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CONSTRUCTION TECHNOLOGY

The Research Progress on Surveying Technology of Architecture Construction

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ABSTRACT Various engineering project construction must go through planning and design, architecture construction, operation management and other stages. Each stage should carry out relevant measurements, including measuring project during the construction phase and initial operational phase which called construction surveying. Engineering Surveying is the key work during construction of architecture projects, which affecting the construction quality and operation process of architecture objects. A detailed surveying work should be conducted at the early stage of official start of architecture engineering, in order to grasp the geological conditions of construction site, and avoiding the occurrence of various diseases phenomenon during post-operation. Therefore, coordination between engineering units is needed to complete the surveying of architecture project together.

KEYWORDS
Architecture construction
Construction surveying
Control network

1. Introduction

Architecture field is inseparable from surveying work. On the features of architecture engineering, the content of architecture engineering surveying generally include two aspects: determination as well as survey and design. Determination is to obtain the data for determining ground point position by measuring equipment and instruments through a series of observations and calculations, or survey the terrain of construction region into a topographic map with a certain percentage, used for architecture engineering planning and design. Survey and design refers to demarcate the building and others designed on drawings on the ground in accordance with the strict requirements of the design and construction, as the basis for the construction.

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2. Main content of architecture construction

2.1. Surveying of large scale topographic maps

It through actual observations from outside and data calculation from inside to draw all kinds of features in the engineering construction area (such as housing, roads, railways, rivers, forests and vegetation) and landforms (ups and downs of ground, such as hills, basins, hills and plains, etc.). It can be present into a variety of topographic maps, cross-sectional maps or with the number according to a certain scale, provide the necessary drawings and data for each phase of the engineering construction.

2.2. Construction loft of buildings or others

Demarcate the building and others designed on drawings on the actual ground in accordance with the special requirements of design and construction from the basis of construction. In addition, during building structure and equipment installation, also need to conduct a variety of measurements to cooperate and guide the construction, ensuring the quality of structure and installation [1].

2.3. Draw the completion general layout

After completion of engineering, completion measurement must be done on architecture, in order to check the engineering construction, location quality, etc. Besides that, all kinds of pipes for production and living and other facilities, especially for the plane position and elevation position

of hidden engineering, should draw before the completion of general layout. It is provide the necessary information for the acceptance of building (structure) before used. Otherwise, later alterations and expansion are needed during overhaul.

2.4. Observation of the building subsidence and deformation

In building construction and use phases, in order to detect the security and stability status of foundation and structure, understand the rationality of design and construction, we must periodically observe the displacement, subsidence, tilt and swing, provide information for identification of engineering quality, study of engineering structure and foundation as well as the safety protection of the building.

3. The surveying precision of architecture construction

3.1. Precision of construction control network

The precision requirement of construction control network should be based on the building stability after completion of engineering, namely architecture tolerance. Correctly determining the precision of construction control network has an important significance. High precision will cause an increase in measured workload, thereby delaying the construction period. On the contrary, it will affect the loft precision, which unable to meet the needs of construction, and resulting in accident due to quality. In general, the precision of construction control network is higher than surveying control network. The precision of construction control network depends on the nature, structure, building materials, construction methods of engineering and other factors. Some requirements are lower while some requirements are very high. For example, the center line of continuous production require a lateral deviation of not more than 1 mm; for the industrial plants with steel structure, the spacing of steel columns center line requirement no more than 2 mm. What must be pointed out is that the main task of Construction Control (grid) network is to survey and design the centerline of each constituent element of system engineering, as well as the centerline of linked building of each constituent element, such as survey and design the centerline of plant, blast furnace and coke oven, belt Corridor, rail or pipeline. The precision of surveying and design of this centerline is lower than the internal precision of each unit engineering. As a large number of surveys and design of centerline with higher precision requirement inside engineering unit, we can establish a separate local unit engineering construction control network. These units of engineering construction control networks are not added based on control network of whole plant, but establish unit engineering local control network with high precision according to the unit engineering centerline surveyed and designed by plant control network.

3.2. Survey and design precision of building center axis

This precision refers to the accurate of relative position between the building surveyed, designed, control network, building red line or the original building around. In addition to automated and continuous production workshop, the general precision requirements are lower.

