INTERSTATE 80 PAVEMENT REHABILITATION CORRIDOR STUDY

by

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Interstate 80 Pavement Rehabilitation Corridor Study

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This report presents findings on the past, present, and expected future performance and rehabilitation needs of the pavement on the Interstate I-80 highway corridor that transverses northern Illinois. The results presented herein cover the time period from initial construction in the 1960's through 2015. The objective of this study is to provide information for IDOT management and engineers to assist in maintaining this critical east-west highway in operating condition and to determine the funding needed for long-term planning and programming. The results are also useful in planning a future rehabilitation strategy to minimize disruption to the traveling public.

Continuously Reinforced Concrete Pavement (CRCP), pavement performance, punchouts, localized failures, D-cracking, performance prediction.
ACKNOWLEDGMENTS

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DISCLAIMER

The contents of this report reflect the views of the authors who were responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Illinois Department of Transportation or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.
Enhancement to Illinois Pavement Management

List of IHR-540 Reports

FHWA-IL-UI-261  Performance of Original and Resurfaced Pavements on the Illinois Freeway System. Documents the survival in terms of mean age and ESALs and their distribution of both original pavements and resurfaced pavements from the 1950's to 1994.

FHWA-IL-UI-266  Work Zones and Their Impact on User Costs. Provides a brief review of the current state-of-practice concerning highway work zones (for rehabilitation activities) and their impact on user delays and costs.

FHWA-IL-UI-267  Evaluation and Improvement of the CRS Prediction Models. Evaluates two CRS prediction models and provides a new improved two-slope method that greatly improves the prediction of future CRS for a given pavement section.

FHWA-IL-UI-268  Field Performance of CRCP in Illinois. Documents the performance of many designs of CRCP on the Interstate highway system (over 2650 directional miles) constructed over the past 50 years and provides a performance prediction model that may be useful for various design and management purposes.

FHWA-IL-UI-269  Interstate 80 Pavement Rehabilitation Corridor Study. Documents the past and present, and forecasts the future performance and rehabilitation needs of the pavement sections on the Interstate I-80 highway corridor in Illinois.
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Interstate 80 Pavement Rehabilitation Corridor Study

1. INTRODUCTION

This report presents findings on the past, present, and future performance and rehabilitation of the pavement on the Interstate I-80 highway corridor that transverses northern Illinois. All data for this study were obtained from the Illinois Pavement Feedback System (IPFS) database (1). The analysis was conducted using the Illinois ILLINET pavement management software (2).

The objective of this study is to provide information for IDOT management and engineers to assist in maintaining this critical east-west highway in operating condition and to determine the funding needed for long-term planning and programming. The results are also useful in planning a future rehabilitation strategy to minimize disruption to the traveling public. By using ILLINET as a tool, planners and engineers in IDOT can develop an effective multi-year rehabilitation plan. The results presented herein cover the time period from initial construction in 1963 through 2015.

The I-80 corridor under consideration spans from milepost 10.68, near Moline, to milepost 126.63, just west of Joliet, for a total length of 115.95 miles. These mileposts coincide with the intersection of I-80 with I-74 on the west and I-55 in the east, respectively. This entire section of I-80 lies in northern Illinois and runs from Iowa on the west to the Chicago area on the east. The corridor consists of 63.89 miles (milepost 10.68 to milepost 74.57) in District 2, 47.97 miles (milepost 74.57 to milepost 122.54) in District 3 and 4.09 miles (milepost 122.54 to milepost 126.63) in District 1.

The predicted future performance of I-80 pavements was analyzed using the ILLINET software using the “Needs” methodology (a minimum CRS triggered rehabilitation) with thin and thick asphalt concrete (AC) overlays and reconstruction selected using the “Decision Tree” methodology. The Condition Rating Survey (CRS) was used as the decision parameter for pavement condition. An analysis was also made considering patching only (without AC overlay), and some comparisons of the two alternatives are given.

