Assessment of the Sound Insulation of the Existing Floor at 57 - 59 Leicester Road, Wigston.

Report Prepared for:

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1.0 Summary

Planning permission is being sought to permit the conversion of the first floor space, above the vacant ground floor retail premises at 57 - 59 Leicester Road in Wigston, to form two residential flats. It is intended that the ground floor commercial use will be preserved post conversion.

In anticipation of the permitted conversion, Druk Limited was commissioned to conduct an assessment of the airborne sound insulation of the existing floor separating the ground floor commercial space from the proposed residential flats on the first floor of the existing building at 57 - 59 Leicester Road in Wigston. The assessment was conducted to establish whether the airborne sound insulation performance of the existing floor would comply with the performance requirements contained within Approved Document E (ADE) “Resistance to the Passage of Sound”, 2003 edition, (amended in 2004, 2015, 2013 and 2015). Where the results of the sound insulation assessments highlight that the sound insulation performance of the existing floor would not comply with the sound insulation performance requirement, suitable remedial measures to enhance the sound insulation performance of the existing floors will be proposed.

The assessment conducted across the floor separating the ground and first floors within the exiting building at 57 - 59 Leicester Road in Wigston has indicated that the current level of airborne sound insulation would not comply with the minimum requirement detailed within ADE. With this in mind and based on securing compliance with the airborne sound insulation requirement contained within ADE, suitable remedial treatments have been specified to limit the transmission of sound across what will become the separating floor between the ground floor commercial space and the proposed flats on the first floor.

Calculations have also been undertaken to assess the suitability of the proposed remedial proposals and these calculations have demonstrated that the proposed remedial options would be capable of improving the airborne sound insulation of the floor to a level that would comply with the minimum sound insulation requirement contained within ADE.

It should however be remembered that whilst every effort has been made to ensure that the following advice represents best practice with respect to achieving the required sound insulation values contained within ADE, it will not represent a performance guarantee as the ultimate performance will depend on a number of contributory factors such as the selection and installation of the various components and the quality of workmanship, all of which are beyond the control of Druk Limited.

Report prepared by:

Robert Smith

2.0 Introduction

Planning permission is being sought to permit the conversion of the first floor space, above the vacant ground floor retail premises at 57 - 59 Leicester Road in Wigston, to form two residential flats. It is intended that the ground floor commercial use will be preserved post conversion.

In anticipation of the permitted conversion, Druk Limited was commissioned to conduct an assessment of the airborne sound insulation of the existing floor separating the ground floor commercial space from the proposed residential apartments on the first floor of the existing building at 57 - 59 Leicester Road in Wigston. The assessment was conducted to establish whether the airborne sound insulation performance of the existing floor would comply with the performance requirements contained within Approved Document E (ADE) “Resistance to the Passage of Sound”, 2003 edition, (amended in 2004, 2015, 2013 and 2015).

3.0 Sound Insulation - Internal Noise Transmission Guidance

3.1 Approved Document E, 2003 edition

Approved Document E (ADE) “Resistance to the Passage of Sound”, 2003 edition, (amended in 2004) provides guidance as to how the requirements of the Building Regulations 2000, as they relate to sound insulation, may be met. The Approved Document details specific sound insulation performance requirements that are required for separating elements, walls and floors, in a number of situations, namely: dwelling houses and flats whether ‘purpose built’ or ‘formed by material change of use’ and rooms for residential purposes which may be either ‘purpose built’ or ‘formed by material change of use’. The specific sound insulation performance requirements that should be achieved by either ‘purpose built’ separating elements or those formed by ‘material change of use’ are detailed in Tables 0.1a and 0.1b of Section 0 in Approved Document E.

As the proposed residential flats will be formed from a conversion of the first floor of the existing premises, previously used for non-residential purposes, the proposed flats would fall within the "Dwelling houses and flats formed by a material change of use” category detailed in Table 0.1a of Approved Document E. As such, the sound insulation performance of the separating elements should comply with the criteria highlighted (emboldened) in table 1 overleaf.

With respect to airborne sound insulation, the quoted performance standard is a minimum requirement, therefore the obtained test result should exceed, or as a minimum equal, the requirement.

For impact sound insulation the quoted performance standard is a maximum level, therefore the obtained test result should not exceed this performance standard.

Table 1. Sound Insulation Performance Criteria

Rooms for Residential Purposes		
Situation	**Airborne sound insulation, $D_{nT,w} + C_{tr}$ dB (Minimum Value)**	**Impact sound insulation, $L'_{nT,w}$ dB (Maximum Value)**
Formed by material Change of use		
Walls	**43**	**-**
Floors and stairs	**43**	**64**

With reference to what would become the floor separating the ground floor commercial space and the proposed first floor flats, according to Diagram 0.1 contained within Section 0 of ADE, which illustrates the requirements of Requirement E1, the performance requirement for this floor relates to airborne sound insulation only.

In some situations where an element, either a wall or floor, separates a residential use from a commercial or non-residential use, ADE provides guidance in addition to that contained within Tables 0.1a and 0.1b relating to the sound insulation standards to be met. In this case ADE at paragraph 0.8 of section 1 states:

"*The performance standards set out in tables 1a and 1b are appropriate for walls, floors and stairs that separate spaces for normal domestic purposes. A higher standard of sound insulation may be required between spaces used for normal domestic purposes and non-domestic purposes*".

The above guidance would be applicable to the floor that would separate the existing ground floor commercial spaces and the proposed first floor flats.

ADE 2003 also defines minimum sound insulation requirements for internal walls and floors that do not serve a separating function. These minimum sound insulation standards for these elements are defined in terms of the weighted sound reduction index, R_w, which is a laboratory derived value and would not be evaluated on site. The minimum requirements for these elements are summarised in the table 2 overleaf. With reference to the airborne sound insulation values contained within table 2 overleaf, it should be remembered that as laboratory values, they would not be included as part of a normal pre-completion testing regime under the terms of ADE 2003 edition.

Table 2. Sound insulation performance criteria, internal walls and floors

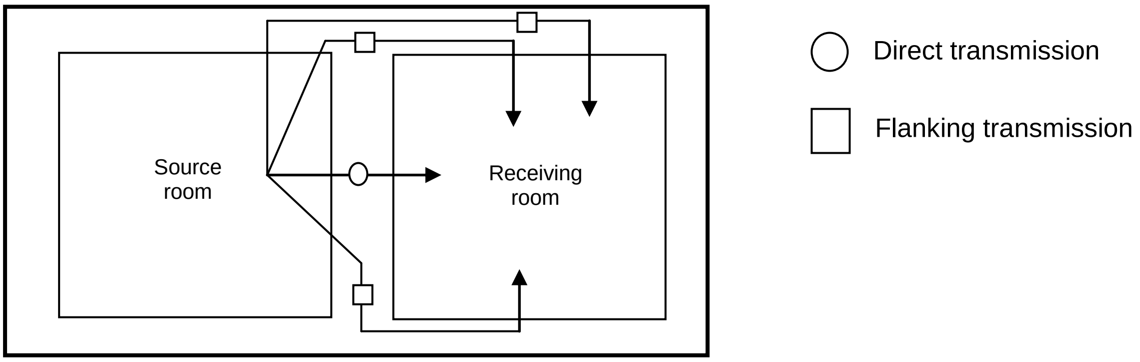
Table 0.2. **Laboratory values for new internal walls and floors within dwelling-houses, flats and rooms for residential purposes, whether purpose built or formed by material change of use**	
	Airborne sound insulation, $R_w + C_{tr}$ dB (Minimum Value)
Walls	**40**
Floors	**40**

4.0 Sound Transmission Pathways

When considering the sound insulation of a structure the transmission of sound energy through the various elements must be considered. The transmission of sound may be regarded as comprising two principal pathways, namely direct transmission and flanking transmission.

As the name suggests, the direct transmission of sound energy relates to that 'portion' that 'passes' directly through the separating element under consideration; consequently, flanking transmission then accounts for all other indirect transmission routes. These basic distinctions are illustrated in figure 1 below.

Figure 1. Basic illustration of the sound transmission pathways through building elements



In any consideration of the sound insulation performance of a separating element, both of these potential contributory elements should be taken into account. It is quite possible that the sound insulation performance of what would otherwise be a perfectly satisfactory separating element, in terms of its sound insulation performance, could be significantly reduced by 'uncontrolled' flanking transmission routes and vice versa.

5.0 Sound Insulation Assessment Details

The airborne sound insulation of the existing floor structure, which will become the separating floor between the ground floor commercial space and the proposed first floor flats, was evaluated by direct measurement, the details of which are described in the subsequent sections.

6.1 Description of the Assessed Premises

The proposed residential flats will be formed from the conversion of the first floor space, previously used as showroom/commercial spaces, above the existing ground floor commercial premises at 57 - 59 Leicester Road in Wigston (photograph 1 below). The existing building is believed to date from the 1960s and is of cavity masonry construction (photograph 2 below) with a timber joist internal floor.

