

Regulation of noise from moored ships



Ships that are moored in ports need energy but since only few ports and ships are equipped with alternative maritime power, ships generate their own power with auxiliary engines creating noise, writes **Rob Witte**, DGMR Consultant for construction, industry, traffic, environment and software.

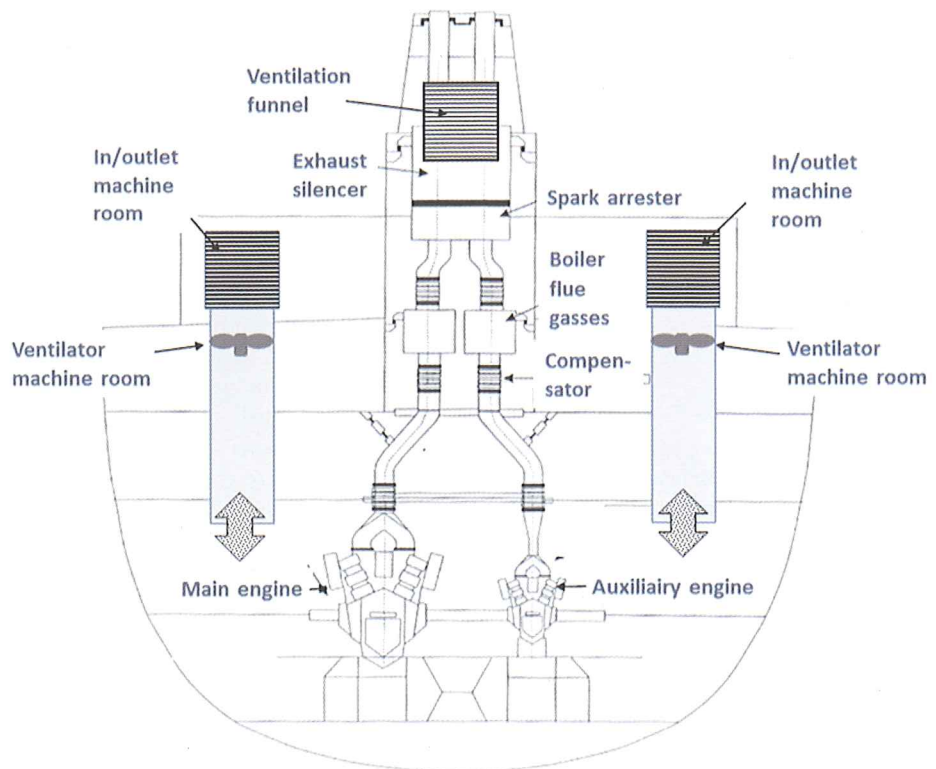


Figure 1: Schematic view of noise sources related to the engines

THE POWER OF these engines are up to 21 MW for the *Emma Maersk* (largest container ship), to 98 MW for the *MS Allure of the Seas* (largest cruise ship). The sound power of different types of ships has been investigated and is now available by dead weight tonnage.

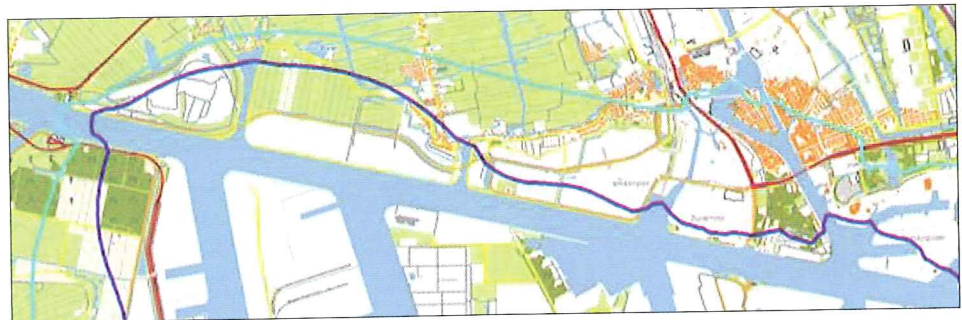
Using this knowledge, calculations were made for the yearly average noise levels around the Port of Amsterdam and results showed that ships are the main contributing noise source in the Amsterdam port area. Other ports will not be very different.

The noise contribution of ships is noticed by the people living near ports. The complaints due to moored ships were investigated for the Rotterdam Port area. They showed that on average 250 complaints are reported every year because of the issue.

Since sea going ships sailing under foreign flag are not subject to national laws, little can be done by individual ports on this subject. Also the International Maritime Organization (IMO) or Environmental Ship Index (ESI) sets no limits on the noise pollution from ships.

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Figure 2: Noise contours 40dB (Night) around Westport area (light blue contour: industry; dark blue contour: ships; orange: houses)



Therefore, international research has to be adopted to regulate ship noise levels.

Sources of noise

Sea going ships are generally moored in a port for 24 hours or more (large bulk vessels) for loading and unloading goods. The on board auxiliary engines generate power and noise and can cause annoyance in the proximity. With the growing ship size this noise footprint will increase.

