FAP Route 869 (IL Route 34)
Section 105R-1
Saline County
From Ellis Road to the Levee, north of Harrisburg

We have reviewed the pavement selection for the above captioned section, which was submitted with your memorandum dated March 15, 2012. Based on life cycle cost, the rigid design was the most economical choice for the calculated pavement designs. The district requested the alternate bid option for this project to receive competitive bids. BDE concurs with the alternate bid request. The approved pavement designs are as follows:

**IL Route 34 (Pavement Reconstruction)**

**Option 1:**
- 15.75 inches of HMA Pavement
- 2 inches of Polymerized HMA Surface Course, Mix "D", N105
- 2.25 inches of Polymerized HMA binder course, IL-19.0, N105
- 11.5 inches of HMA Binder Course, IL-19.0, N90
- 16 inches of Lime Stabilization

**Option 2:**
- 10.5 inches of Jointed PCC Pavement built 14' wide to eliminate the need for tied shoulders
- 4 inches of Stabilized Sub-Base
- 16 inches of Lime Stabilization

If you have any questions, please contact Paul Niedernhofer at (217) 524-1651.
PAVEMENT DESIGN  CALC  CURS
ILL 34  CLASS II  STREET  DATE 2-22-12

SHEET 1 OF 4

EXIST 2011  ADT  6-29-11  RAW DATA  RAW DATA

ADT  4300  44604  1504  5225
SU  215  214  214  248
MU  900  1057  57  66
PV  3185  3333  3333  3866

MINE OPERATOR ESTIMATES THEY WILL BE
SENDING OUT 900 TRUCKS PER DAY BY
JUNE 2012 - ASSUME THIS IS THE MAX
CAPACITY FOR THE MINE - REDUCE RAW DATA
MU BY PRESENT MINE TRAFFIC OF 500 TRUCKS.


Flexible

NORMAL TF = 20 \left[ (0.15)(0.5)(3866) + (112.00)(0.5)(248) + (385.44)(0.5)(66) \right] / 1,000,000

NORMAL TF = 0.153 ✓
MINE OPERATOR STATED TRUCKS WERE LOADED SO THAT THE TOTAL WEIGHT OF THE TRUCK IS 80,000 LBS.

ASSUME TYPICAL AXLE LOAD DISTRIBUTION IS THE SAME AS THE EXAMPLE

12k 32k 18k 18k
 0 0 0 0

FLEXIBLE PAVEMENT ESAL VALUES (TABLE)

0.19 0.86 1.00 1.00 ✓

EQUIVALENCY FACTOR (ESAL/VEH) = 3.05 ✓

MINE OPERATOR STATED THE MINE OPERATES 24 HOURS A DAY, 7 DAYS A WEEK - ASSUME HOLIDAYS ON NEW YEAR'S, 4TH OF JULY, MEMORIAL DAY, THANKSGIVING & CHRISTMAS - 360 WORKING DAYS

MINE TF = 900 x 3.05 x 360 x 20 = 19,760 ✓

1,000,000 ✓

DESIGN TF = 19.76 + 0.53 = 20.29 ✓
Note: The minimum design HMA mixture temperature will be 73°F.

HMA MIXTURE TEMPERATURE
(Mechanistic Design: Flexible Pavement)

Figure 54-5.C

HARD COPIES UNCONTROLLED 54-5.5
DESIGN HMA STRAIN
(Mechanistic Design: Flexible Pavement)

Traffic Factor (18-kip ESALs in Millions)

Design HMA Strain (Micrometers)

400 300 200 175 150 125 100 80 60 40 30

30 20 10 5 3 2 1

Figure 54-5.1E

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

Figure 54-5.F
SSR = POOR

Binder Grade = PG 64-22

Mix Temperature = 80.5°F, FIG 54-50

$E_{HMA} = 54/4^\circ$ FIG 54-5.D

HMA Strain = 5.1 FIG 54-5.E

Thickness = 15.75" FIG 54-5.F

Limiting Strain = 16.75" FIG 54-5.1

USE 15.75"
Note: Use of untied shoulder design requires BDE approval.

