Illinois Department of Transportation

To:	Diane M. O'Keefe	Attn: District One
From:	Scott E. Stitt	
Subject:	Pavement Design	
Date:	November 16, 2011	

FAP Route 397 (IL Route 83)
Section (0405-1 & 0506-2)R-1
Cook County
From Kedzie Avenue to Western Avenue

We have reviewed the pavement selection for the project, which was submitted to BDE by memo dated August 15, 2011. Revisions were submitted to BDE on October. The project will reconstruct IL 83 and a portion of Western Avenue/Dixie Highway. This project meets the requirements for the alternate bidding process. The approved pavement design for this project is as follows:

IL Route 83 (147th Street)

Option 1:

10.5 inches of HMA pavement
- 2 inches of Polymerized HMA surface course, SMA, N80
- 2 inches of Polymerized HMA binder course, SMA, N80
- 6.5 inches of Polymerized HMA binder course, IL-19, N90

12 inches of Aggregate Subgrade

Option 2:

9.25 inches of PCC pavement with tied PCC shoulder
4.5 inches of Stabilized Sub-Base
12 inches of Aggregate Subgrade

Dixie Highway/Western Avenue

Option 1:

12.25 inches of HMA pavement
- 2 inches of Polymerized HMA surface course, SMA, N80
- 2 inches of Polymerized HMA binder course, SMA, N80
- 8.25 inches of Polymerized HMA binder course, IL-19, N90

12 inches of Aggregate Subgrade

Option 2:

10 inches of PCC pavement with tied PCC shoulder
4.5 inches of Stabilized Sub-Base
12 inches of Aggregate Subgrade

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

Illinois Department of Transportation

Memorandum

RECEIVED
AUG 18 2011
BUREAU OF
DESIGN & ENVIRONMENT

To: Scott Stitt Attn: Paul R. Niedernhofer

From: Diane O'Keefe By: Mohamad Khudeira

Subject: Pavement Analysis*

Date: August 15, 2011

Route: FAP 397 IL Route 83
Limits: Kedzie Ave. to Western Ave.
Contract No.: 60M57
Letting: 06CY12

Section: (0405-1&0506-2) R-1
County: Cook
Job No.: D-91-130-11

We are submitting the pavement analysis for the above captioned locations 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 existing IL-83 from Sta. 1005+74 to Sta. 1043+43 for a length of 3,770 feet is to provide two 12-foot thru lanes in each direction with a raised median from west of Kedzie Ave. to east of Western Ave/Dixie Highway.

b) Pavement reconstruction of existing Western Ave./Dixie Highway from Sta. 5998+11 to Sta. 6024+60 for a length of 2,649 feet is to provide two 12-foot thru lanes in each direction with a raised median from south of 149th St. south of 145th St.

District 1 performed a mechanistic pavement design for IL Route 83 (147th Street) and for Western/Dixie Highway and yielded the following:

a) **Illinois Route 83 (147th St.)**
Tied PCC Curb and Gutter
Pavement Reconstruction

Option 1:

10.5" Full depth HMA pavement*
2" Polymerized HMA surface course, SMA, N80
2" Polymerized HMA binder course, SMA, N80
6.5" Polymerized HMA binder course, IL-19, N90
12" Aggregate Subgrade

Option 2:

9.25" PCC pavement*
4.5" Stabilized sub-base.
12" Aggregate Subgrade

~~The life cycle favored full HMA pavement by 0.2%.~~

b) **Dixie Highway/Western Ave.**

Tied PCC Curb and Gutter
Pavement Reconstruction

Option 1:

12.25" full depth HMA pavement*
2" Polymerized HMA surface course, SMA, N80
2" Polymerized HMA binder course, SMA, N80
8.25" Polymerized HMA binder course, IL-19, N90
12" Aggregate Subgrade

Option 2:

10" PCC pavement*
4.5" Stabilized sub-base
12" Aggregate Subgrade

The life cycle favored PCC pavement by 4%.

The Life Cycle cost analysis for both locations is less than 10%. 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.

* Designer Note 1: Geotechnical fabric is to be used where IBR < 2.5

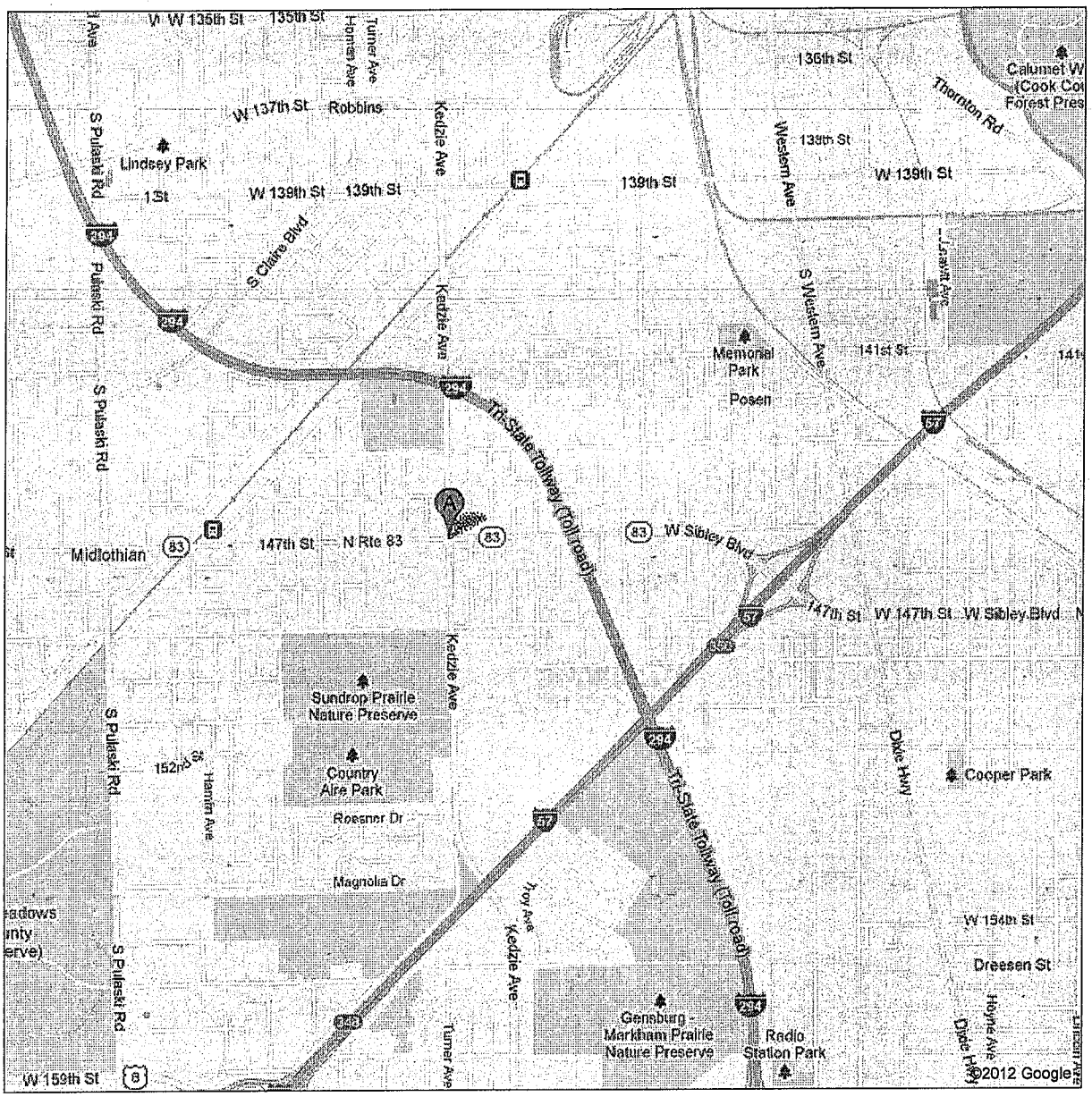
If you have any questions or need additional information, please contact Mr. Mohamad Khudeira, at (847) 705-4209.

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

Google

Address **Illinois 83 & Kedzie Ave**
Midlothian, 60445

Get Google Maps on your phone
Text the word "GMAPS" to 466453



Spreadsheet by Uehle - Rev. 11/02

MECHANISTIC PAVEMENT DESIGN

Date: 6/16/11

INPUT (Enter Data in Gray Shaded Cells)

Route: 147th
Section: 141-2B
County: Cook
Location: Kedzie to Western

Comments: 147th St Design

Designer: MK

	ADT	Year
Current:	17,500	2008
Future:	23000	2030

Facility Type: Other Marked State Route

# of Lanes = 4

Road Class: I

Subgrade Support Rating (SSR): Poor
Construction Year: 2013
Design Period (DP) = 20 years

	Structural Design Traffic			
	Minimum ADT	Actual ADT	Actual %of Total ADT	% of ADT in Design Lane
PV =	0	20,358	95.8%	P = 32%
SU =	300	0	0.0%	S = 45%
MU =	900	893	4.2%	M = 45%
		Struct. Design ADT =	21250	(2023)

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)=	3.90	(Actual ADT)	TF rigid (Actual)=	5.61	(Actual ADT)
TF flexible (Min)=	4.27	(Min ADT Fig 54-2C)	TF rigid (Min)=	6.03	(Min ADT Fig 54-2C)
Use TF flexible =	4.27		Use TF rigid =	6.03	
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 =	66.2	(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	300	900
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%

benesch

Comp. by: _____ Date: _____ Sheet _____ of _____

Chkd. by: _____ Date: _____ Job No. _____

Project: _____

Element: _____

IL-83 Life Cycle

without 4½" stab subbase

Rigid $ 77824
flex $ 98391

98391 - 77824 = 20567

98391 ÷

20.9% PCC

Dixie hwy / Western ave

without 4 ½" stab subbase

Rigid $ 71140
flex $ 95285

95285 - 71140 = 24145

95285 ÷

25.3% PCC

Spreadsheet by Uehle - Rev. 11/02

MECHANISTIC PAVEMENT DESIGN

Date: 6/16/11

INPUT (Enter Data in Gray Shaded Cells)

Route: Dixie Hwy/Western Ave
Section: 1414 2B
County: Cook
Location: 147th

Comments: Dixie Hwy/Western Ave Design

Designer: MK

	ADT	Year
Current:	15200	2008
Future:	11000	2030

Facility Type: Other Marked State Route

# of Lanes = 4

Road Class: I

Subgrade Support Rating (SSR): Poor
Construction Year: 2013
Design Period (DP) = 20 years

