Hedonic Price Models and Geographical Information Systems for Mass Land Valuation in Bangkok Metropolitan Region

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Main Agendas

- How best to increase productivity and capacity in public valuation of land
- How best to promote fairness, equity , and transparency in valuation procedure
- How best to support the forthcoming new property taxation system
- How best to respond to the government’s intensive policy regarding size reduction of public organizations

Aims

- To compare econometric models with traditional methods for land valuation
- To evaluate the utility of geographical information systems for mass land valuation in Thailand

Objectives (1/2)

- To compare the benefits of modern technology and methodology with the traditional valuation method in terms of reliability and accuracy

- To identify attributes affecting land values, such as physical characteristics, accessibility, environment, and neighbourhood quality

Objectives (2/2)

- To eliminate or mitigate any subjective influences from traditional or human methods

- To investigate the application of geographical information systems (GIS) and mass appraisal methodologies for property taxation and other public purposes

Issues with traditional methods of land valuation

- Lack of transparency in process
  - based on human (subjective) estimation of values
- Huge time and resource consumption
  - paper-based works, number of manpower
- Gap for corruption of officials (tax evasion)
  - Use of registered property price records as the main basis for land valuation
  - This does not reflect the real price of land
- Ignorance of attributes affecting land prices
  - No clear standard how to estimate the figures

Hedonic Pricing Method

"The hedonic pricing method places emphasis on the relationship between selling price and attributes of properties for estimating values of properties" *(Rossini, 1997).*

Geographical Information System (GIS)
(Land Management Concepts)

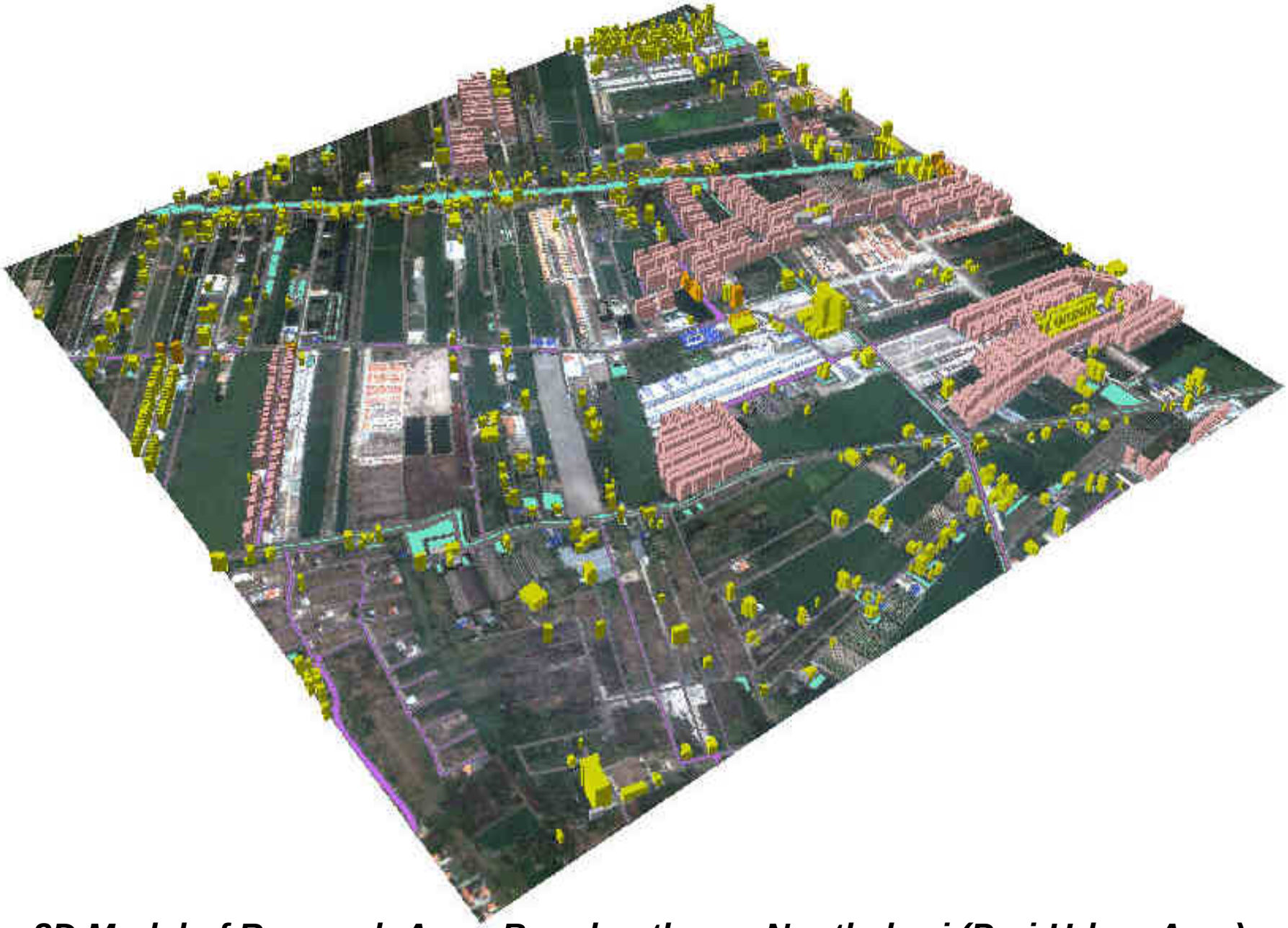
- *"a database management system used to store, retrieve, manipulate, analyze, and display spatial information" and*

- *"one type of computerized mapping system capable of integrating spatial data (land information) and attribute data among different layers on a base map."*

