

STUDY OF STRUCTURAL INTERVENTIONS AND CHANGES AFFECTED ALTAMURA CATHEDRAL (XIII CENTURY) BY MEANS OF DIGITAL PHOTOGRAMMETRIC TECHNIQUES

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Abstract

The paper deals with the use of survey techniques applied on monumental buildings, based on the digital elaboration of images. The simplification of survey procedures and of the graphic restitution widens the application sector on field in which the traditional graphic survey and the classical photogrammetry itself, have been showing, since a long time, their limits in connection with the new documentation demands and with the needs of survey required, by the developments of the theory and practice of refurbishment. In fact, such survey technique offers to the technicians the possibility to carry out the complete analysis of the building by using the straightened image or it as a work support.

An interesting application is the one we find in the field of buildings structural analysis, where it is possible to read the numerous traces which are present on the masonry structures and which refer to the transformations the building underwent during its history, by means of the direct study of the image. Results of the application of the above mentioned techniques to the case of the Cathedral of Altamura (XIII century) are here explained. The building which was set up since 1232, for Fenderico's II of Svevia will, has undergone breakdowns, demolitions and widenings, during its existence, that have deeply modified its native shape. The study of the masonry walls by means of straitened digital images, joint to the data gathered by non-destructive surveys has permitted to widen the knowledge of the building and to put an unbiased referring point between the contrasting thesis about its initial spatial configuration.

1. Introduction

The Cathedral of Altamura, whose construction started in 1232, on Frederick II from Svevia will, has been the object of several studies aiming at defining its originary shape.

The building, as it is today, seems to be composed of two main parts: three medieval naves and the Renaissance choir (transept).

Also the researchers who have recently studied S. Maria Cathedral in Altamura, have taken sides with two main hypothesis, which are both supported by good arguments.

The former and the most ancient one was introduced by local researchers at the end of the last century. It is based on the idea that the originary façade of the cathedral was oriented towards the West and that its overturning, together with the shifting of the rose window and the massive portal, took place in the Renaissance period in order to allow the construction of the present choir.

The latter hypothesis is based on the argument that the cathedral have had the present orientation, with the façade towards East, since it was founded. In the Renaissance period a new choir was added to the building in place of the medieval one because it had become too little for the functions of "Great Collegiate" Church to which it was elevated by Pope Innocenzo VIII in 1485.

Briefly, these are the two hypothesis which, although based on written historical documents and direct verifications on the building, are not totally satisfactory because of some problems and incoherences which both of them do not solve.

The present paper goes through all the previous studies, stressing all the proofs provided by the researchers until now, and giving them a different and more coherent organisation. Moreover, it traces a third, perhaps more convincing hypothesis supported by the analysis of the masonry structure of the building, which has been made by means of a digital photogrammetric survey of the Eastern façade. In fact, this is the side on which the interventions and transformations occurred in the last centuries are more evident.

2. The cathedral of Frederick II

The construction of the building started in 1232 (as it has already been said) inside the walls of the town of Altamura that the emperor Frederick II wanted to found and populate again.

It was presumably finished between 1269 and 1274 (Bozzoni¹), when the cathedral was dedicated by the archpriest Nicola from Catamarra.

Written documents about works in the cathedral refer to years 1301, 1302, 1304 and 1308.

But it is important to dwell upon January 29th 1316, as a relevant date because, on the basis of the following considerations, it must be taken as a

referring point to apprehend the configuration that the cathedral assumed in the Angioin period (XIV century).

In that year a serious disaster happened, this event is reminded on an inscribed stone tablet put above the lateral North portal which was reconstructed by Consiglio's sons from Bitonto. This tablet recalls the collapse of the cathedral, probably damaged by a violent earthquake.

The damages that the building really underwent, can be easily found in the descriptions contained in the payment documents, stored in the capitular archive. These documents refer to the refurbishment interventions made on the church which began in 1851, under the design by Federico Travaglini, an architect from Naples.

Considering these written documents "it can be argued a spread and general crush of both the elevating systems together with a rotation trend" (Civita²).

In fact the masonry structures above the barrel vaults which allowed the entrance into the Renaissance choir were generally damaged and the pillar situated on the left side supporting one of the two arches, delimiting the presbytery, was in a serious static crush "on the most of his height" (Civita³). This was the reason why it was almost totally reconstructed.

Moreover, after the getting off of the plaster covering the vaults in the side naves, several masonry damages became visible with all their extension and depth. Whereas, the arches delimiting the spans were all damaged in the area around the keystones, so that it was necessary the use of iron wedges in order to reset the stones. Moreover, there was a spread disconnection among the joints of the external walls.

The static equilibrium of the structures which got worse as the centuries went by, needed, as an intervention of strengthening, the completion of the lateral wind bracing. It was carried out by constructing the middle arch and by reconstructing the one placed at the entrance of the presbytery, whose height was elevated up to reach the other two.

This intervention is testified by a graphical survey made by W. Schulz in 1830, before the transformations that occurred in the second half of XVIII century, apart from the written documents.

