



Illinois Department of Transportation

To: John Fortmann Attn: District One
From: John D. Baranzelli 
Subject: Pavement Design
Date: July 20, 2013

FAP Route 345 (US Route 20)
Section 10N-1
Kane County
At Allen Road/Brier Hill Road

We have reviewed the pavement selection for the project, which was submitted to BDE by memo dated June 18, 2013. The project will reconstruct US 20 and Allen Road/Brier Hill Road, with the Allen Road and Brier Hill Road designs subject to local concurrence. The life cycle costs for US Route 20 favor the rigid pavement design. Relocated Allan Road and Relocated Brier Hill Road have been designed with a HMA pavement design due to lane closure and driveway issues that will occur during construction. The approved pavement design for this project is as follows:

US Route 20 (Pavement Reconstruction)
Brier Hill Road (Pavement Reconstruction)

9 inches of PCC Pavement with tied PCC Shoulders
4 inches of Stabilized Sub-Base
12 inches of Aggregate Subgrade Improvement

Allen Road (Pavement Reconstruction)

8.5 inches of PCC Pavement with tied PCC shoulders
4 inches of Stabilized Sub-Base
12 inches of Aggregate Subgrade Improvement

Relocated Brier Hill Road (Pavement Reconstruction)
(STA. 802+30 to STA. 805+00)

9.75 inches of HMA Full-Depth Pavement with HMA Shoulders
 2 inches of Polymerized HMA Surface Course, Mix "F" N90
 2.25 inches of Polymerized HMA Binder Course, IL-19, N90
 5.5 inches of HMA Binder Course, IL-19.0, N90
12 inches of Aggregate Subgrade Improvement

Relocated Allen Road (Pavement Reconstruction)
(STA. 998+63 to STA. 1002+00)

8.75 inches of HMA Full-Depth Pavement with HMA Shoulders
 2 inches of Polymerized HMA Surface Course, Mix "F" N90
 2.25 inches of Polymerized HMA Binder Course, IL-19, N90
 4.5 inches of HMA Binder Course, IL-19.0, N90
12 inches of Aggregate Subgrade Improvement

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

c. Allen Road⁸
PCC Shoulders (Tied)
Pavement Reconstruction

- 8 ½" PCC Pavement (Jointed)²
- 4" Stabilized Subbase³
- 12" Aggregate Subgrade Improvement⁴

A segmental pavement analysis was performed on Brier Hill Road from STA. 802+30 to STA. 805+00 and on Allen Road from STA. 998+63 to STA. 1002+00 to provide an equivalent HMA pavement design at the designers request due to long duration of lane closure and necessary accessibility to driveways. Brier Hill Road and Allen Road are subject to local jurisdiction approval and concurrence. Our recommendation is as follows:

b. Brier Hill Road STA. 802+30 to STA. 805+00⁸
Pavement Reconstruction
HMA shoulders

- 9 ¾" HMA Pavement (Full Depth)⁹
 - 2" Polymerized HMA Surface Course Mix "F", N90⁵
 - 2 ¼" Polymerized Binder Course IL-19, N90⁶
 - 5 ½" HMA Binder Course IL-19, N90⁷
- 12" Aggregate Subgrade Improvement⁴

c. Allen Road STA. STA. 998+63 to 1002+00⁸
Pavement Reconstruction
HMA shoulders

- 8 ¾" HMA Pavement (Full Depth)⁹
 - 2" Polymerized HMA Surface Course Mix "F", N90⁵
 - 2 ¼" Polymerized Binder Course IL-19, N90⁶
 - 4 ½" HMA Binder Course IL-19, N90⁷
- 12" Aggregate Subgrade Improvement⁴

¹Designer Note 1: Use pay item #42000306, "PORTLAND CEMENT CONCRETE PAVEMENT 9" (JOINTED) " paid for square yards.

²Designer Note 2: Use pay item #42000311, "PORTLAND CEMENT CONCRETE PAVEMENT 8 ½" (JOINTED) " paid for square yards

³Designer Note 3: Use pay item #31200500, "STABILIZED SUBBASE - HOT-MIX ASPHALT, 4" " paid for in square yards.

⁴Designer Note 4: Use pay item #30300112, "AGGREGATE SUBGRADE IMPROVEMENT, 12", paid in square yards.

⁵Designer Note 5: Use pay item #40603595, "Polymerized Hot-Mix Asphalt Surface Course, Mix "F", N90" in tons.

John Baranzelli
July 2, 2013
Page three

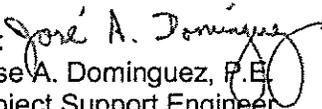
⁶Designer Note 6: Use pay item #40603240, "Polymerized Hot-Mix Asphalt Binder Course, IL-19.0, N90" in tons.

⁷Designer Note 7: Use pay item # 40603090, "HOT-MIX ASPHALT BINDER COURSE, IL-19.0, N90" in tons.

⁸Designer Note 8: Brier Hill Road and Allen Road is subject to local jurisdictional approval and concurrence.

⁹Designer Note 9: Refer to the District One, Bureau of Materials' "Hot-Mix Asphalt – Mix Selection" tables to determine the corresponding HMA mix table requirements for the plans.

If you have any questions or need additional information, please contact Jenpai Chang, Interim Pavement Engineer, at (847) 705-4432.

By: 
Jose A. Dominguez, P.E.
Project Support Engineer

PROJECT AND TRAFFIC INPUTS				(Enter Data in Gray Shaded Cells)																										
Route: US Route 20	Comments:																													
Section:																														
County: Kane	Design Date: 06/14/2013	AS																												
Location: Allen Road and Brier Hill	Modify Date:																													
Facility Type: Other Marked State Route	# of Lanes = 2 or 3 Part of future 4 lanes or more? No One Way Street? No Road Class: II		<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td><-- BY</td> <td>ADT</td> <td>Year</td> </tr> <tr> <td>Current:</td> <td style="text-align: center;">6,700</td> <td style="text-align: center;">2013</td> </tr> <tr> <td>Future:</td> <td style="text-align: center;">11,436</td> <td style="text-align: center;">2040</td> </tr> </table>				<-- BY	ADT	Year	Current:	6,700	2013	Future:	11,436	2040															
<-- BY	ADT	Year																												
Current:	6,700	2013																												
Future:	11,436	2040																												
Subgrade Support Rating (SSR): Poor	Construction Year: 2013		<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th colspan="4">Structural Design Traffic</th> </tr> <tr> <th>Minimum ADT</th> <th>Actual ADT</th> <th>Actual % of Total ADT</th> <th>% of ADT in Design Lane</th> </tr> <tr> <td>PV = 0</td> <td>7,189</td> <td>85.0%</td> <td>P = 50%</td> </tr> <tr> <td>SU = 250</td> <td>379</td> <td>4.5%</td> <td>S = 50%</td> </tr> <tr> <td>MU = 750</td> <td>886</td> <td>10.5%</td> <td>M = 50%</td> </tr> <tr> <td colspan="3">Struct. Design ADT = 8,454</td> <td>(2023)</td> </tr> </table>				Structural Design Traffic				Minimum ADT	Actual ADT	Actual % of Total ADT	% of ADT in Design Lane	PV = 0	7,189	85.0%	P = 50%	SU = 250	379	4.5%	S = 50%	MU = 750	886	10.5%	M = 50%	Struct. Design ADT = 8,454			(2023)
Structural Design Traffic																														
Minimum ADT	Actual ADT	Actual % of Total ADT	% of ADT in Design Lane																											
PV = 0	7,189	85.0%	P = 50%																											
SU = 250	379	4.5%	S = 50%																											
MU = 750	886	10.5%	M = 50%																											
Struct. Design ADT = 8,454			(2023)																											
Design Period (DP) = 20 years																														

TRAFFIC FACTOR CALCULATION			
FLEXIBLE PAVEMENT		RIGID PAVEMENT	
Cpv = 0.15	Cpv = 0.15	Csu = 112.06	Csu = 135.78
Cmu = 385.44	Cmu = 567.21	TF flexible (Actual) = 3.85	TF rigid (Actual) = 5.55
TF flexible (Min) = 3.17	(Min ADT Fig. 54-2.C)	TF flexible (Min) = 3.17	(Min ADT Fig. 54-2.C)

