Illinois Department of Transportation

To:	Diane M. O'Keefe	Attn: District One
From:	John D. Baranzelli	
Subject:	Pavement Design	
Date:	May 31, 2012	

FAP Route 305 (Willow Road)
Cook County
From west of IL 43 to Bristol Road

We have reviewed the pavement selection for the project, which was submitted to BDE by email dated May 24, 2012. The design meets the warrants for a "high stress" intersection with MU ADT exceeding 200 vehicles. The approved pavement design for this project is as follows:

Willow Road and Arterial Roads (Pavement Reconstruction)

9.25 inches of PCC Pavement with Tied PCC Curb & Gutter
4.5 inches of Stabilized Sub-Base
12 inches of Aggregate Subgrade

IL Route 43 (Pavement Reconstruction)

10.25 inches of PCC Pavement with Tied PCC Curb & Gutter
4.5 inches of Stabilized Sub-Base
12 inches of Aggregate Subgrade

The BDE Estimating Unit suggested that the unit price for PCC Pavement 10 ½" [Jointed] should be $51.32 instead of $44.23. The price differential would have been slightly lower, but the rigid pavement option would still be the more economical design.

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:	May 3, 2012		

*Route: FAP 305 (Willow Road)
Limits: west of IL 43 to Bristol St.
Contract No.: 60T35
Letting: 11CY12

Section: NA
County: Cook
Job No.: D-91-331-12

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 Willow Road from west of IL 43 to Bristol Street to accommodate an additional through lane in each direction making it a four lane roadway as well as a wider median.

b.) Pavement reconstruction of IL 43 at Willow Road to accommodate an additional turning lane in each direction making it a six lane roadway.

c.) Pavement reconstruction of arterial roads Three Lakes Drive, Fox Meadow Drive, Sunset Ridge Road, Old Willow Road, Wagner Road, Old Willow Road, Northfield Road, Central Avenue, and Happ Road at Willow Road to accommodate the new geometry for the additional lanes and median widening on Willow Road.

A 30 year mechanistic pavement analysis was performed for the pavement reconstruction of Willow Road from west of IL 43 to Bristol Street since the pavement reconstruction is greater than 25,000 square yards. Willow Road is considered "high stress" as design lane MU ADT is greater than 200 at the signalized intersections. The recommended pavement is:

a.) Willow Road
Pavement Reconstruction
PCC Curb and Gutter (tied)
- 9 ¼" PCC Pavement (Jointed) *
- 4 ½" Stabilized Subbase
- 12" Aggregate Subgrade Improvement

The life cycle cost analysis favors PCC pavement by 12.3%.

A 20 year mechanistic pavement analysis was performed for the pavement reconstruction of IL 43 at Willow Road since the pavement reconstruction is less than 25,000 square yards. Willow Road is considered "high stress" as design lane MU ADT is greater than 200 at the signalized intersections. The recommended pavement is:

b.) IL 43
Pavement Reconstruction
PCC Shoulder (tied) and PCC Curb and Gutter (tied)
10 ¼" PCC Pavement (Jointed) **
12" Aggregate Subgrade Improvement

The life cycle cost analysis favors PCC pavement by 22.4%.

A segmental pavement analysis was performed for the arterial roads of Three Lakes Drive, Fox Meadow Drive, Sunset Ridge Road, Old Willow Road, Wagner Road, Old Willow Road, Northfield Road, Central Avenue, and Happ Road at Willow Road. For ease of construction a PCC pavement is favored to match the pavement reconstruction of Willow Road. Our recommendation is as follows:

c.) Arterial Roads ***
Pavement Reconstruction
PCC Curb and Gutter (tied)
9 ¼" PCC Pavement (Jointed) *
12" Aggregate Subgrade Improvement

*Designer Note 1: To be paid as pay item #42000406, **PORTLAND CEMENT CONCRETE PAVEMENT 9 1/4" (JOINTED),** paid in square yards.

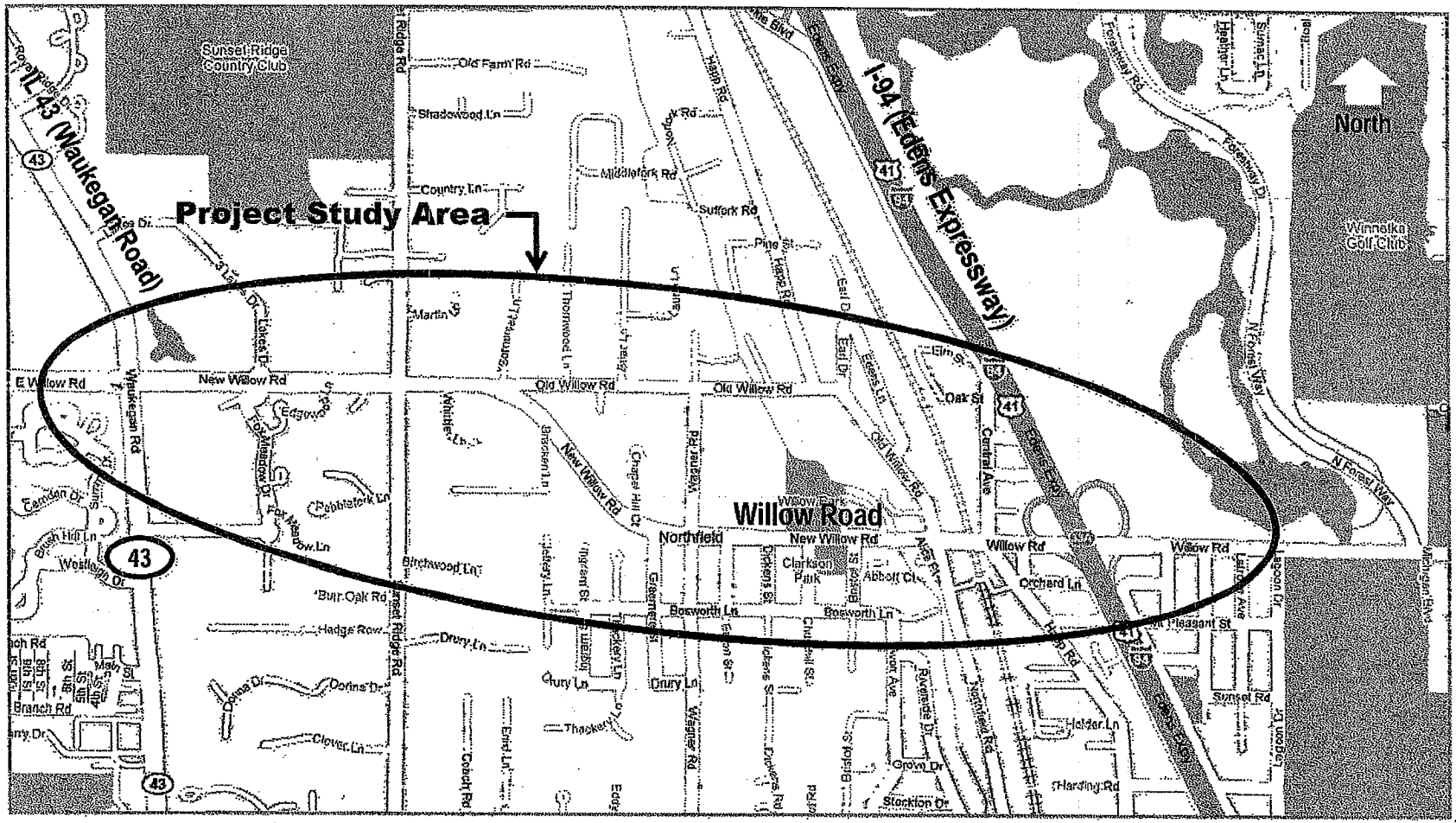
Designer Note 2: To be paid as pay item #42000506, **PORTLAND CEMENT CONCRETE PAVEMENT 10 1/4" (JOINTED), paid in square yards.

*** Designer Note 3: The arterial roads are subject to local jurisdiction concurrence.

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

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

Project Location Map



WillowRoad FUTURE
WWW.WILLOWROADFUTURE.ORG

IL 43

Spreadsheet by Uehle - Rev. 11/02

MECHANISTIC PAVEMENT DESIGN (FOR TF ONLY)

Date: 5/1/12

INPUT (Enter Data in Gray Shaded Cells)

Route: IL 43
Section: N/A
County: Cook
Location: at Willow Road

Comments: Pavement design for IL 43 at Willow Road

Designer: SJP

	ADT	Year
Current:	25700	2005
Future:	36000	2045

Facility Type: Other Marked State Route

# of Lanes = 4

Road Class: I

Subgrade Support Rating (SSR): Fair

Construction Year: 2013

Design Period (DP) = 20 years

	Minimum ADT	Structural Design Traffic: Actual ADT	Actual %of Total ADT	% of ADT in Design Lane
PV =	0	28,156	87.3%	P = 32%
SU =	250	1,413	4.4%	S = 45%
MU =	750	2,701	8.4%	M = 45%
Struct. Design ADT =		32271	(2023)	

FLEXIBLE & RIGID PAVEMENT CALCULATIONS AND ADDITIONAL INPUT

Flexible Pavement

Cpv =	0.15	
Csu =	133	
Cmu =	483	
TF flexible (Actual)=	13.44	(Actual ADT)
TF flexible (Min)=	3.56	(Min ADT Fig 54-2C)
Use TF flexible =	13.44	
AC Type =	20	
AC Mixture Tempurature =		deg. F (Figure 54-5C)
Design AC Mixture Modulus (Eac)=		ksi (Figure 54-5D)
Design Asphalt Concrete Microstrain =	45.3	(Figure 54-5E)
Asphalt Concrete Thickness =		in (Figure 54-5F)

Rigid Pavement

Cpv =	0.15	
Csu =	144	
Cmu =	696	
TF rigid (Actual)=	18.79	(Actual ADT)
TF rigid (Min)=	5.02	(Min ADT Fig 54-2C)
Use TF rigid =	18.79	
	Tied	Shoulder or C. &G.
Rigid Pavt Thick. =	[illegible]	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)

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

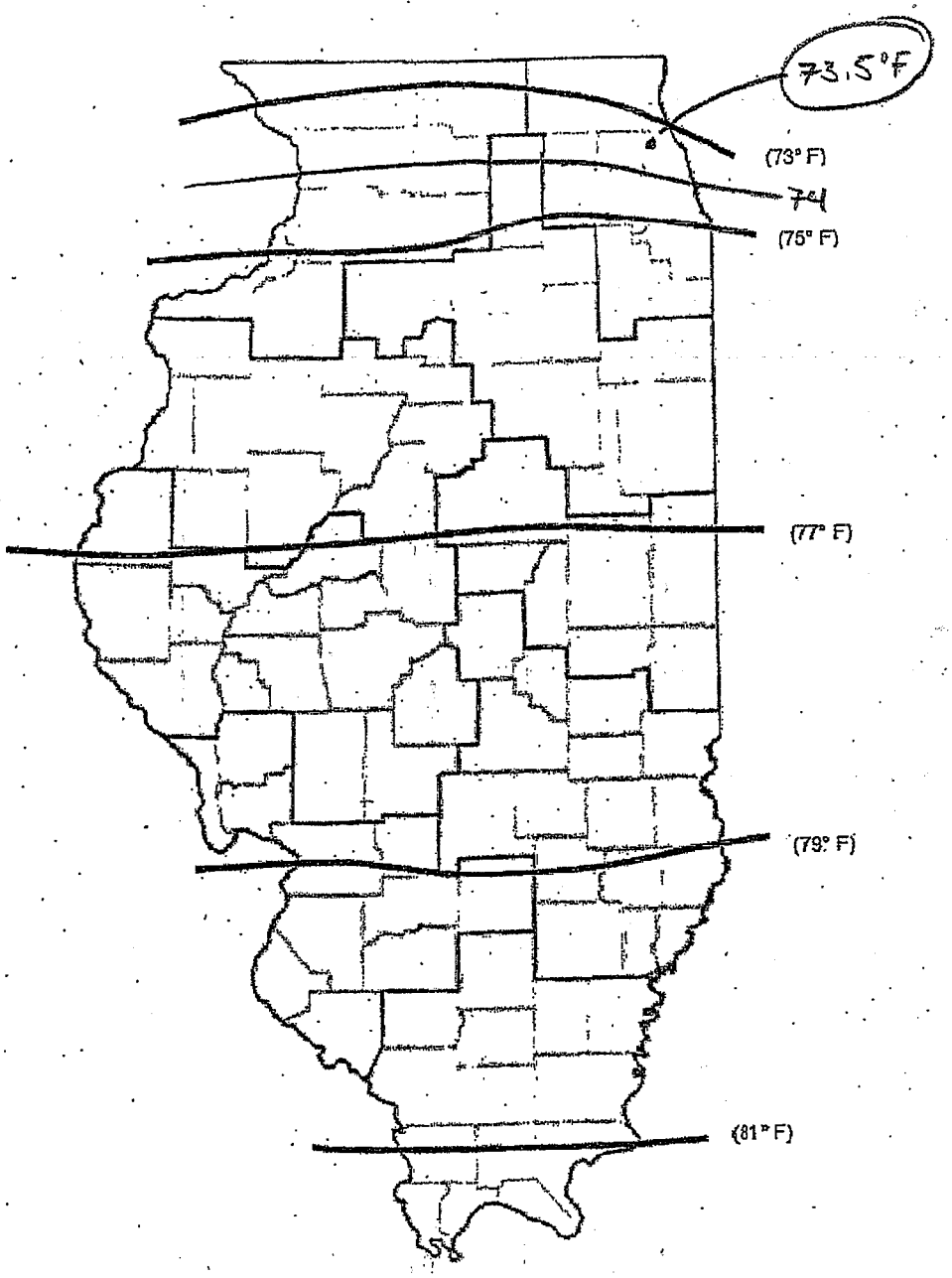
Class Table for One-Way Streets	
ADT	Class
0 - 3500	II
>3501	I

