



# Illinois Department of Transportation

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To: Diane M. O'Keefe      Attn: District One  
From: John D. Baranzelli  
Subject: Pavement Design  
Date: April 30, 2012

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FAP Route 311 (US Route 34)  
Du Page County  
At Canadian National RR

We have reviewed the pavement selection for the project, which was submitted to BDE by email dated April 5, 2012. The life cycle costs favor the rigid pavement design. The approved pavement design for this project is as follows:

US Route 34 (Pavement Reconstruction)

10.5 inches of Jointed PCC Pavement with Tied PCC Curb & Gutter  
12 inches of Aggregate Subgrade Improvement

If you have any questions, please contact Paul Niedernhofer at (217) 524-1651.



# Illinois Department of Transportation

## Memorandum

To: John D. Baranzelli, PE

Attn: Paul R. Niedernhofer

From: Diane O'Keefe

By: Jose Dominguez

Subject: Pavement Analysis\*

Date: April 4, 2012

\*Route: FAP 311 (US 34)

Limits: at Canadian National RR

Contract No.: 60R06

Letting: 06CY13

Section: 652-A

County: DuPage

Job No.: P-91-002-10

We are submitting the pavement analysis for the above captioned location for your review and approval. Please note that the total pavement area for reconstruction exceeds 4,750 Square Yards. The improvement involves the following scope of work:

a.) Pavement reconstruction of US 34 to accommodate a grade separation between US 34 and the EJ&E/CN Railroad by constructing a highway overpass over the railroad.

A 20 year mechanistic pavement analysis was performed for the pavement reconstruction of US 34 since the pavement reconstruction is less than 25,000 square yards. The recommended pavement is:

**a.) US 34**

Pavement Reconstruction

PCC Curb and Gutter (tied)

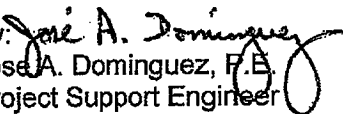
10 1/2" PCC Pavement (Jointed) \*

12" Aggregate Subgrade Improvement

The life cycle cost analysis favors PCC pavement by 62.1%.

\*Designer Note 1: To be paid as pay item #42000511, **PORTLAND CEMENT CONCRETE PAVEMENT 10 1/2" (JOINTED)**, paid in square yards.

If you have any questions or need additional information, please contact Mr. Tom Matousek at (847)705-4255.

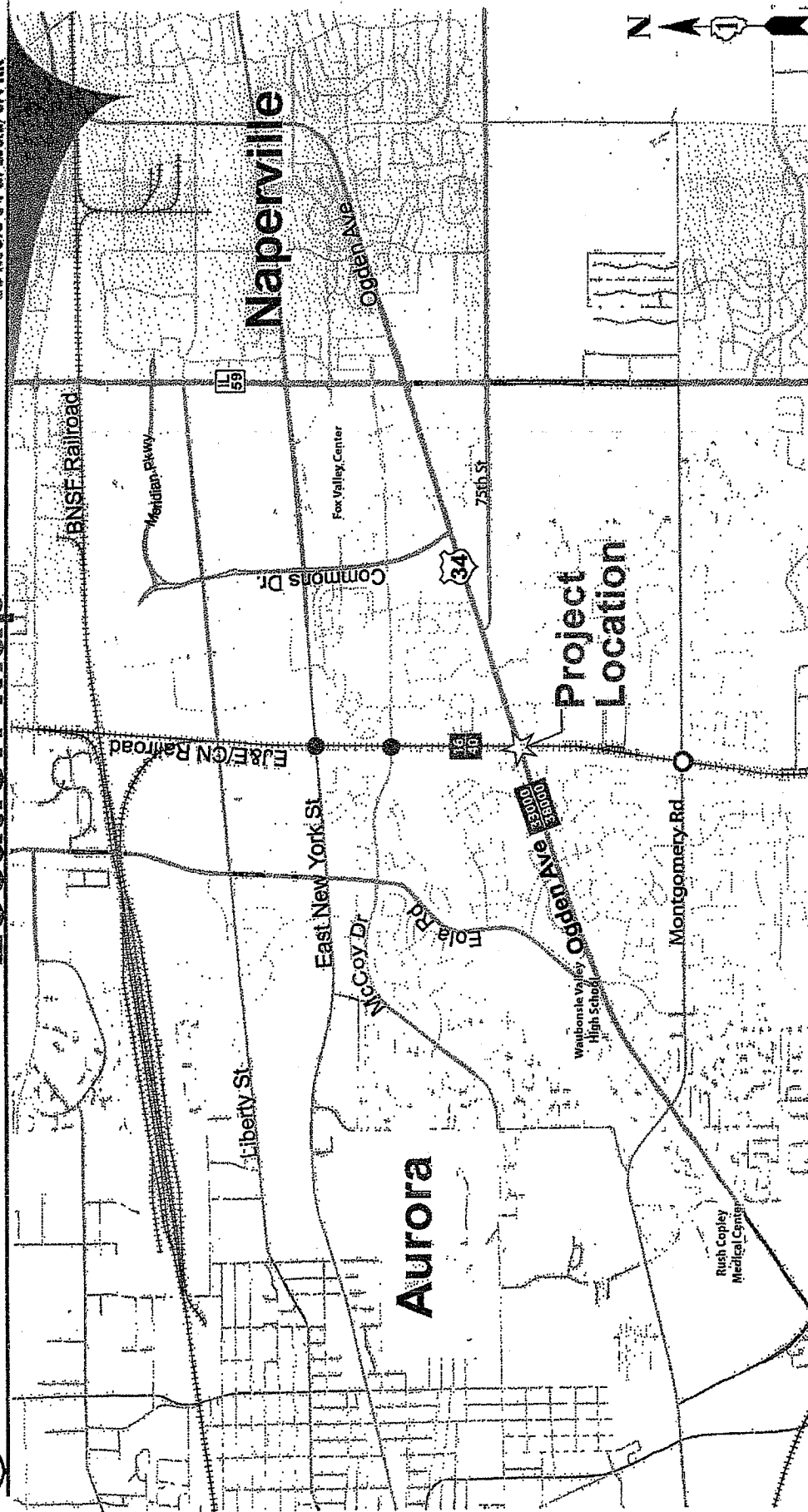
By:   
Jose A. Dominguez, P.E.  
Project Support Engineer



Illinois Department of Transportation

# Location Map

US Route 34 at E18E/CN RR



- ★ Proposed Ogdenville Avenue Grade-Separated Crossing
- Existing At-Grade Crossing
- Existing Grade-Separated Crossing