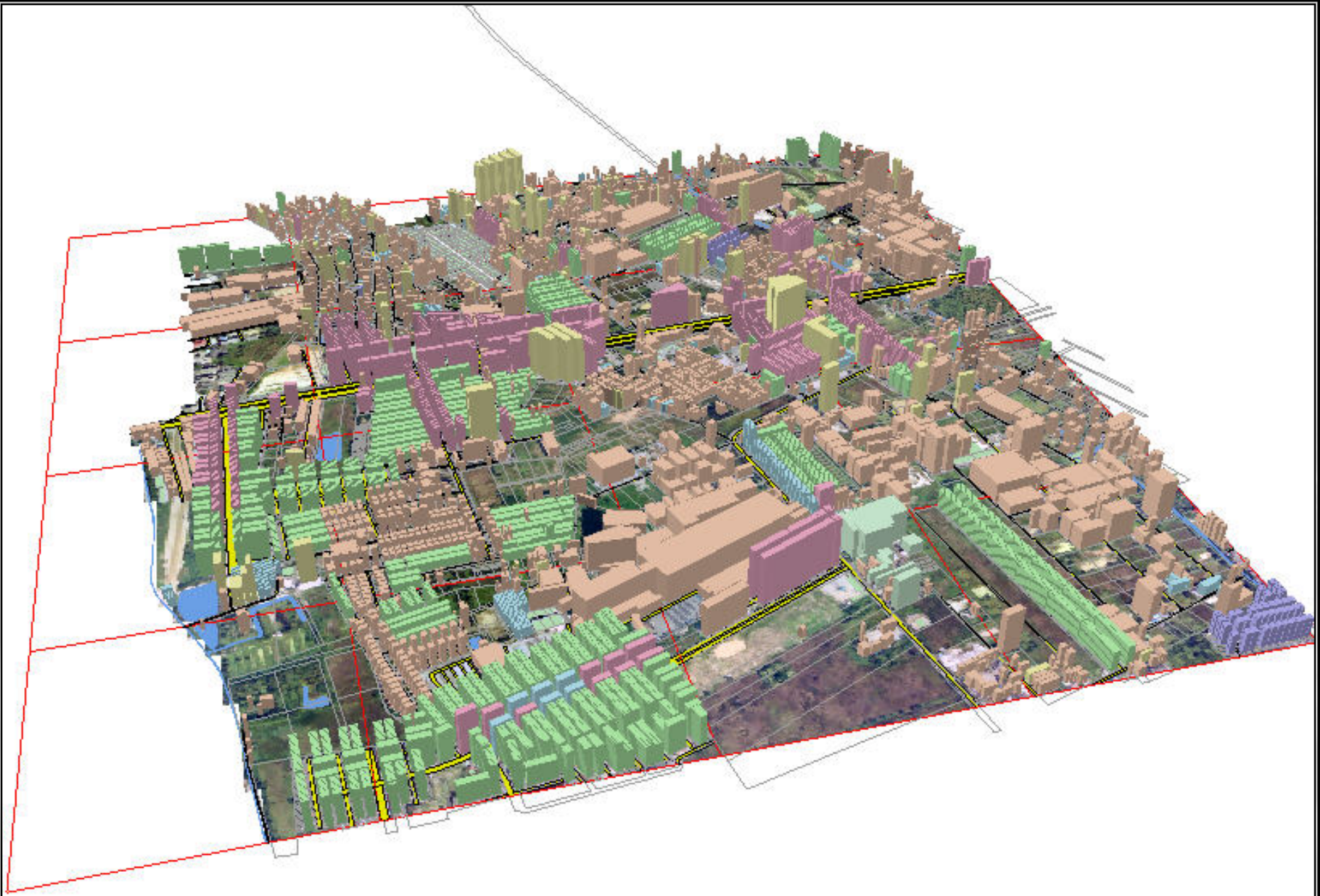
(International Association of Assessing Officers, 2002)

Main Criteria for Research Area Selection

- **Data Availability (spatial and non-spatial)**
- **Diversity of Land Uses**
- **Area Size and Time Limitation**



3D Model of Research Area: Bangbuathong, Nonthaburi (Peri-Urban Area)



3D Model of Research Area: Nongkhaem, Bangkok (Urban Area)

Table: Types and Measurements of Variables (1/2)

Variable	Type	Unit	Description	References
1 Physical Characteristics				
•Lot size	quantitative	wah	wah = 4square meters	*(Ward 2001; Rossini 2006)*
•Parcel width	quantitative	meter	average width of land lot	
•Parcel depth	quantitative	meter	average depth of land lot	
•Soil elevation	quantitative	meter	soil elevation comparing with frontage road	
•Land shape	dummy	(1,0)	normal, abnormal, axe shape, corner, triangle, 2 sides frontage	
2 Environment	five categorical levels	very good-poor	air, water, and noise, levels of pollution	*(Glougemans 2002; Bagdonavicius 2004)*
3 Neighbourhood Quality	Five categorical levels	Very good-poor	Development project and quality, community management, security, and maintenance	*(Bagdonavicius 2004; Laposa 2005)*

Table: Types and Measurements of Variables (2/2)

Variable	Type	Unit	Description	References
Accessibility				
• Access	quantitative & qualitative	metre (1,0)	type, width, condition (3 categorical levels) , surface of frontage road and access	
• Utility and service	quantitative	kilometer	distances to public utilities, services, business areas, and transportation	
Existing land use	qualitative	(1,0)	residential, commercial, agricultural, and vacant	
Building & Improvement				
• Types	qualitative	(1,0)	townhouse, shop-house, single house, semi-detached house etc.	
• Building area	quantitative	Square metre	total building areas calculated from dimension and stories	
• Building age	quantitative	years	The deference of building and selling year	
• Material quality	three categoric al levels	good-poor	material quality	(Ward 2001; Rossini 2006)
Selling price (Dependent)	quantitative	Baht/wah	registered and interviewed	

Problems with qualitative variables

- How can qualitative variables (e.g. environment, neighborhood) be defined without subjectivity?

