To: Jeffrey L. Keirn  
Attn: Carrie Neisen

From: Maureen M. Addis

Subject: Pavement Design Approval

Date: December 28, 2016

Route: I-57 Ramps at the Ina Interchange
Section: D9 Pavement Replacement 2017-1
County: Jefferson
Contract: 78532

We have reviewed the pavement design for the above referenced project which was submitted on December 12, 2016. The scope of the project is to replace approximately 300’ of the SB and NB exit ramps, 400’ of the SB entrance ramp, and 675’ of the NB entrance ramp.

Due to the condition of the existing pavement, the high volume of large trucks, the turning movements of the large trucks at the ramp intersections, and the short length of the project, we concur with the District’s determination of this being a special design; and with a special design, no cost analysis or comparison of pavement types is required.

The approved pavement design is as follows:

10” PCC Pavement w/ tied 10” PCC Shoulder
4” Stabilized Subbase
8” Aggregate Subgrade Improvement

If you have any questions, please contact Mike Brand at (217) 782-7651 or Michael.brand@illinois.gov.
The proposed project is located on the entrance and exit ramps of the I-57/Ina Interchange in Jefferson County. Approximately 2000’ of ramp pavement will be removed and replaced. The existing concrete/HMA overlay ramp pavement is experiencing rapid deterioration due to the extreme high number of multi-unit trucks (600 a day) generated by the Love’s Truck Stop located at this interchange. Additionally, in the last year Love’s Truck Stop has doubled its capacity for truck parking causing the District to anticipate more trucks resulting in higher pavement stress.

Attached please find a project location map, existing condition photos, proposed typical sections, the pavement design spreadsheet with life cycle costs, lifecycle task details for both HMA and PCC, and estimates of cost for both HMA and PCC.

Although the life cycle analysis shows a preference for HMA the district is requesting approval to proceed with PCC pavement on the above referenced contract.

Our reasoning for requesting PCC is as follows –

High Stress Pavement Section – 600 MU’s a day
Multi-unit turning movements at ramp terminal
LOCATION MAP
I-57 at Ina Interchange Ramps
Jefferson County
### PROJECT AND TRAFFIC INPUTS

**Route:** FAI 57 at Ina ramps  
**Section:** D9 Pavt Replacement 2017-1  
**County:** Jefferson  
**Location:** Interchange Ramps at Ina  
**Facility Type:** Interstate or Freeway

**Comments:**  
**Design Date:** <-- BY  
**Modify Date:** <-- BY  
**Current ADT Year:** 2017  
**Future ADT Year:** 2037

#### Traffic Factor Calculation

**Flexible Pavement:**  
- Cpv = 0.15  
- Csuv = 132.5  
- Cmu = 482.53  
- TF flexible (Min) = 3.17

**Rigid Pavement:**  
- Cpv = 0.15  
- Csu = 143.81  
- Cmu = 696.42  
- TF rigid (Min) = 4.59

**NEW CONSTRUCTION / RECONSTRUCTION PAVEMENT DESIGN CALCULATIONS**

- **Full-Depth HMA Pavement:**  
  - Use TF flexible = 6.70
  - PG Grade Lower Binder Lifts = PG 64-22 (Fig. 53-4.R)
  - HMA Mixture Temp. = 79.5 deg. F (Fig. 54-5.C)
  - Design HMA Mixture Modulus (Eavg) = 570 ksi (Fig. 54-5.D)
  - Design HMA Strain (εavg) = 70 (Fig. 54-5.E)
  - Full Depth HMA Design Thickness = 12.50 in. (Fig. 54-5.F)
  - Limiting Strain Criterion Thickness = 16.50 in. (Fig. 54-5.I)

- **CRC Pavement**

<table>
<thead>
<tr>
<th>Class</th>
<th>Csu</th>
<th>Cmu</th>
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</thead>
<tbody>
<tr>
<td>I</td>
<td>143.81</td>
<td>696.42</td>
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<tr>
<td>II</td>
<td>135.78</td>
<td>567.21</td>
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<tr>
<td>III</td>
<td>129.58</td>
<td>562.47</td>
</tr>
<tr>
<td>IV</td>
<td>129.58</td>
<td>562.47</td>
</tr>
</tbody>
</table>

