



A REVIEW OF METRO TUNNEL CONSTRUCTION

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ABSTRACT

The construction of tube tunnel is restricted by geologic conditions. Therefore, it is necessary to choose AN acceptable construction technique that suits the native conditions. This paper summarizes 3 major methods of tube tunnel construction, together with their principles, processes, applicable conditions, strengths, weaknesses, and latest developments. This paper aims to produce relevance depot constructions and related research project.

1. INTRODUCTION

Metro is one in all the most public transports carrying most of the commuters in major cities due to its blessings like potency, safety, convenience and then on. Major cities area unit unending increasing their underground system to satisfy the increasing demands of commuters, thus a lot of and a lot of metros area unit being made.

It is necessary to pick out the acceptable technique of construction for every project. The choice ought to be created supported the attribute of every project, and to satisfy each to perform of the underground engineering itself and also the demand of exploiting and utilizing the helpful house of each higher than and below the bottom. At identical time, the negative effects to surroundings brought by the underground construction ought to be reduced. Choice for construction technique has Brobdingnagian impact on the road embedment, the structural type of underground station and also the construction amount can directly influence the value of the project and also the edges in society, economy, and environmental protection any. There area unit 3 main construction ways that area unit wide employed in the underground construction each reception and abroad, particularly the Cut and canopy technique, New Austrian Tunneling technique, protect technique. The mix and innovation ways of underground construction area unit chiefly supported the higher than ways. In observe, it's necessary to spot the character and application condition of every technique to pick out the foremost appropriate construction technique for the project. During this paper, a review of the 3 ways is conferred to assist engineers gain an additional understanding to those ways.

2. CUT AND COVER METHOD

2.1 Introduction:

Cut and canopy methodology is AN underground construction methodology that starts from the bottom. The excavation is up-to-down from the basement to the designed elevation, then the foremost structure of the tunnel is made from the lowest to high. Finally, the development was complete with backfilling the muse pit or restoring the bottom. The cut and canopy methodology is classified to 2 modalities in keeping with the excavation method: unsupported slope excavation and supported foundation pit excavation. The unsupported slope excavation occupies an oversized space. Whereas within the case of restricted website conditions, measures to bolster the facet wall of foundation pit square measure required to ensure the security of the facet walls and close buildings, that is supported foundation pit excavation..

2.2 The advantages and disadvantages:

The advantages of cut and canopy technique lie its easy and economical technology and a well stressed main body. The first alternative of underground construction once there's no limitation on ground traffic and atmosphere as a result of the subdivision and coincidental construction will be achieved once required. However, it's obvious disadvantages: 1) it'll block the traffic for a protracted time; 2) the noise and vibration have nice impact on urban traffic and residents' lives; 3) it's tough to regulate the land subsidence caused by the excavation of deep foundation pit in saturated soft soil stratum. The application of cut and canopy technique is expounded to several factors, together with the encircling conditions, engineering earth science, hydrologic earth science, the depth of works and its technical and economical indications. Within the railroad line station construction, the cut and canopy technique is especially employed in the subsequent 2 conditions: 1) Shallow buried underground engineering with the thickness of the covering soil of those comes being concerning 5-10 meters; and 2) Underground engineering with giant plane size. For such comes, partial excavation or trench excavation is typically adopted in cut and canopy technique.

2.3 The technical development:

With the progress of scientific technology and therefore the technical level of construction, the cut and canopy technique has been greatly improved within the following aspects [1]:

- 1) Exterior-protected structures. The categories of support for choice embody steel sheet piles, board piles, concrete ready-made sheet piling, column kind board pile, dig pile, cement intermixture pile, soil anchor, soil nail and underground continuous wall.
- 2) Supporting system. There are a unit 2 main classes of support structures, specifically internal support and external pull anchor, and lots of new sorts may well be used for every class. as an example, internal support currently includes steel braces, concrete braces, purlin and column braces.
- 3) Groundwater management technology. Once the cut and canopy technique is applied in areas with high formation, evacuation strategies embody clear evacuation, blind ditch technique and artificial tubing dewatering.
- 4) Technology of canopy excavation. It's excavated from the bottom to an explicit depth, so closes the highest half and therefore the remainder of the lower half is built beneath the closed roof. the duvet excavation technique is adopted to beat the shortage of moving the bottom traffic in Cut and canopy technique.

