



Illinois Department of Transportation

To: Joseph E. Crowe Attn: District Four
From: Scott E. Stitt *Scott E. Stitt*
Subject: Pavement Design
Date: November 2, 2011

FAU Route 6768 (VFW Road)
Section 10-00166-02-PV
Tazewell County
From IL 29 to IL 9 (Court Street) in Pekin

We have reviewed the pavement selection for the above captioned section, which was submitted by email dated September 1, 2011. This roadway will be jurisdictionally transferred to District 4 after completion. Revisions were sent by email on September 22, 2011. Based on revised life cycle costs, the rigid option was less expensive than the HMA design.

The approved pavement design is as follows:

VFW Road from IL 29 to IL 9 (Court Street)

9 inches of rigid pavement with tied shoulders
4 inches of stabilized sub-base

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

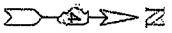
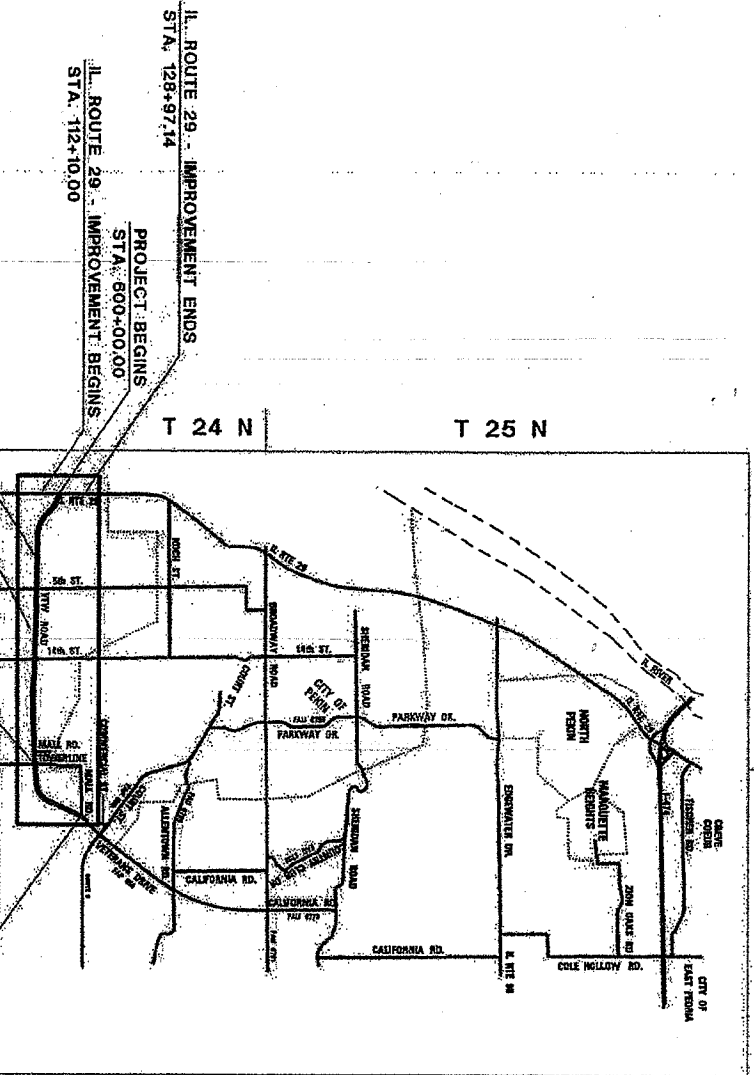
VFW ROAD (FAU 6768)

CITY OF PEKIN

SECTION 10-00166-02-PV

R 5 W

R 4 W



TOWERLINE ROAD - IMPROVEMENT BEGINS
 STA. 109+61.77
 TOWERLINE ROAD - IMPROVEMENT ENDS
 STA. 113+69.00

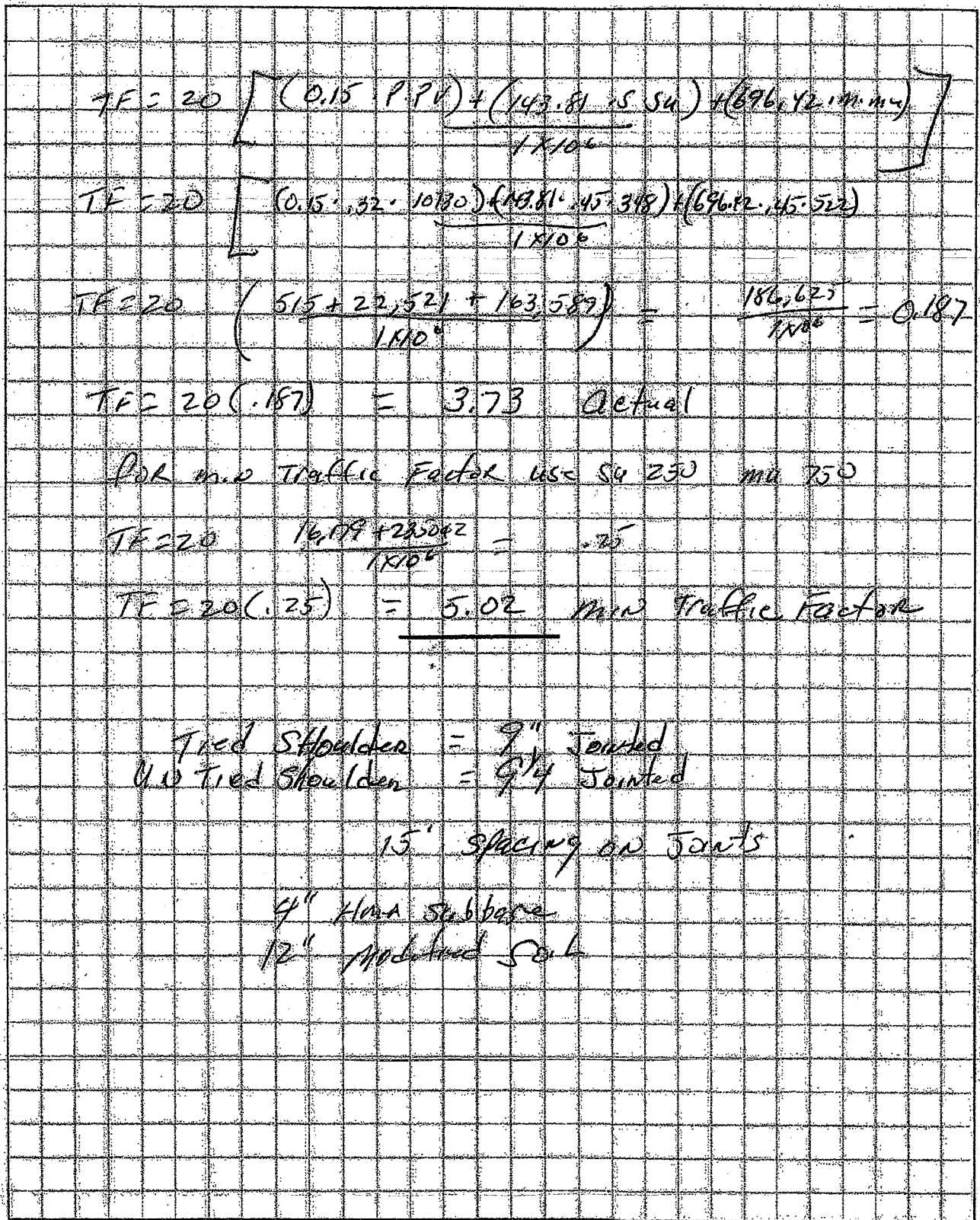
14th STREET - IMPROVEMENT BEGINS
 STA. 62+93.00
 14th STREET - IMPROVEMENT ENDS
 STA. 77+45.50
 5th STREET - IMPROVEMENT BEGINS
 STA. 98+00.00
 5th STREET - IMPROVEMENT ENDS
 STA. 101+50.00