**Rigid Pavement**

- Use TF rigid = 9.51

**RECONSTRUCTION ONLY (SUPPLEMENTAL) PAVEMENT DESIGN CALCULATIONS**

- **HMA Overlay of Rubblized PCC**
  - Use TF flexible = 6.70
  - HMA Overlay Design Thickness = 9.25 in. (Fig. 54-5.U)

**Traffic Factor ESAL Coefficients**

<table>
<thead>
<tr>
<th>Traffic Factor</th>
<th>ESAL Coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rigid (Fig. 54-4.C)</td>
<td></td>
</tr>
<tr>
<td>Flexible (Fig. 54-5.B)</td>
<td></td>
</tr>
</tbody>
</table>

**Contact BMPR for Assistance**

### DESIGN TABLES FROM BDE MANUAL CHAPTER 54 - PAVEMENT DESIGN

#### Class I Roads
- 4 lanes or more
- Part of a future 4 lanes or more
- One-way Streets with ADT > 3500

#### Class II Roads
- 2 lanes with ADT > 2000
- One way Street with ADT <= 3500
- (ADT 750 - 2000)

#### Class III Roads
- 2 lanes
- (ADT < 750)

#### Class IV Roads
- 2 or 3 lanes
- (not future 4 lane & not one-way street)

### Traffic Factor ESAL Coefficients

<table>
<thead>
<tr>
<th>Traffic Factor</th>
<th>ESAL Coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rigid (Fig. 54-4.C)</td>
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<tr>
<td>Flexible (Fig. 54-5.B)</td>
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# LIFE-CYCLE COST ANALYSIS: NEW CONSTRUCTION / RECONSTRUCTION

## FULL-DEPTH HMA PAVEMENT

<table>
<thead>
<tr>
<th>FACILITY TYPE</th>
<th>INTERSTATE</th>
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<tbody>
<tr>
<td>PROJECT LENGTH</td>
<td>1500 FT = 0.28 Miles</td>
</tr>
<tr>
<td># OF CENTERLINES</td>
<td>1 CL</td>
</tr>
<tr>
<td># OF LANES</td>
<td>1 LANE</td>
</tr>
<tr>
<td># OF EDGES</td>
<td>2 EP</td>
</tr>
<tr>
<td>LANE WIDTH - AVERAGE</td>
<td>HMA Left 4 FT, HMA Right 10 FT</td>
</tr>
<tr>
<td>SHOULDER WIDTH</td>
<td>HMA_SD Standard Design</td>
</tr>
<tr>
<td>PAVEMENT THICKNESS (FLEXIBLE)</td>
<td>12.50 IN MAX 16.50 IN</td>
</tr>
<tr>
<td>SHOULDER THICKNESS</td>
<td>12.50 IN</td>
</tr>
<tr>
<td>POLICY OVERLAY THICKNESS</td>
<td>3.75 IN</td>
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### FLEX PAVEMENT TRAFFIC FACTORS

<table>
<thead>
<tr>
<th>Minimum</th>
<th>Actual</th>
<th>Use</th>
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<tr>
<td>3.17</td>
<td>6.70</td>
<td>6.70</td>
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</table>

<table>
<thead>
<tr>
<th><strong>ITEM</strong></th>
<th><strong>THICKNESS</strong></th>
<th><strong>100% QUANTITY</strong></th>
<th><strong>UNIT</strong></th>
<th><strong>UNIT PRICE</strong></th>
<th><strong>COST</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>HMA PAVEMENT (FULL-DEPTH)</td>
<td>(12.50&quot;)</td>
<td>2,667</td>
<td>SQ YD</td>
<td>$82.21 / SQ YD</td>
<td>$219,214</td>
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<tr>
<td>HMA SURFACE COURSE</td>
<td>(2.00&quot;)</td>
<td>302</td>
<td>TONS</td>
<td>$139.00 / TON</td>
<td>$0</td>
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<tr>
<td>HMA TOP BINDER COURSE</td>
<td>(2.25&quot;)</td>
<td>347</td>
<td>TONS</td>
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<tr>
<td>HMA LOWER BINDER COURSE</td>
<td>(8.25&quot;)</td>
<td>1,339</td>
<td>TONS</td>
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<tr>
<td>HMA SHOULDER</td>
<td>(12.50&quot;)</td>
<td>2,333</td>
<td>SQ YD</td>
<td>$67.00 / SQ YD</td>
<td>$156,343</td>
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<tr>
<td>CURB &amp; GUTTER</td>
<td>0</td>
<td>LIN FT</td>
<td>$0.00 / LIN FT</td>
<td>$0</td>
<td></td>
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<tr>
<td>IMPROVED SUBGRADE: Aggregate Width = 33.1</td>
<td>5,514</td>
<td>SQ YD</td>
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<td>UNITS</td>
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<tr>
<td>Reserved For User Supplied Item</td>
<td>0</td>
<td>UNITS</td>
<td>$0.00 / UNITS</td>
<td>$0</td>
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<td>PAVEMENT REMOVAL</td>
<td>2,667</td>
<td>SQ YD</td>
<td>$19.00 / SQ YD</td>
<td>$50,673</td>
<td></td>
</tr>
<tr>
<td>SHOULDER REMOVAL</td>
<td>2,000</td>
<td>SQ YD</td>
<td>$10.00 / SQ YD</td>
<td>$20,000</td>
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</table>

