Illinois Department of Transportation

To:	Paul Loete, P.E	Attn: District Two
From:	Maureen M. Addis	
Subject:	Pavement Design	
Date:	May 4,, 2016	

FAP Route 301 (US 20)
(22,107)R
Stephenson County
At FAP Route 654/FAS Route 1087 (IL 73)

The project, submitted to BDE by memo dated May 30, 2016, will reconstruct the US 20/IL 73 intersection. The project length does not qualify for alternate bid, as it is less than 2 lane-miles. The LCCA favors a flexible design by more than 10%.

The approved pavement design is as follows:

I-39 NW Ramp (Pavement Reconstruction)

10 inches of Full Depth HMA Pavement with HMA Shoulders
- 2 inches of HMA Surface Course, Mix "C", N50
- 8 inches of HMA Binder Course, IL-19.0, N70*

12 inches of Aggregate Subgrade Improvement

* District Materials has recommended using HMA N90 within the intersection proper. The rest of the project utilizes the HMA N70.

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

Illinois Department of Transportation

To:	Maureen Addis	Attn: Paul Niedernhofer
From:	Paul Loete	By: Masood Ahmad
Subject:	Pavement Design	
Date:	May 3, 2016	

FAP Route 301 & FAP 654 (IL73), FAS 1087 (IL73)
Section: (22,107) R
Stephenson County
Job No. P-92-044-16
Contract No: 64L27

Description: Reconstruction of the intersection at US 20 and IL 73 Including installation of traffic signals and turning lanes.

Enclosed is the pavement design analysis for the proposed vertical realignment for the US 20 /IL 73 Intersection. The total reconstruction area is approximately 28,889 square yards of rural roadway along:

- US 20 (east and west legs) approximately 0.63 mile (3,300 feet)
- IL 73 (north and south legs) approximately 0.36 mile (1,835 feet)

The proposed pavement improvement consists of two 12-foot through lanes plus left turn and right turn lanes. The intersection is classified as a high stress intersection and would be signalized. Two types of pavement design options were calculated:

1. Rigid pavement option that includes 4-inch stabilized subbase with two untied HMA shoulders.
2. Flexible-mechanistic design pavement option.

Of the two designs, it was determined that the flexible-mechanistic pavement design presents the lower first and life cycle costs, providing a 22.2% annual cost savings, versus a rigid pavement design and composite design. The recommended design consists of a 2-inch HMA surface course with two lifts of 4-inch HMA leveling binder (machine method). The rigid pavement design consists of 9.5-inch PCC jointed pavement.

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DESIGN & ENVIRONMENT

The department recommends the flexible-mechanistic pavement design option based on cost analysis. According to Section 54-1.05(a) from BDE manual, this intersection is determined to be a high-stress intersection due to the following:

- The intersection will be a stop controlled signalized intersection.
- The proposed approach grade at the intersection will be 3.0% coming from the west and 4.0 % coming from the east along US 20.
- The current MU ADT is 880, which are greater than the 200 vehicles defined by the BDE manual.

Per the above reasons the pavement type recommended for the high-stress intersections shall be limited to one of the following materials:

1. PCC jointed pavement, or
2. HMA mix design N90 type with polymer-modified binder.

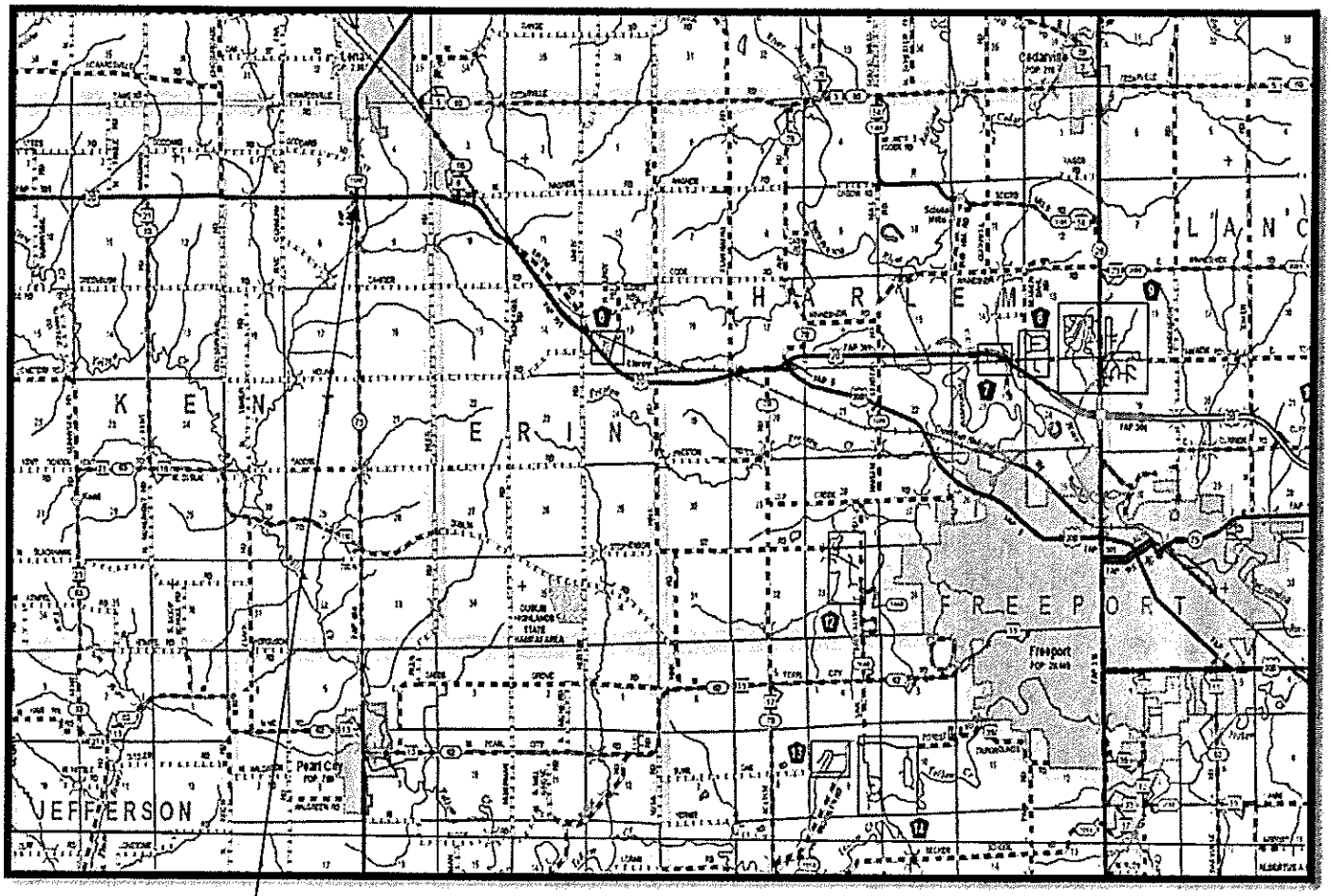
The department recommends using HMA N90 material to a minimum of 150 feet back from the location of the stop bars, or for the maximum length of the turn lanes plus tapers, an area approximately 5,044 square yards. The rest of the project area shall be N70 HMA mix material.

