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 345 (US Route 20)
Kane/Cook Counties
At Allen Road/Brier Hill Road

We have reviewed the pavement selection for the project, which was submitted to BDE by memo dated March 1, 2012. The project will reconstruct US 20 and Allen Road/Brier Hill Road. The design meets the warrants for a "high stress" intersection, with MU ADT exceeding 200 vehicles and the southbound grade exceeding 3.5%. The life cycle costs favors the rigid pavement design. The approved pavement design for this project is as follows:

US Route 20 (Pavement Reconstruction)

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

Allen Road and Brier Hill Road (Pavement Reconstruction)

9 inches of PCC pavement with tied PCC shoulder
4.5 inches of Stabilized Sub-Base
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 1, 2012

*Route: FAP 345 (US 20)
Limits: US 20 at Allen Rd/Brier Hill Rd
Contract No.: 60T27
Letting: 06CY13

Section: 10N-1
County: Kane/Cook
Job No.: P-91-098-10

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 20 at Allen Road for a total length of approximately 1,970 feet to accommodate two 12 foot thru lanes.

b.) Pavement reconstruction of Allen Road between US 20 and the proposed new alignment of Brier Hill Road for a total length of approximately 1,121 feet to provide two 12 foot thru lanes.

c.) Pavement reconstruction of Brier Hill Road at Allen Road for a total length of approximately 441 feet to provide two 12 foot thru lanes.

A 20 year pavement analysis was performed on the above segment. We recommend a mechanistic-rigid pavement design. The intersection of US 20 and Allen Road is considered "high stress" as the design lane MU ADT exceeds 200 vehicles at the stop controlled intersection. The intersection of Allen Road and Brier Hill Road is considered "high stress" as the southern leg approach grade of the stop controlled intersection exceeds 3.5%. The life cycle cost analysis favors PCC pavement by 24.1%

a.) US 20

Pavement Reconstruction
Tied PCC Shoulder

- 9 ½" PCC Pavement (Jointed)
- 4 ½" HMA Stabilized Subbase
- 12" Aggregate Subgrade Improvement

b, c.) Allen Road and Brier Hill Road*
Pavement Reconstruction
Tied PCC Shoulder
- 9" PCC Pavement (Jointed)**
- 4 ½" HMA Stabilized Subbase
- 12" Aggregate Subgrade Improvement

*Designer Note 1: Allen Road and Brier Hill Road are subject to local jurisdictional approval.

**Designer Note 2: Transverse contraction joints should be reduced to a maximum of 14 foot spacing for 9" PCC pavement.

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

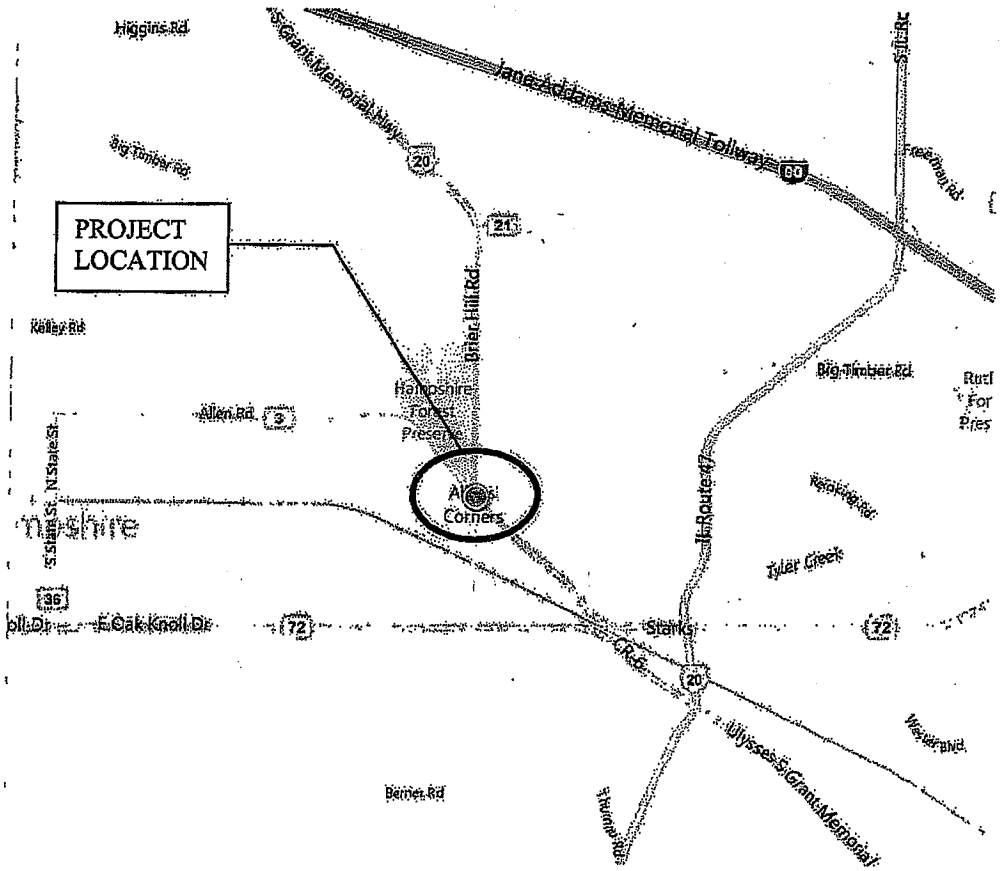
By: José A. Domínguez
Jose A. Dominguez, P.E.
Project Support Engineer

LOCATION MAP

US ROUTE 20

AT

ALLEN ROAD/BRIER HILL ROAD



US 20

USE FOR TF ONLY

Spreadsheet by Uehle - Rev. 11/02

MECHANISTIC PAVEMENT DESIGN

Date: 1/24/12

INPUT (Enter Data in Gray Shaded Cells)

Route: FAP 315 (US 20)
Section: N/A
County: Kane
Location: US 20 at Allen/Brier Hill

Comments: Traffic data for US 20 at Allen/Brier Hill

Designer: TMC

	ADT	Year
Current:	6760	2008
Future:	8432	2026

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

	Structural Design Traffic				
	Minimum ADT	Actual ADT	Actual %of Total ADT	% of ADT in Design Lane	
PV =	0	6,753	82.0%	P =	50%
SU =	250	412	5.0%	S =	50%
MU =	750	1,071	13.0%	M =	50%
Struct. Design ADT =		8235	(2023)		

FLEXIBLE & RIGID PAVEMENT CALCULATIONS AND ADDITIONAL INPUT

Flexible Pavement

Cpv =	0.15	
Csu =	112	
Cmu =	385	
TF flexible (Actual)=	4.60	(Actual ADT)
TF flexible (Min)=	3.17	(Min ADT Fig 54-2C)
Use TF flexible =	4.60	
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 =~~	~~64.6~~	~~(Figure 54-5E)~~
Asphalt Concrete Thickness =	13.50	in. (Figure 54-5F)

Rigid Pavement

Cpv =	0.15	
Csu =	136	
Cmu =	567	
TF rigid (Actual)=	6.64	(Actual ADT)
TF rigid (Min)=	4.59	(Min ADT Fig 54-2C)
Use TF rigid =	6.64	
	Ted	Shoulder or C. &G.
Rigid Pavt Thick =	9.50	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)

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

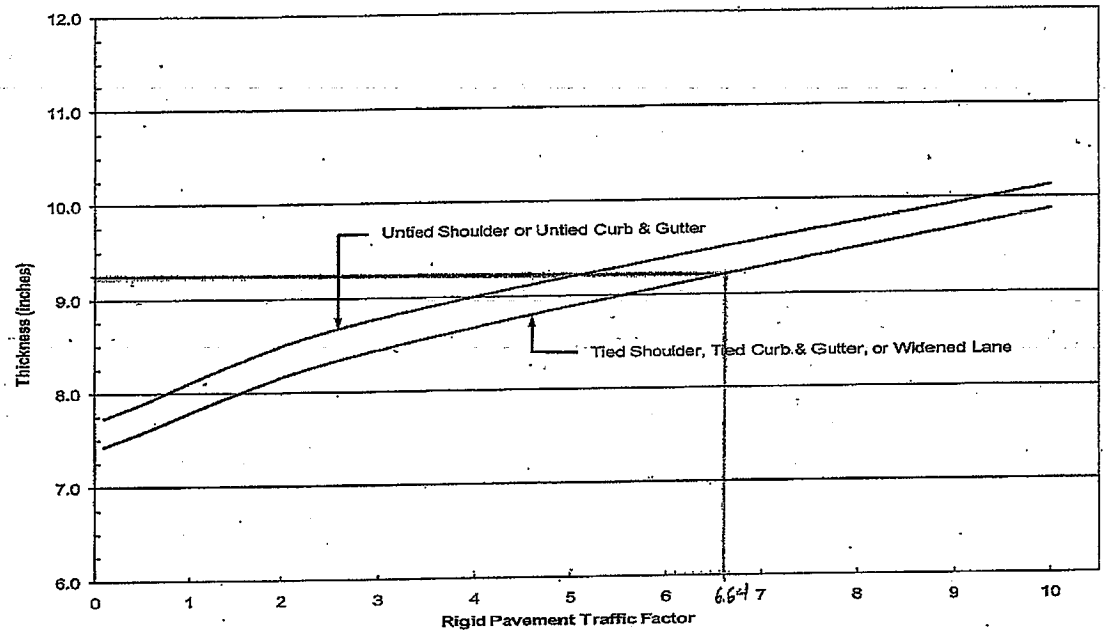
Class Table for One-Way Streets	
ADT	Class
0 - 3500	II
>3501	I

