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Financial viability of horizontal sealing elements with different acoustic performance ratings

Viabilidade financeira de elementos de vedação horizontal com diferentes classificações de desempenho acústico

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***ABSTRACT*:** Faced with the constant development in construction resources and techniques, there is a need to know the materials used since they directly interfere with the acoustic performance of buildings. Moreover, residential buildings are products to be marketed in which builders seek to reduce costs and optimize the application of their economic resources in attributes valued by the target audience, and noise reduction is one of these items. Therefore, to promote the use of elements with adequate acoustic behavior to prioritize the acoustic comfort of users and to encourage the use of materials that contribute to this end, the objective of this paper is to analyze the financial viability between the square meter of construction and the acoustic behavior of different flooring systems. The methodology used impact sound insulation data determined in field tests, obtained through laboratory tests, and the cost analysis was done with commercial software. The results showed the importance of implementing floating floor construction systems to achieve good acoustic performance. Furthermore, it was observed that in several cases, the additional cost with the floating floor application becomes insignificant when diluted in a multi-unit building, given the increase in the final sale value of an apartment with optimized performance (minimum/superior).

Keywords: Building performance. Technology in buildings. Impact noise.

***RESUMO*:** Diante do constante desenvolvimento em recursos e técnicas de construção, há a necessidade de conhecer os materiais utilizados, pois interferem diretamente no desempenho acústico dos edifícios. Além disso, os edifícios residenciais são produtos a serem comercializados nos quais os construtores procuram reduzir custos e otimizar a aplicação de seus recursos econômicos em atributos valorizados pelo público-alvo, sendo a redução do ruído um desses itens. Por esta razão, este trabalho analisou o custo por metro quadrado de construção e o comportamento acústico de diferentes sistemas de pavimentação, promovendo assim o uso de elementos com comportamento acústico adequado para priorizar o conforto acústico dos usuários e incentivar o uso de materiais que contribuam para este fim. Este estudo utilizou dados de isolamento acústico de impacto determinados em testes de campo e obtidos através de testes de laboratório. A análise de custo foi feita com software comercial. Com base nos resultados, o padrão brasileiro de desempenho de construção destacou a importância da implementação de sistemas de construção de pisos flutuantes para alcançar um bom desempenho acústico. Além disso, foi observado que em vários casos, o custo adicional com a aplicação do piso flutuante torna-se insignificante quando diluído em um edifício de várias unidades, dado o aumento do valor final de venda de um apartamento com desempenho otimizado (mínimo/superior).

Palavras-chaves: Desempenho de edificações. Tecnologia em edifícios. Ruído de impacto.

1. INTRODUCTION

Acoustics in buildings is an important element in the analysis of the built environment, considering that the quality of life of humans is conditioned, among other factors, by their environment. Exposure to high levels of sound pressure can be extremely harmful to health, especially to individuals whose exposure is usually frequent (THEMANN; MASTERSON, 2019). Therefore, the sound level of the environment must be appropriate to its function or purpose of use.

Urban noise has become more critical due to the growth of cities, which has increased the number of sources that generate noise since the increase in traffic, the extension of residential areas near airports, and the high demand for construction are exacerbating noise in urban centers, causing increasingly harmful effects (YUAN *et al.,* 2019). As a result, the architecture of Brazilian buildings has been showing constant changes in the construction techniques and materials used, which directly reflect the environmental comfort of buildings (CARVALHO, 2010; PARK; LEE; JEONG, 2018). The employment of such changes can be beneficial or detrimental to the company.

To have a positive performance, it is of utmost importance to know the parameters of acoustic performances and the criteria required by technical standards, such as Brazilian standard NBR 15575 (ABNT, 2021). This standard presents the minimum criteria for residential sound performance evaluations since the acoustic concern is not only a matter of acoustic conditioning of the environment but also of noise control and preservation of the environmental quality.