	Traffic Factor ESAL Coefficients			
	Rigid (Fig. 54-4C)		Flexible (Fig. 54-5B)	
Class	Csu	Cmu	Csu	Cmu
I	143.81	696.42	32.50	482.5%
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

	Figure 54-2B Percentage of ADT in Design Lane					
	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%

IL 43



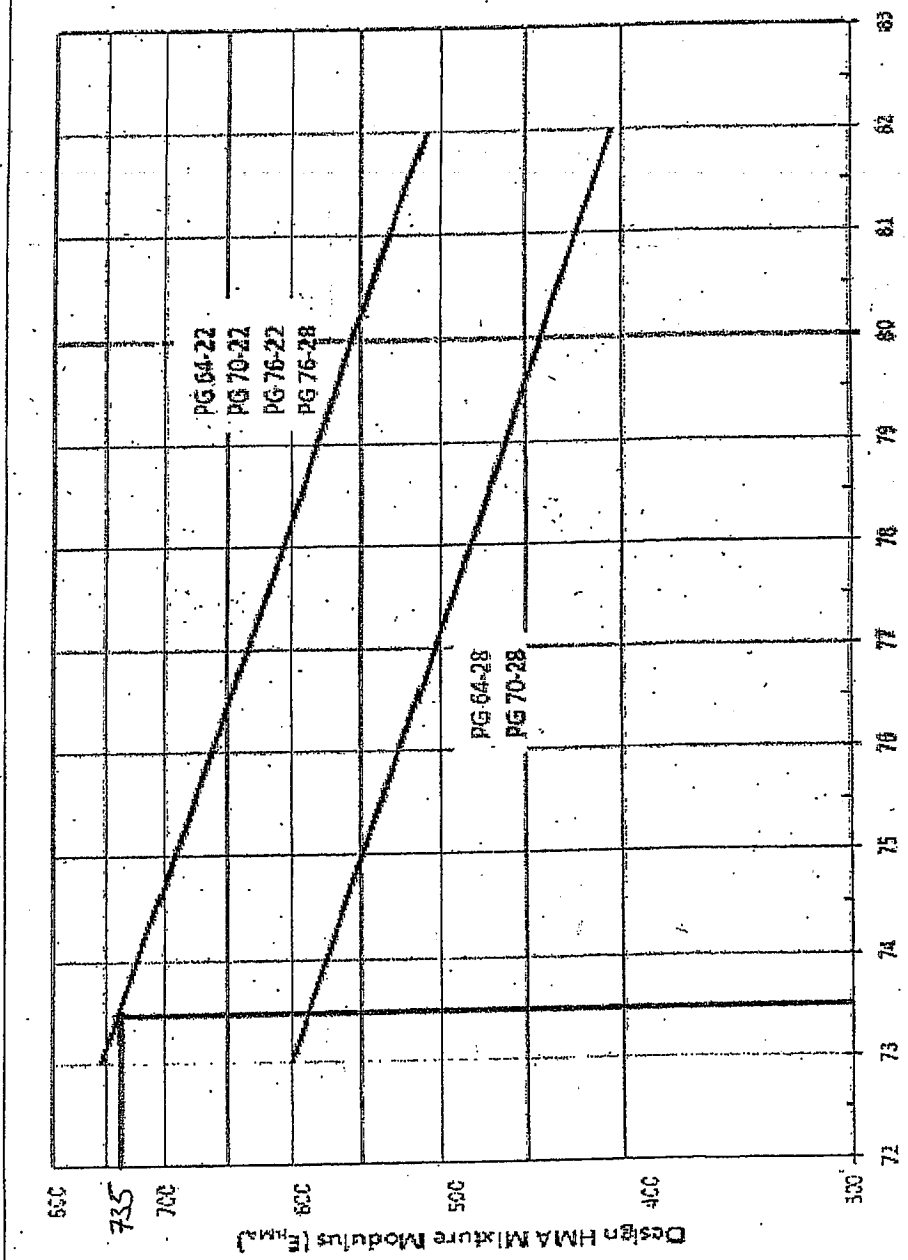
Note: The minimum design HMA mixture temperature will be 73°F.

HMA MIXTURE TEMPERATURE
(Mechanistic Design: Flexible Pavement)

Figure 54-5.C

HARD COPIES UNCONTROLLED

IL 43



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

Figure 54-5.D

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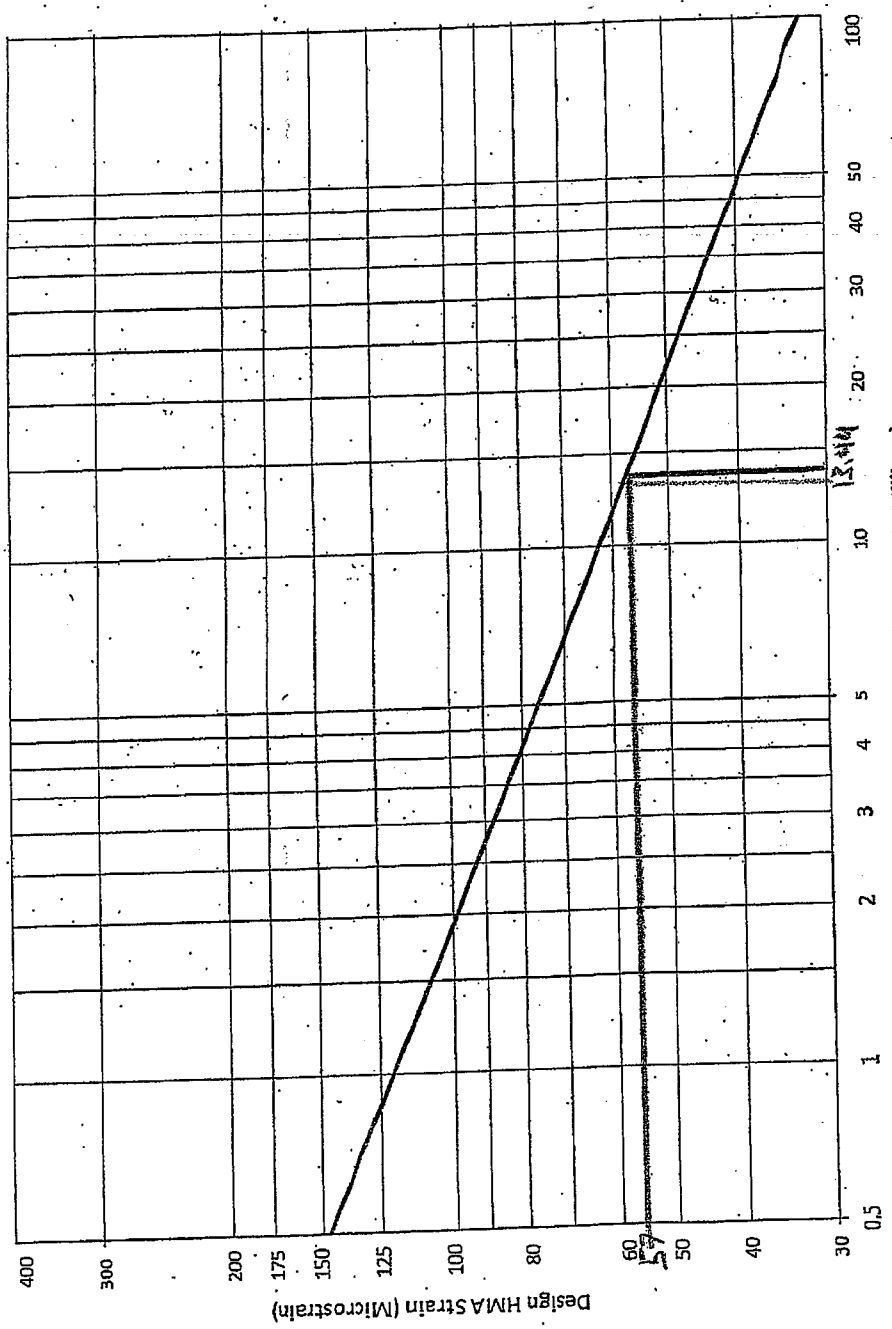

DESIGN HMA STRAIN
(Mechanistic Design: Flexible Pavement)

Figure 54-5.E

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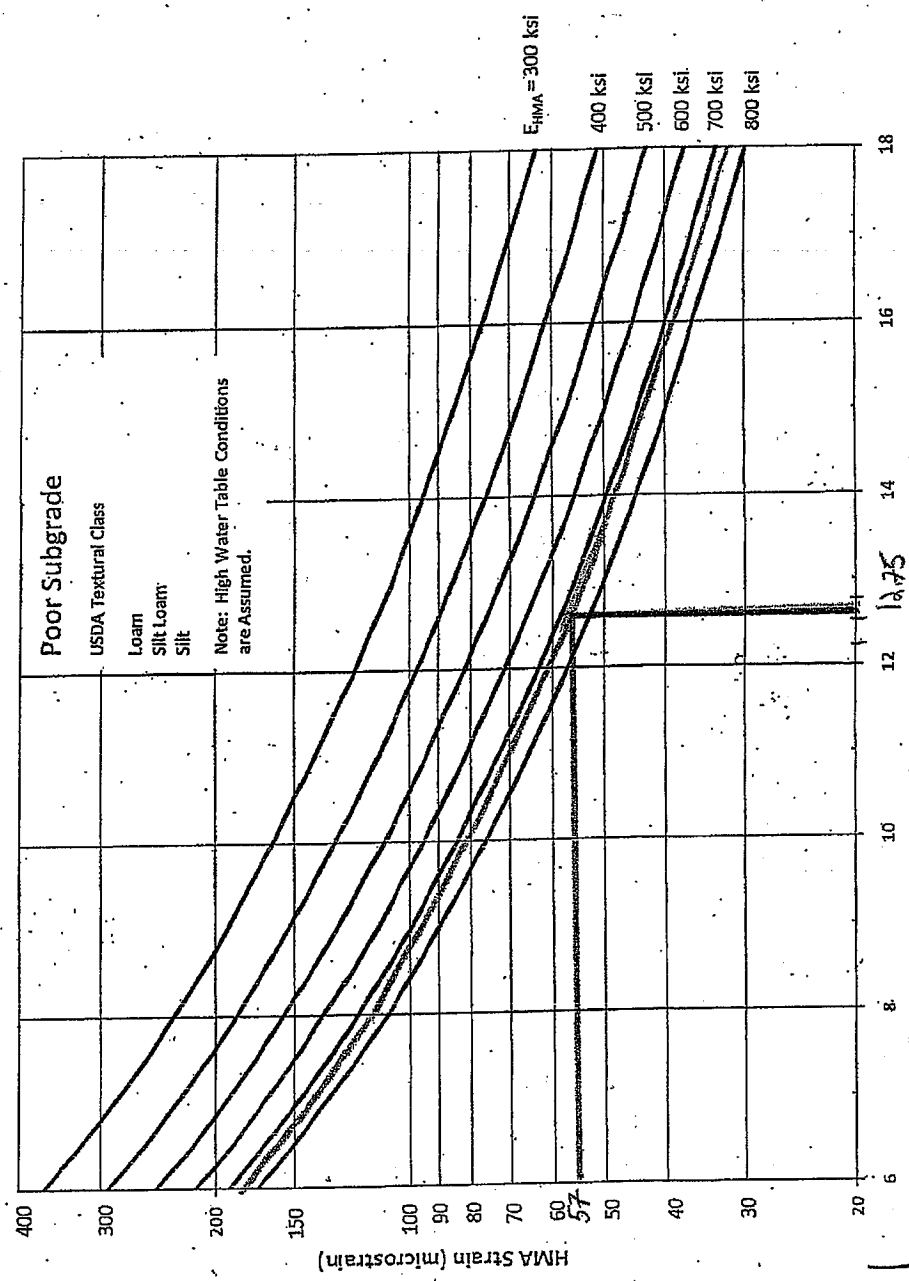
IL 43



