# MICROSILICA MODIFIED CONCRETE
# FOR BRIDGE DECK OVERLAYS

First-Year Interim Report

FHWA Experimental Features
OR 89-03A, OR 89-03B, and OR 89-03C

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## ABSTRACT

The study objective is to see if microsilica concrete (MC) is a viable alternative to the latex modified concrete (LMC) usually used on bridge deck overlays in Oregon. The study addresses MC overlays placed in 1989 on seven Portland cement concrete (PCC) bridge decks. This report covers the performance of the overlays during the first year of use.

After one year, the only distresses on these overlays were cracking and delamination. There was cracking on all of the overlays. In most cases, the cracking was hairline and random. In heavily cracked areas, the cracks connected to form a map pattern. This cracking may be due to drying shrinkage. Similar problems are seen on Oregon State Highway Division (OSHD) LMC overlays.

In addition, there were delaminations on five of the seven overlays. This distress was not extensive, as the worst deck had only 2.5% of its surface delaminated. In most cases, the delaminations were small, scattered throughout the deck, and covered by uncracked MC. The exceptions were two large delaminations that were under sections of the overlay with severe map cracking, and numerous delaminations adjacent to construction and expansion joints. The delaminations that were repaired were almost always between the overlay and the old deck. The cause of these delaminations is not known. Similar distress is often seen on OSHD LMC overlays.

The wheel-to-pavement friction numbers of these overlays were similar to typical state highway pavements and LMC bridge decks in Oregon.

The only maintenance and repair cost to the OSHD was the sealing of cracks on one deck with methacrylate and sand, at a cost of $4,000. This sealant was effective.

The overlays met two of their three design objectives after one year's use. They were still adding strength to the deck and providing a smooth and durable wearing surface. However, as they were cracked, it is surmised that they were no longer sealing the underlying deck from the intrusion of chlorides.

A successful MC overlay was recently placed for the OSHD in Portland. This overlay contrasted to most of the overlays in this study, as the concrete supplier was experienced with MC, the batching to pouring durations were short, and the weather was cool and/or humid with small daily temperature swings.

Continued use of MC is recommended in areas where capable MC suppliers are close to the jobsite and the overlay is to be poured in favorable weather. Further experimentation is recommended to find ways to successfully pour MC in other conditions.

**ACKNOWLEDGEMENTS**

The author thanks the OSHD project managers Ron Busey and Joe Schlieski, and their crews; and OSHD Region I Bridge Inspector Clair Kuiper and his crew; for the information they provided and their review of the report drafts. The author also thanks Keith Johnston, Jarard Richardson, and Fred Lucht of the OSHD; and Cal Frobig of the FHWA for their review of the report drafts.

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# 1.0 INTRODUCTION

## 1.1 Background

Latex modified concrete (LMC) bridge deck overlays are used by the Oregon State Highway Division (OSHD) to add structural strength, to provide a smooth and durable wearing surface, and to seal the deck from the intrusion of de-icing agent chlorides.

Manufacturers of microsilica admixtures claim that microsilica concrete (MC) can be used as an alternative to LMC in bridge deck overlays. In addition, suppliers state that MC can be mixed in batch plants, like Portland cement concrete (PCC). This may save the OSHD money, as batching LMC requires the use and added expense of mobile mixing plants at the jobsite. Furthermore, it is claimed that MC can be placed directly on the existing bridge deck in a manner similar to PCC. This is more economical than LMC, as this material requires that a bonding slurry is brushed onto the deck before placement.

## 1.2 Objectives and Scope

The objective of this study is to see if MC is a suitable alternative to LMC for structural bridge deck overlays. The study covers the construction and short term performance of overlays on five bridges using MC containing Force 10,000$^{R}$ microsilica slurry made by W.R. Grace, Inc.

This interim report covers the first year's performance of the overlays, with emphasis on cracking, delamination, and tire-to-pavement friction. The Appendix contains a summary of the surface inspection results and maintenance activities since construction.

A construction report for these overlays, covering the placement, finishing, curing, construction costs, and post-construction inspection results was published in October 1990 [1]. Another interim report will be issued after the second year inspection, and a final report will be published after the fourth year inspection.

The sealing properties of MC are proven and are not evaluated in this study [2].

## 2.0 LOCATION AND MATERIALS

This chapter describes the overlay's location, layout, environment, traffic loadings, and materials.

### 2.1 Overlay Location and Layout

The overlays are listed in Table 2.1, their locations throughout the state are shown in Figure 2.1, and the location of the pours on the bridge decks are shown in Figure 2.2.

