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EXAMINATION OF NOISE INSULATION OF BUILDINGS ON THE EXAMPLE OF RESIDENTIAL COMPLEXES IN ASTANA

АСТАНАДАҒЫ ТҰРҒЫН ҮЙ КЕШЕНДЕРІНІҢ МЫСАЛЫНДА ҒИМАРАТТАРДЫ ШУ ОҚШАУЛАУ САРАПТАМАСЫ

ЭКСПЕРТИЗА ШУМОИЗОЛЯЦИИ ЗДАНИЙ НА ПРИМЕРЕ ЖИЛЫХ КОМПЛЕКСОВ В АСТАНЕ

Abstract. *The study investigates the effectiveness of noise insulation measures implemented in residential complexes within the urban context of Astana. Noise pollution is a pressing issue in urban environments, affecting residents' quality of life and well-being. This research examines the noise insulation strategies employed in selected residential complexes, analyzing their impact on reducing interior noise levels. The study employs various measurement methods and evaluates the acoustic performance of different building materials and designs used in the construction of these complexes. The findings of this research contribute to a better understanding of noise insulation practices in the context of urban development, providing insights for future architectural design and construction guidelines aimed at enhancing living conditions and minimizing noise-related disturbances.*

Keywords: *noise insulation, buildings, residential complexes, urban environment, noise pollution, acoustic performance, interior noise levels, building materials, architectural design, construction guidelines, urban development, quality of life, well-being, measurement methods*

Аңдатпа. *Көрсетілген зерттеуінде Астананың қалалық контекстінде тұрғын үй кешендерінде жүзеге асырылатын шу оқшаулау шараларының тиімділігі зерттеледі. Шудың ластануы тұрғындардың өмір сүру сапасы мен әл-ауқатына әсер ететін қалалық ортадағы өзекті мәселе болып табылады. Бұл зерттеу жеке тұрғын үй кешендерінде қолданылатын шуды оқшаулау стратегияларын қарастырады, олардың ішкі шу деңгейін төмендетуге әсерін талдайды. Зерттеу әртүрлі өлшеу әдістерін қолданады және осы кешендерді салуда қолданылатын әртүрлі құрылыс материалдары мен құрылымдарының акустикалық сипаттамаларын бағалайды. Бұл зерттеудің нәтижелері қала құрылысы контекстінде шуды оқшаулау әдістерін жақсырақ түсінуге ықпал етеді, өмір сүру жағдайларын жақсартуға және шуға байланысты кедергілерді азайтуға бағытталған болашақ архитектуралық дизайн және құрылыс нұсқауларын түсінуді қамтамасыз етеді.*

Түйін сөздер: *шуды оқшаулау, ғимараттар, тұрғын үй кешендері, қалалық орта, шудың ластануы, акустикалық өнімділік, ішкі шу деңгейлері, құрылыс материалдары, Сәулеттік дизайн,*

Құрылыс бойынша ұсыныстар, қала құрылысы, өмір сапасы, әл-ауқат, өлшеу әдістері.

Аннотация. *В данном исследовании рассматривается эффективность мер по шумоизоляции, реализуемых в жилых комплексах в городском контексте Астаны. Шумовое загрязнение является насущной проблемой в городской среде, влияющей на качество жизни и благополучие жителей. В этом исследовании рассматриваются стратегии шумоизоляции, применяемые в отдельных жилых комплексах, анализируется их влияние на снижение уровня шума внутри помещений. В исследовании используются различные методы измерений и оценивается акустические характеристики различных строительных материалов и конструкций, используемых при строительстве этих комплексов. Результаты этого исследования способствуют лучшему пониманию методов шумоизоляции в контексте городского развития, обеспечивая понимание будущих рекомендаций по архитектурному проектированию и строительству, направленных на улучшение условий жизни и минимизацию помех, связанных с шумом.*

Ключевые слова: *шумоизоляция, здания, жилые комплексы, городская среда, шумовое загрязнение, акустические характеристики, уровни внутреннего шума, строительные материалы, архитектурный дизайн, рекомендации по строительству, городское развитие, качество жизни, благополучие, методы измерения.*

Introduction. Noise is one of the most common factors affecting the quality of life in urban environments. This is especially true for residential complexes, where residents strive for a comfortable and quiet living.