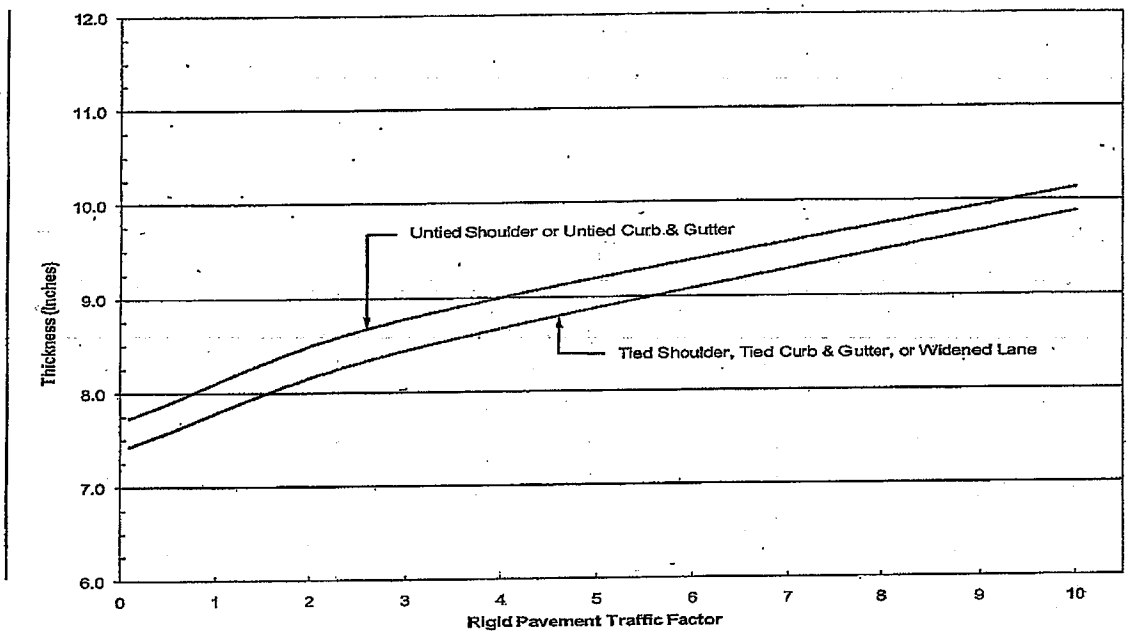
HMA THICKNESS DESIGN CHART
(Mechanistic Design: Flexible Pavement: SSR = Poor)

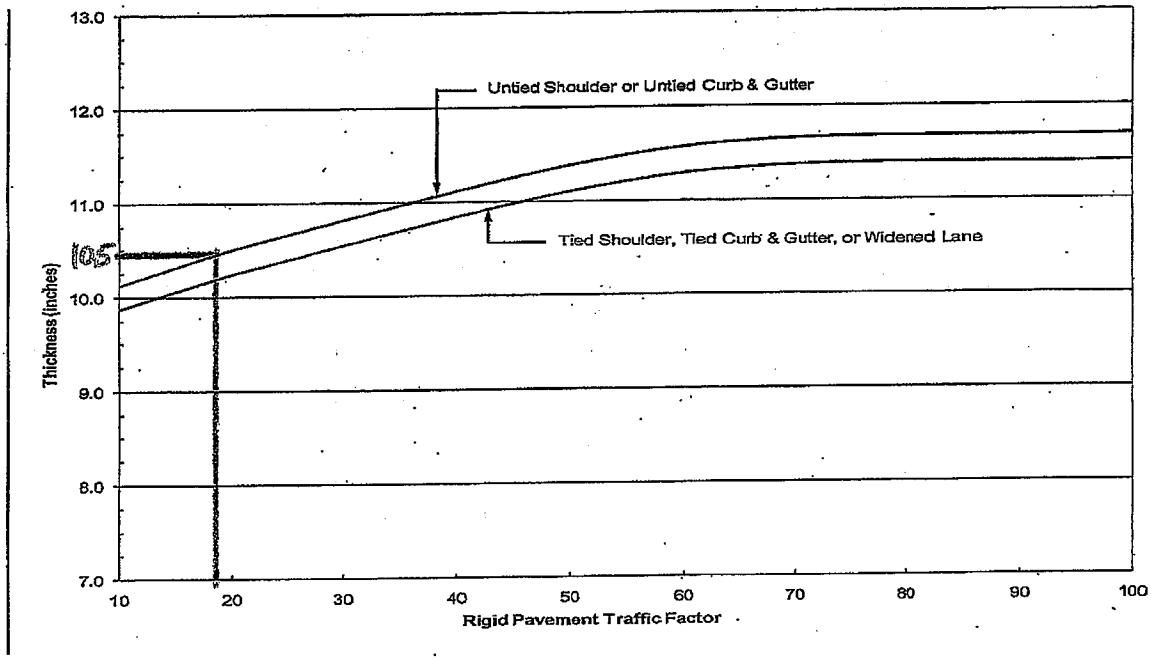
Figure 54-5.F

12.75" FULL DEPTH
- 2" POLY N70 SC
- 2¼" POLY N70 SC
- 8½" N70 BC

HARD COPIES UNCONTROLLED

IL43





Note: Use of untied shoulder design requires BDE approval.

10.5" PCC

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

Figure 54-4.E

HARD COPIES UNCONTROLLED

MECHANISTIC PAVEMENT DESIGN

Date 2-May-12 | Route IL 43
Calcs by: SIP | Section N/A
Checked by: SIP | Cook County
Class I Roads and Streets | Location at Willow Rd
Urban X Rural
Limits of Analysis Station 1091+99 to Station 111+43.4
Length 1943.6 Feet 0.37 Miles

Structural Design Traffic | Percent of S.D.T. in Design Lane
PV = 28156 | P = 87.30%
SU = 1413 | S = 4.40%
MU = 2701 | U = 8.40%
MINIMUM SUBGRADE SUPPORT RATING - "POOR"

Flexible Pavement Design — Actual TF_F = 13.44 — Minimum TF_F = 3.56

Selected Design AC Type
Design AC Mixture Temp 73.5 °F — Design E_{AC} 735 KSI
Design AC Microstrain 57 — AC Thickness 12.75 Inch

Rigid Pavement Design — Actual TF_F = 18.79 — Minimum TF_F = 5.02
Extended Lane 10.5 Inch
15' Panel PCC Thickness for:
Tied Shoulder 0 Inch
Untied Shoulder 0 Inch

Figure 5.05

RIGID PAVEMENT

Date: 2-May-12 Route IL 43
Quantities by SJP Checked by: Section N/A
Unit Prices b SJP Checked by: Cook County
Net Length 1943.6 Lin. Ft. = 0.37 Miles
Number Lanes 4 Urban X Rural

ITEMIZED CONSTRUCTION COST

Quantity	Units	Item		Unit Cost	Total Cost
10366	Sq. Yds.	11 Inch Jointed PCC	@	$44.23	$458,488
11662	Sq. Yds.	4-Inch (Stabilized/Granular Subbase)	@	$0.00	$0
0	Sq. Yds.	PCC Shoulder	@	$0.00	$0
	Lin. Ft.	Pipe Underdrains	@		
0		Subbase Gran. Mat., Type C	@	$0.00	$0
7,774	Lin. Ft.	100% Shoulder Joint Seal	@	$2.00	$15,548

Total Cost of Original Pavement Construction $474,036

ITEMIZED MAINTENANCE AND REHABILITATION ACTIVITY COST

REHABILITATION ACTIVITY 1 - YEAR 10

10	Sq. Yds.	0.1% Full Depth PCC Pavement Patching	@	$130.00	$1,300
		Total Cost of Rehabilitation Activity 1			$1,300

Figure 5.05a(1)

RIGID PAVEMENT (Cont.)

Route IL 43

Section N/A

Cook County

REHABILITATION ACTIVITY 2 - YEAR 15

				Unit Cost	Total Cost
21	Sq. Yds.	0.2% Full Depth PCC Pavement Patching	@	$130.00	$2,730
			Total Cost of Rehabilitation Activity 2		$2,730

REHABILITATION ACTIVITY 3 - YEAR 20

				Unit Cost	Total Cost
207	Sq. Yds.	2% Full Depth PCC Pavement Patching	@	$0.00	$26,910
0	Sq. Yds.	0.5% Full Depth PCC Pavement Patching	@	$85.00	$0
7774	Lin. Ft.	100% Longitudunal/ Shoulder Joint Routing & Sealing	@	$1.00	$7,774
3887	Lin. Ft.	100% Centerline Joint Routing & Sealing	@	$1.00	$3,887
			Total Cost of Rehabilitation Activity 3		$38,571

FIGURE 5.05a(2)

RIGID PAVEMENT (Cont.)

Route IL 43

Section N/A

Cook County

REHABILITATION ACTIVITY 4 - YEAR 25

			Unit Cost	Total Cost
311 Sq. Yds.	3.0% Full Depth PCC Pavement Patching	@	$130.00	$40,430
0 Sq. Yds.	1.0% Full Depth PCC Pavement Patching	@	$85.00	$0
	Total Cost of Rehabilitation Activity 4			$40,430

REHABILITATION ACTIVITY 5 - YEAR 30

			Unit Cost	Total Cost
415 Sq. Yds.	3.0% Full Depth PCC Pavement Patching	@	$85.00	$0
0 Sq. Yds.	1.0% Full Depth PCC Pavement Patching	@	$8.76	$90,806
10,366 Sq. Yds.	Policy HMA Overlay - Pavement	@	$8.76	$90,806
0 Sq. Yds.	Policy HMA Overlay - Shoulder	@	$8.76	$0
	Total Cost of Rehabilitation Activity 5			$144,756

REHABILITATION ACTIVITY 6 - YEAR 35

			Unit Cost	Total Cost
7,774 Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$7,774
3887 Lin. Ft.	100% Centerline Joint Routing & Sealing	@	$1.00	$3,887
3,887 Lin. Ft.	50% Random Crack Routing & Sealing - Assume 100ft/station	@	$1.00	$3,887
2,488 Lin. Ft.	40% Reflective Transverse Crack Routing & Sealing	@	$1.00	$2,488
10 Sq. Yds.	0.1% Partial-Depth Pavement Patching (Mill & Fill Surface-Interstates; Mill & Fill 2.5in. Non-Interstates)		$130.00	$1,300
	Total Cost of Rehabilitation Activity 6			$19,336

Figure 5.05a(3)

RIGID PAVEMENT (Cont.)

Route IL 43

Section N/A

Cook County

REHABILITATION ACTIVITY 7 - YEAR 40

			Unit Cost	Total Cost
52 Sq. Yds.	0.5% Full Depth PCC Pavement Patching	@	$130.00	$6,760
52 Sq. Yds.	0.5% Partial Depth Pavement Patching (Mill & Fill Surface-Interstates; Mill & Fill 2.5in. Non-Interstates)	@	$130.00	$6,760
3,732 Lin. Ft.	60% Reflective Transverse Crack Routing & Sealing	@	$1.00	$3,732
3,887 Lin. Ft.	50% Random Crack Routing & Sealing - Assume 100ft/station	@	$1.00	$3,887
7,774 Lin. Ft.	100% Longitudunal/ Shoulder Joint Routing & Sealing	@	$1.00	$7,774
3,887 Lin. Ft.	100% Centerline Joint Routing & Sealing	@	$1.00	$3,887
	Total Cost of Rehabilitation Activity 7			$32,800

RIGID PAVEMENT (Cont.)

Route IL 43

Section N/A

Cook County

ANNUAL COST DETERMINATION

Present Worth Calculation:

Total Cost of Original Pavement Construction			$474,036
Present Worth of Rehab Activity 1	$1,300	x 0.7441 =	$967
Present Worth of Rehab Activity 2	$2,730	x 0.6419 =	$1,752
Present Worth of Rehab Activity 3	$38,571	x 0.5537 =	$21,357
Present Worth of Rehab Activity 4	$40,430	x 0.4776 =	$19,309
Present Worth of Rehab Activity 5	$144,756	x 0.4120 =	$59,639
Present Worth of Rehab Activity 6	$19,336	x 0.3554 =	$6,872
Present Worth of Rehab Activity 7	$32,800	x 0.3066 =	$10,056
Total Life Cycle Cost (Present Worth)			$119,952

Annual Cost Per Mile Calculation

Total PW	x CRF_n /	Length		= Annual Cost / Year-Mile
$119,952	x0.04079 /	0.37	Mi.	$65,483 per Yr.-Mi.