NEW CONSTRUCTION / RECONSTRUCTION PAVEMENT DESIGN CALCULATIONS			
Full-Depth HMA Pavement		JPC Pavement	
Use TF flexible = 3.85	Use TF rigid = 5.55	Edge Support = Tied Shoulder or C.&G.	
PG Grade Lower Binder Lifts = PG 64-22 (Fig. 53-4.R)	Rigid Pavt Thick. = 9.00 in. (Fig. 54-4.E)		
HMA Mixture Temp. = 74.0 deg. F (Fig. 54-5.C)			
Design HMA Mixture Modulus (E _{HMA}) = 720 ksi (Fig. 54-5.D)			
Design HMA Strain (ε _{HMA}) = 82 (Fig. 54-5.E)			
CRC Pavement			
Full Depth HMA Design Thickness = 10.25 in. (Fig. 54-5.F)	Use TF rigid = 5.55	IBR value = 2	
Limiting Strain Criterion Thickness = 14.50 in. (Fig. 54-5.I)	CRCP Thickness = 8.25 in. (Fig. 54-4.N)		
Use Full-Depth HMA Thickness = 10.25 inches	TF MUST BE > 60 FOR CRCP		

RECONSTRUCTION ONLY (SUPPLEMENTAL) PAVEMENT DESIGN CALCULATIONS			
HMA Overlay of Rubblized PCC		Unbonded Concrete Overlay	
Use TF flexible = 3.85	Review 54-4.03 for limitations and special considerations.		
District = 3,4,5,6	JPCP Thickness = NA inches		
HMA Overlay Design Thickness = 8.25 in. (Fig. 54-5.U)	CONTACT BMPR FOR ASSISTANCE		

DESIGN TABLES FROM BDE MANUAL CHAPTER 54 - PAVEMENT DESIGN							
Class I Roads 4 lanes or more Part of a future 4 lanes or more One-way Streets with ADT > 3500		Class II Roads 2 lanes with ADT > 2000 One way Street with ADT <= 3500		Class III Roads 2 Lanes (ADT 750 -2000)		Class IV Roads 2 Lanes (ADT < 750)	
Min. Str. Design Traffic (Fig 54-2.C)				Class Table for One-Way Streets			
Facility Type		PV	SU	MU	ADT		Class
Interstate or Supplemental Freeway		0	500	1500	0 - 3500		II
Other Marked State Route		0	250	750	>3501		I
Unmarked State Route		No Min	No Min	No Min			
Traffic Factor ESAL Coefficients							
Rigid (Fig. 54-4.C)				Flexible (Fig. 54-5.B)			
Class		Csu	Cmu	Csu	Cmu		
I		143.81	696.42	132.50	482.53		
II		135.78	567.21	112.06	385.44		
III		129.58	562.47	109.14	384.35		
IV		129.58	562.47	109.14	384.35		
Class Table for 2 or 3 lanes (not future 4 lane & not one-way street)							
ADT		Class					
0 - 749		IV					
750 - 2000		III					
>2000		II					
Design Lane Distribution Factors For Structural Design Traffic (Fig. 54-2.B)							
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

Standard Design

ROUTE **US Route 20**
 SECTION
 COUNTY **Kane**
 LOCATION **Allen Road and Brier Hill**

FACILITY TYPE **NON-INTERSTATE**

PROJECT LENGTH **1970 FT ==> 0.37 Miles**
 # OF CENTERLINES **1 CL**
 # OF LANES **2 LANES**
 # OF EDGES **1 EP**
 LANE WIDTH - AVERAGE **12 FT**
 SHOULDER WIDTH HMA Inside **8 FT**
 HMA Outside **8 FT**

PAVEMENT THICKNESS (FLEXIBLE) **10.25 IN** **14.50 IN MAX**
 SHOULDER THICKNESS **8.00 IN** **HMA 8.00 Standard Design**
 POLICY OVERLAY THICKNESS **2.25 IN**

FLEX PAVEMENT	TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
		3.17	3.85	3.85

Read Me!

HMA	COST PER TON	UNIT PRICE
HMA SURFACE		\$95.00 / TON
HMA TOP BINDER		\$90.00 / TON
HMA LOWER BINDER		\$85.00 / TON
HMA BINDER (LEVELING)		\$95.00 / TON
HMA SHOULDER		\$85.00 / TON

INITIAL COSTS

ITEM	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE	COST
HMA PAVEMENT (FULL-DEPTH)	(10.25")	5,253	SQ YD	\$51.42 / SQ YD	\$0
HMA SURFACE COURSE	(2.00")	5,253	SQ YD *	\$15.27 / SQ YD	\$80,218 ~
HMA TOP BINDER COURSE	(2.25")	5,253	SQ YD *	\$10.36 / SQ YD	\$54,425 ~
HMA LOWER BINDER COURSE	(6.00")	5,253	SQ YD *	\$24.63 / SQ YD	\$129,390 ~
HMA SHOULDER	(8.00")	1,751	SQ YD *	\$41.73 / SQ YD	\$73,074 ~
CURB & GUTTER		0	LIN FT	\$30.00 / LIN FT	\$0
SUBBASE GRAN MATL TY C (TONS)		73	TONS	\$25.00 / TON	\$1,825
IMPROVED SUBGRADE:	Aggregate (FRASL = 12.4")	5,333	SQ YD *	\$10.00 / SQ YD	\$53,330
Reserved For User Supplied Item		0	UNITS	\$0.00 / UNITS	\$0
Reserved For User Supplied Item		0	UNITS	\$0.00 / UNITS	\$0
PAVEMENT REMOVAL		5,253	SQ YD	\$0.00 / SQ YD	\$0
SHOULDER REMOVAL		1,751	SQ YD	\$0.00 / SQ YD	\$0

Note: * Denotes User Supplied Quantity
 FLEXIBLE CONSTRUCTION INITIAL COST **\$392,262**
 FLEXIBLE CONSTRUCTION ANNUAL COST PER MILE **\$42,879**

MAINTENANCE COSTS:

ITEM	THICKNESS	MATERIAL	UNIT COST
ROUTINE MAINTENANCE ACTIVITY			\$0.00 LANE-MILE / YEAR
HMA OVERLAY PVMT SURF	(2.00")	Surface Mix	\$15.27 / SQ YD
HMA OVERLAY PVMT	(2.25")	Surface Mix	\$17.18 / SQ YD
HMA SURFACE MIX	(1.50")	Surface Mix	\$11.45 / SQ YD
HMA BINDER MIX	(0.75")	Leveling Binder Mix	\$5.73 / SQ YD
HMA OVERLAY SHLD (Year 30)	(2.25")	Shoulder Mix	\$17.18 / SQ YD
HMA OVERLAY SHLD	(2.00")	Shoulder Mix	\$15.27 / SQ YD
MILLING (2.00 IN)			\$2.50 / SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill Surf)		Surface Mix	\$90.83 / SQ YD
PARTIAL DEPTH SHLD PATCH (Mill & Fill Surf)		Shoulder Mix	\$89.71 / SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill +2.00")		Leveling Binder Mix	\$90.83 / SQ YD
PARTIAL DEPTH SHLD PATCH (Mill & Fill +2.00")		Shoulder Mix	\$89.71 / 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 **\$581,345**
 FLEXIBLE TOTAL ANNUAL COST PER MILE **\$63,548**