Note: * Denotes User Supplied Quantity

**FLEXIBLE CONSTRUCTION INITIAL COST** $539,968

**FLEXIBLE CONSTRUCTION ANNUAL COST PER MILE** $77,520

## MAINTENANCE COSTS:

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<thead>
<tr>
<th><strong>ITEM</strong></th>
<th><strong>THICKNESS</strong></th>
<th><strong>MATERIAL</strong></th>
<th><strong>UNIT</strong></th>
<th><strong>UNIT COST</strong></th>
<th><strong>LANE-MILE / YEAR</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>HMA OVERLAY PVMT SURF</td>
<td>(2.00&quot;)</td>
<td>Surface Mix</td>
<td>2.00</td>
<td>$15.73 / SQ YD</td>
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<tr>
<td>HMA OVERLAY PVMT</td>
<td>(3.75&quot;)</td>
<td>Surface Mix</td>
<td>3.75</td>
<td>$27.43 / SQ YD</td>
<td>$0.00</td>
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<tr>
<td>HMA SURFACE MIX</td>
<td>(1.50&quot;)</td>
<td>Surface Mix</td>
<td>1.50</td>
<td>$11.77 / SQ YD</td>
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<td>HMA BINDER MIX</td>
<td>(2.25&quot;)</td>
<td>Top Binder Mix</td>
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<td>$0.00</td>
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<tr>
<td>HMA OVERLAY SHLD</td>
<td>(1.75&quot;)</td>
<td>Shoulder Mix</td>
<td>1.75</td>
<td>$9.38 / SQ YD</td>
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<td>HMA OVERLAY SHLD</td>
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<td>Shoulder Mix</td>
<td>2.00</td>
<td>$10.72 / SQ YD</td>
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<td>MILLING</td>
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<td>$85.57 / SQ YD</td>
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<tr>
<td>Description</td>
<td>Unit</td>
<td>Cost</td>
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<td></td>
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<td>--------------------------------------------------</td>
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<td>PARTIAL DEPTH SHLD PATCH (Mill &amp; Fill Surf)</td>
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<td>Leveling Binder Mix</td>
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<tr>
<td>Shoulder Mix</td>
<td>2.00</td>
<td>$80.72 / SQ YD</td>
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<tr>
<td>LONGITUDINAL SHOULDER JOINT ROUT &amp; SEAL</td>
<td></td>
<td>$2.00 / LIN FT</td>
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<tr>
<td>CENTERLINE JOINT ROUT &amp; SEAL</td>
<td></td>
<td>$2.00 / LIN FT</td>
<td></td>
<td></td>
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<tr>
<td>RANDOM / THERMAL CRACK ROUT &amp; SEAL</td>
<td>(100% Rehab = 110.00' / Station / Lane)</td>
<td>$2.00 / LIN FT</td>
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**FLEXIBLE TOTAL LIFE-CYCLE COST** $675,831

**FLEXIBLE TOTAL ANNUAL COST PER MILE** $97,025
**PCC PAVEMENT**

**ROUTE**
FAI 57 at Ina ramps

**SECTION**
D9 Pavt Replacement 2017-1

**COUNTY**
Jefferson

**LOCATION**
Interchange Ramps at Ina

**FACILITY TYPE**
INTERSTATE

**PROJECT LENGTH**
1500 FT = = > 0.28 Miles

**# OF CENTERLINES**
1 CL

**# OF LANES**
1 LANES

**# OF EDGES**
2 EP

**LANE WIDTH - AVERAGE**
16 FT

**SHOULDER WIDTH**
- PCC Left: 4 FT
- PCC Right: 10 FT

**Total Width of Paved Shoulders**: 14 FT

**PAVEMENT THICKNESS (RIGID)**
JPCP 10.00 IN TIED SHLD

**SHOULDER THICKNESS**
10.00 IN

**POLICY OVERLAY THICKNESS**
3.75 IN

**RIGID PAVEMENT TRAFFIC FACTORS**

<table>
<thead>
<tr>
<th>MINIMUM</th>
<th>ACTUAL</th>
<th>USE</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.59</td>
<td>9.51</td>
<td>9.51</td>
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</table>

