



# Innovative Vibration Monitoring

VAMS-UBM

Vibration Attenuation Monitoring System for Under Ballast Mats

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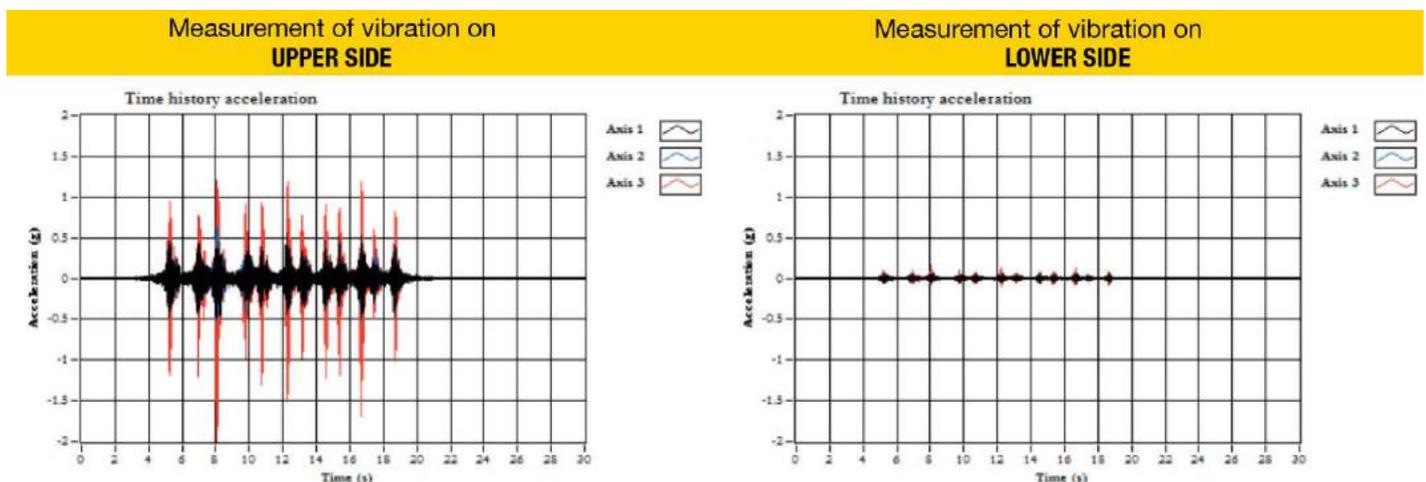
## Vibration Attenuation Monitoring System for Under Ballast Mats

The operation of an underground subway line in urban areas, can cause noise in terms of externally induced vibrations. This constitutes a problem in presence of structures, such as residential buildings (noise to persons), buildings dedicated to vibration sensitive activities to (eg. Hospitals) and buildings of historical and cultural interest which are naturally sensitive to vibration (masonry historic buildings). One of the most used intervention strategy for new railway/subway lines construction, is the use of special antivibration mats, installed between the rail infrastructure (rails, sleepers and ballast) and the tunnel structure, in order to absorb vibrational stresses and break down the noise cause.



These systems, however, are subject to over time degradation, which can not be quantified in advance, especially when their working conditions are far from the ideal conditions proposed in laboratory tests.

The **VAMS-UBM** system consists of pairs of MEMS technology accelerometric sensors, installed in axis inside of antivibration mats, in its upper and lower part. When a rolling stock passes through the area in which these instrumented mats are positioned, there will be a transmission of vibrational waves from above (rail surface) downwards. The acceleration change sampled by the two sensors placed on the same axis (on the upper and lower surface of the mat) is the vibration attenuation. It is mainly a function of the elastic properties of the material. Overtime, due to the wear, the mat varies its elastic properties (the rubber tends to harden), hence the “transfer function” of the vibrational waves must necessarily change. In this way we can associate ti the variation a possible degradation of the antivibration mats.



