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EATHQUAKE EVALUATION OF A HISTORICAL BUILDING IN SAN JUAN CITY – ARGENTINA

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SUMMARY

This research focuses on the seismic capacity of a historical building in San Juan city, in the Argentina's center western region. Firstly, it aims at determining if the building will be able to bear strong future earthquakes satisfactorily. Secondly, it supplies criteria for its preservation. An exhaustive analysis has been carried out, applying a method that compares its demand with its capacity.

INTRODUCTION

At the present, there exists a worldwide tendency to revalue cultural and historical heritage. Preserving this implies both, improving urban quality of life and protecting citizens' sense of belonging to a place that has been adapted to satisfy their needs.

In seismic and arid areas as San Juan province, in the Argentina's center western region, architectural heritage might be particularly damaged not only by climatic and human factors, but also by destructive earthquakes taking place in this area.

San Juan city, located in the country's most seismically active zone, was almost completely destroyed in 1944 by an earthquake of I_{MM} = IX (M=7.4; DH =14 km).

In spite of the widespread destruction some few public buildings remaining erect. They were built in the early 20th century, before that time there were not seismic-resistant regulations. Therefore, these buildings presented a good seismic performance during the subsequent earthquakes of 1952 (I_{MM} = VII), and 1977 (I_{MM} = VII ÷ VIII), though some of them suffered some moderate structural damage. The National Commission for Historical Sites and Monuments of Argentina declared several of these buildings to be part of the national heritage.

San Juan General Hospital "Dr. Guillermo Rawson" is one of the few well-preserved architectural constructions with a European style. This is the reason why it has been chosen as sample of a research project, supported by the National University of San Juan, to evaluate its seismic capacity and analyze its architectural design (1) (2).

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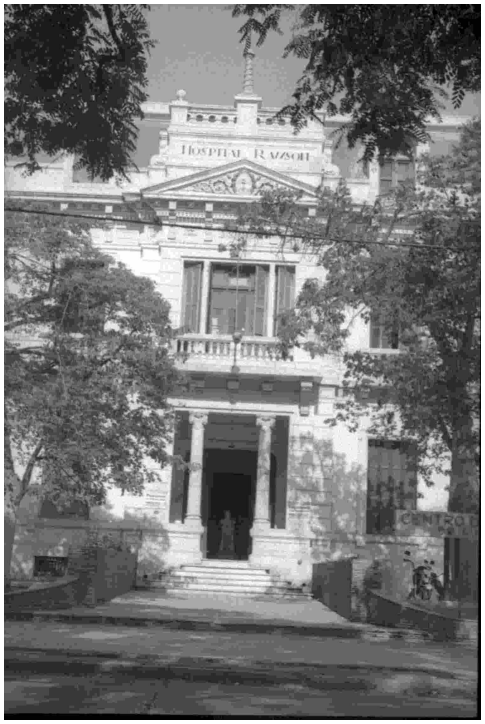
This three-storey masonry building was constructed with beams, columns and slabs of reinforced concrete, following suitable building techniques of the time (figs. Nº 1, 2, 3). Due to its cultural value, it is very important to preserve it. So the evaluation of its seismic capacity was carried out so as to assure a satisfactory behaviour during strong earthquakes in the future. Although the hospital has already resisted some destructive earthquakes, slight deterioration or lack of maintenance could undermine its seismic stability.

Main facade

fig Nº 1

Front view



Lateral front gallery

fig Nº 2

Ground floor

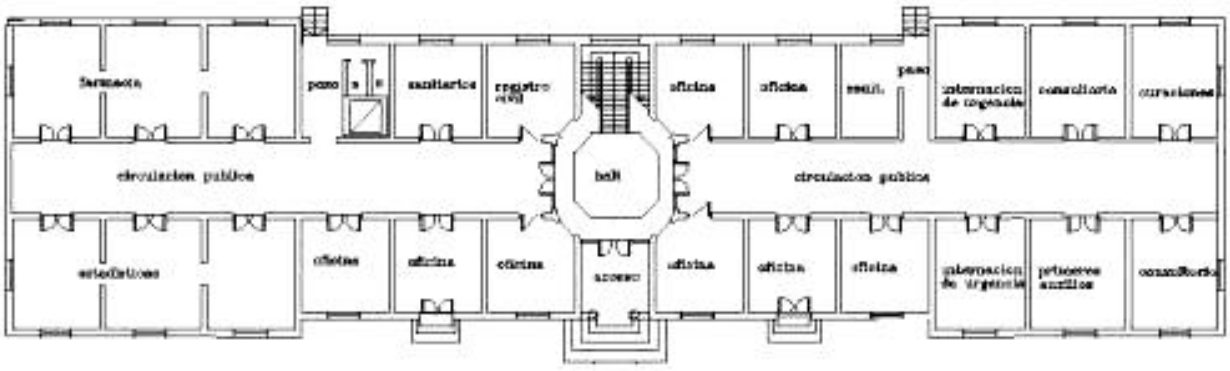


fig Nº 3

The seismic-resistant capacity of the building has been determined considering the relation between its potential seismic capacity and the assumed seismic risk.