**Table 2.1: Overlay Listing**

| OSHD Bridge Number | Bridge Name | Dates of Pouring | Highway | Milepoint | Number of Pours |
|---|---|---|---|---|---|
| 9260B | Northbound Colestin Road Overcrossing Bridge | 4/27/89 | Pacific (OR #1 or US #I-5) | 4.61 | 1 |
| 9260B | Southbound Colestin Road Overcrossing Bridge | 8/31/89<br>9/6/89 | " | " | 2 |
| 9184A | Northbound Neil Creek Road Overcrossing Bridge | 5/11/89 | " | 10.34 | 1 |
| 9184A | Southbound Neil Creek Road Overcrossing Bridge | 9/14/89 | " | " | 1 |
| 7036 | Holladay Street Ramp Bridge | 4/29/89<br>5/6/89 | Columbia River (OR #2 or US #I-84) | 1.32 | 2 |
| 7040AA | Grand Avenue Ramp Bridge | 9/9/89 | " | .52 | 1 |
| 8498W | Westbound Meacham Overcrossing Bridge | 8/3/89<br>8/9/89<br>8/10/89 | Old Oregon Trail (OR #6 or US #I-84) | 237.95 | 3 |

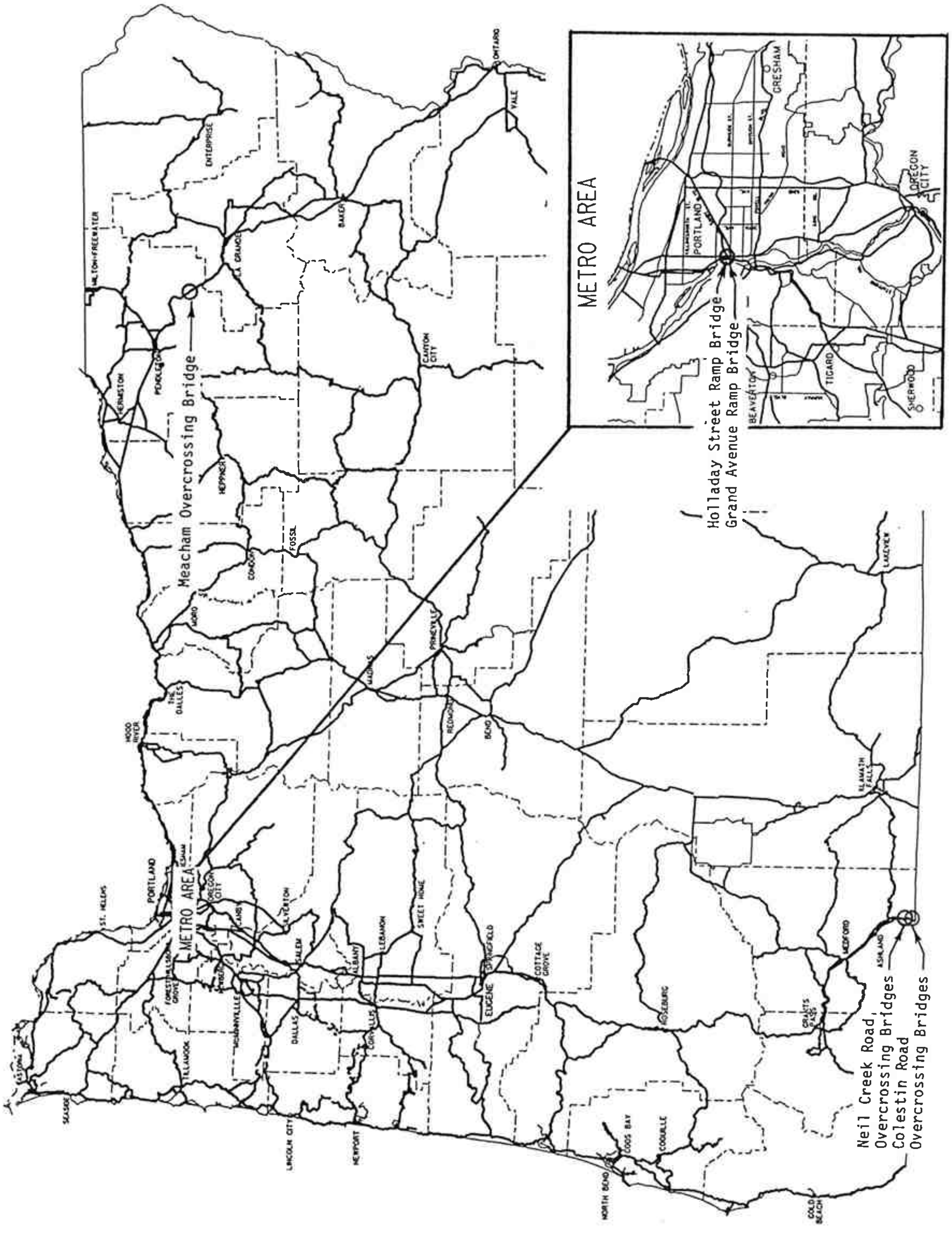



Figure 2.1: Overlay Locations

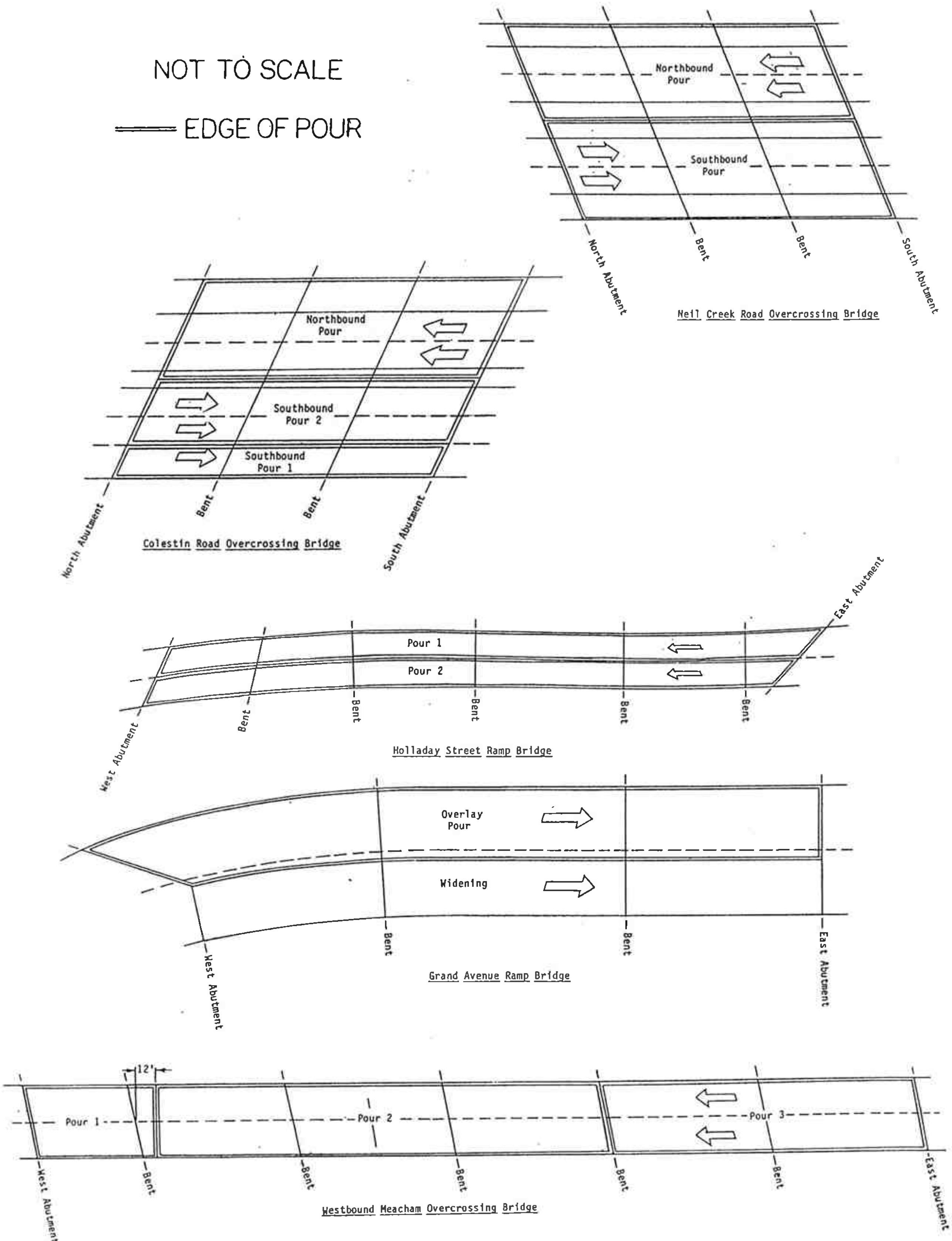



**Figure 2.2: Pour Locations**

## 2.2 Environment and Traffic

Environmental and traffic data are summarized in Table 2.2 [3], [4].

**Table 2.2: Environment and Traffic**

| | Colestin Road Bridge | Neil Creek Bridge | Holladay Street Ramp Bridge | Grand Avenue Ramp Bridge | Westbound Meacham Overcrossing Bridge |
|---|---|---|---|---|---|
| Elevation (feet) | 4,275 | 2,565 | 125 | 65 | 3,740 |
| Average Daily Temperature of Coldest Month (°F) (January) | 30 | 32 | 41 | 41 | 28 |
