

Reinforced soil wall for Monsoon Palace, Aamby Valley

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ABSTRACT: ‘Monsoon Palace’ a residential dwelling unit, which was constructed at Aamby Valley City, Lonavla near North lake. The requirement was to retain the soil along the half an acre area without reducing the aesthetics of the structure and surroundings. The retention requirement was up to 21.0 m height. Reinforced soil wall (RSW) provides an aesthetic as well as an economical solution for the retention of earth / slopes as compared to the conventional RCC Wall. Reinforced soil wall can accommodate differential settlement which RCC wall can’t withstand and gets distressed with cracks. TechFab (India) Industries Ltd suggested the use of TechGrid Uniaxial Geogrid TGU of ultimate tensile strength varying from 40 kN/m to 250 kN/m. These Polyester uniaxial knitted geogrids are used as primary reinforcements to the existing steep slopes. Geomembrane was provided below the top drain to prevent any ingress of precipitation or runoff water. Design of Reinforced soil wall was done by considering the maximum possible vehicular load and other surcharge loads. ReSSA 3.0 Software was used to carry out the global stability check for the designed Reinforced soil wall.

By giving this solution of Reinforced soil wall, client has developed extra land of around 2.0 acres.

Keywords: Reinforced Soil Wall, Techgrid uniaxial geogrids, Geotextiles, Geomembrane

1 INTRODUCTION

An economical and esthetically suitable solution of reinforced soil wall was proposed and subsequently executed for privately owned large residential dwelling unit called ‘Monsoon Palace’. The structure was being built in approximately half an acre area at village Devgar, Taluka Mulshi, North Lake at Aamby Valley City, Lonavla, Pune district in the state of Maharashtra in India.

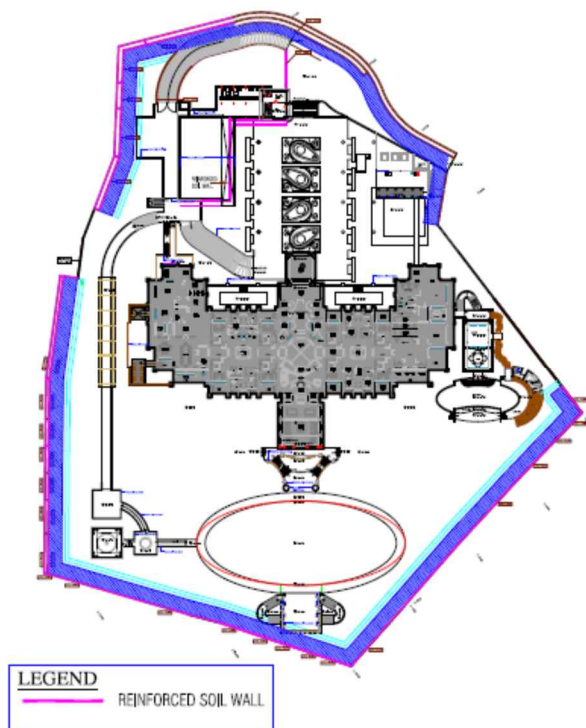


Figure 1. Plan showing location of Reinforced soil wall for slope protection.

2 PROBLEM DESCRIPTION

The Palace is surrounded by hilly terrain and running streams. Due to high embankments and steep slopes of originally slope profile, it was necessary to have a retaining structure for reinstatement purposes. Since these walls were outer walls surrounding the monsoon palace, the client and architect was willing to have an aesthetic and viable solution compared to the conventional solution of Reinforced Concrete wall (RCC).

Reinforced soil wall provides an aesthetic as well as an economical solution for the retention of earth / slopes as compared to the conventional RCC Wall. Reinforced soil wall can accommodate differential settlement which RCC wall can't withstand and gets distressed with cracks.

With consideration to the techno-economics of the project, the client/architect decided to award the project to TechFab India Industries Ltd for the proposed system of RS wall.





