

REZUMATUL tezei de doctorat

**Contribuții la aplicarea unor procedee eficiente de reabilitare structurală a clădirilor**  
(CONTRIBUTIONS TO THE APPLICATION OF EFFECTIVE STRUCTURAL REHABILITATION METHODS OF BUILDINGS)

*În domeniul de studii universitate de doctorat: INGINERIE CIVILĂ.*

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This thesis aims to study and find effective methods of structural rehabilitation buildings in terms of durability, stiffness and bearing capacity, thus providing a basis for further investigation.

Reinforced concrete structures and / or composite structures where the damage is limited need to be repaired / strengthened or demolished when the structural safety is greatly affected and the cost of rehabilitation is very high.

Strengthening of reinforced concrete structures / composites is to increase strength, stiffness and ductility. In cases of structures reinforced concrete frame the increase of stiffness and ductility is made by jacketing beams, columns and nodes. Jacketing is made with reinforced concrete, metal profiles, material carbon fiber reinforced polymers (CFRP), etc.

Achieving the objective of this thesis was done by running the following theoretical and experimental research programs:

- Systematization of a bibliography of current specialist technical literature;
- Proposing calculation relations for assessing the contribution of rehabilitation CFRP products for reinforced concrete composite structures frames with masonry infill;
- Analysis of consolidation sustainability index by applying a specific original model;
- Presenting some practical conclusions on the effect of masonry infill on concrete frameworks and the contribution of CFRP rehabilitation;
- Communication and publishing a number of papers in the proceedings of conferences and national and international journals.

The first phase of research shows an experimental program to determine the displacements of a reinforced concrete framework nodes, of a reinforced concrete frame with carbon fiber fabric loaded with a force evenly distributed on the ruler and loading horizontal knots applied sequentially from left to right and from right to left in increments its value increases from 0 to the maximum value of experimental. Maximum experimental value has been established of Eurocode EN 1998-1-2004.

If strengthening reinforced concrete frames filled with brickwork increasing shear strength, stiffness and ductility of the structure, in cases where the structure presents limited degradations, increasing shear strength, stiffness and ductility it is achieved by rehabilitating with fabric carbon fiber (CFRP) or by making a new masonry wall.

The experimental program determines the behavior of the structure made of reinforced concrete frames filled with masonry brick, hollow vertical bricks and then the same structure rehabilitated with carbon fiber fabric. The structure was loaded with a uniformly distributed vertical force and a horizontal force that was applied in two directions of the plane frame (left-right and then right to left) as in the case of reinforced concrete structure. As a result of experimental tests the nodes displacement were determined and the loads to which they were produced.

The tests were performed at the service limit state (SLS) to compare the results for the six structures tested. The ductility of the structure was determined by a charging-discharging cycle until the relative displacement level was reached. To measure the nodes displacements were used deflectometre accurate to 0.1 mm.

The thesis is developed in five chapters, each chapter is structured around key themes necessary for the completion of a theoretical and experimental study of the subject.

The first three chapters presents the purposes, subject of the thesis and a bibliographic study on frame structures with masonry infills. It details the composition, calculation methods, the behavior, the masonry infills effect and methods of rehabilitation for these structures.

Chapter four presents an original and highly topical study to determine the contribution of masonry infills and reinforcements on the behavior of reinforced concrete frames.

Chapter 1 entitled "*Introduction. The purpose and object of the thesis.*" summarizes the experimental program to determine the representative parameters for the undertaken study. The purpose and objectives of the thesis are clearly established and consist of studying and finding effective methods of rehabilitation of structures, thus providing a basis for further investigation.

Chapter 2 entitled "*Structures frame with infill panels*" presents the systematization of a extensive bibliography and technical specialist literature regarding the composition of structures in reinforced concrete frames, methods of their elastic and inelastic stage calculation. Also addressing problems concerning the design and constructive solution from the behavior of seismic actions to highlight the main requirements and principles of design in accordance with seismic prevailing effect infill panels masonry, types of frame-panel infill links and influence of the infills on the strength and stiffness.

Chapter 3 entitled "*Methods for rehabilitation of structures in frames with panels*" is modeled after the previous chapter, studying a number of national and international publications regarding a matter of great interest and importance, such as the rehabilitation of structures frames. Methods of consolidation are shown for the elements frame of reinforced concrete, including those that were used in the experimental part.

Chapter 4 is called "*Theoretical and experimental study on strengthening frameworks with masonry infills*" and the first part is devoted to a theoretical study on the contribution of CFRP in bearing capacity, judged by different rules (CEB Fib-Fip / 2001, ACI 440.2R -08, SR EN 1992-1) completed by a PhD student proposal for a formula to calculate the theoretical horizontal breaking force. The second part of

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the chapter deals extensively with the experimental program by employing the miniature very complex structures that otherwise is the only practical method for determining efforts. The experimental program examines six types of models: reference frame , reference frame strengthened, frame with coupled masonry made of bricks with vertical hollows, frame with coupled masonry of bricks with vertical hollows strengthened , frame with coupled masonry made of solid bricks and frame with coupled masonry made of solid bricks strengthened . Frameworks tested on the test bench of INCERC Timisoara were loaded with a vertical load uniformly distributed and a horizontal force applied sequentially by increasing the value. The measurements were performed with deflectometre and the dates were processed by the PhD, resulting force-displacement diagrams. Then experimental results were compared with the theoretical values, the conclusions drawn by PhD student being clear and concise.

In the final of the chapter the sustainability consolidation methods was appreciated, assessing the sustainability index is a thing of great interest and necessity for sustainable development.

Chapter 5 entitled "*Conclusions and personal contributions*" presents general data synthesis of the results obtained in the study and conduct experiments taking into account all the new knowledge introduced. Capitalization results and future research directions conclude this chapter.

The paper presents in the end the bibliographical sources used to development thesis, which consist in a significant number of national and international current works.

Dissemination of results was done by a number of five scientific papers published in national and international journals ISI Proceedings ISI or BDI.