

NOISE IMPACT ASSESSMENT OF SMALL HARBOURS

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Harbour noise is an issue that in these last years is subject of a research effort financed by the European Union by means of several Programmes, such as FP7, ENPI CBC Med, LIFE and the Interreg Maritime. Within the framework of this last one, six different projects were financed, forming a cluster regarding port noise nuisance. The deep interconnection of the projects, and the efficient networking activities carried out between them, led to interesting findings and strategies in order to tackle the problems that are related with the noise impact of port activities on the surrounding residential areas. In particular, measurement campaigns conducted within the DECIBEL project in the ports of Portoferraio, Isola del Giglio and Olbia clearly showed that noise issues for small ports which do not have cargo handling are definitely different from the ones that affect the largest ports. The main and most disturbing noise sources in these realities are different, and thus are different also the actions that have to be taken in order to deal with the sound pollution they produce. The analysis of the data collected led to the conclusion that customized solutions must be adopted for every small port considered, taking also into account possible environmental and legislative constraints that are often present in small realities that sometimes can even be part of natural parks or ecologically restricted areas.

Keywords: Interreg Maritime, Port Noise, Ship Noise, Monitoring, Decibel Project

1. Introduction

The European Directive 2002/49/EC known as the "Environmental Noise Directive" (END) aims to harmonize the actions for fighting noise pollution and to make information on exposure to noise available to the public. Moreover, it requires Member States to propose specific action plans for noise pollution when it represents a danger to the health of citizens of certain areas, including urban areas adjacent to small harbours. Port noise can in fact have several serious impacts on population, both from a health and socio-economic point of view [1-5].

Among the actions foreseen in the context of the cross-border program IT-FR Maritime 2014-2020, the development of Decibel project can be found, whose general objective is to improve the sustainability of the small commercial ports of the Cooperation Area by contributing to the mitigation of noise pollution.

Within this context, studies were carried out on the ports of Portoferraio, Isola del Giglio and Olbia in order to identify the noise coming from their activities, with the aim of quantifying the acoustic impact of port noise sources compared to other existing noise pollution, in particular road traffic.

The measurement campaigns carried out in these ports will be presented below, describing the results obtained and the consequent considerations and solutions adopted. Similar studies were realized in other ports (see e.g. [6, 7]), but depending on the noise sources, administrative needs and regulatory provisions, different solutions can be developed.

2. Measurement campaign in Portoferraio

The considered noise emission area in the study consists in the administrative limit of the port and the avenues that run through it, while the impact area includes, in addition to the emission area, the first blocks of buildings facing the port.

The measurement campaign was carried out in the week from 16 to 23 July 2019, during a representative period of the summer tourist season. The monitored activities refer to the noise pollution produced by the ferries that reach the port and the consequent phase in which the vehicles pour onto the city streets.



Figure 1: aerial view of port Portoferraio (LI).

2.1 Description of the measurement campaign

The surveys carried out during the measurement campaign are divided as follows:

- **CC1** and **CC2**: control unit installation stations for carrying out continuous weekly measurements from 16/07/19 to 23/07/2019.
- **Pn**: spot measurements at the survey piers (piers 3 - 5 - 6) during the arrival of ferries and subsequent disembarkation and boarding operations on 16/07/2019.
- **Estn**: spot measurements performed simultaneously with Pn measurements at city streets.
- **Pass-by**: spot measurement along the coastline (detection of the passage of two ferries).



Figure 2: location of the measuring points from the measurement campaign

2.2 Analysis of spot measurements and related results

By analysing the spot measurements P1-1, P1-2, P2-1 and P2-2, many impulsive noise peaks were detected during the disembarking and embarking phases of the vehicles; these noises are generated when the vehicles pass in and out on the bow door of the ferries, due to the impact of the door against the steel support plates lying on the piers and from the impact of the latter against the reinforced concrete.

