



Illinois Department of Transportation

To: Joseph E. Crowe Attn: District Four
From: Scott E. Stitt *Scott E. Stitt*
Subject: Pavement Design
Date: November 17, 2011

FAP Route 313 (US Route 34)
Section 7-2; 6-1
Henderson County
Biggsville Bypass

We have reviewed the pavement selection for the above captioned section, which was submitted by email dated August 12, 2011. Life cycle costs favor the rigid option over the HMA design. The district desires the HMA design based on the following:

- The adjacent section was previously approved as HMA pavement.
- Continuity of pavement for the entire project from Monmouth to Gulfport is desired by the district.
- Constructability on a new alignment allows a paving train to make a high production rate.

The Pavement Review Committee did not have any objections to the district's request to use the HMA design. The approved pavement design is as follows:

US Route 34 – Biggsville Bypass

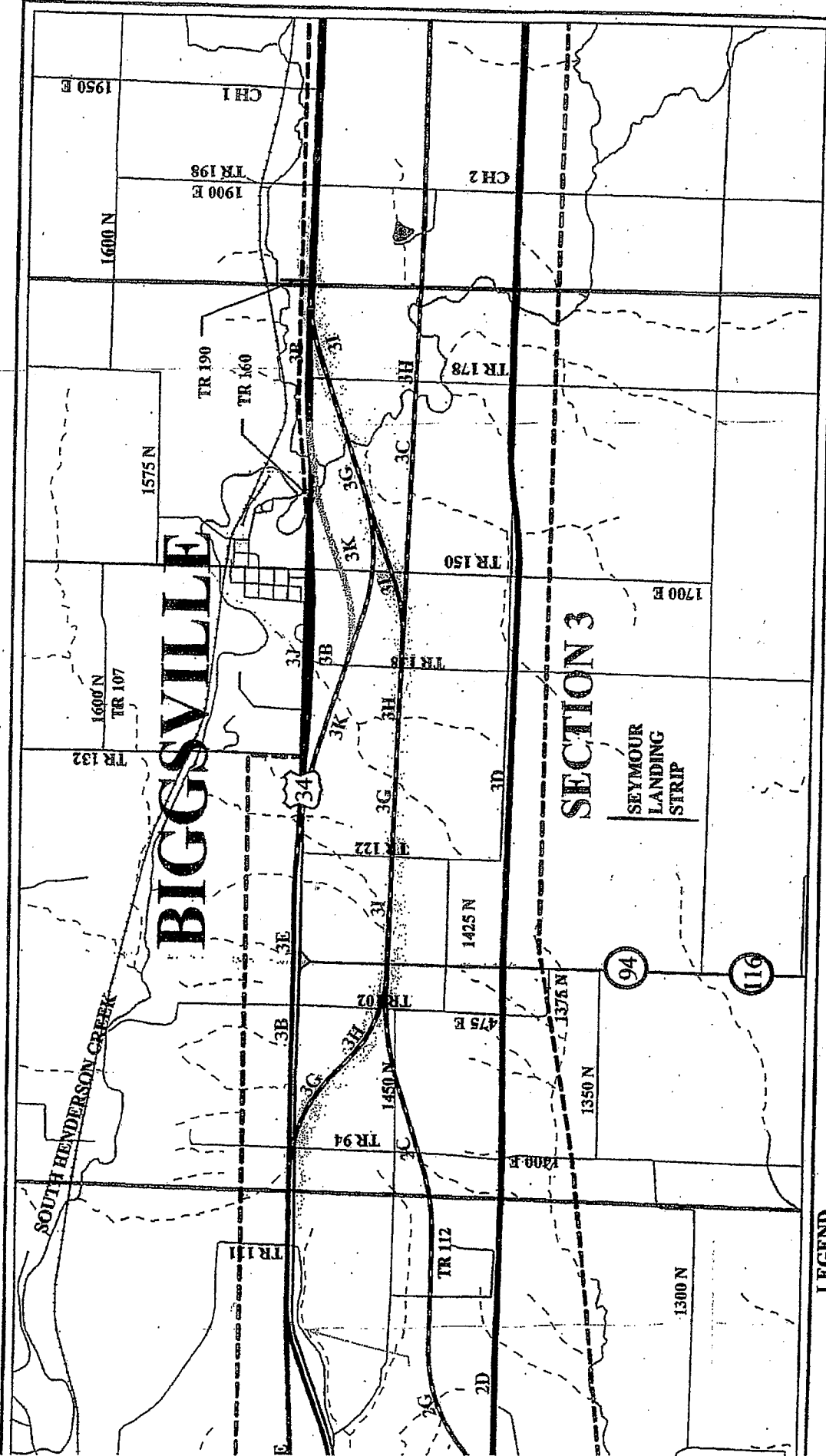
12.25 inches of HMA Pavement (Full Depth)
 2 inches of Polymerized HMA Surface Course, Mix "D," N70
 2.25 inches of Polymerized HMA Binder Course, IL-19.0, N70
 8 inches of HMA Binder Course, IL-19.0, N50
5 inches of Sub-base Granular Material, Type C
12 inches of Lime Modified Soil

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

D. 99. 000004

68407

HENDERSON



	U.S. Route 34 Gulfport to Monmouth	
	EXHIBIT E-3, Preliminary Study Alternates (Phase I), Section 3	
Projection: Stateplane-NAD83 Revised: 02-17-00		