If you have any questions, please contact Ahmad EL-Ahmad 815/284-5944.

AE-0272/fd
Enclosures

North

LOCATION MAP



PROJECT LOCATION MAP

FAP 301 (US 20), FAP 654 (IL 73) & FAS 1087 (IL 73)

Section: (22,107) R Stephenson County

Job No: P-92-044-16 Contract: 64L27

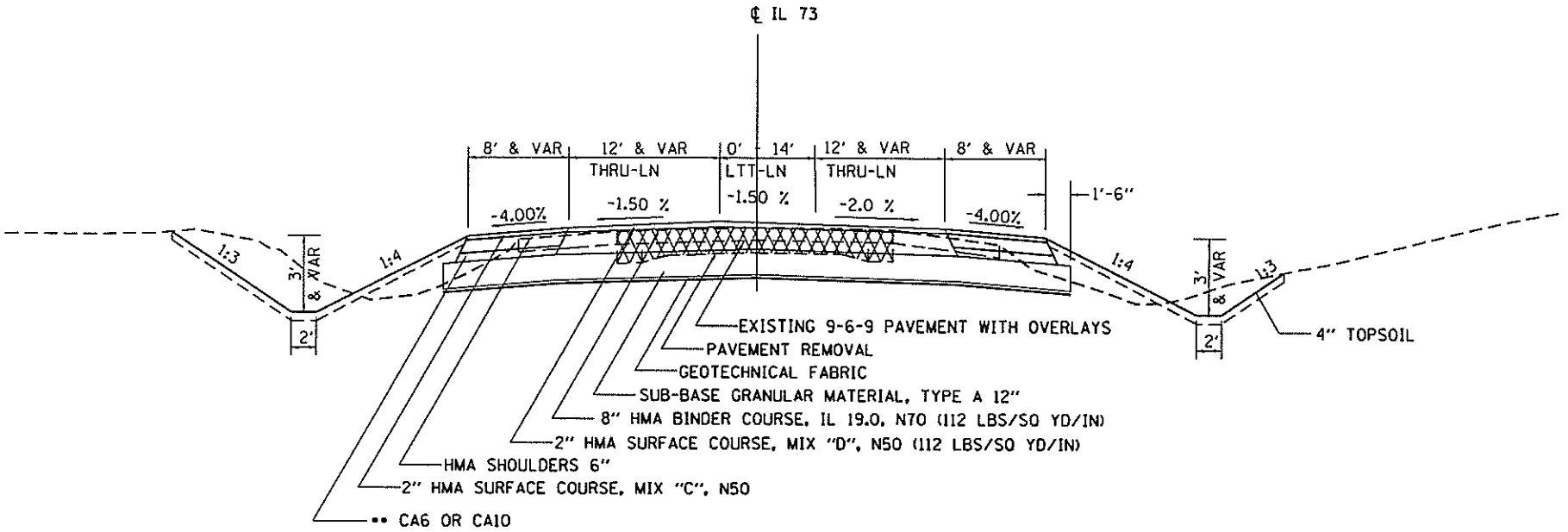
Reconstruction of the intersection at US 20 and IL 73 Including installation of traffic signals and turning lanes.

FIGURE A

TYPICAL SECTIONS

PROPOSED TYPICAL – IL RTE 73

STA 570+35- STA 578+48
STA 579+55- STA 589+00



•• INCLUDED IN THE COST OF HMA SHOULDERS

FILE NAME =	USER NAME =	DESIGNED -	REVISED -
			REVISED -
	PLOT SCALE =	CHECKED -	REVISED -
	PLOT DATE =	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

TYPICAL SECTIONS

SCALE: | SHEET NO. __ OF __ SHEETS | STA. | TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.

