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RR-334 Apparent Sound Insulation in Concrete Block Buildings

Berndt Zeitler, David Quirt, Stefan Schoenwald, Jeffrey Mahn

June, 2015



National Research Conseil national de recherches Canada



Overview

This report presents the results from two substantial experimental studies of sound transmission, together with an explanation of calculation procedures to predict the sound transmission between adjacent spaces in a building whose construction combines concrete block walls with other types of constructions.

Acknowledgements

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Disclaimer

Although it is not repeated at every step of this report, it should be understood that some variation is to be expected in practice due to changing specific design details, poor workmanship, substitution of "generic equivalents" or simply rebuilding the construction.

Despite this caveat, the authors believe that methods and results shown here do provide a good estimate of the apparent sound insulation for the types of constructions presented.

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1 Sound Transmission via Many Paths

The simplest approach to sound transmission between adjacent rooms in buildings considers only the sound transmission through the wall or floor that separates the adjacent spaces. This perspective has been entrenched in North American building codes, which for many decades have considered only the ratings for the individual separating assembly: Sound Transmission Class (STC) or Field Sound Transmission Class (FSTC) for airborne sources or Impact Insulation Class (IIC) for footstep noise.

Implicit in this approach is the simplistic assumption (illustrated in Figure 1.1) that sound is transmitted only through the obvious separating assembly—the separating wall assembly when the rooms are sideby-side, or the floor/ceiling assembly when rooms are one-above-the-other. If the sound insulation is inadequate, this is ascribed to errors in either design of the separating assembly or the workmanship of those who built it, and remediation focuses on that assembly. Unfortunately, this paradigm is still common among designers and builders in North America. In reality, the technical issue is more complex, as illustrated in Figure 1.2.



Figure 1.1: The drawings in Figure 1.1 and 1.2 show a cross-section through a building with two adjacent rooms. Part of the sound from an airborne source in one unit (represented by red loudspeaker in the drawings, which could include anything from a home theatre to people talking loudly) is transmitted to the adjacent unit. The historic approach, illustrated in Figure 1.1, considers <u>only</u> the direct sound transmission through the separating assembly.



Figure 1.2: In reality, there are many paths for sound transmission between adjacent rooms, including both direct transmission through the separating assembly and indirect structure-borne paths, a few of which are indicated here. (See Section 1.4 for more detail.) The structure-borne paths usually significantly affect the overall sound transmission.

There is direct transmission of sound through the separating assembly, but as Figure 1.2 shows, that is only part of the story. The airborne sound source excites all the surfaces in the source space and all of these surfaces vibrate in response. Some of this vibrational energy is transmitted as structure-borne sound across the surfaces abutting the separating assembly, through the junctions where these surfaces join the separating assembly and into surfaces of the adjoining space, where a part of the vibrational energy is radiated as sound. This is called flanking sound transmission.

It follows that the sound insulation between adjacent rooms is always worse than the sound insulation provided by just the obvious separating assembly. This is because the occupants of the adjacent room actually hear the combination of sound due to direct transmission through the separating assembly and any leaks, plus sound due to structure-borne flanking transmission involving all the other elements coupled to the separating assembly.

Of course, this has long been recognized in principle and the fundamental science was largely explained decades ago, with key contributions made by Cremer and Heckl (1), Gerretsen (2,3) and Craik (4), among others. The challenges for being able to predict the structure-borne flanking transmission have been to reduce the complicated calculation process to manageable engineering that yields trustworthy quantitative estimates, and to standardize that process to facilitate its inclusion in a regulatory framework.

For design or regulation, there is a well-established terminology to describe the overall sound transmission including all paths between adjacent rooms. ISO ratings such as the Weighted Apparent Sound Reduction Index (R'_w) have been used in many countries for decades, and ASTM has recently defined the corresponding Apparent Sound Transmission Class (ASTC), which is used in examples in this Report.

While measuring the ASTC rating in a building (following ASTM Standard E336 (5)) is quite straightforward, predicting the ASTC rating due to the set of transmission paths in a building is more complex. However, standardized frameworks for calculating the overall sound transmission have been developed. These calculations use standardized measurements to characterize the sub-assemblies (walls, floors, junctions) as inputs to empirical calculations of the sound insulation between rooms.

In 2005, ISO published a calculation method, ISO 15712-1:2005, "Building acoustics — Estimation of acoustic performance of buildings from the performance of elements — Part 1: Airborne sound insulation between rooms" (6). This is one part of a series of standards: Part 2 (7) deals with "impact sound insulation between rooms", Part 3 (8) deals with "airborne sound insulation against outdoor sound" and Part 4 (9) deals with "transmission of indoor sound to the outside." The ISO 15712 series was originally prepared by the European Commission for Normalization (Committee CEN/TC 126) as EN 12354:2000 (10). The EN 12354 standards have been used for more than a decade to support performance-based European code systems, and they were subsequently adopted as ISO standards without modification by Technical Committee ISO/TC 43/2.

However, there are two significant impediments to applying the methods of ISO 15712-1:2005 in a North American context:

- ISO 15712-1 provides very reliable estimates for some types of construction, but not for the lightweight framed construction widely used for low-rise and mid-rise buildings in North America.
- ISO standards for building acoustics have differences from the ASTM standards used by the construction industry in North America both in their terminology and in specific technical requirements for measurement procedures and ratings.

The following sections of this chapter outline a strategy for dealing with these limitations, both explaining how to merge ASTM and ISO test data and procedures, and providing recommendations for adapting the calculation procedures for common types of construction.

This Report was developed in a project established by the National Research Council of Canada to support transition of construction industry practice to using the ASTC rating rather than the STC rating for sound control objectives in the National Building Code of Canada (NBCC). However the potential range of application goes beyond the minimum requirements of the NBCC – the Report also facilitates design to provide enhanced levels of sound insulation, and should be generally applicable to construction in both Canada and the USA.

1.1 Predicting Sound Transmission in a Building

As noted in the previous section, ISO 15712-1:2005 provides reliable estimates of sound transmission for buildings with structural concrete floors and walls of concrete masonry (constructed with normal weight or lightweight units) or concrete, but it is less accurate for other common types of constructions, especially lightweight wood frame and steel frame constructions.

ISO 15712-1:2005 has other limitations, too. For example, in several places (especially for light frame construction) the ISO standard identifies situations where the detailed calculation is not appropriate, but does not provide specific guidance on how to deal with such cases. Many of these limitations can be overcome by using data from laboratory testing made according to the ISO 10848 series of standards (11–14). The four parts of ISO 10848 were developed by working groups of ISO TC 43/2 to deal with measuring flanking transmission for various combinations of construction types and junctions. Because the current (2005) edition of ISO 15712-1 replicates a European standard developed before 2000, it does not reference the more recent standards such as the ISO 10848 series or the ISO 10140 series (15–19) that is replacing the current ISO 140 series referenced in ISO 15712-1.

To work around these limitations, and to provide more guidance to users on how to use this calculation procedure for specific situations, this Report presents an approach suited to each type of construction:

- For types of construction where the calculation procedure of ISO 15712-1 *is appropriate*, this Report outlines the steps of the standardized calculation process. In order to respect copyright, the Report does not reproduce the equations of ISO 15712-1, but it does indicate which equations apply in each context and provides key adaptations of the ISO expressions;
- For types of construction where the calculation procedure of ISO 15712 *is not appropriate*, this Report presents an alternative approach which is based on experimental data obtained using the ISO 10848 series of standards for laboratory measurement of flanking transmission. The approach combines the sound power due to direct and flanking transmission in the same way as ISO 15712-1, as described in Section 1.4 of this Report.

The appropriate calculation process to be used depends on the type of wall and floor constructions to be combined with the concrete block walls to form a complete building as well as the details of junctions by which they are connected. For this reason, Chapter 4 is divided into sections which describe the suitability for the combination of concrete block walls with other constructions:

- concrete masonry walls with concrete floors in Chapter 4.1,
- concrete masonry walls with lightweight wood-framed walls and floors in Chapter 4.2,
- concrete masonry walls with lightweight steel-framed walls and floors in Chapter 4.3,
- concrete masonry walls with precast concrete floors in Chapter 4.4.

In all cases, the masonry walls may be constructed from normal weight or lightweight concrete block masonry units.

1.2 Standard Scenario for Examples in this Report

When dealing with the prediction of sound transmission between adjoining spaces in a building, as described in the previous section, the predicted attenuation for the various paths depends not just on the constructions involved, but also on the size and shape of each of the room surfaces as well as on the sound absorption in the receiving room. The ability to adjust the calculation to fit the dimensions in a specific building or to normalize to different receiving room conditions enables a skilled designer to obtain more accurate predictions.

However, for purposes of this Report where results will be presented for a variety of constructions in Chapter 4, easy and meaningful comparison of results is facilitated by calculating all the examples for a common set of room geometries and dimensions and using a consistent rating (ASTC) to describe the overall system performance. There are many pairs of examples in the following sections where such comparisons are instructive. This is particularly useful where only one part of the construction is changed from one example to another, since the construction change can be unequivocally related to the change in predicted ASTC rating.

Hence a Standard Scenario has been used for all the examples. The Standard Scenario includes:

- two adjacent rooms that are mirror images of each other, with one side of the separating assembly facing each room, and constituting one complete face of each rectangular room;
- pairs of rooms that are either side-by-side (illustrated in Figure 1.3) or one-above-the-other (illustrated in Figure 1.4).





The pertinent dimensions and junction details (as shown in Figures 1.3 and 1.4) are:

- For horizontal room pairs (i.e. rooms are side-by-side) the separating wall is 2.5 m high by 5 m wide, the flanking floor/ceilings are 4 m by 5 m and the flanking walls are 2.5 m high by 4 m wide.
- For vertical room pairs (i.e. one room is above the other) the separating floor/ceiling is 4 m by 5 m wide and the flanking walls in both rooms are 2.5 m high.
- In general, it is assumed that the junctions at one side of the room (at the separating wall if rooms are side-by-side) are cross junctions, while one or both of the other two junctions are T-junctions. This enables the examples to illustrate the typical differences between the two common junction cases.
- For a horizontal pair, the separating wall has T-junctions with the flanking walls at both the façade and corridor sides and cross junctions at the floor and ceiling.
- For a vertical pair, the façade wall has a T-junction with the separating floor, but the opposing corridor wall has a cross junction, as do the other two walls.

In a building, cases with cross junctions at separating walls on either side and at the corridor side seem quite common, and deviations from this Standard Scenario, such as pairs where one is an end unit, should tend to give slightly higher ASTC ratings.

1.3 Applying the Concepts of ISO Standards in an ASTM Environment

Although the building acoustics standards developed by ASTM Committee E33 are very similar in concept to the corresponding standards developed by ISO TC 43/2, they do present numerous barriers to using a mix of standards from the two domains due to both differences in terminology and the different technical requirements for some of the measurement procedures and ratings.

Even though the ASTM standard E336 recognizes the contribution of flanking to the apparent sound transmission, there are no ASTM standards for measuring the structure-borne flanking transmission that often dominates sound transmission between rooms. Nor is there an ASTM counterpart of ISO 15712-1 for predicting the combination of direct and flanking transmission. In the absence of suitable ASTM standards, this Report uses the procedures of ISO 15712-1 and data from the complementary ISO 10848 measurement standards for some constructions, but connects this ISO calculation framework to the ASTM terms and test data which are widely used by the North American construction industry. To facilitate the use of ISO calculation procedures as well as an understanding by a North American audience, this Report both identifies where data from ASTM laboratory tests can reasonably be used in place of their ISO counterparts and presents the results using ASTM terms). Some obvious counterparts are shown in Table 1.1, and a detailed lexicon of the ISO terms is given in ISO 15712-1:2005.

| ISO Designation | Description | ASTM Counterpart |
|--|---|---|
| ISO 10140 Parts 1 and 2 | Laboratory measurement of the airborne sound transmission through a wall or floor | ASTM E90 (20) |
| sound reduction index <i>R</i> (10140-2 test) | Fraction of sound power transmitted (in dB) in each 1/3-octave-frequency band in standard laboratory test | sound transmission loss TL (ASTM E90 test) |
| weighted sound reduction index R_w (ISO 717-1 (21) from 10140-2 data) | Single-number rating determined from the R or TL values for the set of standard 1/3-octave-frequency bands | sound transmission class STC (ASTM E413 (22) from E90 data) |
| apparent sound reduction index R' (ISO 16283-1 (23) test or calculation) | Fraction of sound power transmitted (in dB) in each 1/3-octave-frequency band, including all of the transmission paths between two rooms | apparent transmission loss ATL (ASTM E336 test or calculation) |
| weighted apparent sound reduction index R'_w | Single-number rating determined from the R' or ATL values for the set of standard 1/3-octave-frequency bands | apparent sound transmission class ASTC |

 Table 1.1:
 Key standards and terms used in ISO 15712-1 for which ASTM has close counterparts

Note that for this description, "counterpart" does not imply the ASTM and ISO standards or terms are exactly equivalent, but in most cases they are very similar. The laboratory test procedures used to

measure the airborne sound transmission through wall or floor assemblies – ASTM E90 and its ISO counterpart ISO 10140-2 – are based on essentially the same procedure with minor variants in test requirements. Hence, the measured quantities "airborne sound transmission loss" from the ASTM E90 test and "sound reduction index" from the ISO standards are sufficiently similar so that data from ASTM E90 measurements can be used in place of data from ISO 10140-2 in the calculations of ISO 15712-1 to obtain a sensible answer. Similarly, the simplified calculation of ISO 15712-1 may be performed using STC ratings to predict the ASTC ratings. But, R_w and STC are not interchangeable. Neither are R'_w and ASTC because of significant differences in the calculation procedures. The close parallel between "sound reduction index" and "sound transmission loss" also means that results from ISO 15712-1 calculation (normally expressed as R' values) can confidently be treated as the calculated Apparent Transmission Loss (ATL) values and then processed according to ASTM 413 to calculate the ASTC rating which is the suggested objective for designers or regulators in the North American context.

A glossary of additional new terms is presented in Table 1.2.

| Table 1.2 : | Key terms | used in this | Report to | deal with | concepts | from I | ISO | 15712-1 | and ISO | 10848 for |
|--------------------|--------------|--------------|-----------|-----------|----------|--------|-----|---------|---------|-----------|
| which ASTM | I has no cou | interparts | | | | | | | | |

| Other Terms used in this Report | Description |
|------------------------------------|--|
| Structural reverberation time | Structural reverberation time (T_s) is a measure indicating the rate of decay of structural vibration in an assembly and can apply either to a laboratory wall or floor specimen, or to a wall or floor assembly insitu in a building. |
| Transmission loss in-situ | Transmission loss in-situ is the counterpart of sound reduction index in-situ (R_{situ}) described in ISO 15712 as "the sound reduction index of an element in the actual field situation". For the detailed calculation of ISO 15712, this depends on structural reverberation time of the element (wall or floor assembly) in the laboratory and in-situ. |
| Vibration reduction index | Vibration reduction index (K_{ij}) is described in ISO 15712 as "direction- averaged vibration level difference over a junction, normalised to the junction length and the equivalent sound absorption length to make it an invariant quantity". For practical application, a value of K_{ij} may be determined using equations in Annex E of ISO 15712-1 or the measurement procedures of ISO 10848. |
| Junction velocity level difference | Junction velocity level difference (JVLD) is described in ISO 15712 as "junction velocity level difference in-situ between an excited element (wall or floor) and the receiving element (wall or floor)". It is calculated by correcting K _{ij} to allow for edge losses (identified through structural reverberation times) of the assemblies in-situ. |
| Flanking transmission loss | Flanking transmission loss (Flanking TL) is the counterpart of flanking sound reduction index (R_{ij}) in ISO 15712. It is a measure of sound transmission via the flanking path from element <i>i</i> in the source room to element <i>j</i> in the receiving room, normalised like apparent sound transmission loss and ASTC, and is described in detail in Section 1.4. |
| Flanking STC | Flanking STC is the single number rating calculated following the STC- calculation procedure of ASTM E413, using values of the flanking transmission loss for one flanking path as the input data. |

The terms in the table have counterparts in ISO 15712-1 (using terminology consistent with measures used in ASTM standards) and pertinent ISO standards such as ISO 15712 and ISO 10848.

In addition, several scientific terms used in ISO-15712 at various stages of the calculation have been used without change. These terms include: radiation efficiency, internal loss factor, total loss factor, equivalent absorption length and transmission factor. The terms are described for this context in the glossary in Annex A of ISO 15712-1.

1.4 Combining Sound Transmitted via Many Paths

The calculations of ISO 15712-1 must deal with the combination of the sound power transmitted via the direct path as well as a set of flanking paths. To discuss this, it is useful to introduce the convention for labelling the transmission paths that is used in ISO 15712-1, as explained in Figure 1.5.



Figure 1.5: This figure shows the labelling convention for transmission paths used in ISO 15712-1. Consider transmission from a source room at the left to the receiving room beside it. Each transmission path involves one surface in the source room (denoted by a capital letter) and one in the receiving room (lower case). Direct transmission through the separating wall is path Dd. For each edge of the separating assembly there are three flanking paths, each involving a surface in the source room and one in the receiving room, that connect at this edge: Ff from flanking surface F to flanking surface f, Df from direct surface D to flanking surface f, and **Fd** from flanking surface F to direct surface d in the receiving room.

Note that the letter "F" or "f" denotes <u>f</u>lanking surface, and "D" or "d" denotes the surface for <u>d</u>irect transmission, i.e. the surface of the separating assembly. These surfaces may be either wall or floor/ceiling assemblies, as detailed in the following Table 1.3. These labels and their use will become more obvious in the calculation examples in Chapter 4 of this Report.

Table 1.3: Surfaces (D, d, F and f) for flanking paths at each junction, as applied in the examples using the Standard Scenario presented in Section 1.2 of this Report. Related drawings are shown in Figures 1.3 and 1.4.

| Room Pair | Surfaces D and d | Flanking Surfaces F and f | Junction (Standard Scenario) |
|------------|--------------------------|-----------------------------------|---------------------------------|
| | Separating wall | Junction 1: floor F and f | Cross junction |
| Horizontal | | Junction 2: façade wall F and f | T-junction |
| (Fig. 1.3) | | Junction 3: ceiling F and f | Cross junction |
| | | Junction 4: corridor wall F and f | T-junction |
| | | Junction 1: wall F and f | Cross junction |
| Vertical | Separating floor/ceiling | Junction 2: façade wall F and f | T-junction |
| (Fig. 1.4) | | Junction 3: wall F and f | Cross junction |
| | | Junction 4: corridor wall F and f | Cross junction |

In Canada, building elements are normally tested according to the ASTM E90 [1] standard, and as of the 2015 revision of the NBCC, the building code requirements are given in terms of the Apparent Sound Transmission Class (ASTC) which is determined according to ASTM E413 from the apparent sound transmission loss (ATL) for the set of 1/3 octave bands from 125 to 4000 Hz. Merging this context with the ISO procedures of ISO 15712-1, the terms "direct sound transmission loss" and "flanking sound transmission loss" have been introduced to provide consistency with the ASTM terminology while matching the function of the direct and flanking sound reduction index (as defined in ISO 15712-1), in keeping with the discussion of terms in Section 1.3.

Section 4.1 of ISO 15712-1 defines a process to calculate the apparent sound transmission by combining the sound power transmitted via the direct path with that transmitted via the twelve first-order flanking paths (three paths at each edge of the separating assembly, as illustrated in Figure 1.5). Equation 14 in ISO 15712-1 is recast here with a slightly different grouping of the paths (treating the set of paths at each edge of the separating assembly in turn) to match the presentation approach chosen for the examples in this Report.

The Apparent Sound Transmission Loss (ATL) between two rooms (assuming the room geometry of Section 1.2 and neglecting the sound that by-passes the building structure, e.g. leaks, ducts,...) is the resultant of the direct sound transmission loss (TL_{Dd}) through the separating wall or floor element and the set of flanking sound transmission loss contributions (TL_{Ff} , TL_{Fd} , and TL_{Df}) of the three flanking paths for every junction at the edges of the separating element (as shown in Fig. 1.5) such that:

$$ATL = -10 \cdot \log_{10} \left(10^{-0.1 \cdot TL_{Dd}} + \sum_{edge=1}^{4} (10^{-0.1 \cdot TL_{Ff}} + 10^{-0.1 \cdot TL_{Fd}} + 10^{-0.1 \cdot TL_{Df}}) \right) \quad \text{Eq. 1.1}$$

Eq. 1.1 is universally valid for all building systems, and the remaining challenge is to find the right expressions to calculate the path transmission for the chosen building system and situation.

The most suitable method to calculate the values for direct transmission or flanking transmission for each path in Eq. 1.1 depends on the type of wall and floor constructions to be combined with the concrete block walls to form the complete building. For this reason, Chapter 4 (which presents the

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calculation methods and examples) is divided into the following sections suitable for the combination of concrete block walls with other constructions:

- concrete masonry walls with concrete floors in Chapter 4.1
- concrete masonry walls with lightweight wood-framed walls and floors in Chapter 4.2
- concrete masonry walls with lightweight steel-framed walls and floors in Chapter 4.3
- concrete masonry walls with precast concrete floors in Chapter 4.4

Each of the flanking sound transmission loss values for a specific path is normalized to nominal room absorption like the apparent sound transmission loss, and can be considered as the ATL that would be observed if only this single path were contributing to the sound transmitted into the receiving room. Normalization of direct and flanking transmission input data to the case where receiving room absorption is numerically equal to the area of the separating assembly (i.e. using the apparent sound transmission loss and the ASTC rating as the measure of system performance) requires suitable corrections in the calculations of ISO 15712-1, or values of flanking transmission loss from laboratory testing according to ISO 10848, so that the set of path transmission loss values can be properly combined or compared. This normalization process is included in the calculation procedures in each section of Chapter 4.

The examples presented in this report use the Simplified Method of ISO 15712-1 to calculate the ATL. The Simplified Method uses the single-number ratings (STC or Flanking STC for each transmission path) as the values for each path transmission loss (TL_{Dd} , TL_{Ff} , TL_{Fd} or TL_{Df}) in Equation 1.1 such that:

$$ASTC = -10\log_{10} \left[10^{-0.1 \cdot STC_{Dd}} + \sum_{edge=1}^{4} (10^{-0.1 \cdot STC_{Ff}} + 10^{-0.1 \cdot STC_{Fd}} + 10^{-0.1 \cdot STC_{Df}}) \right]$$
Eq. 1.2

Where:

- (a) In this adaptation of the Simplified Method, the Apparent Sound Transmission Class (ASTC) is substituted for the ATL in Eq. 1.1.
- (b) The direct path STC_{Dd} is obtained from the laboratory measured STC rating of the bare element and the Δ STC changes due to linings on source "D" and/or receiving side "d" of the separating assembly such that:

$$STC_{Dd} = STC_{lab} + max(\Delta STC_D, \Delta STC_d) + \frac{min(\Delta STC_D, \Delta STC_d)}{2}$$
 Eq. 1.3

(c) The flanking STC for each path STC_{ii} is calculated such that:

$$STC_{ij} = \frac{STC_i}{2} + \frac{STC_j}{2} + K_{ij} + max(\Delta STC_i, \Delta STC_j) + \frac{min(\Delta STC_i, \Delta STC_j)}{2} + 10\log_{10}\left(\frac{S_s}{l_o l_{ij}}\right)$$
Eq. 1.4

where the indices *i* and *j* refer to the coupled flanking elements. Therefore, "*i*" can either be "D" or "F" and "*j*" can be "f" or "d". The geometric correction factor at the end of Eq. 4.1.3 depends on the surface area of the separating assembly (s_s), the length of the junction between flanking and separating elements (l_{ij}) and the reference length $l_0 = 1$ m.

The Simplified Method has been widely used by designers in Europe for many years for calculations based on R_w data. The primary advantage of the Simplified Method is the simplicity of the procedure, which makes it usable by non-specialists, as illustrated by the worked examples in Chapter 4. Although it is less rigorous than the Detailed Method presented in ISO 15712-1 and Guide RR-331 (24), in most cases, the differences between the results of the two methods have been found to be small, and the calculations use approximations that should ensure the results are conservative (lower ASTC values than using the Detailed Method of calculating the ASTC).

Note that this report provides both the data to perform the calculations by the Simplified Method (in tables in Chapters 2 and 3) and the data needed to perform calculations using the Detailed Method (in the Appendices).

The set of path TLs used in Equations 1.1 and 1.2 is less general than the corresponding list of transmission factors in ISO 15712-1 so as to reflect the simplifications due to the Standard Scenario (see Section 1.2 above) and some further simplifications noted in the following cautions.

Cautions and limitations to examples presented in this Report:

This Report was developed to support a proposed transition to ASTC ratings for sound control objectives of the National Building Code of Canada, and simplifications were made in the presentation to meet the specific needs of that application, where sound insulation is addressed only in the context of multi-unit residential buildings. The simplifications include that:

- Transmission around or through the separating assembly, due to leaks at its perimeter or penetrations such as ventilation systems, are assumed to be negligible (and lumped in the rated value for TL_{Dd}).
- Indirect airborne transmission (for example airborne flanking via an unblocked attic or crawl space) is assumed to be suppressed by normal fire blocking requirements.

However, for adjacent occupancies in a multi-family residential building, these issues should be dealt with by normal good practice for fire and sound control between adjoining dwellings.

If this Report is applied to situations other than the separation between adjacent units in multi-family residential buildings, some of these issues may have to be explicitly addressed in the calculation process. For example, for adjoining rooms within a single office or home, flanking paths such as ventilation ducts or open shared plenum spaces may be an issue. The flanking transmission associated with these additional paths should be determined and included in the calculated ASTC rating. ISO 15712-1 includes specific guidance for such issues.

2 Sound Transmission Measurements for Concrete Block Walls

This chapter presents the results of experimental testing of a series of concrete block walls of several types, including walls with a wide variety of linings covering one or both surfaces of the wall specimen.

Testing was conducted according to the ASTM E90 test protocol [1] for direct airborne sound transmission testing of walls or floors, in the NRC's Wall Sound Transmission Test Facility. The facility conforms to all of the facility requirements of ASTM E90, see more details in Appendix A. Full scale wall assemblies were placed in a testing frame with a test opening 3.66 m wide and 2.44 m high, between two decoupled rooms with volumes of approximately 250 m³ and 140 m³ (designated "large chamber" and "small chamber," respectively). A concept drawing of the NRC Wall Sound Transmission Facility is shown in Figure 2.1. The facility was equipped with an automated sound and measurement system for data acquisition and post processing. Sound transmission loss was measured in both directions – from the large chamber to the small chamber and vice-versa – and results were averaged to reduce measurement uncertainty due to factors such as calibration errors.



The frequency dependent sound transmission loss was measured for all assemblies in 1/3-octave bands over an extended frequency range from 31.5 Hz to 10 kHz, although only a limited subset of these is considered in the calculation of the Sound Transmission Class (STC). Note that:

- The set of transmission loss results from 50 Hz to 5000 Hz is presented in Appendix A1.
- This chapter presents a more compact summary of results in terms of the single-number ratings required for the calculations in Chapter 4 to determine the ASTC rating between adjacent spaces in a building.

It is common practice, especially in residential buildings, to add finishing surfaces to the basic structural masonry or concrete wall assemblies (for example, gypsum board wall and ceiling surfaces that conceal both the bare concrete surfaces and building services such as electrical wiring, water pipes and ventilation ducts). The finish commonly comprises gypsum board panels, framing used to support them, and often sound absorptive material filling the inter-stud cavities between the gypsum board and the face of the concrete blocks. These elements are described in ISO 15712-1 as "linings" or "liners" or "layers" or "coverings". The first term - "linings"- is used in this Report.

To characterize the change in the sound transmission loss due to adding a specific lining to a heavy base wall (a concrete block wall in this case), a single number rating called Δ STC is introduced.

ASTM does not define such a rating, but there is a counterpart, ΔR_w in the ISO standards (Annex B of ISO 140-16) and it is a required input for the Simplified Method of ISO 15712-1 presented in Chapter 4. The procedure used in this Report follows that of ISO 140-16 (25) with the STC calculation substituted for the ISO single-number rating calculation, plus additional Steps 4 and 5 as discussed on the next page.

The procedure to calculate Δ STC values for the Simplified Method of ISO 15712-1 (used in Chapter 4) uses Reference Curve B.1 from ISO 140-16 (shown in Fig. 2.2) – a smoothed sound transmission loss curve typical of a heavy wall of masonry.



Determining the Single Number Rating ΔSTC for Added Linings

The procedure presented here for calculating the Δ STC is a subset of a more general set of procedures presented in Report RR-331. Values of the Δ STC calculated from the experimental data in this Report are presented in Tables 2.2.2 and 2.3.2. Readers of this report can simply use the tabulated Δ STC values without the need to perform the calculations detailed here.



Figure 2.3: Steps to calculate the Single Number Rating Δ STC for Added Linings (as detailed below)

The sound transmission loss is measured according to ASTM E90 both for a given base wall (such as the bare concrete block wall assemblies in Section 2.1) and for the base wall with an added lining on one side, and/or both sides. The transmission loss data (in 1/3-octave bands) are processed as follows:

- Step 1. The change in sound transmission loss (ΔTL) due to adding the lining is calculated from the measurement results (with and without the added lining) for each frequency band, including at least 125 Hz to 4 kHz. This may involve averaging results from several pairs of specimens as detailed in Sections 2.2 and 2.3.
- Step 2. (a) Calculate the sum of the TL for the Reference Curve B.1 (in Figure 2.2) plus Δ TL for each frequency band. The STC value for this set of TL values is STC_{1-side}.
- Step 3. (b) Calculate the sum of the TL for the Reference Curve B.1 (in Figure 2.2) plus 2 x Δ TL for each frequency band. The STC value for this set of TL values is STC_{2-sides}.
- Step 4. (c) Calculate the STC value for Reference Curve B.1 (STC_{B.1})
- Step 5. Subtract the STC value for Reference Curve B.1 (STC_{B.1} = 53) from STC_{1-side} to obtain Δ STC_{1-side}.
- Step 6. Subtract the STC value for Reference Curve B.1 (STC_{B.1} = 53) from STC_{2-sides} to obtain Δ STC_{2-sides}.
- Step 7. Δ STC is the smaller of Δ STC_{1-side} or Δ STC_{2-sides} /1.5 rounded to an integer (e.g. 20/1.5 = 13).

 Δ STC is used only in the simplified calculation procedures presented in Chapter 4. Consideration of the change in STC when there is a lining on both sides of the wall (Step 4) and dividing Δ STC_{2-sides} by 1.5 in Step 5 can be understood by considering the use of Δ STC values in Eq. 4.1.2 and 4.1.3 and in the worked examples in Chapter 4. Selection of the more conservative value (at Step 5) is required to avoid a misleading (over-optimistic) Δ STC rating in the simplified calculation procedure, as discussed further in Sections 2.2 and 2.3.

2.1 Concrete Block Walls without Gypsum Board Linings

The focus of this section is the concrete block masonry wall (concrete masonry block units and mortar) without a lining.

This study included tests on walls constructed of two types of concrete blocks:

- 190 mm normal weight concrete block units, nominally 53% solid (assembly surface weight 238kg/m²) designated here as BLK190(NW). See End Note 1 for more details.
- 140 mm lightweight concrete block units, nominally 58% solid (assembly surface weight 134kg/m²) designated here as BLK140(LW). See End Note 4 for more details.

The TL of each of these walls was measured several times, both with the surfaces of the concrete blocks untreated and with one or both surfaces sealed with appropriate sealer/paint. Sealing the surfaces had negligible effect on the sound transmission for walls of BLK190(NW), as shown in Figure 2.1.1. The cases without painted surfaces have the same STC rating as those with paint on one side or both sides, and the TL curves match within less than 1 dB at all frequencies.

Figure 2.1.1:

Sound transmission loss for walls of normal weight concrete blocks (BLK190(NW)) with or without paint on the surfaces.

The specimen codes in the legend indicate whether the block assemblies are unsealed [blue squares for BLK190(NW)], or painted on one side [red diamonds for PAINT_BLK190(NW)], or painted on both sides [green circles for PAINT_BLK190(NW)_PAINT].

Similar coding is used to identify the specimen constructions in subsequent Figures.



The average of the two tests without painted surfaces was used as the reference case for subsequent evaluation of changes in sound transmission due to sealing the surfaces or adding gypsum board linings. The average of the two tests without painted surfaces provides the best reference for the performance of <u>this</u> set of concrete block wall specimens without a lining and it is designated in subsequent discussion and in Fig. 2.2.1 as "2012-Mean BLK190(NW)".

However, as a basis for estimating the performance of a "typical" concrete block wall of this type, this is just one of the available sources of information, and is inevitably biased by its size and boundary conditions. Another series of tests was performed in 1988 by Warnock using a similar test procedure and specimens assembled from very similar concrete blocks (specimen weight per unit area matched within 1%), but with different specimen size and edge conditions. Results from those tests were published in the NRC report IR-586 (26) and a series of research papers (27–29). The studies by

Warnock provides a good second example and the results from the two studies are compared in Figure 2.1.2.



The two walls have similar STC ratings, but the transmission loss curves differ appreciably at the frequencies from 100 to 400Hz where the results for such walls are most affected by the edge conditions. Each result is a valid result for the conditions of the test specimen, but there is no basis for arguing that either is more representative of the expected performance when the wall is installed in a building. The average from the two studies (as shown in Figure 2.1.3) is proposed as the best estimate for BLK190(NW) for calculating sound insulation in buildings in Chapter 4.



Sound transmission loss for wall specimens of 190 mm normal weight concrete blocks, from two test series in the NRC laboratory with different edge conditions.

The mean result is proposed as the best estimate for "typical" BLK190(NW) walls in buildings, and its 1/3-octave-band sound transmission loss data are listed in Table A1.1 in Appendix A1. It is labelled in this report as "NRC-Mean BLK190(NW)"



For walls built from lightweight concrete block masonry units, sealing the surfaces with paint resulted in a marked change in the TL results as shown in Figure 2.1.4. In this case, there were three (essentially identical) tests of the wall specimen with unsealed block. The mean of the three TL results for unsealed BLK140(LW) is shown in Figure 2.1.4, for comparison with the quite different results with paint sealing on one side or both sides of the wall.



Sound transmission loss for a wall specimen of lightweight concrete blocks BLK140(LW) with and without paint on one or both surfaces.

The specimen codes in the legend indicate whether block assemblies bare [blue squares for are BLK140(NW)], or painted on one diamonds side [red for PAINT BLK140(NW)], or painted on both sides [green circles for PAINT_BLK140(NW)_PAINT].



Adding paint to seal one side increased the STC rating from 35 to 39. The smaller changes due to painting the second side raised the STC rating further to 41. For this hollow lightweight concrete block wall, it was concluded that significant sound power leaks through the porous aggregate-cement matrix unless the blocks are sealed. A similar pattern of improvement was observed when the bare wall was sealed with linings of gypsum board on wood furring as shown in Figure 2.1.5.

Figure 2.1.5:

Sound transmission loss for a wall specimen of lightweight concrete blocks BLK140(LW) when a lining of 16 mm gypsum board on 38 mm wood furring (WFUR38_G16) is added on one or both surfaces of the assembly of unpainted blocks.

As in Figure 2.1.4, the change due to adding the lining on the first side is greater than the change when the lining is added on the second side, because adding the first lining also suppresses most of the sound leakage through the blocks.



For both types of surface treatments added to the block assembly (PAINT and WFUR38_G16, as shown in Figures 2.1.4 and 2.1.5, respectively), the added layer serves two functions. First, it provides a surface that effectively blocks air flow and thus increases the TL by suppressing any sound leakage through the lightweight aggregate matrix of the concrete blocks. Second, it also changes the coupling between the sound field in the adjacent room and the concrete block wall assembly – that is, the paint or the gypsum board assembly both function as linings.

Results like those in Figures 2.1.4 and 2.1.5 can be used to separate the effect of suppressing the leakage from the change in TL due only to adding the lining. The smaller changes due to adding a lining on the second side of the wall provide the best estimate of the improvement due to the lining itself, because the sound leakage has already been eliminated by the impervious lining added to the first side. If the change due to adding a lining on the <u>second</u> side is subtracted from the sound transmission loss for the block wall assembly with the same lining on <u>one</u> side, the difference should be a good estimate of the sound transmission loss through the unlined block wall with leakage eliminated.

Figure 2.1.6:

Sound transmission loss for a wall specimen of lightweight concrete blocks BLK140(LW) without the reduction due to leakage through the porous lightweight aggregate.

Estimates of the sound transmission loss without leakage were obtained from the changes due to four types of linings, as explained below. The mean of the four estimates (solid black line) is taken as the best estimate for sound transmission without leakage, designated as Base-BLK140(LW).



Four linings (identified in caption of Figure 2.1.6) had valid tests when installed on 1 side and on both sides of the bare block wall assembly. These four sets of data yielded estimates of sound transmission through the lightweight block assembly with sound leakage suppressed; these estimates are presented in Figure 2.1.6. These four estimates of the sound transmission loss for unlined BLK140(LW) with the effect of leakage suppressed are not identical but there is no basis to reject or prefer any of them. Hence the mean is taken as the best estimate, and this is designated as **Base-BLK140(LW)**.

The results are applied and presented as follows:

- Mean 1/3-octave-band sound transmission loss data for the bare unsealed concrete block walls and for the Base-BLK140(LW) wall without leakage, are given in Table A1.1 in Appendix A1.
- The estimated sound transmission without leakage is used for the calculations of sound transmission via direct and flanking paths for calculation of ASTC according to the Simplified Method in Chapter 4, and is also applicable to calculation by the Detailed Method.
- The change in the STC ratings due to the addition of various linings on lightweight block walls is discussed in detail in Section 2.3.

2.2 Adding Linings on Concrete Block Masonry Walls Constructed with Normal Weight Units

This section presents the results of sound transmission measurements for a series of wall specimens comprising a concrete block wall assembly of normal weight units with an added lining covering one side or both sides. The linings are described in Table 2.2.1.

Table 2.2.1: Linings tested on BLK190(NW) base wall specimen. In all cases, the furring or studs are spaced 610 mm on center and the faces of the concrete block are not painted except where the lining PAINT is explicitly identified.

| Lining Code | Descriptive Lining Code | Description of Lining |
|----------------|-------------------------|--|
| ΔTL-BLK(NW)-01 | PAINT | Paint/sealer covering the surface of the wall |
| ΔTL-BLK(NW)-02 | G13 | 13 mm gypsum board fastened to surface of blocks |
| ΔTL-BLK(NW)-21 | FC22_G13 | 13 mm gypsum board fastened to 22 mm metal furring channels ("hat" profile)* |
| ΔTL-BLK(NW)-22 | FC22_GFB38_G13 | 13 mm gypsum board fastened to 22 mm metal furring channels* with 38mm thick glass fiber batts in compressed in cavities |
| ΔTL-BLK(NW)-31 | WFUR38_G13 | 13 mm gypsum board fastened to 38x38 mm wood furring* |
| ΔTL-BLK(NW)-32 | WFUR38_2G13 | 2 x 13 mm gypsum board fastened to 38x38 mm wood furring* |
| ΔTL-BLK(NW)-33 | WFUR38_GFB38_G13 | 13 mm gypsum board fastened to 38x38 mm wood furring* with 38mm thick glass fiber batts in cavities |
| ΔTL-BLK(NW)-34 | WFUR38_GFB38_2G13 | 2 x 13 mm gypsum board fastened to 38x38 mm wood furring* with 38mm thick glass fiber batts in cavities |
| ΔTL-BLK(NW)-35 | WFUR38_G16 | 16 mm gypsum board fastened to 38x38 mm wood furring* |
| ΔTL-BLK(NW)-36 | WFUR38_GFB38_G16 | 16 mm gypsum board fastened to 38x38 mm wood furring* with 38mm thick glass fiber batts in cavities |
| ΔTL-BLK(NW)-41 | SS41_G13 | 13 mm gypsum board fastened to 41 mm steel studs** |
| ΔTL-BLK(NW)-42 | SS41_GFB38_G13 | 13 mm gypsum board fastened to 41 mm steel studs** with 38mm thick glass fiber batts in cavities |
| ΔTL-BLK(NW)-61 | SS65_G13 | 13 mm gypsum board fastened to 65 mm steel studs** |
| ΔTL-BLK(NW)-62 | SS65_GFB65_G13 | 13 mm gypsum board fastened to 65 mm steel studs** with 65 mm thick glass fiber batts in cavities |
| ΔTL-BLK(NW)-63 | SS65_GFB65_2G13 | 2 x 13 mm gypsum board fastened to 65 mm steel studs** with 65 mm thick glass fiber batts in cavities |
| ΔTL-BLK(NW)-65 | SS65_GFB65_G16 | 16 mm gypsum board fastened to 65 mm steel studs** with 65 mm thick glass fiber batts in cavities |
| ΔTL-BLK(NW)-91 | SS92_G13 | 13 mm gypsum board fastened to 92 mm steel studs** |
| ΔTL-BLK(NW)-92 | SS92_GFB38_G13 | 13 mm gypsum board fastened to 92 mm steel studs** with 38 mm thick glass fiber batts in cavities |
| ΔTL-BLK(NW)-93 | SS92_GFB65_G13 | 13 mm gypsum board fastened to 92 mm steel studs** with 65 mm thick glass fiber batts in cavities |
| ΔTL-BLK(NW)-94 | SS92_GFB92_G13 | 13 mm gypsum board fastened to 92 mm steel studs** with 92 mm thick glass fiber batts in cavities |
| ΔTL-BLK(NW)-96 | SS92_GFB92_2G13 | 2 x 13 mm gypsum board fastened to 92 mm steel studs** with 38 mm thick glass fiber batts in cavities |

(*= mechanically fastened to concrete blocks,

**= 12 mm airspace between blocks and studs)

Figure 2.2.1 presents one example of how adding the gypsum board lining on one side or both sides changes the sound transmission loss.

Figure 2.2.1:

The upper graph shows sound transmission loss for a wall specimen of bare, unpainted normal weight concrete block, versus the result for the same block wall with a lining of gypsum board supported on 38 mm thick wood furring covering one or both of the surfaces.

Note that for an examination of the change due to the addition of a lining in this test series, the appropriate reference case for the bare unpainted block is Mean-2012 BLK190(NW) which is the mean result for the same block wall specimen to which these linings were added, as discussed in Section 2.1.

The lower graph shows the corresponding changes in sound transmission loss (ΔTL) due to adding the WFUR38_G16 lining on one side or both sides of the reference specimen, the unsealed concrete block wall Mean-2012 BLK190(NW).



Two features of the changes should be noted:

- The change is not always an improvement. The figure shows that in this case, the change is negative the TL with the lining is <u>below</u> that for bare BLK190(NW) at frequencies below about 200 Hz.
- Adding a matching lining on both sides of the wall approximately doubles the change in the TL at each frequency band relative to the change observed for adding a lining to one side of the bare concrete block wall (though measurement uncertainty gives some deviation in individual cases).

Despite the change in the TL due to the addition of the lining on the second side, the change in the STC does NOT usually double. This is because negative, low frequency dips like those due to adding this lining have a strong influence on the STC. Although adding this lining on one side increases the STC from 48 to 50, adding the identical lining on both sides reduces the STC to 45. It is this behaviour that forces the conservative process for calculating Δ STC presented at the beginning of Chapter 2.

A strong low frequency resonance (evident as a dip in the change in the transmission loss in Figure 2.2.1 and 2.2.2 below 200 Hz) limits the STC rating.

Figure 2.2.2 shows the effect of filling the cavities (spaces between furring elements and between the faces of the concrete block assembly and the gypsum board) with absorptive material. Here again, adding the lining on one side changes the TL relative to that for the bare BLK190(NW) wall, and adding the matching lining on the second side approximately doubles the change of the TL at each frequency.



Again, the change due to adding a lining is not always an improvement. The figure shows that in this case, for frequencies below 160 Hz, the change in the TL is negative – the TL with the lining is <u>below</u> that for bare BLK190(NW) – but the dip has less effect on the STC than the case shown in Fig. 2.2.1. For the case in Figure 2.2.2 of the lining applied to both sides of the wall, the low frequency resonance is shifted to a lower frequency by filling the inter-furring cavities with sound absorptive material. A lining on one side increases the STC rating from 48 to 52. Adding the same type of lining on the second side does not further increase the STC rating despite the generally higher TL above 125 Hz.

Increasing the weight of the gypsum board, increasing the depth of the cavity between the faces of the gypsum board and the concrete block, or adding absorptive material in the cavity, can all shift the low frequency dip below the frequency range (125 Hz to 4000 Hz) that determines the STC rating. For example, it can be seen in Figure 2.2.3 that increasing the cavity depth to about 100 mm by mounting the gypsum board on 92 mm lightweight steel studs shifts the frequency at which the TL becomes negative to frequencies below 100 Hz. With the larger cavity depth, the STC rating increases to 67 with the lining on one side and to 78 with linings on both sides.

Figure 2.2.3:

Change in the sound transmission loss for wall specimen of bare, unpainted normal weight block, due to adding a lining of gypsum board supported on steel studs covering one or both of the surfaces. Sound absorptive material partly fills the inter-stud cavities (65 mm of material in 92 mm stud depth).

As for other graphs in this section, the reference case is the bare, unsealed 2012-Mean for BLK190(NW).



These results show trends very similar to those reported by Warnock (26–29), despite differences between the studies in regard to the specimen materials (different gypsum board and sound absorptive material) and major changes in the test facility.

Calculating ΔTL and ΔSTC Values for the Linings:

The specimens tested in this study demonstrated the change due to adding a given lining in 3 situations:

- 1. Wall specimens with the lining applied on one side,
- 2. Wall specimens with the same lining applied on both sides,
- 3. Wall specimens with the lining applied on one side but a different lining on the other side.

Each type of lining was tested for the first situation with the lining applied on one side (sometimes several tests were performed) and most were tested in one or both of the other situations. For the first situation, the TL for the bare, unsealed BLK190(NW) wall was subtracted from the TL with the added lining. For the second situation, the TL for the bare, unsealed BLK190(NW) wall was subtracted from the TL with added linings on both sides, and the result was divided by 2. For the third situation, the TL for a BLK190(NW) wall with other lining on one side was subtracted from the TL for the wall with the two mismatched linings. Test results significantly compromised by flanking (which limits apparent TL when the specimen TL approaches the facility limit) were eliminated, and a weighted average was used (50% weighting for situation 1 and 50% for the average of situations 2 and 3).

Results are presented and used as follows:

- The averaged 1/3-octave-band changes in sound transmission loss (ΔTL) for each lining applied to the BLK190(NW) concrete block wall test specimens are given in Table A1.2 in Appendix A1. These data are needed for calculation of the ASTC using the Detailed Method, as discussed in RR-331.
- The set of Δ TL data for each lining were used with the standard reference TL curve, as discussed at the beginning of Chapter 2, to determine Δ STC for each lining when applied to the BLK190(NW) wall specimen. The calculation results are presented in Table 2.2.2 below.

| Lining Code | Lining Descriptive Code | Step 3: (1-side lined) | Step 4: (2-sides lined) | Step 5: |
|----------------|-------------------------|---------------------------|----------------------------|---------|
| | | ΔSTC_{1-side} | $\Delta STC_{2-sides}$ | ΔSTC |
| ΔTL-BLK(NW)-01 | PAINT | 0 | 0 | 0 |
| ΔTL-BLK(NW)-02 | G13 | -1 | -4 | -3 |
| ΔTL-BLK(NW)-21 | FC25_G13 | 0 | -1 | -1 |
| ΔTL-BLK(NW)-22 | FC25_GFB38_G13 | 3 | 3 | 2 |
| ΔTL-BLK(NW)-31 | WFUR38_G13 | 1 | -1 | -1 |
| ΔTL-BLK(NW)-32 | WFUR38_2G13 | 2 | 1 | 1 |
| ΔTL-BLK(NW)-33 | WFUR38_GFB38_G13 | 4 | 6 | 4 |
| ΔTL-BLK(NW)-34 | WFUR38_GFB38_2G13 | 5 | 8 | 5 |
| ΔTL-BLK(NW)-35 | WFUR38_G16 | 1 | -3 | -2 |
| ΔTL-BLK(NW)-36 | WFUR38_GFB38_G16 | 4 | 3 | 2 |
| ΔTL-BLK(NW)-41 | SS41_G13 | 4 | 0 | 0 |
| ΔTL-BLK(NW)-42 | SS41_GFB38_G13 | 9 | 15 | 9 |
| ΔTL-BLK(NW)-61 | SS65_G13 | 7 | 3 | 2 |
| ΔTL-BLK(NW)-62 | SS65_GFB65_G13 | 19 | 33 | 19 |
| ΔTL-BLK(NW)-63 | SS65_GFB65_2G13 | 22 | 43 | 22 |
| ΔTL-BLK(NW)-65 | SS65_GFB65_G16 | 21 | 39 | 21 |
| ΔTL-BLK(NW)-91 | SS92_G13 | 9 | 7 | 5 |
| ΔTL-BLK(NW)-92 | SS92_GFB38_G13 | 17 | 25 | 17 |
| ΔTL-BLK(NW)-93 | SS92_GFB65_G13 | 18 | 31 | 18 |
| ΔTL-BLK(NW)-94 | SS92_GFB92_G13 | 18 | 31 | 18 |
| ΔTL-BLK(NW)-96 | SS92_GFB92_2G13 | 22 | 43 | 22 |

Table 2.2.2: ΔSTC values for linings on BLK190(NW) wall specimens. Note that these are referenced as data for worked examples in the calculations of Chapter 4.

NOTES:

- 1. Headings "Step 3", "Step 4" and "Step 5" refer to steps in the calculation procedure in Figure 2.3.
- 2. All supporting furring or studs are spaced 610 mm on center.
- 3. The Δ STC values are based on measurements on wall specimens with unsealed concrete block. However, because of the low porosity of the normal weight aggregate, the results should also be applicable if the face(s) of a BLK190(NW) wall are painted/sealed.
- 4. The values of Δ STC in Table 2.2.2 should be appropriate for all walls constructed with blocks of normal weight aggregate, including blocks with different thickness or over 53%-solid content.

Note that if there are negative values of Δ TL within the frequency range that determines the STC rating (as in Figures 2.2.1 and 2.2.2) then adding the lining on the second side may give a combined change Δ STC_{2-sides} only slightly exceeding (or even below) Δ STC_{1-side.} This tends to occur if inter-furring cavities are not largely-filled with absorptive material and/or if the cavity depth is less than 40 mm. In those cases, Steps 4 and 5 of the procedure ensure a value of Δ STC suitable for the calculations in Chapter 4 with both sides lined.

2.3 Adding Linings on Concrete Block Masonry Walls Constructed with Lightweight Units

For concrete block walls constructed with lightweight units⁴, the change in the TL due to adding a given lining is quite different from the corresponding results for walls constructed with normal weight units¹.

This study included a variety of gypsum board linings applied to one or both sides of the BLK140(LW) base wall. Most of these linings match one of the linings applied to the normal weight block walls described in the preceding Section.

Table 2.3.1: Linings tested on BLK140(LW) base wall. In all cases, the furring or studs are spaced 610 mm on center and the faces of the concrete block are not painted with sealer except where the lining PAINT is explicitly identified.

| Lining Code | Lining Descriptive Code | Description of Lining |
|----------------|-------------------------|--|
| ΔTL-BLK(LW)-01 | PAINT | Paint/sealer covering the surface of the wall |
| ΔTL-BLK(LW)-31 | WFUR38_G13 | 13 mm gypsum board fastened to 38x38 mm wood furring* |
| ΔTL-BLK(LW)-33 | WFUR38_GFB38_G13 | 13 mm gypsum board fastened to 38x38 mm wood furring* with 38mm thick glass fiber batts in cavities |
| ΔTL-BLK(LW)-35 | WFUR38_G16 | 16 mm gypsum board fastened to 38x38 mm wood furring* |
| ΔTL-BLK(LW)-62 | SS65_GFB65_G13 | 13 mm gypsum board fastened to 65 mm steel studs** with 65 mm thick glass fiber batts in cavities |
| ΔTL-BLK(LW)-65 | SS65_GFB65_G16 | 16 mm gypsum board fastened to 65 mm steel studs** with 65 mm thick glass fiber batts in cavities |
| ΔTL-BLK(LW)-66 | SS65_FOAM65_G13 | 13 mm gypsum board fastened to 65 mm steel studs** with spray polyurethane foam filling cavities |
| ΔTL-BLK(LW)-93 | SS92_GFB65+_G13 | 13 mm gypsum board fastened to 92 mm steel studs** with 65 mm or thicker glass fiber batts in cavities |
| ΔTL-BLK(LW)-95 | SS92_GFB65+_G16 | 16 mm gypsum board fastened to 92 mm steel studs** with 65 mm or thicker glass fiber batts in cavities |

(*= mechanically fastened to concrete blocks, **= 12 mm airspace between blocks and studs)

Note that the Lining Codes are subsequently referenced in the worked examples in Chapter 4.

The sound transmission through Base-BLK140(LW) (i.e. the estimate without leakage through the lightweight block wall, as described in Section 2.1) was used as the reference for all of the calculations of the changes due to adding linings to walls of lightweight concrete blocks. This is obviously the appropriate case for flanking paths (since different walls are involved in the source and receiving room, so leakage through one cannot affect the other) and is also appropriate for direct transmission if the separating wall is sealed with paint or a gypsum board lining.

Figure 2.3.1 shows the effect of adding the 'WFUR38_G16" lining to one side or both sides of the lightweight block wall, using Base-BLK140(LW) as the reference case without a lining. Note that adding the lining on one side results in a change in the TL which is very similar to the effect of adding the matching lining on the second side. This mimics the behaviour observed for linings added to normal weight block walls and confirms the selection of Base-BLK140(LW) as a suitable reference curve.

Figure 2.3.1:

The upper graph shows sound transmission loss for a wall specimen of unpainted lightweight concrete block with a lining of 16 mm gypsum board supported on wood furring covering one or both of the surfaces.

Note that for examination of the change due to the addition of the lining in this test series, the appropriate reference case for the unsealed block is Base-BLK140(LW) with the effect of leakage removed.

The lower graph compares the changes in the sound transmission loss (Δ TL) due to adding the WFUR38_G16 lining to light-weight concrete block specimens versus adding the same lining to normal weight blocks. In both cases the values of Δ TL are mean values for all specimens tested with this lining.



Unlike the changes for the same lining applied to bare BLK190(NW) shown in the previous section in Figure 2.2.1 and in the lower graph of Figure 2.3.1, the changes in the TL observed in the upper graph of Figure 2.3.1 when the lining is added to unsealed lightweight block are consistently positive in the frequency range above 100 Hz. The lower graph provides a comparison between the changes due to

63

125

250

500

Frequency (Hz)

1k

2k

-8.0

4k

this lining when installed on lightweight or normal concrete block walls. Obviously, the improvement is much greater on the unsealed lightweight blocks, and the value of the Δ STC is higher by 8 points.

If a lining were applied to *sealed* lightweight blocks (i.e. if the face of the block were painted and a lining was installed over the painted face), the improvement would be expected to resemble the result for the lining on normal weight blocks. The enhanced effect of the lining on unsealed lightweight block has been ascribed by Warnock to the porous surface of the lightweight block which provides sound absorption and also a slightly larger effective depth of the cavity between the gypsum board and the face of the concrete blocks. This difference is most significant for small cavity depths, especially when there is little or no absorptive material in the cavity, as can be seen by comparing the Δ STC values in Tables 2.2.2 (for linings on normal weight blocks) and 2.3.2 (for linings on lightweight blocks).

With a larger cavity depth and absorption filling most of the cavity, the changes due to adding a gypsum board lining become very similar for normal weight block walls and lightweight block walls, and the effect of sealing the blocks is negligible. This is illustrated in Figure 2.3.2 by values of the ΔTL for a gypsum board lining on 65 mm steel studs, with absorptive material filling most of the (nominally 77 mm) cavity. Comparing the change in transmission loss (ΔTL) for applying this lining on the unsealed lightweight block with the corresponding changes observed for the same lining on normal weight block as well as on lightweight block that has been sealed, it can be seen that the curves are similar up to about 1 kHz, and the values of the ΔSTC are similar.

Figure 2.3.2:

The change in sound transmission loss (Δ TL) for wall specimens of concrete block due to adding a lining of gypsum board supported on 65 mm steel studs covering one or both of the surfaces. Sound absorptive material nearly filled the inter-stud cavities.

Below about 1kHz, the change is similar for all three types of base walls: normal weight block (green), unsealed lightweight block (blue), and sealed lightweight block (red).



The lining whose effect is shown in Figure 2.3.2 was the only lining tested for all three block conditions. Similar agreement was observed between the Δ TL results on normal weight and unsealed lightweight blocks for linings with 92 mm steel studs supporting the gypsum board. In that case the normal weight block's Δ STC was higher by 2 points. Comparison of Δ STC values between Table 2.2.2 (for linings on normal weight blocks) and Table 2.3.2 (for linings on lightweight blocks) shows the differences within ±2 points are typical for absorption-filled cavities greater than 50 mm.

Calculating ΔSTC Values for the Linings:

The average 1/3-octave-band changes in the sound transmission loss (Δ TL) for the set of linings applied to the BLK140(LW) concrete block walls were calculated following the same procedures described in Section 2.2 for linings on normal weight blocks. The results are given in Table A1.3 in Appendix A1.

Following the same procedures as in Section 2.2 for walls of BLK190(NW), the Δ TL values for these specimens were used with the standard reference curve to determine the Δ STC for each lining when applied to one or both sides of the reference specimen. Calculated Δ STC results are given in Table 2.3.2.

Table 2.3.2: The Δ STC values for linings on BLK140(LW) wall specimens.Note that these are referenced as data for the worked examples in the calculations of Chapter 4.

| Lining Code | Lining Descriptive Code | Step 3: (1-side Lined) ΔSTC _{1-side} | Step 4: (2-sides Lined) ΔSTC _{2-sides} | Step 5: ΔSTC |
|----------------|-------------------------|---|---|-----------------|
| ΔTL-BLK(LW)-01 | PAINT | 0 | 0 | 0 |
| ΔTL-BLK(LW)-31 | WFUR38_G13 | 3 | 4 | 3 |
| ΔTL-BLK(LW)-33 | WFUR38_GFB38_G13 | 7 | 14 | 7 |
| ΔTL-BLK(LW)-35 | WFUR38_G16 | 6 | 10 | 6 |
| ΔTL-BLK(LW)-62 | SS65_GFB65_G13 | 15 | 27 | 15 |
| ΔTL-BLK(LW)-65 | SS65_GFB65_G16 | 19 | 35 | 19 |
| ΔTL-BLK(LW)-66 | SS65_FOAM65_G13 | 1 | 0 | 0 |
| ΔTL-BLK(LW)-93 | SS92_GFB65+_G13 | 16 | 29 | 16 |
| ΔTL-BLK(LW)-95 | SS92_GFB65+_G16 | 22 | 39 | 22 |

NOTES:

- 1. Headings "Step 3", "Step 4" and "Step 5" refer to steps in the calculation procedure in Figure 2.3.
- 2. The values of Δ STC in Table 2.3.2 should be appropriate for all walls of concrete block constructed with lightweight units, including blocks of other thickness and blocks with higher than 58%-solid content, when the pertinent face(s) of the concrete blocks is (are) unpainted.
- 3. If a face of the block assembly is finished with paint or a thin coat of plaster, the effect of sealing the surface may be treated as the addition of lining ΔTL-BLK(LW)-01 (i.e. sealing the face of a lightweight block wall is treated the same as adding a lining).
- 4. If a gypsum board lining is added to a face of the block assembly that is sealed with paint or plaster, the corresponding value of Δ STC for gypsum board linings from Table 2.2.2 (i.e. the value for a lining added to normal weight block) should provide a more suitable estimate of the effect of adding the gypsum board lining on the sealed side.

Note that the value of Δ STC (last column in Table 2.3.2) is equal to the change in the STC rating due to a lining on only one side (center column in Table 2.3.2) for all linings except one on unsealed BLK140(LW) wall specimens. Δ STC_{2-sides} is consistently larger than 1.5 x Δ STC_{1-side}, so these values of Δ STC should not provide over-optimistic results in the calculations in Chapter 4.

3 Flanking Sound Transmission Measurements with Concrete Block Walls

This chapter presents the results of experimental testing on a series of building mock-ups comprising concrete block walls connected to flanking assemblies with lightweight framing. Ideally, the standard ISO 15712-1 would be used to estimate the flanking transmission through the lightweight framing. However, ISO 15712-1 has a number of weaknesses for predicting sound transmission in buildings where some or all of the assemblies are of lightweight wood frame or steel frame construction. The calculation in Section 1.4 for combining direct transmission and flanking transmission is still valid, but transmission via the flanking paths is instead determined by measurements following the appropriate parts of ISO 10848, rather than the calculations described in Section 4.1 for buildings where all the wall and floor assemblies are of heavy masonry and/or concrete.

This introduction provides a brief description of the Flanking Facility TH2 and the standardized test methods used to measure the apparent sound insulation between the various room pairs and to isolate and quantify flanking via specific transmission paths.



Schematic drawing of the Flanking Facility TH2 showing wall and floor specimens in grey. Arrows show some possible flanking paths.



The wall and floor specimens divide the space in the flanking facility into four rooms (labelled A, B, C, and D in Figure 3.1). The dimensions of the four rooms are given in Table 3.1.

| Room | Volume (m³) | Length (m) | Width (m) | Height (m) |
|------|----------------|---------------|--------------|------------|
| А | 50.7 | 4.60 | 4.54 | 2.43 |
| В | 45.3 | 4.11 | 4.54 | 2.43 |
| С | 40.0 | 4.66 | 4.38 | 2.07 |
| D | 35.3 | 3.96 | 4.38 | 2.07 |

Table 3.1: The dimensions of the room in the Flanking Facility TH2.

The permanent part of the facility (roof, end walls, foundation floor, and back wall) are constructed of heavy materials and are resiliently isolated from each other as well as from structural support members, with vibration breaks in the permanent surfaces where the specimens are installed. There is also an experimental sidewall covering the front face of the facility. In such a facility, specific construction

changes can be systematically introduced so that resulting changes in the sound insulation performance of the experimental surfaces can be accurately determined.

