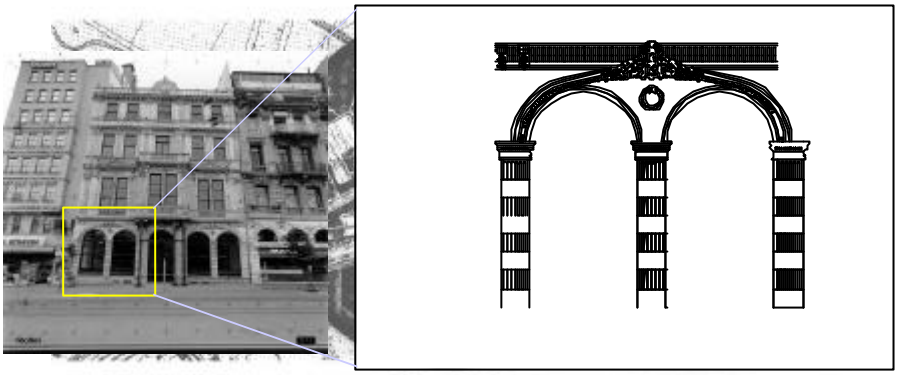
TERRESTRIAL & NUMERICAL PHOTOGRAMMETRY



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PHOTOGRAMMETRY

Photogrammetry is, a system in which an object or an event in time and space is recorded onto a sensitized film or plate by means of appropriate camera or other imaging system, and in which the subsequent image is measured in order to define, portray, digitize or in some way classify the object or event.

Some of nonmapping application of photogrammetry are made in the areas of medicine, dentistry, architecture archeology, experimental analysis of structures hydraulics, ship building, animal husbandry, deformation of dams, glacier and earth slide movements, vehicle motion, missile tracking, accident reconstruction and uderwater events.

The Principle of Photogrammetry

- Assumes the camera produces a perfect central projection,
- There must be no deviation of light rays passing through the lens of the camera,
- The image medium at the focal plane of the camera must be a rigid, planar surface,
- The mathematical relationship between the object and the image is known as the principle of collinearity,
- The principle of collinearity embraces the six degrees of freedom of the camera: three translations and three rotations,
- Departures from the central projection can be modelled as systematic errors in the collinearity condition.

Its most important feature is the fact, that the objects are measured without beingtouched. Therefore, the term "remote sensing" is used by some authors instead of "photogrammetry". "Remote sensing" is a rather young term, which was originally confined to working with aerial photographs and satellite images. Today, it includes also photogrammetry, although it is still associated rather with "image interpretation".

Principally, photogrammetry can be divided into:

1. Depending on the lense-setting:

- **Far range photogrammetry (with camera distance setting to indefinite),**
- **Close range photogrammetry (with camera distance settings to finite values).**

2. Another grouping can be:

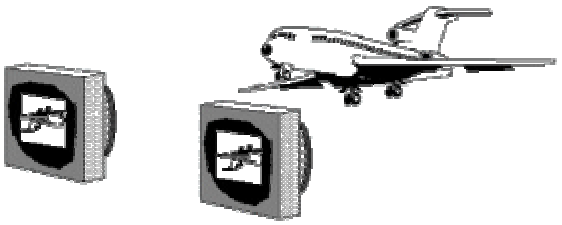
- **Aerial photogrammetry (which is mostly far range photogrammetry),**
- **Terrestrial Photogrammetry (mostly close range photogrammetry).**

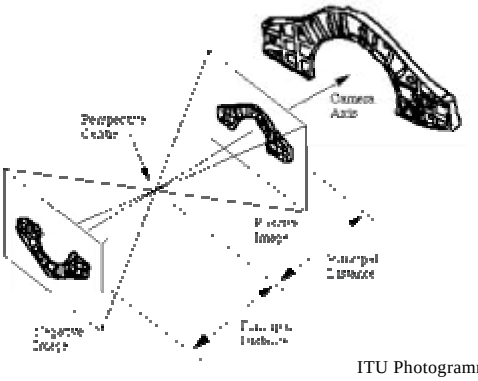
The applications of photogrammetry are widely spread. Principally, it is utilized for object interpretation (What is it? Type? Quality? Quantity) and object measurement (Where is it? Form? Size?). Aerial photogrammetry is mainly used to produce topographical or thematical maps and digital terrain models. Among the users of close-range photogrammetry are architects and civil engineers (to supervise buildings, document their current state, deformations or damages), archaeologists, surgeons (plastic surgery) or police departments (documentation of traffic accidents and crime scenes), just to mention a few.

Photogrammetric Techniques

Single Camera

•2D information only
•application limited to planar objects
•precision dependent on image scale
•no reliability





Close-range Camera Stereopair

•minimum configuration for 3D information
•widely used for aerial and close range
•precision dependent on image scale and base to height ratio
•minimal reliability

What is Photogrammetry?

- Photogrammetry is the **art**, **science**, and **technology** of obtaining **reliable information** about physical objects and the environment through processes of **recording**, **measuring**, and **interpreting** photographic **images**, patterns of electromagnetic radiant energy, and other phenomena.
  - Photos = light
  - gramma = something drawn or written
  - metron = to measure

Photogrammetry Produces

- Coordinates of real world points on objects
- Maps or plans
  - topographic maps
- Orthorectified Imagery
- Digital Terrain Models (DTMs)

without contacting the surface to be measured, and at a predetermined accuracy. Accuracy is mainly determined by the scale of the photograph.

Photogrammetry is used in

- map making
- Geographic Information Systems (GIS)
- Surveying
- Architecture
- movie-making
- accident analysis
- medical imaging
- construction
- mining and heavy industry
- Virtual Reality

Historical Perspective

- 1726 F. Kapeller, constructs a topographic map from drawings of Mt Pilatus on Lake Lucerne.
- 1759, Henry Lambert's treatise on "The Free Perspective", covered geometric fundamentals of today's photogrammetry
- 1829, Guido Schreiber. "The Process and Formulae for air topographic equations and determination of the camera station" (However photographic emulsion still to be invented!)
- 1837, Louis Daguerre - Daguerrotypes - first tangible positive photographic process

- 1859, Tournachon, uses balloon and photography for Napolean's reconnaissance in battle of Solferino.
- 1855, the term "Photogrammetry" coined by geographer Kersten.
- 1864, Aime Laussedat, the "Father of Photogrammetry" surveys Paris by rooftop photography.
- 1889, Textbook on Photogrammetry in German by Koppe.
- 1909, Eduard Dolezal, University of Vienna, founded International Society of Photogrammetry.
- Developments continued throughout Europe, USA, Britain.