In civil construction, there are many concepts for the development of a building, in which most housing projects are composed of several construction elements, such as columns, horizontal division elements (slabs and floor systems), vertical sealing elements (external and internal partitions), and multiple types of coverage (ABNT, 2021). It is also necessary to analyze the material to be used in the closures since new materials are used every time, and many of them are lightweight since they seek to reduce the load on the structure. However, they can present low acoustic insulation (LOURENÇO *et al.*, 2022).

It is also necessary to analyze the envelope materials since new materials are being developed to reduce the structure's load. However, they can present acoustically low insulation (LOURENÇO *et al.,* 2022). Therefore, it is necessary to investigate the financial viability, seeking, in addition to lower price and greater flexibility in construction time, to achieve quality and an adequate level of acoustic comfort for the user.

It is also observed that housing has become a product to be marketed, in which builders seek to optimize their financial investment, concentrating the investments valued by the target audience. As noise is one of these factors, it can interfere with user satisfaction or dissatisfaction, e.g., the beneficial effects of customer satisfaction are not limited to the short term, such as in cost reduction during construction and sales success, but also in the long-term post-occupational satisfaction of users (FERNANDEZ, 2006).

Silva (2000) highlights that subsequent corrections made to the site due to poor planning, construction, or installation, can cause poor acoustic insulation compared to the performance it would have if there had been prior planning. It will also imply economic losses, resulting in the discrediting of those responsible for the project's initial planning.

It is important to note that as of the year 2020, there was the impact of the pandemic (COVID-19), which became one of the largest global health crises in recent decades and affected the cost of inputs (ALBUQUERQUE; SALGUEIRO; CAVALCANTE, 2021). Given this, prices were updated based on the Basic Unit Cost (CUB), an indicator of the Brazilian construction sector calculated monthly by the Unions of the Civil Construction Industry throughout the country.

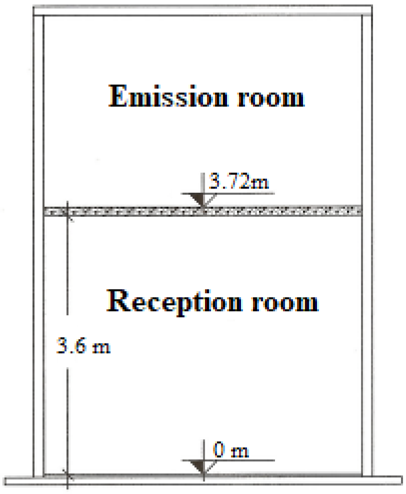
Thus, to help the designer to prepare projects with good acoustic performance for flooring systems that are also cost-effective, this paper aims to analyze the financial viability of flooring systems with different sound performances. The paper presents budget data with updated values (post-pandemic) to evaluate the financial viability of flooring systems with different materials, such as floating floors.

2. METHODOLOGY

The financial viability of horizontal sealing elements with sound transmission values was investigated to promote acoustic strategies in buildings. For this, the research was divided into three stages. The first step was compiling studies carried out in the same place to enable the comparison between the sound transmission values. The second step was to estimate the respective values for the horizontal sealing elements. The last step was to analyze financial viability, relating these values to the sound transmission values compiled.

Thus, three works carried out in 1999, 2007, and 2009 were compiled, in situ, at the Thermoacoustic Laboratory (LaTa) of the Federal University of Santa Maria. The laboratory was considered a field situation because the environments are connected to each other, causing acoustic connection (Figure 1).

Figure 1 - Schematic section of LaTa.



All laboratory tests performed in this work followed the standards determined by Brazilian standard NBR 15575-3 (ABNT, 2013). It should be noted that the first version of the Brazilian housing performance standard was published in 2013 (ABNT, 2013). However, the standards for determining the Standardized Weighted Impact Sound Level ($L'_{nT,w}$) values follow international standards that are also cited in NBR 15575-3 (ABNT, 2021). Thus, the methodology for conducting the tests for all the compiled studies was recommended by ISO 140 (1998) and ISO 717-2 (1996). ISO 140-7 "Acoustics - Measurement of sound insulation in buildings and of building elements - Part 7: Field measurements of impact sound insulation of floors" prescribes the procedures for performing impact noise measurements between two environments. ISO 712-2 "International Organization for Standardization - Acoustic - rating of sound insulation in building elements - Part 2: Impact sound insulation" describes the methodology for weighting floor systems into a single number. Table 1 presents the performance levels shown by NBR 15575-3 (ABNT, 2021) for sealing elements that separate autonomous and collective-use housing units.

