The ASTC rating of constructions with precast concrete hollowcore floors

Mahn, Jeffrey

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The ASTC Rating of Constructions with Precast Concrete Hollowcore Floors

Canadian Precast/Prestressed Concrete Institute

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The ASTC Rating of Constructions with Precast Concrete Hollowcore Floors

Author

Jeffrey Mahn, Ph.D.
Research Officer

Approved

Philip Rizcallah
Program Leader
Building Regulations for Market Access
NRC Construction

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Executive Summary

This report includes ten examples of calculations of the ASTC ratings for constructions consisting of bare concrete masonry walls connected to bare 203 mm (8") precast concrete hollowcore floors. Examples using concrete hollowcore slabs of three different mass per unit areas are presented (269 kg/m^2, 301 kg/m^2 and 338 kg/m^2 without grout or 273 kg/m^2, 305 kg/m^2 and 344 kg/m^2, respectively with grout). The ASTC rating is also calculated for the addition of linings on the floor of 301 kg/m^2 concrete hollowcore slabs. The examples using the detailed method show that constructions of bare (no liners, unpainted) normal weight 190 mm thick hollow concrete block masonry walls connected to bare 203 mm (8”) thick precast/prestressed concrete hollowcore slabs can achieve an ASTC rating of at least 47.

Based on the findings from this study, it is expected that constructions of hollow concrete block masonry walls with a mass per unit area of or greater to 238 kg/m^2 connected to precast concrete hollowcore floors with a mass per unit area equal to or greater than 273 kg/m^2 (with grout) will achieve ASTC ratings which are equal to or greater than 47.

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1. Motivation and Objective

The 2015 edition of the National Building Code of Canada (NBCC) includes significant changes to the acoustic requirements for residential constructions. Earlier editions of the NBCC described the acoustic requirements in terms of the Sound Transmission Class (STC) rating of the assemblies that separate dwellings in a building. In the 2015 edition, for constructions that separate dwelling units, the requirements based on a STC rating were replaced with new requirements based on the Apparent Sound Transmission Class (ASTC) rating. The NBCC requires that the ASTC rating is at least 47 for constructions between dwelling units. The requirements for constructions that separate dwelling units from elevator shafts or refuse chutes remained unchanged in the 2015 NBCC.

The ASTC rating includes contributions from other transmission paths between the rooms (referred to as flanking paths as shown in Figure 1) and is therefore a better metric of the sound transmission that occupants in buildings will experience in practice.

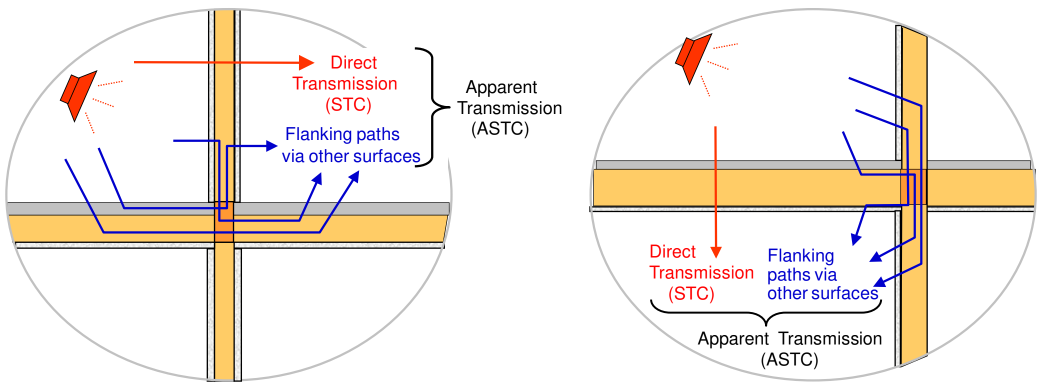


Figure 1: Comparison between STC and ASTC

The 2015 NBCC allows for three methods of demonstrating compliance with the acoustic requirements. The methods include post completion field testing, constructing buildings using the prescribed acceptable solutions found in Part 9 of the NBCC and the prediction of the ASTC rating using the prediction methods based on the standards, ISO 15712 [1] and ISO 10848 [2] and described in detail in the National Research Council Canada Research Report RR-331 *Guide to Calculating Airborne Sound Transmission in Buildings* [3]. This report focuses on the method of showing compliance by the prediction of the ASTC rating.

This report presents ten examples of the calculation of the ASTC rating for constructions with floors made of 203 mm (8") precast/prestressed concrete hollowcore slabs rigidly connected to concrete masonry walls. Examples using concrete hollowcore slabs of three different mass per unit areas (273 kg/m^2, 305 kg/m^2 and 343 kg/m^2) are included. The ASTC rating is also calculated for the addition of linings on the floor of 305 kg/m^2 concrete hollowcore slabs.

2. ASTC Examples

2.1 Standard Scenarios for the Examples

For the purposes of this report, the ASTC ratings are calculated using the Standard Scenarios presented in the National Research Council Canada Research Report RR-331 for side-by-side and one-above-the-other rooms. The Standard Scenario rooms are shown in Figure 2 and Figure 3.

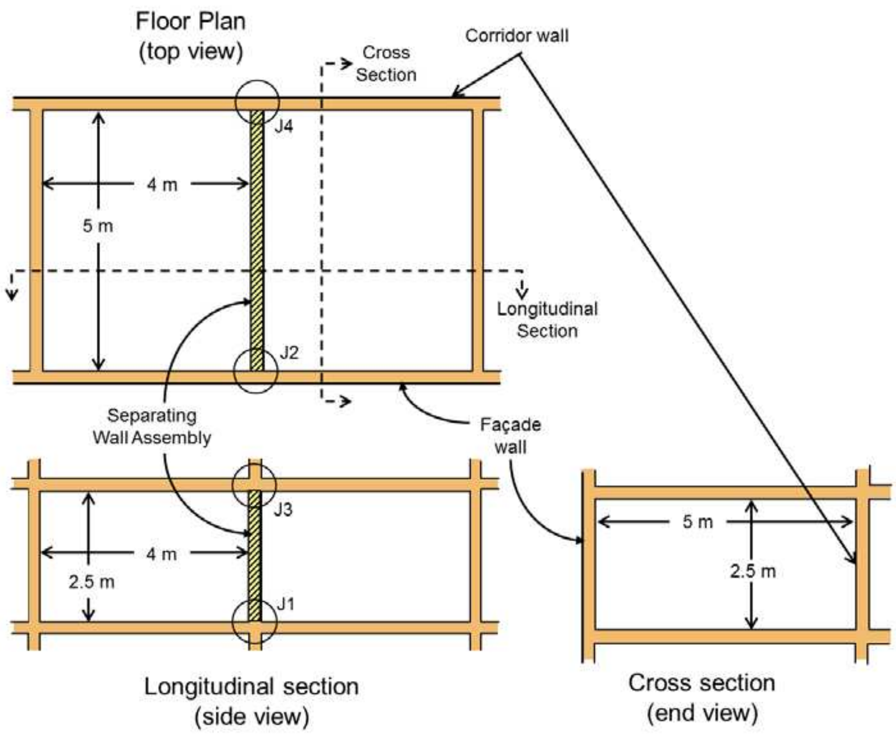


Figure 2: Standard Scenario from the NRC Research Report RR-331 for "horizontal room pair" case where the rooms are side-by side with a separating wall assembly between the rooms.

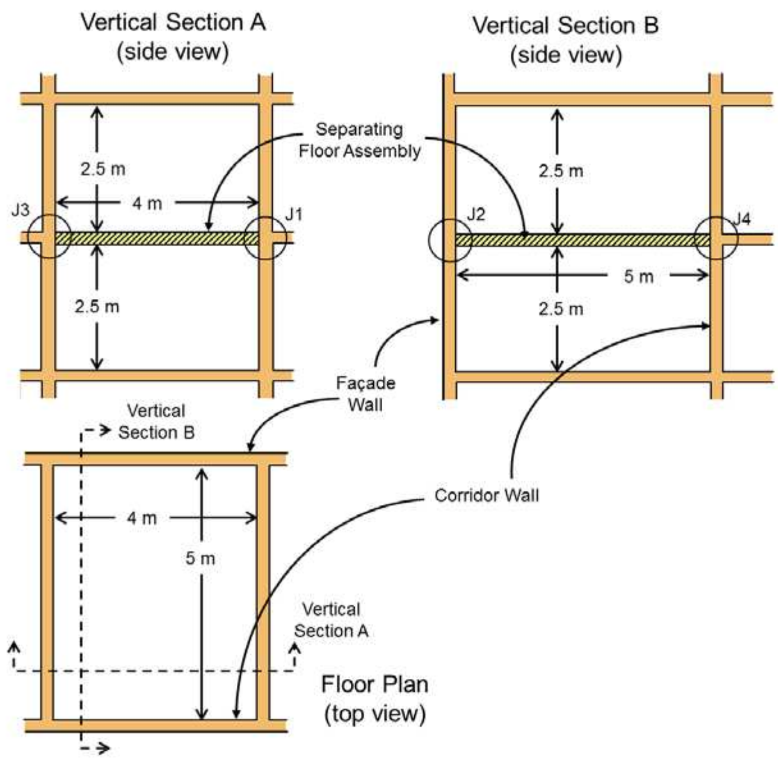


Figure 3: Standard Scenario from the NRC Research Report RR-331 for "vertical room pair" case where one of the pair of rooms is above the other with a floor/ceiling assembly between the two rooms.

The pertinent dimensions and junction details of the Standard Scenario rooms are:

- For horizontal room pairs (rooms are side-by-side) the separating wall is 2.5 m high by 5 m wide, the flanking floors and ceilings are 4 m by 5 m and the flanking walls are 2.5 m by 4 m.
- For vertical room pairs (one room is above the other) the separating floor/ceiling is 4 m by 5 m 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 room 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 room 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.

Deviations from the dimensions shown in the Standard Scenarios can change the ASTC ratings.

2.2 ASTC Examples - 203 mm Precast Concrete Hollowcore Floors

The following examples use the detailed calculation methods to determine the ASTC rating of constructions of 190 mm thick hollow concrete block masonry units with a mass per unit area of 238 kg/m^2 connected to floors and ceilings of 203 mm (8 inch) thick concrete hollowcore slabs. The transmission loss values for the concrete block masonry wall are laboratory measured values from the NRC Report RR-334 [6]. The transmission loss values for the precast concrete hollowcore slabs are laboratory measured values from the NRC Client Reports A1-004972.1 and A1-012467.2. The transmission loss values are summarized in Appendix A.

Also presented are examples with toppings of a 25.4 mm (1") thick underlayment poured directly on the 203 mm thick concrete hollowcore floor with a mass per unit area of 305 kg/m^2 and a topping of the underlayment with 6 mm (1/4") carpet and an 8mm (5/16") underpad. The improvements due to linings are presented in Appendix B.

The examples and ASTC ratings are summarized in Table 1 for side-by-side rooms and in Table 2 for one-above-the-other rooms.

Table 1: Summary of the examples with rooms side-by-side. All of the constructions have separating and flanking walls of concrete masonry and concrete hollowcore floors and ceilings.

Example	Separating and Flanking Wall Assemblies	Floor / Ceiling	Floor Topping		ASTC Rating
			Underlayment	Carpet	
1	190 mm concrete masonry wall - 238 kg/m^2	203 mm (8") concrete hollowcore slabs with grout - 344 kg/m^2	None	None	47
3	190 mm concrete masonry wall - 238 kg/m^2	203 mm (8") concrete hollowcore slabs with grout - 305 kg/m^2	None	None	47
5	190 mm concrete masonry wall - 238 kg/m^2	203 mm (8") concrete hollowcore slabs with grout - 305 kg/m^2	25.4 mm (1") underlayment poured directly on the concrete hollowcore slabs	None	47
7	190 mm concrete masonry wall - 238 kg/m^2	203 mm (8") concrete hollowcore slabs with grout - 305 kg/m^2	25.4 mm (1") underlayment poured directly on the concrete hollowcore slabs	6 mm (1/4") carpet with an 8 mm (5/16") underpad	47
9	190 mm concrete masonry wall - 238 kg/m^2	203 mm (8") concrete hollowcore slabs with grout - 273 kg/m^2	None	None	47

Table 2: Summary of the examples with rooms one-above-the-other. All of the constructions have flanking walls of concrete masonry and concrete hollowcore floors and ceilings.

Example	Separating Floor / Ceiling	Flanking Wall Assemblies	Floor Topping		ASTC Rating
			Underlayment	Carpet	
2	203 mm (8") concrete hollowcore slabs with grout - 344 kg/m^2	190 mm concrete masonry wall - 238 kg/m^2	None	None	54
4	203 mm (8") concrete hollowcore slabs with grout - 305 kg/m^2	190 mm concrete masonry wall - 238 kg/m^2	None	None	51
6	203 mm (8") concrete hollowcore slabs with grout - 305 kg/m^2	190 mm concrete masonry wall - 238 kg/m^2	25.4 mm (1") underlayment poured directly on the concrete hollowcore slabs	None	52
8	203 mm (8") concrete hollowcore slabs with grout - 305 kg/m^2	190 mm concrete masonry wall - 238 kg/m^2	25.4 mm (1") underlayment poured directly on the concrete hollowcore slabs	6 mm (1/4") carpet with an 8 mm (5/16") underpad	52
10	203 mm (8") concrete hollowcore slabs with grout - 273 kg/m^2	190 mm concrete masonry wall - 238 kg/m^2	None	None	49

Note that the examples in this report use transmission loss data which can be found in the following reports:

- A1-012467.1 - The Transmission Loss of 203 mm Thick Prestressed Precast Concrete Hollowcore Floors
- A1-004972.1 - Measurements of Airborne Sound Transmission Loss (ASTM E90) and Impact Sound Transmission (ASTM E492) on One Bare Hollow Core Floor Assembly (203 mm)
- A1-004972.2 - Measurements of Airborne Sound Transmission Loss (ASTM E90) and Impact Sound Transmission (ASTM E492) on One Bare Hollow Core Floor Assembly (305 mm)

Horizontal Room Pair - 203 mm Precast Concrete Hollowcore Floor 344 kg/m^2

Example 1: **(Detailed Method)**

- **Rooms side-by-side**
- **Floors of concrete hollowcore precast slabs[2] with walls of normal weight concrete block walls with rigid junctions**

Separating wall assembly (loadbearing) with:
- One wythe of 190 mm hollow concrete block masonry[1] constructed using normal weight units not less than 53% solid, and with mass per area of 238 kg/m2. No lining on the wall.

Junction 1: Bottom Junction (separating wall / floor) with:
- Floor assembly of precast concrete hollowcore slabs[2] of cross-section 203 mm thick and 2440 mm wide, fully grouted at joints between adjacent slabs and with a mass per area of 344 kg/m^2.
- No topping, flooring or ceiling.
- Rigid mortared cross-junction with concrete block wall assembly.

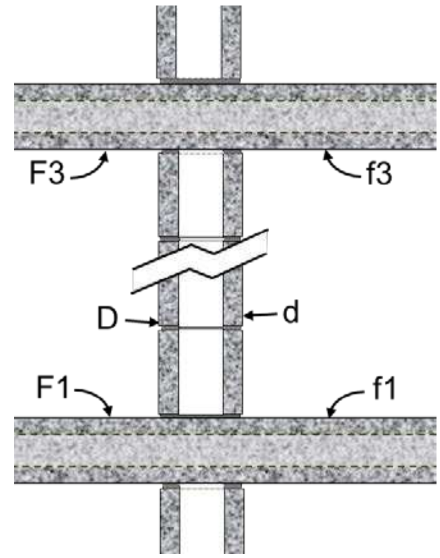
Junction 2 or 4: Each Side (separating wall /abutting side wall) with:
- Abutting side wall and separating wall of hollow concrete block masonry[1] with a mass per area of 238 kg/m^2. No lining.
- Rigid mortared T-junctions

Junction 3: Top Junction (separating wall / ceiling) with:
- Ceiling assembly of precast concrete hollowcore slabs[2] of cross-section 203 mm thick and 2440 mm wide, fully grouted at joints between adjacent slabs, with mass per area of 344 kg/m^2.
- No added ceiling lining
- Rigid mortared cross-junction with concrete block wall assembly

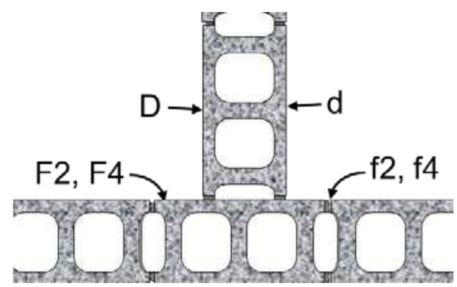
Acoustical Parameters

For the separating wall:						
internal loss, η_i =	0.015	c_L =	3500			
mass (kg/m^2) =	238	f_c =	98	(Eq. C.2)		
	Reference	K_{Ff}	K_{Dd}	K_{Fd}	K_{Df}	$\Sigma l_k \alpha_k$
X-Junction 1 or 3	ISO 15712-1, Eq. E.3	6.1	11.6	8.8	8.8	0.506
T-Junction 2 or 4	ISO 15712-1, Eq. E.4	5.7	-	5.7	5.7	0.420
Total loss η_{tot}	ISO 15712-1, Eq. C.1	0.039	at 500 Hz			
For flanking elements F and f and Junctions 1 & 3						
internal loss, η_i =	0.006	c_L =	3500			
mass (kg/m^2) =	344	f_c =	91	(Eq. C.2)		
Total loss η_{tot}	ISO 15712-1, Eq. C.1	0.030	at 500 Hz			
For flanking elements F and f and Junctions 2 & 4						
internal loss, η_i =	0.015	c_L =	3500			
mass (kg/m^2) =	238	f_c =	98	(Eq. C.2)		
Total loss $\eta_{tot,2}$	ISO 15712-1, Eq. C.1	0.045	at 500 Hz			
Total loss $\eta_{tot,4}$	ISO 15712-1, Eq. C.1	0.042	at 500 Hz			

Illustration for this case



Junction of a 190 mm concrete block separating wall with a floor and ceiling of 203 mm thick precast concrete hollowcore slabs. (Side view of Junctions 1 and 3)



Junction of the separating wall with a side wall, both of 190 mm concrete block. (Plan view of Junctions 2 and 4).