| Mean Daily Temperature Swing in January (°F) | 14 | 14 | 11 | 11 | 14 |
| Average Daily Temperature of Hottest Month (°F) (July) | 63 | 64 | 66 | 66 | 63 |
| Mean Daily Temperature Swing in July (°F) | 31 | 32 | 23 | 23 | 32 |
| Average Annual Precipitation (Inches) | 39 | 39 | 39 | 39 | 30 |
| 1988 Average Daily Two-Way Traffic (vehicles/day)[a] | 12,100 | 12,500 | - | - | 6,100 |
| Heavy Trucks (% of ADT) | 32 | 32 | - | - | 44 |

[a]These bridge decks carry one-way traffic. Consequently, they carry about 1/2 of the two-way traffic loading.

## 2.3 Materials

The MC for the Colestin Road Overcrossing Bridge and Neil Creek Road Overcrossing Bridge deck overlays contained:

**Cement** - Calaveras Type II.
**Aggregates** - 3/4 - 0 inch crushed river gravel from Kendall Bar on the Rogue River.
**Additives** - "Force 10,000" microsilica, "WRDA 19" high range water reducer (superplasticizer), "Daratard 17" set retarder, and "Daravair" air entrainment agent.

The MC for the Holladay Street Ramp Bridge and Grand Avenue Ramp Bridge deck overlays contained:

**Cement** - Ashgrove Type I.
**Aggregates** - 3/4 - 0 inch crushed river gravel dredged from the Willamette River near Ross Island.
**Additives** - "Force 10,000" microsilica, "WRDA 19" high range water reducer (superplasticizer), "WRDA 79" Type A water reducer, and "Darox" air entrainment agent.