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%	1,970	LIN FT	\$2.00	\$3,940	
	CNTR LINE JOINT R&S	100.00%	1,970	LIN FT	\$2.00	\$3,940	
	RNDM / THRM CRACK R&S	50.00%	2,167	LIN FT	\$2.00	\$4,334	
	PD PVMT PATCH M&F SURF	0.10%	5	SQ YD	\$90.83	\$454	
	PWFn =	0.8626		PW =	0.8626 X	\$12,668	\$10,928
YEAR 10							
	LONG SHLD JT R&S	100.00%	1,970	LIN FT	\$2.00	\$3,940	
	CNTR LINE JOINT R&S	100.00%	1,970	LIN FT	\$2.00	\$3,940	
	RNDM / THRM CRACK R&S	50.00%	2,167	LIN FT	\$2.00	\$4,334	
	PD PVMT PATCH M&F SURF	0.50%	26	SQ YD	\$90.83	\$2,362	
	PWFn =	0.7441		PW =	0.7441 X	\$14,576	\$10,846
YEAR 15							
	MILL PVMT & SHLD 2.00"	100.00%	7,004	SQ YD	\$2.50	\$17,510	
	PD PVMT PATCH M&F ADD'L 2.00"	1.00%	53	SQ YD	\$90.83	\$4,814	
	HMA OVERLAY PVMT 2.00"	100.00%	5,253	SQ YD	\$15.27	\$80,218	
	HMA OVERLAY SHLD 2.00 "	100.00%	1,751	SQ YD	\$15.27	\$26,739	
	PWFn =	0.6419		PW =	0.6419 X	\$129,281	\$82,981
YEAR 20							
	LONG SHLD JT R&S	100.00%	1,970	LIN FT	\$2.00	\$3,940	
	CNTR LINE JOINT R&S	100.00%	1,970	LIN FT	\$2.00	\$3,940	
	RNDM / THRM CRACK R&S	50.00%	2,167	LIN FT	\$2.00	\$4,334	
	PD PVMT PATCH M&F SURF	0.10%	5	SQ YD	\$90.83	\$454	
	PWFn =	0.5537		PW =	0.5537 X	\$12,668	\$7,014
YEAR 25							
	LONG SHLD JT R&S	100.00%	1,970	LIN FT	\$2.00	\$3,940	
	CNTR LINE JOINT R&S	100.00%	1,970	LIN FT	\$2.00	\$3,940	
	RNDM / THRM CRACK R&S	50.00%	2,167	LIN FT	\$2.00	\$4,334	
	PD PVMT PATCH M&F SURF	0.50%	26	SQ YD	\$90.83	\$2,362	
	PWFn =	0.4776		PW =	0.4776 X	\$14,576	\$6,962
YEAR 30							
	HMA SD NON-INTERSTATE						
	MILL PVMT & SHLD 2.00"	100.00%	7,004	SQ YD	\$2.50	\$17,510	
	PD PVMT PATCH M&F ADD'L 2.00"	2.00%	105	SQ YD	\$90.83	\$9,537	
	PD SHLD PATCH M&F ADD'L 2.00"	1.00%	18	SQ YD	\$89.71	\$1,615	
	HMA OVERLAY PVMT 2.25 "	100.00%	5,253	SQ YD	\$17.18	\$90,246	
	HMA OVERLAY SHLD 2.25 "	100.00%	1,751	SQ YD	\$17.18	\$30,082	
	PWFn =	0.4120		PW =	0.4120 X	\$148,990	\$61,382
YEAR 35							
	LONG SHLD JT R&S	100.00%	1,970	LIN FT	\$2.00	\$3,940	
	CNTR LINE JOINT R&S	100.00%	1,970	LIN FT	\$2.00	\$3,940	
	RNDM / THRM CRACK R&S	50.00%	2,167	LIN FT	\$2.00	\$4,334	
	PD PVMT PATCH M&F SURF	0.10%	5	SQ YD	\$90.83	\$454	
	PWFn =	0.3554		PW =	0.3554 X	\$12,668	\$4,502
YEAR 40							
	LONG SHLD JT R&S	100.00%	1,970	LIN FT	\$2.00	\$3,940	
	CNTR LINE JOINT R&S	100.00%	1,970	LIN FT	\$2.00	\$3,940	
	RNDM / THRM CRACK R&S	50.00%	2,167	LIN FT	\$2.00	\$4,334	
	PD PVMT PATCH M&F SURF	0.50%	26	SQ YD	\$90.83	\$2,362	
	PWFn =	0.3066		PW =	0.3066 X	\$14,576	\$4,468
							\$189,083
ROUTINE MAINTENANCE ACTIVITY			0.75	Lane Miles	0.00	\$0	\$0
						MAINTENANCE LIFE-CYCLE COST	\$189,083
45	YEAR LIFE CYCLE	CRFn = 0.0407852	MAINTENANCE ANNUAL COST PER MILE			\$20,669	

PCC PAVEMENT

JPCP

ROUTE **US Route 20**
 SECTION **0**
 COUNTY **Kane**
 LOCATION **Allen Road and Brier Hill**

FACILITY TYPE **NON-INTERSTATE**

PROJECT LENGTH **1970 FT ==> 0.37 Miles**
 # OF CENTERLINES **1 CL**
 # OF LANES **2 LANES**
 # OF EDGES **1 EP**
 LANE WIDTH - AVERAGE **12 FT**
 SHOULDER WIDTH **PCC Inside 8 FT**
 PCC Outside 8 FT

PAVEMENT THICKNESS (RIGID) **JPCP 9.00 IN TIED SHLD**
 SHOULDER THICKNESS **9.00 IN**

POLICY OVERLAY THICKNESS **2.50 IN**

RIGID PAVEMENT	TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
		4.59	5.55	5.55
Worksheet Construction Type is	New Construction	The Pavement Type is		JPCP

INITIAL COSTS

ITEM	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE	COST
JPC PAVEMENT	(9.00")	5,253	SQ YD	\$41.24 /SQ YD	\$216,634
PAVEMENT REINFORCEMENT		0	SQ YD	\$0.00 /SQ YD	\$0
STABILIZED SUBBASE	(4.00")	5,582	SQ YD	\$15.00 /SQ YD	\$83,730
PCC SHOULDERS	(9.00" to 9.00")	1,751	SQ YD	\$36.24 /SQ YD	\$63,456
CURB & GUTTER		0	LIN FT	\$30.00 /LIN FT	\$0
SUBBASE GRAN MATL TY C	(~0.90")	73	TONS *	\$25.00 /TON	\$1,825
IMPROVED SUBGRADE:	Aggregate MS&B = 24.4	5,333	SQ YD *	\$10.00 /SQ YD	\$53,330
Reserved For User Supplied Item		0	UNITS	\$0.00 /UNITS	\$0
Reserved For User Supplied Item		0	UNITS	\$0.00 /UNITS	\$0
PAVEMENT REMOVAL		5,253	SQ YD	\$0.00 /SQ YD	\$0
SHOULDER REMOVAL		1,751	SQ YD	\$0.00 /SQ YD	\$0

Note: * Denotes User Supplied Quantity
 RIGID CONSTRUCTION INITIAL COST **\$418,975**
 RIGID CONSTRUCTION ANNUAL COST PER MILE **\$45,799**

MAINTENANCE COSTS:

ITEM	THICKNESS	MATERIAL	UNIT	UNIT COST
ROUTINE MAINTENANCE ACTIVITY				\$0.00 /LANE-MILE /YEAR
HMA POLICY OVERLAY	(2.50")		2.50	
HMA POLICY OVERLAY PVMT	(2.50")	1.0000	2.50	\$19.09 /SQ YD
HMA SURFACE MIX	(1.50")	1.0000	1.50	\$11.45 /SQ YD
HMA BINDER MIX	(1.00")	1.0000	1.00	\$7.64 /SQ YD
HMA POLICY OVERLAY SHLD	(2.50")		2.50	\$19.09 /SQ YD
CLASS A PAVEMENT PATCHING				\$170.00 /SQ YD
CLASS B PAVEMENT PATCHING				\$130.00 /SQ YD
CLASS C SHOULDER PATCHING				\$110.00 /SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill HMA Surf)		Surface Mix	1.80	\$88.17 /SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill HMA 2.50")		Surface Mix	2.80	\$93.49 /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 **\$522,931**
 RIGID TOTAL ANNUAL COST PER MILE **\$57,163**

