

# Using Geographic Information System for Land Mass Appraisal -- The Application of Standardized Price of Land Appraisal in Shenzhen

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**Key words:** Standardized Price of Land, homogenous region, characterization area, standard lot, Geographic Information System (GIS)

## SUMMARY

The Standardized Price of Land shall be determined and published regularly by Chinese laws, but because of various reasons, the Standardized Price of Land is still in the pilot stage all over China. With the practice of Shenzhen City, the paper explores how to appraise the Standardized Price of Land.

Based on a lot of data, the paper puts forward the technical route for the appraisal of Shenzhen's Standardized Price of Land in accordance with the relevant requirements of China's Ministry of Land and Resources and the government in Shenzhen City. According to land use, Shenzhen's Standardized Price of Land can be divided into four kinds of uses: Residential use, commercial use, office use and industrial use. Through the process of dividing homogenous regions, demarcating characterization areas, setting standard lots, appraising standard lots' price and approving standard lots' price, Shenzhen's Standardized Price of Land is appraised for different uses mainly by GIS techniques.

Moreover, land price correction system is established and network management platform is developed to promote the application of Shenzhen's Standardized Price of Land, which can be used in the future in many fields such as land price appraisal, tax base appraisal, land assets verification, land price index, etc.

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## 1. INTRODUCTION

According to Urban Real Estate Administration Law of the People's Republic of China, the Standardized Price of Land, the Basic Price of Land and the appraised prices of various buildings shall be determined and published regularly. But because of various reasons, compared with the Basic Price of Land, consummation of the system of Standardized Price of Land is relatively slow. To this, China's Ministry of Land and Resources started to conduct the trial of publicizing the Standardized Price of Land from 2012, and the government in Shenzhen City has been building the system of Standardized Price of Land in recent years. As an exploratory work, it is important and difficult to build the system of Shenzhen's Standardized Price of Land, which is beneficial to carry out the spirit of China's land management reform and improve Shenzhen's land price management system.

China has promulgated and carried into effect the Urban Real Estate Administration Law of the People's Republic of China, Regulations for Valuation on Urban Land (GB/T 18508-2014), etc. According to the above-mentioned documents, China's land price system consists of the Standardized Price of Land, the Basic Price of Land and the appraised prices, with Basic Price of Land and the Standardized Price of Land at the core. However, China's land price system needs to be perfected, especially when the Standardized Price of Land is still in the absence of China's urban practices. In recent years, China's Ministry of Land and Resources paid high attention to the construction work of the system of Standardized Price of Land and conducted the trial of publicizing the Standardized Price of Land in some cities, such as Tangshan, Shanghai, Changsha, etc. According to the outline of the 13th Five-Year Plan of Land and Resources, the system of Standardized Price of Land and the publicity system of land price will be built in the next five years. Meanwhile the research on the Standardized Price of Land will get rapid development in the future.

After some years' development, Shenzhen City got a big success on its construction and built up a land price system consisted of the Basic Price of Land and the appraised prices of land, without the Standardized Price of Land. Due to many reasons, Shenzhen's Basic Price of Land has been below the market value for long, while the appraised prices of land were given case by case without a unified operation platform. In this context, the Standardized Price of Land is needed to reflect the market value of land and improve the land price management for the government in Shenzhen City. With the practice of Shenzhen, the paper will explore how to appraise the Standardized Price of Land.

## 2. APPRAISAL DATABASE

The appraisal on Shenzhen's Standardized Price of Land requires a lot of data support from not only real estate field but also related industries. It includes feature data that reflects the characteristics of real property itself and index data which reflects the influence from one of the elements of real property value. Whether the data preparation is adequate or the data quality suits the requirements will directly affect the accuracy of measurement results, and further affect the appraisal results. To gather all kinds of data and make sure it is suitable for appraisal is a hard task. However, experienced appraisers know how to use information from the records they have done earlier, because the subject may share the same environment information as in some cases, or undertake the similar impact by similar reasons. It shows great potential and necessity to build a database for appraisal. In general, the database can be divided into three categories: appraisal essential data, spatial data and appraisal thematic data.

### 2.1 Appraisal Essential Data

This is the essential part of appraisal, and includes:

- Real estate sales records data: Includes real estate attribute data and real estate price data. The former refers to non-spatial data associated with the characteristics of the real estate itself, such as land, community, building and apartment etc.; the latter refers to prices related data from presale registration, secondhand market, rental registration and self-defined record, and so on.
- Appraisal parameters data: refers to technical specifications related parameters, coefficients, indices and interest rates, such as general/regional factor description parameters, housing prices coefficients, construction cost indices, appraisal approach parameters, loan interest rate, land remaining term adjustment parameters, etc.

