.20	Lane Miles	0.00	0	\$0
					INTENANCE LIFE		\$9,244,337
45	YEAR LIFE CYCLE CRFn = 0.0	407852		MAINTEN	ANCE ANNUAL CO	OST PER MILE	\$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									
12,111	PAVEMENT PATCH CLASS A		0.10%	255	SQ YD	\$195.00		\$49,725	
		PWFn =	0.7441		PW =	0.7441	Χ	\$49,725	\$37,000
YEAR 15									
<u></u>	PAVEMENT PATCH CLASS A		0.20%	510	SQ YD	\$195.00		\$99,450	
		PWFn =	0.6419		PW =	0.6419	Х	\$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		\$2.00		\$191,136	
		PWFn =	0.5537		PW =	0.5537	Χ	\$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	Χ	\$495,750	\$236,773
YEAR 30	INTERSTATE								
<u></u>	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	Χ	\$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 SUF		0.10%	255	SQ YD	\$79.38		\$20,242	
		PWFn =	0.3554		PW =	0.3554	Х	\$784,786	\$278,900
YEAR 40	1								
	LONGITUDINAL SHLD JT R&S		100.00%	191,136		\$2.00		\$382,272	
	CENTERLINE JT R&S		100.00%	95,568		\$2.00		\$191,136	
	RANDOM CRACK R&S		50.00%	95,568		\$2.00		\$191,136	
	PAVEMENT PATCH CLASS A	_	0.50%		SQ YD	\$195.00		\$248,430	
	PD PVMT PATCH M&F HMA SUF		0.50%	1,274	SQ YD	\$79.38		\$101,128	0044.500
		PWFn =	0.3066		PW =	0.3066	Х	\$1,114,102	\$341,536 \$5,348,703
	DOLITING MAINTENANCE ACTIVE	TV		26.20	Long Miles	\$0.00		\$ 0	* - /
	ROUTINE MAINTENANCE ACTIVI	I T		30.20	Lane Miles	\$0.00 INTANANCE L	IEE -	\$0 CYCLE COST	\$0 \$5,349,703
45	YEAR LIFE CYCLE CI	RFn = 0.0407	7852			INTANANCE L ANCE ANNUAL			\$5,348,703 \$24,105