

**Transportation Pooled Fund Program  
 TPF-5(088) Pooled Fund Study NDE/NDT for Highways and Bridges**

<b>Project Title:</b> TPF-5(088) - Monitoring Cracks Using Fiber Optics Sensors – Demonstration Study at the Brooklyn Bridge Approach Structure.		
<b>Project Manager and Phone Number:</b> Frank Jalinoos, HRDI-10 (202) 493-3082	<b>Project No:</b> TPF-5(088)	Project is:  <input type="checkbox"/> PLANNING <input checked="" type="checkbox"/> R&D
<b>Reporting Period:</b> 1 to 4 Quarter, 2009	<b>Multi Year Project</b>  Yes	
<b>Description of Work Performed and Progress:</b>		
<b>Background and the Objectives</b>		
<p>The Manhattan side of the approach to the Brooklyn Bridge is comprised of two side-byside masonry vaulted structures. These structures encompass four stories each and over the years they have developed several cracks. The cracks are rather large and several millimeters in width. Specifically, one of the major cracks poses concerns. This crack occurred on the Eastern faces of the walls and in general is 10 mm or more in width. The concern is that this crack occurs at the same location on all the four stories. The other concern is that the vault had also developed cracks in one and possibly two locations. More cracks have developed in several locations on all the walls in the higher floors.</p> <p>The objective for this demonstration project was to evaluate the capabilities and the performance of fiber optic based sensors and systems for monitoring the approach masonry vaults of the Brooklyn Bridge in New York City (NYC) using fiber optic sensors. Advantages of the structural health monitoring with optical fiber sensor technology is to monitor the widening of cracks, structural movements, vibrations due to the bridge approach traffic, and unforeseen movements of the structure due to the behavior of the adjacent anchorage containment structure and bridges main cables. Real time monitoring information will provide the authorities with warning against unusual widening of the cracks. Analysis of the structural behavior based on the sensor data will establish the cause and severity for the development of the cracks. The findings will be essential for establishment of efficient and cost effective retrofit programs for this structure.</p>		
<b>Structural Health Monitoring Approach</b>		
<p>All the major cracks were instrumented with a fiber optic crack opening displacement sensor. Additional displacement/crack sensors, temperature sensors displacement sensors, and accelerometer on each one of the four cables of the bridge near the anchorage were considered. The project included the following activities: 1) sensor placement that was housed in the vaulted structure; and, 2) instrumentation and system setup for remote access of data. The user-friendly data analysis software system was designed for the NYC personnel to setup the system to monitor crack openings and closings at all the sensor locations as well as the structural movements. The demonstrated study was successfully completed on February of 2009.</p>		
<b>STATUS AND COMPLETION DATE</b>		
<p align="center">Percentage of work completed to date for total project          Project is: <u>60</u> %</p> <p align="center"><input checked="" type="checkbox"/> on schedule <input type="checkbox"/> behind schedule, explain:</p>		
<p align="center">Expected Completion Date: <u>The Demo project has been completed; the PF study is ongoing.</u></p>		