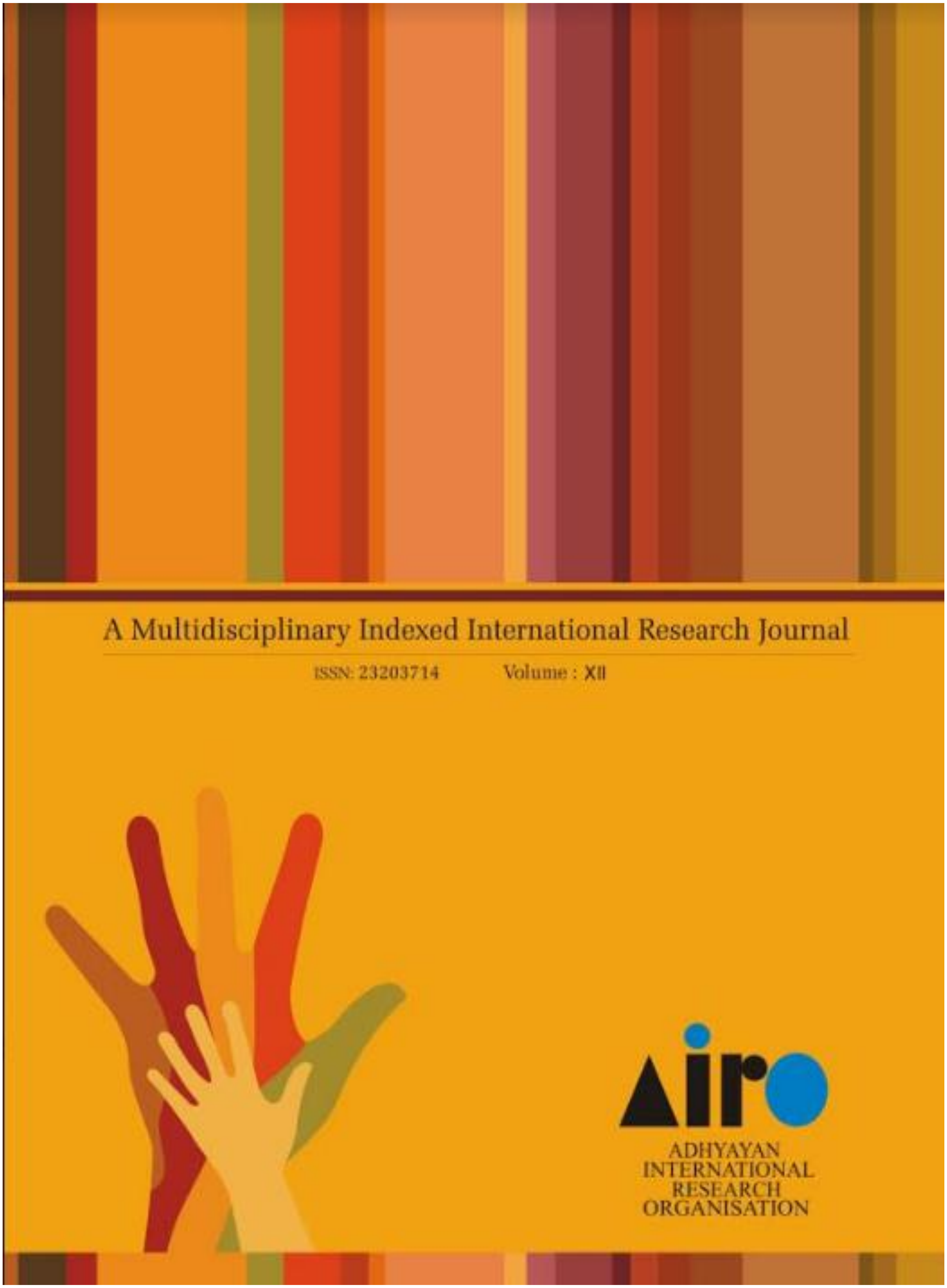
A Multidisciplinary Indexed International Research Journal
ISSN: 23203714
Volume : XII
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ADHYAYAN INTERNATIONAL RESEARCH ORGANISATION

Experimental Studies on Seismic stability of soil walls protected

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ABSTRACT: This paper provides a survey of the seismic performance of reinforced soil walls in late earthquakes using distributed case histories. Included are cases histories of dividers used to supplant regular structures that were harmed amid severe earthquakes and new construction technologies. The paper reviews late physical model testing utilizing shaking tables and abridges lessons got the hang of in regards to seismic performance and potential failure mechanisms. Contrasts in seismic response of reinforced soil walls and ordinary structures are distinguished. Logical and numerical methodologies for the uprooting and fall investigation of reinforced soil structures are compressed. At long last, the present status of point of confinement states configuration codes for reinforced soil wall structures against earthquake is audited. The formed arrangement considers the impact of the nearness of the divider and reinforcements. Solidness examinations are led to decide the required quality of reinforcements and basic slant of the failure angle. Parametric examinations outline the impacts of seismic acceleration on the plan of reinforced retaining wall and likewise the powers in the reinforcements. The power of reinforcements required to oppose coordinate sliding increment quickly as the seismic acceleration increases.

