FAP Route 313 (US Route 34)
Section (4,5)l
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)
COUNTY: WARREN
CATALOG: 031314-01D
JOB: D-94-043-02
CONTRACT: 68234

ROUTE: CLASS I
NO. OF LANES: 4 LANES
DESIGN PERIOD: 20 YEARS
TRAFFIC GROWTH FACTOR: 1.50%
CONSTRUCTION YEAR: 2014

MIX TYPE: PG70-28
MIX TEMPERATURE: 76 F
TIED OR UNTIED SHOULDERS: TIED
SUBGRADE SUPPORT RATING: POOR
FACILITY TYPE: OTHER PRINCIPLE ARTERIAL

<table>
<thead>
<tr>
<th>2009 TRAFFIC</th>
<th>2024 TRAFFIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>AdT = 4,650</td>
<td>AdT = 5,814</td>
</tr>
<tr>
<td>PV = 3,675</td>
<td>PV = 4,595</td>
</tr>
<tr>
<td>SU = 225</td>
<td>SU = 281</td>
</tr>
<tr>
<td>MU = 750</td>
<td>MU = 938</td>
</tr>
</tbody>
</table>

79.03%
4.84%
16.13%

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

<table>
<thead>
<tr>
<th>RIGID PAVEMENT</th>
<th>FLEXIBLE PAVEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Construction Cost/Mile:</td>
<td>2,391,281</td>
</tr>
<tr>
<td>Rehab Cost/Mile:</td>
<td>455,415</td>
</tr>
<tr>
<td>Total Cost/Mile:</td>
<td>2,846,696</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rigid Total Cost Per Mile Over 1 Year:</th>
<th>$128,290</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexible Total Cost Per Mile Over 1 Year:</td>
<td>$139,194</td>
</tr>
</tbody>
</table>

**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 Gulfport. 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

LOCATION MAP

BEGIN PROJECT
STA. 101+426.80
(U.S. 34)

END PROJECT
STA. 473+485.27
(U.S. 34)

PROPOSED WIDENING OF EXISTING TWO-SPAN STRUCTURE (S.N. 094-0041)
CARRYING U.S. ROUTE 34 OVER U.S. ROUTE 67
STA. 446+64.29 @ E.
LENGTH 222'-0" BK. TO BK.
TO BE CONSTRUCTED UNDER THIS CONTRACT
TF (actual) = \[ 20 \times \left( \frac{CPV \times P \times PV}{1,000,000} \right) + \left( \frac{CSU \times S \times SU}{1,000,000} \right) + \left( \frac{CMU \times M \times MU}{1,000,000} \right) \]

\[ = 6.25 \]

TF (Min) = \[ 20 \times \left( \frac{CPV \times P \times PV}{1,000,000} \right) + \left( \frac{CSU \times S \times SU}{1,000,000} \right) + \left( \frac{CMU \times M \times MU}{1,000,000} \right) \]

\[ = 5.02 \]
Note: Use of untied shoulder design requires BDE approval.

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

Figure 54-4.E

54-4.6 HARD COPIES UNCONTROLLED
Note: The minimum design HMA mixture temperature will be 73°F.

HMA MIXTURE TEMPERATURE
(Mechanistic Design: Flexible Pavement)

