

SAINT ANTHONY'S CHAPEL FAÇADE PATHOLOGY DOCUMENTATION

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ABSTRACT

This work presents the results of a process carried out with the aim of obtaining documentation on the pathology of the Saint Anthony's chapel façade. A photogrammetric survey was conducted during which low-cost equipment was used. 71 control points (natural and artificial) were surveyed and 51 photographs were taken. The Photomodeler software allowed us to generate the vectorial model and orthophotos. These results were imported to the CAD application in which the main morphologic characteristics, the major pathologies and the degrees of severity of those deteriorations were interpreted. Information on the pathologies was represented in the cartography in order to create a restoration plan.

1. INTRODUCTION

The village of *Santa Rosa de Calchines* was founded in 1861 with the mission of securing and making peace with a settlement of indigenous *mocoví* people.

In this settlement, it was customary for the community to gather together every June 13 to celebrate St. Anthony's Day, set by the Jesuits in 1750. During the celebration, the tribe's Chief offered a small statuette of the Saint, which was made out of a piece of dark wood so as to resemble the *mocoví*'s skin colour.

In 1902, Mr. Ramón Silva built a chapel in a piece of land of his property where they would keep the statue of the Saint. Yet, the statue did not stay there for very long time, since the *mocovís* said that the Saint "wished to live among his own people".

As the years went by, the chapel deteriorated, and so the DIPCES (Spanish acronym for "Provincial Secretary of Social Technology and Construction"), in charge of the preservation of historic monuments in the province of Santa Fe, decided to request the photogrammetric documentation of the Chapel

façade from the Laboratory of Terrestrial and Aerial Photogrammetry at FICH UNL (Spanish acronyms for "School of Engineering and Water Sciences" at the "Univesidad Nacional del Litoral") in order to have the information which was needed for the design of a restoration plan.

Consequently, the task of putting together all of the requested documentation was carried out both by Faculty members and Photogrammetry II class students, as well.

2. OBJECTIVE

To generate the photogrammetric documentation for the Chapel façade so that it can be used to design a restoration plan.

3. STUDY OF AREAS

St. Anthony's Chapel is located 5 km North of the city along the Provincial Route # 1. The façade faces West and its basic dimensions are 8 x 7 meters approximately.



Figure 1. Saint Anthony's chapel façade

4. METHOD AND EQUIPMENT

The equipments and materials employed were as follows:

- Pentax PCS-515 Total Station and accessories;
- Level TOPCON AT-67 and accessories;
- Topographic accessories;
- Digital photographic camera FUJI *Finepix A200* (1600 x 1200 pixels);
- Software for managing and processing topographic and picture data;
- Photomodeler Pro 3.1.

Initially, they visited the Chapel in order to collect general data, such as historical information, physical characteristics and environment limits, basic dimensions and the extent of the pathologies affecting its façade, and also to undertake photographic tests at different distances from the object.

4.1. Topographic Surveying

First, the photograph which more adequately registered the façade existing pathologies was selected out of the test images. Later, the distribution of the artificial control points was planned, taking into consideration the surface coverage of the chosen photography.

Since we had not suitable equipment, we were not able to set up artificial control points on the upper section. However, 17 natural control points were identified.



Figure 2. Localization of artificial control points

Subsequently, a topographic base parallel of the façade and a local coordinate system was defined. The Total Station was set up on its vertices. Then, the control points angles were measured, and the X, Y and Z coordinates were calculated.

Coordinate control points were calculated using the software GEOD, developed by the Institut für Photogrammetrie und Fernerkundung, of University of Karlsruhe (Germany).

4.2. Photographic survey

An FUJI *Finepix A200* digital camera was employed for the photographic survey. As it is not a metric camera, the Camera Calibrator 3.1 software was used so as to know its internal parameters.

The Photomodeler's user manual recommend that a minimum of three images of the same control point be obtained. In this way, the geometric quality of a restored point increases, when the demarcation of it on other photographs also increases.

