The Accuracy Improvement of Spasial Data for Land Parcel and Buildings Taxation Objects by Using the Large Scale Ortho Image Data

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Keywords: accuracy, digitation, QuickBird image, object extent, propety taxes object, errors

SUMMARY

Land parcel and buildings taxation as one of taxes component which is one of state revenue resources, the so call an objective taxes. It means that all the taxation object in the form of the land parcel and buildings in Indonesia, hence the certainty of land parcel and buildings as an object to be taxed, is a real important thing for the taxation office. The certainty of land parcel and buildings tax is directly related to the size and area of object to be taxed and also depends on the quality of spatial data to be used beside the accurate of land parcel and buildings on the map to be used. For this time being, the land parcel and buildings map as an object to be taxed is put on the Database Management and Information of taxation object (Sismiop), where its has not had the same coordinate reference system (UTM-WGS84). For the consequence, the relative data position and area measured of land parcel and buildings has not depicted condition of reality in field. The large scale image data like an image of satellite QuickBird is a commercial satellite image data which has the spatial resolution 0.61 m and can show a more detail objects on earth perfectly with also has a high temporal resolution. Based on the image of QuickBird enabled to be mapped the land parcel and buildings betterly for the taxation purposes and to certify an certainty of the taxation objects more accurate. In order to get the land parcel and buildings area measured more reasonable according the variables condition of terrain in the field, the satelite image data was enhanced to ortho-rectified image by applying Digital Elevation Model (DEM) data to reach high accurate in geometry product. In this research will propose a method for the land parcel and buildings object mapping for taxation purposes by the satellite image data QuickBird orthogonal. Ground Control Point Measurement (GCP) and ICP (Individually Check Point) was needed to process ortho-rectification and some GPS survey is also implemented differentially by using a receiver GPS of geodetic type. The land parcel and buildings map as a taxation object, was made purely based on satellite image data Quickbird orthogonal. This will be expected to be able to have level of better accuration compared to the taxation object map that was put on Database Management and Information system of taxation objects (Sismiop)and also can give a guarantee of certainty in term of location and size of area of land parcel and buildings objects to be mapped for the taxation office in Indonesia. The advantages result of exploiting satellite image data Quickbird will be expected to obtain the improvement

method for data collection in term of land parcel and buildings location and size area measured as a taxation object will be more effective, economic and efficient for the object valuation and also applicable for map updating for the taxation office database.

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1. INTRODUCTION

1.1. Background

Taxes is one of the state income sources of the country, as one of objective taxes that is known as the lands and buildings taxation (PBB). The estimation revenue from this kind of objective taxes in Indonesia, until the year of 2005 is predicted to the amount of 83.5 million objects to be taxed that from 50 million tax obligators, with coverage ratio of the area approximately 90 %. This number should be well maintain and up to date to support the quality of taxes system, services to the tax obligators and increasement of state revenue.
So the data base processing and maintenance of Land and buildings taxation (PBB) became an important thing to make certainty of this objective taxes.

The certainty of taxation objects in Land and buildings taxation (PBB) are divided into two parts, first in size and location (quantitative measurement) and second in use and condition (qualitative measurement) for the lands or buildings.

Until now, the processing and the maintenance of Land and buildings taxation (PBB) database usually still using a conventional technique such as field measurements. This data processing by field measurements have many difficulties, specialy in a hilly area, such as dense populated area in the city. One of the difficulty is to decide the extention of taxes object, while the field measurement is subject to the taxation objects where located in different altitude of terrrain which hard to do and wasting time.

QuickBird as one of satellite images with a high spatial resolution and the have an ability to collect clearly the information from the object on the earth surface, with a relatively fast in time, and also can be used for identifying the parcel object in a way to maintain the database of Land and buildings taxation (PBB) objects.

This high accuracy QuickBird images map could be done by orthorectification process with the help of DEM data, it would be resulting orthogonal satellite images that could eliminating relief displacement with minimum geometrical errors.

For this research, Bandung area is chosen because it is one of the biggest city in Indonesia which has a high population density, and have a relatively hilly in topographical point a view..

