Illinois Department of Transportation

To: Diane M. O'Keefe Attn: District One

From: John D. Baranzelli

Subject: Pavement Design

Date: March 21, 2012

FAP Route 3502/335 (US Route 45)
Lake County
From IL Route 60 to north of IL Route 22

We have reviewed the pavement selection for the project, which was submitted to BDE by memo dated January 25, 2012. The project will reconstruct portions of US 45, IL 60 and IL 21 within the project limits. This project meets the requirements for the alternate bidding process and the approved pavement design for this project is as follows:

<u>IL 60 from US 45/IL 83 to Medline Place (Pavement Reconstruction)</u>

Option 1:

11.5 inches of HMA pavement
2 inches of Polymerized HMA surface course, Mix "F", N90
2.25 inches of Polymerized HMA binder course, IL-19.0, N90
7.25 inches of HMA binder course, IL-19, N90
12 inches of Aggregate Subgrade
Geotechnical Fabric

Option 2:

10 inches of PCC pavement with tied PCC curb & gutter
4.5 inches of Stabilized Sub-Base
12 inches of Aggregate Subgrade
Geotechnical Fabric

<u>US 45/IL 83 from US 45 to IL 60 & US 45 from US 45/IL 83 to IL 21 (Pavement Reconstruction)</u>

Option 1:

10.5 inches of HMA pavement
2 inches of Polymerized HMA surface course, Mix "F", N90
2.25 inches of Polymerized HMA binder course, IL-19.0, N90
6.25 inches of HMA binder course, IL-19, N90
12 inches of Aggregate Subgrade
Geotechnical Fabric

Option 2:

9.5 inches of PCC pavement with tied PCC curb & gutter
4.5 inches of Stabilized Sub-Base
12 inches of Aggregate Subgrade
Geotechnical Fabric

IL 21 from IL 22 to US 45 (Pavement Reconstruction)

Option 1:

10.75 inches of HMA pavement
2 inches of Polymerized HMA surface course, Mix "F", N90
2.25 inches of Polymerized HMA binder course, IL-19.0, N90
6.5 inches of HMA binder course, IL-19, N90
12 inches of Aggregate Subgrade
Geotechnical Fabric

Option 2:

9.75 inches of PCC pavement with tied PCC curb & gutter
4.5 inches of Stabilized Sub-Base
12 inches of Aggregate Subgrade
Geotechnical Fabric

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

Illinois Department of Transportation

Memorandum

To: Scott Stitt

Attn: Paul R. Niedernhofer

From: Diane O'Keefe

By: Jose Dominguez

Subject: Pavement Analysis*

Date: January 25, 2012

Route: FAP 3502/FAP 335 (US 45)
Limits: IL 60 to N. of IL 22
Contract No.: 60N84
Letting: N/A

Section: 49-Y
County: Lake
Job No.: P-91-065-01

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

a) Pavement reconstruction of IL 60 from US 45/IL 83 to Medline place to provide three eastbound 12-ft thru lanes and two westbound 12-ft thru lanes with a 30-ft barrier median for a total length of approximately 1800-ft.
b) Pavement reconstruction of US 45/IL 83 from US 45 to IL 60 to provide two 12-ft thru lanes in each direction with a 30-ft barrier median for a total length of approximately 2,950-ft.
c) Pavement reconstruction of US 45 from US 45/IL 83 to IL 21 to provide two 12-ft thru lanes in each direction for a total length of approximately 21,900-ft. A 12-ft flush median will be constructed from US 45/IL 83 to Fairway Drive and a 22-ft barrier median will be constructed from Fairway Drive to IL 21.
d) Pavement reconstruction of IL 21 from IL 22 to US 45to provide three 12-ft thru lanes in each direction with a 30-ft barrier median for a total length of approximately 5,950-ft.

District 1 performed a mechanistic pavement analysis for each segment using a 30 year design period. We recommend the following pavement designs:

a) **<u>IL 60 from US 45/IL 83 to Medline Place</u>**
PCC Curb and Gutter
Pavement Reconstruction
Option 1:
11 ½" Full Depth HMA Pavement
2" Polymerized HMA Surface Course, Mix "F", N90
2 ¼" Polymerized HMA Binder Course, IL-19.0, N90
7 ¼" HMA Binder Course, IL-19.0, N90
12" Aggregate Subgrade
Geotechnical Fabric

Option 2:
10" Jointed PCC Pavement
4 ½" HMA Stabilized Subbase
12" Aggregate Subgrade
Geotechnical Fabric

The life-cycle cost analysis favored HMA pavement by 0.5%.

b, c) <u>US 45/IL 83 from US 45 to IL 60 and US 45 from US 45/IL 83 to IL 21</u>

PCC Curb and Gutter
Pavement Reconstruction
Option 1:
10 ½" Full Depth HMA Pavement
2" Polymerized HMA Surface Course, Mix "F", N90
2 ¼" Polymerized HMA Binder Course, IL-19.0, N90
6 ¼" HMA Binder Course, IL-19.0, N90
12" Aggregate Subgrade
Geotechnical Fabric

Option 2:
9 ½" Jointed PCC Pavement
4 ½" HMA Stabilized Subbase
12" Aggregate Subgrade
Geotechnical Fabric

The life-cycle cost analysis favored PCC pavement by 0.4%.

d) <u>IL 21 from IL 22 to US 45</u>
PCC Curb and Gutter
Pavement Reconstruction
Option 1:
10 ¾" Full Depth HMA Pavement
2" Polymerized HMA Surface Course, Mix "F", N90
2 ¼" Polymerized HMA Binder Course, IL-19.0, N90
6 ½" HMA Binder Course, IL-19.0, N90
12" Aggregate Subgrade
Geotechnical Fabric

Option 2:
9 ¾" Jointed PCC Pavement
4 ½" HMA Stabilized Subbase
12" Aggregate Subgrade
Geotechnical Fabric

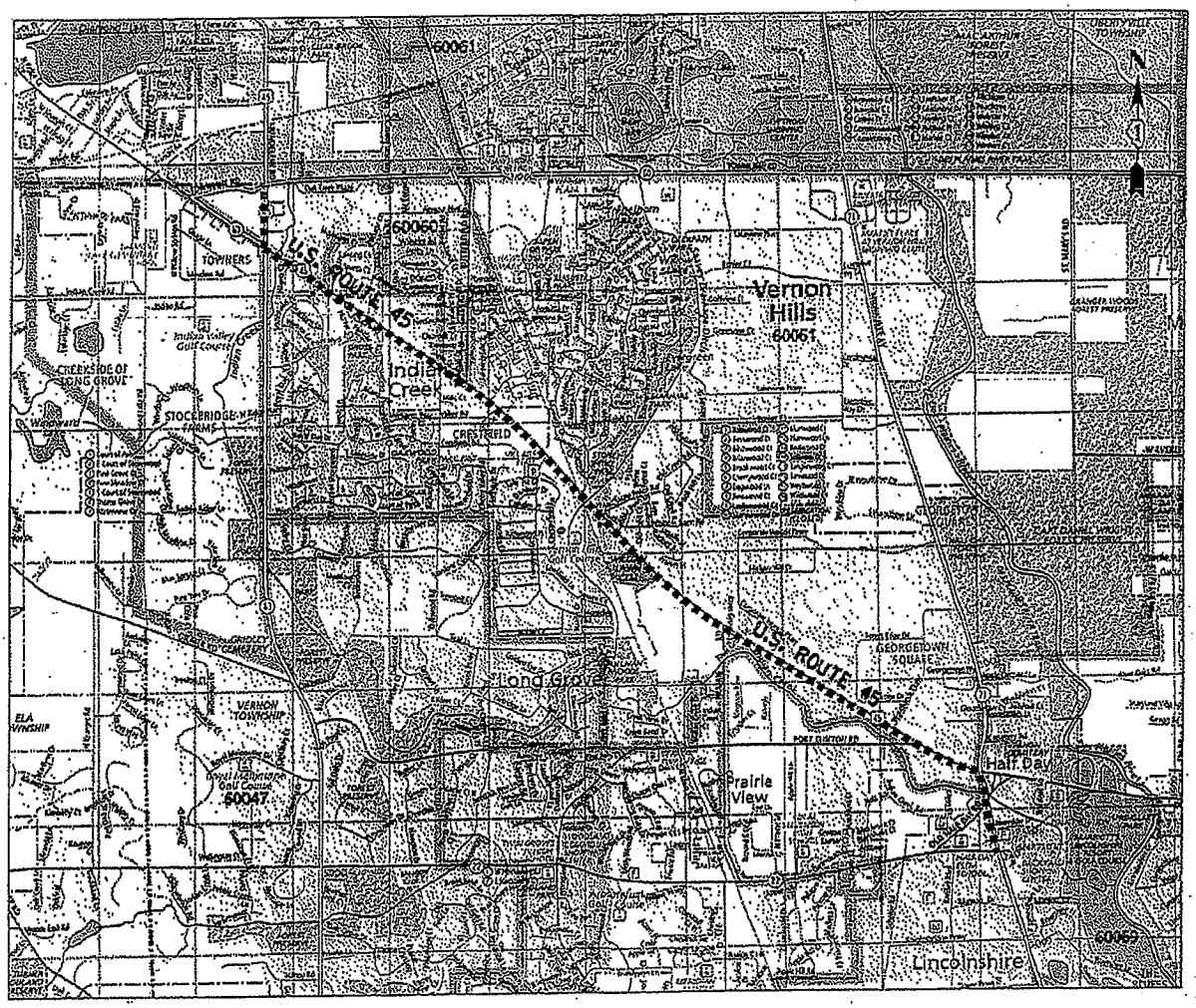
The life-cycle cost analysis favored HMA pavement by 2.4%.

The life-cycle cost analysis does not favor HMA or PCC pavement by more than 10% in any of the locations on the project. An alternate bid consideration with review by pavement selection committee will be required according to the flowchart in Figure 54-1.A of Chapter 54 of the BDE manual.

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

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

PROJECT LOCATION MAP



U.S. ROUTE 45
ILLINOIS ROUTE 60 TO ILLINOIS ROUTE 22
JOB NO. P-91-065-1
PTB # 120 / 02
LAKE COUNTY

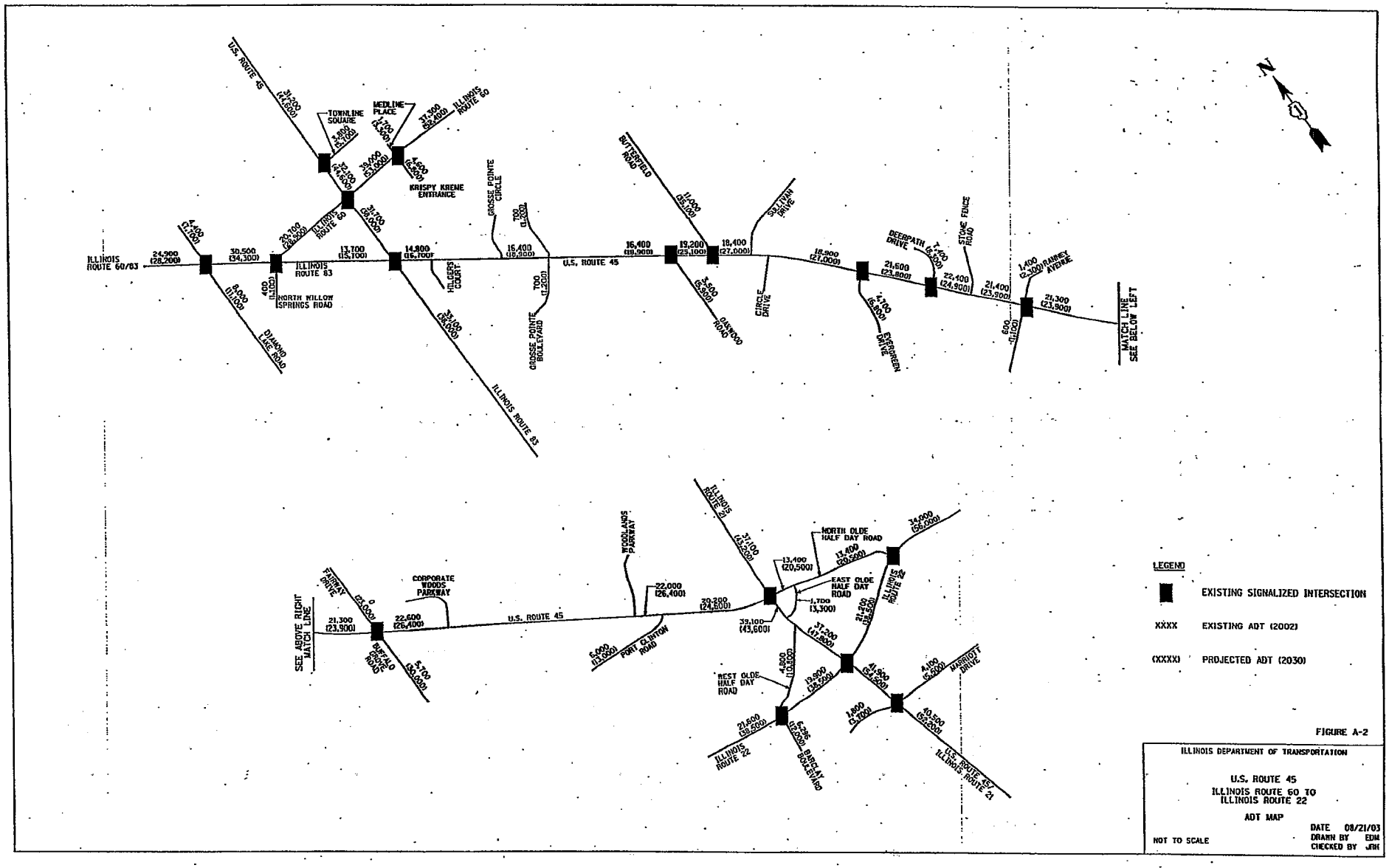


FIGURE A-2

ILLINOIS DEPARTMENT OF TRANSPORTATION

U.S. ROUTE 45
ILLINOIS ROUTE 60 TO
ILLINOIS ROUTE 22

ADT MAP

NOT TO SCALE

DATE 08/21/03
DRAWN BY EDM
CHECKED BY JRH

benesch engineers · scientists · planners	Comp. by: _____ Date: _____ Sheet ____ of ____
	Chkd. by: _____ Date: _____ Job No. _____
	Project: US 45 FROM IL 60 TO IL 22
	Element: PAVEMENT DESIGN - IL 21

IL 21 FROM IL 22 TO US 45

- LENGTH = 5,950 FT - AREA = 47,600 SY - DESIGN ADT = 54,050 MU = 1.4% SU = 3.5%
- CONFIGURATION : 3 THRU LANES EACH DIRECTION
- SHOULDERS : - ENCLOSED DRAINAGE :

- MECHANISTIC RIGID

- 9 3/4" PCC PAVEMENT (JOINTED) → 42000416 : 48,909 SY
- 4 1/2" HMA STABILIZED SUBBASE
- 12" AGGREGATE SUBGRADE
- GEOTECHNICAL FABRIC

- MECHANISTIC FLEXIBLE

- 10 3/4" FULL DEPTH HMA PAVEMENT 40701896 - 38.53 (PCS)
  - 2" POLYMERIZED HMA SURFACE COURSE, MIX "F", N90 → 40603595 : 5,478 TONS @ 1100 T/DAY = 5 DAY
  - 2 1/4" POLYMERIZED HMA BINDER COURSE, IL-19.0, N90 → 40603240 : 6,162 TONS
  - 6 1/2" HMA BINDER COURSE, IL 19.0, N90 → 40603090 : 17,803 TONS
- 12" AGGREGATE SUBGRADE
- GEOTECHNICAL FABRIC

USE FOR TF ONLY

Spreadsheet by Uehle - Rev. 11/02

MECHANISTIC PAVEMENT DESIGN

Date: 12/28/11

INPUT (Enter Data in Gray Shaded Cells)

Route: US 45 from IL 60 to IL 22
Section:
County: Lake
Location: IL 21 from IL 22 to US 45

Comments: Pavement Design for IL 21 from IL 22 to US 45

Designer: MVC

	ADT	Year
Current:	41900	2002
Future:	54500	2030

Facility Type: Other Marked State Route

# of Lanes = 6 or more

Road Class: I

Rural or Urban ? Urban

Subgrade Support Rating (SSR): Poor

Construction Year: 2014

Design Period (DP) = 30 years

	Minimum ADT	Structural Design Traffic: Actual ADT	Actual %of Total ADT	% of ADT in Design Lane	
PV =	0	51,402	95.1%	P =	8%
SU =	250	1,892	3.5%	S =	37%
MU =	750	757	1.4%	M =	37%

Struct. Design ADT = 54050 (2029)

FLEXIBLE & RIGID PAVEMENT CALCULATIONS AND ADDITIONAL INPUT

Flexible Pavement

Cpv =	0.15	
Csu =	133	
Cmu =	483	
TF flexible (Actual)=	6.85	(Actual ADT)
TF flexible (Min)=	4.38	(Min ADT Fig 54-2C)
Use TF flexible =	6.85	
AC Type =	120	
AC Mixture Tempurature =	120	deg. F (Figure 54-5C)
Design AC Mixture Modulus (Eac)=	~~550~~	ksi (Figure 54-5D)
Design Asphalt Concrete Microstrain =	~~56.6~~	(Figure 54-5E)
Asphalt Concrete Thickness =	~~14.75~~	in (Figure 54-5E)

Rigid Pavement

Cpv =	0.15	
Csu =	144	
Cmu =	696	
TF rigid (Actual)=	8.89	(Actual ADT)
TF rigid (Min)=	6.20	(Min ADT Fig 54-2C)
Use TF rigid =	8.89	
Yes		Shoulder or C. &G.
Rigid Pavt 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

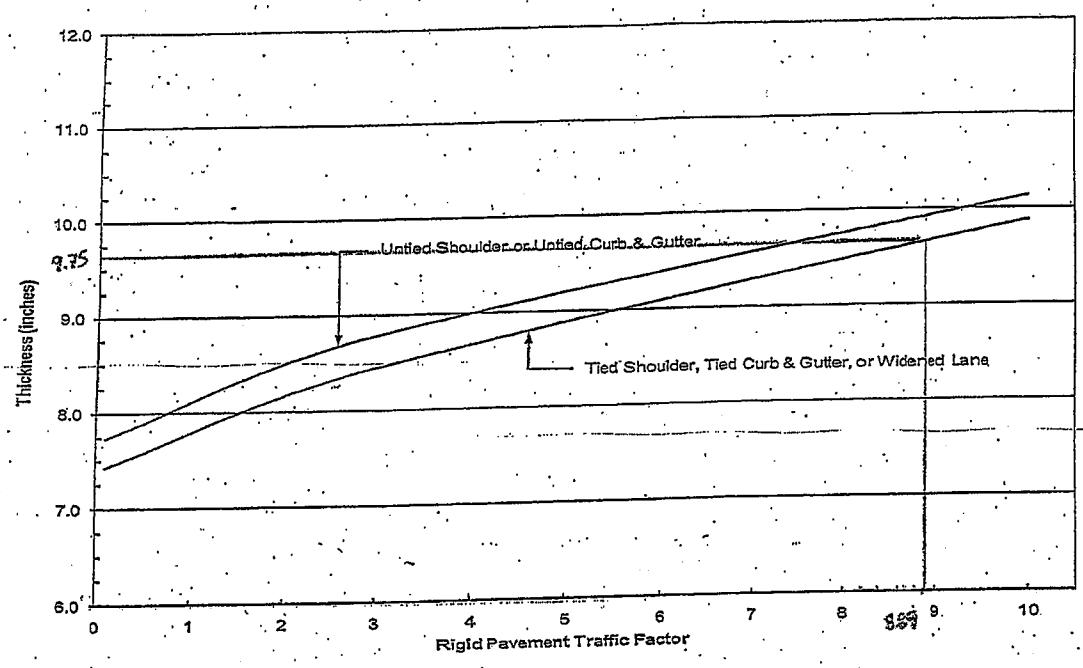
Class Table for One-Way Streets: ADT	Class
0 - 3500	II
>3501	I

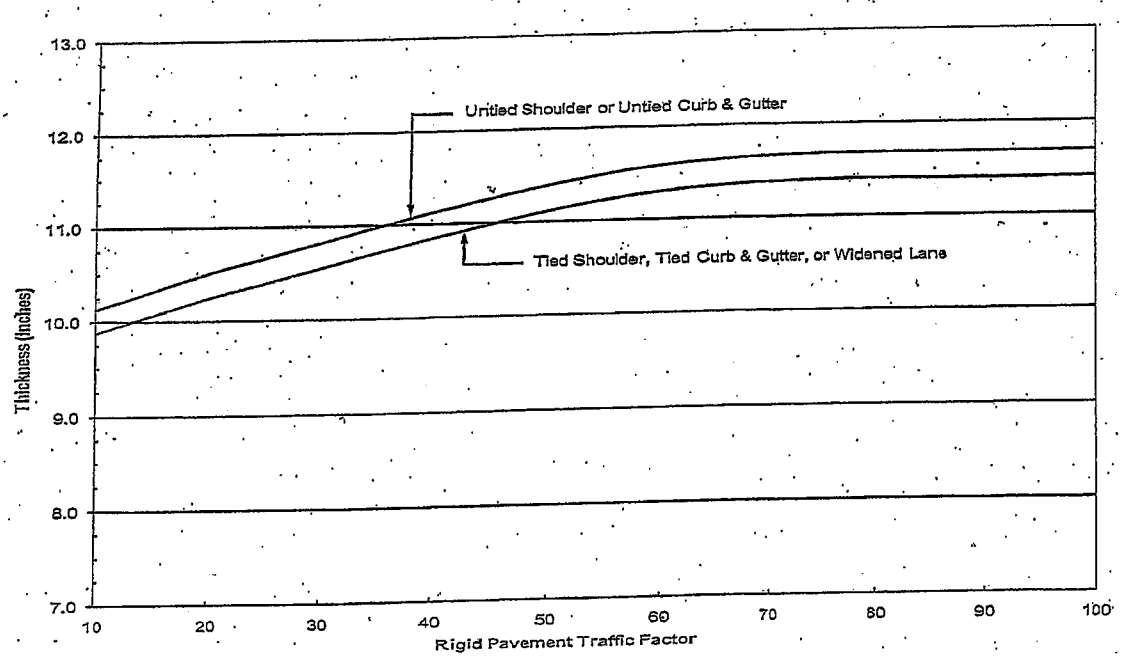
Class	Traffic Factor ESAL Coefficients: Rigid (Fig. 54-4C) Csu	Rigid Cmu	Flexible (Fig. 54-5B) Csu	Flexible Cmu
I	143.81	696.42	132.50	482.53
II	135.78	567.21	112.06	385.44
III	129.58	562.47	109.14	384.35
IV(ADT>400)	127.75	555.90	109.14	384.35
IV(ADT<=400)	127.75	555.90	9.86	78.84

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

Number of Lanes	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%
6 or more	20%	40%	40%	8%	37%	37%





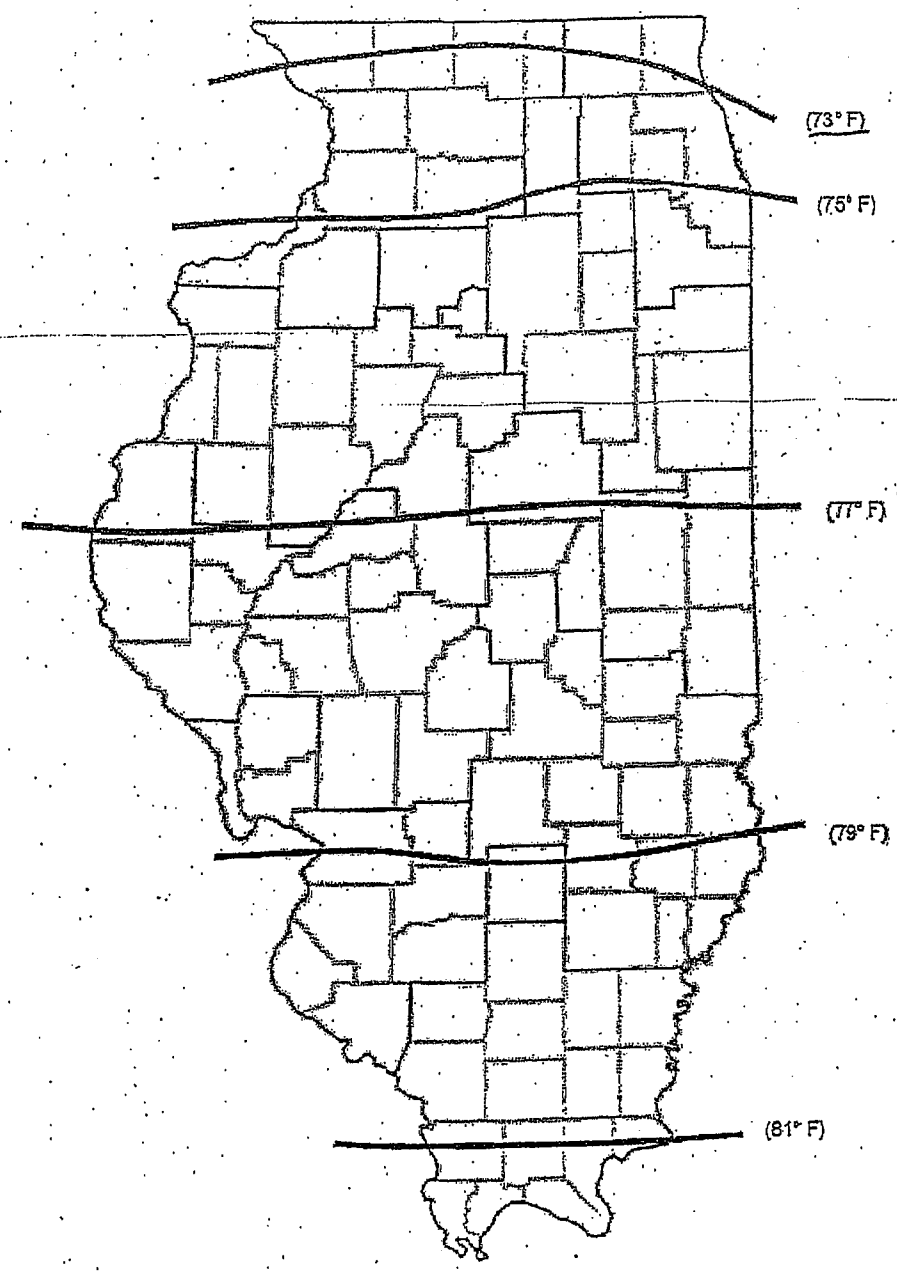
Note: Use of untied shoulder design requires BDE approval.