Using custom hardware and software developed at the NRC, the measurement process, from calibration and microphone probe positioning to report generation is performed completely under computer control. This measurement process provides a high degree of precision and repeatability. For standard tests with airborne or impact sources, sound pressure levels are sampled at 9 positions in each room. The robot systems in each room position the microphones (12.5 mm precision condenser microphones with random incidence response), and signals are measured using an automated sound and measurement system for data acquisition and post processing. Note that:

- For an airborne source, the computer directs noise signals to the loudspeakers in each room in turn to measure the noise reduction between each pair of rooms and the rate of sound decay in each room. A sequence of 12 complete measurements (horizontal, vertical and diagonal pairs of rooms, each for 9 microphone positions in each room) are performed. The measurement data presented in the Report for a given room pair (e.g. A-B) are the average of two measurements where each room of the pair was the source room and the other was the receiving room. The airborne sound transmission measurements conform to ISO 10848-3 as well as ASTM E336. The measurements are repeated many times with various combinations of room surfaces masked with heavy panels to determine the transmission via paths involving specific room surfaces, in compliance with ISO 10848-3.
- Impact measurements (conforming to ASTM E1007 (30) and ISO 16283-1 are made using a standard tapping machine in either room A or B, and measuring the resulting sound pressure levels at all microphone positions in each of the other three rooms. The measurements are repeated many times with various combinations of room surfaces masked with heavy panels to determine the transmission via paths involving specific room surfaces in compliance with ISO 10848-3.
- In addition, measurements according to ISO 10848-4 are performed to characterize junction transmission for the combination of concrete block wall assemblies with various flanking wall and floor/ceiling constructions.

Although some impact transmission data will be presented here in Sections 3.1 and 3.2 and in the tables in the appendices to provide a more complete archival record of the project, the calculations presented in the following sections of Chapter 4 deal only with airborne transmission following the concepts of ISO 15712-1. For calculation of transmitted impact sound in a building, the corresponding calculation procedures of ISO 15712-2 should be applied.

As for the STC and Δ STC results in Chapter 2, this chapter presents single-figure results such as Flanking STC ratings which are used in the Simplified Method calculations of Chapter 4. The corresponding 1/3-octave data needed for calculations by the Detailed Method (as explained in RR-331) are provided in the Appendices.

3.1 Concrete Block Walls with Wood-Framed Floors and Walls

The following tables present the Flanking STC values determined from the flanking measurements on a series of 4-room mock-up constructions in the flanking facility at the NRC.

In each case, the table combines a generic description of the connected wall or floor assemblies and the key details of the connection, together with the sound transmission estimates.

Some of the results are worst-case estimates because transmission by facility surfaces and other nominally-masked paths could not be reduced enough to clearly establish the actual attenuation via the path of interest. As further testing is performed, these shortcomings may be resolved, resulting in higher values of path STC ratings for some of the tabulated values in later editions of this Report. In the meanwhile, these limitations should only affect designs with ASTC ratings well above 60.

Each of the tables which present path transmission loss values includes several parts:

- 1. A generic description of the details of the wall and floor/ceiling assemblies and the connection between them.
- 2. A drawing showing the general features of the junction. Note that each junction of the concrete block wall with floor/ceiling assemblies can be viewed in several ways: (a) as the wall/floor junction between two side-by-side rooms above the floor, (b) as the wall/ceiling junction between two side-by-side rooms below the ceiling and (c) as junction of a flanking concrete block wall with the floor/ceiling assemblies separating two rooms that are one-above-the-other.
- 3. Junction cases (a) to (c) are presented in the tables with stylized drawings to identify the paths in each case, the Path STC values (either Direct STC or Flanking STC) for each path and for the combination of flanking paths at that junction. Note that the paths are designated using the notation shown in Figure 1.5.

The junction naming in the tables follows a simple coding. The purpose of the coding is to indicate which elements and materials are involved. An example of the coding is: BLK190-WF-LB-01 where:

- The first segment indicates the separating assembly, for which:
 - o BLK indicates a concrete block wall element,
 - WJ indicates a wood-joist floor/ceiling element.
- The second segment indicates the junction type:
 - \circ WF=wall/floor
 - WC=wall/ceiling
 - FW=floor/wall
 - WW=wall/wall
- The third segment of LB or NLB indicates a wall/floor or wall/ceiling that is loadbearing or nonloadbearing, respectively (i.e. is framed with joists perpendicular or parallel to the wall).
- The last segment is a unique number for that junction detail. Because the changes in Path STC due to changing a surface finish depend on the supporting framed constructions, a different number is used for each change of a surface of the framed elements.

Therefore, the example code BLK190-WF-LB-01 represents a separating assembly of 190 mm concrete blocks, the junction type is a wall / floor junction and the wall is loadbearing.

Table 3.1.01: Transmission Paths

Wall assembly with:

 one wythe of 190 mm hollow concrete blocks of normal weight aggregate¹ with grout-filled block cavities at 1220 mm o.c. to give stiffness and weight like reinforced block wall (mass 238 kg/m²)

Junction of wall with floor/ceiling assembly:

- course of concrete blocks at junction filled with grout
- 2 x 10 (38 mm x 235 mm) wood ledger plate on each side, fastened through with 16 mm diameter bolts spaced 406 mm o.c.

Floor/Ceiling assembly:

- floor deck of 16 mm oriented strand board (OSB) with no floor finish or floor topping
- floor framed with 38 mm x 235 mm wood joists spaced 406 mm o.c., with joists oriented perpendicular to separating (loadbearing) wall and supported from ledger plate on joist hangers, with 150 mm thick absorptive material in the inter-joist cavities
- ceiling with 1 layer of 13 mm gypsum board³ fastened directly to bottom of floor framing on each side



Junction of loadbearing concrete block wall with wood-framed floor/ceiling assemblies. Illustration not exactly to scale.

| BLK190-WF-LB-01 | Path | Path STC | Impact Path | Path IIC |
|-----------------------|------------------------|----------|---------------|---------------|
| | Dd | 49 | (To be added) | (To be added) |
| D | Ff | 59 | " | " |
| F f | Fd | 59 | " | " |
| | Df | 59 | " | " |
| | Junction (Ff+Fd+Df) | 54 | | |
| BLK190-WC-LB-01 | Path | Path STC | Impact Path | Path IIC |
| Wall-Ceiling Junction | Dd | 49 | | |
| | Ff | 65 | | |
| | Fd | 65 | | |
| F f | Df | 65 | | |
| D | Junction (Ff+Fd+Df) | 60 | | |
| WJ235-FW-LB-01 | Path | Path STC | Impact Path | Path IIC |
| Floor-Wall Junction | Dd | 34 | (To be added) | (To be added) |
| | Ff | 59 | " | " |
| | Fd | 69 | | |
| | Df | 67 | | |
| d'f | Junction (Ff+Fd+Df) | 58 | | |

(See the footnotes located at the end of the document)

Table 3.1.02: Transmission Paths

Wall assembly with:

 one wythe of 190 mm hollow concrete blocks of normal weight aggregate¹ with grout-filled block cavities at 1220 mm o.c. to give stiffness and weight like reinforced block wall (mass 238 kg/m²)

Junction of wall with floor/ceiling assembly:

- course of concrete blocks at junction filled with grout
- 2 x 10 (38 mm x 235 mm) wood ledger plate on each side, fastened through with 16 mm diameter bolts spaced 406 mm o.c.

Floor/Ceiling assembly:

- floor deck of 16 mm oriented strand board (OSB) with no floor finish or floor topping
- floor framed with 38 mm x 235 mm wood joists spaced 406 mm o.c., with joists oriented perpendicular to separating (loadbearing) wall and supported from ledger plate on joist hangers, with 150 mm thick absorptive material in the inter-joist cavities
- ceiling with 2 layers of 16 mm gypsum board³ supported on resilient metal channels (spaced 610 mm o.c.) and fastened directly to bottom of floor framing on each side



Junction of loadbearing concrete block wall with wood-framed floor. Illustration not exactly to scale.

| BLK190-WF-LB-01 | Path | Path STC | Impact Path | Path IIC |
|-----------------------|------------------------|----------|---------------|---------------|
| | Dd | 49 | (To be added) | (To be added) |
| D | Ff | 59 | " | " |
| F f | Fd | 59 | " | " |
| | Df | 59 | " | " |
| | Junction (Ff+Fd+Df) | 54 | | |
| BLK190-WC-LB-02 | Path | Path STC | Impact Path | Path IIC |
| Wall-Ceiling Junction | Dd | 49 | | |
| | Ff | 82 | | |
| | Fd | 69 | | |
| F f | Df | 69 | | |
| Ddd | Junction (Ff+Fd+Df) | 66 | | |
| WJ235-FW-LB-02 | Path | Path STC | Impact Path | Path IIC |
| | Dd | 52 | (To be added) | (To be added) |
| D. | Ff | 59 | " | " |
| | Fd | 73 | | |
| | Df | 67 | | |
| d'f 2 | Junction (Ff+Fd+Df) | 58 | | |

(See the footnotes located at the end of the document)
Table 3.1.03A: Transmission Paths Wall assembly with: one wythe of 190 mm hollow concrete blocks of normal weight aggregate¹ with grout-filled block cavities at 1220 mm o.c. to give stiffness and weight like reinforced block wall (mass 238 kg/m²) Junction of wall with floor/ceiling assembly: course of concrete blocks at junction filled with grout 2 x 10 (38 mm x 235 mm) wood ledger plate on each side, ٠ fastened through with 16 mm diameter bolts spaced 406 mm o.c. Floor/Ceiling assembly: floor deck of 16 mm oriented strand board (OSB) subfloor with no floor finish or floor topping floor framed with 38 mm x 235 mm wood joists spaced 406 mm o.c., with joists oriented parallel to separating (non-loadbearing) wall and supported on joist hangers, with 150 mm thick absorptive Junction of non-loadbearing concrete block material in the inter-joist cavities wall with wood-framed floor. Illustration not ceiling with 2 layers of 16 mm gypsum board supported on exactly to scale. resilient metal channels (spaced 610 mm o.c.) and fastened directly to bottom of floor framing on each side BLK190-WF-NLB-01 Path STC Path Impact Path Wall-Floor Junction Dd 49 (To be added) (To be added) Ff 61 D Fd 60 Df 60 Junction 56 (Ff+Fd+Df) BLK190-WC-NLB-01 Path STC Path Impact Path Wall-Ceiling Junction Dd 49 Ff 82 Fd 71 Df 71 D Ч Junction 68 (Ff+Fd+Df) WJ235-FW-NLB-01 Path Path STC Impact Path Floor-Wall Junction 52 Dd (To be added) (To be added) " Ff 59 n Fd 80 Df 69

(See the footnotes located at the end of the document)

Junction

(Ff+Fd+Df)

59

Path IIC

Path IIC

Path IIC

Table 3.1.03B: Transmission Paths Wall assembly with: one wythe of 190 mm hollow concrete blocks of normal weight aggregate¹ with grout-filled cavities at 1220 mm o.c. to give stiffness and weight like reinforced block wall (mass 238 kg/m²) Junction of wall with floor/ceiling assembly: course of concrete blocks at junction filled with grout 2 x 10 (38 mm x 235 mm) wood ledger plate on each side, fastened through with 16 mm diameter bolts spaced 406 mm o.c. Floor/Ceiling assembly: 16 mm thick OSB floor topping (sheets oriented perpendicular to subfloor, joints staggered, fastened with staples) 16 mm oriented strand board (OSB) subfloor floor framed with 38 mm x 235 mm wood joists spaced 406 mm o.c., with joists oriented parallel to separating (non-loadbearing) Junction of non-loadbearing concrete block wall and supported on joist hangers, with 150 mm thick absorptive wall with wood-framed floor. Illustration not material in the inter-ioist cavities exactly to scale. ceiling with 2 layers of 16 mm gypsum board supported on resilient metal channels (spaced 610 mm o.c.) and fastened directly to bottom of floor framing on each side BLK190-WF-NLB-02 Path Path STC Impact Path Path IIC Wall-Floor Junction (To be added) Dd (To be added) (To be added) u Ff D Fd Df Junction (Ff+Fd+Df) BLK190-WC-NLB-01 Path STC Path IIC Path Impact Path Wall-Ceiling Junction Dd (To be added) ... Ff Fd Df D Junction (Ff+Fd+Df) WJ235-FW-NLB-02 Path STC Path IIC Path Impact Path Floor-Wall Junction Dd (To be added) (To be added) (To be added) u Ff Fd Df Junction (Ff+Fd+Df)





(See the footnotes located at the end of the document)

3.2 Concrete Block Walls with Lightweight Steel-Framed Floors and Walls

(TO BE ADDED LATER)

3.3 Concrete Block Walls with Precast Floors

(TO BE ADDED LATER)

4 Predicting Sound Transmission in Buildings

This chapter presents the calculation approach for predicting the sound transmission in a building which combines concrete block walls with other assemblies of various kinds.

The calculations are based on the concepts presented in Section 1.4 of this Report. The calculations of the sound transmitted between two rooms include a combination of the airborne sound transmission through the separating assembly and the structure-borne transmission via the set of first-order flanking paths between the rooms.

In this Report, the "Simplified Method" of ISO 15712-1 is applied with some modifications when framed assemblies are involved. This modified method uses the single-number ratings (STC for a separating assembly or Flanking STC for each flanking path) as presented in Equation 1.2. The calculation process is explained in detail in this section. This calculation procedure is less rigorous than the Detailed Method presented in the standard and Guide RR-331, but the calculation process is <u>much</u> less complicated. The differences between results of the two methods can be small, and the simplified calculations use approximations that should ensure the results are slightly more conservative (i.e. the ASTC calculated using the Simplified Method tends to be lower).

The choice of input data and process used to calculate the transmission via each flanking path depends on the type of wall and floor constructions which are combined with the concrete block walls to form the complete building.

For this reason, Chapter 4 is divided into sections suitable for the combination of concrete block walls with other constructions:

- Concrete masonry walls with concrete floors in Section 4.1
- Concrete masonry walls with lightweight wood-framed walls and floors in Section 4.2
- Concrete masonry walls with lightweight steel-framed walls and floors in Section 4.3
- Concrete masonry walls with precast concrete plank floors in Section 4.4

4.1 Scenarios for Concrete Block Walls with Structural Concrete Floors

ISO 15712-1 presents a "Simplified model for structure-borne transmission" in Section 4.4 of the standard. This method has some clearly stated limitations, and some implicit cautions including that:

- The simplified method uses a set of ad hoc approximations that are appropriate for buildings with concrete and masonry construction, with or without linings.
- The application of the simplified method "is restricted to primarily homogeneous constructions", further restricted here to homogeneous lightly-damped structural assemblies. Here "lightly-damped" implies a reverberant vibration field that can be characterized by a mean vibration level, and "homogeneous" implies similar bending stiffness in all directions across the surface. This limitation excludes wood-framed and steel-framed assemblies, but includes typical concrete or concrete masonry walls or concrete floors.
- Within that restricted context, the calculation has been structured to predict an ASTC slightly lower than that from the "detailed method" used in the examples presented in Guide RR-331.

The calculation method of Section 4.4 of ISO 15712-1 is based on two main simplifications:

- The most significant simplification is to deal with losses to connected assemblies "in an average way", which requires ignoring the variation of in situ transmission loss due to edge losses to adjoining wall and floor constructions, thereby eliminating much of the calculation process of the detailed method.
- The procedure uses only single number measures. For purposes of this Report, the single number measures are laboratory measured STC ratings for the structural wall and floor assemblies and the ΔSTC values for any linings as the input data. The final output is the overall ASTC rating.

The Simplified Method predicts the overall ASTC rating by following the steps in Figure 4.1.1, which are indicated in the diagram below (and explained in more detail for each step below):



Figure 4.1.1: Steps to calculate the Direct STC and the Flanking STC for each flanking path

- Step 1: Assemble the required laboratory test data for the constructions including the:
 - Laboratory sound transmission class (STC) values based on the TL measured according to ASTM E90 for the structural floor or wall assemblies (of bare concrete or masonry)
 - Mass per unit area for these bare assemblies
 - Measured change in sound transmission class (Δ STC) determined according to Sections 2.2 and 2.3 for each lining that will be added to the bare structural floor or wall assemblies.
- Step 2: Determine correction terms as follows:
 - a) For linings on the source and/or receiving side of the separating assembly, the correction ΔSTC_{Dd} is the sum of the larger of the ΔSTC values for these two linings plus half of the smaller value.
 - b) For each flanking path *ij*, the correction ΔSTC_{ij} for linings on the source surface *i* and/or the receiving surface *j*, is the sum of the larger of the ΔSTC values for these two linings plus half of the smaller value.
 - c) For each edge of the separating assembly, calculate the vibration reduction indices K_{Ff}, K_{Fd}, and K_{Df} for the flanking paths between the assembly in the source room (D or F) and the attached assembly in the receiving room (f or d) using the appropriate case from Annex E of ISO 15712-1. These values depend on the junction geometry and the ratio of the mass per unit area for the connected assemblies. Also calculate the normalization correction, which depends on the length of the flanking junction and the area of the separating assembly.
- Step 3: Calculate the Direct STC rating for the direct transmission through the separating assembly (STC_{Dd}) using Eq. 27 of ISO 15712-1:2005 with the inputs:
 - o Laboratory STC value for the bare structural assembly
 - Correction for linings Δ STC_{Dd} from Step 2(a)
- Step 4: Calculate the Flanking STC for transmission via each pair of connected assemblies at each edge of the separating assembly, using Eq. 28a of ISO 15712-1 with inputs:
 - Laboratory STC value for each bare structural assembly
 - Correction for linings Δ STC_{ii} from Step 2(b)
 - Value of K_{ii} and normalization correction for this path from Step 2(c)
- Step 5: Combine the transmission via the direct and flanking paths to determine the ASTC. In the worked examples, the Direct STC and Flanking STC values are rounded to the nearest integer before they are combined, and the ASTC is also rounded to the nearest integer, to match the nominal precision of the ASTM ratings.

Worked Examples

Each of the worked examples presents all the pertinent physical characteristics of the assemblies and junctions, together with a summary of key steps in the calculation process for these constructions. All of the examples in this section conform to the Standard Scenario presented in Section 1.2 of this Report.

Within the table presented for each worked example, the "References" column describes the source of the input data (combining the NRC report number and identifier for each laboratory test result or derived result), or identifies applicable equations and sections of ISO 15712-1:2005 at each stage of the calculation. Symbols and subscripts identifying the corresponding variable from ISO 15712-1 are given in the adjacent column. Equations and figures from the standard are not reproduced here to respect the copyright. However, the worked examples provide values for a set of scenarios with common base constructions and linings.

Under the single heading "STC, Δ STC", the examples present input data determined in laboratory tests according to ASTM E90, including the:

- STC values of sound transmission loss of wall or floor assemblies
- ΔSTC values calculated from measurements of the change in sound transmission due to adding a given lining to the specified wall or floor assembly. (See pages 14-16.)

Under the heading "ASTC", the examples present the calculated values (rounded to the nearest integer) for transmission via specific paths, including the:

- Direct STC for the calculated in-situ transmission loss of the separating wall or floor assembly
- Flanking STC calculated for each flanking transmission path at each junction
- Apparent STC (ASTC) for the combination of direct and flanking transmission via all paths

When the calculated Flanking STC value for a given path exceeds 90, the value is limited to 90 to allow for the inevitable effect of higher order flanking paths which cause the higher calculated value to be unrepresentative of the true situation. These situations are flagged with the adjacent label "(limit)" and indicate that further enhancements to elements in these paths will give negligible benefit to the ASTC value. The consequence of this limit is that the Junction STC for the set of 3 paths at each edge of the separating assembly cannot exceed 85 and the Total Flanking STC for all 4 edges cannot exceed 79.

The numeric calculations are presented step-by-step in each worked example, using compact notation consistent with the spreadsheet expressions such that:

- For calculation of the Direct STC and the Flanking STC, these expressions are easily recognized as equivalent to Equations 4.1.2 and 4.1.3, respectively. These values are rounded to the nearest integer, for consistency with the corresponding measured values.
- For combining the sound power transmitted via specific paths, the calculation of Eq. 1.2 is presented in several stages. Note that in the compact notation, a term for transmitted sound power fraction such as $10^{-0.1 \cdot STC_{ij}}$ becomes $10^{-7.4}$, if $STC_{ij} = 74$.
- At each stage (such as the Flanking STC for the 3 paths at a given junction) the result is converted into decibel form by calculating -10*LOG10(transmitted sound power fraction), to facilitate comparison of each path or junction with the Direct STC and the final ASTC result.

Example Scenarios

The set of examples contains 6 groups of room geometries and base structure elements:

| Section | Examples | Room Pair | Concrete Block | Loadbearing Walls | Concrete Floor | |
|---------|----------|----------------------------|-------------------|----------------------|----------------|--|
| 111 | H1 to H4 | Horizontal (Side-by-side) | | Yes | 150 mm | |
| 4.1.1 | V1 to V4 | Vertical (One-above-other) | BER190(INW) | Yes | 130 1111 | |
| 117 | H1 to H4 | Horizontal (Side-by-side) | | No | 150 mm | |
| 4.1.2 | V1 to V4 | Vertical (One-above-other) | DEKTOO(INVV) | No | 130 mm | |
| 110 | H1 to H4 | Horizontal (Side-by-side) | | No | 200 mm | |
| 4.1.5 | V1 to V4 | Vertical (One-above-other) | DLN140(LVV) | No | 200 11111 | |

Obviously, other combinations are possible (such as two loadbearing and two non-loadbearing junctions for a pair of rooms one-above-the-other), but the example scenarios are sufficient to illustrate the calculation process for each type of junction.

At the end of each of the three sections 4.1.1 to 4.1.3, there is a brief discussion of the trends in ASTC values for the system and the key sound transmission paths for determining those trends.

4.1.1 Loadbearing Normal Weight Concrete Block Walls with Concrete Floors

Note that all of the examples in Section 4.1.1 have rigid mortared junctions between the loadbearing concrete block walls and the concrete floors as well as between abutting concrete block walls.



| | ISO Symbol | Reference | | STC, & STC | ASTC |
|---------------------------------|-------------------|--|---------------|--|------|
| eparating Partition (190 mm | concrete block) | | | | |
| aboratory STC for Dd | R_s,w | RR-334, NRC-Mean BLK190(NW) | | 49 | |
| STC change by Lining on D | ΔR_D,w | No Lining , | | 0 | |
| STC change by Lining on d | ΔR_d,w | No Lining , | | 0 | |
| Direct STC in situ | R_Dd,w | ISO 15712-1, Eq. 24 and 30 | | 49 + MAX(0,0) + MIN(0,0)/2 = | 49 |
| lunction 1 (Rigid-T/Soft Cross | junction, 190 mm | block separating wall / 150 mm concrete | floor) | | |
| lanking Element F1: | | | | | |
| aboratory STC for F1 | R_F1,w | RR-333, TLF-97-107a | | 52 | |
| STC change by Lining | ΔR_F1,w | No Lining , | | 0 | |
| lanking Element f1: | | | | | |
| aboratory STC for f1 | R_f1,w | RR-333, TLF-97-107a | | 52 | |
| STC change by Lining | ΔR_f1,w | No Lining , | | 0 | |
| lanking STC for path Ff | R_ Ff,w | ISO 15712-1, Eq. 28a and 31 | 52/2 + 52/2 | + MAX(0,0) + MIN(0,0)/2 + 6.1 + 4 = | 62 |
| lanking STC for path Fd | R_ Fd,w | ISO 15712-1, Eq. 28a and 31 | 52/2 + 49/2 | + MAX(0,0) + MIN(0,0)/2 + 8.8 + 4 = | 63 |
| lanking STC for path Df | R_Df,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 52/2 | + MAX(0,0) + MIN(0,0)/2 + 8.8 + 4 = | 63 |
| unction 1: Flanking STC for a | l paths | Subset of Eq. 1.1 | - 10*LOO | G10(10^-6.2 + 10^- 6.3 + 10^- 6.3) = | 58 |
| unction 2 (Rigid T-Junction, 1 | 90 mm block separ | ating wall / 190 mm block flanking wall) | | | |
| lanking Element F2: | | | | | |
| aboratory STC for F2 | R_F2,w | RR-334, NRC-Mean BLK190(NW) | | 49 | |
| STC change by Lining | ΔR_F2,w | No Lining , | | 0 | |
| lanking Element f2: | | | | | |
| aboratory STC for f2 | R_f2,w | RR-334, NRC-Mean BLK190(NW) | | 49 | |
| ASTC change by Lining | ΔR_f2,w | No Lining , | | 0 | |
| lanking STC for path Ff | R_ Ff,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 49/2 | + MAX(0,0) + MIN(0,0)/2 + 5.7 + 7 = | 62 |
| lanking STC for path Fd | R_ Fd,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 49/2 | + MAX(0,0) + MIN(0,0)/2 + 5.7 + 7 = | 62 |
| lanking STC for path Df | R_Df,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 49/2 | + MAX(0,0) + MIN(0,0)/2 + 5.7 + 7 = | 62 |
| unction 2: Flanking STC for a | ll paths | Subset of Eq. 1.1 | - 10*LOO | G10(10^-6.2 + 10^- 6.2 + 10^- 6.2) = | 57 |
| unction 3 (Rigid_T/Soft Cross | junction 190 mm | block separating wall / 150 mm concrete | ceiling slab) | | |
| lanking Element E2: | junction, 190 mm | block separating wait / 150 mm concrete | cennig stabj | | |
| aboratory STC for F3 | R F3 w | RR-333 TLF-97-107a | | 52 | |
| STC change by Lining | AR F3 w | No Lining | | 0 | |
| lanking Element f3 | <u></u> _, | No Lining , | | | |
| aboratory STC for f3 | R f3 w | RR-333 TLF-97-107a | | 52 | |
| STC change by Lining | AR f3 w | No Lining | | 0 | |
| lanking STC for nath Ff | B Ef w | ISO 15712-1 Eq. 28a and 31 | 52/2 + 52/2 | + MAX(0,0) + MIN(0,0)/2 + 6.1 + 4 = | 62 |
| lanking STC for path Fd | R Ed w | 150 157 12 1, Eq. 200 and 51 | 52/2 + 52/2 | + MAX(0,0) + MIN(0,0)/2 + 8.8 + 4 = | 63 |
| lanking STC for path Df | B Dfw | | 49/2 + 52/2 | + MAX(0,0) + MIN(0,0)/2 + 8.8 + 4 = | 63 |
| unction 3: Flanking STC for a | ll paths | Subset of Eq. 1.1 | - 10*LO | $310(10^{-6.2} + 10^{-6.3} + 10^{-6.3}) =$ | 58 |
| unction 4 (Rigid T-junction 1 | 90 mm block senar | ating wall / 190 mm block flanking wall) | | | |
| lanking Element F4: | | ,,, would be a set of the | | | |
| aboratory STC for F4 | R F4.w | RR-334, NRC-Mean BLK190(NW) | | 49 | |
| STC change by Lining | ΔR F4.w | No Lining , | | 0 | |
| lanking Element f4: | | | | | |
| aboratory STC for f4 | R f4,w | RR-334, NRC-Mean BLK190(NW) | | 49 | |
| STC change by Lining | ΔR f4.w | No Lining . | | 0 | |
| lanking STC for path Ff | R Ff.w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 49/2 | + MAX(0,0) + MIN(0.0)/2 + 5.7 + 7 = | 62 |
| lanking STC for path Fd | R Fd.w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 49/2 | + MAX(0,0) + MIN(0,0)/2 + 5.7 + 7 = | 62 |
| lanking STC for path Df | R Df.w | ISO 15712-1. Eq. 28a and 31 | 49/2 + 49/2 | + MAX(0.0) + MIN(0.0)/2 + 5.7 + 7 = | 62 |
| unction 4: Flanking STC for a | l paths | Subset of Eq. 1.1 | - 10*100 | $510(10^{-6.2} + 10^{-6.2} + 10^{-6.2}) =$ | 57 |
| Total Flanking STC (4 Junction | s) | Subset of Eq. 1.1 | 10 100 | Combining 12 Flanking STC values | 52 |
| | | | | | |
| ASTC due to Direct plus All Fla | anking Paths | Equation 1.1 of this Report | Combining Di | rect STC with 12 Flanking STC values | 47 |



| | ISO Symbol | Reference | | | STC, Δ _STC | AS | тс |
|---------------------------------|-------------------|--|--|--|---|----|----|
| eparating Partition (190 mm | concrete block) | | | | | | |
| aboratory STC for Dd | R_s,w | RR-334, NRC-Mean BLK190(NW) | | | 49 | | |
| STC change by Lining on D | ΔR_D,w | RR-334, ΔTL-BLK(NW)-61, SS65_G13 | | | 2 | | |
| STC change by Lining on d | ∆R_d,w | RR-334, ΔTL-BLK(NW)-61, SS65_G13 | | | 2 | | |
| Direct STC in situ | R_Dd,w | ISO 15712-1, Eq. 24 and 30 | | 49 + N | MAX(2,2) + MIN(2,2)/2 = | 52 | |
| unction 1 (Rigid-T/Soft Cross j | unction, 190 mm l | block separating wall / 150 mm concrete | loor) | | | | |
| lanking Element F1: | | | | | | | |
| aboratory STC for F1 | R_F1,w | RR-333, TLF-97-107a | | | 52 | | |
| STC change by Lining | ΔR_F1,w | No Lining , | | | 0 | | |
| lanking Element f1: | | | | | | | |
| aboratory STC for f1 | R_f1,w | RR-333, TLF-97-107a | | | 52 | | |
| STC change by Lining | ΔR_f1,w | No Lining , | | | 0 | | |
| lanking STC for path Ff | R_ Ff,w | ISO 15712-1, Eq. 28a and 31 | 52/2 | + 52/2 + MAX(0,0) | + MIN(0,0)/2 + 6.1 + 4 = | 62 | |
| lanking STC for path Fd | R_ Fd,w | ISO 15712-1, Eq. 28a and 31 | 52/2 | + 49/2 + MAX(0,2) | + MIN(0,2)/2 + 8.8 + 4 = | 65 | |
| lanking STC for path Df | R_ Df,w | ISO 15712-1, Eq. 28a and 31 | 49/2 | + 52/2 + MAX(2,0) | + MIN(2,0)/2 + 8.8 + 4 = | 65 | |
| unction 1: Flanking STC for all | paths | Subset of Eq. 1.1 | | - 10*LOG10(10^-6.2 | + 10^- 6.5 + 10^- 6.5) = | | 59 |
| unction 2 (Rigid T-Junction, 19 | 0 mm block separ | ating wall / 190 mm block flanking wall) | | | | | |
| lanking Element F2: | | | | | | | |
| aboratory STC for F2 | R_F2,w | RR-334, NRC-Mean BLK190(NW) | | | 49 | | |
| STC change by Lining | ΔR_F2,w | RR-334, ATL-BLK(NW)-61, SS65 G13 | | | 2 | | |
| Flanking Element f2: | _ / | | | | | | |
| aboratory STC for f2 | R f2,w | RR-334, NRC-Mean BLK190(NW) | | | 49 | | |
| STC change by Lining | ΔR f2,w | RR-334, ΔTL-BLK(NW)-61, SS65 G13 | | | 2 | | |
| lanking STC for path Ff | R Ff.w | ISO 15712-1. Eq. 28a and 31 | 49/2 | + 49/2 + MAX(2.2) | + MIN(2.2)/2 + 5.7 + 7 = | 65 | |
| lanking STC for path Fd | R Fd,w | ISO 15712-1, Eq. 28a and 31 | and 31 49/2 + 49/2 + MAX(2,2) + MIN(2,2)/2 + 5.7 + 7 = | | | | |
| lanking STC for path Df | R Df.w | ISO 15712-1. Eq. 28a and 31 | 49/2 | + 49/2 + MAX(2.2) | + MIN(2.2)/2 + 5.7 + 7 = | 65 | |
| unction 2: Flanking STC for all | paths | Subset of Eq. 1.1 | | - 10*LOG10(10^-6.5 | $+10^{-}6.5+10^{-}6.5$ = | | 60 |
| | | | | | | | |
| unction 3 (Rigid-T/Soft Cross j | unction, 190 mm l | block separating wall / 150 mm concrete | eiling slal | b) | | | |
| lanking Element F3: | | | | | | | |
| aboratory STC for F3 | R F3,w | RR-333, TLF-97-107a | | | 52 | | |
| ASTC change by Lining | ΔR F3,w | No Lining , | | | 0 | | |
| Flanking Element f3: | _ / | | | | | | |
| aboratory STC for f3 | R f3.w | RR-333. TLF-97-107a | | | 52 | | |
| STC change by Lining | AR f3.w | No Lining . | | | 0 | | |
| lanking STC for path Ff | B Ff w | ISO 15712-1 Eq. 28a and 31 | 52/2 | +52/2 + MAX(0.0) | + MIN(0.0)/2 + 6.1 + 4 = | 62 | |
| lanking STC for path Fd | R Fd.w | | 52/2 | +49/2 + MAX(0.2) | + MIN(0.2)/2 + 8.8 + 4 = | 65 | |
| lanking STC for path Df | R Df.w | | 49/2 | +52/2 + MAX(2.0) | + MIN(2.0)/2 + 8.8 + 4 = | 65 | |
| unction 3: Flanking STC for all | paths | Subset of Eq. 1.1 | ,- | - 10*LOG10(10^-6.2 | + 10^- 6.5 + 10^- 6.5) = | | 59 |
| unction 4 (Rigid T-junction 19 | 0 mm block serar | ating wall / 190 mm block flanking wall) | | | | | |
| lanking Element F4 | | | | | | | |
| aboratory STC for F4 | R F4 w | RR-334, NRC-Mean BLK190(NW) | | | 49 | | |
| STC change by Lining | ΔR F4 w | RR-334 ATI-BLK(NW/)-61 SS65 G13 | | | 2 | | |
| lanking Element f4 | i -, | | | | - | | |
| aboratory STC for f4 | R f4 w | RR-334 NRC-Mean RIK190(NW) | | | 49 | | |
| STC change by Lining | ΔR f4 w/ | RR-334 ATI-BLK(NIM/)-61 SS65 G12 | | | 2 | | |
| anking STC for nath Ef | B Ef w | ISO 15712-1 Eq. 282 and 31 | 10/2 | + 19/2 + MAX(2.2) | + MIN(2 2)/2 + 5 7 + 7 - | 65 | |
| lanking STC for noth Ed | R Edw | ISO 15712-1, Eq. 200 dilu 51 | 43/2 | $+ \frac{1}{2} + $ | + $MIN(2,2)/2 + 5.7 + 7 =$ | 60 | |
| lanking STC for noth Df | | ISO 15712-1, Eq. 200 dilu S1 | 49/2 | $+ + + + + + 2 + 1 \times + \times \times$ | + IVIIIV(2,2)/2 + 5.7 + 7 = | 65 | |
| anking SIC for path Dr | K_DT,W | Subset of Eq. 1.1 | 49/2 | 10*10C10(100 C 5 | + 100 + 5 + 100 + 7 = | 65 | 60 |
| anction 4: Flanking STC for all | | Subset of Eq. 1.1 | - | - 10 LUG10(10 ^x -6.5 | + 10 0.5 + 10 0.5) = | | 50 |
| otal Flanking STC (4 Junctions |) | Subset of Eq. 1.1 | | Combinin | g 12 Flanking STC values | | 54 |
| | | | | | | | |



| | ISO Symbol | Reference | | | stc, Δ_stc | ASTO | : |
|---------------------------------|-------------------|---|--|------------------------|-----------------------------|------|---------|
| Separating Partition (190 mm | concrete block) | | | | | | |
| Laboratory STC for Dd | R_s,w | RR-334, NRC-Mean BLK190(NW | /) | | 49 | | |
| ΔSTC change by Lining on D | ΔR_D,w | RR-334, ΔTL-BLK(NW)-62, SS65 | _GFB65_G13 | | 19 | | |
| ΔSTC change by Lining on d | ∆R_d,w | RR-334, ΔTL-BLK(NW)-62, SS65 | _GFB65_G13 | | 19 | | |
| Direct STC in situ | R_Dd,w | ISO 15712-1, Eq. 24 and 30 | | 49 + MAX(| 19,19) + MIN(19,19)/2 = | 78 | |
| Junction 1 (Rigid-T/Soft Cross | junction, 190 mm | block separating wall / 150 mm co | oncrete floor) | | | | |
| Flanking Element F1: | | | | | | | |
| Laboratory STC for F1 | R_F1,w | RR-333, TLF-97-107a | | | 52 | | |
| ∆STC change by Lining | ΔR_F1,w | No Lining , | | | 0 | | |
| Flanking Element f1: | | | | | | | |
| Laboratory STC for f1 | R_f1,w | RR-333, TLF-97-107a | | | 52 | | |
| ΔSTC change by Lining | ΔR_f1,w | No Lining , | | | 0 | | |
| Flanking STC for path Ff | R_ Ff,w | ISO 15712-1, Eq. 28a and 31 | 52/2 | + 52/2 + MAX(0,0 |) + MIN(0,0)/2 + 6.1 + 4 = | 62 | |
| Flanking STC for path Fd | R_ Fd,w | ISO 15712-1, Eq. 28a and 31 | 52/2 + | 49/2 + MAX(0,19) | + MIN(0,19)/2 + 8.8 + 4 = | 82 | |
| Flanking STC for path Df | R_ Df,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + | 52/2 + MAX(19,0) | + MIN(19,0)/2 + 8.8 + 4 = | 82 | |
| Junction 1: Flanking STC for al | l paths | Subset of Eq. 1.1 | | - 10*LOG10(10^-6.2 | 2 + 10^- 8.2 + 10^- 8.2) = | 6 | 2 |
| Junction 2 (Rigid T-Junction, 1 | 90 mm block separ | rating wall / 190 mm block flankin | g wall) | | | | |
| Flanking Element F2: | | | | | | | |
| Laboratory STC for F2 | R_F2,w | RR-334, NRC-Mean BLK190(NW | /) | | 49 | | |
| ΔSTC change by Lining | ΔR F2,w | RR-334, ΔTL-BLK(NW)-62, SS65 | RR-334, ΔTL-BLK(NW)-62, SS65 GFB65 G13 | | 19 | | |
| Flanking Element f2: | | | | | | | |
| Laboratory STC for f2 | R f2,w | RR-334, NRC-Mean BLK190(NW | 49 | | | | |
| ΔSTC change by Lining | ΔR f2,w | RR-334, ΔTL-BLK(NW)-62, SS65 | 19 | | | | |
| Flanking STC for path Ff | R Ff,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 49 | /2 + MAX(19,19) + | MIN(19,19)/2 + 5.7 + 7 = | 90 | (limit) |
| Flanking STC for path Fd | R Fd,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 49 | /2 + MAX(19,19) + | MIN(19,19)/2 + 5.7 + 7 = | 90 | (limit) |
| Flanking STC for path Df | R Df.w | ISO 15712-1, Eq. 28a and 31 49/2 + 49/2 + MAX(19,19) + MIN(19,19)/2 + 5.7 + 7 = | | | | 90 | (limit) |
| Junction 2: Flanking STC for al | l paths | Subset of Eq. 1.1 | | - 10*LOG10(1 | 0^-9 + 10^- 9 + 10^- 9) = | 8 | 5 |
| | | | | | | | |
| Junction 3 (Rigid-T/Soft Cross | junction, 190 mm | block separating wall / 150 mm co | ncrete ceiling sla | <u>b)</u> | | | |
| Flanking Element F3: | | | | | | | |
| Laboratory STC for F3 | R_F3,w | RR-333, TLF-97-107a | | | 52 | | |
| ΔSTC change by Lining | ΔR_F3,w | No Lining , | | | 0 | | _ |
| Flanking Element f3: | | | | | | | |
| Laboratory STC for f3 | R_f3,w | RR-333, TLF-97-107a | | | 52 | | |
| ΔSTC change by Lining | ΔR_f3,w | No Lining , | | | 0 | | |
| Flanking STC for path Ff | R_ Ff,w | ISO 15712-1, Eq. 28a and 31 | 52/2 | + 52/2 + MAX(0,0 |) + MIN(0,0)/2 + 6.1 + 4 = | 62 | |
| Flanking STC for path Fd | R_Fd,w | | 52/2 + | 49/2 + MAX(0,19) | + MIN(0,19)/2 + 8.8 + 4 = | 82 | |
| Flanking STC for path Df | R_Df,w | | 49/2 + | 52/2 + MAX(19,0) | + MIN(19,0)/2 + 8.8 + 4 = | 82 | |
| Junction 3: Flanking STC for al | l paths | Subset of Eq. 1.1 | | - 10*LOG10(10^-6.2 | 2 + 10^- 8.2 + 10^- 8.2) = | 6 | 2 |
| Junction 4 (Rigid T-junction, 1 | 90 mm block separ | ating wall / 190 mm block flanking | g wall) | | | | |
| Flanking Element F4: | | | | | | | |
| Laboratory STC for F4 | R_F4,w | RR-334, NRC-Mean BLK190(NW | /) | | 49 | | |
| ΔSTC change by Lining | ΔR_F4,w | RR-334, ΔTL-BLK(NW)-62, SS65 | _GFB65_G13 | | 19 | | |
| Flanking Element f4: | | | | | | | |
| Laboratory STC for f4 | R_f4,w | RR-334, NRC-Mean BLK190(NW | /) | | 49 | | |
| ΔSTC change by Lining | ΔR_f4,w | RR-334, ΔTL-BLK(NW)-62, SS65 | _GFB65_G13 | | 19 | | |
| Flanking STC for path Ff | R_ Ff,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 49 | /2 + MAX(19,19) + | MIN(19,19)/2 + 5.7 + 7 = | 90 | (limit) |
| Flanking STC for path Fd | R_Fd,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 49 | /2 + MAX(19,19) + | MIN(19,19)/2 + 5.7 + 7 = | 90 | (limit) |
| Flanking STC for path Df | R_Df,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 49 | /2 + MAX(19,19) + | MIN(19,19)/2 + 5.7 + 7 = | 90 | (limit) |
| Junction 4: Flanking STC for al | l paths | Subset of Eq. 1.1 | | - 10*LOG10(1 | 0^-9 + 10^- 9 + 10^- 9) = | 8 | 5 |
| Total Flanking STC (4 Junction | s) | Subset of Eq. 1.1 | | Combinir | ng 12 Flanking STC values | 5 | 9 |
| | | | | | | | |
| ASTC due to Direct plus All Fla | inking Paths | Equation 1.1 of this Report | Comb | pining Direct STC with | th 12 Flanking STC values | 59 | |



| | ISO Symbol | Reference | | | STC, Δ_STC | AST | гс |
|----------------------------------|-------------------|---|----------------------|----------------------|---|-----|---------|
| Separating Partition (190 mm | concrete block) | | | | · _ | | |
| Laboratory STC for Dd | R s,w | RR-334, NRC-Mean BLK190(NV | √) | | 49 | | |
| ΔSTC change by Lining on D | ΔR_D,w | RR-334, ΔTL-BLK(NW)-62, SS65 | 5_GFB65_G13 | | 19 | | |
| ΔSTC change by Lining on d | ΔR_d,w | RR-334, ΔTL-BLK(NW)-62, SS65_GFB65_G13 19 | | | | | |
| Direct STC in situ | R_Dd,w | ISO 15712-1, Eq. 24 and 30 | | 49 + MAX(2 | 19,19) + MIN(19,19)/2 = | 78 | |
| Junction 1 (Rigid-T/Soft Cross | junction, 190 mm | block separating wall / 150 mm co | oncrete floor) | | | | |
| Flanking Element F1: | | | | | | | |
| Laboratory STC for F1 | R F1,w | RR-333, TLF-97-107a | | | 52 | | |
| ΔSTC change by Lining | ΔR F1,w | No Lining , | | | 0 | | |
| Flanking Element f1: | | | | | | | |
| Laboratory STC for f1 | R_f1,w | RR-333, TLF-97-107a | | | 52 | | |
| ΔSTC change by Lining | ΔR_f1,w | No Lining , | | | 0 | | |
| Flanking STC for path Ff | R_Ff,w | ISO 15712-1, Eq. 28a and 31 | 52/2 | + 52/2 + MAX(0,0) | + MIN(0,0)/2 + 6.1 + 4 = | 62 | |
| Flanking STC for path Fd | R_Fd,w | ISO 15712-1, Eq. 28a and 31 | 52/2 + 4 | 9/2 + MAX(0,19) + | MIN(0,19)/2 + 8.8 + 4 = | 82 | |
| Flanking STC for path Df | R Df,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 5 | 52/2 + MAX(19,0) + | - MIN(19,0)/2 + 8.8 + 4 = | 82 | |
| Junction 1: Flanking STC for al | l paths | Subset of Eq. 1.1 | - | 10*LOG10(10^-6.2 | + 10^- 8.2 + 10^- 8.2) = | | 62 |
| | | | | | | | |
| Junction 2 (Rigid T-Junction, 1 | 90 mm block separ | ating wall / 190 mm block flankin | g wall) | | | | |
| Flanking Element F2: | | | | | | | |
| Laboratory STC for F2 | R_F2,w | RR-334, NRC-Mean BLK190(NV | V) | | 49 | | |
| ΔSTC change by Lining | ΔR_F2,w | RR-334, ΔTL-BLK(NW)-62, SS65_GFB65_G13 19 | | | | | |
| Flanking Element f2: | | | | | | | |
| Laboratory STC for f2 | R_f2,w | KK-334, NKC-Mean BLK190(NW) 49 | | | | | |
| ΔSTC change by Lining | ΔR_f2,w | RR-334, ΔTL-BLK(NW)-62, SS65 | 5_GFB65_G13 | | 19 | | |
| Flanking STC for path Ff | R_ Ff,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 49/ | 2 + MAX(19,19) + | MIN(19,19)/2 + 5.7 + 7 = | 90 | (limit) |
| Flanking STC for path Fd | R_Fd,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 49/ | 2 + MAX(19,19) + | MIN(19,19)/2 + 5.7 + 7 = | 90 | (limit) |
| Flanking STC for path Df | R_Df,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 49/ | 2 + MAX(19,19) + | MIN(19,19)/2 + 5.7 + 7 = | 90 | (limit) |
| Junction 2: Flanking STC for al | l paths | Subset of Eq. 1.1 | | - 10*LOG10(10 |)^-9 + 10^- 9 + 10^- 9) = | | 85 |
| Junction 3 (Rigid-T/Soft Cross | junction, 190 mm | block separating wall / 150 mm co | oncrete ceiling slab | <u>)</u> | | | |
| Flanking Element F3: | | | | | | | |
| Laboratory STC for F3 | R_F3,w | RR-333, TLF-97-107a | | | 52 | | |
| ΔSTC change by Lining | ΔR_F3,w | RR-333, ΔTLF-CON150-01, SUS | 150_GFB150_G16 | | 19 | | |
| Flanking Element f3: | | | | | | | |
| Laboratory STC for f3 | R_f3,w | RR-333, TLF-97-107a | | | 52 | | |
| ΔSTC change by Lining | ΔR_f3,w | RR-333, ΔTLF-CON150-01, SUS | 150_GFB150_G16 | | 19 | | |
| Flanking STC for path Ff | R_Ff,w | ISO 15712-1, Eq. 28a and 31 | 52/2 + 52/ | 2 + MAX(19,19) + | MIN(19,19)/2 + 6.1 + 4 = | 90 | (limit) |
| Flanking STC for path Fd | R_Fd,w | | 52/2 + 49/ | 2 + MAX(19,19) + | MIN(19,19)/2 + 8.8 + 4 = | 90 | (limit) |
| Flanking STC for path Df | R_ Df,w | | 49/2 + 52/ | 2 + MAX(19,19) + | MIN(19,19)/2 + 8.8 + 4 = | 90 | (limit) |
| Junction 3: Flanking STC for al | l paths | Subset of Eq. 1.1 | | - 10*LOG10(10 | 0^-9 + 10^- 9 + 10^- 9) = | | 85 |
| Junction 4 (Rigid T-junction, 1) | 90 mm block separ | ating wall / 190 mm block flankin | g wall) | | | | |
| Flanking Element F4: | | | <u> </u> | | | | |
| Laboratory STC for F4 | R F4.w | RR-334, NRC-Mean BLK190(NV | V) | | 49 | | |
| ΔSTC change by Lining | ΔR F4.w | RR-334, ΔTL-BLK(NW)-62 SS6 | 5 GFB65 G13 | | 19 | | |
| Flanking Element f4: | 2, | | | | | | |
| Laboratory STC for f4 | R f4.w | RR-334, NRC-Mean BLK190(NV | V) | | 49 | | |
| ΔSTC change by Lining | ΔR f4 w | RR-334, ΔTL-BLK(NW)-62 SS6 | 5 GFB65 G13 | | 19 | | |
| Flanking STC for path Ff | R Ff.w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 49/ | 2 + MAX(19.19) + | MIN(19,19)/2 + 5.7 + 7 = | 90 | (limit) |
| Flanking STC for path Fd | R Fd.w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 49/ | 2 + MAX(19.19) + | MIN(19,19)/2 + 5.7 + 7 = | 90 | (limit) |
| Flanking STC for path Df | R Df.w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 49/ | 2 + MAX(19.19) + | MIN(19.19)/2 + 5.7 + 7 = | 90 | (limit) |
| Junction 4: Flanking STC for al | paths | Subset of Eq. 1.1 | .5/2 . 45/ | - 10*LOG10(10 | $(-9)^{-9} + 10^{-9} + 10^{-9} = -9^{-9}$ | | 85 |
| Total Flanking STC (4 Junction | s) | Subset of Eq. 1.1 | | Combinin | g 12 Flanking STC values | | 62 |
| | | | | | | | |
| ASTC due to Direct plus All Ela | nking Paths | Equation 1.1 of this Report | Comb | ining Direct STC wit | h 12 Flanking STC values | 62 | |

| EXAMPLE 4.1.1-V1: | | (SIMPLIFIED METHOD) | Illustrati | on for this ca | ise |
|--|--|---|--|--|----------------------|
| Rooms one-above-th Loadbearing normal floors with rigid junction | ne-other weight concrete tions | e block walls and concret | e | | |
| <u>Separating floor/ceiling asse</u> concrete floor with mas thickness of 150 mm) lining below <u>Junction 1, 3, 4: Cross Junc</u> rigid mortared cross jun wall above and below mass 238 kg/m² (e.g. aggregate¹) with no linin <u>Junction 2: T-Junction of sep</u> rigid mortared T-junctio wall above and below mass 238 kg/m² (e.g. aggregate¹) with no linin | embly with: s 345 kg/m ² (e.g. with no topping tion of separating ction with concre floor of one wy 190 mm hollow ng of walls parating floor / fla ns with concrete I floor of one wy 190 mm hollow ng of walls | h g h t t Cross ju mm thicl block wa | , F3, F4 D d d f3, f4 inction of sep k concrete with III. (Side view of | parating floor of 150 th 190 mm concrete of Junctions 1, 3, 4) | |
| Acoustical Parameters: For 190 mm concrete block w | alls: | | F | 2 | |
| Mass/unit area (kg/m) = | 238 | Wall at junctions 1&3) Wall at junctions 2&4) | | I I | |
| For 150 mm concrete floor: | | | 7 | 12 M 12 8 20 | C. T. S. Asta |
| Mass/uni | t area (kg/m ²) = 3 | 345 | | A Start | A CAR AND |
| | | | | 1 I | |
| Separating parti | tion area $(m^2) = 2$ | 20 | | | |
| Junction 1 and | 3 length (m) = | 5.0 | | u | 2 |
| Junction 2 and | 4 length (m) = 4 | 4.0 | | | |
| 10*log(S_Partition/l_ | junction 1&3) = | 6.0 | | fź | 2 |
| 10*log(S_Partition/l_ | junction2 &4) = | 7.0 | | | |
| | | T-Junctio thick cor block wa | on of separati hcrete floor wi III. (Side view | ing floor of 150 mm th 190 mm concrete of Junction 2). | |
| | | | | | |
| | | Path Ff | Path Fd | Path Df | |
| Junction | Mass ratio for Ff | Kij (in dB) = | 0.0 | 0.0 | Reference |
| Kigid-Cross junction Rigid-T junction | 1.45 | 81 | 8.8 5.8 | 8.8 5.8 | ISO 15/12-1, Eq. E.3 |
| 3 Rigid-Cross junction | 1.45 | 11.6 | 8.8 | 8.8 | ISO 15712-1, Eq. E.3 |
| 4 Rigid-Cross junction | 1.45 | 11.6 | 8.8 | 8.8 | ISO 15712-1, Eq. E.3 |