- LEGEND**
- Project Corridor
 - U.S. Hwy 34
 - U.S. Hwy 67
 - 4 Lane U.S. Hwy
 - Minor State Hwy
 - Primary Roads
 - Streams & Rivers
 - Transmission Corridor
 - County Line
 - Railroad
 - Township Boundary
 - Lakes or Pond
 - City/Village Limits
 - Retained Alternate
 - Eliminated Alternate
 - Section Boundary

PAVEMENT DESIGN AND SELECTION

FAP 313 (US34)
 SECTION : 7-2; 6-1
 COUNTY : HENDERSON
 CATALOG NO : 031314-04D
 CONTRACT NO : 68409

ROUTE :	CLASS I	MIX TYPE :	PG70-28
NO. OF LANES :	4 LANES	MIX TEMPERATURE :	76 F
DESIGN PERIOD :	20 YEARS	TIED OR UNTIED SHOULDERS :	TIED
TRAFFIC GROWTH FACTOR :	1.50%	SUBGRADE SUPPORT RATING :	POOR
CONSTRUCTION YEAR :	2014	FACILITY TYPE (minimm) :	OTHER PRINCIPLE ARTERIAL

2009 TRAFFIC		
ADT =	5,100	
PV =	4,000	78.43%
SU =	300	5.88%
MU =	800	15.69%

2024 TRAFFIC		
ADT =	6,376	
PV =	5,001	
SU =	375	
MU =	1,000	

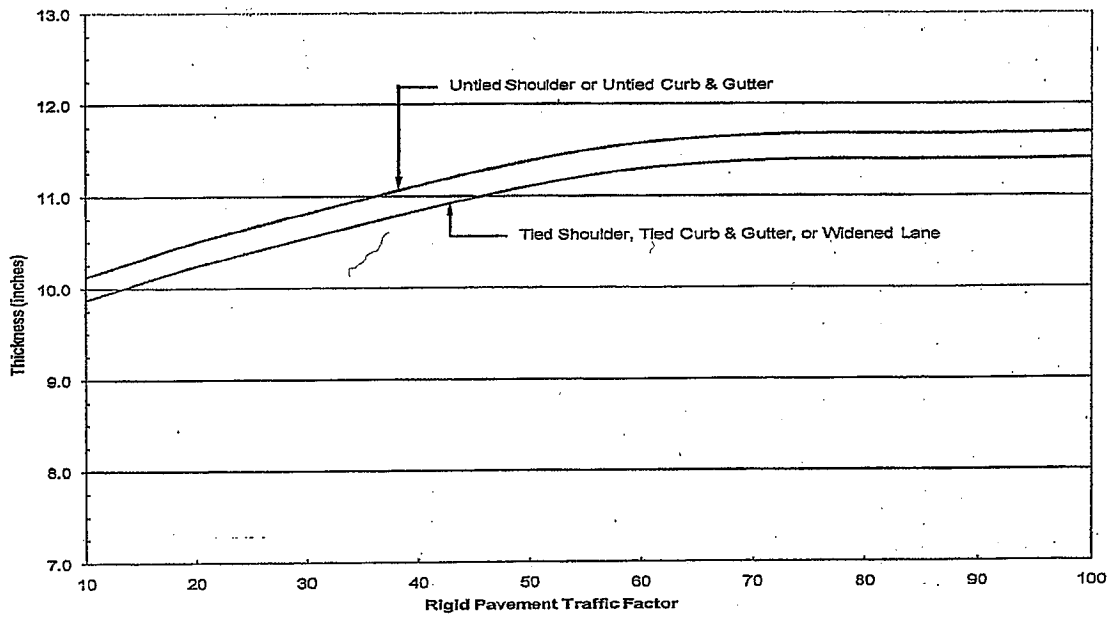
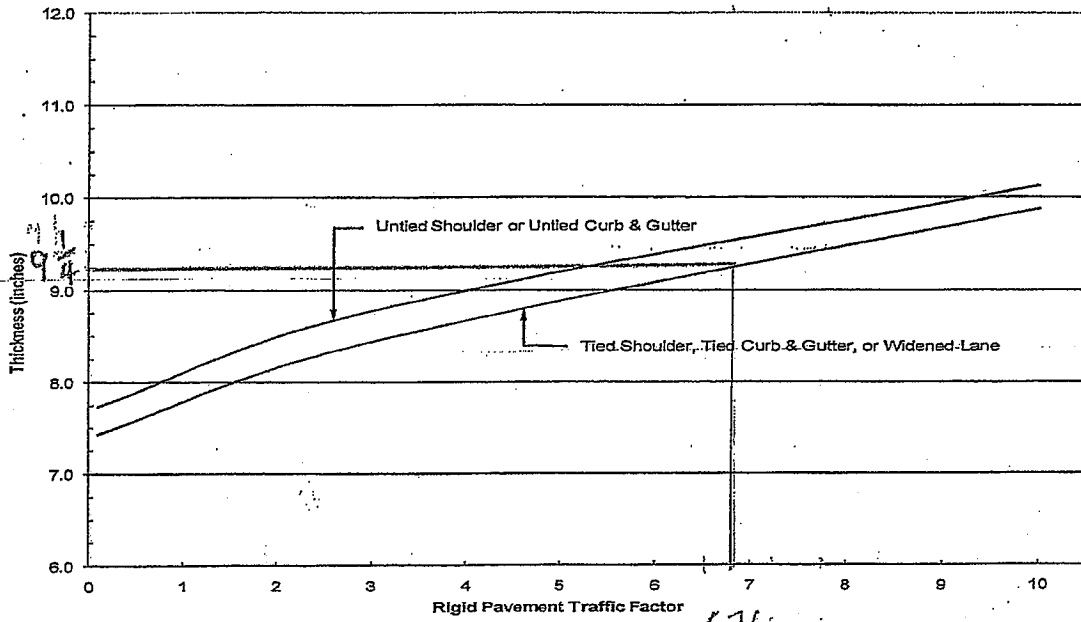
SUMMARY