The MC for the Westbound Meacham Overcrossing Bridge deck overlays contained:

**Cement** - Ashgrove Type I.
**Aggregates** - 3/4 - 0 inch crushed river gravel from the R.D. Mac pit on the Grande Ronde River near Island City.
**Additives** - "Force 10,000" microsilica, "WRDA 19" high range water reducer (superplasticizer), "WRDA 79" Type A water reducer, and "Daravair" air entrainment agent.

The microsilica and all other additives were made by:

W.R. Grace & Co.
Construction Products Division
62 Whittemore Avenue
Cambridge, Massachusetts 02140
(617) 876-1400

The Force 10,000$^{R}$ microsilica was supplied in a water based slurry. The primary ingredient was finely powdered microsilica produced as a by-product from the manufacture of metallic silicon.

## 3.0 FIRST YEAR'S PERFORMANCE

This chapter describes the condition and maintenance of the microsilica overlays from the post-construction inspection in 1989 through the first year's inspection in 1990.

Visual inspections were used to determine cracking, and chain drag surveys were used to find delaminations. The results of these inspections and maintenance activities are summarized in Appendix A.

All wheel-to-pavement friction testing was done at speeds near 40 mph in the left wheel path of the right lane using a trailer mounted K.J. Law friction tester. The data from these tests were converted to standard 40 mph friction numbers ($FN_{40}$) using correlation equations. The test methods, calibration techniques, and equipment conformed to AASHTO T 242-84.

After one year, the only distress was cracking and delamination. There was no significant rutting, polishing, popouts, or other surface distress

### 3.1 Cracking

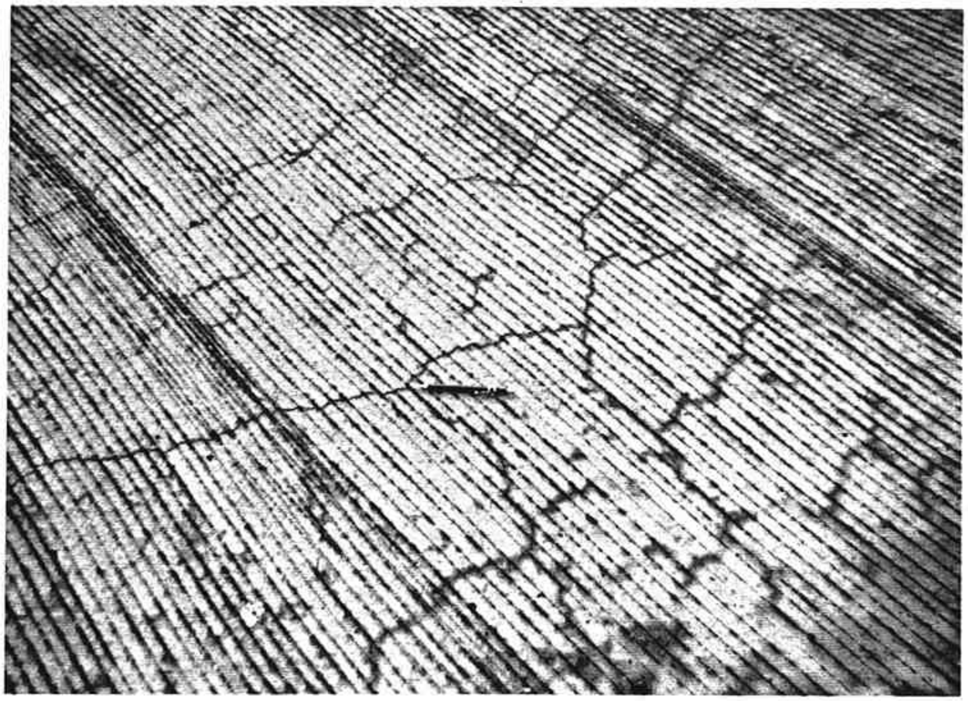
There was cracking on all of the seven overlays. In most cases, the cracks were random and hairline; and if they were sufficiently developed, they connected into a map pattern. Four overlays had alligatored sections. Figure 3.1a shows the crack severity and pattern typical of the map cracked areas. The cracking was most severe on pours that had construction difficulties, and pours over the deeper sections of the overlays, as seen in Figure 3.1b [1].

Most of the cracking occurred after the post-construction inspections. Of the seven overlays, three cracked either during the cure or before the post-construction inspection; and the rest cracked after the post-construction inspection. In all cases, when the overlay cracked while curing, the cracking increased dramatically during the first year.

The majority of these cracks may be due to drying shrinkage of the MC, as [5]:

1) They formed over an extended period -- unlike plastic shrinkage cracks.

2) They were not adjacent to, or over, a structural discontinuity, such as cracks in the existing deck



(a) Hairline cracking of the MC overlay on the Grand Avenue Ramp Bridge. The pavement surrounding the cracks is moist, and consequently darker, than the rest of the surface.

(b) Wider cracking on the deeper section (5 to 7 inches) of the MC overlay on the Holladay Street Ramp Bridge. The remainder of the overlay was about 2-inches thick.

