



# Illinois Department of Transportation

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To: Joseph E. Crowe      Attn: District Four  
From: John D. Baranzelli      *John D. Baranzelli*  
Subject: Pavement Design  
Date: April 4, 2012

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FAP Route 313 (US Route 34)  
Section (4,5)  
Warren County  
From Kirkwood to Monmouth

We have reviewed the pavement selection for the above captioned section, which was submitted by email dated January 23, 2012. The project will construct new pavement and tie-in with the proposed Biggsville Bypass. Based on life cycle costs, the rigid option was less expensive than the HMA design, with the cost difference being < 10%. The district would like to match the approved pavement design for the Biggsville Bypass. No objections were received from the Pavement Selection Committee.

The approved pavement design is as follows:

US Route 34 from Kirkwood to Monmouth (Pavement Construction)

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.

PAVEMENT DESIGN AND SELECTION

FAP : **FAP 313 (US 34)**  
 SECTION : **(4,5)I**  
 COUNTY : **WARREN**  
 CATALOG : **031314-01D**  
 JOB : **D-94-043-02**  
 CONTRACT: **68234**

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 :	OTHER PRINCIPLE ARTERIAL

2009 TRAFFIC	
ADT =	4,650
PV =	3,675      79.03%
SU =	225      4.84%
MU =	750      16.13%

2024 TRAFFIC	
ADT =	5,814
PV =	4,595
SU =	281
MU =	938

SUMMARY

The Proposed work consists of the constructing a new alignment for U.S. 34 from Kirkwood to Monmouth. (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 7.400 miles (39,072 ft). The right and left shoulders will be 10' and 4' wide respectively. The total amount of new pavement to be constructed is 208,384 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 inches.

COST SUMMARY

<b>RIGID PAVEMENT</b>	
INITIAL CONSTRUCTION COST/MILE:	2,391,281
REHAB COST/MILE:	455,415
TOTAL COST/MILE:	2,846,696

RIGID TOTAL COST PER MILE OVER 1 YEAR:	\$128,290
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<b>FLEXIBLE PAVEMENT</b>	
INITIAL CONSTRUCTION COST/MILE:	2,180,248
REHAB COST/MILE:	908,409
TOTAL COST/MILE:	3,088,657

FLEXIBLE TOTAL COST PER MILE OVER 1 YEAR:	\$139,194
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DIFFERENCE =	\$10,904
PERCENT DIFFERENCE =	8.5%

RECOMMENDATION

The preferred type of Pavement, for this project, would be the **FLEXIBLE** Pavement. The selection is based on maintaining continuity of pavement type for the entire project from Monmouth to ~~Geiffport~~ <sup>Gulfport</sup>. The previously submitted sections of US 34 were approved for the Flexible pavement option. (See attached approval)

# PROPOSED FEDERAL AID HIGHWAY PLANS

F.A.P. ROUTE 313 (U.S. ROUTE 34)  
SECTION (4, 5) I

PROJECT  
WEST OF KIRKWOOD TO U.S. 34 / 67 INTERCHANGE  
FOUR LANE EXPRESSWAY - PARTIAL ACCESS CONTROL  
WARREN COUNTY  
C-94-050-02

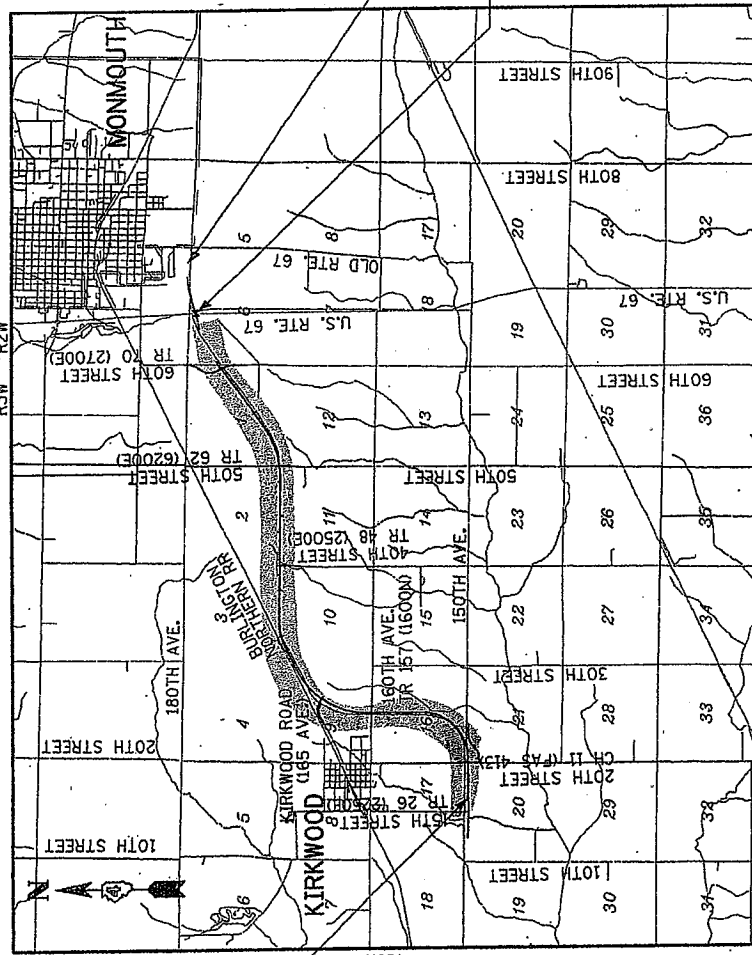
- U.S. ROUTE 34
- SIDE ROADS
- INTERCHANGE RAMPS
- ACCESS ROAD #1

