



Illinois Department of Transportation

To: Diane M. O'Keefe Attn: District One
From: John D. Baranzelli
Subject: Pavement Design
Date: May 14, 2012

FAP Route 525 (US Route 20)
McHenry County
At Harmony Road [Roundabout]

We have reviewed the pavement selection for the project, which was submitted to BDE by email dated May 1, 2012. The project will reconstruct US 20 and Harmony Road using a single lane roundabout design. The design meets the warrants for a "high stress" intersection with MU ADT exceeding 200 vehicles. For this project, all legs of the roundabout will use the thicker pavement design for US 20. The approved pavement design for this project is as follows:

US Route 20 and Harmony Road (Pavement Reconstruction)

9.75 inches of PCC Pavement With Tied PCC Shoulder/Curb & Gutter
4.5 inches of Stabilized Sub-Base
12 inches of Aggregate Subgrade

The BDE Estimating Unit suggested that the unit price for PCC Pavement 9 3/4" [Jointed] should be \$46.00 instead of \$42.71. The price differential would have been slightly lower, but the rigid pavement option would still be the more economical design.

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: May 1, 2012

*Route: FAP 525 (US 20)

Limits: @ Harmony Rd

Contract No.: 60T01

Letting: 06CY13

Section: 11-N

County: McHenry

Job No.: P-91-099-10

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

- a) Widening and reconstruction of a four legged single lane roundabout.
- b) Modification of alignments and profiles for US Route 20 and Harmony Road to facilitate construction of the roundabout.

A 20 year mechanistic pavement design was performed on US 20 at Harmony Rd. This intersection is considered "high stress" as the turning lane MU ADT exceeds 200 vehicles for the stop controlled intersection. We recommend using the same pavement design for the entire length of the project as follows:

John D. Baranzelli, PE
May 1, 2012
Page 2

US 20 at Harmony Rd*

Pavement Reconstruction
Tied PCC Shoulder/ Curb & Gutter (Uniform Thickness)

PCC Pavement:

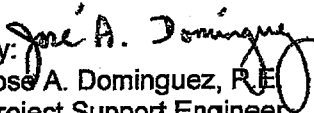
9 3/4" Jointed PCC Pavement** (Item # 42000416)
4 1/2" Hot-Mix Asphalt Stabilized Subbase
12" Aggregate Subgrade Improvement

The life cycle cost analysis favored PCC pavement by 16.3%.

*Designer Note 1: Use the same pavement design for cross roads. Harmony Rd subject to local jurisdiction concurrence.

Designer Note 2: To be paid as item #42000416, **PORTLAND CEMENT CONCRETE PAVEMENT 9 3/4" (JOINTED), paid in square yards.

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

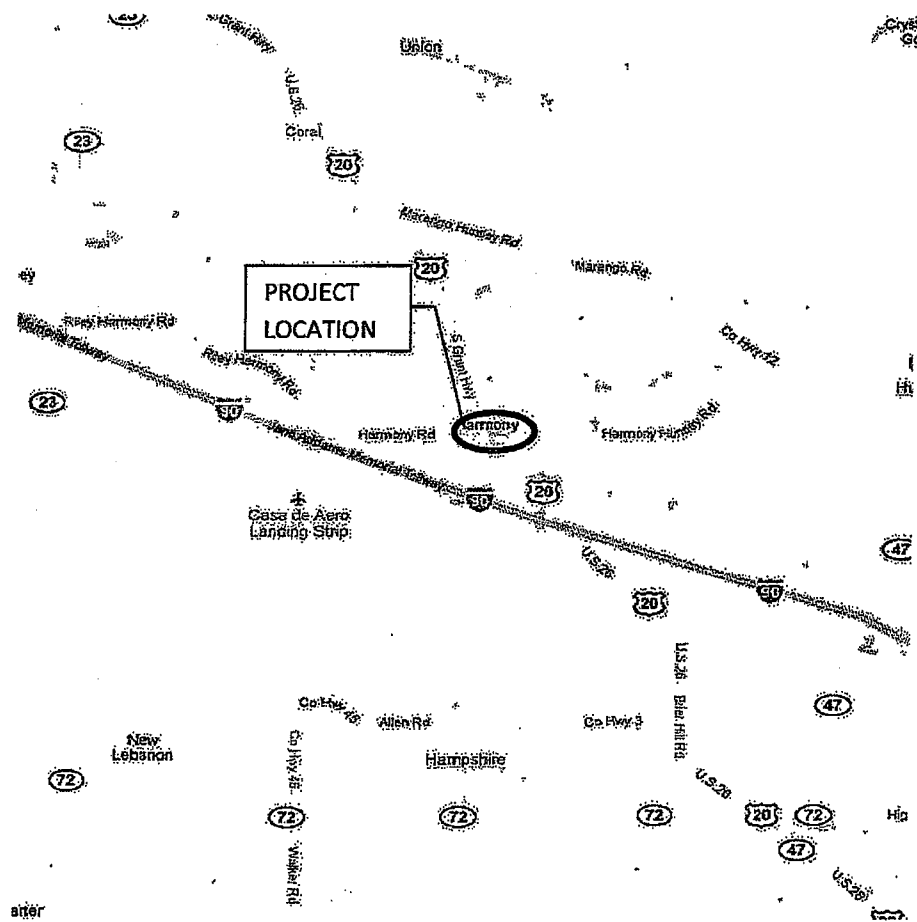
By: 
Jose A. Dominguez, P.E.
Project Support Engineer

PROJECT LOCATION

US 20 (FAP 525)

AT

HARMONY ROAD



MECHANISTIC PAVEMENT DESIGN

INPUT (Enter Data in Gray Shaded Cells)

Route: IAP 526 (US 20)	Comments: Pavement design for US 20 at Harmony Rd
Section: N/A	
County: McHenry	
Location: US 20 at Harmony Rd	Designer: M/C
Facility Type: <input type="checkbox"/> Interchange <input type="checkbox"/> Freeway <input type="checkbox"/> Expressway <input type="checkbox"/> Limited Access Road <input type="checkbox"/> Other	
# of Lanes = 2.0	
Part of future 4 lanes or more? <input type="checkbox"/> Yes <input type="checkbox"/> No	
Road Class: I	
Subgrade Support Rating (SSR): Poor	
Construction Year: 2010	
Design Period (DP) = 20 years	

	ADT	Year
Current:	1000	2010
Future:	1400	2025

Structural Design Traffic			
Minimum ADT	Actual ADT	Actual % of Total ADT	% of ADT in Design Lane
PV = 0	11,854	88.0%	P = 50%
SU = 250	539	4.0%	S = 50%
MU = 750	1,078	8.0%	M = 50%
Struct. Design ADT = 13471		(2023)	

FLEXIBLE & RIGID PAVEMENT CALCULATIONS AND ADDITIONAL INPUT

Flexible Pavement		Rigid Pavement	
Cpv = 0.15		Cpv = 0.15	
Csu = 133		Csu = 144	
Cmu = 483		Cmu = 696	
TF flexible (Actual) = 5.93 (Actual ADT)		TF rigid (Actual) = 8.30 (Actual ADT)	
TF flexible (Min) = 3.95 (Min ADT Fig 54-2C)		TF rigid (Min) = 5.58 (Min ADT Fig 54-2C)	
Use TF flexible = 5.93		Use TF rigid = 8.30	
AC Type = 2T		Shoulder or C. & G. = 1.5	
AC Mixture Temperature = 300 deg. F (Figure 54-5C)		Rigid Pav. Thick = 9.75 in. (Figure 54-4D)	
Design AC Mixture Modulus (Eac) = 550 ksi (Figure 54-5D)			
Design Asphalt Concrete Microstrain = 59.4 (Figure 54-5E)			
Asphalt Concrete Thickness = 14.25 in. (Figure 54-5F)			