FLEXIBLE PAVEMENT

Date: 2-May-12 Route IL 43
Quantities by SJP Checked by: [redacted] Section N/A
Unit Prices by SJP Checked by: [redacted] Cook County
Net Length 1943.6 Lin. Ft. = 0.37 Miles
Number Lanes 4 Urban X Rural
Single Lane Paving X Dual Lane Paving

ITEMIZED CONSTRUCTION COST

Quantity	Units	Item		Unit Cost	Total Cost
10,366	Sq. Yds.	Class I Surface Course	@	$8.76	$90,806
10,366	Sq. Yds.	Class I Binder Course	@	$31.40	$325,492
0	Sq. Yds.	Stabilized Shoulders	@	$0.00	$0
	Lin. Ft.	Pipe Underdrains	@		
0		Subbase Gran. Matl., Type C	@	$0.00	$0
10,366	Sq. Yds.	Poly Binder	@	$9.07	$94,020

Total Cost of Original Pavement Construction $515,177

ITEMIZED MAINTENANCE AND REHABILITATION ACTIVITY COST

REHABILITATION ACTIVITY 1 - YEAR 5

				Unit Cost	Total Cost
1069	Lin. Ft.	50% Random/Thermal Cracking & Sealing (Assume 110ft/station)	@	$1.00	$1,069
7774	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$7,774
3887	Lin. Ft.	100% Centerline Joint Rounting & Sealing	@	$1.00	$3,887
10	Sq. Yds.	0.1% Partial-Depth Pavement Patching	@	$90.00	$900
		Mill & Fill Surface			

Total Cost of Rehabilitation Activity 1 $13,630

FIGURE 5.05b(1)

FLEXIBLE PAVEMENT (Cont.)
Route IL 43
Section N/A
Cook County

REHABILITATION ACTIVITY 2 - YEAR 10				Unit Cost	Total Cost
52	Sq. Yds.	0.5% Partial-depth HMA Pavement Patching - Mill & Fill Surface	@	$90.00	$4,680
1069	Lin. Ft.	50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station)	@	$1.00	$1,069
7774	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$7,774
3887	Lin. Ft.	100% Centerline Joint Rounting & Sealing	@	$1.00	$3,887
		Total Cost of Rehabilitation Activity 2			$17,410

REHABILITATION ACTIVITY 3 - YEAR 15				Unit Cost	Total Cost
10,366	Sq. Yds.	2.00in. Milling - Pavement & Shoulder	@	$1.75	$18,141
104	Sq. Yds.	1.0% Partial-depth Pavement Patching (Mill & Fill Addition 2.00in.)	@	$90.00	$9,360
1,161	Sq. Yds.	2.00in. HMA Overlay Pavement & Shoulder	@	$78.21	$90,807
		Total Cost of Rehabilitation Activity 3			$118,308

FIGURE 5.05b(2)

FLEXIBLE PAVEMENT (Cont.)

Route IL 43

Section N/A

Cook County

				Unit Cost	Total Cost
REHABILITATION ACTIVITY 4 - YEAR 20					
7774	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$7,774
3887	Lin. Ft.	100% Centerline Joint Rounting & Sealing	@	$1.00	$3,887
1069	Lin. Ft.	50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station)	@	$1.00	$1,069
10	Sq. Yds.	0.1% Partial-Depth HMA Pavement Patching (Mill & Fill Surface)	@	$90.00	$900
		Total Cost of Rehabilitation Activity 4			$13,630
REHABILITATION ACTIVITY 5 - YEAR 25				Unit Cost	Total Cost
7774	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$7,774
3887	Lin. Ft.	100% Centerline Joint Rounting & Sealing	@	$1.00	$3,887
1069	Lin. Ft.	50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station)	@	$1.00	$1,069
52	Sq. Yds.	0.5% Partial-Depth Pavement Patching (Mill & Fill Surface)	@	$90.00	$4,680
		Total Cost of Rehabilitation Activity 5			$17,410
REHABILITATION ACTIVITY 6 - YEAR 30				Unit Cost	Total Cost
10,366	Sq. Yds.	2.00in. Milling (Pavement only-Std Design Pavement & Shoulder-Limiting Strain Criteria Design)	@	$1.75	$18,141
207	Sq. Yds.	2.0% Partial-Depth HMA Pavement Patching (Mill & Fill Additional 2.00in. All Designs)	@	$90.00	$18,630
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
2,177	Tons	HMA Overlay Pvmt (3.75in. - Std Design 2.00in.-Limiting Strain Criterion Design)	@	$78.21	$170,273
0	Tons	HMA Overlay Shoulder (1.75in. - Standard Design; 2.00in.-Limiting Strain Criterion Design)	@	$78.21	$0
		Total Cost of Rehabilitation Activity 6			$207,044

FIGURE 5.05b(3)

FLEXIBLE PAVEMENT (Cont.)
Route IL 43
Section N/A
Cook County

REHABILITATION ACTIVITY 7 - YEAR 35				Unit Cost	Total Cost
7774	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$7,774
3887	Lin. Ft.	100% Centerline Joint Rounting & Sealing	@	$1.00	$3,887
1069	Lin. Ft.	50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station)	@	$1.00	$1,069
10	Sq. Yds.	0.1% Partial-Depth HMA Pavement Patching (Mill & Fill Surface)	@	$90.00	$900
		Total Cost of Rehabilitation Activity 7			$13,630

REHABILITATION ACTIVITY 8 - YEAR 40				Unit Cost	Total Cost
7774	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$7,774
3887	Lin. Ft.	100% Centerline Joint Rounting & Sealing (Single Lane and Dual Lane Paving)	@	$1.00	$3,887
1069	Lin. Ft.	50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station)	@	$1.00	$1,069
52	Sq. Yds.	0.5% Partial-Depth Pavement Patching (Mill & Fill Surface)	@	$90.00	$4,680
		Total Cost of Rehabilitation Activity 8			$17,410

Figure 5.05b(4) - continued

FLEXIBLE PAVEMENT (Cont.)
Route IL 43
Section N/A
Cook County

ANNUAL COST DETERMINATION

Present Worth Calculation:

Total Cost of Original Pavement Construction			$515,177
Present Worth of Rehab Activity 1	$13,630	x 0.7441 =	$11,757
Present Worth of Rehab Activity 2	$17,410	x 0.6419 =	$12,955
Present Worth of Rehab Activity 3	$118,308	x 0.5537 =	$75,942
Present Worth of Rehab Activity 4	$13,630	x 0.4776 =	$7,547
Present Worth of Rehab Activity 5	$17,410	x 0.4120 =	$8,315
Present Worth of Rehab Activity 6	$207,044	x 0.3554 =	$85,302
Present Worth of Rehab Activity 7	$13,630	x 0.3066 =	$4,844
Present Worth of Rehab Activity 8	$17,410	x 0.3066 =	$5,338
Total Life Cycle Cost (Present Worth)			$212,000

Annual Cost Per Mile Calculation

Total PW	x CRF_n /	Length		= Annual Cost / Year-Mile
$212,000	x0.04079 /	0.37	Mi.	$80,166 per Yr.-Mi.

MATERIAL TYPE/PERCENTAGE	PCC	22.4%

PLAIN JOINTED PCC PAVEMENT

FILENAME-	IL-43	2-May-12	
ROUTE-	IL 43	4:08 PM	
SECTION-	N/A		
COUNTY-	Cook		
LOCATION-	at Willow Rd		
DATE-	1-May-12		
PROJECT LENGTH (FT)	1943.6 =	0.37	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-	10.5		
TRAFFIC FACTORS	MINIMUM	ACTUAL	
RIGID-	4.02	8.78	

TRAFFIC		Percentages	
PV-	36150	87.80%	
SU-	1413	3.40%	
MU-	2701	6.40%	

INITIAL COSTS

ITEM	QUANTITY	UNIT PRICE	COST
PAVEMENT (SQ YDS)	10,366	$44.25	$458,486
STAB SUBBASE (SQ YDS)	11,662		$0
SHOULDERS (SQ YDS)	0		$0
SHOULDER SEAL (LN FT)	7,774	$2.00	$15,548
SUBBASE GRAN MATL TY C (TONS)	0		$0
CONSTRUCTION INITIAL COST (PW)			$474,036
TOTAL REHABILITATION COST (PW)			$119,952
TOTAL LIFE CYCLE COST (PW)			$593,988
ANNUAL COST PER MILE			$55,483

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)		$8.76
POLICY HMA OVERLAY SHLDR (SQ YDS)		$8.76
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)	10	$130.00	$1,300	
				$1,300	$967
Activity 2 YEAR 15					
	PAVEMENT PATCHING 0.2% (SQ YDS)	21	$130.00	$2,730	
				$2,730	$1,752
Activity 3 YEAR 20					
	PAVEMENT PATCHING 2.0% (SQ YDS)	207	$130.00	$26,910	
	SHOULDER PATCHING 0.5% (SQ YDS)	0	$85.00	$0	
	SHLDR JT ROUT & SEAL 100% (LF)	7,774	$1.00	$7,774	
	CENTERLINE JT ROUT & SEAL 100% (LF)	3,887	$1.00	$3,887	
				$38,571	$21,357
Activity 4 YEAR 25					
	PAVEMENT PATCHING 3.0% (SQ YDS)	311	$130.00	$40,430	
	SHOULDER PATCHING 1.0% (SQ YDS)	0	$85.00	$0	
				$40,430	$18,309
Activity 5 YEAR 30					
	PAVEMENT PATCHING 4.0% (SQ YDS)	415	$130.00	$53,950	
	SHOULDER PATCHING 1.5% (SQ YDS)	0	$85.00	$0	
	POLICY HMS OVERLAY OVMT (SQ YDS)	10,366	$8.76	$90,805	
	POLICY HMA OVERLAY SHLDR (SQ YDS)	0	$8.76	$0	
				$144,756	$59,639
Activity 6 YEARS 35					
	SHLDR JT ROUT & SEAL 100% (LF)	7,774	$1.00	$7,774	
	CENTERLINE JT ROUT & SEAL 100% (LF)	3,887	$1.00	$3,887	
	RANDOM CRACK ROUT & SEAL 50% (LF)	3,887	$1.00	$3,887	
	REFL TRANS CRACK ROUT & SEAL 40%	2,488	$1.00	$2,488	
	PARTIAL PVMT PATCH 0.1% (SQ YDS)	10	$130.00	$1,300	
				$19,336	$6,872
Activity 7 YEAR 40					
	PAVEMENT PATCHING 0.5% (SQ YDS)	52	$130.00	$6,760	
	SHOULDER PATCHING 0.5% (SQ YDS)	52	$130.00	$6,760	
	REFL TRANS CRACK ROUT & SEAL 60%	3,732	$1.00	$3,732	
	RANDOM CRACK ROUT & SEAL 50% (LF)	3,887	$1.00	$3,887	
	SHLDR JT ROUT & SEAL 100% (LF)	7,774	$1.00	$7,774	
	CENTERLINE JT ROUT & SEAL 100% (LF)	3,887	$1.00	$3,887	
				$32,800	$10,056
			Total Rehabilitation Cost (Present Worth)		$119,952

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

FULL DEOTH FLEXIBLE PAVEMENT

ROUTE-	IL 43	2-May-12	
SECTION-	N/A	4:08 PM	
COUNTY-	Cook		
LOCATION-	at Willow Rd		
PROJECT LENGTH (FT)	1943.6		
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	1	1=RURAL, 2=URBAN	
PAVING WIDTH	1	1=SINGLE LANE, 2=DUAL LANE	
INTERSTATE / OTHER ROUTE	OTHER ROUTE		
FLEXIBLE THICKNESS-	12.75		

TRAFFIC FACTORS	MINIMUM	ACTUAL
FLEXIBLE	1.50	10.44

TRAFFIC

PV-	28156	0.873
SU-	1413	0.044
MU-	2701	0.084

PAVEMENT OVERLAY THICKNESS	3.75
SHOULDER OVERLAY THICKNESS	1.75

INITIAL COSTS

ITEM	QUANTITY	UNIT PRICE	COST
SURFACE (SQ YDS)	10,366	$8.70	$90,606
POLY BINDER (SQ YDS)	10,366	$9.07	$94,020
BINDER (SQ YDS)	10,366	$31.40	$325,492
SHOULDERS (SQ YDS)	0		$0
BUBBASE GRAN MATL TY C (TONS)	0		$0
Add. PCC for B-6.24 C&G (CY)	54 #	$90.00	$4,859
		$0.00	

CONSTRUCTION INITIAL COST (PW)	$515,177
TOTAL REHABILITATION COST (PW)	$212,000
TOTAL LIFE CYCLE COST (PW)	$727,177
ANNUAL COST PER MILE	$80,166

