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Corresponding Author	Family Name Arévalo Rodríguez Particle Given Name Federico Prefix Suffix Role Division ETSA Seville Organization University of Seville Address Seville, Spain Email farevalo@us.es
Author	Family Name Martínez Moya Particle Given Name Eduardo Prefix Suffix Role Division ETSA Seville Organization University of Seville Address Seville, Spain Email
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Keywords	Survey - Photogrammetry - Architectural restoration - International Style



Surveying in Architectural Intervention of the Collapse of the International Style. The Case of the Puerta de la Carne Market

Federico Arévalo Rodríguez^(✉) and Eduardo Martínez Moya

ETSA Seville, University of Seville, Seville, Spain
farevalo@us.es

Abstract. Unlike interventions in past architectures, where reconstruction was only recognised in the Krakow Charter (2000) and provided that the building had been “destroyed by armed conflict or natural disasters” and, furthermore, if “there are exceptional social or cultural reasons that are related to the identity of the community”, the rehabilitation of architecture of the International Style presents cases that contradict this issue.

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Keywords: Survey · Photogrammetry · Architectural restoration · International Style

1 The Collapse of the Architectural Heritage of the 20th Century

The concept of collapse has been widely debated in the field of architecture. Collapse tells us about the passage of time, and the only intervention available in many cases is, precisely, the conservation of said collapse or, rather, the halting of that continuous deterioration.

In 20th century architecture, there are circumstances that differ from the processes of collapse in other historical periods, since deterioration usually comes from their inception, from the implementation of new construction techniques whose particularities were not yet known. In other cases, deterioration comes from its conception as ephemeral architecture that never intended to be a “monument”. That is why it may wrongly appear that modern collapse “lacks dignity”.

The charters for the restoration do not contemplate the action of reconstruction in the architecture belonging to the International Style. The Krakow Charter only allows

for reconstruction in special cases of natural disasters or armed conflicts (Rivera and Pérez 2000). This architecture simply does not fit into its concept of architectural heritage. Some of the materials used in 20th century's constructions have a shorter life span than traditional ones and, in addition their own heritage value, they are not comparable to others. Conglomerate made from water, sand and gravel—which belonged the first and quite deficient concretes—has to be viewed not so much for its intrinsic value (which is obviously scarce), but for its capacity to be moulded and achieve unique forms.

Faced with this situation, actions arise in which the only possible option is the replacement of elements that, due to their state of collapse, prevent another intervention.

2 Some Examples of Interventions in the Architecture of the International Style

A proposal to intervene in his already collapsed Villa Savoye (Fig. 1) was presented to Le Corbusier in the 1960s but, according to Quetglas, only two drawings remain from his reform proposal. In the Siza Tea House, it has been possible for the author of the project to intervene in his own collapse. This is an exceptional option in which there is no possible doubt as to its “legality” when re-reading the charters of the restoration.



Fig. 1. Le Corbusier, Villa Savoye (1928–1931) in state of abandonment. Photograph by Victor Gubbins, 1965. Source: Vela Castillo (2011)

Villa Savoye was declared a historical monument by the French government in 1967 and it had gone through an unfortunate intervention a few years earlier (Soraluce 2000, p. 669). It was finally “restored” between 1985 and 1992; here, we use the term in its most literal sense, as if Le Corbusier had finished his building at that very moment, in an intervention that returned the building to its original state (materials, furniture, woodwork...), with great attention to the original colour of the building. Similar cases are those of Villa Tugendhat by Mies Van der Rohe in Brno (1929) or the Zonnestraal Sanatorium built in Hilversum in 1930 by Jan Duiker, where the intervention turns the ephemeral into permanent.