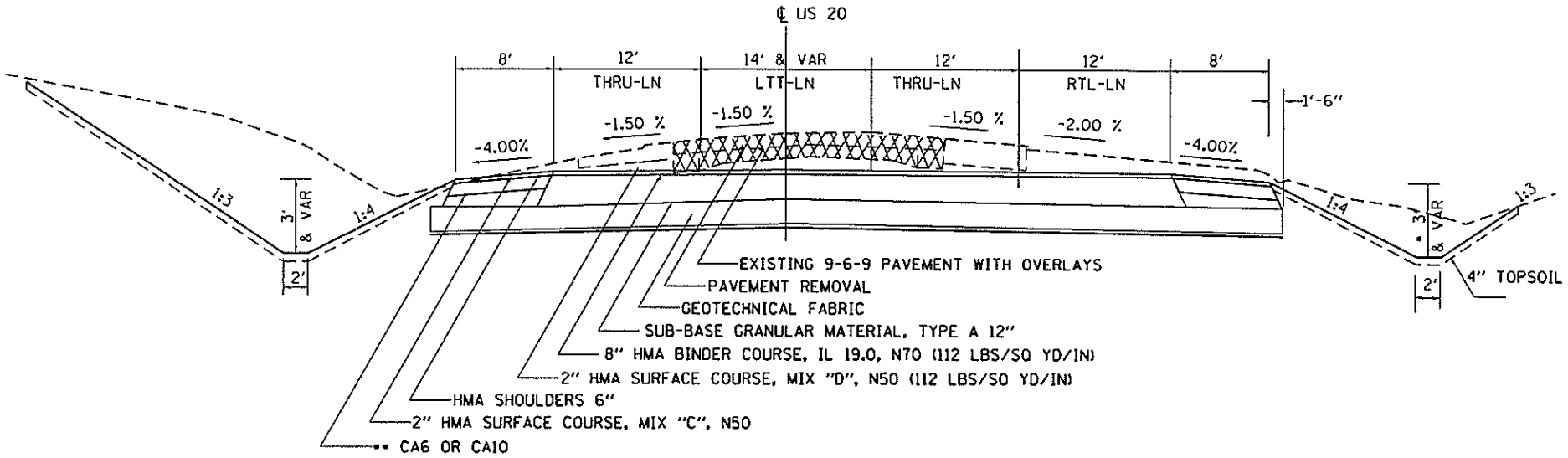
CONTRACT NO.
ILLINOIS FED. AID PROJECT

FIGURE B SHEET 3 OF 5

TYPICAL SECTIONS

PROPOSED TYPICAL – US 20

STA 248+35 - STA 266+45



•• INCLUDED IN THE COST OF HMA SHOULDERS

FILE NAME =	USER NAME = stevenson	DESIGNED -	REVISED -
			REVISED -
	PLOT SCALE =	CHECKED -	REVISED -
	PLOT DATE =	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

TYPICAL SECTIONS

SCALE: | SHEET NO. __ OF __ SHEETS | STA. _____ TO STA. _____

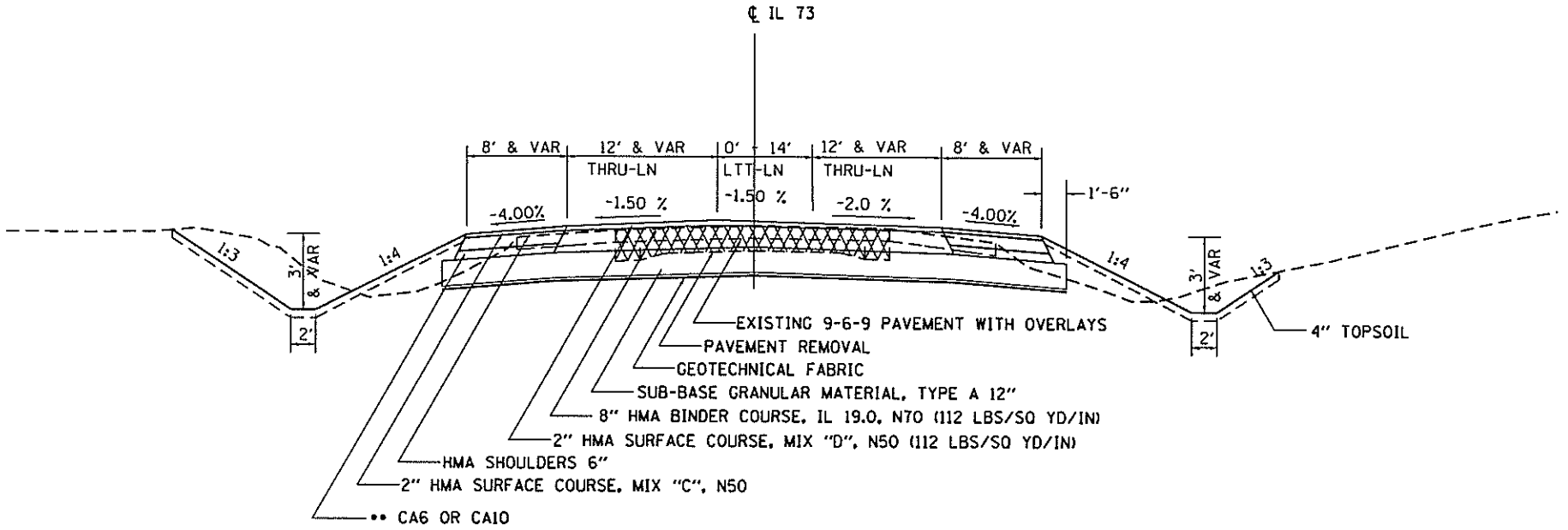
F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		CONTRACT NO.		
	ILLINOIS FED. AID PROJECT			

FIGURE B SHEET 2 OF 5

TYPICAL SECTIONS

PROPOSED TYPICAL – IL RTE 73

STA 570+35- STA 1578+48
STA 579+55- STA 1589+00



•• INCLUDED IN THE COST OF HMA SHOULDERS

FILE NAME =	USER NAME =	DESIGNED -	REVISED -
		CHECKED -	REVISED -
	PLOT SCALE =	DRAWN -	REVISED -
	PLOT DATE =	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

TYPICAL SECTIONS

SCALE: | SHEET NO. __ OF __ SHEETS | STA. | TO STA.