Noise insulation is one of the key aspects of ensuring comfort and well-being in residential buildings. In cities such as Astana, where noise environment is a serious problem, effective noise insulation is becoming an integral part of the lives of city dwellers. Disturbance of the acoustic environment can lead to increased stress levels, reduced sleep quality, concentration problems and poor general well-being.

In this paper we focus on a survey on noise insulation of residential complexes in Astana. We will present a literature review based on studies in the Scopus database to present the essence and significance of noise insulation in residential environments. In addition, we will review various design solutions that are used to achieve effective noise insulation, such as soundproofing materials and floating floors.

We will also present the materials and methods used in noise insulation surveys and refer to regulatory documents, including the RoK SP, to familiarise ourselves with the requirements for such surveys. We used a noise meter in accordance with the RoK SP to measure noise levels at various locations in residential complexes in Astana.

As a result of the survey, we received photographs that demonstrate the state of noise insulation in residential premises, as well as noise level measurements that allowed us to draw conclusions about the quality of noise insulation in the surveyed buildings. Based on the results obtained, we formulated recommendations that will help to improve the effectiveness of noise insulation in residential complexes. In conclusion, we emphasise the importance of using soundproofing materials and proper insulation of engineering systems to ensure a quiet and comfortable residential environment in Astana.

The role of noise insulation in residential complexes. Noise is an undesirable factor that has a negative impact on the health and well-being of people. Residential complexes in Astana, being located in an urban environment, face various noise sources such as roads, transport, construction works and others. Poor noise insulation can lead to noise penetration into residential premises, creating discomfort and disturbing the sleep and rest of residents.

Noise insulation is a complex of technical and architectural measures aimed at reducing the level of noise inside the premises. It is based on the use of special materials and design solutions that are able to absorb, reflect or isolate sound waves.

According to the study "The impact of noise on the life of urban population" conducted by

researchers of the Kazakh National University [2], the negative impact of noise on human health in the urban environment cannot be underestimated. Assessing the quality of noise insulation in residential areas becomes an important step towards creating a more favorable urban environment.

Research in the Scopus database provides valuable information on various aspects of building noise insulation. Let us review some of the results obtained:

Soundproofing materials: The use of special materials such as Acoustic Pro is of significant importance in the field of noise insulation. These materials have a high sound insulation capacity and can be used for walls, ceilings and floors. They are able to reduce noise energy and prevent sound penetration through structures.

Floating floors: Floating floors are one of the most effective design solutions for improving noise insulation. They create an air gap between the main floor and the floor covering, which helps to reduce the transmission of noise vibrations between floors. Floating floors are widely used in residential complexes and can significantly reduce noise levels in the premises.

Sealing materials: Special attention is paid to the sealing materials used to isolate joints and gaps in the building structure. These materials help to prevent sound penetration through joints and create a continuous barrier to noise.

The authors of the study "Sound insulation and its role in creating a comfortable environment in urban construction" [5] emphasize that the quality of sound insulation directly affects the quality of life of residents, and can also affect the solution of the problem of ensuring the health and well-being of citizens.

Additionally, literature studies also indicate the importance of proper design and placement of building systems and equipment to reduce noise and vibration. This includes the use of soundproofing materials for ventilation ducts, pipework and electrical wiring.

The following materials and methods were used to conduct a survey on noise insulation of buildings on the example of residential complexes in Astana.

Materials and methods. A professional noise meter was used as part of the study. A noise meter is an indispensable tool for measuring sound noise levels indoors and outdoors. It provides accurate and objective data necessary to assess the effectiveness of noise insulation.

Figure 1. The "noise meter" tool

To obtain noise level data, the noise meter was placed in different areas of the residential complexes such as flats, corridors, lift halls and public areas. Measurements were taken in different modes, including daytime and nighttime hours, to capture the different conditions and activities of the residents.

To carry out the survey, the relevant standards and regulations that govern noise insulation surveys were studied. In particular, GOSTs and SPs were used with regard to noise insulation of buildings and premises.

