MODEL THE RESIDENTIAL LAND PRICE:

A CASE STUDY OF HAN KOU TOWN, WU HAN CITY, PR CHINA

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ABSTRACT

This paper analyzes the factors that possibly influence the price of residential land in Han Kou town, Wu Han city, China. Based on these factors, as well as the real land auction price, a multiple regression model was employed in this case study. In the modeling process, GIS was used to measure possible influential factors in the price-setting process. In addition, step-wise analysis was used to isolate insignificant factors in the regression model. Six new residential plots in Han Kou town were used to validate the formulated model. The results show that the model can predict residential land price accurately, and is possible to update the government's Bench Mark Price (BMP).

INTRODUCTION

After the open-door policy was implemented in 1978, and especially after land reform was initiated 10 years later, land transaction has been widely allowed in Chinese cities, particularly in the form of long-term leasing. The income from land transactions constitutes a major source of revenue for local and central governments. In order to monitor and direct such transaction processes, the local governments have been encouraged to predict the best possible land valuation, which is referred to as the Bench Mark Price (BMP). Generally the BMP will be developed through the steps outlined below.

Step one involves expert evaluations. In this process, government experts attempt to identify possible factors affecting land price, as well as the weights attributed to these factors.

Estimations of value are made by experts coming from different areas such as urban statistics bureaus, planning, transportation, and environmental protection departments. The average weights of each factor are recorded for the ensuing analysis.

Step two divides the whole urban area into different regions based on different physical characteristics. Once identified, these factors are used to classify and rank these different regions. Again, this process is completed by various local authorities. For example, the environmental protection bureau classifies the whole urban area into different regions based on different environmental qualities. Similarly, the transportation bureau divides the urban area according to different transportation qualities.

Step three involves the formation of physically homogenous zones based on various classifications and different weighted factors, which are assigned in the Step1. At this stage, map overlay technique is employed to rank the regions.

Step four estimates the average land price in each physically homogeneous zone based on existing land transaction data. The basic assumption is that in each physically homogeneous zone, the price for land should be similar based on similar land use types. Thus the price of land is affected by its function.

For example, following the above method, the BMP of residential land in Wu Han city was classified into 6 classes in 2004, each of them belonging to one different physical homogeneous zone. Here, the homogeneous zone refers to area which has the following 5 similar characteristics: degree of prosperity, communication condition, infrastructure and facility condition, environment quality, and population status (Land and Resource Management Center of Wu Han, 2004).

However, because of a lack of data and the lack of experience, as well as a possible time lag, the government’s BMP often deviates dramatically from the actual land transaction price. In fact, in most cases, the government’s BMP is significantly lower than the actual value. Thus, in order to provide a more reasonable estimate for land transactions and in hopes of properly updating the BMP, the authors formulate a regression model in this paper, using residential land as the land use type. Han Kou town, the thriving commercial center of Wu Han city, has been selected as the case study area.

CASE STUDY AREA

Wu Han is the largest city in central China and the capital of Hu Bei Province. At the intersection of the Beijing-Guangzhou railway and the Yangtze-river (the third largest in the world), Wu Han has become one of the key transportation nodes in China. The geographic location and the city’s importance resemble that of Chicago in the United States – hence Wu Han’s nickname, “Chinese Chicago”. Wu Han is a multi-center city. The urban area, which is divided by two rivers (the Yangtze and the Han), consists of three distinct districts: Wu Chang, Han Kou and Han Yang. Each of these districts exhibit unique characteristics. Han Kou is the commercial center of Wu Han city and includes three districts: Jiang An, Jiang Han and Qiao Kou. Han Yang boasts many historic attractions; however, the district also contains a number of heavy industry sites. With more than 20 universities and colleges located within its borders, Wu Chang signifies the cultural and educational core of Wu Han (Xiao, 2002).

As the largest city in the central China, Wu Han had a population of more than 4 million. This figure represents a four-fold increase over the past 50 years. From 1949-2000, Wu Han experienced rapid urbanization. During this period, the developed area of the city increased from 3000 ha to over 30,000 (Cheng and Masser, 2003). Wu Han’s first open auction for residential land took place in March 2001. The selling price for the first 8.3 ha plot exceeded the government’s estimate by nearly 100%; the plot sold for 68 million RMB Yuan (US$8.3 million), whereas the BMP was estimated at only 36 million RMB Yuan (US$4.4 million) (Land and Resource Management Center of Wu Han, 2004). Following a pattern evident in other Chinese cities, the estimated BMP in Wu Han lacks accuracy. In fact, government estimates consistently fall below the actual auction price. As such, current municipal practices produce unreliable estimations of residential land value.

Figure 1 Location of Han Kou town (red line area) and Wu Han city in China (Please find it at the end of the article)

METHODOLOGY

In order to improve the government's precision and timeliness, the authors utilized a regression analysis to produce a model for predicting residential land prices in this case study. In the following discussion, factors that possibly influence residential land prices will be identified based on a review of the literature and interviews of experts in the field.

Literature review about possible influential factors

Location

Based on the bid-rent theories, the location of urban land will have a direct influence on its price. The closer it is to the urban center, the higher the price will be. In their research, Freeman (1979), Huh and Kwak (1997), Tse (2000), and Tse and Love (2000) have explored the effect of accessibility to central areas on residential land prices, and they state that the relationship between residential land prices and locations can be measured by different accessibility factors such as the accessibility to the urban center, sub-center, or other important urban function areas. Based on previous research, we found the following two methods have been widely used to measure the accessibility of different locations (Leake and Huzayyin, 1979; Helling, 1996; Srour et al., 2002):

1. Direct Distance: this method can measure the "relative accessibility" of different locations. It is defined as how two places or points on the same surface are connected. The simplest measurement method is using the straight line distance between two points. If more than two destinations are analyzed (the accessibility of one place to all other places), the contour measurement is preferable.

2. Contour Distance can be used to measure the "absolute accessibility" from a given place to a destination place. This method emphasizes the number of potential destinations or opportunities rather than their distances.

In the following research these two methods will be employed. The direct distance will be used to measure simple accessibility, usually using the straight line to measure the distance between the two points. The contour distance will be used to measure the accessibility to urban centers. The output will be how many minutes it will take to move from one place to another.

