

## MICROSILICA MODIFIED CONCRETE FOR BRIDGE DECK OVERLAYS

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

Laboratory studies have shown that microsilica concrete (MC) has sufficient strength and impermeability to substitute for LMC in bridge deck overlays. In addition, manufacturers of microsilica admixtures state that MC can be mixed in batch plants, like Portland cement concrete (PCC). This may be an advantage over LMC on certain jobs, as batching LMC requires the use of mobile mixing plants at the jobsite.

To see if MC is a viable alternative to LMC, five bridges in Oregon were overlaid in 1989 using this material. The MC contained Force 10,000<sup>R</sup> microsilica slurry, made by W.R. Grace, Inc. of Cambridge, Massachusetts. Two of the bridges were on US I-5 near Ashland, two bridges were on approaches to US I-84 in Portland, and one bridge was on US I-84 near Meacham.

At each site, the MC placed during the first day had the most problems. This may have been due to the contractor's inexperience with the product. On subsequent days, the construction went smoothly.

Most problems occurred because the contractors tried to place mixes that were too stiff, and these mixes lost slump too early in the placement and finishing process. Consequently, the MC was hard to finish and poor quality overlays resulted. Although mechanical finishing was used on all overlays, some of the stiff mixes needed additional hand finishing.

Solutions to the problems with mix workability were:

- 1) Reducing the duration between batching and completion of finishing by: delivering consistent mix to the jobsite, streamlining jobsite testing and mix adjustment, and assuring that enough equipment and people were available to quickly place, finish, and cover the MC.
- 2) Delivering mix that would not lose slump too soon in the construction process by: using mixes with higher slumps, and adding most of the superplasticizer at the jobsite rather than at the batch plant.
- 3) Fogging with a hand held hose-end mister to prevent the mix from sticking to finishing equipment.
- 4) Placing and finishing mix in the downhill direction on decks with a grade.

Delamination and/or cracking was seen on some decks after several months of use. The cause of this distress is not known. However, it occasionally occurs on LMC overlays placed under similar conditions.

Conclusions:

- 1) Although the long-term durability of MC deck overlays in Oregon is not known, some MC overlays constructed in this study had adequate strength, a smooth uncracked surface, and minimal delamination - the same as LMC. Many of the problems observed in this study may be prevented by using the February 1990 or later OSHD specifications.

- 2) Unlike LMC, which requires a mobile mixer at the jobsite and priming of the old deck; MC can be produced in an off-site batch plant, and deck priming is not needed. MC should be considered as an alternative to LMC if a batch plant is within a 20-minute haul distance.
- 3) The combined cost of furnishing and placing MC and LMC were similar, based on experience with the overlays in this study. The lower cost of furnishing MC was offset by the higher cost of finishing.
- 4) MC overlays have higher initial skid resistances than typical LMC surfaces.

The report: "Microsilica Modified Concrete for Bridge Deck Overlays - Construction Report" has just been published by the OSHD Research Unit. It covers the mix design, placement, finishing, curing, and post-construction inspection results for the 1989 overlays. In addition, it contains recommendations on construction and a copy of the February 1990 OSHD specifications for microsilica concrete.

These bridge decks will be monitored by the Research Unit through 1993. Emphasis will be placed on the overlay's resistance to cracking, resistance to delamination, and skid resistance. Chloride impermeability will not be addressed. For more information, contact:

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