2010 Average Daily Traffic (ADT)/2040 ADT  
 2010 Trains per Day/2015 Trains per Day

**MECHANISTIC PAVEMENT DESIGN**

**INPUT** (Enter Data in Gray Shaded Cells)

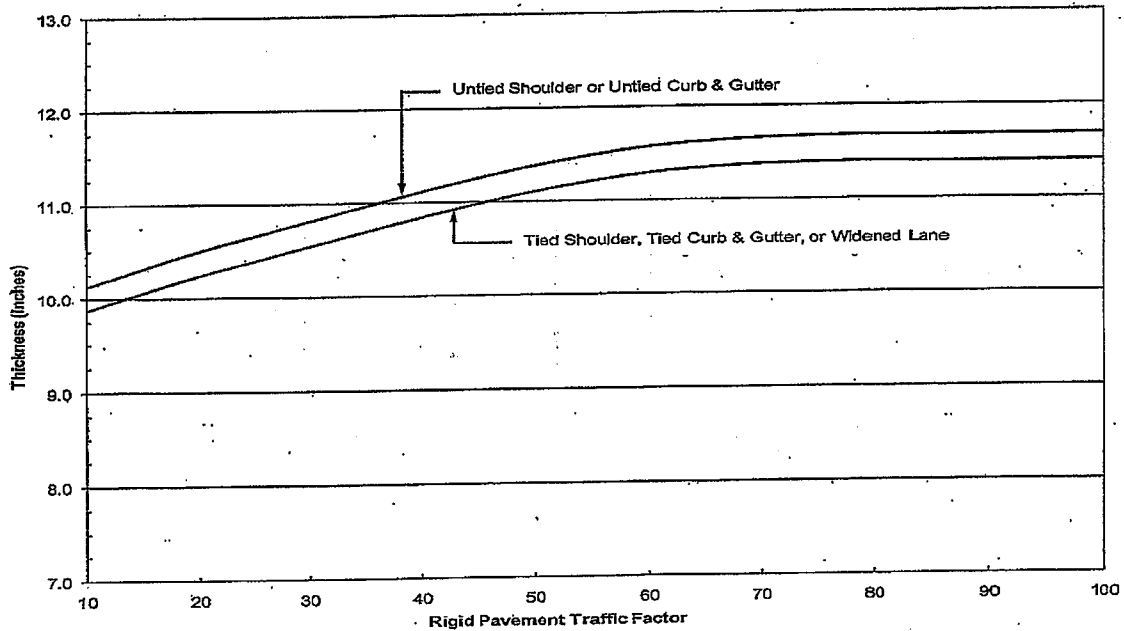
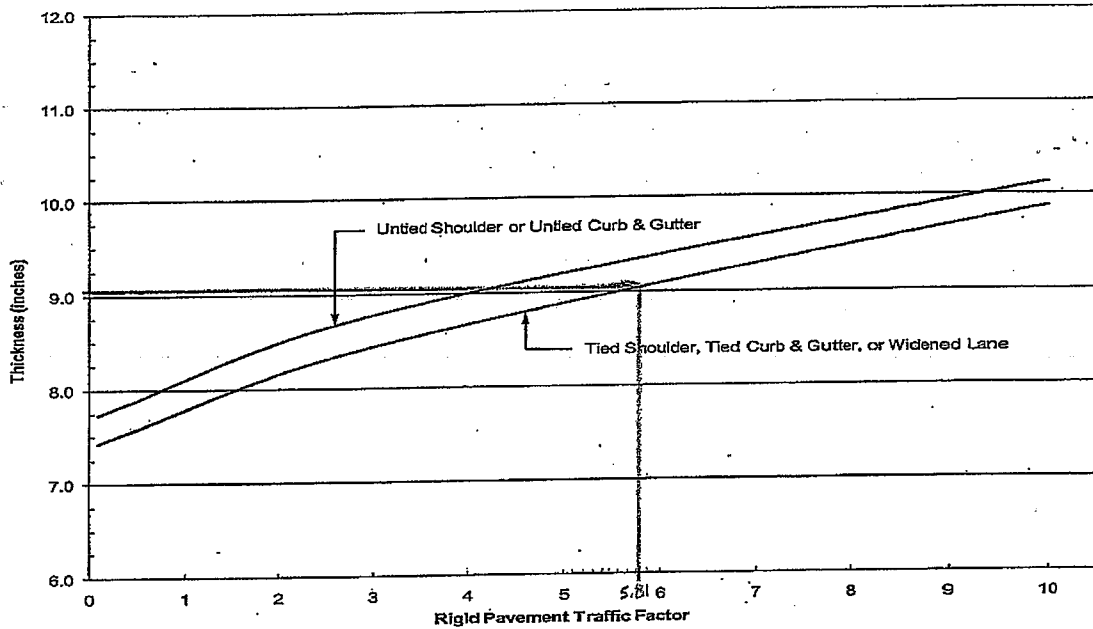
|   |  |                           |                         |      |          |             |            |                       |                         |        |        |       |         |          |     |      |         |          |     |      |         |                      |       |        |  |
|---|--|---------------------------|-------------------------|------|----------|-------------|------------|-----------------------|-------------------------|--------|--------|-------|---------|----------|-----|------|---------|----------|-----|------|---------|----------------------|-------|--------|--|
| Route: IAP-211 (US 34)  | Comments: Traffic Data for US 34 at CNRR   |                           |                         |      |          |             |            |                       |                         |        |        |       |         |          |     |      |         |          |     |      |         |                      |       |        |  |
| Section: 652 A  |  |                           |                         |      |          |             |            |                       |                         |        |        |       |         |          |     |      |         |          |     |      |         |                      |       |        |  |
| County: DuPage  |  |                           |                         |      |          |             |            |                       |                         |        |        |       |         |          |     |      |         |          |     |      |         |                      |       |        |  |
| Location: US 34 at CNRR   | Designer: TMC  |                           |                         |      |          |             |            |                       |                         |        |        |       |         |          |     |      |         |          |     |      |         |                      |       |        |  |
| Facility Type: <input type="checkbox"/> Freeway <input type="checkbox"/> Expressway <input type="checkbox"/> Interchange <input type="checkbox"/> Interchange with Ramp <input type="checkbox"/> Interchange with Ramp and Overpass <input type="checkbox"/> Interchange with Ramp and Overpass and Bridge <input type="checkbox"/> Interchange with Ramp and Overpass and Bridge and Tunnel <input type="checkbox"/> Interchange with Ramp and Overpass and Bridge and Tunnel and Viaduct <input type="checkbox"/> Interchange with Ramp and Overpass and Bridge and Tunnel and Viaduct and Bridge <input type="checkbox"/> Interchange with Ramp and Overpass and Bridge and Tunnel and Viaduct and Bridge and Tunnel <input type="checkbox"/> Interchange with Ramp and Overpass and Bridge and Tunnel and Viaduct and Bridge and Tunnel and Viaduct | <table border="1"> <tr> <td></td> <td>ADT</td> <td>Year</td> </tr> <tr> <td>Current:</td> <td>33000</td> <td>2009</td> </tr> <tr> <td>Future:</td> <td>38000</td> <td>2040</td> </tr> </table>   |                           | ADT                     | Year | Current: | 33000       | 2009       | Future:               | 38000                   | 2040   |        |       |         |          |     |      |         |          |     |      |         |                      |       |        |  |
|   | ADT  | Year                      |                         |      |          |             |            |                       |                         |        |        |       |         |          |     |      |         |          |     |      |         |                      |       |        |  |
| Current:  | 33000  | 2009                      |                         |      |          |             |            |                       |                         |        |        |       |         |          |     |      |         |          |     |      |         |                      |       |        |  |
| Future:   | 38000  | 2040                      |                         |      |          |             |            |                       |                         |        |        |       |         |          |     |      |         |          |     |      |         |                      |       |        |  |
| # of Lanes = 4  |  |                           |                         |      |          |             |            |                       |                         |        |        |       |         |          |     |      |         |          |     |      |         |                      |       |        |  |
| Road Class: I   |  |                           |                         |      |          |             |            |                       |                         |        |        |       |         |          |     |      |         |          |     |      |         |                      |       |        |  |
| Subgrade Support Rating (SSR): Poor   |  |                           |                         |      |          |             |            |                       |                         |        |        |       |         |          |     |      |         |          |     |      |         |                      |       |        |  |
| Construction Year: 2013   |  |                           |                         |      |          |             |            |                       |                         |        |        |       |         |          |     |      |         |          |     |      |         |                      |       |        |  |
| Design Period (DP) = 20 years   |  |                           |                         |      |          |             |            |                       |                         |        |        |       |         |          |     |      |         |          |     |      |         |                      |       |        |  |
|   | <table border="1"> <tr> <td colspan="4">Structural Design Traffic</td> </tr> <tr> <td>Minimum ADT</td> <td>Actual ADT</td> <td>Actual % of Total ADT</td> <td>% of ADT in Design Lane</td> </tr> <tr> <td>PV = 0</td> <td>33,869</td> <td>96.1%</td> <td>P = 32%</td> </tr> <tr> <td>SU = 250</td> <td>589</td> <td>1.7%</td> <td>S = 45%</td> </tr> <tr> <td>MU = 750</td> <td>800</td> <td>2.3%</td> <td>M = 45%</td> </tr> <tr> <td>Struct. Design ADT =</td> <td>35258</td> <td>(2023)</td> <td></td> </tr> </table> | Structural Design Traffic |                         |      |          | Minimum ADT | Actual ADT | Actual % of Total ADT | % of ADT in Design Lane | PV = 0 | 33,869 | 96.1% | P = 32% | SU = 250 | 589 | 1.7% | S = 45% | MU = 750 | 800 | 2.3% | M = 45% | Struct. Design ADT = | 35258 | (2023) |  |
| Structural Design Traffic   |  |                           |                         |      |          |             |            |                       |                         |        |        |       |         |          |     |      |         |          |     |      |         |                      |       |        |  |
| Minimum ADT   | Actual ADT   | Actual % of Total ADT     | % of ADT in Design Lane |      |          |             |            |                       |                         |        |        |       |         |          |     |      |         |          |     |      |         |                      |       |        |  |
| PV = 0  | 33,869   | 96.1%                     | P = 32%                 |      |          |             |            |                       |                         |        |        |       |         |          |     |      |         |          |     |      |         |                      |       |        |  |
| SU = 250  | 589  | 1.7%                      | S = 45%                 |      |          |             |            |                       |                         |        |        |       |         |          |     |      |         |          |     |      |         |                      |       |        |  |
| MU = 750  | 800  | 2.3%                      | M = 45%                 |      |          |             |            |                       |                         |        |        |       |         |          |     |      |         |          |     |      |         |                      |       |        |  |
| Struct. Design ADT =  | 35258  | (2023)                    |                         |      |          |             |            |                       |                         |        |        |       |         |          |     |      |         |          |     |      |         |                      |       |        |  |

