REHABILITATION OF COLLECTIVE HOUSING ENSEMBLES MADE OF LARGE PRECAST CONCRETE PANELS - GENERAL ASPECTS

Ioan Iulian VAGNER[1], *Adrian Constantin DIACONU*[2], *Lucian COZMA*[3]
[1] PhD Student, Teaching Assistant, Architect, Faculty of Architecture, Iassy, e-mail: iulianvagner@yahoo.fr
[2] Senior Researcher 2nd deg., PhD, Eng., INCD URBAN-INCERC, Iassy Branch, e-mail: acdiaconu@yahoo.com
[3] PhD Student, Teaching Assistant, Architect, Faculty of Architecture, Iassy

ABSTRACT

Reconsidering the attitude towards safe and energy efficient buildings makes that the forefront of a rehabilitation process be the ensuring a healthy environment, a certain quality of the indoor environment and as well as ensuring the safety of the inhabitants. The indoor environmental quality, a determining factor regarding the health and welfare of occupants of a building, is determined by the air composition (in reference to chemical pollutants, physical, biological or other nature) and by the comfort (with the main components, acoustic, thermal and visual).

Keywords: rehabilitation; collective housing assemblies; great panels; quality; environment.

REZUMAT

Reconsiderarea atitudinii față de clădiri sigure și eficiente energetic face ca înaintea unui proces de reabilitare să fie asigurarea un mediu sănătos, o anumită calitate a mediului interior precum și asigurarea securității locatarilor. Calitatea mediului interior, un factor determinant în ceea ce privește sănătatea și bunăstarea ocupanților unei clădiri, este determinată de compoziția aerului (cu referire la poluanți chimici, de natura fizică, biologică sau altele) și de confort (având componente principale acustica, elementele termice şi vizuale).

Cuvinte cheie: reabilitare; ansambluri de locuinte colective; panouri mari; calitate; mediu.

1. INTRODUCTION

The rehabilitation of the large collective housing ensembles, raised around 1950 and characterized today by a high level of physical and ethical wear and tear, has been the subject of interest for the Western society and not soon after 1990's represents a matter of interests for Eastern Europe itself. In a world where energy becomes a very delicate issue, interventions on existing buildings are enhanced by a special concern for its preservation, especially for creating as much as possible the independence of the building in terms of energy consumption. Besides the usual aspects of rehabilitation (structural, aesthetical, hydrothermal so.) ensuring a healthy, pleasant and comfortable environment (depending as little as possible on outdoor conditions - meteorological and acoustical) becomes a requirement for the rehabilitation of the large collective housing ensembles, especially considering those made of precast panels.

2. PRINCIPLES AND REQUIREMENTS

The current requirements on this matter, specified also in legislation (The Housing Law – 114/1996, updated in 2001) are much more restrictive than those accepted in previous periods due to the occurred changes in the nature and complexity of the actions (external and internal) that are exerted on the buildings on one hand, and due to the evolution of user requirements, on the other hand.

Directly linked to energy consumption, satisfying these requirements is as important as satisfying those regarding safety and stability to mechanical actions, architectural and aesthetic image or environmental engaging.

In the 1960s sociologists initiated studies on people living in large residential collective housing ensembles, studies that were aimed at determining the housing manner, its quality, individual and collective behavioral changes. The results of these studies were analyzed, followed by a period of time, around 1970, in which the most various solutions have been implemented. The sociological studies highlighted a series of malfunctions that affect the comfort level and generate behavioral changes of the residents. Furthermore, these sociological studies notified deficiencies referring to undersized windows surfaces (misfit to normal use), room-areas lower than the legislation in force, sanitary, thermal, acoustic and visual discomfort items, lack of energy conservation, etc.

Focused on identifying key strategies and means to address energy issues and, more recent, environmental issues, within the generous concept of sustainable development, the researches demonstrated that through an interdisciplinary and multicriterial approach of the building's design, achieving architectural quality, pleasant, comfortable and healthy interior environment and low energy consumption is entirely possible. These attributes define an energy efficient building.

Under these circumstances, the complex process of the rehabilitation of large collective housing ensembles began to define its attitudes and priorities, in a different way than the interventions during 1970-1980. A comprehensive analysis of the relationship between energy consumption and indoor environmental quality in residential buildings has been carried out within the HOPE European Project. The HOPE Project (Health Optimization Protocol for Energy efficient Building) was conducted with 14 participants from 12 European countries between the years 2002 and 2005. More than 160 residential and administrative buildings were investigated, half of them being of relatively low energy consumption. The investigation consisted in a general survey, a discussion with the building manager, and a set of questionnaires distributed to occupants.

The results denied largely the hypothesis relating to direct proportional relation between energy consumption and indoor environmental quality, allowing the classification of buildings that formed the object of the investigations into 4 categories:

- buildings with high energy consumption and an adequate quality of indoor environment;
- buildings with high energy consumption and low indoor environmental quality;
- buildings with low energy consumption and poor quality of the indoor environment;
- buildings with low energy consumption and high indoor environmental quality.

Therefore, it was found that energy consumption depends not only on the inside temperature, on the rigors of the climate and on the ventilation rate, but, even in a greater measure, on architectural and constructive solutions and on operating mode. There have been recorded a high percentage of discontent in buildings where a large amount of energy for mechanical ventilation is consumed, but in which no attention is paid to humidity, occupancy rate or noise protection. And vice versa buildings with low energy consumption, naturally ventilated, present a healthy and comfortable indoor environment.

Figure 1. Chaotic thermal rehabilitation interventions carried out on a collective housing building made of large panels.