Figure 54-5.C
### JOINTED PLAIN CONCRETE PAVEMENT

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QUANTITY</th>
<th>UNIT</th>
<th>UNIT PRICE</th>
<th>PRES. CONST. COST</th>
<th>PRES. CONST. COST/MI</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCC PAVEMENT</td>
<td>220,533</td>
<td>SQ YD</td>
<td>$62,052.60</td>
<td>$9,262,400</td>
<td></td>
</tr>
<tr>
<td>STABILIZED SUB-BASE</td>
<td>220,533</td>
<td>SQ YD</td>
<td>$30,007.63</td>
<td>$3,308,000</td>
<td></td>
</tr>
<tr>
<td>CONCRETE SHOULDERS</td>
<td>128,844</td>
<td>SQ YD</td>
<td>$23,078.02</td>
<td>$3,069,333</td>
<td></td>
</tr>
<tr>
<td>SUB-BASE GRAN MATRIL TYPE C</td>
<td>43,225</td>
<td>TON</td>
<td>$158,577.47</td>
<td>$778,042</td>
<td></td>
</tr>
<tr>
<td>LONGITUDINAL SHOULDER JOINT ROUTING AND SEALING</td>
<td>165,400</td>
<td>LIN FT</td>
<td>$29,020.12</td>
<td>$330,800</td>
<td></td>
</tr>
<tr>
<td>PROCESSING MODIFIED SOIL 12&quot;</td>
<td>349,178</td>
<td>SQ YD</td>
<td>$20,007.63</td>
<td>$698,356</td>
<td></td>
</tr>
<tr>
<td>LIME 4% (120 LBS/CU FT OF SoIL)</td>
<td>7,542</td>
<td>TON</td>
<td>$39,566.24</td>
<td>$400,246</td>
<td></td>
</tr>
</tbody>
</table>

**Present Construction Cost Over the Period of 40 Years:** $16,727,176

**Total Present Cost Per Mile for the Period of 40 Years:** $2,846,696

### ACTIVITIES

#### ACTIVITY 1 - YEAR 10

<table>
<thead>
<tr>
<th>QUANT</th>
<th>UNIT</th>
<th>UNIT PRICE</th>
<th>FUT. REHAB COST</th>
<th>FUT. REHAB COST/MI</th>
<th>PRE. REHAB COST/MI</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.10%</td>
<td>CLASS B PAVEMENT PATCHING</td>
<td>221</td>
<td>SQ YD</td>
<td>$175.00</td>
<td>$38,593</td>
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</tbody>
</table>

#### ACTIVITY 2 - YEAR 15

<table>
<thead>
<tr>
<th>QUANT</th>
<th>UNIT</th>
<th>UNIT PRICE</th>
<th>FUT. REHAB COST</th>
<th>FUT. REHAB COST/MI</th>
<th>PRE. REHAB COST/MI</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.20%</td>
<td>CLASS B PAVEMENT PATCHING</td>
<td>441</td>
<td>SQ YD</td>
<td>$175.00</td>
<td>$77,187</td>
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</table>

#### ACTIVITY 3 - YEAR 20

<table>
<thead>
<tr>
<th>QUANT</th>
<th>UNIT</th>
<th>UNIT PRICE</th>
<th>FUT. REHAB COST</th>
<th>FUT. REHAB COST/MI</th>
<th>PRE. REHAB COST/MI</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.05%</td>
<td>CLASS B PAVEMENT PATCHING</td>
<td>2,000</td>
<td>SQ YD</td>
<td>$175.00</td>
<td>$100.00</td>
</tr>
<tr>
<td>0.05%</td>
<td>CENTER LINE JOINT ROUTING AND SEALING</td>
<td>165,400</td>
<td>LIN FT</td>
<td>$2.00</td>
<td>$330,800</td>
</tr>
<tr>
<td>1.00%</td>
<td>CENTER LINE JOINT ROUTING AND SEALING</td>
<td>82,700</td>
<td>LIN FT</td>
<td>$2.00</td>
<td>$165,400</td>
</tr>
</tbody>
</table>

**Total Present Cost Per Mile for the Period of 40 Years:** $170,133

**Total Present Cost Per Mile for the Period of 40 Years:** $94,203

#### ACTIVITY 4 - YEAR 25

<table>
<thead>
<tr>
<th>QUANT</th>
<th>UNIT</th>
<th>UNIT PRICE</th>
<th>FUT. REHAB COST</th>
<th>FUT. REHAB COST/MI</th>
<th>PRE. REHAB COST/MI</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.30%</td>
<td>CLASS B PAVEMENT PATCHING</td>
<td>662</td>
<td>SQ YD</td>
<td>$175.00</td>
<td>$115,780</td>
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#### ACTIVITY 5 - YEAR 30