	Minimum ADT	Actual ADT	Actual %of Total ADT	% of ADT in Design Lane
		Structural Design Traffic		
PV =	0	10,116	82.0%	P = 32%
SU =	300	0	0.0%	S = 45%
MU =	900	2,221	18.0%	M = 45%
Struct. Design ADT =		12336	(2023)	

FLEXIBLE & RIGID PAVEMENT CALCULATIONS AND ADDITIONAL INPUT

Flexible Pavement

Cpv =	0.15	
Csu =	133	
Cmu =	483	
TF flexible (Actual)=	9.65	(Actual ADT)
TF flexible (Min)=	4.27	(Min ADT Fig 54-2C)
Use TF flexible =	9.65	
AC Type =	20	
AC Mixture Tempurature =		deg. F (Figure 54-5C)
Design AC Mixture Modulus (Eac)=		ksi (Figure 54-5D)
Design Asphalt Concrete Microstrain =	50.6	(Figure 54-5E)
Asphalt Concrete Thickness =		**in. (Figure 54-5F)**

Rigid Pavement

Cpv =	0.15	
Csu =	144	
Cmu =	696	
TF rigid (Actual)=	13.93	(Actual ADT)
TF rigid (Min)=	6.03	(Min ADT Fig 54-2C)
Use TF rigid =	13.93	
Tied		Shoulder or C. &G.
Rigid Pavt Thick. =		**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	300	900
Unmarked State Route	No Min	No Min	No Min

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

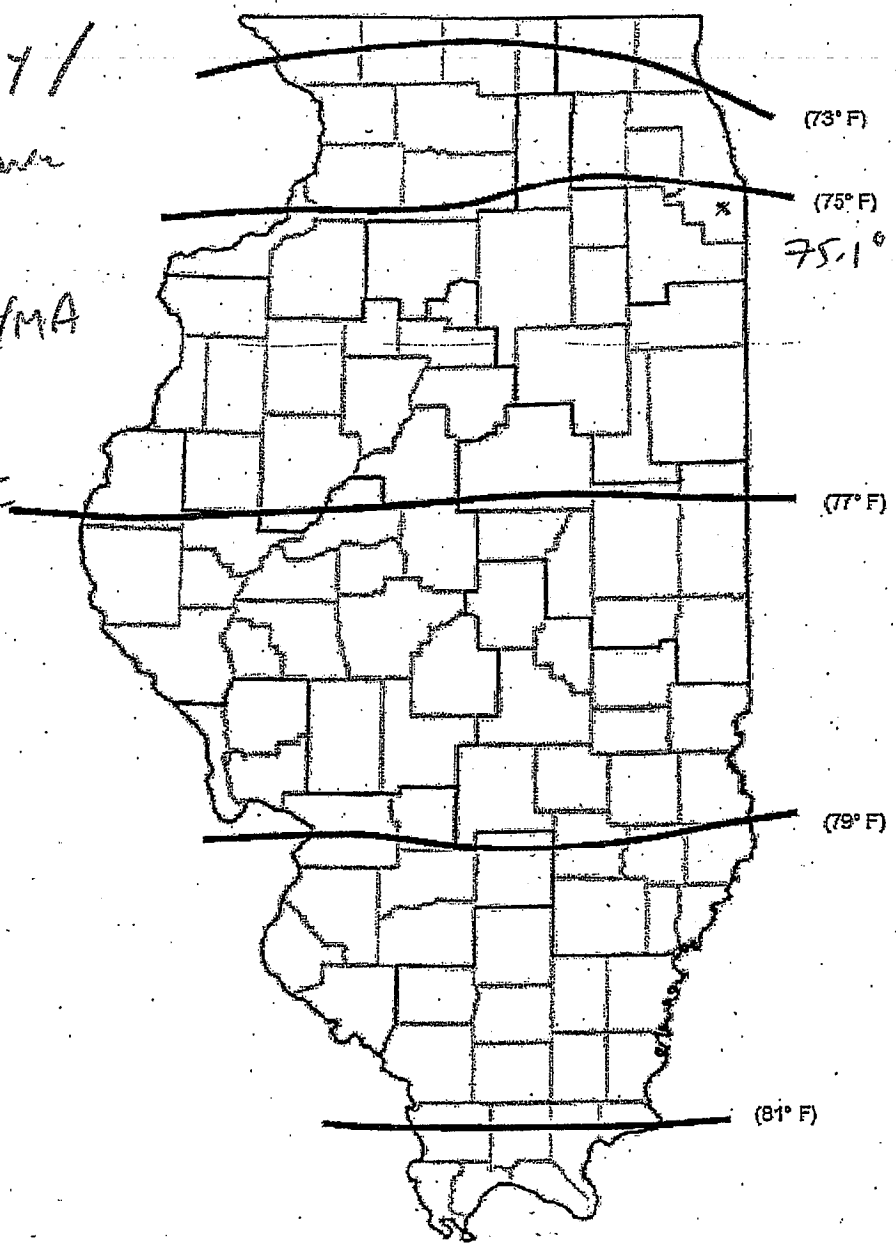
	Traffic Factor ESAL Coefficients			
	Rigid (Fig. 54-4C)		Flexible (Fig. 54-5B)	
Class	Csu	Cmu	Csu	Cmu
I	143.81	696.42	132.50	482.53
II	135.78	567.21	112.06	385.44
III	129.58	562.47	109.14	384.35
IV(ADT>400)	127.75	555.90	109.14	384.35
IV(ADT<=400)	127.75	555.90	9.86	78.84

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%

Dixie hwy / - western area

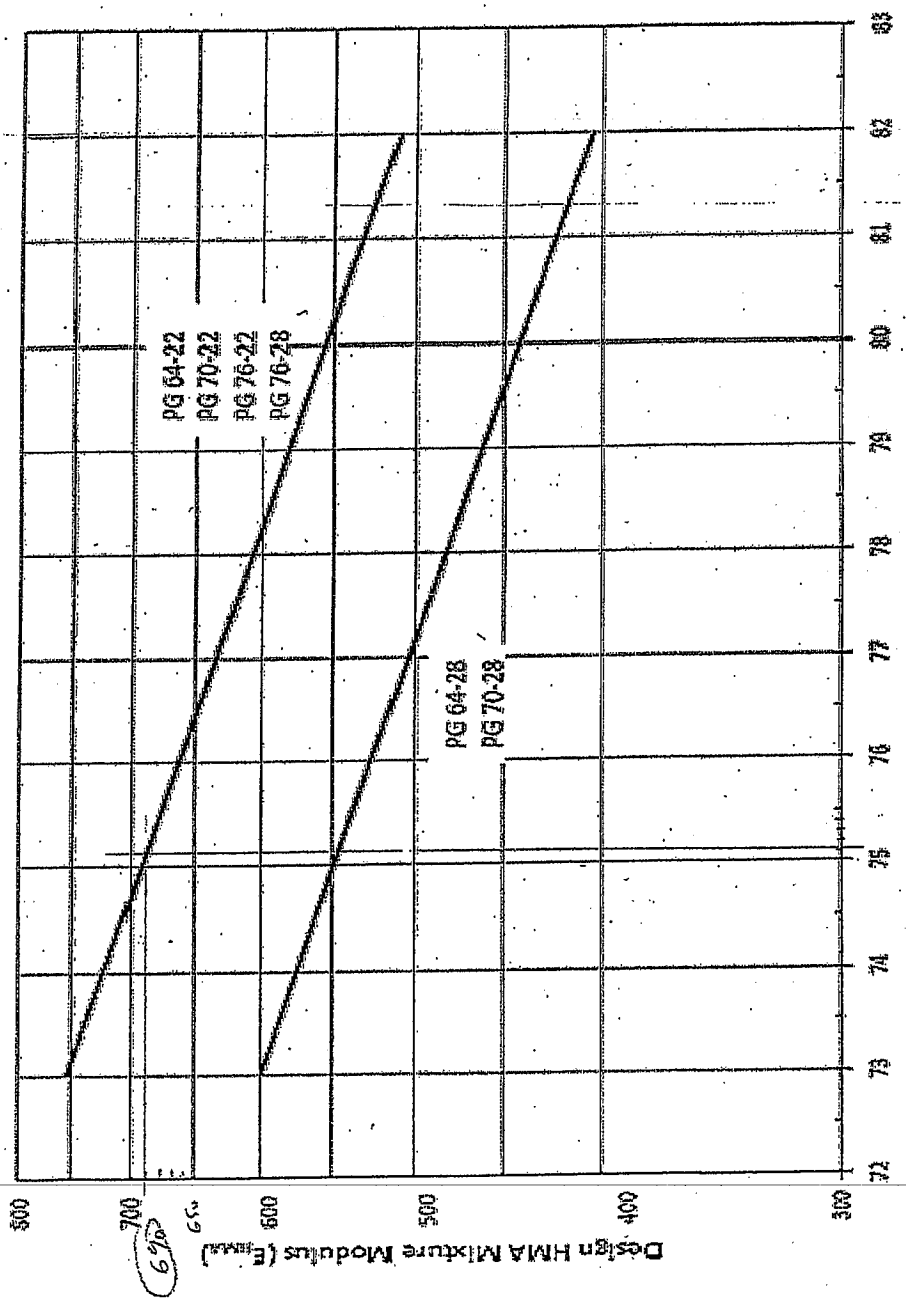
12 ½" HMA or 10" PCC



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

HMA MIXTURE TEMPERATURE
(Mechanistic Design: Flexible Pavement)