| Separation (192 mm concrete block) 5 Stor Charge by Uning on D AL 0.w. No Lining , Stor Charge by Uning on D AL 0.w. Stor Charge by Uning on D AL 0.w. No Lining , Stor Charge by Uning on D AL 0.w. Stor Charge by Uning on D AL 0.w. No Lining , Stor Charge by Uning on D AL 0.w. Direct STC in situ R. Dd.w. ISO 15712-1, Eq. 24 and 30 S2 + MAX(0.0) + MIN(0.0)/2 = 52 Stor Charge by Uning AL 1.w. Rif-S34, NIC-Mean BL(130(NW) 49 Stor Charge by Uning AL 1.w. Nichara BL(130(NW) 49 Stor Charge by Uning AL 1.w. Nichara BL(130(NW) 49 Stor Charge by Uning AL 1.w. Nichara BL(130(NW) 49 Stor Charge by Uning AL 1.w. Nichara BL(130(NW) 49 Stor Charge by Uning AL 1.w. Nichara BL(130(NW) 49 Stor Charge by Uning AL 1.w. Nichara BL(130(NW) 49 Stor Charge by Uning AL 1.w. Nichara BL(130(NW) 49 Stor Charge by Uning AL 1.w. Nichara BL(130(NW) 49 Stor C | | ISO Symbol | Reference | | | stc, Δ_stc | A | бтс |
|---|--------------------------------|-------------------|--|----------------|----------------------|----------------------------|----|-----|
| aboratory ST: for Dd R, 5, w RR 333, TLF 37 (207a) S2 STC: change by Uning on D AR, d, w No Lining, 0 STC: change by Uning on D AR, d, w No Lining, 0 STC: change by Uning on D AR, d, w No Lining, 0 Direct STC: in situ R, Dd, w No Lining, 0 STC: change by Uning AR, FL, W No Lining, 0 STC: change by Uning AR, FL, W No Lining, 0 Aboratory STC for T1 R, Ti, W NR B-334, NRC-Mean BLK190(NV) 49 STC: change by Uning AR, FL, W No Lining, 0 aboratory STC for T1 R, Ti, W NR B-334, NRC-Mean BLK190(NV) 49 stort chanking STC or path F1 R, FL, W No Lining, 0 stort chanking STC for path F1 R, FL, W No Lining, 0 stort chanking STC for path F1 R, FL, W No Lining, 0 stort chanking STC for path F1 R, FL, W No Lining, 0 stort chanking STC for path F1 R, FL, W No Lining, | Separating Partition (190 mm | concrete block) | | | | | | |
| STC Charge by Lining on J AR, J.W. No Lining, J. 0 Direct STC In situ R, Dd,W. NO Lining, J. 0 Direct STC In situ R, Dd,W. NO Lining, J. 0 Direct STC In situ R, Dd,W. NO Lining, J. 0 Direct STC In situ R, Dd,W. NO Lining, J. 0 Hanking STC for situ R. Fl,W. RR 334, MRC-Mean BLK190(NW) 49 Jaboratory STC for F1 R, Fl,W. RR 334, MRC-Mean BLK190(NW) 49 STC change by Lining AR, Fl,W. No Lining, J. 0 Hanking STC for path F4 R, Fl,W. NO Lining, J. 0 STC change by Lining AR, Fl,W. NO Lining, J. 0 Hanking STC for path F4 R, Fl,W. NO Lining, J. 0 Hanking STC for path F4 R, FLW. SU ST21-1, Eq. 28 and 31 49/2 + 49/2 + MAX(0.0) + MIN(0.0)/2 + 18.8 + 6 65 Hunction 1: Flanking STC for path F4 R, FLW. SU ST21-1, Eq. 28 and 31 49/2 + 49/2 + MAX(0.0) + MIN(0.0)/2 + 8.8 + 6 65 Hunction 1: Gligid T-Junction. 190 mm block separating wall / 190 mm block flanking wall 13 -10*10G IO(10^-C, + 10^-C, 5 + 10^-C, 5 + 10^-C, 5 + 10^-C, 5 + 10^- | aboratory STC for Dd | R_s,w | RR-333, TLF-97-107a | | | 52 | | |
| SST C Anage by Linning ond AR_d.w. No Linning. 0 SST C Anage by Linning AR_F1,w. RE-334, NRC-Mean BLK190(NW) 49 SST C Anage by Linning AR_F1,w. NR E-334, NRC-Mean BLK190(NW) 49 SST C Change by Linning AR_F1,w. NR E-334, NRC-Mean BLK190(NW) 49 SST C Change by Linning AR_F1,w. NR E-334, NRC-Mean BLK190(NW) 49 SST C Change by Linning AR_F1,w. NR E-334, NRC-Mean BLK190(NW) 49 SST C Change by Linning AR_F1,w. NR E-334, NRC-Mean BLK190(NW) 49 SST C Change by Linning C T or JI R_F1,w. NR E-334, NRC-Mean BLK190(NW) 49 SST C for path FI R_F1,w. NR E-334, NRC-Mean BLK190(NW) 49 SST C for path FI R_F1,w. Subset of Eq. 1.1 -10*10G10(10*-6.7 + 10*-6.5 + 10*-6.5) = 61 SST C change by Linning Subset of Eq. 1.1 -10*10G10(10*-6.7 + 10*-6.5 + 10*-6.5) = 61 SST C charge by Linning AR_Z,w. No Lining, 0 0 SST C charge by Linning AR_Z,w. No Lining, 0 0 | ASTC change by Lining on D | ΔR_D,w | No Lining , | | | 0 | | |
| Direct STC in situ R_Dd,w ISO 15712-1; Eq. 24 and 30 S2 + MAX(0,0) + MIN(0,0)/2 = S2 unction 1; [ligid: T/Soft Cors junction, 190 mm block separating wall / 150 mm concrete floor) imaking Element F1: 0 aboratory STC for F1 R_F1,w RR-334, RRC-Mean BLK190(NW) 49 storetory STC for F1 R_F1,w RR-334, RRC-Mean BLK190(NW) 49 storetory STC for F1 R_F1,w No lining, 0 storetory STC for f1 R_F1,w No lining, 0 storetory STC for path of R_f(w) ISO 15712-1; Eq. 28 and 31 49/2 + 52/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 6 = 65 storetor 1: Storig STC for apath of R_f(w) ISO 15712-1; Eq. 28 and 31 49/2 + 52/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 6 = 65 storetor 1: Storig STC for apath of R_f(w) ISO 15712-1; Eq. 28 and 31 49/2 + 52/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 6 = 65 storetor 2: [Rigid: T_Junction. 190 mm block separating wall / 190 mm block flanking wall) aboratory STC for F2 R_F2,w RR-334, RC-Mean BLK190(WW) 49 55 storetor 2: Rigid: T_Junction. 190 mm block separating wall / 190 mm block flanking wall) aboratory STC for F2 R_F2,w | ASTC change by Lining on d | ΔR_d,w | No Lining , | | | 0 | | |
| unction 1 [Rigid-T/Soft Cross junction, 190 mm block separating wall / 150 mm concrete floor) 49 Tarking Element E1; 0 aboratory 57 Cor 11 R, F1, w NR F3.44, NRC-Mean BLX190(NW) 49 SST C change by Uning AR, F1, w NR F3.44, NRC-Mean BLX190(NW) 49 aboratory 57 Cor 11 R, F1, w NR F3.44, NRC-Mean BLX190(NW) 49 aboratory 57 Cor 11 R, F1, w NR 512, L5, L5, 28 and 31 49/2 + 52/2 + MAX(0,0) + MIN(0,0)/2 + 11.6 + 6 finanking 57 Cor path Fd R, F4, w ISO 15712, L5, L5, 28 and 31 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 6 65 tranking 57 Cor path Fd R, F4, w ISO 15712, L5, L5, 28 and 31 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 6 65 unction 1. Flanking S7 Cor all paths Subsect of E1, 1.3 -10*10G10(10*-6, 7 + 10*-6, 5 + 10*-6, 5) 61 Stort Charge by Uning AR F2, w No Lining, 0 1 1 Tanking S7 Cor path Fd R, F1/w ISO 15712, L5, L2, Ba and 31 49/2 + 49/2 + MAX(0,0) + MIN(0)/2 + 8.1 + 7 63 Tanking S7 Cor path Fd R, F1/w ISO 15712, L5, L2, Ba and 31 49/2 + 49/2 + MAX(0,0) + MIN(0)/2 + 8.1 + 7 | Direct STC in situ | R_Dd,w | ISO 15712-1, Eq. 24 and 30 | | 52 + N | 1AX(0,0) + MIN(0,0)/2 = | 52 | |
| Hanking Element F1: Application STC for F1 R, F1, w RR-334, NRC-Mean BLK190(NW) 49 Aboratory STC for F1 R, F1, w NR Lining , 0 STC change by Lining AR, F1, w NRC-Mean BLK190(NW) 49 Aboratory STC for f1 R, f1, w NR -334, NRC-Mean BLK190(NW) 49 STC change by Lining AR, f1, w No Lining, 0 Flanking STC for path F1 R, f1, w No Lining, 0 Flanking STC for path F1 R, f1, w ISO 15712.1, Eq. 28a and 31 49/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 6 65 Flanking STC for path F1 R, D.W. ISO 15712.1, Eq. 28a and 31 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 6 65 Iunction 2 (Bigld F Junction, 300 nm block separating wall / 130 nm block flanking wall -01*COG10(10*-6.7 + 10*-6.5 + 10*-6.5) = 61 Aboratory STC for F2 R, F2, w No Lining, 0 -0 Hanking STC for path F1 R, J2, w Rk-334, NRC-Mean BLK190(NW) 49 -0 STC change by Lining AR, F2, w No Lining, 0 -0 -0 Hanking STC for path F1 <td>lunction 1 (Rigid-T/Soft Cross</td> <td>junction, 190 mm</td> <td>block separating wall / 150 mm concrete</td> <td>floor<u>)</u></td> <td></td> <td></td> <td></td> <td></td> | lunction 1 (Rigid-T/Soft Cross | junction, 190 mm | block separating wall / 150 mm concrete | floor <u>)</u> | | | | |
| aboratory STC for F1 R, F1, w RR-334, NRC-Mean BLK190(NW) 49 Backing JE General T1: AR, F1, w No Lining, 0 Backing STC for path F1 R, F1, w No Lining, 492 STC change by Lining AR, F1, w No Lining, 0 STC change by Lining AR, F1, w No Lining, 0 STC for path F1 R, F1, w No Lining, 0 STC for path F1 R, F1, w No Lining, 0 Banking STC for path F1 R, F2, w No Lining, 10°LOGI0(10°-67, 10°, 6.5 ±10°, 6.5) = 61 unction 1: Ranking STC for F2 R, F2, w No Lining, 0 0 0 STC for F2 R, F2, w No Lining, 0 0 0 0 STC for F2 R, F2, w No Lining, 0 | lanking Element F1: | | | | | | | |
| STC change by Lining AR, FL, W No Lining, 0 aboratory STC for f1 R, fL, W No Lining, 49 STC change by Lining AR, fL, W No Lining, 0 Tanking STC for path FI R, fL, W ISO 15712-1, Eq. 28a and 31 49/2 + 49/2 + MAX(0,0) + MIN(0,0)2 + 8.8 + 6 = 65 Tanking STC for path FI R, fL, W ISO 15712-1, Eq. 28a and 31 5/27 + 49/2 + MAX(0,0) + MIN(0,0)2 + 8.8 + 6 = 65 Tanking STC for path FI R, fL, W ISO 15712-1, Eq. 28a and 31 5/27 + 49/2 + MAX(0,0) + MIN(0,0)2 + 8.8 + 6 = 65 Tanking STC for path FI R, fL, W Stote of fL, 1.1 -10*LOGID(10*-6.7 + 10*-6.5 + 10*-6.5) = 61 Unction 2 (figid T-Junction 190 mm block separating wall / 130 mm block flanking wall) aboratory STC for F2 R, F2, W STC change by Lining AR, F2, W No Lining, 0 STC change by Lining AR, F2, W No Lining, 0 STC change by Lining AR, F2, W No Lining, 0 STC change by Lining AR, F2, W No Lining, 0 STC change by Lining AR, F2, W No Lining, 0 STC change by Lining AR, F2, W No Lining, 0 | aboratory STC for F1 | R_F1,w | RR-334, NRC-Mean BLK190(NW) | | | 49 | | |
| Lanking Element 11: AR. 11.w R. 11.w R. 334, NRC-Mean BLK190(WW) 49 STC change by Uning AR. 11,w NO Lining, 0 Lanking STC for path FI R. Flw ISO 15712-1, Eq. 28a and 31 49/2 + 52/2 + MAX(0,0) + MIN(0,0)/2 + 18.8 + 6 65 Lanking STC for path FI R. Fd,w ISO 15712-1, Eq. 28a and 31 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 6 65 Lanking STC for path FI R. Fd,w ISO 15712-1, Eq. 28a and 31 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 6 65 Lanking STC for path FI R. F2,w Subset of Eq. 1.1 -10*LOG1010*-6.7 + 10*-6.5 + 10*-6.5 + 0*-6.5 + 6 61 Lanking STC for path FI R. F2,w R. 834, NRC-Mean BLK190(WW) 49 6 STC change by Uning AR f2,w No Lining, 0 6 Lanking STC for path FI R. F1,w ISO 15712-1, Eq. 28a and 31 49/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 7 = 63 Lanking STC for path FI R. F1,w ISO 15712-1, Eq. 28a and 31 49/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 5.8 + 7 = 63 Lanking STC for path FI R. F1,w ISO 15712-1, Eq. 28a and 31 49/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 5.8 + 7 = 63 <td>STC change by Lining</td> <td>ΔR_F1,w</td> <td>No Lining ,</td> <td></td> <td></td> <td>0</td> <td></td> <td></td> | STC change by Lining | ΔR_F1,w | No Lining , | | | 0 | | |
| aboratory STC for f1 R. F1,w RR 334, NRC-Mean BLK190(NW) 49 Torking STC for path F4 R. F1,w NSO Lining, 0 Tanking STC for path F4 R. F4,w ISO 15712-1, Eq. 28a and 31 49/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 6 = 65 Tanking STC for path F4 R. F4,w ISO 15712-1, Eq. 28a and 31 59/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 6 = 65 Tanking STC for path F4 R. F2,w ISO 15712-1, Eq. 28a and 31 59/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 6 = 65 Tanking STC for path F4 R. F2,w ISO 15712-1, Eq. 28a and 31 59/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 6 = 65 Tanking STC for path F4 R. F2,w NR -334, NRC-Mean BLK190(NW) 49 STC change by Uning AR F2,w No Lining, 0 Tanking STC for path F4 R. F1,w No Lining, 0 Tanking STC for path F4 R. F1,w No Lining, 0 Tanking STC for path F4 R. F4,w No Lining, 0 Tanking STC for path F4 R. F4,w S0 1572.1-1, Eq. 28a and 31 49/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 5.8 + 7 = 63 Tanking STC for path F4 R. F4,w No Lining, </td <td>lanking Element f1:</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> | lanking Element f1: | | | | | | | |
| STC change by Lining AR, F, W No Lining, 0 Tanking STC for path FI R, F, F, W ISO 15712-1; Eq. 28a and 31 49/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 18.4 6 = 65 Ianking STC for path FI R, Fd, W ISO 15712-1; Eq. 28a and 31 49/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 18.4 6 = 65 Ianking STC for path FI R, D, W ISO 15712-1; Eq. 28a and 31 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 4 6 = 65 Ianking STC for path FI R, D, W ISO 15712-1; Eq. 28a and 31 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 4 6 = 65 Ianking STC for fath FI R, F2, W RR-334, NRC-Mean BLK190(NW) 49 49 STC change by Lining AR, F2, W No Lining, 0 61 Ianking STC for path FI R, F2, W No Lining, 0 63 Ianking STC for path FI R, F4, W ISO 15712-1; Eq. 28a and 31 49/2 + 52/2 + MAX(0,0) + MIN(0,0)/2 + 8.1 7 = 63 Ianking STC for path FI R, F4, W ISO 15712-1; Eq. 28a and 31 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 7 = 63 Ianking STC for path FI R, F4, W ISO 15712-1; Eq. 28a and 31 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 7 = 63 Ianking STC fo | aboratory STC for f1 | R_f1,w | RR-334, NRC-Mean BLK190(NW) | | | 49 | | |
| Ianking STC for path Fd RFd_w ISO 15712-1, Eq. 28a and 31 49/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 11.6 + 6 67 Ianking STC for path Fd RFd_w ISO 15712-1, Eq. 28a and 31 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 6 65 Ianking STC for path Fd RDf,w ISO 15712-1, Eq. 28a and 31 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 6 65 Ianking STC for path Fd RDf,w ISO 15712-1, Eq. 28a and 31 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 6 65 Ianking STC for path Fd RTZ,w RR-334, NRC-Mean BLK190(NW) 49 6 Ianking STC for path Fd RTZ,w RR-334, NRC-Mean BLK190(NW) 49 6 STC change by Lining ARTZ,w No Lining, 0 0 Ianking STC for path Fd RTd_w No Lining, 0 0 Ianking STC for path Fd RTd_w No Lining, 0 0 Ianking STC for path Fd RTd_w No Lining, 0 0 Ianking STC for path Fd RTd_w No Lining, 0 0 Ianking STC for path Fd RTd_w No Lining, <td>STC change by Lining</td> <td>ΔR_f1,w</td> <td>No Lining ,</td> <td></td> <td></td> <td>0</td> <td></td> <td></td> | STC change by Lining | ΔR_f1,w | No Lining , | | | 0 | | |
| Ianking STC for path Fd R_ Fd,w ISO 15712-1, Eq. 28a and 31 49/2+52/2+MAX(0,0)+MIN(0,0)/2+8.8+6 65 Ianking STC for path Fd R_ Df,w ISO 15712-1, Eq. 28a and 31 52/2+49/2+MAX(0,0)+MIN(0,0)/2+8.8+6 65 unction 1: Hanking STC for all paths Subset of Eq. 1.1 -10*LOG10(10^-6.7+10^-6.5+10^-6.5) = 61 unction 2. (Rigid T-Junction, 190 mm block separating wall / 190 mm block flanking wall) 49 - - lanking StC for f2 R_ F2,w RR-334, NRC-Mean BLK190(NW) 49 - shortony STC for f2 R_ F2,w No Lining , 0 - lanking StC for path Fd R_ F4,w No Lining , 0 - lanking STC for path Fd R_ F4,w No Lining , 0 - lanking STC for path Fd R_ F4,w No Lining , 0 - - lanking STC for path Fd R_ F4,w No Lining , 0 - - - - - 63 - - - - - - - - - - - - - | lanking STC for path Ff | R_ Ff,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + | 49/2 + MAX(0,0) + | MIN(0,0)/2 + 11.6 + 6 = | 67 | |
| Ianking STC for path Df RDf/w ISO 15712-1, Eq. 28a and 31 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 6 = 65 65 unction 1; Hanking STC for all paths Subset of Eq. 1.1 - 10*LOG10[10^-6.7 + 10^-6.5 + 10^-6.5 + 0 61 unction 2, (Rigid T_Junction, 190 mm block separating wall / 190 mm block flanking wall 49 57 STC change by Uning AR_F2,w No Lining , 0 Ianking Element f2; aboratory STC for f2 R_F2,w No Lining , 0 Janking STC or path Ff R_F2,w No Lining , 0 0 Ianking STC for path Ff R_F1/w ISO 15712-1, Eq. 28a and 31 49/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.1 + 7 = 64 Ianking STC for path Ff R_F1/w ISO 15712-1, Eq. 28a and 31 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.1 + 7 = 63 Ianking STC for path Ff R_F1/w ISO 15712-1, Eq. 28a and 31 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.1 + 7 = 63 Ianking STC for path Ff R_F3/w No Lining , 0 10*LOG1010^-6.4 + 10^-6.3 + 10^-6.3 + 10^-6.3 + 10^-6.3 + 10^-6.3 + 10^-6.3 + 10^-6.3 + 10^-6.3 + 10^-6.3 + 10^-6.3 + 10^-6.3 + 10^-6.5 + 10^-6.5 + 10^-6.5 + 10^-6.5 + 10^-6.5 + 10^-6.5 + 10^-6.5 + 10^-6.5 + 10^-6.5 + 10^-6.5 + 10^-6.5 + 10^-6.5 + 10^-6 | lanking STC for path Fd | R_ Fd,w | ISO 15712-1, Eq. 28a and 31 | 49/2 | + 52/2 + MAX(0,0) | + MIN(0,0)/2 + 8.8 + 6 = | 65 | |
| unction 1: Flanking STC for all paths Subset of Eq. 1.1 Iarking Element F2: aboratory STC for F2 R_F2,w No Lining, aboratory STC for F2 R_F2,w No Lining, aboratory STC for F2 R_F2,w No Lining, aboratory STC for P4 R_F1,w SD 15712-1, Eq. 28a and 31 49/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.1 + 7 = 64 Iarking STC maph Df R_F1,w SD 15712-1, Eq. 28a and 31 49/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.1 + 7 = 63 Iarking STC for path Df R_F1,w ISO 15712-1, Eq. 28a and 31 49/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.1 + 7 = 64 Iarking STC for path Df R_F1,w ISO 15712-1, Eq. 28a and 31 49/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.1 + 7 = 63 Iarking STC for path Df R_F1,w ISO 15712-1, Eq. 28a and 31 49/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.1 + 7 = 64 Iarking STC for path Df R_F1,w SUbset of Eq. 1.1 -10°LOG10(10^-6,4 + 10^-6,3 + 10^-6,3 = 10°LOG10(10^-6,4 + 10^-6,3 + 10^-2,3 = 10°LOG10(10^-6,7 + 10^-2,4 + 40/2 + MAX(0,0) + MIN(0,0)/2 + 8.1 + 6 = 67 Iarking STC for path Df R_F1,w No Lining, 10°LOG10(10^-6,7 + 10^-2,8 + 6 = 65 10°LOG10(10^-6,7 + 10^-2,8 + 7 = 66 10°LOG10(10^-6,7 + 10^-2,8 + 7 = 66 10°LOG10(10^-6,7 + 10^-4,8 + 7 = 68 10°LOG10(10^-6,7 + 10^-4,8 + 7 = 68 10°LOG10(10^-6,8 | lanking STC for path Df | R_ Df,w | ISO 15712-1, Eq. 28a and 31 | 52/2 | + 49/2 + MAX(0,0) | + MIN(0,0)/2 + 8.8 + 6 = | 65 | |
| unction 2 (Rigid T-Junction, 190 mm block separating wall / 190 mm block flanking wall) 49 lanking Element F2; R-F2,w No Lining, 0 storatory STC for F2 R-F2,w No Lining, 0 storatory STC for Path F1 R, Ff,w ISO 15712-1, Eq. 28a and 31 49/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 5.8 + 7 = 63 lanking STC for path F1 R, Df,w ISO 15712-1, Eq. 28a and 31 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 5.8 + 7 = 63 lanking STC for path F1 R, Df,w ISO 15712-1, Eq. 28a and 31 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 5.8 + 7 = 63 unction 3 (Rigid T/Soft Cross lunction, 190 mm block separating wall / 150 mm concrete ceiling slab) 10*10G10(10~6.4 + 10~6.3 + 10~6.3) = 59 unction 3 (Rigid T/Soft Cross lunction, 190 mm block separating wall / 150 mm concrete ceiling slab) 0 13 lanking STC for path F4 R, F3,w RR-334, NRC-Mean BLK190(NW) 49 57C change by Lining AR, F3,w No Lining | unction 1: Flanking STC for al | l paths | Subset of Eq. 1.1 | - | 10*LOG10(10^-6.7 | + 10^- 6.5 + 10^- 6.5) = | | 61 |
| lanking Element F2: 49 aboratory STC for F2 R_F2,w RA 534, NRC-Mean BLK190(NW) 49 aboratory STC for F2 R_F2,w No Lining, 0 lanking Element f2: 0 49 aboratory STC for f2 R_F2,w No Lining, 0 lanking STC for path F4 R_F1,w No Lining, 0 lanking STC for path F4 R_F1,w ISO 15712-1, Eq. 28a and 31 49/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 58 + 7 = 63 lanking STC for path F4 R_F1,w ISO 15712-1, Eq. 28a and 31 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 58 + 7 = 63 lanking STC for path F4 R_F1,w ISO 15712-1, Eq. 28a and 31 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 58 + 7 = 63 lanking STC for path F4 R_F3,w No Lining, 0 10*LOGI0(10^-6.4 + 10^-6.3 + 10^-6.3) = 59 unction 3 (Rigid-TSoft Cross junction, 190 mm block separating wall / 150 mm concrete celling slab) 11 10*LOGI0(10^-6.7 + 10^-6.5) = 61 lanking STC for path F4 R_F3,w R-334, NRC-Mean BLK190(NW) 49 6 67 lanking STC for path F4 R_F | unction 2 (Rigid T-Junction, 1 | 90 mm block separ | ating wall / 190 mm block flanking wall) | | | | | |
| aboratory STC for F2 R, F2, w RR-334, NRC-Mean BLK190(NW) 49 STC change by Lining ΔR, F2, w No Lining, 0 aboratory STC for f2 R, f2, w RR-334, NRC-Mean BLK190(NW) 49 STC change by Lining ΔR, f2, w No Lining, 0 Ianking STC for path Ff R, ff, w No Lining, 0 Ianking STC for path Ff R, ff, w ISO 15712-1, Eq. 28a and 31 49/2 + 49/2 + 4MX(0,0) + MIN(0,0)/2 + 5.8 + 7 = 63 Ianking STC for path Df R, Df, w ISO 15712-1, Eq. 28a and 31 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 5.8 + 7 = 63 Ianking STC for path Df R, Df, w ISO 15712-1, Eq. 28a and 31 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 5.8 + 7 = 63 Ianking STC for path Df R, Df, w ISO 15712-1, Eq. 28a and 31 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 5.8 + 7 = 63 Ianking STC for path Df R, Df, w No Lining, 0 60 67 Ianking STC for path Df R, f3, w No Lining, 0 65 65 Ianking STC for path Df R, f3, w No Lining, 0 64 | lanking Element F2: | | | | | | | |
| SYST C charge by Lining $\Delta R_F 2$, w No Lining, 0 'lanking Element 12: 0 49 Jobratory STC for 12 $R_1 2$, w No Lining, 0 'lanking STC for path Ff $R_F f, w$ ISO 15712-1, Eq. 28a and 31 49/2 + 49/2 + 4MAX(0,0) + MIN(0,0)/2 + 5.8 + 7 = 63 Janking STC for path Ff $R_F f, w$ ISO 15712-1, Eq. 28a and 31 52/2 + 49/2 + 4MAX(0,0) + MIN(0,0)/2 + 5.8 + 7 = 63 Janking STC for path Df $R_C f, w$ ISO 15712-1, Eq. 28a and 31 52/2 + 49/2 + 4MAX(0,0) + MIN(0,0)/2 + 5.8 + 7 = 63 Junction 2: Flanking STC for all paths Subset of Eq. 1.1 -0*LOG10(10^+6.4 + 10^+6.3 + 10^+6.3) = 59 unction 3 (Rigid-T/Soft Cross junction, 190 mm block separating wall / ISO mm concrete ceiling slab) 49 50 Janking Element T3: - - - 61 Janking STC for path Ff $R_F 3$, w No Lining , 0 - Janking STC for path Ff $R_F 3$, w No Lining , 0 0 - Janking STC for path Ff $R_F 3$, w No Lining , 0 0 - - Janking STC for path Ff $R_F 4$, w No Lining , | aboratory STC for F2 | R_F2,w | RR-334, NRC-Mean BLK190(NW) | | | 49 | | |
| lanking Element 12: R 49 aboratory STC for 12 R, f2,w RR-334, NRC-Mean BLK190(NW) 49 aboratory STC for path Ff Rf4,w ISO 15712-1, Eq. 28a and 31 49/2 + 52/2 + MAX(0,0) + MIN(0,0)/2 + 8.1 + 7 = 64 ilanking STC for path Fd Rf4,w ISO 15712-1, Eq. 28a and 31 49/2 + 52/2 + MAX(0,0) + MIN(0,0)/2 + 5.8 + 7 = 63 ilanking STC for path Df Rf0,w ISO 15712-1, Eq. 28a and 31 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 5.8 + 7 = 63 unction 2: Flanking STC for all paths Subset of Eq. 1.1 -0*LOGI0(10*-6.4 + 10*-6.3 + 10*-6.3) = 59 unction 3 (Rigid-T/Soft Cross junction, 190 mm block separating wall / 150 mm concrete celling slab) 49 55 unction 3 (Rigid-T/Soft Cross junction, 190 mm block separating wall / 150 mm concrete celling slab) 49 55 unction 17: aboratory STC for f3 R_F3,w RR-334, NRC-Mean BLK190(NW) 49 55 STC change by Lining AR_T3,w No Lining, 0 0 6 lanking STC for path Ff R_F1,w ISO 15712-1, Eq. 28a and 31 49/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 11.6 + 6 = 65 lanking STC for path Ff R_F1,w ISO 15712-1, Eq. 28a and 31 | ASTC change by Lining | ΔR_F2,w | No Lining , | | | 0 | | |
| aboratory STC for f2 R, f2, w RR-334, NRC-Mean BLK190(NW) A STC change by Lining A R, f2, w No Lining, I Sto I ST21-21, Eq. 28a and 31 49/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 5.1 + 7 = 64 Ianking STC for path Fd R, Fd, w ISO I ST12-1, Eq. 28a and 31 49/2 + 52/2 + MAX(0,0) + MIN(0,0)/2 + 5.1 + 7 = 63 Ianking STC for all paths Subset of Eq. 1.1 -10*LOG10(10*-6.4 + 10*-6.3) = 59 Intrition 3 [Rigid-T/Soft Cross iunction, 190 mm block separating wall / 150 mm concrete ceiling slab) Ianking STC for all paths Subset of Eq. 1.1 Intring, I Sto C change by Lining A R, F3, w RR-334, NRC-Mean BLK190(NW) 49 Iso C change by Lining A R, F3, w RR-334, NRC-Mean BLK190(NW) 49 Iso C change by Lining A R, F3, w RR-334, NRC-Mean BLK190(NW) 49 Ianking STC for path Ff R, Ff, w ISO 15712-1, Eq. 28a and 31 49/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 5.8 + 7 = 63 Intring STC change by Lining A R, F3, w RR-334, NRC-Mean BLK190(NW) 49 Iso C change by Lining A R, F3, w RR-334, NRC-Mean BLK190(NW) 49 Ianking STC for path Ff R, Ff, w ISO 15712-1, Eq. 28a and 31 49/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 6 = 65 Ianking STC for path Ff R, Ff, w ISO 15712-1, Eq. 28a and 31 49/2 + 52/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 6 = 65 Ianking STC for path Ff R, Ff, w ISO 15712-1, Eq. 28a and 31 49/2 + 52/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 6 = 65 Ianking STC for path Ff R, Ff, w ISO 15712-1, Eq. 28a and 31 49/2 + 52/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 6 = 65 Ianking STC for path Ff R, Ff, w ISO 15712-1, Eq. 28a and 31 49/2 + 52/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 6 = 65 Ianking STC for path Ff R, Ff, w ISO 15712-1, Eq. 28a and 31 49/2 + 52/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 6 = 65 Ianking STC for path Ff R, Ff, w ISO 15712-1, Eq. 28a and 31 49/2 + 52/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 6 = 65 Ianking STC for path Ff R, Ff, w R-334, NRC-Mean BLK190(NW) 49 Intring, Ianking STC for path Ff R, Ff, w ISO 15712-1, Eq. 28a and 31 49/2 + 52/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 7 = 66 Ianking STC for path Ff R, Ff, w ISO 15712-1, Eq. 28a and 31 49/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + | lanking Element f2: | | | | | | | |
| SYST C forage by Lining AR, f2,w No Lining, 0 ilanking STC for path Ff R, F/,w ISO 15712-1, Eq. 28a and 31 49/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8. 8 + 7 = 63 ilanking STC for path Fd R, Fd,w ISO 15712-1, Eq. 28a and 31 49/2 + 52/2 + MAX(0,0) + MIN(0,0)/2 + 5. 8 + 7 = 63 ilanking STC for path Fd R, Df,w ISO 15712-1, Eq. 28a and 31 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 5. 8 + 7 = 63 unction 3: fikigid-T/Soft Cross junction, 190 mm block separating wall / 150 mm concrete ceiling slab) 10*LOG10(10^-6.4 + 10^-6.3 + 10^-6.3) = 59 unction 3: fikigid-T/Soft Cross junction, 190 mm block separating wall / 150 mm concrete ceiling slab) 49 50 ilanking STC for Gr Gr 3 R, F3,w RR-334, NRC-Mean BLK190(NW) 49 50 ilanking STC for path Ff R, F3,w No Lining , 0 60 ilanking STC for path Ff R, F3,w No Lining , 0 61 ilanking STC for path Ff R, F3,w No Lining , 0 63 ilanking STC for path Ff R, F4,w No Lining , 0 64 65 ilanking STC for path Ff R, F4,w No Lining , 0 64 64 <td>aboratory STC for f2</td> <td>R_f2,w</td> <td>RR-334, NRC-Mean BLK190(NW)</td> <td></td> <td></td> <td>49</td> <td></td> <td></td> | aboratory STC for f2 | R_f2,w | RR-334, NRC-Mean BLK190(NW) | | | 49 | | |
| Hanking STC for path Ff R_Ff,w ISO 15712-1, Eq. 28a and 31 49/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.1 + 7 = 64 Hanking STC for path Fd R_Fd,w ISO 15712-1, Eq. 28a and 31 49/2 + 52/2 + MAX(0,0) + MIN(0,0)/2 + 5.8 + 7 = 63 unction 2: Flanking STC for path Df R_Of,w ISO 15712-1, Eq. 28a and 31 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 5.8 + 7 = 63 unction 3: (Rigid-T/Soft Cross junction. 190 mm block separating wall / 150 mm concrete ceiling slab) 1 10*LOG10(10^-6.4 + 10^-6.3 + 10^-6.3 + 10^-6.3) = 59 unction 3: (Rigid-T/Soft Cross junction. 190 mm block separating wall / 150 mm concrete ceiling slab) 49 55 STC change by Lining AR_F3,w RR-334, NRC-Mean BLK190(NW) 49 50 STC change by Lining AR_f3,w No Lining , 0 0 1 Hanking STC for path Fd R_f4,w No Lining , 0 0 1 Hanking STC for path Fd R_f4,w No Lining , 0 0 1 Hanking STC for path Fd R_f4,w No Lining , 0 0 1 Hanking STC for path Fd R_f4,w No Lining , 0 | STC change by Lining | ΔR_f2,w | No Lining , | | | 0 | | |
| Hanking STC for path Fd R_fd,w ISO 15712-1, Eq. 28a and 31 49/2 + 52/2 + MAX(0,0) + MIN(0,0)/2 + 5.8 + 7 = 63 Hanking STC for path Df R_Df,w ISO 15712-1, Eq. 28a and 31 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 5.8 + 7 = 63 unction 2: Flanking STC for all paths Subset of Eq. 1.1 -10*LOG10(10^-6.4 + 10^-6.3 + 10^-6.3) = 59 unction 3: (Rigid-T/Soft Cross junction, 190 mm block separating wall / 150 mm concrete ceiling slab) 49 50 Ianking Element F3: aboratory STC for F3 R_F3,w RR-334, NRC-Mean BLK190(NW) 49 aboratory STC for f3 R_f3,w RR-334, NRC-Mean BLK190(NW) 49 50 STC charge by Lining AR_f3,w No Lining, 0 0 Hanking STC for path Fd R_f3,w No Lining, 0 0 Ianking STC for path Fd R_f4,w No Lining, 0 0 Ianking STC for path Fd R_f4,w No Lining, 0 0 Ianking STC for path Fd R_f4,w SO 15712-1, Eq. 28a and 31 49/2 + 52/2 + MAX(0,0) + MIN(0,0)/2 + 11.6 + 6 = 65 Ianking STC for path Fd R_f4,w SUbset of Eq. 1.1 -10*LOG10(10^-6.7 + 10^-6.5 + 10^-6.5) = 61 < | lanking STC for path Ff | R_ Ff,w | ISO 15712-1, Eq. 28a and 31 | 49/2 | + 49/2 + MAX(0,0) | + MIN(0,0)/2 + 8.1 + 7 = | 64 | |
| Hanking STC for path Df R_Df,w ISO 15712-1, Eq. 28a and 31 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 5.8 + 7 = 63 unction 2: Flanking STC for all paths Subset of Eq. 1.1 - 10*LOG10(10~-6.4 + 10~-6.3 + 10~-6.5 + 10~- | lanking STC for path Fd | R_ Fd,w | ISO 15712-1, Eq. 28a and 31 | 49/2 | + 52/2 + MAX(0,0) | + MIN(0,0)/2 + 5.8 + 7 = | 63 | |
| unction 2: Flanking STC for all paths Subset of Eq. 1.1 - 10*LOG10(10^-6.4 + 10^-6.3 + 10^-6.3) = 59 unction 3 (Rigid-L/Soft Cross junction, 190 mm block separating wall / 150 mm concrete ceiling slab) 49 59 lanking Element F3: 0 49 59 aboratory STC for F3 R_F3,w RR-334, NRC-Mean BLK190(NW) 49 50 STC change by Lining AR_F3,w No Lining, 0 60 lanking Element F3: 0 0 67 aboratory STC for F3 R_f3,w RR-334, NRC-Mean BLK190(NW) 49 0 storatory STC for F3 R_f3,w No Lining, 0 0 aboratory STC for F3 R_f4,w No Lining, 0 0 storatory STC for F4 R_f4,w No Lining, 0 0 lanking STC for path Ff R_f4,w No Lining, 0 0 lanking STC for F4 R_F4,w No Lining, 0 0 unction 3: Flanking STC for F4 R_F4,w No Lining, 0 0 lanking Element F4: 0 0 0 0 0 unction 4 (Rigid T-junction, | lanking STC for path Df | R_Df,w | ISO 15712-1, Eq. 28a and 31 | 52/2 | + 49/2 + MAX(0,0) | + MIN(0,0)/2 + 5.8 + 7 = | 63 | |
| unction 3 (Rigid-T/Soft Cross junction, 190 mm block separating wall / 150 mm concrete ceiling slab)lanking Element F3: aboratory STC for F3R_F3,wRR-334, NRC-Mean BLK190(NW)49SSTC change by Lining ahning Element f3: aboratory STC for f3R_f3,wRR-334, NRC-Mean BLK190(NW)49SSTC change by Lining ahning Element f3: aboratory STC for path FfR_f4,wNo Lining, 00'anking STC for path FfR_ff,wISO 15712-1, Eq. 28a and 3149/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 11.6 + 6 = 67'anking STC for path FfR_fd,wSubset of Eq. 1.1-10*LOG10(10^-6.7 + 10^- 6.5 + 10^- 6.5) = 61unction 3: Flanking STC for all pathsSubset of Eq. 1.1-10*LOG10(10^-6.7 + 10^- 6.5 + 10^- 6.5) = 61unction 4 (Rigid T-junction, 190 mm block separating wall / 190 mm block flanking wall)49lanking Element F4: aboratory STC for F4R_F4,wRR-334, NRC-Mean BLK190(NW)aboratory STC for f4R_f4,wNo Lining, 0lanking STC for path FfR_f4,wRR-334, NRC-Mean BLK190(NW)STC change by Lining aboratory STC for f4R_F4,wNo Lining, 0lanking STC for path FfR_f4,wRR-334, NRC-Mean BLK190(NW)49STC change by Lining aboratory STC for f4R_f4,wNo Lining, 0lanking STC for path FfR_f4,wNo Lining, 00lanking STC for path FfR_f4,wNo Lining, 00lanking STC for path FfR_f4,wNo Lining, 00lanking STC for path FfR_f4,wNo Lining, 00 | unction 2: Flanking STC for al | l paths | Subset of Eq. 1.1 | - | 10*LOG10(10^-6.4 | + 10^- 6.3 + 10^- 6.3) = | | 59 |
| Lunction 3 (Rigid-T/Soft Cross junction, 190 mm block separating wall / 150 mm concrete celling slab) 49 :lanking Element F3: | | | | | | | | |
| ianking Element F3: A RF-3.w RR-334, NRC-Mean BLK190(NW) 49 aboratory STC for F3 R_F3,w No Lining , 0 ianking Element f3: 0 0 aboratory STC for F3 R_f3,w No Lining , 0 STC change by Lining $\Delta R_1^{-73},w$ No Lining , 0 aboratory STC for F3 R_f3,w No Lining , 0 STC change by Lining $\Delta R_1^{-73},w$ No Lining , 0 ianking STC for path Ff R_f4,w No Lining , 0 ianking STC for path Df R_ed,w 49/2 + 52/2 + 4MAX(0,0) + MIN(0,0)/2 + 8.8 + 6 = 65 ianking STC for path Df R_of,w Subset of Eq. 1.1 -10*LOG10(10^{-6.7} + 10^{-6.5} + 10^{-6.5} + 10^{-6.5} = 61 unction 3: Flanking STC for F4 R_f4,w Rr-334, NRC-Mean BLK190(NW) 49 49 SSTC change by Lining $\Delta R_1^{-4},w$ No Lining , 0 0 10*LOG10(10^{-6.7} + 10^{-6.5} + 10^{-6.5}) = 61 unction 4: Rigid T-junction, 190 mm block separating wall / 190 mm block flanking wall) 10 0 10*LOG1(10^{-6.7} + 10^{-6.7} + 10^{-6.7} + 10^{-6.7} + 10^{-6.7} + 10^{-6.7} + 10^{-6.7} + 10^{-6.7} + 10^{-7.7} + 10^{-7.7} + 1 | unction 3 (Rigid-T/Soft Cross | junction, 190 mm | block separating wall / 150 mm concrete | ceiling slab | <u>)</u> | | | |
| aboratory SIC tor F3 R_F3,w RR-334, NRC-Mean BLK190(NW) 49 SSTC change by Lining ΔR_F3,w No Lining, 0 aboratory STC for f3 R_f3,w No Lining, 0 aboratory STC for f3 R_f3,w No Lining, 0 starking STC for path Ff R_Ff,w ISO 15712-1, Eq. 28a and 31 49/2+49/2 + MAX(0,0) + MIN(0,0)/2 + 18.8 + 6 = 65 alanking STC for path Fd R_Fd,w ISO 15712-1, Eq. 28a and 31 49/2+49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 6 = 65 alanking STC for path Fd R_Fd,w ISO 15712-1, Eq. 28a and 31 49/2+49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 6 = 65 unction 4 (Rigid T-junction, 190 mm block separating wall / 190 mm block flanking wall) 10*LOG10(10^-6.7 + 10^- 6.5 + 10^- 6.5) = 61 unction 4 (Rigid T-junction, 190 mm block separating wall / 190 mm block flanking wall) 10*LOG10(10^-6.7 + 10^- 6.5 + 10^- 6.5) = 61 unction 4 (Rigid T-junction, 190 mm block separating wall / 190 mm block flanking wall) 10*LOG10(10^-6.7 + 10^- 6.5 + 10^- 6.5) = 61 unction 4 (Rigid T-junction, 190 mm block separating wall / 190 mm block flanking wall) 10*LOG10(10^-6.7 + 10^- 6.5 + 10^- 6.5) = 61 unction 4 (Rigid T-junction, 190 mm block separating wall / 190 mm block flanking wall) 0 | lanking Element F3: | 5.53 | | | | 10 | | |
| $\begin{aligned} & \text{LSTC change by Lining} & \Delta R_{=3}, & \text{No Lining}, & \text{O} & \text{O}$ | aboratory SIC for F3 | R_F3,W | RR-334, NRC-Mean BLK190(NW) | | | 49 | | |
| lanking Lement 13:aboratory STC for f3R_f3,wRR-334, NRC-Mean BLK190(NW)49aboratory STC for path FfR_f4,wISO 15712-1, Eq. 28a and 31 $49/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 11.6 + 6 = 67$ lanking STC for path FdR_fd,w $49/2 + 52/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 6 = 65$ lanking STC for path DfR_Df,w $52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 6 = 65$ unction 3: Flanking STC for all pathsSubset of Eq. 1.1 $-10*LOG10(10^{-6.7} + 10^{6.5} + 10^{6.5}) = 61$ unction 4 (Rigid T-junction, 190 mm block separating wall / 190 mm block flanking wall)49lanking Element F4: aboratory STC for F4R_F4,wRR-334, NRC-Mean BLK190(NW)49SSTC change by Lining lanking STC for path FfR_f4,wRR-334, NRC-Mean BLK190(NW)49SSTC change by Lining lanking STC for f4A_f4,wNo Lining , 00aboratory STC for F4R_f4,wRR-334, NRC-Mean BLK190(NW)49SSTC change by Lining aboratory STC for f4A_f4,wNo Lining , 00lanking STC for path FfR_f4,wNo Lining , 00lanking | ASTC change by Lining | ΔR_F3,W | No Lining , | | | 0 | | |
| aboratory SIC for 13 R_13,w RR-334, NRC-Mean BLK190(NW) 49 SSTC change by Lining AR_f3,w No Lining , 0 'lanking STC for path Ff R_Ff,w ISO 15712-1, Eq. 28a and 31 49/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 11.6 + 6 = 67 'lanking STC for path Ff R_Fd,w S0 15712-1, Eq. 28a and 31 49/2 + 52/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 6 = 65 'lanking STC for path Df R_Df,w Subset of Eq. 1.1 -10*LOG10(10^-6.7 + 10^- 6.5 + 10^- 6.5) = 61 unction 4 (Rigid T-junction, 190 mm block separating wall / 190 mm block flanking wall) -10*LOG10(10^-6.7 + 10^- 6.5 + 10^- 6.5) = 61 unction 4 (Rigid T-junction, 190 mm block separating wall / 190 mm block flanking wall) -10*LOG10(10^-6.7 + 10^- 6.5 + 10^- 6.5) = 61 unction 4 (Rigid T-junction, 190 mm block separating wall / 190 mm block flanking wall) -10*LOG10(10^-6.7 + 10^- 6.5 + 10^- 6.5) = 61 unction 4 (Rigid T-junction, 190 mm block separating wall / 190 mm block flanking wall) -0 -0 -0 'STC change by Lining AR_F4,w RR-334, NRC-Mean BLK190(NW) 49 -0 -0 'STC change by Lining AR_f4,w No Lining , 0 0 -0 -0 'stanking STC for path Ff <td>lanking Element 13:</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> | lanking Element 13: | | | | | | | |
| SIT C change by Lining ΔR_{-13} , w No Lining , 0 ilanking STC for path Ff R_{-} Ff, w ISO 15712-1, Eq. 28a and 31 $49/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 11.6 + 6 =$ 67 ilanking STC for path Fd R_{-} Fd, w $49/2 + 52/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 6 =$ 65 unction 3: Flanking STC for all paths Subset of Eq. 1.1 $-10*LOG10(10^{A-6.7} + 10^{A-6.5} + 10^{A-6.5}) =$ 61 unction 4 (Rigid T-junction, 190 mm block separating wall / 190 mm block flanking wall) $-10*LOG10(10^{A-6.7} + 10^{A-6.5} + 10^{A-6.5}) =$ 61 unction 4 (Rigid T-junction, 190 mm block separating wall / 190 mm block flanking wall) $-10*LOG10(10^{A-6.7} + 10^{A-6.5} + 10^{A-6.5}) =$ 61 unction 4 (Rigid T-junction, 190 mm block separating wall / 190 mm block flanking wall) $-10*LOG10(10^{A-6.7} + 10^{A-6.5} + 10^{A-6.5}) =$ 61 unction 4 (Rigid T-junction, 190 mm block separating wall / 190 mm block flanking wall) $-10*LOG10(10^{A-6.7} + 10^{A-6.5} + 10^{A-6.5}) =$ 61 unction 4 (Rigid T-junction, 190 mm block separating wall / 190 mm block flanking wall) 49 $51C + 10^{A-6.7} + 10^{A-6.5} + 10^{A-6.5} + 10^{A-6.5} + 10^{A-6.5} + 10^{A-6.5} + 10^{A-6.5} + 10^{A-6.6} +$ | aboratory STC for f3 | R_f3,w | RR-334, NRC-Mean BLK190(NW) | | | 49 | | |
| Hanking STC for path Fd R_Ft,w ISO 15/12-1, Eq. 28a and 31 49/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 11.6 + 6 = 67 Hanking STC for path Fd R_Fd,w 49/2 + 52/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 6 = 65 65 Hanking STC for path Df R_Df,w 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 6 = 65 65 unction 3: Flanking STC for all paths Subset of Eq. 1.1 -10*LOG10(10^-6.7 + 10^-6.5 + 10^-6.5) = 61 61 unction 4 (Rigid T-junction, 190 mm block separating wall / 190 mm block flanking wall) -10*LOG10(10^-6.7 + 10^-6.5 + 10^-6.5) = 61 61 unction 4 (Rigid T-junction, 190 mm block separating wall / 190 mm block flanking wall) -10*LOG10(10^-6.7 + 10^-6.5 + 10^-6.5) = 61 61 unction 4 (Rigid T-junction, 190 mm block separating wall / 190 mm block flanking wall) -10*LOG10(10^-6.7 + 10^-6.5 + 10^-6.5) = 61 61 unction 4 (Rigid T-junction, 190 mm block separating wall / 190 mm block flanking wall) 49 -10*LOG10(10^-6.7 + 10^-6.5 + 10^-6.5) = 61 unction 4 (Rigid T-junction, 190 mm block separating wall / 190 mm block flanking wall) 49 -10*LOG10(10^-6.7 + 10^-6.5 + 10^-7 + 10^ | SIC change by Lining | Δκ_13,w | No Lining , | (= /= | 10/0 | | | |
| tanking STC for path FdR_Fd,w $49/2 + 52/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 6 = 65$ tanking STC for path DfR_Df,w $52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 6 = 65$ unction 3: Flanking STC for all pathsSubset of Eq. 1.1 $-10*LOG10(10^{-}6.7 + 10^{-}6.5 + 10^{-}6.5) = 61$ unction 4 (Rigid T-junction, 190 mm block separating wall / 190 mm block flanking wall)10*LOG10(10^{-}6.7 + 10^{-}6.5 + 10^{-}6.5) = 61unction 4 (Rigid T-junction, 190 mm block separating wall / 190 mm block flanking wall)49thanking Element F4:0aboratory STC for F4R_F4,wRR-334, NRC-Mean BLK190(NW)49VSTC change by Lining $\Delta R_F4, W$ No Lining ,0tanking Element f4:0aboratory STC for f4R_f4,wNo Lining ,0tanking STC for path FfR_f4,wNo Lining ,0tanking STC for path Ff <td< td=""><td>ianking STC for path Ff</td><td>R_Ft,w</td><td>ISO 15712-1, Eq. 28a and 31</td><td>49/2 +</td><td>49/2 + MAX(0,0) +</td><td>MIN(0,0)/2 + 11.6 + 6 =</td><td>67</td><td></td></td<> | ianking STC for path Ff | R_Ft,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + | 49/2 + MAX(0,0) + | MIN(0,0)/2 + 11.6 + 6 = | 67 | |
| Hanking STC for path DTR_DT, w $52/2 + 49/2 + 4MAX(0,0) + MIN(0,0)/2 + 8.8 + 6 =$ 65unction 3: Flanking STC for all pathsSubset of Eq. 1.1 $-10^{+}LOG10(10^{-}6.7 + 10^{-}6.5 + 10^{-}6.5) =$ 61unction 4 (Rigid T-junction, 190 mm block separating wall / 190 mm block flanking wall)100^{+}LOG10(10^{-}6.7 + 10^{-}6.5 + 10^{-}6.5) =61unction 4 (Rigid T-junction, 190 mm block separating wall / 190 mm block flanking wall)49100^{-}LOFAC100^{-}LOFAClanking Element F4:049100^{-}LOFAC100^{-}LOFAC100^{-}LOFACaboratory STC for F4R_F4,wNc Lining ,00lanking Element f4:00100^{-}LOFAC100^{-}LOFACaboratory STC for f4R_f4,wNo Lining ,00Ianking STC for path FfR_f4,wNo Lining ,00Ianking STC for path FfR_f4,wISO 15712-1, Eq. 28a and 3149/2 + 52/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 7 =66Ianking STC for path DfR_Df,wISO 15712-1, Eq. 28a and 3152/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 7 =66Ianking STC for path | ianking STC for path Fd | K_Fd,w | | 49/2 | + 52/2 + MAX(0,0) | + IVIIN(0,0)/2 + 8.8 + 6 = | 65 | |
| unction 3: Hanking STC for all pathsSubset of Eq. 1.1 $-10*LOG10(10^{-6.7} + 10^{-6.5} + 10^{-6.5}) =$ 61unction 4 (Rigid T-junction, 190 mm block separating wall / 190 mm block flanking wall)ianking flement F4:ianking Element F4:aboratory STC for F4R_F4,wRR-334, NRC-Mean BLK190(NW)49USTC change by Lining $\Delta R_F4,w$ No Lining ,0ianking Element f4:ianking Element f4:0aboratory STC for f4R_f4,wRR-334, NRC-Mean BLK190(NW)49USTC change by Lining $\Delta R_F4,w$ No Lining ,0ianking STC for path FfR_f4,wNo Lining ,0ianking STC for path FfR_f4,wNo Lining ,0ianking STC for path FfR_f4,wISO 15712-1, Eq. 28a and 3149/2 + 52/2 + MAX(0,0) + MIN(0,0)/2 + 11.6 + 7 =ianking STC for path FfR_fd,wISO 15712-1, Eq. 28a and 3152/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 7 =ianking STC for path DfR_of,wISO 15712-1, Eq. 28a and 3152/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 7 =ianking STC for path DfR_of,wISO 15712-1, Eq. 28a and 3152/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 7 =iotal Flanking STC for all pathsSubset of Eq. 1.1-10*LOG10(10^{-6.8} + 10^{-6.6} + 10^{-6.6} + 10^{-6.6} + 6.6 =iotal Flanking STC (4 Junctions)Subset of Eq. 1.1Combining 12 Flanking STC values54 | ianking STC for path Df | R_Df,w | | 52/2 | + 49/2 + MAX(0,0) | + MIN(0,0)/2 + 8.8 + 6 = | 65 | |
| unction 4 (Rigid T-junction, 190 mm block separating wall / 190 mm block flanking wall) Image: Separating wall / 190 mm block flanking wall) lanking Element F4: Image: Separating wall / 190 mm block flanking wall) 49 aboratory STC for F4 R_F4,w RR-334, NRC-Mean BLK190(NW) 49 SSTC change by Lining ΔR_F4,w No Lining , 0 lanking Element F4: Image: Separating wall / 190 mm block flanking (NW) 49 aboratory STC for F4 R_f4,w No Lining , 0 lanking Element F4: Image: Separating wall / 190 mm block flanking (NW) 49 sSTC change by Lining ΔR_f4,w No Lining , 0 lanking STC for path Ff R_ff,w ISO 15712-1, Eq. 28a and 31 49/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 11.6 + 7 = 68 lanking STC for path Ff R_Fd,w ISO 15712-1, Eq. 28a and 31 49/2 + 52/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 7 = 66 lanking STC for path Df R_Df,w ISO 15712-1, Eq. 28a and 31 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 7 = 66 unction 4: Flanking STC for all paths Subset of Eq. 1.1 -10*LOG10(10^-6.8 + 10^- 6.6 + 10^- 6.6 + 10^- 6.6 + 10^- 6.6 + 10^- 6.6 + 10^- 6.6 + 10^- 6.6 + 10^- 6.6 + 10^- 6.6 + 10^ | unction 3: Flanking STC for al | I paths | Subset of Eq. 1.1 | - | 10*LOG10(10^-6.7 | + 10^- 6.5 + 10^- 6.5) = | | 61 |
| Ianking Element F4: aboratory STC for F4R_F4,wRR-334, NRC-Mean BLK190(NW)49SSTC change by Lining $\Delta R_F4, w$ No Lining ,0Ianking Element f4: aboratory STC for f4R_f4,wRR-334, NRC-Mean BLK190(NW)49SSTC change by Lining $\Delta R_F4, w$ RR-334, NRC-Mean BLK190(NW)49SSTC change by Lining $\Delta R_F4, w$ No Lining ,0Ianking STC for f4R_f4, wNo Lining ,0SSTC change by Lining $\Delta R_F4, w$ No Lining ,0Ianking STC for path FfR_Ff, wISO 15712-1, Eq. 28a and 31 $49/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 11.6 + 7 =$ 68Ianking STC for path FdR_Fd, wISO 15712-1, Eq. 28a and 31 $49/2 + 52/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 7 =$ 66Ianking STC for path DfR_Df, wISO 15712-1, Eq. 28a and 31 $52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 7 =$ 66Ianking STC for path DfR_Df, wISO 15712-1, Eq. 28a and 31 $52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 7 =$ 66Ianking STC for all pathsSubset of Eq. 1.1 $-10*LOG10(10^{-6.8} + 10^{-6.6} + 10^{-6.6} + 0 = 6262Total Flanking STC (4 Junctions)Subset of Eq. 1.1Combining 12 Flanking STC values54$ | unction 4 (Rigid T-junction, 1 | 90 mm block separ | ating wall / 190 mm block flanking wall) | | | | | |
| aboratory STC for F4 R_F4,w RR-334, NRC-Mean BLK190(NW) 49 SSTC change by Lining $\Delta R_F4, w$ No Lining , 0 aboratory STC for f4 R_f4,w No Lining , 0 aboratory STC for f4 R_f4,w RR-334, NRC-Mean BLK190(NW) 49 SSTC change by Lining $\Delta R_1f4, w$ No Lining , 0 SSTC change by Lining $\Delta R_1f4, w$ No Lining , 0 SSTC change by Lining $\Delta R_1f4, w$ No Lining , 0 SSTC change by Lining $\Delta R_1f4, w$ No Lining , 0 SSTC for path Ff R_Ff, w ISO 15712-1, Eq. 28a and 31 49/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 7 = 66 Glanking STC for path Fd R_fd, w ISO 15712-1, Eq. 28a and 31 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 7 = 66 Glanking STC for path Df R_Df, w ISO 15712-1, Eq. 28a and 31 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 7 = 66 Glanking STC for all paths Subset of Eq. 1.1 -10*LOG10(10^-6.8 + 10^-6.6 + 10^- | lanking Element F4: | | | | | | | |
| $ \begin{array}{c c c c c c c c c c c c c c c c c c c $ | aboratory STC for F4 | R_F4,w | RR-334, NRC-Mean BLK190(NW) | | | 49 | | |
| Hanking Element f4: A R_f4,w RR-334, NRC-Mean BLK190(NW) 49 Asboratory STC for f4 R_f4,w No Lining , 0 SSTC change by Lining AR_f4,w No Lining , 0 Hanking STC for path Ff R_Ff,w ISO 15712-1, Eq. 28a and 31 49/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 11.6 + 7 = 68 Hanking STC for path Fd R_Fd,w ISO 15712-1, Eq. 28a and 31 49/2 + 52/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 7 = 66 Hanking STC for path Df R_Df,w ISO 15712-1, Eq. 28a and 31 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 7 = 66 Hanking STC for path Df R_Df,w ISO 15712-1, Eq. 28a and 31 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 7 = 66 Hanking STC for all paths Subset of Eq. 1.1 -10*LOG10(10^{-6.8 + 10^{-6.6 + | STC change by Lining | ΔR_F4,w | No Lining , | | | 0 | | |
| aboratory STC for f4 R_f4,w RR-334, NRC-Mean BLK190(NW) 49 STC change by Lining ΔR_1^4 ,w No Lining , 0 ilanking STC for path Ff R_ff,w ISO 15712-1, Eq. 28a and 31 49/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 11.6 + 7 = 68 ilanking STC for path Fd R_fd,w ISO 15712-1, Eq. 28a and 31 49/2 + 52/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 7 = 66 ilanking STC for path Df R_Df,w ISO 15712-1, Eq. 28a and 31 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 7 = 66 unction 4: Flanking STC for all paths Subset of Eq. 1.1 -10*LOG10(10^-6.8 + 10^6.6 + 10^6.6) = 62 otal Flanking STC (4 Junctions) Subset of Eq. 1.1 Combining 12 Flanking STC values 54 | lanking Element f4: | | | | | | | |
| ΔR_f4,w No Lining , 0 Hanking STC for path Ff R_f4,w No Lining , 0 Hanking STC for path Ff R_f4,w ISO 15712-1, Eq. 28a and 31 49/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 11.6 + 7 = 68 Hanking STC for path Fd R_f4,w ISO 15712-1, Eq. 28a and 31 49/2 + 52/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 7 = 66 Hanking STC for path Df R_Df,w ISO 15712-1, Eq. 28a and 31 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 7 = 66 Janking STC for all paths Subset of Eq. 1.1 -10*LOG10(10^A-6.8 + 10^A-6.6 + 10^A-6.6) = 62 Total Flanking STC (4 Junctions) Subset of Eq. 1.1 Combining 12 Flanking STC values 54 | aboratory STC for f4 | R_f4,w | RR-334, NRC-Mean BLK190(NW) | | | 49 | | |
| Hanking STC for path Ff R_ Ff,w ISO 15712-1, Eq. 28a and 31 49/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 11.6 + 7 = 68 Hanking STC for path Fd R_ Fd,w ISO 15712-1, Eq. 28a and 31 49/2 + 52/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 7 = 66 Hanking STC for path Df R_ Df,w ISO 15712-1, Eq. 28a and 31 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 7 = 66 Unction 4: Flanking STC for all paths Subset of Eq. 1.1 -10*LOG10(10^-6.8 + 10^-6.6 + 10^-6.6) = 62 Total Flanking STC (4 Junctions) Subset of Eq. 1.1 Combining 12 Flanking STC values 54 | STC change by Lining | ΔR_f4,w | No Lining , | | | 0 | | |
| Ianking STC for path Fd R_Fd,w ISO 15712-1, Eq. 28a and 31 49/2 + 52/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 7 = 66 Ianking STC for path Df R_Df,w ISO 15712-1, Eq. 28a and 31 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 7 = 66 unction 4: Flanking STC for all paths Subset of Eq. 1.1 -10*LOG10(10^-6.8 + 10^-6.6 + 10^-6.6) = 62 otal Flanking STC (4 Junctions) Subset of Eq. 1.1 Combining 12 Flanking STC values 54 | lanking STC for path Ff | R_ Ff,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + | 49/2 + MAX(0,0) + | MIN(0,0)/2 + 11.6 + 7 = | 68 | |
| ilanking STC for path Df R_Df,w ISO 15712-1, Eq. 28a and 31 52/2 + 49/2 + MAX(0,0) + MIN(0,0)/2 + 8.8 + 7 = 66 unction 4: Flanking STC for all paths Subset of Eq. 1.1 -10*LOG10(10^-6.8 + 10^- 6.6 + 10^- 6.6) = 62 otal Flanking STC (4 Junctions) Subset of Eq. 1.1 Combining 12 Flanking STC values 54 | lanking STC for path Fd | R_ Fd,w | ISO 15712-1, Eq. 28a and 31 | 49/2 | + 52/2 + MAX(0,0) | + MIN(0,0)/2 + 8.8 + 7 = | 66 | |
| unction 4: Flanking STC for all paths Subset of Eq. 1.1 -10*LOG10(10^-6.8 + 10^- 6.6 + 10^- 6.6) = 62 Total Flanking STC (4 Junctions) Subset of Eq. 1.1 Combining 12 Flanking STC values 54 | lanking STC for path Df | R_ Df,w | ISO 15712-1, Eq. 28a and 31 | 52/2 | + 49/2 + MAX(0,0) | + MIN(0,0)/2 + 8.8 + 7 = | 66 | |
| Total Flanking STC (4 Junctions) Subset of Eq. 1.1 Combining 12 Flanking STC values 54 | unction 4: Flanking STC for al | l paths | Subset of Eq. 1.1 | - | 10*LOG10(10^-6.8 | + 10^- 6.6 + 10^- 6.6) = | | 62 |
| | otal Flanking STC (4 Junction | s) | Subset of Eq. 1.1 | | Combinin | g 12 Flanking STC values | | 54 |
| IS If due to Direct plus All Flanking Vaths Found to this Report Completing Direct Stream and Strea | STC due to Direct plus All Ele | unking Daths | Equation 1.1 of this Poport | Comb | ining Direct STC wit | h 12 Flanking STC values | 50 | |

| EXAMPLE 4.1.1-V2: | | (SIMPLIFIED METHOD) |) | Ilustratio | on for this cas | se |
|---|--|--|------------|------------|---|--|
| Rooms one-above-th Loadbearing normal floors with rigid junc (Same structure as 4) | e-other weight concrete tions .1.1-V1, plus linii | block walls and concre | ete | | F1, F3 | |
| <u>Separating floor/ceiling assembly with:</u> concrete floor with mass 345 kg/m² (e.g. normal weight concrete with thickness of 150 mm) with no topping / flooring on top, or ceiling lining below <u>Junction 1, 3, 4: Cross Junction of separating floor / flanking wall with:</u> rigid mortared cross junction with concrete block wall assemblies. wall above and below floor of one wythe of 190 mm hollow concrete blocks with normal weight aggregate¹, with mass 238 kg/m² flanking walls lined with 13 mm gypsum board³ on 65 mm non-loadbearing steel studs spaced 610 mm o.c. with absorptive material² filling inter-stud cavities <u>Junction 2: T-Junction of separating floor / flanking wall with:</u> rigid mortared T-junctions with concrete block wall assemblies wall above and below floor of one wythe of 190 mm hollow concrete blocks with normal weight aggregate flanking walls with: | | | | | f1, f3 f1, f3 anction of sepa a concrete with I. (Side view o | arating floor of 150 n 190 mm concrete f Junctions 1 or 3) |
| flanking walls lined w loadbearing steel stud material² filling inter-stud <u>Acoustical Parameters:</u> | ith 13 mm gypsı ds spaced 610 d cavities | um board°on 65mm no mm o.c. with absorpti | on- ive | | F2 | |
| For 190 mm concrete block w | alle | | | | D, | |
| Mass (upit area (kg/m^2) = | 229 () | Nall at junctions 18.2) | | | \ | |
| | 238 (1 | Mail at junctions 183 | | | N SALAN AN | |
| | 238 (1 | vali at junctions 2&4) | | | A. 155 | A STATE AND A STATE |
| For 150 mm concrete floor: | | | | | 1 T | |
| Mass/uni | t area (kg/m²) = <mark>3</mark> | 45 | | | 1 | |
| | | | | | d | K Harris |
| Separating partit | $(m^2) = 2$ | 0 | | | | |
| Junction 1 and | 3 length (m) = 5 | .0 | | | 1 | |
| Junction 2 and | 4 length (m) = 4 | .0 | | | fź | 2 |
| 10*log(S Partition/l | iunction $1\&3) =$ | 60 | | | | |
| 10*log(S_Partition/l | iunction 2 & 4) = | 7.0 | ٦ | T-Junctio | n of separatir | ng floor of 150 mm |
| | | | | | crete with 190 le view of Jun e lining details, | mm concrete block ction 2. Junction 4 but cross junction) |
| | | | | | | |
| | | Path Ff | Pa | th Fd | Path Df | |
| Junction | Mass ratio for Ff | Kij (in dB) = | | - | | Reference |
| 1 Rigid-Cross junction | 1.45 | 11.6 | 5 | 8.8 | 8.8 | ISO 15712-1, Eq. E.3 |
| 2 Rigid-T junction | 1.45 | 8.1 | Į | 5.8 | 5.8 | ISO 15712-1, Eq. E.4 |
| 3 Rigid-Cross junction | 1.45 | 11.6 | 8 | 8.8 | 8.8 | ISO 15712-1, Eq. E.3 |
| 4 Rigid-Cross junction | 1.45 | 11.6 | 8 | 8.8 | 8.8 | ISO 15712-1, Eq. E.3 |

| | ISO Symbol | Reference | | | stc, Δ_stc | AST | с |
|---------------------------------|-------------------|---|---|-----------------------|-----------------------------|-----|-----------------|
| Separating Partition (190 mm | concrete block) | | | | | | |
| Laboratory STC for Dd | R_s,w | RR-333, TLF-97-107a | | | 52 | | |
| ΔSTC change by Lining on D | ΔR_D,w | No Lining , | | | 0 | | |
| ΔSTC change by Lining on d | ΔR_d,w | No Lining , | | | 0 | | |
| Direct STC in situ | R_Dd,w | ISO 15712-1, Eq. 24 and 30 | | 52 + 1 | MAX(0,0) + MIN(0,0)/2 = | 52 | |
| Junction 1 (Rigid-T/Soft Cross | junction, 190 mm | block separating wall / 150 mm co | oncrete floor) | | | | |
| Flanking Element F1: | | | | | | | |
| Laboratory STC for F1 | R_F1,w | RR-334, NRC-Mean BLK190(NV | /) | | 49 | | |
| ΔSTC change by Lining | ΔR_F1,w | RR-334, ΔTL-BLK(NW)-62, SS65 | 5_GFB_G13 | | 19 | | |
| Flanking Element f1: | | | | | | | |
| Laboratory STC for f1 | R_f1,w | RR-334, NRC-Mean BLK190(NV | /) | | 49 | | |
| ΔSTC change by Lining | ΔR_f1,w | RR-334, ΔTL-BLK(NW)-62, SS65 | 5_GFB_G13 | | 19 | | |
| Flanking STC for path Ff | R_ Ff,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 49/2 | 2 + MAX(19,19) + N | /IN(19,19)/2 + 11.6 + 6 = | 90 | (limit) |
| Flanking STC for path Fd | R_ Fd,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + | 52/2 + MAX(19,0) · | + MIN(19,0)/2 + 8.8 + 6 = | 84 | |
| Flanking STC for path Df | R_ Df,w | ISO 15712-1, Eq. 28a and 31 | 52/2 + | 49/2 + MAX(0,19) | + MIN(0,19)/2 + 8.8 + 6 = | 84 | |
| Junction 1: Flanking STC for al | l paths | Subset of Eq. 1.1 | | - 10*LOG10(10^-9 | 9 + 10^- 8.4 + 10^- 8.4) = | | 80 |
| Junction 2 (Rigid T-Junction, 1 | 90 mm block separ | ating wall / 190 mm block flankin | g wall) | | | | |
| Flanking Element F2: | | | | | | | |
| Laboratory STC for F2 | R_F2,w | RR-334, NRC-Mean BLK190(NV | /) | | 49 | | |
| ΔSTC change by Lining | ΔR_F2,w | RR-334, ΔTL-BLK(NW)-62, SS65_GFB_G13 | | | 19 | | |
| Flanking Element f2: | | | | | | | |
| Laboratory STC for f2 | R_f2,w | RR-334, NRC-Mean BLK190(NW) 49 | | | | | |
| ΔSTC change by Lining | ΔR_f2,w | RR-334, ΔTL-BLK(NW)-62, SS65 | RR-334, ΔTL-BLK(NW)-62, SS65_GFB_G13 19 | | | | |
| Flanking STC for path Ff | R Ff,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 49 | /2 + MAX(19,19) + | MIN(19,19)/2 + 8.1 + 7 = | 90 | (limit) |
| Flanking STC for path Fd | R_Fd,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + | 52/2 + MAX(19,0) · | + MIN(19,0)/2 + 5.8 + 7 = | 82 | |
| Flanking STC for path Df | R_Df,w | ISO 15712-1, Eq. 28a and 31 52/2 + 49/2 + MAX(0,19) + MIN(0,19)/2 + 5.8 + 7 = | | | | 82 | |
| Junction 2: Flanking STC for al | paths | Subset of Eq. 1.1 | | - 10*LOG10(10^-9 | 9 + 10^- 8.2 + 10^- 8.2) = | | <mark>79</mark> |
| | | | | - | | | |
| Junction 3 (Rigid-T/Soft Cross | junction, 190 mm | <u>block separating wall / 150 mm co</u> | oncrete ceiling slat | <u>o)</u> | | | |
| Flanking Element F3: | | | | | | | |
| Laboratory STC for F3 | R_F3,w | RR-334, NRC-Mean BLK190(NV | /) | | 49 | | |
| ΔSTC change by Lining | ΔR_F3,w | RR-334, ΔTL-BLK(NW)-62, SS65 | GFB_G13 | | 19 | | |
| Flanking Element f3: | | | | | | | |
| Laboratory STC for f3 | R_f3,w | RR-334, NRC-Mean BLK190(NV | /) | | 49 | | |
| ΔSTC change by Lining | ΔR_f3,w | RR-334, ΔTL-BLK(NW)-62, SS65 | GFB_G13 | | 19 | | |
| Flanking STC for path Ff | R_Ff,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 49/2 | 2 + MAX(19,19) + N | /IN(19,19)/2 + 11.6 + 6 = | 90 | (limit) |
| Flanking STC for path Fd | R_Fd,w | | 49/2 + | 52/2 + MAX(19,0) | + MIN(19,0)/2 + 8.8 + 6 = | 84 | |
| Flanking STC for path Df | R_Df,w | | 52/2 + | 49/2 + MAX(0,19) | + MIN(0,19)/2 + 8.8 + 6 = | 84 | |
| Junction 3: Flanking STC for al | l paths | Subset of Eq. 1.1 | | - 10*LOG10(10^-9 | 9 + 10^- 8.4 + 10^- 8.4) = | | 80 |
| Junction 4 (Rigid T-junction, 1 | 90 mm block separ | ating wall / 190 mm block flankin | g wall) | | | | |
| Flanking Element F4: | | | | | | | |
| Laboratory STC for F4 | R_F4,w | RR-334, NRC-Mean BLK190(NV | /) | | 49 | | |
| ΔSTC change by Lining | ΔR_F4,w | RR-334, ΔTL-BLK(NW)-62, SS65 | GFB_G13 | | 19 | | |
| Flanking Element f4: | | | | | | | |
| Laboratory STC for f4 | R_f4,w | RR-334, NRC-Mean BLK190(NV | /) | | 49 | | |
| ΔSTC change by Lining | ΔR_f4,w | RR-334, ΔTL-BLK(NW)-62, SS65 | GFB_G13 | | 19 | | |
| Flanking STC for path Ff | R_ Ff,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 49/2 | 2 + MAX(19,19) + N | /IN(19,19)/2 + 11.6 + 7 = | 90 | (limit) |
| Flanking STC for path Fd | R_ Fd,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + | 52/2 + MAX(19,0) | + MIN(19,0)/2 + 8.8 + 7 = | 85 | |
| Flanking STC for path Df | R_ Df,w | ISO 15712-1, Eq. 28a and 31 | 52/2 + | 49/2 + MAX(0,19) | + MIN(0,19)/2 + 8.8 + 7 = | 85 | |
| Junction 4: Flanking STC for al | paths | Subset of Eq. 1.1 | | - 10*LOG10(10^-9 | 9 + 10^- 8.5 + 10^- 8.5) = | | 81 |
| Total Flanking STC (4 Junction | 5) | Subset of Eq. 1.1 | | Combinir | ng 12 Flanking STC values | | 74 |
| | | | | | | | |
| ASTC due to Direct plus All Fla | nking Paths | Equation 1.1 of this Report | Comb | pining Direct STC wit | th 12 Flanking STC values | 52 | |



