

TECHNICAL BRIEFING

Sound and Attenuation with Glass

Purpose of this document

The purpose of this document is to make the reader aware of some of the characteristics of Sound and Noise. It provides noise attenuation data glass and suggests some possible solutions for noise problems. It should not be seen as a complete treatment of the subject of sound, noise, the attenuation performance of glass or glass solutions for noise problems. This document should not be used alone to make an assessment or decision relating to any product or any potential fitness for purpose of any solution to a noise problem.

Introduction

Sound surrounds us every day of our lives and our hearing is the only sense other than our eyes which can provide information on events which occur a long distance away. Our hearing allows us not only to become aware of an event but to pinpoint its location without seeing it. Sound is present in many forms and intensities and can be pleasing or annoying, soothing or destructive. Therefore it is important that we are able to control it in order to make our lives enjoyable.

Sound

Sound is caused by the vibration of a surface being transferred to a surrounding medium such as the air. The process of transfer is by physical contact. If the vibration is imagined as an oscillation then at one extreme of the oscillation the surface is pushing on the air and at the other extreme it is moving away from the air, therefore sucking the air towards it. When the surface is pushing on the air it produces a slightly higher pressure than normal and when it is moving away it produces a slightly lower pressure than normal, so the oscillation produces alternating higher and lower pressure zones. This difference in pressure causes our ear drum to vibrate and these vibrations travel through the mechanism of the ear to our brain where it is interpreted as the sensation we hear as sound. Sound can be described as a longitudinal pressure wave caused by the vibration of an object.

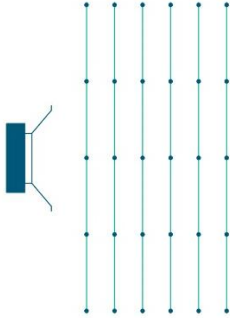


Fig 1. No Sound. And the air is undisturbed

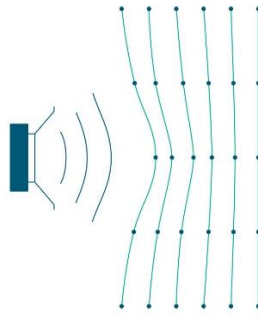


Fig 2. One vibration of the speaker and sound begins to propagate through the air

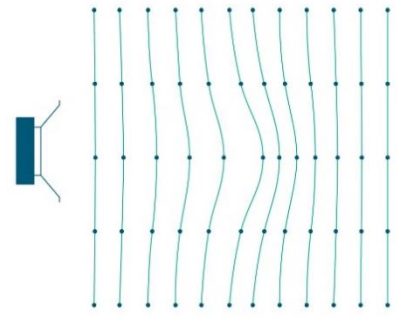


Fig 3. Speaker has stopped, the initial sound continues to propagate through the air

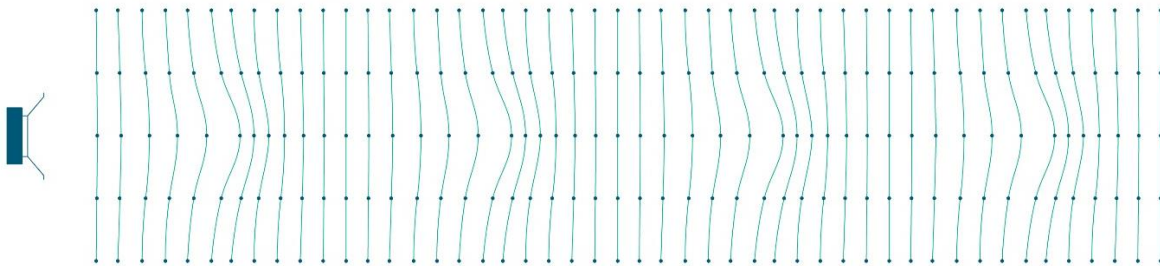


Fig 4. A series of sound waves propagating through the air

Sound and Noise

Noise is unwanted sound. It may be unwanted for a number of reasons some of which are, it is too loud, it is inappropriate for the current activity (e.g. sleep), unpleasant (e.g. not your favoured music) and many other reasons. We do not want to be bothered by sound that we find irritating.

Characteristics of Sound

The speed of vibration can vary considerably and is called the frequency of the sound and is measured in hertz (Hz) and represents the number of vibrations per second of the object causing the sound. When we speak of high or low pitched sound we are referring to the frequency. The frequency range of human hearing ranges from 20 Hz to 20,000Hz. Sound exists outside this frequency range but we cannot hear it. The loudness of the sound is represented by the magnitude of the sound pressure. The higher the pressure the louder the sound. This pressure can be increased to a level where we feel pain and damage can be caused to the hearing mechanism of the ear. The difference between the smallest pressure our ears can sense and the point at which pain is perceived is numerically large and our ears do not sense a doubling of sound pressure

as a doubling of loudness. The decibel was introduced to represent sound pressure. The sound intensity measured in Decibels (dB) is called the Sound Pressure Level and is universally used as a measurement of the Sound Intensity.

The use of the logarithmic scale does present some difficulties, simply because it is not a linear scale. A linear scale means that when the figure representing the quantity of the item being measured is doubled then there will be twice as much of the item present. Most of the quantities we encounter in our daily lives are measured in a linear fashion so if the number representing the amount of particular item is doubled then we expect that there will be twice as much of the item present. Encountering a scale of which is not linear, such as the Decibel scale, for the first time can seem very strange. If the sound pressure level was increased by 10dB then we would feel that the sound was twice as loud so a noise increase from 60dB to 70dB would seem to have doubled. If it was reduced by 10dB then we would feel that the noise had halved so a decrease from 60 to 50dB. See Table 1.

dB Increase	Relative Loudness% Increase	dB Decrease	Relative Loudness% Decrease
0	0	0	0
1	7	1	7
2	15	2	13
3	23	3	19
4	32	4	24
5	41	5	29
6	52	6	34
7	63	7	38
8	74	8	43
9	86	9	46
10	100	10	50
20	400	20	75
30	800	30	88
40	1600	40	94
50	3200	50	97

Table 1. The relationship between dB and relative loudness as sensed by our ears.

It should be noted that the detection of small changes in loudness is difficult. If you left a room and the sound was increased or decreased by 2dB and you later returned to the room you would not detect that the sound level had been altered. This means that you would not detect a 15% increase or a 13% decrease in loudness in this situation. If you were present in the room at the time the sound was altered you would comfortably detect the 2dB alteration.

The pressure wave method of transmission means that sound is not able to travel large distances because it has to shake all the air in between so the energy is quickly absorbed. Placing barriers in the path of sound can increase this absorption and as a consequence can reduce the distance sound is able to travel.

