

Geology of Proposed Weir Foundations of Ashwaraopally Tank, Godavari Lift Irrigation Project, Warangal District. Andhra Pradesh

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Abstract

Ashwaraopally tank envisages formation of a 1.500 km long earth dam having a capacity of 0.500 TMC, which is an up gradation of existing Pangidi cheruvu (Reservoir). The bund is located on dolerite dyke, which is intrusive into grey granite of Peninsular Gneissic Complex of Archean age along with a 48 m long weir.

Geotechnical studies helped to delineate and assess the foundation medium. Fresh and hard, dark gray, fine-grained dolerite is exposed as foundation media. Joints are tight, discontinuous and are closely to moderately closely spaced. Some of the joints are filled with quartz – calcite veins. A thin shear zone is mapped along the body wall trending N65°W - S65°E from u/s to d/s. Logging of borehole core, which falls in the shear zone display highly broken core and permeability values ranging between 70 and 90 lugeons. Loose material was removed and grouting was carried out to control the seepage of water. Proper benching was recommended to dress the steep slopes.

Introduction

Ashwaraopally tank is upgraded from existing Pangidi cheruvu which was constructed making use of existing hillocks and filling the saddle reaches in between during Kakatiya Dynasty to cater to the irrigation needs of the near by areas, to store 0.5 TMC of water as part of GLIP-Phase II. The project is planned to construct 24.5 m high and 1.5 km long earth dam in Warangal district of Andhra Pradesh. A weir of 48 m long having a maximum width of 17.857 m was proposed on the left flank between ch.252 and Ch.300 to discharge 343.585 cumecs of water to irrigate about one lakh acres of land.

The salient features of Ashwaraopally tank are

Name of Project : Ashwaraopally tank GLIP Phase II

Toposheet : 56O/5

Height of earth dam : 24.5 m

Length of earth dam : 1.500 km.

Type of dam : Earth dam.

Capacity of reservoir : 0.5 TMC.

FRL : 400.00

TBL : 404.00

Foundation Geology

The entire weir has been mapped on 1:100 scale. The excavated levels vary between RL.390.68m and RL.383.18m. The width of the body wall is 14.857m from axis and the width of bucket is 3.000m approximately.

Fresh and hard, dark grey, fine-grained dolerite an intrusive in to granitic gneisses of Peninsular Gneissic Complex of Archean age was exposed as foundation media. The rock mass is dissected by three sets of joints. Joints are tight to slightly open, discontinuous and are closely to moderately closely spaced. Quartz- calcite veins of 1.0 mm thick are observed as infillings in joints trending N75°W – S75°E and N10°W – S10°E. Curvilinear joint noticed

17m d/s between Ch.275 and Ch.285 is filled with silty sands. The foundation rock is highly jointed and the prominent joints are mentioned below.

1) N60°to75°W - S60°to75°E/ vertical.

- 2) N25°to35°E - S25°to35°W/ near vertical dips to 60°towards SE.
- 3) N5°to10°W - S5°to10°W/ 40°to45° towards NE.

A thin shear zone was mapped between Ch.278 (10m d/s) and Ch.289 (axis) trending N65°W – S65°E. A fractured clay filled open joint was also noticed parallel to the already mentioned shear zone between Ch.275 (7 m d/s) and 18 m d/s of ch.281 and remedial measures were suggested.

The core recovery percentage varies from 33% to 100% and the RQD varies from nil to 88 percentages. Permeability test conducted in these holes indicated higher values in the upper reaches and the values are decreasing towards depth. Borehole located 15 m d/s of Ch.275 has shown nil core recovery at depths 1.5 m to 6.0 m. Water pressure test indicated values between 72 and 91 lugeons. The borehole seems to have been located in a shear zone (Fig: 2).

Sub-surface explorations

Four no boreholes were drilled to explore the sub-surface geology of Ashwaraopally weir based on the preliminary examination of weir foundations. Logging of the core indicated occurrence of Dolerite as foundation media.

Insitu shear test

Insitu shear test conducted on foundation rock by Andhra Pradesh Engineering Research Laboratory, Hyderabad at ch.252 indicated $c = 70 \text{ T/m}^2$ and $\phi = 35^\circ$ and the same are assumed in the design drawings.