The survey was conducted in accordance with the methodology established in the SP RK. As part of the methodology, a noise meter was installed at various locations in the Astana residential complexes to measure indoor and outdoor noise levels. The measurements were carried out at different times of the day and under different environmental conditions.

During the survey, photographs were taken to show the state of noise insulation in the residential complexes. These photos demonstrate the use of soundproofing materials, design solutions and the level of noise insulation in the premises.

All measurements made and data collected were analysed and evaluated using statistical methods and compared to the regulatory requirements for noise insulation.

Thus, the use of professional equipment, regulatory documents and survey methodology allowed us to obtain objective data on the state of noise insulation in residential complexes in Astana and assess the effectiveness of the applied design solutions.

To increase the sound insulation of double walls and partitions, the following constructive measures are recommended:

– increasing the thickness of the gap between the elements of the double structure;

– elimination of rigid connection between the elements of the double structure, as well as with structures adjacent to walls and partitions [13].

Noise insulation survey. A noise insulation survey is an important step in determining the current noise levels in residential developments and identifying problem areas. It is a process that involves measuring sound levels inside and outside the building, analysing and evaluating the data, and making recommendations to improve noise insulation.

Benefits of a noise insulation survey

Improved quality of life: The results of the survey help to identify problem areas where noise penetrates into living spaces. Based on this data, an action plan can be developed to improve noise insulation, resulting in improved comfort and quality of life for residents.

Health Protection: Chronic noise can have a negative impact on people's health, causing stress, sleep disturbance, concentration problems and an increased risk of cardiovascular disease. A noise control survey helps identify and eliminate noise sources, which helps maintain the health and well-being of occupants.

Compliance with norms and standards: Noise insulation surveys help to ensure that residential developments comply with established noise insulation norms and standards. This is important to protect the interests of residents and ensure a safe and comfortable living environment.

Environmental sustainability: Improving the noise insulation of residential complexes contributes to the reduction of energy consumption and emissions, as it reduces the use of heating and air conditioning systems, which is an important aspect within the framework of environmental sustainability.

Results. The analysis of the data made it possible to identify areas of increased noise inside residential premises and identify factors affecting the quality of noise insulation. The study "Urban Environment and the life of the population", published in the journal "Architectural

Research" [6], emphasizes the importance of introducing modern technologies and materials to improve noise insulation in residential complexes.During the survey on noise insulation of buildings on the example of residential complexes of Astana city the following results were obtained:

Noise measurements inside flats and public areas have shown that in some cases there is noise intrusion from the outside environment. This may be caused by insufficient noise insulation of walls, windows and doors. However, some residential complexes have achieved good noise insulation results, which provides comfortable conditions for residents.

Before conducting the survey with a noise meter, measurement work was carried out to determine the geometric characteristics of the surveyed enclosing structures. The figures below show the photofixation of the structure during the measurement work.

