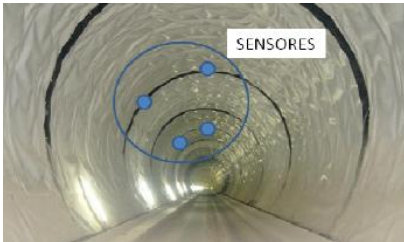


# R&D PROJECT



## Title of the project

**Inertial auscultation system of concrete tunnel linings**

## Acronym

**SINATU**

## Content of the project

Project with file number RTC-2016-2038-4, approved in the 2016 Call of the State R&D Program, oriented to the Challenges of the Society. Challenge 4: Sustainable, Intelligent and Integrated Transport. Thematic Priority I: Development of information technologies and intelligent transport systems. Financed by the Ministry of Economy and Competitiveness and co-financed through FEDER funds. The thematic objective of the project is to promote technological development, innovation and quality research.

The maintenance of any type of infrastructure is essential to guarantee their correct operation and service. In the case of tunnels, it is the concrete lining that focuses the attention of this type of operation because it is where the greatest needs for this type of work are produced.

Currently, most techniques are inspection techniques, whose objective is to achieve corrective maintenance. These techniques are not capable of studying the real-time evolution of defects. That is why auscultation is necessary.

Nowadays, there is only one tunnel auscultation technique based on the installation of different type of sensors (pressure cells, rod extensometer, optic fibre, etc.) capable of introducing the philosophy of predictive maintenance in tunnels. However, this solution, as it requires a large number and variety of sensors, it is expensive and, moreover, it is only applicable to newly constructed tunnels.

## General objectives

The general objective of the project is to design a new inertial system of auscultation capable of characterising, when a vehicle passes over it, the structural condition of the concrete that belongs to the tunnel covering.

To this end, the following technical objectives are established:

- Design of inertial sensors network sensors which, placed on the concrete lining of the tunnel, can record its vibratory behaviour.
- Optimising the design formula for the different pavement layers. Design and development of a long-distance communication system, capable of obtaining information recorded by the sensors and sending it automatically and instantaneously to the control centre.
- Developing a management software capable of processing and analysing the sensor records obtaining as a result the structural lining, detecting, classifying and locating defects in it.

## Results and conclusions

With the SINATU system adjusted and verified, the results of 26 cases have been obtained. The most significant results are the histograms with the values obtained from the NRPSD (normalized ratio of comparative power spectrum density) for each of the sensors.

It can be concluded that the results are satisfactory. Based on the two-dimensional model limitations, it has been possible to characterise the response of the structure facing three different types of defect in multiple configurations: longitudinal crack, circumferential crack and cavity.

In order to identify and quantify the defects suffered by the lining in the future, the section will be monitored in real time.



## BUSINESS AREAS

**Area Infrastructures  
COMSA, S.A.**

## DURATION

2016-2018

## BUDGET

Consortium Budget: 868.797 €  
COMSA Budget: 641.800 €

## KEYWORDS

Auscultation, tunnel, lining, maintenance, sensors, inertial system

## COORDINATOR

Joan Peset (COMSA)

## EXTERNAL FUNDING



"Una manera de hacer Europa"