

L&T Construction Delivers Clean Drinking Water to 2.5 Million Residents in India's Rural Communities

Working in an Open Digital Environment Minimized the Carbon Footprint and Saved 10% in Construction Time

WATER TO EVERY HOUSEHOLD

Har Ghar Jal or "Water to Every Household" is a government initiative under the Jal Jeevan Mission to provide safe and adequate drinking water through individual household tap connections to all households in rural India by 2024. Rajghat's multivillage rural water supply scheme is one of the megaprojects under this program, aiming to supply clean drinking water to 1,573 villages across Madhya Pradesh in the districts of Guna and Ashok Nagar. Offering end-to-end water solutions covering every aspect of the water cycle, L&T Construction won the contract to design and construct the new water scheme, fulfilling a vital human need.

The project required delivering a vast system of water purification and distribution infrastructure to treat 189.28 million liters per day of raw water, as well as transport the treated clean water through an extensive 7,890-kilometer piped system to reach 290,570 homes. Its scope included providing 698 overhead tanks (OHTs) along with ancillary pumps and equipment, millions of household connections, associated electromechanical and instrumentation works, and automation and measurement of water quality and quantity through a supervisory control and data acquisition (SCADA) system to ensure 10 years of operation. "[The] project will enable nearly 2.5 million people to achieve sustainable health through good quality drinking water, thereby impacting the living standard of local communities," said Sudripta Misra, joint general manager and head of engineering for L&T Construction's water and wastewater strategic business group.

ADDRESSING COMPLEX TERRAIN AMID A SHORT TIMELINE

"This project is driven by the chief minister of the state with a stringent time frame," said Misra. Within that time frame, L&T Construction faced numerous

hydraulic, geotechnical, and structural design and analysis challenges given the varying soil properties and terrain. They had to complete structural design and analysis for 800 different structures, including the 698 OHTs, ranging between 12 meters and 25 meters in height, spread over various terrain. To ensure structural integrity, they needed to consider the different soil interactions and load combinations for water current, as well as seismic and wind loads. "Controlling the deflection for such tall structures was challenging under different soil conditions," said Misra. Given the lengthy pipe network, ensuring even distribution and optimal pressure with the most economical pipe size presented further engineering difficulties.

L&T Construction tried several software applications for network and distribution analysis, as well as foundation design. However, these applications proved rigid, time-consuming, and ineffective to meet the project schedule. They quickly realized that they needed flexible, interoperable technology to streamline and automate geotechnical, structural, and hydraulic workflows, seeking to establish a connected digital environment.

PROVIDING CONNECTED TECHNOLOGY SOLUTION

L&T Construction selected OpenFlows, PLAXIS, and STAAD, adopting an open digital solution to develop automated and integrated hydraulic, geotechnical, and structural design and analysis workflows. OpenFlows Water application facilitated accurate hydraulic modeling, automating and simulating network behavior using real-time data to calibrate 3D models, detect leakages, and analyze pressure flows and energy consumption to support and accelerate decision making. Using PLAXIS and STAAD enabled L&T Construction to design the foundation system with flexible foundations based

PROJECT SUMMARY ORGANIZATION

L&T Construction

SOLUTION

Water and Wastewater

LOCATION

Ashok Nagar and Guna, Madhya Pradesh, India

PROJECT OBJECTIVES

- ◆ To provide clean drinking water to 1,573 villages in Madhya Pradesh, India.
- ◆ To design and construct a large water supply scheme amid challenging terrain and a short timeline.

PROJECT PLAYBOOK

OpenFlows™, OpenRoads™, PLAXIS®, STAAD®

FAST FACTS

- ◆ Rajghat's multivillage rural water supply scheme will provide access to clean drinking water for 2.5 million people.
- ◆ Time constraints and complex terrain presented hydraulic, geotechnical, and structural design and analysis challenges.
- ◆ L&T Construction leveraged OpenFlows, PLAXIS, and STAAD to establish a connected digital environment to deliver the network.

ROI

- ◆ Bentley's integrated applications enabled the team to complete project engineering in four months.
- ◆ STAAD reduced the team's modeling time from 16 resource hours to 30 minutes.
- ◆ OpenFlows Water saved 50% in time for hydraulics and distribution network modeling and analysis.



“Bentley’s OpenFlows, STAAD, and PLAXIS applications helped to complete all engineering within four months, while usually in similar projects the engineering duration is between 12 and 13 months.”

– Sudripta Misra, Joint General Manager and Head of Engineering, Water and Wastewater Strategic Business Group, L&T Construction



on geotechnical investigation reports, depicting accurate soil conditions. “With the help of Bentley software, such as STAAD.Pro and PLAXIS 2D, we have reduced the foundation size after first submission without affecting the structural stability,” said Misra.

Working in a connected digital environment using Bentley’s applications, L&T Construction streamlined multidiscipline workflows and approval processes, crucial to meeting the tight project deadlines. They automated design and analysis for repetitive structures, such as the OHTs and underground circular units. “We have effectively utilized the open STAAD module for the design of OHTs, which drastically reduces the manual intervention,” said Misra. Using appropriate load combinations and accurate 3D modeling and simulations, L&T Construction optimized design and construction of the OHTs, pipeline, and intake structure inside the dam. This integrated digital approach facilitated efficient and successful workflows to timely address the terrain challenges.

ADVANCED DIGITIZATION REAPS SAVINGS AND OPTIMIZES NETWORK OPERATIONS

Leveraging Bentley’s integrated applications, L&T Construction completed project engineering in a record time of four months, compared to 12 to 13

months using traditional methods on similar projects. For the OHTs alone, with different types of soil structure and interaction, as well as varying staging heights and capacities, STAAD reduced their modeling time from 16 resource hours to 30 minutes. “Needless to say, this has helped reduce the overall engineering time for producing designs and drawings for the 698 OHTs,” said Misra. Working in an open digital environment saved 50% in overall modeling time, increasing productivity by 32 times. All of these savings and improvements will reduce costs during construction for overhead charges and liquidated damages.

L&T Construction reaped further benefits through digitization and automation. By streamlining and optimizing hydraulic, structural, and geotechnical design and analysis, they also reduced the foundation size to precisely fit the treatment plant, minimizing the carbon footprint to save 10% in construction time. “We have precisely fit the treatment plant without leaving any extra space, thereby reducing the carbon footprint,” said Misra. The BIM models and data will be linked with monitoring devices for digital operations and maintenance. “During operations and maintenance, we can use the data for easy identification of the problems and solutions at the earliest,” said Misra.



L&T Construction leveraged OpenFlows, PLAXIS, and STAAD to provide access to clean drinking water to 2.5 million people.



Bentley’s integrated applications enabled the team to complete project engineering in four months.