We have reviewed the pavement design for the above referenced project which was submitted on May 28, 2020. The project will reconstruct the intersection.

We concur with the district this is a special design due to the high stress induced by having more than 200 MU’s in the design lanes. We also agree with the District’s recommendation to use a mechanistic flexible pavement design for consistency with the adjacent overlaid sections.

In summary, the approved pavement design is as follows:

**IL 72 and Getzelman Road - Reconstruction**
- 9.75” Full-Depth HMA with PCC Curb & Gutter / portions with HMA Shoulders
- 12” Aggregate Subgrade Improvement

**State Street - Reconstruction**
- 8.75” Full Depth HMA with PCC Curb & Gutter
- 12” Aggregate Subgrade Improvement

If you have any questions, please contact Mike Brand at (217) 782-7651.
Illinois Department of Transportation

Memorandum

To: Jack Elston  
Attn: Michael Brand

From: Jose A. Dominguez  
By: Ojas Patel

Subject: Pavement Analysis*

Date: May 28, 2020

*Route: Illinois Route 72
Limits: at State St./Getzelman Rd.
Section: 32R-DR-1
Current target: 09CY20

County: Kane
Contract No.: 62G11
Job No.: D-91-254-18

We have completed the pavement analysis for the above captioned location. Review by the Central Office is required since the total pavement area for reconstruction exceeds 4,750 Square Yards. The following is the scope of the project:

**Reconstruction of the IL 72 @ State St./Getzelman Rd. intersection including culvert replacement at the north and east legs.**

A 20-year pavement analysis was performed on the above segments. IL 72 at State Street is a “High Stress” intersection since the design lane MU ADT exceeds 200 vehicles. As such, this pavement design will be classified as a “Special Design” per BDE Figure 54-1.A. A mechanistic-flexible pavement design is recommended for consistency and ease of future maintenance as the surrounding roadway network is HMA surfaced.

Our recommendation is as follows:

**IL 72/Getzelman Road**

Pavement Reconstruction
Portions PCC Curb and Gutter and Portions HMA Shoulder
9 ¾" Full Depth HMA

2" Polymerized HMA Surface Course, SMA, 9.5, Mix "F", N80
2 ¼" Polymerized HMA Binder Course, IL-19.0, N90
5 ½" HMA Base Course, IL-19.0, N70
12" Aggregate Subgrade Improvement
State Street
Pavement Reconstruction
PCC Curb and Gutter
8 ¾" Full Depth HMA
  2" Polymerized HMA Surface Course, SMA, 9.5, Mix "F", N80
  2 ¼" Polymerized HMA Binder Course, IL-19.0, N90
  4 ½" HMA Base Course, IL-19.0, N70
12" Aggregate Subgrade Improvement

1Designer Note 1: Use pay item 40701876, HOT-MIX ASPHALT PAVEMENT (FULL-DEPTH), 9 ¾", paid for in square yards.

2Designer Note 2: Use pay item 40701856, HOT-MIX ASPHALT PAVEMENT (FULL-DEPTH), 8 ¼", paid for in square yards.

3Designer Note 3: Use pay item 30300112, AGGREGATE SUBGRADE IMPROVEMENT, 12" paid for in square yards.

4Designer Note 4: Refer to the District One, Bureau of Materials' "Hot-Mix Asphalt – Mix Selection" tables to determine the corresponding HMA mix table requirements for the plans.

5Designer Note 5: State Street and Getzelman Road are subject to local jurisdictional approval and concurrence.

If you have any questions or need additional information, please contact Ojas Patel, Pavement Design Engineer, at (847)705-4550.

By: Jose A. Dominguez, P.E.
Project Support Engineer
PROPOSED GETZELMAN/STATE STREET TYPICAL SECTION

STA 199+23.24 TO STA 199+50.00

- 1% MAX
- 2% MAX
- 3% MAX
- 5% MAX
- 1.5% MAX

LEFT TURN LANE

12'

EXROW

5 %
- 1.5 %
- 1.5 %
- 5 %

PROPOSED GETZELMAN/STATE STREET TYPICAL SECTION

STA 200+40.25 TO STA 201+57.00

- 1% MAX
- 2% MAX
- 3% MAX
- 5% MAX
- 1.5% MAX

LEFT TURN LANE

12'

EXROW

5 %
- 1.5 %
- 1.5 %
- 5 %

LEGEND:

1. PROPOSED POLYMERIZED HMA SURFACE COURSE, MIX "F", N90, 2"
2. PROPOSED POLYMERIZED HMA SURFACE COURSE, MIX "F", N90, 1 3/4"
3. PROPOSED HMA BASE COURSE, IL-19.0, N70, 4"
4. PROPOSED HMA BASE COURSE, IL-19.0, N70, 6"
5. PROPOSED HOT-MIX ASPHALT SHOULDERS, 8"
6. PROPOSED AGGREGATE SUBGRADE IMPROVEMENT, 12"
7. PROPOSED COMBINATION CURB AND GUTTER TYPE B-6.12
8. PROPOSED PORTLAND CEMENT CONCRETE SIDEWALK, 6 INCH
**PROJECT AND TRAFFIC INPUTS**

**Route:** IL 72  
**Comments:** IL 72 at State/Getzelman  
**Section:** Kane  
**County:** Kane  
**Location:** IL 72 at State/Getzelman  
**Design Date:** 05/26/2020  
**Modify Date:** 06/02/2020

### Traffic Factor Calculation

#### Flexible Pavement
- **Cpv** = 0.15
- **Csu** = 112.06
- **Cmu** = 385.44
- **TF flexible (Actual)** = 2.25
- **TF flexible (Min)** = 3.17

#### Rigid Pavement
- **Cpv** = 0.15
- **Csu** = 135.78
- **Cmu** = 567.21
- **TF rigid (Actual)** = 3.21
- **TF rigid (Min)** = 4.59

**Traffic Factor (TF)**
- Flexible: 3.17  
- Rigid: 4.59

**New Construction / Reconstruction Pavement Design Calculations**

- **Full-Depth HMA Pavement**
  - Use TF flexible = 3.17
  - PG Grade Lower Binder Lifts = PG 64-22
  - HMA Mixture Temp. = 74.0 deg. F
  - Design HMA Modulus (E_MHA) = 720 ksi
  - Design HMA Strain (S_MHA) = 86
  - Full Depth HMA Design Thickness = 9.75 in.

- **JPC Pavement**
  - Use TF rigid = 4.59
  - Edge Support = Tied Shoulder or C&G

**Reconstruction Only (Supplemental) Pavement Design Calculations**

- **HMA Pavement Over Rubblized PCC**
  - Use TF flexible = 3.17
  - HMA Overlay Design Thickness = 7.25 in.

- **Unbonded Concrete Overlay**
  - Use HMA Overlay Thickness = 999.00 inches

**Contact Research for Assistance**

### 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</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>
<tr>
<td>Part of a future 4 lanes or more</td>
<td>(not future 4 lane &amp; not one-way street)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>One-way Streets with ADT &gt; 3500</td>
<td>(ADT &lt; 750)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Traffic Factor ESAL Coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rigid (Fig. 54-4.C)</td>
</tr>
<tr>
<td>Class</td>
</tr>
<tr>
<td>I</td>
</tr>
<tr>
<td>II</td>
</tr>
<tr>
<td>III</td>
</tr>
<tr>
<td>IV</td>
</tr>
</tbody>
</table>

| Design Lane Distribution Factors For Structural Design Traffic (Fig. 54-2.B) |
|-----------------------------|-----------------------------|-----------------------------|
| Rural | Urban | Number of Lanes | P | S | M | P | S | M |
| 1 Lane Ramp | 100% | 100% | 100% | 100% | 100% |
| 2 or 3 | 50% | 50% | 50% | 50% | 50% |
| 4 | 32% | 45% | 45% | 32% | 45% |
| 6 or more | 20% | 40% | 40% | 8% | 37% | 37% |
FULL-DEPTH HMA PAVEMENT

Standard Design

<table>
<thead>
<tr>
<th>FACILITY TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>FULL-DEPTH HMA PAVEMENT</td>
<td></td>
</tr>
</tbody>
</table>

**RIGID PAVEMENT**

- **FACILITY TYPE**: 
- **LOCATION**: 

**FULL-DEPTH HMA PAVEMENT OVER RUBBLIZED PCC PAVEMENT**

**FACILITY TYPE**: 
**LOCATION**: 

**HMA PAVEMENT OVER RUBBLIZED PCC PAVEMENT**

**FACILITY TYPE**: 
**LOCATION**: 

**INTERSTATE**

- **FACILITY TYPE**: 
- **LOCATION**: 

**JPCP**

- **FACILITY TYPE**: 
- **LOCATION**: 

**PCC PAVEMENT**

- **FACILITY TYPE**: 
- **LOCATION**: 

**RECONSTRUCTION - HMA OVER RUBBLIZED PAVEMENT**

**CONSTRUCTION - PCC UNBONDED OVERLAY**

**LIFE-CYCLE COST ANALYSIS: NEW DESIGN**

**RECONSTRUCTION - NEW DESIGN**

**LIFE-CYCLE COST ANALYSIS: RECONSTRUCTION / REHABILITATION**

**FULL-DEPTH HMA PAVEMENT**

**HMA PAVEMENT OVER RUBBLIZED PCC PAVEMENT**

**RIGID PAVEMENT**

**FULL-DEPTH HMA PAVEMENT OVER RUBBLIZED PCC PAVEMENT**

**HMA PAVEMENT OVER RUBBLIZED PCC PAVEMENT**

**JPCP**

**PCC PAVEMENT**

**RECONSTRUCTION - HMA OVER RUBBLIZED PAVEMENT**

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**HMA PAVEMENT OVER RUBBLIZED PCC PAVEMENT**