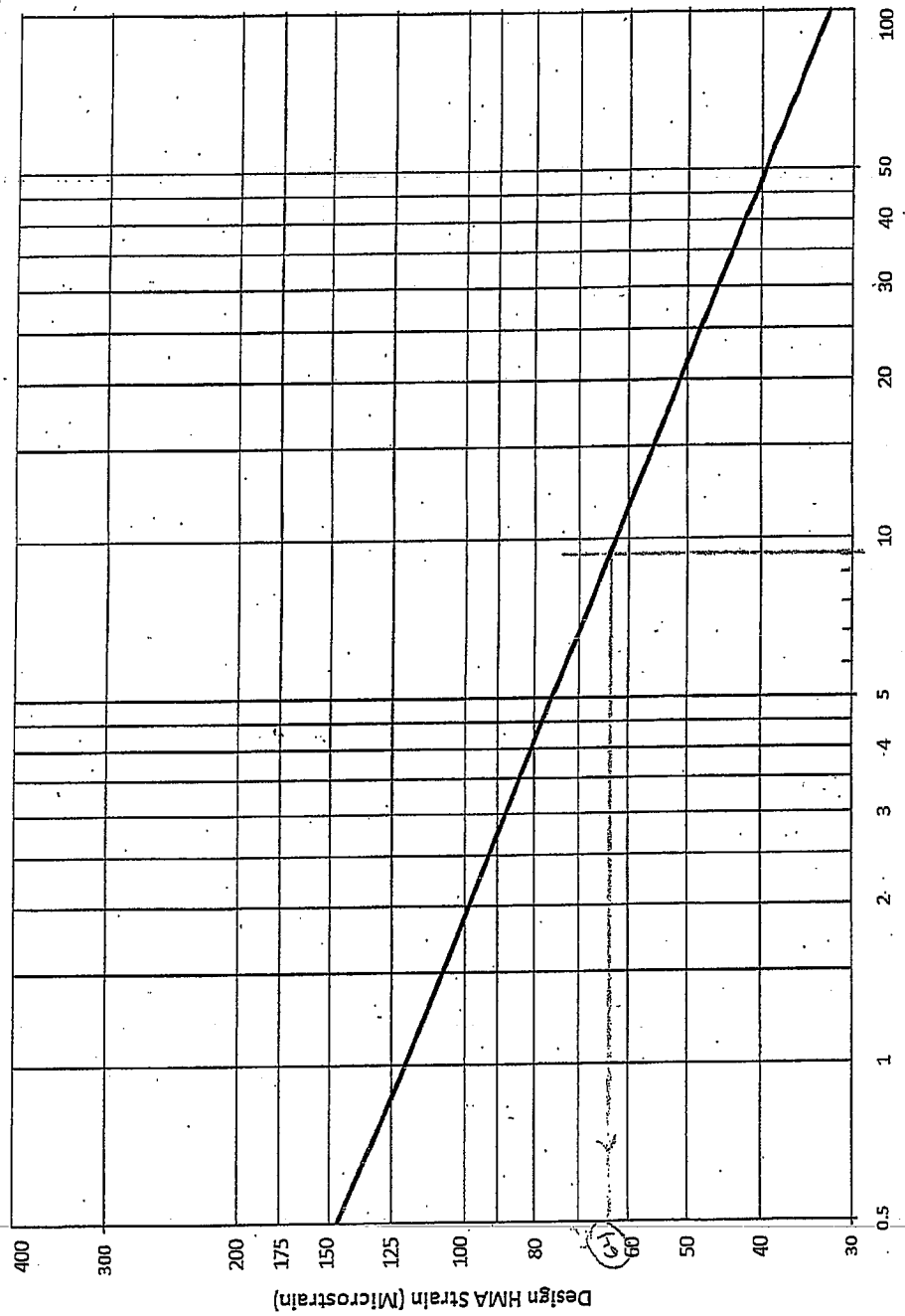
~~Figure 54-5.C~~



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

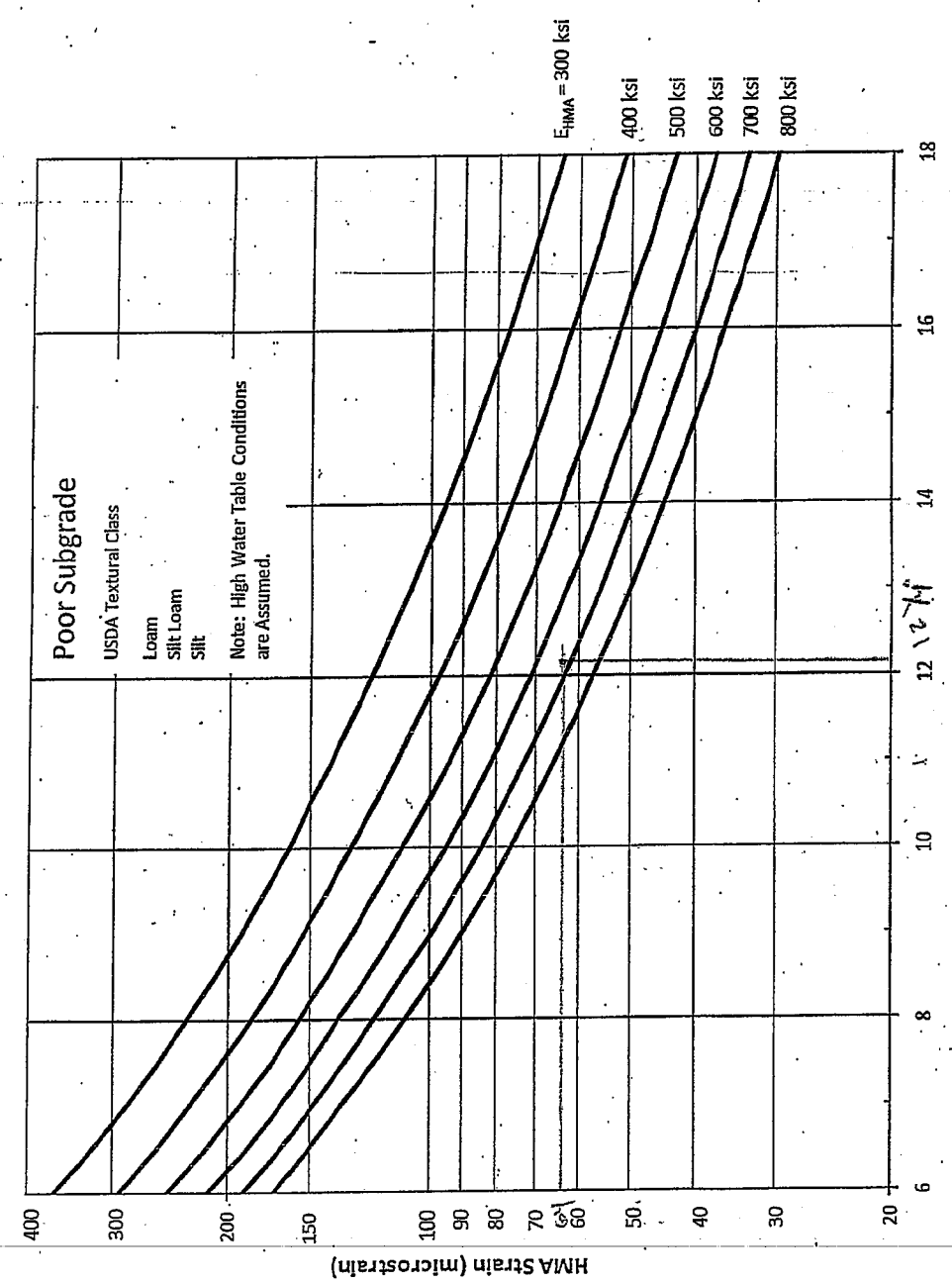
Figure 54-5.D

HARD COPIES UNCONTROLLED



DESIGN HMA STRAIN
(Mechanistic Design: Flexible Pavement)

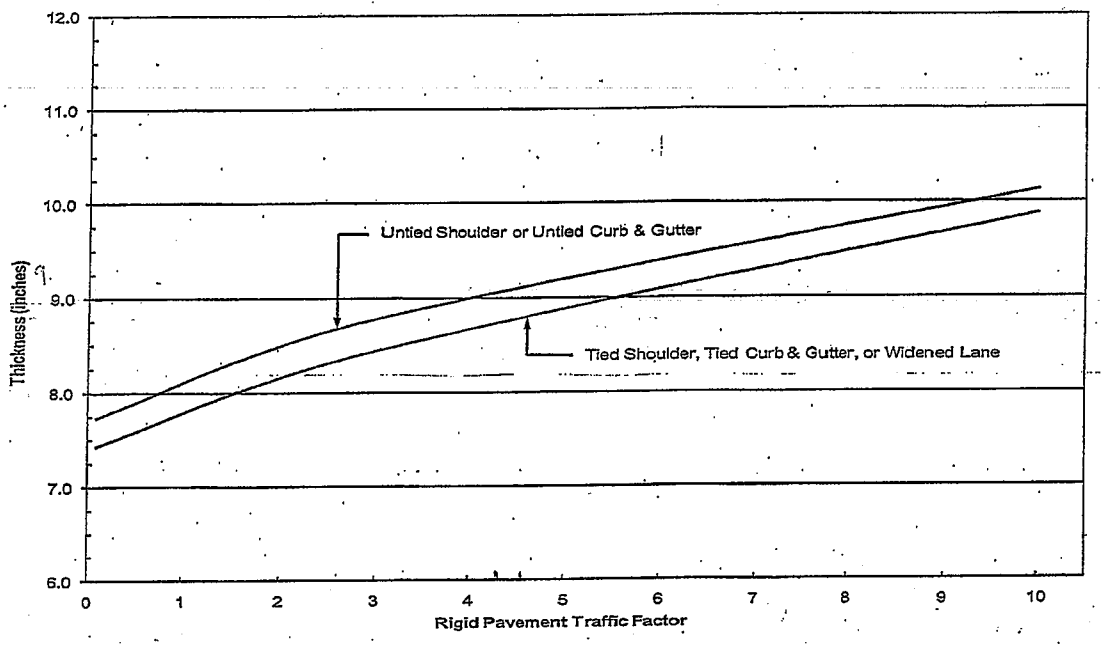
Figure 54-5.E

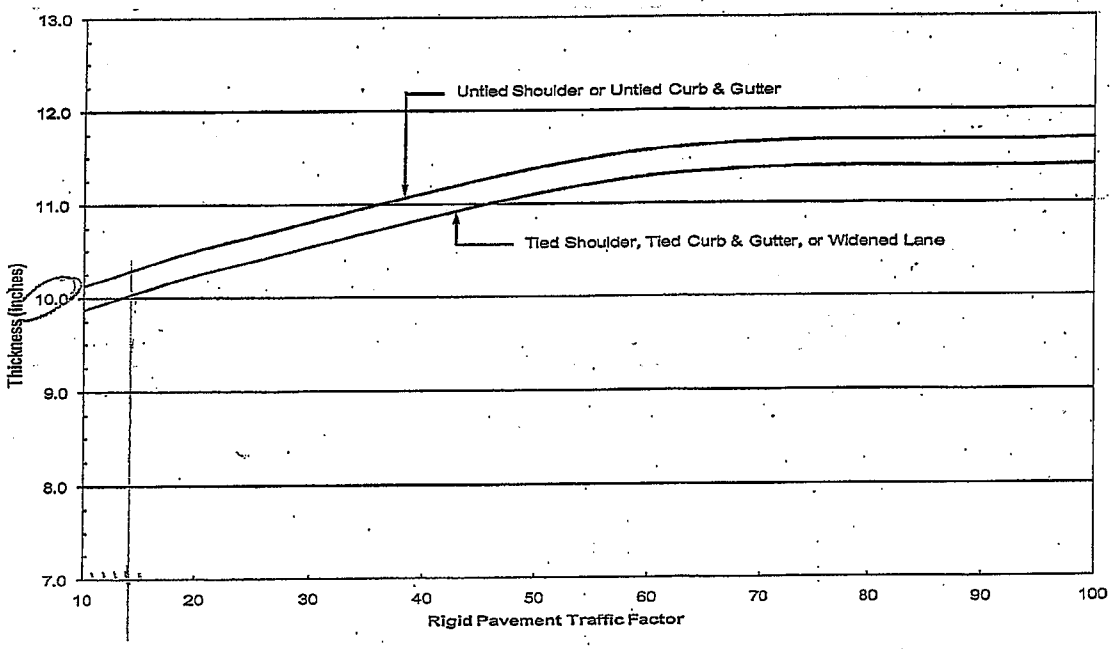


HMA THICKNESS DESIGN CHART
(Mechanistic Design: Flexible Pavement: SSR = Poor)

Figure 54-5.F

HARD COPIES UNCONTROLLED





Note: Use of untied shoulder design requires BDE approval.

