

PLANNING AND PRODUCTION OF 1300 DIGITAL ORTHOPHOTO MAPS OF THE REGION WHICH WERE EFFECTED FROM THE EARTHQUAKE AT TURKEY

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ABSTRACT

Bolu, Yalova, Eskisehir, Bursa, Istanbul, Adapazari, the cities of Turkey on fault of earth's crust, and their environs of these cities were effected from the earthquake on 17 August 1999. As a result of this earthquake 40 000 persons lost their lives, 32000 persons were injured and 50000 buildings were damaged. To help the reconstruction of the area General Command of Mapping planned to produce 1300 1:5000 scale digital orthophoto maps of the area.

1. INTRODUCTION

Earthquake whose center is Gölcük and with 7.4 magnitude made a very big destruction around Gölcük region in August 17th, 1999. In that area many buildings were destroyed. After the earthquake, some of the places which were near the coast before, has been under the sea now. Some displacement occurred on some places.

After the earthquake, there were needed the maps covering the zone of earthquake new settlement and determining the damage amount as possible.

2. PLANNING

2.1. Earthquake Area

The studies showed us that the region effected from the earthquake had an area near 12000 km². In this area, the centers of population were covered by near 1300 1:5000 scaled maps. This region was divided into 5 parts according to the degree of affected area, and it was decided to make the digital orthophoto maps, which is the best and the fastest way.

The region was divided into 26 photogrammetric blocks and then 98 new control points were established by using GPS techniques. The ground measurements have been established between August 19th and September 7th on all over the earthquake area. GPS observations were made on geodetical points. After that black and white aerial photos were taken on September 8th. The kinematic GPS technique was used while taking the aerial photographs.