- E 1A
- E 1B
- E 1C
- E 2
- E 3

- FAGE 1A
- FAGE 1B
- FAGE 1C
- FAGE 2
- FAGE 3

- 3- U.S. ROUTE 34
- 3- SIDE ROADS
- 3- INTERCHANGE RAMPS
- 3- ACCESS ROAD #1

OVER U.S. ROUTE 67 SN 094-0041



LOCATION MAP



RD

EMENTS

- HORIZONTAL  
L RURAL PROFILE - VERTICAL

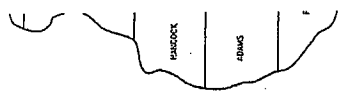
3 - HORIZONTAL

25

LOCATION I

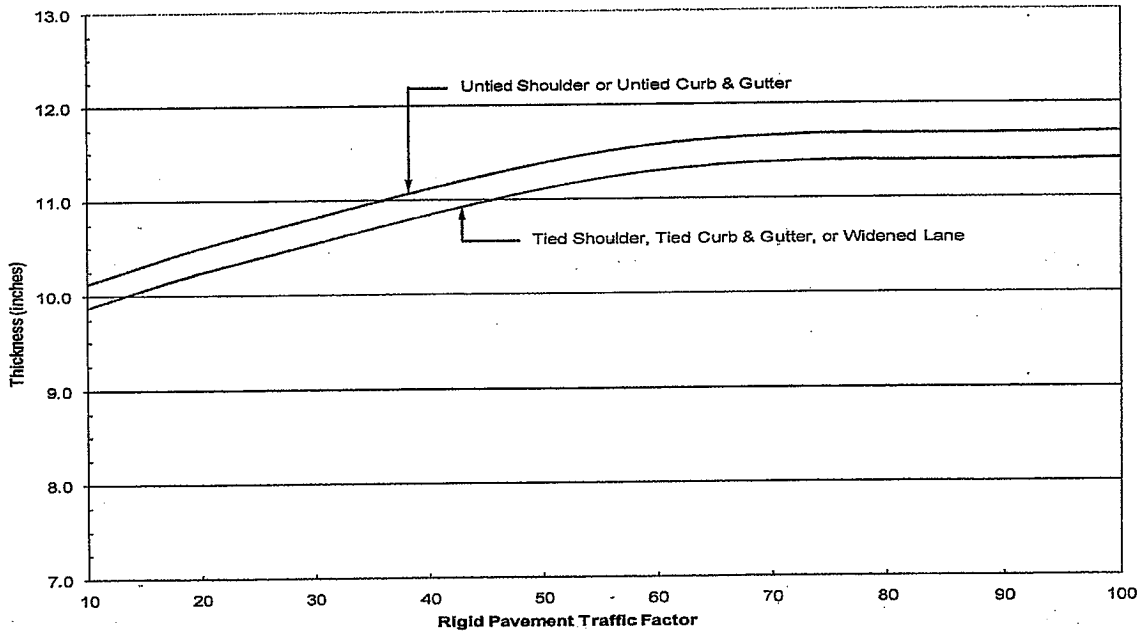
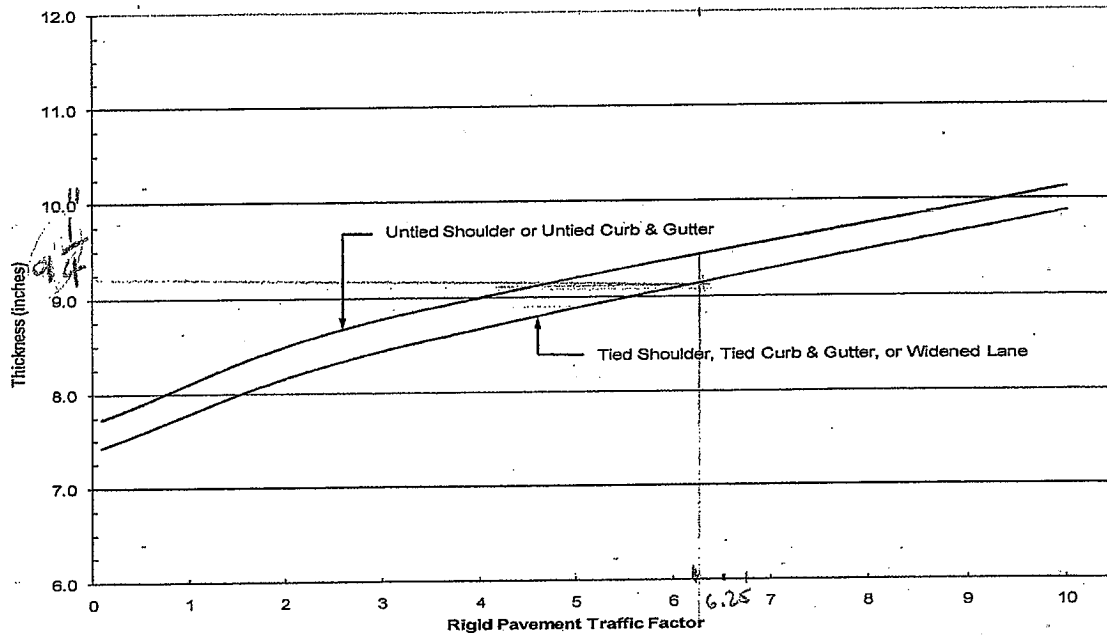
SUBMITT

