

INTRODUCTION AND MANAGEMENT OF NOISE LOW EMISSION ZONES: LIFE MONZA PROJECT

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The introduction of *Low Emission Zones*, urban areas subject to road traffic restrictions in order to ensure compliance with the air pollutants limit values, set by the European Directive on ambient air quality (2008/50/EC), is a common and well-established action in the administrative government of cities. The impacts on air quality improvement are widely analyzed, whereas the effects and benefits concerning the noise have not been addressed in a comprehensive manner. The definition, the criteria for analysis and the management methods of a *Noise Low Emission Zone* are not yet clearly expressed and shared. LIFE MONZA project (Methodologies fOr Noise low emission Zones introduction And management - LIFE15 ENV/ IT/000586) addresses these issues. The first objective of the project, co-funded by the European Commission, is to introduce an easy-replicable method for the identification and the management of the *Noise Low Emission Zone*, an urban area subject to traffic restrictions, whose impacts and benefits regarding noise issues will be analyzed and tested in the pilot area of the city of Monza, located in Northern Italy. Further objectives include the monitoring and the analysis of the effects, due to the introduction of the *Noise Low Emission Zone*, on air quality improvement and on the wellbeing conditions of the inhabitants of a selected pilot area, the identification of the type of interventions that can induce beneficial and synergistic effects, such as those relating to the planning of traffic flows and the adoption of low-noise pavements, and the active involvement of the population in the definition of a more sustainable lifestyle. Background conditions, structure and objectives of the project will be discussed in this paper.

Keywords: environmental noise, low emission zones, sound urban planning

1. Introduction

Low Emission Zones (LEZs), as urban areas subject to road traffic restrictions, have been implemented in order to comply with the air quality objectives introduced by the European Directive on ambient air quality (2008/50/EC), as a measure able to improve environmental quality and to reduce health risks due to traffic conditions. Currently, LEZs have been introduced in more than 100 cities

in Europe, becoming the most common measure adopted in EU, considering road traffic planning, and they are being considered for other cities worldwide [1].

LEZs implementation in Europe is promoted also according to the objectives of the Europe 2020 strategy, particularly regarding the identification of eco-innovation solutions, able to find a balanced environmental improvement, taking into account also the technical and economic feasibility and the social acceptability.

There are many different typologies of LEZs, based on various classes of most pollutant vehicles which are restricted from entering, diverse speed limits, different time periods, etc. Municipalities may choose the types of vehicles restricted in a LEZ according to the degree of emission reduction that is needed – only heavy duty vehicles, or also light duty vehicles, passenger cars, motorcycles and scooters – based on local assessment [2]. LEZs introduction can reduce road traffic, optimize traffic flows and induce people to a lower use of cars, enhancing public transport and defining positive effects on mobility management, social wellbeing and environmental impacts.

In Germany, Denmark, Holland, Sweden and Czech Republic a national legislation on LEZ already exists, but, currently, LEZs implementation procedures vary widely among cities, many approaches are used and there is not a commonly shared legal framework, at EU level, so that a harmonized management method is needed.

The effects of LEZs implementation on air quality improvement are widely analyzed. Many studies have been carried out, having different and contrasting results and in most cases LEZs are considered to be an effective measure to reduce traffic-related air pollutants levels, whereas the effects and the potential benefits concerning the noise reduction have not been addressed in a comprehensive manner. Noise issue is not taken into account and consequently no specific interventions against noise have not been foreseen and implemented.

Air pollution and noise are the two main environmental problems in Europe and, currently, road traffic is the most dominant source of environmental noise with an estimated 125 million people [3] affected by noise levels greater than 55 dB L_{den} .

Concerning the EU policy, the EU Directive 2008/50/EC on ambient air quality and cleaner air for Europe considers the establishment of LEZs a measure to be adopted in air quality action plans, whereas the EU 2002/49/EC Environmental Noise Directive (END) does not provide a definition of LEZ in relation to noise and it is not considered as an action to take into account in noise action plan drafting.

The END focuses on the assessment of people exposed to environmental noise, drafting strategic noise maps; on preventing and reducing environmental noise where necessary and preserving acoustic quality where it is good, drawing up action plans; it also focuses on ensuring public information on environmental noise and its effects. Annex V of END, *Minimum requirements for action plans*, suggests some examples of actions that competent authorities should taken into account, as traffic planning and land-use planning and those issues can be considered in Noise LEZs introduction and management. Furthermore, important contributes to the environmental noise management according to END requirements has been given by some concluded European projects such as LIFE+2010 QUADMAP, LIFE+2008 HUSH and LIFE+2009 NADIA [4-8].

However, at this time, there is a lack of a comprehensive and integrated administrative process about LEZs and noise issue is, in fact, not taken into account. The definition, the criteria for the identification and the management methods of a *Noise Low Emission Zone*, the effectiveness and the potential benefits on noise reduction are not clearly analyzed, expressed and shared yet.