RAILROAD OMISSION
 STA. 630+84.59 - 631+01.09
 STRUCTURE NO. 090-5021
 STA. 685+40.91
 STA. EQUATION: 764+89.25 BACK
 STA. 12+11.95 AHEAD

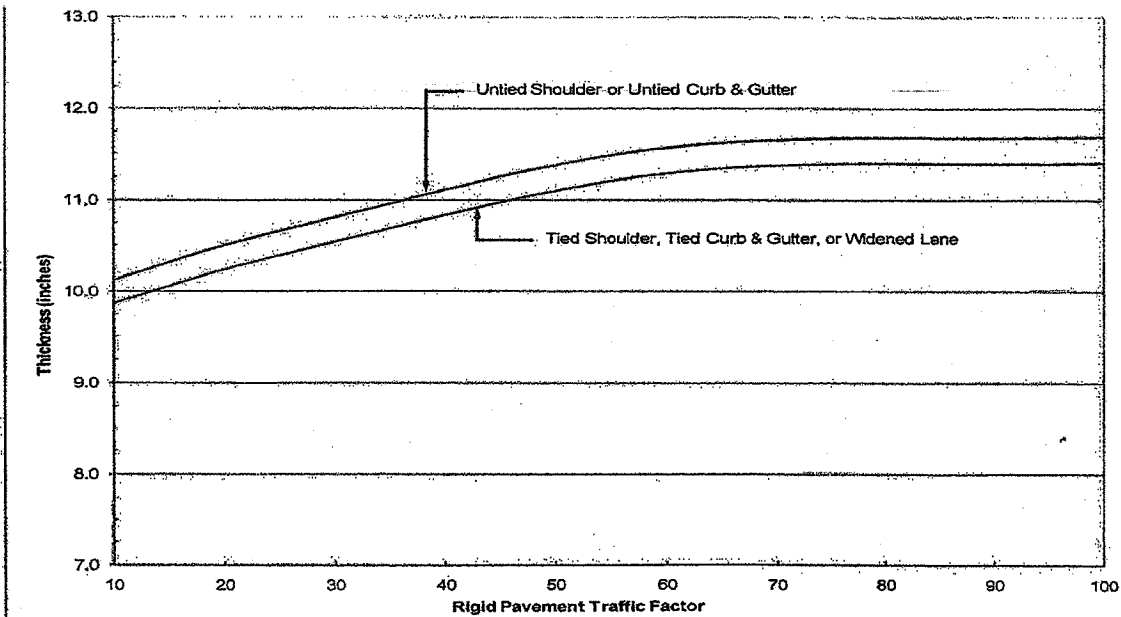
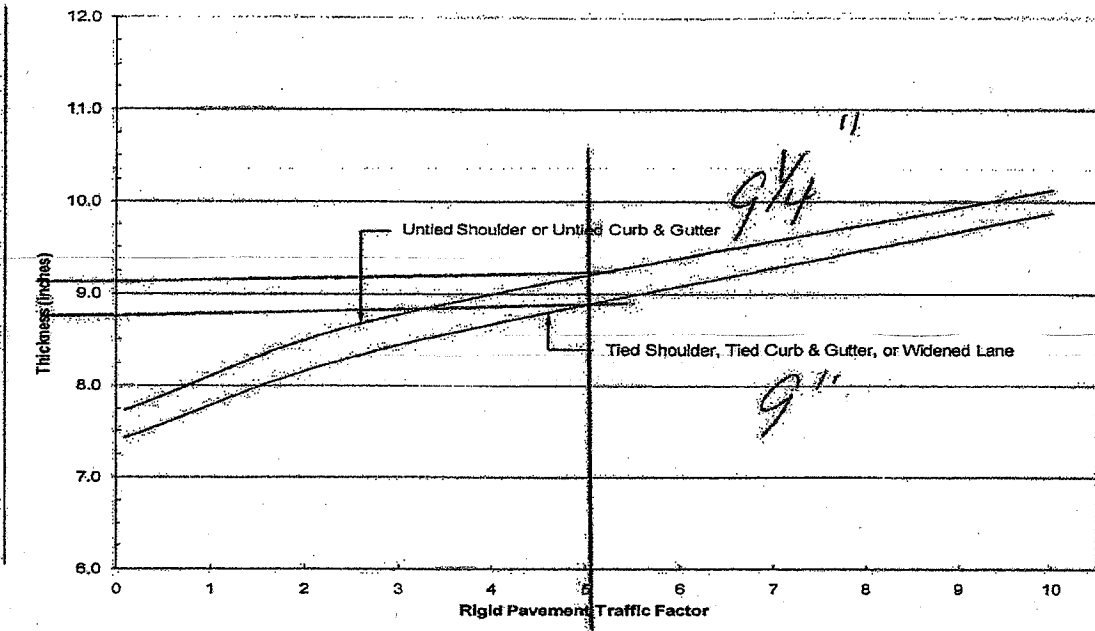
3rd P.M.
LOCATION MAP