The Proposed work consists of the construction of the By-pass on U.S. 34 at the Town of Biggsville.(see exhibit A)
 This new Alignment will be constructed near the existing one. The new Pavement will consists of four(4) lane section for the length of 5.5303 miles (29,200 ft). The right and left shoulders will be 10' and 4' wide respectively. The total amount of new pavement to be constructed is 155,733 sq yd.

For this Pavement Design, only the Mechanistic Pavement Design Method was considered, as per Fig 54-1.A of the BDE Manual. According to the Mechanistic Pavement Design computations, (see exhibit C), the thickness of the jointed-rigid pavement shall be 9 1/4 inches, and the thickness of the flexible pavement shall be 12 1/4 inches.

		N										
TF (actual) =	20	CPV ✓	P	PV	CSU ✓	S	SU	CMU ✓	M	MU	= 6.76	
		(	X	X	X	X	X	X	X	X)	
					1,000,000							
TF (Min) =	20	CPV	P	PV	CSU	S	SU	CMU	M	MU	= 5.02	
		(	X	X	X	X	X	X	X	X)	
					1,000,000							

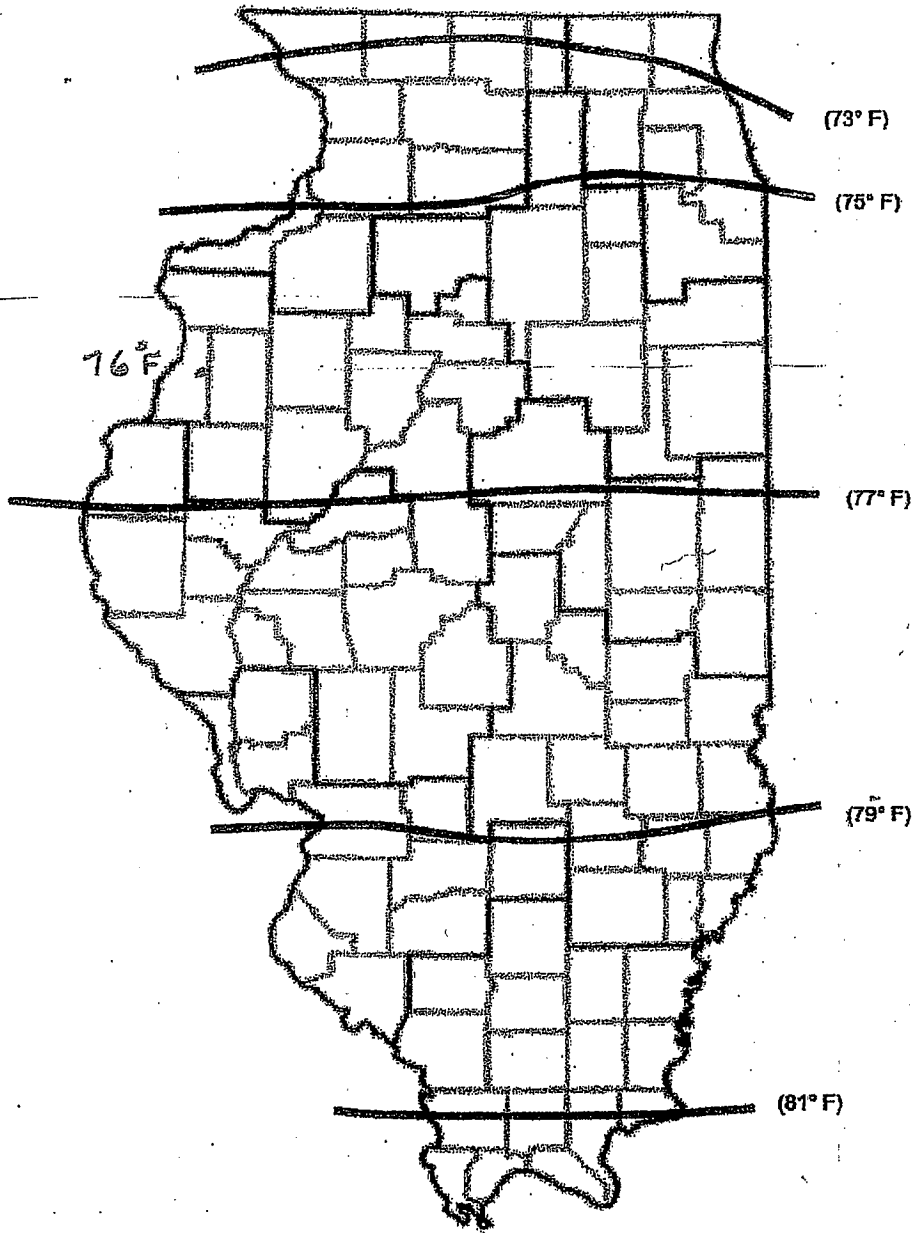
TF (actual) =	20	CPV ✓	P	PV	CSU ✓	S	SU	CMU ✓	M	MU	= 4.80	
		(	X	X	X	X	X	X	X	X)	
					1,000,000							
TF (Min) =	20	CPV	P	PV	CSU	S	SU	CMU	M	MU	= 3.56	
		(	X	X	X	X	X	X	X	X)	
					1,000,000							



