

Roadmap for a Multidisciplinary Project: The Historical Documentation of Two Ottoman Fortresses on the Dardanelles: Seddulbahir & Kumkale

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SUMMARY

Cultural heritage, particularly of architectural structures and their surrounding environs, is among the most important evidence we have to understand a society's past. When documenting this past, each material object takes on an increased significance, as it is through this object, placed at the center of inquiry, that we can better understand its historical value. Unfortunately, as a result of both natural and human interventions, important elements of historical structures are deteriorating rapidly. Hence some precautionary measures are needed to protect historical sites and structures from an array of deleterious conditions. In this study, a historical documentation project on two Ottoman fortresses is briefly discussed. These fortresses, namely the Seddulbahir and Kumkale, located in Turkey, at the Aegean entrance to the Dardanelles, are examples of valuable cultural heritage sites, which have only recently been the subject of intensive historical, and geodesy study and documentation. The two fortresses were built in the mid seventeenth century (1656-1659) by Turhan Sultan, the mother of the Ottoman sultan, Mehmed IV. Since the beginning of the project in 1997, various works have been done. These works include geodetic measurements, archaeological investigations, architectural measurements, historical studies, multimedia and GIS applications. The main aim of the historical documentation project is to combine all the information from the mentioned disciplines in a geographical information system environment. The backgrounds of the project and the studies carried out during the course of project are discussed in the paper.

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1. INTRODUCTION

The location of the Seddulbahir and Kumkale is approximately $26^{\circ}199$ E_{ITRF} and $41^{\circ}006$ N_{ITRF} and the distance between the two fortresses is approximately 4150 meters. Seddulbahir is located on the European side of the straits, at the southern end of the Gallipoli Peninsula. The fortress of Kumkale is on the opposite Asian shore, approximately five kilometers from Troy. Beginning in 1997, our team has been working to fully document both the physical as well as the historical aspects of these two structures. Prior to any preservation or restoration work, it was essential that the fortresses were thoroughly and accurately measured, their physical characteristics recorded, and documentation related to their historical past gathered. This massive amount of very diverse data types then had to be organized and managed with a proper information system. It is with this larger, long-term goal that the team of surveyors, architects, historians and archaeologists began to work together on the Survey and Documentation Project of Seddulbahir and Kumkale and to develop a Geographical Information System (GIS) for the project.

One of the essential requirements of GIS is accurate spatial data; hence among the primary goals of the project was to create a complete and accurate set of maps for both fortresses and their immediate environs. These geodesy maps then served as the foundation upon which various types of data, from archival records of building repairs, to photographic documentation, to photogrammetric records, to oral history data, were layered for future analyses. With this type of data system both the present situation of the fortresses and the condition of the fortresses in the past could be recorded and the architectural changes from the 17th century to the present day could be determined more accurately and efficiently. Natural, economical, social and political events, which have caused structural changes to the fortresses and surrounding buildings and environs, could also be assessed. This paper is a case study of how historical research can be integrated with technological developments like Geographic Information Systems (GIS) and GIS based multimedia applications. The historical documentation project of the Ottoman fortresses at Seddulbahir and Kumkale demonstrates some of the challenges and possibilities of integrating historical research data and methods and new GIS technology.

Highly accurate modern maps, based on geodetic measurements, have been produced and record the topography and present locations of all historical structures remaining above ground, such as the fortress walls, individual towers, 2D and 3D architectural plans of existing structures of the fortress' areas and their environs. In addition to demonstrating the use of GIS in this project, this paper also illustrates how the works for geometric models of

these two fortresses on the Dardanelles were done, how the geodetic measurements were conducted, and how various data sets were integrated and interpreted within a multi-participant, multi-disciplinary GIS project.

2. THE GOALS AND WORKFLOW OF THE PROJECT

Initially, the project began in 1997 in cooperation between Koc University's department of History and Istanbul Technical University's Geodesy and Photogrammetry department. "The Project of the Documentation and Mapping of Seddulbahir and Kumkale Fortresses" is a multi-disciplinary project that consists of the works from various disciplines as geodesy, architecture, archaeology, history and art history. The basic goal of this project is to make a contribution to the preservation works in Turkey, one of the historically richest countries in the world, by such a historical documentation on two fortresses. At the beginning, the work was done on the Seddulbahir fortress, situated on the European shore of the Dardanelles in a village overlooking the Aegean Sea and the entrance to the Strait. Kumkale fortress, located on the Asian side of the Dardanelles was also included in the project by the year 2000. Figure 1 illustrates the methodology of the project. In the following section, the goals and progress of the works carried out by the mentioned disciplines are briefly explained.