Photograph 1. Existing building, 57 - 59 Leicester Road, Wigston

Photograph 2. Existing stretcher bond external leaf, 57 - 59 Leicester Road

6.2 Assessment Details

The sound insulation assessments were conducted between 08:30 - 09:30 hours on the 27th February 2024.

All the measurements were made by Mr. Robert Smith of Druk Limited, 87 St Albans Road, Halifax West Yorkshire. Druk Limited is accredited by UKAS for the purposes of pre-completion sound insulation testing, to demonstrate compliance with the requirements of Approved Document E (2003 edition incorporating the 2004, 2010, 2013 and 2015 amendments), accreditation number 4507.

The sound insulation assessment and all measurements made in connection with the assessment were undertaken in accordance with the suggested procedures detailed in BS EN ISO 140 parts 4:1998: 'Field Measurements of Airborne Sound Insulation Between Rooms'. The result of the assessment was analysed in accordance with the requirements of BS EN ISO 717 part 1:1997: 'Rating of Sound Insulation in Buildings and of Building Elements – Airborne Sound Insulation'.

In additional all the procedures contained in Annex B of Approved Document E, guidance to the Building Regulations, were followed.

6.3 Equipment

The equipment, detailed in the table 3 below, was used throughout the sound insulation assessment.

All the equipment used is calibrated by a UKAS accredited calibration laboratory and the calibration certificates are available on request.

The sound level meter was calibrated before and on completion of the assessments, with no significant deviation being observed.

Table 3. Sound Insulation Testing Equipment

Equipment Description	Manufacturer	Type Number	Serial Number	Date of Calibration	Calibration Certificate Numbers
Sound Level Meter	Norsonic	140	1402738	20th & 23rd July 2021	05334/1, 05334/2 & 05334/3
Acoustic Calibrator	Norsonic	1251	31522	23rd September 2022	05934/1
Noise Sources	JBL	Eon 10	29986/29974	-	
Pink Noise Sources	Neutrik/Mini Instruments	MR2	-	-	

6.4 Assessment Procedure

The field testing of separating elements for airborne sound insulation involves the generation and measurement of a controlled 'level' of noise in one of the pair of rooms (the source room) under test and measuring the resulting noise level in the other room (the receiving room), separated by the element that is under test. In both rooms a minimum of ten individual and randomly selected measurement positions are used, such that a representative assessment of the noise level within the entire volume of the two rooms is made. In both rooms, spatial and temporal averaging of the noise levels is carried out, in each of the ten measurement positions, by manually rotating the microphone through a complete circular path.

Once the source and receiving room noise measurements have been made, corrections are applied to the measured noise levels to account for the effects of both extraneous background noise and the effects of acoustic absorption within the receiving room. With reference to the acoustic absorption of the receiving room, this is determined from measurements of the reverberation time.

Measurements of reverberation time are made within the receiving rooms only; the measurements are made by generating a continuous wide band 'pink' noise signal, for a predetermined time period, after which the signal is turned off and the noise decay within the room is timed. The reverberation time is established by using one noise source position and measuring up to 18 separate decays in a number of randomly selected microphone positions, with multiple measurements being made in each of the measurement positions.

The corrected source and receiving room noise measurements are used to calculated the Standardised Level Differences (D_{nT}) for the individual third octave bands between 100 – 3150Hz; these are then compared with reference values to determine the Weighted Standardised Level Difference ($D_{nT,w}$). In addition, a spectrum adaptation term, the C_{tr}, is calculated which is then added to the Weighted Standardised Level Difference in order to obtain the single figure 'rating' that is compared with the sound insulation performance requirements detailed in ADE.

At the time of the sound insulation assessments, the ground and first floor spaces were unfurnished and unoccupied.

6.5 Assessment Procedure Deviations

The following deviation from the test procedure specified in BS EN ISO 140 part 4:1998 and the guidance contained with ADE was noted.

With respect to the airborne sound insulation assessment conducted between the ground and first floor spaces, not only were the floor areas different but the two spaces were not wholly directly over each other. As such the guidance relating to the source room and receiving room measurement positions detailed with BS EN ISO 140 part 14 "Acoustics – Measurement of Sound Insulation in Buildings and of Building Elements; Guidelines for Special Situations in the Field" was followed.

6.6 Arrangement of Assessed Elements

The source and receiving rooms were as detailed in table 4 below and figure 2 overleaf.

Table 4. Airborne Sound Insulation Assessments - Floor

Source Room	Volume, m^3	Receiving Room	Volume, m^3
Ground floor commercial space	119	First floor, middle section	75

6.7 Background Noise

With reference to the result certificate, presented within Appendix 1 of this report, the tabular presentation of the D_{nT} values may be accompanied by the presence of either a single asterisk '*' or a double asterisk '**' alongside each of the frequency values. The presence of the asterisks denote that the D_{nT} values have been 'background' noise corrected as per the requirements of Section 6.6 of BS EN ISO 140 part 4:1998. The presence of a single asterisk indicates that the measured 'signal' level has been corrected according to equation 8 of BS EN ISO 140 part 4:1998, whereas the presence of a double asterisk indicates that the 1.3dB correction has been applied

At the time of the sound insulation assessments the principal contributor to the background noise climate was road traffic noise.

6.8 Separating Floor Construction

On site inspection suggested that the existing floor was of timber joist construction incorporating: 18 - 22mm floorboards fixed to 200mm solid timber joists, with a ceiling formed from one layer of plasterboard.

7.0 Result and Discussion

The result of the airborne sound insulation assessment is reproduced in table 5 below, graphical presentation of the result may be found within Appendix 1. The result of the airborne sound insulation assessment will also be compared with the performance requirement contained within ADE.

Table 5. Airborne Sound Insulation Results - Floors

Source room	Receiving room	Measured performance $D_{nT,w} + C_{tr}$ dB	ADE Minimum performance $D_{nT,w} + C_{tr}$ dB	ADE, 'Pass' or 'Fail'
Ground floor meeting room	First floor, office	33	43	'Fail'

Figure 2. Existing ground and first floor layouts

From table 5 it can be seen that the measured airborne sound insulation result for the assessed section of floor separating the ground and first floors, would not comply with the minimum performance requirement contained within ADE and as such would not be regarded as being capable of 'passing' a sound insulation test. It is however suggested that the obtained airborne sound insulation value is representative of the floor construction detailed in section 6.8 above, which may be regarded more as an internal rather than a separating floor construction.

The qualitative impression of the airborne sound insulation of the element of floor that was assessed suggested that although the airborne sound insulation of the floor sounded fairly uniform, the floor itself 'contained' a considerable amount of low frequency sound energy. In addition, some mid and a little higher frequency sound energy could be heard 'leaking' into the receiving room via the room doors. With reference to the flanking walls, a significant 'amount' of mid frequency sound energy could also be heard in these elements.

It should also be remembered that the ground floor commercial space had received a suspended 'lay in grid' ceiling finish. Whilst these ceilings are effective at providing additional sound absorption, they often provide very limited enhancements to the sound insulation of a structure and as such any beneficial contribution of the airborne sound insulation would be expected to be minimal.

8.0 Evaluation of Potential Sound Insulation Enhancements

Based on the measured level of airborne sound insulation provided buy the existing floor, the following paragraphs detail potential remedial measures that could be employed to improve the airborne sound insulation of what will become the separating floor between the proposed flats on the ground and first floors. It should however be remembered that whilst every effort has been made to ensure that the following advice represents best practice with respect to achieving the required sound insulation values contained within ADE, it will not represent a performance guarantee as the ultimate performance will depend on a number of contributory factors such as the selection and installation of the various components and the quality of workmanship, all of which are beyond the control of Druk Limited.

Before potential enhancement measures are considered it is first worth noting the difference between the different descriptors used to indicate levels of airborne sound insulation performance. Approved Document E, 2003 edition, expresses airborne sound insulation in terms of the $D_{nT'w} + C_{tr}$ parameter, this being a field test value which includes contributions from both direct and flanking sound transmission. An alternative and often quoted descriptor of airborne sound insulation is the $R_{w,}$ this descriptor has been obtained in a laboratory where the detrimental effects of flanking transmission have, to all intents and purposes, been eliminated. As a consequence it is not unusual for the quoted laboratory sound insulation value, R_w, to be better than the field test, $D_{nT'w} + C_{tr}$ value, although the degree to which the R_w value exceeds the $D_{nT'w} + C_{tr}$ value will depend on factors such as the quality of workmanship on site etc. Typically laboratory sound insulation values exceed on site values by around 5 - 8dB, although this again will depend on workmanship etc.

With reference to the advice contained within the following sections, it has been assumed that the measures detailed would be acceptable to the Local Planning Authority and or Building Control. As a result it would be prudent to discuss these proposed measures with the Local Planning Authority and or Building Control at the earliest opportunity.