**RIGID PAVEMENT**

**FULL-DEPTH HMA PAVEMENT OVER RUBBLIZED PCC PAVEMENT**

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**HMA PAVEMENT OVER RUBBLIZED PCC PAVEMENT**

**RIGID PAVEMENT**

**FULL-DEPTH HMA PAVEMENT OVER RUBBLIZED PCC PAVEMENT**

**HMA PAVEMENT OVER RUBBLIZED PCC PAVEMENT**

**JPCP**

**PCC PAVEMENT**

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**CONSTRUCTION - PCC UNBONDED OVERLAY**

**LIFE-CYCLE COST ANALYSIS: NEW DESIGN**

**RECONSTRUCTION - NEW DESIGN**

**LIFE-CYCLE COST ANALYSIS: RECONSTRUCTION / REHABILITATION**

**FULL-DEPTH HMA PAVEMENT**

**HMA PAVEMENT OVER RUBBLIZED PCC PAVEMENT**

**RIGID PAVEMENT**

**FULL-DEPTH HMA PAVEMENT OVER RUBBLIZED PCC PAVEMENT**

**HMA PAVEMENT OVER RUBBLIZED PCC PAVEMENT**

**JPCP**

**PCC PAVEMENT**

**RECONSTRUCTION - HMA OVER RUBBLIZED PAVEMENT**

**CONSTRUCTION - PCC UNBONDED OVERLAY**

**LIFE-CYCLE COST ANALYSIS: NEW DESIGN**

**RECONSTRUCTION - NEW DESIGN**

**LIFE-CYCLE COST ANALYSIS: RECONSTRUCTION / REHABILITATION**
<table>
<thead>
<tr>
<th>TYPE</th>
<th>PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMA</td>
<td>$153,133</td>
</tr>
<tr>
<td>JPCP</td>
<td>$156,613</td>
</tr>
</tbody>
</table>

**LIFE-CYCLE COST ANALYSIS: FINAL SUMMARY**

<table>
<thead>
<tr>
<th>TOTAL</th>
<th>LIFE-CYCLE COST</th>
<th>PRESENT WORTH</th>
<th>ANNUAL COST PER MILE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$727,263</td>
<td>$711,501</td>
<td>$700,133</td>
</tr>
</tbody>
</table>

LOWEST COST OPTION: HMA

OTHER OPTIONS (LOWEST TO HIGHEST):

- JPCP: $156,613 (2.3%)

S:\GEN\WPDOCS\Pavement Designs\IL 72 at State St & Getzelman Rd - IL 72 - 500-1000 sheet\LifeCycleCost
**PROJECT AND TRAFFIC INPUTS**

**Enter Data in Gray Shaded Cells**

**Route and Traffic Inputs**

- **Route:** State St/Getzelman Rd
- **Comments:** IL 72 at State/Getzelman
- **Design Date:** 05/26/2020
- **Modify Date:** ONP

**Structural Design Traffic**

<table>
<thead>
<tr>
<th>Minimum ADT</th>
<th>Actual ADT</th>
<th>Actual % of Total ADT</th>
<th>% of ADT in Design Lane</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV = No Min</td>
<td>4,903</td>
<td>89.5%</td>
<td>P = 50%</td>
</tr>
<tr>
<td>SU = No Min</td>
<td>219</td>
<td>4.0%</td>
<td>S = 50%</td>
</tr>
<tr>
<td>MU = No Min</td>
<td>356</td>
<td>6.5%</td>
<td>M = 50%</td>
</tr>
</tbody>
</table>

**Traffic Factor Calculation**

<table>
<thead>
<tr>
<th>Flexible Pavement</th>
<th>Rigid Pavement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cpv = 0.15</td>
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</tr>
<tr>
<td>Csu = 112.06</td>
<td>Csu = 135.78</td>
</tr>
<tr>
<td>Cmu = 385.44</td>
<td>Cmu = 567.21</td>
</tr>
</tbody>
</table>

**Flexible Pavement**

- TF flexible (Actual) = 1.63 (Actual ADT)
- TF flexible (Min) = No Min (Min ADT Fig. 54-2.C)

**Rigid Pavement**

- TF rigid (Actual) = 2.32 (Actual ADT)
- TF rigid (Min) = No Min (Min ADT Fig. 54-2.C)

