Elastic Layers to Reduce Sound Transmission in Lightweight Buildings

Fredrik Ljunggren*, Anders Ågren
Luleå University of Technology, 97187 Luleå, Sweden. fredrik.ljunggren@ltu.se

To obtain satisfactory sound insulation is a challenging task when designing lightweight buildings. Poor performance at low frequencies as well as severe flanking transmission has traditionally often been more pronounced compared to heavier constructions. In the present case-study based paper, various aspects of using elastic layers to improve sound insulation in lightweight buildings are considered.The effect on impact and airborne sound insulation by using two different kinds of vibration insulators between floor plans was examined together with the effect of using glues of various degree of elasticity in the construction. In situ measurements were performed inside a four-storey wooden frame based residential building and statistically significant variations in sound insulation were found. The efficiency of the two vibration insulators was further evaluated by vibration reduction measurements over the junctions. The difference in vibration reduction was found to be nearly constant in the frequency range 50–1000 Hz while the improvement of impact sound insulation increased by frequency. A long term test of elastic glues was also conducted, during three years, for stability over time. The best glues preserved a significantly higher damping ratio over time compared to the main part of the glues.

1. INTRODUCTION

Lightweight timber building of today is, despite successively improved sound properties, less favoured compared to heavier constructions in concrete or masonry. Unsatisfactory performance at low frequencies as well as severe flanking transmission have for a long time been treated as typical for lightweight constructions.

One measure in order to improve the acoustic performance in lightweight buildings is to introduce elasticity in the construction. Elastic connections are essentially important in order to reduce sound and vibration transmission but since there might be a conflict against the building's overall stability they must be carefully designed. Regarding concrete floors, it is common to use elastic floor layers, so-called floating floor, for improved impact sound insulation. Such floors might however be hazardous to use in modern lightweight constructions due to a potential risk of enhanced transmission at low frequencies. Instead, one of the most common elastic details in lightweight buildings is the resilient channels found for suspended ceilings, which on the other hand also introduces a resonance in the system.

A solution with application in both light and heavy buildings is the use of elastic layers in junctions where they act as vibration obstruction, normally between two walls, two floors or between a wall and a floor.

The *Volume concept* is a special lightweight construction technique where building volumes (e.g. a room or a small apartment) are prefabricated inside of a factory. The use of prefabricated volumes offer benefits like shortened production time, reduced moisture problem and potentially lower cost as opposed to construction in situ. The technique is thoroughly described in [1]. With the volume concept, it is natural to use fully separating floors where the upper volume contains the load bearing part of the floor and the lower volume contains the ceiling part. Then, the only mechanical connection between two volumes above each other is at the boundaries, which is acoustically favourable.

EN 12354 [2] provides prediction of a variety of general building acoustical parameters, to some extent also regarding elastic layers. However, since the described mathematical models basically are intended for heavy, homogenous, constructions, they are of limited use for lightweight buildings. It is therefore, to a greater extent, necessary to get experimental data for validation of constructional modifications in lightweight building systems compared to concrete buildings.

In the present paper, the effect of using materials with elastic properties is studied:

1) In terms of vibration insulators between volumes to reduce flanking transmission and

2) in terms of glue in between plates for increased elasticity and damping to reduce flanking transmission and to reduce direct transmission.

2. IMPACT AND AIRBORNE SOUND INSULATION

2.1. TEST OBJECT

The test object used in this research was a volume-based four-storey building with general construction as shown in Figure 1. In the upper volume, 225 mm glulam (glued laminated timber) beams act as the load-bearing part together with layers of particle boards and floor plaster boards. The ceiling in the lower volume is built up of 120 mm wooden joists and double layers of plaster boards. The outer walls have a wooden framework 45 × 170 mm, c600 mm, and double layers of plasterboards on the inside.

The walls separating the dwellings are made of separate wooden frameworks 45 × 95 mm, c600 mm with double layers of plaster boards on each side. Note that both the floor section and the ceiling section are hung in between the outer walls.

The actual construction has been developed and refined during several years and it is known from previous studies [3] that both airborne and impact sound insulation are competitive with other concepts, including concrete buildings.

In order to further improve the acoustical performance, two principally different solutions involving elastic material were concerned. One acts as a vibration insulator between the volumes /floor plans in the vertical direction. It was applied as two types: Type I: Continuous strips (cross section area: 20 × 95/170 mm) of bonded polyether foam and Type II: Pads (about 100 × 100 × 25 mm) of micro-cell structured polyurethane spacing 600 mm and with mineral wool filling up the gap in between the pads. Both types are positioned around the volumes' boundaries, the latter aligned to the vertical wall studs. The purpose with the insulators is that they will work as multi-degree of freedom spring isolators for the flanking transmission and significantly improve the overall sound insulation indexes.

Two different kinds of glues, applied in between the floor plaster boards and the particle boards were investigated: Type I: a semi flexible glue, commonly used for analogous building constructions, which tends to preserve some elasticity after hardening and Type II: a documented elastic glue which to a higher extent than type I maintains its elasticity after hardening. The assumption is here that the glue will have two main functions; to serve as an insulating spring and thereby decrease the direct sound transmission through the floor and to serve as a damper since it will create a damped sandwich floor plate. Thus, it is assumed to reduce the average plate vibration velocity and affect the flanking transmission since the vibrations propagating across the floor towards the walls are attenuated more effectively. The glue is applied by a 2 mm toothed spatula. The positions of the elastic layers are shown in Figure 2.