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

Class I Roads 4 lanes or more Part of a future 4 lanes or more One-way Streets with ADT > 3500	Class II Roads 2 lanes with ADT > 2000 One way Street with ADT <= 3500	Class III Roads 2 Lanes (ADT 750 -2000)	Class IV Roads 2 Lanes (ADT < 750)
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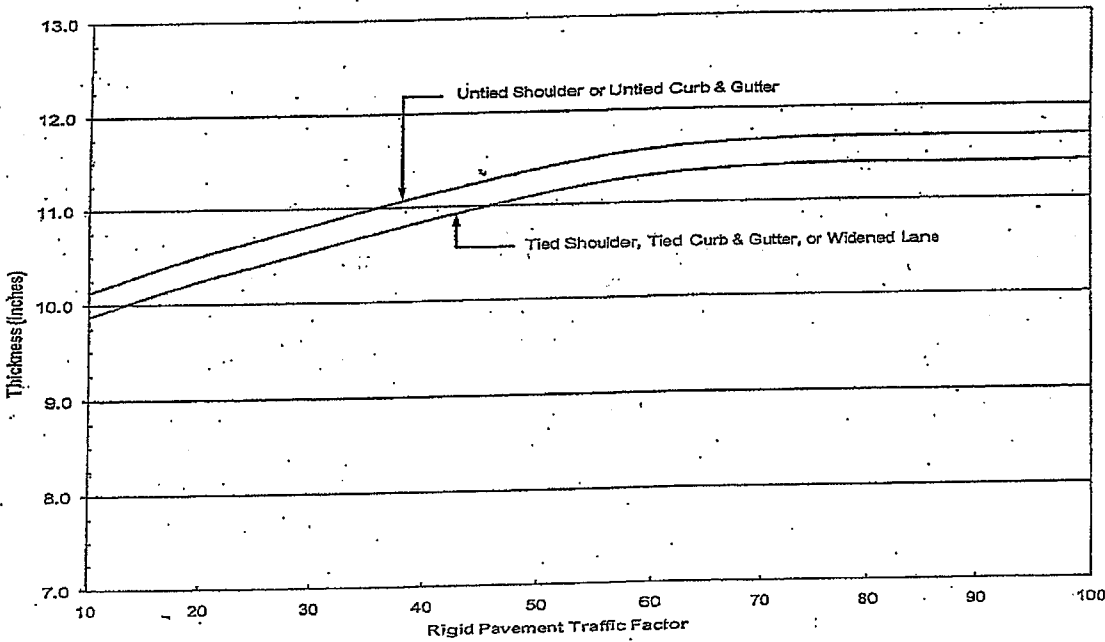
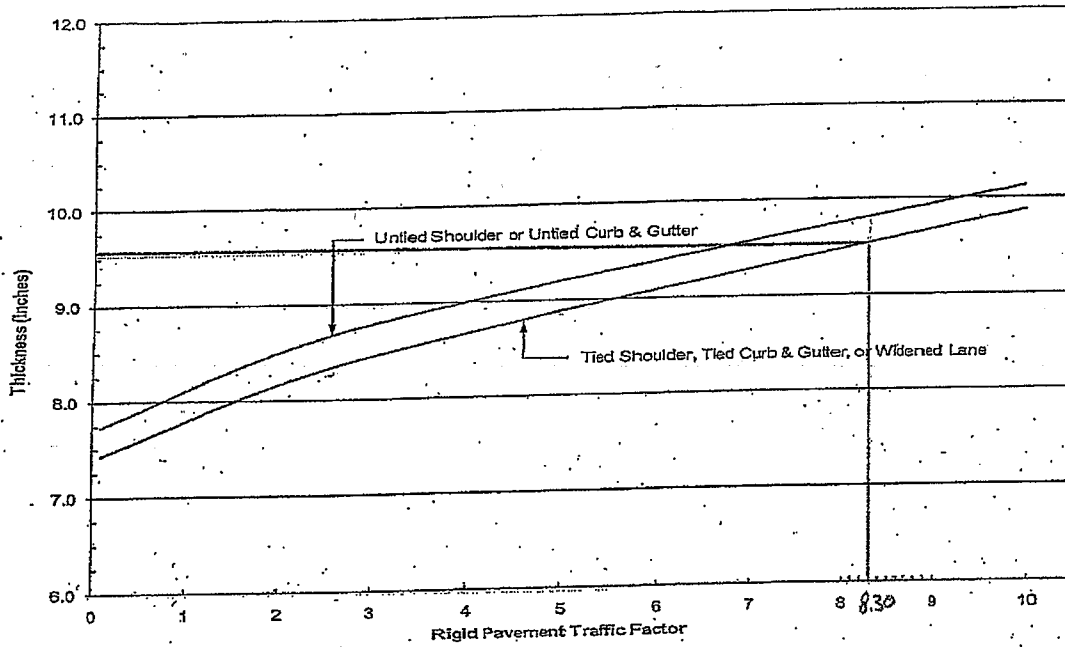
Min. Str. Design Traffic (Fig 54-2C)			
Facility Type	PV	SU	MU
Interstate or Supplemental Freeway	0	500	1500
Other Marked State Route	0	250	750
Unmarked State Route	No Min	No Min	No Min

Class Table for One-Way Streets	
ADT	Class
0 - 3600	II
>3501	I

Traffic Factor ESAL Coefficients				
Class	Rigid (Fig. 54-4C)		Flexible (Fig. 54-5B)	
	Csu	Cmu	Csu	Cmu
II	135.78	567.21	112.06	386.44
III	129.58	562.47	109.14	384.35
IV(ADT>400)	127.75	555.90	109.14	384.35
IV(ADT<=400)	127.75	555.90	9.86	78.84

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

Figure 54-2B Percentage of ADT in Design Lane						
Number of Lanes	Rural			Urban		
	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%

