



# Case Study - Bridges

Structural monitoring of the Manhattan cable stayed bridge

Manhattan, New York

2005-2007



# Structural monitoring - Manhattan cable stayed bridge



Aim	In the framework of a research program on suspension bridge corrosion monitoring, it is desired to acquire continuous long-term data on the strain, deformation and temperatures of the main cable and anchorage of the bridge. The data generated by the monitoring system is used to provide baseline data and to evaluate the possibility of detecting wire brakes through deformation monitoring.
Location	Manhattan, New York
System Integrator	SMARTEC SA
End Customer	Columbia University
Date	2005-2007
Instrumentation	<ul style="list-style-type: none"><li>• SMARTEC SOFO Strain and Temperature Sensors</li><li>• Micron Optics sm125, Optical Sensing Interrogator</li></ul>
Sensors	<ul style="list-style-type: none"><li>• 4 SMARTEC SOFO sensors</li><li>• 4 Micron Optics os3100 Optical Strain Gages</li></ul>
Software	Customer designed
Technology Benefit	Instrumentation allows monitoring of SOFO and FBG sensors. The combination allows both long and short gage strain measurements.



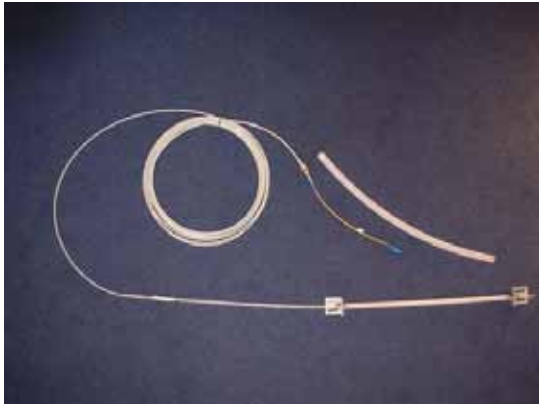
- Suspension bridge monitoring
- Main cable loads
- Eye-bar strain

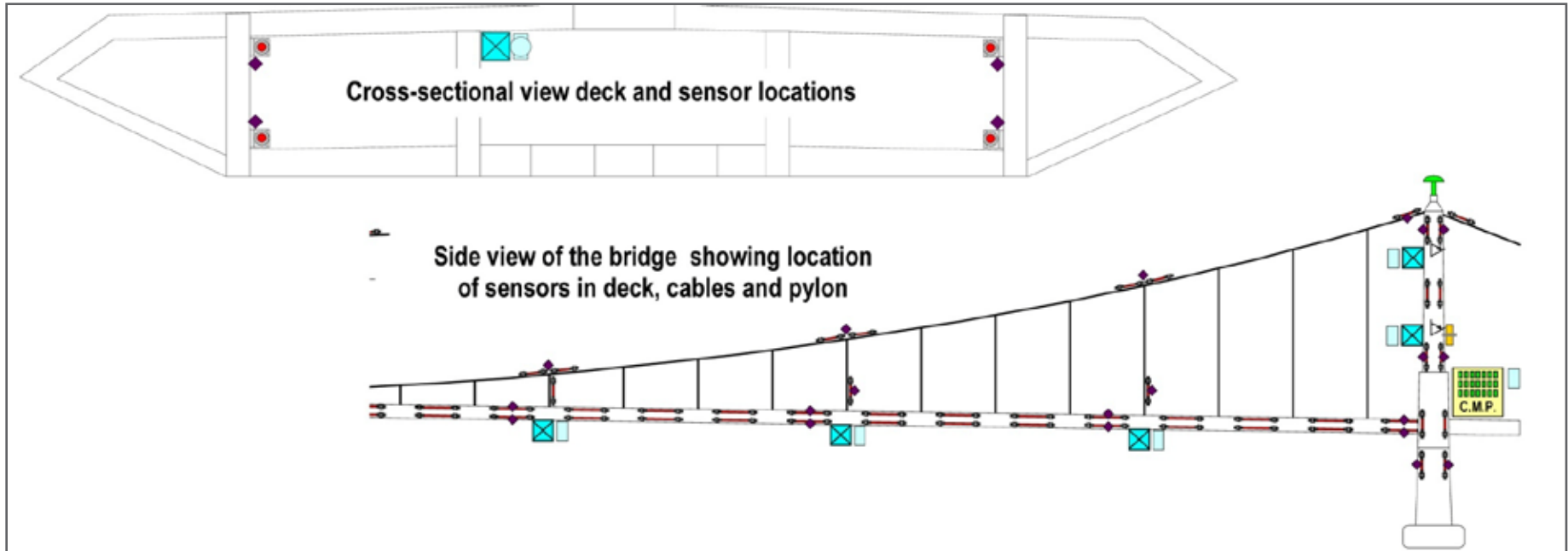



- The Manhattan Bridge is a suspension bridge that crosses the East River in New York City, connecting Lower Manhattan (at Canal Street) with Brooklyn (at Flatbush Avenue Extension). It was the last of the three suspension bridges built across the lower East River, following the Brooklyn and the Williamsburg bridges. The bridge was opened to traffic on December 31, 1909. The total length of the bridge is 2,089 meters [6,855 ft], the length of suspension cables is 983 m (3224 ft) and the main span has a length of 448 m ((1,470 ft).





- SOFO sensors of 6 meters have been installed on one main cable strains and other 2 Bragg grating strain sensors compensated in temperature have been installed at the anchors on individual strands. Purpose of these sensors is to measure strain on main cable and one hanger as a function of: temperature variations, time of day (sunshine), time of year (seasons) and traffic conditions (day / night).
- The system combines SOFO and FBG sensors with a single MOI interrogator.






 Pairs of parallel SOFO standard sensors—average curvature monitoring.

 Intermediate connection boxes (I.C.B.)—centralization and connector protection for group of sensors.

 SOFO V reading unit — quasi-static, automatic, remote, scheduled monitoring (usually installed in Central Measurement Point—C.M.P.)

SOFO Switch — static unlimited channel multiplexing (in C.M.P)

SOFO dynamic — real-time dynamic monitoring (in C.M.P)

SOFO bridge (in C.M.P) and  ADAM modules (in I.C.B.)— full thermocouples integration.



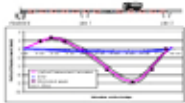
SOFO SDB basic software — management, scheduling and data collection.



SOFO View software—visualization and export in forms of tables, diagrams, images and web site, setting warning alarms.



SOFO Pro software—quasi-real time data pre-analyzing, concrete behavior simulation, complex parameters calculus.



SOFO SPADS—curvature automatic analysis, deformed shape automatic analysis, data export.



- Results

- § The research project is for understanding corrosion issues in large bridges.
- § The main technical requirements for this project were the combination of long and short gage sensors.
- § Data communication was handled through a wireless modem.
- § The software analyzed the complex loading pattern.

- Acknowledgements

- § Columbia University (End customer)
- § SMARTEC/ Roctest (System integrator)  
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