Evaluation of Performance and Cost-Effectiveness of Thin Pavement Surface Treatments

FINAL REPORT

Oregon SP&R Study #5269

by

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16. Abstract

This study describes the findings from the study of 87 closely monitored sites in the State of Oregon which were treated with different types of thin surface materials. All of these surface treatments had a total thickness of two inches or less, and included: chip seals, asphalt penetration macadam or "oil mats", cold in-place recycling (CIR), and thin asphalt concrete overlays.

Attempts were made to define the cost-effectiveness using unit cost, traffic loading, and life of treatment, but specific recommendations concerning the relative cost-effectiveness of the treatments studied were not possible with the data from this study.

Polymer modified chip seals appeared to be generally more cost-effective than conventional chip seals when traffic loading and cost are factored into the evaluation of treatment life.

Chip seals, as used in Oregon, do not correct rutting. Rather, the opposite is true, there is a tendency for ruts to be slightly deeper after applying a chip seal.

Thin, dense-graded, AC overlays appeared to be more cost-effective on a life-cycle basis (LCI), particularly in heavy traffic areas.

Construction practices and weather conditions at laydown can significantly affect the life of a thin surface treatment. The life of any of the treatments studied may be made to last more (or less) time than shown in this study.

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DISCLAIMER

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1.0 INTRODUCTION

1.1 BACKGROUND

An important part of any pavement management system is a thorough understanding of the performance of non-structural pavement treatments, here referred to as "thin surface treatments", for roads and highways. The Strategic Highway Research Program (SHRP) is working on the long-term performance of these types of treatment. Federal, state, and local agencies are also looking for methods to address effects of the increasing number of vehicle-mile and axle loads on their highways. The Oregon Department of Transportation uses a "pavement management system" to identify and address these effects(1).

Structural overlays or total reconstruction of a pavement structure are not always possible due to high cost. Even when affordable, they are not always the most cost effective choices for improving the condition of the highway system. The optimal use of public funds requires an understanding of the criteria for selecting a pavement maintenance or preservation method.

On lower volume roads, an acceptable level of serviceability can be achieved by using non-structural treatments. These treatments can be a part of a periodic preventive and corrective maintenance strategy. Thin surface treatments can be a cost effective alternative for highway maintenance and, in some cases, they can delay the need for rehabilitation.

Since 1985 a total of 87 sites throughout Oregon have been surveyed annually. These sites are treatments constructed in 1984, 1985, and 1986. This final report is intended to summarize the available data, produce an evaluation of treatment cost-effectiveness, and provide direction to any future research in this field.

1.2 STUDY OBJECTIVES

The objectives of the original study, of which this paper is a part, are as follows: to evaluate the serviceability, cost-effectiveness and maintenance requirements of thin surface pavement treatments in the different climatic regions of the State of Oregon.

This is a final report. Its purpose is to summarize the data currently available, produce an evaluation of treatment cost-effectiveness, and provide direction for further research in this field.

2.0 STUDY APPROACH

This study describes the findings from the study of 87 closely monitored sites in the State of Oregon which were treated with different types of thin surface materials. All of these surface treatments had a total thickness of two inches or less, and included: chip seals, asphalt penetration macadam or "oil mats", cold in-place recycling (CIR), and thin asphalt concrete overlays.

A large part of this study is an attempt to define cost-effectiveness for the particular needs at hand. The three main factors in cost-effectiveness are: unit cost, traffic loading, and life of treatment. This chapter discusses three possible ways to evaluate cost-effectiveness and defines three suggested indices to measure it. The Longevity Cost Index (LCI), as defined there, is considered the most meaningful index, although the statistical significance is weak.

The meaning of cost-effectiveness ultimately depends on many factors specific to the site conditions and economics of each project and section of pavement. The analysis of cost-effectiveness, done in 1989, did not demonstrate any major differences in the various treatments, and could not be used with confidence. In the final analysis, the most useful information in this study will be the final average (or median) service life of each treatment.

Service life is not, by itself, a measure of cost-effectiveness but, when combined with knowledge of traffic, weather, cost, and site conditions, can be used in comparing the various treatments.

In 1990 the work plan was modified to reflect that final conclusions concerning the ultimate service life would be made after 13 (or 90%) of the CIR pavements are considered failed or have been overlaid or reconstructed[1]. This occurred in the spring of 1991.

2.1 SITE SELECTION

The locations of the 87 experimental sites are shown on the map in Appendix A. These sites were selected for this study over a period of 3 years; 1984-86. Table 1 identifies the number, location and type of sites selected and the date of construction. All projects were added to the study in the same year as construction.

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[1]This criterion is a change from that specified in the original workplan, which stated that the final report would be made after 90% of **all** pavements fail. This change was made because the longest lasting pavements are CIR and hot-mix AC. Since other information is available on hot-mix longevity, the additional study time necessary to evaluate it is not warranted.

Table 1 - Number of Thin Surface Treatment Projects by Year

Year Added	A/C Dense	A/C Open	CIR	Chip	Chip W/Styrelf	Oil Mat
1984	11	6	3	10	6	7
1985	9	-	4	5	9	3
1986	-	-	9	-	-	-

It was originally intended that the five State Highway Regions would represent the major climatic conditions in the State. Since several major climatic differences exist within each Region, the sites studied do not uniformly represent these climatic zones. In making valid comparisons of cost-effectiveness, the relative severity of the climate in each section must be considered. See the discussion comparing the two types of chip seals in Section 6.1.3.

The climatic zones are summarized as follows:

CA - Cascade environment - most severe climate:
heavy winter snowfall; frequent freeze/thaw cycles; potential tire chain damage.
Annual Precipitation - 40 to 98"
Mean Temp. - January - 21 to 28°F
Mean Temp. - July - 57 to 66°F

CO - Coastal environment - mildest climate:
frequent fog and poor weather for chip sealing.
Annual Precipitation - 55 to 80"
Mean Temp. - January - 39 to 46°F
Mean Temp. - July - 57 to 61°F

W - West of Cascades - mild climate:
Annual Precipitation - 35 to 50"
Mean Temp. - January 36 to 46°F
Mean Temp. - July - 64 to 68°F

E - East of Cascades - most variable (moderate to severe);
Locally frequent freeze/thaw cycles
Annual Precipitation - 9 to 40"
Mean Temp. - January - 21 to 28°F
Mean Temp. - July - 57 to 72°F

Table 2 - Number of Thin Surface Treatments by Climatic Zone

Climate Zone	A/C Dense	A/C Open	CIR	Chip	Chip W/ Styrelf	Oil Mat
E	5	4	15	14	2	10
W	12	4	1	1	9	-
CA	1	2	-	-	2	-
CO	2	1	-	-	2	-
TOTALS	**20**	**11**	**16**	**15**	**15**	**10**

2.2 DISTRESS TYPES AND DATA COLLECTION

This study used a standardized format called "pavement survey" (Appendix B) for data collection. This form was used through most of the monitoring process of each 250-foot experimental section. Data on weather conditions and a detailed description of surface distresses for 5 segments of 50 feet each was collected every year until the section was considered failed or until it was resurfaced or reconstructed.

The pavement distresses of interest were transverse and longitudinal cracking classified according to the observed width of the crack; the percentage of the road affected with alligatoring, ravelling, potholes, loss of chips; and the depth of rutting. Also, bleeding problems, patching, and the condition rating of the overall road with any local characteristics were reported. All this information was entered into a data base program especially developed for this research. The distress types used in the analysis, are discussed below.

2.2.1 EQUIVALENT CRACKING

The detailed condition surveys include counts of both transverse and longitudinal cracks for every 50 feet of pavement. The crack data is recorded in three categories by width: 0 to ⅛", ⅛" to ¼", and greater than ¼". This part of the detailed evaluation generated a large amount of data for each site. The data has to be reduced and simplified, for the purpose of evaluation, to a single number from all crack counts, both longitudinal and transverse. A different multiplying factor is used for each of the different crack widths to provide a numerical value of severity. The factors used are as follows:

Crack Width	Multiplying Factor
0" - ⅛"	¼
⅛" - ¼"	½
¼" - more	1

A further adjustment was used to relate transverse cracks to longitudinal cracks. Because each section evaluated is approximately 4 times longer than it is wide (50' x 12') the value for longitudinal cracking is multiplied by 4 while the value for transverse cracking remains unchanged. The resulting number can be thought of as representing the total lineal feet of cracking having a severity roughly equivalent to a ¼" crack.

Another factor of 1/15 is applied to make the final value comparable to the rating for alligatoring. This is necessary because some pavements originally showing combinations of transverse and longitudinal cracking one year, would be seen as having alligator cracking the next year. This allowed the two distresses to be compared on an equal basis.

The data for equivalent cracking is presented in Figure 3 in Chapter 5.0. Because not all treatments solve the same kind of problems, they are classified in two main groups: asphalt concrete and recycling in one group, and chip seals and oil mats in the other. This division is well supported by the changes in the condition rating between the pre-construction stage and the post-construction observation for each group. Past condition ratings idicate that asphalt concretes and recycling increase the overall condition rating of the road by about two points, while chip seals and oil mats increase the rating by about one point.

2.2.2 RAVELLING

Ravelling, loss of aggregate from the surface, are determined by visual observation by the evaluator. The difference between the the two The number represents a percent of the total surface area affected by the distress.

2.2.3 POTHOLES

Pothole severity is determined by visual observation. The number represents a percent of the total area affected. Very few roads showed any significant problem caused by potholes through the 1991 inspection.

2.2.4 CHIP LOSS

The extent of chip loss is determined by visual observation by the evaluator. The number represents a percent of the total area affected. This distress applies primarily to the two types of chip seals. However, it also has some significance for the cold in-place recycling (CIR) projects that had chip seals placed over the CIR.

2.2.5 AVERAGE RUTTING

The average rutting is derived from rutting as measured in the wheel paths and averaged over the length of the 250-foot test section for each treatment. It is measured to the nearest 1/100 feet.

2.2.6 MAXIMUM RUTTING

The maximum rut depth for each 250-foot test section was reported. It is also measured to the nearest 1/100-foot. In some cases the median of the distribution representing the maximum rutting has a lower value than the corresponding average rutting. This may not seem reasonable, but is caused by a somewhat different set of sites being sampled each year, due to "drop-outs".

2.3 EVALUATION APPROACHES

As a preamble to the discussion of the evaluation approaches, it must be remembered that the data gathering was changed in 1990 in response to the conclusions from the interim report.

Three general approaches are proposed for evaluating treatment cost-effectiveness and performance in this study:

1. The service life of the treatment or the life-cycle analysis established at failure.
2. The reported changes in the overall condition rating of the road.
3. The measured changes of each specific pavement distress.

The first approach is emphasized here because it represents the final long-term behavior of the treatment.

The last two approaches were intended to reduce the first 2 to 4 years of performance data to a single value representing cost-effectiveness. It may still be possible, however, to apply this method if data is collected more uniformly for a future, similar study[2]. The emphasis here should be placed on using total service life, rather than the rate of distress, to evaluate cost-effectiveness of the various treatments.

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[2] Each of the above approaches suffered from a lack of uniform data collection and avialability. Problems with data collection and availability made significant results hard, if not impossible to obtain. Oregon's maintenance tracking systems can provide data for large geographic areas and does not have the resolution to be of value for this type of study.

2.3.1 LIFE CYCLE ANALYSIS

Regardless of all other analysis methods presented here, the answer to the following questions are likely to be the most useful to decision makers in ODOT:

1. How long did each project last;
2. What is the typical life for each type of treatment;
3. How much did it cost to construct and maintain the treatment throughout its life; and,
4. What kind of traffic and weather conditions was the treatment exposed to.

With this information, treatments can be selected that will better optimize the use of highway maintenance and preservation funds.

To determine service life, each experimental section was closely monitored until failure occurs. Proper evaluation of life-cycle costs should also include good information on the cost of any maintenance performed during the life of the treatment. Appendix E contains very general statements regarding maintenance under the narratives describing each site that has failed. In many cases maintenance costs are not significant, as thin surface treatments are themselves often a form of maintenance.

The definition of failure is critical to the proper life-cycle analysis, and is necessarily somewhat subjective. For the purpose of this study, failure can only be defined to the nearest year. It is defined as occurring when any one of the following conditions is met:

1. The surface is classified as "poor" or "very poor"; or, its condition rating is 4 or 5. (See Reference 2 for more detail).

2. There are numerous and extensive repairs that significantly alter the character of the surface;

3. The analyzed section has 30% or more of its surface seriously affected by any of the pavement distresses of interest, or 30% or more of the section has been replaced or re-treated due to distress.

Note here that a failed treatment does not imply that the treatment was not successful. It only indicates that the treatment has come to the end of its useful life. In many cases, this useful life may be great enough to prove the failed treatment to be a very cost effective alternative.

At the present time only 41, out of the total of 87, sites are considered failed. Of the 16 CIR pavement sites, 10 have now failed. The final life-cycle analysis will be accomplished after at least 13 (or 90%) of the CIR pavement sites have failed. See

Table 10 in Section 6.1.3 for a summary of all sites that have failed as of Spring 1991.

Two sites not included in this total were eliminated from the study for reasons not related to treatment condition. This was necessary due to general reconstruction not related to treatment failure. These sites are 84.45 and 86.07. One more was eliminated from the study for reasons not related to the condition of the material.

Final evaluation of cost-effectiveness by life of the treatment can be accomplished by factoring in the three factors discussed in Chapter 6. To aid in evaluating this in the future, an index called the Longevity Cost Index (LCI) is defined below. After the average (or median) life for each treatment is determined, the LCI can be calculated as follows to compare the treatments with each other:

$$LCI = \frac{PRICE/yd^2 + MCOST/yd^2}{LIFE \times \text{Annual MEGASALs}} \qquad (2.1)$$

where: MEGASAL = One Million Equivalent Single Axial Loads

$PRICE/yd^2$ = Initial unit price of the investment

$MCOST/yd^2$ = Unit maintenance cost during treatment life (Present Value)

LIFE= Average or Median life of a treatment (The median may be more appropriate as it can be calculated before all treatments fail)

In using this index, as with the two that are discussed in the following sections, a low value corresponds with a more cost effective treatment. While this may be the best final measure of cost-effectiveness that is possible from this study, it is not infallible. When it is calculated, consideration should be given to the problems and sources of error as listed in Section 6.2.

2.3.2 Analysis of Condition Rating Change

A Cost-effectiveness Index (CEI) was developed to use the established rating method for Oregon, called Pavement Condition Rating (PCR). The CEI method is discussed briefly here and presented more fully in Appendix C. The analysis did not appear to be valid for the available data. In Oregon's PCR rating system, pavements are rated on a scale of 1 through 5, where 1 is very good and 5 is very poor. A standard set of photos (2) helps to establish consistency between different raters. Although some rating information of this type was collected during the annual surveys under this study, these were not used in this analysis. The ratings actually used in the analysis are those performed by regular raters under the Pavement Management System. This system establishes a rating only on even numbered years for roads that are not part of the Interstate System. For this reason the ratings are not available for 1989.

The cost-effectiveness index (CEI) of a surface treatment, as used here, relates the change in the condition rating of a road to its traffic loading for a specific period of time, and the unit cost of construction. This index is defined by the following expression:

$$CEI = \frac{(C_2 - C_1)}{KILOSALs} (PRICE/yd^2 + MCOST/yd^2) \qquad (2.2)$$

where: KILOSAL = 1000 Equivalent single axial load

$PRICE/yd^2$ = Initial unit price of the investment
$MCOST/yd^2$ = Unit maintenance cost during treatment life
C_1 = Initial condition rating
C_2 = Final condition rating

It is important to distinguish between the pre-construction stage and the post-construction observation; in the above expression, C_1 is the condition of the road immediately after its improvement with a thin surface treatment. The final condition rating, C_2, is the condition after the road is exposed to traffic and weather. The difference C_2-C_1 represents the deterioration that has occurred. Consequently, the CEI increases with the degree of deterioration of the road and its unit price; conversely, higher levels of traffic loading generates lower CEI values. Thus, a lower value for CEI corresponds with a more cost effective treatment.

2.3.3 COMPOSITE ANALYSIS OF DISTRESS TYPES

In order to utilize the available data from detailed distress analysis a Composite Cost-Effectiveness Index (CCEI) was developed. This was intended to provide a preliminary evaluation of cost-effectiveness and to better understand the rate at which distress is progressing in each of the treatments. The results gained by applying this method to the available data are provided in Appendix C. This method of analysis is considered too short-term to be valid in determining cost-effectiveness. As this index uses cumulative distress for the period as an input, it will be less valid for data collected after 1989 as the reduction in the number of sites represented decreased. This will would bias the results excessively in favor of the poorer treatments, because any sites that are dropped from the study are likely to be the ones with the greatest distress. This distress, then, will not show up in the surveys performed after the sites are dropped.

Each thin surface treatment is ranked according to the following types of distresses:

1. Rutting - calculated as its average and its maximum rutting depth (in 0.01 feet).

2. Alligatoring - reported as a percentage of the experimental section.

3. Transverse and longitudinal cracks - classified according to their width and counted every 50 feet of the monitored section (as is detailed in Appendix B).

4. The percentage of area that shows loss of chips - only applicable for treatments which include chip seals.

5. Potholes - distress that, for this study, has no significant consideration.

6. Skid resistance - needed to include the consideration of safety in the overall evaluation of a highway.

Note, in some cases, it is not possible to determine if the distress originates in the surface treatment itself or from the underlying material. However, it is assumed that the distress does reflect properties of the treatment being studied.

A CCEI is described below. This index would use weighting factors to form a composite index from changes in each of the distresses. In contrast to the CEI, the CCEI would integrate all information related to cost-effectiveness into a single number. As proposed here, the three basic types of analysis (service life, specific distresses, and condition rating), could be used to derive a CCEI. It is also suggested that the CCEI index could include a weighted value for measured changes in skid resistance, which would factor the problem of public safety into the index. For the current study, however, adequate skid data is not available. The form of the CCEI equation would be as follows:

$$CCEI = \frac{(CI + SDI + Wskid)}{KILOSALs}(PRICE/yd^2 + MCOST/yd^2) \qquad (2.3)$$

where: $CI = W1 \times$ (change in condition rating)

CI = Condition index (per period)
W1 = Weight for overall condition rating
SDI = Sum [Wn x (change in each distress)]
SDI = Surface distress index (per period)
Wn = Weight for each type of distress
Wskid = The weighted change in the skid resistance of the pavement for the analyzed period
$PRICE/yd^2$ = Initial unit price of the investment
$MCOST/yd^2$ = Unit maintenance cost during treatment life

The weights in the above expression are numerical or percentile values that assign a relative importance to each parameter in the formula. The difficulty of calculating these weights makes the composite index an issue for future research and experimentation. Satisfying the needs and perceptions of the users would require their input. Methods are available through Utility Theory (14) which would allow a mathematical means of incorporating personal values and opinions into the weights assigned.

3.0 TREATMENT TYPES

The projects included in this study were treated with four different types of thin surfaces which are briefly described below. All of them are the surface course, or wearing course, for a flexible pavement (5). Flexible pavement is defined as, "a pavement structure which maintains intimate contact with and distributes loads to the subgrade and depends on aggregate interlock, particle friction, and cohesion for stability," according to the AASHTO design guide, 1986 edition (5).

3.1 THIN ASPHALT CONCRETE (AC) OVERLAYS

This study defines thin AC overlays as those that are 2 inches or less in thickness. Thin AC overlays constitute 31 of the sites in this study. Nine (9) of these are "E" and "F" mixes which are open-graded hot-mix materials. Two more are also considered open graded, but these are cold-mix materials, or emulsified asphalt concrete (OGEM). Twenty (20) were constructed with dense-graded "B" and "C" mixes which have the advantage of better workability and longer hauling period as compared to the "E" and "F" mixes (7). The two cold mix materials were constructed with a CMS-2 asphalt emulsion. Finally, in one case a "C" mix was constructed with a geotextile in one lane of the traffic. Appendix D provides further explanation about the asphalt content and proportion of materials for these mixes (8).

In addition to the asphalt concrete course, in some cases the surface was covered with a sand seal as a finishing layer. Chip seals using emulsified asphalt like CRS-2 or CMS-2, and sand seals with CRS-1 emulsions were constructed for others in order to improve their skid resistance and protect them from wearing and weathering. The thickness and type of asphalt concrete selected is given in Table 3.

3.2 CHIP SEALS

This particular treatment has lately regained nationwide popularity as an easy and fast alternative for surface improvement of flexible pavements (9). It is defined as a thin surface formed by spraying asphalt material (either an asphalt emulsion or hot asphalt cement) on the road surface followed by a layer of uniform aggregate (10).

Within this project, ⅜" and ½" layers of chip seal were used on 30 sites, half of them constructed with a modified polymer known as Elf-Aquitane asphalt "Styrelf" process. When the term Styrelf is used in this report, it is meant to refer to polymer-modified chip seals in general.

In a recent survey (9), many users found that the polymerized emulsion presents numerous advantages as binding material for chip seals; the principle advantage being the improvement in initial chip retention. The survey also found that a total of 17 out of 38 public institutions among State Departments of Transportation and Federal Divisions are currently using the Styrelf polymer. The selection process of this type of treatment and the technical conditions that have to be considered are the subject of further discussion in this chapter.

3.3 ASPHALT PENETRATION MACADAM (OIL MATS)

Often called oil mat, asphalt penetration macadam is essentially a series of chip seals. The specific proportions of aggregates and bituminous materials for various thicknesses are presented in Appendix D. This alternative was selected for ten sites employing different thicknesses: 0.75" in six roads, 0.63" in two, 0.38" in one, and another highway with 1.25". The exact locations of all these treatments are described in the Appendix A.

3.4 COLD IN-PLACE RECYCLING (CIR)

Cold in-place recycling has recently been the subject of many technical publications and intense research. In the State of Oregon, it has been utilized extensively as an alternative for maintenance and rehabilitation of asphalt concrete pavements; with the main advantages being that it is relatively inexpensive and easy to construct. It can also be used successfully on severely distressed pavements.

CIR consists of grinding off the top few inches of the surfacing, adding emulsified asphalt and water, then compacting the mixed material. The whole construction process can be performed with full train machinery including its own mill, screens, crusher and paving equipment; or with a single unit train consisting of a crushing machine followed by a paver, or in some cases a motor grader (11). Among the 16 cases of CIR in this study, seven have chip seals, one used the Styrelf polymer in its mix, and one case has a sand seal; all of them with a recycling depth up to 2"

Table 3 - Number of Sites Treated with Asphalt Concrete (A.C.) and Their Finishing Surface

Part A

Thickness	Asphalt Cements			A.C. w/ Chip Seal		A.C. w/ Sand		A.C. w/ Geotextile
	"B"	"C"	"E"	"B"	"E"	"F"	"E"	"C"
0.75"			1		1		3	
1.50"	4	8		1		1		1
2.00		6						
TOTAL	**4**	**14**	**1**	**1**	**1**	**1**	**3**	**1**

Part B

Thickness	A. C. Using Emulsified CMS-2		A. C. With Sand Seal		Total Sites
	Chip Seal	Sand Seal	"F"	"E"	
0.75"				1	6
1.25"	1				1
1.50"			2		17
2.00"		1			7
TOTAL	**1**	**1**	**2**	**1**	**31**

Note: "B" & "C" Mixes are dense-graded
"E" & "F" Mixes are open-graded

4.0 SELECTION CRITERIA FOR THIN SURFACE TREATMENTS

An initial survey of the overall condition of a highway provides information on the need for immediate or future repairs and improvements. In order to make the optimal decision in selecting a thin surface treatment for a road, this pre-construction evaluation should consider the criteria as listed in Table 4. Tables 4 and 5 summarize information from AASHTO (5), the Asphalt Institute (6,10,12), and ODOT (7,9) publications along with conversations with ODOT Distric personnel. It should be pointed out that the engineer's experienced judgement also plays an important role in the final decision.

Tables 4 and 5 together can be used to aid in selecting which treatment type (or types) may be appropriate for the conditions on a given road. If the overall evaluation of the road shows evidence of structural failure or severe visible damage, then thin treatments are not recommended. Complete rehabilitation or a structural overlay may be required. In this case a complete structural surfacing design should be performed including effective thickness analysis and deflection tests (12).

Table 4 - Selection Criteria Definitions

Number	Description
1	Low Skid Resistance
2	Some Degree of Ravelling
3	Oxidized or Brittle Surface
4	Bleeding is Present
5	Base Failure (Deep Rutting)
6	Overall Cracking
7	Initial Signs of Cracking
8	Permeability is Desired
9	Appearance is Poor
10	Pavement is Stripping
11	AADT is 5000 or Greater
12	AADT is Less Than 5000
13	High Speed Traffic
14	Traffic Coefficient Greater Than 10
15	Pavement Rides Poorly
16	Weather Can Cool Suddenly
17	Long Hauling Distance
18	Hand Work Required
19	Extensive Poor Quality Patching
20	Unstable Original Material

Table 5 - Selection Criteria Recommendations *		
Type of Treatment	**Recommended If**	**Not Recommended If**
Dense Graded Hot Mix Class "B" or "C"	When no other can be used and 18, 19	5, 20
Open Graded Hot Mix Class "E" or "F"	2, 6, 8, 11, 13, 14, 19	5, 17, 18, 20
Cold In-place Recycling	2, 6, 9, 15, 17	5, 10, 16, 18, 20
Open Graded Emulsion "OGEM"	2, 5, 6, 8, 13, 17	5, 11, 16, 20
Chip Seal**	1, 2, 3, 7, 9	4, 5, 6, 10, 11, 13, 14, 16, 19, 20
Asphalt Penetration Macadam	1, 2, 7, 9	4, 5, 10, 13, 14, 16, 19, 20

*All code numbers are explained in Table 4.
**Both ordinary and Styrelf chip seals are included here

5.0 TRENDS IN DISTRESS DEVELOPMENT

5.1 DISTRESS CHANGES WITH TIME

Figures 1 through 6 present condition survey data averaged for each individual treatment type. These charts should be interpreted with caution, as the varying severity of traffic and weather conditions are not considered. For example, Figure 1 should not be interpreted to indicate that Styrelf chip seals are more subject to rutting than ordinary chip seals. When ESALs are considered, the two materials appear equal in rutting. Also, it is clear that there is a major difference in the climatic conditions where the two materials were placed.

Figures 1 through 6 are also intended to provide information on the before and after construction condition. Where possible, they also provide general information on how severe the distress becomes 2 years after construction, and how that relates to the original condition. The numbers following the label for each treatment type indicate the number of sites represented in the average value shown. These numbers do not correspond strictly with the total number of sites. This is because, for six of the sites, data for the before construction condition was not available. On two other sites (Styrelf chip seals), the treatment failed after 10 months. For these, data for the second year is not available. The sites eliminated from Figures 1 through 6 are listed in Table 6 below.

Table 6 - Sites Not Used in Figures 1 - 6

Treatment Type	Site Number	Reason Not Used
Cold, In-place, Recycle	84.13 84.38	Before construction data was not available.
Chip Seal, Polymer Modified	84.40 84.41 84.42	Before construction data was not available.
AC, Dense Graded	84.44	Before construction data was not available.
Chip Seal, Polymer Modified	85.01 85.16	Early failure

Observations of Interest - Figures 1 through 6:

- Chip seals do not correct rutting, they generally make it worse. Early chip loss in the wheel tracks is probably the cause.

- Of the projects studied, initial rutting was the most severe on the "AC dense", "AC open", "oil mat", and "recycle" treatments.

- Initial cracking was the most severe on the "recycle" treatments.

- Cracking appears to proceed more rapidly on both types of chip seals than on other treatments.

