NOISE CLIMATE IN THE SEAPORT OF TRAPANI. MEASURE AND EVALUATION

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Abstract

The aim of the present paper is to assess the traffic induced by port activities and to assess the acoustic climate existing in the surrounding area of Trapani seaport. The experimental campaign of traffic and noise measures was carried out in order to define the following elements: traffic influence in the acoustic climate and sound propagation along the seaport area. With an important campaign of traffic and noise measures, in proximity of the roads, in the parking, and finally inside the seaport, the traffic characterisation, the equivalent level and the population exposure (Ld, Ln and LDEN) were calculated.

INTRODUCTION

Scientific literature as much as Italian and international normative legislations about noise pollution produced by harbour infrastructures is limited.

The growing attention that is focused on the topic of harbour and on its acoustic point of view is generated by the remarkable diversification of noise sources which characterizes the specific acoustic port climate (operating activities, shipbuilding, operations of landing and departure of commercial ships, loading and unloading of freights, operations and sound emissions from part of the onboard systems, announcers, systems of propulsion of the ships, etc.). The port noise climate is also induced by another category of parallel activities (road and railway traffic etc).

Another element of interest for the appraisal of acoustic interaction between port and city is the calculation of the degree of acoustic interaction between internal and external human activities within the harbour area with the aim of estimating the contribution of each entity on the overall urban space.

In 1997 a survey was performed on 42 European sites. It appears from the study that in approximately 47% of the cases in Italy, civil buildings can be found within a

distance of 50 meters from the harbour boundaries and in 33% of the cases, it emerges that the local community complains about noise pollution.

In Europe the respective percentages are 22% or 89% in some cases. It was emphasized that complaints were more numerous in continental Europe despite the fact that the average distance between ports and buildings is smaller in Italy than in other places in Europe.

This difference can be explained by the larger extent of activities of the European ports and consequently by their greater acoustic impact, but also by the greater sensibility to the problem that other European nations express.

The critical areas concerned by noise pollution are mainly the terminal merchandise/freights, the dry docks, the terminal container, the terminal cereals and the terminal ferries.

PURPOSE OF THE ANALYSIS

The aim of the present paper is to assess the acoustic climate existing in the surrounding area of Trapani seaport and to evaluate the degree of acoustic interaction between external human activities and internal activities within the seaport boundaries (where numerous operating activities, together with ship sound emissions, cause the specific acoustic port climate).

SURVEY PROCEDURE

The survey of acoustic impact has been led by a multitude of complementary activities:

- the first one was aimed at gathering information about: the physical and meteorological characteristics of the site; direct and indirect harbour activities so as to characterize the more important sources of noise and to subdivide the harbour area in function of the activities;
- the acoustic monitoring of harbour activities was carried out and the acoustic climate generated around and inside the harbour area by the internal sources of noise was assessed;
- the monitoring of the traffic flows and of the noise levels generated in the neighbourhood streets (which also delimit the harbour area and constitute a physical and acoustic frontier between port and city) was carried out;
- acoustic simulations have been carried out for various standard categories of traffic flows and harbour activities.

SITE CHARACTERIZATION

The seaport of Trapani, classified as a first-class port, is located at 13° 30'' E and 38° 00'' W, close to the historical center of Trapani in a densely populated area (Fig 1).

It is located in front of the Egadi isles and the site is an important centre for sport activities as windsurf, and other involving wind and sea (Trapani in 2005 was one of laps of Louis Vitton cup (preparing the America's cup, see figure 2).

