

Corporate name

**Shanghai Urban Construction Design
& Research Institute (Group) Co. Ltd**

Project address

China, Dongguan City, Guangdong

Application software

Autodesk® Revit®

Autodesk® InfraWorks®

Autodesk® Recap™

Autodesk® 3ds Max®

Autodesk® Civil® 3D

We will continue to replicate and optimize the successful approach in the tramway project of Huawei Songshan Lake Park, so that BIM can be truly adopted for engineering design!

—Shen Guohong,
President of Shanghai Urban
Construction Design & Research
Institute (Group) Co. Ltd.

BIM application in Tram Extension Project of Huawei Songshan Lake Intelligent Park



Company profile

Established in 1963, Shanghai Urban Construction Design & Research Institute (Group) Co. Ltd. serves as a comprehensive design consultancy research institute engaged in the surveying, design and general contracting of infrastructure construction. Aimed at providing omni-disciplinary and end-to-end service for project construction, the corporation has made great contributions in scientific exploration and technological innovation, for which it has received nearly one thousand awards and over 100 patents. It runs 13 design institutes, 1 General Contracting Department, 5 subsidiaries. The 1,800-plus staff has footprint throughout China and around the world.

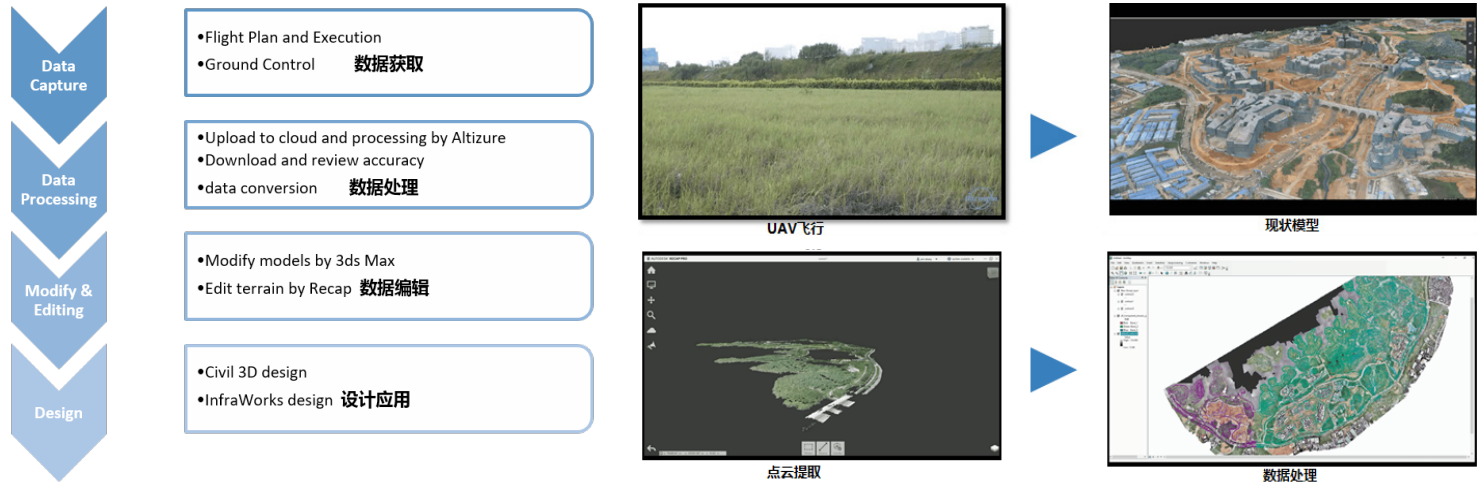
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Project Overview

Located in Songshan Lake Science and Technology Industrial Park, Dongguan, Huawei Terminal Headquarters covers a





total area of about 12 square kilometers, and has replicated 12 best-known urban attractions or landmarks. In March 2014, Ren Zhengfei, Chairman of Huawei, commissioned Shanghai Urban Construction Design & Research Institute to design the Shenzhen Songshan Lake Industrial Park Tramway Extension Project. Divided into three sections, the Project connects all parts of the park with a total length of about 13km. The owner stressed efficient use of ecological resources, application of high technologies, and energy conservation, raising high expectation of bridges' shape and landscaping.