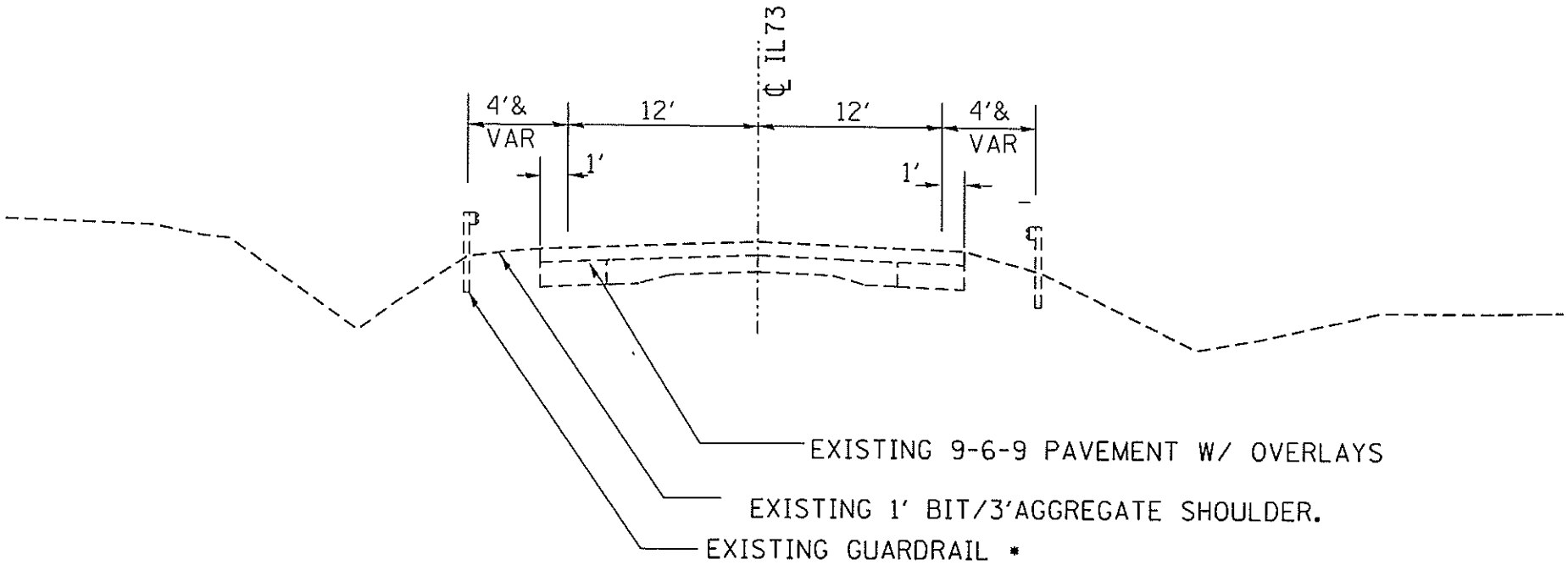
F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		CONTRACT NO.		
		ILLINOIS FED. AID PROJECT		

FIGURE B SHEET 3 OF 5

TYPICAL SECTIONS

EXISTING TYPICAL – IL 73

STA: 570+35 - STA: 578+48
STA: 579+55 - STA: 589+00



*: EXISTING . GUARDRAIL AT BOX CULVERTS LOCATIOS

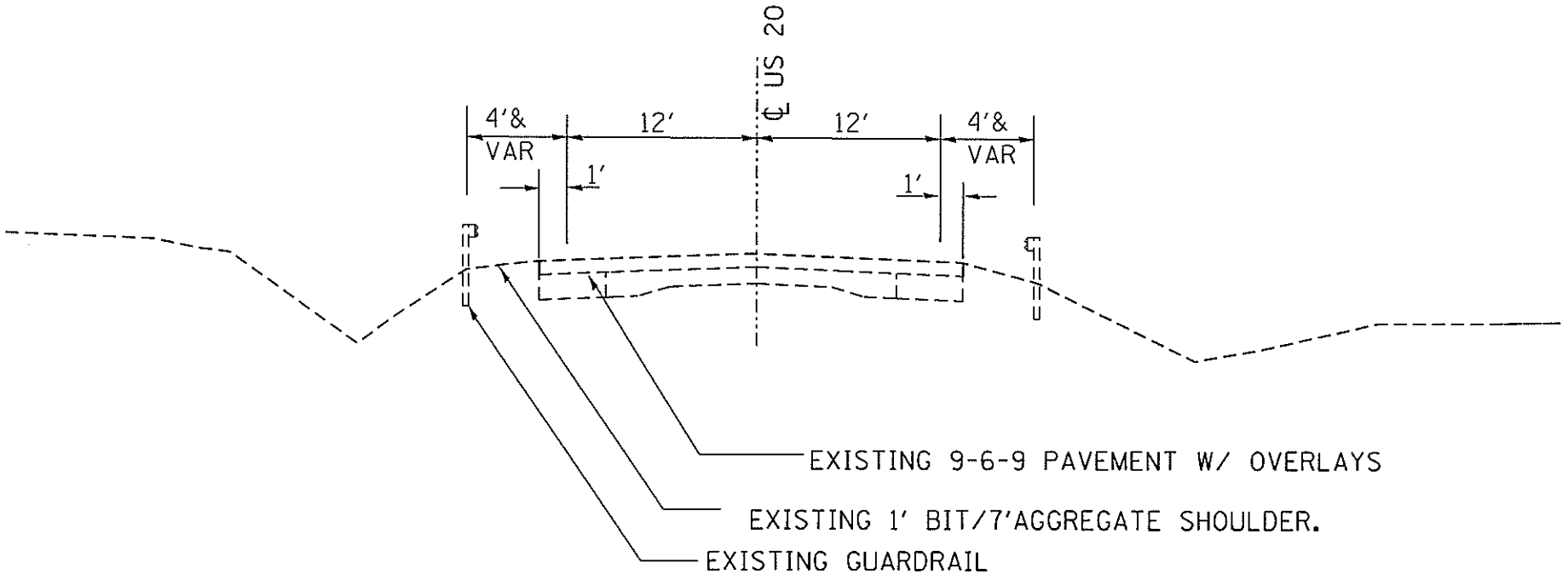
FILE NAME =	USER NAME =	DESIGNED -	REVISED -	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION	US ROUTE 20	F.A.P. RTE. 301	SECTION 122.1071 R	COUNTY STEPHENSON	TOTAL SHEETS / SHEET NO.
		CHECKED -	REVISED -		SCALE: SHEET NO. OF SHEETS STA. TO STA.			CONTRACT NO. 64L27	
	PLOT SCALE =	DATE -	REVISED -			FED. ROAD DIST. NO.	ILLINOIS	FED. AID PROJECT	
	PLOT DATE =		REVISED -						