Table 1 - Performance rating level for impact noise

Elements	$L'_{nT,w}$ (dB)	Performance Level
Floor system separating self-contained housing units located on different floors	66 to 80	Minimum
	56 to 65	Intermediary
	≤ 55	Superior
Floor system for areas of collective use in autonomous housing	51 to 55	Minimum
	46 to 50	Intermediary
	≤ 45	Superior

Source: (ABNT, 2021).

The second step was to estimate the values and situations as close as possible to the elements investigated in the bibliography, which were obtained using the *Orçafascio* software. The delimitation of the investigation context includes the supplier stores from the state of Rio Grande do Sul, which are not identified to preserve their privacy. Unit values were budgeted in 2017, and a correction was made based on the Jan 2023 CUB (published on Jan 2nd, 2023). For this, it was stipulated that the buildings were adopted as type R8-N (multi-family residential with regular finishing pattern).

The main database used in the research was the SINAPI-RS (National System of Research on Civil Construction Costs and Indices) since it is used for real estate financing by *Caixa Econômica Federal* (federal Brazilian bank), whose unit values are updated monthly. However, when the composition required to make the budget was not available, the composition was searched in other databases, such as ORSE (Sergipe Works Budget System), CPOS (Paulista Works and Services Company), FDE (Foundation for Educational Development), SBC (Stablin: Cost Systems and Consulting) and SETOP (Secretary of State for Transport and Public Works), since these databases have their consolidated use in the Brazilian public system. Thus, using a database with unit values from other states, all inputs were exchanged for SINAPI input values in the state of Rio Grande do Sul, since a predefined budget is necessary to have an average amount of inputs. After these steps, the financial viability of horizontal sealing elements was analyzed using Microsoft Excel software.

3. RESULTS AND DISCUSSIONS

This paper presents the compilation of the $L'_{nT,w}$ for several constructive compositions of horizontal sealing of standard pavements and their respective budgeting. It should be noted that the profitability of compiled systems was performed only in those situations where the exact boundary condition existed. Thus, the $L'_{nT,w}$ were collected from an investigation carried out by Pedroso (2007), Brondani (1999), and Neubauer (2009).

3.1 Compilation of $L'_{nT,w}$ values and performance level

Pedroso (2007) analyzed the difference in insulation in impact noise between slabs, using a 12 cm thick slab, on which a sample of 1.0 x 1.0 m, 4 cm thick, of mortar and porcelain coatings or melamine laminated timber was placed. The tests were carried out on a masonry structure of ceramic blocks built at the Federal University of Santa María, especially for this type of test, with a reception chamber of 4.36 x 3.31 m and 3.6 m high and a solid slab 12 cm thick. However, the fact that the structure is not standardized by ISO standards meant that the tests were considered field results. Thus, regarding the service of pavement systems that separate autonomous housing units, analyzed by NBR 15575-3 (ABNT, 2021), all the compositions from Pedroso (2007) presented minimum performance levels and did not meet the minimum requirements for area floor systems for collective use, when placed in residential areas (Table 2).

Table 2 -Horizontal sealing elements by Pedroso (2007).

Floors	$L'_{nT,w}$ (dB)	Floor system separating self-contained housing units located on different floors	Floor system for areas of collective use in autonomous housing
Solid slab 12 cm	78	Minimum	Does not attend
Solid slab 12 cm + mortar 4 cm + porcelain	73	Minimum	Does not attend
12 cm solid slab + 4 cm mortar + laminated timber	75	Minimum	Does not attend

Note: Does not attend Minimum

Source: the authors, based on Pedroso (2007).

