

Safety of Containment of Facades in Urban Rehabilitation Works



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Abstract This research purpose concerns a major challenge facing civil construction today: to promote, safely, the rehabilitation of historic centers. This problem occurs due to several factors, either due to the difficulty of removing debris from a work in historic centers, or because one does not know what the balance of some constructive elements is. Also often in buildings of historical areas is mandatory to maintain the facades. Therefore, this procedure must be carried out very carefully, in order to avoid instability in the structure, which can lead to serious or fatal accidents, since these are high-risk tasks and preventive measures must be effective. A very effective alternative is the use of wooden beams to act as shoring of facades, exerting an opposition to the operant compressive forces.

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1 Introduction

1.1 *Population Flow*

Nowadays, around the big cities there is typically a housing complex where many people live, usually called dormitories. There was a movement of people from urban centers to the periphery [1]. It is therefore necessary, for the municipalities, to make a good management of the urban infrastructures and of the peripheries of the cities. It is essential to find out where there will be concentration of people and manage the issue of location and conditions of real estate, overcrowding, traffic and mobility of residents. It is the responsibility of the urban infrastructure planning of the municipalities and the outskirts of the populous cities to carry out previous studies in the region to organize and limit the supply of real estate in order to avoid that the region bear more people than it usually does [1].

In addition, an alternative that has proven to be effective enough to support the large population in urban areas is the rehabilitation of historical centers, enabling dwellings, previously uninhabitable (especially for safety reasons), to house people with the purpose of restoring the constructive systems and promoting good housing.

Rehabilitation, according to Rocha and Calejo [2], should be considered as an evaluation opportunity where the need is considered to perform a series of operations to make a building operational again according to current standards. It is, therefore, an act that encompasses all actions designed to ensure knowledge of the characteristics of the building and the study of the operational and constructive anomalies that affect it, including all decisions resulting from the objectives behind the act of rehabilitation. The rehabilitation of historic areas is of the utmost importance, either by giving a new life to a vacant building, or by reusing a space that was unused or uninhabited, or according to Rocha et al. [3], for the use of all resources available on a need to build more efficient and sustainable buildings, much to the scarcity of some of the resources, in an understanding of how the project author has today to design, build and maintain the work of architecture.

1.2 *Difficulties and Risks*

Urban environments have been expanding constantly. However in the last three years there has been a demand for housing in historic centers, which had been uninhabited for years and without any type of restoration. According to Salgueiro [4], the historical centers, besides being “the oldest parts of the city”, constitute a “succession of testimonies from various eras, a monument that brings us alive the past, gives us the temporal dimension with the sequence of facts that structure

identities". The need for restoration is observed to meet the needs of a growing population. In most cases, very old cities expose irregular plants that lead to a disorderly flow of goods and people in these areas, in addition to presenting eroded buildings with no protection. After a certain interval of time without dwelling, the constructions deteriorate. At the moment they are unsafe or unfit for use, it is necessary to restore them.

The process of the demolition for the subsequent restoration is not limited to throwing down walls in a disorderly way, throw everything down and transform the property into a field full of rubble. In this act, carried out by an engineer (planning the work), it is possible to check the structural elements of the building and some danger zones. In the possibility of fragile parcels, allowing the risk of collapse, the responsible professional must identify and determine the correct sequence for the demolition to take place, eliminating or minimizing the risks [5].

It is fundamental to carry out a survey of the work with special risks in order to program safety in construction. Rehabilitation works must be carried out by experienced laborers, specialized companies, and practiced by a qualified technician. The most common risks include: the uncontrolled demolition of all parts of the building, the fall in height of people and materials, noise pollution, the projection of dust and particles, damage to neighboring structures and arising from them.

It should be noted that it is recommended to carry out the Neighborhood Report, to avoid problems with the neighbors. Such a study ensures the state of conservation of the real estate around the worksite for damages during the demolition of the elements of the building that is intended to restore, determine responsibilities if it is necessary to make repairs or ask for compensation.

A building permit is required, both for construction and for demolition, where the building in question is located. The hiring of a demolition company is another relevant issue that must be taken into account. The company must provide the contractor with a complete and detailed description of the demolition process that will be carried out.

The clauses concerning the safety of workers must be present in the demolition plan. It should be borne in mind that, in a demolition work, the risk of accidents is greater than in a construction site, since the act of building is more common than the act of demolishing. According to Bowie et al. [6], research has shown increased levels of lead in environmental dust during the demolition of lead paint houses in Baltimore, Maryland, and increased dust on streets, alleys and sidewalks. During this study, community residents and organizations provided reports of other concerns about current demolition practices, including lack of prior notification and health education, and minimal efforts to control dust, rats, wastewater, and public access to sites.

