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Digital Problems and Strategies of Partial Revision in Overall Plan of Land Use

ZHENG Cai-gui*, ZHANG Xiao-cheng, LI Ji-zhuang, LIANG Qi-xue

Chongqing Institute of Surveying and Planning for Land, Chongqing 400020, China

Abstract The technical route of partial revision in overall plan of land use is briefly described. It is pointed out that problems of area measuring in the technical route are mainly due to the digital process. The digital problems of partial revision in overall plan of land use are presented as follows: the maps are not proofread before digitalization; the coordinate matching and projection transformation are not conducted on the maps; the information is asymmetrical pre and post the digitalization; the location lacks precision; the result maps are substandard. The causes of these problems are analyzed, which cover the following aspects. The lack of united management regulations; uneven working abilities of the staff in the compilation units; unawareness of the importance of map digitalization; poor basic conditions of the original plan maps. At last, the relevant suggestions are put forward, for instance, releasing the national united management methods and technical criteria, establishing industrial admittance system and qualification system of compilation units, setting up the mechanism of supervising digitalized results and controlling the quality, conducting coordinate matching and projection transformation and unifying the specification and mode of the results of maps so as to provide technical support for the overall plan of land use, play the micro-regulating role of land use and take a leading role in the sustainable development of social economy.

Key words Overall plan of land use, Technical specification, Digitalization, Revision plan, China

Overall plan of land use is the leading part of land use and the foundation of legal land exploration, application, protection and administration^[1]. Overall land use is dynamic, with the change of regional developmental environment of social economy, the developmental objective of social economy needs regulating correspondingly and the partial revision of overall plan of land use is needed as well according to the law, so as to exploit the effects of overall land use in coordinating the contradiction of land use as well as taking effects of macro-control over the development of social economy^[2]. At present, China lacks the unified *Partial Revision Regulation in Overall Plan of Land Use*. There are many technical problems in the practical work of each region, which directly affect the scientific and effective revision of overall plan. Based on these problems, the problems of digitalization of partial revision in land use are studied. The relevant strategies are put forward in order to ensure more precise data for overall plan of land use and provide basis for the government to determine the land use.

1 The technical route of partial revision in the overall plan

In general, in order to satisfy the land use needs of specific construction projects beyond the planned construction area, the partial revision in overall plan of land use is needed^[3]. The technical route is as follows. According to the reasonable acreage of land use and the demand of spatial layout and based on

the latest survey of the overall plan, the partial revision of the land use structure and the spatial layout of the original plan can be conducted with the permission of policy. Besides, partial revision should be conducted under the conduction of balancing the land occupation and compensation, ensuring the acreage and quality of arable land and not exceeding the total amount of land use^[4]. The technical route is shown on Fig. 1.

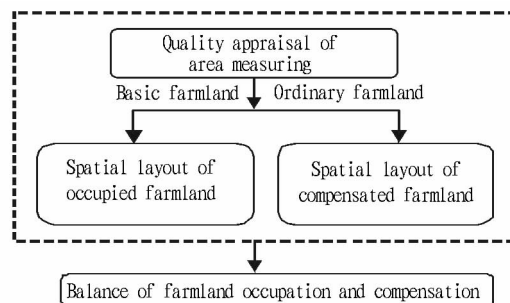


Fig. 1 Technical route of overall plan of land use

It can be seen from Table 1 that both of the occupation and compensation of the size of arable land are based on the area measuring and quality appraisal, while the area measuring is the basis of quality grade conversion. Therefore, the area measuring is precise or not directly related to whether or not the balance of quantity and quality of partial revision. Each region is in the process of planning and revising, so the fundamental database and plan database of land use in some regions and counties have not been established. Therefore the digitalization of paper map of the current land use and the original manual overall plan of land use are required during the process of the partial revision in overall plan of land use. The problems of area measuring mainly come from the process of digitalization in the plan maps.

