Illinois Department of Transportation

To:	Jose Rios	Attn: John A. Baczek
From:	Jack A. Elston	By: Michael Brand
Subject:	Pavement Design Approval	
Date:	February 22, 2021	

Route:	IL 47	Job No.:	D-91-022-14
Section:	(104&105)WRS-9(13)	Contract No.:	60X17
County:	McHenry	Target Letting:	June 2022
Limits:	US 14 to IL 120		

We have reviewed the pavement design for the above referenced project which was submitted on December 31, 2020. The project involves reconstruction of IL 47 to provide two lanes in each direction separated by an 18-foot median.

Pavement designs were prepared for IL 47 and each of the side roads. IL 47 meets the "high-stress" criteria for a special design. Each of sideroads are very short segments and most are also under local jurisdiction so these were selected based upon first costs. In summary, the approved pavement designs are:

IL 47 - Reconstruction
9.75" JPCP with tied C&G
12" ASI

IL 120 - Reconstruction
9.5" Full Depth HMA with C&G
12" ASI

Country Club Road/South Street/McConnel Road - Reconstruction
8.25" Full Depth HMA w/ C&G
12" ASI

Lake Avenue - Reconstruction
9" JPCP with tied C&G
12" ASI

Southview Drive - Reconstruction
7" Full Depth HMA with C&G
12" ASI

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

Illinois Department of Transportation

Memorandum

To: Jack Elston Attn: Michael Brand

From: Jose A. Dominguez By: Ojas Patel

Subject: Pavement Analysis*

Date: December 31, 2020

*Route: Illinois Route 47 County: McHenry
Limits: IL 120 to US 14 Contract No.: 60X17
Section: (104&105)WRS-9(13) Job No.: D-91-022-14
Current target: 06CY22

We have completed the pavement analysis for the above captioned location. Review by the Central Office is required since the total pavement area for reconstruction exceeds 4,750 Square Yards. The following is the scope of the project:

Reconstruction of IL 47 from US 14 to IL 120 to provide two lanes in each direction separated by an 18 foot barrier median.

A 20-year pavement analysis was performed for the above roadway segments. The entire IL 47 corridor within the project limits is a “High Stress” segment since the design lane MU ADT exceeds 200 vehicles. There are 3 signalized and 3 roundabout intersections along with numerous commercial/retail driveway entrances. As such, this pavement design will be classified as a “Special Design” per BDE Figure 54-1.A with review by the Pavement Selection Committee. Because of lower maintenance needs, a mechanistic-rigid pavement design is recommended to reduce the future disruption to traffic in this highly developed commercial area.

The pavement design for IL 120, Country Club Road/South Street, McConnell Road, Southview Drive, was based on a first cost analysis. The pavement design for Lake Avenue is also considered a special design due to the approach grades. The recommended pavement for each segment is as follows:

IL 47
Reconstruction
PCC Curb and Gutter
9 ¾” PCC Pavement (Jointed)[1]
12” Aggregate Subgrade Improvement[8]

IL 47 Pavement Resurfacing (South of US 14)[9]
Cold Milling of HMA Pavement
2 ½” minimum (more if necessary)
1 ¾” Polymerized HMA Surface Course, SMA, N80 (IL-9.5)[2]
¾” Polymerized HMA Binder Course, IL-4.75, N50[3]

IL 120
Reconstruction[9]
PCC Curb and Gutter
9 ½" Full Depth HMA[4]
2" HMA Surface Course, Mix D, IL-9.5, N70
7 ½" HMA Base Course, IL-19.0, N70
12" Aggregate Subgrade Improvement[8]

Country Club Road/South Street[10]
McConnell Road[10]
Reconstruction[9]
PCC Curb and Gutter
8 ¼" Full Depth HMA[5]
2" HMA Surface Course, Mix D, IL-9.5, N70
6 ¼" HMA Base Course, IL-19.0, N70
12" Aggregate Subgrade Improvement[8]

Lake Avenue[10]
Reconstruction
PCC Curb and Gutter
9" PCC Pavement (Jointed)[6]
12" Aggregate Subgrade Improvement[8]

Southview Drive[10]
Reconstruction[9]
PCC Curb and Gutter
7" Full Depth HMA[7]
2" HMA Surface Course, Mix D, IL-9.5, N70
5" HMA Base Course, IL-19.0, N70
12" Aggregate Subgrade Improvement[8]

[1]Designer Note 1: Use pay item **42000416, PORTLAND CEMENT CONCRETE PAVEMENT 9 ¾" (JOINTED),** paid for in square yards. When variable width lanes (12'-18') exceed 14 feet in width a centerline joint should be added to avoid longitudinal cracking; see Bureau of Design Standard 53

[2]Designer Note 2: Use pay item **40605026, POLYMERIZED HOT-MIX ASPHALT SURFACE COURSE, SMA, 9.5, Mix "F", N80** paid for in tons.

[3]Designer Note 3: Use pay item **40603200**, **POLYMERIZED HMA BINDER COURSE, IL-4.75, N50** paid for in tons.

[4]Designer Note 4: Use pay item **40701871, HOT-MIX ASPHALT PAVEMENT (FULL-DEPTH), 9 ½",** paid for in square yards.

[5]Designer Note 5: Use pay item **40701846, HOT-MIX ASPHALT PAVEMENT (FULL-DEPTH), 8 ¼",** paid for in square yards.

[6]Designer Note 6: Use pay item **42000401, PORTLAND CEMENT CONCRETE PAVEMENT 9" (JOINTED),** paid for in square yards.

[7]Designer Note 7: Use pay item **40701821, HOT-MIX ASPHALT PAVEMENT (FULL-DEPTH), 7",** paid for in square yards.

[8]Designer Note 8: Use pay item **30300112, AGGREGATE SUBGRADE IMPROVEMENT, 12"**, paid in square yards.

[9]Designer 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.

[10]Designer Note 10: These routes are subject to local jurisdictional approval and concurrence.

If you have any questions or need additional information, please contact Ojas Patel, Pavement Design Engineer, at (847)705-4550.

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

BDE 5401 Template (Rev. 11/22/2019) **IDOT MECHANISTIC PAVEMENT DESIGN** Printed: 02/23/2021

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

Route: IL 47 | Comments: 60X17 - IL 47 (US 14 to IL 120) Reconstruction
Section: (104&105)WRS-9(13)
County: McHenry | Design Date: 11/20/2020 ONP <-- BY
Location: US 20 to IL 120 | Modify Date: <-- BY

	ADT	Year
Current:	26,200	2018
Future:	33,000	2040

Facility Type: Other Marked State Route
# of Lanes = 4
Road Class: I
Subgrade Support Rating (SSR): Poor
Construction Year: 2023
Design Period (DP) = 20 years

	Structural Design Traffic: Minimum ADT	Actual ADT	Actual %of Total ADT	% of ADT in Design Lane
PV =	0	28,986	94.0%	P = 32%
SU =	250	617	2.0%	S = 45%
MU =	750	1,233	4.0%	M = 45%
Struct. Design ADT =		30,836	(2033)	

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) =	6.12	(Actual ADT)	TF rigid (Actual) =	8.56	(Actual ADT)
TF flexible (Min) =	3.56	(Min ADT Fig. 54-2.C)	TF rigid (Min) =	5.02	(Min ADT Fig. 54-2.C)

NEW CONSTRUCTION / RECONSTRUCTION PAVEMENT DESIGN CALCULATIONS

Full-Depth HMA Pavement

Use TF flexible = 6.12
PG Grade Lower Binder Lifts = PG 64-22 (Fig. 53-4.O)
Goto Map
HMA Mixture Temp. = 73.0 deg. F (Fig. 54-5.C)
Design HMA Mixture Modulus (E_{HMA}) = 760 ksi (Fig. 54-5.D)
Design HMA Strain (ε_{HMA}) = 72 (Fig. 54-5.E)
Goto Map
Full Depth HMA Design Thickness = 10.75 in. (Fig. 54-5.F)
Limiting Strain Criterion Thickness = 14.25 in. (Fig. 54-5.I)

Use Full-Depth HMA Thickness = 10.75 inches

JPC Pavement

Use TF rigid = 8.56
Edge Support = Tied Shoulder or C&G
Rigid Pavt Thick. = 9.75 in. (Fig. 54-4.E)

CRC Pavement

Use TF rigid = 8.56
IBR value = 3
CRCP Thickness = 8.75 in. (Fig. 54-4.M)

TF MUST BE > 60 FOR CRCP

RECONSTRUCTION ONLY (SUPPLEMENTAL) PAVEMENT DESIGN CALCULATIONS

HMA Pavement Over Rubblized PCC

Use TF flexible = 6.12
HMA Overlay Design Thickness = 8.25 in. (Fig. 54-5.U)
Goto Map
Limiting Strain Criterion Thickness = in. (Fig. 54-5.V)

Use HMA Overlay Thickness = 999.00 inches

Unbonded Concrete Overlay

Review 54-4.03 for limitations and special considerations.

JPCP Thickness = NA inches

CONTACT RESEARCH 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)

	Min. Str. Design Traffic (Fig 54-2.C)		
Facility Type	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 Table for One-Way Streets	
ADT	Class
0 - 3500	II
>3501	I

	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)					
	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%

BDE 5401 Template (Rev. 11/22/2019) Printed: 02/23/2021
LIFE-CYCLE COST ANALYSIS: NEW CONSTRUCTION / RECONSTRUCTION

FULL-DEPTH HMA PAVEMENT Standard Design

ROUTE	Job Route					
SECTION	Job Section					
COUNTY	Job County					
LOCATION	Job Location					
FACILITY TYPE			INTERSTATE			
PROJECT LENGTH			1000	FT = = >	0.19	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)			12.00	IN	17.00	IN MAX
SHOULDER THICKNESS			8.00	IN	HMA_SD	Standard Design
HMA OVERLAY THICKNESS			3.75	IN		

FLEX PAVEMENT TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
	7.11	1.00	7.11

Read Me!

HMA COST PER TON	UNIT PRICE
HMA SURFACE	$95.00 / TON
HMA TOP BINDER	$95.00 / TON
HMA LOWER BINDER	$80.00 / TON
HMA BINDER (IL-9.5FG or IL-4.75)	$85.00 / TON
HMA SHOULDER	$72.00 / TON

INITIAL COSTS

ITEM	THICKNESS		100% QUAI	UNIT	UNIT PRICE	COST	
HMA PAVEMENT (FULL-DEPTH)	(12.00")	5333	5,333	SQ YD	$59.62 / SQ YD	$317,988	~
HMA SURFACE COURSE	(2.00")	1.0069	601	TONS	$95.00 / TON	$0	
HMA TOP BINDER COURSE	(2.25")	1.0217	687	TONS	$95.00 / TON	$0	
HMA LOWER BINDER COURSE	(7.75")	1.0564	2,445	TONS	$80.00 / TON	$0	
HMA SHOULDER	(8.00")	3556	1,593	TONS	$72.00 / TON	$114,688	~
CURB & GUTTER			0	LIN FT	$30.00 / LIN FT	$0	
SUBBASE GRAN MATL TY C (TONS)			499	TONS	$25.00 / TON	$12,475	
IMPROVED SUBGRADE:	Modified Soil Width = 86.0		9,556	SQ YD	$7.00 / SQ YD	$66,892	
Reserved For User Supplied Item			0	UNITS	$0.00 / UNITS	$0	
Reserved For User Supplied Item			0	UNITS	$0.00 / UNITS	$0	
PAVEMENT REMOVAL			5,333	SQ YD	$0.00 / SQ YD	$0	
SHOULDER REMOVAL			3,556	SQ YD	$0.00 / SQ YD	$0	

Note: * Denotes User Supplied Quantity

FLEXIBLE CONSTRUC	$512,043
FLEXIBLE CONSTRUC	$110,266

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 M	2.00	$10.71	/ SQ YD
HMA OVERLAY PVMT	(3.75")	1.0130		3.75	$20.21	/ SQ YD
HMA SURFACE MIX	(1.50")	1.0052	Surface M	1.50	$8.02	/ SQ YD
HMA BINDER MIX	(2.25")	1.0182	Top Binder M	2.25	$12.19	/ SQ YD
HMA OVERLAY SHLD (Year 30)	(1.75")		Shoulder	1.75	$7.06	/ SQ YD
HMA OVERLAY SHLD	(2.00")		Shoulder	2.00	$8.06	/ SQ YD
MILLING (2.00 IN)				2.00	$3.00	/ SQ YD
PARTIAL DEPTH PVMT PATCH	(Mill & Fill Surf)		Surface M	2.00	$80.64	/ SQ YD
PARTIAL DEPTH SHLD PATCH	(Mill & Fill Surf)		Shoulder	2.00	$78.06	/ SQ YD
PARTIAL DEPTH PVMT PATCH	(Mill & Fill +2.00 ")		Binder Mix	2.00	$79.52	/ SQ YD
PARTIAL DEPTH SHLD PATCH	(Mill & Fill +2.00 ")		Shoulder	2.00	$78.06	/ 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% Reł	$2.00	/ LIN FT

FLEXIBLE TOTAL LIFE·	$711,101
FLEXIBLE TOTAL ANNI	$153,133

PCC PAVEMENT JPCP

ROUTE			Job Route			
SECTION			Job Section			
COUNTY			Job County			
LOCATION			Job Location			
FACILITY TYPE			INTERSTATE			
PROJECT LENGTH			1000	FT = = >	0.19	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)		JPCP	10.00	IN	TIED SHLD	
SHOULDER THICKNESS			10.00	IN		
HMA OVERLAY THICKNESS			3.75	IN		

RIGID PAVEMENT TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
	10.05	1.00	10.05

Worksheet Construction Type is New Construction The Pavement Type is JPCP

INITIAL COSTS

ITEM	THICKNESS	100% QUA	UNIT	UNIT PRICE	COST
JPC PAVEMENT	(10.00")	5,333	SQ YD	$50.00 / SQ YD	$266,650
PAVEMENT REINFORCEMENT		0	SQ YD	$22.00 / SQ YD	$0
STABILIZED SUBBASE	(4.00")	6,000	SQ YD	$19.00 / SQ YD	$114,000
PCC SHOULDERS	(10.00" to 10.00")	3,556	SQ YD	$40.00 / SQ YD	$142,240
CURB & GUTTER		0	LIN FT	$30.00 / LIN FT	$0
SUBBASE GRAN MATL TY C	(~ 3.48")	418	TONS	$25.00 / TON	$10,450
IMPROVED SUBGRADE:	Modified Soil Width = 82.0	9,111	SQ YD	$7.00 / SQ YD	$63,777
Reserved For User Supplied Item		0	UNITS	$0.00 / UNITS	$0
Reserved For User Supplied Item		0	UNITS	$0.00 / UNITS	$0
PAVEMENT REMOVAL		5,333	SQ YD	$0.00 / SQ YD	$0
SHOULDER REMOVAL		3,556	SQ YD	$0.00 / SQ YD	$0

Note: * Denotes User Supplied Quantity

RIGID CONSTRUCTION	$597,117
RIGID CONSTRUCTION	$128,587

MAINTENANCE COSTS:

ITEM	THICKNESS		MATERIAL	T	UNIT COST
ROUTINE MAINTENANCE ACTIVITY					$0.00 / LANE-MILE / YEAR
HMA OVERLAY	(3.75")			3.75	
HMA OVERLAY PAVEMENT	(3.75")	1.0130		3.75	$20.21 / SQ YD
HMA SURFACE MIX	(1.50")	1.0052	Surface M	1.50	$8.02 / SQ YD
HMA BINDER MIX	(2.25")	1.0182	Top Binder M	2.25	$12.19 / SQ YD
HMA OVERLAY SHOULDER	(3.75")		Shoulder	3.75	$15.12 / 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 M	1.50	$77.98 / SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill HMA 1.50")			Surface M	1.50	$77.98 / SQ YD
LONGITUDINAL SHOULDER JOINT ROUT & SEAL					$2.00 / LIN FT
CENTERLINE JOINT ROUT & SEAL					$2.00 / LIN FT
REFLECTIVE TRANSVERSE CRACK ROUT & SEAL					$2.00 / LIN FT
RANDOM CRACK ROUT & SEAL			(100% Rehab = 100.00' /		$2.00 / LIN FT