Figure 1 – Geographical characterization and aerial view of Trapani seaport

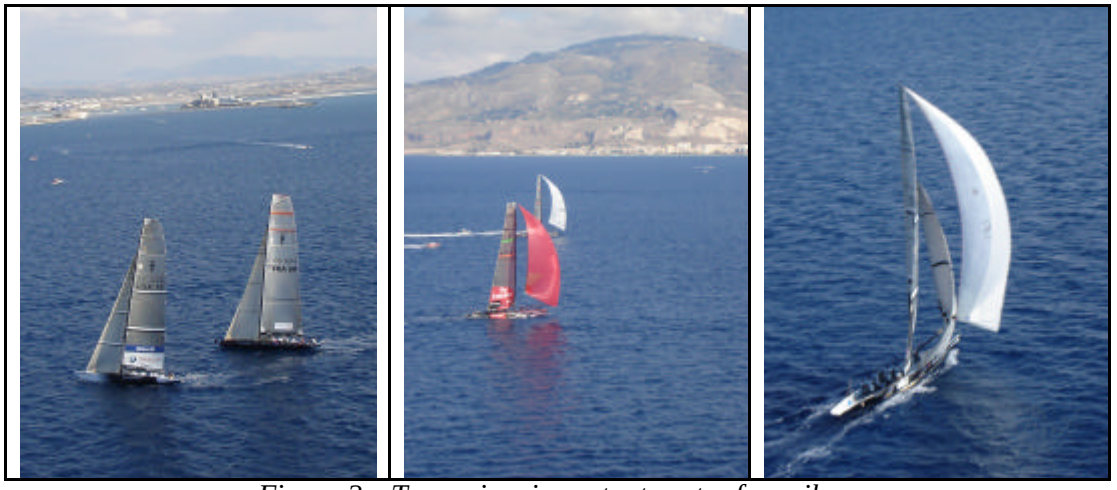

Figure 2 – Trapani an important centre for sailors

The port area is delimited in the north by streets R. Elena, Ammiraglio Staiti e G. Palme, and in the east by the shipyard.

It should be noticed the importance of streets which stands for the clear frontier between city and port and remains an avenue with an important vehicular flow.

Inside the port area, various typologies of buildings are found along the boundary (see figg. 1 and 3), with variable heights between 3 and 6 metres.

It is possible to notice inside the seaport area the presence of a small construction. Besides, the buildings that are located outside the seaport area are from 3 to 20 meters high.

Figure 3 –Ortho-photo-map

AVERAGE METEOROLOGICAL CONDITIONS

Taking into account the influence of the weather conditions (variations of temperature, speed and direction of wind etc) on noise propagation, the study of the standard meteorological conditions of the harbour zone of Trapani was carried out, thanks to the data acquired from the meteorological centre of aeronautic close to the area.

LOCATION OF ACOUSTIC SOURCES

The most important acoustic sources that can be found inside the harbour area are: ships, fixed and mobile systems, traffic flows, etc.

A calendar was formulated for the ships taking into account the typology of activity (freights, transport of passengers etc) and the timetable of permanence in the seaport with the subdivision into acoustically homogeneous phases of activity (loading and unloading, parking, boarding etc).

Areas of harbour activities. The harbour area of Trapani was subdivided into sub-areas taking into account the economic activities and the sources of noise. In the east and south east area are located a parking, the shipyard and other building of service. In the north area are locates the dockings and in the south there is an important boundary between seaport and the salt pan (saline) that is an important natural reserve where are usually present the pink flamingo.

ACOUSTIC SURVEY

The experimental measurement campaign has led us to characterize acoustically the most significant noise sources and to define each ship model (for each condition of permanence inside the harbour area: boarding, landing departure etc.).

Points of acoustic measurements have been established in function of the length of the ships and along the wharves and mooring docks.

Other points of measurement (stations) have been chosen along the streets in the boundary north of the Port. In order to estimate the contribution of the seaport noise in the nearby areas, some stations of measurement have been chosen close to private flats located in via R. Elena. In figure 5 an extract of the map shows some fixed stations where acoustic and traffic data were collected along some days. Other temporary stations were useful to create a grid for noise mapping.

The survey results have been reported in tables containing information like: description of noise sources and ship, description of the events that happened during the measuring time, climate data (temperature, intensity and direction of the wind), index of noise pollution expressed as LAeq, Lmax, Lmin, Pk, Ld, Ln, LDEN, etc; spectrum of noise emission etc.

For each configuration and combination of sources operating in the seaport, maps, tables and charts were drawn. Here are showed as an examples some results of the monitoring campaign.

