

BII 02 Investigation of indigenous knowledge adopted in construction of Galle Fort with respect to geotechnical engineering

Ranathunga A.S.,¹ Madusanka A.D.N.C.,¹ Priyankara N.H.,² Alagiyawanna A.M.N.²

¹Graduate, Faculty of Engineering, ²Department of Civil and Environmental Engineering, Faculty of Engineering

Historical studies play a vigorous role for the progression of civil engineering. In order to put it into practise, Galle fort is the pre-eminent living heritage site within the Southern province of Sri Lanka. However, attention for the work of engineering is less, while lot of architectural investigations is in a highly active stage. Therefore, in this study, it was investigated about such ancient geotechnical engineering aspects through exploring subsurface soil profile, investigating engineering properties of backfill materials and by evaluating stability of the rampart against a rainfall induced slope failure. The sub surface soil profile of the rampart area was explored using geophysical and subsoil exploration methodologies while engineering properties of backfill materials were evaluated using conventional laboratory experiments. Further, a computer based finite element procedure was used to evaluate the slope stability of the rampart. Based on soil investigations, it was revealed that the rampart is entirely constructed on the bedrock which avoids the undesirable settlement of this massive structure with time. Portuguese constructed the rampart up to a height of 6.0m using corals which has sufficient stability against rainfall induced slope failure. With the fortification done to rampart by Dutch, increasing rampart height up to 12.0m, the stability has been significantly reduced. Then, they used a berm which has a height of 6.0m to improve the stability of the rampart indicating their knowledge on geotechnical engineering. By providing weep-holes and constructing a sloping top surface Dutch have reduced the rainfall infiltration to the soil-structure. It decreases the development of pore-water pressure within the soil-structure while increasing the slope stability. Further, by taking the advantage of bedrock dipping pattern, a moat has been constructed by Portuguese to enhance the security of the Fort. This implies the geotechnical engineering knowledge adopted in civil engineering construction even before four centuries.

Keywords: indigenous knowledge, moat, rainfall, rampart, slope stability