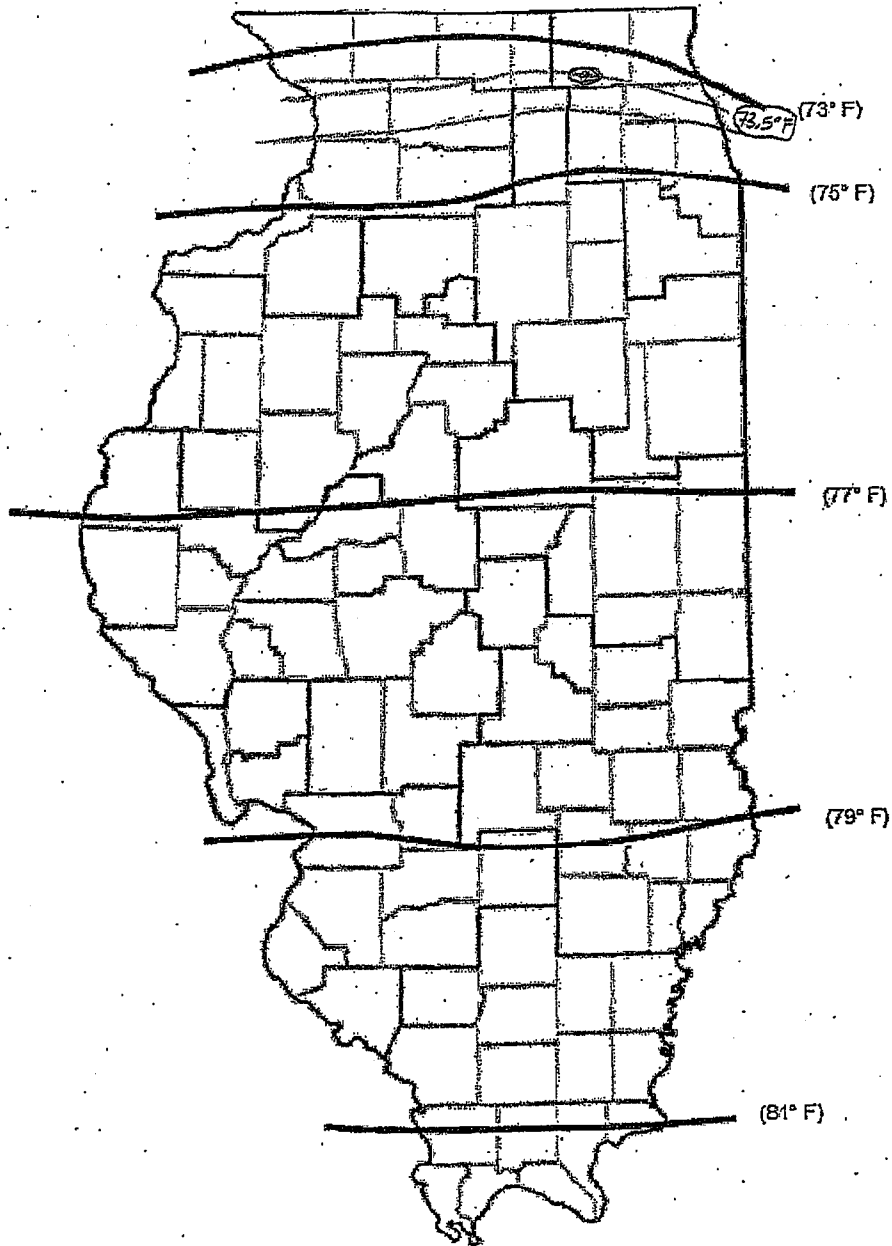


Note: Use of untied shoulder design requires BDE approval.

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

9 3/4" JOINTED PCC PAVEMENT

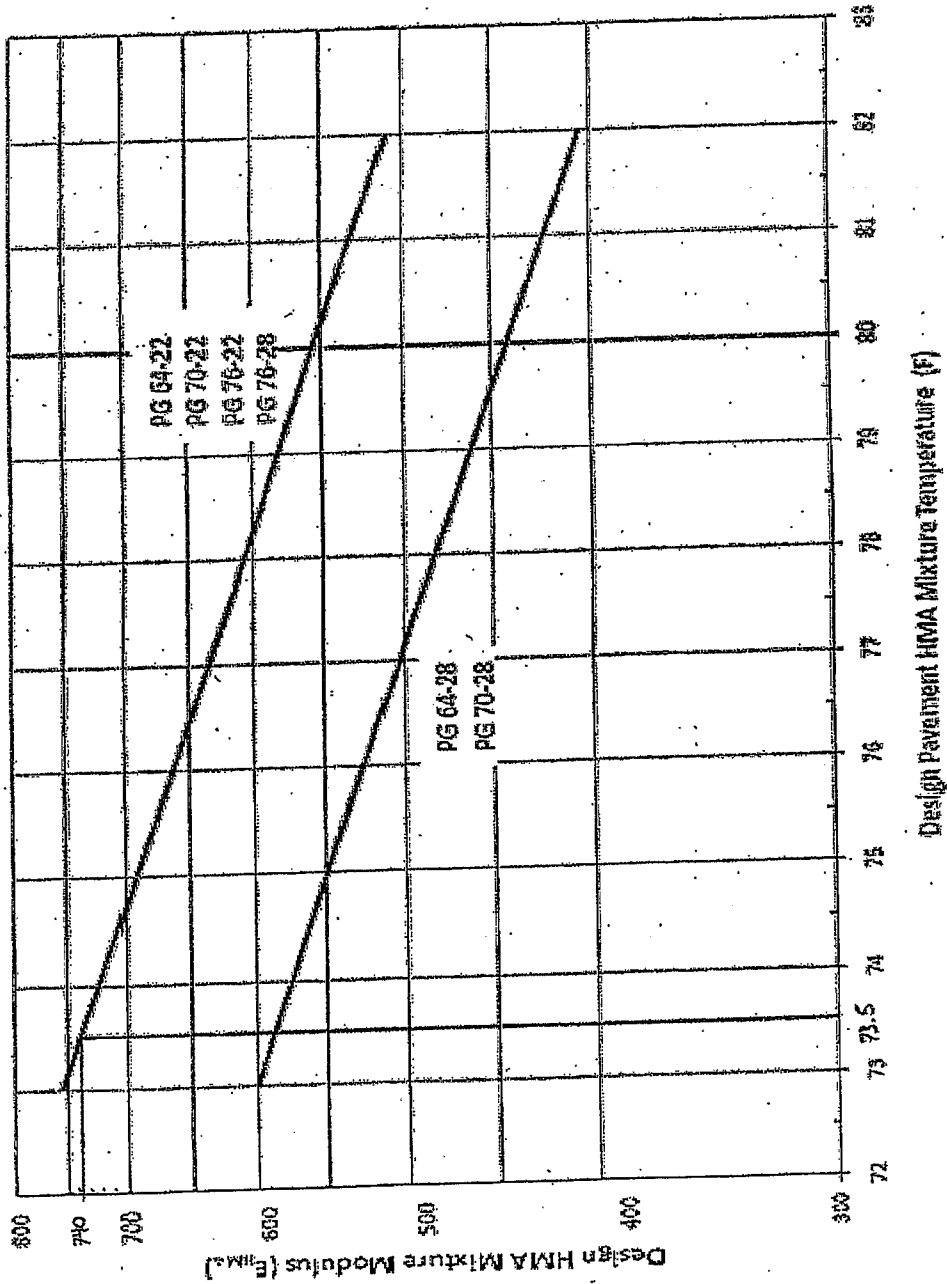
Figure 54-4.E



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

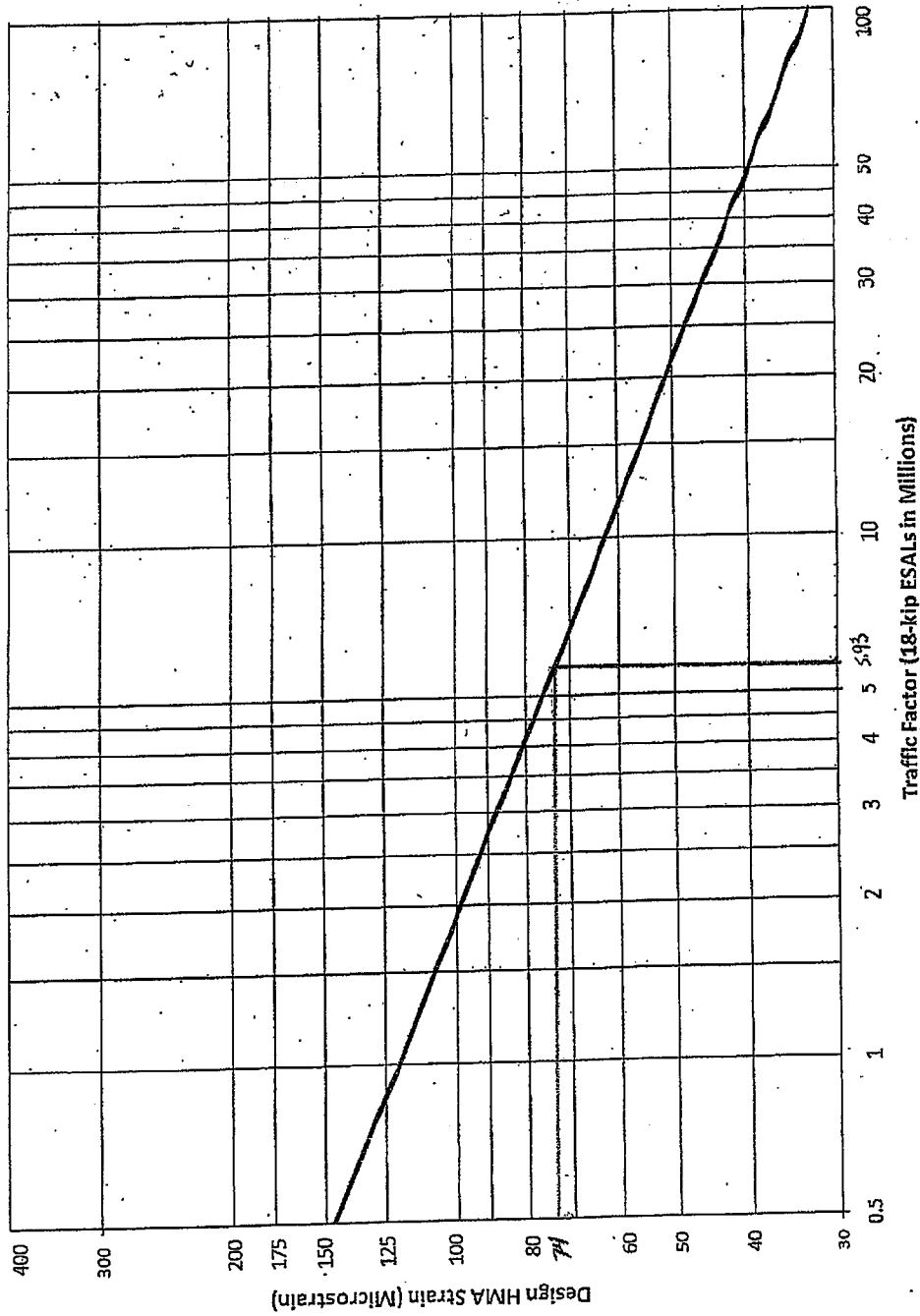
**HMA MIXTURE TEMPERATURE
(Mechanistic Design: Flexible Pavement)**