2.1 Historical Researches

The two fortresses were built in the mid seventeenth century (1656-1659) by Turhan Sultan, the mother of the Ottoman sultan, Mehmed IV. Initially the fortresses were constructed as part of the Ottoman defense against Venetian naval invasions into the Dardanelles during the long war over Crete; since that time they have served the Ottoman and later Turkish defense against a variety of enemies who have coveted either the strategic outlet to the Aegean or a convenient sea access to the Bosphorus and the capital of Istanbul. Both fortresses were instrumental in the Gallipoli campaign of World War I and severely damaged by artillery fire. After World War I and the withdrawal of French and British troops from the Gallipoli region, Seddulbahir and Kumkale were returned to the Ottoman government. Until the spring of 1997, Seddulbahir was maintained as a Turkish naval outpost. Kumkale is still operating as a naval base and is under the jurisdiction of the Ministry of Defense (Anonymous, 2004).

As part of the historical research, various archival records have been compiled. One of the very valuable records are the Ottoman repair records that were compiled, often after damage by war or earthquakes in the region, so that the central government in Istanbul could keep track of costs of repairs made to various Ottoman structures throughout the empire. By using these records, it is possible to determine the different periods of Ottoman repair to the fortresses the sources and nature of building supplies used by the Ottomans in this region. These records also provide us with information about several other aspects of structural repairs to the fortresses. The archival records have also been useful as they often give the names and functions of different parts of the fortress. In summation, the repair records, along with other types of documentation, help us understand which sections of the fortresses were repaired or expanded at a particular time (Thys-Senocak, 1999).

