Illinois Department of Transportation

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

FAP Route 353 (US Route 30)
Cook County
At CNRR north of Sauk Trail

We have reviewed the pavement selection for the project, which was submitted to BDE by memo dated March 20, 2012. The design meets the warrants for a "high stress" intersection, with MU ADT exceeding 200 vehicles at a stop controlled intersection. The life cycle costs favor the rigid pavement design. The approved pavement design for this project is as follows:

US Route 30 (Pavement Reconstruction)

10 inches of Jointed PCC Pavement with Tied PCC Curb & Gutter
12 inches of Aggregate Subgrade Improvement

Sauk Trail (Pavement Reconstruction)

9.5 inches of Jointed PCC Pavement with Tied PCC Curb & Gutter
12 inches of Aggregate Subgrade Improvement

Frontage Roads (Pavement Resurfacing)

9 inches Full Depth HMA Pavement
2 inches HMA Surface Course, Mix "D", N70
7 inches HMA Binder Course, IL-19.0, N70
12 inches of Aggregate Subgrade Improvement

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

Illinois Department of Transportation

Memorandum

To: John D. Baranzelli, PE

Attn: Paul R. Niedernhofer

From: Diane O'Keefe

By: Jose Dominguez

Subject: Pavement Analysis*

Date: March 20, 2012

*Route: FAP 353 (US 30)
Limits: at CNRR north of Sauk Trail
Contract No.: 60R19
Letting: 06CY13

Section: 11-Y-A
County: Cook
Job No.: P-91-003-10

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

a.) Pavement reconstruction of US 30 to accommodate a changes in alignment for a two span bridge over EJ&E/CN Railroad. The reconstruction includes two 12 foot wide through lanes in each direction separated by an 18 foot wide barrier median.

b.) Segmental pavement reconstruction of Sauk Trail includes one 12 foot wide through lane in each direction at the limits of improvement, transitioning to a five lane section in advance of US Route 30.

c.) Segmental pavement construction of Frontage Roads consisting of one 12 foot wide lane in each direction separated by yellow striping. Curb and gutter are proposed along the outside edges of the pavement.

A 20 year pavement analysis was performed for the pavement reconstruction of US 30 since the pavement reconstruction is less than 25,000 square yards. We recommend a mechanistic-rigid pavement design. The intersection of US 30 and Sauk Trail is considered "high stress" as the design lane MU ADT exceeds 200 vehicles at the stop controlled intersection. The life cycle cost analysis favors PCC pavement by 52.3%. The recommended pavement is:

a.) US 30
Pavement Reconstruction
Tied PCC Curb and Gutter
10" PCC Pavement (Jointed)*
12" Aggregate Subgrade Improvement

We recommend a segmental pavement design for Sauk Trail because existing Sauk Trail was built in 1996 as rigid and the proposed pavement at US 30 will also be rigid. The recommended pavement is:

b.) Sauk Trail
Pavement Reconstruction
Tied PCC Curb and Gutter
9 ½" PCC Pavement (Jointed)**
4 ½" HMA Stabilized Subbase
12" Aggregate Subgrade Improvement

A segmental pavement design was used for the Frontage Roads and a full depth HMA of 8" is the calculated based on the minimum traffic factor. Since this pavement will service various businesses where trucks will be used we recommend a 9" flexible pavement design:

c.) Frontage Roads
Pavement Construction
Curb and Gutter
9" Full Depth HMA Pavement***
2" HMA Surface Course, Mix "D", N70
7" HMA Binder Course, IL-19.0, N70
12" Aggregate Subgrade Improvement

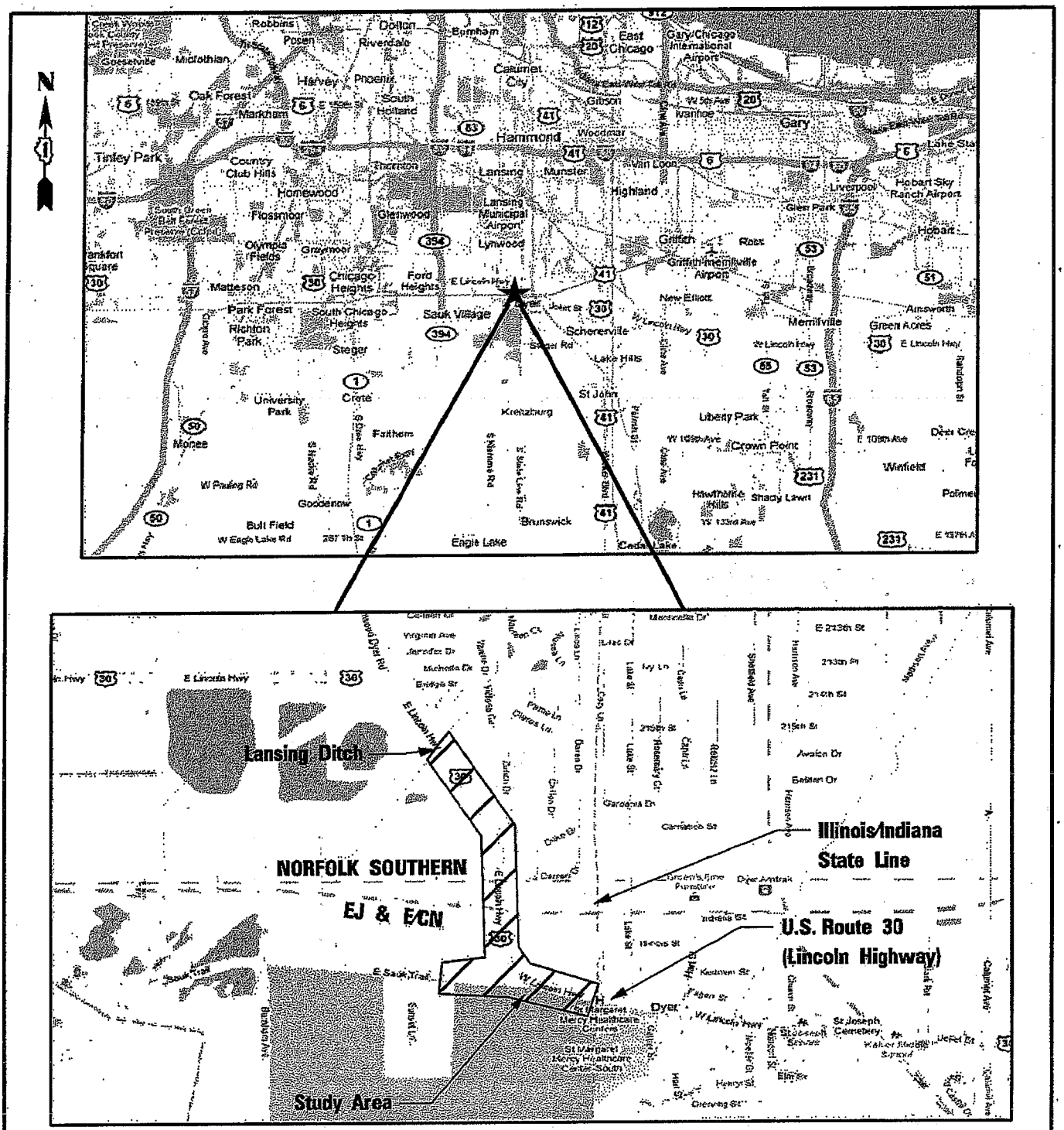
*Designer Note 1: To be paid as pay item #42000501, **PORTLAND CEMENT CONCRETE PAVEMENT 10" (JOINTED)**, paid in square yards.

Designer Note 2: Pavement thickness to match existing pavement. To be paid as pay item #42000411, **PORTLAND CEMENT CONCRETE PAVEMENT 9 ½" (JOINTED), paid in square yards.

***Designer Note 3: To be paid as pay item #40701861, **HOT-MIX ASPHALT PAVEMENT (FULL-DEPTH), 9"**, paid in square yards.

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

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



ILLINOIS DEPARTMENT OF TRANSPORTATION

US ROUTE 30 AT EJ&E/CN RAILROAD

PROJECT LOCATION MAP

SCALE: NTS
DATE: 05-20-11

EXHIBIT A-1

...\Location Map.dgn 5/24/2011 9:36:32 AM

US 30

USE FOR TF ONLY

Spreadsheet by Uehle - Rev. 11/02

MECHANISTIC PAVEMENT DESIGN

Date: 1/18/12

INPUT (Enter Data in Gray Shaded Cells)

Route: FAP 313 (US 30)
Section: 11Y-A
County: Cook
Location: Lansing Ditch to State Line

Comments: Pavement design for US 30 over the CNRR from the Lansing Ditch to the Indiana state line

Designer: TMC

Facility Type: Other Marked State Route

# of Lanes = 4

	ADT	Year
Current:	25000	2009
Future:	34000	2030

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	27,332	92.5%	P = 32%
SU =	250	742	2.5%	S = 45%
MU =	750	1,484	5.0%	M = 45%
		Struct. Design ADT =	29558	(2023)

FLEXIBLE & RIGID PAVEMENT CALCULATIONS AND ADDITIONAL INPUT

Flexible Pavement

Cpv =	0.15	
Csu =	133	
Cmu =	483	
TF flexible (Actual)=	7.35	(Actual ADT)
TF flexible (Min)=	3.56	(Min ADT Fig 54-2C)
Use TF flexible =	7.35	
AC Type =	20	
AC Mixture Tempurature =	80.0	deg. F (Figure 54-5C)
Design AC Mixture Modulus (Eac)=	550	ksi (Figure 54-5D)
Design Asphalt Concrete Microstrain =	55.3	(Figure 54-5E)
Asphalt Concrete Thickness =	15.00	in. (Figure 54-5F)

Rigid Pavement

Cpv =	0.15	
Csu =	144	
Cmu =	696	
TF rigid (Actual)=	10.29	(Actual ADT)
TF rigid (Min)=	5.02	(Min ADT Fig 54-2C)
Use TF rigid =	10.29	
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)

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

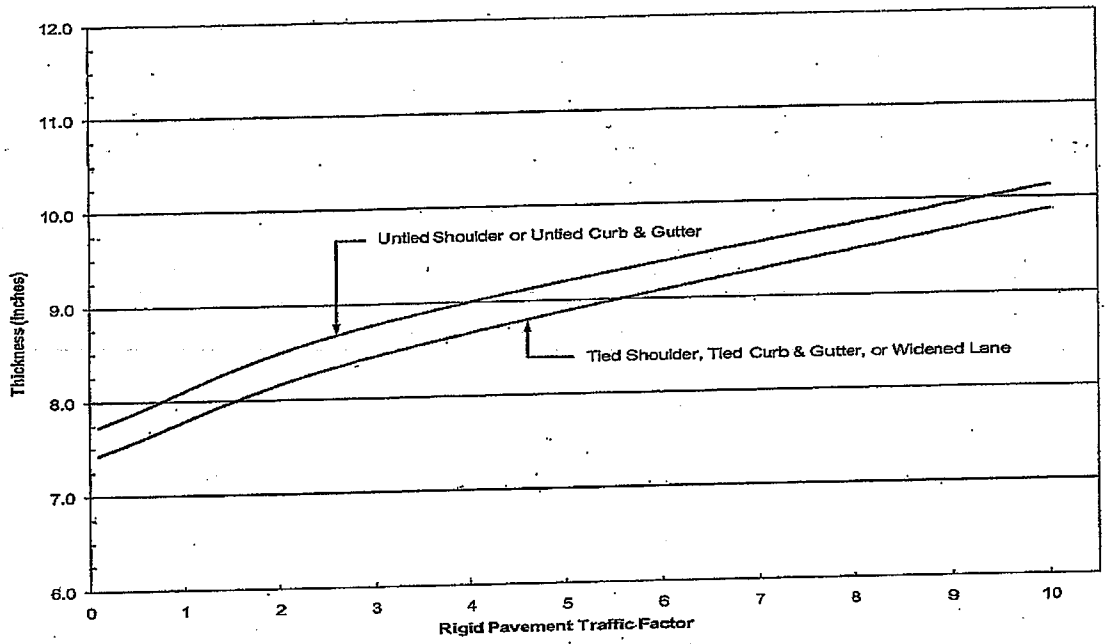
Class Table for One-Way Streets	
ADT	Class
0 - 3500	II
>3501	I

