Illinois Department of Transportation

To:	Diane M. O'Keefe	Attn: District One
From:	John D. Baranzelli	
Subject:	Pavement Design	
Date:	March 29, 2012	

FAP Route 326 (IL Route 47)
Cook County
From Big Timber to Freeman Road

We have reviewed the pavement selection for the project, which was submitted to BDE by memo dated March 15, 2012. The project, designed and being constructed by the Illinois State Toll Highway Authority will reconstruct and widen IL 47 from Big Timber to Freeman Road. 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:

IL Route 47 (Pavement Reconstruction)

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

IL Route 47 (Pavement Widening)

13 inches of HMA Pavement with Tied PCC Curb & Gutter
1.75 inches Polymerized HMA Surface Course, Mix "F", N90
0.75 inches Polymerized Leveling Binder (Machine Method), IL-4.75, N50
2.25 inches Polymerized HMA Binder Course, IL-19.0, N90
8.25 inches of HMA Binder Course, IL-19.0, N90
12 inches of Aggregate Subgrade Improvement

IL Route 47 (Pavement Resurfacing)

Cold Milling of Existing HMA Pavement, 2.5 inches minimum
2.5 inches HMA Resurfacing
1.75 inches Polymerized HMA Surface Course, Mix "F", N90
0.75 inches Polymerized Leveling Binder (Machine Method), IL-4.75, N50

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 15, 2012

*Route: FAP 326 (IL 47)
Limits: Big Timber to Freeman Road
Contract No.: I-11-4000 (Tollway)
Letting: February 2012 (Tollway)

Section: NA
County: Cook
Job No.: NA

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

a.) Pavement reconstruction of IL 47 to accommodate three to four 12 foot through lanes in each direction.

b.) Pavement widening and resurfacing of IL 47 to accommodate a transition from two 12 foot through lanes in each direction to three 12 foot through lanes in each direction and a median.

A 30 year pavement analysis was performed for the pavement reconstruction and widening of IL 47. We recommend a mechanistic-rigid pavement design for the pavement reconstruction and full depth HMA pavement for the pavement widening. The intersection of IL 47 and I-90 is considered "high stress" as the design lane MU ADT exceeds 200 vehicles at the stop controlled intersection. The recommended pavement is:

a.) IL 47

Pavement Reconstruction
Tied PCC Curb and Gutter
- 10 ¼" PCC Pavement (Jointed)
- 4 ½" HMA Stabilized Subbase
- 12" Aggregate Subgrade Improvement

The life cycle cost analysis favors PCC pavement by 31.7%.

b.) IL 47

Pavement Widening*
Tied PCC Curb and Gutter
- 13" HMA Pavement
  - 1 ¾" Polymerized HMA Surface Course, Mix "F", N90
  - ¾" Polymerized Leveling Binder (Machine Method), IL-4.75, N50
  - 2 ¼" Polymerized HMA Binder Course, IL-19.0, N90
  - 8 ¼" HMA Binder Course, IL-19.0, N90
- 12" Aggregate Subgrade Improvement

Existing Pavement Resurfacing*
- Cold Milling of Existing HMA Pavement
  - 2 ½" Minimum more, if necessary
- 2 ½" HMA Resurfacing
  - 1 ¾" Polymerized HMA Surface Course, Mix "F", N90
  - ¾" Polymerized Leveling Binder (Machine Method), IL-4.75, N50

*Designer Note 1: The area of pavement widening and resurfacing incurred much questioning and discussion because the existing pavement to remain in place is 24 feet wide, while the widening is from approximately 24 feet to 36 feet wide in each direction. Further, the existing pavement to remain in place will be used as a striped median and not mainline pavement. The pavement design was performed according to policy as a "widening" even though the pavement could be perceived as a reconstruction. The first cost analysis favored the full depth HMA pavement for the pavement widening.

The project is being designed and built by the Illinois State Toll Highway Authority and is the "Final Plans" stage. We would like to request that the design review be expedited so that there are no delays with the construction.

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

Niedernhofer, Paul R

From: Popovici, Sylvan J.
Sent: Wednesday, April 18, 2012 8:58 AM
To: Niedernhofer, Paul R
Cc: Gonzalez, Doreen; Kwarteng, Isaac E; Matousek, Thomas G; Dominguez, Jose A; Khudeira, Mohamad
Subject: FYI - Addendum to I-90 at IL 47 Pavement Analysis (Tollway)
Attachments: I-90 at IL 47 Tollway_Addendum Memo.pdf

Paul,

For your information and records, attached is an addendum for the widening and resurfacing portion of IL 47 of the pavement analysis for I-90 at IL 47 (Tollway Project). After a review and discussion with District 1 Materials department, it was decided that a 2 ¼" polymerized binder was redundant since there was already a ¾" polymerized leveling binder. Therefore, instead of a 2 ¼" polymerized binder and a 8 ¼" HMA binder, we will be using a 10 ½" HMA binder.

Let us know if you have any questions or comments.

Thank you
Sylvan

Sylvan Popovici, P.E.
Project Engineer
Illinois Department of Transportation
Tel.: (847) 705-4593
Fax: (847) 705-4246
E-Mail: Sylvan.Popovici@illinois.gov

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Illinois Department of Transportation

Memorandum

To: Tony Quigley

Attn: Kibble / Kwarteng

From: Jose Dominguez

By: Tom Matousek / SJP

Subject: Pavement Analysis Addendum*

Date: April 17, 2012

*Route: FAP 326 (IL 47)
Limits: Big Timber to Freeman Road
Contract No.: I-11-4000 (Tollway)
Letting: February 2012 (Tollway)

Section: NA
County: Cook
Job No.: NA

We are submitting an addendum for the pavement analysis for the above captioned location. Please note that the total pavement area for reconstruction exceeds 4,750 Square Yards and the pavement design was previously approved by the Central Office on March 29, 2010. The improvement involves the following scope of work:

a.) Pavement reconstruction of IL 47 to accommodate three to four 12 foot through lanes in each direction.

b.) Pavement widening and resurfacing of IL 47 to accommodate a transition from two 12 foot through lanes in each direction to three 12 foot through lanes in each direction and a median.

A 30 year pavement analysis was performed for the pavement reconstruction and widening of IL 47. We recommend a mechanistic-rigid pavement design for the pavement reconstruction and full depth HMA pavement for the pavement widening. The intersection of IL 47 and I-90 is considered "high stress" as the design lane MU ADT exceeds 200 vehicles at the stop controlled intersection. The recommended pavement is:

a.) IL 47
Pavement Reconstruction
Tied PCC Curb and Gutter
- 10 ¼" PCC Pavement (Jointed)
- 4 ½" HMA Stabilized Subbase
- 12" Aggregate Subgrade Improvement

The life cycle cost analysis favors PCC pavement by 31.7%.

b.) IL 47

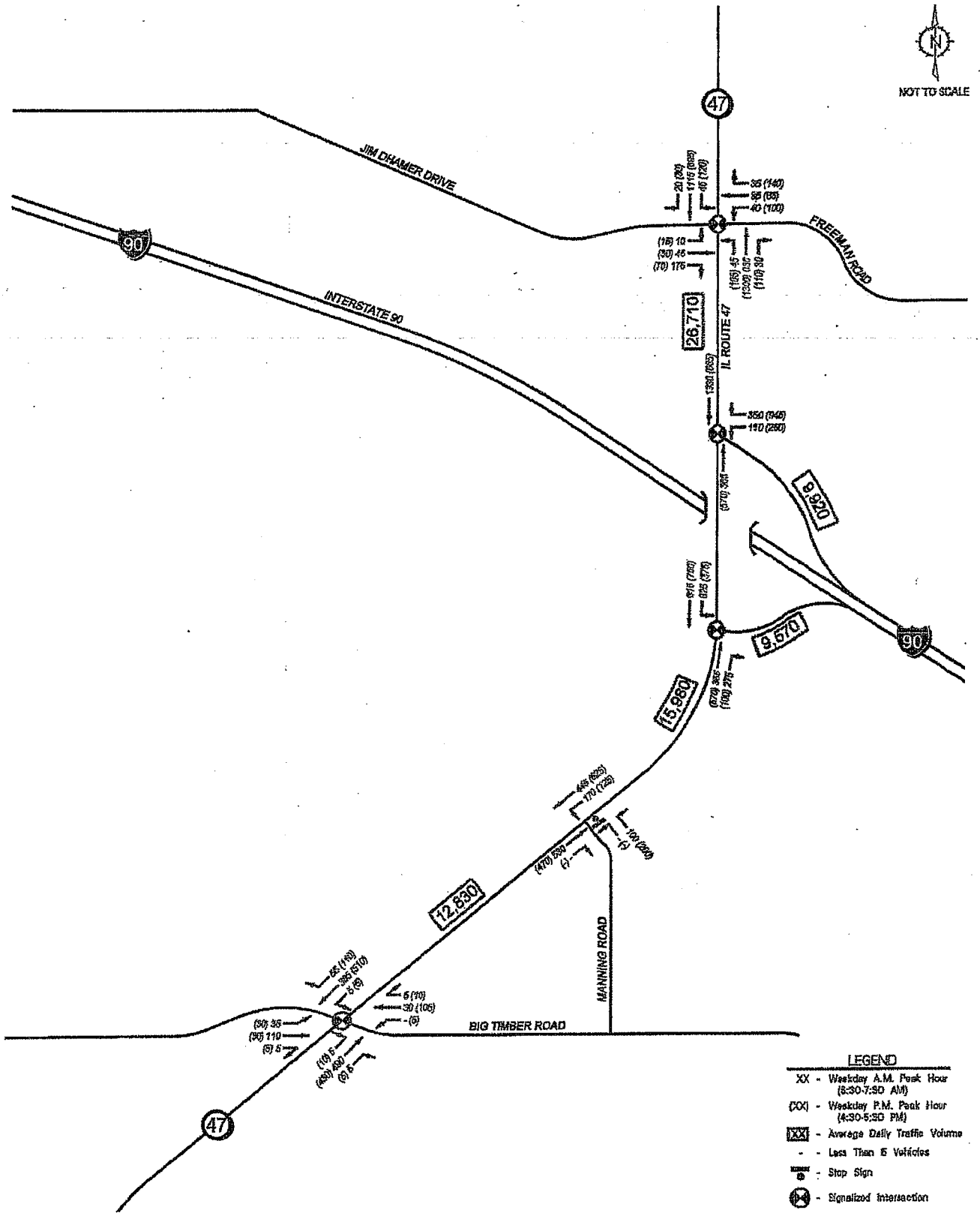
Pavement Widening
Tied PCC Curb and Gutter
- 13" HMA Pavement
  - 1 ¾" Polymerized HMA Surface Course, Mix "F", N90
  - ¾" Polymerized Leveling Binder (Machine Method), IL-4.75, N50
  - 10 ½" HMA Binder Course, IL-19.0, N90 *
- 12" Aggregate Subgrade Improvement