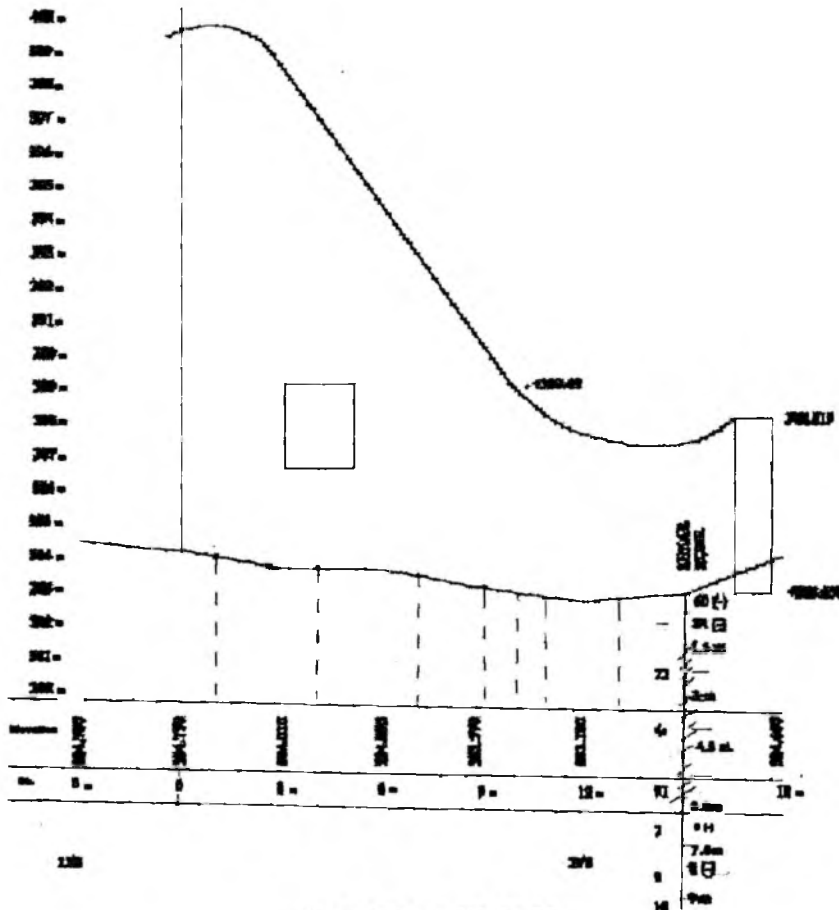


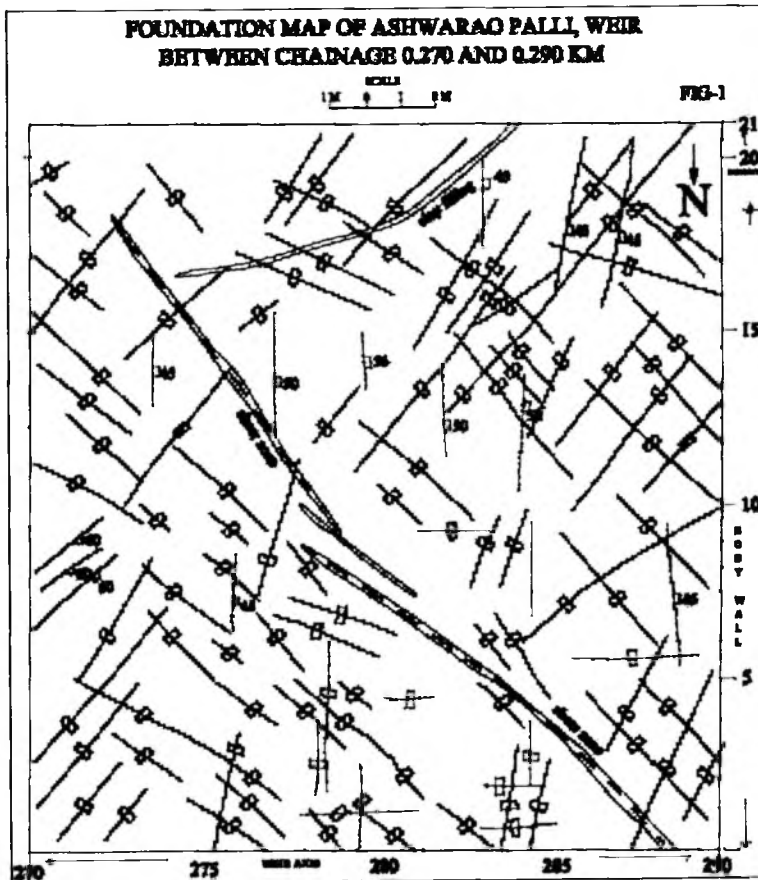
Fig. 2: C.S. at CH. 0.275

Foundation treatment and remedial measures

Two thin shear zones were mapped between Ch.275 (18 m d/s) and ch.289 (axis) trending $N65^{\circ}W \sim S65^{\circ}E$. The rock in these zones is loose, closely fractured, brecciated and filled with clay. Joints with $N10^{\circ}W - S10^{\circ}E$ trend noted between Ch.273 and Ch.280 are also filled with clay. A curvilinear joint having a general trend of $N15^{\circ}E - S15^{\circ}W$ / dipping 45° towards SE is noted between Ch.275 and Ch.285 from 17.5m to 20m d/s (Fig:1).

The following measures were taken in order to avoid seepage from this zone.

1. Removal of loose and weathered rock from this zone.
2. To excavate by twice the width of the shear zones and back fill with rich concrete.
3. Inclined grout holes were suggested at right angles in to this zone and fresh rock at deeper levels. Logging of bore hole core, which is falling on the shear fracture zone at Ch.275 m 15m d/s indicate severely/highly broken core at a depth of 1.5m to 6.0 m and the permeability data indicate high permeability values ranging between 70 and 90 lugeons in 3 m section. It is also observed that joints trending $N10^{\circ}W - S10^{\circ}E$ and dipping 40° towards SW are intersecting this zone giving rise to high permeability values and it is recommended to provide additional grout holes in the following locations.
 - 1). Ch.273.5m, 18m d/s towards $N35^{\circ}E$.
 - 2). Ch.277m, 13.5m d/s towards $N35^{\circ}E$.
 - 3). Ch.280m, 9m d/s towards $N35^{\circ}E$.