Brondani (1999) analyzed and compared the compositions of different types of floating floors, using glass wool, and expanded polystyrene as resilient materials and ceramic and wood blocks as floor coverings on a 12 cm slab. The samples had dimensions of 1.0 x 1.0 m and were tested in the same place as Pedroso (2007). The author's results and respective performance levels are compiled in Table 3.

Table 3 - Horizontal sealing elements by Brondani (1999).

Floors	$L'_{nT,w}$ (dB)	Floor system separating self-contained housing units located on different floors	Floor system for areas of collective use in autonomous housing
12 cm solid slab + 4 cm mortar + ceramic floor	73	Minimum	Does not attend
Solid slab 12 cm + expanded polystyrene 25 mm + mortar 4 cm + ceramic floor	55	Superior	Minimal
Solid slab 12 cm + glass wool 15 mm + mortar 4 cm + ceramic floor	49	Superior	Intermediary
12 cm solid slab + 4 cm mortar + wooden blocks	69	Minimum	Does not attend

Note: Does not attend Minimum Intermediary Superior

Source: authors, based on Brondani (1999).

Neubauer (2009) also conducted tests on the composition of floating floors of a solid slab 12 cm thick, with a sample of 1.0 x 1.0 m of mortar and glass wool (e = 15 mm) and Ipê plank floor covering with bed mortar in the same place as Pedroso (2007) and Brondani (1999). In addition, the same author also analyzed the composition of a 12 cm thick solid slab with 4 cm laying mortar and wood block cladding and found a result similar to Brondani's (1999). Neubauer's (2009) results and the classification concerning flooring system service determined by NBR 15.575 (ABNT, 2021) are presented in Table 4.

Table 4 - Horizontal sealing elements by Neubauer (2009).

Floors	$L'_{nT,w}$ (dB)	Floor system separating self-contained housing units located on different floors	Floor system for areas of collective use in autonomous housing
12 cm solid slab + 4 cm mortar + wooden blocks	69	Minimum	Does not attend
Solid slab 12 cm + glass wool 15 mm + Ipê plank with laying mortar	50	Superior	Intermediary

Note: Does not attend Minimum Intermediary Superior

Source: the authors, based on Neubauer (2009).

3.2 Financial viability analysis of flooring systems

After budgeting the compiled flooring systems, the correction was made based on time about the CUB of September 2017 (R8-N = R$ 1,427.30/m²) for May 2022 (R8-N = R$ 2,347.60/m²). It was observed that there was an increase of 64.48% in time for the same construction standard that was applied and presented in Table 5, which was organized in ascending order of cost. It should be noted that the performance results are adequate for a specific context, which includes the places and dimensions studied, since the envelope can modify the acoustic performance of the environment, in which the dimensions and characteristics of the slab can interfere with its bending and acoustic behavior of the environment. Therefore, it is essential to bear in mind that the sound performance levels achieved, if applied in another environment with different conditions from those analyzed by the authors, the result will be different. Therefore, it may fall into another category of performance level. Thus, financial viability comparisons were made only for the same wrapping conditions.

Thus, the influence exerted by the type of floor chosen on the financial viability was verified. For the same solid slab system (e = 12 cm) with subfloor mortar (e = 4 cm), in which the floor covering varied between laminate ($L'_{nT,w}$ = 75 dB) and wood blocks ($L'_{nT,w}$ = 69 dB), there was an increase of R$ 24.60 in relation to the laminate floor, to increase the attenuation of impact noise by 6 dB (PEDROSO, 2007; BRONDANI, 1999; NEUBAUER, 2009). It is important to note that the type and shape of the wood can make the system more expensive, as was the case with the Ipê wooden plank floor compared to wooden sticks. Notably, these systems could be compared because they were carried out in the same environment where only the samples were changed and had the same dimension (1.0 x 1.0 m).

