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Study on the Protection Methods of Rockery in Classical Gardens

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Abstract

As an important cultural heritage, traditional garden stone rockery has attracted much attention. In recent years, with the frequent climate change and the intensification of the impact of human activities, the health status of traditional garden rockery has been declining. However, the corresponding technical means of health evaluation are still not systematic. Starting from the actual needs of rockery protection, this paper focuses on combing the relevant detection and analysis technologies from the aspects of materials and structural connection, and explores their applicability, in order to improve the protection level of traditional garden stone rockeries in Beijing.

Keywords

Traditional Garden; Stone Rockery; Health Assessment; Technical Method.

1. Introduction

Due to the different materials used, the rockery of historical gardens can be divided into earth mountains, stone mountains and earth rock mountains. The latter can be divided into earth mountains with stones and stone mountains with soil due to the different proportion of soil and stone. For a long time, rockery craftsmen and workers of all dynasties in China have absorbed engineering technologies such as building clay tiles and stone works and the techniques of traditional landscape painting, gradually accumulated experience in practice and created this unique skill. The rockery stones used in imperial gardens in the Qing Dynasty were mainly North Taihu Lake stones. The origin is north of the Yangtze River, so it is called North Taihu Lake stone. Such as Fangshan in Beijing and Yi County in Hebei. The North Taihu stone is different from the South Taihu stone produced in Suzhou. It has no exquisite stone body, but because it contains more iron oxide, the mountain stones are orange yellow, tough and soft, the lake stones have many holes and the same size, and the stone texture is rich, which is suitable for the construction of the northern huangjiayuan forest. In addition, compared with the South Taihu stone, the North Taihu stone is close to the origin. Considering the cost, the transportation cost is low, and the characteristics of local materials make the garden construction more convenient. In recent years, with the frequent climate change and the intensification of the impact of human activities, the health status of historical garden rockeries in Beijing has been declining. Therefore, it is necessary to sort out their health identification technology in order to improve the protection level of such important cultural heritage.

2. Objective to Evaluate the Health of Stone Rockery

Based on the needs of the protection and maintenance of traditional gardens, and in line with the principle of "safety first", it is first necessary to ensure the safety of mountains and rocks, and confirm whether there are potential safety hazards when people visit. The safety confirmation is tested from the two aspects of material and connection. Firstly, the appearance of the stone is tested, and the exposed connecting iron parts are tested. The on-site and laboratory tests provide basic data for the later calculation, analysis and monitoring. After the on-site inspection and later finite element analysis and monitoring, the reliability of the piled

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stone is finally determined, which is the next step of the repair design of the piled stone in the traditional garden Provide reference basis for construction.

3. Health Evaluation Content of Stone Rockery

3.1. Foundation

Inspect the current situation and defects of the lower foundation, judge whether there is uneven settlement and its impact on the upper structure, determine the detailed survey location according to the inspection results, classify the current situation and problems of the foundation and determine the causes after the detailed survey. It mainly includes:(1) Uneven settlement; (2) Site category and foundation soil; (3) Foundation deformation, or its response in the superstructure; (4) The influence or function of other factors (such as groundwater pumping, foundation flooding, water quality, soil corrosion, etc.

3.2. Stone part

Conduct a detailed survey on the current defects of the stone part, conduct a detailed inspection on the cracks, damages, deformities, crispness alkali, swelling and other defects on the external surface, and find out the scope and size of the defective parts. According to the damage condition, the detailed exploration position is determined and the damage condition is graded.

3.3. Pointing and Cementation

Traditionally, putty is used to point the joints. During construction, after each layer of stone is leveled and clamped, the joints, filling and grouting are carried out immediately. Conduct a detailed general survey on the pointing bonding materials, conduct a detailed inspection on the pointing pulverization, damage, cracking and other defects, and find out the scope and size of the defective parts. According to the damage condition, the detailed exploration position is determined and the damage condition is graded.

3.4. Reinforced Iron Movable Part

In classical gardens, iron work such as silver ingot buckle, iron nail, iron shoulder pole, horseshoe hanger and fork hanger are often used to strengthen and connect Duoshan. Conduct a detailed survey on the current situation and integrity of the iron live connection, inspect and record the looseness, corrosion and other defects in detail, and evaluate the impact of its damage on the overall stability of Duoshan.