RIGID TOTAL LIFE-C	$727,263
RIGID TOTAL ANNUAL	$156,613

LIFE-CYCLE COST ANALYSIS: NEW DESIGN

Calculated / Re ######

			JPCP	HMA
CONSTRUCTION	INITIAL COST	PRESENT '	$597,117	$512,043
		ANNUAL C	$128,587	$110,266
MAINTENANCE	LIFE-CYCLE COST	PRESENT '	$130,146	$199,058
		ANNUAL C	$28,026	$42,866
TOTAL	LIFE-CYCLE COST	PRESENT '	$727,263	$711,101
		ANNUAL C	$156,613	$153,133

LIFE-CYCLE COST ANALYSIS: FINAL SUMMARY

LOWEST COST OPTION	=========	HMA	$153,133	
OTHER OPTIONS (LOWEST TO HIGHEST):	TYPE / PE	JPCP	$156,613	2.3%

S:\GEN\WPDOCS\Pavement Designs\D-1\IL 47 - 60X17\[IL 47 - BDE 5401.xlsm]PDFSheets

HMA_SD

MAINTENANCE AND REHABILITATION ACTIVITY SCHEDULE

02/23/21

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FULL-DEPTH HMA PAVEMENT
HMA PAVEMENT OVER RUBBLIZED PCC PAVEMENT
Figure 54-7.C
STANDARD DESIGN

MAINTENANC		ITEM	%	QUANTITY	UNIT	UNIT COST		COST	PRESENT WORTH
YEAR	5								
		LONG SHLD JT R&S	100.00%	4,000	LIN FT	$2.00		$8,000	
		CNTR LINE JOINT R&S	100.00%	2,000	LIN FT	$2.00		$4,000	
		RNDM / THRM CRACK R&S	50.00%	2,200	LIN FT	$2.00		$4,400	
		PD PVMT PATCH M&F SURF	0.10%	5	SQ YD	$80.64		$403	
		PWFn =	0.8626		PW =	0.8626	X	$16,803	$14,494
YEAR	10								
		LONG SHLD JT R&S	100.00%	4,000	LIN FT	$2.00		$8,000	
		CNTR LINE JOINT R&S	100.00%	2,000	LIN FT	$2.00		$4,000	
		RNDM / THRM CRACK R&S	50.00%	2,200	LIN FT	$2.00		$4,400	
		PD PVMT PATCH M&F SURF	0.50%	27	SQ YD	$80.64		$2,177	
		PWFn =	0.7441		PW =	0.7441	X	$18,577	$13,823
YEAR	15								
		MILL PVMT & SHLD 2.00"	100.00%	8,889	SQ YD	$3.00		$26,667	
		PD PVMT PATCH M&F ADD'L 2.00"	1.00%	53	SQ YD	$79.52		$4,215	
		HMA OVERLAY PVMT 2.00"	100.00%	5,333	SQ YD	$10.71		$57,141	
		HMA OVERLAY SHLD 2.00 "	100.00%	3,556	SQ YD	$8.06		$28,672	
		PWFn =	0.6419		PW =	0.6419	X	$116,695	$74,902
YEAR	20								
		LONG SHLD JT R&S	100.00%	4,000	LIN FT	$2.00		$8,000	
		CNTR LINE JOINT R&S	100.00%	2,000	LIN FT	$2.00		$4,000	
		RNDM / THRM CRACK R&S	50.00%	2,200	LIN FT	$2.00		$4,400	
		PD PVMT PATCH M&F SURF	0.10%	5	SQ YD	$80.64		$403	
		PWFn =	0.5537		PW =	0.5537	X	$16,803	$9,303
YEAR	25								
		LONG SHLD JT R&S	100.00%	4,000	LIN FT	$2.00		$8,000	
		CNTR LINE JOINT R&S	100.00%	2,000	LIN FT	$2.00		$4,000	
		RNDM / THRM CRACK R&S	50.00%	2,200	LIN FT	$2.00		$4,400	
		PD PVMT PATCH M&F SURF	0.50%	27	SQ YD	$80.64		$2,177	
		PWFn =	0.4776		PW =	0.4776	X	$18,577	$8,872
		HMA_SD							
YEAR	30	INTERSTATE							
		MILL PVMT ONLY 2.00"	100.00%	5,333	SQ YD	$3.00		$15,999	
		PD PVMT PATCH M&F ADD'L 2.00"	2.00%	107	SQ YD	$79.52		$8,509	
		PD SHLD PATCH M&F SURF 2.00"	1.00%	36	SQ YD	$78.06		$2,810	
		HMA OVERLAY PVMT 3.75 "	100.00%	5,333	SQ YD	$20.21		$107,785	
		HMA OVERLAY SHLD 1.75 "	100.00%	3,556	SQ YD	$7.06		$25,088	
		PWFn =	0.4120		PW =	0.4120	X	$160,191	$65,997
YEAR	35								
		LONG SHLD JT R&S	100.00%	4,000	LIN FT	$2.00		$8,000	
		CNTR LINE JOINT R&S	100.00%	2,000	LIN FT	$2.00		$4,000	
		RNDM / THRM CRACK R&S	50.00%	2,200	LIN FT	$2.00		$4,400	
		PD PVMT PATCH M&F SURF	0.10%	5	SQ YD	$80.64		$403	
		PWFn =	0.3554		PW =	0.3554	X	$16,803	$5,972
YEAR	40								
		LONG SHLD JT R&S	100.00%	4,000	LIN FT	$2.00		$8,000	
		CNTR LINE JOINT R&S	100.00%	2,000	LIN FT	$2.00		$4,000	
		RNDM / THRM CRACK R&S	50.00%	2,200	LIN FT	$2.00		$4,400	
		PD PVMT PATCH M&F SURF	0.50%	27	SQ YD	$80.64		$2,177	
		PWFn =	0.3066		PW =	0.3066	X	$18,577	$5,695
									$199,058
		ROUTINE MAINTENANCE ACTIVITY		0.76	Lane Miles	0.00		$0	$0
								MAINTENANCE	$199,058
	45	YEAR LIFE CYCLE CRFn = 0.0407852						MAINTENANCE	$42,866

JPCP MAINTENANCE AND REHABILITATION ACTIVITY SCHEDULE 02/23/21
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JOINTED PLAIN CONCRETE PAVEMENT
UNBONDED JOINTED PLAIN CONCRETE OVERLAY
Figure 54-7.A

MAINTENANC	ITEM	%	QUANTITY	UNIT	UNIT COST		COST	PRESENT WORTH
YEAR 10								
	PAVEMENT PATCH CLASS B	0.10%	5	SQ YD	$150.00		$750	
	PWFn =	0.7441		PW =	0.7441	X	$750	$558
YEAR 15								
	PAVEMENT PATCH CLASS B	0.20%	11	SQ YD	$150.00		$1,650	
	PWFn =	0.6419		PW =	0.6419	X	$1,650	$1,059
YEAR 20								
	PAVEMENT PATCH CLASS B	2.00%	107	SQ YD	$150.00		$16,050	
	SHOULDER PATCH CLASS C	0.50%	18	SQ YD	$145.00		$2,610	
	LONGITUDINAL SHLD JT R&S	100.00%	4,000	LIN FT	$2.00		$8,000	
	CENTERLINE JT R&S	100.00%	2,000	LIN FT	$2.00		$4,000	
	PWFn =	0.5537		PW =	0.5537	X	$30,660	$16,976
YEAR 25								
	PAVEMENT PATCH CLASS B	3.00%	160	SQ YD	$150.00		$24,000	
	SHOULDER PATCH CLASS C	1.00%	36	SQ YD	$145.00		$5,220	
	PWFn =	0.4776		PW =	0.4776	X	$29,220	$13,956
YEAR 30	INTERSTATE							
	PAVEMENT PATCH CLASS B	4.00%	213	SQ YD	$150.00		$31,950	
	SHOULDER PATCH CLASS C	1.50%	53	SQ YD	$145.00		$7,685	
	HMA OVERLAY 3.75" (PVMT)	100.00%	5,333	SQ YD	$20.21		$107,785	
	HMA OVERLAY 3.75" (SHLD)	100.00%	3,556	SQ YD	$15.12		$53,760	
	PWFn =	0.4120		PW =	0.4120	X	$201,180	$82,883
YEAR 35	INTERSTATE							
	LONGITUDINAL SHLD JT R&S	100.00%	4,000	LIN FT	$2.00		$8,000	
	CENTERLINE JT R&S	100.00%	2,000	LIN FT	$2.00		$4,000	
	RANDOM CRACK R&S	50.00%	2,000	LIN FT	$2.00		$4,000	
	REFLECTIVE TRANSVERSE CRACK R&S	40.00%	1,286	LIN FT	$2.00		$2,572	
	PD PVMT PATCH M&F HMA SURF 1.50"	0.10%	5	SQ YD	$77.98		$390	
	PWFn =	0.3554		PW =	0.3554	X	$18,962	$6,739
YEAR 40	INTERSTATE							
	PAVEMENT PATCH CLASS B	0.50%	27	SQ YD	$150.00		$4,050	
	LONGITUDINAL SHLD JT R&S	100.00%	4,000	LIN FT	$2.00		$8,000	
	CENTERLINE JT R&S	100.00%	2,000	LIN FT	$2.00		$4,000	
	REFLECTIVE TRANSVERSE CRACK R&S	60.00%	1,930	LIN FT	$2.00		$3,860	
	RANDOM CRACK R&S	50.00%	2,000	LIN FT	$2.00		$4,000	
	PD PVMT PATCH M&F HMA SURF 1.50"	0.50%	27	SQ YD	$77.98		$2,105	
	PWFn =	0.3066		PW =	0.3066	X	$26,015	$7,975
								$130,146
	ROUTINE MAINTENANCE ACTIVITY		0.76	Lane Miles	$0.00		$0	$0
							MAINTENANCE	$130,146
	45 YEAR LIFE CYCLE CRFn = 0.0407852						MAINTENANCE	$28,026

BDE 5401 Template (Rev. 11/22/2019) **IDOT MECHANISTIC PAVEMENT DESIGN** Printed: 02/23/2021

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

Route:	IL 120	Comments:	60X17 - IL 47 (US 14 to IL 120) Reconstruction		
Section:	(104&105)WRS-9(13)				
County:	McHenry	Design Date:	11/20/2020	ONP	<-- BY
Location:	at IL 47	Modify Date:			<-- BY

	ADT	Year
Current:	10,000	2018
Future:	12,000	2040

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
Subgrade Support Rating (SSR):	Poor
Construction Year:	2023
Design Period (DP) =	20 years

	Structural Design Traffic			
	Minimum ADT	Actual ADT	Actual %of Total ADT	% of ADT in Design Lane
PV =	0	10,909	96.0%	P = 50%
SU =	250	341	3.0%	S = 50%
MU =	750	114	1.0%	M = 50%
Struct. Design ADT =		11,364	(2033)	

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) =	0.84	(Actual ADT)	TF rigid (Actual) =	1.12	(Actual ADT)
TF flexible (Min) =	3.17	(Min ADT Fig. 54-2.C)	TF rigid (Min) =	4.59	(Min ADT Fig. 54-2.C)

NEW CONSTRUCTION / RECONSTRUCTION PAVEMENT DESIGN CALCULATIONS

Full-Depth HMA Pavement

	Use TF flexible =	3.17	
	PG Grade Lower Binder Lifts =	PG 64-22	(Fig. 53-4.O)
Goto Map	HMA Mixture Temp. =	73.0	deg. F (Fig. 54-5.C)
	Design HMA Mixture Modulus (E_{HMA}) =	760	ksi (Fig. 54-5.D)
	Design HMA Strain (ε_{HMA}) =	86	(Fig. 54-5.E)
	Full Depth HMA Design Thickness =	9.50	in. (Fig. 54-5.F)
Goto Map	Limiting Strain Criterion Thickness =	14.25	in. (Fig. 54-5.I)
	Use Full-Depth HMA Thickness =	**9.50**	**inches**

JPC Pavement

Use TF rigid =	4.59	
Edge Support =	Tied	Shoulder or C&G
Rigid Pavt Thick. =	**9.00**	**in. (Fig. 54-4.E)**

CRC Pavement

Use TF rigid =	4.59	
IBR value =	3	
CRCP Thickness =	**7.75**	**in. (Fig. 54-4.N)**

TF MUST BE > 60 FOR CRCP

RECONSTRUCTION ONLY (SUPPLEMENTAL) PAVEMENT DESIGN CALCULATIONS

HMA Pavement Over Rubblized PCC

	Use TF flexible =	3.17	
	HMA Overlay Design Thickness =	7.00	in. (Fig. 54-5.U)
Goto Map	Limiting Strain Criterion Thickness =		in. (Fig. 54-5.V)
	Use HMA Overlay Thickness =	**999.00**	**inches**

Unbonded Concrete Overlay

Review 54-4.03 for limitations and special considerations.

JPCP Thickness = NA inches

CONTACT RESEARCH 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)

	Min. Str. Design Traffic (Fig 54-2.C)		
Facility Type	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 Table for One-Way Streets	
ADT	Class
0 - 3500	II
>3501	I

	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)					
	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%

BDE 5401 Template (Rev. 11/22/2019) Printed: 02/23/2021
LIFE-CYCLE COST ANALYSIS: NEW CONSTRUCTION / RECONSTRUCTION

FULL-DEPTH HMA PAVEMENT Standard Design

ROUTE	IL 120
SECTION	(104&105)WRS-9(13)
COUNTY	McHenry
LOCATION	at IL 47

FACILITY TYPE NON-INTERSTATE

PROJECT LENGTH			1000	FT = = >	0.19	Miles
# OF CENTERLINES			1	CL		
# OF LANES			2	LANES		
# OF EDGES			2	EP		
LANE WIDTH - AVERAGE			12	FT		
SHOULDER WIDTH	HMA	Left	0	FT		
	HMA	Right	0	FT		
	Total Width of Paved Shoulders		0	FT		

PAVEMENT THICKNESS (FLEXIBLE)	9.50	IN	14.25	IN MAX
SHOULDER THICKNESS	8.00	IN	HMA_SD	Standard Design
HMA OVERLAY THICKNESS	2.00	IN		

FLEX PAVEMENT TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
	3.17	0.84	3.17

Read Me!