**New Construction/Reconstruction Pavement Design Calculations**

- Full-Depth HMA Pavement
  - Use TF flexible = 1.63
  - PG Grade Lower Binder Lifts = PG 64-22 (Fig. 53-4.0)
  - HMA Mixture Temp. = 74.0 deg. F (Fig. 54-5.C)
  - Design HMA Pavement Modulus (E<sub>hmax</sub>) = 720 ksi (Fig. 54-5.D)
  - Design HMA Strain (k<sub>hmax</sub>) = 105 (Fig. 54-5.E)
  - Full Depth HMA Design Thickness = 8.75 in. (Fig. 54-5.F)
  - Limiting Strain Criterion Thickness = 14.50 in. (Fig. 54-5.I)

- JPC Pavement
  - Use TF rigid = 2.32
  - Edge Support = Tied Shoulder or C&B

**Reconstruction Only (Supplemental) Pavement Design Calculations**

- HMA Pavement Over Rubblized PCC
  - Use TF flexible = 1.63
  - HMA Overlay Design Thickness = 6.25 in. (Fig. 54-5.U)
  - Limiting Strain Criterion Thickness = 3.125 in. (Fig. 54-5.V)

- Unbonded Concrete Overlay
  - Use HMA Overlay Thickness = 999.00 inches
  - IRC Pavement
    - Use TF rigid = 2.32
    - IRR value = 3

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

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

**Traffic Factor ESAL Coefficients**

- Rigid (Fig. 54-4.C) Flexible (Fig. 54-5.B)

<table>
<thead>
<tr>
<th>Class</th>
<th>Csu</th>
<th>Cmu</th>
<th>Csu</th>
<th>Cmu</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>143.81</td>
<td>696.42</td>
<td>132.30</td>
<td>482.53</td>
</tr>
<tr>
<td>II</td>
<td>135.78</td>
<td>675.21</td>
<td>112.06</td>
<td>385.44</td>
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<tr>
<td>III</td>
<td>129.58</td>
<td>562.47</td>
<td>109.14</td>
<td>384.35</td>
</tr>
<tr>
<td>IV</td>
<td>129.58</td>
<td>562.47</td>
<td>109.14</td>
<td>384.35</td>
</tr>
</tbody>
</table>

**Design Lane Distribution Factors For Structural Design Traffic (Fig. 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>100%</td>
<td>100%</td>
</tr>
<tr>
<td>2 or 3</td>
<td>50%</td>
<td>50%</td>
</tr>
<tr>
<td>4</td>
<td>32%</td>
<td>45%</td>
</tr>
<tr>
<td>6 or more</td>
<td>20%</td>
<td>40%</td>
</tr>
</tbody>
</table>

**Contact Research for Assistance**

- Class I Roads
- Class II Roads
- Class III Roads
- Class IV Roads

**Facility Type**

- Interstate or Freeway
  - PV = 0
  - SU = 500
  - MU = 1500
- Other Marked State Route
  - PV = 0
  - SU = 250
  - MU = 750
- Unmarked State Route
  - Min. Str. Design Traffic (Fig 54-2.C)
  - ADT Class

**CONTACT RESEARCH FOR ASSISTANCE**

- Review 54-4.03 for limitations and special considerations.

- TF MUST BE > 60 FOR CRCP
### HMA_SD MAINTENANCE AND REHABILITATION ACTIVITY SCHEDULE

**Location**: 

**Facility Type**: 

<table>
<thead>
<tr>
<th>Item</th>
<th>Thickness</th>
<th>Tonnage</th>
<th>Unit Price</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMA PAVEMENT</td>
<td>3.75&quot;</td>
<td>1.0130</td>
<td>1.50&quot;</td>
<td>3.75&quot;</td>
</tr>
</tbody>
</table>

**Notes**:
- Standard Design
- CI
- CSP
- 10/31/19 11:36 AM
- Read Me!
<table>
<thead>
<tr>
<th>Option</th>
<th>Type / Percentage</th>
<th>Cost</th>
<th>Cost Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMA</td>
<td></td>
<td>$711,101</td>
<td></td>
</tr>
<tr>
<td>JPCP</td>
<td></td>
<td>$727,263</td>
<td>$16,162</td>
</tr>
</tbody>
</table>

**Life-Cycle Cost Analysis: Final Summary**

- **Lowest Cost Option:** HMA
- **Other Options (Lowest to Highest):**
  - JPCP: $727,263, 2.3% higher than HMA

TOTAL: Life-Cycle Cost Present Worth: $727,263
Annual Cost Per Mile: $153,133

---

*Source: [State St - Getzelman Rd - IL 72 (BDE 5401.xlsm) LifeCycleCost]*