GROSS LENGTH OF IMPROVEMENT = 20,227.23 FEET = 3.831 MILES
 NET LENGTH OF IMPROVEMENT = 20,227.23 FEET = 3.831 MILES



SH 2083



Note: Use of untied shoulder design requires BDE approval.

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

Figure 54-4.E

Facility Type	Subbase ①		Improved Subgrade Type ② ③	
	Type	Minimum Thickness (inches)		
Class I Interstate / Supplemental Freeways Other Marked Routes Unmarked Routes (TF ≥ 2.0) Unmarked Routes (0.7 < TF < 2.0) Unmarked Routes (0.7 < TF < 2.0) Unmarked Routes (TF ≤ 0.7)	HMA or PCC Stabilized	4	CA, GM, or MS	
	HMA or PCC Stabilized	4	CA, GM, or MS	
	HMA or PCC Stabilized	4	CA, GM, or MS	
	HMA or PCC Stabilized	4	CA, GM, or MS	
	Not required	n/a	CA, GM ④	
	Not required	n/a	CA, GM, or MS	
Class II Marked Routes Unmarked Routes (TF ≥ 2.0) Unmarked Routes (0.7 < TF < 2.0) Unmarked Routes (0.7 < TF < 2.0) Unmarked Routes (TF ≤ 0.7)	HMA or PCC Stabilized	4	CA, GM, or MS	
	HMA or PCC Stabilized	4	CA, GM, or MS	
	HMA or PCC Stabilized	4	CA, GM, or MS	
	Not required	n/a	CA, GM ④	
	Not required	n/a	CA, GM, or MS	
Class III Marked Routes (TF ≥ 2.0) Marked Routes (0.7 < TF < 2.0) Marked Routes (0.7 < TF < 2.0) Marked Routes (TF ≤ 0.7) Unmarked Routes (TF ≥ 2.0) Unmarked Routes (0.7 < TF < 2.0) Unmarked Routes (0.7 < TF < 2.0) Unmarked Routes (TF ≤ 0.7)	HMA or PCC Stabilized	4	CA, GM, or MS	
	HMA or PCC Stabilized	4	CA, GM, or MS	
	Not required	n/a	CA, GM ④	
	Not required	n/a	CA, GM, or MS	
	HMA or PCC Stabilized	4	CA, GM, or MS	
	HMA or PCC Stabilized	4	CA, GM, or MS	
	Not required	n/a	CA, GM ④	
	Not required	n/a	CA, GM, or MS	
Class IV Marked Routes (TF ≥ 2.0) Marked Routes (0.7 < TF < 2.0) Marked Routes (0.7 < TF < 2.0) Marked Routes (TF ≤ 0.7) Unmarked Routes (TF ≥ 2.0) Unmarked Routes (0.7 < TF < 2.0) Unmarked Routes (0.7 < TF < 2.0) Unmarked Routes (TF ≤ 0.7)	HMA or PCC Stabilized	4	CA, GM, or MS	
	HMA or PCC Stabilized	4	CA, GM, or MS	
	Not required	n/a	CA, GM ④	
	Not required	n/a	CA, GM, or MS	
	HMA or PCC Stabilized	4	CA, GM, or MS	
	HMA or PCC Stabilized	4	CA, GM, or MS	
	Not required	n/a	CA, GM ④	
	Not required	n/a	CA, GM, or MS	

Notes:

- ① Regardless of the traffic factor, a CA or GM improved subgrade may be used in lieu of a stabilized subbase in urban sections having curb and gutter and a storm sewer system.
- ② Improved Subgrade Types include:
 - CA – Composite Aggregate (3 in. CA 6/CA 10/RAP over 9 in. Aggregate/PGE)
 - GM – Granular over Modified Soil (4 in. CA 6 or CA 10 over 12 in. Modified Soil)
 - ~~MS – Modified Soil (minimum of 12 in.)~~
- ④ The minimum thickness of improved subgrade shall be according to Section 54-2.01(f).
- ⑤ Modified Soil is not allowed when no stabilized subbase is used.

**MINIMUM STRUCTURAL DESIGN REQUIREMENTS
(Rigid Pavement: Mechanistic Design)**

Figure 54-4.D

BUREAU OF LOCAL ROADS & STREETS
PAVEMENT DESIGN

Jan 2006

37-4(19)

Revised Mainline Pavement

Date: <u>9-25-2011</u>	Route: <u>VEW Rd (F046768)</u>
Calculations by: <u>Red Ward</u>	Section: <u>10-00166-02 -PV</u>
Checked by: _____	County: <u>Tazewell</u>
Class: <u>1</u> Roads and Streets	Location: _____
Limits of Analysis:	Pavement Design:
Station <u>600+00 to 764+89.25</u> To	Subgrade Support Rating (SSR):
Station <u>12111.95 to 49+50</u>	<u>Poor</u> (fair, poor, or granular)
Length: <u>20227.3</u> Ft <u>3.831</u> Miles	Flexible Traffic Factor: <u>3.55 min.</u>
Structural Design Traffic:	Selected Design PG Binder: <u>PG 64-22</u>
ADT: <u>11,600</u>	Design Pavement HMA Temp.: <u>76.6</u> °F
PV: <u>10,730</u>	Design HMA Modulus (E _{AC}): <u>645</u> ksi
SU: <u>348</u>	Design HMA Microstrain: <u>85</u>
MU: <u>522</u>	Pavement Thickness: <u>10 1/2"</u> in
	Subgrade: <u>12" modified soil</u>
	Comments: <u>Fly Ash & Lime</u>

