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ROLE OF GEOTEXTILE TO STABILIZE SOIL WALLS

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ABSTRACT

Geotextile-reinforced soil walls are like similar to the common sandbag walls used for different construction applications. Geotextile-reinforced wallscan be built to large heights due to the geotextile's higher strength and a simple mechanized building process. Construction work does not necessitate the use of skilled labour or advanced machinery. Since many of the materials are prefabricated, construction can be completed in a comparatively short period of time. This paper discusses about the main design factors required to considered during the reinforcement of soil walls using geotextile.

Keywords: *Geotextile, reinforced soil, backfill soil, wall stability.*

1. Introduction

Granular soil is generally solid under compressive stresses. As it is reinforced, the reinforcement can withstand high tensile stresses, resulting in a composite construction with greater strength margins. Steeper slopes may be formed as a result of this greater strength. Geotextile sheets are layered in layers around compacted earth to create a strong composite basis. Geotextile-reinforced soil walls are similar to the common sandbag walls that have been used for decades. Geotextile- reinforced walls, on the other hand, can be built to large heights due to the geotextile's higher strength and a simple mechanized building process [1]. Traditional walls can be more expensive to build than geotextile- reinforced walls. However, because geotextile application to walls is still in its early phases, long-term outcomes like as creep, ageing, and lifespan are unclear based on real-world experience. As a result, a shorter life, severe failure consequences, or expensive maintenance or replacement costs may compensate for a cheaper original cost. [2].

Before being used in essential systems, careful consideration should be given. Geotextile-reinforced walls have a wide variety of applications, from temporary road embankments to permanent barriers that successfully solve slip problems and widen highways. These walls may be built as noise barriers or as abutments for secondary bridges. Because of their adaptability, these walls may be built in areas with weak foundation or in areas prone to earthquake activity.

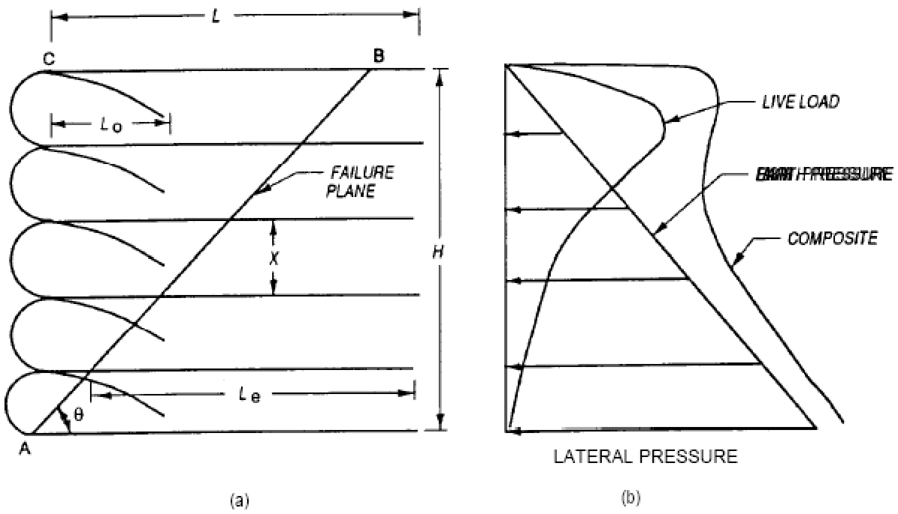

Fig. 1 General Configuration of a Geotextile Retained Soil Wall and Typical Pressure Diagrams

2. Geotextile Based Reinforced Walls

Some advantages of geotextile-reinforced walls over conventional concrete walls are given below:

a. Overall project becomes economical.
b. Construction work does not necessitate the use of skilled labour or advanced machinery. Since many of the materials are prefabricated, construction can be completed in a comparatively short period of time.
c. Support of the foundation is not needed during construction, regardless of the height or length of the wall, as is the case for traditional retaining walls.
d. They are relatively stable and can withstand significant lateral deformations as well as massive differential vertical settlements. Because of the versatility of geotextile reinforced walls, a lower factor of protection can be used for bearing capacity construction than in traditional more stable frameworks.
e. Because of the flexibility and intrinsic energy absorption ability of the coherent earth mass, they could be best suited for earthquake packing.

Following are the few disadvantages of geotextile-reinforced walls over conventional concrete walls.

a. Any reduction in geotextile strength can occur as a result of potential construction disruption.
b. At constant load and soil temperature, some decrease in geotextile strength can occur over time.

3. Design Considerations

These are the main design factors required to considered during the reinforcement of soil walls using geotextile, we can need to consider few design factors. They are mentioned below:

a. The wall face may be either upright or slanted. This may be for structural considerations, ease of construction, or architectural reasons. Since all geotextiles are evenly spaced, construction is simpler. Except for the lowest geotextile layer, all geotextile sheets usually stretch to the same vertical plane[2].
b. Geotextiles that are exposed to UV light will degrade quickly. A protective film should be added to the exposed face of the wall at the end of construction. When aesthetic appearance is significant, a low-cost solution such as a facing system made of used railroad ties or other similar materials can be used.
c. It is recommended that 1 to 2 feet of natural foundation soil be replaced with a crushed-stone foundation layer to allow drainage from inside and behind the wall to ensure the rapid removal of seeping water in a permanent structure.

4. Material Specification

a. Retained Soil

"Retained soil" is soil that has been coated with geotextile sheets. This soil must be non-plastic and permeable. The following retained soils are graded for permanent walls using the Unified Soil Classification System: SW, SP, GW, GP, or all of these as a borderline categorization that is also denoted as GM or SM. Fines in the soil are restricted to 12% after passing through Sieve No. 200. This limitation is enforced due to the possibility of fines being washed away by seeping water. Geotextile pads can trap fines, resulting in liners with reduced permeability. Permeability of retained soil must be more than 10-3 centimeters per second in general. Gravels are not at the top of the rating list. Despite their great permeability and, most likely, great power, their deployment requires extra precaution. Gravel, which includes angular grains, has the potential to puncture geotextile sheets during construction. As a result, geotextile selection must be considered in order to withstand potential damage. If a high-puncture-resistance geotextile is available, GP and GW should replace SP and SW, respectively, in their ranking order. The retained soil unit weight should be determined using standard laboratory compaction tests. A minimum of 95 percent of the complete dry unit weight, as defined by ASTM D 698, should be reached throughout construction. Because the retained soil will most likely be densified more when more layers are laid and compacted, and may be exposed to transitory external sources of water, such as rainfall, the saturated unite weight should be utilized for design reasons.

b. Backfill Soil

As shown in the above Fig. 1, the soil to the right of L is supported by the strengthened wall and is referred to as "backfill soil." This soil has a strong impact on the exterior integrity of the wall. As a result, it should be carefully chosen. Backfill standards used for standard retaining walls can be used here as well. The materials having low permeability should be avoided next to a permanent wall.

5. Conclusion

Because the qualities of the retained soil and backfill may affect the exterior stability of the reinforced wall, the qualities of both materials are required. The unit weight should be calculated in the same manner as for the retained soil, with the maximum density at zero air spaces being used. For the permeable backfill, the strength parameters should be calculated using drained direct shear tests (ASTM D 3080). The backfill and retained soil must have a comparable gradation at their contact to reduce the possibility of soil particle lateral movement. If such a requirement is not feasible, a typical soil filter or a geotextile filter should be built and deployed along the contact.

References

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