Figure 3.1: Surface Cracking After One Year

or delaminations under the overlay -- unlike reflective cracking.

3) They were random in direction -- unlike stress related fractures due to excessive structural loading.

4) They were wider over deeper sections of the overlay -- unlike reflective cracks or stress fractures.

5) They were not due to alkali-silica reactivity, as reactive rock is rarely found in the aggregate sources used for these overlays.

This cracking greatly reduced the performance of these overlays because they could no longer perform their design goal of sealing the underlaying deck from the intrusion of de-icing agent chlorides. This statement is based on the assumption that the cracks increase the permeability of the membrane, as no permeability tests were made comparing the cracked to uncracked MC.

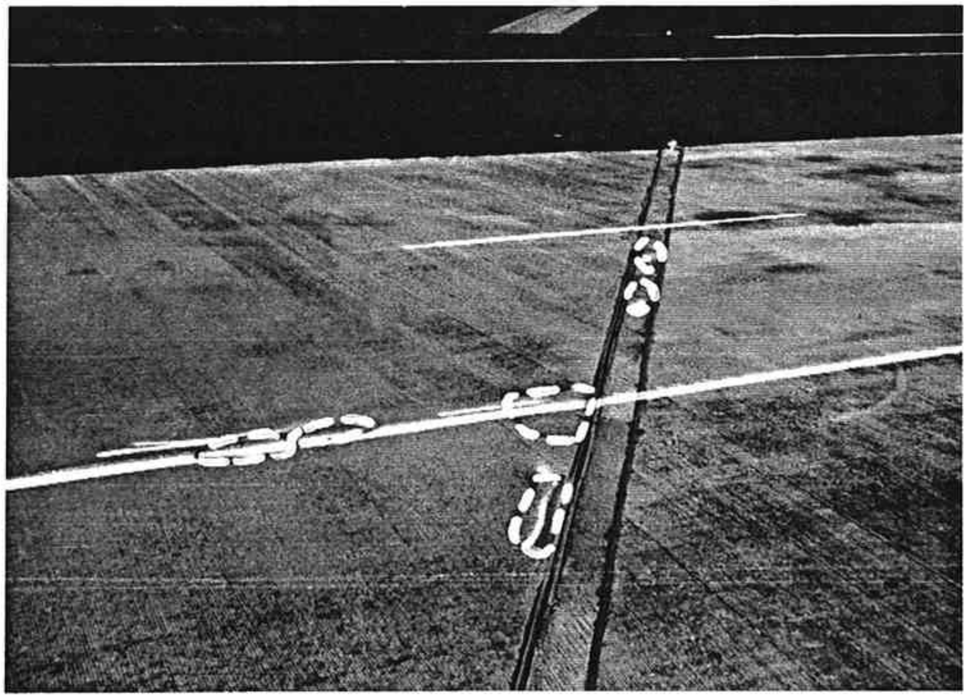
A direct comparison between MC and LMC could not be done, as control sections using LMC were not part of these projects. However, based on the OSHD's recent experience, these MC overlays were cracking in a similar fashion to many LMC overlays.

## 3.2 Delaminations

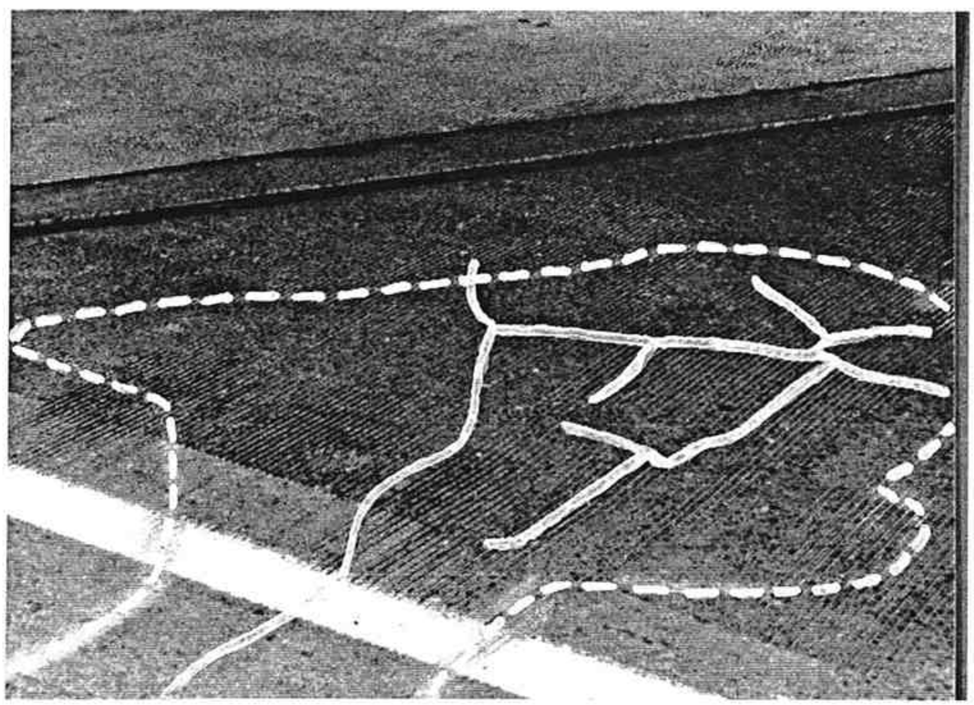
Of the seven overlays, five had some delamination. However, this distress was not extensive, as the worst deck had delaminations under 2.5% of its surface. In almost all cases, the delaminations were small and they were scattered throughout the deck. On three of the overlays, delaminations were detected adjacent to either construction or expansion joints, as shown in Figure 3.2a.

