

## CLOSE RANGE PHOTOGRAMMETRY IN THE DOCUMENTATION OF THE WORK OF SILVA PAES' BRIGADIER, CENTURY XVIII

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### ABSTRACT

The current research approaches the confrontation between the original design and what was built by Brigadier Silva Paes in the XVIII Century; it is analyzed by close-range Photogrammetry and the sample is one of the existing constructions called Fortress of São José of Ponta Grossa in the Island of Santa Catarina (Brazil). This fortification had the purpose of protecting the North Bay entrance of Santa Catarina's Island. This work has been carried out picturing the Barracks of the Troop façade using the equipment SSK ImageStation of Z/I. The same was developed to be used in the aerial Photogrammetry. As a result, it is obtained a three-dimensional geometric picture of good quality that could provide analysis and/or decisions for interventions related to historical architectural works. The fidelity of this work in relation to the original design is not always perceptible, because in all architectural works, be in Brazil or in other countries, they undergone interventions throughout the centuries, which means different architectural styles implementation. Brigadier Silva Paes comes to Brazil to execute architectural remodeling in the fortresses to increase security for the so called Colony of Brazil. Methods and architectural techniques will be demonstrated on the historical use in the works of the century XVIII of Brigadier Silva Paes.

### 1. INTRODUCTION

The importance and contribution of this research aren't only linked to the Science but also for the History. An interesting work fits when opposing the old and historical, with the modern technology. In this way, here it was included, not only the documental Silva Paes' work, but also a scientific method of registration of his architectural deeds.

The characteristics of the Military Engineer's design of Silva Paes, are lines with Renaissance style, although he acted in the Baroque epoch, this is due he was a disciple of the Renaissance Epoch.

Considering the beauty and importance of the *oeuvre d'art*, other important scientific contribution is, firstly, for being the Baroque epoch the first time of artistic manifestation in our country, works executed between the time of our discovery and the Baroque time, or be the Renaissance, not existing anymore or they have been altered; the choice is also due for the existence of the space and mental liberation by the XVIII Century artists side, since then it did not happen, things such as the coalition of the external and internal spaces, the forms static are overcome and the organic architecture is evident.

### 2. OBJECTIVE:

The present article has the aim to show a study done through the architectural Photogrammetry in the documentation of the military engineer's Silva Paes constructions (Century XVIII) presents in the Island of Santa Catarina (Brazil), using the software ImageStation for constructions restitution.

### 3. EMPLOYED MATERIAL

#### 2.1 Material:

- Pentax PAMS 645 medium format camera
- ZEISS Scanner SCAI
- ZEISS Total station Rec Elta 14C
- Kit SSK - Station Digital Photogrammetric:
- 3D Lab' Wildcat 4000 Stereo Frame Buffer

- Crystal Eyes – Stereo Kit
- 3D mouse

### 4. SANTA CATARINA'S ISLAND / BRAZIL



Figure 1 Santa Catarina Island / Brazil

#### 4.1. History

Brigadier Jose da Silva Paes disembarked in Desterro (currently Island of Santa Catarina) in 07/03/1739, where began the colonization process and immigration to the island.

The Portuguese government's interest in the colonization in the Island of Santa Catarina was because the site was a strategic point to Rio da Prata, hindering the use of the island for foreign ships.

The religious and military architecture in the island of Santa Catarina is of the century XVIII while the island people's architecture is all of the century XIX. Portugal assigned Brigadier Silva Paes the command of an expedition to the south of Brazil to defend the Region, who took office the military command and the government, using a triangular system to defend the Island from the invaders.

All of Brigadier Silva Paes' buildings has the Renascentist influence probably because he was a disciple of many renescentist engineers.

**3.2 Some Projects of Silva Paes' Brigadier in the Island:**

- Araçatuba Island's Our Lady of Conception Fortress
- Ratonas Island De Santo Antonio Fortress
- São José da Ponta Grossa Fortress
- Santa Cruz of Anhatomirim Island Fortress



Fig. 2 - Fortress of São José Ponta Grossa

**4. CASE STUDY**

The chosen construction to be photogrammetrically restored is Fortaleza de São José de Ponta Grossa. The construction started in 1740, located in the Northern portion of the Island of Santa Catarina, nearly in front of Anhatomirim Island. It has the major headquarter, chapel, powder warehouse, troop headquarter, ranch, jail, and ramp.

**4.1 Restitution with ImageStation**

The photos are shot parallel to each construction facade in strips from the left to the right; the number of strips is taken according to the construction height and pre-defined parallel distance. Important to notice that in the acquisition of the pictures must be done with minimum of shade.

The obtained data from the metric camera, the fiducial marks, the control-point coordinate is inserted in the Image Station Software Manager; after this phase it is used Mensuration from the above software to obtain the internal, absolute and relative orientation, in which the stereoscopy will happen by 60% coverage on each of the two pictures that shape blocks; it is employed 3D eye glasses to visualize them; once defined, it is Stereo Display employed MicroStation to carry out the façade three-dimension drawings.