Human Sensitivity to Sound

The ear is the tool which human body uses to detect sound waves in the environment and the brain is the device which interprets the information detected by the ear. The ear does not sense all sound frequencies at equal loudness. The threshold of hearing is a measure of the quietest sounds which the ear can detect. It is interesting to note that the sound frequencies at the extreme ends of human sensitivity (20Hz and 20kHz) have to be much louder for humans to be able to hear them, than frequencies in the range human speech. This presents an issue for the analysis of sound problems. To overcome this issue sound measuring equipment has a built in filter to adjust for this variance. This filter is called an A weighting. Sound Pressure level is measured in dB and the adjusted measurement is designated as dB(A). It is used very commonly.

Sound Reduction with Glass

Measurement

The sound reduction of glass is most accurately determined by testing. The tests are undertaken at specialised acoustic laboratories. The test process measures the reduction at each third octave band frequency from 100Hz to as much as 4000Hz. The reduction at each of these octave bands is different. A typical plot is shown in the graph below.

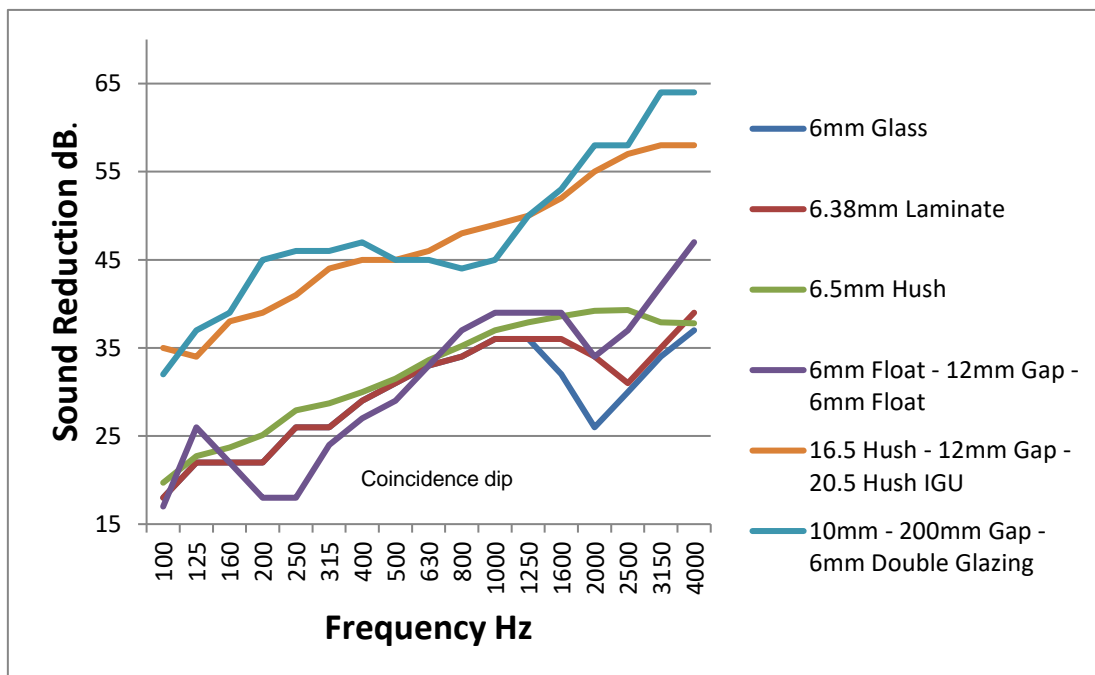


Figure 5. A typical graph of sound reduction for various glass types

This graph shows a typical sound reduction plot for several glazing types. The first thing to notice is that the graph, for all the glass types, slopes upward from left to right indicating that the sound reduction is better in the higher frequencies than the lower frequencies. There is a noticeable dip and recovery in the graph near the right hand side, this is called a coincidence dip and it can be seen in all test data for glass although the magnitude and position change with thickness and type of glass.

Dealing with sound loss levels at various frequencies can be complicated so various methods have been developed to reduce this frequency data to a single figure. STC (Sound Transmission Class) had been the most common parameter used for glass over the years and the process of determination was set out in AS 1276 but this standard has now been superseded by AS/NZS ISO 717.1:2004. This new standard determines the Weighted Sound Reduction Index R_w . The numbers which result from the two methods are often the same as can be seen in the performance tables at the end of this document. The process for the determination of STC and R_w values is very similar and often the numbers are the same or very close however there are some minor differences and they are.

Feature	R_w	STC
Frequency Range	100Hz to 3.15 kHz	125Hz to 4 kHz
Quantity produced	R_w, C, C_{tr}	STC

Modification of glass performance

The plot above shows the basic behaviour of glass when subjected to sound. This can be modified by altering the glass make up. The plot above shows the behaviour of 6mm annealed glass and will also apply to 6mm toughened glass.

The plot for 6.38mm Laminated glass looks slightly different because the coincidence dip is not be as large and this is due to the lower viscosity of the interlayer used to laminate the glass together. There are now interlayers which are designed specially to reduce sound and these combine two materials in the one interlayer and these have a marked effect on the coincidence dip. This can be seen in the plot for 6.5mm Hush, The stiffness of glass is one characteristic which determines its resistance to sound penetration and this is the reason thicker glass is better than thinner glass. It is possible to combine a thicker and a thinner, glass in the one laminate so the difference in thickness can be combined with the difference in viscosity of the interlayer to maximise the sound reduction effect. Air has a vastly different viscosity to glass so can be used as a sound reduction medium. This introduces the possibility to use double glazing as a sound reduction agent. Double glazing can be quite effective, but the appropriate amount of air is required. Typically, the double glazing used for thermal insulation provides only a modest improvement in sound reduction. However, a wider air gap than is possible for hermetically sealed double-glazed units is much more effective. A gap of 50mm to 200mm will provide a substantial reduction when compared to the glass alone. Typically two window frames are required to achieve this. This can be seen in Figure 5.

Solving a noise problem.

It is important to note that the following information relates to glass only.

Solving a noise problem is not as easy as it sounds. The noise level which is acceptable to one person may not be acceptable to another and it is very difficult to allow for this variation by specifying R_w parameters. A detailed solution would involve measuring the nature and intensity of the offending sound and choosing a glass product which will reduce the intensity sufficiently at all frequencies. This assessment process can also be done using single numbers. It means reducing the external noise to a single number and then subtracting the single number for the glass this will provide a single number for the noise coming through the glass. This is relatively simple but consideration must be given to the materials and structure of the building as well.

The sound reduction performance of glass is now measured in R_w and the process of determination of R_w produces two additional parameters C and C_{tr} . These adaptation terms are used to modify the R_w number to better represent the sound reduction of glass for different types of noise.