QUALITATIVE SPECIFICATION OF GENERAL HOSPITAL DR. RAWSON

Historical Background.
This Hospital that dates of 1911, responds formally to the French architectural lines, being the design from its very similar plant to that of the Lariboisiere Hospital in Paris. It was inaugurated in the year 1928. The 1944 earthquake made public buildings, churches and schools collapsed. However, this hospital resulted undamaged, lodging most of the injured people.

Cultural Value of the Building
It is important to determine the cultural value of the building. This was established by "The Burra Charter"(3). This value is determined through:

- *Symbolic Value*: This building is representative of the collective memorabilia. It was erected according to last for ever, as symbols of a civilization to be transmitted to future generations.

- *Architectural Value:* It's one of the few European buildings of the 20th century. Furthermore, it is the only standing hospital of that time with high quality design. Technologically, it has resisted earthquake of great magnitude (for example, in 1944, 1952 and 1977) without significant material or stability damages.

- *Landscape Value:* It's situated in a privileged place in the historical core of the city.

- *Esthetic Value:* For its space originality, its configuration, its scale and its proportions stated in "The Burra Charter".

- *Historical Value:* It has been an icon of good health and hope of life for almost a century. The heritage of these buildings, resides in the perpetuity of offering a specific historical and cultural identity.

- *Social Value:* Until 1971 it was the only hospital in the city and, nowadays, it still provides society with essential services.

This remainder of the past, which have been highly rated, would be more valuable for the next generations, because of their identification with the world of future technology

METHODOLOGY

The seismic-resistant capacity of the building has been evaluated bearing in mind the relation between its potential seismic capacity and the assumed seismic risk.

The potential seismic capacity has been calculated according to different parameters, such as structural typology, dimensions and irregularities of the building, strength and ultimate strength of the materials employed, etc. The assumed risk depends –among other causes– on the earthquake hazard –potential maximum seismic intensity– and the local features of the soil foundation.

This evaluation has demanded different tasks, as reviewing existing documents (historic records are essential to elaborate a diagnosis to preserve a monument), evaluating structural capacity according to documents, site inspections, the building's deterioration and environmental analyses.

Architectural Description of the Building

The building under study, the Rawson Hospital Central Section, has a triple-height central hall lit by a zenithal vitreous window. In them the corridors are developed over this space. A sculptural stair, whose rests show vitreous windows supported by iron brackets, connects the different floors (fig Nº 4).

This hospital was one of the first buildings in the province to have a concrete structure, thanks to the technology evolution the country was undergoing. Consequently, it was constructed using qualified hand labor and imported materials manufactured with the most advanced German technology of the time.

Staircase **Stair rest**

fig Nº 4

The slab and the attic are made of concrete, and the windowsills and projections have small vaults and slate lining. The building displays cedar woodwork and marble steps in the entrances (fig Nº 5).

fig Nº 5

The architectural ornaments, moldings, balustrades and other details are made of iron and mortar. Bricks are believed to have been locally produced, but the rest of the materials were imported from Europe, since concrete was still unknown by the native constructors of the time (fig Nº 6).

Back balcony with balustrade

fig Nº 6

Structural-Architectural Design of the Building

From the structural point of view, this building has the following characteristics:

- resistant typology given by brick walls and reinforced concrete frames in two main directions. A considerable number of 45 cm-wide masonry brick walls with mortar basis, provide great resistance

to the whole building. The frames were constructed with beams, columns and slabs of reinforced concrete, according to conventional techniques of the time.

- use of high-quality building materials
- geometric-architectural characteristics, suitable for buildings in seismic areas. Therefore, it is possible to observe,
- a rectangular, symmetrical plant
- low values in the follows relations
    - the plant's width and length
    - relation between the space of the atrium and the total surface of the stories
    - distance between the center of the atrium and the center of the stories of the plant with respect to the shortest length of the plant
    - the ground level surface with respect to the first level surface.
    - heights of the stories compared with the height of the surface under consideration.
    - mass-stiffness relation of the stories above and the mass-stiffness of the floor being studied.

Not only the city's seismic microzonation studies (4), but also its local ground features have been considered to estimate the assumed seismic risk. San Juan is situated in one of the most dangerous seismic areas of the country.

CONCLUSION

Based on qualitative and quantitative analyses above mentioned, it is possible to assume that the structure of the hospital will have an acceptable seismic-resistant behaviour in the future.

This is due to its nearly symmetric plant and height configuration, simple and aligned structural elements, and the use of wide walls that contribute to the building's resistance.

In conclusion, to assure the preservation of this building treasured as an architectural and historical heritage, the following criteria should be considered:

- Respecting the building's original configuration, i.e. avoiding the addition or removal of structural and non-structural elements that may modify it in plant or in height.
- Respecting typical structural technologies proper of each construction, as the basic principle of preservation.
- Regarding the environment, it is necessary to determine *Historical Protection Areas,* since the conservation of the surroundings contributes to the preservation of the building.

Finally, considering its cultural, social and historical importance, Rawson General Hospital represents a unique architectural typology in San Juan city.

Preserving the scarce cultural and architectural heritage in San Juan city should be a priority, if the aim is not only to achieve a sense of identity, but also to enrich our present and project our future.

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