Existing Pavement Resurfacing
- Cold Milling of Existing HMA Pavement
  - 2 ½" Minimum more, if necessary
- 2 ½" HMA Resurfacing
  - 1 ¾" Polymerized HMA Surface Course, Mix "F", N90
  - ¾" Polymerized Leveling Binder (Machine Method), IL-4.75, N50

* Addendum Note 1: The only change in the pavement design is to part "b", the pavement widening of IL 47, as per District 1 materials the 2 ¼" polymerized binder course is not needed. This results in a 10 ½" HMA binder course as noted.

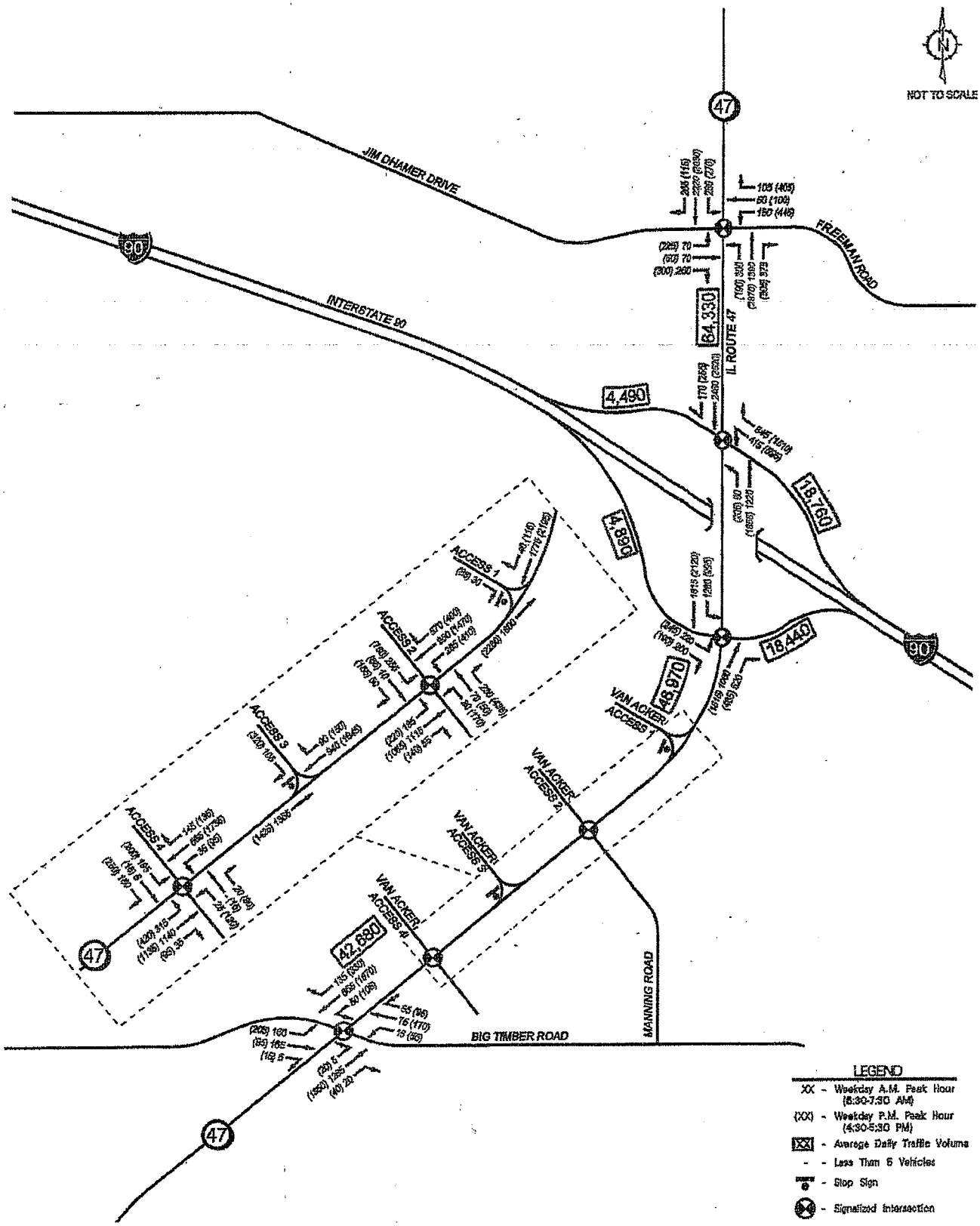
If you have any questions or need additional information, please contact Mr. Tom Matousek at (847)705-4255.

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



EXISTING (2007) TRAFFIC VOLUMES

FIGURE: 1



2030 TRAFFIC VOLUME PROJECTIONS

FIGURE: 9

benesch engineers · scientists · planners	Comp. by: _____ Date: _____ Sheet ____ of ____
	Chkd. by: _____ Date: _____ Job No. _____
	Project: I-90 AT IL 47 (TOLLWAY)
	Element: PAVEMENT DESIGN

IL 47

MECHANISTIC RIGID

- TIED PCC CURB & GUTTER
- 10½" PCC PAVEMENT, JOINTED → 34,400 SY [42000511]
- 4½" HMA STABILIZED SUBBASE
- 12" AGGREGATE SUBGRADE IMPROVEMENT

MECHANISTIC FLEXIBLE

- PCC CURB & GUTTER
- 13" HMA PAVEMENT, FULL-DEPTH [40701941]
  - 2" POLY HMA SURFACE, SMA, N80 → 3,853 TONS [40603153]
  - 2" POLY HMA BINDER, SMA, N80 → 3,853 TONS [40603148]
  - 9" HMA BINDER, IL-19.0, N90 → 17,338 TONS [40603090]
- 12" AGGREGATE SUBGRADE IMPROVEMENT

TOTAL LENGTH ≈ 4300 FT
TYPICAL THROUGH SECTION WIDTH = 12×6 = 72 FT
THROUGH SECTION AREA = 34,480 SY

PLAN AREA = 52,906 SY

benesch engineers · scientists · planners	Comp. by: _____ Date: _____ Sheet ____ of ____
	Chkd. by: _____ Date: _____ Job No. _____
	Project: I-90 AT IL 47 WIDENING
	Element: PAVEMENT DESIGN

IL 47 WIDENING

MECHANISTIC FLEXIBLE

- HMA/AGG SHOULDERS
- 13" HMA PAVEMENT
  - 1 3/4" POLY HMA SURFACE, MIX "F", N90 → 1936 TONS [40603595]
  - 3/4" POLY LEVELING BINDER
  - 2 1/4" POLY HMA BINDER COURSE, IL-19.0, N90 → 1,078 TONS [40603240]
  - 8 1/4" HMA BINDER COURSE, IL-19.0, N90 → 3,954 TONS [40603090]
- 12" AGGREGATE SUBGRADE IMPROVEMENT

MODIFIED AASHTO - FLEXIBLE

- HMA/AGG SHOULDERS
- 16 1/2" HMA PAVEMENT → EXCEEDS ALLOWABLE THICKNESS

COMPOSITE

- HMA/AGG SHOULDERS
- 14 1/4" COMPOSITE PAVEMENT
  - 1 3/4" POLY HMA SURFACE, MIX "F", N90 → 1,936 TONS [40603595]
  - 3/4" POLY LEVELING BINDER
  - 11 3/4" PCC BASE COURSE → 8,558 SQ YDS [35300615]
- 12" AGGREGATE SUBGRADE IMPROVEMENT

↳ ~~12" 35300700~~ ~~11 1/2" 35300610~~ ~~11" 35300600~~ | 10" 35300500 | ~~9" 35300400~~

RESURFACING AREA = 13,825 SQ YDS

WIDENING AREA = 8,558 SQ YDS

USE FOR TF ONLY

IL 47

Spreadsheet by Uehle - Rev. 11/02

MECHANISTIC PAVEMENT DESIGN

Date: 2/16/12

INPUT (Enter Data in Gray Shaded Cells)

Route: IL 47
Section:
County: Kane
Location: IL 47 at I 90

Comments: Traffic data for IL 47 at I 90

Designer: TMC

	ADT	Year
Current:	26700	2002
Future:	54390	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: 2012
Design Period (DP) = 30 years