The “C” adaptation term is relevant to the following noise types

1. Living activities (talking, music, radio, TV)
2. Children playing
3. Railway traffic at medium and high speed
4. Highway traffic with speeds >80km/hr
5. Jet aircraft at short distance
6. Factories emitting mainly medium and high frequency noise

The “ C_{tr} ” adaptation term is relevant to the following noise types

1. Urban road traffic
2. Railway traffic at low speeds
3. Aircraft which are propeller driven
4. Jet aircraft which are a large distance away
5. Disco music
6. Factories emitting mainly low and medium frequency noise.

The tables in Appendix A of this document list the sound reduction in spectral terms and the performance in terms of R_w , C, C_{tr} and STC.

What is required to be known to determine a noise solution?

Three pieces of information are required before a solution can be determined.

1. External noise Level
2. Desired internal noise level
3. Sound reduction data for glass

The process is simple if this information is known.

For example, subtract the desired internal noise level from the external noise level and this will reveal the magnitude of the noise reduction which the glass must achieve.

The next step is to look through the sound reduction data to find the glass which can provide this reduction. Remember to apply the appropriate adaptation term (C or C_{tr}) to the R_w value and use the resulting value for comparison.

The external noise level is often the most difficult to determine because the intensity varies for a number of reasons including the distance from the noise source. The most accurate way for this to be determined is to have the noise measured using an accurate sound meter. Doing this properly requires some expertise. An acoustic engineer has the expertise and equipment to do this properly.

Conclusion

Sound and noise are an ever present phenomenon in our environment and can be the source of much enjoyment or significant annoyance. Glass is an essential component in our buildings and if properly designed can play an important role in ensuring the presence of a comfortable sound environment within the building. There is little reason why an appropriate glass cannot be selected to solve a noise problem as well as satisfy all the other requirements which may be placed on it.

APPENDIX A
Sound Reduction Data for Glass

Frequency (Hz)	3mm	4mm	5mm	6mm	8mm	10mm	12mm	15mm	19mm
100	15	17	17	18	19	24	25	25	25
125	22	23	25	22	27	26	29	29	29
160	19	22	23	22	22	28	31	31	31
200	18	21	23	22	27	26	30	30	31
250	20	21	23	26	25	28	30	31	32
315	22	24	25	26	28	29	32	33	35
400	25	26	28	29	30	32	34	35	36
500	27	29	30	31	33	34	36	37	38
630	29	30	32	33	35	36	36	35	36
800	30	32	33	34	36	37	36	32	35
1000	32	34	35	36	37	36	33	33	38
1250	33	34	36	36	34	33	32	35	40
1600	34	36	36	32	30	33	36	39	44
2000	35	36	32	26	33	38	39	42	47
2500	35	31	26	30	37	41	42	45	50
3150	30	25	32	34	40	43	46	50	52
4000	26	31	35	37	41	44	47	51	55
R_w	30	31	32	32	34	36	37	37	40
C	-1	-2	-2	-2	-1	-1	-2	-1	-1
C_{tr}	-4	-3	-3	-3	-3	-3	-3	-3	-4
STC	29	29	30	30	34	36	36	37	40

Table A1. Sound Attenuation for Monolithic Glass

Frequency (Hz)	6.38mm	8.38mm	10.38mm	12.38mm
100	18	20	24	25
125	22	27	26	28
160	22	26	28	28
200	22	26	26	27
250	26	26	27	31
315	26	28	29	32
400	29	29	31	33
500	31	34	34	35
630	33	36	36	37
800	34	37	37	37
1000	36	35	33	36
1250	36	31	35	35
1600	36	33	34	37
2000	34	35	38	41
2500	31	39	42	44
3150	35	42	44	47
4000	39	43	46	50
R_w	33	34	36	37
C	-1	-1	-1	0
C_{tr}	-3	-3	-3	-3
STC	33	35	36	37

Table A2. Sound Attenuation for QLam Laminated Glass

Frequency (Hz)	6.5mm	8.5mm	10.5mm	12.5mm
100	19.7	22.6	29	28.1
125	22.7	24.9	28	28.2
160	23.7	25.7	28	28.2
200	25.1	27.7	29	30.8
250	27.9	29.8	31	32.9
315	28.7	30.6	32	34.1
400	30.0	31.7	33	34.7
500	31.5	33.3	34	36.0
630	33.6	35.4	36	38.3
800	35.2	36.7	38	39.5
1000	37.0	38.6	39	41.0
1250	37.9	39.7	40	41.2
1600	38.6	40.1	41	40.3
2000	39.2	39.9	40	40.5
2500	39.3	38.7	38	43.3
3150	37.9	38.5	41	47.3
4000	37.8	43.5	44	50.9
5000	41.4	47.2	47	53.9
R_w	36	37	38	40
C	-1	-1	-1	-1
C_{tr}	-4	-3	-3	-3
STC	36	37	38	40

Table A3. Sound Attenuation for QLam Hush

Frequency (Hz)	4mm	6mm	6mm	10mm	10mm	10mm
	12mm	12mm	12mm	12mm	12mm	12mm
	Gap	Gap	Gap	Gap	Gap	Gap
	4mm	6mm	6.38mm	4mm	6mm	6.38mm
100	25	17	19	23	27	27
125	24	26	24	28	27	28
160	23	22	21	26	24	26
200	21	18	19	19	24	26
250	21	18	19	23	29	30
315	19	24	24	26	31	32
400	22	27	28	31	33	34
500	25	29	32	33	34	36
630	30	33	34	36	37	40
800	33	37	38	39	39	41
1000	36	39	40	41	41	42
1250	38	39	40	41	41	41
1600	40	39	39	41	39	41
2000	41	34	35	45	37	42
2500	35	37	39	45	40	44
3150	31	42	44	42	43	49
4000	40	47	49	44	47	53
R_w	31	33	34	36	38	40
C	-2	-2	-2	-2	-2	-2
C_{tr}	-4	-5	-5	-5	-4	-5
STC	31	33	34	36	38	40

Table A4. Sound Attenuation for Double Glazing (12mm Gap)

