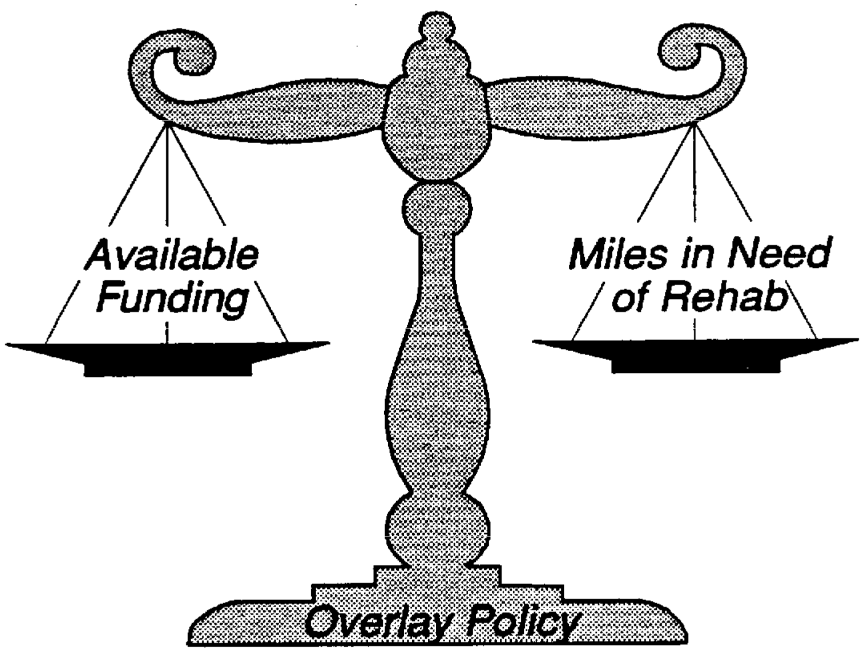
# Bituminous Overlay Policy

## A Performance Evaluation

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16. Abstract

To address an increasing backlog of roadways in need of rehabilitation, the Illinois Department of Transportation (IDOT) began use of a standard overlay thickness policy in the early 1980's. On the non-interstate, or primary, system, first resurfacings or overlays over pavements being widened and resurfaced were allowed 2.5 inches. Subsequent resurfacings were limited to 2 inches. A provision in the policy allowed for exceptions.

This report presents the results of an evaluation of the performance of bituminous overlays constructed on the primary system in accordance with IDOT's overlay policy. Twelve projects were selected for monitoring. The results of visual surveys, deflection testing, and Condition Rating Survey (CRS) histories were analyzed. The standard overlay thickness policy met the FHWA-required minimum 5-year performance period for Federal-aid rehabilitation projects on the primary system. Subsequent overlays were found to have shorter life spans than first overlays. Records of requests for exceptions to the standard overlay thickness policy were also reviewed. Information gathered from the records review was incorporated into the policy and used to create a more efficient process for reviewing requests for exceptions.

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FINAL REPORT

IHR-530

# BITUMINOUS OVERLAY POLICY - A PERFORMANCE EVALUATION

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## EXECUTIVE SUMMARY

In the early 1980's, the Illinois Department of Transportation (IDOT) initiated a standard overlay thickness policy. By mandating the use of policy overlay thicknesses instead of designed structural overlays, a larger number of roadway miles could be rehabilitated, thus reducing the backlog of pavements in need of rehabilitation. Provisions were made in the policy that allowed for thickness exceptions.

The Federal Highway Administration (FHWA) required a minimum performance period of 5 years for Federal-aid rehabilitation projects on the non-interstate, or primary, system. The main objective of this study was to evaluate the performance and life span of primary system rehabilitations using the standard policy overlay thickness as well as those granted exceptions. A secondary objective was to review the exception process and define the criteria by which exceptions to the standard policy were granted.

Records of requests for exceptions to the standard overlay thickness policy were reviewed. Based on the review, the five most common reasons for exceptions were identified and variances for these exceptions were established. Criteria necessary for a policy exception request were defined. The variances and the defined criteria were incorporated into a revised standard overlay thickness policy that was adopted September 15, 1992.

Twelve projects were selected for performance evaluation. The evaluation consisted of making visual surveys, determining deflections, and analyzing the projects' Condition Rating Survey (CRS) histories. Based on this analysis, IDOT's standard overlay thickness policy met the FHWA-required minimum 5-year performance period for Federal-aid rehabilitation projects on the primary system. Based on a limited amount of data, subsequent overlay applications under the standard overlay thickness policy were found to have shorter life spans than first overlays.

## INTRODUCTION

In the early 1980's, the Illinois Department of Transportation (IDOT) was faced with an increasing backlog of roadways in need of rehabilitation. To meet this backlog with the limited funding available, IDOT instituted cost-cutting measures. Rather than design structural overlays for individual projects, a standard overlay thickness policy was introduced. By mandating the use of policy overlay thicknesses instead of designed structural overlays, a larger number of roadway miles could be rehabilitated for the same dollar amount.

On the interstate system, the policy limited first resurfacing thicknesses to 3 inches. On the non-interstate, or primary, system, first resurfacings and overlays over pavements being widened and resurfaced were allowed 2.5 inches. Subsequent overlays were limited to 2 inches. Since not all projects were suited to the policy overlay thickness, a provision in the policy allowed for exceptions. Requests for exceptions had to be submitted to the Engineer of Design. The approval process provided for a field review of the project. With some minor modifications to accommodate changes in IDOT's bituminous concrete mixture design (first overlays on the interstate system were increased from 3 to 3.25 inches and subsequent overlays on the primary system were increased from 2 to 2.25 inches) and provisions for second resurfacings on the interstate system, this policy is still in existence today.

When the standard overlay thickness policy was instituted, IDOT hoped to realize a 6- to 10-year rehabilitation life span. At that time, the Federal Highway Administration (FHWA) required a minimum performance period of 8 years for Federal-aid interstate rehabilitation projects and a minimum performance period of 5 years for Federal-aid rehabilitation projects on the primary system (1). Other researchers have studied the performance and life span of resurfaced interstate pavements in Illinois (2). The main objective of this study was to evaluate the performance and life span of primary system rehabilitations using the standard policy overlay thickness as well as those granted exceptions. A secondary objective was to review the exception process and define the criteria by which exceptions to the standard policy were granted. To accomplish this secondary objective, records of requests for exceptions to the standard overlay thickness policy were reviewed.

## RECORDS REVIEW

All district requests for exceptions to the standard overlay thickness policy made between January 1984 and December 1990 were reviewed. The standard overlay thickness policy allowed districts to submit requests for exceptions to the Central Bureau of Design (currently the Central Bureau of Design and Environment). The Central Bureau of Design considered the requests, sometimes requiring a field review of the project before ruling on the request. In these cases, a Pavement Review Team comprised of three representatives from the Central Bureaus of Design and Materials and Physical Research would meet with district representatives. (Current membership consists of three representatives, one each from the Office of Planning and Programming, the Central Bureau of Design and Environment, and the Central Bureau of Materials and Physical Research.) The Pavement Review Team considered policy exception requests throughout the state to ensure uniformity in policy adherence.

During the 83-month period considered during the records review, 205 requests for exceptions to the standard overlay thickness policy were received. The vast majority of these requests (192, or 94 percent) were for projects on the primary system. Only projects constructed on the primary system were considered in this study. Eighty-six percent of the primary system requests were approved as is, an additional 7 percent were partially approved, and 7 percent were denied. Almost 20 percent of these requests required a field review by the Pavement Review Team.

The records review revealed that requests for exceptions were made for these five reasons (listed in order of decreasing frequency):

- Structural deficiency.
- Jurisdictional transfer (jurisdiction of the route would be transferred to another agency).
- New curb and gutter construction/consistency with adjacent new or reconstructed sections.
- Profile corrections (crown correction, rutting, faulting).
- Heavy traffic.

Averages were calculated for the amount of additional thickness that was granted, the length for which additional thickness was granted, and the percent of project for which additional thickness was granted. This information was used to revise the standard overlay thickness policy.

The revised standard overlay thickness policy was adopted September 15, 1992, and is shown in Appendix A. Using information obtained from the records review, as well as the experience of the Pavement Review Team, variances from the standard overlay thickness policy for the five reasons mentioned above were established. The variances were consistent with Departmental practices with regard to granting exceptions to the policy. The one exception to this statement was the heavy traffic variance. Since the first resurfacing is the foundation for future rehabilitations, an effort was made to determine appropriate overlay thicknesses for heavy traffic based on IDOT's overlay design procedure (3).

The revised standard overlay thickness policy also established the documentation required for variance requests. The required documentation consisted of information a designer needed to be able to analyze a resurfacing project. This same information was considered essential in determining the validity of a standard overlay thickness policy variance request:

- Length and limits of project and limits of request. If the condition of the section is variable, the limits of the distressed areas requiring additional thickness should be defined rather than requesting additional thickness over the entire project.
- Traffic: breakdown of passenger vehicles, single-unit trucks, and multiple-unit trucks.
- Pavement history: date of construction, pavement cross section data, date and description of previous rehabilitations, Condition Rating Survey (CRS) history, and distress history.
- Existing condition: type, severity, and frequency of distress (including photos); directional differences; faulting measurements; rutting measurements; patching quantities for the standard overlay thickness policy versus the reduced patching quantities with the additional thickness overlay and the costs associated with both options; etc.

- Supporting calculations and cost estimates.
- Any other supporting evidence or test data.

When such information was not provided with the variance request, unnecessary field visits were sometimes made, resulting in delays. The revised standard overlay thickness policy formally stated the current Departmental practices with regard to granting policy variances. By formally defining the required criteria, the districts had a clearer understanding of the variance process, thus resulting in a more efficient process.

## PERFORMANCE EVALUATION

To determine the performance and life span of primary system overlays under the standard overlay thickness policy, a sampling of projects from the records review were selected for evaluation. Only projects submitted for consideration of policy exceptions due to structural deficiencies were considered. It was felt that of all five reasons for policy exception requests, structural deficiency would provide the most thorough test of the policy's effectiveness. Policy exception requests that were denied as well as approved were selected. In addition, a few projects that received the standard overlay policy thickness, and for which no additional thickness had been requested, were selected for evaluation.

Table 1 lists the projects selected for study, the year the rehabilitation was completed, and the type of overlay that was placed. The overlay types fell into six categories: policy first overlays on rigid pavements (Policy-1st), additional thickness first overlays on rigid pavements (Additional-1st), policy subsequent overlays on rigid pavements (Policy-2nd), additional thickness subsequent overlays on rigid pavements (Additional-2nd), policy overlays on flexible base pavements (Policy-Flex), and additional thickness overlays on flexible base pavements (Additional-Flex). Some of the projects selected had more than one type of overlay placed.