	Minimum ADT	Structural Design Traffic: Actual ADT	Actual %of Total ADT	% of ADT in Design Lane	
PV =	0	54,644	92.0%	P =	8%
SU =	250	2,376	1.0%	S =	37%
MU =	750	2,376	4.0%	M =	37%
Struct. Design ADT =		59396	(2027)		

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)=	16.24	(Actual ADT)	TF rigid (Actual)=	22.18	(Actual ADT)
TF flexible (Min)=	4.38	(Min ADT Fig 54-2C)	TF rigid (Min)=	6.20	(Min ADT Fig 54-2C)
Use TF flexible =	16.24		Use TF rigid =	22.18	
AC Type =	20			1.0%	Shoulder or C. &G.
AC Mixture Tempurature =	30.0	deg. F (Figure 54-5C)	Rigid Pavt. Thick =	10.25	in. (Figure 54-4D)
Design AC Mixture Modulus (Eac)=	550	ksi (Figure 54-5D)			
Design Asphalt Concrete Microstrain =	42.6	(Figure 54-5E)			
Asphalt Concrete Thickness =	17.75	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)

Facility Type	Min. Str. Design Traffic (Fig 54-2C): PV	SU	MU
Interstate or Supplemental Freeway	0	500	1500
Other Marked State Route	0	260	1500
Unmarked State Route	No Min	No Min	No Min

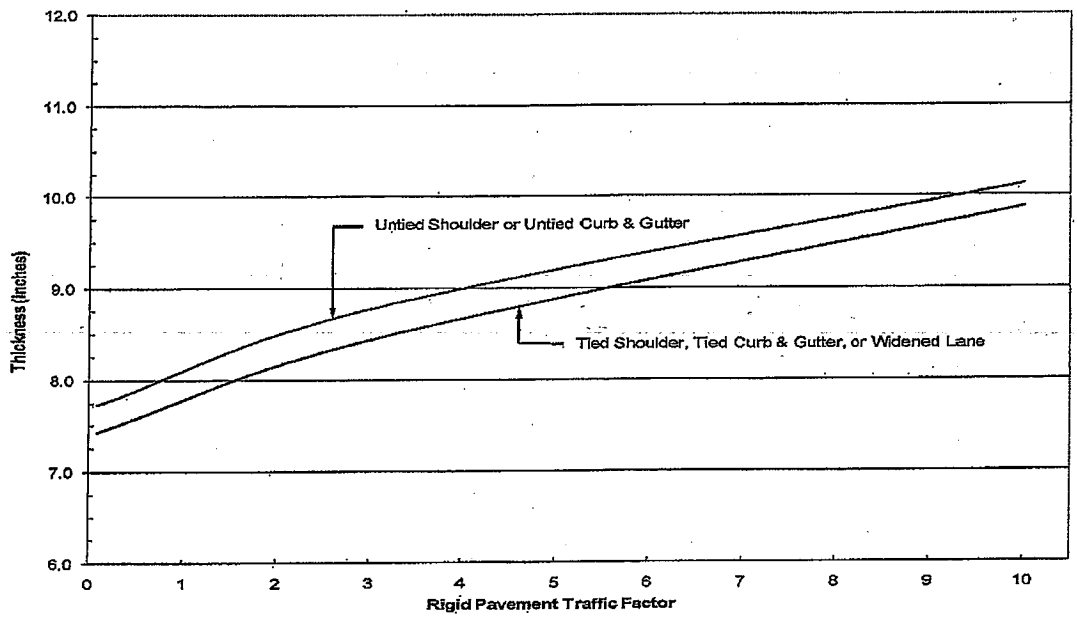
Class Table for One-Way Streets: ADT	Class
0 - 3500	II
>3501	I

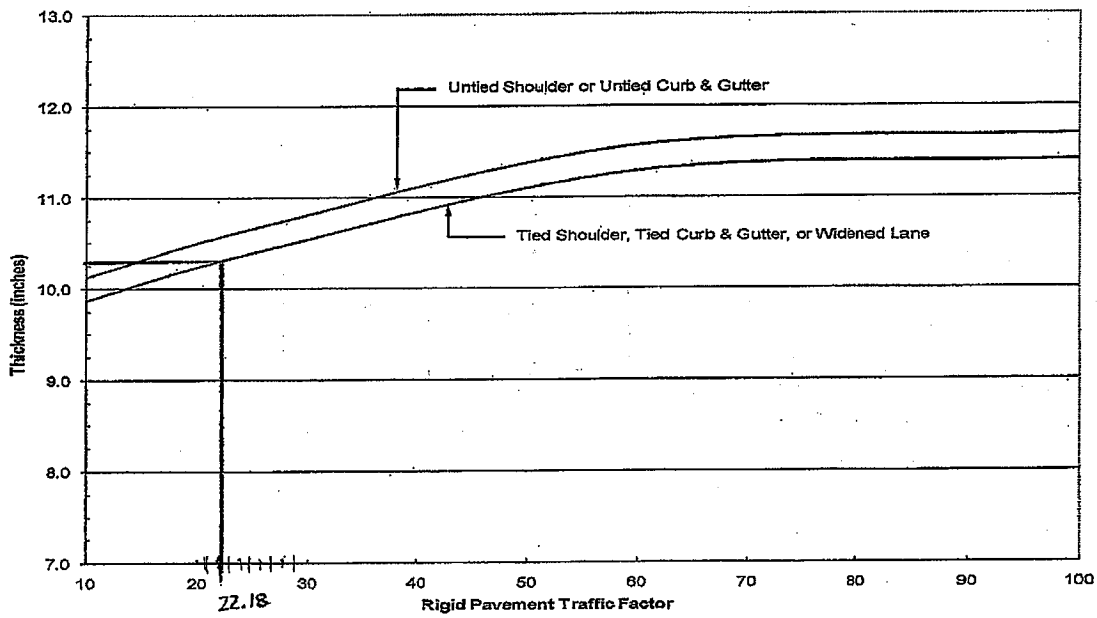
Class	Traffic Factor ESAL Coefficients: Rigid (Fig. 54-4C) Csu	Rigid Cmu	Flexible (Fig. 54-5B) Csu	Flexible Cmu
I	143.61	696.42	132.50	482.53
II	135.78	567.21	112.06	385.44
III	129.58	562.47	109.14	384.35
IV(ADT>400)	127.75	555.90	109.14	384.35
IV(ADT<=400)	127.75	555.90	9.86	78.84

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 47





Note: Use of untied shoulder design requires BDE approval.

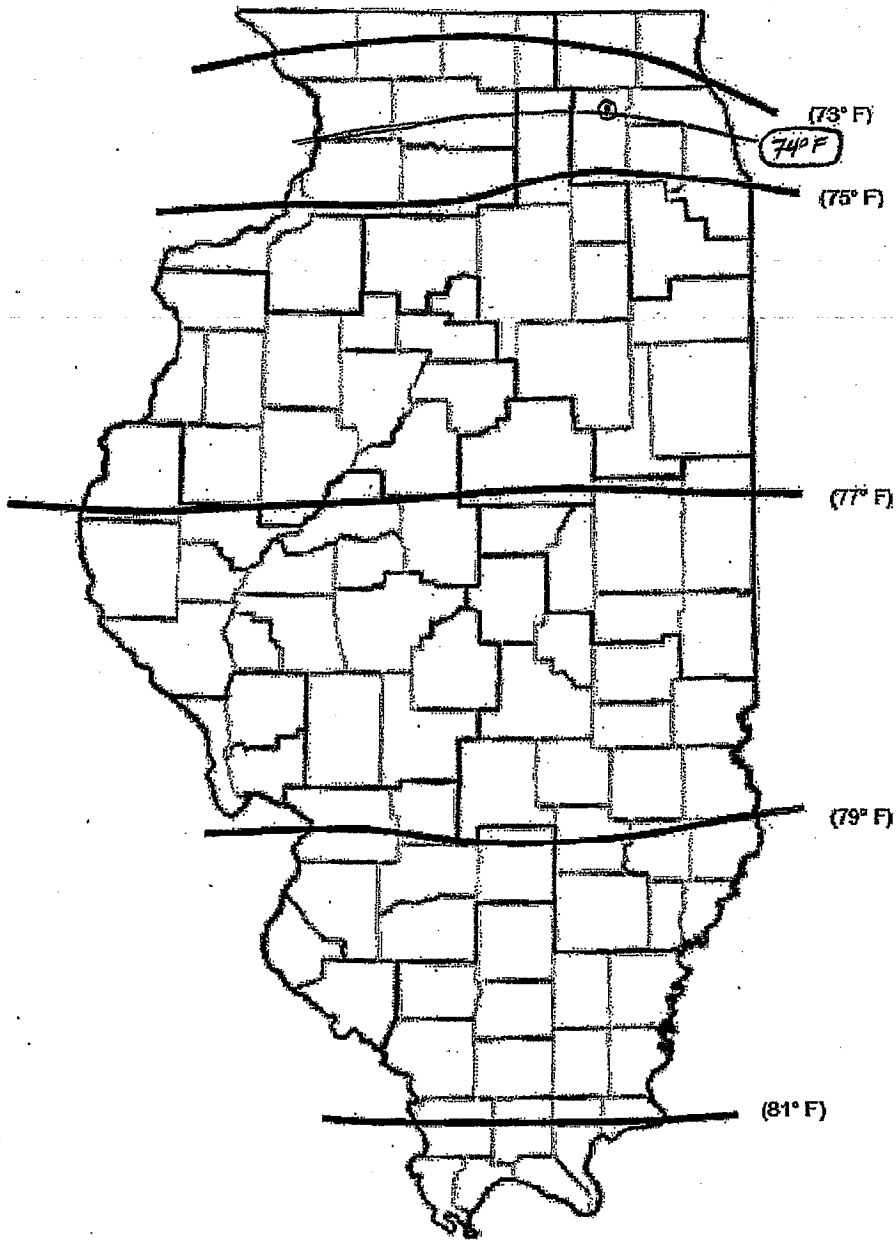
RIGID PAVEMENT DESIGN CHART
(Mechanistic Design: SSR = Poor)