KEYWORDS: Seismic stability, soil walls, protected, construction technologies, performance, solution, reinforcements.

INTRODUCTION: The good performance of geo-synthetic reinforced soil walls (GRS dividers) amid earthquake has been reported broadly in the writing. In India, the greater seismic resistance of GRS dividers contrasted with traditional retaining wall structures has prompted their expanding use for new permanent structures and to supplant customary structures harmed in recent earthquakes. Seismic designs of geotechnical earth structures, such as slopes, retaining walls, embankments and dams, are led routinely utilizing a pseudo-static approach. The approach for holding divider configuration is the most understood pseudo-static systems. It is viewed as an earth pressure approach where the arrangement is gotten by broadening Coulomb's investigation. Pseudo-static security examination that uses a system at an endorsed disappointment plane has been tended to by a few specialists. These examinations all accept the inactivity drive due to an earthquake horizontal increasing speed for a disappointment soil mass along an endorsed plane. The primary seismic design methodology for metal strip reinforced soil structures. A planar disappointment surface was expected and a dynamic earth weight segment was added to the static component in deciding the required reinforcement compel. The geo-synthetic length and quality required to oppose these disappointment modes were exhibited in a few plan diagram. This approach does not consider lasting uprooting. Ling directed a seismic plan for outlining geo-synthetics-reinforced slopes base on a pseudo-static farthest point balance examination, which considers even increasing speed and fuses a lasting dislodging limit. Inward and outer security examination led to decide the required quality and length of geo-synthetics, considering distinctive modes of failure.

REVIEW OF LITERATURE: The analysis of the seismic limit equilibrium condition of walls retaining surcharged backfill soil is based on the following assumptions:

- The system slides from the former to the latter condition;
- The soil-wall system is long enough for the end effects to be neglected (plane-strain conditions);
- The soil is homogeneous, coarse-grained cohesion less soil; as the effect of pore-water pressure is neglected and, therefore, liquefaction is not a concern;
- The failure wedge is a plane;
- The soil-wall system can be subjected only to horizontal displacements;

- The seismic action is at any instant, constant in the whole soil-mass and wall and is directed horizontally.

The reinforced soil-wall system considered in the analysis is schematically shown in Fig. 1, where H is the backfill height or height of the wall.

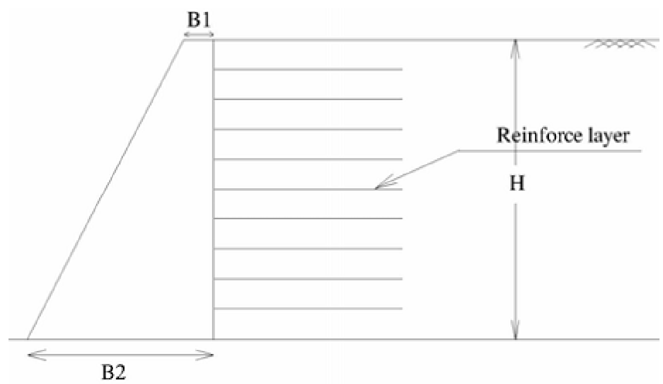


Figure 1 Reinforced soil-wall system

During earthquake the reinforced soil-wall system may either move together with the ground or move relatively respect to the ground. These two conditions are referred to as absolute motion and relative motion, respectively; the system shifting from the former to the latter condition depends on the value of the seismic horizontal $a_h = k_h g$, which k_h and g are the horizontal seismic coefficient and gravity acceleration, respectively. The geometry and acting forces of the system which considered in the analysis is shown in Fig. 2.