**FLEXIBLE & RIGID PAVEMENT CALCULATIONS AND ADDITIONAL INPUT**

| Flexible Pavement                     |                            | Rigid Pavement      |                          |
|---------------------------------------|----------------------------|---------------------|--------------------------|
| Cpv =                                 | 0.15                       | Cpv =               | 0.15                     |
| Csu =                                 | 133                        | Csu =               | 144                      |
| Cmu =                                 | 483                        | Cmu =               | 696                      |
| TF flexible (Actual) =                | 4.21 (Actual ADT)          | TF rigid (Actual) = | 5.81 (Actual ADT)        |
| TF flexible (Min) =                   | 3.56 (Min ADT Fig 54-2C)   | TF rigid (Min) =    | 5.02 (Min ADT Fig 54-2C) |
| Use TF flexible =                     | 4.21                       | Use TF rigid =      | 5.81                     |
| AC Type =                             | 20                         |                     | Shoulder or C. & G.      |
| AC Mixture Temperature =              | 80.0 deg. F (Figure 54-5C) | Rigid Pavr. Thick = | 8.50 in. (Figure 54-4D)  |
| Design AC Mixture Modulus (Eac) =     | 550 ksi (Figure 54-5D)     |                     |                          |
| Design Asphalt Concrete Microstrain = | 66.5 (Figure 54-5E)        |                     |                          |
| Asphalt Concrete Thickness =          | 3.50 in. (Figure 54-5F)    |                     |                          |

**DESIGN TABLES FROM BD&E PAVEMENT DESIGN CH. 54 AND PAVEMENT DESIGN MANUAL**

| Class I Roads  | Class II Roads   |        |                       | Class III Roads                 |   | Class IV Roads         |  |
|--|--|--------|-----------------------|---------------------------------|---|------------------------|--|
| 4 lanes or more<br>Part of a future 4 lanes or more<br>One-way Streets with ADT > 3500 | 2 lanes with ADT > 2000<br>One way Street with ADT <= 3500 |        |                       | 2 Lanes<br>(ADT 750 -2000)      |   | 2 Lanes<br>(ADT < 750) |  |
|  | Min. Str. Design Traffic (Fig 54-2C)                       |        |                       |                                 |   |                        |  |
| Facility Type  | PV   | SU     | MU                    | Class Table for One-Way Streets |   |                        |  |
| Interstate or Supplemental Freeway   | 0  | 500    | 1500                  | ADT                             | Class   |                        |  |
| Other Marked State Route   | 200  | 200    | 200                   | 0 - 3500                        | II  |                        |  |
| Unmarked State Route   | No Min   | No Min | No Min                | >3501                           | I   |                        |  |
|  | Traffic Factor ESAL Coefficients                           |        |                       |                                 |   |                        |  |
|  | Rigid (Fig. 54-4C)   |        | Flexible (Fig. 54-5B) |                                 | Class Table for 2 or 3 lanes (not future 4 lane & not one-way street) |                        |  |
| Class  | Csu  | Cmu    | Csu                   | Cmu                             | ADT   | Class                  |  |
| I  | 143.81   | 696.42 | 132.50                | 482.53                          | 0 - 749   | IV                     |  |
| II   | 135.78   | 567.21 | 112.06                | 385.44                          | 750 - 2000  | III                    |  |
| III  | 129.58   | 562.47 | 109.14                | 384.35                          | >2000   | II                     |  |
| IV(ADT>400)  | 127.75   | 555.90 | 109.14                | 384.35                          |   |                        |  |
| IV(ADT<=400)   | 127.75   | 555.90 | 9.86                  | 78.84                           |   |                        |  |
|  | Figure 54-2B Percentage of ADT in Design Lane              |        |                       |                                 |   |                        |  |
|  | Rural  |        |                       | Urban                           |   |                        |  |
| Number of Lanes  | P  | S      | M                     | P                               | S   | M                      |  |
| 1 Lane Ramp  | 100%   | 100%   | 100%                  | 100%                            | 100%  | 100%                   |  |
| 2 or 3   | 50%  | 50%    | 50%                   | 50%                             | 50%   | 50%                    |  |
| 4  | 52%  | 45%    | 45%                   | 32%                             | 35%   | 37%                    |  |
| 6 or more  | 20%  | 40%    | 40%                   | 8%                              | 37%   | 37%                    |  |

