Construction Stage Geotechnical Investigation of Non-Overflow Dam, Kakarla Gap, Pula Subbaiah Veligonda Scheme, Prakasam District, Andhra Pradesh

T. Nagaraj
Senior Geologist
Geological Survey of India
Southern Region, Hyderabad

Abstract

The Pula Subbaiah Veligonda Project envisages drawl of water from the foreshore of Srisailam dam through a 18.8 km long twin tunnel system to create a huge reservoir known as Eastern Nallamala Sagar with a storage capacity of 58 TMC for irrigation by bridging the three geomorphological saddles viz., Sunkesula, Gottipadia and Kakarla located along the strike ridges of Nallamala hill ranges in Prakasam district, Andhra Pradesh. As an important component of the Scheme, a 60 m high and 356 m long N.O.F., dam bridging the Kakarla Gap, is under advanced stage of construction with its FRL being +244 m near Kakarla village.

The area is characterized by NNE-SSW trending structural strike ridges. The entire Non-Overflow (N.O.F) gravity structure has a length of 356 m with its TBL at +248 m being the ultimate stage. The dam site is located between Ch. (-) 46 m on Left flank to +310 m on Right flank, constituting a total of 17 blocks. These blocks have an individual Key block on either side meant for keying purpose. Fresh and hard, thin to medium bedded quartzite with intercalations of phyllite belonging to Nallamalai Group of Cuddapah Supergroup constitutes the media at the foundation grade for the contemplated structure. The litho units trend sub-parallel to the dam axis and the strike of the formation trends N25°E – S25°W dipping 60° to 65° SE, i.e., towards d/s.

Geotechnical evaluation and detailed geological mapping of foundations of the Key block located between Ch. (-) 46 and (-) 40 m and Block-1, from (-) 40 to (-) 20 m, were carried out on 1:100 scale to render suggestions, prior to laying foundation concrete. These two blocks are excavated on a rising hill with gentle slope of 30°-40°. The Block-1 is 20 m in length and extends from 5.5 to 21.2 m along the toe line from dam axis whereas it extends 0.3 to 2.5 m on heel line. The 6 m long Key block extends to 6 m along the toe line from axis. It was observed that, about 2 to 8 m of rock area was still available beyond the heel line and toe line that can facilitate proper dam butting.

The rock mass is dissected by discontinuities trending – (i) N60° to 80°E – S60° to 80°W / Vertical; (ii) N-S / Vertical, swinging by 10° on either side; (iii) N40°W – S40°E / curvilinear and (iv) Foliation joint. The joint sets are very close to widely spaced and vertical having apertures of 2 to 7 mm, at places.
The shear fracture zone located between 2.6 m d/s of Ch. (-) 40 and 6.8 m d/s of Ch. (-) 20 m is about 30 to 40 cm wide, 0.8 to 1.10 m deep and partly clay filled. It was suggested to back fill the longitudinal seams/shear fracture zones with rich concrete mix after removing the infill material. Shearing, on minor scale could be observed along the N60° to 80°E – S60° to 80°W trending joint sets, having apertures of 2 – 5 mm. Some of the minor weathered seems tend to continue discontinuously into the Key block with pinching and swelling nature.

Based on the geotechnical evaluation and the inputs from geological mapping of foundations of Left side Key block and Block-1 located between Ch. (-) 46 and (-) 20 m, it was recommended to: i) scoop out the soft clayey material occurring as infill, along the seems and properly plug them with concrete; ii) easen the 1-2 m high rock cut slopes along the d/s face with suitable berms/benches at appropriate locations; iii) consolidate the media by grouting to a depth of 12 m for Block-1 and up to 3 m depth for the Key block, with the holes spaced at 4 m interval for effectivity.