Most of the time, the overlay above the delamination was uncracked. However, there were two notable exceptions. On the south end of the Northbound Colestin Road Overcrossing Bridge, the overlay over a 25 square foot delamination was severely map cracked, as shown in Figure 3.2b. On the south end of the Southbound Neil Creek Road Overcrossing Bridge, less severe map cracking was noted over a smaller delamination. In both cases, there were no loose pieces in the cracked overlay.

Many of the delaminations found just after construction were



(a) Delaminations on the Southbound Colestin Road Overcrossing Bridge. In this enhanced photo, the edges of the delaminations are marked by a dashed white line. Delaminations under the fog line are adjacent to a joint between two pours. The other delaminations are adjacent to an expansion joint.



(b) Delamination and cracking on the south end of the Northbound Colestin Road Overcrossing Bridge. In this enhanced photograph, the edge of the delamination is marked by a dashed white line, and the cracks are marked by a solid white line.

Figure 3.2: Delaminations After One Year

chipped out and repaired with MC. In most cases, the delaminations were between the overlay and the old deck. In addition, visual inspection indicated that the MC adjacent to the old deck was well consolidated.

The delaminations occurred both immediately after construction and throughout the first year. Of the eleven pours, five had delaminations detected during the post-construction inspection, and eight had delaminations found during the first year inspection.

The small delaminations that were under uncracked concrete and were not adjacent to a joint did not affect overlay performance. However, the delaminations that were adjacent to cracks or joints did reduce performance, as water and chlorides could enter the delaminations through these breaks and spread under the overlay. Corrosion and/or freeze-thaw damage could result.

Although quantitative data is not available, OSHD project managers report similar delamination problems on LMC overlays.

## 3.3 Pavement Friction

These overlays had satisfactory wheel-to-pavement frictional qualities and were comparable to typical OSHD pavements in Oregon. The friction values are shown in Table 3.1.

**Table 3.1: Pavement Friction**

| Bridge | Deck | Date of Test | Friction Number |
|---|---|---|---|
| Colestin Road Overcrossing Bridge | Northbound<br>Southbound | 7/11/90<br>6/20/89 | 43<br>47 |
| Neil Creek Road Overcrossing Bridge | Northbound | 7/11/90 | 47 |
| Holladay Street Ramp Bridge | | 6/5/89 | 52 |
| Meacham Overcrossing Bridge | | 8/6/90 | 44 |

The frictional qualities of these MC overlays after one year of use were comparable to LMC overlays of the same age. In 1990, the average friction number from the three tests taken on the MC overlays was 45. This is similar to the average friction number determined by 39 tests on eighteen one-year old LMC overlays constructed in 1987 on the Corvallis/ Lebanon Interchange - Halsey Interchange Section of US #I-5. However, this is not a firm conclusion, as the MC frictional average is based on a small number of tests.

## 3.4 Maintenance

Some delamination repair and crack sealing was done after the curing blankets were removed and before the decks were opened to traffic. The contractor paid for these repairs. The only other repair or maintenance was the sealing of the Northbound Colestin Road Overcrossing Bridge deck with Concresive 2075 methacrylate sealer and sand in November 1989 [1]. After one year of traffic on the deck, this sealer continued to seal the cracks that were present when it was applied. This repair cost the OSHD about $4,000.

## 3.5 Summary

After one year, the only distresses observed on these overlays were cracking and delamination.

There was cracking on all overlays. In most cases, the cracking was hairline and random. In heavily cracked areas, the cracks connected to form a map pattern. This cracking may be due to drying shrinkage. Similar problems are also seen on OSHD LMC overlays.

In addition, there were delaminations on five of the seven overlays. This distress was not extensive, as the worst deck had only 2.5% of its surface delaminated. In most cases the delaminations were small, scattered throughout the deck, and covered by uncracked MC. Exceptions were two large delaminations that were under sections of the overlay with severe map cracking, and numerous delaminations adjacent to construction and expansion joints. The delaminations that were repaired were almost always between the overlay and the old deck, and the MC over the delamination appeared to be well consolidated. The cause of these delaminations is not known, and similar distress is often seen on OSHD LMC overlays.

The wheel-to-pavement friction of these overlays was comparable to typical pavements and LMC bridge decks on state highways in Oregon.

The only maintenance and repair cost to the OSHD was the sealing of one deck with methacrylate and sand, at a cost of $4,000.

## 4.0 ADDITIONAL OSHD EXPERIENCE WITH MICROSILICA

Although there were problems with the MC overlays in this study, this material has been successfully used by other states. In addition, an MC overlay recently constructed for the OSHD has carried traffic with little or no cracking. Consequently, the problems seen in this study may not be inherent to MC. Instead, they may have been due to the way that MC was used on these overlays.