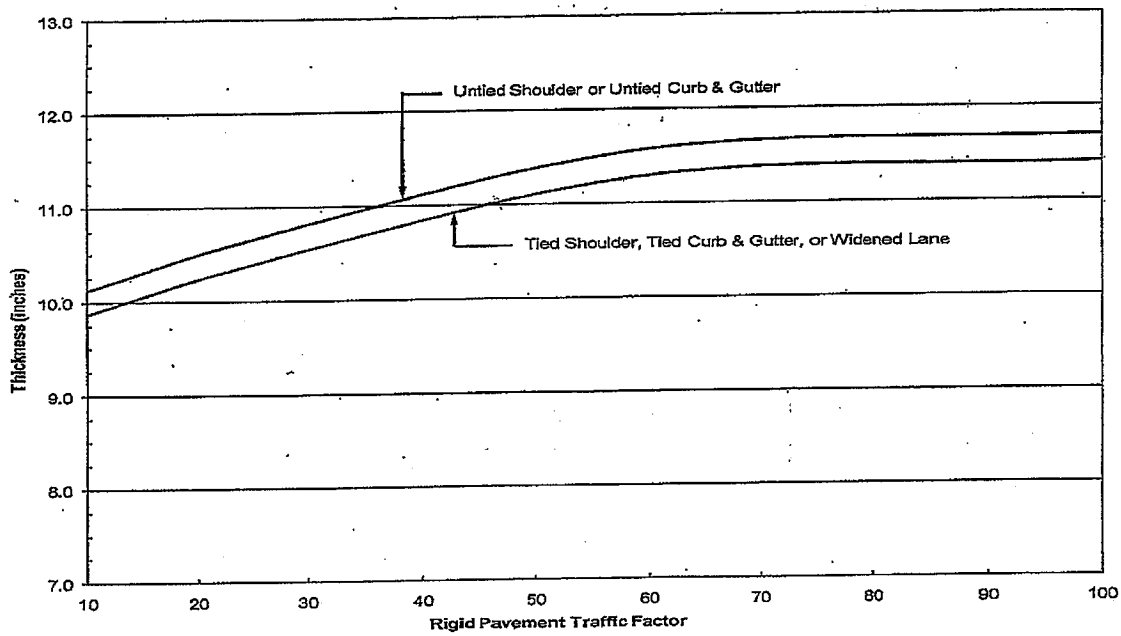
Class	Traffic Factor ESAL Coefficients: Rigid (Fig. 54-4C) Csu	Rigid Cmu	Flexible (Fig. 54-5B) Csu	Flexible Cmu
I	143.81	696.42	132.50	482.53
II	135.78	607.43	112.06	369.44
III	129.58	562.47	109.14	384.35
IV(ADT>400)	127.75	555.90	109.14	384.35
IV(ADT<=400)	127.75	555.90	9.86	78.84

Class Table for 2 or 3 lanes (not future 4 lane & not one-way street)	
ADT	Class
0 - 749	IV
750 - 2000	III
>2000	II

Number of Lanes	Figure 54-2B Percentage of ADT in Design Lane: Rural P	Rural S	Rural M	Urban P	Urban S	Urban M
1 Lane Ramp	100%	100%	100%	100%	100%	100%
2 or 3	50%	50%	50%	50%	50%	50%
4	32%	45%	45%	32%	45%	45%
6 or more	20%	40%	40%	8%	37%	37%

US 20





Note: Use of untied shoulder design requires BDE approval.

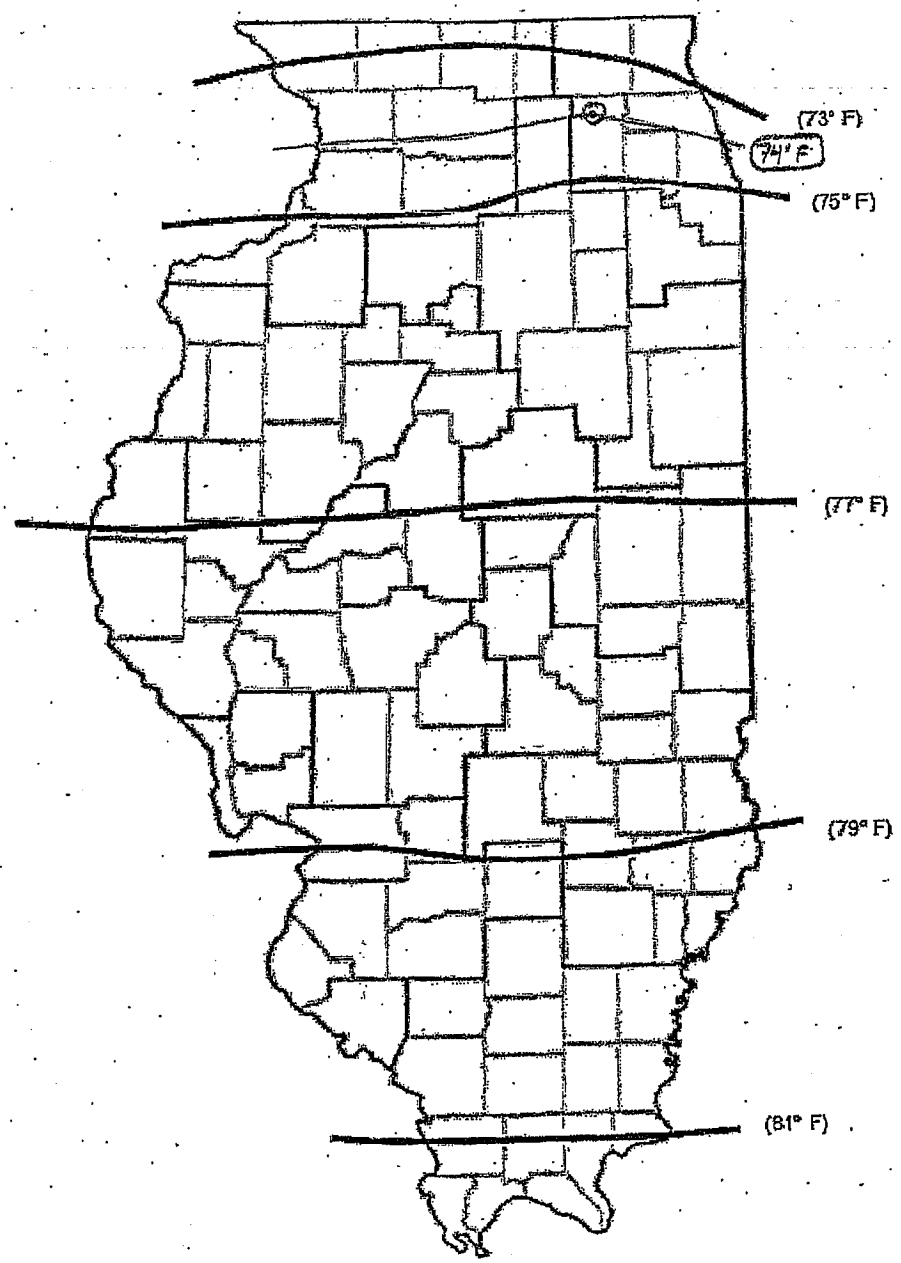
RIGID PAVEMENT DESIGN CHART
(Mechanistic Design: SSR = Poor)

9½" PCC PAVEMENT, JOINTED
9½"

Figure 54-4.E

HARD COPIES UNCONTROLLED

US 20

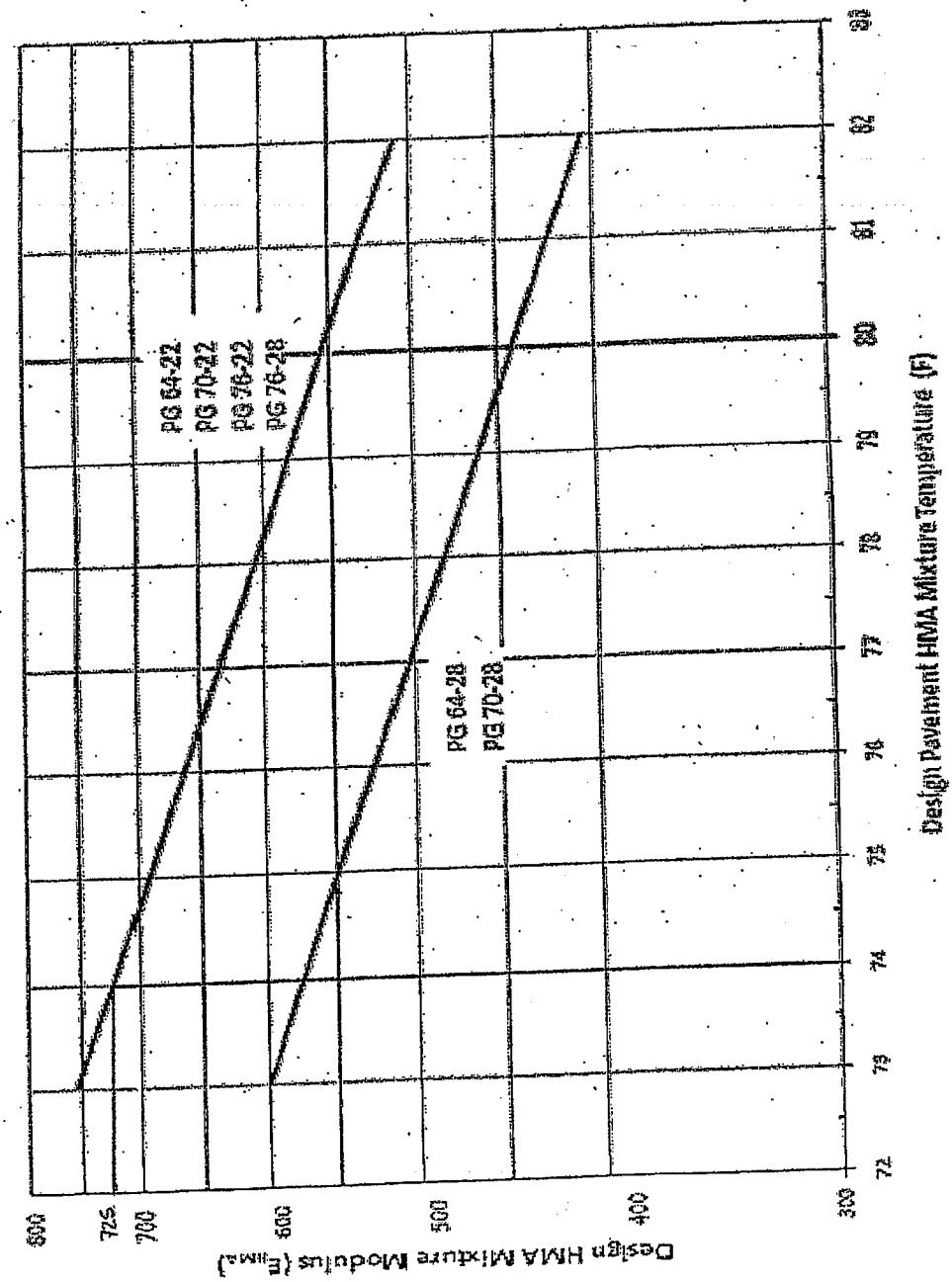


Note: The minimum design HMA mixture temperature will be 73°F.

