

Study on the New Sound Insulation Technology of 10 Mm Thick High Performance Sound Insulation Mortar Floor

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Abstract: The shortcomings can be found in several kinds of floor impact sound insulation structures of civil buildings. There are many theoretical studies on the sound insulation structure, but few on its practice. The engineering quality problems are prone to occur, and the gains outweigh the losses. Therefore, the sound insulation structure has not been widely implemented in the building. The raw material test and impact sound insulation performance test were carried out, and the construction quality was observed via the comparative study of the two states of the application of 10mm thick high-performance sound insulation mortar blank and the completion of decoration. The results show that the sound insulation structure has good effect on improving the impact sound insulation performance of floor, and has the characteristics of simple implementation, no impact on the floor height, and easy control of the engineering quality.

1. Introduction

In September 2019, The General Office of the State Council forwarded the Ministry of Housing and Urban-Rural Development's "Guiding Opinions on Improving the Quality Assurance System and Improving the Quality of Construction Projects", which required the development of elevation quality. For the construction industry, the green construction method was promoted and the implementation of green building was promoted. As people pay more and more attention to indoor acoustic environment quality, it is necessary to improve the acoustic insulation performance of floor impact sound in civil buildings in order to increase the people's sense of gain. On the one hand, many residential building schemes do not carry out elaborate design of floor impact sound insulation structure for the standard floor, or the construction unit cancellations the sound insulation structure in order to reduce the cost, so the problem of floor impact sound is difficult to isolate. On the other hand, the drawings 08J931 Sound Insulation and Sound Absorption Structure of Buildings and 15ZJ502 Sound Insulation and Sound Absorption Structure of Civil Buildings mention 30 mm thick sound insulation mortar, 5 mm thick sound insulation pad and 5 mm thick sound insulation paint, but less consideration is given to the actual situation of floor height of buildings in south China. Therefore, at present, the large-scale use conditions of the floor impact sound insulation structure are not mature. In recent years, a number of experts [1] [2] have studied the sound insulation performance of sound insulation floating floor slabs. Liu Peijie [3] compared the performance of solid wood floor, 20 mm thick XPS insulation board and acoustic insulation floating floor. Sun Fangting [4] compared the performance of 5 mm sound insulation pad, 30 mm thick sound insulation mortar, 30 mm thick composite foam cement board, 20 mm thick XPS insulation board and 5 mm thick sound insulation paint. Xu Shuwei [5] studied the performance of the construction method of 20 mm thick XPS insulation board +20 thick cement mortar (mixed with anti-crack fiber). The above mentioned several floor sound insulation structures have their own limitations, first of all, the comprehensive cost of construction is high, the owner's investment is

large;Secondly, the construction surface layer is thick, floor clearance can not be guaranteed;Once again, there are difficulties in widespread application of large area, and there are many quality problems in engineering construction. Through the study of the improvement of the impact sound insulation performance of 10 mm thick high-performance sound insulation mortar, and the large-scale application practice of several projects in Zhuhai in recent years, it is found that the sound insulation structure is highly applicable to green building projects in south China.

2. Floor Impact Sound Insulation Standard

(1) GB 50368-2005 “Residential Building Code” article 7. 1. 2 mandatory provisions require that the weight of the floor standardized impact sound pressure level ≤ 75 dB, structural measures should be taken to improve the impact sound insulation performance of the floor.

(2) GB 50118-2010 “Code for Sound Insulation Design of Civil Buildings” article 4. 2. 7, Article 4. 2. 8 of the floor weight measurement standard for residential buildings put forward the limit requirements for the floor weight measurement standard impact sound pressure level of bedroom, living room (hall) floor weight measurement standard impact sound pressure level (field measurement) ≤ 75 dB,High requirements of the bedroom, living room (hall) floor weighting standardization of the impact sound pressure level (field measurement) ≤ 65 dB. Gb50096-2011 “Code for Residential Design”, GB/T 50362-2005 “Technical Standard for Residential Performance Assessment”, GB 50378-2019 “Green Building Evaluation Standard” also have similar requirements.