FIGURE 1
Average Rut Depth in Test Section
by Treatment Type

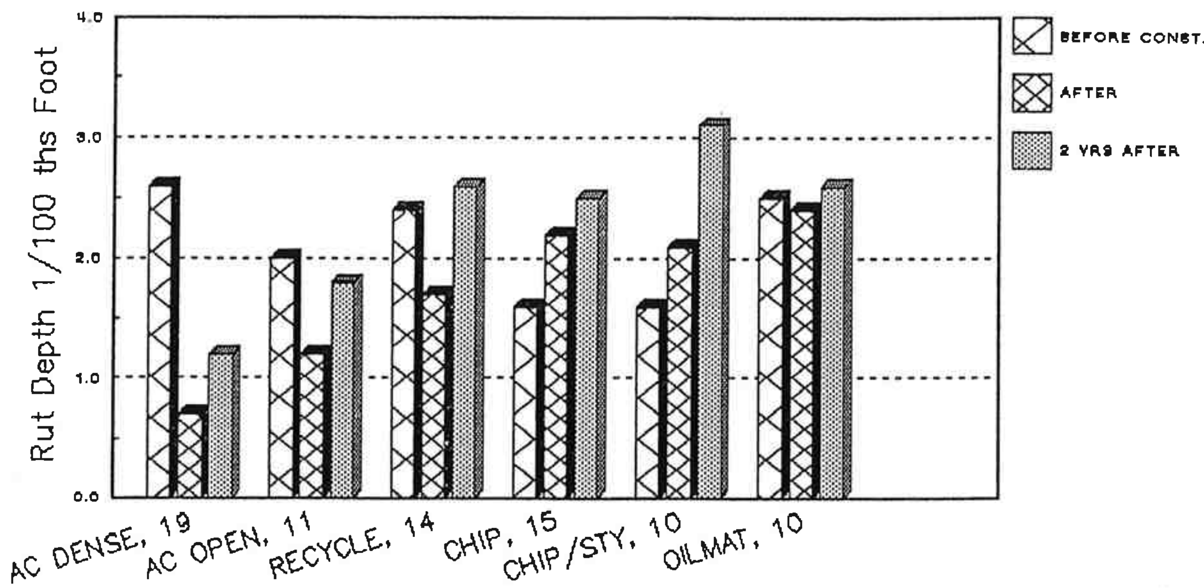


FIGURE 2
Maximum Rut Depth in Test Section
by Treatment Type

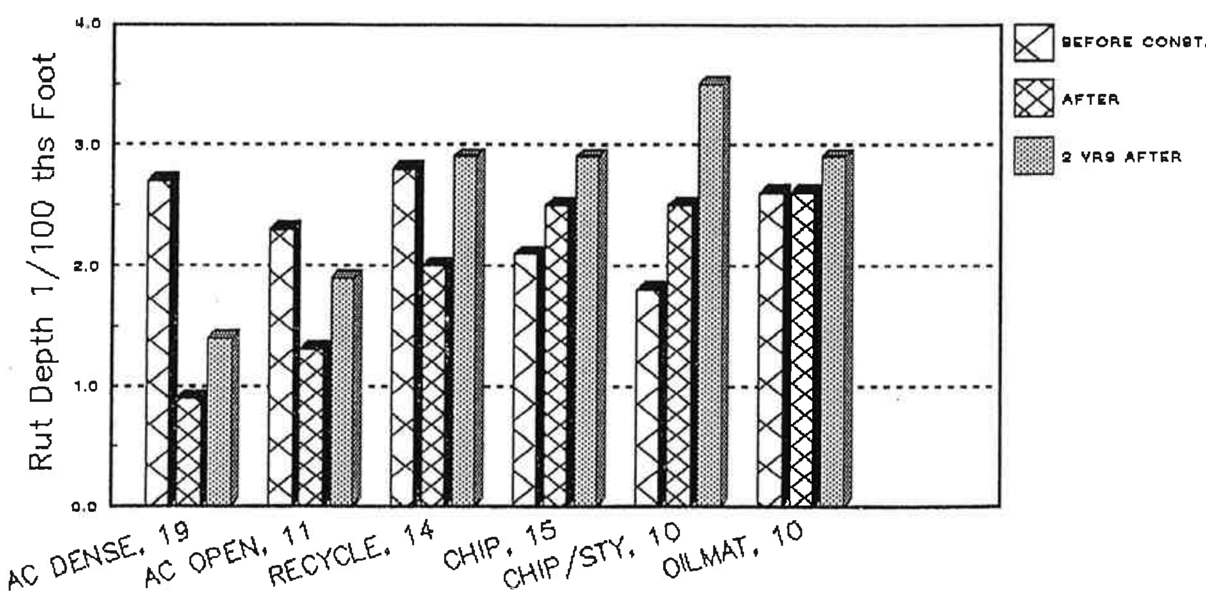


FIGURE 3
Equivalent Cracking by Treatment Type

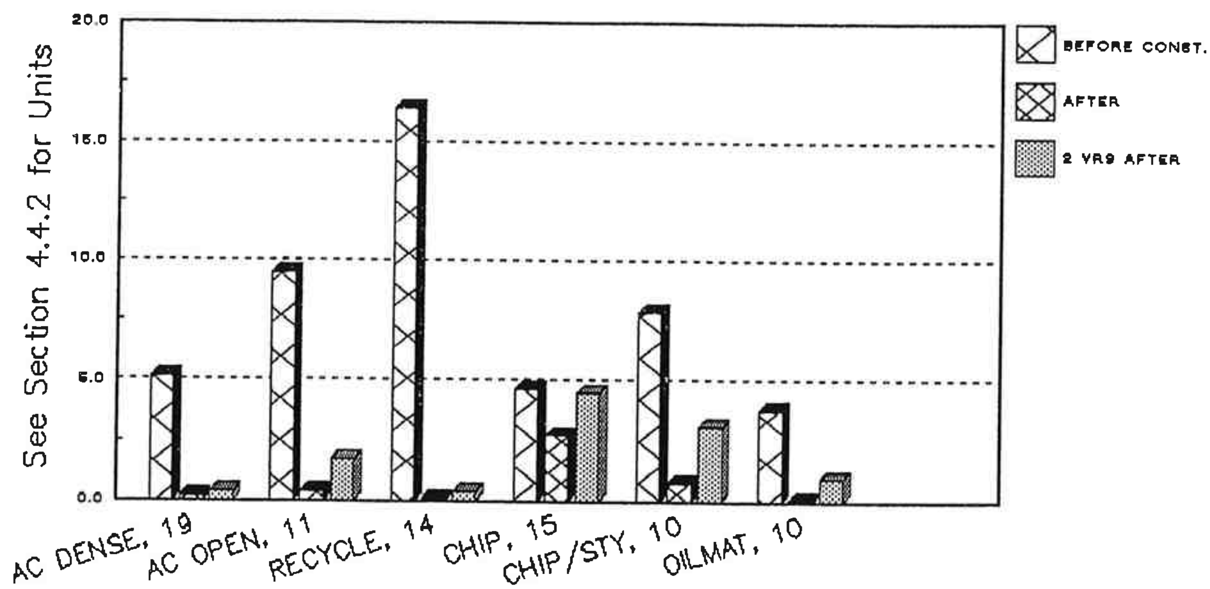


FIGURE 4
Alligator Cracking by Treatment Type

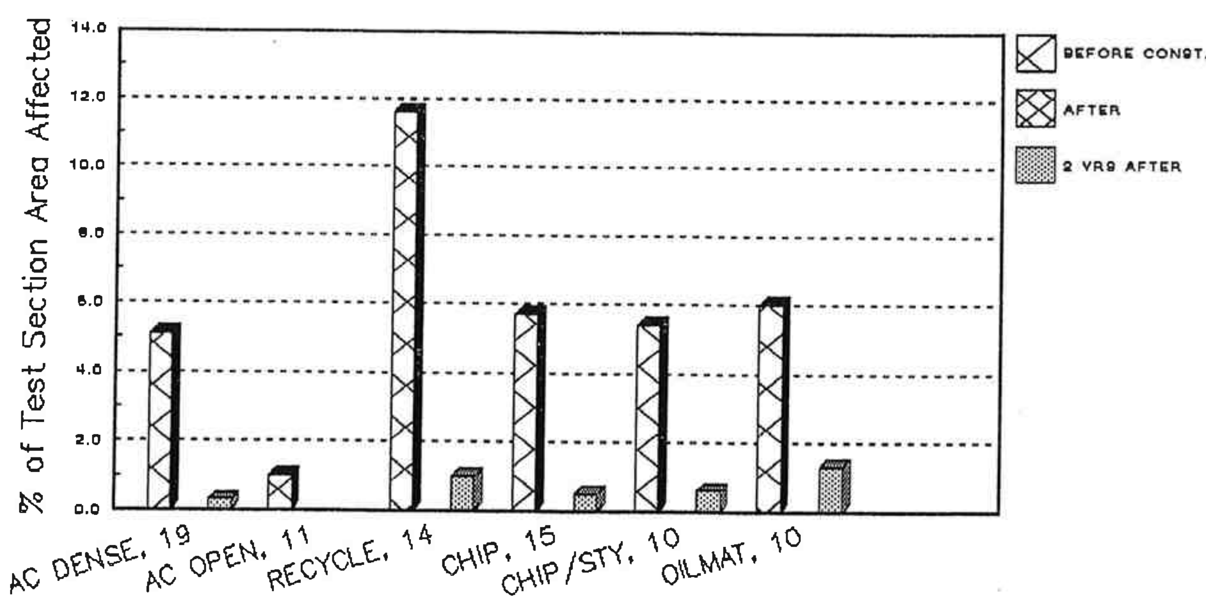


FIGURE 5
Surface Ravelling by Treatment Type

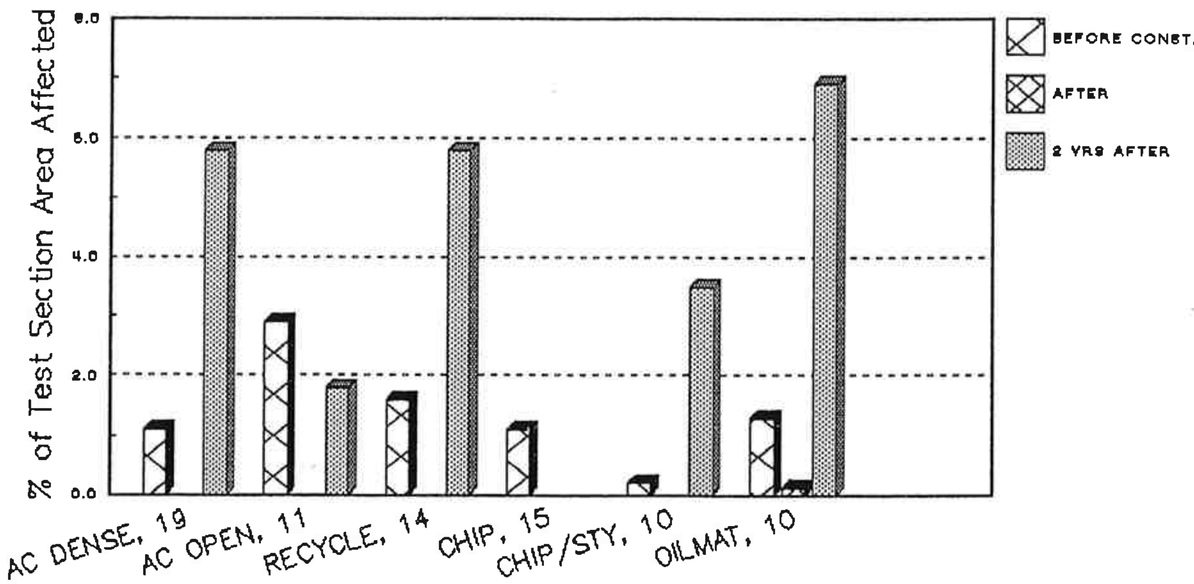
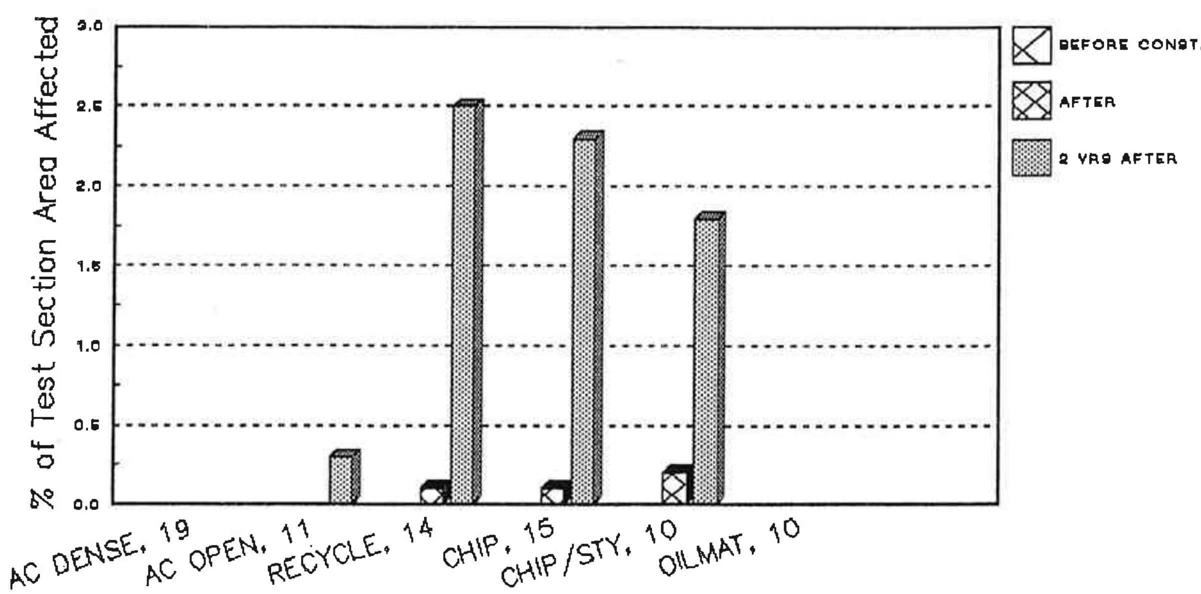


FIGURE 6
Chip Loss by Treatment Type



5.2 DISTRESS CHANGES WITH TRAFFIC LOADING

Figures 7 through 12 present rut depth data versus ESALs for all materials, while Figures 13 and 14 present chip loss data versus ESALs for the two types of chip seals. These are combined data for condition surveys conducted 1, 2, and 3 years after construction.

MARKER

The wide scatter in the plots is due to the random sampling of different projects. The data on these plots do not represent continuous observations of a single site. Instead, they are derived from all projects where 3 years of data was available after construction. It is likely that the scatter is due to a wide variation in pavement structures among the projects represented.

<u>Observations of Interest - Figures 7 through 14:</u>

- Figures 7 and 8 show that it takes approximately one-half as much traffic to develop ruts in CIR pavements as it does to develop similar rut depths in AC dense.

- Figures 8 and 9 show that ruts develop in AC open slightly faster (in terms of traffic loading) than they do in AC dense.

- Figures 11 and 12 show that ruts develop in both types of chip seals at approximately the same rate (in terms of traffic loading). This rate is approximately twice as fast as that for hot mix AC.

- Figures 13 and 14 show that the data for chip loss is too widely scattered to be meaningful. In particular, the apparent decreasing trend in Figure 14 suggests that there may be a lack of consistency in the judgement of evaluators. Similar graphs (not shown) of all other distress types also show illogical trends or wide scatter. This suggests that all types of pavement distress requiring the evaluator to use his judgement may not be valid.

FIGURE 7
Average Rut Depth in Test Section — recycles

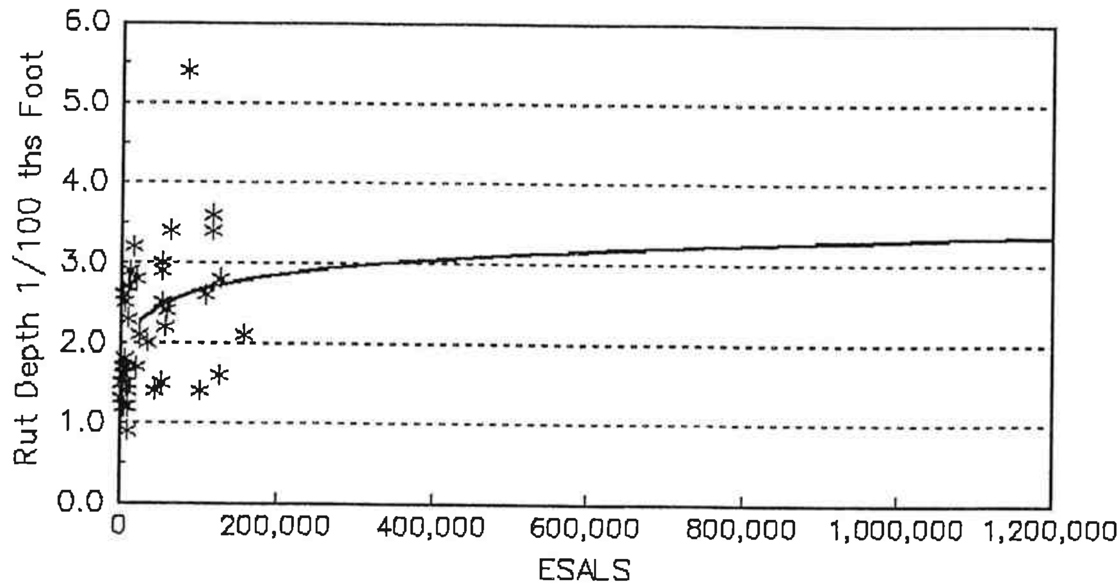


FIGURE 8
Average Rut Depth in Test Section — AC Dense

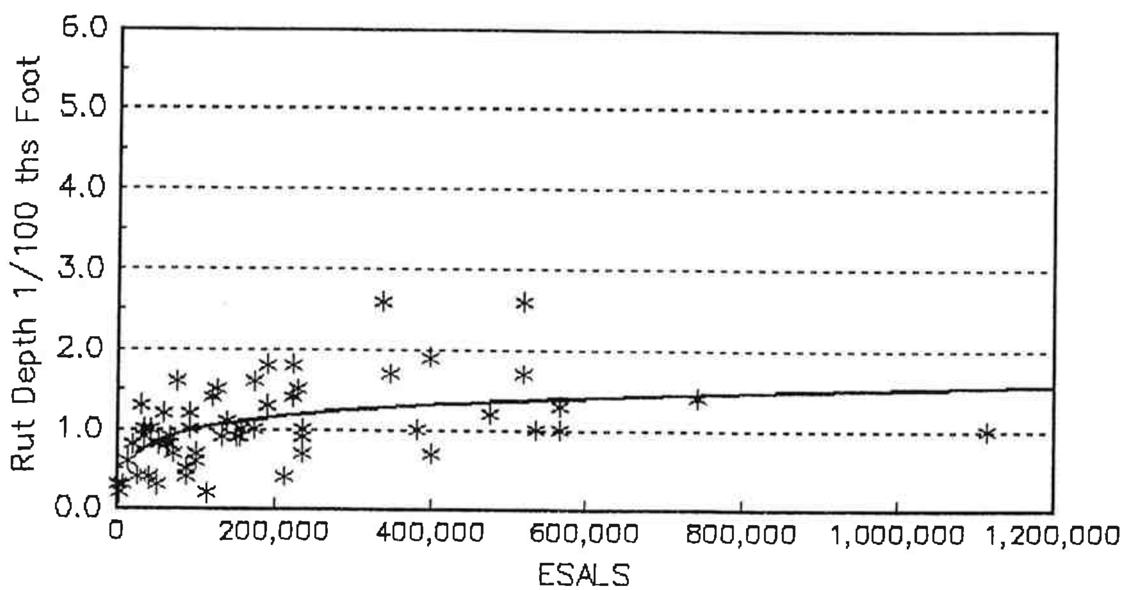


FIGURE 9
Average Rut Depth in Test Section – AC Open

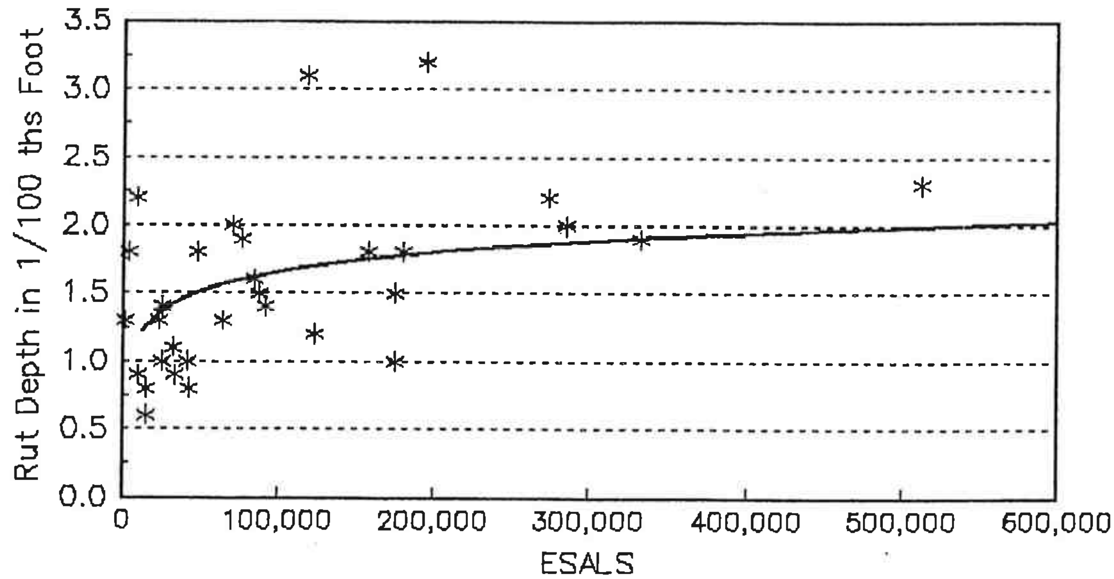


FIGURE 10
Average Rut Depth in Test Section – Oilmat

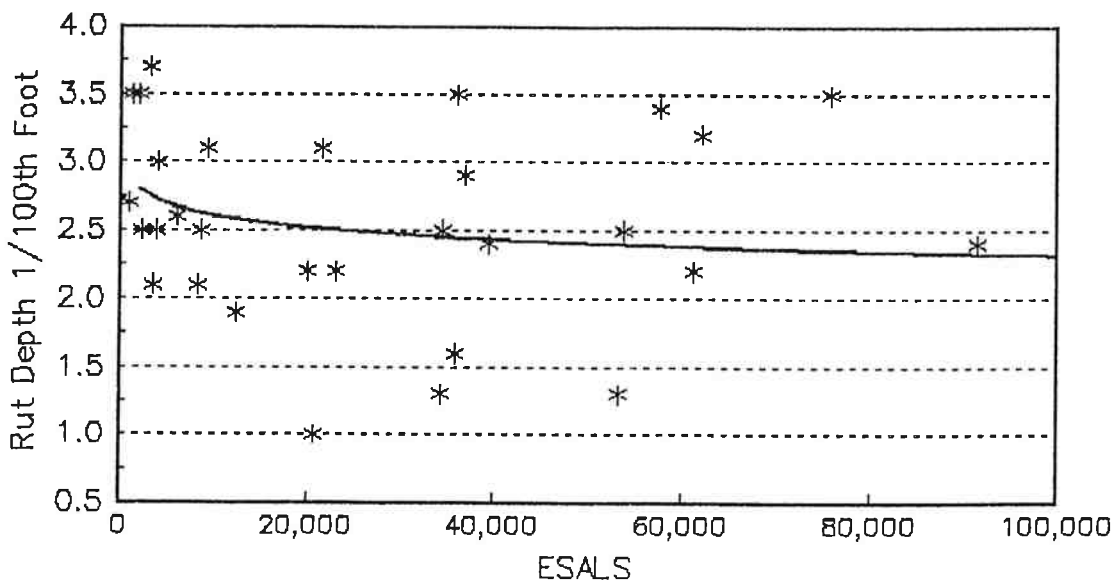


FIGURE 11
Average Rut Depth – Styrelf Chip Seals

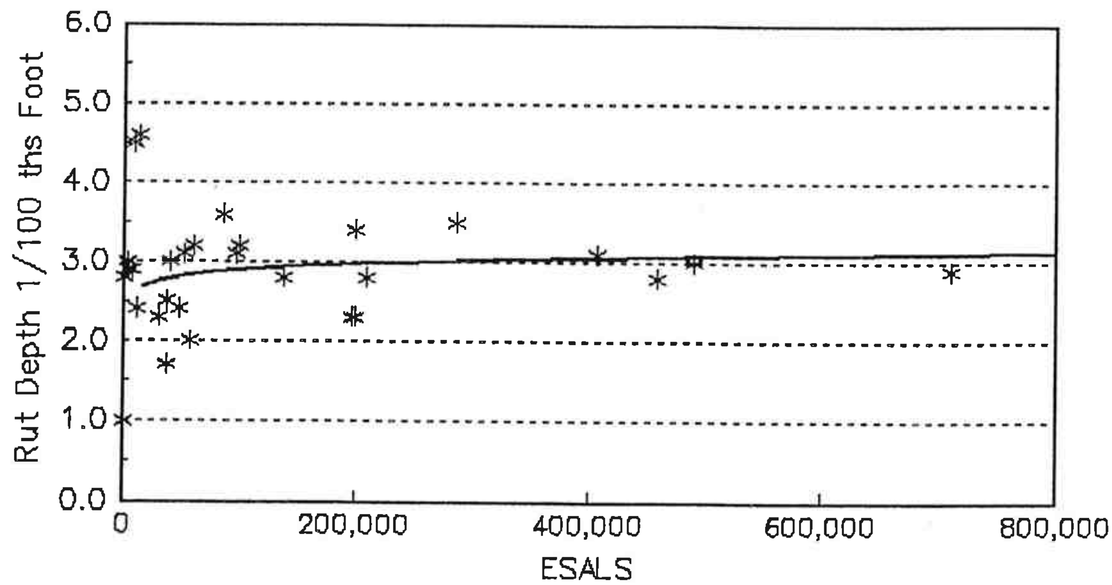


FIGURE 12
Average Rut Depth – Chip Seals

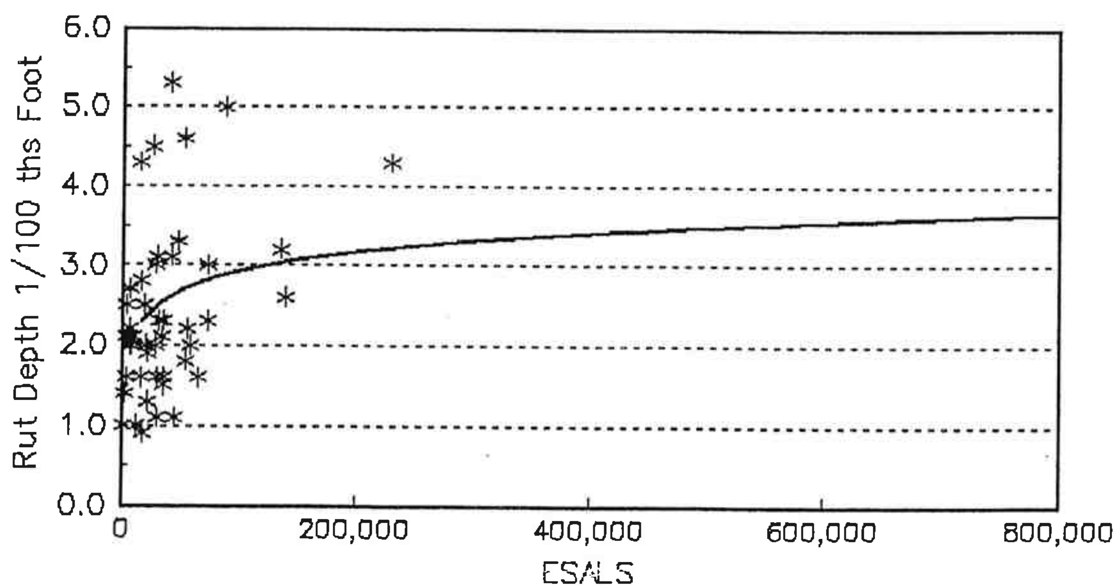


FIGURE 13
Chip Loss in Test Section – Styrelf Chip Seals

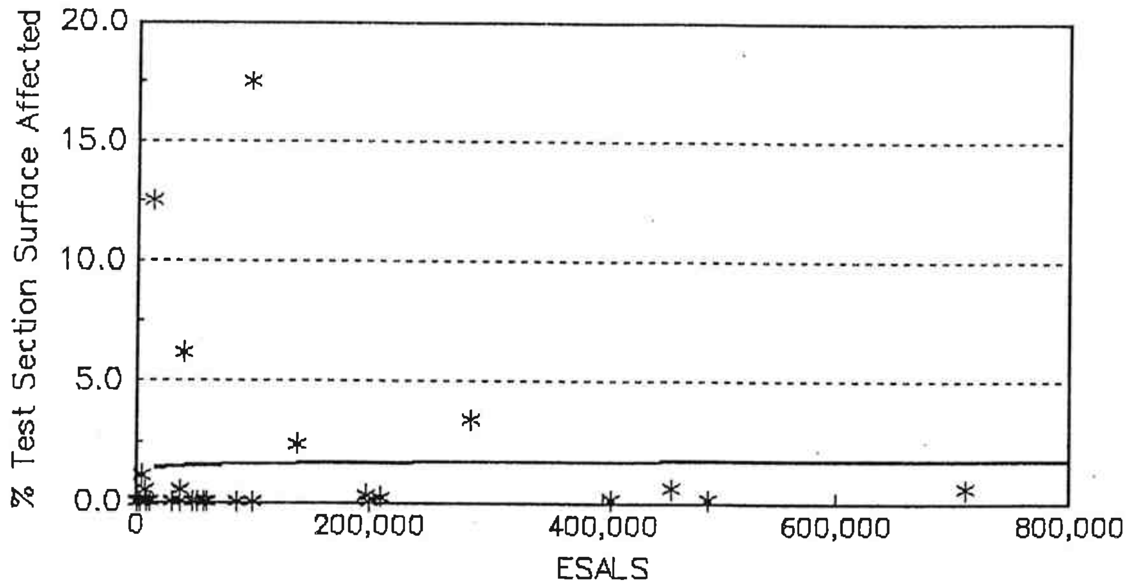
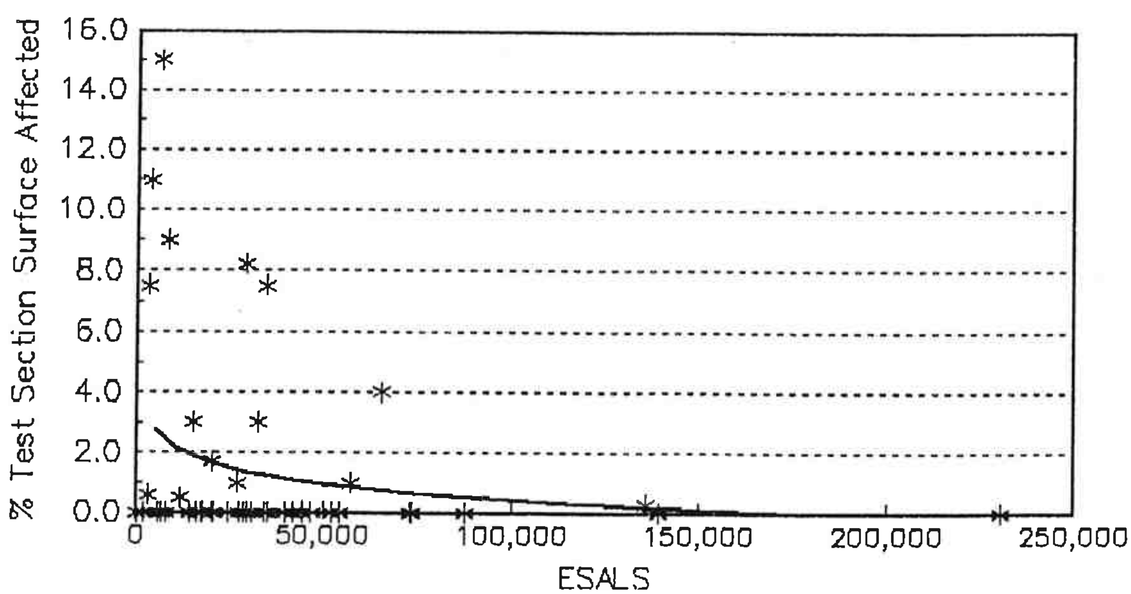


FIGURE 14
Chips Loss in Test Section – Chips Seals



6.0 DISCUSSION

6.1 FACTORS RELATED TO COST-EFFECTIVENESS

The following three major factors must be considered in any comparison of cost-effectiveness:

1. Traffic loading (annual)
2. Unit cost (including maintenance)
3. Treatment life

These factors are discussed below along with data representing these factors for each treatment type. An attempt was made, as presented in Appendix C, to calculate a Cost-Effectiveness index (CEI) for the purpose of comparing the various treatments directly with each other. This comparison was performed to determine if changes in distress over a two-year or a four-year period would show consistent trends in the cost-effectiveness.

Since there were no consistent trends or any major differences that were based on adequate data, this analysis is not considered valid for direct comparisons. The analysis is presented in Appendix C to allow the reader to pick out a few areas where comparisons are possible. Tables C15 and C16, for example, both agree that Styrelf chip seals are generally more cost effective than conventional chip seals in terms of chip loss. A different form of analysis confirms this when traffic loading and cost are factored into the evaluation of treatment life. This should still not be considered a conclusive evaluation, as the two types of chip seals were (for the most part) constructed in very different climatic zones.

6.1.1 TRAFFIC LOADING

Traffic loading is expressed as annual KILOSALs (Thousands of Equivalent Single Axle Loads), and is calculated from the traffic coefficient of design for each road. This is an estimate only. It would be possible to obtain this information more accurately by taking a truck count for every project and treatment, but this level of detail is not justified for this study.