138,890.594d

FULL-DEPTH HMA PAVEMENT
DESIGN CALCULATIONS FOR LOCAL AGENCIES

Figure 37-4P

Ch 54 of BDE
 Mechanistic Flexible Pavt

CLASS 1 Roadway 11,600 ADT - 10yr after Const.
 PU = 92.5% 10,730
 SU = 3.0% 348
 MU = 4.5% 522

% Traffic in design lane PU - 32% MU/SU = 45%

Actual Traffic Factor

$$TF = DP \left[\frac{(0.15 \times P \times PU) + (132.5 \times S \times SU) + (482.53 \times M \times MU)}{1000000} \right]$$

$$TF = 20 \left[\frac{(0.15 \times 0.32 \times 10730) + (132.5 \times 0.45 \times 348) + (482.53 \times 1.45 \times 522)}{1000000} \right]$$

$$TF = 20 \left[\frac{515 + 20750 + 113346}{1000000} \right] = \frac{134611}{1000000} = 0.135$$

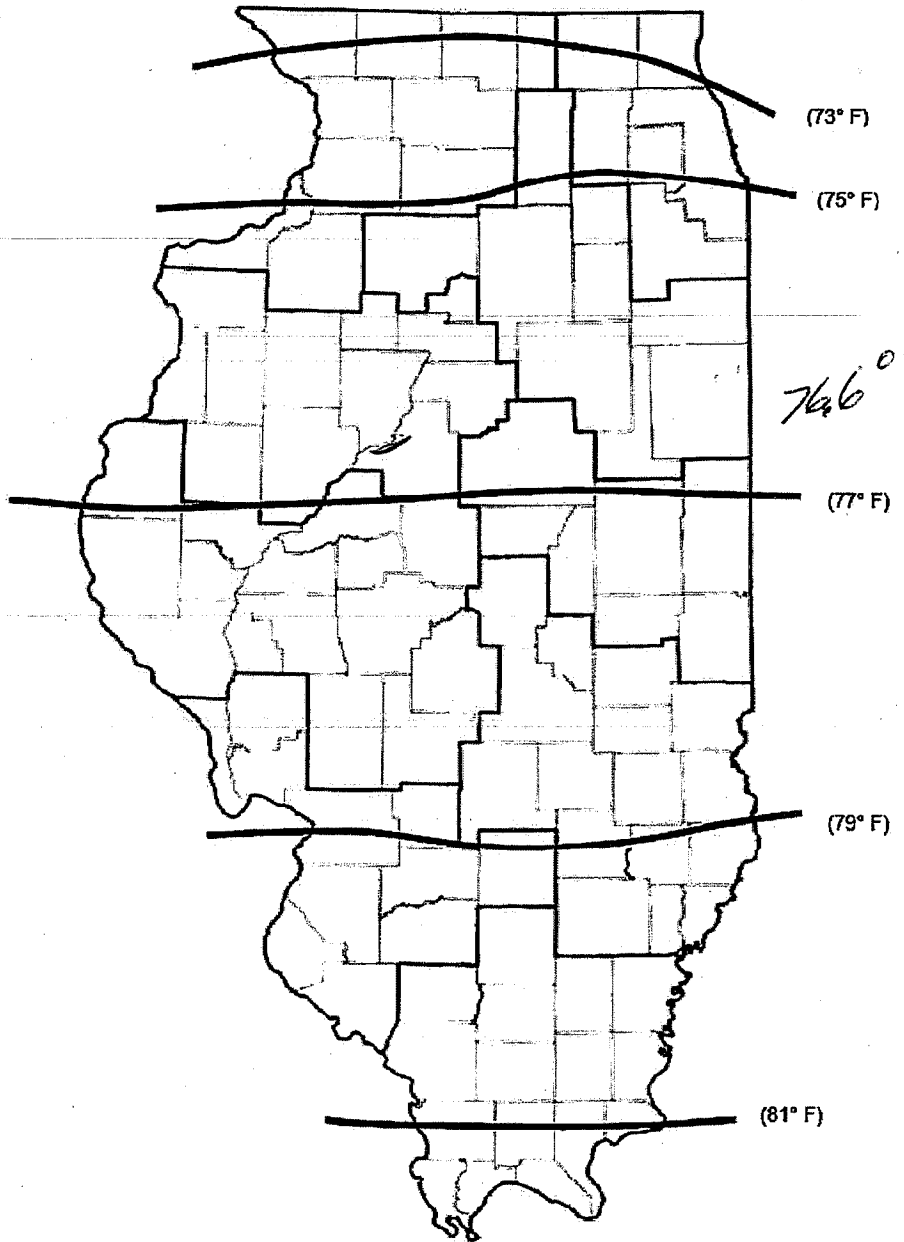
TF = 2.69

MIN. T.F. = 20 $\left[\frac{(132.5 \times 0.45 \times 250) + (482.53 \times 1.45 \times 750)}{1000000} \right]$

$$TF = 20 \left[\frac{14906 + 162854}{1000000} \right] = \frac{177760}{1000000} = 0.178$$

