

Geotechnical Appraisal of Post Construction Problems of Vegetikona Irrigation Tank, Kadapa Dist. Andhra Pradesh

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Abstract

The paper deals with the post-construction problem for the 9.67 m high and 2.0 km long earth dam constructed across the Vegetikona River in Kadapa district, Andhra Pradesh to store 281 mcft of water. It was not holding water since its commissioning. The studies revealed that positive cut-off for the earth dam was not provided during the construction and an upstream auxiliary cut-off in a limited stretch rests on bouldery zone.

Based on the field investigations and analysis of the available information, it was suggested (1) to raise the upstream auxiliary cut off from the bed rock level up to the right flank hillock followed by grouting the foundations. (2) to re-examine whether the already provided auxiliary cut off trench has been taken down to impervious bed rock (3) to remove the 1.20 m thick flood plain deposit formed above FRL in front of H.C. Weir, which is obstructing the surplus arrangements and (4) to study whether the existing surplus arrangements are adequate for the anticipated flood.

Introduction

It was reported that a 9.67 m high and 2.0 km long earth dam constructed in 1988 across the Vegetikona river near Settigunta village to store 281 mcft of water was not holding water since its commissioning. The Project Authorities referred the problem when the earth dam portion between ch. 1529.50 and 1567 m where the head sluice was also located (ch. 1554.87 m) got breached due to the unprecedented floods in 1996. The construction of the original bund started during the year 1963-64 and when the work was nearing completion in 1978 the bund got breached between Ch. 1120.42 m and 1173.78 m due to heavy rains and the two head sluices were washed away. In 1980, when the work in the breached portion was in progress another breach occurred between ch. 663.10 m and 693.59 m. Later, the breached earth dam portion was closed and a new sluice was constructed at ch. 1554.87 m. Later, the breached earth dam portion was closed and a new sluice was constructed at ch. 1554.87 m. The tank received water for the first time

during 1988, but the dam was not holding water for more than 30 days due to leakage. It was reported by the Project engineers that a decision was taken to provide a positive cut-off in the year 1988 for the reach from ch. 823.17 to 1054.87 m in continuation of the positive cut-off provided for the reach from ch. 621.95 to 823.17 m. However, the details pertaining to the cut-off were not available for a comprehensive analysis. Finally, in 1996, the bund got breached at the sluice at ch. 1554.87 m for a length of about 40 m.

Geology of the site

Light grey phyllites, broadly folded, belonging to Cumbum Formation of Cuddapah Super Group are exposed in the area. At the dam site exposures of phyllites are seen only in the right and left abutments and the rest of the area in general is covered either by light grayish to brown color soil whose thickness varies from 0.5 m to 2.0 m or quartzite pebbles and boulders. The strike of the foliation of the phyllites varies from N20° W-S20° E with 20° to 30° dips towards N 70°

E and swerves to E-W with northerly dips suggesting a broad synform. The earth bund was constructed across the axis of the fold.

During the breach, the overburden below the bund got washed away exposing the bedrock/ phyllite between ch. 1529.50 and 1567.00 m. The strike of the foliation of phyllites is E-W with 20° to 30° dips towards North. Predominantly, two sets of joint are noted in the strata. The first set is foliation joint dipping downstream with a dip of 20° to 30° and the second set is moderately to widely spaced joint trending in N 10° W - S 10° E direction and dips 35° to 45° toward right flank, becoming vertical at places. A 1.0 m wide closely spaced fracture zone trending N 10° W - S 10° E direction is noted between ch. 1536 and 1537.00.

Geotechnical discussion

It could not be established whether any cut-off has been provided for the entire length of the dam or not during the first construction. However, cut-off seems to have been provided between ch. 1120.42 and 1173.78 m and between ch. 663.10 and 693.59 m where breaches have occurred. But due to the fact that the dam could not hold water for more than 30 days, it was decided to provide an auxiliary cut-off on the upstream side for the entire length of the earth dam.

The project authorities informed that the cut-off trench between ch. 640.08 and 822.96 m has been taken down to fractured and fissured rock, i.e., down to R.L. 227 m. But the data from the trial pit excavated subsequent to the breach indicated that the quartzite boulders extend down to the R.L. 226 m. Therefore, it is interpreted that the auxiliary cut-off might not have been taken into the bedrock.

The reasons for non-retentivity of water in the reservoir are mainly due to ineffective cut-off and also due to pervious foundations below the bund. Examination of the foreshore area revealed that the natural top soil has also

been removed close to the earth bund, exposing underlying previous bouldery horizon for the reservoir leakage. The lateral extent of this bouldery zone in the foreshore area appears to be considerably large, occupying the central valley portion.

The present breached section (from ch. 1529.50 to 1567.00 m) reveals that no positive cut-off was provided and the bund was formed over a 10 to 15 cm thick pervious layer, which comprises kankar and pebbles. In the remaining part of the earth dam i.e., from ch. 829.96 to 1529.50 m no details pertaining to the depth and the nature of bed rock are available. The examination of the upstream and downstream area of the earth bund revealed that the pebble horizon is expected to be present below the earth bund all along the dam alignment.

Remedial measures and recommendations

In view of the non-retentivity of the water in the tank for not more than 30 days, presence of thick bouldery horizon in the central valley portion and breaching of the bund time and again, right from the inception of the project, it is suggested (I) to extend the upstream auxiliary cut-off from ch. 822.69 m upto the right flank hillock in continuation of the already laid one. The cut-off trench may be taken 1 to 2 m into the bed rock followed by grouting; (b) to confirm whether the auxiliary cut-off has been taken 1.0 m into continuous impervious bed rock in the reach between ch. 640 and 822.96 m.; (c) to strengthen the bund on either side of the present breached section i.e., between ch. 1529.50 and 1567.00 m.; (d) to remove the 1.20 m thick flood plain deposit formed above FRL in front of the H.C. Wier which is obstructing the surplus arrangements and (e) to re-examine the adequacy of the existing surplus arrangements to cope up with any exigency.