DIGITAL PHOTOGRAMMETRIC METHODS IN DOCUMENTATION OF CULTURAL HERITAGES AND BEYSEHIR EXAMPLE

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KEY WORDS: Cultural Heritage, Documentation, Rolove, CAD

ABSTRACT

History of Beysehir city as a governmental administrative centre (settlement centre) has timed back up to Before Christ 6000-7000 Before Christ

> 2000 years HITTITES, 200 years PHIRIGIANS later a government established named PSINYA 600 years LYDIANS 546 years PERSIANS 333 years BIG ALEXANDER 120 Years ROMAN EMPIRE

dominate in this area.

After the sovereignty of ROMAN EMPIRE until 1071, they admitted Seljuk TURKS kingdom. Between 1100 and 1326 years BEYSEHIR district ESREFOGLU state–owned had been established and Fatih SULTAN MEHMET added the Beysehir city to the domination of OTTOMAN EMPIRE.ESREFOGLU mosque, which is the best sample of Turkish architectural heritage, was built in the period of ESREFOGULLARI. It is an unique sample made of wooden pillar mosque comes until this times. Around the mosque there are one covered-market (BEDESTEN) a Turkish Bath, a tomb, a small mosque, a castle door, 29 houses registered by the "CULTURAL AND NATURAL REMAINS PRESERVATION COMMISSION" in Turkey.

In this study, Rolove works have been carried out using the digital photogrammetric evaluation techniques relating to historical works of art as mentioned above.

1. INTRODUCTION

In cultural heritage a lot of works has been done in the last decades. Trough international organizations such as ISPRS, CIPA, and ICOMOS, the documentation and conservation of monuments and sites in 3D form has begun, on the one hand, more and more companies are devoloping more efficent, flexible and accurate digitizers (cameras, lasers, mechanical scanners) on the other hand, information technology is devoloping intelligent software for the further processing of large amounts of scanned data. This enables the scientists to use this data in CAD systems (Ionnides,M.2003).

Photogrammetry acts an important role in documentation of cultural heritage. Because Photogrammetry is very suitable evaluation technique for many complex objects. It is widely used for documentation of archaelogical heritage. For this purpose, terrestrial images are used for a long time, both, for focades and ground plans (Celikoyan,M.2003).

The 3D reconstruction of houses and other man made objects is currently undergoing active reseach, and is an issue of high importance to many users of GIS, including urban planners, architects, telecominication and environmental engineers for historical development, topography, vegetation, land use pattern, transportation network etc (Duran 2002). Modern

photogrammetry can effectively provide metric data of heigh and homogenous quality from existing buildings for CAD purposes(Albert,J. 1995).

Beysehir project is also accomplished by digital hotogrametric techniques .

2. SITE DESCRIPTION

Beysehir is a typical Anatolian city located in south-central part of Turkey. The driving time from Antalya is 3 and from Konya 2 hours by bus. The city is like a gateway between the Central Anatolia and Mediterranean region. The history of Beysehir is very old like the other part of Anatolia, and might be ten thousand years old. Beysehir has a wonderful lake "Lake Beysehir or Torques Lake". This lake is a very important national park in Turkey, and famous not only natural beauty but also wildlife that owns especially birds.



Figure 1 Lake Beysehir or Torques Lake

Project area is Beysehir district Icerisehir ward and streets is considerably narrow. 29 registered historical houses in the study area determinated by municipality and prepared roughly plan to began works (Figure 2)



Figure 2. Registered hauses in study area

3. DATA ACQUISITION AND FIELD WORK

3.1. Measuring Studies of Topographic Map

The applications of GPS in Archaeology are numerous and refer to the determination of the absolute position of reference points, the detail survey of single structures, the kinematic surveying of the ground surface of entire sites. The reliability of this global system and its possibility to achieve high accuracy, together with its productivity, make it the main technique able to frame together the whole metrical information collected at the site in a common reference system (Bitelli and Vittuari, 2000). In order to realise photogrametric project, it is necessary to define a set of control points with inserted in a local reference system. In this project 3 Leica GPS survey instruments used to survey traverse net coordinates 62 traverse points measured for the whole project area. X and Y coordinates calculated with the use of GPS measurements.