### 2.2 Spatial Data

Spatial data contains not only the directly related spatial information of appraisal but also other spatial data that have impact on real estate market. According to the appraisal purpose and data type, it contains:

- Land data: Includes the present situation of land use map and cadaster that describes the ownership, usage, location, and area information of land plots.
- Building data: Describes the spatial characteristics of buildings, the location, ID, floor number, area, height, function, structure and parking lot number and so on.
- Road data: Often represented as line or polygon, which can be used for network analysis, frontage influence analysis, etc.

- Multilevel administration zone data: Describes administration area in different scales, such as district zone, street zone and community zone and so on, which often associate with statistics.
- Remote sensing image: Mainly refers to aerial images and satellite images. Data includes high-resolution digital orthophoto maps on different time slices, and multi-resolution remote sensing satellite photos, etc. It is important data when value at a certain historical time.
- Topographic map: Shows topography or land contours, by means of contour lines.
- Land benchmark price data: Government published average appraisal price according to different land use.
- Point of interests: Include science and technology, education, transportation facilities, shopping centers, sports centers, health institutions, restaurant, utilities, financial institutions, government agencies, etc. they are the major data source for various impact factor analysis.

### **2.3 Appraisal Thematic Data**

This group of data refers to various types of appraisal objects, including:

- Building attribute data: Stores name, structure, and the corresponding cost and pictures.
- Structures and fixtures attribute database: Stores name, type, engineering calculation rules, corresponding price and pictures.
- Plants and trees data: Records different species, name, pricing and pictures.
- Decoration data: Stores name, engineering calculation rules, and corresponding prices and pictures.
- Construction cost data: Records construction cost and related technical and economic indicators.

### **2.4 Data Integration**

Through database all relevant data can be stored and managed for appraisal purpose. For better supporting of analysis, data fusion of spatial and non-spatial data is conducted. And all the data is organized by the unified LAND-BUILDING-APARTMENT data model. In this model, BUILDING is the connection center of all kinds. The connection between LAND and BUILDING can be established through geospatial or attribute link, while the connection between BUILDING and APARTMENT is more rely on analysis, such as geocoding, semantic

matching, and spatial overlay, etc. Other data can also build connections to LAND, BUILD or APARTMENT.

### 3. APPRAISAL PROCESS

There is no ready-made technical route for the appraisal of Standardized Price of Land, because the Standardized Price of Land is still in the pilot stage all over China. The paper puts forward the technical route for the appraisal of Shenzhen's Standardized Price of Land (cp. fig 1), in accordance with the relevant requirements of China's Ministry of Land and Resources and the government in Shenzhen City.

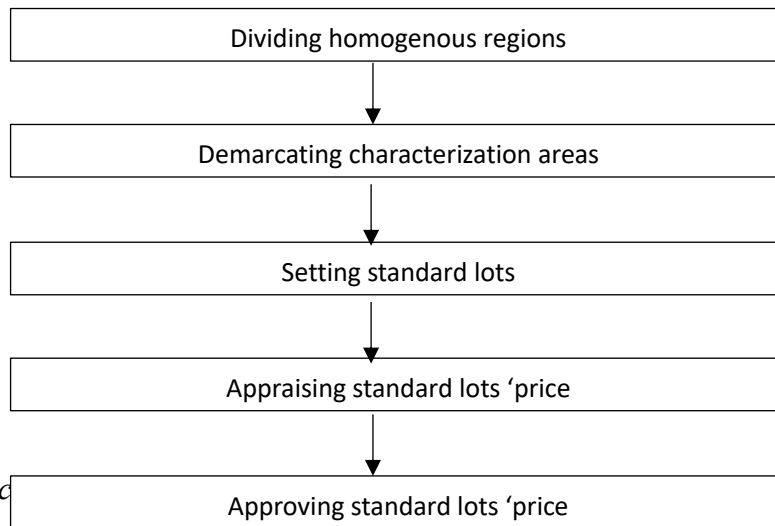


Fig 1 the technical route of Land

Related concepts are as follows:

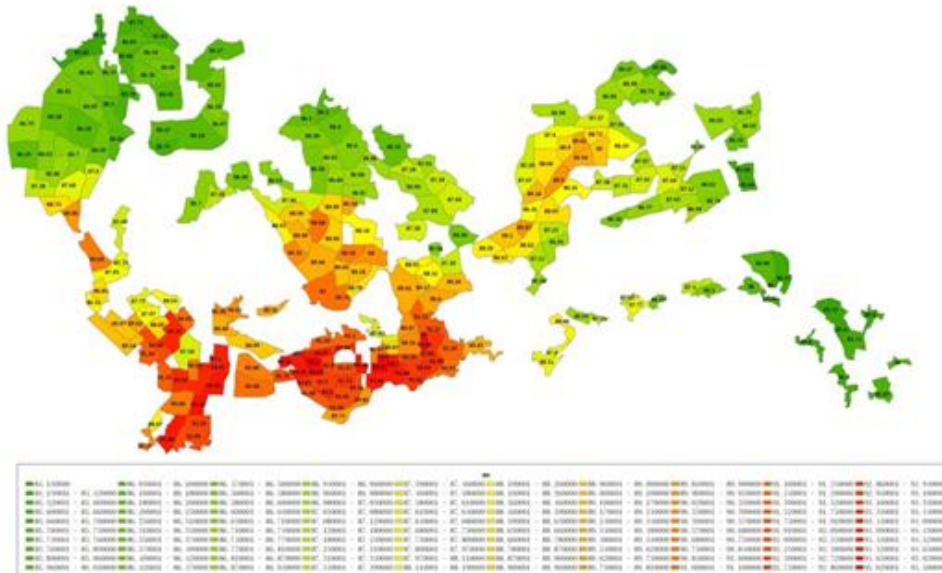
- Homogenous region: Land area where land use and the use conditions are basically identical.
- Characterization area: Land area demarcated on the basis of homogenous region where characteristics such as land conditions and land utilization and land price are basically identical.
- Standard lot: Land lot in characterization area where characteristics such as land conditions and land utilization and land price are standard and representative.

According to land use, Shenzhen's Standardized Price of Land can be divided into four kinds of uses: Residential use, commercial use, office use and industrial use. The following will take residential use for example to show the appraisal process.

#### 3.1 Dividing homogenous regions

First the whole city of Shenzhen is divided into more than five thousand basic units by GIS

techniques with many kinds of method, such as the multi-factor comprehensive appraisal method, the superposition method and etc. Then those basic units are appraised according to the influence factors of land price. After getting their scores, those basic units are ranked and merged into a number of homogenous regions for residential use (cp. fig 2) where the scores and land use conditions are basically identical.



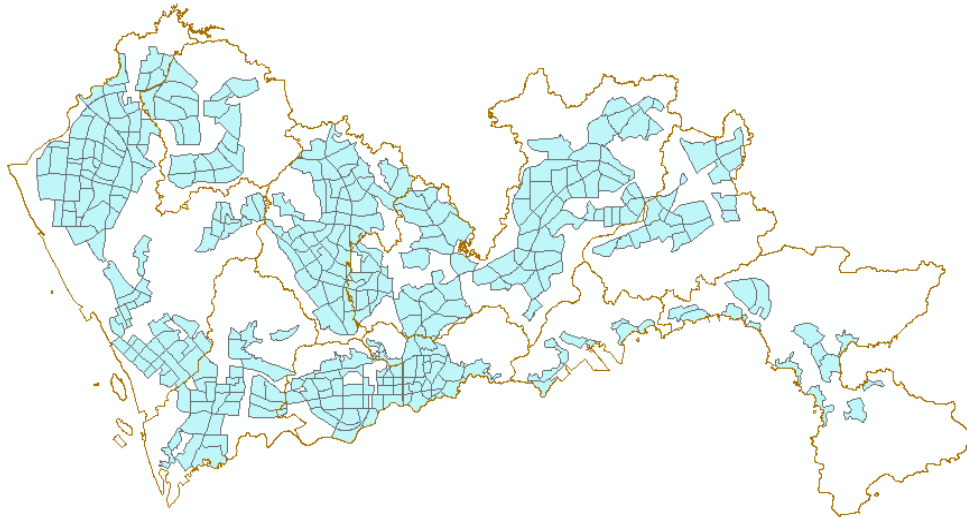
*Fig 2 Homogenous regions and their scores for residential use in Shenzhen*

### 3.2 Demarcating characterization areas

Characterization areas are demarcated on the basis of homogenous regions. Principles to demarcate characterization areas are as follows:

- Land conditions and land price shall be basically identical in the same characterization area.
- Management of characterization areas shall be convenience.
- Land lots in characterization areas shall be unbroken.

Based on those principles, nearly five hundred characterization areas for residential use (cp. fig 3) are demarcated by GIS techniques with many kinds of method such as the induction of land price, the superposition method, etc.



*Fig 3 Characterization areas for residential use in Shenzhen*

### 3.3 Setting standard lots

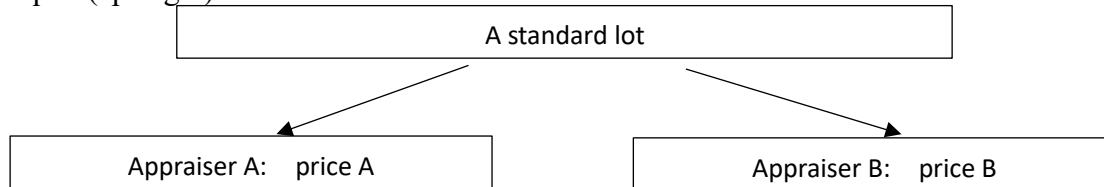
According to the relevant requirements of China's Ministry of Land, there is one and only one standard lot in each characterization area. In order to set standard lots, related information of all land lots in each characterization area is surveyed and then the most standard and representative land lot is chosen as the standard lot in each characterization area. In this way, nearly five hundred standard lots are set for residential use in Shenzhen (cp. fig 4).