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Thus, before the demolition processes, a detailed study of the structure to be dismantled and those in the vicinity should be carried out. In this sense, a Specific Safety Plan becomes an element of paramount importance, since it highlights each task to be carried out, ordering and the form of execution. Also, the aerial lines, cables and pipelines existing in the vicinity must be signaled and protected and, with fences, be bounded by the whole area surrounding the building to be demolished. Likewise, the appropriate location for the removal of the debris should be selected and ensure that all entrances to the public service such as water, electricity and gas have been properly closed and insulated. Otherwise, accidental damage to these conduits can compromise the supply of the entire neighborhood and generate an expense to the owner.

With regard to public protection, the standard is to isolate the zones conditioned to the movement of machines and equipment with sidings, nets. It is mandatory to place warning signs in the surrounding area of the building.

A Demolition Plan is essential to carry out this work, a complement to the Health and Safety Plan (PSS), whose main objective is to establish the procedures to be observed in demolition, assisting the actors and guiding the means involved, with a view to the application of prevention and safety measures, seeking to minimize and eliminate the observed risks.

The demolition process follows some essential steps, which are identified below. After removal of the roof and the slab of the treadmill, it is continued to demolish the last floor. When recovering massive bricks and some partitions, it is necessary to carry out the work manually. Then the walls are demolished, with the help of water in the presence of gypsum plaster, thus reducing the formation of dust, then the removal of balconies or other existing consoles short with the help of levers and picks. Then the removal and transport of the wood floor for reuse is started, with the removal of the wooden beams supporting the floor. This whole process is repeated on the remaining floors, from top to bottom until arriving at the ground floor, in the case of total demolition of the building, with the proper accompaniment and disassembly of part of the scaffold, the height of the floors already removed and always taking into account that the access stairs to the upper floors and the respective handrails should be the last elements to be demolished. After the work is completed, excavators are used to remove debris still in place for transport trucks to treatment or storage areas.

2 Study Case

2.1 Methodology

A study case was chosen to confront the safety problems associated with the demolition and rehabilitation of historic centres. It is a single-family dwelling located in the historical centre of Vila Real, more precisely at Rua da Misericórdia, nº 59, 5000–653 Vila Real. This housing was built on two floors and has been rehabilitated, since it was in an advanced state of degradation and with little safety,

hygiene and comfort. Works have been programmed to remove the partitions and to implant traditional masonry and dry wall inside the wet environments. Safety conditions surrounding the walls and neighbouring buildings, and the way wooden beams are anchored to these walls were implemented to ensure greater safety for the work to be done. According to Cristina et al. [7], during the shoring of the facades, there must be a special attention to the current state of the walls and, if necessary, carry out some repairs to prevent the collapse of the structure, when it's preceding the shoring of the facades, with disastrous consequences that may even be fatal. A shoring poorly built, has the potential to collapse part of the structure, making it vital that this kind of intervention have to be designed by structural engineers or other competent professionals.

Figure 1 shows the general appearance of the building, after demolishing the interior, by the manual demolition method.

In a preliminary phase and to allow the containment of the facade in a safe way, since the beams were in good condition and nailed to the facade, they remained until the end of the construction of the work, as it can be seen in Fig. 2.

Only after the containment of the building facade (Fig. 3) it is possible to work safely, so as to offer no additional risk to the workers. Then the concrete slabs were made using reinforced concrete. As the slabs were being executed, they increased the stability of the building, allowing the work to be carried out safely and without any kind of accident.



Fig. 1 General appearance of the interior of the building after demolition of its interior



Fig. 2 Containment of facades with two existing beams



Fig. 3 Metal beam and facade containment

3 Conclusion

According to Apolpia et al. [8] the term, urban regeneration, is synonymous of rehabilitation or urban renewal. Whatever the mode of expression, this term is based, therefore, on a set of action principles, aiming at the sustainable development of cities. The problem of urban growth can be tackled effectively through the rehabilitation of historic centers. The rehabilitation of historic centers allows new life to be given to the cities that are already dead, but in turn it is an added value for traffic control, as it will avoid the movement of vehicles from the surroundings to the urban center.

Based on the acquired knowledge obtained during the monitoring of the work, and with some practical examples observed in daily life and other research studies in this area, it can be concluded that the safety of workers should be assumed as a factor of great importance, since many accidents occur due to poor planning. The urban rehabilitation represents an added value for the control of traffic and welfare of societies, allowing a new life to cities already lifeless.

It should be noted, that in the buildings rehabilitation, one of the main concerns is the efficient shoring of the neighboring walls of the work and the facades. Previous studies and calculations [4] should be carried out in order to ensure the safety of the workers, the competitors and all those who are, directly or not, affected by the work.

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