

APPLICATION OF FINITE DIFFERENCE TO DEVELOP LAND VALUE MAP

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Outline

Problem in developing Land Value Zone (LVZ) map :

- Difficult to deliniate of Land Values boundaries.
- The samples data of Land Value (market data) are very limited.

Problem Solving

Determining land value by using Finite Difference method.

Study Area

Desa Condongcatur, Kec. Depok, Kab. Sleman, Yogyakarta, Indonesia.

Assumption

1. Digital map use in this research assumed is correct.
2. LVZ map to be used as a visualization data.

Research's Obyectives

Apply Finite Difference method to generate LVZ map.

Hypotesis

Accuracy of Finite Difference method for developing value of LVZ could be improved.
The change of land value between zone is smooth.

Research

- ✦ Material
- ✦ Equipment
- ✦ Research Flow Diagram

Finite Difference Method

- ★ Description
- ★ Boundary Condition
- ★ Methodology
- ★ Convergence and Stability

Results and Discussion

- Isovalue Line
- Accuracy
- Evaluation of Models
- LVZ

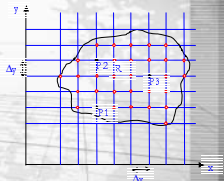
Conclusion

- The implementation of Finite Difference method using data samples of Desa Condongcatur, Depok, Yogyakarta, showed significant correlation with the field data, ie. 80% within the range of valuation criteria standard.
- The characteristics of land value used in this paper only involved limited factors as boundary conditions, however the value of land depends upon so many factors. Therefore, in the future the model should be improved to include other factors influence land value.

The End

Finite Difference

- Method for estimating the land value.
- Require grid mesh which content of character or value.
- The initial data are independent values.
- Finite difference to be used for determining the other value grid.



$\Delta x, \Delta y$ = grid distances
P1, P2, P3 = independent value

Boundary Condition

- Boundary condition is a border line which confine of study area.
- Influence to the values in study area.
- Require to maintain equations in domain of solution met to the real data.
- Outer boundary conditions are an estimated values of land surrounding observed area.
- Inner boundary condition content of factor influence to the land value.

The diagram shows a 2D coordinate system with x and y axes. A closed, irregular shape represents 'The Domain of Solution'. A line follows the perimeter of this shape, labeled 'Boundary Condition'.

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Equations

- Taylor series
- Solution of Taylor series orde 2
- Laplace equation (ellips)
- Algorithm

$$f(x_{i+1}) = f(x_i) + f'(x_i)\Delta x + \frac{f''(x_i)}{2!}\Delta x^2 + \dots + \frac{f^{(n)}(x_i)}{n!}\Delta x^n + R_n$$

$$\frac{d^2 f}{dx^2} = \frac{f(x_{i+1}) - 2f(x_i) + f(x_{i-1}))}{\Delta x^2} = R_n$$

$$\frac{\partial^2 f}{\partial x^2} + \frac{\partial^2 f}{\partial y^2} = 0$$

$$f_{(i,j)} = \frac{(\Delta x)^2 [f_{(i+1,j)} + f_{(i-1,j)}] + (\Delta y)^2 [f_{(i,j+1)} + f_{(i,j-1)}]}{2[(\Delta x)^2 + (\Delta y)^2]}$$

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Material of Research

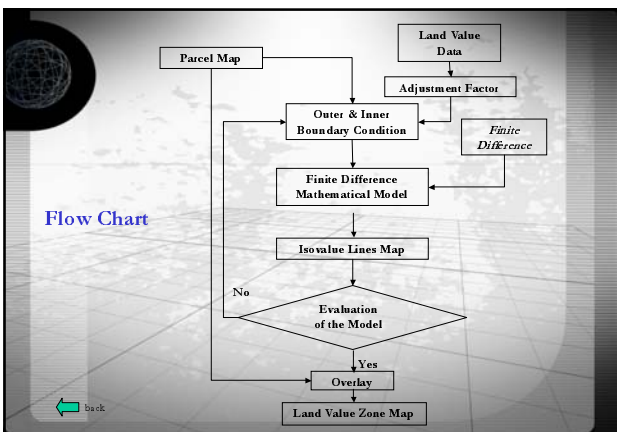
- Value of land at Desa Condongcatur and surroundings, May 2003 to January 2004.
- Land map of Desa Condongcatur (PBB Sleman office, 2002, scale 1 : 1000).

