Illinois Department of Transportation

Memorandum

To:	Omer Osman	Attn: District Eight
From:	Scott E. Stitt	
Subject:	Pavement Design	
Date:	September 26, 2011	

FAP Route 327 (US 50)
Section 21-I-1, 27-I
Clinton County
At FAS Route 1784 (Shattuc Road)

We have reviewed the pavement selection for the above captioned section, which was submitted with your memorandum dated August 16, 2011. Based on the life-cycle analysis, the HMA pavement design was found to be more economical.

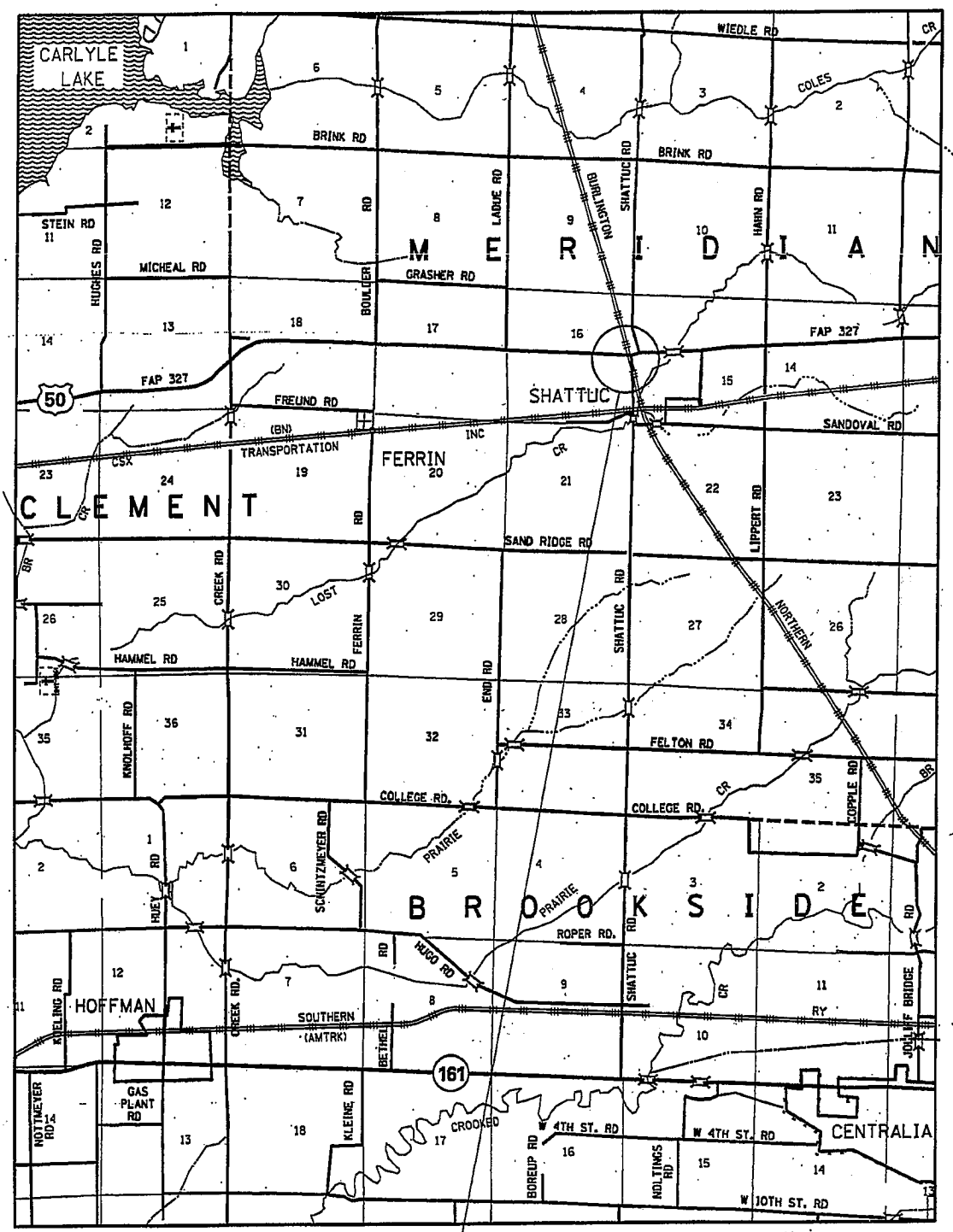
The approved pavement design for both widening and new construction is as follows:

11 inches of Full Depth HMA Pavement with 8 inch HMA Shoulders
12 inches Lime Modified Sub-grade

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

TOTAL SHEETS	SHEET NO.
**	

CONTRACT NO.: 76D53



PROJECT LOCATION

LOCATION MAP

FAS ROUTE 327 / FAS ROUTE 1784
SECTION 21-I-1, 27-I
CLINTON COUNTY

PLOT DATE: 6/15/2011

DATE
6/15/2011
a:\pw_work\pwidot\herbeughrd\d0160087\76d53-pvtdesign-description.dgn

11 : 50

- SPECIAL DESIGN → NO
- NEW CONSTRUCTION / RECONSTRUCTION → NO
- PAVEMENT WIDENING ≥ 6' → YES TYPICAL SHOWS 6' & VARIES (0'-18')
- SHORT SEGMENT (ASSUME < 4750 sq yds) → YES
- BENEFICIAL TO MATCH EXISTING PAVEMENT → NO EXISTING TYPICAL SHOWS 3" OF SURFACE ALREADY; COULD HAVE BEEN 2 RESURFACINGS.
- WIDENING WITH RESURFACING → YES
- NEED:
  1. MECHANISTIC DESIGN: FULL DEPTH HMA
  2. MODIFIED AASHTO DESIGN: FLEXIBLE
  3. COMPOSITE PAVEMENT DESIGN

→ PERFORM FIRST-COST ANALYSIS AND SELECT PAVEMENT TYPE AND DESIGN BASED ON LOWEST FIRST COST

⇒ MECHANISTIC DESIGN (FULL DEPTH) IS THE LOWEST BY $13,770

GIVEN:
- CLASS II ROAD

ADT (DESIGN YEAR TRAFFIC): 3900 (2010); 4000 (2013); 4900 (2023)

PV = 3124 (2010); 3204 (2013); 3925 (2033); 3564 (2023)
SU = 203 (2010); 208 (2013); 255 (2033); 231 (2023)
MU = 573 (2010); 588 (2013); 720 (2033); 654 (2023)

SUBGRADE SUPPORT RATING (SSR) = POOR
ILLINOIS BEARING RATIO (IBR) = 20
HMA MIXTURE TEMPERATURE = 79.2°F (FIG 54-5.c) ROUND TO 79°F

DETERMINE:

- MECHANISTIC DESIGN: FULL DEPTH $168,535 ⇒ 11 in FULL-DEPTH FLEXIBLE
  12 in Lime-Modified Subgrade
- MODIFIED AASHTO DESIGN: FLEXIBLE $154,805 ⇒ 2.5 in HMA Surface Course
  13.25 in HMA Binder Course
  4 in Aggregate Subbase
- COMPOSITE PAVEMENT DESIGN $132,355 ⇒ 2.5 in HMA Surface Course
  8.75 in PCC Base Course

⇒ PERFORM A FIRST-COST ECONOMIC ANALYSIS.

MECHANISTIC - FLEXIBLE

- DETERMINE TRAFFIC FACTORS - ACTUAL & MINIMUM

$TF_{F\,(ACTUAL)}$

$$TF_{F(A)} = 20\left[\frac{(0.15 \cdot 0.50 \cdot 3564) + (112.06 \cdot 0.50 \cdot 231) + (385.44 \cdot 0.50 \cdot 654)}{1 \times 10^6}\right] \quad \text{eq 54-5.2}$$

$TF_{F(A)} = 2.78$

$TF_{F\,(MINIMUM)}$

$$TF_{F(M)} = 20\left[\frac{(112.06 \cdot 0.50 \cdot 250) + (385.44 \cdot 0.50 \cdot 750)}{1 \times 10^6}\right] \quad \text{eq 54-5.2}$$

$TF_{F(M)} = 3.17$

USE $TF_{F(M)} = 3.17$

- DETERMINE DESIGN E_{HMA} FROM FIG 54-5.D AND ROUND TO NEAREST 10.

