inter-noise 83

NOISE AND VIBRATION PLANNING FOR MOBILE OFFSHORE PLATFORMS

Kai A. Abrahamsen (1) and Per T. Gravastrand (2)

(1) Det norske Veritas, P.O. Box 300, N-1322 Hoevik, Norway
(2) Det norske Veritas, P.O. Box 300, N-1322 Hoevik, Norway

INTRODUCTION

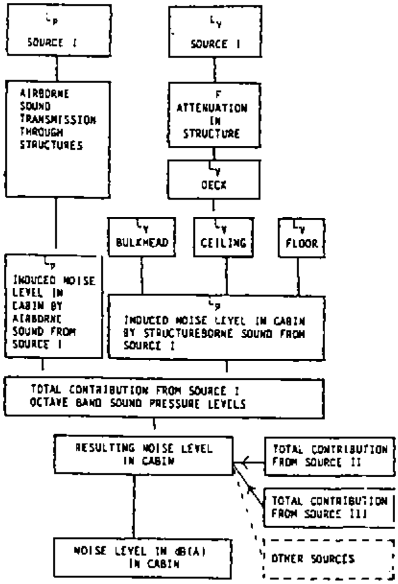
Offshore installations offer an intricate combination of noise and vibration, because machinery is densely packed into steel modules. Hence reverberation, structureborne noise and space restrictions play important roles and make the problem complex. Power generation plant and mud processing equipment are the most severe sources of structureborne noise, while almost all major machinery onboard emit significant airborne noise.

Both UK and Norway have legislation for maximum noise levels on offshore platforms. Experience has, however, shown that it is difficult to design platforms which completely satisfy the regulations.

ACOUSTIC PLANNING

To improve the noise and vibration situation on future platforms, it is generally recommended and in some of the regulations directly required that noise and vibration levels are predicted at the early design stage such that improvements can be implemented when necessary. Airborne noise transmission is usually easily predicted as long as the source strength and acoustic properties of the enclosing structure are known. The structureborne contribution, however, requires more complex calculations and is sometimes left out of the prediction resulting in inaccuracies and uncertainties especially for the accommodation.

Based on several years of intensive research Det norske Veritas has developed a computer program for calculation of structureborne sound transmission in ships. However, the program is based on general power flow theory for flexural and longitudinal waves and can be utilised for offshore structures as well. [1, 2 and 3] describe the theoretical background of the program and the flow chart is shown below.



Flow Chart for Noise Prediction Program NV590

From the necessary inputs: source spectra of both structureborne and airborne sources, properties of the steel structure and radiation properties at the receiving end, resulting sound levels can be calculated. When too high sound levels are predicted the effects of various noise control measures can be simulated by modifying the inputs to the program. If several sources contribute significantly to the sound level in a position, optimal treatment of each source can easily be decided. When necessary the program can be combined with other relevant Veritas programs e.g. for calculation of elastic mounting of machinery or floating floors [4].

The program has recently been utilised successfully on several semi-submersible drilling rigs. One typical rig was partitioned in elements as shown in Figure 1. Source spectra for the diesel generators, the mud pumps and several airborne sources were used as input. The first run of the program showed that the noise levels in the accommodation would be a bit too high and that the 55 dB(A) UK limit for control rooms would be exceeded by nearly 20 dB(A) in the control room near the diesel generators. Reruns were carried out simulating the effects of various noise control measures. Finally it was decided that the application of a damping layer on the main deck would reduce the noise level in the accommodation sufficiently. For the control room, however, further measures were required. The floating floor program was then used to predict reduction due to various floating floor configurations. To reduce the noise level sufficiently a complete floating module was reqquired with additional absorptive materials to avoid standing waves, see Figure 2. Figure 3 displays the predicted noise levels together with levels measured after the rig became operational. As can be seen, most measured levels are within 3 dB of the predicted levels.

REFERENCES

1. A.C. Nilsson, "Attenuation of Structureborne Sound in Superstructures on Ships", JSV (1977) 55(1), 71-91.
2. A.C. Nilsson, "Reduction of Structureborne Sound in Simple Ship Structures; Results of Model Tests", JSV (1978) 61(1), 45-60.
3. A.C. Nilsson, "Noise Prediction and Prevention in Ships", The Society of Naval Architects and Marine Engineers, Ship Vibration Symposium, Arlington Va, October 16-17 1978, N1-N18.
4. B.S. Seland and A.C. Nilsson, "Floating Floors for Use in Marine Constructions", NTNF Report No B.0930.4502.

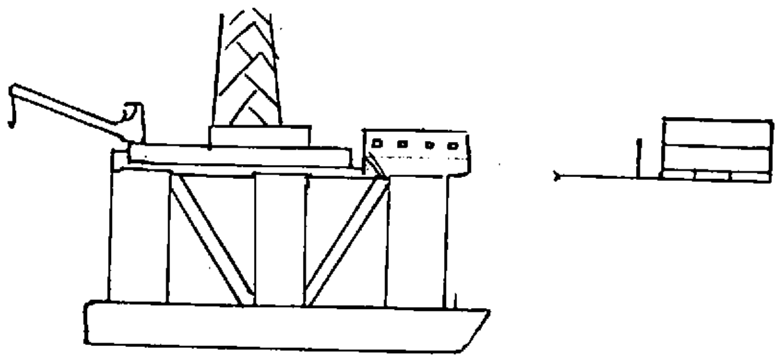


Fig. 1 Partitioning of Main Deck and accommodation into simplified model

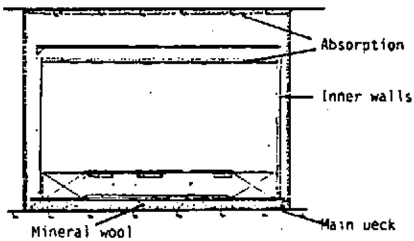


Fig. 2 Control room with floating floor and inner module

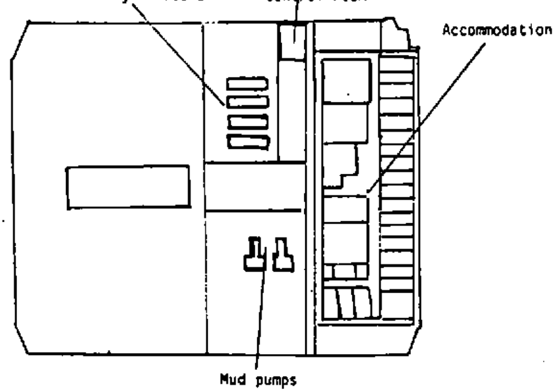


Fig. 3. Predicted and measured noise levels dB(A)

Location	Initial Prediction	Predicted after Noise Control	Measured
Control Room	74	52	55
Cabins	49 - 52	43 - 45	42 - 46
Mess	58	55	54
Change Room	64	60	61