Technique that uses photographs for mapmaking and surveying. As early as 1851 the French inventor Aimé Laussedat perceived the possibilities of the application of the newly invented camera to mapping, but it was not until 50 years later that the technique was successfully employed.

In the decade before World War I, terrestrial photogrammetry, as it came to be known later, was widely used; during the war the much more effective technique of aerial photogrammetry was introduced. Although aerial photogrammetry was used primarily for military purposes until the end of World War II, thereafter peacetime uses expanded enormously. Photography is today the principal method of making maps, especially of inaccessible areas, and is also heavily used in ecological studies and in forestry, among other uses.

From the air, large areas can be photographed quickly using special cameras, and blind areas, hidden from terrestrial cameras, are minimized. Each photograph is scaled, using marked and known ground reference points; thus, a mosaic can be constructed that may include thousands of photographs. Plotting machines and computers are used to overcome complications.

Instruments used in photogrammetry have become very sophisticated. Developments in the second half of the 20th century include satellite photography, very large scale photographs, automatic visual scanning, high-quality colour photographs, use of films sensitive to radiations beyond the visible spectrum, and numerical photogrammetry.

Historical Phases Of Photogrammetry

- Analogue Instruments
  - reconstruct via optical and/or mechanical means the geometry of stereo image formation
- Analytical Instruments
  - measure image coordinates on photographs using electro-optical or mechanical methods aided by human visual system
  - Use mathematical models to compute 3D coordinates

- Digital Instruments
  - convert images to digital format
  - Use mathematical techniques to find matching points
  - Use mathematical models to compute 3D coordinates
  - Cost is lower because of lack of requirement for high accuracy electro-mechanical-optical linkages
  - Accuracy
    - depends on the pixel size
    - has not surpassed the accuracy of analytical methods
      - Matching still problematic in difficult areas

Photogrammetric Processing Techniques

Analogue: A pair of photographs are placed in a mechanical/optical device called a stereoplotter. An operator physically adjusts the orientations of the photographs to match the exposure situation. Detail and heights are traced on a plotting table by a direct mechanical linkage.

Photogrammetric Processing Techniques

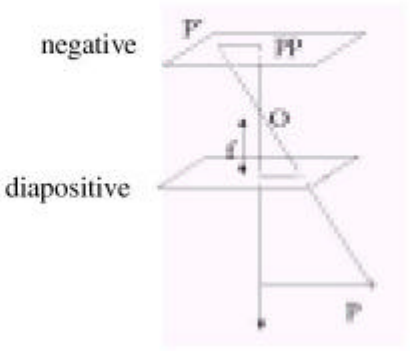
Analytical: Single or pairs of photographs are placed in an X-Y measuring stage which digitally records image coordinates. Mono or stereo comparators are manually driven whilst analytical plotters are semi-automated. Recorded measurements are computer processed and the information registered in a CAD database.

Photogrammetric Processing Techniques

Digital Image: Single or pairs of digital images are loaded into a computer with image processing capabilities. The images may be from satellite or airborne scanners, CCD cameras or are conventional photographs captured by a line scanner. The images are either displayed on the screen for operator interpretation, enhanced by image processing or subjected to image correlation in order to form a digital elevation model or extract detail.

Central Projection

- Fundamental Image Formation Maths
- O: Projection Centre (Camera Position)
- PP: Principal Point
- f: focal length, principal distance, camera constant
- P: point in space
- P': image of point P



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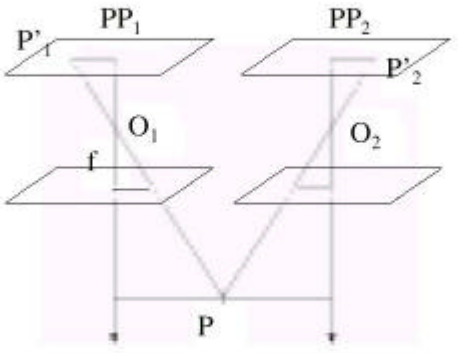
Principle of Stereo Photogrammetry



Position of P is uniquely determined by the intersection of lines P'_1O_1 and P'_2O_2

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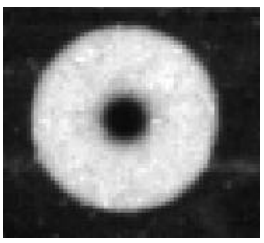
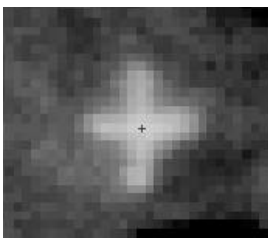
Interior (Inner) Orientation

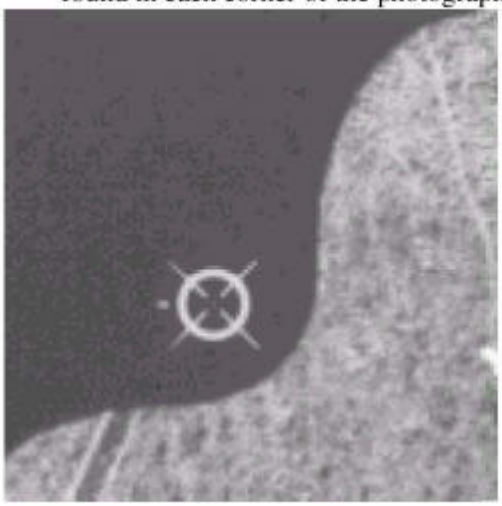
- To make use of the central projection, we need to know
  - the location of PP, the principle point, in the image.
    - Specified in relation to fiducial marks
  - the focal length f.
  - These are usually found in the camera calibration process

Fiducial Marks

Fiducial marks are small targets on the body of metric cameras. Their positions relative to the camera body are calibrated. Thus, they define the image co-ordinate system; in that system, the position of the projection centre is known. Form as well as distribution of fiducial marks depend on the manufacturer. If amateur cameras are used, the images of corners of the camera frame on the negatives can be used instead of fiducial marks.

