

**PROTECTIVE COATINGS ON CONCRETE SURFACES**

**MADDEN MACRYSEAL**

**Experimental Feature  
Final Report**

**By**

**Thomas A. Hardy  
Research Specialist**

**and**

**Leon G. Brock  
Research Coordinator**

**OREGON STATE HIGHWAY DIVISION  
Research Section  
Salem, Oregon 97310**

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## PROTECTIVE COATINGS ON CONCRETE SURFACES - MADDEN MACRYSEAL

### INTRODUCTION

The intrusion of salt-laden moisture into concrete bridge members has caused considerable damage to bridges along the Oregon coast. The increasing chloride ion content of the concrete fosters a galvanic corrosion cell. This results in the rapid corrosion of the reinforcing steel and the spalling of the concrete. To prevent the intrusion of chloride ions into the concrete, the Oregon State Highway Division specifications call for a concrete sealer on select concrete members on coastal bridges.

When the Yachats River Bridge (on US 101 in Lincoln County, Oregon) was constructed in 1977, the contractor requested permission to use Macryseal, supplied by Madden Construction Supply (Portland, Oregon). Since Macryseal was not an approved sealer, preliminary tests were done by the Research Section of the Oregon State Highway Division. These tests indicated that Macryseal provided protection that was comparable to that provided by the sealers already approved. Therefore, permission was granted to use Macryseal and a program to evaluate its performance was scheduled.

The Yachats River Bridge carries two lanes of traffic on a 2-1/2 inch asphalt concrete wearing surface. The bridge is 223 feet long and consists of two prestressed concrete slab approach spans and a prestressed concrete bulb-T main span. The Pacific Ocean (the breakers are only several hundred yards away) provides a salt-rich spray which coats the bridge.

### CONSTRUCTION

Macryseal was applied to all the exposed surfaces of the concrete bridge members. Macryseal is a clear acrylic sealer with 18% solids. The product was applied in two coats using both rollers and low pressure spray equipment. The rates of application were 250 square feet per gallon and 400 square feet per gallon, for the first and second coats, respectively. These rates were difficult to maintain especially on the vertical surfaces. Extra care was needed to achieve an acceptable appearance on the surfaces where appearance was a major consideration, most notably the outside of the curtain wall. Since many of the bridge members were precast using steel forms, their surfaces were smooth and dense. This made it more difficult for the proper amount of sealer to penetrate before it ran off of the vertical surfaces. Consequently, the application was uneven in appearance in several locations.

### EVALUATION

To evaluate the effectiveness of Macryseal in preventing intrusion of chloride ions into the concrete, the chloride ion content of the concrete was determined by laboratory analysis. After one, three and five years of service, samples of concrete dust were collected using an electric drill.

Samples were taken from the west side curtain wall; from both the inside surface which was under the structure and the outside surface which was directly exposed towards the ocean. Except for the first test date, four samples were collected on each test date, two from both the inside and outside surfaces. The following table summarizes the test results.

Chloride Ion Content  
(pounds of Cl<sup>-</sup> per cubic yard of concrete)

Location	Date		
	10/78	2/80	11/82
Outside	0.03	0.1	0.1
	-	0.1	0.1
Inside	0.2	0.1	0.4
	-	0.1	0.5

The levels of chloride ion content in the samples indicate that Macryseal is performing well on the outside of the curtain wall but is not protecting against intrusion of salt on the inside of the curtain wall. Two factors differentiate the two sides of the curtain wall. First, extra care in application on the outside surface provided a more uniform coverage and presumably a better seal. Second, although the outside surface directly faces the ocean and therefore, has more direct exposure to the salt spray, it is also directly exposed to the rain which would tend to rinse the salt off of its vertical surface. The inside face has indirect exposure to the salt, but is protected from the rain.

It is difficult to ascertain the most significant reason for the differing performance of the two curtain wall surfaces. However, the problems associated with application to the precast vertical surfaces seem important. If the application of the sealer is uneven, the recommended coverage is not being achieved and reduced protection would be expected. Preparation of the surface, such as sandblasting, before application of the sealer appears to be desirable to ensure proper coverage.