2.2. METHOD

The building holds a total of 29

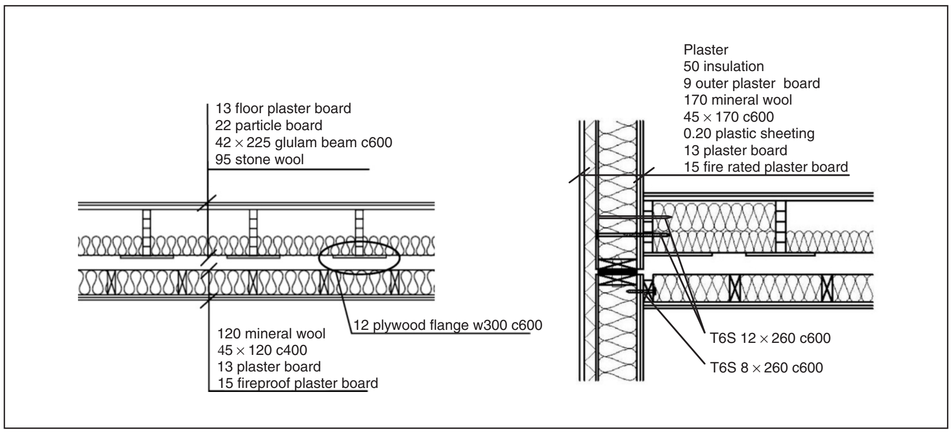

Figure 1. General construction of floor, ceiling and outer walls.

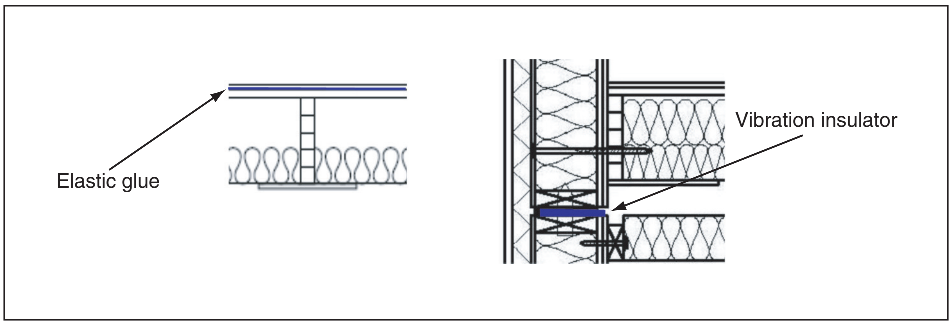

Figure 2. Elastic layer in terms of glue between floor boards (left) and in terms of insulator between upper and lower floor plans (right).

identical apartments, some of them with reversed lay-out, according to Figure 3. Each of the apartments has an area of 35 m^2 and comprises two building volumes. Wooden parquet was commonly used as floor covering.16 of the apartments, divided into four groups A-D with respect to the different treatments, were involved in the study. Each group constitutes one apartment at each floor level 1–4 where level 1 is the ground floor. Each group then contains four apartments yielding three sound measurements between floors in vertical direction. The setup of the four groups, containing all possible combinations of glue and vibration insulators, is shown in Table 1.

Airborne sound reduction and impact sound level were measured vertically between apartments according to ISO 140-4 [4] and 140-7 [5] respectively. The results have been evaluated according to ISO 717-1 [6] and 717-2 [7] together with the Swedish standard SS 025267 (3) [8]. The latter is unique as it is compulsory to include frequencies down to 50 Hz ($C_{50\text{-}3150}$ and $C_{I,50\text{-}2500}$) in contrast to regulations in other European countries where 100 Hz traditionally acts as the lower frequency limit [9].

Furthermore, the Swedish national standard involves a limitation which states that no volume larger than 31 m^3 should be considered regardless of the room's actual size when the impact sound is evaluated and no volume larger than 3.1 times the dividing area when it comes to airborne sound reduction. When applying these limitations to the impact sound pressure, the normalized level L_n corresponds to the standardized level L_{nT} for volumes ≥ 31 m^3. For airborne sound insulation the reduction R corresponds to the standardized level difference D_{nT} when volume/area ≥ 3.1 m. The rules of limitation will prevent the requirements to increase with increased volume which was the case

Table 1: Test configurations

Group	Glue	Vibration insulation
A	Type I, semi-flexible	Type I, strips of bonded polyether foam
B	Type II, elastic	Type I, strips of bonded polyether foam
C	Type I , semi-flexible	Type II, pads of polyurethane
D	Type II, elastic	Type II, pads of polyurethane

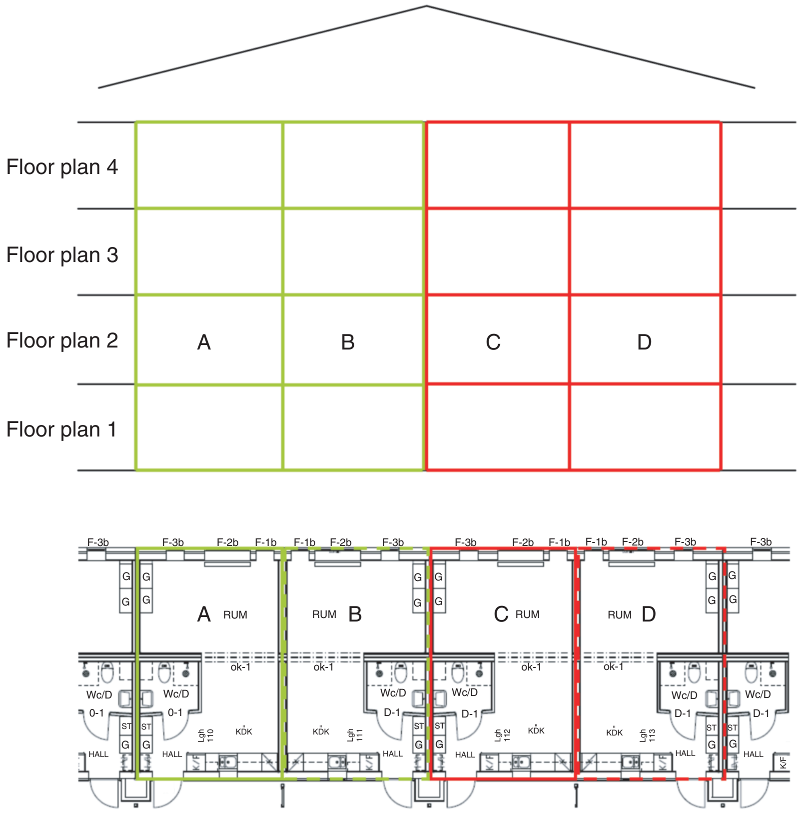

Figure 3. Lay-out of the apartments. Letters refer to test setup according to Table 1.

previously [8].

