

# Sound analysis

## Provided sound analysis of the plot:

### Resumé

Traffic noise sound measurements Strandpromenaden 13- 15, 8700 Horsens

### Traffic noise measurements

In relation to the building activities on Strandpromenaden 13 -15, 8700 Horsens, measurements of the traffic noise  $L_{den}$  in the street has been performed.

The reading has been performed in 1,5 m height from street level, and 5 m. into the plot from the street.

The result is:  $L_{den} = 58\text{dB}$ .

### NOTAT

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## 1. Airborne sound

The demand for airborne sound ensures that the separating construction reduces sound from one room to another.

For residential units, the sound conditions must be in accordance with class C in DS 490 Sound classification of residential units and the levels stated in the Guidelines in the Building Regulations on sound conditions.

**Table 1 – Airborne sound insulation. Limit values indicated as lowest values for weighted reduction number,  $R'_w$  or  $R'_w + C_{50-3150}$**

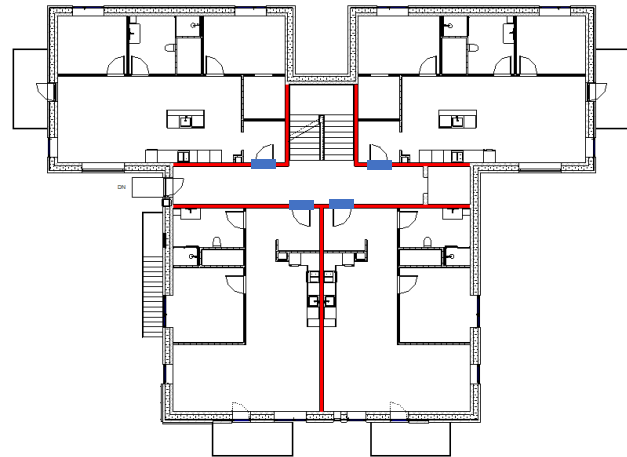
Room type	Class A $R'_w + C_{50-3150}$ in dB	Class B $R'_w + C_{50-3150}$ in dB	Class C $R'_w$ in dB	Class D $R'_w$ in dB
Between a dwelling or shared living room and premises with noisy activities (business or common spaces)	68	63	60	55
Between a dwelling and spaces outside the dwelling	63	58	55	50
Between shared living rooms mutually	63	58	55	50
Door between dwelling and common spaces	32	32	32	27

NOTE - For class A and B is provided for the airborne sound insulation at low frequencies by adding the spectrum correction,  $C_{50-3150}$ , to the  $R'_w$  value. This spectrum correction is used as a protection against inconvenient low frequency noise.

Red indicates the separating walls that separate the apartments from the common area and one another.

Blue indicates the door separating the apartments from the common area

The wall separating the dwellings from each other and the common area is 200 mm concrete that has a sound insulating property ( $R'w$ ) 56 dB.



## 2. Impact sound

The demand ensures that only a limited amount of noise is heard from peoples stay and steps in adjacent and overlying rooms. *Measured in kitchens and living rooms.*

Floors must be laid out so that sound bridges do not form between a floating floor slab and the load-bearing floor deck or the surrounding walls. Large material thickness and high compressibility result in low dynamic stiffness and thus high impact sound attenuation.

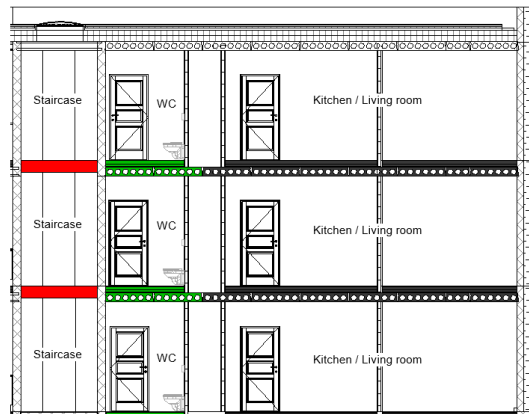


Table 2 - Impact sound level. Limit values indicated as highest values for weighted, normalized impact sound level,

$$L'_{n,W} \text{ or } L'_{n,W} + C_{1,50-2500}$$

Room type	Class A $L'_{n,W} + C_{1,50-2500}$ in dB	Class B $L'_{n,W} + C_{1,50-2500}$ in dB	Class C $L'_{n,W}$ in dB	Class D $L'_{n,W}$ in dB
In living rooms and kitchens as well as at shared living rooms - from premises with noisy activities (business or common spaces)	38	43	48	53
In living rooms and kitchens - from other dwellings and from common spaces	43	48	53	58
In living rooms and kitchens - from shared stairways and passages, from balconies or similar, as well as from toilet- and bath rooms in other dwellings	48	53	58	63
In shared living rooms - from living rooms, other common spaces, stairways, passages, balconies or similar, as well as from toilet- and bath rooms	48	53	58	63

NOTE - For class A and B is provided for the impact sound level at low frequencies by adding the spectrum correction,  $C_{1,50-2500}$ , to the  $L'_{n,W}$ -value. This spectrum correction is used as a protection against inconvenient low frequency noise, which is an ordinary problem in connection with light building-constructions. The spectrum correction is however only to be included, if it is  $\geq 0$  dB.

