AC/CRC ADJACENT LANE SURFACING

Construction Report
First Year Interim Report
Second Year Interim Report

FHWA Experimental Feature
Project No. OR 89-04

by

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ABSTRACT

Asphaltic Concrete (AC) and Portland Cement Concrete (PCC) are common roadway materials used in Oregon. In a recent construction project -- Poverty Flats/Meacham Section -- the Oregon State Highway Division (OSHD) designed, as part of the project, a "test section" consisting of one AC lane and one Continuously Reinforced Concrete (CRC) lane parallel to each other. With a lightly-used inside lane of AC, and a heavily-traveled outside lane of CRC, it was believed that the pavement would have the superior strength, durability, and life span of CRC, yet a lower price than all-CRC pavement. The goals of the study are to determine the performance, safety, and cost-effectiveness of this "AC/CRC Adjacent Lane Surfacing."

A 5-mile AC/CRC test section was built as part of a 12-mile-long upgrade from all-AC to all-CRC surfacing on Interstate 84 between milepoints 225 and 238, in Northeastern Oregon. The climate generally has mild summers and cold, harsh winters. Heavy trucks make up a large percentage (39%) of the daily traffic, and about 90% of those trucks drive in the outside lane. This combination of severe traffic and environment is very hard on AC surfacing and is the reason for this upgrade.

The majority of the existing AC pavement was removed and placed into the median and drainage ditches as granular fill. The remaining pavement was left in place and used as a base for the new CRC pavement (and for the new AC inside lane within the test section). Outside the test section, the CRC was placed in both lanes. Within the test section, the outside lane was built with CRC as described above, while the inside lane was "milled down" and paved with AC. The shoulders were then paved with AC.

After two years of use, surveys show the pavement surfaces are performing well. All distress noted was minimal, considering the local climate and age of the roadway. Accident reports indicate no significant increase in accident rates since construction. However, there is not sufficient data available for a meaningful statistical analysis. The overall motorist safety, based on surface conditions, accidents, and user confidence, has not been affected by the AC/CRC Adjacent Lane pavement.

A preliminary cost analysis comparing this project built with CRC pavement in all lanes to the same project built with AC/CRC adjacent lanes indicates that for a typical 30-year life span, the AC/CRC pavement has a 9% cost savings over the all-CRC pavement. These cost analysis figures are based on actual construction costs and projected maintenance costs.

A final report on this Experimental Features Project will be published in the Summer of 1992. This final report will contain an updated cost analysis, conclusions, and recommendations on AC/CRC Surfacing.

ACKNOWLEDGEMENTS

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1.0 INTRODUCTION

1.1 Background

Asphaltic Concrete (AC) and Portland Cement Concrete (PCC) pavements are commonly used on separate sections of Oregon's Interstate system. The AC surfacing on these highways is often short lived due to heavy truck traffic. The most common forms of AC distress include stripping, wheeltrack rutting, and fatigue cracking in the outer lanes. The PCC sections resist these damages much better. However, PCC pavements have a higher initial cost than AC pavements.

To reduce surfacing costs and produce a durable freeway, the Oregon State Highway Division (OSHD) used PCC in the heavier-traveled outside lane and AC in the lightly-used inside lane of a 13-mile section of southbound Interstate 5 north of Cottage Grove, Oregon. This section has been performing well since its construction in 1985.

A section of Interstate 84 between Pendleton and La Grande, Oregon (a 4-lane divided highway), was to be upgraded from AC to Continuously Reinforced Concrete (CRC) pavement. The use of AC and CRC materials for adjacent lane construction was proposed for this highway reconstruction project. There were concerns within OSHD about the safety and durability of the combination AC/CRC on this section, as this area has a much harsher climate than the region near Cottage Grove. At that time, the Federal Highway Administration (FHWA) also shared the OSHD's concerns about this construction method. Since a large portion of the project funding comes directly from the FHWA, they allowed the use of a section of AC/CRC surfacing as an "Experimental Features Project." To evaluate the combination AC/CRC pavement versus all-CRC pavement, the Research Unit is conducting this study to determine the advantages and disadvantages of AC/CRC surfacing.

1.2 Objectives and Scope

The goals of this study are to determine if the AC/CRC adjacent lane combination is a safe and cost-effective alternative to using CRC in both lanes.

The project studied consists of a "Test Section" (which contains an "Evaluation Section" that will be monitored) and a "Control Section" to serve as a reference. This report covers the design, layout, construction, performance, and projected maintenance of the sections over the first two years. This report also covers the in-place unit costs as well as projected maintenance costs over a 30-year life span. Later, a final report will cover the performance of the test section after 3 years of use, as well as a second cost analysis of the project based on 3 years of actual costs and 27 years of projected costs.

