REHABILITATION AND MODERNIZATION OF BUILDINGS - CASE STUDY

Tudor Panfil TOADER[1], Anamaria Cătălina MIRCEA[2], Adrian LĂZĂRESCU[3], Brăduţ Alexandru IONESCU[4]

[1] Eng., S.C. DIMEX 2000 COMPANY S.R.L., Bistriţa-Năsăud, toader.tudor@yahoo.com
[2] PhD Std., NIRD URBAN-INCERC Cluj-Napoca Branch, anamaria.mircea@incerc-cluj.ro
[3] PhD Std., NIRD URBAN-INCERC Cluj-Napoca Branch, adrian.lazarescu@incerc-cluj.ro
[4] Eng., NIRD URBAN-INCERC Cluj-Napoca Branch, bradut.ionescu@incerc-cluj.ro

ABSTRACT

Over time, the building materials and the construction methods have evolved from simple to complex, from massive to slender. The study and development of rehabilitation and modernization methods for existent structures is a permanent concern of civil engineers and it is an activity which involves a team effort in order to preserve the specific characteristics of a certain building, but also to try and find new methods for modernizing the existing ones with respect to the efficiency and costs generated. The aim of this paper is to present the rehabilitation process of a building, the expertise and the analysis of the best options chosen for the modernization process.

Keywords: rehabilitation; rebuilding; structures

REZUMAT

De-a lungul timpului, materialele de construcții și metodele de construcție au evoluat de la simplu la complex, de la masiv la zvelt. Studiul și dezvoltarea metodelor de reabilitare și modernizare a structurilor existente este o preocupare permanentă a inginerilor civili și este o activitate care implică un efort de echipă pentru a păstra caracteristicile specifice unei anumite clădiri, dar și pentru a încerca să găsească noi metode pentru modernizarea celor existente în ceea ce privește eficiența și costurile generate. Scopul acestei lucrări este de a prezenta procesului de reabilitare a unei clădiri, expertiza și analiza celor mai bune opțiuni alese pentru procesul de modernizare.

Cuvinte cheie: reabilitare; reconstrucție; structuri

1. INTRODUCTION

Rehabilitation and modernization are two words that in recent times are used more and more. The meaning can be subject to confusion when these terms are associated with the most diverse criteria. It is useful in this sense to redefine with as much clarity as possible these processes. The aim of rehabilitation and modernization of buildings is to improve the level of safety and comfort, therefore ensuring the protection of material values (Budescu et al., 2003; Feilden, 2003). Rehabilitation is a process of repairing a system in a state with major deficiencies. This process is aimed to have an improvement both on the safety of the building but also to the aesthetical purposes. Rehabilitation is a social, economic, architectural and urban issue, not just a technical one.

From a technical point of view, the rehabilitation refers to the possibility of a building to be able again to be used in active state, in order to restore some of its functions which have been damaged during the exploitation process or for various reasons. The aims of the consolidation of a building, in the sense of the structural improvement of any part of the building, are very important in order to achieve increased structural capacity (Li et al., 2009). The purposes for the rehabilitation of a damaged building are to ensure the same level of function that the building had before the degradation (Cowan, 2005; Bratu, 2008).

Rehabilitation and modernization are a set of scientific procedures based on prior documentation, aiming both to the improvement in the building's aspect but also to stopping the destructive processes and the

suffered degradations, both of them based on the current needs for improved infrastructure (Grămescu and Barbu, 2008).

Structural rehabilitation and modernization can be accomplished only by considering numerous factors before starting these procedures (Budescu et al., 2001, 2003). Rehabilitation can be done by changing the function of the building, by partially modifying or replacing the construction and also by introducing adjacent construction elements which together with the old structure will form another structural system.

In order to start the rehabilitation process, a building assessment is needed, which consists of revealing the current state of the building, the analysis and the estimations of the condition of the materials used, establishing the intervention measures and designing them, the determination of the effectiveness of the chosen solutions and, finally, the implementation of the structural rehabilitation (Budescu et al., 2001, 2003; Li, 2009).

The aim of this paper is to present the rehabilitation process of a building and the analysis of the best options chosen for the modernization process.

2. CASE STUDY

The analyzed building is a complex of several smaller parts. The owner of the building wanted the rehabilitation and modernization of the existing areas and the transformation into an administrative building (DIMEX2000, 2018). The land on which the rehabilitation and modernization of the existing building is being made consists of an approximately rectangular plot, located in the center of Bistrița city. On the premises, there were a number of buildings in which a workshop for furniture production has once functioned. Because the buildings have not been maintained, they are in an advanced state of deterioration, some of them being in danger of collapsing and therefore being a threat to people working near them.

