UNIVERSAL DESIGN: ACOUSTICS

INTRODUCTION

Acoustic design can have a significant impact on health and wellbeing, communication and productivity. Good acoustic design allows for speech intelligibility and helps promote human interaction and knowledge transfer.

Standards and guidelines typically include requirements for assistive listening systems and recommendations for quantifiable values, such as sound insulation ratings, noise levels and reverberation times. While certain building classifications may warrant specific acoustic design or specialist advice, unfortunately acoustic performance for many buildings is frequently not considered beyond the minimum statutory requirements.

STANDARDS

BCA D1P9 identifies inbuilt communication systems that must be suitable for people who are deaf or hearing impaired. BCA D4D8 includes Deemed-to-Satisfy provisions for hearing augmentation to meet this performance requirement. However, a Performance Solution may be more appropriate, particularly in an educational setting. BCA F7 sets out the Deemed-to-Satisfy airborne and impact sound insulation rating for walls and floors separating types of spaces. BCA Specification 28 details common forms of wall and floor construction and their sound insulation ratings. The sound insulation rating of internal services is also covered under BCA F7. NCC Volume Two includes similar Deemed-to-Satisfy provisions for sound insulation under BCA H4D8.

AS 1428.2 defers to AS/NZS 2107 for the recommended design sound levels for different uses. It expands on the NCC's provision for communication systems where hearing augmentation is installed and includes guidance on the acceptable types of systems and considerations for choosing a system.

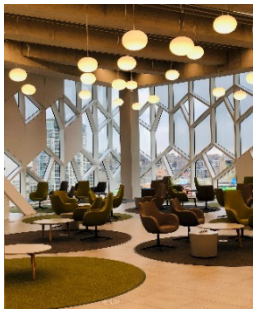
AS 1428.5 outlines the requirements for the design, application and testing of assistive listening systems. It notes hearing augmentation must be provided for counters connected with service provision to the public, public meeting areas, lifts, intercommunication systems, telecommunication systems, emergency warning systems, where PA systems are provided, transport conveyances, and security checkpoints. This standard also includes information on sound field amplification systems that can improve the acoustic environment for all listeners, e.g. classrooms. General information on the incidence and degree of hearing impairment is included in the appendices.

Table 1 in AS/NZS 2107 details the design sound levels and reverberation times for different uses. The standard notes that reverberation time should be minimised for noise control. Appendix A includes an informative diagram showing reverberation times of spaces which are considered to possess good acoustic qualities depending on their function and room volumes.

APPLICATION OF UNIVERSAL DESIGN

How can universal design be applied to acoustics?

- Consider the internal room layout and opportunities for noise mitigation measures with buffer zones and partitions, the use of the space including possible sound and noise sources within the space and locations of these sources, and volume and shape of the room. Consider also if a direct line of sight will be maintained from sound sources to promote intelligible speech.
- Consider likely sources of background noises from external sources, building services and equipment, and users. Identify methods to isolate, separate and mask these noise sources, e.g. dividers, insulation, louvres or screening.
- Consider the potential for noise to travel between spaces through interconnecting walls.
- Select materials and surface finishes with sound absorption or reflectivity qualities appropriate for the space.
- Provide announcements with an appropriate volume and pitch.



Universal design

Universal design is the design of buildings, products or environments to make them accessible and usable to all people of different ages and abilities over time, without the need for adaptation or specialised design.

Relevant standards

NCC (2022) Volume One

- BCA D4D8 *Hearing augmentation.*
- BCA F7 *Sound transmission and insulation.*
- BCA Specification 28 *Sound insulation for building elements.*

NCC Volume Two

- BCA H4D8 *Sound insulation*.