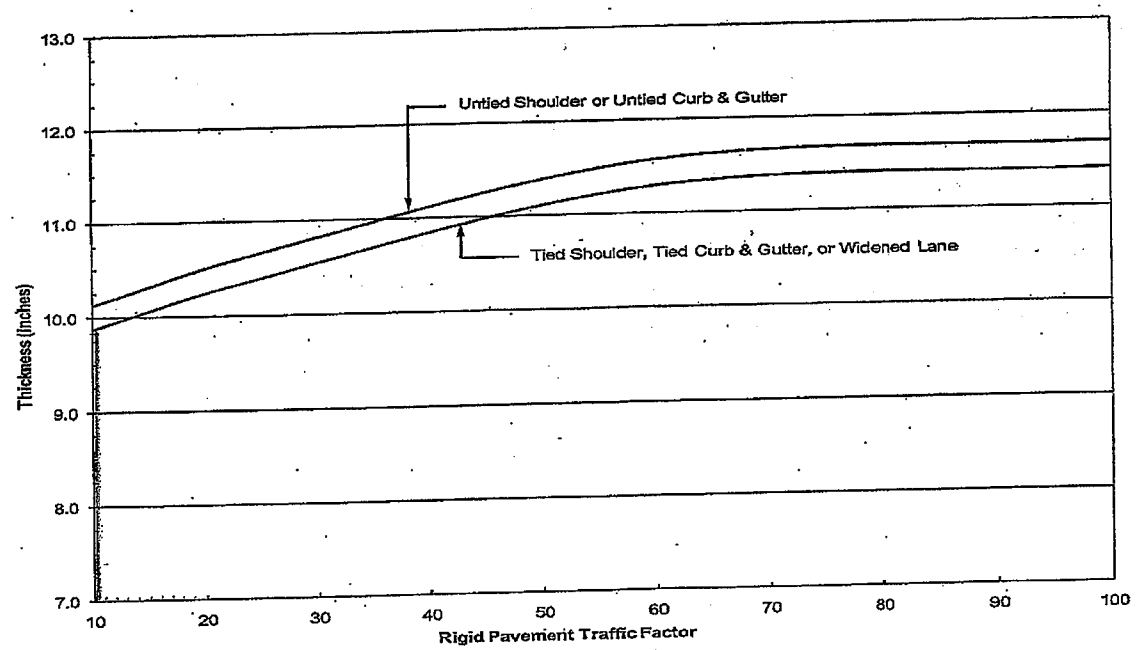
	Traffic Factor ESAL Coefficients			
	Rigid (Fig. 54-4C)		Flexible (Fig. 54-5B)	
Class	Csu	Cmu	Csu	Cmu
I	143.91	595.42	102.50	402.33
II	135.78	567.21	112.06	385.44
III	129.58	562.47	109.14	384.35
IV(ADT>400)	127.75	555.90	109.14	384.35
IV(ADT<=400)	127.75	555.90	9.86	78.84

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	52%	45%	45%	52%	43%	43%
6 or more	20%	40%	40%	8%	37%	37%

US 30





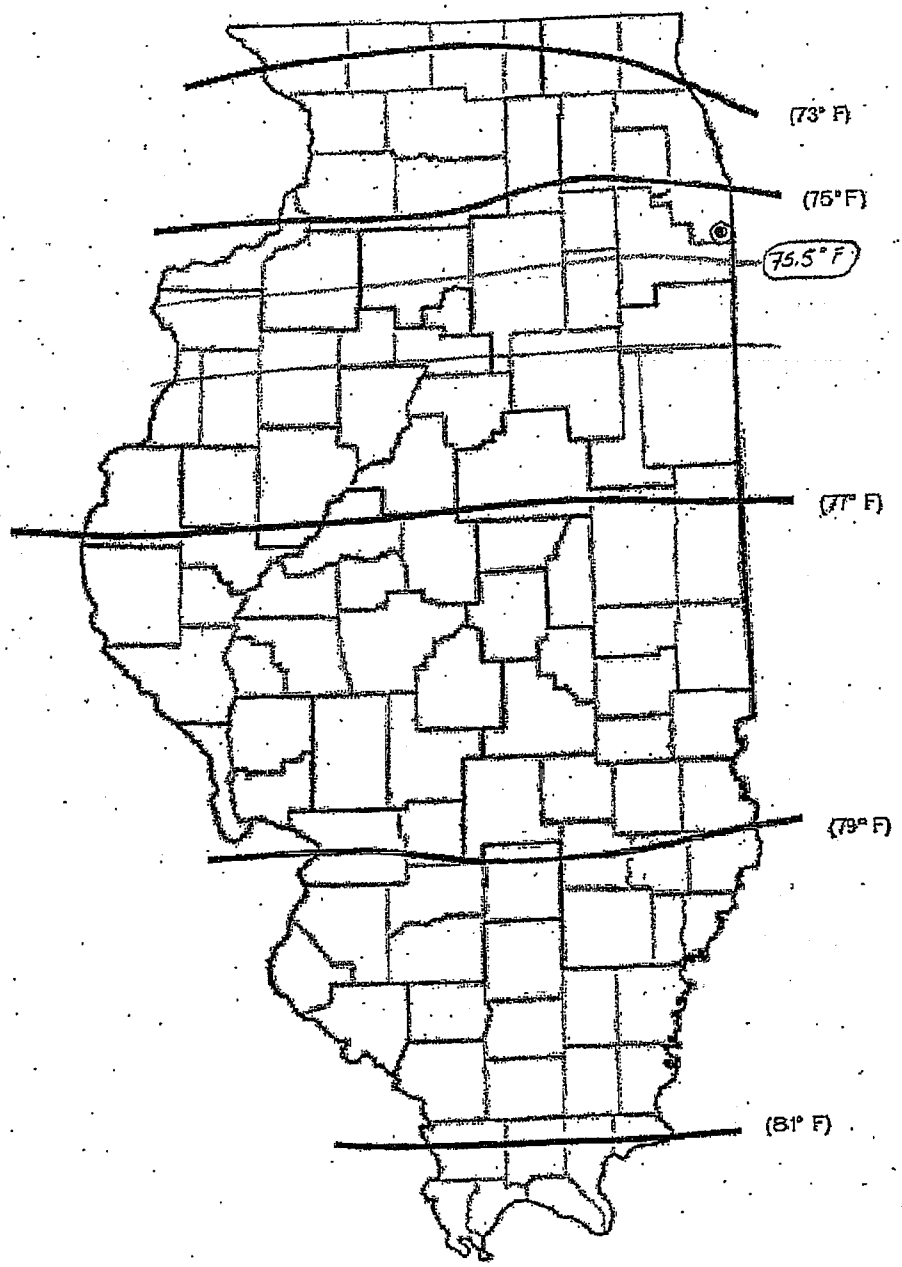
Note: Use of untied shoulder design requires BDE approval.

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

10" JOINTED PCC PAVEMENT

Figure 54-4.E

HARD COPIES UNCONTROLLED

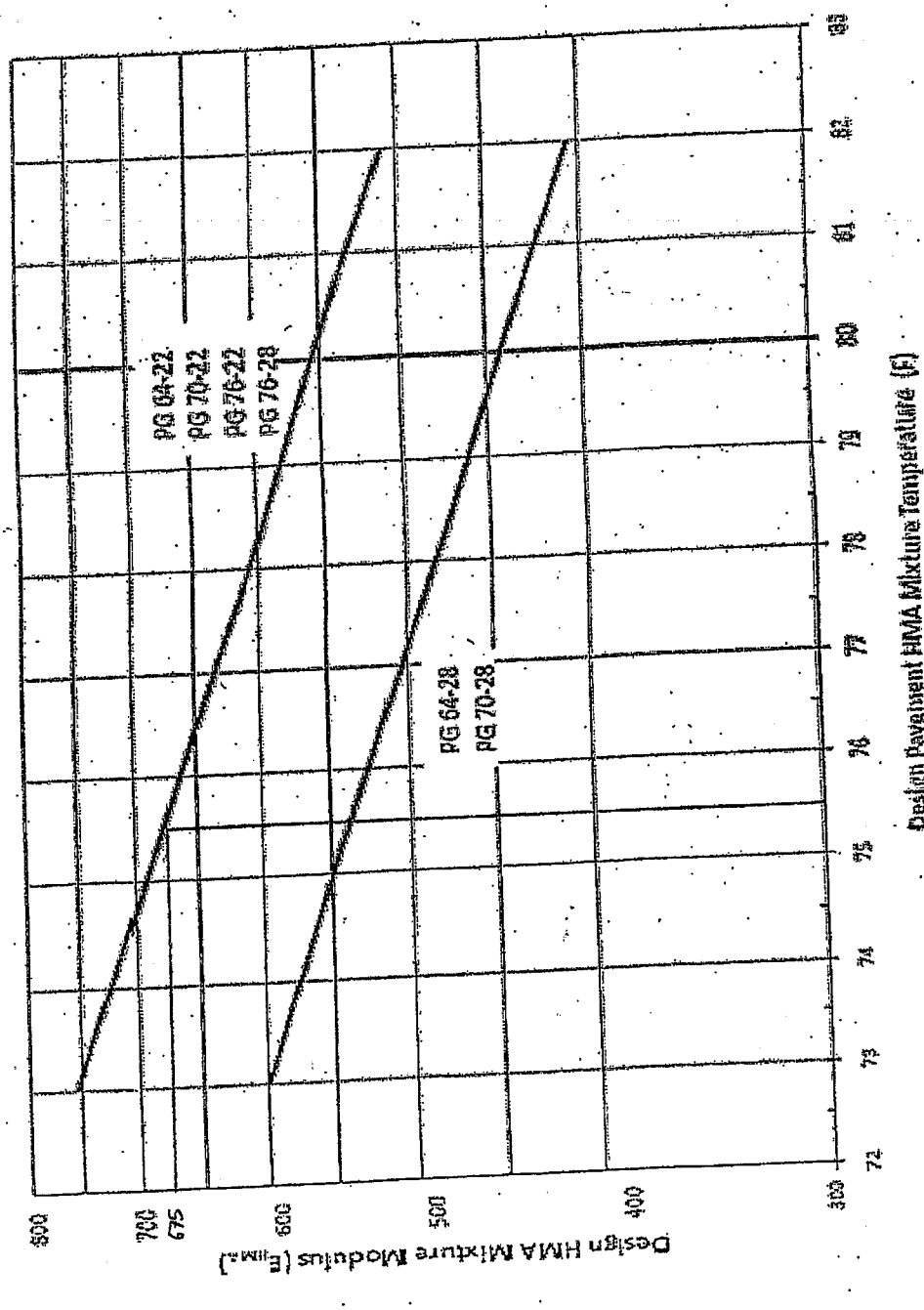


Note: The minimum design HMA mixture temperature will be 73°F.