Social and planning influence

The residential land price is affected by its surrounding social environment. One good example is the crime rate, which affects the residential land price directly. Further, some planning factors such as permitted Floor Area Ratio (FAR), density of development, the dominant and surrounding land uses, and future housing sizes, types or tenures also affect the possible residential land price. Because of cultural differences some factors might have a stronger influence in cities in China than in their western counterparts. For example, in Chinese culture, people like to live near each other, thus the higher development density is regarded as a sign of prosperity and tend to make the residential land price go higher. Another example is the dominant and surrounding land use types in the area. Since most Chinese people rely on bicycles or public transit for shopping, living around a commercial area would be deemed desirable, despite the fact that people need to bear the noises and traffic disturbance brought about by commercial activities. Thus, in order to create the land price model in China, these special factors need to be considered. Due to data limitations, some factors such as housing sizes, types and tenures might not be included in the modeling process. And some factors like crime rate, development density, and dominant land use types might be reflected by one variable called neighborhood quality. These limitations will affect the model prediction and should be considered in the future research. Based on previous research and data availability the following factors have been selected:

1. Permitted Floor Area Ratio.
2. Size of land parcel.
3. Neighborhood quality (Including crime rate, development density, and dominant land use types).

Environment influence

Countless researches have shown that the neighborhood environment will directly affect people's willingness to pay for a house. For example, Abelson (1979) investigated the relationship between noise level and the house prices in Marrickville and Rockdale, suburbs of Sydney, Australia. He found a one unit increase in aircraft noise level in the study area tends to decrease the residential land price around US$540 to US$840 (per house block) in Marrickville and around US$300 in Rockdale. Such a situation is also in true in China. However, because of the cultural difference, some special factors should be considered as well. These factors include water view, green cover ratio, housing locations etc. Based on available data, factors such as, water view/natural amenity view or the lack of it, distance from pollution areas and noise source are selected.

Expert opinion about possible influential factors

After identifying the general influential factors from a review of the literature, 140 questionnaires of experts have been carried out in Han Kou town. The aim of the questionnaires is to find out the influential factors specific to the case study area. The 140 interviewees include real estate developers, urban planners, architects, governmental officials and potential house buyers. They come from three districts of Han Kou town according to the following breakdown: 34 in Jiang An district, 30 in Qiao Kou district, and 76 in Jiang Han district. The result can be found in Table 1.

Table 1 Summary of experts' opinions (Please find it at the end of the article)

As shown in the Table 1, environmental factors, which include natural environment, nearby amenities, educational environment, social environment and security environment etc, play an important role in determining the possible residential land price in the case study area. More than 80% of local experts think public service, location, and transportation are also important.

Finally, based on literature, experts' opinion, and data availability 15 factors have been selected. As shown in Table 2, they are divided into 3 categories: location, social and planning influence, and environmental influence. Most of them will be measured by distance/accessibility or dummy (0, 1) variables.

Table 2 Influential factors in the model (Please find it at the end of the article)

After identifying these possible influential factors in the case study area, the model will be created according to the following steps.

Model Building Process

Measure the dependent and independent variables

In this research, the actual auction price of residential land will be defined as the dependent variable. These data were collected from the Land and Resources Management Center of Wu Han (2004) and measured by Chinese RMB per square meter. The corresponding sample plots were digitized in ArcGIS software.

In this research, the value of accessibility of each sample plot will be measured by ArcGIS software. In detail, we can measure it in the following way. Suppose we want to measure the plot's accessibility to the city center. Firstly, the sample plot and the city center will be defined as origin and destination points, which will be linked to the nearest node in the road coverage map in GIS software. Then we will define the major transportation tools. In the case study area the major transportation tool is the bus. The common speed is 500 meters/minute. Thirdly we will define the search radius based on the speed of the major transportation tool, here it is 500 meters. We will see how many minutes it will take to reach the destination point from the sample plot. After applying this method, we find the accessibility of sample plots to the city center ranging from 3.8 minutes to the 28 minutes, as shown in Figure 2.

Figure 2 Accessibility to the city center (Please find it at the end of the article)

Since in the case study area, there are several sub-city centers, we shall use the shortest distance to reflect its accessibility to the sub-city centers and the unit of measurement will be the meter. The output can be found in Figure 3, which shows the minimum and maximum distance to the sub-center ranging from 253 meters 4500 meters respectively. For the distance to the main road, bus stop, railroad, pollution industry, hospital, post office and market, these factors will be measured by straight line distance in GIS software again using the meter as the distance measure unit.

Figure 3 Accessibility to the sub city center (Please find it at the end of the article)

For other independent variables like the water view and amenity view, we will measure them with a binary dummy variable, which means if the land plot has a water view or an amenity view, its value will be assigned to 1, while if it is outside the scenery view extent the assigned value will be 0. The variables such as size of land parcel and Floor Area Ratio (FAR) can be measured by the real land transaction data and entered into the model directly. Due to data limitations, we will use neighborhood quality to reflect some factors like crime rate, population density, and dominant land use types. Based on field survey and expert opinions, we will rank the neighborhood quality into 3 categories: very suitable for living (Value=3); fairly suitable for living (Value=2); and unsuitable for living (Value=1). Using the above methods, we created the following measurement Table 3.

Table 2 Variables and measurement table (Please find it at the end of the article)

Build the model by multiple regression and stepwise analysis

GIS software provides us a chance to analyze the above influence factors with overlay method. In GIS software, for each research sample, we can get its different attributes like location, transportation, social and environment influence separately. In this research, each independent variable will be represented by one layer and we will get 15 layers in total. After obtaining the different data, a multiple regression method will be used to create the model. The basic price prediction model can be represented by Equation 1. Where PLV is the predicted land price, $X_1 \ldots X_{15}$ are the independent variables identified from the above process.

Equation 1 General multiple regression model (a)

$$PLV= \boldsymbol{f}(X_1 \ldots X_{15})$$

$$\text{Predict land value (PLV)} = b + C_1 X_1 + C_2 X_2 + \ldots + C_{15} X_{15}$$

To each land parcel, if we want to get its predicted land price, we should identify out the intercept *b* and the above parameters from C_1 to C_{15} first. Thus the above formula will be transformed as the Equation 2: (Here, the real land auction price will be used for regression.)

Equation 2 General multiple regression model (b)

$$\text{Land auction price (LAP)} = b + C_1 X_1 + C_2 X_2 + \ldots + C_{15} X_{15}$$

Furthermore the above 15 independent variables might have some strong interrelations, which might reduce the prediction precision. Thus we should do some correlation analysis regarding them. Meanwhile, some variables might have an insignificant contribution in the above formula; we should also isolate them by stepwise analysis. In the following section the data will be analyzed by the above methods.

