Method & Machinery Used To Build Dams Employed To Construct Station Box For Central Metro

Tech used in irrigation saved metro rail 2 yrs

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When construction for the outer walls of the underground Central Metro began, engineers least expected that the mixed soil condition would impede work. Trenches cut to build the walls were inconsistent, the wall joints leaked and lowering iron cages into the trench to pour concrete was difficult.

Time was running out and the deadline had to be met. It was then engineers at Afcons Infrastructure, the company that is building the station, decided to adopt method and machinery used to build dams and reservoirs.

All that they required was a hydromill, a trench cutter with two cutter wheels, a new overcut method of construction and 2.2 lakh cubic metres of concrete. Nearly 250 concrete panels, each 1m thick each, were built next to one another to build a 2,300m-long diaphragm wall for the station.

"Had we adopted the conventional method, it would have taken us five years to build the box as the soil condition was mixed with loose soil on top and rock at the bottom. This was perhaps the first time in the country that overcut method was used to build an underground metro station," an official said.

Construction of the station began in 2012. To build the wall, the hydromill was imported from Germany. Engineers said unlike the conventional stop-end method, an overcut method, where a concrete panel was built after cutting into a part of an adjacent panel, was adopted. Though complex, the method helped workers build a watertight wall in an unpredictable soil condition.

In the overcut method, the hydromill trench cutter is used to dig trenches around 2.5m wide. The trenches are cut alternatively leaving soil in between. As the machine cuts through the soil, a type of clay is poured to loosen and further break down the soil.

Once the trench is cut and the fluid removed, slurry is poured in through a pump from the hydromill to ensure density, sand content, viscosity and pH levels are met. Then construction of the concrete panel begins with the fitting of reinforcement cages and filling of concrete mix. As the trench is filled with concrete, the slurry is pumped out for reuse.

Once the alternate concrete panels are built, excavation of the soil in between them begins. Engineers had to overcut into the already built adjacent panel for about 150mm to 250mm in width. The trench is then filled with concrete after reinforcement bars are fitted.

In the conventional stop-end method, the primary wall is built by placing two stop-end tubes on either side and filling the space in between with concrete. It is followed by construction of the secondary wall but without a stop-end tube. Had Afcons built the station box using the stop-end method, it would have taken 60 months, but with the overcut method, it finished the job in 33 months.

"In the overcut method, lowering and removal of stop-end tubes take less time and the cage is lowered only after trenching is complete. This was a cost effective a s well as a time-saving method," an engineer said.

WHAT IS D-WALL?

Diaphragm or outer walls of an underground station built before construction of tunnels

D-WALL CONSTRUCTION

Total length (1,000mm thick) **2,300m**

- Total number of concrete wall panels built for D-wall **248**
- No. of steel columns **171**

1.3 lakh cubic metre of rock excavated

6.3 lakh cubic metre soil excavated

- Total amount of concrete used

2.2 lakh cubic metre

- Total amount of steel used

55,000 tonnes

GROUND WORK: Activity during the initial stages at Central Metro

Pic: B A Raju

> THIS WAS A COST EFFECTIVE AS WELL AS A TIME-SAVING METHOD – ENGINEER WHO IS PART OF THE CONSTRUCTION PROJECT

Graphic: G Joy Theophilus

1 Excavation for primary panel

2 Cage lowering

3 Panel concreting

4 Excavation for secondary panel. Primary and secondary panels together make the walls of Central Metro

HOW

- Overcut method uses a hydromill, a trench cutter used in irrigation projects like construction of dams and reservoirs
- Trenches are excavated for the construction of primary panels of 2.4m-2.6m width at around 2.5m intervals
- The trench cutter continuously loosens and breaks down the soil while a support fluid (Bentonite clay) is poured in
- Fluid removed and slurry pumped in with mud pump to match parameters like density, sand content, viscosity and pH
- Reinforced cages are fitted into the trench
- Concrete is poured and as it fills the trench, the slurry is displaced and pumped out for reuse
- Once primary panels are built, soil adjacent to the panels is excavated overcutting about 150mm-250mm into the primary panels to build the secondary panels
- Same process is followed to build the secondary panels
- Secondary panels are set using concrete against the edges of primary panels giving a watertight wall

WHY

TIME SAVED | Walls built in 33 months. Conventional method would have taken 60 months

- Helped in building watertight walls
- When using stop-end method, hard rocky soil, incon-sistent trenching and water seepage through the D-wall joints posed hurdles during cage lowering in addition to taking more time to complete