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A HOLISTIC APPROACH TO STRUCTURAL REHABILITATION
A STUDY OF THE METROPOLITAN CATHEDRAL SECTIONS C1 & C2 IN IAŞI, ROMANIA

BY

TUDOR-CRISTIAN PETRESCU*, MIHAI BUDESCU, PETRU MIHAI and IONUȚ-OVIDIU TOMA

”Gheorghe Asachi” Technical University of Iaşi,
Faculty of Civil Engineering and Building Services

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Abstract. Romania has a lot of buildings in serious need of structural rehabilitation, ranging from single-family dwellings and blocks of flats to historical buildings. After the earthquake of 1977, interventions in order to restore the structural bearing capacity of buildings have been few. Although by now some of the buildings (especially monuments) did undergo various rehabilitation procedures, very few of those actually take into account the so-called “holistic approach” to rehabilitation. Broadly, this implies that, as much as possible about the respective structure’s history should be known before a rehabilitation solution is selected by the designer. The results indicate that, when the holistic approach is employed, there is a significantly improved possibility for the selection (by the designer) of an appropriate rehabilitation solution. A case study and subsequent review of such an approach – used for the structural rehabilitation of Sections C1 & C2 of the Metropolitan Cathedral of Iasi – is included.

Keywords: rehabilitation; holistic approach; case study; solution; earthquake.

*Corresponding author: *e-mail:* tudor.petrescu@tuiasi.ro

1. Introduction

It is a well-known fact that, for anyone undertaking rehabilitation works, it is often not an easy task. For any civil engineer, be it junior or senior, often rehabilitation works present particular challenges. Actually, the definition of rehabilitation implies inherent complexities and uncertainties. For example, rehabilitation can be defined as the act or process of making possible a compatible use for a property through repair, alterations and additions while preserving those portions or features which convey its historical, cultural or architectural values (Nps.gov, 2018).

Furthermore, it is important to note that there are differences between rehabilitation, preservation, restoration and reconstruction. These are laid out as follows: Preservation places a high premium on the retention of all historic fabric through conservation, maintenance, and repair. It respects a building's continuum over time, and through successive occupancies, and the respectful changes and alterations that are made. Restoration focuses on the retention of materials from the most significant time in a property's history, while permitting the removal of materials from other periods. Reconstruction establishes limited opportunities to re-create a non-surviving site, landscape, building, structure, or object in all new materials (Coloradopreservation.org, 2018).

As such, it can be observed that rehabilitation may include some aspects of the above-mentioned processes, but in itself, it is none of them (Modi, 2016).

Taking into account the previous statements, in order to realize the successful rehabilitation of a structure, it is very desirable to find out as much as possible about the "past of the building". Although on any construction site there are a number of people which would be suited to investigate the "history" of a building, it is the structural engineer that should perform this activity, as this is the person in charge to carry out the rehabilitation solution. Contrary to popular opinion, the technical expert only provides the rehabilitation solution and is not supposed to "dig up" the "past" of the building.

The main issues regarding historical investigation of a building are that, firstly, there are no building standards that advocate or clearly stipulate this sort of activity and secondly, it is important to know what can and cannot be done in terms of rehabilitation, especially when dealing with a historical building.

2. The Holistic Approach Regarding the Rehabilitation of a Structure

The sum of all necessary activities to be carried out in order to find out as much as possible about the "history" of a building is called the holistic

approach. The holistic approach involves a detailed understanding of how the structure is built, the materials of which it is constructed, how it has been used, how it has performed over time, and all the factors that have affected its current condition.

Possible information about the "past" of a building may be gathered from several sources: Local Authorities and Administration (building documents, land-use plan etc.), Local Archives (relevant papers, historic documents etc.), neighbours, press archives, etc. Gathered information should then be taken into account when deciding upon a rehabilitation solution for the building.

3. Introduction to Case Study – Sections C1 & C2 of the Metropolitan Ensemble in Iaşi, Romania

The Metropolitan Ensemble of Iasi, Romania, is composed of The Metropolitan Cathedral, The Old Church and various other structures, serving mainly administrative purposes. Two such buildings are Sections C1 and C2, which have historical value and have been recently rehabilitated. Section C1 contains The "Iustin Moisescu" Hall and administrative offices. (http://ansam-blulmitropolitaniasi.ro/cladirea-administrativa/sala-iustin-moisescu). Section C2 is made up of "Dumitru Staniloae" Library, PR offices and some general purpose spaces (Ansamblulmitropolitaniasi.ro, 2018).

The historical significance of these two building – besides the fac that they are part of the Metropolitan Ensemble of Iaşi – is that they have been designed by the famous architect G.M. Cantacuzino; he also restored the Mogosoaia Palace and designed the Eforie Ensemble, Tetcani Churchi, I.A.R. hangar in Brasov, among others. (Arhitectura.tuiasi.ro, 2018) An interesting fact is that the two buildings are perfectly symmetrical with respect to each other; they were built between 1959 and 1986.

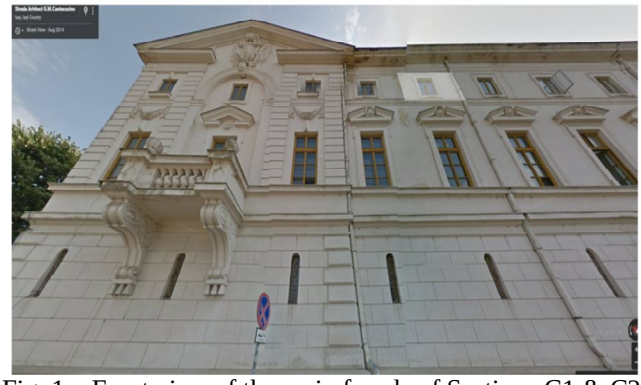

Fig. 1 – Front view of the main façade of Sections C1 & C2.