HMA COST PER TON	UNIT PRICE
HMA SURFACE	$120.33 / TON
HMA TOP BINDER	$99.60 / TON
HMA LOWER BINDER	$99.60 / TON
HMA BINDER (IL-9.5FG or IL-4.75)	$99.60 / TON
HMA SHOULDER	$72.00 / TON

INITIAL COSTS

ITEM	THICKNESS		100% QUAI	UNIT		UNIT PRICE		COST	
HMA PAVEMENT (FULL-DEPTH)	(9.50")	2667	2,667	SQ YD	*	$48.86	/ SQ YD	$130,293	~
HMA SURFACE COURSE	(2.00")	1.0069	301	TONS		$120.33	/ TON	$0	
HMA TOP BINDER COURSE	(2.25")	1.0217	343	TONS		$99.60	/ TON	$0	
HMA LOWER BINDER COURSE	(5.25")	1.0477	821	TONS		$99.60	/ TON	$0	
HMA SHOULDER	(8.00")	0	0	TONS		$72.00	/ TON	$0	~
CURB & GUTTER			5,900	LIN FT	*	$30.00	/ LIN FT	$177,000	
SUBBASE GRAN MATL TY C (TONS)			7	TONS		$25.00	/ TON	$175	
IMPROVED SUBGRADE:	Aggregate	Width = 26.6	2,954	SQ YD		$7.00	/ SQ YD	$20,678	
Reserved For User Supplied Item			0	UNITS		$0.00	/ UNITS	$0	
Reserved For User Supplied Item			0	UNITS		$0.00	/ UNITS	$0	
PAVEMENT REMOVAL			2,667	SQ YD		$15.00	/ SQ YD	$40,005	
SHOULDER REMOVAL			0	SQ YD		$0.00	/ SQ YD	$0	

Note: * Denotes User Supplied Quantity

FLEXIBLE CONSTRUC	$368,151
FLEXIBLE CONSTRUC	$79,280

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 M	2.00	$13.57	/ SQ YD
HMA OVERLAY PVMT	(2.00")	1.0069		2.00	$13.57	/ SQ YD
HMA SURFACE MIX	(2.00")	1.0069	Surface M	2.00	$13.57	/ SQ YD
HMA BINDER MIX	(0.00")	1.0139	IL-9.5FG or I	0.00	$0.00	/ SQ YD
HMA OVERLAY SHLD (Year 30)	(2.00")		Shoulder	2.00	$8.06	/ SQ YD
HMA OVERLAY SHLD	(2.00")		Shoulder	2.00	$8.06	/ SQ YD
MILLING (2.00 IN)				2.00	$3.00	/ SQ YD
PARTIAL DEPTH PVMT PATCH	(Mill & Fill Surf)		Surface M	2.00	$83.48	/ SQ YD
PARTIAL DEPTH SHLD PATCH	(Mill & Fill Surf)		Shoulder	2.00	$78.06	/ SQ YD
PARTIAL DEPTH PVMT PATCH	(Mill & Fill +2.00 ")		Binder Mix	2.00	$81.16	/ SQ YD
PARTIAL DEPTH SHLD PATCH	(Mill & Fill +2.00 ")		Shoulder	2.00	$78.06	/ 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% Reh	$2.00	/ LIN FT

FLEXIBLE TOTAL LIFE-	$447,059
FLEXIBLE TOTAL ANNI	$96,272

PCC PAVEMENT JPCP

ROUTE			IL 120		
SECTION			(104&105)WRS-9(13)		
COUNTY			McHenry		
LOCATION			at IL 47		
FACILITY TYPE			NON-INTERSTATE		
PROJECT LENGTH			1000	FT = = >	0.19 Miles
# OF CENTERLINES			1	CL	
# OF LANES			2	LANES	
# OF EDGES			2	EP	
LANE WIDTH - AVERAGE			12	FT	
SHOULDER WIDTH	PCC	Left	0	FT	
	PCC	Right	0	FT	
	Total Width of Paved Shoulders		0	FT	
PAVEMENT THICKNESS (RIGID)		JPCP	9.00	IN	TIED SHLD
SHOULDER THICKNESS			9.00	IN	
HMA OVERLAY THICKNESS			2.75	IN	

RIGID PAVEMENT TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
	4.59	1.12	4.59

Worksheet Construction Type is Reconstruction The Pavement Type is JPCP

INITIAL COSTS

ITEM	THICKNESS		100% QUA	UNIT		UNIT PRICE		COST
JPC PAVEMENT	(9.00")		2,667	SQ YD		$73.00	/ SQ YD	$194,691
PAVEMENT REINFORCEMENT			0	SQ YD		$22.00	/ SQ YD	$0
STABILIZED SUBBASE	(4.00")		0	SQ YD	*	$19.00	/ SQ YD	$0
PCC SHOULDERS	(9.00" to 9.00")		0	SQ YD		$40.00	/ SQ YD	$0
CURB & GUTTER			5,900	LIN FT	*	$30.00	/ LIN FT	$177,000
SUBBASE GRAN MATL TY C	(~ 0.00")		0	TONS		$25.00	/ TON	$0
IMPROVED SUBGRADE:	Aggregate	Width = 25.0	2,778	SQ YD		$7.00	/ SQ YD	$19,446
Reserved For User Supplied Item			0	UNITS		$0.00	/ UNITS	$0
Reserved For User Supplied Item			0	UNITS		$0.00	/ UNITS	$0
PAVEMENT REMOVAL			2,667	SQ YD		$15.00	/ SQ YD	$40,005
SHOULDER REMOVAL			0	SQ YD		$0.00	/ SQ YD	$0

Note: * Denotes User Supplied Quantity

RIGID CONSTRUCTION	$431,142
RIGID CONSTRUCTION	$92,845

MAINTENANCE COSTS:

ITEM	THICKNESS		MATERIAL	T	UNIT COST
ROUTINE MAINTENANCE ACTIVITY					$0.00 / LANE-MILE / YEAR
HMA OVERLAY	(2.75")			2.75	
HMA OVERLAY PAVEMENT	(2.75")	1.0095		2.75	$17.24 / SQ YD
HMA SURFACE MIX	(1.50")	1.0052	Surface M	1.50	$10.16 / SQ YD
HMA BINDER MIX	(1.25")	1.0148	IL-9.5FG or I	1.25	$7.07 / SQ YD
HMA OVERLAY SHOULDER	(2.75")		Shoulder	2.75	$11.09 / 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 M	1.50	$80.11 / SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill HMA 2.75")			Surface M	2.75	$88.53 / 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' /		$2.00 / LIN FT

RIGID TOTAL LIFE-C	$478,351
RIGID TOTAL ANNUAL	$103,011

LIFE-CYCLE COST ANALYSIS: NEW DESIGN

Calculated / Re ######

			JPCP	HMA
CONSTRUCTION	INITIAL COST	PRESENT '	$431,142	$368,151
		ANNUAL C	$92,845	$79,280
MAINTENANCE	LIFE-CYCLE COST	PRESENT '	$47,209	$78,908
		ANNUAL C	$10,166	$16,993
TOTAL	LIFE-CYCLE COST	PRESENT '	$478,351	$447,059
		ANNUAL C	$103,011	$96,272

LIFE-CYCLE COST ANALYSIS: FINAL SUMMARY

LOWEST COST OPTION	=========	HMA	$96,272	
OTHER OPTIONS (LOWEST TO HIGHEST):	TYPE / PE	JPCP	$103,011	7.0%

S:\GEN\WPDOCS\Pavement Designs\D-1\IL 47 - 60X17\[IL 120 - BDE 5401.xlsm]PDFSheets

HMA_SD

MAINTENANCE AND REHABILITATION ACTIVITY SCHEDULE

02/23/21

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FULL-DEPTH HMA PAVEMENT
HMA PAVEMENT OVER RUBBLIZED PCC PAVEMENT
Figure 54-7.C
STANDARD DESIGN

MAINTENANC	ITEM	%	QUANTITY	UNIT	UNIT COST		COST	PRESENT WORTH
YEAR 5								
	LONG SHLD JT R&S	100.00%	2,000	LIN FT	$2.00		$4,000	
	CNTR LINE JOINT R&S	100.00%	1,000	LIN FT	$2.00		$2,000	
	RNDM / THRM CRACK R&S	50.00%	1,100	LIN FT	$2.00		$2,200	
	PD PVMT PATCH M&F SURF	0.10%	3	SQ YD	$83.48		$250	
	PWFn =	0.8626		PW =	0.8626	X	$8,450	$7,289
YEAR 10								
	LONG SHLD JT R&S	100.00%	2,000	LIN FT	$2.00		$4,000	
	CNTR LINE JOINT R&S	100.00%	1,000	LIN FT	$2.00		$2,000	
	RNDM / THRM CRACK R&S	50.00%	1,100	LIN FT	$2.00		$2,200	
	PD PVMT PATCH M&F SURF	0.50%	13	SQ YD	$83.48		$1,085	
	PWFn =	0.7441		PW =	0.7441	X	$9,285	$6,909
YEAR 15								
	MILL PVMT & SHLD 2.00"	100.00%	2,667	SQ YD	$3.00		$8,001	
	PD PVMT PATCH M&F ADD'L 2.00"	1.00%	27	SQ YD	$81.16		$2,191	
	HMA OVERLAY PVMT 2.00"	100.00%	2,667	SQ YD	$13.57		$36,188	
	HMA OVERLAY SHLD 2.00 "	100.00%	0	SQ YD	$8.06		$0	
	PWFn =	0.6419		PW =	0.6419	X	$46,380	$29,770
YEAR 20								
	LONG SHLD JT R&S	100.00%	2,000	LIN FT	$2.00		$4,000	
	CNTR LINE JOINT R&S	100.00%	1,000	LIN FT	$2.00		$2,000	
	RNDM / THRM CRACK R&S	50.00%	1,100	LIN FT	$2.00		$2,200	
	PD PVMT PATCH M&F SURF	0.10%	3	SQ YD	$83.48		$250	
	PWFn =	0.5537		PW =	0.5537	X	$8,450	$4,679
YEAR 25								
	LONG SHLD JT R&S	100.00%	2,000	LIN FT	$2.00		$4,000	
	CNTR LINE JOINT R&S	100.00%	1,000	LIN FT	$2.00		$2,000	
	RNDM / THRM CRACK R&S	50.00%	1,100	LIN FT	$2.00		$2,200	
	PD PVMT PATCH M&F SURF	0.50%	13	SQ YD	$83.48		$1,085	
	PWFn =	0.4776		PW =	0.4776	X	$9,285	$4,435
	HMA_SD							
YEAR 30	NON-INTERSTATE							
	MILL PVMT & SHLD 2.00"	100.00%	2,667	SQ YD	$3.00		$8,001	
	PD PVMT PATCH M&F ADD'L 2.00"	2.00%	53	SQ YD	$81.16		$4,301	
	PD SHLD PATCH M&F ADD'L 2.00"	1.00%	0	SQ YD	$78.06		$0	
	HMA OVERLAY PVMT 2.00 "	100.00%	2,667	SQ YD	$13.57		$36,188	
	HMA OVERLAY SHLD 2.00 "	100.00%	0	SQ YD	$8.06		$0	
	PWFn =	0.4120		PW =	0.4120	X	$48,490	$19,977
YEAR 35								
	LONG SHLD JT R&S	100.00%	2,000	LIN FT	$2.00		$4,000	
	CNTR LINE JOINT R&S	100.00%	1,000	LIN FT	$2.00		$2,000	
	RNDM / THRM CRACK R&S	50.00%	1,100	LIN FT	$2.00		$2,200	
	PD PVMT PATCH M&F SURF	0.10%	3	SQ YD	$83.48		$250	
	PWFn =	0.3554		PW =	0.3554	X	$8,450	$3,003
YEAR 40								
	LONG SHLD JT R&S	100.00%	2,000	LIN FT	$2.00		$4,000	
	CNTR LINE JOINT R&S	100.00%	1,000	LIN FT	$2.00		$2,000	
	RNDM / THRM CRACK R&S	50.00%	1,100	LIN FT	$2.00		$2,200	
	PD PVMT PATCH M&F SURF	0.50%	13	SQ YD	$83.48		$1,085	
	PWFn =	0.3066		PW =	0.3066	X	$9,285	$2,846
								$78,908
	ROUTINE MAINTENANCE ACTIVITY		0.38	Lane Miles	0.00		$0	$0
							MAINTENANCE	$78,908
	45 YEAR LIFE CYCLE CRFn = 0.0407852						MAINTENANCE	$16,993

JPCP MAINTENANCE AND REHABILITATION ACTIVITY SCHEDULE 02/23/21
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JOINTED PLAIN CONCRETE PAVEMENT
UNBONDED JOINTED PLAIN CONCRETE OVERLAY
Figure 54-7.A

MAINTENANC	ITEM	%	QUANTITY	UNIT	UNIT COST		COST	PRESENT WORTH
YEAR 10								
	PAVEMENT PATCH CLASS B	0.10%	3	SQ YD	$150.00		$450	
	PWFn =	0.7441		PW =	0.7441	X	$450	$335
YEAR 15								
	PAVEMENT PATCH CLASS B	0.20%	5	SQ YD	$150.00		$750	
	PWFn =	0.6419		PW =	0.6419	X	$750	$481
YEAR 20								
	PAVEMENT PATCH CLASS B	2.00%	53	SQ YD	$150.00		$7,950	
	SHOULDER PATCH CLASS C	0.50%	0	SQ YD	$145.00		$0	
	LONGITUDINAL SHLD JT R&S	100.00%	2,000	LIN FT	$2.00		$4,000	
	CENTERLINE JT R&S	100.00%	1,000	LIN FT	$2.00		$2,000	
	PWFn =	0.5537		PW =	0.5537	X	$13,950	$7,724
YEAR 25								
	PAVEMENT PATCH CLASS B	3.00%	80	SQ YD	$150.00		$12,000	
	SHOULDER PATCH CLASS C	1.00%	0	SQ YD	$145.00		$0	
	PWFn =	0.4776		PW =	0.4776	X	$12,000	$5,731
YEAR 30	NON-INTERSTATE							
	PAVEMENT PATCH CLASS B	4.00%	107	SQ YD	$150.00		$16,050	
	SHOULDER PATCH CLASS C	1.50%	0	SQ YD	$145.00		$0	
	HMA OVERLAY 2.75" (PVMT)	100.00%	2,667	SQ YD	$17.24		$45,961	
	HMA OVERLAY 2.75" (SHLD)	100.00%	0	SQ YD	$11.09		$0	
	PWFn =	0.4120		PW =	0.4120	X	$62,011	$25,548
YEAR 35	NON-INTERSTATE							
	LONGITUDINAL SHLD JT R&S	100.00%	2,000	LIN FT	$2.00		$4,000	
	CENTERLINE JT R&S	100.00%	1,000	LIN FT	$2.00		$2,000	
	RANDOM CRACK R&S	50.00%	1,000	LIN FT	$2.00		$2,000	
	REFLECTIVE TRANSVERSE CRACK R&S	40.00%	643	LIN FT	$2.00		$1,286	
	PD PVMT PATCH M&F HMA 2.75"	0.10%	3	SQ YD	$88.53		$266	
	PWFn =	0.3554		PW =	0.3554	X	$9,552	$3,395
YEAR 40	NON-INTERSTATE							
	PAVEMENT PATCH CLASS B	0.50%	13	SQ YD	$150.00		$1,950	
	LONGITUDINAL SHLD JT R&S	100.00%	2,000	LIN FT	$2.00		$4,000	
	CENTERLINE JT R&S	100.00%	1,000	LIN FT	$2.00		$2,000	
	REFLECTIVE TRANSVERSE CRACK R&S	60.00%	965	LIN FT	$2.00		$1,930	
	RANDOM CRACK R&S	50.00%	1,000	LIN FT	$2.00		$2,000	
	PD PVMT PATCH M&F HMA 2.75"	0.50%	13	SQ YD	$88.53		$1,151	
	PWFn =	0.3066		PW =	0.3066	X	$13,031	$3,995
								$47,209
	ROUTINE MAINTENANCE ACTIVITY		0.38	Lane Miles	$0.00		$0	$0
							MAINTENANCE	$47,209
	45 YEAR LIFE CYCLE CRFn = 0.0407852						MAINTENANCE	$10,166

BDE 5401 Template (Rev. 11/22/2019) **IDOT MECHANISTIC PAVEMENT DESIGN** Printed: 02/23/2021

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

Route:	Country Club Road / South Street	Comments:	60X17 - IL 47 (US 14 to IL 120) Reconstruction		
Section:	(104&105)WRS-9(13)				
County:	McHenry	Design Date:	11/20/2020	ONP	<-- BY
Location:	at IL 47	Modify Date:			<-- BY

	ADT	Year
Current:	11,000	2018
Future:	14,000	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:	2023
Design Period (DP) =	20 years

	Structural Design Traffic			
	Minimum ADT	Actual ADT	Actual %of Total ADT	% of ADT in Design Lane
PV =	No Min	12,524	96.0%	P = 50%
SU =	No Min	261	2.0%	S = 50%
MU =	No Min	261	2.0%	M = 50%
Struct. Design ADT =		13,045	(2033)	

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) =	1.32	(Actual ADT)	TF rigid (Actual) =	1.85	(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

	Use TF flexible =	1.32	
	PG Grade Lower Binder Lifts =	PG 64-22	(Fig. 53-4.O)
Goto Map	HMA Mixture Temp. =	73.5	deg. F (Fig. 54-5.C)
	Design HMA Mixture Modulus (E_{HMA}) =	740	ksi (Fig. 54-5.D)
	Design HMA Strain (ε_{HMA}) =	111	(Fig. 54-5.E)
	Full Depth HMA Design Thickness =	8.25	in. (Fig. 54-5.F)
Goto Map	Limiting Strain Criterion Thickness =	14.25	in. (Fig. 54-5.I)
	Use Full-Depth HMA Thickness =	**8.25**	**inches**

JPC Pavement

Use TF rigid =	1.85	
Edge Support =	Tied	Shoulder or C&G
Rigid Pavt Thick. =	**8.25**	**in. (Fig. 54-4.E)**

CRC Pavement

Use TF rigid =	1.85	
IBR value =	3	
CRCP Thickness =	**6.75**	**in. (Fig. 54-4.N)**

TF MUST BE > 60 FOR CRCP

RECONSTRUCTION ONLY (SUPPLEMENTAL) PAVEMENT DESIGN CALCULATIONS

HMA Pavement Over Rubblized PCC

	Use TF flexible =	1.32	
	HMA Overlay Design Thickness =	5.75	in. (Fig. 54-5.U)
Goto Map	Limiting Strain Criterion Thickness =		in. (Fig. 54-5.V)
	Use HMA Overlay Thickness =	**999.00**	**inches**

Unbonded Concrete Overlay

Review 54-4.03 for limitations and special considerations.