With respect to the advice contained within the following sections, this advice relates to the acoustic performance of the separating elements only and does not consider any other aspects of the building including, but not limited to, structural integrity, electrical installation etc. As the proposed remedial measures would add additional mass to the separating floor it is recommended that advice from a suitably qualified and experienced individual or organisation is sought, to ensure that the implementation will not have detrimental effects on any of the existing building elements.

Where appropriate the potential airborne sound insulation of the proposed separating walls and floors, will be evaluated using BASTIAN software which is based on the methods and procedure detailed in BS EN 12354:2000 “Building acoustics – Estimation of acoustic performance of buildings from the performance of elements”. The airborne sound insulation performance will been evaluated in terms of the $D_{nT,w}$ + $C_{tr,}$ so permitting direct comparison with the requirement contained within ADE. It should however be remembered that the calculations produced according to this procedure are based on best practice assumptions as to the construction elements and usual building practice. Consequently the results of these calculations may be considered as a guide as to the sound insulation of the elements rather than a definitive statement. Indeed, recent sound insulation tests have revealed that sound insulation performances calculated using the BASTIAN software produces results that are typically in the region of ± 2 - 3dB of the subsequent in-situ tested results.

The issue of flanking transmission, the potential for flanking sound transmission must not be ignored. Despite this ADE suggests that where the mass of the flanking element is below around 375kg/m^2, flanking transmission is likely to be an issue. In the case of the existing building at 57 – 59 Leicester Road site inspection suggests that this was probably built during the 1960s and is of cavity masonry construction. Consequently, the inner leaf of the external wall is unlikely to achieve the 375kg/m^2 mass suggesting that flanking sound transmission is likely to detrimentally affect the sound insulation performance of the element. This being the case it is recommended that measures to control flanking sound transmission are included in any sound insulation remedial scheme.

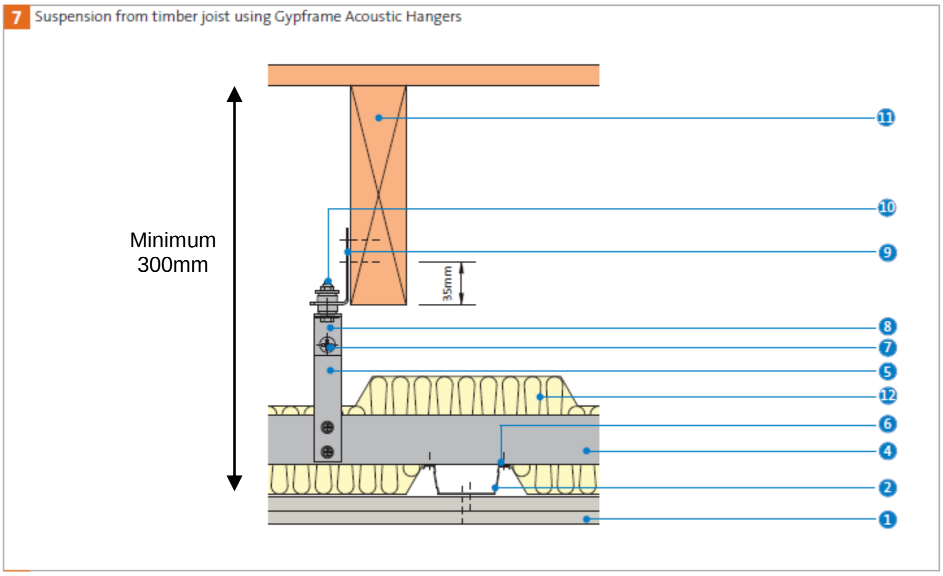
Improvements to the sound insulation of a floor can be effected by remedial works installed above or below the joists. In general works below the level of the joists, typically in the form of a new acoustic ceiling, have the potential to produce greater improvements in the airborne sound insulation of the floor than do works above the level of the joists.

8.1 Separating Floor

On the ground floor the current floor to ‘lay in’ grid ceiling height is around 2.45 meters with the true soffit being around 0.15 metres higher than the lower face of the ‘lay in’ grid ceiling. As a result this may limit the possible number of options that are available to improve the airborne sound insulation of the existing floor.

One possible solution would be the application of a new partially independent ceiling, in which the new ceiling is suspended from the existing ceiling joists by acoustic hangers only creating a ceiling that is partially disconnected from the existing structure. In this system it is quite acceptable to fix the new ceiling boards to either timber ceiling joists or an MF system. Typical details of the partially independent system are detailed in figure 3 below. Acoustic hangers are available from a variety of manufacturers/suppliers and these vary in their complexity of form and or installation.

Figure 3. Suspended ceiling on acoustic hangers (MF ceiling shown)



1. Gyproc plasterboard or British Gypsum specialist board
2. Gypframe MF5 Ceiling Section
3. Gypframe MF6 Perimeter Channel
4. Gypframe MF7 Primary Support Channel
5. Gypframe MF8 Strap Hanger or Gypframe GA1 Steel Angle
6. Gyproc Wafer Head Jack-Point Screw
7. Gypframe MF11 Nut and Bolt
8. Gypframe MF12 Soffit Cleat
9. Gypframe Acoustic Hanger fixed with two Gyproc Drywall Timber Screws
10. M6 bolt and locking nut (by others)
11. Timber joist floor
12. Isover insulation
13. Gypframe GA1 Steel Angle
14. Gyproc Profilex Access Panel

Source: British Gypsum

In the case of the partially independent ceiling, figure 3 details metal furring channels suspended from the existing joists via acoustic hangers to support the ceiling. The complete system, from inside to outside would be as follows:

- Acoustic hangers fixed to the existing joists to provide intermediate support to the metal furring channels.
- 100mm minimum of mineral fibre in the new ceiling void.
- Metal furring primary channel fixed to the acoustic hangers.
- Metal furring ceiling channel fixed to the primary channel.
- Ideally two layers of 12.5mm SoundBloc plasterboard (or equivalent) on staggered joints fixed to the ceiling channels.
- Where the existing ceiling is removed, a minimum gap of 300mm should be maintained between the rear face of the existing floorboards and the rear face of the innermost layer of plasterboard forming the new ceiling.

Calculations have been undertaken to assess the effectiveness of the proposed remedial ceilings. For the purposes of the calculations the following assumptions have been made:

- The density of the inner leaf of the external masonry wall will be in the region of 1600kg/m^3.

The results of the calculations are summarised in table 6 below. Full calculations may be found in Appendix 2.

Table 6. Calculated airborne sound insulation levels, resiliently hung ceiling

location	Calculated level, dB $D_{nT,w} + C_{tr}$	Minimum ADE performance, dB $D_{nT,w} + C_{tr}$
Partially independent ceiling, ground to first floor	42	43

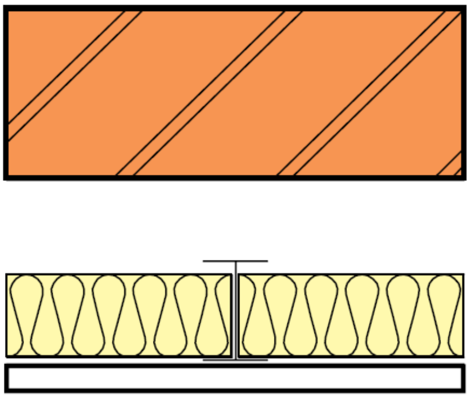
As can be seen from the summary contained in table 6 above, the proposed remedial ceiling option has the potential to enhance the airborne sound insulation of the floor such that it should exceed the minimum performance requirement contained within ADE. However, inspection of the Bastian calculations, contained within Appendix 2, indicates that a significant amount, between 15 - 30%, of the sound transmission would occur via the flanking routes.

In order to overcome the potential for flanking sound transmission, it is suggested that independent wall liners (IWL) are applied to the external walls of the proposed flats at first floor level. For these to be fully effective the wall lining system must be fully independent of the existing wall, must only be fixed at the head and base and should extend from the upper surface of the floorboards/deck of the soffit. Any connections with the face of the existing wall will reduce the overall airborne sound insulation of the installation so must be avoided. The suggested construction of the independent wall is as follows:

- A minimum of 70mm metal or timber stud fixed at the head and base only, installed with a minimum 10mm gap between the rear face of the stud frame and the existing wall.
- A minimum of 50mm of mineral fibre in the stud cavity.
- A minimum of one layer of 12.5mm acoustic plasterboard fixed to the studs.