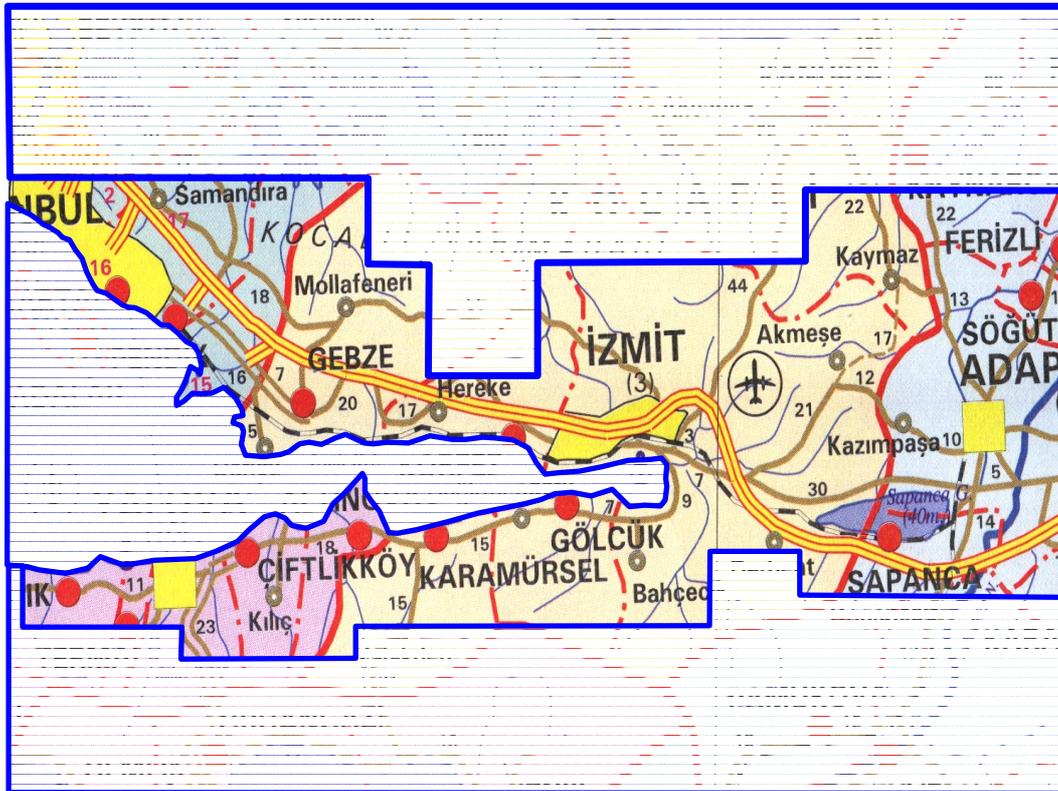


Figure 1. Eartquake area

2.2. Personnel and Production System Planning

In this project, 5 Engineer and 29 operators took roles. 1 aerial film scanner, 7 digital photogrammetric workstations, 2 image processing systems, 7 PC and 1 plotter were used.

2 engineers were the responsible from the aerial triangulation part of production. 8 operators were working for aerial triangulation. The aerial photographs have been scanned by the Zeiss-Scai film scanner at 21μ . GCPs and tie points were measured on Zeiss Phodis AT (aerial triangulation) system. After the finishing this step the kinematic GPS supported aerial triangulation process was carried out by using BINGO and PAT\B GPS softwares.

There are about 4000 photographs in 26 blocks. In photogrammetric triangulation one digital photogrammetric workstation and one PC were used. A black-white photograph can be scanned at 21μ in 10-15 minutes. It takes us to scan 4000 photograpns near 5.6 months. With extra work this step planned to finish in 3 months.

2.3. Production System

At the first step of production, scanned aerial photographs and aerial triangulation adjustment result are imported to the digital photogrammetric workstations. Vision Softplotter software is used on digital photogrammetric workstations. After the needed parameters (camera, projection eg.) were given to the system, inner and exterior orientation of the images were performed. The photogrammetric blocks were prepared and stereo models were extracted from these blocks.