These events are repetitive and occur more than 10 times within an hour during the day, and it was found that the difference between LAImax and LASmax was greater than 6 dB and the duration of the event at -10 dB from the LAFmax value was less than 1s, thus confirming the impulsive characteristic of these noises.

From the analysis of the measurements performed in the Pn stations, it was found that the impulsive noises constitute the main noise source within the area.

3. Measurement campaign in Isola del Giglio

The measurement campaign lasted again one week, from 17 to 24 July 2019, in the summer season. As for Portoferraio, the monitored activities refer mainly to the noise produced by the ferries and the disembarkation of the vehicles.

3.1 Description of the measurement campaign

The surveys carried out during the measurement campaign are divided as follows:

- **CC1**: control unit installation stations for carrying out continuous weekly measurements from 17/07/19 to 24/07/2019.
- **Pn**: spot measurements at the survey pier during the arrival of ferries and subsequent disembarkation and boarding operations on 17/07/2019.
- **Estn**: spot measurements performed simultaneously with Pn measurements at city streets.

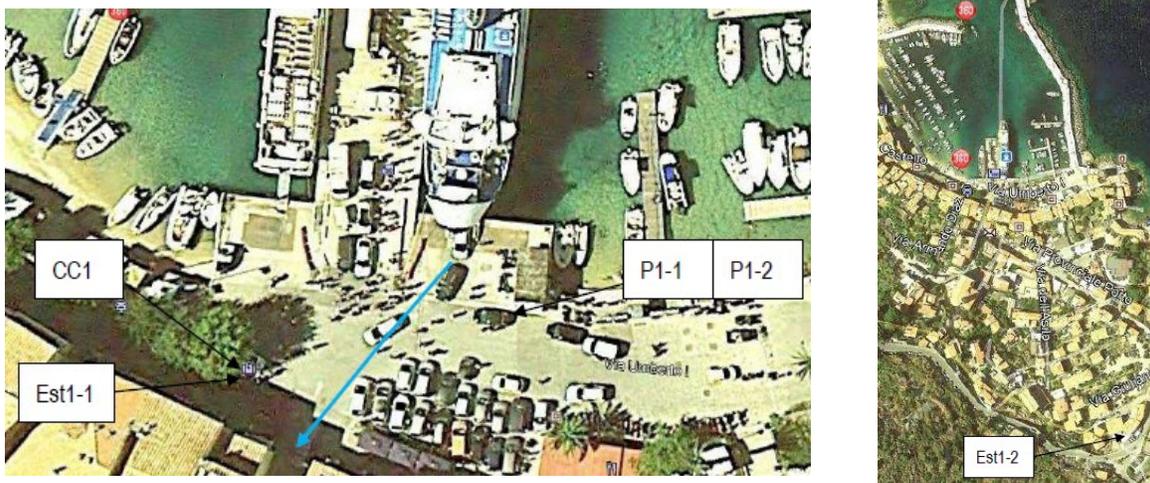


Figure 3: location of the measuring points from the measurement campaign

3.2 Analysis of spot measurements and related results

As for what happened in Portoferraio, it was found that the main noise in the area is due to the Disembarkation operations. The particular environmental constraints of Isola del Giglio, regarding mainly the port paving, which has to be made of granite of a particular local quarry, make it impossible to apply typical solutions like sound-absorbing asphalts.

4. Measurement campaign in Olbia

In Olbia, the specific activities related to the port are confined and do not contribute to noise levels, as the mooring docks are approximately 1.2 km from the first intersection. The measurement points have been identified and validated for their ability to provide a representative picture of the sound pressure levels throughout the area near the commercial port [8, 9].

4.1 Description of the measurement campaign

It has been hypothesized that the survey points chosen are those most exposed to vehicular traffic noise according to a direct cause - effect relationship. The hypothesis was validated by preliminary sound level measurements. The measurement campaign was carried out from 25 to 28 March 2019 (as a low traffic period) and from 23 to 26 August 2019 (as a high traffic period), in the three positions represented in figure 4a. At the same time, traffic monitoring was made in 10 different positions, showed in figure 4b.