SIGNATURE  
DATE SHEET  
LICENSE  
EXPIRES



RIGID		N	CPV	P	PV	CSU	S	SU	CMU	M	MU	
TF (actual) =	X	20	( 0.15 X 0.32 X 15.31 ) + ( 15.31 X 0.45 X 71 ) + ( 696.42 X 0.45 X 938 )			1,000,000						= 6.25
TF (Min) =	X	20	( 0.15 X 0.32 X 143.81 ) + ( 143.81 X 0.45 X 250 ) + ( 696.42 X 0.45 X 750 )			1,000,000						= 5.02

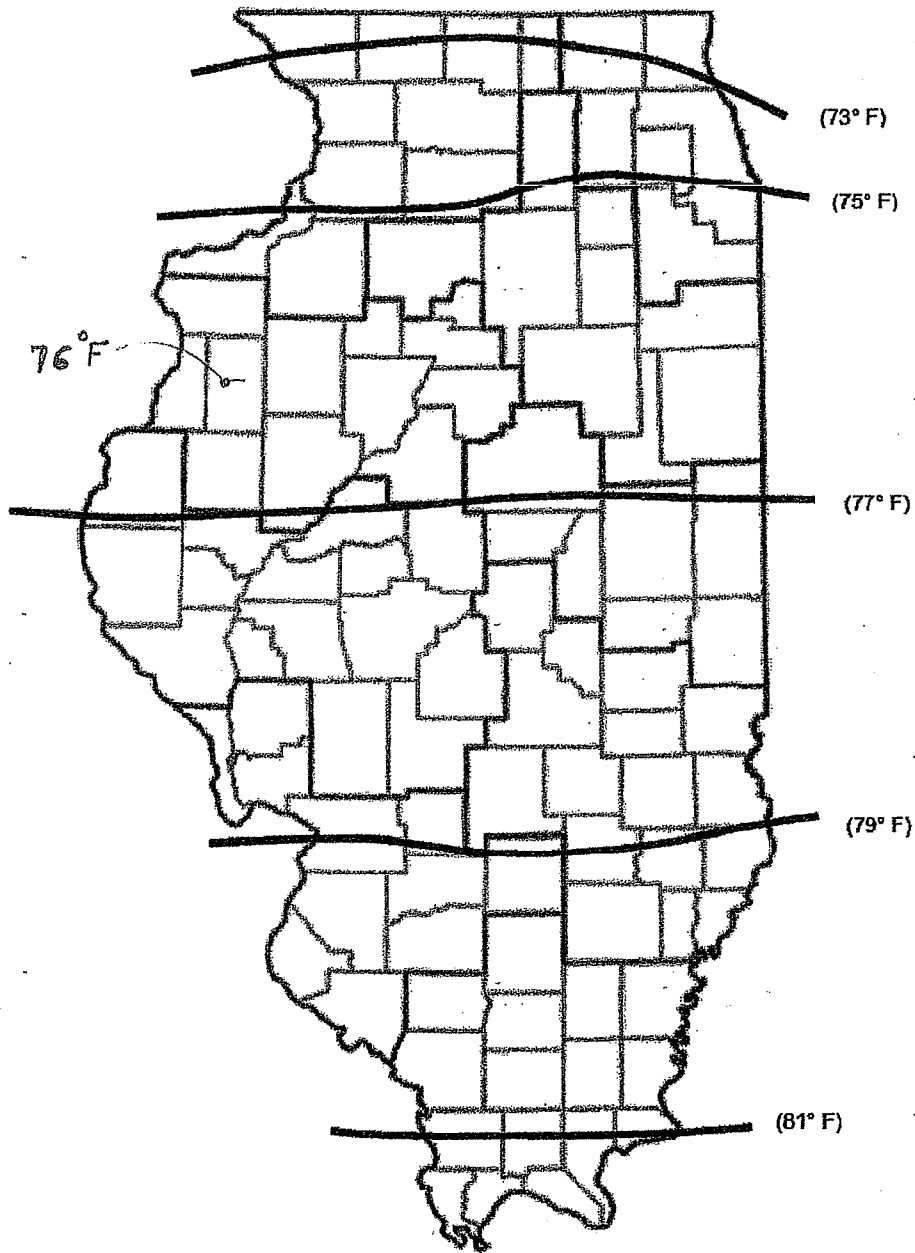
FLEXIBLE		N	CPV	P	PV	CSU	S	SU	CMU	M	MU	
TF (actual) =	X	20	( 0.15 X 0.32 X 132.50 ) + ( 132.50 X 0.45 X 281 ) + ( 482.53 X 0.45 X 938 )			1,000,000						= 4.41
TF (Min) =	X	20	( 0.15 X 0.32 X 0 ) + ( 132.50 X 0.45 X 250 ) + ( 482.53 X 0.45 X 750 )			1,000,000						= 3.56



Note: Use of untied shoulder design requires BDE approval.

