

# INTEGRATION OF CLOSE RANGE PHOTOGRAMMETRY AND TOPOGRAPHIC MEASUREMENTS TO GET THE TRIDIMENSIONAL MODEL OF COMPLEX SCULPTURE.

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## ABSTRACT:

Work criteria from graphic representations of sculptures are established for their conservation and preservation. Sculptures with a complicated geometry make, sometimes, difficult or impossible to obtain the enough photographs to generate a complete three-dimensional (3D) model. The versatility of the measuring stations without prisms or miniprisms complements the classical photogrammetric, topographic measurements, simplifying the enough tasks, so as to model the sculpture. The resultant geometric model can be covered with the projected texture of the original photographs. In this way, the 3D model presents a wholly real look. This model is transformed to the VRML (Virtual Reality Modelling Language) data format, in order to visualise it in Internet, allowing to add a complementary data of the sculpture.

In this paper, there is developed the methodology used in the integration of photogrammetric, topographic measurements in order to model, in 3D way, a sculpture placed in an important square of Las Palmas de Gran Canaria. Eventually, the results, the advantages, the difficulties, as well as the method limitations are analysed.

## 1. INTRODUCTION

The cultural patrimony of a town is irreplaceable, but due to the complexity of some pieces or to the technology of the epoch they have lost a great quantity of sculptures.

Vitorio Macha's sculpture was placed in the year 1909 at Plaza de la Feria. The statue was homage to Benito Pérez Galdós. The statue deteriorates due to the exposition to the sea. Changing over in 1969 for other.



Figure 1. Vitorio Macho's sculpture acting for Galdós

The statue right now is deteriorating due to the action of the sea, as well as to painted. It is for it that to avoid the same loss of her, it has been reconstructed in a model 3D.

As we can observe in the Image 2 the statue he has a great complexity of forms. This motive impedes that the obtaining of the model 3D be obtained only with technical photogrammetric.



Figure 2. current Statue of Benito Pérez Galdós

## 2. DESCRIPTION OF THE WORK

The objectives of work are the obtaining of a mesh to scale 1:100 of the Monument to D. Benito Pérez Galdós, of the Sculptor Pablo Serrano placed at La Plaza de la Feria.

The sculpture has a height brought near of 2,9 m and a diameter of 2,3 meters.

For it we will utilize so much I eat technical photogrammetric and topographic for the detection of hidden zones of the same.



### 3. ELECCION OF THE CAMERA

The used camera was a Pentax 645 belonging to the group of the semi metric cameras. It has a glass badge in the focal plane containing a reticule (badge Roseau) that serves to control the film deformation.

Their format is 6 x 4,5 cm, ideal for the realization of work of closed range Photogrammetry.

### 4. ELECCION OF TAKES

The statue is located on a pedestal of 2.5 meters, that they make the overtaking of photos difficult.

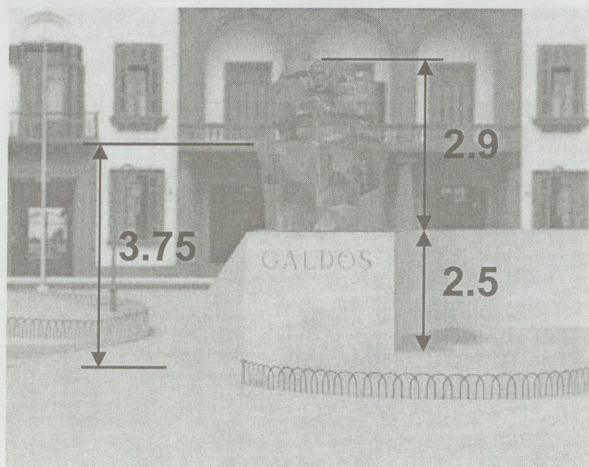


Figure 3. Dimensions of the statue

Exist two possibilities for the overtaking of photographic pairs, four pairs to 90 degrees each one or three pairs to 120 degrees. It can be observed in the figure 4.