MAINTENANCE AND REHABILITATION ACTIVITY SCHEDULE

11/07/13

JOINTED PLAIN CONCRETE PAVEMENT
UNBONDED JOINTED PLAIN CONCRETE OVERLAY
Figure 54-7.A

MAINTENANCE COSTS:	ITEM	%	QUANTITY	UNIT	UNIT COST	COST	PRESENT WORTH
YEAR 10							
	PAVEMENT PATCH CLASS B	0.10%	5	SQ YD	\$130.00	\$650	
		PWFn = 0.7441			PW = 0.7441 X	\$650	\$484
YEAR 15							
	PAVEMENT PATCH CLASS B	0.20%	11	SQ YD	\$130.00	\$1,430	
		PWFn = 0.6419			PW = 0.6419 X	\$1,430	\$918
YEAR 20							
	PAVEMENT PATCH CLASS B	2.00%	105	SQ YD	\$130.00	\$13,650	
	SHOULDER PATCH CLASS C	0.50%	9	SQ YD	\$110.00	\$990	
	LONGITUDINAL SHLD JT R&S	100.00%	1,970	LIN FT	\$2.00	\$3,940	
	CENTERLINE JT R&S	100.00%	1,970	LIN FT	\$2.00	\$3,940	
		PWFn = 0.5537			PW = 0.5537 X	\$22,520	\$12,469
YEAR 25							
	PAVEMENT PATCH CLASS B	3.00%	158	SQ YD	\$130.00	\$20,540	
	SHOULDER PATCH CLASS C	1.00%	18	SQ YD	\$110.00	\$1,980	
		PWFn = 0.4776			PW = 0.4776 X	\$22,520	\$10,756
YEAR 30 NON-INTERSTATE							
	PAVEMENT PATCH CLASS B	4.00%	210	SQ YD	\$130.00	\$27,300	
	SHOULDER PATCH CLASS C	1.50%	26	SQ YD	\$110.00	\$2,860	
	HMA POLICY OVERLAY 2.5" (PVMT)	100.00%	5,253	SQ YD	\$19.09	\$100,273	
	HMA POLICY OVERLAY 2.5" (SHLD)	100.00%	1,751	SQ YD	\$19.09	\$33,424	
		PWFn = 0.4120			PW = 0.4120 X	\$163,857	\$67,507
YEAR 35 NON-INTERSTATE							
	LONGITUDINAL SHLD JT R&S	100.00%	1,970	LIN FT	\$2.00	\$3,940	
	CENTERLINE JT R&S	100.00%	1,970	LIN FT	\$2.00	\$3,940	
	RANDOM CRACK R&S	50.00%	1,970	LIN FT	\$2.00	\$3,940	
	REFLECTIVE TRANSVERSE CRACK R&S	40.00%	1,258	LIN FT	\$2.00	\$2,516	
	PD PVMT PATCH M&F HMA 2.50"	0.10%	5	SQ YD	\$93.49	\$467	
		PWFn = 0.3554			PW = 0.3554 X	\$14,803	\$5,261
YEAR 40 NON-INTERSTATE							
	PAVEMENT PATCH CLASS B	0.50%	26	SQ YD	\$130.00	\$3,380	
	LONGITUDINAL SHLD JT R&S	100.00%	1,970	LIN FT	\$2.00	\$3,940	
	CENTERLINE JT R&S	100.00%	1,970	LIN FT	\$2.00	\$3,940	
	REFLECTIVE TRANSVERSE CRACK R&S	60.00%	1,886	LIN FT	\$2.00	\$3,772	
	RANDOM CRACK R&S	50.00%	1,970	LIN FT	\$2.00	\$3,940	
	PD PVMT PATCH M&F HMA 2.50"	0.50%	26	SQ YD	\$93.49	\$2,431	
		PWFn = 0.3066			PW = 0.3066 X	\$21,403	\$6,561
							\$103,956
	ROUTINE MAINTENANCE ACTIVITY		0.75	Lane Miles	\$0.00	\$0	\$0
							MAINTENANCE LIFE-CYCLE COST \$103,956
45	YEAR LIFE CYCLE	CRFn = 0.0407852					MAINTENANCE ANNUAL COST PER MILE \$11,364

LIFE-CYCLE COST ANALYSIS: NEW DESIGN

Calculated / Revised : 6/17/13 8:44 AM

			JPCP	HMA
CONSTRUCTION	INITIAL COST	PRESENT WORTH	\$418,975	\$392,262
		ANNUAL COST PER MILE	\$45,799	\$42,879
MAINTENANCE	LIFE-CYCLE COST	PRESENT WORTH	\$103,956	\$189,083
		ANNUAL COST PER MILE	\$11,364	\$20,669
TOTAL	LIFE-CYCLE COST	PRESENT WORTH	\$522,931	\$581,345
		ANNUAL COST PER MILE	\$57,163	\$63,548

LIFE-CYCLE COST ANALYSIS: FINAL SUMMARY

LOWEST COST OPTION	=====>	JPCP	\$57,163	
OTHER OPTIONS (LOWEST TO HIGHEST):	TYPE / PERCENTAGE	HMA	\$63,548	11.2%

PROJECT AND TRAFFIC INPUTS (Enter Data in Gray Shaded Cells)

Route: Allen Road	Comments:	
Section:	Design Date: 06/14/2013	AS
County: Kane	Modify Date:	
Location: At US 20		
Facility Type: Unmarked State Route		

# of Lanes = 2 or 3		
Part of future 4 lanes or more ? No		
One Way Street ? No		
Road Class: II		
Subgrade Support Rating (SSR): Poor		
Construction Year: 2013		
Design Period (DP) = 20 years		

	ADT	Year
Current:	3,400	2013
Future:	5,803	2040

	Structural Design Traffic			
	Minimum ADT	Actual ADT	Actual % of Total ADT	% of ADT in Design Lane
PV =	No Min	3,689	86.0%	P = 50%
SU =	No Min	221	5.2%	S = 50%
MU =	No Min	380	8.9%	M = 50%
Struct. Design ADT =	4,290 (2023)			

TRAFFIC FACTOR CALCULATION

FLEXIBLE PAVEMENT	RIGID PAVEMENT
C _{pv} = 0.15	C _{pv} = 0.15
C _{su} = 112.06	C _{su} = 135.78
C _{mu} = 385.44	C _{mu} = 567.21
TF flexible (Actual) = 1.72 (Actual ADT)	TF rigid (Actual) = 2.46 (Actual ADT)
TF flexible (Min) = No Min (Min ADT Fig. 54-2.C)	TF rigid (Min) = No Min (Min ADT Fig. 54-2.C)

NEW CONSTRUCTION / RECONSTRUCTION PAVEMENT DESIGN CALCULATIONS

Full-Depth HMA Pavement	JPC Pavement
Use TF flexible = 1.72	Use TF rigid = 2.46
PG Grade Lower Binder Lifts = PG 64-22 (Fig. 53-4.R)	Edge Support = Tied Shoulder or C.&G.
HMA Mixture Temp. = 74.0 deg. F (Fig. 54-5.C)	Rigid Pavt Thick. = 8.50 in. (Fig. 54-4.E)
Design HMA Mixture Modulus (E _{HMA}) = 720 ksi (Fig. 54-5.D)	
Design HMA Strain (ε _{HMA}) = 103 (Fig. 54-5.E)	CRCP Pavement
Full Depth HMA Design Thickness = 8.75 in. (Fig. 54-5.F)	Use TF rigid = 2.46
Limiting Strain Criterion Thickness = 14.50 in. (Fig. 54-5.I)	IBR value = 2
Use Full-Depth HMA Thickness = 8.75 inches	CRCP Thickness = 7.25 in. (Fig. 54-4.N)

TF MUST BE > 60 FOR CRCP

RECONSTRUCTION ONLY (SUPPLEMENTAL) PAVEMENT DESIGN CALCULATIONS

HMA Overlay of Rubblized PCC	Unbonded Concrete Overlay
Use TF flexible = 1.72	Review 54-4.03 for limitations and special considerations.
District = 3,4,5,6	
HMA Overlay Design Thickness = 6.75 in. (Fig. 54-5.U)	JPCP Thickness = NA inches

CONTACT BMPR FOR ASSISTANCE

DESIGN TABLES FROM BDE MANUAL CHAPTER 54 - PAVEMENT DESIGN

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

	Min. Str. Design Traffic (Fig 54-2.C)		
Facility Type	PV	SU	MU
Interstate or Supplemental Freeway	0	500	1500
Other Marked State Route	0	250	750
Unmarked State Route	No Min	No Min	No Min