Therefore in 1316 the building underwent very serious damages, and in order to find a remedy it was executed a massive intervention of consolidation on that part of the building which was still recoverable.

The knowledge of these coordinates allowed the "geo-referring" of the images, so that at the end of data elaboration they became straightened and in the right graphic scale.

Later it has been made the vectorialisation of the images using a selective method, that is to say only the wall parts subject to damages, sews, alterations and rearrangements were drawn in detail. The graphic restitution of decorations, sculptures and wall parts with an homogeneous texture was limited to the essential signs.

4. Analysis of results

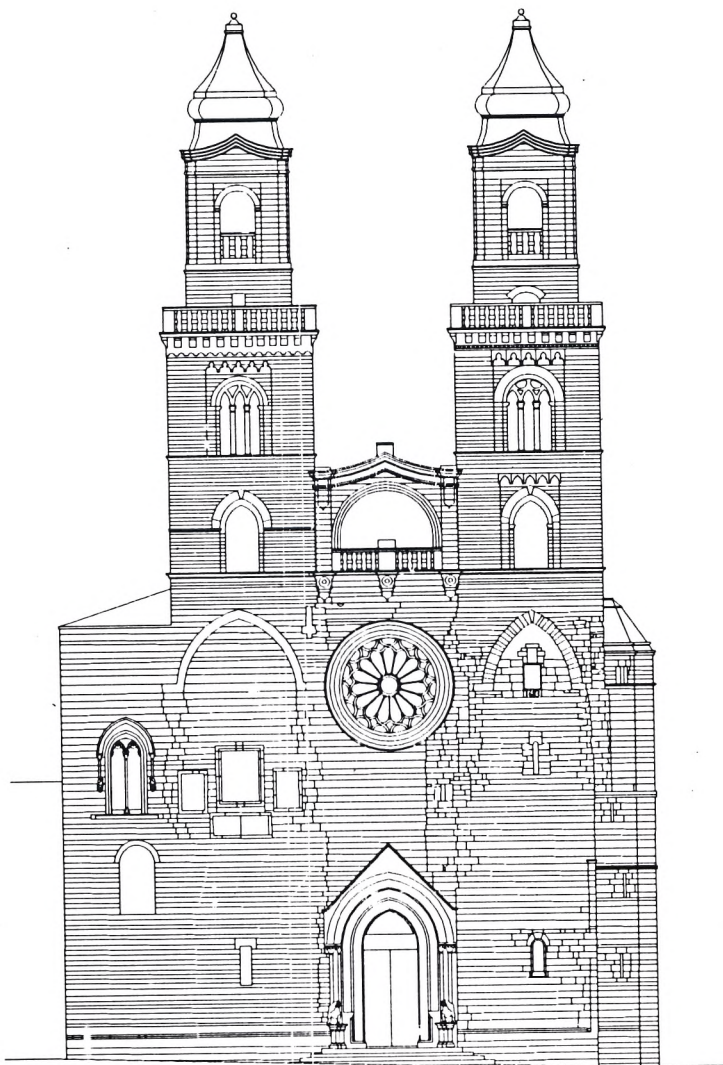
The analysis of the façade, carried out by means of a photogrammetric survey, has allowed a global and at the same time detailed reading of the wall structure. Whereas it would not be possible to get to the same result by a direct observation of the building because of its dimensions (fig.3).

This façade seems to be the result of several transformations and refurbishment interventions executed by means of the combination of different wall textures and changes in materials between calcareous stones and tufa.

The lower part of the façade, made of blocks of calcareous stones, is homogeneous up to 9,50 mt. in height starting from the road level. Moreover in the basement part it is possible to notice a recycled moulding decoration, a pilaster situated in the North-East corner and fragments of bases of such pilasters (fig. 3a). All these elements were parts of a wall decoration which is now almost totally lost.⁵ Today this area is all that remains of the façade rebuilt after 1316.

The wall portions placed on the left, on the right and above the XIV century portal are the only elements of discontinuity in this lower part. They clearly show the signs of a sewing up of the wall structure, probably caused by the subsequent insertion of the present portal. (D'Elia⁶). This discontinuity in the wall structure can be so explained: it was caused by the need of inserting a portal with form and dimensions which had not been planned in the previous design of the Cathedral rebuilding.

Furthermore, the survey has shown that the upper part of the façade mostly belongs to the XVI century, when it was decided to enrich the building with two bells towers and a rose-window.