Table 5 – Cost and Performance of Flooring Systems .

Floors	Source	$L'_{nT,w}$ (dB)	Cost (per m²)
Solid slab of 12 cm	Pedroso (2007)	78	R$ 387.96
12 cm solid slab + 4 cm mortar + ceramic	Brondani (1999)	73	R$ 482.85
Solid slab 12 cm + expanded polystyrene 25 mm + mortar 4 cm + ceramic floor	Brondani (1999)	55	R$ 515.52
Solid slab 12 cm + glass wool 15 mm + mortar 4 cm + ceramic floor	Brondani (1999)	49	R$ 553.72
Solid slab 12 cm + mortar 4 cm + porcelain	Pedroso (2007)	73	R$ 554.97
12 cm solid slab + 4 cm mortar + laminated	Pedroso (2007)	75	R$ 566.74
12 cm solid slab + 4 cm mortar + wooden blocks	Brondani (1999); Neubauer (2009)	69	R$ 591.34
Solid slab 12 cm + glass wool 15 mm + Ipê plank with laying mortar	Neubauer (2009)	50	R$ 878.42

Note: Does not attend* (> 80 dB) Minimum* (66 to 80 dB) Intermediary* (56 to 65 dB) Superior (≤ 55 dB)*
*Floor system separating self-contained housing units located on different floors

The most expensive system was the solid slab (e = 12 cm) with glass wool (e = 15 mm) and Ipê plank, corresponding to R$ 878.42 per square meter. Whose system met the level superior performance to the corresponding part of the flooring system standard separating autonomous housing units and intermediate level for collective use area flooring systems. However, another system that was also classified in these performance levels was the solid slab (e = 12 cm) with glass wool (e = 15 mm), mortar subfloor (e = 4 cm), and ceramic floor covering, with a cost of R$ 553.72 per square meter, presenting a difference of R$ 324.70 in the cost of execution for the same level of performance (joint floor containing Ipê in the composition) (BRONDANI, 1999).

Table 5 shows that the most economical floating floor system with floor covering was the solid slab (e = 12 cm) with expanded polystyrene (e = 25 mm), subsoil mortar (e = 4 cm), and ceramic floor covering, whose composition cost R$ 482.85 per square meter and presented the highest level of performance to comply with the floor system standard, separating autonomous and minimum housing units and for use areas located in residential units (BRONDANI, 1999). This composition is a good profitable option for the level of performance classified for the tested environment and the standardized weighted impact sound level achieved since, when compared with the same composition without a floating floor, it reached the minimum performance level for floor systems that separate autonomous housing units and did not meet the criteria of areas of collective use that are located in residential premises.

Therefore, comparing the cost between systems with and without a floating floor, floating floor systems have a higher execution cost because of the need for a subfloor with mechanical protection, resilient materials, and skilled labor for execution. However, this system presented better performance, with a possible increase in the classification. An example of this is the study by Brondani (1999), which analyzes the influence of the application of 15 mm of glass wool on the solid slab of 12 cm + mortar 4 cm + ceramic floor, which presents $L'_{nT,w}$ = 73 dB and, after applying glass wool and a specific subsoil for floating floors (with metal screen), obtained an improvement of 24 dB, with an increase of only R$ 70.87 per square meter.

3.3 Cost analysis of other flooring systems

Nunes, Zini and Pagnussat (2014) analyzed pavement systems with different types of slabs and coatings. Considering that the authors worked with materials and construction technologies widely used in civil construction, such as ribbed slabs, and applied different technologies (light gravel) to those analyzed in the financial viability analysis, it was decided to highlight the data shown in Table 6. Therefore, compositions that comply with NBR 15.575 (ABNT, 2021) were chosen.

For these four systems, construction costs were calculated using the same methodology described in item 2 to obtain data for constructions with different methods and materials. Thus, Table 7 presents the results obtained. Still, the financial viability analysis was not performed since the sound transmission data could not be directly compared due to divergencies at the study site.