The changes of Land and buildings taxation (PBB) object is happening so fast, in the meanwhile the updating of PBB's object data at the existing system (SISMIOP) needs to be up dated to get the position and the extention of Land and buildings taxation object to fit on its real condition. The satellite images could detecting the changes of taxation object condition in connection with position and an extention of those tax object, In this case hopefully the exixting system (SISMIOP) database could be updating to the real condition.

This research is to get an orthogonal QuickBird images with a high accuracy needs to be done to collect information of position and an extention of taxation objects are able to guarantee the certainty of Land and buildings taxation (PBB) object with the minimum geometrical error and fit on the real condition.

1.2. Research Goal

Examine the accuracy of orthogonal QuickBird images with a hilly topographic area, in order to give the information of tax object position and tax object extensification, and also for updating Land and buildings taxation (PBB) database.

1.3. Problem Formulation

- Difficulties in processing data of potentialy taxes object in a hilly area and far from city. One of the difficulty is to decide extent of taxes object, where the measurement is done to the taxes object in a big amount and un-order, or the object who have a differ altitude. It made the measurement process is harder to do and takes longer time.
- How is the technique of making the digital ortho images?
- Examine of how far the ortho images can be used as a base to get the PBB extent, so it can fit with the real condition.

1.4. Research Scope

This research includes the study of geometric accuracy of orthogonal QuickBird images and analyzing of orthogonal QuickBird images map for the PBB needs, in order to give information of position and extent of the object

1.5. Basic Asumption

Orthogonal QuickBird images by orthorectification have less geometric errors than the images made by rectification. Orthogonal QuickBird images can be used for PBB needs, to give information of the object position and extent, as a basic of updating PBB database, fit to the real condition.

1.6. Research Utility

The using of orthogonal QuickBird images is hoped to be able to identifying PBB object with a high accuracy. Beside, to guarantee the quality of PBB object data in the form of digital map, so it can describe the real situation of taxes object transparently.

1.7. Research Methodology

- Preparation : Literatures study, by gathering data and information from scientific literature, journal, website, etc
- Data Field Gathering :
    - Measuring the object using GPS survey differentially with a GPS receiver geodetic type. This is done for getting data of object position to do a geometric correction to the QuickBird satellite images that we had (GCP and ICP measurements)
    - Measuring distance and extent of the object terrestrially.

- Processing data :
    - Processing GPS data to get GCP/ICP position
    - Processing digital images to get rectification QuickBird images.
    - Processing digital images to get orthogonal QuickBird images.
    - Object Digitations with OSD (on screen digitizing) at orthogonal QuickBird images to get position and extent from the object.
    - Processing DEM into slope.
- Compare the object positional and extent from digitations map images to the field data by seeking the difference of slope of research area.
- Analyzing using accuracy tolerance condition test. Analyze the accuracy extent from images map digitations related with the PBB tolerance

2. IMAGES RECTIFICATION

At rectification, the important things is needs to be done is relocating every pixel in the images input (x',y'), at a particular position in a images input (x,y) that is already corrected by transforms coordinates (Saputra, 2005).

To do the rectification, we need ground control points (GCPs) that can be identified well at the images which is going to be corrected or at the reference field that become accordance.

Orthorectification is the process to reposition images sesuai with the real images in location. When we getting the data, there will be a displacement caused by terrain at the topography variation. So we need to reposition it by orthorectification.

Basically, orthorectification is pretty much the same with the rectification process. The different is, orthorectification is used for the area that has varies altitude texture, and at the process we use DEM (Digital Elevation Model) data. To get the best result from this process, then the DEM data should have a smaller grid spacing interval and a higher vertically accuracy.

3. RESEARCH EXECUTION

3.1. Description of Research Area

The research area is Setra Duta Complex, Cimahi, West Java. This area is one of high class real estate that have mountainous and heterogeneous topography. Total extent of this area is ± 70 Ha.

3.2. Research Material and Tool

a) Research Material

The material that is used in this research are:

1. QuickBird images of West Bandung area including the meta data, that is got from PBB Directory Center Office and BPHTB in Jakarta.
2. Ground Control Point (Geodetic GPS)
3. DEM of research area
4. Object extent as the result of field measurements (Fibre glass long tape)

b) Research Tool

- Hardware :

1. A series of computer with technicaly specification of Intel Pentium IV Processor *Speed clock* 2,8 GHz, RAM type DDR PC-2700 64 MB, Harddisk capacity 40 GB, ”Pixel View” *Video Graphics Array* (VGA) Memory capacity 128 MB, Samsung CD Rom.
2. Canon S200SPx 4800 dpi color inkjet printer.