These acts performed onto the architecture of the International Style coincide with those suggested by Siza or Moneo, who advocate the conservation of the original values of that architecture, “even proposing, whether it is their own work or that of other recognised authors, its most careful and strict restoration, to maintain them perpetually as they were presented at the time they were inaugurated, a conservative idea that, on the other hand, is directly Ruskinian; with equal reasons it is believed that, if the building has disappeared or has been degraded to collapse, it must be rebuilt without further ado” (Jiménez Martín 2018, p. 9). Some examples of this style of reconstruction are the Mies van der Rohe Pavilion in Barcelona; the Esprit Nouveau Pavilion by Le Corbusier; the Spanish Republic Pavilion in Paris, rebuilt in Barcelona; or the Schröder House by Gerrit Rietveld.

Regarding the reconstruction of the Mies Pavilion in Barcelona (Soraluce Blond 2010, pp. 673–676), there is an even more exceptional case, since as Mies himself stated to Oriol Bohigas in 1957, the original plans were lost in Germany and he offered to redo it himself without charging any fees (Cirici et al. 1983, pp. 6–7). As time went by, “specialised publications, when referring to the new pavilion, (...) do not use the concepts of copy or clone, but speak directly of Mies Pavilion, as if he had been resurrected. In this and other cases, the copy has such strength that it can make one forget its true facsimile nature, supplanting the missing original and erasing the passage of time between the two” (Hernández Martínez 2007, p. 14).

An intervention of lesser scope but that exemplifies the poor state of the structures of many works of the International Style can be found in the Fallingwater. Wright excessively lightened the reinforcement of the large projections when calculating the reinforced concrete structure and—although his collaborators reinforced the structure without him knowing (Waggoner 1996, p. 51)—, at the end of the century, the building was in a very poor state from the perspective of stability. The large concrete projections had bent excessively, and the concrete had deteriorated due to the level of humidity and the repairs carried out in previous interventions. A major structural intervention was necessary, featuring a complex process of installing cables that tightened the structure through open slots in the slabs (Soraluce Blond 2010, p. 569).

Therefore, “for a little over a quarter of a century, when significant architecture of the International Style had been intervened, there had been a tendency towards archaeological reconstruction, including constructive improvement with respect to the original work” (Martínez-Medina 2011, p. 3).

3 The Document of Madrid and Its Interpretation

In 2011, the International Conference on Intervention Approaches for the 20th Century Architectural Heritage (CAH20thC) produced the so-called “Document of Madrid for the 20th Century Architectural Heritage”, which adopts certain new approaches that set it apart from previous Charters. Firstly, it states that the construction techniques, materials and methods of construction of the buildings of the International Style differ from those of the past. Therefore, research and development of conservation methods appropriate to these unique constructions is necessary.

This differentiation of the architectures of the past is explained by Campoy in the minutes of this congress: “It is an architecture that was consciously new and voluntarily ephemeral, thus detached from other types of heritage, with a different sense of time and permanence (...). The degradation of the materials, due to their prototypical character through experimental techniques, leads us to reflect on respecting the natural ageing of the work or rescuing the pristine aspect that defined this architecture, assuming the disadvantage entailed by the application of techniques of unknown behaviour” (Campoy Pérez 2011).

The Document of Madrid allows for building extensions, although when differentiating them from the rest. However, it does not recommend the “reconstruction of totally lost heritage properties or their main elements”, since “reconstructions are contemporary works that simply recreate the appearance, but lack authenticity and historical dimension”, although “despite this, the reconstruction of isolated elements or details can contribute to the correct interpretation of the site”.

Although the Document of Madrid does not accept total reconstructions, this option does not correspond to the interventions in “signature” architecture of the 20th century, in which “the modifications suffered in the building have been suppressed when these were not due to their original author (...) that is to say, when dealing with architectures in which authorship is essential, and in which what is presented to us as singularly relevant are the concepts or ideas embodied in them, these are the ones that are situated above all criteria” (García Hermida 2011).

The idea of reconstruction is therefore still vilified, although, in some way, it hints at such a possibility, which makes more sense in the case of the architecture of the International Style than in that of the architecture of the past. There are many cases in which the reinforced concrete structure, that novel material of which very little was known at the beginning of the last century, is close to collapsing. There is only one way to address this: scientific reconstruction of the building to its initial state, according to the examples given above.

