Holistic approach in recovery of concrete architecture as sign of historical identity. Research study in Argentina

Abstract

In the Twentieth century a new ideological paradigm emerged in architecture, leading to mutations of function, form and technology, and marking a break with the traditional configuration of spaces, compositional and aesthetic forms. This trend has imposed an architecture based on simple and functional shapes and industrial materials, giving up excessive ornamentation. Through some selection criteria it is possible to recognize in the modern production “signs and meanings” of historical-documentary value, to be preserved and protected. Currently, there is a lack of consensus in local and national regulations on the criteria to be used for the selection of the works to be recovered rather than demolished, on the materials and construction techniques or about the interventions on the Modern Movement architecture, often guided only by economic criteria. The main challenge is how to recover the existing heritage and adapt it to the necessary conditions of habitability, functionality and sustainability of the XXI century, without breaking with its identity characterized by rationalism, functionalism and industrialized technology. Through a case study in Argentina, the research intends to propose a methodology for the selection of works built in the Twentieth century in order to apply recovery and conservation interventions, and to guide any projects according to a holistic approach.

Keywords: Modern Architecture, Recovery and Conservation, Holism.

Introduction

The architectural production of the last hundred years connotes a large part of territories and cities all over the world that, when inspired by artistic, architectural and handicraft ideals, represents an exclusive complex of ways of planning, building and using contemporary resources. Many works lie in an advanced state of decay, due to the poor cultural recognition by professionals and community and to the lack of conservation and maintenance interventions. Considering the three aspects of architectural work - conservation, transformation, maintenance - in a single methodological unicum allows to pursue the best choice, not harmful to the artefacts but necessary to improve their life and performance, in accordance with current principles of sustainability. However, if these aspects seem to be simple solutions for new buildings, they are more complex in the face of the existing heritage. The search for sustainability means appealing to “govern” the intervention, according to the uniqueness of each building and, therefore, in the protection of its historical, cultural and social characteristics: in the ability to ensure
flexibility for reuse; in the choice of compatible, reversible and distinguishable solutions; in maximizing the exploitation of the building’s intrinsic resource; in organizing an interdisciplinary and well-formed operating group; in rationalizing the organization of the construction site to facilitate the activities and support their safety.\(^1\)

With regard to modern architecture, simple solutions cannot be implemented, but the formal peculiarities and the new technologies require more complete reflections that can bring the practice back to the methodological rigor typical of the restoration discipline. Often, in fact, it is common to consider that the examples of the Twentieth century production, due to their more modern and industrial character, require easier solutions and, above all, reproducibility and maintenance operations in series, not considering the character of craftsmanship, the innovative aspects generated by the Modern Movement and, even, the affection of local communities.\(^2\)

In this scenario, the architecture can be understood as a large complex organism where all its systems work together in order to give it life and functionality. Due to the complexity of the architectural project, many factors interrelate and work together to achieve the goals. It is necessary to understand this complexity and work on each one of the parameters while considering the repercussion as a whole. The holism supposes that all the properties of a system cannot be determined or explained as a sum of its components.\(^3\) An architectural project is mainly articulated in four elements, which cover all project scales: Society, Architectural Design, Structure, Sustainability

**Society:** history, evolution, social and cultural context, demography, popular feeling, integration with industry and commerce, urban and social quality. This stage is useful to maximize the potential of the cultural heritage, to serve as a driver for economic, social and environmental regeneration, by minimizing the damaging consequences of unnecessary expenditure.

**Architectural Design:** artistic act that reflects the language and style of a given period in a specific geographical context; the way in which space and

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functions are articulated. Through the project, the conservation and maintenance operations are carried out.4

Structure: material process, technologies, construction methods, construction site management.

Sustainability: ability to express concisely and persuasively the connections between the built heritage conservation of the wider national and international agendas of sustainability. The protection measures for the environment, the adaptation to the goals of sustainable development, the ability to use existing resources trying to reduce the minimum necessary for construction are included.

From the community, considered as the beginning and the end of the cycle, the needs to be answered arise. An architecture that does not respond to the needs of people, both in terms of functions and design, can cause its deterioration and rejection, by generating unexpected changes in its own development.

In a society in constant growth and change, the architecture has the responsibility to respond to current needs, preserve the legacy of the past and be a promise for the future.

