

# Celebrating Innovation: Mechanically stabilized Reinforced Earth Wall Construction in Opencast Mining.

## Prepared By:

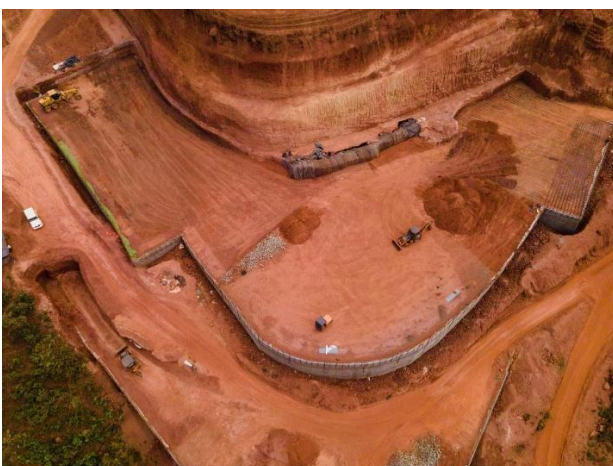
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## Introduction:

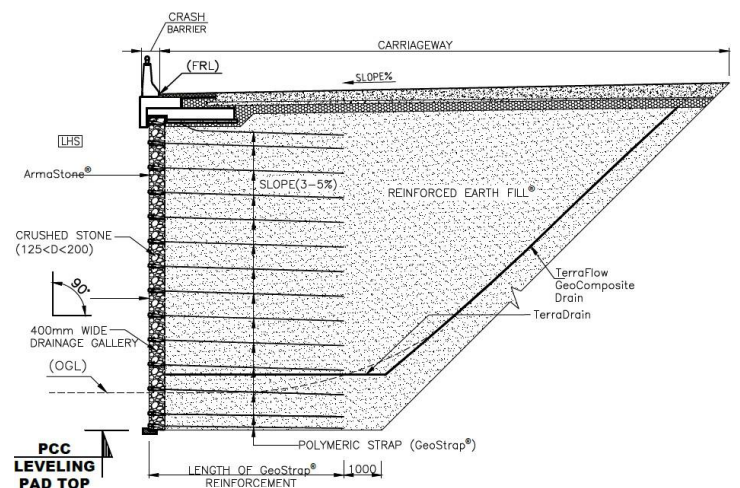
In the evolving landscape of civil engineering, the need for robust soil stabilization techniques is more critical than ever, especially in the demanding environments of mines and industrial sites. Reinforced Earth (RE) wall construction has emerged as a pioneering solution, providing the necessary stability for filled soil and supporting various structures. This article explores the significance of RE walls in ensuring safety, efficiency, and sustainability in these crucial sectors.

## Understanding Reinforced Earth:

Reinforced Earth is a construction method that combines traditional soil with high-strength reinforcement materials, such as geogrids or Geo strips. This innovative approach enhances the soil's load-bearing capacity, offering a stable foundation for diverse structures, from industrial facilities to mining operations.



[Fig-1](#)



[Fig-2](#)

## Structure and Design:

Structure and Design of Reinforced Earth (RE) walls is based on combining compacted soil with reinforcement layers, creating a stable, load-bearing structure suitable for sloped areas and open-cast mines:

- **Layered Composite Structure:**
  - RE walls are constructed with alternating layers of compacted soil and reinforcement materials, such as or Geo textile strips, embedded horizontally. This creates a composite structure that disperses loads evenly, resists lateral forces, and prevents soil deformation. These properties allow the wall to handle heavy loads and adapt to the pressures typically exerted on slopes.
- **Slope Stability:**
  - In sloped terrains, RE walls help counteract lateral earth pressure by providing additional tensile strength within the soil mass. This prevents slope failure and mitigates landslide risks, creating a stable environment, especially in high-risk, erosion-prone areas.
- **Application in Open-Cast Mines:**
  - RE walls are used in open-cast mining to create stable, terraced surfaces, supporting safe excavation and access. By reinforcing the mining slopes, RE walls help prevent wall failures and landslides, enhancing both safety and accessibility for workers and machinery on these steep, multi-tiered surfaces.