Note: Use of untied shoulder design requires BDE approval.

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

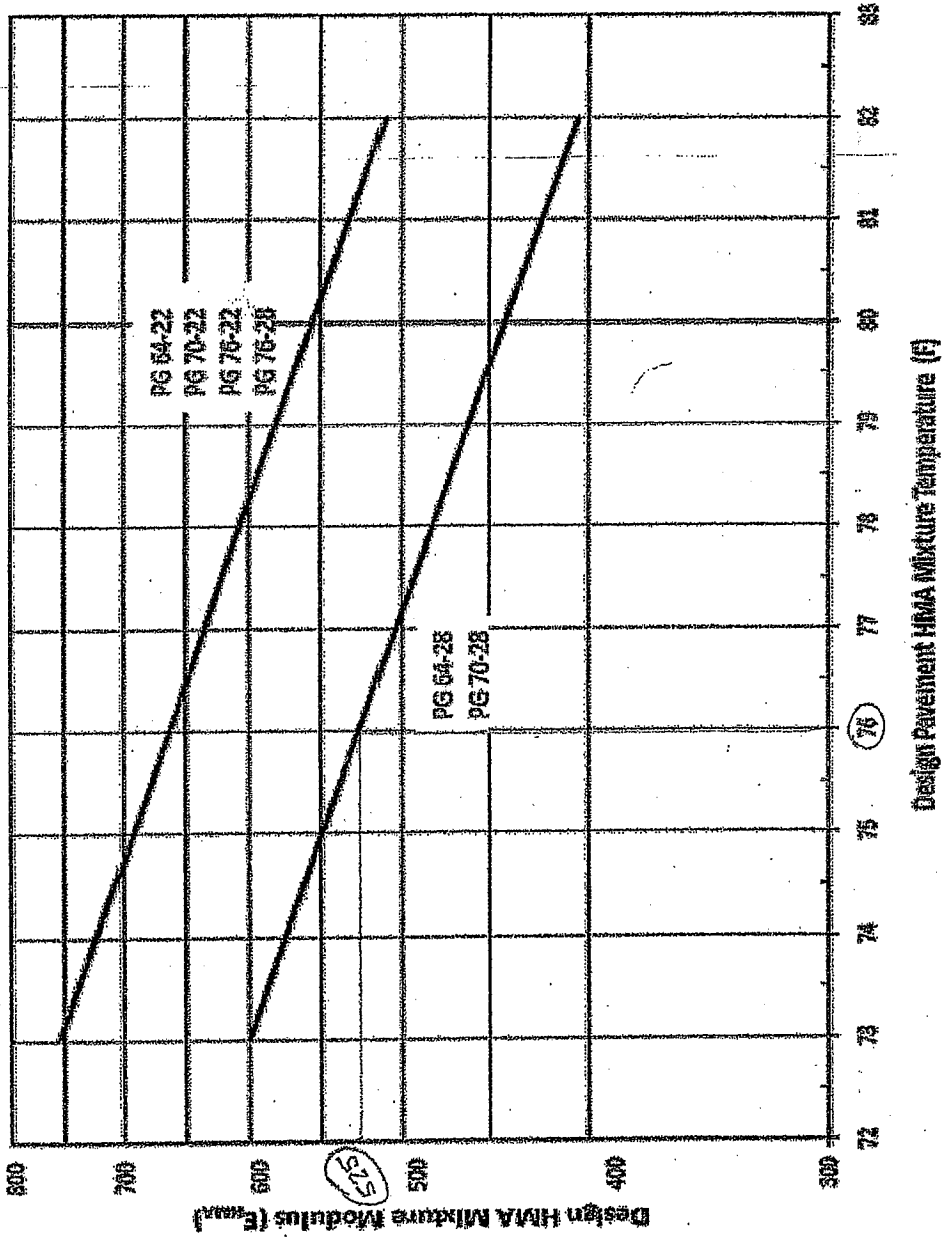
Figure 54-4.E



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

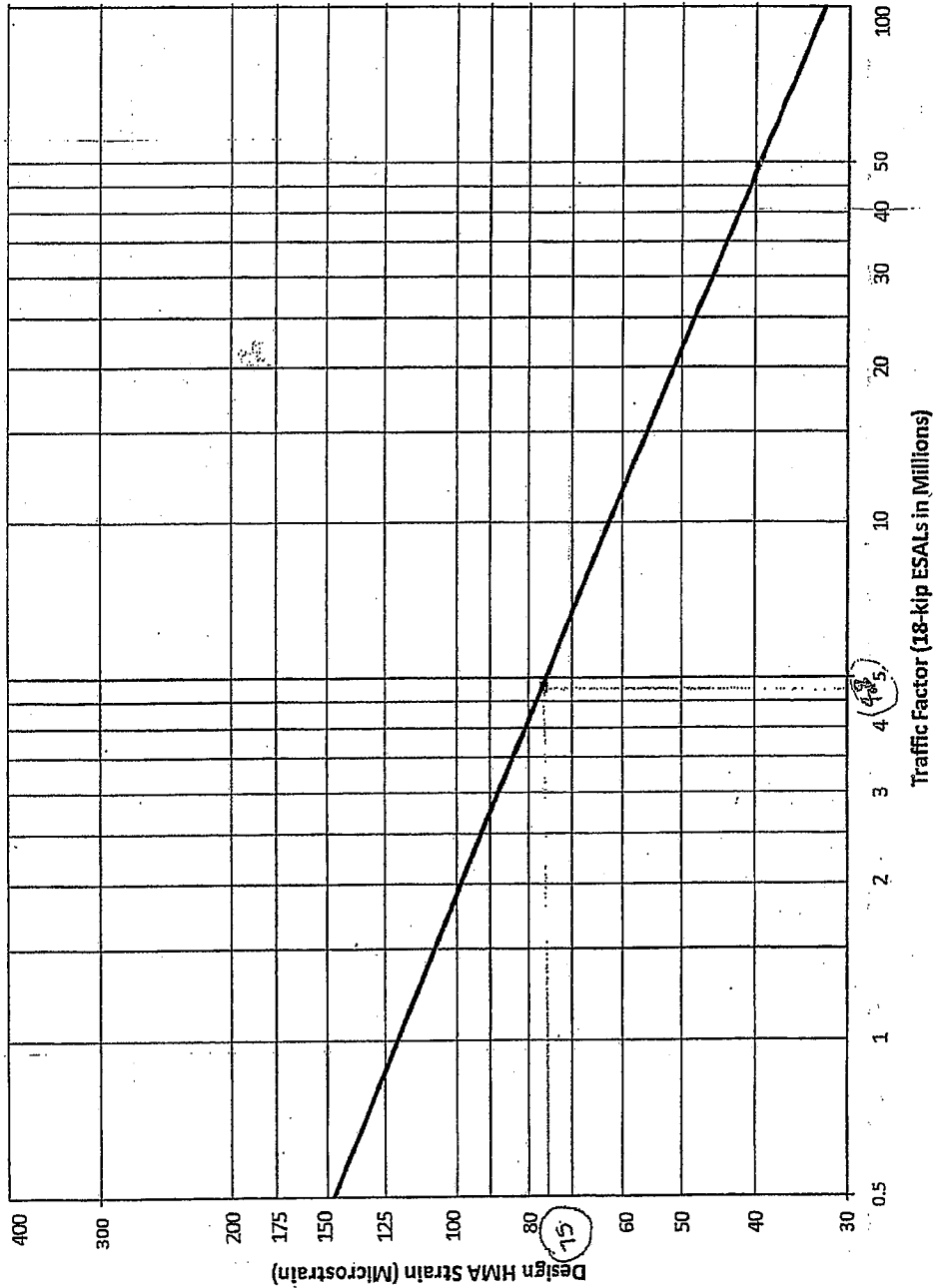
HMA MIXTURE TEMPERATURE
(Mechanistic Design: Flexible Pavement)