Performance evaluation consisted of making visual surveys, deflection testing with IDOT's Dynatest 8002 Falling Weight Deflectometer (FWD), and compiling CRS histories. Visual surveys were conducted on all of the projects during the fall of 1991. Areas of distress and required maintenance were noted. Deflection testing for all projects was done in August and September of 1991. The deflection data were normalized to a 9,000-pound load and analyzed. The average, standard deviation, and coefficient of variation were calculated for deflections under the load. The modulus of subgrade reaction, $E_{Ri}$, was calculated as well. Assuming a normal distribution, approximately 95 percent of the deflections under the load should fall between the average plus or minus two standard deviations. Deflections under the load in excess of the average plus two standard deviations were considered areas of base failure and structural weakness and in need of patching. The presence or absence of such areas was used as a general assessment of the performance of overlays placed under IDOT's standard overlay thickness policy. Deflection data were not used to design future rehabilitations.

The actual timing of rehabilitation in Illinois is based upon CRS, a present-day evaluation of pavement condition. The entire state system is visually surveyed on a biennial basis. A trained panel of raters assigns a CRS value ranging from 1.0 for a failed pavement to 9.0 for a pavement in excellent condition. Rehabilitation programming of primary system pavements is based on CRS, functional class of road, and traffic. Historical CRS values from time of overlay to 1992 were collected to determine the rate of pavement condition decline and used to predict the life of the overlay. The CRS rating is a weighted average for the whole project. Isolated areas of distress are factored into the overall rating. The visual surveys and the FWD testing identified the isolated areas of distress, and in conjunction with the CRS ratings, provided a realistic picture of the pavement condition and need for rehabilitation.

Information on the 12 performance evaluation sections follows. Total length of evaluated pavement does not always equal total project length due to paving omissions and short sections of varying cross section or overlay thickness. Only sections of reasonable length and consistent cross section were monitored to ensure the quality of the data. Figure 1 shows the location of the 12 projects.

**Contract 38699 - Policy-2nd**

A 6.1-mile stretch of IL 115 east of Herscher, Illinois was overlaid in 1985. The CRS at the time of rehabilitation was 3.5. The existing pavement cross section was 3 inches of bituminous concrete over a previously widened 9-6-9 thickened edge concrete pavement (a 6-inch concrete slab that tapered to 9 inches at the edge of pavement; the thickened edge was designed to provide additional support for heavy loads at the edge of pavement). The Pavement Review Team denied a request for additional overlay thickness. Although the pavement surface was old and oxidized, signs of structural distress were not evident. A 2-inch policy overlay was placed.

In 1991, after 6 years in service, a visual survey showed transverse cracking, centerline cracking, widening cracking, and block cracking. Most of the cracks were fairly open. None of the cracks were sealed. Deflection testing with the FWD showed poor subgrade support in general and approximately 8 areas where future patching and/or additional overlay thickness might be warranted. Figure 2 provides the CRS history of the project. This section was overlaid in 1992 at a CRS of 5.3. The 9.0 1992 CRS in Figure 2 reflects the condition rating after the overlay was placed.

**Contract 36574 - Policy-2nd, Policy-Flex**

This 6.0-mile long project was located east of Rantoul, Illinois on U.S. 136. A policy overlay was placed in 1984. In 4.3-mile long Section 1, the 7-inch concrete pavement with an existing 3-inch overlay was widened and a 2-inch overlay was placed. The policy actually allowed a 2.5-inch overlay over a widened pavement. Many designers were not aware of this provision, however, and pavements being widened were frequently resurfaced with only a 2-inch overlay. In 0.3-mile long Section 2, a 2-inch overlay was placed on an existing 4.5-inch overlay on 18 inches of granular material on top of an old concrete pavement. Section 2 was considered a flexible base pavement. The CRS prior to rehabilitation was 5.5.

A visual survey was made of both sections in 1991. In Section 1, transverse, longitudinal, and centerline cracking was apparent. This cracking was inconsistent throughout the section. Belt cracking, a series of parallel and interconnecting cracks, was beginning to form. Alligator cracking, a sign of base failure, was noted infrequently. Approximately 80 yards of patching was needed based on the visual survey; deflection testing confirmed the need for isolated patching.

In Section 2, some transverse and longitudinal cracking was observed. In some areas, the centerline joint was beginning to deteriorate. Deflections were slightly higher in Section 2 than in Section 1, but the subgrade support was much higher ($E_{Ri}$, modulus of subgrade reaction, was 10.7 ksi in Section 2 as compared to 4.1 ksi in Section 1), reflecting the beneficial effect of the granular material. Deflection data had a lower coefficient of variability in Section 2 than in Section 1 (12.3 percent versus 38.1 percent).

Figure 3 shows the CRS history of this project. After 8 years in service, the 1992 CRS was 6.3. The project is scheduled for rehabilitation between Fiscal Year (FY) 1996 and FY 1999.

**Contract 36907 - Policy-2nd, Additional-2nd**

Located southeast of Kewanee, Illinois, this 3.5-mile section on IL 91 was widened and overlaid in 1984. The CRS at the time of rehabilitation was 3.3. The existing cross section was a 2-inch overlay on top of a 9-6-9 thickened edge concrete pavement. A 2-inch policy overlay was placed over approximately 1.1 miles and a 3.5-inch overlay was placed over approximately 2.2 miles. The Pavement Review Team granted the additional thickness due to structural deficiencies. A 2.5-inch overlay was actually allowed by policy since the pavement was being widened.

After 7 years in service, a visual survey in 1991 found some transverse, widening, and random longitudinal cracking. The majority of the cracks had been routed and sealed. The beginnings of block cracking were noted, and some isolated alligator cracking was found in the wheelpaths. Approximately 50 square yards of patching was required; these areas coincided with high deflection readings from the FWD. A low degree of subgrade support was backcalculated ($E_{Ri}$ = 1.1 ksi).

The CRS history for Contract 36907 is shown in Figure 4. The 1992 CRS was 5.8. This section is not proposed for rehabilitation in the FY 1995 to FY 1999 program.

**Contract 38137 - Policy-1st, Additional-1st**

This 6.8-mile long project was located on U.S. 24 between Gridley and Chenoa, Illinois. The CRS prior to overlay was 4.1. The existing pavement was a bare 9-inch concrete pavement on the west end and a bare 10-inch concrete pavement on the east end. A 2.5-inch policy overlay was placed on 91 percent of the project, and the Pavement Review Team granted a request of 3.5 inches on the remainder of the job due to extensive deterioration.

A visual survey in 1991 showed centerline deterioration, a minor amount of random longitudinal cracking and needed patching, and some transverse cracking. A greater amount of transverse cracking was noted in the 2.5-inch overlay section. Deflection testing showed low deflections, good subgrade support, and a relatively sound pavement structure. Only a few areas in need of patching were detected from the deflection testing. The CRS history for this project is shown in Figure 5. The 1992 CRS was 5.0. This project has been proposed for rehabilitation between FY 1996 and FY 1999.

**Contract 38186 - Additional-2nd**

This 3.2-mile long project was located north of Saybrook, Illinois, on CH 5, a state-maintained unmarked route. The existing cross section consisted of a 21-year old 2-inch overlay on a 50-year old 9-6.5-9 thickened edge concrete pavement. The 1982 CRS was 1.8. At the time of rehabilitation in 1984, the pavement exhibited serious edge and centerline break-up, and block and alligator cracking. The Pavement Review Team granted a 3.25-inch overlay policy exception based on structural deficiencies; this section would have qualified for a 2.5-inch overlay since it was being widened.

The project was visually surveyed in 1991. Centerline cracking was found on approximately 80 percent of the job. Routing and sealing the cracks would greatly contribute to the pavement's life. A minor amount of transverse, widening, and random longitudinal cracking was noted as well. Deflection testing identified some areas of high deflection and poor subgrade support, but the pavement was in surprisingly good condition given its pre-rehabilitation state. The section does receive a minimal amount of destructive heavy truck traffic, however. The CRS history of this section was not available, but it is not scheduled for rehabilitation in the FY 1995 to FY 1999 program.

**Contract 40820 - Policy-2nd, Policy-Flex, Additional-Flex**

Located on IL 15 between Albion and Mt. Carmel, Illinois, this 7.7-mile long section was rehabilitated in 1986. The CRS at the time of rehabilitation was 5.1. In Section 1, approximately 1 mile of the project had a 2-inch policy overlay placed on top of the existing 4-inch overlay and 9-6.5-9 thickened edge concrete pavement that had been previously widened (Policy-2nd). The existing cross section of the remainder of the project consisted of 4 inches of bituminous concrete on top of 8 inches of bituminous aggregate mixture (BAM). In Section 2, approximately 0.6 mile of this flexible base pavement received a 2-inch policy overlay (Policy-Flex). The remainder of the flexible base pavement got additional overlay based on FWD testing: 0.5 mile got a 3-inch overlay (Section 3), and 2.0 miles got a 2.5-inch overlay (Section 4).

A visual survey was made in 1991. In all of the sections, the centerline paving joint was opening and starting to deteriorate. Longitudinal, transverse, and block cracking were found in all sections. Widening cracking was found in Section 1 as well. Sections 1 and 2 had more transverse cracking and block cracking than Sections 3 and 4, which had thicker overlays. Deflection testing identified a few isolated areas in need of patching. The subgrade support values were good for Sections 2, 3, and 4 (average $E_{Ri}$ ranged from 6.7 to 8.5 ksi) and lower for Section 1 (average $E_{Ri}$ was 2.4 ksi). Section 1 had the lowest deflections, with an average value of 9.9 mils, as compared to an average deflection of 12.4 to 16.0 mils for Sections 2, 3, and 4. Section 1 was the only rigid pavement base section. The 1992 CRS value was 6.2. The CRS history for this project is shown in Figure 6. This section is not programmed for rehabilitation between FY 1995 and FY 1999.

**Contract 40218 - Additional-Flex**

This 4.3-mile long section was located on IL 16 between Gillespie and Hornsby, Illinois. This section was widened and resurfaced in 1986; the 1984 CRS prior to rehabilitation was 4.8. The existing flexible base pavement was comprised of two cross sections: one was 3 inches of bituminous concrete on 6 inches of granular base, and the second was 7 inches of bituminous concrete on 6 inches of granular base. A 3.25-inch overlay was placed in 1986 over 2.1 miles of the first cross section and 0.5 mile of the second cross section. The Pavement Review Team granted additional thickness based on Benkelman Beam deflection testing.

The visual survey in 1991 identified some intermittent widening and random longitudinal cracking, the start of centerline joint opening, an open surface, and some thermal cracking. In general, less cracking was noted in the section with the thicker existing pavement cross section. Overall, the section appeared in good shape after 5 years of service. Only 3 areas in need of patching were located during deflection testing. Good subgrade support was evident ($E_{Ri}$ averaged 7.5 to 8.2 ksi). The 1992 CRS was 8.3, reflecting the good condition of the project. This project's CRS history is graphically shown in Figure 7. This section is not scheduled for rehabilitation in the FY 1995 to FY 1999 program.

**Contract 40269 - Policy-1st**

Located on IL 97 north of Kilbourne, Illinois, this 4.1-mile long section was widened and resurfaced in 1986. A 2.5-inch policy first overlay was placed over the existing bare 9-6-9 thickened edge concrete pavement. The joints and working cracks in the existing pavement were badly spalled and deteriorated. The 1984 CRS prior to rehabilitation was 3.5.

