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Research and Application of BIM and Unmanned Aerial Vehicle of Urban Green Highway

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Abstract: Under the background of rapid promotion of green highway construction, highway construction pursues efficiency, quality and engineering durability, environmental protection. In addition to environmental problems such as noise and dust, urban green highways also face special problems such as pipeline balance, relocation and construction organization. This paper taking Huadu to Dongguan highway as the research object. The author proposes a method to generate a panorama of a construction site, to create high-quality panoramas, which was evaluated by comparing it with an aerial photograph. Additionally, the approach is tested accuracy.

1. Introduction

Green highway is an important part of green transportation, according to the system theory and the cycle cost thought, overall highway construction resource conservation, ecological and environmental protection, energy saving efficiency and the service, the overall highway planning, design, construction, operation and management of the whole process, with minimal resource usage, the smallest energy consumption using, the lowest pollution emissions, the lightest environmental impact, obtaining the optimal project quality and efficient service, realize the external maximum balance between rigid constraint and supply. However, after several years of green highway construction practice and green highway construction and evaluation standard research, found that although green highway construction has a relatively complete construction program and good expectations, but the proposed green highway construction characteristics, green technology, green concept is difficult to achieve. Especially in the process of green highway construction, prominent environmental problems and illegal construction occur frequently, which fail to reflect the protection of the environment and the restoration of nature. Therefore, this paper combines the environmental problems in the construction process of green highway and the concept of environmental stewardship to realize the environmental supervision during the construction period of green highway and provide scientific basis and effective technical support for the environmental supervision during the construction period of green highway.

In the process of highway information construction, BIM technology and UAV concept in this construction are introduced. The information model is used to organize and manage the resources, activities and products. So that all stages of highways construction to achieve information sharing, saving construction costs, to avoid resource waste.



2. Study area

The Huadu-Dongguan expressway project is a key construction project of Guangdong province and Guangzhou city, and it belongs to the seventh important highway in Guangzhou high speed expressway network. The route starts from the south exit of Baiyun airport in Guangzhou and is connected to the airport expressway. It goes east through Renhe town and Zhongloutan town in Baiyun district, Zhongxin city and Jiulong town in Huangpu district, China-Singapore town, Yongning Street, Xiancun town and Shitan town in Zengcheng district, and ends at Shitan town and is connected to Zengguan Shenzhen expressway. The completion of this project will better enhance the traffic capacity of Baiyun international airport and is of great significance to the economic development of Guangzhou airport economic zone, China-Singapore knowledge city and Zengcheng national economic development zone.

3. Method

(1) Technical personnel shall ask for construction drawings from relevant parties, collect all relevant technical documents and relevant standards and specifications, and find out the situation of pipeline passing through the greenbelt or municipal pipeline under the sidewalk in the urban area, light cable covering and so on.

(2) The engineering and technical personnel shall give detailed technical guidance to the construction personnel, make disclosure according to the design and specification requirements, and understand the engineering characteristics, basic construction contents and quality requirements.

(3) Organize technicians to learn and master the contents of engineering construction drawings, technical requirements, construction acceptance standards and the spirit of relevant documents.

(4) Organize relevant technical personnel to step the construction site, understand the specific situation of the construction site of this bidding section, and ensure the construction scheme is reliable, feasible, reasonable and scientific. Compile construction organization design and relevant construction work instruction according to site survey. Prepare construction plans for special sections and crossings, and examine and approve them according to the prescribed procedures.

4. Data collection by UAV

Uav aerial measurement adopts fixed wing's uav, which has the characteristics of flexibility, high efficiency, fast, fine accuracy, wide range of use and short production cycle.

Unmanned aerial vehicle has great potentials to renovate the practice of safety management in civil engineering. Many researchers investigated the feasibility of applying UAV for safety inspection during construction, and found that the visual assets collected by UAV can improve the safety inspection on jobsites.

In small areas, uav can quickly acquire high-resolution images, and fixed-wing uav have obvious advantages. The digital camera, digital colour aerial camera and other equipment it carries can quickly acquire surface information, obtain high-resolution images and high-precision positioning data, generate DEM, 3-D orthophoto, 3-D landscape model, 3-D surface model and other visual data.

