

The Selection of House Number Coding Scheme in Xi'an

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Abstract—The "block mode" house number system does not conform to the national conditions and domestic habits, nor does it match the geographical environment of Xi'an, so it is necessary to select a "road mode" house number system; in terms of house number coding scheme, since "sequence coding" and "distance coding" have their own coding defects, so it is recommended to adopt the "quantization coding" scheme.

Keywords—*pathfinding environment; house number coding; quantitative coding*

I. INTRODUCTION

Urbanology believes that cities are "Man-thing" and have "lifelike course".¹ As time goes by, cities will continue to metabolize and grow: some old buildings collapse and disappear, some new buildings are built; with the increases and decreases in and the number of buildings, the changes in the location and floor space buildings, and the extension of streets, etc., objectively it requires a house code system that can effectively cope with urban growth and changes, so as to achieve long-term stability. However, the "sequential coding" house number system adopted cannot fully adapt to the "metabolism" and "growth" of cities, and will soon produce chaos such as interrupted numbers, wrong numbers and missing numbers. In 2003, Xi'an completed the seven-month house number reorganization; however, after merely two years, some people found that "No.1 East Section of Huancheng South Road is Shaanxi Daily, but its neighbor on the left is No. 36, and its neighbor on the right is No. 38, "at No. 11 North Xingfu Road, no one knows where the No.7 North Xingfu Road is, because it is about 530 meters away from the North Xingfu Road and is perpendicular to the North Xingfu Road", indicating the traditional house number coding scheme cannot adapt to the development of urbanization.² For the house number problems in Xi'an, this paper will conduct comparative study on the city's house number system model, coding scheme and its advantages and disadvantages, and propose specific suggestions for the selection of house number coding scheme in Xi'an.

II. THE EXISTING HOUSE NUMBER SYSTEM MODE AND CODING METHOD

A. Existing House Number System

1) *Road mode*: The road mode is consistent with people's linear behavior pattern of addressing along the street. It is a house number coding system characterized by linear coding, and it's widely used in the world. In blocks using road coding, buildings are divided into two types: facing the street and not facing the street. Buildings facing the street are owned by the street, while street ownership of buildings not facing the street are generally divided according to the principle of easy access to the main gate. Once the street ownership of all buildings is determined, it is possible to code the house numbers according to the corresponding street coding rules.

The advantage of coding based on street frame is that it is easy to query address along the street, while the disadvantage is that the house numbers inside the block will affect the entire coding system.³

2) *Block mode*: The block code is generally composed of two parts: land coding and house number coding. The first is to code the land, usually using Arabic numerals for serial coding of land. In the coding path, an S-type scheme or surrounding scheme can be adopted; no matter which scheme is adopted, the purpose is to number each land.

After the completion of coding the land in the block, the house numbers are coded. When coding, the land facing the street should first be divided into sizes of 10 meters to 15 meters, and then the households are numbered in a surrounding or S-shaped path.

Cities that adopt block coding generally use a relatively long-lasting linear geographic structure in the environment (such as rivers, railways, roads, streets, etc.) to divide blocks. Usually when dividing blocks, it requires first following the history and tradition of the block, and facilitating management at the same time.

¹ Duan Hanming. Fundamental Urbanology [M]. Xi'an: Shaanxi Science and Technology Press, 2000, 04.

² Xi'an Evening News. Let "Mi System" Go to the World [N]. Xi'an Evening News electronic version, 2005, 11, 20. Ninth edition of News.

³ Yu Huanju, Li Yunling, Cai Yongning. Research on Segmented Quantization House Number Coding Scheme [J]. Bulletin of Surveying and Mapping, 2013(4).

B. Coding Scheme

1) *Sequential coding*: "Sequence coding" refers to the coding scheme of house number assignment to the households that have existed or will build houses according to certain numbering rules after determining the starting point of numbering at a certain point of city street. Sequential coding adopts a variety of coding paths and implements pipeline number assignment, so that there is a strong continuity between the house numbers, which is convenient for searching.

a) *Two-way sequential number*: The two-way sequential number is a numbering method in the "street coding" system. The numbering method is to implement continuous numbering from one side of the street to the end after determining the starting point of numbers, and then conduct continuous numbering to the starting point along the other side after arriving at the end of the street.