DATA PROCESS AND ANALYSIS

Samples distribution

Based on the government's BMP, the urban area of Han Kou town can be divided into 6 zones, where the land price decreases from Zone 1 to Zone 6. Based on the experts' suggestions (5 experts from a Real Estate Company and from the local land administration office) 31 samples were selected in the zones 1, 2, 3, 4, and 5. They are named as No 17 to No 94. There is no land auction data in Zone 6, thus no sample was selected from this area. The samples distribution is shown in Figure 5. The detailed transaction data can be found in Table 4 (Land and Resources Management Center of Wu Han, 2004).

Table 4 Descriptive table of sample plots (Please find it at the end of the article)

Figure 4 Distribution of sample plots in the six land value zone (Please find it at the end of the article)

Table 5 Detailed land auction information about sample plots (Please find it at the end of the article)

Data analysis

Descriptive analysis

In this step, the samples will be explored by descriptive statistics. Based on the analysis, we found auction land price is not normally distributed. Meanwhile, 26% sample plots are near water body and 13% are influenced by the noise of railways. See the Table 6.

Table 6 Descriptive analysis of samples (Please find it at the end of the article)

Correlation Matrix

In this step, we will analyze the interrelation of these 15 variables. Table 7 shows the correlation matrix of the 15 independent variables and the dependent variable. This matrix uses a rank-order correlation coefficient which measures the correlation at the ordinal level. This is a nonparametric version of Spearman's correlation based on the ranks of the data rather than the actual values. The values of the correlation coefficient range from -1 to 1.

Table 7 Correlation matrix of variables (Please find it at the end of the article)

From Table 7, we can see only the independent variables AME and NEQ, ACC and FAR have a relatively higher correlation with each other. And they also have a high correlation with the dependent variable: LAP. Other variables show moderate or weak correlation with one another. Thus it is possible to continue the following analysis.

Regression and Stepwise Analysis

In this step, we use the stepwise analysis to isolate the insignificant variables and form the regression model. The dependent variable and some independent variables will be transformed into common logarithms. Based on step-wise analysis, we can get the final model as shown in Equation 3. In this model, 9 significant variables are included. They are FAR, AME, ACC, NEW, MAK, ARA, POL, POS, and NEQ. Six variables such as SCH, NER, BUS, ACS, HOP, and MAR are discarded by the stepwise analysis, because of their insignificant contributions. The total explanatory power of the final model is 93.9% (Adjusted R Square). And the detailed stepwise analysis processes are shown in Table 8 and Table 9.

$$\text{LOG (Predicted Land Price)} = 2.178+0.165FAR+0.003AME + 0.007ACC+$$

$$0.082NEW+0.163\,\text{Log}\,(MAK)-0.059\,\text{Log}\,(ARA)+0.004POL-0.0051POS+0.003NEQ$$

Equation 3 Final regression model after step-wise analysis

From this model, we can see the coefficient of FAR is positive which means the higher FAR the higher land price will be. This is easy to understand, since for the same land plot the higher FAR will bring more income for developers, thus the land price will be higher. However, it is surprising to notice that ACC also has a positive coefficient, which means less accessibility to the urban center will increase the residential price. It's a little bit different from the situation in the case study area, where people tend to live around the urban center. However the coefficient of ACC is relatively small, which means such an effect is not so obvious. For the other variables, we can see that the coefficients of NEW and AME are positive, which means having a water view or amenity view in the residential area will increase the land price correspondingly. The coefficient of log (MAK) is also positive, which means proximity to the market will have a negative impact on land price. And as we expected, the coefficient of ARA is negative, which means the larger plot is perceived to have a lower unit price in the case study area. Meanwhile the coefficient of POS is also negative, which means if the distance to the post office increases, the land price will decrease. Finally we noticed that both POL and NEQ have positive coefficients; the former means getting nearer to a pollution source will decrease the residential land price. The latter means high neighborhood quality will increase the residential land price. In conclusion, the coefficients of all the variables in the above model do not strongly conflict with our common knowledge in the case study area.

Table 8 Summary of models' explanation ability (Adjusted R Square) (Please find it at the end of the article)

Table 9 The results of stepwise analysis (Please find it at the end of the article)

Model Evaluation with New Data

In order to evaluate the predictive capacity of the above model, supplemental case study data was used to validate the model. We first compared the model's predicted land price with the real auction price; we then separately compared the government's BMP to the actual auction price. Finally, then, the authors compared the accuracy of the model to that of the BMP. The evaluation formulas are shown in the Equation 4. The information and distribution of new samples can be found in the following Table 10 and Figure 6.

Table 10 Description of new samples (Please find it at the end of the article)

Figure 5 Distribution of new samples (Please find it at the end of the article)

The comparative results can be found in Table 11.

Table 11 Comparison of predicted land price, auction price and BMP price (Please find it at the end of the article)

Notes: Predicted Error = Predicted land price (or BMP) –Auction price

Equation 4 Formulas for model evaluation

Deviation Percentage = (Predicted Error /Auction price) *100%

From Table 11, we can see that, compared with the government's BMP, the model's predicted land prices are much closer to the real land auction price. The predicted deviation percentage ranges from -12.6% to 6.4%, which is much less than the BMP deviation percentage (between

-49.5% and 22.3%). Thus, the above model can be used to improve the precision of the government BMP. In general, the model provides a more precise indicator of value in government land auction processes. For the highest deviation point (-12.6%) in predicted price, some explanation is provided in the discussion below.

This sample plot lies in the Zone 3. The government BMP is 2330 RMB / M2 and the detailed site situation can be found in Figure 7.

Figure 6 The location of highest deviation sample plot (Please find it at the end of the article)

The deviation between predicted price and auction price may be a result of the following factor: Although this plot is far from the urban center, yet the area is very near to the main road of the second Yangtze Bridge, which connects the Han Kou with the Wu Chang town. Therefore, transportation is very convenient. Meanwhile, this plot is also close to a top-ranked middle school, as well as Jie-Fang Park (the central park of Wu Han city). These convenient educational facilities and recreational amenities certainly attract potential house buyers and increase the price of residential land in this area.