The recovery of the existing modern architecture

Recovery in architecture is a set of interventions in which transformations and conservation are integrated as much as possible, by taking into account both the material, physical and intangible aspects such as significance and historic evolution5. This activity requires an interdisciplinary approach that includes urban planners, restorers and architects, but also structural engineers, plant engineers, geologists, historians, etc. There is no parameter that is not related to the other, like a chain in which each link is fundamental in the success of the final work.

However, the concept of modern architecture presupposes a “quality judgment”, excluding all the architectural products made in the Twentieth century built only as a response to the market or to the industrial needs.

Hence, it is important to face these moral dilemmas and solve technical and cultural problems when it is necessary to preserve recent cultural heritage, in the awareness that every choice must be calibrated in its own space-time circumstances6. At the same time, a more complete historical study is needed, beyond criticisms and censures.

The issues related to the recovery and conservation of the modern cultural heritage are explained by deepening the effects of the conservative gesture as a

cultural, technical and methodological act. In a first schematization, there are four open concerns:

1. *Selection*. In the impossibility of preserving the whole built environment, it is necessary to identify a map of the artefacts to be preserved and recovered, which show the characteristic of witness of passing time. This screening phase must be conducted in the light of the particular historical and geographical contexts (Tab. 1).

2. *Aim*. It is difficult to suppose a purely aesthetic purpose, as a “museumization” of modern works. The goals can be many: i.e. functional, technological, structural recovery, adaptation or improvement by virtue of legislative provisions, restoration of surfaces or finishing works, materials, etc. In accordance with the aim, the related methodological and operational phases are defined.

3. *Technical difficulties*. Traditional construction methods suffered a fracture, in the late Nineteenth century, with the introduction of new materials and techniques that encouraged the prefabrication and the almost exclusive use of steel and reinforced concrete, replacing the traditional construction with its artisan practice, materials and rule of art. Concrete, first considered eternal, is characterized by particularly delicate internal balance mechanisms and it is influenced by the surrounding conditions.

4. *Method*. Currently the needle oscillates between the rigor of pure conservation and the creativity of a “contemporary redesign”. Appropriate methods need to be defined in relation to the specificity of each problem (Tab. 2).

Preserving the modern, therefore, implies understanding its specific values, with the identification of the mechanisms and criteria that governed its construction, transformation and use overtime.

This topic forces us to deal with the founding themes of contemporary civilization, with the new meanings assumed by the buildings themselves in relation to the deep social, cultural, technological and economic transformations.

The technological innovations as well as the link between form and structure and the standardization processes or experiments are fundamental elements in order to investigate this issue, understanding innovative contents and propose virtuous solutions which overcome speedy operations of demolition or replacement.

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Table 1. Fundamental criteria in the selection of modern works recognizable as signs to be preserved, protected and recovered.

<table>
<thead>
<tr>
<th>Main Criteria in the selection phase</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>Criterion 1: Creative work of human genius</td>
<td>The modern works were designed and built by engineers and architects who determined the development of the construction practice of the Twentieth century. In this way, architectural complexes should be considered not only celebratory of their design and technique but also of those who conceived them.</td>
</tr>
<tr>
<td>Criterion 2: Influence of innovative technologies</td>
<td>The development of technology plays a fundamental role in the selection process in terms of daring engineering and architectural solutions, construction methods, experimental materials, construction techniques, etc. Modern historiography of technology requires an interdisciplinary (social, economic, environmental and political) approach capable of investigating the development of buildings.</td>
</tr>
<tr>
<td>Criterion 3: Exceptional example impressed in the memory of the community</td>
<td>Many buildings reach exceptional levels both for their ingenious construction and for their ability to survive over time. Originality and authenticity, typicality and exceptionality, historical integrity and affection of the community in figurative or functional terms, are some of the aspects that converge in the selection process.</td>
</tr>
<tr>
<td>Criterion 4: Illustrative example of economic or social developments</td>
<td>Modern architecture has been an engine of political, social, economic and cultural development of each country, satisfying people’s desires to live in new, performing and aesthetically satisfying contexts, thus providing a valuable social and economic contribution to the development of society and city.</td>
</tr>
</tbody>
</table>
Table 2. Diagram relating to the methodological approach of knowledge and recovery of modern architecture

Application in Argentina

The research on which this article is based, in order to contemplate the implementation of the holistic development in the recovery of existing architectures, is applied to the building known as the former "Hotel Sol de los
Andes”, located in the city of San Martin de los Andes, an urban centre in the south of the province of Neuquén, in Argentina (Fig. 1).