JPCP Thickness = NA inches

CONTACT RESEARCH 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)

	Min. Str. Design Traffic (Fig 54-2.C)		
Facility Type	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 Table for One-Way Streets	
ADT	Class
0 - 3500	II
>3501	I

	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)					
	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%

BDE 5401 Template (Rev. 11/22/2019) Printed: 02/23/2021
LIFE-CYCLE COST ANALYSIS: NEW CONSTRUCTION / RECONSTRUCTION

FULL-DEPTH HMA PAVEMENT Standard Design

ROUTE	Country Club Road / South Street					
SECTION	(104&105)WRS-9(13)					
COUNTY	McHenry					
LOCATION	at IL 47					
FACILITY TYPE		NON-INTERSTATE				
PROJECT LENGTH			600	FT = = >	0.11	Miles
# OF CENTERLINES			2	CL		
# OF LANES			3	LANES		
# OF EDGES			2	EP		
LANE WIDTH - AVERAGE			12	FT		
SHOULDER WIDTH	HMA	Left	0	FT		
	HMA	Right	0	FT		
	Total Width of Paved Shoulders		0	FT		
PAVEMENT THICKNESS (FLEXIBLE)			8.25	IN	14.25	IN MAX
SHOULDER THICKNESS			8.00	IN	HMA_SD	Standard Design
HMA OVERLAY THICKNESS			2.00	IN		

FLEX PAVEMENT TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
	No Min	1.32	1.32

Read Me!

HMA COST PER TON	UNIT PRICE
HMA SURFACE	$103.55 / TON
HMA TOP BINDER	$88.71 / TON
HMA LOWER BINDER	$88.71 / TON
HMA BINDER (IL-9.5FG or IL-4.75)	$96.13 / TON
HMA SHOULDER	$72.00 / TON

INITIAL COSTS

ITEM	THICKNESS		100% QUAI	UNIT		UNIT PRICE		COST	
HMA PAVEMENT (FULL-DEPTH)	(8.25")	2400	2,400	SQ YD	*	$43.12	/ SQ YD	$103,488	~
HMA SURFACE COURSE	(2.00")	1.0046	270	TONS		$103.55	/ TON	$0	
HMA TOP BINDER COURSE	(2.25")	1.0145	307	TONS		$88.71	/ TON	$0	
HMA LOWER BINDER COURSE	(4.00")	1.0289	553	TONS		$88.71	/ TON	$0	
HMA SHOULDER	(8.00")	0	0	TONS		$72.00	/ TON	$0	~
CURB & GUTTER			1,200	LIN FT	*	$30.00	/ LIN FT	$36,000	
SUBBASE GRAN MATL TY C (TONS)			0	TONS		$25.00	/ TON	$0	
IMPROVED SUBGRADE:	Aggregate	Width = 38.4	2,558	SQ YD		$7.00	/ SQ YD	$17,906	
Reserved For User Supplied Item			0	UNITS		$0.00	/ UNITS	$0	
Reserved For User Supplied Item			0	UNITS		$0.00	/ UNITS	$0	
PAVEMENT REMOVAL			2,400	SQ YD		$15.00	/ SQ YD	$36,000	
SHOULDER REMOVAL			0	SQ YD		$0.00	/ SQ YD	$0	

Note: * Denotes User Supplied Quantity

FLEXIBLE CONSTRUC	$193,394
FLEXIBLE CONSTRUC	$69,411

MAINTENANCE COSTS:

ITEM	THICKNESS		MATERIAL	T	UNIT COST	
ROUTINE MAINTENANCE ACTIVITY					$0.00	LANE-MILE / YEAR
HMA OVERLAY PVMT SURF	(2.00")	1.0046	Surface M	2.00	$11.65	/ SQ YD
HMA OVERLAY PVMT	(2.00")	1.0046		2.00	$11.65	/ SQ YD
HMA SURFACE MIX	(2.00")	1.0046	Surface M	2.00	$11.65	/ SQ YD
HMA BINDER MIX	(0.00")	1.0093	IL-9.5FG or I	0.00	$0.00	/ SQ YD
HMA OVERLAY SHLD (Year 30)	(2.00")		Shoulder	2.00	$8.06	/ SQ YD
HMA OVERLAY SHLD	(2.00")		Shoulder	2.00	$8.06	/ SQ YD
MILLING (2.00 IN)				2.00	$3.00	/ SQ YD
PARTIAL DEPTH PVMT PATCH	(Mill & Fill Surf)		Surface M	2.00	$81.60	/ SQ YD
PARTIAL DEPTH SHLD PATCH	(Mill & Fill Surf)		Shoulder	2.00	$78.06	/ SQ YD
PARTIAL DEPTH PVMT PATCH	(Mill & Fill +2.00 ")		Binder Mix	2.00	$80.77	/ SQ YD
PARTIAL DEPTH SHLD PATCH	(Mill & Fill +2.00 ")		Shoulder	2.00	$78.06	/ 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% Reł	$2.00	/ LIN FT

FLEXIBLE TOTAL LIFE·	$257,450
FLEXIBLE TOTAL ANNI	$92,401

PCC PAVEMENT JPCP

ROUTE			Country Club Road / South Street		
SECTION			(104&105)WRS-9(13)		
COUNTY			McHenry		
LOCATION			at IL 47		
FACILITY TYPE			NON-INTERSTATE		
PROJECT LENGTH			600	FT = = >	0.11 Miles
# OF CENTERLINES			2	CL	
# OF LANES			3	LANES	
# OF EDGES			2	EP	
LANE WIDTH - AVERAGE			12	FT	
SHOULDER WIDTH	PCC	Left	0	FT	
	PCC	Right	0	FT	
	Total Width of Paved Shoulders		0	FT	
PAVEMENT THICKNESS (RIGID)		JPCP	8.25	IN	TIED SHLD
SHOULDER THICKNESS			8.25	IN	
HMA OVERLAY THICKNESS			2.75	IN	

RIGID PAVEMENT TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
	No Min	1.85	1.85

Worksheet Construction Type is Reconstruction The Pavement Type is JPCP

INITIAL COSTS

ITEM	THICKNESS		100% QUA	UNIT		UNIT PRICE		COST
JPC PAVEMENT	(8.25")		2,400	SQ YD		$61.74	/ SQ YD	$148,176
PAVEMENT REINFORCEMENT			0	SQ YD		$22.00	/ SQ YD	$0
STABILIZED SUBBASE	(4.00")		0	SQ YD	*	$19.00	/ SQ YD	$0
PCC SHOULDERS	(8.25" to 8.25")		0	SQ YD		$40.00	/ SQ YD	$0
CURB & GUTTER			1,200	LIN FT	*	$30.00	/ LIN FT	$36,000
SUBBASE GRAN MATL TY C	(~ 0.00")		0	TONS		$25.00	/ TON	$0
IMPROVED SUBGRADE:	Aggregate	Width = 37.0	2,467	SQ YD		$7.00	/ SQ YD	$17,269
Reserved For User Supplied Item			0	UNITS		$0.00	/ UNITS	$0
Reserved For User Supplied Item			0	UNITS		$0.00	/ UNITS	$0
PAVEMENT REMOVAL			2,400	SQ YD		$15.00	/ SQ YD	$36,000
SHOULDER REMOVAL			0	SQ YD		$0.00	/ SQ YD	$0

Note: * Denotes User Supplied Quantity

RIGID CONSTRUCTION	$237,445
RIGID CONSTRUCTION	$85,221

MAINTENANCE COSTS:

ITEM	THICKNESS		MATERIAL	T	UNIT COST	
ROUTINE MAINTENANCE ACTIVITY					$0.00	/ LANE-MILE / YEAR
HMA OVERLAY	(2.75")			2.75		
HMA OVERLAY PAVEMENT	(2.75")	1.0064		2.75	$15.52	/ SQ YD
HMA SURFACE MIX	(1.50")	1.0035	Surface M	1.50	$8.73	/ SQ YD
HMA BINDER MIX	(1.25")	1.0098	IL-9.5FG or I	1.25	$6.80	/ SQ YD
HMA OVERLAY SHOULDER	(2.75")		Shoulder	2.75	$11.09	/ 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 M	1.50	$78.70	/ SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill HMA 2.75")			Surface M	2.75	$85.95	/ 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' /		$2.00	/ LIN FT

RIGID TOTAL LIFE-C	$277,470
RIGID TOTAL ANNUAL	$99,587

LIFE-CYCLE COST ANALYSIS: NEW DESIGN

Calculated / Re ######

			JPCP	HMA
CONSTRUCTION	INITIAL COST	PRESENT '	$237,445	$193,394
		ANNUAL C	$85,221	$69,411
MAINTENANCE	LIFE-CYCLE COST	PRESENT '	$40,025	$64,056
		ANNUAL C	$14,365	$22,990
TOTAL	LIFE-CYCLE COST	PRESENT '	$277,470	$257,450
		ANNUAL C	$99,587	$92,401

LIFE-CYCLE COST ANALYSIS: FINAL SUMMARY

LOWEST COST OPTION	=========	HMA	$92,401	
OTHER OPTIONS (LOWEST TO HIGHEST):	TYPE / PE	JPCP	$99,587	7.8%

S:\GEN\WPDOCS\Pavement Designs\D-1\IL 47 - 60X17\[Country Club Rd_South St - BDE 5401.xlsm]PDFSheets

HMA_SD

MAINTENANCE AND REHABILITATION ACTIVITY SCHEDULE

02/23/21

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FULL-DEPTH HMA PAVEMENT
HMA PAVEMENT OVER RUBBLIZED PCC PAVEMENT
Figure 54-7.C
STANDARD DESIGN

MAINTENANC	ITEM	%	QUANTITY	UNIT	UNIT COST		COST	PRESENT WORTH
YEAR 5								
	LONG SHLD JT R&S	100.00%	1,200	LIN FT	$2.00		$2,400	
	CNTR LINE JOINT R&S	100.00%	1,200	LIN FT	$2.00		$2,400	
	RNDM / THRM CRACK R&S	50.00%	990	LIN FT	$2.00		$1,980	
	PD PVMT PATCH M&F SURF	0.10%	2	SQ YD	$81.60		$163	
	PWFn =	0.8626		PW =	0.8626	X	$6,943	$5,989
YEAR 10								
	LONG SHLD JT R&S	100.00%	1,200	LIN FT	$2.00		$2,400	
	CNTR LINE JOINT R&S	100.00%	1,200	LIN FT	$2.00		$2,400	
	RNDM / THRM CRACK R&S	50.00%	990	LIN FT	$2.00		$1,980	
	PD PVMT PATCH M&F SURF	0.50%	12	SQ YD	$81.60		$979	
	PWFn =	0.7441		PW =	0.7441	X	$7,759	$5,773
YEAR 15								
	MILL PVMT & SHLD 2.00"	100.00%	2,400	SQ YD	$3.00		$7,200	
	PD PVMT PATCH M&F ADD'L 2.00"	1.00%	24	SQ YD	$80.77		$1,938	
	HMA OVERLAY PVMT 2.00"	100.00%	2,400	SQ YD	$11.65		$27,963	
	HMA OVERLAY SHLD 2.00 "	100.00%	0	SQ YD	$8.06		$0	
	PWFn =	0.6419		PW =	0.6419	X	$37,101	$23,814
YEAR 20								
	LONG SHLD JT R&S	100.00%	1,200	LIN FT	$2.00		$2,400	
	CNTR LINE JOINT R&S	100.00%	1,200	LIN FT	$2.00		$2,400	
	RNDM / THRM CRACK R&S	50.00%	990	LIN FT	$2.00		$1,980	
	PD PVMT PATCH M&F SURF	0.10%	2	SQ YD	$81.60		$163	
	PWFn =	0.5537		PW =	0.5537	X	$6,943	$3,844
YEAR 25								
	LONG SHLD JT R&S	100.00%	1,200	LIN FT	$2.00		$2,400	
	CNTR LINE JOINT R&S	100.00%	1,200	LIN FT	$2.00		$2,400	
	RNDM / THRM CRACK R&S	50.00%	990	LIN FT	$2.00		$1,980	
	PD PVMT PATCH M&F SURF	0.50%	12	SQ YD	$81.60		$979	
	PWFn =	0.4776		PW =	0.4776	X	$7,759	$3,706
	HMA_SD							
YEAR 30	NON-INTERSTATE							
	MILL PVMT & SHLD 2.00"	100.00%	2,400	SQ YD	$3.00		$7,200	
	PD PVMT PATCH M&F ADD'L 2.00"	2.00%	48	SQ YD	$80.77		$3,877	
	PD SHLD PATCH M&F ADD'L 2.00"	1.00%	0	SQ YD	$78.06		$0	
	HMA OVERLAY PVMT 2.00 "	100.00%	2,400	SQ YD	$11.65		$27,963	
	HMA OVERLAY SHLD 2.00 "	100.00%	0	SQ YD	$8.06		$0	
	PWFn =	0.4120		PW =	0.4120	X	$39,040	$16,084
YEAR 35								
	LONG SHLD JT R&S	100.00%	1,200	LIN FT	$2.00		$2,400	
	CNTR LINE JOINT R&S	100.00%	1,200	LIN FT	$2.00		$2,400	
	RNDM / THRM CRACK R&S	50.00%	990	LIN FT	$2.00		$1,980	
	PD PVMT PATCH M&F SURF	0.10%	2	SQ YD	$81.60		$163	
	PWFn =	0.3554		PW =	0.3554	X	$6,943	$2,467
YEAR 40								
	LONG SHLD JT R&S	100.00%	1,200	LIN FT	$2.00		$2,400	
	CNTR LINE JOINT R&S	100.00%	1,200	LIN FT	$2.00		$2,400	
	RNDM / THRM CRACK R&S	50.00%	990	LIN FT	$2.00		$1,980	
	PD PVMT PATCH M&F SURF	0.50%	12	SQ YD	$81.60		$979	
	PWFn =	0.3066		PW =	0.3066	X	$7,759	$2,379
								$64,056
	ROUTINE MAINTENANCE ACTIVITY		0.34	Lane Miles	0.00		$0	$0
							MAINTENANCE	$64,056
	45 YEAR LIFE CYCLE CRFn = 0.0407852						MAINTENANCE	$22,990

JPCP MAINTENANCE AND REHABILITATION ACTIVITY SCHEDULE 02/23/21
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JOINTED PLAIN CONCRETE PAVEMENT
UNBONDED JOINTED PLAIN CONCRETE OVERLAY
Figure 54-7.A

