Illinois Department of Transportation

To:	Diane M. O'Keefe	Attn: District One
From:	John D. Baranzelli	
Subject:	Pavement Design	
Date:	April 30, 2012	

FAP Route 780 (IL Route 53)
Du Page County
At IL 56 (Butterfield Road)

We have reviewed the pavement selection for the project, which was submitted to BDE by email dated April 6, 2012. The design meets the warrants for a "high stress" intersection, with the MU ADT exceeding 200 for both IL 53 & IL 56. The life cycle costs favor the rigid pavement design. The approved pavement design for this project is as follows:

IL Route 53 (Pavement Reconstruction)

10.25 inches of Jointed PCC Pavement with Tied PCC Curb & Gutter and/or Shoulders
4.5 inches of Stabilized Sub-Base
12 inches of Aggregate Subgrade Improvement

IL Route 56 (Butterfield Road)(Pavement Reconstruction)

10.25 inches of Jointed PCC Pavement with Tied PCC Curb & Gutter and/or Shoulders
4.5 inches of Stabilized Sub-Base
12 inches of Aggregate Subgrade Improvement

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

Illinois Department of Transportation

Memorandum

To: John D. Baranzelli, PE

Attn: Paul R. Niedernhofer

From: Diane O'Keefe

By: Jose Dominguez

Subject: Pavement Analysis*

Date: April 4, 2012

*Route: FAP 870 (IL 53)
Limits: at IL 56 (Butterfield Road)
Contract No.: 60P75
Letting: 06CY14
Section: 634X-N-3
County: DuPage

Job No.: P-91-439-01

We are submitting the pavement analysis for the above captioned location for your review and approval. Please note that the total pavement area for reconstruction exceeds 4,750 Square Yards. The improvement involves the following scope of work:

a.) Pavement reconstruction of IL 53 to accommodate an additional through lane in each direction making it a four lane roadway.

b.) Pavement reconstruction of IL 56 (Butterfield Road) to accommodate an additional through lane in each direction making it a six lane roadway.

A 30 year pavement analysis was performed for the pavement reconstruction of IL 53 and IL 56 (Butterfield Road) since the pavement reconstruction is greater than 25,000 square yards. IL 53 and IL 56 (Butterfield Road) are considered "high stress" as design lane MU ADT is greater than 200 at the signalized intersection. For ease of construction it is ideal to apply the same pavement depth for IL 53 and IL 56. The recommended pavement is:

a.) IL 53
Pavement Reconstruction
PCC Shoulder (tied) and PCC Curb and Gutter (tied)
- 10 ¼" PCC Pavement (Jointed) *
- 4 ½" Stabilized Subbase
- 12" Aggregate Subgrade Improvement

The life cycle cost analysis favors PCC pavement by 19.7%.

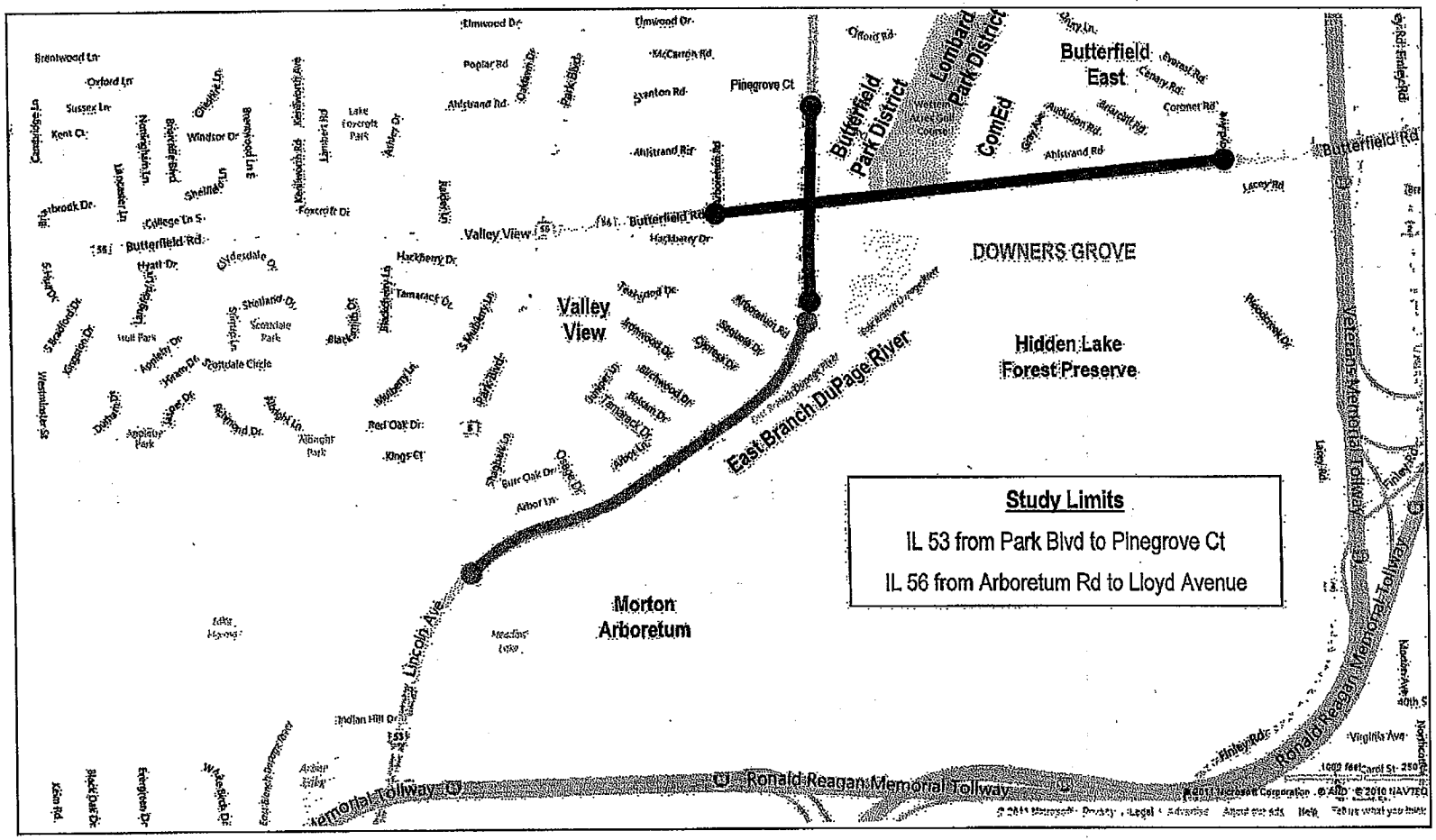
b.) IL 56 (Butterfield Road)
Pavement Reconstruction
PCC Shoulder (tied) and PCC Curb and Gutter (tied)
10 ¼" PCC Pavement (Jointed) *
4 ½" Stabilized Subbase
12" Aggregate Subgrade Improvement

The life cycle cost analysis favors PCC pavement by 25.0%.

*Designer Note 1: To be paid as pay item #42000506, **PORTLAND CEMENT CONCRETE PAVEMENT 10 1/4" (JOINTED),** paid in square yards.

If you have any questions or need additional information, please contact Mr. Tom Matousek at (847)705-4255.

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



Study Limits

IL53 and IL 56 Intersection, and IL 56 Section
(Included in IDOT's Fiscal Year 2012-2017 Program)

IL 53 Section
(Not Included in IDOT's Fiscal Year 2012-2017 Program)

PROJECT LOCATION MAP

Illinois Route 53 at Illinois 56
Phase I Study
DuPage County
P-91-439-01

Spreadsheet by Uehle - Rev. 11/02

MECHANISTIC PAVEMENT DESIGN

Date: 3/12/12

INPUT (Enter Data in Gray Shaded Cells)

Route: IL Route 53
Section:
County: DuPage
Location: IL Route 56

Comments: Complete Reconstruction of 73,700 SY

Designer: SJP

	ADT	Year
Current:	32200	2009
Future:	45000	2030

Facility Type: Multi-Lane Divided Arterial

# of Lanes = 4

Road Class: I

Subgrade Support Rating (SSR): Poor
Construction Year: 2013
Design Period (DP) = 30 years

	Minimum ADT	Structural Design Traffic: Actual ADT	Actual %of Total ADT	% of ADT in Design Lane
PV =	0	41,395	94.6%	P = 32%
SU =	250	1,327	3.0%	S = 45%
MU =	750	1,059	2.4%	M = 45%
		Struct. Design ADT =	43781	(2028)

FLEXIBLE & RIGID PAVEMENT CALCULATIONS AND ADDITIONAL INPUT

Flexible Pavement

Cpv =	0.15	
Csu =	133	
Cmu =	483	
TF flexible (Actual)=	9.33	(Actual ADT)
TF flexible (Min)=	5.33	(Min ADT Fig 54-2C)
Use TF flexible =	9.33	
AC Type =	20	
AC Mixture Tempurature =	80.0	deg. F (Figure 54-5C)
Design AC Mixture Modulus (Eac)=	550	ksi (Figure 54-5D)
Design Asphalt Concrete Microstrain =	51.2	(Figure 54-5E)
Asphalt Concrete Thickness =	15.75	in. (Figure 54-5F)

Rigid Pavement

Cpv =	0.15	
Csu =	144	
Cmu =	696	
TF rigid (Actual)=	12.60	(Actual ADT)
TF rigid (Min)=	7.54	(Min ADT Fig 54-2C)
Use TF rigid =	12.60	
	Use	Shoulder or C. &G.
Rigid Pave Thick =	9.75	in. (Figure 54-4D)

DESIGN TABLES FROM BD&E PAVEMENT DESIGN CH. 54 AND PAVEMENT DESIGN MANUAL

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

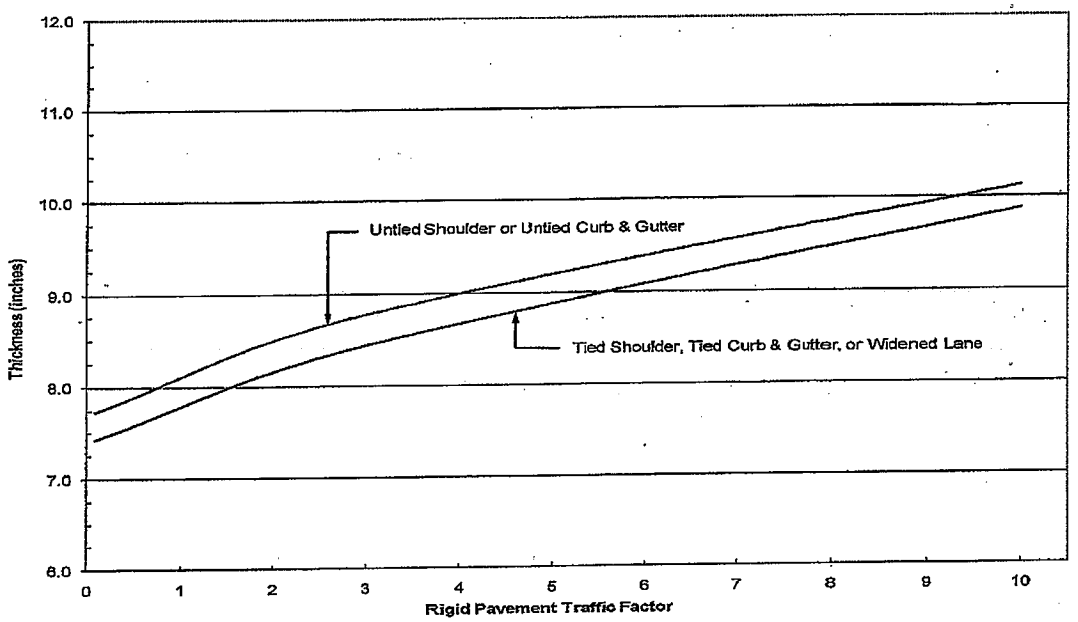
Facility Type	Min. Str. Design Traffic (Fig 54-2C) PV	SU	MU
Interstate or Supplemental Freeway	0	500	1500
Other Marked State Route	0	250	750
Unmarked State Route	No Min	No Min	No Min

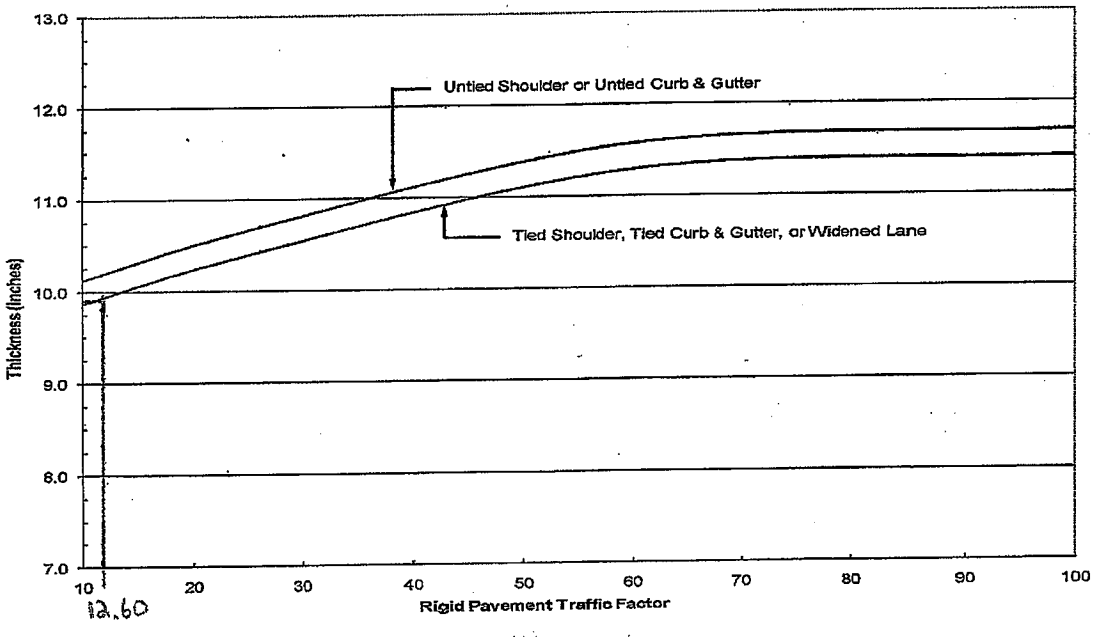
Class Table for One-Way Streets	
ADT	Class
0 - 3500	II
>3501	I

Class	Traffic Factor ESAL Coefficients: Rigid (Fig. 54-4C) Csu	Cmu	Flexible (Fig. 54-5B) Csu	Cmu
I	143.81	696.42	132.50	482.93
II	135.78	567.21	112.06	385.44
III	129.58	562.47	109.14	384.35
IV(ADT>400)	127.75	555.90	109.14	384.35
IV(ADT<=400)	127.75	555.90	9.86	78.84

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

Number of Lanes	Figure 54-2B Percentage of ADT in Design Lane: Rural P	S	M	Urban 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%





Note: Use of untied shoulder design requires BDE approval.