## Materials:

### 1. Use of Pads

#### **Function:**

Pads provide a stable base for the RE wall, distributing loads evenly and preventing settlement.

#### **Application:**

Base Support: Pads, often made of concrete or compacted aggregate, are placed at the foundation of the wall to create a solid and level surface.

#### **Load Distribution:**

They help in spreading the weight of the wall and any applied loads over a larger area, reducing pressure on the underlying soil.

### 2. Use of Steel Mesh

#### **Function:**

Steel mesh offers additional tensile strength to the wall structure.

#### **Application:**

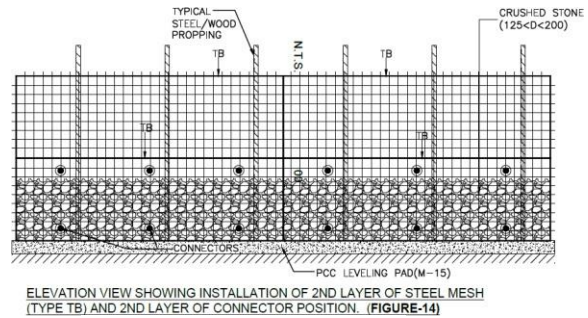
Steel mesh is embedded within the fill material or attached to the wall facing to improve the wall's ability to resist deformation and tensile stresses, especially in steep or unstable slopes.

#### **Connection to Fill:**

The mesh is used to tie together the fill material and the wall facing, enhancing the overall structural integrity of the RE wall.



[Fig-3](#)



[Fig-4](#)

### 3. Use of Coir Non-Woven Geotextiles

**Function:**

Coir non-woven geotextiles are biodegradable fabrics that provide separation and filtration.

**Application:**

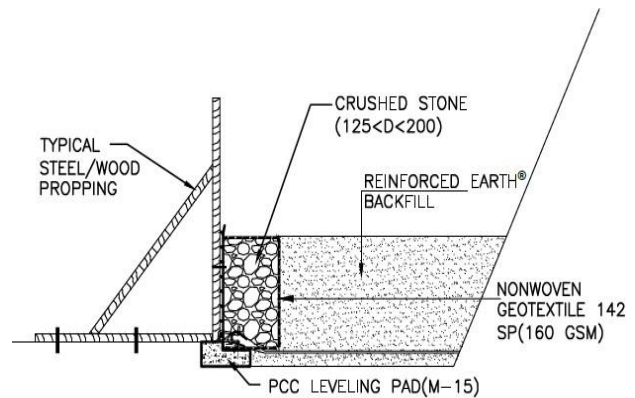
Placed between the soil and the stone fill, coir geotextiles prevent soil mixing, maintaining the integrity of both materials.

**Erosion Control:**

They help in reducing soil erosion on slopes by allowing water drainage while retaining soil particles.



[Fig-5](#)



[Fig-6](#)

### 4. Filling of Stone

**Function:**

Stone fill serves as the primary backfill material in RE wall construction.

**Application:**

Backfill Material: Durable stone aggregates are used as fill material behind the wall to provide mass, stability, and drainage. The angular shape of stone fill enhances interlocking, improving load distribution.



**Drainage:**

The voids between stone fill allow for effective drainage, helping to relieve hydrostatic pressure.



Fig-7

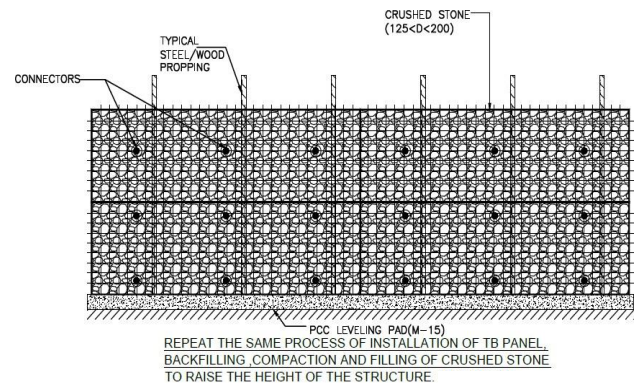


Fig-8

## 5. Laying of GeoStrap

**Function:**

GeoStrap (a type of geosynthetic reinforcement) adds tensile strength to the wall.