Example of a fiducial mark, In this case found in each corner of the photograph



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Fiducial Marks

- There are many varieties of fiducial mark employed by different cameras and manufacturers. They all provide a means of precisely identifying the location of the principle point

Corner Fiducials

Side Fiducials

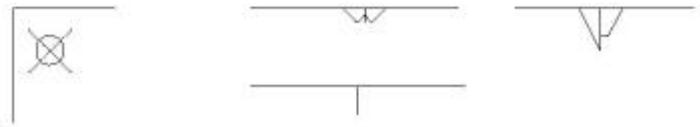

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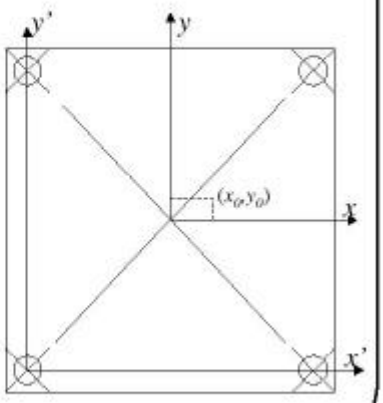
Photo Coordinate System

- A Photo coordinate system is defined in reference to the fiducial marks, and the position of the PP given in the defined coordinate system, as (x_0, y_0).
- Positive x is defined as the direction of flight



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Relating Photo Coordinates to Image Coordinates

- Define
  - Photo Coordinates
    - origin is specified by the fiducial marks
    - positive x in direction of flight
  - Image Coordinates
    - origin is at the Projection Centre
    - positive x in direction of flight
    - negative z in direction of photograph.

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Other Practicalities of Image Formation

- Lens Distortion
- Motion Blur
- Emulsion distortion and orientation
- Film base distortions
- Atmospheric scattering, clouds, smoke, haze, refraction
- Suitable ground control points for camera station position and orientation.
- Curvature of the Earth's surface

Summary

- Photogrammetry is the **art**, **science**, and **technology** of obtaining **reliable information** about physical objects and the environment through processes of **recording**, **measuring**, and **interpreting** photographic **images**, patterns of electromagnetic radiant energy, and other phenomena.
- Analogue, analytical and digital photogrammetry
- Central Projection
- Interior and Exterior Orientation
- Fiducial Marks

- Coordinate Systems
  - Photo coordinate system
  - Image coordinate system
  - World coordinate system
- Point Location with a single photograph
- Point Location with stereo photographs
  - In the real world, we must take into account the deviations from these simple ideal cases, and much of photogrammetry deals with methods for doing this, and attaining the highest possible levels of accuracy.

TERRESTRIAL PHOTOGRAMMETRY

When ground-based cameras are employed, the term terrestrial photogrammetry is used. This term has been historically applied to the system of surveying and mapping from phototographs taken at ground stations. Terrestrial photogrammetry can be further classified;

• as close-range photogrammetry if the camera-object distance is somewhere between 1:10 m to 100 m,

• as macrophotogrammetry if the camera-object distance is in the 0.10 to 0.01 m range,

• as microphotogrammetry when the photos are exposed through a microscope.

PHOTOGRAPHING DEVICES; CAMERAS

A photographic image is a „central perspective“. This implies, that every light ray, which reached the film surface during exposure, passed through the camera lens (which is mathematically considered as a single point, the so called „perspective center“). In order to take measurements of objects from photographs, the ray bundle must be reconstructed. Therefore, the internal geometry of the used camera (which is defined by the focal length, the position of the principal point and the lens distortion) has to be precisely known. The focal length is called „principal distance“, which is the distance of the projection center from the image plane´s principal point.

Depending on the availability of this knowledge, the photogrammetrist devides photographing devices into three categories:

Metric Cameras

They have stable and precisely known internal geometries and very low lens distortions. Therefore, they are very expensive devices. The principal distance is constant, which means, that the lens cannot be sharpened when taking photographs. As a result, metric cameras are only usable within a limited range of distances towards the object. The image coordinate system is defined by (mostly) four fiducial marks, which are mounted on the frame of the camera. Terrestrial cameras can be combined with tripods and theodolites. Aerial metric cameras are built into aeroplanes mostly looking straight downwards. Today, all of them have an image format of 23 by 23 centimeters.

Stereometric Camera

If an object is photographed from two different positions, the line between the two projection centers is called "base". If both photographs have viewing directions, which are parallel to each other and in a right angle to the base (the so called "normal case"), then they have similar properties as the two images of our retinas. Therefore, the overlapping area of these two photographs (which are called a "stereopair") can be seen in 3D, simulating man´s stereoscopic vision.

In practice, a stereopair can be produced with a single camera from two positions or using a stereometric camera. A stereometric camera in principle consists of two metric cameras mounted at both ends of a bar, which has a precisely measured length (mostly 40 or 120 cm). This bar is functioning as the base. Both cameras have the same geometric properties. Since they are adjusted to the normal case, stereopairs are created easily.

Non-metric (Amateur) Cameras

The photogrammetrist speaks of an „amateur camera", when the internal geometry is not stable and unknown, as is the case with any „normal" commercially available camera. However, also these can be very expensive and technically highly developed professional photographic devices. Photographing a test field with many control points and at a repeatably fixed distance setting (for example at infiniy), a „calibration" of the camera can be calculated. In this case, the four corners of the camera frame function as fiducials. However, the precision will never reach that of metric cameras. Therefore, they can only be used for purposes, where no high accuracy is demanded. But in many practical cases such photography is better than nothing, and very useful in cases of emergency.

Digital Cameras

Photography can be taken with a variety of cameras; however, the result must be digital image files. Digital cameras work the best for schedule and efficiency, with no loss of accuracy. The resolution of the cameras defines the field procedures to be used, not the final accuracy. Generally, lower cost, lower resolution cameras take more labor to get the same accuracy as higher resolution cameras. Vexcel can assist in determining the best camera for your particular needs.

CAMERAS IN TERRESTRIAL PHOTOGRAMMETRY

Two basic camera types are employed in terrestrial photogrammetry. These are; metric cameras and non metric cameras.

Metric cameras are designed and calibrated specifically for photogrammetric measurement. It has a known and stable interior orientation and is usually a fixed-focus camera. They also contains fidicual marks with which to recover the interior orientation.

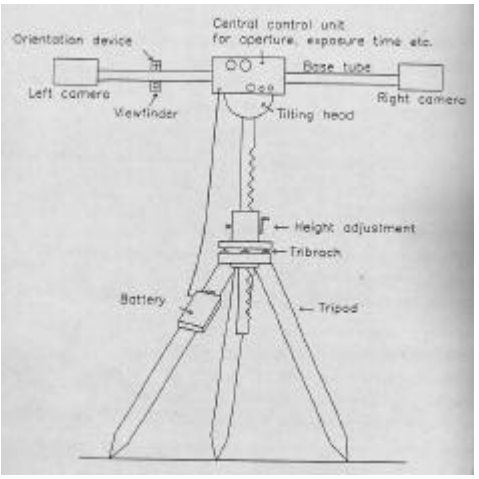
Nonmetric cameras are represented by a variety of fairly high-quality hand-held cameras used by amateur and professional photographers to take good pictorial quality.