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

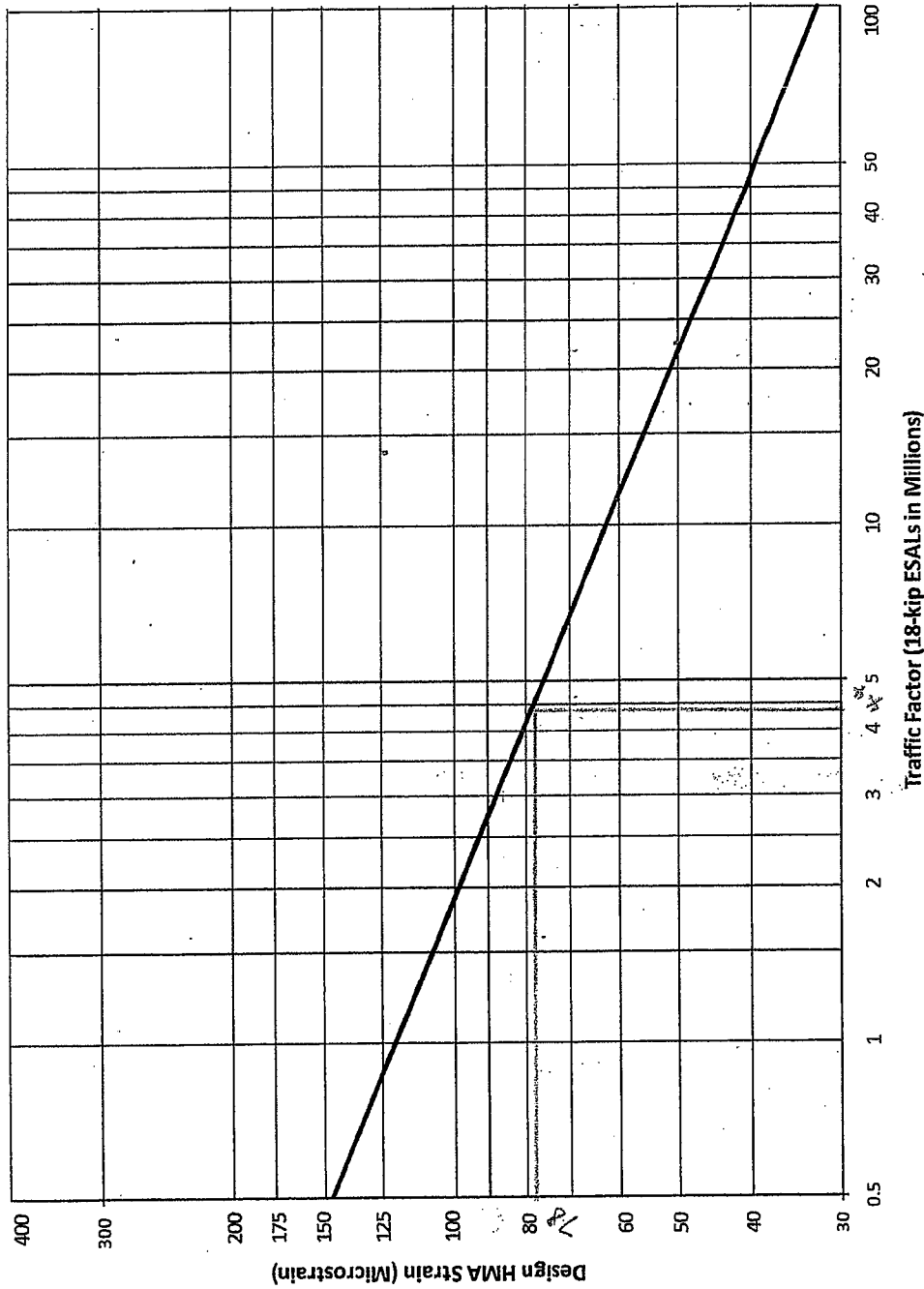
Figure 54-4.E



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

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

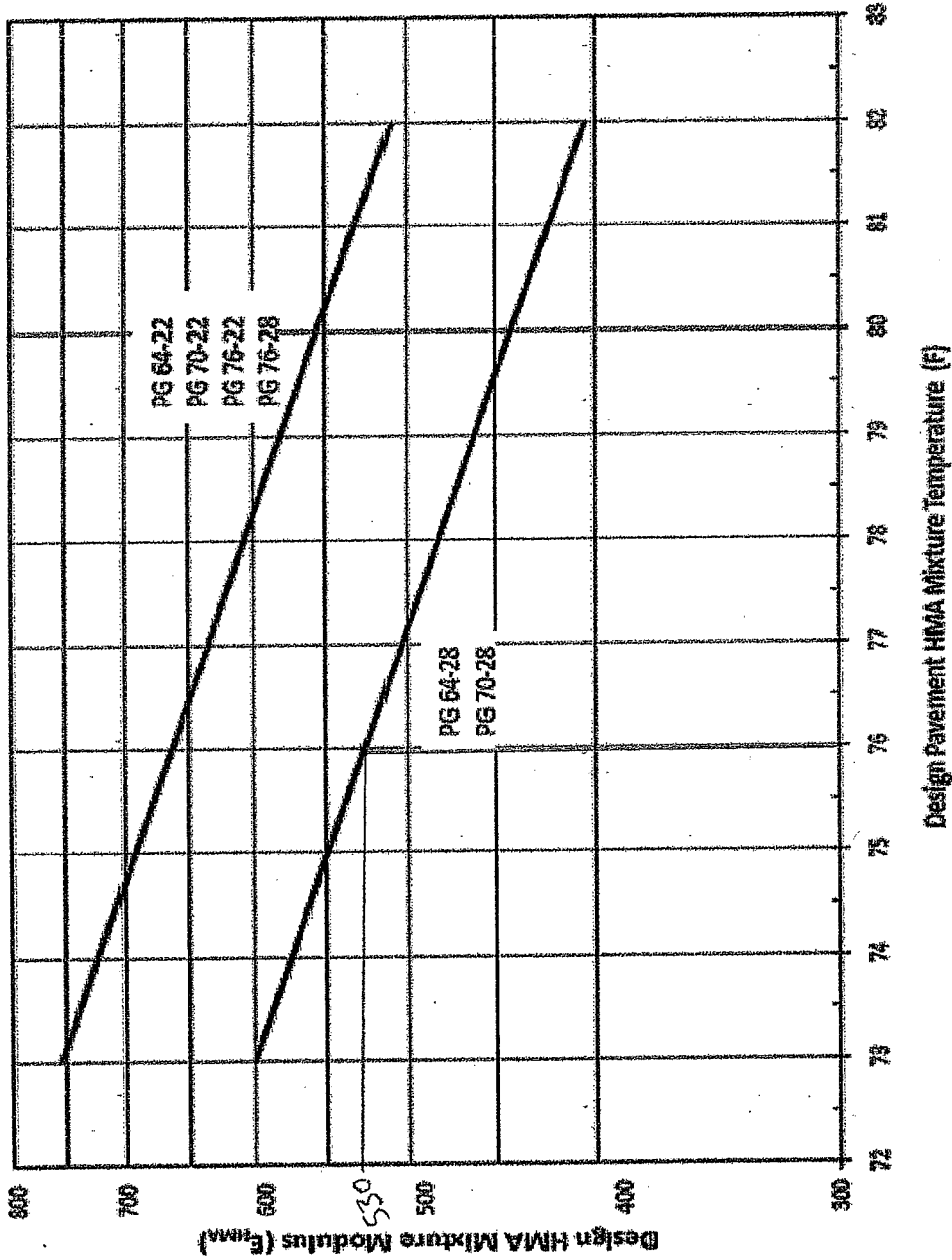
Figure 54-5.C



**DESIGN HMA STRAIN**  
**(Mechanistic Design: Flexible Pavement)**

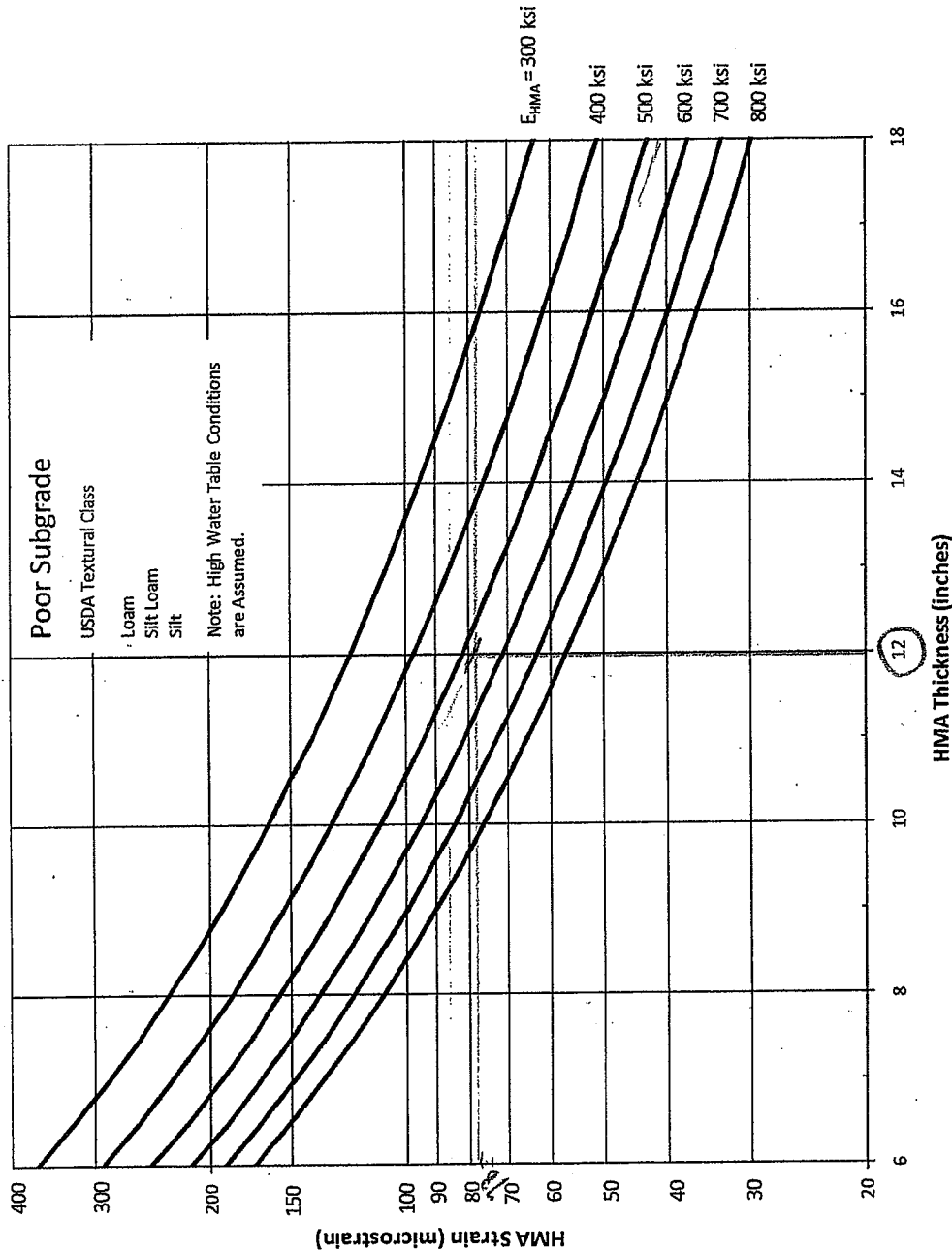
**Figure 54-5.E**





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

Figure 54-5.D



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

Figure 54-5.F

**JOINTED PLAIN CONCRETE PAVEMENT**

**RIGID**

ITEM	QUANTITY	UNIT	UNIT PRICE	PRES CONST COST	PRES CONST COST/MILE
0.75" PCC PAVEMENT	220,533	SQ YD	\$42.00	\$9,262,400	
" STABILIZED SUB-BASE	220,533	SQ YD	\$15.00	\$3,308,000	
" CONCRETE SHOULDERS	128,644	SQ YD	\$30.00	\$3,859,333	
" SUB-BASE GRAN MATRL TYPE C	43,225	TON	\$18.00	\$778,042	
LONGITUDINAL SHOULDER JOINT ROUTING AND SEALING	165,400	LIN FT	\$2.00	\$330,800	
" PROCESSING MODIFIED SOIL 12"	349,178	SQ YD	\$2.00	\$698,356	
LIME 4% (120 LBS/CU FT OF SOIL)	7,542	TON	\$65.00	\$490,246	
<b>PRESENT CONSTRUCTION COST OVER THE PERIOD OF 40 YEARS</b>				<b>\$18,727,176</b>	<b>\$2,391,281</b>