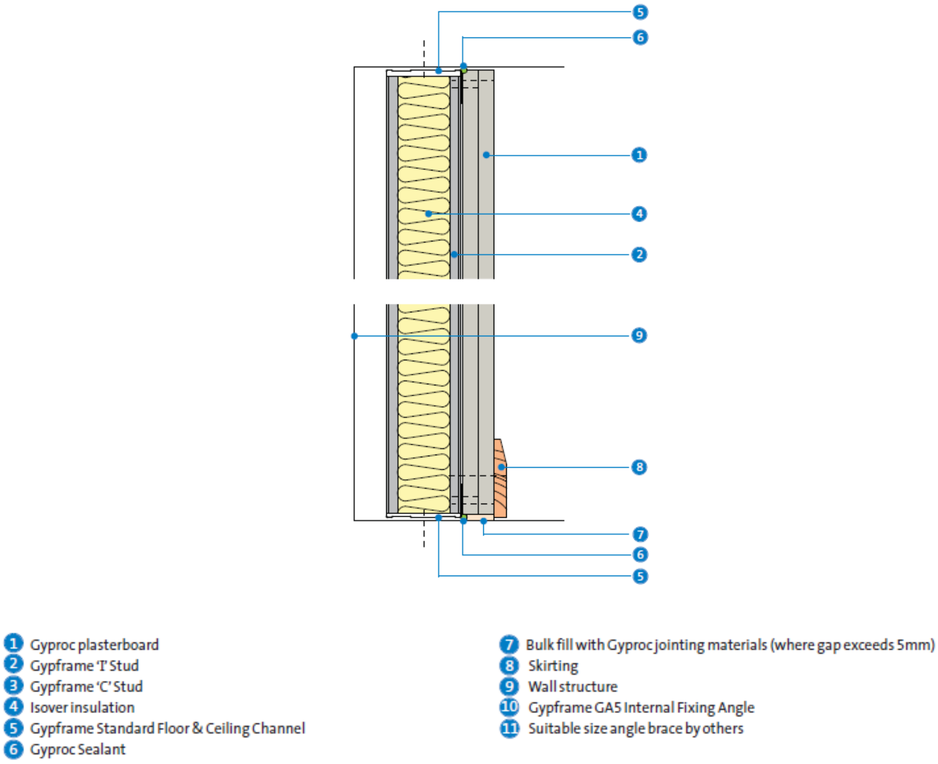
The general details of an independent wall construction are as detailed in figures 5 and 6 overleaf.

Figure 5. Independent wall lining system (one layer of board shown)



Source: British Gypsum

Figure 6. Independent wall lining construction



Source: British Gypsum

Again, the effectiveness of the proposed partially independent ceiling and the independent wall lings at first floor level will be evaluated using the Bastian calculation procedure. The results of the calculations are summarised in table 7 below and full calculations may be found in Appendix 2.

Table 7. Calculated airborne sound insulation levels, resiliently hung ceiling

location	Calculated level, dB $D_{nT,w} + C_{tr}$	Minimum ADE performance, dB $D_{nT,w} + C_{tr}$
Partially independent ceiling and independent wall linings	48	43

As can be seen from the summary contained in table 7 above, the proposed remedial ceiling option has the potential to enhance the airborne sound insulation of the floor such that it should exceed the minimum performance requirement contained within ADE.

An alternative to the use of a ceiling partially suspended from the existing joists via acoustic hangers would be a new 'acoustic' ceiling supported on resilient bars and this would also minimise the reduction in ceiling height.

Here, the resilient bars act like springs and partially disconnect the ceiling from the rest of the structure. The resilient bars are fixed, at right angles, to the existing joists and the new ceiling boards are then fixed through the resilient bars. Where the existing ceiling is retained and a new ceiling mounted on resilient bars is provided below, care must be taken to avoid the detrimental mass-air resonance effects that may occur. Assuming the use of two layers of 15mm SoundBloc plasterboard (or equivalent) avoiding the mass air resonance effects would require that a cavity of around 75mm is formed between the rear face of the new layer of plasterboard and the outer face of the existing ceiling board. This could be achieved by fixing 50 x 50mm (minimum) counter battens to the existing ceiling with resilient bars being installed at right angles to these battens. It would also be prudent to ensure that around 50mm of mineral fibre is lined into the new ceiling cavity.

Basic details of the installation are provided within Appendix 3 and the construction would be as follows:

- Resilient bars fixed to the underside of the counter-battens fixed to the existing joists.
- Two layers of 15mm SoundBloc plasterboard (or equivalent) on staggered joints fixed to the resilient bars.
- 50mm of mineral fibre laid into the new ceiling void.

In addition, although resilient bars can provide performance benefits, the ultimate performance of this type of system is frequently dictated by both the correctness of the resilient bar installation and the cavity that exists between the new and existing ceilings. A common fault that can result in a considerable reduction in the overall performance of the floor, is where the resilient bars have been ‘short circuited’ by the fixings used to secure the plasterboard to the bars. The plasterboard fixings should penetrate into the resilient bar, but they should not pass through the resilient bar into the joists above as this would ‘short circuit’ the resilient bar (figure 7 overleaf). In a two board ceiling the selection of the correct length of fixing is therefore critical, consequently the guidance in table 8 overleaf should be carefully considered.

Figure 7. Correct fixing of plasterboards to a resilient bar

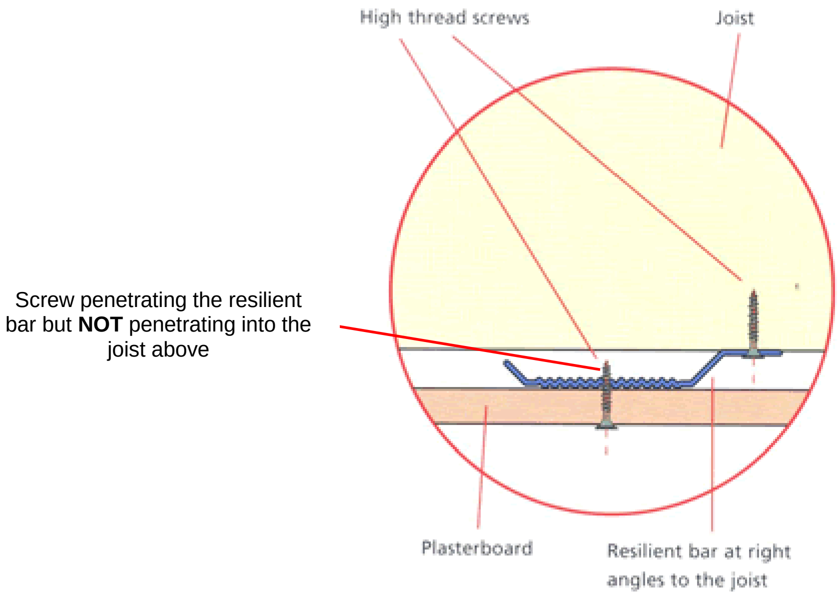


Table 8. Correct screw lengths for use with resilient bars

Table 5 Screw lengths and centres
25mm screws for 12.5mm and 15mm wall board.
32mm screws for 19mm plank.
36mm screws for 12.5mm wall board fixed over 12.5mm wall board.
42mm screws for 12.5mm wall board fixed over 19mm plank and 15mm wall board fixed over 15mm wall board.

Source: British Gypsum

Calculations have been undertaken to assess the overall airborne sound insulation that may be achieved with this type of ceiling and the results are summarised in table 9 below. Full calculations may be found in Appendix 1.

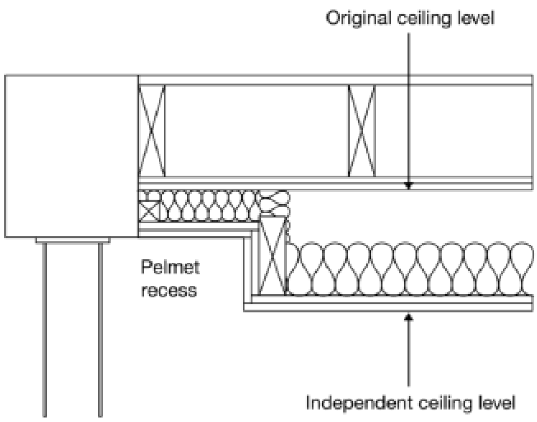
Table 9. Calculated airborne sound insulation levels, resilient bar ceiling - first to second floors

location	Calculated level, dB $D_{nT,w} + C_{tr}$	Minimum ADE performance, dB $D_{nT,w} + C_{tr}$
Ceiling supported on resilient bars	46	43

As can be seen from the summary contained in table 9 above, the proposed floor/ceiling construction would be capable of meeting the minimum sound insulation performance requirement contained within ADE, but with a limited 'safety' margin.

With care it should be possible to ensure that the proposed partially independent ceiling could be installed such that it does not fall below the current head of the front window at ground floor level. Where this cannot be achieved, the construction of a pelmet recess detail to accommodate the window head should be considered. This is a relatively simple construction with the general details being as details in figure 4 below.

Figure 4. Pelmet recess general details



Source: Diagram 4.4, Approved Document E, 2003 edition (incorporating the 2004, 2010, 2013 and 2015 amendments

8.2 Separating and Internal Walls

The layout of the proposed flats suggests that a separating wall will be required to divide the two flats at first floor level. Where new separating walls are required, it has been assumed that these would be formed from light-weight stud partitions. The lightweight walls could be formed from either timber or metal studs as both will provide similar levels of airborne sound insulation. It should be remembered that separating walls would also include those walls separating the living spaces from circulation spaces such as lobbies and stairwells.