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

Figure 54-4.E

HARD COPIES UNCONTROLLED
PCC PAVEMENT DESIGN

TIED SHOULDER

TF = 2.0 F(0.15)0.5(3846) + (5578)(0.5)(248) + (5672)(0.5)(66)

\[
\frac{1000000}{1000000}
\]

TF = 0.72 √

USE THE SAME AXLE LOAD DISTRIBUTION AS HMA

RIGID PAVEMENT ESAL VALUES (TABLE 1)

0.19 1.49 V 1.00 V 1.00

EQUIVALENCY FACTOR (ESAL/VEH) = 3.67 3.68

MIN. TF = 900 * 3.67 * 360 * 20 = 23,785

\[
\frac{23,785}{1000000}
\]

DESIGN TF = 23.78 + 8.72 = 24.50

\[
\frac{24.57}{24.57}
\]

POOR SOIL

THICKNESS 10.5" √ FIG. 54-4.E
**Pavement Design**  
**ILL 34 Class II Street**  
**Date 2-22-12**

<table>
<thead>
<tr>
<th>Sheet 1 of 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Exist 2011 ADT</strong></td>
</tr>
<tr>
<td>ADT 4,300</td>
</tr>
<tr>
<td>Su 215</td>
</tr>
<tr>
<td>Mu 900</td>
</tr>
<tr>
<td>Pu 3,185</td>
</tr>
<tr>
<td><strong>Mine Operator Estimates they will be sending out 900 trucks per day by June 2012 - Assume this is the max capacity for the mine - Reduce raw data by present mine traffic of 500 trucks</strong></td>
</tr>
</tbody>
</table>

\[
\text{Normal TF} = 20 \left[ \left(0.15\right)\left(0.5\right)(3866) + \left(12.06\right)(0.5)\left(249\right) + \left(385.49\right)(0.5)(66) \right] \div 1,000,000
\]

\[
\text{Normal TF} = 0.53
\]
Mine operator stated trucks were loaded so that the total weight of the truck is 80,000 lbs.

Assume typical axle load distribution is the same as the example:

12k 32k 18k 18k

Flexible pavement ESAL values (table!):
0.19 0.86 1.00 1.00

Equivalency factor (ESAL/veh) = 3.05

Mine operator stated the mine operates 24 hours a day, 7 days a week - assume holidays on New Years, 4th of July, Memorial Day, Thanksgiving & Christmas - 360 working days

Mine TF = 900 x 3.05 x 360 x 20 = 19.76

1,000,000

Design TF = 19.76 + 0.53 = 20.29
SSR = POOR

Binder Grade = PG 64-22

Mix Temperature = 80.5°  Fig 54-5.C

$E_{HMA} = 5441$  Fig 54-5.D

HMA Strain = 51  Fig 54-5.E

Thickness = 15.75"  Fig 54-5.F

Limiting Strain = 16.75"  Fig 54-5.I

USE 15.75"
PCC Pavement Design

Tied Shoulder

Sheet 4 of 4

\[
TF = 2.0 \left[ 0.15 \times 0.5 \times (3866 + (3578 \times 0.5 \times 248) + 5672 \times 0.5 \times 66) \right] / 1,000,000
\]

\[TF = 0.72\]

Use the same axle load distribution as HMA.