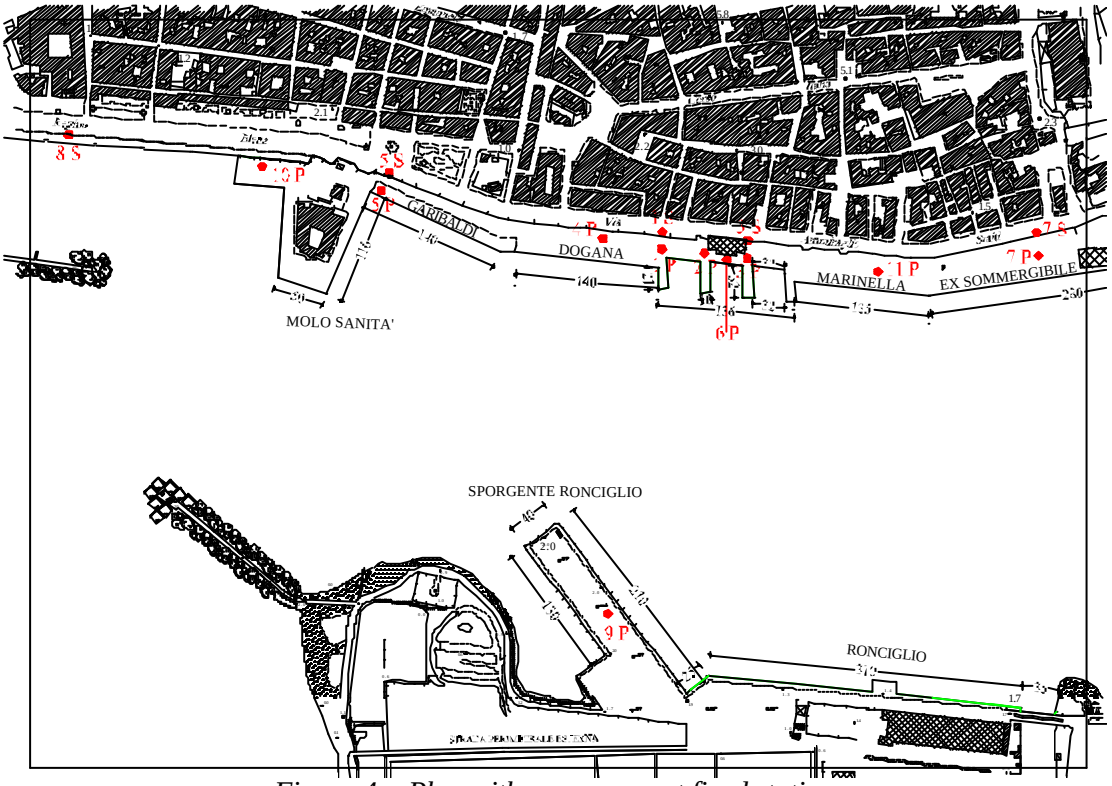

Figure 4 – Plan with measurement fixed station

In figure 5 the measurement point 5P is showed. The recorded noise levels were 67,5 dB(A) during the shipment of the ship Simone Martini (Siremar). During the ship stop (parking) the recorded level was 60,5 dB(A). The influence of the ship in the noise levels was recorded only along a small area and only for few minutes (during the shipment).

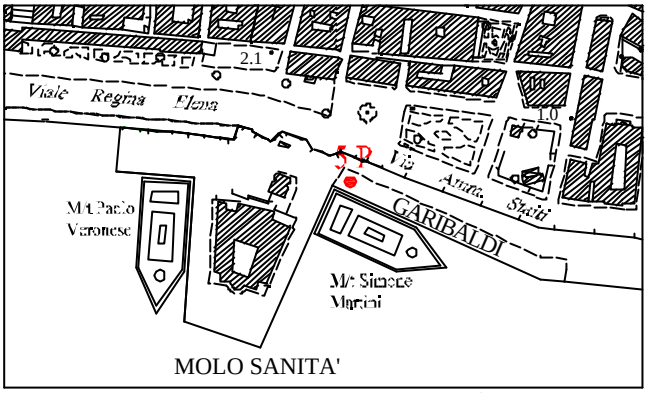

Figure 5 – Plan with a measurement fixed station

The traffic noise was the most important sources of annoyance along the seaport area. In chart 1 the noise levels recorded in the station 7S close a road with an important traffic are showed. In chart 2 the traffic noise data recorded near the station 7S are showed.