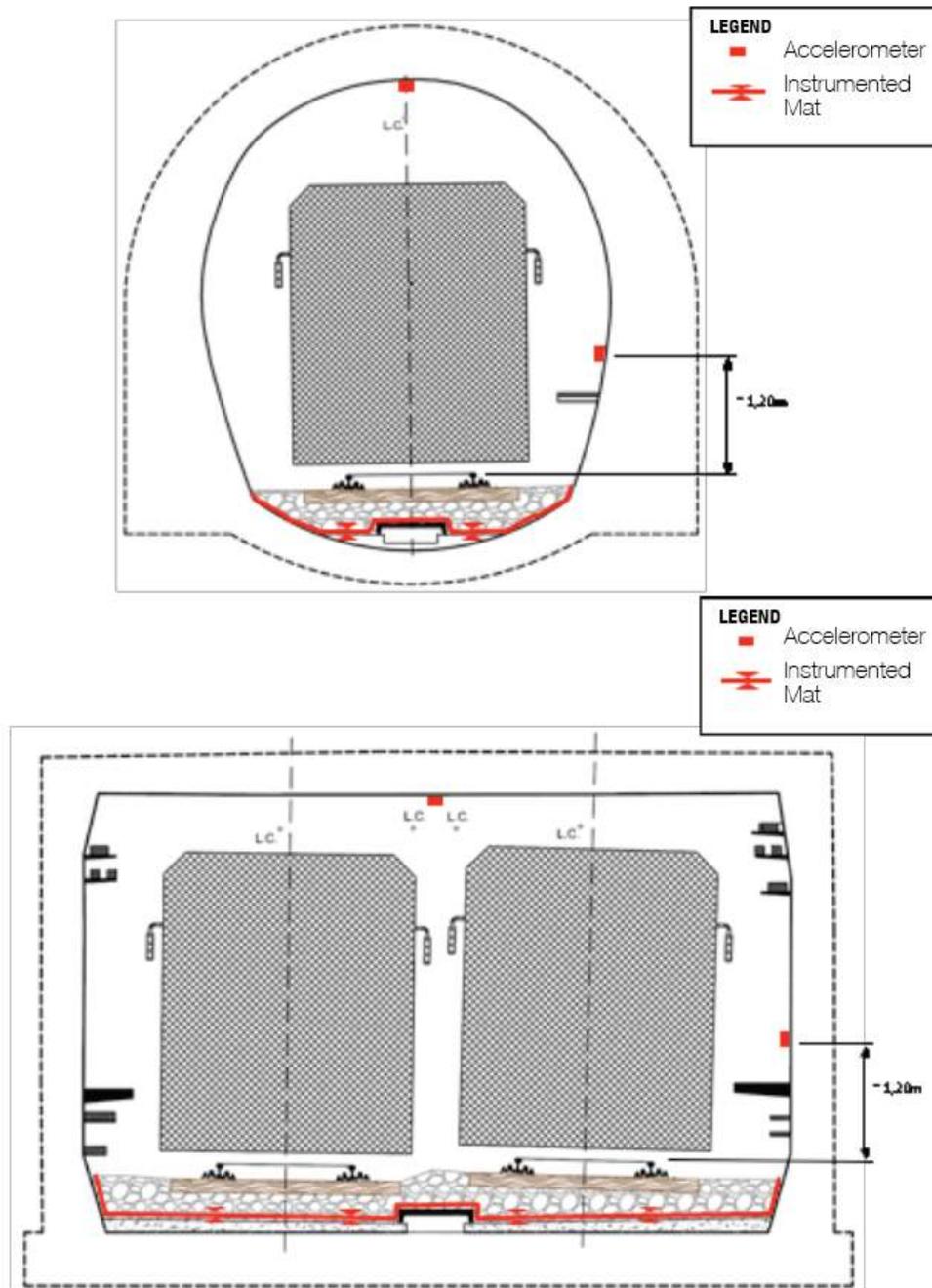
The system is in operation, since 2014, on the Flaminio – Lepanto route (Line A, Rome Metropolitana) allowing:

- ⊙ the monitoring of anti-vibration mats degradation over time;
- ⊙ the detection of abnormal signals related to wheel – rail contact phenomena.

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In addition to the vibration attenuation monitoring provided within the anti-vibration mats, we can extend the functionality of **VAMS-UBM** system, by deploying additional accelerometers in the surrounding of the track, to measure vibrations in external points. For instance, in the Flaminio – Lepanto route (Line A, Rome Metropolitan), there are two accelerometers in each instrumented section, on the side and on the roof of the tunnel, on both single and double track lines.



### ITALIAN AND EUROPEAN PATENT

**Title:** Vibration attenuation device, and the procedure for evaluating the performance of said device

- Italian patent licence: April 3, 2012 Patent n. 0001392956
- European patent licence: May 6, 2015 Patent n. 2218934

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