HMA MIXTURE TEMPERATURE
(Mechanistic Design: Flexible Pavement)

Figure 54-5.C

US 20

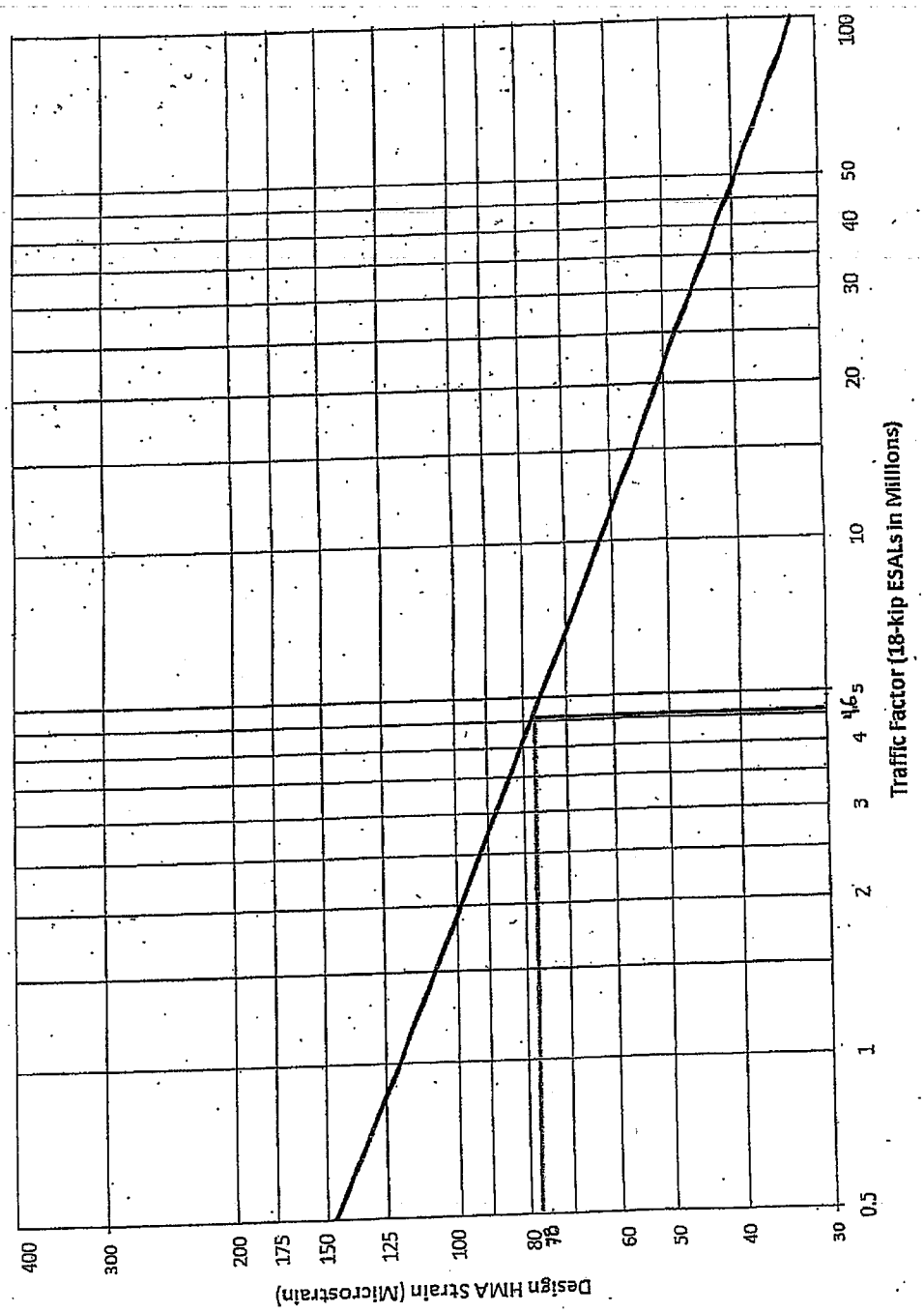


HMA MIXTURE MODULUS (E_{HMA})
(Mechanistic Design: Flexible Pavement)

Figure 54-5.D

HARD COPIES UNCONTROLLED

US 20

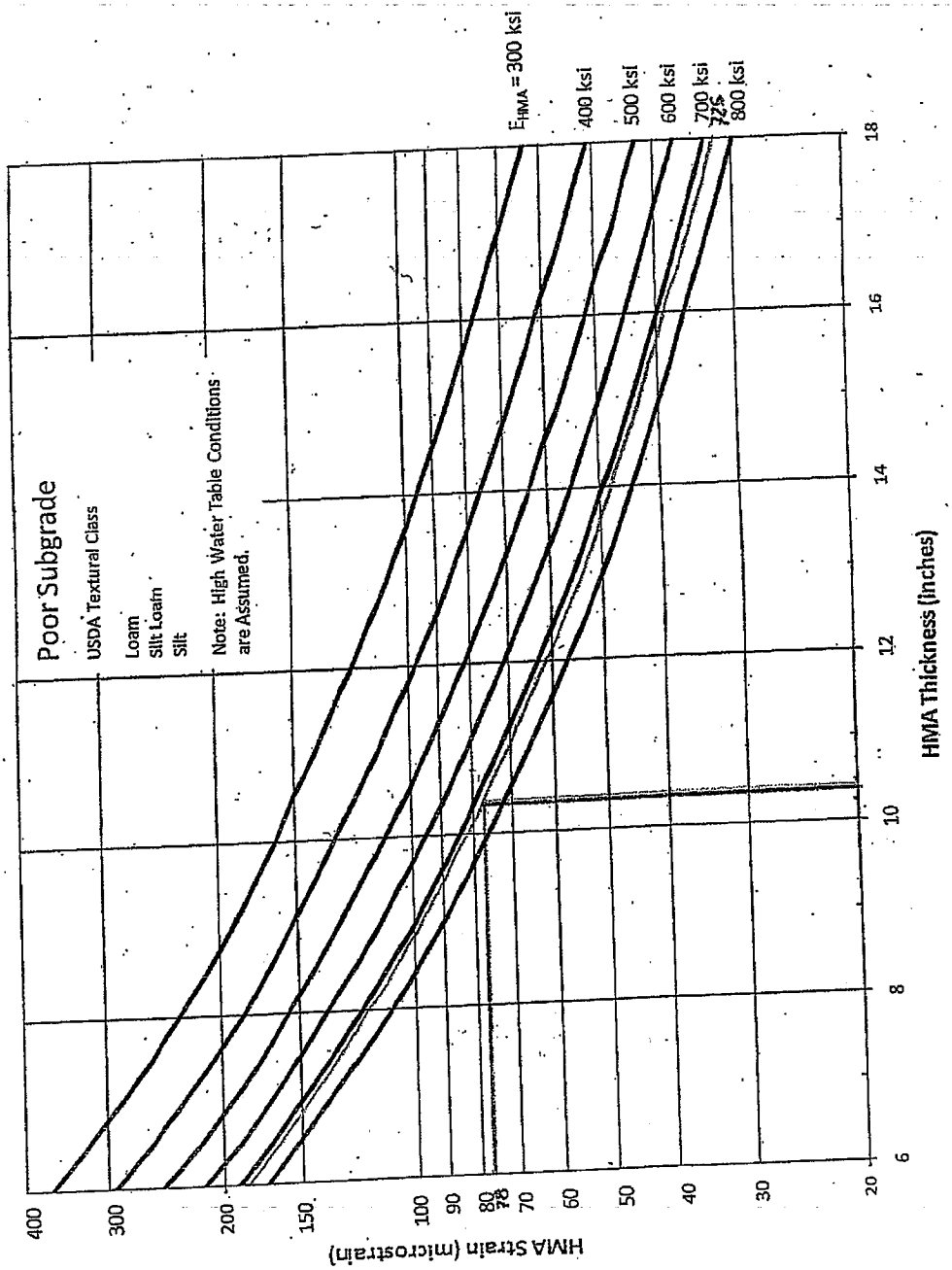


DESIGN HMA STRAIN
(Mechanistic Design: Flexible Pavement)

Figure 54-5.E

HARD COPIES UNCONTROLLED

US 20



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

Figure 54-5.F

10 ½" HMA PAVEMENT (FULL DEPTH)

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ALLEN RD/BRIER HILL RD

USE FOR TF ONLY

Spreadsheet by Uehle - Rev. 11/02

MECHANISTIC PAVEMENT DESIGN

Date: 1/24/12

INPUT (Enter Data in Gray Shaded Cells)