Fig. 2 – Side view of the main façade of Sections C1 & C2.

The case study aims to explain and clarify various aspects of the employment of the holistic approach when Sections C1 & C2 (Figs. 1 and 2) had to undergo rehabilitation. Following this, some recommendations will be put forward, based on the case study; in particular, when dealing with structures with historical value, they are important in order to carry out an efficient rehabilitation.

4. Case Study – Sections C1 & C2 of the Metropolitan Ensemble in Iaşi, Romania

Sections C1 & C2 of the Metropolitan Ensemble in Iasi underwent rehabilitation works as part of a project that encompassed the whole Ensemble, works being completed in 2015. Structural works included masonry injections in order to fill up existing cracks and the concrete jacketing of columns, plates and walls in concrete (Fig. 3), for the purpose of restoring the bearing capacity to current building standards. (Alexander, 2006; Pumarada-O'Neill *et al*., 1998).

Other non – structural works included the cleaning up and restoration of the facades. In particular, the non – structural works are the ones which have the biggest visual impact upon these buildings, so this type of restoration is usually painstaking and time-consuming.

Also of note is that the concrete jacketing of columns, plates and walls was done by concrete casting and pouring, rather than by shotcreting. (Branco & Guerreiro, 2011; Vidivelli, 2009).

The holistic approach was employed when searching for the most appropriate rehabilitation solution. As such, any supplementary information that would contribute to the successful completion of the project was searched for.

Fig. 3 – Concrete jacketing of columns, plates and walls.

Fig. 4 – "New" wall reinforcing, ready for formwork and casting.

So, regarding these buildings, data was obtained from: Local Authorities archives, Metropolitan Ensemble archives, neighbors and neighboring buildings. For example, as a consequence of this "pre - research", it was known the type of concrete and reinforcement used, back when the building

was constructed (later confirmed by some structural analyses and tests). (Woodson, 2009) Furthermore, the initial layout of the building was also found in the original building plans. Finally, there existed records about events and damage sustained during the building's history – such as cosmetic damage and light structural damage from the Vrancea 1977 earthquake.

All this information was gathered by the structural engineer. As it was subsequently proven, this had a major influence on selection the proper rehabilitation method. As previously stated, the concrete jacketing of columns, plates and walls in concrete was done in the "classic" way of using formwork and concrete pouring (Fig. 4) (Costa *et al*., 2014). This was deemed necessary, as the existing reinforcement was of OB37 type and also because extra adherence and strength was needed, which the shotcrete could only provide to a limited extent.

Fig. 5 – Reinforced column. Note the damage done to the paintwork.

However, there were a few negative points of view to this project, from a building rehabilitation point of view. Although the historically important parts of Sections C1 & C2 were restored to bring back their initial beauty and value, it can be argued that the rehabilitation solution itself "watered down" the historical aspect of these structures (Fig. 5). Furthermore, as there was also the desire for some (technical) upgrades (such as top – performance windows to minimize heat losses, modern installations, modern heating etc.), these can also be considered less – than – stellar approaches to the rehabilitation of these buildings (Figs. 6,...,9).

Fig. 6 – New electrical installations layout.

Fig. 7 – New brick wall.

Fig. 8 – Hole in the finished plate for lighting installations.

Fig. 9 – New electrical installations and window space.

6. Discussions, Conclusions and Recommendations

It is clear that the holistic approach is a very “healthy” way to tackle the task of building rehabilitation. This approach should be backed – up by a good knowledge of rehabilitation rules and procedures, so as to conserve the building or restore its historical value as much as possible.

Care should be taken in the rehabilitation procedures themselves. Sometimes they can negatively affect the perceived value of the building.

Finally, building standards should stipulate that it is the structural engineers' responsibility to employ a holistic approach to building rehabilitation, to ensure the best possible results are obtained. These stipulations could also include, for example, the obligation to consult the Local Archives for additional information.

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O ABORDARE HOLISTICĂ A REABILITĂRILOR STRUCTURALE
Studiu de caz privind corpurile C1 & C2 ale Catedralei Metropolitane din Iaşi, România

(Rezumat)

România deține multe clădiri ce au nevoie de reabilitări, acestea fiind de la locuințe unifamiliale și clădiri de apartamente, până la clădiri istorice. După cutremurul din 1977, au existat puține intervenții pentru a restabili capacitatea portantă a clădirilor.

Deşi până in prezent, câteva dintre clădiri (în special monumentele istorice) au trecut prin diverse proceduri de reabilitare, foarte puține dintre acestea țin cont de așa – numita "abordare holistică" a reabilitărilor. În general, aceasta implică faptul că ar trebui sa se cunoască cât mai multe date posibile despre istoricul unei structuri, înainte ca o soluție de reabilitare să fie selectată de către proiectant. Rezultatele arată că, atunci când abordarea holistică este folosită, există o posibilitate semnificativă de a se alege cea mai potrivită soluție pentru reabilitare. Un studiu de caz, precum şi observații vis–a–vis de o abordare de acest tip, utilizată în cazul reabilitării Corpurilor C1 & C2 ale Catedralei Metropolitane din Iaşi, sunt incluse.