DESIGN E_{HMA} = 580 (FIG 54-5.D) ASSUME: USE PG 64-22, PG 70-22, OR PG 76-22

CLASS II EQUIVALENCY FACTORS (FLEX PVMTS)

PV: 0.0004 ⇒ 3564 × 0.0004 = 1.4256

ISU: 0.307 ⇒ 231 × 0.307 = 70.917

MU: 1.056 ⇒ 654 × 1.056 = 690.624

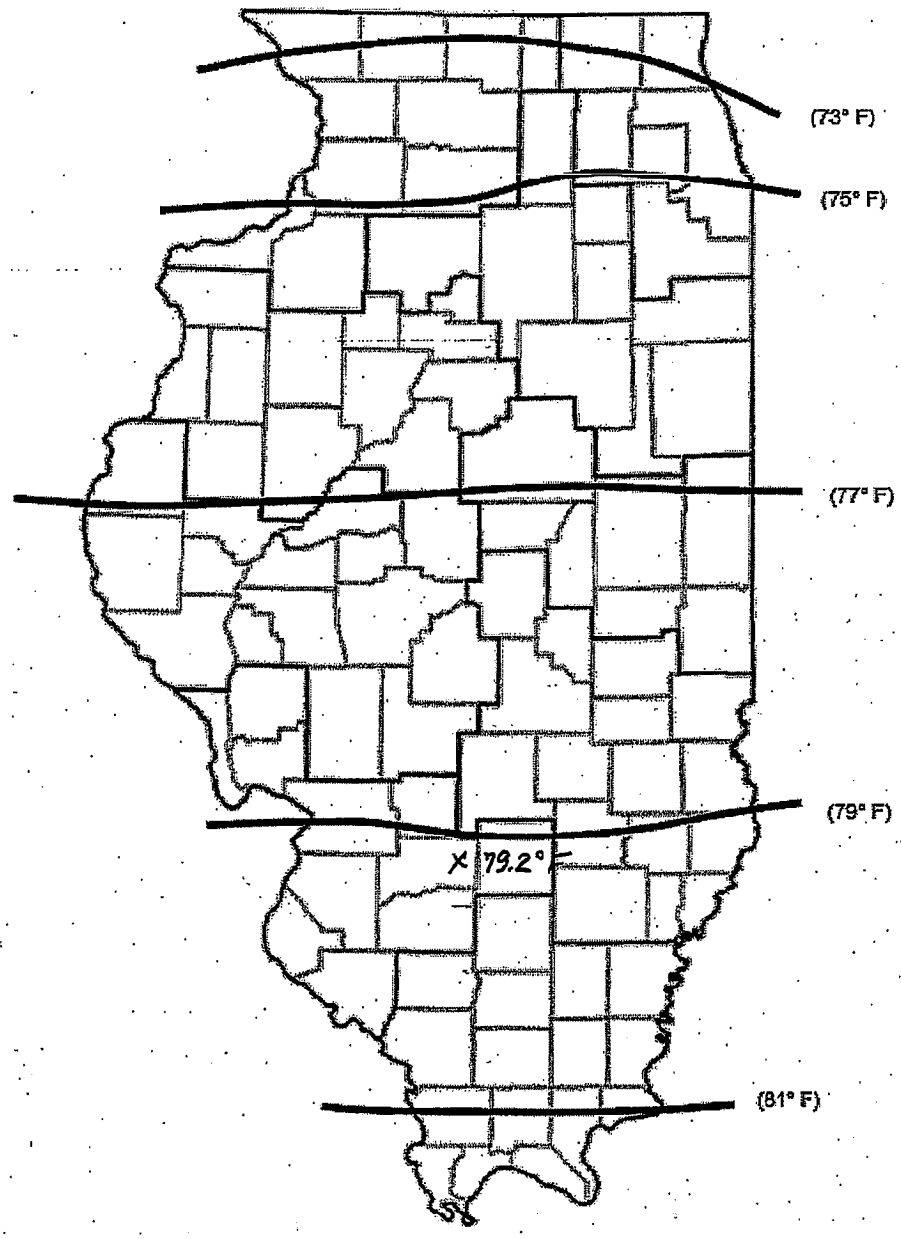
762.967

- DETERMINE THE DESIGN HMA STRAIN USING THE $TF_{F(M)}$ AND FIGURE 54-5.E.

DESIGN HMA STRAIN = 85

- USING THE DESIGN E_{HMA} AND THE DESIGN HMA STRAIN, DETERMINE THE FLEXIBLE THICKNESS FROM FIG 54-5.F FOR A POOR SUBGRADE AND ROUND UP TO THE NEAREST 0.25 in

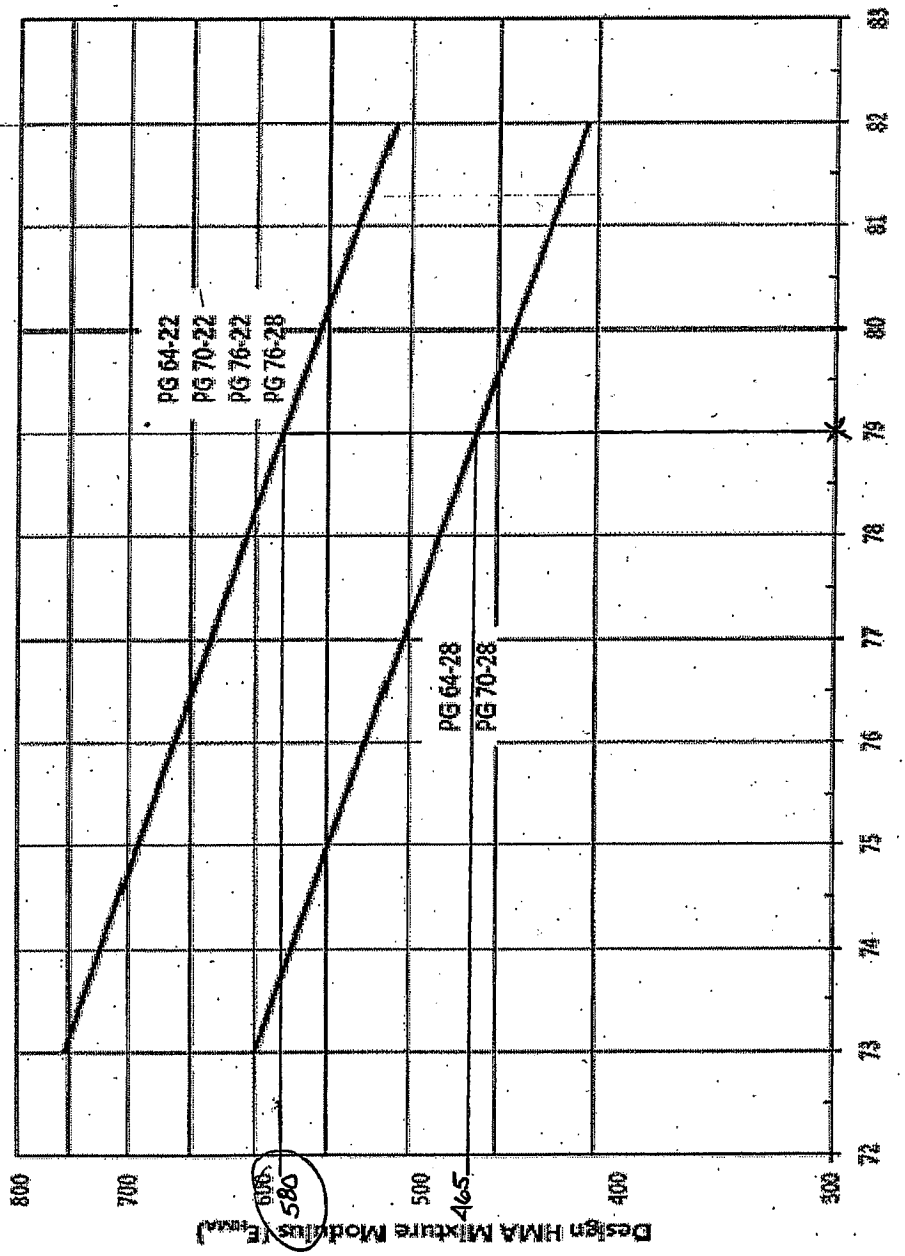
THICKNESS = 11 in ; which is less than 16.5" max pvmt thickness from fig 54-5.I



