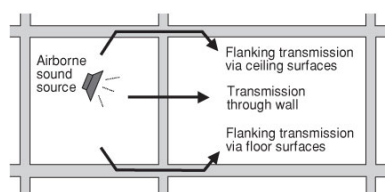


AIRBORNE SOUND INSULATION

INTRODUCTION

This TECHnote addresses the use of insulation to reduce the transmission of airborne sound between habitable rooms. The amount of noise carried from one room to another correlates to the mass and density of building elements, including insulation materials, as well as the design, sealing and installation of the built system.



Airborne sound transmission

SOUND INSULATION PROPERTIES

Acoustic performance may be documented as sound insulation properties. These properties need to be specified by the appropriate quantities using the correct terms, symbols and units.

The AS ISO 140 series provides test methods for sound insulation properties according to frequency bands.

AS/NZS ISO 717.1 which is cited in NCC (2022) deals with the method by which frequency dependent values of sound insulation tests can be converted into a single number rating, characterising performance. The standard also allows input data to be obtained according to AS ISO 140.4, AS 1191 or AS/NZS 2499.

The single number rating is relevant to specifications for all but the most specialised of applications. A notable exception is when the noise source is concentrated in a narrow band, for example, from certain types of machines.

In residential situations, single number rating methods are used with spectrum adaptation terms, recognising that certain frequencies (e.g. sound from music and home theatre systems) are more readily transmitted through some insulating materials than through others.

The value of the weighted sound reduction index R_w may be modified by the addition of a spectrum adaptation term C_{tr} to describe a building element's ability to reduce the transmission of low frequency sound. An adaptation term is required in many of the NCC's requirements for airborne sound insulation.

NCC COMPLIANCE

The options for conformance include the prescriptive approach (Deemed-to-Satisfy) and the performance approach (Verification Method).

Prescriptive Approach

The designer selects a building system from a laboratory tested range. BCA Specification 28 includes a limited number of common wall and floor systems. To conform to NCC requirements, the weighted sound reduction index R_w with spectrum adaptation term C_{tr} must not be less than 50 dB or 45 dB, depending on the building class and the room location.

Performance Approach

The performance approach involves the design of a system that can be verified on completion. When measured in situ, the weighted standardised level difference with spectrum adaptation term, $D_{nT,w} + C_{tr}$, must not be less than 45 dB. Options to satisfy this approach include field testing, expert judgement, comparisons with Deemed-to-Satisfy Provisions or evidence of suitability such as a certificate of conformity issued under the CodeMark Scheme, an ABCB protocol for the certification of building products and systems.



Excessive noise affects amenity

R_w = weighted sound reduction index. A laboratory measurement of airborne sound insulation performance of a building element in dB.

$D_{nT,w}$ = weighted standardized level difference. An equivalent of R_w but measured on-site in dB.

C_{tr} = low frequency sound correction factor. Used to modify the measured sound insulation performance of a building element.

$R_w + C_{tr}$ = resistance of a building element to low frequency sound such as surround sound systems, aircraft and traffic noise, drums and bass guitars.

$D_{nT,w}$ = weighted suspended ceiling normalised level difference. A laboratory measurement of airborne sound insulation performance of a suspended ceiling with a plenum above it.

Relevant standards

AS ISO 140.4: Acoustics - Measurement of sound insulation in buildings and of building elements - Field measurements of airborne sound insulation between rooms.

AS/NZS ISO 717.1 Acoustics - Rating of sound insulation in buildings and of building elements - Airborne sound insulation.

AS 1191 Acoustics - Method for laboratory measurement of airborne sound transmission insulation of building elements.

AS/NZS 2499 Acoustics - Measurements of sound insulation in buildings and of building elements - Laboratory measurement of room-to-room airborne sound insulation of a suspended ceiling with a plenum above it.

AS/NZS ISO 9001 Quality management systems - Requirements

National Construction Code Series (NCC)

Building Code of Australia (BCA)
Volume One Class 2 to Class 9 Buildings

Volume Two Class 1 and Class 10 Buildings

ABCB publication

Sound Transmission and Insulation in Buildings Handbook

AIRBORNE SOUND INSULATION

DESIGN AND INSTALLATION

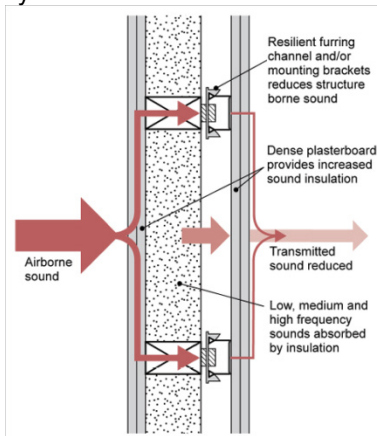
Develop the design of the system to minimise airborne sound transfer and for long-term performance. Make sure systems are airtight, that flanking transmission paths are identified and arrested, that perimeters and penetrations for services and openings are sealed and capable of accommodating building movement.

Attention to detail during construction is also important, to prevent degradation of the system's performance. Make sure any inspections and evidence of compliance are documented.

Liaise with all suppliers involved in the systems, for the compatibility of products and to help obtain the right outcome.

MANUFACTURER'S TESTING DATA

Some acoustic insulation manufacturers have published performance values of wall, ceiling and floor systems incorporating their products. The published R_w and $R_w + C_{tr}$ values that these systems achieve are devised using laboratory tests and a prediction system.



Source: Gyprock Soundchek Systems for homes.

Assurance regarding the manufacturer's claimed values can be obtained by using an AS/NZS ISO 9001 quality management system certified supplier.

OFFICES



Cross-talk can be reduced in commercial situations where acoustically rated partitions do not continue to the structure above, by using materials that combine density with absorption and the sealing of joints. Flexible barriers, acoustic ceiling tiles, baffles and insulating blankets can be specified and detailed to reduce the transmission of airborne sound through or via suspended ceilings.

The performance of ceiling systems is further affected by the presence and treatment of penetrations such as downlights, mechanical ventilation grilles, fire service penetrations and ceiling speakers.

AIRBORNE SOUND INSULATION IN NATSPEC

Acoustic insulation is part of a floor, wall or ceiling/roof system designed and constructed to achieve a required sound insulation value.

Thermal and acoustic insulation requirements often differ and deficiencies in either rating can result. To fulfil both acoustic and thermal requirements, make sure that the insulation meets the minimum performance requirement for both.

Document the required performance of the materials and elements of a building system in the NATSPEC worksections as appropriate.



Relevant worksections

- 0432 Curtain walls
- 0451 Windows and glazed doors
- 0453 Doors and access panels
- 0454 Overhead doors
- 0456 Louvre windows
- 0461 Glazing
- 0463 Glass blockwork
- 0466 Structural glass assemblies
- 0471 Thermal insulation and pliable membranes
- 0472 Acoustic insulation
- 0520 Partitions – combined
- 0521 Partitions – demountable
- 0522 Partitions – framed and lined
- 0524 Partitions – glazed
- 0527 Room dividers
- 0530 Suspended ceilings – combined