USE 10"

RIGID PAVEMENT DESIGN CHART
(Mechanistic Design: SSR = Poor)

Figure 54-4.E

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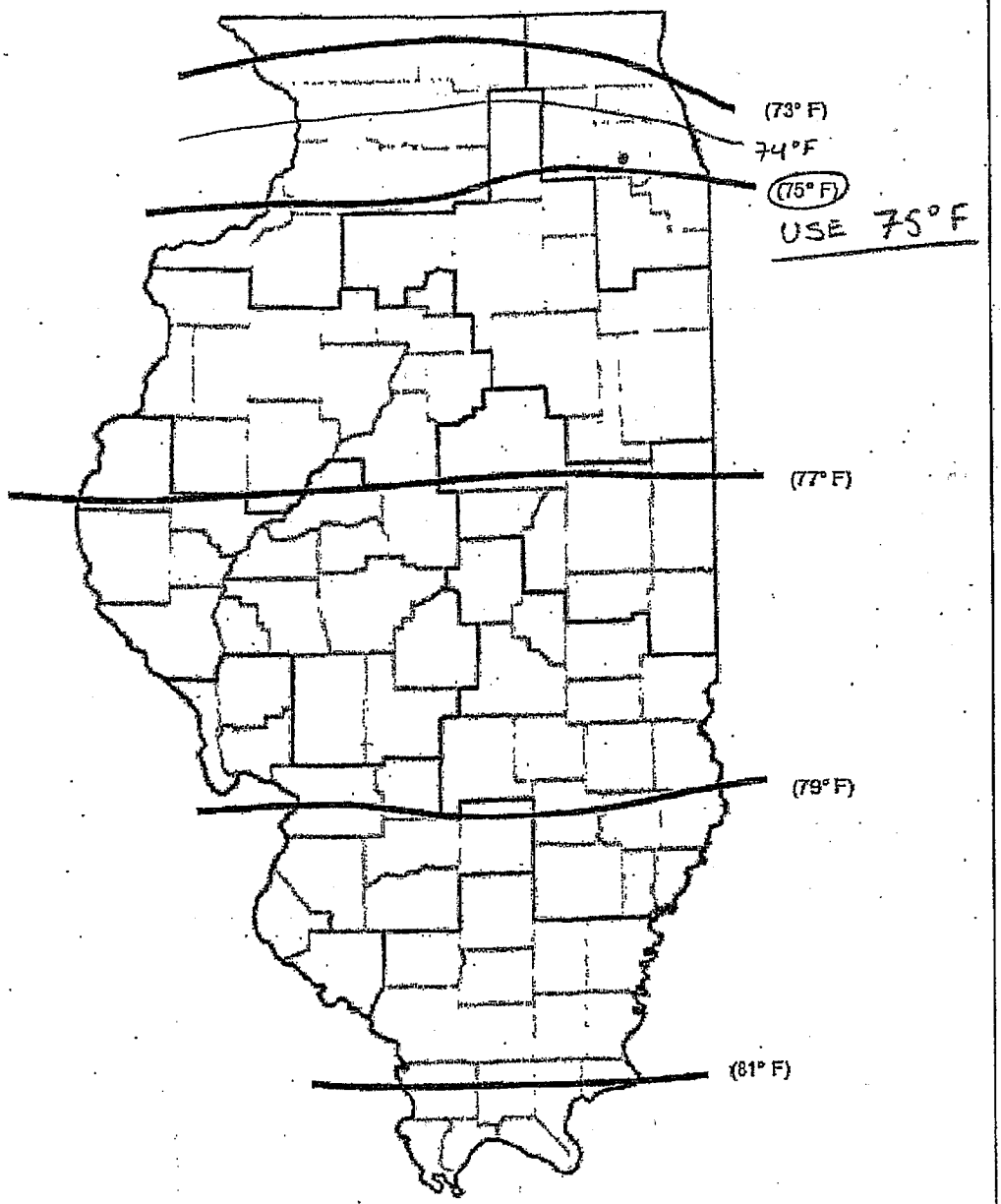

Note: The minimum design HMA mixture temperature will be 73°F.

HMA MIXTURE TEMPERATURE
(Mechanistic Design: Flexible Pavement)

Figure 54-5.C

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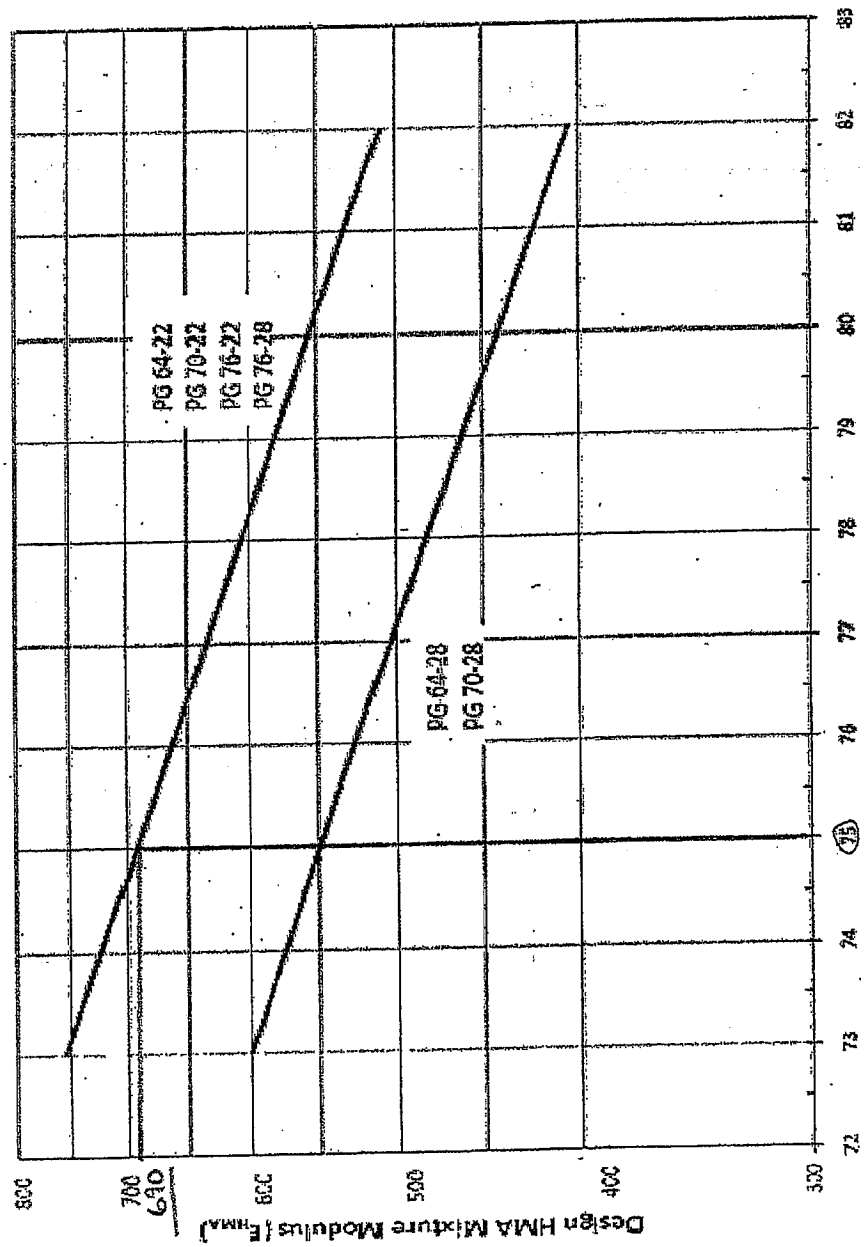

HMA MIXTURE MODULUS (E_{HMA})
(Mechanistic Design: Flexible Pavement)

Figure 54-5.D

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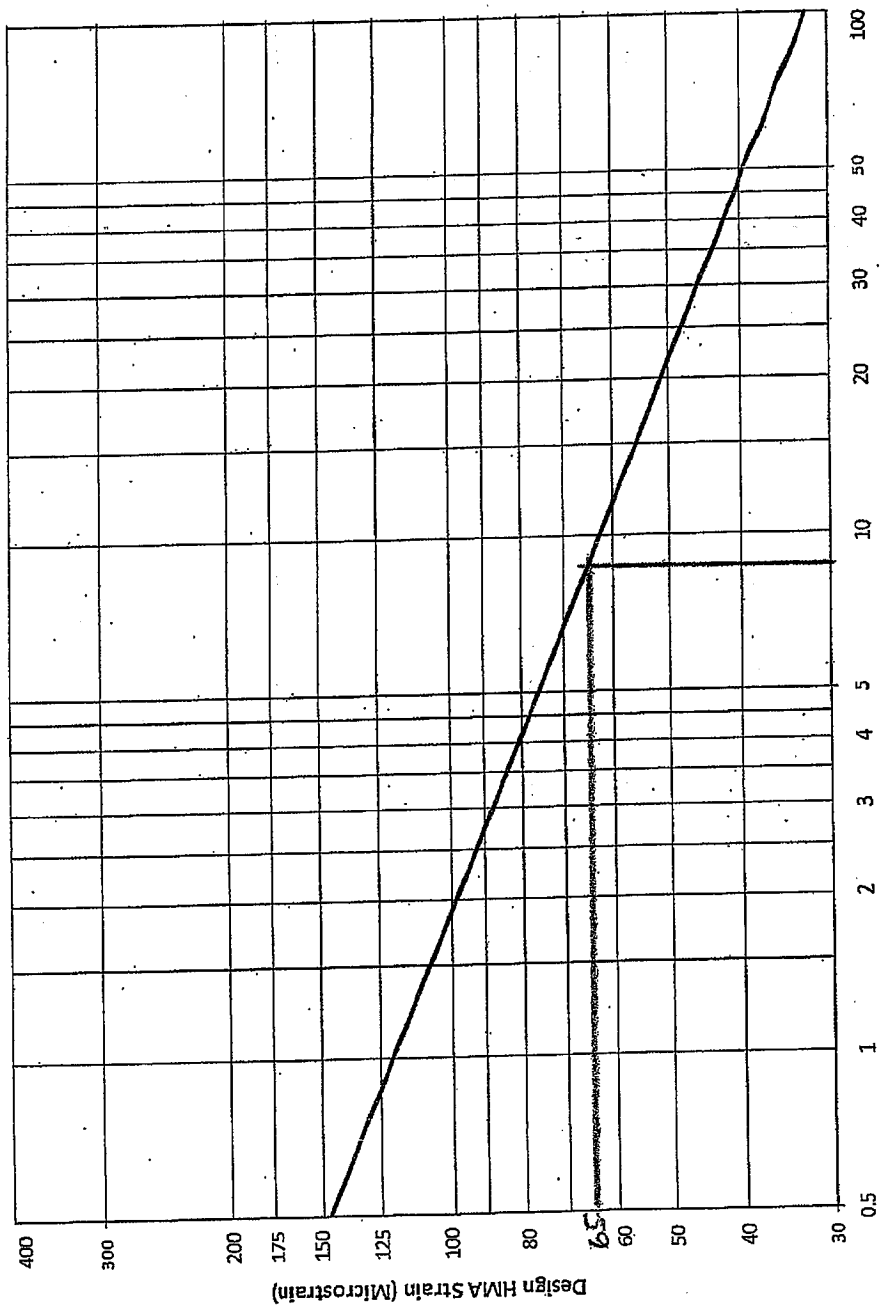
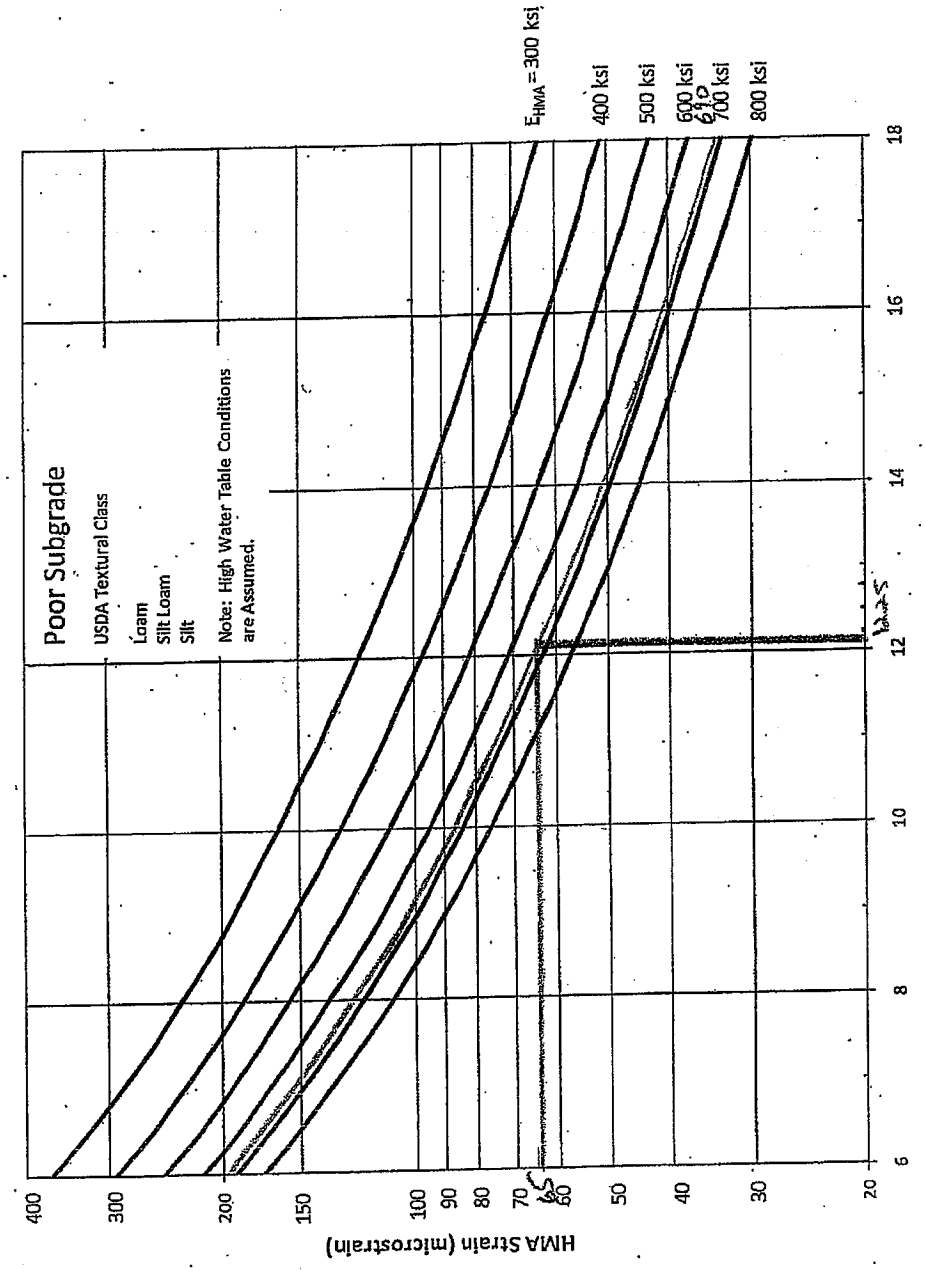