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* Corresponding author. E-mail: caigui77@126.com

2 Digital problems of partial revision in overall plan

2.1 The maps are not proofread before digitalization With the wide application of geographic information technology, the traditional way of area measuring has nearly been abandoned and the computer-based way has become prevalent. But some units do not conduct pretreatment on the paper maps before digitalization (heat treatment or cold treatment). Besides, the error engendered by scanning the map and the error of raster image are not proofread before digitalization as required, some paper even do not have the most basic map balance, so the area measuring can not achieve precision. As for the land use map with the scale 1:10 000, the demand of precision in digital area measuring can be achieved only by applying the 400 dpi resolution ratio and the bearing error should reach 1.27 mm. Therefore, before digitalization the emendation of paper scaling error, the verification of the paper scanning error and the correction of raster image must be conducted strictly so as to ensure the demand of precision. The bearing error before digitalization is shown on Table 1.

Table 1 Orientation error index in different resolution

Scan resolution (dpi)	Scale		
	1:500	1:1 000	1:10 000
200	0.217	0.254	2.54
300	0.085	0.169	1.69
400	0.064	0.127	1.27

2.2 The coordinate matching and projection transformation are not conducted

Both of the present land use map and the overall plan map have strict coordinate system and scale to give convenience to locate the goal elements and spatial reference. However, some compilation units ignore these essential mathematical bases and do not conduct coordinate matching and projection transformation on the map. If the map is not strictly matched according to Beijing 1954 coordinate system and transformed according to Gauss projection after digitalization, it can only be used as schematic map without achieving the precision of digital map area measuring in overall plan of land use. What's worse, it is hard to connect with the neighboring area.

2.3 The asymmetrical information pre and post digitalization

The planning range of a project within the red line covers from one town to several towns, especially the line type projects (the construction of express way and railway) and zonal projects (the construction of reservoir includes inundated area), so the digitalization of plan map needs great efforts. Some units ignore the consistency of current information and the plan information pre and post digitalization. It can be seen from Fig.2 that the location and area of construction land have changed pre and post digitalization. The difference in the scheme is difficult to find out during the process of assessing. If the revised plan map gets permission, it will be endowed with legal validity and the original plan map will be abandoned. As the result of the transitivity and accumulation of errors, the deviation between the revised plan map and the former one will become larger and larger, which violates the requirements of

balancing the occupation and compensation of arable land, maintaining the acreage and quality of farmland and not exceeding the total amount of construction land.

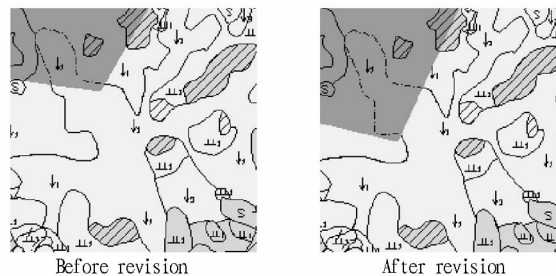


Fig.2 Discrepancy of construction land pre and post map digitalization

The approved land use plan is the basis for land use and management. Being endowed with legal force, the approved land use can not be revised or adjusted at any place or by any person^[5]. The plan is "red line" and "high-tension line" and any violation is illegal. However, as a result of the change of plan map after digitalization and the great differences of it after several times of revision in many regions and towns, the seriousness and authority of the plan disappeared completely.

2.4 The location is not precise In general, the scale of overall plan map in villages and towns is 1:25 000, in pastoral area and forest area is 1:2 500, 1:50 000 or 1:10 000, and in engineering measuring area the scale is 1:500^[6]. Some errors are inevitable when applying the range of large scale to the small scale, but it should be controlled within certain precision. Some large-scale transportation construction projects and hydraulic engineering projects cover large area, so it has difficulty in applying the engineer measuring area to the plan map on the basis that the measure of change survey has not yet been completed. Some units do not use scientific methods in revising this kind of plan map but use the way of hand drawing which leads to great differences. What's worse, the land ownership which caused grave impact on land exploration has been changed.

2.5 The result map is substandard At present, the specific rules for standardizing the revision of map are absent. Some maps even do not have the basic map elements and the unified sample maps, for instance, the absence of plan time limit; the statistical table of each pattern of land use pre and post the time limit, necessary coordinate system, compass, unit of compilation and so on.