Table 6 - Horizontal sealing elements by Nunes, Zini and Pagnussat (2014).

Floors	$L'_{nT,w}$ (dB)	Floor system separating self-contained housing units located on different floors	Floor system for areas of collective use in autonomous housing
Solid slab 10 cm + mortar 5 cm + wood laminate 7 mm + expanded polyethylene blanket 2 mm	56	Intermediary	Does not attend
10 cm solid slab + 5 cm mortar + 7 mm wood laminate + 5 mm polypropylene fiber mat	54	Superior	Minimum
Solid slab 12 cm + light gravel mortar (1:2:3) 4 cm + 2 mm expanded polypropylene blanket + 7 mm wood laminate + 2 mm expanded polyethylene blanket	60	Intermediary	Does not attend
Ribbed slab with EPS (h = 27 cm) + light gravel mortar (1:1:4) 5 cm + common 2 cm mortar + 7 mm wood laminate + 2 mm expanded polyethylene blanket	50	Superior	Intermediary

Note: Does not attend Minimum Intermediary Superior

Table 7 - Cost of horizontal sealing elements by Nunes, Zini and Pagnussat (2014).

Floors	$L'_{nT,w}$ (dB)	System cost (per m²)
Ribbed slab with EPS (h = 27 cm) + light gravel mortar (1:1:4) 5 cm + common 2 cm mortar + 7 mm wood laminate + 2 mm expanded polyethylene blanket	50	R$ **525.56**
Solid slab 12 cm + light gravel mortar (1:2:3) 4 cm + 2 mm expanded polypropylene blanket + 7 mm wood laminate + 2 mm expanded polyethylene blanket	60	R$ **555.21**
Solid slab 10 cm + mortar 5 cm + wood laminate 7 mm + expanded polyethylene blanket 2 mm	56	R$ **558.57**
10 cm solid slab + 5 cm mortar + 7 mm wood laminate + 5 mm polypropylene fiber mat	54	R$ **570.47**

Note: Does not attend* (> 80 dB) Minimum* (66 to 80 dB) Intermediary* (56 to 65 dB) Superior (≤ 55 dB)*
*Floor system separating self-contained housing units located on different floors

Based on Table 7, it is verified that the ribbed slab system with EPS filling, expanded polyethylene blanket (e = 2mm), mortar subfloor containing light gravel (e = 5 cm), common mortar (e = 2 cm), and laminated wood floor (e = 7 mm), cost R$ 525.56 per square meter and met the superior performance level corresponding to the part of the floor system standard that separates the autonomous and intermediate housing units in terms of floor systems for areas of collective use in residential units. This example presents the efficiency of the floating floor system, which highlights that this performance was probably due to the existence of two vibration damping systems (subsoil with light gravel (EVA) and expanded polyethylene blanket), as Nunes, Zini and Pagnussat (2014) point out that flank transmission is one of the main limiting factors in terms of airborne noise isolation in ribbed slabs.

Corroborating, Brancher *et al.* (2016) also mentioned the effectiveness of incorporating EVA aggregates into concrete, as the cost is reduced, increasing the vacuum ratio of the system, decreasing the specific mass of the floor system, reducing the structural load and increasing the sound insulation between floors. Thus, analyzing the application of mortar with light gravel with an expanded polyethylene blanket (e = 2 mm) in a system of a solid slab of 12 cm, mortar flooring (e = 4 cm), and laminated coating, a cost reduction of R$ 11.53 was obtained compared to a floor system without a floating floor. Such a cost difference was because the cost of the 4 cm thick (1:2:3) light gravel mortar screed is cheaper than the conventional one used. Table 8 shows the budgeted values of the subfloors used in the budget compositions. The subfloors with EVA were the most economical, resulting in excellent financial viability.