| | ISO Symbol | Reference | | | stc, Δ_stc | AS | тс |
|---------------------------------|---------------------|---|---|--|--|----|----|
| eparating Partition (190 mm | concrete block) | | | | | | |
| aboratory STC for Dd | R_s,w | RR-333, TLF-97-107a | | | 52 | | |
| STC change by Lining on D | ΔR_D,w | No Lining , | | | 0 | | |
| STC change by Lining on d | ΔR_d,w | RR-333, ATLF-CON150-01, SUS15 | 0_GFB150_G16 | | 19 | | |
| irect STC in situ | R_Dd,w | ISO 15712-1, Eq. 24 and 30 52 + MAX(0,19) + MIN(0,19)/2 = | | | | 71 | |
| unction 1 (Rigid-T/Soft Cross | junction, 190 mm l | block separating wall / 150 mm conc | rete floor) | | | | |
| lanking Element F1: | | | | | | | |
| aboratory STC for F1 | R_F1,w | RR-334, NRC-Mean BLK190(NW) | | | 49 | | |
| STC change by Lining | ΔR_F1,w | RR-334, ΔTL-BLK(NW)-61, SS65_C | 513 | | 2 | | |
| anking Element f1: | | | | | | | |
| aboratory STC for f1 | R_f1,w | RR-334, NRC-Mean BLK190(NW) | | | 49 | | |
| STC change by Lining | ΔR_f1,w | RR-334, ATL-BLK(NW)-61, SS65_C | 613 | | 2 | | |
| anking STC for path Ff | R_ Ff,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + | 49/2 + MAX(2,2) + | - MIN(2,2)/2 + 11.6 + 6 = | 70 | |
| anking STC for path Fd | R_ Fd,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 5 | 52/2 + MAX(2,19) + | + MIN(2,19)/2 + 8.8 + 6 = | 85 | |
| anking STC for path Df | R_ Df,w | ISO 15712-1, Eq. 28a and 31 | 52/2 | + 49/2 + MAX(0,2) | + MIN(0,2)/2 + 8.8 + 6 = | 67 | |
| Inction 1: Flanking STC for al | l paths | Subset of Eq. 1.1 | | - 10*LOG10(10^-7 | + 10^- 8.5 + 10^- 6.7) = | | 65 |
| unction 2 (Rigid T-Junction, 1 | 90 mm block separ | ating wall / 190 mm block flanking v | vall) | | | | |
| anking Element F2: | | | | | | | |
| aboratory STC for F2 | R_F2,w | RR-334, NRC-Mean BLK190(NW) | | | 49 | | |
| STC change by Lining | ΔR_F2,w | RR-334, ATL-BLK(NW)-61, SS65_0 | 513 | | 2 | | |
| lanking Element f2: | | | | | | | |
| aboratory STC for f2 | R_f2,w | RR-334, NRC-Mean BLK190(NW) | | | 49 | | |
| STC change by Lining | ΔR_f2,w | RR-334, ΔTL-BLK(NW)-61, SS65_C | 513 | | 2 | | |
| lanking STC for path Ff | R_ Ff,w | ISO 15712-1, Eq. 28a and 31 | ISO 15712-1, Eq. 28a and 31 49/2 + 49/2 + MAX(2,2) + MIN(2,2)/2 + 8.1 + | | | | |
| lanking STC for path Fd | R_ Fd,w | ISO 15712-1, Eq. 28a and 31 49/2 + 52/2 + MAX(2,19) + MIN(2,19)/2 + 5.8 + 7 = | | | | 83 | |
| lanking STC for path Df | R_ Df,w | ISO 15712-1, Eq. 28a and 31 | 52/2 | + 49/2 + MAX(0,2) | + MIN(0,2)/2 + 5.8 + 7 = | 65 | |
| unction 2: Flanking STC for al | l paths | Subset of Eq. 1.1 | - | 10*LOG10(10^-6.7 | + 10^- 8.3 + 10^- 6.5) = | | 63 |
| unstion 2 (Bigid T/Soft Cross | iunction 100 mm | lock concreting well (150 mm conc | roto colling clok | .1 | | | |
| lanking Element F2: | junction, 190 mm | block separating wait / 150 mm cond | arete cennig side | <u>1</u> | | | |
| aboratory STC for E2 | D E2 W | PR 224 NPC Moon RIK190(NW/) | | | 10 | | |
| STC change by Lining | AP E2 W | | 212 | | 45 | | |
| lanking Elomont f2: | ΔI <u>Λ_</u> 13,W | KK-334, ATE-BEK(IVW)-01, 3303_C | 515 | | 2 | | |
| aboratory STC for f2 | P f2 w | PR 224 NPC Moon RI K190(NW/) | | | 10 | | |
| STC change by Lining | AP f2 w/ | | 212 | | 45 | | |
| looking STC for noth Ef | | ISO 15712 1 Eq. 282 and 21 | 10/2 - | 40/2 + MAX(2 2) + | Z | 70 | |
| anking STC for path Fd | R Edw | 130 13712-1, Eq. 288 and 31 | 49/2 + | (2,2) + 101AA(2,2) + | MIN(2,2)/2 + 11.0 + 0 = | 20 | |
| lanking STC for path Df | R_TU,W | | 43/2 + 3 | $\frac{1}{2} \frac{1}{2} + \frac{1}{2} \frac{1}{2} \frac{1}{2} + \frac{1}{2} $ | + MIN(2,13)/2 + 8.8 + 0 = | 67 | |
| Inction 3: Flanking STC for al | paths | Subset of Eq. 1.1 | 52/2 | - 10*LOG10(10^-7 | $+ 10^{-} 8.5 + 10^{-} 6.7 =$ | 07 | 65 |
| unation 4 (Digid Tiunation 1 | 0 mm black same | ting well / 100 mm block flenking w | | | | | |
| anction 4 (Kigid 1-junction, 1) | to min block separa | ating wait / 150 mm DIOCK Hanking V | <u>vail)</u> | | | | |
| anxing Lieffient 14. | R E4 W | RR-334 NRC-Moon RI K100(NIM) | | | 19 | | |
| STC change by Lining | AR E4 W | RB-334 ATI-BLK/NIM/)-61 SS65 (| 513 | | 2 | | |
| lanking Flement f4 | <u> </u> | 111 334, ATE DER(1400) 01, 3303_0 | | | 2 | | |
| aboratory STC for f4 | R f4 w | RR-334 NRC-Mean RI K190(NW/) | | | 49 | | |
| STC change by Lining | AD f4.w | | 10 | | 49 | | |
| anking STC for noth Ef | Δη_14,W | ISO 15712 1 Eq. 282 and 21 | . د/ ۵۸ | $10/2 \pm MAX(2.2)$ | Z MIN/2 2)/2 ± 11 6 ± 7 = | 71 | |
| anking STC for path Ed | R Edw | ISO 15712-1, Eq. 200 dill 31 | 49/2 + | (+3/2 + WAA(2,2)) | MIN(2,2)/2 + 11.0 + 7 = | 96 | |
| anking STC for path Pd | K_FU,W | ISO 15712-1, Eq. 280 and 31 | 49/2 + 5 | (2,19) + (10) + (2,19) + (2, | $ v_{11}v_{12}(2,19)/2 + \delta_{0}\delta_{0} + / =$ | 00 | |
| anking SIC for path Df | K_ UT,W | 150 15712-1, Eq. 288 and 31 | 52/2 | + 49/2 + IVIAX(U,2) | $+ \text{IVIIIN}(U, Z)/Z + \delta.\delta + / = 100, 000 \text{ m}$ | 60 | 60 |
| atal Flanking STC for al | | Subset of Eq. 1.1 | | 10 LOG10(10 ^k -7.1 | $+ 10^{-6} - 8.0 + 10^{-6} - 0.8$ = | _ | 50 |
| Juli Planking STC (4 Junction | >) | Subset of Eq. 1.1 | | Compinin | g 12 Flanking STC values | | 59 |
| | | | | | | | |



| | ISO Symbol | Reference | | | STC, Δ_STC | AST | c |
|---------------------------------|--------------------|---|---|--------------------|----------------------------|-----|---------|
| Separating Partition (190 mm | concrete block) | | | | | | |
| Laboratory STC for Dd | R_s,w | RR-333, TLF-97-107a | | | 52 | | |
| ΔSTC change by Lining on D | ΔR_D,w | No Lining , | | | 0 | | |
| ΔSTC change by Lining on d | ∆R_d,w | RR-333, ΔTLF-CON150-01, SUS | | 19 | | | |
| Direct STC in situ | R_Dd,w | ISO 15712-1, Eq. 24 and 30 | | 52 + MA | X(0,19) + MIN(0,19)/2 = | 71 | |
| Junction 1 (Rigid-T/Soft Cross | junction, 190 mm l | block separating wall / 150 mm co | oncrete floor) | | | | |
| Flanking Element F1: | | | | | | | |
| Laboratory STC for F1 | R_F1,w | RR-334, NRC-Mean BLK190(NV | V) | | 49 | | |
| ΔSTC change by Lining | ΔR_F1,w | RR-334, ΔTL-BLK(NW)-62, SS6 | 5_GFB_G13 | | 19 | | |
| Flanking Element f1: | | | | | | | |
| Laboratory STC for f1 | R_f1,w | RR-334, NRC-Mean BLK190(NV | V) | | 49 | | |
| ΔSTC change by Lining | ΔR_f1,w | RR-334, ΔTL-BLK(NW)-62, SS6 | 5_GFB_G13 | | 19 | | |
| Flanking STC for path Ff | R_ Ff,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 49/2 | 2 + MAX(19,19) + N | /IN(19,19)/2 + 11.6 + 6 = | 90 | (limit) |
| Flanking STC for path Fd | R_ Fd,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 52/ | /2 + MAX(19,19) + | MIN(19,19)/2 + 8.8 + 6 = | 90 | (limit) |
| Flanking STC for path Df | R_ Df,w | ISO 15712-1, Eq. 28a and 31 | 52/2 + 4 | 49/2 + MAX(0,19) - | + MIN(0,19)/2 + 8.8 + 6 = | 84 | |
| Junction 1: Flanking STC for a | ll paths | Subset of Eq. 1.1 | | - 10*LOG10(10^ | -9 + 10^- 9 + 10^- 8.4) = | | 82 |
| Junction 2 (Rigid T-Junction, 1 | .90 mm block separ | ating wall / 190 mm block flankin | g wall) | | | | |
| Flanking Element F2: | | | | | | | |
| Laboratory STC for F2 | R F2,w | RR-334, NRC-Mean BLK190(NV | V) | | 49 | | |
| ΔSTC change by Lining | ΔR_F2,w | RR-334, ΔTL-BLK(NW)-62, SS6 | 5_GFB_G13 | | 19 | | |
| Flanking Element f2: | | | | | | | |
| Laboratory STC for f2 | R f2,w | RR-334, NRC-Mean BLK190(NV | V) | | 49 | | |
| ΔSTC change by Lining | ΔR f2,w | RR-334, ΔTL-BLK(NW)-62, SS65_GFB_G13 19 | | | | | |
| Flanking STC for path Ff | R Ff,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 49/ | /2 + MAX(19,19) + | MIN(19,19)/2 + 8.1 + 7 = | 90 | (limit) |
| Flanking STC for path Fd | R Fd,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 52/ | /2 + MAX(19,19) + | MIN(19,19)/2 + 5.8 + 7 = | 90 | (limit) |
| Flanking STC for path Df | R_Df,w | ISO 15712-1, Eq. 28a and 31 | 52/2 + 4 | 49/2 + MAX(0,19) - | + MIN(0,19)/2 + 5.8 + 7 = | 82 | |
| Junction 2: Flanking STC for a | ll paths | Subset of Eq. 1.1 | | - 10*LOG10(10^ | -9 + 10^- 9 + 10^- 8.2) = | | 81 |
| | | | | | | | |
| Junction 3 (Rigid-T/Soft Cross | junction, 190 mm l | olock separating wall / 150 mm co | oncrete ceiling slat | <u>o)</u> | | | |
| Flanking Element F3: | | | | | | | |
| Laboratory STC for F3 | R_F3,w | RR-334, NRC-Mean BLK190(NV | V) | | 49 | | |
| ΔSTC change by Lining | ΔR_F3,w | RR-334, ΔTL-BLK(NW)-62, SS6 | 5_GFB_G13 | | 19 | | |
| Flanking Element f3: | | | | | | | |
| Laboratory STC for f3 | R_f3,w | RR-334, NRC-Mean BLK190(NV | V) | | 49 | | |
| ΔSTC change by Lining | ΔR_f3,w | RR-334, ΔTL-BLK(NW)-62, SS6 | 5_GFB_G13 | | 19 | | |
| Flanking STC for path Ff | R_ Ff,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 49/2 | 2 + MAX(19,19) + N | /IN(19,19)/2 + 11.6 + 6 = | 90 | (limit) |
| Flanking STC for path Fd | R_ Fd,w | | 49/2 + 52/ | /2 + MAX(19,19) + | MIN(19,19)/2 + 8.8 + 6 = | 90 | (limit) |
| Flanking STC for path Df | R_ Df,w | | 52/2 + 4 | 49/2 + MAX(0,19) - | + MIN(0,19)/2 + 8.8 + 6 = | 84 | |
| Junction 3: Flanking STC for a | ll paths | Subset of Eq. 1.1 | | - 10*LOG10(10^ | -9 + 10^- 9 + 10^- 8.4) = | | 82 |
| Junction 4 (Rigid T-junction, 1 | 90 mm block separ | ating wall / 190 mm block flankin | g wall) | | | | |
| Flanking Element F4: | | | | | | | |
| Laboratory STC for F4 | R_F4,w | RR-334, NRC-Mean BLK190(NV | V) | | 49 | | |
| ΔSTC change by Lining | ΔR_F4,w | RR-334, ΔTL-BLK(NW)-62, SS6 | 5_GFB_G13 | | 19 | | |
| Flanking Element f4: | | | | | | | |
| Laboratory STC for f4 | R_f4,w | RR-334, NRC-Mean BLK190(NV | V) | | 49 | | |
| ΔSTC change by Lining | ΔR_f4,w | RR-334, ΔTL-BLK(NW)-62, SS6 | 5_GFB_G13 | | 19 | | |
| Flanking STC for path Ff | R_ Ff,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 49/2 | 2 + MAX(19,19) + N | /IN(19,19)/2 + 11.6 + 7 = | 90 | (limit) |
| Flanking STC for path Fd | R_ Fd,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 52/ | /2 + MAX(19,19) + | MIN(19,19)/2 + 8.8 + 7 = | 90 | (limit) |
| Flanking STC for path Df | R_Df,w | ISO 15712-1, Eq. 28a and 31 | 52/2 + 4 | 49/2 + MAX(0,19) - | + MIN(0,19)/2 + 8.8 + 7 = | 85 | |
| Junction 4: Flanking STC for a | ll paths | Subset of Eq. 1.1 | oset of Eq. 1.1 - 10*LOG10(10^-9 + 10^- 9 + 10^- 8.5) = | | | | 83 |
| Total Flanking STC (4 Junction | is) | Subset of Eq. 1.1 | | Combinir | ng 12 Flanking STC values | | 76 |
| ACTC due to Divertial and the | whine Dette | Fountion 1.1 of this Dawn | | ining Direct CTC | h 13 Flanking CTC | 70 | |
| ASTC due to Direct plus All Fla | anking Paths | Equation 1.1 of this Report | Comp | Direct STC Wit | In 12 Flanking STC values | 70 | |

Summary for Section 4.1.1: Masonry and Concrete Constructions with Rigid Junctions

The worked examples 4.1.1-H1 and 4.1.1-V1 illustrate the basic process for calculating the sound transmission between rooms in a building which incorporates rigid junctions at all of the intersections between assemblies of bare concrete masonry walls and concrete floors. Here, "bare" means the assembly of masonry or concrete without a lining (i.e. an added gypsum board finish on the walls or ceiling or a flooring over the concrete slab). Note that for a concrete block wall constructed using normal weight units, tests have shown that the surface could be painted or sealed or have a thin coat of plaster without having an effect on the wall's STC rating. This absence of gypsum board surface linings is not typical of occupied buildings in North America, but presenting the "bare" case gives a clear example of the basic structure-borne transmission for a building with such wall and floor subsystems. When linings are added, the linings simply alter the transfer of sound from the underlying "bare" systems to/from the rooms.

For both the bare assembly and the assembly with linings, the Apparent Sound Transmission Class (ASTC) rating is slightly lower than the STC rating of the separating assembly because the total flanking transmission (via the combination of 12 flanking paths) is of similar magnitude to the Direct Transmission Loss through the separating assembly.

For the side-by-side pair of rooms

The effect of adding linings is shown in Examples 4.1.1-H2 to H4 and the following trends were found:

- Adding a minimal lining with no sound absorptive material in the inter-stud cavities (ΔSTC=2) to all the wall surfaces raises the ASTC rating from 47 to 50.
- Adding a better wall lining with ΔSTC=19 in example 4.1.1-H3 raises the ASTC to 59, but further improvements are limited by the transmission through the bare concrete surfaces of the floor and ceiling.
- Significant further improvement requires treatment of both the floor and ceiling surfaces treating just the ceiling in Example 4.1.1-H4 increases the ASTC rating by only 3 points relative to the preceding example.

For one room above the other

The effect of added linings is shown in Examples 4.1.1-V2 to V4 and the following trends were found:

- As shown in example 4.1.1-V2, adding a good lining to all the flanking wall surfaces increases the ASTC rating by only 2 from 50 to 52 because direct transmission through the separating floor/ceiling is the strongest path even without linings. Therefore, improving the Flanking STC has limited effect.
- This is easily remedied by adding a gypsum board ceiling with sound absorptive material in the cavity under the concrete ceiling slab, which raises the direct path STC rating from 52 to 71.
- With a ceiling in place as shown in example 4.1.1-V3., a quite good system performance of ASTC 58 is possible even with a minimal (ΔSTC=2) lining of the flanking walls.
- Filling the inter-stud cavities with absorptive material to provide a more effective lining of the walls raises the performance to ASTC 70 in example 4.1.1-V4.

4.1.2 Non-Loadbearing Normal Weight Concrete Block Walls with Concrete Floors

This section presents worked examples for adjacent rooms in a building which has structural floors of concrete and walls of normal weight concrete blocks, but includes some non-rigid junctions.

All of the examples in Section 4.1.2 have rigid mortared junctions between the concrete floor surface and the concrete block walls above it (that is, at the joint supporting the concrete block masonry wall on top of the concrete slab) but soft junctions between the bottom surface of the concrete slab and the top of the non-loadbearing concrete block wall below. The soft junctions provide negligible vibration transmission. This significantly alters the paths for the transfer of structure-borne flanking sound to the adjoining rooms relative to the cases in Section 4.1.1 where all of the connecting edges had rigid mortared junctions.

As in Section 4.1.1, the calculations follow the Simplified Procedure of ISO 15712-1 with simple adaptations to deal with the non-rigid junctions:

- Non-loadbearing masonry walls would normally have a fire stop installed between the top of the masonry wall assembly and the underside of the concrete floor above, as shown in the detail drawings in examples in this section. A common type of fire stop would comprise compressible fibrous insulation faced with pliable sealant.
- Such fire stops would transmit negligible vibration between the top of the wall and the concrete ceiling above (or vice versa) so they do not match the criteria for the junction attenuation calculation (Equations E.4 or E.5 in ISO 15712-1:2005).

The assumption that there is minimal vibration transmission through the "soft" seal at the top of the non-loadbearing concrete block wall assembly changes the effective geometry of the junctions, and hence the appropriate equation (from Annex E of ISO 15712-1) needed to calculate the junction attenuation for transmission via the remaining rigid connections.

- With this change, a rigid cross junction between the floor and the concrete block walls above and below is transformed into a rigid T-junction between the floor on both sides of the wall and the wall above.
- Similarly, a rigid T-junction between the edge of a concrete floor and the concrete block walls above and below is transformed into a rigid corner between the floor and the wall above.
- The "soft" junctions are treated in the calculation by assuming that any path through the soft junction (i.e. through fire stop) has minimal transmission, so the Flanking STC for paths via the soft joint is simply set to the maximum value (90).

The resulting sets of paths are illustrated in Figure 4.1.2.1, which also identifies the new equation from Annex E of ISO 15712-1 to be used for each modified case. As discussed in the summary at the end of this section, switching from rigid junctions to non-loadbearing junctions alters the overall calculated ASTC, but the changes are not significant.

Figure 4.1.2.1: Changes in flanking paths at junctions with soft junctions, defined with reference to, but not explicitly defined in Annex E of ISO 15712-1. The yellow element shown in the figures in the second column represents the soft junction which changes the flow of structure-borne sound as compared to the rigid cross junction shown in the first column.

| Loadbearing Walls (in 4.1.1) | Non-Loadbearing Walls (in 4.1.2 and 4.1.3) | Path | Change in Calculation (Equation in ISO 15712-1) |
|---|---|------|---|
| RIGID CROSS JUNCTION for separating wall with floor | RIGID T-JUNCTION for separating wall with floor | Ff | From path 1-3 in Eq. E.3, to path 1-3 in Eq. E.4 |
| P d f | D d f | Fd | From path 1-2 in Eq. E.3, to path 1-2 in Eq. E.4 |
| | | Df | From path 2-3 in Eq. E.3, to path 2-3 in Eq. E.4 |
| RIGID CROSS JUNCTION for separating wall with ceiling | RIGID T-JUNCTION: wall above with ceiling | Ff | From path 1-3 in Eq. E.3, to path 1-3 in Eq. E.4 |
| | | Fd | Minimal transmission |
| | D | Df | Minimal transmission |
| RIGID CROSS JUNCTION for: walls above & below with separating floor/ceiling | RIGID T-JUNCTION for wall above with separating floor/ceiling | Ff | Minimal transmission |
| F D | P D | Fd | From path 1-2 in Eq. E.3, to path 2-1 in Eq. E.4 |
| d f 1 | d f | Df | Minimal transmission |
| RIGID T-JUNCTION for walls above & below with separating floor/ceiling | RIGID CORNER for wall above with separating floor/ceiling | Ff | Minimal transmission |
| P | F D | Fd | From path 1-2 in Eq. E.4, to path 1-2 in Eq. E.9 |
| d f 1 | d f | Df | Minimal transmission |

Worked Examples

Each of the worked examples presents all the pertinent physical characteristics of the assemblies and junctions, together with a summary of key steps in the calculation process for these constructions. These are almost the same as for the preceding section, with simple changes to deal with the non-rigid connections at the fire stops at the top of each concrete block wall.

Within the table for each worked example, the "References" column presents the source of the input data (combining the NRC report number and identifier for each laboratory test result or derived result), or identifies the applicable equations and sections of ISO 15712-1:2005 at each stage of the calculation. Symbols and subscripts identifying the corresponding variable from ISO 15712-1 are given in the adjacent column. Equations and figures from the standard are not reproduced here to respect the copyright, but the description of the equations in Section 4.1.1 explains the adaptations to use ASTM input data.

All of the examples in this section conform to the Standard Scenario presented in Section 1.2 of this Guide.

Under the single heading "STC, Δ STC", the examples present input data determined in laboratory tests according to ASTM E90, including the:

- STC values for the laboratory sound transmission loss of wall or floor assemblies
- ΔSTC values measured in the laboratory for the change in the STC rating due to adding a lining to the specified wall or floor assembly

Under the heading "ASTC", the examples present the calculated values for the transmission via specific paths, including the:

- Direct STC rating for the calculated in-situ transmission loss of the separating wall or floor assembly
- Flanking STC rating calculated for each flanking transmission path at each junction
- Apparent STC (ASTC) rating for the combination of direct and flanking transmission via all paths

When the calculated Flanking STC for a given path exceeds 90, the value is limited to 90 to allow for the inevitable effect of higher order flanking paths which make the higher value to be unrepresentative of the true situation. These situations are flagged with the adjacent label "(limit)" and indicate that further enhancements to elements in these paths will give negligible benefit to the ASTC rating.

The numeric calculations are presented step-by-step in each worked example using compact notation consistent with spreadsheet expressions such that:

- For calculation of Direct STC and Flanking STC, these expressions are easily recognized as equivalent to Equations 4.1.2 and 4.1.3 respectively.
- For paths crossing the soft joint, transmission is assumed to be negligible, so the Flanking STC for paths via the soft joint is set to the maximum limit (90).
- For combining sound power transmitted via specific paths, the calculation of Eq. 1.1 is broken down into several stages. Note that in the compact notation, a term for transmitted sound power fraction such as $10^{-0.1 \cdot TL_{ij}}$ becomes 10^-7.4, if TL_{ij} =74.
- At each stage (such as the Flanking STC for a given junction) the result is converted into decibel form by calculating -10*LOG10(transmitted sound power fraction), to facilitate the comparison of each path or junction with the Direct STC and the final ASTC result.

| EXA | MPLE 4.1.2-H1: | | (SIMPLIFIED METHOD) | Illustrati | on for this ca | se |
|---|--|---|---|---|--|---|
| • | Rooms side-by-side Concrete floors and rigid junctions exc | normal weight cept at top c | concrete block walls wit of non-loadbearing wall | h s | | |
| <u>Sep</u> : • | arating wall assembly (n one wythe of concrete hollow blocks with norm soft seal at top of wall, r | on-loadbearing) blocks with ma al weight aggreg igid junction at b | <u>with:</u> ss 238 kg/m ² (e.g. 190 mr ate ¹) with no lining ottom | n F3- | | f3 |
| <u>Junc</u> • | tion 1: Bottom Junction concrete floor with mass thickness of 150 mm) w rigid mortared T-junctio soft seal with wall below | (separating wall s 345 kg/m ² (e.g. ith no topping or n with concrete | ^h , F1- | | d fire stop f1 | |
| F1 < | | | | | | |
| Rooms side-by-side Concrete floors and normal weight rigid junctions except at top of one wythe of concrete blocks with manhollow blocks with normal weight aggregate. soft seal at top of wall, rigid junction at both soft seal at top of wall, rigid junction at both soft seal at top of wall, rigid junction at both soft seal at top of wall, rigid junction at both soft seal at top of wall, rigid junction at both soft seal at top of wall, rigid junction at both soft seal at top of wall, rigid junction at both soft seal at top of wall, rigid junction at both soft seal with mass 345 kg/m² (e.g. thickness of 150 mm) with no topping or a rigid mortared T-junction with concrete soft seal with wall below Junction 2 or 4: Each Side (separating wall / a abutting side wall and separating wall or 238 kg/m² (e.g. 190 mm hollow bloc aggregate¹), with no lining rigid mortared T-junctions with separating soft seal at top of flanking walls, rigid mortared T-junction swith separating wall / ce concrete ceiling slab with mass 345 concrete with thickness of 150 mm) with a rigid mortared T-junction with concrete soft seal with wall below Acoustical Parameters: For 190 mm concrete block walls: Mass/unit area (kg/m²) = 238 (a 238 (b 238 (c 238 (c | | | rtared junction at bottom <u>eiling) with:</u> kg/m ² (e.g. normal weight | Junction separatir floor t (Side vie | of 190 m ng wall with 15 and w of Junctions | m concrete block 0 mm thick concrete ceiling. 3 1 and 3) |
| aggregate¹), with no lining rigid mortared T-junctions with separating wall soft seal at top of flanking walls, rigid mortared junction at bottom <u>Junction 3: Top Junction (separating wall / ceiling) with:</u> concrete ceiling slab with mass 345 kg/m² (e.g. normal weigh concrete with thickness of 150 mm) with no added ceiling lining rigid mortared T-junction with concrete block wall assembly above soft seal with wall below <u>Acoustical Parameters:</u> | | | | | | |
| For 1 | 90 mm concrete block wa | alls: | | | $D \rightarrow p$ | tutte |
| N | 1ass/unit area (kg/m ²) = | 238 | (Separating wall) | F2 F | -4_ | f2, f4 |
| | | 238 | (Flanking wall) | 101000000000000000000000000000000000000 | STATE OF THE STATE | |
| For 1 | 50 mm concrete floor: | | | | NY | |
| | Mass/uni | t area (kg/m²) = | 345 | No. Com | MAL | |
| | Separating partit | ion area $(m^2) = \frac{1}{2}$ | 12.5 | Junction | of separating f 190 mm | wall with side wall, |
| | Junctio | $\sin \text{length}(m) = $ | 5.0 | (Plan vie | w of Junction | 2 or 4). |
| | Separating partitio | n height (m) = 2 | | | | |
| | 10*log(S_Partition/I_ | Junction (1&3) = | 4.0 | _ | | |
| | TO * log(S_Partition/I_ | junction 2&4) = | 7.0 | | | |
| | | | | D 11 - 1 | | |
| الم مربرا | | Mass ratio for Ff | Path Ft | Path Fd | Path Df | Poforance |
| Junct | 1 Rigid-T/coft | 0.69 | 3 6 | 5.8 | 5.8 | ISO 15712-1 For F 4 |
| | 2 Rigid T-junction | 1.00 | 5.7 | 5.7 | 5.7 | ISO 15712-1, Eq. E.4 |
| | 3 Rigid-T/soft | 0.69 | 3.6 | SOFT | SOFT | ISO 15712-1, Eq. E.4 |

5.7

(See the footnotes located at the end of the document)

Rigid T-junction

4

1.00

ISO 15712-1, Eq. E.4

5.7

5.7

| | ISO Symbol | Reference | | | STC, ∆_STC | AST | с |
|--|--------------------|--|--------------|--|--|---------|-----------------|
| Separating Partition (190 mm | concrete block) | | | | | | |
| Laboratory STC for Dd | R_s,w | RR-334, NRC-Mean BLK190(NW) | | | 49 | | |
| ∆STC change by Lining on D | ΔR_D,w | No Lining , | | 0 | | | |
| ΔSTC change by Lining on d | ΔR_d,w | No Lining , | | | | | |
| Direct STC in situ | R_Dd,w | ISO 15712-1, Eq. 24 and 30 | | 49 + N | MAX(0,0) + MIN(0,0)/2 = | 49 | |
| Junction 1 (Rigid-T/Soft Cross | junction, 190 mm l | block separating wall / 150 mm concrete | floor) | | | | |
| Flanking Element F1: | | | | | | | |
| Laboratory STC for F1 | R_F1,w | RR-333, TLF-97-107a | | | 52 | | |
| ∆STC change by Lining | ΔR_F1,w | No Lining , | | | 0 | | |
| Flanking Element f1: | | | | | | | |
| Laboratory STC for f1 | R_f1,w | RR-333, TLF-97-107a | | | 52 | | |
| ΔSTC change by Lining | ΔR_f1,w | No Lining , | | | 0 | | |
| Flanking STC for path Ff | R_ Ff,w | ISO 15712-1, Eq. 28a and 31 | 52/2 | + 52/2 + MAX(0,0) + MIN(0,0)/2 + 3.6 + 4 = | | 60 | |
| Flanking STC for path Fd | R_ Fd,w | ISO 15712-1, Eq. 28a and 31 | 52/2 | + 49/2 + MAX(0,0) | + MIN(0,0)/2 + 5.8 + 4 = | 60 | |
| Flanking STC for path Df | R_ Df,w | ISO 15712-1, Eq. 28a and 31 | 49/2 | + 52/2 + MAX(0,0) | + MIN(0,0)/2 + 5.8 + 4 = | 60 | |
| Junction 1: Flanking STC for al | l paths | Subset of Eq. 1.1 | | - 10*LOG10(10 | 0^-6 + 10^- 6 + 10^- 6) = | | 55 |
| Junction 2 (Rigid T-Junction. 1 | 90 mm block separ | ating wall / 190 mm block flanking wall) | | | | | |
| Flanking Element F2: | | | | | | | |
| Laboratory STC for F2 | R F2,w | RR-334, NRC-Mean BLK190(NW) | | | 49 | | |
| ΔSTC change by Lining | ΔR F2,w | No Lining , | | | 0 | | |
| Flanking Element f2: | _ / | | | | | | |
| Laboratory STC for f2 | R f2.w | RR-334, NRC-Mean BLK190(NW) | | | 49 | | |
| ΔSTC change by Lining | ΔR f2.w | No Lining . | | | 0 | | |
| Flanking STC for path Ff | R Ff.w | ISO 15712-1. Eq. 28a and 31 | 49/2 | + 49/2 + MAX(0.0) | + MIN(0.0)/2 + 5.7 + 7 = | 62 | |
| Flanking STC for path Fd | R Fd.w | ISO 15712-1. Eq. 28a and 31 | 49/2 | + 49/2 + MAX(0.0) | + MIN(0.0)/2 + 5.7 + 7 = | 62 | |
| Flanking STC for path Df | R Df.w | ISO 15712-1. Eq. 28a and 31 | 49/2 | +49/2 + MAX(0.0) | + MIN(0.0)/2 + 5.7 + 7 = | 62 | |
| Junction 2: Flanking STC for al | I paths | Subset of Eq. 1.1 | - | 10*LOG10(10^-6.2 | + 10^- 6.2 + 10^- 6.2) = | | 57 |
| | | | | | | | |
| Junction 3 (Rigid-T/Soft Cross | junction, 190 mm l | block separating wall / 150 mm concrete | ceiling slal | <u>o)</u> | | | |
| Flanking Element F3: | | | | | | | |
| Laboratory STC for F3 | R_F3,w | RR-333, TLF-97-107a | | | 52 | | |
| ΔSTC change by Lining | ΔR_F3,w | No Lining , | | | 0 | | |
| Flanking Element f3: | | | | | | | |
| Laboratory STC for f3 | R_f3,w | RR-333, TLF-97-107a | | | 52 | | |
| ΔSTC change by Lining | ΔR_f3,w | No Lining , | | | 0 | | |
| Flanking STC for path Ff | R_ Ff,w | ISO 15712-1, Eq. 28a and 31 | 52/2 | + 52/2 + MAX(0,0) | + MIN(0,0)/2 + 3.6 + 4 = | 60 | |
| Flanking STC for path Fd | R_ Fd,w | | | Negligible t | 90 | (limit) | |
| Flanking STC for path Df | R_ Df,w | | | Negligible t | 90 | (limit) | |
| Junction 3: Flanking STC for al | l paths | Subset of Eq. 1.1 | | - 10*LOG10(1 | 0^-6 + 10^- 9 + 10^- 9) = | | <mark>60</mark> |
| Junction 4 (Rigid T-junction. 1 | 90 mm block separa | ating wall / 190 mm block flanking wall) | | | | | |
| Flanking Element F4: | | | | | | | |
| Laboratory STC for F4 | R F4.w | RR-334, NRC-Mean BLK190(NW) | | | 49 | | |
| ΔSTC change by Lining | ΔR F4.w | No Lining . | | | 0 | | |
| Flanking Element f4: | ,., | | | | | | |
| Laboratory STC for f4 | R f4.w | RR-334, NRC-Mean BLK190(NW) | | | 49 | | |
| ΔSTC change by Lining | ΔR f4.w | No Lining . | | | 0 | | |
| Flanking STC for path Ff | R Ff.w | ISO 15712-1. Eq. 28a and 31 | 49/2 | + 49/2 + MAX(0 0) | + MIN(0.0)/2 + 5.7 + 7 = | 62 | |
| Flanking STC for path Fd | R Fd.w | ISO 15712-1, Eq. 28a and 31 | 49/2 | +49/2 + MAX(0.0) | + MIN(0.0)/2 + 5.7 + 7 = | 62 | |
| Flanking STC for nath Df | R Dfw | ISO 15712-1, Eq. 28a and 31 | 49/2 | +49/2 + MAX(0.0) | + MIN(0.0)/2 + 5.7 + 7 = | 62 | |
| lunction 4: Flanking STC for all paths Subset of Eq. 1.1 | | Subset of Eq. 1.1 | -5/2 | 10*LOG10(10^-6.2 | (0,0)/2 + (0,0 | 02 | 57 |
| Total Flanking STC (4 Junctions) | | Subset of Eq. 1.1 | | Combinin | ig 12 Flanking STC values | | 51 |
| | | | | | | | |
| ASTC due to Direct plus All Fla | nking Paths | Equation 1.1 of this Report | Comb | ining Direct STC wit | h 12 Flanking STC values | 47 | |

EXAMPLE 4.1.2-H2:

- Rooms side-by-side
- Concrete floors and normal weight concrete block walls with rigid junctions except at top of non-loadbearing walls (Same structure as 4.1.2-H1, plus lining of walls)

(SIMPLIFIED METHOD)

Separating wall assembly (non-loadbearing) with:

- one wythe of concrete blocks with mass 238 kg/m² (e.g. 190 mm hollow blocks with normal weight aggregate¹)
- soft seal at top of wall, rigid junction at bottom
- separating wall lined on both sides with 13 mm gypsum board³ supported on 65 mm non-loadbearing steel studs spaced 610 mm o.c. with no absorptive material² filling inter-stud cavities

Junction 1: Bottom Junction (separating wall / floor) with:

- concrete floor with mass 345 kg/m² (e.g. normal weight concrete with thickness of 150 mm) with no topping or flooring
- rigid mortared T-junction with concrete block wall assembly above, soft seal with wall below

Junction 2 or 4: Each Side (separating wall /abutting side wall) with:

- side wall and separating wall of concrete blocks with mass 238 kg/m² (e.g. 190 mm hollow blocks with normal weight aggregate¹) with rigid mortared T-junctions
- soft seal at top of flanking walls, rigid mortared junction at bottom
- flanking side walls lined with 13 mm gypsum board³ supported on 65 mm non-loadbearing steel studs spaced 610 mm o.c. with no absorptive material² filling inter-stud cavities

Junction 3: Top Junction (separating wall / ceiling) with:

- concrete ceiling slab with mass 345 kg/m² (e.g. normal weight concrete with thickness of 150 mm) with no added ceiling lining
- rigid mortared T-junction with concrete block wall assembly above, soft seal with wall below

Acoustical Parameters:

| For 190 mm concrete block w | | |
|---------------------------------------|--------------------------------|-------------------|
| Mass/unit area (kg/m ²) = | 238 | (Separating wall) |
| | 238 | (Flanking wall) |
| For 150 mm concrete floor: | | |
| Mass/uni | it area (kg/m ²) = | 345 |
| | | |
| Separating parti | tion area (m^2) = | 12.5 |
| Junctio | on length (m) = | 5.0 |
| Separating partition | n height (m) = | 2.5 |
| 10*log(S_Partition/l_ | junction 1&3) = | 4.0 |
| 10*log(S_Partition/l_ | junction 2&4) = | 7.0 |
| | | |



Junction of 190 mm concrete block separating wall (with gypsum board lining) with 150 mm thick concrete floor and ceiling. (Side view of Junctions 1 and 3)



Junction of separating wall with flanking side wall, both of 190 mm concrete block with gypsum board linings. (Plan view of Junction 2 or 4).

| | | | Path Ff | Path Fd | Path Df | |
|---------|------------------|-------------------|--------------|---------|---------|----------------------|
| Junctio | <u>n</u> | Mass ratio for Ff | Kij(in dB) = | | | Reference |
| 1 | Rigid-T/soft | 0.69 | 3.6 | 5.8 | 5.8 | ISO 15712-1, Eq. E.4 |
| 2 | Rigid T-junction | 1.00 | 5.7 | 5.7 | 5.7 | ISO 15712-1, Eq. E.4 |
| 3 | Rigid-T/soft | 0.69 | 3.6 | SOFT | SOFT | ISO 15712-1, Eq. E.4 |
| 4 | Rigid T-junction | 1.00 | 5.7 | 5.7 | 5.7 | ISO 15712-1, Eq. E.4 |

| | ISO Symbol | Reference | | | stc, ∆_stc | AS | тс |
|---------------------------------|--------------------|---|----------------------------------|---------------------------------------|-----------------------------|----|---------|
| Separating Partition (190 mm | concrete block) | | | | | | |
| Laboratory STC for Dd | R_s,w | RR-334, NRC-Mean BLK190(NW) | | | 49 | | |
| ΔSTC change by Lining on D | ΔR_D,w | RR-334, ΔTL-BLK(NW)-61, SS65_G | 13 | | 2 | | |
| ΔSTC change by Lining on d | ΔR_d,w | RR-334, ΔTL-BLK(NW)-61, SS65_G | 13 | | 2 | | |
| Direct STC in situ | R_Dd,w | ISO 15712-1, Eq. 24 and 30 | | 49 + M. | AX(2,2) + MIN(2,2)/2 = | 52 | |
| Junction 1 (Rigid-T/Soft Cross | iunction, 190 mm | block separating wall / 150 mm concr | ete floor) | | | | |
| Flanking Element F1: | | sidek separating wan 7 190 min conci | | | | | |
| Laboratory STC for F1 | R F1,w | RR-333, TLF-97-107a | | | 52 | | |
| ΔSTC change by Lining | ΔR F1,w | No Lining , | | | 0 | | |
| Flanking Element f1: | | | | | | | |
| Laboratory STC for f1 | R f1,w | RR-333, TLF-97-107a | | | 52 | | |
| ΔSTC change by Lining | ΔR f1,w | No Lining , | | | 0 | | |
| Flanking STC for path Ff | R Ff,w | ISO 15712-1, Eq. 28a and 31 | 52/2 + | + 52/2 + MAX(0,0) + | - MIN(0,0)/2 + 3.6 + 4 = | 60 | |
| Flanking STC for path Fd | R Fd,w | ISO 15712-1, Eq. 28a and 31 | 52/2 + | + 49/2 + MAX(0,2) + | - MIN(0,2)/2 + 5.8 + 4 = | 62 | |
| Flanking STC for path Df | R Df,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + | + 52/2 + MAX(2,0) + | - MIN(2,0)/2 + 5.8 + 4 = | 62 | |
| Junction 1: Flanking STC for a | ll paths | Subset of Eq. 1.1 | | - 10*LOG10(10^-6 + | + 10^- 6.2 + 10^- 6.2) = | | 56 |
| | <u></u> | | | | | | |
| Junction 2 (Rigid T-Junction, 1 | .90 mm block separ | ating wall / 190 mm block flanking w | <u>all)</u> | | | | |
| Laboratory STC for E2 | P E2 w/ | PP 224 NPC Moon PLK100(NIM) | | | 10 | | |
| Laboratory STC for F2 | K_F2,W | RR-334, NRC-IVIEAN BLK190(NVV) | 10 | | 49 | | |
| ASIC change by Lining | ΔR_F2,W | RR-334, Δ1L-BLR(NW)-61, 5565_G | 13 | | Z | | |
| Flanking Element 12: | D £2 | | | | 40 | | |
| ASTC shapped by Liping | K_12,W | RR-334, NRC-IVIEAN BLK190(INV) | 10 | | 49 | | |
| | Δκ_12,w | RR-334, Δ1L-BLK(NW)-01, 5505_G | RR-334, ΔTL-BLK(NW)-61, SS65_G13 | | | 65 | |
| Flanking STC for path Fl | K_FI,W | ISU 15/12-1, Eq. 28a and 31 49/2 + 49/2 + MAX(2,2) + MIN(2,2)/2 + 5.7 + 7 40/2 + 40/2 + MAX(2,2) + MIN(2,2)/2 + 5.7 + 7 | | - IVIIN(2,2)/2 + 5.7 + 7 = | 05 | | |
| Flanking STC for path Df | R_FU,W | ISO 15712-1, Eq. 28a and 31 | 49/2 1 | + 49/2 + IVIAA(2,2) + | -10110(2,2)/2 + 5.7 + 7 = | 05 | |
| Flanking STC for path Dr | K_DI,W | ISO 15712-1, Eq. 288 and 31 | 49/2 1 | + 49/2 + MAX(2,2) + | 100 | 05 | 60 |
| Junction 2. Flanking STC for a | ii patris | Subset of Eq. 1.1 | - 1 | 10 10010(100.5 | - 10*** 0.5 + 10*** 0.5) - | | 00 |
| Junction 3 (Rigid-T/Soft Cross | junction, 190 mm | block separating wall / 150 mm concr | ete ceiling slal | b <u>)</u> | | | |
| Flanking Element F3: | | | | | | | |
| Laboratory STC for F3 | R F3,w | RR-333, TLF-97-107a | | | 52 | | |
| ΔSTC change by Lining | ΔR F3,w | No Lining , | | | 0 | | |
| Flanking Element f3: | _ / | | | | | | |
| Laboratory STC for f3 | R f3,w | RR-333, TLF-97-107a | | | 52 | | |
| ΔSTC change by Lining | ΔR f3,w | No Lining , | | | 0 | | |
| Flanking STC for path Ff | R Ff,w | ISO 15712-1, Eq. 28a and 31 | 52/2 + | + 52/2 + MAX(0,0) + | - MIN(0,0)/2 + 3.6 + 4 = | 60 | |
| Flanking STC for path Fd | R Fd,w | | | Negligible transmission via fire stop | | 90 | (limit |
| Flanking STC for path Df | R Df,w | | | Negligible transmission via fire stop | | 90 | (limit |
| Junction 3: Flanking STC for a | ll paths | Subset of Eq. 1.1 | | - 10*LOG10(10/ | ^-6 + 10^- 9 + 10^- 9) = | | 60 |
| | | | | | | | |
| Junction 4 (Rigid T-junction, 1 | 90 mm block separ | ating wall / 190 mm block flanking w | aii) | | | | |
| Hanking Element F4: | D 51 | | | | 10 | | |
| Laboratory SIC for F4 | K_F4,W | KK-334, NKC-Mean BLK190(NW) | 12 | | 49 | | |
| ASIC change by Lining | ΔR_F4,w | RR-334, Δ1L-BLK(NW)-61, SS65_G | 13 | | 2 | | |
| FIANKING Element 14: | D (1 | | | | 10 | | |
| Laboratory STC for f4 | R_t4,w | RK-334, NRC-Mean BLK190(NW) | | | 49 | | |
| ASIC change by Lining | ΔR_t4,w | κκ-334, Δ1L-BLK(NW)-61, SS65_G | 13 | | 2 | ~- | |
| Flanking STC for path Ff | R_Ft,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + | + 49/2 + MAX(2,2) + | -IVIIN(2,2)/2 + 5.7 + 7 = | 65 | |
| Flanking STC for path Fd | R_Fd,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + | + 49/2 + MAX(2,2) + | -IVIIN(2,2)/2 + 5.7 + 7 = | 65 | |
| Flanking STC for path Df | R_Dt,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + | + 49/2 + MAX(2,2) + | MIN(2,2)/2 + 5.7 + 7 = | 65 | <u></u> |
| Junction 4: Flanking STC for a | ll paths | Subset of Eq. 1.1 | - 1 | 10*LOG10(10^-6.5 + | + 10^- 6.5 + 10^- 6.5) = | | 60 |
| Total Flanking STC (4 Junction | s) | Subset of Eq. 1.1 | | Combining | 12 Flanking STC values | | 53 |
| | white part | | A 11 | | 42 Flanking CTO | | |
| ASIC due to Direct plus All Fla | anking Paths | Equation 1.1 of this Report | Combi | ning Direct STC with | 12 Flanking STC values | 49 | |



| | ISO Symbol | Beference | | | STC. A STC | ۵۵ | TC |
|----------------------------------|-------------------|--|----------------------|----------------------|---------------------------|----|---------|
| Separating Partition (190 mm | concrete block) | hererenee | | | 010, 2_010 | Α. | |
| Laboratory STC for Dd | R s w | RR-334 NRC-Mean BLK190(NV | V) | | 49 | | |
| ASTC change by Lining on D | | RR-334 ATI-BLK(NW)-62 SS6 | 5 GEB65 G13 | | 19 | | |
| ASTC change by Lining on d | ΔR d.w | RR-334, ATL-BLK(NW)-62, SS6 | 5 GFB65 G13 | | 19 | | |
| Direct STC in situ | B Dd w | ISO 15712-1 Eq. 24 and 30 | _0.000_010 | 49 + MAX(19 | (19) + MIN(19 19)/2 = | 78 | |
| | | 100 107 12 1) 24 2 1 414 00 | | 15 * 100 0 (12. | 5)15) · ·····(15)15//1 | | |
| Junction 1 (Rigid-T/Soft Cross | junction, 190 mm | block separating wall / 150 mm co | oncrete floor) | | | | |
| Flanking Element F1: | | | | | | | |
| Laboratory STC for F1 | R_F1,w | RR-333, TLF-97-107a | | | 52 | | |
| ΔSTC change by Lining | ΔR_F1,w | No Lining , | | | 0 | | |
| Flanking Element f1: | | | | | | | |
| Laboratory SIC for f1 | R_f1,w | RR-333, TLF-97-107a | | | 52 | | |
| ΔSTC change by Lining | ΔR_f1,w | No Lining , | | | 0 | | |
| Flanking STC for path Ff | R_Ff,w | ISO 15712-1, Eq. 28a and 31 | 52/2 + | - 52/2 + MAX(0,0) + | + MIN(0,0)/2 + 3.6 + 4 = | 60 | |
| Flanking STC for path Fd | R_Fd,w | ISO 15712-1, Eq. 28a and 31 | 52/2 + 4 | 9/2 + MAX(0,19) + | MIN(0,19)/2 + 5.8 + 4 = | 79 | |
| Flanking STC for path Df | R_Df,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 5 | 2/2 + MAX(19,0) + | MIN(19,0)/2 + 5.8 + 4 = | 79 | |
| Junction 1: Flanking STC for al | l paths | Subset of Eq. 1.1 | | - 10*LOG10(10^-6 - | + 10^- 7.9 + 10^- 7.9) = | | 60 |
| Junction 2 (Rigid T-Junction, 1 | 90 mm block separ | ating wall / 190 mm block flankin | g wall) | | | | |
| Flanking Element F2: | | | | | | | |
| Laboratory STC for F2 | R_F2,w | RR-334, NRC-Mean BLK190(NV | V) | | 49 | | |
| ΔSTC change by Lining | ΔR_F2,w | RR-334, ΔTL-BLK(NW)-62, SS6 | 5_GFB65_G13 | | 19 | | |
| Flanking Element f2: | | | | | | | |
| Laboratory STC for f2 | R_f2,w | RR-334, NRC-Mean BLK190(NV | V) | | 49 | | |
| ΔSTC change by Lining | ΔR_f2,w | RR-334, ΔTL-BLK(NW)-62, SS65_GFB65_G13 | | | 19 | | |
| Flanking STC for path Ff | R_Ff,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 49/2 | 2 + MAX(19,19) + N | 1IN(19,19)/2 + 5.7 + 7 = | 90 | (limit) |
| Flanking STC for path Fd | R_Fd,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 49/2 | 2 + MAX(19,19) + N | 1IN(19,19)/2 + 5.7 + 7 = | 90 | (limit) |
| Flanking STC for path Df | R_ Df,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 49/2 | 2 + MAX(19,19) + N | 1IN(19,19)/2 + 5.7 + 7 = | 90 | (limit) |
| Junction 2: Flanking STC for al | l paths | Subset of Eq. 1.1 | | - 10*LOG10(10 | ^-9 + 10^- 9 + 10^- 9) = | | 85 |
| lumetics 2 (Digid T/Coft Cross | iumatian 100 mm | black concreting well (150 mm a | warata asiling dal | -1 | | | |
| Junction 3 (Rigid-1/Soft Cross | Junction, 190 mm | block separating wait / 150 mm co | oncrete centing stat | <u>)</u> | | | |
| Flanking Element F3: | D 52 ···· | DD 222 TIE 07 407- | | | 52 | | |
| Laboratory STC for F3 | K_F3,W | RR-333, TLF-97-107a | | | 52 | | |
| ΔSTC change by Lining | ΔR_F3,W | No Lining , | | | 0 | | |
| Flanking Element 13: | 5 (3 | | | | | | |
| Laboratory STC for f3 | R_t3,w | RR-333, TLF-97-107a | | | 52 | | |
| ΔSTC change by Lining | ΔR_f3,w | No Lining , | | | 0 | | |
| Flanking STC for path Ff | R_Ff,w | ISO 15712-1, Eq. 28a and 31 | 52/2 + | - 52/2 + MAX(0,0) + | + MIN(0,0)/2 + 3.6 + 4 = | 60 | (1:) |
| Flanking STC for path Fd | R_Fd,w | | | Negligible tr | ansmission via fire stop | 90 | (limit) |
| Flanking STC for path Df | R_Df,w | | | Negligible tr | ansmission via fire stop | 90 | (limit) |
| Junction 3: Flanking STC for al | l paths | Subset of Eq. 1.1 | | - 10*LOG10(10 | ^-6 + 10^- 9 + 10^- 9) = | | 60 |
| Junction 4 (Rigid T-junction, 19 | 90 mm block separ | ating wall / 190 mm block flankin | g wall) | | | | |
| Flanking Element F4: | | | | | | | |
| Laboratory STC for F4 | R_F4,w | RR-334, NRC-Mean BLK190(NV | V) | | 49 | | |
| ∆STC change by Lining | ΔR_F4,w | RR-334, ΔTL-BLK(NW)-62, SS6 | 5_GFB65_G13 | | 19 | | |
| Flanking Element f4: | | | - | | | | |
| Laboratory STC for f4 | R_f4,w | RR-334, NRC-Mean BLK190(NV | V) | | 49 | | |
| ∆STC change by Lining | ΔR_f4,w | RR-334, ΔTL-BLK(NW)-62, SS6 | 5_GFB65_G13 | | 19 | | |
| Flanking STC for path Ff | R_Ff,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 49/2 | 2 + MAX(19,19) + N | 1IN(19,19)/2 + 5.7 + 7 = | 90 | (limit) |
| Flanking STC for path Fd | R_Fd,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 49/2 | 2 + MAX(19,19) + N | 1IN(19,19)/2 + 5.7 + 7 = | 90 | (limit) |
| Flanking STC for path Df | R_Df,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 49/2 | 2 + MAX(19,19) + N | 1IN(19,19)/2 + 5.7 + 7 = | 90 | (limit) |
| Junction 4: Flanking STC for al | l paths | Subset of Eq. 1.1 | | - 10*LOG10(10 | ^-9 + 10^- 9 + 10^- 9) = | | 85 |
| Total Flanking STC (4 Junctions | s) | Subset of Eq. 1.1 | | Combining | 12 Flanking STC values | | 57 |
| | | | | | | | |
| ASTC due to Direct plus All Fla | nking Paths | Equation 1.1 of this Report | Combii | ning Direct STC with | 12 Flanking STC values | 57 | |
EXAMPLE 4.1.2-H4:

(SIMPLIFIED METHOD)

- Rooms side-by-side
- Concrete floors and normal weight concrete block walls with rigid junctions except at top of non-loadbearing walls (Same structure as 4.1.2-H1, enhanced lining of walls)

Separating wall assembly (non-loadbearing) with:

- one wythe of concrete blocks with mass 238 kg/m² (e.g. 190 mm hollow blocks with normal weight aggregate¹)
- soft seal at top of wall, rigid junction at bottom
- separating wall lined both sides with 13 mm gypsum board³ on 65 mm non-loadbearing steel studs spaced 610 mm o.c., with absorptive material² filling inter-stud cavities

Junction 1: Bottom Junction (separating wall / floor) with:

- concrete floor with mass 345 kg/m² (e.g. normal weight concrete with thickness of 150 mm) with no topping or flooring
- rigid mortared T-junction with concrete block wall assembly above, soft seal with wall below

Junction 2 or 4: Each Side (separating wall /abutting side wall) with:

- rigid mortared T-junctions of abutting side wall and separating wall of concrete blocks with mass 238 kg/m² (e.g. 190 mm hollow blocks with normal weight aggregate¹)
- soft seal at top of flanking walls, rigid mortared junction at bottom
- flanking walls lined with 13 mm gypsum board³ on 65 mm nonloadbearing steel studs spaced 610 mm o.c., with absorptive material² filling inter-stud cavities

Junction 3: Top Junction (separating wall / ceiling) with:

- concrete ceiling slab with mass 345 kg/m² (e.g. normal weight concrete with thickness of 150 mm) with rigid mortared T-junction to concrete block wall assembly above, soft seal with wall below
- ceiling lining of 16 mm gypsum board³ fastened to hat-channels supported on cross-channels hung on wires, with 150 mm cavity between concrete and ceiling, with 150 mm absorptive material²

| | | • |
|---------------------------------------|-----------------------|-------------------|
| Acoustical Parameters: | | |
| For 190 mm concrete block w | alls: | |
| Mass/unit area (kg/m ²) = | 238 | (Separating wall) |
| | 238 | (Flanking wall) |
| For 150 mm concrete floor: | | |
| Mass/un | 345 | |
| | | |
| Separating parti | tion area (m^2) = | 12.5 |
| Junctio | on length (m) = | 5.0 |
| Separating partitic | on height (m) = | 2.5 |
| 10*log(S_Partition/l_ | junction 1&3) = | 4.0 |
| 10*log(S_Partition/l_ | junction 2&4) = | 7.0 |
| | | |



Junction of 190 mm concrete block separating wall (with enhanced gypsum board lining) with 150 mm thick concrete floor and ceiling. (Side view of Junctions 1 and 3)



Junction of separating wall with flanking side wall, both of 190 mm concrete block with enhanced gypsum board linings. (Plan view of Junction 2 or 4).

