

Várzeas Bridge

CASE STUDY | BRIDGES

Owner/Contact Information

Owner: Mealhada City Council

Business Type: Governmental Organization

Location: Mealhada, Portugal



Description

The Várzeas Bridge is located in Mealhada, a small town at 20km to the north of Coimbra, the third major city of Portugal (Figure 1). The bridge was designed, fabricated and erected by VESAM in 2008.

The bridge comprises four main girders with a single span of 19 meters (Figure 2). The main girders and the cross beams were fabricated with S355 steel. The bridge deck comprises a concrete slab cast on the top of a steel profiled sheet used as formwork. The abutments and foundations are in concrete.

The cross section of the girders is constant in the entire length. The connections between steel members are bolted.



Figure 1 – Várzeas Bridge.

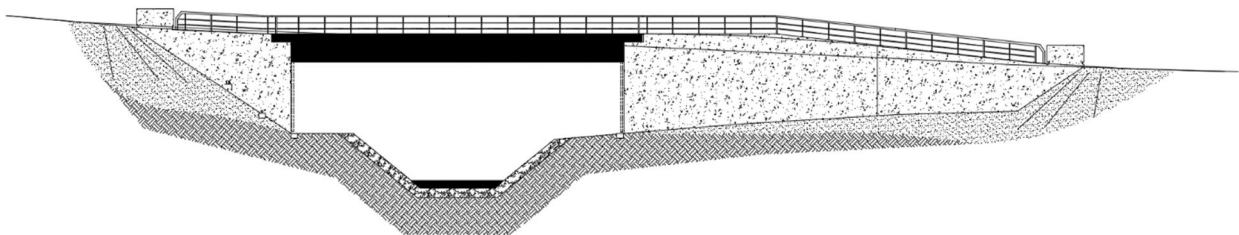


Figure 2 – Longitudinal profile of the Várzeas Bridge.

SHM Installation

The adopted structural health monitoring (SHM) installation comprises the complete monitoring of a single cross section at mid-span (Figure 3).

The instrumentation comprises the following sensors: 1) 12 strain gauges; 2) 3 accelerometers; 3) 1 weather station (wind speed and direction, rainfall); 4) 2 inductive loops; 5) 1 temperature sensor; 6) 1 relative humidity sensor; and 7) 1 corrosion sensor.

The data acquisition unit (SIGMA) is located in the south abutment and connected by wire to all sensors. It is powered by a solar panel combined with a 12V battery. All equipment is provided by VESAM.

The adopted communications protocol for data transfer between the SHM system and the VESAM servers is by GPRS/GSM. The data are collected by the data acquisition unit and sent on a periodically basis to the VESAM server.

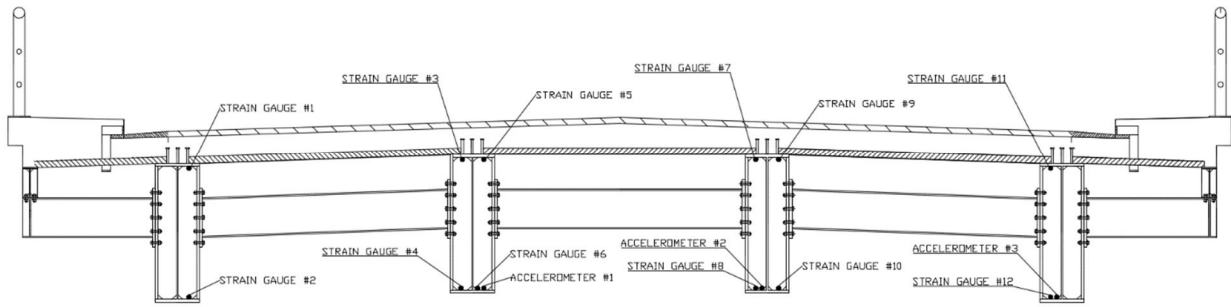


Figure 3 – Instrumentation of the cross section at mid-span.



Figure 4 – Installation of data acquisition system.

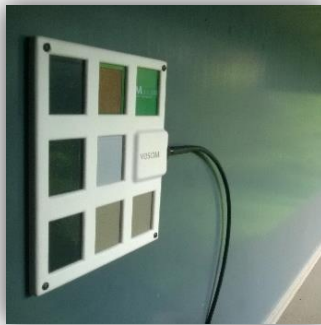


Figure 5 – Installation of the corrosion sensor in the web of the main girder.



Figure 6 – Installation of inductive loop on the pavement for traffic detection.



Figure 7 – Installation of OneSensor (strain gauge, accelerometer, temperature and relative humidity sensors all-in-one).

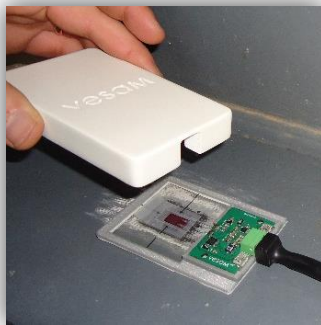


Figure 8 – Installation of strain gauge on the bottom flange of the main girder.



Figure 9 – Weather station with energy harvesting system (solar power).

Expected Benefits

Our client (Mealhada City Council) receives from VESAM, on a daily, weekly or monthly basis, technical reports containing the variation of each monitored parameter. The collected data are also used to calibrate several deterioration models (corrosion, fatigue, among others). On a monthly basis, the status of each deterioration model is reported to our client advising about the need of visual inspections, in situ testing or/and maintenance works. When extreme events are detected, an alert is issued to the client by e-mail, SMS or phone, to provide a fast intervention.

Our client can also access all the information related with the SHM installation by using the online SIGMA SHM portal provided by VESAM.

With this SHM solution, starting from USD 28.800, our client expects to save more than USD 25.000 each year by avoiding regular bridge inspections on a two-year basis and unexpected maintenance operations. A time gap of 3 years can be adopted.

Moreover, the monitoring of the painting scheme performance can lead to a significant saving by delaying the maintenance works by 5 years (time gap of 15 years instead of 10).