Route: Allen Road
Section: N/A
County: Kane
Location: Allen Road at US 20/Brier Hill Rd

Comments: Traffic Data for Allen Road at US 20/Brier Hill Rd

Designer: TMC

	ADT	Year
Current:	3750	2008
Future:	7491	2025

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	Structural Design Traffic: Actual ADT	Actual %of Total ADT	% of ADT in Design Lane	
PV =	0	6,205	88.0%	P =	50%
SU =	250	282	4.0%	S =	50%
MU =	750	564	8.0%	M =	50%
Struct. Design ADT =		7051	(2023)		

FLEXIBLE & RIGID PAVEMENT CALCULATIONS AND ADDITIONAL INPUT

Flexible Pavement

Cpv =	0.15	
Csu =	112	
Cmu =	385	
TF flexible (Actual)=	2.50	(Actual ADT)
TF flexible (Min)=	3.17	(Min ADT Fig 54-2C)
Use TF flexible =	3.17	
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 =	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)=	3.59	(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 54-4D)

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

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

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

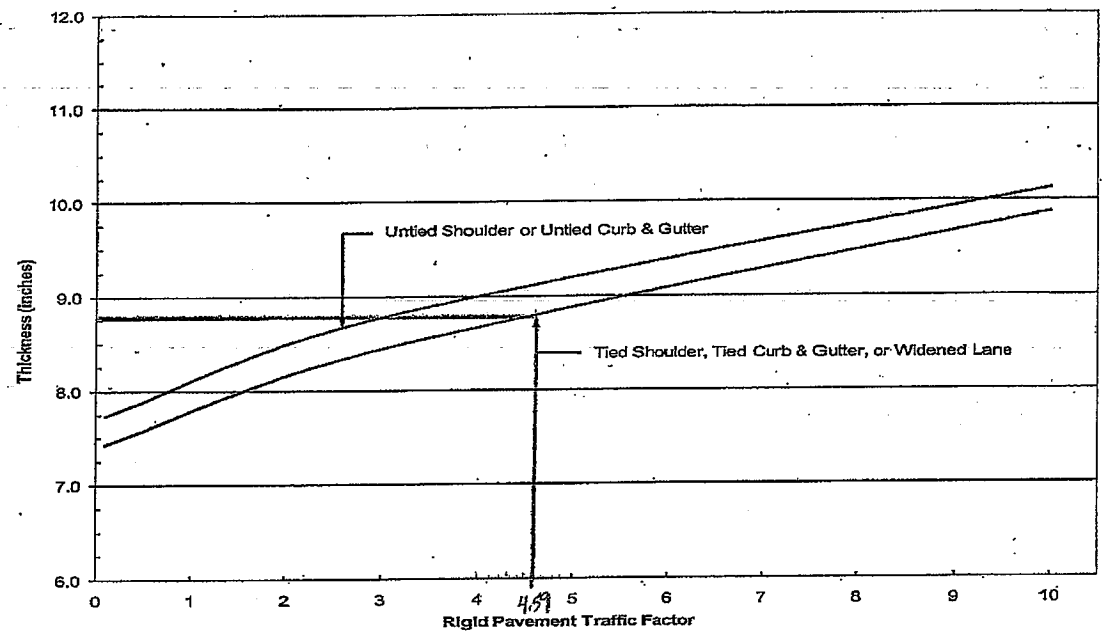
Class Table for One-Way Streets: ADT	Class
0 - 3500	II
>3501	I

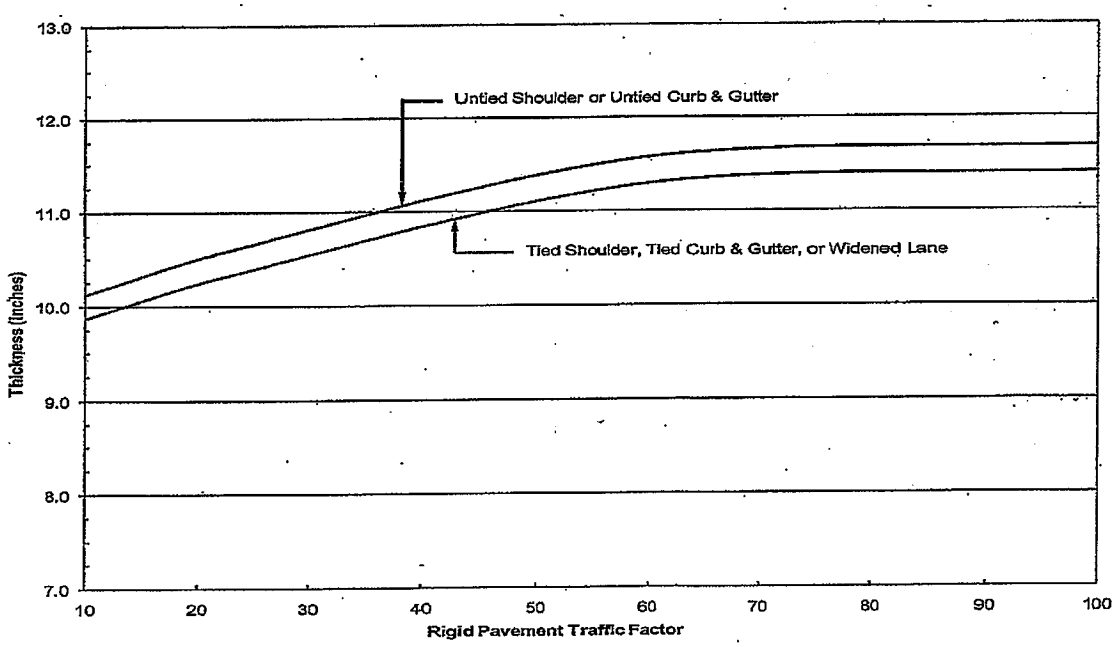
Class	Traffic Factor ESAL Coefficients: Rigid (Fig. 54-4C) Csu	Rigid Cmu	Flexible (Fig. 54-5B) Csu	Flexible Cmu
I	143.81	696.42	132.50	482.53
II	135.78	567.21	112.06	385.44
III	129.58	562.47	109.14	384.35
IV(ADT>400)	127.75	555.90	109.14	384.35
IV(ADT<=400)	127.75	555.90	9.86	78.84

Class Table for 2 or 3 lanes (not future 4 lane & not one-way street): ADT	Class
0 - 749	IV
750 - 2000	III
>2000	II

Number of Lanes	Figure 54-2B Percentage of ADT in Design Lane: Rural P	Rural S	Rural M	Urban P	Urban S	Urban M
1 Lane Ramp	100%	100%	100%	100%	100%	100%
2 or 3	50%	50%	50%	50%	50%	50%
4	32%	45%	45%	32%	45%	45%
6 or more	20%	40%	40%	8%	37%	37%

ALLEN / BRIER HILL





Note: Use of untied shoulder design requires BDE approval.

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

9" PCC PAVEMENT, JOINTED

Figure 54-4.E

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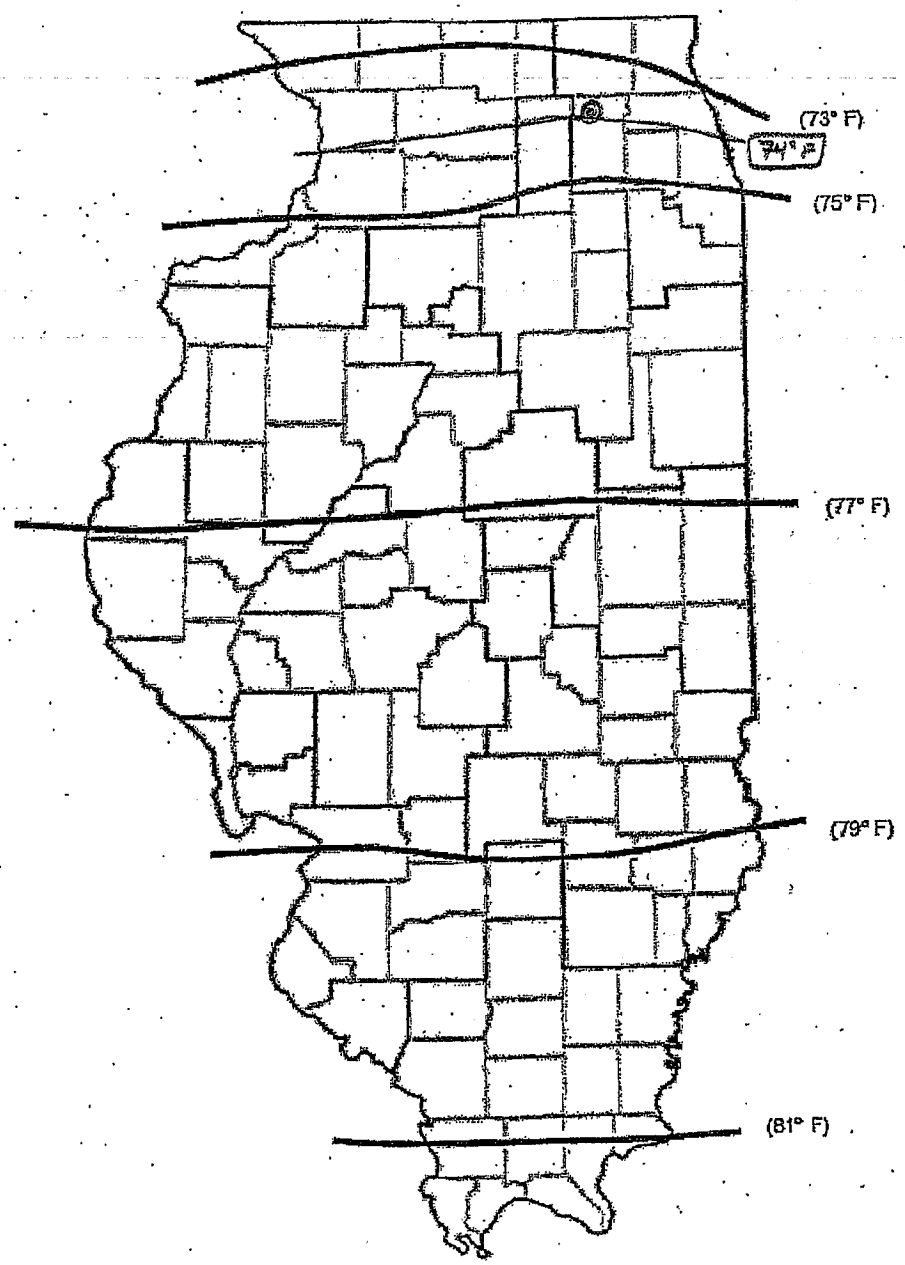
ALLEN/BRIER HILL