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

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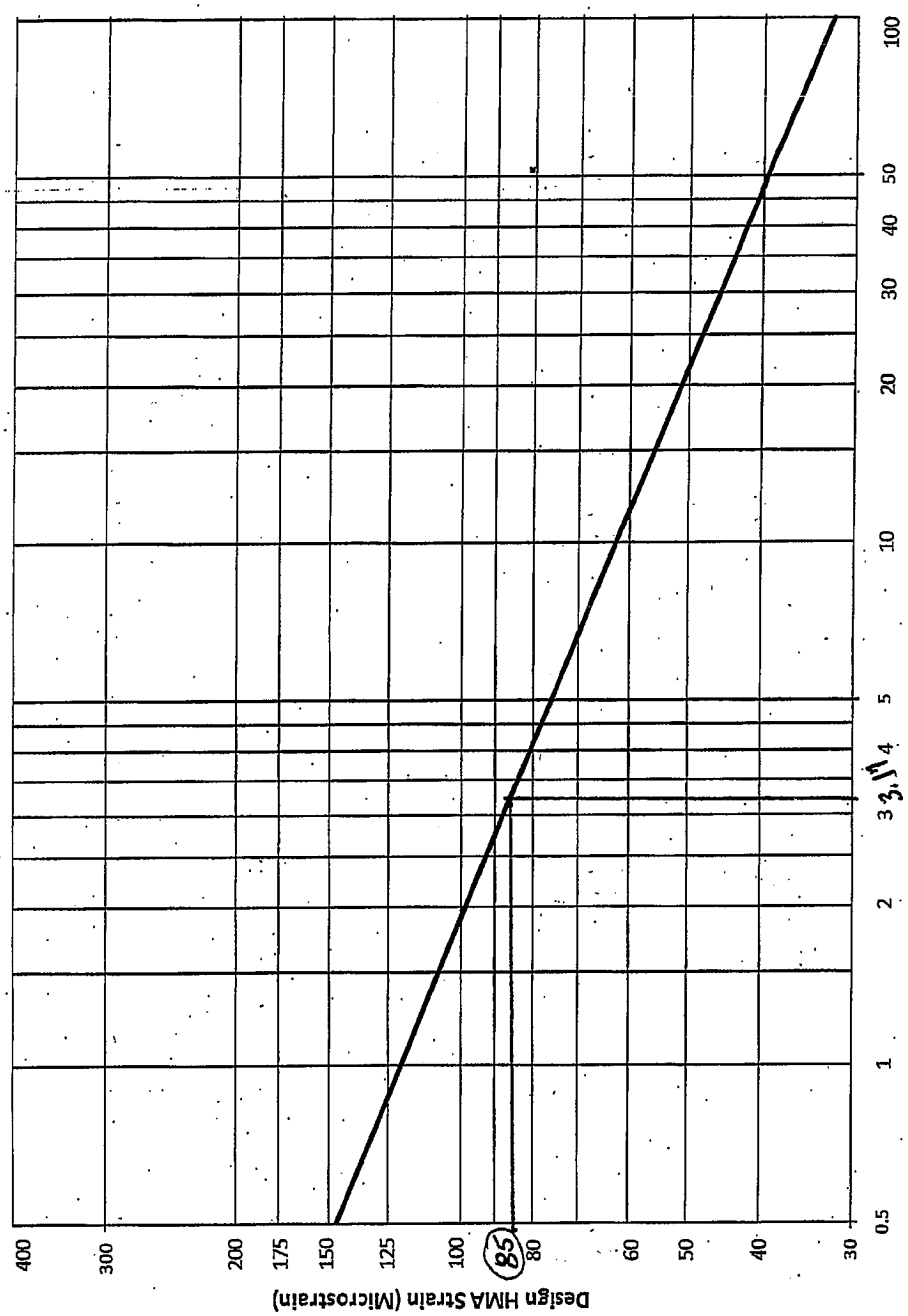
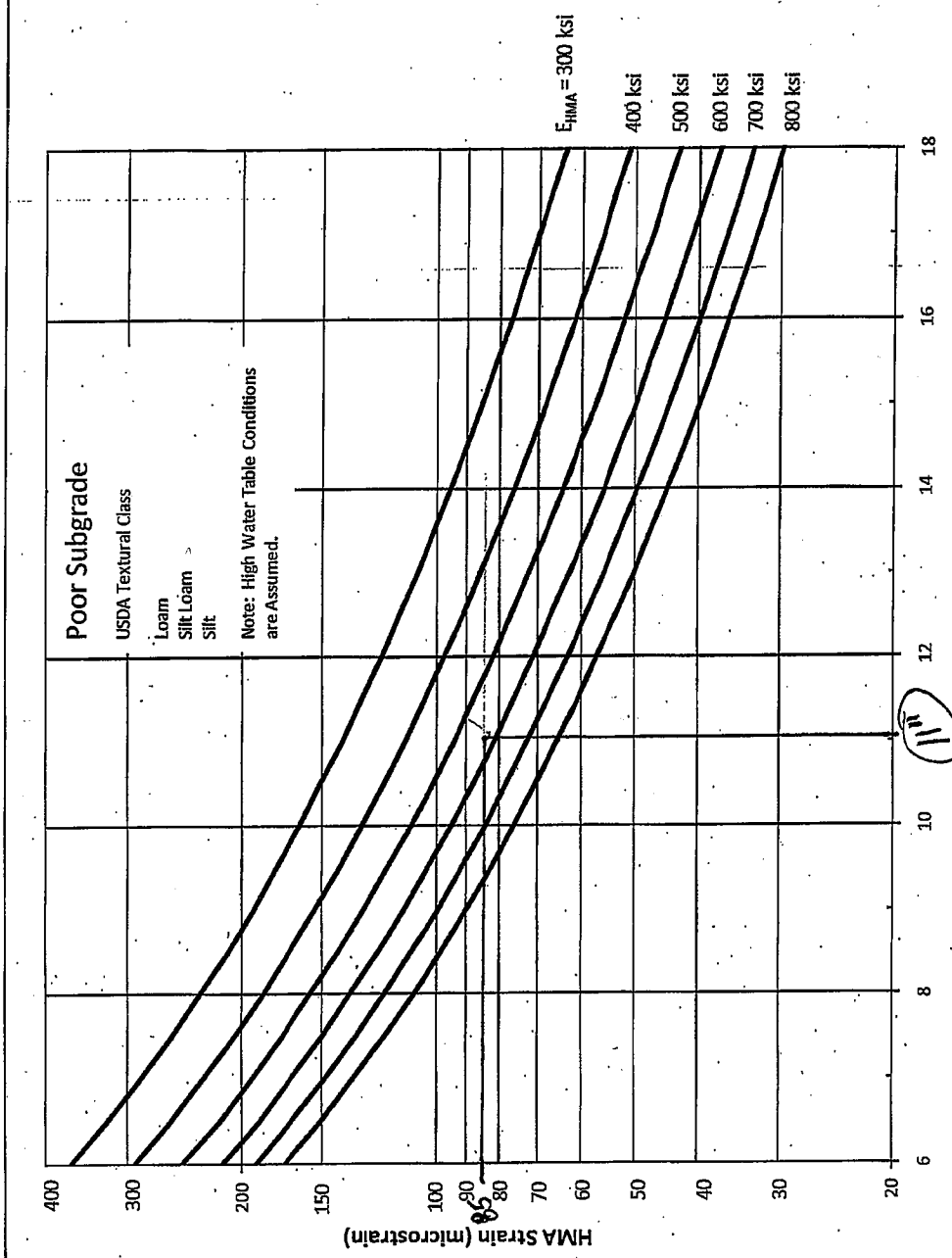


DESIGN HMA STRAIN
(Mechanistic Design: Flexible Pavement)

Figure 54-5.E



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

Figure 54-5.F

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MODIFIED AASHTO DESIGN

- $TF_{F(A)} = 2.78$ (determined from Mechanistic calculation)
- $SN_F = 5.38$; from fig 54-5.N ; which is greater than 4.0 from fig 54-5.S (Note 4) for two-lane State primary highways
- USING EQUATION 54-5.4, DETERMINE THE LAYER THICKNESS OF THE SURFACE COURSE, BASE COURSE, AND SUBBASE COURSE

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

FROM FIG 54-5.0

$a_1 = 0.40$ (HMA)
$a_2 = 0.30$ (Assumes HMA, Stabilized Granular Material 1,500 MS)
$a_3 = 0.11$ (Assumes Granular Material, Type B)
$D_1 = 2.5$ in (Policy resurfacing w/ widening)
$D_3 = 4$ in (Assumed)