AS ISO 717 *Acoustics - Rating of sound insulation in buildings and building elements*

Part 1: *Airborne sound insulation.*

Part 2: *Impact sound insulation.*

AS/NZS 1269 (*Occupational noise management.*

Part 2: *Noise control management.*

AS 1428 series *Design for access and mobility*

Part 2: *Enhanced and additional requirements - Buildings and facilities.*

Part 5: *Communication for people who are deaf or hearing impaired.*

AS/NZS 2107 *Acoustics - Recommended design sound levels and reverberation times for building interiors.*

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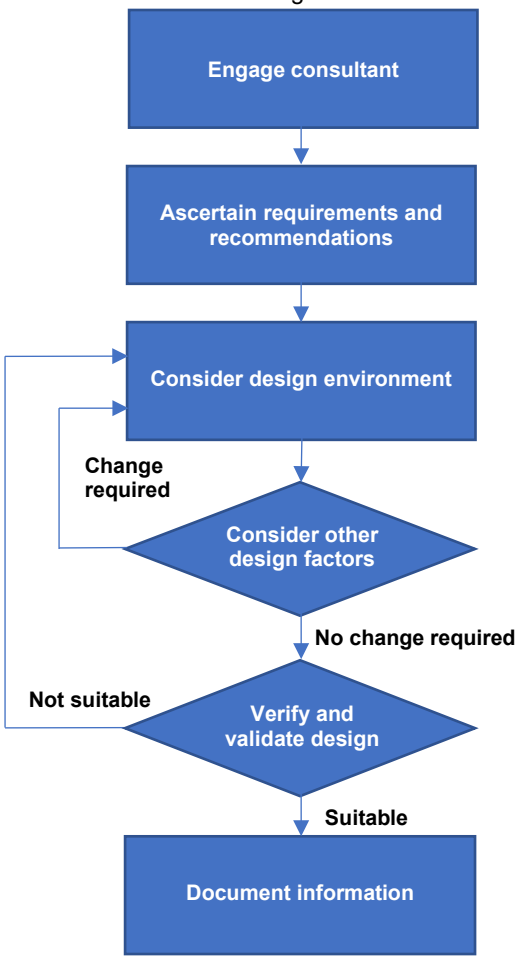
DESIGN PROCESS

What actions should a designer take?



Actions prior to design:

- Consult independent specialist if appropriate. Typically required for medium to large projects. If required, consultation and engagement may take place earlier in the process.

Requirements/Recommendations:

- BCA D4D8,F7and Specification 28.
- AS 1428.2 & AS 1428.5.
- AS/NZS 2107.

Considerations may include:

- Building class.
- Spatial requirements.
- User type and activity.

Considerations may include:

- Internal room layout.
- Material selection.

Confirm suitability in relation to:

- Statutory requirements.
- Design brief/client requirements.

Actions following review:

- Document design process and compliance information.

OTHER CONSIDERATIONS

The designer should also consider the following:

- Specialist advice from an acoustic consultant is recommended where acoustic performance is integral to the function of the space.
- Use of the space, including any hygiene requirements, may preclude the selection of products with greater sound absorption properties, e.g. food preparation areas.
- Openings and penetrations may contribute to noise leakage if not treated appropriately.
- Insulation used for its acoustic properties will also have inherent thermal insulation qualities.
- Sound absorptive materials can reduce reverberation time and improve speech intelligibility. However, an overly absorptive space may be too quiet and be uncomfortable.
- Materials can vary in the level of absorption for different sound frequencies. Data sheets for proprietary products may contain the tested sound absorption coefficients for a range of frequencies as well as the noise reduction coefficient (NRC), which is taken as an average of the tested values. A product with a high NRC may have a lower sound absorption coefficient at a certain frequency than one with a lower NRC,and may not be the most suitable choice if the intention is to absorb sound of a specific frequency.
- Sound masking systems can be used to maintain a balance between speech privacy and intelligibility, if there are any separate functional requirements for privacy.
- Other methods of communication can supplement aural communication, e.g. sight to assist lip reading.

Relevant documents

NATSPEC TECHnotes

- *DES 027 Impact sound insulation*
- *DES 032 Airborne sound insulation*
- *DES 037 Accessible housing*
- *DES 038 Universal design: Introduction*
- *DES 039 Universal design: Slip resistance*
- *DES 040 Universal design: Trip avoidance*
- *DES 042 Universal design: Lighting*
- *DES 043 Universal design: Wayfinding*

Relevant worksections

0472 Acoustic insulation
0511 Lining
0520 Partitions - combined
0521 Partitions - demountable
0522 Partitions - framed and lined
0524 Partitions - glazed
0527 Room dividers
0530 Suspended ceilings - combined
0541 Access floors
0571 Workstations
0963 Sound systems