The image data is acquired and the uav is used to take aerial photos of the construction site. A certain flight height is set according to the accuracy requirements of the result data. The flight route is planned according to the shape and size of the construction site.

Pix4d software was used to process the original images collected by the uav. After importing the original image data, the processes of 3d overlap, point cloud intensive matching and terrain modelling were automatically carried out, and the DOM, DEM and other intermediate results required for monitoring were finally derived.



Figure 1 Map of collection data by UAV

5. BIM and 3D GIS plan

(1) Highway engineering is zonal distribution with long mileage and close relationship with geographic information. The application goal of BIM technology is to ensure the accuracy of engineering data from the planning stage, design stage, construction stage and operation stage, and to facilitate the query of engineering attributes and engineering information.

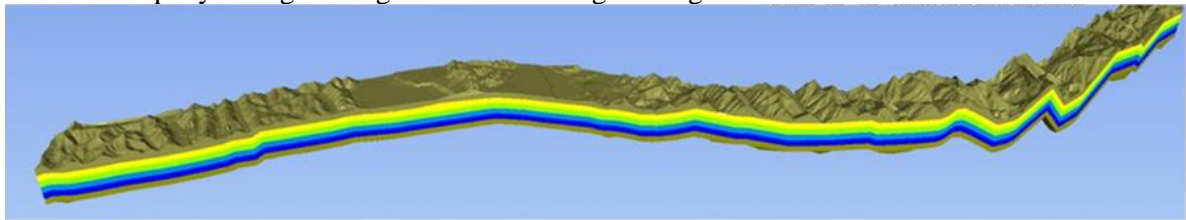


Figure 2 Map 3-D construction road

(2) Highway engineering is closely related to the natural environment. The integration of BIM+GIS is an important technical problem for the implementation of BIM technology in highway engineering. The construction of digital engineering based on BIM is based on the premise of satisfying the application of large-scale highway engineering projects. It is exploring the 3-D expression of object lightweight based on "BIM+3D GIS" project, and taking BIM model as the carrier of engineering information.

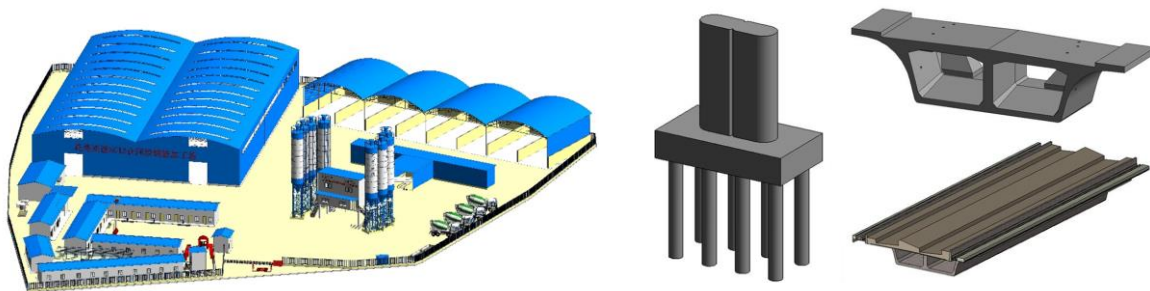


Figure 3 Platform application diagram

(3) The detailed modelling of Bridges and subgrade is carried out. The external dimensions and spatial relations of nodes are correlated in a three-dimensional environment. According to the design drawing, the steel bar, steel pipe and pipe are built for 3-D modelling, and the vehicle inspection and adjustment are completed to improve the design quality and reduce the consequences caused thereby.

6. Conclusions

In this paper, In the process of highway construction, BIM is used to establish the 3-D model of engineering entity object. Meanwhile, the uav is used to collect the construction data. In the process of green highway construction, the construction organization, construction plan and detail components of highway construction are simulated. These technologies can help organize highway construction, optimize the program, calculate the amount of work and adjust the allocation of resources. The

successful application of these technologies can effectively control the cost, improve the construction efficiency, provide data visualization for the construction management decision makers, and bring huge economic benefits.

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