For the purpose of pavement evaluation and rehabilitation, eastbound and westbound pavement sections were analyzed separately. As considered in the ILLINET pavement management software, eastbound Interstate I-80 consists of 33 pavement sections (or projects) and westbound consists of 35 pavement sections (or projects); however, the total lengths of the eastbound and westbound pavements are, of course, equal.
2. HISTORICAL BACKGROUND

The data required to study performance trends on Interstate 80 since its original construction are readily available in the various data files of ILLINET. Because IDOT has continually updated and verified new construction and rehabilitation, it is possible to examine the historical performance of the I-80 corridor. The following aspects were examined over the period from 1963 to 1996: traffic loadings, CRS evaluations, and pavement rehabilitation activities.

Traffic

Figures 1 and 2 show the growth of traffic in each direction on the I-80 corridor in terms of equivalent single axle loads (ESALs). Values were averaged over all sections from mileposts 10.68 and 126.63 for each year reported. As expected, ESALs have increased greatly since construction of the original pavement in 1963. Starting from 235,000 in 1964, the annual ESALs have increased to 1,909,000 in 1996 in the eastbound direction (an increase of 8 times over 32 years). The corresponding figures for the westbound direction are 234,000 and 1,886,000. The annual growth rate of ESALs has varied considerably from year to year over this time period. The overall annual ESAL growth rate from 1963 to 1996 is approximately 6.5 percent compounded annually.

Average daily traffic (ADT) is examined in Figures 3 and 4 and average daily truck traffic (ADTT, heavy commercial trucks) in Figures 5 and 6. Both ADT and ADTT have similar trends in the frequency distribution for each direction in the analysis period. In both ADT and ADTT, the numbers are slightly larger for the eastbound lanes as compared to the westbound lanes. The latest growth rates were calculated as approximately 6% for ADT and 4% for ADTT. Again, slightly higher values were found for eastbound traffic. The percentage of trucks (single and multiple units) is currently 35% along I-80.

CRS Values

Figures 7 and 8 report the average CRS values along with standard deviations for both directions on the I-80 corridor from 1984 to 1996. The same method was used for obtaining the yearly values. Yearly values were averaged over all sections from milepost 10.68 to milepost 126.63 for each year reported. The average CRS ranged between 6.5 and 7.5 over the past 10 years for the entire 115.95 miles. A CRS of 6.0 is generally considered a trigger for rehabilitation. The vertical line in the figures, representing one standard deviation, shows that prior to 1994 there was often a significant amount of I-80 below a CRS of 6.0.
Figure 1. Annual ESALs and percentage growth rates (mileposts 10.68 to 126.63) along eastbound I-80.

Figure 2. Annual ESALs and percentage growth rates (mileposts 10.68 to 126.63) along westbound I-80.
Figure 3. Annual ADT and percentage growth rates (mileposts 10.68 to 126.63) along eastbound I-80.

Figure 4. Annual ADT and percentage growth rates (mileposts 10.68 to 126.63) along westbound I-80.
Figure 5. Annual ADTT and percentage growth rates (mileposts 10.68 to 126.63) along eastbound I-80.

Figure 6. Annual ADTT and percentage growth rates (mileposts 10.68 to 126.63) along westbound I-80.
Figure 7. Average CRS values for all sections along eastbound I-80.

Figure 8. Average CRS values for all sections along westbound I-80.

Pavement Rehabilitation

Figures 9 and 10 show the rehabilitation history on eastbound I-80 in terms of miles of pavement rehabilitated and number of sections rehabilitated, respectively. Figures 11 and 12 show the same data for westbound I-80. As seen in these figures, the first major rehabilitation on I-80 was carried out approximately 20 to 30 years after original construction (1961–1964). Much of the pavement performed longer than expected while carrying far more loadings than designed. Most of this 10-inch jointed reinforced concrete pavement (JRCP) was designed to carry 5 million ESALs, but actually carried three times this amount (15 million). However, after about 20 years, the need for rehabilitation was so strong
that, in some years, over 30 percent of the length was under some type of rehabilitation. Nearly all of the rehabilitation of I-80 was AC overlays.