After 5 years in service, the 1991 visual survey showed that the centerline joint had opened up over the length of the job. Some widening cracking and random longitudinal cracking was found. The majority of the transverse cracks that reflected through the overlay had been sealed with a hot-poured joint sealer by Maintenance forces. Deflection testing showed the need for 1 to 2 patches per mile. Subgrade support averaged only 2.0 ksi for the section, surprising since this county is known for sandy subgrades capable of providing good support. The 1992 CRS was 7.2. Figure 8 shows the CRS history of contract 40269. This section is not scheduled for rehabilitation between FY 1995 and FY 1999.

**Contract 42411 - Additional-1st**

A 1.0-mile stretch of a 3.5-mile long section of IL 97 southeast of Havana, Illinois, adjacent to the previous section, was widened and overlaid with 4.5 inches of bituminous concrete in 1987. The existing cross section was a bare 9-6.5-9 thickened edge concrete pavement with a pre-rehabilitation CRS of 3.8. Additional overlay thickness was granted by the Pavement Review Team because this section served as a control section for an experimental open-graded crack control layer. This section would have qualified for a 2.5-inch overlay since it was a bare pavement and was being widened.

The 1991 visual survey of the 4-year old pavement found only a nominal amount of transverse, widening, and random longitudinal cracking. The majority of the transverse cracks had been sealed with a hot-poured joint sealer by Maintenance forces. Some of the transverse cracks had "tented" up, producing bumps. Deflection testing located one area requiring patching. Subgrade support averaged only 1.6 ksi, again surprisingly low given the typical sandy subgrades found in this area. The CRS history of Contract 42411 is shown in Figure 9; the 1992 CRS was 7.8. Contract 42411 is not programmed for rehabilitation between FY 1995 and FY 1999.

**Contract 38362 - Policy-1st, Policy-2nd**

This 4.5-mile long project was located on IL 78, south of Kewanee, Illinois. In 1984, 2.1 miles got a 2-inch policy overlay on a 9-inch bare concrete pavement. This section actually was entitled to a 2.5-inch overlay since it was the first resurfacing. A 2-inch policy second overlay was placed on 2.3 miles of pavement whose existing cross section was 3 inches of bituminous concrete on a 9-6-9 thickened edge concrete pavement. The 1982 CRS prior to rehabilitation was 5.3.

A visual survey was conducted in 1991. After 7 years in service, the policy first overlay showed transverse cracks with developed belt cracking, and centerline and center of lane cracking. Block cracking had also started to develop. Temporary patches had been placed with cold patch, and reflected patches were beginning to heave through the overlay. These same distresses were apparent in the policy second overlay, except to a much smaller degree. A few areas in need of patching were identified through deflection testing. A higher average deflection was found in the policy second overlay than in the policy first overlay (13.2 mils versus 5.1 mils). Figure 10 details the CRS history for this project. The 1992 CRS was 6.0. This section is not scheduled for rehabilitation in the FY 1995 to FY 1999 program.

**Contract 36101 - Policy-1st**

This 11.7-mile long project was located on IL 1 south of Paris, Illinois. A 2-inch policy overlay was placed on 3.3 miles of bare 9-inch concrete pavement in 1983. This project should have had a 2.5-inch overlay since it was a first resurfacing. The CRS values for this section prior to rehabilitation ranged from 4.3 to 5.0, with an average value of 4.7.

After 8 years in service, the 1991 visual survey showed transverse cracking with associated belt cracking as well as overlaid patch reflection cracking. Some random longitudinal cracking was also found. Deflection testing indicated only 2 areas in need of patching. In general, deflections were low and subgrade support was high. The CRS history for Contract 36101 is shown in Figure 11. The 1992 RS was 7.1, and as a result, this project is not scheduled for rehabilitation between FY 1995 and FY 1999.

**Contract 38296 - Policy-1st, Additional-1st**

Located on IL 116 east of Pontiac, Illinois, this 10.9-mile long section was widened and resurfaced in 1985. The existing bare 9-6-9 thickened edge concrete pavement had a pre-rehabilitation CRS of 3.9. Approximately 7.4 miles had a policy 2-inch overlay (although 2.5 inches would actually have been allowed since the pavement was bare and was being widened) and 1.1 miles was granted a 3-inch overlay by the Pavement Review Team.

The 1991 visual survey revealed transverse cracking, widening cracking, and overlaid patch reflection cracking. Some of the cracks had been sealed with a hot-poured joint sealer. No belt cracking had developed yet. There were no visual differences between the 2- and 3-inch overlay sections. Deflection testing identified a few areas in need of patching. Similar deflections and subgrade support readings were found in each overlay thickness section. The CRS history of Contract 38296 is graphically shown in Figure 12. A CRS of 6.1 was recorded in 1992. This section is not scheduled for rehabilitation between FY 1995 and FY 1999.

## ANALYSIS

The results of the visual surveys, deflection testing, and historical CRS data were analyzed to determine the performance of the standard overlay thickness policy. In general, the visual surveys and deflection testing did not identify any sections in need of immediate rehabilitation. Visual surveys and deflection testing identified areas in need of patching, but for the most part these areas were isolated and not project-wide. Distresses and overall deterioration were apparent, but none of the sections required immediate repair or rehabilitation to accommodate the motoring public.

One of the performance evaluation sections, Contract 38699, was overlaid during the course of this study at the age of 7 years. Two other sections, Contract 36574 and Contract 38137, are scheduled for rehabilitation between FY 1996 and FY 1999. If these pavements were rehabilitated at the first scheduled opportunity in FY 1996 (which begins in July 1995), the overlays will have lasted at least 11 years. The remaining performance evaluation sections are not scheduled for rehabilitation between FY 1995 and FY 1999. This means that all of the performance evaluation sections will have lasted beyond the minimum performance period of 5 years required of Federal-aid rehabilitation projects on the primary system at the time the standard overlay thickness policy was instituted. On this basis, the standard overlay thickness policy has performed adequately.

Historical CRS data were used to estimate the life of overlays placed using the standard overlay thickness policy. To estimate the life of the overlays, rates of deterioration, calculated as loss of CRS rating points per year, were determined for each of the performance evaluation sections except Contract 38186. Historical CRS data were not available for this project as it was an unmarked state route. Table 2 lists the mileage, the last CRS rating, the age of the section at the time of the last CRS rating, and the rate of deterioration for each performance evaluation section except Contract 38136. At the time of construction, projects automatically receive a 9.0 CRS rating. Rates of deterioration were calculated by determining the difference between the 9.0 CRS rating and the last CRS rating and dividing by the age of the overlay at the time of the last CRS rating. An average rate of deterioration for all of the performance evaluation sections was then calculated by weighting the individual project's rates of deterioration by their length. Weighting accounts for the relative importance of a particular value. The weighted average rate of deterioration was calculated to be 0.38 CRS rating points per year. By comparison, the simple average rate of deterioration was calculated to be 0.37 CRS rating points per year. In this small sample not much difference existed between the simple and weighted averages. In the overall statewide population, however, a weighted average would be a more appropriate way to account for the expected greater disparities between project lengths and rates of deterioration.

Table 3 lists the CRS values prior to rehabilitation for all of the performance evaluation sections except Contract 38186. The average CRS value prior to rehabilitation, weighted for individual project length, was 4.38. Assuming a straight-line CRS deterioration rate of 0.38 points per year, a 9.0 CRS rating immediately after rehabilitation, and a CRS rating of 4.38 at the time of rehabilitation, the average life span of all the performance evaluation section overlays would be just over 12 years. This prediction model is an estimate at best. First of all, it represents the average life expectancy of a small sampling of projects which are not necessarily representative of the whole standard overlay thickness policy population. Secondly, CRS values do not always follow a straight-line rate of deterioration. The CRS values often decline fairly rapidly after rehabilitation and then level off and decline more slowly due to continued maintenance. For this study, a straight-line rate of deterioration is a reasonable assumption. Given the age and CRS range of the pavements being evaluated, the assumptions of limited maintenance and straight-line deterioration rates are valid. Rates of deterioration for projects which are older and have undergone extensive maintenance may tend to level off during the mid-life of the project. The use of a straight-line deterioration rate for such projects is probably somewhat conservative.

Given these limitations, it is difficult to definitively quantify the life span of the standard overlay thickness policy based on CRS. On the basis of the average performance evaluation section life span however, the standard overlay thickness policy, with its provisions for exceptions, met the FHWA-required minimum 5-year performance period for Federal-aid rehabilitation projects on the primary system. The policy also apparently has achieved IDOT's goal of a 6- to 10-year rehabilitation life span.

Historical CRS data were also used to estimate the overlay lives for different pavement categories. Similar pavements tend to perform in a similar fashion. Three pavement "families" were investigated: rigid pavement, first overlay (Policy-1st, Additional-1st); rigid pavement, subsequent overlay (Policy-2nd, Additional-2nd); and flexible pavement (Policy-Flex, Additional-Flex). Contract 38186 was again excluded since historical CRS data were not available. For each of these three families, a weighted average rate of deterioration was calculated as described previously. These values are shown in Table 4. The weighted average rate of deterioration for the rigid pavement, first overlay family was 0.34 CRS rating points per year; for the rigid pavement, subsequent overlay family was 0.48 CRS rating points per year; and for the flexible pavement family was 0.34 CRS rating points per year.

Table 5 lists the CRS values prior to rehabilitation by pavement family. The weighted average CRS prior to rehabilitation for the rigid pavement, first overlay family was 4.26; for the rigid pavement, subsequent overlay family was 4.64; and for the flexible pavement family was 5.16. The average overlay life span for the three pavement families was calculated assuming the straight-line CRS deterioration rates show in Table 4, a 9.0 CRS rating immediately after rehabilitation, and the CRS ratings at the time of rehabilitation shown in Table 5. Table 6 shows the average overlay life span calculations. The average life span for all the performance evaluation section overlays was just over 12 years. The average life span for the rigid pavement, first overlay family was almost 14 years; for the rigid pavement, subsequent overlay family was just over 9 years; and for the flexible pavement family was just over 11 years.

The same limitations apply to the pavement family prediction models: they represent an extremely small sampling of projects not necessarily representative of the entire population, and the assumption of a straight-line rate of deterioration, while valid over the ages and CRS ranges of the pavements studied, may not apply to older pavements subjected to extensive maintenance. Given these limitations, certain trends can still be noted. The average overlay life span of all three pavement families met the FHWA-required minimum 5-year performance period as well as IDOT's goal of a 6- to 10-year rehabilitation life span. The flexible pavement and rigid pavement, first overlay families had similar rates of deterioration (0.34 CRS points per year). The rigid pavement, subsequent overlay family had a higher average rate of deterioration (0.48 CRS points per year versus 0.34 CRS points per year) and a shorter average life span (9.1 years versus 13.9 years) than the rigid pavement, first overlay family. This would suggest that subsequent overlay applications of the standard overlay thickness policy may not provide the same service life as first resurfacings. With subsequent overlay applications, the underlying pavement has deteriorated further due to increased age and traffic levels. More extensive rehabilitation will probably be required to provide a rehabilitation service life similar to that of the first overlay. Life-cycle cost analysis of competing strategies will be an important part of the rehabilitation selection process. Costs need to be annualized over the life of the rehabilitation in order to provide a basis of comparison.