Table 7 summarizes the calculations of the sample median and mean (average) for each treatment. When evaluating cost-effectiveness it is essential to include consideration of traffic loading. Possible approaches to include it were previously discussed. Complete data on traffic loading for each project in the study is presented in Appendix H.

Table 7 - Traffic Loading by Treatment Type			
		Annual KILOSALS	
Type of Treatment		Median	Mean
Asphalt, Dense	(ASPHALT,D)	80.300	146.950
Asphalt, Open	(ASPHALT,O)	70.100	70.850
Cold In-place Recycling	(RECYCLE)	49.300	39.360
Chip Seal	(CHIP SEAL)	19.000	24.600
Chip Seal with Polymer	(CHIP,POLY)	161.000	168.100
Oil Mat	(OILMAT)	19.000	16.930

From Table 7, the sample median is similar to the sample mean. The major exception is the dense asphalt, where a value of 555,200 ESALs for one site causes the high average. Use of the median is recommended.

6.1.2 UNIT COST

Table 8 describes the representative values for the initial cost of each treatment. An understanding of cost plays an essential role in this evaluation since a less expensive alternative is not always a more cost effective one. These values, however, represent only treatments in this particular study. They may not be representative of the costs for a specific application, as the cost of a treatment depends on a variety of site-specific factors. Therefore any evaluation of cost-effectiveness for a proposed project should be conducted using cost estimates specific to that site. Detailed data on the unit costs for each site in this study is presented in Appendix H.

Table 8 - Unit Cost of the Initial Investment $\$/yd^2$ by Treatment

Type of Treatment	Median Cost/yd^2	Mean Cost/yd^2
Asphalt, Dense	$ 2.76	$ 3.00
Asphalt, Open	$ 1.91	$ 1.99
Cold In-place Recycling	$ 1.38	$ 1.33
Chip Seal	$ 0.37	$ 0.39
Chip Seal with Polymer	$ 1.03	$ 1.06
Oil Mat	$ 0.98	$ 0.98

These figures represent the cost of the surfacing treatment only, as an effort was made to remove the cost of items in the contract that did not directly contribute to the construction of the surfacing treatment. In general the cost of additional surfacing, such as a chip seal over a CIR, is not included. The figures are expressed in actual dollars and discounted to 1984 dollars using the "social discount rate" recommended by Riggs and West (16).

The interest rate of analysis could vary widely depending upon particular conditions of the economy and changes in the opportunities of investment. The Riggs and West "social discount rate" is a modified low-risk-long-term government security. Although discount rates that include inflation premiums do not reflect real historical inflation rates (17), it can be used here due to an expected margin of error of the field observations within the range of +/-5%.

6.1.3 TREATMENT LIFE

A preliminary evaluation of the life of chip seals is now possible, as a majority of them have reached the end of their service life. The other treatments studied generally last longer and cannot yet be evaluated, except to say what percent have failed after 3, 4, 5, 6, and 7 years. Available data on the service life of now failed treatments are summarized below in Table 10.

Because just 10 out of the 16 CIR sites that actually failed (three others were reconstructed for other reasons), a final evaluation of treatment life may require several more years. The sites that have currently failed include: four asphalt concrete, fourteen chip seals with Styrelf, ten ordinary chip seals, four oil mats, and eleven CIR projects.

6.2 PROBLEMS AND SOURCES OF ERROR

Definitive conclusions about the relative cost-effectiveness of the treatments studied are not possible. The following problems indicate the difficulty of deriving definitive conclusions.

1. Comparisons can only be made between roughly similar types of treatments. Even with similar types of treatments comparisons should be made with caution. Oil mats and chip-seals are intended to treat mildly distressed pavements. They should not be compared to AC overlays and CIR, which are more costly and are capable of treating severely distressed pavements.

2. The usability of these results in any specific location may be limited because the local construction and materials costs may be different from the average costs reported here.

Table 9 - Summary of Years of Service

Treatment Type	Years of Service to Failure (as of Spring 1991)							Totals	
	1 All	2 All	3 All	4 All	5 All	6 84 & 85	7 1984		
	Number Failed / Number Possible Site Numbers of Failed Sites							Failed	Sites
Cold Mix								0	2
Asphaltic Concrete (DENSE GRADED)(ASPHALT,D)						1/20 84.16	1/11 84.06	2	20
Asphaltic Concrete (OPEN GRADED)(ASPHALT,O)				1/9 84.04		1/9 84.01		2	9
Cold In-place Recycling (RECYCLE)			5/16 85.24 85.25 86.05 +86.07 86.11	2/16 86.02 86.03	2/16 84.13 85.12 86.05		1/3 84.47	11	16
Chip Seal (CHIP SEAL)			4/15 84.24 84.25 85.05 85.23	4/15 84.05 84.14 84.26 85.18	2/15 84.02 +84.45			10	15
Chip Seal with Styrelf (CHIP, POLY)	2/15 85.01 85.16		4/15 84.40 84.41 84.42 85.22	2/15 84.35 84.43	2/15 84.39 85.03	4/15 85.09 85.20 85.33 85.36		14	15
Oil Mat (OILMAT)				3/10 84.09 84.28 84.29			1/4 84.48	4	10

\+ These sites are not included in totals because they were eliminated from the study before they came to the end of their useful life.
\+ Evaluation of these sites ended before "failure" of the treatment.
** See Table 4 in section 4.0 for meaning of codes.

W = WEST OF CASCADES   CO = COASTAL
E = EAST OF CASCADES   CA = IN CASCADE MOUNTAINS

Table 10 - Site Conditions at Failed Sites

Site #	Test Hwy #	Test MP	Type of Treatment	Criteria For Use**	Criteria Against Use**	Years of Service	Elev.	Geo. Loc.	Grade Max %	Prcp. In./Yr.	Air Temp. Const.	Min. Evap.	ESALS During Life	Mean ESALS	Built By
84.02	5	24.45	CHIP SEAL	2, 3		5	1,880	E	4	13	74	39	52,290		STATE
84.05	7	120.10	CHIP SEAL	2	6	4	4,200	E	5	12	75	29	190,280		BEND AGG.
84.14	19	26.84	CHIP SEAL	3, 2	6	4	4,450	E	4	17	76	19	53,625		STATE
84.24	48	3.14	CHIP SEAL	3, 2	6	3	3,700	E	1	25	80	20	41,960		BEND AGG.
84.25	48	6.95	CHIP SEAL	3, 2	6	3	3,700	E	2	25	80	20	54,600		BEND AGG.
84.26	48	50.95	CHIP SEAL	3, 2		4	4,700	E	3	30	74	18	73,216		BEND AGG.
84.45+	290	8.60	CHIP SEAL	3, 2	6	5	1,400	E	5	12	75	35	10,086		STATE
85.05	7	163.83	CHIP SEAL	3, 2		3	4,600	E	5	10	74	14	114,730		ORE. ASPH.
85.18	28	101.75	CHIP SEAL	3, 2	6	4	4,500	E	5	19	75	44	123,660		ORE. ASPH.
85.23	48	55.34	CHIP SEAL	3, 2	6	3	4,700	E	5	30	75	25	53,924		ORE. ASPH.
														84,254	
84.35*	130	0.20	CHIP,POLY	3, 2	6	4	13	CO	0	80	68	28	16,056		STATE
84.39*	160	4.41	CHIP,POLY	3, 2, 7	11, 13, 14, 6	5	800	W	5	76	43	15	243,270		STATE
84.40	210	12.88	CHIP,POLY	3, 2	11, 6	3	260	W	1	42	71	20	518,518		STATE
84.41	210	13.12	CHIP,POLY	3, 2	11, 6	3	260	W	1	42	71	20	518,518		STATE
84.42	210	13.32	CHIP,POLY	3, 2	11, 6	3	260	W	1	42	71	20	518,037		STATE
84.43	215	10.30	CHIP,POLY	3, 2	11, 6	4	2,115	CA	2	80	70	22	134,984		STATE
85.01*	2	12.01	CHIP,POLY	3	11, 13	1	200	W	1	45	78	9	550,800		L & T INC
85.03	4	86.25	CHIP,POLY	1, 2, 3, 9	12, 5	5	2,000	E	4	10	75	33	1,179,423		COMPTON
85.09	4	196.43	CHIP,POLY	1, 2, 3, 6	5, 19, 12	7	115	CO	0	79	65-75	N/A	926,541		COMPTON
85.16*	26	47.50	CHIP,POLY	3, 2	11, 6	1	2,500	CA	6	85	68	28	56,166		L & T INC
85.20	35	65.17	CHIP,POLY	1, 2, 3,19	5, 11	6	600	W	2	31	85-95	40	1,295,540		COMPTON
85.22	47	40.11	CHIP,POLY	3, 2	11	3	450	W	6	50	70	15	150,024		FABRICATORS
85.33	103	4.29	CHIP,POLY	1, 2, 3,19	5, 11	6	200	CO	2	60	45-80	N/A	26,910		FABRICATORS
85.36	231	9.51	CHIP,POLY	1, 2, 3,19	5, 11, 4	6	540	W	5	55	65-90	35	630,828		COMPTON
														483,258	

* Criteria against use intentionally ignored to test polymer.
\+ Evaluation of these sites ended before "failure" of the treatment.
** See Table 4 in section 4.0 for meaning of codes.

W = WEST OF CASCADES CO = COASTAL
E = EAST OF CASCADES CA = IN CASCADE MOUNTAINS

Table 10 Continued - Site Conditions at Failed Sites

Site #	Test Hwy # & MP		Type of Treatment	Criteria		Years of Service	Elev.	Geo. Loc.	Grade Max %	Prcp. In./Yr.	Air Temp. Const.	Min. Evap.	ESALS During Life	Mean ESALS	Built By
				FOR USE**	AGAINST USE**										
84.01	4	283.79	ASPHALT,O	2, 1	5	6	4,100	E	1	15	67	18	1,041,378		ROGUE RIVER
84.04	7	1.00	ASPHALT,O	6, 11		4	3,642	E	1	17	68	17	266,304		MID OREGON
														653,841	
84.06	9	331.20	ASPHALT,D	2	5, 20	6	400	CO	5	79	55-75	N/A	473,070		TIDEWATER
84.16	25	Y0.85	ASPHALT,D	2, 18, 19	5	6	960	W	1	32	67	65	1,064,988		COPELAND
														769,029	
84.13	19	17.00	RECYCLE	3, 15	10, 19	5	3,700	E	3	18	76	26	66,456		STATE
84.47	372	17.49	RECYCLE	2, 6, 9, 13, 19	5, 18	7	5,200	E	6	45	40-80	25	14,670		STATE
85.12	15	108.34	RECYCLE	1, 2, 3, 9	5,16	5	3,000	E	2	11	66	10	1,041,375		VALENTINE
85.24	49	35.24	RECYCLE	3, 5, 15	19	4	4,400	E	5	14	79	41	12,660		VALENTINE
85.25	49	48.74	RECYCLE	3, 5, 15	19	4	4,400	E	5	14	79	41	12,660		VALENTINE
86.02	20	23.10	RECYCLE	1, 2, 3	5, 15	4	4,200	E	1	14	70	24	222,312		VALENTINE
86.03	20	41.03	RECYCLE	1, 2, 3	5, 15	4	4,300	E	0	14	70	40	214,572		VALENTINE
86.05	371	11.00	RECYCLE	1, 2, 3	5, 11, 19	5	3,060	E	0	12	65-85	31	36,078		VALENTINE
86.06	41	12.10	RECYCLE	3, 15	10, 5, 19	3	3,000	E	3	17	77	29	206,336		VALENTINE
86.07+	41	28.50	RECYCLE	3, 15	19	3	3,150	E	3	23	75	34	170,000		VALENTINE
86.11	7	243.00	RECYCLE	5, 15	5, 19	5	2,200	E	0	10	80	41	123,120		VALENTINE
														195,024	
84.09	12	21.75	OIL MAT	4, 10		4	2,650	E	5	15	80	22	74,204		L & T INC
84.28	71	29.07	OIL MAT	4, 10		4	4.200	E	2	30	75	15	81,606		L & T INC
84.29	71	41.05	OIL MAT	4, 10		4	3,800	E	5	30	75	15	87,234		L & T INC
84.48	415	35.83	OIL MAT	2, 5	11, 13	7	5,392	E	6	20	47-84	24	14,712		L & T INC
														64,439	

* Criteria against use intentionally ignored to test polymer.
\+ Evaluation of these sites ended before "failure" of the treatment.
** See Table 4 in section 4.0 for meaning of codes.

W = WEST OF CASCADES CO = COASTAL
E = EAST OF CASCADES CA = IN CASCADE MOUNTAINS

3. As indicated by the narrative discussions of failed sites, at least one chip seal project failed early due to poor weather conditions immediately after construction. Any given chip seal job might perform better than the average if good weather was available. Construction practices can also have a major effect on chip-seal durability.

4. The lack of immediate post-construction data limits the ability to evaluate CEI for individual distress types on 1984 projects.

5. The CEI and CCEI indices cannot be used without bias after a significant number of sites are dropped from the study. Doing so would make treatments that have many early failures look better than they should after drop-outs occur.

6. The study attempts to compare the different treatments without the benefit of control sections. Because of this, it is difficult to know how the differences in climate and original pavement conditions might be affecting the results.

7. At least 4 different people have performed the condition surveys over the life of the study. Difference in their subjective evaluations may affect the results.

8. It is not possible to precisely define the time of failure. Because inspections are done only every year, the accuracy of the time to failure may be plus or minus one year.

9. Maintenance cost data should be included in the cost of the treatment, but the available data is very limited.

10. In some cases, the results may be biased because some winters are more severe than others. One severe winter could, for example, cause failure of both a 3-year-old pavement and a 5-year-old pavement that otherwise would have lasted the same amount of time.

11. In some cases, a treatment will not appear to last as long as it should because the site had to be closed due to roadway widening or other factors not related to surface treatment longevity.

This interpretation should be made with caution, however, as the two materials were subjected to very different environments and traffic loadings. As discussed in Chapter 2.1, and shown in Table 3, nearly all of the Styrelf chip seals were west of the Cascades, while the majority of the conventional chip seals were east of the Cascades. As the climate east of the Cascades has greater temperature extremes, this could, in part, account for the reduced life of the ordinary chip seals. The severity of this climatic effect, however, cannot be estimated at this time.

In both cases, the median age (Table 9) and the average age (Table 10) is slightly less than 4 years. A Longevity Cost Index (LCI), as presented in Section 2.3.1., has been calculated for these two materials:

Table 11 - Comparison of Chip Seals		
Factor	**Polymer Chip Seals**	**Ordinary Chip Seals**
MEDIAN AGE	4	4
AVERAGE AGE	4	4
MEDIAL TOTAL ESALs	518,000	54,600
AVERAGE TOTAL ESALs	483,258	84,254
MEDIAN PRICE	$ 1.03	$ 0.37
AVERAGE PRICE	$ 1.06	$ 0.39
LCI (**median** ESAL & Price)	1.99	6.78
LCI (**average** ESAL & Price)	2.19	4.62

Although the two treatments are approximately equal in life span, the much greater traffic loading of the polymer material more than balances out the increased cost. While the differences in the LCI appear to be great, they are of questionable statistical significance.

Two of the polymer sites failed after less than 1 year. These were both experiments to test Styrelf under adverse circumstances. One of them (85.01) had unusually high traffic volumes for a chip seal, and the other (85.16) had adverse weather during construction.

7.0 RECOMMENDATIONS AND CONCLUSIONS

7.1 RECOMMENDATIONS

Specific recommendations concerning the relative cost-effectiveness of the treatments studied are not possible with the data from this study. Recommendations will be limited to suggesting future direction for similar future studies.

1. Future analyses should also use longevity data to confirm or refine selection criteria in Tables 4 and 5.

2. If, in the future, it is desired to more realistically determine the relative cost-effectiveness of various treatments within various climatic zones, then it is recommended that any new study be designed to eliminate as many variables as possible. The SHRP Specific Pavement Studies (SPS) #3 and #4 included extensive evaluation of the existing conditions, multiple treatments at individual sites, and intensive monitoring of treatment life.

7.2 CONCLUSIONS

7.2.1 CHIP SEALS

Polymer Modified Chip Seals - Polymer-modified (In this case, Styrelf) chip seals appear to be generally more cost effective than conventional chip seals when traffic loading and cost are factored into the evaluation of treatment life. The longevity cost indices shown below confirms this.

Chip Seals and Rutting - Chip seals, as used in Oregon, do not correct rutting. Rather, the opposite is true; there is a tendency for ruts to be slightly deeper after applying a chip seal. This is presumed to be due to the effect of early chip loss in the wheel tracks.

Chip Seals and Stripping - While not directly observed in the test sections for this project, it has been reported by SHRP and others that chip seals may aggravate asphalt stripping in pavements with moisture sensitive aggregates. While originally this phenomenon was thought to be primarily associated with polymer modified chip seals, recent cases involving conventional chip seals have been reported.

7.2.2 THIN AC OVERLAYS

Thin, dense-graded, AC overlays may be more cost effective on a life-cycle basis (LCI), particularly in heavy traffic areas. Only 2 of the original 20 sites have failed in service and have accumulated a large amount of axle loads. It can be expected that these overlays will continue to accumulate axle loads, which would improve their LCI.

These treatments were generally used where there was significant pavement distress. They may also be effective in areas with lower levels of distress, due to extended life and accumulated ESALs.

The higher initial capital investment may be a deterrent factor in selecting this type of treatment.

7.2.3 GENERAL CONCLUSIONS

As suggested by the early failure of two of the Styrelf chip seals (85.01 and 85.16), construction practices and weather conditions at laydown can significantly affect the life of a thin surface treatment. The life of any of the treatments studied may be made to last more (or less) time than shown in this study.

Since weather conditions significantly affect the construction of chip seals, projects at the coast (or other areas subject to fog and high humidity) may incur extra costs. Construction should wait for adequately stable weather.

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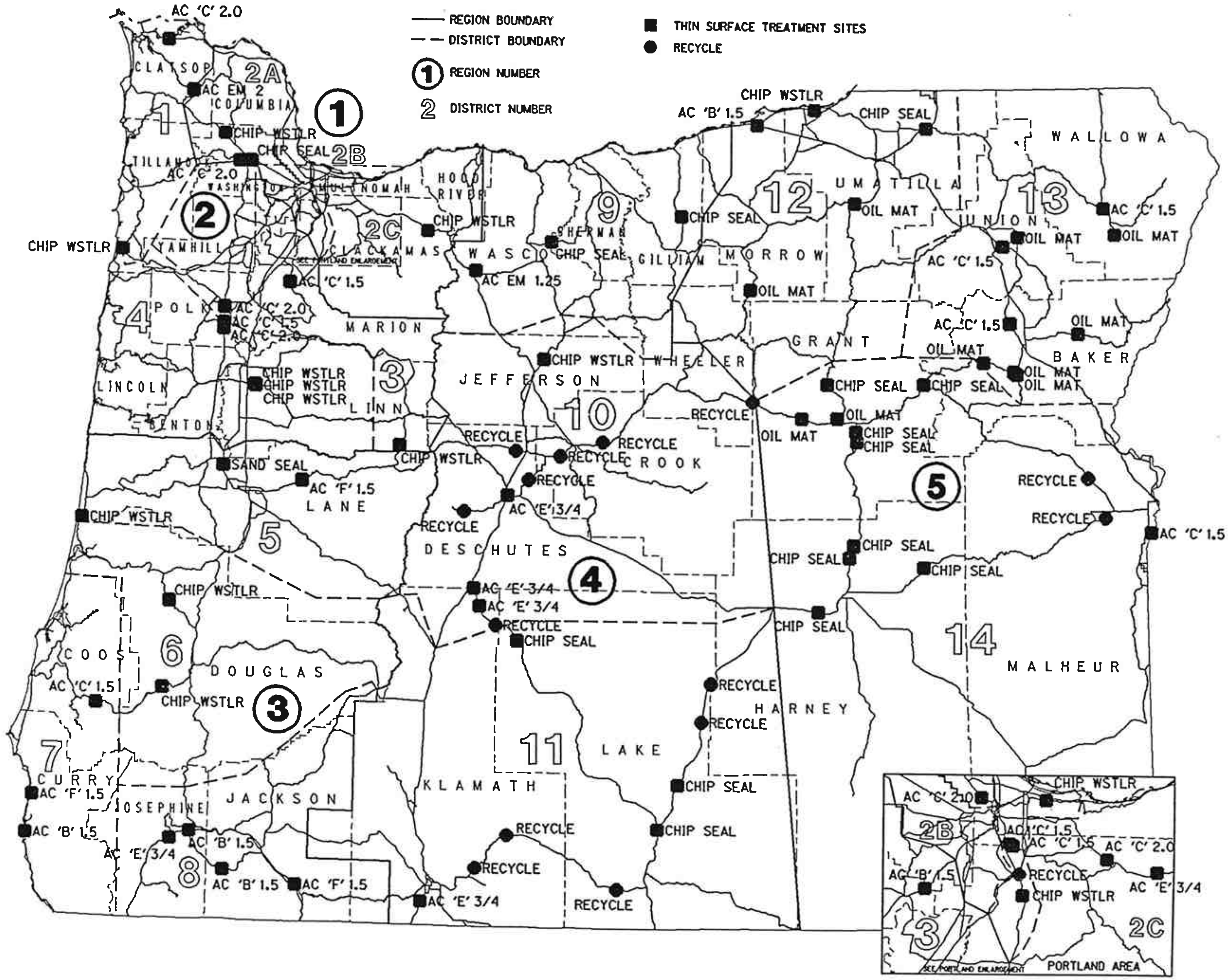
Appendix A

Location of Projects Studied

THIN SURFACE TREATMENTS



Appendix B

Pavement Survey Form - Example

PAVEMENT SURVEY

JOB # 84.03 TREATMENT Oil mat

JOB TITLE no name WESTBOUND

HWY # 5 ROUTE # US 26 MP'S OF TREATMENT 138.2 & 143.9

MP OF 250' SECTION 142.95 LOCATION 10 mi W of Mt. Vernon

DATE OF SURVEY 6/28/88 WEATHER mostly sunny TEMPERATURE 65°F

DISTRESS SUMMARY	0-50	50-100	100-150	150-200	200-250
TRANS. CRACKING #	4	3	4	5	3
0-1/8"	4	3	3	4	3
1/8-1/4"	00	00	1	00	00
1/4"+	00	00	00	00	00
LONGI. CRACKING #	00	00	00	00	00
0-1/8"	00	00	00	00	00
1/8-1/4"	00	00	00	00	00
1/4"+	00	00	00	00	00
ALLIGATORING %	00	00	00	00	00
RAVELLING %	00	00	00	00	00
POTHOLES %	00	00	00	00	00
PATCHED	YES	YES	YES	YES	YES
RUT DEPTH 0.01 FT	3	3	4	4	2.5
LOSS OF CHIPS %	00	00	00	00	00

Appendix C

Analysis of Cost-Effectiveness

Introduction

The data from the 87 experimental sites (Appendices A and E) is evaluated in two different ways in order to accomplish the methodology explained in Chapter 3: a two-year analysis, and a four-year analysis. It is intended to use the field observations, described in this paper.

All the experimental sections constructed in 1984 have one problem in common: none of them have data for the specific distress types immediately after construction. Instead, for 1984 projects, the first data available immediately after construction was that obtained in the following spring. On nearly all of the 1985 and 1986 jobs, after construction data was obtained during the same spring or summer of construction. The following site numbers are the exceptions to this: 85.03, 86.38 (also called 85.38) and 86.03.

For this reason, using the 1984 data would not allow equal evaluation of all sections, as changes do not proceed at the same rate throughout the pavement's life-cycle. The use of 1984 data would therefore tend to bias the results toward showing less difference between the before and after construction conditions. Also, there may be some tendency to show less change in distress during the first two years. Consequently, the data was analyzed in two different ways:

- Including all sites; those both during and after 1984

- Including only those sites established during and after 1985

Analysis of data using the 1984 sites is only included here to provide information on how this problem affects the results.

For this analysis, the median is used as the measure of central tendency. This was done because, in many cases, the mean was affected too strongly by one or two values that were not typical of the particular treatment[3]. Continuous variables (pavement surface distresses and condition rating) are analyzed by constructing a frequency distribution for each individual case and selecting the middle point of the interval that has a cumulative relative frequency equal to or higher than 50%. Discrete variables (traffic loading and unit prices) are represented by the center value of all the data classified in an ascending order (15).

Negative Change Value

For some types of treatments, negative values for their change in specific distresses or condition rating during their life cycle were common. In addition, the calculated four-year

[3]In Chapter 5 the discussions about "Trends in Distress Development" utilizes the mean rather than the median. Although using the median may have been preferred, this analysis was done earlier using mean.

change (the measured cumulative change in the distress condition after four years of service) appears lower than the two-year change (the measured cumulative change in the distress after two years of service) in some treatments. These apparent contradictions may be due to one or more of these four possible reasons:

- The distress was rated under a different category in two different years. (i.e. It was called longitudinal and transverse cracking one year, then alligator cracking the next year.)

- Different people were doing the field work and rated distresses differently.

- The number of jobs evaluated changed because of previous failures of more distressed sites so the median or the average is calculated with different sample sizes in different years.

- Possible displacements among the pavement layers and the existence of reflective cracking.

On the other hand, when an interval with negative values is selected because of an overwhelming number of zeros, a zero value is assigned because it reflects the real unchanged condition of that specific distress for the majority of the sites being analyzed. This is possibly due to the methodology used to construct the accumulated frequency distribution; that is, each interval excludes the left extreme value and includes the intermediate values and the right extreme (a zero number is then included in a negative interval). This rule guarantees that the middle point of the distribution (median) is included in the interval which has an equal or higher accumulated relative frequency of 50%.

Tables C1 through C25 below present summaries of the CEI values for each treatment. The median values for each distress type and for traffic loading and unit price used to compute CEI are also listed.

Table C1
CHANGES IN THE EQUIVALENT CRACKING FOR ASPHALT CONCRETES AND RECYCLING
(MEDIAN VALUES-FROM 1984)

Part a
Sites Constructed from 1984 - Two-Year Change

	EQUIV. CRACK	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Asphalt Concr. Dense	0	80.3	2.73	0	*
Asphalt Concr. Open	0	70.1	1.91	0	*
Recycling	0.45	49.3	1.38	1.25	2

Part b
Sites Constructed from 1984 - Four-Year Change

	EQUIV. CRACK	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Asphalt Concr. Dense	0	80.3	2.73	0	*
Asphalt Concr. Open	0	70.1	1.91	0	*
Recycling	NO DATA	49.3	1.38	NO	NO

* Not enough data to allow a comparison.

Table C2
CHANGES IN THE EQUIVALENT CRACKING FOR ASPHALT CONCRETES AND RECYCLING
(MEDIAN VALUES-FROM 1985)

Part a
Sites Constructed from 1985 - Two-Year Change

	EQUIV. CRACK	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Asphalt Concr. Dense	0	80.3	2.73	0	*
Asphalt Concr. Open	0	70.1	1.91	0	*
Recycling	0	49.3	1.38	0	*

Part b
Sites Constructed from 1985 - Four-Year Change

	EQUIV. CRACK	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Asphalt Concr. Dense	0.55	80.3	2.73	1.87	2
Asphalt Concr. Open	0	70.1	1.91	0	1
Recycling	2.55	49.3	1.38	7.14	3

Table C3
CHANGES IN THE EQUIVALENT CRACKING FOR CHIP SEALS AND OIL MATS
(MEDIAN VALUES-FROM 1984)

Part a
Sites Constructed from 1984 - Two-Year Change

	EQUIV. CRACK	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Chip Seal with Styrelf	1.75	161	1.03	1.1	2
Chip Seal	0	19	0.37	0	1
Oil Mat	0.25	19	0.98	1.29	3

Part b
Sites Constructed from 1984 - Four-Year Change

	EQUIV. CRACK	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Chip Seal with Styrelf	-3.75	161	1.03	neg.	*
Chip Seal	0.75	19	0.37	1.46	2
Oil Mat	0.25	19	0.98	1.29	1

* Not enough data to allow a comparison.

Table C4
CHANGES IN THE EQUIVALENT CRACKING FOR CHIP SEALS AND OIL MATS
(MEDIAN VALUES-FROM 1985)

Part a
Sites Constructed from 1985 - Two-Year Change

	EQUIV. CRACK	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Chip Seal with Styrelf	0.25	161	1.03	1.6	3
Chip Seal	0.75	19	0.37	1.46	2
Oil Mat	0/-0.15	19	0.98	0/neg.	1

Part b
Sites Constructed from 1985 - Four-Year Change

	EQUIV. CRACK	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Chip Seal with Styrelf	0.25	161	1.03	1.6	2/1
Chip Seal	1.25	19	0.37	2.43	3/2
Oil Mat	0/0.49	19	0.98	0/2.5	1/3

Weathering and Raveling

The subsequent Tables C5 to C8 describe the findings related to the change in the weathering and raveling for all the thin surface treatments.

The rankings, again, follow the same methodology explained in Chapter 2, it will remain unchanged all through this evaluation.

Table C5
CHANGES IN THE WEATHERING/RAVELING FOR ASPHALT CONCRETES AND RECYCLING
(MEDIAN VALUES-FROM 1984)

Part a
Sites Constructed from 1984 - Two-Year Change

	WEATH/ RAV.	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Asphalt Concr. Dense	2.5	80.3	2.73	8.5	2
Asphalt Concr. Open	22.5	70.1	1.91	61	3
Recycling	0	49.3	1.38	0	1

Part b
Sites Constructed from 1984 - Four-Year Change

	WEATH/ RAV.	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Asphalt Concr. Dense	27.5	80.3	2.73	93	1*
Asphalt Concr. Open	57.5	70.1	1.91	157	2*
Recycling	NO DATA	49.3	1.38	NO	NO

* Not enough data to allow a comparison.

Table C6
CHANGES IN THE WEATHERING/RAVELING FOR ASPHALT CONCRETES AND RECYCLING
(MEDIAN VALUES-FROM 1985)

Part a
Sites Constructed from 1985 - Two-Year Change

	WEATH/ RAV.	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Asphalt Concr. Dense	0	80.3	2.73	0	*
Asphalt Concr. Open	0	70.1	1.91	0	*
Recycling	0	49.3	1.38	0	*

Part b
Sites Constructed from 1985 - Four-Year Change

	WEATH/ RAV.	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Asphalt Concr. Dense	27.5	80.3	2.73	93.5	2
Asphalt Concr. Open	52.5	70.1	1.91	143	3
Recycling	0	49.3	1.38	0	1

Table C7
CHANGES IN THE WEATHERING/RAVELING FOR CHIP SEALS AND OIL MATS
(MEDIAN VALUES-FROM 1984)

Part a
Sites Constructed from 1984 - Two-Year Change

	WEATH/ RAV.	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Chip Seal with Styrelf	0	161	1.03	0	*
Chip Seal	0	19	0.37	0	*
Oil Mat	2.5	19	0.98	12.9	2

Part b
Sites Constructed from 1984 - Four-Year Change

	WEATH/ RAV.	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Chip Seal with Styrelf	0	161	1.03	0	*
Chip Seal	0	19	0.37	0	*
Oil Mat	7.5	19	0.98	38.7	2

* Not enough data to allow a comparison.