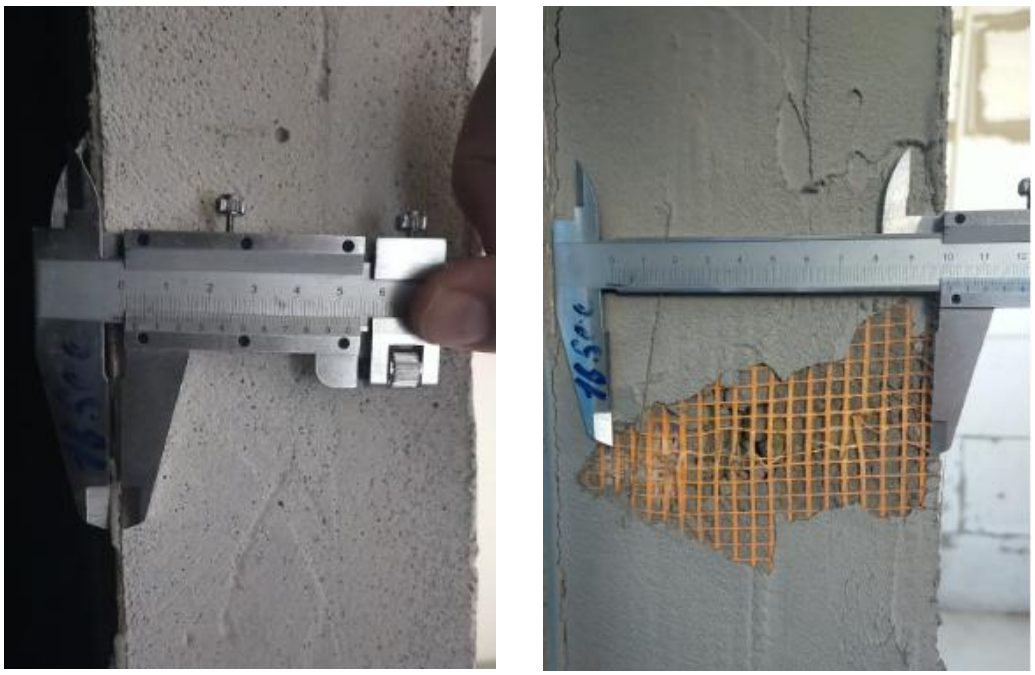

Figure 2. Photofixation of the structure during measurement work

Measurements of external noise levels have shown that there are significant levels of noise from road traffic, construction works and other sources in the residential complexes in Astana. This indicates the need for more effective noise insulation of façades and windows to reduce the impact of external noise on residential areas.

Comparison of the results obtained with the requirements established in the relevant GOSTs and SPs made it possible to assess the degree of compliance of the residential complexes with noise insulation standards. In some cases, non-compliance was identified, which indicates the need to improve noise insulation in these complexes.

The photographs taken during the survey are a visual confirmation of the state of noise insulation in the residential complexes. They show the use of soundproofing materials, the quality of installation and potential areas for improvement.

The average noise level is measured in decibels (dB) and has been used to determine noise compliance with regulatory requirements and for comparison with other sources. On average for

residential and public buildings, daytime noise levels should not exceed 50 decibels (dBA) and nighttime noise levels should not exceed 30 dBA. However, these values can be adjusted depending on the type of residential building, its location, the presence of external noise sources and other factors. Taking into account the indicators above, it can be said that the level of noise insulation in the apartments of Astana is not sufficient and requires a number of measures to ensure more comfortable living conditions for residents, such as: the use of better quality materials for sound insulation, installation of double windows and acoustic works in houses and apartments.

Figure 3. Conducting a survey with a noise meter

Conclusion. Noise insulation survey of buildings is an important step to ensure the comfort and quality of life of residents of residential complexes in Astana. It allows to identify noise sources, develop an action plan and improve the noise insulation of buildings, which contributes to the creation of a calm and pleasant living environment. The survey results help to comply with norms and standards, protect the health of residents and implement environmentally sustainable solutions in the urban environment.

On the basis of the conducted survey on noise insulation of buildings on the example of residential complexes of Astana city, the following conclusions can be made:

Noise insulation is an important aspect of the design and construction of residential complexes. It is aimed at creating comfortable living conditions for residents, protecting them from external noise and preventing the transfer of sound between rooms.

The use of soundproofing materials such as Acoustic Pro and structural solutions including floating floors and sealing materials help to reduce noise levels within the building.

The regulatory requirements set out in GOSTs and SPs serve as a guideline for designing and assessing the effectiveness of noise insulation. It is important to strictly comply with these requirements to ensure a high level of noise insulation in residential complexes.

The survey results showed that there are some deficiencies in the noise insulation of some residential complexes in Astana. This may include insufficient wall thickness, loose joints of

structures and lack of effective insulation of engineering systems.

Based on the above, recommendations to improve noise insulation in residential complexes in Astana include:

Improved structural solutions, including the use of more sound-insulating materials in the construction of walls, ceilings and floors.

Careful insulation of joints and connections to prevent sound from penetrating through them.

Placement of engineering systems and equipment using soundproofing materials to reduce noise vibrations.

Carrying out regular noise insulation audits and surveys in residential developments to maintain and ensure compliance with regulatory requirements.

The use of these recommendations will help to create comfortable and safe living conditions for residents of residential complexes in Astana, reduce the level of external and internal noise and improve the quality of life.

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