Rigid Pavement ESAL Values (Table 1):

<table>
<thead>
<tr>
<th>0.19</th>
<th>1.49</th>
<th>1.00</th>
<th>1.00</th>
</tr>
</thead>
</table>

Equivalency Factor (ESAL/veh) = 3.67

\[
MIN_{TF} = 700 \times 3.67 \times 360 \times 20 \quad 23.76 
\]

\[
MIN_{TF} = \frac{23.76}{1,000,000}
\]

Design TF = 23.76 + 0.72 = 24.50

Poor Soil

Thickness 0.5" FIG 54-4.E
### IDOT Mechanistic Pavement Design

**Project and Traffic Inputs**

**Route:** ILL 34  
**Comments:**

**County:** Saline  
**Design Data:** 02/14/2012  
**Modified Data:**

**Facility Type:** Other Marked State Route  
**# of Lanes:** 2 or 3  
**Part of future 4 lanes or more?** No

**Road Class:** II  
**Subgrade Support Rating (SSR):** Poor  
**Construction Year:** 2012  
**Design Period (DP):** 20 years

**Structural Design Traffic (ADT):**

<table>
<thead>
<tr>
<th></th>
<th>ADT</th>
<th>Total ADT</th>
<th>% of ADT in Design Lane</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual % of</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% of ADT in</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design Lane</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PV</td>
<td>0</td>
<td>3,866</td>
<td>92.6%</td>
</tr>
<tr>
<td>SU</td>
<td>250</td>
<td>245</td>
<td>5.9%</td>
</tr>
<tr>
<td>MU</td>
<td>750</td>
<td>68</td>
<td>1.6%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PV</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SU</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MU</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Traffic Factor Calculation**

**Flexible Pavement**

- Cpv = -
- Csu = -
- Cmu = -
- TF flexible (Actual) = -
- TF flexible (Min) = -

**Rigid Pavement**

- Cpv = -
- Csu = -
- Cmu = -
- TF rigid (Actual) = -
- TF rigid (Min) = -

### Additional Design Inputs and Flexible & Rigid Pavement Thickness Calculations

**HMA Pavement**

- Use TF flexible = 20.29
- PG Grade Lower Binder Lifts = PG 84-22 (Figure 53-4.R)
- HMA Mixture Temp. = 60.5 deg. F (Figure 54-5.C)
- Design HMA Mixture Modulus (F(N)) = 544 ksf (Figure 54-5.D).
- Design HMA Strain (h(N)) = 51 mils (Figure 54-5.E)
- Full Depth HMA Design Thickness = 15.53 in. (Figure 54-5.F)
- Limiting Strain Criterion Thickness = 15.75 in. (Figure 54-5.I)
- Use Full Depth HMA Thickness = 15.53 inches

**JCPA Pavement**

- Use TF rigid = 24.50
- Edge Support = Tied
- Shoulder or C.A.G.
- Rigid Pavement Thick. = 10.40 in. (Figure 54-4.E)
- 10.56

### Design Tables from BDE Manual Chapter 54 - Pavement Design

<table>
<thead>
<tr>
<th>Class I Roads</th>
<th>Class II Roads</th>
<th>Class III Roads</th>
<th>Class IV Roads</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 lanes or more Part of a future 4 lanes or more One-way Streets with ADT &gt; 3500</td>
<td>2 lanes with ADT &gt; 2000</td>
<td>One way Street with ADT &lt;= 3500</td>
<td>2 Lanes (ADT 750 - 2000)</td>
</tr>
</tbody>
</table>

**Traffic Factor ESAL Coefficients**

<table>
<thead>
<tr>
<th>Class</th>
<th>Csu</th>
<th>Cmu</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>143.61</td>
<td>695.42</td>
</tr>
<tr>
<td>II</td>
<td>135.78</td>
<td>661.21</td>
</tr>
<tr>
<td>III</td>
<td>129.58</td>
<td>622.47</td>
</tr>
</tbody>
</table>

**Design Lane Distribution Factors For Structural Design Traffic (Figure 54-2.B)**

<table>
<thead>
<tr>
<th>Number of Lanes</th>
<th>Rural</th>
<th>Urban</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Lane Ramp</td>
<td>P</td>
<td>S</td>
</tr>
<tr>
<td>2 or 3</td>
<td>50%</td>
<td>50%</td>
</tr>
<tr>
<td>4</td>
<td>50%</td>
<td>50%</td>
</tr>
<tr>
<td>5 or more</td>
<td>50%</td>
<td>50%</td>
</tr>
</tbody>
</table>