Figure 54-5.C



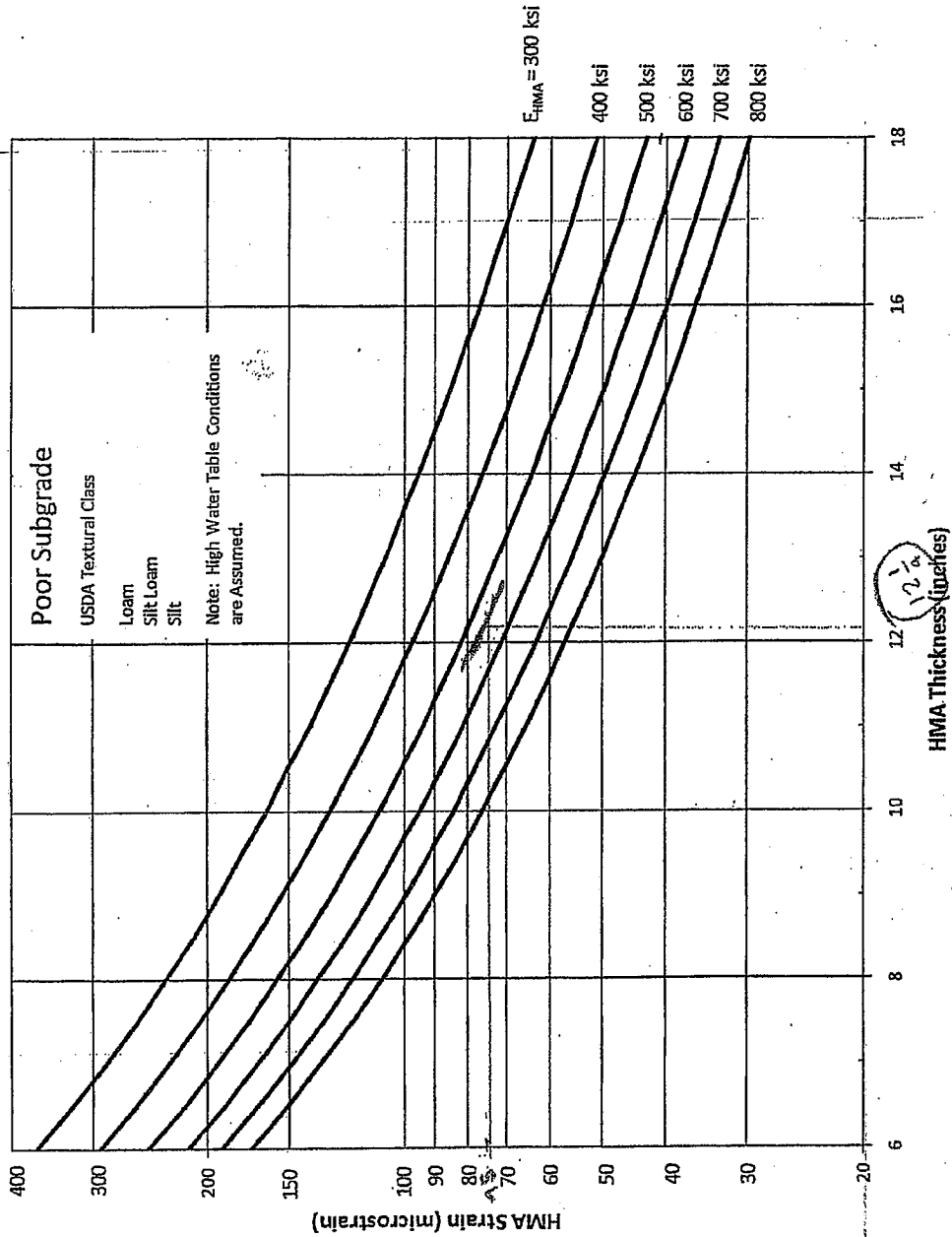
HMA MIXTURE MODULUS (E_{HMA})
(Mechanistic Design: Flexible Pavement)

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

PAVT	5.5303 miles		# OF LANES	# OF EDGES	# OF C LINES	AREA (SQ YD)
	L (FT)	W (FT)				
	29,200	12				155,733

SHLDR	L (FT)	LT	RT	# OF LT	# OF RT	AREA (SQ YD)
		W (FT)	W (IN)			
	29,200	4	10	2	2	90,844

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	
" PCC PAVEMENT	155,733	SQ YD	\$42,240	\$6,540,800		
" STABILIZED SUB-BASE	155,733	SQ YD	\$14,000	\$2,336,000		
" CONCRETE SHOULDERS	90,844	SQ YD	\$24,000	\$2,225,333		
" SUB-BASE GRAN MATRL TYPE C	30,524	TON	\$18,000	\$549,427		
LONGITUDINAL SHOULDER JOINT ROUTING AND SEALING	116,800	LIN FT	\$2.00	\$233,600		
" PROCESSING MODIFIED SOIL 12"	246,578	SQ YD	\$2.00	\$493,156		
LIME 4% (120 LBS/CU FT OF SOIL)	5,326	TON	\$65.00	\$346,195		
PRESENT CONSTRUCTION COST PER MILE OVER THE PERIOD OF 40 YEARS					\$2,391,281	
ACTIVITIES	QUANT	UNIT	UNIT PRICE	FUT REHAB COST	FUT REHAB COST/MILE	PRES REHAB COST/MILE
ACTIVITY 1 ---- YEAR 10	PWF10= 0.7441					
0.10% CLASS B PAVEMENT PATCHING	156	SQ YD	\$175.00	\$27,253	\$4,928	\$3,667
ACTIVITY 2 ---- YEAR 15	PWF15= 0.6419					
0.20% CLASS B PAVEMENT PATCHING	311	SQ YD	\$175.00	\$54,507	\$9,856	\$6,327
ACTIVITY 3 ---- YEAR 20	PWF20= 0.5537					
2.00% CLASS B PAVEMENT PATCHING	3,115	SQ YD	\$175.00	\$545,067		
0.50% CLASS C SHOULDERS PATCHING	454	SQ YD	\$100.00	\$45,422		
100% LONGITUDINAL SHOULDER JOINT ROUTING AND SEALING	116,800	LIN FT	\$2.00	\$233,600		
100% CENTER LINE JOINT ROUTING AND SEALING	58,400	LIN FT	\$2.00	\$116,800		
				\$940,889	\$170,133	\$94,203