Actually, all three of these types of influential factors have been identified by the authors in the model building process. Specifically, we considered proximity to the main road (MAR), distance to schools (SCH), and views of natural amenities (AME). Because of their overall insignificant contributions, MAR and SCH have been isolated in the stepwise analysis process. The final model only included 9 independent variables; 6 other variables were discarded. Although the adjusted R square of the model is 93.9%, it is possible that, in some specific instances, these discarded factors may have a higher contribution than we expected.

CONCLUSION AND DISCUSSION

This paper analyzes the factors that possibly influence the price of residential land in Han Kou town, Wu Han city. With these factors in mind, a regression model was formulated. This model can predict the probable residential land price based on historical data. In addition, the model exhibits the potential to update the government's Bench Mark Price (BMP) in the case study area.

Because of the lack of sufficient, accurate and representative data in the case study area, some land price factors have been neglected in the modeling process. These factors include the type of housing development, housing sizes and type of tenures. Likewise, certain factors were treated in a composite fashion. They are crime rate, development density and dominant land use types. Furthermore, there are some factors we simply don't know how to measure. Feng-Shui provides an instructive example. In

Chinese culture, people believe that different places have different "Feng-Shui," or spiritual character, which directly affects human destinies. Thus, when Chinese people buy a house, they give serious consideration to Feng-Shui. Such a situation is very common in southern China, especially. Though clearly important, Feng-Shui is a difficult factor to measure. We cannot measure it, for instance, by just ruling out the physical distance between the sample plot and some mountains or lakes because Feng-Shui is a very complicated cultural concept. It has a direct relationship with the surrounding cultural context. Clearly, all of these missing or under-represented factors will affect the model's accuracy. Thus it is important to attempt to include them in future research.

Similarly, future research may expand the findings of the case study by applying the model to the two other Wu Han City towns (Wu Chang, Han Yang). During the fieldwork stage of the study, the authors found that Han Kou plots near Wu Chang town have a higher land price than plots near the city centre. This implies that proximity to the other two towns may further elevate the residential land price in the case study area. Such relationships should be explored in the future research as well.

ACKNOWLEDGMENT

The authors would like to thank two anonymous reviewers for their valuable suggestions on this paper.

TABLE

Table 1. SUMMARY OF EXPERTS' OPINIONS

Main factors		Experts' Assessments (%)			
		Very important	Important	Fairly important	Not important
Location		30.0	52.0	14.5	3.5
Transportation		36.5	47.5	14.0	2.0
Environment	Natural environment	42.5	41.0	13.5	3.0
	Nearby amenities	37.0	48.0	13.5	1.5
	Educational environment	40.0	35.5	19.0	5.5
	Social environment	38.5	41.5	16.0	4.0
	Security environment	65.0	26.0	8.0	1.0
Building structure		18.5	56.0	22.0	3.5
Public service		38.5	50.5	8.5	2.5

Table 2. INFLUENTIAL FACTORS IN THE MODEL

Influence factors	Independent variables	Represented by
Location	Accessibility to city center	ACC
	Accessibility to city sub-center	ACS
	Distance to main road	MAR
	Distance to bus stop	BUS
	Distance to hospital	HOP
	Distance to market	MAK
	Distance to post office	POS
	Distance to school	SCH
Social and Planning influence	Size of land parcel	ARA
	Floor area ratio	FAR
	Neighborhood quality	NEQ
Environment influence	Water view	NEW
	Amenities view	AME
	Distance to rail road (noise-pollution)	NER
	Distance to pollution industry	POL

Table 3. VARIABLES AND MEASUREMENT TABLE

Variable Category	Name	Measurement factor	Source	Measurement method
Dependent Variable	Residential Land Price	Land Auction Price--LAP	Auction price from LRMCW	Price in RMB / M^2
Independent Variables	Location	Accessibility to city center--ACC	Digitized Urban Plan map, from UPIW	Travel time to city centre from sample area
		Accessibility to city sub-center--ACS	Digitized Urban Plan map, from UPIW	Straight line distance to sub centre from sample area
		Distance to main road--MAR	Digitized Urban Plan map, from UPIW	Straight line distance to main road
		Distance to bus stop--BUS	Digitized Urban Plan map, from UPIW	Straight line distance to surrounding bus stops.
		Distance to hospital --HOP	Digitized Urban Plan map, from UPIW	Distance to the nearest hospital from sample area.
		Distance to market--MAK	Digitized Urban Plan map, from UPIW	Distance to the nearest market from sample area
		Distance to post office--POS	Digitized Urban Plan map, from UPIW	Distance to the nearest post office from sample area
		Distance to school--SCH	Digitized Urban Plan map, from UPIW	Distance to the nearest school from sample area
	Social and Planning influence	Size of land parcel--ARA	Transaction record from LRMCW	Gross land area in M^2
		Floor area ratio--FAR	Transaction record from LRMCW	Floor area ratio data
		Neighborhood quality—NEQ	Field survey and experts' opinions (Including crime rate, development density, and dominant land use types).	Unsuitable for living (Value=1); Fairly suitable for living (Value=2); and Very suitable for living (Value=3)
	Environment influence	Water View--NEW	Transaction record from LRMCW, field survey	The sample plot with water view (Value=1); The sample plot without water view (Value=0).
		Amenities view--AME	Transaction record from LRMCW, field survey	The sample plot with Amenities view (Value=1), The sample plot without Amenities view (Value=0).
		Distance to rail road (noise-pollution)--NER	Digitized Urban Plan map, from UPIW	Straight line distance to rail road
		Distance to pollution industry--POL	Digitized Urban Plan map, from UPIW	Straight line distance to pollution industry

Table 4. DESCRIPTIVE TABLE OF SAMPLE PLOT

Zone number	BMP (RMB / M^2)	Sample amount	Sample name
1	4398	1	No 40
2	3221	11	No 21、20、59、58、70、82、64、91、94、17、73
3	2330	8	No 18、66、36、41、65、81、84、83
4	1731	9	No 23、26、27、34、35、46、85、71、56
5	1268	2	No 67、93
6	No data	No transaction data in this zone	