MIN. TF = 3.55

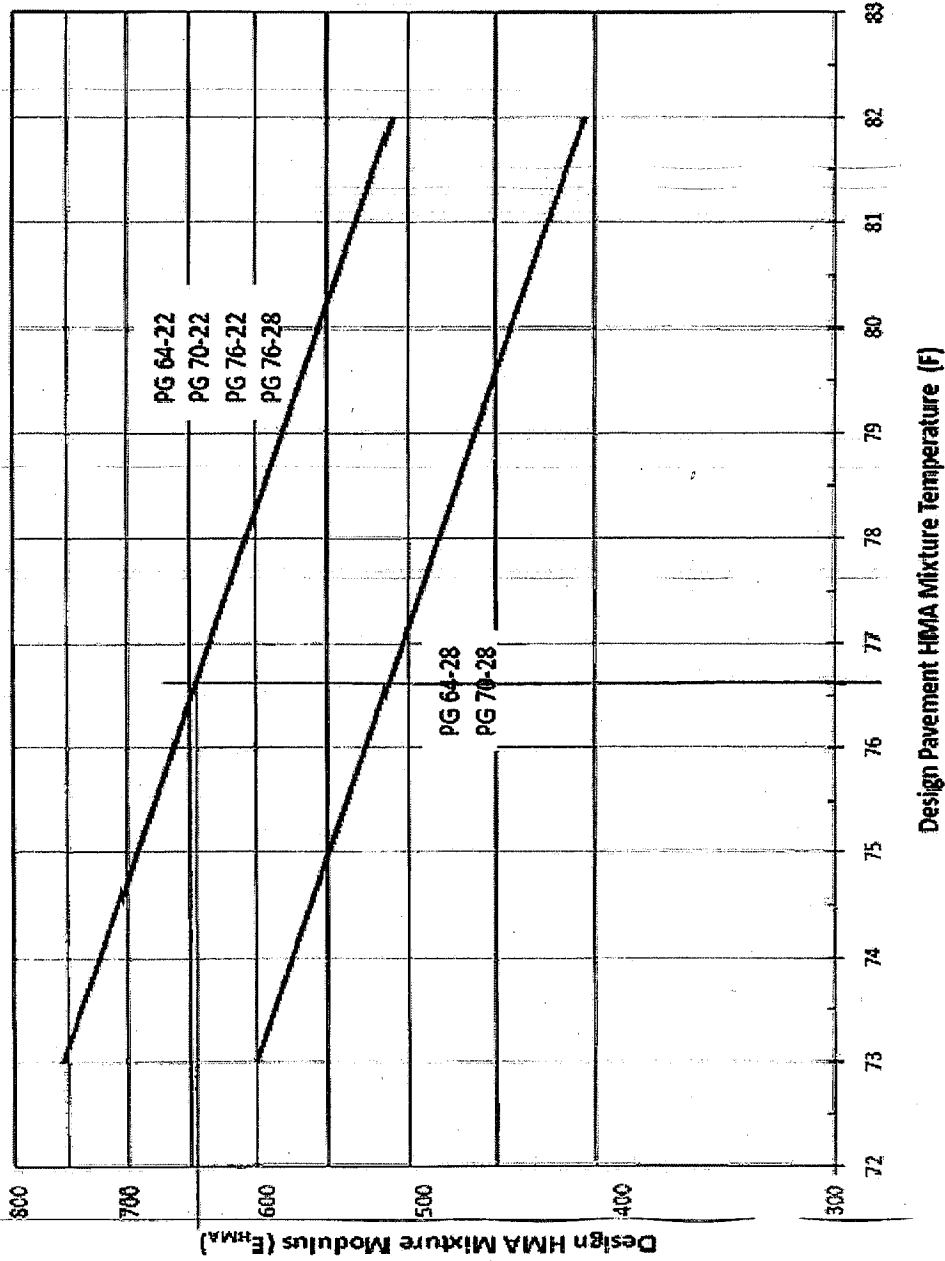
From Fig 54-5.F = 10 1/2" HMA Full depth
 12" modified soil



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

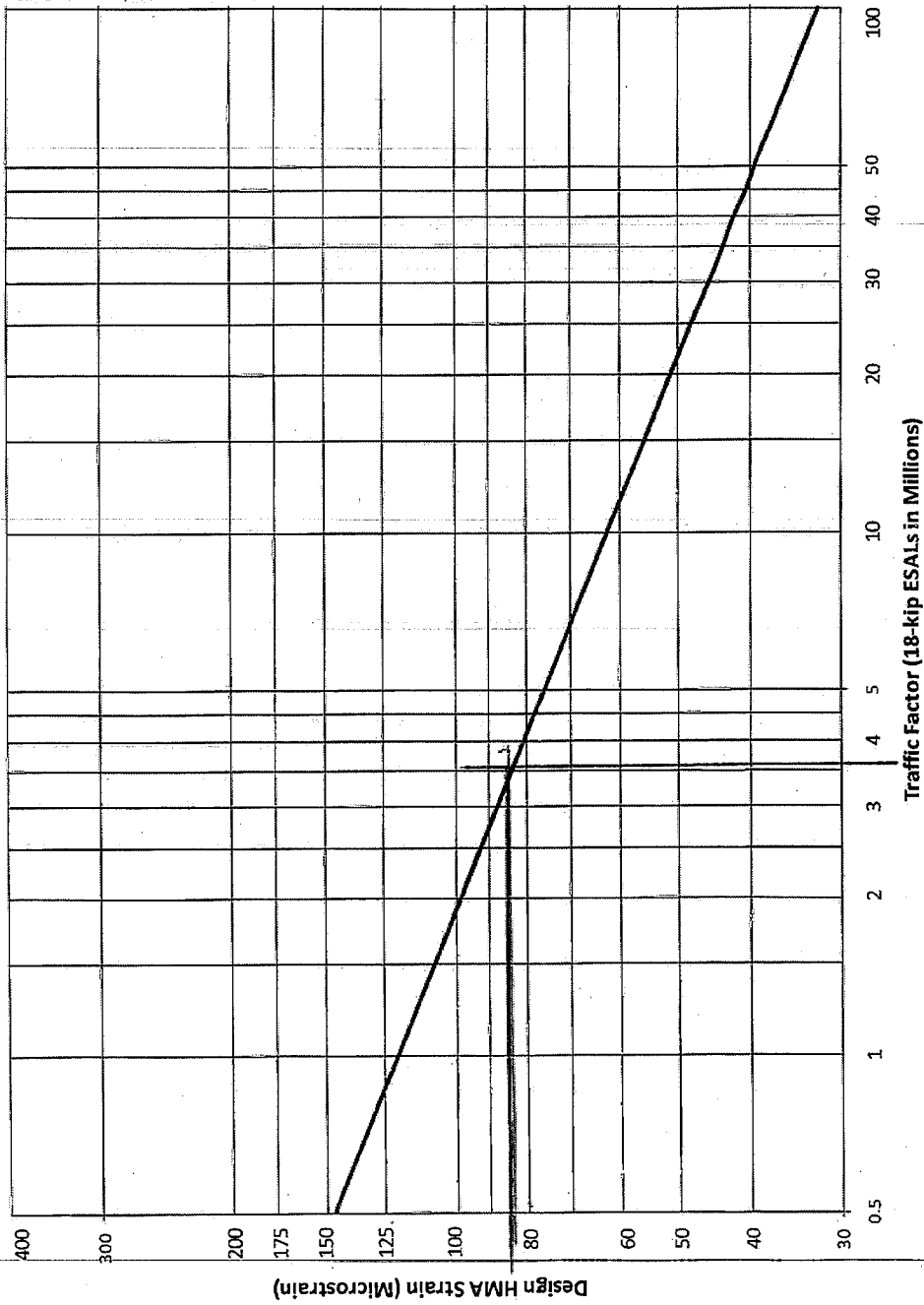
**HMA MIXTURE TEMPERATURE
(Mechanistic Design: Flexible Pavement)**