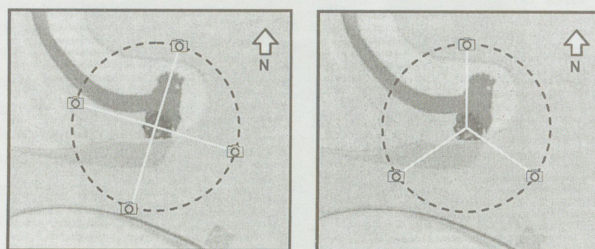


Figure 4. Election of takes

We have selected the option of 3 pairs for three motives:

1. For facility in the overtaking of pairs
2. Low number of control point
3. Zones without coverage of practically equal than the another option

The distance to which you were carried out the takings was of 6 meters (distances hyperfocal). The scale of the photo is 1:134.

### 5. CONTROL POINT

In each pair they have placed five checkpoints such and as it can be observed in the figure 5.

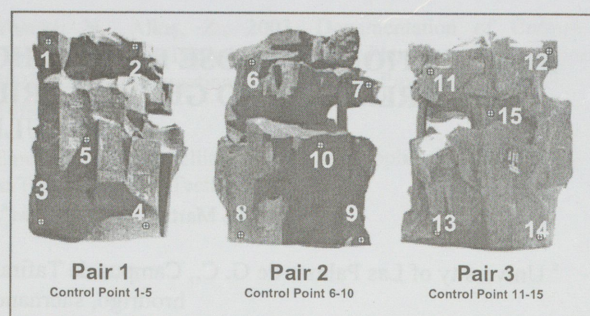


Figure 5. Control Point

For the determination of control points, has created one polygonal that he surrounds the statue. For the measurement of the distances have utilized miniprisms.

RMS the Orientation interior (m)			
Par	X	Y	Z
1	0,002	0,001	0,002
2	0,002	0,002	0,001
3	0,000	0,003	0,001

Table 1. Errors of restitution

After the restitution of pairs, some zones have remained without covering. They will take these their zones for an alternative method.

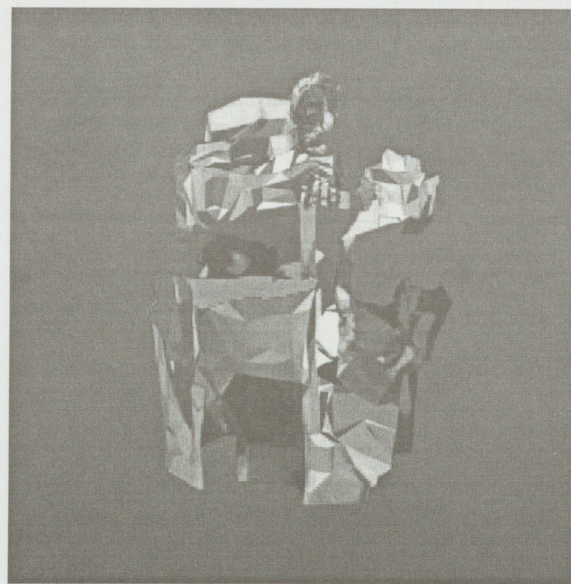


Figure 6. Zones without coverage

### 6. METHOD OF OBTAINING OF ZONES WITHOUT COVERAGE

The zones that could not have been restituted, will get obtain for the radiation method. The radiation will be sold off as from the points of the polygonal created for the obtaining of control point.



