A MULTIDISCIPLINARY APPROACH FOR HARBOUR NOISE POLLUTION REDUCTION: THE REPORT PROJECT

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Within the framework of the Interreg initiative, funded by the European Regional Development Fund, the cross border programme Italy-France Maritime 2014-2020 aims to achieve the goals of the EU 2020 Strategy in the Northern Mediterranean area by promoting smart, sustainable and inclusive growth. In particular, the specific object of the axis 3 - lot 2 of the programme is the improvement of the sustainability of commercial ports and logistics platforms to reduce noise pollution. The project "REPORT – Rumore E PORTi" seeks to realize a joint multidisciplinary study, acting as a link between the other twin projects (LIST Port, DECIBEL, RUMBLE and MON ACUMEN), aimed at creating models for managing the reduction of port noise from different points of view (technical, management, socio-economic) and at different levels (port sources, propagation). This will be possible by means of numerical simulations and by the definition of new algorithms and methodologies aimed to outline and define the best common strategies for the abatement of noise pollution. The result will be a set of easily replicable "instruments" effective for every port reality, that will allow to deal with the different aspects of port noise management in a holistic and therefore sustainable way, in order to guarantee a correct scientific approach and management when assessing the acoustical impact of ports.

Keywords: port noise, European projects, Interreg Maritime Programme

1. Introduction

Ports facing the Mediterranean are often surrounded by densely populated urban areas impacting the noise generated by port sound sources [1, 2, 3]. This problem is gaining ever more attention at the regulatory and technical level due to the increasing sensitivity of the inhabitants exposed to noise pollution, creating a strong opposition to the development of the ports themselves [4, 5].

For this reason, within the Interreg initiative, the second call of the Italy-France Maritime 2014-2020 programme had a specific focus on the reduction of port noise pollution.

1.1 The Interreg Programme

The Interreg Programme is one of the key instruments of the European Union (EU) supporting cooperation across borders through project funding (fig. 1). The programme aims to tackle common challenges and find shared solutions in several different fields (e.g. environment, research, transport, sustainable energy, etc.) and is one of the two goals of the EU Cohesion Policy in the 2014-2020 period. Funded by the European Regional Development Fund (ERDF), it has a budget of 10.1 billion Euro which are invested in the cooperation programmes responsible for managing project funding. Having three types of programmes (i.e. cross border, transnational and interregional, see fig. 2), Interreg contributes around EUR 1 billion to EU external border cooperation pro-
grammes such as the Instrument for Pre-Accession Assistance (IPA) and the European Neighbourhood Instrument (ENI).

Interreg V refers to the fact that the period 2014-2020 is the fifth of Interreg: in accordance with the new design of the EU Cohesion Policy and the targets of Europe 2020 Strategy, Interreg was reshaped deeply in order to achieve both great impact and effective use of the investments.

Figure 1: Interreg position in the EU funding structure (from [6]).

Figure 2: Interreg types of programmes (from [6]).
1.2 The Maritime Programme

The cross-border Interreg Italy-France Maritime 2014-2020 seeks to achieve the goals of the EU 2020 Strategy in the Northern Mediterranean area by promoting smart, sustainable and inclusive growth. The Programme takes into account the issues of marine, coastal and insular areas, but also addresses internal ones, with specific isolation risks.

Its main objective is to help strengthen cross-border cooperation between the designated territories to make this space a competitive, sustainable and inclusive area in the European and Mediterranean landscape.

In the previous programming phase (2007-2013), the Programme has funded 87 projects in the areas of accessibility, competitiveness and innovation, enhancement and protection of natural and cultural resources, environmental and marine monitoring.

For the current programming phase, the Interreg Italy-France Maritime 2014-2020 programme has a budget of 199,649,898 €, of which ERDF 169,702,411 €.

2. The projects of the “noise cluster”

Within axis 3 - lot 2 of the programme, the specific objective is the improvement of the sustainability of commercial ports and logistics platforms to reduce noise pollution.