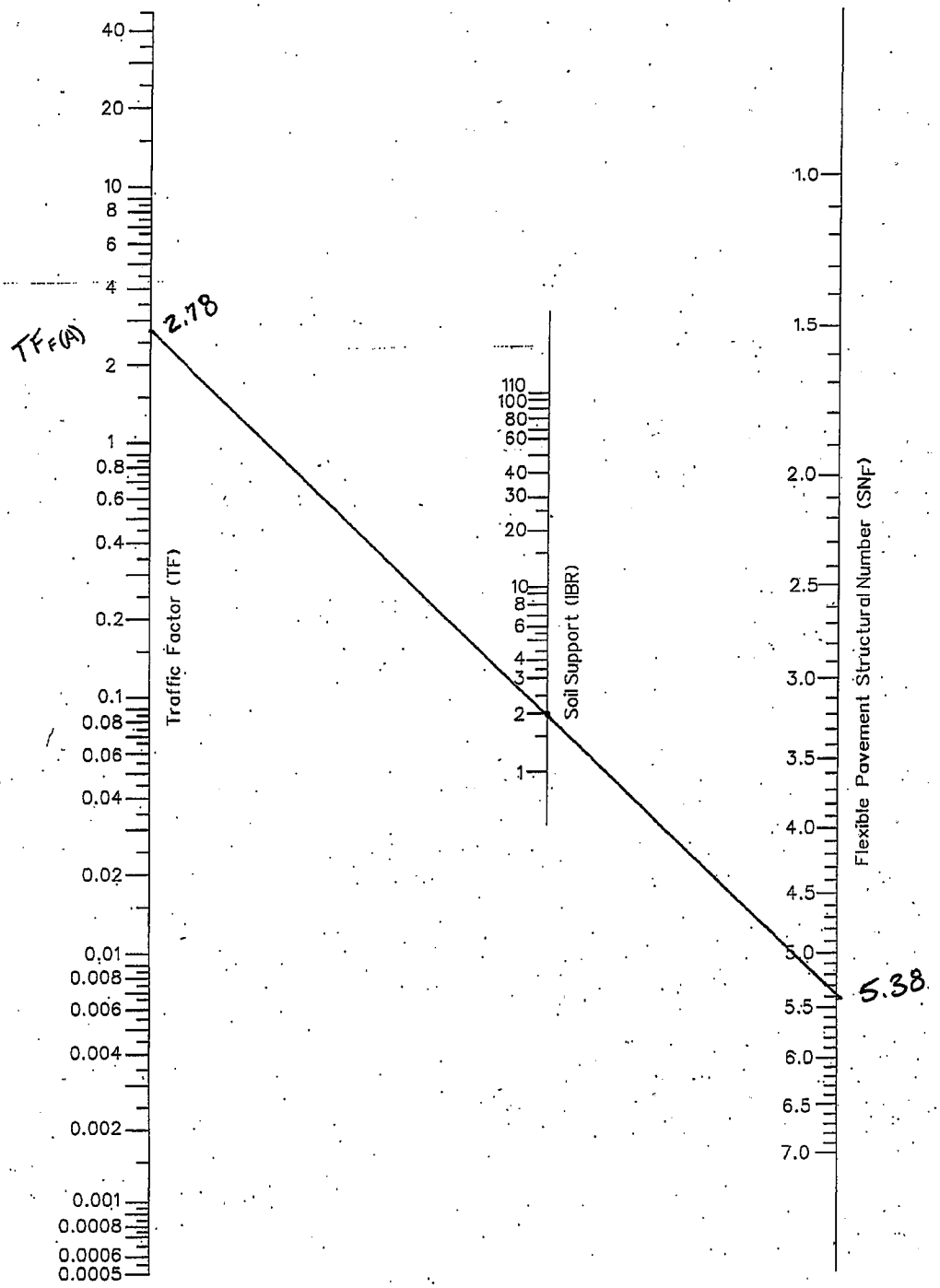
$$5.38 = (0.40)(2.5) + (0.30) D_2 + (0.11)(4)$$

$D_2 = 13.133$ in use 13.25 in

Check:

$2.5 \times 0.4 = 1.00$
$13.25 \times 0.3 = 3.975$
$4 \times 0.11 = 0.44$
$5.415 > 5.38$ ✓OK

FROM FIG 54-5.S, minimum $D_2 = 10$ in ✓OK



FLEXIBLE PAVEMENT DESIGN NOMOGRAPH
(Modified AASHTO Design: Class II, III, and IV Facilities)

Figure 54-5.N

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IMPOSITE PAVEMENT DESIGN

- $TF_{R(A)} = 20\left[\frac{(0.15 \cdot 0.50 \cdot 3564) + (135.78 \cdot 0.5 \cdot 231) + (567.21 \cdot 0.5 \cdot 654)}{1 \times 10^6}\right]$ EQ 54-4.2

$TF_{R(A)} = 4.03$

- FROM FIG 54-6.B, DETERMINE THE COMPOSITE PAVEMENT STRUCTURAL NUMBER (SN_C)

$SN_C = 3.83$

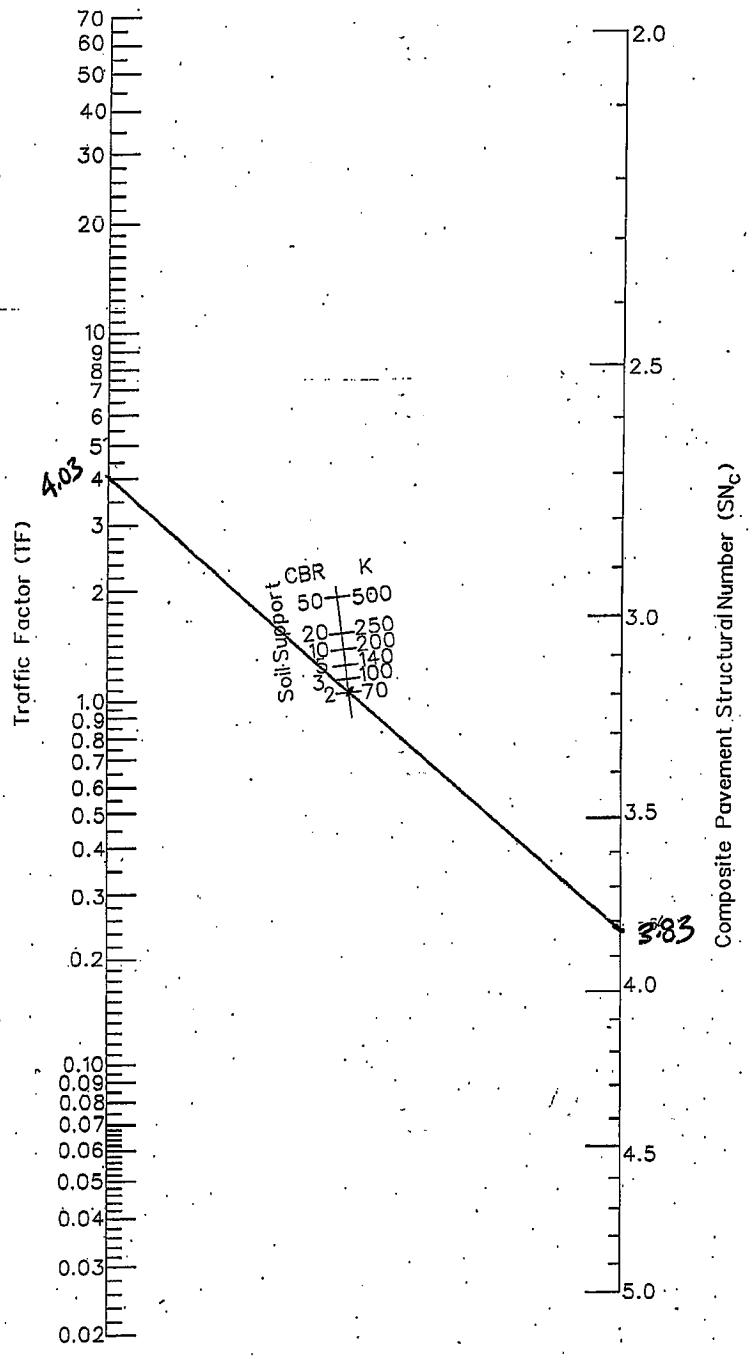
Using Eq. 54-6.3 ; Determine the layer thickness

$SN_C = 0.40 D_S + 0.33 D_B$

where: SN_C = composite pavement structural number
D_S = thickness of HMA policy overlay (inches)
D_B = thickness of new PCC BASE course (inches)

$SN_C = 0.40(2.5) + 0.33 D_B$

$D_B = 8.69$ in use 8.75 in > 7 in min thickness from FIG 54-6.D



COMPOSITE PAVEMENT DESIGN NOMOGRAPH
(Class II, III, and IV Facilities)

Figure 54-6.B

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Illinois Department of Transportation

Route US 50 / SHATTUC RD Sheet _____ of _____
Section 27-I-1, 27-I Computed by RDH Date 5/9/11
County CLINTON Checked by _____ Date _____
Structure No. NA

US 50

NEW PAVEMENT AREA (see attached sheet) = 1630 SQYD

EXISTING PAVEMENT AREA

STA. 698+44.57 TO STA. 711+12.13 = 1267.16' x 24' = 30,411.84 ♯
= 3,379.1 SQYD

HMA SHOULDERS (EAST TO WEST)

LT: STA. 698+41.62 TO STA 703+60 = 518.38' x 3' = 1555.14 ♯
LT: STA. 703+60 TO STA 703+75 = 15' x $\left(\frac{4+3}{2}\right)$' = 52.5 ♯
LT: STA 703+75 TO STA 704+44 = 69' x 4' = 276 ♯
LT: STA 705+63.88 TO STA 710+62.29 = 498.41' x 4' = 1,993.64 ♯
LT: STA 710+62.29 TO STA 711+12.08 = 49.79' x $\left(\frac{4+0}{2}\right)$ = 99.58 ♯
3976.86 ♯
= 441.9 SQYD