Current FHWA policy does not mandate a required rehabilitation life span. Under the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), states are required to consider life-cycle cost analysis of pavement design strategies. Since ISTEA was adopted after this study was underway, cost-effectiveness of rehabilitation alternatives was not considered as part of this study. The standard overlay thickness policy does allow for exceptions, however. Life-cycle cost analysis is a logical means of comparing alternative strategies, and its use is becoming widespread.

## SUMMARY AND RECOMMENDATIONS

To accommodate an increasing backlog of roadways in need of rehabilitation, in the early 1980's IDOT was forced to institute a standard overlay thickness policy. Rather than design individual project overlays, the policy mandated standard overlay thicknesses for both interstate and non-interstate, or primary, system resurfacing projects. A provision in the policy did allow for exceptions, but only after review by a panel of Central Bureau personnel. This policy enabled IDOT to rehabilitate more miles of roadway for the same dollar amount.

The main objective of this study was to evaluate the performance and life span of primary system rehabilitations using the standard policy overlay thickness as well as those granted exceptions. Other researchers have studied the performance and life span of resurfaced interstate pavements in Illinois (2). A secondary objective was to review the exception process and define the criteria by which exceptions to the standard policy were granted.

A records review of all district requests for standard overlay thickness policy exceptions was conducted. During an 83-month period beginning in January 1984, districts made 192 requests for policy exceptions on the primary system. The records review revealed that requests for exceptions were made for these five reasons (listed in order of descreasing frequency):

- Structural deficiency.
- Jurisdictional transfer (jurisdiction of the route would be transferred to another agency).
- New curb and gutter construction/consistency with adjacent new or reconstructed sections.
- Profile corrections (crown correction, rutting, faulting).
- Heavy traffic.

The findings of the records review were incorporated into a revised standard overlay thickness policy which was adopted September 15, 1992. The revised policy is shown in Appendix A.

The revised policy established thickness variances for the five reasons listed above. The revised policy also established the documentation required for variance requests:

- Length and limits of project and limits of request. If the condition of the section is variable, the limits of the distressed areas requiring additional thickness should be defined rather than requesting additional thickness over the entire project.
- Traffic: breakdown of passenger vehicles, single-unit trucks, and multiple-unit trucks.
- Pavement history: date of construction, pavement cross section data, date and description of previous rehabilitations, Condition Rating Survey (CRS) history, and distress history.
- Existing condition: type, severity, and frequency of distress (including photos); directional differences; faulting measurements; rutting measurements; patching quantities for the standard overlay thickness policy versus the reduced patching quantities with the additional thickness overlay and the costs associated with both options; etc.
- Supporting calculations and cost estimates.
- Any other supporting evidence or test data.

Defining the required documentation produced a more efficient variance request process.

After the records review was conducted, 12 projects were selected for performance evaluation. Projects that were submitted for variance requests due to structural deficiency were selected; variance requests that were denied as well as approved were chosen. In addition, a few jobs that had the standard overlay policy thickness were selected for study. Performance evaluation consisted of making visual surveys, deflection testing with IDOT's Dynatest 8002 Falling Weight Deflectometer (FWD), and compiling CRS histories. Deflection testing was used to identify areas of base failures and structural weakness, and to generally assess the performance of overlays placed under the standard overlay thickness policy. Deflection data were not used to design future rehabilitations.

The visual surveys and FWD testing identified areas in need of patching, but none of the 12 sections required immediate rehabilitation to ensure the safety of the motoring public. One of the performance evaluation sections was overlaid during the course of this study at the age of 7 years, and two more are scheduled for rehabilitation between the ages of 11 and 15 years. The remainder of the performance evaluation sections are not scheduled for rehabilitation in the Fiscal Year (FY) 1995 to FY 1999 program.

The CRS histories of 11 of the 12 performance evaluation sections were analyzed. The average rate of deterioration, or loss of CRS rating points over time, for the 11 projects was 0.38 points per year. Given an average CRS value of 4.38 prior to rehabilitation and assuming a straight-line CRS deterioration of 0.38 points per year, the average life span of all the performance evaluation section overlays was just over 12 years. This prediction model is an estimate for two reasons: 1) it is representative of a small sampling of projects not necessarily representative of the whole population, and 2) projects which receive extensive maintenance do not always exhibit a straight-line rate of deterioration, but may instead level off during the mid-life of the project. The assumptions of limited maintenance and straight-line rate of deterioration are valid for the age and CRS range of the pavements that were evaluated. The use of a straight-line deterioration rate for projects outside the range of this study may produce somewhat conservative life estimates.

From a review of the visual surveys, FWD testing, and the CRS history analyses, IDOT's standard overlay thickness policy met the FHWA-required minimum 5-year performance period for Federal-aid rehabilitation projects on the primary system. The standard overlay thickness policy has achieved IDOT's goal of a 6- to 10-year rehabilitation life span as well.

Average rates of deterioration and average life spans were also calculated for three pavement families: rigid pavement, first overlay (0.34 CRS points per year and 13.9 years); rigid pavement, subsequent overlay (0.48 CRS points per year and 9.1 years); and flexible pavement (0.34 CRS points per year and 11.3 years). Although these values are from a very small sampling, an important trend was noted. The rigid pavement, subsequent overlay family had a higher average rate of deterioration and a shorter average life span than the rigid pavement, first overlay family. Subsequent overlay applications of the standard overlay thickness policy do not appear to provide the same service life as first overlays. More extensive rehabilitations may be required to provide a service life equivalent to a first overlay. Annualizing costs over the life of the rehabilitation can provide a basis of comparison for competing rehabilitation strategies.

Based on the results of IHR-530, "Evaluation of Bituminous Overlay Performance", the following recommendations are offered:

- The records review of policy exception requests provided insight into how to streamline the variance process. Incorporating the findings of periodic reviews of exception requests into the policy will help ensure that the policy continues to meet the needs of the districts and the traveling public.
- The first generation of overlays placed using the standard overlay thickness policy met FHWA's minimum 5-year performance period as well as IDOT's goal of 6 to 10 years of life. Given the limited sampling of data, subsequent overlay applications of the standard overlay thickness policy do not provide the same service life as first overlays. More extensive rehabilitations may be required to provide a service life equivalent to a first overlay.
- Under the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), states are required to consider life-cycle cost analysis of pavement design strategies. Life-cycle cost analysis is a logical method of comparing alternative strategies. This study has shown that the standard overlay thickness policy is an effective rehabilitation strategy. Whether the policy is the most cost-effective strategy should be routinely evaluated as part of the policy exception request process. Costs can be annualized over the life of the rehabilitation to serve as a basis of comparison for competing rehabilitation strategies.

## REFERENCES


1. Federal Highway Administration. Federal-aid Highway Program Manual: Volume 6, Chapter 2, Section 4, Subsection 1, Transmittal 428. U.S. Department of Transportation, Federal Highway Administration, Washington, D.C., March 6, 1989.

2. Kathleen T. Hall, Michael I. Darter, and W. Max Rexroad. Performance of Bare and Resurfaced JRCP and CRCP on the Illinois Interstate Highway System - 1991 Update. Civil Engineering Studies, Transportation Engineering Series No. 77, Illinois Cooperative Highway Research Program Series No. 244. University of Illinois, Urbana, Illinois, July 1993, 92 pages.

3. Illinois Department of Transportation. Section 7: Pavement Design. In Design Manual, Illinois Department of Transportation, Bureau of Design, Springfield, Illinois, revised January 1983.

TABLE 1: PERFORMANCE EVALUATION SECTIONS

| Contract | Route | Year of Rehabilitation | Type of Overlay |
|---|---|---|---|
| 38699 | IL 115 | 1985 | Policy-2nd |
| 36574 | US 136 | 1984 | Policy-2nd, Policy-Flex |
| 36907 | IL 91 | 1984 | Policy-2nd, Additional-2nd |
| 38137 | US 24 | 1984 | Policy-1st, Additional-1st |
| 38186 | CH 5 | 1984 | Additional-2nd |
| 40820 | IL 15 | 1986 | Policy-2nd, Policy-Flex, Additional-Flex |
| 40218 | IL 16 | 1986 | Additional-Flex |
| 40269 | IL 97 | 1986 | Policy-1st |
| 42411 | IL 97 | 1987 | Additional-1st |
| 38362 | IL 78 | 1984 | Policy-1st, Policy-2nd |
| 36101 | IL 1 | 1983 | Policy-1st |
| 38296 | IL 116 | 1985 | Policy-1st, Additional-1st |

TABLE 2: CRS DETERIORATION RATES

| Contract | Length, Miles | Last CRS (1992 except where noted) | Age at Last CRS, Years | Rate of Deterioration, CRS Points/Year |
|---|---|---|---|---|
| 38699 | 6.1 | 5.3 (1990, prior to overlay) | 5 | 0.74 |
| 36574 | 6.0 | 6.3 | 8 | 0.34 |
| 36907 | 3.5 | 5.8 | 8 | 0.40 |
| 38137 | 6.8 | 5.0 | 8 | 0.50 |
| 40820 | 7.7 | 6.2 | 6 | 0.47 |
| 40218 | 4.3 | 8.3 | 6 | 0.12 |
| 40269 | 4.1 | 7.2 | 6 | 0.30 |
| 42411 | 3.5 | 7.8 | 5 | 0.24 |
| 38362 | 4.5 | 6.0 | 8 | 0.38 |
| 36101 | 11.7 | 7.1 | 9 | 0.21 |
| 38296 | 10.9 | 6.1 | 7 | 0.41 |
| Total Mileage = | 69.1 | | Weighted average = | 0.38 CRS points/year |

NOTE: Contract 38186 excluded - CRS history after rehabilitation was not available.

## TABLE 3: CRS VALUES PRIOR TO REHABILITATION

| Contract | Year of Rehabilitation | Length, Miles | CRS Prior to Rehabilitation |
|---|---|---|---|
| 38699 | 1985 | 6.1 | 3.5 |
| 36574 | 1984 | 6.0 | 5.5 |
| 36907 | 1984 | 3.5 | 3.3 |
| 38137 | 1984 | 6.8 | 4.1 |
| 40820 | 1986 | 7.7 | 5.1 |
| 40218 | 1986 | 4.3 | 4.8 |
| 40269 | 1986 | 4.1 | 3.5 |
| 42411 | 1987 | 3.5 | 3.8 |
| 38362 | 1984 | 4.5 | 5.3 |
| 36101 | 1983 | 11.7 | 4.7* (AVERAGE) |
| 38296 | 1985 | 10.9 | 3.9 |
| | | Total Mileage = 69.1 | Weighted Average = 4.38 |

NOTE: Contract 38186 was excluded since CRS history was not available.