3. Samsung Monitor SyncMaster 591S 15".

- Software :

1. *Microsoft Windows XP Home Edition* computer operation system is used to run system programming and applied application.
2. *MapInfo Professional release 7.5* is using for :
a. Object Digitation on resulting images
b. Coordinate calculation, distances, and taxes object area.
3. *PCI Geomatica* version 9.0 is used to processing QuickBird images, covering :
a. Images cutting
b. Images rectification (by rectification and orthorectification)
c. DEM conversion from digital contour map into raster form and DEM conversion into slope.

4. *Adobe Photoshop 7.0* is used to help contras enhancement images features so it more easier to interpret ate.

5. *Skipro ver 2.3* to GPS processing.
6. *Trimble Geo Office* is used for downloading and converting GPS data into *Rinex files.*
7. *Ms Excel* is used to count deviation standard, RMS Error.

- Software to write a report

1. Computer Operation System *Microsoft Windows XP Home Edition* is used to run the program system and its application.
2. *Microsoft Office 2003* and its components; *Ms. Word, Ms. Excel, and Ms. Powerpoint,* is used to write the research report, calculate data, and presentation.

3.3. Research Implementation

3.3.1 Preparation

- Beginning Preparation

It is including investigation of research background, problem formulation, hypothesis formulation, research methodology formulation, composing the writing systematical, and data gathering.

- Research Preparation

a. Literature and reference study that related with the research material.
b. Learn the software modules, prepare the hardware, and check the connection between hardware and software.

c. Installing related software including Software *PCI Geomatica 9.0, MapInfo Professional* 7.5, *Adobe Photoshop* version 7.0, and *Microsoft Office* 2003
d. Administration preparation that related to the research, such as letter of data requirement, and letter of field measurement.

3.3.2 Determination of Research Area

Determination of research area is done by several consideration, such as:

- Providence of research material (QuickBird images)
- Mountainous area that is predicted to be having more geometrical error than a flat area.
- Features of ground field by QuickBird images are pretty clear, so it more easier to interpret ate and delineated area border
- This research choosing Setra Duta Complex-Cimahi area which meet those requirements.

3.3.3 Data Collection

The collection of material, data and another data sources that needed for this research consist of :

1. Availability of QuickBird images of West Bandung area including its metadata, are getting from PBB Directory Center Office and BPHTB in Jakarta. Acquisition time, type, and *level product* of QuickBird images is known from scene code, which is : 03AUG21025744-S2A..:
Time : August 21, 2003, 02:57:44 pm
Type : *Pan Sharpened* (S = *Pan sharpened*, M = *Multi Spectral*, P = *Panchromatic*)
Level : *Standard* (2A = *Standard*, 1b = *Basic*)

QuickBird images standard level have been geometrically corrected by DigitalGlobe as the vendor, are already in UTM projection system with WGS'84 as datum, and had 60 cm resolution (Hendra, 2004 – as quoted by Darodjati 2005 and www.eurimage.com).
2. Ground Control Point in the form of GPS point which directly field measured by rapid static. (observation point ± 40 minutes).

Using total 22 points of control points (for GCP and ICP) and it's tied to Pasca-ITB point. Tool which is used are 3 geodetic type GPS Trimble R5700.

3. DEM is got from digital contour map, project result of Bandung Raya highway maps formed with contour interval 5 meters.

4. Measurement of direct field extent object by fibre glass long tape and distometer (*Leica*).

3.3.4 Data Processing

- GPS point processing

GPS points are downloaded with *Trimble Geo Office* and converted into *Rinex* files. Data processing using *Ski pro ver* 2.3.

– Processing of *single point positioning (SPP)* of every point.
– Determining of reference coordinate (Pasca_ITB point).
– Processing every *baseline*.
– Coordinate conversion which is got from Lintang, bujur to UTM projection system.
– Result of the process is coordinates of GCP points with UTM projection in *Ms Excel*.