Noise is measured with sound level metres and with the aid of noise standards these noise levels can be transduced into sound power levels that are based on energy. These sound power levels are independent of their surroundings and can be easily compared. Sound level and sound power are generally expressed by the same unit: dB(A). Common sources for these sound power levels at terminals are given below:

- Gantry crane 100 - 110 dB(A)
- 16 tonne fork lift truck 105 - 110 dB(A)
- AGV 100 (electric/hybrid) - 110 (diesel) dB(A)
- Truck (road) 102 (slow driving) - 110 (accelerating) dB(A)

With the use of dedicated computer programmes, it is possible to migrate industrial activities to sound sources and calculate the consequential noise levels. Often these noise levels are presented as contour lines. In the Netherlands a noise level above 40 dB(A) at night time is unwanted.

Figure 1 shows that the main sources of noise onboard a ship are the funnels and machine room ventilation. But also deck ventilation (RoRo) and reefers on container ships area dominant source of noise. Larger ships make a lot more noise.

Noise levels from moored ships

Based on the ship type, DWT, mooring time and position, a yearly averaged noise level in the surrounding area can be calculated. For the Amsterdam Westport area about 6,000 ships arrive yearly and stay on average 48 hours. For the Rotterdam port area about 30,000 ships arrive yearly and are moored for about 24 hours.

Figure 2 gives the noise contours around the Port of Amsterdam. These contours show that the contribution of moored ships is relatively high.

Some observed ships have high low frequency components in the spectrum. This leads to higher levels of nuisance at greater distances, because of the poor attenuation and isolation for low frequency noise.

In the Rotterdam Port area, the environmental agency DCMR lists all complaints on environmental issues. Over the last three years an average of 250 moored ship related noise complaints were recorded. The description of these complaints range from engine noise to public address systems. Most complaints are caused by failing mufflers on aggregates and compressors.

The perceived nuisance in Rotterdam is measured via questionnaire. This has shown that 2% of the population around the port is often annoyed by noise from ships.

In the Amsterdam port area complaints were also recorded on ship noise, especially around a newly developed industrial area.

No relationship between noise from moored ships and annoyance has been researched, but one can assume that due to the constant noise emission, the impact will be similar to the noise impact of roads.

Mitigating measures

It's not only noise that causes environmental problems but also the air quality due to the auxiliary engine exhausts. A remedy is to use shore power instead of the auxiliary engines when at berth. This will reduce the contribution to the air quality drastically, but unfortunately the noise emission is not reduced in the same way.

When switched to shore power, the remaining sources of noise are:

- pumps (trans shipments, ballast)
- deck ventilation and engine room
- cooling containers (reefers)
- air conditioning

Reductions ranging from 0 (Tankers/RoRo) to 16dB (Bulk) can be expected as a result of using shore power.

The noise directivity of ships could also be used as a mitigating measure, but this will only work if the housing area is on one side and the ship has a noticeable directivity. This is only the case when the sound power level is mainly caused by the ventilation in/outlets. These outlets are relatively easily treated with the aid of silencers that suppress noise down by 10 or 20dB.

Rules on noise emissions

In the SOLAS regulations, there are rules set about noise on board of ships but no regulations are present for noise emissions to the surrounding area. The fact that ships mostly sail under foreign flags doesn't help to set noise limits either.

Where ships owners and terminal owners are connected, authorities have more influence. For instance, DFDS Vlaardingen had to take mitigating noise measures for a RoRo ship, visiting the terminal four times a week. The loud tonal character of the vessel gave rise to many complaints. DGMR advised DFDS on mitigating measures on this subject.

How to tackle noisy ships

Ports gain a large income from moored ships. This includes port dues which are based on the Green Award Certificate or Environmental Ship Index. The Green Award is based on safety and environmental requirements.

If noise was added as a topic to such a Green Award system, ports could award less noisy ships with lower port dues. In this way ports could influence the ships coming to a port and ship owners can make profit by

installing silencers. Making a protocol on noise measurements of sea going vessels is not an easy task, due to the range of sources and operational modes.

For example, the engine of a cooled container runs only when the temperature inside the container is too high. This temperature setting of the cooled container is dependent on its cargo (frozen foods to television sets) and the temperature inside the container is strongly influenced by the outside temperature and radiation. To make a standard out of these variables, the number of cooled containers, the running time for the cooled containers and the sound power level of a cooled container has to be set, next to a standard layout where the cooled containers are stacked.

So for each type of ship a standard has to be developed describing the operational situation in which the sound power levels will be determined.

The way forward

Influence and the awareness of the noise coming from ships is growing. Mitigating measures like shore power is very expensive and will not always reduce the noise levels sufficiently.

Another option to reduce the impact of ships is to make the noise production of moored ships matter to the ship owners. Regulating a part of the port dues to sound power levels will make it profitable to sail silent ships.

A system for measuring and interpreting the results of noise levels on ships has to be established. With this system the shipping company will be able to direct the cause of development for maintenance and design of ships.

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