MAINTENANC	ITEM	%	QUANTITY	UNIT	UNIT COST		COST	PRESENT WORTH
YEAR 10								
	PAVEMENT PATCH CLASS B	0.10%	2	SQ YD	$150.00		$300	
	PWFn =	0.7441		PW =	0.7441	X	$300	$223
YEAR 15								
	PAVEMENT PATCH CLASS B	0.20%	5	SQ YD	$150.00		$750	
	PWFn =	0.6419		PW =	0.6419	X	$750	$481
YEAR 20								
	PAVEMENT PATCH CLASS B	2.00%	48	SQ YD	$150.00		$7,200	
	SHOULDER PATCH CLASS C	0.50%	0	SQ YD	$145.00		$0	
	LONGITUDINAL SHLD JT R&S	100.00%	1,200	LIN FT	$2.00		$2,400	
	CENTERLINE JT R&S	100.00%	1,200	LIN FT	$2.00		$2,400	
	PWFn =	0.5537		PW =	0.5537	X	$12,000	$6,644
YEAR 25								
	PAVEMENT PATCH CLASS B	3.00%	72	SQ YD	$150.00		$10,800	
	SHOULDER PATCH CLASS C	1.00%	0	SQ YD	$145.00		$0	
	PWFn =	0.4776		PW =	0.4776	X	$10,800	$5,158
YEAR 30	NON-INTERSTATE							
	PAVEMENT PATCH CLASS B	4.00%	96	SQ YD	$150.00		$14,400	
	SHOULDER PATCH CLASS C	1.50%	0	SQ YD	$145.00		$0	
	HMA OVERLAY 2.75" (PVMT)	100.00%	2,400	SQ YD	$15.52		$37,257	
	HMA OVERLAY 2.75" (SHLD)	100.00%	0	SQ YD	$11.09		$0	
	PWFn =	0.4120		PW =	0.4120	X	$51,657	$21,282
YEAR 35	NON-INTERSTATE							
	LONGITUDINAL SHLD JT R&S	100.00%	1,200	LIN FT	$2.00		$2,400	
	CENTERLINE JT R&S	100.00%	1,200	LIN FT	$2.00		$2,400	
	RANDOM CRACK R&S	50.00%	900	LIN FT	$2.00		$1,800	
	REFLECTIVE TRANSVERSE CRACK R&S	40.00%	576	LIN FT	$2.00		$1,152	
	PD PVMT PATCH M&F HMA 2.75"	0.10%	2	SQ YD	$85.95		$172	
	PWFn =	0.3554		PW =	0.3554	X	$7,924	$2,816
YEAR 40	NON-INTERSTATE							
	PAVEMENT PATCH CLASS B	0.50%	12	SQ YD	$150.00		$1,800	
	LONGITUDINAL SHLD JT R&S	100.00%	1,200	LIN FT	$2.00		$2,400	
	CENTERLINE JT R&S	100.00%	1,200	LIN FT	$2.00		$2,400	
	REFLECTIVE TRANSVERSE CRACK R&S	60.00%	864	LIN FT	$2.00		$1,728	
	RANDOM CRACK R&S	50.00%	900	LIN FT	$2.00		$1,800	
	PD PVMT PATCH M&F HMA 2.75"	0.50%	12	SQ YD	$85.95		$1,031	
	PWFn =	0.3066		PW =	0.3066	X	$11,159	$3,421
								$40,025
	ROUTINE MAINTENANCE ACTIVITY		0.34	Lane Miles	$0.00		$0	$0
							MAINTENANCE	$40,025
	45 YEAR LIFE CYCLE CRFn = 0.0407852						MAINTENANCE	$14,365

BDE 5401 Template (Rev. 11/22/2019)

IDOT MECHANISTIC PAVEMENT DESIGN

Printed: 02/23/2021

PROJECT AND TRAFFIC INPUTS

(Enter Data in Gray Shaded Cells)

Route:	McConnell Road	Comments:	60X17 - IL 47 (US 14 to IL 120) Reconstruction			
Section:	(104&105)WRS-9(13)					
County:	McHenry	Design Date:	11/20/2020	ONP	<-- BY	
Location:	at IL 47	Modify Date:			<-- BY	

	ADT	Year
Current:	6,400	2018
Future:	8,000	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:	2023
Design Period (DP) =	20 years

	Structural Design Traffic			
	Minimum ADT	Actual ADT	Actual %of Total ADT	% of ADT in Design Lane
PV =	No Min	6,667	89.0%	P = 50%
SU =	No Min	674	9.0%	S = 50%
MU =	No Min	150	2.0%	M = 50%
Struct. Design ADT =		7,491	(2033)	

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) =	1.34	(Actual ADT)	TF rigid (Actual) =	1.78	(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

	Use TF flexible =	1.34	
Goto Map	PG Grade Lower Binder Lifts =	PG 64-22	(Fig. 53-4.O)
	HMA Mixture Temp. =	73.5	deg. F (Fig. 54-5.C)
	Design HMA Mixture Modulus (E_{HMA}) =	740	ksi (Fig. 54-5.D)
	Design HMA Strain (ε_{HMA}) =	111	(Fig. 54-5.E)
Goto Map	Full Depth HMA Design Thickness =	8.25	in. (Fig. 54-5.F)
	Limiting Strain Criterion Thickness =	14.25	in. (Fig. 54-5.I)
	Use Full-Depth HMA Thickness =	**8.25**	**inches**

JPC Pavement

Use TF rigid =	1.78	
Edge Support =	Tied	Shoulder or C&G
Rigid Pavt Thick. =	**8.25**	**in. (Fig. 54-4.E)**

CRC Pavement

Use TF rigid =	1.78	
IBR value =	3	
CRCP Thickness =	**6.75**	**in. (Fig. 54-4.N)**

TF MUST BE > 60 FOR CRCP

RECONSTRUCTION ONLY (SUPPLEMENTAL) PAVEMENT DESIGN CALCULATIONS

HMA Pavement Over Rubblized PCC

	Use TF flexible =	1.34	
Goto Map	HMA Overlay Design Thickness =	5.75	in. (Fig. 54-5.U)
	Limiting Strain Criterion Thickness =		in. (Fig. 54-5.V)
	Use HMA Overlay Thickness =	**999.00**	**inches**

Unbonded Concrete Overlay

Review 54-4.03 for limitations and special considerations.

JPCP Thickness = NA inches

CONTACT RESEARCH 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)

	Min. Str. Design Traffic (Fig 54-2.C)		
Facility Type	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 Table for One-Way Streets	
ADT	Class
0 - 3500	II
>3501	I

	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)					
	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%

BDE 5401 Template (Rev. 11/22/2019) Printed: 02/23/2021
LIFE-CYCLE COST ANALYSIS: NEW CONSTRUCTION / RECONSTRUCTION

FULL-DEPTH HMA PAVEMENT Standard Design

ROUTE	McConnell Road
SECTION	(104&105)WRS-9(13)
COUNTY	McHenry
LOCATION	at IL 47

FACILITY TYPE NON-INTERSTATE

PROJECT LENGTH			550	FT = = >	0.10	Miles
# OF CENTERLINES			2	CL		
# OF LANES			3	LANES		
# OF EDGES			2	EP		
LANE WIDTH - AVERAGE			12	FT		
SHOULDER WIDTH	HMA	Left	0	FT		
	HMA	Right	0	FT		
	Total Width of Paved Shoulders		0	FT		

PAVEMENT THICKNESS (FLEXIBLE)	8.25	IN	14.25	IN MAX
SHOULDER THICKNESS	8.00	IN	HMA_SD	Standard Design
HMA OVERLAY THICKNESS	2.00	IN		

FLEX PAVEMENT TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
	No Min	1.34	1.34

Read Me!

HMA COST PER TON	UNIT PRICE	
HMA SURFACE	$103.55	/ TON
HMA TOP BINDER	$88.71	/ TON
HMA LOWER BINDER	$88.71	/ TON
HMA BINDER (IL-9.5FG or IL-4.75)	$96.13	/ TON
HMA SHOULDER	$72.00	/ TON

INITIAL COSTS

ITEM	THICKNESS		100% QUAI	UNIT		UNIT PRICE		COST	
HMA PAVEMENT (FULL-DEPTH)	(8.25")	2200	2,200	SQ YD	*	$43.12	/ SQ YD	$94,864	~
HMA SURFACE COURSE	(2.00")	1.0046	248	TONS		$103.55	/ TON	$0	
HMA TOP BINDER COURSE	(2.25")	1.0145	281	TONS		$88.71	/ TON	$0	
HMA LOWER BINDER COURSE	(4.00")	1.0289	507	TONS		$88.71	/ TON	$0	
HMA SHOULDER	(8.00")	0	0	TONS		$72.00	/ TON	$0	~
CURB & GUTTER			1,100	LIN FT	*	$30.00	/ LIN FT	$33,000	
SUBBASE GRAN MATL TY C (TONS)			0	TONS		$25.00	/ TON	$0	
IMPROVED SUBGRADE:	Aggregate	Width = 38.4	2,345	SQ YD		$7.00	/ SQ YD	$16,415	
Reserved For User Supplied Item			0	UNITS		$0.00	/ UNITS	$0	
Reserved For User Supplied Item			0	UNITS		$0.00	/ UNITS	$0	
PAVEMENT REMOVAL			2,200	SQ YD		$15.00	/ SQ YD	$33,000	
SHOULDER REMOVAL			0	SQ YD		$0.00	/ SQ YD	$0	

Note: * Denotes User Supplied Quantity

FLEXIBLE CONSTRUC	$177,279
FLEXIBLE CONSTRUC	$69,411

MAINTENANCE COSTS:

ITEM	THICKNESS		MATERIAL	T	UNIT COST		
ROUTINE MAINTENANCE ACTIVITY					$0.00	LANE-MILE / YEAR	
HMA OVERLAY PVMT SURF	(2.00")	1.0046	Surface M	2.00	$11.65	/ SQ YD	
HMA OVERLAY PVMT	(2.00")	1.0046		2.00	$11.65	/ SQ YD	
HMA SURFACE MIX	(2.00")	1.0046	Surface M	2.00	$11.65	/ SQ YD	
HMA BINDER MIX	(0.00")	1.0093	IL-9.5FG or I	0.00	$0.00	/ SQ YD	
HMA OVERLAY SHLD (Year 30)	(2.00")		Shoulder	2.00	$8.06	/ SQ YD	
HMA OVERLAY SHLD	(2.00")		Shoulder	2.00	$8.06	/ SQ YD	
MILLING (2.00 IN)				2.00	$3.00	/ SQ YD	
PARTIAL DEPTH PVMT PATCH	(Mill & Fill Surf)		Surface M	2.00	$81.60	/ SQ YD	
PARTIAL DEPTH SHLD PATCH	(Mill & Fill Surf)		Shoulder	2.00	$78.06	/ SQ YD	
PARTIAL DEPTH PVMT PATCH	(Mill & Fill +2.00 ")		Binder Mix	2.00	$80.77	/ SQ YD	
PARTIAL DEPTH SHLD PATCH	(Mill & Fill +2.00 ")		Shoulder	2.00	$78.06	/ 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% Reł	$2.00	/ LIN FT

FLEXIBLE TOTAL LIFE·	$236,027
FLEXIBLE TOTAL ANNI	$92,413

PCC PAVEMENT JPCP

ROUTE			McConnell Road		
SECTION			(104&105)WRS-9(13)		
COUNTY			McHenry		
LOCATION			at IL 47		
FACILITY TYPE			NON-INTERSTATE		
PROJECT LENGTH			550	FT = = >	0.10 Miles
# OF CENTERLINES			2	CL	
# OF LANES			3	LANES	
# OF EDGES			2	EP	
LANE WIDTH - AVERAGE			12	FT	
SHOULDER WIDTH	PCC	Left	0	FT	
	PCC	Right	0	FT	
	Total Width of Paved Shoulders		0	FT	
PAVEMENT THICKNESS (RIGID)		JPCP	8.25	IN	TIED SHLD
SHOULDER THICKNESS			8.25	IN	
HMA OVERLAY THICKNESS			2.75	IN	

RIGID PAVEMENT TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
	No Min	1.78	1.78

Worksheet Construction Type is Reconstruction The Pavement Type is JPCP

INITIAL COSTS

ITEM	THICKNESS		100% QUA	UNIT		UNIT PRICE		COST
JPC PAVEMENT	(8.25")		2,200	SQ YD		$61.74	/ SQ YD	$135,828
PAVEMENT REINFORCEMENT			0	SQ YD		$22.00	/ SQ YD	$0
STABILIZED SUBBASE	(4.00")		0	SQ YD	*	$19.00	/ SQ YD	$0
PCC SHOULDERS	(8.25" to 8.25")		0	SQ YD		$40.00	/ SQ YD	$0
CURB & GUTTER			1,100	LIN FT	*	$30.00	/ LIN FT	$33,000
SUBBASE GRAN MATL TY C	(~ 0.00")		0	TONS		$25.00	/ TON	$0
IMPROVED SUBGRADE:	Aggregate	Width = 37.0	2,261	SQ YD		$7.00	/ SQ YD	$15,827
Reserved For User Supplied Item			0	UNITS		$0.00	/ UNITS	$0
Reserved For User Supplied Item			0	UNITS		$0.00	/ UNITS	$0
PAVEMENT REMOVAL			2,200	SQ YD		$15.00	/ SQ YD	$33,000
SHOULDER REMOVAL			0	SQ YD		$0.00	/ SQ YD	$0

Note: * Denotes User Supplied Quantity

RIGID CONSTRUCTION	$217,655
RIGID CONSTRUCTION	$85,220

MAINTENANCE COSTS:

ITEM	THICKNESS		MATERIAL	T	UNIT COST	
ROUTINE MAINTENANCE ACTIVITY					$0.00	/ LANE-MILE / YEAR
HMA OVERLAY	(2.75")			2.75		
HMA OVERLAY PAVEMENT	(2.75")	1.0064		2.75	$15.52	/ SQ YD
HMA SURFACE MIX	(1.50")	1.0035	Surface M	1.50	$8.73	/ SQ YD
HMA BINDER MIX	(1.25")	1.0098	IL-9.5FG or I	1.25	$6.80	/ SQ YD
HMA OVERLAY SHOULDER	(2.75")		Shoulder	2.75	$11.09	/ 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 M	1.50	$78.70	/ SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill HMA 2.75")			Surface M	2.75	$85.95	/ 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' /		$2.00	/ LIN FT

RIGID TOTAL LIFE-C	$254,319
RIGID TOTAL ANNUAL	$99,575

LIFE-CYCLE COST ANALYSIS: NEW DESIGN

Calculated / Re ######

			JPCP	HMA
CONSTRUCTION	INITIAL COST	PRESENT '	$217,655	$177,279
		ANNUAL C	$85,220	$69,411
MAINTENANCE	LIFE-CYCLE COST	PRESENT '	$36,664	$58,748
		ANNUAL C	$14,355	$23,002
TOTAL	LIFE-CYCLE COST	PRESENT '	$254,319	$236,027
		ANNUAL C	$99,575	$92,413

LIFE-CYCLE COST ANALYSIS: FINAL SUMMARY

LOWEST COST OPTION	=========	HMA	$92,413	
OTHER OPTIONS (LOWEST TO HIGHEST):	TYPE / PE	JPCP	$99,575	7.7%

S:\GEN\WPDOCS\Pavement Designs\D-1\IL 47 - 60X17\[McConnell Rd - BDE 5401.xlsm]PDFSheets