DESIGN HMA STRAIN
(Mechanistic Design: Flexible Pavement)

Figure 54-5.E



HMA THICKNESS DESIGN CHART
(Mechanistic Design: Flexible Pavement: SSR = Poor)

Figure 54-5.F

USE 13 1/2"

HARD COPIES UNCONTROLLED

MECHANISTIC PAVEMENT DESIGN

Date 4-Apr-12
Calcs by: SIP
Checked by:
Class 1 Roads and Streets
Urban X Rural

Route IL 53 @ IL 56
Section 634X-N-3
DuPage County
Location IL 56

Limits of Analysis Station 697+65 to Station 779+53
Length 8500 Feet 1.61 Miles

Structural Design Traffic
PV = 41395
SU = 1327
MU = 1059

Percent of S.D.T. in Design Lane
P = 94.60%
S = 3.00%
U = 2.40%

MINIMUM SUBGRADE SUPPORT RATING - "POOR"

Flexible Pavement Design Actual TF_F = 9.33 Minimum TF_F = 5.33

Selected Design AC Type
Design AC Mixture Temp 75 °F
Design AC Microstrain 65
Design E_{AC} 690 KSI
AC Thickness 12.25 Inch

Rigid Pavement Design Actual TF_F = 12.6 Minimum TF_F = 7.54

Extended Lane 0 Inch

15' Panel PCC Thickness for:
Tied Shoulder 0 Inch
Untied Shoulder 0 Inch

Figure 5.05

RIGID PAVEMENT

Date: 4-Apr-12 Route IL 53 @ IL 56
Quantities by SJP Checked by: Section 634X-N-3
Unit Prices by TM Checked by: DuPage County
Net Length 8500 Lin. Ft. = 1.61 Miles
Number Lanes 4 Urban X Rural

ITEMIZED CONSTRUCTION COST

Quantity	Units	Item		Unit Cost	Total Cost
45333	Sq. Yds.	0 Inch Jointed PCC	@	$39.31	$1,782,040
51000	Sq. Yds.	4-Inch (Stabilized/Granular Subbase)	@	$16.00	$816,000
0	Sq. Yds.	PCC Shoulder	@	$0.00	$0
	Lin. Ft.	Pipe Underdrains	@		
0		Subbase Gran. Mat., Type C	@	$0.00	$0
34,000	Lin. Ft.	100% Shoulder Joint Seal	@	$2.00	$68,000

Total Cost of Original Pavement Construction $2,666,040

ITEMIZED MAINTENANCE AND REHABILITATION ACTIVITY COST

REHABILITATION ACTIVITY 1 - YEAR 10

45	Sq. Yds.	0.1% Full Depth PCC Pavement Patching	@	$130.00	$5,850
		Total Cost of Rehabilitation Activity 1			$5,850

Figure 5.05a(1)

RIGID PAVEMENT (Cont.)

Route IL 53 @ IL 56

Section 634X-N-3

DuPage County

REHABILITATION ACTIVITY 2 - YEAR 15

			Unit Cost	Total Cost
91 Sq. Yds.	0.2% Full Depth PCC Pavement Patching	@	$130.00	$11,830

Total Cost of Rehabilitation Activity 2 $11,830

REHABILITATION ACTIVITY 3 - YEAR 20

			Unit Cost	Total Cost
907 Sq. Yds.	2% Full Depth PCC Pavement Patching	@	$0.00	$117,910
0 Sq. Yds.	0.5% Full Depth PCC Pavement Patching	@	$85.00	$0
34000 Lin. Ft.	100% Longitudunal/ Shoulder Joint Routing & Sealing	@	$1.00	$34,000
17000 Lin. Ft.	100% Centerline Joint Routing & Sealing	@	$1.00	$17,000

Total Cost of Rehabilitation Activity 3 $168,910

FIGURE 5.05a(2)

RIGID PAVEMENT (Cont.)

Route IL 53 @ IL 56

Section 634X-N-3

DuPage County

REHABILITATION ACTIVITY 4 - YEAR 25

			Unit Cost	Total Cost
1360 Sq. Yds.	3.0% Full Depth PCC Pavement Patching	@	$130.00	$176,800
0 Sq. Yds.	1.0% Full Depth PCC Pavement Patching	@	$85.00	$0
	Total Cost of Rehabilitation Activity 4			$176,800

REHABILITATION ACTIVITY 5 - YEAR 30

			Unit Cost	Total Cost
1813 Sq. Yds.	3.0% Full Depth PCC Pavement Patching	@	$85.00	$0
0 Sq. Yds.	1.0% Full Depth PCC Pavement Patching	@	$12.15	$550,796
45,333 Sq. Yds.	Policy HMA Overlay - Pavement	@	$12.15	$550,796
0 Sq. Yds.	Policy HMA Overlay - Shoulder	@	$12.15	$0
	Total Cost of Rehabilitation Activity 5			$786,486

REHABILITATION ACTIVITY 6 - YEAR 35

			Unit Cost	Total Cost
34,000 Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$34,000
17000 Lin. Ft.	100% Centerline Joint Routing & Sealing	@	$1.00	$17,000
17,000 Lin. Ft.	50% Random Crack Routing & Sealing - Assume 100ft/station	@	$1.00	$17,000
10,880 Lin. Ft.	40% Reflective Transverse Crack Routing & Sealing	@	$1.00	$10,880
45 Sq. Yds.	0.1% Partial-Depth Pavement Patching (Mill & Fill Surface-Interstates; Mill & Fill 2.5in. Non-Interstates)		$130.00	$5,850
	Total Cost of Rehabilitation Activity 6			$84,730

Figure 5.05a(3)

RIGID PAVEMENT (Cont.)

Route IL 53 @ IL 56

Section 634X-N-3

DuPage County

REHABILITATION ACTIVITY 7 - YEAR 40

			Unit Cost	Total Cost
227 Sq. Yds.	0.5% Full Depth PCC Pavement Patching	@	$130.00	$29,510
227 Sq. Yds.	0.5% Partial Depth Pavement Patching (Mill & Fill Surface-Interstates; Mill & Fill 2.5in. Non-Interstates)	@	$130.00	$29,510
16,320 Lin. Ft.	60% Reflective Transverse Crack Routing & Sealing	@	$1.00	$16,320
17,000 Lin. Ft.	50% Random Crack Routing & Sealing - Assume 100ft/station	@	$1.00	$17,000
34,000 Lin. Ft.	100% Longitudunal/ Shoulder Joint Routing & Sealing	@	$1.00	$34,000
17,000 Lin. Ft.	100% Centerline Joint Routing & Sealing	@	$1.00	$17,000
	Total Cost of Rehabilitation Activity 7			$143,340

RIGID PAVEMENT (Cont.)

Route IL 53 @ IL 56

Section 634X-N-3

DuPage County

ANNUAL COST DETERMINATION

Present Worth Calculation:

Total Cost of Original Pavement Construction			$2,666,040
Present Worth of Rehab Activity 1	$5,850	x 0.7441 =	$4,353
Present Worth of Rehab Activity 2	$11,830	x 0.6419 =	$7,594
Present Worth of Rehab Activity 3	$168,910	x 0.5537 =	$93,525
Present Worth of Rehab Activity 4	$176,800	x 0.4776 =	$84,440
Present Worth of Rehab Activity 5	$786,486	x 0.4120 =	$324,032
Present Worth of Rehab Activity 6	$84,730	x 0.3554 =	$30,113
Present Worth of Rehab Activity 7	$143,340	x 0.3066 =	$43,948
Total Life Cycle Cost (Present Worth)			$588,005

Annual Cost Per Mile Calculation

Total PW	x CRF_n /	Length		= Annual Cost / Year-Mile
$588,005	x0.04079 /	1.61	Mi.	$82,443 per Yr.-Mi.

FLEXIBLE PAVEMENT

Date: 4-Apr-12 Route IL 53 @ IL 56
Quantities by SJP Checked by: Section 634X-N-3
Unit Prices by TM Checked by: DuPage County
Net Length 8500 Lin. Ft. = 1.61 Miles
Number Lanes 4 Urban X Rural
Single Lane Paving X Dual Lane Paving

ITEMIZED CONSTRUCTION COST

Quantity	Units	Item		Unit Cost	Total Cost
45,333	Sq. Yds.	Class I Surface Course	@	$12.15	$550,796
45,333	Sq. Yds.	Class I Binder Course	@	$37.76	$1,711,774
0	Sq. Yds.	Stabilized Shoulders	@	$0.00	$0
	Lin. Ft.	Pipe Underdrains	@		
0		Subbase Gran. Matl., Type C	@	$0.00	$0
45,333	Sq. Yds.	Poly Binder	@	$10.78	$488,690

Total Cost of Original Pavement Construction $2,751,260

ITEMIZED MAINTENANCE AND REHABILITATION ACTIVITY COST

REHABILITATION ACTIVITY 1 - YEAR 5

				Unit Cost	Total Cost
4675	Lin. Ft.	50% Random/Thermal Cracking & Sealing (Assume 110ft/station)	@	$1.00	$4,675
34000	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$34,000
17000	Lin. Ft.	100% Centerline Joint Rounting & Sealing	@	$1.00	$17,000
45	Sq. Yds.	0.1% Partial-Depth Pavement Patching Mill & Fill Surface	@	$90.00	$4,050

Total Cost of Rehabilitation Activity 1 $59,725

FIGURE 5.05b(1)

FLEXIBLE PAVEMENT (Cont.)

Route IL 53 @ IL 56

Section 634X-N-3

DuPage County

REHABILITATION ACTIVITY 2 - YEAR 10

				Unit Cost	Total Cost
227	Sq. Yds.	0.5% Partial-depth HMA Pavement Patching - Mill & Fill Surface	@	$90.00	$20,430
4675	Lin. Ft.	50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station)	@	$1.00	$4,675
34000	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$34,000
17000	Lin. Ft.	100% Centerline Joint Rounting & Sealing	@	$1.00	$17,000
		Total Cost of Rehabilitation Activity 2			$76,105

REHABILITATION ACTIVITY 3 - YEAR 15

				Unit Cost	Total Cost
45,333	Sq. Yds.	2.00in. Milling - Pavement & Shoulder	@	$1.75	$79,333
453	Sq. Yds.	1.0% Partial-depth Pavement Patching (Mill & Fill Addition 2.00in.)	@	$90.00	$40,770
5,077	Sq. Yds.	2.00in. HMA Overlay Pavement & Shoulder	@	$108.48	$550,764
		Total Cost of Rehabilitation Activity 3			$670,867

FIGURE 5.05b(2)

FLEXIBLE PAVEMENT (Cont.)

