

Airborne Sound Transmission (R_w , $R_w + C_{tr}$, $D_{nT,w}$, $D_{nT,w} + C_{tr}$)

Airborne Sound

Typical airborne sources are speech, stereos, and appliances. When sound waves travelling through the air reach a building element they cause it to vibrate. These vibrations travel through the element and are radiated out the other side.

Background

The R_w and $D_{nT,w}$ based acoustic measure originated in Europe, and are used in the Building Code of Australia effective from 1 May 2004. Their emphasis when the spectrum adaptation term C_{tr} is used is low frequency sounds. Low frequency sounds are associated with music, home theatre and other sources.

Airborne Rating Definitions

Laboratory Test Ratings (other sound paths suppressed)

R_w

A laboratory rating that only applies to assemblies that have been tested in a laboratory according to standard ISO 140-3. It may apply to airborne transmission in vertical or horizontal directions. R_w is the "weighted sound reduction index". It is a single number rating. In general, a higher number means an assembly blocks more sound. The rating is derived from data that considers an assembly's surface area and the receiving room absorption which both affect receiving room sound pressure level.

$R_w + C_{tr}$

As above for R_w but including the C_{tr} spectrum adaptation term. It effectively adjusts R_w to account for traffic, distant jet aircraft, and disco music through facade walls. The subscript "tr" is for traffic. It is almost always a negative value. For more information see standard ISO 717-1 and AS/NZS 1276. By way of example an R_w of 59 and C_{tr} of -8 may be reported as $R_w + C_{tr} = 51$ dB, or sometimes as $R_w(C_{tr}) = 59 (-8)$ dB.

Field Test Ratings (other sound paths (flanking) included)

$D_{nT,w}$

A field rating that only applies to assemblies that are tested on a specific site according to ISO 140-4. It may apply to airborne transmission in vertical, horizontal, and diagonal directions. $D_{nT,w}$ is the weighted standardized level difference. It is a single number rating. A higher number means that more sound is blocked from one room to another. The rating is derived from data that considers the receiving rooms reverberation time which affects the measured sound pressure level.

$D_{nT,w} + C_{tr}$

As above for $D_{nT,w}$ but including the C_{tr} spectrum adaptation term. It effectively adjusts $D_{nT,w}$ to account for the low frequency emphasis of traffic, distant jet aircraft, and disco sound through facade walls. The subscript "tr" is for traffic. It is almost always a negative value. For more information see standard ISO 717-1, or AS/NZS 1276. By way of example, an R_w of 59 and C_{tr} of -8 may be reported as $R_w + C_{tr} = 51$ dB, or sometimes as $R_w(C_{tr}) = 59 (-8)$ dB.

Test Method

Although the ratings are different, the underlying test method is essentially the same. A loud speaker fills the source room with noise. A microphone measures the sound level in both the source and receiving rooms, and the level difference is calculated. As sound insulation changes with frequency, the source and receiving room sound level is measured at 16 one-third-octave band centre frequencies. The frequencies range from 100Hz to 3150Hz. The measurement data is adjusted to take into account the characteristics of the receiving room. In the case of R_w the room absorption; for $D_{nT,w}$ the reverberation time. The sound level is plotted resulting in a measurement curve. A standard reference curve is then fitted to the measurement curve. The curve for R_w and for $D_{nT,w}$ are different than the curves for $R_w + C_{tr}$ and $D_{nT,w} + C_{tr}$. Rules are followed to fit the reference curve to the measurement curve to obtain single number values. The rules are described in ISO 717-1, or AS/NZS 1276.

Notes:

- (i) The spectrum adaptation term C_{tr} can make quite a difference, and even change the rank of systems. It can adjust values by more than 10dB.
- (ii) There is no relationship between STC and $R_w + C_{tr}$ or $D_{nT,w} + C_{tr}$. These measures use different frequency ranges along with different curves and curve fitting rules.
- (iii) The AAAC (Australian Association of Acoustics Consultants) has a draft noise control star rating system, which uses a similar, but different measure – namely $D_{n,w} + C_{tr}$.
- (iv) This document is intended as a guide only and does not replace the need to consult on matters of building law and customer satisfaction.