ACTIVITY 4 ---- YEAR 25	PWF25= 0.4776					
0.30% CLASS B PAVEMENT PATCHING	467	SQ YD	\$175.00	\$81,760		
1.00% CLASS C SHOULDERS PATCHING	908	SQ YD	\$100.00	\$90,844		
				\$172,604	\$31,211	\$14,906
ACTIVITY 5 ---- YEAR 30	PWF30= 0.4120					
4.00% CLASS B PAVEMENT PATCHING	6,229	SQ YD	\$175.00	\$1,090,133		
1.50% CLASS C SHOULDERS PATCHING	1,363	SQ YD	\$100.00	\$136,267		
2.25 " HMA OVERLAY OF PAVEMENT	19,622	TON	\$8.00	\$1,667,904		
1.50 " HMA OVERLAY OF SHOULDERS	7,631	TON	\$75.00	\$572,320		
				\$3,466,624	\$626,842	\$258,259
ACTIVITY 6 ---- YEAR 35	PWF35= 0.3554					
100% LONGITUDINAL SHOULDER JOINT ROUTING AND SEALING	116,800	LIN FT	\$2.00	\$233,600		
100% CENTER LINE JOINT ROUTING AND SEALING	58,400	LIN FT	\$2.00	\$116,800		
50% RANDOM CRACK ROUTE & SEAL	58,400	LIN FT	\$2.00	\$116,800		
40% REFLEC TRANSVERSE CRACK ROUTE & SEAL	46,720	LIN FT	\$2.00	\$93,440		
0.10% PARTIAL-DEPTH PAVEMENT PATCHING	156	SQ YD	\$15.00	\$2,336		
				\$562,976	\$101,798	\$36,179
ACTIVITY 7 ---- YEAR 40	PWF40= 0.3066					
0.50% CLASS B PAVEMENT PATCHING	779	SQ YD	\$175.00	\$136,267		
100% LONGITUDINAL SHOULDER JOINT ROUTING AND SEALING	116,800	LIN FT	\$2.00	\$233,600		
100% CENTER LINE JOINT ROUTING AND SEALING	58,400	LIN FT	\$2.00	\$116,800		
60% REFLEC TRANSVERSE CRACK ROUTE & SEAL	70,080	LIN FT	\$2.00	\$140,160		
50% RANDOM CRACK ROUTE & SEAL	58,400	LIN FT	\$2.00	\$116,800		
0.50% PARTIAL-DEPTH PAVEMENT PATCHING	779	SQ YD	\$15.00	\$11,680		
				\$755,307	\$136,576	\$41,874
PRESENT REHAB COST PER MILE FOR THE PERIOD OF 40 YEARS					\$455,415	
TOTAL PRESENT COST PER MILE FOR THE PERIOD OF 40 YEARS					\$2,846,696	
PRESENT COST PER MILE PER YEAR			CRF40= 0.0433	\$123,262		