Route IL 53 @ IL 56

Section 634X-N-3

DuPage County

				Unit Cost	Total Cost
REHABILITATION ACTIVITY 4 - YEAR 20					
34000	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$34,000
17000	Lin. Ft.	100% Centerline Joint Rounting & Sealing	@	$1.00	$17,000
4675	Lin. Ft.	50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station)	@	$1.00	$4,675
45	Sq. Yds.	0.1% Partial-Depth HMA Pavement Patching (Mill & Fill Surface)	@	$90.00	$4,050
		Total Cost of Rehabilitation Activity 4			$59,725
				Unit Cost	Total Cost
REHABILITATION ACTIVITY 5 - YEAR 25					
34000	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$34,000
17000	Lin. Ft.	100% Centerline Joint Rounting & Sealing	@	$1.00	$17,000
4675	Lin. Ft.	50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station)	@	$1.00	$4,675
227	Sq. Yds.	0.5% Partial-Depth Pavement Patching (Mill & Fill Surface)	@	$90.00	$20,430
		Total Cost of Rehabilitation Activity 5			$76,105
				Unit Cost	Total Cost
REHABILITATION ACTIVITY 6 - YEAR 30					
45,333	Sq. Yds.	2.00in. Milling (Pavement only-Std Design Pavement & Shoulder-Limiting Strain Criteria Design)	@	$1.75	$79,333
907	Sq. Yds.	2.0% Partial-Depth HMA Pavement Patching (Mill & Fill Additional 2.00in. All Designs)	@	$90.00	$81,630
0	Sq. Yds.	1.0% Full-Depth HMA Shoulder Patching (Mill & Fill Surface-Standard Design Mill & Fill Additional 2.00in.-Limiting Strain Criteria Design)	@	$90.00	$0
9,520	Tons	HMA Overlay Pvmt (3.75in. - Std Design 2.00in.-Limiting Strain Criterion Design)	@	$108.48	$1,032,750
0	Tons	HMA Overlay Shoulder (1.75in. - Standard Design; 2.00in.-Limiting Strain Criterion Design)	@	$108.48	$0
		Total Cost of Rehabilitation Activity 6			$1,193,713

FIGURE 5.05b(3)

FLEXIBLE PAVEMENT (Cont.)
Route IL 53 @ IL 56
Section 634X-N-3
DuPage County

REHABILITATION ACTIVITY 7 - YEAR 35				Unit Cost	Total Cost
34000	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$34,000
17000	Lin. Ft.	100% Centerline Joint Rounting & Sealing	@	$1.00	$17,000
4675	Lin. Ft.	50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station)	@	$1.00	$4,675
45	Sq. Yds.	0.1% Partial-Depth HMA Pavement Patching (Mill & Fill Surface)	@	$90.00	$4,050
		Total Cost of Rehabilitation Activity 7			$59,725

REHABILITATION ACTIVITY 8 - YEAR 40				Unit Cost	Total Cost
34000	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$34,000
17000	Lin. Ft.	100% Centerline Joint Rounting & Sealing (Single Lane and Dual Lane Paving)	@	$1.00	$17,000
4675	Lin. Ft.	50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station)	@	$1.00	$4,675
227	Sq. Yds.	0.5% Partial-Depth Pavement Patching (Mill & Fill Surface)	@	$90.00	$20,430
		Total Cost of Rehabilitation Activity 8			$76,105

Figure 5.05b(4) - continued

FLEXIBLE PAVEMENT (Cont.)
Route IL 53 @ IL 56
Section 634X-N-3
DuPage County

ANNUAL COST DETERMINATION

Present Worth Calculation:

Total Cost of Original Pavement Construction			$2,751,260
Present Worth of Rehab Activity 1	$59,725	x 0.7441 =	$51,519
Present Worth of Rehab Activity 2	$76,105	x 0.6419 =	$56,630
Present Worth of Rehab Activity 3	$670,867	x 0.5537 =	$430,630
Present Worth of Rehab Activity 4	$59,725	x 0.4776 =	$33,070
Present Worth of Rehab Activity 5	$76,105	x 0.4120 =	$36,348
Present Worth of Rehab Activity 6	$1,193,713	x 0.3554 =	$491,810
Present Worth of Rehab Activity 7	$59,725	x 0.3066 =	$21,226
Present Worth of Rehab Activity 8	$76,105	x 0.3066 =	$23,334
Total Life Cycle Cost (Present Worth)			$1,144,567

Annual Cost Per Mile Calculation

Total PW	x CRF_n /	Length		= Annual Cost / Year-Mile
$1,144,567	x0.04079 /	1.61	Mi.	$98,702 per Yr.-Mi.

MATERIAL TYPE/PERCENTAGE	PCC	19.7%

PLAIN JOINTED PCC PAVEMENT

FILENAME-	IL 53 @ IL 56	4-Apr-12	
ROUTE-	IL 53	3:16 PM	
SECTION-	894X-N-3		
COUNTY-	DuPage		
LOCATION-	IL 56		
DATE-	4-Apr-12		
PROJECT LENGTH (FT)	8500 =	1.61	MILES
AVERAGE LANE WIDTH (FT)	12		
NUMBER OF LANES	4		
# OF EDGES	4		
INSIDE SHLDER WIDTH (FT)	0		
OUTSIDE SHLDER WIDTH (FT)	0		
# OF CENTERLINES	2		
RIGID THICKNESS-			
TRAFFIC FACTORS	MINIMUM	ACTUAL	
RIGID-	7.64	12.5	

TRAFFIC		Percentages
PV-	41395	94.60%
SU-	1327	3.00%
MU-	1059	2.40%

INITIAL COSTS

ITEM	QUANTITY	UNIT PRICE	COST
PAVEMENT (SQ YDS)	45,333	$39.31	$1,782,040
STAB SUBBASE (SQ YDS)	51,000	$16.00	$816,000
SHOULDERS (SQ YDS)	0		$0
SHOULDER SEAL (LN FT)	34,000	$2.00	$68,000
SUBBASE GRAN MATL TY C (TONS)	0		$0
CONSTRUCTION INITIAL COST (PW)			$2,666,040
TOTAL REHABILITATION COST (PW)			$588,005
TOTAL LIFE CYCLE COST (PW)			$3,254,045
ANNUAL COST PER MILE			$82,443

MAINTENANCE COSTS:

ITEM		UNIT COST
PAVEMENT PATCHING (SQ YDS)	(Use Class A pricing for CRC)	$130.00
SHOULDER PATCHING (SQ YDS)		$85.00
SHLDR JT ROUT & SEAL (LF)		$1.00
CENTERLINE JT ROUT & SEAL (LF)		$1.00
POLICY HMA OVERLAY PVMT (SQ YDS)		$12.15
POLICY HMA OVERLAY SHLDR (SQ YDS)		$12.15
RANDOM CRACK ROUT & SEAL (LF)		$1.00
REFL TRANS CRACK ROUT & SEAL (LF)		$1.00
PARTIAL PVMT PATCH (SQ YDS)		$130.00

MAINTENANCE COSTS:

	ITEM	QUANTITY	UNIT PRICE	COST	PW
Activity 1 YEAR 10	PAVEMENT PATCHING 0.1% (SQ YDS)	45	$130.00	$5,850	
				$5,850	$4,353
Activity 2 YEAR 15	PAVEMENT PATCHING 0.2% (SQ YDS)	91	$130.00	$11,830	
				$11,830	$7,594
Activity 3 YEAR 20	PAVEMENT PATCHING 2.0% (SQ YDS)	907	$130.00	$117,910	
	SHOULDER PATCHING 0.5% (SQ YDS)	0	$85.00	$0	
	SHLDR JT ROUT & SEAL 100% (LF)	34,000	$1.00	$34,000	
	CENTERLINE JT ROUT & SEAL 100% (LF)	17,000	$1.00	$17,000	
				$168,910	$93,525
Activity 4 YEAR 25	PAVEMENT PATCHING 3.0% (SQ YDS)	1,360	$130.00	$176,800	
	SHOULDER PATCHING 1.0% (SQ YDS)	0	$85.00	$0	
				$176,800	$84,440
Activity 5 YEAR 30	PAVEMENT PATCHING 4.0% (SQ YDS)	1,813	$130.00	$235,690	
	SHOULDER PATCHING 1.5% (SQ YDS)	0	$85.00	$0	
	POLICY HMS OVERLAY OVMT (SQ YDS)	45,333	$12.15	$550,796	
	POLICY HMA OVERLAY SHLDR (SQ YDS)	0	$12.15	$0	
				$786,486	$324,032
Activity 6 YEARS 35	SHLDR JT ROUT & SEAL 100% (LF)	34,000	$1.00	$34,000	
	CENTERLINE JT ROUT & SEAL 100% (LF)	17,000	$1.00	$17,000	
	RANDOM CRACK ROUT & SEAL 50% (LF)	17,000	$1.00	$17,000	
	REFL TRANS CRACK ROUT & SEAL 40%	10,880	$1.00	$10,880	
	PARTIAL PVMT PATCH 0.1% (SQ YDS)	45	$130.00	$5,850	
				$84,730	$30,113
Activity 7 YEAR 40	PAVEMENT PATCHING 0.5% (SQ YDS)	227	$130.00	$29,510	
	SHOULDER PATCHING 0.5% (SQ YDS)	227	$130.00	$29,510	
	REFL TRANS CRACK ROUT & SEAL 60%	16,320	$1.00	$16,320	
	RANDOM CRACK ROUT & SEAL 50% (LF)	17,000	$1.00	$17,000	
	SHLDR JT ROUT & SEAL 100% (LF)	34,000	$1.00	$34,000	
	CENTERLINE JT ROUT & SEAL 100% (LF)	17,000	$1.00	$17,000	
				$143,340	$43,948
			Total Rehabilitation Cost (Present Worth)		$588,005

FULL-DEPTH FLEXIBLE
TRAFFIC FACTOR LESS THAN 15.0 (RURAL)
TRAFFIC FACTOR LESS THAN 10.0 (URBAN)

FULL DEOTH FLEXIBLE PAVEMENT
4-Apr-12
3:16 PM

ROUTE-	IL 53	
SECTION-	634X-N-3	
COUNTY-	DuPage	
LOCATION-	IL 56	
PROJECT LENGTH (FT)	8500	
AVERAGE LANE WIDTH (FT)	12	
NUMBER OF LANES	4	
# OF EDGES	4	
INSIDE SHLDER WIDTH (FT)	0	
OUTSIDE SHLDER WIDTH (FT)	0	
# OF CENTERLINES	2	
PROJECT TYPE	2	1=RURAL, 2=URBAN
PAVING WIDTH	1	1=SINGLE LANE, 2=DUAL LANE
INTERSTATE / OTHER ROUTE	OTHER ROUTE	
FLEXIBLE THICKNESS-	0	

TRAFFIC FACTORS	MINIMUM	ACTUAL
FLEXIBLE	5.33	9.33

TRAFFIC

PV-	41395	0.946
SU-	1327	0.03
MU-	1059	0.024

PAVEMENT OVERLAY THICKNESS	3.75
SHOULDER OVERLAY THICKNESS	1.75

INITIAL COSTS

ITEM	QUANTITY	UNIT PRICE	COST
SURFACE (SQ YDS)	45,333	$12.15	$550,796
POLY BINDER (SQ YDS)	45,333	$10.78	$488,690
BINDER (SQ YDS)	45,333	$37.76	$1,711,774
SHOULDERS (SQ YDS)	0		$0
SUBBASE GRAN MATL TY C (TONS)	0		$0

CONSTRUCTION INITIAL COST (PW)	$2,761,260
TOTAL REHABILITATION COST (PW)	$1,144,567
TOTAL LIFE CYCLE COST (PW)	$3,895,827
ANNUAL COST PER MILE	$98,702

MAINTENANCE COSTS:

ITEM		UNIT COST
RAND/THERM CRACK ROUT & SEAL (LF)		$1.00
SHLDR JT ROUT & SEAL (LF)		$1.00
CENTERLINE JT ROUT & SEAL (LF)		$1.00
PARTIAL PVMT PATCH (SQ YDS)		$90.00
2" MILL PVMT & SHLDR (SQ YDS)	(Use $3.00 for small quantity)	$1.75
2" OVERLAY PVMT & SHLDR (TONS)		$108.48
2" MILL PVMT ONLY (SQ YDS)	(Use $3.00 for small quantity)	$1.75
HMA SHOULDER PATCHING (SQ YDS)		$90.00
POLICY HMA OVERLAY PVMT (TONS)		$108.48
POLICY HMA OVERLAY SHLDR (TONS)		$108.48