RT STA 698+61.50 TO STA 699+07.21 = 45.71' x 3' = 137.13 ♯
RT: STA 699+07.21 TO STA 710+62.18 = 1154.97' x 3' = 3,464.91 ♯
RT STA 710+62.18 TO STA 711+12.17 = 49.99' x $\left(\frac{3+0}{2}\right)$ = 74.99 ♯
3677.03 ♯
= 408.6 SQYD

LT & RT: (441.9 + 408.6) SQYD = 850.5 SQYD

SURFACE (OVER EXISTING & NEW PAVEMENT) (2.5")

1630 SQYD + 3379.1 SQYD = 1967.1 SQYD
(1967.1 SQYD)(0.056 TONS/SQYD/INCH)(2.5 INCH) = 275.4 TONS
≈ 276 TONS

SURFACE (OVER EXISTING PAVEMENT)

3,379.1 SQYD (0.056 TONS/SQYD/INCH)(2.5 INCH) = 473.07 TONS
≈ 473 TONS

MODIFIED AASHTO (FLEX)

BINDER (NEW PAVEMENT)

(1630 SQYD)(0.056 TONS/SQYD/INCH)(13.25 INCH) = 1209.46 TONS
≈ 1210 TONS

SHATTUC RD (COUNTY ROAD)

- Special Design → NO
- NEW CONSTRUCTION / RECONSTRUCTION → YES
- ARE SUPPLEMENTAL DESIGNS VIABLE OPTIONS? → NO
- CONSIDER ONLY NEW PAVEMENT DESIGNS
  - NEED:
    1. MECHANISTIC DESIGN JPCP
    2. MECHANISTIC DESIGN FULL-DEPTH HMA

→ PERFORM LIFE-CYCLE COST ANALYSIS

→ LIFE CYCLE COST DIFFERENCE > 10% →

$573,425 - $500,371 = $73,054

$73,054 / $500,371 = 0.146 = 14.6% which is less than 10%

Therefore, the lowest LIFE-CYCLE COST IS SELECTED (HMA FD)

VEN: CLASS II ROAD

ADT (DESIGN YEAR TRAFFIC): 2550 (2010); 2650 (2013); 3250 (2033)

PV = = 2448 (2010); 2544 (2013); 2832 (2023); 3120 (2033)

SU (2.4%) = 61 (2010); 64 (2013); 71 (2023); 78 (2033)

MU (1.6%) = 41 (2010); 42 (2013); 47 (2023); 52 (2033)

SUBGRADE SUPPORT RATING (SSR): POOR

ILLINOIS BEARING RATIO (IBR): 2.0

HMA MIXTURE TEMPERATURE = 79.2°F (FIG 54-5.C) ROUND TO 79°F

DETERMINE;

- MECHANISTIC DESIGN JPCP: 9.00 in w/ tied PCC shoulders

- MECHANISTIC DESIGN FULL-DEPTH HMA: 11 in FULL DEPTH HMA PVMT
  12 in LIME-MODIFIED SUBGRADE

→ PERFORM A 45-year LIFE-CYCLE COST ANALYSIS:

HMA F.D.: $500,371 ($58,751 TOTAL COST PER MILE)

PCC : $573,425 ($67,181 TOTAL COST PER MILE)

MECHANISTIC DESIGN (RIGID)

- DETERMINE TRAFFIC FACTORS - ACTUAL & MINIMUM

$$TF_{R(ACTUAL)} = 20\left[\frac{(0.15 \cdot 0.5 \cdot 2832) + (135.78 \cdot 0.5 \cdot 71) + (567.21 \cdot 0.5 \cdot 47)}{1 \times 10^6}\right] \quad \text{eq } 54\text{-}4.2$$

$$TF_{R(A)} = 0.37$$

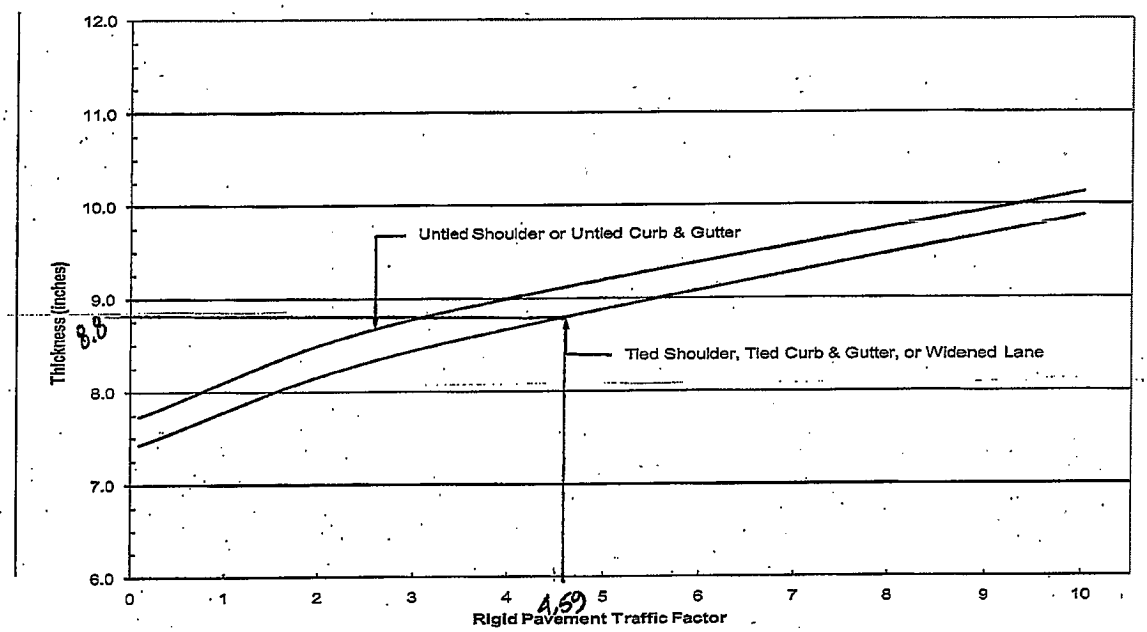
$$TF_{R(MIN)} = 20\left[\frac{(135.78 \cdot 0.5 \cdot 250) + (567.21 \cdot 0.5 \cdot 750)}{1 \times 10^6}\right]$$

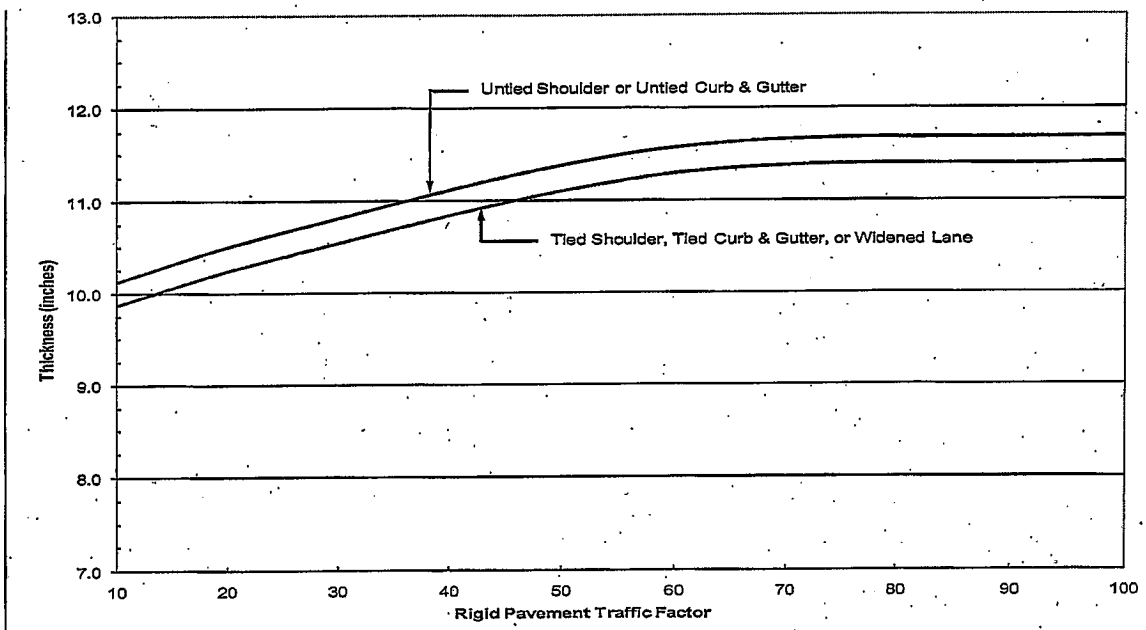
$$TF_{R(M)} = 4.59$$

USE $TF_{R(M)} = 4.59$

- USING THE $TF_{R(M)}$ AND FIG. 54-4.E FOR A POOR SUBGRADE, DETERMINE THE RIGID THICKNESS. ROUND UP TO THE NEAREST 0.25 in.