TERRESTRIAL METRIC CAMERAS

The photographs for terrestrial potogrammetry are usually taken with the cameras in fixed positions, the elements of outer orientation being frequently determined by field survey. Photographs at large distances, camera to object, are only used in special cases, for example for topographic surveys by expeditions and for glaciological research. Detail photographs in hilly areas, e.g. for the constructions of hydroelectric power stations of for quarry surveys, border on close-range photogrammetry in which the camera is focused on finite distances and the depth of field has to be considered.

GENERAL DESIGN OF TERRESTRIAL METRIC CAMERAS: *Stereometric Camera*

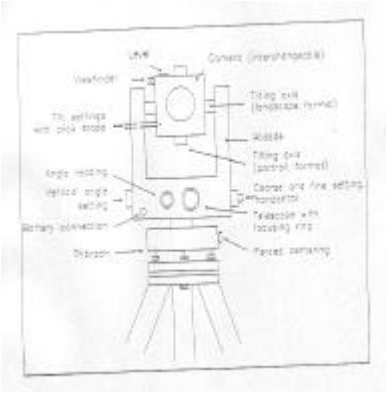
Stereometric Camera consist of two cameras fixed relative to each other in the normal case with, usually, a fixed base. The most common base is 120 cm, for object distances is from 5 to 25 m. They are designed for those cases where a simple photogrammetric arrangement is suitable., for example traffic accident or simple surveys of building facades. Fixed-base cameras baselengths of 40 cm and 200 cm also exist.



Systematic diagram of a stereometric camera.

GENERAL DESIGN OF TERRESTRIAL METRIC CAMERAS: *Independent Metric Camera*

These cameras are used whenever maximum accuracy is required and the base/distance ratio must be carefully considered.



Systematic diagram of a an independent metric camera.

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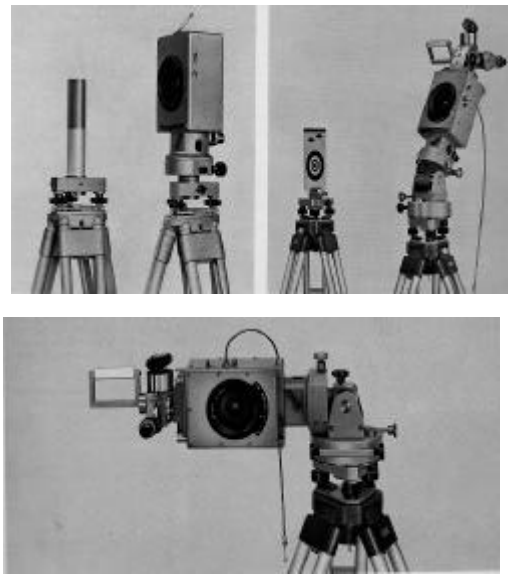
Stereometric Cameras

Independent Metric Camera



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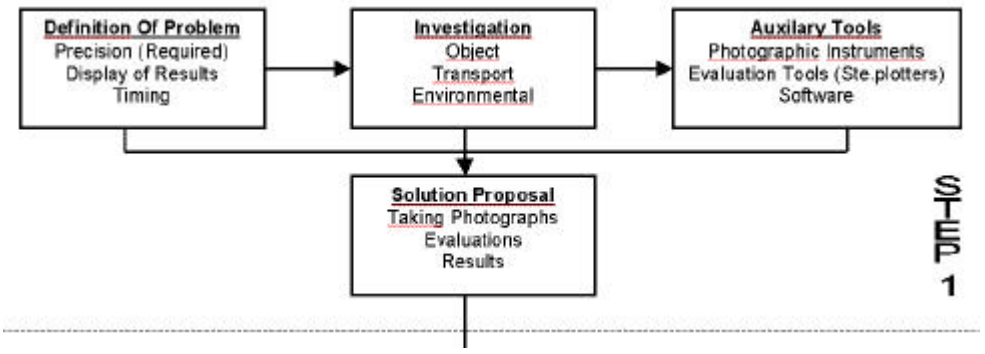
EXAMPLES FOR STEREOMETRIC CAMERAS

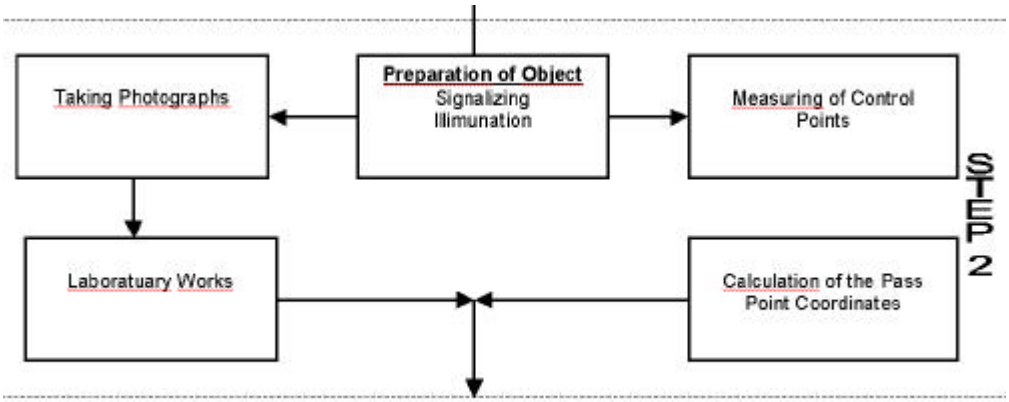
- © **Wild C120**
- © **Wild C40**
- © **Zeiss Oberkohen SMK 120**
- © **Zeiss Oberkohen SMK 40**