**Application:**

Reinforcement Layers: GeoStrap is laid horizontally within the fill layers, extending back into the slope. This reinforces the soil mass, helping to resist lateral forces and enhance stability.

**Connection to Facing:**

The GeoStrap can be connected to facing elements, ensuring that the load is effectively transmitted to the wall.



Fig-9

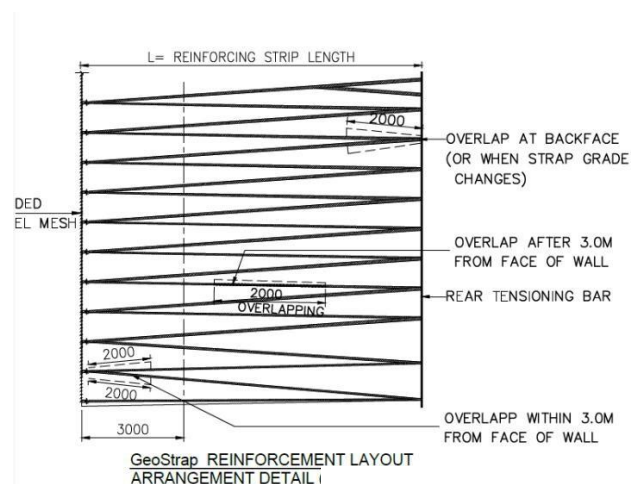


Fig-10

## 6. Use of Geocomposite Drain Rolls

### Function:

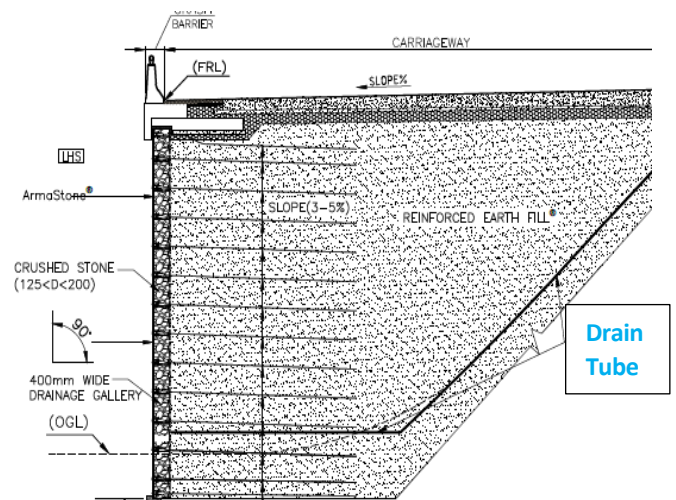
Geocomposite drain rolls combine drainage and filtration properties.

### Application:

**Drainage System:** These rolls are installed behind the wall to facilitate water drainage. They consist of a geotextile layer bonded to a drainage core, allowing for effective water flow while preventing soil intrusion.



[Fig-11](#)



[Fig-12](#)

## Implementation Plan for Using These Materials:

### Site Preparation:

Excavate and prepare the site for the RE wall, ensuring a stable base.  
Place concrete or compacted aggregate pads as the foundation for the wall.

### Installation of Steel Mesh:

Position steel mesh in areas where additional tensile strength is needed, securing it to both the fill and facing elements.

### Use of Coir Non-Woven Geotextiles:

Lay coir geotextiles over the prepared ground and around the stone fill to provide separation and prevent soil erosion.

### Filling with Stone:

Add stone fill in layers, compacting each layer to enhance stability. Ensure proper drainage within the fill material.

### Laying of GeoStrap:

Install GeoStrap horizontally within the compacted fill layers, ensuring proper overlap and connection to the facing.