The quote from Martínez-Medina is particularly appropriate: “We admit that historical and modern architecture are clearly different, so intervention must be done in a different way. We admit that each constitutes a heritage element that generates different identities, each as a reflection of the values of the societies that generated them: historical architecture forms a stable memory, while modern architecture describes a

memory of changing events. It is precisely this specificity, the idea of serving a transience, that most justifies the restorations and archaeological reconstructions at the source” (Martínez-Medina 2011, p. 5).

If modern architectural works are not rehabilitated in the face of the inability to act due to ineffectiveness in the face of a heritage element in structural collapse, there would be no vestiges of the recent past that is crumbling so as not to breach the heritage charters (of pre-20th century heritage): “returning the splendour to the works – which necessarily goes through the technical updating that tends to increase and prolong their life – serves to consolidate, through milestones and icons, a stage of the past that is intended to be present” (Martínez-Medina 2011, p. 5).

4 The Case of the Puerta de la Carne Market of Seville

4.1 Heritage Value of the Building and Proposal for Intervention

A paradigmatic example of this is one of the first works of rationalism in Andalusia. It is the Puerta de la Carne Market, designed in 1927 by architects Gabriel Lupiáñez Gely and Aurelio Gómez Millán. The building is configured volumetrically with a two-storey perimeter piece as a response to the smaller-scale urban environment (Fig. 2 and 3). In the centre of the building stands, with great geometric purity, the central nave of the building, which, with its cylindrical vault shape, housed the market stalls (Fig. 4). This space is the piece with greatest architectural interest, defined internally only by its structure and illuminated from above and from the side.

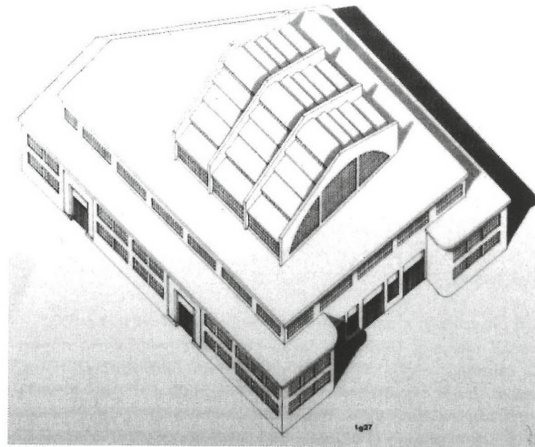
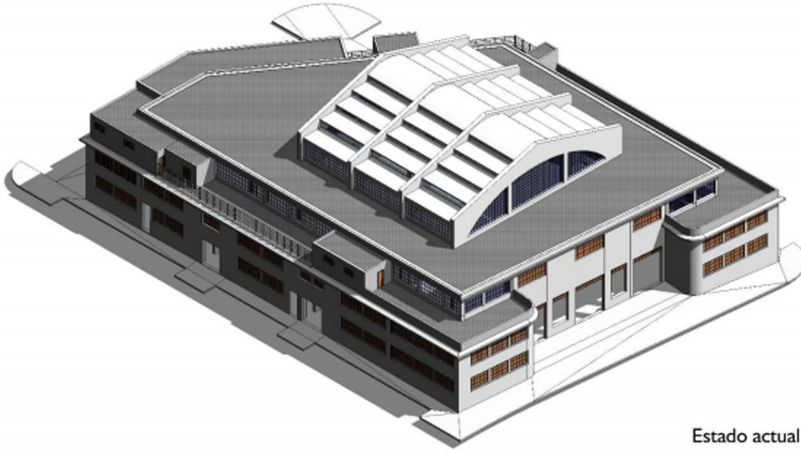


Fig. 2. Market volumetry according to the initial project. Source: Jiménez Ramón 1999, p. 129.