ACTIVITIES	QUANT	UNIT	UNIT PRICE	FUT REHAB COST	FUT REHAB COST/MILE	PRES REHAB COST/MILE
<b>ACTIVITY 1 ---- YEAR 10</b> PWF10= 0.7441						
0.10% CLASS B PAVEMENT PATCHING	221	SQ YD	\$175.00	\$38,593	\$4,928	\$3,667
<b>ACTIVITY 2 ---- YEAR 15</b> PWF15= 0.6419						
0.20% CLASS B PAVEMENT PATCHING	441	SQ YD	\$175.00	\$77,187	\$9,856	\$6,327
<b>ACTIVITY 3 ---- YEAR 20</b> PWF20= 0.5537						
2.00% CLASS B PAVEMENT PATCHING	4,411	SQ YD	\$175.00	\$771,867		
0.50% CLASS C SHOULDERS PATCHING	643	SQ YD	\$100.00	\$64,322		
100% LONGITUDINAL SHOULDER JOINT ROUTING AND SEALING	165,400	LIN FT	\$2.00	\$330,800		
100% CENTER LINE JOINT ROUTING AND SEALING	82,700	LIN FT	\$2.00	\$165,400		
				\$1,332,389	\$170,133	\$94,203
<b>ACTIVITY 4 ---- YEAR 25</b> PWF25= 0.4776						
0.30% CLASS B PAVEMENT PATCHING	662	SQ YD	\$175.00	\$115,780		
1.00% CLASS C SHOULDERS PATCHING	1,286	SQ YD	\$100.00	\$128,644		
				\$244,424	\$31,211	\$14,906
<b>ACTIVITY 5 ---- YEAR 30</b> PWF30= 0.4120						
4.00% CLASS B PAVEMENT PATCHING	8,821	SQ YD	\$175.00	\$1,543,733		
1.50% CLASS C SHOULDERS PATCHING	1,930	SQ YD	\$100.00	\$192,967		
2.25" HMA OVERLAY OF PAVEMENT	27,787	TON	\$85.00	\$2,361,912		
1.50" HMA OVERLAY OF SHOULDERS	10,806	TON	\$75.00	\$810,460		
				\$4,909,072	\$626,842	\$258,259
<b>ACTIVITY 6 ---- YEAR 35</b> PWF35= 0.3554						
100% LONGITUDINAL SHOULDER JOINT ROUTING AND SEALING	165,400	LIN FT	\$2.00	\$330,800		
100% CENTER LINE JOINT ROUTING AND SEALING	82,700	LIN FT	\$2.00	\$165,400		
-50% RANDOM CRACK ROUTE & SEAL	82,700	LIN FT	\$2.00	\$165,400		
40% REFLEC TRANSVERSE CRACK ROUTE & SEAL	66,160	LIN FT	\$2.00	\$132,320		
0.10% PARTIAL-DEPTH PAVEMENT PATCHING	221	SQ YD	\$15.00	\$3,308		
				\$797,228	\$101,798	\$36,179
<b>ACTIVITY 7 ---- YEAR 40</b> PWF40= 0.3066						
0.50% CLASS B PAVEMENT PATCHING	1,103	SQ YD	\$175.00	\$192,967		
100% LONGITUDINAL SHOULDER JOINT ROUTING AND SEALING	165,400	LIN FT	\$2.00	\$330,800		
100% CENTER LINE JOINT ROUTING AND SEALING	82,700	LIN FT	\$2.00	\$165,400		
60% REFLEC TRANSVERSE CRACK ROUTE & SEAL	99,240	LIN FT	\$2.00	\$198,480		
50% RANDOM CRACK ROUTE & SEAL	82,700	LIN FT	\$2.00	\$165,400		
0.50% PARTIAL-DEPTH PAVEMENT PATCHING	1,103	SQ YD	\$15.00	\$16,540		
				\$1,069,587	\$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