THICKNESS = 9.00 in for tied shoulder. (8.8 in rounded up to 9.0 in)





Note: Use of untied shoulder design requires BDE approval.

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

Figure 54-4.E

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MECHANISTIC DESIGN (FLEXIBLE)

- DETERMINE TRAFFIC FACTORS – ACTUAL & MINIMUM

$$TF_{F(A)} = 20\left[\frac{(0.15 \cdot 0.5 \cdot 2832) + (112.06 \cdot 0.5 \cdot 71) + (385.44 \cdot 0.5 \cdot 47)}{/ \times 10^6}\right] \quad \text{eq 54-5.2}$$

$TF_{F(A)} = 0.26$

$$TF_{F(M)} = 20\left[(112.06 \cdot 0.5 \cdot 250) + (385.44 \cdot 0.5 \cdot 750)\right] \quad \text{eq 54-5.2}$$

$TF_{F(M)} = 3.17$

USE $TF_{F(M)} = 3.17$

- DETERMINE DESIGN E_{HMA} FROM FIG 54-5.D. AND ROUND TO NEAREST 10.

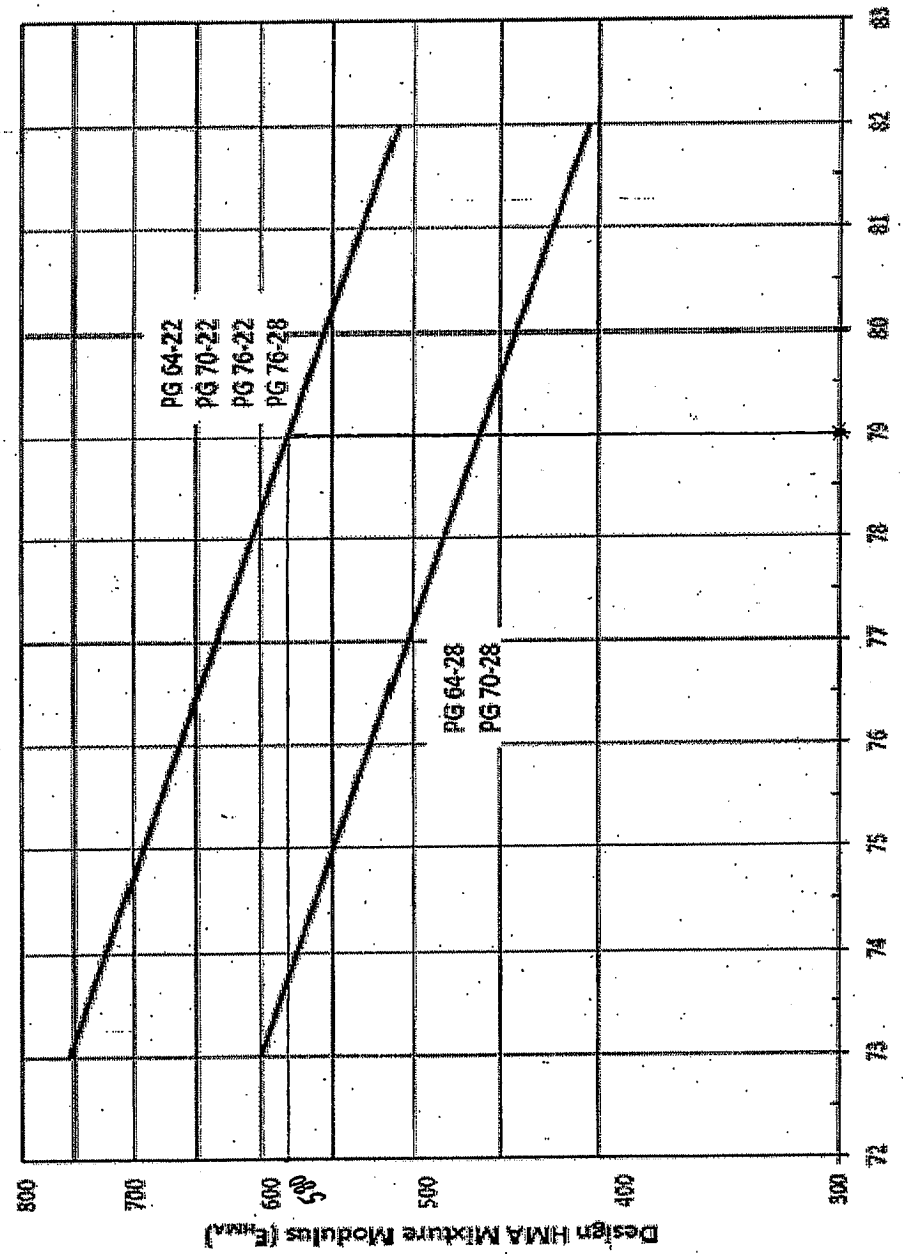
DESIGN $E_{HMA} = 580$ (FIG 54-5.D) ASSUME: USE PG 64-22, PG 70-22, OR PG 76-22

- DETERMINE THE DESIGN HMA STRAIN USING THE $TF_{F(M)}$ AND FIG. 54-5.E

DESIGN HMA STRAIN = 86

- USING THE DESIGN E_{HMA} AND THE DESIGN HMA STRAIN, DETERMINE THE FLEXIBLE THICKNESS FROM FIG 54-5.F FOR A POOR SUBGRADE AND ROUND UP TO THE NEAREST 0.25 in.

THICKNESS = 11 in.; which is less than 16.5" max pvmt. thickness from ~~fig~~ 54-5.I