Figure 54-5.C



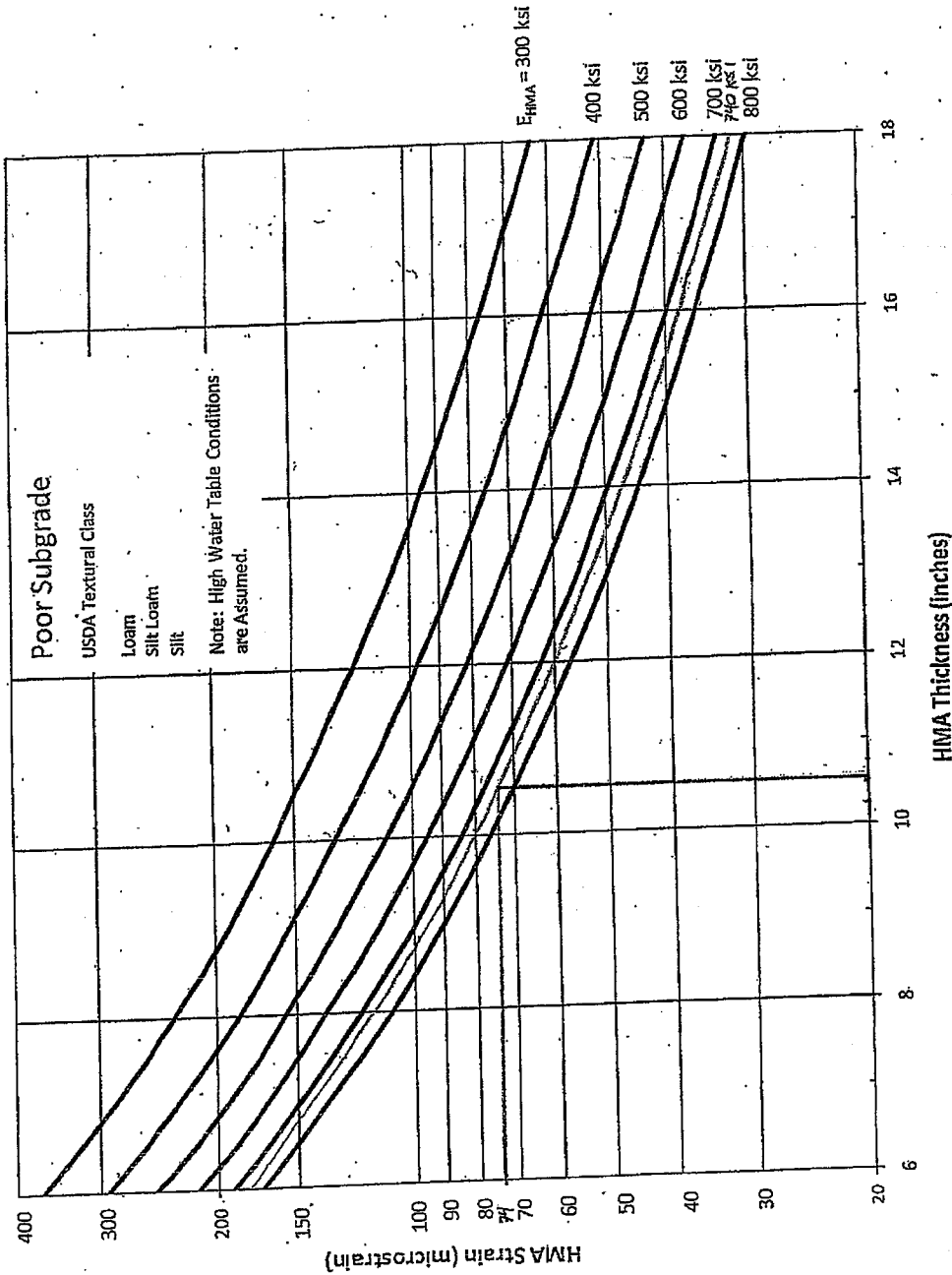
HMA MIXTURE MODULUS (E_{HMA})
(Mechanistic Design: Flexible Pavement)

Figure 54-5.D



DESIGN HMA STRAIN
(Mechanistic Design: Flexible Pavement)

Figure 54-5.E



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

Figure 54-5.F

10 3/4" FULL DEPTH HMA PAVEMENT

MECHANISTIC PAVEMENT DESIGN

Date <u>26-Mar-12</u>	Route <u>US 20 @ Harmony</u>
Calcs by: <u>TCM/AM</u>	Section <u>N/A</u>
Checked by: <u>[REDACTED]</u>	<u>McHenry</u> County
Class <u>II</u> Roads and Streets	Location <u>US 20 @ Harmony Rd</u>
Urban <u>X</u> Rural	
Limits of Analysis	Station <u>889+11</u> to Station <u>909+33</u>
	Length <u>1871</u> Feet <u>0.35</u> Miles

Structural Design Traffic	Percent of S.D.T. in Design Lane
PV = <u>11854</u>	P = <u>88.00%</u>
SU = <u>539</u>	S = <u>4.00%</u>
MU = <u>1078</u>	U = <u>8.00%</u>

MINIMUM SUBGRADE SUPPORT RATING - "POOR"

Flexible Pavement Design Actual $TF_F =$ 5.93 Minimum $TF_F =$ 3.95

	Selected Design AC Type
Design AC Mixture Temp <u>73.5</u> °F	Design E_{AC} <u>740</u> KSI
Design AC Microstrain <u>74</u>	AC Thickness <u>10.75</u> Inch

Rigid Pavement Design Actual $TF_F =$ 8.3 Minimum $TF_F =$ 5.58

	Extended Lane <u>9.75</u> Inch
15' Panel PCC Thickness for:	
	Tied Shoulder <u>9.75</u> Inch
	Untied Shoulder <u>0</u> Inch

Figure 5.05

RIGID PAVEMENT

Date: 26-Mar-12 Route JS 20 @ Harmon
 Quantities by TCM/AM Checked by: [Signature] Section N/A
 Unit Prices by TCM Checked by: [Signature] McHenry County
 Net Length 1871 Lin. Ft. = 0.35 Miles
 Number Lanes 2 Urban Rural