*Fig 4 Standard lots for residential use in Shenzhen*

### 3.4 Appraising standard lots' price

It's important to appraise standard lots' price normatively, because the appraisal results are directly affected by the appraisal methods, appraisal parameters, appraisers, etc. Each standard lot price is appraised by two appraisers independently, strictly followed Regulations for Valuation on Urban Land (GB/T 18508-2014). Therefore, to a same standard lot, appraiser A will get price A, and appraiser B will get price B, where price A and Price B don't have to be equal (cp. fig 5).



*Fig 5 sketch of appraising each standard lot price*

### 3.5 Approving standard lots' price

In order to determine Standardized Price of Land, the results appraised by appraisers are examined and approved by relevant departments. In general, to a same standard lot, if the divergence rate between price A appraised by appraiser A and price B appraised by appraiser B is not over 20%, the advisable price of the standard lot is  $(\text{price A} + \text{price B}) / 2$ . If the divergence rate between price A and price B is over 20%, the advisable price of the standard lot should be considered and reappraised.

After approving standard lots' price, Shenzhen's Standardized Price of Land for residential use is appraised (cp. fig 6).



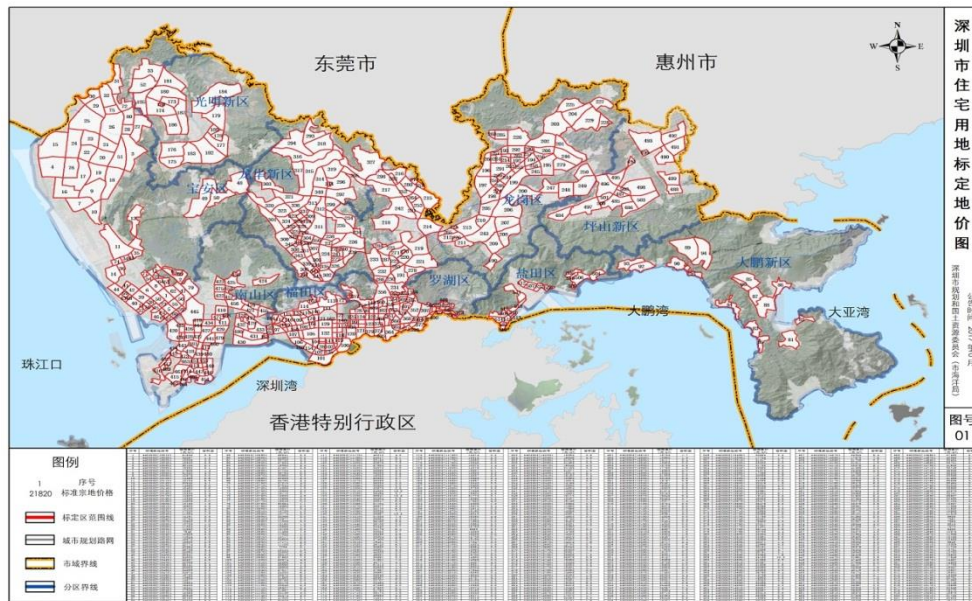


Fig 6 Shenzhen’s Standardized Price of Land for residential use

#### 4. CONCLUSION

In conclusion, Shenzhen’s Standardized Price of Land for different uses including residential use, commercial use, office use and industrial use has been appraised through the process. Moreover, land price correction system is established and network management platform is developed to promote the application of Shenzhen’s Standardized Price of Land. As coefficient correction approach of standard land price has been manifested in Regulations for Valuation on Urban Land (GB/T 18508-2014), Shenzhen’s Standardized Price of Land can be used in the future in many fields such as land price appraisal, tax base appraisal, land assets verification, land price index, etc.

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## **BIOGRAPHICAL NOTES**

Wang Xuan obtained his PhD from Huazhong University of Science and Technology in 2013. He joined Center for Assessment and Development of Real Estate, Shenzhen in 2014 as a postdoctoral researcher. His current research focuses on real estate appraisal.

Ying Liu is the manager of Department of Regional Appraisal, Center for Assessment and Development of Real Estate, Shenzhen. She is a senior engineer, certified real estate appraiser, CREA member, and registered cost engineer.

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