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

Figure 54-4.E

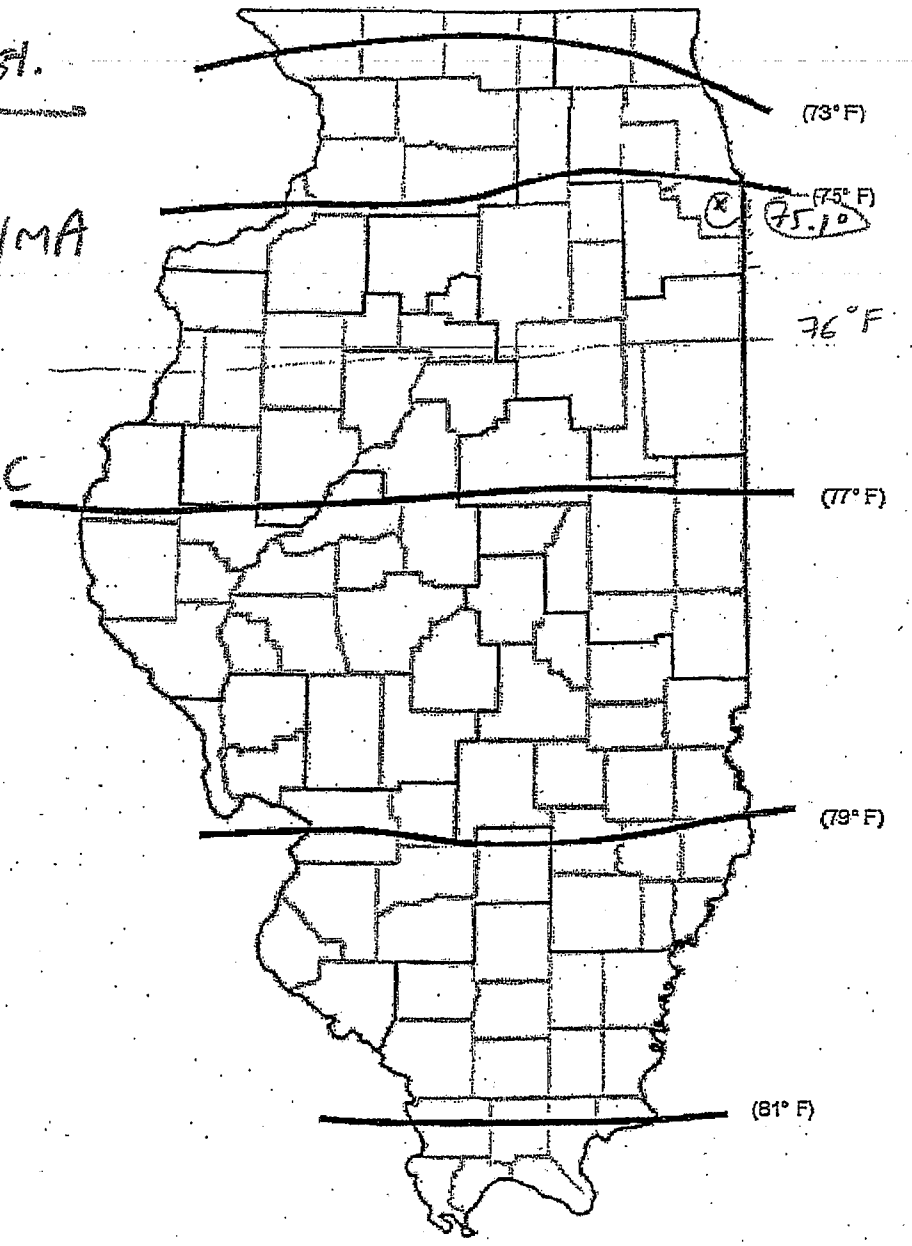
HARD COPIES UNCONTROLLED

147th St.

10 ½" HMA

or

9 ¼" PCC

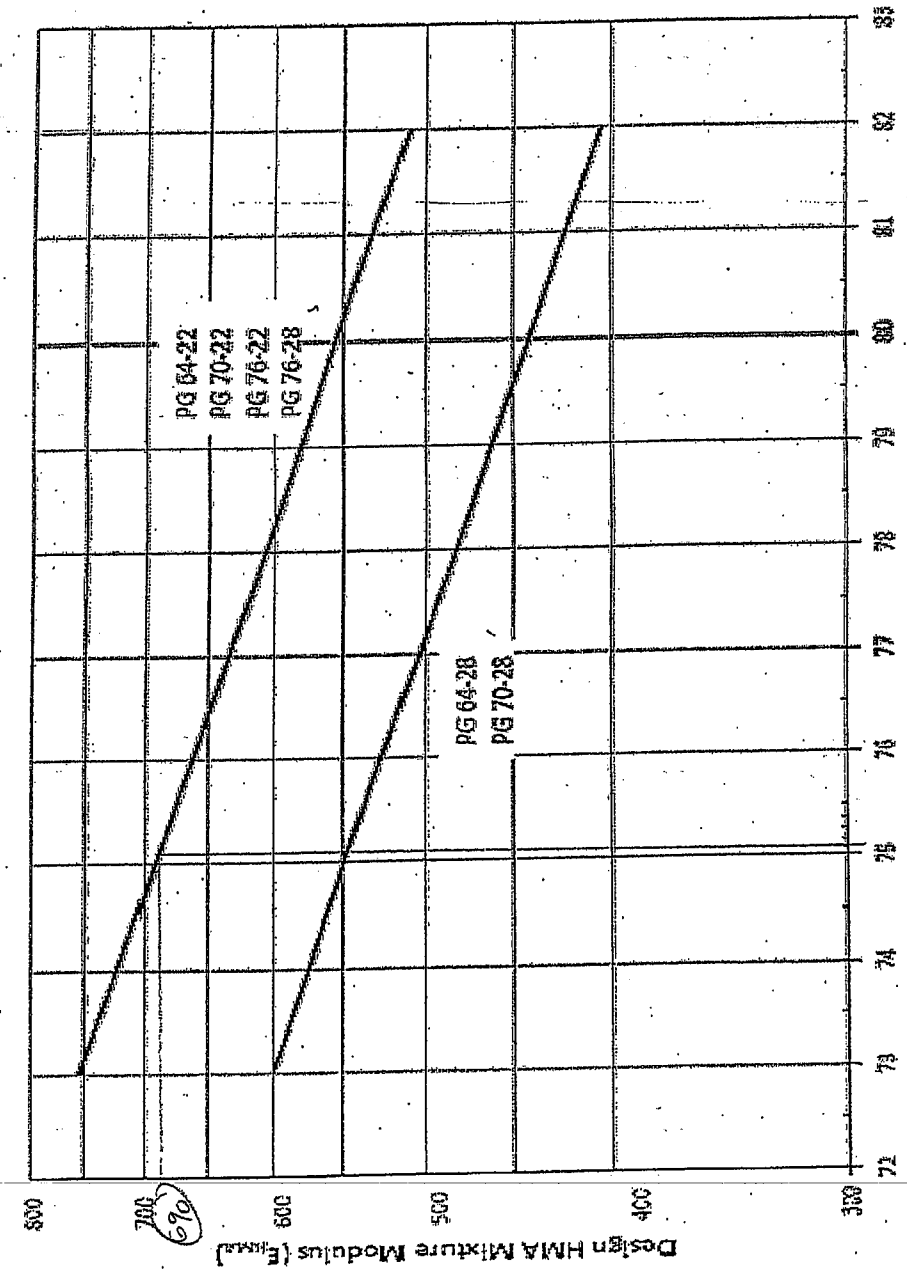


Note: The minimum design HMA mixture temperature will be 73°F.

