AERIAL TRIANGULATION

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Aerial triangulation

- Aerial triangulation is the term applied to the process of determining x,y and z Ground coordinate of individual points on measurements from the photograph.
- The principal application is in extending Ground control through strip or block of photo for use in subsequent photogrammetric operation.

Benefits of Aerial Triangulation

- Minimizing delays and hardships due to adverse weather condition.
- Access to much of the property within the project area is not required.
- Field surveying in difficult area, such as Marshes, Extreme slope, hazardous rock formation, etc; can be minimized.

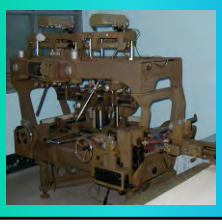
Method of Aerial Triangulation

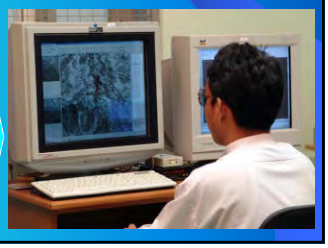
Aerial Triangulation is classified three categories.

- Analogue Aerial Triangulation
- Semi Analytical Aerial Triangulation
- Analytical Aerial Triangulation

Analytical Aerial Triangulation

Analytical Aerial Triangulation tends to be more accurate than Analogue or semi analytical analogue aerial triangulation.





Materials to be performed Aerial Triangulation

- Index map of Aerial photos
- Digital Aerial image data
- Results and Descriptions of Ground control Points
- 3D-airborne position data File of Aerial photo
- Elements of Aerial Camera

Parameter of aerial camera

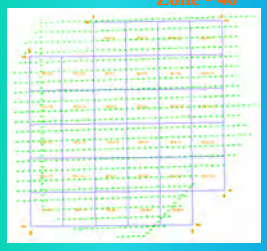
Type and Name	Leica RC-30
Focal distance	153.19mm
Fiducial Data	Less than 6 μ
Distortion	Less than 6 μ
Offset of GPS antenna	Corrected Position

d=Offset of antennah

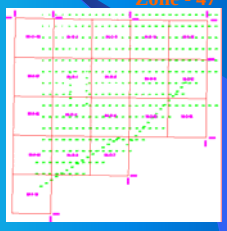
Aerial Triangulation Index Map

Two block of Aerial Triangulation were performed using the block adjustment program

Zone – 46



Zone - 47



The whole study area composed of 1,100 models.

Digital Aerial Image Data

Result and Description of Ground Control Points

Airborne GPS support Aerial triangulation

Airborne GPS support Aerial triangulation was performed in order to get equal precision as usual by less number of ground controls.

Trails of airplane by GPS observation

3D positions are observed by GPS continuously every 1 second

GPS Antenna

GPS loaded airplane for photography

Ground control

Procedure of Aerial triangulation

Preparation

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Input of Control Points and Exposure station

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Input of Aerial Photo Image

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Execution of Inner Orientation

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Observation of photo coordinate

Error snooping by Calculation

Examination

Block Adjustment

Documentation of Result

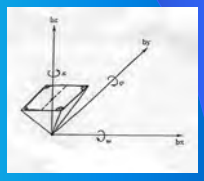
Store Results in CD-Rom

Orientation Parameters

6 elements

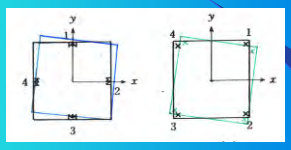
Position of aerial camera and inclination of axes as

(dx, dy, dz), (ω, φ, κ)

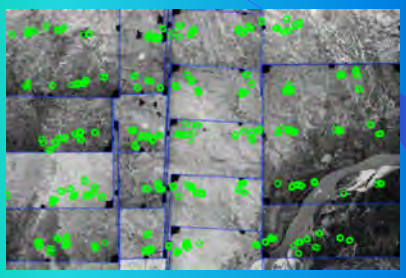


Inner Orientation

Inner orientation is performed to locate the aerial photo by using fiducial mark.



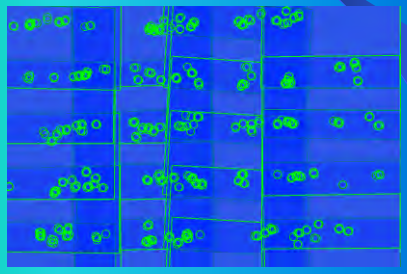
Relative Orientation



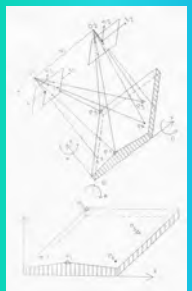
Relative orientation provides a convenient means of checking most point making and photogrammetric measurement.

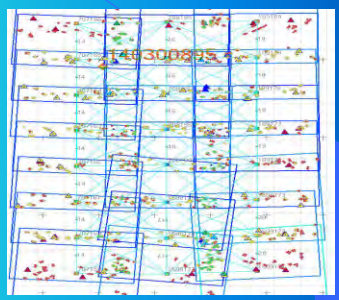
Pass-points and Tie-points

Pass-point and Tie-points are used to connect photos or models and strips.



Block adjustment by bundle adjustment





The block adjustment is performed to transfer from photo coordinate system to object x,y,z coordinate system.

Accuracy of adjustment of aerial triangulation

Theoretical error of adjustment

Plane position - σ x, y = 6 μ(on photo)

=300mm(on ground)

Elevation - σ z = 0.006% of altitude

=450mm(on ground)

Adjusted errors of Horizontal Position

	Axis	Mean ERROR	Max. ERROR
Zone 46	X	0.602	1.686
	Y	0.628	1.547
Zone 47	X	0.378	0.678
	Y	0.585	1.058

Unit: m

Theoretical estimated error is 0.02% of the flight height.

Theoretical error on ground = 590mm

Adjusted errors of vertical position

	Mean Error	Max. Error
Zone 46	0.006	0.023
Zone 47	0.007	0.019

Unit: m

The theoretical error of vertical position is 0.006% of flight height.