ITEMIZED CONSTRUCTION COST

Quantity	Units	Item		Unit Cost	Total Cost
<u>6237</u>	Sq. Yds.	<u>9.8 Inch</u> Jointed PCC	@	<u>\$42.71</u>	<u>\$266,382</u>
<u>6860</u>	Sq. Yds.	4-Inch (Stabilized/Granular Subbase)	@	<u>\$16.00</u>	<u>\$109,760</u>
<u>4.158</u>	Sq. Yds.	<u>9.8 Inch</u> PCC Shoulder	@	<u>\$39.71</u>	<u>\$165,114</u>
	Lin. Ft.	Pipe Underdrains	@		
<u>0</u>		Subbase Gran. Mat., Type C	@	<u>\$0.00</u>	<u>\$0</u>
<u>3.742</u>	Lin. Ft.	100% Shoulder Joint Seal	@	<u>\$2.00</u>	<u>\$7,484</u>

Total Cost of Original Pavement Construction \$548,740

ITEMIZED MAINTENANCE AND REHABILITATION ACTIVITY COST

REHABILITATION ACTIVITY 1 - YEAR 10

<u>6</u> Sq. Yds.	0.1% Full Depth PCC Pavement Patching	@	<u>\$130.00</u>	<u>\$780</u>
Total Cost of Rehabilitation Activity 1				<u>\$780</u>

Figure 5.05a(1)

Sheet 2 of 5
 RIGID PAVEMENT (Cont.)
 Route US 20 @ Harmony
 Section N/A
McHenry County

REHABILITATION ACTIVITY 2 - YEAR 15

		Unit Cost	Total Cost
<u>12</u> Sq. Yds.	0.2% Full Depth PCC Pavement Patching @	<u>\$130.00</u>	<u>\$1,560</u>

Total Cost of Rehabilitation Activity 2 \$1,560

REHABILITATION ACTIVITY 3 - YEAR 20

		Unit Cost	Total Cost
<u>125</u> Sq. Yds.	2% Full Depth PCC Pavement Patching @	<u>\$0.00</u>	<u>\$16,250</u>
<u>21</u> Sq. Yds.	0.5% Full Depth PCC Pavement Patching @	<u>\$85.00</u>	<u>\$1,785</u>
<u>3742</u> Lin. Ft.	100% Longitudunal/ Shoulder Joint Routing & Sealing @	<u>\$1.00</u>	<u>\$3,742</u>
<u>5613</u> Lin. Ft.	100% Centerline Joint Routing & Sealing @	<u>\$1.00</u>	<u>\$5,613</u>

Total Cost of Rehabilitation Activity 3 \$27,390

FIGURE 5.05a(2)

REHABILITATION ACTIVITY 4 - YEAR 25

			Unit Cost	Total Cost
<u>187</u> Sq. Yds.	3.0% Full Depth PCC Pavement Patching	@	<u>\$130.00</u>	<u>\$24,310</u>
<u>42</u> Sq. Yds.	1.0% Full Depth PCC Pavement Patching	@	<u>\$85.00</u>	<u>\$3,570</u>

Total Cost of Rehabilitation Activity 4 \$27,880

REHABILITATION ACTIVITY 5 - YEAR 30

			Unit Cost	Total Cost
<u>249</u> Sq. Yds.	3.0% Full Depth PCC Pavement Patching	@	<u>\$85.00</u>	<u>\$5,270</u>
<u>62</u> Sq. Yds.	1.0% Full Depth PCC Pavement Patching	@	<u>\$12.62</u>	<u>\$78,711</u>
<u>6,237</u> Sq. Yds.	Policy HMA Overlay - Pavement	@	<u>\$12.62</u>	<u>\$78,711</u>
<u>4,158</u> Sq. Yds.	Policy HMA Overlay - Shoulder	@	<u>\$12.62</u>	<u>\$52,474</u>

Total Cost of Rehabilitation Activity 5 \$168,825

REHABILITATION ACTIVITY 6 - YEAR 35

			Unit Cost	Total Cost
<u>3,742</u> Lin. Ft.	100% Longitudinal Shoulder Joint	@	<u>\$1.00</u>	<u>\$3,742</u>
	Routing & Sealing			
<u>5,613</u> Lin. Ft.	100% Centerline Joint	@	<u>\$1.00</u>	<u>\$5,613</u>
	Routing & Sealing			
<u>1,871</u> Lin. Ft.	50% Random Crack	@	<u>\$1.00</u>	<u>\$1,871</u>
	Routing & Sealing - Assume 100ft/station			
<u>1,197</u> Lin. Ft.	40% Reflective Transverse Crack	@	<u>\$1.00</u>	<u>\$1,197</u>
	Routing & Sealing			
<u>6</u> Sq. Yds.	0.1% Partial-Depth Pavement Patching		<u>\$130.00</u>	<u>\$780</u>
	(Mill & Fill Surface-Interstates; Mill & Fill 2.5in. Non-Interstates)			

Total Cost of Rehabilitation Activity 6 \$13,203

Figure 5.05a(3)

REHABILITATION ACTIVITY 7 - YEAR 40

			Unit Cost	Total Cost
<u>31</u> Sq. Yds.	0.5% Full Depth PCC Pavement Patching	@	<u>\$130.00</u>	<u>\$4,030</u>
<u>31</u> Sq. Yds.	0.5% Partial Depth Pavement Patching	@	<u>\$130.00</u>	<u>\$4,030</u>
	(Mill & Fill Surface-Interstates; Mill & Fill 2.5in. Non-Interstates)			
<u>1,796</u> Lin. Ft.	60% Reflective Transverse Crack	@	<u>\$1.00</u>	<u>\$1,796</u>
	Routing & Sealing			
<u>1,871</u> Lin. Ft.	50% Random Crack	@	<u>\$1.00</u>	<u>\$1,871</u>
	Routing & Sealing - Assume 100ft/station			
<u>3,742</u> Lin. Ft.	100% Longitudinal/ Shoulder Joint	@	<u>\$1.00</u>	<u>\$3,742</u>
	Routing & Sealing			
<u>5,613</u> Lin. Ft.	100% Centerline Joint	@	<u>\$1.00</u>	<u>\$5,613</u>
	Routing & Sealing			
	Total Cost of Rehabilitation Activity 7			<u>\$21,082</u>

RIGID PAVEMENT (Cont.)

Route US 20 @ Harmony

Section N/A

McHenry County

ANNUAL COST DETERMINATION

Present Worth Calculation:

Total Cost of Original Pavement Construction \$548,740

Present Worth of Rehab Activity 1	<u>\$780</u>	x 0.7441 =	<u>\$580</u>
Present Worth of Rehab Activity 2	<u>\$1,560</u>	x 0.6419 =	<u>\$1,001</u>
Present Worth of Rehab Activity 3	<u>\$27,390</u>	x 0.5537 =	<u>\$15,166</u>
Present Worth of Rehab Activity 4	<u>\$27,880</u>	x 0.4776 =	<u>\$13,315</u>
Present Worth of Rehab Activity 5	<u>\$168,825</u>	x 0.4120 =	<u>\$69,556</u>
Present Worth of Rehab Activity 6	<u>\$13,203</u>	x 0.3554 =	<u>\$4,692</u>
Present Worth of Rehab Activity 7	<u>\$21,082</u>	x 0.3066 =	<u>\$6,464</u>

Total Life Cycle Cost (Present Worth) \$110,774

Annual Cost Per Mile Calculation

Total PW	x CRF _n /	Length	= Annual Cost / Year-Mile
<u>\$110,774</u>	x 0.04079 /	<u>0.35</u> Mi.	<u>\$76,862</u> per Yr.-Mi.