In this lot, the thematic objective and investment priority are “promoting sustainable transport and removing bottlenecks in key network infrastructures by developing and improving environmentally-friendly (including low-noise) and low-carbon transport systems, including inland waterways and maritime transport, ports, multimodal links and airport infrastructure, in order to promote sustainable regional and local mobility”.

The result indicator of the projects will be the number of commercial ports covered by joint plans for the reduction of noise pollution, whereas output indicators regarding noise will be:

- number of realised joint studies;
- number of realised joint ITS (Intelligent Transportation Systems) instruments;
- number of realised interventions for reducing and monitoring noise pollution in ports.

Within this framework, a cluster of five different projects related to the various aspects of noise was born. The projects deal with different specifically port-related issues, and are interconnected one with the other, thus forming a network whose aim is to share the common knowledge between the projects themselves and to implement cross-border cooperation to solve port noise related issues.

2.1 RUMBLE - Réduction du bruit dans les grandes villes portuaires dans le programme maritime transfrontalier (Noise reduction in large port cities in the cross-border maritime program)

The RUMBLE project has the general objective of improving the sustainability of commercial ports by contributing to the reduction of noise pollution, by carrying out studies, small infrastructures and investments for noise mitigation and for the evaluation of their effectiveness, which can be replicated in all the port realities of the cooperation area. This will reduce the main sources of disturbance induced by the sound sources of the port for the benefit of the resident population in the neighbouring urban areas, i.e. the heavy road traffic generated by the port activities and by the moorings of the vessels. The interventions will be defined following an initial survey of the acoustic climate and taking into consideration the grievances of the citizens received by the managing bodies of the ports and the public institutions in charge. At the same time, in order to operate in a correct and efficient manner, RUMBLE will apply a monitoring strategy:

1) connected to the effectiveness of the mitigation works carried out with the project funds in the pilot areas of Cagliari, Livorno and Ajaccio;
2) finalized to evaluate the effectiveness of a large-scale work already carried out with own funds in the Port of Genoa;
3) to define the best interventions to be implemented in the future in the port of the Metropolitan area of Nice.

The communication activities include focus groups and events dedicated to the involvement of the target groups in all phases of the project, also to validate the results: public authorities with sound planning and monitoring, port companies and citizens, also represented by committees. Replicability and the transferability of the project to other ports will be guaranteed at cross-border level by the Network with the leaders of the other projects, at European level by the presentations carried out by the partners in the institutional events, and also by the partner Universities at the international scientific community level.

2.2 MON ACUMEN – Monitorage actif conjoint urbain-maritime de la nuisance (Joint active urban-maritime monitoring of the nuisance)

The MON ACUMEN project addresses the issues of planning and acoustic control in the commercial ports of the cooperation area by developing a common methodology for analyzing the acoustical climate and the noise detection, creating a shared planning of the monitoring systems and a unitary collection and verification of the acquired data necessary for effective planning as required by Directive 2002/49/EC. MON ACUMEN will allow to have a shared approach on the monitoring of the noise produced by the ports, on the detection systems, data collection, classification for the purposes of acoustic mapping, creating a basic cross-border knowledge base for the management of problems caused by port activities. In fact, the presence of important commercial ports, among the first in the respective national rankings (Genoa, Livorno and Cagliari as regards the movement of goods in Italy, Bastia as regards the movement of passengers in France), very frequented and operating 24 hours a day creates considerable disturbance for the surrounding port cities, with residential neighbourhoods within walking distance of significant noise sources. This impacts daily on the lives of thousands of people in the program area. MON ACUMEN will not only allow to design and set up acoustic detection systems compliant with national and European standards, but also to compare and classify data in useful information for transport policies both in Italy and in France. The absence of a shared approach has in fact led to a substantial discrepancy in acoustic monitoring, to the detriment of health and planning effectiveness. MON ACUMEN will allow benefits in this sense for the ports, the surrounding cities but also the whole Regions in the process of updating the acoustical mapping with shared methodologies.

