Taichung Bridge - Taiwan

Project Description:

The Taichung Bridge, opened in 2003, is a Cable stayed bridge for urban traffic located in Taichung in the middle of Taiwan. Due to the requirement to assess the cable forces, the global state of the structure and the dynamic behavior of the pylon base a Permanent Monitoring System have been installed in 2003.

Taichung Bridge, Taiwan

Quick Facts:

- **Name and Location:** Taichung Bridge; Taichung, Taiwan
- **Operator:** BPI Taiwan
- **Structure category:** Cable stayed bridge
- **Cables:** 44
- **Spans:** 2 spans: 89.5 / 89.5 m
- **Height of the Pylon:** 80 m
- **Structural system:** Steel girder with orthotropic deck
- **Start of SHM:** November, 2003
- **Number of sensors installed:** 15
- **Instrumentation design by:** VCE - Vienna Consulting Engineers, Austria

Description of Structure:

The Taichung Bridge is a Stay Cable Bridge with 44 cables and a total length of 189 m which comprises four lanes and two small lanes for pedestrians and bicycles. The superstructure is represented by steel girders and an orthotropic deck.

Wind Sensor at Taichung Bridge, Taiwan

Purpose of Inspection:

The Permanent Monitoring System gives an overview about the global behavior of the bridge structure and supplies the actual cable forces. The system consists of following parts, which are monitored:

- Dynamic determination of the cable forces of 8 selected cables
- Measuring of temperature, wind speed and wind direction
- Dynamic measurement of the main girders and the pylon top
- 3-dimensional measurement of the pylon base

Sensor Details:

Type of sensors	Number	Location
Acceleration transducers	8	at 1 cable each
Velocity transducers	3	at the main girders
3 dimensional Acceleration transducer	1	at pylon base
Wind sensor	1	5m above the road surface
Temperature sensors	2	inside & outside the box girder

Measurement Equipment and Data Management:

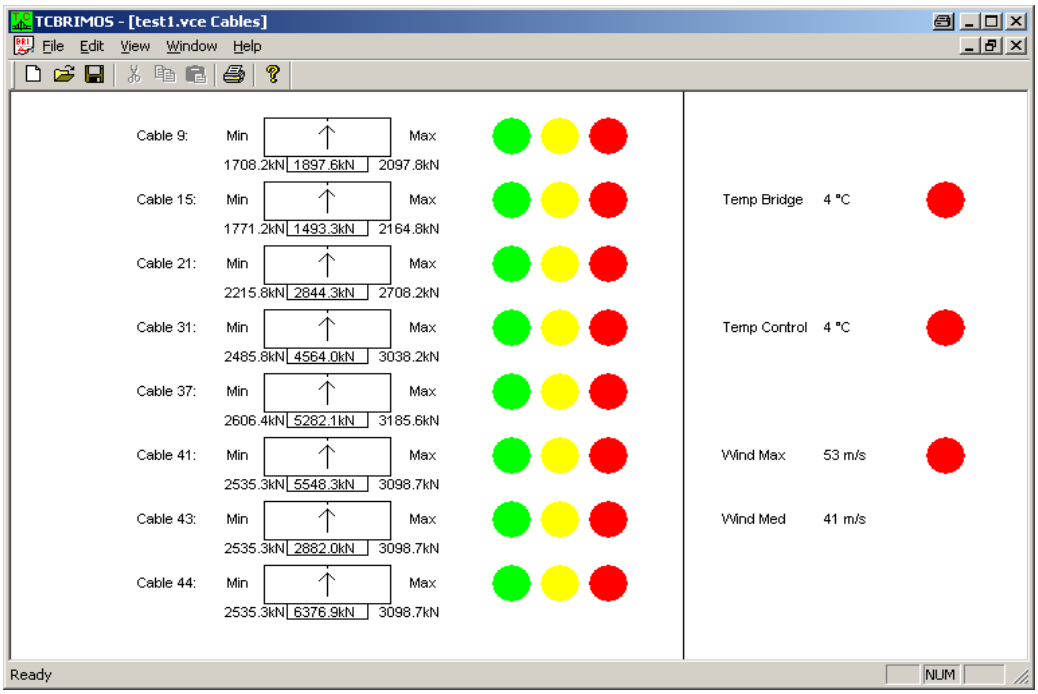
Type of system	Data Management
PC & stand alone - based measuring system	▪ Storage in a long term data base on site ▪ Analysis (statistics, frequency analysis…) and graphical presentation and documentation in office ▪ controlling of the successful operation of the measuring system via modem