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

9 3/4" JOINTED PCC PAVEMENT

Figure 54-4.E

HARD COPIES UNCONTROLLED

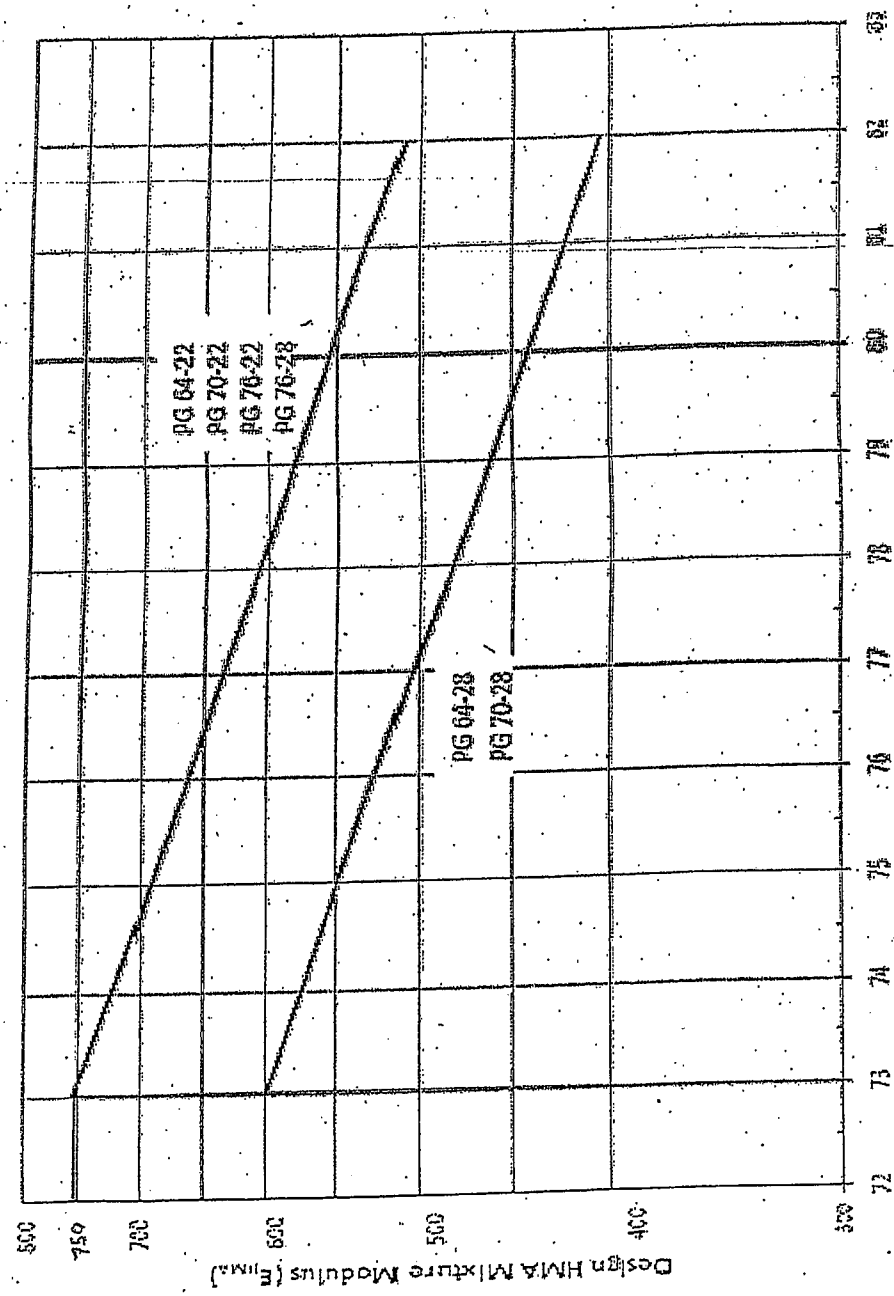


Note: The minimum design HMA mixture temperature will be 73°F.

HMA MIXTURE TEMPERATURE
(Mechanistic Design: Flexible Pavement)

Figure 54-5.C

HARD COPIES UNCONTROLLED



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

Figure 54-5.D

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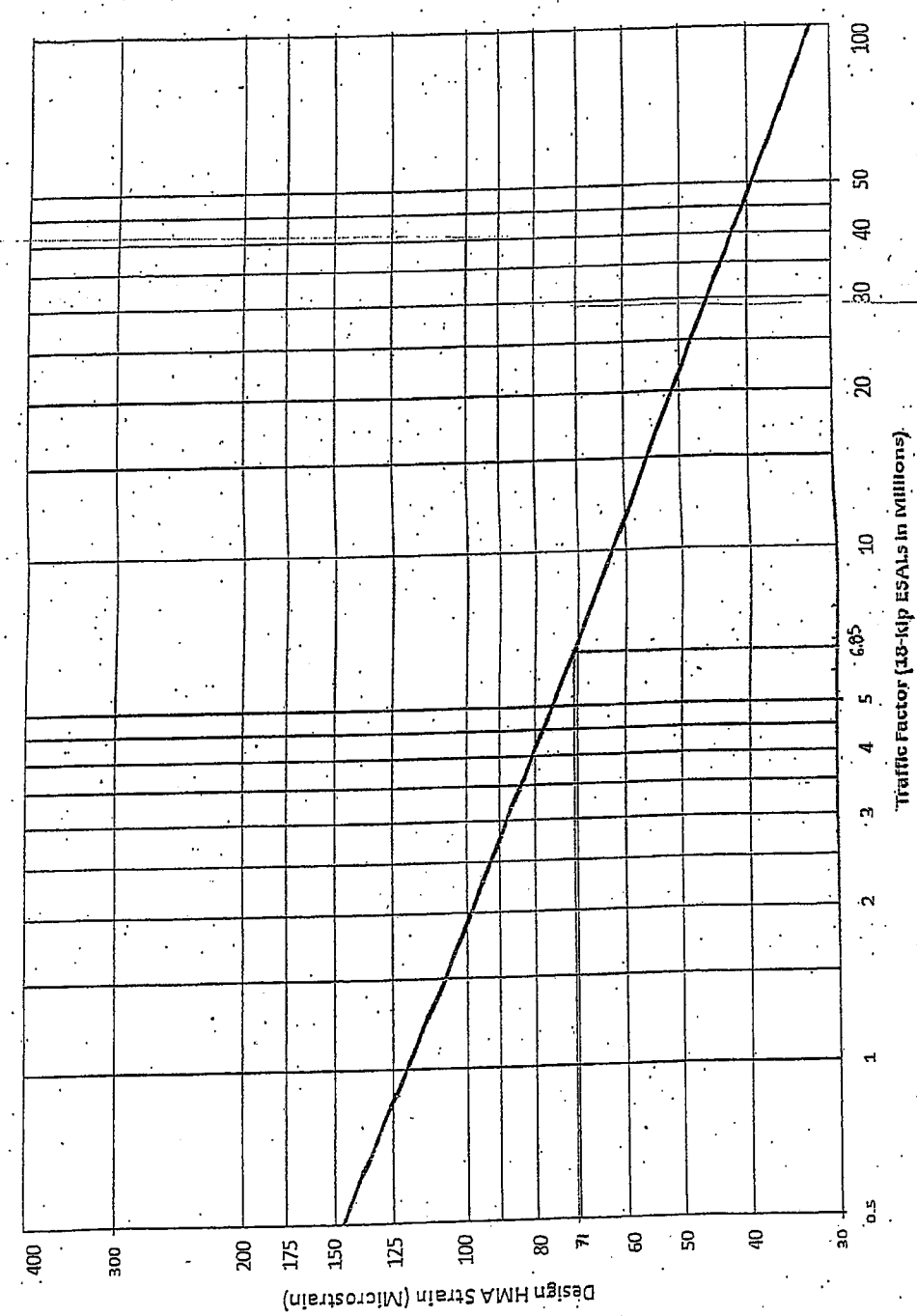

DESIGN HMA STRAIN
(Mechanistic Design: Flexible Pavement)

Figure 54-5.E

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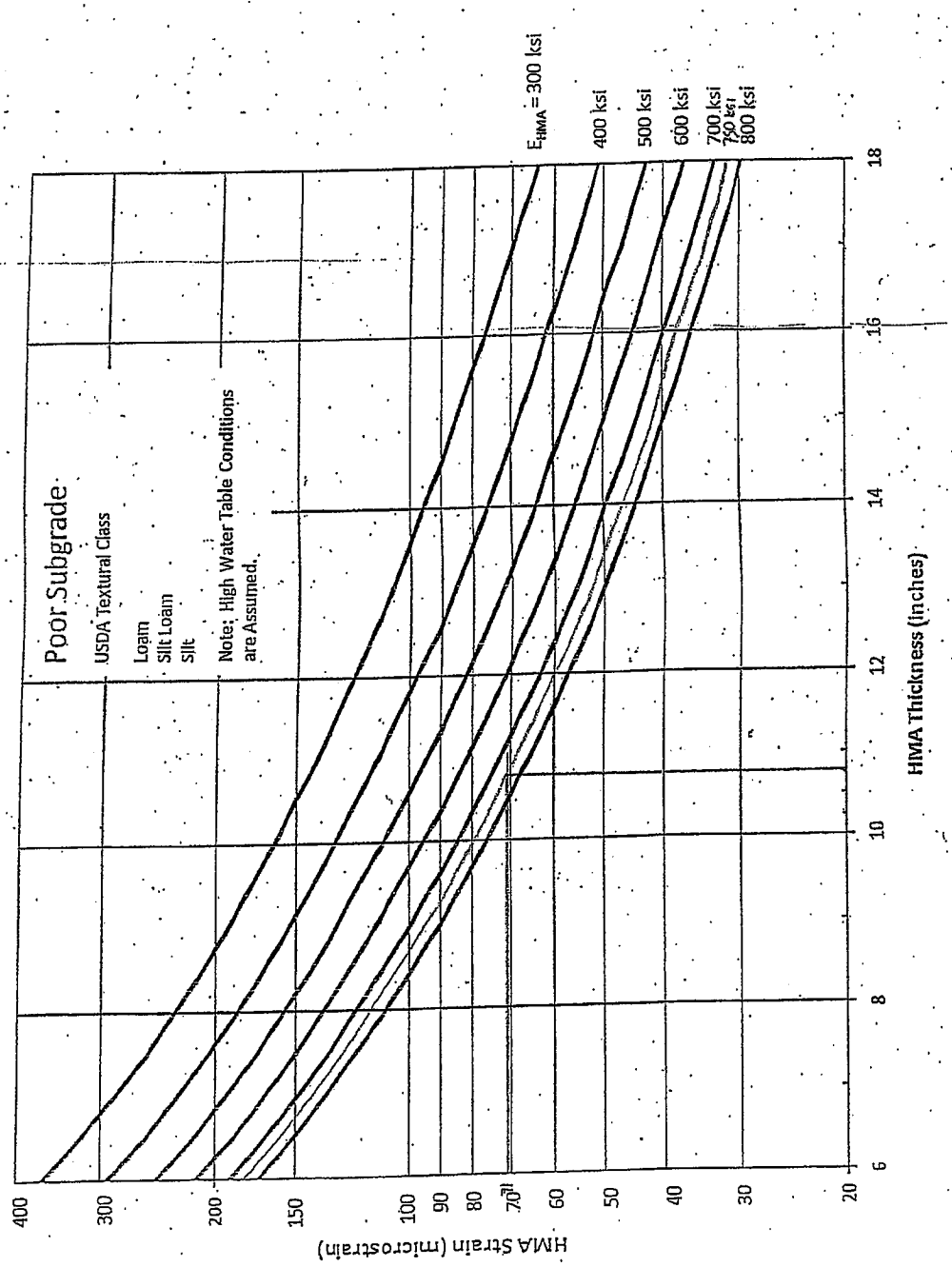

10 3/4" FULL DEPTH HMA

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

Figure 54-5.F

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Revised July 1, 1991

MECHANISTIC PAVEMENT DESIGN

Date JANUARY 19, 2012

FAP 330 Route IL 21

Calculations by: TMC

Section N/A

Checked by:

LAKE County

Class 1 Roads and Streets

Location IL 22 TO US45

Urban ____ Rural X

Limits of Analysis Station 1022+35 to Station 1081+71

Length 5950 Feet 1.13 Miles

Structural Design Traffic

PV = 51,402

SU = 1,892

MU = 757

Percent of S.D.T. in Design Lane

P = 8 %

S = 37 %

U = 37 %

MINIMUM SUBGRADE SUPPORT RATING - " POOR "

Flexible Pavement Design Actual TF_F = 5.26 Minimum TF_F = 6.85

Selected Design AC Type 20

Design AC Mixture Temp. 73 °F.

Design E_{AC} 750 KSI

Design AC Microstrain 71

AC Thickness 10 3/4 Inch

Rigid Pavement Design Actual TF_R = 8.89 Minimum TF_R = 7.44

Extended Lane 9 3/4 Inch

15' Panel PCC Thickness for: Tied Shoulder - Inch

Untied Shoulder - Inch

Figure 5.05

Revised July 1, 1991

RIGID PAVEMENT

Date: _____ FAP Route 330

Quantities by: TMC Checked by: _____ Section N/A

Unit Prices by: _____ Checked by: TMC LAKE County

Net Length 5950 Lin. Ft. 1.13 Miles

~~Number Lanes~~ 6 Urban _____ Rural X

ITEMIZED CONSTRUCTION COST

Quantity	Unit	Item	Unit Cost	Total Cost
48,909 Sq. Yds.	9 3/4 -Inch	Jointed PCC	@ $ 43.30	= $ 2,117,760
52,876 Sq. Yds.	~~4-Inch~~ 4 1/2" HMA	(Stabilized/Granular Subbase)	@ $ 15.00	= $ 793,140
0 Sq. Yds.	_____-Inch	PCC Shoulders	@ $ _____	= $ _____
0 Lin. Ft.		Pipe Underdrains	@ $ _____	= $ _____
0		Subbase Gran. Mat., Type C	@ $ _____	= $ _____
23,800 Lin. Ft.		100% Shoulder Joint Seal	@ $ 2.00	= $ 47,600
			@ $ _____	= $ _____
			@ $ _____	= $ _____

Total Cost of Original Pavement Construction $ 2,958,500

ITEMIZED MAINTENANCE AND REHABILITATION ACTIVITY COST

REHABILITATION ACTIVITY 1 - YEAR 10

49 Sq. Yds.	0.1% Full-Depth PCC Pavement Patching	@ $ 60	= $ 2,940

Total Cost of Rehabilitation Activity 1 $ 2,940

FIGURE 5.05a(1)

FAP Route 330
Section N/A
LAKE County

REHABILITATION ACTIVITY 2 - YEAR 15

98 Sq. Yds. 0.2% Full-Depth PCC Pavement Patching @ $ 60 = $ 5,880

Total Cost of Rehabilitation Activity 2 $ 5,880

REHABILITATION ACTIVITY 3 - YEAR 20

978 Sq. Yds. 2% Full-Depth PCC Pavement Patching @ $ 60 = $ 58,680

0 Sq. Yds. 0.5% Full-Depth PCC Shoulder Patching @ $ 50 = $ 0

23,800 Lin. Ft. 100% Longitudinal/Shoulder Joint Routing & Sealing @ $ 2 = $ 47,600

23,800 Lin. Ft. 100% Centerline Joint Routing & Sealing @ $ 2 = $ 47,600

Total Cost of Rehabilitation Activity 3 $ 153,880

FIGURE 5.05a(2)

RIGID PAVEMENT (Cont.)
FAP Route 330
Section N/A
LAKE County

REHABILITATION ACTIVITY 4 - YEAR 25

1467	Sq. Yds.	3.0% Full-Depth PCC Pavement Patching	@ $ 60	= $	88020
0	Sq. Yds.	1.0% Full-Depth PCC Shoulder Patching	@ $ 50	= $	0

Total Cost of Rehabilitation Activity 4 $ 88,020

REHABILITATION ACTIVITY 5 - YEAR 30

1956	Sq. Yds.	4.0% Full-Depth PCC Pavement Patching	@ $ 60	= $	117,360
0	Sq. Yds.	1.5% Full-Depth PCC Shoulder Patching	@ $ 50	= $	0
48,909	Sq. Yds.	Policy HMA Overlay - Pavement	@ $ 11	= $	537,999
0	Sq. Yds.	Policy HMA Overlay - Shoulder	@ $ 11	= $	0

Total Cost of Rehabilitation Activity 5 $ 655,359

REHABILITATION ACTIVITY 6 - YEAR 35

23,800	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@ $ 2	= $	47,600
23,800	Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $ 2	= $	47,600
17,850	Lin. Ft.	50% Random Crack Routing and Sealing - Assume 100 ft/Station	@ $ 2	= $	35,700
11,424	Lin. Ft.	40% Reflective Transverse Crack Routing & Sealing	@ $ 2	= $	22,848
49	Sq. Yds.	0.1% Partial-Depth Pavement Patching (Mill & Fill Surface-Interstates; Mill & Fill 2.5 in.-Non-Interstates)	@ $ 50	= $	2,450

Total Cost of Rehabilitation Activity 6 $ 156,198

FIGURE 5.05a(3)

RIGID PAVEMENT (Cont.)

FAP Route 330

Section N/A

LAKE County

REHABILITATION ACTIVITY 7 - YEAR 40

245	Sq. Yds.	0.5% Full-Depth PCC Pavement Patching	@ $ 60	= $	14,700
245	Sq. Yds.	0.5% Partial-Depth Pavement Patching (Mill & Fill Surface-Interstates; Mill & Fill 2.5 in. Non-Interstates)	@ $ 50	= $	12,250
17,136	Lin. Ft.	60% Reflective Transverse Crack Routing and Sealing	@ $ 2	= $	34,272
17,850	Lin. Ft.	50% Random Crack Routing & Sealing- Assume 100ft/Station	@ $ 2	= $	35,700
23,800	Lin. Ft.	100% Longitudinal/Shoulder Joint Routing & Sealing	@ $ 2	= $	47,600
23,800	Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $ 2	= $	47,600

Total Cost of Rehabilitation Activity 7 $ 192,122

FIGURE 5.05a(4)

Revised July 1, 1991
Sheet 5 of 5

RIGID PAVEMENT (Cont.)

FAP Route 330

Section N/A

LAKE County

ANNUAL COST DETERMINATION

Present Worth Calculation:

Total Cost of Original Pavement Construction $ 2,117,760

Present Worth of Rehabilitation Activity 1	$ 2,940	X 0.7441 =	$ 2,188
Present Worth of Rehabilitation Activity 2	$ 5,880	X 0.6419 =	$ 3,774
Present Worth of Rehabilitation Activity 3	$ 153,880	X 0.5537 =	$ 85,203
Present Worth of Rehabilitation Activity 4	$ 88,020	X 0.4776 =	$ 42,038
Present Worth of Rehabilitation Activity 5	$ 655,359	X 0.4120 =	$ 270,008
Present Worth of Rehabilitation Activity 6	$ 156,198	X 0.3554 =	$ 55,513
Present Worth of Rehabilitation Activity 7	$ 192,122	X 0.3066 =	$ 58,905

Total Life Cycle Cost (Present Worth) $ 2,958,500

Annual Cost Per Mile Calculation

Total pw X CRF_n/Length = Annual Cost/Year-Mile

($ 2,958,500 X 0.04679/ 1.13 Mi.) = $ 125,479 /Yr.-Mi.

FIGURE 5.05a(5)

FLEXIBLE PAVEMENT

Date: _____ FAP Route 330

Quantities by: TMC Checked by: _____ Section N/A

Unit Prices by: _____ Checked by: TMC LAKE County

Net Length 5950 Lin. Ft. 1.13 Miles

Number Lanes 6 Urban _____ Rural X

Single Lane Paving X Dual Lane Paving _____

ITEMIZED CONSTRUCTION COST

Quantity	Unit	Item	Unit Cost	Total Cost
48,909	Sq. Yds.	2" POLY HMA SURFACE, MIX F, N90 ~~-Class I Surface Course~~	@ $ 10.52	= $ 514,523
48,909	Sq. Yds.	2¼ POLY HMA BINDER, IL 19.0, N90 -Inch Class I Binder Course	@ $ 10.54	= $ 515501
0	Sq. Yds.	— -Inch Stabilized Shoulders	@ $	= $
0	Lin. Ft.	Pipe Underdrains	@ $	= $
0		Subbase Gran. Matl., Type C	@ $	= $
48,909	SQ YDS.	4½" HMA BINDER, IL-19.0, N90	@ $ 29.84	= $ 1,459,445
0			@ $	= $

Total Cost of Original Pavement Construction $ 2,489,469

ITEMIZED MAINTENANCE AND REHABILITATION ACTIVITY COST

REHABILITATION ACTIVITY 1 - YEAR 5

3,273	Lin. Ft.	50% Random/Thermal Crack Routing & Sealing (Assume 110ft/station)	@ $ 2	= $ 6,546
23,800	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@ $ 2	= $ 47,600
23,800	Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $ 2	= $ 47,600
49	Sq. Yds.	0.1% Partial-Depth Pavement Patching -Mill & Fill Surface	@ $ 38	= $ 1,862

Total Cost of Rehabilitation Activity 1 $ 103,608

FIGURE 5.05b(1)

FLEXIBLE PAVEMENT (Cont.)

