

POLYTECHNIC OF TORINO
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Honors theses

The Acoustics of school canteen

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This graduation thesis tried to determine, evacuate and optimize the quality of acoustic comfort in three school canteens.

Today, optimal hearing conditions in school premises is particularly important, from a health-focused perspective. In fact, it has been widely demonstrated that the quality of the environment where children spend most of their daytime strongly affects their learning results, their ability to concentrate and their psycho-physical weariness (which accumulates during their daily activities).

High background noise levels and an excessive reverberation compromise word intelligibility, defined as the percentage of sentences correctly understood by a listener, in relation with the whole number of sentences uttered by a speaker.

The intelligibility of speech depends on specific objective parameters, that is reverberation time and signal-to-noise ratio, defined as the difference between the signal level and the background noise level in a specific point of space.

This data has been collected during a measurement campaign, and it was processed in order to acoustically define all the environments under investigations.



Fibreglass panels

The greatest effort was to determine STI, Speech Transmission Index, as the marking parameter of speech intelligibility for each case under analysis. As some measures could have not been taken with the participation of students, fibreglass panels were used around the tables, in order to simulate full-room conditions.

To calculate STI and evaluate the acoustic comfort of the canteens, reverberation time (impulse response method) and background noise level (full-room conditions) were measured at each location.

The sound source used to measure STI was a dummy, whose particular structure simulates the reflections caused by facial physiognomy; this allowed to correctly simulate the sound field generated around a human body.



Head and Torso Simulator Briel & Kjaer type 4128

In order to obtain the spatial trend of the index, measurements were made at specific places in the canteens, by placing the sound source on a chair, just like a child sitting at the table, and moving the microphone to the positions of hypothetical listeners.

The results showed that, in these canteens, speech intelligibility is highly influenced not only by reverberation time, but mainly by the sound pressure level in the room which, because of the typology of users, reaches very high values.

On the basis of these results, a project of acoustic re-qualification was hypothesised for a single case under analysis; the validity of the project was verified by means of a highly specialised simulation software (ODEON 6.0).

The simulations allowed the devising of some design solutions which take actions, first of all, to lower the density of occupation, which isn't likely to ever reach optimal levels because of the limits imposed by the school management, and in the same time to work on sound pressure level, by means of absorbing materials.

The project, devised following the experimental results and verified with ODEON, provides that some separators, made in absorbing materials, should be placed around the tables, in order to reduce the sound pressure level in the room and, consequently, reach acceptable STI values.



Proposed solution for the separators

The use of the simulation software was extremely important for this study. This software allows the user to anticipate acoustic phenomena more precisely than statistical models, because of the high quantity of information they provide to the user.

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