	Traffic Factor ESAL Coefficients			
	Rigid (Fig. 54-4.C)		Flexible (Fig. 54-5.B)	
Class	C _{su}	C _{mu}	C _{su}	C _{mu}
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)					
	Rural			Urban		
Number of Lanes	P	S	M	P	S	M
1 Lane Ramp	100%	100%	100%	100%	100%	100%
2 or 3	50%	50%	50%	50%	50%	50%
4	32%	45%	45%	32%	45%	45%
6 or more	20%	40%	40%	8%	37%	37%

LIFE-CYCLE COST ANALYSIS: NEW CONSTRUCTION / RECONSTRUCTION

FULL-DEPTH HMA PAVEMENT

Standard Design

ROUTE SECTION COUNTY LOCATION
 Allen Road Kane At US 20

FACILITY TYPE NON-INTERSTATE

PROJECT LENGTH 1121 FT ==> 0.21 Miles
 # OF CENTERLINES 1 CL
 # OF LANES 2 LANES
 # OF EDGES 2 EP
 LANE WIDTH - AVERAGE 12 FT
 SHOULDER WIDTH HMA Inside 8 FT
 HMA Outside 8 FT

PAVEMENT THICKNESS (FLEXIBLE) 8.75 IN 14.50 IN MAX
 SHOULDER THICKNESS 8.00 IN HMA 8.00 Standard Design
 POLICY OVERLAY THICKNESS 2.25 IN

FLEX PAVEMENT	TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
		No Min	1.72	No Min

HMA COST PER TON	UNIT PRICE
HMA SURFACE	\$95.00 / TON
HMA TOP BINDER	\$90.00 / TON
HMA LOWER BINDER	\$85.00 / TON
HMA BINDER (LEVELING)	\$95.00 / TON
HMA SHOULDER	\$85.00 / TON

INITIAL COSTS	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE	COST
HMA PAVEMENT (FULL-DEPTH)	(8.75")	2,989	SQ YD	\$44.69 / SQ YD	\$0
HMA SURFACE COURSE	(2.00")	2,989	SQ YD *	\$10.05 / SQ YD	\$30,043 ~
HMA TOP BINDER COURSE	(2.25")	2,989	SQ YD *	\$10.10 / SQ YD	\$30,192 ~
HMA LOWER BINDER COURSE	(4.50")	2,989	SQ YD *	\$19.83 / SQ YD	\$59,278 ~
HMA SHOULDER	(8.00")	1,993	SQ YD *	\$41.73 / SQ YD	\$83,163 ~
CURB & GUTTER		0	LIN FT	\$30.00 / LIN FT	\$0
SUBBASE GRAN MATL TY C (TONS)		0	TONS	\$25.00 / TON	\$0
IMPROVED SUBGRADE: Aggregate		5,333	SQ YD *	\$10.00 / SQ YD	\$53,330
Reserved For User Supplied Item		0	UNITS	\$0.00 / UNITS	\$0
Reserved For User Supplied Item		0	UNITS	\$0.00 / UNITS	\$0
PAVEMENT REMOVAL		2,989	SQ YD	\$0.00 / SQ YD	\$0
SHOULDER REMOVAL		1,993	SQ YD	\$0.00 / SQ YD	\$0

Note: * Denotes User Supplied Quantity
 FLEXIBLE CONSTRUCTION INITIAL COST \$256,006
 FLEXIBLE CONSTRUCTION ANNUAL COST PER MILE \$49,179

MAINTENANCE COSTS:	THICKNESS	MATERIAL	UNIT COST
ROUTINE MAINTENANCE ACTIVITY			\$0.00 LANE-MILE / YEAR
HMA OVERLAY PVMT SURF	(2.00")	Surface Mix	\$10.05 / SQ YD
HMA OVERLAY PVMT	(2.25")	Surface Mix	\$11.31 / SQ YD
HMA SURFACE MIX	(1.50")	Surface Mix	\$7.54 / SQ YD
HMA BINDER MIX	(0.75")	Leveling Binder Mix	\$3.77 / SQ YD
HMA OVERLAY SHLD (Year 30)	(2.25")	Shoulder Mix	\$11.31 / SQ YD
HMA OVERLAY SHLD	(2.00")	Shoulder Mix	\$10.05 / SQ YD
MILLING (2.00 IN)			\$2.50 / SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill Surf)		Surface Mix	\$90.83 / SQ YD
PARTIAL DEPTH SHLD PATCH (Mill & Fill Surf)		Shoulder Mix	\$89.71 / SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill +2.00")		Leveling Binder Mix	\$90.83 / SQ YD
PARTIAL DEPTH SHLD PATCH (Mill & Fill +2.00")		Shoulder Mix	\$89.71 / 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 \$362,108
 FLEXIBLE TOTAL ANNUAL COST PER MILE \$69,561

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%	2,242	LIN FT	\$2.00	\$4,484	
	CNTR LINE JOINT R&S	100.00%	1,121	LIN FT	\$2.00	\$2,242	
	RNDM / THRM CRACK R&S	50.00%	1,233	LIN FT	\$2.00	\$2,466	
	PD PVMT PATCH M&F SURF	0.10%	3	SQ YD	\$90.83	\$272	
	PWFn =	0.8626		PW =	0.8626 X	\$9,464	\$8,164
YEAR 10							
	LONG SHLD JT R&S	100.00%	2,242	LIN FT	\$2.00	\$4,484	
	CNTR LINE JOINT R&S	100.00%	1,121	LIN FT	\$2.00	\$2,242	
	RNDM / THRM CRACK R&S	50.00%	1,233	LIN FT	\$2.00	\$2,466	
	PD PVMT PATCH M&F SURF	0.50%	15	SQ YD	\$90.83	\$1,362	
	PWFn =	0.7441		PW =	0.7441 X	\$10,554	\$7,853
YEAR 15							
	MILL PVMT & SHLD 2.00"	100.00%	4,982	SQ YD	\$2.50	\$12,455	
	PD PVMT PATCH M&F ADD'L 2.00"	1.00%	30	SQ YD	\$90.83	\$2,725	
	HMA OVERLAY PVMT 2.00"	100.00%	2,989	SQ YD	\$10.05	\$30,043	
	HMA OVERLAY SHLD 2.00"	100.00%	1,993	SQ YD	\$10.05	\$20,029	
	PWFn =	0.6419		PW =	0.6419 X	\$65,252	\$41,883
YEAR 20							
	LONG SHLD JT R&S	100.00%	2,242	LIN FT	\$2.00	\$4,484	
	CNTR LINE JOINT R&S	100.00%	1,121	LIN FT	\$2.00	\$2,242	
	RNDM / THRM CRACK R&S	50.00%	1,233	LIN FT	\$2.00	\$2,466	
	PD PVMT PATCH M&F SURF	0.10%	3	SQ YD	\$90.83	\$272	
	PWFn =	0.5537		PW =	0.5537 X	\$9,464	\$5,240
YEAR 25							
	LONG SHLD JT R&S	100.00%	2,242	LIN FT	\$2.00	\$4,484	
	CNTR LINE JOINT R&S	100.00%	1,121	LIN FT	\$2.00	\$2,242	
	RNDM / THRM CRACK R&S	50.00%	1,233	LIN FT	\$2.00	\$2,466	
	PD PVMT PATCH M&F SURF	0.50%	15	SQ YD	\$90.83	\$1,362	
	PWFn =	0.4776		PW =	0.4776 X	\$10,554	\$5,041
HMA_SD							
YEAR 30 NON-INTERSTATE							
	MILL PVMT & SHLD 2.00"	100.00%	4,982	SQ YD	\$2.50	\$12,455	
	PD PVMT PATCH M&F ADD'L 2.00"	2.00%	60	SQ YD	\$90.83	\$5,450	
	PD SHLD PATCH M&F ADD'L 2.00"	1.00%	20	SQ YD	\$89.71	\$1,794	
	HMA OVERLAY PVMT 2.25"	100.00%	2,989	SQ YD	\$11.31	\$33,798	
	HMA OVERLAY SHLD 2.25"	100.00%	1,993	SQ YD	\$11.31	\$22,532	
	PWFn =	0.4120		PW =	0.4120 X	\$76,029	\$31,323
YEAR 35							
	LONG SHLD JT R&S	100.00%	2,242	LIN FT	\$2.00	\$4,484	
	CNTR LINE JOINT R&S	100.00%	1,121	LIN FT	\$2.00	\$2,242	
	RNDM / THRM CRACK R&S	50.00%	1,233	LIN FT	\$2.00	\$2,466	
	PD PVMT PATCH M&F SURF	0.10%	3	SQ YD	\$90.83	\$272	
	PWFn =	0.3554		PW =	0.3554 X	\$9,464	\$3,363
YEAR 40							
	LONG SHLD JT R&S	100.00%	2,242	LIN FT	\$2.00	\$4,484	
	CNTR LINE JOINT R&S	100.00%	1,121	LIN FT	\$2.00	\$2,242	
	RNDM / THRM CRACK R&S	50.00%	1,233	LIN FT	\$2.00	\$2,466	
	PD PVMT PATCH M&F SURF	0.50%	15	SQ YD	\$90.83	\$1,362	
	PWFn =	0.3066		PW =	0.3066 X	\$10,554	\$3,235
							\$106,102
ROUTINE MAINTENANCE ACTIVITY				0.42 Lane Miles	0.00	\$0	\$0
				MAINTENANCE LIFE-CYCLE COST		\$106,102	
45	YEAR LIFE CYCLE	CRFn = 0.0407852	MAINTENANCE ANNUAL COST PER MILE			\$20,382	