3 Analysis of the reasons

3.1 The absence of unified management methods and technical regulations

At present, the national united *Management Methods of Partial Revision in Overall Plan of Land Use* and *Assessing Report of Effects Caused by Partial Revision on the Planning Implementation* in China is absent. Some provinces and cities released *The Temporary Management Methods on Accessing of Revision in Overall Plan of Land Use*. Some provinces delayed the release of it out of various reasons. However, the released methods just stipulate the approval procedures and the required elements, while the support of

the technical regulations is absent. Without the support of technical regulations, the quality of the compilation plan can not be guaranteed and some even have grave errors.

3.2 The professional level of the staff in the compilation units is uneven Since the absence of unified management, many intermediary agencies undertake the business of revision to fight for the market. But as a result of the inadequate professional quality, uneven ability of the staff and the lack of market supervision mechanism, the market of plan is chaotic which has bad effect on the society.

3.3 Some staff can not aware the importance of the digitalization of maps Some units just blindly rush the projects at the expense of quality. Because of the insufficient understanding of the importance of map digitalization, the precision of the map plan is gravely affected as well as the land exploitation.

3.4 The basic conditions of the original plan map is poor The last overall plan of land use is compiled from 1996 to 1997. Confined by the development of computer technology and geographic information, the maps are mainly cyanotype made by manual stitching and coloring with the scale of 1:10 000. After several years, the color is transferred or faded away, for example, the color of basic farmland is deep yellow and the ordinary farmland is light yellow. However, affected by humidity or many other factors, the deep yellow fades into light yellow gradually. It is difficult to ensure that the staff of digitalization can distinguish the map spots accurately and completely.

4 Countermeasures

4.1 The national unified management methods and technical specification should be built The national united *Management Methods of Partial Revision in Overall Plan of Land Use and Accessing Report of Effects Caused by Partial Revision on the Planning Implementation* must be released as soon as possible. Only the united management methods and technical specification can standardized the industry of revision and protect the law authority of plan of land use.

4.2 The establishment of industry admittance system and qualification system of compilation unit We should put an end to the current chaotic market of plan revision and establish the industry admittance system and qualification system. Only the qualified units can be engaged in the industry. The qualification should be classified into different grades, the primary grade units are permitted to accept the revision plan of the national large-scale construction project; the secondary units are allowed to accept the revision plan of large-scale construction project at provincial level; the tertiary units can only accept the business of revision plan under the level of region and town.

4.3 The establishment of the supervision and quality control mechanism of digital results The change of plan map beyond the permission of law caused by human factors must be eradicated. Each key stage must present the quality test report and the specific parameter setting. The quality test report of the changed elements pre and post the digitalization of plan map must be presented in particular. Besides, the genuine signature of the person in charge in the compilation unit is a necessity.

4.4 The coordinate matching and projection transformation must be conducted on the result map The digital pres-

ent maps and the overall plan maps of land use must accord with the current standard of coordinate system and the setting of projection parameters. The control coordinate must be pointed out in large-scale construction projects (the large scale hydro-engineering projects) to check the precision of location.

4.5 The unification of format and mode of the result map All the revision of plan must provide the schematic map of partial revision plan. The schematic map includes the maps pre and post the revision and it must be submitted as the text attachments. If there are many schematic maps, the maps must be marked with serial numbers. The single schematic map should have necessary map elements, for instance, coordinate system, scale, compass, sample plan map and so on. The overall plan map of land use should cover coordinate system, the survey date of the current status change of land use, the unit of the survey, the compilation unit, date of digitalization and some other introductions.

5 Conclusions

The partial revision in overall plan of land use is the inevitable result arising from the contradiction between dynamic development of social economy and the relatively static plan. During the process of informatization, the unified management methods and technical regulations must be set up to ensure the healthy development of the revision of land plan so as to provide strong technical support to the formation of overall land, give play to the macro control functions of the overall plan and provide assistance to the sustainable development of social economy.

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