Tabel 5. Bygningstype 1. Boligadskillende etageadskillelser i beton og letbeton, som kan forventes at overholde krav til luftlydisolation  $R'_w \geq 55$  dB og trinlydniveau  $L'_{n,w} \leq 53$  dB.

Opbygning af etageadskillelse, gulv/dæk	Gulvgruppe 1 $\Delta L_w \geq 17$ dB $\Delta R_w \geq 0$ dB	Gulvgruppe 2 $\Delta L_w \geq 20$ dB $\Delta R_w \geq 3$ dB	Gulvgruppe 3 $\Delta L_w \geq 25$ dB $\Delta R_w \geq 7$ dB
Anbefalet fladevægt af dæk, min. ca.	550 kg/m <sup>2</sup>	440 kg/m <sup>2</sup>	310 kg/m <sup>2</sup>
Eksempler på dæk og tykkelser			
Betondæk	230 mm	185 mm	150 mm
Betonhuldæk		340 mm	220 mm
Betonhuldæk m. betonafretning/påstøbning	340 mm + 40 mm	220 mm + 55 mm	
Letbetondæk (rumvægt 2000 kg/m <sup>3</sup> )	280 mm	220 mm	180 mm
Betonhuldæk m. lydisolierende nedhængt loft			180 mm, 2×13 mm gipsplade, 100 mm hulrum m. 75 mm lydabsorbent

**Gulvgruppe 3**

Laboratoriemålt trinlyddæmpning:  $\Delta L_w \geq 25$  dB

Laboratoriemålt forøgelse af luftlydisolation:  $\Delta R_w \geq 7$  dB

Eksempler på gulvttyper, der med det rette valg af materialer kan leve op til kravene i gulvgruppe 3:

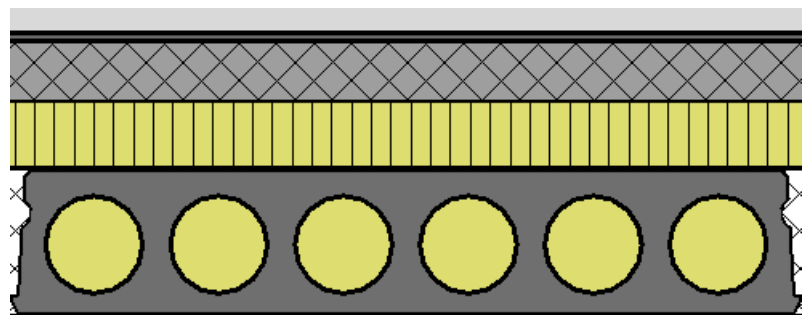
- Valgfri gulvbelægning på min. 40 mm støbt svømmende gulv på tykt trinlyddæmpende underlag, fx min. 25 mm trykfast mineraluld.
- Valgfri gulvbelægning på pladegulv med eller uden strøer og på særlig trinlyddæmpende opklodsning samt evt. lydabsorberende materiale i hulrummet.

Wall construction	
Recommended surface weight, min. approx.	440 kg/m <sup>2</sup>
Examples of walls and thicknesses	
Concrete (bulk weight 2400 kg/m <sup>3</sup> )	185 mm
Lightweight concrete (bulk weight 2000 kg/m <sup>3</sup> )	220 mm
Brick wall (bulk weight 1260-1800 kg/m <sup>3</sup> )	350 mm

(Source Sbi 237)

**Actual floor construction:**

- 220 mm hollow core element
- 100 mm Thermotec floor insulation
- 3 mm sound insulation cover
- 90 mm concrete
- Sound and moisture underlay
- 7 mm laminate



**Choice of sound insulating materials:**

Acoustic underlay placed on top of the hollow core decks – 3 mm [scanunderlay.dk](http://scanunderlay.dk) (sound reduction of up to 21dB)

Laminate underlay – 2,8 mm [wallmann.dk](http://wallmann.dk) (sound reduction up to 19 dB)