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)		$78.21
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)		$78.21
POLICY HMA OVERLAY SHLDR (TONS)		$78.21

MATERIAL TYPE/PERCENTAGE		
	PCC	22.4%

MAINTENANCE COSTS

	ITEM	QUANTITY	UNIT PRICE	COST	PW
Activity 1					
YEAR 5	RAND/THERM CRACK ROUT & SEAL 50% (LF)	1,069	$1.00	$1,069	
	SHLDR JT ROUT & SEAL 100% (LF)	7,774	$1.00	$7,774	
	CENTERLINE JT ROUT & SEAL 100% (LF)	3,887	$1.00	$3,887	
	PARTIAL PVMT PATCH 0.1% (SQ YDS)	10	$90.00	$900	
				$13,630	$11,767
Activity 2					
YEAR 10	PARTIAL PVMT PATCH 0.5% (SQ YDS)	52	$90.00	$4,680	
	RAND/THERM CRACK ROUT & SEAL 50% (LF)	1,069	$1.00	$1,069	
	SHLDR JT ROUT & SEAL 100% (LF)	7,774	$1.00	$7,774	
	CENTERLINE JT ROUT & SEAL 100% (LF)	3,887	$1.00	$3,887	
				$17,410	$12,955
Activity 3					
YEAR 15	2" MILL PVMT & SHLDR 100% (SQ YDS)	10,366	$1.75	$18,141	
	PARTIAL PVMT PATCH 1.0% (SQ YDS)	104	$90.00	$9,360	
	2" OVERLAY PVMT & SHLDR 100% (TONS)	1,161	$78.21	$90,807	
				$118,308	$75,942
Activity 4					
YEAR 20	SHLDR JT ROUT & SEAL 100% (LF)	7,774	$1.00	$7,774	
	CENTERLINE JT ROUT & SEAL 100% (LF)	3,887	$1.00	$3,887	
	RAND/THERM CRACK ROUT & SEAL 50% (LF)	1,069	$1.00	$1,069	
	PARTIAL PVMT PATCH 0.1% (SQ YDS)	10	$90.00	$900	
				$13,630	$7,547
Activity 5					
YEAR 25	SHLDR JT ROUT & SEAL 100% (LF)	7,774	$1.00	$7,774	
	CENTERLINE JT ROUT & SEAL 100% (LF)	3,887	$1.00	$3,887	
	RAND/THERM CRACK ROUT & SEAL 50% (LF)	1,069	$1.00	$1,069	
	PARTIAL PVMT PATCH 0.5% (SQ YDS)	52	$90.00	$4,680	
				$17,410	$8,315
Activity 6					
YEAR 30	2" MILL PVMT & SHLDR 100% (SQ YDS)	10,366	$1.75	$18,141	
	PARTIAL PVMT PATCH 2.0% (SQ YDS)	207	$90.00	$18,630	
	HMA SHLDR PATCHING 1.0% (SQ YDS)	0	$90.00	$0	
	POLICY HMA OVERLAY PVMT (TONS)	2,177	$78.21	$170,273	
	POLICY HMA OVERLAY SHLDR (TONS)	0	$78.21	$0	
				$207,044	$85,302
Activity 7					
YEAR 35	SHLDR JT ROUT & SEAL 100% (LF)	7,774	$1.00	$7,774	
	CENTERLINE JT ROUT & SEAL 100% (LF)	3,887	$1.00	$3,887	
	RAND/THERM CRACK ROUT & SEAL 50% (LF)	1,069	$1.00	$1,069	
	PARTIAL PVMT PATCH 0.1% (SQ YDS)	10	$90.00	$900	
				$13,630	$4,844
Activity 8					
YEAR 40	SHLDR JT ROUT & SEAL 100% (LF)	7,774	$1.00	$7,774	
	CENTERLINE JT ROUT & SEAL 100% (LF)	3,887	$1.00	$3,887	
	RAND/THERM CRACK ROUT & SEAL 50% (LF)	1,069	$1.00	$1,069	
	PARTIAL PVMT PATCH 0.5% (SQ YDS)	52	$90.00	$4,680	
				$17,410	$5,338

Total Rehabilitation Cost (Present Worth) $212,000

WILLOW

Spreadsheet by Uehle - Rev. 11/02

MECHANISTIC PAVEMENT DESIGN

Date: 4/10/12

INPUT (Enter Data in Gray Shaded Cells)

Route: Willow Rd
Section: N/A
County: Cook
Location: IL-43 to I-94

Comments: Pavement design for Willow Rd: IL-43 to I-94

Designer: MK

	ADT	Year
Current:	37200	2009
Future:	43000	2040

Facility Type: Unmarked State Route

# of Lanes = 4

Road Class: I

	Minimum ADT	Structural Design Traffic: Actual ADT	Actual %of Total ADT	% of ADT in Design Lane
PV =	No Min	38,799	95.2%	P = 32%
SU =	No Min	1,671	4.1%	S = 45%
MU =	No Min	285	0.7%	M = 45%
		Struct. Design ADT =	40755	(2028)

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

FLEXIBLE & RIGID PAVEMENT CALCULATIONS AND ADDITIONAL INPUT

Flexible Pavement			Rigid Pavement		
Cpv =	0.15		Cpv =	0.15	
Csu =	133		Csu =	144	
Cmu =	483		Cmu =	696	
TF flexible (Actual)=	4.90	(Actual ADT)	TF rigid (Actual)=	5.98	(Actual ADT)
TF flexible (Min)=	No Min	(Min ADT Fig 54-2C)	TF rigid (Min)=	No Min	(Min ADT Fig 54-2C)
Use TF flexible =	4.90		Use TF rigid =	5.98	
AC Type =	20			Tied	Shoulder or C. &G.
AC Mixture Tempurature =		deg. F (Figure 54-5C)	Rigid Pavt Thick.=	9.50	in. (Figure 54-4D)
Design AC Mixture Modulus (Eac)=		ksi (Figure 54-5D)			
Design Asphalt Concrete Microstrain =	63.3	(Figure 54-5E)			
Asphalt Concrete Thickness =		in. (Figure 54-5F)			

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)

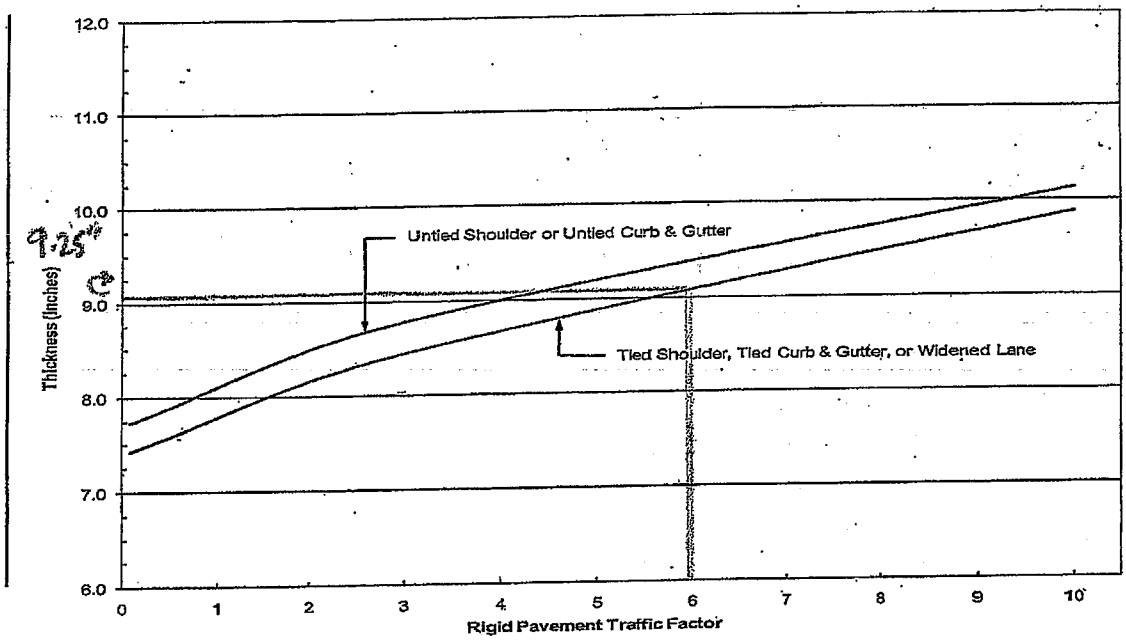
	Min. Str. Design Traffic (Fig 54-2C)		
Facility Type	PV	SU	MU
Interstate or Supplemental Freeway	0	500	1500
Other Marked State Route	0	250	750
Unmarked State Route	No Min	No Min	No Min

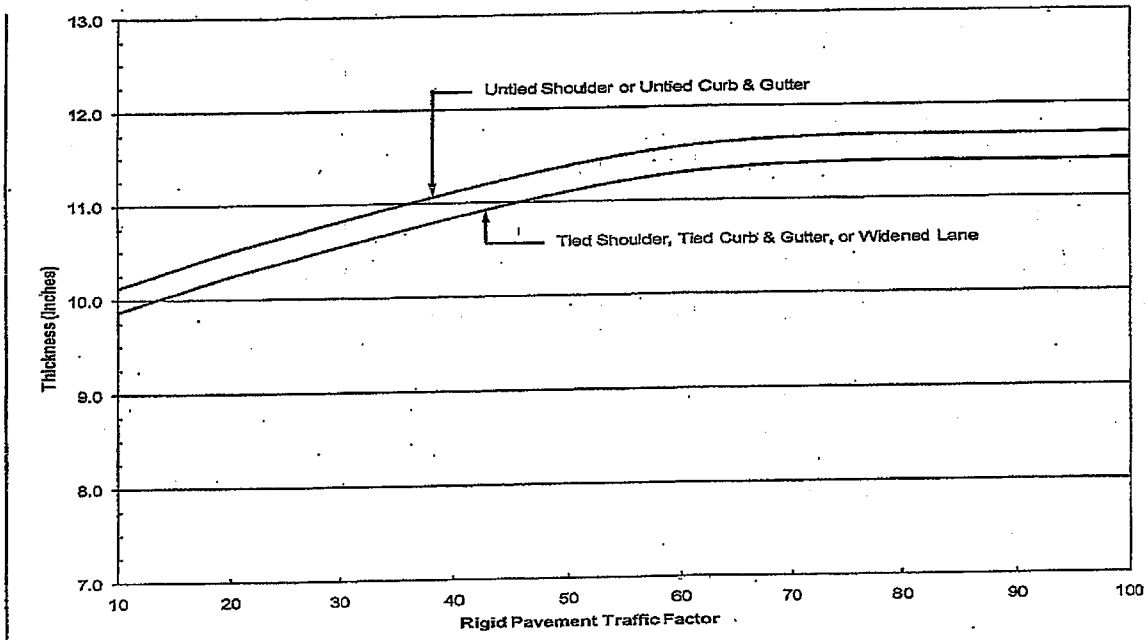
Class Table for One-Way Streets	
ADT	Class
0 - 3500	II
>3501	I

	Traffic Factor ESAL Coefficients			
	Rigid (Fig. 54-4C)		Flexible (Fig. 54-5B)	
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(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

	Figure 54-2B Percentage of ADT in Design Lane					
	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%





