AN INVESTIGATION OF DIGITAL ORTHOPHOTOS FOR LARGE SCALE MAPPING&CADASTRE RENOVATION

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Commission IV, WG IV/9

KEY WORDS: Orthophoto Map, Accuracy, Cadastre, Fast Cadastre, Mobil Cadastre

ABSTRACT:

Photogrammetric softwares , functions and applications were tremendously effected by developments of image proccessing technologies in past decades. One of the applications of photogrammetric softwares is digital orthophoto production. Most of orthophoto products are used of planning, monitoring, GIS application ,etc.. A digital orthophoto plays great important role to take fast decision. Especially to control activities in large areas and countywide. Besides this, according to parallel development image processing technologies, it is necessary to test an orthophoto for accuracy, cost and time consuming.It is important to complete whole cadastral mapping and to fast renovation of cadastre for large countries, like us. To do that it can be a usefull way to use orthophotos for renovation, if **the accuracy, applicable, reliable and cost of orthophoto** is sufficient. So it can be called **"fast cadastre"** or **"mobile cadastre"**. This paper presents a test results by including geometric accuracy, cost of an orthophoto and required time to produce an orthophoto for large scale mapping. An investigation carried out especially for large scale cadastral mapping and cadastral renovation purposes.

1.INTRODUCTION

As a result of rapid changes and developments in the computer technology, the wide range of digital and verbal geographical products developed, the diversity of users' expectations and needs, new technology-oriented expectations and new understandings brought by the process of adaptation to the European Union, General Directorate of Land Register and Cadastre (TKGM) is in a process of change, transformation and restructuring.

In an age where information and technology cross national borders, international standards and rules gain weight in every field. Industrial communities are reshaped on the basis of information technology and transform into an information community. Digital mapping, land register and cadastral data constitute a foundation for position-based information systems that concern a vast section of the nation.

As a result of the reflection of developing "e" based technologies to our sector and entity, projects are also being carried out at our entity in relation to:

1.Completion of installation cadastre in three years,
2.Cadastre Renovation,
3.Extension of TAKBIS (Land Register and Cadastre Info System)
4.Automation of the Land Register Archive system
5.Establihment of CORS-TR
6.Development of Turkish National Geographic Information System Infrastructure.

Some of these projects are nearing the stage of conclusion and some others are yet in the stage of design. Orthophotos will play gerat important role to presentation of above project. Especially for cadastral renovation and as a level of Turkish National Geographic Information System Infrastructure. This paper present test results for cadastaral renowation.

2. METHODOLOGY

All details which contained buildings roof edge, signalised check points in the project area were measured by tachometers . And co-ordinates of those details calculated in ED50 systems. After production of orthophotos according to different pixel size and dtm grid width some of buildings roof edge and signalised check points were measured on orthophotos by using conventional CAD software. Finally a comparison of those co-ordinates were done as following ways;

- comparison of signalised check point,
- comparison of roof edge after shift movement according to ground,
- comparison of roof edge using two orthophotos covered same area,

3. TEST AREA and WORK STEPS

Chosen test area which contains rural area, high buildings and shanties covered by 8 black / white aerial photos in 1/4000 scale. A RMK camera used for photo flight. All images were scanned in different pixel size (14,21,28 micron) by SCAI scanning device. Images quality and enhancements, required personnel and time taken into account during scanning producure. A block was configured for image orientation and further proccessing. PHODIS PAT software was used for aerial triangulation and measurements. Totally 6 signalised full control points and 5 signalized check points were used as additional measurements. All measurements adjusted by PATB-GPS sotware program using self calibration method, of course by eliminating blunders. According to known exterior orientation all models were prepared. Table 1 shows summary worksteps ,required times and Table 2 accuracy information up to controlling of models.

Work Steps	**28 micron 72 MB**	**21 micron 125 MB**	**14 micron 270 MB**
Preparation	5 min/image	5 min/image	5 min/image
Scanning	5 min	8 min	12 min
Control& Enhacements	2 min	2 min	2 min
Data Transfer	1.5 min	3 min	6 min
Pyramit Calcul.	2 min	4 min	5 min
Icon calculation	1 min	1 min	1 min
Automatic IO	1 min	1.5 min	2 min
Auto. TPM	2.5 min	3.5 min	5 min
Control&Add. Meas.	7 min	7 min	7 min
Bundle Adjust. &I/O	6 min	6 min	6 min
Left Epipolar Calculation	4 min	6 min	14 min
Right Epipolar CA.	4 min	6 min	14 min
L.Epi.Pyramit CA.	1 min	4 min	5 min
R.Epi.Pyramit CA.	1 min	4 min	5 min
General Control	1 min	1 min	1 min