10 1/2" PCC PAVEMENT (JOINTED)

Figure 54-4.E

HARD COPIES UNCONTROLLED

IL 47

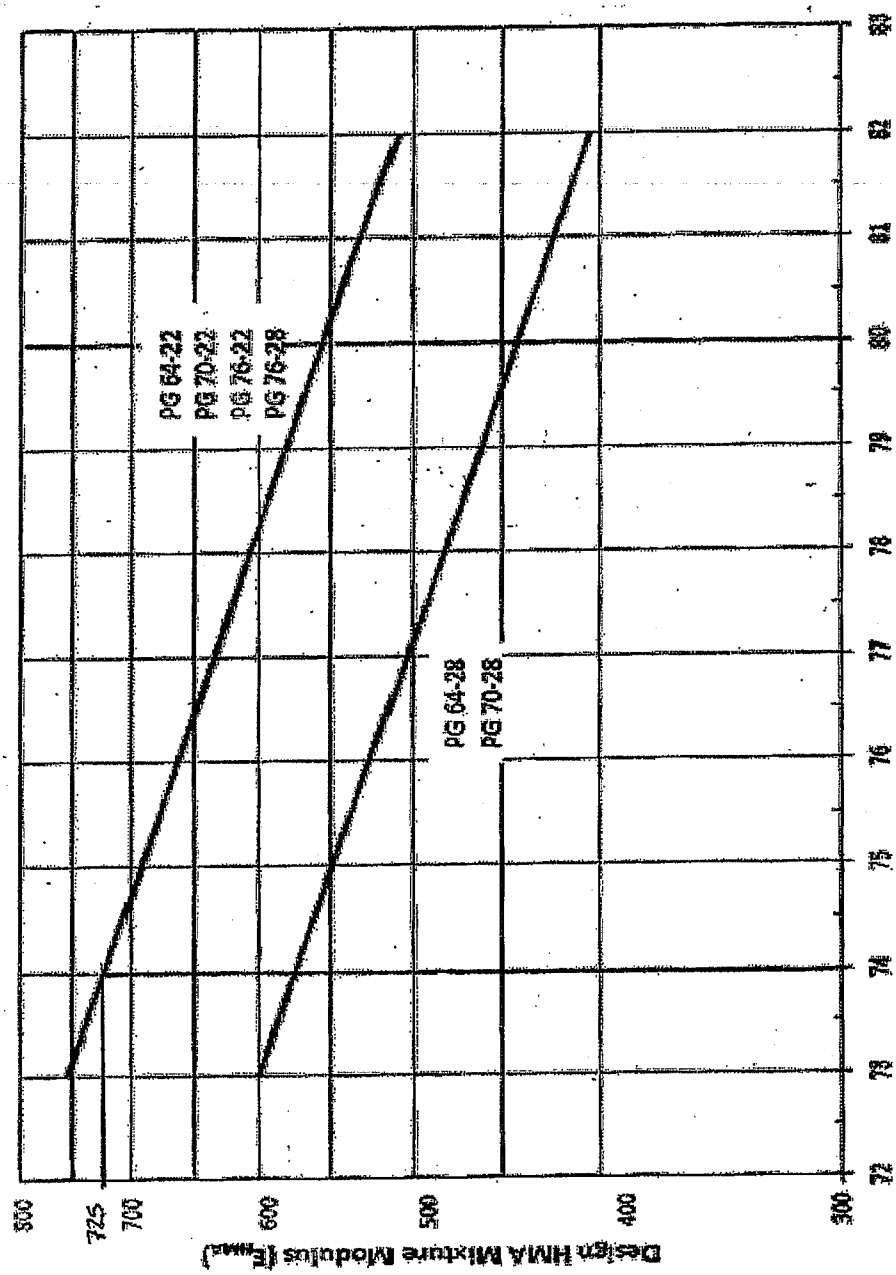


Note: The minimum design HMA mixture temperature will be 73 °F.

HMA MIXTURE TEMPERATURE
(Mechanistic Design: Flexible Pavement)

Figure 54-5.C

IL 47



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

Figure 54-5.D

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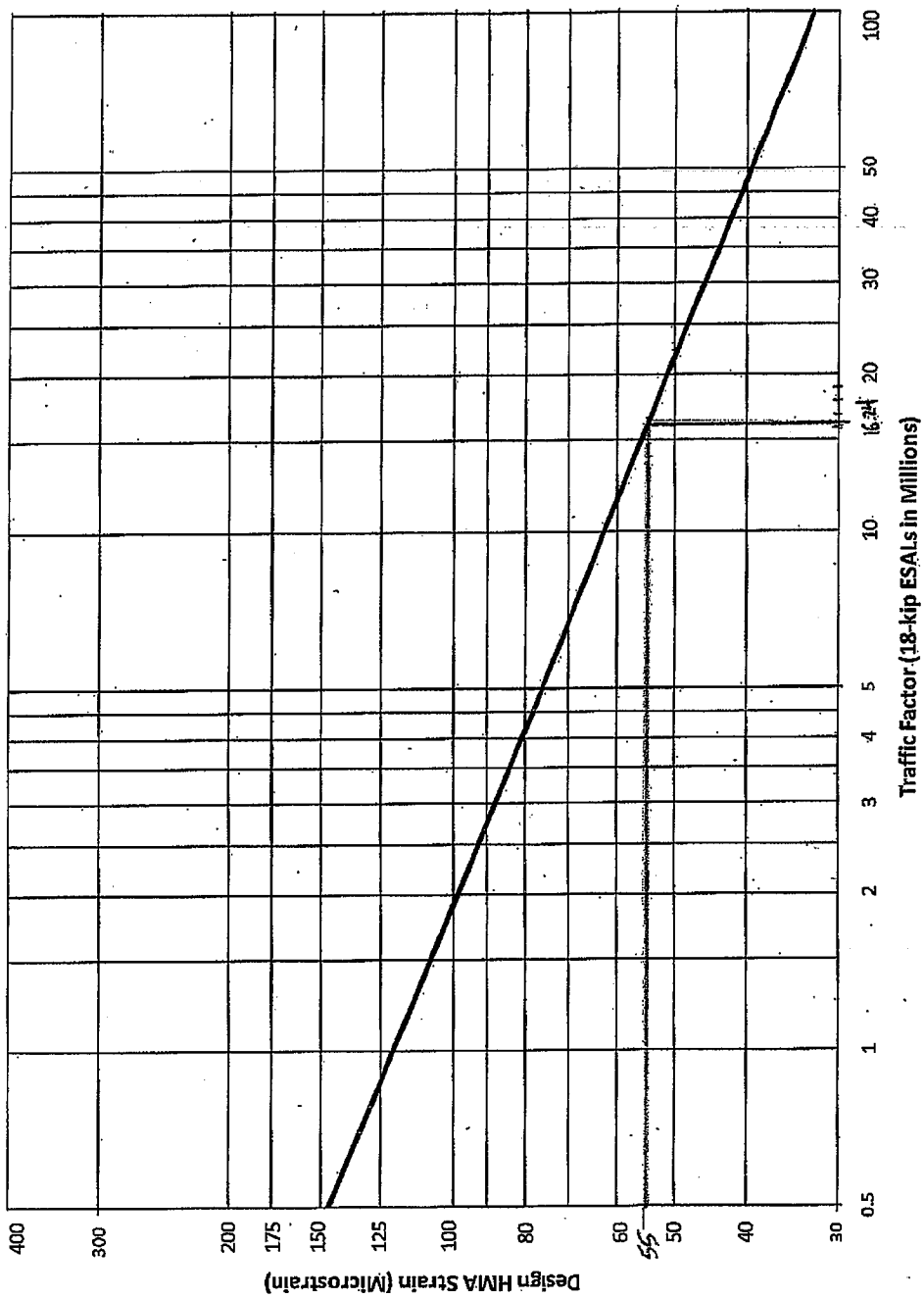
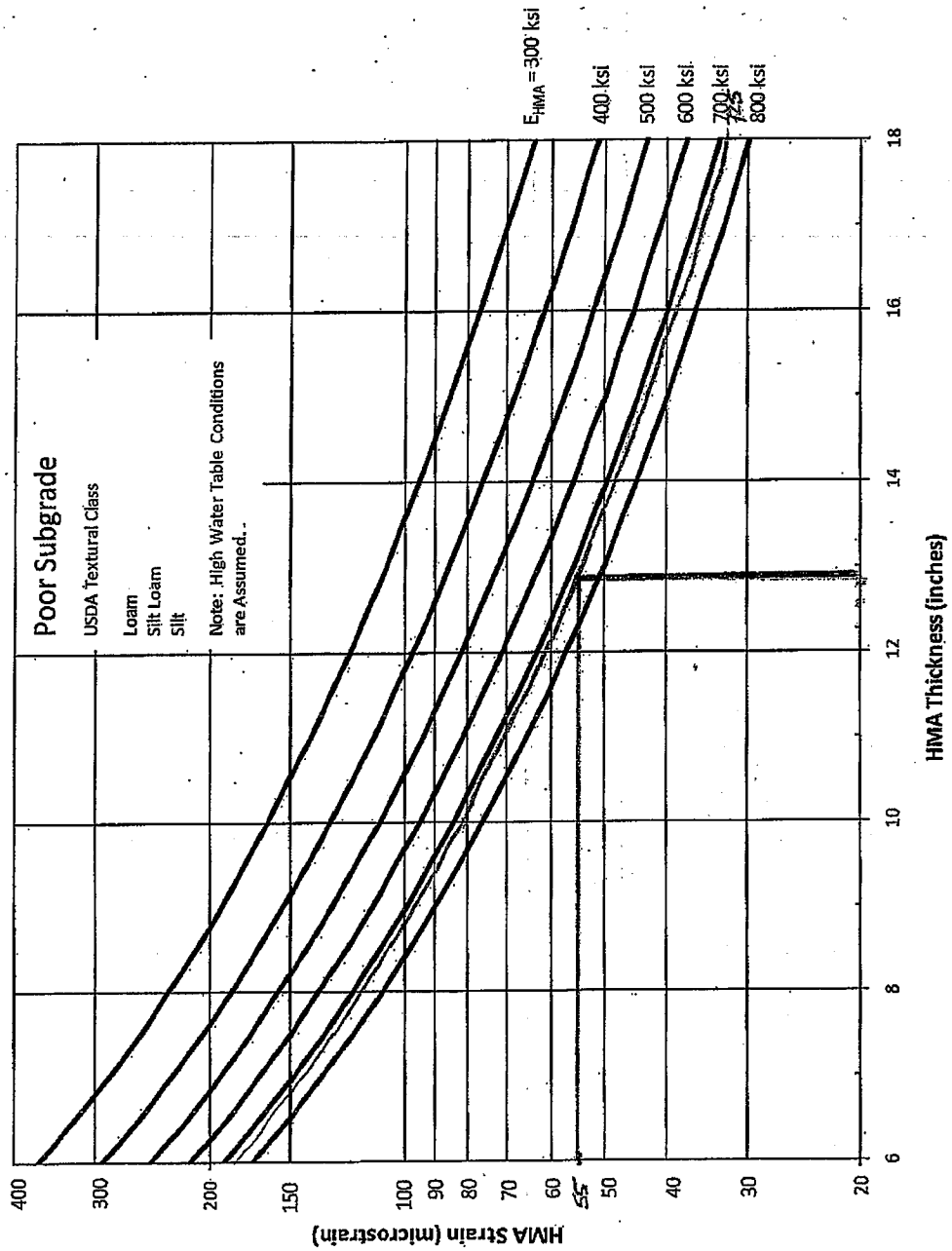
IL 47