HMA MIXTURE TEMPERATURE
(Mechanistic Design: Flexible Pavement)

Figure 54-5.C

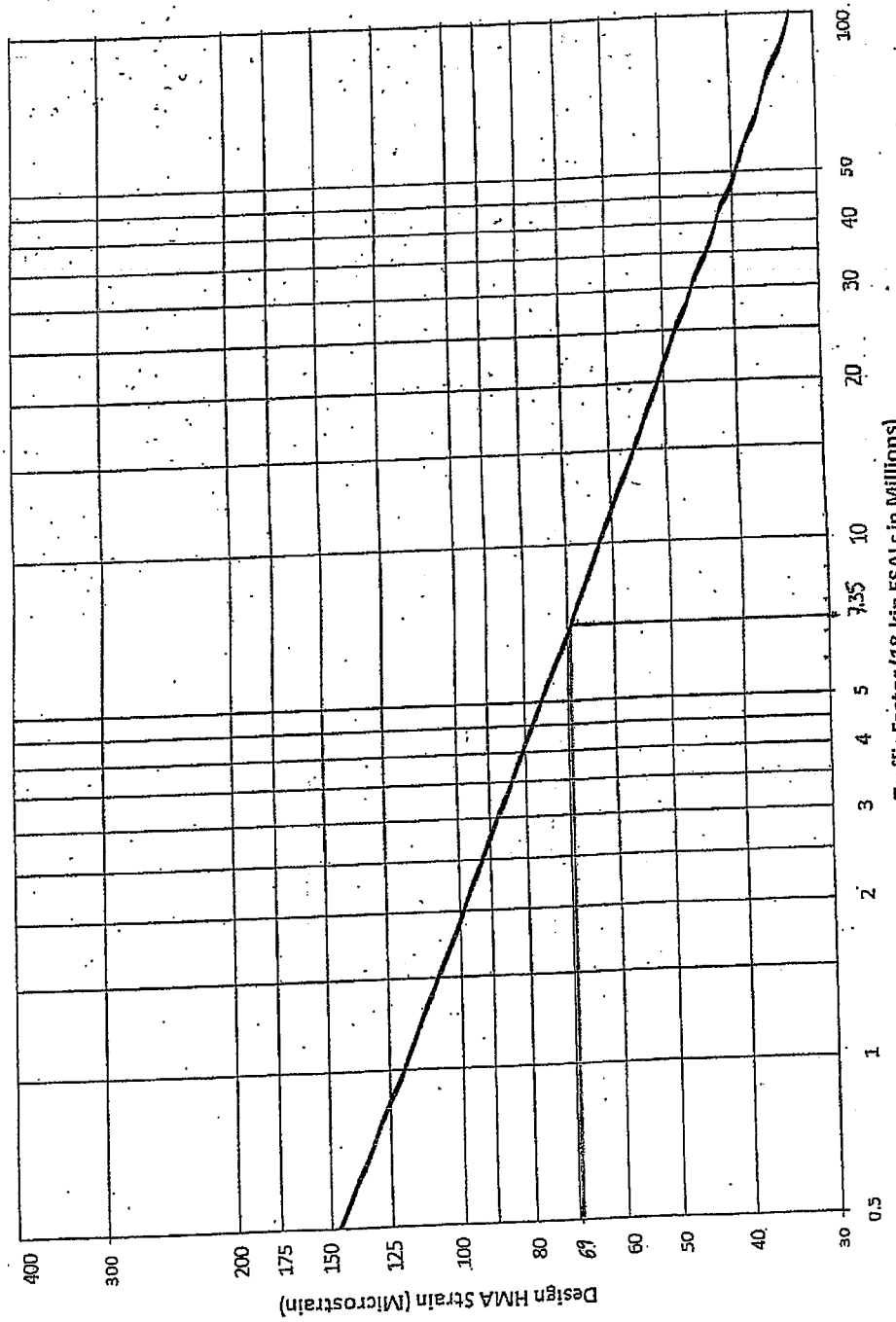
HARD COPIES UNCONTROLLED



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

Figure 54-5.D

HARD COPIES UNCONTROLLED

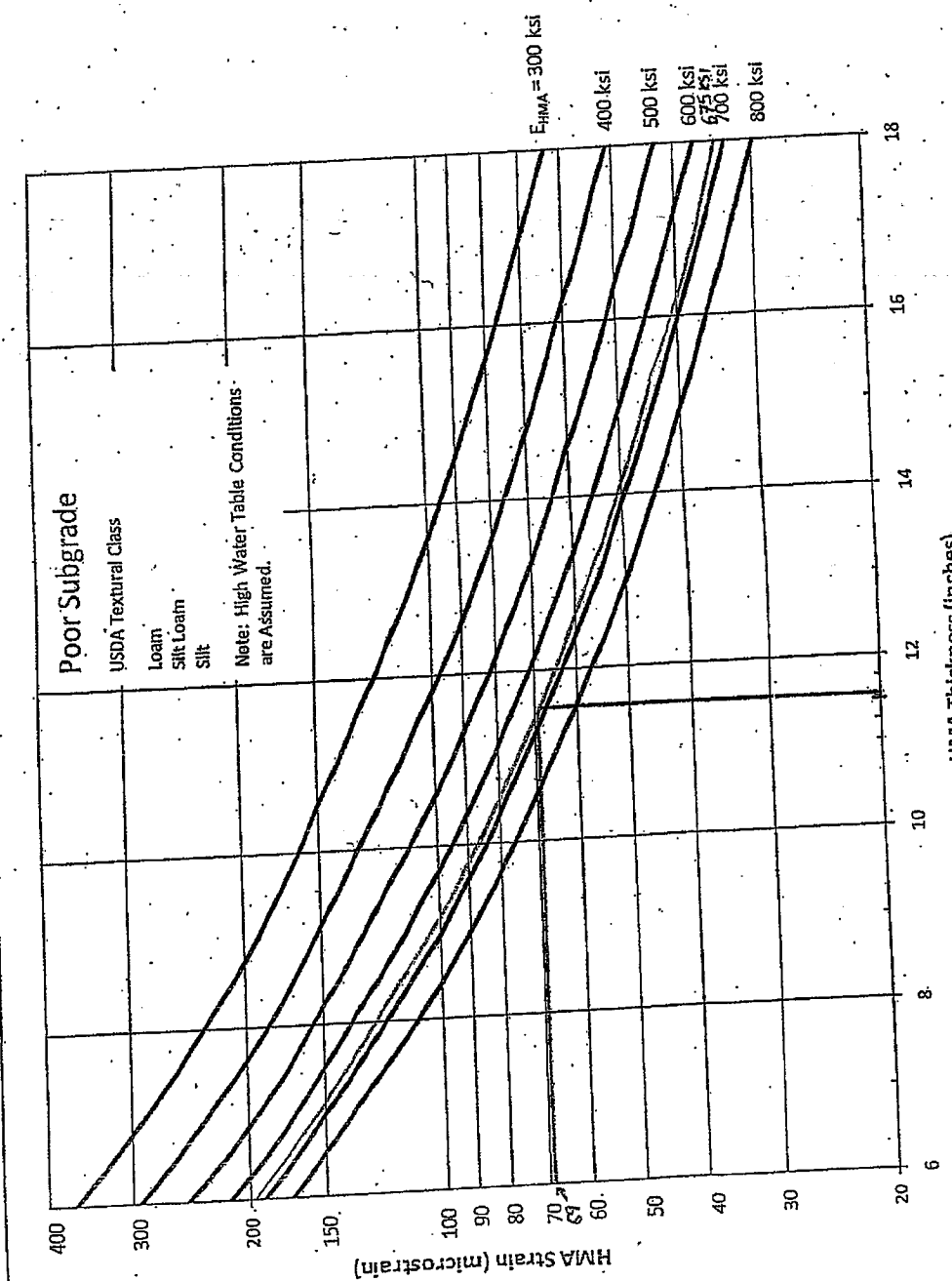


DESIGN HMA STRAIN
(Mechanistic Design: Flexible Pavement)

Figure 54-5.E

HARD COPIES UNCONTROLLED

US 30



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

Figure 54-5.F

11 3/4" FULL DEPTH HMA PAVEMENT

HARD COPIES UNCONTROLLED

SAUK TRAIL

USE FOR TF ONLY

Spreadsheet by Uehle - Rev. 11/02

MECHANISTIC PAVEMENT DESIGN

Date: 1/18/12

INPUT (Enter Data in Gray Shaded Cells)

Route: Sauk Trail
Section: 11-Y-A
County: Cook
Location: Sauk Trail at US 30

Comments: Pavement design for Sauk Trail at US 30

Designer: TMC

	ADT	Year
Current:	13600	2002
Future:	17700	2040

Facility Type: Other Marked State Route

# of Lanes = 2 or 3
Part of future 4 lanes or more ? No
One Way Street ? No
Road Class: II

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

	Minimum ADT	Actual ADT	Actual %of Total ADT	% of ADT in Design Lane
		Structural Design Traffic		
PV =	0	15,220	96.2%	P = 50%
SU =	250	427	2.7%	S = 50%
MU =	750	174	1.1%	M = 50%
		Struct. Design ADT =	15821	(2023)

FLEXIBLE & RIGID PAVEMENT CALCULATIONS AND ADDITIONAL INPUT

Flexible Pavement

Cpv =	0.15	
Csu =	112	
Cmu =	385	
TF flexible (Actual)=	1.17	(Actual ADT)
TF flexible (Min)=	3.17	(Min ADT Fig 54-2C)
Use TF flexible =	3.17	
AC Type =	PG	
AC Mixture Tempurature =	80.0	deg. F (Figure 54-5C)
Design AC Mixture Modulus (Eac)=	550	ksi (Figure 54-5D)
Design Asphalt Concrete Microstrain =	73.0	(Figure 54-5E)
Asphalt Concrete Thickness =	12.75	in. (Figure 54-5F)

Rigid Pavement

Cpv =	0.15	
Csu =	136	
Cmu =	567	
TF rigid (Actual)=	1.59	(Actual ADT)
TF rigid (Min)=	4.59	(Min ADT Fig 54-2C)
Use TF rigid =	4.59	
	Tied	Shoulder or C. &G.
Rigid Pavt Thick =	9.25	in. (Figure 54-4B)

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

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

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

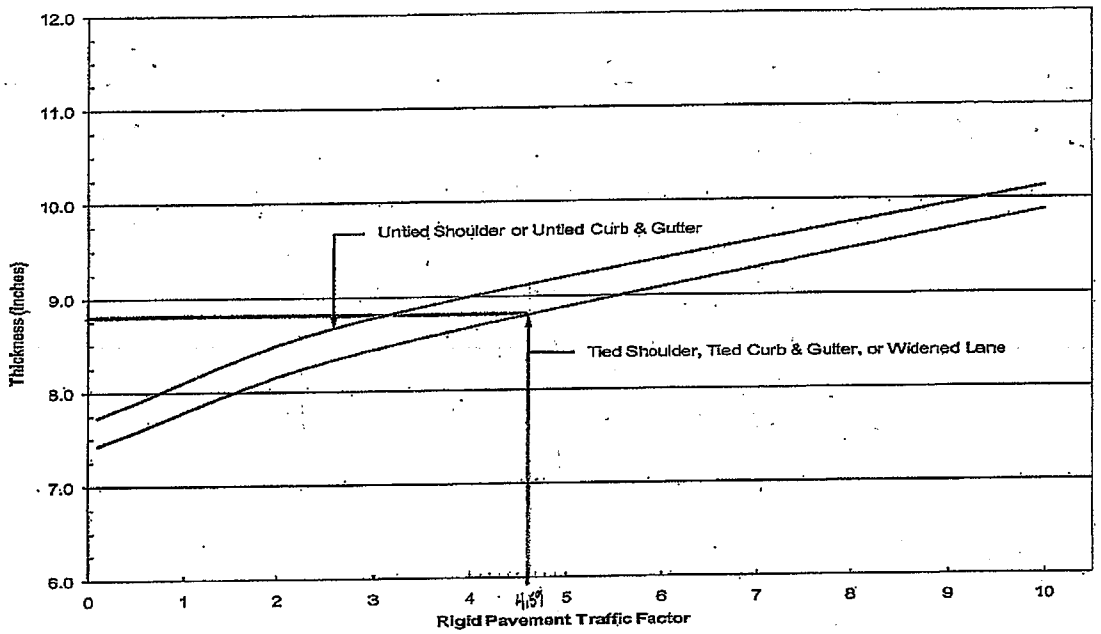
Class Table for One-Way Streets	
ADT	Class
0 - 3500	II
>3501	I

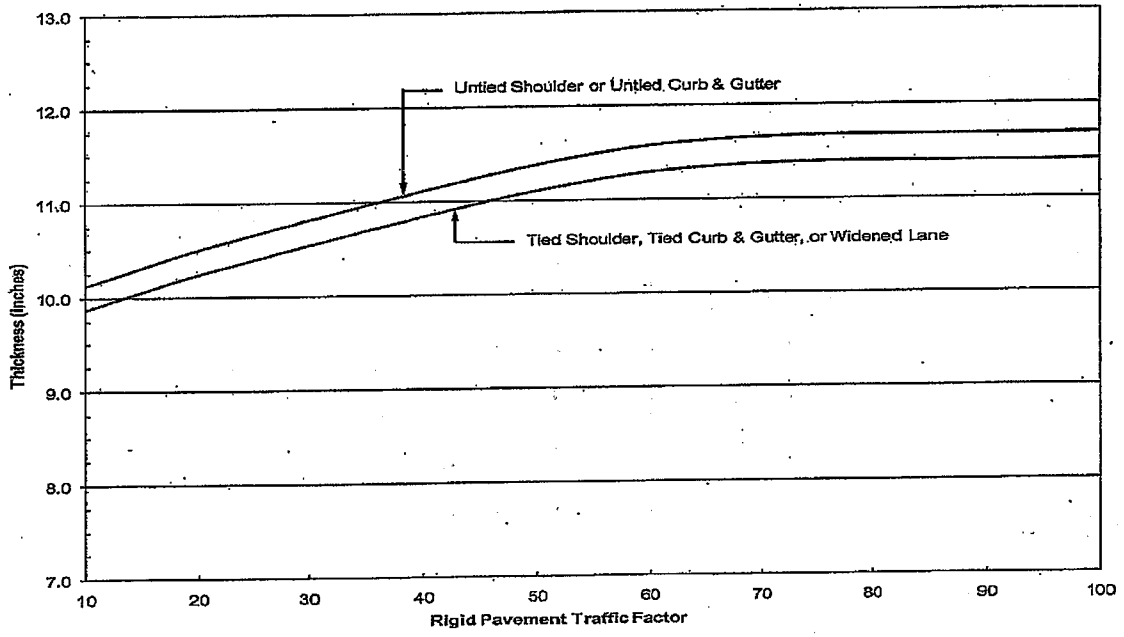
	Traffic Factor ESAL Coefficients			
	Rigid (Fig. 54-4C)		Flexible (Fig. 54-5B)	
Class	Csu	Cmu	Csu	Cmu
I	143.81	696.42	132.50	482.53
II	136.79	667.21	112.06	395.44
III	129.58	562.47	109.14	384.35
IV(ADT>400)	127.75	555.90	109.14	384.35
IV(ADT<=400)	127.75	555.90	9.86	78.84

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%

SAUK TRAIL





Note: Use of untied shoulder design requires BDE approval.