<table>
<thead>
<tr>
<th>QUANT</th>
<th>UNIT</th>
<th>UNIT PRICE</th>
<th>FUT. REHAB COST</th>
<th>FUT. REHAB COST/MI</th>
<th>PRE. REHAB COST/MI</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.00%</td>
<td>CLASS B PAVEMENT PATCHING</td>
<td>8,821</td>
<td>SQ YD</td>
<td>$175.00</td>
<td>$1,543,733</td>
</tr>
<tr>
<td>1.50%</td>
<td>CENTER LINE JOINT ROUTING AND SEALING</td>
<td>1,930</td>
<td>SQ YD</td>
<td>$100.00</td>
<td>$192,967</td>
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</tbody>
</table>

#### ACTIVITY 6 - YEAR 35

<table>
<thead>
<tr>
<th>QUANT</th>
<th>UNIT</th>
<th>UNIT PRICE</th>
<th>FUT. REHAB COST</th>
<th>FUT. REHAB COST/MI</th>
<th>PRE. REHAB COST/MI</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>LONGITUDINAL SHOULDER JOINT ROUTING AND SEALING</td>
<td>165,400</td>
<td>LIN FT</td>
<td>$2.00</td>
<td>$330,800</td>
</tr>
<tr>
<td>100%</td>
<td>CENTER LINE JOINT ROUTING AND SEALING</td>
<td>82,700</td>
<td>LIN FT</td>
<td>$2.00</td>
<td>$165,400</td>
</tr>
<tr>
<td>100%</td>
<td>CENTER LINE JOINT ROUTING AND SEALING</td>
<td>82,700</td>
<td>LIN FT</td>
<td>$2.00</td>
<td>$165,400</td>
</tr>
<tr>
<td>0.10%</td>
<td>HMA OVERLAY OF PAVEMENT</td>
<td>27,787</td>
<td>TON</td>
<td>$81,040.00</td>
<td>$2,361,912</td>
</tr>
<tr>
<td>1.50%</td>
<td>HMA OVERLAY OF PAVEMENT</td>
<td>10,808</td>
<td>TON</td>
<td>$81,040.00</td>
<td>$810,460</td>
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</table>

#### ACTIVITY 7 - YEAR 40

<table>
<thead>
<tr>
<th>QUANT</th>
<th>UNIT</th>
<th>UNIT PRICE</th>
<th>FUT. REHAB COST</th>
<th>FUT. REHAB COST/MI</th>
<th>PRE. REHAB COST/MI</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.50%</td>
<td>CLASS B PAVEMENT PATCHING</td>
<td>1,103</td>
<td>SQ YD</td>
<td>$175.00</td>
<td>$192,967</td>
</tr>
<tr>
<td>100%</td>
<td>LONGITUDINAL SHOULDER JOINT ROUTING AND SEALING</td>
<td>165,400</td>
<td>LIN FT</td>
<td>$2.00</td>
<td>$330,800</td>
</tr>
<tr>
<td>100%</td>
<td>CENTER LINE JOINT ROUTING AND SEALING</td>
<td>82,700</td>
<td>LIN FT</td>
<td>$2.00</td>
<td>$165,400</td>
</tr>
<tr>
<td>60%</td>
<td>REFLEC TRANSVERSE CRACK ROUTE &amp; SEAL</td>
<td>66,160</td>
<td>LIN FT</td>
<td>$2.00</td>
<td>$132,320</td>
</tr>
<tr>
<td>50%</td>
<td>RANDOM CRACK ROUTE &amp; SEAL</td>
<td>82,700</td>
<td>LIN FT</td>
<td>$2.00</td>
<td>$165,400</td>
</tr>
<tr>
<td>0.50%</td>
<td>PARTIAL-DEPTH PAVEMENT PATCHING</td>
<td>1,103</td>
<td>SQ YD</td>
<td>$15.00</td>
<td>$16,540</td>
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**Total Present Cost Per Mile for the Period of 40 Years:** $138,576