Three MC pours were used to overlay the bridge where the Swift Interchange - Delta Park Interchange Section of US #I-5 crosses Victory Blvd. in Portland. The west, center, and east pours were made in November 1990, May 1991, and July 1991, respectively. No delaminations or cracks were detected during the post-construction inspections that were done just after the curing blankets were removed and before traffic was allowed on the panels. In addition, there has been very little cracking while the overlays have been under traffic.

People working on this project attribute much of the overlay's success to:

1) **Batch plant equipment and personnel that were able to correctly make sophisticated mixes with many admixtures, such as MC.** This is in contrast to overlays in this study, as there were frequent problems with the timing and amount of admixture additions.

2) **A short 15-minute haul time between the batch plant and the jobsite.** As a result, the admixtures such as set retarder, superplasticizer, and air entrainment agent were added at the batch plant; and further additions (retempering) were rarely needed at the jobsite. This assured that the MC was poured within 30 minutes after it was batched; and consequently, the mix was easy to handle and consolidate during placement.

   In this study, the batching to pouring intervals ranged from 39 to 106 minutes. In almost all cases, the mixes required retempering at the jobsite. In addition, some of these mixes lost slump too early in the placement and finishing process and were hard to place and finish. Furthermore, in most cases, they had the worst cracking and delamination problems.

3) **A cool and humid environment during the pouring.**

These successful pours were made on either cool clear days or warm overcast and humid days. This prevented rapid evaporation of water from the surface of the fresh MC. In contrast, almost all pours in this study were made in hotter and/or drier conditions.

# 5.0 CONCLUSIONS AND RECOMMENDATIONS

This chapter contains conclusions and recommendations based on one year's experience with the study overlays.

## 5.1 Conclusions

After one year, the overlays were still meeting their design objective of adding structural strength, as none of the cracking and delamination was severe enough to weaken the overlay. In addition, the overlays were satisfying their design goal of giving a smooth and durable surface, as the cracked and delaminated areas were still intact. However, the overlays were not meeting their design objective of sealing the underlying deck from chlorides. Water can contact the existing deck through cracks in the overlays, delaminations under cracked sections of the overlay, and delaminations adjacent to construction and/or expansion joints.

The wheel-to-pavement frictional properties of MC were similar to typical state highway pavements and LMC bridge decks in Oregon.

The problems on the study overlays do not mean that MC is a poor alternative to LMC, as the OSHD has similar cracking and delaminating problems with both materials. MC may have the potential to be a good overlay material; as a recent MC overlay built for the OSHD has resisted early cracking. Experience with this successful overlay indicates that these items may be important:

1) Batch plant equipment and personnel able to correctly make sophisticated mixes with many admixtures, such as MC.

2) A short duration between batching and pouring.

3) A favorable environment for the bridge deck overlay construction with cool and/or humid weather and small daily temperature fluctuations.

## 5.2 Recommendations

Based on the preliminary results of this study, it is recommended that MC continue to be used for structural overlays in areas where there are concrete plants capable of handling MC, where there are short durations between batching and pouring, where there is cool and/or humid weather and small daily temperature fluctuations during pouring.

Continued experimentation is recommended to develop methods to successfully pour MC in areas where there are long durations between batching and pouring, hot and/or dry weather during placement, and large daily temperature fluctuations.

## 6.0 REFERENCES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3. William Loy and others, Atlas of Oregon (Eugene, Oregon: University of Oregon Books, 1976), pp. 130-32, 135.

4. Oregon State Highway Division, Traffic Volume Tables for 1989, Official Publication 90-1 (Salem, Oregon: Oregon Department of Transportation, 1990), pp. 15, 31, 130, and 146.

5. D.G. Manning and D.H. Bye, Bridge Deck Rehabilitation Manual, Part 1: Condition Surveys (Downsview, Ontario: Ontario Ministry of Transportation and Communications, November 1983), p. 1.

## APPENDIX A: SURFACE CONDITION AND MAINTENANCE

### Table A-1a: Surface Condition and Maintenance - Northbound Colestin Road Overcrossing Bridge Overlay

| Date of Inspection or Repair | Comments |
|---|---|
| April, '89 | **Poured**. |
| May, '89 | **Isolated cracks** were found when the deck was uncovered after the cure. The cracks were sealed with methacrylate sealer.<br><br>**Isolated delaminations** were chipped out and repaired with MC. |
| November, '89 | **Extensive map cracking** was found. The deck was flooded with Concresive 2075 methacrylate sealer and covered with #30 grit sand.<br><br>**1.9% of the surface was delaminated**. The delaminations were scattered throughout the deck, and most were 1 to 3 square feet in area. |
| September, '90 | **Severe alligator cracks** were found on 2% of the surface [Figure 3.2b]. **Alligator cracking was starting** on 1% of the surface. **Severe cracking** was found between the inside fog line and face of the inside bridge rail. **Random transverse and longitudinal cracks** up to 6 feet long were found on the right lane. **Cracking** was found on the strip of MC between the expansion joint and the poured filler on the ends of the bridge. **Little cracking** was seen on the left lane.<br><br>**2.5% of the surface was delaminated**. These small delaminations were scattered throughout the deck, as in the 11-89 inspection. |