FULL-DEPTH HMA PAVEMENT
HMA PAVEMENT OVER RUBBLIZED PCC PAVEMENT
Figure 54-7.C
STANDARD DESIGN

MAINTENANC	ITEM	%	QUANTITY	UNIT	UNIT COST		COST	PRESENT WORTH
YEAR 5								
	LONG SHLD JT R&S	100.00%	1,100	LIN FT	$2.00		$2,200	
	CNTR LINE JOINT R&S	100.00%	1,100	LIN FT	$2.00		$2,200	
	RNDM / THRM CRACK R&S	50.00%	908	LIN FT	$2.00		$1,816	
	PD PVMT PATCH M&F SURF	0.10%	2	SQ YD	$81.60		$163	
	PWFn =	0.8626		PW =	0.8626	X	$6,379	$5,503
YEAR 10								
	LONG SHLD JT R&S	100.00%	1,100	LIN FT	$2.00		$2,200	
	CNTR LINE JOINT R&S	100.00%	1,100	LIN FT	$2.00		$2,200	
	RNDM / THRM CRACK R&S	50.00%	908	LIN FT	$2.00		$1,816	
	PD PVMT PATCH M&F SURF	0.50%	11	SQ YD	$81.60		$898	
	PWFn =	0.7441		PW =	0.7441	X	$7,114	$5,293
YEAR 15								
	MILL PVMT & SHLD 2.00"	100.00%	2,200	SQ YD	$3.00		$6,600	
	PD PVMT PATCH M&F ADD'L 2.00"	1.00%	22	SQ YD	$80.77		$1,777	
	HMA OVERLAY PVMT 2.00"	100.00%	2,200	SQ YD	$11.65		$25,633	
	HMA OVERLAY SHLD 2.00 "	100.00%	0	SQ YD	$8.06		$0	
	PWFn =	0.6419		PW =	0.6419	X	$34,010	$21,830
YEAR 20								
	LONG SHLD JT R&S	100.00%	1,100	LIN FT	$2.00		$2,200	
	CNTR LINE JOINT R&S	100.00%	1,100	LIN FT	$2.00		$2,200	
	RNDM / THRM CRACK R&S	50.00%	908	LIN FT	$2.00		$1,816	
	PD PVMT PATCH M&F SURF	0.10%	2	SQ YD	$81.60		$163	
	PWFn =	0.5537		PW =	0.5537	X	$6,379	$3,532
YEAR 25								
	LONG SHLD JT R&S	100.00%	1,100	LIN FT	$2.00		$2,200	
	CNTR LINE JOINT R&S	100.00%	1,100	LIN FT	$2.00		$2,200	
	RNDM / THRM CRACK R&S	50.00%	908	LIN FT	$2.00		$1,816	
	PD PVMT PATCH M&F SURF	0.50%	11	SQ YD	$81.60		$898	
	PWFn =	0.4776		PW =	0.4776	X	$7,114	$3,398
	HMA_SD							
YEAR 30	NON-INTERSTATE							
	MILL PVMT & SHLD 2.00"	100.00%	2,200	SQ YD	$3.00		$6,600	
	PD PVMT PATCH M&F ADD'L 2.00"	2.00%	44	SQ YD	$80.77		$3,554	
	PD SHLD PATCH M&F ADD'L 2.00"	1.00%	0	SQ YD	$78.06		$0	
	HMA OVERLAY PVMT 2.00 "	100.00%	2,200	SQ YD	$11.65		$25,633	
	HMA OVERLAY SHLD 2.00 "	100.00%	0	SQ YD	$8.06		$0	
	PWFn =	0.4120		PW =	0.4120	X	$35,787	$14,744
YEAR 35								
	LONG SHLD JT R&S	100.00%	1,100	LIN FT	$2.00		$2,200	
	CNTR LINE JOINT R&S	100.00%	1,100	LIN FT	$2.00		$2,200	
	RNDM / THRM CRACK R&S	50.00%	908	LIN FT	$2.00		$1,816	
	PD PVMT PATCH M&F SURF	0.10%	2	SQ YD	$81.60		$163	
	PWFn =	0.3554		PW =	0.3554	X	$6,379	$2,267
YEAR 40								
	LONG SHLD JT R&S	100.00%	1,100	LIN FT	$2.00		$2,200	
	CNTR LINE JOINT R&S	100.00%	1,100	LIN FT	$2.00		$2,200	
	RNDM / THRM CRACK R&S	50.00%	908	LIN FT	$2.00		$1,816	
	PD PVMT PATCH M&F SURF	0.50%	11	SQ YD	$81.60		$898	
	PWFn =	0.3066		PW =	0.3066	X	$7,114	$2,181
								$58,748
	ROUTINE MAINTENANCE ACTIVITY		0.31	Lane Miles	0.00		$0	$0
							MAINTENANCE	$58,748
	45 YEAR LIFE CYCLE CRFn = 0.0407852						MAINTENANCE	$23,002

JPCP MAINTENANCE AND REHABILITATION ACTIVITY SCHEDULE 02/23/21
-

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

MAINTENANC	ITEM	%	QUANTITY	UNIT	UNIT COST		COST	PRESENT WORTH
YEAR 10								
	PAVEMENT PATCH CLASS B	0.10%	2	SQ YD	$150.00		$300	
	PWFn =	0.7441		PW =	0.7441	X	$300	$223
YEAR 15								
	PAVEMENT PATCH CLASS B	0.20%	4	SQ YD	$150.00		$600	
	PWFn =	0.6419		PW =	0.6419	X	$600	$385
YEAR 20								
	PAVEMENT PATCH CLASS B	2.00%	44	SQ YD	$150.00		$6,600	
	SHOULDER PATCH CLASS C	0.50%	0	SQ YD	$145.00		$0	
	LONGITUDINAL SHLD JT R&S	100.00%	1,100	LIN FT	$2.00		$2,200	
	CENTERLINE JT R&S	100.00%	1,100	LIN FT	$2.00		$2,200	
	PWFn =	0.5537		PW =	0.5537	X	$11,000	$6,090
YEAR 25								
	PAVEMENT PATCH CLASS B	3.00%	66	SQ YD	$150.00		$9,900	
	SHOULDER PATCH CLASS C	1.00%	0	SQ YD	$145.00		$0	
	PWFn =	0.4776		PW =	0.4776	X	$9,900	$4,728
YEAR 30	NON-INTERSTATE							
	PAVEMENT PATCH CLASS B	4.00%	88	SQ YD	$150.00		$13,200	
	SHOULDER PATCH CLASS C	1.50%	0	SQ YD	$145.00		$0	
	HMA OVERLAY 2.75" (PVMT)	100.00%	2,200	SQ YD	$15.52		$34,152	
	HMA OVERLAY 2.75" (SHLD)	100.00%	0	SQ YD	$11.09		$0	
	PWFn =	0.4120		PW =	0.4120	X	$47,352	$19,508
YEAR 35	NON-INTERSTATE							
	LONGITUDINAL SHLD JT R&S	100.00%	1,100	LIN FT	$2.00		$2,200	
	CENTERLINE JT R&S	100.00%	1,100	LIN FT	$2.00		$2,200	
	RANDOM CRACK R&S	50.00%	825	LIN FT	$2.00		$1,650	
	REFLECTIVE TRANSVERSE CRACK R&S	40.00%	533	LIN FT	$2.00		$1,066	
	PD PVMT PATCH M&F HMA 2.75"	0.10%	2	SQ YD	$85.95		$172	
	PWFn =	0.3554		PW =	0.3554	X	$7,288	$2,590
YEAR 40	NON-INTERSTATE							
	PAVEMENT PATCH CLASS B	0.50%	11	SQ YD	$150.00		$1,650	
	LONGITUDINAL SHLD JT R&S	100.00%	1,100	LIN FT	$2.00		$2,200	
	CENTERLINE JT R&S	100.00%	1,100	LIN FT	$2.00		$2,200	
	REFLECTIVE TRANSVERSE CRACK R&S	60.00%	799	LIN FT	$2.00		$1,598	
	RANDOM CRACK R&S	50.00%	825	LIN FT	$2.00		$1,650	
	PD PVMT PATCH M&F HMA 2.75"	0.50%	11	SQ YD	$85.95		$945	
	PWFn =	0.3066		PW =	0.3066	X	$10,243	$3,140
								$36,664
	ROUTINE MAINTENANCE ACTIVITY		0.31	Lane Miles	$0.00		$0	$0
							MAINTENANCE	$36,664
	45 YEAR LIFE CYCLE CRFn = 0.0407852						MAINTENANCE	$14,355

BDE 5401 Template (Rev. 11/22/2019) **IDOT MECHANISTIC PAVEMENT DESIGN** Printed: 02/23/2021

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

Route:	Lake Avenue	Comments:	60X17 - IL 47 (US 14 to IL 120) Reconstruction		
Section:	(104&105)WRS-9(13)				
County:	McHenry	Design Date:	11/20/2020	ONP	<-- BY
Location:	at IL 47	Modify Date:			<-- BY

	ADT	Year
Current:	13,200	2018
Future:	18,000	2040

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
Subgrade Support Rating (SSR):	Poor
Construction Year:	2023
Design Period (DP) =	20 years

	Structural Design Traffic			
	Minimum ADT	Actual ADT	Actual %of Total ADT	% of ADT in Design Lane
PV =	0	15,155	92.0%	P = 50%
SU =	250	988	6.0%	S = 50%
MU =	750	329	2.0%	M = 50%
Struct. Design ADT =		16,473	(2033)	

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) =	2.40	(Actual ADT)	TF rigid (Actual) =	3.23	(Actual ADT)
TF flexible (Min) =	3.17	(Min ADT Fig. 54-2.C)	TF rigid (Min) =	4.59	(Min ADT Fig. 54-2.C)

NEW CONSTRUCTION / RECONSTRUCTION PAVEMENT DESIGN CALCULATIONS

Full-Depth HMA Pavement

	Use TF flexible =	3.17	
	PG Grade Lower Binder Lifts =	PG 64-22	(Fig. 53-4.O)
Goto Map	HMA Mixture Temp. =	73.5	deg. F (Fig. 54-5.C)
	Design HMA Mixture Modulus (E_{HMA}) =	740	ksi (Fig. 54-5.D)
	Design HMA Strain (ε_{HMA}) =	86	(Fig. 54-5.E)
Goto Map	Full Depth HMA Design Thickness =	9.75	in. (Fig. 54-5.F)
	Limiting Strain Criterion Thickness =	14.25	in. (Fig. 54-5.I)
	Use Full-Depth HMA Thickness =	**9.75**	**inches**

JPC Pavement

Use TF rigid =	4.59	
Edge Support =	Tied	Shoulder or C&G
Rigid Pavt Thick. =	**9.00**	**in. (Fig. 54-4.E)**

CRC Pavement

Use TF rigid =	4.59	
IBR value =	3	
CRCP Thickness =	**7.75**	**in. (Fig. 54-4.N)**

TF MUST BE > 60 FOR CRCP

RECONSTRUCTION ONLY (SUPPLEMENTAL) PAVEMENT DESIGN CALCULATIONS

HMA Pavement Over Rubblized PCC

	Use TF flexible =	3.17	
	HMA Overlay Design Thickness =	7.25	in. (Fig. 54-5.U)
Goto Map	Limiting Strain Criterion Thickness =		in. (Fig. 54-5.V)
	Use HMA Overlay Thickness =	**999.00**	**inches**

Unbonded Concrete Overlay

Review 54-4.03 for limitations and special considerations.

JPCP Thickness = NA inches

CONTACT RESEARCH 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)

	Min. Str. Design Traffic (Fig 54-2.C)		
Facility Type	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 Table for One-Way Streets	
ADT	Class
0 - 3500	II
>3501	I

	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)					
	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%

BDE 5401 Template (Rev. 11/22/2019) Printed: 02/23/2021
LIFE-CYCLE COST ANALYSIS: NEW CONSTRUCTION / RECONSTRUCTION

FULL-DEPTH HMA PAVEMENT Standard Design

ROUTE	Job Route					
SECTION	Job Section					
COUNTY	Job County					
LOCATION	Job Location					
FACILITY TYPE			INTERSTATE			
PROJECT LENGTH			1000	FT = = >	0.19	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)			12.00	IN	17.00	IN MAX
SHOULDER THICKNESS			8.00	IN	HMA_SD	Standard Design
HMA OVERLAY THICKNESS			3.75	IN		

FLEX PAVEMENT TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
	7.11	1.00	7.11

Read Me!

HMA COST PER TON	UNIT PRICE
HMA SURFACE	$95.00 / TON
HMA TOP BINDER	$95.00 / TON
HMA LOWER BINDER	$80.00 / TON
HMA BINDER (IL-9.5FG or IL-4.75)	$85.00 / TON
HMA SHOULDER	$72.00 / TON

INITIAL COSTS

ITEM	THICKNESS		100% QUAI	UNIT	UNIT PRICE	COST	
HMA PAVEMENT (FULL-DEPTH)	(12.00")	5333	5,333	SQ YD	$59.62 / SQ YD	$317,988	~
HMA SURFACE COURSE	(2.00")	1.0069	601	TONS	$95.00 / TON	$0	
HMA TOP BINDER COURSE	(2.25")	1.0217	687	TONS	$95.00 / TON	$0	
HMA LOWER BINDER COURSE	(7.75")	1.0564	2,445	TONS	$80.00 / TON	$0	
HMA SHOULDER	(8.00")	3556	1,593	TONS	$72.00 / TON	$114,688	~
CURB & GUTTER			0	LIN FT	$30.00 / LIN FT	$0	
SUBBASE GRAN MATL TY C (TONS)			499	TONS	$25.00 / TON	$12,475	
IMPROVED SUBGRADE:	Modified Soil Width = 86.0		9,556	SQ YD	$7.00 / SQ YD	$66,892	
Reserved For User Supplied Item			0	UNITS	$0.00 / UNITS	$0	
Reserved For User Supplied Item			0	UNITS	$0.00 / UNITS	$0	
PAVEMENT REMOVAL			5,333	SQ YD	$0.00 / SQ YD	$0	
SHOULDER REMOVAL			3,556	SQ YD	$0.00 / SQ YD	$0	

Note: * Denotes User Supplied Quantity

FLEXIBLE CONSTRUC	$512,043
FLEXIBLE CONSTRUC	$110,266

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 M	2.00	$10.71	/ SQ YD
HMA OVERLAY PVMT	(3.75")	1.0130		3.75	$20.21	/ SQ YD
HMA SURFACE MIX	(1.50")	1.0052	Surface M	1.50	$8.02	/ SQ YD
HMA BINDER MIX	(2.25")	1.0182	Top Binder M	2.25	$12.19	/ SQ YD
HMA OVERLAY SHLD (Year 30)	(1.75")		Shoulder	1.75	$7.06	/ SQ YD
HMA OVERLAY SHLD	(2.00")		Shoulder	2.00	$8.06	/ SQ YD
MILLING (2.00 IN)				2.00	$3.00	/ SQ YD
PARTIAL DEPTH PVMT PATCH	(Mill & Fill Surf)		Surface M	2.00	$80.64	/ SQ YD
PARTIAL DEPTH SHLD PATCH	(Mill & Fill Surf)		Shoulder	2.00	$78.06	/ SQ YD
PARTIAL DEPTH PVMT PATCH	(Mill & Fill +2.00 ")		Binder Mix	2.00	$79.52	/ SQ YD
PARTIAL DEPTH SHLD PATCH	(Mill & Fill +2.00 ")		Shoulder	2.00	$78.06	/ 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% Reł	$2.00	/ LIN FT

FLEXIBLE TOTAL LIFE·	$711,101
FLEXIBLE TOTAL ANNI	$153,133

PCC PAVEMENT JPCP

ROUTE			Job Route			
SECTION			Job Section			
COUNTY			Job County			
LOCATION			Job Location			
FACILITY TYPE			INTERSTATE			
PROJECT LENGTH			1000	FT = = >	0.19	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)		JPCP	10.00	IN	TIED SHLD	
SHOULDER THICKNESS			10.00	IN		
HMA OVERLAY THICKNESS			3.75	IN		

RIGID PAVEMENT TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
	10.05	1.00	10.05

Worksheet Construction Type is New Construction The Pavement Type is JPCP

INITIAL COSTS

ITEM	THICKNESS	100% QUA	UNIT	UNIT PRICE	COST
JPC PAVEMENT	(10.00")	5,333	SQ YD	$50.00 / SQ YD	$266,650
PAVEMENT REINFORCEMENT		0	SQ YD	$22.00 / SQ YD	$0
STABILIZED SUBBASE	(4.00")	6,000	SQ YD	$19.00 / SQ YD	$114,000
PCC SHOULDERS	(10.00" to 10.00")	3,556	SQ YD	$40.00 / SQ YD	$142,240
CURB & GUTTER		0	LIN FT	$30.00 / LIN FT	$0
SUBBASE GRAN MATL TY C	(~ 3.48")	418	TONS	$25.00 / TON	$10,450
IMPROVED SUBGRADE:	Modified Soil Width = 82.0	9,111	SQ YD	$7.00 / SQ YD	$63,777
Reserved For User Supplied Item		0	UNITS	$0.00 / UNITS	$0
Reserved For User Supplied Item		0	UNITS	$0.00 / UNITS	$0
PAVEMENT REMOVAL		5,333	SQ YD	$0.00 / SQ YD	$0
SHOULDER REMOVAL		3,556	SQ YD	$0.00 / SQ YD	$0