**Total Present Cost Per Mile for the Period of 40 Years:** $41,874

#### CRF40 = 0.0433

**Present Cost per Mile for the Period of 40 Years:** $123,262

#### CRF45 = 1.04079

**Present Cost per Mile for the Period of 40 Years:** $128,290
### FULL-DEPTH HMA PAVEMENT

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QUANTITY</th>
<th>UNIT</th>
<th>UNIT PRICE</th>
<th>PREV COST</th>
<th>FUT REHAB COST</th>
<th>PREV COST</th>
<th>FUT REHAB COST</th>
<th>PREV COST</th>
<th>FUT REHAB COST</th>
<th>PREV COST</th>
<th>FUT REHAB COST</th>
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</tbody>
</table>

- **ACTIVITY 1 --- YEAR 5**  
  - PWF5 = 0.8626
  - LONDTIONAL SHOULDER JOINT ROUTING & SEALING  
    - 100%  
    - 165,400 LIN FT  
    - FUT $2,000.00  
    - PREV $330,000
  - CENTRELINE JOINT ROUTING & SEALING  
    - 82,700 LIN FT  
    - FUT $2,000.00  
    - PREV $165,000
  - RANDOM/TEMPERATURE CRACK ROUTING & SEALING (SEE NOTE)  
    - 90,070 LIN FT  
    - FUT $2,000.00  
    - PREV $181,940
  - PARTIAL-DEPTH PAVEMENT PATCHING (MILL & FILL SURFACE)  
    - 221 SQ YD  
    - FUT $15.00  
    - PREV $3,308

- **ACTIVITY 2 --- YEAR 10**  
  - PWF10 = 0.7441
  - LONDTIONAL SHOULDER JOINT ROUTING & SEALING  
    - 165,400 LIN FT  
    - FUT $2,000.00  
    - PREV $330,000
  - CENTRELINE JOINT ROUTING & SEALING  
    - 82,700 LIN FT  
    - FUT $2,000.00  
    - PREV $165,000
  - RANDOM/TEMPERATURE CRACK ROUTING & SEALING (SEE NOTE)  
    - 90,070 LIN FT  
    - FUT $2,000.00  
    - PREV $181,940
  - PARTIAL-DEPTH PAVEMENT PATCHING (MILL & FILL SURFACE)  
    - 1,103 SQ YD  
    - FUT $15.00  
    - PREV $1,860,012

- **ACTIVITY 3 --- YEAR 15**  
  - PWF15 = 0.6419
  - MILLING/PAVEMENT AND SHOULDER  
    - 2  
    - 349,176 SQ YD  
    - FUT $15.00  
    - PREV $6,985,358
  - PARTIAL-DEPTH PAVEMENT PATCHING (MILL AND FILL ADDITIONAL 2 IN.)  
    - 2  
    - 2,005 SQ YD  
    - FUT $185,000  
    - PREV $2,099,477
  - HMA OVERLAY SURFACE POLYMER MIX "D"  
    - 24,700 TON  
    - FUT $185,000  
    - PREV $2,099,477
  - HMA OVERLAY SHOULDER  
    - 14,408 TON  
    - FUT $185,000  
    - PREV $2,099,477

- **ACTIVITY 4 --- YEAR 20**  
  - PWF20 = 0.5537
  - LONDTIONAL SHOULDER JOINT ROUTING & SEALING  
    - 165,400 LIN FT  
    - FUT $2,000.00  
    - PREV $330,000
  - CENTRELINE JOINT ROUTING & SEALING  
    - 82,700 LIN FT  
    - FUT $2,000.00  
    - PREV $165,000
  - RANDOM/TEMPERATURE CRACK ROUTING & SEALING (SEE NOTE)  
    - 90,070 LIN FT  
    - FUT $2,000.00  
    - PREV $181,940
  - PARTIAL-DEPTH PAVEMENT PATCHING (MILL & FILL SURFACE)  
    - 221 SQ YD  
    - FUT $15.00  
    - PREV $3,308