Frequency (Hz)	4mm	6mm	8mm	8mm	10mm	10mm	12mm
	12mm Gap	12mm Gap	12mm Gap	12mm Gap	12mm Gap	12mm Gap	12mm Gap
	6.5mm Hush	6.5mm Hush	6.5mm Hush	8.5mm Hush	8.5mm Hush	12.5mm Hush	12.5mm Hush
40	-	-	23	-	19	19	-
50	-	-	27	-	24	27	-
63	-	-	25	-	25	25	-
80	23	23	23	23	24	25	26
100	31	31	32	31	31	33	33
125	28	26	28	26	28	28	23
160	27	28	29	30	32	34	33
200	19	22	28	33	31	37	38
250	22	26	31	30	33	37	37
315	28	30	35	35	39	41	41
400	32	34	38	38	41	43	43
500	34	35	39	40	41	43	43
630	37	38	42	42	43	44	43
800	39	40	43	43	44	46	44
1000	42	43	44	44	44	46	44
1250	44	45	45	44	45	46	47
1600	45	45	45	44	47	47	51
2000	47	45	49	46	52	52	53
2500	47	46	55	53	55	55	56
3150	44	52	57	56	57	58	60
4000	48	56	57	60	58	58	62
5000	59	61	58	63	58	58	64
R_w	37	39	42	43	44	46	46
C	-2	-2	-1	-2	-1	-1	-2
C_{tr}	-6	-5	-4	-5	-4	-4	-6
STC	37	39	42	43	44	46	46

Table A5. Sound Attenuation for QLam Hush Double Glazing (12mm Gap)

Frequency (Hz)	4mm	6mm	6mm	8mm	8mm	10mm
	16mm Gap	16mm Gap	16mm Gap	16mm Gap	16mm Gap	16mm Gap
	8.5mm Hush	6.5mm Hush	8.5mm Hush	8.5mm Hush	10.5mm Hush	16.5mm Hush
40	22	-	-	22	-	20
50	27	-	-	27	-	25
63	23	-	-	29	-	23
80	23	22	23	22	22	26
100	30	31	31	28	29	29
125	28	24	22	26	26	29
160	25	28	30	30	33	34
200	23	25	26	36	37	37
250	26	28	29	35	35	39
315	31	32	32	38	39	41
400	37	37	38	41	41	43
500	37	37	38	42	43	44
630	38	40	41	43	45	46
800	41	41	43	43	46	46
1000	43	43	44	44	47	47
1250	45	45	46	45	47	46
1600	47	45	46	45	46	48
2000	49	46	45	49	47	53
2500	47	47	46	54	53	56
3150	46	53	52	57	58	57
4000	53	57	58	60	61	58
5000	59	61	62	62	64	58
<i>R_w</i>	40	41	41	44	45	47
<i>C</i>	-2	-2	-1	-1	-1	-1
<i>C_{tr}</i>	-6	-6	-5	-5	-4	-5
<i>STC</i>	40	41	41	44	45	47

Table A6. Sound Attenuation for QLam Hush Double Glazing (16mm Gap)

Frequency (Hz)	8mm	8mm
	20mm	20mm
	Gap	Gap
	8.5mm Hush	12.5mm Hush
40	22	20
50	27	27
63	26	24
80	22	22
100	30	27
125	28	29
160	35	36
200	35	38
250	36	37
315	40	42
400	42	43
500	43	44
630	45	46
800	47	47
1000	48	48
1250	48	48
1600	48	48
2000	51	51
2500	55	55
3150	57	57
4000	58	58
5000	58	58
<i>R_w</i>	46	47
<i>C</i>	-1	-1
<i>C_{tr}</i>	-4	-5
<i>STC</i>	46	47

Table A7. Sound Attenuation for QLam Hush Double Glazing (20mm Gap)

Frequency (Hz)	6mm
	25mm Gap
	8.5mm Hush
40	23
50	26
63	21
80	19
100	28
125	27
160	34
200	29
250	33
315	35
400	41
500	42
630	44
800	46
1000	48
1250	49
1600	50
2000	50
2500	50
3150	56
4000	60
5000	62
R_w	45
C	-2
C_{tr}	-6
STC	45

Table A8. Sound Attenuation for QLam Hush Double Glazing (25mm Gap)

Frequency (Hz)	6.5mm Hush	8.5mm Hush	8.5mm Hush	10.5mm Hush	12.5mm Hush	8.5mm Hush	12.5mm Hush	16.5mm Hush
	12mm Gap	12mm Gap	12mm Gap	12mm Gap	12mm Gap	12mm Gap	12mm Gap	12mm Gap
	6.5mm Hush	8.5mm Hush	12.5mm Hush	12.5mm Hush	12.5mm Hush	16.5mm Hush	16.5mm Hush	20.5mm Hush
40	-	-	-	-	-	19	21	28
50	-	-	-	-	-	26	26	26
63	-	-	-	-	-	23	24	24
80	23	25	25	25	25	25	26	26
100	31	32	32	32	32	34	34	35
125	26	27	27	29	30	30	31	34
160	28	30	31	32	34	34	37	38
200	22	28	33	34	36	34	38	39
250	26	30	33	35	36	36	39	41
315	30	35	37	39	40	40	42	44
400	34	38	41	41	42	43	44	45
500	35	39	42	43	43	44	45	45
630	38	42	44	44	45	45	46	46
800	40	44	45	45	46	47	48	48
1000	43	46	46	46	47	49	50	49
1250	45	48	47	48	47	50	50	50
1600	45	50	48	48	48	51	52	52
2000	45	52	49	47	46	55	55	55
2500	46	52	51	50	51	57	57	57
3150	52	53	54	55	57	58	58	58
4000	56	61	60	60	61	58	58	58
5000	61	65	63	62	64	58	58	58
R_w	39	43	45	45	46	47	49	49
C	-2	-1	-2	-1	-1	-1	-1	-1
C_{tr}	-5	-5	-5	-4	-4	-5	-5	-4
STC	39	43	45	45	46	47	49	49

Table A9. Sound Attenuation for Double QLam Hush Double Glazing (12mm Gap)

Frequency (Hz)	8.5mm Hush	10.5mm Hush	16.5mm Hush
	20mm Gap	20mm Gap	20mm Gap
	12.5mm Hush	12.5mm Hush	20.5mm Hush
40	-	-	28
50	-	-	26
63	-	-	23
80	22	22	23
100	28	30	36
125	29	32	37
160	35	36	40
200	35	37	39
250	38	38	42
315	40	41	44
400	42	43	45
500	44	44	46
630	46	45	47
800	45	46	49
1000	47	47	50
1250	48	48	51
1600	49	50	53
2000	50	50	55
2500	52	52	57
3150	56	58	58
4000	61	62	58
5000	64	64	58
R_w	47	47	50
C	-2	-1	-1
C_{tr}	-5	-4	-4
STC	47	47	50

Table A10. Sound Attenuation for Double QLam Hush Double Glazing (20mm Gap)

Frequency (Hz)	4mm	6mm	4mm
	8mm Gap	8mm Gap	10mm Gap
	6.5mm Hush	10.5mm Hush	6.5mm Hush
40	-	-	-
50	-	-	-
63	-	-	-
80	23	25	23
100	31	32	31
125	28	28	28
160	27	31	27
200	24	27	21
250	21	26	20
315	26	30	26
400	29	34	31
500	31	34	32
630	33	37	35
800	36	39	38
1000	39	42	41
1250	42	44	43
1600	44	44	44
2000	46	43	46
2500	46	44	46
3150	43	53	44
4000	47	59	47
5000	59	62	59
R_w	35	39	36
C	-1	-1	-2
C_{tr}	-4	-4	-5
STC	35	39	35