The used team is the total station TC-307 whose characteristics are:

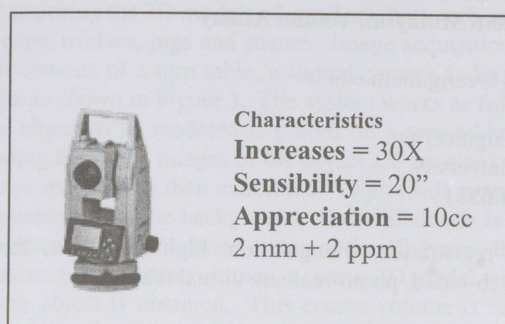


Figure 8. characteristics of TC-307

As you can observe in the figure 9, the areas that must capture for the method of radiation are:

Visible areas  
Hide areas

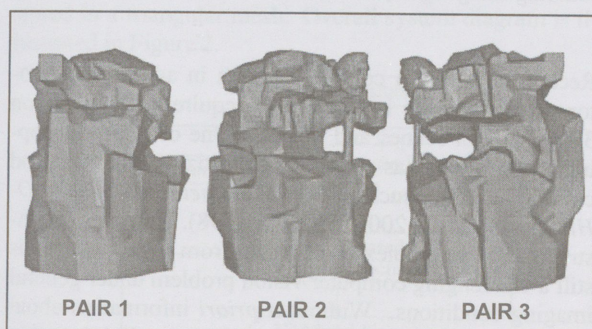
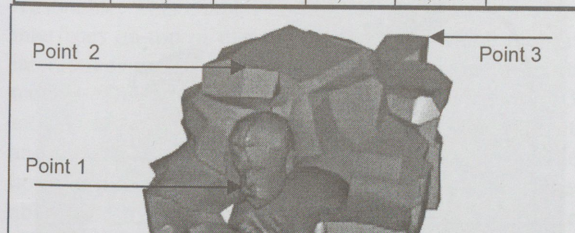


Figure 9. Hide and visible areas

The errors in both types of models are inferior to the two centimetres, for what the rising is to scale 1:100.

Tolerance 0,020 m					
Control Point	Method	X	Y	Z	Distance (m)
1	Resti	7,356	4,315	5,124	0,015
	Topo	7,346	4,313	5,132	
2	Resti	6,682	3,842	5,503	0,020
	Topo	6,665	3,848	5,508	
3	Resti	5,270	4,470	5,412	0,014
	Topo	5,269	4,477	5,404	



## 7. TEXTURE AND MODEL 3D

Finally the missing to do is to put him texture the model to get the sensation from photo realism. For it he selects the part that it not be deteriorated of the statue to utilize her of final texture.

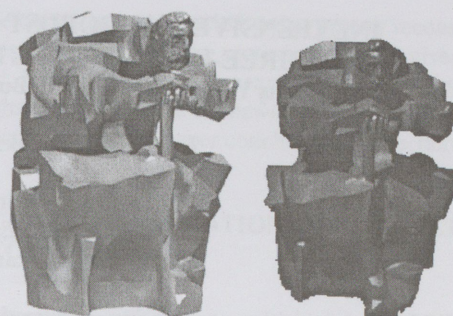


Figure 10. Without texture and texture image  
With this we have the model 3d of our statue to include at a surroundings of virtual reality or in videos and animations.

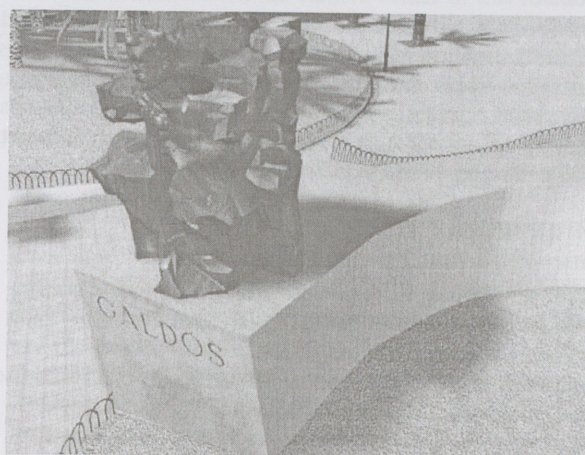


Figure 11. Virtual imagery of the plaza

## 8. CONCLUSION

The method proposed in this paper is applicable in most cases of statue with complex elements. Besides the topographic techniques permit generating us the model of a very simple form, not only the statue, but the rest of elements. Everything it provides a virtual model, that they permit preserving us the cityscapes for the future.