江苏恒美德新材料有限公司
Jiangsu Chemlead New Material Co., Ltd.

JIANGSU CHEMLEAD NEW MATERIAL CO.,LTD.

FRP Rockbolt

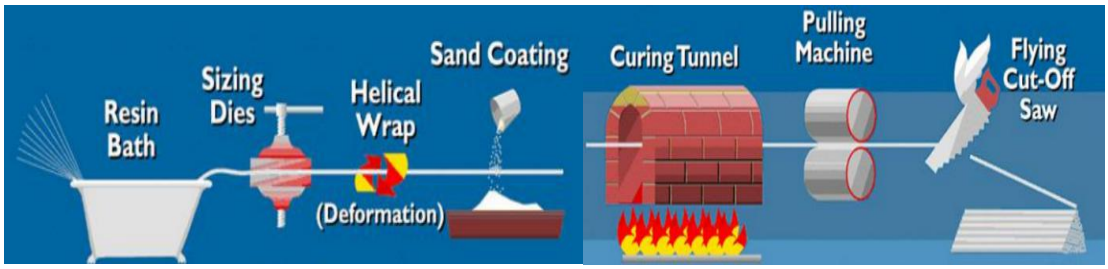
Product Manual

Introduction of Fiber Reinforced Polymer

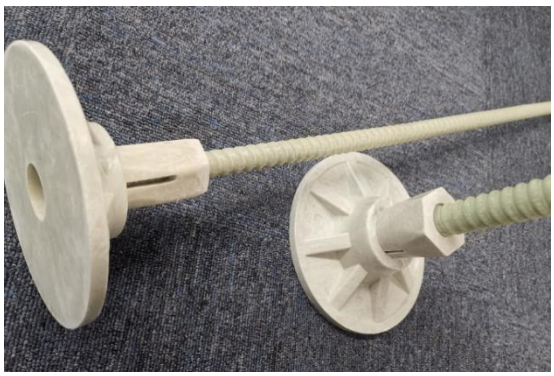
FRP(Short of Fiber Reinforced Polymer) is a kind of composite material mad through the composite process with polymer resin as the matrix such as glass/basalt fiber or carbon fiber as the reinforcement. It has the advantage of high tensile strength, low weight , corrosion resistance and non-conductive than the steel.

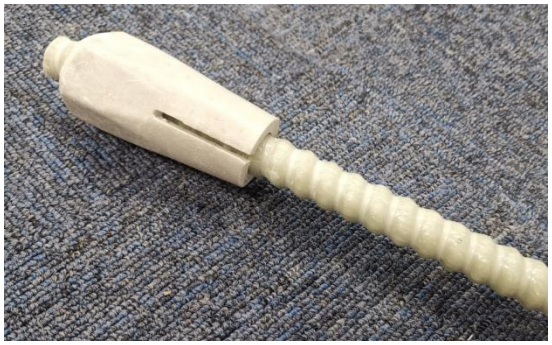
Production Process

Glass fiber reinforced polymer rebar （GFRP） is made from high technical performance resin（UP/VE/EP/PU）and glass fiber by pultrusion process.



Products






Products Introduction

As an effective way of supporting mining roadway, GFRP rockbolt improve the roadway support effect and enhance the stability of the surrounding rock with lower cost significantly. It makes roadway formation work to be fast lower labor intensity and safe. Therefore, GFRP Rockbolt has become a main support method of mine roadway support and has been widely applied.

Compare with Steel：

.Light Weight

.High Tensile Strength

.Corrosion Resistance

.Anti-static Conditioning

.Excellent cuttability

.No-conductive(electric, thermal)

.Flame Resistance

.Continuous threaded profile

.Flexibility

.No electrical conductivity

.Wide range of various dimensions

Classification

Mining Rockbolt

Solid Rockbolt

Hollow Rockbolt

Self-drilling Type Rockbolt

FRP Cable anchor bolts

Mining Rockbolt

The full-thread FRP bolts for mining are produced in according to the standard of MTT 1061-2008 "Resin Anchor, Glass Fiber Reinforced Plastic Rod Body and Accessories".