Table 1. Test block work steps and required times

	Planimetry-Hight 28 micron	Planimetry-Hight 21 micron	Planimetry-Hight 14 micron
Aprio.sig.image points	5 micron	5 micron	5 micron
Aprio.sig.contr. points	2-5 cm	2-5 cm	5-8 cm
Apost..sig.image points	11-26 mm	7-15 mm	4-8 mm
Apost..sig.cont. points	40-40 mm	18-18 mm	50-22 mm
Sigma Naught	36 mm	21 mm	13 mm

Table 2. Test block accuracy informations

After creating models, digital terrain models were calculated for test area in different grid width (10,30,50 meter) using MATCH-T software. Computing times differs according to scanning resolutions. For example in 14 micron Match-t needs 1.5 hours. In very sense buildings area at least %50 dtm points needs editing. Of course it takes too much time. All edited dtm points were inserted required format to use for orthophoto. Table 3 shows DTM specifications and information.

As a default parameters for orthophoto production “pixel by pixel” method for geometry , “bicubic” method for radiometry and 1:1000 output scale of orthophoto were chosen. Ground resolutions of orthophoto estimated using image scale and scanning resolutions. Table 4 shows summary information of produced orthophotos.

Finally, general comparison of measured details have been presented at Table 5.

Terrain type : Undulating(rural area, Shanty and dense high Buildings)
DTM area : 600*970 m
DTM app sigma=0.10 m
Morphology :**NO**
Smoothing : Medium
Average Sea L.:130 m

Scan Res.	DTM Method(M/A)	Grid Width	Intern Accu.	Mesh size	Point/Mesh	Num.of Points	EditingTime	Calc Time	Data Col.Width
28	M	50	-	-	-	247	-	15	50
28	M	30	-	-	-	704	-	40	30
28	M	10	-	-	-	5950	-	300	10
28	A	50	0.040	48*48	26	273	7	30	5
28	A	30	0.036	48*48	13	714	18	30	5
28	A	10	0.044	19*19	4	6039	150	30	
21	A	50	0.038	32*32	8	260	7	40	2.5
21	A	30	0.037	38*38	11	693	17	34	3
21	A	10	0.038	32*32	8	6039	150	40	2.5
14	A	50	0.033	48*48	15	278	7	80	2.5
14	A	30	0.033	48*48	15	714	18	80	2.5
14	A	10	0.033	48*48	15	6143	150	80	2.5

Table 3.DTM specification and information

4. CONCLUSION

Signalised check points(which describes rural areas) are sufficient for 1:1000 scale. Buildings by shift vector and signalised check points (which describes urban areas) are insufficient for 1:1000 scale building by two OP are sufficient for 1:1000 scale.

If we have true orthophotos we can measure both terrestrial boundaries and manmade objects such as buildings without using any shift vectors. And this results show us that orthophotos or true orthophotos can be produced very fast, accurately and reliable for not only cadastral application but also updating and maintaining cadastral GIS databases, classifying and mapping pervious and impervious surface areas, identifying wetland areas, updating land use maps, estimating crop yields and health, preparing timber stand inventories, planning for new construction sites, verifying areas for licensing and permitting pipeline management ,utilities infrastructure management ,oblique photography for land management and disaster management.

Default parameters of orthophotos Scale 1: 1000 Resctification : pixel by pixel Radiometry : bicubic					
Scanning (micron)	Texture in OP	Ground Resolut. (m)	OP size (MB)	Calculation Time (minute)	DTM Grid Width (m)
28	Good	0.112	45	10	50
28	Good	0.112	45	12	30
28	little broken	0.112	45	20	10
28	Good	0.112	45	7	50
28	Good	0.112	45	9	30
28	Large Broken	0.112	45	11	10
21	Good	0.084	80	15	50
21	Good	0.084	80	17	30
21	large broken	0.084	80	20	10
14	Good	0.05	210	32	50
14	Good	0.05	210	32	30
14	Good	0.05	210	42	10

Table 4. Default parameters of orthophotos

Scan Res.	dtm GW	Check P. rms (comp 1)	Buildings rm by shift ve. (comp 2)	Buildings rms by two OP (comp 3)
28	50	0.143	0.21-0.87	
28	30	0.117	0.14-0.93	0.208
28	10	0.134	0.18-0.69	
28	50	0.122	0.17-0.75	
28	30	0.100	0.40-0.98	0.208
28	10	0.097	----------	
21	50	0.119	0.21-0.70	
21	30	0.025	0.16-0.61	0.152
21	10	0.077	----------	
14	50	0.087	0.35-1.44	
14	30	0.078	0.18-0.43	0.133
14	10	0.089	0.19-0.62	

Table 5.General comparison of measured details