Table C8
CHANGES IN THE WEATHERING/RAVELING FOR CHIP SEALS AND OIL MATS
(MEDIAN VALUES-FROM 1985)

Part a
Sites Constructed from 1985 - Two-Year Change

	WEATH/ RAV.	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Chip Seal with Styrelf	0	161	1.03	0	*
Chip Seal	0	19	0.37	0	*
Oil Mat	0/25.2	19	0.98	0/130	*

Part b
Sites Constructed from 1985 - Four-Year Change

	WEATH/ RAV.	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Chip Seal with Styrelf	0	161	1.03	0	*
Chip Seal	0	19	0.37	0	*
Oil Mat	2/11	19	0.98	10/57	2

* Not enough data to allow a comparison.

<u>Pot Holes</u>

The changes in this distress and the ranking for each treatment are shown in Tables C9 to C12 (next pages).

Table C9

CHANGES IN THE POT HOLES FOR ASPHALT CONCRETES AND RECYCLING
(MEDIAN VALUES-FROM 1984)

Part a
Sites Constructed from 1984 - Two-Year Change

	POT HOLES	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Asphalt Concr. Dense	0	80.3	2.73	0	*
Asphalt Concr. Open	0	70.1	1.91	0	*
Recycling	0	49.3	1.38	0	*

Part b
Sites Constructed from 1984 - Four-Year Change

	POT HOLES	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Asphalt Concr. Dense	0	80.3	2.73	0	*
Asphalt Concr. Open	0	70.1	1.91	0	*
Recycling	NO DATA	49.3	1.38	NO	NO

* Not enough data to allow a comparison.

Table C10

CHANGES IN THE POT HOLES FOR ASPHALT CONCRETES AND RECYCLING
(MEDIAN VALUES-FROM 1985)

Part a
Sites Constructed from 1985 - Two-Year Change

	POT HOLES	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Asphalt Concr. Dense	0	80.3	2.73	0	*
Asphalt Concr. Open	0	70.1	1.91	0	*
Recycling	0	49.3	1.38	0	*

Part b
Sites Constructed from 1985 - Four-Year Change

	POT HOLES	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Asphalt Concr. Dense	0	80.3	2.73	0	*
Asphalt Concr. Open	0	70.1	1.91	0	*
Recycling	0	49.3	1.38	0	*

* Not enough data to allow a comparison.

Table C11
CHANGES IN THE POT HOLES FOR CHIP SEALS AND OIL MATS
(MEDIAN VALUES-FROM 1984)

Part a
Sites Constructed from 1984 - Two-Year Change

	POT HOLES	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Chip Seal with Styrelf	0	161	1.03	0	*
Chip Seal	0	19	0.37	0	*
Oil Mat	0	19	0.98	0	*

Part b
Sites Constructed from 1984 - Four-Year Change

	POT HOLES	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Chip Seal with Styrelf	0	161	1.03	0	*
Chip Seal	0	19	0.37	0	*
Oil Mat	0	19	0.98	0	*

* Not enough data to allow a comparison.

Table C12
CHANGES IN THE POT HOLES FOR CHIP SEALS AND OIL MATS
(MEDIAN VALUES-FROM 1985)

Part a
Sites Constructed from 1985 - Two-Year Change

	POT HOLES	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Chip Seal with Styrelf	0	161	1.03	0	*
Chip Seal	0	19	0.37	0	*
Oil Mat	0	19	0.98	0	*

Part b
Sites Constructed from 1985 - Four-Year Change

	POT HOLES	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Chip Seal with Styrelf	0	161	1.03	0	*
Chip Seal	0	19	0.37	0	*
Oil Mat	0	19	0.98	0	*

* Not enough data to allow a comparison.

<u>Chip Loss</u>

Tables C13 to C16 analyze the change in the chip loss for all the treatments of interest. This particular distress is especially important for the evaluation of chip seals and the ones that used the Styrelf emulsion.

Table C13
CHANGES IN THE CHIP LOSS FOR ASPHALT CONCRETES AND RECYCLING
(MEDIAN VALUES-FROM 1984)

Part a
Sites Constructed from 1984 - Two-Year Change

	CHIP LOSS	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Asphalt Concr. Dense	0	80.3	2.73	0	*
Asphalt Concr. Open	0	70.1	1.91	0	*
Recycling	0	49.3	1.38	0	*

Part b
Sites Constructed from 1984 - Four-Year Change

	CHIP LOSS	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Asphalt Concr. Dense	0	80.3	2.73	0	*
Asphalt Concr. Open	0	70.1	1.91	0	*
Recycling	NO DATA	49.3	1.38	NO	NO

* Not enough data to allow a comparison.

Table C14
CHANGES IN THE CHIP LOSS FOR ASPHALT CONCRETES AND RECYCLING
(MEDIAN VALUES-FROM 1985)

Part a
Sites Constructed from 1985 - Two-Year Change

	CHIP LOSS	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Asphalt Concr. Dense	0	80.3	2.73	0	*
Asphalt Concr. Open	0	70.1	1.91	0	*
Recycling	1.5	49.3	1.38	4.2	2

Part b
Sites Constructed from 1985 - Four-Year Change

	CHIP LOSS	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Asphalt Concr. Dense	0	80.3	2.73	0	*
Asphalt Concr. Open	0	70.1	1.91	0	*
Recycling	1.5	49.3	1.38	4.2	2

* Not enough data to allow a comparison.

Table C15
CHANGES IN THE CHIP LOSS FOR CHIP SEALS AND OIL MATS
(MEDIAN VALUES-FROM 1984)

Part a
Sites Constructed from 1984 - Two-Year Change

	CHIP LOSS	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Chip Seal with Styrelf	0.5	161	1.03	0.3	2
Chip Seal	0	19	0.37	0	*
Oil Mat	0	19	0.98	0	*

Part b
Sites Constructed from 1984 - Four-Year Change

	CHIP LOSS	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Chip Seal with Styrelf	0.5	161	1.03	0.3	2*
Chip Seal	2.5	19	0.37	4.8	3
Oil Mat	0	19	0.98	0	1

* Not enough data to allow a comparison.

Table C16
CHANGES IN THE CHIP LOSS FOR CHIP SEALS AND OIL MATS
(MEDIAN VALUES-FROM 1985)

Part a
Sites Constructed from 1985 - Two-Year Change

	CHIP LOSS	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Chip Seal with Styrelf	0.5	161	1.03	0.32	2
Chip Seal	3.5	19	0.37	6.8	3
Oil Mat	0	19	0.98	0	1

Part b
Sites Constructed from 1985 - Four-Year Change

	CHIP LOSS	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Chip Seal with Styrelf	0	161	1.03	0	*
Chip Seal	8.5	19	0.37	16.6	2
Oil Mat	0	19	0.98	0	*

* Not enough data to allow a comparison.

Average Rutting

The "average rutting" is derived from "rutting" as measured in the wheel paths and averaged over the length of the 250-foot test section for each treatment. It is measured to the nearest 1/100 feet. The representative values of the field measurements and the corresponding ranking for each treatment are described in Tables C17 to C18 (refer to next pages).

Table C17
CHANGES IN THE AVERAGE RUTTING FOR ASPHALT CONCRETES AND RECYCLING
(MEDIAN VALUES-FROM 1984)

Part a
Sites Constructed from 1984 - Two-Year Change

	AVERAGE RUTTING	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Asphalt Concr. Dense	0.45	80.3	2.73	1.53	2
Asphalt Concr. Open	0.35	70.1	1.91	0.95	1
Recycling	0.55	49.3	1.38	1.54	3

Part b
Sites Constructed from 1984 - Four-Year Change

	AVERAGE RUTTING	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Asphalt Concr. Dense	1.05	80.3	2.73	3.75	2
Asphalt Concr. Open	0.75	70.1	1.91	2	1
Recycling	NO DATA	49.3	1.38	NO	NO

Table C18
CHANGES IN THE AVERAGE RUTTING FOR ASPHALT CONCRETES AND RECYCLING
(MEDIAN VALUES-FROM 1985)

Part a
Sites Constructed from 1985 - Two-Year Change

	AVERAGE RUTTING	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Asphalt Concr. Dense	0.65	80.3	2.73	2.21	3
Asphalt Concr. Open	0.45	70.1	1.91	1.23	1
Recycling	0.75	49.3	1.38	2.1	2

Part b
Sites Constructed from 1985 - Four-Year Change

	AVERAGE RUTTING	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Asphalt Concr. Dense	1.05	80.3	2.73	3.57	3
Asphalt Concr. Open	0.55	70.1	1.91	1.5	2
Recycling	0.35	49.3	1.38	0.98	1

Table C19
CHANGES IN THE AVERAGE RUTTING FOR CHIP SEALS AND OIL MATS
(MEDIAN VALUES-FROM 1984)

Part a
Sites Constructed from 1984 - Two-Year Change

	AVERAGE RUTTING	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Chip Seal with Styrelf	0.65	161	1.03	0.42	1
Chip Seal	0.25	19	0.37	0.49	2
Oil Mat	0.25	19	0.98	1.29	3

Part b
Sites Constructed from 1984 - Four-Year Change

	AVERAGE RUTTING	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Chip Seal with Styrelf	1.45	161	1.03	0.93	1
Chip Seal	0.75	19	0.37	1.47	2
Oil Mat	0.65	19	0.98	3.35	3

Table C20
CHANGES IN THE AVERAGE RUTTING FOR CHIP SEALS AND OIL MATS
(MEDIAN VALUES-FROM 1985)

Part a
Sites Constructed from 1985 - Two-Year Change

	AVERAGE RUTTING	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Chip Seal with Styrelf	1.05	161	1.03	0.67	2
Chip Seal	0	19	0.37	0	*
Oil Mat	0	19	0.98	0	*

Part b
Sites Constructed from 1985 - Four-Year Change

	AVERAGE RUTTING	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Chip Seal with Styrelf	1.05	161	1.03	0.67	2
Chip Seal	0	19	0.37	0	*
Oil Mat	0	19	0.98	0	*

* Not enough data to allow a comparison.

Maximum Rutting

The maximum rut depth for each 250-foot test section was reported. It is also measured to the nearest 1/100-foot. Tables C21 to C24 summarize the results of this analysis. In some cases the median of the distribution representing the "maximum rutting" has a lower value than the corresponding "average rutting". There are two partial explanations of this: 1) In some cases rutting may have been measured incorrectly the first year; and 2) In some cases a "hump" formed at the centerline during construction may have been worn off by traffic. This would have the effect of reducing the rut depth.

Table C21
CHANGES IN THE MAXIMUM RUTTING FOR ASPHALT CONCRETES AND RECYCLING
(MEDIAN VALUES-FROM 1984)

Part a
Sites Constructed from 1984 - Two-Year Change

	MAXIMUM RUTTING	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Asphalt Concr. Dense	0.55	80.3	2.73	1.87	3
Asphalt Concr. Open	0.35	70.1	1.91	0.95	1
Recycling	0.55	49.3	1.38	1.54	2

Part b
Sites Constructed from 1984 - Four-Year Change

	MAXIMUM RUTTING	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Asphalt Concr. Dense	1.15	80.3	2.73	3.91	2
Asphalt Concr. Open	0.75	70.1	1.91	2	1
Recycling	NO DATA	49.3	1.38	NO	NO

Table C22
CHANGES IN THE MAXIMUM RUTTING FOR ASPHALT CONCRETES AND RECYCLING
(MEDIAN VALUES-FROM 1985)

Part a
Sites Constructed from 1985 - Two-Year Change

	MAXIMUM RUTTING	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Asphalt Concr. Dense	0.55	80.3	2.73	1.87	2
Asphalt Concr. Open	0.55	70.1	1.91	1.5	1
Recycling	0.75	49.3	1.38	2.1	3

Part b
Sites Constructed from 1985 - Four-Year Change

	MAXIMUM RUTTING	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Asphalt Concr. Dense	1.05	80.3	2.73	3.57	3
Asphalt Concr. Open	0.75	70.1	1.91	2.04	2
Recycling	0.45	49.3	1.38	1.26	1

Table C23
CHANGES IN THE MAXIMUM RUTTING FOR CHIP SEALS AND OIL MATS
(MEDIAN VALUES-FROM 1984)

Part a
Sites Constructed from 1984 - Two-Year Change

	MAXIMUM RUTTING	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Chip Seal with Styrelf	0.95	161	1.03	0.61	2
Chip Seal	0.15	19	0.37	0.29	1
Oil Mat	0.25	19	0.98	1.29	3

Part b
Sites Constructed from 1984 - Four-Year Change

	MAXIMUM RUTTING	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Chip Seal with Styrelf	1.95	161	1.03	0.3	1
Chip Seal	0.75	19	0.37	4.8	2
Oil Mat	0.85	19	0.98	0	3

Table C24
CHANGES IN THE MAXIMUM RUTTING FOR CHIP SEALS AND OIL MATS
(MEDIAN VALUES-FROM 1985)

Part a
Sites Constructed from 1985 - Two-Year Change

	MAXIMUM RUTTING	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Chip Seal with Styrelf	0.95	161	1.03	0.61	2
Chip Seal	0	19	0.37	0	*
Oil Mat	0	19	0.98	0	*

Part b
Sites Constructed from 1985 - Four-Year Change

	MAXIMUM RUTTING	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Chip Seal with Styrelf	1.05	161	1.03	0.67	2
Chip Seal	0	19	0.37	0	*
Oil Mat	0	19	0.98	0	*

* Not enough data to allow a comparison.

Condition Rating

In the Condition Rating Analysis, changes in the overall condition rating are evaluated. As is done for the specific pavement distresses, each type of surface treatment is ranked for different periods: 2-year change, 3-year change, and so forth.

One major difference from the Analysis of Specific Distress Types is that condition rating is applied to the entire section of road where each treatment is used, as opposed to evaluating only 250-foot sections. Also, under the Condition Rating Analysis, the improvement in the condition rating of a road due to the treatment is reported, though not evaluated. The change which is actually used in the analysis, however, is the deterioration with time of the various treatments. The starting point for measuring the change is defined as the observed condition immediately after the treatment is placed.

The change recorded in Tables C25 and C26 is obtained by taking the difference between the first condition rating after construction and the condition rating at 2 years and 4 years after. The value presented in these tables is the median of these differences for all sites under each treatment.

In addition, a comparison between the pre-construction observation and the post-construction observation gives a sample median of 1.95 points of difference for asphalt concretes and recycling, and 0.95 points of difference for chip seals and oil mats. These last values represent the degree of improvement that each treatment produces. The fact that some thin surface treatments increase 2 points in the condition rating of the road and others just 1 point is further justification for making a ranking evaluation in two groups.

Tables C28 and C29 summarize the findings of the changes in the condition rating for each thin surface treatment.

Table C25
CHANGES IN THE CONDITION RATING

A two-year analysis

	CONDITION RATING	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Asphalt Concr. Dense	0	80.3	2.73	3.57	*
Asphalt Concr. Open	0	70.1	1.91	2.04	*
Recycling	0	49.3	1.38	1.26	*

	CONDITION RATING	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Chip Seal with Styrelf	0	161	1.03	0.67	*
Chip Seal	0	19	0.37	0	*
Oil Mat	0	19	0.98	0	*

* Not enough data to allow a comparison

Table C26
CHANGES IN THE CONDITION RATING

A four-year analysis

	CONDITION RATING	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Asphalt Concr. Dense	0.95	80.3	2.73	3.22	3
Asphalt Concr. Open	0.95	70.1	1.91	2.59	1
Recycling	0.95	49.3	1.38	2.66	2

	CONDITION RATING	TRAFFIC LOADING	UNIT COST	CEI x100	OVERALL RANK
Chip Seal with Styrelf	0.95	161	1.03	0.61	2
Chip Seal	0	19	0.37	0	*
Oil Mat	0	19	0.98	0	*

* Not enough data to allow a comparison

A summary of the ranking values for each treatment and criterion may help the overall evaluation of this study: Tables C27 and C28 provide a brief picture of the particular behavior of each thin surface treatment. In the tables below, each treatment has the ranking value from the analysis of the sites constructed from 1985 in the first line, and the rankings from the sites constructed in 1984 (without the data of the first year) in the second line. It should be pointed out, again, the difficulty of making numerical assessments to values from field observations with a high degree of dispersion, and integrating all the analyzed parameters in a whole number which may represent how cost effective is one thin surface treatment related to another.

Table C27
SUMMARY OF RANKINGS - A TWO-YEAR ANALYSIS

TREATMENT	WEA. RAV.	EQ. CRACK	POT HOLES	CHIP LOSS	AV. RUTT.	MAX RUTT.	COND. RAT.	COMP. RANK
Asphalt Dense	1* 2	1* 1*	1* 1*	1* 1*	3 2	2 3	1*	1.43
Asphalt Open	1* 3	1* 1*	1* 1*	1* 1*	1 1	1 1	1*	1.00
Recycling	1* 1	1* 2	1* 1*	2 1*	2 3	3 2	1*	1.57
Chip S.Styrelf	1* 1*	3 2	1* 1*	2 2	2 1	2 2	1*	1.71
Chip Seals	1* 1*	2 1	1* 1*	3 1*	1* 2	1* 1	1*	1.43
Oil Mats	2** 2	1 3	1* 1*	1 1*	1* 3	1* 3	1*	1.14

* A rank of 1 was assigned because of an unchanged condition of the road surface for that particular parameter, that is, the value of the change in the condition is zero (it does not provide conclusive results for this evaluation).

** There are just two sites constructed in 1985; therefore, there are equal probabilities of occurrence for the changes reported in each site. A rank of 2 was assigned due to the change in the weathering from the 1984 sites; it could be a rank of 1 also, from the 1985 data. For more information, refer to the detailed tables in Chapter 4.

Table C28
SUMMARY OF RANKINGS - A FOUR-YEAR ANALYSIS

TREATMENT	WEA. RAV.	EQ. CRACK	POT HOLES	CHIP LOSS	AV. RUTT.	MAX RUTT.	COND. RAT.	COMP. RANK
Asphalt Dense	2 1*	2 1*	1* 1*	1* 1*	3 2	3 2	3	2.14
Asphalt Open	3 2	1 1*	1* 1*	1* 1*	2 1	2 1	1	1.57
Recycling	1 NO++	3 NO	1* NO	2 NO	1 NO	1 NO	2	1.57
Chip S.Styrelf	1* 1+	2 NEG+	1* 1+	1* 2+	2 1+	2 1+	2	1.57
Chip Seals	1* 1*	3 2	1* 1*	2 3	1* 2	1* 2	1*	1.43
Oil Mats	2 2	1** 1	1* 1*	1* 1	1* 3	1* 3	1*	1.14

* A rank of 1 was assigned because of an unchanged condition of the road surface for that particular parameter, that is, the value of the change in the condition is zero (it does not provide conclusive results for this evaluation).

** There are just two sites constructed in 1985; therefore, there are equal probabilities of occurrence for the changes reported in each site. A rank of 1 was assigned due to the change in the weathering from the 1984 sites; it could be a rank of 3 also, from the 1985 data.

+ The findings from the sites constructed in 1984 are referred (reduced) to one site because most of the chip seals with Styrelf for this period either failed, were closed, or the information was incomplete.

++ All recycling projects (constructed from 1985) do not have the data for the four-year analysis after the first year of service. Just sites constructed from 1984 have the five years of service required for this part.

As is seen from the multiple notes in the above tables, conclusive results from this evaluation would be a nearly impossible task.

The composite rank (last column of Tables C27 and C28) is calculated assuming all the parameters are equally weighted into the CEI formula. Future studies may change this assumption, and the final results may vary.

The rankings from the sites constructed in 1984 are compared to the findings from the sites implemented in 1985 as a sensitivity analysis; in Tables C27 and C28, it is noticed the poor correlation between these two ranking systems for each parameter. For most of the cases, the final analysis is made based on the data from the sites constructed from 1985 (sites with the post-construction observation).

From the two-year analysis, few things could be said about the behavior of the asphalt concretes and recycling concerning weathering, equivalent cracking, pot holes and condition rating since these parameters did not change in two years. To some extent the asphalt concretes performed better in the chip loss change than the recycling; it is also confirmed by their lower ranking value in the four-year analysis. The open-graded asphalt concretes did show advantage against the others in the average and maximum rutting for the two-year period. In an overall view, asphalt concretes look superior in the short-term (the two-year evaluation) to the recycling, especially the open-graded mixtures as indicated by the low composite ranking value. On the other hand, the four-year analysis gives an apparent improvement to the performance of the recycling regarding weathering, average rutting and maximum rutting. Also, after four years of service the open-graded mixes present better results in the overall condition rating and equivalent cracking. As a conclusion of the four-year evaluation, the open-graded asphalt concretes and the recycling seem to be more cost effective than the asphalt-dense mixes.

Oil mats present a superior performance in all the parameters for the two-year analysis and almost all the distresses (except weathering) for the four-year analysis. Unfortunately, there are just two sites with oil mat treatments constructed from 1985, and the information from the sites constructed in 1984 appears to be an unreliable source. For these reasons, the conclusions for this group of thin surface treatments are focused into the two kinds of chip seals used. In the short-run (two years of service), the chip seals with Styrelf have an apparent higher performance on the chip loss, although the other chip seals are better ranked in all the distresses and got a better cost-effectiveness composite ranking. For the four-year evaluation, chip seals, again, performed better than the chip seal with Styrelf (with the exception of the equivalent cracking and the chip loss).

Appendix D

Definitions of AC Mix Types

Asphalt Content and Proportion of Material for Hot Mixes

SIEVE SIZE	PERCENTAGES OF AGGREGATE BY WEIGHT DENSE GRADED "B"	"C"	"D"	OPEN GRADED "E"	"F"
1"	100	-	-	-	100
¾"	95-100	100	-	100	95-100
½"	81-93	95-100	100	95-100	66-80
¼"	52-72	52-80	85-100	52-72	18-30
No.10	21-41	21-46	37-57	5-15	5-19
No.40	8-24	8-25	13-29	-	-
No.200	2-7	3-8	4-9	1-5	1-6
Asphalt	4-8	4-8	4-8	4-9	4-8
Hydrated Lime or Portland Cement Filler				0.5-1.5	0.5-1.5

Source: "Standard Specifications for Highway Construction - OREGON - 1984"

APPENDIX E

Narratives for Failed Sites

Closed site 84.02

SITE: 84.02 OR RT 19, MP 15.4 - 28.0 (Hwy 5) Useful life: 5 years

TREATMENT: Chip Seal

CONSTRUCTED BY: State Forces

RATE OF APPLICATION: 0.45 gal./sq. yd. of CRS-2
27 lb./sq. yd. (½" - #10)

AMBIENT TEMPERATURE: 80°F

ESALs: 30/day; 52,290/life

This is a ½" chip seal. The existing road, with the exception of MP 22.4 to 24.6, has from 0.8 to 1.2" of oil mat and approximately 8" of base. These sections were constructed between 1928 and 1959. The last 3½ miles underwent a major breakup last spring requiring extensive blade patching.

The portion between MP 22.4 and 24.6 was constructed in 1977 and has 3" of A.C. and the seal on this portion will last seven years rather than the three years indicated for the overall project.

This job was closed because of extensive patching, potholing, and reflective cracking. No problems were reported with construction. Most of the job exceeded its expected life.

Closed site 84.04

SITE 84.04 U.S. 20, Mp 0.9 - 1.2 useful life 4 years
(Hwy. 7)

TREATMENT: Open graded E-Mix

CONSTRUCTED BY : Mid Oregon Ready Mix

DEPTH of TREATMENT: ¾", asphalt content 7.4%

AMBIENT TEMPERATURE: 65 -76°F, medium humidity

ESALs: 192/day; 262,656/life

Treatment was installed over old, dense asphalt concrete. Construction problems included waiting on mix and equipment breakdowns so that operation was not continuous as specifications require. Seal coat was delayed until the following year. The first freezing temperature occurred on the last night of construction. The site was closed because of reflective cracking and raveling.

SITE: 84.05 US 20 Mp 115.5 - 128.8 useful life: 4 years
(Hwy. 7)

TREATMENT: Chip seal

CONSTRUCTED BY: Bend Aggregate & Paving

RATE OF APPLICATION: 0.30 gal/sq. yd.; .011 cu. yds./sq. yd.

AMBIENT TEMPERATURE: 65 - 85°F

ESALs: 134/day; 186,528/life

Treatment was installed over old, dense asphalt concrete. Some areas had 50% alligatoring, rutting was also excessive. Flying rock was the only problem reported, because the contractor did not have adequate processing equipment to keep up with oiling operations.

This job is considered to have had a normal useful life. It was closed due to pot holing, cracking and extensive blade patching.

SITE: 84.09 OR RT 86 Mp 21.0 - 42.0 Useful life: 4 years
(Hwy. 12)

TREATMENT: Oil mat (0-32 modified)

CONSTRUCTED BY: L & T INC.

RATE OF APPLICATION: 02 gal/sq. yd.; .010 cu.yd./sq. yd. (⅜" - #10)
.02 gal/sq. yd.; 005 cu.yd./sq. yd. (¼" - #10)

AMBIENT TEMPERATURE: 80 - 98^{O}F

ESALs: 52/day; 72,020/life

Treatment was installed over an existing oil mat which was from 27 to 38 years old. Construction problems included not enough rollers on the job, and delays in materials deliveries, no traffic problems were reported (this section has every low traffic coefficient).

The maintenance forces in this section reported that the oil mat did not cure properly, and it began to ravel immediatley after construction. They believed that the emulsion was the cause of not curing. All the lab tests for the CRS-2 passed although only half of the required number were taken.

This job was closed because of ravelling and extensive patching. The expected life of six years was not achieved. The main cause of this appears to be construction practice, and possible change in specification of the aggregate.

Because no oil spread records were included in the semi final data, it is not certain how spread rates for the CRS-2 were controlled.

SITE: 84.13 OR RT 31, MP 16.9 - 18.3 Useful life: 5 years
(Hwy. 19)

TREATMENT: Recycle and Seal

CONSTRUCTED BY: State Forces

DEPTH OF TREATMENT: 1½ inches

AMBIENT TEMPERATURE: 80°F

ESALs: 39/day; 66,456/life

TREATMENT was installed over a 12-year-old 3" A.C. pavement. No construction problems were reported. Since the work was performed by state forces, no lab tests were taken.

This job was closed because of extensive patching. Areas not patched were beginning to show cracking and potholes.

Closed Site 84.14

SITE: 84.14 OR 31, MP 18.3 - 30.4 Useful life: 4 years
(Hwy. 19)

TREATMENT: Chip Seal

CONSTRUCTED BY : State Forces

RATE OF APPLICATION: 0.39 gal/sq. yd.; 21.2 lb/sq. yd.
(CRS-2) (½ - ¼ cinders)

AMBIENT TEMPERATURE: 65 - 87^{o}F

ESALs: 39/day; 53,625/life

Treatment was installed over 12-year-old, dense graded asphalt concrete. Preparation work by maintenance forces included blade patching and sealing of transverse cracks with rubber crack seal.

No data has been found on either the construction narrative or the material testing. This is typical for work done by state forces.

This site was closed due to reflective cracking and rutting. Part of the job was given a condition 4 by planning (Mp 26.5 - 30.30).

SITE: 84.24 US 395 Mp 2.5 - 10 Useful life: 3 years
84.25 (Hwy. 48)

TREATMENT: Chip Seal

CONSTRUCTED BY: Bend Aggregate & Paving

RATE OF APPLICATION: 0.32 gal/yd. sq.; .011 cu yds./sq. yd.

AMBIENT TEMPERATURE: 65 - 98°F

ESALs: 40/day; 42,320/life

Treatment was installed over a 22-year-old dense graded asphaltic concrete. No construction problems were reported and weather conditions were almost ideal. All materials met specifications, although 2 more samples should have taken.

These sites were closed in 1987 due to extensive patching.

SITE: 84.26 US 395 Mp 40.9 - 52.90 Useful life 4 years
(Hwy 48)

TREATMENT: Chip Seal

CONSTRUCTED BY: Bend Aggregate & Paving

RATE OF APPLICATION: 0.32 gal/sq. yd.; .011 cu. yds./sq. yd.

AMBIENT TEMPERATURE: $65^{o}F$ - $85^{o}F$

ESALs: 52/day; 71,708/life

Treatment was installed over 22-year-old open grade F-mix (USFS Design). No construction problems were reported and weather conditions were almost ideal. All materials met specifications, although 2 more samples should have been taken. This project does contain steep grades (up to 2.7%), and much of the failing sections were on these steeper grades.

This project was closed in 1988 due to patching and had a condition rating of 4 by the planning section.

SITE: 84.28 Ore 7 MP 25 - 29 Useful life 4 years
(Hwy. 71)

TREATMENT: Oil mat (0 - 32) modified

CONSTRUCTED BY: L & T INC.

RATE OF APPLICATION: 0.35 gal./sq. yd.;.010 cu. yd./sq.yd. (⅜" - #10)

AMBIENT TEMPERATURE: 65°F - 82°F; high humidity

ESALs: 58/day; 81,870/life

Treatment was installed over an 18-year-old oil mat. Two minor construction problems were mentioned. One roller broke down on Aug. 7th, only one was working that day. The emulsion spread rate was reduced from 0.40 to 0.35 because the section completed on Aug. 2nd appeared to be flushing. All aggregate and emulsion samples met specifications. Weather conditions were almost ideal except for a humid day on the 8th of August.

The site was closed because of patching pot, holes, rutting and ravelling.

SITE: 84.29 ORE 7 MP 29 - 42 Useful life 4 years
(Hwy. 71)

TREATMENT: Oil mat (0 - 32) modified

CONSTRUCTED BY: L & T INC.

RATE OF APPLICATION: 0.35 gal./sq. yd.; .010 cu.yd./sq.yd. (⅜" - #10)

AMBIENT TEMPERATURE: 65 - 94°F

ESALs: 62/day; 87,420/life

Treatment was installed over a 34-year-old oil mat which had been patched by maintenance forces. No construction problems were reported on this section. All materials met specifications. Weather conditions were almost ideal except for high humidity on the 8th of August.

This section was closed because of patching, pot holing, rutting and ravelling. Maintenance cost were about 30% replacement costs.

SITE: 84.35 FAS 123 MP 0 - 1.0 Useful life 4 years
(Hwy. 130)

TREATMENT: Chip seal w/Styrelf

CONSTRUCTED BY: State Forces

RATE OF APPLICATION: None reported

AMBIENT TEMPERATURE: 65 - 70°F

ESALs: 12/day; 16,056/life

Treatment was applied to a 24-year-old 2" oil mat that had been patched several times and had areas of high distress. Since this was a general services contract, materials were accepted on visual inspection. No information is available concerning material testing or spread rates. The aggregate was reported as old and dirty and was taken from a stock pile made in 1947.

