

Recent Research – TRB Compendium of Papers 2006

Evaluation of Methods of Rebar Protection, Spall Prevention and Repair Techniques on Concrete Girders WHRP Project [0092-06-06](#)

The paper(s) abstracted below report recent research that may be related to the subject matter or methodologies of this WHRP project. For access to the CD-ROM and full text of the paper, contact Hussain Bahia (bahia@engr.wisc.edu) or Greg Waidley (gwaidley@engr.wisc.edu) at WHRP or John Cherney (john.cherney@dot.state.wi.us) at the WisDOT Library.

Corrosion Process and Abatement in Reinforced Concrete Wrapped by Fiber Reinforced Polymer

Paper No. 06-1801

Authors: Lisa K. Spainhour, Isaac A. Wootton

Abstract: The corrosion performance of steel reinforcement embedded in concrete samples encased by a coat of epoxy or a carbon fiber reinforced polymer (CFRP) wrap was investigated experimentally. Concrete samples were wrapped with one to three fabric layers impregnated with one of two different two-part epoxies. To accelerate corrosion, samples were subjected to an impressed current and a high salinity solution. Current flow measurements dynamically monitored corrosion activity during testing while corrosion induced reinforcement mass losses were measured following testing. Theoretical predictions of total mass loss, based on Faraday's law, were compared with actual corrosion mass loss values. A strong correlation between the predicted and actual corrosion mass loss values validated the use of theoretical estimates to examine the effect, over time, of CFRP wraps on the corrosion process. Test results indicated that CFRP wrapped specimens had prolonged test life, decreased reinforcement mass loss, and lower corrosion rates. The performance of wrapped specimens was superior to that of either control samples or those coated only with epoxy. Results indicated that the level of corrosion abatement provided by the CFRP wraps was influenced more by the type of epoxy used than the number of wrap layers. CFRP wraps when used to rehabilitate bridge foundations can not only provide an additional protective barrier to the concrete-encased steel bars by hindering the availability of corrosion agents but also confine the concrete, thereby delaying the onset of corrosion, retarding deterioration from cracking and spalling, and slowing the overall corrosion rate.

Static and Dynamic Testing of a Concrete T-Beam Bridge Before and After Carbon Fiber Reinforced Polymers (CFRP) Retrofit

Paper No. 06-2601

Authors: F. Necati Catbas, Kirk A. Grimmelsman, S. Korhan Ciloglu, Ildefonso Burgos-Gil, Manuel Coll-Borgo

Abstract: This paper summarizes the design and execution of field studies to improve the performance of a deteriorated bridge using new material. The results from field tests conducted on Bridge 2028 in Cayey, Puerto Rico before and after the two span concrete T-beam bridge was retrofitted with carbon fiber reinforced polymer (CFRP) material are presented and discussed. The objective of the CFRP retrofit was to extend the life of the bridge by increasing its load rating. Field testing was performed before and after the retrofit was installed to objectively evaluate the improvement in load capacity and stiffness. The field testing program included both static load tests and dynamic tests. The first set of field tests were conducted in November, 2002 to identify the baseline performance characteristics of the bridge before the retrofit was installed. The CFRP retrofit was installed in October, 2003 and a second set of nearly identical field tests were performed in August, 2004 to characterize the as-retrofitted performance of bridge. The test results indicated that the retrofit increased the bending stiffness of the bridge by 15% and decreased the tensile strains in the bottom rebars of the concrete T-beams by 13%. Furthermore, the maximum rebar strains under a very heavy truck load case were only 10% of the yield strength after the retrofit was installed. The change in stiffness determined from deflection measurements is well correlated with the observations made from the dynamic test results. The field testing program showed that the CFRP retrofit was successful in improving the mechanical behavior of the bridge. The long-term performance and durability of the CFRP retrofit could be affected by a number of parameters such as the local environmental conditions. The field testing program could be

periodically repeated in the future, or a continuous monitoring program could be implemented to objectively evaluate the long-term performance and durability of the CFRP retrofit.