In this respect two main options available: a twin independent stud wall system or a single stud wall system. Such systems can provide good levels of airborne sound insulation, although as with many elements great attention to detail and workmanship will be required in order to obtain the best sound insulation performance.

Twin independent stud frame walls are variety of overall depths, typically 200 - 300mm, with the greater depth offering superior performance and also the ability to hide services within the stud cavity. With reference to this situation it is suggested that the 250 or 300mm overall depth walls would provide the best results. Sound insulation test data for a 200mm and 300mm deep twin independent stud wall suggest that airborne sound insulation results of around 49 - 56dB $D_{nT,w} + C_{tr,}$ can be achieved. As can be seen the airborne sound insulation of such a wall has the potential to provide levels of airborne sound insulation that would comply with the minimum requirements detailed within ADE. With the foregoing in mind it is suggested that the separating walls between the flats should be of the following construction as a minimum:

- Twin 50/70mm metal or 75mm timber studs.
- The stud frames should be connected via the minimum number of cross-braces as detailed by the manufacturer/supplier, typically these are installed at 1200maximum on walls over 2400mm in height.
- A 50mm gap (approximately) between the studs.
- A minimum of 50mm of mineral fibre in the inter-stud cavity.
- Both stud frames lined with two layers of 12.5mm SoundBloc (or equivalent) plasterboard on staggered joints.

Where space is at a premium a single stud construction may be used and one such option that has been used widely in a range of student accommodation developments requires the use of a 70mm metal stud, but with a few amendments to enhance the airborne sound insulation perfromnace. In this case the following construction would provide an acceptable performance:

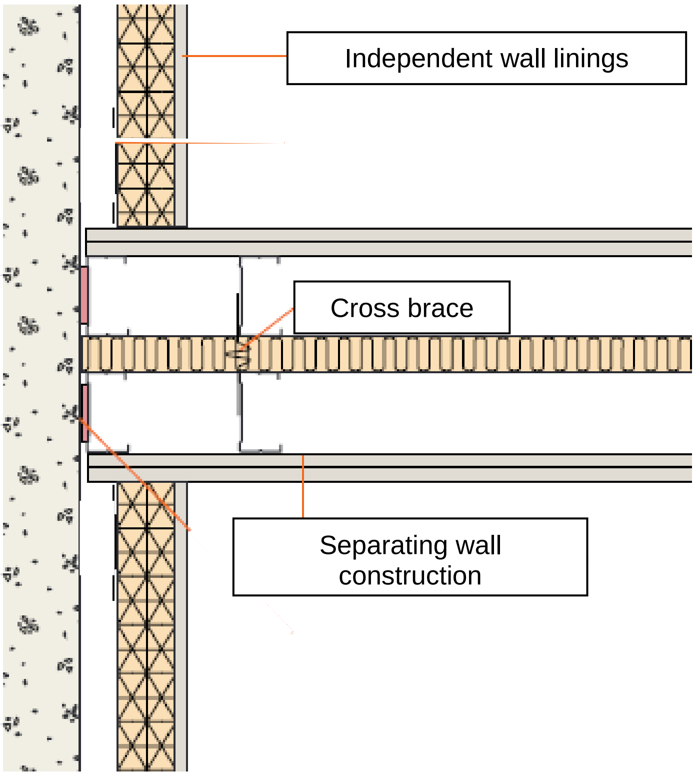
- 70mm metal stud.
- Resilient bar fixed to one side of the metal stud.
- A minimum of 50mm mineral fibre in the stud cavity.
- A minimum of two layers of 12.5mm SoundBloc board (or equivalent), on staggered joints, fixed to the stud/resilient bar, on both sides of the stud .
- The metal stud and wall lining boards should be sealed to the existing structures by bulk filling all junctions with a suitable permanently flexible acoustic mastic.

Where resilient bars are used the installation guidance detailed above should be followed.

Recent test data for walls of this type of construction have indicated that airborne sound insulation values of between 45 - 49dB $D_{nT,w}$ + $C_{tr,}$ can be achieved. Again, it can be seen that the sound insulation of such a wall has the potential to provide levels of airborne sound insulation that would comply with the minimum requirements detailed within ADE although the 'safety margin' is not as great as the twin independent stud construction.

As it is intended to line the existing external walls at first floor level to help control the potential flanking transmission, these wall linings can be used to protect the junction between the separating wall and the external walls and the arrangement detailed in figure 8 overleaf should be employed.

Figure 8. Separating wall junction with inner leaf of the external wall showing the wall lining system (concrete external wall shown)



Source: Lafarge Plasterboard

8.3 Internal Walls

In addition to the minimum airborne sound insulation requirement for separating walls, ADE also specifies a minimum requirement for internal walls. In this case the minimum requirement is framed in terms of a laboratory value and as such is expressed in terms of an R_w value and the minimum requirement is contained within table 2 above. As the values in table 2 above relate to laboratory test values, they would not be assessed on site. However, it is should be remembered that all constructions should comply with this minimum requirement.

Many constructions would be able to provide levels of airborne sound insulation that comply with this minimum performance requirement and these include a 70mm metal stud lined on both sides with one layer of 12.5mm SoundBloc plasterboard (overall performance 40dB R_w) and a CLS timber stud frame (63 x 38mm nominal) lined on both sides with one layer of 12.5mm SoundBloc plasterboard (overall performance 40dB R_w). It is however recommended that mineral fibre is lined in to the wall cavity as this will both enhance the sound insulation performance of the wall and improve the overall perception of 'quality' from an occupants point of view.

9.0 Reverberation Times (RTs) in Common Areas

Although the reverberation times within common areas is outside the scope of this report, the following is offered as additional guidance.

Approved Document E (ADE) 2003 introduced the following with respect to the reverberation within common areas:

E3. The common internal parts of buildings which contain flats shall be designed and constructed in such a way as to prevent more reverberation around the common parts than is reasonable.

The control of reverberation within a space is governed by the following factors, namely the volume of the space concerned, the amount of absorption present in square metres and the efficiency of the absorbing material used. Two methods are detailed as solutions to the ADE requirements, namely Method A and Method B.

If 'Method A' is chosen for this development, then for entrance halls, corridors or hallways, an area of absorbent material equal to or greater in area than the ceiling area is to be installed throughout the relevant areas as identified above to provide the same surface area as the floor area. The absorber selected must achieve an acoustic absorption coefficient of class “C” ref. EN ISO 11654. In the case of stairwells the combined area of the treads, the upper surface of the intermediate landings, the upper surface of the landings and the ceiling area on the top floor are evaluated. An area equivalent to this area should then be covered with a class D absorber or an area equal to at least 50% of this area is to be covered if a class C absorber is selected.

If 'Method B' is chosen, then the amount of absorbent material to be used is determined by calculation and the calculation procedure is undertaken in octave bands. The total absorption area is determined by a combination of the sound absorption coefficient of the material and the surface area it covers. Typically, entrance halls should be provided with a minimum of $0.20m^2$ total absorption area per cubic metre of the volume of the space and for corridors and hallways, this rises to $0.25m^2$. The type B method is however, not particularly suitable for stairwells.

10.0 <u>Conclusion</u>

The sound insulation assessment conducted across the floor separating the ground and first floors within the exiting building at 57 - 59 Leicester Road in Wigston has indicated that the current level of airborne sound insulation would not comply with the minimum requirement detailed within ADE. With this in mind and based on securing compliance with the airborne sound insulation requirement contained within ADE, suitable remedial treatments have been specified to limit the transmission of sound across what will become the separating floor between the ground floor commercial space and the proposed flats on the ground and first floors.

Calculations have also been undertaken to assess the suitability of the proposed remedial proposals and these calculations have demonstrated that the proposed remedial options would be capable of improving the airborne sound insulation of the floor to a level that would comply with the minimum sound insulation requirement contained within ADE.

It should however be remembered that whilst every effort has been made to ensure that the following advice represents best practice with respect to achieving the required sound insulation values contained within ADE, it will not represent a performance guarantee as the ultimate performance will depend on a number of contributory factors such as the selection and installation of the various components and the quality of workmanship, all of which are beyond the control of Druk Limited.