Worksheet Construction Type is Reconstruction

The Pavement Type is JPCP

**INITIAL COSTS**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>THICKNESS</th>
<th>100% QUANTITY</th>
<th>UNIT</th>
<th>UNIT PRICE</th>
<th>COST</th>
</tr>
</thead>
<tbody>
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<td>2,667 SQ YD</td>
<td>$96.00 / SQ YD</td>
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<tr>
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<td>$0</td>
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<tr>
<td>STABILIZED SUBBASE</td>
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<td>$103,340</td>
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<tr>
<td>PCC SHOULDERS</td>
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<tr>
<td>CURB &amp; GUTTER</td>
<td>0 LIN FT</td>
<td>$0.00 / LIN FT</td>
<td>$0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SUBBASE GRAN MATL TY C</td>
<td>(~1.68&quot;)</td>
<td>0 TONS</td>
<td>$0.00 / TON</td>
<td>$0</td>
<td></td>
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<tr>
<td>IMPROVED SUBGRADE:</td>
<td>Aggregate Width = 31.0'</td>
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<td>0 UNITS</td>
<td>$0.00 / UNITS</td>
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<tr>
<td>PAVEMENT REMOVAL</td>
<td>2,667 SQ YD</td>
<td>$19.00 / SQ YD</td>
<td>$50,673</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHOULDER REMOVAL</td>
<td>2,000 SQ YD</td>
<td>$10.00 / SQ YD</td>
<td>$20,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: * Denotes User Supplied Quantity

**RIGID CONSTRUCTION INITIAL COST**
$777,692

**RIGID CONSTRUCTION ANNUAL COST PER MILE**
$111,648

**MAINTENANCE COSTS:**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>THICKNESS</th>
<th>MATERIAL</th>
<th>T</th>
<th>UNIT COST</th>
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</thead>
<tbody>
<tr>
<td>ROUTINE MAINTENANCE ACTIVITY</td>
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<td></td>
<td></td>
<td>$0.00 / LANE-MILE / YEAR</td>
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<td>(3.75&quot;)</td>
<td>3.75</td>
<td>$27.43 / SQ YD</td>
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<tr>
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<td>1.0195 Surface Mix 1.50</td>
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<td>1.0273 Top Binder Mix 2.25</td>
<td>$15.66 / SQ YD</td>
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<tr>
<td>HMA POLICY OVERLAY SHLD</td>
<td>(3.75&quot;)</td>
<td>Shoulder Mix 3.75</td>
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<tr>
<td>CLASS A PAVEMENT PATCHING</td>
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<td>$195.00 / SQ YD</td>
</tr>
<tr>
<td>CLASS B PAVEMENT PATCHING</td>
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<td>$150.00 / SQ YD</td>
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<tr>
<td>CLASS C SHOULDER PATCHING</td>
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<td>Surface Mix 1.50</td>
<td>$81.68 / SQ YD</td>
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<tr>
<td>PARTIAL DEPTH PVMT PATCH (Mill &amp; Fill HMA 1.50&quot;)</td>
<td></td>
<td>Surface Mix 1.50</td>
<td>$81.68 / SQ YD</td>
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<tr>
<td>LONGITUDINAL SHOULDER JOINT ROUT &amp; SEAL</td>
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<td></td>
<td></td>
<td>$2.00 / LIN FT</td>
</tr>
<tr>
<td>CENTERLINE JOINT ROUT &amp; SEAL</td>
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<td></td>
<td>$2.00 / LIN FT</td>
</tr>
<tr>
<td>REFLECTIVE TRANSVERSE CRACK ROUT &amp; SEAL</td>
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<td>$2.00 / LIN FT</td>
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<td>RANDOM CRACK ROUT &amp; SEAL</td>
<td>(100% Rehab = 100.00' / Station / Lane)</td>
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<td>$2.00 / LIN FT</td>
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**RIGID TOTAL LIFE-CYCLE COST**
$863,346