Table A11. Sound Attenuation for QLam Hush Double Glazing (8mm & 10mm Gap)

Frequency (Hz)	6mm	6mm	10mm
	100mm Gap	150mm Gap	200mm Gap
	4mm	4mm	6mm
100	25	27	32
125	27	30	37
160	27	30	39
200	33	34	45
250	33	34	46
315	37	39	46
400	41	42	47
500	46	46	45
630	50	50	45
800	54	54	44
1000	57	57	45
1250	59	58	50
1600	58	58	53
2000	52	52	58
2500	51	49	58
3150	48	47	64
4000	57	52	64
<i>R_w</i>	46	47	49
<i>C</i>	-2	-2	-1
<i>C_{tr}</i>	-7	-6	-4
<i>STC</i>	46	47	49

Table A12. Sound Attenuation for Wide Air Gap Double Glazing

APPENDIX B

Noise Reduction Solutions Using Glazing

The following tables take the specified “Design Sound Level Range” for rooms from AS/NZS 2107: 2016, for various occupancies and activities, and lists the glass to be used to achieve the upper and lower sound level at the room side of the glass.

The standard provides a range for the “Design Sound Level” for a variety of occupancies and activities. The lower level of the range is the most desirable while the upper level should be seen as the least desirable.

The glass solution to achieve the lower level of the “Design Sound Level” range is found in the “Glass required to limit transmission to recommended design noise level” column of the table. This is the most desirable solution.

The glass solution to achieve the upper level of the “Design Sound Level” range is found in the “Glass required to limit transmission to maximum design noise level” column of the table. This is the least desirable solution.

The tables provide the solution for both traffic and aircraft noise for some of the building use designations shown in AS/NZS 2107: 2016. The attenuation of traffic noise in this table is represented by R_w+C_{tr} and aircraft noise is represented by R_w+C . These tables relate to the noise level at the room side of the glass not necessarily the noise level in the room because the level in the room is also influenced by other factors such as the roof, walls and floor, not just the glass in the windows.

It should be remembered the “Design Sound Levels” suggested in AS2107 may not necessarily be appropriate in all circumstances. There are various methods for analysing and finding a solution to a noise problem. An acoustic consultant is an authoritative source of information and advice for analysing and developing solutions to noise problems. Consideration should be given to employing their expertise.

Type of Occupancy	External Noise Level dB	Traffic Noise				Aircraft Noise			
		Internal noise level (room side of glass)				Internal noise level (room side of glass)			
		Glass required to limit transmission to recommended design noise level		Glass required to limit transmission to maximum design noise level		Glass required to limit transmission to recommended design noise level		Glass required to limit transmission to maximum design noise level	
		dB	dB	dB	dB	dB	dB	dB	
Board Room Design Sound Level Range 30dB to 40dB <i>(Recommended noise level in room = 30dB)</i> <i>(Maximum suggested noise level permitted in room = 40dB)</i>	65	10.5mm QLam Hush	30	4mm QFloat	37	6.5mm QLam Hush	30	4mm QFloat	36
	70	10mm QFloat + 12mm Gap + 8.5mm QLam Hush	30	6.38mm QLam	40	8mm QFloat + 12mm Gap + 6.5mm QLam Hush	29	6.38mm QLam	38
	75	16.5mm QLam Hush + 12mm Gap + 20.5mm QLam Hush	30	10.5mm QLam Hush	40	10mm QFloat + 12mm Gap + 12.5mm QLam Hush	30	6.5mm QLam Hush	40
	80	No standard solution	-	8.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	40	No standard solution	-	8mm QFloat + 12mm Gap + 6.5mm QLam Hush	39
Cafeteria Design Sound Level Range 45dB to 50dB <i>(Recommended noise level in room = 45dB)</i> <i>(Maximum suggested noise level in room = 50dB)</i>	65	4mm QFloat	37	4mm QFloat	37	4mm QFloat	36	4mm QFloat	36
	70	4mm QFloat	42	4mm QFloat	42	4mm QFloat	41	4mm QFloat	41
	75	6.38mm QLam	45	4mm QFloat	47	5mm QFloat	45	4mm QFloat	46
	80	10.5mm QLam Hush	45	6.38mm QLam	50	6.5mm QLam Hush	45	6.38mm QLam	48
Call Centre Design Sound Level Range 40dB to 45dB <i>(Recommended noise level in room = 40dB)</i> <i>(Maximum suggested noise level in room = 45dB)</i>	65	4mm QFloat	37	4mm QFloat	37	4mm QFloat	36	4mm QFloat	36
	70	6.38mm QLam	40	4mm QFloat	42	5mm QFloat	40	4mm QFloat	41
	75	10.5mm QLam Hush	40	6.38mm QLam	45	6.5mm QLam Hush	40	5mm QFloat	45
	80	8.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	40	10.5mm QLam Hush	45	8mm QFloat + 12mm Gap + 6.5mm QLam Hush	39	6.5mm QLam Hush	45

Type of Occupancy	External Noise Level dB	Traffic Noise				Aircraft Noise			
		Internal noise level (room side of glass)				Internal noise level (room side of glass)			
		Glass required to limit transmission to recommended design noise level		Glass required to limit transmission to maximum design noise level		Glass required to limit transmission to recommended design noise level		Glass required to limit transmission to maximum design noise level	
		dB	dB	dB	dB	dB	dB	dB	
Computer Room Design Sound Level Range 45dB to 50dB <i>(Recommended noise level in room = 45dB)</i> <i>(Maximum suggested noise level in room = 50dB)</i>	65	4mm QFloat	37	4mm QFloat	37	4mm QFloat	36	4mm QFloat	36
	70	4mm QFloat	42	4mm QFloat	42	4mm QFloat	41	4mm QFloat	41
	75	6.38mm QLam	45	4mm QFloat	47	5mm QFloat	45	4mm QFloat	46
	80	10.5mm QLam Hush	45	6.38mm QLam	50	6.5mm QLam Hush	45	6.38mm QLam	48
Consulting Rooms Design Sound Level Range 40dB to 45dB <i>(Recommended noise level in room = 40dB)</i> <i>(Maximum suggested noise level in room = 45dB)</i>	65	4mm QFloat	37	4mm QFloat	37	4mm QFloat	36	4mm QFloat	36
	70	6.38mm QLam	40	4mm QFloat	42	5mm QFloat	40	4mm QFloat	41
	75	10.5mm QLam Hush	40	6.38mm QLam	45	6.5mm QLam Hush	40	5mm QFloat	45
	80	8.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	40	10.5mm QLam Hush	45	8mm QFloat + 12mm Gap + 6.5mm QLam Hush	39	6.5mm QLam Hush	45
General Office Areas Design Sound Level Range 40dB to 45dB <i>(Recommended noise level in room = 40dB)</i> <i>(Maximum suggested noise level in room = 45dB)</i>	65	4mm QFloat	37	4mm QFloat	37	4mm QFloat	36	4mm QFloat	36
	70	6.38mm QLam	40	4mm QFloat	42	5mm QFloat	40	4mm QFloat	41
	75	10.5mm QLam Hush	40	6.38mm QLam	45	6.5mm QLam Hush	40	5mm QFloat	45
	80	8.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	40	10.5mm QLam Hush	45	8mm QFloat + 12mm Gap + 6.5mm QLam Hush	39	6.5mm QLam Hush	45