Figure 2. Photographs showing the ‘Monsoon palace’ and surroundings

3 SOLUTION PROPOSED

It was proposed by TechFab to use Uniaxial Geogrid of ultimate tensile strength varying from 40 kN/m to 250 kN/m. These Polyester Uniaxial Knitted & PVC coated Geogrids are used as primary reinforcements to the existing steep slopes. These Geogrids are manufactured from superior grades of polyester filament yarn with high tenacity, high tensile modulus, low creep and low shrinkage. Yarns with high molecular weight (> 25,000) and low carboxyl end groups (< 30) were used to ensure durability of the Geogrids used for this permanent structure. The knitted grid is then given high quality polymeric coating using a specially formulated PVC compound.

Inclusion of this product transforms a compacted fill into a coherent composite material. When the soil strains in response to applied loads, tensile forces are generated in the Geogrid because of the excellent interaction between the Geogrid and soil. The tensile forces developed in the reinforcement keeps the reinforced soil mass in stable equilibrium.

Geomembrane was provided below the top drain to prevent any ingress of precipitation or runoff water. Design of Reinforced Soil Wall was done by considering the maximum possible vehicular load and other surcharge loads. ReSSA 3.0 Software was used to carry out the global stability check for the designed Reinforced Soil Wall.

Different sections were designs, as per the site specific height of retention requirement. To have sufficient factor of safety for the wall, with overall stability checks, ReSSA software is used and wherever needed berms are provided after each lift of 7m. Maximum height of wall is 21 meter with three tiers, each of 7 m heights.

At the top of the embankment, for certain locations, road networks were established with 6 meter width. Considering the height of wall, back to back walls are designed for road network, as reinforced soil wall on both sides.