	ISO Symbol	Reference	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	ASTC
Separating Partition (190 mm concrete block wall)									
Sound Transmission Loss	$R_{D,lab}$	RR-334, NRC-Mean BLK190(NW)	35	38	44	50	58	62	49
Structural Reverberation Time lab	$T_{s,lab}$	ISO 15712-1, Eq. C.5	0.299	0.191	0.119	0.072	0.042	0.024	
Change by Lining on D	ΔR_D	No Lining	0	0	0	0	0	0	
Change by Lining on d	ΔR_d	No Lining	0	0	0	0	0	0	
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.267	0.176	0.113	0.069	0.041	0.024	
Leakage or Airborne Flanking		Sealed & Blocked	0	0	0	0	0	0	
Direct TL in-situ	$R_{D,situ}$	ISO 15712-1, Eq. 24	36	38	44	50	58	62	49

(For the notes in this table please see the corresponding endnotes on page 26.)

Example 1	ISO Symbol	Reference	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	ASTC
Junction 1 (Rigid cross junction, 190 mm block separating wall / 203 mm precast hollow core floor 344 kg/m²)									
Sound Transmission Loss F1 or f1	$R_{F1,lab}$	Measured	38	46	52	60	65	72	56
Structural Reverberation Time lab	$T_{s,lab}$	Measured	0.458	0.328	0.200	0.168	0.109	0.061	
Change by Lining on F1	ΔR_{F1}	No Lining	0	0	0	0	0	0	
Change by Lining on f1	ΔR_{f1}	No Lining	0	0	0	0	0	0	
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.320	0.220	0.147	0.096	0.061	0.039	
TL in-situ for Element F1	$R_{F1,situ}$	ISO 15712-1 Eq. 19	39	47	54	62	67	74	58
TL in-situ for Element f1	$R_{f1,situ}$	ISO 15712-1 Eq. 19	39	47	54	62	67	74	58
Junction 1 - Coupling									
In-situ Velocity Level Difference for Ff	$D_{v,F1,f1,situ}$	ISO 15712-1 Eq. 21, 22	9.6	9.8	10.0	10.4	10.8	11.2	
In-situ Velocity Level Difference for Fd	$D_{v,F1,d,situ}$	ISO 15712-1 Eq. 21, 22	11.8	12.0	12.3	12.8	13.4	14.0	
In-situ Velocity Level Difference for Df	$D_{v,D,f1,situ}$	ISO 15712-1 Eq. 21, 22	11.8	12.0	12.3	12.8	13.4	14.0	
Flanking Transmssion Loss - Path Values									
Flanking TL for Path Ff1	R_{F1f1}	ISO 15712-1 Eq. 25a	47	55	62	70	76	83	66
Flanking TL for Path Fd1	R_{F1d}	ISO 15712-1 Eq. 25a	48	54	60	68	75	81	65
Flanking TL for Path Df1	R_{Df1}	ISO 15712-1 Eq. 25a	48	54	60	68	75	81	65
Flanking STC for Junction 1			43	50	56	64	71	77	60
Junction 2 (Rigid T-Junction, 190 mm block separating wall / 190 mm block facade wall)									
Transmission Loss Element F2	$R_{F2,lab}$	RR-334, NRC-Mean BLK190(NW)	35	38	44	50	58	62	49
Structural Reverberation Time lab	$T_{s,lab}$	ISO 15712-1 Eq. C5	0.299	0.191	0.119	0.072	0.042	0.024	
Change by Lining on F2	ΔR_{F2}	No Lining	0	0	0	0	0	0	
Change by Lining on f2	ΔR_{f2}	No Lining	0	0	0	0	0	0	
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.226	0.149	0.098	0.061	0.037	0.022	
TL in-situ for Element F2	$R_{F2,situ}$	ISO 15712-1 Eq. 19	36	39	45	51	59	62	50
TL in-situ for Element f2	$R_{f2,situ}$	ISO 15712-1 Eq. 19	36	39	45	51	59	62	50
Junction 2 - Coupling									
In-situ Velocity Level Difference for Ff	$D_{v,F2,f2,situ}$	ISO 15712-1 Eq. 21, 22	10.8	11.0	11.4	11.9	12.6	13.3	
In-situ Velocity Level Difference for Fd	$D_{v,F2,d,situ}$	ISO 15712-1 Eq. 21, 22	10.9	11.2	11.5	12.1	12.9	13.6	
In-situ Velocity Level Difference for Df	$D_{v,D,f2,situ}$	ISO 15712-1 Eq. 21, 22	10.9	11.2	11.5	12.1	12.9	13.6	
Flanking Transmssion Loss - Path Values									
Flanking TL for Path Ff2	R_{F2f2}	ISO 15712-1 Eq. 25a	48	51	57	64	73	76	62
Flanking TL for Path Fd2	R_{F2d}	ISO 15712-1 Eq. 25a	47	50	57	63	72	76	61
Flanking TL for Path Df2	R_{Df2}	ISO 15712-1 Eq. 25a	47	50	57	63	72	76	61
Flanking STC for Junction 2			43	46	52	59	68	71	57
Junction 3 (Rigid cross junction, 190 mm block separating wall / 203 mm precast hollow core ceiling slab 344 kg/m²)									
All values are the same as for Junction 1									
Flanking TL for Path Ff3	R_{F3f3}	ISO 15712-1 Eq 25b	47	55	62	70	76	83	66
Flanking TL for Path Fd3	R_{F3d}	ISO 15712-1 Eq 25b	48	54	60	68	75	81	65
Flanking TL for Path Df3	R_{Df3}	ISO 15712-1 Eq 25b	48	54	60	68	75	81	65
Flanking STC for Junction 3			43	50	56	64	71	77	60
Junction 4 (Rigid T-junction, 190 mm block separating wall / 190 mm block corridor wall)									
All of the input data is the same as for Junction 2, but different junctions at the ceiling and floor result in different loss factors than Junction 2.									
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.244	0.163	0.105	0.065	0.039	0.023	
TL in-situ for Element F4	$R_{F4,situ}$	ISO 15712-1 Eq. 19	36	39	45	50	58	62	50
TL in-situ for Element f4	$R_{f4,situ}$	ISO 15712-1 Eq. 19	36	39	45	50	58	62	50
Junction 4 - Coupling									
In-situ Velocity Level Difference for Ff	$D_{v,F4,f4,situ}$	ISO 15712-1 Eq. 21, 22	10.4	10.7	11.1	11.7	12.3	13.2	
In-situ Velocity Level Difference for Fd	$D_{v,F4,d,situ}$	ISO 15712-1 Eq. 21, 22	10.7	11.0	11.4	12.0	12.7	13.6	
In-situ Velocity Level Difference for Df	$D_{v,D,f4,situ}$	ISO 15712-1 Eq. 21, 22	10.7	11.0	11.4	12.0	12.7	13.6	
Flanking Transmssion Loss - Path Values									
Flanking TL for Path Ff4	R_{F4f4}	ISO 15712-1 Eq 25b	47	51	57	63	71	76	62
Flanking TL for Path Fd4	R_{F4d}	ISO 15712-1 Eq 25b	47	50	56	63	71	76	61
Flanking TL for Path Df4	R_{Df4}	ISO 15712-1 Eq 25b	47	50	56	63	71	76	61
Flanking STC for Junction 4			42	46	52	58	66	71	57
Total Flanking STC (combined transmssion for all of the flanking paths)			37	41	47	54	62	67	52
ASTC due to Direct plus Flanking Transmission		RR-335, Eq. 1.1	33	37	42	49	57	61	**47**

Vertical Room Pair - 203 mm Precast Concrete Hollowcore Floor 344 kg/m^2

Example 2: (Detailed Method)

- **Rooms one-above-the-other**
- **Floors of concrete hollowcore precast slabs[2] with walls of normal weight concrete block walls with rigid junctions**

Separating wall assembly (loadbearing) with:

- Floor assembly of precast concrete hollowcore slabs[2] of cross-section 203 mm thick and 2440 mm wide, fully grouted at joints between adjacent slabs and with a mass per area of 344 kg/m^2.
- No topping, flooring or ceiling.

Junction 1, 3, 4: Cross-junction of separating floor / flanking wall with:

- One wythe of 190 mm hollow concrete block masonry[1] constructed using normal weight units not less than 53% solid, and with mass per area of 238 kg/m^2.
- No lining on the walls.
- Rigid mortared cross-junction with concrete block wall assembly.

Junction 2: T-Junction of separating floor / flanking wall with:

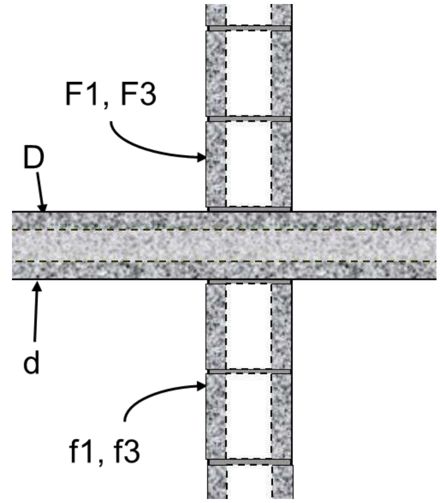
- Abutting side wall and separating wall of hollow concrete block masonry[1] with a mass per area of 238 kg/m^2.
- No lining on the walls.
- Rigid mortared T-junctions

NOTE: The sound transmission would be essentially unchanged if the concrete hollowcore floor slabs were oriented perpendicular to the case illustrated.

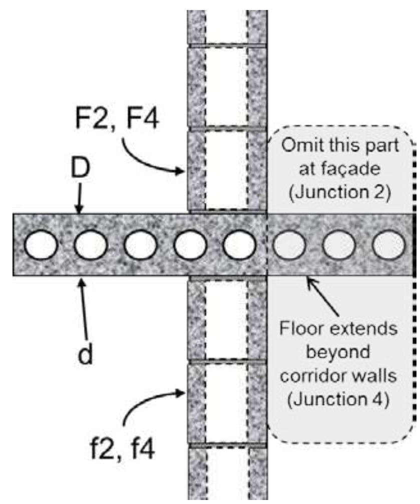
Acoustical Parameters

For the separating floor						
internal loss, η_i =	0.006	c_L =	3500			
mass (kg/m^2) =	344	f_c =	91	(Eq. C.2)		
	Reference	K_{Ff}	$K_{Dd'}$	K_{Fd}	K_{Df}	$\Sigma l_k \alpha_k$
X-Junction 1, 3	ISO 15712-1, Eq. E.3	11.6	6.1	8.8	8.8	0.782
X-Junction 4	ISO 15712-1, Eq. E.3	11.6	6.1	8.8	8.8	0.626
T-Junction 2	ISO 15712-1, Eq. E.4	8.1	-	5.8	5.8	0.657
Total loss η_{tot}	ISO 15712-1, Eq. C.1	0.030	at 500 Hz			
For flanking elements F and f and Junctions 1 & 3						
internal loss, η_i =	0.015	c_L =	3500			
mass (kg/m^2) =	238	f_c =	98	(Eq. C.2)		
Total loss η_{tot}	ISO 15712-1, Eq. C.1	0.039	at 500 Hz			
For flanking elements F and f and Junctions 2 & 4						
internal loss, η_i =	0.015	c_L =	3500			
mass (kg/m^2) =	238	f_c =	98	(Eq. C.2)		
Total loss $\eta_{tot,2}$	ISO 15712-1, Eq. C.1	0.045	at 500 Hz			
Total loss $\eta_{tot,4}$	ISO 15712-1, Eq. C.1	0.042	at 500 Hz			

Illustration for this case



Cross-junction of a separating floor assembly of 203 mm thick precast concrete hollowcore slabs with 190 mm concrete block flanking walls. (Side view of Junctions 1 and 3)



T-Junction of a separating floor of 203 mm thick precast concrete hollowcore slabs with 190 mm concrete block walls. (Plan view of Junctions 2 and 4).

	ISO Symbol	Reference	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	ASTC
Separating Partition (203 mm precast hollow core floor 344 kg/m^2)									
Sound Transmission Loss F1 or f1	$R_{D,lab}$	Measured	38	46	52	60	65	72	56
Structural Reverberation Time lab	$T_{s,lab}$	Measured	0.458	0.328	0.200	0.168	0.109	0.061	
Change by Lining on Source Side	ΔR_D	No Lining	0	0	0	0	0	0	
Change by Lining on Receive Side	ΔR_d	No Lining	0	0	0	0	0	0	
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.320	0.220	0.147	0.096	0.061	0.039	
Leakage or Airborne Flanking		No leakage	0	0	0	0	0	0	
Direct TL in-situ	$R_{D,situ}$	ISO 15712-1, Eq. 24	40	47	54	62	68	74	58

(For the notes in this table please see the corresponding endnotes on page 26.)