Type of Occupancy	External Noise Level dB	Traffic Noise				Aircraft Noise			
		Internal noise level (room side of glass)				Internal noise level (room side of glass)			
		Glass required to limit transmission to recommended design noise level		Glass required to limit transmission to maximum design noise level		Glass required to limit transmission to recommended design noise level		Glass required to limit transmission to maximum design noise level	
		dB	dB	dB	dB	dB	dB	dB	
Executive Offices Design Sound Level Range 35dB to 40dB <i>(Recommended noise level in room = 35dB)</i> <i>(Maximum suggested noise level in room = 40dB)</i>	65	6.38mm QLam	35	4mm QFloat	37	5mm QFloat	35	4mm QFloat	36
	70	10.5mm QLam Hush	35	6.38mm QLam	40	6.5mm QLam Hush	35	6.38mm QLam	38
	75	8.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	35	10.5mm QLam Hush	40	8mm QFloat + 12mm Gap + 6.5mm QLam Hush	34	6.5mm QLam Hush	40
	80	16.5mm QLam Hush + 12mm Gap + 20.5mm QLam Hush	35	8.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	40	12.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	35	8mm QFloat + 12mm Gap + 6.5mm QLam Hush	39
Reception Area Design Sound Level Range 40dB to 45dB <i>(Recommended noise level in room = 40dB)</i> <i>(Maximum suggested noise level in room = 45dB)</i>	65	4mm QFloat	37	4mm QFloat	37	4mm QFloat	36	4mm QFloat	36
	70	6.38mm QLam	40	4mm QFloat	42	5mm QFloat	40	4mm QFloat	41
	75	10.5mm QLam Hush	40	6.38mm QLam	45	6.5mm QLam Hush	40	5mm QFloat	45
	80	8.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	40	10.5mm QLam Hush	45	8mm QFloat + 12mm Gap + 6.5mm QLam Hush	39	6.5mm QLam Hush	45
Lobby Design Sound Level Range 45dB to 50dB <i>(Recommended noise level in room = 45dB)</i> <i>(Maximum suggested noise level in room = 50dB)</i>	65	4mm QFloat	37	4mm QFloat	37	4mm QFloat	36	4mm QFloat	36
	70	4mm QFloat	42	4mm QFloat	42	4mm QFloat	41	4mm QFloat	41
	75	6.38mm QLam	45	4mm QFloat	47	5mm QFloat	45	4mm QFloat	46
	80	10.5mm QLam Hush	45	6.38mm QLam	50	6.5mm QLam Hush	45	6.38mm QLam	48

Type of Occupancy	External Noise Level dB	Traffic Noise				Aircraft Noise			
		Internal noise level (room side of glass)				Internal noise level (room side of glass)			
		Glass required to limit transmission to recommended design noise level	dB	Glass required to limit transmission to maximum design noise level	dB	Glass required to limit transmission to recommended design noise level	dB	Glass required to limit transmission to maximum design noise level	dB
General Offices Design Sound Level Range 40dB to 45dB <i>(Recommended noise level in room = 40dB)</i> <i>(Maximum suggested noise level in room = 45dB)</i>	65	4mm QFloat	37	4mm QFloat	37	4mm QFloat	36	4mm QFloat	36
	70	6.38mm QLam	40	4mm QFloat	42	5mm QFloat	40	4mm QFloat	41
	75	10.5mm QLam Hush	40	6.38mm QLam	45	6.5mm QLam Hush	40	5mm QFloat	45
	80	8.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	40	10.5mm QLam Hush	45	8mm QFloat + 12mm Gap + 6.5mm QLam Hush	39	6.5mm QLam Hush	45
Airport Departure Lounge Design Sound Level Range 45dB to 50dB <i>(Recommended noise level in room = 45dB)</i> <i>(Maximum suggested noise level in room = 50dB)</i>	65	4mm QFloat	37	4mm QFloat	37	4mm QFloat	36	4mm QFloat	36
	70	4mm QFloat	42	4mm QFloat	42	4mm QFloat	41	4mm QFloat	41
	75	6.38mm QLam	45	4mm QFloat	47	5mm QFloat	45	4mm QFloat	46
	80	10.5mm QLam Hush	45	6.38mm QLam	50	6.5mm QLam Hush	45	6.38mm QLam	48
Airport Passenger Check-in Area Design Sound Level Range 45dB to 50dB <i>(Recommended noise level in room = 45dB)</i> <i>(Maximum suggested noise level in room = 50dB)</i>	65	4mm QFloat	37	4mm QFloat	37	4mm QFloat	36	4mm QFloat	36
	70	4mm QFloat	42	4mm QFloat	42	4mm QFloat	41	4mm QFloat	41
	75	6.38mm QLam	45	4mm QFloat	47	5mm QFloat	45	4mm QFloat	46
	80	10.5mm QLam Hush	45	6.38mm QLam	50	6.5mm QLam Hush	45	6.38mm QLam	48