Table 5. DETAILED LAND AUCTION INFORMATION ABOUT SAMPLE PLOTS

No.	Area (m^2)	Auction year	Land price (Rmb/m^2)	FAR	Benchmark price
17	21693	2002	3112	2. 21	3221
18	14227	2002	4671	3. 02	2330
20	6101	2002	2263	2. 95	3221
21	3817	2002	4718	4. 45	3221
23	46420	2002	1025	1. 18	1731
26	73263	2002	970	1. 50	1731
27	141858	2002	858	1. 57	1731
34	17521	2002	1016	1. 59	1731
35	142536	2003	936	1. 57	1731
36	2276	2003	2268	1. 62	2330
40	2896	2003	4733	2. 31	4398
41	7344	2003	2534	2. 20	2330
46	76477	2003	2163	1. 80	1731
56	13612	2003	1698	1. 76	1731
58	12035	2003	8322	4. 10	3221
59	7740	2003	5507	4. 5	2330
64	112950	2003	4960	4. 00	3221
65	10941	2003	2349	2. 80	2330
66	11270	2003	4546	3. 50	2330
67	4444	2003	856	1. 50	1268
70	10585	2004	4320	3. 00	3221
71	49536	2004	1474	1. 44	1731
73	16880	2004	12281	5. 50	3221
81	11782	2004	6377	3. 80	2330
82	16769	2004	6377	3. 50	2330
83	311844	2004	4188	2. 5	2330
84	21630	2004	4854	3. 80	2330
85	19879	2004	1213	1. 50	1731
91	7147	2004	7566	3. 20	3221
93	1113	2004	4401	2. 1	1268
94	6800	2004	8220	4. 1	3221

Table 6. DESCRIPTIVE ANALYSIS OF SAMPLES

	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance
area	31	310730	1113	311844	38818.88	64054.533	4102983204.908
FAR	31	4.32	1.18	5.50	2.7281	1.15252	1.328
NEQ	31	50	50	100	80.32	16.017	256.559
POL	31	50	50	100	97.74	9.560	91.398
AME	31	50	50	100	77.74	22.317	498.065
HOP	31	900	300	1200	735.48	329.189	108365.591
POS	31	1300	300	1600	1100.00	503.322	253333.333
NEW	31	1	0	1	.26	.445	.198
NERI	31	1	0	1	.13	.341	.116
SCH	31	8.35	.61	8.96	5.0932	2.11265	4.463
MAK	31	700	300	1000	564.52	293.880	86365.591
MAR	31	50	50	100	60.32	18.526	343.226
BUS	31	2	1	3	2.10	.539	.290
ACC	31	23.82	3.84	27.66	12.8835	6.05745	36.693
ACS	31	4195.00	254.00	4449.00	1071.2258	757.38069	573625.514
Valid N (listwise)	31						

Table 7. CORRELATION MATRIX OF VARIABLES

	AJU	ARA	FAR	NEQ	POL	HOP	AME	POS	NEW	NERI	SCH	MAK	MAR	BUS	ACC	ACS
AJU	1.000	-.340(*)	.911(**)	.705(**)	.398(*)	-.224	.737(**)	.003	.375(*)	-.237	-.498(**)	-.466(**)	.448(**)	-.399(*)	-.830(**)	.073
ARA		1.000	-.281	-.276	.096	-.241	-.326(*)	-.055	.041	-.032	.305(*)	.204	-.215	-.063	.440(**)	-.375(*)
FAR			1.000	.545(**)	.352(*)	-.310(*)	.621(**)	-.120	.272	-.248	-.582(**)	-.523(**)	.422(**)	-.473(**)	-.789(**)	.001
NEQ				1.000	.246	-.248	.737(**)	-.024	.251	-.073	-.366(*)	-.220	.249	-.317(*)	-.639(**)	.125
POL					1.000	.074	.314(*)	-.263	.155	.101	-.111	-.268	-.193	-.460(**)	-.312(*)	-.369(*)
HOP						1.000	-.125	.124	.072	.126	.323(*)	.230	-.231	.237	.119	.167
AME							1.000	.076	.459(**)	-.254	-.318(*)	-.408(*)	.267	-.428(**)	-.682(**)	.333(*)
POS								1.000	.135	-.255	-.128	-.140	.260	.097	-.074	.443(**)
NEW									1.000	-.227	-.272	-.337(*)	.366(*)	-.253	-.379(*)	.058
NERI										1.000	.124	.160	-.224	.128	.301(*)	-.226
SCH											1.000	.462(**)	-.422(**)	.270	.551(**)	-.014
MAK												1.000	-.157	.555(**)	.482(**)	.149
MAR													1.000	-.072	-.265	.199
BUS														1.000	.376(*)	.454(**)
ACC															1.000	-.044
ACS																1.000

* Correlation is significant at the 0.05 level (1-tailed).
** Correlation is significant at the 0.01 level (1-tailed).

Table 8. SUMMARY OF MODELS' EXPLANATION ABILITY (ADJUSTED R SQUARE)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.879	.773	.765	.15531
2	.948	.899	.891	.10564
3	.965	.932	.925	.08804
4	.969	.939	.930	.08470
5	.972	.944	.933	.08292
6	.973	.947	.934	.08246
7	.974	.950	.934	.08217
8	.976	.953	.936	.08126
9	.979	.957	.939	.07897

