COMMODORE BARRY BRIDGE - USA

Project Description:

The Commodore John Barry Bridge (CBB) spans the Delaware River between Chester, Pennsylvania and Bridgeport, New Jersey. The bridge has five traffic lanes and currently serves more than six million vehicles annually, a significant percentage of which is heavy truck traffic. It was opened to traffic in 1974.

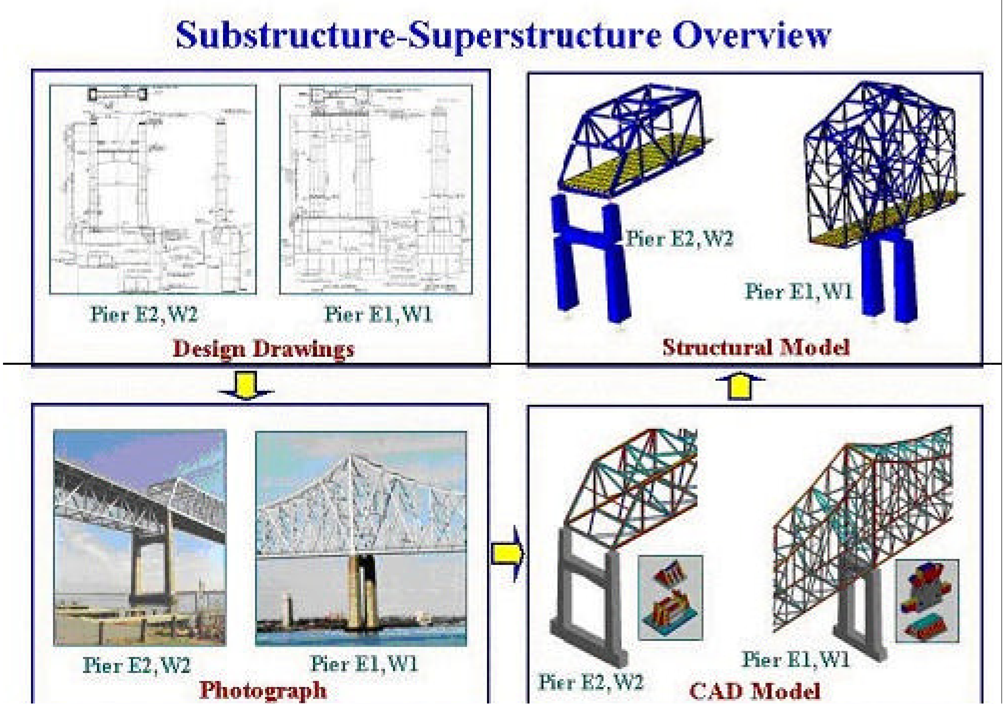
Commodore Barry Bridge Through-Truss Structure

Quick Facts:

- **Name and location:** Commodore John Barry Bridge (CBB) spans the Delaware River between Chester, Pennsylvania and Bridgeport, New Jersey, USA.
- **Owner:** Delaware River Port Authority (DRPA) of Pennsylvania and N. J., USA
- **Structure category:** Long-span steel truss bridge
- **Spans:** 3 spans; 822 ft / 1,644 ft / 822 ft.
- **Structural system:** Steel truss bridge
- **Start of SHM:** 1998
- **Number of sensors installed:** 97 sensors
- **Instrumentation design by:** Drexel Intelligent Infrastructure Institute

Description of Structure:

The total length of the bridge is 13,912 feet. The study focuses on the long span through truss section of the bridge which is 3,288 ft. long. The sub-structures of the through-truss, comprised of four reinforced concrete piers, were constructed on pile foundations in the riverbed. The main truss has 73 panel points spaced at 45.7 feet intervals. The two principal trusses of the through-truss are spaced 72.5 feet apart. The floor system of the bridge is an 8-inch thick lightweight reinforced concrete deck that is composite with 9 steel beams laterally spaced at 6.9 feet.