#### CONCLUSION

The conclusion reached by this study is that when applied correctly, Macryseal is an adequate sealer and inhibits intrusion of salt into concrete. However, the recommended coverage will be difficult to achieve without prior sandblasting to prepare the surface.

## EXPERIMENTAL PROJECT REPORT

EXPERIMENTAL PROJECT	EXPERIMENTAL PROJECT NO. STATE YEAR NUMBER SUP. 1 <input type="checkbox"/> 0 4 7 3 - 02 <input type="checkbox"/>	CONSTRUCTION PROJ. NO. 8 RF 144(15)	LOCATION 28 Yachats
	EVALUATION FUNDING 1 <input type="checkbox"/> HP&R 3 <input type="checkbox"/> DEMONSTRATION 48 2 <input checked="" type="checkbox"/> CONSTRUCTION 4 <input type="checkbox"/> IMPLEMENTATION	NEEP NO. 49 <input type="checkbox"/>	PROPRIETARY FEATURE? 51 <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
SHORT TITLE	TITLE 52 PROTECTIVE COATINGS ON CONCRETE SURFACES - MADDEN MACRYSEAL		
THIS FORM	DATE MO. YR. 140 0 4 - 8 5	REPORTING 144 1 <input type="checkbox"/> INITIAL 2 <input type="checkbox"/> ANNUAL 3 <input checked="" type="checkbox"/> FINAL	
KEY WORDS	KEY WORD 1 145 BRIDGESUPERSTRUCTURE	KEY WORD 2 167 COATINGS	
	KEY WORD 3 189	KEY WORD 4 211	
	UNIQUE WORD 233	PROPRIETARY FEATURE NAME 255 MADDEN MACRYSEAL	
CHRONOLOGY	Date Work Plan Approved: MO. YR. 277 0 4 - 7 3	Date Feature Constructed: MO. YR. 281 0 6 - 7 7	Evaluation Scheduled Until: MO. YR. 285 1 1 - 8 2
			Evaluation Extended Until: MO. YR. 289 <input type="checkbox"/>
			Date Evaluation Terminated: MO. YR. 293 1 1 - 8 2
QUANTITY AND COST	QUANTITY OF UNITS (Rounded to whole numbers) 297 <input type="checkbox"/>	UNITS 1 <input type="checkbox"/> LIN. FT. 5 <input type="checkbox"/> TON 2 <input checked="" type="checkbox"/> S.Y. 6 <input type="checkbox"/> LBS. 3 <input type="checkbox"/> S.Y.-IN. 7 <input type="checkbox"/> EACH 4 <input type="checkbox"/> C.Y. 8 <input type="checkbox"/> LUMP SUM 305	UNIT COST (Dollars, Cents) <input type="checkbox"/> 6 3 306
AVAILABLE EVALUATION REPORTS	<input type="checkbox"/> CONSTRUCTION 315	<input type="checkbox"/> PERFORMANCE	<input checked="" type="checkbox"/> FINAL
EVALUATION	CONSTRUCTION PROBLEMS 318 1 <input type="checkbox"/> NONE 2 <input checked="" type="checkbox"/> SLIGHT 3 <input type="checkbox"/> MODERATE 4 <input type="checkbox"/> SIGNIFICANT 5 <input type="checkbox"/> SEVERE		PERFORMANCE 319 1 <input type="checkbox"/> EXCELLENT 2 <input type="checkbox"/> GOOD 3 <input checked="" type="checkbox"/> SATISFACTORY 4 <input type="checkbox"/> MARGINAL 5 <input type="checkbox"/> UNSATISFACTORY
	APPLICATION 320 1 <input type="checkbox"/> ADOPTED AS PRIMARY STD. 4 <input type="checkbox"/> PENDING 2 <input checked="" type="checkbox"/> PERMITTED ALTERNATIVE 5 <input type="checkbox"/> REJECTED 3 <input type="checkbox"/> ADOPTED CONDITIONALLY 6 <input type="checkbox"/> NOT CONSTRUCTED (Explain in Remarks if 3, 4, 5, or 6 is checked)		
REMARKS	321 Madden Construction Supply has closed their northwest		
	offices and is apparently no longer in business. Imperial		
	Paint Co. of Portland, OR manufactured Madden Macryseal.		
	Imperial now produces a product which they claim is identical - 1460 Clearacrylic sealer 700		