MAINTENANCE AND REHABILITATION ACTIVITY SCHEDULE

11/07/13

JOINTED PLAIN CONCRETE PAVEMENT
UNBONDED JOINTED PLAIN CONCRETE OVERLAY
Figure 54-7.A

MAINTENANCE COSTS:	ITEM	%	QUANTITY	UNIT	UNIT COST	COST	PRESENT WORTH
YEAR 10							
	PAVEMENT PATCH CLASS B	0.10%	3	SQ YD	\$130.00	\$390	
		PWFn = 0.7441			PW = 0.7441 X	\$390	\$290
YEAR 15							
	PAVEMENT PATCH CLASS B	0.20%	6	SQ YD	\$130.00	\$780	
		PWFn = 0.6419			PW = 0.6419 X	\$780	\$501
YEAR 20							
	PAVEMENT PATCH CLASS B	2.00%	60	SQ YD	\$130.00	\$7,800	
	SHOULDER PATCH CLASS C	0.50%	10	SQ YD	\$110.00	\$1,100	
	LONGITUDINAL SHLD JT R&S	100.00%	2,242	LIN FT	\$2.00	\$4,484	
	CENTERLINE JT R&S	100.00%	1,121	LIN FT	\$2.00	\$2,242	
		PWFn = 0.5537			PW = 0.5537 X	\$15,626	\$8,652
YEAR 25							
	PAVEMENT PATCH CLASS B	3.00%	90	SQ YD	\$130.00	\$11,700	
	SHOULDER PATCH CLASS C	1.00%	20	SQ YD	\$110.00	\$2,200	
		PWFn = 0.4776			PW = 0.4776 X	\$13,900	\$6,639
YEAR 30							
	NON-INTERSTATE						
	PAVEMENT PATCH CLASS B	4.00%	120	SQ YD	\$130.00	\$15,600	
	SHOULDER PATCH CLASS C	1.50%	30	SQ YD	\$110.00	\$3,300	
	HMA POLICY OVERLAY 2.5" (PVMT)	100.00%	2,989	SQ YD	\$12.56	\$37,553	
	HMA POLICY OVERLAY 2.5" (SHLD)	100.00%	1,993	SQ YD	\$12.56	\$25,036	
		PWFn = 0.4120			PW = 0.4120 X	\$81,489	\$33,572
YEAR 35							
	NON-INTERSTATE						
	LONGITUDINAL SHLD JT R&S	100.00%	2,242	LIN FT	\$2.00	\$4,484	
	CENTERLINE JT R&S	100.00%	1,121	LIN FT	\$2.00	\$2,242	
	RANDOM CRACK R&S	50.00%	1,121	LIN FT	\$2.00	\$2,242	
	REFLECTIVE TRANSVERSE CRACK R&S	40.00%	720	LIN FT	\$2.00	\$1,440	
	PD PVMT PATCH M&F HMA 2.50"	0.10%	3	SQ YD	\$93.49	\$280	
		PWFn = 0.3554			PW = 0.3554 X	\$10,688	\$3,798
YEAR 40							
	NON-INTERSTATE						
	PAVEMENT PATCH CLASS B	0.50%	15	SQ YD	\$130.00	\$1,950	
	LONGITUDINAL SHLD JT R&S	100.00%	2,242	LIN FT	\$2.00	\$4,484	
	CENTERLINE JT R&S	100.00%	1,121	LIN FT	\$2.00	\$2,242	
	REFLECTIVE TRANSVERSE CRACK R&S	60.00%	1,080	LIN FT	\$2.00	\$2,160	
	RANDOM CRACK R&S	50.00%	1,121	LIN FT	\$2.00	\$2,242	
	PD PVMT PATCH M&F HMA 2.50"	0.50%	15	SQ YD	\$93.49	\$1,402	
		PWFn = 0.3066			PW = 0.3066 X	\$14,480	\$4,439
							\$57,891
	ROUTINE MAINTENANCE ACTIVITY		0.42	Lane Miles	\$0.00	\$0	\$0
							MAINTENANCE LIFE-CYCLE COST \$57,891
45	YEAR LIFE CYCLE	CRFn = 0.0407852				MAINTENANCE ANNUAL COST PER MILE	\$11,121

LIFE-CYCLE COST ANALYSIS: NEW DESIGN

Calculated / Revised : 6/17/13 8:29 AM

			JPCP	HMA
CONSTRUCTION	INITIAL COST	PRESENT WORTH	\$281,930	\$256,006
		ANNUAL COST PER MILE	\$54,159	\$49,179
MAINTENANCE	LIFE-CYCLE COST	PRESENT WORTH	\$57,891	\$106,102
		ANNUAL COST PER MILE	\$11,121	\$20,382
TOTAL	LIFE-CYCLE COST	PRESENT WORTH	\$339,821	\$362,108
		ANNUAL COST PER MILE	\$65,280	\$69,561

LIFE-CYCLE COST ANALYSIS: FINAL SUMMARY

LOWEST COST OPTION	=====>	JPCP	\$65,280	
OTHER OPTIONS (LOWEST TO HIGHEST):	TYPE / PERCENTAGE	HMA	\$69,561	6.6%

PROJECT AND TRAFFIC INPUTS (Enter Data in Gray Shaded Cells)

Route: Brier Hill Road	Comments:										
Section:	Design Date: 06/14/2013	AS <-- BY									
County: Kane	Modify Date:	<-- BY									
Location: At US 20		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td></td> <td>ADT</td> <td>Year</td> </tr> <tr> <td>Current:</td> <td style="text-align: center;">4,100</td> <td style="text-align: center;">2013</td> </tr> <tr> <td>Future:</td> <td style="text-align: center;">7,000</td> <td style="text-align: center;">2040</td> </tr> </table>		ADT	Year	Current:	4,100	2013	Future:	7,000	2040
	ADT	Year									
Current:	4,100	2013									
Future:	7,000	2040									
Facility Type: Unmarked State Route	# of Lanes = 2 or 3										
	Part of future 4 lanes or more? No										
	One Way Street? No										
	Road Class: II										
Subgrade Support Rating (SSR): Poor											
Construction Year: 2013											
Design Period (DP) = 20 years											

Structural Design Traffic			
	Minimum ADT	Actual ADT	Actual % of Total ADT
PV =	No Min	4,196	81.1%
SU =	No Min	252	4.9%
MU =	No Min	725	14.0%
Struct. Design ADT =	5,174 (2023)		