Example 2	ISO Symbol	Reference	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	ASTC
Junction 1 (Rigid Cross junction, 203 mm precast hollow core floor 344 kg/m² / 190 mm block wall)									
Flanking Path Ff_1									
Sound Transmission Loss F1 or f1	$R_{F1,lab}$	RR-334, NRC-Mean BLK190(NW)	35	38	44	50	58	62	49
Structural Reverberation Time lab	$T_{s,lab}$	ISO 15712-1, Eq. C.5	0.299	0.191	0.119	0.072	0.042	0.024	
Change by Lining on Source Side	ΔR_{F1}	No Lining	0	0	0	0	0	0	
Change by Lining on Receive Side	ΔR_{f1}	No Lining	0	0	0	0	0	0	
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.267	0.176	0.113	0.069	0.041	0.024	
TL in-situ for Element F1	$R_{F1,situ}$	ISO 15712-1 Eq. 19	35	38	44	50	58	62	49
TL in-situ for Element f1	$R_{f1,situ}$	ISO 15712-1 Eq. 19	35	38	44	50	58	62	49
Junction 1 - Coupling									
In-situ Velocity Level Difference for Ff	$D_{v,F1,f1,situ}$	ISO 15712-1 Eq. 21, 22	13.9	14.2	14.6	15.2	16.0	16.8	
In-situ Velocity Level Difference for Fd	$D_{v,F1,d,situ}$	ISO 15712-1 Eq. 21, 22	11.8	12.0	12.3	12.8	13.4	14.0	
In-situ Velocity Level Difference for Df	$D_{v,D,f1,situ}$	ISO 15712-1 Eq. 21, 22	11.8	12.0	12.3	12.8	13.4	14.0	
Flanking Transmssion Loss - Path Values									
Flanking TL for Path Ff1	R_{F1f1}	ISO 15712-1 Eq. 25a	**51**	**54**	**61**	**67**	**76**	**81**	**65**
Flanking TL for Path Fd1	R_{F1d}	ISO 15712-1 Eq. 25a	**50**	**56**	**62**	**70**	**77**	**83**	**67**
Flanking TL for Path Df1	R_{Df1}	ISO 15712-1 Eq. 25a	**50**	**56**	**62**	**70**	**77**	**83**	**67**
Flanking STC for Junction 1			46	50	57	64	72	77	62
Junction 2 (Rigid T-junction, 203 mm precast hollow core floor 344 kg/m² / 190 mm block façade wall)									
Flanking Path Ff_2									
Transmission Loss Element F2	$R_{F2,lab}$	RR-334, NRC-Mean BLK190(NW)	35	38	44	50	58	62	49
Structural Reverberation Time lab	$T_{s,lab}$	ISO 15712-1, Eq. C.5	0.299	0.191	0.119	0.072	0.042	0.024	
Change by Lining on Source Side	ΔR_{F2}	No Lining	0	0	0	0	0	0	
Change by Lining on Receive Side	ΔR_{f2}	No Lining	0	0	0	0	0	0	
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.226	0.149	0.098	0.061	0.037	0.022	
TL in-situ for Element F2	$R_{F2,situ}$	ISO 15712-1 Eq. 19	36	39	45	51	59	62	50
TL in-situ for Element f2	$R_{f2,situ}$	ISO 15712-1 Eq. 19	36	39	45	51	59	62	50
Junction 2 - Coupling									
In-situ Velocity Level Difference for Ff	$D_{v,F2,f2,situ}$	ISO 15712-1 Eq. 21, 22	11.1	11.4	11.7	12.3	13.0	13.7	
In-situ Velocity Level Difference for Fd	$D_{v,F2,d,situ}$	ISO 15712-1 Eq. 21, 22	9.6	9.8	10.1	10.5	11.1	11.7	
In-situ Velocity Level Difference for Df	$D_{v,D,f2,situ}$	ISO 15712-1 Eq. 21, 22	9.6	9.8	10.1	10.5	11.1	11.7	
Flanking Transmssion Loss - Path Values									
Flanking TL for Path Ff2	R_{F2f2}	ISO 15712-1 Eq. 25a	50	53	60	66	75	79	65
Flanking TL for Path Fd2	R_{F2d}	ISO 15712-1 Eq. 25a	49	55	61	69	76	81	66
Flanking TL for Path Df2	R_{Df2}	ISO 15712-1 Eq. 25a	49	55	61	69	76	81	66
Flanking STC for Junction 2			44	49	56	63	71	75	60
Junction 3 (Rigid Cross junction, 203 mm precast hollow core floor 344 kg/m² / 190 mm block wall)									
All values are the same as for Junction 1									
Flanking STC for Junction 3			46	50	57	64	72	77	62
Junction 4 (Rigid Cross junction, 203 mm precast hollow core floor 344 kg/m² / 190 mm block corridor wall)									
All of the input data is the same as for Junction 2, but different junctions at the ceiling and floor result in different loss factors than Junction 2.									
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.244	0.163	0.105	0.065	0.039	0.023	
TL in-situ for Element F4	$R_{F4,situ}$	ISO 15712-1 Eq. 19	36	39	45	50	58	62	50
TL in-situ for Element f4	$R_{f4,situ}$	ISO 15712-1 Eq. 19	36	39	45	50	58	62	50
Junction 4 - Coupling									
In-situ Velocity Level Difference for Ff	$D_{v,F4,f4,situ}$	ISO 15712-1 Eq. 21, 22	14.2	14.5	14.9	15.5	16.2	17.0	
In-situ Velocity Level Difference for Fd	$D_{v,F4,d,situ}$	ISO 15712-1 Eq. 21, 22	12.4	12.6	13.0	13.4	14.0	14.6	
In-situ Velocity Level Difference for Df	$D_{v,D,f4,situ}$	ISO 15712-1 Eq. 21, 22	12.4	12.6	13.0	13.4	14.0	14.6	
Flanking Transmssion Loss - Path Values									
Flanking TL for Path Ff4	R_{F4f4}	ISO 15712-1 Eq 25b	53	57	63	69	77	82	68
Flanking TL for Path Fd4	R_{F4d}	ISO 15712-1 Eq 25b	52	57	64	71	78	84	68
Flanking TL for Path Df4	R_{Df4}	ISO 15712-1 Eq 25b	52	57	64	71	78	84	68
Flanking STC for Junction 4			47	52	59	65	73	78	63
Total Flanking STC (combined transmssion for all of the flanking paths)			40	44	51	58	66	71	56
ASTC due to Direct plus Flanking Transmission		RR-335, Eq. 1.1	37	43	49	57	64	69	**54**

Horizontal Room Pair - 203 mm Precast Concrete Hollowcore Floor 305 kg/m^2

Example 3: **(Detailed Method)**

- **Rooms side-by-side**
- **Floors of precast concrete hollowcore slabs[2] with walls of normal weight concrete block walls with rigid junctions**

Separating wall assembly (loadbearing) with:

- One wythe of 190 mm hollow concrete block masonry1 constructed using normal weight units not less than 53% solid, and with mass per area of 238 kg/m2. No lining on the wall.

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

- Floor assembly of precast concrete hollowcore slabs[2] of cross-section 203 mm thick and 2440 mm wide, fully grouted at joints between adjacent slabs and with a mass per area of 305 kg/m^2.
- No topping, flooring or ceiling.
- Rigid mortared cross-junction with concrete block wall assembly.

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

- Abutting side wall and separating wall of hollow concrete block masonry[1] with a mass per area of 238 kg/m^2. No lining.
- Rigid mortared T-junctions

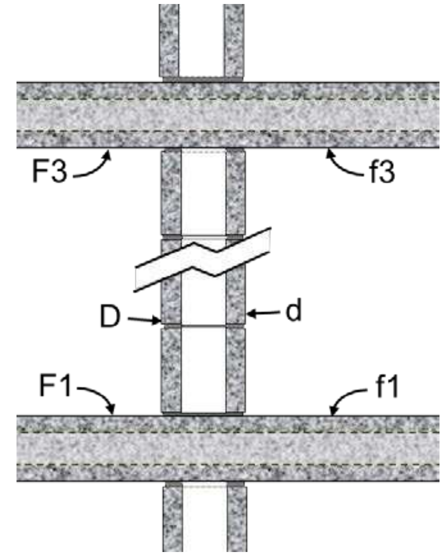
Junction 3: Top Junction (separating wall / ceiling) with:

- Ceiling assembly of precast concrete hollowcore slabs[2] of cross-section 203 mm thick and 2440 mm wide, fully grouted at joints between adjacent slabs, with mass per area of 305 kg/m^2.
- No added ceiling lining
- Rigid mortared cross-junction with concrete block wall assembly

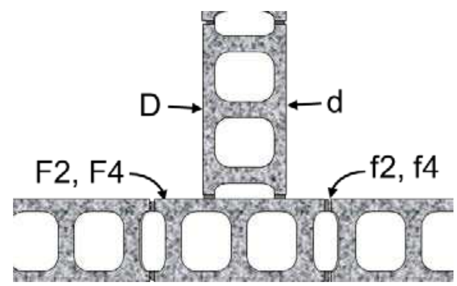
Acoustical Parameters

For the separating wall:						
internal loss, η_i =	0.015	c_L =	3500			
mass (kg/m^2) =	238	f_c =	98	(Eq. C.2)		
	Reference	K_{Ff}	K_{Dd}	K_{Fd}	K_{Df}	$\Sigma l_k \alpha_k$
X-Junction 1 or 3	ISO 15712-1, Eq. E.3	6.9	10.6	8.8	8.8	0.663
T-Junction 2 or 4	ISO 15712-1, Eq. E.4	5.7	-	5.7	5.7	0.420
Total loss η_{tot}	ISO 15712-1, Eq. C.1	0.043	at 500 Hz			
For flanking elements F and f and Junctions 1 & 3						
internal loss, η_i =	0.006	c_L =	3500			
mass (kg/m^2) =	305	f_c =	160	(Eq. C.2)		
Total loss η_{tot}	ISO 15712-1, Eq. C.1	0.025	at 500 Hz			
For flanking elements F and f and Junctions 2 & 4						
internal loss, η_i =	0.015	c_L =	3500			
mass (kg/m^2) =	238	f_c =	98	(Eq. C.2)		
Total loss $\eta_{tot,2}$	ISO 15712-1, Eq. C.1	0.050	at 500 Hz			
Total loss $\eta_{tot,4}$	ISO 15712-1, Eq. C.1	0.046	at 500 Hz			

Illustration for this case



Junction of a 190 mm concrete block separating wall with a floor and ceiling of 203 mm thick precast concrete hollowcore slabs. (Side view of Junctions 1 and 3)



Junction of the separating wall with a side wall, both of 190 mm concrete block. (Plan view of Junctions 2 and 4).

	ISO Symbol	Reference	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	ASTC
Separating Partition (190 mm concrete block wall)									
Sound Transmission Loss	$R_{D,lab}$	RR-334, NRC-Mean BLK190(NW)	35	38	44	50	58	62	49
Structural Reverberation Time lab	$T_{s,lab}$	ISO 15712-1, Eq. C.5	0.299	0.191	0.119	0.072	0.042	0.024	
Change by Lining on D	ΔR_D	No Lining	0	0	0	0	0	0	
Change by Lining on d	ΔR_d	No Lining	0	0	0	0	0	0	
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.238	0.157	0.102	0.063	0.038	0.022	
Leakage or Airborne Flanking		Sealed & Blocked	0	0	0	0	0	0	
Direct TL in-situ	$R_{D,situ}$	ISO 15712-1, Eq. 24	36	39	45	51	59	62	50

(For the notes in this table please see the corresponding endnotes on page 26.)

Example 3	ISO Symbol	Reference	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	ASTC
Junction 1 (Rigid cross junction, 190 mm block separating wall / 203 mm precast hollow core floor 305 kg/m²)									
Sound Transmission Loss F1 or f1	$R_{F1,lab}$	Measured A1-012467.2	36	43	51	57	63	71	54
Structural Reverberation Time lab	$T_{s,lab}$	Measured	0.283	0.192	0.129	0.085	0.055	0.034	
Change by Lining on F1	ΔR_{F1}	No Lining	0	0	0	0	0	0	
Change by Lining on f1	ΔR_{f1}	No Lining	0	0	0	0	0	0	
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.383	0.267	0.176	0.116	0.073	0.046	
TL in-situ for Element F1	$R_{F1,situ}$	ISO 15712-1 Eq. 19	35	41	50	55	62	70	53
TL in-situ for Element f1	$R_{f1,situ}$	ISO 15712-1 Eq. 19	35	41	50	55	62	70	53
Junction 1 - Coupling									
In-situ Velocity Level Difference for Ff	$D_{v,F1,f1,situ}$	ISO 15712-1 Eq. 21, 22	9.7	9.7	10.0	10.4	10.8	11.4	
In-situ Velocity Level Difference for Fd	$D_{v,F1,d,situ}$	ISO 15712-1 Eq. 21, 22	11.5	11.7	12.0	12.5	13.1	13.8	
In-situ Velocity Level Difference for Df	$D_{v,D,f1,situ}$	ISO 15712-1 Eq. 21, 22	11.5	11.7	12.0	12.5	13.1	13.8	
Flanking Transmssion Loss - Path Values									
Flanking TL for Path Ff1	R_{F1f1}	ISO 15712-1 Eq. 25a	43	49	58	63	71	79	61
Flanking TL for Path Fd1	R_{F1d}	ISO 15712-1 Eq. 25a	46	51	58	64	72	79	62
Flanking TL for Path Df1	R_{Df1}	ISO 15712-1 Eq. 25a	46	51	58	64	72	79	62
Flanking STC for Junction 1			40	46	53	59	67	74	57
Junction 2 (Rigid T-Junction, 190 mm block separating wall / 190 mm block facade wall)									
Transmission Loss Element F2	$R_{F2,lab}$	RR-334, NRC-Mean BLK190(NW)	35	38	44	50	58	62	49
Structural Reverberation Time lab	$T_{s,lab}$	ISO 15712-1 Eq. C5	0.299	0.191	0.119	0.072	0.042	0.024	
Change by Lining on F2	ΔR_{F2}	No Lining	0	0	0	0	0	0	
Change by Lining on f2	ΔR_{f2}	No Lining	0	0	0	0	0	0	
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.202	0.135	0.088	0.056	0.034	0.020	
TL in-situ for Element F2	$R_{F2,situ}$	ISO 15712-1 Eq. 19	37	39	45	51	59	63	50
TL in-situ for Element f2	$R_{f2,situ}$	ISO 15712-1 Eq. 19	37	39	45	51	59	63	50
Junction 2 - Coupling									
In-situ Velocity Level Difference for Ff	$D_{v,F2,f2,situ}$	ISO 15712-1 Eq. 21, 22	11.2	11.5	11.8	12.3	12.9	13.7	
In-situ Velocity Level Difference for Fd	$D_{v,F2,d,situ}$	ISO 15712-1 Eq. 21, 22	11.4	11.6	12.0	12.5	13.2	14.0	
In-situ Velocity Level Difference for Df	$D_{v,D,f2,situ}$	ISO 15712-1 Eq. 21, 22	11.4	11.6	12.0	12.5	13.2	14.0	
Flanking Transmssion Loss - Path Values									
Flanking TL for Path Ff2	R_{F2f2}	ISO 15712-1 Eq. 25a	49	51	58	64	73	78	63
Flanking TL for Path Fd2	R_{F2d}	ISO 15712-1 Eq. 25a	48	51	57	64	72	77	62
Flanking TL for Path Df2	R_{Df2}	ISO 15712-1 Eq. 25a	48	51	57	64	72	77	62
Flanking STC for Junction 2			44	46	53	59	68	73	58
Junction 3 (Rigid cross junction, 190 mm block separating wall / 203 mm precast hollow core ceiling slab 305 kg/m²)									
All values are the same as for Junction 1									
Flanking TL for Path Ff3	R_{F3f3}	ISO 15712-1 Eq 25b	43	49	58	63	71	79	61
Flanking TL for Path Fd3	R_{F3d}	ISO 15712-1 Eq 25b	46	51	58	64	72	79	62
Flanking TL for Path Df3	R_{Df3}	ISO 15712-1 Eq 25b	46	51	58	64	72	79	62
Flanking STC for Junction 3			44	45	53	59	67	74	57
Junction 4 (Rigid T-junction, 190 mm block separating wall / 190 mm block corridor wall)									
All of the input data is the same as for Junction 2, but different junctions at the ceiling and floor result in different loss factors than Junction 2.									
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.223	0.147	0.096	0.059	0.037	0.021	
TL in-situ for Element F4	$R_{F4,situ}$	ISO 15712-1 Eq. 19	36	39	45	51	59	63	50
TL in-situ for Element f4	$R_{f4,situ}$	ISO 15712-1 Eq. 19	36	39	45	51	59	63	50
Junction 4 - Coupling									
In-situ Velocity Level Difference for Ff	$D_{v,F4,f4,situ}$	ISO 15712-1 Eq. 21, 22	10.8	11.1	11.5	12.0	12.6	13.5	
In-situ Velocity Level Difference for Fd	$D_{v,F4,d,situ}$	ISO 15712-1 Eq. 21, 22	11.2	11.5	11.8	12.4	13.0	13.9	
In-situ Velocity Level Difference for Df	$D_{v,D,f4,situ}$	ISO 15712-1 Eq. 21, 22	11.2	11.5	11.8	12.4	13.0	13.9	
Flanking Transmssion Loss - Path Values									
Flanking TL for Path Ff4	R_{F4f4}	ISO 15712-1 Eq 25b	48	51	57	64	73	77	62
Flanking TL for Path Fd4	R_{F4d}	ISO 15712-1 Eq 25b	48	51	57	64	72	77	62
Flanking TL for Path Df4	R_{Df4}	ISO 15712-1 Eq 25b	48	51	57	64	72	77	62
Flanking STC for Junction 4			43	46	52	59	68	72	57
Total Flanking STC (combined transmssion for all of the flanking paths)			35	40	47	53	61	67	51
ASTC due to Direct plus Flanking Transmission		RR-335, Eq. 1.1	33	36	43	49	57	61	**47**

Example 4: **(Detailed Method)**

- **Rooms one-above-the-other**
- **Floors of precast concrete hollowcore slabs[2] with walls of normal weight concrete block walls with rigid junctions**

Separating wall assembly (loadbearing) with:
- Floor assembly of precast concrete hollowcore slabs[2] of cross-section 203 mm thick and 2440 mm wide, fully grouted at joints between adjacent slabs and with a mass per area of 305 kg/m².
- No topping, flooring or ceiling.

Junction 1, 3, 4: Cross-junction of separating floor / flanking wall with:
- One wythe of 190 mm hollow concrete block masonry[1] constructed using normal weight units not less than 53% solid, and with mass per area of 238 kg/m².
- No lining on the walls.
- Rigid mortared cross-junction with concrete block wall assembly.

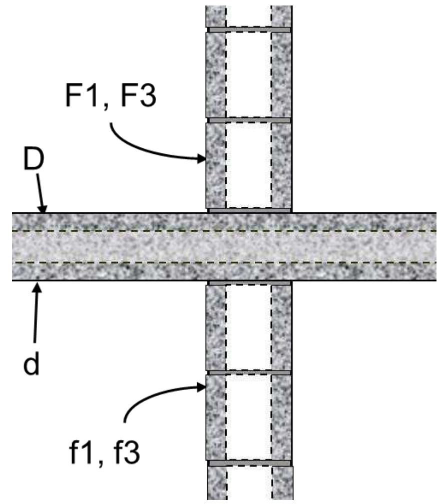
Junction 2: T-Junction of separating floor / flanking wall with:
- Abutting side wall and separating wall of hollow concrete block masonry[1] with a mass per area of 238 kg/m².
- No lining on the walls.
- Rigid mortared T-junctions

NOTE: The sound transmission would be essentially unchanged if the concrete hollowcore floor slabs were oriented perpendicular to the case illustrated.