In cities, there is great difference in the numbers on both sides of the street using the two-way sequential numbering (especially when the street is long, the gap is even more wide), which is complex and unpredictable, so it has been basically eliminated now.

b) *Surrounding sequence number*: Surrounding sequential numbering is a common numbering method in the "block code" system. As with two-way sequential numbering, it requires determining the starting point of numbering first. In order to make the starting point of numbering regular and facilitate the understanding of pathfinders, it is generally necessary to select a significant landmark, and then select the closest point to the landmark as the starting point of numbering. For example, in Mannheim, Germany, the royal palace at the city center is taken as a landmark to set up the starting point of numbering; some cities in Japan use the municipal government, subway station, main street intersection located at the city center as a landmark to set up the starting point of numbering, etc.

c) *S-shaped sequential numbering*: The S-shaped sequential numbering is also a numbering method in the "block code" system. It selects the starting point of numbering in the same way as the surrounding sequential numbering. After the starting point of numbering is selected, a S-shaped movement is performed in the horizontal or vertical direction along the starting point, so that each house in the block gets a house number.

The advantage of the S-shaped sequential path coding is that it allows those houses that are not facing the street to have a regular, easy-to-find house number. For those houses on the corner of the street, it can also carry out well-organized numbering, so it can handle large, complex neighborhoods. Compared with the surrounding sequential numbering, the S-shaped sequential numbering method has poor stability, and has problem such as interrupted numbers, skipped numbers and missing numbers with the demolition and construction of the buildings.

d) *Odd-even double-sequence numbering*: The odd-even double-sequence numbering is an excellent numbering rule in the "street coding" system and is used by many cities. It can be seen that the two-way sequential numbering numbers based on the buildings facing the street on both sides of the street, while the odd-even double-sequence numbering is based on the street itself, whose starting point exists on both sides of the street. The numbering method is to first determine the orientation of the odd numbers and even numbers (for example, Xi'an takes the south side of east-west streets as the even number and the north side as odd number; the east side of north-south streets as the odd number and the west side as the even number), then synchronize numbering from the starting point of the street to the end of the street.

The odd-even double-sequence numbering separates odd numbers from even numbers, and forms sequential numbers on both sides. It forms a close relationship between the numbers on both sides of the street, which is regular and easy to find, and is adopted by most cities in China.

2) *Distance coding*: The distance code is a coding method that uses the distance data between the central line of the entrance of resident house and the starting point of coding as the house number. Compared with sequential coding, distance coding does not build the coding system on the variable buildings and households, but ties to the constant distance (road), which ensures the uniqueness of all the house numbers in the street and can effectively solve the problems of skipped number and repeated number, etc. In addition, the house number with distance coding is the distance between the resident and the starting point of coding, which allows visitors to clearly understand the location of the interviewed in the street.

Since the sequential coding lacks the necessary stability, in the case of demolition and reconstruction of buildings, this set of house numbers will be disordered. Therefore, distance coding is proposed to replace the sequential coding scheme. However, the house numbers with distance coding have no other rules except the sense of distance; and there is a lack of continuity between the house numbers, which is inconvenient to remember. According to the survey, many streets in Xi'an are longer than 1 kilometer, such as East Street (2131 meters long), West Street (1923 meters long), South Second Ring Road (10790 meters long), South Third Ring Road (20500 meters long), etc. If the distance coding is used for house number on these road sections, the quantity and value of the numbers will be very large.

3) *Quantitative coding*: The so-called "quantitative coding" is to divide the two sides of an existing street (or a planned street) into segments according to a certain number assignment and form continuous small segments, and then select an inextensible end of the street, use the rule of "odd-even double-sequence numbering" to serially number the small sections on both sides of the street. When the building is built in a small segment, the number of the small segment is taken as the house number. If the building is large and takes

up two small segments, then the number of the segment occupied by the entrance is taken as the house number.

