MATERIAL CONSERVATION AND LEGIBILITY: THE DOUBLE AIM OF THE ARCHAEOLOGICAL STRUCTURAL INTERVENTION.

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SUMMARY

The restoration of the archaeological examples examined, in particular the *lacunae* reintegration, not only protects the internal nucleus and reconstructs the original architectural image of the monument structure, but also allows its proper consolidation. The structural intervention guarantees the material conservation of the architectural object and at the same time, is an opportunity to rediscover the original architectonic meaning of the building, while realising the main objective of the restoration process.

1. THE *SEVERIANO AMPHITHEATRE* OF ALBANO (ROME)

The Severiano Amphitheatre of Albano is a large elliptical structure built in the first decades of the III c. A.D. by the Second Partic Legion.
It was partially excavated directly from the rock and built with layered stone arches which probably would have reached a height of 22 metres. Before being restored little remained of the original structure and it was in a poor and unstable condition.
The high level of degradation, especially in the crown of some vaults,

Figure1: The amphitheatre before the restoration.

resulted in many walls remaining unsupported. This meant that they risked collapsing in the event of seismic activity. Moreover there were some part of concrete (*opus*) not contrasted by the lateral forces of the vaults. To stabilise these ruins two solutions existed. The first of these was to build a steel structure to link the different parts, the alternative was to reintegrate the masonry arches. We opted for the second solution as it allowed us to restore legibility to the archaeological text. As a result, it is easier for visitors to understand the architectonic significance of the remaining structures.
With the help of the archaeologist of the *Soprintendenza*, we conducted a survey of the masonry, trying to understand the techniques engaged in, the materials used and the thickness of original walls.
With this information we were able to design[1] a reintegration which concentrated on both the structural requirements and reconstruction aspects. We engaged in traditional techniques as accurately as possible but did not carry out an integral reconstruction as it would have been excessive due to the high level of decay.
We also tried to conform the new parts so as not to hide the relevant archaeological evidence that existed in the concrete *nucleus.*

Figure 2: Partial reconstruction of the vaults.

Figure 3: Vault's frontal prospect.

The reintegration of the arches meant the structure retained its *original static functionality* which for centuries guaranteed its stability and this also represented an original *value* that had to be preserved exactly as its material components.
The use of original techniques and materials also guaranteed the durability and longevity of the monument as they are totally chemically compatible with the ancient materials. Furthermore, conducting the work in this way meant that, should the structure need to be dismantled in the future no problems would be experienced. This is another reason why we avoided using modern concrete due to its great adhesiveness.

2. THE *CELLOMAIO BATHS* IN ALBANO (ROMA)

In the Cellomaio Baths the situation was dangerous because of some deep *lacunae* in the crown and in the haunch of an 8 metre wide arch constructed of roman bricks. However, the problem was to execute the reintegration while maintaining perfect cohesion between the new and

Figure 4: The arch before the reintegration.

Figure 5: the arch after the reintegration.

original parts, also to preserve its structural continuity and original static function. We tried to do this by minimising the use of internal or external steel elements[2].
The wedge shape of the *lacune* in the crown prevent the reintegration sliding downwards. Lateral detachment is prevented by the insertion of specially shaped brick pegs inside the original nucleus to hold the two parts together. We managed, therefore to maintain perfect structural continuity between the original and the new part without using metal components. In some parts of the haunches, where the reintegration was too thin to be shored-up by the simple contrast between the bricks, it was necessary to hold it in place by using thin stainless steel bars. This again allowed us to retain the original static functionality of the structure and has allowed us to re-establish its original architectonic image. This demonstrates how important the strict connection between the image and the structure was for the ancient roman contractors and so how important it is now that the structural reintegration is designed rediscovering the original architectonic image.

3. STRUCTURAL MEASURES UNDER THE S.CLEMENTE BASILICA OF ROME (NOT REALISED)

In 1996 archaeologists found a very important large paleo-Christian baptisimal font. It was decorated internally with strips of fine marble and had a very unusual hexagonal shape. The problem was that it was buried under the foundations of an important structural wall of a four storey convent of the XVIII c. The wall was situated in a large room with an apse above which, on the first floor was, on one side, a tunnel vault. Furthermore, adjacent to this wall there was a marble column that was originally located exactly in the centre of a wide room built around the XII or XIII c. covered with four (only two remain) identical groin vaults. This situation was very complex due to structural, architectonic and museological reasons.
The structural problem was to find a way to support the wall and the column, so that the font could be excavated, which until then had only been reached by some small excavations.
Apart from difficulties relating to static problems (such as the length of the wall and the existence of delicate masonry walls rich in historical evidence), the complexity of the operation was due to the overlaid structure of different historical periods (ancient, medieval, late-baroque).