FAP Route 330
Section N/A
LAKE County

REHABILITATION ACTIVITY 2 - YEAR 10

245 Sq. Yds.	0.5% Partial-Depth HMA Pavement Patching - Mill & Fill Surface	@ $ 38	= $ 9,310
3,273 Lin. Ft.	50% Random Thermal Crack Routing & Sealing (Assume 110ft/station)	@ $ 2	= $ 6,546
23,800 Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@ $ 2	= $ 47,600
23,800 Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $ 2	= $ 47,600

Total Cost of Rehabilitation Activity 2 $ 111,056

REHABILITATION ACTIVITY 3 - YEAR 15

48,909 Sq. Yds.	2.00 in. Milling - Pavement & Shoulder	@ $ 2.25	= $ 110,045
489 Sq. Yds.	1.0% Partial-Depth Pavement Patching (Mill & Fill Additional 2.00 in.)	@ $ 38	= $ 18,582
5,478 Tons	2.00 in. HMA Overlay Pavement & Shoulder	@ $ 74	= $ 405,372

Total Cost of Rehabilitation Activity 3 $ 533,999

FIGURE 5.05b(2)

FAP Route 330
Section N/A
LAKE County

REHABILITATION ACTIVITY 4 - YEAR 20

23,800	Lin. Ft.	100% Longitudinal Shoulder Joint Routing and Sealing	@ $ 2	= $	47,600
23,800	Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $ 2	= $	47,600
3,273	Lin. Ft.	50% Random/Thermal Crack Routing & Sealing (Assume 110 ft/Station)	@ $ 2	= $	6,546
49	Sq. Yds.	0.1% Partial-Depth HMA Pavement Patching (Mill & Fill Surface)	@ $ 38	= $	1862
		Total Cost of Rehabilitation Activity 4		$	103608

REHABILITATION ACTIVITY 5 - YEAR 25

23800	Lin. Ft.	100% Longitudinal Shoulder Joint Routing and Sealing	@ $ 2	= $	47,600
23800	Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $ 2	= $	47,600
3273	Lin. Ft.	50% Random/Thermal Crack Routing & Sealing (Assume 110 ft/Station)	@ $ 2	= $	6,546
245	Lin. Ft.	0.50% Partial-Depth Pavement Patching (Mill & Fill Surface)	@ $ 38	= $	9,310
		Total Cost of Rehabilitation Activity 7		$	111,056

REHABILITATION ACTIVITY 6 - YEAR 30

48,909	Sq. Yds.	2.00 in. Milling (Pavement Only - Standard Design Pavement & Shoulder - Limiting Strain Criterion Design)	@ $ 2.25	= $	110,045
978	Sq. Yds.	2.0% Partial-Depth HMA Pavement Patching (Mill & Fill Additional 2.00 in. All Designs)	@ $ 38	= $	37,164
0	Sq. Yds.	1.0% Full-Depth HMA Shoulder Patching (Mill & Fill Surface - Standard Design; Mill & Fill Additional 2.00 in. - Limiting Strain Criterion Design)	@ $ 50	$	0
10,271	Tons	HMA Overlay (Pavement 3.75 in. - Standard Design 2.00 in. - Limiting Strain Criterion Design)	@ $ 74	= $	760,054
0	Tons	HMA Overlay - Shoulder (1.75 in. Standard Design; 2.00 in. - Limiting Strain Criterion Design)	@ $ 74	= $	0

Total Cost of Rehabilitation Activity 6 $ 907,263

FIGURE 5.05b(3)

FLEXIBLE PAVEMENT (Cont.)

FAP Route 330
Section N/A
LAKE County

REHABILITATION ACTIVITY 7 - YEAR 35

23,800 Lin. Ft.	100% Longitudinal Shoulder Joint Routing and Sealing	@ $ 2	= $ 47600
23,800 Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $ 2	= $ 47600
3,273 Lin. Ft.	50% Random/Thermal Crack Routing & Sealing (Assume 110 ft/station)	@ $ 2	= $ 6546
49 Sq. Yds.	0.10% Partial-Depth Pavement Patching (Mill & Fill Surface)	@ $ 38	= $ 1862

Total Cost of Rehabilitation Activity 7 $ 103,608

REHABILITATION ACTIVITY 8 - YEAR 40

23,800 Lin. Ft.	100% Longitudinal Shoulder Joint Routing and Sealing	@ $ 2	= $ 47,600
23,800 Lin. Ft.	100% Centerline Joint Routing & Sealing (Single lane and dual lane paving)	@ $ 2	= $ 47,600
3,273 Lin. Ft.	50% Random/Thermal Crack Routing & Sealing	@ $ 2	= $ 6,546
245 Sq. Yds.	0.50% Partial-Depth Pavement Patching (Mill & Fill Surface)	@ $ 38	= $ 9,310

Total Cost of Rehabilitation Activity 8 $ 111,056

FIGURE 5.05b(4) - continued

Revised July 1, 1991
Sheet 5 of 5

FLEXIBLE PAVEMENT (Cont.)

FAP Route 330

Section N/A

LAKE County

ANNUAL COST DETERMINATION

Present Worth Calculation:

				Present Worth
Total Cost of Original Pavement Construction				$ 2,489,469
Present Worth of Rehabilitation Activity	1	$ 103608	X 0.8626 =	$ 89,372
Present Worth of Rehabilitation Activity	2	$ 111,056	X 0.7441 =	$ 82,637
Present Worth of Rehabilitation Activity	3	$ 533,999	X 0.6419 =	$ 342,774
Present Worth of Rehabilitation Activity	4	$ 103,608	X 0.5537 =	$ 57,368
Present Worth of Rehabilitation Activity	5	$ 111,056	X 0.4776 =	$ 53,040
Present Worth of Rehabilitation Activity	6	$ 907,263	X 0.4120 =	$ 373,792
Present Worth of Rehabilitation Activity	7	$ 103,608	X 0.3554 =	$ 36,822
resent Worth of Rehabilitation Activity	8	$ 111,056	X 0.3066 =	$ 34,050

Total Life Cycle Cost (Present Worth) $ 3,559,324

Annual Cost Per Mile Calculation

Present Worth Total Cost X CRF_n/Length = Annual Cost/Year-Mile

($ 3,559,324 X 0.04079/1.13 Mi.) = $ 128,482 /Yr.-Mi.

$$\frac{128,482 - 125,479}{125,479} = 0.0239$$

FAVORS PCC BY 2.4%

FIGURE 5.05b(5)

PLAIN JOINTED PCC PAVEMENT

FILENAME-	IL 21	19-Jan-12	
ROUTE-	IL 21	08:00 AM	
SECTION-	N/A		
COUNTY-	Lake		
LOCATION-	IL 22 to US 45		
DATE-	12/2/2011		
PROJECT LENGTH (FT)	5950 =	1.13	MILES
AVERAGE LANE WIDTH (FT)	12.33		
NUMBER OF LANES	6		
# OF EDGES	4		
INSIDE SHLDER WIDTH (FT)	0		
OUTSIDE SHLDER WIDTH (FT)	0		
# OF CENTERLINES	4		
RIGID THICKNESS-	9.75		
TRAFFIC FACTORS	MINIMUM	ACTUAL	
RIGID-	7.44	8.89	
TRAFFIC			
PV-	0	51402	
SU-	300	1892	
MU-	900	757	

INITIAL COSTS

ITEM	QUANTITY	UNIT PRICE	COST
PAVEMENT (SQ YDS)	48,909	$43.30	$2,117,760
STAB SUBBASE (SQ YDS)	52,876	$15.00	$793,140
SHOULDERS (SQ YDS)	0	$0.00	$0
SHOULDER SEAL (LN FT)	23,800	$2.00	$47,600
SUBBASE GRAN MATL TY C (TONS	0	$0.00	$0
CONSTRUCTION INITIAL COST (PW)			$2,958,500
TOTAL REHABILITATION COST (PW)			$517,629
TOTAL LIFE CYCLE COST (PW)			$3,476,129
ANNUAL COST PER MILE			$125,479

MAINTENANCE COSTS:

ITEM	UNIT COST
PAVEMENT PATCHING (SQ YDS)	$60.00
SHOULDER PATCHING (SQ YDS)	$50.00
SHLDR JT ROUT & SEAL (LF)	$2.00
CENTERLINE JT ROUT & SEAL (LF)	$2.00
POLICY HMA OVERLAY PVMT (SQ YDS)	$11.00
POLICY HMA OVERLAY SHLDR (SQ YDS)	$11.00
RANDOM CRACK ROUT & SEAL (LF)	$2.00
REFL TRANS CRACK ROUT & SEAL (LF)	$2.00
PARTIAL PVMT PATCH (SQ YDS)	$50.00

MAINTENANCE COSTS

	ITEM	QUANTITY	UNIT PRICE	COST	PW
Activity 1					
YEAR 10					
	PAVEMENT PATCHING 0.1% (SQ YDS)	49	$60.00	$2,940	
				$2,940	$2,188
Activity 2					
YEAR 15					
	PAVEMENT PATCHING 0.2% (SQ YDS)	98	$60.00	$5,880	
				$5,880	$3,774
Activity 3					
YEAR 20					
	PAVEMENT PATCHING 2.0% (SQ YDS)	978	$60.00	$58,680	
	SHOULDER PATCHING 0.5% (SQ YDS)	0	$50.00	$0	
	SHLDR JT ROUT & SEAL 100% (LF)	23,800	$2.00	$47,600	
	CENTERLINE JT ROUT & SEAL 100.0% (L	23,800	$2.00	$47,600	
				$153,880	$85,203
Activity 4					
YEAR 25					
	PAVEMENT PATCHING 3.0% (SQ YDS)	1,467	$60.00	$88,020	
	SHOULDER PATCHING 1.0% (SQ YDS)	0	$50.00	$0	
				$88,020	$42,038
Activity 5					
YEAR 30					
	PAVEMENT PATCHING 4.0% (SQ YDS)	1,956	$60.00	$117,360	
	SHOULDER PATCHING 1.5% (SQ YDS)	0	$50.00	$0	
	POLICY HMA OVERLAY PVMT (SQ YDS)	48,909	$11.00	$537,999	
	POLICY HMA OVERLAY SHLDR (SQ YDS)	0	$11.00	$0	
				$655,359	$270,008
Activity 6					
YEAR 35					
	SHLDR JT ROUT & SEAL 100% (LF)	23,800	$2.00	$47,600	
	CENTERLINE JT ROUT & SEAL 100.0% (L	23,800	$2.00	$47,600	
	RANDOM CRACK ROUT & SEAL 50% (LF)	17,850	$2.00	$35,700	
	REFL TRANS CRACK ROUT & SEAL 40%	11,424	$2.00	$22,848	
	PARTIAL PVMT PATCH 0.1% (SQ YDS)	49	$50.00	$2,450	
				$156,198	$55,513
Activity 7					
YEAR 40					
	PAVEMENT PATCHING 0.5% (SQ YDS)	245	$60.00	$14,700	
	PARTIAL PVMT PATCH 0.5% (SQ YDS)	245	$50.00	$12,250	
	REFL TRANS CRACK ROUT & SEAL 60%	17,136	$2.00	$34,272	
	RANDOM CRACK ROUT & SEAL 50% (LF)	17,850	$2.00	$35,700	
	SHLDR JT ROUT & SEAL 100% (LF)	23,800	$2.00	$47,600	
	CENTERLINE JT ROUT & SEAL 100.0% (L	23,800	$2.00	$47,600	
				$192,122	$58,905
	Total Rehabilitation Cost (Present Worth)				$517,629

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

ROUTE-	IL 21	19-Jan-12
SECTION-	N/A	08:00 AM
COUNTY-	Lake	
LOCATION-	IL 22 to US 45	
PROJECT LENGTH (FT)	5950	
AVERAGE LANE WIDTH (FT)	12.33	

FULL-DEPTH FLEXIBLE PAVEMENT
MAINTENANCE COSTS

	ITEM	QUANTITY	UNIT PRICE	COST	Present Worth
Activity 1					
YEAR 5	RAND/THERM CRACK ROUT & SEAL 50%	3,273	$2.00	$6,546	
	SHLDR JT ROUT & SEAL 100% (LF)	23,800	$2.00	$47,600	
	CENTERLINE JT ROUT & SEAL 100.0% (L	23,800	$2.00	$47,600	

NUMBER OF LANES	6	
# OF EDGES	4	
INSIDE SHLDER WIDTH (FT)	0	
OUTSIDE SHLDER WIDTH (FT)	0	
# OF CENTERLINES	4	
PROJECT TYPE	1	1=RURAL, 2=URBAN
PAVING WIDTH	1	1=SINGLE LANE, 2=DUAL LANE

FLEXIBLE THICKNESS-	10.75	
TRAFFIC FACTORS	MINIMUM	ACTUAL
FLEXIBLE	5.26	6.85

TRAFFIC		
PV-	0	51402
SU-	300	1892
MU-	900	757

PAVEMENT OVERLAY THICKNESS	3.75
SHOULDER OVERLAY THICKNESS	1.75

INITIAL COSTS

ITEM	QUANTITY	UNIT PRICE	COST
SURFACE (SQ YDS)	48,909	$10.52	$514,523
POLY BINDER (SQ YDS)	48,909	$10.54	$515,501
BINDER (SQ YDS)	48,909	$29.84	$1,459,445
SHOULDERS (SQ YDS)	0	$0.00	$0
SUBBASE GRAN MATL TY C (TONS	0	$0.00	$0

CONSTRUCTION INITIAL COST (PW)	$2,489,469
TOTAL REHABILITATION COST (PW)	$1,069,855
TOTAL LIFE CYCLE COST (PW)	$3,559,324
ANNUAL COST PER MILE	$128,482

MAINTENANCE COSTS:

ITEM	UNIT COST
RAND/THERM CRACK ROUT & SEAL (LF)	$2.00
SHLDR JT ROUT & SEAL (LF)	$2.00
CENTERLINE JT ROUT & SEAL (LF)	$2.00
PARTIAL PVMT PATCH (SQ YDS)	$38.00
2" MILL PVMT & SHLDR (SQ YDS)	$2.25
2" OVERLAY PVMT & SHLDR (TONS)	$74.00
2" MILL PVMT ONLY (SQ YDS)	$2.25
HMA SHOULDER PATCHING (SQ YDS)	$50.00
POLICY HMA OVERLAY PVMT (TONS)	$74.00
POLICY HMA OVERLAY SHLDR (TONS)	$74.00

MATERIAL TYPE/PERCENTAGE PCC 2.4%

	PARTIAL PVMT PATCH 0.1% (SQ YDS)	49	$38.00	$1,862	
				$103,608	$89,372
Activity 2					
YEAR 10	PARTIAL PVMT PATCH 0.5% (SQ YDS)	245	$38.00	$9,310	
	RAND/THERM CRACK ROUT & SEAL 50%	3,273	$2.00	$6,546	
	SHLDR JT ROUT & SEAL 100% (LF)	23,800	$2.00	$47,600	
	CENTERLINE JT ROUT & SEAL 100.0% (L	23,800	$2.00	$47,600	
				$111,056	$82,637
Activity 3					
YEAR 15	2" MILL PVMT & SHLDR 100% (SQ YDS)	48,909	$2.25	$110,045	
	PARTIAL PVMT PATCH 1.0% (SQ YDS)	489	$38.00	$18,582	
	2" OVERLAY PVMT & SHLDR 100% (TONS	5,478	$74.00	$405,372	
				$533,999	$342,774
Activity 4					
YEAR 20	SHLDR JT ROUT & SEAL 100% (LF)	23,800	$2.00	$47,600	
	CENTERLINE JT ROUT & SEAL 100.0% (L	23,800	$2.00	$47,600	
	RAND/THERM CRACK ROUT & SEAL 50%	3,273	$2.00	$6,546	
	PARTIAL PVMT PATCH 0.1% (SQ YDS)	49	$38.00	$1,862	
				$103,608	$57,368
Activity 5					
YEAR 25	SHLDR JT ROUT & SEAL 100% (LF)	23,800	$2.00	$47,600	
	CENTERLINE JT ROUT & SEAL 100.0% (L	23,800	$2.00	$47,600	
	RAND/THERM CRACK ROUT & SEAL 50%	3,273	$2.00	$6,546	
	PARTIAL PVMT PATCH 0.5% (SQ YDS)	245	$38.00	$9,310	
				$111,056	$53,040
Activity 6					
YEAR 30	2" MILL PVMT ONLY 100% (SQ YDS)	48,909	$2.25	$110,045	
	PARTIAL PVMT PATCH 2.0% (SQ YDS)	978	$38.00	$37,164	
	HMA SHOULDER PATCHING 1.0% (SQ YD	0	$50.00	$0	
	POLICY HMA OVERLAY PVMT (TONS)	10,271	$74.00	$760,054	
	POLICY HMA OVERLAY SHLDR (TONS)	0	$74.00	$0	
				$907,263	$373,792
Activity 7					
YEAR 35	SHLDR JT ROUT & SEAL 100% (LF)	23,800	$2.00	$47,600	
	CENTERLINE JT ROUT & SEAL 100.0% (L	23,800	$2.00	$47,600	
	RAND/THERM CRACK ROUT & SEAL 50%	3,273	$2.00	$6,546	
	PARTIAL PVMT PATCH 0.1% (SQ YDS)	49	$38.00	$1,862	
				$103,608	$36,822
Activity 8					
YEAR 40	SHLDR JT ROUT & SEAL 100% (LF)	23,800	$2.00	$47,600	
	CENTERLINE JT ROUT & SEAL 100.0% (L	23,800	$2.00	$47,600	
	RAND/THERM CRACK ROUT & SEAL 50%	3,273	$2.00	$6,546	
	PARTIAL PVMT PATCH 0.5% (SQ YDS)	245	$38.00	$9,310	
				$111,056	$34,050

Total Rehabilitation Cost (Present Worth) $1,069,855

benesch engineers · scientists · planners	Comp. by: _____ Date: _____ Sheet ____ of ____
	Chkd. by: _____ Date: _____ Job No. _____
	Project: US 45 FROM IL 60 TO IL 22
	Element: PAVEMENT DESIGN - IL 60

IL 60 FROM US 45/IL83 TO MEDLINE PLACE

- LENGTH = 1,800 FT - AREA = 12,000 SY - DESIGN ADT = 52,500 SU = 3.2% MU = 1.6%
- CONFIGURATION = 2 WB THRU LANES, 3 EB THRU LANES
- SHOULDERS = - ENCLOSED DRAINAGE =

- MECHANISTIC RIGID

- 10" PCC PAVEMENT (JOINTED)
- 4½" HMA STABILIZED SUBBASE
- 12" AGGREGATE SUBGRADE
- GEOTECHNICAL FABRIC

- MECHANISTIC FLEXIBLE

- 11½" FULL DEPTH HMA PAVEMENT
  - 2" POLYMERIZED HMA SURFACE COURSE, MIX "F", N90
  - 2¼" POLYMERIZED HMA BINDER COURSE, IL-19.0, N90
  - 7¼" HMA BINDER COURSE, IL 19.0, N90
- 12" AGGREGATE SUBGRADE
- GEOTECHNICAL FABRIC

USE FOR TF ONLY

Spreadsheet by Uehle - Rev. 11/02

MECHANISTIC PAVEMENT DESIGN

Date: 12/28/11

INPUT (Enter Data in Gray Shaded Cells)

Route: US 45 from IL 60 to IL 22
Section: N/A
County: Lake
Location: IL 60 from US 45/ IL 83 to Medina Pl

Comments: Pavement design for IL 60 from US 45/ IL 83 to Medina Place

Designer: MC

	ADT	Year
Current:	39000	2002
Future:	53000	2030

Facility Type: Other Marked State Route

# of Lanes = 4

Road Class: I

Subgrade Support Rating (SSR): Poor

Construction Year: 2014

Design Period (DP) = 30 years

	Minimum ADT	Structural Design Traffic: Actual ADT	Actual %of Total ADT	% of ADT in Design Lane
PV =	0	49,980	95.2%	P = 32%
SU =	250	1,680	3.2%	S = 45%
MU =	750	840	1.6%	M = 45%
Struct. Design ADT =		52500	(2029)	

FLEXIBLE & RIGID PAVEMENT CALCULATIONS AND ADDITIONAL INPUT

Flexible Pavement

Cpv =	0.15	
Csu =	133	
Cmu =	483	
TF flexible (Actual)=	8.55	(Actual ADT)
TF flexible (Min)=	5.33	(Min ADT Fig 54-2C)
Use TF flexible =	8.55	
AC Type =	120	
AC Mixture Tempurature =	100.0	deg. F (Figure 54-5C)
Design AC Mixture Modulus (Eac)=	~~550~~	ksi (Figure 54-5D)
Design Asphalt Concrete Microstrain =	~~52.7~~	(Figure 54-5E)
Asphalt Concrete Thickness =	15.50	in. (Figure 54-5F)

Rigid Pavement

Cpv =	0.15	
Csu =	144	
Cmu =	696	
TF rigid (Actual)=	11.23	(Actual ADT)
TF rigid (Min)=	7.54	(Min ADT Fig 54-2C)
Use TF rigid =	11.23	
	Tied	Shoulder or C. &G.
Rigid Pavt 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

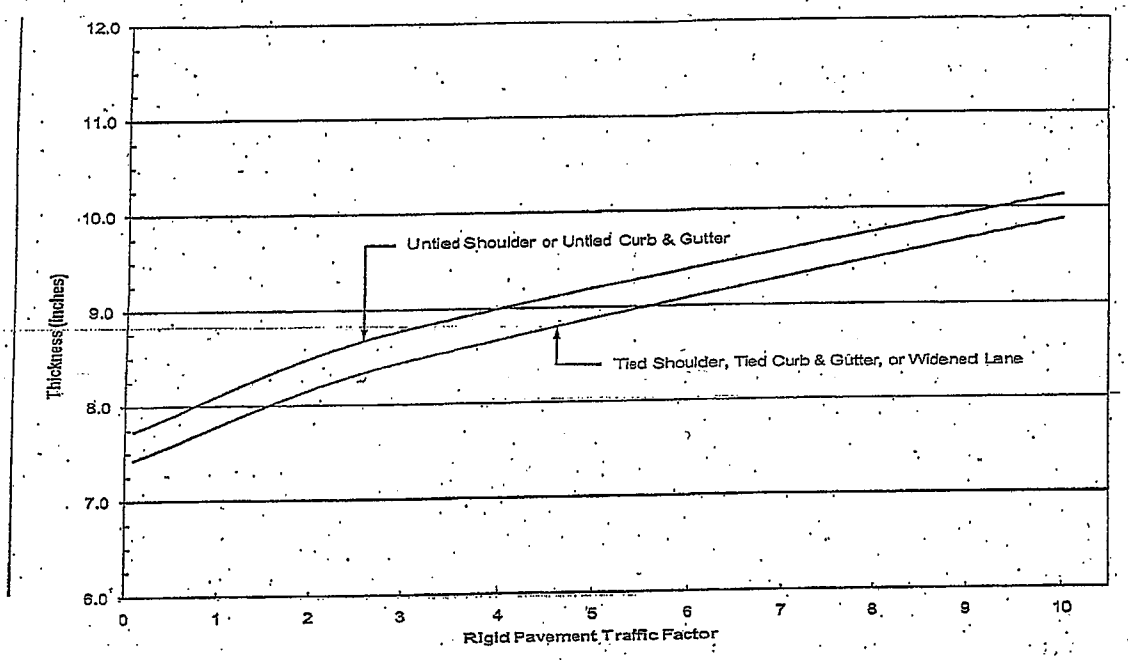
Class	Traffic Factor ESAL Coefficients: Rigid (Fig. 54-4C) Csu	Rigid Cmu	Flexible (Fig. 54-5B) Csu	Flexible Cmu
I	143.81	696.42	132.50	482.53
II	135.78	567.21	112.06	385.44
III	129.58	562.47	109.14	384.35
IV(ADT>400)	127.75	555.90	109.14	384.35
IV(ADT<=400)	127.75	555.90	9.86	78.84