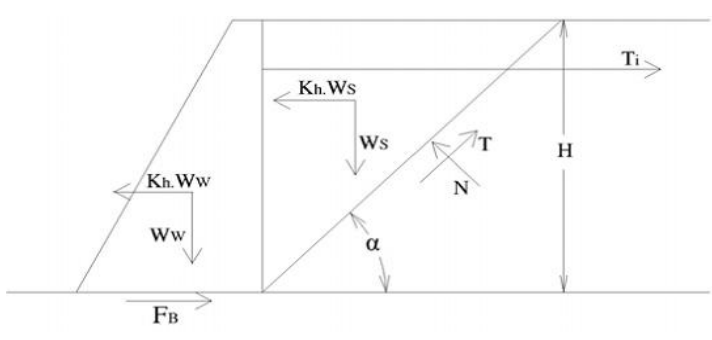


Figure 2- The geometry and acting forces of the reinforced soil-wall system

Soil Nailing: Soil nailing is a technique in which soil slopes, excavations or retaining walls are reinforced by the insertion of relatively slender reinforcing elements into the slope – often general purpose reinforcing bars. Such structural element which provides load transfer to the ground in excavation reinforcement application is called nail (Fig. 3). Soil nails are usually installed at an inclination of 10 to 20 degrees with horizontal and are primarily subjected to tensile stress. Tensile stress is applied passively to the nails in response to the deformation of the retained materials during subsequent excavation process. Soil nailing is typically used to stabilize existing slopes or excavations where top-to-bottom construction is advantageous compared to the other retaining wall systems. As construction proceeds from the top to bottom, shot Crete or concrete is also applied on the excavation face to provide continuity.

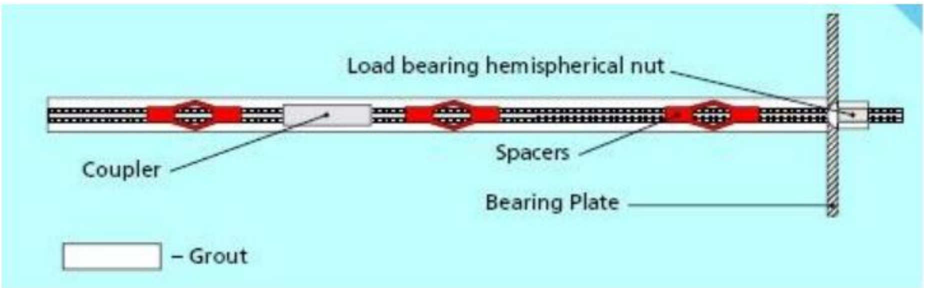


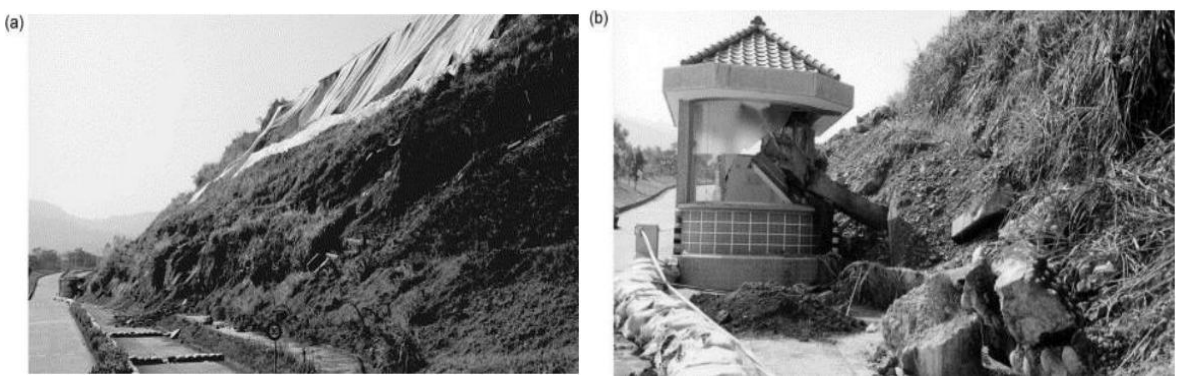
Figure 3: A typical Soil Nail

Geo-grids: A geo-grid is geo-synthetic material used to reinforce soils and similar materials. Soils pull apart under tension but geo-grids are strong in tension. This fact allows them to transfer forces to a larger area of soil than otherwise. Geo-grids are commonly made of polymer materials, such as polyester, polyethylene or polypropylene.

Figure 4: Geo-grids made from different materials

Geo-synthetics: Geo-synthetics are the for the most part polymeric products used to fathom civil engineering problems. The polymeric nature of the items makes them reasonable for use in the ground where elevated amounts of sturdiness are required. Reinforcement is the synergistic improvement of an aggregate framework's quality made by the presentation of a geo-textile, geo-grid or geo-cell into dirt or other disconnected and isolated material. Uses of this capacity are in mechanically settled and held earth walls and soak soil slopes; they can be consolidated with stone work facings to make vertical retaining walls. Likewise included is the utilization of basal reinforcement over soft soils and over profound establishments for dikes and overwhelming surface loadings. Firm polymer geo-grids and geo-cells don't need to be held in pressure to give soil reinforcement, unlike geo-textiles.