For the case treated here, it means that when calculating L_n, the volume 31 m^3 is used even though the true volume is 67 m^3, resulting in a somewhat lower reported $L_{n,w}$ than otherwise. However, the restriction of volume related to dividing area does not affect any calculation of R.

2.3. RESULTS

The resulting sound indexes, $L'_{n,w}$, $C_{I,50\text{-}2500}$, R'_w and $C_{50\text{-}3150}$ are presented in Table 2 and their means together with 95% confidence intervals are shown in Figure 4. The confidence intervals were calculated by a pooled estimate of the variance (i.e. assuming that the variance for the different setups A-D in Table 2 individually is of equal size). Diagram of impact sound and sound reduction in 1/3 octave bands can be seen in Figure 5.

2.3.1. EFFECTS OF VIBRATION INSULATION

When the polyurethane pads were used as the insulation instead of the polyether strips, a clear improvement can be seen. The effect is noticeable within a wide frequency range from about 80 Hz and above for floor plan 1 and from about 160 Hz for plan 2 and 3 resulting in 2–5 dB lower impact sound level index $L'_{n,w} + C_{I,50\text{-}2500}$ with an average improvement of about 3 dB (4 dB considering $L'_{n,w}$ solely). It is noticed that the improvements are somewhat greater for floors in the lower part of the building compared to the higher part. Setup C (semi-flexible glue, polyurethane pads) shows statistically significant (level 0.05) lower impact sound, $L'_{n,w} + C_{I,50\text{-}2500}$, than setup A (semi-flexible glue, bonded polyether strips). No such evidence is found when comparing setup D (elastic glue, polyurethane pads) with setup B (elastic glue, bonded polyether strips).

In a similar way, the airborne sound is affected by the choice of vibration insulation over a wide frequency range starting from about 80 Hz for floor plan 1, from 100 Hz for plan 2 and from 160 Hz for plan 3. This results in 4–7 dB higher sound reduction index $R'_w + C_{50\text{-}3150}$ when the polyurethane insulation is used with an average improvement of about 5 dB (6 dB considering R'_w solely). Statistically significant difference is found between setup C and A as well as between setup

Table 2: Obtained sound reduction R'w and impact sound L'n,w together with low frequency terms

Floor plan	Setup	Glue	Vibration insulation	$L'_{n,w}$	$C_{I,50\text{-}2500}$	$L'_{n,w} + C_{I,50\text{-}2500}$	R'_w	$C_{50\text{-}3150}$	$R'_w + C_{50\text{-}3150}$
1	A	Type I,	Type I, strips	52	1	**53**	54	−1	**53**
2		semi-	of bonded	52	0	**52**	56	−1	**55**
3		flexible	polyether foam	49	1	**50**	57	−1	**56**
1	B	Type II,	Type I, strips	48	2	**50**	56	−1	**55**
2		elastic	of bonded	47	1	**48**	56	−1	**55**
3			polyether foam	47	4	**49***	58	−2	**56**
1	C	Type I,	Type II,	46	2	**48**	61	−1	**60**
2		semi-	polyurethane	47	2	**49**	62	−2	**60**
3		flexible	pads	45	3	**48**	63	−2	**61**
1	D	Type II,	Type II,	45	3	**48**	61	−2	**59**
2		elastic	polyurethane	44	2	**46**	63	−3	**60**
3			pads	44	3	**48**	63	−2	**61**

**Originally, 51 dB was measured due to worse results for the lowest freq., not related to the type of glue. 49 dB is an estimated value assuming similar low freq. behaviour as the others.*

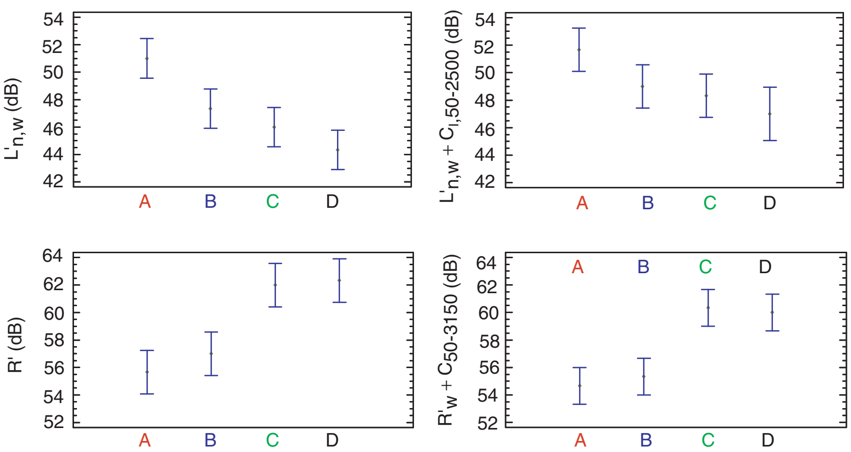

Figure 4. 95% Confidence intervals of impact sound $L_{n,w}$ and $L_{n,w} + C_{I,50\text{-}2500}$ (upper) and sound reduction R_w and $R_w + C_{50\text{-}3150}$ (lower). A: semi-flexible glue, bonded polyether strips. B: elastic glue, bonded polyether strips. C: semi-flexible glue, polyurethane pads. D: elastic glue, polyurethane pads.