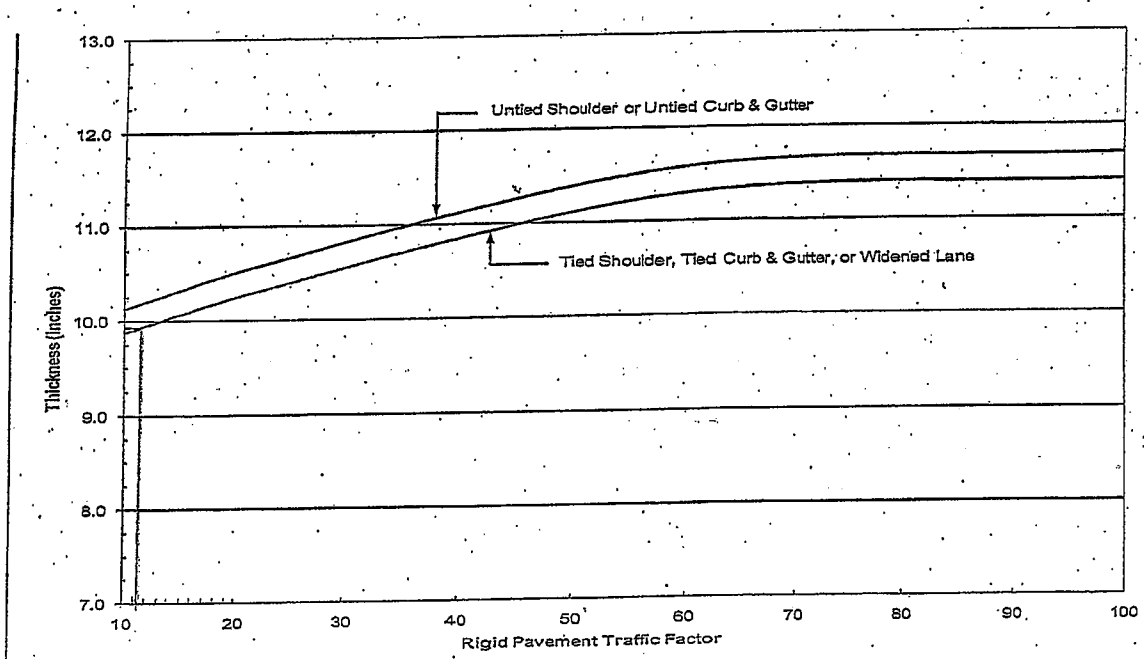
Class Table for 2 or 3 lanes (not future 4 lane & not one-way street)

ADT	Class
0 - 749	IV
750 - 2000	III
>2000	II

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%
6 or more	20%	40%	40%	8%	37%	37%

IL 60





$TF_R = 11.23$

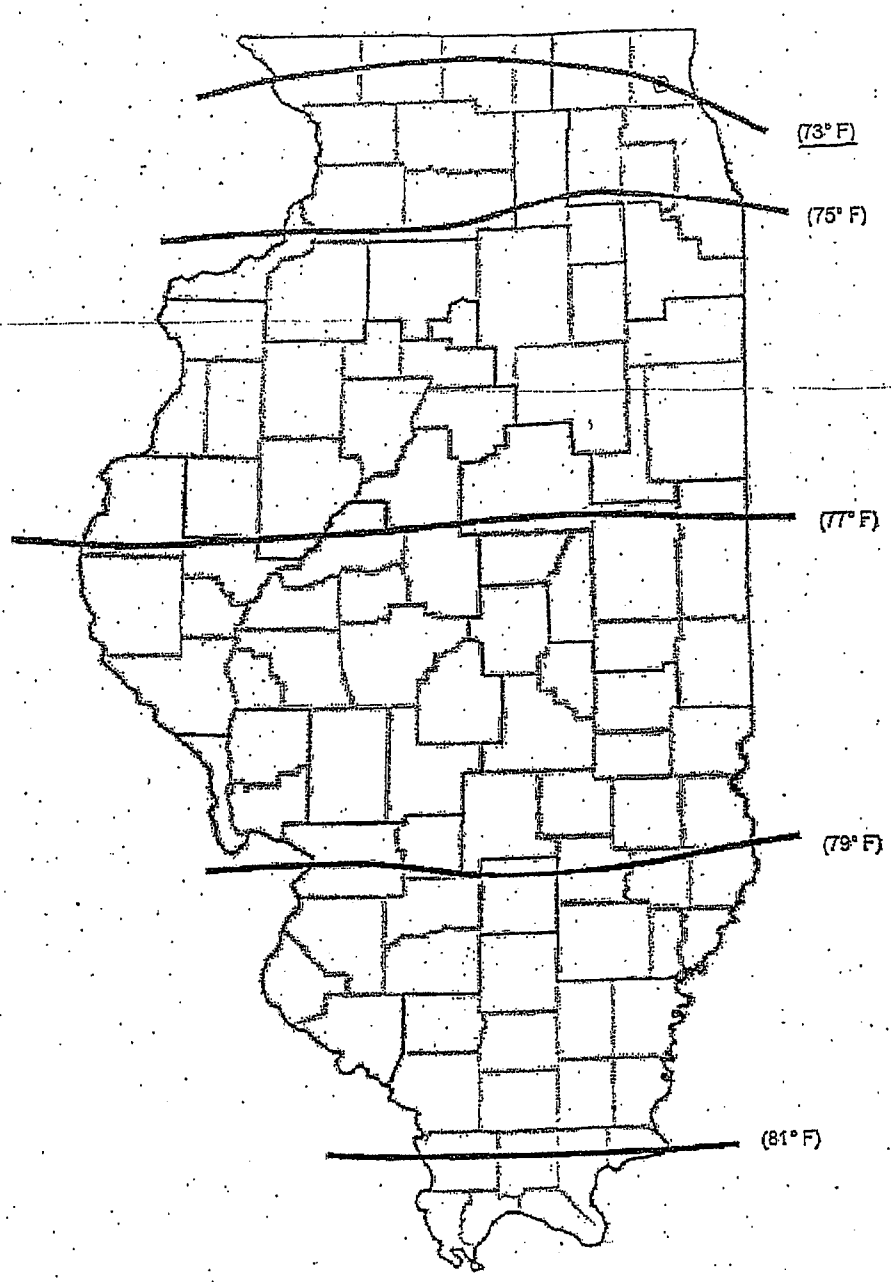
Note: Use of untied shoulder design requires BDE approval.

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

10" PCC PAVEMENT (JOINTED)

Figure 54-4.E

HARD COPIES UNCONTROLLED

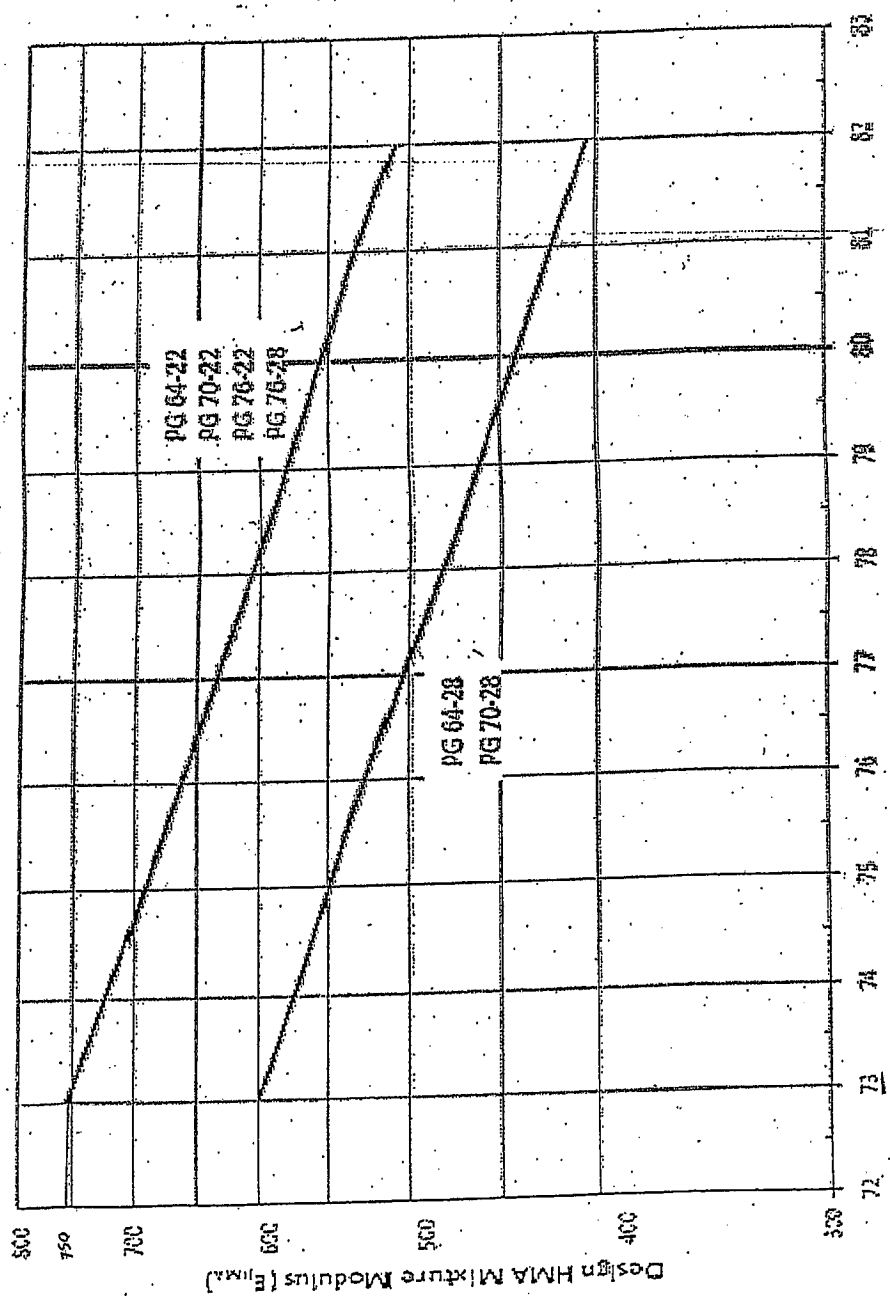


Note: The minimum design HMA mixture temperature will be 73°F.

HMA MIXTURE TEMPERATURE
(Mechanistic Design: Flexible Pavement)

Figure 54-5.C

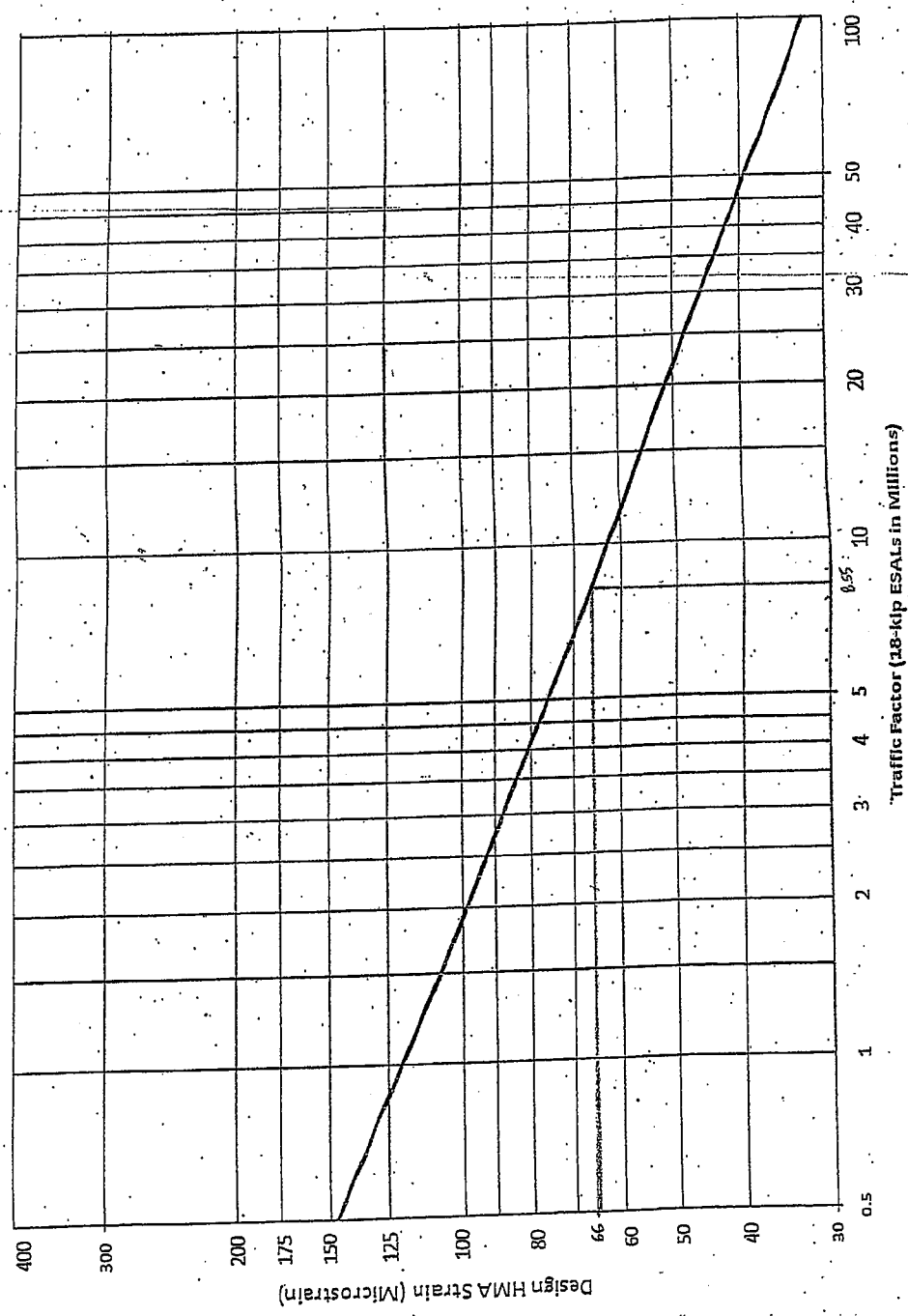
HARD COPIES UNCONTROLLED



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

Figure 54-5.D

HARD COPIES UNCONTROLLED

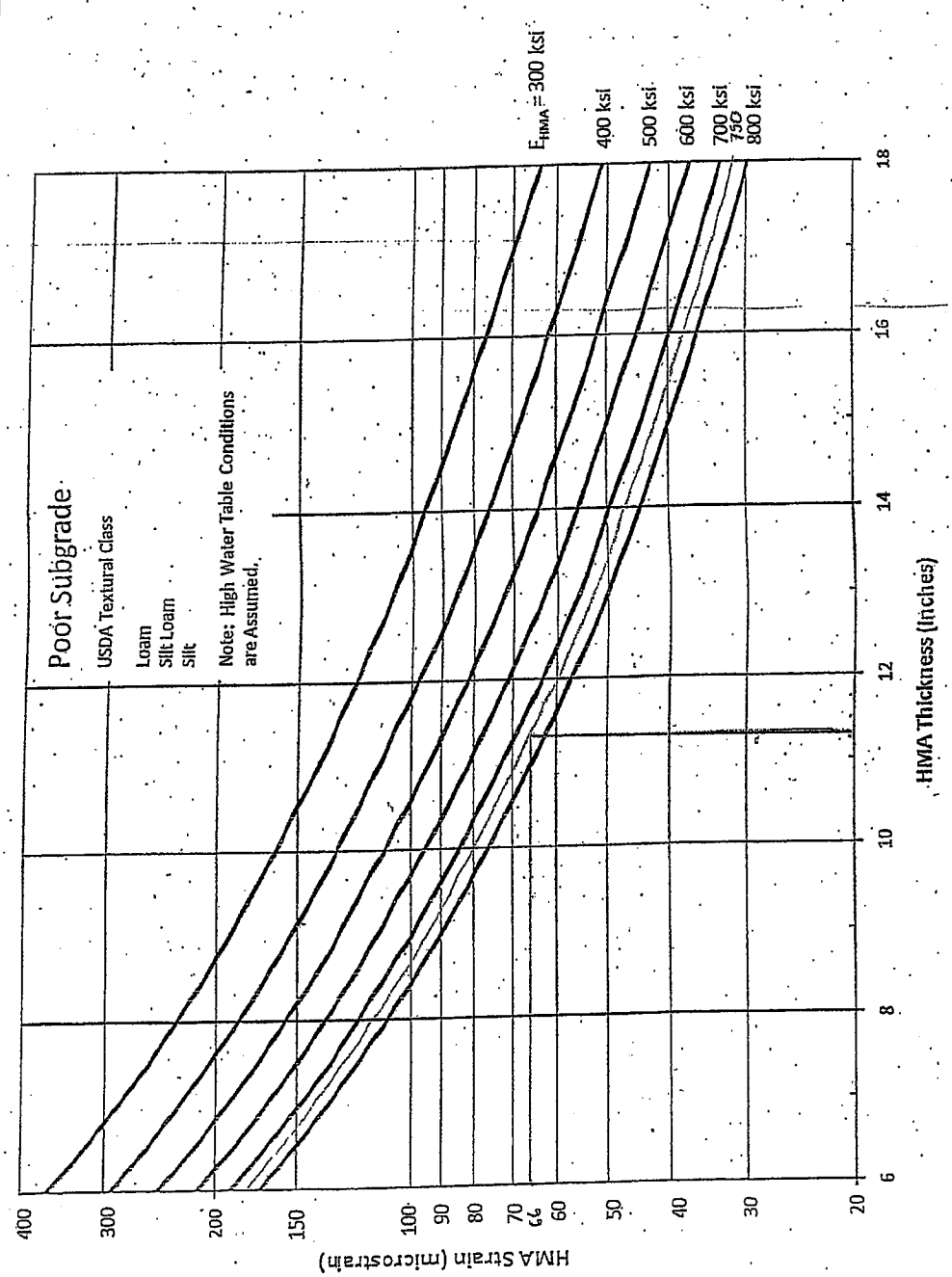


DESIGN HMA STRAIN
(Mechanistic Design: Flexible Pavement)

Figure 54-5.E

HARD COPIES UNCONTROLLED

IL 60



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

Figure 54-5.F

11.5" FULL DEPTH HMA PAVEMENT

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Revised July 1, 1991

MECHANISTIC PAVEMENT DESIGN

Date JANUARY 5, 2012

FAP 335 Route IL 60

Calculations by: TMC

Section N/A

Checked by:

LAKE County

Class 1 Roads and Streets

Location US 45/IL 83 TO MEDLINE

Urban Rural X

Limits of Analysis Station 6187+05 to Station 6204+90

Length 1800 Feet 0.34 Miles

Structural Design Traffic

PV = 49,980

SU = 1,680

MU = 840

Percent of S.D.T. in Design Lane

P = 32 %

S = 45 %

U = 45 %

MINIMUM SUBGRADE SUPPORT RATING - " POOR "

Flexible Pavement Design Actual TF_F = 8.55 Minimum TF_F = 6.40

Selected Design AC Type 20

Design AC Mixture Temp. 73 ° F.

Design E_{AC} 750 KSI

Design AC Microstrain 66

AC Thickness 11 1/2 Inch

Rigid Pavement Design Actual TF_R = 11.23 Minimum TF_R = 9.04

15' Panel PCC Thickness for:

Extended Lane 10 Inch

Tied Shoulder ____ Inch

Untied Shoulder ____ Inch

Figure 5.05

Revised July 1, 1991

RIGID PAVEMENT

Date: _____ FAP Route 335

Quantities by: TMC Checked by: _____ Section N/A

Unit Prices by: _____ Checked by: TMC LAKE County

Net Length 1,800 Lin. Ft. 0.34 Miles

Number Lanes 4 Urban _____ Rural X

ITEMIZED CONSTRUCTION COST

Quantity	Unit	Item	Unit Cost	Total Cost
12,000 Sq. Yds.	10" -Inch	Jointed PCC	@ $ 45.26	= $ 543,120
13,200 Sq. Yds.	~~4-inch~~ 4.5" HMA	(Stabilized/~~Granular~~ Subbase)	@ $ 15	= $ 198,000
0 Sq. Yds.	— -Inch	PCC Shoulders	@ $ —	= $ —
0 Lin. Ft.		Pipe Underdrains	@ $ —	= $
0		Subbase Gran. Mat., Type C	@ $ —	= $
7,200 Lin. Ft.		100% Shoulder Joint Seal	@ $ 2.00	= $ 14,400
			@ $ —	= $ —
			@ $ —	= $ —

Total Cost of Original Pavement Construction $ 755,520

ITEMIZED MAINTENANCE AND REHABILITATION ACTIVITY COST

REHABILITATION ACTIVITY 1 - YEAR 10

12 Sq. Yds.	0.1% Full-Depth PCC Pavement Patching	@ $ 60	= $ 720

Total Cost of Rehabilitation Activity 1 $ 720

FIGURE 5.05a(1)

Revised July 1, 1991
Sheet 2 of 5
RIGID PAVEMENT (Cont.)
FAP Route 335
Section N/A
LAKE County

REHABILITATION ACTIVITY 2 - YEAR 15

24 Sq. Yds. 0.2% Full-Depth PCC Pavement Patching @ $ 60 = $ 1,440

Total Cost of Rehabilitation Activity 2 $ 1,440

REHABILITATION ACTIVITY 3 - YEAR 20

240 Sq. Yds. 2% Full-Depth PCC Pavement Patching @ $ 60 = $ 14,400

0 Sq. Yds. 0.5% Full-Depth PCC Shoulder Patching @ $ ~~50~~ = $ 0

7,200 Lin. Ft. 100% Longitudinal/Shoulder Joint Routing & Sealing @ $ 2 = $ 14,400

3,600 Lin. Ft. 100% Centerline Joint Routing & Sealing @ $ 2 = $ 7,200

Total Cost of Rehabilitation Activity 3 $ 36,000

FIGURE 5.05a(2)

RIGID PAVEMENT (Cont.)

FAP Route 335

Section N/A

LAKE County

REHABILITATION ACTIVITY 4 - YEAR 25

360	Sq. Yds.	3.0% Full-Depth PCC Pavement Patching	@ $ 60	= $ 21,600
-	Sq. Yds.	1.0% Full-Depth PCC Shoulder Patching	@ $ -	= $ -

Total Cost of Rehabilitation Activity 4 $ 21,600

REHABILITATION ACTIVITY 5 - YEAR 30

480	Sq. Yds.	4.0% Full-Depth PCC Pavement Patching	@ $ 60	= $ 28,800
0	Sq. Yds.	1.5% Full-Depth PCC Shoulder Patching	@ $ -	= $ 0
12,000	Sq. Yds.	Policy HMA Overlay - Pavement	@ $ 11	= $ 132,000
0	Sq. Yds.	Policy HMA Overlay - Shoulder	@ $ -	= $ 0

Total Cost of Rehabilitation Activity 5 $ 160,800

REHABILITATION ACTIVITY 6 - YEAR 35

7,200	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@ $ 2	= $ 14,400
3,600	Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $ 2	= $ 7,200
4,500	Lin. Ft.	50% Random Crack Routing and Sealing - Assume 100 ft/Station	@ $ 2	= $ 9,000
2,880	Lin. Ft.	40% Reflective Transverse Crack Routing & Sealing	@ $ 2	= $ 5,760
12	Sq. Yds.	0.1% Partial-Depth Pavement Patching (Mill & Fill Surface-Interstates, Mill & Fill 2.5 in.-Non-Interstates)	@ $ 50	= $ 600

Total Cost of Rehabilitation Activity 6 $ 36,960

FIGURE 5.05a(3)

RIGID PAVEMENT (Cont.)

FAP Route 335

Section N/A

LAKE County

REHABILITATION ACTIVITY 7 - YEAR 40

60	Sq. Yds.	0.5% Full-Depth PCC Pavement Patching	@ $ 60	= $	3,600
60	Sq. Yds.	0.5% Partial-Depth Pavement Patching (Mill & Fill Surface-Interstates; Mill & Fill 2.5 in. Non-Interstates)	@ $ 50	= $	3,000
4,320	Lin. Ft.	60% Reflective Transverse Crack Routing and Sealing	@ $ 2	= $	8,640
4,500	Lin. Ft.	50% Random Crack Routing & Sealing- Assume 100ft/Station	@ $ 2	= $	9,000
7,200	Lin. Ft.	100% Longitudinal/Shoulder Joint Routing & Sealing	@ $ 2	= $	14,400
3,600	Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $ 2	= $	7,200

Total Cost of Rehabilitation Activity 7 $ 45,840

FIGURE 5.05a(4)

RIGID PAVEMENT (Cont.)

