

# PERFORMANCE ANALYSIS OF THE LOW-COST ACOUSTIC SENSORS DEVELOPED FOR THE DYNAMAP PROJECT: A CASE STUDY IN THE MILAN URBAN AREA

F. Alías<sup>1</sup>, R.M. Alsina-Pagès<sup>1</sup>, J.C. Socoró<sup>1</sup>, F. Orga<sup>1</sup>, L. Nencini<sup>2</sup>

<sup>1</sup> GTM – Grup de recerca en Tecnologies Mèdia, La Salle – Universitat Ramon Llull  
C/Quatre Camins, 30. 08022 Barcelona, Spain

<sup>2</sup> Bluewave acoustics Via del Fonditore 344,58022 Follonica, Italy  
e-mail: nencini@blue-wave.com

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**Hypothesis.** The low cost acoustic sensor developed by BlueWave S.r.l. will provide enough quality audio signals to detect the ANE in real-life operating conditions. The hypothesis is evaluated using raw acoustic measurements collected in the DYNAMAP's Milan Pilot area.

**DYNAMAP Project**, (LIFE13 ENV/IT/001254 2014-2019) [1]  
“Development of low cost sensors networks for real time noise mapping”  
<http://www.life-dynamap.eu/>

## Project goals

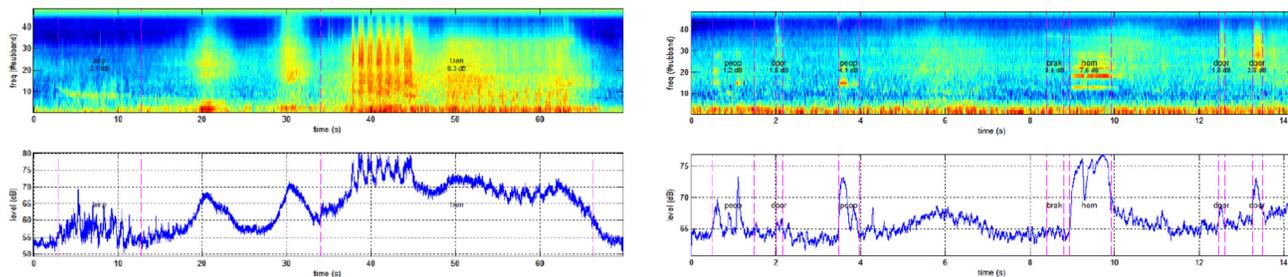
- Implement the European Directive 2002/49/EC (END)
- Automate the noise mapping process using a low-cost sensor network
- Compute and represent (GIS) road traffic noise maps.
- Implement and test the system in 2 sites with different characteristics:  
**Milan** (urban) and Rome (suburban).

## Noise types to be considered for maps

- Road Traffic Noise (RTN): general noise produced by vehicles in motion.
- Background Noise (BKN): extraneous sound which can be heard while listening to or monitoring other sounds.

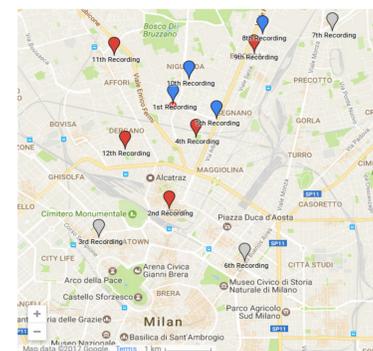
## What is an ANE?

- An **Anomalous Noise Event (ANE)** is a non-traffic related audio noise neither background noise, whose noise impact should be removed from the equivalent noise level (LAeq) computation.
- The **Anomalous Noise Event Detector (ANED)** prevents ANEs from the noise map computation.
- The performance of the ANED depends on the quality, diversity, amount and distribution of the labelled ANEs, so the quality of the raw acoustic measured signal is crucial.



