

Acoustic Design of Swimming Halls

Introduction

Swimming halls are large spaces with hard surfaces. This creates a loud environment with bouncing sound waves. Improvements for a more comfortable sound environment exist but may be difficult to apply. The study investigates possible solutions and the way acoustics is included in the project.

Summary

Swimming halls are large rooms and may be compared to empty apartments. Imagine the rooms completely empty from furniture and textiles. The sound environment is suddenly very different. The sound is lingering and creating echoes. The same case appears for swimming halls. The hard surfaces reflect the sound waves between walls and results in a high volume and echoes. This is creating an exhausting environment and noise is a health issue. It will also be hard to have conversations over a large distance, for example with a child in the water.

The safety aspect makes the ability to talk important and the risk for hearing impairment makes the loud volume matter. Questionnaires show that visitors are lightly affected. The employees on the other hand are highly affected.

In order to improve the acoustic environment in swimming halls the bouncing sound waves need to be reduced, i.e. the reverberation time should be close to 1 s, which is possible to achieve according to the study. The ability to talk is preferably at an excellent level but this is harder to achieve. The water itself makes a dominating sound source and needs to be reduced, which will help to increase the ability to talk.

According to interviews, measurements and simulations the main solutions are

absorbents and inclined walls. Absorbents are material used to reduce sound and are applied for common acoustic problems in all types of buildings, but the moisture and function demands in swimming halls makes this harder. Soft absorbents should be placed from 3 meters and up and below perforated hard absorbents are best used, which will have resistance to the curious fingers of children. The different types of absorbents will reduce more of the sound spectrum in total. The inclined wall will break up the sound waves earlier and direct it to the ceiling where absorbents need to be placed. The sound then disappears into the ceiling. The impact of an inclined wall is studied with simulations and the most interesting discovery is that the sound waves blend together quicker and creates an even sound level in the room earlier, this is due to a phenomenon called diffusing.

One problem in swimming halls is the desired glass surfaces. It is enjoyable to be able to look out at the nature during a swim but the glass will make the sound bounce back to the room. Reduced glass surfaces should therefore be considered.

So now we now the necessary improvements, but how do we achieve them? According to the interviews, conducted with 9 persons with expertise in swimming halls, the sound discussion needs to be started at the beginning of the project. Inclined walls for example must be chosen before the design is decided. With an earlier sound debate the cost will be lower and, of course, the result better. Experience and collaboration between acoustics and architects will provide a comfortable and attractive swimming hall, more enjoyable for everyone.