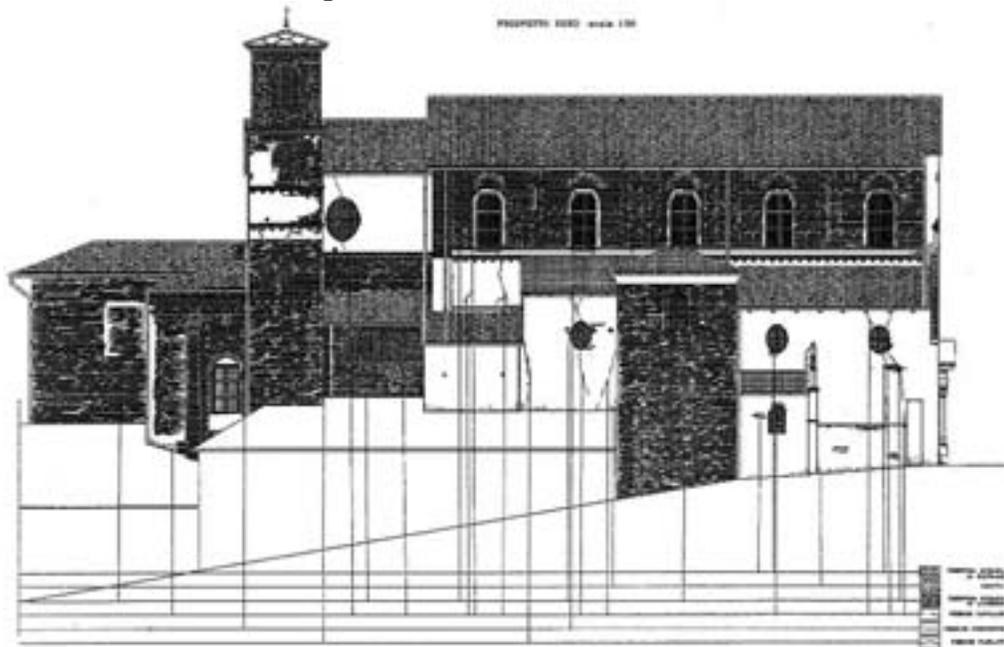


Analysis of the structural and architectural damages and hypothesis of reinforcement of the church S.Bernardino in Saluzzo, Italy

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The study carried out on the church of S.Bernardino in Saluzzo is essentially divided in 4 work sessions: the historical research, the exact measurements of the building, the checking calculation of the vault structures and of the vertical walls, the hypothesis of reinforcement based on the analysis of the chink situation and on the possible causes of the damages.



THE BUILDING

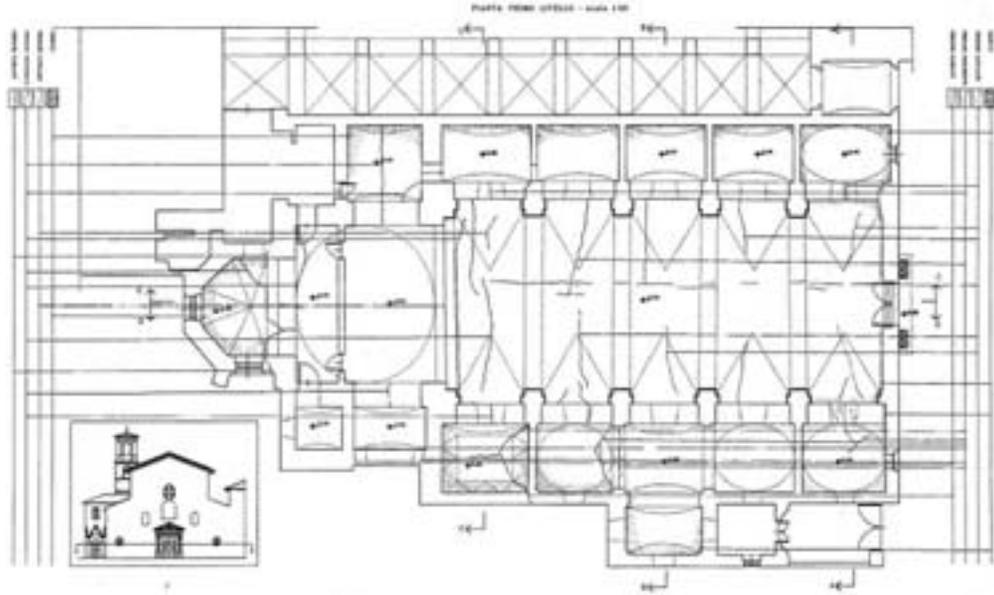
The principal body of the church consists of a nave, having sizes 10 x 22 x height 13,5 m. , divided in 5 spans covered by barrel vaults separated by wide arches; against the central nave are built the presbytery and the apse on the eastern side , and two aisles on the southern and northern sides, each of them divided in five vault chapels.