 - 4). Ch.285m, 4.5m d/s towards $N35^{\circ}E$.
 - 5). Ch.289m, 1m d/s towards $N35^{\circ}E$.



6).Ch.273.5m, 14.5m d/s towards S35°W. 7).Ch.276.5m, 9m d/s towards S35°W. 8).Ch.281.5m, 5m d/s towards S35°W. 9).Ch.286m, 1.5m d/s towards S35°W up to a depth of 10m to effectively seal the shear zones and an angle of 80° is to be maintained for the grout holes.

4. To use water jets to remove clay effectively and to back fill with rich concrete.

Proper benches are to be provided between Ch.252 and Ch260 at 10m d/s to ease the steep slopes.

Conclusions

Ashwaraopally tank is upgraded from existing Pangidi cheruvu to store 0.5 TMC of water. The weir proposed has a length of 48 m and width 16.5 m to discharge 343.585 cumecs of water to irrigate land in parts of Warangal district.

Fresh grey to black, hard and compact dolerite dyke an intrusive in to granitic gneisses of Peninsular Gneissic Complex of Archean age are exposed as foundation media. The rock mass is dissected by three sets of joints which are tight to slightly open, discontinuous and are closely to moderately closely spaced. Quartz- calcite veins of 1.0 mm thick are observed as infillings in some joints. Drilling carried out shows higher lugeons in the shear zone.

Besides the joints which are tight two thin

shear zones are mapped between Ch.275 (18 m d/s) and ch.289 (axis) trending N65°W ~ S65°E. The rock in these zones is loose, closely fractured, brecciated and filled with clay. In order to control the seepage of water through these zones removal of loose and weathered rock and grouting are carried out.

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