FLEXIBLE PAVEMENT

Date: 26-Mar-12 Route US 20 @ Harmony
 Quantities by TCM/AM Checked by: [Signature] Section N/A
 Unit Prices by: TM Checked by: [Signature] McHenry County
 Net Length 1871 Lin. Ft. = 0.35 Miles
 Number Lanes 2 Urban Rural
 Single Lane Paving Dual Lane Paving

ITEMIZED CONSTRUCTION COST

<u>Quantity</u>	<u>Units</u>	<u>Item</u>		<u>Unit Cost</u>	<u>Total Cost</u>
<u>6,237</u>	Sq. Yds.	Class I Surface Course	@	<u>\$12.62</u>	<u>\$78,711</u>
<u>6,237</u>	Sq. Yds.	Class I Binder Course	@	<u>\$28.49</u>	<u>\$177,692</u>
<u>4158</u>	Sq. Yds.	Stabilized Shoulders	@	<u>\$48.75</u>	<u>\$202,703</u>
	Lin. Ft.	Pipe Underdrains	@		
<u>0</u>		Subbase Gran. Matl., Type C	@	<u>\$0.00</u>	<u>\$0</u>
<u>6,237</u>	Sq. Yds.	Poly Binder	@	<u>\$12.63</u>	<u>\$78,773</u>

Total Cost of Original Pavement Construction \$537,879

ITEMIZED MAINTENANCE AND REHABILITATION ACTIVITY COST

REHABILITATION ACTIVITY 1 - YEAR 5

				<u>Unit Cost</u>	<u>Total Cost</u>
<u>1029</u>	Lin. Ft.	50% Random/Thermal Cracking & Sealing (Assume 110ft/station)	@	<u>\$1.00</u>	<u>\$1,029</u>
<u>3742</u>	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	<u>\$1.00</u>	<u>\$3,742</u>
<u>5613</u>	Lin. Ft.	100% Centerline Joint Rounting & Sealing	@	<u>\$1.00</u>	<u>\$5,613</u>
<u>6</u>	Sq. Yds.	0.1% Partial-Depth Pavement Patching	@	<u>\$90.00</u>	<u>\$540</u>
		Mill & Fill Surface			

Total Cost of Rehabilitation Activity 1 \$10,924

REHABILITATION ACTIVITY 2 - YEAR 10

				<u>Unit</u>	<u>Total</u>
				<u>Cost</u>	<u>Cost</u>
<u>31</u>	Sq. Yds.	0.5% Partial-depth HMA Pavement	@	<u>\$90.00</u>	<u>\$2,790</u>
		Patching - Mill & Fill Surface			
<u>1029</u>	Lin. Ft.	50% Random/ Thermal Crack Routing	@	<u>\$1.00</u>	<u>\$1,029</u>
		& Sealing (Assume 110ft/station)			
<u>3742</u>	Lin. Ft.	100% Longitudinal Shoulder Joint	@	<u>\$1.00</u>	<u>\$3,742</u>
		Routing & Sealing			
<u>5613</u>	Lin. Ft.	100% Centerline Joint Rounting & Sealing	@	<u>\$1.00</u>	<u>\$5,613</u>

Total Cost of Rehabilitation Activity 2 \$13,174

REHABILITATION ACTIVITY 3 - YEAR 15

				<u>Unit</u>	<u>Total</u>
				<u>Cost</u>	<u>Cost</u>
<u>10,395</u>	Sq. Yds.	2.00in. Milling - Pavement & Shoulder	@	<u>\$1.75</u>	<u>\$18,191</u>
<u>62</u>	Sq. Yds.	1.0% Partial-depth Pavement Patching	@	<u>\$90.00</u>	<u>\$5,580</u>
		(Mill & Fill Addition 2.00in.)			
<u>1,164</u>	Sq. Yds.	2.00in. HMA Overlay Pavement &	@	<u>\$112.68</u>	<u>\$131,158</u>
		Shoulder			

Total Cost of Rehabilitation Activity 3 \$154,929

FLEXIBLE PAVEMENT (Cont.)

Route US 20 @ Harmony

Section N/A

McHenry County

				<u>Unit</u>	<u>Total</u>
				<u>Cost</u>	<u>Cost</u>
REHABILITATION ACTIVITY 4 - YEAR 20					
<u>3742</u>	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	<u>\$1.00</u>	<u>\$3,742</u>
<u>5613</u>	Lin. Ft.	100% Centerline Joint Rounting & Sealing	@	<u>\$1.00</u>	<u>\$5,613</u>
<u>1029</u>	Lin. Ft.	50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station)	@	<u>\$1.00</u>	<u>\$1,029</u>
<u>6</u>	Sq. Yds.	0.1% Partial-Depth HMA Pavement Patching (Mill & Fill Surface)	@	<u>\$90.00</u>	<u>\$540</u>

Total Cost of Rehabilitation Activity 4 \$10,924

				<u>Unit</u>	<u>Total</u>
				<u>Cost</u>	<u>Cost</u>
REHABILITATION ACTIVITY 5 - YEAR 25					
<u>3742</u>	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	<u>\$1.00</u>	<u>\$3,742</u>
<u>5613</u>	Lin. Ft.	100% Centerline Joint Rounting & Sealing	@	<u>\$1.00</u>	<u>\$5,613</u>
<u>1029</u>	Lin. Ft.	50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station)	@	<u>\$1.00</u>	<u>\$1,029</u>
<u>31</u>	Sq. Yds.	0.5% Partial-Depth Pavement Patching (Mill & Fill Surface)	@	<u>\$90.00</u>	<u>\$2,790</u>

Total Cost of Rehabilitation Activity 5 \$13,174

				<u>Unit</u>	<u>Total</u>
				<u>Cost</u>	<u>Cost</u>
REHABILITATION ACTIVITY 6 - YEAR 30					
<u>6,237</u>	Sq. Yds.	2.00in. Milling (Pavement only-Std Design @ Pavement & Shoulder-Limiting Strain Criteria Design)	@	<u>\$1.75</u>	<u>\$10,915</u>
<u>125</u>	Sq. Yds.	2.0% Partial-Depth HMA Pavement Patching (Mill & Fill Additional 2.00in. All Designs)	@	<u>\$90.00</u>	<u>\$11,250</u>
<u>42</u>	Sq. Yds.	1.0% Full-Depth HMA Shoulder Patching (Mill & Fill Surface-Standard Design Mill & Fill Additional 2.00in.-Limiting Strain Criteria Design)	@	<u>\$90.00</u>	<u>\$3,780</u>
<u>1,310</u>	Tons	HMA Overlay Pvmt (3.75in. - Std Design 2.00in.-Limiting Strain Criterion Design)	@	<u>\$112.68</u>	<u>\$147,609</u>
<u>407</u>	Tons	HMA Overlay Shoulder (1.75in. - Standard Design; 2.00in.-Limiting Strain Criterion Design)	@	<u>\$112.68</u>	<u>\$45,860</u>

Total Cost of Rehabilitation Activity 6 \$219,414

FIGURE 5.05b(3)

FLEXIBLE PAVEMENT (Cont.)

Route US 20 @ Harmony

Section N/A

McHenry County

REHABILITATION ACTIVITY 7 - YEAR 35

				<u>Unit</u>	<u>Total</u>
				<u>Cost</u>	<u>Cost</u>
<u>3742</u>	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	<u>\$1.00</u>	<u>\$3,742</u>
<u>5613</u>	Lin. Ft.	100% Centerline Joint Rounting & Sealing	@	<u>\$1.00</u>	<u>\$5,613</u>
<u>1029</u>	Lin. Ft.	50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station)	@	<u>\$1.00</u>	<u>\$1,029</u>
<u>6</u>	Sq. Yds.	0.1% Partial-Depth HMA Pavement Patching (Mill & Fill Surface)	@	<u>\$90.00</u>	<u>\$540</u>
Total Cost of Rehabilitation Activity 7					<u>\$10,924</u>

REHABILITATION ACTIVITY 8 - YEAR 40

				<u>Unit</u>	<u>Total</u>
				<u>Cost</u>	<u>Cost</u>
<u>3742</u>	Lin. Ft.	100% Longitudinal Shoulder Joint Routing & Sealing	@	<u>\$1.00</u>	<u>\$3,742</u>
<u>5613</u>	Lin. Ft.	100% Centerline Joint Rounting & Sealing (Single Lane and Dual Lane Paving)	@	<u>\$1.00</u>	<u>\$5,613</u>
<u>1029</u>	Lin. Ft.	50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station)	@	<u>\$1.00</u>	<u>\$1,029</u>
<u>31</u>	Sq. Yds.	0.5% Partial-Depth Pavement Patching (Mill & Fill Surface)	@	<u>\$90.00</u>	<u>\$2,790</u>
Total Cost of Rehabilitation Activity 8					<u>\$13,174</u>

Figure 5.05b(4) - continued

FLEXIBLE PAVEMENT (Cont.)

