NEPTUNES, mitigating noise from sea-going vessels at berth

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Summary
Noise emitted by sea-going vessels at berth, at anchor or maneuvering results in annoyance among residents living near ports. Within the NEPTUNES project, which stands for Noise Exploration Program To Understand Noise Emitted by Seagoing vessels, research is going on how to mitigate and reduce noise from these vessels. After the preparatory work, an inventory phase was started; complaints were gathered and also was examined whether legislation or policies were in place to counter ship-generated noise. Also was asked to what extent noise measurements, awareness building and expectation management are available in the ports joining the NEPTUNES project. The results of this inventory phase will be presented in this paper. After the inventory phase, a design phase will be started to develop a method for measuring ship-generated noise and noise interventions. These noise interventions should also encompass the "soft" interventions such as expectation management and awareness building among sailors and staff of the port terminals. The design phase will also deliver a proposal for noise labelling of sea-going ships. Besides the results of the inventory phase of the NEPTUNES project, the paper will also give a sketch of the project and project organization.

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1. Introduction

The NEPTUNES project was initiated by the Port of Rotterdam and aims to get more insight into the ship-generated noise problems in ports collaborating in this NEPTUNES project. The project researches what type of ships and sources are the cause of annoyance perceived by residents living close to the port. Advancing the science of measuring and quantifying the ship-generated noise is part of the project as well to identify the problems with legislation, regulations or policies if legislation etc. if these are available. The project also aims to find ways to mitigate annoyance. The acronym NEPTUNES stands for Noise Exploration Program To Understand Noise Emitted by Seagoing ships. Within the NEPTUNES project, nineteen ports collaborate, eleven ports actively as project member and eight ports as a member of the so called resonance group. The ports are mainly situated in Europe. Two ports are situated in Oceania and one port in North-America. Besides the project plan the project should deliver the next deliverables:

1. Questionnaire
2. Measurement protocol
3. Best Practice Guide
4. Roadmap Implementation

This paper focusses on the first deliverable, the questionnaire which was set out to collect all kind of information regarding ship-generated noise in the ports joining the NEPTUNES project.

With ship-generated noise is meant noise caused by the auxiliaries and equipment of the ship at berth or at anchor and also noise from maneuvering ships.

2. Progress until March 2018

The questionnaire was established and set out among all ports in order to collect information about the annoyance (complaints) reported by residents living near ports. Besides this, the questionnaire requested information about ownership, expertise, number of complaints, responsibilities and powers of the Port Authorities and other bodies involved in registering complaints and the follow-up actions such as inspection, enforcement etc. After a test with the questionnaire, the final questionnaire was sent in by the ports and reported by the Central Project Team in February 2018. Simultaneously the Measurement Protocol was developed. Both, the final inventory report and the measurement protocol were approved by the Project Board. Not all ports were able to fill out the questionnaire for various reasons.

3. NEPTUNES organization

The NEPTUNES project is divided up into five phases, which are:

0: Preparatory phase
1: Inventory phase
2: Design phase
3: Implementation phase
4: Dissemination phase

The organization structure is depicted below.

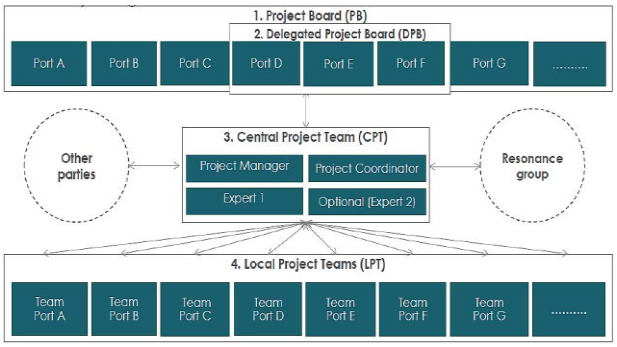

Figure 1: Project organization NEPTUNES

On top of the structure is the Project Board (PB) which consists of all project members (12). For the day to day steering, risk and conflict management the Delegated Project Board (DPB) is responsible, and the Central Project Team (CPT) coordinates and is mainly doing the work. In case additional noise measurements are needed, see elsewhere in this paper, than the Local Project Teams (LPT) are active. These additional noise measurements are not part of the NEPTUNES project. The resonance group consist of members not active in the NEPTUNES project.

4. Results

The questionnaire was returned by fourteen ports. From the questionnaire filled out by these ports was derived that they have different owners. Six

ports are owned by the Local Authorities, six by a mix of authorities, two by the national government (state owned) and two ports are privatized. Only five out of the fourteen ports have an acoustician employed in the port organization; the others are relying on acoustic consultants. Having an acoustician working within the port authorities organisation, it might by easier to identify potential conflicts in an early stage.

The 5 year average number of complaints varies enormously. The complaints assigned to port noise vary from 2 to 10000 complaints and complaints assigned to ship-generated noise varies from 0 to 1000 complaints. This is not a surprise because the ports also vary in size, numbers and types of ships that call the port. It also appeared that roles, responsibilities and powers of the port authorities and other bodies involved in complaint registration and follow-up (enforcement and prosecution) differ. Ports are active when complaints are reported. For instance, noise measurements are conducted, and captains are asked to operate more quietly. In those cases that ship-generated noise is covered by an environmental permit, enforcement of legal limits is easier, and by one port it was reported that it even could lead to a fine when the noise levels did not meet the limit values.