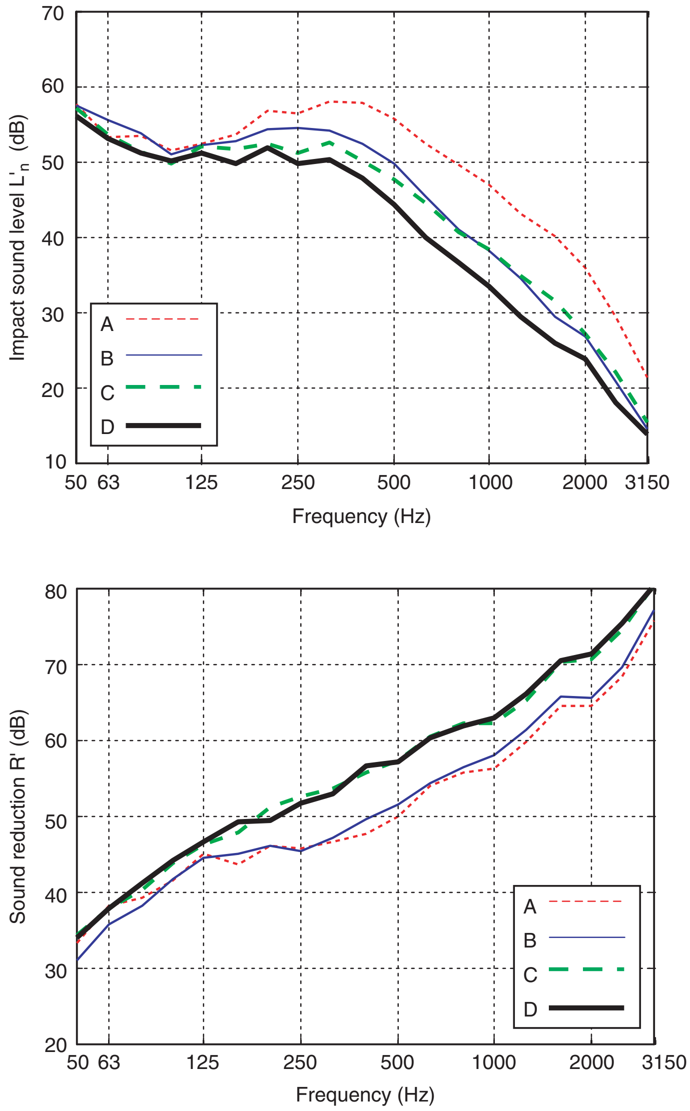

Figure 5. *Mean value of impact sound (upper) and sound reduction (lower). A: semi-flexible glue, bonded polyether strips. B: elastic glue, bonded polyether strips. C: semi-flexible glue, polyurethane pads. D: elastic glue, polyurethane pads.*

D and B in terms of $R'_w + C_{50\text{-}3150}$.

2.3.2. Effects of glue

The elastic floor board glue lowered the impact sound level, especially for frequencies above 400 Hz. The effect is however also seen at lower frequencies, most evident for the lowest floor plan. The index $L'_{n,w} + C_{I,50\text{-}2500}$ drops 1–4 dB when the elastic glue is used instead of the semi-flexible one in combination with the polyether vibration insulation and 0-3 dB combined with the polyurethane ditto. However, neither setup B nor D shows statistically lower impact sound $L'_{n,w} + C_{I,50\text{-}2500}$ compared to setup A and C respectively but restricted to $L'_{n,w}$, the difference between setup A and C is significant.

Regarding the airborne sound insulation, no effect related to the different glues was observed.

2.3.3. Effects of vibration insulation and glue, combined

The best sound properties of the possible test variants was obtained for the case elastic glue combined with the polyurethane based vibration insulation. The overall improvement, compared to the case of semi-elastic glue and polyether insulation, is about 4 dB and 5 dB for impact sound and airborne sound reduction respectively including the C-terms. The difference between setup A and D is statistically significant concerning both $L'_{n,w} + C_{I,50\text{-}2500}$ and $R'_w + C_{50\text{-}3150}$.

2.4. DISCUSSION

Correctly constructed and designed, volume based lightweight building technique thus has potential to obtain good acoustic performance. Even when the starting point is a construction that already shows respectable sound insulation, there is room for further improvements.

A vital factor in this context concerns the floor plan, i.e. the effect of static load. As building volumes are stacked upon each other an increased load accumulates to the lower floors. These various loads to various floor plans, and furthermore to specific walls, must be taken into account when designing the vibration insulation stiffness, like it was done in this study regarding the polyurethane insulator.

The tested polyether foam is however only available from the manufacturer in a couple of variants which make it hard to meet the required stiffness. As a result, the insulator between the lower floors gets overloaded, and it is therefore common to obtain the best sound insulation for the uppermost plans. The floor dependence of the sound insulation is not at all that obvious for the polyurethane insulators. This tendency can be seen in the present study and further documentation illustrating the phenomenon has been reported [10].

3. VIBRATION MEASUREMENTS OVER THE JUNCTION

3.1. METHOD

3.1.1. Flanking transmission

To achieve a further indication of the true vibration reduction effectiveness of the polyurethane insulator versus the polyether one, vibration measurements over the floor-wall junction for a number of building objects with basically identical construction as in the previous section, but with different insulator, were studied. The acceleration was measured at two positions, at a right angle to the surface. One accelerometer was positioned on the upper floor, 20 cm from the wall and one accelerometer at the lower wall, 20 cm from the ceiling. The vibration level difference, from floor to wall, was determined for two positions in each room, one in parallel direction to the loadbearing beams and one in orthogonal direction. The source was a tapping machine at the centre of the floor. The used method is considerably simplified compared to the laboratory based method described in ISO 10848 [11] and it was chosen due to limited access for data. See the principles in Figure 6.