LIFE MONZA project (Methodologies fOr Noise low emission Zones introduction And management - LIFE15 ENV/ IT/000586) addresses these issues.

2. LIFE MONZA objectives

LIFE MONZA project aims at introducing an easy-replicable method, and related guidelines, for the identification and the management of the *Noise Low Emission Zone* (NLEZ), an urban area subject

to road traffic restrictions, characterized by low noise levels, whose impacts and potential benefits regarding noise issues will be analyzed and tested in a selected pilot area of the city of Monza, located in Northern Italy.

The second objective regards specific *top-down measures*, adopted by the municipality and able to turn up the pilot area in a permanent Noise LEZ, consisting in infrastructural interventions and traffic management.

The third objective is to involve people in an active management system of more sustainable lifestyle choices - *bottom-up measures* - related to the reduction of noise and the improvement of air quality and wellbeing conditions, in their living and working environment. In order to encourage the local community involvement and to strengthen the dialogue between citizens and public bodies, a number of specific activities are foreseen.

The fourth objective is to reduce the average noise levels in the pilot area of Libertà district, with positive complementary effects also on the air quality and benefits on wellbeing conditions of inhabitants. In the district there are significant average levels of noise pollution, affecting a large number of citizens and it is identified as a hotspot in the Noise Action Plan implemented by the city of Monza according to END requirements. In particular, a main average noise reduction and an air quality improvement are expected in correspondence of the Viale Libertà axis, due to the foreseen *top-down measures* to be put into practice. Moreover, less significant but still relevant noise reduction are expected in the entire Libertà district, thanks to both the *top-down measures* implemented in the Viale Libertà and the *bottom-up actions* to be encouraged inside the district itself.

3. Methods tested in the pilot area

The methodologies for NLEZs introduction and management will be tested in the pilot area of Libertà district, in Monza. The city of Monza has started to develop an Urban Traffic Plan aimed at achieving three important goals: a new parking pricing policy in the city centre and in the immediate surroundings; a park&ride scheme to connect peripheral areas with the city centre by shuttle buses; the implementation of 30 km/h areas; one of which, the Libertà district, will also be tested through this project as a Noise LEZ, in order to have a pilot case able to be replicable in other areas in the city and in other contexts. The Libertà district (Fig. 1) is a densely populated area with about 15,000 inhabitants, located in the North-Eastern side of the city of Monza, crossed by a major road (Viale Libertà). The main road of the district, Viale Libertà, is daily crossed by about 30,000 vehicles. It is one of the most important access roads to Monza from Eastern surrounding area and towns and it is currently also the primary East-West corridor North of the city center.



Figure 1: Noise LEZ pilot area boundaries (Libertà district).

The area has been identified as a hotspot in Noise Action Plan and, in particular, based on Noise Mapping dated 2012 it can be observed that in a range of 30 m from the Viale Libertà almost the 100% of the receivers is exposed to levels higher than 65 dB during the day and higher than 55 dB during the night.

In the Life MONZA project, in a section of Viale Libertà infrastructural interventions (*top-down measures*) to reduce the average noise levels due to the road traffic will be designed and implemented, detecting also the potential positive effects on air quality, with respect of the surrounding area. The effects of these *top-down measures*, together with the promotion of *bottom-up measures* carried out by citizens, will allow the Libertà district to become a permanent noise LEZ.

3.1 Top-down measures

The *top-down measures* consist in infrastructural interventions and traffic management related to the Libertà street, the main road crossing the Libertà district.

In particular, the traffic management consists in the creation of a limited traffic zone to forbid the access to trucks and limitation of the vehicles.

The infrastructural interventions consist in the road paving substitution (with a new low-noise paving) and in the implementation of two pedestrian crossings provided with safety islands in correspondence of a section of the Libertà street included in the Libertà district.

3.2 Bottom-up measures - People involvement in Noise LEZ implementation

LEZ restricts the access to some vehicles and introduces new speed limits, defining a new use of the territory and forcing the inhabitants to change their habits. Past experiences have shown that the use of *top-down measures*, as infrastructural interventions introduced by the local governments for the LEZ establishment, could be refused by a part of the inhabitants, who consider the LEZ only as cause of restrictions, losing the potential opportunities provided by the LEZ itself.

A further outcome of LIFE MONZA project is the involvement of people in an active management system of lifestyle choices related to the reduction of noise and to the improvement of air quality and health in their living and/or working environment, by means of a series of *bottom-up* activities dedicated to promote residents involvement.

Meetings will be organized in the primary and high schools located in Libertà district, in order to raise awareness in students about noise and a sustainable home – school mobility system, particularly during the INAD events (International Noise Awareness Days).