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

Figure 54-5.D

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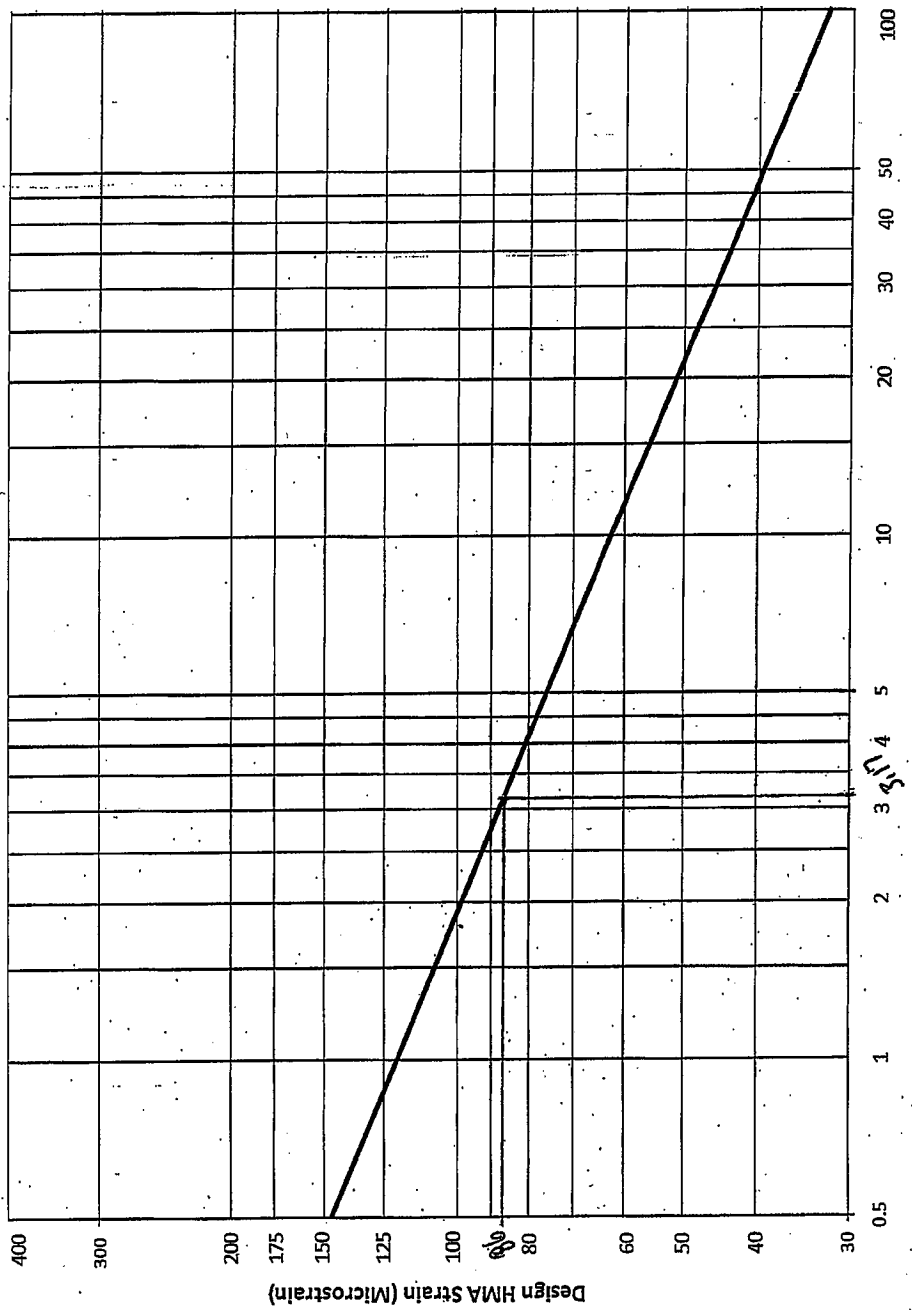
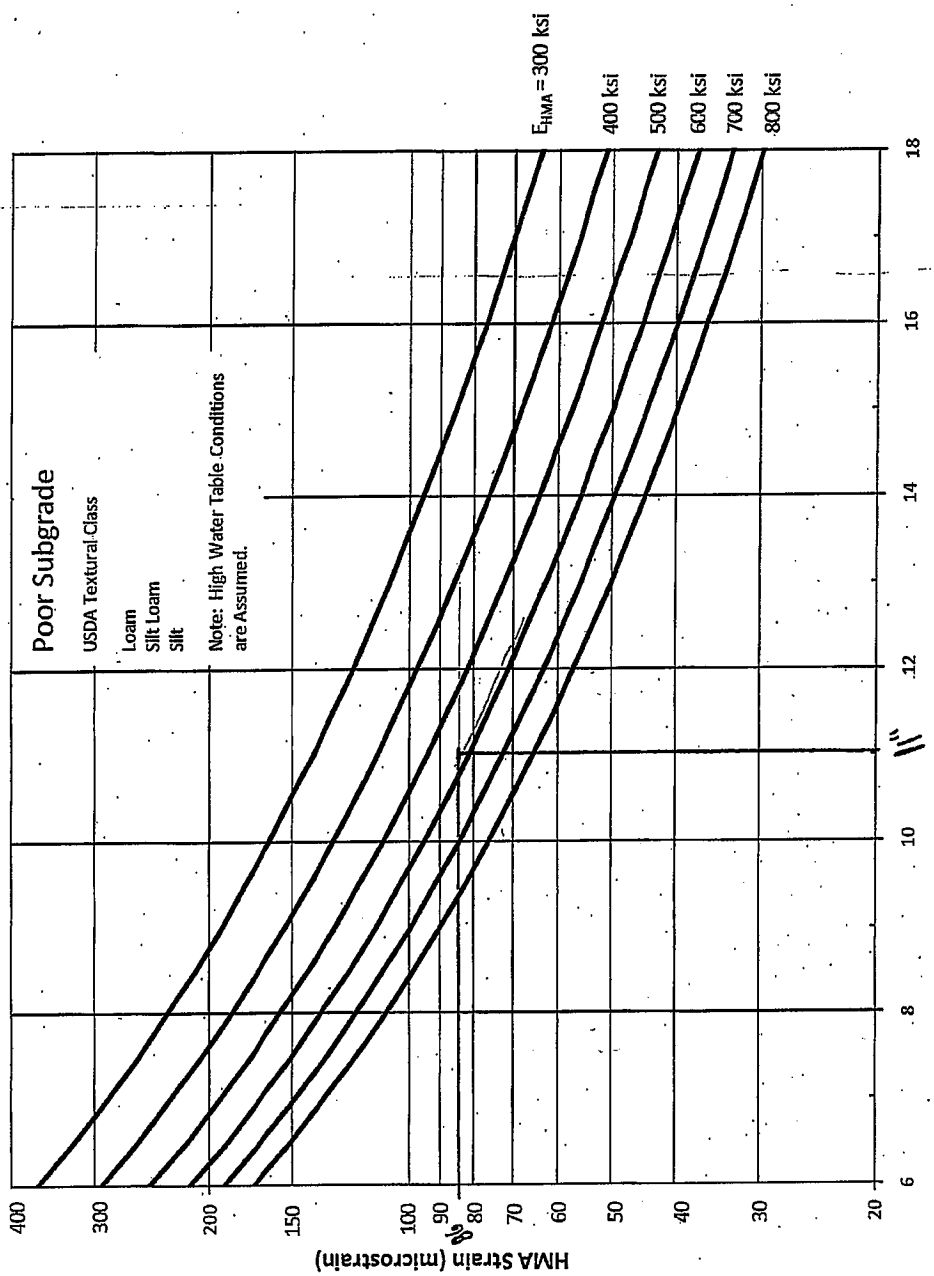


DESIGN HMA STRAIN
(Mechanistic Design: Flexible Pavement)

Figure 54-5.E



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

Figure 54-5.F

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Illinois Department of Transportation

Route US 50/ SHATTUC RD Sheet _____ of _____
Section 21-I-1, 27-I Computed by RDH Date _____
County CLINTON Checked by _____ Date _____
Structure No. NA

SHATTUC RD

- SIDEROAD TO OLD SHATTUC RD @ STA. 89+15
  STA 10+12 to STA 11+25.5 = 113.5' x 24 (4 lanes) ≈ 3195 #
- STA 81+50 to STA 100+28.93 = 1878.93' x 24' ≈ 45,095 #
- STA 100+28.93 + STA. 101+29.54 = (measured by CADD) ≈ 4,255 #

52,545 #

52,545 # (1 SQ YD / 9 SQ FT) = 5838.3 SQ YD

SHOULDERS: (NEW ROAD & NOT A HEAVILY TRAVELED RD BY TRUCKS ∴ USE MIN THICKNESS OF 8")

STA 81+50 to 101+29.53 = 1979.53' x 2 sides = 3959.06'

3959.06' x 4' WIDTH = 15836.24 # = 1759.6 SQ YD

LIME MODIFIED SOIL (12")

- PAVEMENT & SHOULDERS

5838.3 + 1759.6 = 7597.9 sq yd ≈ 7600 SQ YDS

(7600 sq yd)(1 ft)(1 yd / 3 ft)(1.4445 ton / cu yd) = 3659.4 tons ≈ 3660 tons

BBS 2049 (Rev. 4/00)

PLAIN JOINTED PCC PAVEMENT

FILENAME-	US 50 @ SHADDUC RD	11-Aug-11	
ROUTE-	FAP 327 / FAS 1784	11:26 AM	
SECTION-	21-I-1, 27-I		
COUNTY-	CLAINTON		
LOCATION-	INTERSECTION		
DATE-	08/11/11		
PROJECT LENGTH (FT)	1979.38 =	0.37	MILES
AVERAGE LANE WIDTH (FT)	12		
NUMBER OF LANES	2		
# OF EDGES	2		
INSIDE SHLDER WIDTH (FT)	4		
OUTSIDE SHLDER WIDTH (FT)	4		
# OF CENTERLINES	1		
RIGID THICKNESS-	9		
TRAFFIC FACTORS	MINIMUM	ACTUAL	
RIGID-	4.59	0.37	
TRAFFIC			
PV-	0	2832	
SU-	150	71	
MU-	450	47	

INITIAL COSTS

ITEM	QUANTITY	UNIT PRICE	COST
PAVEMENT (SQ YDS)	5,278	$60.00	316,680
SUB BASE (SQ YDS)	5,938	$9.50	56,411
SHOULDERS (SQ YDS)	1,759	$65.00	114,335
SUBBASE GRAN MATL TY C (TONS	241	$0.00	0
SHOULDER SEAL (LN FT)	3,959	$1.00	3,959
			0
			0

CONSTRUCTION INITIAL COST	$491,385
CONSTRUCTION ANNUAL COST	$56,704
TOTAL LIFE CYCLE COST-	$573,425
ANNUAL COST PER MILE-	$67,181

MAINTENANCE COSTS:

ITEM	UNIT COST
SHOULDER JOINT ROUTE AND SEAL (FT)	$0.99
CENTERLINE JOINT ROUTE AND SEAL (FT)	$0.99
PAVEMENT PATCHING (SQ YDS)	$150.00
SHOULDER PATCHING (SQ YDS)	$150.00
HOLES DRILLED (EACH)	$21.00
GROUT SOLIDS (CU FT)	$20.00
PAVEMENT GRINDING (SQ YDS)	$5.00
POLICY HMA OVERLAY - PAV'T (SQ YDS) - 2.25" THICKNESS	$10.00
POLICY HMA OVERLAY - SHLDR (SQ YDS) - 2.25" THICKNESS	$9.00
PARTIAL DEPTH PATCHING - REM & REPLACE (SQ YDS) - 2.5" THICK	$45.00