DESIGN HMA STRAIN
(Mechanistic Design: Flexible Pavement)

Figure 54-5.E

IL 47



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

Figure 54-5.F

13" HMA PAVEMENT (FULL-DEPTH)

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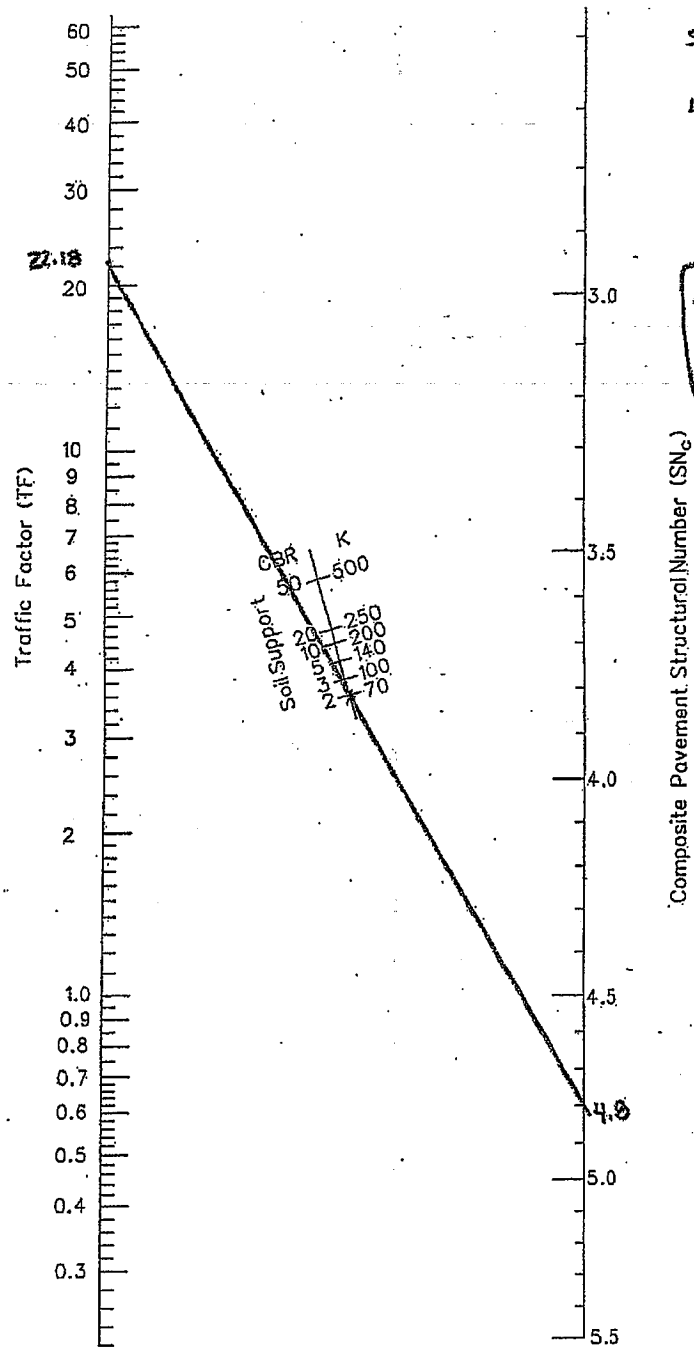
IL 47 - WIDENING



$SN_c = 0.40 D_s + 0.33 D_B$

$4.8 = (0.40)(2.5) + 0.33 D_B$

$D_B = 11.52$

COMPOSITE PAVEMENT
- 2½" HMA SURFACE
- 11¾" PCC BASE COURSE
- 12" AGG SUBGRADE IMP

COMPOSITE PAVEMENT DESIGN NOMOGRAPH
(Class I Facilities)

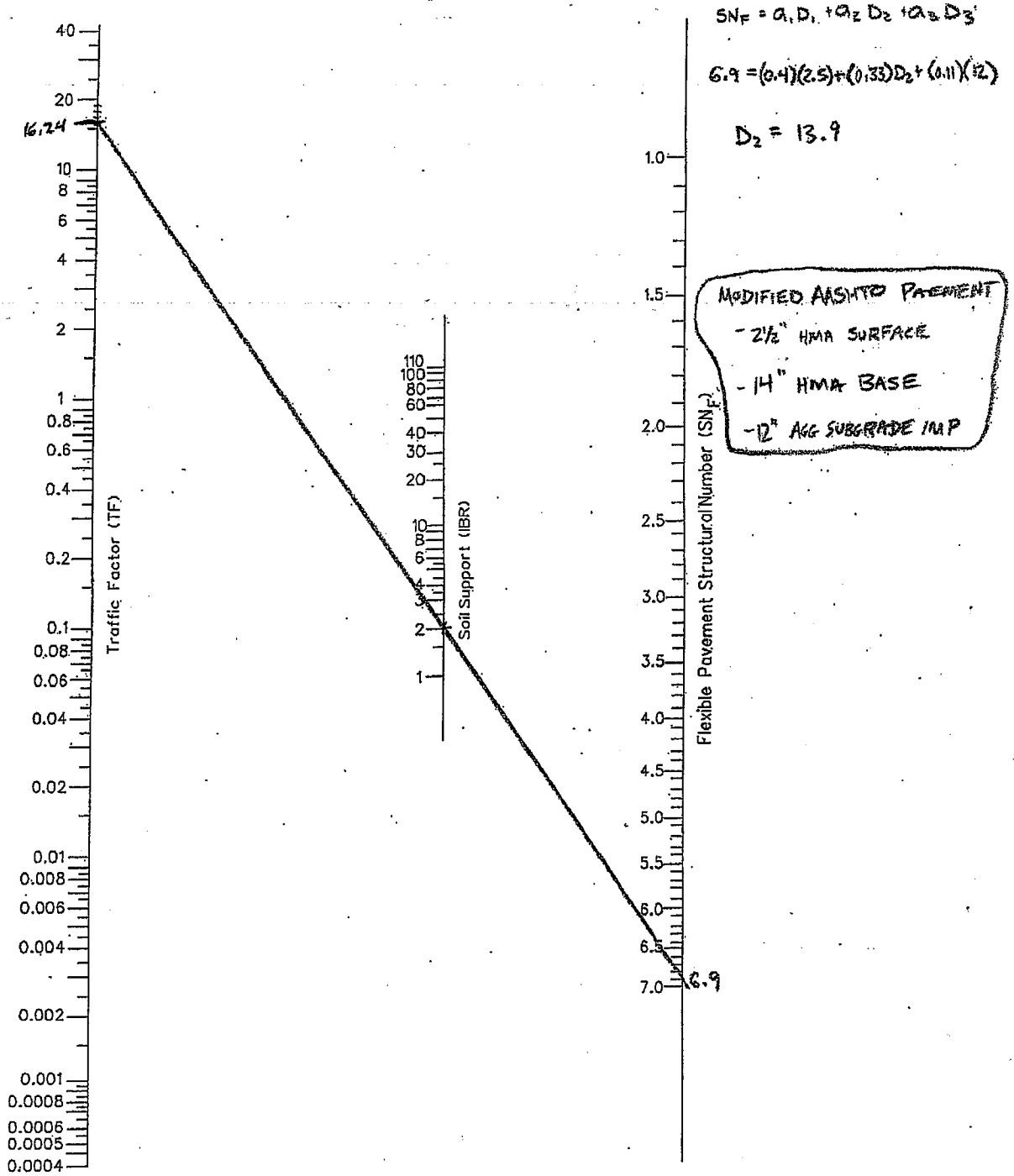
Figure 54-6.A

IL 47 - WIDENING

$SN_F = a_1 D_1 + a_2 D_2 + a_3 D_3$

$6.9 = (0.4)(2.5) + (0.33) D_2 + (0.11)(12)$

$D_2 = 13.9$



FLEXIBLE PAVEMENT DESIGN NOMOGRAPH
(Modified AASHTO Design: Class I Facilities)