EXAMPLES FOR INDEPENDENT METRIC CAMERAS

- **Wild P31**
- **Wild P32**
- **Zeiss Jena UMK**

STEPS OF A TERRESTRIAL PHOTOGRAMMETRIC APPLICATION





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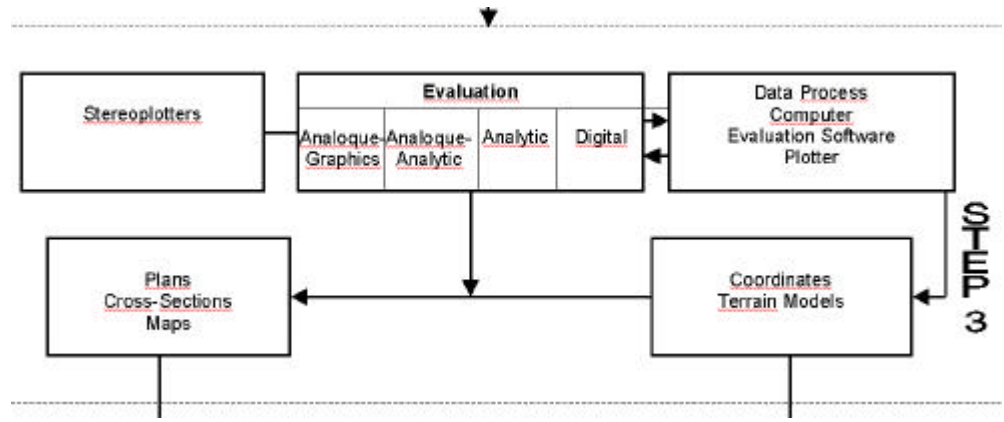

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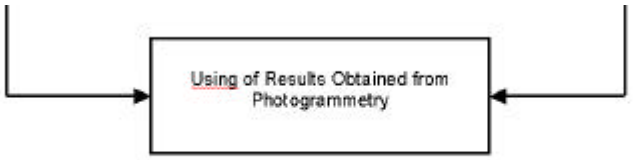
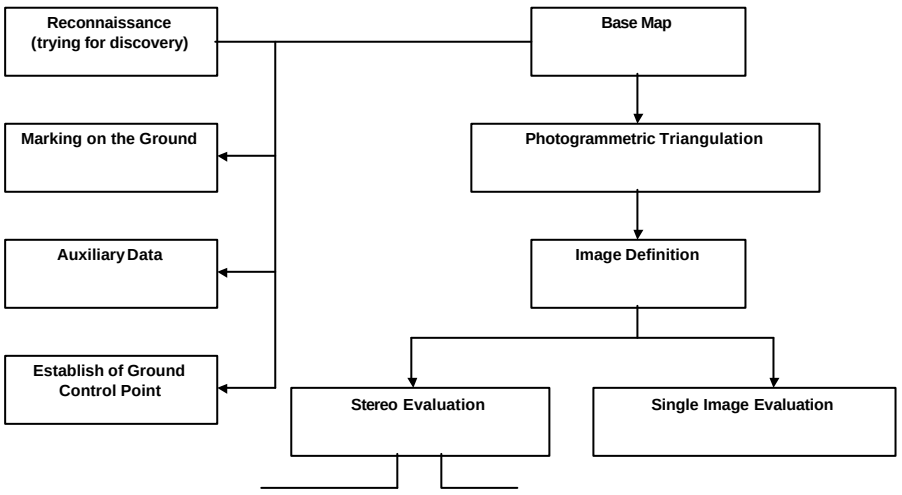
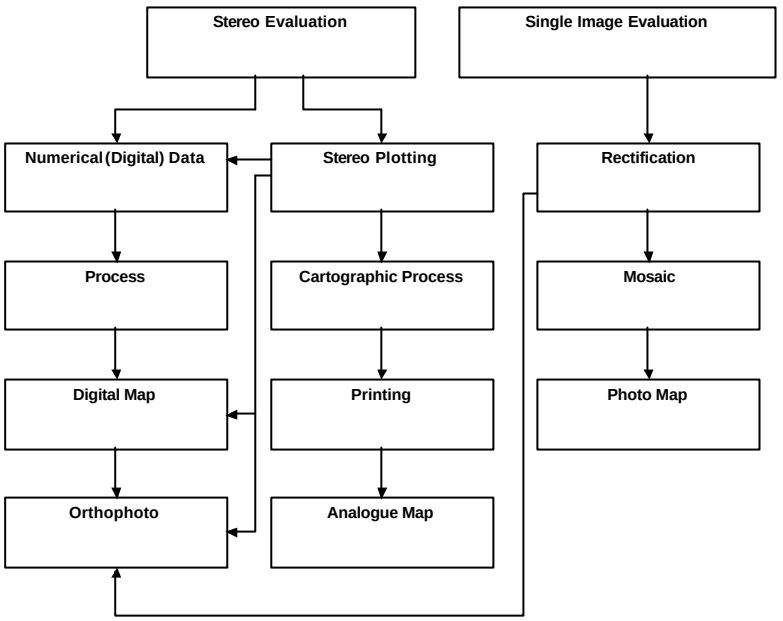


STEP 4

FLOWCHART OF PHOTOGRAMMETRIC MAP PRODUCTION





TERRESTRIAL AND NUMERICAL PHOTOGRAMMETRY

Dursun Z. aeker

AREAS OF APPLICATIONS OF CLOSE-RANGE PHOTOGRAMMETRY

The ever-expanding areas of application of close-range photogrammetry can be grouped into three major areas: architectural photogrammetry, biomedical and bioengineering photogrammetry (biostereometrics) and industrial photogrammetry.

ARCHITECTURE

It is noteworthy that the very first measurements ever made by photogrammetry (in the middle of the 19th century) had to do with monuments. It is also a fact that the term "photogrammetry" was introduced by an architect,

Albrecht Meydenbauer, who made his first photogrammetric surveys in 1867. For over century, photogrammetric methods and equipment have continued to evolve. More recently, the field of architectural application of photogrammetry has undergone considerable expansion both in scope and diversity.

SURVEYS OF HISTORICAL MONUMENTS

Photogrammetric surveys of historic monuments can be grouped in three major categories:

- **Rapid And Relatively Simple Surveys**
- **Accurate and Complete Surveys**
- **Very accurate surveys.**

Operational Procedures

Procedures for all of the above-discussed types of photogrammetric surveys are well established and documented. Independent stereopairs of photographs are taken either horizontally, vertically or at some inclination using the camera(s) most suitable for the individual project. Base-to-distance ratio is kept rather small (1/5 to 1/15). External controls are kept as simple as possible (such as number of distances and checks on the levelling bubbles of the camera). In case of complex object, however, a network of reference points is necessary. Camera stations are normally located on the ground, on scaffoldings, on nearby buildings, on a hydraulic lift truck or even in helicopters, which are sometimes used to take horizontal photographs of the upper portions of tall buildings.

BIOSTEREOMETRICS (BIOMEDICAL AND BIOENGINNERING APPLICATIONS OF PHOTOGRAMMETRY)

The study of biological form is one of the most engaging subjects in the history of human thought, which is hardly surprising considering the immense variety of living things. As new measurement techniques and experimental strategies have appeared, new fields of inquiry have been launched and more minds have become absorbed with the riddle of biological form. Discovery of the microscope and X-rays prompted the development of microbiology and radiology, respectively. More recently advances in electronics, photo optics, computers and related technologies have helped to expand the frontiers of morphological research. Growing interest in the stereometric analysis of biological form typifies this trend.