3. NEW AUSTRIAN TUNNELLING METHOD

INTRODUCTION

The New Austrian Tunnelling technique (NATM) is that the application of rock mechanics theory and supported maintaining and utilizing the self-bearing capability of the encompassing rock. The key principle of

3.1 NATM is victimization the encompassing rock as a neighborhood of the web.

The construction method of recent Austrian technique is: 1) Line positioning; 2) drilling, loading and blasting; 3) mud removal by ventilation; 4) anchor and steel support and bar-mat reinforcement; 5) shotcreting to make the preliminary bracing; 6) building the concrete because the secondary lining. Rabcewicz stressed 3 key points of NATM: the primary is that the application of a thin-sprayed concrete lining; the second is that the closure of the ring as shortly as attainable and therefore the third one is systematic deformation measuring.

3.2 The advantages and disadvantages:

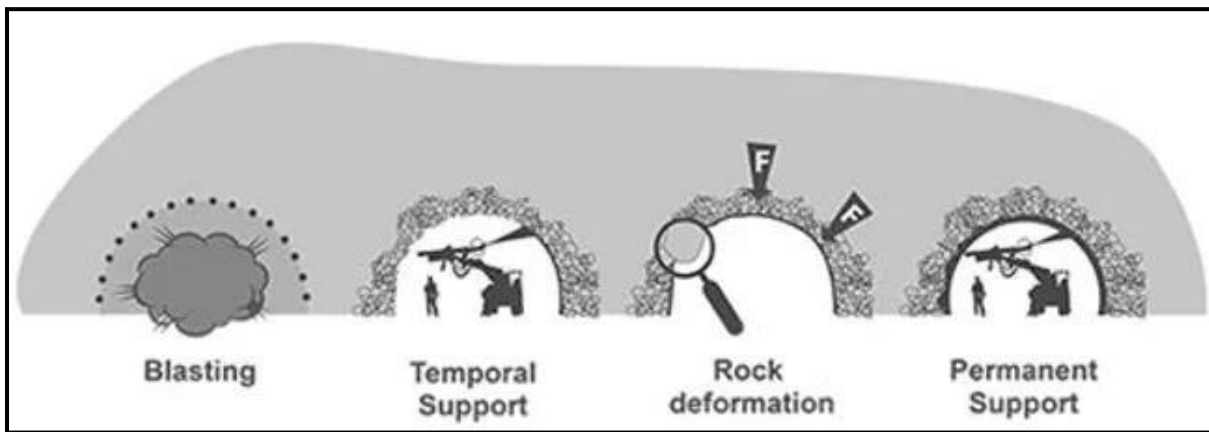
The advantage of latest Austrian technique is that it maintains the strength of the initial encompassing rock to the biggest extent. The timely support and shut contact with the rock surface conjointly helps the mixing of the encircling rock and lining, that omits the supporting part within the ancient construction. By victimization skinny layer support, the engineering amount of excavation and masonry is reduced. Besides, the planning and construction area unit way cheaper with lower value. NATM will show its superiority in weak encompassing rock, poor earth science conditions and shallow tunnels. Whereas the disadvantage of latest Austrian technique is that it asks for the next demand of technology and variety of collapses and failures of NATM tunnels occurred within the history [3].

Since NATM ought to build use of the strength of encompassing rock mass, there are a unit some needs for earth science conditions. It's primarily applicable to some stable and comparatively onerous rock lots. In distinction, the applicable of NATM ought to be assessed rigorously for poor earth science conditions, like the existence of water burst and therefore the heaving sand, or once the rock is very broken and therefore the excavation surface cannot be utterly self-stabilized

3.3 The development of NATM

The development of NATM is said closely with the event of the fabric, approach and instrumentation for shotcrete and rock bolt support. Within the field of construction instrumentation, it's promising to develop a shotcrete system with high initial and long strength, low rebound, low mud and high

productivity that is matched with the high-efficiency mud collector, the automated injection gear and therefore the short-cycle material provide system.