Construction problems were encountered with compaction. Visual inspection indicated that the steel-wheeled rolled was not getting full compaction. The manufactures representative indicated that better results would have been achieved with a rubber-tired roller.

This section was selected as a test of how well Styrelf could make up for problems of dirty aggregate and highly distressed substrate. It demonstrated that Styrelf cannot solve these problems.

SITE: 84.39 OR RT 213, MP 3.8 - 7.0 Useful life: 5 years
(Hwy. 160)

TREATMENT: Chip seal w/Styrelf

CONSTRUCTED BY: State Forces

RATE OF APPLICATION: 0.30 gal/sq. yd.
(no rate reported (¼" - #10)

AMBIENT TEMPERATURE: 75°F

ESALs: 160/day; 285,600/life

Treatment was applied over a 10-year-old dense graded asphaltic concrete. Patching had been done prior to the seal application. No construction problems were encountered and the weather was ideal.

The usefull life of this project was 5 years. This is satisfactory considering the number of ESALs endured. Conditions contributing to failure are: high ADT (11000) and high speed (55 mph +). This site was known to be a severe test for a chip seal. It was intenionally selected to test the durability of the polymer modified asphalt.

This site was closed because of extensive patching, potholing, and reflective cracking. This distress was mostly in the underlying material and the chips were still in place. Since the treatment was essentially intact at the end of the period studied, the 5-year life reported here does not necessarily reflect the durability of the treatment.

SITE: 84.40 OR 34 Mp 12.60 - 12.85 Useful life 3 years
(Hwy. 210)

TREATMENT: Chip seal w/Styrelf

CONSTRUCTED BY: State Forces

RATE OF APPLICATION: Oil 0.25 gals/sq. yd.; ¼" - #10
(no rate reported)

AMBIENT TEMPERATURE: 75°F

ESALs: 481/day; 518,037/life

Treatment was applied over a 19-year-old dense graded asphaltic concrete. No patching was done prior to the seal application. This site was part of a test that included adjacent sites (84.41, 84.42). The project manager reported this section to be in the best condition of the three.

Construction problems with spread rates were adjusted by visual inspection. Traffic was to be kept off the new mat for two hours after laydown but this was not possible. No problems with flying rock were reported. This could be an advantage of using Styrelf.

The useful life of this project was 3 years. Although this seems too short to be competetive with ordinary chip seals, the total number of ESALs endured explains this. Conditions contributing to failure are: no prior patching of distressed areas, releasing traffic onto the mat to soon, and using only a steel wheeled roller.

SITE: 84.41 OR 34 Mp 12.85 - 13.20 Useful life: 3 years
(Hwy. 210)

TREATMENT: Chip seal w/Styrelf

CONSTRUCTED BY: State Forces

RATE OF APPLICATION: Oil, 0.35 gals/sq. yd.; ½" - ¼"

AMBIENT TEMPERATURE: 75°F

ESALs: 481/day; 518,518/life

Treatment was applied over 19-year-old dense grade asphaltic concrete. No patching was done prior to the chip seal application. This site was part of a test that included adjacent sites (84.40, 84.42). This section was reported to be in very poor condition before the chip seal was laid. This was the first section to show signs of distress after the treatment was applied.

Construction problems were encountered so that it was not possible to keep traffic off the new mat for two hours as intended. While no flying rock complaints were received, allowing traffic on the new mat prematurely could have reduced its life.

Like the two adjacent sections, the treatment lasted a satisfactory length of time considering the number of ESALs it endured. Other factors contributing to failure include: no prior patching of distress areas, using steel wheeled rollers only.

SITE: 84.42 OR 34 Mp 13.20 - 13.35 Useful life: 3 years
(Hwy. 210)

TREATMENT: Chip Seal w/Styrelf

CONSTRUCTED BY: State Forces

RATE OF APPLICATION: 0.35 gal/sq. yd.; (½" - ¼") 1st
0.25 gal/sq. yd.; (¼" - 10") 2nd

AMBIENT TEMPERATURE: 75°F

ESALs: 481/day; 518,037/life

Treatment was installed over a 19-year-old dense graded asphaltic concrete. No patching was done just prior to the chip seal application. This site was part of a test that included adjacent sites (84.40, 84.41). This section received a double layer of chip seal which lasted much better the first year than the other two sections. The only construction problem reported was with traffic control. The manufacturers representative recommended keeping traffic off the new mat for two hours. Due to tight scheduling this was not done.

This treatment had a reasonable life span considering the total ESALs it endured. Other factors contributing to failure include: no patching prior to chip seal, use of steel wheeled rollers only, no real control over mix proportions.

SITE: 84.43 OR 126 Mp 10.2 - 10.7 Useful life: 4 years
(Hwy. 215)

TREATMENT: Chip seal w/Styrelf

CONSTRUCTED BY: State Forces

RATE OF APPLICATION: 0.35 gals/sq. yd.; agg: no data

AMBIENT TEMPERATURE: 65 - 70^{o}F (with shaded spots)

ESALs: 94/day; 131,412/life

Treatment was installed over a 22-year-old dense graded asphaltic concrete. The section did have a few distressed areas but was in general well maintained with several good condition patches.

No construction problems were reported. Material testing was not performed. Spread rates for aggregates were not mentioned.

This site had been selected to test Styrelf in a high cool mountainous area. Although the intensive section was rated as fair, much of the section was poor. Chip loss, pot holes and rutting were the reasons for closing this site.

In terms of time, this site failed earlier than expected if Styrelf is to be cost effective compared to ordinary chip seals. In terms of ESALs, however, it compares favorably with ordinary chip seals. Factors contributing to failure include: quality control of materials, location and climate (snow zone with chained trucks) and use of steel wheeled roller only (related to rutting).

SITE: 84.45 OR RT 216 MP 0 - 13.7 Useful life: 4 years
(Hwy 290)

TREATMENT: Chip seal

CONSTRUCTED BY: State Forces

RATE OF APPLICATION:

AMBIENT TEMPERATURE: 82°F

ESALs: 6/day; 10,086/life

Treatment was installed over an existing oil mat which was laid in 1947. No construction problems were reported. No lab tests were taken because this job was done by state forces.

This job was reoiled in late summer of 1988, after several curves and edge breaks were widened. The site had to be closed because the original treatment could no longer be evaluated. The treatment itself did not fail.

SITE: 85.01 I-84, MP 10.2 - 16.7 Useful life: 10 mos.
(Hwy. 2)

TREATMENT: Chip Seal w/Styrelf

CONSTRUCTED BY: L & T, Inc.

DEPTH OF TREATMENT: 0.32 gal./sq. yd.: 24 lbs/sq. yd.

AMBIENT TEMPERATURE: 70 - 92°F and low humidity
eastbound work - up to 85°F
westbound work - high humidity and overcast

ESALs: 2,160/day; 648,000/life

Treatment was installed over old, dense asphalt concrete recently patched by maintenance forces. The pavement was dry and clean, so that no preperation was required. The eastbound lanes were done August 17-18, 1985. While under construction, traffic was allowed through for as short time to relieve severe congestion on the bypass. The westbound lanes were treated on August 24-25, 1985, and no traffic problems were experienced and traffic was kept off the road through initial curing.

The seal was reported to last through most of November, before starting to fail. Aggregate was lost more rapidly in outside lanes and closer to Portland where traffic was heavier. When the site was inspected in Spring 1986, the seal was virtually gone. Because of the pattern of failure observed, it is believed, this short life is due to higher ESALs. In terms of ESALs endured this treatment lasted a reasonable length of time.

SITE: 85.05 US 20, Mp 157.9 - 165.6 Useful life: 3 years
(Hwy. 7)

TREATMENT: Chip Seal

CONSTRUCTED BY: Oregon Asphalt Paving Co.

RATE OF APPLICATION: .035 gal/sq. yd.; .012 cu. yd./sq. yd.

AMBIENT TEMPERATURE: 65 - 75^{o}F, cold nights in upper 30's

ESALs: 110/day; 114,730/life

Treatment was installed over 8-year-old dense graded modified "C" mix. No preparation of pavement was reported. Only minor construction problems were encountered and were corrected early in the job. Work was started on the east bound end and proceeded west bound. This section has a long truck climbing lane of 5 miles at 3% grade. It was also in this section that most of the non-specification CRS-2 was used. The site was closed because of extensive blade patches. The unpatched had "pock mark" type potholes in the wheel paths, particulary on the west bound lanes. Causes of failure may be related to failing CRS-2 and possible stripping.

SITE: 85.16 US 26, MP 44.4 - 54.7 Useful life: 10 mos.
(Hwy. 2)

TREATMENT: Chip Seal w/Styrelf

CONSTRUCTED BY: L & T, Inc.

DEPTH OF TREATMENT: 0.32 gal/sq. yd.; 24 lbs./sq. yd.

AMBIENT TEMPERATURE: 65°F and lower

ESALs: 222/day; 66,000/life

Treatment was installed over old, dense asphalt concrete recently patched by maintenance forces. Work was started August 19, with some remedial work performed later. During construction, fog rolled in and the temperature dropped to 50°F.

The seal was reported to last through most of November, before starting to fail. When the site was inspected in Spring 1986, the seal was virtually gone. It appears high temperature and low humidity are essential to successful chip sealing. Additionally, this project is in the mountains where more chains and studded tires are used.

SITE 85.18 US RT 395 MP 97.5 - 103.8 Useful life: 4 years
(HWY 19)

TREATMENT: Chip seal

CONSTRUCTED BY: Oregon Asphaltic Paving Co.

RATE OF APPLICATIONs: 0.30 gal.\sq. yd.
0.010 cu. yd.\sq. yd.

AMBIENT TEMPERATURE: 75°F

ESALs: 90/day; 123,660/life

Treatment was installed over a 5-year-old 4" A.C. pavement. Construction problems included a rain delay on the first day (July 29, 1985) and then a complete close down until August 5, 1985 due to heavy rainfall. The project was finished without further problems.

The CRS-2 used on August 5, 1985 (41% of the total used on the job) did not comply with specifications.

This job was closed due to patching, cracking, and pot holing.

SITE: 85.22 US 26 MP 37.4 - 46.3 Useful life: 3 years
(Hwy. 47)

TREATMENT: Styrelf Chip Seal

CONSTRUCTED BY: Fabricators Inc.

RATE OF APPLICATION: 0.35 gal/sq. yd.; .011 cu.yd./sq.yd.

AMBIENT TEMPERATURE: 65 - 85° F
ESALs: 141/DAY; 150,024/life

Treatment was installed over 22-year-old, dense graded asphalt concrete. Preparation work by maintenance forces includes pot hole patching and repair of broken up areas.

Construction problems were encountered because of weather and equipment problems. On the afternoon of Aug. 6, the temperature started falling below 68', and the oil distributor got up 10 minutes ahead of the rock spreader. On Aug. 7, it rained and the temperature was below 65' all day (no more chip seal was laid on this project unit after Aug. 6 until Aug. 12). Accurate oil spread rates were difficult to maintain because of problems with the gallon meter or pump on the distributor.

The project manager made the following point regarding cost reductions of chip seals constructed in the coast range.

"We suggest that it would be more economical to have state forces place chip seals in this area in the future. The weather in the coast range is so unpredictable that the contractor has to raise his bid to take into account the possibility of days of down time. Whereas state forces could chip seal whenever weather permitted, using rented equipment if need be".

This site was closed due to rutting, chip-loss and extensive maintenance. In 1986, a grindout and inlay of 26,968 sq. yards costing $105,432, was made. This represented 15% of the surface of the project and 45% of the original unit cost of the treatment.

SITE: 85.23 RTE US 395 MP 52.8 - 58.9 Useful life: 3 years
(Hwy. 48)

TREATMENT: Chip Seal

CONSTRUCTION BY: L & T, Inc.

RATE OF APPLICATION: 0.30 fal/sq. yd.; 0.010 cu. yd/sq. yd.

AMBIENT TEMPERATURE: 75°F

ESALs: 52/day; 53,925/life

Treatment was installed over a 5-year-old dense graded asphalt concrete. The only construction problem encountered was keeping traffic off the overlay at center line. This was because of the narrow roadway. Most of this section is on a steep grade (up to 5%). The aggregates met specifications but 82% of the emulsion failed.

This job was closed because of raveling, potholing, and reflective cracking. It received a rating of 4 from the Planning Section.

SITE: 85.24 U.S. RT 395 MP 35.0 - 65.6 Useful life: 4 years
(Hwy. 49)

TREATMENT: Recycle and Chip Seal

CONSTRUCTED BY: Valentine Construction Co.

DEPTH of TREATMENT: 2"

AMBIENT TEMPERATURE: $78^{o}F$

ESALs: 12/day; 16,620/life

Treatment was installed over 4 inches of asphalt pavement about 17 years old. Construction problems were encountered with the grinding of the old asphalt by the recycle train.

Maintenance work included pothole patching and crack sealing prior to the recycle operation. This section has problems with severe spring break up and has been heavily patched many times since 1967. This would make a very inconsistent mix for recycling.

This job was considered failed as of the Spring of 1988 because more than 30% of the original recycle work was re-recycled as of 1988.

The intensive site at MP 35.24 did show a considerable amount of reflective cracking and was beginning to pothole.

SITE: 85.25 US RT 395 MP 35.0 - 65.6 Useful life: 4 years
(Hwy. 49)

TREATMENT: Recycle and Chip Seal

CONSTRUCTED BY: Valentine Construction Co.

DEPTH OF TREATMENT: 2"

AMBIENT TEMPERATURE: 78°F

ESALs: 12/day; 16,620/life

Treatment was installed over 4" of asphalt pavement about 17 years old. Construction problems were encountered with the grinding of the old asphalt by the recycle train.

Maintenance work included pothole patching and crack sealing prior to the recycle operation. This section has problems with severe spring break up and has been heavily patched many times since 1967. This would make a very inconsistent mix for recycling.

This job was considered failed as of the Spring of 1988 because more than 30% of the original recycle work was re-recycled as of 1988.

The intensive site of mile post 48.74 had very little distress. This was an exceptional area because there were severe potholed areas just to the north and south of this section.

SITE: 85.31 OR 99W MP 109.7 - 116.7 Useful life: 2 years
(Hwy. 91)

TREATMENT: Sand seal (fog seal with sand blanket to protect which curing)

CONSTRUCTED BY: Wildish

RATE OF APPLICATION: 0.20 gal/sq. yd.; 0.003 lbs/sq.yd.
(CSS-1) (sand)

ESALs: 227/day; 166,698/life

This treatment was applied over a 5-year-old dense graded asphalt concrete to rejuvenate a "dry pavement"/ No problems with construction or materials were encountered. Weather conditions were satisfactory.

Due to the limited data on this type of seal no conclusion can be made. Its useful life of 2 years appears normal.

SITE: 86.06 U.S. RT 26 MP 6.8 - 16.6 Useful life: 3 years
(Hwy 41)

TREATMENT: Recycle and Sand Seal

CONSTRUCTED BY: Valentine Construction Co.

DEPTH OF TREATMENT: 2" (max.)

A/C EMULSION = 1.2%

AMBIENT TEMPERATURE: 60 - 70°F

ESALs: 208/day; 206,336/life

Treatment was installed over old asphaltic concrete and old macadam. By information obtained from Cores, Millings and field reconnaissance "the unit was divided into three mix design areas with each area representing changes in the composition of the existing mat that would occur within the recycle depth."

Construction problems were encountered with rain at about MP 7 to 7.5. Also, grinder teeth were worn out and not changed for about 2 miles (14.8 to 16.5). Both of these areas had immediate raveling after the recycle was completed.

This site was closed due to extensive patching, potholing, and cracking.

SITE: 86.07 U.S. RT 26, MP 24.4 - 35.0 Useful life: 3 years
(Hwy. 41)

TREATMENT: Recycle and Chip seal

CONSTRUCTED BY: Valintine Construction

DEPTH OF TREATMENT : 2 "(max)

AMBIENT TEMPERATURE: 70 - 80°F

ESALs: 170/day; 168,640/life

Treatment was installed over old asphaltic concrete and old macadam. By information obtained frome cores, millings, and field reconnaissance: "The unit was divided into 4 mix design areas with each area representing changes in the composition of the existing mat that would occur within the recycle depth."

This site was closed due an overlay and bike path construction. The thin surface treatment was in good condition and the site would have remained open for several years.

SITE: 86.11 US RT 20 MP 238.7 - 245.5 Useful life: 3 years
(Hwy 7)

TREATMENT: Recycle

CONSTRUCTED BY: Valentine Construction Co.

DEPTH OF APPLICATION: 2¼"

AMBIENT TEMPERATURE: 90°F

Treatment was installed over cold asphaltic concrete from 26 to 30 years old. No construction problems were encountered except getting the profiler rate slow enough to match the paver. The appearance of the mat was like "hot mix." Dale Allen cautioned that emulsion is too high.

This job did show a high degree of rutting, which indicates a soft mix caused by too high emulsion.

The job was closed due to extensive patching, potholing, and reflective cracking.

APPENDIX F

Abbreviations Key for Detailed Distress Survey Data

Abbreviation	Explaination
Treat code	= treatment code
	(dense graded mixes)
ACB150CS	= asphalt concrete, "B" mix, 1.5 inches deep, chip sealed
ACB150	= asphalt concrete, "B" mix, 1.5 inches deep
ACC150	= asphalt concrete, "C" mix, 1.5 inches deep
ACC150	= asphalt concrete, "C" mix, 1.5 inches deep
ACC200	= asphalt concrete, "C" mix, 2.0 inches deep
ACC150OG	= asphalt concrete, "C" mix, 1.5 inches deep, over geotextile
	(open graded mixes)
ACE075CS	= asphalt concrete, "E" mix, 0.75 inches deep, chip sealed
ACE075	= asphalt concrete, "E" mix, 0.75 inches deep
ACE075S	= asphalt concrete, "E" mix, 0.75 inches deep, sealed
ACF150SS	= asphalt concrete, "F" mix, 1.5 inches deep, sand sealed
ACF150S	= asphalt concrete, "F" mix, 1.5 inches deep, sealed
ACM125CS	= asphalt concrete, emulsion,1.25 inches deep, chip sealed
ACM200S	= asphalt concrete, emulsion,2.0 inches deep, sealed
	(oil mats)
OM038	= oilmat, 0.38 inches deep
OM063	= oilmat, 0.63 inches deep
OM075	= oilmat, 0.75 inches deep
OM0125	= oilmat, 1.25 inches deep
	(chip seals)
CS	= chip seal
CSWS	= chip seal with Styrelf(polymier additive)
RE	= cold-in-place recycle
RECS	= cold-in-place recycle with Styrelf chip seal
RESS	= cold-in-place recycle with sand seal

other codes

pre = sites which had an inspection before the treatment was applied

TREATMENT	HWY	TEST MILE POINT	TREAT CODE	DATE OF TEST	PRE	EQIV CRAK	WEA / RAV	POT HOLES	AVE RUT	MAX RUT	CHIP LOSS	CLOSED	JOBNUM
ASPHALT,DENSE	9	331.20	ACB150CS	840710	*	.00	.0	.0	3.0	3.0	.0		84.06
	9	331.20	ACB150CS	850814		.00	.0	.0	.8	1.2	.0		84.06
	9	331.20	ACB150CS	860617		.00	.0	.0	1.5	1.9	.0		84.06
	9	331.20	ACB150CS	870519		.00	.0	.0	1.8	2.3	.0		84.06
	9	331.20	ACB150CS	880511		.00	.0	.0	1.9	2.3	.0		84.06
	9	331.20	ACB150CS	890607		.00	7.0	.0	2.3	2.5	.0		84.06
	10	65.70	ACC150	840718	*	.00	.0	2.0	5.0	5.0	.0		84.08
	10	65.70	ACC150	850820		3.19	.0	.0	.9	1.4	.0		84.08
	10	65.70	ACC150	860512		5.48	.0	.0	1.2	1.6	.0		84.08
	10	65.70	ACC150	870512		2.55	.2	.0	1.2	1.6	.0		84.08
	10	65.70	ACC150	880615		3.38	.9	.0	1.5	1.9	.0		84.08
	10	65.70	ACC150	890523		6.04	27.0	.0	2.0	2.7	.0		84.08
	25	.85	ACB150	840710	*	.00	.0	.0	1.0	1.0	.0		84.16
	25	.85	ACB150	850814		.00	.0	.0	1.3	1.4	.0		84.16
	25	.85	ACB150	860617		.00	.0	.0	1.7	1.8	.0		84.16
	25	.85	ACB150	870520		.26	.0	.0	1.7	2.1	1.5		84.16
	25	.85	ACB150	880509		.00	25.0	.0	1.7	2.2	.0		84.16
	25	.85	ACB150	890606		.00	65.0	.0	2.4	2.8	.0		84.16
	26	23.00	ACC200	840720	*	.00	.0	5.0	4.0	4.0	.0		84.17
	26	23.00	ACC200	850730		.00	.0	.0	1.4	1.6	.0		84.17
	26	23.00	ACC200	860508		.00	.0	.0	1.5	1.6	.0		84.17
	26	23.00	ACC200	870723		.00	85.0	.0	1.9	2.0	.0		84.17
	26	23.00	ACC200	880711		.00	85.0	.0	2.4	2.6	.0		84.17
	26	23.00	ACC200	890714		.00	100.0	.1	2.8	2.8	.0		84.17
	35	31.75	ACC150	840710	*	1.50	1.0	.0	2.0	2.0	.0		84.21
	35	31.75	ACC150	850815		.00	.0	.0	1.6	1.8	.0		84.21
	35	31.75	ACC150	860616		.00	.0	.0	2.6	2.7	.0		84.21
	35	31.75	ACC150	870519		.00	.0	.0	2.6	2.8	.0		84.21
	35	31.75	ACC150	880512		.00	.0	.0	2.8	3.0	.0		84.21
	35	31.75	ACC150	890608		.00	31.0	.0	2.9	3.0	.0		84.21
	37	47.00	ACC200	840723	*	1.50	.0	.0	4.0	4.0	.0		84.22
	37	47.00	ACC200	850729		.00	.6	.0	.7	.8	.0		84.22
	37	47.00	ACC200	860507		.00	.0	.0	.9	1.1	.0		84.22
	37	47.00	ACC200	870709		.00	.0	.0	1.8	2.3	.0		84.22
	37	47.00	ACC200	880712		.00	.0	.0	1.8	2.1	.0		84.22
	37	47.00	ACC200	890612		.00	.0	.0	1.8	1.9	.0		84.22

TREATMENT	HWY	TEST MILE POINT	TREAT CODE	DATE OF TEST	PRE	EQIV CRAK	WEA / RAV	POT HOLES	AVE RUT	MAX RUT	CHIP LOSS	CLOSED	JOBNUM
ASPHALT,DENSE	91	58.66	ACC200	840709	*	6.00	.0	.0	2.0	2.0	.0		84.31
	91	58.66	ACC200	850725		.00	.0	.0	.9	1.5	.0		84.31
	91	58.66	ACC200	860530		.00	.0	.0	1.1	1.8	.0		84.31
	91	58.66	ACC200	870605		.00	15.0	.0	1.4	2.0	.0		84.31
	91	58.66	ACC200	880505		.00	25.0	.0	2.1	2.2	.0		84.31
	91	58.66	ACC200	890703		.00	25.0	25.0	1.8	2.1	.0		84.31
	91	66.00	ACC200	840723	*	2.63	.0	.0	2.0	2.0	.0		84.32
	91	66.00	ACC200	850725		.00	.0	.0	.8	.8	.0		84.32
	91	66.00	ACC200	860417		.00	31.2	.0	.7	.8	.0		84.32
	91	66.00	ACC200	870605		.00	50.0	.0	1.0	1.1	.0		84.32
	91	66.00	ACC200	880505		.00	50.0	.0	1.2	1.2	.0		84.32
	91	66.00	ACC200	890703		.19	60.0	.0	1.6	1.9	.0		84.32
	92	3.00	ACC200	840723	*	.00	.0	.0	6.0	6.0	.0		84.33
	92	3.00	ACC200	850905		.00	.0	.0	.4	.7	.0		84.33
	92	3.00	ACC200	860507		.00	13.5	.0	.7	.9	.0		84.33
	92	3.00	ACC200	870722		.00	5.0	.0	1.4	1.9	.0		84.33
	92	3.00	ACC200	880713		.00	2.8	.0	1.2	1.2	.0		84.33
	92	3.00	ACC200	890613		.00	18.0	.0	2.1	2.1	.0		84.33
	140	48.00	ACC150	840807	*	.53	.0	.0	1.0	1.0	.0		84.36
	140	48.00	ACC150	850723		.15	.0	.0	.3	.3	.0		84.36
	140	48.00	ACC150	860509		.38	.0	.0	1.0	1.1	.0		84.36
	140	48.00	ACC150	870720		.75	.0	.0	1.0	1.2	.0		84.36
	140	48.00	ACC150	880428		.86	.0	.0	1.0	1.2	.0		84.36
	140	48.00	ACC150	890721		1.43	25.0	.0	1.1	1.2	.0		84.36
	272	20.95	ACB150	840711	*	.00	.0	.0	.0	.0	.0		84.44
	272	20.95	ACB150	850813		.00	.0	.0	1.0	1.3	.0		84.44
	272	20.95	ACB150	860617		.00	.0	.0	1.4	1.6	.0		84.44
	272	20.95	ACB150	870520		.00	.0	.0	1.7	2.0	.0		84.44
	272	20.95	ACB150	880510		.00	.0	.0	1.7	2.0	.0		84.44
	272	20.95	ACB150	890606		.15	62.0	.0	1.7	2.3	.0		84.44
	6	168.04	ACB150	850506	*	4.09	.0	.0	1.3	1.3	.0		85.04
	6	168.04	ACB150	851007		.00	.0	.0	.2	.2	.0		85.04
	6	168.04	ACB150	860603		.38	.0	.0	1.2	1.2	.0		85.04
	6	168.04	ACB150	870728		.34	.0	.0	1.0	1.0	.0		85.04
	6	168.04	ACB150	880620		1.16	5.0	.0	1.0	1.0	.0		85.04
	6	168.04	ACB150	890515		2.18	20.0	.0	1.3	1.3	.0		85.04

TREATMENT	HWY	TEST MILE POINT	TREAT CODE	DATE OF TEST	PRE	EQIV CRAK	WEA / RAV	POT HOLES	AVE RUT	MAX RUT	CHIP LOSS	CLOSED	JOBNUM
ASPHALT,DENSE	7	266.52	ACC150	850417	*	21.79	1.7	.3	2.0	2.4	.0		85.06
	7	266.52	ACC150	851009		.00	.0	.0	.3	.5	.0		85.06
	7	266.52	ACC150	860513		.19	.0	.0	1.3	1.5	.0		85.06
	7	266.52	ACC150	870505		.30	.0	.0	1.6	1.9	.0		85.06
	7	266.52	ACC150	880622		.79	1.0	.0	1.6	1.7	.0		85.06
	7	266.52	ACC150	890523		3.38	25.0	.0	1.7	1.9	.0		85.06
	66	10.67	ACC150	850418	*	10.80	.0	.0	1.6	2.2	.0		85.27
	66	10.67	ACC150	851008		.00	.0	.0	.2	.4	.0		85.27
	66	10.67	ACC150	860513		.00	.0	.0	.6	.9	.0		85.27
	66	10.67	ACC150	870512		.00	.0	.0	1.0	1.3	.0		85.27
	66	10.67	ACC150	880616		.00	1.0	.0	1.1	1.3	.0		85.27
	66	10.67	ACC150	890524		1.50	5.0	.0	1.1	1.4	.0		85.27
	66	43.11	ACC150	850417	*	3.41	.0	5.6	2.0	2.2	.0		85.28
	66	43.11	ACC150	851009		.00	.0	.0	.3	.6	.0		85.28
	66	43.11	ACC150	860513		.68	.0	.0	.8	1.0	.0		85.28
	66	43.11	ACC150	870513		.45	.0	.0	1.0	1.2	.0		85.28
	66	43.11	ACC150	880615		.75	.0	.0	1.0	1.1	.0		85.28
	66	43.11	ACC150	890524		2.81	26.5	.0	1.8	2.0	.0		85.28
	91	19.58	ACB150	850430	*	12.26	.5	.3	2.0	2.2	.0		85.29
	91	19.58	ACB150	851024		.00	.0	.0	.6	.8	.0		85.29
	91	19.58	ACB150	860509		.19	14.0	.0	.9	1.0	.0		85.29
	91	19.58	ACB150	870721		.26	15.0	.0	1.0	1.0	.0		85.29
	91	19.58	ACB150	880711		.34	60.0	.0	1.6	2.1	.0		85.29
	91	19.58	ACB150	890721		.53	60.0	.0	1.9	2.3	.0		85.29
	91	64.00	ACC150	850401	*	16.80	.0	.0	1.3	1.6	.0		85.30
	91	64.00	ACC150	851022		.00	.0	.0	.4	.5	.0		85.30
	91	64.00	ACC150	860417		.00	25.0	.0	.8	.9	.0		85.30
	91	64.00	ACC150	870605		.00	50.0	.0	.9	1.0	.0		85.30
	91	64.00	ACC150	880505		.00	50.0	.0	1.3	1.5	.0		85.30
	91	64.00	ACC150	890703		.00	70.0	.0	1.3	1.7	.0		85.30
	92	86.23	ACC200	850422	*	1.50	18.0	.0	1.3	1.6	.0		85.32
	92	86.23	ACC200	851104		.75	.0	.0	.4	.5	.0		85.32
	92	86.23	ACC200	860527		.90	.0	.0	.9	.9	.0		85.32
	92	86.23	ACC200	870708		.00	.0	.0	1.0	1.0	.0		85.32
	92	86.23	ACC200	880713		.00	10.0	.0	1.4	1.5	.0		85.32
	92	86.23	ACC200	890613		.00	25.0	.0	1.4	1.5	.0		85.32