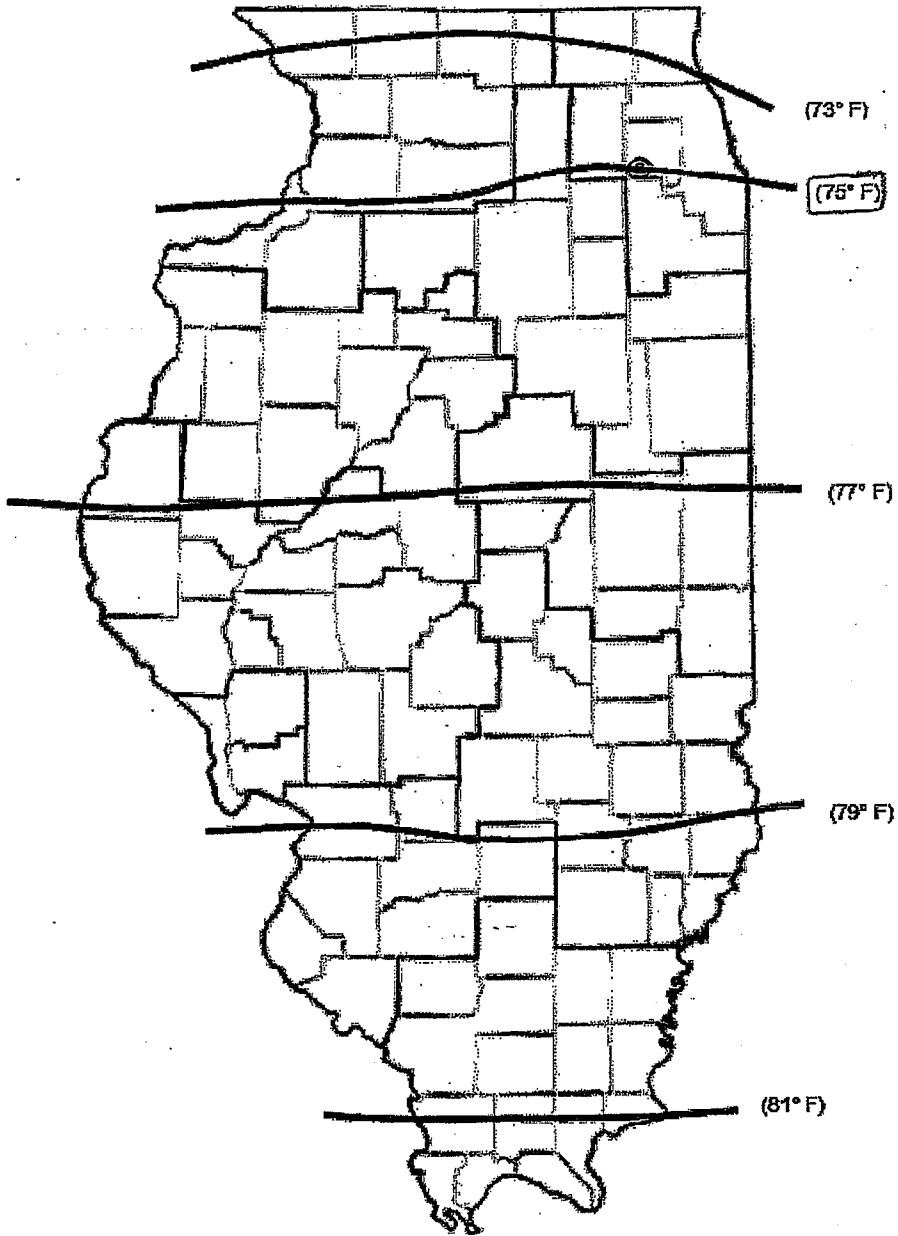


Note: Use of untied shoulder design requires BDE approval.

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

9/4" PCC PAVEMENT (JOINTED)