Substructure-Superstructure Overview

Purpose of Instrumentation:

The purpose of monitoring the truss bridge is to evaluate the following:

- the actual stresses of the critical elements that govern the structural safety performance such as the hangers, stringers and the truss members that were constructed with an electro-slag welding process;
- ambient environmental conditions at the bridge;
- performance of the primary movement systems;
- performance of the truss hangers and the auxiliary support system that was added as a retrofit;
- the effectiveness and condition of approximately 1,000 vibration dampers

Sensor Details*:

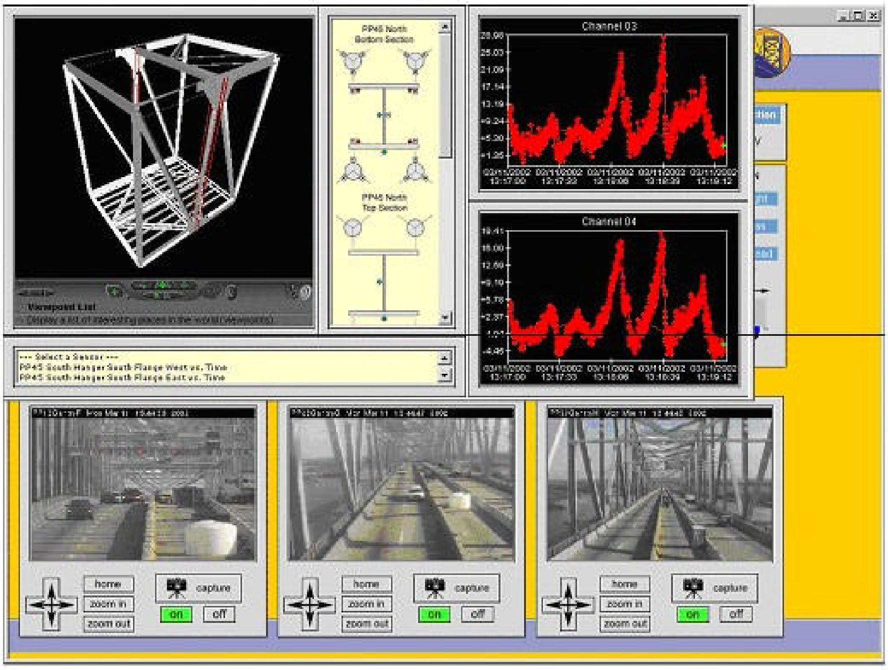
Type	Number	Location
ultrasonic wind sensors	4	on tower and at midspan
strain gages, tiltmeters, and crackmeters	231	on the truss members, hangers and auxiliary support system, floor system, and piers
accelerometers	16	for the vibration dampers

Examples of Outcomes:

The layout of the information systems that was designed in conjunction with the monitors for this project provides a user-friendly, intuitive and secure interface. The basic building blocks of the health and performance monitoring system can be summarized as follows:

- Sensing, data acquisition and control;
- Data processing and information management;
- Human and organizational interfacing for adoption as a management tool.

The data and information processing challenges are influenced by the necessity of providing proper training for the human operators, which is, in fact, the key to organizational acceptance and adoption. The latter is naturally the true measure of success for any technological innovation.



Real Time Synchronized Hanger Strain Data and Live Load Imaging

Benefits of using SHM Technologies in the Project:

Monitoring the Commodore Barry Bridge shows the following:

- The damper should have a useful life of at least 50 years if controlled by the durability of neoprene.
- No changes were observed in the conditions of any of the defects that were identified a decade ago.
- A closer scrutiny of the measured strain and temperature histograms indicated that the hanger intrinsic strains were affected by the complex movement and force-release systems at and in the vicinity of these members. A distinctly unsymmetrical behavior at the long-term strains of the two-instrumented hangers was attributed to a difference in the behavior of the movement systems at their respective boundaries on the North and the South trusses. In addition, an out of plane behavior was noted in the hangers that were expected to be concentrically loaded due to radiation and temperature changes.

References:

1- F.N.Catbas, S.K.Ciloglu, K.Grimmelsman, Q.Pan, M.Pervizpour and A.E.Aktan “Limitations in the Structural Identification of Long-Span Bridges” Proceedings of the International Workshop on Structural Health Monitoring of Bridges/ Colloquium on Bridge Vibration‘ 03, September 1-2, 2003.

2- A. Emin Aktan, F.Necati Catbas, Kirk A. Grimmelsman, and Mesut Pervizpour “Development of a Model Health Monitoring Guide for Major Bridges” Technical report submitted to Federal Highway Administration Research and Development, Drexel Intelligent Infrastructure and Transportation Safety Institute, Drexel, USA, September 2002.

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