Rahall Transportation Institute
Research Project Description Form

Project Number: 208067
Project Title: Assessing the Service Life of Corrosion-Deteriorated Reinforced Concrete Members in Highway Bridges in West Virginia

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Project Objective: The primary objective of this study is to develop a manual that will be adopted by the WVDOH. The manual shall aim at providing a procedure for: (a) assessing the condition of reinforced concrete bridge members subjected to corrosion-induced deterioration; and (b) predicting the remaining service life of these members.

Abstract: Corrosion-induced deterioration of reinforced concrete bridge superstructure members is a common and costly problem in the United States. In a recent report to Congress, the Federal Highway Administration (FHWA) reported that of the nation's 577,000 bridges 134,000 were classified as structurally deficient. According to the July 9, 2010 Bridge Data Book published by The WVDOH 979 of the 6,789 bridges in West Virginia are classified as structurally deficient. Structurally deficient bridges are those that are closed, have a low load posting, or that require rehabilitation or replacement. Approximately 40 percent of the current backlog of highway bridge repair and rehabilitation costs is directly attributed to the corrosion of reinforced concrete bridge elements.

WVDOH is not unique in that they use visual inspection as a valid technique to monitor the extent of cracking and damage for bridge members. This visual inspection technique would allow bridge inspectors and bridge engineers of old to

determine the extent of the maintenance required for each bridge member. However, various techniques have been developed over the years to assess the condition of concrete bridge elements that will assist today's bridge engineers in making these decisions with more reliability. Therefore, there is an urgent need to identify or develop suitable procedures for assessing the condition of corrosion-deteriorated bridge members, estimating their expected remaining service life, and determining the effects of maintenance and repair options on their service life.

Task Descriptions: 1) Review the methods for predicting the remaining service life of deteriorated bridge members subjected to chloride ion induced corrosion;
2) Review the methods to quantify the service life extension expected from alternative maintenance and repair options;
3) Discuss the applicability of including corrosion inhibitors and the performance evaluation of steel reinforcement corrosion inhibitors;
4) Assess and analyze all the information from the previous three tasks and identify the optimum procedures for assessing the condition of corrosion-deteriorated reinforced concrete bridge members, predicting the remaining service life of such members, and quantifying the service life extension expected from alternative maintenance and repair options.

Milestones, Dates, Schedule:
1) Carry out a literature review. (Approximate Duration: 21 Months)
2) Review the methods to quantify the service life extension. (Approximate Duration: 20 Months)
3) Discuss the applicability of including corrosion inhibitors and the performance evaluation of steel rebars corrosion inhibitors with strain gauges. (Approximate Duration: 20 Months)
4) Discuss theoretical modeling of concrete corrosion. (Approximate Duration: 14 Months)
5) Investigate the feasibility of detailed mapping of the surface core sampling.(Approximate Duration: 12 Months)
6) Discuss inspection methods to determine concrete rebar condition in bridge members. (Approximate Duration: 12 Months)
7) Assess and analyze the information from the previous tasks. (Approximate Duration: 8 Months)
8) Develop a manual for assessing the condition of corrosion-damaged highway bridge members in West Virginia. (Approximate Duration: 8 Months)
9) Prepare a final report and disseminate the project findings. (Approximate Duration: 8 Months)

Yearly and Total Budget: $285,983

Student Involvement: Two graduate students were involved in the project.

Relationship to Other Research Projects: The project findings shall assist in assigning an accurate condition code to each structural element as these values factor heavily into the calculation of structural deficiency, functional obsolescence, and the sufficiency rating of structures. The sufficiency rating of a structure determines whether it is eligible for federal funding. This becomes a very important aspect to State DOT's when trying to forecast financial needs for a bridge management and maintenance programs.

Technology Transfer Activities: A final report and a manual will be compiled. Two presentations will be given in international conferences.

Potential Benefits of this Project: The objectives for this project are to make a recommendation for a method to determine the remaining service life of corrosion deteriorated concrete structures and to establish a solid foundation to begin to develop a manual to develop a protocol for field assessment of these same structures.

TRB Keywords: Bridges, Reinforced Concrete, Reinforcement Corrosion; Condition Rating and Assessment; Service Life; Bridge Maintenance and Management.