3. The Implementation and Existing Problems of Floor Impact Sound Insulation

3.1 Sound Insulation Performance of Ordinary Floor

As a load-bearing component, the floor has a certain capacity of air sound insulation. The air sound insulation capacity of 120 mm thick reinforced concrete and decoration layer commonly used in residential buildings is 48~50 dB, plus other structural measures, which can basically meet the requirements of air sound insulation. The impact sound pressure levels of weighting standardization of 120 mm thick and 150 mm thick exposed solid reinforced concrete floor are 79~3 dB and 78~80 dB [2], respectively, which cannot meet the requirements of green building and ≤ 75 dB. The effect of increasing the thickness of the floor is not obvious, and the weight is also increased, so it is necessary to increase the sound insulation structure to improve the floor impact sound on the ordinary reinforced concrete floor.

In order to reduce the standardized pressure level of the impact sound of the reinforced concrete floor, it is necessary to carry out the structural design of the floor impact sound isolation measures in the way of vibration propagation, mainly through the surface layer, cushion layer and ceiling to isolate the impact sound.

3.2 Commonly Used Acoustic Insulation Floating Floor Structure

In south China, hot summer and warm winter, the ground insulation system is not required. The commonly used floor impact sound insulation structures are:

(1) 10 mm thick floor tile +30 mm thick sound insulation mortar structure, the impact sound insulation improvement of 16 dB [4], the compressive strength of sound insulation mortar ≥ 5.0 MPa, combustion performance A2, the drawback is that it will lead to the local elevation of the floor, affect the installation of the door, the floor height is also reduced.

(2) 10 mm thick floor tile +40 mm thick fine stone concrete protective layer +5 mm thick sound insulation cushion structure, the impact sound insulation improvement of 15~25 dB [4]. Sound insulation pad is divided into crosslinked polyethylene foam and rubber particles sound insulation pad, combustion performance B2, defect is 40 mm thick fine aggregate concrete is easy craze, after decorating floor tile is easy to empty drum, the general structure of sound insulation layer thickness

to 60 mm, floor constant load increase, building material, high cost and significantly lower floors clear height of the residence.

(3) 10 mm thick floor tile +40 mm thick fine stone concrete protective layer +5 mm thick sound insulation coating structure, the impact sound insulation improvement of 12 dB [4]. Sound insulation coating is made of acrylic acid, damping filler as the main components of the product, combustion performance B2. The shortcoming is the same as sound insulation pad, which is not studied and applied much at present.

3.3 There Are Some Problems in the Common Acoustic Insulation Floating Floor

(1) At present, there are more theoretical studies, less large-scale applications, more requirements in the design stage, not many real construction landing, real construction quality is not much, or do some model rooms to cope with.

(2) The research index is single, attaches importance to improving the performance of the impact sound insulation, but does not pay attention to the actual feasibility, durability and applicability, and does not study the comprehensive quality of the whole project and the quality of the whole life cycle of the floor impact sound insulation structure. As a result, there are some project weight standardization crash sound pressure level to meet the requirements, but there are many empty drum, cracking, fire prevention, environmental protection and other common quality problems.

(3) Many design units did not consider the thickness influence of the sound insulation structure of the floor impact, and did not reduce the elevation of the base floor locally.

(4) The specification only gives the pressure level requirement of the impact sound of the weight measurement standardization, but does not put forward the acceptance standard of construction quality, and the construction quality is not up to.

3.4 Mm Thick High-Performance Sound Insulation Mortar Sound Insulation New Technology

3.5 Material Performance

10 mm sound insulation mortar is a mortar prepared in accordance with a certain mix ratio on site. The material composition is cement, sand, sound insulation particles, special adhesive for sound insulation mortar, and other admixtures. Sound insulation particles are new materials, and guangdong Provincial Construction Engineering Quality and Safety Supervision General Station is entrusted to test the content of harmful substances in building materials, which does not exceed the standard requirements. The report number is E2019 (49) 008245440400441, and the results are shown in Table 1. It meets the requirements of green building materials products.