Figure 9. Pavement rehabilitation history for eastbound I-80 (miles of highway).

Figure 10. Pavement rehabilitation history for eastbound I-80 (number of construction sections).
Figure 11. Pavement rehabilitation history for westbound I-80 (miles of highway).

Figure 12. Pavement rehabilitation history for westbound I-80 (number of construction sections).
3. CURRENT (1996) CONDITIONS

The data for the current pavement conditions, traffic values, and the pavement structure were obtained from the ILLINET database that was last updated for the year 1996. Using the latest values reported by IDOT, an assessment of the pavement structural integrity of the I-80 corridor was made. This highway corridor in Illinois is crucial to both intrastate and interstate commerce.

**Current Traffic**

Figures 13 and 14 convey the distribution of the 1996 ESAL values along each direction of the I-80 corridor. Remembering that milepost numbering begins at the west side of the state and continues to the east, it can be seen that traffic increases progressively from milepost 10.68 (1.5 million annual ESALs) to milepost 126.63 (2.25 million annual ESALs). Thus, traffic increases approaching Chicago. At milepost 60, there is a tremendous increase in the number of annual ESALs, corresponding to the intersection of I-80 with I-180. There is another increase at the intersection of I-80 and I-39 at milepost 79. Table 1 shows a breakdown of I-80 into three sections with differing traffic levels.

Figure 13. Distribution of the 1996 ESAL values along the sections on eastbound I-80.
Figure 14. Distribution of the 1996 ESAL values along the sections on westbound I-80.

Table 1. Traffic values for 1996 on I-80.

<table>
<thead>
<tr>
<th>Traffic (ESALs)</th>
<th>≤ 1.5 million</th>
<th>1.5 million - 2.0 million</th>
<th>&gt; 2.0 million</th>
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<td>I-80 East</td>
<td>MP 10.68 - 45.42 Sections 1 to 11</td>
<td>MP 45.42 - 79.31 Sections 12 to 21</td>
<td>MP 79.31 – 126.63 Sections 22 to 33</td>
</tr>
<tr>
<td>I-80 West</td>
<td>MP 10.68 - 45.42 Sections 1 to 12</td>
<td>MP 45.42 - 79.31 Sections 13 to 23</td>
<td>MP 79.31 – 126.63 Sections 24 to 35</td>
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</table>

The distributions of the ADT values for all sections along I-80 east and I-80 west are shown in Figures 15 and 16, respectively. There is an increase in the ADT closer to Chicago. The higher ADT values indicated at the beginning mileposts correspond with the intersection of I-80 and I-74. ADT then comes to a steady state until the intersection of I-80 and I-180 at milepost 60. At this location it begins to increase through the intersection of I-80 and I-39 at milepost 79. There is a slight decrease in ADT as traffic exits I-80 near Ottawa onto Illinois State Routes 23, 71, and near Morris onto State Route 6. At State Route 47 there is a great influx of traffic on the corridor and ADT finally maximizes at the intersection of I-80 and I-55.
Figure 15. Distribution of the 1996 one-directional ADT along the sections on eastbound I-80.

![Bar chart showing ADT distribution on eastbound I-80](image)

Figure 16. Distribution of the 1996 one-directional ADT along the sections on westbound I-80.

![Bar chart showing ADT distribution on westbound I-80](image)
CRS Values

The 1996 CRS values along each direction of the I-80 corridor are reported in Figures 17 and 18. Note that I-80 eastbound has 33 individual sections while I-80 west has 35 individual sections, even though they have the same length. Also, the sections between mileposts 105.35 and 115.01 have been reconstructed. Two sections fall below the critical CRS rating of 6.0. The most deteriorated section is at milepost 83, which is 7 miles west of Ottawa. The other section is located at milepost 29, just east of the Atkinson exit. The remainder of the corridor has been rated at a CRS of 6.0 or above.

Figure 17. Distribution of the 1996 CRS values along eastbound I-80.