MAINTENANCE COSTS	ITEM	QUANTITY	UNIT PRICE	COST	PW
YEAR 10					
	FD PATCHING 0.1% (SQ YD)	5	$150.00	750	
	SHLDER JT 100.0% (LIN FT)	3,959	$0.99	3,919	
	CENTERLINE JT 100.0% (LIN FT)	1,979	$0.99	1,959	
	FD SHOULDER PATCH 1.0% (SQ YD)	18	$150.00	2,700	
				9,328	6,941
YEAR 15					
	FD PATCHING 0.2% (SQ YD)	11	$150.00	1,650	
				1,650	1,059
YEAR 20					
	FD PATCHING 2.0% (SQ YD)	106	$150.00	15,900	
	FD SHOULDER PATCH 0.5% (SQ YD)	9	$150.00	1,350	
	SHLDER JT 100.0% (LIN FT)	3,959	$0.99	3,919	
	CENTERLINE JT 100.0% (LIN FT)	1,979	$0.99	1,959	
				23,128	12,806
YEAR 25					
	FD SHOULDER PATCH 1.0% (SQ YD)	18	$150.00	2,700	
	FD PATCHING 3.0% (SQ YD)	158	$150.00	23,700	
				26,400	12,609
YEAR 30					
	FD PATCHING 4.0% (SQ YD)	211	$150.00	31,650	
	SHOULDER PATCH 1.5% (SQ YD)	26	$150.00	3,900	
	POLICY HMA OVERLAY - PAV'T (SQ YD) - 2.25"	5,278	$10.00	52,780	
	POLICY HMA OVERLAY - SHLDR (SQ YD) - 2.25"	1,759	$9.00	15,831	
				104,161	42,914
YEAR 35					
	RANDOM CRACK SEAL 50.0% (LIN F	49	$0.99	49	
	CENTERLINE JT 100.0% (LIN FT)	1,979	$0.99	1,959	
	SHLDER JT 100.0% (LIN FT)	3,959	$0.99	3,919	
	REFLECTIVE TRANS CRACK SEAL 40 % (LIN FT)	190	$0.99	188	
	PD PATCHING 0.1% (SQ YD)	5	$45.00	225	
				6,340	2,253
YEAR 40					
	FD PATCHING 0.5% (SQ YD)	26	150.00	3,900	
	PD PATCHING 0.5% (SQ YD)	26	$45.00	1,170	
	REFLECTIVE TRANS CRACK SEAL 60 % (LIN FT)	285	$0.99	282	
	RANDOM CRACK SEAL 50.0% (LIN F	49	$0.99	49	
	CENTERLINE JT 100.0% (LIN FT)	1,979	$0.99	1,959	
	SHLDER JT 100.0% (LIN FT)	3,959	$0.99	3,919	
				11,279	3,458

MAINTANENCE LIFE CYCLE COST	$82,040
MAINTANENCE ANNUAL COST	$9,467

FULL-DEPTH ...BLE

TRAFFIC FACTOR LESS THAN 15.0 (RURAL)
TRAFFIC FACTOR LESS THAN 10.0 (URBAN)

ROUTE-	FAP 327 / FAS 1784	11-Aug-11
SECTION-	21-I-1, 27-I	11:26 AM
COUNTY-	CLAINTON	
LOCATION-	INTERSECTION	

PROJECT LENGTH (FT)	1979.38	
AVERAGE LANE WIDTH (FT)	12	
NUMBER OF LANES	2	
# OF EDGES	2	
INSIDE SHLDER WIDTH (FT)	4	
OUTSIDE SHLDER WIDTH (FT)	4	
# OF CENTERLINES	1	
PROJECT TYPE	1	1=RURAL, 2=URBAN
PAVING WIDTH	1	1=SINGLE LANE, 2=DUAL LANE
FLEXIBLE THICKNESS-	11	

TRAFFIC FACTORS	MINIMUM	ACTUAL
FLEXIBLE	3.17	0.26
TRAFFIC		
PV-	0	2832
SU-	150	71
MU-	450	47
OVERLAY THICKNESS	2	

INITIAL COSTS

ITEM	QUANTITY		UNIT PRICE	COST
SURFACE (SQ YDS)		5,278	$9.45	49,877
(TONS)	739 tons @ 2.25"		$0.00	
BINDER (SQ YDS)		5,352	$44.55	238,432
(TONS)	2623 tons @ 8.75"		$0.00	
SHOULDERS (SQ YDS) - 8"		1,759	$40.00	70,360
SUBBASE GRAN MATL TY C (TONS		171	$0.00	0
			$0.00	0
			$0.00	0
				0
CONSTRUCTION INITIAL COST-				$358,669
CONSTRUCTION ANNUAL COST-				$41,389
TOTAL LIFE CYCLE COST-				$500,371
ANNUAL COST PER MILE -				$58,751

MAINTENANCE COSTS:

ITEM	UNIT COST
SHOULDER JOINT ROUTE AND SEAL (FT)	$1.00
CENTERLINE JOINT ROUTE AND SEAL (FT)	$1.00
THERMAL CRACKS ROUTE AND SEAL (FT)	$1.00
RANDOM CRACKS ROUTE AND SEAL (FT)	$1.00
PAVEMENT PATCHING (SQ YDS)	$150.00
SHOULDER PATCHING (SQ YDS)	$120.00
OVERLAY (TON)	$90.00
MILLING (SQ YDS)	$2.25
PARTIAL DEPTH PATCHING - REM & REPLACE (SQ YDS) - 2.0" THICK	$40.00

MATERIAL TYPE/PERCENTAGE ASPHALT 14.3%

FULL-DEPTH FLEXIBLE PAVEMENT
MAINTENANCE COSTS

* FOR SINGLE LANE PAVING
** FOR FULL WIDTH PAVING
*** FOR BOTH SINGLE LANE & FULL WIDTH PAVING

	ITEM		QUANTITY	UNIT PRICE	COST	PW
YEAR 5						
	THERMAL CRACK	50.0% (LIN FT)	317	$1.00	317	
	SHLDER JT	100.0% (LIN FT)	3,959	$1.00	3,959	
	* CENTERLINE JT	100.0% (LIN FT)	1,979	$1.00	1,979	
	PD PATCHING	0.1% (SQ YD)	5	$40.00	200	
					6,455	5,568
YEAR 10						
	PD PATCHING	0.5% (SQ YD)	26	$40.00	1,040	
	RANDOM THERMAL CRACK	50.0% (LIN	317	$1.00	317	
	SHLDER JT	100.0% (LIN FT)	3,959	$1.00	3,959	
	CENTERLINE JT	100.0% (LIN FT)	1,979	$1.00	1,979	
					7,295	5,428
YEAR 15						
	MILLING - PAVT & SHOULDER (SQ YD) -		7,037	$2.25	15,833	
	HMA OVERLAY - PAVT & SHLDR (TONS)		788	$90.00	70,920	
	PD PATCHING	1.0% (SQ YD)	53	$40.00	2,120	
					88,873	57,048
YEAR 20						
	SHLDER JT	100.0 %(LIN FT)	3,959	$1.00	3,959	
	* CENTERLINE JT	100.0% (LIN FT)	1,979	$1.00	1,979	
	THERMAL CRACK	50.0% (LIN FT)	633	$1.00	633	
	PD PATCHING	1.0% (SQ YD)	5	$40.00	200	
					6,771	3,614
YEAR 25						
	SHLDER JT	100.0 %(LIN FT)	3,959	$1.00	3,959	
	CENTERLINE JT	100.0% (LIN FT)	1,979	$1.00	1,979	
	THERMAL CRACK	50.0% (LIN FT)	633	$1.00	633	
	PD PATCHING	0.5% (SQ YD)	26	$40.00	1,040	
					3,652	1,744
YEAR 30						
	MILLING - PAVT & SHOULDER (SQ YD) -		7,037	$2.25	15,833	
	PD PATCHING	2.0% (SQ YD)	106	$40.00	4,240	
	SHLDER PATCH	1.0% (SQ YD)	18	$120.00	2,160	
	HMA OVERLAY - PAVT & SHLDR (TONS)		788	$90.00	70,920	
					93,153	38,379
YEAR 35						
	CENTERLINE JT	100.0% (LIN FT)	1,979	$1.00	1,979	
	SHLDER JT	100.0 %(LIN FT)	3,959	$1.00	3,959	
	THERMAL CRACK	50.0% (LIN FT)	633	$1.00	633	
	PD PATCHING	0.1% (SQ YD)	5	$40.00	200	
					6,771	2,406
YEAR 40						
	CENTERLINE JT	100.0% (LIN FT)	1,979	$40.00	79,160	
	SHLDER JT	100.0 %(LIN FT)	3,959	$2.25	8,908	
	THERMAL CRACK	50.0% (LIN FT)	633	$1.00	633	
	PD PATCHING	0.5% (SQ YD)	26	$40.00	1,040	
					89,741	27,515

MAINTANENC LIFE CYCLE COSTS	$141,702
MAINTANENC ANNUAL COST PER MILE	$16,352