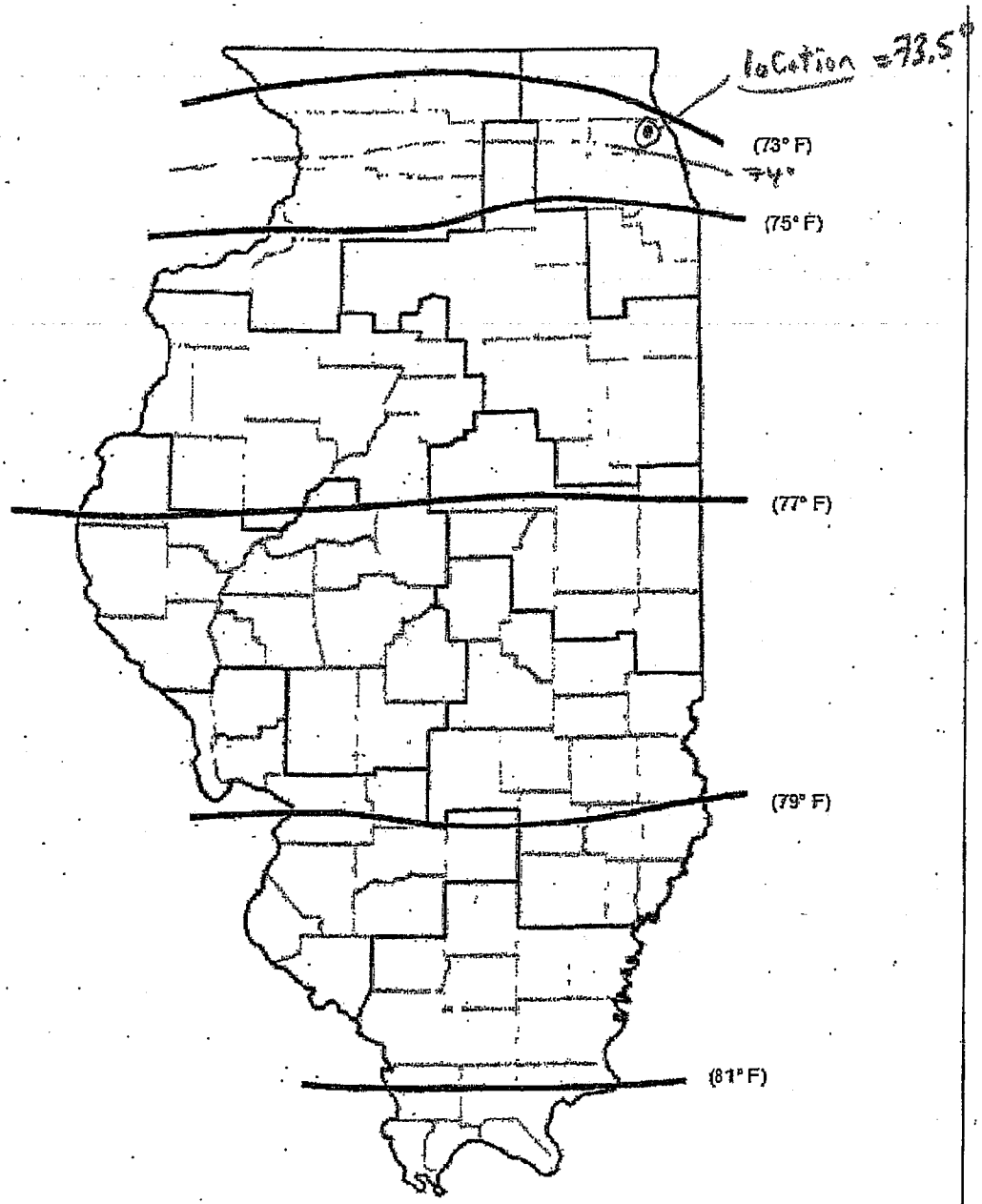
Note: Use of untied shoulder design requires BDE approval.

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

Figure 54-4.E

HARD COPIES UNCONTROLLED

WILLOW



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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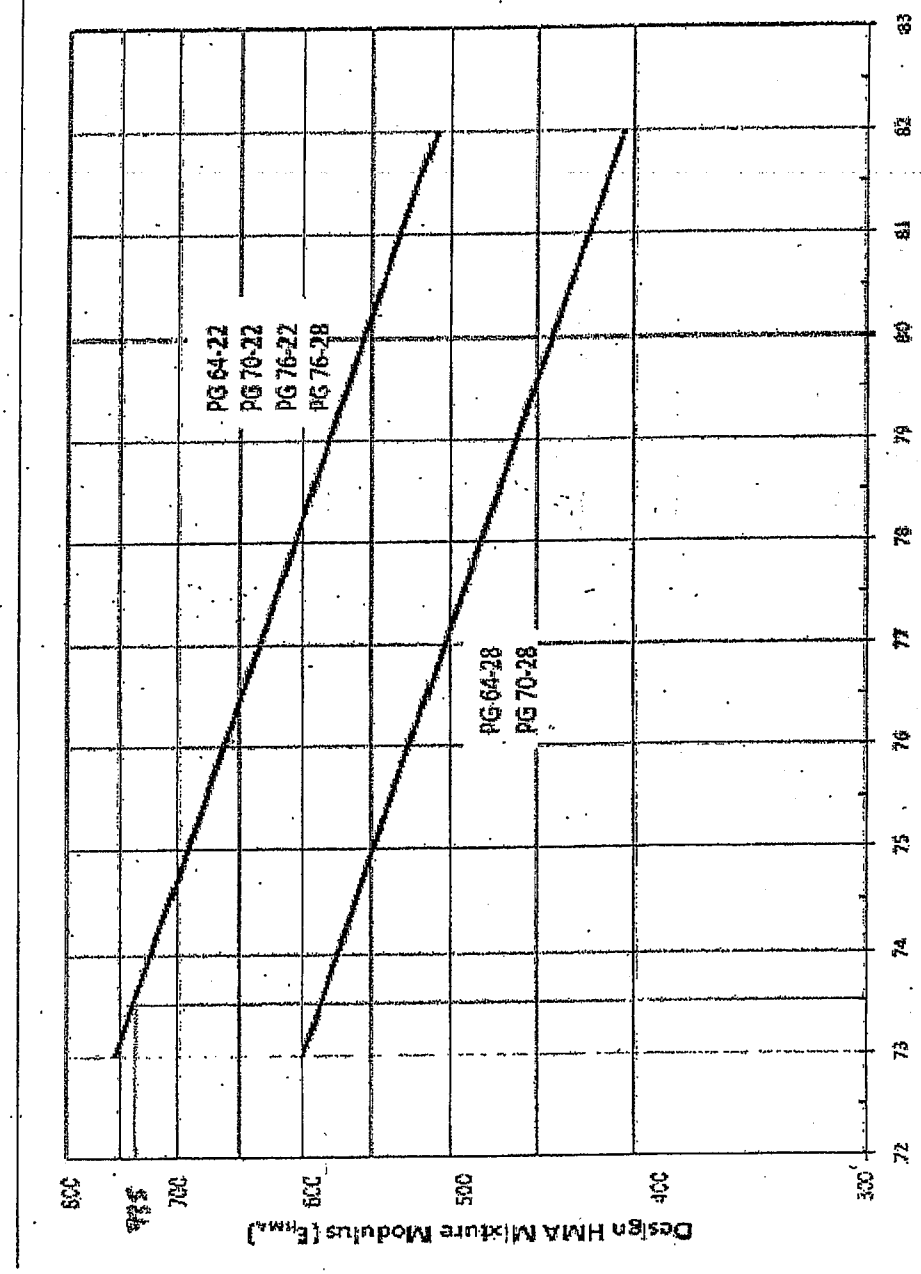
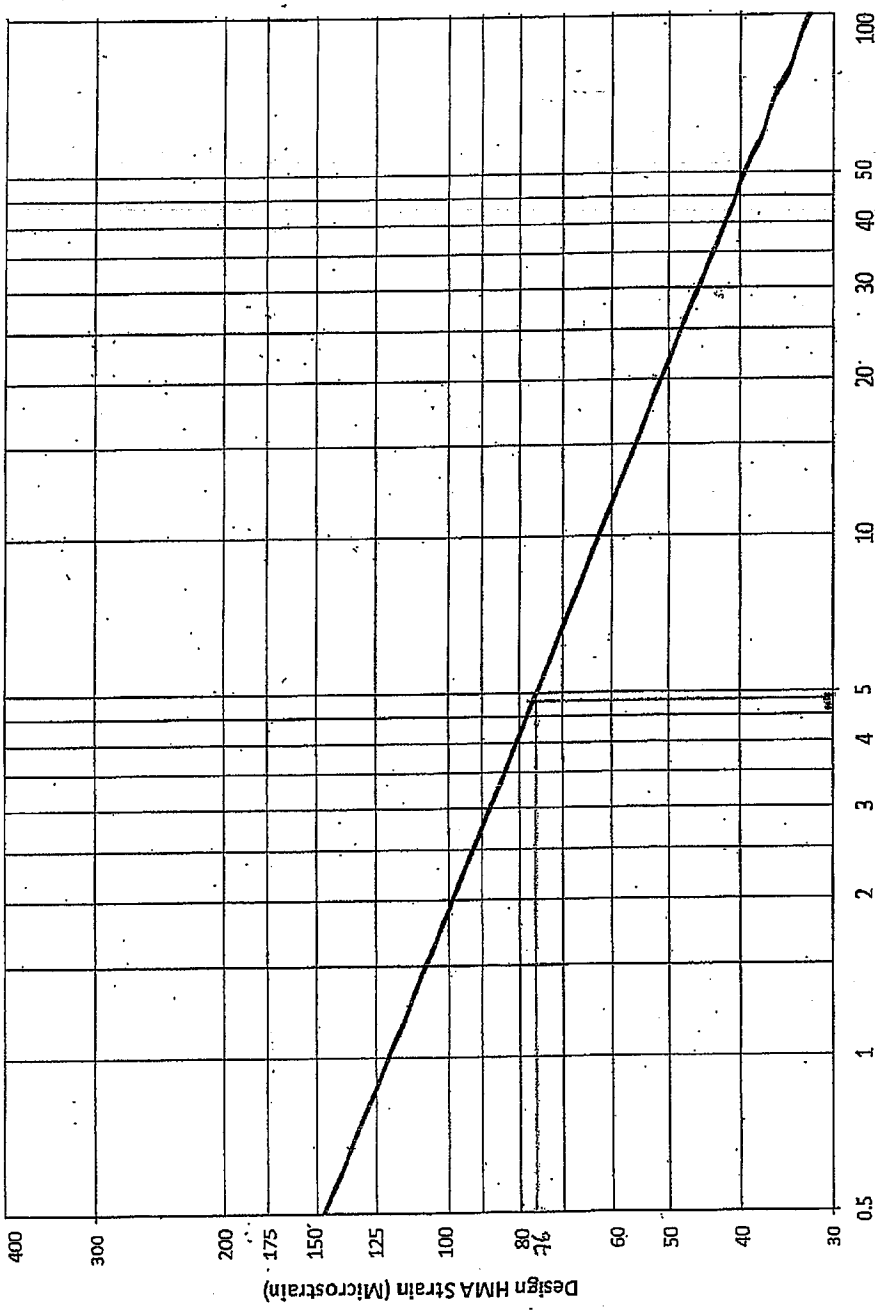


HMA MIXTURE MODULUS (E_{HMA})
(Mechanistic Design: Flexible Pavement)

Figure 54-5.D

HARD COPIES UNCONTROLLED

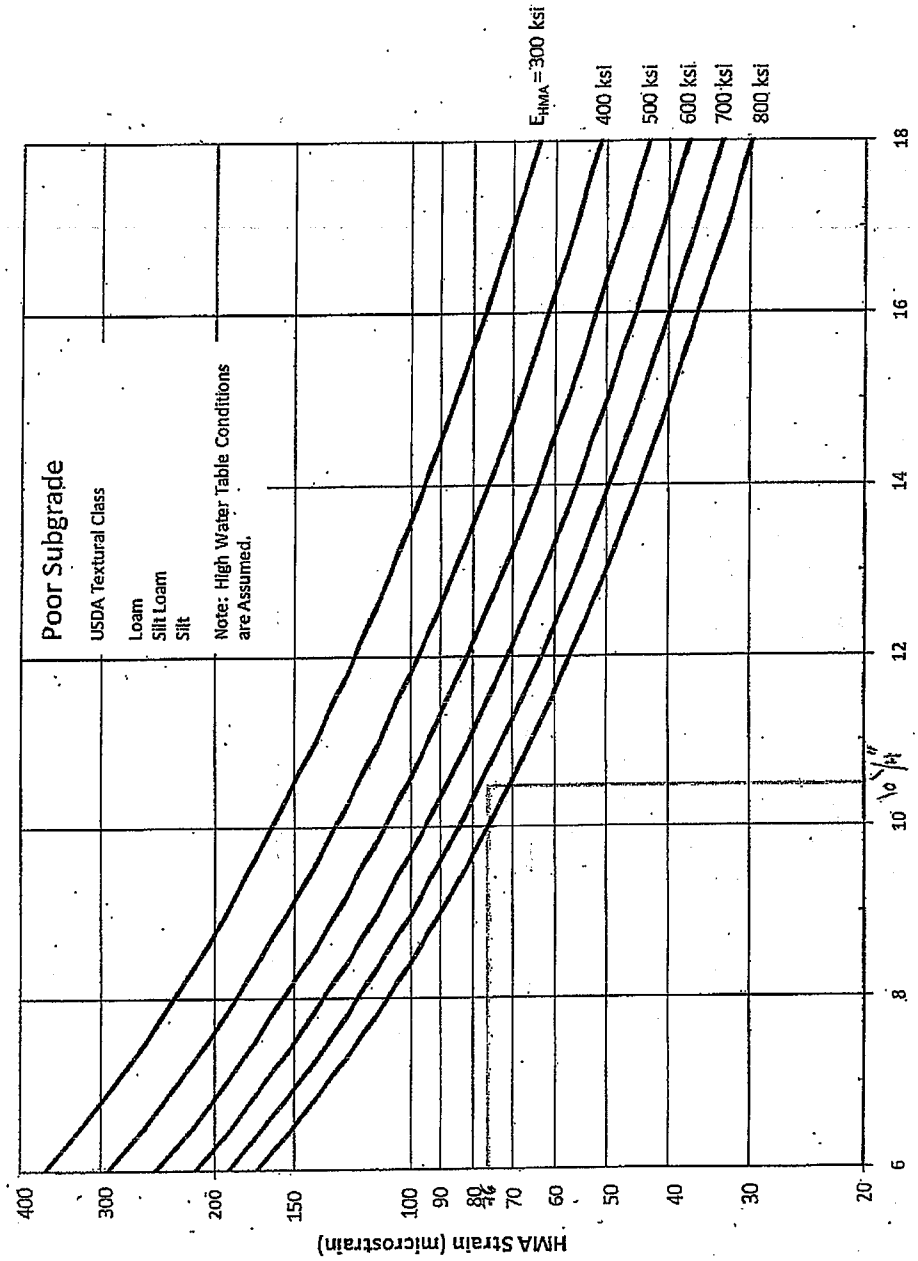
WILLOW



DESIGN HMA STRAIN
(Mechanistic Design: Flexible Pavement)