![Graph showing CRS values along eastbound I-80]

Figure 18. Distribution of the 1996 CRS values along westbound I-80.

![Graph showing CRS values along westbound I-80]
The frequency distributions of the 1996 CRS values are plotted on Figures 19 through 22. The frequency distribution is plotted in terms of length (in miles) and number of sections. Table 2 details the exact frequency distribution, showing the number of sections and total length within the CRS ranges. In terms of both length in miles and number of sections, the eastbound lanes are in a more acceptable condition than the westbound lanes. Only 12 percent of I-80 is currently below a CRS of 6.0; however, 36 percent of the length is between CRS values of 6.0 and 7.0. A large rehabilitation effort will be required in the next several years to maintain the pavement above a CRS of 6.0.

Figure 19. Frequency distribution of 1996 CRS values for eastbound I-80 (miles of highway).

Figure 20. Frequency distribution of 1996 CRS values for eastbound I-80 (number of construction sections).
Figure 21. Frequency distribution of 1996 CRS values for westbound I-80 (miles of highway).

![Frequency Distribution of CRS Values, in 1996, for all sections on I-80 westbound.](image)

Figure 22. Frequency distribution of 1996 CRS values for westbound I-80 (number of construction sections).

![Frequency Distribution of CRS Values, in 1996, for all sections on I-80 westbound.](image)

Table 2. Frequency distribution of 1996 CRS values for I-80.

<table>
<thead>
<tr>
<th>CRS Range</th>
<th>4 - 5</th>
<th>5 - 6</th>
<th>6 - 7</th>
<th>7 - 8</th>
<th>8 - 9</th>
<th>Total</th>
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<tr>
<td>I-80 east sections</td>
<td>1</td>
<td>6</td>
<td>12</td>
<td>4</td>
<td>10</td>
<td>33</td>
</tr>
<tr>
<td>I-80 west sections</td>
<td>1</td>
<td>1</td>
<td>18</td>
<td>3</td>
<td>12</td>
<td>35</td>
</tr>
<tr>
<td>I-80 east miles</td>
<td>5.47</td>
<td>15.22</td>
<td>36.53</td>
<td>16.71</td>
<td>42.02</td>
<td>115.95</td>
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<tr>
<td>I-80 west miles</td>
<td>5.47</td>
<td>1.71</td>
<td>50.04</td>
<td>10.40</td>
<td>48.33</td>
<td>115.95</td>
</tr>
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Existing Pavement Structure

Figures 23 and 24 show the existing pavement structure on I-80. Note that the depths of cold milling have been deducted from the total thickness of the AC overlay. The figures show that a vast majority of the sections have been overlaid at least once. The average thickness of the existing AC surface is approximately 5 inches on both eastbound and westbound lanes. The original pavement type of the I-80 corridor under consideration is predominantly JRCP, but there are a few exceptions, as noted in Table 3.

Figure 23. Existing pavement structure in 1996 on eastbound I-80.

Figure 24. Existing pavement structure in 1996 on westbound I-80.
Table 3. Pavement type other than JRCP

<table>
<thead>
<tr>
<th>Pavement Type</th>
<th>Milepost Limits</th>
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<tr>
<td>CRCP (Continuously Reinforced Concrete Pavement)</td>
<td>105.35 – 115.01 (eastbound and westbound)</td>
</tr>
<tr>
<td>HMAC (Hot Mixed Asphalt Pavement)</td>
<td>83.34 - 88.81 (westbound) (AASHO Road Test)</td>
</tr>
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</table>
4. PREDICTED FUTURE PERFORMANCE

The predicted performance and rehabilitation needs of the corridor are discussed in this section. Traffic loads were predicted into the future for use in predicting future life and rehabilitation needs. The phenomenal amount of heavy traffic this corridor has already carried and the additional amount it will be required to carry is of great concern, due to the amount of rehabilitation and resulting lane closures needed.

