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GEOMETRIC CORRECTION OF AERIAL PHOTOGRAPH OF SCANNING 600 DPI MEASUREMENT OF A COASTAL AREA (TAMBAKHARJO)

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ABSTRACT

The objective of this research was to investigate how far is the deviation in measurement of an area of aerial photograph scanning 600 dpi 1 : 5500 scale compared with the photographic map of 1 : 1000 scale in Semarang municipality along with the use for measurement of the extent of land area. In order to scan 600 dpi the product of the geometry correction can be used to calculate the extent of the land area at an accuracy level of 0.38 m.

Keywords : Scanning 600 dpi Transformation Geometric Aerial photograph.

I. INTRODUCTION

Physical development in Indonesia has increased rapidly in all sectors ,for instance in the real estate business, industry, road construction, agriculture, the fishing industry and others. In the physical development a map has a very important role. Maps are needed in most activities connected with development: from the earliest step, i.e. choosing the location, conducting feasibility studies, to monitoring or controlling the development.

The problem associated with producing a map photo is related to the length of time it takes to measure an object in the field especially if a more detailed map of a wider area is desired. Because of this, plans which were drawn on the basis of a particular map at a certain time became useless because the data were no longer valid. This is due to the situation that is changing very quickly.

The aerial photograph has radial errors to the center. The further the distance to the center appearance of the measurement of extent on the film the errors of the result of photograph will be higher (Sutanto 1980).

On the measurement of extent areas between serial photographs using the 1 : 5500 scale compared with map photographs using the 1 : 1000 scale which is adopted by the "Badan Pertanahan Nasional,"(the National Land Use Agency) each 100 square meters has a 2.20 square meters margin of error [2] . In order to use aerial photograph of a 1 : 5500 scale in the plate areas to calculate the extent of area, a correction is needed, using the formula

$$f(x) = A \exp^{(B^*X)}$$

where A =0,92 B = 0,38
and x the distance from the central point (Sardiyatmo 1996).

Aerial photo used in this research has a standard format measuring 23 cm x 23 cm on a 1: 5500 scale scanning 600 dpi of each piece capable of capturing

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an area of 1.6 km^2 on plate area (1-3) degrees.

The scanner is an equipment to convert an aerial photo to digital as pixel with spectral value. Its function is to show the cleanness of the pixel which contains 225 lavels (Generally) 0 for black and 255 for white.

The quality of a scanner can be evaluated from the size of pixel that can be produced. For example, a scanner capable of scanning from 200 dpi (dot per inch) to 1.000 dpi (scanning 200 dpi) means that the equipment can produce 200 dots per inch. The higher the scanning, the smoother the resolution. Correlation of dpi and film resolution is the capability to separate the line in each inch aerial photograph of 40 lines/mm. This result show the capability to differentiate an object of 25 micron of this unit equal to 1000 dpi. The smoother the size of pixel the bigger memory size needed (Sutaat 1994).

Geometric transformation is a method of changing a coordinate of aerial photo to justify with coordinate of land. To have a good transformation we must select 8 control points of land separately. If the sign value of transformation was < 3 it mean the transformation of geometric is good. The result of this research was 0.67. The ILWIS program was used to calculate the area through aerial photo transformation. The result of the transformation is shown in table 1.

II. MATERIAL AND METHODS

The method of identification of the area of aerial photo scanning of 600 dpi with area size on the map photo was used. The measurement of the map photo through digital planimeter and measurement of a n area by aerial photo scanning 600 dpi geometric transformation was done with ILWIS programme.

Methods

When an aerial photo on a 1 : 5500 scale was scanned at 600 dpi, the aerial picture photograph was changed to pixels in which each square inch consists of 600 pixels or points. Afterwards, the transformation to pixels should be adjusted with land coordinate with a fine two-dimension transformation (Moffit and Mikhail . 1980). Independent sample test was used for statistic analysis. The purpose of this test is to find out the differences between two averages statistically, for example: we use independent samples of n_1 and n_2 from observation with averages of $\overline{x_1}$ and $\overline{x_2}$, therefore hypotesis test with sygnificant level of α is:

Ho: Scanning aerial photo 600 dpi = Map photo

H_1: Scanning aerial photo 600 dpi) ≠ Map photo

if $n < 30$, it means that the distribution of data is close to student distribution (t) (Samsubar 1983).

$$t_h = \frac{\overline{X_1} - \overline{X_2}}{\sqrt{\left[\frac{(n_1-1)\,s_{x1}^2 + (n_2-1)\,s_{x2}^2}{n_1 + n_2 - 2}\right]\left[\frac{1}{n_1} + \frac{1}{n_2}\right]}}$$

Ho accepted if $t_h < t_\alpha$ and $t_h > -t_{\alpha v}$

Ho rejected if $t_h < t_\alpha$ and $t_h < -z_\alpha$

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III. RESULT AND DISCUSSION

Aerial photograph scanning 600 dpi area first iscorrection of the geometric which mean that absis and ordinat aerial photograph from scanning should be adjusted with the absis and ordinate of land from eight points separately. The eight of points can be seen below:

No.	Contoh Point Name		Ordinate (x)	Absis (y)
1.	Pertigaaan Yayasan Kristen	(2)	196762	81222
2.	Bundaran pertama	(4)	197774	60614
3.	Bundaran kedua	(6)	197520	61054
4.	Perempatan jalan	(7)	197785	61048
5.	Perempatan jalan	(11)	197010	61015
6.	Pojok sawah	(3)	196796	60582
7.	Pojok pertigaan	(12)	197410	80193
8.	Pojok sawah	(9)	197735	60200

Those eight control points were used for transformation of coordinate of aerial photograph digital image. The calculation processes was done with cubic pline and adjusted with ILWIS (Suharyadi 1991).