SOKKIA digital levelling instrument was used for the determination of z values of 62 traverse points. Topgon 3005 reflocterless totalstation was used to measure target coordinates. About 15 target point measured for every house. As mentioned above the total station has also the capability to work in reflectorless mode. So, reflectorless mode was selected surveying of the target points. All points were measured in Turkish reference coordinate system.

3.2. Calibration and Photographic Data Collection

Commercial digital cameras provide a sufficent resolution for the major part of architectural photogrammetric applications.(Alby,E. 2003) Photographic session executed with Kodak EasyShare DX4530 and Nicon Coolpix 950 digital cameras that we have calibrated in our laboratory with EOS systems Inc. Photomodeller software for calibration, obtaining both the principal distances and the position of the principal point and K1, K2 constants to value the radial symmetric distortion of the lens.(Figure 2) This camera produces TIFF and JPEG images.

Camera Name:	nikon 04			
Focal Length:	7.1390	mm		
Format Size W:	6.2734	H:	4.7057	mm
Principal Point $ imes$	3.1078	Y:	2.3732	mm
Lens Distortion K1:	0.003509	K2:	-1.308E-005	
P1:	5.308E-005	P2:	-5.418E-006	

Nikon Coolpix E950



Kodak EasyShare DX4530

Figure 3 Calibration results of the cameras

We tried to take all facede of house see in one screeen for easy photogrammetric evaluation. But streets were quite narrow. We used at least tree station to take photograph.Some times we obliged to use 10 or more station points to take photograph. Taking photographs of houses two ore more than two flats were made from the roof of opposide side house. The main façade had to be divided into 5-10 parts, to be processed independently.Later divided parts project was merged to obtain one facade in software





Figure 4 Taking photograps

4. PHOTOGRAMETRIC EVALUATION

Photomodeller software by EOS System Inc. was used for photogrammetric evaluation. Photomodeller software package is well-known as being low cost 3D measurement tool for architectural and archeological aplications.

This project was executed in colloboration with restoration experts. In principle all data were acquired digitally in 3D. Nevertheless additional analogous plans in 2D were requested by the restoration experts. So, created 3D models of buildings were transferred to 3D DXF file and later converted 2D dxf file. Revision and completion of the photogrammetric results has to be done by architects due to a few missing parts and adjusting to the architectural representation. Figure (5) shows the original photogrammetric data while Figure (6) revised data by the preservation experts.

5.CONCLUSION

In this project, photogrammetric rollover studies were executed at Beysehir for 29 registered houses by CULTURAL AND

NATURAL REMAINS PRESERVATION COMMISSION in TURKEY.

Restoration experts used photogrammetric results for restoration studies, but photogrammetric can be elaborated by the restorers. Produced data by the photogrammetrist must be revised by the architects that experts in restoration. Because restores use specific representation some legal standards in restoration projects.

Photogrammetric methods a lot of superiority according to classical rollover methods. In classical methods obtained data can be only in analogue but in photogrammetry you can obtain both analogue and digital data for the objects

REFERENCES

Bitelli, G. and Vittuari, L., 2000. Perspectives on the integration of modern surveying techniques for archaeology: a case study. Proceedings 2nd International Congress on Science and Bitelli, G., Tini, M.A., Vittuari, L., 2 Technology for the Safeguard of Cultural Heritage in the Mediterranean Basin, Elsevier, Paris.

Ionnides M, Stylianidis , Stylianou S, 2003 3D reconstruction and visutozation in cultural heritage, CIPA 2003 New Perceptives Symposium , Antalya TURKEY

Celikoyan M, Altan O, Kempe G, Toz G, Evaluation of theatre by using low – Altitude aerial and terrestrial photogrammetry, CIPA 2003 New Perceptives Symposium, Antalya TURKEY

Duran Z, Toz G, 2002 using 3D GIS for documentation of historical monument, In: Close Range-Imaging – Long range vision, Corfu, Greece

Albert J, Wiedemann A, 1995, Acquisition of CAD data from existing buildings by Photogrammetry. In proceedings of the 6th International conference on Computing in Civil and Building Engineering, Berlin, Germany

Alby E, Grussenmeyer P, Perrin J.P, 2003, Integration of close range photogrammetric surveys in the design process of architectural projects. CIPA 2003 New Perceptives Symposium, Antalya TURKEY







Figure 6. Autocad Drawings