3.5. The Upper Part of the Building

As the pavilion is built on the stacked rockery, the deformation and settlement deformation of the upper part of the building has an obvious impact on the upper part of the building, so the tilt deformation and foundation cracking defects on the upper part of the building are inspected and tested, the causes are analyzed, and the deformation and overall safety of the building are evaluated.

4. Fangshan Stone Wigwam Health Diagnosis Technology

4.1. Foundation Foundation Testing

Common rockery foundation is divided into two kinds, one is "gray soil ramming", the other is "pile". In the detection work, often use radar wave technology to detect the foundation foundation of the rockery, geological radar is a kind of short pulse broadband high frequency electromagnetic wave signal, detection of underground media distribution technology. The technology adopts the continuous movement detection method, through the transmitting antenna to transmit high-frequency electromagnetic wave underground, electromagnetic wave

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signal in the underground propagation when encountering different media interface, it will produce reflection, transmission. After the reflected electromagnetic waves are received by the receiving antenna which moves synchronously with the transmitting antenna, the movement characteristics of the reflected electromagnetic waves are precisely recorded by the radar host, and the scanned image of the internal or underground media section is obtained; through processing and image analysis of the scanned image, the purpose of identifying the internal or underground target objects is achieved. Radar by detecting the presence of undesirable geological conditions in the underground soil layer, it can determine its location and the scope of influence, so that effective treatment measures can be taken to eliminate safety hazards. At the same time, it can also be combined with the excavation of exploratory holes and other means of foundation foundation foundation survey, to further determine the foundation soil quality and foundation form.

4.2. Stone Testing

Stone testing is generally divided into two parts: laboratory testing and field testing. Stone due to different lithology, its stability is also different. Through the petrographic analysis in the laboratory of the rockery stone, the mineral composition can be determined. The physical properties of the stone and mechanical strength testing, on the other hand, can obtain the block density, porosity, water absorption, water content and point load strength of the stone. For stone deterioration analysis, the degree of looseness of the deteriorated material can be analyzed using the mercury-pressure method or the BET method. Finally, the degree of deterioration and the cause of deterioration are determined by combining the degree of loosening, lithological changes and microscopic morphological analysis (energy spectrum analysis). On-site inspection link using non-metallic ultrasonic detector for the qualitative detection of internal defects in stone. Ultrasonic testing as a typical nondestructive testing technology, it uses ultrasound propagation in the material, encountering the interface reflected back acoustic signal characteristics, or acoustic energy in different media attenuation characteristics and other properties, through the electronic display instrument to display the reflected wave signal or graphics, the object to be detected.

4.3. Building Component Detection

For the detection of the wooden components of the wigwam superstructure can use stress waves, micro-drilling resistance meter, etc. for site investigation, and brick components can use rebound meter combined with non-metallic ultrasonic technology for detection.

4.4. Stability Assessment

Stacked stone rockery in the construction, often using iron to strengthen the connection of the stone, reinforced iron plays a very important role in the stability of the rockery. Metal detector can be used on site to determine the location of the iron. For the local or overall deformation of the rockery, the point cloud model obtained by 3D laser scanning technology can be applied for quantitative analysis. The dynamic characteristics of the wigwam structure as an important parameter for structural seismic analysis can be tested using natural environmental excitation on the wigwam, and the structural self-oscillation frequency, damping and other modal parameters can be obtained by the pulsation method without damaging the structural performance of the wigwam. Finally, simulation and analysis of the overall or local safety of the rockery are carried out using the finite element method.

5. Fangshan Stone Rockery Repair Technology

For the defects of the stone itself, if the stone itself exists non-stress cracks and defects do not affect its safety, may not be processed. For the existence of surface weathering of the stone, the

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surface anti-weathering treatment can be carried out. For serious corrosion of the connection iron can be added in the adjacent position and grouting fixed iron. For local or overall deformation of the wigwam parts, combined with the development of deformation, can be used to support the top and other technical measures.

6. Conclusion

Safety and functionality are the key issues in the maintenance of traditional garden rockeries, and health diagnosis methods relying on new technologies can provide strong support for them and continue the authenticity and integrity of heritage to the maximum extent. This thesis is only a preliminary exploration, and many related issues involved are yet to be further developed in order to contribute to traditional garden heritage conservation.

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