



Progress Report for IZA Project ZC-24: Rebar Product Research

September, 2005

ILZRO ZC-24: Update on the Performance of Galvanized Rebar in Concrete

ILZRO ZC-24 is a consolidation of a number of ILZRO rebar focused research projects, including ZC-1-3 "Performance of galvanized Rebar in Marine Substructure Service", ZC-3 "Achieving the 100 Year Bridge Using Galvanized Rebar" and ZC-10 "Long Term Data on Galvanized Rebar Performance in Bridges Exposed in Aggressive Environments".

ILZRO '05 ZC-24 funding totaled \$14,000 requiring the decision to focus on ZC-3 to ensure continued monitoring and maintenance of the specimens at Florida Atlantic University and the Florida DOT. These funds have not been allocated awaiting a project review by Rod Powers of the Florida DOT. Ongoing monitoring and maintenance of the samples cost considerably more than the ILZRO funds available and Florida DOT are reviewing the results to date before committing additional resources to continue the tests.

ILZRO ZC-3: Achieving the 100 Year Bridge Using Galvanized Rebar

A contract extension was awarded to Florida Atlantic University (FAU) in 2004 to continue monitoring the ASTM G-109 specimens under test. Parallel testing of a similar test matrix but using tombstone type specimens is also underway at the Florida Department of Transport lab in Gainesville. A Progress Report issued by FAU in February '05 found the following:

- 1) Cumulative charge transfer measurements (CCT) indicated that galvanized "standard" concrete samples appeared to be passivating while corrosion of the black rebar samples continued to progress. Subsequent autopsying of one sample of each showed both galvanized and black rebar to be in good condition.
- 2) Electrochemical data for all samples having admixtures (silica fume and fly ash) to the concrete, for both black and galvanized rebar, have shown no corrosion activity. A presentation made by the Florida DOT of results to date of their tombstone specimens clearly showed improved performance of galvanized rebar in the control, or standard concrete. Specimens having admixtures have yet to fail and therefore it is still too early to determine what benefit galvanized coatings provide in higher quality concretes.

ILZRO ZC-1-2: *Galvanized Steel Reinforcement in Concrete*, edited by Stephen Yeomens

This long awaited book was finally published in 2005. Sales of the book have been strong (over 300 copies to date) and it is an excellent resource for supporting the galvanized rebar market development effort.

Action Plan 2006

1. Achieving the 100 Year Bridge Using Galvanized Rebar

Subject to positive conclusions of the '05 project review, the zinc industry needs to support continued testing of these samples. Positive results from a Florida DOT backed research project would be an excellent endorsement for promoting galvanized rebar in marine environments.

2. Performance Reports

Recent ILZRO ZC-10 field studies have focused on concrete bridge decks in northern climates exposed to deicing salt. With much of galvanized rebar's growth and long term opportunity coming from pour in place and precast concrete bridge and highway, infrastructure and architectural applications exposed to marine conditions, it's desirable to inspect a number of older marine installations utilizing galvanized rebar. Much has already been documented about the successful use of galvanized rebar in Bermuda (chapter in Yeoman's new book). ILZRO will seek out other marine bridge and highway and architectural applications to investigate.

3. Zinc Coating's Reaction with Fresh Concrete

One of the major areas of uncertainty regarding the galvanized rebar performance is the initial reaction of the zinc coating in fresh concrete. Uncertainty regarding the amount of hydrogen evolution, its effect on bond strength and concrete porosity, as well as the benefit provided by chromate or other passivation treatments needs to be better understood. The first step will be a literature review of existing work done in this area followed by discussions with key researchers in the field. The concrete industry will also be contacted to understand the future direction of concrete chemistries and the impact this may have on galvanized rebar. Results of the literature review will help determine the test matrix of different concrete pour solutions and galvanized surfaces – passivated (chromate and alternatives), un-passivated, weathered, annealed to remove eta layer, etc. The effect of these different conditions on the zinc coating's initial reaction in fresh concrete will be determined and the information will help set guidelines regarding compatible concrete chemistries and zinc coating finishes. 2006

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