Post Construction Stage Geotechnical Investigation on Idamalayar Hydro Electric Project Idukki District, Kerala

K. Aravind Senior Geologist gsiaravind@gmail.com Abhishek Kumar Geologist abhi3383@gmail.com Geological Survey of India Chennai

Abstract

Post Construction stage geotechnical investigation was taken up to assess the cause and extent of the reported leakage in the intermediate inspection gallery, near construction block joint of 15 & 16, at Ch. 436m. Initially, it was apprehended by the project authorities that the probable reason for the seepage could be the shear zone in block 16, which coincide with the fault trace in the foundation. But, the inspection of the site revealed a different picture and is dealt briefly in this paper.

The Idamalayar Hydro Electric Project comprises a 373 m long concrete gravity dam of about 102.4 m height (from the deepest foundation level), constructed across Idamala Ar River, at Ennakkal, Idukki District, Kerala. It has 1564 m long Head Race Tunnel followed by 89.116 m high Surge Shaft and 858 m long surface Penstocks (two nos.) descending to the surface Power House of capacity 75 MW (37.5 MW x 2 nos.).

The dam foundation rests on hard and massive charnockite/gneiss, beset with minor shears/fault and joints. The rocks on the left flank are comparatively massive and less disturbed than the right flank. The regional foliation is trending N 40° to 70° W – S 40° to 70°E direction dipping 40° to 75° towards N 30° - 50° E. The foliation dips into the flanks there by suggesting an antiformal valley, with the river flowing along the axis of the fold. The rock is cut across by 6 sets of joints of which foliation joint set is prominent.

A transverse gallery has been provided, from main drainage cum foundation gallery at about 2 m left of the shear zone (as reported in the foundation mapping), to the toe in block 16, for drainage and treatment for future needs. In addition, two more longitudinal galleries, at the middle and toe area of block 12 and 16, are provided. Two reliefs

wells/reinforced shafts, in block 16 across the shear zone, was provided.

Upon inspection of lower inspection galleries (3 nos. parallel to one another) near construction block joint of 15 & 16, at Ch. 436m and the transverse gallery, no leakage could be observed in any of the block joints or in their vicinity. Inspection of the gallery, at the location of shear zone revealed absolutely no seepage from the shear zone section, except from the foundation drains and the release wells. Ironically, while there is no seepage in the lower inspection galleries, above the block joints 15 & 16, coinciding with the trace of shear zone, significant seepage has been reported from the middle inspection gallery. However, no signs of wall deformation and development of cracks justifying differential settlements in the shear zone section could be observed. It is, therefore, evident that the reason for the leakage reported in the middle gallery is not due to the shear zone or due to any other geological reasons.

The seepage and the dam water level were analyzed and the results indicated, that the seepage have stopped while the water level goes down to the level of intermediate gallery, i.e., 128.50 m. Therefore it was concluded that, the reason for seepage in the intermediate gallery is due to damage in the construction joint, between block 15 & 16 not due to any geological factor. The copper strip provided to seal the construction joints might have been corroded, giving way to the dam water to seep through from u/s face of the dam along the construction joint. Admist, it was found that most of the shaft drains got chocked due to calcinations and failed to channelise the water. It is also, presumed that the water trapped within the shaft drains have found a passage through the block joints. Measures like reaming of chocked drains and grouting of leakage loci during the lean season have been recommended.