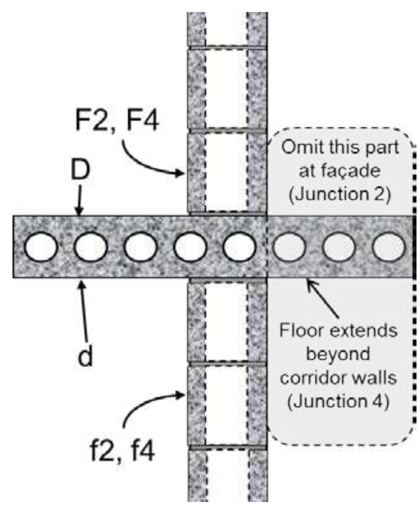
Acoustical Parameters

For the separating floor						
internal loss, η_i =	0.006	c_L =	3500			
mass (kg/m²) =	305	f_c =	160			
	Reference	K_{Ff}	$K_{Dd'}$	K_{Fd}	K_{Df}	$\Sigma l_k \alpha_k$
X-Junction 1, 3	ISO 15712-1, Eq. E.3	10.6	6.9	8.8	8.8	0.820
X-Junction 4	ISO 15712-1, Eq. E.3	10.6	6.9	8.8	8.8	0.656
T-Junction 2	ISO 15712-1, Eq. E.4	7.3	-	5.8	5.8	0.657
Total loss η_{tot}	ISO 15712-1, Eq. C.1	0.025	at 500 Hz			
For flanking elements F and f and Junctions 1 & 3						
internal loss, η_i =	0.015	c_L =	3500			
mass (kg/m²) =	238	f_c =	98	(Eq. C.2)		
Total loss η_{tot}	ISO 15712-1, Eq. C.1	0.043	at 500 Hz			
For flanking elements F and f and Junctions 2 & 4						
internal loss, η_i =	0.015	c_L =	3500			
mass (kg/m²) =	238	f_c =	98	(Eq. C.2)		
Total loss $\eta_{tot,2}$	ISO 15712-1, Eq. C.1	0.050	at 500 Hz			
Total loss $\eta_{tot,4}$	ISO 15712-1, Eq. C.1	0.046	at 500 Hz			

Illustration for this case



Cross-junction of a separating floor assembly of 203 mm thick precast concrete hollowcore slabs with 190 mm concrete block flanking walls. (Side view of Junctions 1 and 3)



T-Junction of a separating floor of 203 mm thick precast concrete hollowcore slabs with 190 mm concrete block walls. (Plan view of Junctions 2 and 4).

	ISO Symbol	Reference	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	ASTC
Separating Partition (203 mm precast hollow core floor 305 kg/m²)									
Sound Transmission Loss F1 or f1	$R_{D,lab}$	Measured A1-012467.2	38	46	52	60	65	72	56
Structural Reverberation Time lab	$T_{s,lab}$	Measured	0.283	0.192	0.129	0.085	0.055	0.034	
Change by Lining on Source Side	ΔR_D	No Lining	0	0	0	0	0	0	
Change by Lining on Receive Side	ΔR_d	No Lining	0	0	0	0	0	0	
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.383	0.267	0.176	0.116	0.073	0.046	
Leakage or Airborne Flanking		No leakage	0	0	0	0	0	0	
Direct TL in-situ	$R_{D,situ}$	ISO 15712-1, Eq. 24	37	44	51	58	64	71	55

(For the notes in this table please see the corresponding endnotes on page 26.)

Example 4	ISO Symbol	Reference	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	ASTC
Junction 1 (Rigid Cross junction, 203 mm precast hollow core floor 305 kg/m² / 190 mm block wall)									
Flanking Path Ff_1									
Sound Transmission Loss F1 or f1	$R_{F1,lab}$	RR-334, NRC-Mean BLK190(NW)	35	38	44	50	58	62	49
Structural Reverberation Time lab	$T_{s,lab}$	ISO 15712-1, Eq. C.5	0.299	0.191	0.119	0.072	0.042	0.024	
Change by Lining on Source Side	ΔR_{F1}	No Lining	0	0	0	0	0	0	
Change by Lining on Receive Side	ΔR_{f1}	No Lining	0	0	0	0	0	0	
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.238	0.157	0.102	0.063	0.038	0.022	
TL in-situ for Element F1	$R_{F1,situ}$	ISO 15712-1 Eq. 19	36	39	45	51	58	62	50
TL in-situ for Element f1	$R_{f1,situ}$	ISO 15712-1 Eq. 19	36	39	45	51	58	62	50
Junction 1 - Coupling									
In-situ Velocity Level Difference for Ff	$D_{v,F1,f1,situ}$	ISO 15712-1 Eq. 21, 22	13.4	13.7	14.0	14.7	15.3	16.2	
In-situ Velocity Level Difference for Fd	$D_{v,F1,d,situ}$	ISO 15712-1 Eq. 21, 22	11.5	11.7	12.0	12.5	13.1	13.8	
In-situ Velocity Level Difference for Df	$D_{v,D,f1,situ}$	ISO 15712-1 Eq. 21, 22	11.5	11.7	12.0	12.5	13.1	13.8	
Flanking Transmssion Loss - Path Values									
Flanking TL for Path Ff1	R_{F1f1}	ISO 15712-1 Eq. 25a	**51**	**55**	**61**	**68**	**75**	**80**	**66**
Flanking TL for Path Fd1	R_{F1d}	ISO 15712-1 Eq. 25a	**49**	**54**	**61**	**68**	**75**	**81**	**65**
Flanking TL for Path Df1	R_{Df1}	ISO 15712-1 Eq. 25a	**49**	**54**	**61**	**68**	**75**	**81**	**65**
Flanking STC for Junction 1			45	50	56	63	70	76	61
Junction 2 (Rigid T-junction, 203 mm precast hollow core floor 305 kg/m² / 190 mm block façade wall)									
Flanking Path Ff_2									
Transmission Loss Element F2	$R_{F2,lab}$	RR-334, NRC-Mean BLK190(NW)	35	38	44	50	58	62	49
Structural Reverberation Time lab	$T_{s,lab}$	ISO 15712-1, Eq. C.5	0.299	0.191	0.119	0.072	0.042	0.024	
Change by Lining on Source Side	ΔR_{F2}	No Lining	0	0	0	0	0	0	
Change by Lining on Receive Side	ΔR_{f2}	No Lining	0	0	0	0	0	0	
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.202	0.135	0.088	0.056	0.034	0.020	
TL in-situ for Element F2	$R_{F2,situ}$	ISO 15712-1 Eq. 19	37	39	45	51	59	63	50
TL in-situ for Element f2	$R_{f2,situ}$	ISO 15712-1 Eq. 19	37	39	45	51	59	63	50
Junction 2 - Coupling									
In-situ Velocity Level Difference for Ff	$D_{v,F2,f2,situ}$	ISO 15712-1 Eq. 21, 22	10.8	11.0	11.4	11.8	12.4	13.2	
In-situ Velocity Level Difference for Fd	$D_{v,F2,d,situ}$	ISO 15712-1 Eq. 21, 22	9.4	9.5	9.9	10.2	10.8	11.4	
In-situ Velocity Level Difference for Df	$D_{v,D,f2,situ}$	ISO 15712-1 Eq. 21, 22	9.4	9.5	9.9	10.2	10.8	11.4	
Flanking Transmssion Loss - Path Values									
Flanking TL for Path Ff2	R_{F2f2}	ISO 15712-1 Eq. 25a	51	53	59	66	75	79	64
Flanking TL for Path Fd2	R_{F2d}	ISO 15712-1 Eq. 25a	48	53	59	66	74	80	64
Flanking TL for Path Df2	R_{Df2}	ISO 15712-1 Eq. 25a	48	53	59	66	74	80	64
Flanking STC for Junction 2			44	48	55	61	69	75	59
Junction 3 (Rigid Cross junction, 203 mm precast hollow core floor 305 kg/m² / 190 mm block wall)									
All values are the same as for Junction 1									
Flanking STC for Junction 3			45	50	56	63	70	76	61
Junction 4 (Rigid Cross junction, 203 mm precast hollow core floor 305 kg/m² / 190 mm block corridor wall)									
All of the input data is the same as for Junction 2, but different junctions at the ceiling and floor result in different loss factors than Junction 2.									
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.223	0.147	0.096	0.059	0.037	0.021	
TL in-situ for Element F4	$R_{F4,situ}$	ISO 15712-1 Eq. 19	36	39	45	51	59	63	50
TL in-situ for Element f4	$R_{f4,situ}$	ISO 15712-1 Eq. 19	36	39	45	51	59	63	50
Junction 4 - Coupling									
In-situ Velocity Level Difference for Ff	$D_{v,F4,f4,situ}$	ISO 15712-1 Eq. 21, 22	13.7	14.0	14.3	14.9	15.5	16.4	
In-situ Velocity Level Difference for Fd	$D_{v,F4,d,situ}$	ISO 15712-1 Eq. 21, 22	12.2	12.4	12.7	13.1	13.7	14.4	
In-situ Velocity Level Difference for Df	$D_{v,D,f4,situ}$	ISO 15712-1 Eq. 21, 22	12.2	12.4	12.7	13.1	13.7	14.4	
Flanking Transmssion Loss - Path Values									
Flanking TL for Path Ff4	R_{F4f4}	ISO 15712-1 Eq 25b	53	56	62	69	78	82	67
Flanking TL for Path Fd4	R_{F4d}	ISO 15712-1 Eq 25b	50	56	62	69	77	83	66
Flanking TL for Path Df4	R_{Df4}	ISO 15712-1 Eq 25b	50	56	62	69	77	83	66
Flanking STC for Junction 4			46	51	57	64	72	78	62
Total Flanking STC (combined transmssion for all of the flanking paths)			39	43	50	57	64	70	54
ASTC due to Direct plus Flanking Transmission		RR-335, Eq. 1.1	35	41	47	54	61	67	**51**

Horizontal Room Pair - 203 mm Concrete Hollowcore Floor 305 kg/m^2 - Underlayment Topping

Example 5: **(Detailed Method)**

- **Rooms side-by-side**
- **Floors of precast concrete hollowcore slabs[2] with walls of normal weight concrete block walls with rigid junctions**

Separating wall assembly (loadbearing) with:

- One wythe of 190 mm hollow concrete block masonry[1] constructed using normal weight units not less than 53% solid, and with mass per area of 238 kg/m^2. No lining on the wall.

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

- Floor assembly of concrete hollowcore precast slabs[2] of cross-section 203 mm thick and 2440 mm wide, fully grouted at joints between adjacent slabs and with a mass per area of 305 kg/m^2.
- Topping of 25.4 mm (1") underlayment poured directly on the slabs.
- Rigid mortared cross-junction with concrete block wall assembly.

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

- Abutting side wall and separating wall of hollow concrete block masonry[1] with a mass per area of 238 kg/m^2. No lining.
- Rigid mortared T-junctions

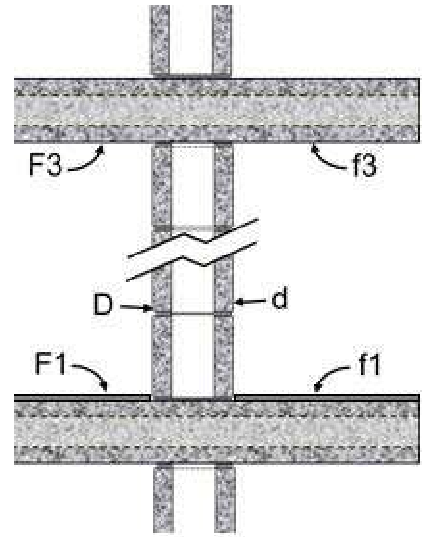
Junction 3: Top Junction (separating wall / ceiling) with:

- Ceiling assembly of concrete hollowcore precast slabs2 of cross-section 203 mm thick and 2440 mm wide, fully grouted at joints between adjacent slabs, with mass per area of 305 kg/m2.
- No added ceiling lining
- Rigid mortared cross-junction with concrete block wall assembly

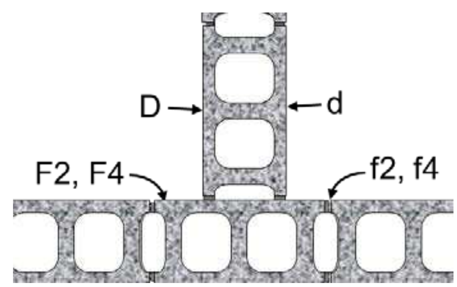
Acoustical Parameters

For the separating wall:						
internal loss, η_i =	0.015	c_L =	3500			
mass (kg/m^2) =	238	f_c =	98	(Eq. C.2)		
	Reference	K_{Ff}	$K_{Dd'}$	K_{Fd}	K_{Df}	$\Sigma l_k \alpha_k$
X-Junction 1 or 3	ISO 15712-1, Eq. E.3	6.9	10.6	8.8	8.8	0.602
T-Junction 2 or 4	ISO 15712-1, Eq. E.4	5.7	-	5.7	5.7	0.420
Total loss η_{tot}	ISO 15712-1, Eq. C.1	0.042	at 500 Hz			
For flanking elements F and f and Junctions 1 & 3						
internal loss, η_i =	0.006	c_L =	3500			
mass (kg/m^2) =	305	f_c =	125	(Eq. C.2)		
Total loss η_{tot}	ISO 15712-1, Eq. C.1	0.026	at 500 Hz			
For flanking elements F and f and Junctions 2 & 4						
internal loss, η_i =	0.015	c_L =	3500			
mass (kg/m^2) =	238	f_c =	98	(Eq. C.2)		
Total loss $\eta_{tot,2}$	ISO 15712-1, Eq. C.1	0.048	at 500 Hz			
Total loss $\eta_{tot,4}$	ISO 15712-1, Eq. C.1	0.044	at 500 Hz			

Illustration for this case



Junction of a 190 mm concrete block separating wall with a floor and ceiling of 203 mm thick precast concrete hollowcore slabs. (Side view of Junctions 1 and 3)



Junction of the separating wall with a side wall, both of 190 mm concrete block. (Plan view of Junctions 2 and 4).

	ISO Symbol	Reference	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	ASTC
Separating Partition (190 mm concrete block wall)									
Sound Transmission Loss	$R_{D,lab}$	RR-334, NRC-Mean BLK190(NW)	35	38	44	50	58	62	49
Structural Reverberation Time lab	$T_{s,lab}$	ISO 15712-1, Eq. C.5	0.299	0.191	0.119	0.072	0.042	0.024	
Change by Lining on D	ΔR_D	No Lining	0	0	0	0	0	0	
Change by Lining on d	ΔR_d	No Lining	0	0	0	0	0	0	
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.248	0.163	0.105	0.065	0.039	0.023	
Leakage or Airborne Flanking		Sealed & Blocked	0	0	0	0	0	0	
Direct TL in-situ	$R_{D,situ}$	ISO 15712-1, Eq. 24	36	39	45	51	58	62	50

(For the notes in this table please see the corresponding endnotes on page 26.)