TRAFFIC FACTOR CALCULATION	
FLEXIBLE PAVEMENT	RIGID PAVEMENT
Cpv = 0.15	Cpv = 0.15
Csu = 112.06	Csu = 135.78
Cmu = 385.44	Cmu = 567.21
TF flexible (Actual) = 3.09 (Actual ADT)	TF rigid (Actual) = 4.46 (Actual ADT)
TF flexible (Min) = No Min (Min ADT Fig. 54-2.C)	TF rigid (Min) = No Min (Min ADT Fig. 54-2.C)

NEW CONSTRUCTION / RECONSTRUCTION PAVEMENT DESIGN CALCULATIONS

Full-Depth HMA Pavement	JPC Pavement
Use TF flexible = 3.09	Use TF rigid = 4.46
PG Grade Lower Binder Lifts = PG 64-22 (Fig. 53-4.R)	Edge Support = Tied Shoulder or C.&G.
HMA Mixture Temp. = 74.0 deg. F (Fig. 54-5.C)	Rigid Pavt Thick. = 9.00 in. (Fig. 54-4.E)
Design HMA Mixture Modulus (E _{HMA}) = 720 ksi (Fig. 54-5.D)	
Design HMA Strain (ε _{HMA}) = 87 (Fig. 54-5.E)	CRC Pavement
Full Depth HMA Design Thickness = 9.75 in. (Fig. 54-5.F)	Use TF rigid = 4.46
Limiting Strain Criterion Thickness = 14.50 in. (Fig. 54-5.I)	IBR value = 2
Use Full-Depth HMA Thickness = 9.75 inches	CRCP Thickness = 8.00 in. (Fig. 54-4.N)

TF MUST BE > 60 FOR CRCP

RECONSTRUCTION ONLY (SUPPLEMENTAL) PAVEMENT DESIGN CALCULATIONS

HMA Overlay of Rubblized PCC	Unbonded Concrete Overlay
Use TF flexible = 3.09	Review 54-4.03 for limitations and special considerations.
District = 3,4,5,6	
HMA Overlay Design Thickness = 7.75 in. (Fig. 54-5.U)	JPCP Thickness = NA inches

CONTACT BMPR FOR ASSISTANCE

DESIGN TABLES FROM BDE MANUAL CHAPTER 54 - PAVEMENT DESIGN

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

Facility Type	Min. Str. Design Traffic (Fig 54-2.C)		
	PV	SU	MU
Interstate or Supplemental Freeway	0	500	1500
Other Marked State Route	0	250	750
Unmarked State Route	No Min	No Min	No Min

Class	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

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

Standard Design

ROUTE SECTION COUNTY LOCATION
Brier Hill Road
Kane
At US 20

FACILITY TYPE **NON-INTERSTATE**

PROJECT LENGTH **441 FT** ==> 0.08 Miles
 # OF CENTERLINES 1 CL
 # OF LANES **2 LANES**
 # OF EDGES 2 EP
 LANE WIDTH - AVERAGE **12 FT**
 SHOULDER WIDTH HMA Inside **8 FT**
 HMA Outside **8 FT**

PAVEMENT THICKNESS (FLEXIBLE) **9.75 IN** **14.50 IN MAX**
 SHOULDER THICKNESS **8.00 IN** **Standard Design**
 POLICY OVERLAY THICKNESS **2.25 IN**

FLEX PAVEMENT TRAFFIC FACTORS MINIMUM ACTUAL USE
No Min **3.09** **No Min**

Read Me!

HMA COST PER TON	UNIT PRICE
HMA SURFACE	\$95.00 / TON
HMA TOP BINDER	\$90.00 / TON
HMA LOWER BINDER	\$85.00 / TON
HMA BINDER (LEVELING)	\$95.00 / TON
HMA SHOULDER	\$85.00 / TON

INITIAL COSTS

ITEM	THICKNESS	100% QUANTITY	UNIT	UNIT PRICE	COST
HMA PAVEMENT (FULL-DEPTH)	(9.75")	1,176	SQ YD	\$49.75 / SQ YD	\$58,509 ~
HMA SURFACE COURSE	(2.00")	1,176	SQ YD *	\$10.77 / SQ YD	\$0
HMA TOP BINDER COURSE	(2.25")	1,176	SQ YD *	\$10.81 / SQ YD	\$0
HMA LOWER BINDER COURSE	(5.50")	1,176	SQ YD *	\$22.78 / SQ YD	\$0
HMA SHOULDER	(8.00")	784	SQ YD *	\$41.73 / SQ YD	\$32,716 ~
CURB & GUTTER		0	LIN FT	\$30.00 / LIN FT	\$0
SUBBASE GRAN MATL TY C (TONS)		9	TONS	\$25.00 / TON	\$225
IMPROVED SUBGRADE:	Aggregate	5,333	SQ YD *	\$10.00 / SQ YD	\$53,330
Reserved For User Supplied Item		0	UNITS	\$0.00 / UNITS	\$0
Reserved For User Supplied Item		0	UNITS	\$0.00 / UNITS	\$0
PAVEMENT REMOVAL		1,176	SQ YD	\$0.00 / SQ YD	\$0
SHOULDER REMOVAL		784	SQ YD	\$0.00 / SQ YD	\$0

Note: * Denotes User Supplied Quantity
 FLEXIBLE CONSTRUCTION INITIAL COST \$144,780
 FLEXIBLE CONSTRUCTION ANNUAL COST PER MILE \$70,698

MAINTENANCE COSTS:

ITEM	THICKNESS	MATERIAL	UNIT COST
ROUTINE MAINTENANCE ACTIVITY			\$0.00 LANE-MILE / YEAR
HMA OVERLAY PVMT SURF	(2.00")	Surface Mix	\$10.77 / SQ YD
HMA OVERLAY PVMT	(2.25")	Surface Mix	\$12.12 / SQ YD
HMA SURFACE MIX	(1.50")	Surface Mix	\$8.08 / SQ YD
HMA BINDER MIX	(0.75")	Leveling Binder Mix	\$4.04 / SQ YD
HMA OVERLAY SHLD (Year 30)	(2.25")	Shoulder Mix	\$12.12 / SQ YD
HMA OVERLAY SHLD	(2.00")	Shoulder Mix	\$10.77 / SQ YD
MILLING (2.00 IN)			\$2.50 / SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill Surf)		Surface Mix	\$90.83 / SQ YD
PARTIAL DEPTH SHLD PATCH (Mill & Fill Surf)		Shoulder Mix	\$89.71 / SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill +2.00")		Leveling Binder Mix	\$90.83 / SQ YD
PARTIAL DEPTH SHLD PATCH (Mill & Fill +2.00")		Shoulder Mix	\$89.71 / 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 \$188,097
 FLEXIBLE TOTAL ANNUAL COST PER MILE \$91,850