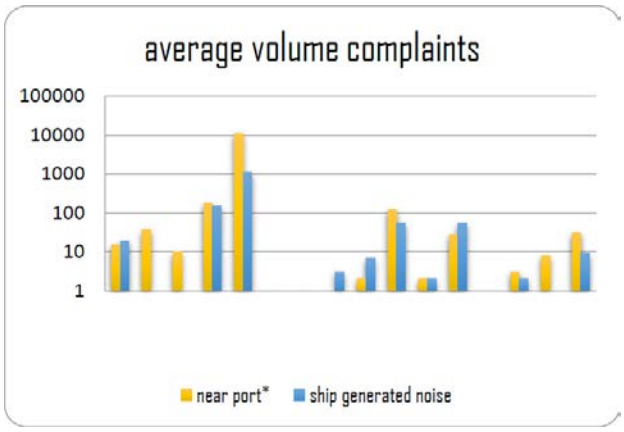

Figure 2: Average volume of complaints over the last 4-5 years

Most of the complaints reported are sent in during the evening and night period. It should be noted that, due to the national or local legislation, these periods also differs in a few cases. In seven ports legislation is applicable to ship-generated noise, other ports do not have legislation. However, in five ports legislation could be applicable in special circumstances and in two ports no legislation is in place. The other ports do not have any legislation.

It was found that legislation reported is using different indicators. Also, the limit values were found to be different. It varies from 45 dB $L_{A(day)}$ to even 70 dB $L_{A(day)}$ depending on the harbour in those ports and the situation. For the evening and the night, also different limit values were found. $L_{A(day)}$, $L_{A(evening)}$,

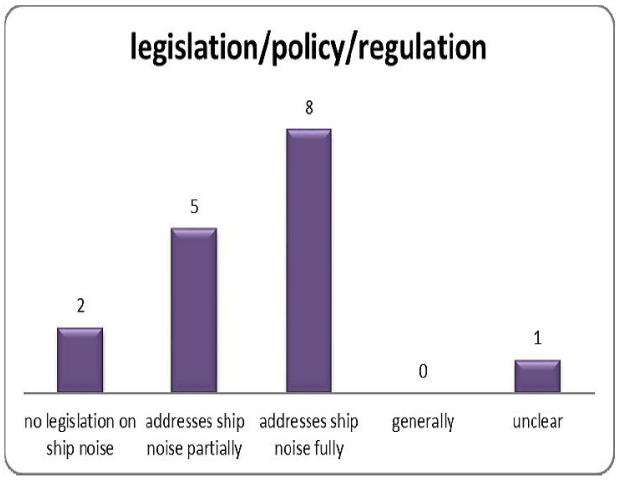

Figure 3: Legislation in place on the ship-generated noise

$L_{A(night)}$, SEL, L_1, L_{10}, $L_{A(T=15\ min.)}$ were found as indicators in those cases were legislation was in place.

Most significant contributing type of ships was reported and also the most important sources. This will be presented in [1]. In that paper also attention will be payed to the noise measurements delivered, the protocols followed during those noise measurements and the measures applied to reduce ship-generated noise.

To have an idea about the share of ship-generated noise to the total noise exposed in the residential areas in the vicinity of the ports it was requested to deliver the number of exposed people for total noise and for ship-generated noise separately. Ship-generated noise (noise map) was rarely found; only one port had drawn a ship-generated noise map. Even the total noise map was not fully reported due to the delays in delivering the noise maps according to the Environmental Noise Directive 2002/49/EC [2].

As the Best Practice Guide planned in the NEPTUNES project should also comprise “soft measures” such as gaining awareness among terminal staff and sailors and performing

expectation management the questionnaire asked for possible elements of it. It appeared that ports use communication instruments that could be defined as elements of an awareness and expectation management approach. Training the terminal staff and make them aware that they have to take into consideration the noise and annoyance in residential districts. They can also send this message to the sailors. Other actions that have been reported are monitoring and auditing the noise or having a dialogue with the residents, group of residents, pressure groups and municipalities situated in the vicinity of the port. There are two kinds of dialogues found; a regular dialogue (e.g. once or twice annually) and an incident driven dialogue (when the port or the housing district are getting closer to each other).

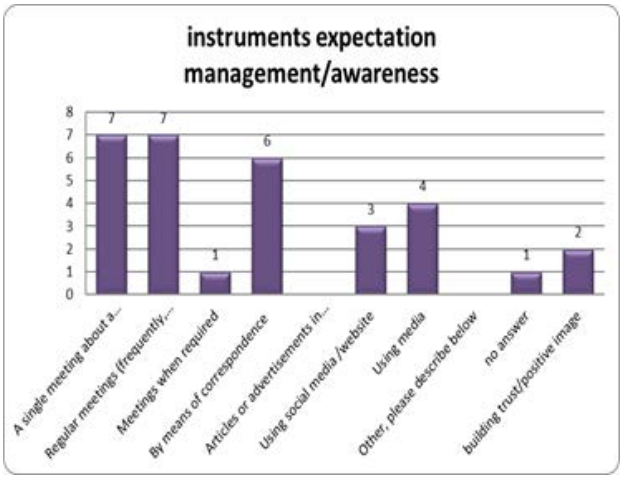

Figure 4: Instruments awareness and expectation management

In the next phase of the NEPTUNES, a more comprehensive set of actions and instruments will be provided. On the one hand, based on the outcomes of the questionnaire and on the other hand on best practices found in literature and other ports.

