GEOTECHNICAL SITE CHARACTERIZATION AND GEOMECHANICAL ANALYSIS FOR CONCRETE DAM FOUNDATION AT MIDDLE AND UPPER PAUNGLAUNG DAMS, PYINMANA TOWNSHIP, MANDALAY REGION

PhD DISSERTATION

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MAY, 2016

ABSTRACT

The Middle and Upper Paunglaung Dam sites are on the Paunglaung Chaung which is the uppermost major tributary of the Sittaung River, Pyinmana Township, Mandalay Region. It is bounded by North Lattitude 19° 40′ 00″ to 19° 55′ 00″ and East Longitude 96° 25′ 00″ to 96° 45′ 00″. The reference map is one-inch topographic map, with index numbers 94A/5, 94A/6, 94A/9 & 94A/10. Regionally, the Middle Paunglaung dam site is constituted of Paleozoic meta-sedimentary rocks, which are divided into meta-sandstone and quartzite, and Mesozoic granite with some gneiss. Intrusive rocks intercalate with other rock types at small localities. In accordance with the results of reconnaissance investigation, six alternative sites are chosen from the viewpoint of topograph. Based on the geological and engineering geological considerations, dam site – 2 was finally selected for Middle Paunglaung Hydropower Project. Plateau limestone, sedimentary and meta-sedimentary rocks, and igneous rocks are found in the UPPL area of the five alternative dam sites (C-1, C-1.5, C-2, C-3 and D) dam site C-1 was technically selected for a major hydroelectric dam project in terms of good bedrock condition, lesser amount of excavating disposal, narrow river cross-section, and suitable design conditions for Roller Compacted Concrete Dam. The CRIEPI rock mass classification system and the Geological Strength Index (GSI) classification system are used for geomechanical analysis of Upper Paunglaung concrete dam foundation bedrock quality. Based on CRIEPI rock mass classification system, three engineering geological zones on the Upper Paunglaung dam footprint can be divided, namely slightly weathered meta-sandstone (CRIEPI grade CH), moderately weathered meta-sandstone (CRIEPI grade CM), and virtually sound granite (CRIEPI grade CH-B). The meta-sandstone rock mass has a GSI value of 50-70 or more. The granite exhibits few or no discontinuities in several stretches of the UPPL dam foundation. In these cases GSI values are in the range of 60-75 or more. When fault zones are encountered in dam foundation, the rock masses are heavily broken and brecciated. The GSI value in that case lies in the range of 25-40. The two main types of grouting which are performed at Upper Paunglaung Dam are curtain grouting and consolidation grouting. According to the water pressure test results, the flow types of water are mostly laminar flow at the study area. In conclusion, the Lugeon values at the study area are less than 2 after the grouting. The stability analysis is performed for the non-overflow section with fresh granite as foundation base using the UPPL dam cross-section geometry. The rigid body analysis is carried out based on the gravity method. The stability of the analyzed section is within the limit of the defined safety factors. The maximum and minimum principal stresses at the toe and heel are very much lower than the allowable stress of the foundation rocks. All sliding safety factors are above the required safety factors. No tension and overturning failures are observed.

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