PAVT	5.5303 miles		# OF LANES	# OF EDGES	# OF CLINES	AREA (SQ YD)
	L (FT)	W (FT)				
	29,200					155,733

SHLDR	LENGTH	LT WIDTH	RT WIDTH	# OF LT	# OF RT	AREA
	L(FT)	(FT)	(FT)			(SQ YD)
	29,200		10			90,844

FULL-DEPTH HMA PAVEMENT		FLEXIBLE			
ITEM	QUANTITY	UNIT	UNIT PRICE	PRES CONST COST	PRES CONST COST/MILE
" Polymerized HMA Surface Course Mix "D" N70	17,442	TON	\$82.31	\$1,435,662	
" Polymerized HMA Binder Course IL-19.0, N70	19,622	TON	\$76.20	\$1,495,227	
" HMA Binder Course IL-19.0, N50	69,769	TON	\$72.53	\$5,060,312	
" HMA SHOULDERS	40,698	TON	\$57.62	\$2,335,162	
" SUB-BASE GRAN MATRL TYPE C	25,436	TON	\$18.30	\$457,856	
" PROCESSING MODIFIED SOIL	246,578	SQ YD	\$1.98	\$493,156	
LIME 4% (120 LBS/CU FT OF SOIL)	5,326	TON	\$65.00	\$346,195	
PRESENT CONSTRUCTION COSTS OVER THE PERIOD OF 40 YEARS				\$12,223,570	\$2,210,289