The geo-grids were utilized as reinforcement and the slope was inlayed by on location soil, which was salty clay. The incline had a wrap-around confronting. The reinforced structure was built by stacking a progression of reinforced slopes, with a reinforcement spacing of 1 m. The pictures of disappointment slope are shown thus:



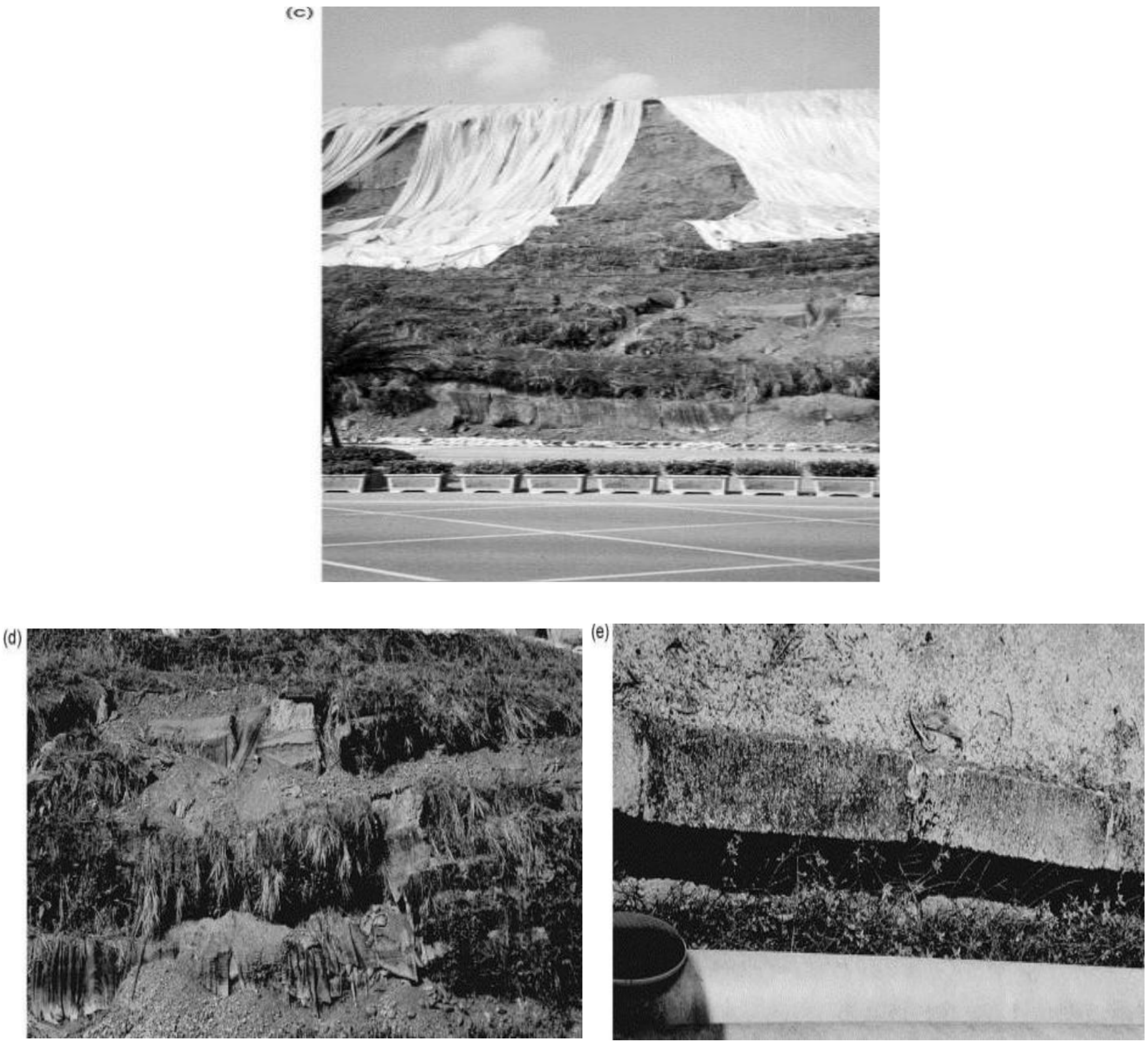


Figure 5: geo-synthetic-reinforced slope (a) side view of failure, (b) damaged security office, (c) front view of failure, (d) close view of failure showing the reinforcement and backfill soil, (e) settlement of concrete pavement along the foot of the slope