### **Installation of Geocomposite Drain Rolls:**

Place geocomposite drain rolls in strategic locations behind the wall to facilitate drainage. Cover them with additional stone fill to ensure effective water management.

### **Importance of RE Walls in Mine slopes:**

In mining, where the ground can be unpredictable, the stability of filled soil is vital for safe and efficient extraction processes. The application of RE walls offers several advantages:

#### **1. Enhanced Stability:**

By reinforcing filled soil, RE walls prevent settlement and slippage, crucial for the safety of personnel and equipment.

#### **2. Support for Heavy Structures:**

RE walls provide the necessary support for heavy machinery and structures, ensuring that they remain securely anchored in challenging conditions.

- 3. Preventing Landslides and Collapses:** RE walls stabilize steep slopes, reducing the risk of landslides or sudden soil collapses that can endanger lives and equipment in both mines and sloped terrains.
- 4. Enhanced Erosion Control:** They minimize soil erosion, preventing loose rocks or debris from dislodging, which could otherwise cause dangerous rockfalls, especially in high-rainfall areas or areas with loose soil.
- 5. Stable Access for Operations:** By supporting access roads and paths, RE walls create safe, reliable routes for heavy machinery and worker movement, especially on steep slopes in mines or hilly areas.
- 6. Load-Bearing Capacity:** They are designed to bear heavy loads, helping secure heavy mining equipment or infrastructure on uneven ground without compromising stability.
- 7. Environmental Compatibility:** RE walls allow for vegetation and natural drainage, reducing environmental degradation while maintaining slope stability for long-term safety.

### **Applications in Industrial Settings**

In industries, the stability of foundations and surrounding soil is essential for various operations, including manufacturing and storage. RE walls offer multiple benefits:

#### **1. Load Distribution:**

The design of RE walls allows for even distribution of loads, reducing stress on the underlying soil and preventing structural failure.

## **2. Adaptability:**

RE walls can be customized to meet specific project requirements, accommodating various structural designs and weights.

## **3. Cost-Effectiveness:**

By minimizing the need for extensive excavation and backfilling, RE walls can significantly reduce construction costs while maintaining high safety standards.

## **The Construction Process:**

The construction of RE walls involves several critical steps:

### **1. Site Evaluation:**

Geotechnical studies assess soil strength, slope angles, load requirements, and environmental conditions to guide material choice and wall design.

### **2. Design Planning:**

Engineers develop a custom design based on findings, choosing reinforcement materials (e.g., Geo textile, Geo strips... etc) that suit the site's geotechnical needs and loading conditions.

### **3. Excavation and Preparation:**

The site is excavated to the required depth, and controlled filling is done to create a solid foundation. The base layer is compacted to stabilize the ground for wall assembly.

### **4. Placement of Reinforcement:**

Reinforcement layers are positioned horizontally within each layer of compacted soil, providing tensile strength that counteracts lateral earth pressure and slope-induced forces.

### **5. Wall Assembly:**

Modular wall panels or facing units are installed, giving structure to the reinforced soil. These components are often aesthetically designed, especially in industrial or public areas.

### **6. Finalization and Drainage:**

Proper drainage systems (such as Geocomposite Drain Rolls drain tube and gravel layers) are added to control water flow and minimize hydrostatic pressure, which enhances the wall's long-term stability.

This method results in a durable, stable, and safe wall structure, ideal for preventing landslides and ensuring safe access in slopy and mining environments.

### **Environmental Benefits:**

The implementation of RE walls aligns with sustainable construction practices. By utilizing local materials and reducing waste, this technique minimizes the environmental impact associated with traditional construction methods. Moreover, the design can incorporate greenery and landscaping, promoting ecological balance at industrial and mining sites.

### **Conclusion:**

Reinforced Earth wall construction stands as a testament to innovation in soil stabilization, addressing the unique challenges (space constraints) faced in mines and industrial applications. Its ability to enhance stability, support various structures, and offer cost-effective solutions makes it a vital component of modern civil engineering. As industries strive for safer and more sustainable practices, RE walls will continue to play an essential role in shaping the future of infrastructure development without using steel and concrete.

