

A Preliminary Study on the Practical Issues in Using RTK GPS for 3D Mapping

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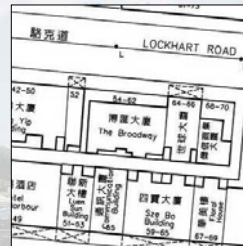
Agenda

- Background
- Use of RTK-GPS in SMO
- The Case Study
- Conclusion and Recommendation

Survey and Mapping Office (SMO)

- The SMO of the HKSAR Government is the central authority for land surveying and all types of mapping in HK.
- One of SMO's major responsibilities is to maintain a comprehensive set of maps covering the whole HK territory in different scales in hardcopy and digital form.

Mapping Products (1)



1:1000 Basic Survey Sheet



1:10000 Derived Map

Mapping Products (2)




1:20000 Topographic Map




1:20000 Country Side Map

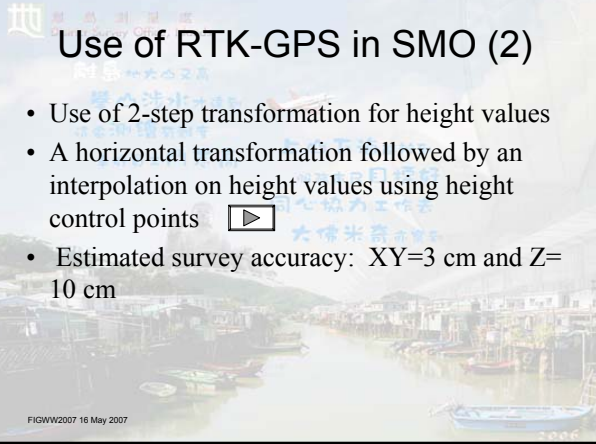
Use of RTK-GPS in SMO (1)

- Use of static GPS and Real Time Kinematic (RTK-GPS) in land surveying work since 1993 and 1997 respectively.
- In 2006, launch of Satellite Positioning Reference Station (SatRef) supporting RTK-GPS with GSM connection 



Use of RTK-GPS in SMO (2)

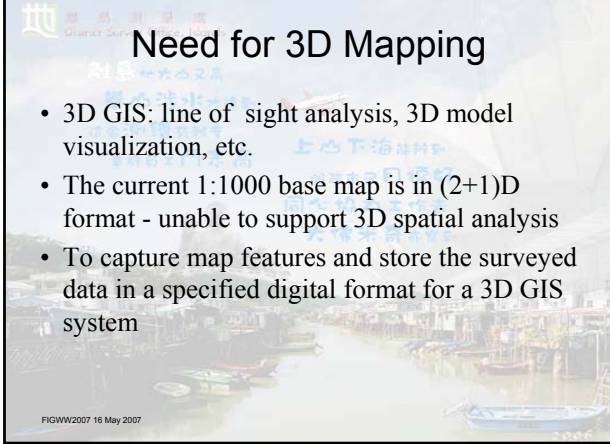
- Use of 2-step transformation for height values
- A horizontal transformation followed by an interpolation on height values using height control points 
- Estimated survey accuracy: XY=3 cm and Z=10 cm



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Need for 3D Mapping

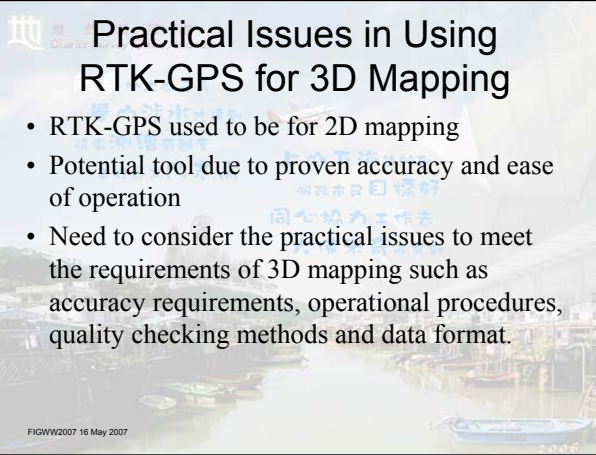
- 3D GIS: line of sight analysis, 3D model visualization, etc.
- The current 1:1000 base map is in (2+1)D format - unable to support 3D spatial analysis
- To capture map features and store the surveyed data in a specified digital format for a 3D GIS system



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Practical Issues in Using RTK-GPS for 3D Mapping

