1. ABSTRACT

The monastery of Santa Maria della Sanità in Naples, also called San Vincenzo, with its unique elliptical cloisters was built in the 17th century by the Neapolitan architect Fra' Nuvolo. In 1807 a bridge was built over the monastery which necessitated the demolition of three of the sixteen vaults and columns to accommodate the massive masonry piers that were required to support the new structure.

The Soprintendenza per i Beni Ambientali e Architettonici di Napoli e Provincia is now engaged in the restoration of the monastery. Having planned to rebuild the destroyed structures, a decision was made not to use reinforced concrete, but to utilise materials as close as possible to the original ones, thereby obtaining similar structural characteristics and respecting the ancient fabric of the building.

The operation was particularly delicate due to the presence of rare frescoes on the remaining walls and vaults, chiaroscuro works of the 17th century.

The columns were built in tufo, a Neapolitan stone of volcanic origin, and layers of bricks; the vaults entirely in tufo. Because of the elliptical form of the cloisters, the geometry of the vaults is particularly unusual: a trapezoidal perimeter with two curved sides. Every section has a unique arch and every vault also differs from the adjacent one.

2. HISTORICAL NOTES

The Monastery of Santa Maria della Sanità in Naples was founded by the Dominican Order in the 16th century. It was built on a site traditionally used for burials.

In 1569 a cave was discovered, later identified as the catacomb of Saint Gaudioso, a bishop who died in Naples in 492. The land was then granted to the Dominican Fathers and became the site of the church and convent, taking their name from the healthy climate of the area.

The complex was designed by Giuseppe Donzelli, the Dominican brother Frà Nuvolo. Construction began in 1602.

The original monastery was considerably larger than it is now. There are many archival sources which document the changes that have taken place over the years. It is possible to appreciate the former extent of the monastic settlement by reference to a drawing copied in 1714 by the Dominican Friar A. Majorino, from the original plan.
The convent included several orchards and gardens, and was arranged on two separate levels. The upper section was reserved for the functions more closely related to monastic life; down below were the church with the steeple, the sacristy, the cloisters and the Spetiaria (pharmacy). The church has a central plan, a Greek cross with barrel vaults, at the centre of which is the high, majolica-tiled, dome.

The plan of the oval cloisters adjacent to the church follows precisely the same geometrical structure as one of the graphic systems included by Serlio in the first book of De Architettura: the plan is polycentric rather than elliptical, with the centres of the arches laid out along two equilateral triangles with one joint side, corresponding to the longer axis of the oval.

It is questionable whether Frà Nuvolo had access to the Trattato by Sebastiano Serlio, first published in Latin in 1537, but he was certainly in contact with contemporary architects, and well informed on architectural developments. Rare frescoes decorate the vaults and the walls of the elliptical cloisters. They were made in the 17th century by Federico Di Pino with a special technique, graffi, created by scratching a white surface laid on a black one to obtain a chiaroscuro effect.

From 1807, Giuseppe Bonaparte began to abolish religious orders. Records relating to the convent accounts cease abruptly on the 18th January 1808. The construction work for a new road linking the two royal palaces of Naples, known initially as Corso Napoleone, then Nuova strada Capodimonte and called today Corso Amedeo di Savoia, had already started in 1807. When the power of the monastic orders was wiped out, it became possible to plan and carry out the project that caused the destruction of the oval cloisters and the demolition of most of the convent. The rectangular cloisters and the whole northern side were demolished, whilst on the south side the monks' dormitory was reduced to 36 cells. The huge rectangular columns made of tufo that hold up the bridge of Sanità were built in the beautiful oval cloisters, and part of the crossed vaults were demolished.

3. THE RESTORATION OPTION
The Soprintendenza per i Beni Ambientali e Architettonici di Napoli e Provincia is now engaged in the restoration of the monastery.

The decline of the monument began with the construction of the bridge in 1807, requiring the demolition of the entire upper part of the monastery; the cloisters and other halls were invaded by the huge masonry piers. In more recent times the monument has suffered from indiscriminate alterations, totally out of keeping with its prestige, such as cheap annexes built on to the upper level and the replacement of original materials with others of inferior quality.

In the sixties a very poor rectangular building one floor high was built under the level of the demolished vaults on the western side. The curved decorated wall was hidden, and a toilet was installed in one of the niches surmounted by plaster shells so further compromising the view of the unique elliptical area of the cloisters. It was clearly impossible to demolish the bridge; a more feasible option was to undertake a correct restoration that would remove all the extraneous elements and rebuild the original ones the presence of which could be ascertained beyond doubt.

As far as we can tell, it has been a long time since a new masonry vault was been built in our city. In the field of architectural restoration there are many objection to rebuilding
old structures, partly because of the risk of recreating something "false", partly due to
the technical difficulties involved.
It is a common belief that there are no longer any craftsmen able to carry out such work.