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

HMA MIXTURE TEMPERATURE
(Mechanistic Design: Flexible Pavement)

Figure 54-5.C

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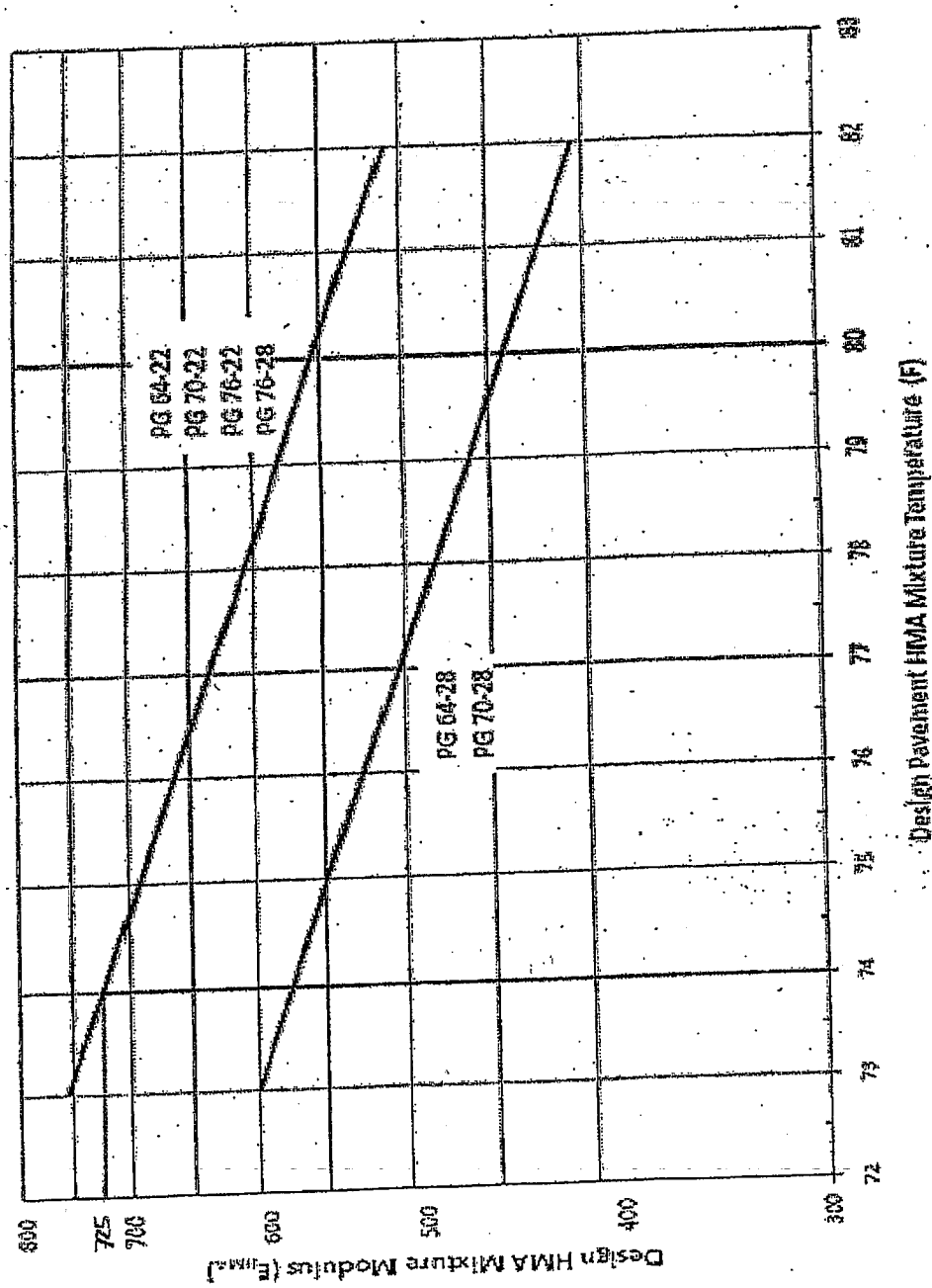
ALLEN / BRIER HILL



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

Figure 54-5.D

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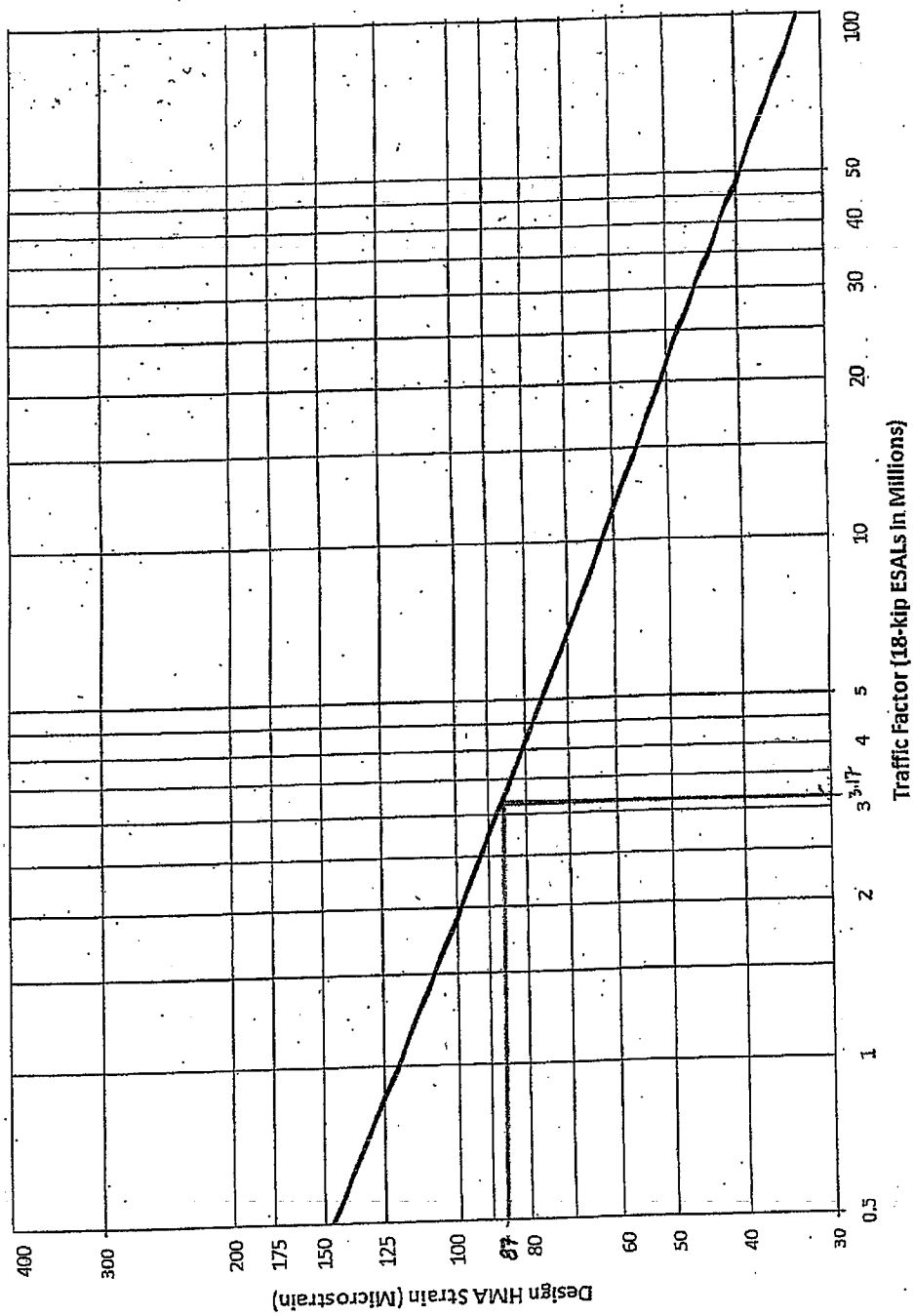
ALLEN/BRIAR HILL



DESIGN HMA STRAIN
(Mechanistic Design: Flexible Pavement)

