RESEARCH
Oregon Department of Transportation

Research Notes

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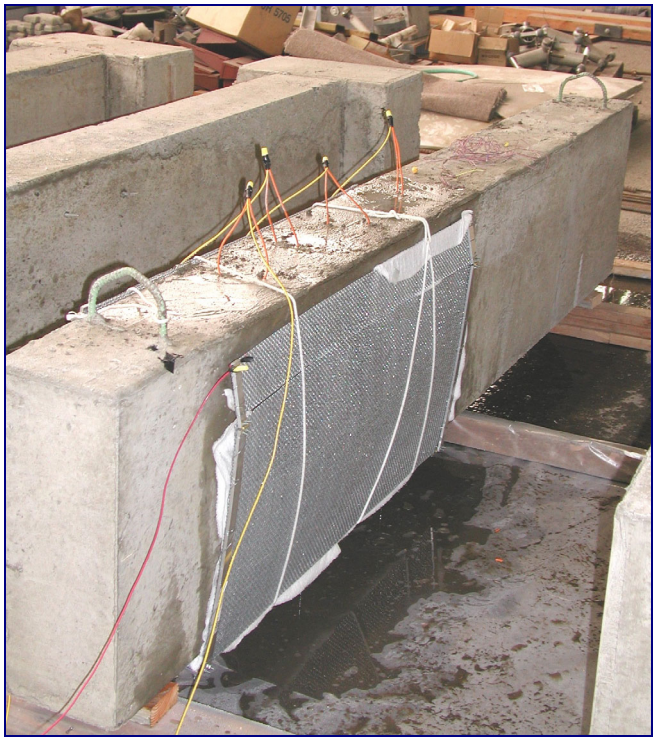
Shear Capacity of Corrosion-Damaged RC Beams

Bridges on Oregon's coast must withstand a corrosive marine environment. Concrete in reinforced concrete structures offers temporary protection to the reinforcing steel against the environment; but eventually the embedded steel succumbs to the inexorable nature of carbon steel to rust. A thin layer of rust is enough to spall the concrete cover, exposing the underlying steel directly to the corrosive environment.

Experience has shown that the vertically oriented steel bars (shear stirrups), which are in place to provide shear capacity to a beam, are the most prone to degradation. Horizontal steel bars, which add flexural capacity to the beam, also corrode, but the bars are thicker and placed in multiple layers through the width of the beam. Corrosion damage can be so severe that some shear stirrups are completely severed.

Corrosion damage in a bridge beam

Research conducted by Oregon State University and the Department of Energy, Albany Research Center, investigated the effect of corrosion-damaged stirrups on shear capacity and the progression of corrosion damage in coastal Oregon bridges. After casting and curing, the stirrups of fourteen large-size beams were corroded to varying levels of damage, ranging from pristine to complete local section loss. A hydraulic system was used to slowly load the beams to failure, while measuring how much the beams deflected and strained. After failure, the actual corrosion damage to the stirrups was documented.



Beam undergoing controlled corrosion

Five models of varying complexity were applied to the data to predict the decrease in shear capacity as a function of damage. A simplified practical method of hand calculations, based on a traditional approach by the American Concrete Institute, was developed for designers to use in determining the capacity of bridges. The method uses the average remaining stirrup cross sectional area as the measure of damage. Recommendations were made on how to inspect beams in order to acquire the data necessary to conduct the capacity calculations.

Request a copy of the report:

"Shear Capacity Assessment of Corrosion Damaged Reinforced Concrete Beams"

from the Research Unit. Or view the report on the Research website listed below.

For more information on this and other bridge research, contact Steve Soltesz, Research Coordinator, at 503-986-2851, or via e-mail at steven.m.soltesz@odot.state.or.us.

Oregon Department of Transportation

Research Unit
200 Hawthorne Ave. SE, Suite B-240
Salem, OR 97301-5192

Telephone: 503-986-2700
FAX: 503-986-2844

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