3.1.2. Attenuation over the floor surface

The glue's ability to mitigate vibrations propagating over the floor is indeed an important property related to flanking transmission. The vibration attenuation over the floor surface decides how much of the source's original vibration energy that is allowed to reach the boundaries of the room where it can be further transferred via the flanking connections.

The actual construction with fully elastic glue in between the plaster board and particle board was compared with two other buildings where no elastic glues were used. In one of the buildings the floor was based on 70 mm cross laminated timber (CLT) plates and glulam beams. The other one was formed in a more traditional lightweight style using a timber framed base where the floor plate was represented by 2 × 13 mm plaster board combined with 22 mm particle board. All three objects used freely lying parquet as floor covering.

The impact hammer was positioned in the centre of the floor and vibrations

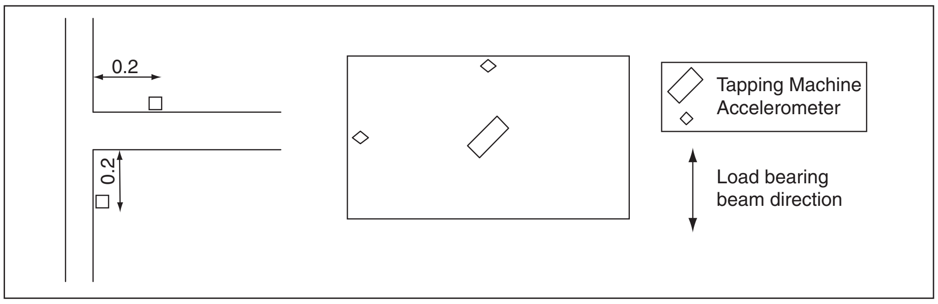

Figure 6. Sketch of positions of source and response points for flanking vibration measurements.

were measured along two perpendicular directions from close to the hammer (50 cm) to close to the wall (20 cm), five accelerometers along each line according to Figure 7.

3.2. RESULTS

3.2.1. Flanking transmission

The results from the flanking vibration measurements are shown in Figure 8 in terms of acceleration level difference, dB ref 10^{-6} m/s^2, between floor and wall, $L_{a,floor}$ - $L_{a,wall}$, averaged over two positions, parallel and orthogonal to the beams. It is evident that the polyurethane insulator reduces vibration transmission to a higher extent than the corresponding polyether one. In the measured frequency range 50–1000 Hz the reduction using polyurethane is roughly in the order of 10 dB greater. Compared to the impact sound levels L_n reported above, the effect is observed from about 100-160 Hz and above and the magnitude is about 4–6 dB from 250 Hz. It is therefore reasonable to believe that for the specific construction treated here, flanking transmission starts to become an important sound propagation path from about 160 Hz. Below that frequency, despite effective vibration insulation across the junction, no effect can be seen in the impact sound level suggesting that here the direct transmission through the floor is the dominating sound propagating path.

A least square polynomial fitting of first and second order for vibration reduction improvement and impact sound level improvements respectively are given according to equation (1) and (2) as functions of frequency. The degree of explanation, R^2, is 0.17 for the vibrations, a relatively low value due the comparatively large variations among several adjacent 1/3 octave bands. For the improved impact sound level, R^2 is 0.94. The improvement of vibration reduction is then almost constant in the actual frequency range, about 13 dB, while the impact sound improvement increases with frequency. The equations are graphically represented in Figure 9. Due to the limited number of measurement points the results should only be seen as indicative.

Vibration reduction:

$$V_{pu}(f) - V_{ps}(f) = -2.1 \cdot 10^{-3} \cdot f + 13.2 \tag{1}$$

Impact sound improvement:

$$L_{n,ps}(f) - L_{n,pu}(f) = -1.8 \cdot 10^{-5} \cdot f^2 + 2.7 \cdot 10^{-2} \cdot f - 1.12 \tag{2}$$

Note: *pe* – polyether and *pu* – polyurethane

3.2.2. Attenuation over the floor surface

The results from the vibration propagation measurements of the floor are seen in Figure 10 where it is noticed that the construction treated here, with elastic glue, has the highest averaged acceleration attenuation (dB/m) in the frequency range 160–3150 Hz. From Figure 5 it was seen that the glue starts to affect the

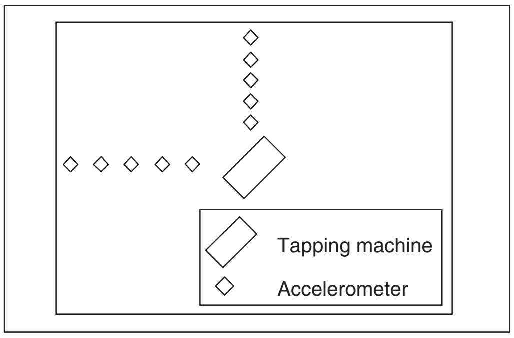

Figure 7. Sketch of measuring vibration propagation over the floor.