FAP Route 335

Section N/A

LAKE County

ANNUAL COST DETERMINATION

Present Worth Calculation:

Total Cost of Original Pavement Construction $ 755,520

Present Worth of Rehabilitation Activity 1	$ 720	X 0.7441 =	$ 536
Present Worth of Rehabilitation Activity 2	$ 1,446	X 0.6419 =	$ 924
Present Worth of Rehabilitation Activity 3	$ 36,000	X 0.5537 =	$ 19,933
Present Worth of Rehabilitation Activity 4	$ 21,605	X 0.4776 =	$ 10,316
Present Worth of Rehabilitation Activity 5	$ 160,800	X 0.4120 =	$ 66,250
Present Worth of Rehabilitation Activity 6	$ 36,960	X 0.3554 =	$ 13,136
Present Worth of Rehabilitation Activity 7	$ 45,840	X 0.3066 =	$ 14,055

Total Life Cycle Cost (Present Worth) $ 880,670

Annual Cost Per Mile Calculation

Total pw X CRF_n/Length = Annual Cost/Year-Mile

($ 880,670 X 0.04079/0.34 Mi.) = $ 105,654 /Yr.-Mi.

FIGURE 5.05a(5)

FLEXIBLE PAVEMENT

Date: _____ FAP Route 335

Quantities by: TMC Checked by: _____ Section N/A

Unit Prices by: _____ Checked by: TMC LAKE County

Net Length 1800 Lin. Ft. 0.34 Miles

~~Number Lanes~~ 5 Urban _____ Rural X

Single Lane Paving X Dual Lane Paving _____

ITEMIZED CONSTRUCTION COST

Quantity	Unit	Item		Unit Cost	Total Cost
12,000	Sq. Yds.	2"	POLY HMA SURFACE, MIX F, N90 ~~Class I~~ Surface Course	@ $ 10.91	= $ 130,920
12,000	Sq. Yds.	2¼"	POLY HMA BINDER, IL 19.0, N90 -Inch ~~Class I~~ Binder Course	@ $ 11.37	= $ 136,440
–	Sq. Yds.		-Inch Stabilized Shoulders	@ $ –	= $ –
–	Lin. Ft.		Pipe Underdrains	@ $ –	= $ –
–			Subbase Gran. Matl., Type C	@ $ –	= $ –
12,000	SQ YDS	7¼"	HMA BINDER, IL 19.0, N90	@ $ 29.27	= $ 351,240
–				@ $ –	= $ –

Total Cost of Original Pavement Construction $ 618,600

ITEMIZED MAINTENANCE AND REHABILITATION ACTIVITY COST

REHABILITATION ACTIVITY 1 - YEAR 5

990 Lin. Ft.	50% Random/Thermal Crack Routing & Sealing (Assume 110ft/station)	@ $ 2	= $ 1,980
7,200 Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@ $ 2	= $ 14,400
3,600 Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $ 2	= $ 7,200
12 Sq. Yds.	0.1% Partial-Depth Pavement Patching -Mill & Fill Surface	@ $ 38	= $ 456

Total Cost of Rehabilitation Activity 1 $ 24,036

FIGURE 5.05b(1)

FLEXIBLE PAVEMENT (Cont.)

FAP Route 335

Section N/A

LAKE County

REHABILITATION ACTIVITY 2 - YEAR 10

60 Sq. Yds.	0.5% Partial-Depth HMA Pavement Patching - Mill & Fill Surface	@ $ 38	= $ 2,280
990 Lin. Ft.	50% ~~Thermal~~ Random Crack Routing & Sealing (Assume 110 ft/station)	@ $ 2	= $ 1,980
7,200 Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@ $ 2	= $ 14,400
3,600 Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $ 2	= $ 7,200

Total Cost of Rehabilitation Activity 2 $ 25,860

REHABILITATION ACTIVITY 3 - YEAR 15

12,000 Sq. Yds.	2.00 in. Milling - Pavement & Shoulder	@ $ 2.25	= $ 27,000
120 Sq. Yds.	1.0% Partial-Depth Pavement Patching (Mill & Fill Additional 2.00 in.)	@ $ 38	= $ 4,560
1,344 Tons	2.00 in. HMA Overlay Pavement & Shoulder	@ $ 74	= $ 99,456

Total Cost of Rehabilitation Activity 3 $ 131,016

FIGURE 5.05b(2)

FAP Route 335
Section N/A
LAKE County

REHABILITATION ACTIVITY 4 - YEAR 20

7,200	Lin. Ft.	100% Longitudinal Shoulder Joint Routing and Sealing	@ $ 2	= $	14,400
3600	Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $ 2	= $	7,200
990	Lin. Ft.	50% Random/Thermal Crack Routing & Sealing (Assume 110 ft/Station)	@ $ 2	= $	1,980
12	Sq. Yds.	0.1% Partial-Depth HMA Pavement Patching (Mill & Fill Surface)	@ $ 38	= $	456
		Total Cost of Rehabilitation Activity 4		$	24,036

REHABILITATION ACTIVITY 5 - YEAR 25

7,200	Lin. Ft.	100% Longitudinal Shoulder Joint Routing and Sealing	@ $ 2	= $	14,400
3,600	Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $ 2	= $	7,200
990	Lin. Ft.	50% Random/Thermal Crack Routing & Sealing (Assume 110 ft/Station)	@ $ 2	= $	1,980
60	Lin. Ft.	0.50% Partial-Depth Pavement Patching (Mill & Fill Surface)	@ $ 38	= $	2,280
		Total Cost of Rehabilitation Activity 7		$	25,860

REHABILITATION ACTIVITY 6 - YEAR 30

12,000	Sq. Yds.	2.00 in. Milling (Pavement Only - Standard Design Pavement & Shoulder - Limiting Strain Criterion Design)	@ $ 2.25	= $	27,000
240	Sq. Yds.	2.0% Partial-Depth HMA Pavement Patching (Mill & Fill Additional 2.00 in. All Designs)	@ $ 38	= $	9120
0	Sq. Yds.	1.0% Full-Depth HMA Shoulder Patching (Mill & Fill Surface - Standard Design (Mill & Fill Additional 2.00 in. - Limiting Strain Criterion Design)	@ $ ~~50~~	$	—
2,520	Tons	HMA Overlay Pavement (3.75 in. - Standard Design 2.00 in. - Limiting Strain Criterion Design)	@ $ 74	= $	186,480
0	Tons	HMA Overlay - Shoulder (1.75 in. Standard Design; 2.00 in. - Limiting Strain Criterion Design)	@ $ —	= $	—

Total Cost of Rehabilitation Activity 6 $ 222,600

FIGURE 5.05b(3)

FLEXIBLE PAVEMENT (Cont.)

FAP Route 335
Section N/A
LAKE County

REHABILITATION ACTIVITY 7 - YEAR 35

7,200 Lin. Ft.	100% Longitudinal Shoulder Joint Routing and Sealing	@ $ 2	= $	14,400
3,600 Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $ 2	= $	7,200
990 Lin. Ft.	50% Random/Thermal Crack Routing & Sealing (Assume 110 ft/Station)	@ $ 2	= $	1,980
12 Sq. Yds.	0.10% Partial-Depth Pavement Patching (Mill & Fill Surface)	@ $ 38.00	= $	456
	Total Cost of Rehabilitation Activity 7		$	24,036

REHABILITATION ACTIVITY 8 - YEAR 40

7,200 Lin. Ft.	100% Longitudinal Shoulder Joint Routing and Sealing	@ $ 2	= $	14,400
3,600 Lin. Ft.	100% Centerline Joint Routing & Sealing (Single lane and dual lane paving)	@ $ 2	= $	7,200
990 Lin. Ft.	50% Random/Thermal Crack Routing & Sealing	@ $ 2	= $	1,980
60 Sq. Yds.	0.50% Partial-Depth Pavement Patching (Mill & Fill Surface)	@ $ 38	= $	2,280
	Total Cost of Rehabilitation Activity 8		$	25,860

FIGURE 5.05b(4) - continued

Revised July 1, 1991
Sheet 5 of 5

FLEXIBLE PAVEMENT (Cont.)

FAP Route 335

Section N/A

LAKE County

ANNUAL COST DETERMINATION

Present Worth Calculation:

				Present Worth
Total Cost of Original Pavement Construction				$ 618,600
Present Worth of Rehabilitation Activity	1	$ 24,036	X 0.8626 =	$ 20,733
Present Worth of Rehabilitation Activity	2	$ 25,860	X 0.7441 =	$ 19,242
Present Worth of Rehabilitation Activity	3	$ 131,016	X 0.6419 =	$ 84,099
Present Worth of Rehabilitation Activity	4	$ 24,036	X 0.5537 =	$ 13,309
Present Worth of Rehabilitation Activity	5	$ 25,860	X 0.4776 =	$ 12,351
Present Worth of Rehabilitation Activity	6	$ 222,600	X 0.4120 =	$ 91,711
Present Worth of Rehabilitation Activity	7	$ 24,036	X 0.3554 =	$ 8,542
resent Worth of Rehabilitation Activity	8	$ 25,860	X 0.3066 =	$ 7,929

Total Life Cycle Cost (Present Worth) $ 876,516

Annual Cost Per Mile Calculation

Present Worth Total Cost X CRF_n/Length = Annual Cost/Year-Mile

($ 876,516 X 0.04079/0.34 Mi.) = $ 105,156 /Yr.-Mi.

$$\frac{105,654 - 105,156}{105,156} = 0.005$$

FAVORS HMA BY 0.5%

FIGURE 5.05b(5)

IL 60

PLAIN JOINTED PCC PAVEMENT

FILENAME-	IL 60	05-Jan-12
ROUTE-	IL 60	09:08 AM
SECTION-	N/A	
COUNTY-	Lake	
LOCATION-	US 45/IL 83 to Medline	
DATE-	12/2/2011	

PROJECT LENGTH (FT)	1800 =	0.34	MILES
AVERAGE LANE WIDTH (FT)	12		
NUMBER OF LANES	5		
# OF EDGES	4		
INSIDE SHLDER WIDTH (FT)	0		
OUTSIDE SHLDER WIDTH (FT)	0		
# OF CENTERLINES	2		
RIGID THICKNESS-	10		
TRAFFIC FACTORS	MINIMUM	ACTUAL	
RIGID-	9.04	11.23	

TRAFFIC		
PV-	0	49980
SU-	300	1680
MU-	900	840

INITIAL COSTS

ITEM	QUANTITY	UNIT PRICE	COST
PAVEMENT (SQ YDS)	12,000	$45.26	$543,120
STAB SUBBASE (SQ YDS)	13,200	$15.00	$198,000
SHOULDERS (SQ YDS)	0	$0.00	$0
SHOULDER SEAL (LN FT)	7,200	$2.00	$14,400
SUBBASE GRAN MATL TY C (TONS	0	$0.00	$0

CONSTRUCTION INITIAL COST (PW)	$755,520
TOTAL REHABILITATION COST (PW)	$125,150
TOTAL LIFE CYCLE COST (PW)	$880,670
ANNUAL COST PER MILE	$105,654

MAINTENANCE COSTS:

ITEM	UNIT COST
PAVEMENT PATCHING (SQ YDS)	$60.00
SHOULDER PATCHING (SQ YDS)	$50.00
SHLDR JT ROUT & SEAL (LF)	$2.00
CENTERLINE JT ROUT & SEAL (LF)	$2.00
POLICY HMA OVERLAY PVMT (SQ YDS)	$11.00
POLICY HMA OVERLAY SHLDR (SQ YDS)	$11.00
RANDOM CRACK ROUT & SEAL (LF)	$2.00
REFL TRANS CRACK ROUT & SEAL (LF)	$2.00
PARTIAL PVMT PATCH (SQ YDS)	$50.00

MAINTENANCE COSTS

	ITEM	QUANTITY	UNIT PRICE	COST	PW
Activity 1 YEAR 10					
	PAVEMENT PATCHING 0.1% (SQ YDS)	12	$60.00	$720	
				$720	$536
Activity 2 YEAR 15					
	PAVEMENT PATCHING 0.2% (SQ YDS)	24	$60.00	$1,440	
				$1,440	$924
Activity 3 YEAR 20					
	PAVEMENT PATCHING 2.0% (SQ YDS)	240	$60.00	$14,400	
	SHOULDER PATCHING 0.5% (SQ YDS)	0	$50.00	$0	
	SHLDR JT ROUT & SEAL 100% (LF)	7,200	$2.00	$14,400	
	CENTERLINE JT ROUT & SEAL 100.0% (L	3,600	$2.00	$7,200	
				$36,000	$19,933
Activity 4 YEAR 25					
	PAVEMENT PATCHING 3.0% (SQ YDS)	360	$60.00	$21,600	
	SHOULDER PATCHING 1.0% (SQ YDS)	0	$50.00	$0	
				$21,600	$10,316
Activity 5 YEAR 30					
	PAVEMENT PATCHING 4.0% (SQ YDS)	480	$60.00	$28,800	
	SHOULDER PATCHING 1.5% (SQ YDS)	0	$50.00	$0	
	POLICY HMA OVERLAY PVMT (SQ YDS)	12,000	$11.00	$132,000	
	POLICY HMA OVERLAY SHLDR (SQ YDS)	0	$11.00	$0	
				$160,800	$66,250
Activity 6 YEAR 35					
	SHLDR JT ROUT & SEAL 100% (LF)	7,200	$2.00	$14,400	
	CENTERLINE JT ROUT & SEAL 100.0% (L	3,600	$2.00	$7,200	
	RANDOM CRACK ROUT & SEAL 50% (LF)	4,500	$2.00	$9,000	
	REFL TRANS CRACK ROUT & SEAL 40%	2,880	$2.00	$5,760	
	PARTIAL PVMT PATCH 0.1% (SQ YDS)	12	$50.00	$600	
				$36,960	$13,136
Activity 7 YEAR 40					
	PAVEMENT PATCHING 0.5% (SQ YDS)	60	$60.00	$3,600	
	PARTIAL PVMT PATCH 0.5% (SQ YDS)	60	$50.00	$3,000	
	REFL TRANS CRACK ROUT & SEAL 60%	4,320	$2.00	$8,640	
	RANDOM CRACK ROUT & SEAL 50% (LF)	4,500	$2.00	$9,000	
	SHLDR JT ROUT & SEAL 100% (LF)	7,200	$2.00	$14,400	
	CENTERLINE JT ROUT & SEAL 100.0% (L	3,600	$2.00	$7,200	
				$45,840	$14,055
	Total Rehabilitation Cost (Present Worth)				$125,150

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

ROUTE-	IL 60	05-Jan-12
SECTION-	N/A	09:08 AM
COUNTY-	Lake	
LOCATION-	US 45/IL 83 to Medline	

PROJECT LENGTH (FT)	1800
AVERAGE LANE WIDTH (FT)	12

FULL-DEPTH FLEXIBLE PAVEMENT
MAINTENANCE COSTS

	ITEM	QUANTITY	UNIT PRICE	COST	Present Worth
Activity 1 YEAR 5	RAND/THERM CRACK ROUT & SEAL 50%	990	$2.00	$1,980	
	SHLDR JT ROUT & SEAL 100% (LF)	7,200	$2.00	$14,400	
	CENTERLINE JT ROUT & SEAL 100.0% (L	3,600	$2.00	$7,200	

NUMBER OF LANES	5	
# 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

FLEXIBLE THICKNESS-	11.5	
TRAFFIC FACTORS	MINIMUM	ACTUAL
FLEXIBLE	6.4	8.55

TRAFFIC		
PV-	0	49980
SU-	300	1680
MU-	900	840

PAVEMENT OVERLAY THICKNESS	3.75
SHOULDER OVERLAY THICKNESS	1.75

INITIAL COSTS

ITEM	QUANTITY	UNIT PRICE	COST
SURFACE (SQ YDS)	12,000	$10.91	$130,920
POLY BINDER (SQ YDS)	12,000	$11.37	$136,440
BINDER (SQ YDS)	12,000	$29.27	$351,240
SHOULDERS (SQ YDS)	0	$0.00	$0
SUBBASE GRAN MATL TY C (TONS	0	$0.00	$0

CONSTRUCTION INITIAL COST (PW)	$618,600
TOTAL REHABILITATION COST (PW)	$257,916
TOTAL LIFE CYCLE COST (PW)	$876,516
ANNUAL COST PER MILE	$105,156

MAINTENANCE COSTS:

ITEM	UNIT COST
RAND/THERM CRACK ROUT & SEAL (LF)	$2.00
SHLDR JT ROUT & SEAL (LF)	$2.00
CENTERLINE JT ROUT & SEAL (LF)	$2.00
PARTIAL PVMT PATCH (SQ YDS)	$38.00
2" MILL PVMT & SHLDR (SQ YDS)	$2.25
2" OVERLAY PVMT & SHLDR (TONS)	$74.00
2" MILL PVMT ONLY (SQ YDS)	$2.25
HMA SHOULDER PATCHING (SQ YDS)	$50.00
POLICY HMA OVERLAY PVMT (TONS)	$74.00
POLICY HMA OVERLAY SHLDR (TONS)	$74.00

MATERIAL TYPE/PERCENTAGE	ASPHALT	0.5%

	PARTIAL PVMT PATCH 0.1% (SQ YDS)	12	$38.00	$456	
				$24,036	$20,733
Activity 2					
YEAR 10	PARTIAL PVMT PATCH 0.5% (SQ YDS)	60	$38.00	$2,280	
	RAND/THERM CRACK ROUT & SEAL 50%	990	$2.00	$1,980	
	SHLDR JT ROUT & SEAL 100% (LF)	7,200	$2.00	$14,400	
	CENTERLINE JT ROUT & SEAL 100.0% (L	3,600	$2.00	$7,200	
				$25,860	$19,242
Activity 3					
YEAR 15	2" MILL PVMT & SHLDR 100% (SQ YDS)	12,000	$2.25	$27,000	
	PARTIAL PVMT PATCH 1.0% (SQ YDS)	120	$38.00	$4,560	
	2" OVERLAY PVMT & SHLDR 100% (TONS	1,344	$74.00	$99,456	
				$131,016	$84,099
Activity 4					
YEAR 20	SHLDR JT ROUT & SEAL 100% (LF)	7,200	$2.00	$14,400	
	CENTERLINE JT ROUT & SEAL 100.0% (L	3,600	$2.00	$7,200	
	RAND/THERM CRACK ROUT & SEAL 50%	990	$2.00	$1,980	
	PARTIAL PVMT PATCH 0.1% (SQ YDS)	12	$38.00	$456	
				$24,036	$13,309
Activity 5					
YEAR 25	SHLDR JT ROUT & SEAL 100% (LF)	7,200	$2.00	$14,400	
	CENTERLINE JT ROUT & SEAL 100.0% (L	3,600	$2.00	$7,200	
	RAND/THERM CRACK ROUT & SEAL 50%	990	$2.00	$1,980	
	PARTIAL PVMT PATCH 0.5% (SQ YDS)	60	$38.00	$2,280	
				$25,860	$12,351
Activity 6					
YEAR 30	2" MILL PVMT ONLY 100% (SQ YDS)	12,000	$2.25	$27,000	
	PARTIAL PVMT PATCH 2.0% (SQ YDS)	240	$38.00	$9,120	
	HMA SHOULDER PATCHING 1.0% (SQ YD	0	$50.00	$0	
	POLICY HMA OVERLAY PVMT (TONS)	2,520	$74.00	$186,480	
	POLICY HMA OVERLAY SHLDR (TONS)	0	$74.00	$0	
				$222,600	$91,711
Activity 7					
YEAR 35	SHLDR JT ROUT & SEAL 100% (LF)	7,200	$2.00	$14,400	
	CENTERLINE JT ROUT & SEAL 100.0% (L	3,600	$2.00	$7,200	
	RAND/THERM CRACK ROUT & SEAL 50%	990	$2.00	$1,980	
	PARTIAL PVMT PATCH 0.1% (SQ YDS)	12	$38.00	$456	
				$24,036	$8,542
Activity 8					
YEAR 40	SHLDR JT ROUT & SEAL 100% (LF)	7,200	$2.00	$14,400	
	CENTERLINE JT ROUT & SEAL 100.0% (L	3,600	$2.00	$7,200	
	RAND/THERM CRACK ROUT & SEAL 50%	990	$2.00	$1,980	
	PARTIAL PVMT PATCH 0.5% (SQ YDS)	60	$38.00	$2,280	
				$25,860	$7,929
	Total Rehabilitation Cost (Present Worth)				$257,916

benesch engineers · scientists · planners	Comp. by: _____ Date: _____ Sheet ____ of ____
	Chkd. by: _____ Date: _____ Job No. _____
	Project: US 45 From IL 60 to IL 22
	Element: Pavement Design - US 45

US 45 FROM IL 83 TO IL 21

- LENGTH = 21,900 FT AREA = 116,800 SY
- DESIGN ADT = 26,264 SU = 3.8% MU = 1.1%
- CONFIGURATION = 2 THRU LANES EACH DIRECTION

- MECHANISTIC RIGID

- 9½" PCC PAVEMENT (JOINTED)
- 4½" HMA STABILIZED SUBBASE
- 12" AGGREGATE SUBGRADE,
- GEOTECHNICAL FABRIC

- MECHANISTIC FLEXIBLE

- 10½" HMA PAVEMENT (FULL DEPTH)
  - 2" HMA SURFACE COURSE, POLYMERIZED MIX "F", N90
  - 2¼" POLYMERIZED BINDER COURSE, IL 19.0, N90
  - 6¼" HMA BINDER COURSE, IL 19.0, N90
- 12" AGGREGATE SUBGRADE
- GEOTECHNICAL FABRIC

USE FOR TF ONLY

Spreadsheet by Uehle - Rev. 11/02

MECHANISTIC PAVEMENT DESIGN

Date: 12/28/11

INPUT (Enter Data in Gray Shaded Cells)

Route: US 45 from IL 60 to IL 22
Section: N/A
County: Lake
Location: US 45 from IL 83 to IL 21

Comments: Pavement design for US 45 from IL 83 to IL 21

Designer: MO

	ADT	Year
Current:	22600	2002
Future:	26400	2030

Facility Type: Other Marked State Route

# of Lanes = 4

Road Class: I

Subgrade Support Rating (SSR): Poor

Construction Year: 2014

Design Period (DP) = 30 years

	Minimum ADT	Structural Design Traffic: Actual ADT	Actual % of Total ADT	% of ADT in Design Lane	
PV =	0	24,977	95.1%	P =	32%
SU =	250	998	3.8%	S =	45%
MU =	750	289	1.1%	M =	45%

Struct. Design ADT = 26264 (2029)

FLEXIBLE & RIGID PAVEMENT CALCULATIONS AND ADDITIONAL INPUT

Flexible Pavement

Cpv =	0.15	
Csu =	133	
Cmu =	483	
TF flexible (Actual)=	3.70	(Actual ADT)
TF flexible (Min)=	5.33	(Min ADT Fig 54-2C)
Use TF flexible =	5.33	
AC Type =	20	
AC Mixture Tempurature =	86.00	deg. F (Figure 54-5C)
Design AC Mixture Modulus (Eac)=	~~550~~	ksi (Figure 54-5D)
Design Asphalt Concrete Microstrain =	~~61.5~~	(Figure 54-5E)
Asphalt Concrete Thickness =	~~14.08~~	in. (Figure 54-5F)

Rigid Pavement

Cpv =	0.15	
Csu =	144	
Cmu =	696	
TF rigid (Actual)=	4.69	(Actual ADT)
TF rigid (Min)=	7.54	(Min ADT Fig 54-2C)
Use TF rigid =	7.54	
	60	Shoulder or C. &G.
Rigid Pavt. Thick =	~~9.76~~	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