HMA MIXTURE TEMPERATURE
(Mechanistic Design: Flexible Pavement)

Figure 54-5.C

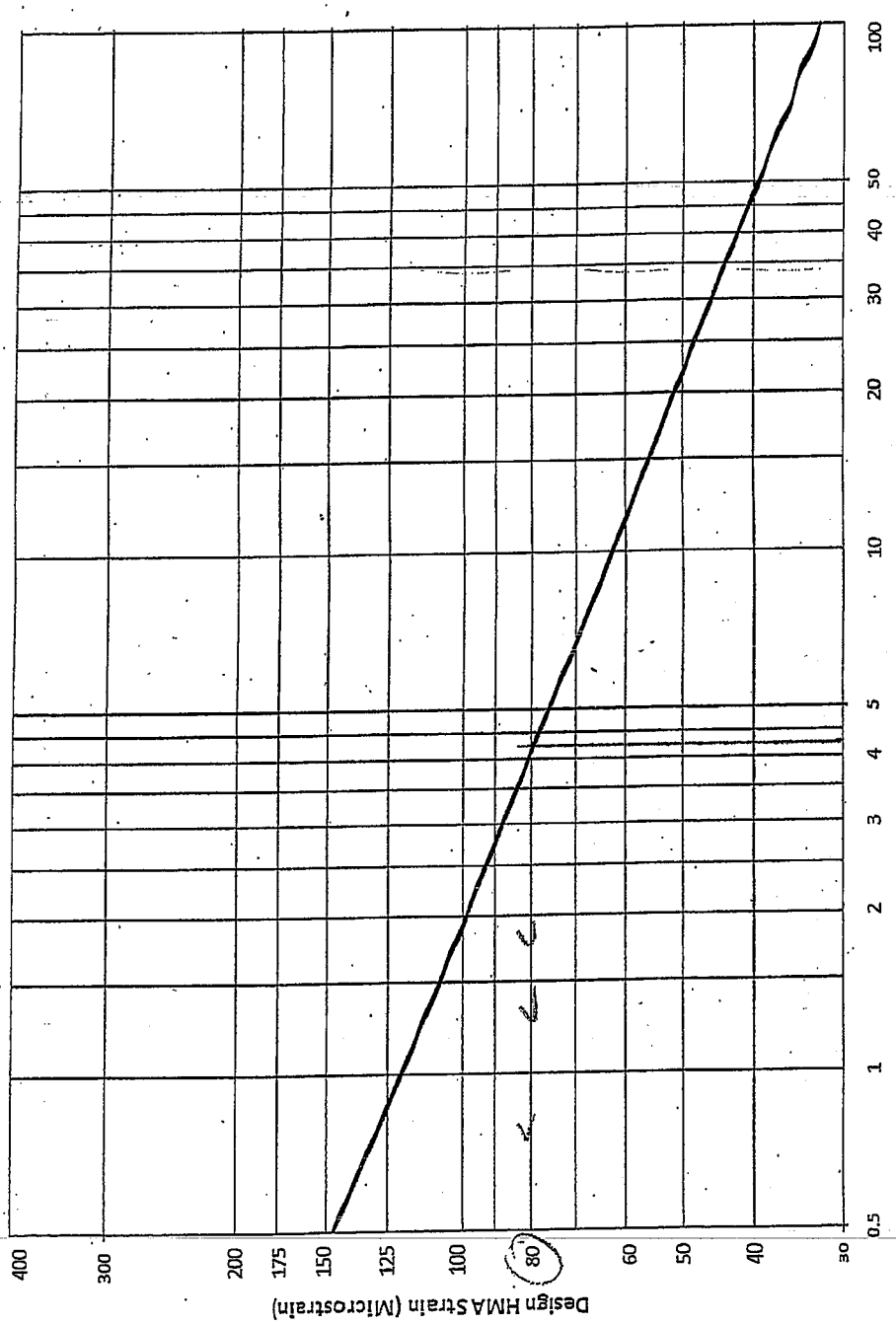
HARD COPIES UNCONTROLLED



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

Figure 54-5.D

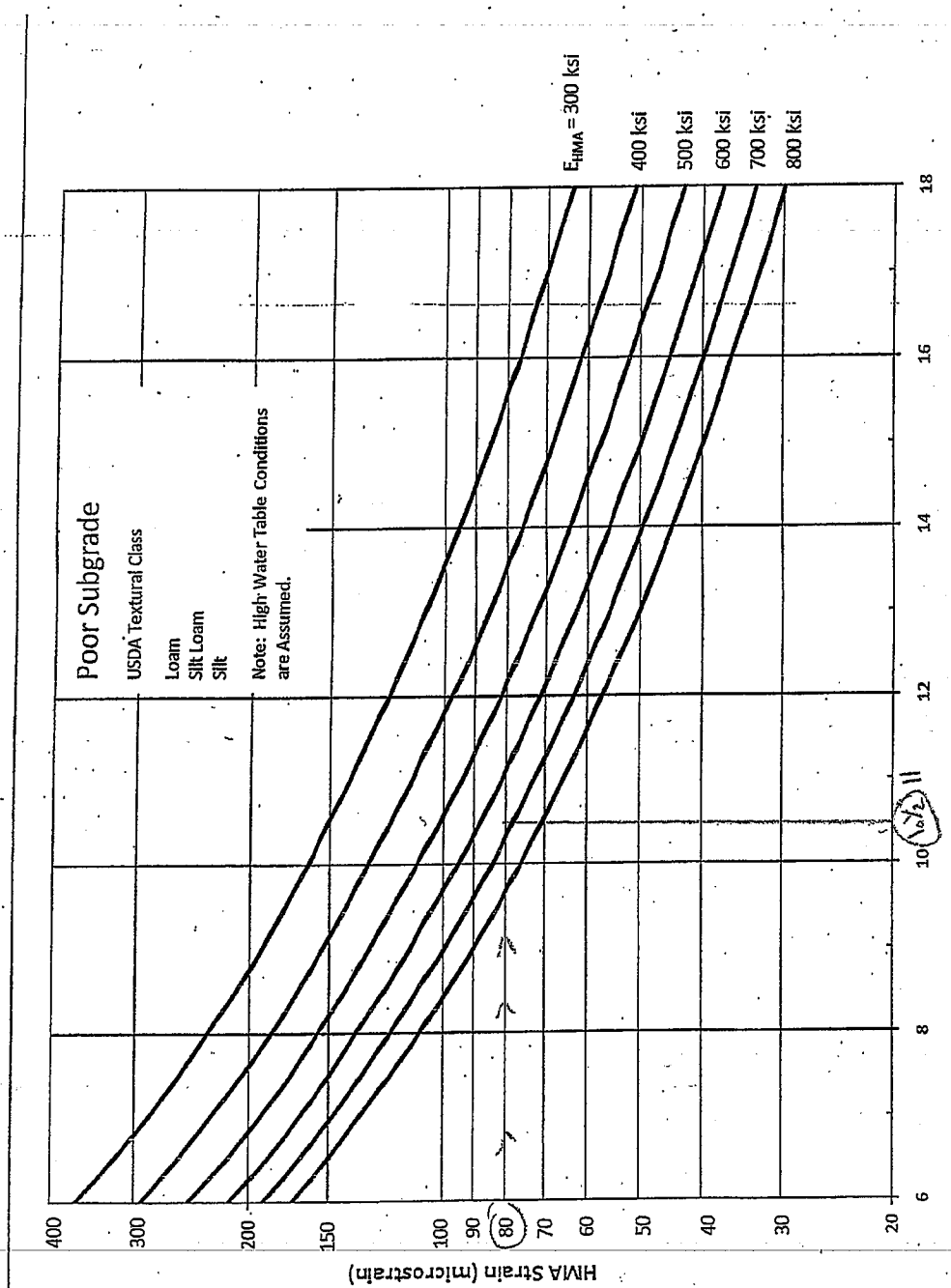
HARD COPIES UNCONTROLLED



DESIGN HMA STRAIN
(Mechanistic Design: Flexible Pavement)

Figure 54-5.E

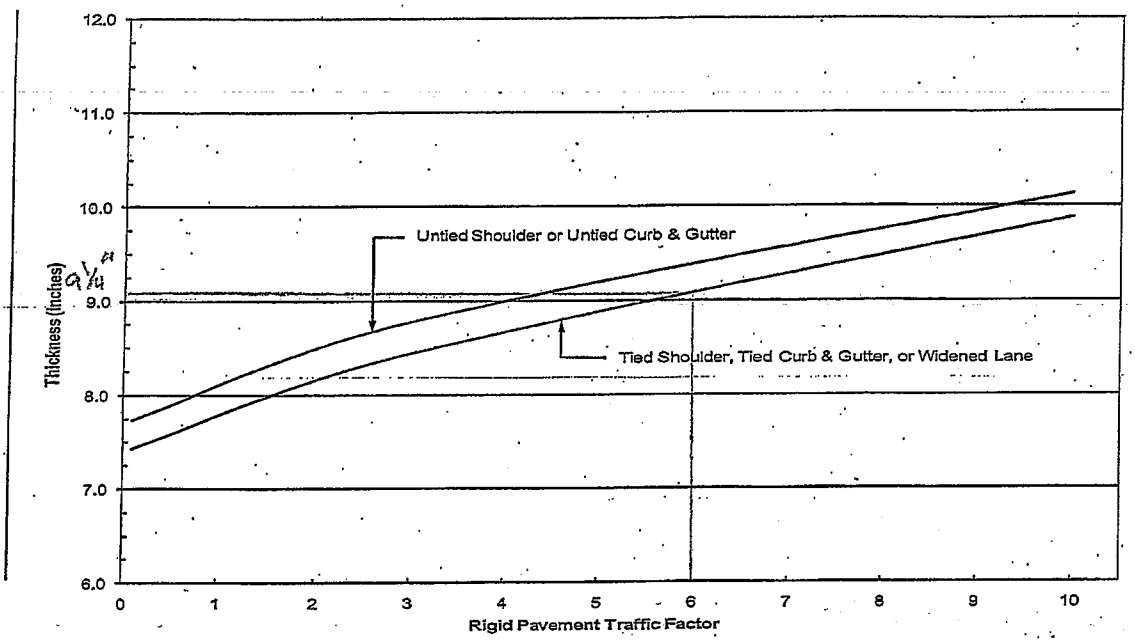
HARD COPIES UNCONTROLLED

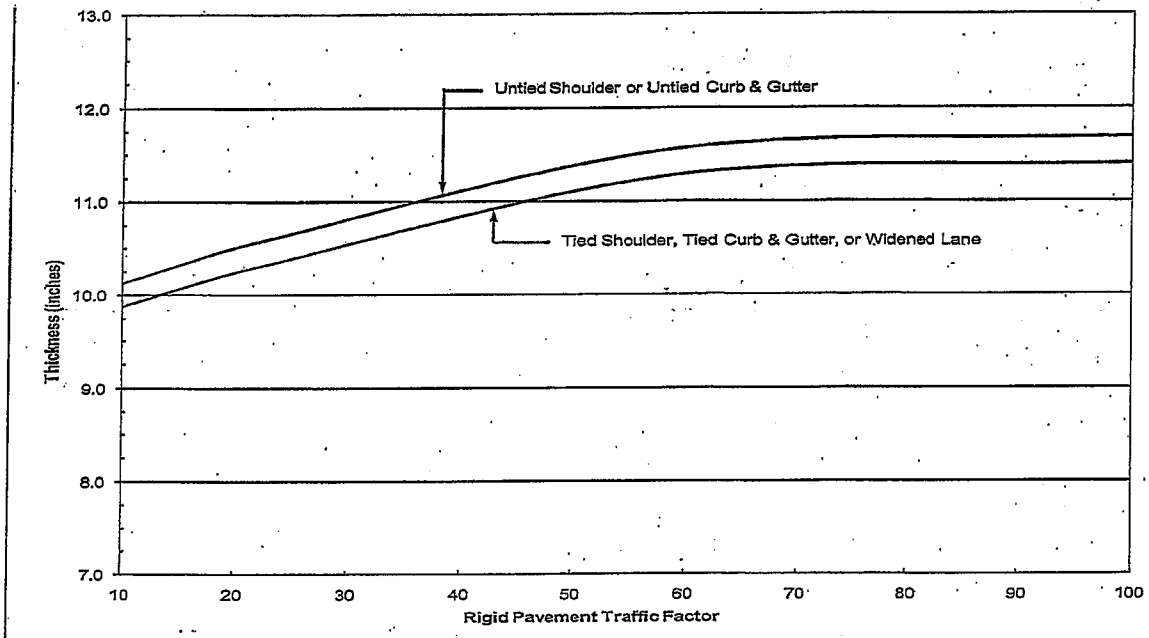


HMA THICKNESS DESIGN CHART
(Mechanistic Design: Flexible Pavement: SSR = Poor)

Figure 54-5.F

HARD COPIES UNCONTROLLED





Note: Use of untied shoulder design requires BDE approval.