Features of quantitative coding:

a) Good structural stability: Unlike the sequential coding that links house numbers with the buildings or households, quantitative coding binds the house numbers to the street, and separates the buildings from the house number system, which completely releases the coding from the buildings and protects from the influence of demolition and construction, so it has superior structural stability.

b) The system is easy to read: Since the spacing of each small segment with quantitative coding is the same and has been quantized in a certain rule, even if the number does not directly reflect the distance, pathfinders can understand the distance between the two house numbers on the street through the house number corresponding to the small segment, estimate the length of the whole street and master the distance of the relevant road, which is highly readable.

III. WHAT KIND OF HOUSE NUMBER CODING SCHEME XI'AN SHOULD SELECT

A. Block Mode or Road Mode

House number is an important information basis for path-finding when people visit other places. Therefore, when selecting the coding system, it is necessary to determine according to the building layout characteristics, road space characteristics, traditional house number coding scheme and addressing psychological habits of the city.

According to the basic pattern and spatial characteristics of Xi'an city, the urban roads in Xi'an are in the shape of Sudoku: there is an east-west and a north-south central axis running through the bell tower, most of the roads also show a due north-south trend, and the buildings are basically built along the street, forming an urban spatial form centered on roads. Obviously, this urban spatial pattern is completely different from the irregular planar urban structure centered on block buildings in Japan and South Korea; therefore, the block coding method is not suitable, while the street coding is more suitable.

In addition, according to the traditional house number coding method and citizen's addressing psychological habits, Xi'an has always adopted the road coding scheme in history, and its addressing inertia psychology has also been formed for a long time; if there is no sufficient reason, it can't be changed rashly, otherwise it will cause widespread cognitive impairment and affect the normal function of the house number system. Based on the above reasons, it is believed that the road coding scheme is the most suitable for Xi'an urban spatial characteristics and people's pathfinding psychological habits. Therefore, in the future, Xi'an should adopt road coding in house number system planning.

B. Sequential Coding, Distance Coding or Quantitative Coding

In the above text, the sequential coding and its numbering method ("two-way sequential numbering", "surrounding

sequential numbering", "S-shaped sequential number" and "odd-even double-sequence numbering") are analyzed, and it is concluded that although the sequential coding has a long history and wide application, it lacks stability of system and cannot meet the requirements of urban "growth" and expansion; secondly, serious research on the advantages and disadvantages of "distance coding" is also carried out, and it is believed that the distance coding has problems such as too long numbers, inconvenient to remember, etc. Finally, it is concluded that "quantitative coding" is the most excellent: firstly, the quantitative coding separates the coding system with houses and ties it to the street, the house number has been pre-assigned for each assignment section, so it can not only prevent the collapse of the house numbering system caused by the demolition and reconstruction of the buildings, but it is also convenient to develop numbers for the new households; secondly, since the house numbers come from the segment occupied by the houses, visitors only need to know the assignment number distance of the segment in advance to estimate their position in the street and the length of the whole street; thirdly, the quantitative coding makes the management of civil affairs department simple and standardized, and the management of house numbers becomes a simply purely technical work.

What is certain is that quantitative coding is currently the most scientific and reasonable urban house number system coding scheme, which represents the most advanced planning concept in the current address coding field, and should be used as the preferred house number coding scheme for the reconstruction of Xi'an house numbering system in the future.

IV. CONCLUSION

Compared with sequential coding, quantitative coding can effectively resolve the damage of the coding system due to house demolition and construction in the cities. It has strong system stability and should be promoted nationwide. Some studies have pointed out that the service life of sequential coding is about 10 years. If the house numbers in a city with a population of about 10 million are reorganized, it cost about 72 million yuan 10 years ago.⁴ Considering the factors of rising prices, if the house number system of a city with the population scale as Xi'an is reconstructed, the cost may exceed 10 million yuan. If it is rectified every 10 years, its cost is undoubtedly an enormous figure. Therefore, based on the research results of this paper, it is expected to propose to the management department of cities that are implementing the house number system with sequential coding to recognize the limitations of sequential coding as soon as possible, and organize the local scholars and experts to develop a set of house number system with quantitative coding suitable for local urban development, so as adapt to the objective needs of China's urbanization construction and benefits the people.

⁴ Wang Yungui. Quantitative house number [J]. China Place Name, 2001, (3).

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