# **Data-driven** detection of trends and anomalies in **civil engineering** application

sponsor: OSMOS Group

**Prize:** The team selected by the jury on this subject will win a **2 k€ prize** offered by OSMOS Group

## 1. Context

In-situ measurements on civil engineering structures are expanding as a useful solution to contribute to their operation and maintenance. However, there are no standardized data analysis processes to convert raw measurements into relevant synthetic information about the mechanical behavior of the structure.

The objective of this study is to benchmark different approaches to derive structural health scores from strain and vibration measurements in the case of a road viaduct, considering the effects of traffic.

The case study is a prestressed concrete box-girder viaduct located in France. 24 strain sensors and 24 accelerometers, set at different locations along four spans, have been recording the response of the deck to traffic loads for three years, at a sampling rate of 100 Hz (recordings are triggered by threshold and not continuous over the three years). The measurements will be made (partially) available as a consistent dataset.

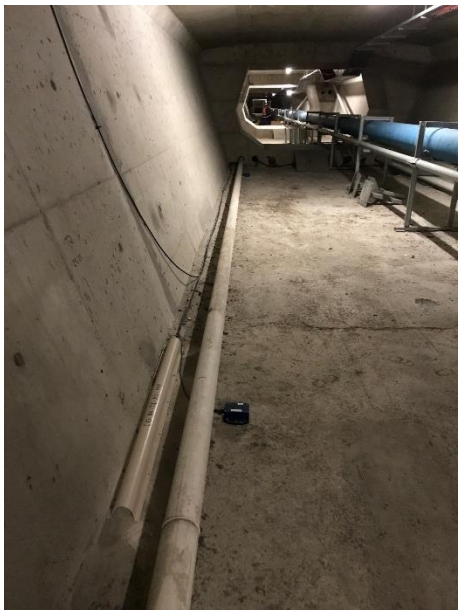

*Figure 1: Inside the prestressed concrete box-girder: Strain sensor (protected by the white half-pipe duct) and accelerometer (little blue box)*

Each team shall propose a detailed methodology to quantify stability, anomalies, or trends, and end up with a synthetic health score for the viaduct. The methodology will be implemented in an algorithm and tested on the provided dataset. “Data-driven only” approaches are required; numerical models of

the structure are not available and should not be used. The dataset does not include labels: machine learning or AI techniques to be used should be unsupervised.

## 2. Tools

The dataset will be released as a set of json files (including readme and files index).

Any data analysis tool can be chosen by the teams, although open source is preferred (Python, R). For teams using R, the dataset can also be released in rds files.

## 3. Steps

- March 2nd: The dataset is released on-line
- April 1st: deadline for submitting questions for remote meetings gathering OSMOS Group and all teams, to take place in April
- July 1st: deadline for submitting a two-page methodology and results summary
- July 9th: presentation of results during a plenary session

## 4. Expected results

The teams are expected to develop an algorithm to process the in-situ measurement data for data-driven assessment of the response and reliability of the civil structure regarding traffic loads. The algorithm must be efficient enough to run on a standard office computer. Final results of the process shall be given as summarized structural health scores indicating the stability of the observed mechanical behavior. The computation is “off-line”, considering the whole dataset, and shall include and combine all the sensors. Real-time “on-line” alerting processes are not expected.

The teams should also propose metrics to evaluate the performances of their algorithm.

The evaluation criteria are the following:

- 40 %: Quality of the scientific approach, clarity and effectiveness of the presentation, quality of the discussions with the jury
- 40 %: Quality of the results obtained (including quality of the code published) and presented / demonstrated during the special session
- 20 %: Innovation and expected impact in the field

The teams are encouraged to share code/data under open-source licenses and to publish their results after the conference. However, this is not mandatory and the organizers and other teams will not have access to proprietary code, even if executed via a web server.

## 5. Organizer: OSMOS Group

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