Estado actual

Fig. 3. Market volumetry in its current state. Authors: Roque Angulo Fornos and José Antonio Alba Dorado (2015).



Fig. 4. Interior of the Puerta de la Carne Market (1927). Source: Jiménez Martín 2018, p. 10.

Regarding the choice of using reinforced concrete, Jiménez Ramón indicates that it was a frequent option at that time, as all the architects who entered the competition did so. The greatest contribution of the project lies in the use of concrete as an expressive material, used in such a way that this “expressive intention is fundamentally evident in the great parallel arches that not only qualify and give personality to the main space of the building, but also look out and create a decompositive image of the body through a gable roof” (Jiménez Ramón 1999, p. 133).

The building has a high degree of heritage protection, both locally and in the General Catalogue of Andalusian Historical Heritage, where it is registered as a “General Cataloguing Property”. In 2007, it was declared a Property of Cultural Interest, along with five other buildings in the province of Seville. After its closure in 1999 due to its dilapidated condition, the building’s rehabilitation project is currently underway, and several test pit campaigns and studies on the state of the building were carried out during the first analyses. It was concluded that the building’s collapse is not merely a matter of aesthetics, since the concrete structure is deeply degraded, with advanced oxidation of the reinforcements and areas where even these reinforcements have disappeared due to carbonation. The reinforcements are smooth, which is logical due to the date of their construction, as they did not have the necessary coverings for their adequate preservation.

In order to maintain the central zone of the building in the intervention project—which is the most recognisable element and where the heritage values are based, fundamentally due to the lightness of the concrete structure and to spatiality (Fig. 5)—the introduction of a large metal orthopaedic structure that would reinforce the reinforced concrete structure was initially proposed. This would be a metal structure that would surround each reinforced concrete element, both columns and beams. In reality, this would be a metal structure to which all the building’s stresses would have to be transferred, since the strength of the existing concrete structure must be considered to be zero.



Fig. 5. Current state of the market. Photography: Federico Arévalo.

This reinforcement possibility was rejected for two reasons. One of them is due to the fact that the coating to protect the metallic reinforcements against fire entails an unacceptable increase in the size of the pillars, thus deforming the sensation of lightness of the building. The other reason was structural, since having to line all the concrete with a new metal structure would pervert the fundamental concept of the building. It would be considered an intervention failure, since it would look like a box that would wrap the collapse of the structure, something like an attempt committed against the original idea of the building.

Faced with this insurmountable collapse and based on the peculiarity of the architecture of the International Style, where materiality is not necessarily the element to be protected, the replacement of the central element of the building was proposed on the condition that it be reliably reconstructed. This is the moment when an exact survey of reality becomes the only possibility for architectural substitution. It is assumed that drawing is the great ally in the intervention of heritage, both in its description and analysis, and in its reconstruction (Martínez Moya 2014).

In a way, an option similar to that indicated in the conclusions of the Document of Madrid is being proposed: “in some cases, the materials used in the construction of 20th century sites have a shorter life span than traditional ones. The absence of conservation methods based on their characteristics may lead to more drastic interventions than traditional ones and may also require additional interventions in the future. The original materials or their construction details should be documented and, if they have to be removed, representative samples should be kept”.

4.2 Surveying Process

To carry out the survey of the building, two digital captures were made using SFM (Structure From Motion) photogrammetric techniques. A preliminary one (Fig. 6), less exhaustive and without metric support, for which the collaboration of Dr. Antonio Almagro Gorbea was requested, the main objective of which was to obtain orthophotos of the exterior and interior façades that allowed an initial examination of the building’s state of conservation.



Fig. 6. Preliminary photogrammetric capture. Orthophoto of the interior façade. Author: Antonio Almagro Gorbea (2015).