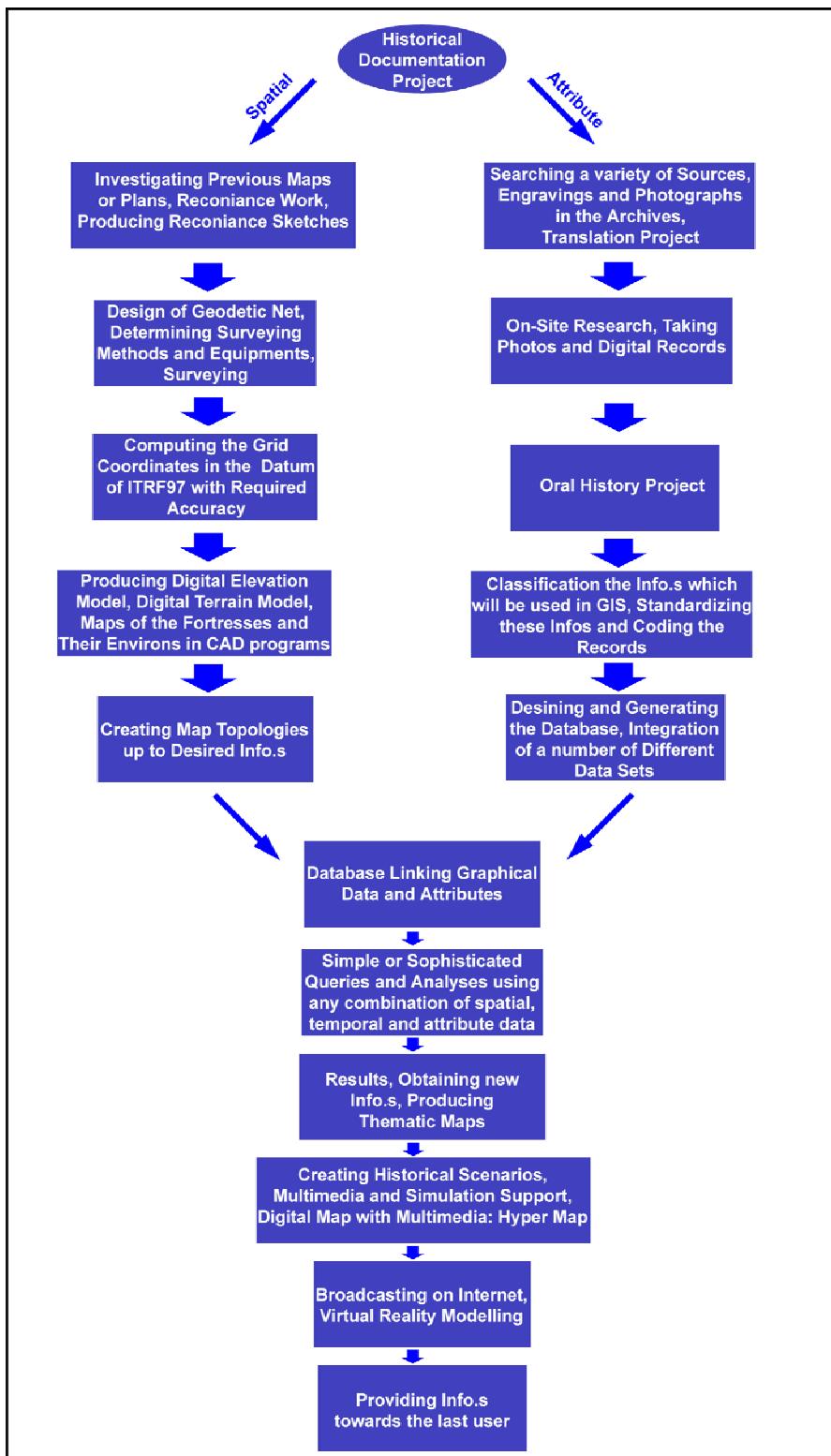


Figure 1: Methodology of the project (Guney and Celik, 2003a)

In addition to the repair records, many Ottoman and European travelers' descriptions, chroniclers' reports and engravings of Seddulbahir and Kumkale have been collected from the archives of Istanbul, Venice, Paris, and libraries in the United States. Moreover, a large collection of late 19th century and World War I era photographs of Seddulbahir and Kumkale, which have given us a good idea of the condition of the fortresses both before they were bombarded in the war and after, have been accumulated. These photographs include the ones found in the Imperial War Museum and the Public Records Office in London and in the Islamic Research Center at Yildiz Palace in Istanbul. As an example to the compiled photographs, Figure 1 shows the temporal changes in the Seddulbahir fortress.



Figure 2: Temporal changes in Seddulbahir (Guney et al., 2002)

As an additional part of the project, an oral history study was conducted in Seddulbahir village (Cenker and Thys-Senocak, 2000). In Kumkale cemetery, epigraphic documentation was also done by the team historians (Anonymous, 2004).

2.2 Architectural Surveys and Archaeological Investigations

The aim of architectural work is to provide detailed drawings of existing structures of Seddulbahir and Kumkale in order to be used in further restoration or preservation projects. In this context, in combination with the geodetic measurements, the characteristic points of the structures were surveyed. The architectural characteristics of the fortresses have also been investigated in the light of the Ottoman architecture in the time of their constructions. It is expected that these drawings, investigations and the laboratory analyses of stone, mortar, metal and wood samples taken from Seddulbahir are to be used in the final restoration proposal.

Archaeological investigations have also been conducted parallel to the architectural surveys. This is because the region where the fortresses are located is historically a very important place. Fortresses' past is tied not only to the Ottoman era, but also to many other historical phases. For example, Turhan Sultan's fortress of Kumkale is located just five kilometers from the ancient site of Troy. Kumkale was constructed largely from building materials and spolia excavated by Heinrich Schliemann during his first archaeological campaigns on the Trojan plain. From the excavation reports of Schliemann at Troy to the current excavations in the surrounding areas, the history, especially the pre-Ottoman history of the region has been investigated.

2.3 Geodetic Work

The goal of geodetic measurements in the Seddulbahir and Kumkale fortresses is to make highly accurate maps, including topographical maps of present locations of the remainings in and around the fortresses and the architectural plans of existing structures. As infrastructure for the geodetic measurements, control networks covering the entire area of the fortresses were established. The control networks in the Seddulbahir and Kumkale fortresses consist of 4 and 6 points, respectively. These networks were then densified by traverse points. Beginning from the first measurement campaign in 1997, both conventional techniques and GPS technique have been used in combination. At first, all network points were positioned in "World Geodetic System 1984 (WGS84)" coordinate system. The measurements on control network points were collected using static survey, while the traverse points were measured mainly by Real Time GPS surveys. Some traverses, within the towers, rooms and other structures were measured with Total Station. Following the positioning of all network points, the networks were connected to Turkey's national coordinate system, namely "Turkish National Fundamental GPS Network (TUTGA)", of which frame is International Terrestrial Reference Frame-Epoch 1996 (ITRF96). For the connection, a TUTGA point nearby the Kumkale fortress was used as reference point. Thus, TUTGA coordinates of the control points were obtained and these coordinates were switched to grid coordinates in ITRF96 using "Transverse Mercator" projection set with 3° zone width and 27° central meridian. Determining the borders of study fields and a detailed topographical survey of the fortresses' coverage areas was carried out using Real Time Kinematic GPS technique. In other words, a digital terrain model for the coverage area was produced. The 3D information on the landscape of surveying fields was then realized. Another instrument, used to fix some objects within small rooms is Disto, a hand-held distance measurement tool. In addition, some walls at Kumkale were also measured with terrestrial photogrammetric technique. Through the photogrammetric evaluation, the models and plans of the walls were produced (Celik et al., 2001 and Duran et al., 2002).