The project team used Autodesk AEC Collection as BIM solution to cover different BIM technical workflows, which include

- 1) Use UAV to acquire high-resolution data of the site, process data through Autodesk Recap and other software, and develop point cloud and 3D models consistent with the current terrain;
- 2) Implement an integrated workflow that combines Civil 3D with InfraWorks in the design phase for BIM-driven design, which improved collaboration and communication efficiency;
- 3) Use BIM + VR for interaction with the owner.

Through the seamless integration of new

technologies, the multi-disciplinary project team coordinated on the InfraWorks platform, which ensured convenience, reducing the design cycle from 6 months to 2 months and saving about 30% of labor force. At the same time, the program was more responsive to new demands, delivering greater accuracy of design, and offering more possibilities of owner communication. All these have been acknowledged as excellent practice by the owner.

InfraWorks offered intuitive and flexible features for design in a real 3D environment. It also provides the flexibility to compare multiple solutions and easily adjust designs. The BIM-driven workflow combining Civil 3D with InfraWorks can improve design quality. The integrated BIM model greatly facilitated communication with the owner.

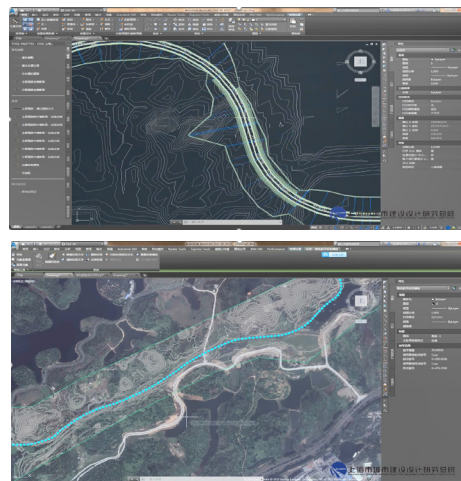
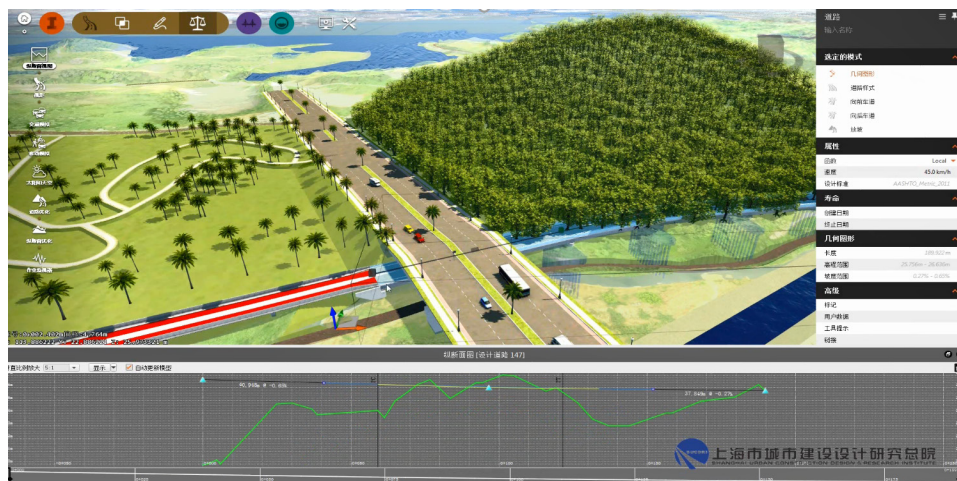
Highlights of BIM Application

1. Workflow of UAV data acquisition and processing:

The Project staff collected data in the pre-project stage using Swiss Fixed-wing UAV and DJI Multirotor UAV, processed the data in a programmed manner by

BIM, in combination with GIS, was simultaneously embedded in the pre-project design process. It played an important role in the Huawei project, which features complex terrain, high requirements for landscaping and an intensive schedule with multiple stages. This design approach has outstanding advantages in the following four aspects. First, greater accuracy of three-dimensional design in the track vertical sections, ensuring alignment between track and terrain. Second, quick response to project changes. Third, paperless project presentation to the project owner to facilitate communication. Fourth, BIM-enabled precision guidance for construction, to minimize rework.