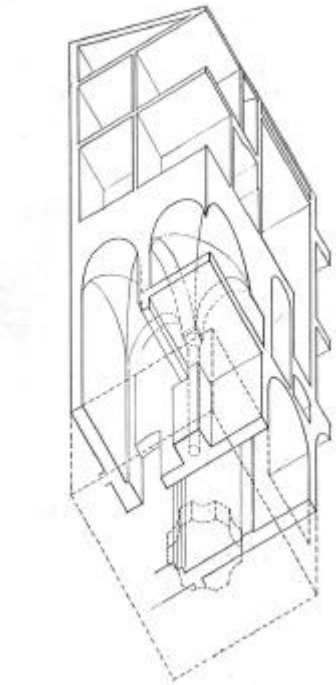

Figure 6: Scheme of the situation before the intervention.

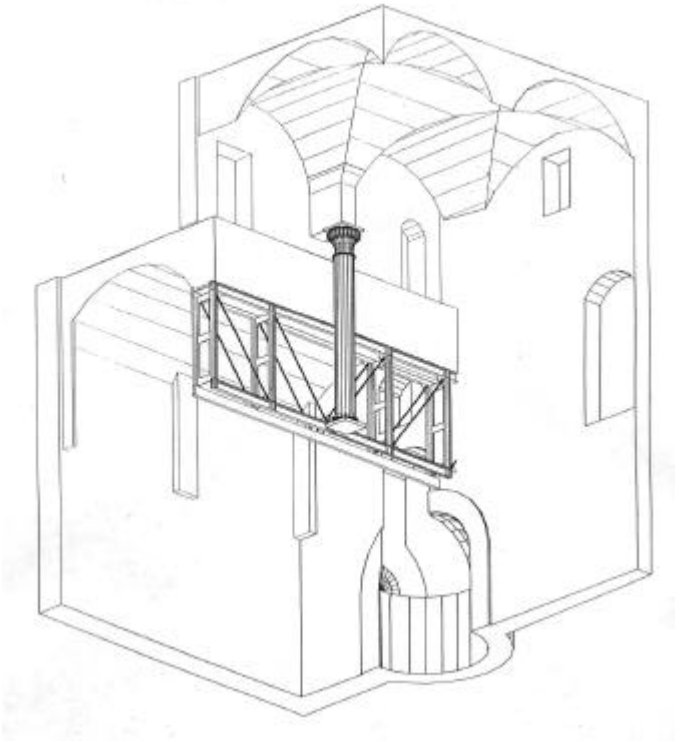

Figure 7: Partial scheme of our proposals. (graphic design by C. Carbone)

The aim was to find a structural solution that would allow the different ages of the overlaid masonry structure to be read easily, bearing in mind that the lower level would have to be displayed to the public as a pleasant, tidy and interesting architectonic image.
The active debate between the people involved in this project focussed, above all, on the reconstruction of the column room floor at the column base level. In our opinion, the complete reconstruction would result in an architectonic space at the level of the basin room that was too small.

Figure 8:Rendering of our proposal (C.Carbone).

Our suggestion [3] was to support the wall on a high stainless steel truss that would leave the column behind it visible. We proposed to reconstruct only the half floor on the slab side where there was the column. The idea was to support the column on two transversal steel beams. This solution would have enabled us to carry out the work successfully, by highlighting the new structure and demonstrating the artifice of supporting a wall to allow the excavation underneath it.

The final realisation was different due to the death of prof. Antonino Giuffrè in November 1997 and prevailing different opinion about the solution.

4. THE *ARCHITECTS' HOUSE* IN HADRIAN'S VILLA (TIVOLI)

This intervention[4] is characterised by the high level of reversibility that is obtained by positioning the reinforcing structures upon the original walls. This method is usually difficult to follow as it changes the image of the structure. However, in this case it was permissible as an extra level existed on the original structure, as was discovered in a historical investigation.