- Are there any more attributes affecting the prices of lands in the study areas?

Measurement of Qualitative Variables

(Based on Local People Knowledge)

Type	Guidelines for Measurement
1 Road Condition	Surface Condition and Safety
2 Air pollution	Duration of Emersion and Degree of Danger
3 Water Pollution	Waste Accumulation and Duration of Spoiled Flood
4 Noise Pollution	Proximity to Polluted Source and Duration of Polluted Activity
5 Quality of Development Project	Reputation of Developer and Building Style and Design
6 Maintenances	Maintenance and Environment Protection
7 Safety	Security Staff and CCTV

Process of Sales Data Collection and Record

Registered Property Sale Database

Property Sale Map

Land Parcel Ownership Database

Investigation and Interview (Sales Data Collection Form)

Attribute Data

- Physical Characteristics
- Accessibility
- Neighborhood
- Environment
- Land Use

Property Sale Price

1)Vacant Land 2)Residential

3)Commercial

Building Inspection

Area, Condition, Types *(Detached House , Townhouse, Shop-house)*

Financial Adjustment

Present Price of Whole Property

Building Cost & Depreciation

Present Price of Land

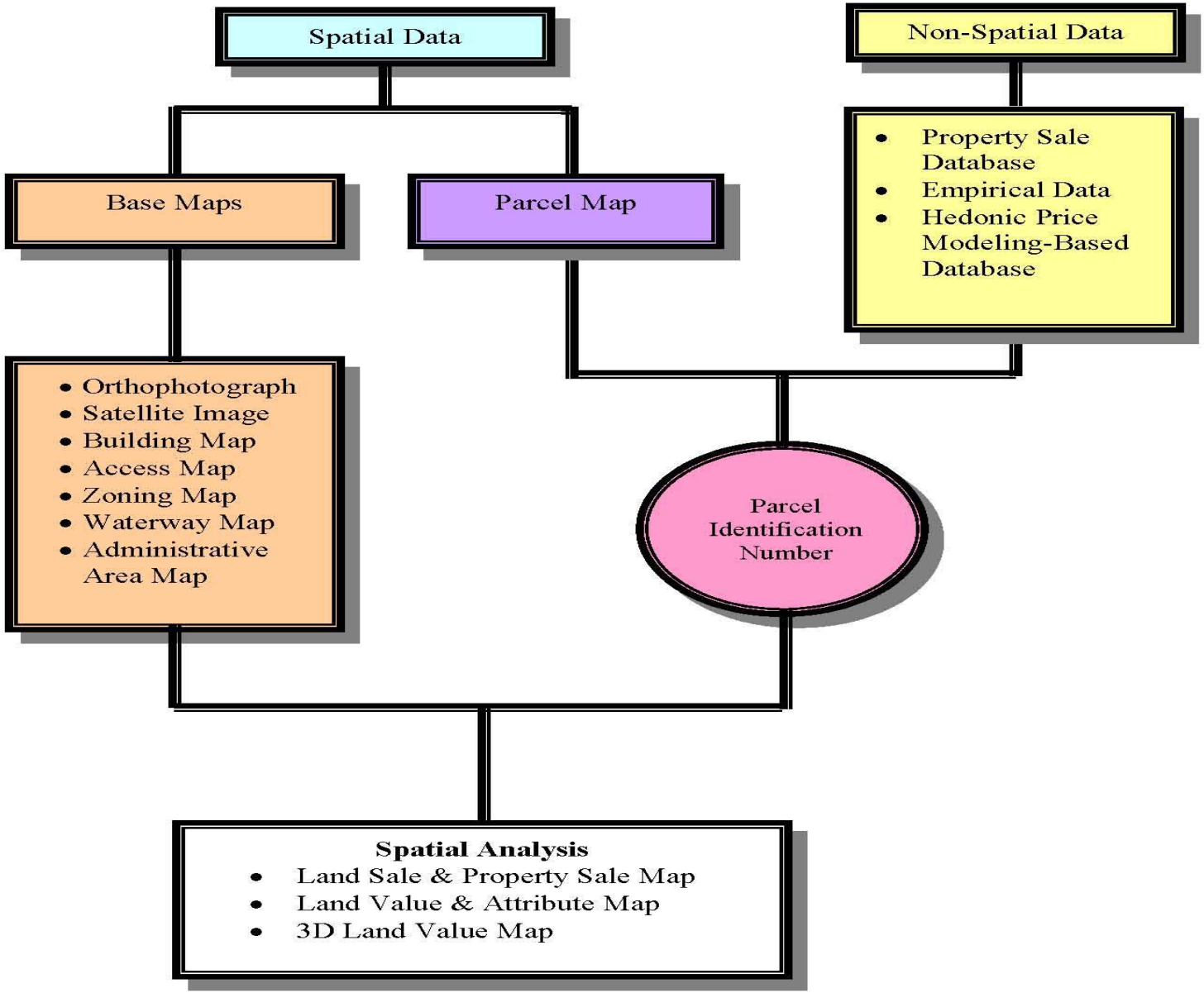
Recording

Quantifying and Recording

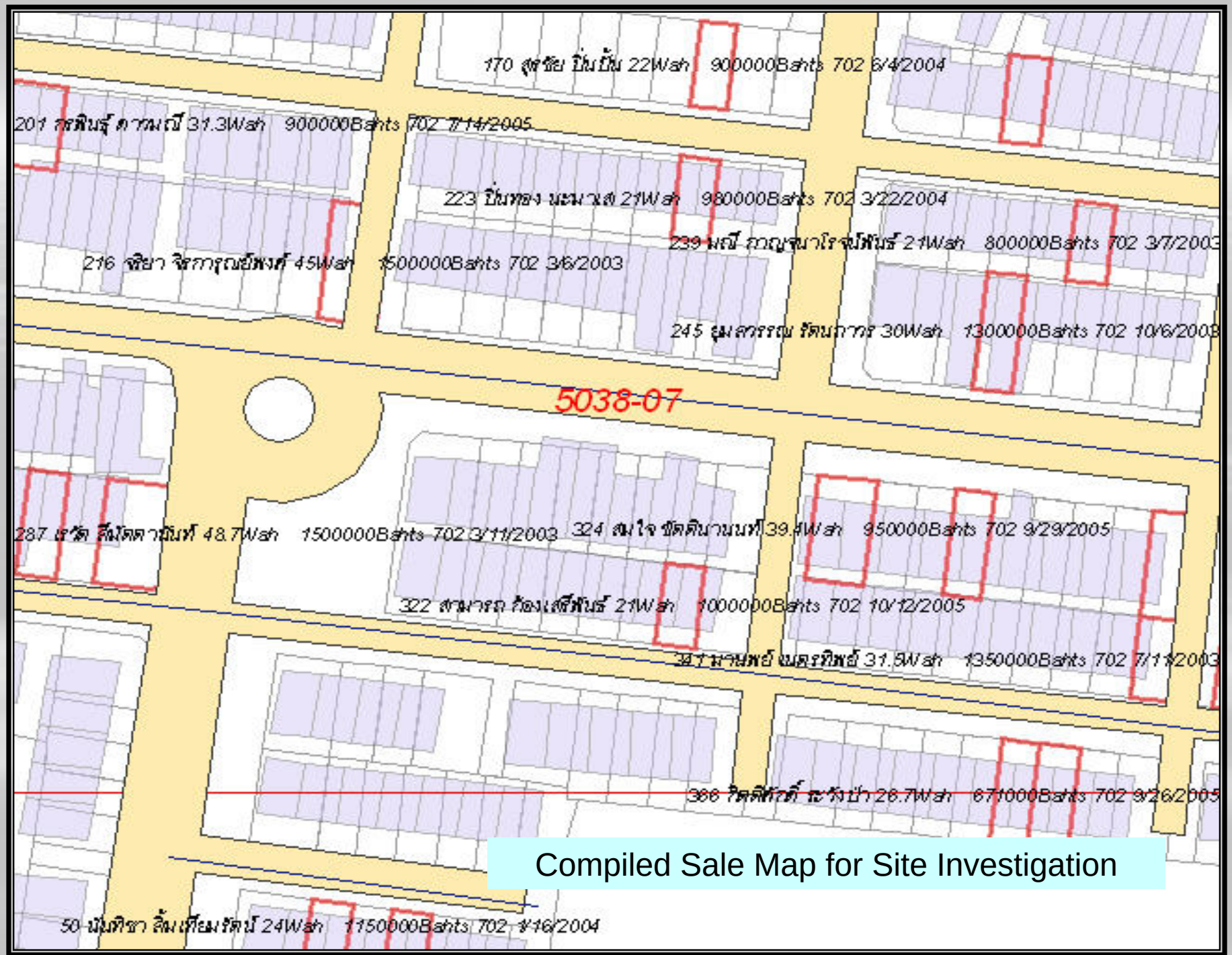
Land Price and Attribute Database for Hedonic Price Analysis

II….GIS Section

GIS-related Processes



GIS visual outcomes of land values



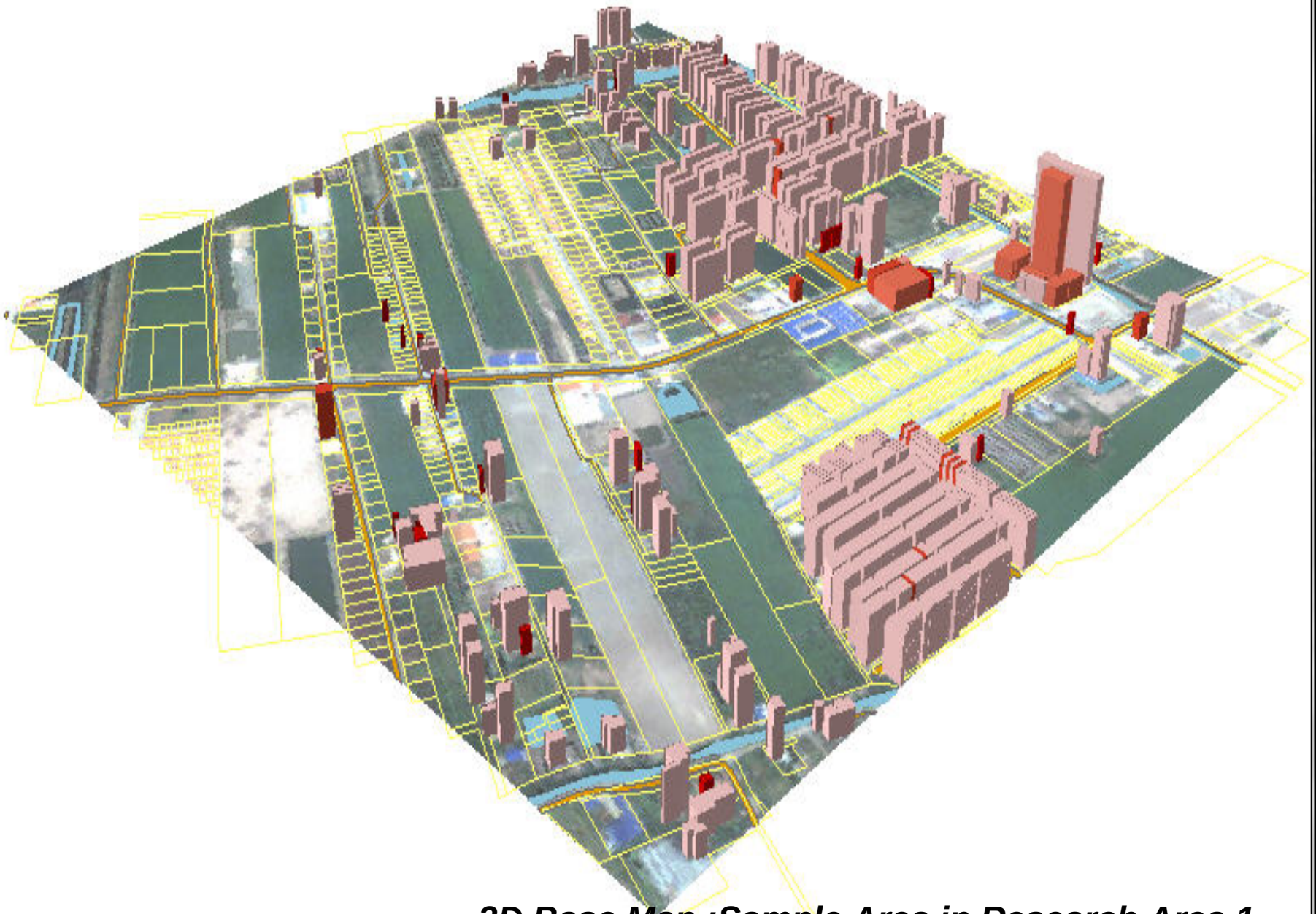
Compiled Sale Map for Site Investigation