Subsequently, a definitive capture was carried out. This was more exhaustive in terms of the space extension and volumes captured, and done with greater precision. In this case, the development of the capture work included taking the necessary number of photographs for the digital restitution, by means of photogrammetric techniques, of a series of models in the form of dense point clouds. To guarantee the accuracy and rigour of these models, the process was supported by the taking of a limited number of control points through a total topography station, in order to obtain the correct georeferencing and scaling of the resulting models.

The restitution phase, prior to the final survey, involved the unification of the captured point clouds and their coordination with the photogrammetric model, previously oriented, obtaining a unified cloud (Fig. 7); as well as the generation, based on the previous data, of a textured three-dimensional model of the building that served to obtain orthophotos of the different façades and interior spaces in their current state (Fig. 8 and 9). Lastly, as a final product of the architectural survey of the building, based on a combination of the complete point cloud and the orthophotos obtained, a three-dimensional model of the building was developed using software based on BIM technology, which allowed to obtain and edit the projections of all the floor plan, elevation and section views necessary for their exhaustive description (Fig. 10).

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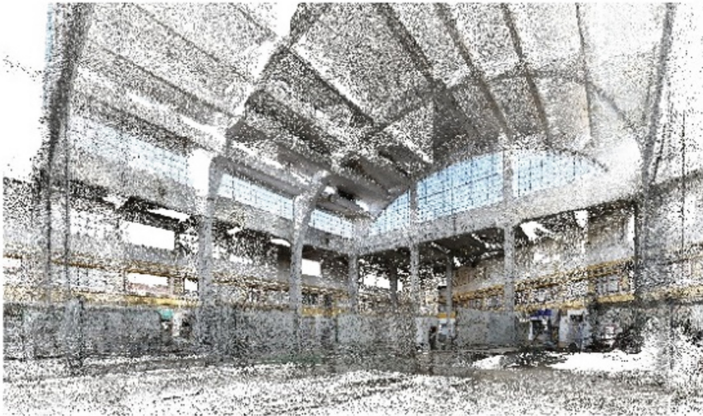


Fig. 7. Final photogrammetric capture. Point cloud perspective view captured. Author: Roque Angulo Fornos (2015).



Fig. 8. Final photogrammetric capture. Orthophoto of the cross-section through the central space. Author: Roque Angulo Fornos (2015).



Fig. 9. Final photogrammetric capture. Orthophoto of the longitudinal section through the central space. Author: Roque Angulo Fornos (2015).



Fig. 10. Final photogrammetric capture. Orthophoto of the main façade. Author: Roque Angulo Fornos (2015).

Once this exact survey was obtained, it was proposed to reconstruct the structure in a mimetic way, although with a different concrete from the original one, which would be much more resistant to the structural needs of the building, fulfilling the requirements in case of earthquake and the durability conditions. This action coincides with that indicated by Campoy, since the materiality would be “subordinated to the merely accidental, subject to the passage of time and subject to particularities offered by the technique at the time. According to this hypothesis, its construction techniques can be reviewed and replaced or modified when it has dysfunctions, as long as its conceptual value remains intact” (Campoy Pérez 2011).

The result was that the competent bodies approved the substitution intervention, considering the special circumstances mentioned in this information. This is a model procedure, in that the architects presented an anomalous situation regarding traditional heritage, which is understood and accepted by both local and regional control bodies as a way of guaranteeing the survival of a building of such architectural value.

5 Conclusion

Architectural survey has traditionally been linked to a type of heritage from historical stages prior to 20th century architecture. However, in certain cases of irreversible collapse, surveying becomes a suitable method for the reconstruction of elements of the International Style that show serious structural pathologies.

In these cases of extreme structural collapse, and not in other cases, the accuracy of a survey based on techniques such as photogrammetry or laser scanning offer enough guarantee to provide the necessary accuracy to develop a mimetic reconstruction of the building.

This reconstruction must be based on multidisciplinary research, as indicated in the Document of Madrid, and in which the architectural survey becomes an essential element, not as a description of the building, but as a means to ensure the reliable reconstruction of collapsed parts of a building when no other option is possible.

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