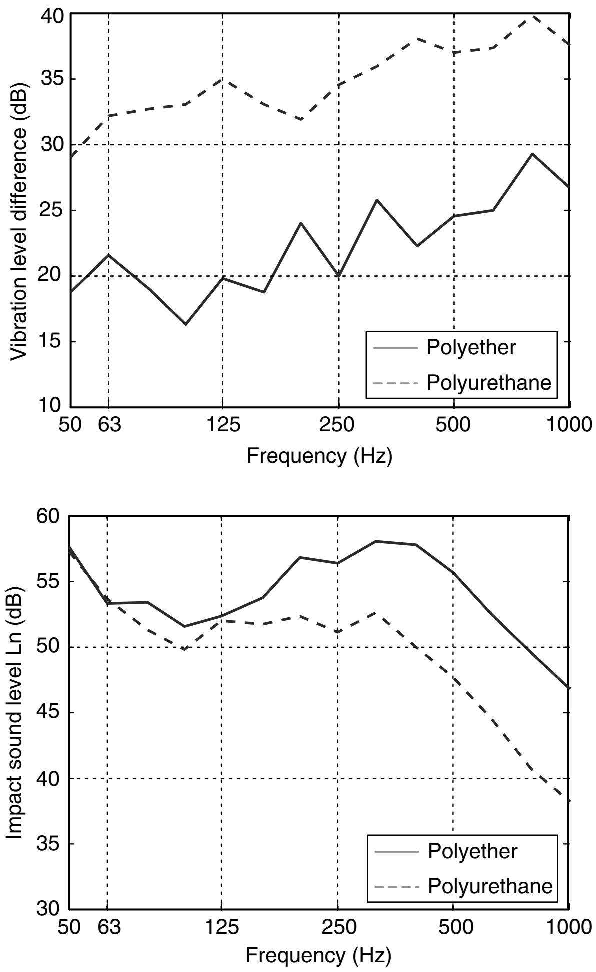

Figure 8. Vibration level difference across the junction (upper) and impact sound insulation (lower) using two different vibration insulators.

impact sound at around 160 Hz while the effect was clearer from about 400 Hz and above, the latter is also indicated in Figure 10.

However, since the constructions used for comparisons are not exactly equal to the original one, the measurements should not be taken as a "proof" for the benefit of elastic glues but serves more as an indication.

3.3. DISCUSSION

The flanking vibration measurements resulted in two empirical expressions that might be used to give a coarse estimation of the vibration reduction across the junction and/or to coarsely estimate the improvement of impact sound insulation in similar lightweight constructions. However, the suggested equations suffer from a number of

limitations that all may affect the accuracy:
1. a single accelerometer was used to represent a complete line or surface, 2. the response was located 20 cm from the actual joint and 3 the floor response was measured on top of floating parquet (parquet lying freely on a thin foam) and hence not directly to the solid floor structure. Further measurements with more measurement positions are recommended.

4. LONG TERM EFFECTS

4.1. METHOD

An elastic glue must preserve its properties over time in order to be an appropriate component of a building system. To document a number of different glues' long term performance, a small scale laboratory measurement series was initiated. Pieces of 13 mm floor gypsum board and 22 mm particle board, both having the size of 50 × 60 cm^2, were glued together. The test specimen then got the same material configuration as the floor layer in the tested building. In all, six different elastic glues, all available on the Scandinavian market were used in the test. Two of the glues were the ones treated above and four additional glues, all marketed as elastic.

The glues are denoted A-F, where A is the semi-elastic glue and B is the fully elastic glue, previously used. When measuring a test specimen, it was suspended by elastic springs and then excited by an impact hammer. The

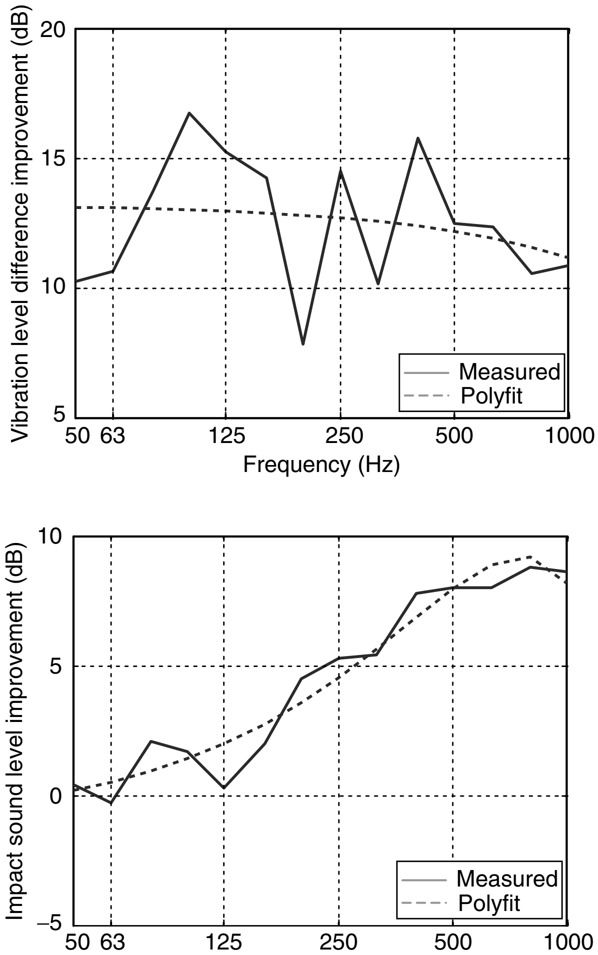

Figure 9. Improvement in terms of vibration reduction over junction (upper) and impact sound level (lower) as a result of changed flanking vibration insulator. Polyurethane insulator compared to polyether insulator.

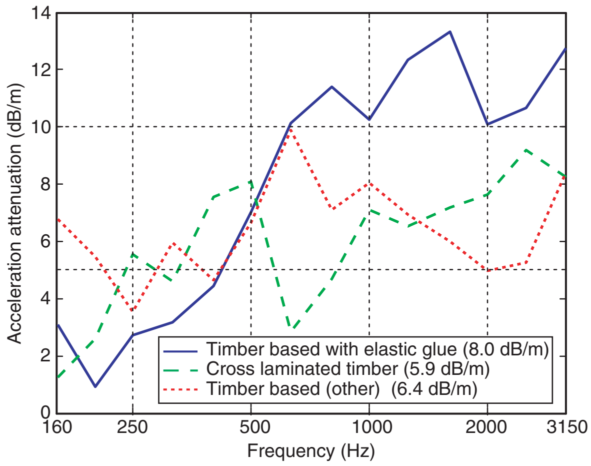

Figure 10. Vibration attenuation (dB/m) for different objects, averaged over two perpendicular directions.

impact force as well as the acceleration response in four different positions was measured simultaneously. Test setup according to Figure 11.