	D	E	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE
1	ID	Accessed Lands	COM	VL	Bu sarin	Na risa	Silapa karnparkl	B_Age 2008	De tached House	SH	Land Depth (m)	Land Area (wah)	Land Area (m2)	Corner	Edge	Sand wich	Dist Mainroad (m)	Rd Side	Rd Minor MB	Sur Width (m)	Rd Asphalt	Canal	Nei_MalFair	Nei_Sec Poor	Predicted Plus Access	Rounded Value
2	5038061	0	0	1	0	0	0	0	0	0	106	1,103	4,412	0	0	0	0	0	0	7	1	0	0	0	18228.949	18,200
3	5038062	1	0	0	0	0	0	0	0	0	0	554	2,216	0	0	0	-	0	0	0	0	0	0	0	0	-
4	5038063	0	0	1	0	0	0	0	0	0	77	1,405	5,620	0	0	0	228	1	0	3	0	0	1	1	11614.472	11,600
5	5038064	0	0	1	0	0	0	0	0	0	8	1,405	5,620	0	0	0	158	1	0	3	0	0	1	1	13459.335	13,500
6	5038065	0	0	1	0	0	0	0	0	0	110	800	3,200	0	0	0	0	0	0	7	1	0	0	0	18139.121	18,100
7	5038066	0	0	1	0	0	0	0	0	0	110	800	3,200	0	0	0	0	0	0	7	1	0	0	0	18139.121	18,100
8	5038067	0	0	1	0	0	0	0	0	0	110	800	3,200	0	0	0	0	0	0	7	1	0	0	0	18139.121	18,100
9	5038068	0	0	0	0	0	0	0	0	0	14	23	90	0	0	0	84	0	1	6	0	0	1	0	26534.548	26,500
10	5038069	1	0	0	0	0	0	0	0	0	0	20	80	0	0	0	-	0	0	-	0	0	0	0	0	-
11	50380610	1	0	0	0	0	0	0	0	0	0	893	3,572	0	0	0	-	0	0	-	0	0	0	0	0	-
12	50380611	0	0	1	0	0	0	0	0	0	286	3,400	13,600	0	0	0	0	0	0	7	1	0	0	0	14186.689	14,200
13	50380612	0	0	1	0	0	0	0	0	0	320	4,000	16,000	0	0	0	0	0	0	7	1	0	0	0	13423.151	13,400
14	50380613	0	0	1	0	0	0	0	0	0	295	3,400	13,600	0	0	0	0	0	0	7	1	0	0	0	13984.576	14,000
15	50380614	0	0	1	0	0	0	0	0	0	320	4,000	16,000	0	0	0	0	0	0	7	1	0	0	0	13423.151	13,400
16	50380615	0	0	1	0	0	0	0	0	0	22	93	372	0	0	0	170	1	0	4	0	0	0	1	7566.565	7,600
17	50380616	0	0	1	0	0	0	0	0	0	22	111	444	0	0	0	150	1	0	4	0	0	0	1	7650.945	7,700
18	50380617	0	0	1	0	0	0	0	0	0	21	107	428	0	0	0	130	1	0	4	0	0	0	1	7757.782	7,800
19	50380618	0	0	1	0	0	0	0	0	0	20	102	408	0	0	0	110	1	0	4	0	0	0	1	7864.619	7,900
20	50380619	0	0	1	0	0	0	0	0	0	19	98	392	0	0	0	90	1	0	4	0	0	0	1	7971.456	8,000
21	50380620	0	0	1	0	0	0	0	0	0	18	43	172	0	0	0	70	1	0	4	0	0	0	1	8078.293	8,100
22	50380621	0	0	1	0	0	0	0	0	0	17	88	352	0	0	0	50	1	0	4	0	0	0	1	8185.13	8,200
23	50380622	0	0	1	0	0	0	0	0	0	28	127	508	0	0	0	0	0	0	7	1	0	0	0	19980.595	20,000
24	50380623	0	0	1	0	0	0	0	0	0	23	99	396	0	0	0	0	0	0	7	1	0	0	0	20092.88	20,100
25	50380624	0	0	1	0	0	0	0	0	0	17	101	404	0	0	0	50	1	0	4	0	0	0	1	8185.13	8,200