## TABLE 4: CRS DETERIORATION RATES BY PAVEMENT FAMILY

| Pavement Family | Contract | Length, Miles | Rate of Deterioration, CRS Points/Year |
|---|---|---|---|
| Rigid Pavement, First Overlay | 38137 | 6.8 | 0.50 |
| | 40269 | 4.1 | 0.30 |
| | 42411 | 3.5 | 0.24 |
| | 38362 | 4.5 | 0.38 |
| | 36101 | 11.7 | 0.21 |
| | 38296 | 10.9 | 0.41 |
| | | Total Mileage = 41.5 | Weighted Average = 0.34 CRS Points Per Year |
| Rigid Pavement, Subsequent Overlays | 38699 | 6.1 | 0.74 |
| | 36574 | 6.0 | 0.34 |
| | 36907 | 3.5 | 0.40 |
| | 40820 | 7.7 | 0.47 |
| | 38362 | 4.5 | 0.38 |
| | | Total Mileage = 27.8 | Weighted Average = 0.48 CRS Points Per Year |
| Flexible Pavement | 36574 | 6.0 | 0.34 |
| | 40820 | 7.7 | 0.47 |
| | 40218 | 4.3 | 0.12 |
| | | Total Mileage = 18.0 | Weighted Average = 0.34 CRS Points Per Year |

NOTE: Contract 38186 excluded since CRS history was not available.

TABLE 5: CRS VALUES PRIOR TO REHABILITATION BY PAVEMENT FAMILY

| Pavement Family | Contract | Length, Miles | CRS Prior to Rehabilitation |
|---|---|---|---|
| Rigid Pavement, First Overlay | 38137 | 6.8 | 4.1 |
| | 40269 | 4.1 | 3.5 |
| | 42411 | 3.5 | 3.8 |
| | 38362 | 4.5 | 5.3 |
| | 36101 | 11.7 | 4.7* (AVERAGE) |
| | 38296 | 10.9 | 3.9 |
| | | Total Mileage = 41.5 | Weighted Average = 4.26 |
| Rigid Pavement, Subsequent Overlays | 38699 | 6.1 | 3.5 |
| | 36574 | 6.0 | 5.5 |
| | 36907 | 3.5 | 3.3 |
| | 40820 | 7.7 | 5.1 |
| | 38362 | 4.5 | 5.3 |
| | | Total Mileage = 27.8 | Weighted Average = 4.64 |
| Flexible Pavement | 36574 | 6.0 | 5.5 |
| | 40820 | 7.7 | 5.1 |
| | 40218 | 4.3 | 4.8 |
| | | Total Mileage = 18.0 | Weighted Average = 5.16 |

NOTE: Contract 38186 excluded since CRS history was not available.

TABLE 6 AVERAGE OVERLAY LIFE SPAN CALCULATIONS

- ALL SECTIONS (n = 11)

$$\frac{(9.0 - 4.38) \text{ CRS Points}}{0.38 \text{ CRS PTS./YR.}} = 12.2 \text{ Years}$$

- RIGID PAVEMENT, FIRST OVERLAY (n = 6)

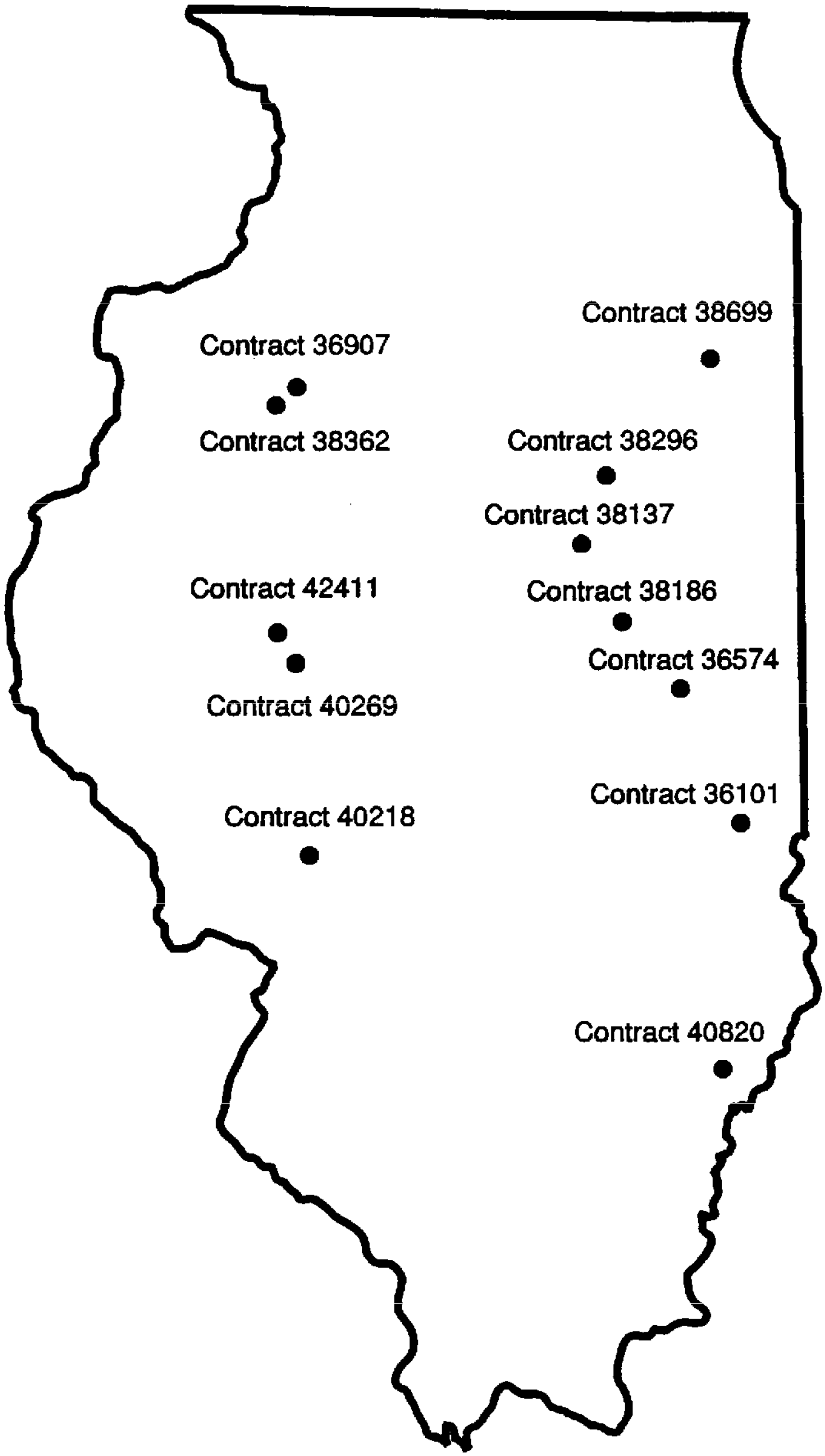
$$\frac{(9.0 - 4.26) \text{ CRS Points}}{0.34 \text{ CRS PTS./YR.}} = 13.9 \text{ Years}$$

- RIGID PAVEMENT, SUBSEQUENT OVERLAY (n = 5)

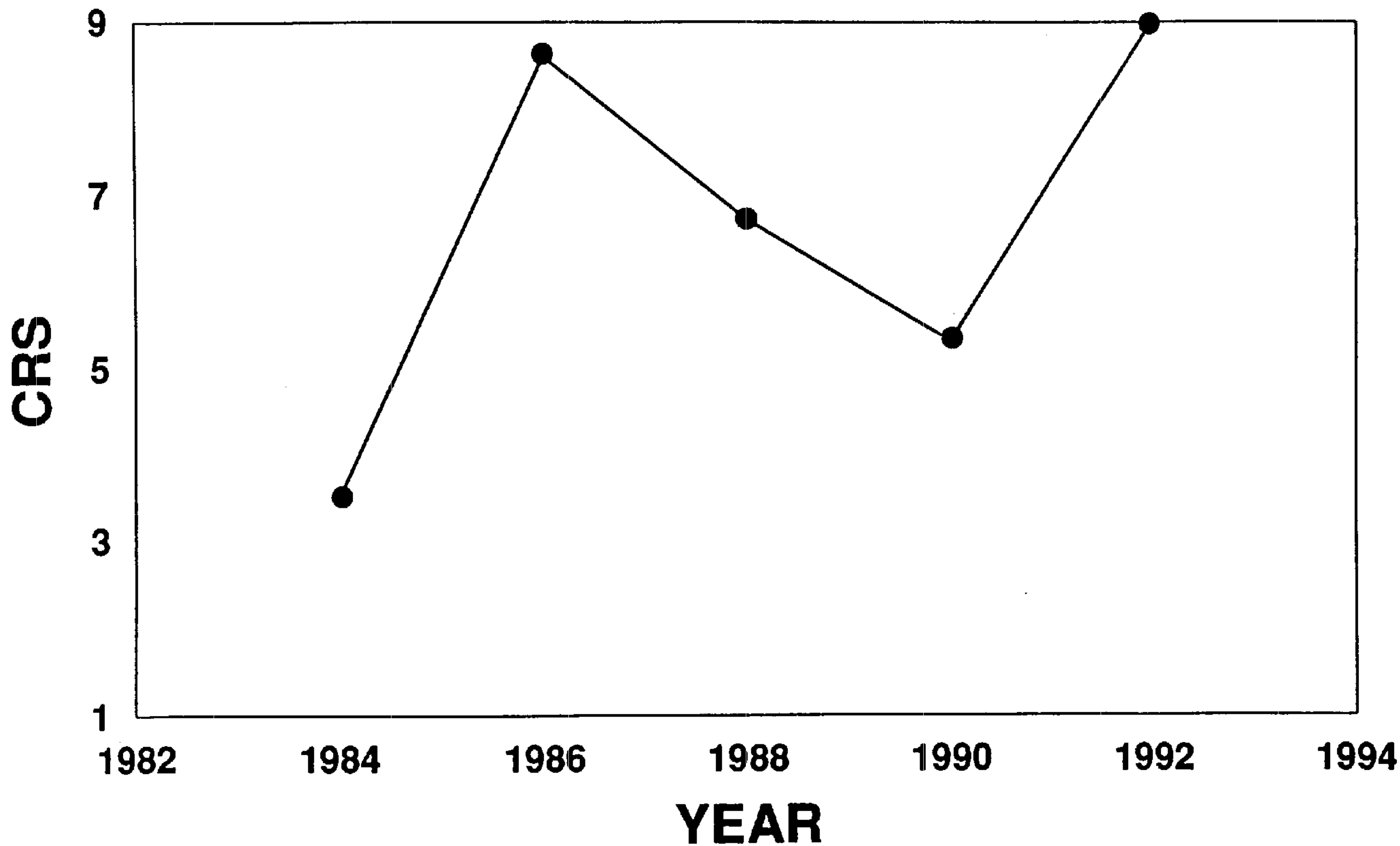
$$\frac{(9.0 - 4.64) \text{ CRS Points}}{0.48 \text{ CRS PTS./YR.}} = 9.1 \text{ Years}$$

- FLEXIBLE PAVEMENT (n = 3)

$$\frac{(9.0 - 5.16) \text{ CRS Points}}{0.34 \text{ CRS PTS./YR.}} = 11.3 \text{ Years}$$


Contract 38699
Contract 36907
Contract 38362
Contract 38296
Contract 38137
Contract 42411
Contract 38186
Contract 36574
Contract 40269
Contract 36101
Contract 40218
Contract 40820