Thermotec insulation – 100 mm [smartgulv.dk](http://smartgulv.dk) (sound reduction up to 47 dB)

**Thermotec**

TRINLYD	Trinlyd, hult dæk med brædder	76 dB	76 dB	76 dB	76 dB
	Forbedring af trinlyd	-31 dB	-30 dB	-30 dB	-29 dB
	Tillæg grundet aldring	2 dB	2 dB	2 dB	2 dB
	Trinlyd thermotec®-Isoleret huldæk med trægulv	47 dB	48 dB	48 dB	49 dB

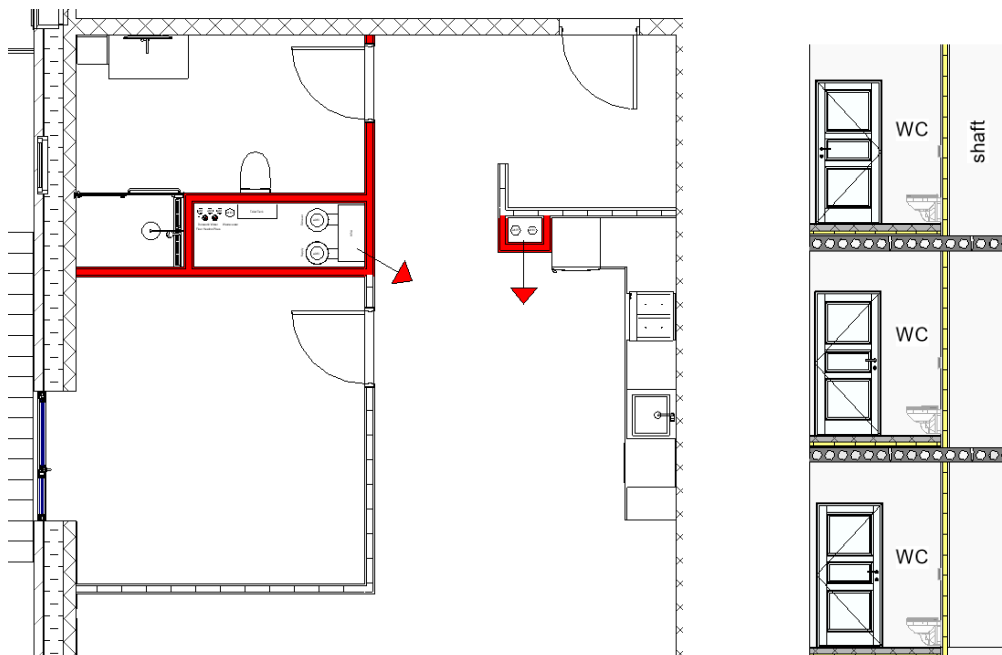
  

OPBYGNING	1 Cementafretningslag	100 mm		80 mm		
	2 thermotec®-akustiksystembane	6 mm				
	3 thermotec® BEPS-WD 70 N	100 mm	80 mm	100 mm	80 mm	
	4 Hult dæk med brædder (330 kg/m <sup>2</sup> )	220 mm				


**3. Noise from installation**

Requirements must ensure that disturbing noise from installation is limited, in kitchens and living rooms. Noise level measured in (L: Level)

SBI 237 : Use of water installations in above or below dwellings can cause noise from water pipes and thereby contribute to the noise level in the dwelling. Therefore, the location of the installations for bathrooms and toilets must be carefully considered. There are also requirements for airborne sound insulation in the vertical direction.



Room type	Measuring size	Class A in dB	Class B in dB	Class C in dB	Class D in dB
In living rooms and kitchens as well as in shared living rooms	$L_{Aeq,T}$	20	25	30	35

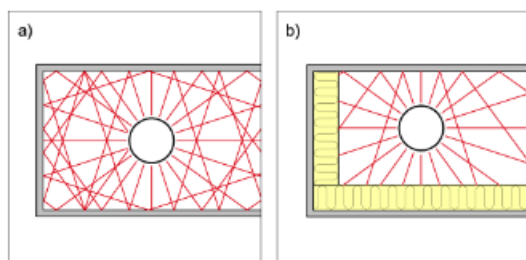
A sound technical optimization is carried out by:

- Use of soft bends, e.g. two 45° bends or bends with a large rounding radius, instead of 88.5° sharp bends
- Use of 45° branch pipe or branch pipe with a flow-technically soft inlet (swept entry) wherever drainage is technically possible
- Use of elastic pipe penetrations
- Use of pipe carriers with damping inserts
- Use of appropriate pipes such as fx. noise-reducing plastic pipes.