2.3 LIST Port – Limitazione inquinamento sonoro da traffico nei porti commerciali (Traffic noise pollution limitation in commercial ports)

The challenge of LIST-PORT is to improve the acoustic climate of port cities through the use of integrated ITS for traffic management: the general objective is to evaluate how these systems affect the reduction of traffic volumes and therefore of sound pollution in ports and in the surrounding urban areas. Within the project the traffic and noise levels will be monitored in the ports and in the main roads; then the road networks will be modelled, in order to obtain a virtual model capable of simulating new network scenarios. After assessing the criticalities, alternative solutions of travel paths and/or access to ports will be identified, to be introduced through the use of ITS based on info-mobility platforms, which will be able to provide real time information to drivers. A subsequent evaluation will measure the decrease in traffic and sound pollution due to the introduction of these ITS, identifying at the same time corrective measures.

The project is based on a cross-border approach, where the experimental results obtained in four pilot-cities will be evaluated and compared with the different urban, orographic and territorial configurations, in order to define a methodological standardization that will be replicable in other contexts. The final beneficiaries will be residents and visitors of the port cities, as well as the port operators who will be able to rely on an optimal management of port access and on a more effective management of internal traffic.
2.4 DECIBEL - Dépollution acoustique des centres portuaires urbains et insulaires 
(Acoustic pollution reduction of urban and insular port centers)

The DECIBEL project responds to the challenge of improving the acoustic environment of urban island port areas (Bastia, Ile Rousse, Olbia, Portoferraio and Giglio), by developing a model for the reduction of noise pollution specific for insular urban ports characterized by the closeness between port working areas and the neighbouring residential areas. At first, a study will be carried out in each partner port to establish commonalities and specificities in terms of noise pollution but also an inventory of existing and effective acoustic reduction solutions.

After the definition of the model, developed strictly in collaboration with the other projects of the cluster, pilot and monitoring actions will be studied and undertaken in order to reduce the noise pollution. Finally, a database of good practices will be created, and will be used to disseminate the project results.

All of these elements will enable the drafting of a joint document integrating a common strategy as well as a cross-border action plan for the definition of land traffic regulation models from port activities with the objective of reducing noise emissions. The issue of noise pollution from berthed vessels will also be included.

Each partner port will carry out a pilot action consistent with the established cross-border action plan. Monitoring of these actions will be carried out in terms of monitoring the sound impact according to the criteria defined in the cross-border action plan.

2.5 REPORT – Rumore e porti (Noise and harbours)

The REPORT project will act as a trait d’union between all of the previously described projects RUMBLE, MON ACUMEN, LIST Port and DECIBEL.

The general long-term objective of REPORT is the mitigation of sound emissions from ports in the area of cross-border cooperation to make port infrastructures of the Maritime Space more sustainable. This can be achieved through the creation of a specific approach to correct noise management. This methodology, multidisciplinary thanks to the different skills of the scientific bodies that make up the partnership, aims to be implemented and integrated within the Directive 2002/49/EC which does not specifically require an assessment of port noise, but simply assimilates it to industrial noise without taking into account the characteristics and peculiarities of these realities, such as complex sound sources of different nature and characteristics, distribution of the sources themselves and peculiar characteristics of propagation.

Facing this regulatory gap, common to the entire maritime space in a multidisciplinary way (at the same time from technical, managerial and socio-economic point of view), and suggesting common methods for the specific management of port noise, the innovative REPORT approach is necessary in order to reach the common and transnational dimension which is characteristic of European standards and directives.