—Liang Zheng and Huang Liangliang,
Project Manager of Shanghai Urban
Construction Design & Research
Institute (Group) Co. Ltd.



means of Recap, ArcGIS, 3ds Max and other software, and finally obtained high-resolution topography and perimeter data for the site. Taking the workflow of Ebee Fixed-Wing UAV for example:

- Set the flight path, and simulate environment of the path.
- On-site route planning by operator, manually controlled take-off, real-time observation of flight parameters by the ground station, and auto-piloted landing.
- Processing of UAV aerial survey data in the cloud to generate point cloud data.
- Use Recap to manually edit the point cloud, delete water surface, buildings, etc., and get pure-terrain model of the site.

- Use the GIS 3D analysis function of ArcGISScan to calculate variation of ground points edited by Recap. Generate a grid terrain model that can be easily imported into InfraWorks and Civil 3D for design and display.
- To improve design effect and performance, use 3ds Max to retouch and streamline drone-modeled data and generate stand-alone key models.
- Use Model Builder feature of InfraWorks to download area models outside the park, and overlay the processed data from the drone.

2. BIM-driven design with the combination of Civil 3D and InfraWorks:

After acquiring and integrating the real-world environment of the project through InfraWorks, the terrain data were exported to Civil 3D, where the plane and vertical section designs of the tramway project were carried out on the basis of the terrain surface. The results of route plan were imported into InfraWorks to initially define the road and tram cross-sectional patterns, including ground tracks, overhead tracks, underground tunnels and so on. The 3D model would be generated in a real project environment.

InfraWorks offered intuitive and flexible support for optimizing, tuning, comparing and selecting tramway design in a real 3D environment. The software provided the flexibility to switch between multiple solutions, and easily change and adjust





designs, substantially enhancing design efficiency. In the original design, the tram route cross hills, compromising passenger comfort and the local landscape, and raising the cost of construction. Aware of the issue, designers promptly adjusted in InfraWorks by simply clicking and dragging the mouse.

After the design was finalized, the adjusted routes in InfraWorks were updated to Civil 3D, where the cross sections of road, grading and so on were detailed. Then the updated results in Civil 3D were synchronized to InfraWorks for display.

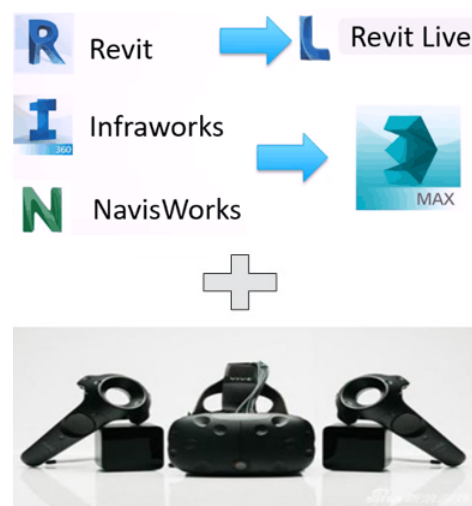
Drains, sidewalks, conventional bridges and other common objects can be directly imported in Civil 3D when the track routes were finalized. By selecting style of these objects, 3D models were generated. Finally, thanks to the data integration capability of InfraWorks, data of different formats of buildings, landscapes and rivers were integrated into a unified environment, in order to create a true 3D digital model of the Huawei Songhua Lake Intelligent Park. This integrated BIM model greatly facilitated communication with the owner, who gave high credit to the exercise.

The robust data interoperability between Civil 3D and InfraWorks brought tremendous convenience to designers,

making design and collaboration more efficient. The BIM-driven workflow combining Civil 3D with InfraWorks can improve design quality, reduce cost of communication, and minimize rework in design.

3. BIM + VR application:

Autodesk offers an all-in-one solution ranging from BIM to VR. With the Revit Live workflow, VR outcome is one click away from Revit models, which is very handy for VR demonstration of single buildings. For the VR presentation of the entire park, we exported InfraWorks model to 3ds Max in FBX format for optimization, and then



imported it into 3ds Max Interactive for VR content creation. Both Revit Live and 3ds Max Interactive are compatible with mainstream VR devices, such as HTC Vive. BIM + VR has prominent practical value in Huawei Songshan Lake Intelligent Park and similar projects, meeting the high demand for landscaping and facilitating designer-owner interaction.

The integration of a variety of new technologies, and as well as multi-party collaboration and participation, has truly realized BIM-driven design. Also I would like to thank Autodesk for offering us abundant options of BIM software, creating a friendly and accessible environment for the designers.

—Li Hui

BIM Manager of Shanghai Urban Construction Design & Research Institute (Group) Co. Ltd.