2.0 LOCATION AND DESIGN

2.1 Location and Cross-Section

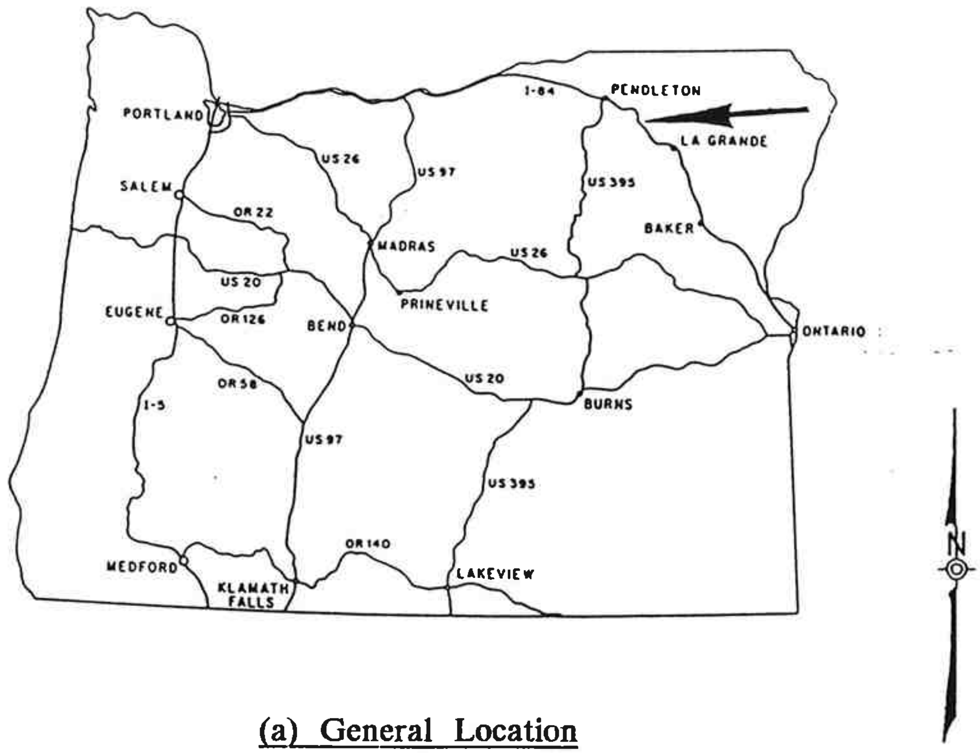
This project was built in 1989 when the Old Oregon Trail Highway (US Route I-84/Oregon Highway #6) was reconstructed between milepoints 225.7 and 238.0 (Figure 2.1). The 5-mile test section is located in the westbound lanes of the divided highway between milepoints 232.9 and 237.9. An evaluation section, located between milepoints 235.5 and 237.5 of the test section, will be monitored and inspected annually to represent the performance of the test section. The control section, a segment of all-CRC pavement located between milepoints 230.5 and 232.5, will be used as a baseline or reference point for objectives of this research. This control section was chosen because it has a similar environment and traffic pattern to the test section. These sections are not marked, but can be found by using the posted mile markers.

On the section upgraded to all-CRC pavement, 8" and 5" of the existing AC was cold planed out of the outside and inside lanes, respectively (Figure 2.2a). The removed AC was used either to line the median drainage ditch or build up the slopes adjacent to the shoulders. A single slab of continuously reinforced CRC pavement was poured across both lanes. The slab had depths of 11" in the outside lane and 8" in the inside lane. The shoulders consisted of a 3" thick layer of Oregon Class "B" AC.