Data Analysis Procedures:

Type of analysis	Software	Additional features
Ambient analysis, calculation of cable forces and lifetime calculations	Self made software	▪ no expert system

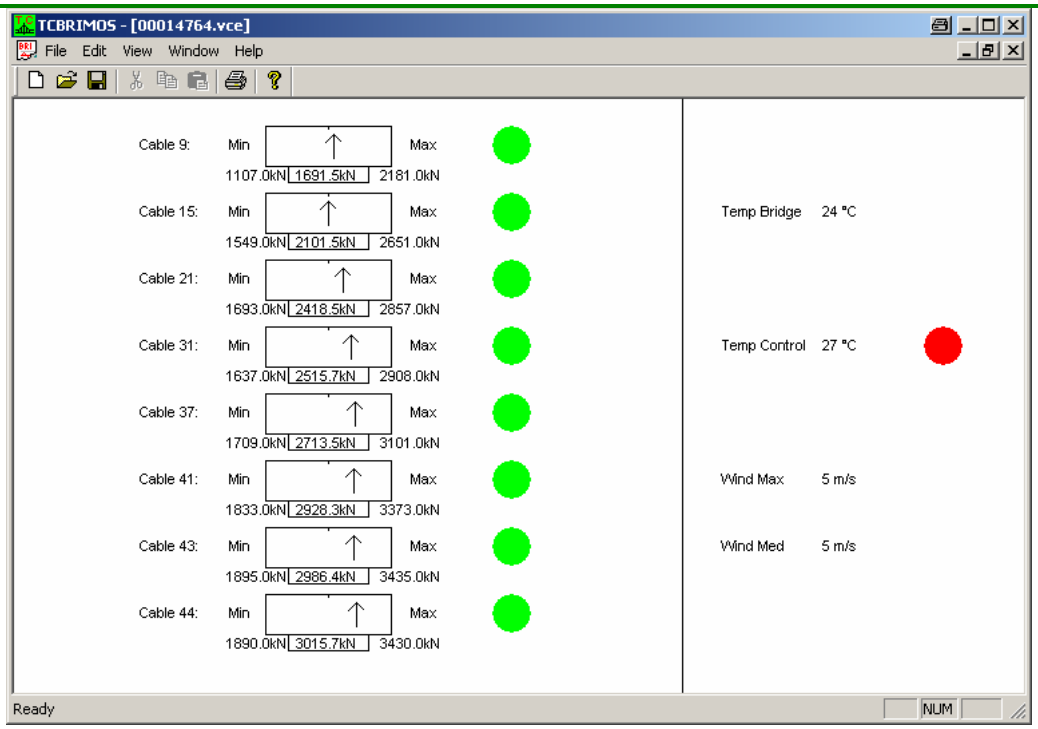
Examples of Outcomes:

The Permanent Monitoring System at Taichung Bridge measures vibration, temperature and wind. The self-made software supplies the cable forces of 8 selected cables in the way that the client can easily check the status of the cable forces in the form of a light.



Theoretical output of the Monitoring System

The green light shows immediately that all cable forces are all right.



Real Output of the Permanent Monitoring System

Benefits of using Permanent Measuring System in the Project:

The ability to merge high-precision sensor data of accelerations and velocities in dependence of separately registered wind and temperature data provides the possibility to realize lifetime considerations, which are of highest importance for bridge operators.

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