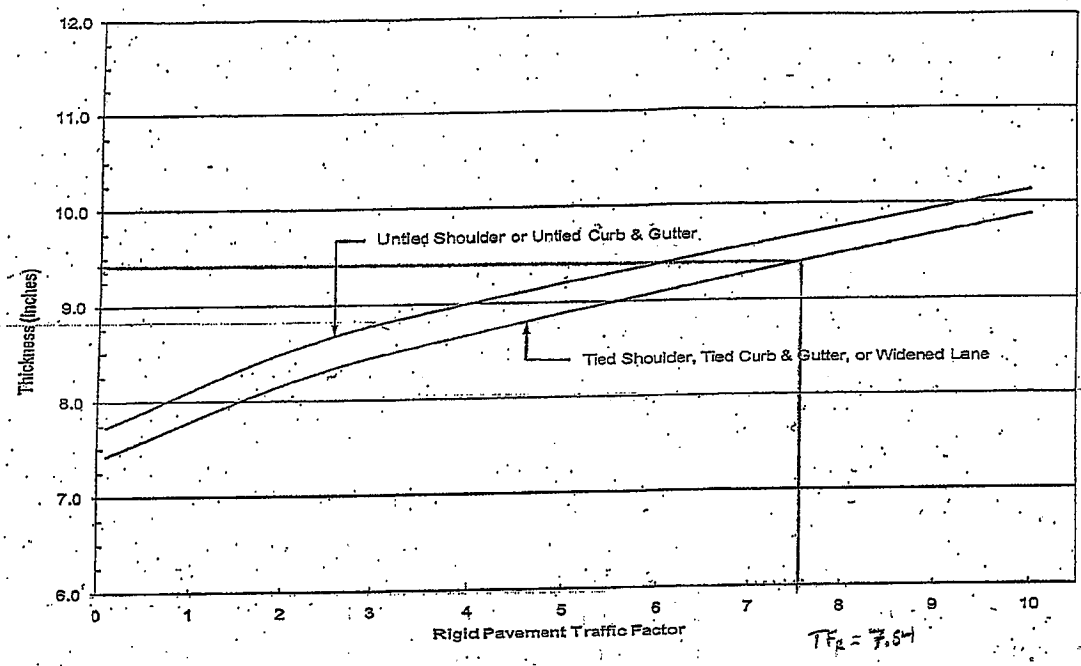
Class Table for One-Way Streets: ADT	Class
0 - 3500	II
>3501	I

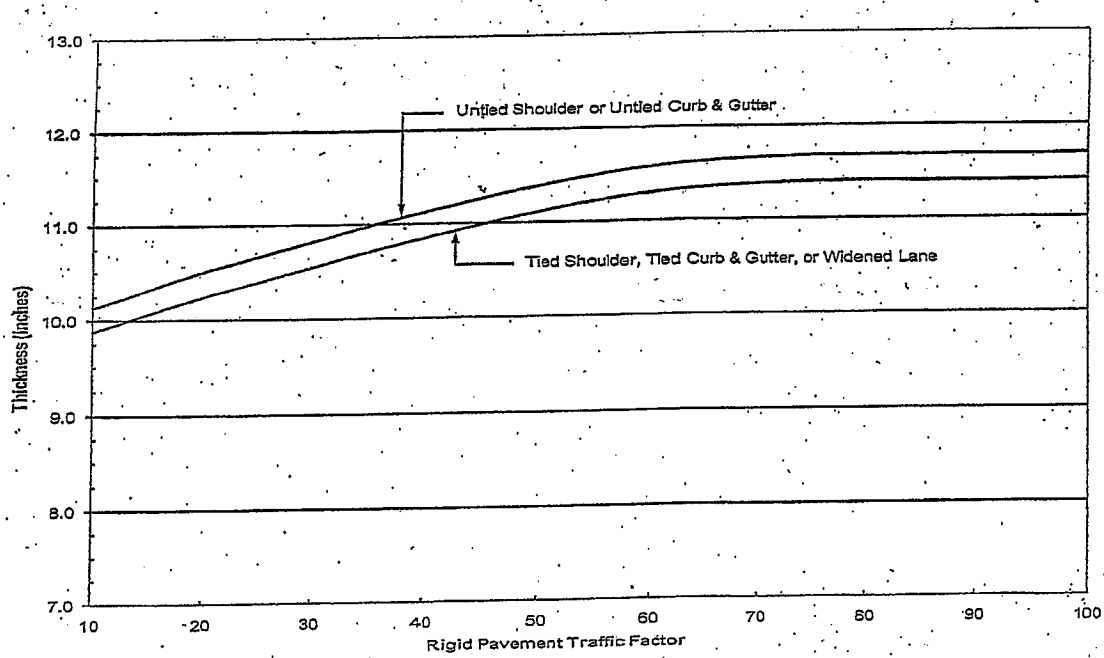
Class	Traffic Factor ESAL Coefficients: Rigid (Fig. 54-4C) Csu	Rigid Cmu	Flexible (Fig. 54-5B) Csu	Flexible Cmu
I	143.81	696.42	132.50	482.53
II	135.78	567.21	112.06	385.44
III	129.58	562.47	109.14	384.35
IV(ADT>400)	127.75	555.90	109.14	384.35
IV(ADT<=400)	127.75	555.90	9.86	78.84

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

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%
6 or more	20%	40%	40%	8%	37%	37%

US 45





Note: Use of untied shoulder design requires BDE approval.

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

9 1/2" PCC PAVEMENT (JOINTED)

Figure 54-4.E

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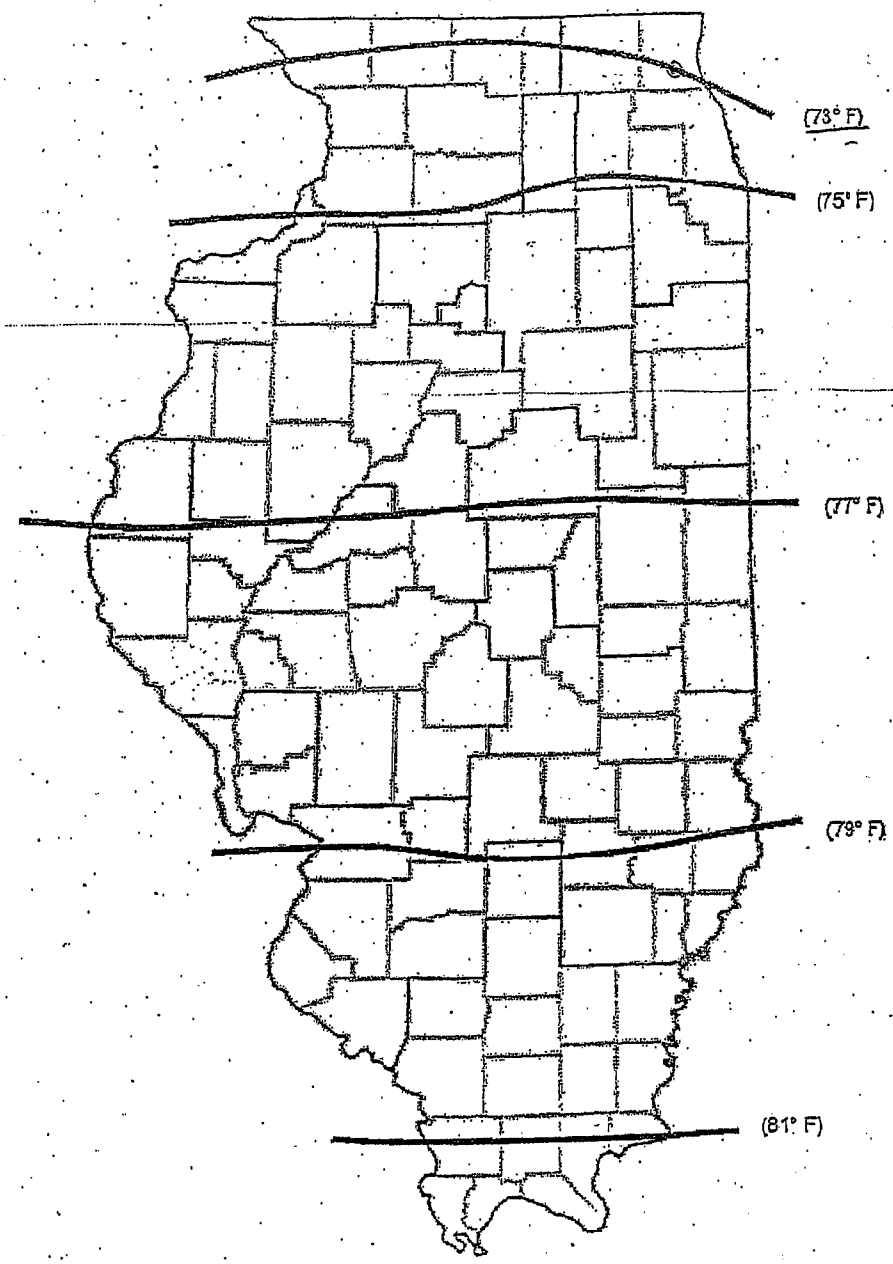
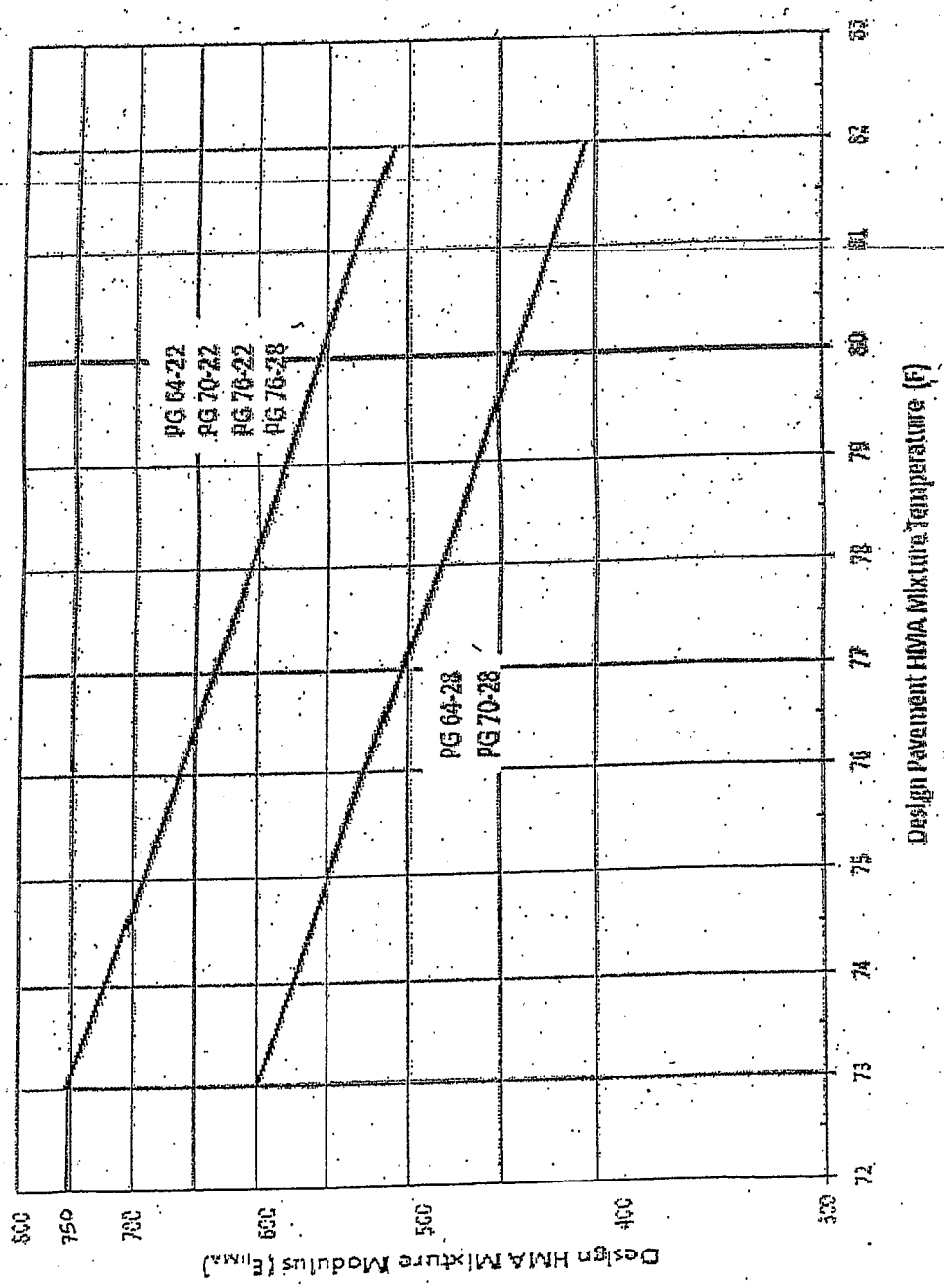


Note: The minimum design HMA mixture temperature will be 73 °F.

HMA MIXTURE TEMPERATURE
(Mechanistic Design: Flexible Pavement)

Figure 54-5.C

HARD COPIES UNCONTROLLED

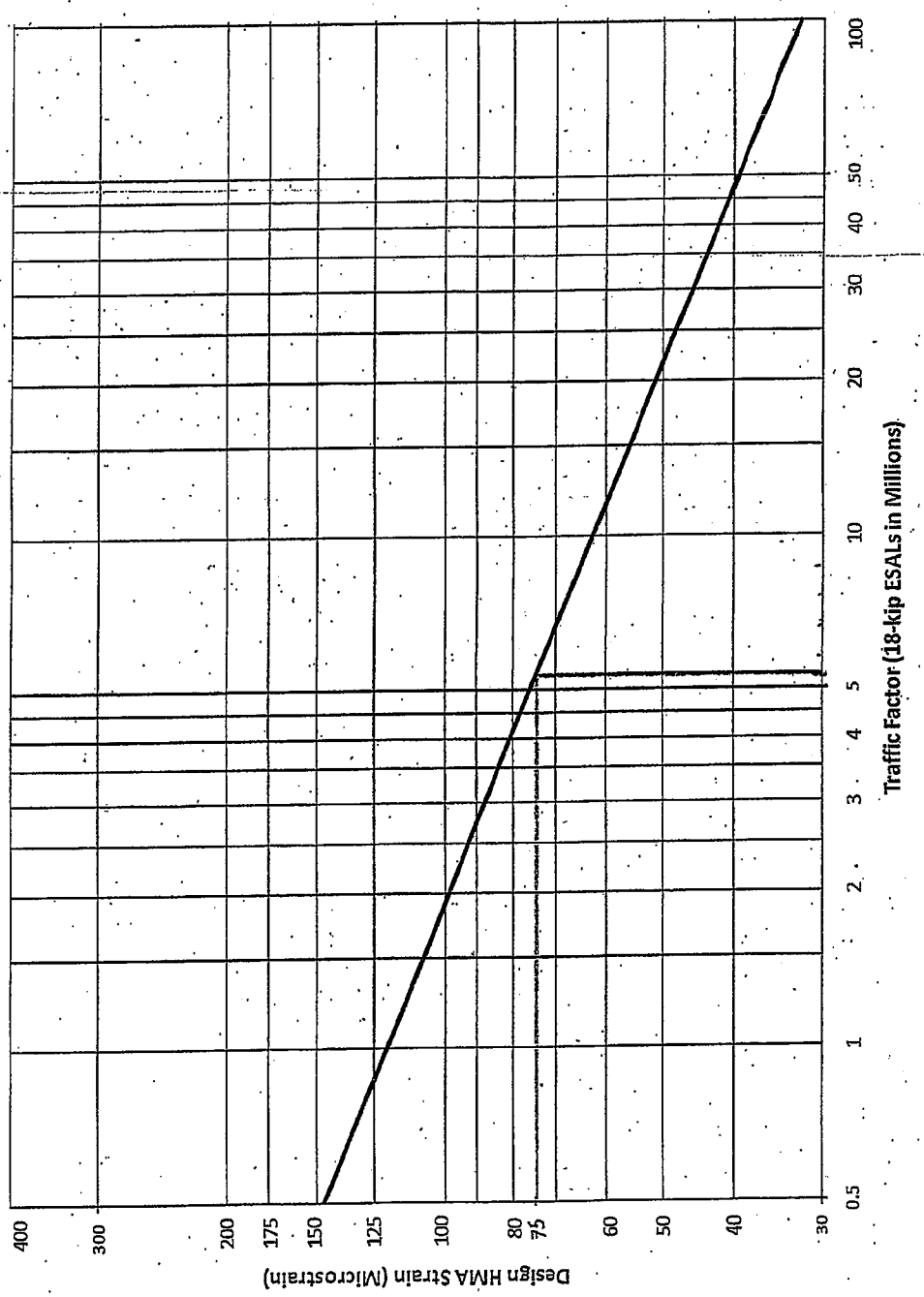


HMA MIXTURE MODULUS (E_{HMA})
(Mechanistic Design: Flexible Pavement)

Figure 54-5.D

HARD COPIES UNCONTROLLED

US 45

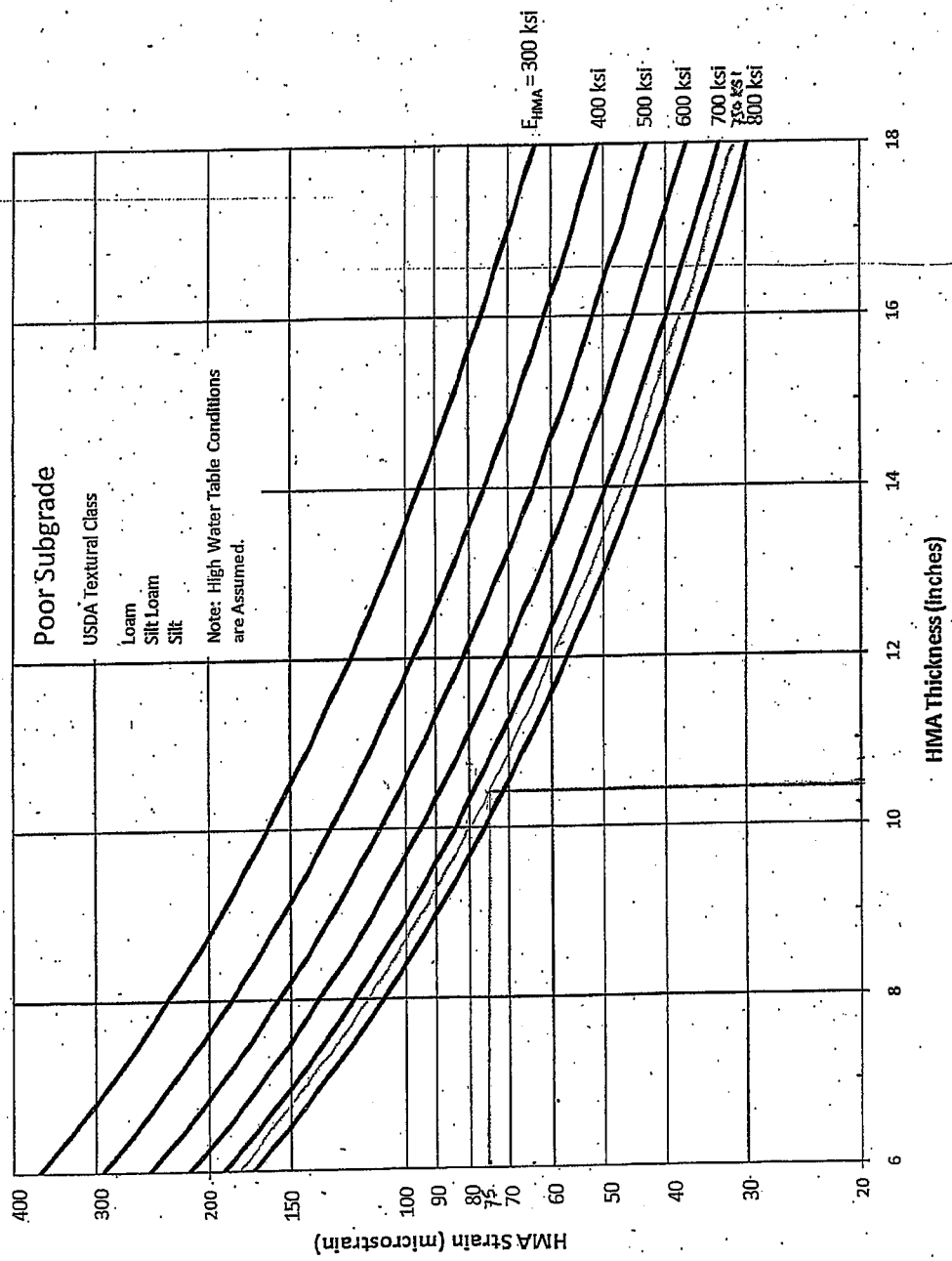


$TF_f = 5.33$

DESIGN HMA STRAIN
(Mechanistic Design: Flexible Pavement)

Figure 54-5.E

US 45



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

Figure 54-5.F

10½" HMA PAVEMENT (FULL DEPTH)

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benesch engineers · scientists · planners	Comp. by: _____ Date: _____ Sheet ____ of ____
	Chkd. by: _____ Date: _____ Job No. _____
	Project: US 45 FROM IL 60 TO IL 22
	Element: PAVEMENT DESIGN - US 45/IL 83

US 45/IL 83 FROM US 45 TO IL 60

- LENGTH = 2,950 FT - AREA = 15,733 SY - DESIGN ADT: 44,154 SU: 3.5% MU = 1.1%
- CONFIGURATION = 2 THRU LANES EACH DIRECTION

MECHANISTIC RIGID

- 9½" PCC PAVEMENT (JOINTED)
- 4½" HMA STABILIZED SUBBASE
- 12" AGGREGATE SUBGRADE
- GEOTECHNICAL FABRIC

MECHANISTIC FLEXIBLE

- 10½" HMA PAVEMENT (FULL DEPTH)
  - 2" HMA SURFACE COURSE POLYMERIZED, MIX "F", N90
  - 2¼" POLYMERIZED HMA BINDER COURSE, IL-19.0, N90
  - 6¼" HMA BINDER COURSE, IL 19.0, N90
- 12" AGGREGATE SUBGRADE
- GEOTECHNICAL FABRIC

USE FOR TF ONLY

Spreadsheet by Uehle - Rev. 11/02

MECHANISTIC PAVEMENT DESIGN

Date: 12/28/11

INPUT (Enter Data in Gray Shaded Cells)

Route: US 45 from IL 60 to IL 22
Section: N/A
County: Lake
Location: US 45/IL 83 from US 45 to IL 60

Comments: Pavement design for US 45/IL 83 from US 45 to IL 60

Designer: TMC

	ADT	Year
Current:	32,100	2012
Future:	42,600	2030

Facility Type: Other Marked State Route

# of Lanes = 4

Road Class: I

Subgrade Support Rating (SSR): Poor

Construction Year: 2014

Design Period (DP) = 30 years

	Minimum ADT	Structural Design Traffic: Actual ADT	Actual %of Total ADT	% of ADT in Design Lane	
PV =	0	42,123	95.4%	P =	32%
SU =	250	1,545	3.5%	S =	45%
MU =	750	486	1.1%	M =	45%
Struct. Design ADT =		44154	(2029)		

FLEXIBLE & RIGID PAVEMENT CALCULATIONS AND ADDITIONAL INPUT

Flexible Pavement

Cpv =	0.15	
Csu =	133	
Cmu =	483	
TF flexible (Actual)=	5.99	(Actual ADT)
TF flexible (Min)=	5.33	(Min ADT Fig 54-2C)
Use TF flexible =	5.99	
AC Type =	20	
AC Mixture Tempurature =	90	deg. F (Figure 54-5C)
Design AC Mixture Modulus (Eac)=	558	ksi (Figure 54-5D)
Design Asphalt Concrete Microstrain =	59.2	(Figure 54-5E)
Asphalt Concrete Thickness =	14.25	in. (Figure 54-5F)

Rigid Pavement

Cpv =	0.15	
Csu =	144	
Cmu =	696	
TF rigid (Actual)=	7.63	(Actual ADT)
TF rigid (Min)=	7.54	(Min ADT Fig 54-2C)
Use TF rigid =	7.63	
Tied		Shoulder or C. &G.
*Rigid Pavt 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