From this process a sigma of 0.67 was obtained, and a new image was produced with the following dimension:
Lowest X: 196.000 and higest X: 198.000
Lowest Y: 60.000 and higest Y: 61.300
The image was then digitized to make a polygon for each sample. The result was presented in table 1.

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Table 1. The Calculation of Extend Error of Tambakharjo Land

No.	600 dpi (m^2)	Map Photograph (m)	Differences (m^2)	(x-rt) (m^2)	$(x-rt)^2$ (m^2)
B24	591,15	600	-8,85	-28,13	791,42
B29	549,17	550	-0,83	-36,15	1306,98
B3	3810,60	3810,60	30,60	-6,38	40,73
C25	178,02	180	-1,98	-35,00	1225,16
C4	2601,95	2650	-48,05	11,07	122,49
C9	1160,70	1200	-39,30	2,32	5,37
D28	1985,30	1900	85,30	48,22	2334,60
D32	1908,50	1990	-81,50	44,52	1981,83
D5	4594,36	4536	58,36	21,37	457,00
E30	735,65	725	10,65	-26,33	693,38
E31	2670,50	2640	30,50	-6,48	42,02
E33	911,08	900	11,08	-25,90	670,92
E8	470,05	500	-29,95	-7,03	49,45
F2	3334,10	3300	34,10	-2,88	8,30
F6	2216,97	2250	-33,03	-3,95	15,62
F7	4502,17	4600	-97,83	60,84	3702,45
G22	3344,10	3300	44,10	7,12	50,66
G23	743,49	780	-36,51	-0,47	0,22
G1	810,28	825	-14,72	-22,26	495,60
G14	723,15	700	23,15	-13,83	191,33
H26	3653,87	3630	25,87	-13,11	171,93
H10	1305,60	1280	25,60	-11,38	129,55
H11	2505,40	2500	5,40	-31,58	997,43
I27	288,30	300	-11,70	-25,28	693,19
I16	2295,05	2200	95,05	58,06	3371,86
I19	1524,70	1560	-35,30	-1,68	2,83
J12	3794,24	3700	94,24	57,25	3278,45
J13	1405,40	1350	55,40	18,41	339,21
J15	955,60	920	35,60	-1,38	1,91
J17	693,75	720	-26,25	-10,73	115,18
J18	907,65	890	17,65	-19,33	373,73
Total	57170,85	56956,0	214,85	0,0	233606,89
Average	1844,22	1837,29	6,93		761,51
St.Dev	1296,57	1287,42			
Varian	1681095,00	1657468			

Total = Total area of land
Average = Averages of land
St.Dev = Standard Deviation

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Based on the calculation of table 1 from 30 samples of land areas:

x_1 = The area of aerial photo digital 600 dpi

x_2 = The area of map photo 1 : 1000 scale

Since samples date $n < 30$ distribution t was used as follow:

$t_H = 0,02$

t table ($\alpha = 005$) = -1,68 dan + 1,68

From calculation above Ho was accepted.

Conclusion: the measurement of extent land with aerial photo from scanner 600 dpi of geometric correction was accepted (can be used). And deviation of measurement errors for each 100 m^2 was 0,38 m^2.

When compared with the result of Erna Herryani Soesilowati, 1993 the correction of land area using photographic map has an error level of 1,14 m^2 for each 100 m^2 area this level is considered sufficient.

Table 2. The Data of Extent of Tambakharjo Areas

No.	600 dpi (m^2)	Peta foto (m^2)	$\frac{Lp-Ls}{Lp} x100$
B24	591,15	600	1,47
B29	549,17	550	0,15
B3	3810,60	3780	-0,80
C25	178,02	180	1,10
C4	2601,95	2650	1,81
C9	1160,70	1200	3,27
D28	1985,30	1900	-4,48
D32	1908,50	1990	4,09
D5	4594,36	4536	-1,28
E30	735,65	725	-1,46
E31	2670,50	2640	-1,15
E33	911,08	900	-1,23
E8	470,05	500	5,99
F2	3334,10	3300	-1,03
F6	2216,97	2250	1,46
F7	4502,17	4600	2,12
G22	3344,10	3300	-1,33
G23	743,49	780	4,68
G1	810,28	825	1,78
G14	723,15	700	-3,30
H26	3653,87	3630	-0,65
H10	1305,60	1280	-2,00
H11	2505,40	2500	-0,21
I7	288,30	300	3,90
I16	2295,05	2200	-4,32
I19	1524,70	1560	2,26
J12	3794,24	3700	-2,54
J13	1405,40	1350	-4,10
J15	955,60	920	-3,86
J17	693,75	720	3,64
J18	907,65	890	-1,98
Total	57170,85	56956	73,48
Average	1844,22	837,	2,44

Total = Total extent area

Average = Averages extent area

The data in table 2 indicates the smallest of the percentage was 0,1 and the largest was 4,6 with the average deviation of 0,38

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IV. CONCLUSION

1. The aerial photograph scanning 600 dpi of plate ares ($1^0 - 3^0$) which has been geometric transformased has an accuracy level of mean deviation 0,38 each 100 metre squares.

2. To get a good transformation of "new map or photo" at least 8 control points a separatelly needed and the level of accuracy should be < 3.

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