

Scour Monitoring of the Indian River Inlet Bridge: Pilot Study

By

JENNIFER RIGHMAN
JACK PULEO
JAMIE MACMAHAN
MICHAEL CHAJES

Center for Innovative Bridge Engineering
College of Engineering
University of Delaware

January 2009

Delaware Center for Transportation
University of Delaware
355 DuPont Hall
Newark, Delaware 19716
(302) 831-1446



The Delaware Center for Transportation is a university-wide multi-disciplinary research unit reporting to the Chair of the Department of Civil and Environmental Engineering, and is co-sponsored by the University of Delaware and the Delaware Department of Transportation.

DCT Staff

Ardeshir Faghri
Director

Jerome Lewis
Associate Director

Ellen Pletz
Assistant to the Director

Earl "Rusty" Lee
T² Program Coordinator

Matheu Carter
T² Engineer

Sandra Wolfe
Event Coordinator

DCT Policy Council

Natalie Barnhart, Co-Chair
Chief Engineer, Delaware Department of Transportation

Babatunde Ogunnaike, Co-Chair
Dean, College of Engineering

Delaware General Assembly Member
Chair, Senate Highways & Transportation Committee

Delaware General Assembly Member
Chair, House of Representatives Transportation/Land Use & Infrastructure Committee

Ajay Prasad
Professor, Department of Mechanical Engineering

Harry Shenton
Chair, Civil and Environmental Engineering

Michael Strange
Director of Planning, Delaware Department of Transportation

Ralph Reeb
Planning Division, Delaware Department of Transportation

Stephen Kingsberry
Executive Director, Delaware Transit Corporation

Shannon Marchman
Representative of the Director of the Delaware Development Office

James Johnson
Executive Director, Delaware River & Bay Authority

Holly Rybinski
Project Manager-Transportation, AECOM

*Delaware Center for Transportation
University of Delaware
Newark, DE 19716
(302) 831-1446*

SCOUR MONITORING OF THE INDIAN RIVER INLET BRIDGE: PILOT STUDY

FINAL REPORT

Submitted to
Delaware Department of Transportation (DelDOT)

By
Jennifer Righman, Ph.D., Jack Puleo, Ph.D.,
Jamie MacMahan, Ph.D., and Michael Chajes, Ph.D

January 5, 2009

1. Period of performance: July 1, 2006 through June 30, 2008
2. Amount of funds awarded: \$50,112
3. Nature of research: The objectives of this research were to develop and implement a scour evaluation plan for the Indian River Inlet Bridge, to monitor the structural integrity of the bridge piers, and to correlate any observed pier movements to changes in scour conditions.

4. Principal results:

A large portion of the efforts on this project related to installation of tilt sensors. The original scope of work was modified from installation of a tilt sensor on the southern inlet pier to installing tilt sensors on both of the inlet piers. These are housed in environmental enclosures and are wired to a data logger in an environmental enclosure on the north side of the inlet. Obtaining power for this instrumentation was a challenge, which was successfully overcome. Although not in the original scope of work, in late 2008, the tilt sensor installation was modified to allow for “live” data collection at the request of state personnel. The PIs are still dealing with intermittent communications problems.

The tilt sensors have been successfully operational and recording data. Noise in the data that was initially present was reduced by altering the grounding scheme of the sensors. A method for filtering the data was also devised and employed. This data shows slight changes in pier orientation that are on the order of 0.04 degrees, which is the accuracy of the sensor. Lately one of the sensors has shown slightly more shift. We are uncertain if this is real, but have no other explanation as the last time we checked the sensors there did not appear to be any mechanical malfunction. In addition, the other measuring axis of that particular sensor showed little to no variation in the signal. We attempted to compare data from these sensors with DelDOT survey data but ran into difficulties. The DelDOT survey data indicates the level of the piers are rising which has been interpreted to mean that the benchmark from which the survey data is shot is subsiding. Without proper GPS or total station data to compare to the tilt sensors, we have no way to verify their readings. **It is suggested by the PIs that a standard static survey over the benchmarks used to do the monthly total station surveys of the prisms on the piers be completed every 6 months in order to quantify the movement in the benchmark to which all prism survey data is referenced.** Furthermore, it is suggested that rather than recording only the average height of the prism from the total station shot that all elevations are recorded

for later comparison.

Current meter profiling over a tidal cycle was also performed.

The instrumentation schemes devised and resulting data obtained from this pilot study is now being utilized in the continuation of this project, Near Real-Time Monitoring of Indian River Inlet Scour Hole Edge Evolution Seaward of the Bridge Piers: Phase I.

5. Signature of principal investigator:

A handwritten signature in cursive script, appearing to read "Fred R. McCall".