Table 9. THE RESULTS OF STEPWISE ANALYSIS

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.857	0.073		39.312	0
	FAR	0.244	0.025	0.879	9.935	0
2	(Constant)	2.561	0.071		36.278	0
	FAR	0.179	0.02	0.646	8.954	0
	AME	0.006	0.001	0.425	5.889	0
3	(Constant)	2.941	0.12		24.588	0
	FAR	0.144	0.019	0.519	7.474	0
	AME	0.005	0.001	0.336	5.182	0
	ACC	-0.014	0.004	-0.264	-3.649	0.001
4	(Constant)	2.754	0.156		17.702	0
	FAR	0.146	0.019	0.526	7.864	0
	AME	0.004	0.001	0.266	3.606	0.001
	ACC	-0.011	0.004	-0.209	-2.748	0.011
	NEQ	0.003	0.002	0.137	1.781	0.087
5	(Constant)	2.759	0.152		18.108	0
	FAR	0.147	0.018	0.529	8.067	0
	AME	0.003	0.001	0.223	2.854	0.009
	ACC	-0.011	0.004	-0.202	-2.702	0.012
	NEQ	0.003	0.002	0.151	1.986	0.058
	NEW	0.057	0.039	0.078	1.459	0.157
6	(Constant)	2.901	0.197		14.744	0
	FAR	0.148	0.018	0.531	8.145	0
	AME	0.003	0.001	0.2	2.49	0.02
	ACC	-0.01	0.004	-0.191	-2.548	0.018
	NEQ	0.003	0.002	0.157	2.07	0.049
	NEW	0.063	0.039	0.087	1.616	0.119
	logARA	-0.033	0.029	-0.058	-1.131	0.269
7	(Constant)	2.675	0.286		9.349	0
	FAR	0.154	0.019	0.553	8.126	0
	AME	0.003	0.001	0.214	2.639	0.015
	ACC	-0.011	0.004	-0.205	-2.706	0.013
	NEQ	0.003	0.002	0.138	1.77	0.09
	NEW	0.07	0.039	0.098	1.788	0.087
	logARA	-0.036	0.029	-0.064	-1.252	0.223
	LOGMAK	0.092	0.085	0.064	1.081	0.291
8	(Constant)	2.415	0.353		6.838	0
	FAR	0.158	0.019	0.569	8.299	0
	AME	0.003	0.001	0.202	2.5	0.02
	ACC	-0.008	0.004	-0.159	-1.89	0.072
	NEQ	0.003	0.002	0.139	1.806	0.085
	NEW	0.076	0.039	0.105	1.927	0.067
	logARA	-0.052	0.031	-0.092	-1.663	0.11
	LOGMAK	0.111	0.085	0.077	1.296	0.208
	POL	0.002	0.002	0.074	1.233	0.231
9	(Constant)	2.178	0.377		5.773	0
	FAR	0.165	0.019	0.595	8.651	0
	AME	0.003	0.001	0.198	2.527	0.02
	ACC	-0.007	0.004	-0.135	-1.618	0.121
	NEQ	0.003	0.002	0.151	2.011	0.057
	NEW	0.082	0.038	0.113	2.133	0.045
	logARA	-0.059	0.031	-0.105	-1.922	0.068
	LOGMAK	0.163	0.09	0.114	1.813	0.084
	POL	0.003	0.002	0.102	1.663	0.111
	POS	-0.0051	0.034	-0.077	-1.514	0.145

Table 10. DESCRIPTION OF NEW SAMPLES

No	Area (M^2)	Land Location	Auction Price (RMB/M^2)	FAR	BMP (RMB)	Zone No.
1	20300	Jiang An District, Sheng Li Street	3596	3.5	4398	1
2	1112.57	Jiang An District, Huang Pu Street, Luo Jia Zhuang Neighborhood	4404	1.6	2330	3
3	6809.76	Jiang An District, Taipei Road	8223	4	4398	1
4	58620.39	Qiao Kou District, Jian Yi Road	1600	1.6	1731	4
5	39679.55	Qiao Kou District, Bao Feng Road	4614	4	2330	3
6	315234.2	Jiang An District, Cha Ma Road	2830	2.19	1731	4

Table 11. COMPARISON OF PREDICTED LAND PRICE, AUCTION PRICE AND BMP

Predicted Land Price (RMB/ M^2)	Auction Price (RMB/ M^2)	BMP (RMB/ M^2)	Deviation Percentage of Predicted Land Price (%)	Deviation Percentage of BMP (%)
3654	3596	4398	1.6	22.3
3847	4404	2330	-12.6	-47.1
7692	8223	4398	-6.5	-46.5
1668	1600	1731	4.3	8.2
4909	4614	2330	6.4	-49.5
2512	2830	1731	-11.2	-38.8