Figure 54-5.E

WILLOW



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

Figure 54-5.F

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MECHANISTIC PAVEMENT DESIGN

Date 1-May-12
Calcs by: MK
Checked by: SIP
Class 1 Roads and Streets
Urban X Rural
Limits of Analysis Station 631+58 to Station 737+80.9
Length 9518 Feet 1.80 Miles

Route Willow Rd
Section N/A
Cook County
Location IL-43 to I-94

Structural Design Traffic
PV = 38799
SU = 1671
MU = 285

Percent of S.D.T. in Design Lane
P = 95.20%
S = 4.10%
U = 0.70%

MINIMUM SUBGRADE SUPPORT RATING - "POOR"

Flexible Pavement Design Actual TF_F = 4.9 Minimum TF_F = N/A

Selected Design AC Type
Design AC Mixture Temp 73.5 °F
Design AC Microstrain 76
Design E_{AC} 735 KSI
AC Thickness 10.25 Inch

Rigid Pavement Design Actual TF_F = 5.98 Minimum TF_F = N/A

Extended Lane 9.25 Inch

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

Figure 5.05

RIGID PAVEMENT

Date: 1-May-12 Route Willow Rd
Quantities by MK Checked by: SIP Section N/A
Unit Prices by: TM Checked by: Cook County
Net Length 9518 Lin. Ft. = 1.8 Miles
Number Lanes 4 Urban X Rural

ITEMIZED CONSTRUCTION COST

Quantity	Units	Item		Unit Cost	Total Cost
44417	Sq. Yds.	9.3 Inch Jointed PCC	@	$36.00	$1,599,012
50763	Sq. Yds.	4-Inch (Stabilized/Granular Subbase)	@	$16.00	$812,208
0	Sq. Yds.	PCC Shoulder	@	$0.00	$0
	Lin. Ft.	Pipe Underdrains	@		
0		Subbase Gran. Mat., Type C	@	$0.00	$0
38,072	Lin. Ft.	100% Shoulder Joint Seal	@	$2.00	$76,144

Total Cost of Original Pavement Construction $2,487,364

ITEMIZED MAINTENANCE AND REHABILITATION ACTIVITY COST

REHABILITATION ACTIVITY 1 - YEAR 10

44	Sq. Yds.	0.1% Full Depth PCC Pavement Patching	@	$130.00	$5,720
		Total Cost of Rehabilitation Activity 1			$5,720

Figure 5.05a(1)

RIGID PAVEMENT (Cont.)

Route Willow Rd

Section N/A

Cook County

REHABILITATION ACTIVITY 2 - YEAR 15

			Unit Cost	Total Cost
89 Sq. Yds.	0.2% Full Depth PCC Pavement Patching	@	$130.00	$11,570

Total Cost of Rehabilitation Activity 2 $11,570

REHABILITATION ACTIVITY 3 - YEAR 20

			Unit Cost	Total Cost
888 Sq. Yds.	2% Full Depth PCC Pavement Patching	@	$0.00	$115,440
0 Sq. Yds.	0.5% Full Depth PCC Pavement Patching	@	$85.00	$0
38072 Lin. Ft.	100% Longitudunal/ Shoulder Joint Routing & Sealing	@	$1.00	$38,072
19036 Lin. Ft.	100% Centerline Joint Routing & Sealing	@	$1.00	$19,036

Total Cost of Rehabilitation Activity 3 $172,548

FIGURE 5.05a(2)

RIGID PAVEMENT (Cont.)

Route Willow Rd
Section N/A
Cook County

REHABILITATION ACTIVITY 4 - YEAR 25

			Unit Cost	Total Cost
1333 Sq. Yds.	3.0% Full Depth PCC Pavement Patching	@	$130.00	$173,290
0 Sq. Yds.	1.0% Full Depth PCC Pavement Patching	@	$85.00	$0
	Total Cost of Rehabilitation Activity 4			$173,290

REHABILITATION ACTIVITY 5 - YEAR 30

			Unit Cost	Total Cost
1777 Sq. Yds.	3.0% Full Depth PCC Pavement Patching	@	$85.00	$0
0 Sq. Yds.	1.0% Full Depth PCC Pavement Patching	@	$12.35	$548,550
44,417 Sq. Yds.	Policy HMA Overlay - Pavement	@	$12.35	$548,550
0 Sq. Yds.	Policy HMA Overlay - Shoulder	@	$12.35	$0
	Total Cost of Rehabilitation Activity 5			$779,560

REHABILITATION ACTIVITY 6 - YEAR 35

			Unit Cost	Total Cost
38,072 Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$38,072
19036 Lin. Ft.	100% Centerline Joint Routing & Sealing	@	$1.00	$19,036
19,036 Lin. Ft.	50% Random Crack Routing & Sealing - Assume 100ft/station	@	$1.00	$19,036
12,183 Lin. Ft.	40% Reflective Transverse Crack Routing & Sealing	@	$1.00	$12,183
44 Sq. Yds.	0.1% Partial-Depth Pavement Patching (Mill & Fill Surface-Interstates; Mill & Fill 2.5in. Non-Interstates)		$130.00	$5,720
	Total Cost of Rehabilitation Activity 6			$94,047

Figure 5.05a(3)

RIGID PAVEMENT (Cont.)

Route Willow Rd

Section N/A

Cook County

REHABILITATION ACTIVITY 7 - YEAR 40

				Unit Cost	Total Cost
222	Sq. Yds.	0.5% Full Depth PCC Pavement Patching	@	$130.00	$28,860
222	Sq. Yds.	0.5% Partial Depth Pavement Patching (Mill & Fill Surface-Interstates; Mill & Fill 2.5in. Non-Interstates)	@	$130.00	$28,860
18,275	Lin. Ft.	60% Reflective Transverse Crack Routing & Sealing	@	$1.00	$18,275
19,036	Lin. Ft.	50% Random Crack Routing & Sealing - Assume 100ft/station	@	$1.00	$19,036
38,072	Lin. Ft.	100% Longitudunal/ Shoulder Joint Routing & Sealing	@	$1.00	$38,072
19,036	Lin. Ft.	100% Centerline Joint Routing & Sealing	@	$1.00	$19,036
		Total Cost of Rehabilitation Activity 7			$152,139

RIGID PAVEMENT (Cont.)

Route Willow Rd

Section N/A

Cook County

ANNUAL COST DETERMINATION

Present Worth Calculation:

Total Cost of Original Pavement Construction			$2,487,364
Present Worth of Rehab Activity 1	$5,720	x 0.7441 =	$4,256
Present Worth of Rehab Activity 2	$11,570	x 0.6419 =	$7,427
Present Worth of Rehab Activity 3	$172,548	x 0.5537 =	$95,540
Present Worth of Rehab Activity 4	$173,290	x 0.4776 =	$82,763
Present Worth of Rehab Activity 5	$779,560	x 0.4120 =	$321,179
Present Worth of Rehab Activity 6	$94,047	x 0.3554 =	$33,424
Present Worth of Rehab Activity 7	$152,139	x 0.3066 =	$46,646
Total Life Cycle Cost (Present Worth)			$591,235

Annual Cost Per Mile Calculation

Total PW	x CRF_n /	Length		= Annual Cost / Year-Mile
$591,235	x0.04079 /	1.8	Mi.	$69,764 per Yr.-Mi.

FLEXIBLE PAVEMENT

Date: 1-May-12 Route Willow Rd

Quantities by MK Checked by: SIP Section N/A

Unit Prices by TM Checked by: Cook County

Net Length 9518 Lin. Ft. = 1.8 Miles

Number Lanes 4 Urban X Rural

Single Lane Paving X Dual Lane Paving

ITEMIZED CONSTRUCTION COST

Quantity	Units	Item		Unit Cost	Total Cost
44,417	Sq. Yds.	Class I Surface Course	@	$12.35	$548,550
44,417	Sq. Yds.	Class I Binder Course	@	$28.58	$1,269,438
0	Sq. Yds.	Stabilized Shoulders	@	$0.00	$0
	Lin. Ft.	Pipe Underdrains	@		
0		Subbase Gran. Matl., Type C	@	$0.00	$0
44,417	Sq. Yds.	Poly Binder	@	$10.18	$452,165

Total Cost of Original Pavement Construction $2,297,525

ITEMIZED MAINTENANCE AND REHABILITATION ACTIVITY COST

REHABILITATION ACTIVITY 1 - YEAR 5

				Unit Cost	Total Cost
5235	Lin. Ft.	50% Random/Thermal Cracking & Sealing (Assume 110ft/station)	@	$1.00	$5,235
38072	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$38,072
19036	Lin. Ft.	100% Centerline Joint Rounting & Sealing	@	$1.00	$19,036
44	Sq. Yds.	0.1% Partial-Depth Pavement Patching Mill & Fill Surface	@	$90.00	$3,960

Total Cost of Rehabilitation Activity 1 $66,303

FIGURE 5.05b(1)

FLEXIBLE PAVEMENT (Cont.)

Route Willow Rd

Section N/A

Cook County

REHABILITATION ACTIVITY 2 - YEAR 10				Unit Cost	Total Cost
222	Sq. Yds.	0.5% Partial-depth HMA Pavement Patching - Mill & Fill Surface	@	$90.00	$19,980
5235	Lin. Ft.	50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station)	@	$1.00	$5,235
38072	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$38,072
19036	Lin. Ft.	100% Centerline Joint Rounting & Sealing	@	$1.00	$19,036
		Total Cost of Rehabilitation Activity 2			$82,323

REHABILITATION ACTIVITY 3 - YEAR 15				Unit Cost	Total Cost
44,417	Sq. Yds.	2.00in. Milling - Pavement & Shoulder	@	$1.75	$77,730
444	Sq. Yds.	1.0% Partial-depth Pavement Patching (Mill & Fill Addition 2.00in.)	@	$90.00	$39,960
4,975	Sq. Yds.	2.00in. HMA Overlay Pavement & Shoulder	@	$110.27	$548,583
		Total Cost of Rehabilitation Activity 3			$666,273

FIGURE 5.05b(2)

FLEXIBLE PAVEMENT (Cont.)

Route: Willow Rd
Section: N/A
Cook County

				Unit Cost	Total Cost
REHABILITATION ACTIVITY 4 - YEAR 20					
38072	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$38,072
19036	Lin. Ft.	100% Centerline Joint Rounting & Sealing	@	$1.00	$19,036
5235	Lin. Ft.	50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station)	@	$1.00	$5,235
44	Sq. Yds.	0.1% Partial-Depth HMA Pavement Patching (Mill & Fill Surface)	@	$90.00	$3,960
		Total Cost of Rehabilitation Activity 4			$66,303
REHABILITATION ACTIVITY 5 - YEAR 25				Unit Cost	Total Cost
38072	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$38,072
19036	Lin. Ft.	100% Centerline Joint Rounting & Sealing	@	$1.00	$19,036
5235	Lin. Ft.	50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station)	@	$1.00	$5,235
222	Sq. Yds.	0.5% Partial-Depth Pavement Patching (Mill & Fill Surface)	@	$90.00	$19,980
		Total Cost of Rehabilitation Activity 5			$82,323
REHABILITATION ACTIVITY 6 - YEAR 30				Unit Cost	Total Cost
44,417	Sq. Yds.	2.00in. Milling (Pavement only-Std Design Pavement & Shoulder-Limiting Strain Criteria Design)	@	$1.75	$77,730
888	Sq. Yds.	2.0% Partial-Depth HMA Pavement Patching (Mill & Fill Additional 2.00in. All Designs)	@	$90.00	$79,920
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
9,328	Tons	HMA Overlay Pvmt (3.75in. - Std Design 2.00in.-Limiting Strain Criterion Design)	@	$110.27	$1,028,579
0	Tons	HMA Overlay Shoulder (1.75in. - Standard Design; 2.00in.-Limiting Strain Criterion Design)	@	$110.27	$0
		Total Cost of Rehabilitation Activity 6			$1,186,229

FIGURE 5.05b(3)

FLEXIBLE PAVEMENT (Cont.)