| | | | Path Ff | Path Fd | Path Df | |
|---------|------------------|-------------------|--------------|---------|---------|----------------------|
| Junctio | <u>n</u> | Mass ratio for Ff | Kij(in dB) = | | | Reference |
| 1 | Rigid-T/soft | 0.69 | 3.6 | 5.8 | 5.8 | ISO 15712-1, Eq. E.4 |
| 2 | Rigid T-junction | 1.00 | 5.7 | 5.7 | 5.7 | ISO 15712-1, Eq. E.4 |
| 3 | Rigid-T/soft | 0.69 | 3.6 | SOFT | SOFT | ISO 15712-1, Eq. E.4 |
| 4 | Rigid T-junction | 1.00 | 5.7 | 5.7 | 5.7 | ISO 15712-1, Eq. E.4 |

| Separating Partition (190 mm concrete block) Laboratory STC for Dd R_s,w ASTC change by Lining on D AR_d,w Direct STC in situ R_Dd,w Junction 1 (Rigid-T/Soft Cross junction, 190 mm Hanking Element F1: Laboratory STC for F1 R_F1,w ASTC change by Lining ΔR_F1,w Flanking Element F1: Laboratory STC for f1 Laboratory STC for f1 R_f1,w ASTC change by Lining ΔR_f1,w Flanking STC for path Ff R_fd,w MASTC change by Lining ΔR_f1,w Flanking STC for path Fd R_fd,w Flanking STC for path Fd R_fd,w Junction 1: Flanking STC for all paths Junction 1: Flanking STC for all paths Junction 2 (Rigid T-Junction, 190 mm block seg Flanking Element F2: Laboratory STC for F2 R_F2,w ASTC change by Lining ΔR_F2,w Flanking Element F2: Laboratory STC for path Ff Laboratory STC for path Ff R_fd,w Flanking STC for path Ff R_fd,w STC change by Lining ΔR_f2,w Flanking STC for path Ff R_fd,w Junction 2 (Ri | Beference | Î | | STC A STC | | TC |
|---|-------------------------------------|----------------------|---------------------------|--|----|---------|
| Separating Partition (190 min concrete block) Laboratory STC for Dd R_s,w ASTC change by Lining on D AR_D,w ASTC change by Lining on d AR_d,w Direct STC in situ R_Dd,w Junction 1 (Rigid-T/Soft Cross junction, 190 min Flanking Element F1: Laboratory STC for F1 Laboratory STC for F1 R_f1,w ASTC change by Lining AR_f1,w Flanking STC for path Ff R_f4,w ASTC change by Lining AR_f1,w Flanking STC for path Ff R_f4,w Junction 1: Flanking STC for all paths Junction 1: Flanking STC for all paths Junction 2 (Rigid T-Junction, 190 mm block seg Flanking Element F2: Laboratory STC for F2 R_F2,w ASTC change by Lining AR_F2,w Flanking Element F2: Laboratory STC for F2 Laboratory STC for path Ff R_f4,w STC change by Lining AR_f2,w Flanking STC for path Ff R_f4,w Flanking STC for path Ff R_f4,w STC change by Lining AR_f3,w Junction 3 (Rigid-T/Soft Cross junction, 190 min Flanking Element F3: Laboratory STC for F3 | Kererence | | | 3ic, Δ_3ic | AS | |
| Laboratory STC for Du ASTC ASTC change by Lining on D AR_D,w ASTC change by Lining on d AR_d,w Direct STC in situ R_Dd,w Flanking Element F1: Laboratory STC for F1 R_F1,w Laboratory STC for F1 R_f1,w STC change by Lining AR_f1,w Flanking Element f1: Laboratory STC for path Ff R_f1,w Laboratory STC for path Ff R_fd,w STC change by Lining AR_f1,w Flanking STC for path Ff R_fd,w Flanking STC for path Ff R_fd,w Junction 1: Flanking STC for all paths Junction 1: Flanking STC for all paths Junction 2 (Rigid T-Junction, 190 mm block seg Flanking Element F2: Laboratory STC for F2 R_f2,w ASTC change by Lining AR_f2,w Flanking Element F2: Laboratory STC for path Ff Laboratory STC for path Ff R_fd,w Flanking STC for path Ff R_fd,w Flanking STC for path Ff R_fd,w Flanking STC for path Ff R_fd,w STC change by Lining AR_f3,w Junction 3 (Rigid-T/Soft Cross junction, 190 mm Junction 2: Flanking | PR 224 NPC Moon RIK100(N) | A/) | | 40 | | |
| ASTC change by Lining on D ΔR_D, W ASTC change by Lining on D ΔR_D, W Direct STC in situ R_Dd, W Junction 1 (Rigid-T/Soft Cross junction, 190 mi Flanking Element F1: Laboratory STC for F1 Laboratory STC for F1 R_F1, W ASTC change by Lining ΔR_f1, W Laboratory STC for F1 R_f1, W ASTC change by Lining ΔR_f1, W Flanking STC for path Ff R_fd, W Flanking STC for path Ff R_fd, W Junction 1: Flanking STC for all paths Junction 1: Flanking STC for all paths Junction 2 (Rigid T-Junction, 190 mm block seg Flanking Element F2: Laboratory STC for F2 R_f2, W ASTC change by Lining ΔR_f2, W ASTC change by Lining ΔR_f2, W Flanking STC for path Ff R_f2, W ASTC change by Lining ΔR_f2, W Flanking STC for path Ff R_f3, W STC change by Lining ΔR_f3, W Junction 2 (Rigid-T/Soft Cross junction, 190 mm Junction 2: Flanking STC for sall paths Junction 3 (Rigid-T/Soft Cross junction, 190 mm Junction 3: Rigid-T/Soft Cross junction, 190 mm Junction 3 (Rigid-T/Soft Cross junction, 190 mm < | | | | 49 | | |
| ASTC change by Lining of d ΔR_0,w Direct STC in situ R_Dd,w Junction 1 (Rigid-T/Soft Cross junction, 190 mm Flanking Element F1: Laboratory STC for F1 R_F1,w ASTC change by Lining ΔR_f1,w Flanking Element f1: Laboratory STC for f1 R_f1,w Laboratory STC for path Ff R_f1,w Flanking STC for path Fd R_fd,w Junction 1 (Rigid T-Junction, 190 mm block seg Flanking Element F2: Laboratory STC for F2 R_f2,w ASTC change by Lining ΔR_f2,w Flanking Element f2: Laboratory STC for f2 Laboratory STC for path Ff R_f2,w Flanking STC for path Ff R_f2,w Flanking STC for path Ff R_f3,w ASTC change by Lining ΔR_F3,w Flanking STC for path Ff R_f3,w ASTC change by Lining ΔR_F3,w Junction 3 (Rigid-T/Soft Cros | RR-334, ATL-BLK(NVV)-02, 550 | | | 19 | | |
| Junction 1 (Rigid-T/Soft Cross junction, 190 mm Flanking Element F1: Laboratory STC for F1 R_F1,w ASTC change by Lining AR_F1,w Flanking Element f1: Laboratory STC for f1 R_f1,w Laboratory STC for f1 R_f1,w Flanking STC for path Ff R_Ff,w Flanking STC for path Fd R_Fd,w Flanking STC for path Fd R_Fd,w Flanking STC for path Fd R_F2,w Flanking Element F2: Laboratory STC for F2 Laboratory STC for F2 R_F2,w ASTC change by Lining AR_F2,w Flanking STC for path Ff R_F2,w Flanking STC for path Ff R_f4,w STC change by Lining AR_f2,w Flanking STC for path Ff R_f4,w Flanking STC for path Ff R_f4,w Flanking STC for path Ff R_f4,w STC change by Lining AR_F3,w Junction 3 (Rigid-T/Soft Cross junction, 190 mm Flanking Element F3: Laboratory STC for F3 R_F3,w ASTC change by Lining AR_F3,w ASTC change by Lining AR_f3,w ASTC change by Lining AR_f | RR-334, Δ1L-BLK(NW)-02, 530 | 5_GFB05_G13 | 40 · NAAV(1) | 19 10) : MIN(10, 10)/2 - | 70 | |
| Junction 1 (Rigid-T/Soft Cross junction, 190 mm Flanking Element F1: Laboratory STC for F1 R_F1,w ASTC change by Lining AR_F1,w Flanking Element f1: Laboratory STC for f1 R_f1,w ASTC change by Lining AR_f1,w Flanking STC for path Ff R_Ff,w Flanking STC for path Fd R_Fd,w Flanking STC for path Fd R_Fd,w Junction 1: Flanking STC for all paths Junction 2 (Rigid T-Junction, 190 mm block seg Flanking Element F2: Laboratory STC for F2 R_F2,w ASTC change by Lining AR_F2,w Flanking Element f2: Laboratory STC for f2 R_f2,w ASTC change by Lining AR_f2,w Flanking STC for path Ff R_Ff,w Flanking STC for path Ff R_Fd,w Flanking STC for f3 R_F3,w ASTC change by Lining AR_F3,w Flanking STC for f3 R_f3,w ASTC change by Lining AR_f3,w Harding STC for path Ff R_Fd,w Flanking Element F4: Laboratory STC for F4 R_F4,w STC change by Lining AR_F4,w Flanking STC for path Ff R_Fd,w Flanking STC for path Ff | 130 137 12-1, Eq. 24 anu 30 | | 49 + WAA(1 | 5,15) + WIIN(15,15)/2 - | 70 | |
| Flanking Element F1: Laboratory STC for F1 R_F1,w ASTC change by Lining ΔR_F1,w Flanking Element f1: Laboratory STC for f1 R_f1,w ASTC change by Lining ΔR_f1,w Flanking STC for path Ff R_f4,w Flanking STC for path Fd R_f4,w Flanking STC for path Fd R_f4,w Flanking STC for path Df R_Df,w Junction 1: Flanking STC for all paths Junction 1: Flanking STC for all paths Junction 2 (Rigid T-Junction, 190 mm block seg Flanking Element F2: Laboratory STC for F2 R_F2,w ASTC change by Lining ΔR_F2,w ASTC change by Lining ΔR_F2,w Flanking STC for path Ff R_f2,w ASTC change by Lining ΔR_F3,w Flanking STC for path Ff R_f4,w Flanking STC for path Ff R_f3,w ASTC change by Lining ΔR_F3,w Junction 3 (Rigid-T/Soft Cross junction, 190 mm Flanking STC for path Ff Laboratory STC for F3 R_f3,w ASTC change by Lining ΔR_F3,w Flanking STC for path Ff R_f3,w ASTC change by Lining ΔR_f3,w | n block separating wall / 150 mm c | oncrete floor) | | | | |
| Laboratory STC for F1 R_F1,w ΔSTC change by Lining ΔR_F1,w Flanking Element f1: Laboratory STC for f1 R_f1,w STC change by Lining ΔR_f1,w Flanking STC for path Ff R_Ff,w Flanking STC for path Ff R_Ff,w Flanking STC for path Fd R_Fd,w Flanking STC for path Fd R_Fd,w Flanking STC for path Df R_Df,w Junction 1: Flanking STC for all paths Junction 2 (Rigid T-Junction, 190 mm block seg Elanking Element F2: Laboratory STC for F2 Laboratory STC for F2 R_F2,w ASTC change by Lining ΔR_F2,w Flanking Element f2: Laboratory STC for F2 Laboratory STC for path Ff R_fd,w Flanking STC for path Ff R_fd,w Flanking STC for path Ff R_fd,w Junction 2: Flanking STC for all paths Junction 2: Flanking STC for all paths Junction 3 (Rigid-T/Soft Cross junction, 190 mm Jeak Flanking Element f3: Laboratory STC for F3 R_F3,w Junction 3: Rigid-T/Soft Cross junction, 190 mm Jeak Sr,w Flanking STC for path Ff R_f3,w STC change b | | | | | | |
| ΔSTC change by Lining ΔR_F1,w Flanking Element f1: Laboratory STC for f1 R_f1,w SATC change by Lining ΔR_f1,w Flanking STC for path Ff R_Fd,w Flanking STC for path Fd R_Fd,w Flanking STC for path Df R_Df,w Junction 1: Flanking STC for all paths Junction 2 (Rigid T-Junction, 190 mm block seg Flanking Element F2: Laboratory STC for F2 Laboratory STC for F2 R_F2,w ASTC change by Lining ΔR_F2,w Flanking STC for path Ff R_f2,w Flanking STC for path Ff R_f4,w STC change by Lining ΔR_F3,w Junction 3 (Rigid-T/Soft Cross junction, 190 mm Flanking STC for F3 R_F3,w Junction 3 (Rigid-T/Soft Cross junction, 190 mm Flanking Element F3: Laboratory STC for F3 Laboratory STC for F3 R_F3,w ASTC change by Lining ΔR_f3,w ASTC change by Lining ΔR_f3,w ASTC change by Lining ΔR_f3,w STC | RR-333, TLF-97-107a | | | 52 | | |
| Flanking Element f1: Laboratory STC for f1 R_f1,w ASTC change by Lining ΔR_f1,w Flanking STC for path Ff R_Ff,w Flanking STC for path Fd R_Df,w Flanking STC for path Df R_Df,w Junction 1: Flanking STC for all paths Junction 1: Flanking STC for all paths Junction 2 (Rigid T-Junction, 190 mm block seg Flanking Element F2: Laboratory STC for F2 R_F2,w ASTC change by Lining ΔR_F2,w Flanking Element f2: Laboratory STC for f2 Laboratory STC for path Ff R_fd,w Flanking STC for path Ff R_fd,w Junction 3 (Rigid-T/Soft Cross junction, 190 mm Interpretation Junction 3 (Rigid-T/Soft Cross junction, 190 mm Interpretation Laboratory STC for F3 R_f3,w STC change by Lining ΔR_f3,w Flanking Element f3: Laboratory STC for path Ff Laboratory STC for p | No Lining , | | | 0 | | |
| Laboratory STC for f1 R_f1,w ΔSTC change by Lining ΔR_f1,w Flanking STC for path Ff R_ff,w Flanking STC for path Df R_Df,w Junction 1: Flanking STC for all paths Junction 1: Flanking STC for all paths Junction 2 (Rigid T-Junction, 190 mm block seg Flanking Element F2: Laboratory STC for F2 R_F2,w STC change by Lining ΔR_F2,w Flanking Element F2: Laboratory STC for f2 Laboratory STC for path Ff R_f2,w STC change by Lining ΔR_f2,w Flanking STC for path Ff R_fd,w Flanking STC for path Ff R_fd,w Flanking STC for path Df R_Df,w Junction 2: Flanking STC for all paths Junction 2: Flanking STC for all paths Junction 3 (Rigid-T/Soft Cross junction, 190 mm Flanking Element F3: Laboratory STC for F3 R_F3,w ASTC change by Lining ΔR_f3,w STC change by Lining ΔR_f3,w Flanking STC for path Ff R_f3,w ASTC change by Lining ΔR_f3,w Flanking STC for path Ff R_f3,w STC change by Lining ΔR_f3,w | | | | | | |
| ΔSTC change by Lining ΔR_f1,w Flanking STC for path Ff R_Ff,w Flanking STC for path Fd R_Df,w Flanking STC for path Fd R_Df,w Junction 1: Flanking STC for all paths Inction 1: Flanking STC for all paths Junction 2 (Rigid T-Junction, 190 mm block seg Flanking Element F2: Laboratory STC for F2 R_F2,w ASTC change by Lining ΔR_F2,w Flanking Element f2: Laboratory STC for f2 Laboratory STC for path Ff R_f2,w STC change by Lining ΔR_f2,w Flanking STC for path Ff R_f4,w Flanking STC for path Ff R_f4,w Flanking STC for path Ff R_f4,w Flanking STC for path Ff R_f3,w Junction 3 (Rigid-T/Soft Cross junction, 190 mm Flanking Element F3: Laboratory STC for F3 R_f3,w ASTC change by Lining ΔR_f3,w Flanking STC for path Ff R_f3,w ASTC change by Lining ΔR_f3,w Flanking STC for path Ff R_f4,w Flanking STC for path Ff R_f4,w Flanking STC for path Ff R_f4,w Flanking STC for path Ff < | RR-333, TLF-97-107a | | | 52 | | |
| Flanking STC for path Ff R_ Ff,w Flanking STC for path Fd R_ Cd,w Flanking STC for path Df R_ Df,w Junction 1: Flanking STC for all paths Junction 2 (Rigid T-Junction, 190 mm block seg Flanking Element F2: Laboratory STC for F2 R_ F2,w ASTC change by Lining ΔR_ F2,w ASTC change by Lining ΔR_ F2,w ASTC change by Lining ΔR_ f2,w Flanking STC for path Ff R_ f2,w ASTC change by Lining ΔR_ f2,w Flanking STC for path Ff R_ fd,w Flanking STC for path Ff R_ Fd,w STC change by Lining ΔR_ f2,w Flanking STC for path Ff R_ fd,w Flanking STC for path Df R_ Df,w Junction 3 (Rigid-T/Soft Cross junction, 190 mm Flanking Element F3: Laboratory STC for F3 R_ F3,w ASTC change by Lining ΔR_ F3,w ASTC change by Lining ΔR_ f3,w Flanking STC for path Ff R_ fd,w Flanking STC for F4 R_ f4,w | No Lining , | | | 0 | | |
| Flanking STC for path Fd R_Fd,w Flanking STC for path Df R_Df,w Junction 1: Flanking STC for all paths Junction 2 (Rigid T-Junction, 190 mm block seg Flanking Element F2: Laboratory STC for F2 R_F2,w ASTC change by Lining ΔR_F2,w Elaboratory STC for f2 R_f2,w ASTC change by Lining ΔR_f2,w Flanking STC for path Ff R_fd,w Junction 3 (Rigid-T/Soft Cross junction, 190 mm Flanking STC for path Ff Junction 3 (Rigid-T/Soft Cross junction, 190 mm Flanking STC for path Ff Junction 3 (Rigid-T/Soft Cross junction, 190 mm Flanking STC for path Ff Flanking STC for path Ff R_f3,w ASTC change by Lining ΔR_f3,w STC change by Lining ΔR_f3,w Flanking STC for path Ff R_f4,w STC change by Lining ΔR_f4,w Flanking STC for path Ff R_f4,w Junction 3: Flanking STC for all paths Junction 3: Flanking STC | ISO 15712-1, Eq. 28a and 31 | 52/2 + | 52/2 + MAX(0,0) + | + MIN(0,0)/2 + 3.6 + 4 = | 60 | |
| Flanking STC for path Df R_Df,w Junction 1: Flanking STC for all paths Junction 2 (Rigid T-Junction, 190 mm block seg Elanking Element F2: Laboratory STC for F2 R_F2,w ASTC change by Lining ΔR_F2,w Elanking Element f2: Laboratory STC for F2 Laboratory STC for f2 R_f2,w ASTC change by Lining ΔR_f2,w Flanking Element f2: Laboratory STC for path Ff Laboratory STC for path Ff R_fd,w Flanking STC for path Fd R_fd,w Flanking STC for path Fd R_fd,w Junction 2: Flanking STC for all paths Junction 3 (Rigid-T/Soft Cross junction, 190 mm Junction 3 (Rigid-T/Soft Cross junction, 190 mm Flanking Element F3: Laboratory STC for F3 R_F3,w ASTC change by Lining ΔR_F3,w Flanking Element f3: Laboratory STC for F3 Laboratory STC for path Ff R_fd,w ASTC change by Lining ΔR_f3,w Flanking STC for path Ff R_fd,w STC change by Lining ΔR_f4,w Flanking STC for path Ff R_fd,w Junction 3: Flanking STC for path Ff R_fd,w <td>ISO 15712-1, Eq. 28a and 31</td> <td>52/2 + 49</td> <td>9/2 + MAX(0,19) +</td> <td>MIN(0,19)/2 + 5.8 + 4 =</td> <td>79</td> <td></td> | ISO 15712-1, Eq. 28a and 31 | 52/2 + 49 | 9/2 + MAX(0,19) + | MIN(0,19)/2 + 5.8 + 4 = | 79 | |
| Junction 1: Flanking STC for all paths Junction 2 (Rigid T-Junction, 190 mm block seg Flanking Element F2: Laboratory STC for F2 R_F2,w ASTC change by Lining AR_F2,w Flanking STC for path Ff R_fr,w Flanking STC for path Ff R_Ff,w Flanking STC for path Ff R_Ff,w Flanking STC for path Ff R_Fd,w Junction 2: Flanking STC for all paths Junction 3 (Rigid-T/Soft Cross junction, 190 mm Flanking Element F3: Laboratory STC for F3 R_F3,w ASTC change by Lining AR_F3,w ASTC change by Lining AR_F3,w Flanking STC for path Ff R_fr,w Flanking STC for path Ff R_F3,w ASTC change by Lining AR_F3,w STC change by Lining AR_F3,w STC change by Lining AR_F3,w Junction 3: Flanking STC for all paths Junction 4 (Rigid T-junction, 190 mm block seg Flanking Element F4: Laboratory STC for F4 R_F4,w ASTC change by Lining AR_F4,w Flanking STC for path Ff R_F4,w STC change by Lining AR_F4,w Flanking STC for F4 R_F4,w STC change by Lining AR_F4,w Flanking STC for path Ff R_F4,w STC change by Lining AR_F4,w Flanking STC for path Ff R_F4,w STC change by Lining AR_F4,w Flanking STC for path Ff R_F4,w STC change by Lining AR_F4,w Flanking STC for path Ff R_F4,w STC change by Lining AR_F4,w Flanking STC for path Ff R_F4,w STC change by Lining AR_F4,w Flanking STC for path Ff R_F4,w STC change by Lining AR_F4,w Flanking STC for path Ff R_F4,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 52 | 2/2 + MAX(19,0) + | MIN(19,0)/2 + 5.8 + 4 = | 79 | |
| Junction 2 (Rigid T-Junction, 190 mm block seg Flanking Element F2: Laboratory STC for F2 R_F2,w ASTC change by Lining Δ R_F2,w Flanking Element f2: Laboratory STC for f2 R_f2,w ASTC change by Lining Δ R_f2,w Flanking STC for path Ff R_Ff,w Flanking STC for path Pf R_Df,w Junction 2: Flanking STC for all paths Junction 3 (Rigid-T/Soft Cross junction, 190 mm Flanking Element F3: Laboratory STC for F3 R_F3,w ASTC change by Lining Δ R_F3,w ASTC change by Lining Δ R_f3,w Flanking STC for path Ff R_f4,w Flanking STC for F4 R_F4,w Junction 3: Flanking STC for all paths | Subset of Eq. 1.1 | - | - 10*LOG10(10^-6 - | + 10^- 7.9 + 10^- 7.9) = | | 60 |
| Flanking Element F2: Laboratory STC for F2 R_F2,w ASTC change by Lining $\Delta R_F2, w$ Flanking Element f2: Laboratory STC for F2 Laboratory STC for f2 R_f2,w Flanking Element f2: Laboratory STC for f2 Laboratory STC for f2 R_f2,w Flanking Element f2: Laboratory STC for path Ff Laboratory STC for path Fd R_fd,w Flanking STC for path Fd R_fd,w Flanking STC for path Df R_Df,w Junction 2: Flanking STC for all paths Junction 3 (Rigid-T/Soft Cross junction, 190 mm Junction 3 (Rigid-T/Soft Cross junction, 190 mm Flanking Element F3: Laboratory STC for F3 R_F3,w ASTC change by Lining $\Delta R_F3, w$ Flanking Element f3: Laboratory STC for path Ff Laboratory STC for path Ff R_fd,w STC change by Lining $\Delta R_fd, w$ STC for path Ff R_fd,w Flanking STC for path Ff R_fd,w Junction 3: Flanking STC for path Ff R_fd,w Junction 4: (Rigid T-junction, 190 mm block seg Flanking STC for path Ff Flanking Element F4: Laboratory STC for F4 <t< td=""><td>arating wall / 190 mm block flanki</td><td>ng wall)</td><td></td><td></td><td></td><td></td></t<> | arating wall / 190 mm block flanki | ng wall) | | | | |
| Laboratory STC for F2 R_F2,w ASTC change by Lining $\Delta R_F2,w$ Flanking Element f2: Laboratory STC for f2 R_f2,w Flanking STC for path Ff R_ff,w Flanking STC for path Ff R_f,w Flanking STC for path Fd R_fd,w Junction 2: Flanking STC for all paths Junction 3 (Rigid-T/Soft Cross junction, 190 mi Flanking Element F3: Laboratory STC for F3 R_F3,w Δ STC change by Lining $\Delta R_F3,w$ STC change by Lining $\Delta R_f3,w$ Flanking STC for path Ff R_ff,w Flanking STC for path Ff R_f4,w Δ STC change by Lining $\Delta R_f3,w$ Flanking STC for path Ff R_ff,w Flanking STC for path Ff R_ff,w Flanking STC for path Ff R_ff,w Flanking STC for path Ff R_f4,w STC change by Lining $\Delta R_f3,w$ Flanking STC for path Ff R_ff,w Flanking STC for path Ff R_ff,w Flanking STC for path Ff R_f4,w STC change by Lining $\Delta R_f4,w$ Flanking Element f4: Laboratory STC for f4 R_f4,w ASTC change by Lining $\Delta R_f4,w$ Flanking STC for path Ff R_f4,w STC change by Lining $\Delta R_f4,w$ Flanking STC for path Ff R_f4,w STC change by Lining $\Delta R_f4,w$ Flanking STC for path Ff R_f4,w STC change by Lining $\Delta R_f4,w$ Flanking STC for path Ff R_f4,w STC change by Lining $\Delta R_f4,w$ Flanking STC for path Ff R_f4,w STC change STC for path Ff R_f4,w | Stating wan / 150 mm block fidiki | | | | | |
| Laboratory STC for F2 R_F2 ,wASTC change by Lining ΔR_F2 ,wLaboratory STC for f2 R_f2 ,wLaboratory STC for f2 R_f2 ,wFlanking STC for path Ff R_f4 ,wFlanking STC for path Fd R_f4 ,wFlanking STC for path Df R_f4 ,wFlanking STC for path Df R_f4 ,wFlanking STC for path Df R_f4 ,wJunction 2: Flanking STC for all pathsJunction 3 (Rigid-T/Soft Cross junction, 190 mmFlanking Element F3:Laboratory STC for F3 R_f3 ,wASTC change by Lining ΔR_f3 ,wASTC change by Lining ΔR_f3 ,wASTC change by Lining ΔR_f3 ,wFlanking STC for path Ff R_f4 ,wFlanking STC for path Ff R_f4 ,wFlanking STC for path Df R_f4 ,wFlanking STC for F4 R_f4 ,wSTC change by Lining ΔR_f4 ,wFlanking Element F4:Laboratory STC for F4Laboratory STC for F4 R_f4 ,wASTC change by Lining ΔR_f4 ,wFlanking Element F4:Laboratory STC for f4Laboratory STC for F4 R_f4 ,wASTC change by Lining ΔR_f4 ,wFlanking STC for path Ff R_f4 ,wASTC change by Lining ΔR_f4 ,wFlanking STC for path Ff R_f4 ,w | RR-334 NRC-Mean RI K190/M | M/) | | 49 | | |
| ASTC change by Lining ΔR_F2,W Flanking Element f2: Laboratory STC for f2 R_f2,W ASTC change by Lining ΔR_f2,W Flanking STC for path Ff R_f4,W Flanking STC for path Ff R_f4,W Flanking STC for path Fd R_f4,W Flanking STC for path Fd R_f4,W Flanking STC for path Df R_Df,W Junction 2: Flanking STC for all paths Junction 3 (Rigid-T/Soft Cross junction, 190 mm Flanking Element F3: Laboratory STC for F3 Laboratory STC for F3 R_F3,W ASTC change by Lining ΔR_F3,W Flanking Element f3: Laboratory STC for f3 Laboratory STC for f3 R_f3,W STC change by Lining ΔR_f3,W Flanking STC for path Ff R_f4,W STC change by Lining ΔR_f4,W Flanking STC for path Df R_Df,W Junction 3: Flanking STC for all paths Junction 3: Flanking STC for all paths Junction 4 (Rigid T-junction, 190 mm block seg Elanking Element F4: Laboratory STC for F4 R_F4,W STC change by Lining ΔR_F4,W Elanking Element F4: Laboratory STC for f4 | | E CERCE C12 | | 45 | | |
| Haiking Leffent 12 Laboratory STC for f2 R_f2,w ASTC change by Lining $\Delta R_f2,w$ Flanking STC for path Ff R_Fd,w Flanking STC for path Fd R_fd,w Flanking STC for path Fd R_fd,w Flanking STC for path Fd R_fd,w Flanking STC for path Df R_Df,w Junction 2: Flanking STC for all paths Junction 3 (Rigid-T/Soft Cross junction, 190 mm Elanking Element F3: Laboratory STC for F3 Laboratory STC for F3 R_F3,w ASTC change by Lining $\Delta R_F3,w$ STC change by Lining $\Delta R_f3,w$ ASTC change by Lining $\Delta R_f3,w$ STC for path Ff R_f4,w STC for path Ff R_f4,w Flanking STC for path Ff R_f4,w Flanking STC for path Ff R_f4,w Junction 3: Flanking STC for all paths Junction 4 (Rigid T-junction, 190 mm block seg Junction 4 (Rigid T-junction, 190 mm block seg Flanking Element F4: Laboratory STC for F4 R_F4,w ASTC change by Lining $\Delta R_F4,w$ Flanking Element F4: Laboratory STC for f4 R_f4,w Laboratory S | RR-334, Δ1L-BLR(NW)-02, 330 | 5_GFB05_G15 | | 19 | | |
| Laboratory STC for 12 R_12,w ASTC change by Lining AR_12,w Flanking STC for path Ff R_ Ff,w Flanking STC for path Fd R_ Fd,w Flanking STC for path Df R_ Df,w Junction 2: Flanking STC for all paths Junction 3 (Rigid-T/Soft Cross junction, 190 mm Flanking Element F3: Laboratory STC for F3 Laboratory STC for F3 R_F3,w ASTC change by Lining AR_F3,w ASTC change by Lining AR_f3,w STC change by Lining AR_f4,w STC for path Ff R_fd,w STC for path Ff R_fd,w Junction 3: Flanking STC for all paths Junction 3: Flanking STC for all paths Junction 4 (Rigid T-junction, 190 mm block seg Flanking Element F4: Laboratory STC for F4 R_F4,w ASTC change by Lining AR_F4,w STC change by Lining AR_f4,w < | PR 224 NPC Maap RIK100(N) | A() | | 40 | | |
| ASTC change by Lining ALT, Z, W Flanking STC for path Ff R_Ff, w Flanking STC for path Fd R_Df, w Junction 2: Flanking STC for all paths Junction 2: Flanking STC for all paths Junction 3 (Rigid-T/Soft Cross junction, 190 mm Flanking Element F3: Laboratory STC for F3 R_F3, w ASTC change by Lining AR_F3, w ASTC change by Lining AR_f3, w STC change by Lining AR_f4, w Junction 3: Flanking STC for path Ff R_Df, w Junction 3: Flanking STC for all paths Junction 3: Flanking STC for all paths Junction 4 (Rigid T-junction, 190 mm block seg Flanking Element F4: Laboratory STC for F4 R_F4, w ASTC change by Lining AR_F4, w < | | 5 GER65 G12 | | 49 | | |
| Flanking STC for path Fd R_Fd,w Flanking STC for path Df R_Df,w Junction 2: Flanking STC for all paths Junction 2: Flanking STC for all paths Junction 3 (Rigid-T/Soft Cross junction, 190 mm Flanking Element F3: Laboratory STC for F3 R_F3,w ASTC change by Lining $\Delta R_F3, w$ Flanking Element f3: Laboratory STC for f3 Laboratory STC for f3 R_f3,w ASTC change by Lining $\Delta R_A, f3, w$ Flanking STC for path Ff R_f4,w STC change by Lining $\Delta R_A, f3, w$ Flanking STC for path Ff R_f4,w Junction 3: Flanking STC for all paths Junction 3: Flanking STC for all paths Junction 4: (Rigid T-junction, 190 mm block seg Flanking Element F4: Laboratory STC for F4 R_F4,w ASTC change by Lining $\Delta R_F4, w$ ASTC change by Lining $\Delta R_F4, w$ Flanking Element F4: Laboratory STC for f4 Laboratory STC for F4 R_f4, w ASTC change by Lining $\Delta R_F4, w$ Flanking STC for path Ff R_f4, w ASTC change by Lining $\Delta R_F4, w$ Flanking STC for path Ff R_f4, w | ISO 15712-1 Eq. 282 and 21 | 10/2 + 10/2 | $\pm MAY(10, 10) \pm M$ | 13 | 00 | (limit) |
| Hanking STC for path Df R_16,w Junction 2: Flanking STC for all paths Junction 3: Rigid-T/Soft Cross junction, 190 mi Flanking Element F3: Laboratory STC for F3 R_F3,w ASTC change by Lining AR_F3,w ASTC change by Lining ABCT Change by Lining ASTC change by Lining AR_f3,w ASTC change by Lining AR_f3,w Flanking STC for path Ff R_Fd,w Flanking STC for path Df R_Df,w Junction 3: Flanking STC for all paths Junction 4 (Rigid T-junction, 190 mm block seg Flanking Element F4: Laboratory STC for F4 R_F4,w ASTC change by Lining AR_F4,w Flanking Element f4: Laboratory STC for f4 R_F4,w STC change by Lining ASTC change by Lining AR_f4,w </td <td>ISO 15712-1, Eq. 28a and 31</td> <td>49/2 + 49/2</td> <td>+ MAX(19,19) + W</td> <td>$\frac{1111(19,19)}{2+5.7+7-}$</td> <td>90</td> <td>(limit)</td> | ISO 15712-1, Eq. 28a and 31 | 49/2 + 49/2 | + MAX(19,19) + W | $\frac{1111(19,19)}{2+5.7+7-}$ | 90 | (limit) |
| Junction 2: Flanking STC for all paths Junction 2: Flanking STC for all paths Junction 3 (Rigid-T/Soft Cross junction, 190 mm Flanking Element F3: Laboratory STC for F3 R_F3,w ASTC change by Lining $\Delta R_F3,w$ Laboratory STC for f3 R_f3,w SSTC change by Lining $\Delta R_f3,w$ SSTC change by Lining $\Delta R_f3,w$ Flanking STC for path Ff R_f4,w Flanking STC for path Ff R_f4,w Flanking STC for path Df R_Df,w Junction 3: Flanking STC for all paths Junction 4 (Rigid T-junction, 190 mm block sep Flanking Element F4: Laboratory STC for F4 Laboratory STC for F4 R_F4,w ASTC change by Lining $\Delta R_F4,w$ Flanking Element f4: Laboratory STC for f4 Laboratory STC for f4 R_f4,w ASTC change by Lining $\Delta R_F4,w$ Flanking STC for path Ff R_f4,w Mathing STC for path Ff R_f4,w Flanking STC for path Ff R_f4,w Mathing STC for path Ff R_f4,w | ISO 15712-1, Eq. 28a and 31 | 45/2 + 45/2 | + MAX(19,19) + W | $\frac{1111(19,19)}{2} + 5.7 + 7 =$ | 90 | (limit) |
| Junction 3 (Rigid-T/Soft Cross junction, 190 mm Flanking Element F3: Laboratory STC for F3 R_F3,w ASTC change by Lining $\Delta R_F3,w$ Junction 3: Flanking Element f3: Laboratory STC for f3 Laboratory STC for f3 R_f3,w ASTC change by Lining $\Delta R_f3,w$ ASTC change by Lining $\Delta R_f3,w$ Flanking STC for path Ff R_f4,w Flanking STC for path Df R_Df,w Junction 3: Flanking STC for all paths Junction 4 (Rigid T-junction, 190 mm block seg Flanking Element F4: Laboratory STC for F4 Laboratory STC for F4 R_F4,w ASTC change by Lining $\Delta R_F4,w$ Hanking Element f4: Laboratory STC for f4 Laboratory STC for f4 R_f4,w ASTC change by Lining $\Delta R_F4,w$ Hanking STC for path Ff R_f4,w Hanking STC for path Ff R_f4,w Flanking STC for path Ff R_f4,w | Subset of Eq. 1.1 | 45/2 1 45/2 | - 10*10610(10 | (10,15,15)/2 + 5.7 + 7 = | 50 | 85 |
| Junction 3 (Rigid-T/Soft Cross junction, 190 mm Flanking Element F3: Laboratory STC for F3 R_F3,w ASTC change by Lining $\Delta R_F3,w$ Hanking Element f3: Laboratory STC for F3 Laboratory STC for f3 R_f3,w ASTC change by Lining $\Delta R_f3,w$ ASTC change by Lining $\Delta R_f3,w$ ASTC change by Lining $\Delta R_f3,w$ Flanking STC for path Ff R_f4,w Flanking STC for path Df R_Df,w Flanking STC for path Df R_Df,w Junction 3: Flanking STC for all paths Munching Element F4: Laboratory STC for F4 R_F4,w ASTC change by Lining $\Delta R_F4,w$ Flanking Element F4: Laboratory STC for f4 Laboratory STC for F4 R_f4,w ASTC change by Lining $\Delta R_F4,w$ Flanking Stor for path Ff R_f4,w STC change by Lining $\Delta R_F4,w$ Flanking STC for path Ff R_f4,w STC change by Lining $\Delta R_F4,w$ Flanking STC for path Ff R_f4,w | | | 10 10010(10 | 5 10 5 10 5 1 | | 00 |
| Flanking Element F3: Laboratory STC for F3 R_F3,w ΔSTC change by Lining ΔR_F3,w Flanking Element f3: Laboratory STC for f3 Laboratory STC for f3 R_f3,w ASTC change by Lining ΔR_f3,w STC change by Lining ΔR_f3,w Flanking STC for path Ff R_f4,w Flanking STC for path Fd R_fd,w Junction 3: Flanking STC for all paths Junction 4 (Rigid T-junction, 190 mm block sep Flanking Element F4: Laboratory STC for F4 Laboratory STC for F4 R_F4,w ASTC change by Lining ΔR_F4,w Flanking Element f4: Laboratory STC for f4 Laboratory STC for f4 R_f4,w Habring STC for path Ff R_f4,w STC change by Lining ΔR_f4,w Flanking STC for path Ff R_f4,w Flanking STC for path Ff R_f4,w | n block separating wall / 150 mm c | oncrete ceiling slab | <u>)</u> | | | |
| Laboratory STC for F3 R_F3,w ΔSTC change by Lining ΔR_F3,w Flanking Element f3: Laboratory STC for f3 Laboratory STC for f3 R_f3,w SSTC change by Lining ΔR_f3,w Flanking STC for path Ff R_Ff,w Flanking STC for path Ff R_fd,w Flanking STC for path Ff R_Df,w Junction 3: Flanking STC for all paths Junction 4 (Rigid T-junction, 190 mm block seg Flanking Element F4: Laboratory STC for F4 Laboratory STC for F4 R_F4,w STC change by Lining ΔR_F4,w Flanking Element f4: Laboratory STC for f4 Laboratory STC for f4 R_f4,w Flanking STC for path Ff R_f4,w Flanking STC for path Ff R_f4,w | | | | | | |
| ΔSTC change by Lining ΔR_F3,w Flanking Element f3: Laboratory STC for f3 R_f3,w Laboratory STC for f3 AR_f3,w Flanking STC for path Ff R_Ff,w Flanking STC for path Fd R_fd,w Flanking STC for path Fd R_Df,w Junction 3: Flanking STC for all paths Junction 4 (Rigid T-junction, 190 mm block seg Flanking Element F4: Laboratory STC for F4 Laboratory STC for F4 R_F4,w ASTC change by Lining ΔR_F4,w Flanking Element f4: Laboratory STC for f4 Laboratory STC for f4 R_f4,w ASTC change by Lining ΔR_F4,w Flanking Element f4: Laboratory STC for f4 Laboratory STC for f4 R_f4,w ASTC change by Lining ΔR_f4,w Flanking STC for path Ff R_f4,w STC change ST for path Ff R_f4,w | RR-333, TLF-97-107a | | | 52 | | |
| Flanking Element f3: Laboratory STC for f3 R_f3,w ASTC change by Lining ΔR_f3,w Flanking STC for path Ff R_ff,w Flanking STC for path Fd R_fd,w Flanking STC for path Fd R_Df,w Junction 3: Flanking STC for all paths Junction 4 (Rigid T-junction, 190 mm block seg Flanking Element F4: Laboratory STC for F4 Laboratory STC for F4 R_F4,w ASTC change by Lining ΔR_F4,w Flanking Element f4: Laboratory STC for f4 Laboratory STC for f4 R_f4,w ASTC change by Lining ΔR_F4,w Flanking STC for path Ff R_f4,w Flanking STC for path Ff R_f4,w | RR-333, ATLF-CON150-01, SU | S150_GFB150_G16 | | 19 | | |
| Laboratory STC for f3 R_f3,w ΔSTC change by Lining ΔR_f3,w Flanking STC for path Ff R_f4,w Flanking STC for path Fd R_fd,w Flanking STC for path Fd R_fd,w Flanking STC for path Df R_Df,w Junction 3: Flanking STC for all paths Junction 4 (Rigid T-junction, 190 mm block seg Flanking Element F4: Laboratory STC for F4 Laboratory STC for F4 R_F4,w ASTC change by Lining ΔR_F4,w Flanking Element f4: Laboratory STC for f4 Laboratory STC for f4 R_f4,w ASTC change by Lining ΔR_f4,w Flanking STC for path Ff R_f4,w STC change ST for path Ff R_f4,w Flanking STC for path Ff R_f4,w | | | | | | |
| ∆STC change by Lining ∆R_f3, w Flanking STC for path Ff R_ Ff, w Flanking STC for path Fd R_ Df, w Junction 3: Flanking STC for all paths Junction 3: Flanking STC for all paths Junction 4 (Rigid T-junction, 190 mm block seg Flanking Element F4: Laboratory STC for F4 R_F4, w ASTC change by Lining ∆R_F4, w Flanking Element f4: Laboratory STC for f4 Laboratory STC for f4 R_f4, w ASTC change by Lining ∆R_f4, w Hanking STC for path Ff R_f4, w MSTC for path Ff R_f4, w | RR-333, TLF-97-107a | | | 52 | | |
| Flanking STC for path Ff R_Ff,w Flanking STC for path Fd R_Fd,w Flanking STC for path Df R_Df,w Junction 3: Flanking STC for all paths Junction 4 (Rigid T-junction, 190 mm block sep Flanking Element F4: Laboratory STC for F4 Laboratory STC for F4 R_F4,w ASTC change by Lining ΔR_F4,w Elaboratory STC for f4 R_f4,w STC change by Lining ΔR_f4,w Flanking STC for path Ff R_f4,w MSTC change STC for path Ff R_f4,w | RR-333, ATLF-CON150-01, SU | S150_GFB150_G16 | | 19 | | |
| Flanking STC for path Fd R_Fd,w Flanking STC for path Df R_Df,w Junction 3: Flanking STC for all paths Image: STC for all paths Junction 4 (Rigid T-junction, 190 mm block september fa: Image: STC for F4 Laboratory STC for F4 R_F4,w ASTC change by Lining AR_F4,w Elanking Element F4: Image: STC for f4 Laboratory STC for f4 R_f4,w STC change by Lining AR_f4,w STC change by Lining AR_f4,w STC change STC for path Ff R_f4,w Flanking STC for path Ff R_f4,w | ISO 15712-1, Eq. 28a and 31 | 52/2 + 52/2 | + MAX(19,19) + N | 1IN(19,19)/2 + 3.6 + 4 = | 88 | |
| Flanking STC for path Df R_Df,w Junction 3: Flanking STC for all paths Junction 4 (Rigid T-junction, 190 mm block seg Flanking Element F4: Laboratory STC for F4 R_F4,w STC change by Lining ΔR_F4,w Flanking Element f4: Laboratory STC for f4 Laboratory STC for f4 R_f4,w STC change by Lining ΔR_f4,w Flanking STC for path Ff R_f4,w Flanking STC for path Ff R_f4,w | | | Negligible tr | ansmission via fire stop | 90 | (limit) |
| Junction 3: Flanking STC for all paths Junction 4 (Rigid T-junction, 190 mm block seg Flanking Element F4: Laboratory STC for F4 R_F4,w ASTC change by Lining $\Delta R_F4, w$ Laboratory STC for f4 R_f4,w ASTC change by Lining $\Delta R_F4, w$ ASTC change by Lining $\Delta R_F4, w$ ASTC change by Lining $\Delta R_F4, w$ Flanking STC for f4 R_f4, w ASTC change by Lining $\Delta R_F4, w$ Flanking STC for path Ff R_f4, w Flanking STC for path Ff R_f4, w | | | Negligible tr | ansmission via fire stop | 90 | (limit) |
| Junction 4 (Rigid T-junction, 190 mm block seg Flanking Element F4: Laboratory STC for F4 R_F4,w ASTC change by Lining \Delta_R_F4,w Isboratory STC for f4 R_f4,w Laboratory STC for f4 R_f4,w ASTC change by Lining \Delta_R_f4,w ASTC change by Lining \Delta_R_f4,w ASTC change STC for path Ff R_f4,w Flanking STC for path Ff R_f4,w | Subset of Eq. 1.1 | | - 10*LOG10(10^- | 8.8 + 10^- 9 + 10^- 9) = | | 84 |
| Flanking Element F4: Control Laboratory STC for F4 R_F4,w ASTC change by Lining AR_F4,w Laboratory STC for F4 R_f4,w Laboratory STC for f4 R_f4,w SSTC change by Lining AR_f4,w ASTC change by Lining AR_f4,w Flanking STC for path Ff R_f4,w Flanking STC for path Ff R_f4,w | arating wall / 100 mm black flankin | ag wall) | | | | |
| Laboratory STC for F4 R_F4,w ΔSTC change by Lining ΔR_F4,w Flanking Element f4: Laboratory STC for f4 Laboratory STC for f4 R_f4,w ΔSTC change by Lining ΔR_f4,w Flanking STC for path Ff R_f4,w Flanking STC for path Ff R_f4,w | arating wait / 150 mm block flankir | ig wall) | | | | |
| ΔSTC change by Lining ΔR_F4,w Flanking Element f4: Laboratory STC for f4 R_f4,w ΔSTC change by Lining ΔR_f4,w ΔSTC change by Lining ΔR_f4,w Flanking STC for path Ff R_f4,w Flanking STC for path Ff R_f4,w | RR-334, NRC-Mean BLK190(N) | W) | | 49 | | |
| Flanking Element f4: Flanking Element f4: Laboratory STC for f4 R_f4,w ASTC change by Lining AR_f4,w Flanking STC for path Ff R_f4,w Flanking STC for path Ff R_f4,w | RB-334 ATI-RIK(NW)-62 SS6 | 5 GEB65 G13 | | 19 | | |
| Laboratory STC for f4 R_f4,w ΔSTC change by Lining ΔR_f4,w Flanking STC for path Ff R_Ff,w Flanking STC for path Ff R_Ff,w | | 5_51005_015 | | 1.7 | | |
| ASTC change by Lining AR_{4,w} Flanking STC for path Ff R_Ff,w Flanking STC for path Ff R_Ff,w | RR-334 NRC-Mean RI K190/M | M/) | | 49 | | |
| Flanking STC for path Ff R_ Ff,w Flanking STC for path Fd R_ Fd,w | RB-334 ATI-RIK(NW)-62 SS6 | 5 GEB65 G13 | | 19 | | |
| Flanking STC for path Fd R_Fd,w | ISO 15712-1 Eq. 28a and 31 | <u>49/2 + 49/2</u> | + MAX(19 19) + M | 1IN(19 19)/2 + 5 7 + 7 - | 90 | (limit) |
| | ISO 15712-1 For 28a and 31 | 49/2 + 49/2 | + MAX(19, 19) + M | 11N(19 19)/2 + 5 7 + 7 - | 90 | (limit) |
| Flanking STC for nath Df R Df w | ISO 15712-1 Eq. 28a and 31 | 49/2 + 49/2 | $+ M\Delta X(19, 19) + M$ | $\frac{10}{10}$ $\frac{10}{2}$ + 5.7 + 7 - | 90 | (limit) |
| Junction 4: Flanking STC for all paths | Subset of Eq. 1.1 | -J/2 · -J/2 | - 10*10610(10 | $(-9 + 10^{-}9 + 10^{-}9) =$ | 50 | 85 |
| Total Flanking STC (4 Junctions) | Subset of Eq. 1.1 | | Combining | 12 Flanking STC values | | 60 |
| gere (realistication) | - Subject of Eq. 111 | | Comoning | | | |
| ASTC due to Direct plus All Flanking Paths | Equation 1.1 of this Report | Combin | ing Direct STC with | 12 Flanking STC values | 60 | |

| EXAMPLE 4.1.2-V1: | | (SIMPLIFIED METHOD) | Illustrati | on for this cas | e |
|---|--|--|--|--|--|
| Rooms one-above-t Concrete floors and rigid junctions ex | he-other I normal weight cept at top o | concrete block walls with of non-loadbearing walls | n 5 | =1 F3 | |
| <u>Separating floor/ceiling asse</u> concrete floor with mass thickness of 150 mm) lining below <u>Junction 1, 3, 4: Cross Junc</u> rigid mortared T junction soft joint with walls below wall above and below mass 238 kg/m² (e.g. aggregate¹) with no linit <u>Junction 2: T-Junction of see</u> rigid mortared T junction soft joint with walls below wall above and below mass 238 kg/m² (e.g. aggregate¹) with no linit | embly with: s 345 kg/m ² (e.g with no topping tion of separating on with concrete h w floor of one wy 190 mm hollow ng of walls parating floor / fla on with concrete h w floor of one wy 190 mm hollow ng of walls | normal weight concrete with / flooring on top, or ceiling g floor / flanking wall with: block wall assemblies above withe of concrete blocks with blocks with normal weigh anking wall with: block wall assemblies above withe of concrete blocks with blocks with normal weigh | h h h h t d h t cross ju mm thick block wa | f1, f3 | rating floor of 150 190 mm concrete Junctions 1, 3, 4) |
| Acoustical Parameters: | | | 1 | | |
| For 190 mm concrete block w | valls: | | _ | _ | |
| Mass/unit area (kg/m ²) = | 238 | (Wall at junctions 1&3) | | F | 2 |
| | 238 | (Wall at junctions 2&4) | | | |
| For 150 mm concrete floor: | | | _ | Ų | |
| Mass (up | $\frac{1}{2}$ it area (kg/m ²) - | 245 | | | <u>1</u> |
| iviass/uli | it area (kg/iii) = | 345 | | | |
| | 2 | | 10.00 | | and the second |
| Separating parti | tion area (m²) = | 20 | | | |
| Junction 1 and | d 3 length (m) = | 5.0 | | ۵ŕ | |
| Junction 2 and | d 4 length (m) = | 4.0 | | | |
| 10*log(S_Partition/I | iunction $1\&3) =$ | 6.0 | | Non-rigid | f2 📓 📓 |
| 10*log(S_Partition/L | iunction 2 & 4) = | 7.0 | _ | fire stop | |
| | | | T-Junctic thick con block wa | on of separatin Icrete floor with II. (Side view o | g floor of 150 mm 190 mm concrete f Junction 2). |
| | | | | | |
| | | Path Ff | Path Fd | Path Df | |
| Junction | Mass ratio for Ff | Kij (in dB) = | | | Reference |
| 1 Rigid-T/soft | 1.45 | SOFT | 5.8 | SOFT | ISO 15712-1, Eq. E.4 |
| 2 Rigid-Corner/soft | 1.45 | SOFT | -0.6 | SOFT | ISO 15712-1, Eq. E.9 |
| 3 Rigid-T/soft | 1.45 | SOFT | 5.8 | SOFT | ISO 15712-1, Eq. E.4 |
| 4 Rigid-T/soft | 1.45 | SOFT | 5.8 | SOFT | ISO 15712-1, Eq. E.4 |

| | ISO Symbol | Reference | | | STC, ∆_STC | AS | тс |
|----------------------------------|--------------------|--------------------------------------|--|---------------------|-----------------------------|-----------|-----------------|
| Separating Partition (190 mm | concrete block) | | | | | | - |
| Laboratory STC for Dd | R s,w | RR-333, TLF-97-107a | | | 52 | | |
| ΔSTC change by Lining on D | ΔR D,w | No Lining , | | | 0 | | |
| ΔSTC change by Lining on d | ΔR d.w | No Lining . | | | 0 | | |
| Direct STC in situ | R Dd,w | ISO 15712-1, Eq. 24 and 30 | | 52 + M | AX(0,0) + MIN(0,0)/2 = | 52 | |
| | _ / | | | | | | |
| Junction 1 (Rigid-T/Soft Cross | junction, 190 mm l | lock separating wall / 150 mm conc | rete floor) | | | | |
| Flanking Element F1: | | | | | | | |
| Laboratory STC for F1 | R_F1,w | RR-334, NRC-Mean BLK190(NW) | | | 49 | | |
| ΔSTC change by Lining | ΔR_F1,w | No Lining , | | | 0 | | |
| Flanking Element f1: | | | | | | | |
| Laboratory STC for f1 | R_f1,w | RR-334, NRC-Mean BLK190(NW) | | | 49 | | |
| ΔSTC change by Lining | ΔR_f1,w | No Lining , | | | 0 | | |
| Flanking STC for path Ff | R_ Ff,w | ISO 15712-1, Eq. 28a and 31 | | Negligible tr | ansmission via fire stop | 90 | (limit) |
| Flanking STC for path Fd | R_ Fd,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + | - 52/2 + MAX(0,0) - | + MIN(0,0)/2 + 5.8 + 6 = | 62 | |
| Flanking STC for path Df | R_Df,w | ISO 15712-1, Eq. 28a and 31 | | Negligible tr | ansmission via fire stop | 90 | (limit) |
| Junction 1: Flanking STC for al | l paths | Subset of Eq. 1.1 | | - 10*LOG10(10^- | 9 + 10^- 6.2 + 10^- 9) = | | 62 |
| lunction 2 (Pigid T lunction 1 | 00 mm block conor | ting wall (100 mm black flanking w | (JII) | | | | |
| Flanking Element F2: | So min block separ | ating wait / 150 mm DIUCK HaliKing W | rai() | | | | |
| Laboratory STC for F2 | R F2 w | RR-334, NRC-Mean BLK190(NW) | | | 49 | | |
| ASTC change by Lining | AR E2 W | No Lining | | | 45 | | |
| Elanking Element f2: | ΔI <u>Λ</u> ΙΖ,W | NO LITTING , | | | 0 | | |
| Laboratory STC for f2 | P f2 w | PP 224 NPC Moon RI K190(NW) | | | 40 | | |
| ASTC change by Lining | AP f2 w | No Liping | | | 49 | | |
| Elanking STC for noth Ef | | ISO 15712 1 Eq. 282 and 21 | | Nogligible tr | ansmission via fire ston | 00 | (limit) |
| Flanking STC for path Ed | R Edw | ISO 15712-1, Eq. 282 and 21 | 40/2 | | | 50 | (IIIIII) |
| Flanking STC for path Df | R_FU,W | ISO 15712-1, Eq. 28a and 21 | SO 15/12-1, Eq. 28a and 31 49/2 + 52/2 + MAX(0,0) + MIN(0,0)/2 + -0.6 + 7 = | | 57 | (line it) | |
| Flanking STC for path Df | R_DT,W | ISO 15712-1, Eq. 28a and 31 | | | | 90 | |
| Junction 2: Flanking STC for al | i patns | Subset of Eq. 1.1 | | - 10°LOG10(10^- | $9 + 10^{-5.7} + 10^{-9} =$ | | 57 |
| Junction 3 (Rigid-T/Soft Cross | junction, 190 mm l | block separating wall / 150 mm conc | rete ceiling sla | b) | | | |
| Flanking Element F3: | | | | | | | |
| Laboratory STC for F3 | R F3.w | RR-334, NRC-Mean BLK190(NW) | | | 49 | | |
| ASTC change by Lining | ΔR F3.w | No Lining . | | | 0 | | |
| Elanking Element f3: | | | | | | | |
| Laboratory STC for f3 | R f3 w | RB-334 NRC-Mean BLK190(NW) | | | 49 | | |
| ASTC change by Lining | AR f3 w | No Lining | | | 0 | | |
| Flanking STC for nath Ff | B Ef w | ISO 15712-1 Eq. 28a and 31 | | Negligihle tr | ansmission via fire ston | 90 | (limit) |
| Flanking STC for nath Ed | B Ed w | 150 157 12 1, Eq. 200 und 51 | 49/2 - | -52/2 + MAX(0.0) | + MIN(0.0)/2 + 5.8 + 6 = | 62 | (iiiiic) |
| Flanking STC for nath Df | B Dfw | | 13/2 | Negligible tr | ansmission via fire ston | 90 | (limit) |
| Junction 3: Flanking STC for al | I paths | Subset of Eq. 1.1 | | - 10*LOG10(10^- | 9 + 10^- 6.2 + 10^- 9) = | 50 | 62 |
| | | | | | | | |
| Junction 4 (Rigid T-junction, 1) | 90 mm block separ | ating wall / 190 mm block flanking w | rall) | | | | |
| Flanking Element F4: | 5.54 | | | | 10 | | |
| Laboratory STC for F4 | R_F4,w | KR-334, NRC-Mean BLK190(NW) | | | 49 | | |
| ΔSTC change by Lining | ΔR_F4,w | No Lining , | | | 0 | | |
| Flanking Element f4: | | | | | | | |
| Laboratory STC for f4 | R_f4,w | RR-334, NRC-Mean BLK190(NW) | | | 49 | | |
| ∆STC change by Lining | ΔR_f4,w | No Lining , | | | 0 | | |
| Flanking STC for path Ff | R_ Ff,w | ISO 15712-1, Eq. 28a and 31 | | Negligible tr | ansmission via fire stop | 90 | (limit) |
| Flanking STC for path Fd | R_ Fd,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + | - 52/2 + MAX(0,0) - | + MIN(0,0)/2 + 5.8 + 7 = | 63 | |
| Flanking STC for path Df | R_Df,w | ISO 15712-1, Eq. 28a and 31 | | Negligible tr | ansmission via fire stop | 90 | (limit) |
| Junction 4: Flanking STC for al | l paths | Subset of Eq. 1.1 | | - 10*LOG10(10^- | 9 + 10^- 6.3 + 10^- 9) = | | 63 |
| Total Flanking STC (4 Junction | s) | Subset of Eq. 1.1 | | Combining | 3 12 Flanking STC values | | <mark>54</mark> |
| ACTC due to Direct alue of the | nking Dath- | Equation 1.1 of this Demont | Course 1 | aing Direct CTC | 12 Flooking CTC | 50 | |
| ASIC due to Direct plus All Fla | nking Paths | Equation 1.1 of this Report | Combi | ing Direct STC with | 1 12 Flanking STC values | 50 | |

| EXAMPLE 4 1 2-V2 | | (SIMPLIEIED METHOD | Illustrat | ion for this cas | A |
|---|--|---|--|--|---|
| Rooms one-above-th Concrete floors and rigid junctions ex (Same structure as 4) | ne-other normal weight cept at top c I.1.2-V1, with lin | concrete block walls w of non-loadbearing wa ing of walls) | ith IIs | E1 E3 | |
| <u>Separating floor/ceiling asse</u> concrete floor with mas thickness of 150 mm) lining below <u>Junction 1, 3, 4: Cross Junc</u> rigid mortared T junctio soft joint with walls belo wall above and below f blocks with normal weig flanking walls lined wi loadbearing steel stu material² filling inter-stu <u>Junction 2: T-Junction of se</u> rigid mortared T junctio soft joint with walls belo wall above and below f | embly with: s 345 kg/m ² (e.g. with no topping tion of separating n with concrete b w loor of one wythe ght aggregate ¹ , w ith 13 mm gyps ds spaced 610 d cavities parating floor / fla n with concrete b w loor of one wythe | normal weight concrete w / flooring on top, or ceili <u>a floor / flanking wall with:</u> plock wall assemblies above of 190 mm hollow concre ith mass 238 kg/m ² um board ³ on 65 mm no 0 mm o.c. with absorpt unking wall with: plock wall assemblies above of 190 mm hollow concre | ith ng ve, ete on- ve Cross ju mm thic block wa | f1, f3 f1, f3 unction of sepa k concrete with all. (Side view of | Non-rigid fire stop |
| blocks with normal weig flanking walls lined w loadbearing steel stu material² filling inter-stur <u>Acoustical Parameters:</u> | pht aggregate ¹ , w ith 13 mm gyps ds spaced 610 d cavities | ith mass 238 kg/m ² um board ³ on 65 mm no) mm o.c. with absorpt | on- ve | F2 | |
| For 190 mm concrete block w | alls: | | | Ĭ | |
| Mass/unit area $(kg/m^2) =$ | 238 | (Wall at junctions 1&3) | 123 | ************************************** | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 |
| | 238 | (Wall at junctions 2&4) | | | |
| For 150 mm concrete floor: | | | 6460F2 | | |
| Mass/uni | $t area (kg/m^2) - $ | 215 | | / | |
| iviass/ ull | it alea (kg/iii) – . | 545 | | a _{Non-rigio} | |
| | | | | fire stop | |
| Separating parti | tion area (m ⁻) = . | 20 | | (| |
| Junction 1 and | 3 length (m) = | 5.0 | | f2 | |
| Junction 2 and | 4 length (m) = | 4.0 | | 12 | |
| 10*log(S_Partition/l_ | junction 1&3) = | 6.0 | T lupoti | on of concretin | a floor of 150 mm |
| 10*log(S_Partition/I_ | junction2 &4) = | 7.0 | thick co wall. (Si has sam | ncrete with 190 de view of Junc ne lining details, | mm concrete block ction 2. Junction 4 but cross junction) |
| | | | | | |
| | | Path Ff | Path Fd | Path Df | |
| Junction | Mass ratio for Ff | Kij (in dB) = | | | Reference |
| 1 Rigid-T/soft | 1.45 | SOFT | 5.8 | SOFT | ISO 15712-1, Eq. E.4 |
| 2 Rigid-Corner/soft | 1.45 | SOFT | -0.6 | SOFT | ISO 15712-1, Eq. E.9 |
| 3 Rigid-T/soft | 1.45 | SOFT | 5.8 | SOFT | ISO 15712-1, Eq. E.4 |
| 4 Rigid-T/soft | 1.45 | SOFT | 5.8 | SOFT | ISO 15712-1, Eq. E.4 |

| | ISO Symbol | Reference | | | STC, A_STC | AS | тс |
|------------------------------------|-------------------|--|---------------------|--|--|----|-----------|
| Separating Partition (190 mm | concrete block) | | | | | | |
| Laboratory STC for Dd | R s,w | RR-333, TLF-97-107a | | | 52 | | |
| ΔSTC change by Lining on D | ΔR D,w | No Lining , | | | 0 | | |
| Δ STC change by Lining on d | ΔR d,w | No Lining , | | | 0 | | |
| Direct STC in situ | R_Dd,w | ISO 15712-1, Eq. 24 and 30 | | 52 + M/ | AX(0,0) + MIN(0,0)/2 = | 52 | |
| Junction 1 (Rigid-T/Soft Cross | junction 190 mm | block separating wall / 150 mm co | ncrete floor) | | | | |
| Flanking Element F1: | Junction, 190 min | block separating wair / 150 min ce | <u>nerete noor</u> | | | | |
| Laboratory STC for F1 | R_F1,w | RR-334, NRC-Mean BLK190(NV | V) | | 49 | | |
| ΔSTC change by Lining | ΔR_F1,w | RR-334, ΔTL-BLK(NW)-62, SS65 | 5_GFB_G13 | | 19 | | |
| Flanking Element f1: | | | | | | | |
| Laboratory STC for f1 | R_f1,w | RR-334, NRC-Mean BLK190(NV | V) | | 49 | | |
| ΔSTC change by Lining | ΔR_f1,w | RR-334, ΔTL-BLK(NW)-62, SS65 | 5_GFB_G13 | | 19 | | |
| Flanking STC for path Ff | R_ Ff,w | ISO 15712-1, Eq. 28a and 31 | | Negligible tra | ansmission via fire stop | 90 | (limit) |
| Flanking STC for path Fd | R_ Fd,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 5 | 52/2 + MAX(19,0) + I | VIN(19,0)/2 + 5.8 + 6 = | 81 | |
| Flanking STC for path Df | R_ Df,w | ISO 15712-1, Eq. 28a and 31 | | Negligible tra | ansmission via fire stop | 90 | (limit) |
| Junction 1: Flanking STC for a | l paths | Subset of Eq. 1.1 | | - 10*LOG10(10^-9 | 9 + 10^- 8.1 + 10^- 9) = | | 80 |
| Junction 2 (Pigid T Junction 1 | 90 mm block const | ating wall / 190 mm block flankin | a wall) | | | | |
| Flanking Element 52: | 50 mm block separ | ating wait / 150 mm block Hankin | <u>g wdlij</u> | | | | |
| Flanking Element F2: | P F2 w | PR 224 NRC Moon RIK100(NM | | | 40 | | |
| ACTC shange by Lining | к_г2,w | | | | 49 | | |
| | ΔR_F2,W | RR-334, Δ1L-BLK(NW)-02, 5505 | D_GFB_G13 | | 19 | | |
| Flanking Element 12: | D £2 | DD 224 NDC Maan DLK100(NM | 1 | | 40 | | |
| Laboratory STC for 12 | K_12,W | RR-334, NRC-IVIEALI BLK190(INV | | | 49 | | |
| | Δκ_12,w | RR-334, Δ1L-BLK(NW)-02, 5503 | D_GFB_G13 | No altath ta An | 19 | | (1: |
| Flanking STC for path Ff | R_FT,W | ISO 15712-1, Eq. 28a and 31 Negligible transmission via fire stop | | 90 | (limit) | | |
| Flanking STC for path Pd | K_FU,W | ISO 15712-1, Eq. 28a and 31 49/2 + 52/2 + MAX(19,0) + MIN(19,0)/2 + -0.6 + 7 = | | 76 | (1: | | |
| Flanking STC for path Df | R_DT,W | ISO 15712-1, Eq. 28a and 31 | | | ansmission via fire stop | 90 | |
| Junction 2: Flanking STC for a | i patns | Subset of Eq. 1.1 | | - 10*LOG10(10*-9 | 9 + 10^- 7.6 + 10^- 9) = | | /6 |
| Junction 3 (Rigid-T/Soft Cross | junction, 190 mm | block separating wall / 150 mm co | oncrete ceiling sla | <u>ab)</u> | | | |
| Flanking Element F3: | | | | | | | |
| Laboratory STC for F3 | R_F3,w | RR-334, NRC-Mean BLK190(NV | V) | | 49 | | |
| ΔSTC change by Lining | ΔR_F3,w | RR-334, ΔTL-BLK(NW)-62, SS65 | 5_GFB_G13 | | 19 | | |
| Flanking Element f3: | | | | | | | |
| Laboratory STC for f3 | R_f3,w | RR-334, NRC-Mean BLK190(NV | V) | | 49 | | |
| ΔSTC change by Lining | ΔR_f3,w | RR-334, ΔTL-BLK(NW)-62, SS65 | 5_GFB_G13 | | 19 | | |
| Flanking STC for path Ff | R_ Ff,w | ISO 15712-1, Eq. 28a and 31 | | Negligible tra | ansmission via fire stop | 90 | (limit) |
| Flanking STC for path Fd | R_ Fd,w | | 49/2 + 5 | 52/2 + MAX(19,0) + I | VIN(19,0)/2 + 5.8 + 6 = | 81 | |
| Flanking STC for path Df | R_Df,w | | | Negligible tra | ansmission via fire stop | 90 | (limit) |
| Junction 3: Flanking STC for a | l paths | Subset of Eq. 1.1 | | - 10*LOG10(10^-9 | 9 + 10^- 8.1 + 10^- 9) = | | 80 |
| Junction 4 (Rigid T-junction 1 | 90 mm block separ | ating wall / 190 mm block flankin | g wall) | | | | |
| Flanking Element F4 | | | <u></u> | | | | |
| Laboratory STC for F4 | R F4 w | RR-334, NRC-Mean BLK190(NV | V) | | 49 | | |
| ASTC change by Lining | ΔR F4 w | RB-334 ATI-BLK(NW/)-62 SS6 | GFB G13 | | 19 | | |
| Flanking Flement f4 | <u> </u> | | _010_010 | | 13 | | |
| Laboratory STC for f4 | R f4 w | RR-334 NRC-Mean RI K190(NM | () | | 49 | | |
| ASTC change by Lining | ΔR f4 w/ | RB-334 ATI-BLK(NW/)-62 SS6 | 5 GFB G13 | | 19 | | |
| Flanking STC for noth Ef | B Efw | ISO 15712-1 Eq. 282 and 21 | _010_010 | Negligible tr | ansmission via fire stop | 90 | (limi+) |
| Flanking STC for path Fd | R Edw | ISO 15712-1, Eq. 28a and 31 | /9/2 + 9 | (100 megligible 100 megligible 100 | MIN(19.0)/2 + 5.8 + 7 - | 82 | (iiiiiii) |
| Flanking STC for path Df | B Dfw | ISO 15712-1, Eq. 200 and 31 | 43/2 + 3 | Negligible ter | $\frac{1}{1} \frac{1}{1} \frac{1}$ | 02 | (limi+) |
| Junction 4: Flanking STC for a | I naths | Subset of Eq. 1.1 | | - 10*10610/104 0 | $+ 10^{-} 8.2 + 10^{-} 0.1 -$ | 50 | 81 |
| Total Flanking STC (4 Junction | s) | Subset of Eq. 1.1 | | Combining | 12 Flanking STC values | | 73 |
| | | | | | | | |
| | 11 8.11 | 5 11 44 CULL 5 1 | | | | | |