Note: * Denotes User Supplied Quantity

RIGID CONSTRUCTION	$597,117
RIGID CONSTRUCTION	$128,587

MAINTENANCE COSTS:

ITEM	THICKNESS		MATERIAL	T	UNIT COST
ROUTINE MAINTENANCE ACTIVITY					$0.00 / LANE-MILE / YEAR
HMA OVERLAY	(3.75")			3.75	
HMA OVERLAY PAVEMENT	(3.75")	1.0130		3.75	$20.21 / SQ YD
HMA SURFACE MIX	(1.50")	1.0052	Surface M	1.50	$8.02 / SQ YD
HMA BINDER MIX	(2.25")	1.0182	Top Binder M	2.25	$12.19 / SQ YD
HMA OVERLAY SHOULDER	(3.75")		Shoulder	3.75	$15.12 / 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 M	1.50	$77.98 / SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill HMA 1.50")			Surface M	1.50	$77.98 / SQ YD
LONGITUDINAL SHOULDER JOINT ROUT & SEAL					$2.00 / LIN FT
CENTERLINE JOINT ROUT & SEAL					$2.00 / LIN FT
REFLECTIVE TRANSVERSE CRACK ROUT & SEAL					$2.00 / LIN FT
RANDOM CRACK ROUT & SEAL			(100% Rehab = 100.00' /		$2.00 / LIN FT

RIGID TOTAL LIFE-C	$727,263
RIGID TOTAL ANNUAL	$156,613

LIFE-CYCLE COST ANALYSIS: NEW DESIGN

Calculated / Re ######

			JPCP	HMA
CONSTRUCTION	INITIAL COST	PRESENT '	$597,117	$512,043
		ANNUAL C	$128,587	$110,266
MAINTENANCE	LIFE-CYCLE COST	PRESENT '	$130,146	$199,058
		ANNUAL C	$28,026	$42,866
TOTAL	LIFE-CYCLE COST	PRESENT '	$727,263	$711,101
		ANNUAL C	$156,613	$153,133

LIFE-CYCLE COST ANALYSIS: FINAL SUMMARY

LOWEST COST OPTION	=========	HMA	$153,133	
OTHER OPTIONS (LOWEST TO HIGHEST):	TYPE / PE	JPCP	$156,613	2.3%

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HMA_SD

MAINTENANCE AND REHABILITATION ACTIVITY SCHEDULE

02/23/21

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FULL-DEPTH HMA PAVEMENT
HMA PAVEMENT OVER RUBBLIZED PCC PAVEMENT
Figure 54-7.C
STANDARD DESIGN

MAINTENANC		ITEM	%	QUANTITY	UNIT	UNIT COST		COST	PRESENT WORTH
YEAR	5								
		LONG SHLD JT R&S	100.00%	4,000	LIN FT	$2.00		$8,000	
		CNTR LINE JOINT R&S	100.00%	2,000	LIN FT	$2.00		$4,000	
		RNDM / THRM CRACK R&S	50.00%	2,200	LIN FT	$2.00		$4,400	
		PD PVMT PATCH M&F SURF	0.10%	5	SQ YD	$80.64		$403	
		PWFn =	0.8626		PW =	0.8626	X	$16,803	$14,494
YEAR	10								
		LONG SHLD JT R&S	100.00%	4,000	LIN FT	$2.00		$8,000	
		CNTR LINE JOINT R&S	100.00%	2,000	LIN FT	$2.00		$4,000	
		RNDM / THRM CRACK R&S	50.00%	2,200	LIN FT	$2.00		$4,400	
		PD PVMT PATCH M&F SURF	0.50%	27	SQ YD	$80.64		$2,177	
		PWFn =	0.7441		PW =	0.7441	X	$18,577	$13,823
YEAR	15								
		MILL PVMT & SHLD 2.00"	100.00%	8,889	SQ YD	$3.00		$26,667	
		PD PVMT PATCH M&F ADD'L 2.00"	1.00%	53	SQ YD	$79.52		$4,215	
		HMA OVERLAY PVMT 2.00"	100.00%	5,333	SQ YD	$10.71		$57,141	
		HMA OVERLAY SHLD 2.00 "	100.00%	3,556	SQ YD	$8.06		$28,672	
		PWFn =	0.6419		PW =	0.6419	X	$116,695	$74,902
YEAR	20								
		LONG SHLD JT R&S	100.00%	4,000	LIN FT	$2.00		$8,000	
		CNTR LINE JOINT R&S	100.00%	2,000	LIN FT	$2.00		$4,000	
		RNDM / THRM CRACK R&S	50.00%	2,200	LIN FT	$2.00		$4,400	
		PD PVMT PATCH M&F SURF	0.10%	5	SQ YD	$80.64		$403	
		PWFn =	0.5537		PW =	0.5537	X	$16,803	$9,303
YEAR	25								
		LONG SHLD JT R&S	100.00%	4,000	LIN FT	$2.00		$8,000	
		CNTR LINE JOINT R&S	100.00%	2,000	LIN FT	$2.00		$4,000	
		RNDM / THRM CRACK R&S	50.00%	2,200	LIN FT	$2.00		$4,400	
		PD PVMT PATCH M&F SURF	0.50%	27	SQ YD	$80.64		$2,177	
		PWFn =	0.4776		PW =	0.4776	X	$18,577	$8,872
		HMA_SD							
YEAR	30	INTERSTATE							
		MILL PVMT ONLY 2.00"	100.00%	5,333	SQ YD	$3.00		$15,999	
		PD PVMT PATCH M&F ADD'L 2.00"	2.00%	107	SQ YD	$79.52		$8,509	
		PD SHLD PATCH M&F SURF 2.00"	1.00%	36	SQ YD	$78.06		$2,810	
		HMA OVERLAY PVMT 3.75 "	100.00%	5,333	SQ YD	$20.21		$107,785	
		HMA OVERLAY SHLD 1.75 "	100.00%	3,556	SQ YD	$7.06		$25,088	
		PWFn =	0.4120		PW =	0.4120	X	$160,191	$65,997
YEAR	35								
		LONG SHLD JT R&S	100.00%	4,000	LIN FT	$2.00		$8,000	
		CNTR LINE JOINT R&S	100.00%	2,000	LIN FT	$2.00		$4,000	
		RNDM / THRM CRACK R&S	50.00%	2,200	LIN FT	$2.00		$4,400	
		PD PVMT PATCH M&F SURF	0.10%	5	SQ YD	$80.64		$403	
		PWFn =	0.3554		PW =	0.3554	X	$16,803	$5,972
YEAR	40								
		LONG SHLD JT R&S	100.00%	4,000	LIN FT	$2.00		$8,000	
		CNTR LINE JOINT R&S	100.00%	2,000	LIN FT	$2.00		$4,000	
		RNDM / THRM CRACK R&S	50.00%	2,200	LIN FT	$2.00		$4,400	
		PD PVMT PATCH M&F SURF	0.50%	27	SQ YD	$80.64		$2,177	
		PWFn =	0.3066		PW =	0.3066	X	$18,577	$5,695
									$199,058
		ROUTINE MAINTENANCE ACTIVITY		0.76	Lane Miles	0.00		$0	$0
								MAINTENANCE	$199,058
	45	YEAR LIFE CYCLE CRFn = 0.0407852						MAINTENANCE	$42,866

JPCP MAINTENANCE AND REHABILITATION ACTIVITY SCHEDULE 02/23/21
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JOINTED PLAIN CONCRETE PAVEMENT
UNBONDED JOINTED PLAIN CONCRETE OVERLAY
Figure 54-7.A

MAINTENANC	ITEM	%	QUANTITY	UNIT	UNIT COST		COST	PRESENT WORTH
YEAR 10								
	PAVEMENT PATCH CLASS B	0.10%	5	SQ YD	$150.00		$750	
	PWFn =	0.7441		PW =	0.7441	X	$750	$558
YEAR 15								
	PAVEMENT PATCH CLASS B	0.20%	11	SQ YD	$150.00		$1,650	
	PWFn =	0.6419		PW =	0.6419	X	$1,650	$1,059
YEAR 20								
	PAVEMENT PATCH CLASS B	2.00%	107	SQ YD	$150.00		$16,050	
	SHOULDER PATCH CLASS C	0.50%	18	SQ YD	$145.00		$2,610	
	LONGITUDINAL SHLD JT R&S	100.00%	4,000	LIN FT	$2.00		$8,000	
	CENTERLINE JT R&S	100.00%	2,000	LIN FT	$2.00		$4,000	
	PWFn =	0.5537		PW =	0.5537	X	$30,660	$16,976
YEAR 25								
	PAVEMENT PATCH CLASS B	3.00%	160	SQ YD	$150.00		$24,000	
	SHOULDER PATCH CLASS C	1.00%	36	SQ YD	$145.00		$5,220	
	PWFn =	0.4776		PW =	0.4776	X	$29,220	$13,956
YEAR 30	INTERSTATE							
	PAVEMENT PATCH CLASS B	4.00%	213	SQ YD	$150.00		$31,950	
	SHOULDER PATCH CLASS C	1.50%	53	SQ YD	$145.00		$7,685	
	HMA OVERLAY 3.75" (PVMT)	100.00%	5,333	SQ YD	$20.21		$107,785	
	HMA OVERLAY 3.75" (SHLD)	100.00%	3,556	SQ YD	$15.12		$53,760	
	PWFn =	0.4120		PW =	0.4120	X	$201,180	$82,883
YEAR 35	INTERSTATE							
	LONGITUDINAL SHLD JT R&S	100.00%	4,000	LIN FT	$2.00		$8,000	
	CENTERLINE JT R&S	100.00%	2,000	LIN FT	$2.00		$4,000	
	RANDOM CRACK R&S	50.00%	2,000	LIN FT	$2.00		$4,000	
	REFLECTIVE TRANSVERSE CRACK R&S	40.00%	1,286	LIN FT	$2.00		$2,572	
	PD PVMT PATCH M&F HMA SURF 1.50"	0.10%	5	SQ YD	$77.98		$390	
	PWFn =	0.3554		PW =	0.3554	X	$18,962	$6,739
YEAR 40	INTERSTATE							
	PAVEMENT PATCH CLASS B	0.50%	27	SQ YD	$150.00		$4,050	
	LONGITUDINAL SHLD JT R&S	100.00%	4,000	LIN FT	$2.00		$8,000	
	CENTERLINE JT R&S	100.00%	2,000	LIN FT	$2.00		$4,000	
	REFLECTIVE TRANSVERSE CRACK R&S	60.00%	1,930	LIN FT	$2.00		$3,860	
	RANDOM CRACK R&S	50.00%	2,000	LIN FT	$2.00		$4,000	
	PD PVMT PATCH M&F HMA SURF 1.50"	0.50%	27	SQ YD	$77.98		$2,105	
	PWFn =	0.3066		PW =	0.3066	X	$26,015	$7,975
								$130,146
	ROUTINE MAINTENANCE ACTIVITY		0.76	Lane Miles	$0.00		$0	$0
							MAINTENANCE	$130,146
	45 YEAR LIFE CYCLE CRFn = 0.0407852						MAINTENANCE	$28,026

BDE 5401 Template (Rev. 11/22/2019) **IDOT MECHANISTIC PAVEMENT DESIGN** Printed: 02/23/2021

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

Route:	Southview Drive	Comments:	60X17 - IL 47 (US 14 to IL 120) Reconstruction			
Section:	(104&105)WRS-9(13)					
County:	McHenry	Design Date:	11/20/2020	ONP	<-- BY	
Location:	at IL 47	Modify Date:			<-- BY	

	ADT	Year
Current:	1,500	2018
Future:	2,000	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:	III
Subgrade Support Rating (SSR):	Poor
Construction Year:	2023
Design Period (DP) =	20 years

	Structural Design Traffic			
	Minimum ADT	Actual ADT	Actual %of Total ADT	% of ADT in Design Lane
PV =	No Min	1,620	88.0%	P = 50%
SU =	No Min	129	7.0%	S = 50%
MU =	No Min	92	5.0%	M = 50%
Struct. Design ADT =		1,841	(2033)	

TRAFFIC FACTOR CALCULATION

FLEXIBLE PAVEMENT			RIGID PAVEMENT		
Cpv =	0.15		Cpv =	0.15	
Csu =	109.14		Csu =	129.58	
Cmu =	384.35		Cmu =	562.47	
TF flexible (Actual) =	0.50	(Actual ADT)	TF rigid (Actual) =	0.69	(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

	Use TF flexible =	0.50	Per BDE 54-5.01(i)-1g
	PG Grade Lower Binder Lifts =	PG 64-22	(Fig. 53-4.O)
Goto Map	HMA Mixture Temp. =	73.5	deg. F (Fig. 54-5.C)
	Design HMA Mixture Modulus (E_{HMA}) =	740	ksi (Fig. 54-5.D)
	Design HMA Strain (ε_{HMA}) =	147	(Fig. 54-5.E)
	Full Depth HMA Design Thickness =	7.00	in. (Fig. 54-5.F)
Goto Map	Limiting Strain Criterion Thickness =	14.25	in. (Fig. 54-5.I)
	Use Full-Depth HMA Thickness =	**7.00**	**inches**

JPC Pavement

Use TF rigid =	0.69	
Edge Support =	Tied	Shoulder or C&G
Rigid Pavt Thick. =	**7.75**	**in. (Fig. 54-4.E)**

CRC Pavement

Use TF rigid =	0.69	
IBR value =	3	
CRCP Thickness =	**5.75**	**in. (Fig. 54-4.N)**

TF MUST BE > 60 FOR CRCP

RECONSTRUCTION ONLY (SUPPLEMENTAL) PAVEMENT DESIGN CALCULATIONS

HMA Pavement Over Rubblized PCC

	Use TF flexible =	0.50	
	HMA Overlay Design Thickness =	4.75	in. (Fig. 54-5.U)
Goto Map	Limiting Strain Criterion Thickness =		in. (Fig. 54-5.V)
	Use HMA Overlay Thickness =	**999.00**	**inches**

Unbonded Concrete Overlay

Review 54-4.03 for limitations and special considerations.

JPCP Thickness = NA inches

CONTACT RESEARCH 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)

	Min. Str. Design Traffic (Fig 54-2.C)		
Facility Type	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 Table for One-Way Streets	
ADT	Class
0 - 3500	II
>3501	I

	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)					
	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%

BDE 5401 Template (Rev. 11/22/2019) Printed: 02/23/2021
LIFE-CYCLE COST ANALYSIS: NEW CONSTRUCTION / RECONSTRUCTION

FULL-DEPTH HMA PAVEMENT Standard Design

ROUTE	Southview Drive
SECTION	(104&105)WRS-9(13)
COUNTY	McHenry
LOCATION	at IL 47

FACILITY TYPE NON-INTERSTATE

PROJECT LENGTH			450	FT = = >	0.09	Miles
# OF CENTERLINES			2	CL		
# OF LANES			3	LANES		
# OF EDGES			2	EP		
LANE WIDTH - AVERAGE			12	FT		
SHOULDER WIDTH	HMA	Left	0	FT		
	HMA	Right	0	FT		
	Total Width of Paved Shoulders		0	FT		

PAVEMENT THICKNESS (FLEXIBLE)	7.00	IN	14.25	IN MAX
SHOULDER THICKNESS	8.00	IN	HMA_SD	Standard Design
HMA OVERLAY THICKNESS	2.00	IN		

FLEX PAVEMENT TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
	No Min	0.50	0.50

Read Me!