Figure 54-5.E

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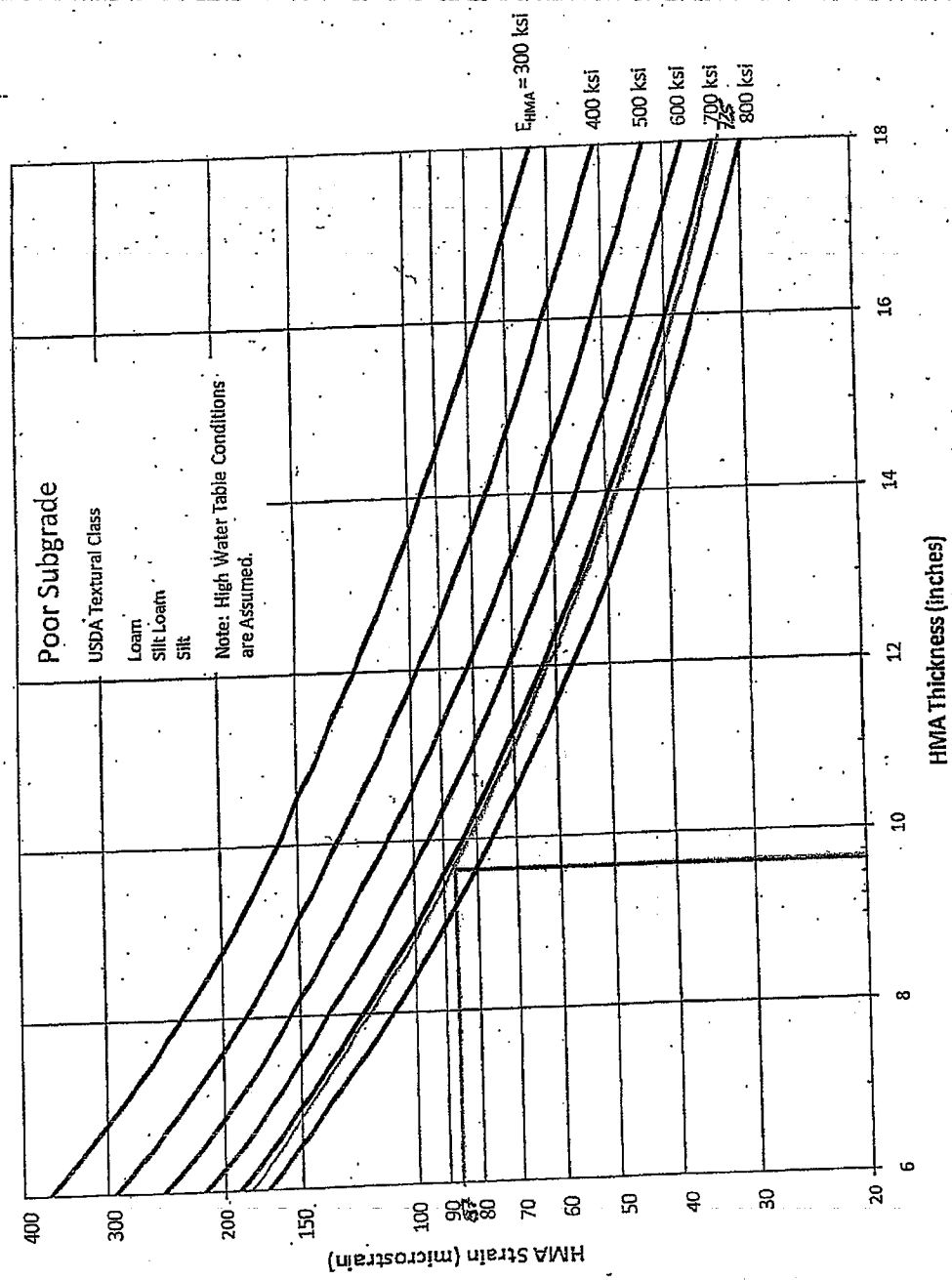
ALLEN/BRIER HILL



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

Figure 54-5.F

9 3/4" HMA PAVEMENT (FULL DEPTH)

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Revised July 1, 1991

MECHANISTIC PAVEMENT DESIGN

Date 02/23/2012

Calculations by: TMC

Checked by: SJP

Class II Roads and Streets

Urban ____ Rural X

US Route 20

Section NA

KANE County

Location AT ALLEN RD / BRIER HILL RD

Limits of Analysis Station 687+18.74 to Station 706+88.58

Length 1970 Feet ~~0.56~~ 0.37 Miles

Structural Design Traffic

PV = 6753

SU = 412

MU = 1071

Percent of S.D.T. in Design Lane

P = 50 %

S = 50 %

U = 50 %

MINIMUM SUBGRADE SUPPORT RATING - "Poor"

Flexible Pavement Design Actual TF_F = 4.60 Minimum TF_F = 3.17

Selected Design AC Type 20

Design AC Mixture Temp. 74 ° F.

Design E_{AC} 725 KSI

Design AC Microstrain 78

AC Thickness 10.5 Inch

Rigid Pavement Design Actual TF_R = 6.64 Minimum TF_R = 4.59

15' Panel PCC Thickness for:

Extended Lane 9.5 Inch

Tied Shoulder 9.5 Inch

Untied Shoulder — Inch

Figure 5.05

RIGID PAVEMENT

Date: 02/23/2012 US Route 20

Quantities by: TMC Checked by: SJP Section —

Unit Prices by: TMC Checked by: SJP KANE County

Net Length 1970 Lin. Ft. 0.37 Miles

Number Lanes 2 Urban — Rural 2

ITEMIZED CONSTRUCTION COST

Quantity	Unit	Item	Unit Cost	Total Cost
5253 Sq. Yds.	9.5 -Inch	Jointed PCC	@ $ 41.25	= $ 216,686.00
5910 Sq. Yds.	4-Inch (Stabilized/Granular Subbase)		@ $ 17.00	= $ 100,470.00
4378 Sq. Yds.	9.5 -Inch PCC Shoulders		@ $ 34.25	= $ 149,947.00
— Lin. Ft.	Pipe Underdrains		@ $ —	= $ —
—	Subbase Gran. Mat., Type C		@ $ —	= $ —
3940 Lin. Ft.	100% Shoulder Joint Seal		@ $ 2.00	= $ 7,880.00
			@ $	= $
			@ $	= $

Total Cost of Original Pavement Construction $ 474,983.00

ITEMIZED MAINTENANCE AND REHABILITATION ACTIVITY COST

REHABILITATION ACTIVITY 1 - YEAR 10

5 Sq. Yds. 0.1% Full-Depth PCC Pavement Patching @ $ 60.00 = $ 300.00

Total Cost of Rehabilitation Activity 1 $ 300.00

FIGURE 5.05a(1)

RIGID PAVEMENT (Cont.)

US Route 20
Section —
KANE County

REHABILITATION ACTIVITY 2 - YEAR 15

11 Sq. Yds. 0.2% Full-Depth PCC Pavement Patching @ $ 60.00 = $ 660.00

Total Cost of Rehabilitation Activity 2 $ 660.00

REHABILITATION ACTIVITY 3 - YEAR 20

105 Sq. Yds. 2% Full-Depth PCC Pavement Patching @ $ 60.00 = $ 6300

22 Sq. Yds. 0.5% Full-Depth PCC Shoulder Patching @ $ 60.00 = $ 1100

3940 Lin. Ft. 100% Longitudinal/Shoulder Joint Routing & Sealing @ $ 2.00 = $ 7880

1970 Lin. Ft. 100% Centerline Joint Routing & Sealing @ $ 2.00 = $ 3940

Total Cost of Rehabilitation Activity 3 $ 19220

FIGURE 5.05a(2)

RIGID PAVEMENT (Cont.)
US Route 20
Section —
KANE County

REHABILITATION ACTIVITY 4 - YEAR 25

158 Sq. Yds.	3.0% Full-Depth PCC Pavement Patching	@ $ 60.00	= $	9480
44 Sq. Yds.	1.0% Full-Depth PCC Shoulder Patching	@ $ 50.00	= $	2200
	Total Cost of Rehabilitation Activity 4		$	11680

REHABILITATION ACTIVITY 5 - YEAR 30

210 Sq. Yds.	4.0% Full-Depth PCC Pavement Patching	@ $ 60.00	= $	12600
66 Sq. Yds.	1.5% Full-Depth PCC Shoulder Patching	@ $ 50.00	= $	3300
5253 Sq. Yds.	Policy HMA Overlay - Pavement	@ $ 11.00	= $	57783
4378 Sq. Yds.	Policy HMA Overlay - Shoulder	@ $ 11.00	= $	48158
	Total Cost of Rehabilitation Activity 5		$	121,841.00

REHABILITATION ACTIVITY 6 - YEAR 35

3940 Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@ $ 2.00	= $	7880
1970 Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $ 2.00	= $	3940
1970 Lin. Ft.	50% Random Crack Routing and Sealing - Assume 100 ft/Station	@ $ 2.00	= $	3940
1261 Lin. Ft.	40% Reflective Transverse Crack Routing & Sealing	@ $ 2.00	= $	2522
5 Sq. Yds.	0.1% Partial-Depth Pavement Patching (Mill & Fill Surface-Interstates; Mill & Fill 2.5 in.-Non-Interstates)	@ $ 50.00	= $	250
	Total Cost of Rehabilitation Activity 6		$	18532

FIGURE 5.05a(3)

RIGID PAVEMENT (Cont.)

US Route 20

Section —

KANE County

REHABILITATION ACTIVITY 7 - YEAR 40

26	Sq. Yds.	0.5% Full-Depth PCC Pavement Patching	@ $ 60.00	= $ 1560
26	Sq. Yds.	0.5% Partial-Depth Pavement Patching (Mill & Fill Surface-Interstates; Mill & Fill 2.5 in. Non-Interstates)	@ $ 50.00	= $ 1300
1891	Lin. Ft.	60% Reflective Transverse Crack Routing and Sealing	@ $ 2.00	= $ 3782
1970	Lin. Ft.	50% Random Crack Routing & Sealing- Assume 100ft/Station	@ $ 2.00	= $ 3940
3940	Lin. Ft.	100% Longitudinal/Shoulder Joint Routing & Sealing	@ $ 2.00	= $ 7880
1970	Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $ 2.00	= $ 3940

Total Cost of Rehabilitation Activity 7 $ 22402

FIGURE 5.05a(4)

Revised July 1, 1991
Sheet 5 of 5

RIGID PAVEMENT (Cont.)