| EXAMPLE 4.1.2-V3: | | (SIMPLIFIED METHOD) | Illustratio | on for this case | 2 |
|--|--|---|--|---|----------------------|
| Rooms one-above-th Concrete floors and rigid junctions ex (Same structure as 4) | ne-other normal weigh cept at top I.1.2-V1, with lin | t concrete block walls wit of non-loadbearing wall ning of walls and ceiling) | F1 | I, F3 | Non rigid |
| Separating floor/ceiling asset concrete floor with mass thickness of 150 mm) w ceiling lining below: 16 supported on cross-che between concrete and conconcrete and concrete and concrete and concrete and concrete a | embly with: s 345 kg/m ² (e.g vith no topping / i mm gypsum bo nannels hung c ceiling, with 150 nction of separat n with concrete w loor of one wyth yht aggregate , v ith 13 mm gyps s spaced 610 n avities parating floor / fl n with concrete | D D D Cross jum mm thick block wal | f1, f3 t concrete with II. (Side view of | ating floor of 150 190 mm concrete Junctions 1 & 3) | |
| soft joint with walls belo wall above and below f blocks with normal weig flanking walls lined w loadbearing steel stud material² in inter-stud ca | w loor of one wyth ht aggregate ¹ , v ith 13 mm gyps Is spaced 610 n avities | e of 190mm hollow concret vith mass 238 kg/m ² sum board ³ on 65mm nor mm o.c. with no absorptiv | - | F2 D | |
| For 100 mm concrete black w | alla | | 1.17 | 1949 - 1949 - 1949 - 1949 - 1949 - 1949 - 1949 - 1949 - 1949 - 1949 - 1949 - 1949 - 1949 - 1949 - 1949 - 1949 - | 1 |
| For 190 mm concrete block w | 220 | (Mall at junctions 192) | 125 | | A STATE OF STATE |
| Mass/unit area (kg/m) = | 238 | (Wall at junctions 1&3) | - 200 | 200000000000000 | |
| For 150 mm concrete floor: | 230 | (Wall at julictions 204) | a Carden | | |
| FOI 150 IIIII CONCIECE HOOI. | $\frac{1}{2}$ | 245 | | d' | |
| iviass/ull | it area (kg/iii) – | 345 | | | |
| Constrating partie | tion area (m^2) - | 20 | | non-rigia 1 | 8 8 |
| Separating part | (1011 a) = (111) = | 20 | | 12 | |
| | $4 \log gth (m) =$ | 5.0 | | | |
| 10*log(S. Dartition/ | 4 length (m) = | 4.0 | T-Junctio | n of separating | floor of 150 mm |
| 10 log(S_Partition/I_ | junction (28.4) = | 7.0 | thick con | crete with 190 r | nm concrete block |
| 10 105(5_1 010001)1_ | | 7.0 | has same | e lining details, t | out cross junction 4 |
| | | | 1 | | |
| | | Path Ff | Path Fd | Path Df | |
| Junction | Mass ratio for Ff | Kij (in dB) = | Tuttitu | | Reference |
| 1 Rigid-T/soft | 1.45 | SOFT | 5.8 | SOFT | ISO 15712-1, Eq. E.4 |
| 2 Rigid-Corner/soft | 1.45 | SOFT | -0.6 | SOFT | ISO 15712-1, Eq. E.9 |
| 3 Rigid-T/soft | 1.45 | SOFT | 5.8 | SOFT | ISO 15712-1, Eq. E.4 |
| 4 Rigid-T/soft | 1.45 | SUFI | 5.8 | SOFI | ISO 15712-1, Eq. E.4 |

| | ISO Symbol | Reference | | | STC, ∆_STC | AS | тс |
|---------------------------------|-------------------|--------------------------------------|--|-----------------------------|--------------------------------|----|---------|
| Separating Partition (190 mm | concrete block) | | | | | | |
| Laboratory STC for Dd | R_s,w | RR-333, TLF-97-107a | | | 52 | | |
| ΔSTC change by Lining on D | ΔR_D,w | No Lining , | | | 0 | | |
| ΔSTC change by Lining on d | ΔR_d,w | RR-333, ATLF-CON150-01, SUS15 | 0_GFB150_G16 | | 19 | | |
| Direct STC in situ | R_Dd,w | ISO 15712-1, Eq. 24 and 30 | | 52 + MAX | (0,19) + MIN(0,19)/2 = | 71 | |
| lunation 1 (Digid T/Coft Cross | iumatian 100 mm | | wata flaav) | | | | |
| Flanking Element F1: | Junction, 190 mm | block separating wall / 150 mm conc | rete floor) | | | | |
| Laboratory STC for E1 | R F1 w | BR-334 NRC-Mean BLK190(NW) | | | 49 | | |
| ASTC change by Lining | AR F1 w | BB-334 ATI-BLK(NW)-61 SS65 G | 313 | | 2 | | |
| Flanking Element f1 | 2 1, | | | | _ | | |
| Laboratory STC for f1 | R f1 w | BR-334 NRC-Mean BLK190(NW) | | | 49 | | |
| ASTC change by Lining | ΔR f1 w | BB-334 ATI-BLK(NW)-61 SS65 C | 313 | | 2 | | |
| Flanking STC for path Ff | B Ff w | ISO 15712-1 Eq. 28a and 31 | 15 | Negligible tra | ansmission via fire stop | 90 | (limit) |
| Flanking STC for path Fd | B Ed w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 5 | $2/2 + M\Delta X(2 19) + 1$ | MIN(2 19)/2 + 5.8 + 6 = | 82 | (inne) |
| Flanking STC for path Df | B Dfw | ISO 15712-1, Eq. 28a and 31 | 45/215 | Negligible tr | ansmission via fire ston | 90 | (limit) |
| Junction 1: Flanking STC for al | I naths | Subset of Eq. 1.1 | ubset of Eq. 1.1 $-10^{+}10G10(10^{-9} + 10^{-8} 2 + 1)$ | | | | 81 |
| | i patris | Subset of Eq. 1.1 | | 10 10010(10 | 5 10 0.2 10 57- | | 01 |
| Junction 2 (Rigid T-Junction, 1 | 90 mm block separ | ating wall / 190 mm block flanking v | vall) | | | | |
| Flanking Element F2: | | | | | | | |
| Laboratory STC for F2 | R_F2,w | RR-334, NRC-Mean BLK190(NW) | | | 49 | | |
| ∆STC change by Lining | ΔR_F2,w | RR-334, ΔTL-BLK(NW)-61, SS65_C | 513 | | 2 | | |
| Flanking Element f2: | | | | | | | |
| Laboratory STC for f2 | R_f2,w | RR-334, NRC-Mean BLK190(NW) | | | 49 | | |
| ∆STC change by Lining | ΔR_f2,w | RR-334, ΔTL-BLK(NW)-61, SS65_0 | 513 | | 2 | | |
| Flanking STC for path Ff | R_ Ff,w | ISO 15712-1, Eq. 28a and 31 | | Negligible tra | ansmission via fire stop | 90 | (limit) |
| Flanking STC for path Fd | R_ Fd,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 52 | 2 + MAX(2,19) + N | /IIN(2,19)/2 + -0.6 + 7 = | 77 | |
| Flanking STC for path Df | R_ Df,w | ISO 15712-1, Eq. 28a and 31 | | Negligible tra | ansmission via fire stop | 90 | (limit) |
| Junction 2: Flanking STC for a | l paths | Subset of Eq. 1.1 | | - 10*LOG10(10^-9 | 9 + 10^- 7.7 + 10^- 9) = | | 77 |
| | | | | | | | |
| Junction 3 (Rigid-T/Soft Cross | junction, 190 mm | block separating wall / 150 mm conc | rete ceiling sla | <u>b)</u> | | | |
| Flanking Element F3: | 5 53 | | | | 10 | | |
| Laboratory SIC for F3 | R_F3,W | RR-334, NRC-Mean BLK190(NW) | | | 49 | | |
| ΔSTC change by Lining | ΔR_F3,w | RR-334, ΔTL-BLK(NW)-61, SS65_G | 513 | | 2 | | |
| Flanking Element 13: | | | | | | | |
| Laboratory STC for f3 | R_t3,w | RR-334, NRC-Mean BLK190(NW) | | | 49 | | |
| ΔSTC change by Lining | ΔR_f3,w | RR-334, Δ1L-BLK(NW)-61, SS65_G | 513 | | 2 | | |
| Flanking STC for path Ff | R_Ff,w | ISO 15712-1, Eq. 28a and 31 | | Negligible tra | ansmission via fire stop | 90 | (limit) |
| Flanking STC for path Fd | R_Fd,w | | 49/2 + 5 | 2/2 + MAX(2,19) + | MIN(2,19)/2 + 5.8 + 6 = | 82 | |
| Flanking STC for path Df | R_Df,w | | | Negligible tra | ansmission via fire stop | 90 | (limit) |
| Junction 3: Flanking STC for a | I paths | Subset of Eq. 1.1 | | - 10*LOG10(10^-9 | 9 + 10^- 8.2 + 10^- 9) = | | 81 |
| Junction 4 (Rigid T-iunction. 1 | 90 mm block separ | ating wall / 190 mm block flanking w | vall) | | | | |
| Flanking Element F4: | | | <u>.</u> | | | | |
| Laboratory STC for F4 | R F4.w | RR-334, NRC-Mean BLK190(NW) | | | 49 | | |
| ΔSTC change by Lining | ΔR F4.w | RR-334, ATL-BLK(NW)-61, SS65, G | 613 | | 2 | | |
| Flanking Element f4: | , | | | | - | | |
| Laboratory STC for f4 | R f4.w | RR-334, NRC-Mean BLK190(NW) | | | 49 | | |
| ΔSTC change by Lining | ΔR f4.w | RR-334, ΔTL-BLK(NW)-61, SS65, G | 613 | | 2 | | |
| Flanking STC for path Ff | R Ff.w | ISO 15712-1. Eq. 28a and 31 | | Negligible tra | ansmission via fire stop | 90 | (limit) |
| Flanking STC for path Fd | R Fd.w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 5 | 2/2 + MAX(2.19) + | MIN(2.19)/2 + 5.8 + 7 = | 83 | (|
| Flanking STC for nath Df | B Dfw | ISO 15712-1, Eq. 28a and 31 | 13/2 * 3 | Negligible tr | ansmission via fire ston | 90 | (limit) |
| Junction 4: Flanking STC for al | paths | Subset of Eq. 1.1 | | - 10*LOG10(10^-0 | $9 + 10^{-} 8.3 + 10^{-} 9) =$ | 50 | 82 |
| Total Flanking STC (4 Junction | s) | Subset of Eq. 1.1 | | Combining | 12 Flanking STC values | | 73 |
| | | | | | | | |
| | | | | | | | |

| EXAMPLE 4.1.2-V4: | | (SIMPLIFIED METHOD) | Illustration | n for this case | |
|---|--|--|--|---|--|
| Rooms one-above-t Concrete floors and rigid junctions ex (Same structure as) | he-other I normal weigh cept at top 4.1.2-V1, with lir | t concrete block walls wit of non-loadbearing wall ning of walls and ceiling) | n s | 1 F3 | |
| Separating floor/ceiling asset concrete floor with mass thickness of 150 mm) w ceiling lining below: 16 supported on cross-c between concrete and Junction 1, 3 or 4: Cross Ju rigid mortared T junction soft joint with walls below blocks with normal weig flanking walls lined w loadbearing steel stu material² filling inter-stu Junction 2: T-Junction of see rigid mortared T junction soft joint with walls below | embly with: as 345 kg/m ² (e.g with no topping / f mm gypsum box hannels hung of ceiling, with 150 <u>nction of separat</u> on with concrete ow floor of one wyth ght aggregate ¹ , v with 13 mm gyps uds spaced 61 ud cavities <u>parating floor / fl</u> on with concrete ow floor of one wyth floor of one wyth | . normal weight concrete wit flooring on top ard ³ fastened to hat-channel on wires, cavity of 150 mr mm absorptive material ² ting floor / flanking wall with: block wall assemblies above e of 190 mm hollow concret with mass 238 kg/m ² sum board ³ on 65 mm nor 0 mm o.c. with absorptive anking wall with: block wall assemblies above e of 190 mm hollow concret | n D D D D D D D D D D D D D D D D D D D | 1, f3 tion of separat concrete with 1 (Side view of Ju | Non-rigid fire stop |
| Wall above and below blocks with normal weig flanking walls lined w loadbearing steel stu material² filling inter-stu <u>Acoustical Parameters:</u> | ght aggregate ¹ , v vith 13 mm gyps uds spaced 61 ud cavities | vith mass 238 kg/m ² sum board ³ on 65 mm nor 0 mm o.c. with absorptiv | - | F2 | |
| For 190 mm concrete block w | valls: | | | , | |
| Mass/unit area (kg/m^2) = | 238 | (Wall at junctions 1&3) | | | |
| | 238 | (Wall at junctions 284) | | | State State |
| For 150 mm concrete floor: | 250 | | | | |
| | · · · · · · · · · · · · · · · · · · · | 2.45 | | S A A A A A A A A A A A A A A A A A A A | |
| Mass/un | it area (kg/m) = | 345 | | / / | |
| | 2 | | d | / / | |
| Separating part | ition area $(m^2) =$ | 20 | G | | |
| Junction 1 and | d 3 length (m) = | 5.0 | fi IN | ion-rigia 7 | |
| Junction 2 and | d 4 length (m) = | 4.0 | " | te stop f2 | |
| 10*log(S_Partition/I | junction 1&3) = | 6.0 | | | |
| 10*log(S_Partition/I | junction2 &4) = | 7.0 | T-Junction | of separating | floor of 150 mm |
| | | | thick concr wall. (Side has same l | view of Junctic lining details, bu | m concrete block on 2. Junction 4 it cross junction) |
| | | | | | |
| | | Path Ff | Path Ed | Path Df | |
| Junction | Mass ratio for Ff | Kii (in dB) = | ratii ru | | Reference |
| 1 Rigid-T/soft | 1.45 | SOFT | 5.8 | SOFT I | SO 15712-1, Eq. E.4 |
| 2 Rigid-Corner/soft | 1.45 | SOFT | -0.6 | SOFT I | SO 15712-1, Eq. E.9 |
| 3 Rigid-T/soft | 1.45 | SOFT | 5.8 | SOFT I | SO 15712-1, Eq. E.4 |
| 4 Rigid-T/soft | 1.45 | SOFT | 5.8 | SOFT I | SO 15712-1, Eq. E.4 |

| | ISO Symbol | Reference | | | STC, Δ _STC | AS | тс |
|---------------------------------|--------------------|-----------------------------------|----------------------|----------------------|----------------------------------|----|---------|
| Separating Partition (190 mm | n concrete block) | | | | | | |
| Laboratory STC for Dd | R_s,w | RR-333, TLF-97-107a | | | 52 | | |
| ΔSTC change by Lining on D | ∆R_D,w | No Lining , | | | 0 | | |
| ΔSTC change by Lining on d | ΔR_d,w | RR-333, ΔTLF-CON150-01, SUS | 5150_GFB150_G16 | | 19 | | |
| Direct STC in situ | R_Dd,w | ISO 15712-1, Eq. 24 and 30 | | 52 + MAX | ((0,19) + MIN(0,19)/2 = | 71 | |
| Junction 1 (Rigid-T/Soft Cross | s junction, 190 mm | block separating wall / 150 mm co | oncrete floor) | | | | |
| Flanking Element F1: | | | | | | | |
| Laboratory STC for F1 | R_F1,w | RR-334, NRC-Mean BLK190(NV | V) | | 49 | | |
| ΔSTC change by Lining | ΔR_F1,w | RR-334, ΔTL-BLK(NW)-62, SS6 | 5_GFB_G13 | | 19 | | |
| Flanking Element f1: | - | | | | | | |
| Laboratory STC for f1 | R_f1,w | RR-334, NRC-Mean BLK190(NV | V) | | 49 | | |
| ΔSTC change by Lining | ΔR_f1,w | RR-334, ΔTL-BLK(NW)-62, SS6 | 5_GFB_G13 | | 19 | | |
| Flanking STC for path Ff | R_ Ff,w | ISO 15712-1, Eq. 28a and 31 | | Negligible tr | ansmission via fire stop | 90 | (limit) |
| Flanking STC for path Fd | R_ Fd,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 52/2 | 2 + MAX(19,19) + N | /IN(19,19)/2 + 5.8 + 6 = | 90 | (limit) |
| Flanking STC for path Df | R_Df,w | ISO 15712-1, Eq. 28a and 31 | | Negligible tr | ansmission via fire stop | 90 | (limit) |
| Junction 1: Flanking STC for a | ll paths | Subset of Eq. 1.1 | | - 10*LOG10(10 | ^-9 + 10^- 9 + 10^- 9) = | | 85 |
| Junction 2 (Rigid T-Junction, 1 | 190 mm block separ | ating wall / 190 mm block flankin | g wall) | | | | |
| Flanking Element F2: | | | | | | | |
| Laboratory STC for F2 | R F2,w | RR-334, NRC-Mean BLK190(NV | V) | | 49 | | |
| ΔSTC change by Lining | ΔR F2,w | RR-334, ΔTL-BLK(NW)-62, SS6 | 5 GFB G13 | | 19 | | |
| Flanking Element f2: | _ , | | | | | | |
| Laboratory STC for f2 | R f2,w | RR-334, NRC-Mean BLK190(NV | V) | | 49 | | |
| ΔSTC change by Lining | ΔR f2,w | RR-334, ΔTL-BLK(NW)-62, SS6 | 5 GFB G13 | | 19 | | |
| Flanking STC for path Ff | R Ff,w | ISO 15712-1, Eq. 28a and 31 | | Negligible tr | ansmission via fire stop | 90 | (limit) |
| Flanking STC for path Fd | R_Fd,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 52/2 | + MAX(19,19) + M | IN(19,19)/2 + -0.6 + 7 = | 85 | |
| Flanking STC for path Df | R Df,w | ISO 15712-1, Eq. 28a and 31 | | Negligible tr | ansmission via fire stop | 90 | (limit) |
| Junction 2: Flanking STC for a | ll paths | Subset of Eq. 1.1 | | - 10*LOG10(10^- | 9 + 10^- 8.5 + 10^- 9) = | | 83 |
| | | | | | | | |
| Junction 3 (Rigid-T/Soft Cross | s junction, 190 mm | block separating wall / 150 mm c | oncrete ceiling slal | <u>o)</u> | | | |
| Flanking Element F3: | | | | | | | |
| Laboratory STC for F3 | R_F3,w | RR-334, NRC-Mean BLK190(NV | V) | | 49 | | |
| ΔSTC change by Lining | ΔR_F3,w | RR-334, ΔTL-BLK(NW)-62, SS6 | 5_GFB_G13 | | 19 | | |
| Flanking Element f3: | | | | | | | |
| Laboratory STC for f3 | R_f3,w | RR-334, NRC-Mean BLK190(NV | V) | | 49 | | |
| ΔSTC change by Lining | ΔR_f3,w | RR-334, ΔTL-BLK(NW)-62, SS6 | 5_GFB_G13 | | 19 | | |
| Flanking STC for path Ff | R_ Ff,w | ISO 15712-1, Eq. 28a and 31 | | Negligible tr | ansmission via fire stop | 90 | (limit) |
| Flanking STC for path Fd | R_ Fd,w | | 49/2 + 52/2 | 2 + MAX(19,19) + N | /IN(19,19)/2 + 5.8 + 6 = | 90 | (limit) |
| Flanking STC for path Df | R_Df,w | | | Negligible tr | ansmission via fire stop | 90 | (limit) |
| Junction 3: Flanking STC for a | ll paths | Subset of Eq. 1.1 | | - 10*LOG10(10 | <u>^-9 + 10^- 9 + 10^- 9) =</u> | | 85 |
| Junction 4 (Rigid T-junction, 1 | 90 mm block separ | ating wall / 190 mm block flankin | g wall) | | | | |
| Flanking Element F4: | | | | | | | |
| Laboratory STC for F4 | R_F4,w | RR-334, NRC-Mean BLK190(NV | V) | | 49 | | |
| ΔSTC change by Lining | ΔR_F4,w | RR-334, ΔTL-BLK(NW)-62, SS6 | 5_GFB_G13 | | 19 | | |
| Flanking Element f4: | | | | | | | |
| Laboratory STC for f4 | R_f4,w | RR-334, NRC-Mean BLK190(NV | V) | | 49 | | |
| ΔSTC change by Lining | ΔR_f4,w | RR-334, ΔTL-BLK(NW)-62, SS6 | 5_GFB_G13 | | 19 | | |
| Flanking STC for path Ff | R_ Ff,w | ISO 15712-1, Eq. 28a and 31 | | Negligible tr | ansmission via fire stop | 90 | (limit) |
| Flanking STC for path Fd | R_ Fd,w | ISO 15712-1, Eq. 28a and 31 | 49/2 + 52/2 | 2 + MAX(19,19) + N | /IN(19,19)/2 + 5.8 + 7 = | 90 | (limit) |
| Flanking STC for path Df | R_Df,w | ISO 15712-1, Eq. 28a and 31 | | Negligible tr | ansmission via fire stop | 90 | (limit) |
| Junction 4: Flanking STC for a | II paths | Subset of Eq. 1.1 | | - 10*LOG10(10 | ^-9 + 10^- 9 + 10^- 9) = | | 85 |
| Total Flanking STC (4 Junction | ns) | Subset of Eq. 1.1 | | Combining | 3 12 Flanking STC values | | 78 |
| ASTC due to Direct plue All FL | anking Daths | Equation 1.1 of this Panart | Combi | ning Direct STC with | 12 Elapking STC values | 70 | |
| ASTC due to Direct plus All Fla | anking raths | | Combil | Ing Direct STC WIth | TIZ FIANKING STC VAIUES | 70 | |

Summary for Section 4.1.2: Non-loadbearing Normal Weight Concrete Block Walls with Concrete Floors

The worked examples 4.1.2-H1 and 4.1.2-V1, both of which did not include linings on the masonry or concrete surfaces, illustrate the basic process for calculating sound transmission between rooms in a building with bare, non-loadbearing concrete masonry walls and concrete floors (i.e. without added gypsum board finish on the walls or ceiling, or flooring over the concrete slab).

In both cases with no linings, the Apparent Sound Transmission Class (ASTC) rating is lower than the STC rating of the separating assembly because the flanking transmission (via the combination of the 12 flanking paths) is of similar magnitude as the Direct Transmission Loss through the separating assembly. Comparing these examples with the loadbearing cases in Section 4.1.1 shows no change in the ASTC rating (47 for the side-by-side case and 50 with one room above the other).

Looking at the individual paths, it becomes clear that the soft connections between the top of the nonloadbearing walls and the ceiling eliminate some flanking paths, but the flanking transmission along the remaining paths become stronger. When linings are added, these differences become more obvious.

For the side-by-side pair of rooms

The effect of added linings is shown in examples 4.1.2-H2 to H4 and the following trends are shown:

- Adding a minimal lining with no sound absorptive material in the cavities (ΔSTC=2) to all of the wall surfaces raises the ASTC rating from 47 to 49.
- Adding a better wall lining with ΔSTC=19 in example 4.1.2-H3 raises the ASTC rating to 57, but further improvements are limited by the transmission through the bare concrete surfaces of the floor and ceiling (which have a combined Flanking STC of 57 versus the value of 59 with the rigid junctions in the previous section).
- Significant further improvement requires treatment of both the floor and ceiling surfaces treating just the ceiling in example 4.1.2-H4 increases the ASTC rating by only 3 points to 60.

Therefore, for constructions with soft junctions at the top of the non-loadbearing concrete block walls, adding an effective floor treatment becomes more critical to achieving a high ASTC rating between sideby-side rooms. [Example(s) will be added when Report RR-333 becomes available.]

For one room above the other

The effect of adding linings is shown in examples 4.1.2-V2 to V4 and the following trends are shown:

- As shown in example 4.1.2-V2, adding a good lining to all of the flanking wall surfaces increases the ASTC rating from 50 to 52 because direct transmission through the separating floor/ceiling is the strongest path, so improving the Flanking STC paths via the wall surfaces has limited effect.
- This limitation is easily remedied by adding a gypsum board ceiling with sound absorptive material in the cavity under the concrete ceiling assembly, which raises the direct path from 52 to 71.
- With an effective ceiling lining in place, as shown in example 4.1.2-V3., a very good system performance of ASTC 69 is possible even with a minimal (Δ STC=2) lining of the flanking walls. This happens because the only effective flanking paths (those not blocked by the fire stops) involve transmission via the ceiling surface, and hence, benefit from the ceiling lining.
- Filling the inter-stud cavities with absorptive material to provide a more effective lining of the walls in example 4.1.2-V4 raises the system performance only slightly to ASTC 70. Further improvement would require better linings for the ceiling and the floor above.

4.1.3 Non-Loadbearing Lightweight Concrete Block Walls with Concrete Floors

All of the examples in Section 4.1.3 have rigid mortared junctions between the concrete floors and the lightweight concrete block walls above the floor, but soft connections (non-loadbearing) between the concrete ceiling and the walls below.

This gives a pattern of structure-borne flanking sound transfer to adjoining rooms similar to the cases illustrated in the preceding section. Hence, the changes in the flanking paths for this section are the same as those illustrated in Figure 4.1.2.1 at the beginning of the preceding Section 4.1.2.

However, in this section, the flanking transmission is altered by substituting lighter masonry walls (having 140 mm thickness and constructed of lightweight block units) and combining them with a heavier 200 mm concrete floor. The resulting change (in ratio of mass per unit area of the separating surface relative to that of the flanking surface) alters the calculated values for the vibration reduction indices K_{Ff} , K_{Fd} , and K_{Df} for the flanking paths between the surfaces in the source room (D or F) and the attached surfaces in the receiving room (f or d).

Note that all of the worked examples in this section pertain to lightweight blocks that have not been sealed by painting the surfaces of the blocks. The effect on the sound transmission loss of leakage through the lightweight blocks has been included where appropriate:

- Leakage through the unlined concrete block walls should not have any effect for flanking paths, since different assemblies are involved in the source and receiving room and leakage through the wall exposed in the source room will not emerge from the attached flanking assembly in the receiving room. Thus, sound transmission paths via the unlined wall assemblies of lightweight concrete block have the STC value for *Base*-BLK140(LW), as discussed in Section 2.1.
- Direct transmission through a separating wall of unsealed and unlined lightweight concrete blocks should have the STC value for <u>Bare</u>-BLK140(LW), since the leakage is a legitimate part of the performance of such a wall. In effect, the leakage creates an extra flanking path for the direct transmission, reducing the wall's STC value from the Base case (STC 38) to the Bare case (STC 35). However, this leakage transmission is blocked if the separating wall is covered on one side or both sides with paint or a gypsum board lining.

The appropriate correction for leakage is explicitly identified in the worked examples in Section 4.1.3.

The Δ STC changes (which are given in Table 2.3.2) have been calculated as improvements using **Base**-BLK140(LW) as the reference case without lining(s). This is obviously the appropriate reference for flanking paths (since different walls are involved in the source and receiving room, so leakage through one cannot affect the other) and is also appropriate for direct transmission through a lined separating wall because the addition of the lining(s) blocks the leakage transmission.

A description of the steps in the calculation process is given at the beginning of Section 4.1 with all of the needed references to the pertinent expressions in ISO 15712-1. The worked examples provide values for a set of realistic scenarios.



| | ISO Symbol | Reference | | | STC, Δ STC | AS | тс |
|--------------------------------|----------------------|--------------------------------------|-------------------|---|-----------------------------|-----|---------|
| Separating Partition (190 mn | n concrete block) | | | | , | | |
| Laboratory STC for Dd | R s,w | RR-334, Base BLK140(LW) | | | 38 | | |
| Leakage if no lining | _ / | RR-334, Bare BLK140(LW) | | | -3 | | |
| ASTC change by Lining on D | AR D.W | No Lining . | | | 0 | | |
| ASTC change by Lining on d | AR dw | Nolining | | | 0 | | |
| Direct STC in situ | B Dd w | ISO 15712-1 Eq. 24 and 30 | | 35 + M | AX(0,0) + MIN(0,0)/2 = | 35 | |
| | | | | | | | |
| Junction 1 (Rigid-T/Soft Cros | s junction, 190 mm l | block separating wall / 150 mm con | crete floor) | | | | |
| Flanking Element F1: | | | | | | | |
| Laboratory STC for F1 | R F1.w | RR-333, TLF-12-013 | | | 58 | | |
| ASTC change by Lining | AR F1.w | No Lining . | | | 0 | | |
| Flanking Element f1: | | | | | | | |
| Laboratory STC for f1 | R f1 w | BB-333 TLF-12-013 | | | 58 | | |
| ASTC change by Lining | AR f1 w | No Lining | | | 0 | | |
| Elanking STC for nath Ef | B Ef w | ISO 15712-1 Eq. 282 and 31 | 58/2 + | 58/2 + MAX(0.0) + | MIN(0,0)/2 + 0.2 + 1 - | 62 | |
| Elanking STC for nath Ed | B Ed w | ISO 15712-1, Eq. 28a and 31 | 58/2 | 38/2 + MAX(0,0) + 38/2 + MAX(0,0) + 38/2 + MAX(0,0) + 38/2 + MAX(0,0) + 38/2 | + MIN(0,0)/2 + 7.3 + 4 - | 59 | |
| Elanking STC for path Df | R_TG,W | ISO 15712 1, Eq. 28a and 31 | 29/2 | 58/2 + MAX(0,0) | + MIN(0,0)/2 + 7.3 + 4 = | 50 | |
| Junction 1: Flanking STC for a | Il naths | Subset of Eq. 1.1 | 36/2 | 10*10G10(10^-6.2 | $+ 10^{-} 50 + 10^{-} 50$ | 35 | 55 |
| function 1. Hanking STC for a | | Subset 01 Eq. 1.1 | | 10 10010(10 0.2 | 10 - 5.5 + 10 - 5.5 / - | | 55 |
| lunction 2 (Rigid T-lunction | 190 mm block senar | ating wall / 190 mm block flanking | wall) | | | | |
| Flanking Flement F2 | | | | | | | |
| Laboratory STC for E2 | R F2 w | RR-334 Base BLK140(LW/) | | | 38 | | |
| ASTC change by Lining | AP E2 W | No Liping | | | 0 | | |
| Elanking Elamont f2: | Διι 2,₩ | No Lining , | | | 0 | | |
| | D f2 | PD 224 Page PLK140(L)M() | | | 20 | | |
| | K_12,W | RR-334, Base BLK140(LVV) | | | 38 | | |
| ASIC change by Lining | ΔR_TZ,W | No Lining , | 20/2 | 20/2 | | - 4 | |
| Flanking STC for path Ff | R_FT,W | ISO 15712-1, Eq. 28a and 31 | 38/2 - | + 38/2 + MAX(0,0) - | + IVIIN(0,0)/2 + 5.7 + 7 = | 51 | |
| Flanking STC for path Fd | R_Fd,w | ISO 15712-1, Eq. 28a and 31 | 38/2 - | + 38/2 + MAX(0,0) - | + MIN(0,0)/2 + 5.7 + 7 = | 51 | |
| Flanking STC for path Df | R_Df,w | ISO 15712-1, Eq. 28a and 31 | 38/2 - | + 38/2 + MAX(0,0) - | + MIN(0,0)/2 + 5.7 + 7 = | 51 | |
| Junction 2: Flanking STC for a | ili patns | Subset of Eq. 1.1 | | 10*LOG10(10^-5.1 | + 10^- 5.1 + 10^- 5.1) = | | 46 |
| Junction 3 (Rigid-T/Soft Cros | s junction 190 mm | lock separating wall / 150 mm con | crete ceiling sla | h) | | | |
| Flanking Element F3 | s junction, 150 mm | sock separating wan 7 150 mm com | crete terning sia | <u>51</u> | | | |
| Laboratory STC for F3 | R F3 w | RR-333 TLE-12-013 | | | 58 | | |
| ASTC change by Lining | AR F3 W | No Lining | | | 0 | | |
| Elanking Elamont f2: | Δi(_13,w | No Lining , | | | U | | |
| Laboratory STC for f2 | P f2 w | BB 222 TIE 12 012 | | | EO | | |
| ASTC change by Lining | AP f2 w | No Liping | | | 58 | | |
| | Δκ_13,w | No Lining , | F9/2 - | 59/2 · MAX(0.0) · | | ~ | |
| Flanking STC for path Fr | K_FI,W | 150 157 12-1, Eq. 28a anu 31 | 58/2 + | 58/2 + IVIAX(U,U) + | VIIIN(0,0)/2 + -0.2 + 4 = | 02 | (1: |
| Flanking STC for path Fd | R_Fd,W | | | Negligible tr | ansmission via fire stop | 90 | (limit) |
| Flanking STC for path Dr | K_DI,W | Subset of Eq. 1.1 | | | | 90 | |
| Junction 3: Flanking STC for a | in paths | Subset of Eq. 1.1 | | - 10°LOG10(10^- | $6.2 + 10^{-9} + 10^{-9} =$ | | 02 |
| Junction 4 (Rigid T-junction | 90 mm block senar | ating wall / 190 mm block flanking | (llew | | | | |
| Flanking Floment FA | | ating wait / 150 min block hanking t | <u>wanij</u> | | | | |
| Laboratory STC for EA | R E4 144 | RR-334 Base BLK140(LW) | | | 38 | | |
| ASTC change by Lining | AP E4.W | No Liping | | | 0 | | |
| | ∆n_F4,₩ | NO LIIIIIg, | | | U | | |
| Laboratory STC for f4 | D f4 | PP 224 Paco PL/(140/114/) | | | 29 | | |
| Laboratory STC TOF T4 | K_14,W | No Lining | | | 38 | | |
| | ΔK_14,W | | 20/2 | 20/2 | | F4 | |
| Flanking STC for path H | K_ HT,W | 150 15712-1, Eq. 28a and 31 | 38/2 - | + 38/2 + IVIAX(U,U) - | + $VIIN(U,U)/2 + 5.7 + 7 =$ | 51 | |
| Flanking STC for path Fd | R_ Fd,w | ISO 15712-1, Eq. 28a and 31 | 38/2 - | + 38/2 + MAX(0,0) - | + MIN(0,0)/2 + 5.7 + 7 = | 51 | |
| Hanking STC for path Df | R_Dt,w | ISO 15712-1, Eq. 28a and 31 | 38/2 - | + 38/2 + MAX(0,0) - | + MIN(0,0)/2 + 5.7 + 7 = | 51 | |
| Junction 4: Flanking STC for a | II paths | Subset of Eq. 1.1 | - : | 10*LOG10(10^-5.1 | + 10^- 5.1 + 10^- 5.1) = | | 46 |
| | ncl | Subset of Fa 1 1 | | Combining | 12 Flanking STC values | | 43 |
| Total Flanking STC (4 Junction | 15) | 5055ct 01 Eq. 1.1 | | | | | |
| Total Flanking STC (4 Junction | | | | | | | |

EXAMPLE 4.1.3-H2: (SIMPLIFIED METHOD) Illustration for this case Rooms side-by-side Concrete floors and lightweight concrete block walls with rigid junctions except at top of non-loadbearing walls (Same structure as 4.1.3-H1, with lining of walls) Separating wall assembly (non-loadbearing) with: F3 one wythe of unsealed non-loadbearing concrete blocks with mass 134 kg/m² (e.g. 140 mm hollow blocks of lightweight aggregate⁴) soft seal at top of wall, rigid junction at bottom separating wall lined on both sides with 13 mm gypsum board³ Non-rigid supported on 38 mm wood furring spaced 610 mm o.c. with fire stop absorptive material² filling inter-stud cavities Junction 1: Bottom Junction (separating wall / floor) with: concrete floor with mass 460 kg/m² (e.g. normal weight concrete with thickness of 200 mm) with no topping or flooring rigid mortared junction with concrete block wall assembly above Junction 2 or 4: Each Side (separating wall /abutting side wall) with: abutting flanking side wall of unsealed concrete blocks with mass 134 kg/m² (e.g. 140 mm hollow blocks with lightweight aggregate⁴) soft seal at top of flanking walls, rigid junction at bottom Junction of 140 mm concrete block rigid mortared T-junctions between separating and flanking walls separating wall (with gypsum board lining) flanking walls lined with 13 mm gypsum board³ supported on 38 mm with 200 mm thick concrete floor and wood furring spaced 610 mm o.c. with absorptive material² filling ceiling. (Side view of Junctions 1 and 3) inter-stud cavities Junction 3: Top Junction (separating wall / ceiling) with: concrete ceiling slab with mass 460 kg/m² (e.g. normal weight d concrete with thickness of 200 mm) with no added ceiling lining soft seal at junction with concrete block wall assembly below f2, f4 Acoustical Parameters: F2. F4 For 140 mm lightweight concrete block walls: Mass/unit area $(kg/m^2) = 134$ (Separating wall) 134 (Flanking wall) For 200 mm concrete floor: Mass/unit area $(kg/m^2) = 460$ Junction of separating wall with flanking side wall, both of 140 mm concrete block Separating partition area $(m^2) = 12.5$ with avpsum board lininas. (Plan view of Junction 2 or 4). Junction length (m) = 5.0Separating partition height (m) = 2.510*log(S Partition/l junction 1&3) = 4.0 10*log(S Partition/l junction 2&4) = 7.0 Path Ff Path Fd Path Df Kij (in dB) = Junction Mass ratio for Ff Reference 7.3 ISO 15712-1, Eq. E.4 Rigid-T/soft 0.29 -0.2 7.3 1 **Rigid T-junction** ISO 15712-1, Eq. E.4 2 1.00 5.7 5.7 5.7

-0.2

5.7

SOFT

5.7

SOFT

5.7

(See the footnotes located at the end of the document)

Rigid-T/soft

Rigid T-junction

3

4

0.29

1.00

ISO 15712-1, Eq. E.4

ISO 15712-1, Eq. E.4

| | ISO Symbol | Reference | | | STC, Δ STC | AS | гс |
|--|-------------------|--|----------------------|------------------------------|------------------------------------|----|----------------------|
| Separating Partition (190 mm | concrete block) | | | | | | |
| Laboratory STC for Dd | R sw | RR-334 Base BLK140(LW) | | | 38 | | |
| Leakage if no lining | | N/A | | | 0 | | |
| ASTC change by Lining on D | AR Dw | RR-334 ATL-BLK(1)M/)-33 W/F | UR38 GEB38 G13 | | 7 | | |
| ASTC change by Lining on d | AR dw | PP-224 ATL PLK(1)()-22 W/E | UR28 CEB28 C12 | | 7 | | |
| Direct STC in situ | B Ddw | ISO 15712-1 Eq. 24 and 20 | 0138_01538_013 | 28 ± M | $(X \times (7,7) + M(N)(7,7)/2) =$ | 40 | |
| Directore in situ | K_Du,w | 130 137 12-1, Eq. 24 and 30 | | 50 + 1 1 1 | AA(7,7) + WIIN(7,7)/2 - | 49 | |
| lunction 1 (Pigid T/Soft Cross | junction 100 mm | alock congrating wall / 150 mm c | ancrata floor) | | | | |
| Flanking Flament F1 | junction, 190 mm | Slock separating wait / 150 mm c | | | | | |
| Fidiking Element F1. | P E1 w | BB 222 TIE 12 012 | | | EQ | | |
| | N_F1,W | NR-333, 1LF-12-013 | | | 50 | | |
| ΔSIC change by Lining | ΔR_F1,W | NO LINING , | | | U | | |
| Flanking Element T1: | D (4 | DD 222 TIE 12 012 | | | 50 | | |
| Laboratory SIC for f1 | R_f1,W | RR-333, TLF-12-013 | | | 58 | | |
| ΔSTC change by Lining | ΔR_f1,w | No Lining , | | | 0 | | |
| Flanking STC for path Ff | R_ Ff,w | ISO 15712-1, Eq. 28a and 31 | 58/2 + | 58/2 + MAX(0,0) + | MIN(0,0)/2 + -0.2 + 4 = | 62 | |
| Flanking STC for path Fd | R_ Fd,w | ISO 15712-1, Eq. 28a and 31 | 58/2 + | + 38/2 + MAX(0,7) · | + MIN(0,7)/2 + 7.3 + 4 = | 66 | |
| Flanking STC for path Df | R_ Df,w | ISO 15712-1, Eq. 28a and 31 | 38/2 + | + 58/2 + MAX(7,0) · | + MIN(7,0)/2 + 7.3 + 4 = | 66 | |
| Junction 1: Flanking STC for a | l paths | Subset of Eq. 1.1 | - 1 | 10*LOG10(10^-6.2 | + 10^- 6.6 + 10^- 6.6) = | | 59 |
| | | | | | | | |
| Junction 2 (Rigid T-Junction, 1 | 90 mm block separ | ating wall / 190 mm block flanki | ng wall) | | | | |
| Flanking Element F2: | | | | | | | |
| Laboratory STC for F2 | R_F2,w | RR-334, Base BLK140(LW) | | | 38 | | |
| ΔSTC change by Lining | ΔR_F2,w | RR-334, ΔTL-BLK(LW)-33, WF | UR38_GFB38_G13 | | 7 | | |
| Flanking Element f2: | | | | | | | |
| Laboratory STC for f2 | R_f2,w | RR-334, Base BLK140(LW) | | | 38 | | |
| ∆STC change by Lining | ΔR_f2,w | RR-334, ΔTL-BLK(LW)-33, WF | UR38_GFB38_G13 | | 7 | | |
| Flanking STC for path Ff | R_Ff,w | ISO 15712-1, Eq. 28a and 31 | 38/2 + | + 38/2 + MAX(7,7) - | + MIN(7,7)/2 + 5.7 + 7 = | 61 | |
| Flanking STC for path Fd | R Fd,w | ISO 15712-1, Eq. 28a and 31 | 38/2 + | + 38/2 + MAX(7,7) - | + MIN(7,7)/2 + 5.7 + 7 = | 61 | |
| Flanking STC for path Df | R Df,w | ISO 15712-1, Eq. 28a and 31 | 38/2 + | + 38/2 + MAX(7,7) - | + MIN(7,7)/2 + 5.7 + 7 = | 61 | |
| Junction 2: Flanking STC for a | l paths | Subset of Eq. 1.1 | - 1 | 10*LOG10(10^-6.1 | + 10^- 6.1 + 10^- 6.1) = | | 56 |
| ç | • | | | | | | |
| Junction 3 (Rigid-T/Soft Cross | junction, 190 mm | olock separating wall / 150 mm c | oncrete ceiling slal | b) | | | |
| Flanking Element F3: | | | | | | | |
| Laboratory STC for F3 | R F3.w | RR-333. TLF-12-013 | | | 58 | | |
| ΔSTC change by Lining | ΔR F3.w | No Lining . | | | 0 | | |
| Flanking Element f3 | / | | | | | | |
| Laboratory STC for f3 | R f3 w | RB-333 TIF-12-013 | | | 58 | | |
| ASTC change by Lining | AR f3 w | No Lining | | | 0 | | |
| Elanking STC for path Ef | P Ef w | ISO 15712-1 Eq. 285 and 21 | 58/2 ± | $58/2 \pm MAX(0.0) \pm$ | MIN(0,0)/2 + 0.2 + 4 - | 62 | |
| Flanking STC for path Ed | R_TI,W | 130 137 12-1, Eq. 288 and 31 | 56/2 + | Nogligible tr | 10110(0,0)/2 + -0.2 + 4 = | 02 | (limit) |
| Flanking STC for path Pd | K_FU,W | | | Negligible tr | ansmission via fire stop | 90 | (IIIIII) (limait) |
| Flanking STC for path Dr | K_DI,W | Subset of Fr. 1.1 | | | | 90 | |
| Junction 3: Flanking STC for a | ii patns | Subset of Eq. 1.1 | | - 10°LOG10(10^- | $6.2 + 10^{-9} + 10^{-9} =$ | | 02 |
| Innation 4 (Divid Timetion 1 | 00 mm bladt samer | ating well (100 mm black flankin | aall) | | | | |
| Junction 4 (Rigid 1-junction, 1 | 90 mm block separ | ating wail / 190 mm block flankir | i <u>g waii)</u> | | | | |
| | D 54 | | | | 20 | | |
| Laboratory SIC for F4 | R_F4,W | RR-334, Base BLK14U(LW) | | | 38 | | |
| ΔSIC change by Lining | ΔR_F4,w | RR-334, ΔTL-BLK(LW)-33, WF | UK38_GFB38_G13 | | 1 | | |
| Flanking Element f4: | | | | | | | |
| Laboratory STC for f4 | R_f4,w | RR-334, Base BLK140(LW) | | | 38 | | |
| ∆STC change by Lining | ΔR_f4,w | RR-334, ΔTL-BLK(LW)-33, WF | UR38_GFB38_G13 | | 7 | | |
| Flanking STC for path Ff | R_ Ff,w | ISO 15712-1, Eq. 28a and 31 | 38/2 + | + 38/2 + MAX(7,7) · | + MIN(7,7)/2 + 5.7 + 7 = | 61 | |
| Flaulding CTC fax math Ed | R_ Fd,w | ISO 15712-1, Eq. 28a and 31 | 38/2 + | + 38/2 + MAX(7,7) · | + MIN(7,7)/2 + 5.7 + 7 = | 61 | |
| Flanking STC for path Fd | R Df.w | ISO 15712-1, Eq. 28a and 31 | 38/2 + | + 38/2 + MAX(7,7) · | + MIN(7,7)/2 + 5.7 + 7 = | 61 | |
| Flanking STC for path Df | _ / | | | 10*10C10/10A C 1 | +100.61+100.61) = | | 56 |
| Flanking STC for path Pd Flanking STC for path Df Junction 4: Flanking STC for a | I paths | Subset of Eq. 1.1 | - 1 | 10 LOG10(10 - 6.1 | +10-0.1+10-0.17= | | 50 |
| Flanking STC for path Fd Flanking STC for path Df Junction 4: Flanking STC for a Total Flanking STC (4 Junction | ll paths s) | Subset of Eq. 1.1 Subset of Eq. 1.1 | - 1 | Combining | 12 Flanking STC values | | 52 |
| Flanking STC for path Fo Flanking STC for path Df Junction 4: Flanking STC for a Total Flanking STC (4 Junction | ll paths s) | Subset of Eq. 1.1 Subset of Eq. 1.1 | - 1 | Combining | 12 Flanking STC values | | 52 |



| | ISO Symbol | Reference | | | STC, Δ STC | AS | тс |
|--------------------------------|----------------------|-----------------------------------|---------------------|---|---|------|---------|
| Separating Partition (190 mn | n concrete block) | | | | , | . 10 | - |
| Laboratory STC for Dd | R s,w | RR-334, Base BLK140(LW) | | | 38 | | |
| Leakage if no lining | _ / | N/A | | | 0 | | |
| ΔSTC change by Lining on D | ΔR D.w | RR-334, ΔTL-BLK(LW)-62, SS6 | 5 GFB65 G13 | | 15 | | |
| ASTC change by Lining on d | AR dw | RB-334 ATI-BLK(1W)-62 SS6 | 5 GFB65 G13 | | 15 | | |
| Direct STC in situ | B Dd w | ISO 15712-1 Eq. 24 and 30 | 5_01005_015 | 38 + MAX(1 | 5 15) + MIN(15 15)/2 = | 61 | |
| | | | | | -,,(,,,- | | |
| Junction 1 (Rigid-T/Soft Cros | s iunction. 190 mm l | block separating wall / 150 mm c | oncrete floor) | | | | |
| Flanking Element F1: | | | | | | | |
| Laboratory STC for F1 | R F1.w | RR-333, TLF-12-013 | | | 58 | | |
| ASTC change by Lining | ΔR F1 w | No Lining | | | 0 | | |
| Elanking Element f1: | | | | | | | |
| Laboratory STC for f1 | R f1 w | RR-333 TLF-12-013 | | | 58 | | |
| ASTC change by Lining | AR f1 w | No Lining | | | 0 | | |
| Elanking STC for nath Ef | B Ef w | ISO 15712-1 Eq. 282 and 31 | 58/2 + | 58/2 + MAX(0.0) + | MIN(0,0)/2 + 0.2 + 4 - | 62 | |
| Flanking STC for path Ed | B Ed w | ISO 15712-1, Eq. 28a and 31 | 58/2 + 3 | $\frac{30}{2} + MAX(0,0) + \frac{8}{2} + MAX(0,15) + \frac{1}{2}$ | MIN(0,0)/2 + 7.3 + 4 - | 74 | |
| Flanking STC for path Df | R_Dfw | ISO 15712-1, Eq. 28a and 31 | 38/2 + 5 | 8/2 + MAX(0, 13) + 8/2 + MAX(15.0) + | MIN(0,15)/2 + 7.3 + 4 = | 74 | |
| lunction 1: Flanking STC for a | all naths | Subset of Eq. 1.1 | 30/2 + 3 | 10*10G10(10^-6 2 | $+ 10^{-}74 + 10^{-}74$ | /4 | 61 |
| and on 1. Hanking Ste for a | | Subjet of Eq. 1.1 | _ | 10 10010(10 -0.2 | . 10 7.4 / 10 - 7.4 / - | | 51 |
| unction 2 (Rigid T-Junction | 190 mm block separ | ating wall / 190 mm block flanki | ng wall) | | | | |
| Flanking Flement F2 | | | <u></u> | | | | |
| Laboratory STC for F2 | R F2 w | RB-334 Base BLK140(LW/) | | | 38 | | |
| ASTC change by Lining | AP 52 W | | 5 65965 612 | | 15 | | |
| Elanking Element f2: | ΔI <u>Λ_</u> Ι 2,W | KK-334, ΔΤΕ-ΒΕΚ(EW)-02, 330 | 5_01805_015 | | 15 | | |
| | D f2 | | | | 20 | | |
| ACTC abanga by Lining | K_12,W | RR-334, Base BLK140(LVV) | | | 38 | | |
| | ΔR_IZ,W | RR-334, Δ1L-BLK(LW)-62, 350 | 5_GFB05_G13 |) · NAAV/1E 1E) · N | 15 | 72 | |
| Flanking STC for path Fl | K_FI,W | ISO 15712-1, Eq. 28a and 31 | 38/2 + 38/ | 2 + WAX(15,15) + W | (11N(15,15)/2 + 5.7 + 7 = 4N)/45 45)/2 + 5.7 + 7 = 4N)/45 + 5.7 + 7 = 4N)/45 + 5.7 + 7 = 4N)/45 + 5.7 + 7 | 73 | |
| Flanking STC for path Fd | R_Fd,W | ISO 15712-1, Eq. 28a and 31 | 38/2 + 38/ | 2 + MAX(15,15) + N | (11N(15,15)/2 + 5.7 + 7 = 0.00)/2 + 5.7 + 7 = 0.000000000000000000000000000000000 | 73 | |
| Flanking STC for path Df | R_DT,W | ISO 15712-1, Eq. 28a and 31 | 38/2 + 38/ | 2 + MAX(15,15) + N | (100, 15, 15)/2 + 5.7 + 7 = | /3 | <u></u> |
| Junction 2: Flanking STC for a | in paths | Subset of Eq. 1.1 | | 10-10010(10/-7.3 | + 10^- 7.3 + 10^- 7.3) = | | 68 |
| Junction 3 (Rigid-T/Soft Cros | s junction 190 mm l | lock separating wall / 150 mm c | oncrete ceiling sla | h) | | | |
| Flanking Element F3: | - Junetion) 200 mm | | | <u>~1</u> | | | |
| Laboratory STC for E3 | R F3 w | RR-333 TIF-12-013 | | | 58 | | |
| ASTC change by Lining | AR F3 w | No Lining | | | 0 | | |
| Elanking Element f3: | BI(_15,W | No Lining , | | | Ū | | |
| Laboratory STC for f3 | R f3 w | RR-333 TIF-12-013 | | | 58 | | |
| ASTC change by Lining | AP f2 w/ | No Lining | | | 0 | | |
| Elanking STC for path Ef | D Ef w | ISO 15712-1 Eq. 282 and 21 | 58/2 + | $58/2 \pm MAX(0.0) \pm$ | MIN(0,0)/2 + 0.2 + 4 = | 62 | |
| Flanking STC for path Ed | R_Fd.w | 130 137 12-1, Eq. 288 and 31 | 56/2 + | Nogligible tr | 10110(0,0)/2 + -0.2 + 4 = | 02 | (limit) |
| Flanking STC for path Df | R_FU,W | | | Negligible tr | ansmission via fire stop | 90 | (limit) |
| lunction 2: Elanking STC for a | n_ DI,w | Subset of Eq. 1.1 | | | $6.2 \pm 100, 0 \pm 100, 0 = -$ | 90 | 62 |
| Junction 5. Flanking STC for a | in pauls | Subset of Eq. 1.1 | | - 10 10010(10 | 0.2 + 10 9 + 10 9) - | | 02 |
| Junction 4 (Rigid T-junction 1 | 190 mm block senar | ating wall / 190 mm block flankir | ng wall) | | | | |
| Flanking Element F4 | | | | | | | |
| Laboratory STC for F4 | R F4 w | RR-334 Base BLK140(LM/) | | | 38 | | |
| ASTC change by Lining | AR E4 W | RR-334, ATL_PLV(1)(LW) | 5 GEB65 G12 | | 15 | | |
| | Δ κ_ г4,w | RR-334, Δ1L-BLR(LW)-02, 330 | 5_GFB05_G15 | | 15 | | |
| Laboratory STC for f4 | D f4 | PP-224 Paco PL//140/114/ | | | 28 | | |
| Laboratory SIC TOF T4 | K_14,W | RR-334, Base BLK14U(LW) | | | 38 | | |
| Lonking STC for moth of | ΔK_14,W | κκ-334, Δ1L-BLK(LW)-62, SS6 | 5_GFB65_G13 | | 15 | | |
| Flanking STC for path H | K_ HT,W | ISO 15712-1, Eq. 28a and 31 | 38/2 + 38/ | 2 + IVIAX(15, 15) + N | (11N(15,15)/2 + 5.7 + 7 = 0.000) | /3 | |
| Flanking STC for path Fd | R_ Fd,w | ISO 15712-1, Eq. 28a and 31 | 38/2 + 38/ | 2 + MAX(15,15) + N | (10(15,15)/2 + 5.7 + 7 = -7) | 73 | |
| Hanking STC for path Df | R_Df,w | ISO 15712-1, Eq. 28a and 31 | 38/2 + 38/ | 2 + MAX(15,15) + N | /IIN(15,15)/2 + 5.7 + 7 = | 73 | |
| Junction 4: Flanking STC for a | all paths | Subset of Eq. 1.1 | - | 10*LOG10(10^-7.3 | + 10^- 7.3 + 10^- 7.3) = | | 68 |
| Total Flambing CTC // Jumphics | ns) | Subset of Eq. 1.1 | | Combining | g 12 Flanking STC values | | 58 |
| Total Flanking STC (4 Junction | | | | | | | |
| Total Flanking STC (4 Junction | | | | | | _ | |



| | ISO Symbol | Reference | | | STC, ∆_STC | A | тс |
|---------------------------------|--------------------|-----------------------------------|----------------------|--------------------|---------------------------|----|---------|
| Separating Partition (190 mm | concrete block) | | | | · - | | |
| Laboratory STC for Dd | R s.w | RR-334. Base BLK140(LW) | | | 38 | | |
| Leakage if no lining | | N/A | | | 0 | | |
| ASTC change by Lining on D | AR D.w | RR-334, ATL-BLK(LW)-62, SS6 | 5 GFB65 G13 | | 15 | | |
| ASTC change by Lining on d | AR dw | BR-334 ATL-BLK(LW)-62 SS6 | 5 GEB65 G13 | | 15 | | |
| Direct STC in situ | R Dd.w | ISO 15712-1. Eq. 24 and 30 | _0.000_010 | 38 + MAX(1) | 5.15) + MIN(15.15)/2 = | 61 | |
| | , | | | | -,,(,,,- | | |
| Junction 1 (Rigid-T/Soft Cross | junction, 190 mm b | olock separating wall / 150 mm c | oncrete floor) | | | | |
| Flanking Element F1: | | | | | | | |
| Laboratory STC for F1 | R F1,w | RR-333, TLF-12-013 | | | 58 | | |
| ΔSTC change by Lining | ΔR F1,w | No Lining , | | | 0 | | |
| Flanking Element f1: | _ / | | | | | | |
| Laboratory STC for f1 | R f1,w | RR-333, TLF-12-013 | | | 58 | | |
| ΔSTC change by Lining | ΔR f1,w | No Lining , | | | 0 | | |
| Flanking STC for path Ff | R Ff.w | ISO 15712-1. Eq. 28a and 31 | 58/2 + | 58/2 + MAX(0.0) + | MIN(0.0)/2 + -0.2 + 4 = | 62 | |
| Flanking STC for path Fd | R Fd.w | ISO 15712-1. Eq. 28a and 31 | 58/2 + 3 | 8/2 + MAX(0.15) + | MIN(0.15)/2 + 7.3 + 4 = | 74 | |
| Flanking STC for path Df | R Df.w | ISO 15712-1. Eq. 28a and 31 | 38/2 + 5 | 8/2 + MAX(15.0) + | MIN(15.0)/2 + 7.3 + 4 = | 74 | |
| Junction 1: Flanking STC for a | Il paths | Subset of Eq. 1.1 | - 1 | LO*LOG10(10^-6.2 | + 10^- 7.4 + 10^- 7.4) = | | 61 |
| 0 | | | | | | | |
| Junction 2 (Rigid T-Junction, 1 | 90 mm block separ | ating wall / 190 mm block flankir | g wall) | | | | |
| Flanking Element F2: | | | | | | | |
| Laboratory STC for F2 | R F2,w | RR-334, Base BLK140(LW) | | | 38 | | |
| ΔSTC change by Lining | ΔR F2.w | RR-334, ΔTL-BLK(LW)-62, SS6 | 5 GFB65 G13 | | 15 | | |
| Flanking Element f2: | <u>_</u> , | | | | | | |
| Laboratory STC for f2 | R f2.w | RR-334, Base BLK140(LW) | | | 38 | | |
| ASTC change by Lining | ΔR f2.w | RR-334, ATL-BLK(LW)-62, SS6 | 5 GFB65 G13 | | 15 | | |
| Flanking STC for path Ff | R Ff.w | ISO 15712-1. Eq. 28a and 31 | 38/2 + 38/2 | 2 + MAX(15.15) + N | 4IN(15,15)/2 + 5.7 + 7 = | 73 | |
| Flanking STC for path Fd | R Fd.w | ISO 15712-1. Eq. 28a and 31 | 38/2 + 38/2 | 2 + MAX(15.15) + N | IIN(15.15)/2 + 5.7 + 7 = | 73 | |
| Flanking STC for path Df | R Df.w | ISO 15712-1. Eq. 28a and 31 | 38/2 + 38/2 | 2 + MAX(15.15) + N | IIN(15.15)/2 + 5.7 + 7 = | 73 | |
| Junction 2: Flanking STC for a | Il paths | Subset of Eq. 1.1 | - 1 | LO*LOG10(10^-7.3 | + 10^- 7.3 + 10^- 7.3) = | | 68 |
| | | | | | | | |
| Junction 3 (Rigid-T/Soft Cross | junction, 190 mm b | olock separating wall / 150 mm c | oncrete ceiling slal | <u>o)</u> | | | |
| Flanking Element F3: | | | | | | | |
| Laboratory STC for F3 | R_F3,w | RR-333, TLF-12-013 | | | 58 | | |
| ΔSTC change by Lining | ΔR_F3,w | RR-333, ΔTLF-CON150-01, SUS | 150_GFB150_G16 | | 19 | | |
| Flanking Element f3: | | | | | | | |
| Laboratory STC for f3 | R_f3,w | RR-333, TLF-12-013 | | | 58 | | |
| ΔSTC change by Lining | ΔR_f3,w | RR-333, ΔTLF-CON150-01, SUS | 150_GFB150_G16 | | 19 | | |
| Flanking STC for path Ff | R_Ff,w | ISO 15712-1, Eq. 28a and 31 | 58/2 + 58/2 | + MAX(19,19) + M | IN(19,19)/2 + -0.2 + 4 = | 90 | (limit) |
| Flanking STC for path Fd | R Fd,w | | | Negligible tr | ansmission via fire stop | 90 | (limit) |
| Flanking STC for path Df | R_Df,w | | | Negligible tr | ansmission via fire stop | 90 | (limit) |
| Junction 3: Flanking STC for a | II paths | Subset of Eq. 1.1 | | - 10*LOG10(10 | ^-9 + 10^- 9 + 10^- 9) = | | 85 |
| | | | | | | | |
| Junction 4 (Rigid T-junction, 1 | 90 mm block separa | ating wall / 190 mm block flankin | g wall) | | | | |
| Flanking Element F4: | | | | | | | |
| Laboratory STC for F4 | R_F4,w | RR-334, Base BLK140(LW) | | | 38 | | |
| ∆STC change by Lining | ΔR_F4,w | RR-334, ΔTL-BLK(LW)-62, SS6 | 5_GFB65_G13 | | 15 | | |
| Flanking Element f4: | | | | | | | |
| Laboratory STC for f4 | R_f4,w | RR-334, Base BLK140(LW) | | | 38 | | |
| ∆STC change by Lining | ΔR_f4,w | RR-334, ΔTL-BLK(LW)-62, SS6 | 5_GFB65_G13 | | 15 | | |
| Flanking STC for path Ff | R_ Ff,w | ISO 15712-1, Eq. 28a and 31 | 38/2 + 38/2 | 2 + MAX(15,15) + N | /IN(15,15)/2 + 5.7 + 7 = | 73 | |
| Flanking STC for path Fd | R_ Fd,w | ISO 15712-1, Eq. 28a and 31 | 38/2 + 38/2 | 2 + MAX(15,15) + N | /IN(15,15)/2 + 5.7 + 7 = | 73 | |
| Flanking STC for path Df | R_Df,w | ISO 15712-1, Eq. 28a and 31 | 38/2 + 38/2 | 2 + MAX(15,15) + N | /IN(15,15)/2 + 5.7 + 7 = | 73 | |
| Junction 4: Flanking STC for a | ll paths | Subset of Eq. 1.1 | - 1 | LO*LOG10(10^-7.3 | + 10^- 7.3 + 10^- 7.3) = | | 68 |
| Total Flanking STC (4 Junction | ns) | Subset of Eq. 1.1 | | Combining | 3 12 Flanking STC values | | 60 |
| | | | | | | | |
| | | | | | | | |