In the application of coal mine tunnels, rigid bolts have obvious advantages as follows:

1) High strength and large anchoring force;

2) Light weight, easy to transport and operation;

3) Low cost, fast lane formation speed and low labor intensity；

4) Excellent cuttability, no need to dismantle, ensuring the efficiency of roadway mining;

5) Flame retardant;

6) Antistatic, no sparks during cutting, ensuring the safety of coal mine production.

+

1. Specification

Tensile Strength / MPa	Shearing Strength / MPa	Torsion /（N·m）
≥800	≥150	≥40

Size	18	20	22	24	27
Appearance	质地均匀，无气泡、裂纹				
Tensile Strength（MPa）	800	800	800	800	800
Shearing Strength（MPa）	150	150	150	150	150
Torsion（N·m）	45	55	70	90	120
Anti-electrical（Ω）	≤3×10^7				
Flame Resistance	Flaming time ≤15s / Flameless Burning≤60s				
Breaking Load of FRP Nut & Plate	60-100kN				

Solid Rockbolt / Soil Nail

Solid glass fiber anchor bolt is a foundation support material, it is widely used in tunnel, slope, foundation pit and other fields.

Due to the non-cutting characteristics, steel rockbolt have an potential adverse effects on the subsequent nearby roads, pipelines, tunnels and underground construction of buildings.

The glass fiber anchors/soil nails not only have the advantages of strong strength, corrosion resistance, and light weight, but also have the characteristics of simple construction and reduce a lot of labor costs. Therefore, with FRP Rockbolt it can reduce the energy consumption caused by the production of steel bars significantly, also avoid the pollution caused by the production of steel bars.

Specification

Diameter（mm）	Area (mm2)	Tensile Load（KN）	Thread Breaking Load（KN）	Tensile Strength（MPa）	Shearing Strength（MPa）	E-Moudlus（GPa)	Elongation（%）
20	254	220	60	700	150	≧40	≧2.0
22	314	250	60	700			
24	379	290	70	700			≧1.8
25	415	320	70	700			
27	490	380	70	700			
28	531	420	80	700			
32	707	550	80	700			
36	907	600	100	600			

Standard - Local Standard

DGJ32/TJ 162-2014

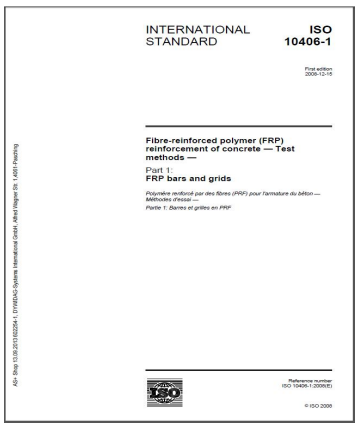
《玻璃纤维增强复合材料筋基坑工程应用技术规程》

DGJ32/TJ 108-2010

《玻璃纤维增强树脂土钉基坑支护技术规程》

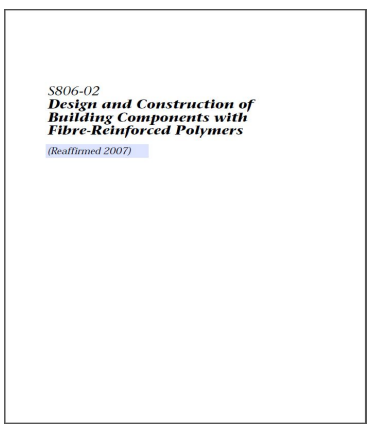
Standard-International

ISO 10406-1 / CSA S806 / BS7861


INTERNATIONAL STANDARD ISO 10406-1

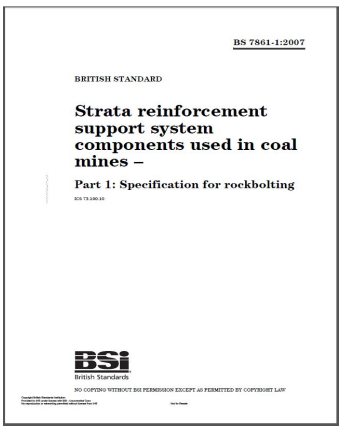
Fibre-reinforced polymer (FRP) reinforcement of concrete — Test methods —