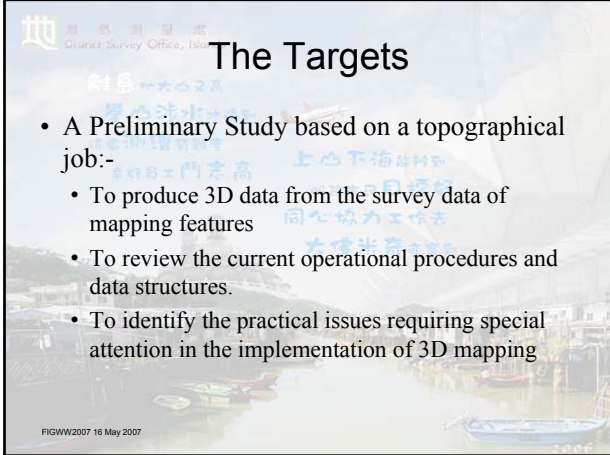
- RTK-GPS used to be for 2D mapping
- Potential tool due to proven accuracy and ease of operation
- Need to consider the practical issues to meet the requirements of 3D mapping such as accuracy requirements, operational procedures, quality checking methods and data format.



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The Targets


- A Preliminary Study based on a topographical job:-
 - To produce 3D data from the survey data of mapping features
 - To review the current operational procedures and data structures.
 - To identify the practical issues requiring special attention in the implementation of 3D mapping



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Project Details

- Location: Chek Lap Kok Sky Plaza Carpark
- Area: 14 Ha
- Major features: building carpark, road, slope and pavement
- Site condition: open to sky




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Site Environment



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Site Environment



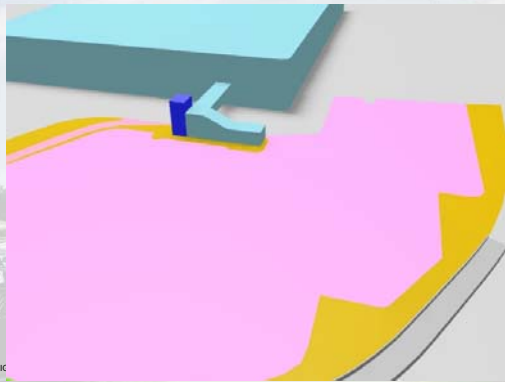
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Data Manipulation

- Use of RTK GPS for kerb lines, flyover, slope, street furniture
- Use of Total Station for running traverse and fix staircase, buildings, spot level and obstructed points – with assigned height values
- Create 3D models from surveyed data

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Flythrough Animation



FIG

Practical Issues (1) – Use of RTK-GPS

- RTK-GPS Positional Accuracy
 - Hz=0.03m Vertical=0.10m
 - Meets 1:1000 BMS mapping
- Difficulties in Field Operation
 - Obstruction
 - GSM signal coverage
 - Bulky equipment
- Coordinates Transformation
 - A 2-step approach to achieve precise height value

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Practical Issues (2) – Field Survey

- Revise the existing survey specifications to include vertical features
 - Define what types of features to be surveyed
 - Define how the features to be surveyed

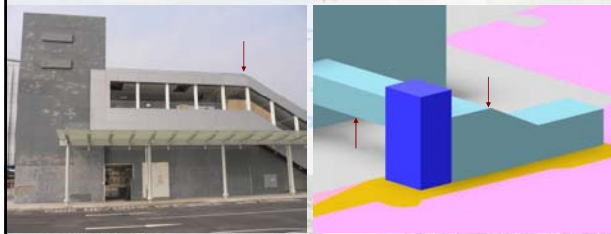
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Example: Curved Roof Top




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Example: Sloping Surface and Headroom



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Practical Issues (3) – 3D Modeling

- Proprietary 3D data format adopted by different 3D software packages
- Quality checking on 3D data: position, completeness, duplicated points, over/under-shooting, face normal, etc. 
- 3D model products- flythrough animation is one of the examples

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Practical Issues (4) – Training Need

- 3D modeling is a labour intensive process
- Staff used to work on 2D mapping
- Need 3D modeling training for staff

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Further Study

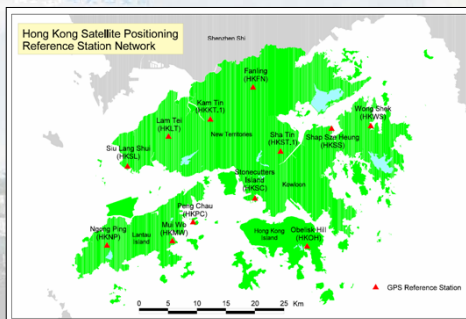
- This is a preliminary study requiring further study on the above issues mentioned to draw up a set of specifications before the implementation of 3D mapping.

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Thank You

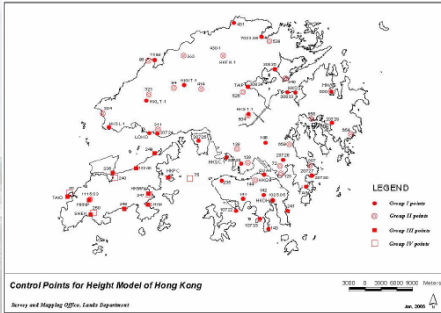
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SatRef



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Height Control Points



Checking for 3D Models