- QuickBird Images Process

– Images slicing (PCI Geomatic)
– Contrast enhancement (adobe phootshop)
– Geometrical Correction

a. Defining *Ground Control Point* (*GCP*)
b. Images Rectification and orthorectification
c. Rectification process is using first degree polynomial model.

Orthorectification is using relational function.

– Conversing PCI Geomatic result images into TIFF form.
– The PCI Geomatic coordinates is kept as a text files and then it is changed into Ms. Excel.
– Images digitations at MapInfo. (5 times digitations for every object)
– Calculation of field coordinates, distance, and extent at MapInfo.

- Data Processing of Field Extent

Processing of field distance and extent data using Ms. Excel. The result from this process can be a distance and extent reference.

4. RESULT AND DISCUSSION

4.1 Data Processing Result

- GPS Process

From the result of GPS process we have some accurate coordinates, with the lowest accuracy 0,004m

- QuickBird Images Processing

– Images Slicing, to get a QuickBird images of research area so we can minimize saving memory and make the next process faster.
– Contrast enhancement, to get a higher images contrast, so the images is clear enough to be interpreted and delineated.
– Geometrical Correction result QuickBird images from rectification process with a right position and shape to the earth surface.

Description	eGCP	RMSe
10 GCP Rekti	1.078	0.937
10 GCP Ortho	0.835	0.564
22 GCP Rekti	0.948	0.876
22 GCP Ortho	0.625	0.546

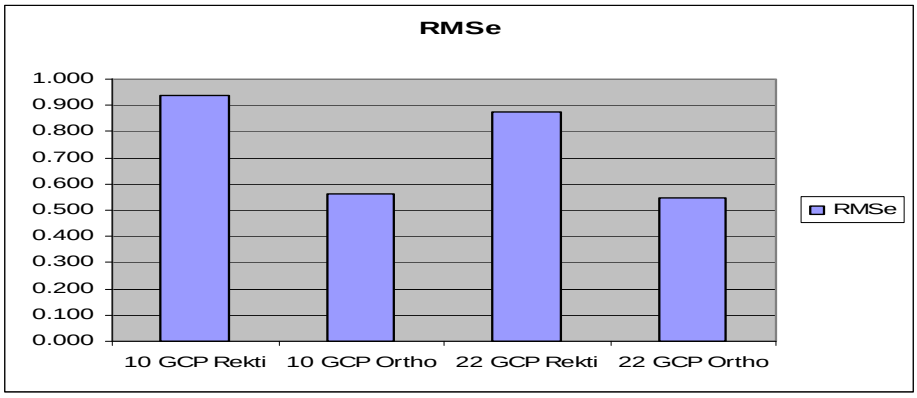
- Processing Data of Object Field Extent

Processing data of object field extent by calculating extent of the object which are the *extent* and height function. The result extent by calculate can be seen in appendix page.

4.2 Discussion

- Comparison and Analyzing RMSe from a rectification images

Result images :

