

A Soil Nailing Wall Slope Engineering Measures

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Abstract. The soil nailed wall is for slope stability and foundation pit excavation of a soil retaining structure, the combination of soil nails and prestressed anchor rod form a composite soil nailing wall structure. According to soil nailing - combination of prestressed anchor and soil, in a certain county shanbei slope support engineering, make significant optimization of the supporting design of slope, guarantee the stability of slope supporting and security and the surrounding environment, providing a reference for similar geological engineering slope supporting role.

Introduction

Soil nailing wall is made of natural soil by in situ soil nail wall reinforcement and combined with shot crete panels, forming a similar gravity retaining wall to resist wall earth pressure, so as to maintain the excavation face stability, the soil retaining wall is called the soil nailing wall. Mechanism of soil nailing wall and the traditional retaining structure is different, the traditional retaining structure based on passive restriction mechanism, namely the retaining structure of its own strength and stiffness, bear the following lateral earth pressure, while the soil nailing wall is placed in the body by soil with a certain length and density of soil nail. The interaction of soil nail and soil, formed can greatly improve the undisturbed soil strength and stiffness of composite foundation, and can significantly improve the overall stability of soil slope. The practice of soil nailing wall with reinforced tunnel reinforce the rock mass with a case study of ore is similar, therefore, also known as a case or a case retaining wall slope reinforced[1~4].

Soil nailing wall has its own unique advantages: simple structure, high bearing capacity, safe and reliable, strong applicability, low engineering cost. But also has its own shortcomings: in mud, sand, or construction difficulties, in sandy pebble soil rich in groundwater in the geological construction difficulties.

The mechanism of soil nailing wall supporting

At present is to simplify the soil nail wall supporting role for stem cell treatment. Stem cell only considering soil nail axial tensile (pressure)

To use. Calculation, will generate additional stiffness of soil nailing (anchor) superposition to the corresponding unit stiffness matrix of soil, to reflect soil nailing (anchor) on soil deformation constraint function, for buried in the soil in any direction of soil nailing (anchor), if known its direction cosine,,, according to theory of finite element balance equation of soil nail unit nodes

$$[K_e]\{\delta\}^e = \{f\}^e \quad (1)$$

Type: $[K_e]$ for soil nailing (anchor) element stiffness matrix; $\{\delta\}^e$ as a unit node displacement array; $\{f\}^e$ as a unit node load array.

Due to soil nailing (anchor) at both ends, buried in soil mass unit, respectively, according to the theory of finite element interpolation and virtual work far away from the soil nailing can be obtained (anchor) on soil stiffness matrix of "contribution", the "contribution" is due to soil nailing (anchor) of the additional stiffness matrix produced by soil $[K_e]_a$, its value is

$$[K_e]_a = [N]^T [K_e] [N] \quad (2)$$

Type: soil nail (anchor) to add the element shape function matrix, its expression see literature [5].

The additional stiffness matrix superposition in the unit stiffness matrix of soil, soil nail (anchor) is obtained and the unit stiffness matrix of the:

$$[K_e]_c = [K_e]_s + [K_e]_a \quad (3)$$

Soil type in the element stiffness matrix expression is as follows:

$$[K_e]_s = \int [B]^T [D_{ep}]_s [B] dV \quad (4)$$

Soil type for the elastoplastic matrix, expression as shown in literature [6].

Under the support of shear strength of soil after using type:

$$C_1 = C_0 + \eta \frac{\tau_s}{ab} \quad (5)$$

Type: the bond strength of the soil to support before; Compressive force of the soil to support after; For soil nailing material shear strength; For the soil nailing cross-sectional area; For the soil nailing longitudinal and transverse spacing; For strengthening coefficient, generally preferable 2 ~ 4[7、8].

The engineering application

Project summary. Shaanxi a county town east village, is apart from the city is about 1.00 km, geomorphic unit II level terrace in the left bank of the yan, a company in the east, north to Jurassic rock slope and gully topography, bare cliff rock part, the west is a resident of caves and roof, open terrain, the transportation is convenient, the rock slope stability. High terrain north south low, elevation, the north cliff exposed area of 287.00 m, soil cliffs and gullies area 120.00 m long, cliff face height 10 ~ 27.0 m, the step of irregular distribution. Half old cave partly dismantled, col residents mostly residues, implement the cliff slope protection engineering must carry on filling and slope protection, gully area having a unified construction and drainage culverts, slope protection engineering method USES the framework of prestressed anchor - the new structure, soil nailing wall thickness of 0.2 m[9~10].

Soil nailing wall design. According to the result of calculation analysis, soil nailing wall steel grid USES 1.5 x 1.5 m, soil nail length is 5.0 m, 120 mm in diameter, 15 ° downward sloping, soil nail master jin 1 Φ 16, panel steel fabric φ 8 @ 150, both inside and outside configuration, 200 degrees, use C30 concrete system of the model on site, spacing of 15.0 m for a deformation cracks, table 20 mm thick cement mortar layer, flour and decorate a certain geometric patterns, combine the mountain slope protection and beautify the environment better. The specific scheme layout as shown in figure 1 ~ figure 4.