A case study was carried out on the building composed of five smaller parts, built in different stages, with details specific to the destination and the period in which they were erected.

In order to fully understand the process of rehabilitation and modernization, a description of the existing structures in terms of architecture and structural elements needs to be presented.

The building is a linear single-story structure, with a ceramic tile rooftop.

The perimeter walls and transversal walls were made of brick masonry filled with lime sand mortar, on simple concrete foundations prepared with unsorted aggregates. The foundation base depth was given by the geotechnical study. The perimeter walls were wooden frames. Each frame had three openings, two marginal and one, lower, central. Frame posts were made out of steel pipe. The floor above the ground floor consisted of wooden beams, arranged at spaces of 80…90 cm, in the middle.

The connection between the building parts was created through a connecting structure. Architecturally, these form a single building, consisting of a series of rooms and a longitudinal corridor. The supporting walls were made of brick masonry with a thickness of 49 centimeters. They were supported on plain concrete foundations with a width of 50 cm and a depth of 90 cm. The floor was made out of reinforced concrete over the longitudinal and transverse walls and is composed of transverse main beams (arranged transversely across the walls) and three longitudinal beams. These divided the openings of the main beams into four equal parts.

Fig. 1. Existing situation of the building

As a result of the preliminary observations and of the desire of the owner to change the destination of the building, a technical report of the building was made, that established that the interventions on the existing constructions are possible. Important technical approaches to ensure the resistance, stability and safety in use of the structural elements of the future modified building, were required. All the works related to the design of the new premises were carried out on the basis of a technical project, elaborated according to the findings and conclusions of the expert's report, which included solutions and details that led to well-designed structural assemblies, in terms of mechanical, static and dynamic actions – vertical and horizontal – applied to all the plans.

3. DISCUSSIONS

Due to the high level of degradation of the building and based on the technical report, a series of steps were proposed in order to achieve the change in destination of the building that will be a designated office space.

The parts of the building that presented an advanced stage of degradation were demolished (Fig. 2).

Fig. 2. Aspects from the demolition process

The new building will have two new spaces. For the future vertically-extended construction, a reinforced concrete frame structure will be adopted. The columns will be positioned according to the details of the technical plans elaborated in the rehabilitation project. They will be provided with custom foundations, designed and dimensioned according to the strength and stiffness requirements of the current design regulations. In order to add a level to one of the buildings, the old roof and wood frames will be demolished (Fig. 3) and new reinforced concrete beams will replace them.

Fig 3. Part of the building without the old roof

For the part of the building that was not demolished, the horizontal expansion will be realized from masonry bricks and concrete columns. The new openings created in the walls will be provided with reinforced concrete lintels.

The building will be thermally insulated with expanded polystyrene of 15 cm thickness. Pluvial waters will be captured in the gutters and will be led to the external sewerage system connected to the pipes. The wood material that will be put into different parts of the new buildings in order to protect the elements was fireproofed and treated with fungicidal and antiseptic substances (Figs. 4 and 5).

Fig. 4. Proposed new building

Fig. 5. Current stage of the rebuilding phase

4. CONCLUSIONS

As stated above, the purpose of the rehabilitation of a building refers to its return to the active state, or to change of the destination of the building by changing its functions. All the parameters that need to be taken into account have to be precisely analysed from all the consolidation, restoration, remodelling, intervention, demolition or rehabilitation points of view. In the rehabilitation process, steps that are being taken in order to design and implement the ideas should be the steps required to ensure the success of interventions. Only through a complex and coherent rehabilitation process, that integrates all the architectural, constructive, technical interventions and most important, the desired needs of the building's function, modernization could be achieved.

The aim of the present research was to present the rehabilitation process of a building and to present the best options chosen for the modernization process. It can be seen that rehabilitation is a very complex action, in which more procedures can happen at the same time and the case study presented in this paper shows exactly the same thing – in order to change the destination of a building, that is in a high level of degradation, the best solution was to demolish the parts of the building that were too damaged, expanding horizontally and keeping the old assembly for another part, and levelling up and modernizing another part of the building by using materials with better properties. This shows the versatility of the rehabilitation process and also the very diverse techniques that have to be put all together in order to achieve the desired request from the owners.

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