Display of land value database in accordance with geographical sites

Display of Land Value Patterns and Clusters

3D Land Value Model :Sample Area in Research Area 1



3D Base Map :Sample Area in Research Area 1

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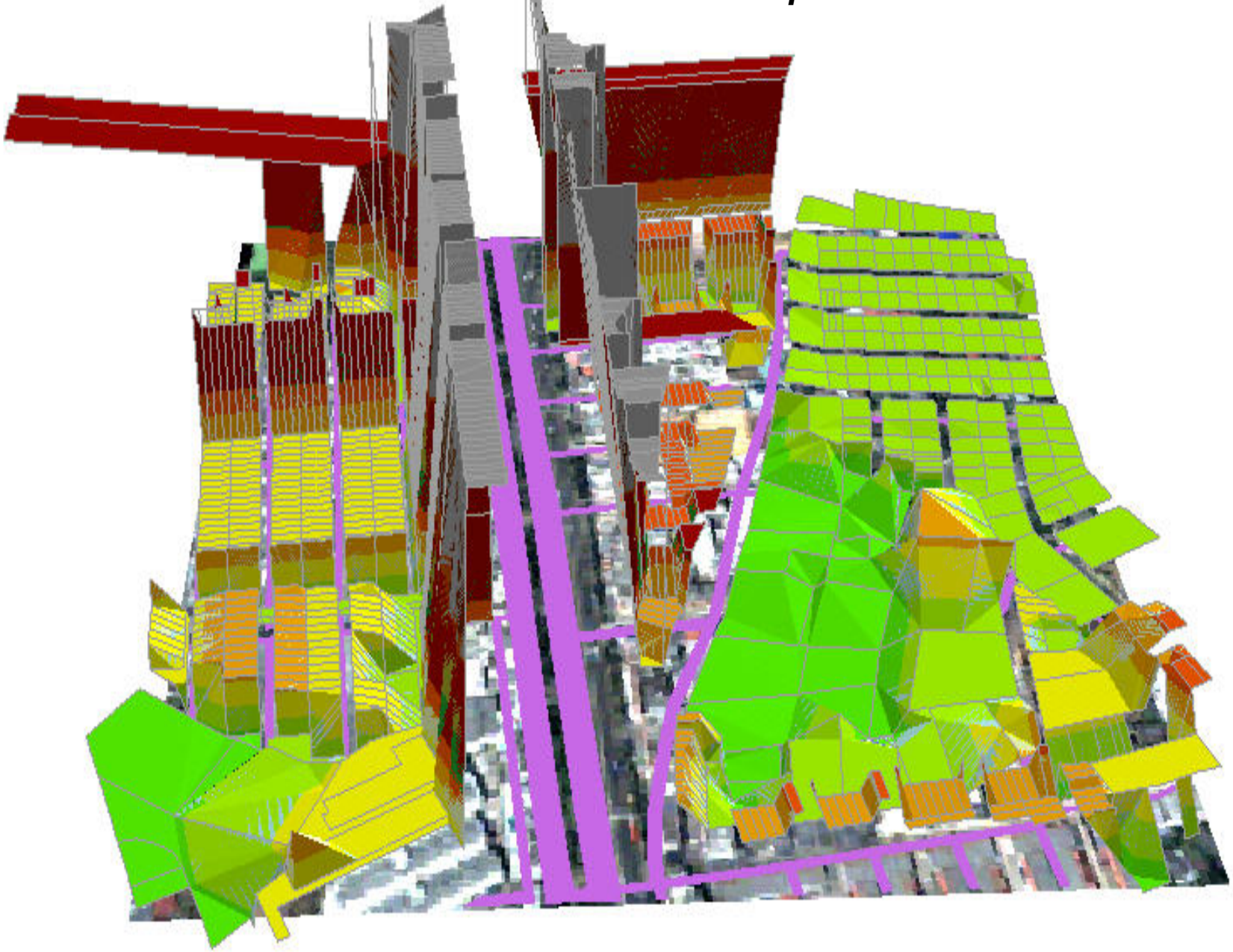
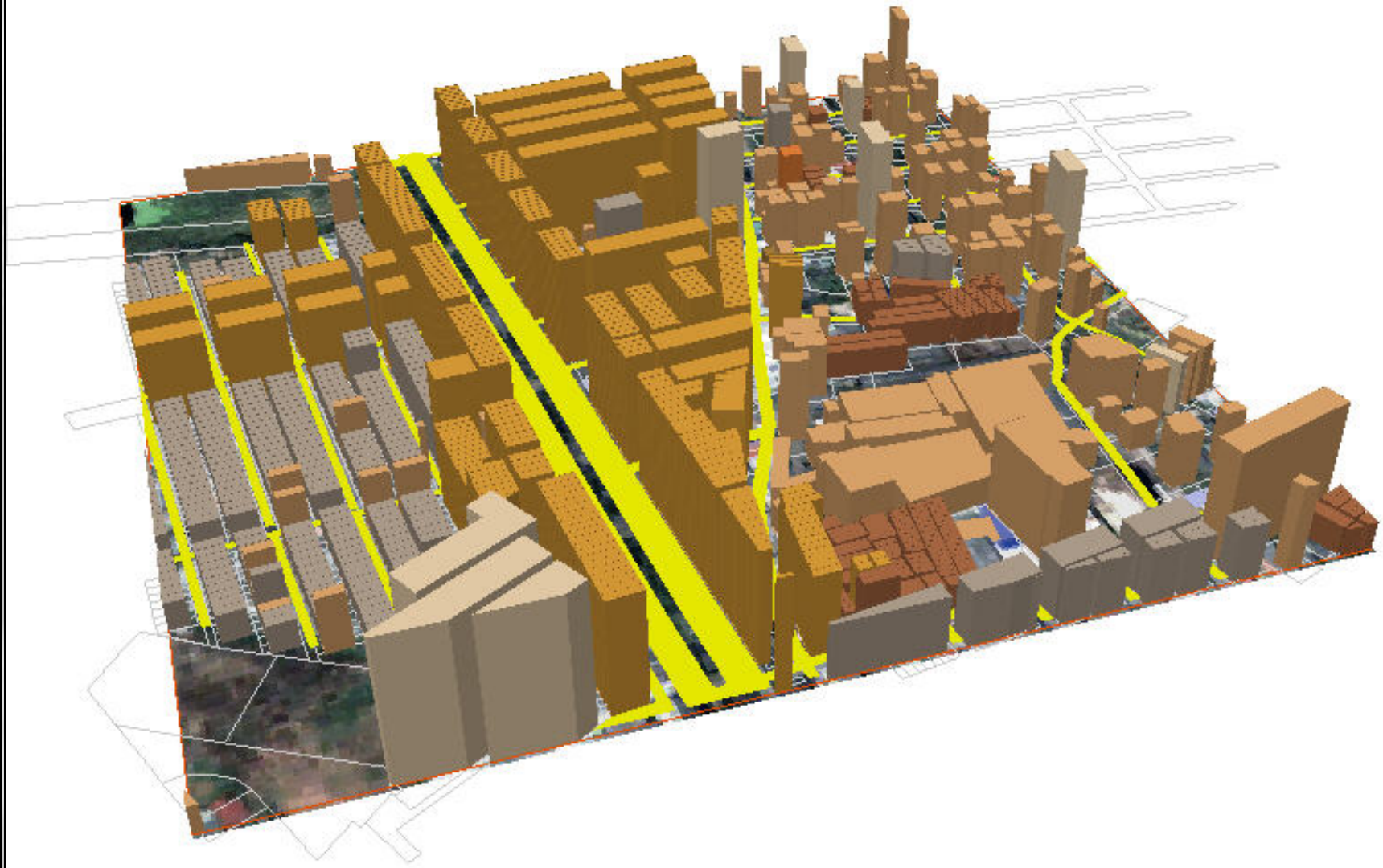
Display land value database in accordance with geographical sites