FIFURE B SHEET 4 OF 5

TYPICAL SECTIONS

EXISTING TYPICAL – US20

STA: 240+00 - STA: 277+00



*: EXISTING . GUARDRAIL AT BOX CULVERTS LOCATIOS

FILE NAME =	USER NAME =	DESIGNED -	REVISED -	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION	US ROUTE 20	F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS / SHEET NO.
	PLOT SCALE =	CHECKED -	REVISED -			301	122.10TR	KENDALL	
	PLOT DATE =	DATE -	REVISED -		SCALE: / SHEET NO. OF SHEETS STA. TO STA.				CONTRACT NO. 64L27
						FED. ROAD DIST. NO.	ILLINOIS FED. AID PROJECT		

FIFURE B SHEET 5 OF 5

BDE 5401 Template (Rev. 09/05/2013)

IDOT MECHANISTIC PAVEMENT DESIGN

Printed: 05/04/2016

PROJECT AND TRAFFIC INPUTS

(Enter Data in Gray Shaded Cells)

Route: FAP 301 (US20) & FAP 654 / FAS 1087 (
Section: (22. 107) R
County: Stephenson
Location: US 20 / IL 73 Intersection
Comments:
Design Date: 04/14/2016 EL-Ahmad <-- BY
Modify Date: 04/01/2016 <-- BY

	ADT	Year
Current:	-	-
Future:	-	-

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: 2018
Design Period (DP) = 20 years

	Minimum ADT	Structural Design Traffic: Actual ADT	Actual %of Total ADT	% of ADT in Design Lane
PV =	0	6,280	83.7%	P = 50%
SU =	250	340	4.5%	S = 50%
MU =	750	880	11.7%	M = 50%
Struct. Design ADT =		7,500	(2028)	

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) =	3.78	(Actual ADT)	TF rigid (Actual) =	5.46	(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 = 3.78
PG Grade Lower Binder Lifts = PG 64-22 (Fig. 53-4.R)
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}) = 82 (Fig. 54-5.E)
Goto Map
Full Depth HMA Design Thickness = 10.00 in. (Fig. 54-5.F)
Limiting Strain Criterion Thickness = 14.25 in. (Fig. 54-5.I)

Use Full-Depth HMA Thickness = 10.00 inches

JPC Pavement

Use TF rigid = 5.46
Edge Support = Untied Shoulder or C.&G.

Rigid Pavt Thick. = 9.50 in. (Fig. 54-4.E)

CRC Pavement

Use TF rigid = 5.46
IBR value = 3

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

Use TF flexible = 3.78
HMA Overlay Design Thickness = 7.50 in. (Fig. 54-5.U)
Goto Map
Limiting Strain Criterion Thickness = 10.63 in. (Fig. 54-5.V)

Use HMA Overlay Thickness = 7.50 inches

Unbonded Concrete Overlay

Review 54-4.03 for limitations and special considerations.

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)

	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. 09/05/2013) Printed: 05/04/2016

LIFE-CYCLE COST ANALYSIS: NEW CONSTRUCTION / RECONSTRUCTION

FULL-DEPTH HMA PAVEMENT

Standard Design

ROUTE	FAP 301 (US20) & FAP 654 / FAS 1087 (IL 73)
SECTION	(22. 107) R
COUNTY	Stephenson
LOCATION	US 20 / IL 73 Intersection.
FACILITY TYPE	NON-INTERSTATE

PROJECT LENGTH			5165	FT = = >	0.98 Miles
# OF CENTERLINES			2	CL	
# OF LANES			3	LANES	
# OF EDGES			2	EP	
LANE WIDTH - AVERAGE			12.21	FT	
SHOULDER WIDTH	HMA	Left	0	FT	
	HMA	Right	0	FT	
	Total Width of Paved Shoulders		0	FT	

PAVEMENT THICKNESS (FLEXIBLE)	10.00 IN	14.25 IN MAX	
SHOULDER THICKNESS	0.00 IN	HMA_SHLD	Standard Design
POLICY OVERLAY THICKNESS	2.25 IN		

FLEX PAVEMENT TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
	3.17	3.69	3.69

Read Me!