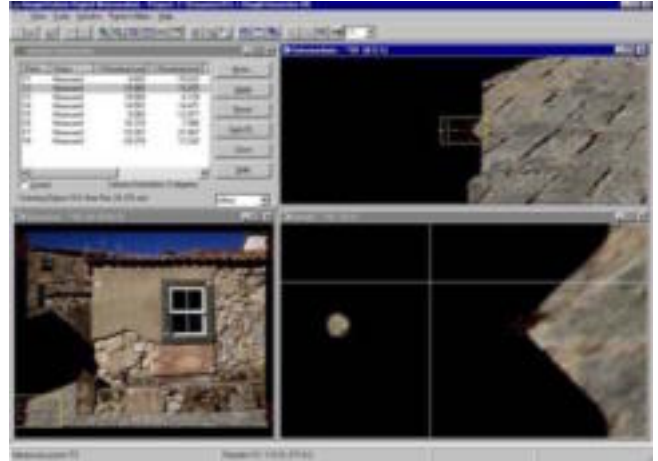


Fig.3 - Orientation Internal, photo 59

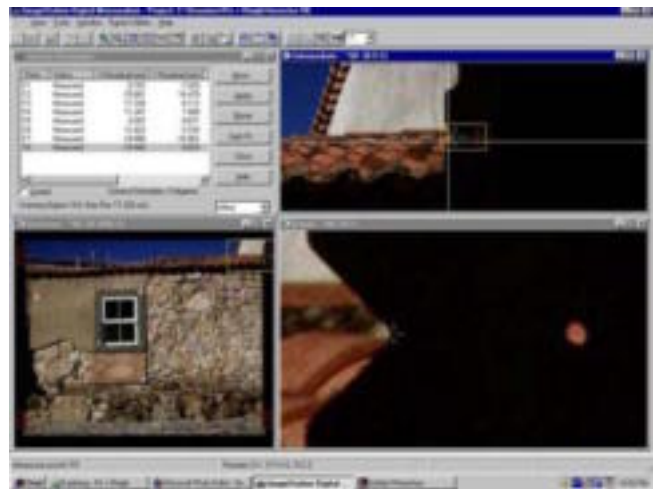


Fig. 4 - Orientation Internal, photo 60

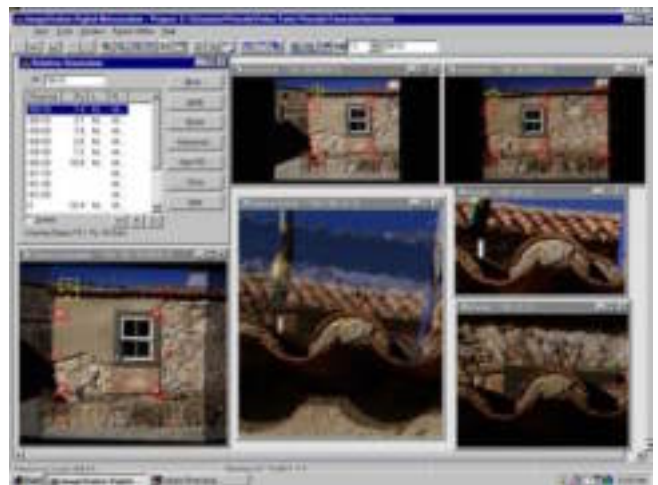


Fig. 5 – Relative Orientation 59+60

The relative orientation has the objective of guiding the position and attitude to each other the pair of pictures, therefore, without taking in consideration the land referential.

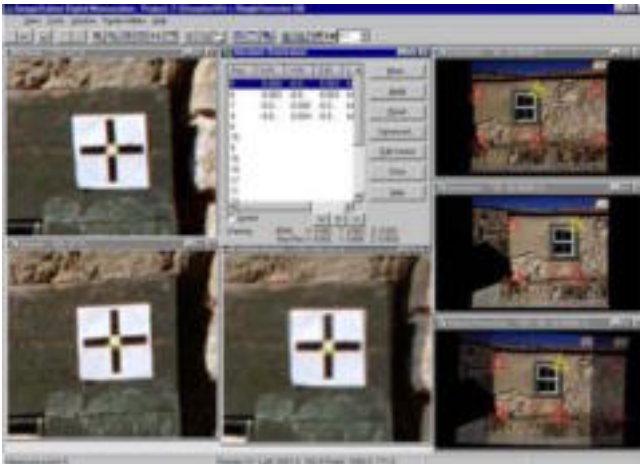


Fig. 6 – Absolute Orientation 59+60

It can be defined as the sequence of the accomplished operations in order to place an already done relative orientation. In ISDM this process is summarized in doing the control points measurement and identification that were identified in the construction.



Fig.7 Stereo Display, 59+60



Fig.8 – Photogrammetric restitution with original image of the XVIII century.



Fig.9 - Photogrammetric restitution

## 5 - FINAL COMMENTS

According to the above presented, one has two conclusions to draw: by the Architectural style and the Technological side.

Being the first artistic manifestation in Brazil, the Baroque style comprises the constructions built between our Discovery and its epoch because the Renascentist buildings does not exist anymore. Those questions have pondered the choice of Brigadier da Silva Paes buildings' for the photogrammetric study who is deemed the Southern Brazilian builder.

The software potential was explored, by defining its best use according to the detailing level and the desired use as well as providing tools for heritage building's documentation, maintaining and preserving. By evaluating possible errors in the adopted methodology and by analyzing the advantages and/or disadvantages of short distance digital Photogrammetry for data bank implementing in relation to conventional methods. The Photogrammetry's fields of application nowadays expand as function of its techniques development and upgrading that allow graphical restitution, homogenous and continual of objects, monuments, urban space, and archeological sites.

Above all, the use of close-range Photogrammetry makes possible the comparison of what was done and what was modified during its life in historical buildings so that makes possible the recovery of original features of any building.

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