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

Figure 54-4.E

HARD COPIES UNCONTROLLED

Revised July 1, 1991

MECHANISTIC PAVEMENT DESIGN

Dixie / Western Ave
~~Route~~

Date 6/20/2011

Calculations by: MK

Checked by: _____

Section 1414.2B

_____ County

Class I Roads and Streets

Location IL-83

Urban ✓ Rural _____

Limits of Analysis Station 5998+11 to Station 6024+60

Length 2649 Feet 0.5 Miles

Structural Design Traffic

PV = 10,116

SU = 0

MU = 2221

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 = 9.65 Minimum TF_F = 4.27

Selected Design AC Type 20

Design AC Mixture Temp. 75.1 ° F.

Design E_{AC} 690 KSI

Design AC Microstrain 64

AC Thickness 12 1/4" Inch

Rigid Pavement Design Actual TF_R = 13.97 Minimum TF_R = 6.03

Extended Lane 10" Inch

15' Panel PCC Thickness for: Tied Shoulder _____ Inch

Untied Shoulder _____ Inch

Figure 5.05

Revised July 1, 1991

RIGID PAVEMENT

Date: 6/20/2011 Dixie hwy / Westerave ~~Route~~

Quantities by: _____ Checked by: _____ Section _____

Unit Prices by: _____ Checked by: _____ _____ County

Net Length 2649 Lin. Ft. 0.5 Miles

Number Lanes 4 Urban ✓ Rural _____

ITEMIZED CONSTRUCTION COST

Quantity	Unit	Item	Unit Cost	Total Cost
12,951 Sq. Yds.	10" -Inch	Jointed PCC	@ $ 50	= $ 647550
14,717 Sq. Yds.	~~4-Inch~~ 4 1/2" Stab Subbase	(Stabilized/Granular Subbase)	@ $ 17	= $ 250189
____ Sq. Yds.	____ -Inch	PCC Shoulders	@ $ ____	= $ ____
____ Lin. Ft.		Pipe Underdrains	@ $ ____	= $ ____
____		Subbase Gran. Mat., Type C	@ $ ____	= $ ____
10,596 Lin. Ft.		100% Shoulder Joint Seal	@ $ 2	= $ 21192
			@ $ ____	= $ ____
			@ $ ____	= $ ____

Total Cost of Original Pavement Construction $ 918,931

ITEMIZED MAINTENANCE AND REHABILITATION ACTIVITY COST

REHABILITATION ACTIVITY 1 - YEAR 10

13 Sq. Yds.	0.1% Full-Depth PCC Pavement Patching	@ $ 90	= $ 1170

Total Cost of Rehabilitation Activity 1 $ 1170

FIGURE 5.05a(1)

REHABILITATION ACTIVITY 2 - YEAR 15

26 Sq. Yds. 0.2% Full-Depth PCC Pavement Patching @ $ 90 = $ 2340

Total Cost of Rehabilitation Activity 2 $ 2340

REHABILITATION ACTIVITY 3 - YEAR 20

260 Sq. Yds. 2% Full-Depth PCC Pavement Patching @ $ 90 = $ 23400

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

10596 Lin. Ft. 100% Longitudinal/Shoulder Joint Routing & Sealing @ $ 2 = $ 21192

5298 Lin. Ft. 100% Centerline Joint Routing & Sealing @ $ 2 = $ 10596

Total Cost of Rehabilitation Activity 3 $ 55188

FIGURE 5.05a(2)

RIGID PAVEMENT (Cont.)

___ Route _____

Section _____

_____ County

REHABILITATION ACTIVITY 4 - YEAR 25

390	Sq. Yds.	3.0% Full-Depth PCC Pavement Patching	@ $ 90	= $	35100
0	Sq. Yds.	1.0% Full-Depth PCC Shoulder Patching	@ $ _____	= $	_____
		Total Cost of Rehabilitation Activity 4		$	35100

REHABILITATION ACTIVITY 5 - YEAR 30

520	Sq. Yds.	4.0% Full-Depth PCC Pavement Patching	@ $ 90	= $	46800
0	Sq. Yds.	1.5% Full-Depth PCC Shoulder Patching	@ $ _____	= $	_____
12951	Sq. Yds.	Policy HMA Overlay - Pavement	@ $ 20	= $	259020
0	Sq. Yds.	Policy HMA Overlay - Shoulder	@ $ _____	= $	_____
		Total Cost of Rehabilitation Activity 5		$	305820

REHABILITATION ACTIVITY 6 - YEAR 35

10596	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@ $ 2	= $	21192
5298	Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $ 2	= $	10596
1325	Lin. Ft.	50% Random Crack Routing and Sealing - Assume 100 ft/Station	@ $ 2	= $	2650
1059	Lin. Ft.	40% Reflective Transverse Crack Routing & Sealing	@ $ 2	= $	2118
13	Sq. Yds.	0.1% Partial-Depth Pavement Patching (Mill & Fill Surface-Interstates; Mill & Fill 2.5 in-Non-Interstates)	@ $ 60	= $	780
		Total Cost of Rehabilitation Activity 6		$	37336

FIGURE 5.05a(3)

RIGID PAVEMENT (Cont.)

____ Route _____

Section _____

_____ County

REHABILITATION ACTIVITY 7 - YEAR 40

65	Sq. Yds.	0.5% Full-Depth PCC Pavement Patching	@ $ 90	= $ 5850
65	Sq. Yds.	0.5% Partial-Depth Pavement Patching (Mill & Fill Surface-Interstates; Mill & Fill 2.5 in. Non-Interstates)	@ $ 60	= $ 3900
1272	Lin. Ft.	60% Reflective Transverse Crack Routing and Sealing	@ $ 2	= $ 2544
1325	Lin. Ft.	50% Random Crack Routing & Sealing- Assume 100ft/Station	@ $ 2	= $ 2650
10596	Lin. Ft.	100% Longitudinal/Shoulder Joint Routing & Sealing	@ $ 2	= $ 21192
5298	Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $ 2	= $ 10596

Total Cost of Rehabilitation Activity 7 $ 46732

$\left(\frac{2649 \times 12}{15}\right) \times 0.6$

FIGURE 5.05a(4)

RIGID PAVEMENT (Cont.)

____ Route _____

Section _____

_____ County

ANNUAL COST DETERMINATION

Present Worth Calculation:

Total Cost of Original Pavement Construction $ 918,931

Present Worth of Rehabilitation Activity 1	$ 1170	X 0.7441 = $	871
Present Worth of Rehabilitation Activity 2	$ 2340	X 0.6419 = $	1502
Present Worth of Rehabilitation Activity 3	$ 55188	X 0.5537 = $	30558
Present Worth of Rehabilitation Activity 4	$ 35100	X 0.4776 = $	16764
Present Worth of Rehabilitation Activity 5	$ 30582	X 0.4120 = $	125998
Present Worth of Rehabilitation Activity 6	$ 37336	X 0.3554 = $	13269
Present Worth of Rehabilitation Activity 7	$ 46732	X 0.3066 = $	14328

Total Life Cycle Cost (Present Worth) $ 112,221

Annual Cost Per Mile Calculation

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

($ 112 221 X 0.04679/0.5 Mi.) = $ 91550 /Yr.-Mi.

FIGURE 5.05a(5)

FLEXIBLE PAVEMENT

Date: _____ Route _____

Quantities by: MK Checked by: _____ Section _____

Unit Prices by: _____ Checked by: _____ _____ County

Net Length 2649 Lin. Ft. 0.5 Miles

Number Lanes 4 Urban ✓ Rural _____

~~Single Lane Paving~~ ✓ Dual Lane Paving _____

ITEMIZED CONSTRUCTION COST

Quantity	Unit	Item		Unit Cost	Total Cost
12951	Sq. Yds.		4" Poly SMA S.C. @120/Ton 2901 Tons -Class I Surface Course	@ $ 26.88	= $ 348120
12951	Sq. Yds.		8 1/4" P HMA B.C. N90 5983 Ton -Inch Class I Binder Course @70/Ton	@ $ 32.33	= $ 418810
	Sq. Yds.		-Inch Stabilized Shoulders	@ $	= $
	Lin. Ft.		Pipe Underdrains	@ $	= $
			Subbase Gran. Matl., Type C	@ $	= $
				@ $	= $
				@ $	= $

Total Cost of Original Pavement Construction $ 766930

ITEMIZED MAINTENANCE AND REHABILITATION ACTIVITY COST

REHABILITATION ACTIVITY 1 - YEAR 5

1325 Lin. Ft.	50% Random/Thermal Crack Routing & Sealing (Assume 110ft/station)	@ $ 2	= $ 2650
10596 Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@ $ 2	= $ 21192
5298 Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $ 2	= $ 10596
13 Sq. Yds.	0.1% Partial-Depth Pavement Patching -Mill & Fill Surface	@ $ 50	= $ 650

Total Cost of Rehabilitation Activity 1 $ 35088

FIGURE 5.05b(1)

FLEXIBLE PAVEMENT (Cont.)