US Route 20

Section —

KANE County

ANNUAL COST DETERMINATION

Present Worth Calculation:

Total Cost of Original Pavement Construction $ 474,983.00

Present Worth of Rehabilitation Activity 1	$ 300	X 0.7441 =	$ 223
Present Worth of Rehabilitation Activity 2	$ 660	X 0.6419 =	$ 424
Present Worth of Rehabilitation Activity 3	$ 19220	X 0.5537 =	$ 10642
Present Worth of Rehabilitation Activity 4	$ 11680	X 0.4776 =	$ 5578
Present Worth of Rehabilitation Activity 5	$ 121841	X 0.4120 =	$ 50198
Present Worth of Rehabilitation Activity 6	$ 18532	X 0.3554 =	$ 6586
Present Worth of Rehabilitation Activity 7	$ 22402	X 0.3066 =	$ 6868

Total Life Cycle Cost (Present Worth) $ 80519

Annual Cost Per Mile Calculation

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

($ 555,502 X 0.04079/.37 Mi.) = $ 61,240.09 Yr.-Mi.

FIGURE 5.05a(5)

FLEXIBLE PAVEMENT

Date: FEB. 23, 2012 US Route 20

Quantities by: TMC Checked by: SJP Section —

Unit Prices by: TMC Checked by: SJP KANE County

Net Length 1970 Lin. Ft. 0.37 Miles

Number Lanes 2 Urban _____ Rural 2

Single Lane Paving X Dual Lane Paving _____

ITEMIZED CONSTRUCTION COST

Quantity	Unit	Item	Unit Cost	Total Cost
5253	Sq. Yds.	2" ~~Class I Surface Course~~ POLY HMA SURFACE, MIX F, N90	@ $ 13.35	= $ 70 128
5253	Sq. Yds.	2 1/4" ~~Inch Class I Binder Course~~ POLY HMA BINDER, IL-19.0, N90	@ $ 13.16	= $ 69 129
4378	Sq. Yds.	10.5 -Inch Stabilized Shoulders	@ $ 51.38	= $ 224 942
—	Lin. Ft.	Pipe Underdrains	@ $ —	= $ —
—		Subbase Gran. Matl., Type C	@ $ —	= $ —
5253		6 1/4" HMA BINDER, IL-19.0, N90	@ $ 29.86	= $ 156 855
			@ $	= $

Total Cost of Original Pavement Construction $ 521 054

ITEMIZED MAINTENANCE AND REHABILITATION ACTIVITY COST

REHABILITATION ACTIVITY 1 - YEAR 5

1084	Lin. Ft.	50% Random/Thermal Crack Routing & Sealing (Assume 110ft/station)	@ $ 2.00	= $ 2168
3940	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@ $ 2.00	= $ 7880
1970	Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $ 2.00	= $ 3940
5	Sq. Yds.	0.1% Partial-Depth Pavement Patching —Mill & Fill Surface	@ $ 38.00	= $ 190

Total Cost of Rehabilitation Activity 1 $ 14178

FIGURE 5.05b(1)

FLEXIBLE PAVEMENT (Cont.)

US Route 20

Section —

KANE County

REHABILITATION ACTIVITY 2 - YEAR 10

26 Sq. Yds.	0.5% Partial-Depth HMA Pavement Patching- Mill & Fill Surface	@ $ 38.00	= $ 988
1084 Lin. Ft.	50% Random/Thermal Crack Routing & Sealing (Assume 110 ft/station)	@ $ 2.00	= $ 2168
3940 Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@ $ 2.00	= $ 7880
1970 Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $ 2.00	= $ 3940

Total Cost of Rehabilitation Activity 2 $ 14976

REHABILITATION ACTIVITY 3 - YEAR 15

9631 Sq. Yds.	2.00 in. Milling - Pavement & Shoulder	@ $ 2.25	= $ 21670
53 Sq. Yds.	1.0% Partial-Depth Pavement Patching (Mill & Fill Additional 2.00 in.)	@ $ 38.00	= $ 2014
1079 Tons	2.00 in. HMA Overlay Pavement & Shoulder	@ $ 74.00	= $ 79846

Total Cost of Rehabilitation Activity 3 $ 103530

FIGURE 5.05b(2)

Revised July 1, 1991
Sheet 3 of 5
FLEXIBLE PAVEMENT (Cont.)

US Route 20
Section –
KANE County

REHABILITATION ACTIVITY 4 - YEAR 20

3940 Lin. Ft. 100% Longitudinal Shoulder Joint Routing and Sealing @ $ 2.00 = $ 7880

1970 Lin. Ft. 100% Centerline Joint Routing & Sealing @ $ 2.00 = $ 3940

~~1970~~ 1084 Lin. Ft. 50% Random/Thermal Crack Routing & Sealing (Assume 110 ft/Station) @ $ 2.00 = $ 2168

~~1084~~ 5 Sq. Yds. 0.1% Partial-Depth HMA Pavement Patching (Mill & Fill Surface) @ $ 38.00 = $ 190

Total Cost of Rehabilitation Activity 4 $ 14178

REHABILITATION ACTIVITY 5 - YEAR 25

3940 Lin. Ft. 100% Longitudinal Shoulder Joint Routing and Sealing @ $ 2.00 = $ 7880

1970 Lin. Ft. 100% Centerline Joint Routing & Sealing @ $ 2.00 = $ 3940

1084 Lin. Ft. 50% Random/Thermal Crack Routing & Sealing (Assume 110 ft/Station) @ $ 2.00 = $ 2168

26 Lin. Ft. 0.50% Partial-Depth Pavement Patching (Mill & Fill Surface) @ $ 38.00 = $ 988

Total Cost of Rehabilitation Activity 7 $ 14976

REHABILITATION ACTIVITY 6 - YEAR 30

5253 Sq. Yds. 2.00 in. Milling (Pavement Only - Standard Design Pavement & Shoulder - Limiting Strain Criterion Design) @ $ 2.25 = $ 11819

105 Sq. Yds. 2.0% Partial-Depth HMA Pavement Patching (Mill & Fill Additional 2.00 in. All Designs) @ $ 38.00 = $ 3990

44 Sq. Yds. 1.0% Full-Depth HMA Shoulder Patching (Mill & Fill Surface - Standard Design; Mill & Fill Additional 2.00 in. - Limiting Strain Criterion Design) @ $ 50.00 $ 2200

1103 Tons HMA Overlay Pavement (3.75 in. - Standard Design; 2.00 in. - Limiting Strain Criterion Design) @ $ 74.00 = $ 81622

429 Tons HMA Overlay - Shoulder (1.75 in. Standard Design; 2.00 in. - Limiting Strain Criterion Design) @ $ 74.00 = $ 31746

Total Cost of Rehabilitation Activity 6 $ 131,377.00

FIGURE 5.05b(3)

Revised July 1, 1991
Sheet 4 of 5

FLEXIBLE PAVEMENT (Cont.)

US Route 20
Section —
KANE County

REHABILITATION ACTIVITY 7 - YEAR 35

3940 Lin. Ft.	100% Longitudinal Shoulder Joint Routing and Sealing	@ $ 2.00	= $	7880
1970 Lin. Ft.	100% Centerline Joint Routing & Sealing	@ $ 2.00	= $	3940
1084 Lin. Ft.	50% Random/Thermal Crack Routing & Sealing (Assume 110 ft/Station)	@ $ 2.00	= $	2168
5 Sq. Yds.	0.10% Partial-Depth Pavement Patching (Mill & Fill Surface)	@ $ 38.00	= $	190
	Total Cost of Rehabilitation Activity 7		$	14178

REHABILITATION ACTIVITY 8 - YEAR 40

3940 Lin. Ft.	100% Longitudinal Shoulder Joint Routing and Sealing	@ $ 2.00	= $	7880
1970 Lin. Ft.	100% Centerline Joint Routing & Sealing (Single lane and dual lane paving)	@ $ 2.00	= $	3940
1084 Lin. Ft.	50% Random/Thermal Crack Routing & Sealing	@ $ 2.00	= $	2168
26 Sq. Yds.	0.50% Partial-Depth Pavement Patching (Mill & Fill Surface)	@ $ 38.00	= $	988
	Total Cost of Rehabilitation Activity 8		$	14976

FIGURE 5.05b(4) - continued

Revised July 1, 1991
Sheet 5 of 5

FLEXIBLE PAVEMENT (Cont.)

US Route 20
Section —
KANE County

ANNUAL COST DETERMINATION

Present Worth Calculation:

				Present Worth
Total Cost of Original Pavement Construction				$ 521 054
Present Worth of Rehabilitation Activity	1	$ 14 178	X 0.8626 =	$ 12230
Present Worth of Rehabilitation Activity	2	$ 14976	X 0.7441 =	$ 11144
Present Worth of Rehabilitation Activity	3	$ 103 530	X 0.6419 =	$ 66 456
Present Worth of Rehabilitation Activity	4	$ 14178	X 0.5537 =	$ 7850
Present Worth of Rehabilitation Activity	5	$ 14976	X 0.4776 =	$ 7153
Present Worth of Rehabilitation Activity	6	$ 131 377	X 0.4120 =	$ 54127
Present Worth of Rehabilitation Activity	7	$ 14178	X 0.3554 =	$ 5039
resent Worth of Rehabilitation Activity	8	$ 14976	X 0.3066 =	$ 4592

Total Life Cycle Cost (Present Worth) $ 168591

Annual Cost Per Mile Calculation

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

($ 689645 X 0.04079 / .37 Mi.) = $ 76029 /Yr.-Mi.