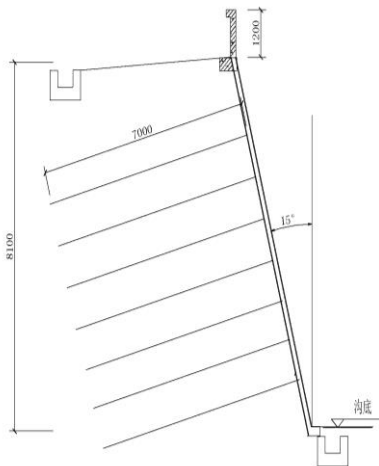


Figure. 1 soil nail wall governance cliff face profile

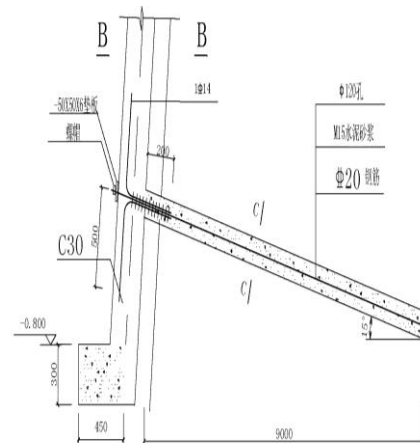
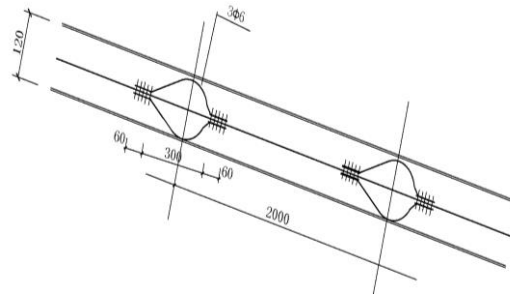
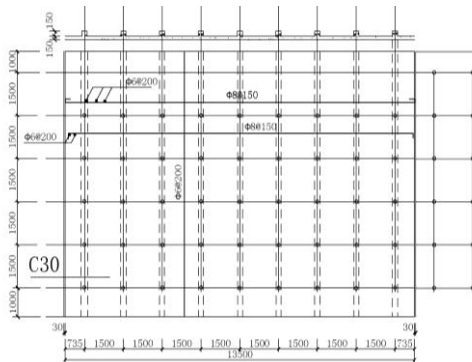


Figure. 2 soil nail wall profile



The construction points for attention

Soil nails into a hole. Flat section size, as shown with the luoyang shovel people into hole, parallel operation must be monitored at any time during the process of drilling hole Angle and diameter, try to protect the natural state of slope, don't cut the soil in order to level off.

Nail hole grouting. Whether steel in strict inspection before brush anti-rust paint, using circular stirrup auxiliary u-shaped steel hanger after nailing reinforcement fixed at the center of the hole, using gravity type low-pressure perfusion pressure (< 0.5 MPa). With catheter starting at the bottom of the grouting, grouting tube at the same time, at a constant speed slowly withdraw, catheter pulp outlet should always be in a hole in the slurry under the surface of 200 mm, that all escape hole gas energy. Grouting with M15 cement mortar, water cement ratio should be controlled within the range (0.4 ~ 0.45), and appropriate adding suitable amount of hardener, promote early coagulation and bleeding. Construction when slurry flow can not meet the requirements, can be coupled with high efficiency water reducing agent, it is strictly prohibited to any increase in water consumption. Slurry slump should be controlled between 180 ~ 200 mm, stir well immediately after put into use, the midway stop or job after rinse off with clear water.

Panel installation. Grouting is completed at least 3 days, slope shovel, concave slope fill. Pouring amount in case of soil nail reinforcement concrete, ensure the steel anchor in concrete. Panel only lateral branch mode, inside the slope is to ensure that the thinnest place concrete 150 mm. Nail reinforcement holes at outcrop pattern for concrete design strength after tighten the nut. Expansion joints in asphalt sand plug.

Material. Soil nail reinforcement with three-stage steel, diameter of 20, the end of 500 mm within the scope of brush anti-rust paint twice, 60 mm within the scope of the processing thread. Appropriate USES lap welding, double-sided welding, welding seam is not less than 80 mm, grouting to the orifice of about 500 mm when to stop, to switch to the best of 3:7 lime soil moisture content block, hammer close-grained.

All metal components are brush anti-rust paint two times before installation, after the completion of repair brush again. Panel adopts C30 ready-mixed concrete in situ.

Soil nail reinforcement pull-out test. According to the actual construction method in adjacent slope position over 6.0 m, 8.0 m, 10.0 m, 12.0 m pull-out test. The test results report design units in a timely manner.

Conclusion

Through shaanxi county soil nail wall slope protection calculation, construction technology, construction quality detection method research, in the whole construction. Process , soil nail wall supporting structure deformation is not big, does not appear dangerous, and eventually to stabilize , and find the maximum horizontal displacement is not appear on the top of the soil nailing wall,

because of the slope soil inhomogeneity, it is to early settlement of soil nailing in the subsequent play a role in the construction process. This project not only overcome the influence of project itself and the engineering geological conditions and the economic and efficient. Through the application of soil nailing wall retaining structure, providing a certain reference for the similar geological conditions of project value and function.

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