Example 5	ISO Symbol	Reference	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	ASTC
Junction 1 (Rigid cross junction, 190 mm block separating wall / 203 mm precast hollow core floor 305 kg/m²)									
Sound Transmission Loss F1 or f1	$R_{F1,lab}$	Measured A1-012467.2	36	43	51	57	63	71	54
Structural Reverberation Time lab	$T_{s,lab}$	Measured	0.283	0.192	0.129	0.085	0.055	0.034	
Change by Lining on F1	ΔR_{F1}	25.4 mm Underlayment	2	0	1	4	4	3	
Change by Lining on f1	ΔR_{f1}	25.4 mm Underlayment	2	0	1	4	4	3	
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.359	0.251	0.169	0.110	0.069	0.042	
TL in-situ for Element F1	$R_{F1,situ}$	ISO 15712-1 Eq. 19	35	41	50	56	62	70	53
TL in-situ for Element f1	$R_{f1,situ}$	ISO 15712-1 Eq. 19	35	41	50	56	62	70	53
Junction 1 - Coupling									
In-situ Velocity Level Difference for Ff	$D_{v,F1,f1,situ}$	ISO 15712-1 Eq. 21, 22	10.0	10.0	10.2	10.6	11.1	11.7	
In-situ Velocity Level Difference for Fd	$D_{v,F1,d,situ}$	ISO 15712-1 Eq. 21, 22	11.6	11.8	12.1	12.6	13.2	13.9	
In-situ Velocity Level Difference for Df	$D_{v,D,f1,situ}$	ISO 15712-1 Eq. 21, 22	11.6	11.8	12.1	12.6	13.2	13.9	
Flanking Transmssion Loss - Path Values									
Flanking TL for Path Ff1	R_{F1f1}	ISO 15712-1 Eq. 25a	47	50	60	72	79	85	63
Flanking TL for Path Fd1	R_{F1d}	ISO 15712-1 Eq. 25a	48	51	59	68	76	82	63
Flanking TL for Path Df1	R_{Df1}	ISO 15712-1 Eq. 25a	48	51	59	68	76	82	63
Flanking STC for Junction 1			43	46	55	64	72	78	58
Junction 2 (Rigid T-Junction, 190 mm block separating wall / 190 mm block facade wall)									
Transmission Loss Element F2	$R_{F2,lab}$	RR-334, NRC-Mean BLK190(NW)	35	38	44	50	58	62	49
Structural Reverberation Time lab	$T_{s,lab}$	ISO 15712-1 Eq. C5	0.299	0.191	0.119	0.072	0.042	0.024	
Change by Lining on F2	ΔR_{F2}	No Lining	0	0	0	0	0	0	
Change by Lining on f2	ΔR_{f2}	No Lining	0	0	0	0	0	0	
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.210	0.140	0.092	0.058	0.035	0.021	
TL in-situ for Element F2	$R_{F2,situ}$	ISO 15712-1 Eq. 19	37	39	45	51	59	63	50
TL in-situ for Element f2	$R_{f2,situ}$	ISO 15712-1 Eq. 19	37	39	45	51	59	63	50
Junction 2 - Coupling									
In-situ Velocity Level Difference for Ff	$D_{v,F2,f2,situ}$	ISO 15712-1 Eq. 21, 22	11.1	11.3	11.7	12.1	12.8	13.5	
In-situ Velocity Level Difference for Fd	$D_{v,F2,d,situ}$	ISO 15712-1 Eq. 21, 22	11.2	11.5	11.9	12.4	13.0	13.8	
In-situ Velocity Level Difference for Df	$D_{v,D,f2,situ}$	ISO 15712-1 Eq. 21, 22	11.2	11.5	11.9	12.4	13.0	13.8	
Flanking Transmssion Loss - Path Values									
Flanking TL for Path Ff2	R_{F2f2}	ISO 15712-1 Eq. 25a	49	51	58	64	73	77	62
Flanking TL for Path Fd2	R_{F2d}	ISO 15712-1 Eq. 25a	48	51	57	64	72	77	62
Flanking TL for Path Df2	R_{Df2}	ISO 15712-1 Eq. 25a	48	51	57	64	72	77	62
Flanking STC for Junction 2			44	46	53	59	68	72	57
Junction 3 (Rigid cross junction, 190 mm block separating wall / 203 mm precast hollow core ceiling slab 305 kg/m²)									
All values are the same as for Junction 1 except the topping									
Flanking TL for Path Ff3	R_{F3f3}	ISO 15712-1 Eq 25b	43	49	58	65	71	80	61
Flanking TL for Path Fd3	R_{F3d}	ISO 15712-1 Eq 25b	46	51	58	65	72	79	62
Flanking TL for Path Df3	R_{Df3}	ISO 15712-1 Eq 25b	46	51	58	65	72	79	62
Flanking STC for Junction 3			44	45	53	60	67	75	57
Junction 4 (Rigid T-junction, 190 mm block separating wall / 190 mm block corridor wall)									
All of the input data is the same as for Junction 2, but different junctions at the ceiling and floor result in different loss factors than Junction 2.									
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.232	0.154	0.100	0.061	0.038	0.022	
TL in-situ for Element F4	$R_{F4,situ}$	ISO 15712-1 Eq. 19	36	39	45	51	58	62	50
TL in-situ for Element f4	$R_{f4,situ}$	ISO 15712-1 Eq. 19	36	39	45	51	58	62	50
Junction 4 - Coupling									
In-situ Velocity Level Difference for Ff	$D_{v,F4,f4,situ}$	ISO 15712-1 Eq. 21, 22	10.6	10.9	11.3	11.9	12.5	13.3	
In-situ Velocity Level Difference for Fd	$D_{v,F4,d,situ}$	ISO 15712-1 Eq. 21, 22	11.0	11.3	11.7	12.3	12.9	13.7	
In-situ Velocity Level Difference for Df	$D_{v,D,f4,situ}$	ISO 15712-1 Eq. 21, 22	11.0	11.3	11.7	12.3	12.9	13.7	
Flanking Transmssion Loss - Path Values									
Flanking TL for Path Ff4	R_{F4f4}	ISO 15712-1 Eq 25b	48	51	57	64	71	76	62
Flanking TL for Path Fd4	R_{F4d}	ISO 15712-1 Eq 25b	47	51	57	64	72	76	62
Flanking TL for Path Df4	R_{Df4}	ISO 15712-1 Eq 25b	47	51	57	64	72	76	62
Flanking STC for Junction 4			43	46	52	59	67	71	57
Total Flanking STC (combined transmssion for all of the flanking paths)			36	40	47	54	62	67	51
ASTC due to Direct plus Flanking Transmission		RR-335, Eq. 1.1	33	36	43	49	57	61	**47**

Vertical Room Pair - 203 mm Precast Hollowcore Floor 305 kg/m² - Underlayment Topping

Example 6: **(Detailed Method)**

- **Rooms one-above-the-other**
- **Floors of precast concrete hollowcore slabs[2] with walls of normal weight concrete block walls with rigid junctions**

Separating wall assembly (loadbearing) with:

- Floor assembly of precast concrete hollowcore slabs[2] of cross-section 203 mm thick and 2440 mm wide, fully grouted at joints between adjacent slabs and with a mass per area of 305 kg/m².
- Topping of 25.4 mm (1") underlayment poured directly on the slabs.

Junction 1, 3, 4: Cross-junction of separating floor / flanking wall with:

- One wythe of 190 mm hollow concrete block masonry[1] constructed using normal weight units not less than 53% solid, and with mass per area of 238 kg/m2.
- No lining on the walls.
- Rigid mortared cross-junction with concrete block wall assembly.

Junction 2: T-Junction of separating floor / flanking wall with:

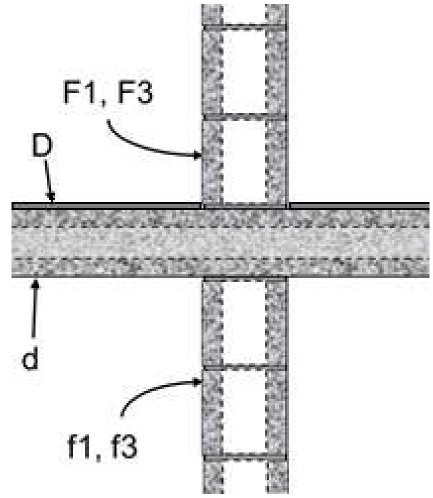
- Abutting side wall and separating wall of hollow concrete block masonry[1] with a mass per area of 238 kg/m².
- No lining on the walls.
- Rigid mortared T-junctions

NOTE: The sound transmission would be essentially unchanged if the concrete hollowcore floor slabs were oriented perpendicular to the case illustrated.

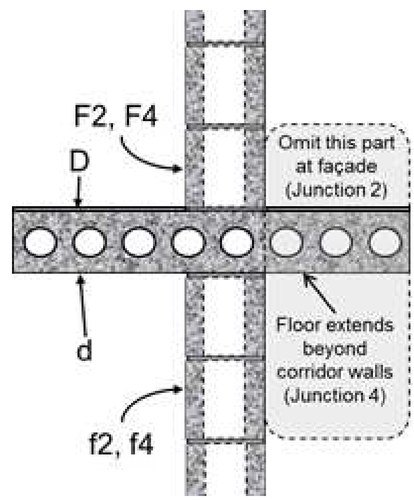
Acoustical Parameters

For the separating floor						
internal loss, η_i =	0.006	c_L =	3500			
mass (kg/m²) =	305	f_c =	125	(Eq. C.2)		
	Reference	K_{Ff}	$K_{Dd'}$	K_{Fd}	K_{Df}	$\Sigma l_k \alpha_k$
X-Junction 1, 3	ISO 15712-1, Eq. E.3	10.6	6.9	8.8	8.8	0.773
X-Junction 4	ISO 15712-1, Eq. E.3	10.6	6.9	8.8	8.8	0.618
T-Junction 2	ISO 15712-1, Eq. E.4	7.3	-	5.8	5.8	0.657
Total loss η_{tot}	ISO 15712-1, Eq. C.1	0.026	at 500 Hz			
For flanking elements F and f and Junctions 1 & 3						
internal loss, η_i =	0.015	c_L =	3500			
mass (kg/m²) =	238	f_c =	98	(Eq. C.2)		
Total loss η_{tot}	ISO 15712-1, Eq. C.1	0.042	at 500 Hz			
For flanking elements F and f and Junctions 2 & 4						
internal loss, η_i =	0.015	c_L =	3500			
mass (kg/m²) =	238	f_c =	98	(Eq. C.2)		
Total loss $\eta_{tot,2}$	ISO 15712-1, Eq. C.1	0.048	at 500 Hz			
Total loss $\eta_{tot,4}$	ISO 15712-1, Eq. C.1	0.044	at 500 Hz			

Illustration for this case



Cross-junction of a separating floor assembly of 203 mm thick precast concrete hollowcore slabs with 190 mm concrete block flanking walls. (Side view of Junctions 1 and 3)



T-Junction of a separating floor of 203 mm thick precast concrete hollowcore slabs with 190 mm concrete block walls. (Plan view of Junctions 2 and 4).

	ISO Symbol	Reference	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	ASTC
Separating Partition (203 mm precast hollow core floor 305 kg/m²)									
Sound Transmission Loss F1 or f1	$R_{D,lab}$	Measured A1-012467.2	38	46	52	60	65	72	56
Structural Reverberation Time lab	$T_{s,lab}$	Measured	0.283	0.192	0.129	0.085	0.055	0.034	
Change by Lining on Source Side	ΔR_D	25.4 mm Underlayment	2	0	1	4	4	3	
Change by Lining on Receive Side	ΔR_d	No Lining	0	0	0	0	0	0	
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.359	0.251	0.169	0.110	0.069	0.042	
Leakage or Airborne Flanking		No leakage	0	0	0	0	0	0	
Direct TL in-situ	$R_{D,situ}$	ISO 15712-1, Eq. 24	39	45	52	62	68	74	56

(For the notes in this table please see the corresponding endnotes on page 26.)

Example 6	ISO Symbol	Reference	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	ASTC
Junction 1 (Rigid Cross junction, 203 mm precast hollow core floor 305 kg/m² / 190 mm block wall)									
Flanking Path Ff_1									
Sound Transmission Loss F1 or f1	$R_{F1,lab}$	RR-334, NRC-Mean BLK190(NW)	35	38	44	50	58	62	49
Structural Reverberation Time lab	$T_{s,lab}$	ISO 15712-1, Eq. C.5	0.299	0.191	0.119	0.072	0.042	0.024	
Change by Lining on Source Side	ΔR_{F1}	No Lining	0	0	0	0	0	0	
Change by Lining on Receive Side	ΔR_{f1}	No Lining	0	0	0	0	0	0	
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.248	0.163	0.105	0.065	0.039	0.023	
TL in-situ for Element F1	$R_{F1,situ}$	ISO 15712-1 Eq. 19	36	39	45	50	58	62	50
TL in-situ for Element f1	$R_{f1,situ}$	ISO 15712-1 Eq. 19	36	39	45	50	58	62	50
Junction 1 - Coupling									
In-situ Velocity Level Difference for Ff	$D_{v,F1,f1,situ}$	ISO 15712-1 Eq. 21, 22	13.2	13.5	13.9	14.5	15.2	16.0	
In-situ Velocity Level Difference for Fd	$D_{v,F1,d,situ}$	ISO 15712-1 Eq. 21, 22	11.6	11.8	12.1	12.6	13.2	13.9	
In-situ Velocity Level Difference for Df	$D_{v,D,f1,situ}$	ISO 15712-1 Eq. 21, 22	11.6	11.8	12.1	12.6	13.2	13.9	
Flanking Transmssion Loss - Path Values									
Flanking TL for Path Ff1	R_{F1f1}	ISO 15712-1 Eq. 25a	**51**	**55**	**61**	**67**	**75**	**80**	**66**
Flanking TL for Path Fd1	R_{F1d}	ISO 15712-1 Eq. 25a	**49**	**55**	**61**	**68**	**75**	**81**	**65**
Flanking TL for Path Df1	R_{Df1}	ISO 15712-1 Eq. 25a	**49**	**55**	**61**	**68**	**75**	**81**	**65**
Flanking STC for Junction 1			45	50	56	63	70	76	61
Junction 2 (Rigid T-junction, 203 mm precast hollow core floor 305 kg/m² / 190 mm block façade wall)									
Flanking Path Ff_2									
Transmission Loss Element F2	$R_{F2,lab}$	RR-334, NRC-Mean BLK190(NW)	35	38	44	50	58	62	49
Structural Reverberation Time lab	$T_{s,lab}$	ISO 15712-1, Eq. C.5	0.299	0.191	0.119	0.072	0.042	0.024	
Change by Lining on Source Side	ΔR_{F2}	No Lining	0	0	0	0	0	0	
Change by Lining on Receive Side	ΔR_{f2}	No Lining	0	0	0	0	0	0	
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.210	0.140	0.092	0.058	0.035	0.021	
TL in-situ for Element F2	$R_{F2,situ}$	ISO 15712-1 Eq. 19	37	39	45	51	59	63	50
TL in-situ for Element f2	$R_{f2,situ}$	ISO 15712-1 Eq. 19	37	39	45	51	59	63	50
Junction 2 - Coupling									
In-situ Velocity Level Difference for Ff	$D_{v,F2,f2,situ}$	ISO 15712-1 Eq. 21, 22	10.6	10.9	11.2	11.7	12.3	13.1	
In-situ Velocity Level Difference for Fd	$D_{v,F2,d,situ}$	ISO 15712-1 Eq. 21, 22	9.4	9.6	9.9	10.3	10.9	11.5	
In-situ Velocity Level Difference for Df	$D_{v,D,f2,situ}$	ISO 15712-1 Eq. 21, 22	9.4	9.6	9.9	10.3	10.9	11.5	
Flanking Transmssion Loss - Path Values									
Flanking TL for Path Ff2	R_{F2f2}	ISO 15712-1 Eq. 25a	51	53	59	66	74	79	64
Flanking TL for Path Fd2	R_{F2d}	ISO 15712-1 Eq. 25a	48	53	59	67	74	80	64
Flanking TL for Path Df2	R_{Df2}	ISO 15712-1 Eq. 25a	48	53	59	67	74	80	64
Flanking STC for Junction 2			44	48	55	61	69	75	59
Junction 3 (Rigid Cross junction, 203 mm precast hollow core floor 305 kg/m² / 190 mm block wall)									
All values are the same as for Junction 1									
Flanking STC for Junction 3			45	50	56	63	70	76	61
Junction 4 (Rigid Cross junction, 203 mm precast hollow core floor 305 kg/m² / 190 mm block corridor wall)									
All of the input data is the same as for Junction 2, but different junctions at the ceiling and floor result in different loss factors than Junction 2.									
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.232	0.154	0.100	0.061	0.038	0.022	
TL in-situ for Element F4	$R_{F4,situ}$	ISO 15712-1 Eq. 19	36	39	45	51	58	62	50
TL in-situ for Element f4	$R_{f4,situ}$	ISO 15712-1 Eq. 19	36	39	45	51	58	62	50
Junction 4 - Coupling									
In-situ Velocity Level Difference for Ff	$D_{v,F4,f4,situ}$	ISO 15712-1 Eq. 21, 22	13.5	13.8	14.1	14.8	15.3	16.2	
In-situ Velocity Level Difference for Fd	$D_{v,F4,d,situ}$	ISO 15712-1 Eq. 21, 22	12.2	12.4	12.7	13.2	13.7	14.4	
In-situ Velocity Level Difference for Df	$D_{v,D,f4,situ}$	ISO 15712-1 Eq. 21, 22	12.2	12.4	12.7	13.2	13.7	14.4	
Flanking Transmssion Loss - Path Values									
Flanking TL for Path Ff4	R_{F4f4}	ISO 15712-1 Eq 25b	53	56	62	69	76	81	67
Flanking TL for Path Fd4	R_{F4d}	ISO 15712-1 Eq 25b	50	56	62	69	76	82	66
Flanking TL for Path Df4	R_{Df4}	ISO 15712-1 Eq 25b	50	56	62	69	76	82	66
Flanking STC for Junction 4			46	51	57	64	71	77	62
Total Flanking STC (combined transmssion for all of the flanking paths)			39	43	50	57	64	70	54
ASTC due to Direct plus Flanking Transmission		RR-335, Eq. 1.1	36	41	48	56	63	68	**52**

Example 7: **(Detailed Method)**

- **Rooms side-by-side**
- **Floors of precast concrete hollowcore slabs[2] with walls of normal weight concrete block walls with rigid junctions**

Separating wall assembly (loadbearing) with:
- One wythe of 190 mm hollow concrete block masonry[1] constructed using normal weight units not less than 53% solid, and with mass per area of 238 kg/m^2. No lining on the wall.

Junction 1: Bottom Junction (separating wall / floor) with:
- Floor assembly of precast concrete hollowcore slabs[2] of cross-section 203 mm thick and 2440 mm wide, fully grouted at joints between adjacent slabs and with a mass per area of 305 kg/m^2.
- Topping of 25.4 mm (1") underlayment poured directly on the slabs and 6 mm (1/4") carpet on an 8 mm (5/16") underpad.
- Rigid mortared cross-junction with concrete block wall assembly.