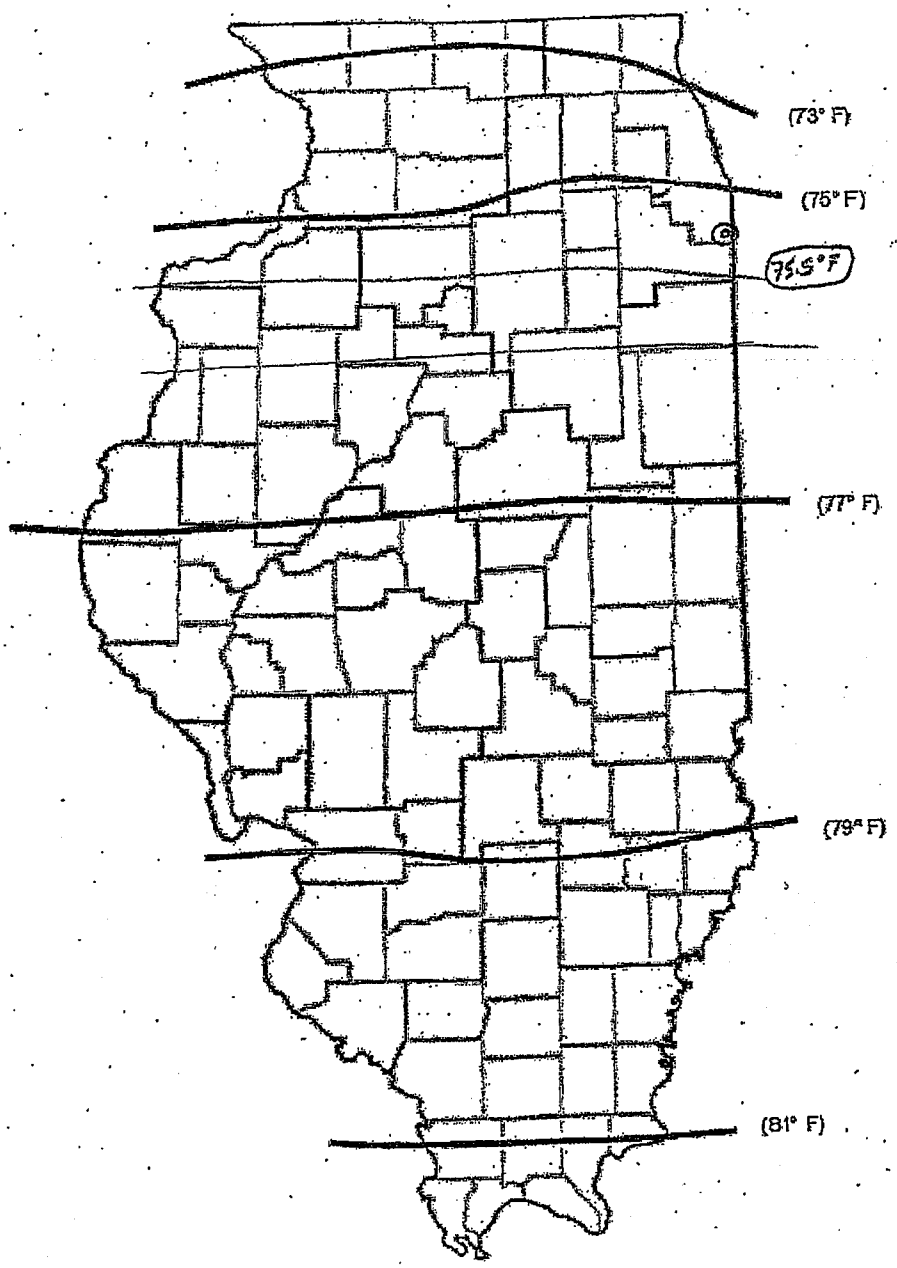
RIGID PAVEMENT DESIGN CHART
(Mechanistic Design: SSR = Poor)

9" JOINTED PCC PAVEMENT

Figure 54-4.E

HARD COPIES UNCONTROLLED

SAUK-TRAIL



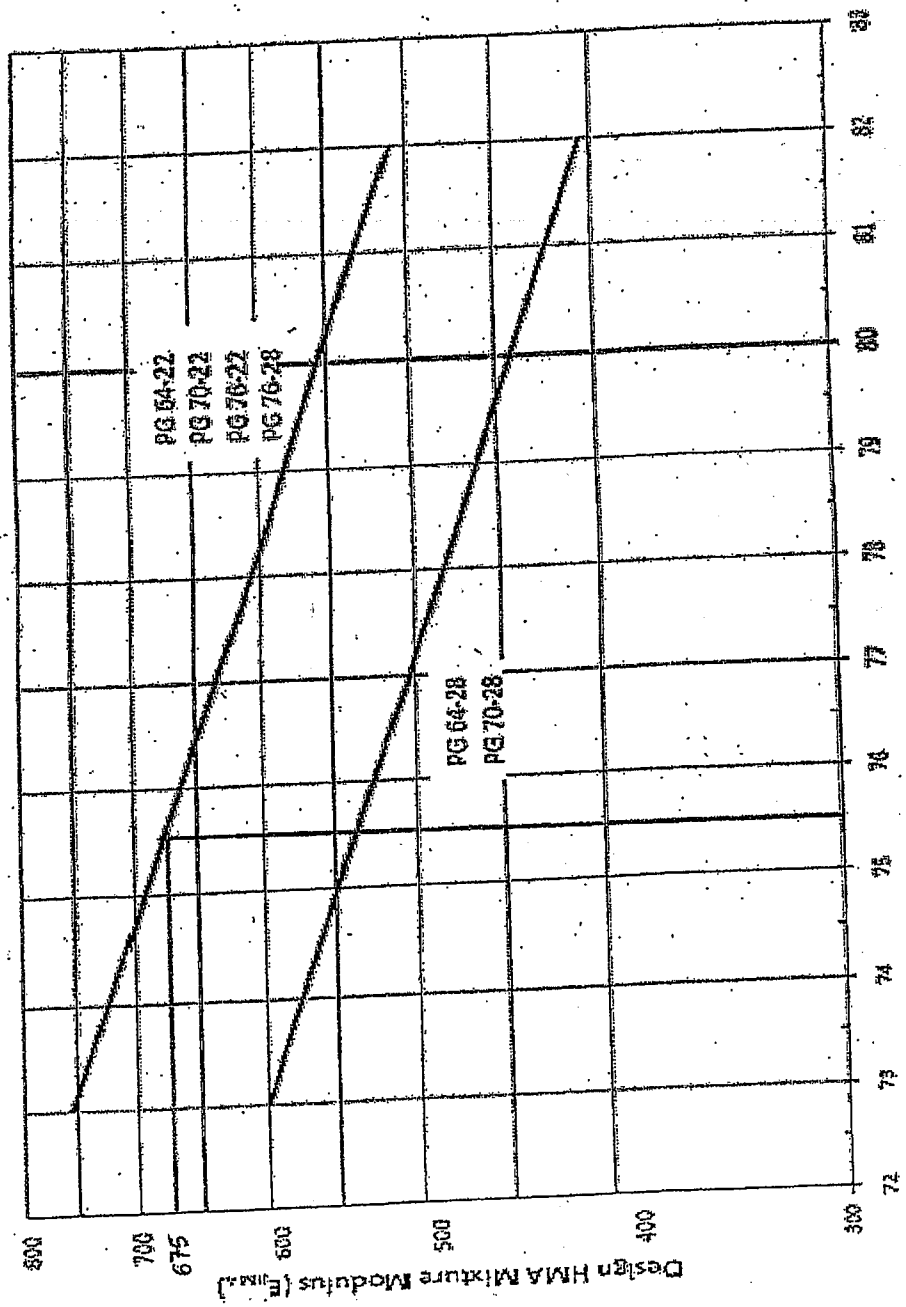
Note: The minimum design HMA mixture temperature will be 73°F.

HMA MIXTURE TEMPERATURE
(Mechanistic Design: Flexible Pavement)