MATERIAL TYPE/PERCENTAGE	PCC	19.7%

MAINTENANCE COSTS

	ITEM	QUANTITY	UNIT PRICE	COST	PW
Activity 1					
YEAR 5	RAND/THERM CRACK ROUT & SEAL 50% (LF)	4,675	$1.00	$4,675	
	SHLDR JT ROUT & SEAL 100% (LF)	34,000	$1.00	$34,000	
	CENTERLINE JT ROUT & SEAL 100% (LF)	17,000	$1.00	$17,000	
	PARTIAL PVMT PATCH 0.1% (SQ YDS)	45	$90.00	$4,050	
				$59,725	$51,519
Activity 2					
YEAR 10	PARTIAL PVMT PATCH 0.5% (SQ YDS)	227	$90.00	$20,430	
	RAND/THERM CRACK ROUT & SEAL 50% (LF)	4,675	$1.00	$4,675	
	SHLDR JT ROUT & SEAL 100% (LF)	34,000	$1.00	$34,000	
	CENTERLINE JT ROUT & SEAL 100% (LF)	17,000	$1.00	$17,000	
				$76,105	$56,830
Activity 3					
YEAR 15	2" MILL PVMT & SHLDR 100% (SQ YDS)	45,333	$1.75	$79,333	
	PARTIAL PVMT PATCH 1.0% (SQ YDS)	453	$90.00	$40,770	
	2" OVERLAY PVMT & SHLDR 100% (TONS)	5,077	$108.48	$550,764	
				$670,867	$430,630
Activity 4					
YEAR 20	SHLDR JT ROUT & SEAL 100% (LF)	34,000	$1.00	$34,000	
	CENTERLINE JT ROUT & SEAL 100% (LF)	17,000	$1.00	$17,000	
	RAND/THERM CRACK ROUT & SEAL 50% (LF)	4,675	$1.00	$4,675	
	PARTIAL PVMT PATCH 0.1% (SQ YDS)	45	$90.00	$4,050	
				$59,725	$33,070
Activity 5					
YEAR 25	SHLDR JT ROUT & SEAL 100% (LF)	34,000	$1.00	$34,000	
	CENTERLINE JT ROUT & SEAL 100% (LF)	17,000	$1.00	$17,000	
	RAND/THERM CRACK ROUT & SEAL 50% (LF)	4,675	$1.00	$4,675	
	PARTIAL PVMT PATCH 0.5% (SQ YDS)	227	$90.00	$20,430	
				$76,105	$36,348
Activity 6					
YEAR 30	2" MILL PVMT & SHLDR 100% (SQ YDS)	45,333	$1.75	$79,333	
	PARTIAL PVMT PATCH 2.0% (SQ YDS)	907	$90.00	$81,630	
	HMA SHLDR PATCHING 1.0% (SQ YDS)	0	$90.00	$0	
	POLICY HMA OVERLAY PVMT (TONS)	9,520	$108.48	$1,032,750	
	POLICY HMA OVERLAY SHLDR (TONS)	0	$108.48	$0	
				$1,193,713	$491,810
Activity 7					
YEAR 35	SHLDR JT ROUT & SEAL 100% (LF)	34,000	$1.00	$34,000	
	CENTERLINE JT ROUT & SEAL 100% (LF)	17,000	$1.00	$17,000	
	RAND/THERM CRACK ROUT & SEAL 50% (LF)	4,675	$1.00	$4,675	
	PARTIAL PVMT PATCH 0.1% (SQ YDS)	45	$90.00	$4,050	
				$59,725	$21,228
Activity 8					
YEAR 40	SHLDR JT ROUT & SEAL 100% (LF)	34,000	$1.00	$34,000	
	CENTERLINE JT ROUT & SEAL 100% (LF)	17,000	$1.00	$17,000	
	RAND/THERM CRACK ROUT & SEAL 50% (LF)	4,675	$1.00	$4,675	
	PARTIAL PVMT PATCH 0.5% (SQ YDS)	227	$90.00	$20,430	
				$76,105	$23,334

Total Rehabilitation Cost (Present Worth)	$1,144,567

Spreadsheet by Uehle - Rev. 11/02

MECHANISTIC PAVEMENT DESIGN

Date: 3/12/12

INPUT (Enter Data in Gray Shaded Cells)

Route: [redacted]
Section:
County: [redacted]
Location: [redacted]

Comments: [redacted]

Designer: [redacted]

	ADT	Year
Current:	[redacted]	[redacted]
Future:	[redacted]	[redacted]

Facility Type: [redacted]

# of Lanes = [redacted]

Road Class: I
Rural or Urban ?
Subgrade Support Rating (SSR): [redacted]
Construction Year: [redacted]
Design Period (DP) = [redacted] years

	Minimum ADT	Structural Design Traffic: Actual ADT	Actual %of Total ADT	% of ADT in Design Lane
PV =	0	89,332	95.8%	P = 20%
SU =	250	1,902	[redacted]	S = 40%
MU =	750	1,995	[redacted]	M = 40%
		Struct. Design ADT = 93229	(2028)	

FLEXIBLE & RIGID PAVEMENT CALCULATIONS AND ADDITIONAL INPUT

Flexible Pavement

Cpv = 0.15
Csu = 133
Cmu = 483
TF flexible (Actual)= [redacted] (Actual ADT)
TF flexible (Min)= 4.74 (Min ADT Fig 54-2C)
Use TF flexible = [redacted]
AC Type = [redacted]
AC Mixture Tempurature = [redacted] deg. F (Figure 54-5C)
Design AC Mixture Modulus (Eac)= 550 ksi (Figure 54-5D)
Design Asphalt Concrete Microstrain = 44.1 (Figure 54-5E)
Asphalt Concrete Thickness = [redacted] in. (Figure 54-5F)

Rigid Pavement

Cpv = 0.15
Csu = 144
Cmu = 696
TF rigid (Actual)= [redacted] (Actual ADT)
TF rigid (Min)= 6.70 (Min ADT Fig 54-2C)
Use TF rigid = [redacted]
[redacted] Shoulder or C. &G.
Rigid Pavt Thick = [redacted] in. (Figure 54-4D)

DESIGN TABLES FROM BD&E PAVEMENT DESIGN CH. 54 AND PAVEMENT DESIGN MANUAL

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

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

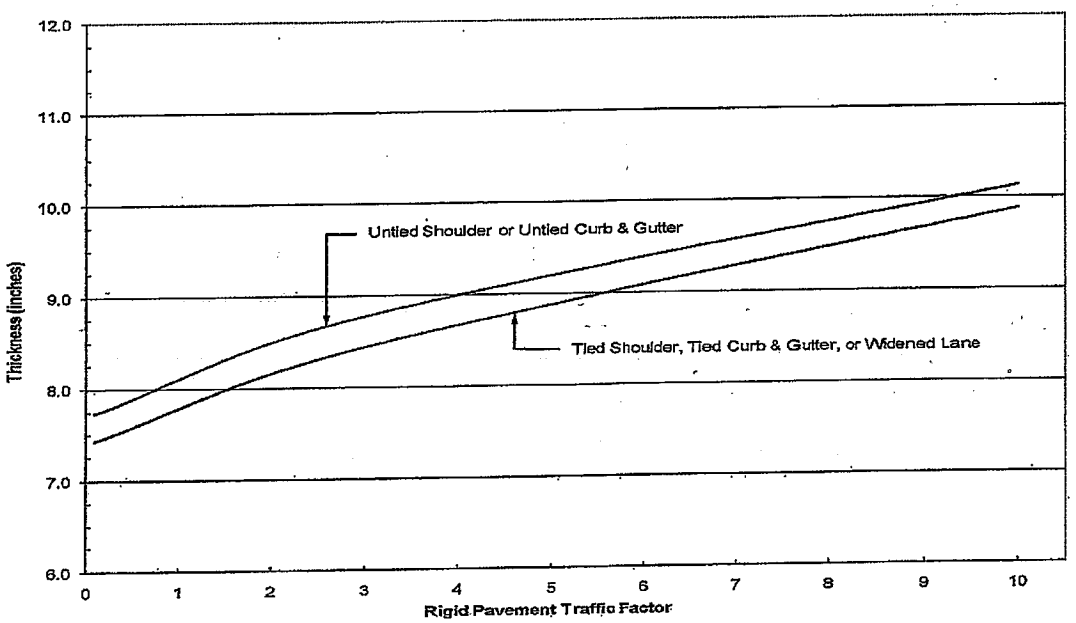
Class Table for One-Way Streets	
ADT	Class
0 - 3500	II
>3501	I

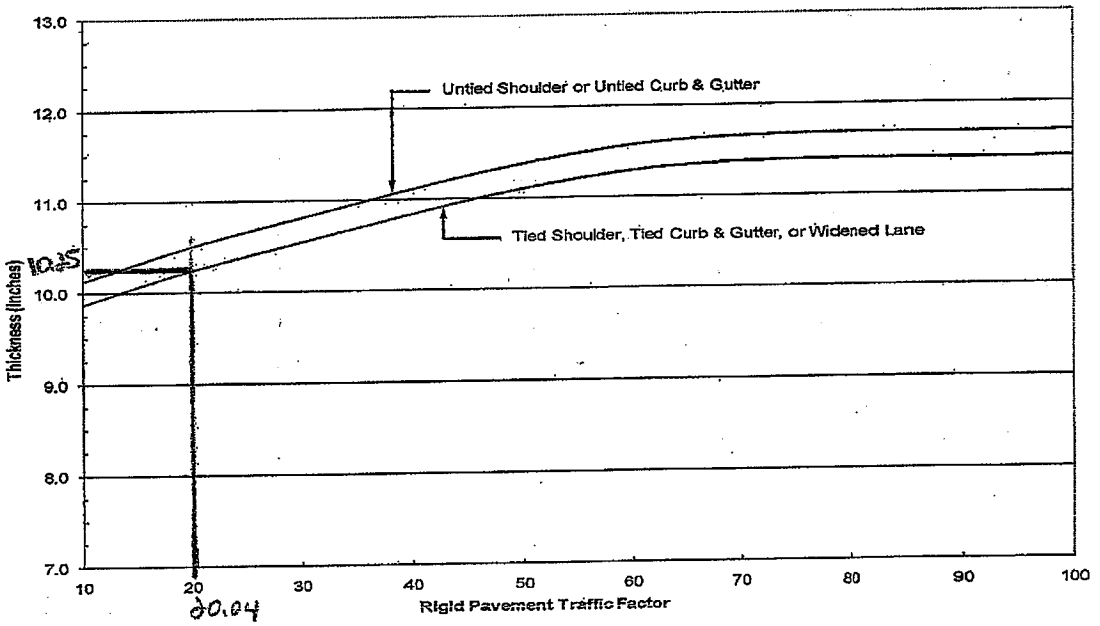
Class	Traffic Factor ESAL Coefficients: Rigid (Fig. 54-4C) Csu	Rigid Cmu	Flexible (Fig. 54-5B) Csu	Flexible Cmu
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
II	135.78	567.21	112.06	385.44
III	129.58	562.47	109.14	384.35
IV(ADT>400)	127.75	555.90	109.14	384.35
IV(ADT<=400)	127.75	555.90	9.86	78.84

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

Number of Lanes	Figure 54-2B Percentage of ADT in Design Lane: Rural P	Rural S	Rural M	Urban P	Urban S	Urban 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%
5 or more	20%	40%	40%	8%	37%	37%

IL 56





Note: Use of untied shoulder design requires BDE approval.

RIGID PAVEMENT DESIGN CHART
(Mechanistic Design: SSR = Poor)

Figure 54-4.E

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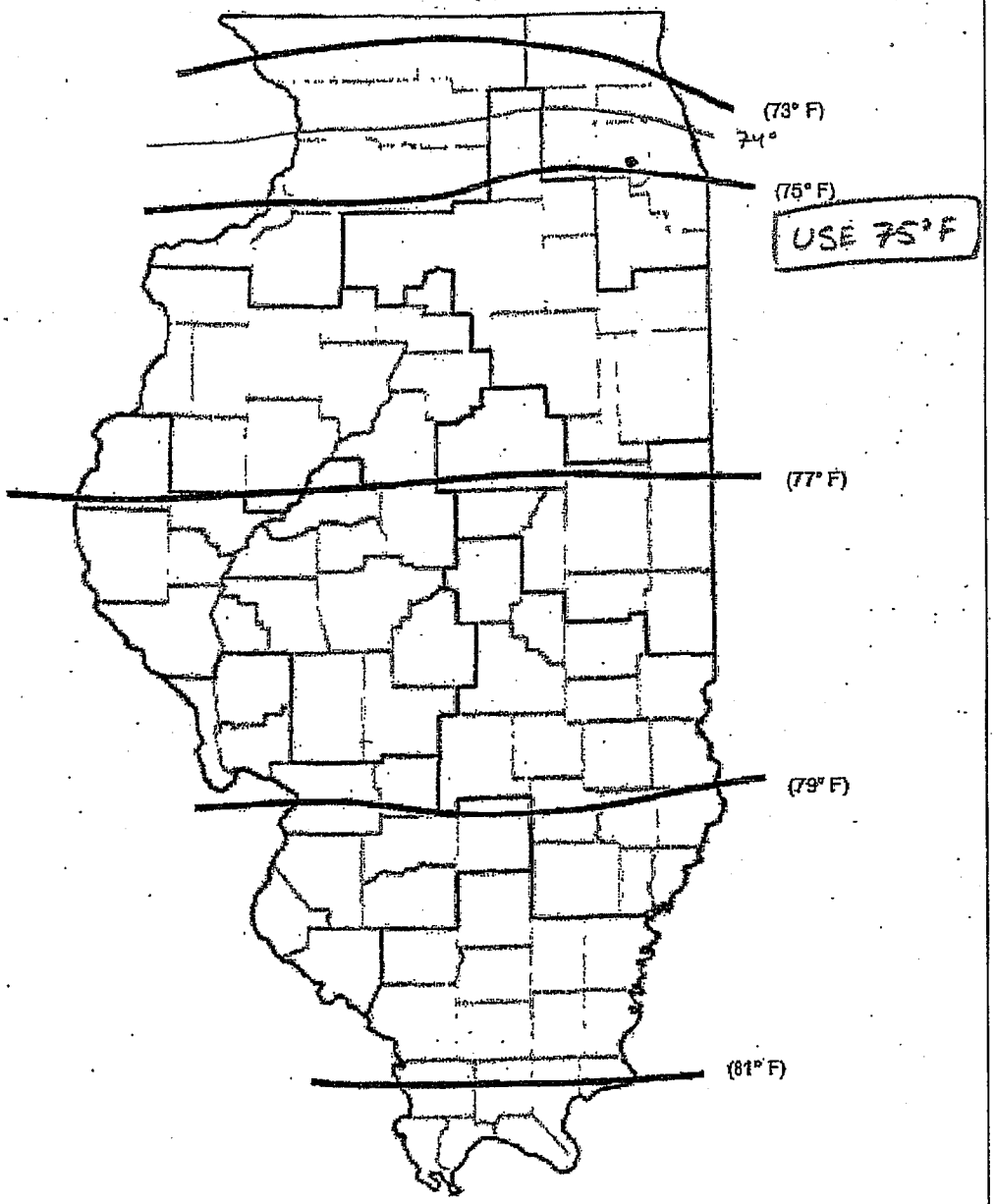
IL 56



Note: The minimum design HMA mixture temperature will be 73°F.