## CONTRACT 38699



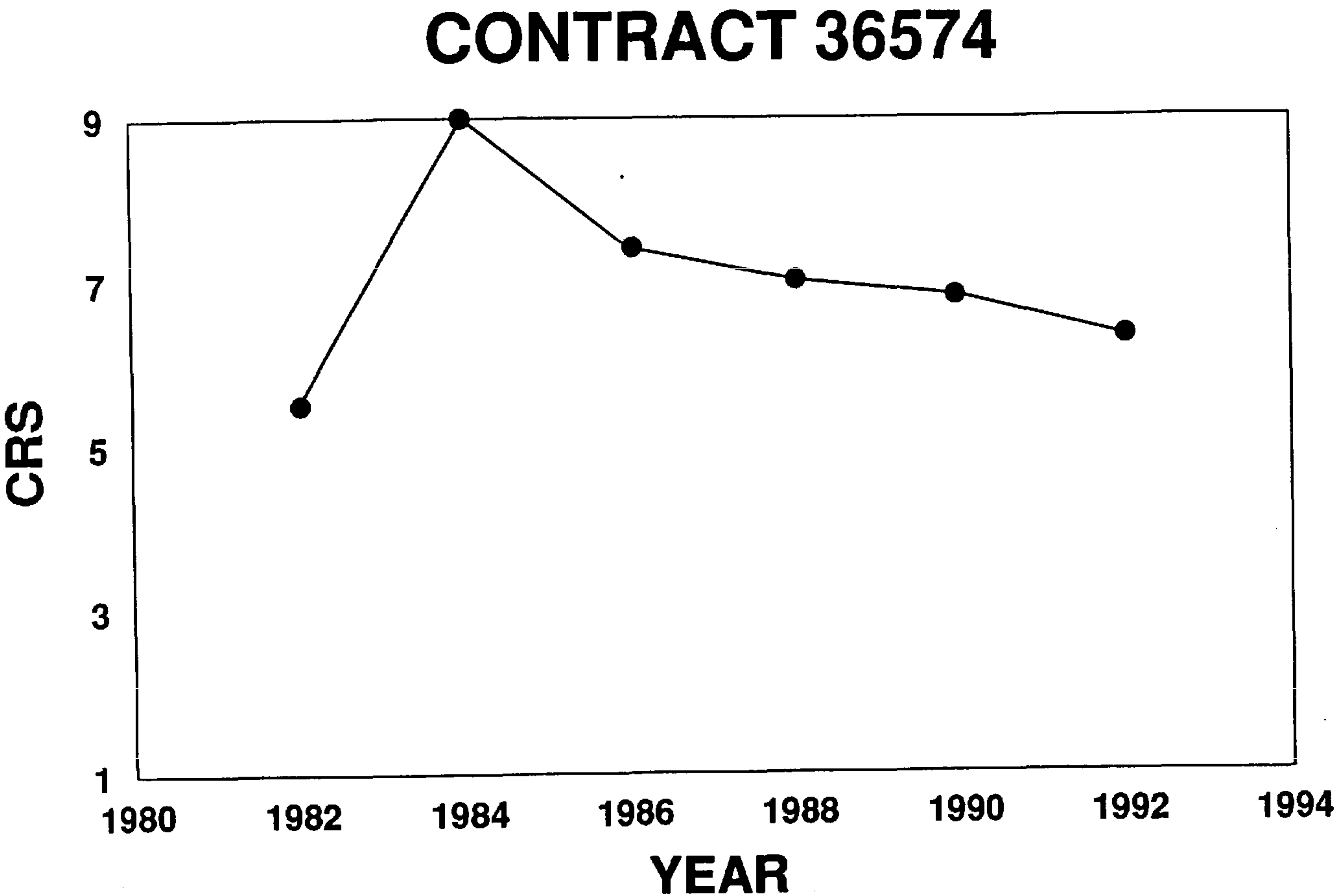



Figure 3: CRS History for Contract 36574


CONTRACT 36907
CRS
9
7
5
3
1
1980
1982
1984
1986
1988
1990
1992
1994
YEAR


Figure 5: CRS History for Contract 38137

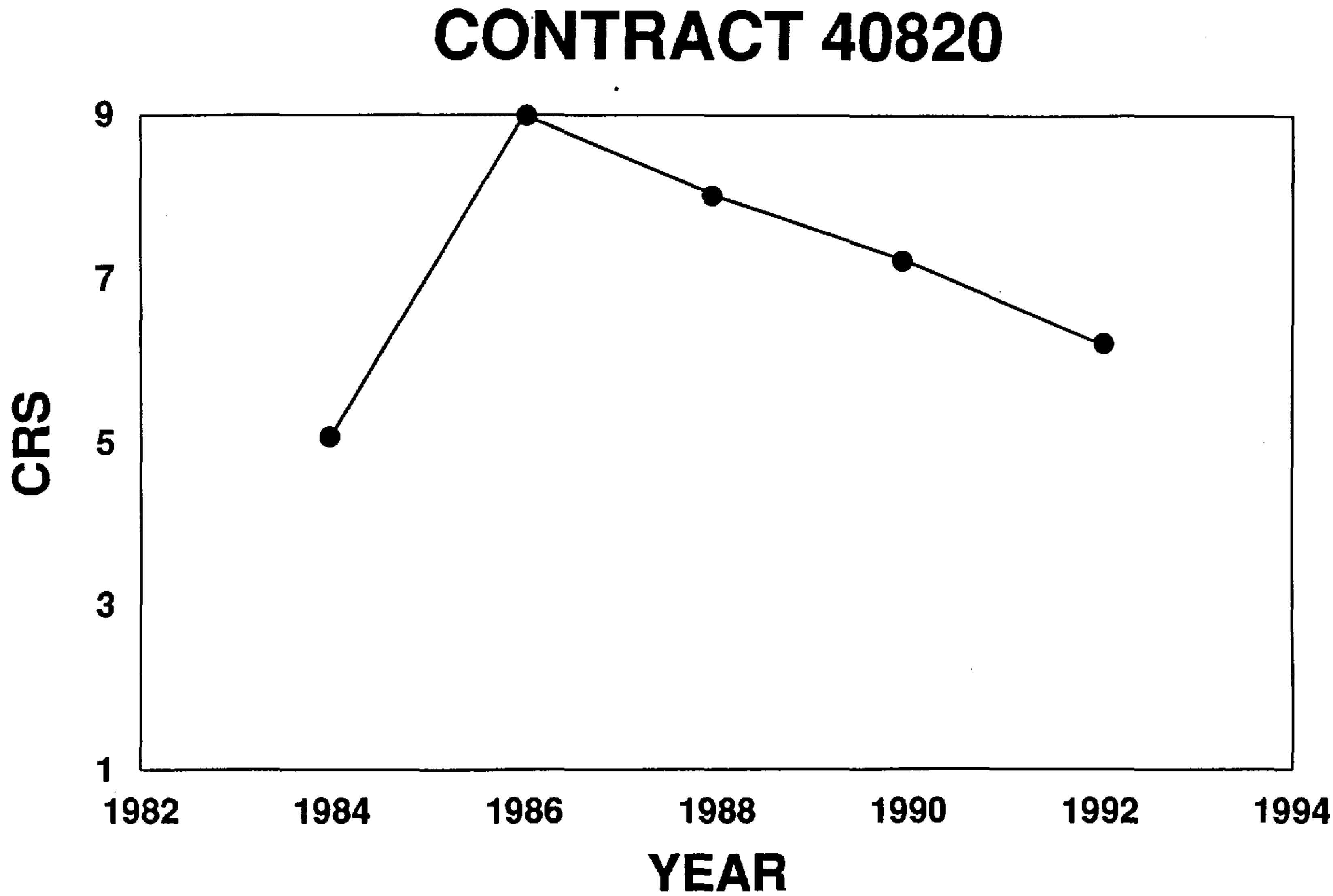