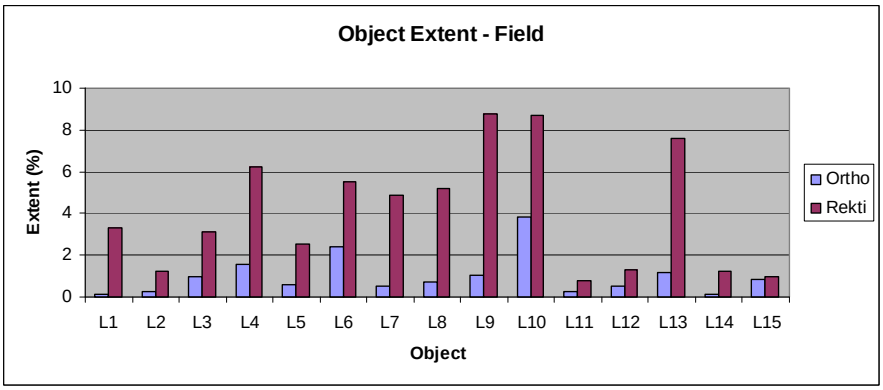


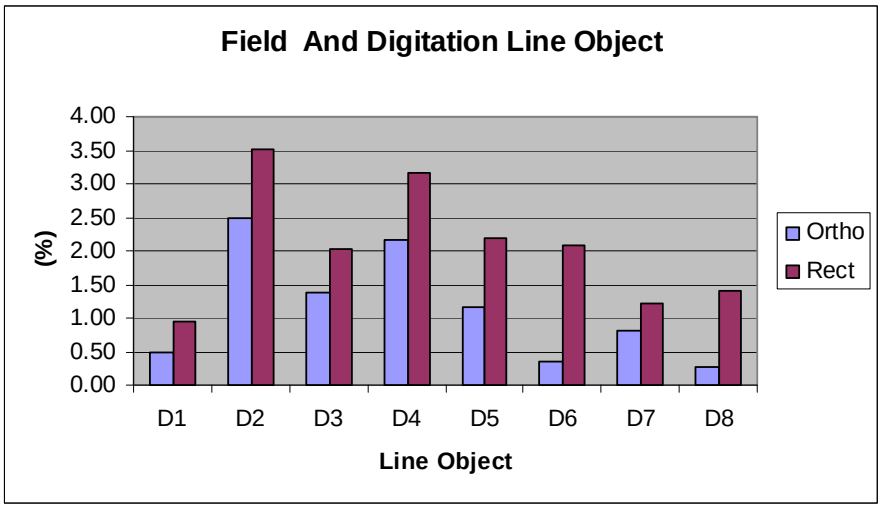
From what can be seen above, images accuracy that is resulted by orthorectification process have a less geometric error, than rectification process without using DEM.

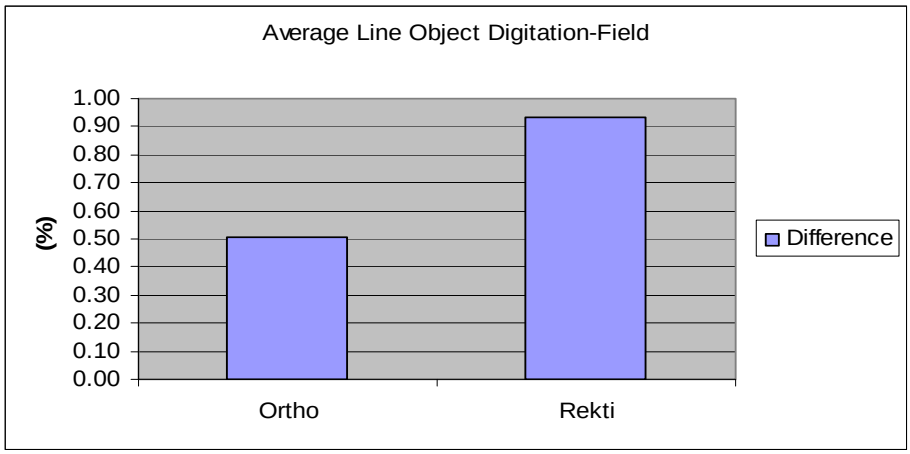
According to RMS Check Point, add GCP points from 10 to 22, is not giving any significant influence to the images accuracy level both in rectification and orthorectification process.

The increase of images accuracy can be seen significantly when we compare rectification to the orthorectifiction process. Which is the result of images accuracy by orthorectification is better that rectification.

- Comparison field line object with the result of digitations



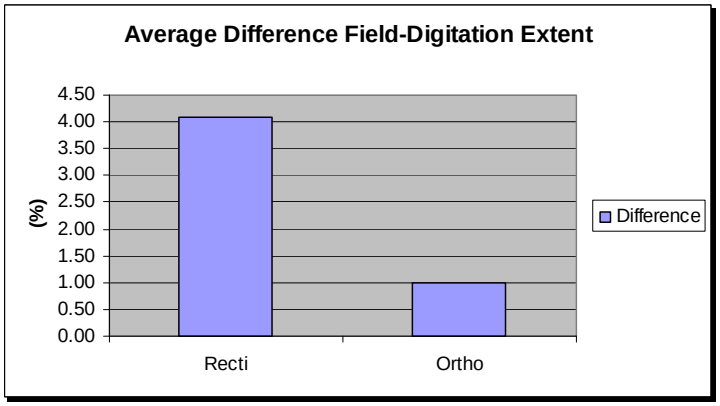




From digitations and field measurements, we can see that the tendency of digitations accuracy of the orthogonal images that already going through the orthorectification process, is better than the one from rectification process.