Appendix 1: Measured Airborne Sound Insulation Result

Calculation of the Standardised Level Difference According to ISO 140-4
Field Measurements of Airborne Sound Insulation Between Rooms

Client: Mr. D. Singh
Test Location: 57 - 59 Leicester Road, Wigston
Transmission Direction: Vertical via Floor
Date of Test: 27th February 2024

Description of test arrangement and direction of measurement :
Ground floor shop to first floor middle room

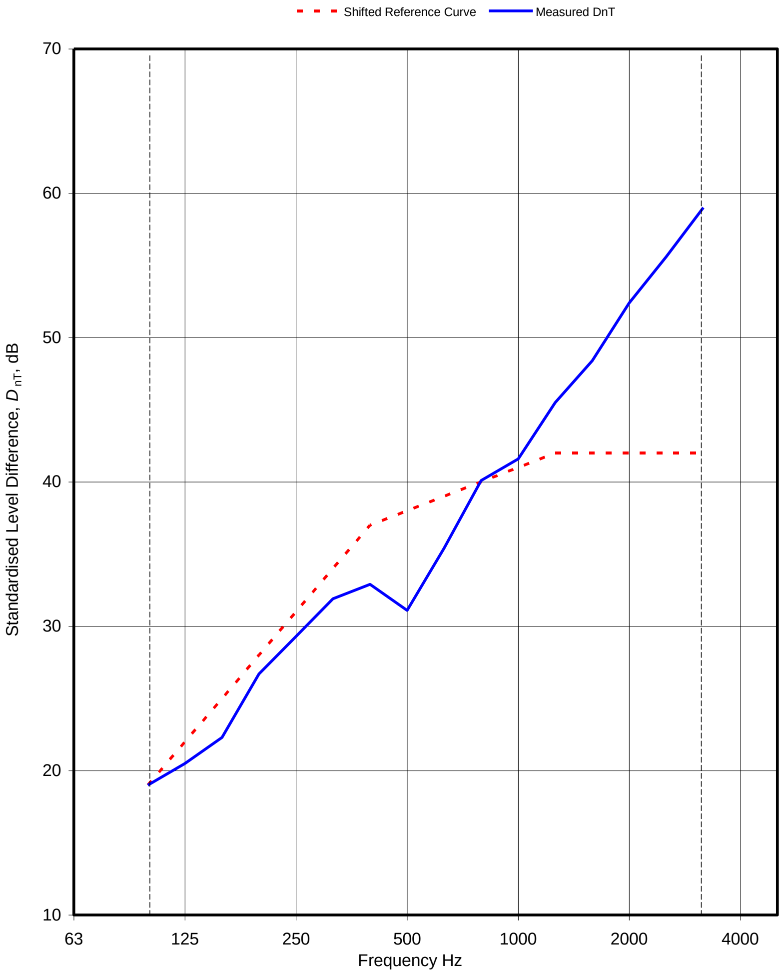
Floor Construction (notional)
Existing timber floorboards fixed to 200 x 50mm (nominal) solid floor joists with a plasterboard ceiling below. An additional lay in grid ceiling has been provided below the plasterboard ceiling

Source Room
Volume, m^3: 119

Receiver Room
Volume, m^3: 75

Frequency, Hz	D_{nT} dB
50	
63	
80	
100	19.0
125	20.5
160	22.3
200	26.7
250	29.3
315	31.9
400	32.9
500	31.1
630	35.4
800	40.1
1000	41.6
1250	45.5
1600	48.4
2000	52.4
2500	55.6
3150	59.0
4000	
5000	

* background adjusted measurement
** background corrected measurement



Rating According to ISO 717-1

$D_{nT,w}$ (C : C_{tr}) = 38 (-1 -5) dB

Overall Result, $D_{nT,w} + C_{tr}$, dB = 33

Evaluation based on field measurement results obtained by an engineering method

Test Certificate N°: 3271.1
Test Institute: *Druk* Ltd, 87 St Albans Road Halifax HX3 0ND

Date of Certificate: 28.02.2024
Tetser Name: *R Smith*

Appendix 2. Calculation Results

Partially independent ceiling with no wall linings to first floor flats

BASTIAN® - Worksheet 1 [DM (1)]

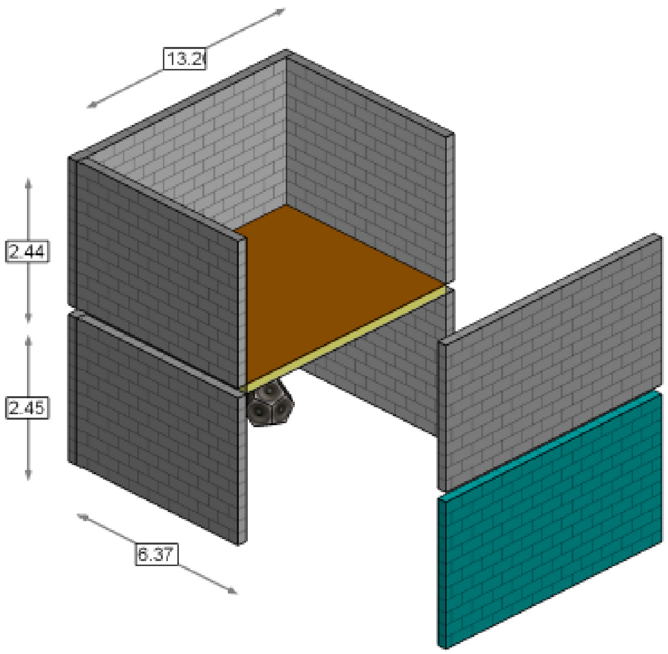
Project Info

Client:	Mr. D. Singh
Project:	Convesrion of first floor space to two residential flats
Worksheet:	Worksheet 1 [DM (1)]
Program:	BASTIAN V 2.3

Worksheet Configuration

Calculation Model:	DM (1)
Perf. Param. Airborne Sound Transm. in Buildings:	DnT,w + Ctr
Perf. Param. Impact Sound Transm. in Buildings:	L'n,w
Perf. Param. Outdoor Sound Transmission:	R'45°,w
Reference Reverberation Time T0 (s):	0.5
f1: Surface mass m"4 (kg/m²):	200
f1: Outer leaf interrupted:	no
f2: Surface mass m"4 (kg/m²):	200
f2: Outer leaf interrupted:	no
f3: Surface mass m"4 (kg/m²):	200
f4: Surface mass m"4 (kg/m²):	200
Correction Sigma_free/Sigma_forced for Monolithic Flanking Elements:	off
Correction Sigma_free/Sigma_forced for Lightweight Flanking Elements:	off
Alpha_k-Limit, MIN (-):	-
Alpha_k-Limit, MAX (-):	-
Ts-Limit for Elements, MIN (dB):	-
Ts-Limit for Elements, MAX (dB):	-
R'45° - R' (dB):	1.0
R'tr,s - R' (dB):	0.0
Level Difference DeltaL_fs (dB):	-

Room View



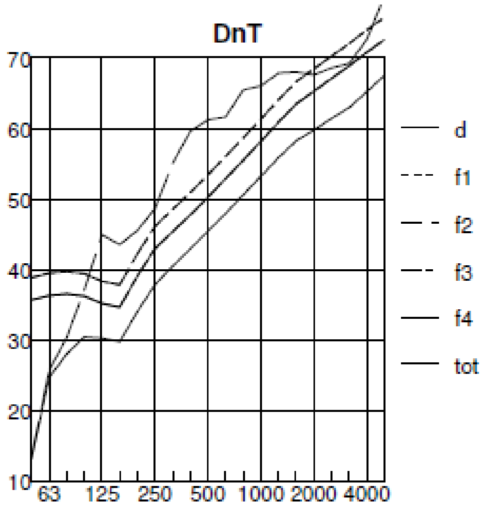
Worksheet-Table

		Sending Room		Juncti	Receiving Room		DnT,w (0.5 s)		L'n,w	
M	t	Basic Element	Additional I	Type-I	Basic Element	Additional I	dB	%	dB	%
X	d	195 x 50 joists with 18mm deck,acc hangers					53.0	7		
X	f1	BAST: brick (1600 kg/m³) 115 mm, render 1		18	BAST: brick (1600 kg/m³) 115 mm,		49.9	15		
X	f2	BAST: brick (1600 kg/m³) 115 mm, render 1		18	BAST: brick (1600 kg/m³) 115 mm,		49.9	15		
X	f3	BAST: brick (1600 kg/m³) 115 mm, render 1		18	BAST: brick (1600 kg/m³) 115 mm,		46.7	31		
X	f4	BAST: brick (1600 kg/m³) 115 mm, render 1		18	BAST: brick (1600 kg/m³) 115 mm,		46.7	31		
						Total:	41.8	100		

Airborne Sound per Element

tau	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	DnT,w (0.5 s) +
d	13.3	25.7	30.4	37.2	44.9	43.6	45.6	48.7	55.0	59.6	61.2	61.7	65.4	66.1	67.9	68.0	67.6	68.6	69.2	72.6	78.8	53.0
f1	38.9	39.5	39.7	39.4	38.4	37.9	42.2	46.1	48.6	51.0	53.5	56.1	58.7	61.4	64.0	66.6	68.4	70.2	72.0	73.9	75.7	49.9
f2	38.9	39.5	39.7	39.4	38.4	37.9	42.2	46.1	48.6	51.0	53.5	56.1	58.7	61.4	64.0	66.6	68.4	70.2	72.0	73.9	75.7	49.9
f3	35.7	36.3	36.6	36.3	35.2	34.7	39.1	43.0	45.4	47.8	50.3	52.9	55.5	58.2	60.9	63.5	65.3	67.1	68.9	70.8	72.6	46.7
f4	35.7	36.3	36.6	36.3	35.2	34.7	39.1	43.0	45.4	47.8	50.3	52.9	55.5	58.2	60.9	63.5	65.3	67.1	68.9	70.8	72.6	46.7
tot	13.3	24.7	28.1	30.5	30.3	29.8	34.0	37.9	40.5	43.0	45.5	48.0	50.6	53.2	55.9	58.3	59.8	61.4	63.0	65.2	67.5	41.8