4.2. RESULTS

The mean frequency response function over the four response points, for each of the six test specimens, measured three days after assembling, are presented in Figure 12. The two first modes which could be clearly identified for all specimens are referred to as mode 1 and 2 respectively.

The first test with the different glues was conducted 18th of June 2009. The same test has then been repeated seven times; 26th of June 2009, December 2009, June 2010, December 2010, June 2011, December 2011 and June 2012. The resulting modal damping ratios of the two modes for all test occasions are presented in Figure 13 and the corresponding natural frequencies in Figure 14. The reported modal damping was extracted according to the 3–dB rule.

Four of the glues have damping ratios of about 1% after half a year, including the semi-elastic one, type I, used in previous experiments. Two of the glues stand out in terms of damping. Glue “*D*” shows about 3% and glue “*B*”, corresponding to type II - fully elastic - in previous field test, about 5–6%.

4.3. DISCUSSION

Most of the changes of the glues’ dynamic parameters took place during the first six months after assembling, a tendency which is observed for both modes. After that, the damping is in

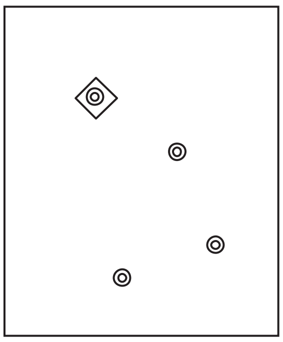 

Figure 11. Sketch of a test specimen including sensors (left) and experimental setup (right).

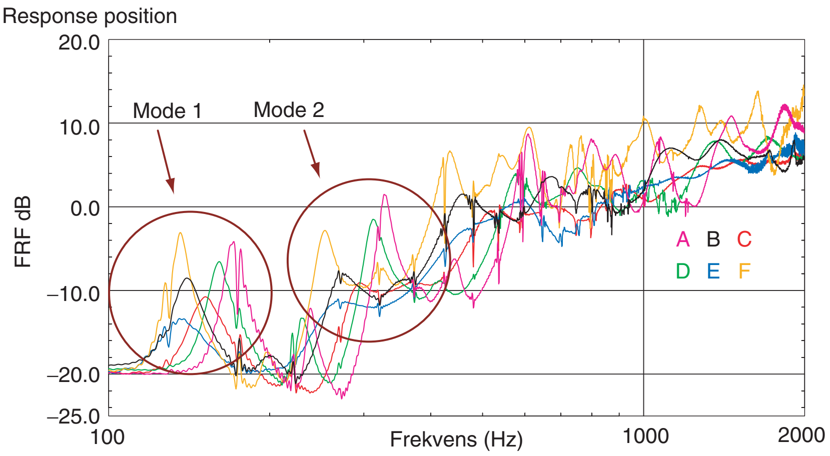

Figure 12. *Frequency response functions for six different glues, accelerance (dB/1.0). "A" refers to the semi-elastic glue and "B" to the fully elastic glue.*

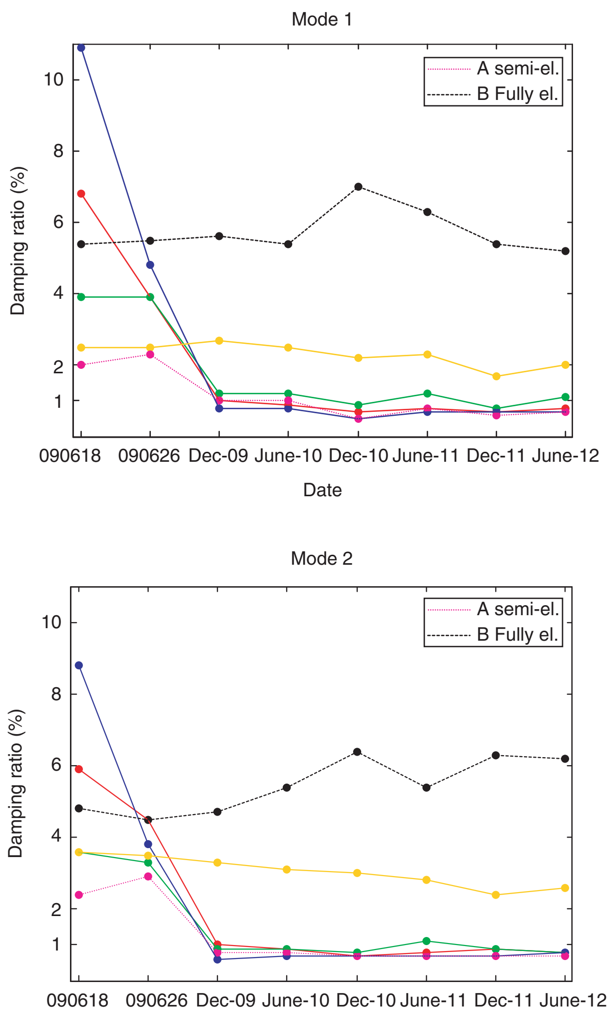

Figure 13. *Damping ratios of two modes for the tested specimen ranging 3 years in time.*

general stabilized even though some of the glues still, slowly, tend to lose damping over time. Also note the tendency of summer-winter variation which can be seen after the first year.

Any vibration insulator being considered must meet the requirement in the long run in order to be favourable. The polyurethane vibration insulator considered here has been used in various building applications and almost unaffected performance after 16 years, with estimated full functionality of at least another 30 years, has been reported [12].