**Table A-1b: Surface Condition and Maintenance - Southbound Colestin Road Overcrossing Bridge Overlay**

| Date of Inspection or Repair | Comments |
|---|---|
| August and September, '89 | **Poured**. |
| September, '89 | **No cracking or delaminations** were found when the deck was uncovered after the cure. |
| September, '90 | **Several cracks** 20 to 30 feet long were found in Pour 1, the climbing lane, near the leading edge of the bridge. **Scattered cracks** up to 12 feet long were found throughout the rest of Pour 1 and Pour 2. **Cracking** was found on the strip of MC between the expansion joints and the poured filler on both ends of bridge.<br><br>**.7% of the surface was delaminated**. Most delaminations were on the right edge of Pour 2 where it abutted Pour 1 [Figure 3.2a]. |

**Table A-1c: Surface Condition and Maintenance - Northbound Neil Creek Road Overcrossing Bridge Overlay**

| Date of Inspection or Repair | Comments |
|---|---|
| May, '89 | **Poured**. |
| May, '89 | **No cracks** were found when the deck was uncovered after the cure.<br><br>**A few delaminations** were found. They were chipped out and repaired with MC. |
| November, '89 | **No cracks** were found.<br><br>**1.4% of the surface was delaminated**. .3 to 1.0 feet of the leading edge of the deck was delaminated. There were scattered small delaminations throughout the rest of the deck. |
| September, '90 | **Random cracks** up to 9 feet long were found on both travel lanes. **1 foot long cracks** extended from the outside bridge rail into the deck at 1 to 1-1/2 foot intervals.<br><br>**2.2% of the surface was delaminated**. These delaminations were scattered, as noted in the 11-89 inspection. |

**Table A-1d: Surface Condition and Maintenance - Southbound Neil Creek Road Overcrossing Bridge Overlay**

| Date of Inspection or Repair | Comments |
|---|---|
| September, '89 | **Poured**. |
| September, '89 | **No cracks or delaminations** were found when the deck was uncovered after the cure. |
| September, '90 | **Alligator pattern cracking** was found on 22% of the deck, and **scattered cracks** up to 36 inches long were seen on the rest of the span.<br><br>**.2% of the deck was delaminated**. There were two delaminations, and both were under sections of the deck that were alligator cracked. |

**Table A-1e: Surface Condition and Maintenance - Holladay Street Ramp Bridge Overlay**

| Date of Inspection or Repair | Comments |
|---|---|
| April & May, '89 | **Poured**. |
| May, '89 | On Pour 1, the right lane, **four 1-inch long shrinkage cracks** were found immediately after the curing blankets were removed. **Three short longitudinal cracks** appeared in the deep (5 to 7 inches) section of the overlay at the west end of the bridge after the cure blankets were off for 24 hours. The cracks were sealed.<br><br>**Diamond grinding** was used to smooth the rough surface of Pour 1. **No cracks** were seen on Pour 2, the left lane, and no grinding was needed.<br><br>**No delaminations** were found. |
| October, '90 | **Cracking** was found on 50% of the right lane and 30% of the left lane. Near both ends of the bridge, the cracks appeared to be deeper and were **alligatored**. The cracking was most severe on the deep section of the overlay at the west end of the right lane [Figure 3.1b]. **Alligator cracking** was also noted on a short section of standard PCC mix located at the east end of the right lane. This PCC was used in the last truckload of mix for the right lane, as the concrete supplier ran out of MC mix.<br><br>**No delaminations** were found. |

**Table A-1f: Surface Condition and Maintenance - Grand Avenue Ramp Bridge Overlay**

| Date of Inspection or Repair | Comments |
|---|---|
| September, '89 | **Poured**. |
| September, '89 | **No cracks** were seen when the curing blankets were removed.<br><br>**Grinding** was done on a small section of the overlay to correct the deck profile.<br><br>**No delaminations** were found. |
| October, '90 | **Short hairline alligator cracking** was noted on 34% of the MC overlay [Figure 3.1a].<br><br>**Short transverse cracks** were noted on 24% of the widened PCC deck near the right bridge rail.<br><br>**No delaminations** were detected. |

**Table A-1g: Surface Condition and Maintenance - Westbound Meacham Overcrossing Bridge Overlay**

| Date of Inspection or Repair | Comments |
|---|---|
| August, '89 | **Poured**. |
| September, '89 | **Three cracks** 1 to 1-1/2 feet long were found and sealed on Pour 1. Construction personnel feel that these cracks may be tears from tining. **No cracks** were found on any other spans.<br><br>**.3% of Pour 1** and **.1% of Pours 2 and 3** were delaminated. Almost all delaminations were on the west edges of the pours adjacent to the expansion joints. All delaminations were chipped out and repaired with MC. |
| November, '90 | **Isolated scattered cracks** were found on Pours 1 and 3, with the heaviest cracking on Pour 1. **Little or no** cracking was found on Pour 2.<br><br>**.1% of Pour 1, .01% of Pour 2, and .04% of Pour 3 were delaminated**. Almost all delaminations were under or next to patches made on delaminations found in September, 1989. |