It is observed that with the financial viability comparisons made, computational simulations of the acoustic performance of buildings must be performed since the acoustic performance of a system can change according to the absorption coefficient of materials, reverberation time, background noise, resilience of materials, their density, dimensions, among others. Therefore, the more complex the systems, the more difficult it is to apply a theoretical model and analysis of the propagation media, requiring knowledge of the differences between the materials used and the type of slab used (HOPKINS, 2004; GALBRUN, 2010).

Table 8 - Costs of used subfloors.

Subfloors	Cost (per m²)
Common mortar (e = 2 cm)	R$ 35.45
Mortar (e = 4 cm)	R$ 50.76
Mortar (e = 5 cm)	R$ 58.93
Mortar with metal mesh (e = 4 cm)	R$ 77.87
Mortar with metal mesh (e = 5 cm)	R$ 84.81
Mortar with light gravel (1:2:3) (e = 4 cm)	R$ 27.47
Mortar with light gravel (1:1:4) (e = 5 cm)	R$ 34.29

This analysis confirms the importance of implementing floating floor construction systems to achieve good acoustic performance in terms of the performance standard. Nunes and Patrício (2016) corroborate this, mentioning that the efficiency of floating floors can be supported by mass-spring-mass systems, in which the mass of the base of the system is related to the rigidity of the slab, the spring would be the application of an elastic material, which attenuates the vibrations caused by the impact and the mass of the upper part portrays the rigidity. In addition, others highlight the effectiveness of using resilient materials to improve impact noise insulation in floor systems (OLIVEIRA *et al.,* 2021; XAVIER; MELO; FERREIRA, 2020; PANOSSO; PAUL, 2020).

So, given the current Brazilian scenario, which often presents resistance to new construction technologies, the massive slab construction system widely used in the country can be maintained. Furthermore, the subfloor execution team can be trained to apply the floating floor system to look for a more effective construction method because when it comes to acoustic performance, there can be no acoustic connection in the floating floor system (HOPKINS, 2012).

4. FINAL CONSIDERATIONS

The Brazilian civil construction scenario has been increasing in technological development, although some construction companies persist in using old techniques. This situation is in the adaptation process since, given the regulatory requirements of acoustic actuation and the analyses carried out, traditional construction systems will probably need adaptations.

Given the results obtained and also the discomfort generated by impact noise in multi-story buildings due to the walking of users, falling objects, and the dragging of furniture, it is essential to attenuate these vibrations with the adoption of floating floors (for example), whose solutions must be planned and detailed even at the planning stage of the building, since subsequent corrections are less efficient and more expensive. In this work, a compilation of several studies that carried out acoustic insulation field tests were performed for different pavement systems used in the country. The comparisons served as an example since using field values to make design predictions is not recommended.

Exemplifying the effectiveness of the floating floor, the work showed a solid slab of 12 cm, without a floating floor, which met the minimum performance level when separating autonomous housing units, according to Brazilian Standard NBR 15575-3 (ABNT, 2021), which resulted in a cost of R$ 482.85 per square meter. This same slab, when receiving a floating floor (expanded polystyrene of 25 mm), studied by Brondani (1999), achieved superior performance in this classification, with an increase of only R$ 32.66 per square meter. It is observed that this cost becomes insignificant when it is diluted in a building of several units, considering the increase in the final sale value of an apartment with differentiated performance (minimum/major).

The importance of training the subfloor execution team to apply the floating floor system is highlighted to find a more effective construction method since, in the case of acoustic performance, there can be no acoustic connection in the floating floor system. In addition, the correct placement of the armor and the correct finish near the walls are essential. Thus, this comparative analysis incentivizes engineering companies, real estate, and users, demonstrating that applying an element with better acoustic performance will only sometimes significantly increase costs.

To carry out more in-depth studies on the theme, we intend to complement the compilation of data on sound insulation measurements to contemplate the most varied types of construction materials and building systems used in the country; to analyze the same horizontal sealing elements by estimating the beams and columns for a better comparison; for a model building, to do the structural calculations of the various types of existing slabs, to estimate them, and to carry out simulations in noise simulation software, analyzing which is the best cost and benefit for the case studies.

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