___ Route _____

Section _____

_____ County

REHABILITATION ACTIVITY 2 - YEAR 10

65 Sq. Yds.	0.5% Partial-Depth HMA Pavement Patching - Mill & Fill Surface	@ $	50	= $ 3250
1325 Lin. Ft.	50% Random/Thermal Crack Routing & Sealing (Assume 110ft/station)	@ $	2	= $ 2650
10596 Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@ $	.2	= $ 21192
5298 Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $	2	= $ 10596

Total Cost of Rehabilitation Activity 2 $ 37688

REHABILITATION ACTIVITY 3 - YEAR 15

12951 Sq. Yds.	2.00 in. milling - Pavement & Shoulder	@ $	2.25	= $ 29140
130 Sq. Yds.	1.0% Partial-Depth Pavement Patching (Mill & Fill Additional 2.00 in.)	@ $	50	= $ 6500
1450 Tons	2.00 in. HMA Overlay Pavement & Shoulder	@ $	90	= $ 130500

Total Cost of Rehabilitation Activity 3 $ 166140

FLEXIBLE PAVEMENT (Cont.)

____ Route _____

Section _____

_____ County

REHABILITATION ACTIVITY 4 - YEAR 20

10596	Lin. Ft.	100% Longitudinal Shoulder Joint Routing and Sealing	@ $ 2	= $	21192
5298	Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $ 2	= $	10596
1325	Lin. Ft.	50% Random/Thermal Crack Routing & Sealing (Assume 110 ft/Station)	@ $ 2	= $	2650
13	Sq. Yds.	0.1% Partial-Depth HMA Pavement Patching (Mill & Fill Surface)	@ $ 50	= $	650
		Total Cost of Rehabilitation Activity 4		$	35088

REHABILITATION ACTIVITY 5- YEAR 25

10596	Lin. Ft.	100% Longitudinal Shoulder Joint Routing and Sealing	@ $ 2	= $	21192
5298	Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $ 2	= $	10596
1325	Lin. Ft.	50% Random/Thermal Crack Routing & Sealing (Assume 110 ft/Station)	@ $ 2	= $	2650
65	~~Lin. Ft.~~ Sq. Yd.	0.50% Partial-Depth Pavement Patching (Mill & Fill Surface)	@ $ 50	= $	3250
		Total Cost of Rehabilitation Activity 7		$	37688

REHABILITATION ACTIVITY 6 - YEAR 30

12951	Sq. Yds.	2.00 in. Milling (Pavement Only-Standard Design Pavement & Shoulder-Limiting Strain Criterion Design)	@ $ 2.25	= $	29140
260	Sq. Yds.	2.0% Partial-Depth HMA Pavement Patching (Mill & Fill Additional 2.00 in. All Designs)	@ $ 50	= $	13000
130	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	$	6500
2720	Tons	HMA Overlay (3.75 in.-Standard Pavement Design 2.00 in.--Limiting Strain Criterion Design)	@ $ 90	= $	244800
1450	Tons	HMA Overlay-Shoulder (1.75 in. Standard Design; 2.00 in.-Limiting Strain Criterion Design)	@ $ 90	= $	130500

Total Cost of Rehabilitation Activity 6 $ 423940

FIGURE 5.05b(3)

FLEXIBLE PAVEMENT (Cont.)

___ Route _____
Section _____
_____ County

REHABILITATION ACTIVITY 7 - YEAR 35

10596	Lin. Ft.	100% Longitudinal Shoulder Joint Routing and Sealing	@ $ 2	= $	21192
5298	Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $ 2	= $	10596
1325	Lin. Ft.	50% Random/Thermal Crack Routing & Sealing (Assume 110 ft/Station)	@ $ 2	= $	2650
13	Sq. Yds.	0.10% Partial-Depth Pavement Patching (Mill & Fill Surface)	@ $ 50	= $	650
		Total Cost of Rehabilitation Activity 7		$	35088

REHABILITATION ACTIVITY 8 - YEAR 40

10596	Lin. Ft.	100% Longitudinal Shoulder Joint Routing and Sealing	@ $ 2	= $	21192
5298	Lin. Ft.	100% Centerline Joint Routing & Sealing (Single lane and dual lane paving)	@ $ 2	= $	10596
1325	Lin. Ft.	50% Random/Thermal Crack Routing & Sealing	@ $ 2	= $	2650
65	Sq. Yds.	0.50% Partial-Depth Pavement Patching (Mill & Fill Surface)	@ $ 50	= $	3250
		Total Cost of Rehabilitation Activity 8		$	37688

FIGURE 5.05b(4) - continued

FLEXIBLE PAVEMENT (Cont.)

____ Route _____

Section _____

_____ County

ANNUAL COST DETERMINATION

Present Worth Calculation:

					Present Worth
Total Cost of Original Pavement Construction					$ 266930
Present Worth of Rehabilitation Activity	1	$ 35088	X 0.8626 =	$	30267
Present Worth of Rehabilitation Activity	2	$ 37688	X 0.7441 =	$	28043
Present Worth of Rehabilitation Activity	3	$ 166140	X 0.6419 =	$	106645
Present Worth of Rehabilitation Activity	4	$ 35088	X 0.5537 =	$	19428
Present Worth of Rehabilitation Activity	5	$ 37688	X 0.4776 =	$	18000
Present Worth of Rehabilitation Activity	6	$ 423940	X 0.4120 =	$	174663
Present Worth of Rehabilitation Activity	7	$ 35088	X 0.3554 =	$	12470
resent Worth of Rehabilitation Activity	8	$ 37688	X 0.3066 =	$	11555

Total Life Cycle Cost (Present Worth) $ 116800

Annual Cost Per Mile Calculation

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

($ 116800 X 0.04079/0.5 Mi.) = $ 95285/Yr.-Mi.

Conclusion:

Rigid = $ 91550 } → 95285 - 91550 = 3735

Flex = $ 95285 } → 3735 / 91550 =

4 % PCC

FIGURE 5.05b(5)

Revised July 1, 1991

MECHANISTIC PAVEMENT DESIGN

Date 6/16/2011 — IL Route 83

Calculations by: MK — Section 1414.2B

Checked by: _____ — Cook County

Class I Roads and Streets — Location Kezie to western

Urban ✓ Rural _____

Limits of Analysis — Station 1005+73 to Station 1080+00

Length 7427 Feet 1.41 Miles

Structural Design Traffic — Percent of S.D.T. in Design Lane

PV = 20,358 — P = 32 %

SU = 0 — S = 45 %

MU = 893 — U = 45 %

MINIMUM SUBGRADE SUPPORT RATING = "poor"

Flexible Pavement Design — Actual TF_F = 3.9 — Minimum TF_F = 4.27

Selected Design AC Type 20

Design AC Mixture Temp. 75.1 ° F. — Design E_{AC} 690 KSI

Design AC Microstrain 80 — AC Thickness 10 1/2" Inch

Rigid Pavement Design — Actual TF_R = 5.61 — Minimum TF_R = 6.03

Extended Lane 9 1/4" Inch

15' Panel PCC Thickness for: Tied Shoulder _____ Inch

Untied Shoulder _____ Inch

Figure 5.05

RIGID PAVEMENT

Date: 6/19/11 IL Route 83

Quantities by: _____ Checked by: _____ Section 1414.2B

Unit Prices by: _____ Checked by: _____ Cook County

Net Length 7427 Lin. Ft. 1.41 Miles

Number Lanes 4 Urban ✓ Rural _____

ITEMIZED CONSTRUCTION COST

Quantity	Unit	Item	Unit Cost	Total Cost
42,912 Sq. Yds.	9¼"-Inch (4.5")	Jointed PCC	@ $ 45	= $ 1931040
47,863 Sq. Yds.	~~4~~-Inch	(Stabilized/Granular Subbase)	@ $ 15	= $ 717945
0 Sq. Yds.	_____-Inch	PCC Shoulders	@ $ _____	= $ _____
_____ Lin. Ft.		Pipe Underdrains	@ $ _____	= $ _____
0		Subbase Gran. Mat., Type C	@ $ _____	= $ _____
29,708 Lin. Ft.		100% Shoulder Joint Seal	@ $ 2	= $ 59416
			@ $ _____	= $ _____
			@ $ _____	= $ _____

Total Cost of Original Pavement Construction $ 2708461

ITEMIZED MAINTENANCE AND REHABILITATION ACTIVITY COST

REHABILITATION ACTIVITY 1 - YEAR 10

43 Sq. Yds.	0.1%	Full-Depth PCC Pavement Patching	@ $ 90	= $ 3870

Total Cost of Rehabilitation Activity 1 $ 3870

RIGID PAVEMENT (Cont.)

___ Route _____

Section _____

_____ County

REHABILITATION ACTIVITY 2 - YEAR 15

86 Sq. Yds. 0.2% Full-Depth PCC Pavement Patching @ $ 90 = $ 7740

Total Cost of Rehabilitation Activity 2 $ 7740

REHABILITATION ACTIVITY 3 - YEAR 20

860 Sq. Yds. 2% Full-Depth PCC Pavement Patching @ $ 90 = $ 77400

5 Sq. Yds. 0.5% Full-Depth PCC Shoulder Patching @ $ _____ = $ _____

29708 Lin. Ft. 100% Longitudinal/Shoulder Joint Routing & Sealing @ $ 2 = $ 59416

14854 Lin. Ft. 100% Centerline Joint Routing & Sealing @ $ 2 = $ 29708

Total Cost of Rehabilitation Activity 3 $ 166524

FIGURE 5.05a(2)

RIGID PAVEMENT (Cont.)

___ Route _____

Section _____

_____ County

REHABILITATION ACTIVITY 4 - YEAR 25

1290	Sq. Yds.	3.0% Full-Depth PCC Pavement Patching	@ $ 90	= $	116100
0	Sq. Yds.	1.0% Full-Depth PCC Shoulder Patching	@ $ _____	= $	_____
		Total Cost of Rehabilitation Activity 4		$	116100

REHABILITATION ACTIVITY 5 - YEAR 30

1720	Sq. Yds.	4.0% Full-Depth PCC Pavement Patching	@ $ 90	= $	154800
0	Sq. Yds.	1.5% Full-Depth PCC Shoulder Patching	@ $ _____	= $	_____
42912	Sq. Yds.	Policy HMA Overlay - Pavement	@ $ 20	= $	858240
0	Sq. Yds.	Policy HMA Overlay - Shoulder	@ $ _____	= $	_____
		Total Cost of Rehabilitation Activity 5		$	1129140

REHABILITATION ACTIVITY 6 - YEAR 35

29708	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@ $ 2	= $	59416
14854	Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $ 2	= $	29708
3713	Lin. Ft.	50% Random Crack Routing and Sealing - Assume 100 ft/Station	@ $ 2	= $	7426
2970	Lin. Ft.	40% Reflective Transverse Crack Routing & Sealing	@ $ 2	= $	5940
43	Sq. Yds.	0.1% Partial-Depth Pavement Patching (Mill & Fill Surface - Interstates; Mill & Fill 2.5 in. - Non-Interstates)	@ $ 60	= $	2580
		Total Cost of Rehabilitation Activity 6		$	105070

RIGID PAVEMENT (Cont.)