INDUSTRIAL PHOTOGRAMMETRY

Photogrammetry has been applied in numerous industrial fields and the potentially for further expansion and growth is seemingly limitless. Industrial photogrammetry has been described as "*application of photogrammetry in building construction, civil engineering, mining, vehicle and machine construction, metallurgy, ship building and traffic, with their fundamentals and border subjects, including the the phases of research, planning, production engineering, manufacture testing, monitoring, repair and reconstruction. Objects measured by photogrammetric techniques may be solid, liquid or gaseous bodies or physical phenomena, whether stationary or moving, that allow of being photographed*" by Meyer (1973).

Economic benefits of photogrammetric approach

$ Measurement time on the object is reduced by %90 - %95,

$ Saving in manpower,

$ Reduce machine and time for blade machining through optimisation of the metal removal rate,

$ Reduced material expenditure in the propeller casting manifacture through optimised molds,

$ A cut in recycling time for non-ferrous metals,

$ Shorter production time for propeller manufacture.

Examples of Industrial Applications

- ✓Automobile Construction
- ✓Mining Engineer
- ✓Machine Constructions
- ✓Objects in Motion
- ✓Shipbuilding
- ✓Structures and Buildings
- ✓Traffic Engineering

Architectural Close Range Application Done by Our Department

- Hagia Sophia Photogrammetric Record of a World Cultural Heritage
- Soðukçeþme Sokaðý (Coldfountain Street)
- Obtaining of a Facade Plan of Dolmabahce Palace by Digital Photogrammetric Techniques
- Kucuksu Pavillion
- Seniye Sultan Mansion
- Amcazade Huseyin Pasha Mension
- Historical Galatasaray Postoffice

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OLD CITY SILHOUETTE OF ISTANBUL

In this study, it has been intended to obtain a 1:500 scaled silhouette of old Ýstanbul in order to protect the historical structure. For this purpose, the photographs were taken from the arbitrary points on board of a sea craft. The control points were marked along the shore. UMK10/1318 Photogrammetric camera has been used to take photographs and Digital Photogrammetric System (PICTRAN)was used for evaluation.

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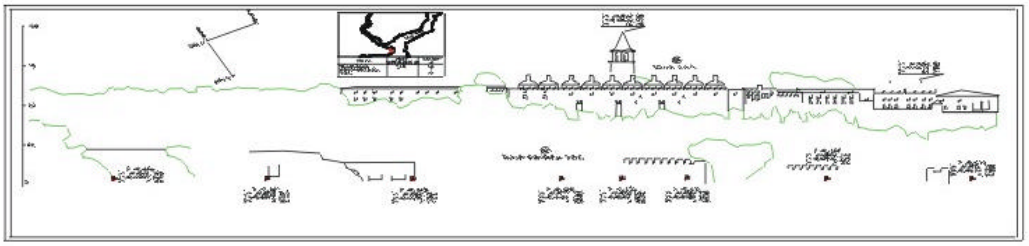
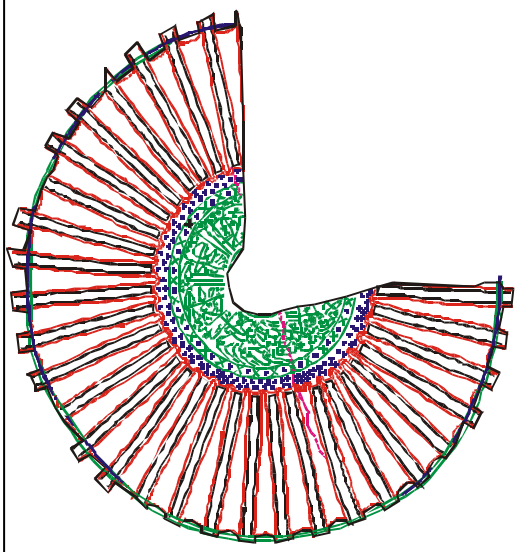


An Example Drawing of Old City Silhoutte of Istanbul

The Haghia Sophia in Istanbul belongs with its unique dome construction to the outstanding and extraordinary architectural structures in the whole world. Build between 532 and 537 during the Byzantine Impair Justinian (527-565), it reflects the sum of all experiences and knowledge of the classical antiquity and it is one of the important monuments of the world heritage. Haigha Sophia considered as the first and the last unique application in terms of its architecture, magnificence and functionality has been inspiration for Ottoman mosque on the basis of giving opinion, and is product of synthesis of west and east. The art is one of the wonders of the world remained until now.

Hagia Sophia
Photogrammetric Record of
a World Cultural Heritage



The Conservation and Restoration Branch of Historical Buildings asked the Photogrammetry Division of the Istanbul Technical University to prepare orthophotos of the Hagia Sophia. Together with the Institute of Photogrammetry and Remote Sensing of the Vienna University of Technology, it was decided to create a high quality 3D model of the dome, so that the obtained results can later be also used in an "Hagia-Sophia Information System". This Information system has the duty to collect all the information about the building and will be a useful guide for everyone. As one result a 3D photo-model was generated and stored using the data format VRML (Virtual Reality Modeling Language). This paper describes the measurement process, the generation of the 3D model, the production of the terrestrial orthophotos and the setup of an information system.

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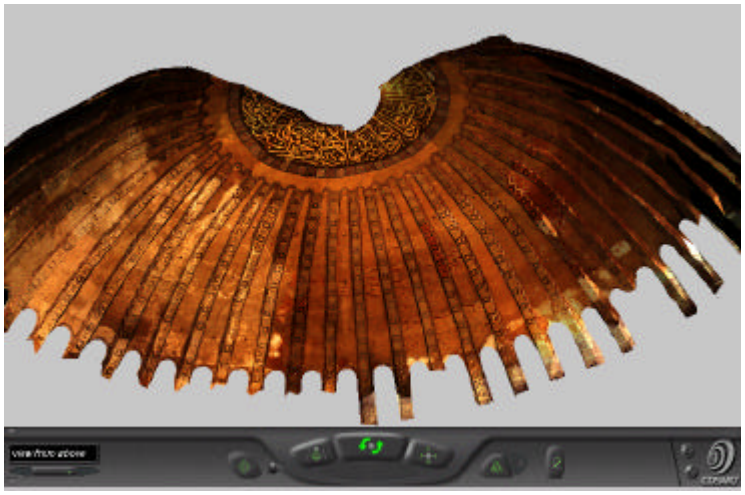

Vrml model of Hagia Sophia

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SOĐUKÇE ª ME SOKAĐI (GOLD FOUNTAIN STREET)

On appoaching the Imperial Gate leading into the outer courtyard of Topkapi Palace one's attention is immediately attracted by the row of old Istanbul houses in the street running off the left. This narrow street between the palace walls and Ayasofya is known as the "Street of the Cool Fountain".