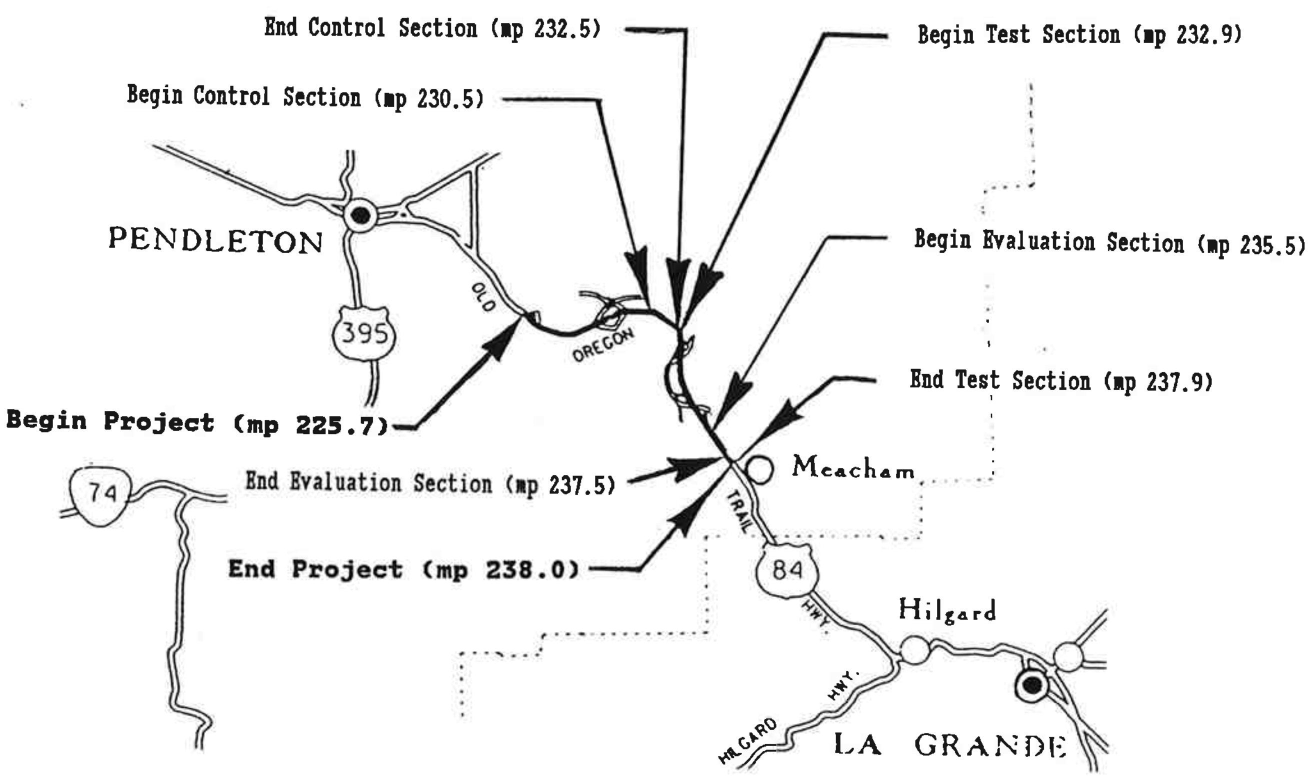
The section of AC/CRC differed from the all-CRC section as follows (Figure 2.2b).

1) 2" of existing AC pavement was removed from the inside lane.

2) The inside lane was paved with a 2" thick base course and a 3" thick wearing course of Oregon Class "B" AC. The Oregon Class "B" mix consists of a dense graded, 3/4" maximum size aggregate and a conventional grade of asphalt. In this case, Idaho AC-15 was used. As on all Interstate highways in Oregon, the aggregate was lime-treated to decrease the likelihood of stripping.

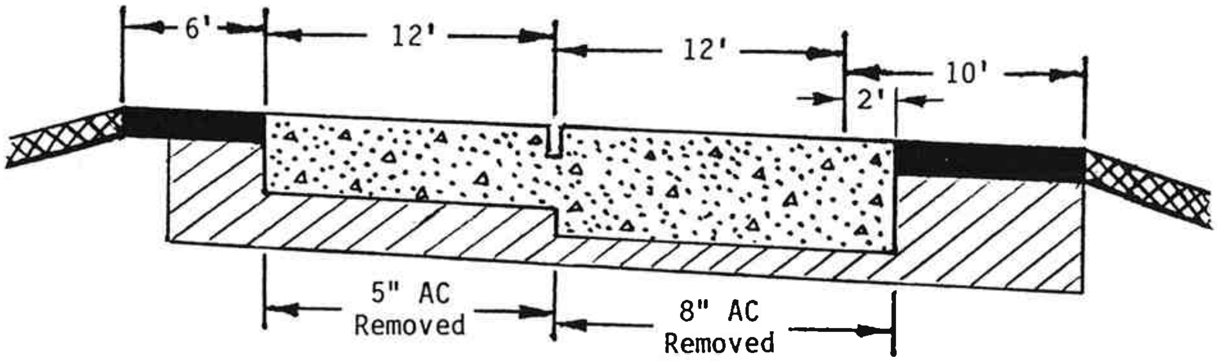


(a) General Location

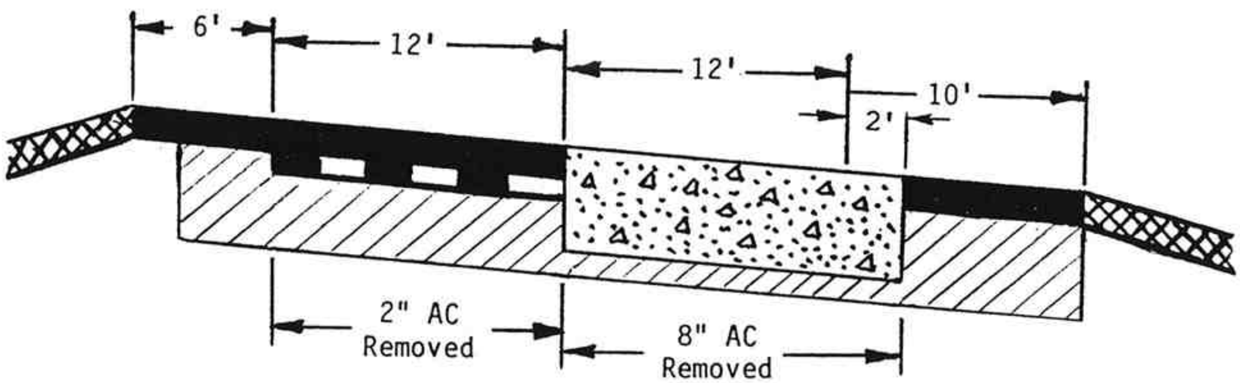


(b) Project Site

Figure 2.1 - Location



(a) CRC Cross Section



(b) AC/CRC Cross Section

11 inches of CRC in outside lane and 8 inches of CRC in inside lane.