FIGURE

Figure 1. LOCATION OF HAN KOU TOWN (RED LINE AREA) AND WU HAN CITY IN CHINA

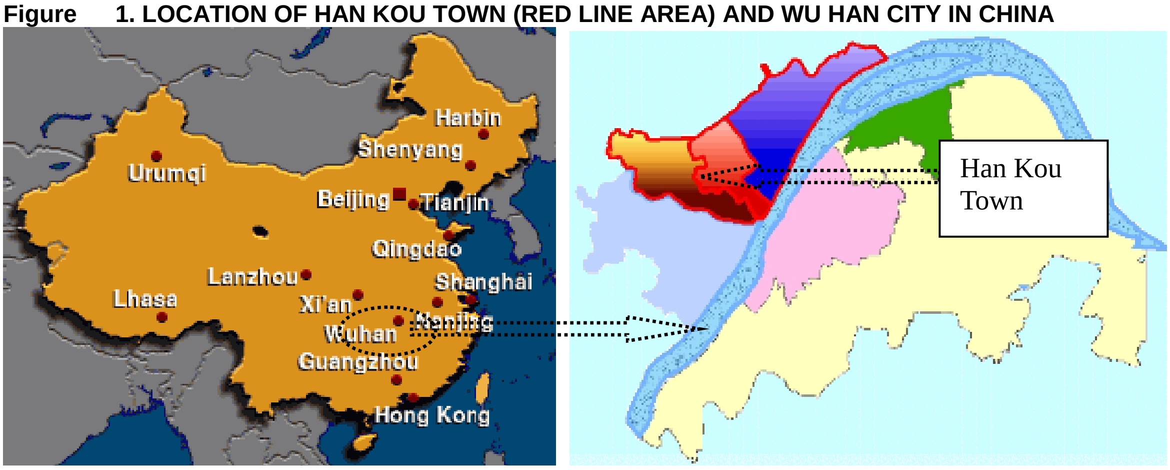

Figure 2. ACCESSIBILITY TO THE CITY CENTER

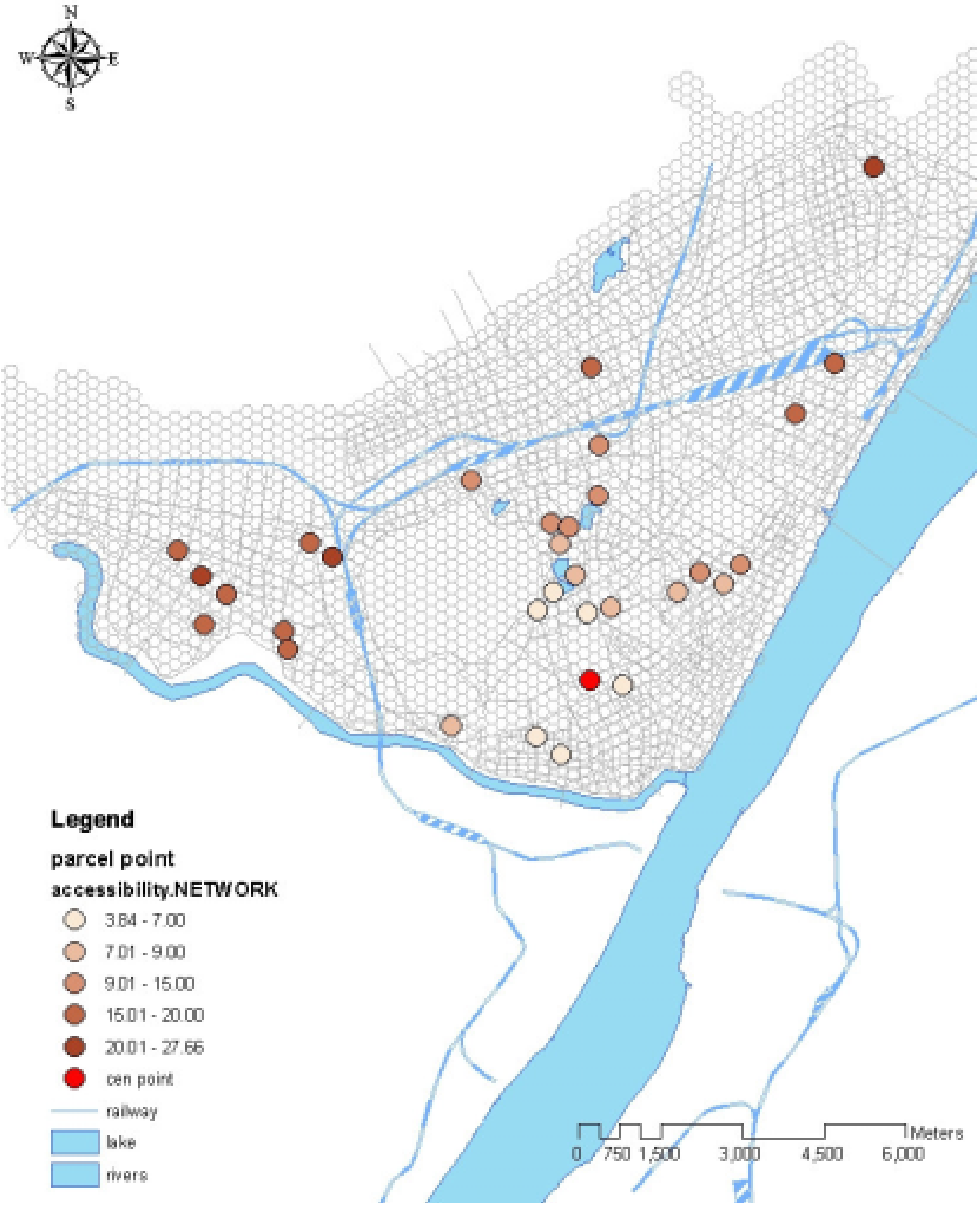

Figure 3. ACCESSIBILITY TO THE SUB CITY CENTER

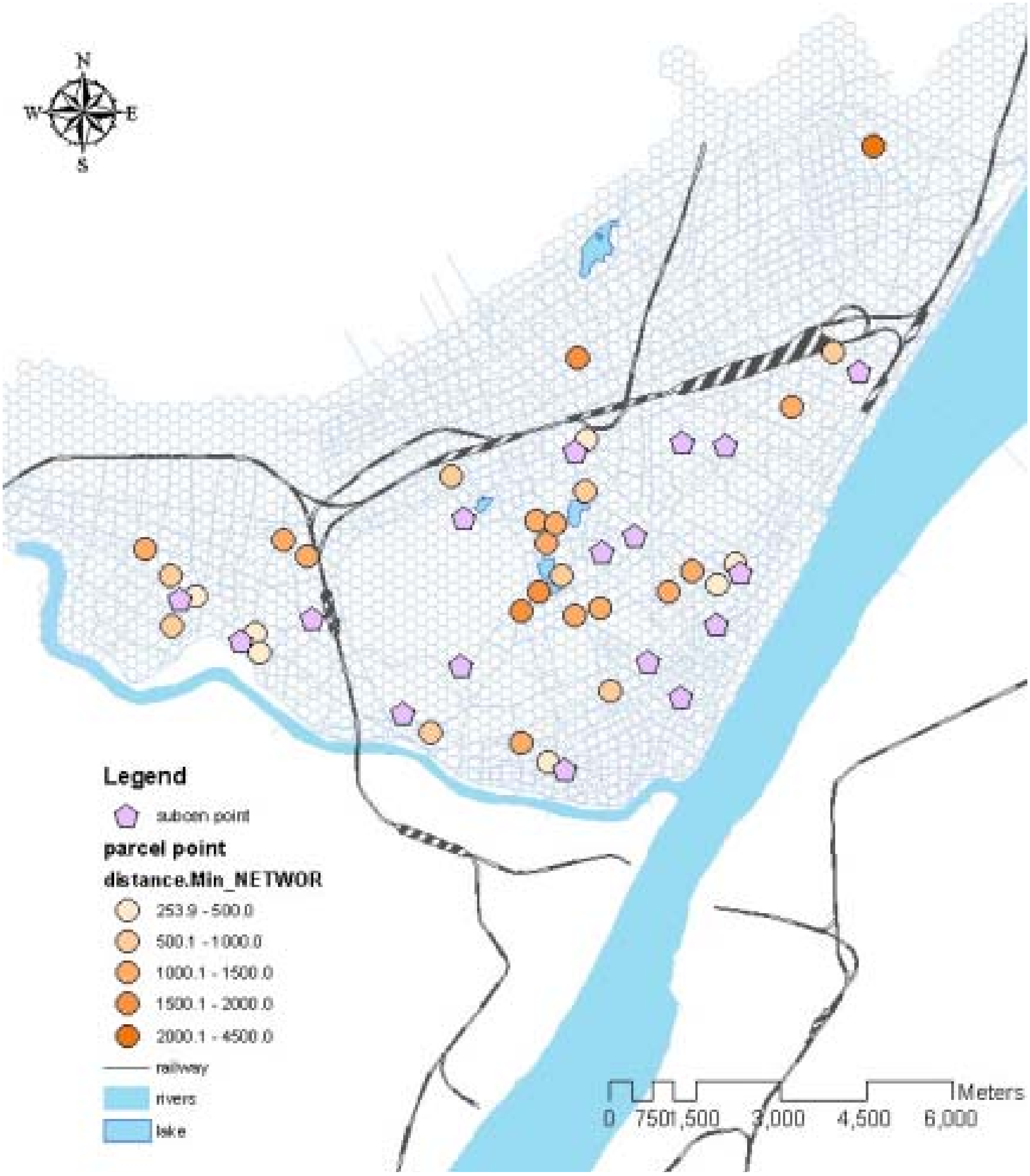

Figure 4. DISTRIBUTION OF SAMPLE PLOTS IN THE SIX LAND VALUE ZONE

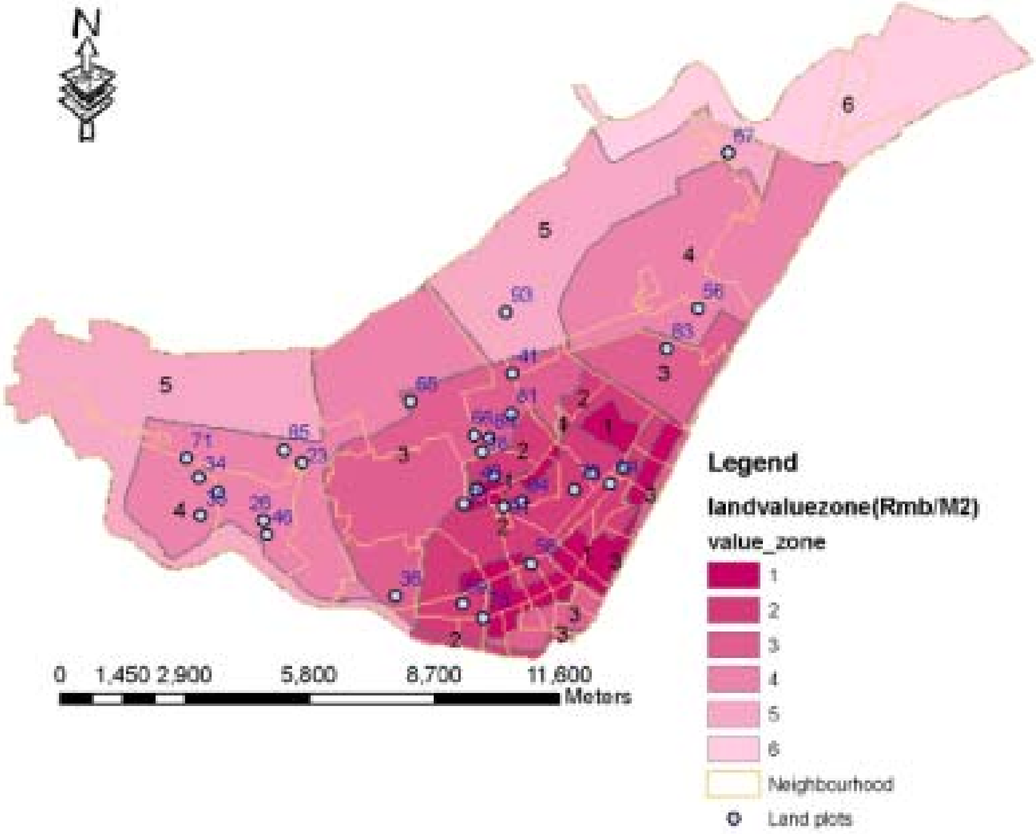