PRESENT COST PER MILE PER YEAR

CRF45= 1.04079

\$128,290

PAVT	7.8314 miles		# OF LANES	# OF EDGES	# OF C LINES	AREA (SQ YD)
	L (FT)	W (FT)				
	41,930	12	3	4	2	220,533

SHLDR	LENGTH (FT)	LT WIDTH (FT)	RT WIDTH (FT)	# OF LT	# OF RT	AREA (SQ YD)
	41,930	12	10	2	2	128,644

FULL-DEPTH HMA PAVEMENT			FLEXIBLE				
ITEM	QUANTITY	UNIT	UNIT PRICE	PRES CONST COST	PRES CONST COST/MILE		
2" PAVEMENT HMA SURFACE CONFORM MIX "D" NYD	24,700	TON	\$82.31	\$2,033,035			
2" PAVEMENT HMA BINDER COURSE MIX "D" NYD	24,700	TON	\$76.20	\$1,882,120			
2" HMA BINDER COURSE TOP COURSE	98,799	TON	\$72.63	\$7,165,887			
HMA SHOULDERS	57,633	TON	\$72.63	\$4,156,471			
2" SUB-BASE GRANULAR FILL	36,020	TON	\$18.40	\$648,368			
2" PREPARED AND BLENDED SOIL	349,178	SQ YD	\$2.00	\$698,356			
2" LIME TREATED SUB-CURVE OF SOIL	7,542	TON	\$65.00	\$490,246			
PRESENT CONSTRUCTION COST OVER THE PERIOD OF 40 YEARS				\$17,074,482		\$2,180,248	
ACTIVITIES		QUANT	UNIT	UNIT PRICE	FUT REHAB COST	FUT REHAB COST/MILE	PRES REHAB COST/MILE
<b>ACTIVITY 1 ---- YEAR 5</b>		PWF5= 0.8626					
100%	LONGITUDINAL SHOULDER JOINT ROUTING & SEALING	165,400	LIN FT	\$2.00	\$330,800		
100%	CL JOINT ROUTING & SEALING (SINGLE LANE PAVING)	82,700	LIN FT	\$2.00	\$165,400		
50%	RANDOM/THERMAL CRACK ROUTING & SEALING (SEE NOTE)	90,970	LIN FT	\$2.00	\$181,940		
0.10%	PARTIAL-DEPTH PAVEMENT PATCHING (MILL & FILL SURFACE)	221	SQ YD	\$15.00	\$3,308		
				\$681,448	\$87,014	\$75,059	
<b>ACTIVITY 2 ---- YEAR 10</b>		PWF10= 0.7441					
100%	LONGITUDINAL SHOULDER JOINT ROUTING & SEALING	165,400	LIN FT	\$2.00	\$330,800		
100%	CENTERLINE JOINT ROUTING & SEALING	82,700	LIN FT	\$2.00	\$165,400		
50%	RANDOM/THERMAL CRACK ROUTING & SEALING (SEE NOTE)	90,970	LIN FT	\$2.00	\$181,940		
0.50%	PARTIAL-DEPTH PAVEMENT PATCHING (MILL & FILL SURFACE)	1,103	SQ YD	\$15.00	\$16,540		
				\$694,680	\$88,704	\$66,005	
<b>ACTIVITY 3 ---- YEAR 15</b>		PWF15= 0.6419					
2	MILLING-PAVEMENT AND SHOULDERS	349,178	SQ YD	\$2.00	\$698,356		
1.0%	PARTIAL-DEPTH PAVEMENT PATCHING (MILL AND FILL ADDITIONAL 2 IN.)	2,205	SQ YD	\$15.00	\$33,080		
2	HMA OVERLAY SURFACE POLYMER MIX "D"	24,700	TON	\$85.00	\$2,099,477		
2	HMA OVERLAY SHOULDERS	14,408	TON	\$75.00	\$1,080,613		
				\$3,911,526	\$499,465	\$320,606	
<b>ACTIVITY 4 ---- YEAR 20</b>		PWF20= 0.5537					
100%	LONGITUDINAL SHOULDER JOINT ROUTING & SEALING	165,400	LIN FT	\$2.00	\$330,800		
100%	CENTERLINE JOINT ROUTING & SEALING	82,700	LIN FT	\$2.00	\$165,400		
50%	RANDOM/THERMAL CRACK ROUTING & SEALING (SEE NOTE)	90,970	LIN FT	\$2.00	\$181,940		
0.10%	PARTIAL-DEPTH PAVEMENT PATCHING (MILL & FILL SURFACE)	221	SQ YD	\$15.00	\$3,308		
				\$681,448	\$87,014	\$48,180	
<b>ACTIVITY 5 ---- YEAR 25</b>		PWF25= 0.4776					
100%	LONGITUDINAL SHOULDER JOINT ROUTING & SEALING	165,400	LIN FT	\$2.00	\$330,800		
100%	CENTERLINE JOINT ROUTING & SEALING	82,700	LIN FT	\$2.00	\$165,400		
50%	RANDOM/THERMAL CRACK ROUTING & SEALING (SEE NOTE)	90,970	LIN FT	\$2.00	\$181,940		
0.50%	PARTIAL-DEPTH PAVEMENT PATCHING (MILL & FILL SURFACE)	1,103	SQ YD	\$15.00	\$16,540		
				\$694,680	\$88,704	\$42,365	
<b>ACTIVITY 6 ---- YEAR 30</b>		PWF30= 0.4120					
2	MILLING PAVEMENT AND SHOULDERS	349,178	SQ YD	\$2.00	\$698,356		
2.0%	PARTIAL-DEPTH PAVEMENT PATCHING (MILL AND FILL)	4,411	SQ YD	\$15.00	\$66,160		
1.0%	PARTIAL-DEPTH SHOULDERS PATCHING (MILL AND FILL)	1,286	SQ YD	\$15.00	\$19,297		
3.75	HMA OVERLAY-PAVT POLYMER MIX "D"	46,312	TON	\$85.00	\$3,936,520		
1.75	HMA OVERLAY-SHOULDERS	12,607	TON	\$75.00	\$945,537		
				\$5,665,869	\$723,477	\$298,073	
<b>ACTIVITY 7 ---- YEAR 35</b>		PWF35= 0.3554					
100%	LONGITUDINAL SHOULDER JOINT ROUTING & SEALING	165,400	LIN FT	\$2.00	\$330,800		
100%	CENTERLINE JOINT ROUTING & SEALING	82,700	LIN FT	\$2.00	\$165,400		
50%	RANDOM/THERMAL CRACK ROUTING & SEALING (SEE NOTE)	90,970	LIN FT	\$2.00	\$181,940		
0.10%	PARTIAL-DEPTH PAVEMENT PATCHING (MILL & FILL SURFACE)	221	SQ YD	\$15.00	\$3,308		
				\$681,448	\$87,014	\$30,925	
<b>ACTIVITY 8 ---- YEAR 40</b>		PWF40= 0.3066					
100%	LONGITUDINAL SHOULDER JOINT ROUTING & SEALING	165,400	LIN FT	\$2.00	\$330,800		
100%	CENTERLINE JOINT ROUTING & SEALING	82,700	LIN FT	\$2.00	\$165,400		
50%	RANDOM/THERMAL CRACK ROUTING & SEALING (SEE NOTE)	90,970	LIN FT	\$2.00	\$181,940		
0.50%	PARTIAL-DEPTH PAVEMENT PATCHING (MILL & FILL SURFACE)	1,103	SQ YD	\$15.00	\$16,540		
				\$694,680	\$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						\$3,088,657	
PRESENT COST PER MILE PER YEAR		CRF40= 0.0433				\$133,739	
PRESENT COST PER MILE PER YEAR		CRF45= 1.04079				\$139,194	



# Illinois Department of Transportation

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

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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.