Resulting Diagram



DnT,w = 48
DnT,w + C = 47
DnT,w + Ctr = 42
DnT,w + C100-5000 = 48
DnT,w + Ctr,100-5000 = 42
DnT,w + C50-5000 = 47
DnT,w + Ctr,50-5000 = 36
DnT,w + C50-3150 = 46
DnT,w + Ctr,50-3150 = 36

Partially independent ceiling with wall linings to first floor flats

BASTIAN® - Worksheet 1 [DM (1)]

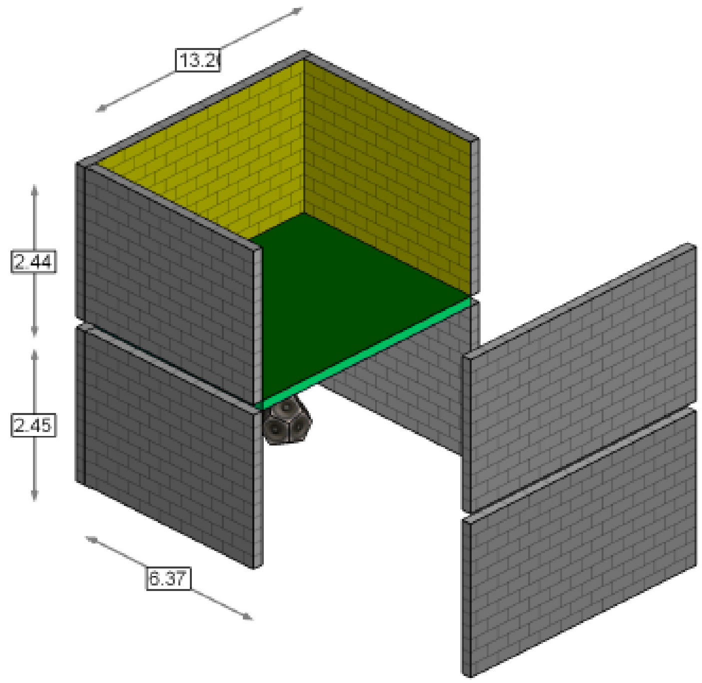
Project Info

Client:	Mr. D. Singh
Project:	Convesrion of first floor space to two residential flats
Worksheet:	Worksheet 1 [DM (1)]
Program:	BASTIAN V 2.3

Worksheet Configuration

Calculation Model:	DM (1)
Perf. Param. Airborne Sound Transm. in Buildings:	DnT,w + Ctr
Perf. Param. Impact Sound Transm. in Buildings:	L'n,w
Perf. Param. Outdoor Sound Transmission:	R'45°,w
Reference Reverberation Time T0 (s):	0.5
f1: Surface mass m"4 (kg/m²):	200
f1: Outer leaf interrupted:	no
f2: Surface mass m"4 (kg/m²):	200
f2: Outer leaf interrupted:	no
f3: Surface mass m"4 (kg/m²):	200
f4: Surface mass m"4 (kg/m²):	200
Correction Sigma_free/Sigma_forced for Monolithic Flanking Elements:	off
Correction Sigma_free/Sigma_forced for Lightweight Flanking Elements:	off
Alpha_k-Limit, MIN (-):	-
Alpha_k-Limit, MAX (-):	-
Ts-Limit for Elements, MIN (dB):	-
Ts-Limit for Elements, MAX (dB):	-
R'45° - R' (dB):	1.0
R'tr,s - R' (dB):	0.0
Level Difference DeltaL_fs (dB):	-

Room View



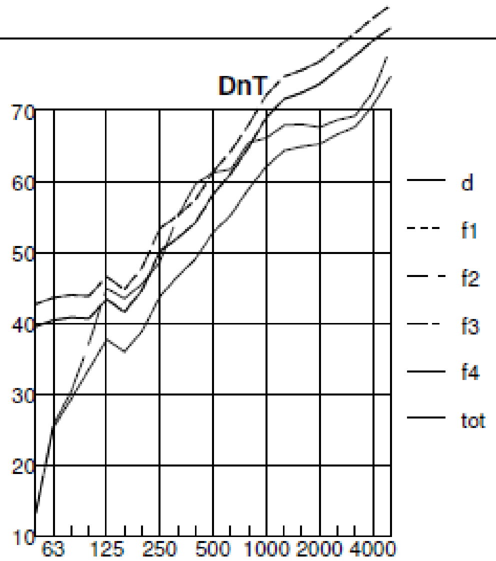
Worksheet-Table

		Sending Room		Juncti	Receiving Room		DnT,w (0.5 s		L'n,w	
N	t	Basic Element	Additional	Type-	Basic Element	Additional Layer	dB	%	dB	%
X	d	195 x 50 joists with 18mm deck,acc hang					53.0	28		
X	f1	BAST: brick (1600 kg/m³) 115 mm, rende		18	BAST: brick (1600 kg/m³) 115 mr	15mm SB p.b on ind	56.9	12		
X	f2	BAST: brick (1600 kg/m³) 115 mm, rende		18	BAST: brick (1600 kg/m³) 115 mr	15mm SB p.b on ind	56.9	12		
X	f3	BAST: brick (1600 kg/m³) 115 mm, rende		18	BAST: brick (1600 kg/m³) 115 mr	15mm SB p.b on ind	53.7	24		
X	f4	BAST: brick (1600 kg/m³) 115 mm, rende		18	BAST: brick (1600 kg/m³) 115 mr	15mm SB p.b on ind	53.7	24		
						Total:	47.9	100		

Airborne Sound per Element

tau	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	DnT,w (0.5 s) +
d	13.3	25.7	30.4	37.2	44.9	43.5	45.6	48.7	55.0	59.6	61.2	61.7	65.5	66.1	67.9	68.0	67.6	68.6	69.2	72.6	78.8	53.0
f1	42.7	43.6	44.0	43.8	46.5	44.7	47.8	53.3	55.2	57.4	61.4	64.3	68.0	72.2	74.8	75.7	76.8	78.8	80.8	83.0	84.8	56.9
f2	42.7	43.6	44.0	43.8	46.5	44.7	47.8	53.3	55.2	57.4	61.4	64.3	68.0	72.2	74.8	75.7	76.8	78.8	80.8	83.0	84.8	56.9
f3	39.5	40.5	40.8	40.7	43.4	41.6	44.7	50.2	52.0	54.2	58.2	61.1	64.8	69.0	71.6	72.5	73.7	75.7	77.7	79.8	81.6	53.7
f4	39.5	40.5	40.8	40.7	43.4	41.6	44.7	50.2	52.0	54.2	58.2	61.1	64.8	69.0	71.6	72.5	73.7	75.7	77.7	79.8	81.6	53.7
tot	13.3	25.3	29.4	33.5	37.7	36.0	38.9	43.8	46.6	49.1	52.8	55.2	59.0	62.1	64.3	64.9	65.2	66.6	67.7	70.7	74.7	47.9

Resulting Diagram



DnT,w = 54
DnT,w + C = 53
DnT,w + Ctr = 48
DnT,w + C100-5000 = 54
DnT,w + Ctr,100-5000 = 48
DnT,w + C50-5000 = 50
DnT,w + Ctr,50-5000 = 37
DnT,w + C50-3150 = 49
DnT,w + Ctr,50-3150 = 37

Resilient bar ceiling with wall linings to first floor flats

BASTIAN® - Worksheet 1 [DM (1)]