Figure 5. DISTRIBUTION OF NEW SAMPLES

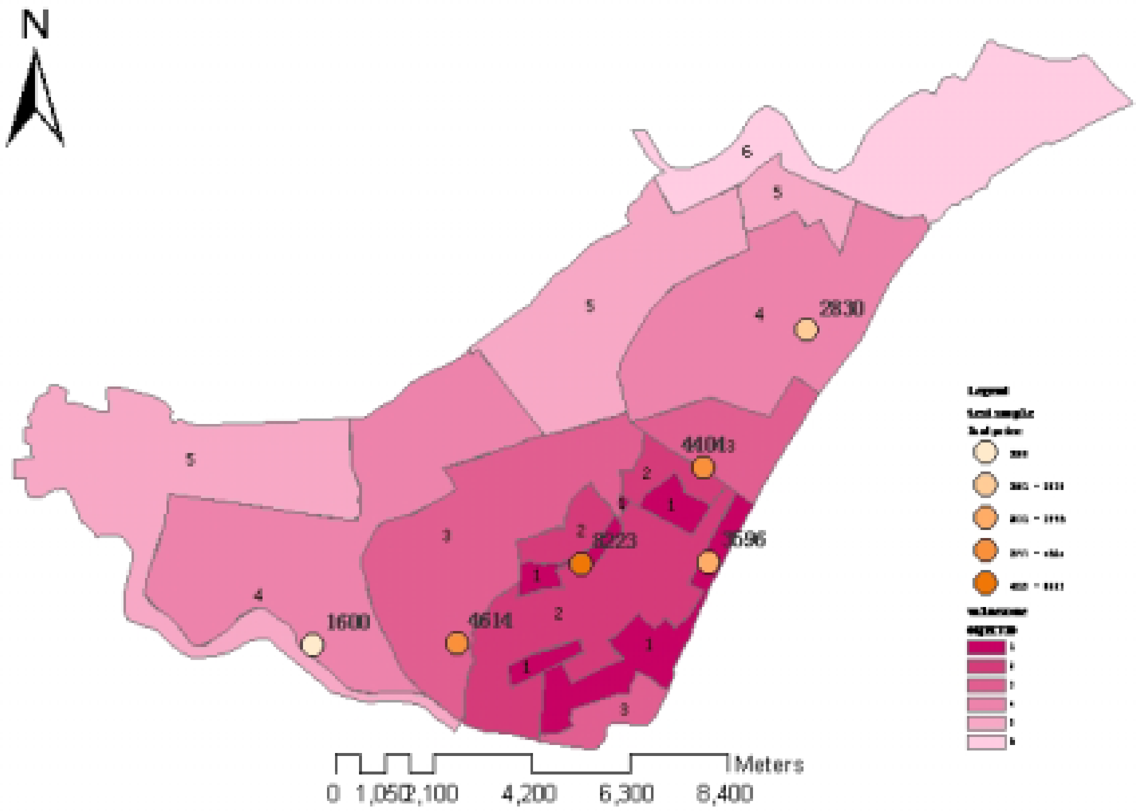

Figure 6. THE LOCATION OF HIGHEST DEVIATION SAMPLE PLOT

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GLOSSARY

1) BMP: Bench Mark Price, defined by government and aims to provide the reference price for land auction process;

2) LRMCW: Land and Resources Management Center of Wu Han city; and

3) UPIW: Urban Planning Institute of Wu Han city