

White paper documenting needs related to digital bridge monitoring system

BIM4CE

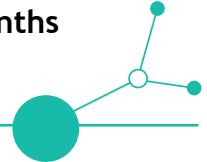
Project title: "Bridge monitoring using real-time data and digital twins for Central Europe"

Project acronym: **BIM4CE**

Partnership: 8 partners, 3 countries, 6 regions

Project duration: **36 months**

Project webpage: <https://www.interreg-central.eu/projects/bim4ce/>





Digital Bridge Monitoring Systems

Monitoring System Types

Monitoring system types include dynamic, static, and environmental monitoring systems.

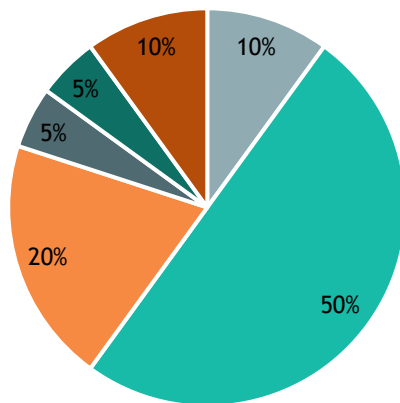
Types and positions of sensors based on the types of monitoring systems

Monitoring System Type	Sensor Type	Position
Dynamic monitoring	Triaxle accelerometer on deck	Beam/Deck
	Triaxial accelerometer on pier or abutment	Pier/Abutment
	Strain sensors	Beam/Deck
Static monitoring	Biaxial inclinometer on deck	Beam/Deck
	Biaxial inclinometer on pier or abutment	Pier/Abutment
	Longitudinal displacement transducer	Support/Restraint device
	Transverse displacement transducer	Support/Restraint device
	Strain sensors	Beam/Deck/Pier/Abutment/Support Device
Environmental monitoring	Printable flexible temperature sensors	Beam/Deck/Pier
	Weather Station	Deck top surface/Top of abutment
	Printable Moisture sensors under the moisture insulation layer	Deck, under the moisture insulation layer
	Printable Pressure sensors based on piezoelectric effect or capacitive measurement	Deck



Monitoring System Budget Restraints

Costs of the entire monitoring system are as follows:



- Engineering analyses aimed at designing the monitoring system
- Supply of components (acquisition system, and communication and power supply local network)
- Installation of the monitoring system (and subsequent decommissioning)
- Ordinary and extraordinary maintenance of hardware components
- Supply and maintenance of the software platform
- Engineering analyses aimed at performing the SHM service

The other costs to be considered:

- general administrative costs;
- costs required to connect the SHM system to the global power supply and communication network.

The cost of a complete monitoring system (24 sensors) >>> € 20,000 per span, including:

- € 10,000 (50 %) per span for the sensors;
- € 6,000 (30 %) per span for the acquisition and analysis devices, including the CPU;
- € 2,000 (10 %) per span for the sensor wiring;
- € 2,000 (10 %) per span for the local communication and power supply network.



The total cost is significantly influenced by the **type of implemented** monitoring system, the **type and geometry of the structure** and the **morphology of the place**.

Budget limit for dynamic and static global monitoring, and the monitoring of some local vulnerabilities:

€ 50,000 per span (with an average length of 35 m)