The average difference between field distance and digitations rectification distance is 0.931 meters. While at orthorectification, the average difference is 0.507 meters.

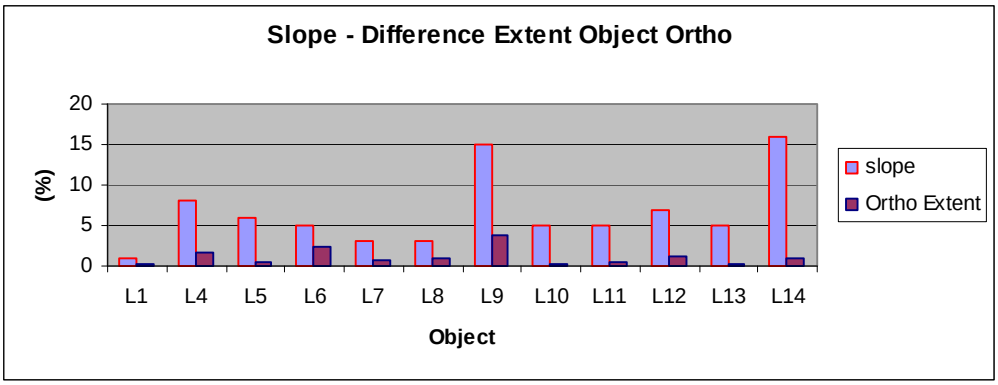
- Comparison Object Extent and images digitations extent



Extent difference of the highest object at rectification is 146.615 m^2 and for the lowest object is 8.117 m^2. In orthorectification extent difference of the highest object is 19.357 m^2 and the lowest is 1.006 m^2.

Average extent difference field measurements and digitations in rectification process is 34.048 m^2 and for orthorectification is 7.826 m^2.

After compare this result, the percentage of average extent difference between field extent and digitations of rectification images is 4 % and for orthorectification is 1 %.

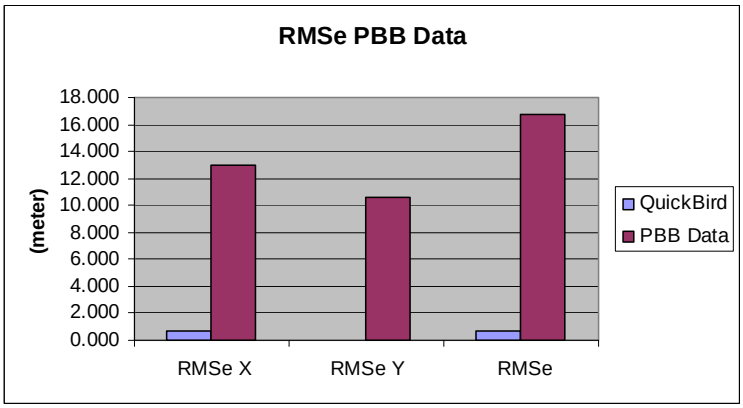


After comparing that, we can see the trend of increasing difference is equal to the increasing slope from the accordance object. And so, the slope difference affect to extent difference that resulted by ortho images digitations.