Figure 54-5.C



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

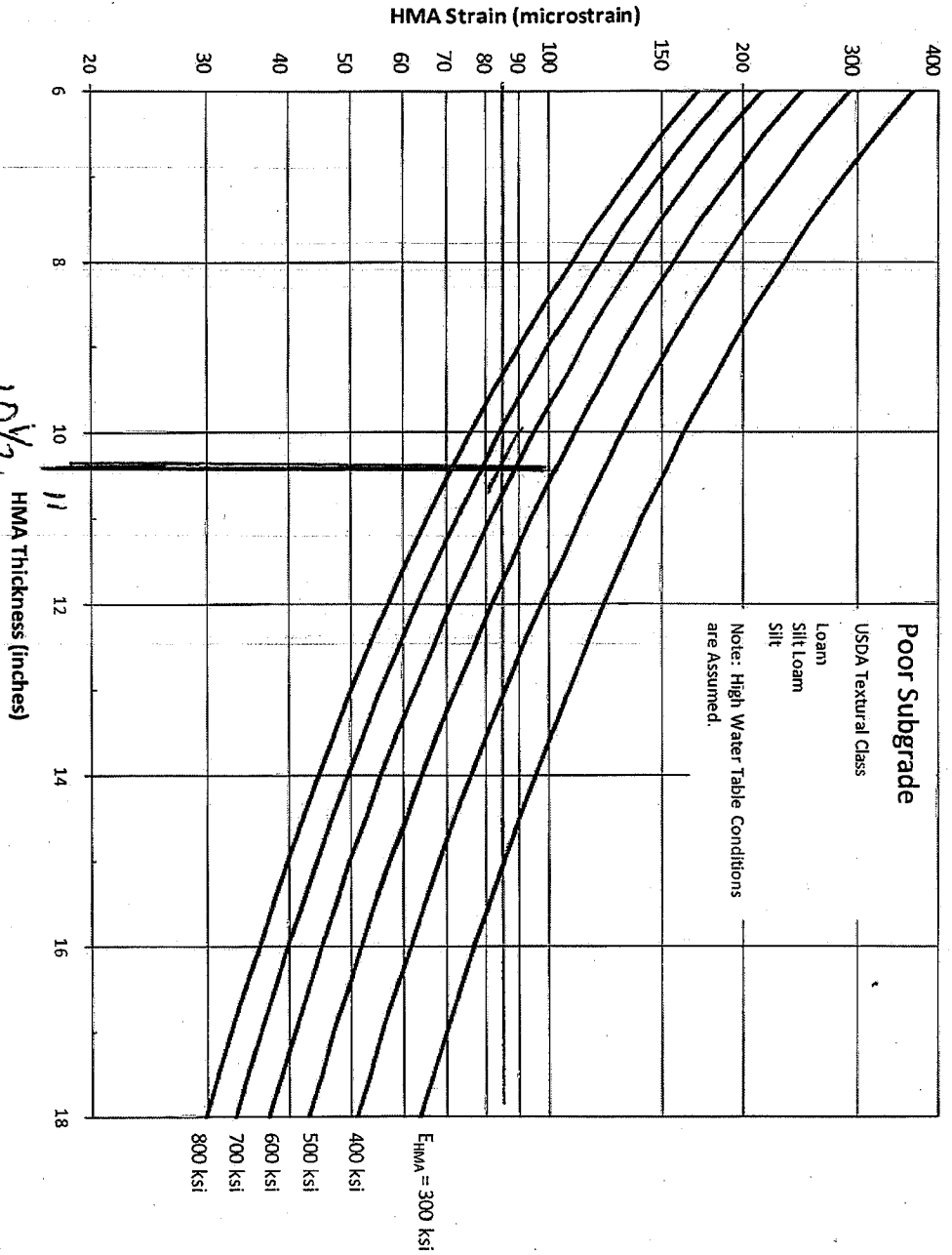
Figure 54-5.D



DESIGN HMA STRAIN
(Mechanistic Design: Flexible Pavement)