From the technical point of view, a simulation model will be developed in order to find homogeneous optimal criteria, systems and actions aimed at monitoring and reducing noise, both within the port area and in the surrounding urban areas. Regarding the management, it will be analyzed the variation of noise emissions from land traffic through a forecast scenario of common solutions for corrective actions with studies on the management and regularization of traffic. Moreover, socio-economical investigation will deal with methodologies and specific innovative studies not yet applied in this area to assess the social cost incurred by residents and tourists due to noise pollution in the vicinity of the ports.

Furthermore, REPORT will also operate with experimental field analyzes, both on the sound sources (with evaluations obtained through joint forecasting scenarios acting for example on the propulsion systems of the vehicles), focused on the study of noise propagation in such a peculiar field as the port.

In particular, models and methodologies will be developed to describe the propagation of sound in the port environment (with peculiar and unique features such as the presence of bodies of water),
as well as simulation models and traffic management aimed at reducing noise, and models having as their object the acoustical impact due to different types of propulsion adopted for vehicles transiting and operating in the area. All the models will be validated and a socio-economic survey will be carried out through the administration of questionnaires to the population during summer, so as to be able to economically assess the social costs that noise pollution near ports have.

The impact of light traffic and traffic of goods on the port and urban environment will be analyzed from both a transport point of view and in terms of the physics involved, and management and/or infrastructural solutions will be examined and suggested according to their applicability and their possible effectiveness in relation to the different studied contexts. This will be possible through numerical simulations and by the definition of new algorithms and methodologies to outline and define the best common strategies for the abatement of noise pollution.

The result will be a set of "instruments" that can be replicated in every port reality, that will allow to deal with the issue of port noise management in a holistic and therefore sustainable way, in order to guarantee a correct scientific and management approach during the assessment phase of the acoustical impact of the ports.

The REPORT partnership is formed by public bodies aimed at research distributed across all the territories of the cooperation area: University of Genoa, Regional Environmental Protection Agency of Tuscany, University of Pisa, CSTB (Centre Scientifique et Technique du Bâtiment, Scientific and Technical Centre for Building), Université de Corse Pasquale Paoli and University of Cagliari.

Through its heterogeneous and specific scientific competences, transversal and integrated, and thanks to the strength of previous collaborations on the subject, this partnership guarantees to be able to face every aspect of the management and reduction of port noise pollution in a complete way.

3. Conclusions

Port noise is a critical point that can contribute to limiting the development of commercial ports. Its analysis is complicated due to the different types of sources present. Despite several studies on this topic and the great availability of technologies for acoustic containment, to date, limited experience in the field makes it difficult to evaluate the effectiveness of noise control and the effective impact of improvement interventions.

Thanks to the funding received from the Interreg Italy-France Maritime 2014-2020 programme, a cluster of five projects related to port noise management and control will work jointly in order to achieve the common goal of more sustainable and environmental-friendly ports.

In particular, the REPORT project aims at the realization of a joint multidisciplinary study, acting as a trait d'union between the other four “twin projects” (LIST Port, DECIBEL, RUMBLE and MON ACUMEN), whose goal is to create models for the management of port noise reduction from different points of view (technical, management, socio-economic) and at different levels (port sources, propagation).

Facing a regulatory gap of the whole Maritime Space and suggesting common methods for the specific management of noise from port infrastructures, the cross-border approach of REPORT is necessary in order to reach the common and transnational (European) dimension, typical of European standards and directives.

Acting on this aspects at local, regional or national level, would in fact deal to a dispersion - and therefore to an increase - of efforts and resources, which would be incomplete and unsuitable to tackle such a problem of whose interest is common and shared in both French and Italian territories.

Moreover, heterogeneous initiatives, dissimilar in all the territories, would not allow to obtain similar and comparable results.

The single response and different approaches from each territory would therefore not be as effective or complete as the ones provided by a cross-border approach and an expert partnership across different sectors, and would prevent the formulation of common criteria.
Acknowledgements

This work has been developed in the framework of the EU cooperation project REPORT (Rumore e Porti). 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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