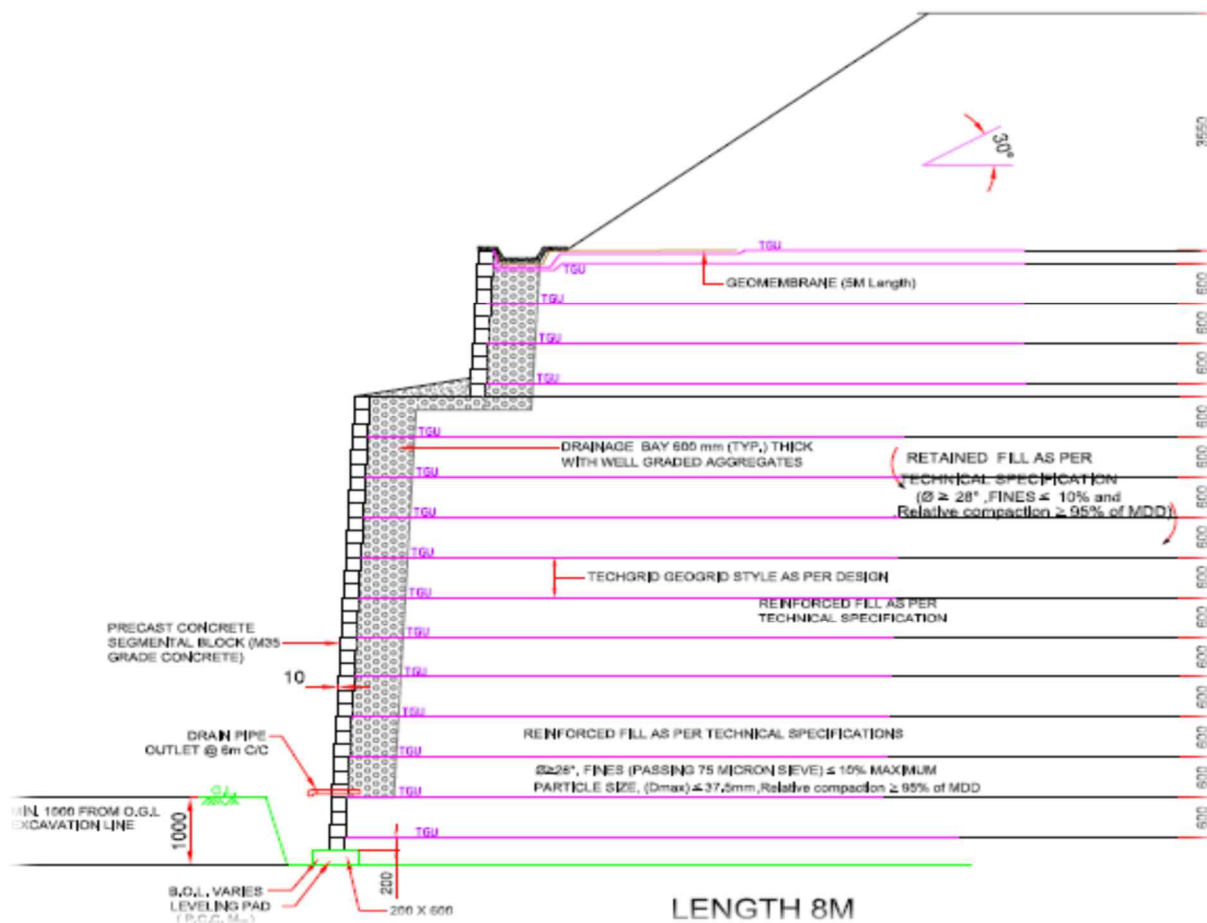


Figure 3. Cross Sectional details of the designed RS Wall

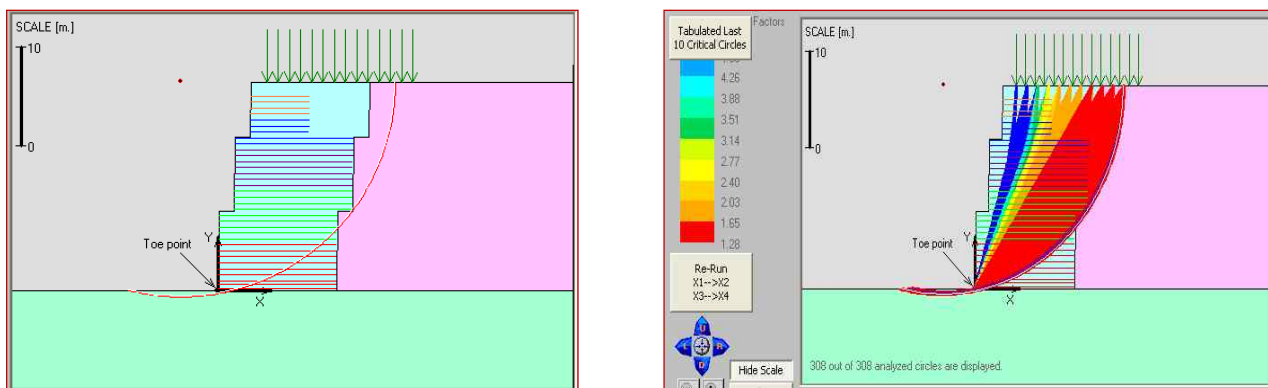


Figure 3. Factor of safety map for Global stability analysis

4 EXECUTION ON SITE

Based on the approval given by the Client / Architect for the suitability of the design and drawings the execution work was awarded to the contractor. Modular blocks were used as facia to support the reinforced / back fill. Since modular blocks are relatively smaller in size, they are easy to cast and are able to follow the curve profile as and when required. The execution was carried out stage wise as per the design and drawings furnished by TechFab India Industries Ltd.

The project was successfully completed in March 2012.





Figure 5. Photographs during execution of RS block wall

5 CONCLUSIONS

- Reinforced soil wall (RSW) have provided an aesthetic as well as an economical solution for the retention of earth / slopes as compared to the conventional RCC Wall for a residential dwelling unit.
- the use of TechGrid Uniaxial Geogrid TGU of ultimate tensile strength varying from 40 kN/m to 250 kN/m was used for reinforced soil wall constructed having height up to 21.0 m.
- These Polyester uniaxial knitted geogrids are used as primary reinforcements to the existing steep slopes.
- Geomembrane was provided below the top drain to prevent any ingress of precipitation or runoff water.