HMA COST PER TON	UNIT PRICE
HMA SURFACE	$84.31 / TON
HMA TOP BINDER	$74.41 / TON
HMA LOWER BINDER	$69.86 / TON
HMA BINDER (LEVELING)	$82.46 / TON
HMA SHOULDER	$74.00 / TON

INITIAL COSTS

ITEM	THICKNESS	100% QUANTITY	UNIT		UNIT PRICE	COST	
HMA PAVEMENT (FULL-DEPTH)	(10.00")	21,020	SQ YD	*	$42.67 / SQ YD	$896,923	~
HMA SURFACE COURSE	(2.00")	2,364	TONS	*	$84.31 / TON	$0	
HMA TOP BINDER COURSE	(2.25")	4,793	TONS	*	$74.41 / TON	$0	
HMA LOWER BINDER COURSE	(5.75")	4,879	TONS	*	$69.86 / TON	$0	
HMA SHOULDER	(0.00")	0	SQ YD	*	$0.00 / SQ YD	$0	~
CURB & GUTTER		0	LIN FT	*	$0.00 / LIN FT	$0	
SUBBASE GRAN MATL TY C (TONS)		1,111	TONS	*	$30.00 / TON	$33,330	
IMPROVED SUBGRADE:	Modified Soil	31,535	SQ YD	*	$15.10 / SQ YD	$476,179	
HMA SHOULDER (8.00")		8,170	SQ YD	*	$33.15 / SQ YD	$270,836	
Reserved For User Supplied Item		0	UNITS		$0.00 / UNITS	$0	
PAVEMENT REMOVAL		16,479	SQ YD	*	$10.00 / SQ YD	$164,790	
SHOULDER REMOVAL		0	SQ YD	*	$0.00 / SQ YD	$0	

Note: * Denotes User Supplied Quantity

FLEXIBLE CONSTRUCTION INITIAL COST	$1,842,058
FLEXIBLE CONSTRUCTION ANNUAL COST PER MILE	$76,801

MAINTENANCE COSTS:

ITEM	THICKNESS	MATERIAL		UNIT COST	
ROUTINE MAINTENANCE ACTIVITY				$0.00	LANE-MILE / YEAR
HMA OVERLAY PVMT SURF	(2.00")	Surface Mix	2.00	$86.30	/ TON
HMA OVERLAY PVMT	(2.25")		2.25	$89.54	/ TON
HMA SURFACE MIX	(1.50")	Surface Mix	1.50	$93.00	/ TON
HMA BINDER MIX	(0.75")	eling Binder Mix	0.75	$82.46	/ TON
HMA OVERLAY SHLD (Year 30)	(2.25")	Shoulder Mix	2.25	$0.00	/ TON
HMA OVERLAY SHLD	(2.00")	Shoulder Mix	2.00	$0.00	/ TON
MILLING (2.00 IN)			2.00	$3.27	/ SQ YD
PARTIAL DEPTH PVMT PATCH	(Mill & Fill Surf)	Surface Mix	2.00	$81.35	/ SQ YD
PARTIAL DEPTH SHLD PATCH	(Mill & Fill Surf)	Shoulder Mix	2.00	$0.00	/ SQ YD
PARTIAL DEPTH PVMT PATCH	(Mill & Fill +2.00 ")	Leveling Binder Mix	2.00	$51.75	/ SQ YD
PARTIAL DEPTH SHLD PATCH	(Mill & Fill +2.00 ")	Shoulder Mix	2.00	$0.00	/ SQ YD
LONGITUDINAL SHOULDER JOINT ROUT & SEAL				$0.75	/ LIN FT
CENTERLINE JOINT ROUT & SEAL				$0.75	/ LIN FT
RANDOM / THERMAL CRACK ROUT & SEAL	(100% Rehab = 110.00' / Station / Lane)			$0.75	/ LIN FT