3D Land Value Model :Sample Area in Research Area 2





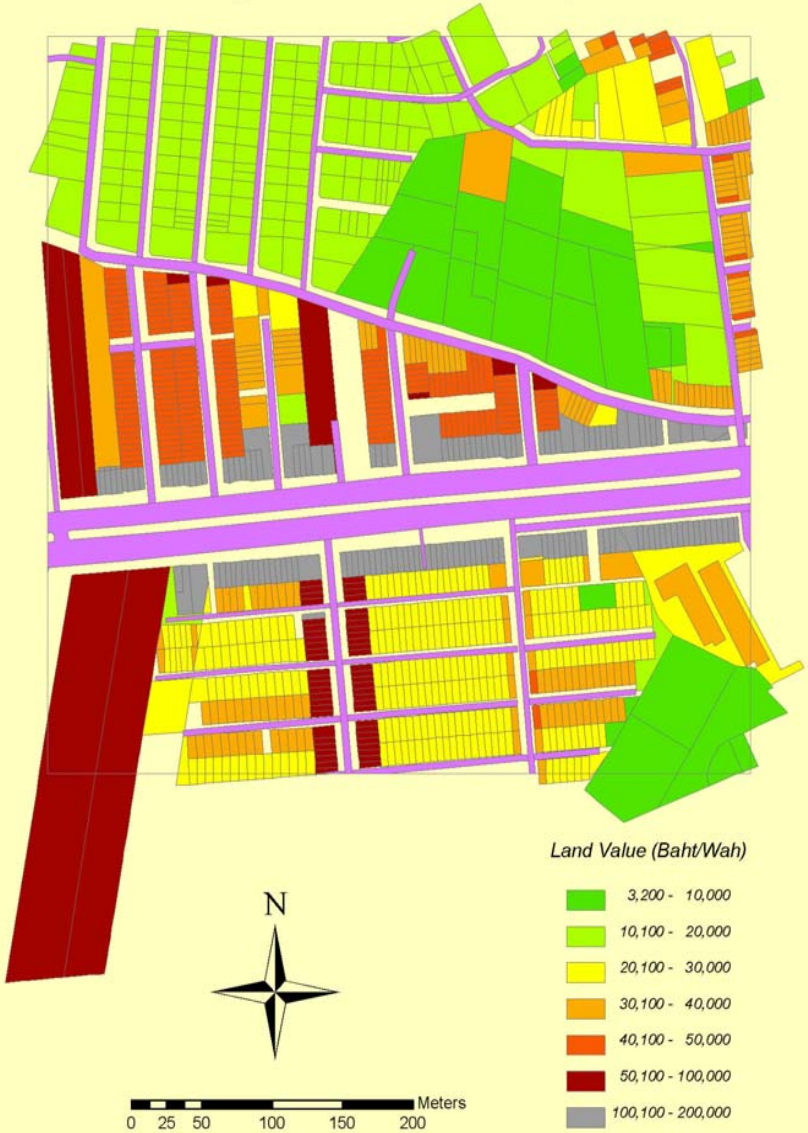
3D Base Map :Sample Area in Research Area 2

Land Value Map of Bangbuathong Research Area

(5036 I 5038 : Sheet No.6,7,10, and 11)