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Equipment

- Personal Computer, spesifikasi *mainboard* Chaintech KT333, *processor* AMD Athlon 1,8 GHz, RAM 256 MB, *harddisk* 30 GB, *monitor* 15" 0,28 dpi, *CDROM* 52x, *CDRW* 52x/2-4x/52x.
- Softwares :
 - Auto Cad Map, to digitize and configure the map.
 - Arc View and Map Info, to overlay the map.
 - Surfer, to determine isovalue line.
- Handy drive 256 MB for data transferring.

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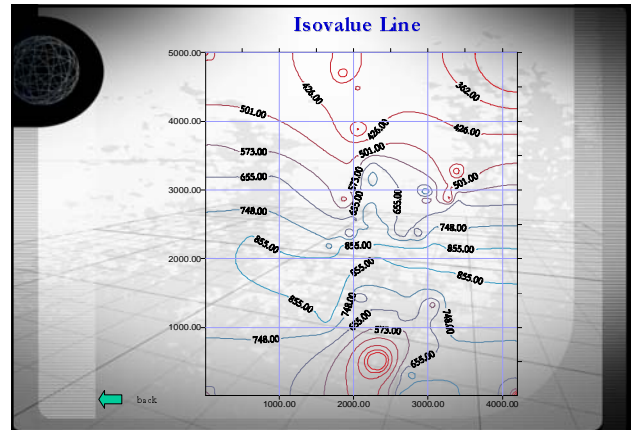
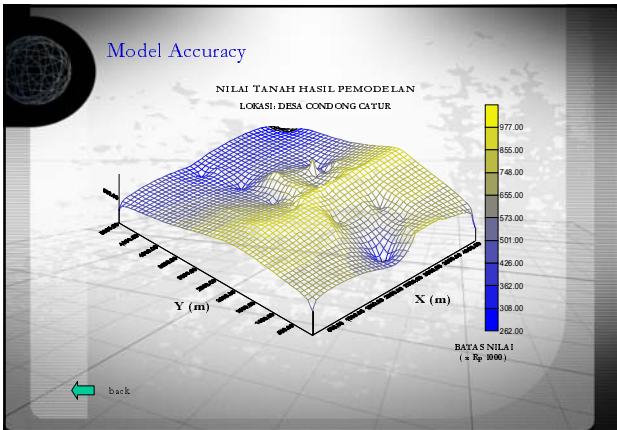


Convergence and Stability

The graphs show the convergence of the model over iterations. The first graph shows the value of Z versus iteration number for different grid mesh sizes (100x100, 200x200, 400x400). The second graph shows the value of Z versus iteration number for different adjustment factors (0.1, 0.2, 0.3). The third graph shows the value of Z versus iteration number for different grid mesh sizes (100x100, 200x200, 400x400) and adjustment factors (0.1, 0.2, 0.3).

Numbers of iteration and grid mesh influence to convergence and stability.

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Evaluation

- The evaluation of quality of finite different method was carried out by examining how the model satisfied of the criteria outlined in the standard valuation processes.
- Studies 1990 mentioned that deviation on mean value should be in the range of 0.9 to 1.10 (10% of deviation).
- The model was tested using 40 data samples, there were 8 samples of parcel data exceeded the range of the valuation standard.
- Result yields that 32 samples (80%) are met to the criteria of quality model.

The change of land value class	decrease	constant	increase
Percentage of land values (rupiahs)	0.00%	0.01%	99.99%
Total area of parcel (square metre)		722	5,819,821
Mean increasing land values/m ² (rupiahs)			425,742.08

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