MINISTRY OF EDUCATION
TE TĀHUHU O TE MĀTAURANGA

DESIGNING QUALITY LEARNING SPACES (DQLS)

Acoustics

(Version 3.0, December 2020)

Good acoustic design supports all students and creates a better place in which to learn and teach in. This overview provides a summary of the Ministry's new Acoustic requirements for creating quality learning environments that are fit for purpose. The requirements form part of the Ministry's Designing Quality Learning Spaces (DQLS) suite of documents. This overview covers the target audience, mandatory requirements, and key design concepts.

The target audience for the acoustic requirements is designers and engineers involved in the design of the Ministry's school buildings.

It is to be used for new builds, including extensions, pre-fabricated and any new contracts for modular buildings, and refurbishments of existing school buildings, including significant alterations.

The acoustic document covers four key areas:

- The importance of good acoustics for learning
- Acoustic concepts and mandatory requirements
- Design guidance for the main areas of acoustic performance
- Verification methodologies to be used when signing off completed spaces and undertaking Post Occupancy Evaluation (POE)

Mandatory Requirements for Acoustic Design

The mandatory requirements address four key issues:

- Reverberation Time (RT)
- Sound transmission between learning spaces (STC)
- Impact insulation between floors (IIC)
- Indoor ambient noise levels

Requirements for some common learning spaces are provided in the table below.

Refurbishment Recommendations

- In general terms, acoustic strategies for upgrade projects are much the same as for new buildings because there is generally room for some improvement in acoustics as part of any upgrade
- If there are significant changes to layout, occupancy levels, activity types and/or there are significant problems with the existing acoustic condition, then the requirements set out in the table below should be followed as far as is reasonably practicable
- In existing buildings, not meeting one or more of the acoustic mandatory performance targets is not an automatic trigger for an upgrade

Space	Reverberation Time (RT) (seconds)	STC ratings of walls*	Indoor ambient noise levels (dB L_{Aeq})	
	New Build & Refurbishment	New Build & Refurbishment	New Build	Refurbishment
Learning Spaces > 300 m^3	0.4 – 1.1 depending on volume (see DQLS Page 9)	STC 50 separate STC 45 connected	45	45
Learning Spaces < 300 m^3	0.4 – 0.5 Primary 0.5 – 0.6 Secondary	STC 50 separate STC 45 connected	40	45
Breakout spaces	0.4 – 0.5	STC 50 separate STC 45 connected	40	45
Music rooms	0.5 – 0.8	STC 60	40	45
Assembly halls	0.5 – 1.3 depending on volume	STC 60	35	35
Offices / teacher workspaces	0.4 – 0.5	STC 45	40	45

* There are STC requirements for doors, windows and openings, and exceptions for some adjoining spaces.
The IIC requirements for rooms with suspended floor slabs are IIC 55 for new buildings and IIC 50 for refurbishments.

Key Acoustic Design Concepts

Figure 1 shows the key acoustic concepts. Each concept's colour is applied throughout the Acoustic document to provide a clear distinction between different acoustic concept. For example, pink text is about sound absorption.