Reconsidering the attitude towards this new element makes that ensuring a healthy environment and a certain indoor environmental quality to be the forefront of any rehabilitation process. The indoor environmental quality, determining factor as regards the health and welfare of occupants of a building, is determined by the composition of the air (referring to chemical, physical, biological or otherwise pollutants) and comfort (with the main components, acoustic, thermal, visual). The most of the “pseudo” rehabilitation interventions conducted in recent years in Romania do nothing but emphasizing the degrading of comfort conditions without making any improvement of the current situation.

Air composition. Indoor sources of pollution

The building may present health risks for its inhabitants so far as it accommodates chemical or physical sources of pollution and/or ensures favorable conditions for the development of microorganisms.

The main polluting sources in buildings may generate chemical, physical and/or biological pollutants.

Synthetic chemical products are an integral part our surrounding environment. They can be found in food, water, air, being emitted by building materials, furniture, cleaning products, etc. The effects of chemical pollution on health are multiple and ranging from simple sensory perception to extremely serious effects that can affect the respiratory, the nervous system and the gastrointestinal tract.

The main pollutants physically present inside buildings are excessive humidity, radon, dust, fibers (especially asbestos), electric and magnetic fields, low and high frequency electromagnetic fields. The presence of these pollutants can cause various symptoms from respiratory dryness, memory loss and difficulty in concentration to cancerous disease.

The category of biological pollutants include germs, viruses, bacteria, pollen and odors developing in indoor air and coming from human beings, pets, dust mites, cockroaches, indoor plants, mold etc. They cause allergies and respiratory diseases, the most vulnerable being children and the elderly. The risks related to these pollutants are particularly higher as their concentration is higher.

Comfort

According to the type of the main information received from the environment, comfort generally involves thermal, visual and acoustic comfort. The perceived level of comfort (especially from the architectural and constructive point of view) involves a degree of subjectivity, but also it is the result of simultaneous action of objective, quantifiable, architectural, construction, psychological and exploitation factors. If the acoustic comfort is not directly related to energy, ensuring thermal and visual comfort throughout the entire year requires a specific value of energy consumption for heating, cooling and lighting.

Thermal comfort

”American Society of Heating Refrigerating and Air Conditioning Engineers” defines thermal comfort as “the thermal environment that ensures human with thermal satisfaction” (Vogt J.J., 1985) „Confort physiologique - Technique de l'ingénieur„ nr. 8/1985. This is done under an optimal ratio between thermal ambiance, air movement and humidity, all considered to be the main requests for achieving performance of thermal comfort.

Thermal comfort is achieved by:

- ensuring medium operative temperature as result of air temperature, surface delimiters, humidity and air movement speed in accordance with the activity and clothing of the inhabitants;
- limiting asymmetry of radiant temperature and temperature gradients to acceptable values;
- avoiding situations in which the inhabitants are in contact with surfaces too cold or too hot;
- avoiding air currents (speed limitation of air movement).

These demands are required to be satisfied under both winter and summer conditions.

Visual comfort

Visual comfort is achieved by providing appropriate lighting to activities, avoiding very pronounced contrasts, especially blindness. The used spectrum of light must be continuous and the color temperature adapted to lighting. Natural lighting is comfortable as far as its intensity can be controlled.

Acoustic comfort

Acoustic comfort can be ensured by avoiding embarrassing noise by acoustic insulation on impact on noise or air or reducing their intensity directly at source. The accepted noise level reaches norm values correlated with the nature of the work to be done in a certain space (intellectual activity, recreation, health care and so on). Reducing energy consumption is needed for a healthy and comfortable indoor environment and can be achieved by applying passive measures, associated to minimum energetic consumption, integrated into architectural concept and design of the building. For example, climate or mechanical ventilation installations, properly designed and operated, which could contribute to ensuring a healthy and comfortable living environment, fit in the category of active measures, whereas thermal protection and controlled ventilation are active measures.

Envelope insulation

Envelope insulation involves rational use in composition of a building's envelope, materials that prevent heat transfer inside and outside in winter, outdoor-indoor in summer.

Figure 2. Thermal rehabilitation of buildings – facade interventions

There are less known materials, with superior thermal properties, to be introduced into practice:

- insulating materials as thin layers associated with reflective foil, which are designed to reflect infrared radiation and thus to suppress radiation heat transfer;
- vacuum insulating materials obtained by venting a fibrous or cellular support packaged in a sealed sheet, with a silica gel among them that has special properties, being less conductive than air at normal pressure.

The efficiency of insulation requires continuity over the entire surface of the building's envelope. Any physical or geometrical discontinuity generates a thermal bridge characterized by more heat loss, condensation risk and discomfort.

Ventilation

The role of ventilation is complex, encompassing both in refreshing polluted indoor air through air evacuation and replacing it with fresh air, and in ensuring thermal and humidity comfort, especially in summer.

3. CONCLUSIONS

One of the basic concerns of architects and engineers in recent decades, besides the activity of building new structures, was related to maintaining optimal operating parameters for existing structures and for interventions of structural and architectural rehabilitation. This requires quite often extensive, complicated, often and very expensive interventions. The rehabilitation process (mostly from an architectural point of view) begins to grow in Romania, primarily because of a large process determined by the current legislation on the thermal rehabilitation of buildings and especially on collective housing.

In general, the interventions on engineering structures in order to maintain their functionality can be classified into the following types of work:

- rehabilitation works;
- consolidation works (works for increasing load-bearing capacity);
- works of improving general behavior at seismic action - measures for increasing the ductility and energy absorption capacity.

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