

Technical Article-24

SLOPE STABILITY IN OPEN CASTMINE

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SLOPE STABILITY IN OPEN CAST MINE (SOIL NAILING METHOD)

ABSTRACT

Slope in open cast mines undergoes many considerations like loose soil slopes, low rock mass strength, water pressure, high water table, pore pressure within the soil, steepness of slopes, fractures etc., for improve the stability of slopes we adopt engineering techniques. Those techniques aim to increase the stability.

DEFINITION

Soil nailing is a remedial construction measure to treat unstable natural soil slope or unstable man-made slopes as construction technique that allows the safe over steepening of new or existing soil slopes.

APPLICATIONS

- ❖ It is used to reinforce and stabilize the slope of soil and retaining walls.
- ❖ Soil nailing is done for widening roadways, railway embankment, landslides, and floor protection on the bank of rivers, highway embankment, cutting etc.
- ❖ It is used for retrofitting and construction the bridge abutments.

LITERATURE AND PREVIEW

The technique involves the inserting of relatively slender reinforcing element in slopes. Solid bars installed in per-drilled holes on slope. Solid bars installed using drilling technique are usually fully grouted and installed at a slight downward inclination with bars installed at regular spaced points across the slope face. Alternatively, a flexible reinforcing mesh be held against the soil face.

INTRODUCTION

Soil Nailing technique process:

- ❖ Excavation for installing the nail ground surface.
- ❖ Drilling is done for designed cut heights.
- ❖ Nails are driven into drilled holes.
- ❖ Bond is made between nail ground using grouting material.
- ❖ Installation of soil nail head plate.
- ❖ The construction phase of shotcrete on soil nail face with wire mesh or reinforcement if required.

Types of soil nailing methods

I. Drilling and grouted soil nailing method:

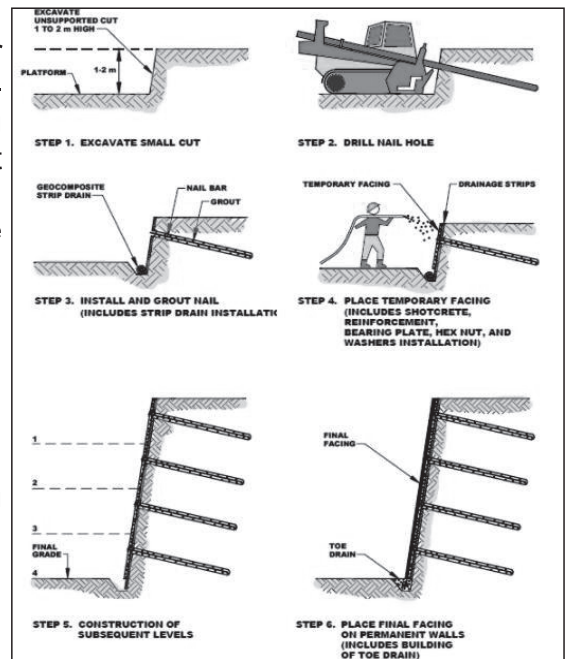
- In this method, in naturally or excavated slope face
- With help of drilling machine holes are made
- Nails are inserted in these drilled holes with grouting materials concrete or shotcrete in the spacing interval of 1.5m using (100-200mm) diameter nails.
- The reinforcement for temporary facing wire mesh shall be placed.

II. Driven soil nailing method

III. Self-drilling soil nail method

IV. Jet grouted soil nailing method

V. Launched soil nailing method.





(Figure-01 : Drilling)



(Figure-02 : Nail installation)

### **MACHINERY USED FOR SOIL NAILING**

- I. Rotary machine with a downhole hammer.
- II. Air compressor
- III. Grout mixer
- IV. Grout pump (for shotcrete)

### **METHODOLOGY**

#### **ANALYSIS**

The soil should be able to stand unsupported one to two meters high for a minimum of two days when cut vertical or nearly vertical and all soil nails within a cross section should be located above the groundwater table.

1. For considering soil nailing first, the existing ground should be examined.
2. Advantages and disadvantages for a soil nail wall should be assessed for the particular application being considered.
3. Cost of the soil nail should be considered.

### **COMPONENTS**

**SOIL NAIL:** This component includes tendon, grout, and corrosion -proof soil nail.

**Tendon:** Tendon is a ground-reinforcing element like a steel (hollow or solid) bar that is inserted behind a soil nail wall.

**Grout:** Grout is used for transforming the shear and tensile stresses from tendon to the ground to increase the stability. Portland cement and water are used to be placed in drilling holes under gravity by using the tremie method.

**Corrosion Proof:** For long-lasting, the soil nail should be protected against corrosion.

To protect the soil nail from corrosion, it is encapsulated by a sheath of a fusion- bonded epoxy coating or galvanization.

#### **1. OTHER COMPONENTS:**

Other components like nut, bolts, washers, bearing plates, and headed studs are embedded with soil nails. There should be proper drainage system around soil nailing site using ground anchors, geosynthetic material, and so on.

#### **Types of soil nailing methods**

##### **1. Drilling and grouted soil nailing method:**

- e) In this method, in naturally or excavated slope face With help of drilling machine holes are made
- f) Nails are inserted in these drilled holes with grouting materials concrete or shotcrete in the spacing interval of 1.5m using (100-200mm) diameter nails.
- g) The reinforcement for temporary facing wire mesh shall be placed.

##### **2. Driven soil nailing method**

3. Self-drilling soil nail method
4. Jet grouted soil nailing method
5. Launched soil nailing method.

**ADVANTAGES**

1. Shotcrete facing is economical.
2. Cost-effective method for durability and stability of slope soil failure.
3. It can be applied for relatively large area.
4. It is suitable for various application like temporary excavation shoring, tunnel portals, repairing of failure structures, etc.
5. Installation process takes less time.
6. It has less impact on the environmental system.
7. It uses fewer materials and machinery.
8. It has no height limitations.

**DISADVANTAGES**

1. Unsuitable for high water table areas.

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