Saint-Jean Bridge – Bordeaux, France

Project Description:

The Saint-Jean Bridge is located in Bordeaux, France. Opened in 1965, it was built to release Pierre Bridge. Like most prestressed concrete bridges built at that time when thermo-mechanical behaviours were not taken into account, it is not sufficiently prestressed. To determine whether prestress reinforcement works have to be carried out or not and to validate calculations, Bordeaux Urban Community ordered experimental investigations including SHM.

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Quick Facts:

- **Name and Location:** Saint-Jean Bridge, Bordeaux, France
- **Owner:** City of Bordeaux, France
- **Structure category:** medium span bridge
- **Spans: 8 spans:** 15.4m-67.76 m - 4 x 77.00 m – 67.76m-15.4m
- **Structural system:** triple box-girder prestressed concrete bridge
- **Start of SHM :** 2000. SHM described here : November 2003
- **Number of sensors installed:** 26
- **Instrumentation design by :** Public Works Laboratory in Bordeaux (laboratoire régional des Ponts et Chaussée à Bordeaux)

Description of Structure:

The Saint-Jean bridge is located in the city of Bordeaux. It is a triple-girder bridge with a total length of 474 m. It consists of 8 spans, the four intermediate are 77m long surrounded by two 67.76m long spans and 15.4m long spans. As the first and last spans are much shorter than their neighbor (0.23 time smaller), it required special disposal to prevent rising of the span.
Bridge girder is 3.3m deep.

Purpose of Inspection:

The purpose of this inspection is twofold.

First, it is to monitor the thermo-mechanical behavior of the bridge. More precisely, two specific box-girder joints are monitored. The most-open joint (noticed during inspection and expected so by calculations) located in the third span, and one thin joint located in the fourth span, that inspection hesitated to qualify. Measurements are done with standard sensors, namely LVDT and strain gauges.

The second purpose is to evaluate the influence of sensor length over its accuracy and even its relevance. As a result, sensors with length ranging from 10cm to 400cm were installed at different places were deformations are either large (first 77m-span) or small (thin junction on the second 77m-span). Two types of very-long-length-sensors are compared to traditional sensors: optical fiber sensors (OFS) and vibrating wire sensors (VWS). Those sensors measure strains due temperature, on a day-night-cycles and also on winter-summer cycles: every season (starting in Nov. 2003), measurements are carried out during three weeks.

Sensor Details*:

Type of sensors	Number	Location
Thermal Gauges	6	
LVDT	2 (10cm long)	first 77m-span, on an open-joint
Optical Fiber Sensor (OFS)	2 (60cm, 200cm)	
LVDT	1	
Vibrating Wire Sensor (VWS)	1 (50cm)	second 77m-span, thin joint
OFS	2 (200cm, 50cm)	
LVDT	2	
VWS	4 (2*50cm 2*250cm)	second 77m-span, open-joint
OFS	2 (50cm, 400cm)	
Strain Gauges	1	
LVDT	1 (10cm)	Plain concrete
VWS	1 (50cm)	
OFS	1 (25cm)	

Measurement Equipment and Data Management:

Type of system	Data Management
PC based measurement system	• data pre-analysis on site • main analysis, graphical presentation and documentation in office

Data Analysis Procedures:

Type of analysis	Software
	• self made software

Benefits of using SHM Technologies in the Project:

After visual inspections revealed problems, calculations were made on the basis of original documents, sometime missing or incomplete. Structural Health Monitoring technologies allow validating those calculations. It is economically important as prestressed reinforcement works will depend on those calculations.
We also benefit from the presence of standard instrumentation (strain gauges and LVDT) to study different types of sensors, to compare their relevance and accuracy as a function of the sensor length.

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