- **ACTIVITY 5 --- YEAR 25**  
  - PWF25 = 0.4776
  - LONDTIONAL SHOULDER JOINT ROUTING & SEALING  
    - 165,400 LIN FT  
    - FUT $2,000.00  
    - PREV $330,000
  - CENTRELINE JOINT ROUTING & SEALING  
    - 82,700 LIN FT  
    - FUT $2,000.00  
    - PREV $165,000
  - RANDOM/TEMPERATURE CRACK ROUTING & SEALING (SEE NOTE)  
    - 90,070 LIN FT  
    - FUT $2,000.00  
    - PREV $181,940
  - PARTIAL-DEPTH PAVEMENT PATCHING (MILL & FILL SURFACE)  
    - 1,103 SQ YD  
    - FUT $15.00  
    - PREV $1,860,012

- **ACTIVITY 6 --- YEAR 30**  
  - PWF30 = 0.4120
  - MILLING/PAVEMENT AND SHOULDER  
    - 2  
    - 349,176 SQ YD  
    - FUT $2,000.00  
    - PREV $6,985,358
  - PARTIAL-DEPTH PAVEMENT PATCHING (MILL AND FILL)  
    - 2  
    - 4,411 SQ YD  
    - FUT $15.00  
    - PREV $60,000
  - PARTIAL-DEPTH SHOULDER PATCHING (MILL AND FILL)  
    - 1  
    - 1,288 SQ YD  
    - FUT $15.00  
    - PREV $19,297
  - HMA OVERLAY-PAVEMENT POLYMER MIX "D"  
    - 46,312 TON  
    - FUT $85.00  
    - PREV $3,939,520
  - HMA OVERLAY-SHOULDER  
    - 12,607 TON  
    - FUT $75.00  
    - PREV $3,454,537

- **ACTIVITY 7 --- YEAR 35**  
  - PWF35 = 0.3554
  - LONDTIONAL SHOULDER JOINT ROUTING & SEALING  
    - 165,400 LIN FT  
    - FUT $2,000.00  
    - PREV $330,000
  - CENTRELINE JOINT ROUTING & SEALING  
    - 82,700 LIN FT  
    - FUT $2,000.00  
    - PREV $165,000
  - RANDOM/TEMPERATURE CRACK ROUTING & SEALING (SEE NOTE)  
    - 90,070 LIN FT  
    - FUT $2,000.00  
    - PREV $181,940
  - PARTIAL-DEPTH PAVEMENT PATCHING (MILL & FILL SURFACE)  
    - 221 SQ YD  
    - FUT $15.00  
    - PREV $3,308

- **ACTIVITY 8 --- YEAR 40**  
  - PWF40 = 0.3088
  - LONDTIONAL SHOULDER JOINT ROUTING & SEALING  
    - 165,400 LIN FT  
    - FUT $2,000.00  
    - PREV $330,000
  - CENTRELINE JOINT ROUTING & SEALING  
    - 82,700 LIN FT  
    - FUT $2,000.00  
    - PREV $165,000
  - RANDOM/TEMPERATURE CRACK ROUTING & SEALING (SEE NOTE)  
    - 90,070 LIN FT  
    - FUT $2,000.00  
    - PREV $181,940
  - PARTIAL-DEPTH PAVEMENT PATCHING (MILL & FILL SURFACE)  
    - 1,103 SQ YD  
    - FUT $15.00  
    - PREV $1,860,012

**PRESENT CONSTRUCTION COST OVER THE PERIOD OF 40 YEARS**

$17,074,462  
$17,074,462

**TOTAL PRESENT COST PER MILE FOR THE PERIOD OF 40 YEARS**

$3,086,657  
$3,086,657

**PRESENT COST PER MILE PER YEAR**

CRF40 = 0.0433  
CRF45 = 1.04079
FAP Route 313 (US Route 34)
Section 7-26-1
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
6 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.