Type of Occupancy	External Noise Level dB	Traffic Noise				Aircraft Noise			
		Internal noise level (room side of glass)				Internal noise level (room side of glass)			
		Glass required to limit transmission to recommended design noise level	dB	Glass required to limit transmission to maximum design noise level	dB	Glass required to limit transmission to recommended design noise level	dB	Glass required to limit transmission to maximum design noise level	dB
Art Gallery Design Sound Level Range 40dB to 45dB <i>(Recommended noise level in room = 40dB)</i> <i>(Maximum suggested noise level in room = 45dB)</i>	65	4mm QFloat	37	4mm QFloat	37	4mm QFloat	36	4mm QFloat	36
	70	6.38mm QLam	40	4mm QFloat	42	5mm QFloat	40	4mm QFloat	41
	75	10.5mm QLam Hush	40	6.38mm QLam	45	6.5mm QLam Hush	40	5mm QFloat	45
	80	8.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	40	10.5mm QLam Hush	45	8mm QFloat + 12mm Gap + 6.5mm QLam Hush	39	6.5mm QLam Hush	45
Exhibition Areas Design Sound Level Range 40dB to 50dB <i>(Recommended noise level in room = 40dB)</i> <i>(Maximum suggested noise level in room = 50dB)</i>	65	4mm QFloat	37	4mm QFloat	37	4mm QFloat	36	4mm QFloat	36
	70	6.38mm QLam	40	4mm QFloat	42	5mm QFloat	40	4mm QFloat	41
	75	10.5mm QLam Hush	40	6.38mm QLam	45	6.5mm QLam Hush	40	4mm QFloat	46
	80	8.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	40	10.5mm QLam Hush	45	8mm QFloat + 12mm Gap + 6.5mm QLam Hush	39	6.38mm QLam	48
Place of Worship Design Sound Level Range 30dB to 40dB <i>(Recommended noise level in room = 30dB)</i> <i>(Maximum suggested noise level in room = 40dB)</i>	65	10.5mm QLam Hush	30	4mm QFloat	37	6.5mm QLam Hush	30	4mm QFloat	36
	70	8.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	30	6.38mm QLam	40	8mm QFloat + 12mm Gap + 6.5mm QLam Hush	29	5mm QFloat	40
	75	16.5mm QLam Hush + 12mm Gap + 20.5mm QLam Hush	30	10.5mm QLam Hush	40	12.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	30	6.5mm QLam Hush	40
	80	No standard solution	-	8.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	40	No standard solution	-	8mm QFloat + 12mm Gap + 6.5mm QLam Hush	39

Type of Occupancy	External Noise Level dB	Traffic Noise				Aircraft Noise			
		Internal noise level (room side of glass)				Internal noise level (room side of glass)			
		Glass required to limit transmission to recommended design noise level	dB	Glass required to limit transmission to maximum design noise level	dB	Glass required to limit transmission to recommended design noise level	dB	Glass required to limit transmission to maximum design noise level	dB
Court Room Design Sound Level Range 30dB to 35dB <i>(Recommended noise level in room = 30dB)</i> <i>(Maximum suggested noise level in room = 35dB)</i>	65	10.5mm QLam Hush	30	6.38 QLam	35	6.5mm QLam Hush	30	5mm QFloat	35
	70	8.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	30	10.5mm QLam Hush	35	8mm QFloat + 12mm Gap + 6.5mm QLam Hush	29	6.5mm QLam Hush	35
	75	16.5mm QLam Hush + 12mm Gap + 20.5mm QLam Hush	30	8.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	35	12.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	30	8mm QFloat + 12mm Gap + 6.5mm QLam Hush	34
	80	No standard solution	-	16.5mm QLam Hush + 12mm Gap + 20.5mm QLam Hush	35	No standard solution	-	12.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	35
Library Reading Area Design Sound Level Range 40dB to 45dB <i>(Recommended noise level in room = 40dB)</i> <i>(Maximum suggested noise level in room = 45dB)</i>	65	4mm QFloat	37	4mm QFloat	37	4mm QFloat	36	4mm QFloat	36
	70	6.38mm QLam	40	4mm QFloat	42	5mm QFloat	40	4mm QFloat	41
	75	10.5mm QLam Hush	40	6.38mm QLam	45	6.5mm QLam Hush	40	5mm QFloat	45
	80	8.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	40	10.5mm QLam Hush	45	8mm QFloat + 12mm Gap + 6.5mm QLam Hush	39	6.5mm QLam Hush	45
Museum Exhibition Area Design Sound Level Range 40dB to 45dB <i>(Recommended noise level in room = 40dB)</i> <i>(Maximum suggested noise level in room = 45dB)</i>	65	4mm QFloat	37	4mm QFloat	37	4mm QFloat	36	4mm QFloat	36
	70	6.38mm QLam	40	4mm QFloat	42	5mm QFloat	40	4mm QFloat	41
	75	10.5mm QLam Hush	40	6.38mm QLam	45	6.5mm QLam Hush	40	5mm QFloat	45
	80	8.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	40	10.5mm QLam Hush	45	8mm QFloat + 12mm Gap + 6.5mm QLam Hush	39	6.5mm QLam Hush	45

Type of Occupancy	External Noise Level dB	Traffic Noise				Aircraft Noise			
		Internal noise level (room side of glass)				Internal noise level (room side of glass)			
		Glass required to limit transmission to recommended design noise level	dB	Glass required to limit transmission to maximum design noise level	dB	Glass required to limit transmission to recommended design noise level	dB	Glass required to limit transmission to maximum design noise level	dB
Post Offices and General Banking Areas	65	4mm QFloat	37	4mm QFloat	37	4mm QFloat	36	4mm QFloat	36
Design Sound Level Range 45dB to 50dB	70	4mm QFloat	42	4mm QFloat	42	4mm QFloat	41	4mm QFloat	41
<i>(Recommended noise level in room = 45dB)</i>	75	6.38mm QLam	45	4mm QFloat	47	5mm QFloat	45	4mm QFloat	46
<i>(Maximum suggested noise level in room = 50dB)</i>	80	10.5mm QLam Hush	45	6.38mm QLam	50	6.5mm QLam Hush	45	5mm QFloat	50
Railway and Bus Terminal Ticket Areas	65	4mm QFloat	37	4mm QFloat	37	4mm QFloat	36	4mm QFloat	36
Design Sound Level Range 45dB to 50dB	70	4mm QFloat	42	4mm QFloat	42	4mm QFloat	41	4mm QFloat	41
<i>(Recommended noise level in room = 45dB)</i>	75	6.38mm QLam	45	4mm QFloat	47	5mm QFloat	45	4mm QFloat	46
<i>(Maximum suggested noise level in room = 50dB)</i>	80	10.5mm QLam Hush	45	6.38mm QLam	50	6.5mm QLam Hush	45	5mm QFloat	50
Restaurants, and Coffee shops	65	4mm QFloat	37	4mm QFloat	37	4mm QFloat	36	4mm QFloat	36
Design Sound Level Range 40dB to 50dB	70	6.38mm QLam	40	4mm QFloat	42	5mm QFloat	40	4mm QFloat	41
<i>(Recommended noise level in room = 40dB)</i>	75	10.5mm QLam Hush	40	6.38mm QLam	45	6.5mm QLam Hush	40	4mm QFloat	46
<i>(Maximum suggested noise level in room = 50dB)</i>	80	8.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	40	6.38mm QLam	50	8mm QFloat + 12mm Gap + 6.5mm QLam Hush	39	5mm QFloat	50