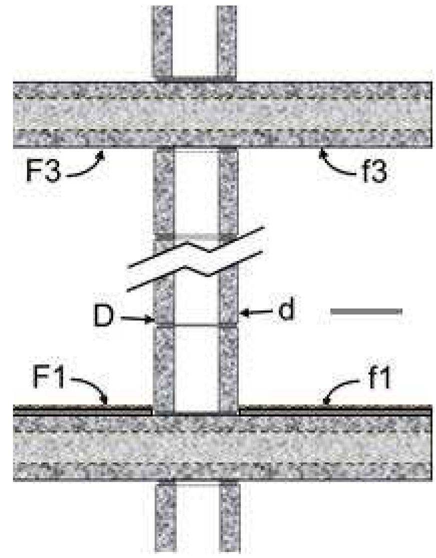
Junction 2 or 4: Each Side (separating wall /abutting side wall) with:
- Abutting side wall and separating wall of hollow concrete block masonry[1] with a mass per area of 238 kg/m^2. No lining.
- Rigid mortared T-junctions

Junction 3: Top Junction (separating wall / ceiling) with:
- Ceiling assembly of precast concrete hollowcore slabs[2] of cross-section 203 mm thick and 2440 mm wide, fully grouted at joints between adjacent slabs, with mass per area of 305 kg/m^2.
- No added ceiling lining
- Rigid mortared cross-junction with concrete block wall assembly

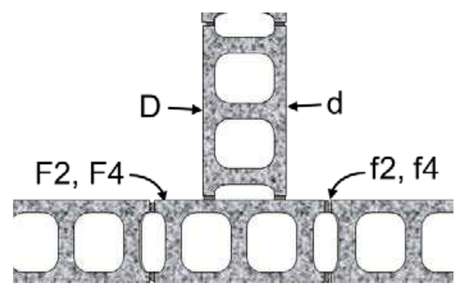
Acoustical Parameters

For the separating wall:						
internal loss, η_i =	0.015	c_L =	3500			
mass (kg/m^2) =	238	f_c =	98	(Eq. C.2)		
	Reference	K_{Ff}	$K_{Dd'}$	K_{Fd}	K_{Df}	$\Sigma l_k \alpha_k$
X-Junction 1 or 3	ISO 15712-1, Eq. E.3	6.9	10.6	8.8	8.8	0.602
T-Junction 2 or 4	ISO 15712-1, Eq. E.4	5.7	-	5.7	5.7	0.420
Total loss η_{tot}	ISO 15712-1, Eq. C.1	0.042	at 500 Hz			
For flanking elements F and f and Junctions 1 & 3						
internal loss, η_i =	0.006	c_L =	3500			
mass (kg/m^2) =	305	f_c =	125	(Eq. C.2)		
Total loss η_{tot}	ISO 15712-1, Eq. C.1	0.026	at 500 Hz			
For flanking elements F and f and Junctions 2 & 4						
internal loss, η_i =	0.015	c_L =	3500			
mass (kg/m^2) =	238	f_c =	98	(Eq. C.2)		
Total loss $\eta_{tot,2}$	ISO 15712-1, Eq. C.1	0.048	at 500 Hz			
Total loss $\eta_{tot,4}$	ISO 15712-1, Eq. C.1	0.044	at 500 Hz			

Illustration for this case



Junction of a 190 mm concrete block separating wall with a floor and ceiling of 203 mm thick precast concrete hollowcore slabs. (Side view of Junctions 1 and 3)



Junction of the separating wall with a side wall, both of 190 mm concrete block. (Plan view of Junctions 2 and 4).

	ISO Symbol	Reference	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	ASTC
Separating Partition (190 mm concrete block wall)									
Sound Transmission Loss	$R_{D,lab}$	RR-334, NRC-Mean BLK190(NW)	35	38	44	50	58	62	49
Structural Reverberation Time lab	$T_{s,lab}$	ISO 15712-1, Eq. C.5	0.299	0.191	0.119	0.072	0.042	0.024	
Change by Lining on D	ΔR_D	No Lining	0	0	0	0	0	0	
Change by Lining on d	ΔR_d	No Lining	0	0	0	0	0	0	
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.248	0.163	0.105	0.065	0.039	0.023	
Leakage or Airborne Flanking		Sealed & Blocked	0	0	0	0	0	0	
Direct TL in-situ	$R_{D,situ}$	ISO 15712-1, Eq. 24	36	39	45	51	58	62	50

(For the notes in this table please see the corresponding endnotes on page 26.)

Example 7	ISO Symbol	Reference	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	ASTC
Junction 1 (Rigid cross junction, 190 mm block separating wall / 203 mm precast hollow core floor 305 kg/m²)									
Sound Transmission Loss F1 or f1	$R_{F1,lab}$	Measured A1-012467.2	36	43	51	57	63	71	54
Structural Reverberation Time lab	$T_{s,lab}$	Measured	0.283	0.192	0.129	0.085	0.055	0.034	
Change by Lining on F1	ΔR_{F1}	Underlayment & Carpet	1	0	1	5	10	8	
Change by Lining on f1	ΔR_{f1}	Underlayment & Carpet	1	0	1	5	10	8	
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.359	0.251	0.169	0.110	0.069	0.042	
TL in-situ for Element F1	$R_{F1,situ}$	ISO 15712-1 Eq. 19	35	41	50	56	62	70	53
TL in-situ for Element f1	$R_{f1,situ}$	ISO 15712-1 Eq. 19	35	41	50	56	62	70	53
Junction 1 - Coupling									
In-situ Velocity Level Difference for Ff	$D_{v,F1,f1,situ}$	ISO 15712-1 Eq. 21, 22	10.0	10.0	10.2	10.6	11.1	11.7	
In-situ Velocity Level Difference for Fd	$D_{v,F1,d,situ}$	ISO 15712-1 Eq. 21, 22	11.6	11.8	12.1	12.6	13.2	13.9	
In-situ Velocity Level Difference for Df	$D_{v,D,f1,situ}$	ISO 15712-1 Eq. 21, 22	11.6	11.8	12.1	12.6	13.2	13.9	
Flanking Transmssion Loss - Path Values									
Flanking TL for Path Ff1	R_{F1f1}	ISO 15712-1 Eq. 25a	45	49	61	75	91	96	62
Flanking TL for Path Fd1	R_{F1d}	ISO 15712-1 Eq. 25a	47	50	60	70	82	87	63
Flanking TL for Path Df1	R_{Df1}	ISO 15712-1 Eq. 25a	47	50	60	70	82	87	63
Flanking STC for Junction 1			42	45	56	66	79	84	58
Junction 2 (Rigid T-Junction, 190 mm block separating wall / 190 mm block facade wall)									
Transmission Loss Element F2	$R_{F2,lab}$	RR-334, NRC-Mean BLK190(NW)	35	38	44	50	58	62	49
Structural Reverberation Time lab	$T_{s,lab}$	ISO 15712-1 Eq. C5	0.299	0.191	0.119	0.072	0.042	0.024	
Change by Lining on F2	ΔR_{F2}	No Lining	0	0	0	0	0	0	
Change by Lining on f2	ΔR_{f2}	No Lining	0	0	0	0	0	0	
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.210	0.140	0.092	0.058	0.035	0.021	
TL in-situ for Element F2	$R_{F2,situ}$	ISO 15712-1 Eq. 19	37	39	45	51	59	63	50
TL in-situ for Element f2	$R_{f2,situ}$	ISO 15712-1 Eq. 19	37	39	45	51	59	63	50
Junction 2 - Coupling									
In-situ Velocity Level Difference for Ff	$D_{v,F2,f2,situ}$	ISO 15712-1 Eq. 21, 22	11.1	11.3	11.7	12.1	12.8	13.5	
In-situ Velocity Level Difference for Fd	$D_{v,F2,d,situ}$	ISO 15712-1 Eq. 21, 22	11.2	11.5	11.9	12.4	13.0	13.8	
In-situ Velocity Level Difference for Df	$D_{v,D,f2,situ}$	ISO 15712-1 Eq. 21, 22	11.2	11.5	11.9	12.4	13.0	13.8	
Flanking Transmssion Loss - Path Values									
Flanking TL for Path Ff2	R_{F2f2}	ISO 15712-1 Eq. 25a	49	51	58	64	73	77	62
Flanking TL for Path Fd2	R_{F2d}	ISO 15712-1 Eq. 25a	48	51	57	64	72	77	62
Flanking TL for Path Df2	R_{Df2}	ISO 15712-1 Eq. 25a	48	51	57	64	72	77	62
Flanking STC for Junction 2			44	46	53	59	68	72	57
Junction 3 (Rigid cross junction, 190 mm block separating wall / 203 mm precast hollow core ceiling slab 305 kg/m²)									
All values are the same as for Junction 1									
Flanking TL for Path Ff3	R_{F3f3}	ISO 15712-1 Eq 25b	43	49	58	65	71	80	61
Flanking TL for Path Fd3	R_{F3d}	ISO 15712-1 Eq 25b	46	51	58	65	72	79	62
Flanking TL for Path Df3	R_{Df3}	ISO 15712-1 Eq 25b	46	51	58	65	72	79	62
Flanking STC for Junction 3			44	45	53	60	67	75	57
Junction 4 (Rigid T-junction, 190 mm block separating wall / 190 mm block corridor wall)									
All of the input data is the same as for Junction 2, but different junctions at the ceiling and floor result in different loss factors than Junction 2.									
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.232	0.154	0.100	0.061	0.038	0.022	
TL in-situ for Element F4	$R_{F4,situ}$	ISO 15712-1 Eq. 19	36	39	45	51	58	62	50
TL in-situ for Element f4	$R_{f4,situ}$	ISO 15712-1 Eq. 19	36	39	45	51	58	62	50
Junction 4 - Coupling									
In-situ Velocity Level Difference for Ff	$D_{v,F4,f4,situ}$	ISO 15712-1 Eq. 21, 22	10.6	10.9	11.3	11.9	12.5	13.3	
In-situ Velocity Level Difference for Fd	$D_{v,F4,d,situ}$	ISO 15712-1 Eq. 21, 22	11.0	11.3	11.7	12.3	12.9	13.7	
In-situ Velocity Level Difference for Df	$D_{v,D,f4,situ}$	ISO 15712-1 Eq. 21, 22	11.0	11.3	11.7	12.3	12.9	13.7	
Flanking Transmssion Loss - Path Values									
Flanking TL for Path Ff4	R_{F4f4}	ISO 15712-1 Eq 25b	48	51	57	64	71	76	62
Flanking TL for Path Fd4	R_{F4d}	ISO 15712-1 Eq 25b	47	51	57	64	72	76	62
Flanking TL for Path Df4	R_{Df4}	ISO 15712-1 Eq 25b	47	51	57	64	72	76	62
Flanking STC for Junction 4			43	46	52	59	67	71	57
Total Flanking STC (combined transmssion for all of the flanking paths)			36	40	47	54	62	68	51
ASTC due to Direct plus Flanking Transmission		RR-335, Eq. 1.1	33	36	43	49	57	61	**47**

Example 8: **(Detailed Method)**

- **Rooms one-above-the-other**
- **Floors of precast concrete hollowcore slabs[2] with walls of normal weight concrete block walls with rigid junctions**

Separating wall assembly (loadbearing) with:

- Floor assembly of precast concrete hollowcore slabs[2] of cross-section 203 mm thick and 2440 mm wide, fully grouted at joints between adjacent slabs and with a mass per area of 305 kg/m^2.
- Topping of 25.4 mm (1") underlayment poured directly on the slabs and 6 mm (1/4") carpet on an 8 mm (5/16") underpad.

Junction 1, 3, 4: Cross-junction of separating floor / flanking wall with:

- One wythe of 190 mm hollow concrete block masonry[1] constructed using normal weight units not less than 53% solid, and with mass per area of 238 kg/m^2.
- No lining on the walls.
- Rigid mortared cross-junction with concrete block wall assembly.

Junction 2: T-Junction of separating floor / flanking wall with:

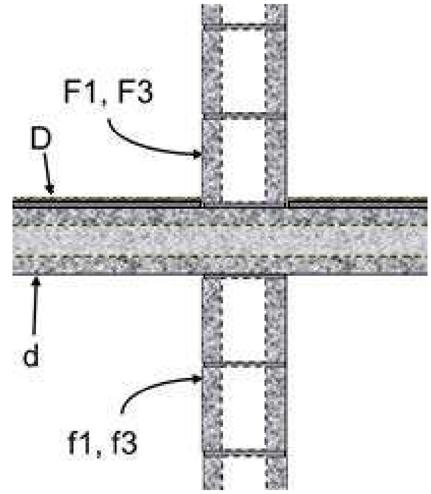
- Abutting side wall and separating wall of hollow concrete block masonry[1] with a mass per area of 238 kg/m^2.
- No lining on the walls.
- Rigid mortared T-junctions

NOTE: The sound transmission would be essentially unchanged if the concrete hollowcore floor slabs were oriented perpendicular to the case illustrated.

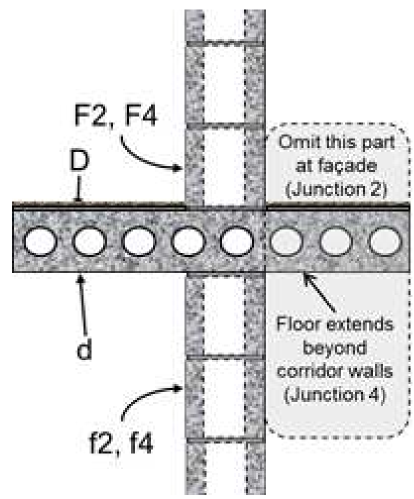
Acoustical Parameters

For the separating floor						
internal loss, η_i =	0.006	c_L =	3500			
mass (kg/m^2) =	305	f_c =	125	(Eq. C.2)		
	Reference	K_{Ff}	$K_{Dd'}$	K_{Fd}	K_{Df}	$\Sigma l_k \alpha_k$
X-Junction 1, 3	ISO 15712-1, Eq. E.3	10.6	6.9	8.8	8.8	0.773
X-Junction 4	ISO 15712-1, Eq. E.3	10.6	6.9	8.8	8.8	0.618
T-Junction 2	ISO 15712-1, Eq. E.4	7.3	-	5.8	5.8	0.657
Total loss η_{tot}	ISO 15712-1, Eq. C.1	0.026	at 500 Hz			
For flanking elements F and f and Junctions 1 & 3						
internal loss, η_i =	0.015	c_L =	3500			
mass (kg/m^2) =	238	f_c =	98	(Eq. C.2)		
Total loss η_{tot}	ISO 15712-1, Eq. C.1	0.042	at 500 Hz			
For flanking elements F and f and Junctions 2 & 4						
internal loss, η_i =	0.015	c_L =	3500			
mass (kg/m^2) =	238	f_c =	98	(Eq. C.2)		
Total loss $\eta_{tot,2}$	ISO 15712-1, Eq. C.1	0.048	at 500 Hz			
Total loss $\eta_{tot,4}$	ISO 15712-1, Eq. C.1	0.044	at 500 Hz			

Illustration for this case



Cross-junction of a separating floor assembly of 203 mm thick precast concrete hollowcore slabs with 190 mm concrete block flanking walls. (Side view of Junctions 1 and 3)



T-Junction of a separating floor of 203 mm thick precast concrete hollowcore slabs with 190 mm concrete block walls. (Plan view of Junctions 2 and 4).

	ISO Symbol	Reference	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	ASTC
Separating Partition (203 mm precast hollow core floor 305 kg/m^2)									
Sound Transmission Loss F1 or f1	$R_{D,lab}$	Measured A1-012467.2	38	46	52	60	65	72	56
Structural Reverberation Time lab	$T_{s,lab}$	Measured	0.283	0.192	0.129	0.085	0.055	0.034	
Change by Lining on Source Side	ΔR_D	Underlayment & Carpet	1	0	1	5	10	8	
Change by Lining on Receive Side	ΔR_d	No Lining	0	0	0	0	0	0	
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.359	0.251	0.169	0.110	0.069	0.042	
Leakage or Airborne Flanking		No leakage	0	0	0	0	0	0	
Direct TL in-situ	$R_{D,situ}$	ISO 15712-1, Eq. 24	38	44	52	64	74	79	55

(For the notes in this table please see the corresponding endnotes on page 26.)