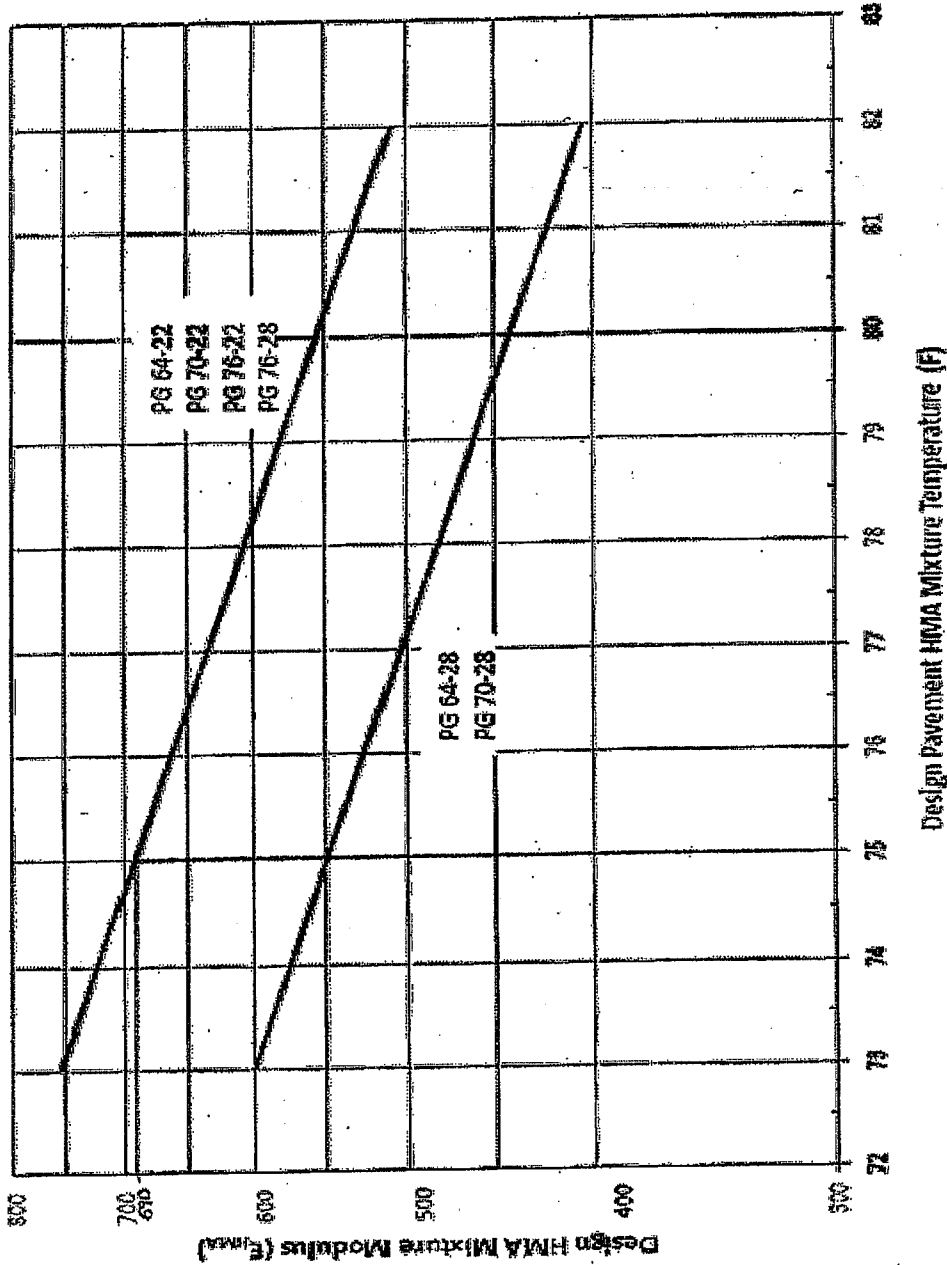
Figure 54-4.E



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

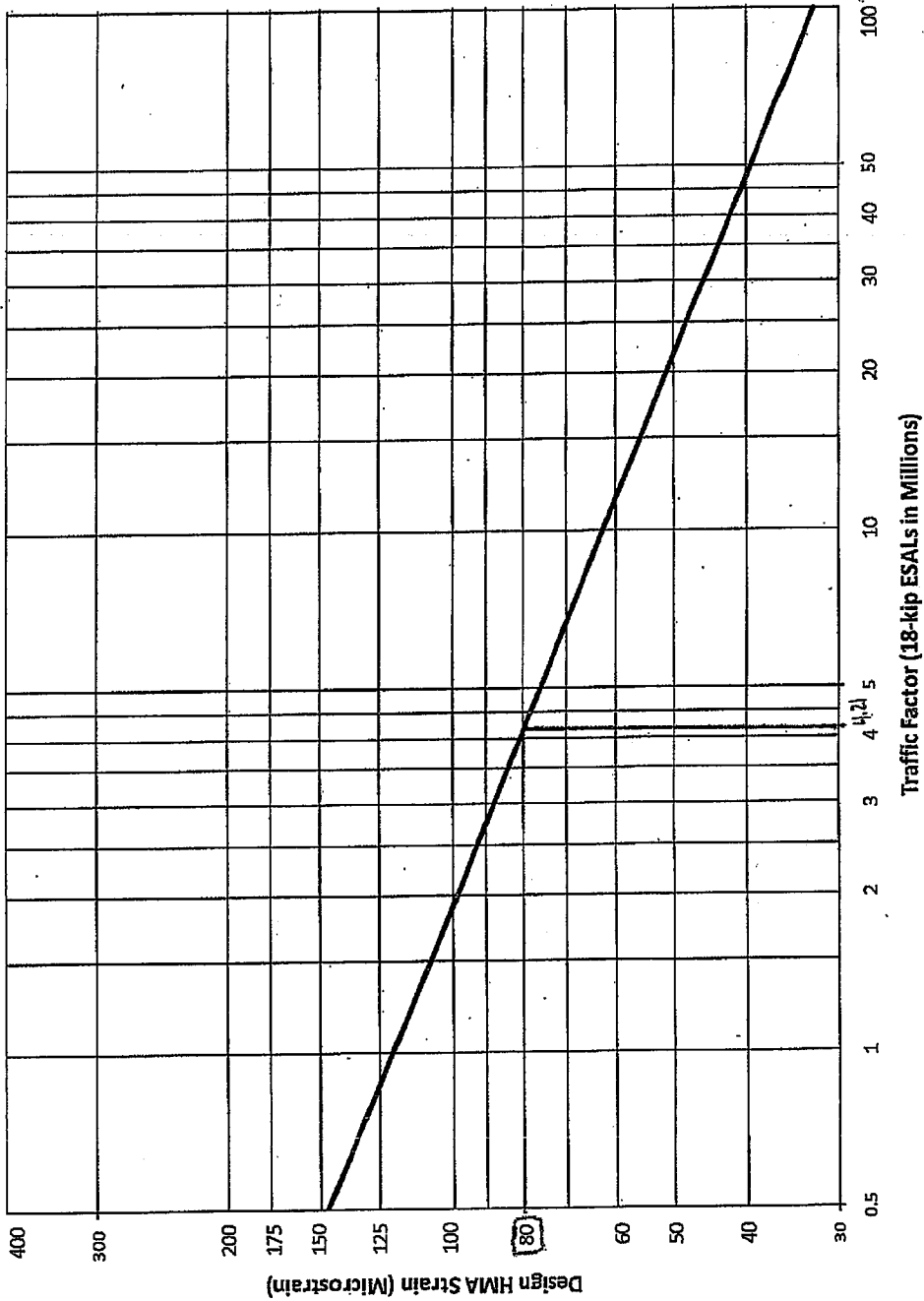
**HMA MIXTURE TEMPERATURE  
(Mechanistic Design: Flexible Pavement)**

Figure 54-5.C



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

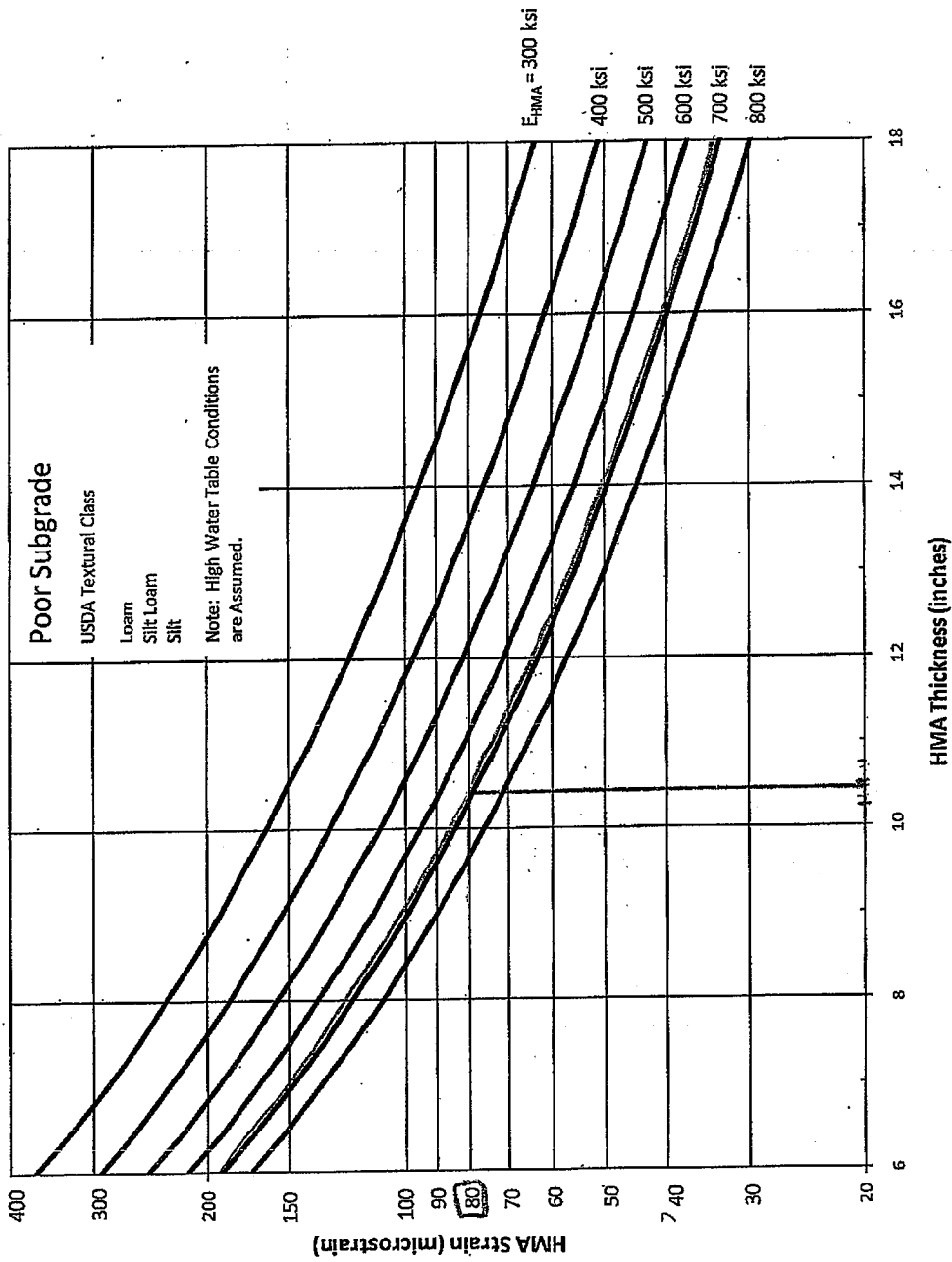
Figure 54-5.D



DESIGN HMA STRAIN  
(Mechanistic Design: Flexible Pavement)

Figure 54-5.E





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

10 1/2" HMA PAVEMENT (FULL-DEPTH)

Figure 54-5.F

## MECHANISTIC PAVEMENT DESIGN

Date 4-Apr-12 Route US 34 @ CNRR  
Calcs by: SJP Section 652-A  
Checked by: \_\_\_\_\_ Location DuPage County  
Class I Roads and Streets  
Urban \_\_\_\_\_ Rural X  
Limits of Analysis Station 9+00 to Station 9+56  
Length 2806 Feet 0.53 Miles

Structural Design Traffic                      Percent of S.D.T. in Design Lane  
PV = 33869                                      P = 96.10%  
SU = 589                                         S = 1.70%  
MU = 800                                         U = 2.30%