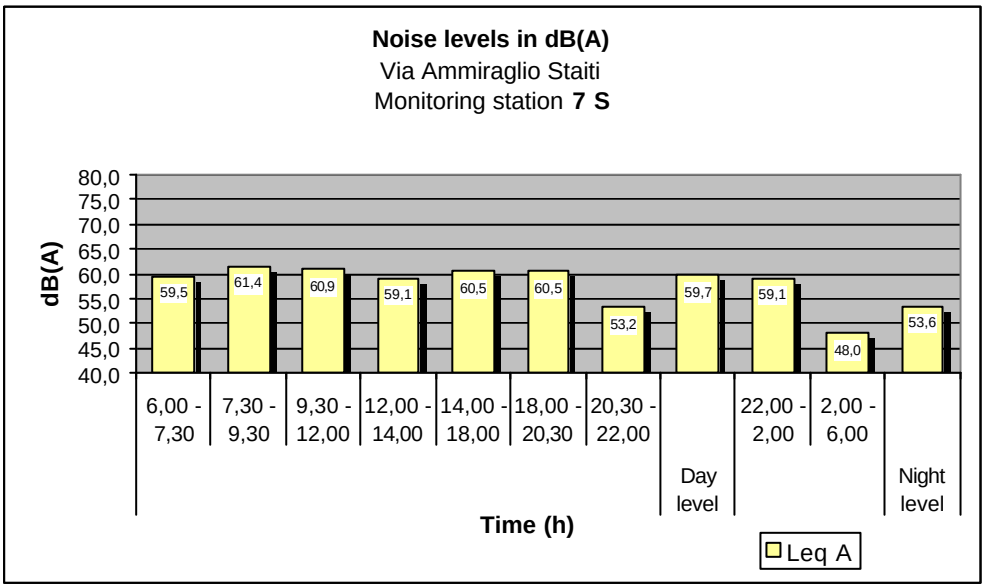

Chart 1 – Noise levels in via Ammiraglio Staiti near the station 7s.

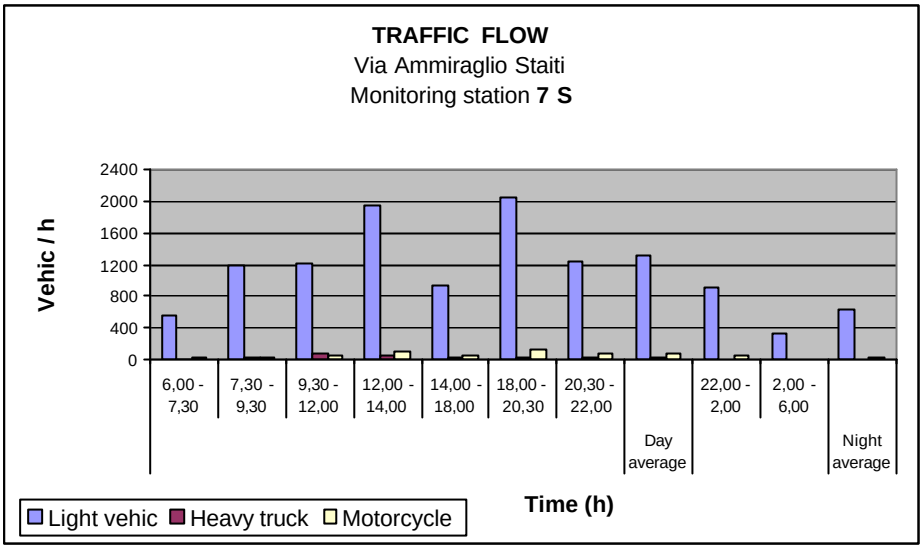

Chart 2 – Traffic flow in via Ammiraglio Staiti near the station 7s.

Thanks to these pieces of information, tables have been established with the aim of estimating the distribution of the iso-phonic curves according to the position of the ship and other sources of noise in the port.

To be able to evaluate the acoustic interaction between seaport and town, measures of traffic flow and noise levels for the day and night time of reference were performed. Considering the exposure to noise levels, it was possible to notice that in daytime the urban traffic noise (excluding the traffic noise induced by seaport activities) completely hides the seaport noise, while in night time this is no more the case and it certainly disturbs even more inhabitants as it can impede them from sleeping.