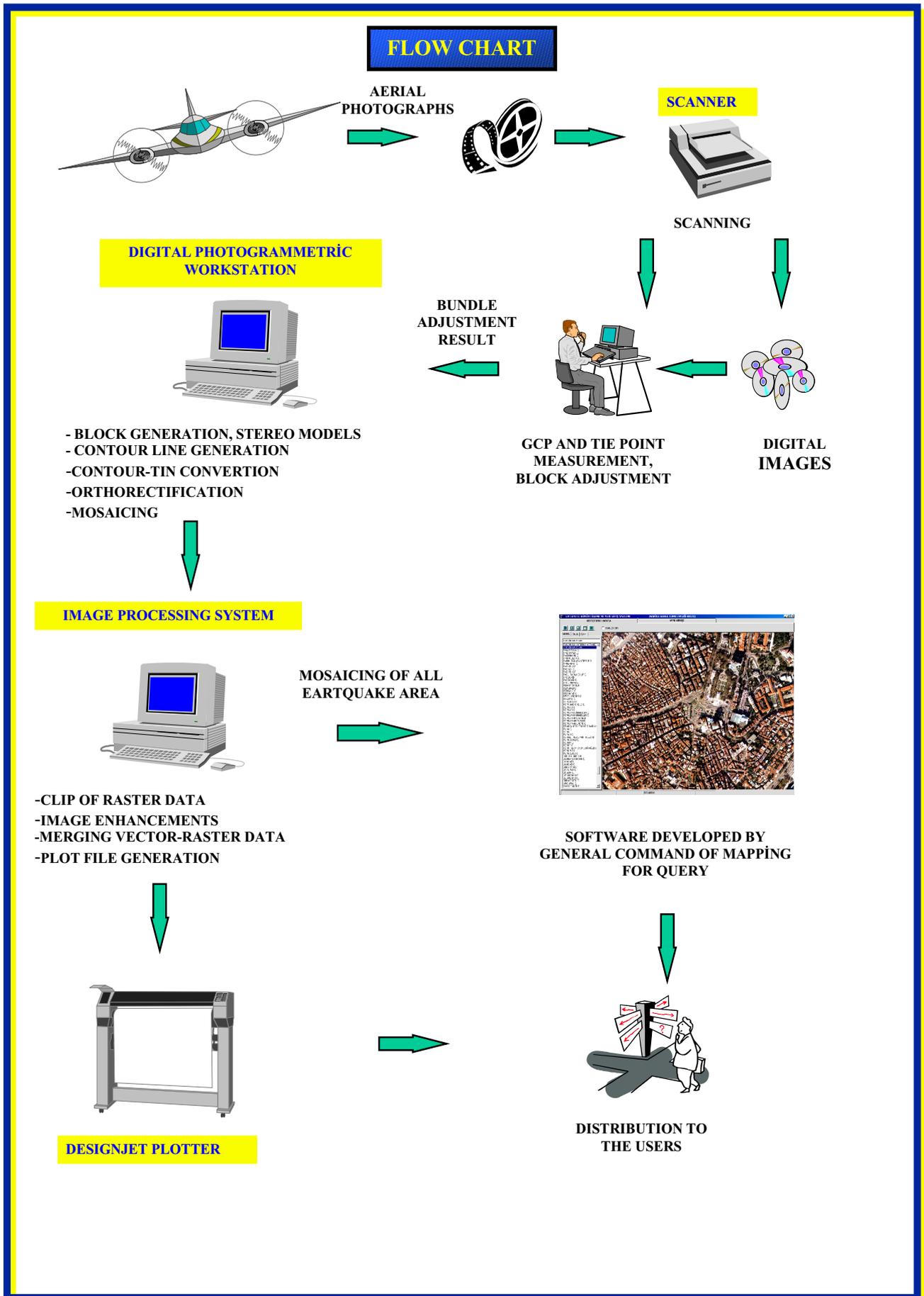


Figure 2. Flow Chart

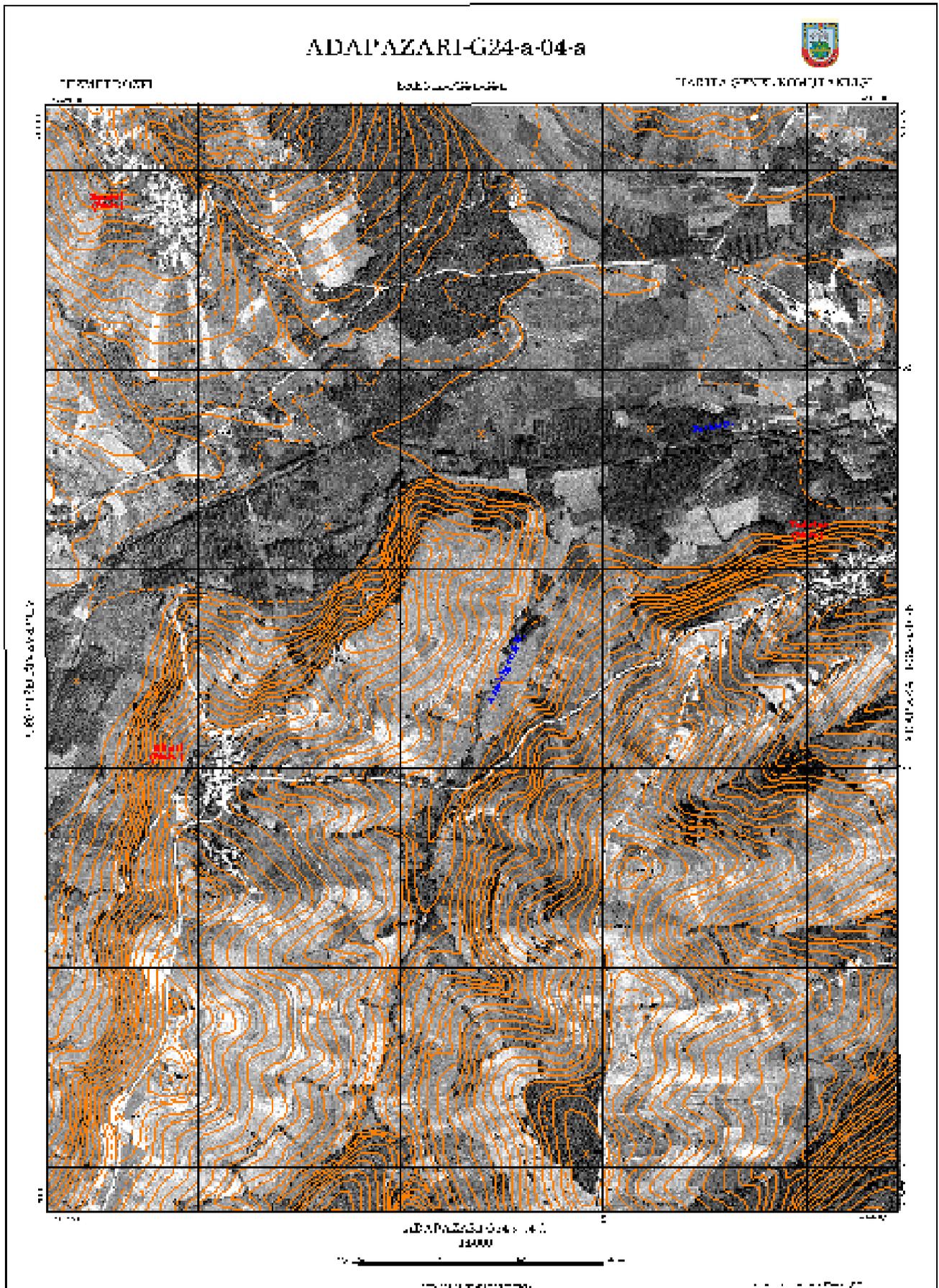


Figure 3 . Orthophoto Map

At the next step, contour lines were collected on stereo models with 5 meter intervals by operators. The most time consuming part of the project was this elevation data derivation. Earthquake area was generally covered by forests and urban areas. Because of this, we could not use automatic techniques at this step. The collected contour lines were converted to TIN format to use in orthorectification. This TIN data were edited on stereo models for better results. Break lines and mass points were added to the TIN data

At the orthorectification step, aerial images which are at TIF format and elevation data which is at TIN format were used. These orthophotos were produced with 0.5 meter spatial resolution. Also the accuracy calculated was about 0.5 meter. Accuracy was controlled over several orthorectified images with different topography. The results were found to be very near to each others. Orthorectifying the photographs are being made by batch processing at nights. Orthorectified images were mosaicked at digital photogrammetric workstations.

The contour lines on the orthophotos were edited at 4 PC.

The processes of clip, adding legend and dropping vector data were carried out on image processing system. PCI (EASI/PACE) software used for this processes. After the merging of edited vector data and raster data, the orthophoto maps were printed with 1:5000 scale by using HP 2500 CP plotter. Since the generated orthophoto maps are used in many applications with related disciplines, these products were mosaiced and the compressed, and then recorded on the CD s. By using this way we are capable of storing a mosaic including 600-700 compressed sheet in one CD.

A software, free of charge, were developed by General Command of Mapping in Turkey. With this software the users can easily carry out coordinate , distance, area measurements, finding places with the name they want and to revise the database for their own purposes.

3. CONCLUSIONS

In that kind of emergencies, the important thing is not the cost or an optimal solution. The important thing is the time to help the people who suffer from the disaster. So in that project the fastest way is tried to be find. Many times priority was given to some areas. It is not true to say that this work flow is very successfull from every point. But it can be easily said that this work flow is very flexible and very successful for the aims that were decided: To help the people in shortest time.