MINIMUM SUBGRADE SUPPORT RATING - "POOR"

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Flexible Pavement Design                      Actual  $TF_F =$  4.21                      Minimum  $TF_F =$  3.56

Selected Design AC Type  
Design AC Mixture Temp 75 °F                      Design  $E_{AC}$  690 KSI  
Design AC Microstrain 80                              AC Thickness 10.50 Inch

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Rigid Pavement Design                      Actual  $TF_F =$  5.81                      Minimum  $TF_F =$  5.02

Extended Lane 0 Inch  
15' Panel PCC Thickness for:  
Tied Shoulder 0 Inch  
Untied Shoulder 0 Inch

Figure 5.05

**RIGID PAVEMENT**

Date: 4-Apr-12 Route US 34 @ CNRR  
 Quantities by SIP Checked by: [redacted] Section 652-A  
 Unit Prices by [redacted] Checked by: [redacted] DuPage County  
 Net Length 2806 Lin. Ft. = 0.53 Miles  
 Number Lanes 4 Urban Rural X

**ITEMIZED CONSTRUCTION COST**

| Quantity      | Units    | Item                                 |   | <u>40.82</u><br>Unit<br>Cost | <u>610,871</u><br>Total<br>Cost |
|---------------|----------|--------------------------------------|---|------------------------------|---------------------------------|
| <u>14965</u>  | Sq. Yds. | <u>0</u> Inch Jointed PCC            | @ | <del>\$35.22</del>           | <del>\$527,067</del>            |
| <u>0</u>      | Sq. Yds. | 4-Inch (Stabilized/Granular Subbase) | @ | \$0.00                       | \$0                             |
| <u>0</u>      | Sq. Yds. | PCC Shoulder                         | @ | \$0.00                       | \$0                             |
|               | Lin. Ft. | Pipe Underdrains                     | @ |                              |                                 |
| <u>0</u>      |          | Subbase Gran. Mat., Type C           | @ | \$0.00                       | \$0                             |
| <u>11,224</u> | Lin. Ft. | 100% Shoulder Joint Seal             | @ | \$2.00                       | \$22,448                        |

Total Cost of Original Pavement Construction ~~\$549,515~~  
633,319

**ITEMIZED MAINTENANCE AND REHABILITATION ACTIVITY COST**

**REHABILITATION ACTIVITY 1 - YEAR 10**

15 Sq. Yds. 0.1% Full Depth PCC Pavement Patching @ \$110.00 \$1,650  
 Total Cost of Rehabilitation Activity 1 \$1,650

REHABILITATION ACTIVITY 2 - YEAR 15

|                    |   | Unit Cost       | Total Cost     |
|--------------------|---|-----------------|----------------|
| <u>30</u> Sq. Yds. | 0.2% Full Depth PCC Pavement Patching @ | <u>\$110.00</u> | <u>\$3,300</u> |

Total Cost of Rehabilitation Activity 2    \$3,300

REHABILITATION ACTIVITY 3 - YEAR 20

|                       |  | Unit Cost      | Total Cost      |
|-----------------------|--|----------------|-----------------|
| <u>299</u> Sq. Yds.   | 2% Full Depth PCC Pavement Patching @                    | <u>\$0.00</u>  | <u>\$32,890</u> |
| <u>0</u> Sq. Yds.     | 0.5% Full Depth PCC Pavement Patching @                  | <u>\$85.00</u> | <u>\$0</u>      |
| <u>11224</u> Lin. Ft. | 100% Longitudunal/ Shoulder Joint<br>Routing & Sealing @ | <u>\$0.65</u>  | <u>\$7,296</u>  |
| <u>5612</u> Lin. Ft.  | 100% Centerline Joint<br>Routing & Sealing @             | <u>\$0.70</u>  | <u>\$3,928</u>  |

Total Cost of Rehabilitation Activity 3    \$44,114

FIGURE 5.05a(2)

RIGID PAVEMENT (Cont.)

Route US 34 @ CNRR  
 Section 652-A

DuPage County

REHABILITATION ACTIVITY 4 - YEAR 25

|                     |                                       |   | Unit Cost       | Total Cost      |
|---------------------|---------------------------------------|---|-----------------|-----------------|
| <u>449</u> Sq. Yds. | 3.0% Full Depth PCC Pavement Patching | @ | <u>\$110.00</u> | <u>\$49,390</u> |
| <u>0</u> Sq. Yds.   | 1.0% Full Depth PCC Pavement Patching | @ | <u>\$85.00</u>  | <u>\$0</u>      |

Total Cost of Rehabilitation Activity 4 \$49,390

REHABILITATION ACTIVITY 5 - YEAR 30

|                        |                                       |   | Unit Cost      | Total Cost       |
|------------------------|---------------------------------------|---|----------------|------------------|
| <u>599</u> Sq. Yds.    | 3.0% Full Depth PCC Pavement Patching | @ | <u>\$85.00</u> | <u>\$0</u>       |
| <u>0</u> Sq. Yds.      | 1.0% Full Depth PCC Pavement Patching | @ | <u>\$12.23</u> | <u>\$183,022</u> |
| <u>14,965</u> Sq. Yds. | Policy HMA Overlay - Pavement         | @ | <u>\$12.23</u> | <u>\$183,022</u> |
| <u>0</u> Sq. Yds.      | Policy HMA Overlay - Shoulder         | @ | <u>\$12.23</u> | <u>\$0</u>       |

Total Cost of Rehabilitation Activity 5 \$248,912

REHABILITATION ACTIVITY 6 - YEAR 35

|                        |   |   | Unit Cost       | Total Cost     |
|------------------------|---|---|-----------------|----------------|
| <u>11,224</u> Lin. Ft. | 100% Longitudinal Shoulder Joint                                      | @ | <u>\$0.65</u>   | <u>\$7,296</u> |
|                        | Routing & Sealing   |   |                 |                |
| <u>5612</u> Lin. Ft.   | 100% Centerline Joint   | @ | <u>\$0.70</u>   | <u>\$3,928</u> |
|                        | Routing & Sealing   |   |                 |                |
| <u>5,612</u> Lin. Ft.  | 50% Random Crack  | @ | <u>\$0.65</u>   | <u>\$3,648</u> |
|                        | Routing & Sealing - Assume 100ft/station                              |   |                 |                |
| <u>3,592</u> Lin. Ft.  | 40% Reflective Transverse Crack                                       | @ | <u>\$0.65</u>   | <u>\$2,335</u> |
|                        | Routing & Sealing   |   |                 |                |
| <u>15</u> Sq. Yds.     | 0.1% Partial-Depth Pavement Patching                                  |   | <u>\$110.00</u> | <u>\$1,650</u> |
|                        | (Mill & Fill Surface-Interstates; Mill & Fill 2.5in. Non-Interstates) |   |                 |                |

Total Cost of Rehabilitation Activity 6 \$18,857

REHABILITATION ACTIVITY 7 - YEAR 40

|                        |   |   | Unit Cost       | Total Cost      |
|------------------------|---|---|-----------------|-----------------|
| <u>75</u> Sq. Yds.     | 0.5% Full Depth PCC Pavement Patching                                 | @ | <u>\$110.00</u> | <u>\$8,250</u>  |
| <u>75</u> Sq. Yds.     | 0.5% Partial Depth Pavement Patching                                  | @ | <u>\$110.00</u> | <u>\$8,250</u>  |
|                        | (Mill & Fill Surface-Interstates; Mill & Fill 2.5in. Non-Interstates) |   |                 |                 |
| <u>5,388</u> Lin. Ft.  | 60% Reflective Transverse Crack                                       | @ | <u>\$0.65</u>   | <u>\$3,502</u>  |
|                        | Routing & Sealing   |   |                 |                 |
| <u>5,612</u> Lin. Ft.  | 50% Random Crack  | @ | <u>\$0.65</u>   | <u>\$3,648</u>  |
|                        | Routing & Sealing - Assume 100ft/station                              |   |                 |                 |
| <u>11,224</u> Lin. Ft. | 100% Longitudinal/ Shoulder Joint                                     | @ | <u>\$0.65</u>   | <u>\$7,296</u>  |
|                        | Routing & Sealing   |   |                 |                 |
| <u>5,612</u> Lin. Ft.  | 100% Centerline Joint   | @ | <u>\$0.70</u>   | <u>\$3,928</u>  |
|                        | Routing & Sealing   |   |                 |                 |
|                        | Total Cost of Rehabilitation Activity 7                               |   |                 | <u>\$34,874</u> |

RIGID PAVEMENT (Cont.)