Route Willow Rd

Section N/A

Cook County

REHABILITATION ACTIVITY 7 - YEAR 35				Unit Cost	Total Cost
38072	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$38,072
19036	Lin. Ft.	100% Centerline Joint Rounting & Sealing	@	$1.00	$19,036
5235	Lin. Ft.	50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station)	@	$1.00	$5,235
44	Sq. Yds.	0.1% Partial-Depth HMA Pavement Patching (Mill & Fill Surface)	@	$90.00	$3,960
		Total Cost of Rehabilitation Activity 7			$66,303

REHABILITATION ACTIVITY 8 - YEAR 40				Unit Cost	Total Cost
38072	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$38,072
19036	Lin. Ft.	100% Centerline Joint Rounting & Sealing (Single Lane and Dual Lane Paving)	@	$1.00	$19,036
5235	Lin. Ft.	50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station)	@	$1.00	$5,235
222	Sq. Yds.	0.5% Partial-Depth Pavement Patching (Mill & Fill Surface)	@	$90.00	$19,980
		Total Cost of Rehabilitation Activity 8			$82,323

Figure 5.05b(4) - continued

FLEXIBLE PAVEMENT (Cont.)
Route Willow Rd
Section N/A
Cook County

ANNUAL COST DETERMINATION

Present Worth Calculation:

Total Cost of Original Pavement Construction $2,297,525

Present Worth of Rehab Activity 1	$66,303	x 0.7441 =	$57,193
Present Worth of Rehab Activity 2	$82,323	x 0.6419 =	$61,257
Present Worth of Rehab Activity 3	$666,273	x 0.5537 =	$427,681
Present Worth of Rehab Activity 4	$66,303	x 0.4776 =	$36,712
Present Worth of Rehab Activity 5	$82,323	x 0.4120 =	$39,317
Present Worth of Rehab Activity 6	$1,186,229	x 0.3554 =	$488,726
Present Worth of Rehab Activity 7	$66,303	x 0.3066 =	$23,564
Present Worth of Rehab Activity 8	$82,323	x 0.3066 =	$25,240

Total Life Cycle Cost (Present Worth) $1,159,690

Annual Cost Per Mile Calculation

Total PW	x CRF_n /	Length		= Annual Cost / Year-Mile
$1,159,690	x0.04079 /	1.8	Mi.	$78,344 per Yr.-Mi.

MATERIAL TYPE/PERCENTAGE	PCC	12.3%

PLAIN JOINTED PCC PAVEMENT

FILENAME-	Willow Rd	1-May-12	
ROUTE-	Willow Rd	12:57 PM	
SECTION-	N/A		
COUNTY-	Cook		
LOCATION-	IL 43 to I-94		
DATE-			
PROJECT LENGTH (FT)	9616	1.8	MILES
AVERAGE LANE WIDTH (FT)	10.5		
NUMBER OF LANES	4		
# OF EDGES	4		
INSIDE SHLDER WIDTH (FT)	0		
OUTSIDE SHLDER WIDTH (FT)	0		
# OF CENTERLINES	2		
RIGID THICKNESS-	9.25		
TRAFFIC FACTORS	MINIMUM	ACTUAL	
RIGID-	N/A	5.98	

TRAFFIC		Percentages
PV-	8799	95.20%
SU-	167	1.10%
MU-	286	0.70%

INITIAL COSTS

ITEM	QUANTITY	UNIT PRICE	COST
PAVEMENT (SQ YDS)	44,417	$36.00	$1,599,012
STAB SUBBASE (SQ YDS)	50,763	$16.00	$812,208
SHOULDERS (SQ YDS)	0		$0
SHOULDER SEAL (LN FT)	38,072	$2.00	$76,144
SUBBASE GRAN MATL TY C (TONS)	0		$0
CONSTRUCTION INITIAL COST (PW)			$2,487,364
TOTAL REHABILITATION COST (PW)			$591,235
TOTAL LIFE CYCLE COST (PW)			$3,078,599
ANNUAL COST PER MILE			$69,764

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)		$12.35
POLICY HMA OVERLAY SHLDR (SQ YDS)		$12.35
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)	44	$130.00	$5,720	
				$5,720	$4,256
Activity 2 YEAR 15	PAVEMENT PATCHING 0.2% (SQ YDS)	89	$130.00	$11,570	
				$11,570	$7,427
Activity 3 YEAR 20	PAVEMENT PATCHING 2.0% (SQ YDS)	888	$130.00	$115,440	
	SHOULDER PATCHING 0.5% (SQ YDS)	0	$85.00	$0	
	SHLDR JT ROUT & SEAL 100% (LF)	38,072	$1.00	$38,072	
	CENTERLINE JT ROUT & SEAL 100% (LF)	19,036	$1.00	$19,036	
				$172,548	$95,540
Activity 4 YEAR 25	PAVEMENT PATCHING 3.0% (SQ YDS)	1,333	$130.00	$173,290	
	SHOULDER PATCHING 1.0% (SQ YDS)	0	$85.00	$0	
				$173,290	$82,763
Activity 5 YEAR 30	PAVEMENT PATCHING 4.0% (SQ YDS)	1,777	$130.00	$231,010	
	SHOULDER PATCHING 1.5% (SQ YDS)	0	$85.00	$0	
	POLICY HMS OVERLAY OVMT (SQ YDS)	44,417	$12.35	$548,550	
	POLICY HMA OVERLAY SHLDR (SQ YDS)	0	$12.35	$0	
				$779,560	$321,179
Activity 6 YEARS 35	SHLDR JT ROUT & SEAL 100% (LF)	38,072	$1.00	$38,072	
	CENTERLINE JT ROUT & SEAL 100% (LF)	19,036	$1.00	$19,036	
	RANDOM CRACK ROUT & SEAL 50% (LF)	19,036	$1.00	$19,036	
	REFL TRANS CRACK ROUT & SEAL 40%	12,183	$1.00	$12,183	
	PARTIAL PVMT PATCH 0.1% (SQ YDS)	44	$130.00	$5,720	
				$94,047	$33,424
Activity 7 YEAR 40	PAVEMENT PATCHING 0.5% (SQ YDS)	222	$130.00	$28,860	
	SHOULDER PATCHING 0.5% (SQ YDS)	222	$130.00	$28,860	
	REFL TRANS CRACK ROUT & SEAL 60%	18,275	$1.00	$18,275	
	RANDOM CRACK ROUT & SEAL 50% (LF)	19,036	$1.00	$19,036	
	SHLDR JT ROUT & SEAL 100% (LF)	38,072	$1.00	$38,072	
	CENTERLINE JT ROUT & SEAL 100% (LF)	19,036	$1.00	$19,036	
				$152,139	$46,648
			Total Rehabilitation Cost (Present Worth)		$591,235

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

FULL DEOTH FLEXIBLE PAVEMENT

ROUTE-	Willow Rd	1-May-12
SECTION-	N/A	12:57 PM
COUNTY-	Cook	
LOCATION-	IL-43 to I-94	

PROJECT LENGTH (FT)	9518	
AVERAGE LANE WIDTH (FT)	10.5	
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	2	1=SINGLE LANE, 2=DUAL LANE
INTERSTATE / OTHER ROUTE	OTHER ROUTE	
FLEXIBLE THICKNESS-	10.25	

TRAFFIC FACTORS	MINIMUM	ACTUAL
FLEXIBLE	N/A	4.0

TRAFFIC

PV-	38789	0.952
SU-	1671	0.041
MU-	285	0.007

PAVEMENT OVERLAY THICKNESS	2.5
SHOULDER OVERLAY THICKNESS	1.5

INITIAL COSTS

ITEM	QUANTITY	UNIT PRICE	COST
SURFACE (SQ YDS)	44,417	$12.35	$548,550
POLY BINDER (SQ YDS)	44,417	$10.18	$452,165
BINDER (SQ YDS)	44,417	$28.58	$1,269,498
SHOULDERS (SQ YDS)	0		$0
SUBBASE GRAN MATL TY C (TONS)	0		$0
additional pcc for B 6;24 C&G & 1" diff	38018 #	$0.72	$27,372
Note 9,504 X 4 X 1" @ $90/CY		$0.00	

CONSTRUCTION INITIAL COST (PW)	$2,297,525
TOTAL REHABILITATION COST (PW)	$1,159,690
TOTAL LIFE CYCLE COST (PW)	$3,457,215
ANNUAL COST PER MILE	$78,344

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)		$110.27
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)		$110.27
POLICY HMA OVERLAY SHLDR (TONS)		$110.27

MATERIAL TYPE/PERCENTAGE		
	PCC	12.3%

MAINTENANCE COSTS

	ITEM	QUANTITY	UNIT PRICE	COST	PW
Activity 1					
YEAR 5	RAND/THERM CRACK ROUT & SEAL 50% (LF)	5,235	$1.00	$5,235	
	SHLDR JT ROUT & SEAL 100% (LF)	38,072	$1.00	$38,072	
	CENTERLINE JT ROUT & SEAL 100% (LF)	19,036	$1.00	$19,036	
	PARTIAL PVMT PATCH 0.1% (SQ YDS)	44	$90.00	$3,960	
				$66,303	$57,193
Activity 2					
YEAR 10	PARTIAL PVMT PATCH 0.5% (SQ YDS)	222	$90.00	$19,980	
	RAND/THERM CRACK ROUT & SEAL 50% (LF)	5,235	$1.00	$5,235	
	SHLDR JT ROUT & SEAL 100% (LF)	38,072	$1.00	$38,072	
	CENTERLINE JT ROUT & SEAL 100% (LF)	19,036	$1.00	$19,036	
				$82,323	$61,257
Activity 3					
YEAR 15	2" MILL PVMT & SHLDR 100% (SQ YDS)	44,417	$1.75	$77,730	
	PARTIAL PVMT PATCH 1.0% (SQ YDS)	444	$90.00	$39,960	
	2" OVERLAY PVMT & SHLDR 100% (TONS)	4,975	$110.27	$548,583	
				$666,273	$427,661
Activity 4					
YEAR 20	SHLDR JT ROUT & SEAL 100% (LF)	38,072	$1.00	$38,072	
	CENTERLINE JT ROUT & SEAL 100% (LF)	19,036	$1.00	$19,036	
	RAND/THERM CRACK ROUT & SEAL 50% (LF)	5,235	$1.00	$5,235	
	PARTIAL PVMT PATCH 0.1% (SQ YDS)	44	$90.00	$3,960	
				$66,303	$36,712
Activity 5					
YEAR 25	SHLDR JT ROUT & SEAL 100% (LF)	38,072	$1.00	$38,072	
	CENTERLINE JT ROUT & SEAL 100% (LF)	19,036	$1.00	$19,036	
	RAND/THERM CRACK ROUT & SEAL 50% (LF)	5,235	$1.00	$5,235	
	PARTIAL PVMT PATCH 0.5% (SQ YDS)	222	$90.00	$19,980	
				$82,323	$39,317
Activity 6					
YEAR 30	2" MILL PVMT & SHLDR 100% (SQ YDS)	44,417	$1.75	$77,730	
	PARTIAL PVMT PATCH 2.0% (SQ YDS)	886	$90.00	$79,920	
	HMA SHLDR PATCHING 1.0% (SQ YDS)	0	$90.00	$0	
	POLICY HMA OVERLAY PVMT (TONS)	9,328	$110.27	$1,028,579	
	POLICY HMA OVERLAY SHLDR (TONS)	0	$110.27	$0	
				$1,186,229	$488,726
Activity 7					
YEAR 35	SHLDR JT ROUT & SEAL 100% (LF)	38,072	$1.00	$38,072	
	CENTERLINE JT ROUT & SEAL 100% (LF)	19,036	$1.00	$19,036	
	RAND/THERM CRACK ROUT & SEAL 50% (LF)	5,235	$1.00	$5,235	
	PARTIAL PVMT PATCH 0.1% (SQ YDS)	44	$90.00	$3,960	
				$66,303	$23,564
Activity 8					
YEAR 40	SHLDR JT ROUT & SEAL 100% (LF)	38,072	$1.00	$38,072	
	CENTERLINE JT ROUT & SEAL 100% (LF)	19,036	$1.00	$19,036	
	RAND/THERM CRACK ROUT & SEAL 50% (LF)	5,235	$1.00	$5,235	
	PARTIAL PVMT PATCH 0.5% (SQ YDS)	222	$90.00	$19,980	
				$82,323	$25,240

Total Rehabilitation Cost (Present Worth)	$1,159,690