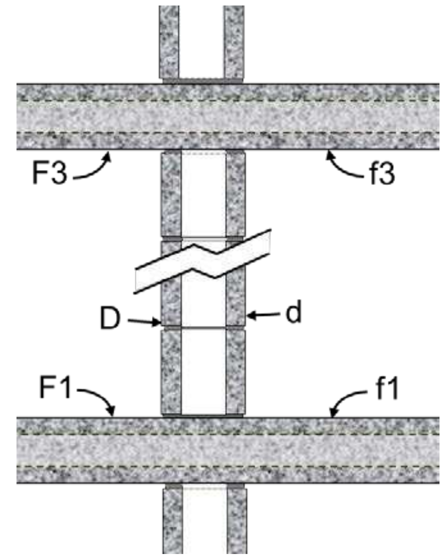
Example 8	ISO Symbol	Reference	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	ASTC
Junction 1 (Rigid Cross junction, 203 mm precast hollow core floor 305 kg/m² / 190 mm block wall)									
Flanking Path Ff_1									
Sound Transmission Loss F1 or f1	$R_{F1,lab}$	RR-334, NRC-Mean BLK190(NW)	35	38	44	50	58	62	49
Structural Reverberation Time lab	$T_{s,lab}$	ISO 15712-1, Eq. C.5	0.299	0.191	0.119	0.072	0.042	0.024	
Change by Lining on Source Side	ΔR_{F1}	No Lining	0	0	0	0	0	0	
Change by Lining on Receive Side	ΔR_{f1}	No Lining	0	0	0	0	0	0	
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.248	0.163	0.105	0.065	0.039	0.023	
TL in-situ for Element F1	$R_{F1,situ}$	ISO 15712-1 Eq. 19	36	39	45	50	58	62	50
TL in-situ for Element f1	$R_{f1,situ}$	ISO 15712-1 Eq. 19	36	39	45	50	58	62	50
Junction 1 - Coupling									
In-situ Velocity Level Difference for Ff	$D_{v,F1,f1,situ}$	ISO 15712-1 Eq. 21, 22	13.2	13.5	13.9	14.5	15.2	16.0	
In-situ Velocity Level Difference for Fd	$D_{v,F1,d,situ}$	ISO 15712-1 Eq. 21, 22	11.6	11.8	12.1	12.6	13.2	13.9	
In-situ Velocity Level Difference for Df	$D_{v,D,f1,situ}$	ISO 15712-1 Eq. 21, 22	11.6	11.8	12.1	12.6	13.2	13.9	
Flanking Transmssion Loss - Path Values									
Flanking TL for Path Ff1	R_{F1f1}	ISO 15712-1 Eq. 25a	51	55	61	67	75	80	66
Flanking TL for Path Fd1	R_{F1d}	ISO 15712-1 Eq. 25a	49	55	61	68	75	81	65
Flanking TL for Path Df1	R_{Df1}	ISO 15712-1 Eq. 25a	49	55	61	68	75	81	65
Flanking STC for Junction 1			45	50	56	63	70	76	61
Junction 2 (Rigid T-junction, 203 mm precast hollow core floor 305 kg/m² / 190 mm block façade wall)									
Flanking Path Ff_2									
Transmission Loss Element F2	$R_{F2,lab}$	RR-334, NRC-Mean BLK190(NW)	35	38	44	50	58	62	49
Structural Reverberation Time lab	$T_{s,lab}$	ISO 15712-1, Eq. C.5	0.299	0.191	0.119	0.072	0.042	0.024	
Change by Lining on Source Side	ΔR_{F2}	No Lining	0	0	0	0	0	0	
Change by Lining on Receive Side	ΔR_{f2}	No Lining	0	0	0	0	0	0	
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.210	0.140	0.092	0.058	0.035	0.021	
TL in-situ for Element F2	$R_{F2,situ}$	ISO 15712-1 Eq. 19	37	39	45	51	59	63	50
TL in-situ for Element f2	$R_{f2,situ}$	ISO 15712-1 Eq. 19	37	39	45	51	59	63	50
Junction 2 - Coupling									
In-situ Velocity Level Difference for Ff	$D_{v,F2,f2,situ}$	ISO 15712-1 Eq. 21, 22	10.6	10.9	11.2	11.7	12.3	13.1	
In-situ Velocity Level Difference for Fd	$D_{v,F2,d,situ}$	ISO 15712-1 Eq. 21, 22	9.4	9.6	9.9	10.3	10.9	11.5	
In-situ Velocity Level Difference for Df	$D_{v,D,f2,situ}$	ISO 15712-1 Eq. 21, 22	9.4	9.6	9.9	10.3	10.9	11.5	
Flanking Transmssion Loss - Path Values									
Flanking TL for Path Ff2	R_{F2f2}	ISO 15712-1 Eq. 25a	51	53	59	66	74	79	64
Flanking TL for Path Fd2	R_{F2d}	ISO 15712-1 Eq. 25a	48	53	59	67	74	80	64
Flanking TL for Path Df2	R_{Df2}	ISO 15712-1 Eq. 25a	48	53	59	67	74	80	64
Flanking STC for Junction 2			44	48	55	61	69	75	59
Junction 3 (Rigid Cross junction, 203 mm precast hollow core floor 305 kg/m² / 190 mm block wall)									
All values are the same as for Junction 1									
Flanking STC for Junction 3			45	50	56	63	70	76	61
Junction 4 (Rigid Cross junction, 203 mm precast hollow core floor 305 kg/m² / 190 mm block corridor wall)									
All of the input data is the same as for Junction 2, but different junctions at the ceiling and floor result in different loss factors than Junction 2.									
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.232	0.154	0.100	0.061	0.038	0.022	
TL in-situ for Element F4	$R_{F4,situ}$	ISO 15712-1 Eq. 19	36	39	45	51	58	62	50
TL in-situ for Element f4	$R_{f4,situ}$	ISO 15712-1 Eq. 19	36	39	45	51	58	62	50
Junction 4 - Coupling									
In-situ Velocity Level Difference for Ff	$D_{v,F4,f4,situ}$	ISO 15712-1 Eq. 21, 22	13.5	13.8	14.1	14.8	15.3	16.2	
In-situ Velocity Level Difference for Fd	$D_{v,F4,d,situ}$	ISO 15712-1 Eq. 21, 22	12.2	12.4	12.7	13.2	13.7	14.4	
In-situ Velocity Level Difference for Df	$D_{v,D,f4,situ}$	ISO 15712-1 Eq. 21, 22	12.2	12.4	12.7	13.2	13.7	14.4	
Flanking Transmssion Loss - Path Values									
Flanking TL for Path Ff4	R_{F4f4}	ISO 15712-1 Eq 25b	53	56	62	69	76	81	67
Flanking TL for Path Fd4	R_{F4d}	ISO 15712-1 Eq 25b	50	56	62	69	76	82	66
Flanking TL for Path Df4	R_{Df4}	ISO 15712-1 Eq 25b	50	56	62	69	76	82	66
Flanking STC for Junction 4			46	51	57	64	71	77	62
Total Flanking STC (combined transmssion for all of the flanking paths)			39	43	50	57	64	70	54
ASTC due to Direct plus Flanking Transmission		RR-335, Eq. 1.1	35	41	48	56	64	69	**52**

Horizontal Room Pair - 203 mm Precast Concrete Hollowcore Floor 273 kg/m^2

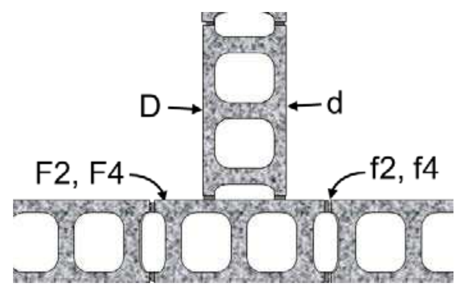
Example 9: **(Detailed Method)**

- **Rooms side-by-side**
- **Floors of precast concrete hollowcore slabs[2] with walls of normal weight concrete block walls with rigid junctions**

Illustration for this case



Junction of a 190 mm concrete block separating wall with a floor and ceiling of 203 mm thick precast concrete hollowcore slabs. (Side view of Junctions 1 and 3)



Junction of the separating wall with a side wall, both of 190 mm concrete block. (Plan view of Junctions 2 and 4).

Separating wall assembly (loadbearing) with:

- One wythe of 190 mm hollow concrete block masonry[1] constructed using normal weight units not less than 53% solid, and with mass per area of 238 kg/m^2. No lining on the wall.

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

- Floor assembly of precast concrete hollowcore slabs[2] of cross-section 203 mm thick and 2440 mm wide, fully grouted at joints between adjacent slabs and with a mass per area of 273 kg/m^2.
- No topping, flooring or ceiling.
- Rigid mortared cross-junction with concrete block wall assembly.

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

- Abutting side wall and separating wall of hollow concrete block masonry[1] with a mass per area of 238 kg/m^2. No lining.
- Rigid mortared T-junctions

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

- Ceiling assembly of precast concrete hollowcore slabs[2] of cross-section 203 mm thick and 2440 mm wide, fully grouted at joints between adjacent slabs, with mass per area of 273 kg/m^2.
- No added ceiling lining
- Rigid mortared cross-junction with concrete block wall assembly

Acoustical Parameters

For the separating wall:						
internal loss, η_i =	0.015	c_L =	3500			
mass (kg/m^2) =	238	f_c =	98	(Eq. C.2)		
	Reference	K_{Ff}	K_{Dd}	K_{Fd}	K_{Df}	$\Sigma l_k \alpha_k$
X-Junction 1 or 3	ISO 15712-1, Eq. E.3	7.7	9.7	8.7	8.7	0.644
T-Junction 2 or 4	ISO 15712-1, Eq. E.4	5.7	-	5.7	5.7	0.420
Total loss η_{tot}	ISO 15712-1, Eq. C.1	0.043	at 500 Hz			
For flanking elements F and f and Junctions 1 & 3						
internal loss, η_i =	0.006	c_L =	3500			
mass (kg/m^2) =	273	f_c =	125	(Eq. C.2)		
Total loss η_{tot}	ISO 15712-1, Eq. C.1	0.026	at 500 Hz			
For flanking elements F and f and Junctions 2 & 4						
internal loss, η_i =	0.015	c_L =	3500			
mass (kg/m^2) =	238	f_c =	98	(Eq. C.2)		
Total loss $\eta_{tot,2}$	ISO 15712-1, Eq. C.1	0.050	at 500 Hz			
Total loss $\eta_{tot,4}$	ISO 15712-1, Eq. C.1	0.045	at 500 Hz			

	ISO Symbol	Reference	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	ASTC
Separating Partition (190 mm concrete block wall)									
Sound Transmission Loss	$R_{D,lab}$	RR-334, NRC-Mean BLK190(NW)	35	38	44	50	58	62	49
Structural Reverberation Time lab	$T_{s,lab}$	ISO 15712-1, Eq. C.5	0.299	0.191	0.119	0.072	0.042	0.024	
Change by Lining on D	ΔR_D	No Lining	0	0	0	0	0	0	
Change by Lining on d	ΔR_d	No Lining	0	0	0	0	0	0	
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.241	0.160	0.102	0.065	0.038	0.022	
Leakage or Airborne Flanking		Sealed & Blocked	0	0	0	0	0	0	
Direct TL in-situ	$R_{D,situ}$	ISO 15712-1, Eq. 24	36	39	45	51	59	62	50

(For the notes in this table please see the corresponding endnotes on page 26.)

Example 9	ISO Symbol	Reference	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	ASTC
Junction 1 (Rigid cross junction, 190 mm block separating wall / 203 mm precast hollow core floor 273 kg/m²)									
Sound Transmission Loss F1 or f1	$R_{F1,lab}$	Measured A1-012467.2	36	43	51	57	63	71	54
Structural Reverberation Time lab	$T_{s,lab}$	Measured	0.170	0.080	0.060	0.050	0.060	0.040	
Change by Lining on F1	ΔR_{F1}	No Lining	0	0	0	0	0	0	
Change by Lining on f1	ΔR_{f1}	No Lining	0	0	0	0	0	0	
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.367	0.259	0.169	0.110	0.069	0.042	
TL in-situ for Element F1	$R_{F1,situ}$	ISO 15712-1 Eq. 19	33	37	47	53	62	71	49
TL in-situ for Element f1	$R_{f1,situ}$	ISO 15712-1 Eq. 19	33	37	47	53	62	71	49
Junction 1 - Coupling									
In-situ Velocity Level Difference for Ff	$D_{v,F1,f1,situ}$	ISO 15712-1 Eq. 21, 22	10.6	10.7	11.0	11.4	11.9	12.5	
In-situ Velocity Level Difference for Fd	$D_{v,F1,d,situ}$	ISO 15712-1 Eq. 21, 22	11.6	11.7	12.1	12.5	13.2	13.9	
In-situ Velocity Level Difference for Df	$D_{v,D,f1,situ}$	ISO 15712-1 Eq. 21, 22	11.6	11.7	12.1	12.5	13.2	13.9	
Flanking Transmssion Loss - Path Values									
Flanking TL for Path Ff1	R_{F1f1}	ISO 15712-1 Eq. 25a	42	46	56	62	72	81	58
Flanking TL for Path Fd1	R_{F1d}	ISO 15712-1 Eq. 25a	45	49	57	63	72	80	61
Flanking TL for Path Df1	R_{Df1}	ISO 15712-1 Eq. 25a	45	49	57	63	72	80	61
Flanking STC for Junction 1			39	43	52	58	67	76	55
Junction 2 (Rigid T-Junction, 190 mm block separating wall / 190 mm block facade wall)									
Transmission Loss Element F2	$R_{F2,lab}$	RR-334, NRC-Mean BLK190(NW)	35	38	44	50	58	62	49
Structural Reverberation Time lab	$T_{s,lab}$	ISO 15712-1 Eq. C5	0.299	0.191	0.119	0.072	0.042	0.024	
Change by Lining on F2	ΔR_{F2}	No Lining	0	0	0	0	0	0	
Change by Lining on f2	ΔR_{f2}	No Lining	0	0	0	0	0	0	
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.202	0.135	0.088	0.056	0.034	0.020	
TL in-situ for Element F2	$R_{F2,situ}$	ISO 15712-1 Eq. 19	37	39	45	51	59	63	50
TL in-situ for Element f2	$R_{f2,situ}$	ISO 15712-1 Eq. 19	37	39	45	51	59	63	50
Junction 2 - Coupling									
In-situ Velocity Level Difference for Ff	$D_{v,F2,f2,situ}$	ISO 15712-1 Eq. 21, 22	11.2	11.5	11.8	12.3	12.9	13.7	
In-situ Velocity Level Difference for Fd	$D_{v,F2,d,situ}$	ISO 15712-1 Eq. 21, 22	11.3	11.6	12.0	12.4	13.2	14.0	
In-situ Velocity Level Difference for Df	$D_{v,D,f2,situ}$	ISO 15712-1 Eq. 21, 22	11.3	11.6	12.0	12.4	13.2	14.0	
Flanking Transmssion Loss - Path Values									
Flanking TL for Path Ff2	R_{F2f2}	ISO 15712-1 Eq. 25a	49	51	58	64	73	78	63
Flanking TL for Path Fd2	R_{F2d}	ISO 15712-1 Eq. 25a	48	51	57	64	72	77	62
Flanking TL for Path Df2	R_{Df2}	ISO 15712-1 Eq. 25a	48	51	57	64	72	77	62
Flanking STC for Junction 2			44	46	53	59	68	73	58
Junction 3 (Rigid cross junction, 190 mm block separating wall / 203 mm precast hollow core ceiling slab 273 kg/m²)									
All values are the same as for Junction 1									
Flanking TL for Path Ff3	R_{F3f3}	ISO 15712-1 Eq 25b	42	46	56	62	72	81	58
Flanking TL for Path Fd3	R_{F3d}	ISO 15712-1 Eq 25b	45	49	57	63	72	80	61
Flanking TL for Path Df3	R_{Df3}	ISO 15712-1 Eq 25b	45	49	57	63	72	80	61
Flanking STC for Junction 3			44	43	52	58	67	76	55
Junction 4 (Rigid T-junction, 190 mm block separating wall / 190 mm block corridor wall)									
All of the input data is the same as for Junction 2, but different junctions at the ceiling and floor result in different loss factors than Junction 2.									
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.226	0.149	0.098	0.061	0.037	0.022	
TL in-situ for Element F4	$R_{F4,situ}$	ISO 15712-1 Eq. 19	36	39	45	51	59	62	50
TL in-situ for Element f4	$R_{f4,situ}$	ISO 15712-1 Eq. 19	36	39	45	51	59	62	50
Junction 4 - Coupling									
In-situ Velocity Level Difference for Ff	$D_{v,F4,f4,situ}$	ISO 15712-1 Eq. 21, 22	10.8	11.0	11.4	11.9	12.6	13.3	
In-situ Velocity Level Difference for Fd	$D_{v,F4,d,situ}$	ISO 15712-1 Eq. 21, 22	11.1	11.4	11.8	12.3	13.0	13.8	
In-situ Velocity Level Difference for Df	$D_{v,D,f4,situ}$	ISO 15712-1 Eq. 21, 22	11.1	11.4	11.8	12.3	13.0	13.8	
Flanking Transmssion Loss - Path Values									
Flanking TL for Path Ff4	R_{F4f4}	ISO 15712-1 Eq 25b	48	51	57	64	73	76	62
Flanking TL for Path Fd4	R_{F4d}	ISO 15712-1 Eq 25b	48	51	57	64	72	77	62
Flanking TL for Path Df4	R_{Df4}	ISO 15712-1 Eq 25b	48	51	57	64	72	77	62
Flanking STC for Junction 4			43	46	52	59	68	72	57
Total Flanking STC (combined transmssion for all of the flanking paths)			35	38	46	52	61	68	50
ASTC due to Direct plus Flanking Transmission		RR-335, Eq. 1.1	32	36	42	48	57	61	**47**

Vertical Room Pair - 203 mm Precast Concrete Hollowcore Floor 273 kg/m^2

Example 10: **(Detailed Method)**

- **Rooms one-above-the-other**
- **Floors of precast concrete hollowcore slabs[2] with walls of normal weight concrete block walls with rigid junctions**

Separating wall assembly (loadbearing) with:

- Floor assembly of precast concrete hollowcore slabs[2] of cross-section 203 mm thick and 2440 mm wide, fully grouted at joints between adjacent slabs and with a mass per area of 273 kg/m^2.
- No topping, flooring or ceiling.