The table of main criteria in the selection phase is used to justify the choice to recover, conserve and return to the community this kind of construction.

**Figure 1. Geographical location of San Martín de los Andes and its evolution over time**

Criterion 1: Creative work of human genius

Built in 1974 at the time of the tourist development, the construction was a 5-star hotel, with all the services, green spaces and recreation areas.

The paradigm of Argentinean tourism in the 80’s was characterized by attracting tourists with greater purchasing power through luxury complexes that
solved all their needs in one place. At the beginning, the hotel had 72 rooms, 19 suites and apartments, with private bathroom, restaurant, lounge, solarium, swimming pool, cafeteria, bar, shopping mall, conference room and casino.

The building consisted of three big blocks of reinforced concrete. It was inserted in the middle of the mountain, joining with the existing topography, by generating several terraces that allow to appreciate all the beautiful views, above the high vegetation.

The hotel was built with the clear intention of highlighting and showing its category and luxury and, due to its size, it broke through the surrounding natural landscape, rising above the city (Fig. 2).

Figure 2. Aerial view; plan level zero and upper levels

In 2002 the municipality of San Martin, as a precautionary measure to resolve a confused network of commercial and tourist licenses, decided to close the hotel, by turning it into a province’s property, so that any new decision had to be approved by the provincial government.

In 2005 a private investor presented a project to restore the old structure, turning it in school and hotel.

The walls and the floors were demolished, the furniture was removed. During the renovation new external enclosures were built and some small structural reforms were made. After these works, never completed, the work was interrupted and the project was completely abandoned, with a much greater deterioration than the original one (Fig. 3).

In 2013, some activities of the Escuela del Sol, whose building had been completely destroyed by a fire in late 2012, and of the Technological University and the University of Avellaneda were allocated. About 1,200 square meters were renovated, with new classrooms and spaces, modifying the original layout.

The paradigm started to change, from a building that creates goods and services for tourists to one that produces knowledge by spreading education
and culture within the city and for its inhabitants. At the same time, it made possible to solve spatial problems, creating educational, primary, secondary and university institutions that currently do not have sufficient space for their teaching.

**Figure 3.** Main façade; current state of the building.

![Main façade; current state of the building.](image)

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**Criterion 2: Influence of innovative technologies**

Reinforced concrete technology in Argentina is a relatively new; its potentiality allowed designers to develop and respond to their creative ideas thanks to the new material versatility. This construction was considered a landmark within the city, both in winter and in summer.

Traditionally the city was characterized by low buildings, in wood, stone and brick walls. The hotel was the first building with a new language, with its concrete structure and its large size in the middle of the mountain. After its construction and due to the great criticisms received by the inhabitants, the municipality decided to propose clear rules for new buildings, thus avoiding the loss of the traditional image of a mountain village. These regulations established mandatory percentages of any materials, including wood and stone, and the maximum heights of buildings, which could not exceed 3 levels. Over the years, however, the hotel has become an iconic element easily recognizable, a real reference point for visitors and residents.
Criterion 3: Exceptional example impressed in the memory of the community

There were so many years in which the building was abandoned that few remember it in its moment of magnificence: little remains of the impressive image as it was conceived. Today it is a product of the various transformations undergone over time.

However, for a long time it was not accepted by the community for its “break” with the surrounding landscape, but soon it became a symbol for the city and impressed in the memory of citizens, almost a giant watching over the territory from above.

Today the current face is well impressed in the urban landscape. By viewing the mountain and seeing how this large building stands among the vegetation, Hotel Sol de los Andes is a singular and representative element of a whole city.

Criterion 4: Illustrative example of economic or social developments

The hotel meant a big change for the location; before its construction, there were no hotels of this size within the city. The hotel opened soon its doors as a national ski centre and an airport had to be built to accommodate tourists from all over the country. Many tourists, after their trip, decided to stay permanently in San Martin in search of peace and to escape from the metropolitan life. San Martin, therefore, has been positioned as one of the main cities nationwide, chosen by tourists, due to the Chapelco ski centre and the various activities offered thanks to its proximity to the naturalistic ecosystems.