3 inches of Class "B" AC wearing course.

2 inches of Class "B" AC base course.

Recycled Asphalt Pavement (taken from existing roadway).

Existing Bituminous Pavement

Figure 2.2 - Cross - Sections

2.2 Climate and Traffic

The test section is in a high mountain forest area with the following climate [1]:

Table 2.1: Climate

Elevation:	3,500' to 4,000'
Average daily temperature of coldest month (January):	25°F
Mean daily temperature swing in January:	14°F
Ave daily temperature of hottest month (July):	61°F
Mean daily temperature swing in July:	24°F
Average annual precipitation:	39"
Frost penetration:	36"

This highway is subject to heavy truck traffic throughout the year. In the winter, many of these trucks use tire chains. Automobiles also use chains, as well as studded tires and tire cables. Projected traffic loadings (shown below) were calculated in 1988 during the design phase; actual loadings may differ [2]:

Table 2.2: Traffic Projections

1990 Two-way Average Daily Traffic	=	6,227
Annual Growth Rate	=	4.52%
Trucks, Percent of ADT	=	39%
Trucks, Percent in Outside Lane	=	90%

One-Way Traffic Loading in 18-kip Equivalent Single Axle Loads (ESALs)

Year		AC Inner Lane Cumulative		CRC Outer Lane Cumulative
1990	--	115,000	--	946,000
1991	--	235,000	--	1,940,000
1992	--	361,000	--	2,980,000
2010 (20yr)	--	3,900,000	--	32,200,000
2020 (30yr)	--	6,840,000	--	56,400,000

2.3 Condition of Roadway Before Construction

Prior to construction, this roadway consisted of a combination of AC inlays, AC overlays, and seal coats. The total average thickness was 11 1/2". Maintenance records describe frequent and extensive surfacing distress such as ravelling, rutting, cracking, and stripping. Most of this distress was in the outside lane.

The structural condition of the roadway was measured with a falling weight deflectometer in May 1987, between Milepoints 236 and 237, in the outer wheeltrack of the outer westbound lane. The average deflection was .0138", corrected to a 9,000 lb load at 70°F (this average deflection is typical of interstate freeways of asphaltic concrete).

2.4 Design

The CRC pavement was designed using AASHTO methods for 90% reliability after 20 years and checked for 70% reliability after 30 years [3]. The CRC design thicknesses were 11" in the outside lane and 8" in the inside lane. These dimensions were used in construction.

The preliminary pavement design indicated that no "structural overlay" would be required in the inside lane. The AC inlay and overlay simply corrected the surface defects in the existing pavement.

3.0 CONSTRUCTION

Construction of the test section as well as the additional measures required for the AC/CRC adjacent lanes are discussed in this section. All pavement construction on this project was performed by ACME Concrete Company, Spokane, WA.

3.1 Cold Plane Pavement Removal

Using a rotary milling machine, the inside and outside lanes were milled down 5" and 8", respectively, as shown in Figure 2.2. The removed AC material was placed as granular fill in the medians and shoulders, as well as lining material for the drainage ditches. On a few occasions, the existing AC had to be removed completely (as much as 11") due to the pavement's poor condition. If the existing base or pavement was not stable, it may have created a failure in the new overlying pavement. Therefore, in these areas, the removed asphalt pavement was replaced by new AC to form a level base for the overlying AC or CRC surfacing.

3.2 Concrete Paving

With the exception of the test section, the majority of the mainline CRC pavement was placed as a single 26' wide panel, excluding various expansion joints. A longitudinal sawcut -- 1/4" wide x 2 2/3" deep -- was made between the inside lane and outside lane over the entire length of the concrete pavement. This sawcut is called a "longitudinal weakened plane joint" and acts as a stress relief point for the cross-section.

In the 5-mile length of the test section, however, only the outside (right) lane was paved with concrete. The inside lane was left clear for the AC pavement to be constructed later. For this section, the concrete finishing equipment had to be modified with a special cut-off plate (see Figure 3.1 on page 8). This cut-off plate was necessary to produce a neat, vertical edge in the concrete, as a jagged or irregular edge would create problems when compacting the asphalt pavement next to the CRC lane.