33 horizontal photographs at a distance of 5 meters, and 18 slanted photos at 10 m, were taken as regular, convergent shots.

A ladder was used to take the pictures from the higher points. Moreover, detailed pictures were taken of the façade main ornaments.

4.3. Restitution in Photomodeler

Firstly, project restitution for each area of study was created. Objects and camera information was also incorporated. Secondly, control and auxiliary points were marked in one photograph and referencing other two photographs of the same sector. Then, restored points were processed and project quality data were analyzed by the same software. Finally, three new photographs were joined and the same steps were developed. The same was done with all the photographs of the projects.

Project scaling was carried out using three points of the topographic survey. A table with: id of point; X, Y and Z coordinates; photos; tightness and angle was obtained.

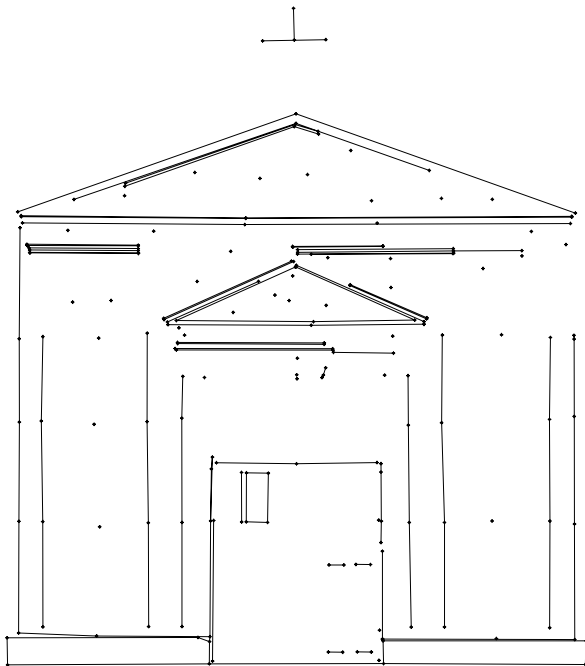


Figure 3. View of project restitution

Finally, the vectorial file was exported in DXF format and then 18 orthophotos were generated: 10 of these focused on the depth of the façade's main wall, and the remaining 8 focused on other architectural details found at different depths.

4.4. Pathologic cartography

After that, the vectorial file and orthophotos were imported to the CAD application. The orthophotos were scaled and spatially positioned. Besides, the orthophotos were processed through various embossing filters in order to emphasize the pathologies.

Then, the main morphologic features, the major pathologies and the degrees of severity of those deteriorations were defined. These included the following:

- Main lines
- Secondary lines
- Capitals and column bases details
- Blacksmith's works
- Entrance gate
- Small cracks (up to 3 mm)
- Medium cracks (3 to 8 mm)
- Major cracks (greater than 8 mm).
- Deteriorated plaster
- Fallen plaster
- Replaced plaster
- Deteriorated bricks
- Invasive vegetation

The pathologies were interpreted based on the orthophotos. In situations of indecision we had to have recourse to photographs of the details.

Finally, a cartography of the façade was designed.

5. CONCLUSION

After a first analysis, we are able to say that St. Anthony's Chapel façade presents a high percentage of deterioration.

From the standpoint of morphology, the support base of the right columns is shorter than the support base of the left columns. The main entrance door has missing portions and has been poorly repaired. The capital of columns and the main details are well kept (Figure 4).

With regards to pathologies, the major cracks are located mostly between the two main right-hand columns and in the upper triangle of the façade. Seemingly, the major crack, which is in fact a fissure through the brick, is affecting the structure of wall, since the façade details are displaced vertically. (Figure 5).

The fallen plaster, i.e. the exposed brick wall, is found chiefly in the lower section of the façade, and the most damaged areas are around its left side. These same sections are where deteriorated bricks show, and also where a few affected areas have been put plaster on in recent years.