Figure 54-5.M

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First Cost Analysis of Widening Project

Date:	2/23/2012			Route	IL 47
Quantities by:	TMC	Checked by:	SJP	Section	
Unit prices by:	TMC/SJP	Checked by:	SJP	County	
		Net Length		Project	I-90 at IL 47
				Contract	

Full Depth HMA

Area (Sq. Yd.)	Height (Inches)	Weight (Tons)	Material		Unit Cost	Total	ITEM #
		0	HMA Surface Course, MIX "D" N50	@		$0.00	40603335
		0	HMA Surface Course, MIX "D" N70	@		$0.00	40603340
13825	2.5	1936	Poly HMA Surface Course, MIX "F" N90	@	$90	$174,195.00	40603595
		0	Poly HMA Surface Course, SMA N80	@		$0.00	40603153
		0	HMA Binder course, IL-19, N50	@		$0.00	40603080
		0	HMA Binder course, IL-19, N70	@		$0.00	40603085
8558	8.25	3954	HMA Binder course, IL-19, N90	@	$80	$316,303.68	40603090
8558	2.25	1078	Poly HMA Binder course, IL-19, N90	@	$87	$93,812.80	40603240
		0	HMA Binder course, SMA, N80	@		$0.00	40603148
8558	NA	NA	12" Aggregate Subgrade	@	$15	$128,370.00	20001050
			Total			**$712,681.48**	

Composite

Area (Sq. Yd.)	Height (Inches)	Weight (Tons)	Material		Unit Cost	Total	ITEM #
		0	HMA Surface Course, MIX "D" N50	@		$0.00	40603335
		0	HMA Surface Course, MIX "D" N70	@		$0.00	40603340
13825	2.5	1936	Poly HMA Surface Course, MIX "F" N90	@	$90	$174,195.00	40603595
		0	Poly HMA Surface Course, SMA N80	@		$0.00	40603153
8558	11.75	NA	PCC Base Course	@	$48	$410,784.00	85300410
8558	NA	NA	12" Aggregate Subgrade	@	$15	$128,370.00	31101200
			Total			**$713,349.00**	

MECHANISTIC PAVEMENT DESIGN

Date 21-Mar-12
Calcs by: SJP
Checked by:
Class I Roads and Streets
Urban X Rural
Limits of Analysis Station 110+16 to Station 197+04
Length 4300 Feet 0.81 Miles

Route IL 47 @ I-90
Section NA
Cook County
Location Big Timber to Freeman

Structural Design Traffic
PV = 54644
SU = 2376
MU = 2376

Percent of S.D.T. in Design Lane
P = 92.00%
S = 4.00%
U = 4.00%

MINIMUM SUBGRADE SUPPORT RATING - "POOR"

Flexible Pavement Design Actual TF_F = 16.24 Minimum TF_F = 4.38

Selected Design AC Type
Design AC Mixture Temp 74 °F
Design AC Microstrain 55
Design E_{AC} 725 KSI
AC Thickness 13.00 Inch

Rigid Pavement Design Actual TF_F = 22.18 Minimum TF_F = 6.2
Extended Lane 10.5 Inch
15' Panel PCC Thickness for:
Tied Shoulder 0 Inch
Untied Shoulder 0 Inch

Figure 5.05

RIGID PAVEMENT

Date:	21-Mar-12			Route	IL 47 @ I-90
Quantities by	SJP	Checked by:		Section	NA
Unit Prices by	TM	Checked by:		Cook	County
Net Length	4300	Lin. Ft. =	0.81	Miles	
Number Lanes	6	Urban	X	Rural	

ITEMIZED CONSTRUCTION COST

Quantity	Units	Item		Unit Cost	Total Cost
34400	Sq. Yds.	11 Inch Jointed PCC	@	$40.05	$1,377,720
37267	Sq. Yds.	4-Inch (Stabilized/Granular Subbase)	@	$16.00	$596,272
0	Sq. Yds.	PCC Shoulder	@	$0.00	$0
	Lin. Ft.	Pipe Underdrains	@		
0		Subbase Gran. Mat., Type C	@	$0.00	$0
17,200	Lin. Ft.	100% Shoulder Joint Seal	@	$2.00	$34,400

Total Cost of Original Pavement Construction $2,008,392

ITEMIZED MAINTENANCE AND REHABILITATION ACTIVITY COST

REHABILITATION ACTIVITY 1 - YEAR 10

34	Sq. Yds.	0.1% Full Depth PCC Pavement Patching	@	$130.00	$4,420
		Total Cost of Rehabilitation Activity 1			$4,420

Figure 5.05a(1)

RIGID PAVEMENT (Cont.)

Route IL 47 @ I-90

Section NA

Cook County

REHABILITATION ACTIVITY 2 - YEAR 15

			Unit Cost	Total Cost
69 Sq. Yds.	0.2% Full Depth PCC Pavement Patching	@	$130.00	$8,970

Total Cost of Rehabilitation Activity 2 $8,970

REHABILITATION ACTIVITY 3 - YEAR 20

			Unit Cost	Total Cost
688 Sq. Yds.	2% Full Depth PCC Pavement Patching	@	$0.00	$89,440
0 Sq. Yds.	0.5% Full Depth PCC Pavement Patching	@	$85.00	$0
17200 Lin. Ft.	100% Longitudunal/ Shoulder Joint Routing & Sealing	@	$1.00	$17,200
17200 Lin. Ft.	100% Centerline Joint Routing & Sealing	@	$1.00	$17,200

Total Cost of Rehabilitation Activity 3 $123,840

FIGURE 5.05a(2)

RIGID PAVEMENT (Cont.)

Route IL 47 @ I-90

Section NA

Cook County

REHABILITATION ACTIVITY 4 - YEAR 25

			Unit Cost	Total Cost
1032 Sq. Yds.	3.0% Full Depth PCC Pavement Patching	@	$130.00	$134,160
0 Sq. Yds.	1.0% Full Depth PCC Pavement Patching	@	$85.00	$0

Total Cost of Rehabilitation Activity 4 $134,160

REHABILITATION ACTIVITY 5 - YEAR 30

			Unit Cost	Total Cost
1376 Sq. Yds.	3.0% Full Depth PCC Pavement Patching	@	$85.00	$0
0 Sq. Yds.	1.0% Full Depth PCC Pavement Patching	@	$12.67	$435,848
34,400 Sq. Yds.	Policy HMA Overlay - Pavement	@	$12.67	$435,848
0 Sq. Yds.	Policy HMA Overlay - Shoulder	@	$12.67	$0

Total Cost of Rehabilitation Activity 5 $614,728

REHABILITATION ACTIVITY 6 - YEAR 35

			Unit Cost	Total Cost
17,200 Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$17,200
17200 Lin. Ft.	100% Centerline Joint Routing & Sealing	@	$1.00	$17,200
12,900 Lin. Ft.	50% Random Crack Routing & Sealing - Assume 100ft/station	@	$1.00	$12,900
8,256 Lin. Ft.	40% Reflective Transverse Crack Routing & Sealing	@	$1.00	$8,256
34 Sq. Yds.	0.1% Partial-Depth Pavement Patching (Mill & Fill Surface-Interstates; Mill & Fill 2.5in. Non-Interstates)		$130.00	$4,420

Total Cost of Rehabilitation Activity 6 $59,976

Figure 5.05a(3)

RIGID PAVEMENT (Cont.)

Route IL 47 @ I-90

Section NA

Cook County

REHABILITATION ACTIVITY 7 - YEAR 40

			Unit Cost	Total Cost
172 Sq. Yds.	0.5% Full Depth PCC Pavement Patching	@	$130.00	$22,360
172 Sq. Yds.	0.5% Partial Depth Pavement Patching	@	$130.00	$22,360
	(Mill & Fill Surface-Interstates; Mill & Fill 2.5in. Non-Interstates)			
12,384 Lin. Ft.	60% Reflective Transverse Crack Routing & Sealing	@	$1.00	$12,384
12,900 Lin. Ft.	50% Random Crack Routing & Sealing - Assume 100ft/station	@	$1.00	$12,900
17,200 Lin. Ft.	100% Longitudunal/ Shoulder Joint Routing & Sealing	@	$1.00	$17,200
17,200 Lin. Ft.	100% Centerline Joint Routing & Sealing	@	$1.00	$17,200
	Total Cost of Rehabilitation Activity 7			$104,404

RIGID PAVEMENT (Cont.)