The concrete had a slump of 1 1/2" to 2". Although this was within specified limits, it was too high for CRC paving. Concrete with a slump of this level is difficult to finish on a vertical edge. As a result, the finishers over-worked the concrete and the edge did not have a neat, vertical face. A concrete saw was used to trim 1" to 2" from the inside edge of the CRC lane to correct this. By removing this minimum width of pavement, the contractor was able to keep this joint under the center lane stripe and avoid cutting the reinforcing bars. If the additional cut-off plate on the finishing machine had been a "slip-form type," oriented parallel to the concrete (instead of perpendicular to the pavement surface), this edge slumping may not have occurred.

3.3 Asphaltic Concrete Paving

With the CRC pavement completed, the AC paving began. Asphaltic tack coat was applied to the edge of the CRC panel and to the existing asphalt base (or new leveling patch where applicable). The new "Class B" AC was compacted and rolled to match the height of the adjacent concrete lane. Standard procedures were used to compact the asphalt, with special attention to adequately compacting the AC near the AC/CRC joint. This ensured that the AC would not consolidate with age and settle to a different height than the CRC. Finally, the shoulders were paved with the same Class "B" AC. All AC paving was performed in accordance with OSHD Standard Specification 403.

A representative of the general contractor (ACME Concrete Co., Spokane, WA) stated there was no substantial time savings with the AC/CRC Adjacent Lane construction over conventional all-CRC construction.

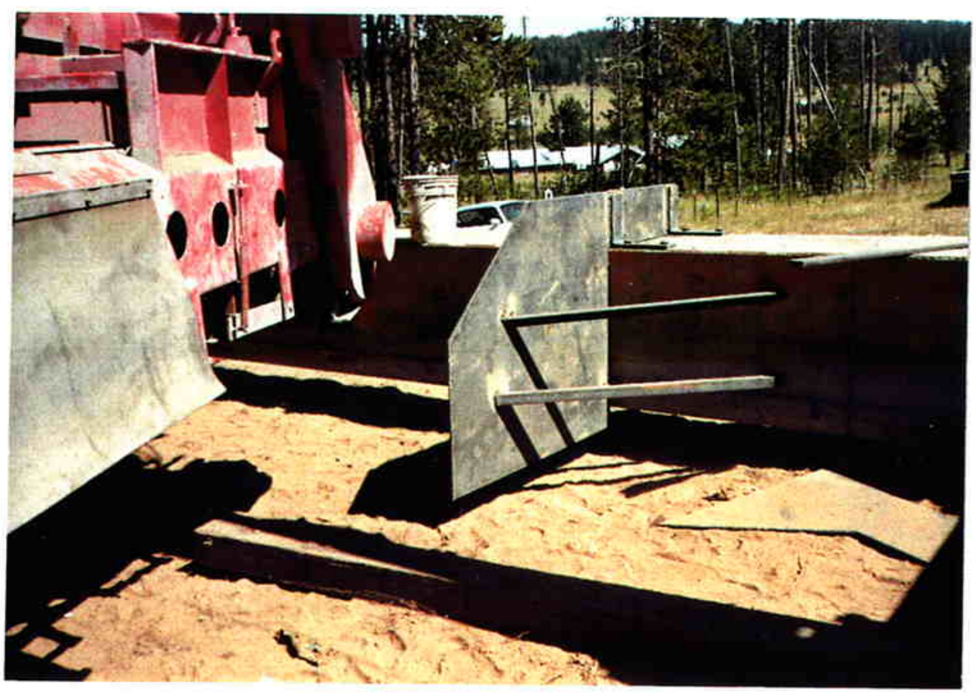


Figure 3.1: Special cut-off plate on CRC finishing machine

4.0 PAVEMENT EVALUATION

(Spring 1990)

4.1 Pavement Condition

Although the test section was finished in Fall 1989, temporary striping was in place on 0.6 miles of the west end of the AC/CRC pavement. This striping, placed in the Fall of 1989, was intended to detour traffic around construction to be performed in 1990. This construction included structural bridge work as well as the eastbound pavement lanes. During this time all traffic (east and westbound) was detoured through the newly-rebuilt westbound pavement. This detour created a very difficult environment for a visual inspection. Because of this situation and the fact that the past winter had been mild, the Research Unit decided to postpone the visual surface inspection until Spring 1991.

In the Summer of 1990, the Pavement Design Unit performed Skid Resistance testing on the test and control sections of the project, in accordance with AASHTO Standard Method T 242-90 (ASTM E 274-90). The result of this test procedure is a value relating to the friction between a standard rubber tire and the pavement surface. In a published report, the FHWA has determined recommended minimum skid values, according to the curvature of the roadway and the posted maximum speed [4]. For this project, the FHWA's recommended minimum skid value is 41. Skid values for both the asphalt and concrete pavement lanes are shown below in Table 4.1:

Table 4.1 - Pavement Skid Data

Continuously Reinforced Concrete Pavement		
Minimum Skid Value	=	41.7
Maximum Skid Value	=	57.3
Average Skid Value	=	49.2
Standard Deviation	=	4.4

Asphaltic Concrete Pavement		
Minimum Skid Value	=	46.9
Maximum Skid Value	=	54.2
Average Skid Value	=	50.7
Standard Deviation	=	2.2

As the above figures indicate, the frictional characteristics of both pavement types were well above the recommended minimum level. Also note that the average skid values for the concrete and asphalt surfaces are approximately equal.