ILLINET was run with two different types of criteria. The first analysis is through the year 2007. Network Algorithms utilized were selected for Needs of the corridor along with Life Cycle Cost and Average CRS. The second analysis was determined for Network Algorithms selected for Needs of the corridor I-80 based on Decision Tree and Average CRS through 2015. The patching only option was removed from consideration in the second study, thus limiting alternatives for rehabilitation to asphalt overlays and reconstruction. The reports generated by ILLINET were then refined to isolate the data for Interstate I-80.

Traffic

The annual growth rate used to predict traffic in each direction was taken from the 1996 data. Traffic growth leading into Chicago is higher than traffic leaving the area. By 2015, the predicted eastbound traffic will reach over 5.75 million annual ESALs, and the predicted westbound traffic will reach 5.25 million. The growth rate of ESALs used in ILLINET predictions is 6%—a huge amount of heavy axles that would cause problems for virtually any pavement.

ADTT for each direction has essentially the same growth rate. A growth rate of almost 4% was used for estimation of future truck traffic. This assessment was made from the average of the 4 most recent years of data available. By 2015, the predicted ADTT in each direction will near 6,400 considering both single and multiple units.

Historically, the growth rate of ADT and ADTT varies from year to year probably depending on economic conditions. However, for prediction purposes, a constant growth rate is assumed. In the 30 years of historical data, even when the growth rate drops suddenly, it picks back up and then returns to the previous level of traffic within 2 years.

Figures 25 through 30 show the traffic predictions for the eastbound and westbound lanes of I-80.
Figure 25. Predicted annual ESALs for all sections on eastbound I-80.

![Graph showing predicted annual ESALs for eastbound I-80 from 1997 to 2015.](image)

Traffic Growth for All Sections on I-80 eastbound. (6.07% growth rate)

Figure 26. Predicted annual ESALs for all sections on westbound I-80.

![Graph showing predicted annual ESALs for westbound I-80 from 1997 to 2015.](image)

Traffic Growth for All Sections on I-80 westbound. (5.52% growth rate)
Figure 27. Predicted ADT for all sections on eastbound I-80.

Figure 28. Predicted ADT for all sections on westbound I-80.
Figure 29. Predicted ADTT for all sections on eastbound I-80.

![Graph showing predicted ADTT for eastbound I-80 with 3.52% growth rate from 1996 to 2015.]

Figure 30. Predicted ADTT for all sections on westbound I-80.

![Graph showing predicted ADTT for westbound I-80 with 3.53% growth rate from 1996 to 2015.]

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CRS Values

Figures 31 and 32 report graphically the rehabilitation predictions made by ILLINET. Figures 31a and 32a show rehabilitation projections for patching only whereas Figures 31b and 32b show projections for AC overlays. When patching alone is considered an alternative, the standard deviation is reduced in the prediction and the average CRS decreases. After a certain time period, however, a large amount of patching is required to keep the pavement in service. Patch and routine maintenance helps stabilize the condition of the roadway and thus results in a somewhat uniform condition. Of course, patching can only go on for a limited time period before it is no longer feasible or cost-effective.

Figure 31a. Predicted average CRS values for all sections on eastbound I-80 through 2006 (patching only).

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Predicted average CRS values for I-80 eastbound.
The vertical lines represent one Standard Deviation from the average value.
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Figure 31b. Predicted average CRS values for all sections on eastbound I-80 through 2006 (AC overlay).

