

COMPANY

Water Supplies Department, HKSAR Government

PROJECT

5/WSD/19 - Improvement to Dongjiang Water Mains P4 at Sheung Shui and Fanling

LOCATION

Sheung Shui and Fanling

TYPE

Water works

SCHEDULED TIME OF COMPLETION

Q1 2023

Digital Transformation and Hardware Upgrade of Raw Water Supply System



About Water Supplies Department, HKSAR Government

Hong Kong enjoys one of the safest and most reliable water supplies in the world. The Water Supplies Department (WSD) is responsible for operating and maintaining fresh water and flushing water supplies and distribution systems to ensure reliable water supplies to the customers. The fresh water supply system covers not only the populated city centres and satellite towns but also rural areas and villages covering a total of 99.99% of Hong Kong's population. On the other side, the seawater supply network for flushing covers about 85% of the Hong Kong's population.

BIM PARTNERS

Summit Technology (Hong Kong) Limited
Build.IT

AUTODESK PRODUCTS USED

Autodesk® Architecture, Engineering & Construction Collection

Autodesk® BIM 360®

Autodesk® ReCap® Pro

Project Description

The Dongjiang water mains (DJWM) P4 is one of the raw water mains for transfer of DJ raw water. It transfers the DJ raw water from Muk Wu Raw Water Pumping Station to Tai Po Tau Raw Water Pumping Station, where the DJ raw water will be further distributed to various water treatment works and the Plover Cove reservoir. The glass reinforced plastic (GRP) pipes of the section of DJ water mains P4 at Sheung Shui and Fanling were laid more than 30 years ago. They are approaching the end of their service life. Therefore, we need to replace this section of the GRP pipes timely to ensure the reliability of water supply to Hong Kong. The scope of the project comprises the replacement of about 5 kilometers (km) of aged GRP pipes of the section of DJ water mains P4 by steel pipes of diameters ranging from 2 100 millimeters (mm) to 2 300 mm. Moreover, digital transformation of the existing DJ water main P4 and Muk Wu Raw Water Pumping Station is required to facilitate asset management.

Project Challenges

The existing DJWM P4 water main has been shut down for its replacement works. A very tight schedule, i.e., laying about 5km of large diameter (2.2m) water main within 2 years, has been set for the project to minimize the additional electricity cost.

The project team has to exercise extreme care to ensure the safe operation of the MTRC's rail and Fanling Highway when replacing the proposed P4 water main adjacent to them. In particular, the project team has to deal with high pedestrian flow, high traffic flow, congested underground structures and utilities for the proposed trenchless works near the Sheung Shui MTR Station.

Solutions for Challenges

The project team integrate BIM together with the following latest technologies to overcome the above mentioned challenges:

- Tunnel Boring Machine (TBM);
- Laser scanning for generating a point cloud model of the existing P4 water main;
- Ground Penetration Radar (GPR) to verify the locations of the underground structures;
- Gyroscope for ascertaining the alignment of the existing cable tunnel of CLP.

The information gathered was incorporated into the federal BIM model for determining the alignment of the proposed P4 water main. The project team has successfully identified a feasible alignment and satisfactorily completed the works without clashing with any existing underground structures and utilities.

How does BIM benefit the project?

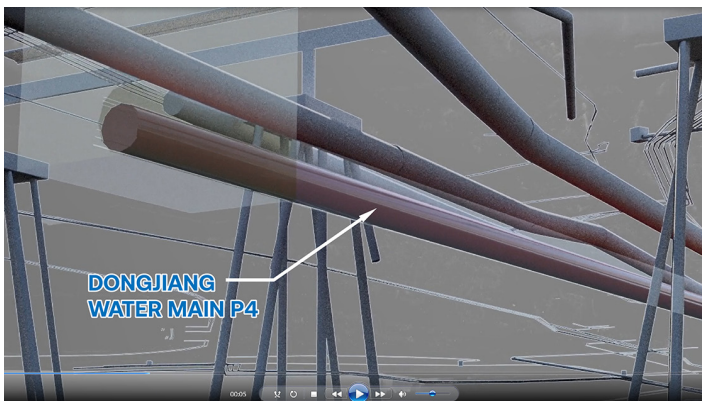
The foremost benefit brought about by BIM is communication. Its 3D environment is the perfect platform for collaboration. Clash detection of BIM enables the project team to identify the best water main alignment in terms of construction time and cost to suit the site conditions. 5D BIM can expedite the option evaluation of water mains' alignments in both design and construction stages and account finalization of the works contract after its completion. The staff resources can be saved. Last but not the least, the BIM models for this project can be used for asset management via COBie. A water network model can be created from the BIM model of water mains for assessing the performance of water supply systems and identifying improvements.

Better with BIM

By using the as-built BIM model of the water mains, the project team can now locate the water mains on-site in real time to facilitate design of new water mains and asset management of existing water mains. The first method is to use GPS. The BIM models of water mains can be downloaded in a tablet and combine it with the real environment via AR technology for locating the water mains on-site. The second method is to locate the water mains indirectly via platform for 3D Geospatial such as Google Earth or Cesium.



DongJiang Water Main P4 in Google Earth
Image Courtesy of Water Supplies Department, HKSAR Government



Clash Detection of underground utilities
Image Courtesy of Water Supplies Department, HKSAR Government



Replacement of Exposed DongJiang Water Main P4
Image Courtesy of Water Supplies Department, HKSAR Government



Surveying Point Cloud of Muk Wu Pumping Station by Drone
Image Courtesy of Water Supplies Department, HKSAR Government



TBM Launching Pit near Sheung Shui MTR Station
Image Courtesy of Water Supplies Department, HKSAR Government



Cross-Sectional View of Muk Wu Pumping Station
Image Courtesy of Water Supplies Department, HKSAR Government



Lifting and aligning of OD2000 PE pipes for butt fusion welding
Image Courtesy of Water Supplies Department, HKSAR Government



Completion of TBM Tunnel Works
Image Courtesy of Water Supplies Department, HKSAR Government