Junction 1, 3, 4: Cross-junction of separating floor / flanking wall with:

- One wythe of 190 mm hollow concrete block masonry[1] constructed using normal weight units not less than 53% solid, and with mass per area of 238 kg/m^2.
- No lining on the walls.
- Rigid mortared cross-junction with concrete block wall assembly.

Junction 2: T-Junction of separating floor / flanking wall with:

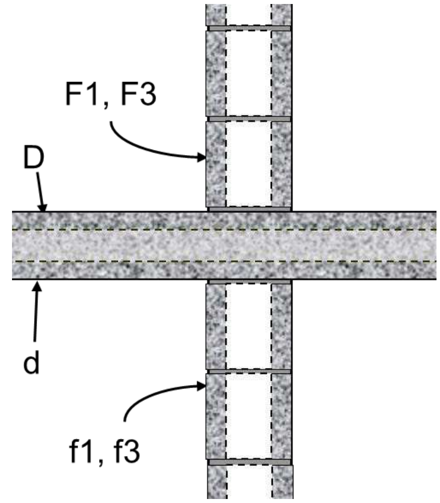
- Abutting side wall and separating wall of hollow concrete block masonry[1] with a mass per area of 238 kg/m^2.
- No lining on the walls.
- Rigid mortared T-junctions

NOTE: The sound transmission would be essentially unchanged if the concrete hollowcore floor slabs were oriented perpendicular to the case illustrated.

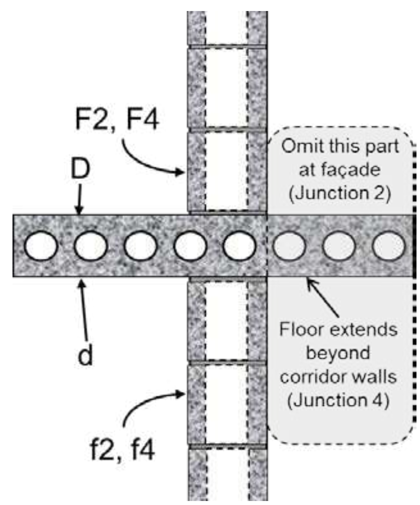
Acoustical Parameters

For the separating floor						
internal loss, η_i =	0.006	c_L =	3500			
mass (kg/m^2) =	273	f_c =	125	(Eq. C.2)		
	Reference	K_{Ff}	$K_{Dd'}$	K_{Fd}	K_{Df}	$\Sigma l_k \alpha_k$
X-Junction 1, 3	ISO 15712-1, Eq. E.3	9.7	7.7	8.7	8.7	0.721
X-Junction 4	ISO 15712-1, Eq. E.3	9.7	7.7	8.7	8.7	0.577
T-Junction 2	ISO 15712-1, Eq. E.4	6.6	-	5.7	5.7	0.672
Total loss η_{tot}	ISO 15712-1, Eq. C.1	0.026	at 500 Hz			
For flanking elements F and f and Junctions 1 & 3						
internal loss, η_i =	0.015	c_L =	3500			
mass (kg/m^2) =	238	f_c =	98	(Eq. C.2)		
Total loss η_{tot}	ISO 15712-1, Eq. C.1	0.043	at 500 Hz			
For flanking elements F and f and Junctions 2 & 4						
internal loss, η_i =	0.015	c_L =	3500			
mass (kg/m^2) =	238	f_c =	98	(Eq. C.2)		
Total loss $\eta_{tot,2}$	ISO 15712-1, Eq. C.1	0.050	at 500 Hz			
Total loss $\eta_{tot,4}$	ISO 15712-1, Eq. C.1	0.045	at 500 Hz			

Illustration for this case



Cross-junction of a separating floor assembly of 203 mm thick precast concrete hollowcore slabs with 190 mm concrete block flanking walls. (Side view of Junctions 1 and 3)



T-Junction of a separating floor of 203 mm thick precast concrete hollowcore slabs with 190 mm concrete block walls. (Plan view of Junctions 2 and 4).

	ISO Symbol	Reference	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	ASTC
Separating Partition (203 mm precast hollow core floor 273 kg/m^2)									
Sound Transmission Loss F1 or f1	$R_{D,lab}$	Measured A1-012467.2	38	46	52	60	65	72	56
Structural Reverberation Time lab	$T_{s,lab}$	Measured	0.170	0.080	0.060	0.050	0.060	0.040	
Change by Lining on Source Side	ΔR_D	No Lining	0	0	0	0	0	0	
Change by Lining on Receive Side	ΔR_d	No Lining	0	0	0	0	0	0	
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.367	0.259	0.169	0.110	0.069	0.042	
Leakage or Airborne Flanking		No leakage	0	0	0	0	0	0	
Direct TL in-situ	$R_{D,situ}$	ISO 15712-1, Eq. 24	35	41	48	56	64	72	51

(For the notes in this table please see the corresponding endnotes on page 26.)

Example 10	ISO Symbol	Reference	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	ASTC
Junction 1 (Rigid Cross junction, 203 mm precast hollow core floor 273 kg/m² / 190 mm block wall)									
Flanking Path Ff_1									
Sound Transmission Loss F1 or f1	$R_{F1,lab}$	RR-334, NRC-Mean BLK190(NW)	35	38	44	50	58	62	49
Structural Reverberation Time lab	$T_{s,lab}$	ISO 15712-1, Eq. C.5	0.299	0.191	0.119	0.072	0.042	0.024	
Change by Lining on Source Side	ΔR_{F1}	No Lining	0	0	0	0	0	0	
Change by Lining on Receive Side	ΔR_{f1}	No Lining	0	0	0	0	0	0	
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.241	0.160	0.102	0.065	0.038	0.022	
TL in-situ for Element F1	$R_{F1,situ}$	ISO 15712-1 Eq. 19	36	39	45	50	58	62	50
TL in-situ for Element f1	$R_{f1,situ}$	ISO 15712-1 Eq. 19	36	39	45	50	58	62	50
Junction 1 - Coupling									
In-situ Velocity Level Difference for Ff	$D_{v,F1,f1,situ}$	ISO 15712-1 Eq. 21, 22	12.5	12.7	13.2	13.7	14.5	15.3	
In-situ Velocity Level Difference for Fd	$D_{v,F1,d,situ}$	ISO 15712-1 Eq. 21, 22	11.6	11.7	12.1	12.5	13.2	13.9	
In-situ Velocity Level Difference for Df	$D_{v,D,f1,situ}$	ISO 15712-1 Eq. 21, 22	11.6	11.7	12.1	12.5	13.2	13.9	
Flanking Transmssion Loss - Path Values									
Flanking TL for Path Ff1	R_{F1f1}	ISO 15712-1 Eq. 25a	51	54	60	66	75	79	65
Flanking TL for Path Fd1	R_{F1d}	ISO 15712-1 Eq. 25a	48	53	60	67	75	82	64
Flanking TL for Path Df1	R_{Df1}	ISO 15712-1 Eq. 25a	48	53	60	67	75	82	64
Flanking STC for Junction 1			44	48	55	62	70	76	59
Junction 2 (Rigid T-junction, 203 mm precast hollow core floor 273 kg/m² / 190 mm block façade wall)									
Flanking Path Ff_2									
Transmission Loss Element F2	$R_{F2,lab}$	RR-334, NRC-Mean BLK190(NW)	35	38	44	50	58	62	49
Structural Reverberation Time lab	$T_{s,lab}$	ISO 15712-1, Eq. C.5	0.299	0.191	0.119	0.072	0.042	0.024	
Change by Lining on Source Side	ΔR_{F2}	No Lining	0	0	0	0	0	0	
Change by Lining on Receive Side	ΔR_{f2}	No Lining	0	0	0	0	0	0	
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.202	0.135	0.088	0.056	0.034	0.020	
TL in-situ for Element F2	$R_{F2,situ}$	ISO 15712-1 Eq. 19	37	39	45	51	59	63	50
TL in-situ for Element f2	$R_{f2,situ}$	ISO 15712-1 Eq. 19	37	39	45	51	59	63	50
Junction 2 - Coupling									
In-situ Velocity Level Difference for Ff	$D_{v,F2,f2,situ}$	ISO 15712-1 Eq. 21, 22	10.0	10.3	10.7	11.1	11.7	12.5	
In-situ Velocity Level Difference for Fd	$D_{v,F2,d,situ}$	ISO 15712-1 Eq. 21, 22	9.4	9.5	9.9	10.3	10.9	11.6	
In-situ Velocity Level Difference for Df	$D_{v,D,f2,situ}$	ISO 15712-1 Eq. 21, 22	9.4	9.5	9.9	10.3	10.9	11.6	
Flanking Transmssion Loss - Path Values									
Flanking TL for Path Ff2	R_{F2f2}	ISO 15712-1 Eq. 25a	50	52	59	65	74	79	64
Flanking TL for Path Fd2	R_{F2d}	ISO 15712-1 Eq. 25a	47	51	58	65	74	80	62
Flanking TL for Path Df2	R_{Df2}	ISO 15712-1 Eq. 25a	47	51	58	65	74	80	62
Flanking STC for Junction 2			43	46	53	60	69	75	58
Junction 3 (Rigid Cross junction, 203 mm precast hollow core floor 273 kg/m² / 190 mm block wall)									
All values are the same as for Junction 1									
Flanking STC for Junction 3			44	48	55	62	70	76	59
Junction 4 (Rigid Cross junction, 203 mm precast hollow core floor 273 kg/m² / 190 mm block corridor wall)									
All of the input data is the same as for Junction 2, but different junctions at the ceiling and floor result in different loss factors than Junction 2.									
Structural Reverberation Time in-situ	$T_{s,situ}$	ISO 15712-1, Eq. C.1-C.3	0.226	0.149	0.098	0.061	0.037	0.022	
TL in-situ for Element F4	$R_{F4,situ}$	ISO 15712-1 Eq. 19	36	39	45	51	59	62	50
TL in-situ for Element f4	$R_{f4,situ}$	ISO 15712-1 Eq. 19	36	39	45	51	59	62	50
Junction 4 - Coupling									
In-situ Velocity Level Difference for Ff	$D_{v,F4,f4,situ}$	ISO 15712-1 Eq. 21, 22	12.8	13.0	13.4	13.9	14.6	15.3	
In-situ Velocity Level Difference for Fd	$D_{v,F4,d,situ}$	ISO 15712-1 Eq. 21, 22	12.2	12.3	12.7	13.1	13.7	14.4	
In-situ Velocity Level Difference for Df	$D_{v,D,f4,situ}$	ISO 15712-1 Eq. 21, 22	12.2	12.3	12.7	13.1	13.7	14.4	
Flanking Transmssion Loss - Path Values									
Flanking TL for Path Ff4	R_{F4f4}	ISO 15712-1 Eq 25b	52	55	61	68	77	80	66
Flanking TL for Path Fd4	R_{F4d}	ISO 15712-1 Eq 25b	49	54	61	68	77	83	65
Flanking TL for Path Df4	R_{Df4}	ISO 15712-1 Eq 25b	49	54	61	68	77	83	65
Flanking STC for Junction 4			45	49	56	63	72	77	60
Total Flanking STC (combined transmssion for all of the flanking paths)			38	42	49	56	64	70	53
ASTC due to Direct plus Flanking Transmission		RR-335, Eq. 1.1	33	38	45	53	61	68	**49**

2.3 Footnotes for the Examples

1. For the 190 mm thick concrete block walls in these examples, the value of 238 kg/m^2 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/m^3. 190 mm NW concrete block units are not less than 53% solid, and 140 mm NW concrete block units are not less than 73% solid, each giving a minimum wall mass per area over 238 kg/m^2.

2. The continuous hollow voids of the concrete hollowcore slabs can be oriented either parallel or perpendicular to the concrete block wall. The mass per unit areas given in the examples are for the floors with grout. The mass per unit areas of the concrete hollow core floors with and without grout are shown in Table 3

Table 3: Mass per unit area of the hollowcore floors with and without grout.

Mass per unit area of the bare concrete hollowcore Slab (kg/m^2)	Mass per unit area of the grouted hollowcore floor (kg/m^2)
269	273
301	305
338	344

3. Summary and Conclusions

The standard scenarios of RR-331 have been used to calculate the ASTC ratings of constructions of floors made of 203 mm (8") precast/prestressed concrete hollowcore slabs rigidly connected to concrete masonry walls. Examples using concrete hollowcore slabs of three different mass per unit areas (273 kg/m^2, 305 kg/m^2 and 343 kg/m^2) were included. In each case, the constructions achieved an ASTC rating greater than 47 for the side-by-side and one-above-the-other scenarios.

Hollow concrete block masonry walls with a mass per unit area greater than 238 kg/m^2 are expected to have transmission loss values that are equal to or greater than the values reported for the hollow concrete block masonry walls evaluated for this study. Likewise, precast concrete hollowcore floors with a mass per unit area greater than 273 kg/m^2 are expected to have transmission loss values that are equal to or greater than the values reported for the precast concrete hollowcore floors evaluated in this study. Therefore, based on the findings from this study, it is expected that constructions of hollow concrete block masonry walls with a mass per unit area of or greater to 238 kg/m^2 connected to precast concrete hollowcore floors with a mass per unit area equal to or greater than 273 kg/m^2 will achieve ASTC ratings which are equal to or greater than 47.

References

[1] ISO 15712-1:2005 -- Building acoustics -- Estimation of acoustic performance of buildings from the performance of elements -- Part 1: Airborne sound insulation between rooms. Geneva, Switzerland: International Standards Organization; 2005.

[2] ISO 10848-1:2006 -- Acoustics -- Laboratory measurement of the flanking transmission of airborne and impact sound between adjoining rooms -- Part 1: Frame document. Geneva, Switzerland: International Standards Organization; 2006.

[3] Hoeller C, Quirt, D., Mahn J, NRC Research Report *RR-331: Guide to Calculating Airborne Sound Transmission in Buildings*: 3rd Edition. Ottawa, Canada: National Research Council Canada; 2017.

Appendix A - Transmission Loss Data

The transmission loss of the floors of concrete hollowcore slabs are shown in 1/3 octave bands in Table 4. The data is from test report A1-012467.2. The single number ratings are shown in Table 5.

Table 4: Transmission loss of the 203 mm thick concrete hollowcore floors.

	Transmission Loss (dB)	
1/3 Octave Band Center Frequency (Hz)	203 mm (8") concrete hollowcore slabs with grout - 273 kg/m^2	203 mm (8") concrete hollowcore slabs with grout - 305 kg/m^2
	TLF-18-008	TLF-17-081
100	40	37
125	40	36
160	40	38
200	41	41
250	43	43
315	46	45
400	50	49
500	51	51
630	53	53
800	55	55
1000	57	57
1250	59	60
1600	60	62
2000	60	63
2500	62	65
3150	66	67
4000	69	71
5000	68	72

Table 5: Sound transmission class (STC) and impact insulation class (IIC) ratings of the floors made of concrete hollowcore slabs.

Floor	STC	IIC
203 mm (8") concrete hollowcore slabs with grout - 273 kg/m^2	55	23
203 mm (8") concrete hollowcore slabs with grout - 305 kg/m^2	54	23

Appendix B - Change in Transmission Loss Due to Linings

The change in the transmission loss due to the addition of toppings to the 305 kg/m^2 floor are shown in Table 6.

Table 6: Change in the transmission loss due to the installation of linings on the 203 mm 305 kg/m^2 concrete hollowcore floor.

1/3 Octave Band Center Frequency (Hz)	Change in Transmission Loss on 203 mm thick 305 kg/m^2 concrete hollowcore floors (dB)	
	25.4 mm (1") underlayment poured directly on the concrete hollowcore slabs	25.4 mm (1") underlayment poured directly on the concrete hollowcore slabs and 6mm (1/4") carpet with a 8 mm (5/16") underpad
	TLF-18-001	TLF-18-002
100	1	-1
125	2	1
160	-1	-2
200	1	1
250	0	0
315	1	0
400	0	0
500	1	1
630	2	2
800	3	3
1000	4	5
1250	4	7
1600	4	8
2000	4	10
2500	4	12
3150	3	13
4000	3	8
5000	1	5