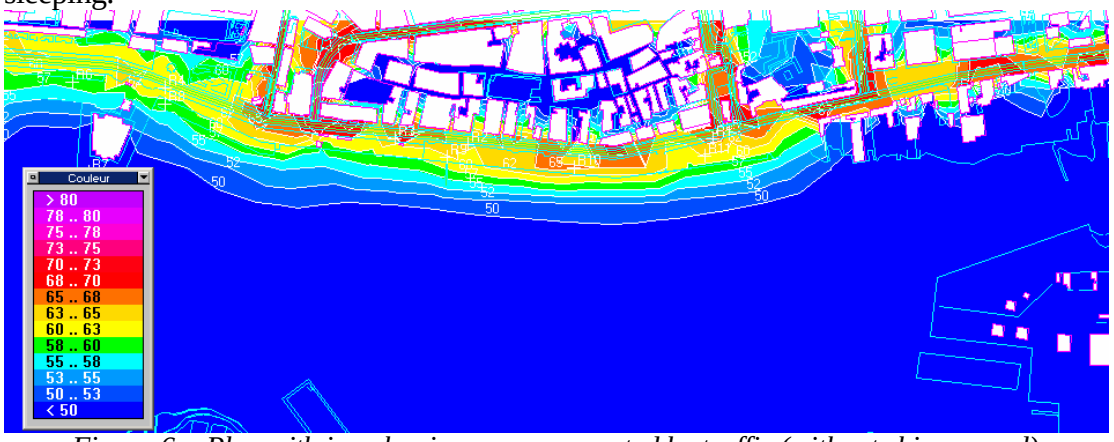

Figure 6 – Plan with iso-phonic curves generated by traffic (without ship or yard)

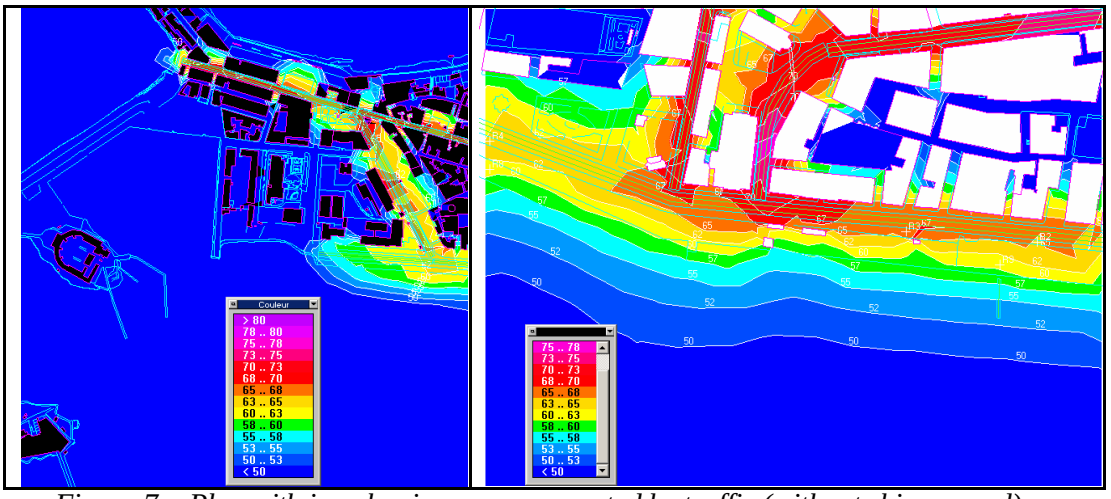

Figure 7 – Plan with iso-phonic curves generated by traffic (without ship or yard)

Finally, we are able to assert that the traffic flow of Streets (which delimits the port area) constitutes an acoustic and physical frontier between port and city. The seaport area paradoxically is a protection against traffic noise and pollution for the saline and his fauna. This study give the same outcome of a precedent study issued by the authors concerning the seaport of Palermo.

SUMMARY

In this paper a procedure for assessing the noise impact along the seaport area is applied. After the evaluation and measurement of noise pollution, it is now possible to affirm that the most disturbing sources of noise around the seaport area are generated by road traffic flow.

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