

FIRST YEAR PERFORMANCE OF MICROSILICA CONCRETE 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, to provide a smooth and durable wearing surface, and to seal the underlying 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, MC can be mixed in off-site batch plants, like Portland cement concrete (PCC). This is 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, seven bridges in Oregon were overlaid with this material in 1989. The MC contained Force 10,000^R microsilica slurry made by W.R. Grace, Inc. of Cambridge, Massachusetts. Four of these 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.

Performance in the Fall of 1990, after one year:

- 1) The only distresses 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, and similar problems are 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 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.

- 2) The wheel-to-pavement friction of these overlays was similar to typical State highway pavements and LMC bridge decks in Oregon.
- 3) 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. This seal was effective.

Conclusions, after one year:

- 1) The overlays were still meeting their design goal of adding structural strength and giving a smooth and durable surface. However, as they were cracked, 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.

- 2) The wheel-to-pavement frictional properties of MC were satisfactory.
- 3) 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. In addition, MC has the potential to be a good overlay material, as it has been successfully placed for other agencies. In addition, it was successfully placed for the OSHD in a recent overlay in Portland. Experience with this successful overlay indicates that the following items are important:
 - a) Batch plant equipment and personnel able to correctly make sophisticated mixes with many admixtures, such as MC.
 - b) A short duration between batching and pouring.
 - c) A favorable environment for deck overlay construction with cool and/or humid weather.

Recommendations, after one year:

- 1) It is recommended that MC continue to be used for structural overlays in areas where there are:
 - a) concrete plants capable of handling MC
 - b) short durations between batching and pouring
 - c) favorable weather conditions (cool and/or humid weather and small air temperature fluctuations during pouring).
- 2) Continued experimentation is recommended to find ways of successfully placing MC in other conditions.

The report: "Microsilica Modified Concrete for Bridge Deck Overlays - First Year Interim Report" has just been published by the OSHD Research Unit. Similar reports will be issued after two and four years of use, as these decks will be monitored by the Research Unit through 1993. In addition, the OSHD will be starting a study in the near future titled "Premature Distress of LMC and MC Bridge Deck Overlays." For a copy of the interim report, or information about either study, please contact:

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