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Predicted average CRS values for I-80 eastbound.
The vertical lines represent one Standard Deviation from the average value.
```
Figure 32a. Predicted average CRS values for all sections on westbound I-80 through 2006 (patching only).

Figure 32b. Predicted average CRS values for all sections on westbound I-80 through 2006 (AC overlay).

When AC resurfacing and reconstruction are available options, the average CRS increases over time. It is important to remember that when resurfacing is performed the CRS over that length of pavement increases to the maximum value of 9.0. When patching is performed without overlay, the overall CRS of the corridor is not affected much. In terms of ILLINET parameters, the patching option was analyzed by Needs and the asphalt overlay option was analyzed as a Decision Tree. Even when patching only is removed as an option, ILLINET usually recommends a 3-inch overlay in both directions at various sections until 1999 to achieve a CRS of 6.0. For any rehabilitation strategy that results in a 9.0 CRS (i.e., AC overlay), the average CRS over time will average about 1 point CRS above the trigger value. The only way to raise the average CRS is to raise the trigger value. Since patching does not raise CRS to 9.0 the network average drops over time.

Remaining Life

Figures 33 and 34 detail the remaining life in years for the entire route range for each year from 1997 to 2015. Information about the predicted future performance on the route was obtained by defining remaining
life until CRS=6.0 for each section along the entire route for each year from 1997 to 2015. When CRS reaches 6.0, ILLINET triggers a rehabilitation plan. Asphalt overlay and reconstruction were the only options considered. From the analysis, no reconstruction was prescribed by ILLINET for any section of the corridor. However, both 3- and 5-inch AC overlays were selected depending on CRS level.

Figures 35 and 36 relate the predicted remaining life and the average CRS through the year 2015. Predicted values were averaged over the continuous corridor for each year reported. As expected, remaining life increases as the average CRS increases. It is noted that these are predicted values that are valid only when coupled with the rehabilitation strategy proposed by ILLINET. Note that if no bar exists, then the CRS is less than 6.0 and no remaining life exists.

Figure 33. Predicted remaining life with asphalt overlay, for each section on eastbound I-80.

![Graph showing predicted remaining life for eastbound I-80]

Figure 34. Predicted remaining life with asphalt overlay, for each section on westbound I-80.

![Graph showing predicted remaining life for westbound I-80]
Figure 35. Predicted remaining life and average CRS without patching, for eastbound I-80.

![Graph showing predicted remaining life and average CRS for eastbound I-80.](image)

Figure 36. Predicted remaining life and average CRS without patching for westbound I-80.

![Graph showing predicted remaining life and average CRS for westbound I-80.](image)
Predicted Rehabilitation Needs

Future rehabilitation needs (type and costs) that will maintain the CRS value above 6.0 for each section were predicted through 2015 using ILLINET. Figures 37 through 40 show the predicted rehabilitation needs and the corresponding CRS values for eastbound and westbound I-80. These plots show the following:

- Observation (horizontally) at any given mile point (say at 50 eastbound), shows that this section is scheduled for an AC overlay three times (years 2002, 2008, and 2014). The short life of these overlays could result in a lot of lane closures and traffic delays.
- Observation (vertically) along the length of I-80 in any given year shows that the amount of lane closures for rehabilitation can be substantial. In year 2002, about 33 percent of the length eastbound is scheduled for rehabilitation.

Of course, if this amount of rehabilitation is unacceptable, longer-term rehabilitation (i.e., reconstruction) will be necessary. But these are the results, given the AC overlay alternative.

Figure 37. Predicted rehabilitation needs (1997–2015) with asphalt overlay for all sections on eastbound I-80.
Figure 38. Predicted rehabilitation needs (1997–2015) with asphalt overlay, for all sections on westbound I-80.
Figure 39. Predicted CRS (1997–2015) with asphalt overlay for all sections on eastbound I-80.
Figure 40. Predicted CRS (1997–2015) with asphalt overlay for all sections on westbound I-80.
Estimated Costs

Figures 41 through 45 show various plots of life-cycle rehabilitation costs of the proposed rehabilitation plan, CRS values, and remaining life. These costs represent the mean one-directional per mile costs along the 116-mile corridor. They have been inflated by 4 percent per year over the base year of 1997. The life-cycle cost is related to the average yearly CRS (see Figures 41 and 42) and the remaining life of the pavement (see Figures 43 and 44). As more funding is available for rehabilitation of the I-80 pavement, the mean CRS and life expectancy increases (time until overlay). Figure 45 shows that average CRS along I-80 is directly related to the amount of funding for rehabilitation of the corridor.