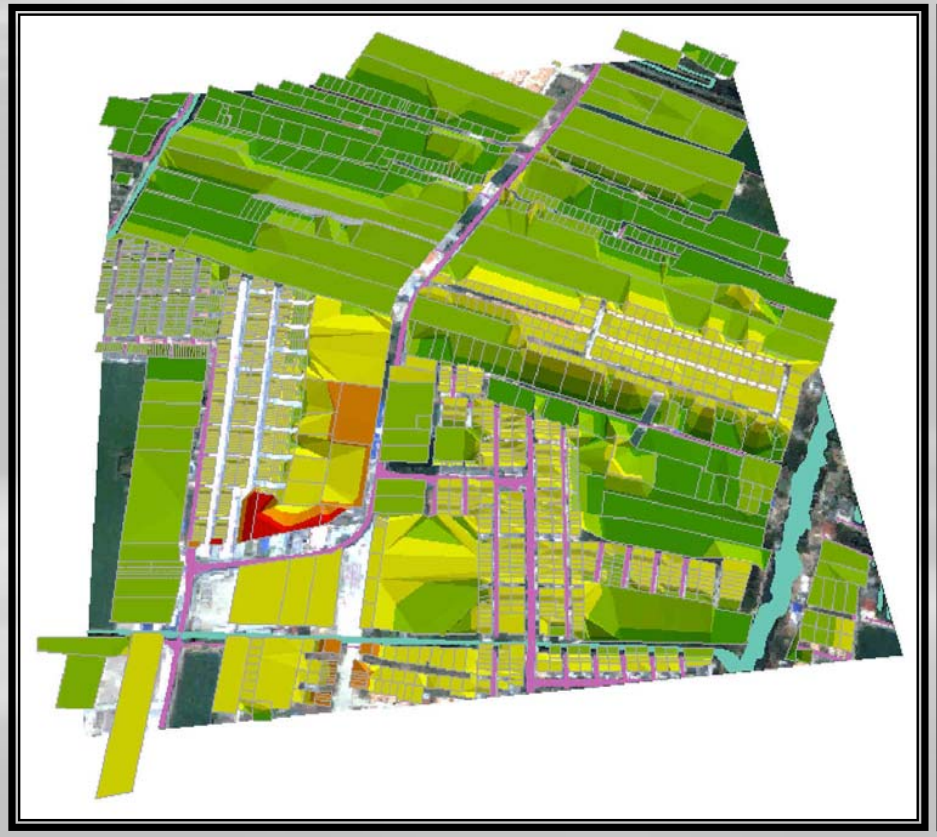
Land Value Map of Nongkhaem Research Area

(5036 II 4414 : Sheet No.6)

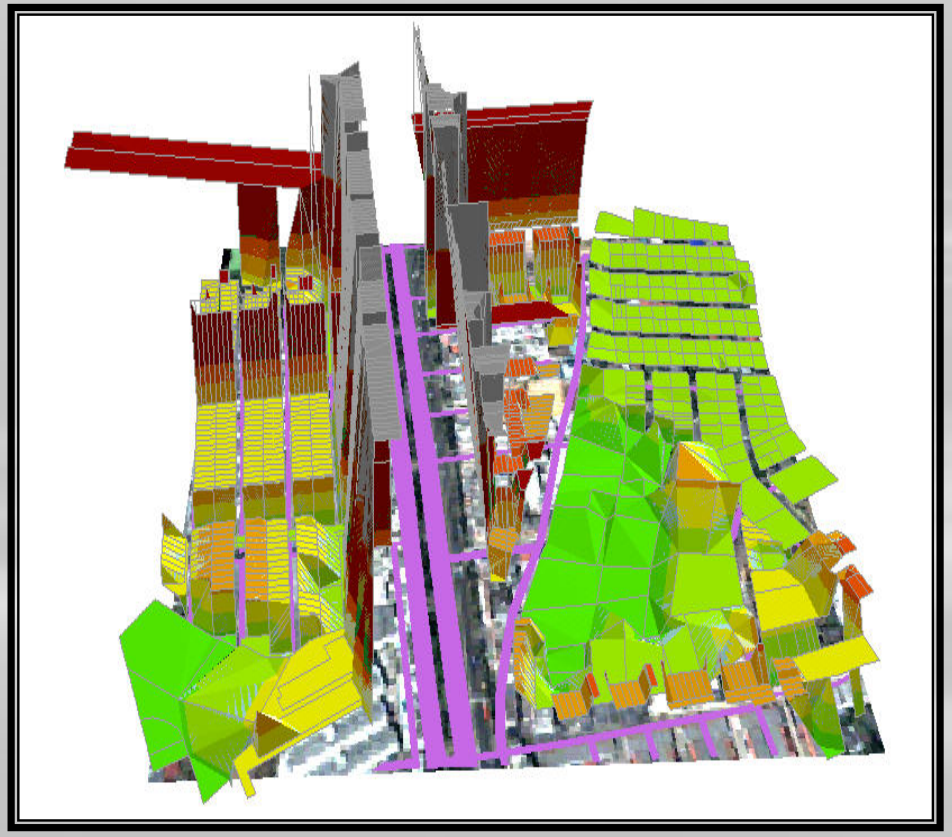


3D Land Value Model :Sample Area

Research Area 1



Research Area 2



Summary of Work Done to Create Research Database

Academic Year	Types of Data	Cases (Rows)	Filled Field (Columns)	Filled Cells (Records)	Processes Involved
1-2	*Questionnaire Responses' Database*	*40 Pre-tested*	*Open Question*		
		127 Responses	*130*	*16,510*	*Coding, Recording, Summary, and Graphic Presentation*
2	*Sales Collection Database*	*1,999 Inspected Sales Data*	*130*	*259,870*	*Measuring, Coding, Ranging, and Recording, Amending*
3	*Significant Variable Figures*	*3,038 Predicted Parcels*	*24*	*64,841*	*Inspecting, Quantifying, and Recording*
	Total	*4,204*	*284*	*341,221*	

Conclusions

- Huge amount of work involved in developing both the hedonic price model and the GIS
- This would be costly for the whole country at initial stage
  - All data models do explain over 78.0% of variation in land value
  - Allowance for frequent update, fast production time
- Clear benefits in terms of accuracy, replication and transparency of process
  - But relies in part on subjectivity of attributes
  - Taken into account significant variables affecting land prices


Thank you!