5. CONCLUSIONS

The design of a vibration insulator between two floor plans can be a key factor in order to minimize flanking transmission and thereby obtain better total sound performance in lightweight buildings. In the reported study, a well designed polyurethane insulator improved the impact sound index $L'_{n,w} + C_{I,50\text{-}2500}$ by 3 dB on average and the sound reduction index $R'_w + C_{50\text{-}3150}$ by 5 dB on average, all related to the alternative bonded polyether foam. The latter is described as a general sound insulator for various building acoustic applications but is, contrary to the polyurethane insulator, not designed to match any specific building construction regarding static and dynamic loads, natural frequencies etc. Nor has its long terms effect been proven.

The difference in vibration reduction over junctions between the two insulators was found to be at an almost constant level, 13 dB, over the

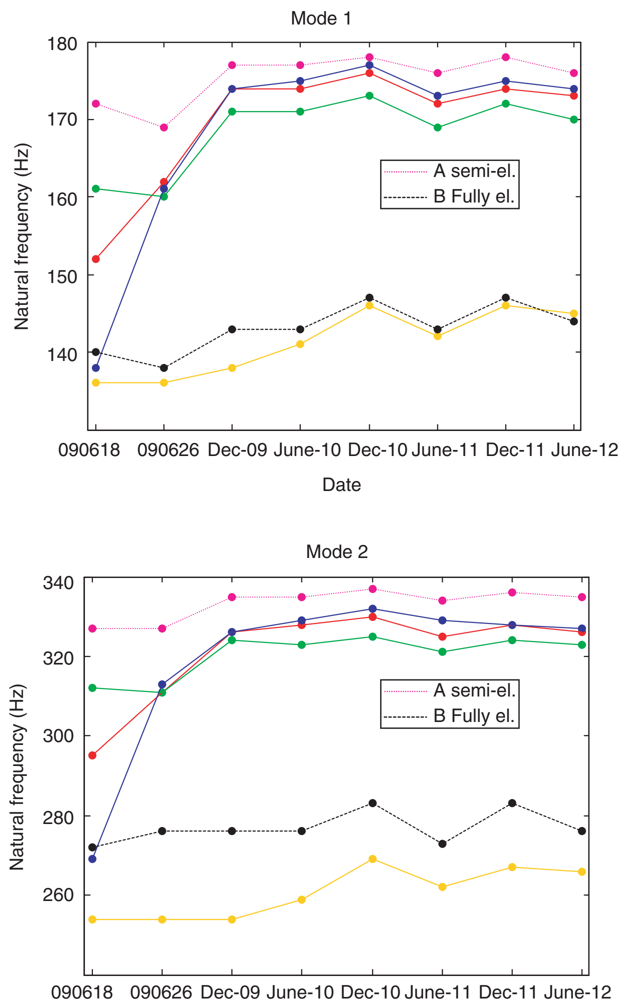

Figure 14. Natural frequencies of two modes for the tested specimen ranging 3 years in time.

frequency range 50–1000 Hz. The impact sound level difference on the other hand, was increased by frequency, approximately 2 dB per octave band.

The type of glue to be used in between the particle board and gypsum board for the tested construction's sub floor is as well a parameter of importance. In the field test $L'_{n,w}$ decreased about 2-3 dB when the fully elastic glue was used compared to the alternative semi-elastic glue, a result of both reduced direct sound and reduced flanking transmission. The effect was greater when the fully elastic glues were combined with the less effective polyether vibration insulator. This indicates that the flanking transmission when using a more efficient vibration insulator has already been reduced and that further reduction does not affect the sound reduction index to the same extent.

It is concluded that a majority of the tested glues, despite often high initial damping, drop to a damping ratio of about 1% within a relatively short period of time. The difference is large compared with the two outperforming glues having damping ratios of 3-5% even after 3 years.

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IATA WELCOMES MORE STRINGENT NOISE STANDARDS

The International Air Transport Association (IATA) has welcomed the agreement on a new noise standard with more stringent requirements for future aircraft achieved by the International Civil Aviation Organization (ICAO). The ICAO Committee on Aviation Environmental Protection (CAEP) comprising ICAO member states, industry, and environmental non-governmental organizations, reviewed technological feasibility, environmental benefits and economic factors and reached a consensus to move forward on a new standard that will result in a reduction of 7 Effective Perceived Noise Decibels (EPNdB) compared to the current Chapter 4 Standard. “Air transport is already 75% quieter than it was four decades ago and the industry will continuously pursue cost-effective noise management options to reduce the number of people subject to aircraft noise, in line with our broader global commitments on sustainability and environmental performance,” said Tony Tyler IATA’s Director General and CEO. The new standard will be applicable to new aircraft types for which a request for certification is submitted after 31 December 2017 and for lower-weight new aircraft as of 2020. The current Chapter 4 Standard came into effect in 2006. “This is another good example of ICAO successfully tackling a difficult environmental issue. This collaborative work ensures that the development and implementation of global standards reflect the specific needs of society at large and capabilities of states while bringing certainty to long-term airline fleet investment,” said Tyler.
More info: IATA, 800 Place Victoria (rue Gauvin), Montreal, Canada www.iata.org

NO MORE MUSIC AT THE BEACH

Santa Rosa (Fl) County commissioners have had numerous discussions in recent years about noise complaints related to the Navarre Beach fishing pier. However, commissioners were limited in what they could do because the county does not have a noise ordinance for Navarre Beach. Commissioner Jim Melvin said a group of homeowners filed a formal noise complaint against the pier with the county in December, which was the first time a signed complaint had come in rather a verbal one. “We’re going to fashion a noise ordinance that will meet the needs of the beach environment,” Melvin said. “We’re giving serious thought to banning amplified sounds of any variety without special dispensation. If there’s a going to be a special event, you come to the board and get a one-time waiver. I hope we’re going to put some teeth in it; a small enough fine that it doesn’t put anybody out of business but big enough that they feel the sting to enforce it,” Melvin said the ordinance would be designed to prevent amplified music and noises being played outdoors.