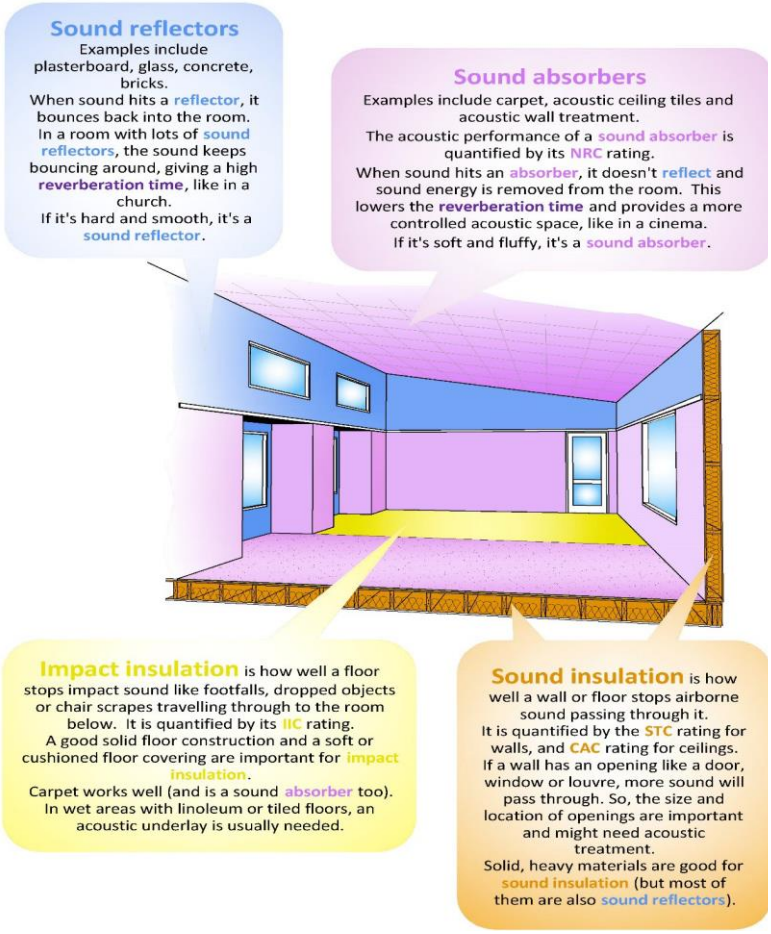

Figure 1: Important acoustic concepts and their colour codes used throughout the Acoustic document

Understanding Internal Environmental Quality

The requirements set out in the DQLS – Acoustics are based on industry best practice, the latest research, feedback received from the Ministry's design reviews and responses to a wide range of technical queries.

One of the key findings is the importance of having an integrated approach to building design, with an aim to optimise a building's performance.

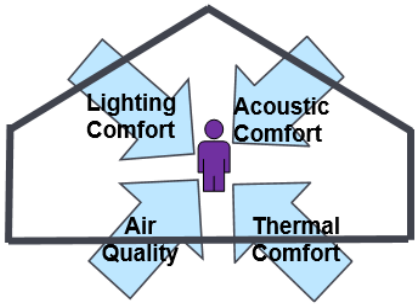

Figure 2: What is internal environment quality? Source: Bluyssen, (2009)

The internal environmental factors in Figure 2 must be addressed during the design phase so that comfort is achieved.

A holistic approach is essential, and no single internal environmental quality factor should be altered without assessing its effect on all the others.

This is because they interact with one another e.g. achieving good daylighting must be balanced against possible uncomfortable heat gain from the sun, and the need for ventilation can increase noise levels inside.

Helpful Tips and Rules of Thumb

Here are some helpful tips and rules of thumb to assist with acoustic design:

- Sound absorption must be well distributed throughout a space. If it is only placed on one surface, sound will reflect off the other hard surfaces making for a higher RT and possible echoes

  Treat the ceiling with a highly absorptive product (NRC 0.85 or higher), as well as most of the available wall area

- The RT spectrum must be balanced, with similar RTs at low, medium and high frequencies, otherwise the room can sound boomy. Low frequency noise is only absorbed by thicker materials (i.e. 40mm or thicker). Thin materials (like carpet and acoustic pinboards) only absorb higher frequencies.

  Usually, a combination of thick and thin materials is required to achieve a balanced RT

- Glass is very common in classrooms as windows and wall partitions, but it reflects sound. The size and location of glass panels need to be designed with acoustics in mind to avoid issues

- Doors and windows in an acoustically rated wall degrade its acoustic performance. Careful positioning of doors, selection of door materials, seals and joinery are therefore important

- Sliding doors are desirable in large learning spaces, but have poor acoustic performance.

  They should be used only where the teachers are going to need the flexibility of changing the size of the teaching space, and they need to be aware of the acoustic compromise

- Floor coverings and ceilings are important for achieving the minimum IIC requirements. Hard flooring and exposed soffits make compliance difficult, but some solutions can be made to work

This is a brief overview of the acoustic requirements. The Ministry's full requirements for acoustics in schools is available on the Ministry's website.

Other documents in the DQLS series that form part of the Ministry's guidelines are: Lighting and Indoor Air Quality and Thermal Comfort