

Client:

Shanghai Pujiang Cable
Company Ltd. (SPCC)

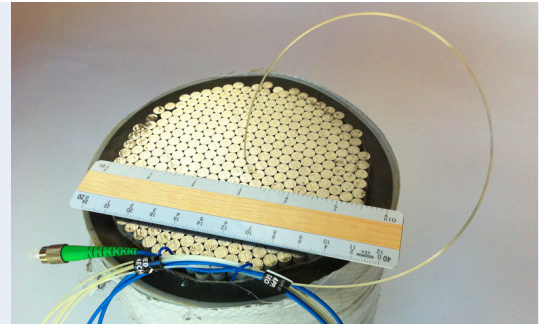
Location:

Meizhou City, China

Background & Project Challenges

As cable-stayed and suspension bridges age, they become increasingly susceptible to deterioration and decay. Long-term measurement of cable force, temperature and moisture/humidity can help provide better understanding bridge performance and reduce maintenance costs over the life of the structure. Current cable force monitoring programs are often performed on an "as-needed" basis through vibration analysis. Another common practice is to use external accelerometers in conjunction with vibration analysis software to determine average force over a set time period. However the latter can only provide information for a single data point at any given time and may miss critical events of interest or peak dynamic forces.

Fiber optic technology offers effective alternatives to traditional cable monitoring techniques without the disadvantages of conventional methods and equipment. Shanghai Pujiang Cable Company (SPCC) initiated a program to develop SMART cable that uses embedded fiber Bragg grating optical sensors installed during fabrication to monitor new and existing cable forces over time. SPCC's cable is a parallel wire system which offers the ideal cable geometry for the use of embedded fiber optics to measure force, temperature and moisture/humidity stay cables and main cables on suspension bridges.



Geocomp Role & Accomplishments

For the program to develop SMART cable, sensor installation procedures were developed and implemented and verification and proof-of-concept testing was performed and evaluated. Prototype testing was replicated and conducted on a 223-count wire cable at SPCC's facilities in China. Various installation techniques were evaluated before proceeding with the final installation and tensile testing of a 4-m-long test cable. The test cable was tensioned to 40% Guaranteed Ultimate Tensile Strength in 500 kN increments. Installation techniques and repeatable results were verified through cyclic loading.

To duplicate installation techniques in the field, the Guangzhou Bridge in Meizhou City, China, was made available as a field testing where sensors were installed during erection of the cables in the main tower. Several two-meter long fiber optic rods were installed and bonded in the tower cable anchorage assembly prior to tensioning. Stay cable was tensioned using hydraulic jacks and loads were measured from jack pressure. Cable forces calculated from jack pressure were compared with cable forces measured by fiber optic strain sensors and showed excellent agreement and repeatability during cyclic loading.

For More Information Contact:

Tom Weinmann, Vice President and
Practice Area Leader - Structural Monitoring

1390 Busch Parkway t 224.676.1371

Buffalo Grove, IL 60089

tweinmann@geocomp.com