Route US 34 @ CNRR  
 Section 652-A

DuPage County

**ANNUAL COST DETERMINATION**

Present Worth Calculation:

Total Cost of Original Pavement Construction

~~55,315~~  
\$549,515

|                                   |                  |            |                  |
|-----------------------------------|------------------|------------|------------------|
| Present Worth of Rehab Activity 1 | <u>\$1,650</u>   | x 0.7441 = | <u>\$1,228</u>   |
| Present Worth of Rehab Activity 2 | <u>\$3,300</u>   | x 0.6419 = | <u>\$2,118</u>   |
| Present Worth of Rehab Activity 3 | <u>\$44,114</u>  | x 0.5537 = | <u>\$24,426</u>  |
| Present Worth of Rehab Activity 4 | <u>\$49,390</u>  | x 0.4776 = | <u>\$23,589</u>  |
| Present Worth of Rehab Activity 5 | <u>\$248,912</u> | x 0.4120 = | <u>\$102,552</u> |
| Present Worth of Rehab Activity 6 | <u>\$18,857</u>  | x 0.3554 = | <u>\$6,702</u>   |
| Present Worth of Rehab Activity 7 | <u>\$34,874</u>  | x 0.3066 = | <u>\$10,692</u>  |

Total Life Cycle Cost (Present Worth) - \$171,307

Annual Cost Per Mile Calculation

Total PW x CRF<sub>n</sub> / Length  
\$171,307 x 0.04079 / 0.53 Mi.

= Annual Cost / Year-Mile  
\$55,476 per Yr.-Mi.

61,926

**FLEXIBLE PAVEMENT**

Date: 4-Apr-12 Route US 34 @ CNRR  
 Quantities by SJP Checked by: [Redacted] Section 652-A  
 Unit Prices by: TM Checked by: [Redacted] DuPage County  
 Net Length 2806 Lin. Ft. = 0.53 Miles  
 Number Lanes 4 Urban Rural X  
 Single Lane Paving X Dual Lane Paving

**ITEMIZED CONSTRUCTION COST**

| <u>Quantity</u> | <u>Units</u> | <u>Item</u>                 |   | <u>Unit Cost</u> | <u>Total Cost</u> |
|-----------------|--------------|-----------------------------|---|------------------|-------------------|
| <u>14,965</u>   | Sq. Yds.     | Class I Surface Course      | @ | <u>\$12.23</u>   | <u>\$183,022</u>  |
| <u>14,965</u>   | Sq. Yds.     | Class I Binder Course       | @ | <u>\$31.70</u>   | <u>\$474,391</u>  |
| <u>0</u>        | Sq. Yds.     | Stabilized Shoulders        | @ | <u>\$0.00</u>    | <u>\$0</u>        |
|                 | Lin. Ft.     | Pipe Underdrains            | @ |                  |                   |
| <u>0</u>        |              | Subbase Gran. Matl., Type C | @ | <u>\$0.00</u>    | <u>\$0</u>        |
| <u>14,965</u>   | Sq. Yds.     | Poly Binder                 | @ | <u>\$11.05</u>   | <u>\$165,363</u>  |

Total Cost of Original Pavement Construction \$822,776

**ITEMIZED MAINTENANCE AND REHABILITATION ACTIVITY COST**

**REHABILITATION ACTIVITY 1 - YEAR 5**

|              |          |  |   | <u>Unit Cost</u> | <u>Total Cost</u> |
|--------------|----------|--|---|------------------|-------------------|
| <u>1543</u>  | Lin. Ft. | 50% Random/Thermal Cracking & Sealing (Assume 110ft/station) | @ | <u>\$0.50</u>    | <u>\$772</u>      |
| <u>11224</u> | Lin. Ft. | 100% Longitudinal Shoulder Joint Routing & Sealing           | @ | <u>\$0.50</u>    | <u>\$5,612</u>    |
| <u>5612</u>  | Lin. Ft. | 100% Centerline Joint Rounting & Sealing                     | @ | <u>\$0.50</u>    | <u>\$2,806</u>    |
| <u>15</u>    | Sq. Yds. | 0.1% Partial-Depth Pavement Patching Mill & Fill Surface     | @ | <u>\$85.00</u>   | <u>\$1,275</u>    |

Total Cost of Rehabilitation Activity 1 \$10,465

FIGURE 5.05b(1)



FLEXIBLE PAVEMENT (Cont.)

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REHABILITATION ACTIVITY 2 - YEAR 10

|              |          |  |   | <u>Unit</u>    | <u>Total</u>   |
|--------------|----------|--|---|----------------|----------------|
|              |          |  |   | <u>Cost</u>    | <u>Cost</u>    |
| <u>75</u>    | Sq. Yds. | 0.5% Partial-depth HMA Pavement Patching - Mill & Fill Surface     | @ | <u>\$85.00</u> | <u>\$6,375</u> |
| <u>1543</u>  | Lin. Ft. | 50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station) | @ | <u>\$0.50</u>  | <u>\$772</u>   |
| <u>11224</u> | Lin. Ft. | 100% Longitudinal Shoulder Joint Routing & Sealing                 | @ | <u>\$0.50</u>  | <u>\$5,612</u> |
| <u>5612</u>  | Lin. Ft. | 100% Centerline Joint Rounting & Sealing                           | @ | <u>\$0.50</u>  | <u>\$2,806</u> |

Total Cost of Rehabilitation Activity 2 \$15,565

REHABILITATION ACTIVITY 3 - YEAR 15

|               |          |   |   | <u>Unit</u>     | <u>Total</u>     |
|---------------|----------|---|---|-----------------|------------------|
|               |          |   |   | <u>Cost</u>     | <u>Cost</u>      |
| <u>14,965</u> | Sq. Yds. | 2.00in. Milling - Pavement & Shoulder                               | @ | <u>\$1.65</u>   | <u>\$24,692</u>  |
| <u>150</u>    | Sq. Yds. | 1.0% Partial-depth Pavement Patching (Mill & Fill Addition 2.00in.) | @ | <u>\$85.00</u>  | <u>\$12,750</u>  |
| <u>1,676</u>  | Sq. Yds. | 2.00in. HMA Overlay Pavement & Shoulder                             | @ | <u>\$109.20</u> | <u>\$183,013</u> |

Total Cost of Rehabilitation Activity 3 \$220,455

FIGURE 5.05b(2)

FLEXIBLE PAVEMENT (Cont.)