Figure 6: CRS History for Contract 40820

# CONTRACT 40218

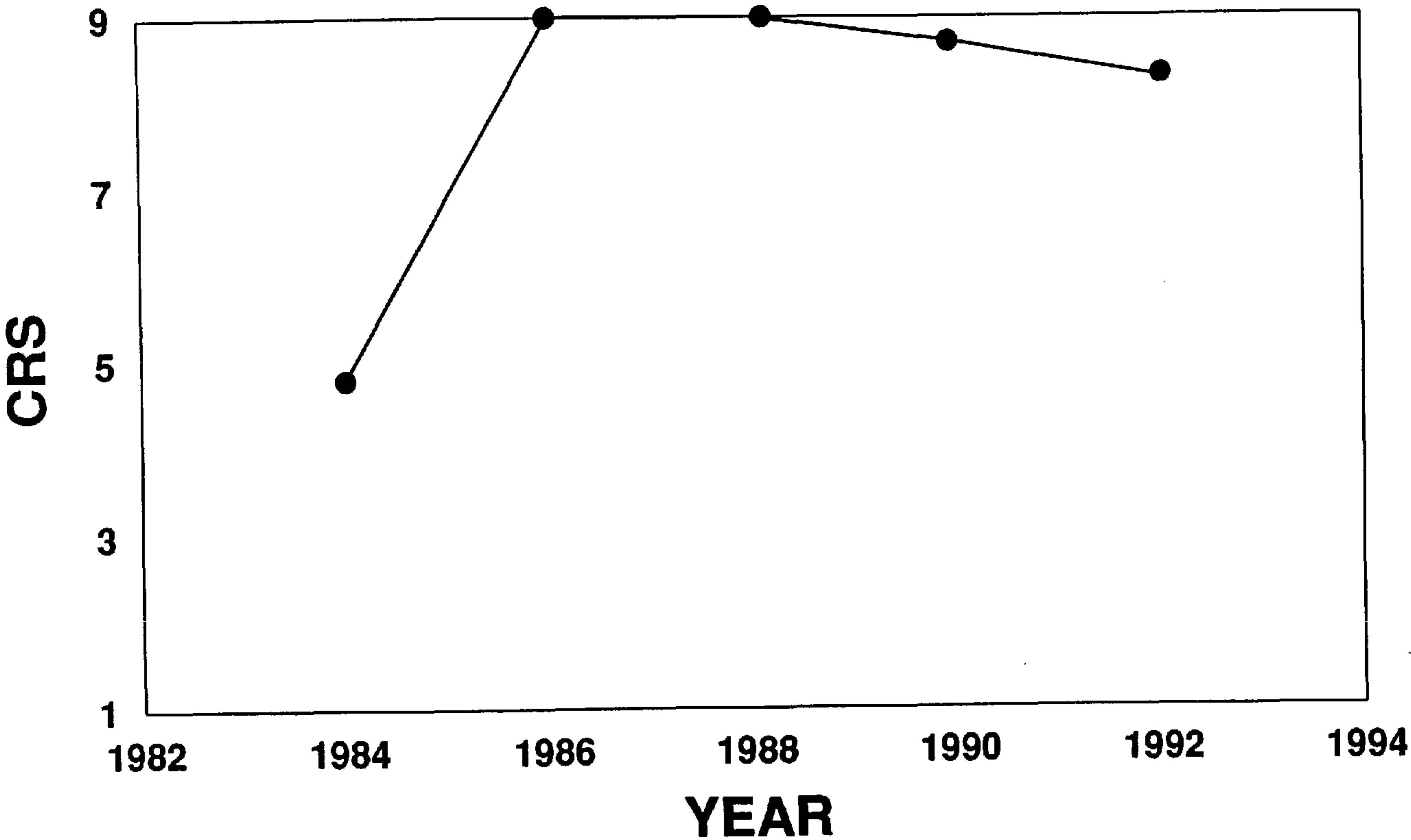



Figure 7: CRS History for Contract 40218


Figure 8: CRS History for Contract 40269

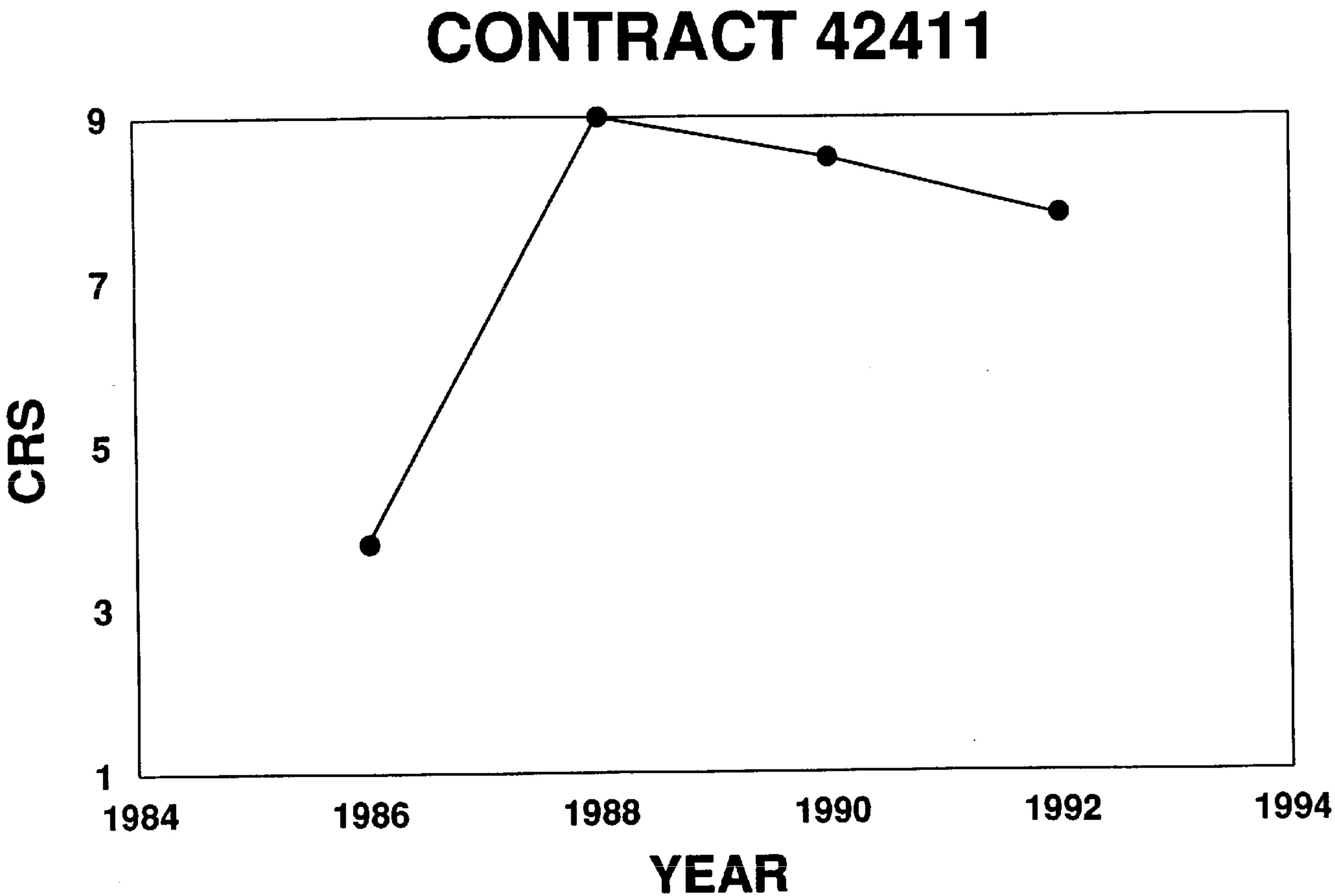
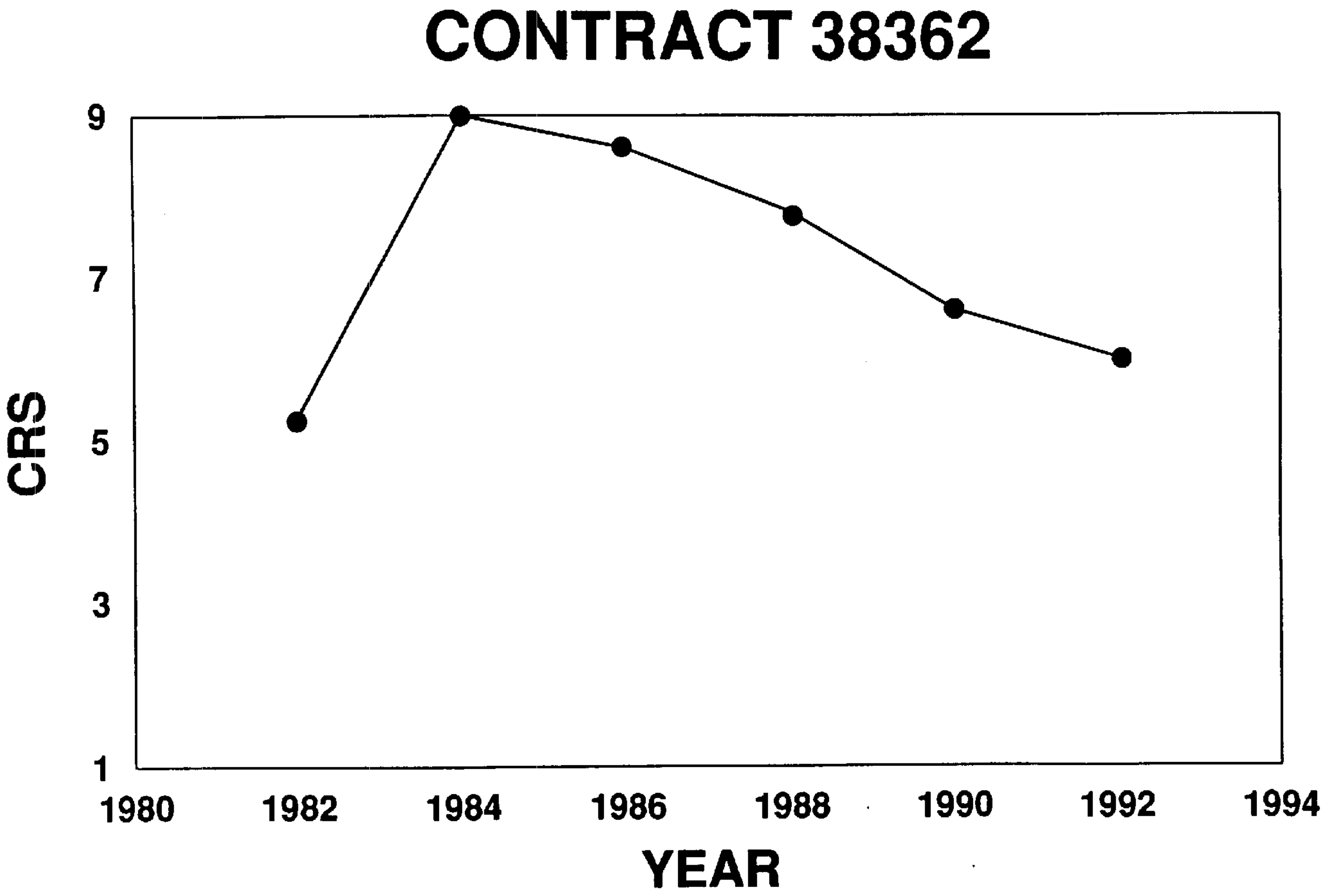