4.2 User Comments

State maintenance forces, weighmasters, police, truckers, and citizens who travelled over the test section during the previous winter were interviewed. There were many comments about driver confusion when traffic was routed from one type of pavement to another.

In sections of the detour (described earlier in section 4.1) vehicles had their inside wheels on the CRC pavement of the travel lanes and their outside wheels on the AC shoulders. There were more remarks about this detour than the AC/CRC test section itself. The highway users felt this was awkward. Instead of traveling from one pavement type to another (as when travelling through the detour or changing lanes) they prefer either all-AC or all-CRC pavement.

The users were asked again to comment on the AC/CRC adjacent lane pavement in the Spring of 1991, and their comments are discussed in Section 4.4.

(SPRING 1991)

The test and control sections were formally inspected for the first time in May 1991 after a typically severe winter. Full interstate traffic had been open to the test section almost one year since the construction detour had been removed in the Summer of 1990.

4.3 Pavement Condition

Pavement distress described in this section is based on the "Distress Identification Manual for the Long-Term Pavement Performance Studies" [5]. Visual inspections of the test and control sections showed that the pavements were holding up very well. The AC surfaces revealed the following distress:

Table 4.2 - Asphalt Pavement Distress

Low Severity Weathering (10% to 20% of surface area),
Low Severity Transverse Cracking (average = 3 per 100'),
Minor Wheel Rutting (average rut depth = 0.01'),
Moderate Shoulder Weathering,
Low Severity Potholes in Shoulders.

The concrete lane of the test section appeared to be in the same condition as that of the control section lanes. The concrete pavement also showed minor wearing as well as the following types and levels of distress:

Table 4.3 - Concrete Pavement Distress

Low Severity Transverse Cracking (average = 23 per 100'),
Moderate Severity Transverse Cracking (average = 1 per 100'),
Moderate Construction Joint Deterioration
(Corner Breaks, etc. / approx. 1 per mile)
Popouts - 1" to 2" diameter (average = 3 per 100').

These hairline transverse cracks are typical of Continuously Reinforced Concrete (CRC) Pavements. Occasionally, a transverse crack from the concrete lane would continue into the asphalt lane. If deicing practices included the use of salt in this area, these cracks could allow salt to penetrate into the CRC and result in severe corrosion of the reinforcement. In Oregon, they normally do not present a likelihood of failure, since salt is not allowed as a deicing agent on CRC pavement.

All longitudinal AC/CRC joints that were inspected appeared to be in good condition. No differential settlement between the AC and the CRC was observed. Overall, the asphalt and concrete pavements have endured very well for this location and climate.

Pavement friction will be tested during the Summer of 1991 and compared to the previous year's results. Based on the OSHD's experience with AC and CRC pavements, the skid values should be very similar. The concrete surface will most likely have the same skid values, while the AC surface values should be slightly higher than last year's, due to some of the asphalt oil wearing off the surface. Both AC and CRC skid values should be in the range of 45 to 55, which is significantly greater than the FHWA's recommended minimum value of 41.

4.4 User Comments

The same group of highway users were asked to comment again on the AC/CRC adjacent lane construction. Their remarks are noted below.

Maintenance forces stated there has been no work performed on the project that would not have to be done on "all-AC" or "all-CRC" construction. This is true for both summer and winter maintenance. They also noted that during prolonged subfreezing weather, there was less ice on the CRC lane. They feel that the heavier traffic in the outer lane may reduce ice buildup, as is the case for most 4-lane divided highways.

Most trucks traveled through the test section using the outside (CRC) lane. However, several local truck drivers consistently used the inside (AC) lane. One operator, who drove a single unit, two-axle truck across the test section daily, was asked why he preferred the inside lane. He said the AC pavement had a much smoother and quieter ride and it was easier to see patches of ice.

Two local drivers were interviewed who drove tractor-trailer trucks across the test section two or three times a day. These truckers used the outer lane and did not notice a rough or noisy ride. However, they said their trucks had air suspensions and sound-insulated cabs. Both drivers said that in the winter, the AC lane thawed sooner in the morning and froze later in the evening.

4.5 Accident Reports

Detailed accident reports were compiled and studied for this area from 1986 through 1990. As could be expected, the few occurrences that did take place were in the winter months (November through March). Individual accidents in the test and control sections were reviewed and were found to be very similar for the two areas. No indication that the accidents could be related to a difference in AC or CRC surface condition could be found. Some examples of these accidents are described below:

Side-swipes, due to improper lane changes,

Single vehicles colliding with a guardrail or other fixed objects,

Vehicles confronting deer or elk on the roadway, and

Vehicles overturning into median or shoulder ditches.