FLEXIBLE TOTAL LIFE-CYCLE COST	$2,247,938
FLEXIBLE TOTAL ANNUAL COST PER MILE	$93,724

HMA_SD

MAINTENANCE AND REHABILITATION ACTIVITY SCHEDULE 05/04/16

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%	10,330	LIN FT	$0.75	$7,748	
	CNTR LINE JOINT R&S	100.00%	10,330	LIN FT	$0.75	$7,748	
	RNDM / THRM CRACK R&S	50.00%	8,522	LIN FT	$0.75	$6,392	
	PD PVMT PATCH M&F SURF	0.10%	21	SQ YD	$81.35	$1,708	
	PWFn =	0.8626		PW =	0.8626 X	$23,596	$20,354
YEAR 10							
	LONG SHLD JT R&S	100.00%	10,330	LIN FT	$0.75	$7,748	
	CNTR LINE JOINT R&S	100.00%	10,330	LIN FT	$0.75	$7,748	
	RNDM / THRM CRACK R&S	50.00%	8,522	LIN FT	$0.75	$6,392	
	PD PVMT PATCH M&F SURF	0.50%	105	SQ YD	$81.35	$8,542	
	PWFn =	0.7441		PW =	0.7441 X	$30,430	$22,643
YEAR 15							
	MILL PVMT & SHLD 2.00"	100.00%	21,020	SQ YD	$3.27	$68,735	
	PD PVMT PATCH M&F ADD'L 2.00"	1.00%	210	SQ YD	$51.75	$10,868	
	HMA OVERLAY PVMT 2.00"	100.00%	2,365	TON	$86.30	$204,095	
	HMA OVERLAY SHLD 2.00 "	100.00%	0	TON	$0.00	$0	
	PWFn =	0.6419		PW =	0.6419 X	$283,698	$182,095
YEAR 20							
	LONG SHLD JT R&S	100.00%	10,330	LIN FT	$0.75	$7,748	
	CNTR LINE JOINT R&S	100.00%	10,330	LIN FT	$0.75	$7,748	
	RNDM / THRM CRACK R&S	50.00%	8,522	LIN FT	$0.75	$6,392	
	PD PVMT PATCH M&F SURF	0.10%	21	SQ YD	$81.35	$1,708	
	PWFn =	0.5537		PW =	0.5537 X	$23,596	$13,065
YEAR 25							
	LONG SHLD JT R&S	100.00%	10,330	LIN FT	$0.75	$7,748	
	CNTR LINE JOINT R&S	100.00%	10,330	LIN FT	$0.75	$7,748	
	RNDM / THRM CRACK R&S	50.00%	8,522	LIN FT	$0.75	$6,392	
	PD PVMT PATCH M&F SURF	0.50%	105	SQ YD	$81.35	$8,542	
	PWFn =	0.4776		PW =	0.4776 X	$30,430	$14,534
	HMA_SD						
YEAR 30	NON-INTERSTATE						
	MILL PVMT & SHLD 2.00"	100.00%	21,020	SQ YD	$3.27	$68,735	
	PD PVMT PATCH M&F ADD'L 2.00"	2.00%	420	SQ YD	$51.75	$21,735	
	PD SHLD PATCH M&F ADD'L 2.00"	1.00%	0	SQ YD	$0.00	$0	
	HMA OVERLAY PVMT 2.25 "	100.00%	2,662	TON	$89.54	$238,362	
	HMA OVERLAY SHLD 2.25 "	100.00%	0	TON	$0.00	$0	
	PWFn =	0.4120		PW =	0.4120 X	$328,832	$135,474
YEAR 35							
	LONG SHLD JT R&S	100.00%	10,330	LIN FT	$0.75	$7,748	
	CNTR LINE JOINT R&S	100.00%	10,330	LIN FT	$0.75	$7,748	
	RNDM / THRM CRACK R&S	50.00%	8,522	LIN FT	$0.75	$6,392	
	PD PVMT PATCH M&F SURF	0.10%	21	SQ YD	$81.35	$1,708	
	PWFn =	0.3554		PW =	0.3554 X	$23,596	$8,386
YEAR 40							
	LONG SHLD JT R&S	100.00%	10,330	LIN FT	$0.75	$7,748	
	CNTR LINE JOINT R&S	100.00%	10,330	LIN FT	$0.75	$7,748	
	RNDM / THRM CRACK R&S	50.00%	8,522	LIN FT	$0.75	$6,392	
	PD PVMT PATCH M&F SURF	0.50%	105	SQ YD	$81.35	$8,542	
	PWFn =	0.3066		PW =	0.3066 X	$30,430	$9,329
							$405,880
	ROUTINE MAINTENANCE ACTIVITY		2.93	Lane Miles	0.00	$0	$0
					MAINTENANCE LIFE-CYCLE COST		$405,880
45	YEAR LIFE CYCLE	CRFn = 0.0407852			MAINTENANCE ANNUAL COST PER MILE		$16,922

PCC PAVEMENT

JPCP

ROUTE			FAP 301 (US20) & FAP 654 / FAS 1087 (IL 73)		
SECTION			(22. 107) R		
COUNTY			Stephenson		
LOCATION			US 20 / IL 73 Intersection.		
FACILITY TYPE			NON-INTERSTATE		
PROJECT LENGTH			5165 FT	= = >	0.98 Miles
# OF CENTERLINES			2 CL		
# OF LANES			3 LANES		
# OF EDGES			2 EP		
LANE WIDTH - AVERAGE			12.21 FT		
SHOULDER WIDTH	PCC	Left	0 FT		
	PCC	Right	0 FT		
	Total Width of Paved Shoulders		0 FT		
PAVEMENT THICKNESS (RIGID)		JPCP	9.50 IN	UNTIED SHLD	
SHOULDER THICKNESS			0.00 IN		
POLICY OVERLAY THICKNESS			2.50 IN		

RIGID PAVEMENT TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
	4.59	5.35	5.35
Worksheet Construction Type is New Construction		The Pavement Type is	JPCP

INITIAL COSTS

ITEM	THICKNESS	100% QUANTITY	UNIT		UNIT PRICE		COST
JPC PAVEMENT	(9.50")	21,020	SQ YD	*	$52.91	/ SQ YD	$1,112,168
PAVEMENT REINFORCEMENT		0	SQ YD		$0.00	/ SQ YD	$0
STABILIZED SUBBASE	(4.00")	22,742	SQ YD	*	$14.20	/ SQ YD	$322,936
PCC SHOULDERS	(0.00" to 0.00")	0	SQ YD	*	$0.00	/ SQ YD	$0
CURB & GUTTER		0	LIN FT		$0.00	/ LIN FT	$0
SUBBASE GRAN MATL TY C	(5.53")	2,757	TONS	*	$24.00	/ TON	$66,168
IMPROVED SUBGRADE:	Aggregate Width = 54.9'	31,535	SQ YD	*	$15.10	/ SQ YD	$476,179
HMA SHOULDER (8.00")		8,170	SQ YD	*	$33.15	/ SQ YD	$270,836
Reserved For User Supplied Item		0	UNITS		$0.00	/ UNITS	$0
PAVEMENT REMOVAL		16,479	SQ YD	*	$10.00	/ SQ YD	$164,790
SHOULDER REMOVAL		0	SQ YD	*	$0.00	/ SQ YD	$0

Note: * Denotes User Supplied Quantity

RIGID CONSTRUCTION INITIAL COST	$2,413,077
RIGID CONSTRUCTION ANNUAL COST PER MILE	$100,609

MAINTENANCE COSTS:

ITEM	THICKNESS		MATERIAL	T	UNIT COST	
ROUTINE MAINTENANCE ACTIVITY					$0.00	/ LANE-MILE / YEAR
HMA POLICY OVERLAY	(2.50")			2.50		
HMA POLICY OVERLAY PVMT	(2.50")	1.0057		2.50	$90.19	/ TON
HMA SURFACE MIX	(1.50")	1.0034	Surface Mix	1.50	$93.30	/ TON
HMA BINDER MIX	(1.00")	1.0091	eling Binder Mix	1.00	$85.64	/ TON
HMA POLICY OVERLAY SHLD	(2.50")		Shoulder Mix	2.50	$0.00	/ TON
CLASS A PAVEMENT PATCHING					$0.00	/ SQ YD
CLASS B PAVEMENT PATCHING					$204.40	/ SQ YD
CLASS C SHOULDER PATCHING					$0.00	/ SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill HMA Surf)			Surface Mix	1.50	$0.00	/ SQ YD
PARTIAL DEPTH PVMT PATCH (Mill & Fill HMA 2.50")			Surface Mix	2.50	$86.90	/ SQ YD
LONGITUDINAL SHOULDER JOINT ROUT & SEAL					$0.75	/ LIN FT
CENTERLINE JOINT ROUT & SEAL					$0.75	/ LIN FT
REFLECTIVE TRANSVERSE CRACK ROUT & SEAL					$0.75	/ LIN FT
RANDOM CRACK ROUT & SEAL	(100% Rehab = 100.00' / Station / Lane)				$0.75	/ LIN FT

RIGID TOTAL LIFE-CYCLE COST	$2,747,492
RIGID TOTAL ANNUAL COST PER MILE	$114,552

JPCP

MAINTENANCE AND REHABILITATION ACTIVITY SCHEDULE 05/04/16

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%	21	SQ YD	$204.40		$4,292	
	PWFn =	0.7441		PW =	0.7441	X	$4,292	$3,194
YEAR 15								
	PAVEMENT PATCH CLASS B	0.20%	42	SQ YD	$204.40		$8,585	
	PWFn =	0.6419		PW =	0.6419	X	$8,585	$5,510
YEAR 20								
	PAVEMENT PATCH CLASS B	2.00%	420	SQ YD	$204.40		$85,848	
	SHOULDER PATCH CLASS C	0.50%	0	SQ YD	$0.00		$0	
	LONGITUDINAL SHLD JT R&S	100.00%	10,330	LIN FT	$0.75		$7,748	
	CENTERLINE JT R&S	100.00%	10,330	LIN FT	$0.75		$7,748	
	PWFn =	0.5537		PW =	0.5537	X	$101,344	$56,112
YEAR 25								
	PAVEMENT PATCH CLASS B	3.00%	631	SQ YD	$204.40		$128,976	
	SHOULDER PATCH CLASS C	1.00%	0	SQ YD	$0.00		$0	
	PWFn =	0.4776		PW =	0.4776	X	$128,976	$61,600
YEAR 30	NON-INTERSTATE							
	PAVEMENT PATCH CLASS B	4.00%	841	SQ YD	$204.40		$171,900	
	SHOULDER PATCH CLASS C	1.50%	0	SQ YD	$0.00		$0	
	HMA POLICY OVERLAY 2.5" (PVMT)	100.00%	2,960	TON	$90.19		$266,921	
	HMA POLICY OVERLAY 2.5" (SHLD)	100.00%	0	TON	$0.00		$0	
	PWFn =	0.4120		PW =	0.4120	X	$438,821	$180,788
YEAR 35	NON-INTERSTATE							
	LONGITUDINAL SHLD JT R&S	100.00%	10,330	LIN FT	$0.75		$7,748	
	CENTERLINE JT R&S	100.00%	10,330	LIN FT	$0.75		$7,748	
	RANDOM CRACK R&S	50.00%	7,748	LIN FT	$0.75		$5,811	
	REFLECTIVE TRANSVERSE CRACK R&S	40.00%	5,040	LIN FT	$0.75		$3,780	
	PD PVMT PATCH M&F HMA 2.50"	0.10%	21	SQ YD	$86.90		$1,825	
	PWFn =	0.3554		PW =	0.3554	X	$26,912	$9,564
YEAR 40	NON-INTERSTATE							
	PAVEMENT PATCH CLASS B	0.50%	105	SQ YD	$204.40		$21,462	
	LONGITUDINAL SHLD JT R&S	100.00%	10,330	LIN FT	$0.75		$7,748	
	CENTERLINE JT R&S	100.00%	10,330	LIN FT	$0.75		$7,748	
	REFLECTIVE TRANSVERSE CRACK R&S	60.00%	7,560	LIN FT	$0.75		$5,670	
	RANDOM CRACK R&S	50.00%	7,748	LIN FT	$0.75		$5,811	
	PD PVMT PATCH M&F HMA 2.50"	0.50%	105	SQ YD	$86.90		$9,125	
	PWFn =	0.3066		PW =	0.3066	X	$57,564	$17,647
								$334,415
	ROUTINE MAINTENANCE ACTIVITY		2.93	Lane Miles	$0.00		$0	$0
					MAINTENANCE LIFE-CYCLE COST			$334,415
45	YEAR LIFE CYCLE	CRFn = 0.0407852			MAINTENANCE ANNUAL COST PER MILE			$13,943

LIFE-CYCLE COST ANALYSIS: NEW DESIGN

Calculated / Revised : 4/27/16 9:15 AM

			JPCP	HMA
CONSTRUCTION	INITIAL COST	PRESENT WORTH	$2,413,077	$1,842,058
		ANNUAL COST PER MILE	$100,609	$76,801
MAINTENANCE	LIFE-CYCLE COST	PRESENT WORTH	$334,415	$405,880
		ANNUAL COST PER MILE	$13,943	$16,922
TOTAL	LIFE-CYCLE COST	PRESENT WORTH	$2,747,492	$2,247,938
		ANNUAL COST PER MILE	$114,552	$93,724

LIFE-CYCLE COST ANALYSIS: FINAL SUMMARY

LOWEST COST OPTION	==========>	**HMA**	**$93,724**	
OTHER OPTIONS (LOWEST TO HIGHEST):	TYPE / PERCENTAGE	**JPCP**	**$114,552**	**22.2%**

P:\Pavement Design Stuff\D-2\US 20 with IL 73\[US 20 with IL 73 Mechanistic Pavement Design with LCCA.xlsm]LifeCycleCost