Deteriorated plaster is seen almost in every area of the façade. Nevertheless, when we look at the four main columns, it is noticeable that their right-hand sides are the ones which present deteriorated plaster. This situation might be explained by the fact that the Southern wind is the prevailing wind in that region and, consequently, the column sides facing South are more severely affected than its other sides. (Figure 5).

Invasive vegetation, such as lichen and moss, grows around the Chapel and now is on the edges of the façade upper triangle, and a lower amount of it can be seen in the small triangle. Grass and bracken has grown in the support base fissures. We also detected herbaceous plants on the roof, beside the cross.

In conclusion, the photogrammetric documentation obtained by means of low-cost equipment presents enough information to establish the first stages of a restoration plan, chiefly by providing the ability to assess the sections of the façade which present higher degrees of deterioration as a result of the pathologies identified.

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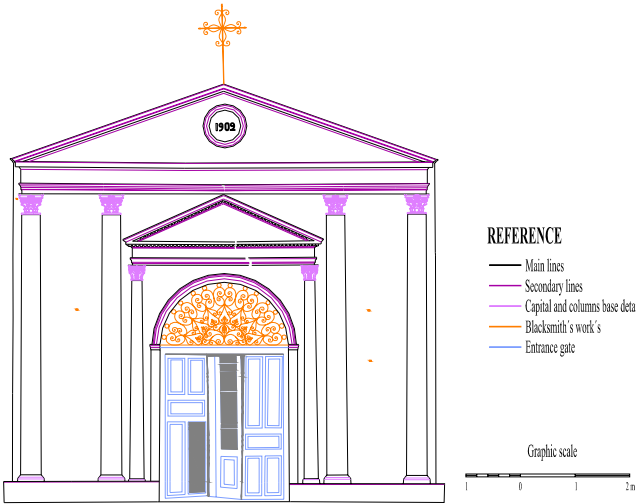


Figure 4. Morphologic features.

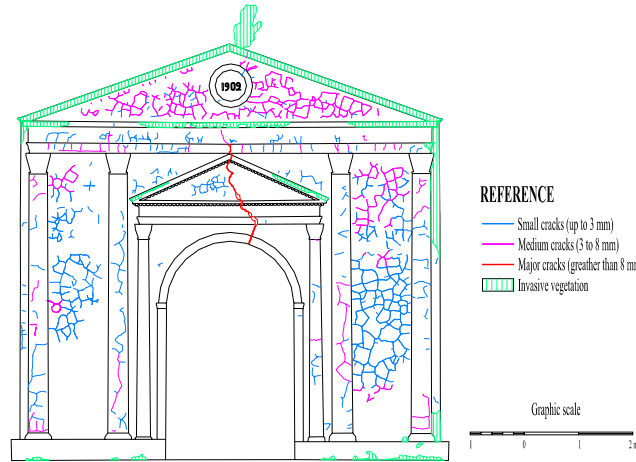


Figure 5. Distribution of cracks and invasive vegetation

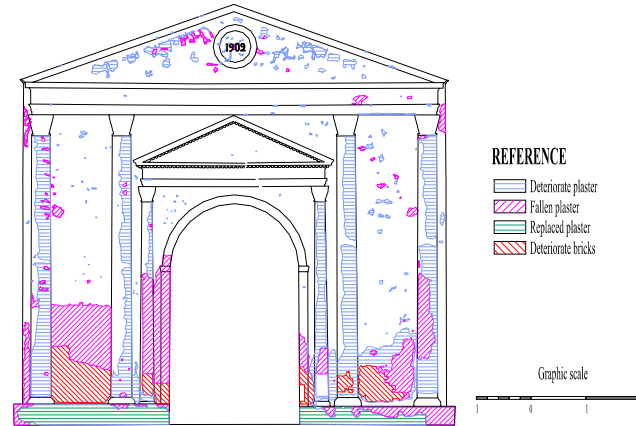


Figure 6. State of plaster