

CAPABILITY SHEET

AIRBORNE SOUND

AN OVERVIEW OF THE EXPERTISE AND EXPERIENCE OF BOSKALIS WITH AIRBORNE SOUND

WORKING QUIETLY

Airborne sound is a developed field in the construction world, with firm legislation but continued public concerns regarding impacts of operations on people and nature. These concerns are grounded in guidelines from the World Health Organization and regulation in the EU. Limits and monitoring requirements are a reality for many projects. Sound impacts originate from short, intensive operations such as blasting and piling and longer continuous operations such as dredging. With experience of airborne sound impact and mitigation Boskalis understands these concerns and is committed to execute projects while protecting the people and the environment in the most effective manner.

BOSKALIS APPROACH

Boskalis aims to incorporate community and environmental opportunities and concerns in the early stages of project development to enhance project design, realize integral benefits and streamline permit application processes. Fully understanding our sound footprint (e.g. daytime versus nighttime or housing versus commercial area) assists in reducing the impacts of airborne sound and minimizes unnecessary and costly mitigation measures.

As the underlying processes of sound propagation are highly site specific, adaptive strategies are implemented to effectively manage sound impacts, with mitigation measures based on the sensitive receptors in the area and monitored sound levels.



A

- A** Airborne sound measurements in Qatar
- B** The Manu Pekka prior to the refit
- C** The Manu Pekka after the refit

ADAPTIVE PROJECT PLANNING & DESIGN

The same concept is used for dredging. During pipeline construction for Nord Stream in Germany, the dredging activities were designed to minimize the disturbance on local residents and bird nesting areas. This included modelling of sound levels prior to execution followed by optimization of the:

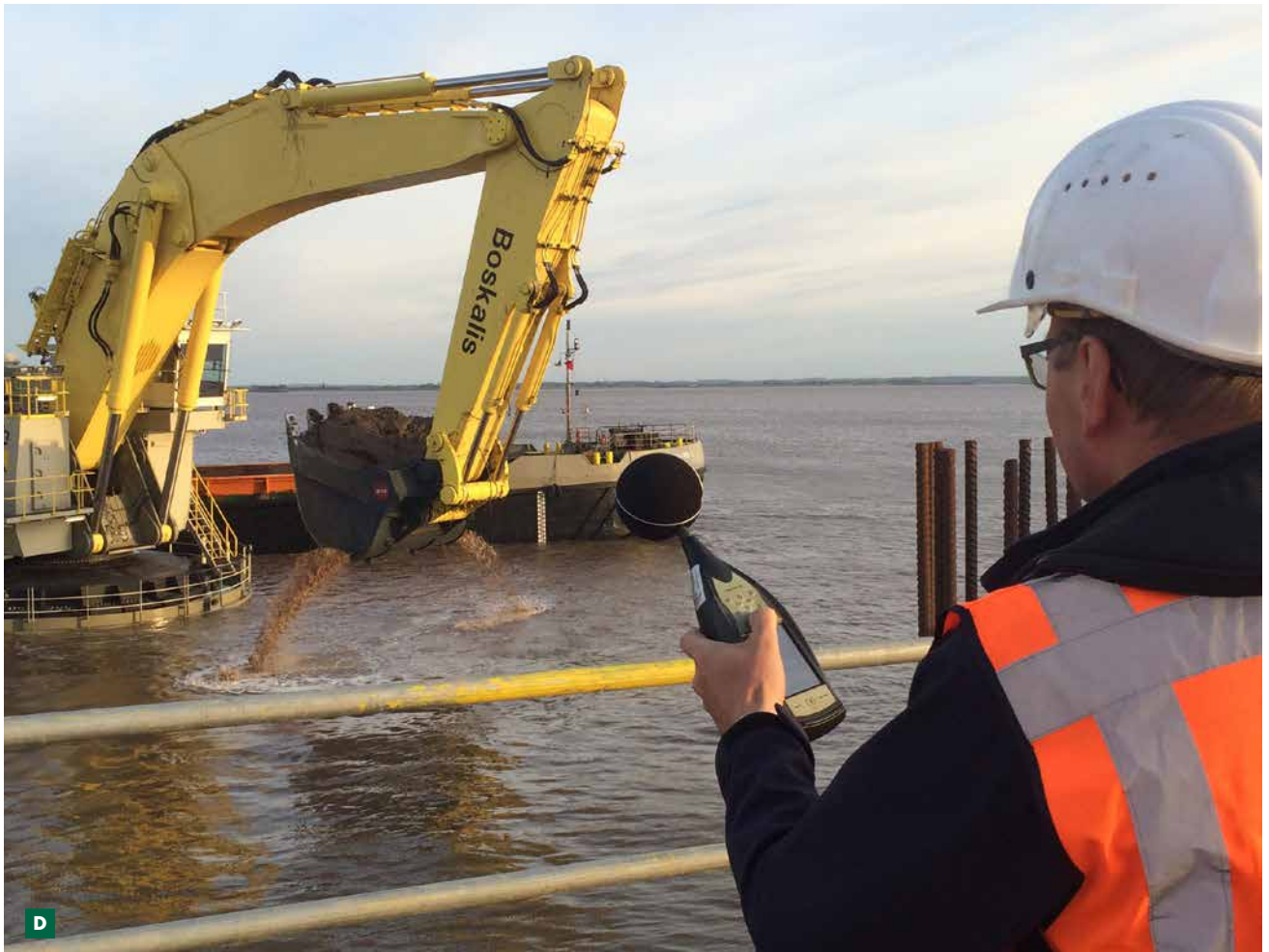
- location and density of equipment
- timing of operations
- monitoring and
- stakeholder involvement



B



C



D

This project planning and careful execution minimized the impact ensuring no exceedances of the limits enforced by the German Authorities and no complaints received.

IN-HOUSE KNOWLEDGE DEVELOPMENT

In-house sound monitoring of different vessels and modus of operation, together with strategic collaboration with leading experts in the field has enabled Boskalis to develop insights into local sound impacts and the effectiveness of mitigation measures. Measurements in the UK during a channel deepening project ensured increasing operational windows and development of new dredging equipment.

Boskalis has robust and up-to-date experience in mitigation of noise both for health and safety and for the environment. We design our vessels to be quieter, improve our vessels as opportunities arise and ensure compliance on our projects. Work method design and mitigating measures are subject to continuous improvement. These include but are not limited to the use of acoustic screens, silencers, isolation, acoustic enclosure and mufflers. Sound generated by our activities is

monitored and results in feedback for further fine tuning of operations and into the choice of future mitigation measures.

ACTION IN THE FIELD

When potential challenges are identified we send out dedicated sound engineers to measure at the receptors and onboard. This allows us the capability to constantly improve and adjust our work methods both for the public and our crew. This mitigation technique is regularly used on our projects, such as work done for the World Bank in Gabon.

FUTURE TRENDS

As the demands of the industry for quieter work increases, we are working with monitoring companies and consultancies to improve our performance. Our knowledge develops by keeping strong ties with open 3rd party collaboration, contributing monitoring data and providing measurement opportunities to validate data.

D Sound measurements at the new Backhoe dredger Magnor

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