___ Route _____

Section _____

_____ County

REHABILITATION ACTIVITY 7 - YEAR 40

215	Sq. Yds.	0.5% Full-Depth PCC Pavement Patching	@ $ 90 = $	19350
215	Sq. Yds.	0.5% Partial-Depth Pavement Patching (Mill & Fill Surface - Interstates; Mill & Fill 2.5 in. Non-Interstates)	@ $ 60 = $	12900
3565	Lin. Ft.	60% Reflective Transverse Crack Routing and Sealing	@ $ 2 = $	7130
3713	Lin. Ft.	50% Random Crack Routing & Sealing - Assume 100ft/Station	@ $ 2 = $	7426
29708	Lin. Ft.	100% Longitudinal/Shoulder Joint Routing & Sealing	@ $ 2 = $	59416
14854	Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $ 2 = $	29708

Total Cost of Rehabilitation Activity 7 $ 135930

$\left(\frac{7427 \times 12}{15}\right) \times 0.6$

FIGURE 5.05a(4)

RIGID PAVEMENT (Cont.)

___ Route _____

Section _____

_____ County

ANNUAL COST DETERMINATION

Present Worth Calculation:

Total Cost of Original Pavement Construction $ 27,840

Present Worth of Rehabilitation Activity 1	$ 3870	X 0.7441 = $	2880
Present Worth of Rehabilitation Activity 2	$ 7740	X 0.6419 = $	4968
Present Worth of Rehabilitation Activity 3	$ 166524	X 0.5537 = $	92204
Present Worth of Rehabilitation Activity 4	$ 116160	X 0.4776 = $	55449
Present Worth of Rehabilitation Activity 5	$ 112940	X 0.4120 = $	46526
Present Worth of Rehabilitation Activity 6	$ 105070	X 0.3554 = $	37342
Present Worth of Rehabilitation Activity 7	$ 135930	X 0.3066 = $	41676

Total Life Cycle Cost (Present Worth) $ 34,8126

Annual Cost Per Mile Calculation

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

($ 34,8126 X 0.04079/1.41 Mi.) = $ 98594 /Yr.-Mi.

FIGURE 5.05a(5)

Revised July 1, 1991
Sheet 1 of 5

FLEXIBLE PAVEMENT

Date: _____ IL Route 83

Quantities by: MK Checked by: _____ Section 1414.2B

Unit Prices by: _____ Checked by: _____ Cook County

Net Length _____ Lin. Ft. _____ Miles

Number Lanes 4 Urban ✓ Rural _____

Single Lane Paving ✓ Dual Lane Paving _____

ITEMIZED CONSTRUCTION COST

Quantity	Unit	Item	Unit Cost	Total Cost
42,912	Sq. Yds.	4" Poly SMA S.C @116/Ton (9612 Tons) ~~Class I Surface Course~~	@ $ 25.98	= $ 1114853
42,912	Sq. Yds.	6 1/2" Poly HMA B.C. Nq 1562 Tons -Inch Class I Binder Course @65/Ton	@ $ 22.66	= $ 1015298
	Sq. Yds.	-Inch Stabilized Shoulders	@ $	= $
	Lin. Ft.	Pipe Underdrains	@ $	= $
		Subbase Gran. Matl., Type C	@ $	= $
			@ $	= $
			@ $	= $

Total Cost of Original Pavement Construction $ 2130150

ITEMIZED MAINTENANCE AND REHABILITATION ACTIVITY COST

REHABILITATION ACTIVITY 1 - YEAR 5

3713 Lin. Ft.	50% Random/Thermal Crack Routing & Sealing (Assume 110ft/station)	@ $ 2	= $ 7426
29708 Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@ $ 2	= $ 59416
14854 Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $ 2	= $ 29708
43 Sq. Yds.	0.1% Partial-Depth Pavement Patching -Mill & Fill Surface	@ $ 50	= $ 2150

Total Cost of Rehabilitation Activity 1 $ 98700

FIGURE 5.05b(1)

FLEXIBLE PAVEMENT (Cont.)

___ Route _____

Section _____

_____ County

REHABILITATION ACTIVITY 2 - YEAR 10

215 Sq. Yds.	0.5% Partial-Depth HMA Pavement Patching - Mill & Fill Surface	@ $ 50	= $ 10750
3713 Lin. Ft.	50% Random Thermal Crack Routing & Sealing (Assume 110 ft/station)	@ $ 2	= $ 7426
29708 Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@ $ 2	= $ 59416
14854 Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $ 2	= $ 29708

Total Cost of Rehabilitation Activity 2 $ 107300

REHABILITATION ACTIVITY 3 - YEAR 15

42912 Sq. Yds.	2.00 in. Milling - Pavement & Shoulder	@ $ 2.25	= $ 96552
430 Sq. Yds.	1.0% Partial-Depth Pavement Patching (Mill & Fill Additional 2.00 in.)	@ $ 50	= $ 21500
4806 Tons	2.00 in. HMA Overlay Pavement & Shoulder	@ $ 90	= $ 432540

Total Cost of Rehabilitation Activity 3 $ 550592

FIGURE 5.05b(2)

___ Route _____
Section _____
_____ County

REHABILITATION ACTIVITY 4 - YEAR 20

29708 Lin. Ft. 100% Longitudinal Shoulder Joint Routing and Sealing @ $ 2 = $ 59416

14854 Lin. Ft. 100% Centerline Joint Routing & Sealing @ $ 2 = $ 29708

3713 Lin. Ft. 50% Random/Thermal Crack Routing & Sealing (Assume 110 ft/Station) @ $ 2 = $ 7426

43 Sq. Yds. 0.1% Partial-Depth HMA Pavement + Patching (Mill & Fill Surface) @ $ 50 = $ 2150

Total Cost of Rehabilitation Activity 4 $ 98700

REHABILITATION ACTIVITY 5 - YEAR 25

29708 Lin. Ft. 100% Longitudinal Shoulder Joint Routing and Sealing @ $ 2 = $ 59416

14854 Lin. Ft. 100% Centerline Joint Routing & Sealing @ $ 2 = $ 29708

3713 Lin. Ft. 50% Random/Thermal Crack Routing & Sealing (Assume 110 ft/Station) @ $ 2 = $ 7426

215 ~~Lin. Ft.~~ Sq. Yd. 0.50% Partial-Depth Pavement Patching (Mill & Fill Surface) @ $ 50 = $ 10750

Total Cost of Rehabilitation Activity 7 $ 107300

REHABILITATION ACTIVITY 6 - YEAR 30

42912 Sq. Yds. 2.00 in. Milling (Pavement Only - Standard Design Pavement & Shoulder - Limiting Strain Criterion Design) @ $ 2.25 = $ 96552

860 Sq. Yds. 2.0% Partial-Depth HMA Pavement Patching (Mill & Fill Additional 2.00 in. All Designs) @ $ 50 = $ 43000

430 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 = $ 21500

9011 Tons HMA Overlay (3.75 in. - Standard Design Pavement; 2.00 in. - Limiting Strain Criterion Design) @ $ 90 = $ 810990

4806 Tons HMA Overlay - Shoulder (1.75 in. Standard Design; 2.00 in. - Limiting Strain Criterion Design) @ $ 90 = $ 432540

Total Cost of Rehabilitation Activity 6 $ 1404582

FIGURE 5.05b(3)

FLEXIBLE PAVEMENT (Cont.)

___ Route _____
Section _____
_____ County

REHABILITATION ACTIVITY 7 - YEAR 35

29708 Lin. Ft.	100% Longitudinal Shoulder Joint Routing and Sealing	@ $ 2	= $	59416
14854 Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $ 2	= $	29708
3713 Lin. Ft.	50% Random/Thermal Crack Routing & Sealing (Assume 110 ft/station)	@ $ 2	= $	7426
43 Sq. Yds.	0.10% Partial-Depth Pavement Patching (Mill & Fill Surface)	@ $ 50	= $	2150
	Total Cost of Rehabilitation Activity 7		$	98700

REHABILITATION ACTIVITY 8 - YEAR 40

29708 Lin. Ft.	100% Longitudinal Shoulder Joint Routing and Sealing	@ $ 2	= $	59416
14854 Lin. Ft.	100% Centerline Joint Routing & Sealing (Single lane and dual lane paving)	@ $ 2	= $	29708
3713 Lin. Ft.	50% Random/Thermal Crack Routing & Sealing	@ $ 2	= $	7426
215 Sq. Yds.	0.50% Partial-Depth Pavement Patching (Mill & Fill Surface)	@ $ 50	= $	10750
	Total Cost of Rehabilitation Activity 8		$	107300

FLEXIBLE PAVEMENT (Cont.)

____ Route _____
Section _____
_____ County

ANNUAL COST DETERMINATION

Present Worth Calculation:

					Present Worth
Total Cost of Original Pavement Construction				$	213015
Present Worth of Rehabilitation Activity	1	$ 98700	X 0.8626 =	$	85139
Present Worth of Rehabilitation Activity	2	$ 107300	X 0.7441 =	$	79842
Present Worth of Rehabilitation Activity	3	$ 550592	X 0.6419 =	$	353425
Present Worth of Rehabilitation Activity	4	$ 98700	X 0.5537 =	$	54650
Present Worth of Rehabilitation Activity	5	$ 107300	X 0.4776 =	$	51246
Present Worth of Rehabilitation Activity	6	$ 1404582	X 0.4120 =	$	578688
Present Worth of Rehabilitation Activity	7	$ 98700	X 0.3554 =	$	35078
resent Worth of Rehabilitation Activity	8	$ 107300	X 0.3066 =	$	32898

Total Life Cycle Cost (Present Worth) $ 3401116

Annual Cost Per Mile Calculation

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

($ 3401116 X 0.04079 / 1MI Mi.) = $ 98391 /Yr.-Mi.

Conclusion:-

Rigid = $ 98594
flex = $ 98391

98594 - 98391 = 203

203 / 98391 = 0.2% HMA

FIGURE 5.05b(5)