MATERIAL TYPE : PCC

PERCENTAGE: $\frac{76029 - 61240}{61240} = 24.1\%$

FIGURE 5.05b(5)

PLAIN JOINTED PCC PAVEMENT

FILENAME-	US 20 at Allen	23-Feb-12	
ROUTE-	FAP 345	09:18 AM	
SECTION-	N/A		
COUNTY-	Kane		
LOCATION-	US 20 at Allen Rd		
DATE-			
PROJECT LENGTH (FT)	1970 =	0.37	MILES
AVERAGE LANE WIDTH (FT)	12		
NUMBER OF LANES	2		
# OF EDGES	2		
INSIDE SHLDER WIDTH (FT)	10		
OUTSIDE SHLDER WIDTH (FT)	10		
# OF CENTERLINES	1		
RIGID THICKNESS-	9.5		
TRAFFIC FACTORS	MINIMUM	ACTUAL	
RIGID-	0	0	
TRAFFIC			
PV-	0	0	
SU-	0	0	
MU-	0	0	

INITIAL COSTS

ITEM	QUANTITY	UNIT PRICE	COST
PAVEMENT (SQ YDS)	5,253	$41.25	$216,686
STAB SUBBASE (SQ YDS)	5,910	$17.00	$100,470
SHOULDERS (SQ YDS)	4,378	$34.25	$149,947
SHOULDER SEAL (LN FT)	3,940	$2.00	$7,880
SUBBASE GRAN MATL TY C (TONS	0	$0.00	$0

CONSTRUCTION INITIAL COST (PW)	$474,983
TOTAL REHABILITATION COST (PW)	$80,519
TOTAL LIFE CYCLE COST (PW)	$555,502
ANNUAL COST PER MILE	$61,240

MAINTENANCE COSTS:

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

MAINTENANCE COSTS	ITEM	QUANTITY	UNIT PRICE	COST	PW
Activity 1					
YEAR 10					
	PAVEMENT PATCHING 0.1% (SQ YDS)	5	$60.00	$300	
				$300	$223
Activity 2					
YEAR 15					
	PAVEMENT PATCHING 0.2% (SQ YDS)	11	$60.00	$660	
				$660	$424
Activity 3					
YEAR 20					
	PAVEMENT PATCHING 2.0% (SQ YDS)	105	$60.00	$6,300	
	SHOULDER PATCHING 0.5% (SQ YDS)	22	$50.00	$1,100	
	SHLDR JT ROUT & SEAL 100% (LF)	3,940	$2.00	$7,880	
	CENTERLINE JT ROUT & SEAL 100.0% (L	1,970	$2.00	$3,940	
				$19,220	$10,642
Activity 4					
YEAR 25					
	PAVEMENT PATCHING 3.0% (SQ YDS)	158	$60.00	$9,480	
	SHOULDER PATCHING 1.0% (SQ YDS)	44	$50.00	$2,200	
				$11,680	$5,578
Activity 5					
YEAR 30					
	PAVEMENT PATCHING 4.0% (SQ YDS)	210	$60.00	$12,600	
	SHOULDER PATCHING 1.5% (SQ YDS)	66	$50.00	$3,300	
	POLICY HMA OVERLAY PVMT (SQ YDS)	5,253	$11.00	$57,783	
	POLICY HMA OVERLAY SHLDR (SQ YDS)	4,378	$11.00	$48,158	
				$121,841	$50,198
Activity 6					
YEAR 35					
	SHLDR JT ROUT & SEAL 100% (LF)	3,940	$2.00	$7,880	
	CENTERLINE JT ROUT & SEAL 100.0% (L	1,970	$2.00	$3,940	
	RANDOM CRACK ROUT & SEAL 50% (LF)	1,970	$2.00	$3,940	
	REFL TRANS CRACK ROUT & SEAL 40%	1,261	$2.00	$2,522	
	PARTIAL PVMT PATCH 0.1% (SQ YDS)	5	$50.00	$250	
				$18,532	$6,586
Activity 7					
YEAR 40					
	PAVEMENT PATCHING 0.5% (SQ YDS)	26	$60.00	$1,560	
	PARTIAL PVMT PATCH 0.5% (SQ YDS)	26	$50.00	$1,300	
	REFL TRANS CRACK ROUT & SEAL 60%	1,891	$2.00	$3,782	
	RANDOM CRACK ROUT & SEAL 50% (LF)	1,970	$2.00	$3,940	
	SHLDR JT ROUT & SEAL 100% (LF)	3,940	$2.00	$7,880	
	CENTERLINE JT ROUT & SEAL 100.0% (L	1,970	$2.00	$3,940	
				$22,402	$6,868
			Total Rehabilitation Cost (Present Worth)		$80,519

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

ROUTE-	FAP 345	23-Feb-12
SECTION-	N/A	09:18 AM
COUNTY-	Kane	
LOCATION-	US 20 at Allen Rd	
PROJECT LENGTH (FT)	1970	
AVERAGE LANE WIDTH (FT)	12	

FULL-DEPTH FLEXIBLE PAVEMENT
MAINTENANCE COSTS

	ITEM	QUANTITY	UNIT PRICE	COST	Present Worth
Activity 1					
YEAR 5	RAND/THERM CRACK ROUT & SEAL 50%	1,084	$2.00	$2,168	
	SHLDR JT ROUT & SEAL 100% (LF)	3,940	$2.00	$7,880	
	CENTERLINE JT ROUT & SEAL 100.0% (L	1,970	$2.00	$3,940	

NUMBER OF LANES	2	
# OF EDGES	2	
INSIDE SHLDER WIDTH (FT)	10	
OUTSIDE SHLDER WIDTH (FT)	10	
# OF CENTERLINES	1	
PAVING WIDTH	1	1=SINGLE LANE, 2=DUAL LANE
FLEXIBLE THICKNESS-	10.5	

TRAFFIC FACTORS	MINIMUM	ACTUAL
FLEXIBLE	0	0

TRAFFIC		
PV-	0	0
SU-	0	0
MU-	0	0

PAVEMENT OVERLAY THICKNESS	3.75
SHOULDER OVERLAY THICKNESS	1.75

INITIAL COSTS

ITEM	QUANTITY	UNIT PRICE	COST
SURFACE (SQ YDS)	5,253	$13.35	$70,128
POLY BINDER (SQ YDS)	5,253	$13.16	$69,129
BINDER (SQ YDS)	5,253	$29.86	$156,855
SHOULDERS (SQ YDS)	4378	$51.38	$224,942
SUBBASE GRAN MATL TY C (TONS	0	$0.00	$0

CONSTRUCTION INITIAL COST (PW)	$521,054
TOTAL REHABILITATION COST (PW)	$168,591
TOTAL LIFE CYCLE COST (PW)	$689,645
ANNUAL COST PER MILE	$76,029

MAINTENANCE COSTS:

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

MATERIAL TYPE/PERCENTAGE PCC 24.1%

	PARTIAL PVMT PATCH 0.1% (SQ YDS)	5	$38.00	$190	
				$14,178	$12,230
Activity 2					
YEAR 10	PARTIAL PVMT PATCH 0.5% (SQ YDS)	26	$38.00	$988	
	RAND/THERM CRACK ROUT & SEAL 50%	1,084	$2.00	$2,168	
	SHLDR JT ROUT & SEAL 100% (LF)	3,940	$2.00	$7,880	
	CENTERLINE JT ROUT & SEAL 100.0% (L	1,970	$2.00	$3,940	
				$14,976	$11,144
Activity 3					
YEAR 15	2" MILL PVMT & SHLDR 100% (SQ YDS)	9,631	$2.25	$21,670	
	PARTIAL PVMT PATCH 1.0% (SQ YDS)	53	$38.00	$2,014	
	2" OVERLAY PVMT & SHLDR 100% (TONS	1,079	$74.00	$79,846	
				$103,530	$66,456
Activity 4					
YEAR 20	SHLDR JT ROUT & SEAL 100% (LF)	3,940	$2.00	$7,880	
	CENTERLINE JT ROUT & SEAL 100.0% (L	1,970	$2.00	$3,940	
	RAND/THERM CRACK ROUT & SEAL 50%	1,084	$2.00	$2,168	
	PARTIAL PVMT PATCH 0.1% (SQ YDS)	5	$38.00	$190	
				$14,178	$7,850
Activity 5					
YEAR 25	SHLDR JT ROUT & SEAL 100% (LF)	3,940	$2.00	$7,880	
	CENTERLINE JT ROUT & SEAL 100.0% (L	1,970	$2.00	$3,940	
	RAND/THERM CRACK ROUT & SEAL 50%	1,084	$2.00	$2,168	
	PARTIAL PVMT PATCH 0.5% (SQ YDS)	26	$38.00	$988	
				$14,976	$7,153
Activity 6					
YEAR 30	2" MILL PVMT ONLY 100% (SQ YDS)	5,253	$2.25	$11,819	
	PARTIAL PVMT PATCH 2.0% (SQ YDS)	105	$38.00	$3,990	
	HMA SHOULDER PATCHING 1.0% (SQ YI	44	$50.00	$2,200	
	POLICY HMA OVERLAY PVMT (TONS)	1,103	$74.00	$81,622	
	POLICY HMA OVERLAY SHLDR (TONS)	429	$74.00	$31,746	
				$131,377	$54,127
Activity 7					
YEAR 35	SHLDR JT ROUT & SEAL 100% (LF)	3,940	$2.00	$7,880	
	CENTERLINE JT ROUT & SEAL 100.0% (L	1,970	$2.00	$3,940	
	RAND/THERM CRACK ROUT & SEAL 50%	1,084	$2.00	$2,168	
	PARTIAL PVMT PATCH 0.1% (SQ YDS)	5	$38.00	$190	
				$14,178	$5,039
Activity 8					
YEAR 40	SHLDR JT ROUT & SEAL 100% (LF)	3,940	$2.00	$7,880	
	CENTERLINE JT ROUT & SEAL 100.0% (L	1,970	$2.00	$3,940	
	RAND/THERM CRACK ROUT & SEAL 50%	1,084	$2.00	$2,168	
	PARTIAL PVMT PATCH 0.5% (SQ YDS)	26	$38.00	$988	
				$14,976	$4,592

Total Rehabilitation Cost (Present Worth) $168,591