Table 1 Test Results Of Harmful Substances in Building Materials

Test item Standard	Technical requirement	Test result
Benzene /(g/kg)	<0. 02 g/kg	not detected
Toluene + xylene /(g/kg)	<0. 02 g/kg	not detected
Free toluene diisocyanate / (g/kg)	<0. 1 g/kg	not detected
Soluble lead / (mg/kg)	--	1
Soluble cadmium / (mg/kg)	--	1
Soluble chromium / (mg/kg)	--	1
Soluble tribute / (mg/kg)	<0. 1 mg/kg	not detected

3.6 Construction Practice

The construction method includes two kinds: one is the sound insulation structure in the blank state. The 10 mm thick high-performance sound insulation mortar is directly laid on the reinforced concrete floor. The construction method is simple and clear, see Figure 1 (a);The other is the completion of the decoration of sound insulation structure, in the sound insulation mortar brush cement oil and tile surface layer see Figure 1 (b).

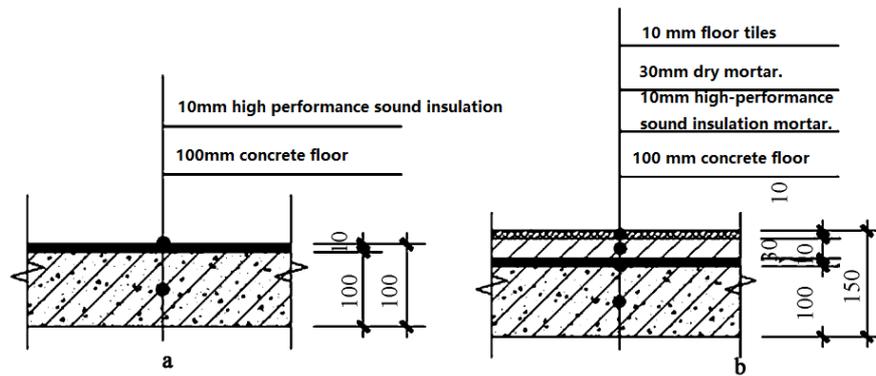


Fig.1 Two Construction Methods of 10 Mm Thick High-Performance Sound Insulation Mortar

3.7 Advantages

(1) Good sound insulation effect. More than 10 projects in Zhuhai city have adopted the new technology of panel impact sound insulation to construct the floor with 10 mm thick high-performance sound insulation mortar and put it into use. The evaluation value of floor impact sound single value is 59~64 dB, and the finished decoration is 73 dB.

(2) Floor height is not affected. It does not affect the installation elevation of the door. Compared with the three floating floor slab methods in the map, it can increase the floor net height by 40~50 mm, reduce the floor constant load by 1.0~1.25 KN/m², and reduce the cost. The construction unit and the owner can accept it.

(3) Material safety and durability. The combustion performance is A2, which is better than sound insulation pad, and meets the requirements of relevant fire codes. According to the results in Table 1, the content of harmful substances in building materials is within the permitted range. The detection strength can be $\geq M7.5$, close to the strength of ordinary cement and lime mortar.

(4) Simple structure and easy implementation. The more floor impact sound insulation construction layers, the more complex the process, the more likely to be the construction quality problems, and even difficult to distinguish which problems emerge. The 10 mm thick high-performance sound insulation mortar has a single layer, simple construction process, easy to implement, and controllable quality of hollowing. The laid floor tile after make it rough surface can increase the bonding force of ground surface layer.

4. Conclusion

(1) In recent years, the green building in the design stage has been gradually transformed into the green building in the construction stage. The floor weight standardization of the impact sound pressure level limit is the strong bar of the green building. 10 mm thick high-performance sound insulation mortar technology has been used in more than 10 projects in Zhuhai, covering an area of about 500000 m². The evaluation value of floor impact sound single value can reach the blank state ≤ 64 dB, and the finished state of floor tile can reach ≤ 73 dB, meeting the specification requirements.

(2) The limit requirement of the impact sound pressure level for the standardization of floor weight measurement is proposed based on the actual use of ground layer in pavement. The above two engineering examples show that the difference between the two is 9-14 dB when there is no floor tile surface on the surface of 10 mm thick sound insulation mortar. When the blank of a few engineering projects needs to be tested on the surface of sound insulation mortar for acceptance, the designer proposes a reasonable limit of the standard impact sound pressure level of the blank state meter. In order to ensure that the sound insulation performance after decoration meets the standard requirements, the design margin shall be no less than 12 dB.

(3) Compared with other sound insulation technology, it has the advantages of simple implementation, no impact on floor net height, saving building materials, reducing self-weight, reducing cost, reducing engineering quality complaints, etc.

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