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Fig. 3

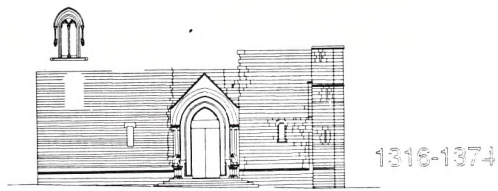


fig.3a

1316-1374



fig.3b

1500

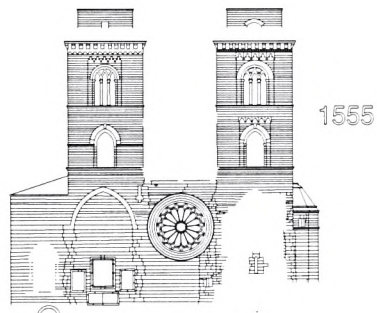
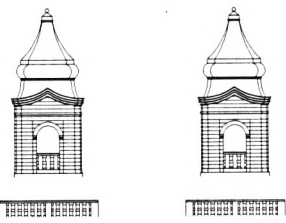


fig.3c

1553



1729



fig.3d

In fact the construction of the bells tower in Romanesque style, situated in the North-West corner, is documented in the XVI century (Santoro⁷). The tower underwent several restoration interventions because of static problems, until it fell down on May 17th 1523⁸. The rebuilding works finished on August 30th 1524⁹ (photo n°2, fig. 3b).

The remains of this bells tower are still visible in the façade for 19,50 mt. in height starting from the road level. The corner blocks and the discharging arch are perfectly readable. The arch was built in order to optimise the distribution of the loads on the wall underneath and to move the loads away from the central part which is weaker than the others because of the presence of mullioned windows with one light.

Subsequently it was decided to reshape the façade and devised a solution which allowed to point out its monumentality.

Therefore two twin bells towers and a rose-window were built. News about the design of the present towers by *Magister Rogerio* are

contained in a written document dated: May 31st 1554. The bell tower on the right, facing the square, is built on the residual parts of the previous one. By the survey it has been possible to notice the presence of frequent lateral stones added in order to enlarge the section which interrupt the line of corner blocks of the previous structure. Moreover it has been noticed the masonry wall superimposed upon the upper part of the existing stairs little tower.

The central and the left part of the façade were mostly rebuilt using tufa blocks.

In the upper area of the façade the residual traces of the Middle Age were completely upset with the moving of a central mullioned window with two lights to the left part, which is its present position. This change was made in the XVI century in order to put in that central position the great rose-window (fig.3c).

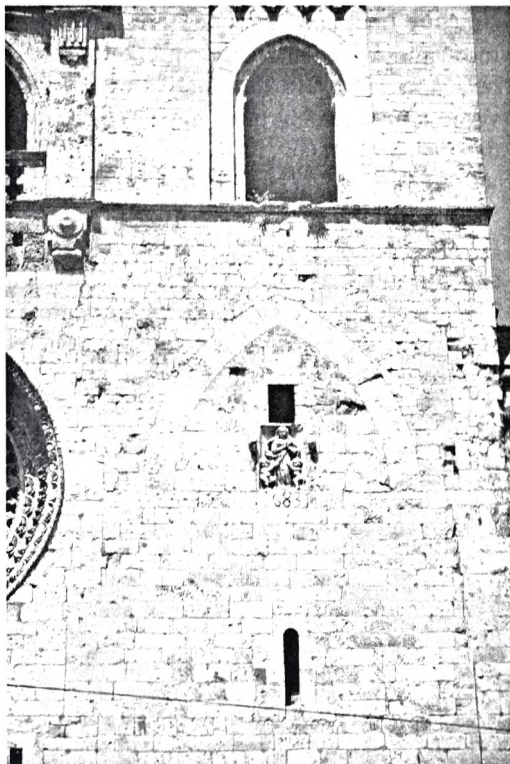


photo 2

Whereas on the left part the second bells tower was built, and a discharging arch was made, because of the same static reasons of the previous one.

In 1729 St. Mary shrine and the storeys built on the two bells tower followed the XVI century intervention, as the style and the different grey stones used clearly show. The overcharges added have made the existing underlying structure undergo unplanned pressions, which caused the cracks around the rose-window and an intervention of unsew-sew of the wall underneath the left bells tower. In the tufa wall are inserted calcareous stones blocks whose vertical arrangement takes again the cracks development, which was saned by this intervention (fig. 3d).

5. Conclusions

Digital photogrammetry has proved to be a considerable tool for the documentation and the analysis of the existing building heritage once more.

The use of technologies modern but simple to use together with the objective analysis of the building and the historical data has let us add a basic (perhaps decisive) loose piece to the knowledge of the constructive phases of the Cathedral of Altamura.

References

¹ C.D.B., vol.XII, *Le carte di Altamura (1232-1509)*, Bari 1935, docc 1,334.

² Civita 1995 pag 282

³ Civita 1995 pag 282

⁴ Today it is possible to see a similar situation in the back façade of Basilica of S. Nicola in Bari.

⁵ It was this decoration which made Frederick church similar to the near Cathedral of Matera, as it has already been said in chapter 2.

⁶ According to P. Belli D'Elia the present portal was made in a period which goes from 1356 to 1374, because of the presence of two badges over the portal that might belong to Queen Giovanna I and Count Roberto from Bisceglie

⁷ Santoro O, 1959, pag 75

⁸ R.A. 6, p 38 v.

⁹ R.A. 6, p 41

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