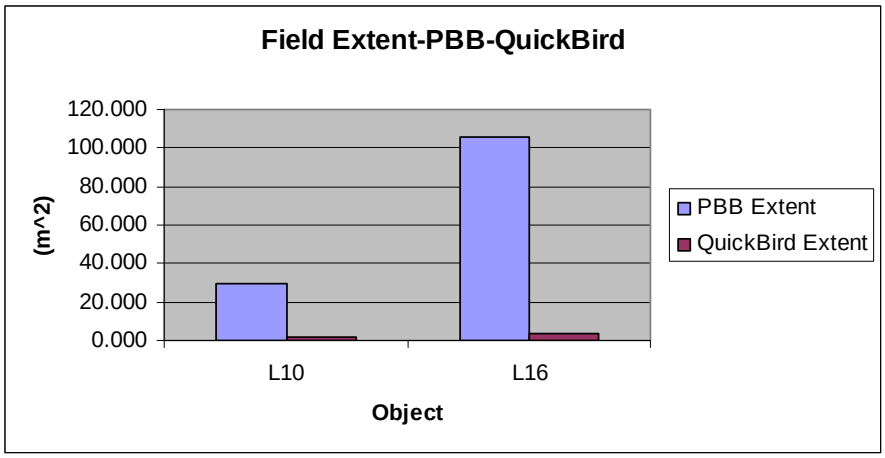
- PBB Data Analysis

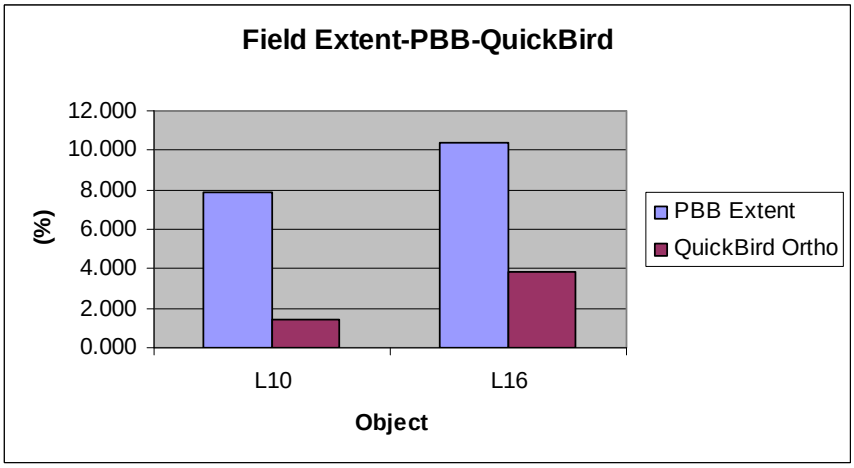
Analyzing is done to test the certainty of position and extent of object including spatial information on SIG PBB map with real data. The result of the test:.

Description	RMSe X	RMSe Y	RMSe
Image data	0.652	0.024	0.653
PBB data	12.961	10.588	16.736



Position rigorous using orthorectified images ± 0.653 m, and with spatial data of PBB resulting ± 13.620 m. There is an escalation of rigorous to be 20 times using orthorectified images as information sources of object position.





Basic on calculation and graphic at above picture, The percentage of extent difference, the percentage average of extent difference between field extent and PBB spatial data is 9 %. The percentage average of extent difference between field extent and digitation result of orthorectified images is 3 %. There is an escalation of rigorous of tax object extent to be 3 times using orthorectified images on this research.

- PBB regulation for object tolerance in area measurements

According to PBB regulation about the tolerance of area measurements, is not more than 10% in area measured. From what we have seen from the result from this research, the

tolerance in both rectification and orthorectification is also below 10 %. Because of that, images result can be used for map updating to PBB data and it can be suitable with the data from the field.

5. CONCLUSION

5. 1. Conclusion

From processing and analyzing result data from research, there are several things can be conclude

1. The process of QuickBird images at this research is resulting RMS Check Point in rectification is 0.937 meters for 10 GCP, and 0,876 meters for 22 GCP. In orthorectification resulting RMS 0.564 meters for 10 GCP, and 0.546 meters for 22 GCP.
2. The average difference between field distance and digitations rectification distance is 0.931 meters. While at orthorectification, the average difference is 0.507 meters.
3. Average extent difference field measurements and digitations in rectification process is 34.048 m^2 and for orthorectification is 7.826 m^2.
4. The percentage of average extent difference between field extent and digitations of rectification images is 4 % and for orthorectification is 1 %.
5. The difference between field extent and digitations result extent is affected by slope in the research area.
6. QuickBird images resulted from this research is accepted by tolerance level (10%).

5.2 Suggestion

1. It is necessary to do a research about cost efficiency and comparison time of measurements between taxes object field by QuickBird images and field measurements.
2. PBB Directory and BPHTB can utilize orthogonal QuickBird images for a area with a mountainous topography, to do a taxes abject field measurement, so the quality of PBB data can be guaranteed.
3. It is necessary to do geometrical correction with ortho images for a higher accuracy and also with more accurate DEM.
4. It is necessary to do geometrical correction by doing orthorectification with various DEM and various type of QuickBird data.

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BIOGRAPHICAL NOTES

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