Route US 20 @ Harmony

Section N/A

McHenry County

ANNUAL-COST DETERMINATION

Present Worth Calculation:

Total Cost of Original Pavement Construction \$537,879

Present Worth of Rehab Activity 1	<u>\$10,924</u>	x 0.7441 =	<u>\$9,423</u>
Present Worth of Rehab Activity 2	<u>\$13,174</u>	x 0.6419 =	<u>\$9,803</u>
Present Worth of Rehab Activity 3	<u>\$154,929</u>	x 0.5537 =	<u>\$99,449</u>
Present Worth of Rehab Activity 4	<u>\$10,924</u>	x 0.4776 =	<u>\$6,049</u>
Present Worth of Rehab Activity 5	<u>\$13,174</u>	x 0.4120 =	<u>\$6,292</u>
Present Worth of Rehab Activity 6	<u>\$219,414</u>	x 0.3554 =	<u>\$90,399</u>
Present Worth of Rehab Activity 7	<u>\$10,924</u>	x 0.3066 =	<u>\$3,882</u>
Present Worth of Rehab Activity 8	<u>\$13,174</u>	x 0.3066 =	<u>\$4,039</u>

Total Life Cycle Cost (Present Worth) \$229,336

Annual Cost Per Mile Calculation

Total PW	x CRF _n /	Length	= Annual Cost / Year-Mile
<u>\$229,336</u>	x 0.04079 /	<u>0.35</u> Mi.	<u>\$89,413</u> per Yr.-Mi.

MATERIAL TYPE/PERCENTAGE	PCC	16.3%
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PLAIN JOINTED FOG PAVEMENT

FILENAME- 015-20 @ Hiramton
ROUTE- IAP-525
SECTION- N/A
COUNTY- Washington
LOCATION- US 20 @ Hiramton Rd
DATE- 26-Mar-12
26-Mar-12

MAINTENANCE COSTS:
Activity 1
YEAR 10

PAVEMENT PATCHING 0.1% (SQ YDS)

Activity 2
YEAR 16

PAVEMENT PATCHING 0.2% (SQ YDS)

Activity 3
YEAR 20

PAVEMENT PATCHING 2.0% (SQ YDS)
SHOULDER PATCHING 0.5% (SQ YDS)
SHLDR JT ROUT & SEAL 100% (LF)
CENTERLINE JT ROUT & SEAL 100% (LF)

Activity 4
YEAR 25

PAVEMENT PATCHING 3.0% (SQ YDS)
SHOULDER PATCHING 1.0% (SQ YDS)

Activity 5
YEAR 30

PAVEMENT PATCHING 4.0% (SQ YDS)
SHOULDER PATCHING 4.5% (SQ YDS)
POLICY HMA OVERLAY CVMT (SQ YDS)
POLICY HMA OVERLAY SHLDR (SQ YDS)

Activity 8
YEARS 35

SHLDR JT ROUT & SEAL 100% (LF)
CENTERLINE JT ROUT & SEAL 100% (LF)
RANDOM CRACK ROUT & SEAL 50% (LF)
REFL TRANS CRACK ROUT & SEAL 40%
PARTIAL PMVT PATCH 0.1% (SQ YDS)

Activity 7
YEAR 40

PAVEMENT PATCHING 0.5% (SQ YDS)
SHOULDER PATCHING 0.5% (SQ YDS)
REFL TRANS CRACK ROUT & SEAL 60%
RANDOM CRACK ROUT & SEAL 50% (LF)
SHLDR JT ROUT & SEAL 100% (LF)
CENTERLINE JT ROUT & SEAL 100% (LF)

PARTIAL PMVT PATCH (SQ YDS)

PROJECT LENGTH (FT) 0.35 MILES
AVERAGE LANE WIDTH (FT)
NUMBER OF LANES
OF EDGES
INSIDE SHOULDER WIDTH (FT)
OUTSIDE SHOULDER WIDTH (FT)
OF CENTERLINES
RIGID THICKNESS
TRAFFIC FACTORS

MINIMUM 3.75
ACTUAL 5.5
PERCENTAGES
PV- 11.85% 88.00%
SU- 5.88 4.00%
MU- 10.78 8.00%

INITIAL COSTS

ITEM	QUANTITY	UNIT PRICE	COST
PAVEMENT (SQ YDS)	6,237	\$42.71	\$266,382
STAB SUBBASE (SQ YDS)	6,860	\$16.00	\$109,760
SHOULDERS (SQ YDS)	4,158	\$38.71	\$165,114
SHOULDER SEAL (LN FT)	3,742	\$2.00	\$7,484
SUBBASE GRAN MATL TY C (TONS)	0	\$19,000	\$0

CONSTRUCTION INITIAL COST (PW) \$546,740
TOTAL REHABILITATION COST (PW) \$110,774
TOTAL LIFE CYCLE COST (PW) \$658,514
ANNUAL COST PER MILE \$78,882

UNIT COST
PAVEMENT PATCHING (SQ YDS) \$30,000
SHOULDER PATCHING (SQ YDS) \$85,000
SHLDR JT ROUT & SEAL (LF) \$1,000
CENTERLINE JT ROUT & SEAL (LF) \$1,000
POLICY HMA OVERLAY PMVT (SQ YDS) \$12,500
POLICY HMA OVERLAY SHLDR (SQ YDS) \$12,500
RANDOM CRACK ROUT & SEAL (LF) \$1,000
REFL TRANS CRACK ROUT & SEAL (LF) \$1,000
PARTIAL PMVT PATCH (SQ YDS) \$130,000

ITEM	QUANTITY	UNIT PRICE	COST	PW
PAVEMENT PATCHING 0.1% (SQ YDS)	6	\$130.00	\$780	\$580
PAVEMENT PATCHING 0.2% (SQ YDS)	12	\$130.00	\$1,560	\$1,001
PAVEMENT PATCHING 2.0% (SQ YDS)	128	\$130.00	\$16,250	
SHOULDER PATCHING 0.5% (SQ YDS)	21	\$85.00	\$1,785	
SHLDR JT ROUT & SEAL 100% (LF)	3,742	\$1.00	\$3,742	
CENTERLINE JT ROUT & SEAL 100% (LF)	5,613	\$1.00	\$5,613	
TOTAL				\$15,165
PAVEMENT PATCHING 3.0% (SQ YDS)	187	\$130.00	\$24,310	
SHOULDER PATCHING 1.0% (SQ YDS)	42	\$85.00	\$3,570	
TOTAL				\$13,315
PAVEMENT PATCHING 4.0% (SQ YDS)	249	\$130.00	\$32,370	
SHOULDER PATCHING 4.5% (SQ YDS)	62	\$85.00	\$5,270	
POLICY HMA OVERLAY CVMT (SQ YDS)	9,237	\$12.62	\$78,711	
POLICY HMA OVERLAY SHLDR (SQ YDS)	4,158	\$12.62	\$52,474	
TOTAL				\$89,555
SHLDR JT ROUT & SEAL 100% (LF)	3,742	\$1.00	\$3,742	
CENTERLINE JT ROUT & SEAL 100% (LF)	5,613	\$1.00	\$5,613	
RANDOM CRACK ROUT & SEAL 50% (LF)	1,871	\$1.00	\$1,871	
REFL TRANS CRACK ROUT & SEAL 40%	1,197	\$1.00	\$1,197	
PARTIAL PMVT PATCH 0.1% (SQ YDS)	6	\$130.00	\$780	
TOTAL				\$13,203
PAVEMENT PATCHING 0.5% (SQ YDS)	31	\$130.00	\$4,030	
SHOULDER PATCHING 0.5% (SQ YDS)	31	\$130.00	\$4,030	
REFL TRANS CRACK ROUT & SEAL 60%	1,786	\$1.00	\$1,786	
RANDOM CRACK ROUT & SEAL 50% (LF)	1,871	\$1.00	\$1,871	
SHLDR JT ROUT & SEAL 100% (LF)	3,742	\$1.00	\$3,742	
CENTERLINE JT ROUT & SEAL 100% (LF)	5,613	\$1.00	\$5,613	
TOTAL				\$21,082
Total Rehabilitation Cost (Present Worth)				\$110,774