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Photogrammetric Evaluation of Sogukcesme Street

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SOĐUKÇE ª ME SOKAĐI

The houses built against the palace valls form part of a complex that includes the fountain dated 1810 that gives the street its name and a cistern forming part of the chain of great water depots from the Roman period, the whole reflecting the character of a city that has served as capital of three great empires.

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Obtaining of Facade Plan of Dolmabahçe Palace by Digital Photogrammetric Techniques

The aim of the project was to make facade plans of Dolmabahçe Palace with a scale of 1/100, 1/50, 1/20 and 1/10. A preliminary study was done and control points were signalized. By the help of surveying methods, ground control points coordinates were measured. Photographs were taken due to a Study Plan, and were scanned. Evaluation was done using digital photogrammetric software, PICTRAN. After interior and exterior orientation, points were measured on oriented photographs, and bundle adjustment was used. Information produced in Pictran was transferred into AUTOCAD system. Cross-section plans were obtained by conventional methods.

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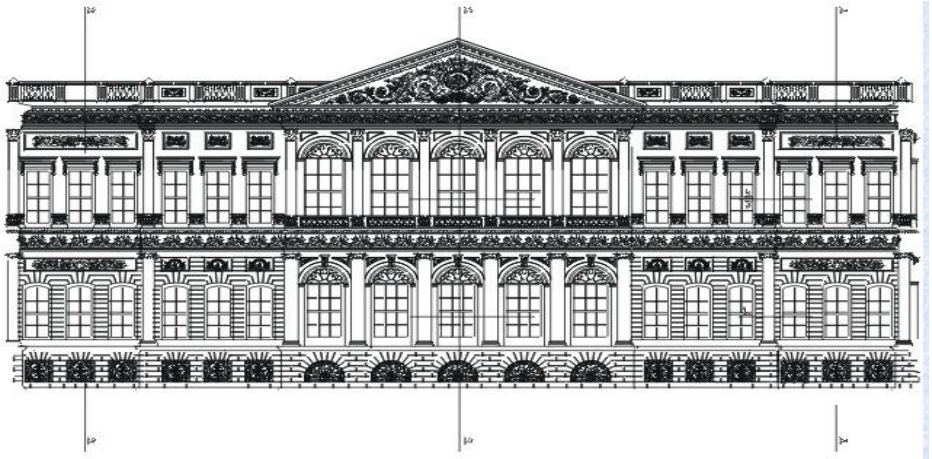

Obtaining of Facade Plan of Dolmabahce Palace

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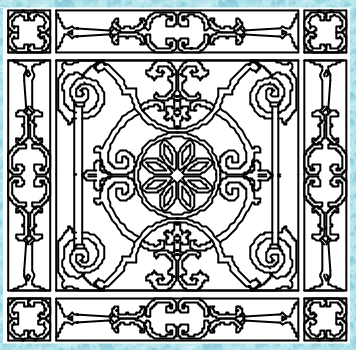
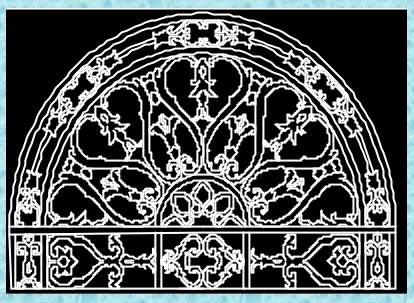


Windows Details from Facade Plan of Dolmabahce Palace



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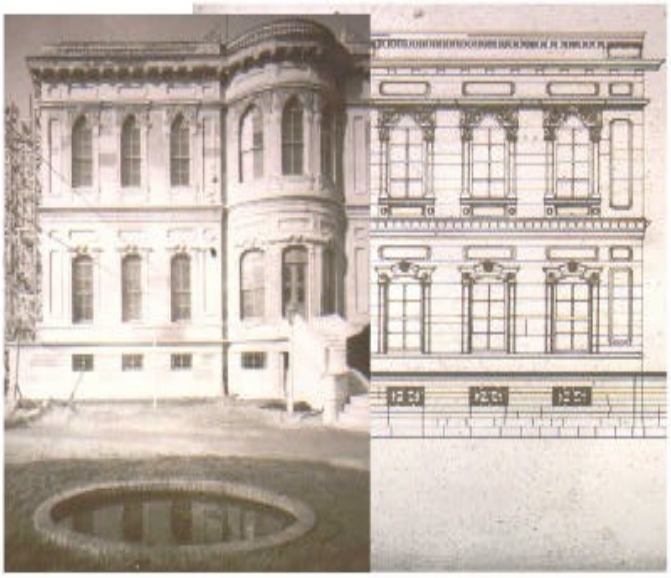
KÜCÜKSU PAVILION



This attractive part of the Bosphorus on the Asian shore is mentioned by Byzantine historians, and in Ottoman times became one of the imperial parks known as Kandil Bahçesi (Lantern Garden). Sultan Murad IV (1623-1640) was particularly fond of Küçüksu and gave it the name Gümü° Selvi (Silver Cypress), and in several sources from the l7th century onwards the name Bağçe-i Göksu is used.

Seniye Sultan Mansion

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Amcazade Hüseyin Paºa Mansion

The only survivor of the old, wood-built waterside residences is the Amcazade Hüseyin Paºa Mansion on the coast at Kanlıca. In fact only a part of this great mansion, the T-shaped reception room with its great windows overlooking the Bosphorus, remains.