HMA COST PER TON	UNIT PRICE	
HMA SURFACE	$158.25	/ TON
HMA TOP BINDER	$102.15	/ TON
HMA LOWER BINDER	$102.15	/ TON
HMA BINDER (IL-9.5FG or IL-4.75)	$130.20	/ TON
HMA SHOULDER	$72.00	/ TON

INITIAL COSTS

ITEM	THICKNESS		100% QUAI	UNIT		UNIT PRICE		COST	
HMA PAVEMENT (FULL-DEPTH)	(7.00")	1800	1,800	SQ YD	*	$46.78	/ SQ YD	$84,204	~
HMA SURFACE COURSE	(2.00")	1.0046	203	TONS		$158.25	/ TON	$0	
HMA TOP BINDER COURSE	(2.25")	1.0145	230	TONS		$102.15	/ TON	$0	
HMA LOWER BINDER COURSE	(2.75")	1.0260	284	TONS		$102.15	/ TON	$0	
HMA SHOULDER	(8.00")	0	0	TONS		$72.00	/ TON	$0	~
CURB & GUTTER			900	LIN FT	*	$30.00	/ LIN FT	$27,000	
SUBBASE GRAN MATL TY C (TONS)			0	TONS		$25.00	/ TON	$0	
IMPROVED SUBGRADE:	Aggregate	Width = 38.2	1,908	SQ YD		$7.00	/ SQ YD	$13,356	
Reserved For User Supplied Item			0	UNITS		$0.00	/ UNITS	$0	
Reserved For User Supplied Item			0	UNITS		$0.00	/ UNITS	$0	
PAVEMENT REMOVAL			1,800	SQ YD		$15.00	/ SQ YD	$27,000	
SHOULDER REMOVAL			0	SQ YD		$0.00	/ SQ YD	$0	

Note: * Denotes User Supplied Quantity

FLEXIBLE CONSTRUC	$151,560
FLEXIBLE CONSTRUC	$72,528

MAINTENANCE COSTS:

ITEM	THICKNESS		MATERIAL	T	UNIT COST		
ROUTINE MAINTENANCE ACTIVITY					$0.00	LANE-MILE / YEAR	
HMA OVERLAY PVMT SURF	(2.00")	1.0046	Surface M	2.00	$17.81	/ SQ YD	
HMA OVERLAY PVMT	(2.00")	1.0046		2.00	$17.81	/ SQ YD	
HMA SURFACE MIX	(2.00")	1.0046	Surface M	2.00	$17.81	/ SQ YD	
HMA BINDER MIX	(0.00")	1.0093	IL-9.5FG or I	0.00	$0.00	/ SQ YD	
HMA OVERLAY SHLD (Year 30)	(2.00")		Shoulder	2.00	$8.06	/ SQ YD	
HMA OVERLAY SHLD	(2.00")		Shoulder	2.00	$8.06	/ SQ YD	
MILLING (2.00 IN)				2.00	$3.00	/ SQ YD	
PARTIAL DEPTH PVMT PATCH	(Mill & Fill Surf)		Surface M	2.00	$87.72	/ SQ YD	
PARTIAL DEPTH SHLD PATCH	(Mill & Fill Surf)		Shoulder	2.00	$78.06	/ SQ YD	
PARTIAL DEPTH PVMT PATCH	(Mill & Fill +2.00 ")		Binder Mix	2.00	$84.58	/ SQ YD	
PARTIAL DEPTH SHLD PATCH	(Mill & Fill +2.00 ")		Shoulder	2.00	$78.06	/ 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% Reh	$2.00	/ LIN FT

FLEXIBLE TOTAL LIFE-	$211,559
FLEXIBLE TOTAL ANNI	$101,241

PCC PAVEMENT JPCP

ROUTE			Southview Drive		
SECTION			(104&105)WRS-9(13)		
COUNTY			McHenry		
LOCATION			at IL 47		
FACILITY TYPE			NON-INTERSTATE		
PROJECT LENGTH			450	FT = = >	0.09 Miles
# OF CENTERLINES			2	CL	
# OF LANES			3	LANES	
# OF EDGES			2	EP	
LANE WIDTH - AVERAGE			12	FT	
SHOULDER WIDTH	PCC	Left	0	FT	
	PCC	Right	0	FT	
	Total Width of Paved Shoulders		0	FT	
PAVEMENT THICKNESS (RIGID)		JPCP	7.75	IN	TIED SHLD
SHOULDER THICKNESS			7.75	IN	
HMA OVERLAY THICKNESS			2.75	IN	

RIGID PAVEMENT TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
	No Min	0.69	0.69

Worksheet Construction Type is Reconstruction The Pavement Type is JPCP

INITIAL COSTS

ITEM	THICKNESS	100% QUA	UNIT		UNIT PRICE		COST
JPC PAVEMENT	(7.75")	1,800	SQ YD		$62.09	/ SQ YD	$111,762
PAVEMENT REINFORCEMENT		0	SQ YD		$22.00	/ SQ YD	$0
STABILIZED SUBBASE	(4.00")	0	SQ YD	*	$19.00	/ SQ YD	$0
PCC SHOULDERS	(7.75" to 7.75")	0	SQ YD		$40.00	/ SQ YD	$0
CURB & GUTTER		900	LIN FT	*	$30.00	/ LIN FT	$27,000
SUBBASE GRAN MATL TY C	(~ 0.00")	0	TONS		$25.00	/ TON	$0
IMPROVED SUBGRADE:	Aggregate Width = 37.0	1,850	SQ YD		$7.00	/ SQ YD	$12,950
Reserved For User Supplied Item		0	UNITS		$0.00	/ UNITS	$0
Reserved For User Supplied Item		0	UNITS		$0.00	/ UNITS	$0
PAVEMENT REMOVAL		1,800	SQ YD		$15.00	/ SQ YD	$27,000
SHOULDER REMOVAL		0	SQ YD		$0.00	/ SQ YD	$0

Note: * Denotes User Supplied Quantity

RIGID CONSTRUCTION	$178,712
RIGID CONSTRUCTION	$85,522

MAINTENANCE COSTS:

ITEM	THICKNESS		MATERIAL	T	UNIT COST	
ROUTINE MAINTENANCE ACTIVITY					$0.00	/ LANE-MILE / YEAR
HMA OVERLAY	(2.75")			2.75		
HMA OVERLAY PAVEMENT	(2.75")	1.0064		2.75	$22.54	/ SQ YD
HMA SURFACE MIX	(1.50")	1.0035	Surface M	1.50	$13.34	/ SQ YD
HMA BINDER MIX	(1.25")	1.0098	IL-9.5FG or I	1.25	$9.20	/ SQ YD
HMA OVERLAY SHOULDER	(2.75")		Shoulder	2.75	$11.09	/ 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 M	1.50	$83.29	/ SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill HMA 2.75")			Surface M	2.75	$94.37	/ 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' /		$2.00	/ LIN FT

RIGID TOTAL LIFE-C	$214,061
RIGID TOTAL ANNUAL	$102,438

LIFE-CYCLE COST ANALYSIS: NEW DESIGN

Calculated / Re ######

			JPCP	HMA
CONSTRUCTION	INITIAL COST	PRESENT '	$178,712	$151,560
		ANNUAL C	$85,522	$72,528
MAINTENANCE	LIFE-CYCLE COST	PRESENT '	$35,349	$59,999
		ANNUAL C	$16,916	$28,712
TOTAL	LIFE-CYCLE COST	PRESENT '	$214,061	$211,559
		ANNUAL C	$102,438	$101,241

LIFE-CYCLE COST ANALYSIS: FINAL SUMMARY

LOWEST COST OPTION	=========	HMA	$101,241
OTHER OPTIONS (LOWEST TO HIGHEST):	TYPE / PE	JPCP	$102,438

1.2%

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HMA_SD

MAINTENANCE AND REHABILITATION ACTIVITY SCHEDULE

02/23/21

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FULL-DEPTH HMA PAVEMENT
HMA PAVEMENT OVER RUBBLIZED PCC PAVEMENT
Figure 54-7.C
STANDARD DESIGN

MAINTENANC	ITEM	%	QUANTITY	UNIT	UNIT COST		COST	PRESENT WORTH
YEAR 5								
	LONG SHLD JT R&S	100.00%	900	LIN FT	$2.00		$1,800	
	CNTR LINE JOINT R&S	100.00%	900	LIN FT	$2.00		$1,800	
	RNDM / THRM CRACK R&S	50.00%	743	LIN FT	$2.00		$1,486	
	PD PVMT PATCH M&F SURF	0.10%	2	SQ YD	$87.72		$175	
	PWFn =	0.8626		PW =	0.8626	X	$5,261	$4,538
YEAR 10								
	LONG SHLD JT R&S	100.00%	900	LIN FT	$2.00		$1,800	
	CNTR LINE JOINT R&S	100.00%	900	LIN FT	$2.00		$1,800	
	RNDM / THRM CRACK R&S	50.00%	743	LIN FT	$2.00		$1,486	
	PD PVMT PATCH M&F SURF	0.50%	9	SQ YD	$87.72		$790	
	PWFn =	0.7441		PW =	0.7441	X	$5,876	$4,372
YEAR 15								
	MILL PVMT & SHLD 2.00"	100.00%	1,800	SQ YD	$3.00		$5,400	
	PD PVMT PATCH M&F ADD'L 2.00"	1.00%	18	SQ YD	$84.58		$1,522	
	HMA OVERLAY PVMT 2.00"	100.00%	1,800	SQ YD	$17.81		$32,051	
	HMA OVERLAY SHLD 2.00 "	100.00%	0	SQ YD	$8.06		$0	
	PWFn =	0.6419		PW =	0.6419	X	$38,973	$25,015
YEAR 20								
	LONG SHLD JT R&S	100.00%	900	LIN FT	$2.00		$1,800	
	CNTR LINE JOINT R&S	100.00%	900	LIN FT	$2.00		$1,800	
	RNDM / THRM CRACK R&S	50.00%	743	LIN FT	$2.00		$1,486	
	PD PVMT PATCH M&F SURF	0.10%	2	SQ YD	$87.72		$175	
	PWFn =	0.5537		PW =	0.5537	X	$5,261	$2,913
YEAR 25								
	LONG SHLD JT R&S	100.00%	900	LIN FT	$2.00		$1,800	
	CNTR LINE JOINT R&S	100.00%	900	LIN FT	$2.00		$1,800	
	RNDM / THRM CRACK R&S	50.00%	743	LIN FT	$2.00		$1,486	
	PD PVMT PATCH M&F SURF	0.50%	9	SQ YD	$87.72		$790	
	PWFn =	0.4776		PW =	0.4776	X	$5,876	$2,806
	HMA_SD							
YEAR 30	NON-INTERSTATE							
	MILL PVMT & SHLD 2.00"	100.00%	1,800	SQ YD	$3.00		$5,400	
	PD PVMT PATCH M&F ADD'L 2.00"	2.00%	36	SQ YD	$84.58		$3,045	
	PD SHLD PATCH M&F ADD'L 2.00"	1.00%	0	SQ YD	$78.06		$0	
	HMA OVERLAY PVMT 2.00 "	100.00%	1,800	SQ YD	$17.81		$32,051	
	HMA OVERLAY SHLD 2.00 "	100.00%	0	SQ YD	$8.06		$0	
	PWFn =	0.4120		PW =	0.4120	X	$40,496	$16,684
YEAR 35								
	LONG SHLD JT R&S	100.00%	900	LIN FT	$2.00		$1,800	
	CNTR LINE JOINT R&S	100.00%	900	LIN FT	$2.00		$1,800	
	RNDM / THRM CRACK R&S	50.00%	743	LIN FT	$2.00		$1,486	
	PD PVMT PATCH M&F SURF	0.10%	2	SQ YD	$87.72		$175	
	PWFn =	0.3554		PW =	0.3554	X	$5,261	$1,870
YEAR 40								
	LONG SHLD JT R&S	100.00%	900	LIN FT	$2.00		$1,800	
	CNTR LINE JOINT R&S	100.00%	900	LIN FT	$2.00		$1,800	
	RNDM / THRM CRACK R&S	50.00%	743	LIN FT	$2.00		$1,486	
	PD PVMT PATCH M&F SURF	0.50%	9	SQ YD	$87.72		$790	
	PWFn =	0.3066		PW =	0.3066	X	$5,876	$1,801
								$59,999
	ROUTINE MAINTENANCE ACTIVITY		0.26	Lane Miles	0.00		$0	$0
							MAINTENANCE	$59,999
	45 YEAR LIFE CYCLE CRFn = 0.0407852						MAINTENANCE	$28,712

JPCP MAINTENANCE AND REHABILITATION ACTIVITY SCHEDULE 02/23/21
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JOINTED PLAIN CONCRETE PAVEMENT
UNBONDED JOINTED PLAIN CONCRETE OVERLAY
Figure 54-7.A

MAINTENANC	ITEM	%	QUANTITY	UNIT	UNIT COST		COST	PRESENT WORTH
YEAR 10								
	PAVEMENT PATCH CLASS B	0.10%	2	SQ YD	$150.00		$300	
	PWFn =	0.7441		PW =	0.7441	X	$300	$223
YEAR 15								
	PAVEMENT PATCH CLASS B	0.20%	4	SQ YD	$150.00		$600	
	PWFn =	0.6419		PW =	0.6419	X	$600	$385
YEAR 20								
	PAVEMENT PATCH CLASS B	2.00%	36	SQ YD	$150.00		$5,400	
	SHOULDER PATCH CLASS C	0.50%	0	SQ YD	$145.00		$0	
	LONGITUDINAL SHLD JT R&S	100.00%	900	LIN FT	$2.00		$1,800	
	CENTERLINE JT R&S	100.00%	900	LIN FT	$2.00		$1,800	
	PWFn =	0.5537		PW =	0.5537	X	$9,000	$4,983
YEAR 25								
	PAVEMENT PATCH CLASS B	3.00%	54	SQ YD	$150.00		$8,100	
	SHOULDER PATCH CLASS C	1.00%	0	SQ YD	$145.00		$0	
	PWFn =	0.4776		PW =	0.4776	X	$8,100	$3,869
YEAR 30	NON-INTERSTATE							
	PAVEMENT PATCH CLASS B	4.00%	72	SQ YD	$150.00		$10,800	
	SHOULDER PATCH CLASS C	1.50%	0	SQ YD	$145.00		$0	
	HMA OVERLAY 2.75" (PVMT)	100.00%	1,800	SQ YD	$22.54		$40,577	
	HMA OVERLAY 2.75" (SHLD)	100.00%	0	SQ YD	$11.09		$0	
	PWFn =	0.4120		PW =	0.4120	X	$51,377	$21,167
YEAR 35	NON-INTERSTATE							
	LONGITUDINAL SHLD JT R&S	100.00%	900	LIN FT	$2.00		$1,800	
	CENTERLINE JT R&S	100.00%	900	LIN FT	$2.00		$1,800	
	RANDOM CRACK R&S	50.00%	675	LIN FT	$2.00		$1,350	
	REFLECTIVE TRANSVERSE CRACK R&S	40.00%	432	LIN FT	$2.00		$864	
	PD PVMT PATCH M&F HMA 2.75"	0.10%	2	SQ YD	$94.37		$189	
	PWFn =	0.3554		PW =	0.3554	X	$6,003	$2,133
YEAR 40	NON-INTERSTATE							
	PAVEMENT PATCH CLASS B	0.50%	9	SQ YD	$150.00		$1,350	
	LONGITUDINAL SHLD JT R&S	100.00%	900	LIN FT	$2.00		$1,800	
	CENTERLINE JT R&S	100.00%	900	LIN FT	$2.00		$1,800	
	REFLECTIVE TRANSVERSE CRACK R&S	60.00%	648	LIN FT	$2.00		$1,296	
	RANDOM CRACK R&S	50.00%	675	LIN FT	$2.00		$1,350	
	PD PVMT PATCH M&F HMA 2.75"	0.50%	9	SQ YD	$94.37		$849	
	PWFn =	0.3066		PW =	0.3066	X	$8,445	$2,589
								$35,349
	ROUTINE MAINTENANCE ACTIVITY		0.26	Lane Miles	$0.00		$0	$0
							MAINTENANCE	$35,349
	45 YEAR LIFE CYCLE CRFn = 0.0407852						MAINTENANCE	$16,916