HMA MIXTURE TEMPERATURE
(Mechanistic Design: Flexible Pavement)

Figure 54-5.C

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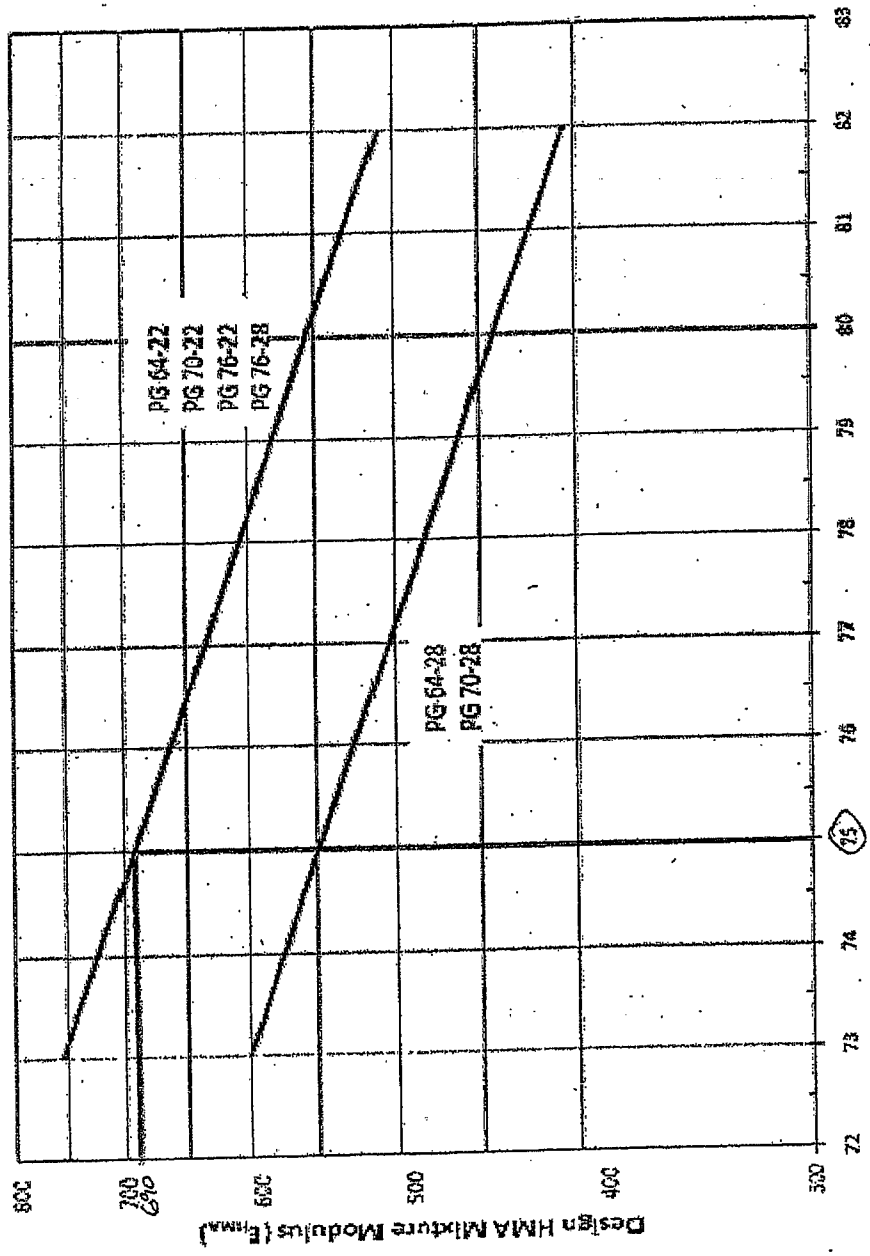
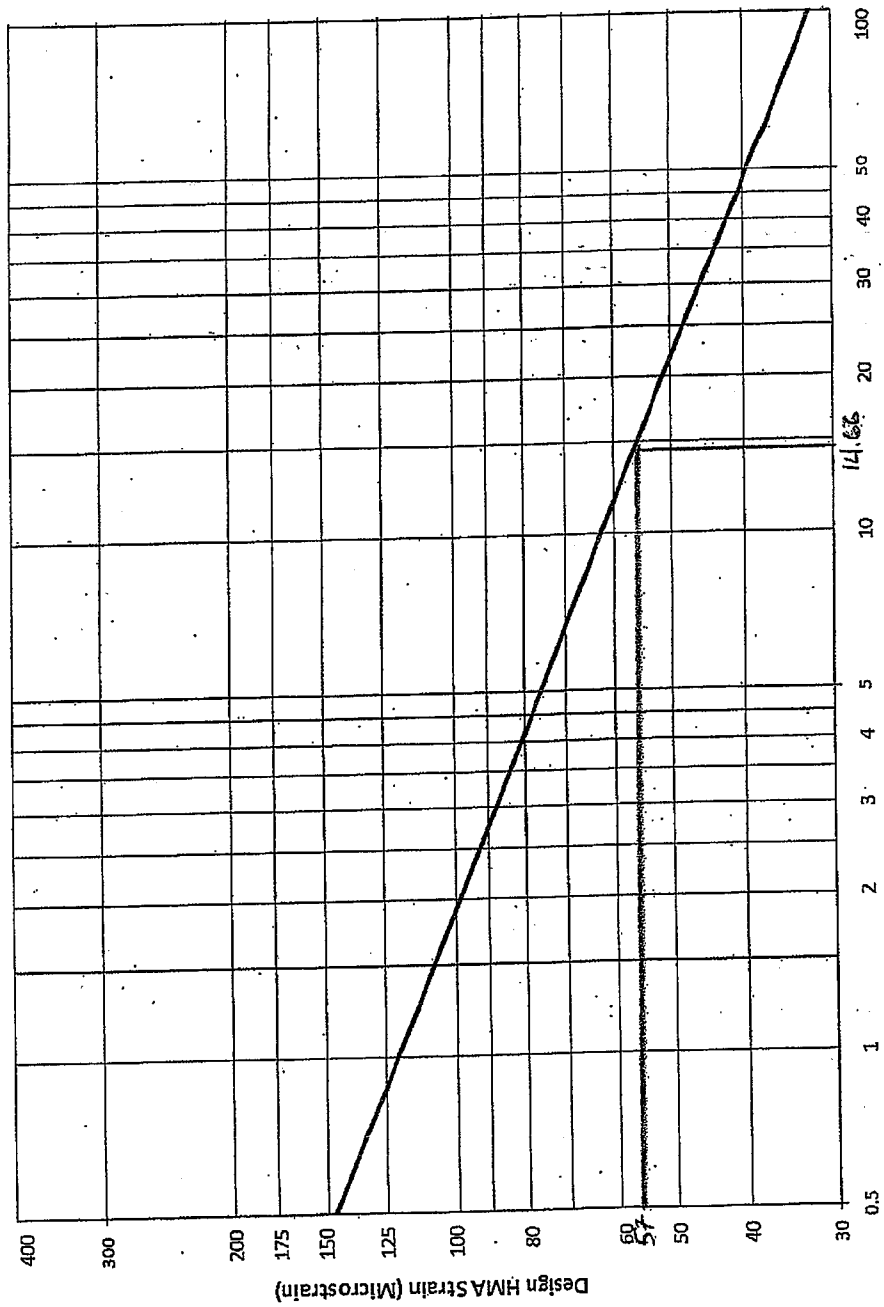


HMA MIXTURE MODULUS (E_{HMA})
(Mechanistic Design: Flexible Pavement)

Figure 54-5.D

HARD COPIES UNCONTROLLED

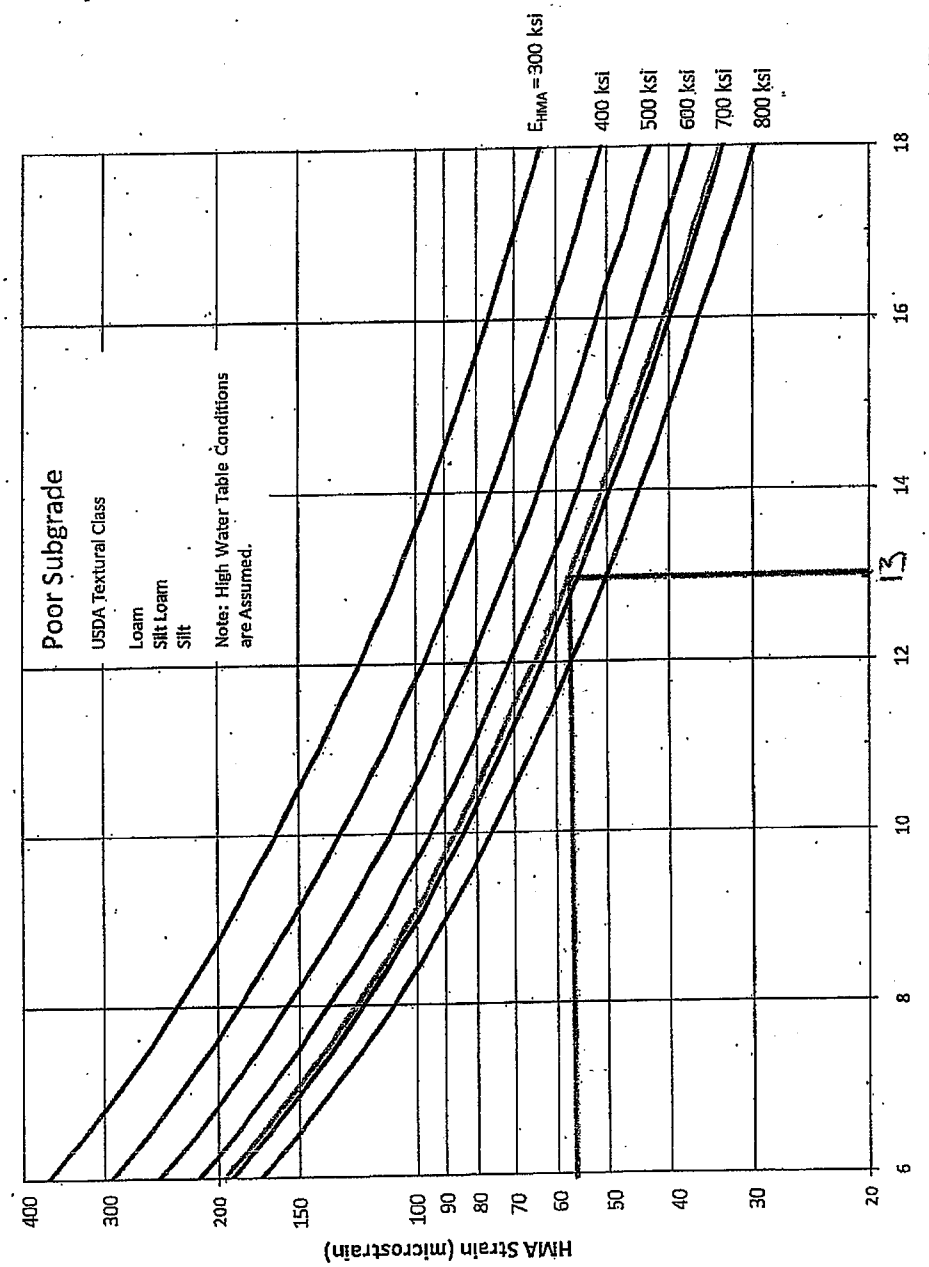
IL 56



DESIGN HMA STRAIN
(Mechanistic Design: Flexible Pavement)

Figure 54-5.E

IL 56



USE 13" Full Depth

HMA THICKNESS DESIGN CHART
(Mechanistic Design: Flexible Pavement: SSR = Poor)