Figure 54-5.E

SP



PAVT	3.7300 miles		# OF LANES 5	# OF EDGES 2	# OF C LINES 1	AREA (SQ YD) 138,893
	L (FT)	W (FT)				
	20,834	12				

SHLDR	LENGTH	LT WIDTH	RT WIDTH	# OF LT 1	# OF RT 1	AREA (SQ YD) 31,189
	L (FT)	(FT)	(FT)			
	17,544		8			

FULL-DEPTH HMA PAVEMENT		FLEXIBLE					
ITEM	QUANTITY	UNIT	UNIT PRICE	PRES CONST COST	PRES CONST COST/MILE		
2 " Polymerized HMA Surface Course Mix "D" N70	15,556	TON	\$82.14	\$1,277,774			
2.5 " Polymerized H M A Binder Course IL-19.0, N70	19,445	TON	\$76.64	\$1,490,270			
6 " H M A Binder Course IL-19.0, N50 8 3/4"	46,668	TON	\$72.66	\$3,390,909			
8 " HMA SHOULDERS 8"	13,973	TON	\$78.65	\$1,098,962			
9.216 " SUB-BASE GRAN MATRL TYPE C 5"	16,097	TON	\$18.00	\$289,740			
12.4 " PROCESSING MODIFIED SOIL 12"	170,083	SQ YD	\$2.00	\$340,165			
LIME 4% (120 LBS/CU FT OF SOIL)	3,927	TON	\$65.00	\$255,242			
PRESENT CONSTRUCTION COSTS OVER THE PERIOD OF 40 YEARS				\$8,143,062	\$2,183,127		
ACTIVITIES		QUANT	UNIT	UNIT PRICE	FUT REHAB COST	FUT REHAB COST/MILE	PRES REHAB COST/MILE
ACTIVITY 1 ---- YEAR 5		PWF5= 0.8626					
100%	LONGITUDINAL SHOULDER JOINT ROUTING & SEALING	35,088	LIN FT	\$2.00	\$70,176		
100%	CL JOINT ROUTING & SEALING (SINGLE LANE PAVING)	20,834	LIN FT	\$2.00	\$41,668		
50%	RANDOM/THERMAL CRACK ROUTING & SEALING (SEE NOTE)	57,294	LIN FT	\$2.00	\$114,587		
0.10%	PARTIAL-DEPTH PAVEMENT PATCHING (MILL & FILL SURFACE)	139	SQ YD	\$100.00	\$13,889		
				\$240,320	\$64,429	\$55,576	
ACTIVITY 2 ---- YEAR 10		PWF10= 0.7441					
100%	LONGITUDINAL SHOULDER JOINT ROUTING & SEALING	35,088	LIN FT	\$2.00	\$70,176		
100%	CENTERLINE JOINT ROUTING & SEALING	20,834	LIN FT	\$2.00	\$41,668		
50%	RANDOM/THERMAL CRACK ROUTING & SEALING (SEE NOTE)	57,294	LIN FT	\$2.00	\$114,587		
0.50%	PARTIAL-DEPTH PAVEMENT PATCHING (MILL & FILL SURFACE)	694	SQ YD	\$100.00	\$69,447		
				\$295,878	\$79,324	\$59,025	
ACTIVITY 3 ---- YEAR 15		PWF15= 0.6419					
2 "	MILLING-PAVEMENT AND SHOULDERS	170,083	SQ YD	\$2.00	\$340,165		
1.0%	PARTIAL-DEPTH PAVEMENT PATCHING (MILL AND FILL ADDITIONAL 2 IN.)	1,389	SQ YD	\$100.00	\$138,893		
2 "	HMA OVERLAY SURFACE POLYMER MIX "D"	15,556	TON	\$83.00	\$1,291,152		
2 "	HMA OVERLAY SHOULDERS	3,493	TON	\$78.00	\$272,470		
				\$2,042,681	\$547,636	\$351,527	
ACTIVITY 4 ---- YEAR 20		PWF20= 0.5537					
100%	LONGITUDINAL SHOULDER JOINT ROUTING & SEALING	35,088	LIN FT	\$2.00	\$70,176		
100%	CENTERLINE JOINT ROUTING & SEALING	20,834	LIN FT	\$2.00	\$41,668		
50%	RANDOM/THERMAL CRACK ROUTING & SEALING (SEE NOTE)	57,294	LIN FT	\$2.00	\$114,587		
0.10%	PARTIAL-DEPTH PAVEMENT PATCHING (MILL & FILL SURFACE)	139	SQ YD	\$100.00	\$13,889		
				\$240,320	\$64,429	\$35,674	
ACTIVITY 5 ---- YEAR 25		PWF25= 0.4776					
100%	LONGITUDINAL SHOULDER JOINT ROUTING & SEALING	35,088	LIN FT	\$2.00	\$70,176		
100%	CENTERLINE JOINT ROUTING & SEALING	20,834	LIN FT	\$2.00	\$41,668		
50%	RANDOM/THERMAL CRACK ROUTING & SEALING (SEE NOTE)	57,294	LIN FT	\$2.00	\$114,587		
0.50%	PARTIAL-DEPTH PAVEMENT PATCHING (MILL & FILL SURFACE)	694	SQ YD	\$100.00	\$69,447		
				\$295,878	\$79,324	\$37,885	
ACTIVITY 6 ---- YEAR 30		PWF30= 0.4120					
2 "	MILLING PAVEMENT AND SHOULDERS	170,083	SQ YD	\$2.00	\$340,165		
2.0%	PARTIAL-DEPTH PAVEMENT PATCHING (MILL AND FILL)	2,778	SQ YD	\$100.00	\$277,787		
1.0%	PARTIAL-DEPTH SHOULDERS PATCHING (MILL AND FILL)	312	SQ YD	\$100.00	\$31,189		
3.75 "	HMA OVERLAY-PAVT POLYMER MIX "D"	29,168	TON	\$83.00	\$2,420,911		
1.75 "	HMA OVERLAY-SHOULDRES	3,057	TON	\$78.00	\$238,411		
				\$3,308,463	\$886,988	\$365,439	
ACTIVITY 7 ---- YEAR 35		PWF35= 0.3554					
100%	LONGITUDINAL SHOULDER JOINT ROUTING & SEALING	35,088	LIN FT	\$2.00	\$70,176		
100%	CENTERLINE JOINT ROUTING & SEALING	20,834	LIN FT	\$2.00	\$41,668		
50%	RANDOM/THERMAL CRACK ROUTING & SEALING (SEE NOTE)	57,294	LIN FT	\$2.00	\$114,587		
0.10%	PARTIAL-DEPTH PAVEMENT PATCHING (MILL & FILL SURFACE)	139	SQ YD	\$100.00	\$13,889		
				\$240,320	\$64,429	\$22,898	
ACTIVITY 8 ---- YEAR 40		PWF40= 0.3066					
100%	LONGITUDINAL SHOULDER JOINT ROUTING & SEALING	35,088	LIN FT	\$2.00	\$70,176		
100%	CENTERLINE JOINT ROUTING & SEALING	20,834	LIN FT	\$2.00	\$41,668		
50%	RANDOM/THERMAL CRACK ROUTING & SEALING (SEE NOTE)	57,294	LIN FT	\$2.00	\$114,587		
0.50%	PARTIAL-DEPTH PAVEMENT PATCHING (MILL & FILL SURFACE)	694	SQ YD	\$100.00	\$69,447		
				\$295,878	\$79,324	\$24,321	
PRESENT REHAB COST PER MILE FOR THE PERIOD OF 40 YEARS						\$79,324	\$952,346
TOTAL PRESENT COST PER MILE FOR THE PERIOD OF 40 YEARS							\$3,135,472
PRESENT COST PER MILE PER YEAR		CRF40= 0.0433					\$135,766