Figure 9: CRS History for Contract 42411


CONTRACT 38362
CRS
9
7
5
3
1
1980
1982
1984
1986
1988
1990
1992
1994
YEAR

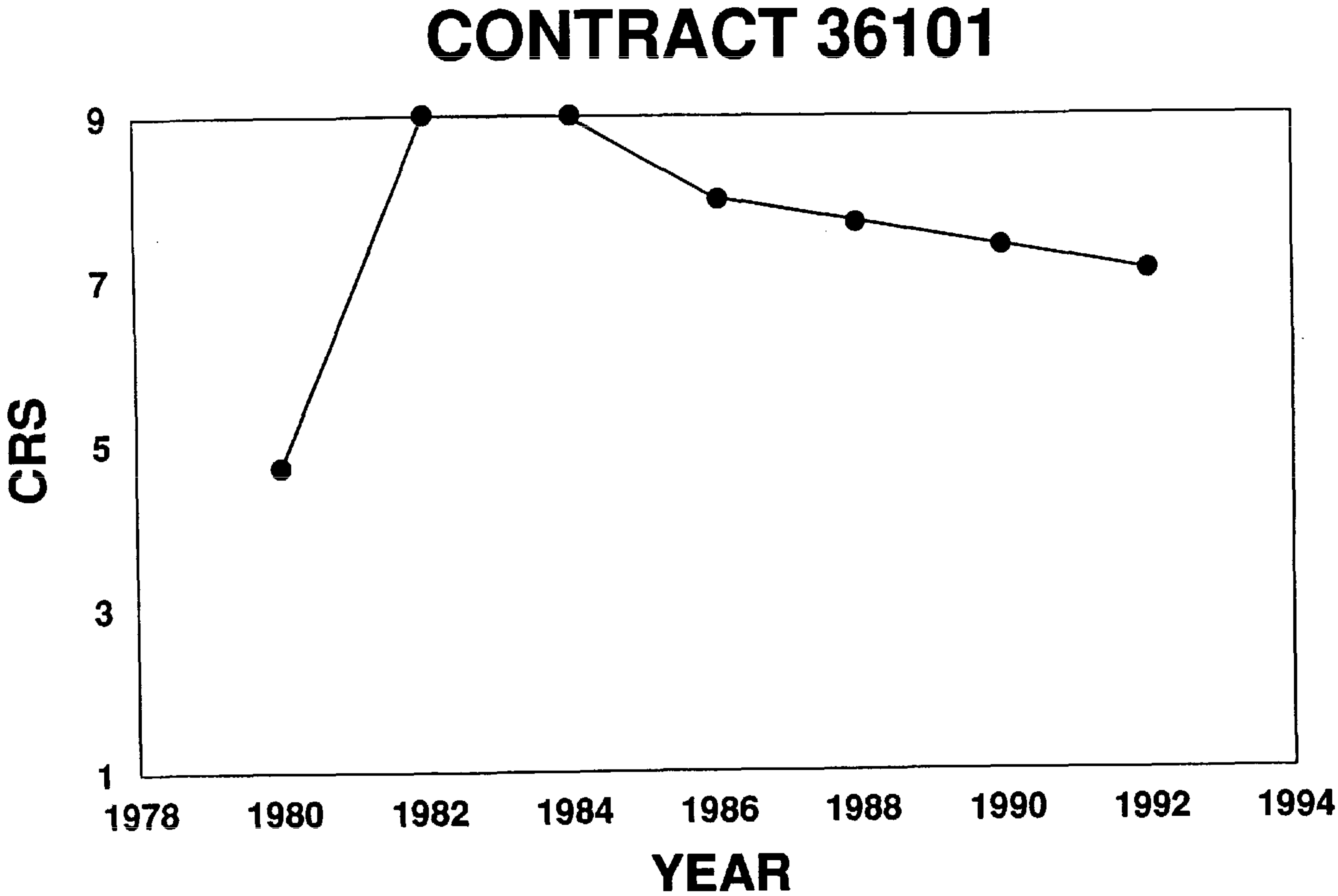



Figure 11: CRS History for Contract 36101

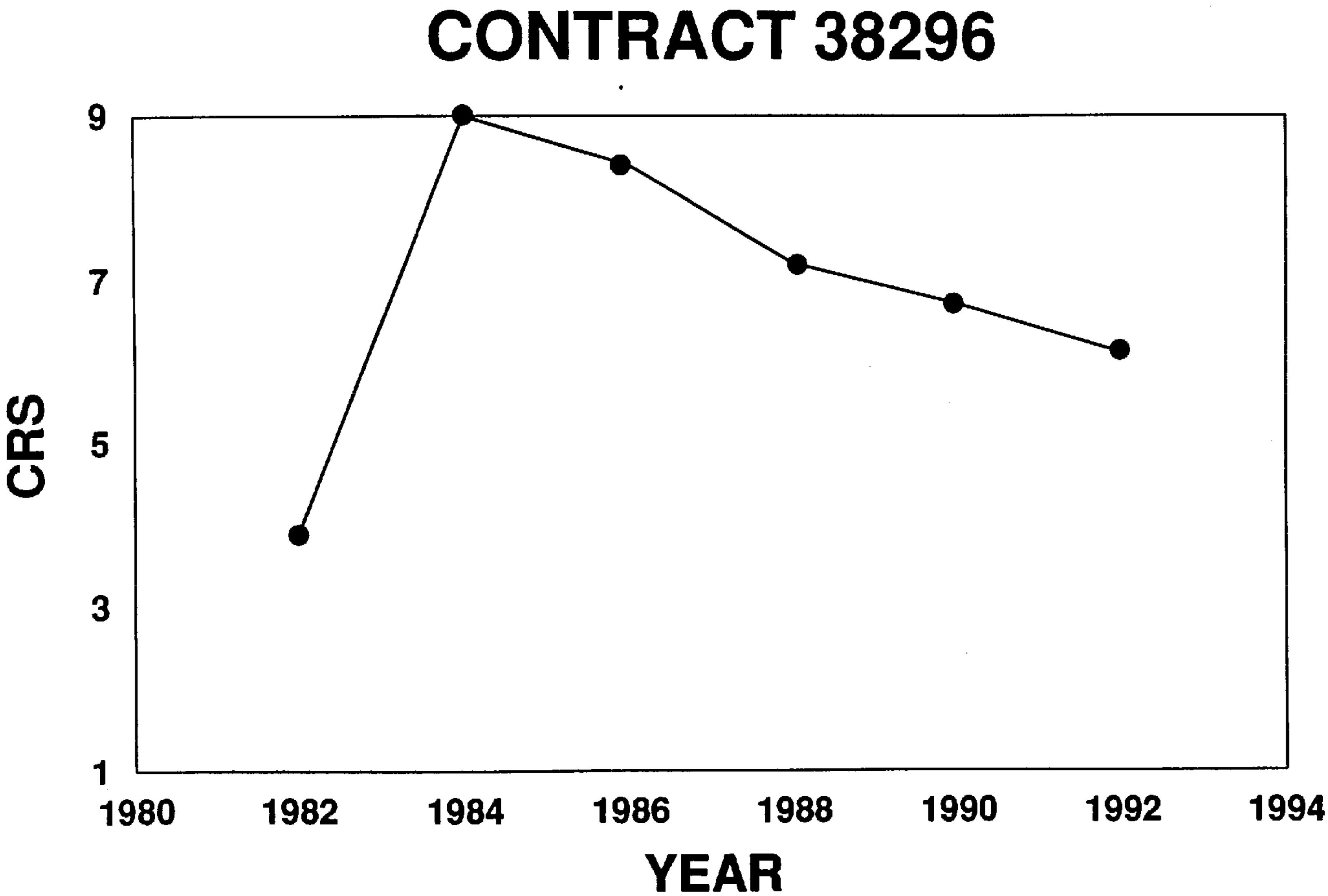



Figure 12: CRS History for Contract 38296

**APPENDIX A**

## GUIDELINES FOR RESURFACING OF OTHER STATE MAINTAINED HIGHWAYS (NON-INTERSTATE)

Effective September 15, 1992

The policy thicknesses given below were developed mainly for rigid type pavements. For most flexible base pavements, other than full-depth flexible pavements designed using mechanistic procedures, the thicknesses shown for the various categories will also apply. However, if a flexible base pavement shows medium to high levels of base failures as evidenced by alligator cracking or similar distress, the Bureau of Materials and Physical Research should be contacted for guidance in designing the overlay thickness. Mechanistically designed flexible pavements should also be referred to the Bureau of Materials and Physical Research for assistance in designing the overlay thickness.

Current department policies expect that pavement rehabilitation projects on these routes have a performance period of at least five years. Historical data and IDOT experience indicate that, for the majority of previously resurfaced pavements, a 2-inch overlay will exceed the required performance period. However, due to changes in mixture design and concerns over ease of constructability, the standard overlay thickness for previously resurfaced pavements has been established as 2.25 inches. Cold milling to remove rutting and similar distress should also be considered. On those highways where the existing concrete has not been resurfaced, or where widening is being placed, the standard overlay thickness may be increased to 2.5 inches.

However, variations do exist within and between projects, and thicker overlays are sometimes required for either bare pavements or previously resurfaced pavements. The following guidelines address certain situations when additional thickness may be warranted and the criteria that must be met to receive additional thickness. Requests for additional thickness for any of the variances listed below must be submitted to the Engineer of Design and Environment and approval will be contingent upon the supporting documentation.

a) Variance 1 - Jurisdictional transfer:

Requests for additional resurfacing thickness will be approved only if the transfer is approved by the accepting agency. The amount of additional thickness should be held to the minimum which will allow the transfer to be accomplished. A field review conducted by the Bureaus of Design and Environment and Materials and Physical Research and the district may be required for projects for which unusual or experimental treatments are proposed.

b) Variance 2 - Consistency:

Projects which border upon new or reconstructed sections with 15-year or greater design periods may qualify for additional thickness. The overlay should be designed for the same design period using the method outlined in Section 7 of the Design Manual. The calculations should accompany the request.

Projects which contain an urban cross section with new curb and gutter may also qualify for additional thickness. The overlay should be designed for a 15-year design period using the method outlined in Section 7 of the Design Manual. The calculations should accompany the request.

c) Variance 3 - Profile corrections:

Current department policies require a cross slope of 3/16 inch/foot for new construction to promote cross drainage and prevent the ponding of water on the pavement surface. Most existing pavements constructed with circular crowns contain adequate cross slope to accomplish this objective. For this reason, crown correction will not normally be required during resurfacing contracts. When, due to uneven settlement or other reasons, a minimum cross slope of 1/8 inch/foot is not available, consideration should first be given to cold milling to obtain the proper crown. If cold milling is not feasible, plans for crown corrections should be prepared on the basis of a minimum cross slope of 1/8 inch/foot and should be accomplished within the policy resurfacing thickness permitted above.

Pavement conditions that cannot be corrected by cold milling and/or a policy overlay may warrant additional thickness. These include projects where the existing widening has tipped or settled, rutting exists, or localized depressions are present. Estimates of the material quantities required should accompany the request.

d) Variance 4 - Structural deficiency:

Pavements with severe base failures; jointed reinforced concrete (JRC) and continuously reinforced concrete (CRC) pavements with excessive total patching quantities which can be reduced by the additional overlay thickness; JRC pavements with average faulting in excess of 0.5 inch; JRC, CRC, and overlaid concrete pavements exhibiting D-cracking; and pavements with current Condition Rating Survey (CRS) ratings of 3.5 and less may qualify for a 3.5-inch overlay.

e) Variance 5 - Heavy traffic:

Class I, II, and III primary highways with heavy traffic that have not been previously resurfaced will be eligible for additional resurfacing thickness as shown in Table 1 below. The current average daily traffic (ADT) will be used for eligibility determination and should be submitted with the request.

First and subsequent resurfacing projects for which substantial increases in traffic are expected (as in the case of detours), and projects for which commercial traffic travels fully loaded in one direction and empty in the other shall be considered special cases and should be referred to the Bureaus of Design and Environment and Materials and Physical Research for analysis.

TABLE 1: FIRST RESURFACINGS FOR CLASS I, II AND III PRIMARY HIGHWAYS

| MULTIPLE UNITS PER DAY (2-WAY TRAFFIC) | EQUIVALENT THICKNESS OF EXISTING PCC SLAB, INCHES $D_c$* | OVERLAY THICKNESS, INCHES |
|---|---|---|
| < 500 | | 2.5 all |
| 500 - 1000 | $D_c \leq 7.5$ | 3.25 |
| | $D_c > 7.5$ | 2.5 |
| 1000-1500 | $D_c < 7.5$ | 4.0 |
| | $D_c = 7.5\text{-}8.5$ | 3.25 |
| | $D_c > 8.5$ | 2.5 |
| > 1500 | $D_c \leq 8.0$ | 4.0 |
| | $D_c > 8.0$ | 3.25 |

*Values for $D_c$ may be found in Table 7-300.06 of the Design Manual.

Required Documentation for Overlay Thickness Variance Requests

The required documentation necessary for consideration of overlay thickness variance requests shall consist of:

a) Length and limits of project and limits of request: If the condition of the section is variable, the limits of the distressed areas requiring additional thickness should be clearly defined by station or log mile rather than requesting additional thickness over the entire project.

b) Traffic: including breakdown of passenger vehicles, single-unit trucks, and multiple-unit trucks.

c) Pavement history: date of construction, pavement cross section data, date and description of previous rehabilitations, and CRS rating and distress history.

d) Existing condition: type, severity, and frequency of distress (including photos); directional differences; faulting measurements; rutting measurements; patching quantities for the standard policy overlay versus the reduced patching quantities with the additional thickness overlay and the costs associated with both options.

e) Supporting calculations and cost estimates where noted elsewhere herein.

f) Any other supporting evidence or test data.

Based upon the quality of the supporting documentation, a field review conducted by the Bureaus of Design and Environment and Materials and Physical Research and the district may still be warranted dependent upon the total length of the project and the percent of the project for which additional overlay thickness is requested.

The above guidelines indicate maximum policy thicknesses. In cases where resurfacing is being placed for cosmetic reasons such as when widening joints and lane lines conflict, it may be desirable to place less than the policy thickness. Requests to use less than policy resurfacing thickness must also be submitted to and approved by the Engineer of Design and Environment. Approval will be based on supporting documentation.