



DOFC 卓越光纖



Hsin-Han Bridge

- Characterizing aged bridge response by loading test
Tao-Yuan County, Taiwan, January 2005





Aim	The aim of this project is not only to validate the usability but also to determine the critical loading factor of this bridge.
Location	Mountain area of Fu-Sing Township, Tao-Yuan County, Taiwan
System Integrator	Center of Bridge Engineering Research (CBER) of National Central University
Customer	Prime Optical Fiber Corporation (POFC), www.pofc.com
Date	January 2005
Instrumentation	Micron Optics si425-500 Optical Sensing Interrogator
Sensors	(26) Prime Optical Fiber Corp, FBG Bending Gauges
Software	Customer designed
FBG Technology Benefit	FBG sensors to provide real-time quantitative information on the structural condition of the bridge.



- § Surface mounted FBG Bending Gauges
- § Health diagnosis by measuring deflection of an aged, single span bridge
- § Including static and dynamic testing
- § Application of FBG interrogation system





- § The residents of tribe in the mountain area of Fu-Sing township, Tao-Yuan County, Taiwan have long feared the safety of the aged, single-span Hsin-Han bridge.
- § This bridge was designed and constructed in 1966, when traffic loading was light and scarce at the time, but now more and more heavy-duty truck go through this bridge with recent prosperity of this tribeship.
- § The township head had urged health diagnosis of the bridge, and the case became a project under study. Dr. Chung-Yu Wang, chief of the Center of Bridge Engineering Research (CBER) at National Central University (NCU), leads his team in running the project.



- § This aged bridge is 60m in length and 5m in width. It was constructed based on a cantilever model without any pier support to avoid impact due to potential mudflow or landslide. The bridge has been in operation for about 40 years and the original structural design drawing are no longer available, and only the exterior and cosmetic data of this bridge is available. To evaluate the health of this bridge accurately, it presented serious challenge without any historical data.
- § The FBG Bending Gauges of Prime Optical Fiber Corporation (POFC) is capable of measuring overall deflection curve for the object of interest in the multi-linking mode. Dr. Wang proposed using that as a diagnosing tool to record the response of the bridge under static and dynamic loading. With the response data, further data manipulation will be processed to evaluate if any damage exists in the bridge that the residents had long feared.



- § 26 FBG Bending Gauges in total are used in this project. For comparison purpose, a newly developed laser displacement measurement system is also tested to compare with fiber optical sensor system.
- § Four electric velocity- meters included to evaluate the stability of the bridge while loading test.
- § Each FBG Bending Gauge is applied with tunable stage fixture which was mounted onto the bridge surface directly for the zero operation.
- § Half of them were inter-connected in series and feed into channel 1 & 2 of MOI's si425-500, while the other half were inter-connected and plugged into channel 3 & 4.

Hsin-Han Bridge – Data Results



In static loading test, a heavily loaded truck was parked at specified locations on the bridge for data recording. While in dynamic load testing, the same truck was driven across the bridge at 30km/hr speed and the FBG interrogator si425-500 recorded all the data at full speed of 250Hz.





- Results

- § Results of this test are still being processed and calculated to yield a final report to the township authority.
- § Qualitative results had already shown feasibility of this method in determining bridge safety.
- § Further improvements and modifications will be made on stage fixtures for the FBG Bending Gauge for several project of CBER in the near future.
- § After this case study, team members of CBER praise the advantage of optical fiber sensor, especially for its immunity to EMI and multiplexibility that greatly reduce the loathsome line processing.
- § Now, the CBER is keeping its direction to make use of this technology and POFC optical sensing products as their main tool for bridge health diagnosis.

- Acknowledgements

- § Dr. Chung-Yu Wang, chief of the Center of Bridge Engineering Research (CBER) at National Central University
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