Problem: The backfill soils and concrete structures from the slope moved for more than 10 m and buried the road. The security office was damaged. A close view of the slope shows that the reinforcements are seen to pull out of the slope. Note that the concrete pavement around the site, at the foot and crest of the slope, deformed excessively. It is, however, not certain if the failure of this reinforced structure was attributed to the seismic excitation alone. Excessive deformation of this reinforced slope was reported previously following an excavation at the foot of the slope in

1994. The original configuration of this reinforced slope and the configuration after failure in 1994.

Solution: According, to paper solution of this problem is another case study of Nai Lu housing development site, Chung Hsin New Village. A 35 m high reinforced structure, located near Chung Hsin New Village, remains stable after the earthquake. The structure was composed of six multiple reinforced slopes, facing south–west. The slope has a wrap-around facing and was fully vegetated. It was the tallest reinforced soil structures at the time of completion of construction. Note that the road pavement along the slope suffered significant damage.

Figure 6: Housing development site: (a) stable geo-synthetic-reinforced slope with vegetated facing, (b) severely cracked pavement along the road to the slope

Advantages of GRS walls over conventional walls: GRS walls develop different response mechanisms while resisting large earthquake loads. For example, the more ductile response of GRS walls was noted in model tests subjected to simulated seismic loading. In most current design codes, factors of safety against prescribed failure (collapse) mechanisms are evaluated using pseudo-static methods for both conventional and GRS walls. Within this common framework the following benefits of using GRS walls may be realized:

a) Design seismic coefficients can be reduced when designing for GRS walls.

b) Minimum values for acceptable factors of safety can be varied depending on the type of wall (e.g. GRS walls or conventional walls)

c) Failure mechanisms that do not occur for GRS structures can be omitted. For example, starting with the design code for railway GRS walls with rigid facings in India, bearing capacity failure is not considered (except for extremely weak subsoil conditions). This is based on the work of that shaking table test models of these structures remained upright even when the bearing capacity of the foundation soil below the footing was exceeded.

(a) View of reinforced-soil wall and bridge pier with some horizontal undulations due to differential settlement of foundation soil

(b) View of collapsed bridge superstructure and undulation of road surface

Figure 7- Damage to Arifiye overpass bridge in Turkey during 1999 Kocaeli Earthquake

Displacement based examinations will move toward becoming more important as architects concentrate on execution based (serviceability-based) outline. It is the conclusion of the essayists that reinforced soil walls can be required to out-perform ordinary unreinforced soil holding wall structures concerning dislodging execution. All things considered, coordinate correlation of the relocation time reaction of these two different classes of structures under ostensibly indistinguishable conditions utilizing the same computational methods stays to be finished.

In addition, reinforced soil walls are for the most part more flexible than conventional walls Thus; they might be utilized as a part of zones where extensive uneven removals because of surface blaming amid earthquake events are expected. (Figure 7a) shows an approach dike of the Arifiye Bridge connect in Turkey following the 1999 Kocaeli quake. It was constructed as a reinforced soil wall utilizing metal reinforcement strips. Although the bridge connect fallen completely (Figure 7b), the reinforced soil wall survived the quake in place and stayed in benefit. The reinforced soil wall sustained huge changeless distortions for the most part because of huge differential settlements at the establishment

The good performance of this wall contrasts with the conduct of a traditional reinforced concrete divider in Taiwan (Figure 8), which fallen totally because of extensive uneven removals

Figure 8- Collapse of reinforced concrete retaining wall during 1999 earthquakes and undulation of road surface along local road

CONCLUSION: This paper has looked into a substantial assortment of work concentrated on the seismic performance, examination and plan of geo-synthetic-reinforced soil (GRS) walls. The consequences of field walls that have survived significant earthquakes and the aftereffects of model tests demonstrate that GRS walls perform well amid a seismic event when appropriately planned. This has prompted many structures staying in benefit after major earthquakes while ordinary structures have not. As a result of their good performance, GRS structures are being viewed as more oftentimes for the substitution of regular structures in reconstruction works. New holding divider innovations that incorporate geo-synthetic items are recognized in the paper – e.g. joined soil cement and geo-synthetic reinforcement layers, and geo-foam seismic buffers with and without geo-synthetic reinforcement layers. At last, the paper has featured the advance toward restrict states plan for geo-technical engineering structures. By and by, except for India, the consideration of seismic design guidelines for GRS structures inside a LSD system is slacking.

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