The inside wall surfaces which once were almost completely painted in fresco or handled in a monochromatic painting are presently much damaged owing to the capillary humidity coming up.

The apse choir is particularly involved in this damage situation.

THE HISTORICAL DOCUMENTATION

It was collected taking as references the tests of the local chroniciers (Muletti and Savio) as well as the evidences written in the Church Ledger. The facts which probably influenced mostly the static conditions of the church are: - the further elevation of the central nave in 1753, which caused a considerable increase of the loads on all the walls and on the ground; - the earthquake which shook the hill of Saluzzo in the thirties of '900.



THE EXACT MEASUREMENTS OF THE ARCHITECTONICAL AND STRUCTURAL DAMAGES

The damage types are essentially synthesized in:

- passing-through chinkes;
- advanced chinkes;
- capillary chinkes;
- humidity

(types specified on the graphic tables as explanation legenda of the damages)

The barrel vaults of the five spans which make up the central nave and particularly the last two spans against the presbitero, have some advanced cracks in key, perpendicular to their directrix, whereas some capillary cracks are found parallel to the same directrix still corresponding to the keystone

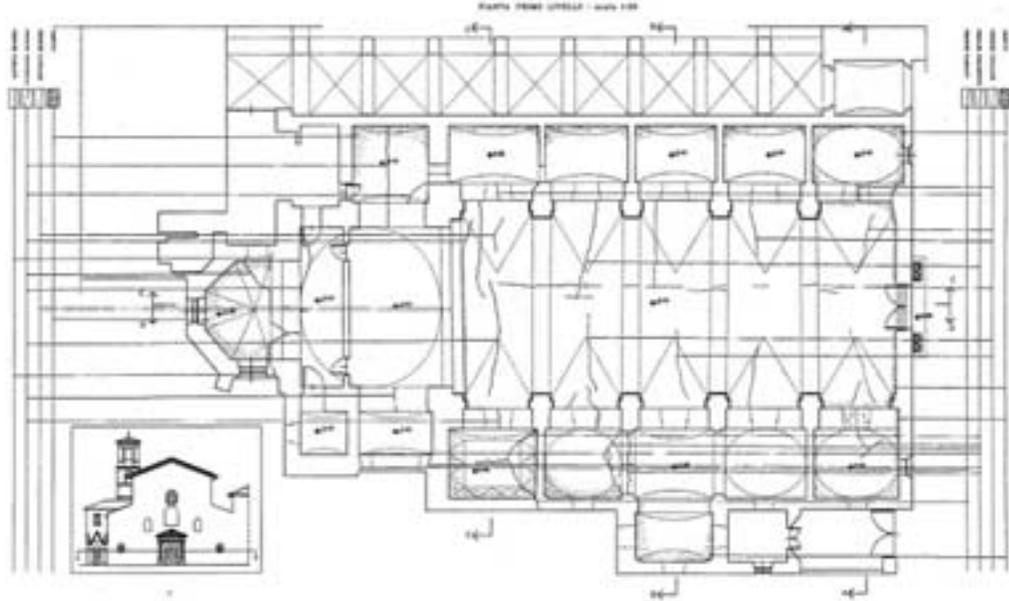
The walls present advanced and capillary cracks having mostly vertical and 45° direction on both sides of the central nave.

The first two side chapels ,both on northern and on southern sides, present only some capillary cracks of small sizes; the third chapel on the northern side, besides having a wide humidity situation, presents advanced cracks, particularly corresponding to the key and the directrix of the arch which divides this chapel from the next one.

The presbitero chapels present advanced cracks corresponding to the keystone parallel to the directrix of the same.

The apse is damaged by passing-through and advanced cracks, which follow the direction of the ribs of the (umbrella) vault in the contacting side between the transept and the apse self.

The chink situation coming out shows clearly that the cause of the structural modifications is principally



THE STRUCTURAL CHECKING

The vault structures were checked through the MERY methods.

A further checking was the calculation of the sliding rock ground, on which the church is placed, so that it is possible to evaluate the influence of the hill gradient on the depth horizontal movements, which cause the damage.

Of the greatest importance were the geological analyses of the development plan of Saluzzo, from which results that the ground is clayey with some "scisti" rock strata in the depth: these characteristics enable, in the unloading foundation zones, some modifications due principally to horizontal movements, which are made worse by infiltrations from a very superficial water layer

HYPOTHESIS OF REINFORCEMENT

On the basis of the analysed data, were considered the structures for a suitable evaluation of the safety stage in the present conditions and the most suitable actions to give the necessary stability conditions to the building, respecting the previous static solutions.

The reinforcement actions planned are essentially :

- the repair of the passing-through cracks by means of reinforced concrete
- the reinforcement of the foundations by means of microsupports (micropoles), which overpassing the clayey strata on which the foundations selves are placed, may reach a depth suitable to secure the bulding stability.

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