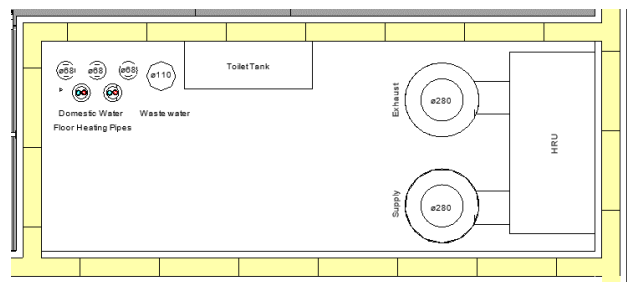
The sound transmission from the installation item to walls and decks can be avoided by installing a vibration-damping material between the installation item and the wall or deck.

Shaft noise insulation:

By placing a noise-absorbing covering, e.g. 30 mm thick mineral wool mats, on a longitudinal and a transverse shaft inner wall, noise absorption is increased and noise reflection is reduced. With such carefully designed cladding, a reduction of the noise level in the shaft of 10 dB can be achieved:



Recommendation



Actual – 70 mm insulation

Ventilation duct sound insulation in shaft:

ø160 mm duct size with **60 mm insulation** on each side

There is a vibration dampener behind the ventilation unit, which is mounted on the wall.

#### 4. Noise from traffic

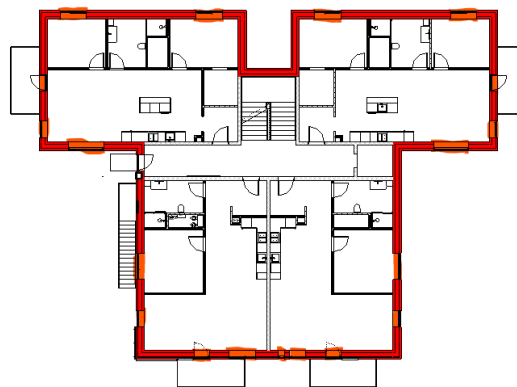
Demand must ensure inhabitants against extensive noise from traffic on streets and railroads.

Room type	Measuring size	Class A in dB	Class B in dB	Class C in dB	Class D in dB
In living rooms and shared living rooms	L <sub>den</sub>	23	28	33	38
	L <sub>night</sub>	15	20	25	30

In cases where the noise level outdoors is higher than the limit value L<sub>den</sub> = 58 dB from roads and L<sub>den</sub> = 64 dB from railways (Miljøstyrelsen, 2007a and b), it must be ensured that the climate screen's sound insulation is sufficient so that the building regulations' requirements for the traffic noise level indoors, L<sub>den</sub> ≤ 33 dB, and any requirements in environmental and planning legislation are complied with.

The traffic noise indoors consists of the sum of the noise contribution transmitted through the climate screen's individual building parts:

- Windows and exterior doors
- Ventilation openings (outdoor air vents)
- Outer wall and roof/ceiling.

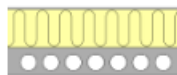


#### 4.1 Roof

The roof construction of our building is flat green roof constructed on hollow core deck elements.

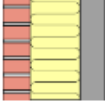
*The acoustic properties of the roof will, for heavy roof constructions with a load-bearing structure of concrete, be determined by the total weight and density of the roof construction*  
 – SBI 244

Roof construction Description	R' <sub>w</sub> [dB]	R' <sub>w</sub> + C <sub>tr</sub> [dB]
Parallel roof on heavy construction with unventilated covering, e.g. 220 mm concrete/light clinker concrete deck element with polystyrene or mineral wool insulation and roof membrane	50-55	45-50



### 4.2 External wall construction

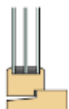
*Heavy exterior wall constructions with concrete or brick as load-bearing parts, which are covered with heat insulation and an unventilated rain screen, e.g. plaster on mineral wool, will usually have better sound insulation than light exterior walls based on skeleton constructions in wood or steel with a ventilated rain screen. – SBI 244*

Wall type	Description	Flat weight [kg/m <sup>2</sup> ]	$R'_w$ [dB]	$R'_w + C_{tr}$ [dB]
	Cavity wall of brick and concrete			
	Form wall: 108 mm	420-530	55-60	50-55
	Cavity: 200 mm, insulated			
	Rear wall: 100-150 mm			

### 4.3 Window

Windows used for our building are triple glazed windows with Alu/wood frame.

Construction	Description	$R'_w$ [dB]	$R'_w + C_{tr}$ [dB]
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Window with three-layer insulating glass  
(glass thickness 4 mm)