TREATMENT	HWY	TEST MILE POINT	TREAT CODE	DATE OF TEST	PRE	EQIV CRAK	WEA / RAV	POT HOLES	AVE RUT	MAX RUT	CHIP LOSS	CLOSED	JOBNUM
ASPHALT,DENSE	171	1.64	ACC150	850430	*	2.10	.0	.0	4.0	4.8	.0		85.34
	171	1.64	ACC150	851023		.00	.0	.0	.4	.9	.0		85.34
	171	1.64	ACC150	860508		.00	.0	.0	.7	.8	.0		85.34
	171	1.64	ACC150	870722		.00	.0	.0	1.0	1.1	.0		85.34
	171	1.64	ACC150	880428		.00	.0	.0	1.1	1.2	.0		85.34
	171	1.64	ACC150	890612		.00	80.0	.0	1.4	1.6	.0		85.34
	171	2.21	ACC1500G	850430	*	12.56	.0	.0	3.3	3.4	.0		85.35
	171	2.21	ACC1500G	851023		.00	.0	.0	.5	.9	.0		85.35
	171	2.21	ACC1500G	860508		.00	.0	.0	1.0	1.1	.0		85.35
	171	2.21	ACC1500G	870722		.00	.0	.0	1.3	1.5	.0		85.35
	171	2.21	ACC1500G	880428		.15	.0	.0	1.7	1.9	.0		85.35
	171	2.21	ACC1500G	890612		.19	80.0	.0	1.8	2.0	.0		85.35
ASPHALT,OPEN	4	283.19	ACE075CS	840711	*	.00	.0	.0	1.5	2.0	.0		84.01
	4	283.19	ACE075CS	850813		.00	.0	.0	1.0	1.1	.0		84.01
	4	283.19	ACE075CS	860619		.00	.0	.0	1.9	2.2	.0		84.01
	4	283.19	ACE075CS	870608		.00	10.0	.0	2.3	2.7	.0		84.01
	4	283.19	ACE075CS	880714		.00	.0	.0	4.6	6.4	.0		84.01
	4	283.19	ACE075CS	890606		.00	.0	.0	3.5	4.0	.2		84.01
	7	1.00	ACE075	840716	*	3.00	.0	.0	3.0	3.0	.0		84.04
	7	1.00	ACE075	850910		3.30	.0	.0	2.0	2.0	.0		84.04
	7	1.00	ACE075	860520		8.44	.0	.0	3.1	3.1	.0		84.04
	7	1.00	ACE075	870624		2.74	.0	.0	3.2	3.2	.0		84.04
	7	1.00	ACE075	880629		7.28	20.0	.0	3.9	3.9	.0	CLOSED	84.04
	19	2.32	ACE075S	840823	*	19.50	.0	.0	2.0	2.0	.0		84.10
	19	2.32	ACE075S	850911		.60	.0	.0	.6	.7	.0		84.10
	19	2.32	ACE075S	860520		6.38	.0	.0	1.0	1.0	.0		84.10
	19	2.32	ACE075S	870623		6.71	80.0	.0	1.0	1.0	.0		84.10
	19	2.32	ACE075S	880606		7.31	80.0	.0	1.0	1.0	.0		84.10
	19	2.32	ACE075S	890502		4.31	80.0	.0	1.0	1.0	.0		84.10
	19	8.30	ACE075S	840823	*	8.25	.0	.0	1.0	1.0	.0		84.12
	19	8.30	ACE075S	850911		.34	.0	.0	.8	.9	.0		84.12
	19	8.30	ACE075S	860520		1.84	.0	.0	1.0	1.0	.0		84.12
	19	8.30	ACE075S	870623		1.88	60.0	.0	1.0	1.0	.0		84.12
	19	8.30	ACE075S	880606		2.78	60.0	.0	1.0	1.0	.0		84.12
	19	8.30	ACE075S	890502		3.53	60.0	.0	1.0	1.0	.0		84.12

TREATMENT	HWY	TEST MILE POINT	TREAT CODE	DATE OF TEST	PRE	EQIV CRAK	WEA / RAV	POT HOLES	AVE RUT	MAX RUT	CHIP LOSS	CLOSED	JOBNUM
ASPHALT,OPEN	26	32.45	ACE075S	180714	*	.00	25.0	.0	1.2	1.2	.0		84.18
	26	32.45	ACE075S	840720	*	.00	3.0	3.0	3.0	3.0	.0		84.18
	26	32.45	ACE075S	850730		.00	.0	.0	1.6	1.6	.0		84.18
	26	32.45	ACE075S	860508		.04	.0	.0	1.8	1.8	.0		84.18
	26	32.45	ACE075S	870723		.04	60.0	.0	2.2	2.2	.0		84.18
	26	32.45	ACE075S	880711		.00	60.0	.0	2.4	2.4	40.0		84.18
	26	32.45	ACE075S	890714		.00	60.0	.0	2.4	2.4	.0		84.18
	102	30.00	ACM20S	840723	*	.00	.0	.0	3.0	3.0	.0		84.34
	102	30.00	ACM20S	850724		.00	.0	.0	1.4	1.5	.0		84.34
	102	30.00	ACM20S	860527		.00	.0	.0	1.8	1.8	.7		84.34
	102	30.00	ACM20S	870708		.00	1.5	.0	1.9	2.0	.0		84.34
	102	30.00	ACM20S	880712		.00	2.8	.0	2.6	2.8	.0		84.34
	102	30.00	ACM20S	890612		.00	2.5	.2	2.9	3.0	5.5		84.34
	9	317.05	ACF150SS	850410	*	.64	.0	.0	1.6	2.0	.0		85.10
	9	317.05	ACF150SS	851030		.00	.0	.0	.9	1.0	.0		85.10
	9	317.05	ACF150SS	860617		.00	.0	.0	1.4	1.6	.0		85.10
	9	317.05	ACF150SS	870519		.00	.0	.0	1.5	1.6	.0		85.10
	9	317.05	ACF150SS	880511		.00	25.0	.0	1.5	1.6	.0		85.10
	9	317.05	ACF150SS	890607		.00	52.5	.0	1.3	1.7	.0		85.10
	15	20.10	ACF150SS	850410	*	9.79	.0	.0	3.0	3.0	.0		85.11
	15	20.10	ACF150SS	851028		.00	.0	.0	.8	.9	.0		85.11
	15	20.10	ACF150SS	860528		.00	.0	.0	1.2	1.3	.0		85.11
	15	20.10	ACF150SS	870720		2.14	15.0	.0	2.0	2.1	2.2		85.11
	15	20.10	ACF150SS	880715		.00	65.0	.0	1.6	1.7	.0		85.11
	15	20.10	ACF150SS	890518		.00	90.0	.0	2.0	2.3	.0		85.11
	21	2.01	ACF150S	850408	*	24.00	.0	.0	2.3	3.4	.0		85.14
	21	2.01	ACF150S	851029		.00	.0	.0	.9	1.1	.0		85.14
	21	2.01	ACF150S	860618		.00	.0	.0	1.1	1.3	.0		85.14
	21	2.01	ACF150S	870520		.00	5.0	.0	1.3	1.6	.0		85.14
	21	2.01	ACF150S	880510		.00	37.5	.0	1.3	1.6	.0		85.14
	21	2.01	ACF150S	890606		.00	67.5	.0	1.3	1.5	.0		85.14
	25	8.46	ACE075SS	850408	*	26.29	.0	.0	1.1	1.2	.0		85.15
	25	8.46	ACE075SS	851030		.00	.0	.0	1.3	1.7	.0		85.15
	25	8.46	ACE075SS	860617		.00	.0	.0	1.5	2.0	.0		85.15
	25	8.46	ACE075SS	870520		.00	.0	.0	1.8	2.2	.0		85.15
	25	8.46	ACE075SS	880510		.45	.2	.0	1.8	2.2	.0		85.15

TREATMENT	HWY	TEST MILE POINT	TREAT CODE	DATE OF TEST	PRE	EQIV CRAK	WEA / RAV	POT HOLES	AVE RUT	MAX RUT	CHIP LOSS	CLOSED	JOBNUM
ASPHALT,OPEN	25	8.46	ACE075SS	890606		1.80	24.0	.0	1.9	2.5	.0		85.15
	44	3.82	ACM125CS	850419	*	12.79	6.5	.1	2.2	3.0	.0		85.21
	44	3.82	ACM125CS	851015		.00	.0	.0	1.3	1.3	.0		85.21
	44	3.82	ACM125CS	860602		.00	.0	.0	1.8	2.0	.0		85.21
	44	3.82	ACM125CS	870729		.00	.0	.0	2.2	2.5	.0		85.21
	44	3.82	ACM125CS	880630		.00	5.0	.0	2.3	2.7	.0		85.21
	44	3.82	ACM125CS	890508		.00	30.0	.0	2.5	3.0	.0		85.21
RECYCLE	19	17.00	RES05	850911		2.21	.0	.0	1.4	1.5	.0		84.13
	19	17.00	RES05	860528		4.61	2.8	.0	2.3	2.8	.0		84.13
	19	17.00	RES05	870623		2.51	20.0	.0	2.7	3.4	.0		84.13
	19	17.00	RES05	880607		2.89	21.0	.0	3.0	3.4	.0		84.13
	19	17.00	RES05	890502		2.70	22.0	.0	3.5	4.3	.0	CLOSED	84.13
	160	.82	RECYCLE	850904		.04	.0	.0	.8	.8	.0		84.38
	160	.82	RECYCLE	860509		4.65	.0	.0	2.6	2.6	.0		84.38
	160	.82	RECYCLE	870604		.94	5.0	.0	3.4	3.4	.0		84.38
	160	.82	RECYCLE	880428		1.50	15.0	.2	2.8	2.8	.0		84.38
	160	.82	RECYCLE	890714		1.76	28.0	.0	2.9	2.9	.0		84.38
	372	17.49	RES	840823	*	11.06	.0	.2	2.0	2.0	.0		84.47
	372	17.49	RES	850910		.04	.0	.0	1.7	1.7	.0		84.47
	372	17.49	RES	860520		.41	3.9	.0	1.6	1.8	.2		84.47
	372	17.49	RES	870624		.49	20.0	.0	1.7	1.9	.2		84.47
	372	17.49	RES	880606		2.29	40.0	.0	1.7	1.9	.2		84.47
	372	17.49	RES	890502		2.96	50.0	.0	1.9	2.1	.2		84.47
	15	108.39	RE	850415	*	18.79	.0	.2	2.0	2.0	.0		85.12
	15	108.39	RE	850930		1.31	.0	.0	.9	1.3	.0		85.12
	15	108.39	RE	860519		12.08	3.5	.0	1.5	1.9	.0		85.12
	15	108.39	RE	870624		2.21	40.0	.0	1.6	2.1	.0		85.12
	15	108.39	RE	860629		2.33	50.0	.0	1.8	2.3	.0		85.12
	15	108.39	RE	890517		7.46	50.0	.0	1.9	2.0	.0		85.12
	20	86.02	RECS	850416	*	9.26	.0	.0	1.2	1.4	.0		85.13
	20	86.02	RECS	851002		.00	.0	.0	1.4	1.5	2.1		85.13
	20	86.02	RECS	860521		.19	.0	.0	1.4	1.5	4.6		85.13
	20	86.02	RECS	870609		.53	.0	.0	1.4	1.5	7.5		85.13
	20	86.02	RECS	880607		.53	.0	.0	1.4	1.5	12.5		85.13
	20	86.02	RECS	890503		2.55	.0	.0	1.8	2.0	12.5		85.13

DETAILED DISTRESS SURVEY BY TREATMENT TYPE

TREATMENT	HWY	TEST MILE POINT	TREAT CODE	DATE OF TEST	PRE	EQIV CRAK	WEA / RAV	POT HOLES	AVE RUT	MAX RUT	CHIP LOSS	CLOSED	JOBNUM
RECYCLE	49	35.24	RECS	850509	*	30.53	.0	.0	2.3	2.4	.0		85.24
	49	35.24	RECS	851002		.00	.0	.0	1.5	1.7	.0		85.24
	49	35.24	RECS	860521		2.55	.0	.0	1.5	1.7	2.0		85.24
	49	35.24	RECS	870609		1.95	.0	.0	1.5	1.7	2.0		85.24
	49	35.24	RECS	880608		3.23	.0	.0	1.5	1.7	2.0		85.24
	49	35.24	RECS	890504		3.86	.0	.0	1.7	2.0	2.0	CLOSED	85.24
	49	48.74	RECS	850509	*	20.06	.0	.0	1.7	1.8	.0		85.25
	49	48.74	RECS	851002		.00	.0	.0	1.3	1.5	.0		85.25
	49	48.74	RECS	860521		.00	.0	.0	1.2	1.2	1.4		85.25
	49	48.74	RECS	870609		.00	.0	.0	1.2	1.2	2.0		85.25
	49	48.74	RECS	880608		.00	.0	.0	1.4	1.5	2.0		85.25
	49	48.74	RECS	890504		.23	.0	.0	1.9	2.2	2.0	CLOSED	85.25
	423	4.40	RECS	860428	*	38.70	13.9	.0	2.1	2.8	.0		86.01
	423	4.40	RECS	860917		.00	.0	.0	2.6	2.6	.0		86.01
	423	4.40	RECS	870608		.00	.0	.0	2.7	2.9	.0		86.01
	423	4.40	RECS	880714		.00	5.0	.0	2.8	3.4	.0		86.01
	423	4.40	RECS	890606		.00	.0	.5	3.2	3.7	10.5		86.01
	20	23.10	RECS	850428	*	.00	.0	.0	2.4	2.4	.0		86.02
	20	23.10	RECS	860428	*	19.80	.0	.0	2.3	3.2	22.0		86.02
	20	23.10	RECS	860917		.00	.0	.0	2.9	3.4	.0		86.02
	20	23.10	RECS	870609		.00	.0	.0	3.0	3.4	.0		86.02
	20	23.10	RECS	880714		.00	.0	.0	3.4	4.1	1.5		86.02
	20	23.10	RECS	890605		4.69	.0	.0	3.6	4.0	1.5		86.02
	20	41.03	RECSWS	860428	*	22.95	9.0	.1	3.7	3.8	.0		86.03
	20	41.03	RECSWS	870609		.00	.0	.0	2.5	2.6	.0		86.03
	20	41.03	RECSWS	880607		.08	.0	.0	2.6	2.7	.0		86.03
	20	41.03	RECSWS	890503		.98	.0	.0	2.1	2.7	51.0		86.03
	371	11.00	RECS	860430	*	22.50	.0	.0	3.8	5.8	.0		86.05
	371	11.00	RECS	860924		.00	.0	.0	1.5	1.6	.0		86.05
	371	11.00	RECS	870922		.00	.0	.0	2.3	2.5	.0		86.05
	371	11.00	RECS	880629		.00	.0	.0	3.2	3.3	18.5		86.05
	371	11.00	RECS	890517		4.73	.0	.0	4.0	4.0	19.5		86.05
	41	12.10	RESS	860430	*	8.55	.0	.0	4.2	4.4	.0		86.06
	41	12.10	RESS	860918		.00	.0	.0	2.5	2.6	.0		86.06

:EATMENT	HWY	TEST MILE POINT	TREAT CODE	DATE OF TEST	PRE	EQIV CRAK	WEA / RAV	POT HOLES	AVE RUT	MAX RUT	CHIP LOSS	CLOSED	JOBNUM
:CYCLE	41	12.10	RESS	860924		.00	.0	.0	1.7	1.8	.0		86.06
	41	12.10	RESS	870622		.00	26.0	.0	3.4	3.6	.0		86.06
	41	12.10	RESS	880629		.00	27.0	.0	3.3	3.5	.0		86.06
	41	12.10	RESS	890517		.53	13.0	4.0	3.8	4.1	.0	CLOSED	86.06
	41	28.50	RECS	860430	*	11.89	.0	.0	1.4	1.9	.0		86.07
	41	28.50	RECS	860923		.00	.0	.0	1.6	2.2	.0		86.07
	41	28.50	RECS	870622		.00	.0	.0	2.9	3.5	2.4		86.07
	41	28.50	RECS	880628		.00	.0	.0	3.6	4.1	3.5		86.07
	41	28.50	RECS	890517		.08	.0	.2	4.0	4.4	13.5	CLOSED	86.07
	41	96.90	RE	860501	*	8.55	.0	.0	2.3	3.0	.0		86.09
	41	96.90	RE	860923		.00	.0	.0	1.7	2.4	.0		86.09
	41	96.90	RE	870506		.11	.0	.0	2.2	2.6	.0		86.09
	41	96.90	RE	880628		.15	.0	.0	2.8	3.2	.0		86.09
	41	96.90	RE	890510		.60	.0	.2	3.0	3.5	.0		86.09
	5	264.00	RE	860513	*	13.16	.0	.0	1.2	1.3	.0		86.10
	5	264.00	RE	860919		.00	.0	.0	1.2	1.4	.0		86.10
	5	264.00	RE	870505		.00	.0	.0	2.1	2.2	.0		86.10
	5	264.00	RE	880622		.11	2.5	.0	2.4	2.5	.0		86.10
	5	264.00	RE	890524		.15	2.5	.0	2.6	2.8	.0		86.10
	7	243.00	RE	860513	*	13.58	.0	.0	3.5	3.7	.0		86.11
	7	243.00	RE	860918		.00	.0	.0	1.8	2.0	.0		86.11
	7	243.00	RE	870504		.00	.0	.0	2.0	2.0	.0		86.11
	7	243.00	RE	880622		.00	2.5	.0	5.4	5.8	.0		86.11
	7	243.00	RE	890524		.04	14.5	.0	5.8	6.6	.0	CLOSED	86.11
IIP,SEAL	5	24.45	CS	840719	*	.75	.0	1.0	2.0	2.0	.0		84.02
	5	24.45	CS	850823		.56	.0	.0	1.0	1.1	.5		84.02
	5	24.45	CS	860602		.71	.0	.0	2.0	2.1	1.7		84.02
	5	24.45	CS	870728		.49	.0	.0	2.1	2.2	3.0		84.02
	5	24.45	CS	880627		.86	.0	.0	2.3	2.3	4.7		84.02
	5	24.45	CS	890509		1.28	.0	.0	2.2	2.3	9.8	CLOSED	84.02
	7	120.10	CS	840716	*	15.00	.0	.0	6.0	8.0	.0		84.05
	7	120.10	CS	850828		14.40	.0	.0	4.6	6.5	.0		84.05
	7	120.10	CS	860521		12.19	.0	.0	5.0	7.2	.0		84.05
	7	120.10	CS	870609		1.91	25.0	.0	2.6	3.1	.0		84.05
	7	120.10	CS	880623		4.01	.0	25.0	2.7	3.3	.0	CLOSED	84.05

DETAILED DISTRESS SURVEY BY TREATMENT TYPE

TREATMENT	HWY	TEST MILE POINT	TREAT CODE	DATE OF TEST	PRE	EQIV CRAK	WEA / RAV	POT HOLES	AVE RUT	MAX RUT	CHIP LOSS	CLOSED	JOBNUM
CHIP,SEAL	19	26.84	CS	840716	*	.00	.0	.0	2.0	2.0	.0		84.14
	19	26.84	CS	850830		9.19	.0	.0	4.3	4.6	.0		84.14
	19	26.84	CS	860520		11.78	.0	.0	4.5	5.2	.0		84.14
	19	26.84	CS	870623		4.95	.0	.0	5.3	5.9	.0		84.14
	19	26.84	CS	880607		6.94	.0	.0	5.4	6.1	.0	CLOSED	84.14
	19	121.00	CS	840716	*	.30	.0	.0	3.0	3.0	.0		84.15
	19	121.00	CS	850829		.00	.0	.0	2.5	2.8	.0		84.15
	19	121.00	CS	860520		.00	.0	.0	3.1	3.2	.0		84.15
	19	121.00	CS	870609		.00	.0	.0	3.3	3.4	.0		84.15
	19	121.00	CS	880608		.00	.0	.0	3.0	3.0	.0		84.15
	19	121.00	CS	890503		.56	.0	.0	3.1	3.2	.0		84.15
	37	50.95	CS	840723	*	.38	.0	.0	1.0	1.0	.0		84.23
	37	50.95	CS	850729		.00	.0	.0	3.0	3.1	.0		84.23
	37	50.95	CS	860507		.00	.3	.0	3.2	3.4	.3		84.23
	37	50.95	CS	870709		.00	.0	.0	4.3	4.8	.0		84.23
	37	50.95	CS	880712		.00	.0	.0	4.5	4.8	2.5		84.23
	37	50.95	CS	890612		.00	.0	.0	4.6	5.1	2.5		84.23
	48	3.14	CS	840717	*	2.63	.0	.0	2.0	2.0	.0		84.24
	48	3.14	CS	850827		12.60	.0	.8	2.8	3.0	.0		84.24
	48	3.14	CS	860614		29.70	.0	.8	3.0	3.1	.0		84.24
	48	3.14	CS	870610		10.20	.0	.8	3.1	3.2	.0	CLOSED	84.24
	48	6.95	CS	840717	*	.00	2.0	.0	5.0	5.0	.0		84.25
	48	6.95	CS	850828		.15	.0	.0	1.9	2.5	.0		84.25
	48	6.95	CS	860604		.08	.0	.0	2.3	3.0	.0		84.25
	48	6.95	CS	870610		.08	.0	.0	2.2	2.8	.0	CLOSED	84.25
	48	50.95	CS	840717	*	.00	.0	.0	.0	.0	.0		84.26
	48	50.95	CS	850828		.71	.0	.0	1.3	1.4	.0		84.26
	48	50.95	CS	860521		2.89	.0	.0	1.5	1.6	.0		84.26
	48	50.95	CS	870610		1.54	.0	.0	1.8	2.0	.0		84.26
	48	50.95	CS	880609		5.21	.0	.0	2.0	2.3	.0	CLOSED	84.26
	71	2.00	CS	840717	*	3.75	.0	.0	1.0	1.0	.0		84.27
	71	2.00	CS	850822		3.15	.0	.0	.9	1.0	.0		84.27
	71	2.00	CS	860513		4.80	.0	.0	1.1	1.2	.0		84.27
	71	2.00	CS	870505		4.65	.0	.0	1.1	1.2	.0		84.27

DETAILED DISTRESS SURVEY BY TREATMENT TYPE

TREATMENT	HWY	TEST MILE POINT	TREAT CODE	DATE OF TEST	PRE	EQIV CRAK	WEA / RAV	POT HOLES	AVE RUT	MAX RUT	CHIP LOSS	CLOSED	JOBNUM
CHIP,SEAL	71	2.00	CS	880628		4.84	.0	.0	1.3	1.5	.0		84.27
	71	2.00	CS	890510		6.98	.0	.0	1.3	1.5	.5		84.27
	290	8.60	CS	840720	*	.75	1.0	.0	1.0	1.0	.0		84.45
	290	8.60	CS	850819		.00	.0	.0	1.4	1.6	.0		84.45
	290	8.60	CS	860602		.15	.0	.0	2.5	2.6	11.0		84.45
	290	8.60	CS	870729		.60	.0	.0	2.7	3.1	15.0		84.45
	290	8.60	CS	880630		1.54	.0	.0	2.8	3.1	20.0		84.45
	290	8.60	CS	890508		.38	.0	.0	2.2	2.4	20.0	CLOSED	84.45
	7	163.83	CS	850508	*	.04	3.0	.0	1.5	2.1	.0		85.05
	7	163.83	CS	851003		.00	.0	.0	2.2	2.4	.0		85.05
	7	163.83	CS	860521		.00	.0	.0	2.3	2.9	.0		85.05
	7	163.83	CS	870610		.00	.0	.0	2.3	2.9	.0		85.05
	7	163.83	CS	880622		.00	.0	.0	2.3	2.9	.0	CLOSED	85.05
	8	18.00	CS	850507	*	1.24	3.1	.7	.9	1.4	.0		85.07
	8	18.00	CS	851008		.00	.0	.0	2.0	2.4	.0		85.07
	8	18.00	CS	860512		.38	.0	.0	1.6	1.9	8.2		85.07
	8	18.00	CS	870511		.34	.0	.0	1.6	1.9	4.0		85.07
	8	18.00	CS	880620		.34	.0	.0	1.6	1.9	5.5		85.07
	8	18.00	CS	890516		.90	.0	.0	1.5	1.9	8.5		85.07
	28	101.75	CS	850507	*	7.13	.0	.0	1.0	1.4	.0		85.18
	28	101.75	CS	851017		.00	.0	.0	2.0	2.0	.0		85.18
	28	101.75	CS	860604		.49	.0	.0	2.0	2.0	1.0		85.18
	28	101.75	CS	870506		.71	.0	.0	2.0	2.0	1.0		85.18
	28	101.75	CS	880627		1.73	.0	.0	2.1	2.2	1.0		85.18
	28	101.75	CS	890510		9.15	.0	1.8	2.0	2.0	1.0	CLOSED	85.18
	48	55.34	CS	850508	*	28.39	.0	.0	.9	1.2	.0		85.23
	48	55.34	CS	851010		.08	.0	.0	1.6	1.7	.6		85.23
	48	55.34	CS	860526		2.63	.0	.0	1.6	1.7	3.0		85.23
	48	55.34	CS	870610		3.26	.0	.1	1.6	1.7	7.5		85.23
	48	55.34	CS	880609		6.08	.0	.2	1.7	1.8	12.5	CLOSED	85.23
	49	73.03	CS	850416	*	9.23	7.6	.1	.6	.6	.0		85.26
	49	73.03	CS	851002		.00	.0	.0	1.0	1.0	.0		85.26
	49	73.03	CS	860521		.60	.0	.0	2.1	2.4	7.5		85.26
	49	73.03	CS	870727		.83	.0	.0	2.1	2.1	9.0		85.26
	49	73.03	CS	880608		1.46	.0	.0	2.2	2.3	9.0		85.26

TREATMENT	HWY	TEST MILE POINT	TREAT CODE	DATE OF TEST	PRE	EQIV CRAK	WEA / RAV	POT HOLES	AVE RUT	MAX RUT	CHIP LOSS	CLOSED	JOBNUM
CHIP,SEAL	49	73.03	CS	890504		1.31	.0	.0	2.0	2.1	9.0		85.26
CHIP,WSTLR	130	.20	CSWS	840806	*	.00	1.0	.0	1.0	1.0	.0		84.35
	130	.20	CSWS	850801		2.81	.0	.5	2.9	3.5	1.1		84.35
	130	.20	CSWS	860417		12.30	.0	.0	2.9	3.0	.5		84.35
	130	.20	CSWS	870706		.00	5.0	.7	4.6	5.2	12.5		84.35
	130	.20	CSWS	880414		1.05	2.0	.0	1.2	1.4	4.5	CLOSED	84.35
	160	4.41	CSWS	840814		.45	.0	.0	1.0	1.0	.0		84.39
	160	4.41	CSWS	850904		3.90	.0	.0	3.1	3.4	.0		84.39
	160	4.41	CSWS	860509		11.78	.0	.0	3.6	3.6	.0		84.39
	160	4.41	CSWS	870604		.00	.0	.0	4.0	4.4	.5		84.39
	160	4.41	CSWS	880711		.00	.0	.0	4.4	4.6	.5		84.39
	160	4.41	CSWS	890714		.26	.0	.0	4.6	5.4	.8	CLOSED	84.39
	210	12.88	CSWS	850731		8.78	.0	.0	2.1	2.3	.3		84.40
	210	12.88	CSWS	860528		10.65	.2	.2	3.4	3.9	.7	CLOSED	84.40
	210	12.88	CSWS	870721		.00	.0	.0	.0	.0	.0		84.40
	210	13.12	CSWS	850903		1.76	.0	.1	2.6	2.8	.8		84.41
	210	13.12	CSWS	860528		35.74	.4	.0	3.5	3.7	.3	CLOSED	84.41
	210	13.12	CSWS	870721		.00	.0	.0	.0	.0	.0		84.41
	210	13.32	CSWS	850903		1.28	.0	.0	1.4	1.9	.0		84.42
	210	13.32	CSWS	860528		2.96	.0	.0	2.4	2.7	1.4	CLOSED	84.42
	215	10.30	CSWS	840815		.60	.5	.0	1.0	1.0	.0		84.43
	215	10.30	CSWS	850909		2.85	.0	.0	2.5	2.5	.0		84.43
	215	10.30	CSWS	860519		4.35	.0	.0	3.2	3.6	.0		84.43
	215	10.30	CSWS	870625		.00	.0	.2	3.4	3.9	11.0		84.43
	215	10.30	CSWS	880713		2.18	.0	.0	4.1	4.4	11.0	CLOSED	84.43
	2	12.01	CSWS	850614	*	7.24	.0	.0	3.7	4.7	.0		85.01
	2	12.01	CSWS	851103		.00	.0	.0	2.7	3.8	.0		85.01
	2	12.01	CSWS	860507		.98	2.0	.0	4.4	5.6	.0	CLOSED	85.01
	2	188.63	CSWS	850506	*	1.46	.0	.0	1.8	1.9	.0		85.02
	2	188.63	CSWS	851007		.00	.0	.0	2.4	2.8	.0		85.02
	2	188.63	CSWS	860603		.04	.0	.0	2.8	3.1	.2		85.02

DETAILED DISTRESS SURVEY BY TREATMENT TYPE

TREATMENT	HWY	TEST MILE POINT	TREAT CODE	DATE OF TEST	PRE	EQIV CRAK	WEA / RAV	POT HOLES	AVE RUT	MAX RUT	CHIP LOSS	CLOSED	JOBNUM
CHIP,WSTLR	2	188.63	CSWS	870728		.04	.0	.0	3.0	3.2	.1		85.02
	2	188.63	CSWS	880620		.26	.0	.0	2.9	3.1	.1		85.02
	2	188.63	CSWS	890515		.64	.0	.0	2.7	3.2	.1		85.02
	4	86.25	CSWS	850510	*	25.01	.1	.0	1.9	2.1	.0		85.03
	4	86.25	CSWS	860605		.00	.0	.0	2.3	2.6	.3		85.03
	4	86.25	CSWS	870624		.00	.0	.0	2.8	2.8	.6		85.03
	4	86.25	CSWS	880629		.08	.0	.0	2.9	3.2	.6		85.03
	4	86.25	CSWS	890516		.15	.0	.2	3.0	3.3	1.7		85.03
	9	196.43	CSWS	850425	*	15.64	.0	.0	1.0	1.1	.0		85.09
	9	196.43	CSWS	851031		3.26	.0	.0	1.7	2.1	.5		85.09
	9	196.43	CSWS	860616		3.83	.0	.0	2.8	3.0	2.4		85.09
	9	196.43	CSWS	870518		3.83	.0	.0	3.5	4.0	3.4		85.09
	9	196.43	CSWS	880511		3.98	.0	.3	3.5	4.0	14.7		85.09
	9	196.43	CSWS	890607		2.10	.0	.0	3.9	4.9	14.7		85.09
	26	47.50	CSWS	850612	*	.11	.5	.0	1.2	1.3	.0		85.16
	26	47.50	CSWS	851021		.00	.0	.0	1.7	2.0	.0		85.16
	26	47.50	CSWS	860508		.00	.0	.6	1.5	1.9	.0	CLOSED	85.16
	35	65.17	CSWS	850425	*	11.40	.0	.0	1.2	1.3	.0		85.20
	35	65.17	CSWS	851029		1.69	.0	.0	2.0	2.3	.0		85.20
	35	65.17	CSWS	860616		6.86	.0	.0	2.3	2.6	.0		85.20
	35	65.17	CSWS	870519		4.50	.0	.0	3.1	3.3	.1		85.20
	35	65.17	CSWS	880512		4.50	.0	.0	2.8	3.0	.1		85.20
	35	65.17	CSWS	890608		2.21	.0	1.0	2.9	3.1	.0		85.20
	47	40.11	CSWS	850613	*	6.00	.0	.5	1.7	2.0	.0		85.22
	47	40.11	CSWS	851104		.00	.0	.0	2.4	2.9	.0		85.22
	47	40.11	CSWS	860527		1.76	.0	.0	3.0	3.4	6.2		85.22
	47	40.11	CSWS	870707		.19	42.5	.0	3.1	4.0	17.5	CLOSED	85.22
	103	4.29	CSWS	850613	*	16.05	.0	.0	1.9	2.3	.0		85.33
	103	4.29	CSWS	851105		.00	.0	.0	2.8	3.9	.0		85.33
	103	4.29	CSWS	860527		.15	.0	.0	3.0	4.0	.0		85.33
	103	4.29	CSWS	870707		.15	.0	.0	4.5	5.8	.0		85.33
	103	4.29	CSWS	880712		.15	.0	.0	4.6	6.0	.0		85.33
	103	4.29	CSWS	890612		.15	.0	.2	5.0	6.5	.0		85.33
	23	9.51	CSWS	850424		10.09	.9	.0	2.0	2.2	.0		85.36