Nearly all of the reported accidents involved a vehicle driving too fast and/or traveling on ice. In the situation of an ice pack on the roadway, there is little difference between the AC and the CRC surfacing, other than the aspect of the ice melting sooner on one type or the other. Accidents from 1986 through 1990 are shown in Table 4.4:

Table 4.4 - Accident Data

AC/CRC Test Section			
Year	Number of Accidents	Accident Rate[1]	Pavement Type
1986	6	1.06	AC
1987	3	0.53	AC
1988	2	0.35	AC
1989	3	0.53	AC/CRC - Construction began
1990	6	1.06	AC/CRC - Under detour

All CRC Control Section			
Year	Number of Accidents	Accident Rate[1]	Pavement Type
1986	1	0.24	AC
1987	3	0.73	AC
1988	2	0.49	AC
1989	5	1.22	All CRC - Construction began
1990	4	0.98	All CRC

The accident rates shown above appear to range a great deal from one year to the next. No conclusions can be made about accident data at this time, as there is insufficient data available for a statistical analysis.

[1] Accident Rate = Number of Accidents per Million Vehicle Miles

5.0 PAVEMENT SAFETY

If safety depended only on pavement surface conditions (friction, distress, etc.), it would be very easy to measure. In order to determine roadway safety, though, several factors must be examined. These factors include pavement conditions, accident reports, and "user confidence," all of which play an important role in the safety of the roadway.

The pavement surface conditions, as described earlier in Section 4.3, are quite favorable. All levels of distress (cracking, weathering, and rutting) are typical for pavements of this type and age. The concrete and asphalt surfaces both have approximately the same skid values. In general, the pavement conditions are very good.

Accident rates for the test and control sections indicate a large change from one year to another. As stated earlier, with such a small number of accidents, the statistical analysis is not meaningful. The accidents in the test section, though, do appear to be relatively the same in number and magnitude to the ones in the control section.

User confidence is sometimes just as important as the conditions mentioned above. Some of the public has shown a rather negative opinion of this test section. In the past, the highway users have generally been exposed to either all-AC pavements or all-CRC pavements. When they drive over the AC/CRC Adjacent Lane pavement, they feel somewhat uncomfortable. However, these comments come from only a few people. Much of this concern was directed towards the construction detour which has since been removed. Most people are not bothered by the AC/CRC pavement and many do not even notice the change in surfacing as they drive over it. Based on experience with the "Cottage Grove section," the public is expected to become accustomed to this style of pavement and feel comfortable driving on it. Based on the current data collected for this project, there has not been any negative impact on safety as a result of the AC/CRC Adjacent Lane pavement.

6.0 COST ANALYSIS

Another main interest of the AC/CRC adjacent lane surfacing deals with the overall cost-effectiveness of this method of construction.

6.1 Construction Costs

Based upon actual construction costs and contract expenditures, the comparison shows the differences between this project as built entirely with the AC/CRC and the same project as built with all CRC. The comparison considers all bid items pertaining to mainline construction (excavation, embankments, roadwork, paving, signing, temporary protection and direction of traffic, etc). This comparison excludes all structural work as well as anything not directly related to mainline construction. Since this project was designed to upgrade the highway from all-AC to all-CRC pavement, the option of all-AC will not be included in this cost comparison.

The following values represent construction costs, in 1990 dollars, per mile of the full roadway section, including both eastbound and westbound lanes.

Table 6.1: In-Place Unit Cost Summary for Mainline Paving

Total Cost for All-CRC Pavement	=	$ 1,233,000/mile.
Total Cost for AC/CRC Pavement	=	$ 1,116,000/mile.
Total Savings of AC/CRC (10%)	=	$ 117,000/mile.

As the above figures indicate, there is a large savings in the case of the AC/CRC. Because of the short length of the test section, the AC/CRC construction costs were probably high. If the entire project was built with the AC/CRC method, the unit costs of this pavement would likely be reduced. This could increase the above construction savings to 15% to 20%. However, this is only a comparison of construction costs; maintenance costs must also be considered.

6.2 Maintenance Costs

As of the Spring of 1991, there has been only one maintenance expenditure for this project; minor shoulder patchwork. Therefore, a projected schedule of future maintenance costs is appropriate.

Based on estimates from the OSHD District #12 Maintenance office, the following comparison shows the projected costs of maintaining this project with AC/CRC surfacing and the same project with only CRC surfacing.

The concrete pavement is considered to have one life cycle of about 30 years with little maintenance in its early stages and a series of corrective procedures in the later part of its life. In contrast, the asphalt pavement is considered to have a life span of about 14 to 15 years. It is assumed that it must be sealed and patched periodically and completely rebuilt after that 15-year period. This means grinding the existing asphalt and repaving up to the original grade. This shorter cycle must be repeated twice to achieve an equivalent life span to that of the concrete pavement.