Figure 54-5.F

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MECHANISTIC PAVEMENT DESIGN

Date 4-Apr-12
Calcs by: SIP
Checked by: TM
Class I Roads and Streets
Urban X Rural
Limits of Analysis Station 159+60 to Station 228+28
Length 3200 Feet 0.61 Miles

Route IL 56 @ IL 53
Section 634X-N-3
DuPage County
Location at IL 53

Structural Design Traffic
PV = 89332
SU = 1902
MU = 1995

Percent of S.D.T. in Design Lane
P = 95.80%
S = 2.00%
U = 2.10%

MINIMUM SUBGRADE SUPPORT RATING - "POOR"

Flexible Pavement Design Actual TF_F = 14.66 Minimum TF_F = 4.74

Selected Design AC Type
Design AC Mixture Temp 75 °F
Design AC Microstrain 57
Design E_{AC} 690 KSI
AC Thickness 13.00 Inch

Rigid Pavement Design Actual TF_F = 20.04 Minimum TF_F = 6.7
Extended Lane 10.25 Inch
15' Panel PCC Thickness for:
Tied Shoulder 0 Inch
Untied Shoulder 0 Inch

Figure 5.05

RIGID PAVEMENT

Date: 4-Apr-12 Route IL 56 @ IL 53
Quantities by SJP Checked by: Section 634X-N-3
Unit Prices by TM Checked by: DuPage County
Net Length 3200 Lin. Ft. = 0.61 Miles
Number Lanes 6 Urban X Rural

ITEMIZED CONSTRUCTION COST

Quantity	Units	Item		Unit Cost	Total Cost
25600	Sq. Yds.	10 Inch Jointed PCC	@	$39.85	$1,020,160
27733	Sq. Yds.	4-Inch (Stabilized/Granular Subbase)	@	$16.00	$443,728
0	Sq. Yds.	PCC Shoulder	@	$0.00	$0
	Lin. Ft.	Pipe Underdrains	@		
0		Subbase Gran. Mat., Type C	@	$0.00	$0
12,800	Lin. Ft.	100% Shoulder Joint Seal	@	$2.00	$25,600

Total Cost of Original Pavement Construction $1,489,488

ITEMIZED MAINTENANCE AND REHABILITATION ACTIVITY COST

REHABILITATION ACTIVITY 1 - YEAR 10

26	Sq. Yds.	0.1% Full Depth PCC Pavement Patching	@	$130.00	$3,380
		Total Cost of Rehabilitation Activity 1			$3,380

Figure 5.05a(1)

RIGID PAVEMENT (Cont.)

Route IL 56 @ IL 53

Section 634X-N-3

DuPage County

REHABILITATION ACTIVITY 2 - YEAR 15

			Unit Cost	Total Cost
51 Sq. Yds.	0.2% Full Depth PCC Pavement Patching	@	$130.00	$6,630

Total Cost of Rehabilitation Activity 2 $6,630

REHABILITATION ACTIVITY 3 - YEAR 20

			Unit Cost	Total Cost
512 Sq. Yds.	2% Full Depth PCC Pavement Patching	@	$0.00	$66,560
0 Sq. Yds.	0.5% Full Depth PCC Pavement Patching	@	$85.00	$0
12800 Lin. Ft.	100% Longitudunal/ Shoulder Joint Routing & Sealing	@	$1.00	$12,800
6400 Lin. Ft.	100% Centerline Joint Routing & Sealing	@	$1.00	$6,400

Total Cost of Rehabilitation Activity 3 $85,760

FIGURE 5.05a(2)

RIGID PAVEMENT (Cont.)

Route IL 56 @ IL 53

Section 634X-N-3

DuPage County

REHABILITATION ACTIVITY 4 - YEAR 25

			Unit Cost	Total Cost
768 Sq. Yds.	3.0% Full Depth PCC Pavement Patching	@	$130.00	$99,840
0 Sq. Yds.	1.0% Full Depth PCC Pavement Patching	@	$85.00	$0

Total Cost of Rehabilitation Activity 4 $99,840

REHABILITATION ACTIVITY 5 - YEAR 30

			Unit Cost	Total Cost
1024 Sq. Yds.	3.0% Full Depth PCC Pavement Patching	@	$85.00	$0
0 Sq. Yds.	1.0% Full Depth PCC Pavement Patching	@	$12.25	$313,600
25,600 Sq. Yds.	Policy HMA Overlay - Pavement	@	$12.25	$313,600
0 Sq. Yds.	Policy HMA Overlay - Shoulder	@	$12.25	$0

Total Cost of Rehabilitation Activity 5 $446,720

REHABILITATION ACTIVITY 6 - YEAR 35

			Unit Cost	Total Cost
12,800 Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$12,800
6400 Lin. Ft.	100% Centerline Joint Routing & Sealing	@	$1.00	$6,400
9,600 Lin. Ft.	50% Random Crack Routing & Sealing - Assume 100ft/station	@	$1.00	$9,600
6,144 Lin. Ft.	40% Reflective Transverse Crack Routing & Sealing	@	$1.00	$6,144
26 Sq. Yds.	0.1% Partial-Depth Pavement Patching (Mill & Fill Surface-Interstates; Mill & Fill 2.5in. Non-Interstates)		$130.00	$3,380

Total Cost of Rehabilitation Activity 6 $38,324

Figure 5.05a(3)

RIGID PAVEMENT (Cont.)

Route IL 56 @ IL 53

Section 634X-N-3

DuPage County

REHABILITATION ACTIVITY 7 - YEAR 40

			Unit Cost	Total Cost
128 Sq. Yds.	0.5% Full Depth PCC Pavement Patching	@	$130.00	$16,640
128 Sq. Yds.	0.5% Partial Depth Pavement Patching (Mill & Fill Surface-Interstates; Mill & Fill 2.5in. Non-Interstates)	@	$130.00	$16,640
9,216 Lin. Ft.	60% Reflective Transverse Crack Routing & Sealing	@	$1.00	$9,216
9,600 Lin. Ft.	50% Random Crack Routing & Sealing - Assume 100ft/station	@	$1.00	$9,600
12,800 Lin. Ft.	100% Longitudunal/ Shoulder Joint Routing & Sealing	@	$1.00	$12,800
6,400 Lin. Ft.	100% Centerline Joint Routing & Sealing	@	$1.00	$6,400
	Total Cost of Rehabilitation Activity 7			$71,296

RIGID PAVEMENT (Cont.)

Route IL 56 @ IL 53

Section 634X-N-3

DuPage County

ANNUAL COST DETERMINATION

Present Worth Calculation:

Total Cost of Original Pavement Construction $1,489,488

Present Worth of Rehab Activity 1	$3,380	x 0.7441 =	$2,515
Present Worth of Rehab Activity 2	$6,630	x 0.6419 =	$4,256
Present Worth of Rehab Activity 3	$85,760	x 0.5537 =	$47,485
Present Worth of Rehab Activity 4	$99,840	x 0.4776 =	$47,684
Present Worth of Rehab Activity 5	$446,720	x 0.4120 =	$184,049
Present Worth of Rehab Activity 6	$38,324	x 0.3554 =	$13,620
Present Worth of Rehab Activity 7	$71,296	x 0.3066 =	$21,859

Total Life Cycle Cost (Present Worth) $321,468

Annual Cost Per Mile Calculation

Total PW	x CRF_n /	Length		= Annual Cost / Year-Mile
$321,468	x0.04079 /	0.61	Mi.	$121,097 per Yr.-Mi.

FLEXIBLE PAVEMENT

Date: 4-Apr-12 Route IL 56 @ IL 53
Quantities by SJP Checked by: [redacted] Section 634X-N-3
Unit Prices by TM Checked by: [redacted] DuPage County
Net Length 3200 Lin. Ft. = 0.61 Miles
Number Lanes 6 Urban X Rural
Single Lane Paving X Dual Lane Paving

ITEMIZED CONSTRUCTION COST

Quantity	Units	Item		Unit Cost	Total Cost
25,600	Sq. Yds.	Class I Surface Course	@	$12.25	$313,600
25,600	Sq. Yds.	Class I Binder Course	@	$41.38	$1,059,328
0	Sq. Yds.	Stabilized Shoulders	@	$0.00	$0
	Lin. Ft.	Pipe Underdrains	@		
0		Subbase Gran. Matl., Type C	@	$0.00	$0
25,600	Sq. Yds.	Poly Binder	@	$10.78	$275,968

Total Cost of Original Pavement Construction $1,648,896

ITEMIZED MAINTENANCE AND REHABILITATION ACTIVITY COST

REHABILITATION ACTIVITY 1 - YEAR 5

				Unit Cost	Total Cost
1760	Lin. Ft.	50% Random/Thermal Cracking & Sealing (Assume 110ft/station)	@	$1.00	$1,760
12800	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$12,800
6400	Lin. Ft.	100% Centerline Joint Rounting & Sealing	@	$1.00	$6,400
26	Sq. Yds.	0.1% Partial-Depth Pavement Patching	@	$90.00	$2,340
		Mill & Fill Surface			

Total Cost of Rehabilitation Activity 1 $23,300

FIGURE 5.05b(1)

FLEXIBLE PAVEMENT (Cont.)
Route IL 56 @ IL 53
Section 634X-N-3
DuPage County

REHABILITATION ACTIVITY 2 - YEAR 10

				Unit Cost	Total Cost
128	Sq. Yds.	0.5% Partial-depth HMA Pavement Patching - Mill & Fill Surface	@	$90.00	$11,520
1760	Lin. Ft.	50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station)	@	$1.00	$1,760
12800	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$12,800
6400	Lin. Ft.	100% Centerline Joint Rounting & Sealing	@	$1.00	$6,400
		Total Cost of Rehabilitation Activity 2			$32,480

REHABILITATION ACTIVITY 3 - YEAR 15

				Unit Cost	Total Cost
25,600	Sq. Yds.	2.00in. Milling - Pavement & Shoulder	@	$1.75	$44,800
256	Sq. Yds.	1.0% Partial-depth Pavement Patching (Mill & Fill Addition 2.00in.)	@	$90.00	$23,040
2,867	Sq. Yds.	2.00in. HMA Overlay Pavement & Shoulder	@	$109.38	$313,578
		Total Cost of Rehabilitation Activity 3			$381,418

FLEXIBLE PAVEMENT (Cont.)

Route IL 56 @ IL 53

Section 634X-N-3

DuPage County

				Unit Cost	Total Cost
REHABILITATION ACTIVITY 4 - YEAR 20					
12800	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$12,800
6400	Lin. Ft.	100% Centerline Joint Rounting & Sealing	@	$1.00	$6,400
1760	Lin. Ft.	50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station)	@	$1.00	$1,760
26	Sq. Yds.	0.1% Partial-Depth HMA Pavement Patching (Mill & Fill Surface)	@	$90.00	$2,340
		Total Cost of Rehabilitation Activity 4			$23,300
				Unit Cost	Total Cost
REHABILITATION ACTIVITY 5 - YEAR 25					
12800	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$12,800
6400	Lin. Ft.	100% Centerline Joint Rounting & Sealing	@	$1.00	$6,400
1760	Lin. Ft.	50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station)	@	$1.00	$1,760
128	Sq. Yds.	0.5% Partial-Depth Pavement Patching (Mill & Fill Surface)	@	$90.00	$11,520
		Total Cost of Rehabilitation Activity 5			$32,480
				Unit Cost	Total Cost
REHABILITATION ACTIVITY 6 - YEAR 30					
25,600	Sq. Yds.	2.00in. Milling (Pavement only-Std Design Pavement & Shoulder-Limiting Strain Criteria Design)	@	$1.75	$44,800
512	Sq. Yds.	2.0% Partial-Depth HMA Pavement Patching (Mill & Fill Additional 2.00in. All Designs)	@	$90.00	$46,080
0	Sq. Yds.	1.0% Full-Depth HMA Shoulder Patching (Mill & Fill Surface-Standard Design Mill & Fill Additional 2.00in.-Limiting Strain Criteria Design)	@	$90.00	$0
5,376	Tons	HMA Overlay Pvmt (3.75in. - Std Design 2.00in.-Limiting Strain Criterion Design)	@	$109.38	$588,000
0	Tons	HMA Overlay Shoulder (1.75in. - Standard Design; 2.00in.-Limiting Strain Criterion Design)	@	$109.38	$0
		Total Cost of Rehabilitation Activity 6			$678,880

FIGURE 5.05b(3)

FLEXIBLE PAVEMENT (Cont.)
Route IL 56 @ IL 53
Section 634X-N-3
DuPage County

REHABILITATION ACTIVITY 7 - YEAR 35

				Unit Cost	Total Cost
12800	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$12,800
6400	Lin. Ft.	100% Centerline Joint Rounting & Sealing	@	$1.00	$6,400
1760	Lin. Ft.	50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station)	@	$1.00	$1,760
26	Sq. Yds.	0.1% Partial-Depth HMA Pavement Patching (Mill & Fill Surface)	@	$90.00	$2,340
		Total Cost of Rehabilitation Activity 7			$23,300

REHABILITATION ACTIVITY 8 - YEAR 40

				Unit Cost	Total Cost
12800	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$12,800
6400	Lin. Ft.	100% Centerline Joint Rounting & Sealing (Single Lane and Dual Lane Paving)	@	$1.00	$6,400
1760	Lin. Ft.	50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station)	@	$1.00	$1,760
128	Sq. Yds.	0.5% Partial-Depth Pavement Patching (Mill & Fill Surface)	@	$90.00	$11,520
		Total Cost of Rehabilitation Activity 8			$32,480

Figure 5.05b(4) - continued

FLEXIBLE PAVEMENT (Cont.)
Route IL 56 @ IL 53
Section 634X-N-3
DuPage County

ANNUAL COST DETERMINATION

Present Worth Calculation:

Total Cost of Original Pavement Construction $1,648,896

Present Worth of Rehab Activity 1	$23,300	x 0.7441 =	$20,099
Present Worth of Rehab Activity 2	$32,480	x 0.6419 =	$24,168
Present Worth of Rehab Activity 3	$381,418	x 0.5537 =	$244,832
Present Worth of Rehab Activity 4	$23,300	x 0.4776 =	$12,901
Present Worth of Rehab Activity 5	$32,480	x 0.4120 =	$15,512
Present Worth of Rehab Activity 6	$678,880	x 0.3554 =	$279,699
Present Worth of Rehab Activity 7	$23,300	x 0.3066 =	$8,281
Present Worth of Rehab Activity 8	$32,480	x 0.3066 =	$9,958

Total Life Cycle Cost (Present Worth) $615,450

Annual Cost Per Mile Calculation

Total PW	x CRF_n /	Length		= Annual Cost / Year-Mile
$615,450	x0.04079 /	0.61	Mi.	$151,414 per Yr.-Mi.