Figure 54-5.C

HARD COPIES UNCONTROLLED

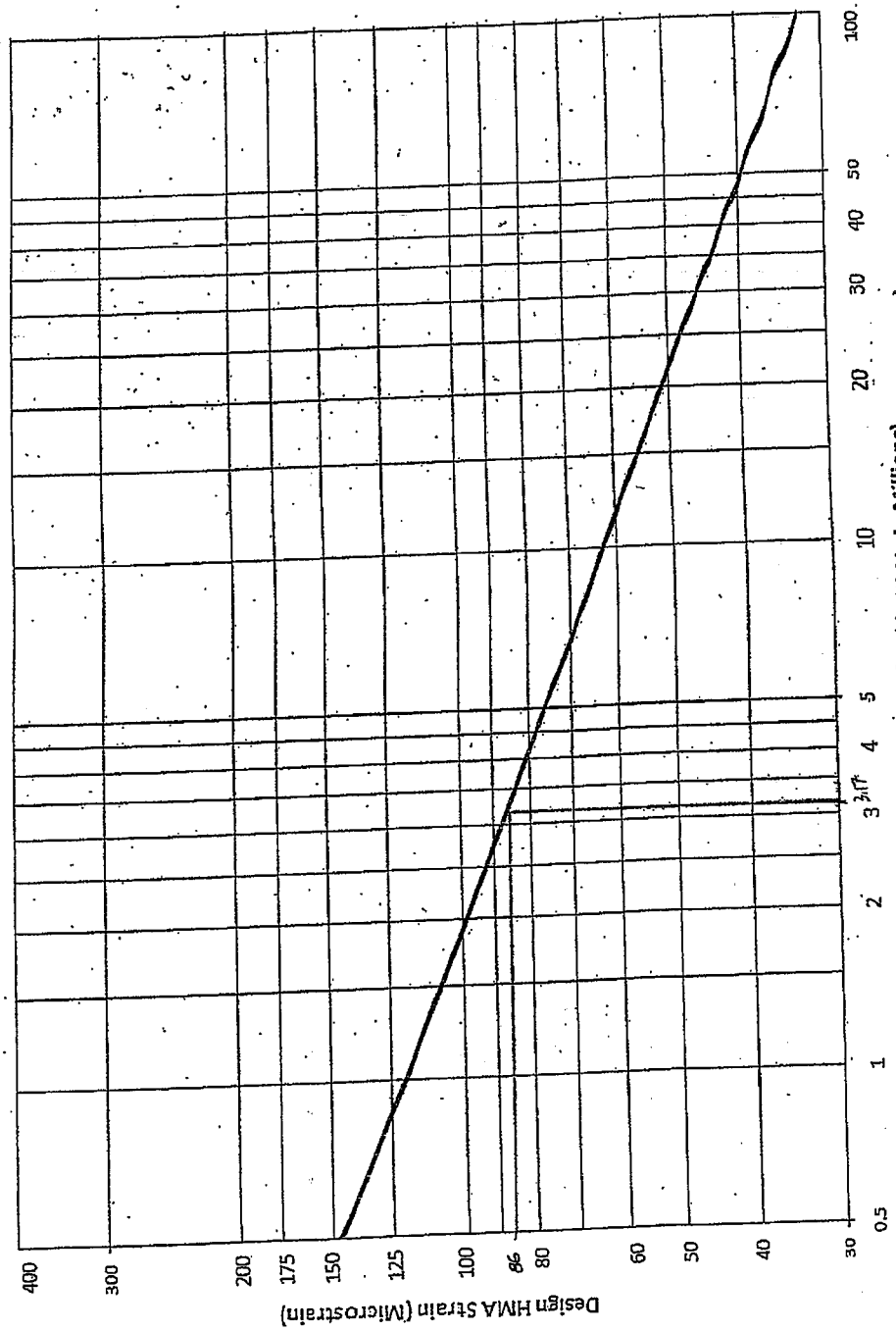
SAUK TRAIL



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

Figure 54-5.D

HARD COPIES UNCONTROLLED

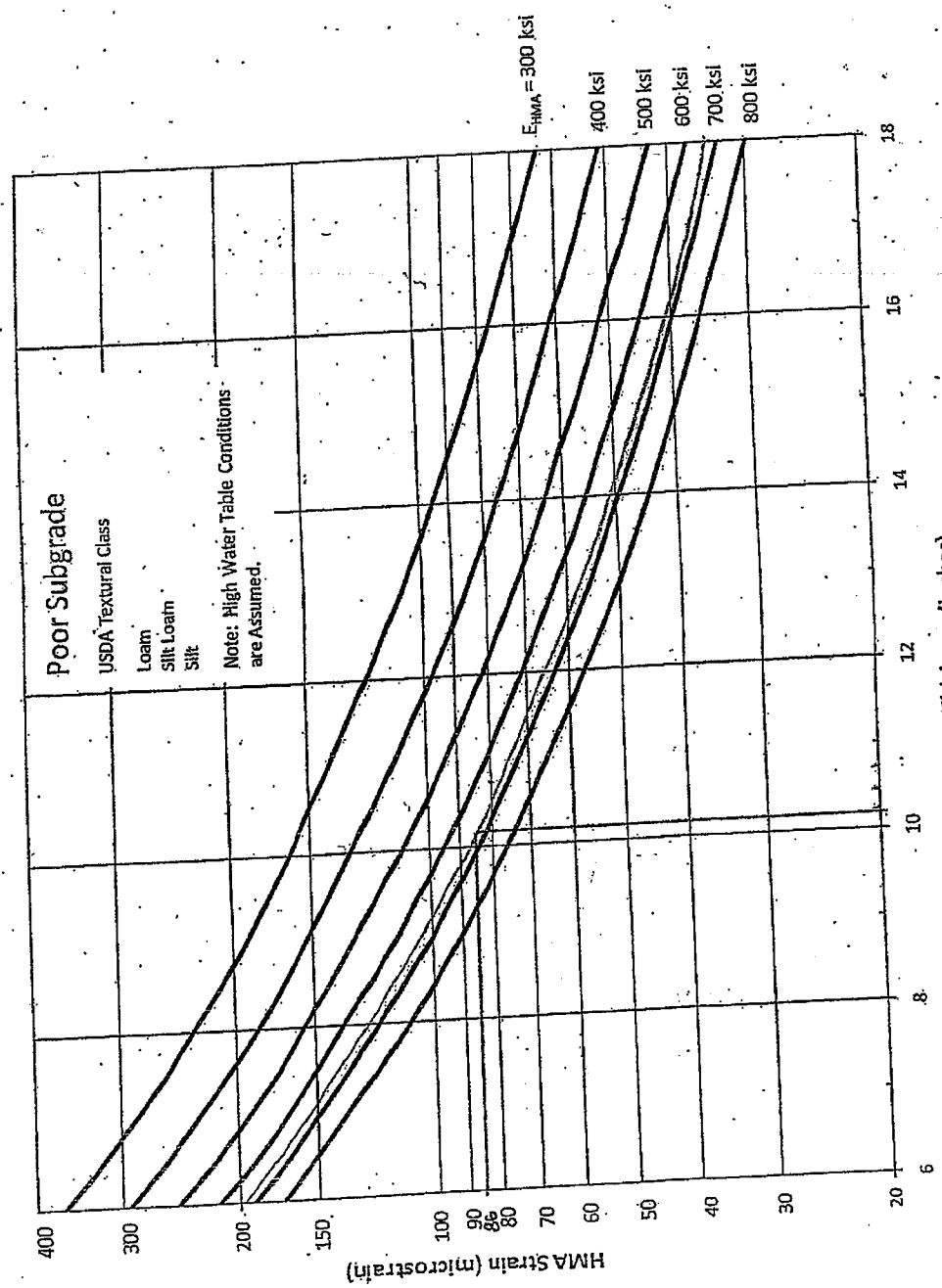


DESIGN HMA STRAIN
(Mechanistic Design: Flexible Pavement)

Figure 54-5.E

HARD COPIES UNCONTROLLED

SAUK TRAIL



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

Figure 54-5.F

10¼" FULL DEPTH HMA PAVEMENT

HARD COPIES UNCONTROLLED

FRONTAGE ROAD

Spreadsheet by Uehle - Rev. 11/02

MECHANISTIC PAVEMENT DESIGN

Date: 3/14/12

INPUT (Enter Data in Gray Shaded Cells)

Route: Frontage Road
Section:
County: Cook
Location: from Sauk Trail to 115 St

Comments: Construction of Frontage Road along US 30 - Dixie Hwy to accommodate traffic growth. Limits: Sauk Trail and U.S. 30

Designer: SJP

	ADT	Year
Current:	1000	2012
Future:	1500	2042

Facility Type: Urban 2 Lane Route

# of Lanes = 2

Part of future 4 lanes or more ? No

One Way Street ? No

Road Class: III

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 =	No Min	1,378	97.0%	P = 50%
SU =	No Min	28	2.0%	S = 50%
MU =	No Min	14	1.0%	M = 50%
Struct. Design ADT =		1421	(2023)	

FLEXIBLE & RIGID PAVEMENT CALCULATIONS AND ADDITIONAL INPUT

Flexible Pavement

Cpv =	0.15	
Csu =	109	
Cmu =	384	
TF flexible (Actual)=	0.09	(Actual ADT)
TF flexible (Min)=	No Min	(Min ADT Fig 54-2C)
Use TF flexible =	0.50	Per BDE 54-5.01(h)-1g
AC Type =	PG	
AC Mixture Tempurature =	90.0	deg. F (Figure 54-5C)
Design AC Mixture Modulus (Eac)=	550	ksi (Figure 54-5D)
Design Asphalt Concrete Microstrain =	134.4	(Figure 54-5E)
Asphalt Concrete Thickness =	9.00	in (Figure 54-5F)

Rigid Pavement

Cpv =	0.15	
Csu =	130	
Cmu =	562	
TF rigid (Actual)=	0.12	(Actual ADT)
TF rigid (Min)=	No Min	(Min ADT Fig 54-2C)
Use TF rigid =	0.12	
	7.00	Shoulder or C. &G.
Rigid Pavt Thick =	7.75	in (Figure 54-4B)

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

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

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

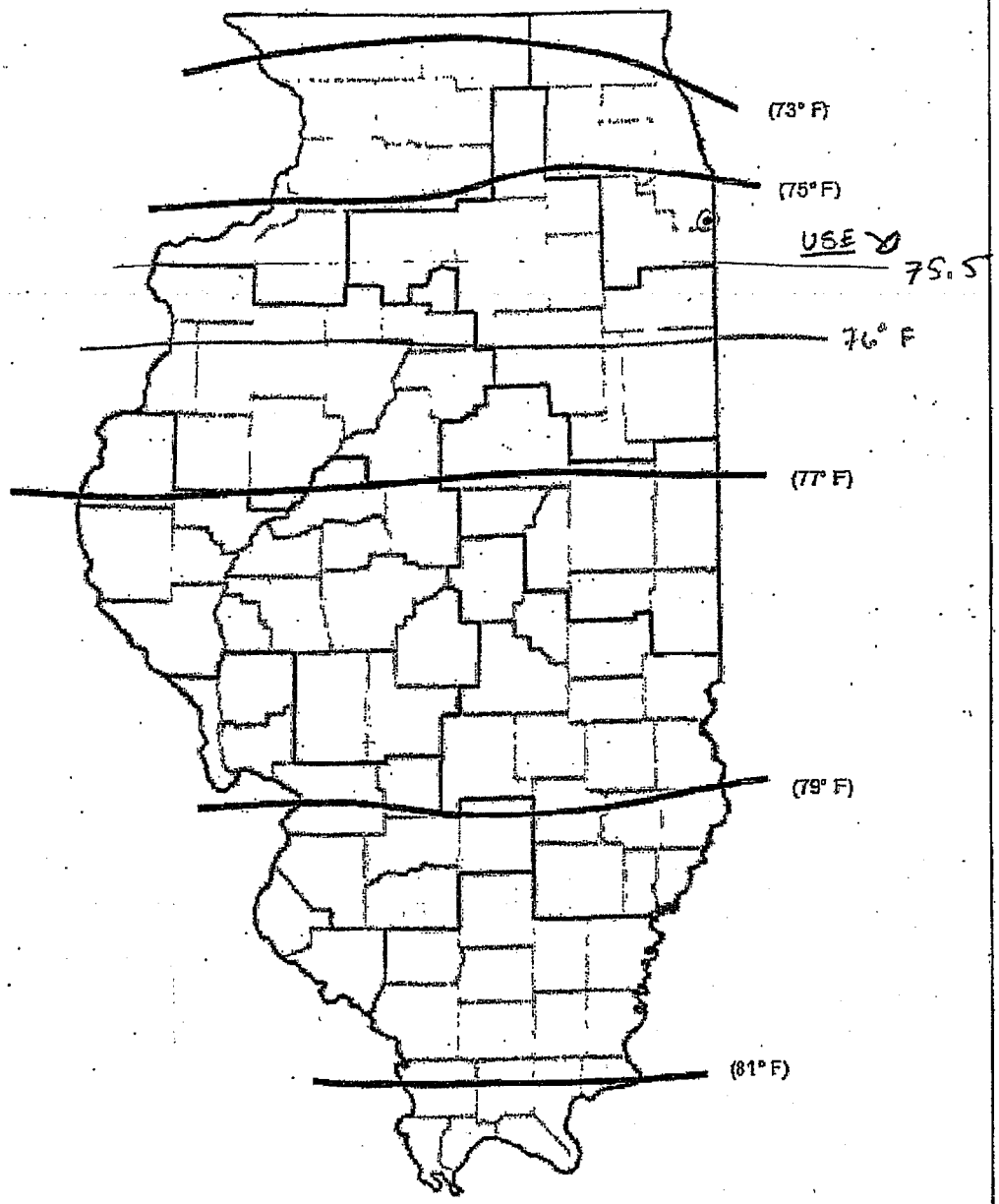
Class Table for One-Way Streets	
ADT	Class
0 - 3500	II
>3501	I

	Traffic Factor ESAL Coefficients			
	Rigid (Fig. 54-4C)		Flexible (Fig. 54-5B)	
Class	Csu	Cmu	Csu	Cmu
I	143.81	696.42	132.50	482.53
II	135.78	567.21	112.06	385.44
III	129.89	560.47	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%