All the field works in Seddulbahir and Kumkale were completed in 2000 and 2002, respectively. Ozoner and Celik (1999), Celik et al. (2001), Ozoner et al. (2001) and Guney et al. (2002) give detailed information about how the geodetic measurements were carried out.

After the completion of the geodetic measurements, Digital Terrain Models (DTM) of the fortresses and their surroundings, 3D architectural drawings were produced in CAD environment with the software, AutoCAD Land Development Desktop.

2.4 GIS Applications

As pointed out before, the main goal of this multi-disciplinary, multi-participant project is to combine all the data in a GIS environment. In this context, the most important issue is the standardization of the data, i.e. integration of the data from different sources. By standardization, portability of data and data processing tools can be achieved. Defining attribute encoding in the specific standards facilitates the transfer of self-describing databases. One of the goals of the standardizing in the project is that geographical data can be transferred between all kinds of historical documentation GIS products and platforms (Guney and Celik, 2003a).

A multimedia supported GIS application is developed as a pilot project for the Kumkale Cemetery that is located approximately 750 meters to the Kumkale fortress. In the application used the GIS package, “AutoCAD Map 2000”. The input data includes the DTM data, created through real-time kinematic positioning, positional, epigraphic and morphological data of 276 tombstones. All spatial information first has been drawn in the software AutoCAD Land Development Desktop and then attribute information of the tombstones has been assigned the positions of the stones using “AutoCAD Map 3.0” (Celik et al., 2001).

TOMBSTONE #10

EPIGRAPH

hüve-l hayy-ül baki
'Azraîl can-i azize dest
urub almayıne oltu acisi
bilinmez basına gelmeyince
merham
ve magfur Kirkagaçlı
Cavizade Osman aga
.ruhiyyün elfatiha
sene 1210

DRAWING

OTHER INFORMATION

Reference Made To:	father
Family Name:	cavusoglu
Geo-Origin:	kirkagac
Father:	N/A
Gender:	male
Spouse:	N/A

Figure 3: A sample electronic form for a tombstone (Guney and Celik, 2003a)

Depends on the classification of the gravestones in Kumkale Cemetery some sample hand drawings and 2D - 3D digital images were produced to indicate the variety of the tombstones in the cemetery generally. Using "Discreet 3D Studio Max", "Macromedia Flash 6.0" and "Adobe Photoshop 7.0" standard electronic forms (e-form) were created for each gravestone in Kumkale Cemetery in order to recognize and obtain detail information about a gravestone. This e-form includes the photograph, hand drawing with 1:10 scale, image generated in digital environment, original epigraph in Ottoman language and attribute table of the related gravestone (Guney and Celik, 2003a). In Figure 3, a sample electronic form for a tombstone is illustrated.

The multimedia supported GIS application on Kumkale Cemetery has been published on the Internet (Anonymous, 2004). Celik et al. (2001), Guney et al. (2002), Guney and Celik (2003a), Guney and Celik (2003b), Guney et al. (2003) give detailed information over the GIS applications of the project.

3. CONCLUSIONS

Since the beginning of the project, numerous visual materials like photographs, engravings, maps, etc. have been compiled and documented. The fortresses have been taken photographed and filmed. Historical information about the fortresses and their surroundings has been collected. As an additional study, oral history study was conducted in the village of Seddulbahir. In the geodetic measurement campaigns, approximately 15000 points have been positioned and detailed maps and plans of the fortresses have been produced and a pilot GIS application has been developed for the Kumkale Cemetery.

This multi-disciplinary project helped engineers and historians understand each other. The Seddulbahir-Kumkale team has been working together for almost seven years. The works of the team have already been a successful model for such interdisciplinary projects. It is also obvious that, such kind of collaborative studies would make great contributions to the preservation of historical sites. In the project, different equipments as GPS equipment, high-tech total stations, etc. have been used. This project is one of the first surveying projects in Turkey to use such kind of advanced geodetic equipments.

The historical documentation gives very valuable information to be used for the future restoration projects for the fortresses. The GIS applications that are still in progress would make a contribution to the public interest.

Further information about the project is available on the Internet site "<http://www.seddulbahir-kumkale.com>". The GIS application on Kumkale Cemetery and the publications about the different parts of the project are also available on this site.

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