TREATMENT	HWY	TEST MILE POINT	TREAT CODE	DATE OF TEST	PRE	EQIV CRAK	WEA / RAV	POT HOLES	AVE RUT	MAX RUT	CHIP LOSS	CLOSED	JOBNUM
CHIP,WSTLR	231	9.51	CSWS	851028		.00	.0	.0	2.3	2.4	.0		85.36
	231	9.51	CSWS	860616		.00	.0	.0	3.2	3.2	.0		85.36
	231	9.51	CSWS	870518		.00	.0	.0	3.4	3.4	.0		85.36
	231	9.51	CSWS	880512		.00	.0	.0	3.4	3.4	.0		85.36
	231	9.51	CSWS	890608		.00	.0	.0	3.4	3.5	.0		85.36
OILMAT	5	142.95	OM075	840717	*	9.00	.0	.0	2.0	2.0	.0		84.03
	5	142.95	OM075	850827		.34	.0	.0	2.2	2.2	.0		84.03
	5	142.95	OM075	860604		4.05	.0	.0	2.5	2.7	.0		84.03
	5	142.95	OM075	870610		4.43	.0	.0	2.5	2.7	.0		84.03
	5	142.95	OM075	880628		4.54	.0	.0	3.2	3.3	.0		84.03
	5	142.95	OM075	890509		6.38	8.5	.0	3.3	3.4	.0		84.03
	12	21.75	OM063	840708	*	.00	2.0	.0	3.0	3.0	.0		84.09
	12	21.75	OM063	850821		.00	.0	.0	1.0	1.2	.0		84.09
	12	21.75	OM063	860513		.00	29.5	.0	1.3	1.5	.0		84.09
	12	21.75	OM063	870513		.00	55.5	.0	1.3	1.5	.0		84.09
	12	21.75	OM063	880615		.00	.0	.0	.0	.0	.0	CLOSED	84.09
	28	118.00	OM075	840717	*	.00	.0	.0	4.0	4.0	.0		84.19
	28	118.00	OM075	850827		.00	.0	.0	1.6	2.5	.0		84.19
	28	118.00	OM075	860604		.11	.0	.0	2.2	2.8	.0		84.19
	28	118.00	OM075	870506		.11	.0	.0	2.4	3.2	.0		84.19
	28	118.00	OM075	880628		.08	.0	.0	2.6	3.4	.0		84.19
	28	118.00	OM075	890510		.30	.0	.0	2.6	3.4	.0		84.19
	71	29.07	OM075	840717	*	3.00	5.0	.0	2.0	2.0	.0		84.28
	71	29.07	OM075	850822		.08	.0	.0	3.1	3.3	.0		84.28
	71	29.07	OM075	860513		4.35	.0	.0	2.9	3.4	.0		84.28
	71	29.07	OM075	870505		4.28	.0	.0	3.4	3.7	.0		84.28
	71	29.07	OM075	880621		2.63	10.0	.0	3.6	4.1	.0	CLOSED	84.28
	71	41.05	OM075	840718	*	4.50	.0	.0	2.0	2.0	.0		84.29
	71	41.05	OM075	850822		.08	.0	.0	2.2	2.3	.0		84.29
	71	41.05	OM075	860513		.79	.0	.0	2.4	2.5	.0		84.29
	71	41.05	OM075	870513		1.61	.2	.0	3.2	3.9	.0		84.29
	71	41.05	OM075	880621		2.29	.4	.0	3.4	4.1	.0	CLOSED	84.29
	351	5.00	OM038	840718	*	.00	5.0	.0	2.0	2.0	.0		84.46
	351	5.00	OM038	850820		.00	.3	.0	3.5	3.5	.0		84.46
	351	5.00	OM038	860512		.00	.6	.0	3.5	3.8	.0		84.46

DETAILED DISTRESS SURVEY BY TREATMENT TYPE

TREATMENT	HWY	TEST MILE POINT	TREAT CODE	DATE OF TEST	PRE	EQIV CRAK	WEA / RAV	POT HOLES	AVE RUT	MAX RUT	CHIP LOSS	CLOSED	JOBNUM
OILMAT	351	5.00	OM038	870512		.00	2.6	.1	3.7	3.8	.0		84.46
	351	5.00	OM038	880615		.00	3.1	.0	3.7	3.8	.0		84.46
	351	5.00	OM038	890523		.00	17.7	.3	4.2	4.4	.0		84.46
	415	35.83	OM075	840718	*	.00	1.0	1.0	2.0	2.0	.0		84.48
	415	35.83	OM075	850821		.00	.0	.0	2.5	3.0	.0		84.48
	415	35.83	OM075	860513		.00	.0	.0	2.5	2.9	.0		84.48
	415	35.83	OM075	870505		.00	.0	.0	2.6	3.0	.0		84.48
	415	35.83	OM075	880621		.15	5.0	.0	2.9	3.6	.0		84.48
	415	35.83	OM075	890523		.15	10.0	.0	3.2	3.8	.0		84.48
	28	22.41	OM063	850418	*	3.45	.0	.0	2.5	3.2	.0		85.17
	28	22.41	OM063	851008		.00	.0	.0	2.5	2.9	.0		85.17
	28	22.41	OM063	860603		.00	.0	.0	3.5	4.2	.0		85.17
	28	22.41	OM063	870511		.00	.0	.0	3.5	4.2	.0		85.17
	28	22.41	OM063	880621		.30	15.0	.0	3.5	4.2	.0		85.17
	28	22.41	OM063	890516		.79	17.0	.0	3.5	4.2	.0		85.17
	321	19.79	OM075	850418	*	.60	.0	.0	2.3	2.6	.0		85.37
	321	19.79	OM075	851016		.00	.0	.0	2.7	3.0	.0		85.37
	321	19.79	OM075	860613		.15	5.8	.0	3.0	3.2	.0		85.37
	321	19.79	OM075	870728		.00	31.0	.0	3.1	3.2	.0		85.37
	321	19.79	OM075	880627		.00	41.0	.0	3.2	3.3	.0		85.37
	321	19.79	OM075	890509		.00	52.0	.0	3.2	3.3	.0		85.37
	342	16.82	OM125	850418	*	17.29	.3	.0	2.5	3.6	.0		85.38
	342	16.82	OM125	870512		.00	1.0	.0	2.1	2.1	.0		85.38
	342	16.82	OM125	880616		.00	7.5	.0	2.1	2.2	.0		85.38
	342	16.82	OM125	890522		1.80	36.5	.0	1.9	2.0	.0		85.38

TRTYPE	JOBNUM	TRTYPE	HWYNUM	TSBMP	COND84	COND85	COND86	COND87	COND88	COND89
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ASPHALT,DENSE	84.06	ASPHALT,DENSE	9	331.20	.0	2.0	2.0	2.0	2.0	2.5
	84.08	ASPHALT,DENSE	10	65.70	.0	.0	2.0	2.0	3.0	3.5
	84.16	ASPHALT,DENSE	25	.85	.0	2.0	2.0	2.0	2.0	2.6
	84.17	ASPHALT,DENSE	26	23.00	.0	1.0	2.0	2.0	2.0	2.2
	84.21	ASPHALT,DENSE	35	31.75	.0	2.0	2.0	2.0	2.0	2.7
	84.22	ASPHALT,DENSE	37	47.00	.0	2.0	2.0	2.0	2.0	2.2
	84.31	ASPHALT,DENSE	91	58.66	.0	1.0	1.0	1.0	2.0	2.2
	84.32	ASPHALT,DENSE	91	66.00	.0	1.0	1.0	1.0	2.0	2.1
	84.33	ASPHALT,DENSE	92	3.00	.0	1.0	2.0	2.0	2.0	2.1
	84.36	ASPHALT,DENSE	140	48.00	.0	2.0	2.0	2.0	2.0	2.2
	84.44	ASPHALT,DENSE	272	20.95	.0	2.0	2.0	2.0	2.0	2.5
	85.04	ASPHALT,DENSE	6	168.04	.0	.0	2.0	2.0	2.0	2.0
	85.06	ASPHALT,DENSE	7	266.52	.0	.0	2.0	2.0	2.0	2.0
	85.27	ASPHALT,DENSE	66	10.67	.0	2.0	1.0	1.0	2.0	2.9
	85.28	ASPHALT,DENSE	66	43.11	.0	.0	2.0	2.0	2.0	2.2
	85.29	ASPHALT,DENSE	91	19.58	.0	.0	2.0	2.0	2.5	2.8
	85.30	ASPHALT,DENSE	91	64.00	.0	.0	1.0	1.0	2.0	2.1
	85.32	ASPHALT,DENSE	92	86.23	.0	1.0	2.0	2.0	2.0	2.2
	85.34	ASPHALT,DENSE	171	1.64	.0	1.0	1.0	1.0	1.0	2.0
	85.35	ASPHALT,DENSE	171	2.21	.0	1.0	1.0	1.0	1.0	2.0
ASPHALT,OPEN	84.01	ASPHALT,OPEN	4	283.19	.0	2.5	3.0	2.0	2.0	3.0
	84.04	ASPHALT,OPEN	7	1.00	.0	3.0	3.0	3.0	3.0	3.0
	84.10	ASPHALT,OPEN	19	2.32	.0	3.0	3.0	3.0	3.0	3.0
	84.12	ASPHALT,OPEN	19	8.30	.0	3.0	3.0	3.0	3.0	3.0
	84.18	ASPHALT,OPEN	26	32.45	.0	1.0	2.0	2.0	2.0	2.6
	84.34	ASPHALT,OPEN	102	30.00	.0	2.0	2.0	2.0	2.0	2.3
	85.10	ASPHALT,OPEN	9	317.05	.0	.0	2.0	2.0	2.0	2.0
	85.11	ASPHALT,OPEN	15	20.10	.0	.0	1.0	1.0	2.0	2.5
	85.14	ASPHALT,OPEN	21	2.01	.0	.0	1.0	1.0	2.0	2.0
	85.15	ASPHALT,OPEN	25	8.46	.0	.0	2.0	2.0	2.0	2.0
	85.21	ASPHALT,OPEN	44	3.82	.0	.0	2.0	2.0	2.0	2.0
CHIP,SEAL	84.02	CHIP,SEAL	5	24.45	.0	2.0	3.0	2.5	3.0	3.5
	84.05	CHIP,SEAL	7	120.10	.0	3.0	3.0	3.0	3.0	.0
	84.14	CHIP,SEAL	19	26.84	.0	3.0	3.0	3.0	3.0	3.6
	84.15	CHIP,SEAL	19	121.00	2.0	2.0	3.0	3.0	3.0	3.0
	84.23	CHIP,SEAL	37	50.95	.0	2.0	2.0	2.0	2.0	2.0
	84.24	CHIP,SEAL	48	3.14	.0	3.0	3.0	3.0	3.0	3.0
	84.25	CHIP,SEAL	48	6.95	.0	3.0	3.0	3.0	3.0	3.0
	84.26	CHIP,SEAL	48	50.95	.0	2.0	2.0	2.0	4.0	3.0
	84.27	CHIP,SEAL	71	2.00	.0	3.0	3.0	3.0	3.0	3.5
	84.45	CHIP,SEAL	290	8.60	.0	3.0	3.0	3.0	3.0	2.0
	85.05	CHIP,SEAL	7	163.83	.0	.0	2.0	2.0	3.0	3.0
	85.07	CHIP,SEAL	8	18.00	.0	.0	2.0	2.0	2.0	2.0
	85.18	CHIP,SEAL	28	101.75	.0	.0	2.0	2.0	2.0	2.2
	85.23	CHIP,SEAL	48	55.34	.0	.0	2.0	2.0	4.0	.0
	85.26	CHIP,SEAL	49	73.03	.0	.0	2.0	2.0	2.0	2.2
CHIP,WSTLR	84.35	CHIP,WSTLR	130	.20	.0	2.0	3.0	3.0	3.0	.0
	84.39	CHIP,WSTLR	160	4.41	.0	2.0	2.0	2.0	3.0	4.0
	84.40	CHIP,WSTLR	210	12.88	.0	3.0	3.0	3.0	3.0	.0
	84.41	CHIP,WSTLR	210	13.12	.0	3.0	3.0	3.0	3.0	.0
	84.42	CHIP,WSTLR	210	13.32	.0	3.0	3.0	3.0	3.0	.0
	84.43	CHIP,WSTLR	215	10.30	.0	.0	3.0	3.0	3.0	.0

Appendix G

APPENDIX G

Pavement Condition Rating Data

TRTYPE	JOBNUM	TRTYPE	HWYNUM	TSBMP	COND84	COND85	COND86	COND87	COND88	COND89
CHIP,WSTLR	85.01	CHIP,WSTLR	2	12.01	.0	.0	4.0	4.0	.0	.0
	85.02	CHIP,WSTLR	2	188.63	.0	.0	3.0	3.5	3.5	3.5
	85.03	CHIP,WSTLR	4	86.25	.0	.0	2.0	2.0	2.0	3.0
	85.09	CHIP,WSTLR	9	196.43	.0	.0	2.0	2.0	3.0	3.2
	85.16	CHIP,WSTLR	26	47.50	.0	.0	2.0	2.0	.0	.0
	85.20	CHIP,WSTLR	35	65.17	.0	.0	2.0	2.0	2.0	2.4
	85.22	CHIP,WSTLR	47	40.11	.0	.0	2.0	2.0	3.0	.0
	85.33	CHIP,WSTLR	103	4.29	.0	2.0	3.0	3.0	3.0	3.4
	85.36	CHIP,WSTLR	231	9.51	.0	.0	2.0	2.0	3.0	3.1
OILMAT	84.03	OILMAT	5	142.95	.0	.0	2.5	2.5	2.5	2.5
	84.09	OILMAT	12	21.75	.0	3.0	3.2	3.0	3.0	4.0
	84.19	OILMAT	28	118.00	.0	3.0	3.0	3.0	3.0	3.0
	84.28	OILMAT	71	29.07	.0	3.0	3.0	3.0	3.0	3.0
	84.29	OILMAT	71	41.05	.0	3.0	3.0	3.0	3.0	3.0
	84.46	OILMAT	351	5.00	.0	3.0	3.0	3.0	3.0	3.2
	84.48	OILMAT	415	35.83	.0	3.0	3.0	3.0	3.0	3.5
	85.17	OILMAT	28	22.41	.0	2.0	2.0	2.0	3.0	3.2
	85.37	OILMAT	321	19.79	.0	2.0	3.0	3.0	3.0	3.5
	85.38	OILMAT	342	16.82	.0	.0	.0	3.0	3.0	3.0
RECYCLE	84.13	RECYCLE	19	17.00	.0	3.0	3.0	3.0	3.0	3.0
	84.38	RECYCLE	160	.82	.0	2.0	2.0	3.0	3.0	3.1
	84.47	RECYCLE	372	17.49	.0	.0	3.0	3.0	3.0	3.3
	85.12	RECYCLE	15	108.39	.0	2.0	2.0	2.0	2.0	3.5
	85.13	RECYCLE	20	86.02	.0	.0	1.0	1.0	2.0	2.2
	85.24	RECYCLE	49	35.24	.0	.0	2.0	2.0	2.0	3.0
	85.25	RECYCLE	49	48.74	.0	.0	2.0	2.0	2.0	3.0
	86.01	RECYCLE	423	4.40	.0	.0	.0	2.0	2.0	3.0
	86.02	RECYCLE	20	23.10	.0	.0	.0	2.0	3.0	3.0
	86.03	RECYCLE	20	41.03	.0	.0	.0	2.0	2.0	2.5
	86.05	RECYCLE	371	11.00	.0	.0	.0	2.0	2.0	2.5
	86.06	RECYCLE	41	12.10	.0	.0	2.0	2.0	3.0	3.4
	86.07	RECYCLE	41	28.50	.0	.0	.0	2.0	2.0	2.6
	86.09	RECYCLE	41	96.90	.0	.0	.0	1.0	1.0	2.5
	86.10	RECYCLE	5	264.00	.0	.0	.0	2.0	2.0	2.2
	86.11	RECYCLE	7	243.00	.0	.0	.0	2.0	3.0	3.0

Appendix G

JOBNUM	TRTYPE	HWYNUM	TSBMP	COND84	COND85	COND86	COND87	COND88	COND89
84.01	ASPHALT,OPEN	4	283.19	.0	2.5	3.0	2.0	2.0	3.0
84.02	CHIP,SEAL	5	24.45	.0	2.0	3.0	2.5	3.0	3.5
84.03	OILMAT	5	142.95	.0	.0	2.5	2.5	2.5	2.5
84.04	ASPHALT,OPEN	7	1.00	.0	3.0	3.0	3.0	3.0	3.0
84.05	CHIP,SEAL	7	120.10	.0	3.0	3.0	3.0	3.0	.0
84.06	ASPHALT,DENSE	9	331.20	.0	2.0	2.0	2.0	2.0	2.5
84.08	ASPHALT,DENSE	10	65.70	.0	.0	2.0	2.0	3.0	3.5
84.09	OILMAT	12	21.75	.0	3.0	3.2	3.0	3.0	4.0
84.10	ASPHALT,OPEN	19	2.32	.0	3.0	3.0	3.0	3.0	3.0
84.12	ASPHALT,OPEN	19	8.30	.0	3.0	3.0	3.0	3.0	3.0
84.13	RECYCLE	19	17.00	.0	3.0	3.0	3.0	3.0	3.0
84.14	CHIP,SEAL	19	26.84	.0	3.0	3.0	3.0	3.0	3.6
84.15	CHIP,SEAL	19	121.00	2.0	2.0	3.0	3.0	3.0	3.0
84.16	ASPHALT,DENSE	25	.85	.0	2.0	2.0	2.0	2.0	2.6
84.17	ASPHALT,DENSE	26	23.00	.0	1.0	2.0	2.0	2.0	2.2
84.18	ASPHALT,OPEN	26	32.45	.0	1.0	2.0	2.0	2.0	2.6
84.19	OILMAT	28	118.00	.0	3.0	3.0	3.0	3.0	3.0
84.21	ASPHALT,DENSE	35	31.75	.0	2.0	2.0	2.0	2.0	2.7
84.22	ASPHALT,DENSE	37	47.00	.0	2.0	2.0	2.0	2.0	2.2
84.23	CHIP,SEAL	37	50.95	.0	2.0	2.0	2.0	2.0	2.0
84.24	CHIP,SEAL	48	3.14	.0	3.0	3.0	3.0	3.0	3.0
84.25	CHIP,SEAL	48	6.95	.0	3.0	3.0	3.0	3.0	3.0
84.26	CHIP,SEAL	48	50.95	.0	2.0	2.0	2.0	4.0	3.0
84.27	CHIP,SEAL	71	2.00	.0	3.0	3.0	3.0	3.0	3.5
84.28	OILMAT	71	29.07	.0	3.0	3.0	3.0	3.0	3.0
84.29	OILMAT	71	41.05	.0	3.0	3.0	3.0	3.0	3.0
84.31	ASPHALT,DENSE	91	58.66	.0	1.0	1.0	1.0	2.0	2.2
84.32	ASPHALT,DENSE	91	66.00	.0	1.0	1.0	1.0	2.0	2.1
84.33	ASPHALT,DENSE	92	3.00	.0	1.0	2.0	2.0	2.0	2.1
84.34	ASPHALT,OPEN	102	30.00	.0	2.0	2.0	2.0	2.0	2.3
84.35	CHIP,WSTLR	130	.20	.0	2.0	3.0	3.0	3.0	.0
84.36	ASPHALT,DENSE	140	48.00	.0	2.0	2.0	2.0	2.0	2.2
84.38	RECYCLE	160	.82	.0	2.0	2.0	3.0	3.0	3.1
84.39	CHIP,WSTLR	160	4.41	.0	2.0	2.0	2.0	3.0	4.0
84.40	CHIP,WSTLR	210	12.88	.0	3.0	3.0	3.0	3.0	.0
84.41	CHIP,WSTLR	210	13.12	.0	3.0	3.0	3.0	3.0	.0
84.42	CHIP,WSTLR	210	13.32	.0	3.0	3.0	3.0	3.0	.0
84.43	CHIP,WSTLR	215	10.30	.0	.0	3.0	3.0	3.0	.0
84.44	ASPHALT,DENSE	272	20.95	.0	2.0	2.0	2.0	2.0	2.5
84.45	CHIP,SEAL	290	8.60	.0	3.0	3.0	3.0	3.0	2.0
84.46	OILMAT	351	5.00	.0	3.0	3.0	3.0	3.0	3.2
84.47	RECYCLE	372	17.49	.0	.0	3.0	3.0	3.0	3.3
84.48	OILMAT	415	35.83	.0	3.0	3.0	3.0	3.0	3.5
85.01	CHIP,WSTLR	2	12.01	.0	.0	4.0	4.0	.0	.0
85.02	CHIP,WSTLR	2	188.63	.0	.0	3.0	3.5	3.5	3.5
85.03	CHIP,WSTLR	4	86.25	.0	.0	2.0	2.0	2.0	3.0
85.04	ASPHALT,DENSE	6	168.04	.0	.0	2.0	2.0	2.0	2.0
85.05	CHIP,SEAL	7	163.83	.0	.0	2.0	2.0	3.0	3.0
85.06	ASPHALT,DENSE	7	266.52	.0	.0	2.0	2.0	2.0	2.0
85.07	CHIP,SEAL	8	18.00	.0	.0	2.0	2.0	2.0	2.0
85.09	CHIP,WSTLR	9	196.43	.0	.0	2.0	2.0	3.0	3.2
85.10	ASPHALT,OPEN	9	317.05	.0	.0	2.0	2.0	2.0	2.0

JOBNUM	TRTYPE	HWYNUM	TSBMP	COND84	COND85	COND86	COND87	COND88	COND89
85.11	ASPHALT,OPEN	15	20.10	.0	.0	1.0	1.0	2.0	2.5
85.12	RECYCLE	15	108.39	.0	2.0	2.0	2.0	2.0	3.5
85.13	RECYCLE	20	86.02	.0	.0	1.0	1.0	2.0	2.2
85.14	ASPHALT,OPEN	21	2.01	.0	.0	1.0	1.0	2.0	2.0
85.15	ASPHALT,OPEN	25	8.46	.0	.0	2.0	2.0	2.0	2.0
85.16	CHIP,WSTLR	26	47.50	.0	.0	2.0	2.0	.0	.0
85.17	OILMAT	28	22.41	.0	2.0	2.0	2.0	3.0	3.2
85.18	CHIP,SEAL	28	101.75	.0	.0	2.0	2.0	2.0	2.2
85.20	CHIP,WSTLR	35	65.17	.0	.0	2.0	2.0	2.0	2.4
85.21	ASPHALT,OPEN	44	3.82	.0	.0	2.0	2.0	2.0	2.0
85.22	CHIP,WSTLR	47	40.11	.0	.0	2.0	2.0	3.0	.0
85.23	CHIP,SEAL	48	55.34	.0	.0	2.0	2.0	4.0	.0
85.24	RECYCLE	49	35.24	.0	.0	2.0	2.0	2.0	3.0
85.25	RECYCLE	49	48.74	.0	.0	2.0	2.0	2.0	3.0
85.26	CHIP,SEAL	49	73.03	.0	.0	2.0	2.0	2.0	2.2
85.27	ASPHALT,DENSE	66	10.67	.0	2.0	1.0	1.0	2.0	2.9
85.28	ASPHALT,DENSE	66	43.11	.0	.0	2.0	2.0	2.0	2.2
85.29	ASPHALT,DENSE	91	19.58	.0	.0	2.0	2.0	2.5	2.8
85.30	ASPHALT,DENSE	91	64.00	.0	.0	1.0	1.0	2.0	2.1
85.32	ASPHALT,DENSE	92	86.23	.0	1.0	2.0	2.0	2.0	2.2
85.33	CHIP,WSTLR	103	4.29	.0	2.0	3.0	3.0	3.0	3.4
85.34	ASPHALT,DENSE	171	1.64	.0	1.0	1.0	1.0	1.0	2.0
85.35	ASPHALT,DENSE	171	2.21	.0	1.0	1.0	1.0	1.0	2.0
85.36	CHIP,WSTLR	231	9.51	.0	.0	2.0	2.0	3.0	3.1
85.37	OILMAT	321	19.79	.0	2.0	3.0	3.0	3.0	3.5
85.38	OILMAT	342	16.82	.0	.0	.0	3.0	3.0	3.0
86.01	RECYCLE	423	4.40	.0	.0	.0	2.0	2.0	3.0
86.02	RECYCLE	20	23.10	.0	.0	.0	2.0	3.0	3.0
86.03	RECYCLE	20	41.03	.0	.0	.0	2.0	2.0	2.5
86.05	RECYCLE	371	11.00	.0	.0	.0	2.0	2.0	2.5
86.06	RECYCLE	41	12.10	.0	.0	2.0	2.0	3.0	3.4
86.07	RECYCLE	41	28.50	.0	.0	.0	2.0	2.0	2.6
86.09	RECYCLE	41	96.90	.0	.0	.0	1.0	1.0	2.5
86.10	RECYCLE	5	264.00	.0	.0	.0	2.0	2.0	2.2
86.11	RECYCLE	7	243.00	.0	.0	.0	2.0	3.0	3.0

APPENDIX H

Unit Cost and Axle Loading Data

TREATMENRT	HWY	TEST MILE POINT	TREAT CODE	UNIT COST $/SQ.YD.	ANNUAL EQUIV AXLE LOADS	JOBNUM	COUNT
ASPHALT,DENSE	9	331.20	ACB150CS	2.18	71175	84.06	1
	10	65.70	ACC150	3.59	33215	84.08	1
	25	.85	ACB150	2.69	187245	84.16	1
	26	23.00	ACC200	2.66	140525	84.17	1
	35	31.75	ACC150	2.63	196735	84.21	1
	37	47.00	ACC200	3.63	77745	84.22	1
	91	58.66	ACC200	2.40	83220	84.31	1
	91	66.00	ACC200	3.21	64605	84.32	1
	92	3.00	ACC200	6.58	283240	84.33	1
	140	48.00	ACC150	2.93	53655	84.36	1
	272	20.95	ACB150	2.98	18980	84.44	1
	6	168.04	ACB150	3.10	555165	85.04	1
	7	266.52	ACC150	2.54	46355	85.06	1
	66	10.67	ACC150	3.17	19345	85.27	1
	66	43.11	ACC150	2.86	22265	85.28	1
	91	19.58	ACB150	2.44	251485	85.29	1
	91	64.00	ACC150	2.77	77380	85.30	1
	92	86.23	ACC200	3.32	204765	85.32	1
	171	1.64	ACC150	2.88	275940	85.34	1
	171	2.21	ACC150OG	3.77	275940	85.35	1
		NUMBER OF SITES =			20		
		UNIT COST $/SQ.YD =			3.12		
		ANNUAL EQUIV AXLE LOADS =			146949		
ASPHALT,OPEN	4	283.19	ACE075CS	1.41	185055	84.01	1
	7	1.00	ACE075	1.49	70080	84.04	1
	19	2.32	ACE075S	1.91	14600	84.10	1
	19	8.30	ACE075S	1.91	14600	84.12	1
	26	32.45	ACE075S	1.30	95630	84.18	1
	102	30.00	ACM20S	2.98	26280	84.34	1
	9	317.05	ACF150SS	2.32	91980	85.10	1
	15	20.10	ACF150SS	2.49	140890	85.11	1
	21	2.01	ACF150S	2.97	34675	85.14	1
	25	8.46	ACE075SS	2.60	101470	85.15	1
	44	3.82	ACM125CS	1.50	4015	85.21	1
		NUMBER OF SITES =			11		
		UNIT COST $/SQ.YD =			2.08		
		ANNUAL EQUIV AXLE LOADS =			70843		
RECYCLE	19	17.00	RES05	1.77	14235	84.13	1
	160	.82	RECYCLE	.36	78475	84.38	1
	372	17.49	RES	1.01	2190	84.47	1
	15	108.39	RE	.75	67890	85.12	1
	20	86.02	RECS	1.50	54750	85.13	1
	49	35.24	RECS	1.51	4380	85.24	1
	49	48.74	RECS	1.51	4380	85.25	1
	423	4.40	RECS	1.60	9490	86.01	1
	20	23.10	RECS	1.60	57305	86.02	1

UNIT COST AND AXLE LOADS BY TREATMENT TYPE

TREATMENRT	HWY	TEST MILE POINT	TREAT CODE	UNIT COST $/SQ.YD.	ANNUAL EQUIV AXLE LOADS	JOBNUM	COUNT
RECYCLE	20	41.03	RECSWS	1.99	55115	86.03	1
	371	11.00	RECS	1.84	7665	86.05	1
	41	12.10	RESS	1.39	75920	86.06	1
	41	28.50	RECS	1.84	62050	86.07	1
	41	96.90	RE	1.18	60955	86.09	1
	5	264.00	RE	2.20	31025	86.10	1
	7	243.00	RE	2.20	43800	86.11	1
		NUMBER OF SITES =			16		
		UNIT COST $/SQ.YD =			1.52		
		ANNUAL EQUIV AXLE LOADS =			39352		
CHIP,SEAL	5	24.45	CS	.33	10950	84.02	1
	7	120.10	CS	.35	48910	84.05	1
	19	26.84	CS	.37	14235	84.14	1
	19	121.00	CS	.59	16425	84.15	1
	37	50.95	CS	.25	80665	84.23	1
	48	3.14	CS	.35	14600	84.24	1
	48	6.95	CS	.35	18980	84.25	1
	48	50.95	CS	.35	18980	84.26	1
	71	2.00	CS	.35	16060	84.27	1
	290	8.60	CS	.47	2190	84.45	1
	7	163.83	CS	.45	40150	85.05	1
	8	18.00	CS	.62	36135	85.07	1
	28	101.75	CS	.40	32850	85.18	1
	48	55.34	CS	.40	18980	85.23	1
	49	73.03	CS	.46	4380	85.26	1
		NUMBER OF SITES =			15		
		UNIT COST $/SQ.YD =			.41		
		ANNUAL EQUIV AXLE LOADS =			24966		
CHIP,WSTLR	130	.20	CSWS	.77	4380	84.35	1
	160	4.41	CSWS	1.17	49275	84.39	1
	210	12.88	CSWS	1.42	175565	84.40	1
	210	13.12	CSWS	1.42	175565	84.41	1
	210	13.32	CSWS	1.42	175565	84.42	1
	215	10.30	CSWS	1.88	34310	84.43	1
	2	12.01	CSWS	1.13	788400	85.01	1
	2	188.63	CSWS	.85	244550	85.02	1
	4	86.25	CSWS	.85	247835	85.03	1
	9	196.43	CSWS	.66	160965	85.09	1
	26	47.50	CSWS	.98	81030	85.16	1
	35	65.17	CSWS	.65	224110	85.20	1
	47	40.11	CSWS	1.34	51465	85.22	1
	103	4.29	CSWS	1.32	4745	85.33	1
	231	9.51	CSWS	.70	108405	85.36	1
		NUMBER OF SITES =			15		
		UNIT COST $/SQ.YD =			1.10		
		ANNUAL EQUIV AXLE LOADS =			168411		