FRONTAGE ROAD

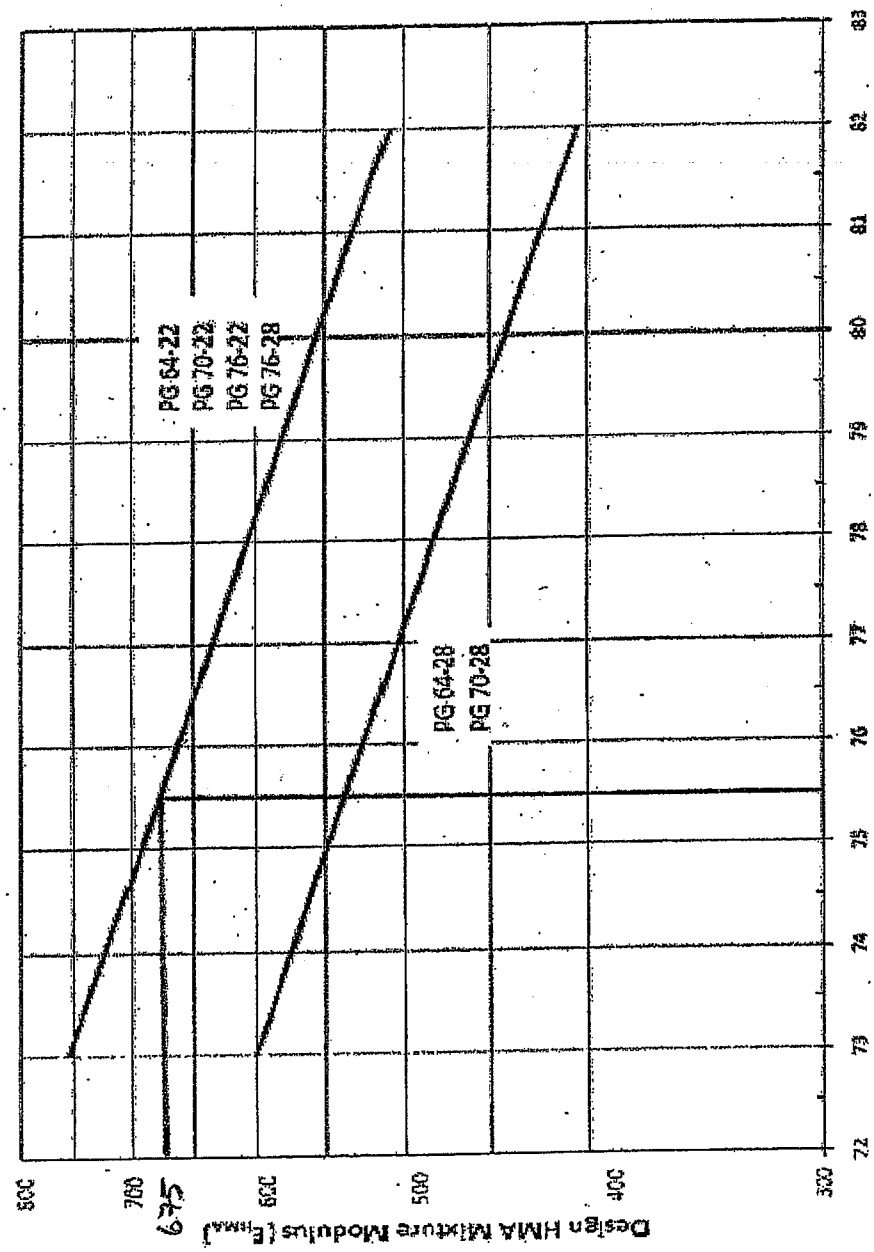


Note: The minimum design HMA mixture temperature will be 73°F.

HMA MIXTURE TEMPERATURE
(Mechanistic Design: Flexible Pavement)

Figure 54-5.C

FRONTAGE RD

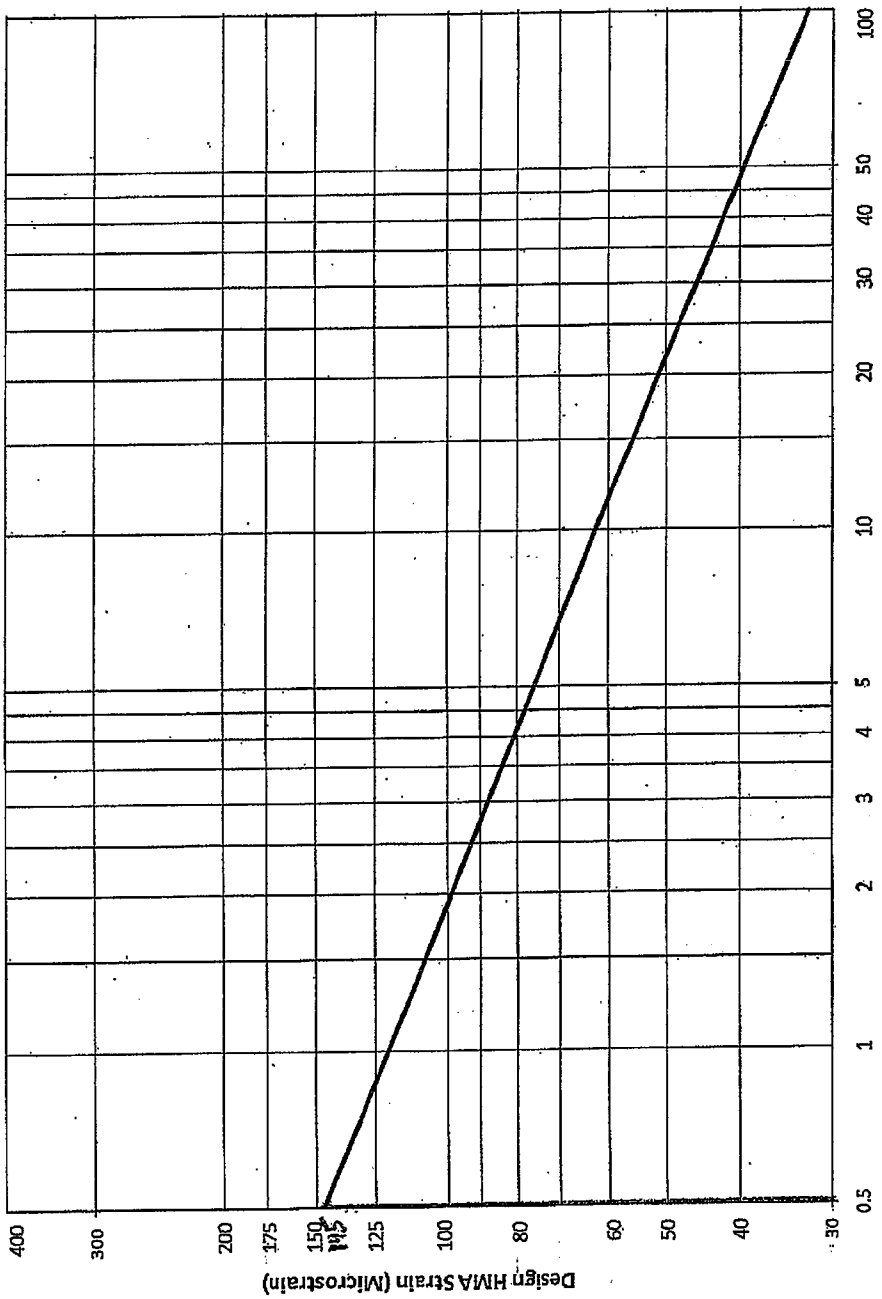


HMA MIXTURE MODULUS (E_{HMA})
(Mechanistic Design: Flexible Pavement)

Figure 54-5.D

HARD COPIES UNCONTROLLED

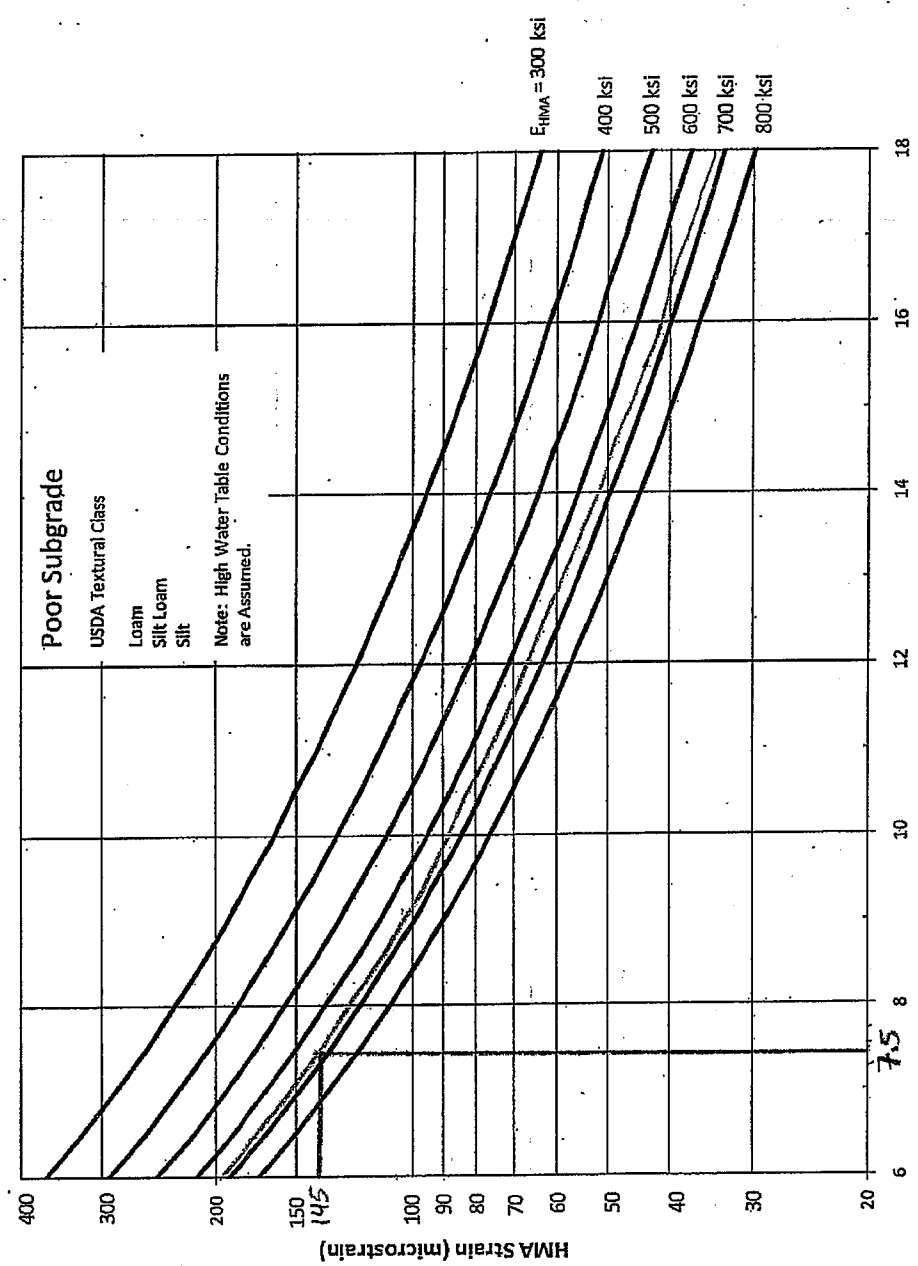
FRONTAGE RD



DESIGN HMA STRAIN
(Mechanistic Design: Flexible Pavement)

Figure 54-5.E

FRONTAGE RD



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

Figure 54-5.F

USE 8" - FULL DEPTH

LD USE 9" b/c it will service small business & uncertainty of ex. conditions. ? - short rant

HARD COPIES UNCONTROLLED

MECHANISTIC PAVEMENT DESIGN

Date 21-Mar-12
Calcs by: SP, AM
Checked by:
Class I Roads and Streets
Urban X Rural
Limits of Analysis Station 267+04 to Station 298+11
Length 3107 Feet 0.59 Miles

Route US 30 over CNRR
Section 11-Y-A
COOK County
Location AT CN RR

Structural Design Traffic
PV = 27332
SU = 742
MU = 1484

Percent of S.D.T. in Design Lane
P = 92.50%
S = 2.50%
U = 5.00%

MINIMUM SUBGRADE SUPPORT RATING - "POOR"

Flexible Pavement Design Actual TF_F = 7.35 Minimum TF_F = 3.56

Selected Design AC Type
Design AC Mixture Temp 75.5 °F
Design AC Microstrain 69
Design E_{AC} 675 KSI
AC Thickness 11.75 Inch

Rigid Pavement Design Actual TF_F = 10.29 Minimum TF_F = 5.02

Extended Lane 10 Inch

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

Figure 5.05

RIGID PAVEMENT

Date: 21-Mar-12 Route US 30 over CNRR

Quantities by SP, AM Checked by: Section 11-Y-A

Unit Prices by TM Checked by: COOK County

Net Length 3107 Lin. Ft. = 0.59 Miles

Number Lanes 4 Urban X Rural

ITEMIZED CONSTRUCTION COST

Quantity	Units	Item		Unit Cost	Total Cost
16571	Sq. Yds.	10 Inch Jointed PCC	@	$41.86	$693,662
0	Sq. Yds.	4-Inch (Stabilized/Granular Subbase)	@	$0.00	$0
0	Sq. Yds.	PCC Shoulder	@	$0.00	$0
	Lin. Ft.	Pipe Underdrains	@		
0		Subbase Gran. Mat., Type C	@	$0.00	$0
12,428	Lin. Ft.	100% Shoulder Joint Seal	@	$2.00	$24,856

Total Cost of Original Pavement Construction $718,518

ITEMIZED MAINTENANCE AND REHABILITATION ACTIVITY COST

REHABILITATION ACTIVITY 1 - YEAR 10

17 Sq. Yds.	0.1% Full Depth PCC Pavement Patching	@	$130.00	$2,210
	Total Cost of Rehabilitation Activity 1			$2,210

Figure 5.05a(1)

RIGID PAVEMENT (Cont.)