Figure 41. Average yearly cost ($ per mile) and average yearly CRS for eastbound I-80.

Figure 42. Average yearly cost ($ per mile) and average yearly CRS for westbound I-80.
Figure 43. Average yearly cost ($ per mile) and average yearly remaining life for eastbound I-80.

![Graph showing predicted future average yearly remaining life vs average yearly cost for eastbound I-80.]

Figure 44. Average yearly cost ($ per mile) and average yearly remaining life for westbound I-80.

![Graph showing predicted future remaining life vs cost for the average of all sections on I-80 westbound.]

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Figure 45. General prediction of average yearly cost ($ per centerline mile) vs. average CRS along I-80.

Grouping of Construction Projects

An analysis was done to investigate future rehabilitation options for the IDOT 5-year rehabilitation plan. The concept of grouping projects together to reduce construction time within a corridor was explored. From the analysis previously shown for predicted future needs, sections can be combined on an annual basis. The I-80 corridor can be grouped into three different segments and the rehabilitation needs of each segment addressed within a program year to reduce lane closure time.

Table 4 shows the results of restricting rehabilitation to every other year. The corridor is divided into three rehabilitation segments as follows: (1) MP 10.68 to MP 32.58, (2) MP 35.9 to MP 74.57, (3) MP 76.95 to MP 126.63. When grouped in this manner, projects are rehabilitated when needed. This analysis also shows that it is possible to do all rehabilitation within each of the three segments in one year such that the segment would not require work for the following 5 years. If all the predicted work was completed by 2006, there would be a 5-year window where there would be no work required on the entire corridor. After this time period the entire corridor would again require rehabilitation.
Table 4. Rehabilitation Restricted To Every Other Year

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*3 = A nominal 3 in AC overlay
5 = A nominal 5 in AC overlay
R = Reconstruction

**Costs in $/one-direction (inflated from 1995 at 4% per year)**
5. Summary of Findings and Recommendations

A corridor study for pavements was conducted for Interstate 80 in Illinois between I-74 and I-55, beginning at milepost 10.68 near Moline and ending at 126.63 west of Joliet. This 116 mile long corridor extends in an east-west direction through Districts 1, 2, and 3 in the northern part of Illinois.

The objective of this study was to provide information for IDOT management and engineers to assist in maintaining this critical east-west highway in operating condition and to determine the funding needed for long-term planning and programming. The results are also useful in planning a future rehabilitation strategy to minimize disruption to the traveling public.

Data for the study were obtained from the Illinois Pavement Feedback Data system and the ILLLINET software was used for the analysis for predicting the future needs and requirements of this essential highway corridor into the next century.

Historical Perspective

This I-80 corridor was constructed in the early 1960’s of 10 in thick jointed reinforced concrete pavement (JRCP) with 100-ft joint spacing and mesh reinforcement, except for a section near Ottawa that included the original sections of the historic AASHO Road Test conducted from 1958 to 1960.

Historical Traffic Growth

Heavy axle loads (in terms of ESALs) have increased every year since construction in the early 1960’s at an average compounded rate of approximately 6.5% as shown in Figures 1 and 2. ADT and ADTT both grew at a rate of approximately 5 percent. Axle load limits and axle configuration changes caused the ESALs to increase faster than truck volume. Both east and westbound traffic have experienced similar trends, but the eastbound lanes have slightly higher ESALs.

Historical Pavement Condition

Performance for the corridor was analyzed using the CRS index. The 116 miles of the I-80 corridor has averaged a CRS above 6.0 throughout its life, although substantial portions (over 33 percent) have dropped below 6.0 during specific years.

Previous Rehabilitation

The original JRCP was rehabilitated using AC overlays starting in the early 1980’s. Multiple AC overlays have been placed over time to keep various sections of the pavement in service. The eastbound lanes have required more extensive rehabilitation than the westbound lanes, which may be due to the somewhat heavier traffic in this direction.