Route IL 47 @ I-90

Section NA

Cook County

ANNUAL COST DETERMINATION

Present Worth Calculation:

Total Cost of Original Pavement Construction $2,008,392

Present Worth of Rehab Activity 1	$4,420	x 0.7441 =	$3,289
Present Worth of Rehab Activity 2	$8,970	x 0.6419 =	$5,758
Present Worth of Rehab Activity 3	$123,840	x 0.5537 =	$68,570
Present Worth of Rehab Activity 4	$134,160	x 0.4776 =	$64,075
Present Worth of Rehab Activity 5	$614,728	x 0.4120 =	$253,268
Present Worth of Rehab Activity 6	$59,976	x 0.3554 =	$21,315
Present Worth of Rehab Activity 7	$104,404	x 0.3066 =	$32,010

Total Life Cycle Cost (Present Worth) $448,285

Annual Cost Per Mile Calculation

Total PW	x CRF_n /	Length		= Annual Cost / Year-Mile
$448,285	x0.04079 /	0.81	Mi.	$123,713 per Yr.-Mi.

FLEXIBLE PAVEMENT

Date: 21-Mar-12 Route IL 47 @ I-90
Quantities by SJP Checked by: Section NA
Unit Prices by TM Checked by: Cook County
Net Length 4300 Lin. Ft. = 0.81 Miles
Number Lanes 6 Urban X Rural
Single Lane Paving X Dual Lane Paving

ITEMIZED CONSTRUCTION COST

Quantity	Units	Item		Unit Cost	Total Cost
34,400	Sq. Yds.	Class I Surface Course	@	$12.67	$435,848
34,400	Sq. Yds.	Class I Binder Course	@	$44.70	$1,537,680
0	Sq. Yds.	Stabilized Shoulders	@	$0.00	$0
	Lin. Ft.	Pipe Underdrains	@		
0		Subbase Gran. Matl., Type C	@	$0.00	$0
34,400	Sq. Yds.	Poly Binder	@	$11.22	$385,968

Total Cost of Original Pavement Construction $2,359,496

ITEMIZED MAINTENANCE AND REHABILITATION ACTIVITY COST

REHABILITATION ACTIVITY 1 - YEAR 5

				Unit Cost	Total Cost
2365	Lin. Ft.	50% Random/Thermal Cracking & Sealing (Assume 110ft/station)	@	$1.00	$2,365
17200	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$17,200
17200	Lin. Ft.	100% Centerline Joint Rounting & Sealing	@	$1.00	$17,200
34	Sq. Yds.	0.1% Partial-Depth Pavement Patching Mill & Fill Surface	@	$90.00	$3,060

Total Cost of Rehabilitation Activity 1 $39,825

FIGURE 5.05b(1)

FLEXIBLE PAVEMENT (Cont.)

Route IL 47 @ I-90

Section NA

Cook County

REHABILITATION ACTIVITY 2 - YEAR 10

				Unit Cost	Total Cost
172	Sq. Yds.	0.5% Partial-depth HMA Pavement Patching - Mill & Fill Surface	@	$90.00	$15,480
2365	Lin. Ft.	50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station)	@	$1.00	$2,365
17200	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$17,200
17200	Lin. Ft.	100% Centerline Joint Rounting & Sealing	@	$1.00	$17,200

Total Cost of Rehabilitation Activity 2 $52,245

REHABILITATION ACTIVITY 3 - YEAR 15

				Unit Cost	Total Cost
34,400	Sq. Yds.	2.00in. Milling - Pavement & Shoulder	@	$1.75	$60,200
344	Sq. Yds.	1.0% Partial-depth Pavement Patching (Mill & Fill Addition 2.00in.)	@	$90.00	$30,960
3,853	Sq. Yds.	2.00in. HMA Overlay Pavement & Shoulder	@	$113.13	$435,871

Total Cost of Rehabilitation Activity 3 $527,031

FIGURE 5.05b(2)

FLEXIBLE PAVEMENT (Cont.)

Route IL 47 @ I-90

Section NA

Cook County

				Unit Cost	Total Cost
REHABILITATION ACTIVITY 4 - YEAR 20					
17200	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$17,200
17200	Lin. Ft.	100% Centerline Joint Rounting & Sealing	@	$1.00	$17,200
2365	Lin. Ft.	50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station)	@	$1.00	$2,365
34	Sq. Yds.	0.1% Partial-Depth HMA Pavement Patching (Mill & Fill Surface)	@	$90.00	$3,060
		Total Cost of Rehabilitation Activity 4			$39,825
				Unit Cost	Total Cost
REHABILITATION ACTIVITY 5 - YEAR 25					
17200	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$17,200
17200	Lin. Ft.	100% Centerline Joint Rounting & Sealing	@	$1.00	$17,200
2365	Lin. Ft.	50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station)	@	$1.00	$2,365
172	Sq. Yds.	0.5% Partial-Depth Pavement Patching (Mill & Fill Surface)	@	$90.00	$15,480
		Total Cost of Rehabilitation Activity 5			$52,245
				Unit Cost	Total Cost
REHABILITATION ACTIVITY 6 - YEAR 30					
34,400	Sq. Yds.	2.00in. Milling (Pavement only-Std Design Pavement & Shoulder-Limiting Strain Criteria Design)	@	$1.75	$60,200
688	Sq. Yds.	2.0% Partial-Depth HMA Pavement Patching (Mill & Fill Additional 2.00in. All Designs)	@	$90.00	$61,920
0	Sq. Yds.	1.0% Full-Depth HMA Shoulder Patching (Mill & Fill Surface-Standard Design Mill & Fill Additional 2.00in.-Limiting Strain Criteria Design)	@	$90.00	$0
7,224	Tons	HMA Overlay Pvmt (3.75in. - Std Design 2.00in.-Limiting Strain Criterion Design)	@	$113.13	$817,215
0	Tons	HMA Overlay Shoulder (1.75in. - Standard Design; 2.00in.-Limiting Strain Criterion Design)	@	$113.13	$0
		Total Cost of Rehabilitation Activity 6			$939,335

FIGURE 5.05b(3)

FLEXIBLE PAVEMENT (Cont.)

Route IL 47 @ I-90

Section NA

Cook County

REHABILITATION ACTIVITY 7 - YEAR 35

				Unit Cost	Total Cost
17200	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$17,200
17200	Lin. Ft.	100% Centerline Joint Rounting & Sealing	@	$1.00	$17,200
2365	Lin. Ft.	50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station)	@	$1.00	$2,365
34	Sq. Yds.	0.1% Partial-Depth HMA Pavement Patching (Mill & Fill Surface)	@	$90.00	$3,060
		Total Cost of Rehabilitation Activity 7			$39,825

REHABILITATION ACTIVITY 8 - YEAR 40

				Unit Cost	Total Cost
17200	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	$1.00	$17,200
17200	Lin. Ft.	100% Centerline Joint Rounting & Sealing (Single Lane and Dual Lane Paving)	@	$1.00	$17,200
2365	Lin. Ft.	50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station)	@	$1.00	$2,365
172	Sq. Yds.	0.5% Partial-Depth Pavement Patching (Mill & Fill Surface)	@	$90.00	$15,480
		Total Cost of Rehabilitation Activity 8			$52,245

Figure 5.05b(4) - continued

FLEXIBLE PAVEMENT (Cont.)

Route IL 47 @ I-90

Section NA

Cook County

ANNUAL COST DETERMINATION

Present Worth Calculation:

Total Cost of Original Pavement Construction $2,359,496

Present Worth of Rehab Activity 1	$39,825	x 0.7441 =	$34,353
Present Worth of Rehab Activity 2	$52,245	x 0.6419 =	$38,876
Present Worth of Rehab Activity 3	$527,031	x 0.5537 =	$338,301
Present Worth of Rehab Activity 4	$39,825	x 0.4776 =	$22,051
Present Worth of Rehab Activity 5	$52,245	x 0.4120 =	$24,952
Present Worth of Rehab Activity 6	$939,335	x 0.3554 =	$387,006
Present Worth of Rehab Activity 7	$39,825	x 0.3066 =	$14,154
Present Worth of Rehab Activity 8	$52,245	x 0.3066 =	$16,018

Total Life Cycle Cost (Present Worth) $875,711

Annual Cost Per Mile Calculation

Total PW	x CRF_n /	Length		= Annual Cost / Year-Mile
$875,711	x0.04079 /	0.81	Mi.	$162,919 per Yr.-Mi.