Route US 30 over CNRR

Section 11-Y-A

COOK County

REHABILITATION ACTIVITY 2 - YEAR 15

				Unit Cost	Total Cost
33	Sq. Yds.	0.2% Full Depth PCC Pavement Patching	@	$130.00	$4,290

Total Cost of Rehabilitation Activity 2 $4,290

REHABILITATION ACTIVITY 3 - YEAR 20

				Unit Cost	Total Cost
331	Sq. Yds.	2% Full Depth PCC Pavement Patching	@	$0.00	$43,030
0	Sq. Yds.	0.5% Full Depth PCC Pavement Patching	@	$85.00	$0
12428	Lin. Ft.	100% Longitudunal/ Shoulder Joint Routing & Sealing	@	$1.00	$12,428
6214	Lin. Ft.	100% Centerline Joint Routing & Sealing	@	$1.00	$6,214

Total Cost of Rehabilitation Activity 3 $61,672

FIGURE 5.05a(2)

RIGID PAVEMENT (Cont.)

Route US 30 over CNRR

Section 11-Y-A

COOK County

REHABILITATION ACTIVITY 4 - YEAR 25

			Unit Cost	Total Cost
497 Sq. Yds.	3.0% Full Depth PCC Pavement Patching	@	$130.00	$64,610
0 Sq. Yds.	1.0% Full Depth PCC Pavement Patching	@	$85.00	$0
	Total Cost of Rehabilitation Activity 4			$64,610

REHABILITATION ACTIVITY 5 - YEAR 30

			Unit Cost	Total Cost
663 Sq. Yds.	3.0% Full Depth PCC Pavement Patching	@	$85.00	$0
0 Sq. Yds.	1.0% Full Depth PCC Pavement Patching	@	$14.22	$235,640
16,571 Sq. Yds.	Policy HMA Overlay - Pavement	@	$14.22	$235,640
0 Sq. Yds.	Policy HMA Overlay - Shoulder	@	$14.22	$0
	Total Cost of Rehabilitation Activity 5			$321,830

REHABILITATION ACTIVITY 6 - YEAR 35

			Unit Cost	Total Cost
12,428 Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$12,428
6214 Lin. Ft.	100% Centerline Joint Routing & Sealing	@	$1.00	$6,214
6,214 Lin. Ft.	50% Random Crack Routing & Sealing - Assume 100ft/station	@	$1.00	$6,214
3,977 Lin. Ft.	40% Reflective Transverse Crack Routing & Sealing	@	$1.00	$3,977
17 Sq. Yds.	0.1% Partial-Depth Pavement Patching (Mill & Fill Surface-Interstates; Mill & Fill 2.5in. Non-Interstates)		$130.00	$2,210
	Total Cost of Rehabilitation Activity 6			$31,043

Figure 5.05a(3)

RIGID PAVEMENT (Cont.)

Route US 30 over CNRR

Section 11-Y-A

COOK County

REHABILITATION ACTIVITY 7 - YEAR 40

			Unit Cost	Total Cost
83 Sq. Yds.	0.5% Full Depth PCC Pavement Patching	@	$130.00	$10,790
83 Sq. Yds.	0.5% Partial Depth Pavement Patching (Mill & Fill Surface-Interstates; Mill & Fill 2.5in. Non-Interstates)	@	$130.00	$10,790
5,965 Lin. Ft.	60% Reflective Transverse Crack Routing & Sealing	@	$1.00	$5,965
6,214 Lin. Ft.	50% Random Crack Routing & Sealing - Assume 100ft/station	@	$1.00	$6,214
12,428 Lin. Ft.	100% Longitudunal/ Shoulder Joint Routing & Sealing	@	$1.00	$12,428
6,214 Lin. Ft.	100% Centerline Joint Routing & Sealing	@	$1.00	$6,214
	Total Cost of Rehabilitation Activity 7			$52,401

RIGID PAVEMENT (Cont.)

Route US 30 over CNRR

Section 11-Y-A

COOK County

ANNUAL COST DETERMINATION

Present Worth Calculation:

Total Cost of Original Pavement Construction			$718,518
Present Worth of Rehab Activity 1	$2,210	x 0.7441 =	$1,644
Present Worth of Rehab Activity 2	$4,290	x 0.6419 =	$2,754
Present Worth of Rehab Activity 3	$61,672	x 0.5537 =	$34,148
Present Worth of Rehab Activity 4	$64,610	x 0.4776 =	$30,858
Present Worth of Rehab Activity 5	$321,830	x 0.4120 =	$132,594
Present Worth of Rehab Activity 6	$31,043	x 0.3554 =	$11,033
Present Worth of Rehab Activity 7	$52,401	x 0.3066 =	$16,066
Total Life Cycle Cost (Present Worth)			$229,097

Annual Cost Per Mile Calculation

Total PW	x CRF_n /	Length		= Annual Cost / Year-Mile
$229,097	x0.04079 /	0.59	Mi.	$65,514 per Yr.-Mi.

FLEXIBLE PAVEMENT

Date: 21-Mar-12 Route US 30 over CNRR
Quantities by SP, AM Checked by: Section 11-Y-A
Unit Prices by TM Checked by: COOK County
Net Length 3107 Lin. Ft. = 0.59 Miles
Number Lanes 4 Urban X Rural
Single Lane Paving X Dual Lane Paving

ITEMIZED CONSTRUCTION COST

Quantity	Units	Item		Unit Cost	Total Cost
16,571	Sq. Yds.	Class I Surface Course	@	$14.22	$235,640
16,571	Sq. Yds.	Class I Binder Course	@	$32.74	$542,535
0	Sq. Yds.	Stabilized Shoulders	@	$0.00	$0
	Lin. Ft.	Pipe Underdrains	@		
0		Subbase Gran. Matl., Type C	@	$0.00	$0
16,571	Sq. Yds.	Poly Binder	@	$11.97	$198,355

Total Cost of Original Pavement Construction $976,530

ITEMIZED MAINTENANCE AND REHABILITATION ACTIVITY COST

REHABILITATION ACTIVITY 1 - YEAR 5

				Unit Cost	Total Cost
1709	Lin. Ft.	50% Random/Thermal Cracking & Sealing (Assume 110ft/station)	@	$1.00	$1,709
12428	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$12,428
6214	Lin. Ft.	100% Centerline Joint Rounting & Sealing	@	$1.00	$6,214
17	Sq. Yds.	0.1% Partial-Depth Pavement Patching Mill & Fill Surface	@	$90.00	$1,530

Total Cost of Rehabilitation Activity 1 $21,881

FIGURE 5.05b(1)

FLEXIBLE PAVEMENT (Cont.)

Route US 30 over CNRR

Section 11-Y-A

COOK County

				Unit Cost	Total Cost
REHABILITATION ACTIVITY 2 - YEAR 10					
83	Sq. Yds.	0.5% Partial-depth HMA Pavement Patching - Mill & Fill Surface	@	$90.00	$7,470
1709	Lin. Ft.	50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station)	@	$1.00	$1,709
12428	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$12,428
6214	Lin. Ft.	100% Centerline Joint Rounting & Sealing	@	$1.00	$6,214
		Total Cost of Rehabilitation Activity 2			$27,821

				Unit Cost	Total Cost
REHABILITATION ACTIVITY 3 - YEAR 15					
16,571	Sq. Yds.	2.00in. Milling - Pavement & Shoulder	@	$1.75	$28,999
166	Sq. Yds.	1.0% Partial-depth Pavement Patching (Mill & Fill Addition 2.00in.)	@	$90.00	$14,940
1,856	Sq. Yds.	2.00in. HMA Overlay Pavement & Shoulder	@	$126.96	$235,646
		Total Cost of Rehabilitation Activity 3			$279,585

FLEXIBLE PAVEMENT (Cont.)

Route US 30 over CNRR

Section 11-Y-A

COOK County

				Unit Cost	Total Cost
REHABILITATION ACTIVITY 4 - YEAR 20					
12428	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$12,428
6214	Lin. Ft.	100% Centerline Joint Rounting & Sealing	@	$1.00	$6,214
1709	Lin. Ft.	50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station)	@	$1.00	$1,709
17	Sq. Yds.	0.1% Partial-Depth HMA Pavement Patching (Mill & Fill Surface)	@	$90.00	$1,530
		Total Cost of Rehabilitation Activity 4			$21,881
REHABILITATION ACTIVITY 5 - YEAR 25				Unit Cost	Total Cost
12428	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$12,428
6214	Lin. Ft.	100% Centerline Joint Rounting & Sealing	@	$1.00	$6,214
1709	Lin. Ft.	50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station)	@	$1.00	$1,709
83	Sq. Yds.	0.5% Partial-Depth Pavement Patching (Mill & Fill Surface)	@	$90.00	$7,470
		Total Cost of Rehabilitation Activity 5			$27,821
REHABILITATION ACTIVITY 6 - YEAR 30				Unit Cost	Total Cost
16,571	Sq. Yds.	2.00in. Milling (Pavement only-Std Design Pavement & Shoulder-Limiting Strain Criteria Design)	@	$1.75	$28,999
331	Sq. Yds.	2.0% Partial-Depth HMA Pavement Patching (Mill & Fill Additional 2.00in. All Designs)	@	$90.00	$29,790
0	Sq. Yds.	1.0% Full-Depth HMA Shoulder Patching (Mill & Fill Surface-Standard Design Mill & Fill Additional 2.00in.-Limiting Strain Criteria Design)	@	$90.00	$0
3,480	Tons	HMA Overlay Pvmt (3.75in. - Std Design 2.00in.-Limiting Strain Criterion Design)	@	$126.96	$441,836
0	Tons	HMA Overlay Shoulder (1.75in. - Standard Design; 2.00in.-Limiting Strain Criterion Design)	@	$126.96	$0
		Total Cost of Rehabilitation Activity 6			$500,625

FLEXIBLE PAVEMENT (Cont.)
Route US 30 over CNRR
Section 11-Y-A
COOK County

		REHABILITATION ACTIVITY 7 - YEAR 35		Unit Cost	Total Cost
12428	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$12,428
6214	Lin. Ft.	100% Centerline Joint Rounting & Sealing	@	$1.00	$6,214
1709	Lin. Ft.	50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station)	@	$1.00	$1,709
17	Sq. Yds.	0.1% Partial-Depth HMA Pavement Patching (Mill & Fill Surface)	@	$90.00	$1,530
		Total Cost of Rehabilitation Activity 7			$21,881

		REHABILITATION ACTIVITY 8 - YEAR 40		Unit Cost	Total Cost
12428	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$12,428
6214	Lin. Ft.	100% Centerline Joint Rounting & Sealing (Single Lane and Dual Lane Paving)	@	$1.00	$6,214
1709	Lin. Ft.	50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station)	@	$1.00	$1,709
83	Sq. Yds.	0.5% Partial-Depth Pavement Patching (Mill & Fill Surface)	@	$90.00	$7,470
		Total Cost of Rehabilitation Activity 8			$27,821

Figure 5.05b(4) - continued

FLEXIBLE PAVEMENT (Cont.)
Route US 30 over CNRR
Section 11-Y-A
COOK County

ANNUAL COST DETERMINATION

Present Worth Calculation:

Total Cost of Original Pavement Construction			$976,530
Present Worth of Rehab Activity 1	$21,881	x 0.7441 =	$18,875
Present Worth of Rehab Activity 2	$27,821	x 0.6419 =	$20,702
Present Worth of Rehab Activity 3	$279,585	x 0.5537 =	$179,466
Present Worth of Rehab Activity 4	$21,881	x 0.4776 =	$12,116
Present Worth of Rehab Activity 5	$27,821	x 0.4120 =	$13,287
Present Worth of Rehab Activity 6	$500,625	x 0.3554 =	$206,258
Present Worth of Rehab Activity 7	$21,881	x 0.3066 =	$7,777
Present Worth of Rehab Activity 8	$27,821	x 0.3066 =	$8,530
Total Life Cycle Cost (Present Worth)			$467,011

Annual Cost Per Mile Calculation

Total PW	x CRF_n /	Length		= Annual Cost / Year-Mile
$467,011	x0.04079 /	0.59	Mi.	$99,800 per Yr.-Mi.