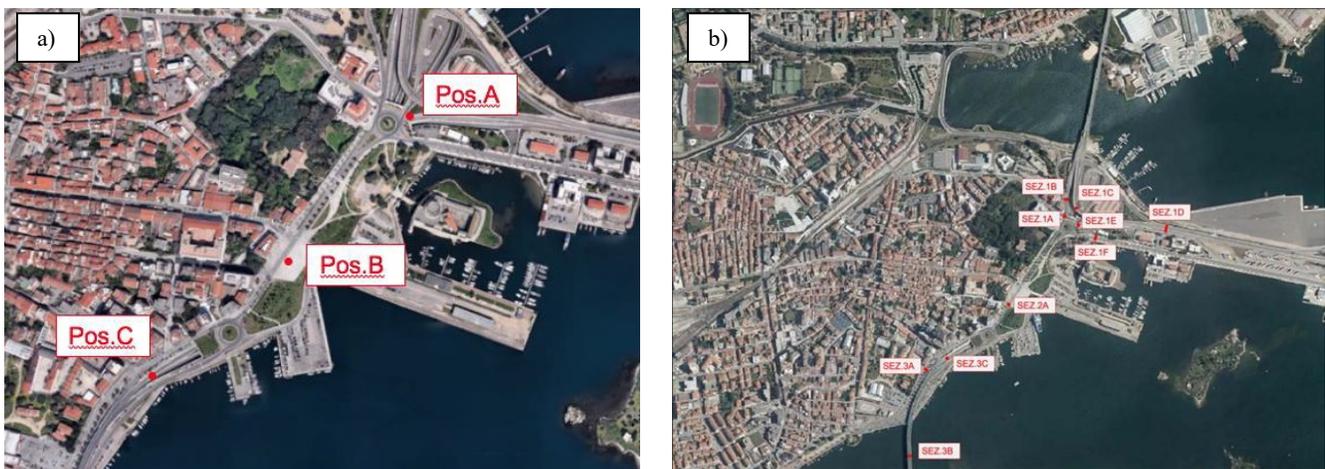


Figure 4: location of the noise (a) and traffic (b) measuring points from the measurement campaign

4.2 Analysis of measurements

As expected, from the comparison between the trend in sound pressure levels and the related traffic measurements, a cause-effect correlation between these two quantities is evident. The other port noise sources seem negligible in the case of Port of Olbia.

5. Conclusions

Measurement campaigns in order to assess port noise were carried out in Portoferraio, Isola del Giglio and Olbia; similar campaigns were also carried out in the ports of Bastia and Ile Rousse, and in general it was noted that for all of these ports (exception made for Olbia) the impulsive noise generated by the passage of vehicles on the ramps of Ro-Pax ships was the main noise source.

As for the noise generated by the impacts of the ramps and metal plates, it was suggested the use of a more durable method for anchoring the latter to the concrete pavement. It was also suggested the interposition of resilient elements between the pavement and the ramps. Such interventions could allow a reduction of $LeqA$ between 4 dB (A) and 6 dB (A).

Moreover, in the framework of the European project RUMBLE (also part of the Interreg IT-FR 14-20 Maritime Programme), an acoustic mitigation intervention was carried out in Portoferraio by the application of a sound-absorbing asphalt. The same solution was adopted in Olbia.

In the port of Isola del Giglio, due to regulatory constraints, no intervention could be carried out regarding the mitigation of impulsive noise and the possible installation of a sound-absorbing asphalt to reduce the noise coming from vehicular traffic.

In the port of Bastia, it was decided to change the port car fleet to reduce the noise by switching from internal combustion vehicles to electric ones.

Acknowledgements

This work has been developed in the framework of the EU cooperation project DECIBEL (Dépollution acoustique des centres portuaires urbains et insulaires). This project has received funding from the European Union's INTERREG IT-FR "Maritime" Programme under Tuscany Region Decree № 15796 issued on 3rd October 2017.

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