4. DEFEND METHODOLOGY

4.1. Introduction

Till now, defend methodology is that the most generally used methodology in subway construction. Tunnel boring machines (TBM) are unit employed in fashionable defend tunnelling. A TBM consists of a defend and trailing support mechanisms. The soil is excavated by the cutting wheel at the face of the defend and being removed through the machinery as suspension or left as-is reckoning on the kind of the TBM. A group of hydraulic jack's area unit won't to push the TBM forward. Then, the erector is employed to select up formed concrete segments and find them within the designed position to make a replacement tunnel ring.

The main procedures of the defend methodology area unit as follows: 1) excavating foundation pit or building vertical shaft at the start and finish of the tunnel; 2) excavating the soil layer; 3) advancing the TBM and deviation correction ; 4) lining assembling; 5) lining pressing.

TBM is consisted of defend shell (shield), creating by removal mechanism, propulsion mechanism, selling mechanism, lining mechanism and auxiliary mechanism.

4.2 The Options and application

- 1) The options of defend methodology are:
- 2) There are a unit very little impact on the bottom traffic and encompassing atmosphere
- 3) The defend machine is intended, factory-made or reformed in keeping with the characteristics of the tunnel and earth science conditions.
- 4) There are unit high needs for construction exactitude
- 5) The construction cannot be people the benefits of defend methodology area unit as follows:
- 6) Most of the operations area unit disbursed underground, that don't have any impact on the bottom traffic or navigation and small impact of noise and vibration on the near residents.
- 7) The main methodology of the event, the defend propulsion, earth cutting and lining grouping, unit of measurement circulated and thus the development is simple to manage
- 8) A higher technology superiority once constructing a tunnel with deep depth and long distance at a locality of poor soil quality and high water level. The main method of the development, the protect propulsion, earth cutting and lining aggregation, are circulated and also the construction is simple to manage

A higher technology superiority once constructing a tunnel with deep depth and long distance at an area of poor soil quality and high water level, however, there are some issues of the protect methodology, like the poor ability within the section with variable section size, the high prices on the protect machine, uneconomical selection for brief construction section and a foul operating atmosphere for employees.

The protect methodology will cross stratum with advanced engineering and hydrogeological characteristics and incorporates a wide application scope. It's appropriate for the development totally different of various structures starting from the subway tunnel to the underwater tunnel and also the buried

station thanks to the various diameter of the protect and different shapes like the one circle protect, double O-tube protect and multi-circular face protect.

4.3 The development of construction method of protect tunnel:

With the fast development of subway in China, the protect methodology are wide applied and progressed thanks to its blessings on safety, environmental protection and construction amount [4]. the event of protect methodology followed by the event of contemporary science and technology can specialise in the diversification of the development section, the technology of lining assembly and also the automation of the protect construction.

1) Special cross-sectional protects [6]. so as to adapt to completely different geologic conditions and a few special comes, additional and additional protect machine structures ar showing, like multi-circular protect, elliptical protect, rectangular protect, deformation section protect, H&V shield, mechanized protect, etc.

2) The development of latest construction technology, which incorporates the import and export technology, the bottom arrival technology et al, thus on meet the special construction necessities.

3) The automation of the piece assembly and also the development of latest lining technology. The technologies embrace pressure-grouting concrete lining, pipe joint technology, pipe joint flowing management technology and also the producing of pipe with high strength and sturdiness et al.

4)Automatic excavation. With the event of engineering, to protect can have the perform of knowledge assortment and automatic direction management.

5. CONCLUSION

The cut and canopy methodology remains the first selection in railroad construction, however exploiting maintenance technology of deep foundation pit and in addition as slope support is that the necessity of a way higher economical use within the more.

As for NATM, the sturdy ability of adapting to advanced geologic conditions may be a huge advantage of it. However, utilizing new Austrian tunneling methodology is additional advanced as a result of this methodology needs quite the employment of sprayed concrete. It's the understanding of the theoretical basis of the NATM that needs most.

High value as protect methodology brings, its management in bottom settlement and also the quick and safe construction guarantees a continual development for it. The mix of shallow mining methodology and protect methodology will fill use of its blessings by utilizing the interval protect machine to unendingly complete the interval tunnel and also the station traffic, that improves the advance distance of the protect machine, and shortens the development amount and reduces the number of civil works.

In general,{different totally completely different completely different} geologic conditions and construction environments needs different ways for various project. Additional with efficiency and economically construction are achieved if an affordable construction theme is correctly selected and elegant.

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