MATERIAL TYPE/PERCENTAGE	PCC	52.33%

PLAIN JOINTED PCC PAVEMENT

FILENAME-	US 30 over CNRF	21-Mar-12	
ROUTE-	FAP 353	2:18 PM	
SECTION-	11-Y-A		
COUNTY-	COOK		
LOCATION-	AT CN RR		
DATE-	21-Mar-12		
PROJECT LENGTH (FT)	3107 =	0.59	MILES
AVERAGE LANE WIDTH (FT)	12		
NUMBER OF LANES	4		
# OF EDGES	4		
INSIDE SHLDER WIDTH (FT)	0		
OUTSIDE SHLDER WIDTH (FT)	0		
# OF CENTERLINES	2		
RIGID THICKNESS-	10		

TRAFFIC FACTORS	MINIMUM	ACTUAL
RIGID-	5.02	10.29

TRAFFIC		Percentages
PV-	27332	92.50%
SU-	742	2.50%
MU-	1484	5.00%

INITIAL COSTS

ITEM	QUANTITY	UNIT PRICE	COST
PAVEMENT (SQ YDS)	16,571	$41.86	$693,662
STAB SUBBASE (SQ YDS)	0	$0.00	$0
SHOULDERS (SQ YDS)	0	$0.00	$0
SHOULDER SEAL (LN FT)	12,428	$2.00	$24,856
SUBBASE GRAN MATL TY C (TONS)	0	$0.00	$0
CONSTRUCTION INITIAL COST (PW)			$718,518
TOTAL REHABILITATION COST (PW)			$229,097
TOTAL LIFE CYCLE COST (PW)			$947,615
ANNUAL COST PER MILE			$65,514

MAINTENANCE COSTS:

ITEM		UNIT COST
PAVEMENT PATCHING (SQ YDS)	(Use Class A pricing for CRC)	$130.00
SHOULDER PATCHING (SQ YDS)		$85.00
SHLDR JT ROUT & SEAL (LF)		$1.00
CENTERLINE JT ROUT & SEAL (LF)		$1.00
POLICY HMA OVERLAY PVMT (SQ YDS)		$14.22
POLICY HMA OVERLAY SHLDR (SQ YDS)		$14.22
RANDOM CRACK ROUT & SEAL (LF)		$1.00
REFL TRANS CRACK ROUT & SEAL (LF)		$1.00
PARTIAL PVMT PATCH (SQ YDS)		$130.00

MAINTENANCE COSTS:

	ITEM	QUANTITY	UNIT PRICE	COST	PW
Activity 1 YEAR 10					
	PAVEMENT PATCHING 0.1% (SQ YDS)	17	$130.00	$2,210	
				$2,210	$1,644
Activity 2 YEAR 15					
	PAVEMENT PATCHING 0.2% (SQ YDS)	33	$130.00	$4,290	
				$4,290	$2,754
Activity 3 YEAR 20					
	PAVEMENT PATCHING 2.0% (SQ YDS)	331	$130.00	$43,030	
	SHOULDER PATCHING 0.5% (SQ YDS)	0	$85.00	$0	
	SHLDR JT ROUT & SEAL 100% (LF)	12,428	$1.00	$12,428	
	CENTERLINE JT ROUT & SEAL 100% (LF)	6,214	$1.00	$6,214	
				$61,672	$34,148
Activity 4 YEAR 25					
	PAVEMENT PATCHING 3.0% (SQ YDS)	497	$130.00	$64,610	
	SHOULDER PATCHING 1.0% (SQ YDS)	0	$85.00	$0	
				$64,610	$30,858
Activity 5 YEAR 30					
	PAVEMENT PATCHING 4.0% (SQ YDS)	663	$130.00	$86,190	
	SHOULDER PATCHING 1.5% (SQ YDS)	0	$85.00	$0	
	POLICY HMS OVERLAY OVMT (SQ YDS)	16,571	$14.22	$235,640	
	POLICY HMA OVERLAY SHLDR (SQ YDS)	0	$14.22	$0	
				$321,830	$132,594
Activity 6 YEARS 35					
	SHLDR JT ROUT & SEAL 100% (LF)	12,428	$1.00	$12,428	
	CENTERLINE JT ROUT & SEAL 100% (LF)	6,214	$1.00	$6,214	
	RANDOM CRACK ROUT & SEAL 50% (LF)	6,214	$1.00	$6,214	
	REFL TRANS CRACK ROUT & SEAL 40%	3,977	$1.00	$3,977	
	PARTIAL PVMT PATCH 0.1% (SQ YDS)	17	$130.00	$2,210	
				$31,043	$11,033
Activity 7 YEAR 40					
	PAVEMENT PATCHING 0.5% (SQ YDS)	83	$130.00	$10,790	
	SHOULDER PATCHING 0.5% (SQ YDS)	83	$130.00	$10,790	
	REFL TRANS CRACK ROUT & SEAL 60%	5,965	$1.00	$5,965	
	RANDOM CRACK ROUT & SEAL 50% (LF)	6,214	$1.00	$6,214	
	SHLDR JT ROUT & SEAL 100% (LF)	12,428	$1.00	$12,428	
	CENTERLINE JT ROUT & SEAL 100% (LF)	6,214	$1.00	$6,214	
				$52,401	$16,056
			Total Rehabilitation Cost (Present Worth)		$229,097

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

ROUTE-	FAP 353	21-Mar-12
SECTION-	11-Y-A	2:18 PM
COUNTY-	COOK	
LOCATION-	AT CN RR	

PROJECT LENGTH (FT)	3107	
AVERAGE LANE WIDTH (FT)	12	
NUMBER OF LANES	4	
# OF EDGES	4	
INSIDE SHLDER WIDTH (FT)	0	
OUTSIDE SHLDER WIDTH (FT)	0	
# OF CENTERLINES	2	
PROJECT TYPE	2	1=RURAL, 2=URBAN
PAVING WIDTH	1	1=SINGLE LANE, 2=DUAL LANE
INTERSTATE / OTHER ROUTE	OTHER ROUTE	
FLEXIBLE THICKNESS-	11.75	

TRAFFIC FACTORS	MINIMUM	ACTUAL
FLEXIBLE	3.56	7.35

TRAFFIC

PV-	27332	0.925
SU-	742	0.025
MU-	1484	0.05

PAVEMENT OVERLAY THICKNESS	3.75
SHOULDER OVERLAY THICKNESS	1.75

INITIAL COSTS

ITEM	QUANTITY	UNIT PRICE	COST
SURFACE (SQ YDS)	16,571	$14.22	$235,640
POLY BINDER (SQ YDS)	16,571	$11.97	$198,355
BINDER (SQ YDS)	16,571	$32.74	$542,535
SHOULDERS (SQ YDS)	0	$0.00	$0
SUBBASE GRAN MATL TY C (TONS)	0	$0.00	$0

CONSTRUCTION INITIAL COST (PW)	$976,530
TOTAL REHABILITATION COST (PW)	$467,011
TOTAL LIFE CYCLE COST (PW)	$1,443,541
ANNUAL COST PER MILE	$99,800

MAINTENANCE COSTS:

ITEM		UNIT COST
RAND/THERM CRACK ROUT & SEAL (LF)		$1.00
SHLDR JT ROUT & SEAL (LF)		$1.00
CENTERLINE JT ROUT & SEAL (LF)		$1.00
PARTIAL PVMT PATCH (SQ YDS)		$90.00
2" MILL PVMT & SHLDR (SQ YDS)	(Use $3.00 for small quantity)	$1.75
2" OVERLAY PVMT & SHLDR (TONS)		$126.96
2" MILL PVMT ONLY (SQ YDS)	(Use $3.00 for small quantity)	$1.75
HMA SHOULDER PATCHING (SQ YDS)		$90.00
POLICY HMA OVERLAY PVMT (TONS)		$126.96
POLICY HMA OVERLAY SHLDR (TONS)		$126.96

MATERIAL TYPE/PERCENTAGE	PCC	52.3%

FULL DEOTH FLEXIBLE PAVEMENT
MAINTENANCE COSTS

	ITEM	QUANTITY	UNIT PRICE	COST	PW
Activity 1					
YEAR 5	RAND/THERM CRACK ROUT & SEAL 50% (LF)	1,709	$1.00	$1,709	
	SHLDR JT ROUT & SEAL 100% (LF)	12,428	$1.00	$12,428	
	CENTERLINE JT ROUT & SEAL 100% (LF)	6,214	$1.00	$6,214	
	PARTIAL PVMT PATCH 0.1% (SQ YDS)	17	$90.00	$1,530	
				$21,881	$18,875
Activity 2					
YEAR 10	PARTIAL PVMT PATCH 0.5% (SQ YDS)	83	$90.00	$7,470	
	RAND/THERM CRACK ROUT & SEAL 50% (LF)	1,709	$1.00	$1,709	
	SHLDR JT ROUT & SEAL 100% (LF)	12,428	$1.00	$12,428	
	CENTERLINE JT ROUT & SEAL 100% (LF)	6,214	$1.00	$6,214	
				$27,821	$20,702
Activity 3					
YEAR 15	2" MILL PVMT & SHLDR 100% (SQ YDS)	16,571	$1.75	$28,999	
	PARTIAL PVMT PATCH 1.0% (SQ YDS)	166	$90.00	$14,940	
	2" OVERLAY PVMT & SHLDR 100% (TONS)	1,856	$126.96	$235,646	
				$279,585	$179,466
Activity 4					
YEAR 20	SHLDR JT ROUT & SEAL 100% (LF)	12,428	$1.00	$12,428	
	CENTERLINE JT ROUT & SEAL 100% (LF)	6,214	$1.00	$6,214	
	RAND/THERM CRACK ROUT & SEAL 50% (LF)	1,709	$1.00	$1,709	
	PARTIAL PVMT PATCH 0.1% (SQ YDS)	17	$90.00	$1,530	
				$21,881	$12,116
Activity 5					
YEAR 25	SHLDR JT ROUT & SEAL 100% (LF)	12,428	$1.00	$12,428	
	CENTERLINE JT ROUT & SEAL 100% (LF)	6,214	$1.00	$6,214	
	RAND/THERM CRACK ROUT & SEAL 50% (LF)	1,709	$1.00	$1,709	
	PARTIAL PVMT PATCH 0.5% (SQ YDS)	83	$90.00	$7,470	
				$27,821	$13,287
Activity 6					
YEAR 30	2" MILL PVMT & SHLDR 100% (SQ YDS)	16,571	$1.75	$28,999	
	PARTIAL PVMT PATCH 2.0% (SQ YDS)	331	$90.00	$29,790	
	HMA SHLDR PATCHING 1.0% (SQ YDS)	0	$90.00	$0	
	POLICY HMA OVERLAY PVMT (TONS)	3,480	$126.96	$441,836	
	POLICY HMA OVERLAY SHLDR (TONS)	0	$126.96	$0	
				$500,625	$206,256
Activity 7					
YEAR 35	SHLDR JT ROUT & SEAL 100% (LF)	12,428	$1.00	$12,428	
	CENTERLINE JT ROUT & SEAL 100% (LF)	6,214	$1.00	$6,214	
	RAND/THERM CRACK ROUT & SEAL 50% (LF)	1,709	$1.00	$1,709	
	PARTIAL PVMT PATCH 0.1% (SQ YDS)	17	$90.00	$1,530	
				$21,881	$7,777
Activity 8					
YEAR 40	SHLDR JT ROUT & SEAL 100% (LF)	12,428	$1.00	$12,428	
	CENTERLINE JT ROUT & SEAL 100% (LF)	6,214	$1.00	$6,214	
	RAND/THERM CRACK ROUT & SEAL 50% (LF)	1,709	$1.00	$1,709	
	PARTIAL PVMT PATCH 0.5% (SQ YDS)	83	$90.00	$7,470	
				$27,821	$8,530

Total Rehabilitation Cost (Present Worth) $467,011