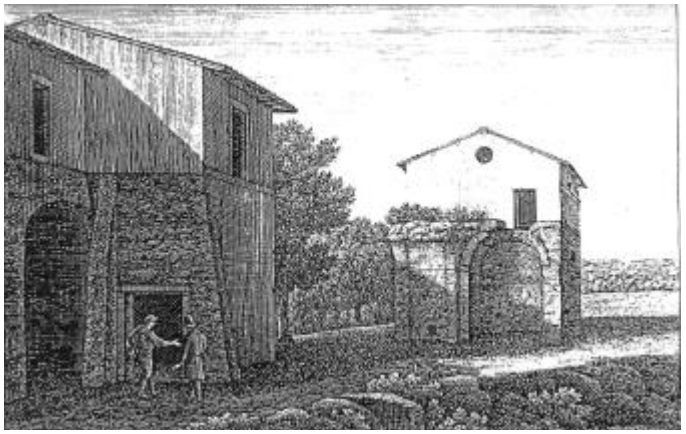

Figure 9: Picture drawn by G. Ristori Gabrielli in 1770.

The observation of the walls and the evidence found rivalled that of Hadrian's time there had already been an additional level over the existing vaults. Moreover archive documents prove that, more recently, there was a room on the first floor, it no longer exists but probably dated back to the XVIII c.

On a side of the Villa plans, drawn in 1770 by Giovanni Ristori Gabrielli[5], there are some pictures. One of these represents the building that we examined. It has another room over which there is a double pitch roof. In the XIX c. this room was occupied by some Danish architects and was used as an office to draw pictures of the Villa. This is the reason for the current denomination of this structure.

The existence of vertical cracks, especially in the corners, were dangerous due to the horizontal forces exerted by the ceiling tunnel volts.

Therefore, it was necessary to adopt measures that would, in the event of seismic activity, prevent the outward collapse of the walls.

The usual solution in these situations is the insertion of tie bars at the spring line level of the volts. This solution would have involved the drilling of six perforation troughs in the original walls to locate three steel tie bars blocked at the external side of the walls.

However, due to the history of the building an alternative solution was found. Considering that the building had at one time been a level higher, we decided to partially reconstruct the external walls to a height of about one metre. Inserting inside the reconstruction a longitudinal steel bar to allow a circular tie at the top level of the building. This solution meant that the original masonry, despite the addition of the structural measures remained unaltered. Furthermore, this also resulted in giving a suggestion of the original form, when the upper level still existed. This visual suggestion helps to give *legibility* back to a incomplete formal context that was hardly comprehensible but without the need for carrying out a total reconstruc-tion.

This structural restoration has to be considered compatible with the original construction technique for a number of different reasons. Firstly, from a *philological* point of view because the new walls have been constructed from the same material as the original ones. Secondly,

Figure 10: The building after structural restoration.

from a *mechanical* point of view because the added structure has the same degree of stiffness as the original masonry. Thirdly, from a *formal* and *symbolic* point of view for the reason that we have already mentioned but especially for the *reversibility*. In fact, the additions stabilise the walls of the ancient structure performing its containing action due to the friction with the underlay masonry. This balances the horizontal forces produced by the vaults and any possible seismic action. The result is obtained without the need for steel bars in perforations.

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[1] Structural design given to arch. C.Tocci, who has collaborated on the compilation of this text, and arch. G. Manieri Elia. The general project of restoration was given to arch. M. Silvestri by the *Comune di Albano* and has been supervised by the *Soprintendenza archeologica per il Lazio* and in particular by arch. S. Gizzi, archaeologist G. Ghini, and geom. I. Galli.

[2] Restoration design given to arch. M.Silvestri by the *Comune di Albano*. It has been supervised by the *Soprintendenza Archeologica per il Lazio* and in particular by arch. S. Gizzi, arcaeologist G. Ghini and geom. I. Galli.

[3] Structural design given to ing. A.Giuffrè by the *Soprintendenza Archeologica di Roma*, structural survey and stress analysis given to arch. C. Carocci. Collaboration on the design and the structural survey by arch. C. Tocci and arch. G. Manieri Elia.

[4] The structural design of the "Architects' House" is by arch. Cesare Tocci, arch. Giovanni Manieri Elia and Mss Margherita Giuffrè with the supervision of ing. Antonino Giuffrè. The general restoration design was carried out by the Soprintendenza Archeologica per il Lazio. The works were directed by arch. M. Lolli Ghetti, arch. S. Gizzi and archaeologist R. Righi.

[5] G. Ristori Gabbrielli, *Pianta e misura della possessione spettante al Conte Fede … posta nel territorio di Tivoli, nella quale si ritrovano diverse antiche fabbriche, e rovine della celebre Villa Adriana*, Rome 1770.