3.3. Building details on lofting precision

It refers to the lofting precision of each part of building with respect to the main axis. The level of precision depends on the building's material, uses, construction methods, etc. For example, the survey and design precision requirement of high-rise buildings and continuous production industrial buildings is higher, those of general building details is lower. The survey and design precision of details should be determined according to the nature of the engineering and design requirements, we should not be one-sided to pursue high-precision, resulting in a waste of manpower, material and time ; but it should be not too low, which will affect the quality of construction and even cause accidents. In general, the survey and design precision of length should not be less than 1.5000−1.2000, angle survey and design precision should not be less than ±20~±40.

4. The basic principles of architecture construction surveying

In order to make the location of architecture, building and various pipeline and others meet the design and user requirements, carry out survey and design and construction easily and in batch, construction surveying must follow the principle of "From entirety to local, first control and then broken section", for example, firstly we should establish a unified construction control network on construction sites based on the surveying control network established at the original investigation and design phase, and then survey and design the axis of architecture according to construction control network, finally survey and design the architecture details (foundation, walls, doors, windows, etc.) according to the axis. Construction Control Network is not only the basis for construction lofting, but also the bases for deformation observation as well as building reform and expansion [2].

5. The basic characteristics of architecture construction control network

Compared with the surveying control network, architecture construction control network has the following characteristics:

(1) Density of control point is large, precision requirement is high, the use is frequent, lots of construction interference, all the position of control point should be distributed properly and was stable, easy to use, and the pile point were not destructed during construction. Therefore, the selection, measurement of control point, protec-

tion of pile point and other works should be determined through uniformly considering construction plan, site layout.

(2) In the construction control measurement, precision of local control networks is higher than overall control network. As previously mentioned, the precision of local control network of a unit engineering may be the highest part of whole system engineering precision, therefore, there is no need to establish the same precision for the whole control network as the local control network. Thus, a wide range of overall control network just pass a starting point and starting azimuth to the local control network, while the local control network may be arranged in the form of free web [3].

6. The main form of architecture construction plane control network

Construction Plane Control Network often take the form of a triangular mesh, wire mesh, building baseline or Building Grid mesh. Comprehensive consideration should be made on the selection of plane control network based on architecture general plan, the size, and topography of construction site, construction programs and other factors. For mountainous terrain and hilly areas with large ups and down, triangulation measurement method or corner measurement method which often used to establish control network; for the region with flat terrain and difficult traffic, such as construction site with extension or alteration, or quite irregular building distribution, we can use wire mesh. For small construction sites with flat and simple ground, we often arrange one or several buildings baseline, to form a simple graph and as a basis of construction lofting, while for the industrial sites with flat terrain, lots of building, regular distribution and larger density, usually the construction grid mesh is adopted. In short, the form of construction control network should be consistent with the layout of design general layout.

When adopting Triangulation mesh as construction control network, we often set up two levels, one is the basic network, mainly control the entire site, it can be established according to the primary or secondary small triangulation technology of urban surveying specification; another is survey and design of triangulation mesh, which directly controls the axis and detail position of the building, which encrypted on the basis of basic network. Moreover, when the area is small, two-level small triangulation mesh may be used for single layout [4].

When using the wire mesh as construction control network, also set into two levels, one level is the basic network, mainly sets into a ring, and may be established according to the primary or secondary surveying technical requirements of city specification of surveying and mapping; Another level is survey and design of wire mesh, which used to survey and design local building, and it may be established according to urban secondary or tertiary wire technical requirements.

7. Conclusion

With the rapid development of our economy, high-rise buildings are springing up, and due to the increased of layer number and height, the body had become increasingly complex. In construction surveying and mapping, regardless of the vertical transfer or elevation transmission of structural plane, the transfer times are increased obviously. For construction, surveying and mapping work are required in order to ensure to achieve the precision requirement of structure construction. It not only increases the requirements on technology, but also has higher requirements of construction surveying and mapping specification.

Conflicts of interest

These authors have no conflicts of interest to declare.

Authors' contributions

These authors contributed equally to this work.

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