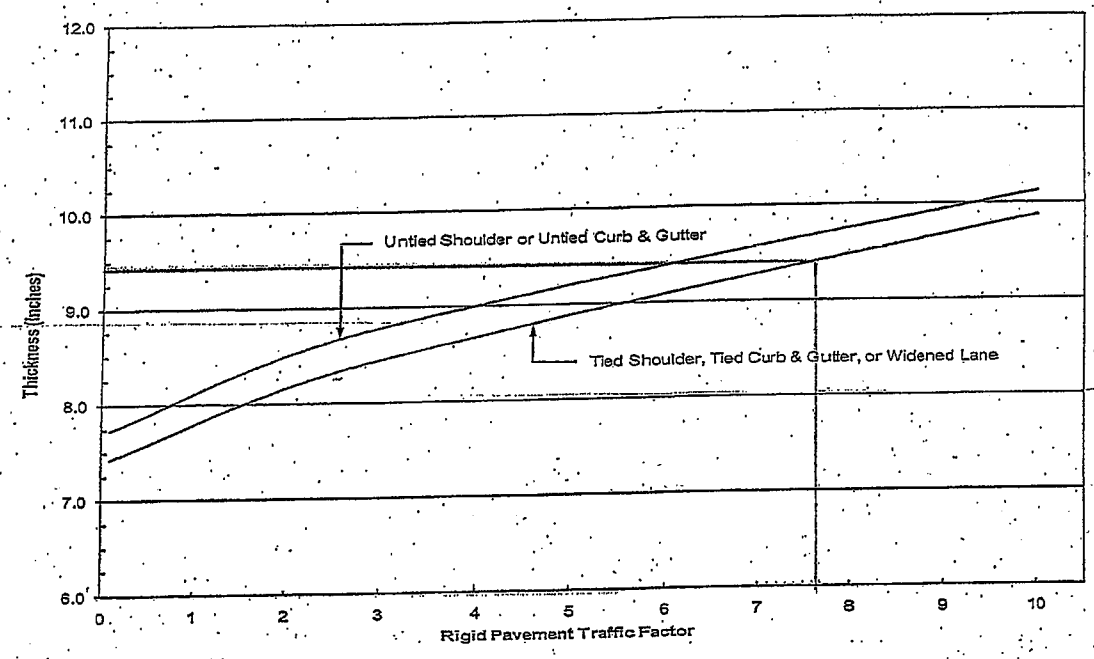
Class Table for One-Way Streets: ADT	Class
0 - 3500	II
>3501	I

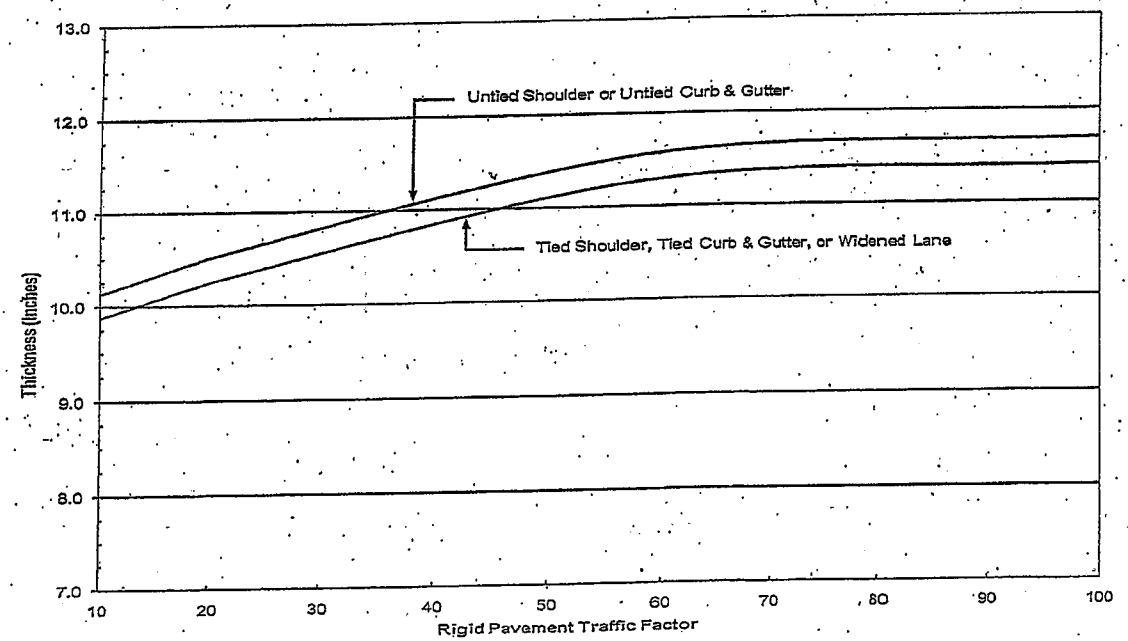
Class	Traffic Factor ESAL Coefficients: Rigid (Fig. 54-4C) Csu	Cmu	Flexible (Fig. 54-5B) Csu	Cmu
I	143.81	696.42	132.50	482.53
II	135.78	567.21	112.06	385.44
III	129.58	562.47	109.14	384.35
IV(ADT>400)	127.75	555.90	109.14	384.35
IV(ADT<=400)	127.75	555.90	9.86	78.84

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

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%
6 or more	20%	40%	40%	8%	37%	37%

US 45 / IL 83





Note: Use of untied shoulder design requires BDE approval.

TF_R = 7.63

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

9 1/2" PCC PAVEMENT (JOINTED)

Figure 54-4.E

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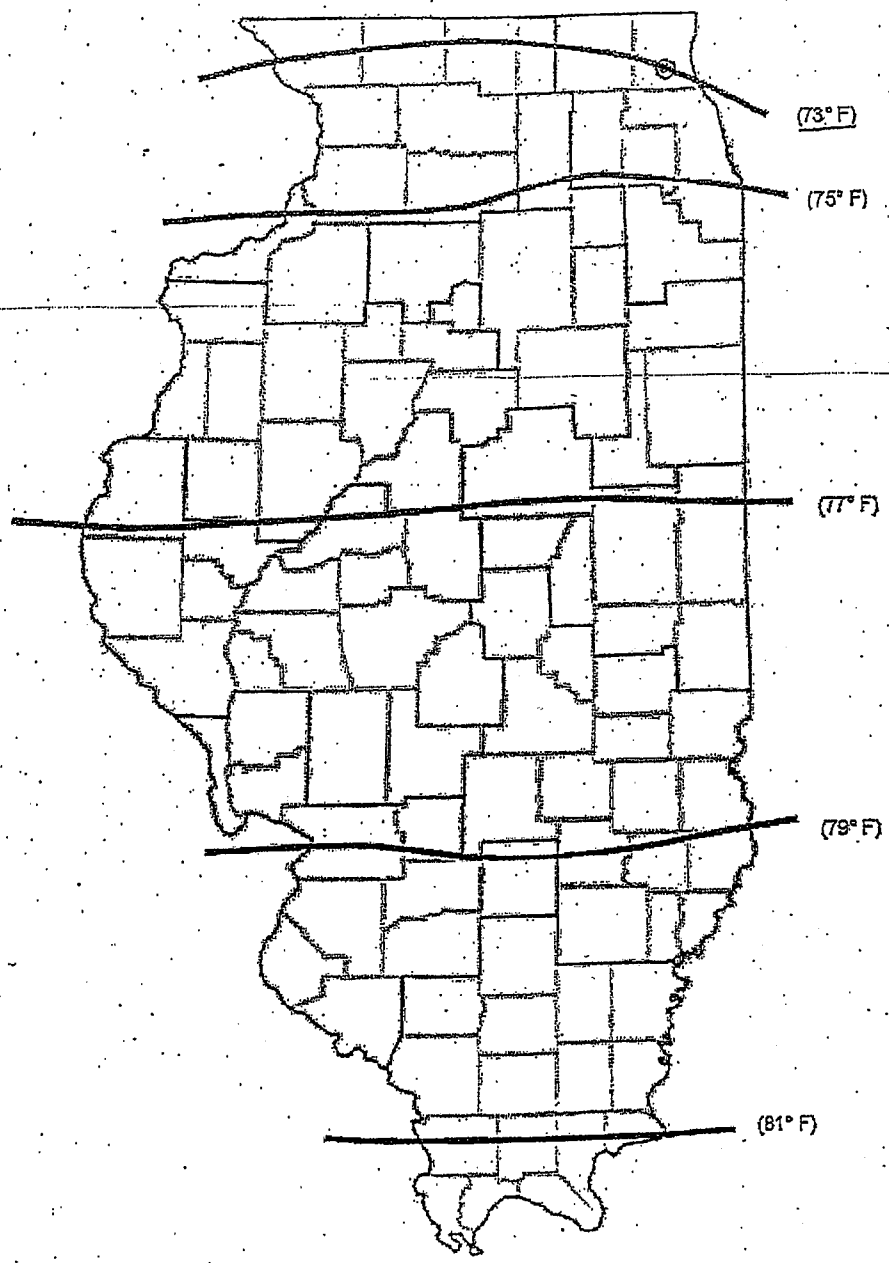
US 45/IL 83



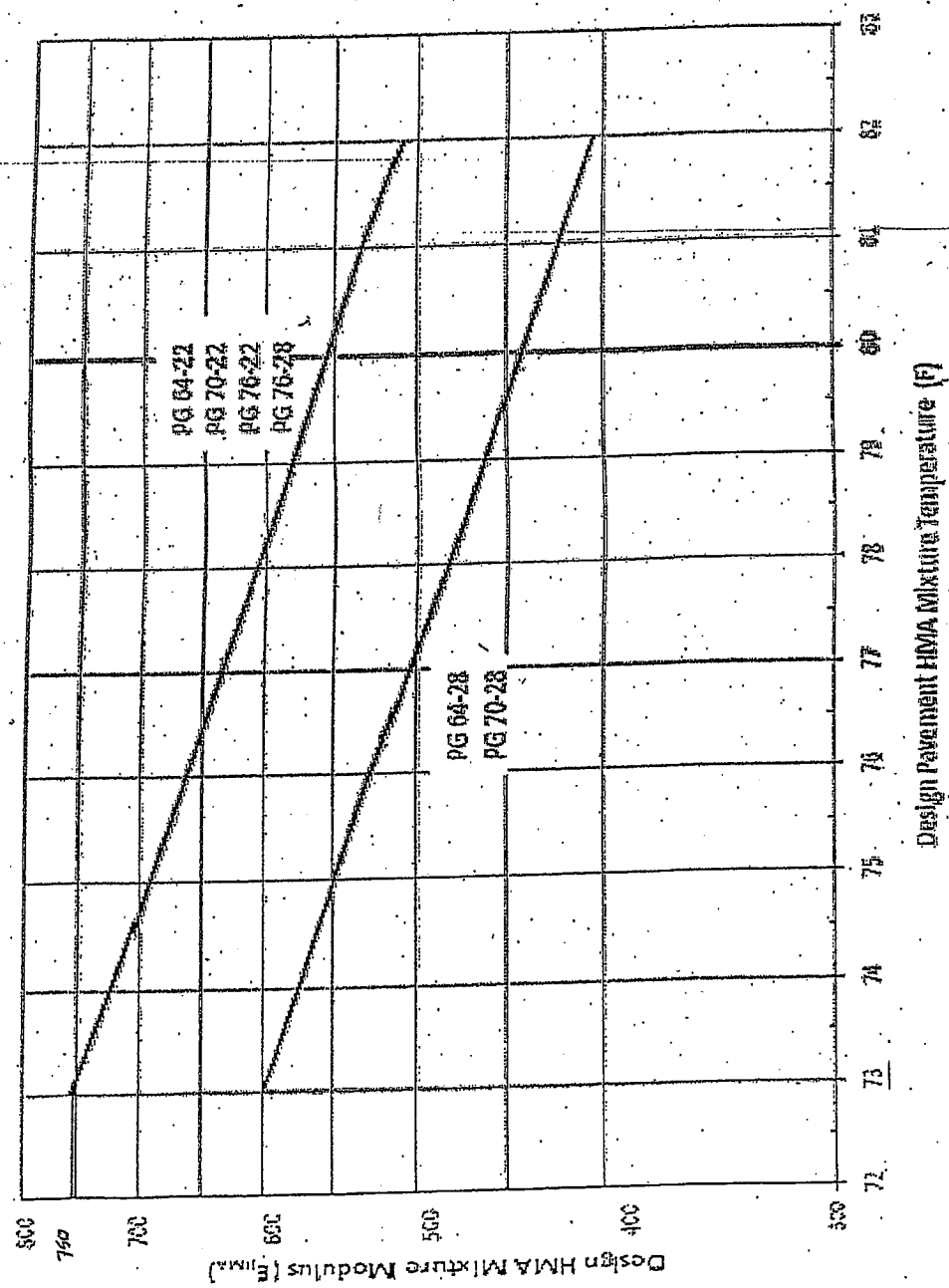
Note: The minimum design HMA mixture temperature will be 73°F.

HMA MIXTURE TEMPERATURE
(Mechanistic Design: Flexible Pavement)

Figure 54-5.C

HARD COPIES UNCONTROLLED

US 45/IL 83



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

Figure 54-5.D

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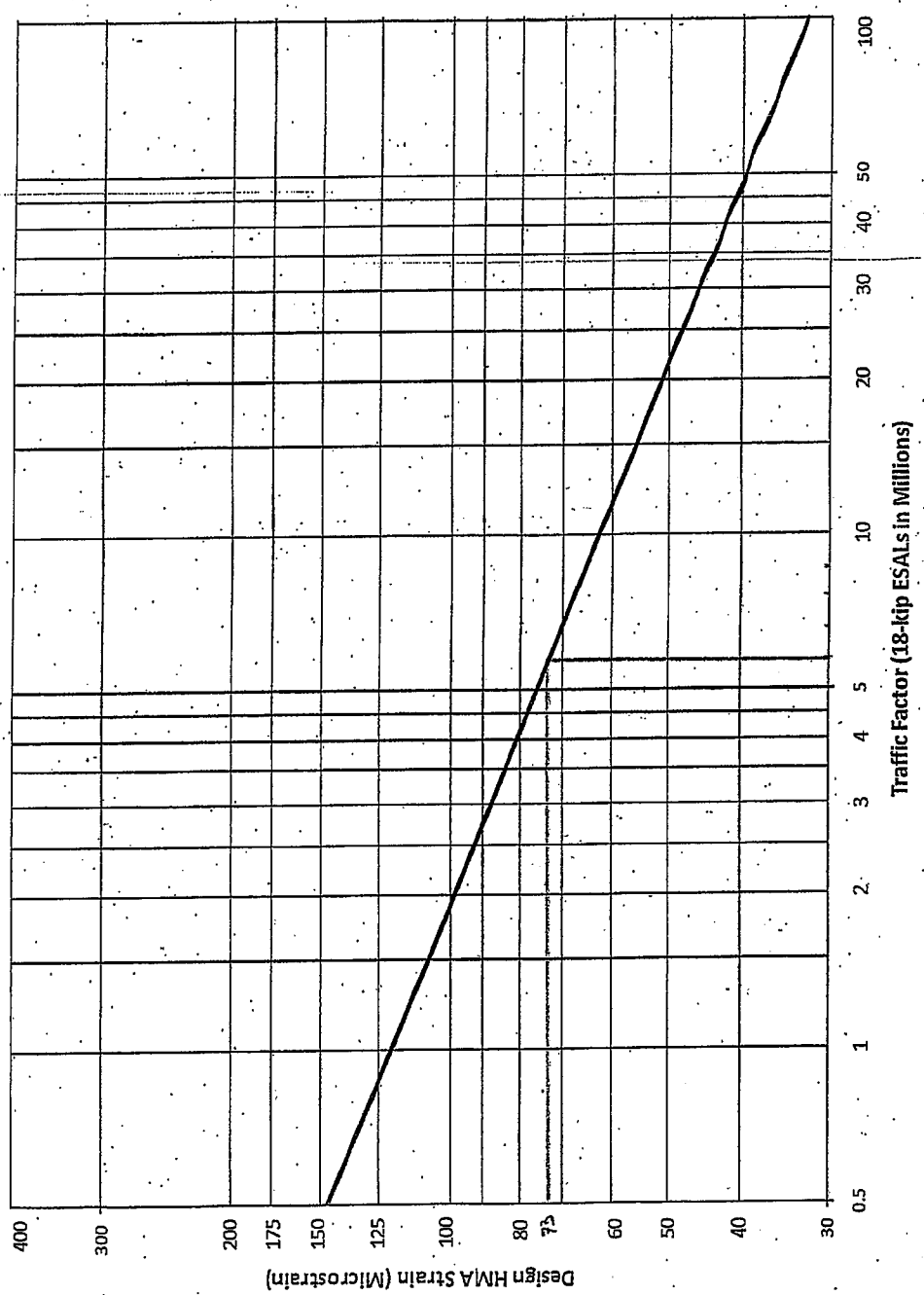
US 45/IL 83

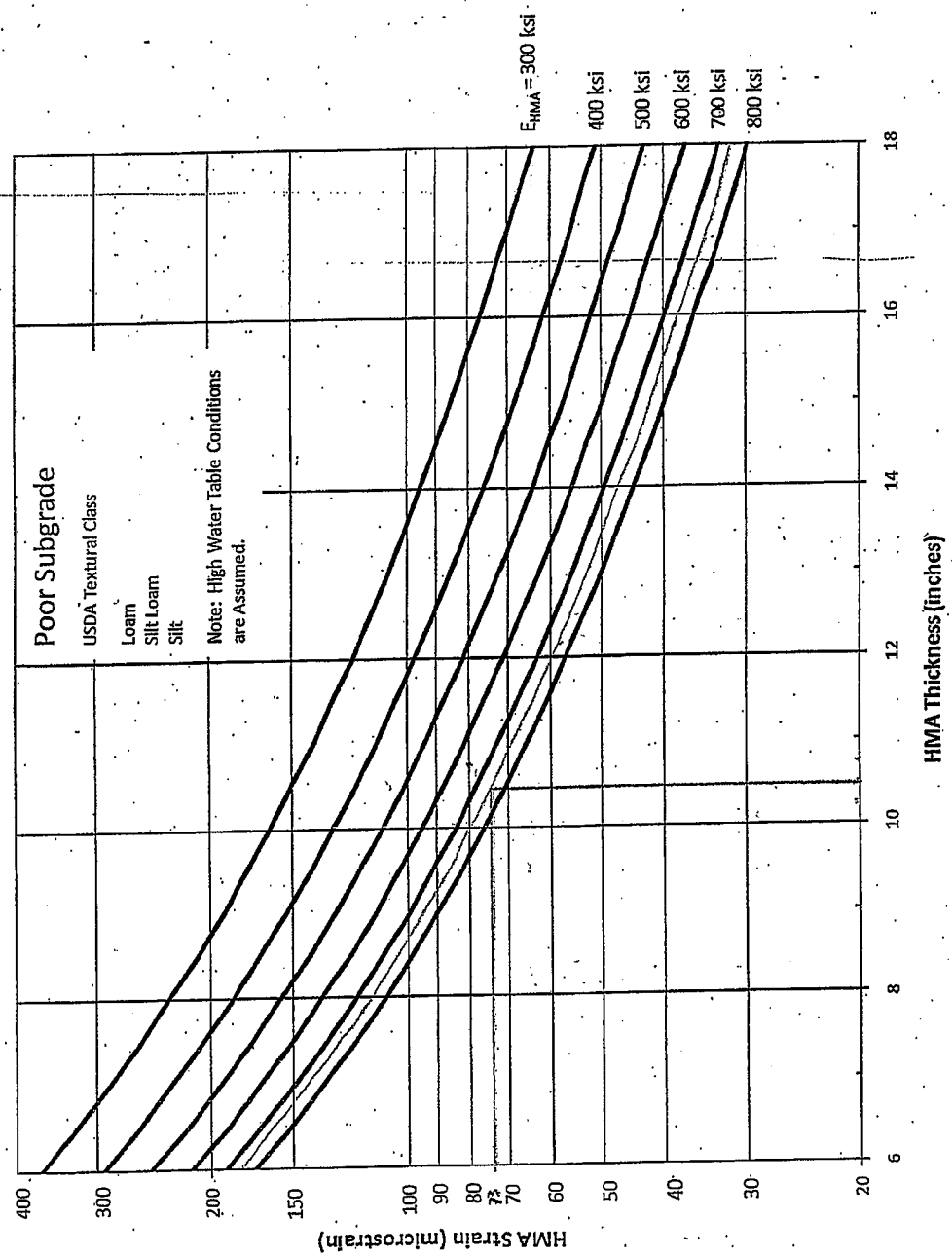


$TF_t = 5.99$

DESIGN HMA STRAIN
(Mechanistic Design: Flexible Pavement)

Figure 54-5.E

US 45/IL 83



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

Figure 54-5.F

10½" HMA PAVEMENT (FULL DEPTH)

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US 45 & US 45/IL 83

Revised July 1, 1991

MECHANISTIC PAVEMENT DESIGN

Date JANUARY 5, 2012

FAP 344 Route US 45 & US45/IL83

Calculations by: TMC

Section N/A

Checked by:

LAKE County

Class 1 Roads and Streets

Location IL 60 TO IL 22
US45 TO IL 60

Urban Rural X

Limits of Analysis Station US45-4042+63 (IL83-8335+50) to Station US45-4262+25 (IL83-8366+40)

Length 24,850 Feet 4.71 Miles

Structural Design Traffic

	US45	US45/IL83
PV =	24,977	42,123
SU =	998	1545
MU =	289	486

Percent of S.D.T. in Design Lane

P = 32 %

S = 45 %

U = 45 %

MINIMUM SUBGRADE SUPPORT RATING - "POOR"

Flexible Pavement Design Actual TF_F = US45 3.70, US45/IL83 5.99 Minimum TF_F = US45 5.33, US45/IL83 5.33

Selected Design AC Type 20

Design AC Mixture Temp. 73 ° F. Design E_{AC} 750 KSI

Design AC Microstrain 72 AC Thickness 10 1/2 Inch

Rigid Pavement Design Actual TF_R = US45 4.69, US45/IL83 7.63 Minimum TF_R = US45 7.54, US45/IL83 7.54

Extended Lane 9 1/2 Inch

15' Panel PCC Thickness for: Tied Shoulder — Inch

Untied Shoulder — Inch

Figure 5.05

Revised July 1, 1991

RIGID PAVEMENT

Date: _____ FAP Route 344

Quantities by: TMC Checked by: _____ Section N/A

Unit Prices by: _____ Checked by: TMC LAKE County

Net Length 21,900 Lin. Ft. 4.15 Miles

Number Lanes 4 Urban _____ Rural X

ITEMIZED CONSTRUCTION COST

Quantity	Unit	Item	Unit Cost	Total Cost
132,533 Sq. Yds.	9½ -Inch	Jointed PCC	@ $ 37.85	= $ 5,016,374
149,100 Sq. Yds.	~~4-Inch~~ 4½" HMA	(Stabilized/~~Granular~~ Subbase)	@ $ 15.00	= $ 2,236,500
0 Sq. Yds.	— -Inch	PCC Shoulders	@ $ —	= $ —
0 Lin. Ft.		Pipe Underdrains	@ $ —	= $ —
0		Subbase Gran. Mat., Type C	@ $ —	= $ —
99,400 Lin. Ft.		100% Shoulder Joint Seal	@ $ 2	= $ 198,800
			@ $ —	= $ —
			@ $ —	= $ —

Total Cost of Original Pavement Construction $ 7,451,674

ITEMIZED MAINTENANCE AND REHABILITATION ACTIVITY COST

REHABILITATION ACTIVITY 1 - YEAR 10

133 Sq. Yds. 0.1% Full-Depth PCC Pavement Patching @ $ 60 = $ 7,980

Total Cost of Rehabilitation Activity 1 $ 7,980

FIGURE 5.05a(1)

Revised July 1, 1991
Sheet 2 of 5
RIGID PAVEMENT (Cont.)
FAP. Route 344
Section N/A
LAKE County

REHABILITATION ACTIVITY 2 - YEAR 15

265 Sq. Yds. 0.2% Full-Depth PCC Pavement Patching @ $ 60 = $ 15,900

Total Cost of Rehabilitation Activity 2 $ 15,900

REHABILITATION ACTIVITY 3 - YEAR 20

2,651 Sq. Yds. 2% Full-Depth PCC Pavement Patching @ $ 60 = $ 159,060

0 Sq. Yds. 0.5% Full-Depth PCC Shoulder Patching @ $ 50 = $ —

99,400 Lin. Ft. 100% Longitudinal/Shoulder Joint Routing & Sealing @ $ 2 = $ 198,800

49,700 Lin. Ft. 100% Centerline Joint Routing & Sealing @ $ 2 = $ 99,400

Total Cost of Rehabilitation Activity 3 $ 457,260

FIGURE 5.05a(2)

RIGID PAVEMENT (Cont.)
FAP Route 344
Section N/A
LAKE County

REHABILITATION ACTIVITY 4 - YEAR 25

3,976	Sq. Yds.	3.0% Full-Depth PCC Pavement Patching	@ $ 60	= $	238,560
0	Sq. Yds.	1.0% Full-Depth PCC Shoulder Patching	@ $ 50	= $	-

Total Cost of Rehabilitation Activity 4 $ 238,560

REHABILITATION ACTIVITY 5 - YEAR 30

5,301	Sq. Yds.	4.0% Full-Depth PCC Pavement Patching	@ $ 60	= $	318,060
0	Sq. Yds.	1.5% Full-Depth PCC Shoulder Patching	@ $ 50	= $	-
132,533	Sq. Yds.	Policy HMA Overlay - Pavement	@ $ 11	= $	1,457,863
0	Sq. Yds.	Policy HMA Overlay - Shoulder	@ $ 11	= $	-

Total Cost of Rehabilitation Activity 5 $ 1,775,923

REHABILITATION ACTIVITY 6 - YEAR 35

99,400	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@ $ 2	= $	198,800
49,700	Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $ 2	= $	99,400
49,700	Lin. Ft.	50% Random Crack Routing and Sealing - Assume 100 ft/Station	@ $ 2	= $	99,400
31,808	Lin. Ft.	40% Reflective Transverse Crack Routing & Sealing	@ $ 2	= $	63,616
133	Sq. Yds.	0.1% Partial-Depth Pavement Patching (Mill & Fill Surface-Interstates; Mill & Fill 2.5 in.-Non-Interstates)	@ $ 50	= $	6,650

Total Cost of Rehabilitation Activity 6 $ 467,866

FIGURE 5:05a(3)

Revised July 1, 1991
Sheet 4 of 5

RIGID PAVEMENT (Cont.)