UNIT COST AND AXLE LOADS BY TREATMENT TYPE

TREATMENRT	HWY	TEST MILE POINT	TREAT CODE	UNIT COST $/SQ.YD.	ANNUAL EQUIV AXLE LOADS	JOBNUM	COUNT
OILMAT	5	142.95	OM075	.98	18980	84.03	1
	12	21.75	OM063	.93	18980	84.09	1
	28	118.00	OM075	.98	32850	84.19	1
	71	29.07	OM075	1.12	21170	84.28	1
	71	41.05	OM075	1.12	22630	84.29	1
	351	5.00	OM038	.56	1095	84.46	1
	415	35.83	OM075	1.12	2190	84.48	1
	28	22.41	OM063	.86	42340	85.17	1
	321	19.79	OM075	.86	4745	85.37	1
	342	16.82	OM125	1.56	4380	85.38	1
		NUMBER OF SITES =			10		
		UNIT COST $/SQ.YD =			1.01		
		ANNUAL EQUIV AXLE LOADS =			16936		

APPENDIX I

Friction Data

FRICTION DATA
for
PAVEMENT SURVEY SITES

HWY	JOB #	MP	BMP	EMP	YEAR	DOT	RATING
004	84-01	283.19	282.00	291.70	88	N&S	F
005	84-02	24.45	15.00	28.00	-	-	-
005	84-03	142.95	138.20	143.90	88	W	A+
007	84-04	1.00	0.90	1.20	-	-	-
007	84-05	120.10	115.50	128.80	88	E	A
009	84-06	331.20	328.40	334.80	87	S	A
010	84-08	65.70	64.60	65.80	85	N	A
012	84-09	21.75	21.00	42.00	86	E	A+
					88	E&W	A
019	84-10	0.00	0.00	16.90	86	S	A+
019	84-12	8.30	0.00	16.90	86	S	A+
019	84-13	17.00	16.90	18.30	86	S	A+
019	84-14	26.84	18.30	30.40	86	S	A+
019	84-15	121.00	120.60	122.80	88	S	A-F/M-F
025	84-16	0.85	0.70	1.70	87	S	M/F
026	84-17	23.00	22.40	25.30	87	E	A
026	84-18	32.45	25.30	33.20	87	E	A
028	84-19	118.00	115.40	120.50	85	N	A
035	84-21	31.75	31.60	31.80	87	E&W	A
037	84-22	47.00	37.60	51.30	88	W	A+
037	84-23	50.95	37.60	51.30	88	W	A+
048	84-24	3.14	2.50	10.00	85	N	A
048	84-25	6.95	2.50	10.00	85	N	A
048	84-26	50.95	40.90	52.90	85	N	A
071	84-27	2.00	1.90	7.00	85	N	A
071	84-28	29.07	25.00	42.00	85	N	F
071	84-29	41.05	25.00	42.00	85	N	F
081	84-30	9.10	5.70	11.10	87	S	A
091	84-31	58.66	57.80	70.50	87	N	A
091	84-32	60.00	57.80	70.50	87	N	A
092	84-33	3.00	2.80	4.10	87	W	A
102	84-34	30.00	29.20	35.80	-	-	-
130	84-35	0.20	0.00	1.00	86	E	A
140	84-36	48.00	46.10	48.50	85	N	A
160	84-38	0.82	0.80	1.10	85	S	M
160	84-39	4.41	3.80	7.00	85	S	A
210	84-40	12.88	12.60	13.40	85	E	A
215	84-43	10.30	10.20	10.70	-	-	-
272	84-44	20.95	16.00	21.60	87	E	A
290	84-45	8.60	0.00	13.70	85	E	A+
351	84-46	5.00	0.00	6.00	85	E	M/F
372	84-47	17.49	16.60	21.40	88	W	A+
415	84-48	35.83	21.00	37.00	85	N	A
002	85-02	188.63	185.80	191.10	87	E	F
004	85-03	86.25	80.20	91.50	88	N	A-F/A

FRICTION DATA
for
PAVEMENT SURVEY SITES

HWY	JOB #	MP	BMP	EMP	YEAR	DOT	RATING
006	85-04	168.04	167.50	168.20	87	E	A
007	85-05	163.83	157.90	165.60	88	E	A
007	85-06	266.52	266.40	266.80	88	E	F
008	85-07	18.00	16.10	26.50	87	N	A
009	85-09	196.43	190.80	199.70	87	S	A
009	85-10	317.05	317.00	319.40	87	S	A
015	85-11	20.10	15.60	20.30	87	E	A
015	85-12	108.39	107.50	111.90	87	E	A
020	85-13	86.02	81.90	92.20	88	W	A/A+
021	85-14	2.01	1.50	4.50	87	E	A
025	85-15	8.46	7.00	9.00	87	S	A
028	85-17	22.41	16.00	23.00	-	-	-
028	85-18	101.75	95.50	103.80	-	-	-
035	85-20	65.17	62.00	73.20	87	E	A
044	85-21	3.82	0.00	12.50	-	-	-
047	85-22	40.11	37.40	46.30	87	E	A
048	85-23	55.34	52.80	58.90	-	-	-
049	85-24	35.24	35.00	65.60	-	-	-
049	85-25	48.74	35.00	65.60	-	-	-
049	85-26	73.08	65.60	73.20	-	-	-
066	85-27	10.67	2.90	11.30	86	N&S	A
066	85-28	43.11	40.80	50.00	86	S	A
091	85-29	19.58	19.40	20.40	87	N	A
091	85-30	64.00	63.20	64.40	87	N	A
091	85-31	113.06	109.70	116.70	87	N	A
092	85-32	86.23	83.40	87.70	87	W	A
103	85-33	4.29	0.00	9.00	-	-	-
171	85-34	1.64	0.00	3.90	86	E	A
171	85-35	2.21	0.00	3.90	86	E	A
231	85-36	9.51	0.00	11.40	87	N	A/F
321	85-37	19.79	14.80	25.80	-	-	-
342	85-38	16.87	14.00	21.80	-	-	-
423	86-01	4.40	0.00	7.00	-	-	-
020	86-02	23.10	19.00	25.00	88	W	A/A+
020	86-03	41.03	35.90	53.60	88	W	A/A+
005	86-05	11.00	0.00	15.00	88	E	A
041	86-06	12.10	6.80	16.60	88	E	A+
041	86-07	28.50	24.40	35.00	88	E	A
041	86-09	96.90	90.50	98.40	88	E	A+
005	86-10	264.00	254.60	267.20	88	E&W	A+/A
007	86-11	243.00	238.70	245.50	88	E	A

A+=all SN'S 55-65+
A=SN'S above 40

M=35 to 39
F=all below 35

_/_=Total treatment/Int.Study
"-"=NO data since treatment

APPENDIX J

"Dynaflect" Deflection Data

DYNAFLECT DATA

TREATMENT	HWY	TEST MILE POINT	TREAT CODE	DATE OF TEST	PRE	MAX DEFL	SURF COND INDX	BASE COND INDX	CLOSED	JOBNUM
ASPHALT,DENSE	9	331.20	ACB150CS	870428		.64	.13	.05		84.06
	10	65.70	ACC150	861007		.78	.19	.08		84.08
	25	.85	ACB150	870825		.58	.22	.06		84.16
	26	23.00	ACC200	840806	*	.84	.31	.05		84.17
	26	23.00	ACC200	850808		.75	.21	.06		84.17
	26	23.00	ACC200	860721		.78	.23	.06		84.17
	35	31.75	ACC150	820414	*	.85	.33	.03		84.21
	35	31.75	ACC150	840508	*	.86	.35	.02		84.21
	35	31.75	ACC150	860410		.77	.31	.03		84.21
	35	31.75	ACC150	870429		.60	.14	.05		84.21
	37	47.00	ACC200	840816	*	.60	.21	.04		84.22
	37	47.00	ACC200	850731		.62	.23	.04		84.22
	37	47.00	ACC200	860630		.66	.24	.04		84.22
	91	58.66	ACC200	830406	*	1.28	.43	.12		84.31
	91	58.66	ACC200	840816	*	.80	.29	.08		84.31
	91	58.66	ACC200	850402		.96	.26	.10		84.31
	91	58.66	ACC200	851031		1.07	.20	.10		84.31
	91	58.66	ACC200	860507		1.04	.22	.11		84.31
	91	58.66	ACC200	870422		1.00	.20	.10		84.31
	91	66.00	ACC200	820429	*	1.45	.45	.11		84.32
	91	66.00	ACC200	840416	*	1.38	.32	.12		84.32
	91	66.00	ACC200	861029		1.05	.16	.12		84.32
	92	3.00	ACC200	840816	*	.86	.15	.07		84.33
	92	3.00	ACC200	851024		.47	.01	.05		84.33
	92	3.00	ACC200	860508		.50	.01	.03		84.33
	140	48.00	ACC150	870603		.86	.22	.09		84.36
	272	20.95	ACB150	870506		1.69	.65	.22		84.44

TREATMENT	HWY	TEST MILE POINT	TREAT CODE	DATE OF TEST	PRE	MAX DEFL	SURF COND INDX	BASE COND INDX	CLOSED	JOBNUM
ASPHALT,DENSE	6	168.04	ACB150	850523	*	.87	.31	.14		85.04
	6	168.04	ACB150	850920		.97	.24	.07		85.04
	6	168.04	ACB150	860530		.72	.19	.07		85.04
	7	266.52	ACC150	850417	*	1.53	.41	.18		85.06
	7	266.52	ACC150	851022		1.64	.25	.17		85.06
	7	266.52	ACC150	860528		1.38	.26	.16		85.06
	66	10.67	ACC150	830628	*	1.21	.42	.14		85.27
	66	10.67	ACC150	850418	*	1.42	.22	.07		85.27
	66	10.67	ACC150	850828		.87	.26	.07		85.27
	66	10.67	ACC150	860528		.93	.26	.08		85.27
	66	10.67	ACC150	870616		.95	.17	.13		85.27
	66	43.11	ACC150	830628	*	1.31	.45	.16		85.28
	66	43.11	ACC150	850417	*	1.38	.25	.12		85.28
	66	43.11	ACC150	850918		.93	.15	.11		85.28
	66	43.11	ACC150	860528		.99	.22	.11		85.28
	66	43.11	ACC150	870616		.90	.20	.13		85.28
	91	19.58	ACB150	830505	*	.79	.34	.06		85.29
	91	19.58	ACB150	850430	*	.78	.26	.08		85.29
	91	19.58	ACB150	851031		.83	.16	.09		85.29
	91	19.58	ACB150	860604		.69	.17	.08		85.29
	91	19.58	ACB150	870603		.76	.17	.08		85.29
	91	64.00	ACC150	850401	*	1.42	.31	.13		85.30
	91	64.00	ACC150	851031		1.23	.18	.10		85.30
	91	64.00	ACC150	860507		1.27	.19	.14		85.30
	92	86.23	ACC200	830411	*	.93	.18	.09		85.32
	92	86.23	ACC200	850422	*	.92	.09	.09		85.32
	92	86.23	ACC200	851016		.70	.08	.08		85.32
	92	86.23	ACC200	860422		.67	.06	.09		85.32
	92	86.23	ACC200	870511		.75	.12	.09		85.32
	171	1.64	ACC150	830502	*	.76	.11	.09		85.34
	171	1.64	ACC150	850430	*	.67	.06	.08		85.34
	171	1.64	ACC150	851030		.62	.05	.07		85.34

TREATMENT	HWY	TEST MILE POINT	TREAT CODE	DATE OF TEST	PRE	MAX DEFL	SURF COND INDX	BASE COND INDX	CLOSED	JOBNUM
ASPHALT,DENSE	171	1.64	ACC150	860605		.77	.10	.09		85.34
	171	1.64	ACC150	870707		.84	.15	.07		85.34
	171	2.21	ACC1500G	850430	*	.69	.07	.08		85.35
	171	2.21	ACC1500G	851030		.55	.04	.06		85.35
	171	2.21	ACC1500G	860605		.57	.04	.06		85.35
OTHER	91	113.06	SS	861021		.46	.02	.06		85.31
	0	.00		870701		.00	.00	.00	CLOSED	85.31
ASPHALT,OPEN	4	283.19	ACE075CS	820720	*	3.43	1.36	.38		84.01
	4	283.19	ACE075CS	840710	*	1.10	.17	.15		84.01
	4	283.19	ACE075CS	850813		.98	.07	.08		84.01
	4	283.19	ACE075CS	860624		1.15	.10	.15		84.01
	7	1.00	ACE075	840809	*	.71	.23	.09		84.04
	7	1.00	ACE075	841017		.76	.11	.07		84.04
	7	1.00	ACE075	850813		.75	.27	.09		84.04
	7	1.00	ACE075	860710		.77	.14	.11		84.04
	0	.00		880629		.00	.00	.00	CLOSED	84.04
	19	2.32	ACE075S	830517	*	1.70	.32	.20		84.10
	19	2.32	ACE075S	840809	*	1.48	.23	.22		84.10
	19	2.32	ACE075S	850513		1.55	.23	.25		84.10
	19	2.32	ACE075S	860715		1.47	.20	.18		84.10
	19	2.32	ACE075S	870625		1.57	.23	.25		84.10
	19	8.30	ACE075S	840823	*	.96	.19	.13		84.12
	19	8.30	ACE075S	850916		1.03	.17	.15		84.12
	19	8.30	ACE075S	860715		.99	.14	.12		84.12
	26	32.45	ACE075S	840806	*	.62	.18	.05		84.18
	26	32.45	ACE075S	850808		.66	.13	.06		84.18
	26	32.45	ACE075S	860721		.75	.19	.06		84.18
	102	30.00	ACM20S	861030		1.43	.34	.08		84.34
	9	317.05	ACF150SS	830426	*	.79	.30	.03		85.10

TREATMENT	HWY	TEST MILE POINT	TREAT CODE	DATE OF TEST	PRE	MAX DEFL	SURF COND INDX	BASE COND INDX	CLOSED	JOBNUM
ASPHALT,OPEN	9	317.05	ACF150SS	850410	*	.70	.16	.03		85.10
	9	317.05	ACF150SS	851015		.71	.22	.05		85.10
	9	317.05	ACF150SS	860409		.64	.14	.04		85.10
	9	317.05	ACF150SS	870428		.64	.14	.05		85.10
	15	20.10	ACF150SS	830725	*	1.26	.30	.11		85.11
	15	20.10	ACF150SS	850408	*	1.28	.30	.13		85.11
	15	20.10	ACF150SS	851008		1.19	.25	.11		85.11
	15	20.10	ACF150SS	860714		1.03	.27	.12		85.11
	15	20.10	ACF150SS	870604		1.40	.37	.15		85.11
	21	2.01	ACF150S	820621	*	.77	.33	.06		85.14
	21	2.01	ACF150S	840614	*	.83	.23	.06		85.14
	21	2.01	ACF150S	850409	*	.78	.18	.07		85.14
	21	2.01	ACF150S	851015		.79	.16	.07		85.14
	21	2.01	ACF150S	860514		.74	.15	.07		85.14
	44	3.82	ACM125CS	830726	*	1.80	.85	.12		85.21
	44	3.82	ACM125CS	850419	*	2.41	.64	.15		85.21
	44	3.82	ACM125CS	850924		1.73	.43	.14		85.21
	44	3.82	ACM125CS	860522		1.91	.55	.17		85.21
	44	3.82	ACM125CS	870727		1.67	.62	.16		85.21
RECYCLE	19	17.00	RES05	820721	*	3.08	1.66	.34		84.13
	19	17.00	RES05	821116	*	3.14	.71	.37		84.13
	19	17.00	RES05	840723	*	2.88	.91	.31		84.13
	19	17.00	RES05	840823	*	2.84	.94	.33		84.13
	19	17.00	RES05	850916		3.58	.97	.39		84.13
	19	17.00	RES05	860715		3.30	.85	.35		84.13
	0	.00		890502		.00	.00	.00	CLOSED	84.13
	160	.82	RECYCLE	840911		1.11	.42	.10		84.38
	160	.82	RECYCLE	841023		1.11	.18	.12		84.38
	160	.82	RECYCLE	851030		1.00	.17	.10		84.38
	160	.82	RECYCLE	860910		.98	.21	.10		84.38
	372	17.49	RES	840823	*	1.48	.56	.13		84.47
	372	17.49	RES	850813		1.58	.60	.14		84.47
	372	17.49	RES	860714		1.78	.64	.14		84.47
	15	108.39	RE	830725	*	1.31	.73	.04		85.12

TREATMENT	HWY	TEST MILE POINT	TREAT CODE	DATE OF TEST	PRE	MAX DEFL	SURF COND INDX	BASE COND INDX	CLOSED	JOBNUM
RECYCLE	15	108.39	RE	850415	*	1.35	.57	.07		85.12
	15	108.39	RE	850917		1.42	.53	.07		85.12
	15	108.39	RE	860620		1.34	.53	.07		85.12
	15	108.39	RE	870716		1.32	.59	.06		85.12
	20	86.02	RECS	820727	*	.83	.20	.08		85.13
	20	86.02	RECS	840724	*	.87	.22	.11		85.13
	20	86.02	RECS	850416	*	1.31	.27	.12		85.13
	20	86.02	RECS	850822		1.11	.41	.11		85.13
	20	86.02	RECS	860729		.97	.23	.10		85.13
	49	35.24	RECS	850514	*	1.38	.42	.14		85.24
	49	35.24	RECS	850822		1.78	.58	.14		85.24
	49	35.24	RECS	860730		1.64	.57	.13		85.24
	0	.00		880608		.00	.00	.00	CLOSED	85.24
	49	48.74	RECS	850514	*	1.39	.55	.10		85.25
	49	48.74	RECS	850822		1.36	.62	.09		85.25
	49	48.74	RECS	860730		1.62	.78	.10		85.25
	0	.00		880608		.00	.00	.00	CLOSED	85.25
	423	4.40	RECS	860429	*	1.56	.49	.12		86.01
	423	4.40	RECS	861016		1.47	.39	.11		86.01
	20	23.10	RECS	860519	*	1.96	.67	.19		86.02
	20	23.10	RECS	861016		2.13	.53	.14		86.02
	20	41.03	RECSWS	830614	*	1.62	.53	.14		86.03
	20	41.03	RECSWS	850611	*	1.64	.53	.15		86.03
	20	41.03	RECSWS	860519	*	1.95	.62	.19		86.03
	20	41.03	RECSWS	861015		1.75	.48	.15		86.03
	20	41.03	RECSWS	870624		1.86	.52	.21		86.03
	371	11.00	RECS	860520	*	1.64	.79	.02		86.05
	371	11.00	RECS	861013		1.61	.82	.04		86.05
	41	12.10	RESS	860520	*	1.66	.72	.08		86.06
	41	12.10	RESS	861014		1.87	.67	.09		86.06
	0	.00		890517		.00	.00	.00	CLOSED	86.06

TREATMENT	HWY	TEST MILE POINT	TREAT CODE	DATE OF TEST	PRE	MAX DEFL	SURF COND INDX	BASE COND INDX	CLOSED	JOBNUM
RECYCLE	41	28.50	RECS	830517	*	1.44	.70	.14		86.07
	41	28.50	RECS	850516	*	1.55	.49	.12		86.07
	41	28.50	RECS	860520	*	1.63	.52	.13		86.07
	41	28.50	RECS	861014		2.00	.54	.14		86.07
	41	28.50	RECS	870721		1.83	.61	.14		86.07
	0	.00		890517		.00	.00	.00	CLOSED	86.07
	41	96.90	RE	820609	*	1.51	.49	.17		86.09
	41	96.90	RE	840620	*	1.35	.31	.14		86.09
	41	96.90	RE	860618		1.67	.44	.14		86.09
	41	96.90	RE	861014		1.30	.30	.13		86.09
	12	595.58	RE	860415	*	1.58	.29	.14		86.10
	12	595.58	RE	861008	*	1.71	.51	.16		86.10
	7	243.00	RE	830622	*	1.82	.62	.23		86.11
	7	243.00	RE	850619	*	1.69	.51	.25		86.11
	7	243.00	RE	860415	*	1.89	.42	.20		86.11
	7	243.00	RE	861008		2.15	.49	.25		86.11
	7	243.00	RE	870617		2.36	.64	.30		86.11
	0	.00		890524		.00	.00	.00	CLOSED	86.11
CHIP,SEAL	5	24.45	CS	840806		.71	.32	.05		84.02
	5	24.45	CS	850723		.71	.25	.05		84.02
	5	24.45	CS	860619		.83	.24	.06		84.02
	5	24.45	CS	870714		.71	.27	.05		84.02
	0	.00		890509		.00	.00	.00	CLOSED	84.02
	7	120.10	CS	840808		1.79	.85	.11		84.05
	7	120.10	CS	850822		1.90	.68	.11		84.05
	7	120.10	CS	860612		1.88	.71	.12		84.05
	7	120.10	CS	870611		1.99	.74	.15		84.05
	0	.00		880623		.00	.00	.00	CLOSED	84.05
	19	26.84	CS	830615	*	2.88	1.54	.20		84.14
	19	26.84	CS	840809	*	2.04	.70	.18		84.14
	19	26.84	CS	850612		2.45	1.26	.20		84.14
	19	26.84	CS	860715		2.61	.84	.22		84.14
	19	26.84	CS	870622		2.58	1.07	.20		84.14
	0	.00		880607		.00	.00	.00	CLOSED	84.14

TREATMENT	HWY	TEST MILE POINT	TREAT CODE	DATE OF TEST	PRE	MAX DEFL	SURF COND INDX	BASE COND INDX	CLOSED	JOBNUM
CHIP,SEAL	19	121.00	CS	840808		1.83	.76	.17		84.15
	19	121.00	CS	850822		2.13	.80	.19		84.15
	19	121.00	CS	860730		2.34	.77	.21		84.15
	19	121.00	CS	870623		2.23	.83	.23		84.15
	37	50.95	CS	840816	*	.89	.24	.08		84.23
	37	50.95	CS	850731		.99	.36	.09		84.23
	37	50.95	CS	860630		1.06	.39	.08		84.23
	48	3.14	CS	830720	*	.59	.26	.03		84.24
	48	3.14	CS	840808		.56	.22	.03		84.24
	48	3.14	CS	850725		.55	.19	.03		84.24
	48	3.14	CS	860610		.60	.26	.04		84.24
	0	.00		870610		.00	.00	.00	CLOSED	84.24
	48	3.14	CS	870715		.53	.24	.03		84.24
	48	6.95	CS	840808		1.00	.33	.07		84.25
	48	6.95	CS	850725		.96	.34	.06		84.25
	48	6.95	CS	860610		.98	.41	.08		84.25
	0	.00		870610		.00	.00	.00	CLOSED	84.25
	48	50.95	CS	840808		1.40	.44	.10		84.26
	48	50.95	CS	850723		1.27	.50	.09		84.26
	48	50.95	CS	860610		1.44	.36	.12		84.26
	0	.00		880609		.00	.00	.00	CLOSED	84.26
	71	2.00	CS	840807		.78	.24	.07		84.27
	71	2.00	CS	850626		.90	.24	.11		84.27
	71	2.00	CS	860610		.92	.27	.09		84.27
	290	8.60	CS	840806	*	.80	.50	.05		84.45
	290	8.60	CS	850715		.81	.48	.07		84.45
	290	8.60	CS	860522		1.28	.58	.06		84.45
	0	.00		890508		.00	.00	.00	CLOSED	84.45
	8	18.00	CS	861007		.91	.19	.09		85.07
	8	18.00	CS	870615		1.01	.20	.08		85.07
	28	101.75	CS	861014		.44	.05	.07		85.18

DYNAFLECT DATA

TREATMENT	HWY	TEST MILE POINT	TREAT CODE	DATE OF TEST	PRE	MAX DEFL	SURF COND INDX	BASE COND INDX	CLOSED	JOBNUM
CHIP,SEAL	0	.00		890510		.00	.00	.00	CLOSED	85.18
	48	55.34	CS	870722		1.56	.30	.16		85.23
	0	.00		880609		.00	.00	.00	CLOSED	85.23
	49	73.03	CS	830615	*	.88	.45	.03		85.26
	49	73.03	CS	850416	*	1.09	.54	.03		85.26
	49	73.03	CS	870826		.92	.42	.03		85.26
	49	73.03	CS	870828		.95	.42	.04		85.26
CHIP,WSTLR	130	.20	CSWS	861029		1.49	.44	.10		84.35
	0	.00		880414		.00	.00	.00	CLOSED	84.35
	160	4.41	CSWS	830502	*	1.04	.49	.06		84.39
	160	4.41	CSWS	850430		1.02	.34	.07		84.39
	160	4.41	CSWS	860908		.88	.32	.06		84.39
	160	4.41	CSWS	870630		.99	.44	.08		84.39
	0	.00		890714		.00	.00	.00	CLOSED	84.39
	210	12.88	CSWS	870602		1.15	.39	.11		84.40
	0	.00		870721		.00	.00	.00	CLOSED	84.40
	210	13.12	CSWS	870602		1.40	.38	.18		84.41
	0	.00		870721		.00	.00	.00	CLOSED	84.41
	210	13.32	CSWS	870602		1.10	.30	.14		84.42
	0	.00		870721		.00	.00	.00	CLOSED	84.42
	215	10.30	CSWS	830725	*	1.01	.48	.03		84.43
	215	10.30	CSWS	850716		.73	.39	.05		84.43
	215	10.30	CSWS	870723		1.01	.51	.02		84.43
	0	.00		880713		.00	.00	.00	CLOSED	84.43
	2	12.01	CSWS	820908	*	.28	.11	.03		85.01
	2	12.01	CSWS	840912	*	.33	.13	.02		85.01
	0	.00		860507		.00	.00	.00	CLOSED	85.01
	2	12.01	CSWS	861002		.44	.10	.04		85.01

TREATMENT	HWY	TEST MILE POINT	TREAT CODE	DATE OF TEST	PRE	MAX DEFL	SURF COND INDX	BASE COND INDX	CLOSED	JOBNUM
CHIP,WSTLR	4	86.25	CSWS	861013		1.27	.55	.06		85.03
	4	86.25	CSWS	870518		1.23	.50	.07		85.03
	9	196.43	CSWS	830427	*	2.10	.64	.17		85.09
	9	196.43	CSWS	850411	*	1.80	.25	.17		85.09
	9	196.43	CSWS	870429		1.58	.20	.15		85.09
	26	47.50	CSWS	830804	*	.65	.27	.03		85.16
	26	47.50	CSWS	850808	*	.49	.10	.04		85.16
	0	.00		860508		.00	.00	.00	CLOSED	85.16
	35	65.17	CSWS	820719	*	.86	.26	.12		85.20
	35	65.17	CSWS	840710	*	1.10	.21	.11		85.20
	35	65.17	CSWS	860716		.80	.13	.10		85.20
	47	40.11	CSWS	820427	*	1.09	.38	.06		85.22
	47	40.11	CSWS	840424	*	1.15	.31	.07		85.22
	47	40.11	CSWS	860423		1.12	.28	.08		85.22
	0	.00		880712		.00	.00	.00	CLOSED	85.22
	103	4.29	CSWS	861029		1.63	.46	.16		85.33
	231	9.51	CSWS	830509	*	.97	.50	.03		85.36
	231	9.51	CSWS	850509	*	.74	.30	.05		85.36
	231	9.51	CSWS	870507		.85	.41	.06		85.36
OILMAT	12	21.75	OM063	870616		1.78	.67	.14		84.09
	0	.00		880615		.00	.00	.00	CLOSED	84.09
	28	118.00	OM075	840807		.62	.33	.04		84.19
	28	118.00	OM075	850724		.68	.31	.05		84.19
	28	118.00	OM075	860617		.80	.34	.05		84.19
	28	118.00	OM075	870715		.72	.33	.05		84.19
	71	29.07	OM075	840807	*	.98	.37	.09		84.28
	71	29.07	OM075	850820		1.08	.33	.05		84.28
	71	29.07	OM075	860819		1.09	.35	.08		84.28

TREATMENT	HWY	TEST MILE POINT	TREAT CODE	DATE OF TEST	PRE	MAX DEFL	SURF COND INDX	BASE COND INDX	CLOSED	JOBNUM
OILMAT	0	.00		880621		.00	.00	.00	CLOSED	84.28
	71	41.05	OM075	840807	*	1.36	.46	.11		84.29
	71	41.05	OM075	850820		1.57	.45	.07		84.29
	71	41.05	OM075	860819		1.40	.41	.12		84.29
	0	.00		880621		.00	.00	.00	CLOSED	84.29
	351	5.00	OM038	861007		1.53	.61	.11		84.46
	415	35.83	OM075	840807		.92	.29	.10		84.48
	415	35.83	OM075	850820		.91	.29	.05		84.48
	415	35.83	OM075	860819		.89	.25	.09		84.48
	28	22.41	OM063	850418	*	1.77	.43	.14		85.17
	28	22.41	OM063	850925		1.73	.53	.19		85.17
	28	22.41	OM063	860617		1.40	.36	.16		85.17
	28	22.41	OM063	870715		1.40	.39	.16		85.17
	321	19.79	OM075	850418	*	1.13	.37	.04		85.37
	321	19.79	OM075	850919		.67	.28	.03		85.37
	321	19.79	OM075	860618		.67	.29	.03		85.37
	342	16.82	OM125	850418	*	2.34	.72	.13		85.38
	342	16.82	OM125	850828	*	1.42	.55	.13		85.38
	342	16.82	OM125	861008		1.69	.48	.17		85.38
	342	16.82	OM125	870616		1.70	.47	.22		85.38