MATERIAL TYPE/PERCENTAGE	PCC	25.0%

PLAIN JOINTED PCC PAVEMENT

FILENAME-	IL 50 @ IL 53	4-Apr-12	
ROUTE-	IL 56	3:24 PM	
SECTION-	634X-N-3		
COUNTY-	DuPage		
LOCATION-	at IL 53		
DATE-	4-Apr-12		
PROJECT LENGTH (FT)	3200 =	0.61	MILES
AVERAGE LANE WIDTH (FT)	12		
NUMBER OF LANES	6		
# OF EDGES	4		
INSIDE SHLDER WIDTH (FT)	0		
OUTSIDE SHLDER WIDTH (FT)	10		
# OF CENTERLINES	2		
RIGID THICKNESS-	10.25		

TRAFFIC FACTORS	MINIMUM	ACTUAL
RIGID-	9.7	20.04

TRAFFIC		Percentages
PV-	89332	95.60%
SU-	1902	2.00%
MU-	1995	2.10%

INITIAL COSTS

ITEM	QUANTITY	UNIT PRICE	COST
PAVEMENT (SQ YDS)	25,600	$39.85	$1,020,160
STAB SUBBASE (SQ YDS)	27,733	$16.00	$443,728
SHOULDERS (SQ YDS)	0		$0
SHOULDER SEAL (LN FT)	12,800	$2.00	$25,600
SUBBASE GRAN MATL TY C (TONS)	0		$0

CONSTRUCTION INITIAL COST (PW)	$1,489,488
TOTAL REHABILITATION COST (PW)	$321,468
TOTAL LIFE CYCLE COST (PW)	$1,810,956
ANNUAL COST PER MILE	$121,097

MAINTENANCE COSTS:

ITEM		UNIT COST
PAVEMENT PATCHING (SQ YDS)	(Use Class A pricing for CRC)	$130.00
SHOULDER PATCHING (SQ YDS)		$85.00
SHLDR JT ROUT & SEAL (LF)		$1.00
CENTERLINE JT ROUT & SEAL (LF)		$1.00
POLICY HMA OVERLAY PVMT (SQ YDS)		$12.25
POLICY HMA OVERLAY SHLDR (SQ YDS)		$12.25
RANDOM CRACK ROUT & SEAL (LF)		$1.00
REFL TRANS CRACK ROUT & SEAL (LF)		$1.00
PARTIAL PVMT PATCH (SQ YDS)		$130.00

MAINTENANCE COSTS:

	ITEM	QUANTITY	UNIT PRICE	COST	PW
Activity 1 YEAR 10					
	PAVEMENT PATCHING 0.1% (SQ YDS)	26	$130.00	$3,380	
				$3,380	$2,515
Activity 2 YEAR 15					
	PAVEMENT PATCHING 0.2% (SQ YDS)	51	$130.00	$6,630	
				$6,630	$4,256
Activity 3 YEAR 20					
	PAVEMENT PATCHING 2.0% (SQ YDS)	512	$130.00	$66,560	
	SHOULDER PATCHING 0.5% (SQ YDS)	0	$85.00	$0	
	SHLDR JT ROUT & SEAL 100% (LF)	12,800	$1.00	$12,800	
	CENTERLINE JT ROUT & SEAL 100% (LF)	6,400	$1.00	$6,400	
				$85,760	$47,485
Activity 4 YEAR 25					
	PAVEMENT PATCHING 3.0% (SQ YDS)	768	$130.00	$99,840	
	SHOULDER PATCHING 1.0% (SQ YDS)	0	$85.00	$0	
				$99,840	$47,684
Activity 5 YEAR 30					
	PAVEMENT PATCHING 4.0% (SQ YDS)	1,024	$130.00	$133,120	
	SHOULDER PATCHING 1.5% (SQ YDS)	0	$85.00	$0	
	POLICY HMS OVERLAY OVMT (SQ YDS)	25,600	$12.25	$313,600	
	POLICY HMA OVERLAY SHLDR (SQ YDS)	0	$12.25	$0	
				$446,720	$184,049
Activity 6 YEARS 35					
	SHLDR JT ROUT & SEAL 100% (LF)	12,800	$1.00	$12,800	
	CENTERLINE JT ROUT & SEAL 100% (LF)	6,400	$1.00	$6,400	
	RANDOM CRACK ROUT & SEAL 50% (LF)	9,600	$1.00	$9,600	
	REFL TRANS CRACK ROUT & SEAL 40%	6,144	$1.00	$6,144	
	PARTIAL PVMT PATCH 0.1% (SQ YDS)	26	$130.00	$3,380	
				$38,324	$13,620
Activity 7 YEAR 40					
	PAVEMENT PATCHING 0.5% (SQ YDS)	126	$130.00	$16,640	
	SHOULDER PATCHING 0.5% (SQ YDS)	128	$130.00	$16,640	
	REFL TRANS CRACK ROUT & SEAL 60%	9,216	$1.00	$9,216	
	RANDOM CRACK ROUT & SEAL 50% (LF)	9,600	$1.00	$9,600	
	SHLDR JT ROUT & SEAL 100% (LF)	12,800	$1.00	$12,800	
	CENTERLINE JT ROUT & SEAL 100% (LF)	6,400	$1.00	$6,400	
				$71,296	$21,859
			Total Rehabilitation Cost (Present Worth)		$321,468

FULL-DEPTH FLEXIBLE
TRAFFIC FACTOR LESS THAN 15.0 (RURAL)
TRAFFIC FACTOR LESS THAN 10.0 (URBAN)

FULL DEOTH FLEXIBLE PAVEMENT
4-Apr-12
3:24 PM

ROUTE-	IL 56	
SECTION-	634X-N-3	
COUNTY-	DuPage	
LOCATION-	at IL 53	
PROJECT LENGTH (FT)	3200	
AVERAGE LANE WIDTH (FT)	12	
NUMBER OF LANES	6	
# OF EDGES	4	
INSIDE SHLDER WIDTH (FT)	0	
OUTSIDE SHLDER WIDTH (FT)	0	
# OF CENTERLINES	2	
PROJECT TYPE	2	1=RURAL, 2=URBAN
PAVING WIDTH	1	1=SINGLE LANE, 2=DUAL LANE
INTERSTATE / OTHER ROUTE	OTHER ROUTE	
FLEXIBLE THICKNESS-	0	

TRAFFIC FACTORS	MINIMUM	ACTUAL
FLEXIBLE	474	14.66

TRAFFIC

PV-	89332	0.958
SU-	1902	0.02
MU-	1995	0.021

PAVEMENT OVERLAY THICKNESS	3.75
SHOULDER OVERLAY THICKNESS	1.75

INITIAL COSTS

ITEM	QUANTITY	UNIT PRICE	COST
SURFACE (SQ YDS)	25,600	$12.25	$313,600
POLY BINDER (SQ YDS)	25,600	$10.78	$275,968
BINDER (SQ YDS)	25,600	$41.38	$1,059,328
SHOULDERS (SQ YDS)	0		$0
SUBBASE GRAN MATL TY C (TONS)	0		$0

CONSTRUCTION INITIAL COST (PW)	$1,648,896
TOTAL REHABILITATION COST (PW)	$615,450
TOTAL LIFE CYCLE COST (PW)	$2,264,346
ANNUAL COST PER MILE	$151,414

MAINTENANCE COSTS:

ITEM		UNIT COST
RAND/THERM CRACK ROUT & SEAL (LF)		$1.00
SHLDR JT ROUT & SEAL (LF)		$1.00
CENTERLINE JT ROUT & SEAL (LF)		$1.00
PARTIAL PVMT PATCH (SQ YDS)		$90.00
2" MILL PVMT & SHLDR (SQ YDS)	(Use $3.00 for small quantity)	$1.75
2" OVERLAY PVMT & SHLDR (TONS)		$109.38
2" MILL PVMT ONLY (SQ YDS)	(Use $3.00 for small quantity)	$1.75
HMA SHOULDER PATCHING (SQ YDS)		$90.00
POLICY HMA OVERLAY PVMT (TONS)		$109.38
POLICY HMA OVERLAY SHLDR (TONS)		$109.38

MATERIAL TYPE/PERCENTAGE	PCC	25.0%

MAINTENANCE COSTS

	ITEM	QUANTITY	UNIT PRICE	COST	PW
Activity 1					
YEAR 5	RAND/THERM CRACK ROUT & SEAL 50% (LF)	1,760	$1.00	$1,760	
	SHLDR JT ROUT & SEAL 100% (LF)	12,800	$1.00	$12,800	
	CENTERLINE JT ROUT & SEAL 100% (LF)	6,400	$1.00	$6,400	
	PARTIAL PVMT PATCH 0.1% (SQ YDS)	26	$90.00	$2,340	
				$23,300	$20,099
Activity 2					
YEAR 10	PARTIAL PVMT PATCH 0.5% (SQ YDS)	128	$90.00	$11,520	
	RAND/THERM CRACK ROUT & SEAL 50% (LF)	1,760	$1.00	$1,760	
	SHLDR JT ROUT & SEAL 100% (LF)	12,800	$1.00	$12,800	
	CENTERLINE JT ROUT & SEAL 100% (LF)	6,400	$1.00	$6,400	
				$32,480	$24,168
Activity 3					
YEAR 15	2" MILL PVMT & SHLDR 100% (SQ YDS)	25,600	$1.75	$44,800	
	PARTIAL PVMT PATCH 1.0% (SQ YDS)	256	$90.00	$23,040	
	2" OVERLAY PVMT & SHLDR 100% (TONS)	2,867	$109.38	$313,578	
				$381,418	$244,832
Activity 4					
YEAR 20	SHLDR JT ROUT & SEAL 100% (LF)	12,800	$1.00	$12,800	
	CENTERLINE JT ROUT & SEAL 100% (LF)	6,400	$1.00	$6,400	
	RAND/THERM CRACK ROUT & SEAL 50% (LF)	1,760	$1.00	$1,760	
	PARTIAL PVMT PATCH 0.1% (SQ YDS)	26	$90.00	$2,340	
				$23,300	$12,901
Activity 5					
YEAR 25	SHLDR JT ROUT & SEAL 100% (LF)	12,800	$1.00	$12,800	
	CENTERLINE JT ROUT & SEAL 100% (LF)	6,400	$1.00	$6,400	
	RAND/THERM CRACK ROUT & SEAL 50% (LF)	1,760	$1.00	$1,760	
	PARTIAL PVMT PATCH 0.5% (SQ YDS)	128	$90.00	$11,520	
				$32,480	$15,512
Activity 6					
YEAR 30	2" MILL PVMT & SHLDR 100% (SQ YDS)	25,600	$1.75	$44,800	
	PARTIAL PVMT PATCH 2.0% (SQ YDS)	512	$90.00	$46,080	
	HMA SHLDR PATCHING 1.0% (SQ YDS)	0	$90.00	$0	
	POLICY HMA OVERLAY PVMT (TONS)	5,376	$109.38	$588,000	
	POLICY HMA OVERLAY SHLDR (TONS)	0	$109.38	$0	
				$678,880	$279,699
Activity 7					
YEAR 35	SHLDR JT ROUT & SEAL 100% (LF)	12,800	$1.00	$12,800	
	CENTERLINE JT ROUT & SEAL 100% (LF)	6,400	$1.00	$6,400	
	RAND/THERM CRACK ROUT & SEAL 50% (LF)	1,760	$1.00	$1,760	
	PARTIAL PVMT PATCH 0.1% (SQ YDS)	26	$90.00	$2,340	
				$23,300	$8,281
Activity 8					
YEAR 40	SHLDR JT ROUT & SEAL 100% (LF)	12,800	$1.00	$12,800	
	CENTERLINE JT ROUT & SEAL 100% (LF)	6,400	$1.00	$6,400	
	RAND/THERM CRACK ROUT & SEAL 50% (LF)	1,760	$1.00	$1,760	
	PARTIAL PVMT PATCH 0.5% (SQ YDS)	128	$90.00	$11,520	
				$32,480	$9,958

Total Rehabilitation Cost (Present Worth) $615,450