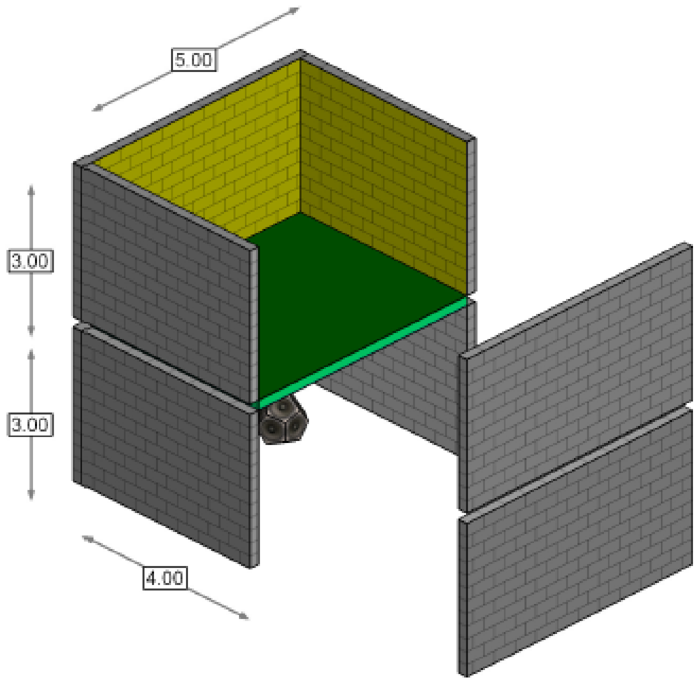
Project Info

Project Name:	57 - 59 Leicester Road. Wigston
Client:	Mr. D. Singh
Project:	Conversion of the first floor spaces to residential flats
Worksheet:	Worksheet 1 [DM (1)]
Program:	BASTIAN V 2.3

Worksheet Configuration

Calculation Model:	DM (1)
Perf. Param. Airborne Sound Transm. in Buildings:	DnT,w + Ctr
Perf. Param. Impact Sound Transm. in Buildings:	L'n,w
Perf. Param. Outdoor Sound Transmission:	R'45°,w
Reference Reverberation Time T0 (s):	0.5
f1: Surface mass m"4 (kg/m²):	200
f1: Outer leaf interrupted:	no
f2: Surface mass m"4 (kg/m²):	200
f2: Outer leaf interrupted:	no
f3: Surface mass m"4 (kg/m²):	200
f4: Surface mass m"4 (kg/m²):	200
Correction Sigma_free/Sigma_forced for Monolithic Flanking Elements:	off
Correction Sigma_free/Sigma_forced for Lightweight Flanking Elements:	off
Alpha_k-Limit, MIN (-):	-
Alpha_k-Limit, MAX (-):	-
Ts-Limit for Elements, MIN (dB):	-
Ts-Limit for Elements, MAX (dB):	-
R'45° - R' (dB):	1.0
R'tr,s - R' (dB):	0.0
Level Difference DeltaL_fs (dB):	-

Room View



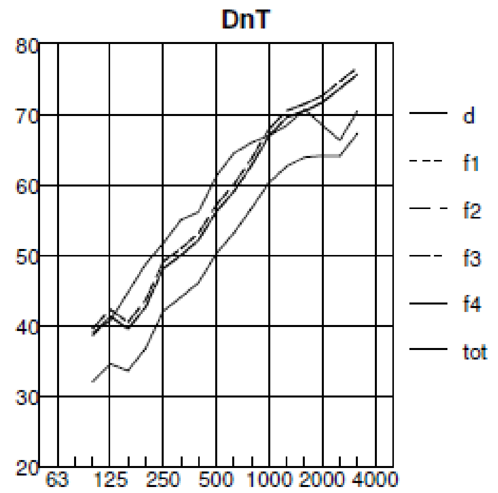
Worksheet-Table

		Sending Room		Juncti	Receiving Room		DnT,w (0.5 s		L'n,w	
N	t	Basic Element	Additional	Type-l	Basic Element	Additional Layer	dB	%	dB	%
X	d	SI floor on 200 x 50mm joists, res bar a					54.4	13		
X	f1	BAST: brick (1600 kg/m³) 115 mm, ren		18	BAST: brick (1600 kg/m³) 115 mm	15mm SB p.b on ind	52.7	19		
X	f2	BAST: brick (1600 kg/m³) 115 mm, ren		18	BAST: brick (1600 kg/m³) 115 mm	15mm SB p.b on ind	52.7	19		
X	f3	BAST: brick (1600 kg/m³) 115 mm, ren		18	BAST: brick (1600 kg/m³) 115 mm	15mm SB p.b on ind	51.7	24		
X	f4	BAST: brick (1600 kg/m³) 115 mm, ren		18	BAST: brick (1600 kg/m³) 115 mm	15mm SB p.b on ind	51.7	24		
						Total:	45.6	100		

Airborne Sound per Element

tau	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	DnT,w (0.5 s) +
d				39.1	40.7	44.8	48.8	51.7	55.0	56.2	61.2	64.5	66.0	67.0	68.4	70.7	68.5	66.3	70.5			54.4
f1				39.6	42.3	40.5	43.6	49.1	50.9	53.1	57.1	60.0	63.7	67.9	70.5	71.4	72.6	74.6	76.6			52.7
f2				39.6	42.3	40.5	43.6	49.1	50.9	53.1	57.1	60.0	63.7	67.9	70.5	71.4	72.6	74.6	76.6			52.7
f3				38.7	41.4	39.6	42.7	48.2	50.0	52.2	56.2	59.1	62.8	67.0	69.6	70.5	71.7	73.7	75.7			51.7
f4				38.7	41.4	39.6	42.7	48.2	50.0	52.2	56.2	59.1	62.8	67.0	69.6	70.5	71.7	73.7	75.7			51.7
tot				32.1	34.6	33.7	36.8	42.1	44.1	46.2	50.3	53.2	56.7	60.4	62.7	63.9	64.1	64.1	67.3			45.6

Resulting Diagram



DnT,w = 52
DnT,w + C = 50
DnT,w + Ctr = 46

Appendix 3. Installation Information - Resilient Bar Ceiling

www.british-gypsum.com

Installation - RB1 Ceiling

- Mark the underside of joists at 450mm centres to indicate the positioning of Gypframe RB1 Resilient Bars (centres will be 400mm for 2400mm long board).
- Fix Gypframe RB1 Resilient Bars through their flange to each joist using 36mm Gyproc Drywall Screws.
- If the resilient bars are not long enough to span the ceiling, join by nesting together under a joist and a screw through both flanges.

- Cut Gypframe RB1 Resilient Bar noggings to fit between the rows of bar at the ceiling perimeter and screw-fix to the joist.

- Lay Isover General Purpose Roll (100mm) between joists to rest on the resilient bars.
- Fix base layer board to the resilient bars using appropriate length Gyproc Drywall Screws with the long edge of boards at right angles to the resilient bars.
- Insert screws at 230mm maximum centres in the field of boards, and 150mm maximum centres at board ends.

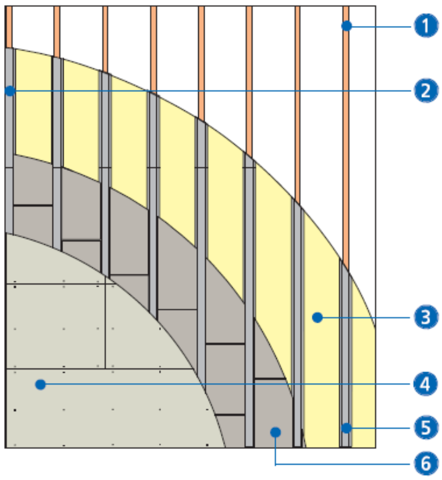
Technical support: T 0844 800 1991 F 0844 561 8816 E bgtechnical.enquiries@bpb.com

- Fix face layer board through to all resilient bar supports using appropriate length Gyproc Drywall Screws. Insert screws no closer than 10mm from bound board edges and 13mm from cut edges. Stagger board joints in the second layer relative to the first (see **Junction details**).

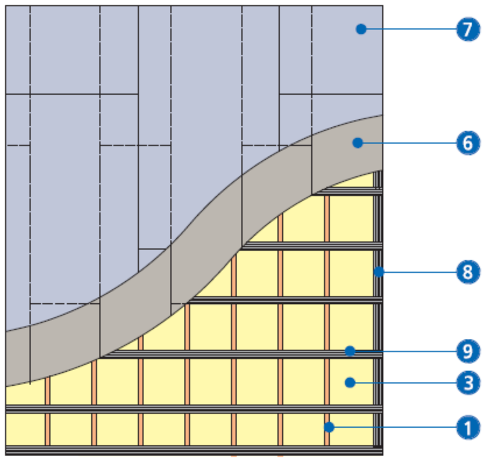
NB Select length of fixing to provide a nominal 10mm penetration into the Gypframe RB1 Resilient Bar supports. Ensure no contact of screw with timber joists.

Technical support: T 0844 800 1991 F 0844 561 8816 E bgtechnical.enquiries@bpb.com

Junction details - plan drawings



17 Cut-away floor plan (chipboard flooring)



18 Reflected ceiling plan (12.5mm x 1200mm x 2700mm Gyproc SoundBloc over Gyproc Plank fixed to Gypframe RB1 Resilient Bars

1. Solid timber joists
2. Gypframe SIF2 Floor Channel
3. Isover General Purpose Roll (100mm)
4. Chipboard flooring
5. Gypframe SIF1 / SIF4 Floor Channel
6. Gyproc Plank
7. Gyproc SoundBloc
8. Gypframe RB1 Resilient Bar noggings at room perimeter
9. Gypframe RB1 Resilient Bar