Students of the schools located in the Libertà district will be involved in a competition of ideas for the design of elements aimed at identifying the Noise LEZ. In particular, a contest will be carried out, in the high schools, concerning the design of a new logo for identifying Noise LEZ of Libertà district, and good practices to reduce noise in the area will be launched. The logo especially created for LIFE MONZA will help street users to identify the noise LEZ and it will be engraved on the street paving, in order to recall drivers that this area is a Noise LEZ.

Another contest will also be launched, in primary schools, to select a picture for identifying Noise LEZ and possible good practices to reduce noise in the area will also be opened.

The *bottom-up activities* will be reported and “*measured*” by means of a specifically devoted mobile application, that will be developed within the project. The App will manage voluntary actions and measure benefits and concrete changes in people lifestyle, to be transposed in a bonus for citizens.

4. Monitoring activities

As already mentioned, one of the main objectives is the reduction of the average noise levels in the pilot area of Libertà district, with positive additional effects also on the air quality and benefits on wellbeing conditions of inhabitants. From this point of view, the effects due to the implementation of the NLEZ will be analyzed, in *ante* and *post-operam* conditions, and monitoring activities related to noise, air quality and quality of life will be conducted.

Noise monitoring activities will be carried out using both standard equipment (using sound level meters of class I precision) and a smart low-cost monitoring system, employed as a continuous monitoring unit in the *ex ante* and *ex post* scenarios. The smart monitoring system will be a prototypal one, developed during the project and, at the end of the project, the prototype will be given for free to Monza municipality that will take care of using it for monitoring activities in the three years after life period.

Recent developments of low-cost sensors allow long term noise measurements, in an extensive way, with high quality output data, which seem to be comparable, under specific conditions and for defined ranges of tolerances, to data obtained by using standard technical equipment.

Urban areas, such as Noise LEZs, is expected to be the correct scale for sensors networks deployment so that LIFE MONZA project can also provide a contribution, analyzing the efficiency of the smart low-cost monitoring sensors and allowing data comparison between these and the higher cost technical equipment.

An automatic road traffic monitoring system will also be used, in order to support long and short term noise monitoring activities and also air quality analysis. Air Quality monitoring within the pilot area will be carried out according to requirements provided by Directive 2008/50/EC on ambient air quality and cleaner air for Europe.

Also, the low-cost and easy operation of the diffusive sampling technique will be used for a large scale air pollution surveys with a high spatial resolution.

In order to compare the spatial variability of air pollution before and after the noise LEZ implementation, NO₂ and benzene land use regression models in a defined urban area of Monza, including the noise LEZ, will be developed.

In other words the objectives of monitoring activities is to assess whether the implementation of the Noise LEZ contributes, as an ancillary effect, to reduce air pollution levels in the pilot area.

Regarding the monitoring of the quality of life, a two-step survey will be performed: before and after the institution of the Noise LEZ. The WHOQOL-Bref questionnaire, that is the only tool that has a specific environmental domain and is already validated in Italian language, will be used.

A survey will be conducted, through a questionnaire structured in different sections, regarding the noise and air quality perceptions, the quality of life conditions and the socio-economic aspects and the use of private or public transports. The questionnaire will be delivered to the inhabitants of the pilot area, before and after the introduction of Noise LEZ and both the *top-down* and the *bottom-up measures*, in order to analyze the effects in a comprehensive and accurate way.

5. Conclusions

The first objective of LIFE MONZA project is to develop an easy-replicable method for the identification and the management of the *Noise Low Emission Zone* (Noise LEZ), to be intended as an urban area subject to road traffic restrictions where low noise levels are also achieved.

The project, co-funded by the European Commission, started in September 2016 and the completion date is scheduled for the 2020. The project focuses on environmental noise topic, but the potential synergies with air quality improvement and quality of life conditions will also be analysed.

The project can give contribution to the policy measures and implementation at different levels. At European level, in order to contribute to the implementation of the European directives, avoiding duplications and overlaps, potential synergies existing between the issues related to noise pollution and air quality will be investigated during the project. Being the project focused on noise issue, the methodology developed for Noise LEZ will contribute to the implementation of the END, particularly regarding the noise action plans, designed to manage noise issues and their effects, exploring the effectiveness and potential benefits due to the introduction of Noise LEZ.

At National level, the results of the project can be applied for the definition of an harmonization and simplification process among transposition decrees of EU Directives concerning noise pollution

and air quality and for the development of a proposal of a common method for identification and management of Noise LEZ.

The local level is very important, because the governments of the municipalities introduce and manage the Noise LEZs and the availability of a common procedure and the knowledge about the impacts and benefits due to Noise LEZ introduction can contribute to make the cities more sustainable and to enforce the dialogue between public institutions and citizens.

ACKNOWLEDGEMENT

The authors would like to thank all who sustained them with this research, especially the European Commission for its financial contribution to the Project into the LIFE+2015 program.

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