MATERIAL TYPE/PERCENTAGE	PCC	31.7%

PLAIN JOINTED PCC PAVEMENT

FILENAME-	IL 47 @ I-90	21-Mar-12	
ROUTE-	IL 47	1:52 PM	
SECTION-	NA		
COUNTY-	Cook		
LOCATION-	Big Timber to Freeman		
DATE-	21-Mar-12		
PROJECT LENGTH (FT)	4300 =	0.81	MILES
AVERAGE LANE WIDTH (FT)	12		
NUMBER OF LANES	6		
# OF EDGES	4		
INSIDE SHLDER WIDTH (FT)	0		
OUTSIDE SHLDER WIDTH (FT)	0		
# OF CENTERLINES	4		
RIGID THICKNESS-	10.5		
TRAFFIC FACTORS	MINIMUM	ACTUAL	
RIGID-	6.2	22.18	

TRAFFIC

		Percentages
PV-	54844	92.00%
SU-	2376	4.00%
MU-	2376	4.00%

INITIAL COSTS

ITEM	QUANTITY	UNIT PRICE	COST
PAVEMENT (SQ YDS)	34,400	$40.05	$1,377,720
STAB SUBBASE (SQ YDS)	37,267	$16.00	$596,272
SHOULDERS (SQ YDS)	0	$0.00	$0
SHOULDER SEAL (LN FT)	17,200	$2.00	$34,400
SUBBASE GRAN MATL TY C (TONS)	0	$0.00	$0
	CONSTRUCTION INITIAL COST (PW)		$2,008,392
	TOTAL REHABILITATION COST (PW)		$448,285
	TOTAL LIFE CYCLE COST (PW)		$2,456,677
	ANNUAL COST PER MILE		$123,713

MAINTENANCE COSTS:

ITEM		UNIT COST
PAVEMENT PATCHING (SQ YDS)	(Use Class A pricing for CRC)	$130.00
SHOULDER PATCHING (SQ YDS)		$85.00
SHLDR JT ROUT & SEAL (LF)		$1.00
CENTERLINE JT ROUT & SEAL (LF)		$1.00
POLICY HMA OVERLAY PVMT (SQ YDS)		$12.67
POLICY HMA OVERLAY SHLDR (SQ YDS)		$12.67
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)	34	$130.00	$4,420	
				$4,420	$3,289
Activity 2 YEAR 15					
	PAVEMENT PATCHING 0.2% (SQ YDS)	69	$130.00	$8,970	
				$8,970	$5,758
Activity 3 YEAR 20					
	PAVEMENT PATCHING 2.0% (SQ YDS)	688	$130.00	$89,440	
	SHOULDER PATCHING 0.5% (SQ YDS)	0	$85.00	$0	
	SHLDR JT ROUT & SEAL 100% (LF)	17,200	$1.00	$17,200	
	CENTERLINE JT ROUT & SEAL 100% (LF)	17,200	$1.00	$17,200	
				$123,840	$68,570
Activity 4 YEAR 25					
	PAVEMENT PATCHING 3.0% (SQ YDS)	1,032	$130.00	$134,160	
	SHOULDER PATCHING 1.0% (SQ YDS)	0	$85.00	$0	
				$134,160	$84,075
Activity 5 YEAR 30					
	PAVEMENT PATCHING 4.0% (SQ YDS)	1,376	$130.00	$178,880	
	SHOULDER PATCHING 1.5% (SQ YDS)	0	$85.00	$0	
	POLICY HMS OVERLAY OVMT (SQ YDS)	34,400	$12.67	$435,848	
	POLICY HMA OVERLAY SHLDR (SQ YDS)	0	$12.67	$0	
				$614,728	$253,268
Activity 6 YEARS 35					
	SHLDR JT ROUT & SEAL 100% (LF)	17,200	$1.00	$17,200	
	CENTERLINE JT ROUT & SEAL 100% (LF)	17,200	$1.00	$17,200	
	RANDOM CRACK ROUT & SEAL 50% (LF)	12,900	$1.00	$12,900	
	REFL TRANS CRACK ROUT & SEAL 40%	8,256	$1.00	$8,256	
	PARTIAL PVMT PATCH 0.1% (SQ YDS)	34	$130.00	$4,420	
				$59,976	$21,315
Activity 7 YEAR 40					
	PAVEMENT PATCHING 0.5% (SQ YDS)	172	$130.00	$22,360	
	SHOULDER PATCHING 0.5% (SQ YDS)	172	$130.00	$22,360	
	REFL TRANS CRACK ROUT & SEAL 60%	12,384	$1.00	$12,384	
	RANDOM CRACK ROUT & SEAL 50% (LF)	12,900	$1.00	$12,900	
	SHLDR JT ROUT & SEAL 100% (LF)	17,200	$1.00	$17,200	
	CENTERLINE JT ROUT & SEAL 100% (LF)	17,200	$1.00	$17,200	
				$104,404	$32,010
	Total Rehabilitation Cost (Present Worth)				$448,285

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

ROUTE-	IL 47	21-Mar-12
SECTION-	NA	1:52 PM
COUNTY-	Cook	
LOCATION-	Big Timber to Freeman	

PROJECT LENGTH (FT)	4300	
AVERAGE LANE WIDTH (FT)	12	
NUMBER OF LANES	6	
# OF EDGES	4	
INSIDE SHLDER WIDTH (FT)	0	
OUTSIDE SHLDER WIDTH (FT)	0	
# OF CENTERLINES	4	
PROJECT TYPE	2	1=RURAL, 2=URBAN
PAVING WIDTH	1	1=SINGLE LANE, 2=DUAL LANE
INTERSTATE / OTHER ROUTE	OTHER ROUTE	
FLEXIBLE THICKNESS-	0	

TRAFFIC FACTORS	MINIMUM	ACTUAL
FLEXIBLE	4.38	16.24

TRAFFIC

PV-	54644	0.92
SU-	2376	0.04
MU-	2376	0.04

PAVEMENT OVERLAY THICKNESS	3.75
SHOULDER OVERLAY THICKNESS	1.75

INITIAL COSTS

ITEM	QUANTITY	UNIT PRICE	COST
SURFACE (SQ YDS)	34,400	$12.67	$435,848
POLY BINDER (SQ YDS)	34,400	$11.22	$385,968
BINDER (SQ YDS)	34,400	$44.70	$1,537,680
SHOULDERS (SQ YDS)	0	$0.00	$0
SUBBASE GRAN MATL TY C (TONS)	0	$0.00	$0

CONSTRUCTION INITIAL COST (PW)	$2,359,496
TOTAL REHABILITATION COST (PW)	$875,711
TOTAL LIFE CYCLE COST (PW)	$3,235,207
ANNUAL COST PER MILE	$162,919

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)		$113.13
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)		$113.13
POLICY HMA OVERLAY SHLDR (TONS)		$113.13

MATERIAL TYPE/PERCENTAGE PCC 31.7%

FULL DEOTH FLEXIBLE PAVEMENT
MAINTENANCE COSTS

	ITEM	QUANTITY	UNIT PRICE	COST	PW
Activity 1					
YEAR 5	RAND/THERM CRACK ROUT & SEAL 50% (LF)	2,365	$1.00	$2,365	
	SHLDR JT ROUT & SEAL 100% (LF)	17,200	$1.00	$17,200	
	CENTERLINE JT ROUT & SEAL 100% (LF)	17,200	$1.00	$17,200	
	PARTIAL PVMT PATCH 0.1% (SQ YDS)	34	$90.00	$3,060	
				$39,825	$34,353
Activity 2					
YEAR 10	PARTIAL PVMT PATCH 0.5% (SQ YDS)	172	$90.00	$15,480	
	RAND/THERM CRACK ROUT & SEAL 50% (LF)	2,365	$1.00	$2,365	
	SHLDR JT ROUT & SEAL 100% (LF)	17,200	$1.00	$17,200	
	CENTERLINE JT ROUT & SEAL 100% (LF)	17,200	$1.00	$17,200	
				$52,245	$38,876
Activity 3					
YEAR 15	2" MILL PVMT & SHLDR 100% (SQ YDS)	34,400	$1.75	$60,200	
	PARTIAL PVMT PATCH 1.0% (SQ YDS)	344	$90.00	$30,960	
	2" OVERLAY PVMT & SHLDR 100% (TONS)	3,853	$113.13	$435,871	
				$527,031	$338,301
Activity 4					
YEAR 20	SHLDR JT ROUT & SEAL 100% (LF)	17,200	$1.00	$17,200	
	CENTERLINE JT ROUT & SEAL 100% (LF)	17,200	$1.00	$17,200	
	RAND/THERM CRACK ROUT & SEAL 50% (LF)	2,365	$1.00	$2,365	
	PARTIAL PVMT PATCH 0.1% (SQ YDS)	34	$90.00	$3,060	
				$39,825	$22,051
Activity 5					
YEAR 25	SHLDR JT ROUT & SEAL 100% (LF)	17,200	$1.00	$17,200	
	CENTERLINE JT ROUT & SEAL 100% (LF)	17,200	$1.00	$17,200	
	RAND/THERM CRACK ROUT & SEAL 50% (LF)	2,365	$1.00	$2,365	
	PARTIAL PVMT PATCH 0.5% (SQ YDS)	172	$90.00	$15,480	
				$52,245	$24,952
Activity 6					
YEAR 30	2" MILL PVMT & SHLDR 100% (SQ YDS)	34,400	$1.75	$60,200	
	PARTIAL PVMT PATCH 2.0% (SQ YDS)	688	$90.00	$61,920	
	HMA SHLDR PATCHING 1.0% (SQ YDS)	0	$90.00	$0	
	POLICY HMA OVERLAY PVMT (TONS)	7,224	$113.13	$817,215	
	POLICY HMA OVERLAY SHLDR (TONS)	0	$113.13	$0	
				$939,335	$387,008
Activity 7					
YEAR 35	SHLDR JT ROUT & SEAL 100% (LF)	17,200	$1.00	$17,200	
	CENTERLINE JT ROUT & SEAL 100% (LF)	17,200	$1.00	$17,200	
	RAND/THERM CRACK ROUT & SEAL 50% (LF)	2,365	$1.00	$2,365	
	PARTIAL PVMT PATCH 0.1% (SQ YDS)	34	$90.00	$3,060	
				$39,825	$14,154
Activity 8					
YEAR 40	SHLDR JT ROUT & SEAL 100% (LF)	17,200	$1.00	$17,200	
	CENTERLINE JT ROUT & SEAL 100% (LF)	17,200	$1.00	$17,200	
	RAND/THERM CRACK ROUT & SEAL 50% (LF)	2,365	$1.00	$2,365	
	PARTIAL PVMT PATCH 0.5% (SQ YDS)	172	$90.00	$15,480	
				$52,245	$16,018

Total Rehabilitation Cost (Present Worth) $875,711