| ISO Symbol Separating Partition (190 mm concrete block) Laboratory STC for Dd R_s,w ASTC change by Lining on D AR_D,w ASTC change by Lining on d AR_d,w Direct STC in situ R_Dd,w Junction 1 (Rigid-T/Soft Cross junction, 190 mm block Flanking Element F1: Laboratory STC for F1 R_f1,w ASTC change by Lining AR_f1,w Flanking Element f1: Laboratory STC for f1 R_f1,w Flanking STC for path Ff R_f4,w Flanking STC for path Ff Maction 2 (Rigid T-Junction, 190 mm block separat Flanking Element F2: Laboratory STC for F2 R_F2,w Flanking STC for path Ff R_f4,w Flanking STC for path Ff R_f4,w | Reference RR-333, TLF-12-013 No Lining , ISO 15712-1, Eq. 24 and 30 ock separating wall / 150 mm co ock separating wall / 150 mm co RR-334, Base BLK140(LW) No Lining , ISO 15712-1, Eq. 28a and 31 | oncrete floor) 38/2 + 1g wall) | 58 + M Negligible tr - 58/2 + MAX(0,0) + Negligible tr - 10*LOG10(10^- | STC, A_STC | AS 58 90 61 | TC |
|---|---|--------------------------------------|---|---|----------------------|---------|
| Separating Partition (190 mm concrete block) Laboratory STC for Dd R_s, w ASTC change by Lining on D $\Delta R_o, w$ Direct STC in situ R_od, w Direct STC in situ R_od, w Junction 1 (Rigid-T/Soft Cross junction, 190 mm block Flanking Element F1: Laboratory STC for F1 Laboratory STC for F1 R_f1, w ASTC change by Lining $\Delta R_f1, w$ Flanking Element f1: Laboratory STC for f1 Laboratory STC for f1 R_f1, w ASTC change by Lining $\Delta R_f1, w$ Flanking STC for path Ff R_ef, w Flanking STC for path Ff R_ef, w Flanking STC for path Fd R_ef, w Flanking STC for path Df R_od, w Junction 1: Flanking STC for all paths Junction 2 (Rigid T-Junction, 190 mm block separated the separated the set | RR-333, TLF-12-013 No Lining , No Lining , ISO 15712-1, Eq. 24 and 30 ock separating wall / 150 mm c RR-334, Base BLK140(LW) No Lining , ISO 15712-1, Eq. 28a and 31 ISO 1 | oncrete floor) 38/2 + 1g wall) | 58 + M Negligible tr - 58/2 + MAX(0,0) + Negligible tr - 10*LOG10(10^- | 58 0 0 AX(0,0) + MIN(0,0)/2 = 38 0 ansmission via fire stop + MIN(0,0)/2 + 7.3 + 6 = ansmission via fire stop + MIN(0,0)/2 + 7.3 + 6 = | 58 90 61 | (limit) |
| Laboratory STC for Dd R_s,w ASTC change by Lining on D ΔR_D,w ASTC change by Lining on d ΔR_d,w Direct STC in situ R_Dd,w Junction 1 (Rigid-T/Soft Cross junction, 190 mm ble Flanking Element F1: Laboratory STC for F1 Laboratory STC for F1 R_f1,w Flanking Element f1: Laboratory STC for f1 R_f1,w Flanking STC for path Ff R_f4,w Flanking STC for path Ff R_f2,w Flanking Element f2: Laboratory STC for f2 R_f2,w Flanking STC for path Ff R_f4,w Flanking STC for path Ff R_f4,w Flanking STC for path Ff Ff,w | RR-333, TLF-12-013 No Lining , No Lining , ISO 15712-1, Eq. 24 and 30 ock separating wall / 150 mm co RR-334, Base BLK140(LW) No Lining , ISO 15712-1, Eq. 28a and 31 ISO 15712-1, Eq. 38a and 31 ISO | oncrete floor) 38/2 + 1g wall) | 58 + M Negligible tr - 58/2 + MAX(0,0) + Negligible tr - 10*LOG10(10^- | 58 0 0 AX(0,0) + MIN(0,0)/2 = 38 0 38 0 ansmission via fire stop + MIN(0,0)/2 + 7.3 + 6 = ansmission via fire stop + 100, 6 1 + 100, 9 ↓ | 58 90 61 | (limit) |
| ΔSTC change by Lining on D ΔR_D,w ΔSTC change by Lining on d ΔR_d,w Direct STC in situ R_Dd,w Junction 1 (Rigid-T/Soft Cross junction, 190 mm ble Flanking Element F1: Laboratory STC for F1 R_F1,w MSTC change by Lining ΔR_F1,w Flanking Element f1: Laboratory STC for f1 Laboratory STC for f1 R_f1,w ASTC change by Lining ΔR_f1,w Flanking STC for path Ff R_f,w Flanking STC for path Fd R_f4,w Flanking STC for path Fd R_f4,w Flanking STC for path Fd R_F2,w Junction 1: Flanking STC for all paths Junction 2 (Rigid T-Junction, 190 mm block separate Junction 2 (Rigid T-Junction, 190 mm block separate Flanking Element F2: Laboratory STC for F2 R_F2,w STC change by Lining ΔR_f2,w Flanking STC for path Ff R_f,w Flanking STC for path Ff R_f,w Flanking STC for path Ff R_fd,w F | No Lining , No Lining , ISO 15712-1, Eq. 24 and 30 ock separating wall / 150 mm co RR-334, Base BLK140(LW) No Lining , RR-334, Base BLK140(LW) No Lining , ISO 15712-1, Eq. 28a and 31 ISO 15712-1, Eq. 28a and 31 ISO 15712-1, Eq. 28a and 31 Subset of Eq. 1.1 cing wall / 190 mm block flanking RR-334, Base BLK140(LW) | oncrete floor) 38/2 + ig wall) | 58 + M Negligible tr. - 58/2 + MAX(0,0) + Negligible tr. - 10*LOG10(10^-1 | 0 0 AX(0,0) + MIN(0,0)/2 = 38 0 38 0 ansmission via fire stop + MIN(0,0)/2 + 7.3 + 6 = ansmission via fire stop + MIN(0,0)/2 + 7.3 + 6 = | 58 90 61 | (limit) |
| ΔSTC change by Lining on d ΔR_d,w Direct STC in situ R_Dd,w Junction 1 (Rigid-T/Soft Cross junction, 190 mm ble Elanking Element F1: Laboratory STC for F1 R_F1,w ASTC change by Lining ΔR_f1,w STC change by Lining ΔR_f1,w Flanking Element f1: Laboratory STC for f1 Laboratory STC for f1 R_f1,w ASTC change by Lining ΔR_f1,w Flanking STC for path Ff R_Fd,w Flanking STC for path Df R_Df,w Junction 1: Flanking STC for all paths Junction 1: Flanking STC for all paths Junction 2 (Rigid T-Junction, 190 mm block separat Flanking Element F2: Laboratory STC for F2 R_F2,w ASTC change by Lining ΔR_F2,w Flanking STC for path Ff R_f4,w STC change by Lining ΔR_f2,w Flanking STC for path Ff R_f4,w Flanking STC for pa | No Lining , ISO 15712-1, Eq. 24 and 30 ock separating wall / 150 mm c RR-334, Base BLK140(LW) No Lining , ISO 15712-1, Eq. 28a and 31 ISO 15712-1, Eq. 38a and 38a and 38a and 38a and 3 | oncrete floor) 38/2 + 1g wall) | 58 + M Negligible tr. - 58/2 + MAX(0,0) + Negligible tr. - 10*LOG10(10^-1 | 0 AX(0,0) + MIN(0,0)/2 = 38 0 38 0 ansmission via fire stop + MIN(0,0)/2 + 7.3 + 6 = ansmission via fire stop 4 + 100, 6 1 + 100, 9 } | 90 61 | (limit) |
| Direct STC in situ R_Dd,w Junction 1 (Rigid-T/Soft Cross junction, 190 mm ble Flanking Element F1: Laboratory STC for F1 R_F1,w Laboratory STC for F1 R_F1,w STC change by Lining $\Delta R_F1,w$ Flanking Element f1: Laboratory STC for f1 R_f1,w STC change by Lining $\Delta R_F1,w$ Flanking STC for path Ff R_Ff,w Flanking STC for path Fd R_Fd,w Flanking STC for path Fd R_Df,w Junction 1: Flanking STC for all paths Junction 1: Flanking STC for all paths Junction 2 (Rigid T-Junction, 190 mm block separat Flanking Element F2: Laboratory STC for F2 R_F2,w STC change by Lining $\Delta R_F2,w$ Flanking STC for path Ff R_F4,w Flanking STC for path Ff R_Df,w Junction 2: Flanking STC for all paths Junction 2: Flanking STC for path Ff Junction 3 (Rigid-T/Soft Cross junction, 190 mm block Junction 2: Flanking STC for F3 Junction 3 (Rigid-T/Soft Cross junction, 190 mm block F3,w Junction 3 (Rigid-T/Soft Cross junction, 190 mm block Junction 3: R_F3,w ASTC change by Lining $\Delta R_F3,w$ Laboratory STC for F3 | ISO 15712-1, Eq. 24 and 30 ock separating wall / 150 mm c RR-334, Base BLK140(LW) No Lining , ISO 15712-1, Eq. 28a and 31 ISO 15712-1, Eq. 28a and 31 ISO 15712-1, Eq. 28a and 31 ISO 15712-1, Eq. 28a and 31 Subset of Eq. 1.1 ing wall / 190 mm block flanking RR-334, Base BLK140(LW) | oncrete floor) 38/2 + 1g wall) | 58 + M Negligible tr. - 58/2 + MAX(0,0) + Negligible tr. - 10*LOG10(10^- | AX(0,0) + MIN(0,0)/2 = 38 0 38 0 ansmission via fire stop + MIN(0,0)/2 + 7.3 + 6 = ansmission via fire stop 4 + 100, 6 1 + 100, 9 } | 90 90 | (limit) |
| Junction 1 (Rigid-T/Soft Cross junction, 190 mm bld Flanking Element F1: Laboratory STC for F1 R_F1,w ASTC change by Lining $\Delta R_F1,w$ Flanking Element f1: Laboratory STC for f1 R_f1,w Laboratory STC for f1 R_f1,w ASTC change by Lining $\Delta R_f1,w$ Flanking STC for path Ff R_Ff,w Flanking STC for path Fd R_Fd,w Flanking STC for path Df R_Df,w Junction 1: Flanking STC for all paths Junction 2 (Rigid T-Junction, 190 mm block separate Junction 2 (Rigid T-Junction, 190 mm block separate Flanking Element F2: Laboratory STC for F2 R_F2,w ASTC change by Lining $\Delta R_F2,w$ Flanking STC for path Ff R_F4,w Flanking STC for path Ff R_fd,w Flanking STC for path Ff R_fd,w Flanking STC for path Ff R_fd,w Flanking STC for path Ff R_bd,w STC change by Lining $\Delta R_f3,w$ | ock separating wall / 150 mm c RR-334, Base BLK140(LW) No Lining , RR-334, Base BLK140(LW) No Lining , ISO 15712-1, Eq. 28a and 31 ISO 15712-1, Eq. 28a and 31 ISO 15712-1, Eq. 28a and 31 Subset of Eq. 1.1 Subset of Eq. 1.1 Cing wall / 190 mm block flanking RR-334, Base BLK140(LW) | oncrete floor) 38/2 + ig wall) | Negligible tr. 58/2 + MAX(0,0) + Negligible tr. - 10*LOG10(10^-1 | 38 0 38 0 ansmission via fire stop t MIN(0,0)/2 + 7.3 + 6 = ansmission via fire stop ansmission via fire stop | 90 61 | (limit) |
| Flanking Element F1: Laboratory STC for F1 R_F1,w ASTC change by Lining $\Delta R_F1,w$ Flanking Element f1: Laboratory STC for f1 R_f1,w ASTC change by Lining $\Delta R_f1,w$ Flanking STC for path Ff R_Fd,w Flanking STC for path Ff R_Fd,w Flanking STC for path Fd R_Df,w Junction 1: Flanking STC for all paths Junction 2 (Rigid T-Junction, 190 mm block separat Junction 2 (Rigid T-Junction, 190 mm block separat Flanking Element F2: Laboratory STC for F2 R_F2,w Flanking Element F2: Laboratory STC for f2 Laboratory STC for f2 R_f2,w ASTC change by Lining $\Delta R_f2,w$ Flanking STC for path Ff R_fd,w Flanking STC for path Ff R_fd,w Flanking STC for path Df R_Df,w Junction 2: Flanking STC for all paths Junction 2: Flanking STC for all paths Junction 3 (Rigid-T/Soft Cross junction, 190 mm block Junction 2: Flanking STC for all paths Junction 3 (Rigid-T/Soft Cross junction, 190 mm block Junction 3: R_F3,w ASTC change by Lining $\Delta R_F3,w$ ASTC change by Lining $\Delta R_F3,w$ | RR-334, Base BLK140(LW) No Lining , RR-334, Base BLK140(LW) No Lining , ISO 15712-1, Eq. 28a and 31 ISO 15712-1, Eq. 28a and 31 ISO 15712-1, Eq. 28a and 31 ISO 15712-1, Eq. 28a and 31 Subset of Eq. 1.1 | 38/2 + Ig wall) | Negligible tr - 58/2 + MAX(0,0) + Negligible tr - 10*LOG10(10^- | 38 0 38 0 ansmission via fire stop MIN(0,0)/2 + 7.3 + 6 = ansmission via fire stop 4 + 100.6 1 + 100.9 1 | 90 61 | (limit) |
| Laboratory STC for F1R_F1,wASTC change by Lining Δ R_F1,wFlanking Element f1:Laboratory STC for f1R_f1,wLaboratory STC for f1R_f1,wFlanking STC for path FfR_Ff,wFlanking STC for path FdR_Df,wJunction 1: Flanking STC for all pathsJunction 2 (Rigid T-Junction, 190 mm block separatLaboratory STC for F2R_F2,wLaboratory STC for f2R_F2,wFlanking Element F2:Laboratory STC for f2Laboratory STC for f2R_f2,wFlanking STC for path FfR_f4,wFlanking STC for path FfR_f2,wFlanking STC for path FfR_f4,wFlanking STC for path FfR_f4,wFlanking STC for path DfR_Df,wJunction 2: Flanking STC for all pathsJunction 2: Flanking STC for all pathsJunction 3 (Rigid-T/Soft Cross junction, 190 mm blockJunction 3 (Rigid-T/Soft Cross junction, 190 mm blockLaboratory STC for F3R_F3,wASTC change by Lining Δ R_F3,wASTC change by Lining Δ R_f3,w | RR-334, Base BLK140(LW) No Lining , RR-334, Base BLK140(LW) No Lining , ISO 15712-1, Eq. 28a and 31 ISO 15712-1, Eq. 28a and 31 ISO 15712-1, Eq. 28a and 31 Subset of Eq. 1.1 Characteristic for the set of the s | 38/2 + Ig wall) | Negligible tr - 58/2 + MAX(0,0) + Negligible tr - 10*LOG10(10^- | 38 0 38 0 ansmission via fire stop + MIN(0,0)/2 + 7.3 + 6 = ansmission via fire stop 0 + 100.6 1 + 100.9 1 | 90 61 | (limit) |
| $\begin{tabular}{lllllllllllllllllllllllllllllllllll$ | No Lining , RR-334, Base BLK140(LW) No Lining , ISO 15712-1, Eq. 28a and 31 ISO 15712-1, Eq. 28a and 31 ISO 15712-1, Eq. 28a and 31 Subset of Eq. 1.1 Ling wall / 190 mm block flanking RR-334, Base BLK140(LW) No Lining | 38/2 + ig wall) | Negligible tr. - 58/2 + MAX(0,0) + Negligible tr. - 10*LOG10(10^-1 | 0 38 0 ansmission via fire stop MIN(0,0)/2 + 7.3 + 6 = ansmission via fire stop b + 100, 6 1 + 100, 9) | 90 61 | (limit) |
| Flanking Element f1: Laboratory STC for f1 R_f1,w Δ STC change by Lining Δ R_f1,w Flanking STC for path Ff R_Ff,w Flanking STC for path Fd R_Fd,w Flanking STC for path Df R_Df,w Junction 1: Flanking STC for all paths Junction 1: Flanking STC for all paths Junction 2 (Rigid T-Junction, 190 mm block separat Flanking Element F2: Laboratory STC for F2 Laboratory STC for f2 R_F2,w ASTC change by Lining Δ R_f2,w Flanking STC for path Ff R_Lf,w Flanking STC for path Ff R_fd,w Flanking STC for path Df R_Df,w Junction 2: Flanking STC for all paths Junction 2: Flanking STC for all paths Junction 3 (Rigid-T/Soft Cross junction, 190 mm block Junction 3: R_F3,w ASTC change by Lining Δ R_F3,w ASTC change by Lining Δ R_F3,w Laboratory STC for F3 R_f3,w ASTC change by Lining Δ R_f3,w | RR-334, Base BLK140(LW) No Lining , ISO 15712-1, Eq. 28a and 31 ISO 15712-1, Eq. 28a and 31 ISO 15712-1, Eq. 28a and 31 Subset of Eq. 1.1 Subset of Eq. 1.1 RR-334, Base BLK140(LW) | 38/2 + Ig wall) | Negligible tr. 58/2 + MAX(0,0) + Negligible tr. - 10*LOG10(10^-1 | 38 0 ansmission via fire stop + MIN(0,0)/2 + 7.3 + 6 = ansmission via fire stop + 100.6 1 + 100.9 - | 90 61 | (limit) |
| Laboratory STC for f1 R_f1,w ΔSTC change by Lining ΔR_f1,w Flanking STC for path Ff R_Ff,w Flanking STC for path Df R_Df,w Junction 1: Flanking STC for all paths Junction 1: Flanking STC for all paths Junction 2 (Rigid T-Junction, 190 mm block separat Flanking Element F2: Laboratory STC for F2 R_F2,w ASTC change by Lining ΔR_F2,w Flanking STC for path Ff R_F2,w Flanking STC for path Ff R_f4,w Flanking STC for path Fd R_f4,w Flanking STC for path Fd R_f4,w Flanking STC for path Df R_Df,w Junction 2: Flanking STC for all paths Junction 2: Flanking STC for all paths Junction 3 (Rigid-T/Soft Cross junction, 190 mm ble Flanking Element F3: Laboratory STC for F3 R_F3,w ASTC change by Lining ΔR_F3,w Laboratory STC for F3 R_f3,w ASTC change by Lining ΔR_f3,w <td>RR-334, Base BLK140(LW) No Lining , ISO 15712-1, Eq. 28a and 31 ISO 15712-1, Eq. 28a and 31 ISO 15712-1, Eq. 28a and 31 Subset of Eq. 1.1 Ling wall / 190 mm block flankin RR-334, Base BLK140(LW)</td> <td>38/2 + Ig wall)</td> <td>Negligible tr 58/2 + MAX(0,0) + Negligible tr - 10*LOG10(10^-1</td> <td>38 0 ansmission via fire stop $MIN(0,0)/2 + 7.3 + 6 =$ ansmission via fire stop $4 + 100 - 6 + 1 + 100 - 9$</td> <td>90 61</td> <td>(limit)</td> | RR-334, Base BLK140(LW) No Lining , ISO 15712-1, Eq. 28a and 31 ISO 15712-1, Eq. 28a and 31 ISO 15712-1, Eq. 28a and 31 Subset of Eq. 1.1 Ling wall / 190 mm block flankin RR-334, Base BLK140(LW) | 38/2 + Ig wall) | Negligible tr 58/2 + MAX(0,0) + Negligible tr - 10*LOG10(10^-1 | 38 0 ansmission via fire stop $MIN(0,0)/2 + 7.3 + 6 =$ ansmission via fire stop $4 + 100 - 6 + 1 + 100 - 9$ | 90 61 | (limit) |
| $\label{eq:response} \begin{array}{ c c c c } & \Delta R_{c} f1,w \\ \hline \text{Flanking STC for path Ff} & R_{c} Ff,w \\ \hline \text{Flanking STC for path Fd} & R_{c} fd,w \\ \hline \text{Flanking STC for path Df} & R_{c} Df,w \\ \hline \text{Junction 1: Flanking STC for all paths} \\ \hline \begin{array}{ c c c c } \hline \\ \hline $ | No Lining , ISO 15712-1, Eq. 28a and 31 ISO 15712-1, Eq. 28a and 31 ISO 15712-1, Eq. 28a and 31 Subset of Eq. 1.1 ing wall / 190 mm block flankin RR-334, Base BLK140(LW) No Lining | 38/2 + I <u>g wall)</u> | Negligible tr - 58/2 + MAX(0,0) + Negligible tr - 10*LOG10(10^-1 | 0 ansmission via fire stop $MIN(0,0)/2 + 7.3 + 6 =$ ansmission via fire stop $0 + 100 + 6 + 100 + 0 = -$ | 90 61 | (limit) |
| Flanking STC for path Ff R_Ff,w Flanking STC for path Fd R_Fd,w Flanking STC for path Df R_Df,w Junction 1: Flanking STC for all paths Junction 2 (Rigid T-Junction, 190 mm block separat Flanking Element F2: Laboratory STC for F2 R_F2,w Flanking Element f2: Laboratory STC for f2 R_F2,w Flanking Element f2: Laboratory STC for f2 R_F2,w Flanking St for path Ff R_f4,w Flanking STC for path Ff R_f4,w Flanking STC for path Df R_Df,w Junction 2: Flanking STC for all paths Junction 3 (Rigid-T/Soft Cross junction, 190 mm block Flanking Element F3: Laboratory STC for F3 R_F3,w ASTC change by Lining ΔR_F3,w ASTC change by Lining ΔR_F3,w ASTC change by Lining ΔR_F3,w Laboratory STC for F3 R_f3,w ΔSTC change by Lining ΔR_F3,w | ISO 15712-1, Eq. 28a and 31 ISO 15712-1, Eq. 28a and 31 ISO 15712-1, Eq. 28a and 31 Subset of Eq. 1.1 Subset of Eq. 1.1 RR-334, Base BLK140(LW) | 38/2 + I <u>g wall)</u> | Negligible tr - 58/2 + MAX(0,0) + Negligible tr - 10*LOG10(10^- | ansmission via fire stop MIN(0,0)/2 + 7.3 + 6 = ansmission via fire stop 0 + 100-6 1 + 100-9) = | 90 61 | (limit) |
| Flanking STC for path Fd R_Fd,w Flanking STC for path Df R_Df,w Junction 1: Flanking STC for all paths Junction 2 (Rigid T-Junction, 190 mm block separat Flanking Element F2: Laboratory STC for F2 R_F2,w ASTC change by Lining ΔR_F2,w Flanking Element f2: Laboratory STC for f2 Laboratory STC for f2 R_f2,w ASTC change by Lining ΔR_f2,w Flanking STC for path Ff R_f4,w Flanking STC for path Df R_Df,w Junction 2: Flanking STC for all paths Junction 2: Flanking STC for all paths Junction 3 (Rigid-T/Soft Cross junction, 190 mm block Flanking Element F3: Laboratory STC for F3 Laboratory STC for F3 R_F3,w ASTC change by Lining ΔR_F3,w ASTC change by Lining ΔR_F3,w ASTC change by Lining ΔR_F3,w | ISO 15712-1, Eq. 28a and 31 ISO 15712-1, Eq. 28a and 31 Subset of Eq. 1.1 ing wall / 190 mm block flankin RR-334, Base BLK140(LW) | 38/2 + I <u>g wall)</u> | - 58/2 + MAX(0,0) + Negligible tr - 10*LOG10(10^- | MIN(0,0)/2 + 7.3 + 6 = ansmission via fire stop | 61 | (limit) |
| Flanking STC for path Df R_Df,w Junction 1: Flanking STC for all paths Junction 2 (Rigid T-Junction, 190 mm block separat Elanking Element F2: Laboratory STC for F2 R_F2,w ASTC change by Lining ΔR_F2,w Flanking Element f2: Laboratory STC for f2 Laboratory STC for f2 R_f2,w Flanking StC for path Ff R_f2,w Flanking STC for path Ff R_f4,w Flanking STC for path Df R_Df,w Junction 2: Flanking STC for all paths Junction 3 (Rigid-T/Soft Cross junction, 190 mm block separat Laboratory STC for F3 R_F3,w ASTC change by Lining ΔR_F3,w Junction 3 (Rigid-T/Soft Cross junction, 190 mm block separat Junction 3 (Rigid-T/Soft Cross junction, 190 mm block separat Flanking Element F3: Laboratory STC for F3 R_F3,w ΔSTC change by Lining ΔR_F3,w ΔSTC change by Lining ΔR_F3,w ΔSTC change by Lining ΔR_f3,w | ISO 15712-1, Eq. 28a and 31 Subset of Eq. 1.1 ing wall / 190 mm block flankir RR-334, Base BLK140(LW) | ıg wall) | Negligible tra - 10*LOG10(10^- | ansmission via fire stop 9 + 100-6.1 + 100-9.1 - 100-9.1 | 00 | (limi+) |
| Junction 1: Flanking STC for all paths Junction 2 (Rigid T-Junction, 190 mm block separat Flanking Element F2: Laboratory STC for F2 R_F2,w ASTC change by Lining $\Delta R_F2,w$ Flanking Element f2: Laboratory STC for f2 Laboratory STC for f2 R_f2,w Flanking STC for path Ff R_Ff,w Flanking STC for path Ff R_Fd,w Flanking STC for path Fd R_Df,w Junction 2: Flanking STC for all paths Junction 3 (Rigid-T/Soft Cross junction, 190 mm block Flanking Element F3: Laboratory STC for F3 R_F3,w ASTC change by Lining $\Delta R_F3,w$ ΔSTC change by Lining $\Delta R_F3,w$ ASTC change by Lining $\Delta R_F3,w$ ΔSTC change by Lining $\Delta R_f3,w$ | Subset of Eq. 1.1 ing wall / 190 mm block flankir RR-334, Base BLK140(LW) | ıg wall) | - 10*LOG10(10^- | $9 + 10^{-} 6 1 + 10^{-} 9 = -$ | 90 | (innit) |
| Junction 2 (Rigid T-Junction, 190 mm block separat Elanking Element F2: Laboratory STC for F2 R_F2,w ASTC change by Lining $\Delta R_F2,w$ Elanking Element f2: Laboratory STC for f2 Laboratory STC for f2 R_f2,w ASTC change by Lining $\Delta R_f2,w$ ASTC change by Lining $\Delta R_f2,w$ Flanking STC for path Ff R_fd,w Flanking STC for path Df R_c Df,w Junction 2: Flanking STC for all paths Junction 3 (Rigid-T/Soft Cross junction, 190 mm block Flanking Element F3: Laboratory STC for F3 R_cF3,w ASTC change by Lining $\Delta R_cF3,w$ | ing wall / 190 mm block flankir RR-334, Base BLK140(LW) | <u>ıg wall)</u> | | 5.10 0.1 10 - 57- | | 61 |
| Flanking Element F2: Laboratory STC for F2 R_F2,w ASTC change by Lining Δ R_F2,w Flanking Element f2: Laboratory STC for f2 Laboratory STC for f2 R_f2,w ASTC change by Lining Δ R_f2,w Flanking STC for path Ff R_Ff,w Flanking STC for path Fd R_Df,w Junction 2: Flanking STC for all paths Junction 3 (Rigid-T/Soft Cross junction, 190 mm ble Flanking Element F3: Laboratory STC for F3 Laboratory STC for F3 R_F3,w ASTC change by Lining Δ R_F3,w ASTC change by Lining Δ R_F3,w | RR-334, Base BLK140(LW) | | | | | |
| Laboratory STC for F2 R_F2,w Δ STC change by Lining Δ R_F2,w Flanking Element f2: Laboratory STC for f2 Laboratory STC for f2 R_f2,w Δ STC change by Lining Δ R_f2,w Flanking STC for path Ff R_Ff,w Flanking STC for path Fd R_Cd,w Flanking STC for path Df R_Df,w Junction 2: Flanking STC for all paths Junction 3 (Rigid-T/Soft Cross junction, 190 mm blue) Flanking Element F3: Laboratory STC for F3 Laboratory STC for f3 R_F3,w ASTC change by Lining Δ R_F3,w ASTC change by Lining Δ R_F3,w ASTC change by Lining Δ R_f3,w | RR-334, Base BLK140(LW) | | | | | |
| $\begin{array}{llllllllllllllllllllllllllllllllllll$ | Nolining | | | 38 | | |
| Flanking Element f2: Laboratory STC for f2 R_f2,w ΔSTC change by Lining ΔR_f2,w Flanking STC for path Ff R_Ff,w Flanking STC for path Fd R_Df,w Junction 2: Flanking STC for all paths Image for the state of the | NO LINING , | | | 0 | | |
| Laboratory STC for f2 R_f2,w ΔSTC change by Lining ΔR_f2,w Flanking STC for path Ff R_F4,w Flanking STC for path Fd R_Df,w Junction 2: Flanking STC for all paths Junction 3 (Rigid-T/Soft Cross junction, 190 mm ble Flanking Element F3: Laboratory STC for F3 R_F3,w Laboratory STC for f3 R_F3,w Laboratory STC for f3 R_f3,w ΔSTC change by Lining ΔR_f3,w ΔSTC change by Lining ΔR_f3,w | | | | | | |
| $\label{eq:result} \begin{split} \Delta STC change by Lining & \Delta A_f2, w \\ \hline Flanking STC for path Ff & R_Ff, w \\ \hline Flanking STC for path Fd & R_Df, w \\ \hline Flanking STC for path Df & R_Df, w \\ \hline Junction 2: Flanking STC for all paths \\ \hline Junction 3 (Rigid-T/Soft Cross junction, 190 mm ble Flanking Element F3: Laboratory STC for F3 & R_F3, w \\ \hline SSTC change by Lining & \Delta R_F3, w \\ \hline \Delta STC change by Lining & \Delta R_f3, w \\ \hline \Delta STC change by Lining & \Delta R_f3, w \\ \hline \Delta STC change by Lining & \Delta R_f3, w \\ \hline STC cha$ | RR-334, Base BLK140(LW) | | | 38 | | |
| Flanking STC for path Ff R_Ff,w Flanking STC for path Fd R_Fd,w Flanking STC for path Df R_Df,w Junction 2: Flanking STC for all paths Junction 3 (Rigid-T/Soft Cross junction, 190 mm bleflanking Element F3: Laboratory STC for F3 R_F3,w ASTC change by Lining ΔR_F3,w Laboratory STC for f3 R_f3,w ΔSTC change by Lining ΔR_f3,w | No Lining , | | | 0 | | |
| Flanking STC for path Fd R_Fd,w Flanking STC for path Df R_Df,w Junction 2: Flanking STC for all paths Junction 3 (Rigid-T/Soft Cross junction, 190 mm bleflanking Element F3: Laboratory STC for F3 R_F3,w ΔSTC change by Lining ΔR_F3,w Laboratory STC for f3 R_f3,w ΔSTC change by Lining ΔR_f3,w | ISO 15712-1, Eq. 28a and 31 | | Negligible tr | ansmission via fire stop | 90 | (limit) |
| Flanking STC for path Df R_Df,w Junction 2: Flanking STC for all paths Junction 3 (Rigid-T/Soft Cross junction, 190 mm ble Flanking Element F3: Laboratory STC for F3 R_F3,w ΔSTC change by Lining ΔR_F3,w Laboratory STC for F3 R_f3,w ΔSTC change by Lining ΔR_f3,w | ISO 15712-1, Eq. 28a and 31 | 38/2 | 2 + 58/2 + MAX(0,0 |) + MIN(0,0)/2 + 5 + 7 = | 60 | |
| Junction 2: Flanking STC for all paths Junction 3 (Rigid-T/Soft Cross junction, 190 mm ble Flanking Element F3: Laboratory STC for F3 R_F3,w ASTC change by Lining AR_F3,w Elaboratory STC for F3 R_f3,w ASTC change by Lining AR_f3,w | ISO 15712-1, Eq. 28a and 31 | | Negligible tr | ansmission via fire stop | 90 | (limit) |
| Junction 3 (Rigid-T/Soft Cross junction, 190 mm ble Flanking Element F3: Laboratory STC for F3 R_F3,w ΔSTC change by Lining ΔR_F3,w Flanking Element f3: Laboratory STC for f3 Laboratory STC for f3 R_f3,w ΔSTC change by Lining ΔR_f3,w | Subset of Eq. 1.1 | | - 10*LOG10(10 | ^-9 + 10^- 6 + 10^- 9) = | | 60 |
| Junction 3 (Rigid-T/Soft Cross junction, 190 mm ble Flanking Element F3: Laboratory STC for F3 R_F3,w ΔSTC change by Lining ΔR_F3,w Laboratory STC for f3 R_f3,w ΔSTC change by Lining ΔR_f3,w | | | | | | |
| Flanking Element F3: Laboratory STC for F3 R_F3,w ΔSTC change by Lining ΔR_F3,w Flanking Element f3: Laboratory STC for f3 Laboratory STC for f3 R_f3,w ΔSTC change by Lining ΔR_f3,w | ock separating wall / 150 mm c | oncrete ceiling slat | <u>o)</u> | | | |
| Laboratory STC for F3 R_F3,w ΔSTC change by Lining ΔR_F3,w Flanking Element f3: Laboratory STC for f3 Laboratory STC for f3 R_f3,w ΔSTC change by Lining ΔR_f3,w | | | | | | |
| ΔSTC change by Lining ΔR_F3,w Flanking Element f3: | RR-334, Base BLK140(LW) | | | 38 | | |
| Flanking Element f3: | No Lining , | | | 0 | | |
| Laboratory STC for f3 R_f3,w ΔSTC change by Lining ΔR_f3,w | | | | | | |
| $\Delta STC change by Lining \qquad \Delta R_f3, w$ | RR-334, Base BLK140(LW) | | | 38 | | |
| | No Lining , | | | 0 | | |
| Flanking STC for path Ff R_Ff,w | ISO 15712-1, Eq. 28a and 31 | | Negligible tr | ansmission via fire stop | 90 | (limit) |
| Flanking STC for path Fd R_Fd,w | | 38/2 + | - 58/2 + MAX(0,0) + | + MIN(0,0)/2 + 7.3 + 6 = | 61 | |
| Flanking STC for path Df R_Df,w | | | Negligible tr | ansmission via fire stop | 90 | (limit) |
| Junction 3: Flanking STC for all paths | Subset of Eq. 1.1 | | - 10*LOG10(10^- | 9 + 10^- 6.1 + 10^- 9) = | | 61 |
| Junction 4 (Rigid T-junction, 190 mm block separat | ing wall / 190 mm block flankir | ıg wall) | | | | |
| Flanking Element F4: | · · · · · · · · · · · · · · · · · · · | | | | | |
| Laboratory STC for F4 R F4.w | RR-334, Base BLK140(LW) | | | 38 | | |
| Δ STC change by Lining Δ R F4 w | No Lining , | | | 0 | | |
| Flanking Element f4: | | | | | | |
| Laboratory STC for f4 R f4.w | RR-334, Base BLK140(LW) | | | 38 | | |
| Δ STC change by Lining Δ R f4 w | No Lining . | | | 0 | | |
| Flanking STC for path Ff R Ff.w | ISO 15712-1, Eq. 28a and 31 | | Negligible tr | ansmission via fire stop | 90 | (limit) |
| Flanking STC for path Fd R Fd w | ISO 15712-1, Eq. 28a and 31 | 38/2 + | - 58/2 + MAX(0.0) + | + MIN(0.0)/2 + 7.3 + 7 = | 62 | (|
| Flanking STC for path Df R Df w | ISO 15712-1. Eq. 28a and 31 | 50,2 | Negligible tr | ansmission via fire stop | 90 | (limit) |
| Junction 4: Flanking STC for all paths | Subset of Eq. 1.1 | | - 10*LOG10(10^- | $9 + 10^{-} 6.2 + 10^{-} 9) =$ | 50 | 62 |
| Total Flanking STC (4 Junctions) | Subset of Eq. 1.1 | | Combining | 12 Flanking STC values | | 55 |
| | | | | | | |
| ASTC due to Direct plus All Flanking Paths | | Combir | ning Direct STC with | 12 Flanking STC values | 53 | |



| | ISO Symbol | Reference | | | stc, ∆_stc | AS | тс |
|---------------------------------|--|-----------------------------------|----------------------|---------------------|--|----|-----------------|
| Separating Partition (190 mm | concrete block) | | | | | | |
| Laboratory STC for Dd | R_s,w | RR-333, TLF-12-013 | | | 58 | | |
| ΔSTC change by Lining on D | ∆R_D,w | No Lining , | | | 0 | | |
| ΔSTC change by Lining on d | ∆R_d,w | No Lining , | | | 0 | | |
| Direct STC in situ | R_Dd,w | ISO 15712-1, Eq. 24 and 30 | | 58 + M | AX(0,0) + MIN(0,0)/2 = | 58 | |
| Junction 1 (Rigid-T/Soft Cross | junction, 190 mm l | olock separating wall / 150 mm c | oncrete floor) | | | | |
| Flanking Element F1: | | | | | | | |
| Laboratory STC for F1 | R_F1,w | RR-334, Base BLK140(LW) | | | 38 | | |
| ΔSTC change by Lining | ΔR_F1,w | RR-334, ΔTL-BLK(LW)-33, WF | UR38_GFB38_G13 | | 7 | | |
| Flanking Element f1: | | | | | | | |
| Laboratory STC for f1 | R_f1,w | RR-334, Base BLK140(LW) | | | 38 | | |
| ΔSTC change by Lining | ΔR_f1,w | RR-334, ΔTL-BLK(LW)-33, WF | UR38_GFB38_G13 | | 7 | | |
| Flanking STC for path Ff | R_ Ff,w | ISO 15712-1, Eq. 28a and 31 | | Negligible tr | ansmission via fire stop | 90 | (limit) |
| Flanking STC for path Fd | R_ Fd,w | ISO 15712-1, Eq. 28a and 31 | 38/2 + | - 58/2 + MAX(7,0) - | + MIN(7,0)/2 + 7.3 + 6 = | 68 | |
| Flanking STC for path Df | R_Df,w | ISO 15712-1, Eq. 28a and 31 | | Negligible tr | ansmission via fire stop | 90 | (limit) |
| Junction 1: Flanking STC for al | paths | Subset of Eq. 1.1 | | - 10*LOG10(10^- | 9 + 10^- 6.8 + 10^- 9) = | | 68 |
| Junction 2 (Rigid T-Junction, 1 | 90 mm block separ | ating wall / 190 mm block flanki | ng wall) | | | | |
| Flanking Element F2: | | | | | | | |
| Laboratory STC for F2 | R_F2,w | RR-334, Base BLK140(LW) | | | 38 | | |
| ΔSTC change by Lining | ΔR F2,w | RR-334, ΔTL-BLK(LW)-33, WF | UR38 GFB38 G13 | | 7 | | |
| Flanking Element f2: | | | | | | | |
| Laboratory STC for f2 | R f2,w | RR-334, Base BLK140(LW) | | | 38 | | |
| ΔSTC change by Lining | ΔR_f2,w | RR-334, ΔTL-BLK(LW)-33, WF | UR38_GFB38_G13 | | 7 | | |
| Flanking STC for path Ff | R_Ff,w | ISO 15712-1, Eq. 28a and 31 | | Negligible tr | ansmission via fire stop | 90 | (limit) |
| Flanking STC for path Fd | R_ Fd,w | ISO 15712-1, Eq. 28a and 31 | 38/2 | 2 + 58/2 + MAX(7,0 |) + MIN(7,0)/2 + 5 + 7 = | 67 | |
| Flanking STC for path Df | R_Df,w | ISO 15712-1, Eq. 28a and 31 | | Negligible tr | ansmission via fire stop | 90 | (limit) |
| Junction 2: Flanking STC for al | l paths | Subset of Eq. 1.1 | | - 10*LOG10(10^- | 9 + 10^- 6.7 + 10^- 9) = | | 67 |
| Junction 3 (Rigid-T/Soft Cross | junction 190 mm l | lock senarating wall / 150 mm c | oncrete ceiling slat | 2) | | | |
| Elanking Element F3: | junction, 190 mm | | | <u> </u> | | | |
| Laboratory STC for F3 | R F3 w | RR-334 Base BLK140(LW) | | | 38 | | |
| ASTC change by Lining | AR E3 w | RR-334 ATI-BLK(1W)-33 WE | LIR38 GER38 G13 | | 7 | | |
| Flanking Element f3: | <u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u></u> | 111 354, ATE BER (EW) 35, WI | 01130_01230_013 | | | | |
| Laboratory STC for f3 | R f3 w | RR-334 Base BLK140(LW) | | | 38 | | |
| ASTC change by Lining | ΔR f3 w | RR-334 ATI-BLK(1W)-33 WF | UR38 GEB38 G13 | | 7 | | |
| Flanking STC for path Ff | B Ffw | ISO 15712-1 Eq. 28a and 31 | 01100_01000_010 | Negligible tr | ansmission via fire stop | 90 | (limit) |
| Flanking STC for path Fd | R Fd.w | 100 107 12 1, 24, 200 010 01 | 38/2 + | 58/2 + MAX(7.0) - | MIN(7.0)/2 + 7.3 + 6 = | 68 | (|
| Flanking STC for path Df | R Df.w | | | Negligible tr | ansmission via fire stop | 90 | (limit) |
| Junction 3: Flanking STC for al | paths | Subset of Eq. 1.1 | | - 10*LOG10(10^- | 9 + 10^- 6.8 + 10^- 9) = | | <mark>68</mark> |
| Innation 4 (Digid Timpation 1 | 0 mm black some | ting well / 100 mm block flenkin | aall) | | | | |
| Flanking Flamont 54: | to min block separa | ating wall / 190 mm block flankli | <u>ig wall)</u> | | | | |
| Laboratory STC for 54 | D E4 | PP.224 Paco PL/140/14/ | | | 29 | | |
| ASTC change by Lining | N_F4,W | PD 224 ATL DLV (1M) 22 M/ | UD29 CEP29 C12 | | 7 | | |
| Flanking Flement fA | ∆N_F4,W | 11-334, ATE-BEN LWJ-33, WF | 0130_01 030_013 | | | | |
| Laboratory STC for f4 | R f4 w | RR-33/ Bace PLK1/0/1/M/ | | | 38 | | |
| ASTC change by Lining | ΛR f4 w | RR-334 ATI_PIK/114/22 W/F | UR38 GEP29 C12 | | 7 | | |
| Elanking STC for noth Ef | D Ef w | ISO 15712-1 Eq. 282 and 21 | 0130_01 030_013 | Nogligible tr | ansmission via fire stop | 00 | (limit) |
| Flanking STC for path Ed | | ISO 15712-1, Eq. 28d dild 31 | 20/2 - | | MIN(7 ∩)/2 ± 7 2 ± 7 = | 50 | (IIIIIt) |
| Flanking STC for path Df | P Dfw | ISO 15712-1, Eq. 200 and 31 | 50/2 1 | Nogligible tr | $\frac{1}{1000} = \frac{1}{1000} = 1$ | 09 | (limit) |
| Junction 4: Flanking STC for al | n_DI,W | Subset of Eq. 1.1 | | | $a_1 = 100$, $60 + 100$, $a_1 = 100$ | 90 | |
| Total Flanking STC // Junction | | Subset of Eq. 1.1 | | Combining | 12 Flanking STC values | | 62 |
| |) | Subset of Eq. 1.1 | | Combining | 12 Haliking STC values | | 02 |
| | | | | | | | |

| EXAMPLE 4.1.3-V3: | | (SIMPLIFIED METHOD) | Illustratio | on for this ca | se |
|---|--|---|---|----------------------------|---------------------------|
| Rooms one-above-th Concrete floors and rigid junctions ex (Same structure as 4) | ne-other d lightweight cept at top I.1.3-V1, plus ei | concrete block walls with of non-loadbearing walls nhanced lining of walls) | 5 | 22222 | |
| <u>Separating floor/ceiling asset</u> concrete floor with mas thickness of 200 mm) lining below. <u>Junction 1, 3, 4: Cross Junc</u> rigid mortared T junctio soft joint with walls below bearing concrete block blocks with lightweight a flanking walls lined wi loadbearing steel stu material² filling inter-stu- <u>Junction 2: T-Junction of set</u> | embly with: s 460 kg/m ² (e.g with no topping tion of separatin n with concrete w floor of one w s with mass 13 aggregate ⁴) ith 13 mm gyps ds spaced 61 d cavities parating floor / fl | I. normal weight concrete with / flooring on top, or ceiling g floor / flanking wall with: block wall assemblies above wythe of unsealed non-load 4 kg/m ² (e.g. 140 mm hollow sum board ³ on 65 mm non 0 mm o.c. with absorptive anking wall with: | F D d d Cross jun mm thick | f1, f3 | Non-rigid fire stop |
| rigid mortared junction and soft joint (negligible wall above and below bearing concrete block blocks with lightweight a flanking walls lined w loadbearing steel stu material² filling inter-stur <u>Acoustical Parameters:</u> | s with concrete transmission) to floor of one v s with mass 13 aggregate ⁴) vith 13 mm gyp ds spaced 61 d cavities | o wall assembly above o wall assembly below vythe of unsealed non-load 4 kg/m ² (e.g. 140 mm hollow osum board ³ on 65 mm non 0 mm o.c. with absorptive | , block wal | II. (Side view o D ↓ | f Junctions 1 or 3) F2 |
| For 140 mm lightweight conc | rete block walls: | | 3.3 | S. Ash S. | |
| Mass/unit area (kg/m ²) = | 134 134 | (Wall at junctions 1&3) (Wall at junctions 2&4) | | | |
| For 200 mm concrete floor: | | | | d / | |
| Mass/uni | it area (kg/m²) = | 460 | | Non-rigid | |
| Separating parti | tion area $(m^2) =$ | 20 | | fire stop | |
| | 13 longth (m) = | 5.0 | | | t2 |
| | $\int \operatorname{length}(\operatorname{III}) =$ | 1.0 | | | |
| | (14) $(11) =$ | 4.0 | T-Junctio | n of separatir | ng floor of 200 mm |
| | Junction 1&3) = | 6.0 | thick con | crete with 140 | mm concrete block |
| | Junction2 &4) = | 7.0 | wall. (Sid | le view of Jun | ction 2. Junction 4 |
| | | | | | |
| | | Path Ff | Path Fd | Path Df | Deference |
| 1 Digid T/coff | iviass ratio for Ff | | 73 | SOET | |
| Rigid-Corner/soft | 3.43 | SOFT | 7.5 5.0 | SOFT | ISO 15712-1, Eq. E.4 |
| 3 Rigid-T/soft | 3.43 | SOFT | 7.3 | SOFT | ISO 15712-1, Eq. E.4 |
| 4 Rigid-T/soft | 3.43 | SOFT | 7.3 | SOFT | ISO 15712-1, Eq. E.4 |
| | | | | | |

| | ISO Symbol | Reference | | | stc, ∆_stc | AS | тс |
|----------------------------------|--------------------|-----------------------------------|---------------------|----------------------|-----------------------------|----|----------|
| Separating Partition (190 mm | concrete block) | | | | | | |
| Laboratory STC for Dd | R_s,w | RR-333, TLF-12-013 | | | 58 | | |
| ΔSTC change by Lining on D | ΔR_D,w | No Lining , | | | 0 | | |
| ΔSTC change by Lining on d | ∆R_d,w | No Lining , | | | 0 | | |
| Direct STC in situ | R_Dd,w | ISO 15712-1, Eq. 24 and 30 | | 58 + M | AX(0,0) + MIN(0,0)/2 = | 58 | |
| Junction 1 (Rigid-T/Soft Cross | junction, 190 mm l | block separating wall / 150 mm co | oncrete floor) | | | | |
| Flanking Element F1: | | | | | | | |
| Laboratory STC for F1 | R_F1,w | RR-334, Base BLK140(LW) | | | 38 | | |
| ΔSTC change by Lining | ΔR_F1,w | RR-334, ΔTL-BLK(LW)-62, SS6 | 5_GFB65_G13 | | 15 | | |
| Flanking Element f1: | | | | | | | |
| Laboratory STC for f1 | R_f1,w | RR-334, Base BLK140(LW) | | | 38 | | |
| ∆STC change by Lining | ΔR_f1,w | RR-334, ΔTL-BLK(LW)-62, SS6 | 5_GFB65_G13 | | 15 | | |
| Flanking STC for path Ff | R_ Ff,w | ISO 15712-1, Eq. 28a and 31 | | Negligible tra | ansmission via fire stop | 90 | (limit) |
| Flanking STC for path Fd | R_ Fd,w | ISO 15712-1, Eq. 28a and 31 | 38/2 + 5 | 8/2 + MAX(15,0) + I | MIN(15,0)/2 + 7.3 + 6 = | 76 | |
| Flanking STC for path Df | R_ Df,w | ISO 15712-1, Eq. 28a and 31 | | Negligible tra | ansmission via fire stop | 90 | (limit) |
| Junction 1: Flanking STC for all | paths | Subset of Eq. 1.1 | | - 10*LOG10(10^-9 | 9 + 10^- 7.6 + 10^- 9) = | | 76 |
| Junction 2 (Rigid T-Junction, 19 | 90 mm block separ | ating wall / 190 mm block flankin | g wall) | | | | |
| Flanking Element F2: | | | | | | | |
| Laboratory STC for F2 | R F2.w | RR-334, Base BLK140(LW) | | | 38 | | |
| ΔSTC change by Lining | ΔR F2.w | RR-334, ΔTL-BLK(LW)-62, SS6 | 5 GFB65 G13 | | 15 | | |
| Flanking Element f2: | _ / | | | | | | |
| Laboratory STC for f2 | R f2.w | RR-334, Base BLK140(LW) | | | 38 | | |
| ΔSTC change by Lining | ΔR f2.w | RR-334, ΔTL-BLK(LW)-62, SS6 | 5 GFB65 G13 | | 15 | | |
| Flanking STC for path Ff | R Ff.w | ISO 15712-1. Eq. 28a and 31 | | Negligible tra | ansmission via fire stop | 90 | (limit) |
| Flanking STC for path Fd | R Fd.w | ISO 15712-1. Eq. 28a and 31 | 38/2 + | 58/2 + MAX(15.0) | + MIN(15.0)/2 + 5 + 7 = | 75 | (|
| Flanking STC for path Df | R Df.w | ISO 15712-1. Eq. 28a and 31 | ,- | Negligible tra | ansmission via fire stop | 90 | (limit) |
| Junction 2: Flanking STC for all | paths | Subset of Eq. 1.1 | | - 10*LOG10(10^-9 | 9 + 10^- 7.5 + 10^- 9) = | | 75 |
| | | | | | | | |
| Junction 3 (Rigid-T/Soft Cross | junction, 190 mm l | block separating wall / 150 mm co | oncrete ceiling sla | <u>b)</u> | | | |
| Flanking Element F3: | | | | | | | |
| Laboratory STC for F3 | R_F3,w | RR-334, Base BLK140(LW) | | | 38 | | |
| ΔSTC change by Lining | ΔR_F3,w | RR-334, ΔTL-BLK(LW)-62, SS6 | 5_GFB65_G13 | | 15 | | |
| Flanking Element f3: | _ | | | | | | |
| Laboratory STC for f3 | R f3,w | RR-334, Base BLK140(LW) | | | 38 | | |
| ΔSTC change by Lining | ΔR_f3,w | RR-334, ΔTL-BLK(LW)-62, SS6 | 5_GFB65_G13 | | 15 | | |
| Flanking STC for path Ff | R Ff,w | ISO 15712-1, Eq. 28a and 31 | | Negligible tra | ansmission via fire stop | 90 | (limit) |
| Flanking STC for path Fd | R_Fd,w | | 38/2 + 5 | 8/2 + MAX(15,0) + I | MIN(15,0)/2 + 7.3 + 6 = | 76 | |
| Flanking STC for path Df | R Df,w | | | Negligible tra | ansmission via fire stop | 90 | (limit) |
| Junction 3: Flanking STC for all | paths | Subset of Eq. 1.1 | | - 10*LOG10(10^-9 | 9 + 10^- 7.6 + 10^- 9) = | | 76 |
| Junction 4 (Rigid T-junction, 19 | 0 mm block separ | ating wall / 190 mm block flankin | g wall) | | | | |
| Flanking Element F4: | | | | | | | |
| Laboratory STC for F4 | R F4.w | RR-334, Base BLK140(LW) | | | 38 | | |
| ASTC change by Lining | ΔR F4 w | RB-334 ATL-BLK(1W)-62 SS6 | 5 GEB65 G13 | | 15 | | |
| Flanking Element f4: | 2, | | | | 10 | | |
| Laboratory STC for f4 | R f4 w | RR-334, Base BLK140(LW) | | | 38 | | |
| ASTC change by Lining | ΔR f4 w | RB-334 ATL-BLK(1W)-62 SS6 | 5 GEB65 G13 | | 15 | | |
| Flanking STC for nath Ff | R Ffw | ISO 15712-1. Fg. 28a and 31 | | Negligible tra | ansmission via fire stop | 90 | (limit) |
| Flanking STC for path Fd | R_Fdw | ISO 15712-1, Eq. 28a and 31 | 38/2 + 5 | 8/2 + MAX(15.0) + 1 | MIN(15.0)/2 + 7.3 + 7 = | 77 | (initic) |
| Flanking STC for path Df | R_Dfw | ISO 15712-1, Eq. 28a and 31 | 50/2 1 5 | Negligible tr | ansmission via fire ston | 90 | (limit) |
| Junction 4: Flanking STC for all | naths | Subset of Eq. 1.1 | | - 10*10610/10^-0 | $+ 10^{-} 77 + 10^{-} 9) =$ | 50 | 77 |
| Total Flanking STC (4 Junctions | ;) | Subset of Eq. 1.1 | | Combining | 12 Flanking STC values | | 70 |
| | | | | | | | |
| ASTC due to Direct plus All Fla | nking Paths | Equation 1.1 of this Report | Combi | ning Direct STC with | 12 Flanking STC values | 58 | |



SOFT

7.3

SOFT

(See the footnotes located at the end of the document)

Rigid-T/soft

4

3.43

ISO 15712-1, Eq. E.4

| | ISO Symbol | Reference | | | STC, ∆_STC | AS | тс |
|---------------------------------|--------------------|-----------------------------------|---------------------|--------------------|---------------------------|----|---------|
| Separating Partition (190 mm | concrete block) | | | | - | | |
| Laboratory STC for Dd | R_s,w | RR-333, TLF-12-013 | | | 58 | | |
| ΔSTC change by Lining on D | ΔR_D,w | No Lining , | | | 0 | | |
| ΔSTC change by Lining on d | ΔR_d,w | RR-333, ΔTLF-CON150-01, SUS | 6150_GFB150_G16 | | 19 | | |
| Direct STC in situ | R_Dd,w | ISO 15712-1, Eq. 24 and 30 | | 58 + MAX | (0,19) + MIN(0,19)/2 = | 77 | |
| Junction 1 (Rigid-T/Soft Cross | junction, 190 mm l | block separating wall / 150 mm c | oncrete floor) | | | | |
| Flanking Element F1: | | | | | | | |
| Laboratory STC for F1 | R_F1,w | RR-334, Base BLK140(LW) | | | 38 | | |
| ΔSTC change by Lining | ΔR_F1,w | RR-334, ΔTL-BLK(LW)-62, SS6 | 5_GFB65_G13 | | 15 | | |
| Flanking Element f1: | | | | | | | |
| Laboratory STC for f1 | R_f1,w | RR-334, Base BLK140(LW) | | | 38 | | |
| ΔSTC change by Lining | ΔR_f1,w | RR-334, ΔTL-BLK(LW)-62, SS6 | 5_GFB65_G13 | | 15 | | |
| Flanking STC for path Ff | R_ Ff,w | ISO 15712-1, Eq. 28a and 31 | | Negligible tra | ansmission via fire stop | 90 | (limit) |
| Flanking STC for path Fd | R_ Fd,w | ISO 15712-1, Eq. 28a and 31 | 38/2 + 58/2 | 2 + MAX(15,19) + M | IIN(15,19)/2 + 7.3 + 6 = | 88 | |
| Flanking STC for path Df | R_ Df,w | ISO 15712-1, Eq. 28a and 31 | | Negligible tra | ansmission via fire stop | 90 | (limit) |
| Junction 1: Flanking STC for a | l paths | Subset of Eq. 1.1 | | - 10*LOG10(10^-9 | 9 + 10^- 8.8 + 10^- 9) = | | 84 |
| Junction 2 (Rigid T-Junction, 1 | 90 mm block separ | ating wall / 190 mm block flankir | g wall) | | | | |
| Flanking Element F2: | | | | | | | |
| Laboratory STC for F2 | R F2.w | RR-334, Base BLK140(LW) | | | 38 | | |
| ASTC change by Lining | ΔR F2.w | RR-334, ATL-BLK(LW)-62, SS6 | 5 GFB65 G13 | | 15 | | |
| Flanking Element f2: | 2.(2,1) | | 5_0.005_010 | | 10 | | |
| Laboratory STC for f2 | R f2 w | RB-334 Base BLK140(LW) | | | 38 | | |
| ASTC change by Lining | ΔR f2.w | RR-334, ATL-BLK(LW)-62, SS6 | 5 GFB65 G13 | | 15 | | |
| Flanking STC for path Ff | R Ffw | ISO 15712-1 Eq. 28a and 31 | | Negligible tra | ansmission via fire stop | 90 | (limit) |
| Flanking STC for path Fd | R Fd.w | ISO 15712-1, Eq. 28a and 31 | 38/2 + 58 | 3/2 + MAX(15.19) + | MIN(15.19)/2 + 5 + 7 = | 87 | (|
| Flanking STC for path Df | R Dfw | ISO 15712-1 Eq. 28a and 31 | | Negligible tra | ansmission via fire stop | 90 | (limit) |
| Junction 2: Flanking STC for a | I paths | Subset of Eq. 1.1 | | - 10*I 0G10(10^-9 | $(+10^{-}87+10^{-}9) =$ | | 84 |
| | | | | | | | |
| Junction 3 (Rigid-T/Soft Cross | junction, 190 mm | block separating wall / 150 mm c | oncrete ceiling sla | <u>b)</u> | | | |
| Flanking Element F3: | | | | | | | |
| Laboratory STC for F3 | R_F3,w | RR-334, Base BLK140(LW) | | | 38 | | |
| ∆STC change by Lining | ΔR_F3,w | RR-334, ΔTL-BLK(LW)-62, SS6 | 5_GFB65_G13 | | 15 | | |
| Flanking Element f3: | | | | | | | |
| Laboratory STC for f3 | R_f3,w | RR-334, Base BLK140(LW) | | | 38 | | |
| ΔSTC change by Lining | ΔR_f3,w | RR-334, ΔTL-BLK(LW)-62, SS6 | 5_GFB65_G13 | | 15 | | |
| Flanking STC for path Ff | R_ Ff,w | ISO 15712-1, Eq. 28a and 31 | | Negligible tra | ansmission via fire stop | 90 | (limit) |
| Flanking STC for path Fd | R_ Fd,w | | 38/2 + 58/2 | 2 + MAX(15,19) + M | IN(15,19)/2 + 7.3 + 6 = | 88 | |
| Flanking STC for path Df | R_ Df,w | | | Negligible tra | ansmission via fire stop | 90 | (limit) |
| Junction 3: Flanking STC for a | I paths | Subset of Eq. 1.1 | | - 10*LOG10(10^-9 | 9 + 10^- 8.8 + 10^- 9) = | | 84 |
| Junction 4 (Rigid T-junction 1 | 90 mm block separ | ating wall / 190 mm block flankin | g wall) | | | | |
| Flanking Element F4 | | | | | | | |
| Laboratory STC for F4 | R F4 w | RR-334, Base BLK140(LW) | | | 38 | | |
| ASTC change by Lining | AR F4 w | BB-334 ATL-BLK(1W)-62 SS6 | 5 GEB65 G13 | | 15 | | |
| Flanking Element f4 | <u> </u> | | | | | | |
| Laboratory STC for f4 | R f4 w | RB-334 Base BLK140(LW) | | | 38 | | |
| ASTC change by Lining | ΔR f4 w | BR-334, ATL-BLK(1W)-62 SS6 | 5 GFB65 G13 | | 15 | | |
| Elanking STC for nath Ef | B Ef w | ISO 15712-1 Eq. 282 and 31 | 5_01005_015 | Negligible tra | ansmission via fire stop | 90 | (limit) |
| Flanking STC for nath Fd | R Fd w | ISO 15712-1, Eq. 260 and 31 | 38/2 + 58/2 | 2 + MAX(15 19) + M | N(15.19)/2 + 73 + 7 = | 89 | (11111) |
| Elanking STC for path Df | B Dfw | ISO 15712-1, Eq. 28a and 31 | 30/2 : 30/2 | Negligible tr | ansmission via fire ston | 90 | (limit) |
| Junction 4: Flanking STC for a | I paths | Subset of Eq. 1.1 | | - 10*10610/10^-0 | $+10^{-89+10^{-9}}$ | 50 | 85 |
| Total Flanking STC (4 Junction | s) | Subset of Eq. 1.1 | | Combining | 12 Flanking STC values | | 78 |
| | • | | | | | | |
| | | | | | | | |

Summary for Section 4.1.3: Non-loadbearing Lightweight Concrete Block Walls with Concrete Floors

The worked examples 4.1.3-H1 and 4.1.3-V1 illustrate the basic process for calculating the sound transmission between rooms in a building with bare non-loadbearing lightweight concrete masonry walls and concrete floors (i.e. without added gypsum board finish on the walls or ceiling, or flooring over the concrete slab). These examples differ from those of the preceding section mainly in the weight of the structural surfaces – the floors are heavier and the concrete block masonry walls are much lighter.