In the case of S. Maria della Sanità there were no doubts about the previous structure of
the monument: we have historical records about its destruction as well as old drawings
and plans, so there was little risk of "inventing" the old building. Moreover the symmetry
of the plan gave us a clear guideline.

Having planned to rebuild the destroyed structures, a decision was made not to use
reinforced concrete but to use materials as close as possible to the original ones, thereby
obtaining similar structural characteristics and respecting the 17th century fabric of the
building.

After the November 1980 earthquake the Soprintendenza per i Beni Ambientali e
Architettonici di Salerno e Avellino has carried out experimental work with vaulted
structures in the earthquake-stricken region of Southern Italy, amply demonstrating their
seismic behaviour and resistance. The experiments are now being undertaken by the
Soprintendenza per i Beni Ambientali e Architettonici di Napoli e Prov., with a
project, that is carried on at present to test the behaviour of vaulted structures under
simulated seismic forces. The project involves the construction of 1:1 models whose
movements will be measured.
The use of vaulted structures in a seismic area is no longer a taboo: their resistance has
been empirically demonstrated by their survival of several earthquakes and disasters and
is now supported by scientific arguments. We have discovered that our craftsmen still
have the skill to build them: the time had come to undertake the reconstruction of the
vaults, and it was much less difficult than we imagined.

4. THE RECONSTRUCTION

The section of the cloisters that was destroyed is close to the large piers that support the
bridge. We can deduce that in 1807 it was found necessary to demolish three arcades of
the cloister in order to build the foundations for the bridge.
We have made exploratory excavations in this area and have found traces of the
foundation plinth of two columns, with the foundations of the bridge support going much
deeper.

Because of the pseudo-elliptical form of the cloisters, the geometry of the vaults is
particularly unusual: the plan of each vault is a trapezium with two curved sides; in
elevation every section has a different arch because of the increasing length of its chord.
In addition, every vault differs from the adjacent one, as they are not identical segments
of a circle.

The columns have a square base, with two opposite sides slightly curved, and are smaller
than the half columns protruding from the perimetral wall, both being radial to the
centre of the ellipse. The arch which links them has a trapezoidal plan.
Thanks to the quadrisymmetry of the plan, it was possible to establish precisely the
position of the columns, which was confirmed eventually by excavation.

The columns have been built in tufo, the traditional material of Neapolitan masonry,
used in the the rest of the cloisters. They have been built with alternate layers of tufo and
bricks, to make them more solid and aseismic. The layer of mortar was as thin as possible. The vaults have been built entirely in tufo.

During the reconstruction work, arches and vaults were held up by wooden frames covered with layers of MDF to support the blocks until completion of the structure. The layer of mortar was as thin as possible. The vaults have been built entirely in tufo.

The standard size of today's Neapolitan tufo block is 400 x 250 x 120 mm; the original stones were more irregular, but in our opinion it was not necessary to reproduce uneven size of the stones.

The thickness of the arches (25 cm) does not vary, while the vaults are thinner in the centre (20 cm) and thicker at the imposta (45 cm). The dimensions were chosen empirically at first by measuring the existing structures, and were subsequently verified by calculation.

We have calculated by the Hayman method that the load bearing capacity of this structure is not more than 30 or 40 N/mm², which is standard for a vaulted structure.

Tufo is a volcanic stone with poor structural and weathering capacity, calculated at around 500 N/mm². It should be remembered that our structure is not made by a monolithic stone, but of many stones assembled together. On the basis of other experiments we are carrying out concurrently we can assume a safety level of 20 for tufo masonry.

Since there were some partially collapsed vaults, it was possible to study the way the structural fabric of the vault and the position of the stones without damaging anything. As you know, cross vaults can be laid in different ways: in lines parallel to the perimetral arches, or perpendicular to the diagonals and so on. Our vaults were found to be organized in the way we show in the picture, and we followed this method faithfully.

The connection with the existing walls was made without excavating we filled the old lines when existing or simply joined the new stones to the old with the mortar. The connection with the existing vaults was made in the same way but made more difficult due to the presence of the presence on the remaining walls and vaults of rare frescoes. To complete the work, the bases of the columns have been lined with thick slabs of basalto, a black stone similar to the original piperno that is no longer available. All the mouldings and the cornices of base and top have been faithfully reproduced, but there are always slight differences that make it clear it is a reconstruction.

The capitals with angel faces looking towards the centre of the cloisters have been reproduced in black cement, taking a rubber cast from one of the better preserved originals as it would have been too expensive to have them carved in stone. However the result is so similar to the original that it is a pity they are almost completely hidden by the bridge.

The frescos have been consolidated and cleaned. The restoration of the frescoes will be completed at the same time as the rest of the cloisters.

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**PARTICOLARE DEL PILASTRO 1:10**

**1° ricorso**

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**Dimensioni:**
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- 2° e 3° ricorso: 65 x 85
- PROSPETTO: 85 x 85