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	116,800	LIN FT	\$2.00	\$233,600		
100%	CL JOINT ROUTING & SEALING (SINGLE LANE PAVING)	58,400	LIN FT	\$2.00	\$116,800		
50%	RANDOM/THERMAL CRACK ROUTING & SEALING (SEE NOTE)	64,240	LIN FT	\$2.00	\$128,480		
0.10%	PARTIAL-DEPTH PAVEMENT PATCHING (MILL & FILL SURFACE)	156	SQ YD	\$15.00	\$2,336		
				\$481,216	\$87,014	\$75,059	
ACTIVITY 2 ---- YEAR 10		PWF10= 0.7441					
100%	LONGITUDINAL SHOULDER JOINT ROUTING & SEALING	116,800	LIN FT	\$2.00	\$233,600		
100%	CENTERLINE JOINT ROUTING & SEALING	58,400	LIN FT	\$2.00	\$116,800		
50%	RANDOM/THERMAL CRACK ROUTING & SEALING (SEE NOTE)	64,240	LIN FT	\$2.00	\$128,480		
0.50%	PARTIAL-DEPTH PAVEMENT PATCHING (MILL & FILL SURFACE)	779	SQ YD	\$15.00	\$11,680		
				\$490,560	\$88,704	\$66,005	
ACTIVITY 3 ---- YEAR 15		PWF15= 0.6419					
2 "	MILLING-PAVEMENT AND SHOULDERS	246,578	SQ YD	\$2.00	\$493,156		
1.0%	PARTIAL-DEPTH PAVEMENT PATCHING (MILL AND FILL ADDITIONAL 2 IN.)	1,557	SQ YD	\$15.00	\$23,360		
2 "	HMA OVERLAY SURFACE POLYMER MIX "D"	17,442	TON	\$85.00	\$1,482,681		
2 "	HMA OVERLAY SHOULDERS	10,175	TON	\$75.00	\$763,093		
				\$2,762,190	\$499,465	\$320,606	
ACTIVITY 4 ---- YEAR 20		PWF20= 0.5537					
100%	LONGITUDINAL SHOULDER JOINT ROUTING & SEALING	116,800	LIN FT	\$2.00	\$233,600		
100%	CENTERLINE JOINT ROUTING & SEALING	58,400	LIN FT	\$2.00	\$116,800		
50%	RANDOM/THERMAL CRACK ROUTING & SEALING (SEE NOTE)	64,240	LIN FT	\$2.00	\$128,480		
0.10%	PARTIAL-DEPTH PAVEMENT PATCHING (MILL & FILL SURFACE)	156	SQ YD	\$15.00	\$2,336		
				\$481,216	\$87,014	\$48,180	
ACTIVITY 5 ---- YEAR 25		PWF25= 0.4776					
100%	LONGITUDINAL SHOULDER JOINT ROUTING & SEALING	116,800	LIN FT	\$2.00	\$233,600		
100%	CENTERLINE JOINT ROUTING & SEALING	58,400	LIN FT	\$2.00	\$116,800		
50%	RANDOM/THERMAL CRACK ROUTING & SEALING (SEE NOTE)	64,240	LIN FT	\$2.00	\$128,480		
0.50%	PARTIAL-DEPTH PAVEMENT PATCHING (MILL & FILL SURFACE)	779	SQ YD	\$15.00	\$11,680		
				\$490,560	\$88,704	\$42,365	
ACTIVITY 6 ---- YEAR 30		PWF30= 0.4120					
2 "	MILLING PAVEMENT AND SHOULDERS	246,578	SQ YD	\$2.00	\$493,156		
2.0%	PARTIAL-DEPTH PAVEMENT PATCHING (MILL AND FILL)	3,115	SQ YD	\$15.00	\$46,720		
1.0%	PARTIAL-DEPTH SHOULDERS PATCHING (MILL AND FILL)	908	SQ YD	\$15.00	\$13,627		
3.75 "	HMA OVERLAY-PAVT POLYMER MIX "D"	32,704	TON	\$85.00	\$2,779,840		
1.75 "	HMA OVERLAY-SHOULDERS	8,903	TON	\$75.00	\$667,707		
				\$4,001,049	\$723,477	\$298,073	
ACTIVITY 7 ---- YEAR 35		PWF35= 0.3554					
100%	LONGITUDINAL SHOULDER JOINT ROUTING & SEALING	116,800	LIN FT	\$2.00	\$233,600		
100%	CENTERLINE JOINT ROUTING & SEALING	58,400	LIN FT	\$2.00	\$116,800		
50%	RANDOM/THERMAL CRACK ROUTING & SEALING (SEE NOTE)	64,240	LIN FT	\$2.00	\$128,480		
0.10%	PARTIAL-DEPTH PAVEMENT PATCHING (MILL & FILL SURFACE)	156	SQ YD	\$15.00	\$2,336		
				\$481,216	\$87,014	\$30,925	
ACTIVITY 8 ---- YEAR 40		PWF40= 0.3066					
100%	LONGITUDINAL SHOULDER JOINT ROUTING & SEALING	116,800	LIN FT	\$2.00	\$233,600		
100%	CENTERLINE JOINT ROUTING & SEALING	58,400	LIN FT	\$2.00	\$116,800		
50%	RANDOM/THERMAL CRACK ROUTING & SEALING (SEE NOTE)	64,240	LIN FT	\$2.00	\$128,480		
0.50%	PARTIAL-DEPTH PAVEMENT PATCHING (MILL & FILL SURFACE)	779	SQ YD	\$15.00	\$11,680		
				\$490,560	\$88,704	\$27,197	
PRESENT REHAB COST PER MILE FOR THE PERIOD OF 40 YEARS							\$908,409
TOTAL PRESENT COST PER MILE FOR THE PERIOD OF 40 YEARS							\$3,118,698
PRESENT COST PER MILE PER YEAR		CRF40= 0.0433					\$136,040

COST SUMMARY

RIGID PAVEMENT

INITIAL CONSTRUCTION COST/MILE OVER 40 YEARS: 2,391,281
REHAB COST/MILE OVER 40 YEARS: 455,415
TOTAL COST/MILE OVER 40 YEARS: 2,846,696

RIGID TOTAL COST PER MILE OVER 1 YEAR: \$123,262

FLEXIBLE PAVEMENT

INITIAL CONSTRUCTION COST/MILE OVER 40 YEARS: 2,210,289
REHAB COST/MILE OVER 40 YEARS: 908,409
TOTAL COST/MILE OVER 40 YEARS: 3,118,698

FLEXIBLE TOTAL COST PER MILE OVER 1 YEAR: \$135,040

PERCENT DIFFERENCE = 9.6%

RECOMMENDATION

The preferred type of Pavement would be the RIGID Pavement. The Choice is based on the cost of the Proposed Pavement.