The Apparent Sound Transmission Class (ASTC) rating is lower than the STC rating of the separating assembly but the relative contributions of the direct transmission and the flanking transmission are quite different from those for normal weight concrete blocks in the preceding Section 4.1.2. For the side-by-side rooms, the direct transmission through the unsealed lightweight concrete block wall (STC 35) is clearly dominant in example 4.1.3-H1. For vertical transmission, the flanking paths involving the lightweight block walls are marginally dominant in 4.1.3-V1, giving an ASTC rating of 53.

For the side-by-side pair of rooms

The effect of added linings is shown in Examples 4.1.3-H2 to H4. It is clear that although the unsealed lightweight block starts from a low rating, good system performance can be achieved with the use of suitable linings. In specific examples:

- Adding a minimal lining (with Δ STC=7) to all the wall surfaces raises the ASTC rating from 38 to 49.
- In example 4.1.3-H3, adding a better wall lining with Δ STC=15 raises the ASTC rating to 61. Further improvement is limited by the transmission via the bare concrete surfaces of the floor and ceiling.

Significant further improvement in the ASTC rating requires the treatment of <u>both</u> the floor and ceiling surfaces – treating just the ceiling in example 4.1.3-H4 increases the ASTC rating by only 1 to 57, as the floor-floor and ceiling-ceiling paths have a Flanking STC in the low 60s. Hence, with the non-loadbearing junctions at the top of the concrete block walls, the addition of an effective floor treatment is essential for achieving a very high ASTC rating between side-by-side rooms. [More examples will be added when data from report RR-333 become available.]

For one room above the other

The effect of adding linings is shown in Examples 4.1.3-V2 to V4. The use of linings ranging from minimally performing to good changes the dominant transmission path such that:

- The effect of a minimal lining on the flanking walls with ΔSTC=7 raises the ASTC rating from 53 to 57 as shown in Example 4.1.3-V2.
- With a better lining in Example 4.1.3-V3, the direct transmission through the separating floor/ceiling becomes the dominant path, and the ASTC rating reaches its limit of 58 due to the Direct Path.
- This limitation is eased by adding a gypsum board ceiling with sound absorptive material in the cavity under the concrete ceiling slab, which raises the STC rating of the direct path from 58 to 77 and raises the ASTC to 75, as shown in example 4.1.2-V4. A good floor lining could add even more.

With effective ceiling and flanking wall linings in place, as shown in example 4.1.3-V4, a very good system performance of ASTC 75 is possible.

4.2 Scenarios for Concrete Block Walls with Wood-Framed Floors and Walls

This section presents the calculation approach for buildings that combine lightweight wood-framed assemblies (walls and floors) with walls of normal weight or lightweight concrete blocks. The transmission of structure-borne vibration in a building with wood-framed assemblies differs markedly from that in heavy homogeneous structures of masonry and concrete.

- For direct transmission through the separating lightweight framed assembly, the high internal loss factors of the wood-framed assembly result in minimal dependence on the connections to the adjoining structures, so laboratory measured sound transmission values are used without adjustment.
- For flanking paths where one or both of the assemblies is wood-framed, a different approach is required than was presented in earlier sections of this Report. The calculation process is very simple, but it requires a "new" type of laboratory test data the flanking transmission loss measured according to ISO 10848-3.
- Linings on the concrete block surfaces (either for direct or flanking transmission) may be treated using a simple additive correction ΔSTC as in Section 4.1.

An experimental study of such systems was performed at the NRC, as described in Chapter 3 of this Report, and results from this study were used for the examples in this section.

<u>The Calculation Process</u> requires specific laboratory test data, but can be performed using singlenumber ratings following the steps illustrated in Figure 4.2.1, and explained in detail below.



Figure 4.2.1: Steps to calculate the ASTC rating for lightweight framed construction (as detailed below)

Step 1: (a) For the bare separating assembly, the in-situ STC rating is equal to the STC rating measured in the laboratory according to ASTM E90.

(b) If the separating assembly is a masonry wall, add the Δ STC correction for lining(s) on the source room and/or receiving room surfaces (D and d) to obtain the Direct STC rating. This procedure matches that of Section 4.1. (If there are two linings, one on each side, the correction equals the larger of the two lining corrections plus half of the lesser one. See Eq. 4.2.2.)

Step 2: (a) Determine the Flanking STC rating for the 3 flanking paths Ff, Fd and Df at each edge of the separating assembly. Values measured in accordance with ISO 10848-3 should be renormalized by applying Equation 4.2.1. If only the Flanking STC for combined transmission by the set of 3 paths at a junction is available, that data may be used. If both flanking surfaces F and f are concrete masonry walls, the Flanking STC for path Ff may either be taken from measurement according to ISO 10848-3, or calculated using the assembly STC rating and the vibration reduction index (measured or calculated) as in Section 4.1.

(b) If one surface for a flanking path (source room or receiving room) is a masonry wall, add the Δ STC correction for any lining added to the masonry surface, to obtain the Flanking STC for that path. If both flanking surfaces are masonry walls with linings, the correction equals the larger of the two lining Δ STC corrections plus half of the lesser one. See Eq. 4.2.3.

- Step 3: Combine the transmission via the direct path and 12 flanking paths using Equation 1.2 from Section 1.4 of this Report (equivalent to Eq. 26 in Section 4.4 of ISO 15712-1), as follows:
 - If the Flanking STC rating calculated for any flanking path is over 90, set the value to 90.
 - Round the final ASTC result to the nearest integer.

<u>Using measured values of Flanking TL or Normalised Flanking Level Difference</u> : Where values measured according to ISO 10848-3 are to be converted into Flanking STC for these calculations, they must be re-normalized to reflect the differences between the laboratory test situation and the prediction scenario. This applies to laboratory results expressed as the Flanking TL or to the Normalised Flanking Level Difference $(D_{n,f})$. The expressions to use in the calculation are:

Flanking
$$TL_{ij} = D_{n,f}(lab) + 10 \log(S_{situ}/10) + 10 \log(l_{lab}/l_{ij})$$
 in dB Eq. 4.2.1

Flanking TL_{ii} = Flanking TL (lab) + 10 log(S_{situ}/S_{lab}) + 10 log(l_{lab}/l_{ii}) in dB

where:

- The indices *i* and *j* refer to the coupled flanking elements; thus, "*i*" can either be "D" or "F" and "*j*" can be "f" or "d"
- The term, S_{situ} is the area (in m²) of the separating assembly in the prediction scenario
- l_{ii} is the length (in m) of the junction between elements *i* and *j* for the prediction scenario
- S_{lab} and l_{lab} are the corresponding values for the specimen in the ISO 10848 laboratory test
- The corresponding Flanking STC_{ij} can be determined from the 1/3-octave values of the Flanking TL_{ij} using the procedure described in ASTM E413

Expressing the Process using Equations:

Following from Eq. 1.2 of this Report and Eq. 26 of ISO 15712-1:2005, the ASTC value between two rooms (neglecting sound that is by-passing the building structure, e.g. leaks, ducts,...) is estimated according to the Simplified Method as the logarithmic expression of the Direct STC rating (STC_{Dd}) of the separating wall or floor element and the sum of the Flanking STC ratings of the three flanking paths for every junction at the four edges of the separating element (as shown in Fig. 1.5) such that:

$$ASTC = -10\log_{10}\left[10^{-0.1 \cdot STC_{Dd}} + \sum_{edge=1}^{4} (10^{-0.1 \cdot STC_{Ff}} + 10^{-0.1 \cdot STC_{Fd}} + 10^{-0.1 \cdot STC_{Df}})\right]$$

Eq. 1.1 is appropriate for all types of building systems with the room geometry of the Standard Scenario, and is applied here using the following expressions to calculate the sound transmission for each path:

- (a) In this adaptation of the Simplified Method, the Apparent Sound Transmission Class (ASTC) is substituted for the ATL in Eq. 1.1.
- (b) The direct path STC_{Dd} is obtained from the laboratory measured STC rating of the bare element and the Δ STC changes due to linings on source "D" and/or receiving side "d" of the separating assembly such that:

$$STC_{Dd} = STC_{lab} + max(\Delta STC_D, \Delta STC_d) + \frac{min(\Delta STC_D, \Delta STC_d)}{2}$$

(c) The calculation of the Flanking STC_{ij} for each flanking path depends on the constructions involved. Here, indices *i* and *j* refer to the coupled flanking elements, where "*i*" can either be "D" or "F" and "*j*" can be "f" or "d". The options include:

- In all cases, values of $D_{n,f}$ or Flanking TL measured according to ISO 10848-3 may be used after normalization to determine the Flanking STC. Alternatively, if both flanking elements F and f are concrete masonry wall assemblies, then Eq. 4.1.3 of Section 4.1 could be used to determine the Flanking STC_{*Ff*},
- If one or both of the flanking elements is a concrete masonry wall, then Eq. 4.2.2 should be used to add the correction due to any linings, using Δ STC = 0 for a lightweight framed assembly because lining corrections are not appropriate for framed assemblies.

$$STC_{Dd} = STC_{lab} + max(\Delta STC_D, \Delta STC_d) + \frac{min(\Delta STC_D, \Delta STC_d)}{2}$$
 Eq. 4.2.2

The worked examples present all of the pertinent physical characteristics of the assemblies and junctions, including references for the sources of the laboratory test data. All of the examples conform to the Standard Scenario presented in Section 1.2 of this Report. The calculations were performed following the steps presented near the beginning of Section 4.2 (See Figure 4.2.1).

Under the heading "STC, Δ STC", the examples present input data values which were determined by applying the calculation process of ASTM E413 to laboratory test data of several types:

- STC values measured in the laboratory according to ASTM E90 for the sound transmission loss of wall or floor assemblies
- ΔSTC values calculated from ASTM E90 measurements of the change in sound transmission due to adding a given lining to the specified wall or floor assembly. (See pages 14-16.)
- Flanking STC values measured according to ISO 10848 for a specific set of flanking surfaces.

Under the heading "ASTC", the examples present the values calculated for transmission via specific paths (the Direct STC value for in-situ transmission loss of the separating wall or floor assembly and the Flanking STC for the set of paths at each junction) plus the overall Apparent STC (ASTC) value for the combination of direct and flanking transmission via all paths. Each is rounded to the nearest integer, for consistency with the normal presentation of STC ratings.

EXAMPLE 4.2-H1:

(SIMPLIFIED METHOD) Illustration for this case

- Rooms side-by-side
- Separating wall of normal weight concrete block with wood-framed flanking floors and walls

Separating wall assembly with:

- one wythe of reinforced concrete blocks with mass 238 kg/m² (e.g. 190 mm hollow blocks with normal weight aggregate¹, with reinforcing steel and grout-filled cells at 1220 mm o.c.)
- no lining of separating concrete block walls

Bottom Junction 1 (separating wall and floor) with:

- 2 x10 (38 mm x 235 mm) wood ledger plate on each side, fastened through with 16 mm diameter bolts spaced 406 mm o.c.
- cells in concrete blocks between ledger plates are filled with grout
- floor framed with 38 mm x 235 mm wood joists spaced 406 mm o.c., with joists oriented perpendicular to separating (loadbearing) wall and supported from ledger plates on joist hangers, with 150 mm thick absorptive material² in the inter-joist cavities
- floor deck of 16 mm oriented strand board (OSB) fastened to joists on floor surfaces F1 and f1
- no floor finish or floor topping

Top Junction 3 (separating wall and ceiling) with:

- ceiling framed with wood joists (same details as bottom junction)
- ceiling with 1 layer of 13 mm gypsum board³ fastened directly to bottom of floor framing on each side

Side Junctions 2 or 4 (separating wall and abutting side walls) with:

- flanking side walls framed with 38 mm x 89 mm wood studs spaced 406 mm o.c., with 89 mm sound-absorptive material² in inter-stud cavities
- side wall framing is not continuous across the junction, and is connected with approved fasteners to the separating concrete block wall which has grout-filled cells at the junction
- 13 mm gypsum board³ on the side walls ends at separating wall assembly and is attached directly to wall framing

Note: For path/surface designations in the procedure below, treat the room on the left as the source room (surfaces D and F)

| | In Scenario | In Laboratory |
|---|-------------|-------------------|
| Separating partition area (m^2) = | 12.5 | 10.4 |
| Floor/separating wall junction length (m) = | 5.0 | 4.6 |
| Wall/separating wall junction length (m) = | 2.5 | 2.26 |
| | | |
| Normalization For Junctions 1 and 3: | | |
| 10*log(S_situ/S_lab) + 10*log(l_lab/l_situ) = | 0.44 | RR-334, Eq. 4.2.1 |
| | | |
| Normalization For Junctions 2 & 4: | | |
| 10*log(S_situ/S_lab) + 10*log(l_lab/l_situ) = | 0.36 | RR-334, Eq. 4.2.1 |
| 10 108(5_310/5_10) + 10 108(1_10)/1_310) = | 0.50 | RR-554, Eq. 4.2.1 |

(See the footnotes located at the end of the document)







Junction 2 or 4 of separating concrete block wall with abutting side walls, with side walls' framing and gypsum board terminating at separating wall (Plan view)

| | ISO Symbol | Reference | | | STC, ∆_STC | ASTC |
|--------------------------------|-------------------------|-----------------------|------------------|---------------------------|-------------------------|------|
| Separating Partition (190 mr | <u>n concrete block</u> | <u>.)</u> | | | | |
| Laboratory STC for Dd | R_s,w | RR-334, NRC-Mean | BLK190(NW) | | 49 | |
| ΔSTC change by Lining on D | ΔR_D,w | No Lining, | | | 0 | |
| ΔSTC change by Lining on d | ΔR_d,w | No Lining , | | | 0 | |
| Direct STC in situ | R_Dd,w | ISO 15712-1, Eq. 24 | and 30 | 49 + MA | X(0,0) + MIN(0,0)/2 = | 49 |
| | | | | | | |
| Junction 1 (Cross junction, 19 | 90 mm block sep | arating wall / Wood | joist floor) | | | |
| For Flanking Path Ff 1: | | | | | | |
| Laboratory Flanking STC | | R334, BLK190-WF-L | B-01 | | 59 | |
| Flanking STC for path Ff_1 | R_Ff,w | ISO 15712-1, Eq. 28 | | | 59 + 0.44 = | 59 |
| For Flanking Path Fd 1: | | | | | | |
| Laboratory Flanking STC | R_Fd,w | R334, BLK190-WF-L | B-01 | | 59 | |
| ΔSTC change by Lining on d | ΔR_d,w | No Lining , | | | 0 | |
| Flanking STC for path Fd_1 | R_Fd,w | ISO 15712-1, Eq. 28 | | | 59 + 0 + 0.44 = | 59 |
| For Flanking Path Df 1: | | | | | | |
| Laboratory Flanking STC | R_Df,w | R334, BLK190-WF-L | B-01 | | 59 | |
| ∆STC change by Lining on D | ΔR_D,w | No Lining , | | | 0 | |
| Flanking STC for path Fd_1 | R_Df,w | ISO 15712-1, Eq. 28 | | | 59 + 0 + 0.44 = | 59 |
| Junction 1: Flanking STC for a | all paths | Subset of Eq. 1.1 | | - 10*LOG10(10^-5.9 + | 10^- 5.9 + 10^- 5.9) = | 54 |
| | | _ | | | | |
| Junction 2 (T-Junction, 190 n | nm block separat | ting wall / wood stuc | flanking wall) | | | |
| For Flanking Path Ff 2: | | | | | | |
| Laboratory Flanking STC | | R334, BLK190-WW- | LB-01 | | 81 | |
| Flanking STC for path Ff_2 | R_Ff,w | ISO 15712-1, Eq. 28 | | | 81+0.36 = | 81 |
| For Flanking Path Fd 2: | | | | | | |
| Laboratory Flanking STC | R_Fd,w | R334, BLK190-WW- | LB-01 | | 71 | |
| ΔSTC change by Lining on d | ΔR_d,w | No Lining , | | | 0 | |
| Flanking STC for path Fd_2 | R_Fd,w | ISO 15712-1, Eq. 28 | | | 71+0+0.36 = | 71 |
| For Flanking Path Df 2: | | | | | | |
| Laboratory Flanking STC | R_Df,w | R334, BLK190-WW- | LB-01 | | 71 | |
| ΔSTC change by Lining on D | ΔR_D,w | No Lining , | | | 0 | |
| Flanking STC for path Fd_2 | R_Df,w | ISO 15712-1, Eq. 28 | | | 71 + 0 + 0.36 = | 71 |
| Junction 2: Flanking STC for a | all paths | Subset of Eq. 1.1 | | - 10*LOG10(10^-8.1 + | 10^- 7.1 + 10^- 7.1) = | 68 |
| | | | | | | |
| Junction 3 (Cross junction, 19 | 90 mm block sep | arating wall / Wood | joist ceiling) | | | |
| For Flanking Path Ff 3: | | | | | | |
| Laboratory Flanking STC | | R334, BLK190-WC-L | B-01 | | 65 | |
| Flanking STC for path Ff_3 | R_Ff,w | ISO 15712-1, Eq. 28 | | | 65 + 0.44 = | 65 |
| For Flanking Path Fd 3: | | | | | | |
| Laboratory Flanking STC | R_Fd,w | R334, BLK190-WC-L | B-01 | | 65 | |
| ΔSTC change by Lining on d | ΔR_d,w | No Lining , | | | 0 | |
| Flanking STC for path Fd_3 | R_Fd,w | ISO 15712-1, Eq. 28 | | | 65 + 0 + 0.44 = | 65 |
| For Flanking Path Df 3: | | | | | | |
| Laboratory Flanking STC | R_Df,w | R334, BLK190-WC-L | B-01 | | 65 | |
| ΔSTC change by Lining on D | ΔR_D,w | No Lining , | | | 0 | |
| Flanking STC for path Fd_3 | R_Df,w | ISO 15712-1, Eq. 28 | | | 65 + 0 + 0.44 = | 65 |
| Junction 3: Flanking STC for a | all paths | Subset of Eq. 1.1 | | - 10*LOG10(10^-6.5 + | 10^- 6.5 + 10^- 6.5) = | 60 |
| | | | | | | |
| Junction 4 (T-Junction, 190 n | nm block separat | ting wall / wood stud | l flanking wall) | | | |
| All values the same as for Jur | nction 2 | | | | | |
| Flanking STC for path Ff_4 | R_Ff,w | Same as for Ff_2 | | | + 0.36 = | 81 |
| Flanking STC for path Fd_4 | R_Fd,w | Same as for Fd_2 | | | +71+0.36 = | 71 |
| Flanking STC for path Fd_4 | R_Df,w | Same as for Df_2 | | | + 71 + 0.36 = | 71 |
| Junction 4: Flanking STC for a | all paths | Subset of Eq. 1.1 | | - 10*LOG10(10^-8.1 + | 10^- 7.1 + 10^- 7.1) = | 68 |
| Total Flanking STC (4 Junctio | ns) | Subset of Eq. 1.1 | | Combining | 12 Flanking STC values | 53 |
| ASTC due to Direct plus Tota | l Flanking | Equation 1.1 | Co | mbining Direct STC with 1 | 12 Flanking STC values | 48 |
| | 0 | | | 0 | 0.0.0.000 | |

EXAMPLE 4.2-H2:

- Rooms side-by-side
- Separating wall of normal weight concrete block with wood-framed flanking floors and walls (Same structure as Example 4.2.1, plus linings)

(SIMPLIFIED METHOD)

Separating wall assembly with:

- one wythe of reinforced concrete blocks with mass 238 kg/m² (e.g. 190 mm hollow blocks with normal weight aggregate¹, with reinforcing steel and grout-filled cells at 1220 mm o.c.)
- concrete block assembly lined on each side by 1 layer of 13 mm gypsum board³ supported on 41 mm steel studs that are not in contact with the concrete blocks and are spaced 610 mm o.c., with absorptive material² filling the inter-stud cavities

Bottom Junction 1 (separating wall and floor) with:

- 2 x10 (38 x 235 mm) wood ledger plate on each side, fastened through with 16 mm diameter bolts spaced 406 mm o.c.
- cells in concrete blocks between ledger plates are filled with grout
- floor framed with 38 x 235 mm wood joists spaced 406 mm o.c., with joists oriented perpendicular to separating (loadbearing)wall and supported from ledger plates on joist hangers, with 150 mm thick absorptive material² in the inter-joist cavities
- floor deck of 16 mm oriented strand board (OSB) fastened to joists on floor surfaces F1 and f1
- no floor finish or floor topping

Top Junction 3 (separating wall and ceiling) with:

- ceiling framed with wood joists (same details as bottom junction)
- ceiling with one layer of 13 mm gypsum board³ fastened directly to bottom of floor framing on each side

Side Junctions 2 or 4 (separating wall and abutting side walls) with:

- flanking side walls framed with 38 mm x 89 mm wood studs spaced 406 mm o.c., with 89 sound-absorptive material² filling the inter-stud cavities
- side wall framing is not continuous across the junction, and is connected with approved fasteners to the separating concrete block wall which has grout-filled cells at the junction
- 13 mm gypsum board³ on the side walls ends at separating wall assembly and is attached directly to wall framing

Note: For path/surface designations in the procedure below, treat the room at left as the source room (surfaces D and F)

| | In Scenario | In Laboratory |
|---|-------------|-------------------|
| Separating partition area $(m^2) =$ | 12.5 | 10.4 |
| Floor/separating wall junction length (m) = | 5.0 | 4.6 |
| Wall/separating wall junction length (m) = | 2.5 | 2.26 |
| | | |
| Normalization For Junctions 1 and 3: | | |
| 10*log(S_situ/S_lab) + 10*log(l_lab/l_situ) = | 0.44 | RR-334, Eq. 4.2.1 |
| | | |
| Normalization For Junctions 2 & 4: | | |
| 10*log(S_situ/S_lab) + 10*log(l_lab/l_situ) = | 0.36 | RR-334, Eq. 4.2.1 |
| | | |







Junction 2 or 4 of separating concrete block wall with abutting side walls, with side walls' framing and gypsum board terminating at separating wall (Plan view)

| | ISO Symbol | Reference | | STC, ∆ STC | ASTC |
|--------------------------------|------------------------|---------------------------------|-------------------------|---------------------------|-----------|
| Separating Partition (190 mr | n concrete block | () | | | |
| Laboratory STC for Dd | R s.w | RR-334, NRC-Mean BLK190(N | W) | 49 | |
| ASTC change by Lining on D | AR D.w | RR-334, ATI-BLK(NW)-42 | , | 9.0 | |
| ASTC change by Lining on d | AR dw | RR-334 ATL-BLK(NW)-42 | | 9.0 | |
| Direct STC in situ | R Dd.w | ISO 15712-1. Eq. 24 and 30 | 49 + MA | X(9.9) + MIN(9.9)/2 = | 63 |
| | | | | | |
| unction 1 (Cross junction, 1 | 90 mm block ser | parating wall / Wood joist floo | <u>r)</u> | | |
| or Flanking Path Ff 1: | | | | | |
| aboratory Flanking STC | | R334, BLK190-WF-LB-01 | | 59 | |
| lanking STC for path Ff_1 | R_Ff,w | ISO 15712-1, Eq. 28 | | 59 + 0.44 = | 59 |
| or Flanking Path Fd 1: | | | | | |
| aboratory Flanking STC | R_Fd,w | R334, BLK190-WF-LB-01 | | 59 | |
| STC change by Lining on d | ΔR_d,w | RR-334, ΔTL-BLK(NW)-42 | | 9 | |
| lanking STC for path Fd_1 | R_Fd,w | ISO 15712-1, Eq. 28 | | 59 + 9 + 0.44 = | 68 |
| or Flanking Path Df 1: | | | | | |
| aboratory Flanking STC | R_Df,w | R334, BLK190-WF-LB-01 | | 59 | |
| STC change by Lining on D | ΔR_D,w | RR-334, ΔTL-BLK(NW)-42 | | 9 | |
| lanking STC for path Fd_1 | R_Df,w | ISO 15712-1, Eq. 28 | | 59 + 9 + 0.44 = | 68 |
| unction 1: Flanking STC for a | all paths | Subset of Eq. 1.1 | - 10*LOG10(10^-5.9 + | 10^- 6.8 + 10^- 6.8) = | 58 |
| | | | | | |
| unction 2 (T-Junction, 190 n | <u>nm block separa</u> | ting wall / wood stud flanking | <u>wall)</u> | | |
| | | D224 D1//100 M/M/10 01 | | 01 | |
| Laboratory Flanking STC | | R334, BLK190-WW-LB-01 | | 81 | 04 |
| -lanking SIC for path Ff_2 | R_Ff,W | ISO 15712-1, Eq. 28 | | 81+0.36 = | 81 |
| or Flanking Path Fd 2: | | | | | |
| aboratory Flanking STC | R_Fd,w | R334, BLK190-WW-LB-01 | | /1 | |
| ASIC change by Lining on d | ΔR_d,w | RR-334, Δ1L-BLK(NW)-42 | | 9 | |
| lanking STC for path Fd_2 | R_Fd,w | ISO 15712-1, Eq. 28 | | 71 + 9 + 0.36 = | 80 |
| For Flanking Path Df 2: | | | | | |
| aboratory Flanking STC | R_Df,w | R334, BLK190-WW-LB-01 | | 71 | |
| ASTC change by Lining on D | ΔR_D,w | RR-334, ΔTL-BLK(NW)-42 | | 9 | |
| lanking STC for path Fd_2 | R_Df,w | ISO 15712-1, Eq. 28 | | 71 + 9 + 0.36 = | 80 |
| unction 2: Flanking STC for a | all paths | Subset of Eq. 1.1 | - 10*LOG10(10^-8. | .1 + 10^- 8 + 10^- 8) = | 76 |
| unction 2 (Cross junction 1) | 0 mm block cor | arating wall / Wood joist coili | ing) | | |
| Car Clanking Dath Cf. 2. | SO THIT DIOCK SEL | Jarating wair / wood joist cen | ing) | | |
| abaratory Flanking STC | | D224 DLK100 M/C LD 01 | | C F | |
| aboratory Flanking STC | | K334, BLK190-WC-LB-01 | | 05 | CT |
| Tanking STC for path Fi_3 | K_FI,W | ISO 13712-1, Eq. 28 | | 05 + 0.44 = | 05 |
| | D Ed | D224 D1//100 M/C LD 01 | | 65 | |
| | K_FU,W | R334, BLR190-WC-LB-UI | | 05 | |
| Londing GTC for noth Ed. 2 | Δκ_u,w | KR-334, Δ1L-BLK(INW)-42 | | 9 | 74 |
| Cor Elaphing Dath Df 2: | K_F0,W | 130 13712-1, EQ. 28 | | 05 + 9 + 0.44 = | /4 |
| aboratory Flanking CTC | D Df | D224 DLK100 M/C LD 01 | | 65 | |
| aboratory Flanking STC | K_DT,W | K354, BLK190-WC-LB-U1 | | 05 | |
| Longe by Lining on D | ΔK_D,W | KK-334, Δ1L-BLK(NW)-42 | | 9 | 74 |
| -lanking SIC for path Fd_3 | R_DT,W | ISO 15712-1, Eq. 28 | 40*10040/404 6 5 | 65 + 9 + 0.44 = | 74 |
| unction 3: Flanking STC for a | all paths | Subset of Eq. 1.1 | - 10*LOG10(10^-6.5 + | $10^{-7.4} + 10^{-7.4} =$ | 64 |
| unction 4 (T-Junction. 190 n | nm block separa | ting wall / wood stud flanking | wall) | | |
| All values the same as for Jur | iction 2 | | - | | |
| lanking STC for path Ff 4 | R Ff.w | All values the same as for lun | ction 2 | | 81 |
| lanking STC for nath Fd 4 | R Fd w | All values the same as for lun | ction 2 | | 80 |
| lanking STC for nath Fd 4 | R Dfw | All values the same as for lun | ction 2 | | 80 |
| unction 4: Flanking STC for a | all paths | Subset of Eq. 1.1 | - 10*LOG10(10^-8. | 1 + 10^- 8 + 10^- 8) = | 76 |
| otal Flanking STC (4 Junctio | ns) | Subset of Eq. 1.1 | Combining | 12 Flanking STC values | 57 |
| | | | | | |
| STC due to Direct plue Tete | Elanking | Equation 1.1 | mbining Direct STC with | 12 Elapking STC values | 56 |


| | ISO Symbol | Reference | | STC, ∆_STC | ASTC |
|-------------------------------|---------------------|---------------------------|------------------|----------------------------------|------|
| Separating partition (wood | joist floor) | | | | |
| Laboratory STC for Dd | R_s,w | RR-336, WJ235-02 | | 53 | |
| Direct STC in situ | R_Dd,w | No adjustment, ISO 157 | 712-1, 4.2.2 | | 53 |
| | | | | | |
| lunction 1 (Cross junction, C | Concrete block flag | nking wall / Wood joist s | eparating floor) | | |
| For Flanking Path Ff 1: | | | | | |
| Laboratory Flanking STC | R_s,w | RR-334, WJ235-FW-LB- | 02 | 59 | |
| ∆STC change by Lining on F | ΔR_F,w | No Lining , | | 0 | |
| ∆STC change by Lining on f | ΔR_f,w | No Lining , | | 0 | |
| Normalization correction | | ISO 15712-1, Eq.28a | | -0.3 | |
| Flanking STC for path Ff_1 | R_Ff,w | ISO 15712-1, Eq. 28 | 59 + MA | X(0,0) + MIN(0,0)/2 + -0.29 = 59 | |
| For Flanking Path Fd 1: | | | | | |
| Laboratory Flanking STC | R_Fd,w | RR-334, WJ235-FW-LB- | 02 | 73 | |
| ∆STC change by Lining on F | ΔR_d,w | No Lining , | | 0 | |
| Flanking STC for path Fd_1 | R_ Fd,w | ISO 15712-1, Eq. 28 | | 73 + 0 + -0.29 = 73 | |
| For Flanking Path Df_1: | | | | | |
| Laboratory Flanking STC | R_Df,w | RR-334, WJ235-FW-LB- | 02 | 67 | |
| ∆STC change by Lining on f | ΔR_D,w | No Lining , | | 0 | |
| Flanking STC for path Fd_1 | R_Df,w | ISO 15712-1, Eq. 28 | | 67 + 0 + -0.29 = 67 | |
| Junction 1: Flanking STC for | all paths | Subset of Eq. 1.1 | - 10*LOG10(10 |)^-5.9 + 10^- 7.3 + 10^- 6.7) = | 58 |
| | | | | | |
| lunction 2 (T-Junction, Woo | d stud flanking wa | ll / Wood joist separatin | <u>g floor)</u> | | |
| For Flanking Path Ff 2: | | | | | |
| Laboratory Flanking STC | | R336, WJ235-VF_NLB-0 |)2 | 63 | |
| Flanking STC for path Ff_2 | R_Ff,w | ISO 15712-1, Eq. 28 | | 63 + 0.68 = 64 | |
| For Flanking Path Fd_2: | | | | | |
| Laboratory Flanking STC | R_Fd,w | R336, WJ235-VF_NLB-0 |)2 | 80 | |
| Flanking STC for path Fd_2 | R_Fd,w | ISO 15712-1, Eq. 28 | | 80 + 0.68 = 81 | |
| For Flanking Path Df 2: | | | | | |
| Laboratory Flanking STC | R_Df,w | R336, WJ235-VF_NLB-0 |)2 | 60 | |
| Flanking STC for path Fd_2 | R_Df,w | ISO 15712-1, Eq. 28 | | 60 + 0.68 = 61 | |
| unction 2: Flanking STC for | all paths | Subset of Eq. 1.1 | - 10*LOG10(10 |)^-6.4 + 10^- 8.1 + 10^- 6.1) = | 59 |
| | | | | | |
| lunction 3 (Cross junction, C | Concrete block fla | nking wall / Wood joist s | eparating floor) | | |
| Flanking STC for path Ff_3 | R_Ff,w | Same as for Ff_1 | 59 + MA | X(0,0) + MIN(0,0)/2 + -0.29 = 59 | |
| Flanking STC for path Fd_3 | R_Fd,w | Same as for Fd_1 | | 73 + 0 + -0.29 = 73 | |
| Flanking STC for path Fd_3 | R_Df,w | Same as for Df_1 | | 67 + 0 + -0.29 = 67 | |
| lunction 3: Flanking STC for | all paths | Subset of Eq. 1.1 | - 10*LOG10(10 |)^-5.9 + 10^- 7.3 + 10^- 6.7) = | 58 |
| | | | | | |
| Junction 4 (Cross-Junction, | Wood stud flankin | g wall / Wood joist separ | ating floor) | | |
| All values the same as for Ju | nction_2 | | | | |
| Flanking STC for path Ff_4 | R_Ff,w | Same as for Ff_2 | | 63 + 0.68 = 64 | |
| Flanking STC for path Fd_4 | R_ Fd,w | Same as for Fd_2 | | 80 + 0.68 = 81 | |
| Flanking STC for path Fd_4 | R_Df,w | Same as for Df_2 | | 60 + 0.68 = 61 | |
| Junction 4: Flanking STC for | all paths | Subset of Eq. 1.1 | - 10*LOG10(10 | 0^-6.4 + 10^- 8.1 + 10^- 6.1) = | 59 |
| Total Flanking STC (4 Junctio | ons) | Subset of Eq. 1.1 | Con | bining 12 Flanking STC values | |
| | | | | | |
| | al Flaubium | C | 0 1 | | |



| | ISO Symbol | Reference | | | STC, ∆_STC | | ASTC |
|--------------------------------|--------------------|---------------------------|----------------------------------|-------------------|------------------------|----|------|
| Separating partition (wood | joist floor) | | | | | | - |
| Laboratory STC for Dd | R s,w | RR-336, WJ235-02 | | | 53 | | |
| Direct STC in situ | R_Dd,w | No adjustment, ISO 15 | 712-1, 4.2.2 | | | | 53 |
| | | | | | | | |
| Junction 1 (Cross junction, C | oncrete block fla | nking wall / Wood joist | separating floo | <u>or)</u> | | | |
| For Flanking Path Ff 1: | | | | | | | |
| Laboratory Flanking STC | R_s,w | RR-334, WJ235-FW-LB | -02 | | 59 | | |
| ∆STC change by Lining on F | ΔR_F,w | RR-334, ΔTL-BLK(NW)- | 33 | | 4 | | |
| ∆STC change by Lining on f | ΔR_f,w | RR-334, ΔTL-BLK(NW)- | 33 | | 4 | | |
| Normalization correction | | ISO 15712-1, Eq.28a | | | -0.3 | | |
| Flanking STC for path Ff_1 | R_Ff,w | ISO 15712-1, Eq. 28 | | 59 + MAX(4,4) + | MIN(4,4)/2 + -0.29 = | 65 | |
| For Flanking Path Fd 1: | | | | | | | |
| Laboratory Flanking STC | R_Fd,w | RR-334, WJ235-FW-LB | -02 | | 73 | | |
| ∆STC change by Lining on F | ∆R_d,w | RR-334, ΔTL-BLK(NW)- | 33 | | 4 | | |
| Flanking STC for path Fd_1 | R_ Fd,w | ISO 15712-1, Eq. 28 | | | 73 + 4 + -0.29 = | 77 | |
| For Flanking Path Df_1: | | | | | | | |
| aboratory Flanking STC | R_Df,w | RR-334, WJ235-FW-LB | -02 | | 67 | | |
| ∆STC change by Lining on f | ΔR_D,w | RR-334, ΔTL-BLK(NW)- | 33 | | 4 | | |
| Flanking STC for path Fd_1 | R_Df,w | ISO 15712-1, Eq. 28 | | | 67 + 4 + -0.29 = | 71 | |
| Junction 1: Flanking STC for | all paths | Subset of Eq. 1.1 | - 10*L | OG10(10^-6.5 + 1 | 0^- 7.7 + 10^- 7.1) = | | 64 |
| | | | | | | | |
| unction 2 (T-Junction, Woo | d stud flanking wa | ll / Wood joist separatir | ng floor) | | | | |
| For Flanking Path Ff 2: | | | | | | | |
| Laboratory Flanking STC | | R336, WJ235-VF_NLB- | 02 | | 63 | | |
| Flanking STC for path Ff_2 | R_Ff,w | ISO 15712-1, Eq. 28 | | | 63 + 0.68 = | 64 | |
| For Flanking Path Fd 2: | | | | | | | |
| aboratory Flanking STC | R_Fd,w | R336, WJ235-VF_NLB- | 02 | | 80 | | |
| Flanking STC for path Fd 2 | R Fd,w | ISO 15712-1, Eq. 28 | | | 80 + 0.68 = | 81 | |
| For Flanking Path Df 2: | | | | | | | |
| Laboratory Flanking STC | R Df,w | R336, WJ235-VF NLB- | 02 | | 60 | | |
| Flanking STC for path Fd 2 | R Df,w | ISO 15712-1, Eq. 28 | | | 60 + 0.68 = | 61 | |
| unction 2: Flanking STC for | all paths | Subset of Eq. 1.1 | - 10*L | DG10(10^-6.4 + 1 | 0^- 8.1 + 10^- 6.1) = | | 59 |
| | - | | | · | | | |
| unction 3 (Cross junction, C | oncrete block fla | nking wall / Wood joist s | separating floo | or) | | | |
| Flanking STC for path Ff_3 | R_Ff,w | Same as for Ff_1 | | 59 + MAX(4,4) + | MIN(4,4)/2 + -0.29 = | 65 | |
| Flanking STC for path Fd 3 | R_Fd,w | Same as for Fd_1 | | , | 73 + 4 + -0.29 = | 77 | |
| Flanking STC for path Fd 3 | R_Df,w | Same as for Df 1 | | | 67 + 4 + -0.29 = | 71 | |
| Junction 3: Flanking STC for | all paths | Subset of Eq. 1.1 | - 10*L | DG10(10^-6.5 + 1 | 0^- 7.7 + 10^- 7.1) = | | 64 |
| <u> </u> | - | | | · | | | |
| Junction 4 (Cross-Junction, V | Nood stud flankin | g wall / Wood joist sepa | rating floor) | | | | |
| All values the same as for Jui | nction 2 | | | | | | |
| lanking STC for path Ff_4 | R_Ff,w | Same as for Ff_2 | | | 63 + 0.68 = | 64 | |
| lanking STC for path Fd 4 | R_Fd,w | Same as for Fd_2 | | | 80 + 0.68 = | 81 | |
| lanking STC for path Fd_4 | R_Df,w | Same as for Df_2 | | | 60 + 0.68 = | 61 | |
| unction 4: Flanking STC for | all paths | Subset of Eq. 1.1 | - 10*L | OG10(10^-6.4 + 1 | 0^- 8.1 + 10^- 6.1) = | | 59 |
| Total Flanking STC (4 Junctio | ons) | Subset of Eq. 1.1 | Combining 12 Flanking STC values | | | | 55 |
| | | | | | | | |
| ASTC due to Direct plus Tota | al Flanking | Subset of Eq. 1.1 | Combining | Direct STC with 1 | 2 Flanking STC values | | 51 |

Summary for Section 4.2: Concrete Block Walls with Lightweight Flanking Walls and Floors

The worked examples 4.2-H1 and 4.2-V1 illustrate the basic process for calculating the sound transmission between rooms in a building which incorporate bare concrete masonry walls and lightweight framed flanking assemblies. These examples differ from those of the preceding section because lightweight assemblies are treated differently than concrete or concrete block assemblies in the calculation process.

The overall ASTC rating is lower than the STC rating of the separating assembly, and the relative magnitude of the direct and flanking transmissions are quite similar (though the flanking transmission is slightly less important than the direct transmission in cases of side-by-side rooms).

For the side-by-side pair of rooms

The effect of added linings is shown in example 4.2.-H2 and the following trends were found:

- Adding a lining with ΔSTC=9 to the concrete block surfaces (both sides of separating wall) raises the ASTC rating from 48 to 56. Even this moderate improvement of the STC rating of the separating wall makes flanking transmission the dominant transmission, especially for the floor-floor and ceilingceiling paths.
- If the ceiling in example 4.2-H2 is also improved by mounting the gypsum board ceiling on resilient channels, the Flanking STC for the ceiling paths (Junction 3) would improve to 75. However, this would increase the ASTC rating by only 1 point because the benefit is limited by flanking at the floor junction combined with the appreciable direct transmission.

Significant further improvement in the ASTC rating requires the treatment of <u>both</u> the floor and the ceiling surfaces as well as the use of better linings on the separating wall. With these changes, the ASTC rating could be raised to 65 or higher.

With one room above the other

The effect of added linings on the concrete block flanking walls is shown in Example 4.2-V2.

 Example 4.2-V2 shows the effect of adding a minimal wall lining with ΔSTC=4 to all of the concrete block surfaces. Even this small improvement makes the flanking transmission via the concrete block walls nearly insignificant. The use of better linings could raise the Flanking STC for Junctions 1 and 3 (paths involving the concrete block walls) to the point where they are clearly insignificant, but would not improve the ASTC rating appreciably.

Achieving significantly higher ASTC ratings requires the improvement of the floor surface and the woodframed flanking walls, as well as the use of better linings on the concrete block flanking walls. With such changes, the ASTC rating could be raised to 65 or higher.

4.3 Scenarios for Concrete Block Walls with Steel-Framed Floors and Walls

(TO BE ADDED LATER)

4.4 Scenarios for Concrete Block Walls with Precast Concrete Floors

(TO BE ADDED LATER)

5 Appendices of Sound Transmission Data

This chapter presents full 1/3-octave-band sound transmission data for constructions tested in this project as well as for other constructions included in the Calculation Scenarios of Chapter 4.

Appendix A1: Concrete Block Walls with and without Linings

This section presents the laboratory measured sound transmission data (measured according to ASTM E90 as described in Chapter 2) for the concrete block wall assemblies tested in this project. It also presents the change in the sound transmission due to the addition of linings and the direct sound transmission data for other wall or floor constructions included in the Calculation Scenarios of Chapter 4.

Test Procedure and Facility

Full scale wall assemblies were placed in a testing frame with a test opening which was 3.66 m wide and 2.44 m high. The test opening was located between two decoupled rooms with volumes of approximately 250 m^3 and 140 m^3 (referred to in this report as the large and the small rooms).

In each room, a calibrated Brüel & Kjær condenser microphone (type 4166 or 4165) with preamp was moved under computer control to nine measurement positions and measurements were made in both rooms using a National Instruments NI4472 data acquisition system installed in a desktop computer. The sound field in each room was created using four bi-amped loudspeakers driven by separate amplifiers and noise sources. To increase the randomness of the sound field, there were fixed diffusing panels located in each room.

Measurements of the airborne sound transmission loss (STL) were conducted in accordance with the requirements of ASTM E90-09, "Standard Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions". Airborne sound transmission loss tests were performed in the forward (the large room is the receiving room) and reverse (the small room is the receiving room) directions. The results presented in this report are the average of the test results for the two transmission directions.

In each case, the sound transmission loss values were calculated from the time and spatially averaged sound pressure levels measured in both the source and the receiving rooms and the average reverberation times of the receiving room. The one-third octave band sound pressure levels were measured for 32 seconds at nine microphone positions in each room and then averaged to calculate the average sound pressure level in each room. Five sound decays were averaged to calculate the reverberation time at each microphone position in the receiving room. These times were then average together to calculate the average reverberation times for the room.

| Table A1.1: STL data for concrete bloc | k walls |
|--|---------|
|--|---------|

| Lining Code | Description | STC | 63 Hz | | | 1 | L 25 H a | z | 250 Hz | | |
|------------------------|---|-----|-------|----|----|----|-----------------|----|--------|----|----|
| Mean TL- BLK190(NW) | 190 mm thick hollow-core concrete blocks, 53% solid, normal weight aggregate ¹ , faces sealed or unsealed | 49 | 34 | 34 | 33 | 36 | 35 | 36 | 36 | 38 | 41 |
| Bare- BLK140(LW) | 140 mm thick hollow-core concrete blocks, 58% solid, lightweight aggregate ⁴ , faces unsealed | 35 | 24 | 22 | 19 | 19 | 22 | 22 | 23 | 24 | 26 |
| Base- BLK140(LW) | 140 mm thick hollow-core concrete blocks as above, but calculated TL without leakage (See Section 2.1) | 38 | 26 | 23 | 20 | 20 | 21 | 23 | 25 | 26 | 28 |

| Table A1.2: Change in STL due | e to linings on | BLK190(NW) |
|-------------------------------|-----------------|------------|
|-------------------------------|-----------------|------------|

| Lining Code | Description | ΔSTC | | 63 Hz | 2 | 1 | 25 H | z | 2 | 250 H | z |
|----------------|--------------------------|------|----|-------|----|----|------|----|----|-------|----|
| ΔTL-BLK(NW)-01 | Lining PAINT | 0 | 0 | -1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| ΔTL-BLK(NW)-02 | Lining G13 | -3 | 0 | 1 | 0 | 0 | 1 | 1 | -1 | -1 | -2 |
| ΔTL-BLK(NW)-21 | Lining FC25_G13 | -1 | -1 | 0 | -1 | -3 | -4 | -4 | 1 | -1 | -1 |
| ΔTL-BLK(NW)-22 | Lining FC25_GFB38_G13 | 2 | -1 | 0 | -2 | -4 | -4 | -1 | 2 | 4 | 3 |
| ΔTL-BLK(NW)-31 | Lining WFUR38_G13 | -1 | -1 | -2 | -3 | -5 | -6 | -3 | 6 | 6 | -1 |
| ΔTL-BLK(NW)-32 | Lining WFUR38_2G13 | 1 | -2 | -1 | -4 | -8 | -5 | -3 | 10 | 9 | 1 |
| ΔTL-BLK(NW)-33 | Lining WFUR38_GFB38_G13 | 4 | -2 | -1 | -5 | -6 | -1 | 4 | 8 | 8 | 4 |
| ΔTL-BLK(NW)-34 | Lining WFUR38_GFB38_2G13 | 5 | -2 | -1 | -6 | -7 | 1 | 6 | 7 | 9 | 4 |
| ΔTL-BLK(NW)-35 | Lining WFUR38_G16 | -2 | -2 | -1 | -2 | -7 | -7 | -3 | 0 | 5 | 5 |
| ΔTL-BLK(NW)-36 | Lining WFUR38_GFB38_G16 | 2 | -2 | -2 | -4 | -7 | -4 | 6 | 6 | 4 | 7 |
| ΔTL-BLK(NW)-41 | Lining SS41_G13 | 0 | -2 | -3 | -1 | -6 | -5 | -4 | 1 | 3 | 7 |
| ΔTL-BLK(NW)-42 | Lining SS41_GFB38_G13 | 9 | -3 | -4 | -5 | -2 | 2 | 7 | 11 | 11 | 12 |
| ΔTL-BLK(NW)-61 | Lining SS65_G13 | 2 | -3 | -2 | -1 | -7 | -4 | 1 | 6 | 8 | 9 |
| ΔTL-BLK(NW)-62 | Lining SS65_GFB65_G13 | 19 | -6 | -1 | 0 | 7 | 11 | 15 | 18 | 19 | 20 |
| ΔTL-BLK(NW)-63 | Lining SS65_GFB65_2G13 | 22 | -2 | 3 | 7 | 13 | 16 | 21 | 22 | 22 | 23 |
| ΔTL-BLK(NW)-65 | Lining SS65_GFB65_G16 | 21 | -4 | 2 | 5 | 11 | 14 | 19 | 19 | 20 | 23 |
| ΔTL-BLK(NW)-91 | Lining SS92_G13 | 5 | -3 | -2 | -1 | -6 | -2 | 1 | 7 | 9 | 12 |
| ΔTL-BLK(NW)-92 | Lining SS92_GFB38_G13 | 17 | -6 | -3 | -2 | 3 | 7 | 13 | 16 | 17 | 19 |
| ΔTL-BLK(NW)-93 | Lining SS92_GFB65_G13 | 18 | -4 | 1 | -1 | 5 | 10 | 15 | 17 | 18 | 20 |
| ΔTL-BLK(NW)-94 | Lining SS92_GFB92_G13 | 18 | -5 | 0 | 1 | 6 | 10 | 15 | 17 | 19 | 20 |
| ΔTL-BLK(NW)-96 | Lining SS92_GFB92_2G13 | 22 | -1 | 3 | 7 | 12 | 17 | 21 | 21 | 21 | 23 |

| | 500 H | z | 1 | .000 H | Iz | 2 | 2000 H | z | 4000 Hz | | | Reference |
|----|-------|----|----|--------|----|----|--------|----|---------|----|----|---|
| 43 | 44 | 47 | 48 | 50 | 53 | 55 | 58 | 58 | 60 | 62 | 64 | Mean of TLA-12-190, TLA-12-225 averaged with TL-88-356 from IR-586 [Ref 12.1] |
| 29 | 31 | 34 | 36 | 38 | 39 | 40 | 35 | 37 | 40 | 43 | 45 | Mean of TLA-13-028, 029, 044 |
| 32 | 35 | 39 | 41 | 43 | 47 | 50 | 45 | 45 | 49 | 54 | 55 | Calculated from TLA-13-045,046 and TLA-13-031,032 |

(Continuation of Table A1.1 from opposite page):

(Continuation of Table A1.2 from opposite page)

| ! | 500 Hz | Z | 1 | .000 H | z | 2 | 2000 H | z | 4 | 1000 H | z | Reference |
|----|--------|----|----|--------|----|----|--------|----|----|--------|----|---------------------------------------|
| 0 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 1 | -1 | TLA-12-252, 253, 255 |
| -3 | -2 | -1 | 3 | 4 | 5 | 5 | 4 | 3 | 3 | 3 | 3 | TLA-12-216, 217, 213-212, 215- 208 |
| 0 | 1 | 1 | 3 | 5 | 7 | 7 | 5 | 2 | 2 | 4 | 4 | TLA-12-226 |
| 4 | 5 | 3 | 5 | 6 | 9 | 8 | 6 | 4 | 5 | 6 | 5 | TLA-12-227 |
| -1 | -1 | 1 | 2 | 3 | 4 | 4 | 4 | 1 | 1 | 3 | 4 | TLA-12-208, 215-216 |
| 1 | -1 | 2 | 3 | 5 | 6 | 6 | 6 | 4 | 5 | 6 | 7 | TLA-12-212, 213-216 |
| 2 | 2 | 4 | 5 | 6 | 7 | 6 | 5 | 2 | 2 | 4 | 5 | TLA-12-209, 210 |
| 4 | 2 | 4 | 5 | 5 | 7 | 7 | 7 | 5 | 5 | 7 | 8 | TLA-12-211 |
| 0 | 0 | 1 | 2 | 3 | 4 | 4 | 1 | 0 | 3 | 4 | 5 | TLA-12-193-196, 204 |
| 3 | 3 | 3 | 4 | 4 | 5 | 5 | 2 | 1 | 3 | 5 | 5 | TLA-12-191, 192 |
| 10 | 10 | 10 | 12 | 10 | 10 | 10 | 11 | 11 | 13 | 15 | 15 | TLA-12-230, 231 |
| 13 | 10 | 8 | 9 | 7 | 8 | 9 | 9 | 11 | 12 | 13 | 13 | TLA-12-229, 232, 237-236 |
| 13 | 14 | 14 | 16 | 15 | 15 | 15 | 13 | 11 | 13 | 16 | 15 | TLA-12-240, 241, 239 |
| 22 | 21 | 21 | 20 | 18 | 16 | 17 | 17 | 16 | 18 | 21 | 19 | TLA-12-235, 238, 237-236 |
| 25 | 25 | 23 | 22 | 20 | 19 | 20 | 19 | 18 | 21 | 23 | 20 | TLA-12-236, 237-235 |
| 25 | 24 | 23 | 23 | 21 | 20 | 20 | 16 | 16 | 20 | 23 | 21 | TLA-12-234 |
| 14 | 13 | 13 | 15 | 16 | 16 | 16 | 14 | 13 | 16 | 18 | 18 | TLA-12-242 |
| 22 | 21 | 18 | 18 | 18 | 19 | 19 | 18 | 15 | 16 | 19 | 18 | TLA-12-245, 250, 252 |
| 21 | 21 | 20 | 20 | 20 | 20 | 19 | 18 | 16 | 18 | 20 | 19 | TLA-12-244, 248, 245-246 |
| 20 | 21 | 19 | 20 | 19 | 19 | 19 | 18 | 16 | 18 | 20 | 19 | TLA-12-243, 246, 245-244 |
| 24 | 23 | 22 | 21 | 20 | 21 | 21 | 19 | 17 | 21 | 22 | 20 | TLA-12-247 |

| Lining Code | Description | ΔSTC | 63 Hz | | | | L25 H | z | 2 | 250 Hz | | |
|----------------|-------------------------|------|-------|----|----|----|-------|----|----|--------|----|--|
| ΔTL-BLK(LW)-01 | Lining PAINT | 0 | 1 | 2 | 3 | 2 | 4 | 3 | 2 | 1 | 1 | |
| ΔTL-BLK(LW)-31 | Lining WFUR38_G13 | 3 | -1 | -1 | -2 | -2 | 1 | 1 | 4 | 7 | 4 | |
| ΔTL-BLK(LW)-33 | Lining WFUR38_GFB38_G13 | 7 | 0 | 0 | -2 | -2 | 3 | 7 | 8 | 13 | 9 | |
| ΔTL-BLK(LW)-35 | Lining WFUR38_G16 | 6 | 1 | 1 | -1 | -1 | 3 | 5 | 6 | 11 | 8 | |
| ΔTL-BLK(LW)-62 | Lining SS65_GFB65_G13 | 15 | -5 | -4 | -2 | 4 | 8 | 11 | 13 | 15 | 18 | |
| ΔTL-BLK(LW)-65 | Lining SS65_GFB65_G16 | 19 | -3 | 0 | 3 | 5 | 12 | 14 | 17 | 19 | 21 | |
| ΔTL-BLK(LW)-66 | Lining SS65_FOAM65_G13 | 0 | 1 | 5 | 6 | 5 | 8 | 5 | 2 | 1 | -1 | |
| ΔTL-BLK(LW)-93 | Lining SS92_GFB65+_G13 | 16 | -5 | -3 | 0 | 6 | 9 | 12 | 13 | 15 | 17 | |
| ΔTL-BLK(LW)-95 | Lining SS92_GFB65+_G16 | 22 | -2 | 2 | 4 | 8 | 14 | 16 | 19 | 22 | 23 | |

| Table | 41.3 Change | in STI | due to lini | ngs on lig | , htweight | unsealed | RI K140(| I W/) |
|-------|--------------|--------|-------------|-------------|---------------|----------|----------|---------|
| Table | ALIJ. Change | | uuc to mm | 163 011 116 | SILVICISIL | unscalca | | L V V J |

| 5 | 500 Hz | : | 1 | .000 H | z | 20 | 000 Hz | 2 | 4000 Hz | | | Reference |
|----|--------|----|----|--------|----|----|--------|----|---------|----|----|---------------------------------------|
| 1 | 0 | -1 | -1 | -1 | -2 | -3 | -1 | 0 | 0 | -1 | -1 | TLA-13-045, 046 |
| 1 | 2 | 2 | 3 | 4 | 5 | 6 | 9 | 5 | 4 | 4 | 6 | TLA-13-030 |
| 7 | 5 | 5 | 6 | 7 | 9 | 9 | 11 | 6 | 5 | 4 | 6 | TLA-13-042, 033-031 |
| 4 | 4 | 3 | 4 | 6 | 7 | 7 | 7 | 5 | 6 | 6 | 8 | TLA-13-031, 032, 033-042, 034- 035 |
| 19 | 18 | 15 | 16 | 20 | 22 | 23 | 28 | 27 | 25 | 23 | 23 | TLA-13-040, 047 |
| 22 | 23 | 22 | 24 | 27 | 28 | 28 | 28 | 28 | 28 | 29 | 27 | TLA-13-043, 037-035, 038-039 |
| -1 | 1 | 3 | 7 | 9 | 14 | 15 | 14 | 7 | 7 | 11 | 12 | TLA-13-058-045, 057-040 |
| 19 | 19 | 17 | 17 | 20 | 22 | 22 | 27 | 25 | 24 | 24 | 24 | TLA-13-039, 038-043 |
| 24 | 25 | 24 | 26 | 28 | 29 | 28 | 29 | 29 | 29 | 29 | 27 | TLA-13-035, 036, 034-031, 037- 043 |

(Continuation of Table A1.3 from opposite page):

Appendix A2: Concrete Block Walls with Wood-Framed Floors and Walls

(TO BE ADDED LATER)

Appendix A3: Concrete Block Walls with Steel-Framed Floors and Walls (TO BE ADDED LATER)

Appendix A4: Concrete Block Walls with Precast Concrete Floors

(TO BE ADDED LATER)

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Sources for Sound Transmission Data

Source references for sound transmission data (both collections of conventional laboratory test results for wall and floor assemblies according to ASTM E90, and flanking transmission tests according to ISO 10848) including many NRC Construction reports in the RR- and IR- series are available from the website of the NRC Canada: <u>http://nparc.cisti-icist.nrc-cnrc.gc.ca/npsi/ctrl?lang=en</u>

Collections of conventional laboratory test results for wall or floor assemblies evaluated according to ASTM E90 are presented in a series of NRC publications. Of particular relevance to this report on concrete blocks are the following:

- IR-586, "Sound Transmission Loss Measurements through 190 mm and 140 mm Blocks With Added Drywall and Through Cavity Block Walls", A.C.C. Warnock (1990). This presents results similar to those in Chapter 2 of this report. Changes in the lining materials and test facilities make detailed comparison uncertain, but the results show very similar trends.
- A.C.C. Warnock, "Sound transmission through concrete blocks with attached drywall", J. Acoustical Soc. Am., vol. 90, pp 1454-1463, (1991)
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The software application soundPATHS is accessible online at the website of the National Research Council Canada. The predictions provided by the application are based on a detailed calculation using 1/3-octave data for the direct and flanking paths as determined by experimental studies in the laboratories of the National Research Council Canada. Technical details concerning the

measurement protocol (consistent with ISO 10848) and discussion of the findings of the experimental studies are presented in a series of NRC reports:

- IR-754, "Flanking Transmission at Joints in Multi-Family Dwellings. Phase 1: Effects of Fire Stops at Floor/Wall Intersections", T.R.T. Nightingale and R.E. Halliwell, (1997),
- RR-103, "Flanking Transmission in Multi-Family Dwellings Phase II : Effects of Continuous Structural Elements at Wall/Floor Junctions", T.R.T. Nightingale, R.E. Halliwell, J.D. Quirt, (2002),
- RR-168, "Flanking Transmission at the Wall/Floor Junction in Multifamily Dwellings -Quantification and Methods of Suppression", T.R.T. Nightingale, R.E. Halliwell, J.D. Quirt and F. King (2005),
- RR-218, "Flanking Transmission in Multi-Family Dwellings Phase IV", T.R.T. Nightingale, J.D. Quirt, F. King and R.E. Halliwell, (2006),
- Research Report RR-219, "Guide for Sound Insulation in Wood Frame Construction", J.D. Quirt, T.R.T. Nightingale, and F. King, (2006). Uses a subset of the database used for SoundPATHS software in a table-based framework to predict the ASTC for a range of wood-framed assemblies. See also NRC Construction Technology Update 66 "Airborne Sound Insulation in Multi-Family Buildings", J.D. Quirt and T.R.T. Nightingale (2008)
- J. K. Richardson, J. D. Quirt, R. Hlady, "Best Practice Guide on Fire Stops and Fire Blocks and their Impact on Sound Transmission, NRCC #49677 (2007)

The databases of flanking transmission data used in Guide RR-331 and in soundPATHS will be consolidated in a series of NRC publications presenting data from recent studies in collaboration with industry partners:

- RR-333 Apparent Sound Insulation in Concrete Buildings (2016)
- RR-334 Apparent Sound Insulation in Concrete Block Buildings (2015)
- RR-335 Apparent Sound Insulation in Cross Laminated Timber Buildings (2016)
- RR-336 Apparent Sound Insulation in Wood-framed Buildings (2016)
- RR-337 Apparent Sound Insulation in Steel-framed Buildings (2016)

7 Explanatory Notes

1 For the 190 mm thick concrete block walls in these examples, the value of 238 kg/m² is the measured mass per unit area for the tested wall specimen including mortar. Normal weight (NW) concrete block masonry units conform to CSA A165.1 and have a concrete mass density of not less than 2000 kg/m³. 190 mm NW hollow core units are not less than 53% solid, and 140 mm NW hollow core units are not less than 73% solid, each giving a minimum wall mass per area over 200 kg/m².

2 For the lightweight concrete block walls in these examples, the value of 134 kg/m² is the measured mass per unit area for the tested wall specimen including mortar. Lightweight concrete block masonry units conform to CSA A165.1 and have a concrete mass density of approximately 1700 kg/m³. Hollow core units are not less than 58% solid, which was the case tested.

3 Resilient metal channels are formed from steel with a maximum thickness of 0.46 mm (25 gauge), with the profile essentially as shown in Figure 6.1 There are slits or holes in the single "leg" between the faces fastened to the framing and to the gypsum board. Installation of the channels must conform to ASTM C754.

Figure 6.1:

Drawing to illustrate typical profile of a resilient metal channel. The approximate dimensions in crosssection are 13 mm x 60 mm (Copied from Figure A-9.10.3.1 of National Building Code of Canada with permission; drawing not precisely to scale).