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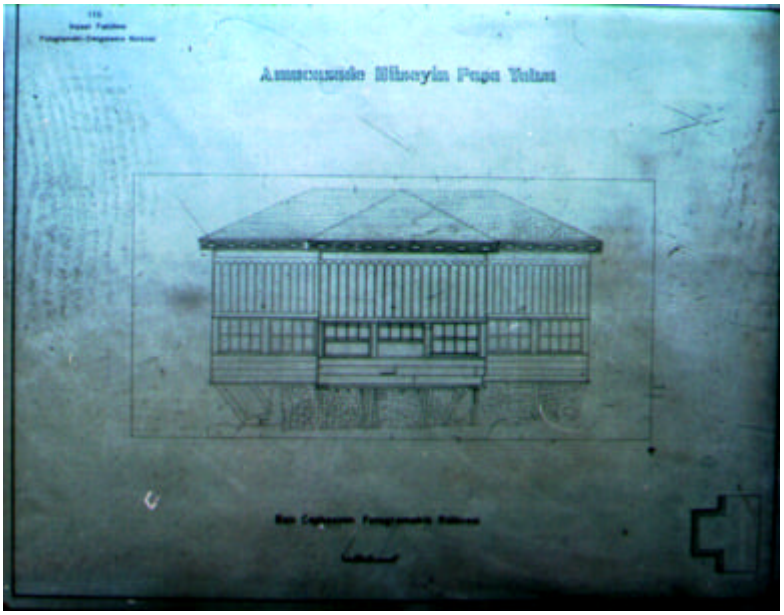

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Unfortunately its walls, which are embellished with painted and gold leaf designs, have deteriora-ted rapidly during the last 50 years because of neglect. In the middle of this room is a marble pool and over it, a domed roof bearing traces of its former magnificence.

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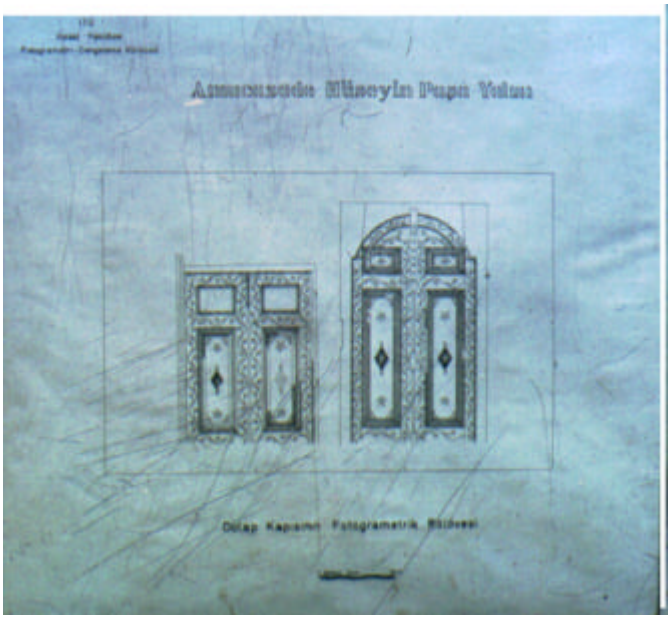

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Photogrammetric and Geodetic Map Revision for Boğazkale Archaeological Excavation Field

The aim of the project is to revise the map of Boğazkale Archaeological Excavation Field by means of geodetic and photogrammetric methods. According to the plan which is prepared for taking photographs; a preliminary study done at Boğazkale Archaeological Field. Control points are painted on the rocks. Photographs were taken by SMK 120 stereo photogrammetric camera. Photographs are evaluated at Ý.T.Ü. Engineering Faculty Photogrammetry Laboratory by means of B8S analytical photogrammetric instrument. A PC based Digital photogrammetric software PICTRAN was used for evaluation.

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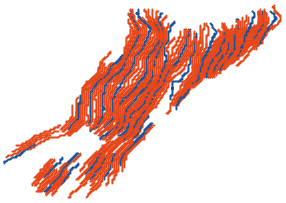
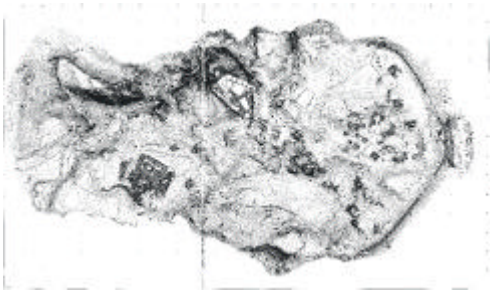
Camera calibration is made according to bundle adjustment and photographs that were taken without approximate values of orientation parameters, are scanned and oriented. Points are measured on oriented photographs and point coordinates are determined by means at intersected homologous rays. According to the project appropriateness, Digital Terrain Model (DTM) of Boğazkale Archaeological Field as obtained by the help of software, which is developed by the Photogrammetry Division. Information, which was produced in Pictran software, is afterwards transferred into AUTOCAD system.





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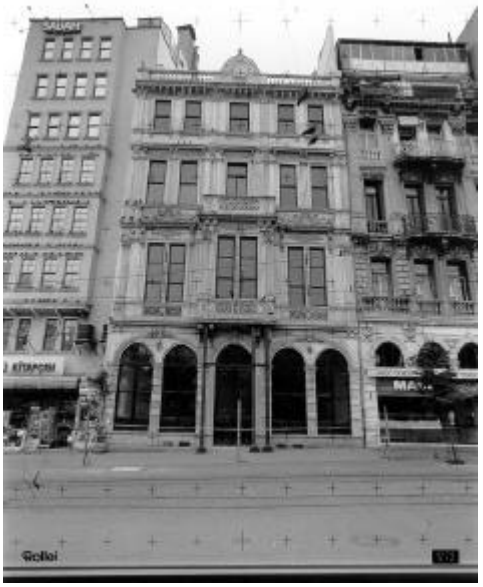
Architectural Photogrammetric Work At Historical Galatasaray Post Office



In this study, it has been obtained data for architechtural CAD drawing with 1/20 and 1/50 scale by means of Digital Close Range Photogrammetric techniques at historical Post Office of Galatasaray building. Pictran D - B software were used for Digital Photogrammetric Software evaluation. Rollei 6008 Metric Camera were used for taking photos with focus 40 mm lens.

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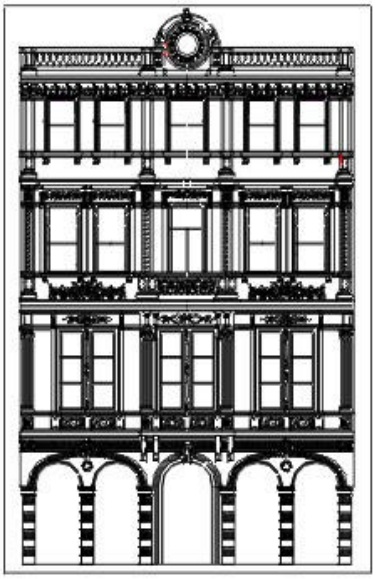
The control points were market on the building side with slycon. AutoCAD R14 were used for drawing the plans for architechtural work. These products will use for restoration and reconstruction of the historical Galatasaray Post Office building in Istanbul city.



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