Today, a part of the functions of the Municipality are located on the ground floor of the building with an occupation of 1,337.63 m², which corresponds to only 25% of the whole area. The upper floors are not occupied because of the safety of the structure that cannot be guaranteed.

The project

In accordance with the concept of holism in architecture, the proposed project is structured in 4 key interrelated points, to more easily understand the complexity of the work carried out.

Society

The city of San Martin de los Andes is characterized by the mixture between urbanized areas and nature, with a “main urban plant”, corresponding with the historical centre, and many peripheral expansions. Its configuration evidences some metropolitan logics, beyond the small size of this municipality.

In 2018, the San Martín de los Andes 2030 Strategic Plan began to operate in the district with the aim of establishing the profile of clear policies for a
sustainable development with a regional vision and integrated with the strategic
guidelines of the Province of Neuquén. The objectives of this plan are carried
out through 16 strategic projects, including the creation of a new hospital, a
recycling plant, a conference centre, a linear park, distributed within the city.

The site belongs to different entities, which are geographically linked in
this area of intervention. The Municipality, National Park and the Mapuche
community have jurisdiction over this sector, with some conflicts between
them. So, any new use must contemplate all these actors, by generating a
construction with social equity.

Close to the property there is the neighbourhood Canteras (not planned at
the time of the construction of the hotel) that is inhabited by 230 families and
almost 700 inhabitants.

In order to choose the new uses, an online survey was carried out to know
the people opinion about the building in order to take it into account during
project stage. Three main criteria were evaluated: Knowledge, accessibility and
uses (Fig. 4).

Knowledge, level of information about the current state of building and
site; accessibility, simplicity in accessing the site; new uses considered most
relevant for the building. After elaborating the different answers, the decision
was to generate a mixed program.

Figure 4. Summary table of the web questionnaire made to the community.

The building incorporates a civic centre to develop and promote the local
culture and a university an cultural space. The pyramid of the local population
shows a decrease in young people (18-35 years), who leave small countries to
move towards more important cities with the ambition of obtaining a university degree.

Structure

In July 2015, the Municipality of San Martín de los Andes commissioned a technical report to evaluate the current state of the structure. Non-destructive tests were carried out to determine the quality of the concrete, the quantity of steel and the arrangement of the reinforcements of the resistant elements. This information was the basis for this work.

The structure is mainly composed of three volumes, two with only one level and the third with five levels. Due to its characteristics, the highest building is the most structurally compromised especially for its poor performance to the seismic forces. Therefore, it was decided to base the study on this portion. The resistant structure is made up of columns, beams and solid slabs. The upper rectangular part is divided into three blocks separated by expansion joints. The columns and beams form porticoes in both directions with variable height sections.

It was performed a pushover analysis, i.e. a non-linear method. In general, the structure capacity depends on the strength and deformation capacity of each of its individual components. In order to determine the capacities after the elastic limit, non-linear analysis procedures are necessary. This process was carried out by the software SeismoBuild, able to predict the displacement behaviour of spatial frames under static or dynamic loads.

In conclusion, the torsional stresses presented in the elements are not very large, helped by the plan regularity and to the disposition of its structural elements. The structure is capable of supporting gravitational loads, but it cannot resist seismic loads.

It is proposed to generate a metal great rigidity exoskeleton to absorb the seismic loads avoiding reinforcing all the connections. The structure, integrated into the architectural design, solves not only the structural resistance but also environmental and functional comfort issues (Fig. 5).

The methodology to carry out this seismic study is a theoretical method that considers the seismic loads as unidirectional, taking into account the two directions of analysis to find the necessary stiffness, simplifying the calculation method. It is important to consider is the connection between the two configurations: the existing reinforced concrete structure and the new steel structure. It is possible to work with a rigid horizontal plane, which guarantees the uniformity of the loads. This plane was generated thanks to the implementation of a horizontal beam that will be mounted under the existing ones.

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8The structural analyzes - only a small part is reported here - were conducted under the supervision of Prof. Ing. Massimo Latour, Department of Civil Engineering, University of Salerno.
This new beam will be responsible for resisting the loads applied by the vertical planes on them and transmitting these actions (Fig. 6).