PAVT	3.9458 miles		# OF	# OF	# OF	AREA (SQ YD)
	L (FT)	W (FT)	LANES	EDGES	C LINES	
	20,834	12	5	2	1	

SHLDR	L (FT)	LT W (FT)	RT W (IN)	# OF LT	# OF RT	AREA (SQ YD)
	17,544		8	1	1	

MAINTENANCE AND REHABILITATION ACTIVITY SCHEDULE
JOINTED PLAIN CONCRETE PAVEMENT **RIGID**
AND UNBONDED JOINTED PAIN CONCRETE OVERLAY

ITEM	QUANTITY	UNIT	UNIT PRICE	PRES CONST COST	PRES CONST COST/MILE
Enter Pavement Pay Items					
9 " PCC PAVEMENT 9"	138,893	SQ YD	\$41.30	\$5,736,295	
" STABILIZED SUB-BASE 4"	138,893	SQ YD	\$15.00	\$2,083,400	
" CONCRETE SHOULDERS 8"	31,189	SQ YD	\$31.70	\$988,702	
9.216 " SUB-BASE GRAN MATRL TYPE C	16,097	TON	\$18.00	\$289,740	
LONGITUDINAL SHOULDER JOINT ROUTING AND SEALING	35,088	LIN FT	\$2.00	\$70,176	
12.399 " PROCESSING MODIFIED SOIL 12"	170,083	SQ YD	\$2.00	\$340,165	
LIME 4% (120 LBS/CU FT OF SOIL)	3,926	TON	\$65.00	\$255,221	
PRESENT CONSTRUCTION COSTS OVER THE PERIOD OF 40 YEARS				\$9,763,699	\$2,474,433

ACTIVITIES		QUANT	UNIT	UNIT PRICE	FUT REHAB COST	FUT REHAB COST/MILE	PRES REHAB COST/MILE
ACTIVITY 1 ---- YEAR 10							
0.10% CLASS B PAVEMENT PATCHING		139	SQ YD	\$190.00	\$26,390	\$6,688	\$4,977
ACTIVITY 2 ---- YEAR 15							
0.20% CLASS B PAVEMENT PATCHING		278	SQ YD	\$190.00	\$52,779	\$13,376	\$8,586
ACTIVITY 3 ---- YEAR 20							
2.00% CLASS B PAVEMENT PATCHING		2,778	SQ YD	\$190.00	\$527,795		
0.50% CLASS C SHOULDERS PATCHING		156	SQ YD	\$150.00	\$23,392		
100% LONGITUDINAL SHOULDER JOINT ROUTING AND SEALING		35,088	LIN FT	\$2.00	\$70,176		
100% CENTER LINE JOINT ROUTING AND SEALING		20,834	LIN FT	\$2.00	\$41,668		
					\$663,031	\$168,033	\$93,040
ACTIVITY 4 ---- YEAR 25							
0.30% CLASS B PAVEMENT PATCHING		417	SQ YD	\$190.00	\$79,169		
1.00% CLASS C SHOULDERS PATCHING		312	SQ YD	\$150.00	\$46,784		
					\$125,953	\$31,921	\$15,245
ACTIVITY 5 ---- YEAR 30							
4.00% CLASS B PAVEMENT PATCHING		5,556	SQ YD	\$190.00	\$1,055,589		
1.50% CLASS C SHOULDERS PATCHING		468	SQ YD	\$150.00	\$70,176		
2.25 " HMA OVERLAY OF PAVEMENT		17,501	TON	\$85.00	\$1,487,548		
1.50 " HMA OVERLAY OF SHOULDERS		2,620	TON	\$80.00	\$209,592		
					\$2,822,905	\$715,414	\$294,751
ACTIVITY 6 ---- YEAR 35							
100% LONGITUDINAL SHOULDER JOINT ROUTING AND SEALING		35,088	LIN FT	\$2.00	\$70,176		
100% CENTER LINE JOINT ROUTING AND SEALING		20,834	LIN FT	\$2.00	\$41,668		
50% RANDOM CRACK ROUTE & SEAL		52,085	LIN FT	\$2.00	\$104,170		
40% REFLEC TRANSVERSE CRACK ROUTE & SEAL		41,668	LIN FT	\$2.00	\$83,336		
0.10% PARTIAL-DEPTH PAVEMENT PATCHING		139	SQ YD	\$100.00	\$13,889		
					\$313,239	\$79,385	\$28,213
ACTIVITY 7 ---- YEAR 40							
0.50% CLASS B PAVEMENT PATCHING		694	SQ YD	\$190.00	\$131,949		
100% LONGITUDINAL SHOULDER JOINT ROUTING AND SEALING		41,668	LIN FT	\$2.00	\$83,336		
100% CENTER LINE JOINT ROUTING AND SEALING		20,834	LIN FT	\$2.00	\$41,668		
60% REFLEC TRANSVERSE CRACK ROUTE & SEAL		62,502	LIN FT	\$2.00	\$125,004		
50% RANDOM CRACK ROUTE & SEAL		52,085	LIN FT	\$2.00	\$104,170		
0.50% PARTIAL-DEPTH PAVEMENT PATCHING		694	SQ YD	\$100.00	\$69,447		
					\$555,573	\$140,800	\$43,169
PRESENT REHAB COST PER MILE FOR THE PERIOD OF 40 YEARS							\$487,981
TOTAL PRESENT COST PER MILE FOR THE PERIOD OF 40 YEARS							\$2,962,414
PRESENT COST PER MILE PER YEAR							\$128,273