The last question was regarding spatial an urban planning. When expansion or intensification of port areas is planned, or new housing district is planned this could lead to conflict and more complaints. Most of the ports are aware of it. In some states, legislation is in place that rules the processes of expansion plans on both sides. In other states, this is missing, and one relies on voluntary collaboration etc.

In most of the ports, there are instruments to have a dialogue with the stakeholders about the plans to expand the port area. This is mostly based on legislation, and sometimes it is based on agreements, policies and other non-legislative instruments.

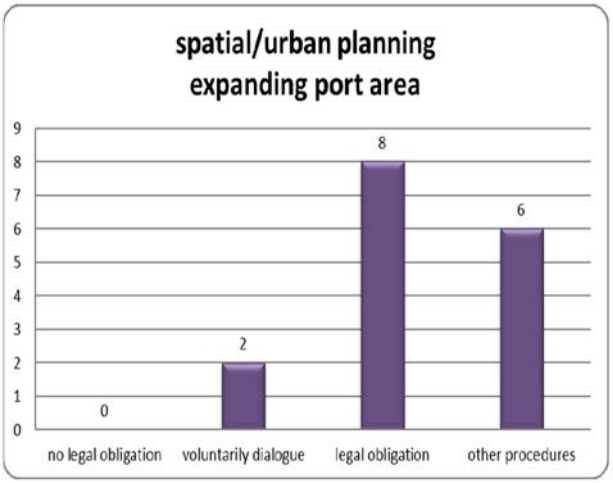

Figure 5: Actions, procedures and legislation land use planning (expanding port areas)

Ports are aware that communication with the other stakeholders is important because they could be confronted with objections and appeals during the planning process that could delay or frustrate their plans.

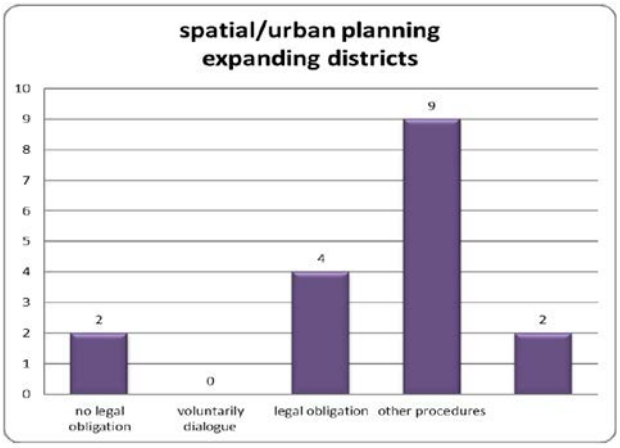

Figure 6: Actions, procedures and legislation land use planning (expanding residential districts)

Not only residents but also others like enterprises, NGO's and other umbrella organisations could act contra-productive. So it is key to start the communication at a very early stage when having plans.

5. Conclusions

The ports within NEPTUNES differ a lot in size, the volume of complaints, powers and responsibilities, legislation and procedures. As the

volume of complaints in some port is rather low, it does not say that in future the volume of complaints will increase. Due to expanding residential areas and the growth of the ports, it might be expected that complaints, annoyance and sleep disturbance will increase. It assumed that world population grows next decades to 9 billion (2050) people [4] and that prosperity and wellbeing increases meaning more production and more consumption which in turn leads to more transshipment and larger vessels or an increase of them that will call the ports.

Hence, ports are aware of this developments and looking for possibilities to avoid complaints and annoyance. Besides that, they recognize that when only considering the complaints sent in by complainants is does not say anything about the annoyance, sleep disturbance and other noise related harmful health effects in men.

Therefore, activities in the second phase, the design phase, are of utmost importance. Developing a harmonized and standardized noise measurement method will lead to comparability of the ship-generated noise and hopefully to a classification. This classification could be the base of a noise labelling system that, when implemented could be used as an incentive. By means of a differentiated charging system (fees) ports can offer a profitable fee to ships that are less noisy and a higher fee to ships that are noisy. This incentive could have a positive impact on ship-builders and ship-owners by making quieter ships or making the ships quieter. Within the NEPTUNES project, a Best Practice Guide will be developed to support these ship-builders and ship-owners. This Best Practice Guide will also comprise measures that could be applied to the landside (terminal, quays and residential areas). Gaining awareness among terminal staff and sailors is also part of the Best Practice Guide as the first step to quiet behavior. Behavioral change is hard to achieve a takes a long time [3] and meet many constraints.

Acknowledgements

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