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Unit Total

Cost Cost

REHABILITATION ACTIVITY 4 - YEAR 20

|              |          |  |   |                |                |
|--------------|----------|--|---|----------------|----------------|
| <u>11224</u> | Lin. Ft. | 100% Longitudinal Shoulder Joint Routing & Sealing                 | @ | <u>\$0.50</u>  | <u>\$5,612</u> |
| <u>5612</u>  | Lin. Ft. | 100% Centerline Joint Rounting & Sealing                           | @ | <u>\$0.50</u>  | <u>\$2,806</u> |
| <u>1543</u>  | Lin. Ft. | 50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station) | @ | <u>\$0.50</u>  | <u>\$772</u>   |
| <u>15</u>    | Sq. Yds. | 0.1% Partial-Depth HMA Pavement Patching (Mill & Fill Surface)     | @ | <u>\$85.00</u> | <u>\$1,275</u> |

Total Cost of Rehabilitation Activity 4 \$10,465

Unit Total

Cost Cost

REHABILITATION ACTIVITY 5 - YEAR 25

|              |          |  |   |                |                |
|--------------|----------|--|---|----------------|----------------|
| <u>11224</u> | Lin. Ft. | 100% Longitudinal Shoulder Joint Routing & Sealing                 | @ | <u>\$0.50</u>  | <u>\$5,612</u> |
| <u>5612</u>  | Lin. Ft. | 100% Centerline Joint Rounting & Sealing                           | @ | <u>\$0.50</u>  | <u>\$2,806</u> |
| <u>1543</u>  | Lin. Ft. | 50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station) | @ | <u>\$0.50</u>  | <u>\$772</u>   |
| <u>75</u>    | Sq. Yds. | 0.5% Partial-Depth Pavement Patching (Mill & Fill Surface)         | @ | <u>\$85.00</u> | <u>\$6,375</u> |

Total Cost of Rehabilitation Activity 5 \$15,565

Unit Total

Cost Cost

REHABILITATION ACTIVITY 6 - YEAR 30

|               |          |  |   |                 |                  |
|---------------|----------|--|---|-----------------|------------------|
| <u>14,965</u> | Sq. Yds. | 2.00in. Milling (Pavement only-Std Design Pavement & Shoulder-Limiting Strain Criteria Design)   | @ | <u>\$1.65</u>   | <u>\$24,692</u>  |
| <u>299</u>    | Sq. Yds. | 2.0% Partial-Depth HMA Pavement Patching (Mill & Fill Additional 2.00in. All Designs)  | @ | <u>\$85.00</u>  | <u>\$25,415</u>  |
| <u>0</u>      | Sq. Yds. | 1.0% Full-Depth HMA Shoulder Patching (Mill & Fill Surface-Standard Design Mill & Fill Additional 2.00in.-Limiting Strain Criteria Design) | @ | <u>\$85.00</u>  | <u>\$0</u>       |
| <u>3,143</u>  | Tons     | HMA Overlay Pvmt (3.75in. - Std Design 2.00in.-Limiting Strain Criterion Design)   | @ | <u>\$109.20</u> | <u>\$343,204</u> |
| <u>0</u>      | Tons     | HMA Overlay Shoulder (1.75in. - Standard Design; 2.00in.-Limiting Strain Criterion Design)   | @ | <u>\$109.20</u> | <u>\$0</u>       |

Total Cost of Rehabilitation Activity 6 \$393,311

FIGURE 5.05b(3)

FLEXIBLE PAVEMENT (Cont.)  
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REHABILITATION ACTIVITY 7 - YEAR 35

|   |          |  |   | <u>Unit</u>    | <u>Total</u>    |
|---|----------|--|---|----------------|-----------------|
|   |          |  |   | <u>Cost</u>    | <u>Cost</u>     |
| <u>11224</u>                            | Lin. Ft. | 100% Longitudinal Shoulder Joint Routing & Sealing                 | @ | <u>\$0.50</u>  | <u>\$5,612</u>  |
| <u>5612</u>                             | Lin. Ft. | 100% Centerline Joint Rounting & Sealing                           | @ | <u>\$0.50</u>  | <u>\$2,806</u>  |
| <u>1543</u>                             | Lin. Ft. | 50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station) | @ | <u>\$0.50</u>  | <u>\$772</u>    |
| <u>15</u>                               | Sq. Yds. | 0.1% Partial-Depth HMA Pavement Patching (Mill & Fill Surface)     | @ | <u>\$85.00</u> | <u>\$1,275</u>  |
| Total Cost of Rehabilitation Activity 7 |          |  |   |                | <u>\$10,465</u> |

REHABILITATION ACTIVITY 8 - YEAR 40

|   |          |   |   | <u>Unit</u>    | <u>Total</u>    |
|---|----------|---|---|----------------|-----------------|
|   |          |   |   | <u>Cost</u>    | <u>Cost</u>     |
| <u>11224</u>                            | Lin. Ft. | 100% Longitudinal Shoulder Joint Routing & Sealing                          | @ | <u>\$0.50</u>  | <u>\$5,612</u>  |
| <u>5612</u>                             | Lin. Ft. | 100% Centerline Joint Rounting & Sealing (Single Lane and Dual Lane Paving) | @ | <u>\$0.50</u>  | <u>\$2,806</u>  |
| <u>1543</u>                             | Lin. Ft. | 50% Random/ Thermal Crack Routing & Sealing (Assume 110ft/station)          | @ | <u>\$0.50</u>  | <u>\$772</u>    |
| <u>75</u>                               | Sq. Yds. | 0.5% Partial-Depth Pavement Patching (Mill & Fill Surface)                  | @ | <u>\$85.00</u> | <u>\$6,375</u>  |
| Total Cost of Rehabilitation Activity 8 |          |   |   |                | <u>\$15,565</u> |

**ANNUAL COST DETERMINATION**

Present Worth Calculation:

|                                   |   |                         |
|-----------------------------------|---|-------------------------|
|                                   | <b>Total Cost of Original Pavement Construction</b> | <b><u>\$822,776</u></b> |
| Present Worth of Rehab Activity 1 | <u>\$10,465</u> x 0.7441 =                          | <u>\$9,027</u>          |
| Present Worth of Rehab Activity 2 | <u>\$15,565</u> x 0.6419 =                          | <u>\$11,582</u>         |
| Present Worth of Rehab Activity 3 | <u>\$220,455</u> x 0.5537 =                         | <u>\$141,510</u>        |
| Present Worth of Rehab Activity 4 | <u>\$10,465</u> x 0.4776 =                          | <u>\$5,794</u>          |
| Present Worth of Rehab Activity 5 | <u>\$15,565</u> x 0.4120 =                          | <u>\$7,434</u>          |
| Present Worth of Rehab Activity 6 | <u>\$393,311</u> x 0.3554 =                         | <u>\$162,044</u>        |
| Present Worth of Rehab Activity 7 | <u>\$10,465</u> x 0.3066 =                          | <u>\$3,719</u>          |
| Present Worth of Rehab Activity 8 | <u>\$15,565</u> x 0.3066 =                          | <u>\$4,772</u>          |
|                                   | <b>Total Life Cycle Cost (Present Worth)</b>        | <b><u>\$345,882</u></b> |

Annual Cost Per Mile Calculation

|                  |                      |             |     |                             |
|------------------|----------------------|-------------|-----|-----------------------------|
| Total PW         | x CRF <sub>n</sub> / | Length      |     | = Annual Cost / Year-Mile   |
| <u>\$345,882</u> | x 0.04079 /          | <u>0.53</u> | Mi. | <u>\$89,943</u> per Yr.-Mi. |

|                          |     |       |
|--------------------------|-----|-------|
| MATERIAL TYPE/PERCENTAGE | PCC | 62.1% |
|--------------------------|-----|-------|

*30.2%*

*$\frac{89943 - 61725}{89943} = 31\% \text{ PCC over HMA}$*