Type of Occupancy	External Noise Level dB	Traffic Noise				Aircraft Noise			
		Internal noise level (room side of glass)				Internal noise level (room side of glass)			
		Glass required to limit transmission to recommended design noise level	dB	Glass required to limit transmission to maximum design noise level	dB	Glass required to limit transmission to recommended design noise level	dB	Glass required to limit transmission to maximum design noise level	dB
Coffee Bars Design Sound Level Range 45dB to 50dB <i>(Recommended noise level in room = 45dB)</i> <i>(Maximum suggested noise level in room = 50dB)</i>	65	4mm QFloat	37	4mm QFloat	37	4mm QFloat	36	4mm QFloat	36
	70	4mm QFloat	42	4mm QFloat	42	4mm QFloat	41	4mm QFloat	41
	75	6.38mm QLam	45	4mm QFloat	47	5mm QFloat	45	4mm QFloat	46
	80	10.5mm QLam Hush	45	6.38mm QLam	50	6.5mm QLam Hush	45	5mm QFloat	50
Houses and Apartments near minor roads <i>Sleeping Areas</i> Design Sound Level Range 30dB to 35dB <i>(Recommended noise level in room = 30dB)</i> <i>(Maximum suggested noise level in room = 35dB)</i>	65	10.5mm QLam Hush	30	6.38mm QLam	35	6.5mm QLam Hush	30	5mm QFloat	35
	70	8.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	30	10.5mm QLam Hush	35	8mm QFloat + 12mm Gap + 6.5mm QLam Hush	29	6.5mm QLam Hush	35
	75	16.5mm QLam Hush + 12mm Gap + 20.5mm QLam Hush	30	8.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	35	12.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	30	8mm QFloat + 12mm Gap + 6.5mm QLam Hush	34
	80	No standard solution	-	16.5mm QLam Hush + 12mm Gap + 20.5mm QLam Hush	35	No standard solution	-	12.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	35
Houses and Apartments near minor roads <i>Living Areas</i> Design Sound Level Range 30dB to 40dB <i>(Recommended noise level in room = 30dB)</i> <i>(Maximum suggested noise level in room = 40dB)</i>	65	10.5mm QLam Hush	30	4mm QFloat	37	6.5mm QLam Hush	30	4mm QFloat	36
	70	8.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	30	6.38mm QLam	40	8mm QFloat + 12mm Gap + 6.5mm QLam Hush	29	5mm QFloat	40
	75	16.5mm QLam Hush + 12mm Gap + 20.5mm QLam Hush	30	10.5mm QLam Hush	40	12.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	30	6.5mm QLam Hush	40
	80	No standard solution	-	8.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	40	No standard solution	-	8mm QFloat + 12mm Gap + 6.5mm QLam Hush	39

Type of Occupancy	External Noise Level	Traffic Noise				Aircraft Noise			
		Internal noise level (room side of glass)				Internal noise level (room side of glass)			
		Glass required to limit transmission to recommended design noise level	dB	Glass required to limit transmission to maximum design noise level	dB	Glass required to limit transmission to recommended design noise level	dB	Glass required to limit transmission to maximum design noise level	dB
Houses and Apartments near major roads <i>Sleeping Areas</i> Design Sound Level Range 35dB to 40dB <i>(Recommended noise level in room = 35dB)</i> <i>(Maximum suggested noise level in room = 40dB)</i>	65	6.38mm QLam	35	4mm QFloat	37	5mm QFloat	35	4mm QFloat	36
	70	10.5mm QLam Hush	35	6.38mm QLam	40	6.5mm QLam Hush	35	5mm QFloat	40
	75	8.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	35	10.5mm QLam Hush	40	8mm QFloat + 12mm Gap + 6.5mm QLam Hush	34	6.5mm QLam Hush	40
	80	16.5mm QLam Hush + 12mm Gap + 20.5mm QLam Hush	35	8.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	40	12.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	35	8mm QFloat + 12mm Gap + 6.5mm QLam Hush	39
Houses and Apartments near major roads <i>Living Areas</i> Design Sound Level Range 35dB to 45dB <i>(Recommended noise level in room = 35dB)</i> <i>(Maximum suggested noise level in room = 45dB)</i>	65	6.38mm QLam	35	4mm QFloat	37	5mm QFloat	35	4mm QFloat	36
	70	10.5mm QLam Hush	35	4mm QFloat	42	6.5mm QLam Hush	35	4mm QFloat	41
	75	8.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	35	6.38mm QLam	45	8mm QFloat + 12mm Gap + 6.5mm QLam Hush	34	5mm QFloat	45
	80	16.5mm QLam Hush + 12mm Gap + 20.5mm QLam Hush	35	10.5mm QLam Hush	45	12.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	35	6.5mm QLam Hush	45

Type of Occupancy	External Noise Level dB	Traffic Noise				Aircraft Noise			
		Internal noise level (room side of glass)				Internal noise level (room side of glass)			
		Glass required to limit transmission to recommended design noise level	dB	Glass required to limit transmission to maximum design noise level	dB	Glass required to limit transmission to recommended design noise level	dB	Glass required to limit transmission to maximum design noise level	dB
Hotels and Motels near minor roads <i>Sleeping areas</i> Design Sound Level Range 30dB to 35dB (Recommended noise level in room = 30dB) (Maximum suggested noise level in room = 35dB)	65	10.5mm QLam Hush	30	6.38mm QLam	35	6.5mm QLam Hush	30	5mm QFloat	35
	70	8.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	30	10.5mm QLam Hush	35	8mm QFloat + 12mm Gap + 6.5mm QLam Hush	29	6.5mm QLam Hush	35
	75	16.5mm QLam Hush + 12mm Gap + 20.5mm QLam Hush	30	8.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	35	12.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	30	8mm QFloat + 12mm Gap + 6.5mm QLam Hush	34
	80	No standard solution	-	16.5mm QLam Hush + 12mm Gap + 20.5mm QLam Hush	35	No standard solution	-	12.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	35
Hotels and Motels near major roads <i>Sleeping Areas</i> Design Sound Level Range 35dB to 40dB (Recommended noise level in room = 35dB) (Maximum suggested noise level in room = 40dB)	65	6.38mm QLam	35	4mm QFloat	37	5mm QFloat	35	4mm QFloat	36
	70	10.5mm QLam Hush	35	6.38mm QLam	40	6.5mm QLam Hush	35	5mm QFloat	40
	75	8.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	35	10.5mm QLam Hush	40	8mm QFloat + 12mm Gap + 6.5mm QLam Hush	34	6.5mm QLam Hush	40
	80	16.5mm QLam Hush + 12mm Gap + 20.5mm QLam Hush	35	8.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	40	12.5mm QLam Hush + 12mm Gap + 12.5mm QLam Hush	35	8mm QFloat + 12mm Gap + 6.5mm QLam Hush	39

Users should satisfy themselves of the completeness of the information and seek advice where required from an industry professional.

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