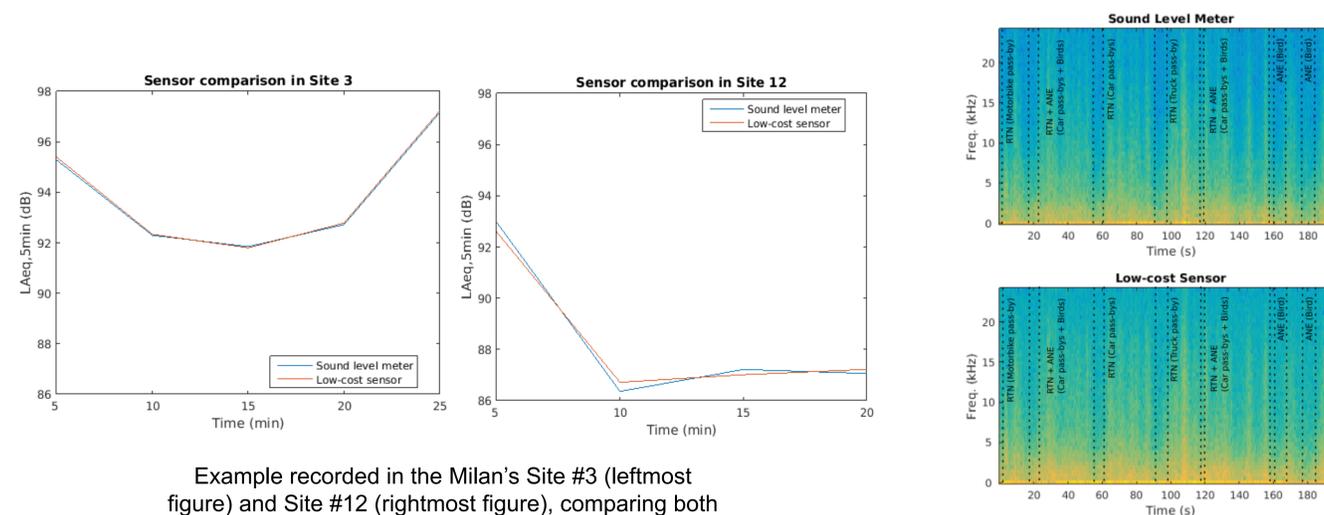
In order to detect the different types of noise events, an exhaustive labelling of real-life data has been conducted. In the pictures, two real examples of the detected ANEs are depicted with their spectrograms and LAeq levels [2].

**Experiments.** Simultaneous measurements using a reference sound level meter and the low cost sensor have been performed to obtain raw acoustic data from RTN, BKN and ANE in a real-life environment.



Left picture shows the map of the Milan pilot area (district 9) with the locations of the measurements. Right Picture shows the simultaneous acoustic measurements using both sound level meter and low-cost sensor in Milan's Site #12 [3].

**Results.** LAeq<sub>5min</sub> (dB) and spectrograms comparisons show high level of similarity.



Example recorded in the Milan's Site #3 (leftmost figure) and Site #12 (rightmost figure), comparing both low-cost sensor and sound level meter in terms of LAeq5mins values

ANE example (bird) registered with the sound level meter (upper) and the low cost sensor (lower).

The comparison of the low cost sensor performance with the sound level meter is being conducted in a controlled environment by BlueWave S.r.l., and will be published in further work.

## References:

- [1] Sevillano, X., et. al. *DYNAMAP - Development of low cost sensors networks for real time noise mapping*, Noise Mapping, **3** (2016), 172-189.
- [2] Alias, F. and Socoró, J.C. *Description of Anomalous Noise Events for Reliable Dynamic Traffic Noise Mapping in Real-Life Urban and Suburban Soundscapes*, Appl. Sci., **7**(2) (2017), 146.
- [3] Zambon, G., et. al. *Cluster categorization of urban roads to optimize their noise monitoring*, Environ. monit. and assessment, **188**(1) (2016), 1-11.

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