sylex® FIBER OPTICS

Monitoring of „Starý most“ bridge Bratislava, Slovakia, 2015

During 2014-2016, more than 460mtr long steel bridge has been built over the Danube River in Bratislava using the incremental launching method.

Nowadays, it serves as an integral part of the Bratislava’s public transportation system connecting both parts of the city for pedestrians and trams.

Project story

Building and consequent exploitation of the “Starý most” bridge required evaluation of the stress state of the bridge elements both during the incremental launching method and after putting the bridge into operation.
These two tasks required a different approach, but one solution.

In the first stage, we had to locate our fiber optic sensors for temporary measurement during bridge construction to provide measuring data to construction engineers to compare them with the bridge model.
This stage required installation and real-time measurement during each an all of the bridge elements launching over the river. There was no second chance in case the system would not meet measurement requirements, so we decided to take the advantage of the measuring network modularity and arranged for a real-time expansion of the measuring network as the bridge was shifting towards the other shore.

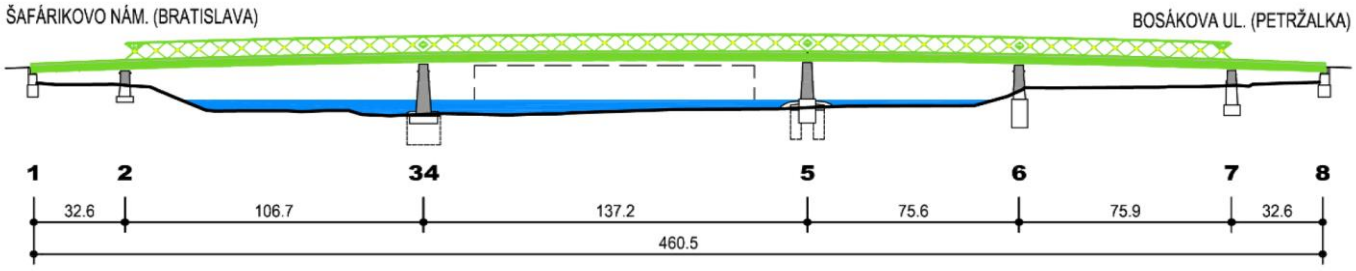

Figure X: Incremental Launching Method

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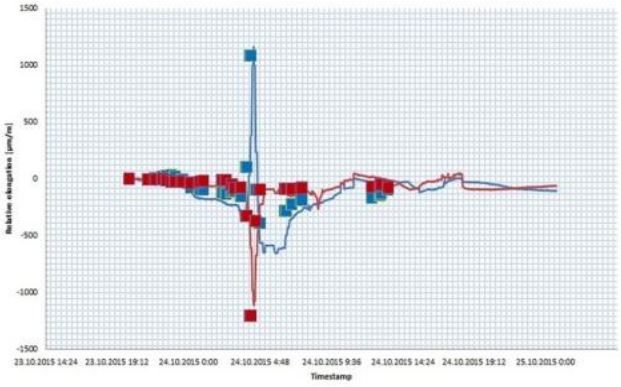
Picture 3 gives a comparison of relative elongation/compression evolution of segment D10 of the bridge according to the simulation model calculated by the engineers (red and blue squares) and real measured values (red and blue lines). Each color represented a measuring point opposite to the other, giving elongation and compression results simultaneously. Close correlation of theoretical and real values has proven that our sensing solution provides accurate data for civil engineers to rely on temporary and long-term structural health monitoring.



Relative elongation/compression evolution & comparison

In the second stage, before putting the bridge into operation, we had to install our sensors to different locations to provide for a continuous long-term measurement, but using the same connection network and measurement instruments. Again, modularity and robustness of the fiber optic network allowed us to easily expand the system with new sensors on new locations without a need to disconnect the sensors from the first stage or built another connection network.

Flexible deployability of the sensoring network

Long term monitoring solution with a dual temperature compensation

One of 6 connection boxes in a series configuration

Dedicated watertight connection boxes enabled modular expansion of the sensing network, as well as almost unlimited network topology for the best cabling solution.

Modularity and robustness of the sensing network not only allowed fast and reliable expansion, but also enabled us to include dual temperature compensation for long-term over-the-top measurement results. Thanks to weather resistant sensors design, no protective measures were required, making the installation quick and leaving a neutral aesthetical effect.

Integrated measurement instruments and optical distribution cable

All measurement instruments are safely located in a weather protective box, hidden under the right side of the bridge. Main backbone cable, incorporating the complete sensing network into one cable, is connected into the channel switch, interrogator and an industrial PC with 3G internet connection.

Conclusion

Modularity of the FBG system, its compactness and robustness enabled to achieve both consecutive tasks - strain profile measurement during construction stage and subsequent long term static measurement of the bridge under exploitation. It has been confirmed that the expected strain values during the construction stage of the bridge, as well as during the static tests correlated with the measured values from the sensing network. The close correlation not only confirms the bridge model values and reliability of the monitoring system, but also ensures that future data acquired from static measurement will correlate with the state of the bridge.

Products solution

- SC-01 long gauge strain sensors with integrated temperature compensation
- STS-01 surface temperature sensors
- WCB-01 watertight connection boxes
- SCN-816 interrogator, 16-channels, industrial PC Set
- Customized connection cable network
- Indoor wall mountable cabinet