**RIGID TOTAL ANNUAL COST PER MILE**
$123,945
### LIFE-CYCLE COST ANALYSIS: NEW DESIGN

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<tr>
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<th>JPCP</th>
<th>HMA</th>
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<tr>
<td><strong>CONSTRUCTION</strong></td>
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<td>$539,968</td>
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<tr>
<td><strong>MAINTENANCE</strong></td>
<td><strong>LIFE-CYCLE COST</strong></td>
<td><strong>PRESENT WORTH</strong></td>
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<td></td>
<td>$85,654</td>
<td>$135,863</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>LIFE-CYCLE COST</strong></td>
<td><strong>PRESENT WORTH</strong></td>
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<td>$675,831</td>
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### LIFE-CYCLE COST ANALYSIS: FINAL SUMMARY

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<th><strong>HMA</strong></th>
<th><strong>$97,025</strong></th>
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<td><strong>OTHER OPTIONS (LOWEST TO HIGHEST):</strong></td>
<td><strong>TYPE / PERCENTAGE</strong></td>
<td><strong>JPCP</strong></td>
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S:\GEN\WPDOCS\Pavement Designs\D-9\I-57 Ramps at Ina Interchange - 78532\[78532_IDOT Mechanistic Pavement Design with LCCA 112816.xlsm\]PDFSheets
## Full-Depth HMA Pavement

### HMA Overlay of Rubblized PCC Pavement

#### Figure 54-7.C

**Standard Design**

### Maintenance Costs: Present Worth

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<tr>
<th>Year</th>
<th>Item Description</th>
<th>Percentage</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Cost</th>
<th>Cost</th>
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<td>Lin Ft</td>
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</table>

### Maintenance Life-Cycle Cost

- **Total Maintenance Life-Cycle Cost**: $135,863

### Routine Maintenance Activity

- **Cost**: $0

### Maintenance Annual Cost per Mile

- **Cost**: $19,505
### Jointed Plain Concrete Pavement

**UNBONDED JOINTED PLAIN CONCRETE OVERLAY**

#### Figure 54-7.A

**PRESENT MAINTENANCE COSTS:**

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<th>YEAR</th>
<th>ITEM</th>
<th>%</th>
<th>QUANTITY</th>
<th>UNIT</th>
<th>UNIT COST</th>
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<td>LIN FT</td>
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**ROUTINE MAINTENANCE ACTIVITY**

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**MAINTENANCE LIFE-CYCLE COST**

$85,654

**MAINTENANCE ANNUAL COST PER MILE**

$12,297
TYPICAL SECTION #1

ENTRANCE & EXIT RAMPS

JEFFERSON COUNTY
SOUTHBOUND RAMPS
F.A.I. ROUTE 57

(Looking in direction of increasing station)

EXISTING 2" HOT-MIX ASPHALT SHOULDER SURFACE
EXISTING PIPE UNDERDRAINS
EXISTING 2" HOT-MIX ASPHALT SURFACE
EXISTING 10" PCC PAVEMENT
EXISTING 6" AGGREGATE SURFACE

PROPOSED AGGREGATE SHOULDER TYPE B, 10"
PROPOSED 4" STABILIZED SUBBASE
PROPOSED 10" PCC SHOULDER
PROPOSED PAVED SHOULDER REMOVAL

EXISTING PIPE UNDERDRAINS
EXISTING 2" HOT-MIX ASPHALT SHOULDER SURFACE
EXISTING 2" HOT-MIX ASPHALT SURFACE
EXISTING 10" PCC PAVEMENT
EXISTING 6" AGGREGATE SURFACE

PROPOSED AGGREGATE SHOULDER TYPE B, 10"
PROPOSED 4" STABILIZED SUBBASE
PROPOSED 10" PCC SHOULDER
PROPOSED PAVED SHOULDER REMOVAL

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

TO BE USED
TRAFFIC INTERCHANGE RAMPS
RAMP "A" SOUTHBOUND ENTRANCE
STATION 1A+00 TO STATION 4A+64.00

FILE NAME
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PLOT DATE
12/12/2016

DATE DESIGNED

DATE CHECKED

DATE DRAWN

DATE REVISED

DATE REVISED

DATE REVISED

DATE REVISED

FILE NAME

USER NAME

PLOT SCALE

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