FAP Route 344

Section N/A

LAKE County

REHABILITATION ACTIVITY 7 - YEAR 40

663	Sq. Yds.	0.5% Full-Depth PCC Pavement Patching	@ $ 60	= $	39,780
663	Sq. Yds.	0.5% Partial-Depth Pavement Patching (Mill & Fill Surface-Interstates; Mill & Fill 2.5 in. Non-Interstates)	@ $ 50	= $	33,150
47,712	Lin. Ft.	60% Reflective Transverse Crack Routing and Sealing	@ $ 2	= $	95,424
49,700	Lin. Ft.	50% Random Crack Routing & Sealing- Assume 100ft/Station	@ $ 2	= $	99,400
99,400	Lin. Ft.	100% Longitudinal/Shoulder Joint Routing & Sealing	@ $ 2	= $	198,800
49,700	Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $ 2	= $	99,400

Total Cost of Rehabilitation Activity 7 $ 565,954

FIGURE 5.05a(4)

Revised July 1, 1991
Sheet 5 of 5

RIGID PAVEMENT (Cont.)

FAP Route 344

Section N/A

LAKE County

ANNUAL COST DETERMINATION

Present Worth Calculation:

Total Cost of Original Pavement Construction $ 7,451,674

Present Worth of Rehabilitation Activity 1	$ 7,980	X 0.7441 =	$ 5,938
Present Worth of Rehabilitation Activity 2	$ 15,906	X 0.6419 =	$ 10,206
Present Worth of Rehabilitation Activity 3	$ 457,260	X 0.5537 =	$ 253,185
Present Worth of Rehabilitation Activity 4	$ 238,565	X 0.4776 =	$ 113,936
Present Worth of Rehabilitation Activity 5	$ 1,775,923	X 0.4120 =	$ 731,680
Present Worth of Rehabilitation Activity 6	$ 467,866	X 0.3554 =	$ 166,280
Present Worth of Rehabilitation Activity 7	$ 565,954	X 0.3066 =	$ 173,521

Total Life Cycle Cost (Present Worth) $ 8,906,420

Annual Cost Per Mile Calculation

Total pw X CRF_n/Length = Annual Cost/Year-Mile

($ 8,906,420 X 0.04079/4.71 Mi.) = $ 77,132 /Yr.-Mi.

FIGURE 5.05a(5)

FLEXIBLE PAVEMENT

Date: _____ FAP Route 344

Quantities by: TMC Checked by: _____ Section N/A

Unit Prices by: _____ Checked by: TMC LAKE County

Net Length 21,900 Lin. Ft. 4.15 Miles

Number Lanes 4 Urban _____ Rural X

Single Lane Paving X Dual Lane Paving _____

ITEMIZED CONSTRUCTION COST

Quantity	Unit	Item	Unit Cost	Total Cost
132,533	Sq. Yds.	2" Poly HMA Surface, Mix F, N90 -Class I Surface Course	@ $ 9.75	= $ 1,292,197
132,533	Sq. Yds.	2¼" Poly HMA Binder, IL19.0, N90 -Inch ~~Class I~~ Binder Course	@ $ 10.07	= $ 1,334,607
0	Sq. Yds.	- -Inch Stabilized Shoulders	@ $ -	= $ -
0	Lin. Ft.	Pipe Underdrains	@ $ -	= $ -
0		Subbase Gran. Matl., Type C	@ $ -	= $ -
132,533	SQ YDS	6 1/4" HMA BINDER COURSE, IL19.0, N90	@ $ 24.55	= $ 3,253,685
0			@ $ -	= $ -

Total Cost of Original Pavement Construction $ 5,880,489

ITEMIZED MAINTENANCE AND REHABILITATION ACTIVITY COST

REHABILITATION ACTIVITY 1 - YEAR 5

13,668	Lin. Ft.	50% Random/Thermal Crack Routing & Sealing (Assume 110ft/station)	@ $ 2	= $ 27,336
99,400	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@ $ 2	= $ 198,800
49,700	Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $ 2	= $ 99,400
133	Sq. Yds.	0.1% Partial-Depth Pavement Patching -Mill & Fill Surface	@ $ 38	= $ 5,054

Total Cost of Rehabilitation Activity 1 $ 330,590

FIGURE 5.05b(1)

FLEXIBLE PAVEMENT (Cont.)

FAP Route 344

Section N/A

LAKE County

REHABILITATION ACTIVITY 2 - YEAR 10

663 Sq. Yds.	0.5% Partial-Depth HMA Pavement Patching - Mill & Fill Surface	@ $ 38	= $ 25,194
13,668 Lin. Ft.	5.0% ~~Thermal~~ Random Crack Routing & Sealing (Assume 110 ft/station)	@ $ 2	= $ 27,336
99,400 Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@ $ 2	= $ 198,800
49,700 Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $ 2	= $ 99,400

Total Cost of Rehabilitation Activity 2 $ 350,730

REHABILITATION ACTIVITY 3 - YEAR 15

132,533 Sq. Yds.	2.00 in. Milling - Pavement & Shoulder	@ $ 2.25	= $ 298,199
1,325 Sq. Yds.	1.0% Partial-Depth Pavement Patching (Mill & Fill Additional 2.00 in.)	@ $ 38	= $ 50,350
14,844 Tons	2.00 in. HMA Overlay Pavement & Shoulder	@ $ 74	= $ 1,098,456

Total Cost of Rehabilitation Activity 3 $ 1,447,005

FIGURE 5.05b(2)

FAP Route 344
Section N/A
LAKE County

REHABILITATION ACTIVITY 4 - YEAR 20

99,400	Lin. Ft.	100% Longitudinal Shoulder Joint Routing and Sealing	@ $ 2	= $	198,800
49,700	Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $ 2	= $	99,400
13,668	Lin. Ft.	50% Random/Thermal Crack Routing & Sealing (Assume 110 ft/Station)	@ $ 2	= $	27,336
133	Sq. Yds.	0.1% Partial-Depth HMA Pavement Patching (Mill & Fill Surface)	@ $ 38	= $	5,054
		Total Cost of Rehabilitation Activity 4		$	330,590

REHABILITATION ACTIVITY 5 - YEAR 25

99,400	Lin. Ft.	100% Longitudinal Shoulder Joint Routing and Sealing	@ $ 2	= $	198,800
49,700	Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $ 2	= $	99,400
13,668	Lin. Ft.	50% Random/Thermal Crack Routing & Sealing (Assume 110 ft/Station)	@ $ 2	= $	27,336
667	Lin. Ft.	0.50% Partial-Depth Pavement Patching (Mill & Fill Surface)	@ $ 38	= $	25,194
		Total Cost of Rehabilitation Activity 7		$	350,730

REHABILITATION ACTIVITY 6 - YEAR 30

132,533	Sq. Yds.	2.00 in. Milling (Pavement Only - Standard Design; Pavement & Shoulder - Limiting Strain Criterion Design)	@ $ 2.25	= $	298,199
2,651	Sq. Yds.	2.0% Partial-Depth HMA Pavement Patching (Mill & Fill Additional 2.00 in. All Designs)	@ $ 38	= $	100,738
0	Sq. Yds.	1.0% Full-Depth HMA Shoulder Patching (Mill & Fill Surface - Standard Design; Mill & Fill Additional 2.00 in. - Limiting Strain Criterion Design)	@ $ —	$	—
27,832	Tons	HMA Overlay Pavement (3.75 in. - Standard Design; 2.00 in. - Limiting Strain Criterion Design)	@ $ 74	= $	2,059,568
0	Tons	HMA Overlay - Shoulder (1.75 in. Standard Design; 2.00 in. - Limiting Strain Criterion Design)	@ $	= $	—

Total Cost of Rehabilitation Activity 6 $ 2,458,505

FIGURE 5.05b(3)

FLEXIBLE PAVEMENT (Cont.)

FAP Route 344
Section N/A
LAKE County

REHABILITATION ACTIVITY 7 - YEAR 35

99,400 Lin. Ft.	100% Longitudinal Shoulder Joint Routing and Sealing	@ $ 2	= $	198,800
49,700 Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $ 2	= $	99,400
13,668 Lin. Ft.	50% Random/Thermal Crack Routing & Sealing (Assume 110 ft/station)	@ $ 2	= $	27,336
133 Sq. Yds.	0.10% Partial-Depth Pavement Patching (Mill & Fill Surface)	@ $ 38	= $	5,054
	Total Cost of Rehabilitation Activity 7		$	330,590

REHABILITATION ACTIVITY 8 - YEAR 40

99,400 Lin. Ft.	100% Longitudinal Shoulder Joint Routing and Sealing	@ $ 2	= $	198,800
49,700 Lin. Ft.	100% Centerline Joint Routing & Sealing (Single lane and dual lane paving)	@ $ 2	= $	99,400
13,668 Lin. Ft.	50% Random/Thermal Crack Routing & Sealing	@ $ 2	= $	27,336
663 Sq. Yds.	0.50% Partial-Depth Pavement Patching (Mill & Fill Surface)	@ $ 38	= $	25,194
	Total Cost of Rehabilitation Activity 8		$	350,730

FIGURE 5.05b(4) - continued

FLEXIBLE PAVEMENT (Cont.)

FAP Route 344
Section N/A
LAKE County

ANNUAL COST DETERMINATION

Present Worth Calculation:

				Present Worth
Total Cost of Original Pavement Construction				$ 5880,489
Present Worth of Rehabilitation Activity	1	$ 330,590	X 0.8626 =	$ 285,167
Present Worth of Rehabilitation Activity	2	$ 350,730	X 0.7441 =	$ 260,978
Present Worth of Rehabilitation Activity	3	$ 1447,005	X 0.6419 =	$ 928,833
Present Worth of Rehabilitation Activity	4	$ 330,590	X 0.5537 =	$ 183,048
Present Worth of Rehabilitation Activity	5	$ 350,730	X 0.4776 =	$ 167,509
Present Worth of Rehabilitation Activity	6	$ 2,458,505	X 0.4120 =	$ 1,012,904
Present Worth of Rehabilitation Activity	7	$ 330,590	X 0.3554 =	$ 117,492
resent Worth of Rehabilitation Activity	8	$ 350,730	X 0.3066 =	$ 107,534

Total Life Cycle Cost (Present Worth) $ 8,943,954

Annual Cost Per Mile Calculation

Present Worth Total Cost X CRF_n/Length = Annual Cost/Year-Mile

($ 8,943,954 X 0.04079/4.71 Mi.) = $ 77,457 /Yr.-Mi.

$$\frac{77,457 - 77,132}{77,132} = 0.004$$

FAVORS PCC BY 0.4 %

FIGURE 5.05b(5)

US45 & US45/IL 83

PLAIN JOINTED PCC PAVEMENT

FILENAME-	US 45/IL 83	05-Jan-12
ROUTE-	US 45/IL 83	09:09 AM
SECTION-	N/A	
COUNTY-	Lake	
LOCATION-	US 45 to IL 60	
DATE-	12/2/2011	

PROJECT LENGTH (FT)	24850 =	4.71	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-	9.5		
TRAFFIC FACTORS	MINIMUM	ACTUAL	
RIGID-	9.04	7.63	

TRAFFIC		
PV-	0	42123
SU-	300	1545
MU-	900	486

INITIAL COSTS

ITEM	QUANTITY	UNIT PRICE	COST
PAVEMENT (SQ YDS)	132,533	$37.85	$5,016,374
STAB SUBBASE (SQ YDS)	149,100	$15.00	$2,236,500
SHOULDERS (SQ YDS)	0	$0.00	$0
SHOULDER SEAL (LN FT)	99,400	$2.00	$198,800
SUBBASE GRAN MATL TY C (TONS	0	$0.00	$0

CONSTRUCTION INITIAL COST (PW)	$7,451,674
TOTAL REHABILITATION COST (PW)	$1,454,746
TOTAL LIFE CYCLE COST (PW)	$8,906,420
ANNUAL COST PER MILE	$77,132

MAINTENANCE COSTS:

ITEM	UNIT COST
PAVEMENT PATCHING (SQ YDS)	$60.00
SHOULDER PATCHING (SQ YDS)	$50.00
SHLDR JT ROUT & SEAL (LF)	$2.00
CENTERLINE JT ROUT & SEAL (LF)	$2.00
POLICY HMA OVERLAY PVMT (SQ YDS)	$11.00
POLICY HMA OVERLAY SHLDR (SQ YDS)	$11.00
RANDOM CRACK ROUT & SEAL (LF)	$2.00
REFL TRANS CRACK ROUT & SEAL (LF)	$2.00
PARTIAL PVMT PATCH (SQ YDS)	$50.00

MAINTENANCE COSTS

ITEM	QUANTITY	UNIT PRICE	COST	PW
Activity 1				
YEAR 10				
PAVEMENT PATCHING 0.1% (SQ YDS)	133	$60.00	$7,980	
			$7,980	$5,938
Activity 2				
YEAR 15				
PAVEMENT PATCHING 0.2% (SQ YDS)	265	$60.00	$15,900	
			$15,900	$10,206
Activity 3				
YEAR 20				
PAVEMENT PATCHING 2.0% (SQ YDS)	2,651	$60.00	$159,060	
SHOULDER PATCHING 0.5% (SQ YDS)	0	$50.00	$0	
SHLDR JT ROUT & SEAL 100% (LF)	99,400	$2.00	$198,800	
CENTERLINE JT ROUT & SEAL 100.0% (L	49,700	$2.00	$99,400	
			$457,260	$253,185
Activity 4				
YEAR 25				
PAVEMENT PATCHING 3.0% (SQ YDS)	3,976	$60.00	$238,560	
SHOULDER PATCHING 1.0% (SQ YDS)	0	$50.00	$0	
			$238,560	$113,936
Activity 5				
YEAR 30				
PAVEMENT PATCHING 4.0% (SQ YDS)	5,301	$60.00	$318,060	
SHOULDER PATCHING 1.5% (SQ YDS)	0	$50.00	$0	
POLICY HMA OVERLAY PVMT (SQ YDS)	132,533	$11.00	$1,457,863	
POLICY HMA OVERLAY SHLDR (SQ YDS)	0	$11.00	$0	
			$1,775,923	$731,680
Activity 6				
YEAR 35				
SHLDR JT ROUT & SEAL 100% (LF)	99,400	$2.00	$198,800	
CENTERLINE JT ROUT & SEAL 100.0% (L	49,700	$2.00	$99,400	
RANDOM CRACK ROUT & SEAL 50% (LF)	49,700	$2.00	$99,400	
REFL TRANS CRACK ROUT & SEAL 40%	31,808	$2.00	$63,616	
PARTIAL PVMT PATCH 0.1% (SQ YDS)	133	$50.00	$6,650	
			$467,866	$166,280
Activity 7				
YEAR 40				
PAVEMENT PATCHING 0.5% (SQ YDS)	663	$60.00	$39,780	
PARTIAL PVMT PATCH 0.5% (SQ YDS)	663	$50.00	$33,150	
REFL TRANS CRACK ROUT & SEAL 60%	47,712	$2.00	$95,424	
RANDOM CRACK ROUT & SEAL 50% (LF)	49,700	$2.00	$99,400	
SHLDR JT ROUT & SEAL 100% (LF)	99,400	$2.00	$198,800	
CENTERLINE JT ROUT & SEAL 100.0% (L	49,700	$2.00	$99,400	
			$565,954	$173,521
Total Rehabilitation Cost (Present Worth)				$1,454,746

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

ROUTE-	US 45/IL 83	05-Jan-12
SECTION-	N/A	09:09 AM
COUNTY-	Lake	
LOCATION-	US 45 to IL 60	
PROJECT LENGTH (FT)	24850	
AVERAGE LANE WIDTH (FT)	12	

FULL-DEPTH FLEXIBLE PAVEMENT

MAINTENANCE COSTS

ITEM	QUANTITY	UNIT PRICE	COST	Present Worth
Activity 1				
YEAR 5 RAND/THERM CRACK ROUT & SEAL 50%	13,668	$2.00	$27,336	
SHLDR JT ROUT & SEAL 100% (LF)	99,400	$2.00	$198,800	
CENTERLINE JT ROUT & SEAL 100.0% (L	49,700	$2.00	$99,400	

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

FLEXIBLE THICKNESS-	10.5	
TRAFFIC FACTORS	MINIMUM	ACTUAL
FLEXIBLE	6.4	5.99

TRAFFIC		
PV-	0	42123
SU-	300	1545
MU-	900	486

PAVEMENT OVERLAY THICKNESS	3.75
SHOULDER OVERLAY THICKNESS	1.75

INITIAL COSTS

ITEM	QUANTITY	UNIT PRICE	COST
SURFACE (SQ YDS)	132,533	$9.75	$1,292,197
POLY BINDER (SQ YDS)	132,533	$10.07	$1,334,607
BINDER (SQ YDS)	132,533	$24.55	$3,253,685
SHOULDERS (SQ YDS)	0	$0.00	$0
SUBBASE GRAN MATL TY C (TONS	0	$0.00	$0

CONSTRUCTION INITIAL COST (PW)	$5,880,489
TOTAL REHABILITATION COST (PW)	$3,063,465
TOTAL LIFE CYCLE COST (PW)	$8,943,954
ANNUAL COST PER MILE	$77,457

MAINTENANCE COSTS:

ITEM	UNIT COST
RAND/THERM CRACK ROUT & SEAL (LF)	$2.00
SHLDR JT ROUT & SEAL (LF)	$2.00
CENTERLINE JT ROUT & SEAL (LF)	$2.00
PARTIAL PVMT PATCH (SQ YDS)	$38.00
2" MILL PVMT & SHLDR (SQ YDS)	$2.25
2" OVERLAY PVMT & SHLDR (TONS)	$74.00
2" MILL PVMT ONLY (SQ YDS)	$2.25
HMA SHOULDER PATCHING (SQ YDS)	$50.00
POLICY HMA OVERLAY PVMT (TONS)	$74.00
POLICY HMA OVERLAY SHLDR (TONS)	$74.00

MATERIAL TYPE/PERCENTAGE PCC 0.4%

	PARTIAL PVMT PATCH 0.1% (SQ YDS)	133	$38.00	$5,054	
				$330,590	$285,167
Activity 2					
YEAR 10	PARTIAL PVMT PATCH 0.5% (SQ YDS)	663	$38.00	$25,194	
	RAND/THERM CRACK ROUT & SEAL 50%	13,668	$2.00	$27,336	
	SHLDR JT ROUT & SEAL 100% (LF)	99,400	$2.00	$198,800	
	CENTERLINE JT ROUT & SEAL 100.0% (L	49,700	$2.00	$99,400	
				$350,730	$260,978
Activity 3					
YEAR 15	2" MILL PVMT & SHLDR 100% (SQ YDS)	132,533	$2.25	$298,199	
	PARTIAL PVMT PATCH 1.0% (SQ YDS)	1,325	$38.00	$50,350	
	2" OVERLAY PVMT & SHLDR 100% (TONS	14,844	$74.00	$1,098,456	
				$1,447,005	$928,833
Activity 4					
YEAR 20	SHLDR JT ROUT & SEAL 100% (LF)	99,400	$2.00	$198,800	
	CENTERLINE JT ROUT & SEAL 100.0% (L	49,700	$2.00	$99,400	
	RAND/THERM CRACK ROUT & SEAL 50%	13,668	$2.00	$27,336	
	PARTIAL PVMT PATCH 0.1% (SQ YDS)	133	$38.00	$5,054	
				$330,590	$183,048
Activity 5					
YEAR 25	SHLDR JT ROUT & SEAL 100% (LF)	99,400	$2.00	$198,800	
	CENTERLINE JT ROUT & SEAL 100.0% (L	49,700	$2.00	$99,400	
	RAND/THERM CRACK ROUT & SEAL 50%	13,668	$2.00	$27,336	
	PARTIAL PVMT PATCH 0.5% (SQ YDS)	663	$38.00	$25,194	
				$350,730	$167,509
Activity 6					
YEAR 30	2" MILL PVMT ONLY 100% (SQ YDS)	132,533	$2.25	$298,199	
	PARTIAL PVMT PATCH 2.0% (SQ YDS)	2,651	$38.00	$100,738	
	HMA SHOULDER PATCHING 1.0% (SQ YD	0	$50.00	$0	
	POLICY HMA OVERLAY PVMT (TONS)	27,832	$74.00	$2,059,568	
	POLICY HMA OVERLAY SHLDR (TONS)	0	$74.00	$0	
				$2,458,505	$1,012,904
Activity 7					
YEAR 35	SHLDR JT ROUT & SEAL 100% (LF)	99,400	$2.00	$198,800	
	CENTERLINE JT ROUT & SEAL 100.0% (L	49,700	$2.00	$99,400	
	RAND/THERM CRACK ROUT & SEAL 50%	13,668	$2.00	$27,336	
	PARTIAL PVMT PATCH 0.1% (SQ YDS)	133	$38.00	$5,054	
				$330,590	$117,492
Activity 8					
YEAR 40	SHLDR JT ROUT & SEAL 100% (LF)	99,400	$2.00	$198,800	
	CENTERLINE JT ROUT & SEAL 100.0% (L	49,700	$2.00	$99,400	
	RAND/THERM CRACK ROUT & SEAL 50%	13,668	$2.00	$27,336	
	PARTIAL PVMT PATCH 0.5% (SQ YDS)	663	$38.00	$25,194	
				$350,730	$107,534
	Total Rehabilitation Cost (Present Worth)				$3,063,465