**Figure 5. Structural development of the proposal: (1) Feasibility study on the nodes (2) Modelling of the structure (3) Verification of the sections (4) Proposal for the implementation**

![Figure 5](image1.png)

**Figure 6. Details of the main connections post-project.**

![Figure 6](image2.png)

After modelling the whole structure with SAP2000, two pertinent verifications were performed. The first was to verify that the steel sections do not creep under seismic loads, according to the limits set by the regulations; the
second was carried out by checking the movements of the structures in both the
directions.

Architectural Design

As mentioned above, the structure is integrated into the architectural
design. This new structure allows to generate transition spaces between the
different volumes, incorporating a spatial aggregate, which allows the
subdivision of the different functions and the horizontal and vertical circulation
of users (Fig. 7).

Figure 7. View of the proposal in its immediate surroundings; ground floor;
functions layouts

Structure and architecture merge to form a new language, generating a new
imprint in the landscape. Using the modulation of the previously designed
structure and taking into account the local solar map, we found an average
angle of 52 degrees that allowed us to work on a surface that lets to filter the
direct radiation of the sun during the summer season and exploit it in winter.
The 100% recyclable textile technology allows to dissipate up to 95% of the
heat in summer, saving up to 50% in heating costs. The contemporary language

9The structural analysis has foreseen numerous verifications that it is impossible to report in this scientific
contribution, since it is intended to demonstrate mainly the effectiveness of the holistic approach in
architecture.
does not disguise itself in the context but stands out as well as the original building. The white finish allows it to be used as a screen on holidays.

The organization within the building was stratified in different levels. The civic centre is located on the ground floor, divided into 3 volumes: the first, corresponding to the access, houses a gastronomical area and it is complemented by a covered plaza for various activities outdoor; the second includes both the administrative area and the art and music rooms that have special requirements; the third contains all the activities that require movement, such as dance, theatre, body expression, etc. It also incorporates an auditorium for 200 people in which the stage can be used both indoors and outdoors. The media library is located on the first floor, as a link between the civic centre and the university sector. The following floors houses the university spaces (Figs. 8, 9).

**Figure 8. Project plans (second, third and fourth floors) and section A-A**

**Figure 9. Exterior and interior renders**
Sustainability

Nowadays, sustainability is one of the most important parameters to take into consideration, assumed as the capacity to reduce waste and to use natural resources. For this reason, three systems that work simultaneously were designed, allowing the project to become self-sufficient (Fig. 10).

The first system is the use of solar energy with the implementation of photovoltaic panels, incorporated at the end of the metal roof. The energy collected is used to power the building electrically and, in the winter period, is used for the operation of boilers, which operate a radiant floor system.

The second system contemplates the reuse of rainwater. The water is collected by a system of gutters placed on the roof and conveyed to filters, to then be accumulated in a tank located on the ground floor. Finally, the shape of the designed facade allows us to take advantage of the winds of the area and to obtain the correct ventilation of the whole proposal.

Figure 10. Functioning of the systems for the use of natural resources. Use of the sun’s energy (1,2); Heating with radiant floor systems (3,4); Reuse of rainwater (5,6,7,8)

Conclusion

A holistic approach to recover the existing buildings means to “govern” the intervention, according to the uniqueness of each construction and, therefore, to ensure the enjoyment over time, the flexibility in choosing compatible, reversible and distinguishable solutions, the exploitation of the building’s intrinsic resources.

With regard to modern production, pre-packaged solutions cannot be implemented, but the formal and technological peculiarities of the modern buildings require wider reflections that can bring the practice back to the methodological rigor typical of the conservation and restoration discipline. In the first instance, it is essential to generate a critical appreciation regarding the
quality of the work, through wide and effective selection criteria, so as to be
able to direct the choices towards the most prudent intervention, since it would
not be possible to dedicate the same conservative care to all the buildings in
reinforced concrete of the Twentieth century.

Today the conservation / transformation / maintenance of architecture
cannot ignore the challenges evoked by an emerging awareness of cultural and
operational change in architectural practice, aimed at more sustainable goals of
efficiency, efficacy, safety and functionality, without neglecting ethical and
aesthetic demands, beyond rules and regulations.

Therefore, it is necessary to address these issues in scientific research in an
even more interdisciplinary way and ensure that they are incorporated into
professional activity. The academy, institutions, professionals and communities
should reactivate the cultural debate between the various components that have
made possible to preserve the historical heritage, to design the contemporary
and to maintain the existing, without giving in to mere legislative, economic or
financial dominance.

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