For this cost analysis, interest rates for construction and maintenance were assumed to be 6% and 5%, respectively (from the OSHD's Planning Section). All costs are given in 1990 dollars. A 30-year life cycle is used with a "zero salvage value" at the end of that period.

Table 6.2: Projected Pavement Maintenance Costs

AC/CRC Pavement Maintenance Costs

0 - 2 yrs	No Maintenance Required	
4 - 5 yrs	Traffic Protection for Sealing Centerline AC/CRC Joint	= $ 600/mile
6 - 7 yrs	Surface Patching & Plug Patching	= $ 200/mile
7 - 8 yrs	Patching of Punchouts every 8 yrs with Traffic Protection Included	= $ 1,800/mile
14 - 15 yrs	Grind out & Repave AC Lane	= $ 54,500/mile

```
Years   0        5   7 8          15 16      20  22  24        30
 1990 ----------------------------------------------------------- 2020
                 |   |  |          |  |       |   |   |
                 |   V  |          |  |       |   V   |
                 V  200 |          |  |       V  200  |
Dollars         600     V          |  V      600      V
per mile              1,800        | 1,800          1,800
                                   V
                                 54,500
```

Total 30-year Projected Maintenance for AC/CRC = $ 26,500/mile

Table 6.2: Projected Pavement Maintenance Costs (continued)

All-CRC Pavement Maintenance Costs

0 - 2 yrs	No Maintenance Required	
2 - 3 yrs	Shoulder Patching from Detour	= $ 24,500/mile
7 - 8 yrs	Patching of Punchouts every 8 yrs with Traffic Protection included	= $ 1,800/mile

```
Years  0     3         8              16             24          30
 1990  ----------------------------------------------------------- 2020
             |         |              |              |
             |         V              V              V
Dollars      V       1,800          1,800          1,800
per mile  24,500
```

Total 30-year Projected Maintenance for ALL CRC = $ 24,000/mile

When the above maintenance values are added to the construction costs, the total project costs, in 1990 dollars, are:

Construction Costs for All-CRC Pavement = $ 1,233,000/mile
Maintenance Costs for All-CRC Pavement = $ 24,000/mile

Total 30-year Costs for All-CRC Pavement = $ 1,257,000/mile

Construction Costs for AC/CRC Pavement = $ 1,116,000/mile
Maintenance Costs for AC/CRC Pavement = $ 26,500/mile

Total 30 year Costs for AC/CRC Pavement = $ 1,142,500/mile

The above figures indicate a savings of about 9% if AC/CRC surfacing is used. Again, this is based on 2 years of actual and 28 years of projected maintenance.

7.0 CONCLUSIONS AND RECOMMENDATIONS

The main objectives of this research are to evaluate the performance, safety, and cost-effectiveness of the AC/CRC Adjacent Lane Surfacing. The 1991 spring pavement evaluation revealed the surfacing has distress normal to other AC and CRC pavements under similar conditions. Also, skid values of both pavement types are approximately equal and well above recommended minimum values. Because this is only an interim report, the only definite conclusions that can be made about the performance are that the pavements are holding up well at this time and are expected, in the next few years, to continue in the same manner.

The field inspections and skid test data (explained in Section 4 - Field Evaluation) show that the surface conditions are good. The accident rates for the test and control sections appear to range a great deal from year to year. As stated earlier, no conclusions can be made about accident rates at this time, because of insufficient data available for a valid statistical analysis. Some highway users who were asked to comment about ice on the roadway stated that, in the winter, ice would melt sooner in the morning and form later in the evening on the AC surfaces. On the other hand, there were observations that indicated the ice broke up sooner in the outside (CRC) lane because of the heavier traffic in that lane. Though its safety is not actually lower than that of all-AC or all-CRC lanes, a small number of people find it generally uncomfortable to drive on the AC/CRC pavement. In time, we believe all of the public will become accustomed to the AC/CRC surfacing. Overall, safety has not been effected by the AC/CRC Adjacent Lane pavement.

Finally, the third object of concern is the cost-effectiveness of the AC/CRC Adjacent Lane construction. Using projected maintenance costs, the analysis indicates a 9% savings for construction and maintenance of the AC/CRC Adjacent Lane method. As these pavements grow older, an evaluation of cost and total value can be made using actual maintenance figures. At this time, the estimates and projected conditions suggested in this report show there is substantial cost savings with the AC/CRC Adjacent Lane Surfacing.

The AC/CRC surfacing was built with standard equipment and construction methods normally used for AC and CRC paving, with only minor modifications necessary. The only construction problem noted was the excessive edge slumping along the inside of the CRC lane. This was primarily due to the irregular cut-off plate and over tooling by the concrete finishers. The problem was quickly remedied by sawcutting the lane edge.

Based on information to date for this study, AC/CRC Adjacent Lane Surfacing appears to be a viable alternative construction method to "all CRC" surfacing.

8.0 REFERENCES

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