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%	882	LIN FT	\$2.00	\$1,764	
	CNTR LINE JOINT R&S	100.00%	441	LIN FT	\$2.00	\$882	
	RNDM / THRM CRACK R&S	50.00%	485	LIN FT	\$2.00	\$970	
	PD PVMT PATCH M&F SURF	0.10%	1	SQ YD	\$90.83	\$91	
	PWFn =	0.8626		PW =	0.8626 X	\$3,707	\$3,198
YEAR 10							
	LONG SHLD JT R&S	100.00%	882	LIN FT	\$2.00	\$1,764	
	CNTR LINE JOINT R&S	100.00%	441	LIN FT	\$2.00	\$882	
	RNDM / THRM CRACK R&S	50.00%	485	LIN FT	\$2.00	\$970	
	PD PVMT PATCH M&F SURF	0.50%	6	SQ YD	\$90.83	\$545	
	PWFn =	0.7441		PW =	0.7441 X	\$4,161	\$3,096
YEAR 15							
	MILL PVMT & SHLD 2.00"	100.00%	1,960	SQ YD	\$2.50	\$4,900	
	PD PVMT PATCH M&F ADD'L 2.00"	1.00%	12	SQ YD	\$90.83	\$1,090	
	HMA OVERLAY PVMT 2.00"	100.00%	1,176	SQ YD	\$10.77	\$12,666	
	HMA OVERLAY SHLD 2.00 "	100.00%	784	SQ YD	\$10.77	\$8,444	
	PWFn =	0.6419		PW =	0.6419 X	\$27,100	\$17,394
YEAR 20							
	LONG SHLD JT R&S	100.00%	882	LIN FT	\$2.00	\$1,764	
	CNTR LINE JOINT R&S	100.00%	441	LIN FT	\$2.00	\$882	
	RNDM / THRM CRACK R&S	50.00%	485	LIN FT	\$2.00	\$970	
	PD PVMT PATCH M&F SURF	0.10%	1	SQ YD	\$90.83	\$91	
	PWFn =	0.5537		PW =	0.5537 X	\$3,707	\$2,052
YEAR 25							
	LONG SHLD JT R&S	100.00%	882	LIN FT	\$2.00	\$1,764	
	CNTR LINE JOINT R&S	100.00%	441	LIN FT	\$2.00	\$882	
	RNDM / THRM CRACK R&S	50.00%	485	LIN FT	\$2.00	\$970	
	PD PVMT PATCH M&F SURF	0.50%	6	SQ YD	\$90.83	\$545	
	PWFn =	0.4776		PW =	0.4776 X	\$4,161	\$1,987
HMA SD							
YEAR 30 NON-INTERSTATE							
	MILL PVMT & SHLD 2.00"	100.00%	1,960	SQ YD	\$2.50	\$4,900	
	PD PVMT PATCH M&F ADD'L 2.00"	2.00%	24	SQ YD	\$90.83	\$2,180	
	PD SHLD PATCH M&F ADD'L 2.00"	1.00%	8	SQ YD	\$89.71	\$718	
	HMA OVERLAY PVMT 2.25 "	100.00%	1,176	SQ YD	\$12.12	\$14,249	
	HMA OVERLAY SHLD 2.25 "	100.00%	784	SQ YD	\$12.12	\$9,499	
	PWFn =	0.4120		PW =	0.4120 X	\$31,546	\$12,997
YEAR 35							
	LONG SHLD JT R&S	100.00%	882	LIN FT	\$2.00	\$1,764	
	CNTR LINE JOINT R&S	100.00%	441	LIN FT	\$2.00	\$882	
	RNDM / THRM CRACK R&S	50.00%	485	LIN FT	\$2.00	\$970	
	PD PVMT PATCH M&F SURF	0.10%	1	SQ YD	\$90.83	\$91	
	PWFn =	0.3554		PW =	0.3554 X	\$3,707	\$1,317
YEAR 40							
	LONG SHLD JT R&S	100.00%	882	LIN FT	\$2.00	\$1,764	
	CNTR LINE JOINT R&S	100.00%	441	LIN FT	\$2.00	\$882	
	RNDM / THRM CRACK R&S	50.00%	485	LIN FT	\$2.00	\$970	
	PD PVMT PATCH M&F SURF	0.50%	6	SQ YD	\$90.83	\$545	
	PWFn =	0.3066		PW =	0.3066 X	\$4,161	\$1,276
							\$43,317
ROUTINE MAINTENANCE ACTIVITY				0.17 Lane Miles	0.00	\$0	\$0
						MAINTENANCE LIFE-CYCLE COST	\$43,317
45	YEAR LIFE CYCLE	CRFn = 0.0407852	MAINTENANCE ANNUAL COST PER MILE				\$21,152

JOINTED PLAIN CONCRETE PAVEMENT
UNBONDED JOINTED PLAIN CONCRETE OVERLAY
Figure 54-7.A

MAINTENANCE COSTS:	ITEM	%	QUANTITY	UNIT	UNIT COST	COST	PRESENT WORTH
YEAR 10							
	PAVEMENT PATCH CLASS B	0.10%	1	SQ YD	\$130.00	\$130	
		PWF _n = 0.7441			PW = 0.7441 X	\$130	\$97
YEAR 15							
	PAVEMENT PATCH CLASS B	0.20%	2	SQ YD	\$130.00	\$260	
		PWF _n = 0.6419			PW = 0.6419 X	\$260	\$167
YEAR 20							
	PAVEMENT PATCH CLASS B	2.00%	24	SQ YD	\$130.00	\$3,120	
	SHOULDER PATCH CLASS C	0.50%	4	SQ YD	\$110.00	\$440	
	LONGITUDINAL SHLD JT R&S	100.00%	882	LIN FT	\$2.00	\$1,764	
	CENTERLINE JT R&S	100.00%	441	LIN FT	\$2.00	\$882	
		PWF _n = 0.5537			PW = 0.5537 X	\$6,206	\$3,436
YEAR 25							
	PAVEMENT PATCH CLASS B	3.00%	35	SQ YD	\$130.00	\$4,550	
	SHOULDER PATCH CLASS C	1.00%	8	SQ YD	\$110.00	\$880	
		PWF _n = 0.4776			PW = 0.4776 X	\$5,430	\$2,593
YEAR 30 NON-INTERSTATE							
	PAVEMENT PATCH CLASS B	4.00%	47	SQ YD	\$130.00	\$6,110	
	SHOULDER PATCH CLASS C	1.50%	12	SQ YD	\$110.00	\$1,320	
	HMA POLICY OVERLAY 2.5" (PVMT)	100.00%	1,176	SQ YD	\$13.46	\$15,832	
	HMA POLICY OVERLAY 2.5" (SHLD)	100.00%	784	SQ YD	\$13.46	\$10,555	
		PWF _n = 0.4120			PW = 0.4120 X	\$33,817	\$13,932
YEAR 35 NON-INTERSTATE							
	LONGITUDINAL SHLD JT R&S	100.00%	882	LIN FT	\$2.00	\$1,764	
	CENTERLINE JT R&S	100.00%	441	LIN FT	\$2.00	\$882	
	RANDOM CRACK R&S	50.00%	441	LIN FT	\$2.00	\$882	
	REFLECTIVE TRANSVERSE CRACK R&S	40.00%	278	LIN FT	\$2.00	\$556	
	PD PVMT PATCH M&F HMA 2.50"	0.10%	1	SQ YD	\$93.49	\$93	
		PWF _n = 0.3554			PW = 0.3554 X	\$4,177	\$1,484
YEAR 40 NON-INTERSTATE							
	PAVEMENT PATCH CLASS B	0.50%	6	SQ YD	\$130.00	\$780	
	LONGITUDINAL SHLD JT R&S	100.00%	882	LIN FT	\$2.00	\$1,764	
	CENTERLINE JT R&S	100.00%	441	LIN FT	\$2.00	\$882	
	REFLECTIVE TRANSVERSE CRACK R&S	60.00%	418	LIN FT	\$2.00	\$836	
	RANDOM CRACK R&S	50.00%	441	LIN FT	\$2.00	\$882	
	PD PVMT PATCH M&F HMA 2.50"	0.50%	6	SQ YD	\$93.49	\$561	
		PWF _n = 0.3066			PW = 0.3066 X	\$5,705	\$1,749
							\$23,458
	ROUTINE MAINTENANCE ACTIVITY		0.17	Lane Miles	\$0.00	\$0	\$0
							MAINTENANCE LIFE-CYCLE COST \$23,458
45	YEAR LIFE CYCLE	CRF _n = 0.0407852					MAINTENANCE ANNUAL COST PER MILE \$11,455

LIFE-CYCLE COST ANALYSIS: NEW DESIGN

Calculated / Revised : 6/17/13 8:48 AM

			JPCP	HMA
CONSTRUCTION	INITIAL COST	PRESENT WORTH	\$159,512	\$144,780
		ANNUAL COST PER MILE	\$77,892	\$70,698
MAINTENANCE	LIFE-CYCLE COST	PRESENT WORTH	\$23,458	\$43,317
		ANNUAL COST PER MILE	\$11,455	\$21,152
TOTAL	LIFE-CYCLE COST	PRESENT WORTH	\$182,970	\$188,097
		ANNUAL COST PER MILE	\$89,347	\$91,850

LIFE-CYCLE COST ANALYSIS: FINAL SUMMARY

LOWEST COST OPTION	=====>	JPCP	\$89,347	
OTHER OPTIONS (LOWEST TO HIGHEST):	TYPE / PERCENTAGE	HMA	\$91,850	2.8%

LOCATION MAP

US ROUTE 20

AT

ALLEN ROAD/BRIER HILL ROAD