Total Rehabilitation Cost (Present Worth)

FULL DEPTH FLEXIBLE
 TRAFFIC FACTOR LESS THAN 15.0 (RURAL)
 TRAFFIC FACTOR LESS THAN 10.0 (URBAN)
 ROUTE: FAP 625
 SECTION: McHenry
 COUNTY: US 20 @ Harmony Rd
 LOCATION: 1871

PROJECT LENGTH (FT) 1871
 AVERAGE LANE WIDTH (FT) 15
 NUMBER OF LANES 2
 # OF EDGES 10
 INSIDE SHOULDER WIDTH (FT) 10
 # OF CENTERLINES 3
 PROJECT TYPE 1=RURAL, 2=URBAN
 PAVING WIDTH 1=SINGLE LANE, 2=DUAL LANE
 INTERSTATE / OTHER ROUTE
 FLEXIBLE THICKNESS
 TRAFFIC FACTORS
 MINIMUM 0
 ACTUAL 5.88

TRAFFIC
 PV- 11864 0.88
 SU- 539 0.04
 MIL- 1078 0.08

PAVEMENT OVERLAY THICKNESS 375
 SHOULDER OVERLAY THICKNESS 4.75

INITIAL COSTS	ITEM	QUANTITY	UNIT PRICE	COST
	SURFACE (SQ YDS)	6,237	\$12,924	\$78,711
	POLY BINDER (SQ YDS)	6,237	\$12,673	\$78,773
	BINDER (SQ YDS)	6,237	\$177,992	\$1,109,491
	SHOULDERS (SQ YDS)	4168	\$48.75	\$202,703
	SUBBASE GRAN MATL. T/C (TONS)	0	\$0	\$0

CONSTRUCTION INITIAL COST (PW) \$537,878
 TOTAL REHABILITATION COST (PW) \$228,338

TOTAL LIFE CYCLE COST (PW) \$787,216
 ANNUAL COST PER MILE \$88,413

MAINTENANCE COSTS:

ITEM	UNIT COST
RANDTHERM CRACK ROUT & SEAL (LF)	\$1.00
SHLDR JT ROUT & SEAL (LF)	\$1.00
CENTERLINE JT ROUT & SEAL (LF)	\$1.00
PARTIAL PVMIT PATCH (SQ YDS)	\$60.00
2" MILL PVMIT & SHLDR (SQ YDS)	\$175
2" OVERLAY PVMIT & SHLDR (TONS)	\$112.88
2" MILL PVMIT ONLY (SQ YDS)	\$1.75
HMA SHOULDER PATCHING (SQ YDS)	\$80.00
POLICY HMA OVERLAY PVMIT (TONS)	\$112.88
POLICY HMA OVERLAY SHLDR (TONS)	\$112.88

MATERIAL TYPE/PERCENTAGE PCC 18.3%

FULL DEPTH FLEXIBLE PAVEMENT
 MAINTENANCE COSTS

ACTIVITY	ITEM	QUANTITY	UNIT PRICE	COST	PW
Activity 1	YEAR 5 RANDTHERM CRACK ROUT & SEAL 50% (LF)	1,029	\$1.00	\$1,029	
	SHLDR JT ROUT & SEAL 100% (LF)	3,742	\$1.00	\$3,742	
	CENTERLINE JT ROUT & SEAL 100% (LF)	5,613	\$1.00	\$5,613	
	PARTIAL PVMIT PATCH 0.1% (SQ YDS)	8	\$60.00	\$480	
				\$10,824	\$9,423
Activity 2	YEAR 10 PARTIAL PVMIT PATCH 0.6% (SQ YDS)	31	\$60.00	\$1,860	
	RANDTHERM CRACK ROUT & SEAL 50% (LF)	1,029	\$1.00	\$1,029	
	SHLDR JT ROUT & SEAL 100% (LF)	3,742	\$1.00	\$3,742	
	CENTERLINE JT ROUT & SEAL 100% (LF)	5,613	\$1.00	\$5,613	
				\$13,174	\$9,803
Activity 3	YEAR 15 2" MILL PVMIT & SHLDR 100% (SQ YDS)	10,395	\$1.75	\$18,191	
	PARTIAL PVMIT PATCH 1.0% (SQ YDS)	62	\$60.00	\$3,720	
	2" OVERLAY PVMIT & SHLDR 100% (TONS)	1,164	\$112.88	\$131,158	
				\$154,929	\$88,448
Activity 4	YEAR 20 SHLDR JT ROUT & SEAL 100% (LF)	3,742	\$1.00	\$3,742	
	CENTERLINE JT ROUT & SEAL 100% (LF)	5,613	\$1.00	\$5,613	
	RANDTHERM CRACK ROUT & SEAL 50% (LF)	1,029	\$1.00	\$1,029	
	PARTIAL PVMIT PATCH 0.1% (SQ YDS)	8	\$60.00	\$480	
				\$10,824	\$6,049
Activity 5	YEAR 25 SHLDR JT ROUT & SEAL 100% (LF)	3,742	\$1.00	\$3,742	
	CENTERLINE JT ROUT & SEAL 100% (LF)	5,613	\$1.00	\$5,613	
	RANDTHERM CRACK ROUT & SEAL 50% (LF)	1,029	\$1.00	\$1,029	
	PARTIAL PVMIT PATCH 0.5% (SQ YDS)	31	\$60.00	\$1,860	
				\$13,174	\$6,282
Activity 6	YEAR 30 2" MILL PVMIT & SHLDR 100% (SQ YDS)	6,237	\$1.75	\$10,915	
	PARTIAL PVMIT PATCH 2.0% (SQ YDS)	125	\$60.00	\$7,500	
	HMA SHLDR PATCHING 1.0% (SQ YDS)	42	\$60.00	\$2,520	
	POLICY HMA OVERLAY PVMIT (TONS)	1,316	\$112.88	\$147,889	
	POLICY HMA OVERLAY SHLDR (TONS)	407	\$112.88	\$45,980	
				\$219,414	\$99,389
Activity 7	YEAR 35 SHLDR JT ROUT & SEAL 100% (LF)	3,742	\$1.00	\$3,742	
	CENTERLINE JT ROUT & SEAL 100% (LF)	5,613	\$1.00	\$5,613	
	RANDTHERM CRACK ROUT & SEAL 50% (LF)	1,029	\$1.00	\$1,029	
	PARTIAL PVMIT PATCH 0.1% (SQ YDS)	8	\$60.00	\$480	
				\$10,824	\$5,882
Activity 8	YEAR 40 SHLDR JT ROUT & SEAL 100% (LF)	3,742	\$1.00	\$3,742	
	CENTERLINE JT ROUT & SEAL 100% (LF)	5,613	\$1.00	\$5,613	
	RANDTHERM CRACK ROUT & SEAL 50% (LF)	1,029	\$1.00	\$1,029	
	PARTIAL PVMIT PATCH 0.5% (SQ YDS)	31	\$60.00	\$1,860	
				\$13,174	\$4,038

Total Rehabilitation Cost (Present Worth) \$228,338