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# soil stabilization by using soil nailing system

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## Abstract:

Soil nailing is a relatively new method, which has been used for over 3 decades for soil reinforcement purposes. It is an in-situ card reinforcing method, in which the primary applications are to retain excavation or cuts and to stabilize slopes. The principal reinforcing materials, the nails, are inserted into the earth as passive inclusions providing reinforcement to the earth that help the earth structure to gain its overall strength, which makes soil nailing technique more desirable than other earth reinforcing methods when performed on cuttings or excavations, is its easy and flexible top-down construction (excavation, nail installation and placement of shortcrete). In this paper, I tried to gather and study some research papers for proper analysis of application of in situ soil nailing and properties of soil nailing.

**Keywords** — Soil nails, Stability of slopes, Inclination of slopes, Loose fill, Type of soil, Shear strength.

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## I. INTRODUCTION

Soil nailing is a construction remedial measure to stabilize ground and usage of this method could be effective to bring more stability to structure and reduce chances of failure. It's developed from New Austrian Tunneling method. The first round of this method was applied in 1972 railroad widening project near Versailles, France in 1975 And 1976 Germany and USA used this method respectively. The existing slope is reinforced and

strengthened by embedding steel bars called soil nails into the slope. In this method, the construction proceeds from top to bottom which is useful where the ground is excavated in lifts of limited height.

Soil nailing is in-situ soil reinforcement method and the construction procedure is installing nails to the particular excavated soil, this method used from more than 30 years and vast investigation of researchers shows soil nailing is economical

procedure as compare to other methods to stabilize soil slopes.

## II. SOIL NAILS –

Soil nailing is a technique in which soil slopes excavation or retaining walls are passively reinforced by the insertion of relatively slender elements normally steel reinforcing bars. Such structural elements which provide load transfer to the ground in excavation reinforcement application is called nail. 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 system. As construction is advantageous compared to the other retaining wall systems. As construction processed from the top to bottom shotcrete or concrete is also applied on the excavation face to provide continuity. Depicts cross section of a grouted nailed wall along with some field photographs of the same. In the present soil nailing is being carried out at large in railway construction work for the stabilization of side slopes in existing track-road or lying of new track adjoining to an existing one.

Soil nailing method used more spaced is not available in hilly area and railway tract. Angle of

repose is depending type of soil.

## III. APPLICATION OF SOIL NAIL WALL

### 1) Highway in soil nailing



### 2) Railway in soil nailing



## IV. SYSTEM DEVELOPMENT

Present study of different location in soil stabilization by using soil nailing system and comparative study of these locations. Comparative study of four site location there are compare the all parameters different types of technique is used and result is given of this projects all four site location in some parameters is same parameter.

## V. Selection Of Location

- 1) Bhutan
- 2) Punjab
- 3) Bangalore
- 4) Haryana

## VI. Comparative Study On 4 Different SITE LOCATION

Comparative study on four different site location Comparative study of four site location there are compare the all parameters different types of technique is used and result is given of this projects all four site location in some parameters is same parameter.

PARAMETERS	BHUTAN	PUNJAB	BANGLORE	HARAYA NA
Types of soil	Clay and silt	Under laying soil	Gravel silt	Natural gravel soil
Angle of repose (degree)	35°	25°	30°	35°
Height of structure	4 to 7m	7 to 10m	8m	5 to 8m
Nail length	700mm	100mm	500mm	700mm
Nail diameter	25mm	20mm	20mm	25mm
Nail depth	0.75m	0.75m	3.75m	6.75m
Factor of safety	2	1.3	1.35	1.3
Nail spacing	10° to 20°	10° to 20°	10° to 20°	10° to 20°

## VII. RESULT

The result section present the actual findings of the study .you also will read a description of the system development how the all locations are try to nailing in different soils and what is the result of that nailing where we start the soil nailing. We might see the summary of the all locations and their processes how we nails the soil in different techniques and methods also the various types of soil we have seen and how the nails are with different parameters is used in this nailing system .The studied parameters include the slope angle, shear strength of the angle slope, soil nailing length, number of soil nailing and the stiffness soil nailing. In present study we are doing case study of four different sites where already soil nailing system has been used and we will analyses of this case study in terms of types of soil, shear strength, angle of repose, and factor of safety for slope.