Current Conditions (1996)

Traffic

During the mid-1960’s, the annual number of heavy axles per year in one direction (ESALs) was approximately 400,000 in one direction. In 1996, they range from 1.5 million ESALs on the western portion to about 2.25 million approaching Chicago. This is a very large number of heavy axles per year and is of course increasing every year (by about 6 percent).

Pavement Condition

Approximately 13 percent of the miles of I-80 were below 6.0 in 1996. However, an additional 37 percent ranged from 6 to 7 CRS representing a large amount of pavement that will soon need rehabilitation. Only 25 percent of the route is above 7.0. If remaining life is defined as the time when the CRS reaches 6.0, most of the corridor has 4 years or less as shown in Figures 33 and 34.

Existing Pavement Structure

All of the original JRCP has been overlaid with AC several times and one section has been reconstructed with CRCP. Typically, about 5 in of AC material exists over the 10 in JRCP.

Predicted Future Condition (1997 to 2015)

Future Traffic

ESALs are expected to continue to increase at a rate of 5.5 to 6.0 percent per year. This leads to doubling of annual ESALs in about 12 years. Assuming that this growth will occur, the average ESALs per year in one direction will average 5 million by the year 2013.

Future Pavement Condition and Remaining Life

A large and continuing rehabilitation effort will be required to maintain a minimum of 6.0 CRS. Of course the future pavement condition (CRS) as well as pavement ride quality will depend on the amount of rehabilitation that is accomplished. The multiyear rehabilitation effort described herein would maintain the CRS above 6.0. The average annual rate of CRS decline for the typical AC/JRCP along I-80 has been about 0.37 per year from a CRS of 9 to 6.5 and 0.17 below 6.5. As traffic loadings increase, this rate of deterioration will increase.

Predicted Rehabilitation Needs and Costs for 1997 to 2015

Figures 41 and 42 show the estimated mean yearly cost per mile over the I-80 corridor in each direction to maintain all sections above a CRS of 6.0 from 1997 to 2015. Rehabilitation work was mainly 3 and 5 in AC overlays. This mean cost per direction ranges from about zero to $225,000 per lane mile along the 116 miles. Note that these costs include a 4 percent per year inflation factor over the base year of 1997 and that no cost was discounted. These costs would thus be the expected costs required at each year in the future. Overall, a mean annual cost of approximately $200,000 (inflated dollars) for both directions will be needed to maintain a CRS of 6.0 or better on all sections. Note that these costs only cover pavement rehabilitation.
Given this extent of future rehabilitation needs, careful programming of future rehabilitation projects along I-80 will be required to minimize disruptions to traffic.

**Future Rehabilitation Alternatives**

Note that in this analysis, only 3- and 5-inch AC overlays were selected. This may not be possible in the future due to the extensive deterioration of the underlying JRCP on many sections that include “D” cracking or other types concrete deterioration. Any AC overlay projects will require extensive full-depth repairs to the existing underlying JRCP. Due to the many lane closures required with repeated AC overlays, longer life overlay or reconstruction alternatives may become necessary.

**Method to Improve Average Corridor System Condition.**

The only way to actually improve the condition along the I-80 corridor is to increase the trigger CRS from 6.0 to say 6.5. For example, a trigger of 6.0 results in an average CRS over time of approximately 7.0. A trigger of 6.5 would increase the average CRS along I-80 to approximately 7.5 at an additional cost of $2.3 million per year over the 122 miles of I-80. This value is determined from Figure 45 as follows. At a mean CRS = 7.5 the cost is $270,000 per two-directional mile. At a mean CRS of 7.0 the cost is $251,000 per two-directional mile. The difference is $19,000 per two-directional mile. The total additional cost is thus $19,000 * 122 miles = $2.3 million per year for the I-80 corridor.

**Grouping of Construction Projects**

An analysis was done to investigate future rehabilitation options for the IDOT 5-year plan. The concept of grouping highway segments together to reduce rehabilitation construction time within the corridor was explored. From the analysis previously shown for predicted future needs, sections can be combined on an annual basis. The I-80 corridor can be separated into three different segments and the rehabilitation needs of each segment addressed within alternating years to reduce lane closure time. This analysis shows that it is possible to do all rehabilitation within each of the three segments in one year such that the segment would not require work for the following 5 years.
References