### RESULT AND DISCUSSION

- 1) Detail study of location for the present choosing first location in Bhutan is soil stabilization the type of soil in Bhutan is clay and silty soil and the angle of repose in Bhutan is 35°. This is about the safe bearing capacity. And drill hole diameter is 100 to 200mm. nail spacing is 10° to 20°
- 2) Clay soil is the more angle of repose because friction of this soil is more as compare to other location. Factor of safety Bhutan is more other location compare because soil of Bhutan is clay silty soil this soil Water is present of clay soil.

Height of retaining wall Bhutan is 4 to 7m.

3) The second location is Punjab. Type of soil in Punjab is under laying soil under laying soil means gravel soil angle of repose is  $25^\circ$ . Factor of safety is 1.3 is less than of Bhutan because this soil is gravel soil.

4) Height of this road side wall is 7 to 10m. Used element in soil nailing steel bar, centralizer, grout etc.

5) Third location is Bangalore type of soil is gravel silt soil and the soil angle of repose is  $30^\circ$  and factor of safety 1.35. Is more than Punjab because the soil is silty gravel soil. Retaining of hotel complex wall height of this wall is 8m.

6) Fourth location is Haryana. Type of soil Haryana is natural soil and angle of repose is  $35^\circ$ . Height of the structure is 5 to 8m. The soil-nailed retaining wall is considered to be effective in hilly regions.

7) This paper presented a case study in which soil-nailed wall was designed and constructed. The soil nailing was done in a complex ground conditions having both soil cover and weathered hard rock. The pull out test conducted has confirmed that the designed nail capacity.

8) Material used for nailing system is steel reinforcement, grout mix, shotcrete.

9) Machines used for soil nailing system is drilling equipment, compressor, grout mix equipment, Shotcreting Guniting Equipments.

10) Initial excavation is carried out to a depth for which the face of the excavation may remain

unsupported for a short period of time e.g. 24 to 48 hours.

11) Depth for each excavation reaches slightly below the elevation where nails will be installed

12) All location are different height of wall and present study of this location. This location is not all parameters.

### **VIII. CONSTRUCTION PROCEDURE OF SOIL NAILING.**

- i. Excavating of soil.
- ii. Drilling of holes.
- iii. Installing Soil nails and grout.
- iv. Shotcrete installation for soil surfacing.
- v. Construction of top and bottom sequentially.
- vi. Providing final facing for aesthetic look.

### **IX. APPLICATIONS –**

1. Landslide remedial.
2. Railway embankment.
3. Roadway widening under existing bridge.
4. Stabilization of existing retaining walls.

### **X. OBJECTIVES OF PROJECT –**

1. Soil nailing stabilization is good as compare to the types of stabilization.
2. It can resist dynamic load.
3. Stabilization of soil used by nail is improving the soil workability.
4. To reduce moisture susceptibility of fine grain soil.
5. Soil nailing stabilization can be providing

where inclination is 10 to 20.

## XI. CONCLUSION –

- 1) Comparative study of four site location there are compare the all parameters different types of technique is used and result is given of this projects all four site location in some parameters is same and different parameter.
- 2) The soil-nailed retaining wall is considered to be effective in hilly regions. This paper presented a case study in which soil-nailed wall was designed and constructed.
- 3) The soil nailing was done in a complex ground conditions having both soil cover and weathered hard rock. The pull out test conducted has confirmed that the designed nail capacity.
- 4) Cost analysis performed by comparing the designed soil-nailed wall and conventional retaining wall for this site indicated that the soil-nailed wall was economical for the present case study.
- 5) Thus this method proves to be more efficient in retaining steep slopes where very less space is available for construction of conventional retaining walls. Soil nailing is embraced by practicing engineers as a highly competitive well proven technique.
- 6) Soil nailing has certain similarities to both reinforced earth and anchoring, although its particular operating principles and construction methods give it a firm and

distinct identity.

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