Part 1: FRP bars and grids


S806-02

Design and Construction of Building Components with Fibre-Reinforced Polymers

(Reaffirmed 2007)


BS 7861-1:2007

BRITISH STANDARD

Strata reinforcement support system components used in coal mines –

Part 1: Specification for rockbolting

Hollow Rockbolt

Hollow anchor bolts include advanced hollow grouting anchor rods for pre-support and system radial anchor rods for general tunnel composite lining arches. Mainly used for permanent system support and advanced pre-support of surrounding rock with medium geological conditions.

Different from ordinary mortar bolts, FRP hollow bolts changes the traditional first grouting and then anchoring process to first anchoring and then grouting. The pressure during grouting can reach tens of kilograms. Not only can the anchor holes be filled, but also in areas with developed fissures, the grout It penetrates into the cracks under the action of grouting pressure to achieve the purpose of improving the surrounding rock structure.

Advantage：

1. Rapid initial support to control the deformation of the surrounding rock and ensure the stability of the surrounding rock.

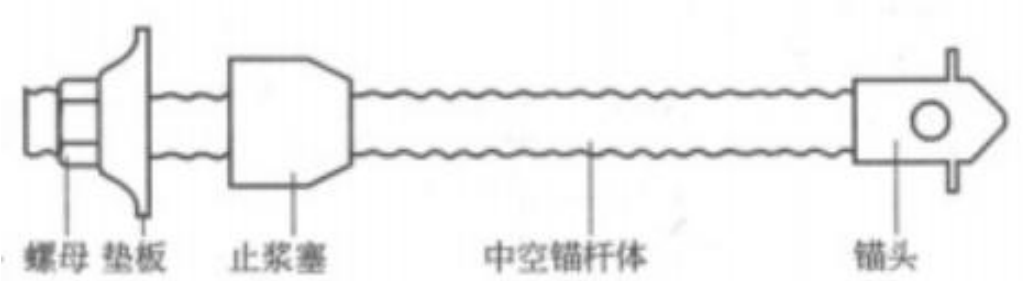
2. The hollow design enables the anchor rod to realize the function of a grouting pipe and avoids the loss of mortar caused by the traditional construction process when the grouting pipe is pulled out.

3. The grouting is full, and pressure grouting can be realized to improve the quality of the project.

4. Due to the role of various accessories, the centering of the rod body is very good, and the mortar can wrap the full length of the anchor rod body, avoiding the risk of corrosion and achieving the purpose of long-term support.

5. Convenient installation, no need to process the thread on site, you can easily install the backing plate and nut.

6. Combined with the supporting bolt special grouting pump and grouting technology, it is the only wrong solid system in China that has completely solved many problems of traditional anchoring and supporting.



Technical data

Out D Inner D 直径（mm）	Tensile Load（KN）	Cross Area（mm2）	Tensile Strength（MPa）	E-Mouldus（GPa）	Shearing（MPa）	Breaking load of thread（KN）
25/12	210	302	650	≥45	≥150	70
28/12	320	415	700			70
32/15	350	530	630			90
60/40	716	1385	500	≥30	≥100	/

Local Standard

MT/T 1061-2008 《树脂锚杆玻璃纤维增强塑料杆体及附件》

TB/T 3209-2008 《中空锚杆技术条件》

GB 50086-2015《岩土锚杆与喷射混凝土支护工程技术规范》

Self-drilling type Anchor Bolt

Hollow self-drilling bolts are mainly used for supporting soft soils where pre-hole formation is difficult. In actual application, the rod body of the assembled drill bit is connected with the drilling rig, which can be directly drilled into the soil without pre-holes; multiple rod bodies are connected by special connectors and are driven into the soil one by one until the length required by the design is reached.

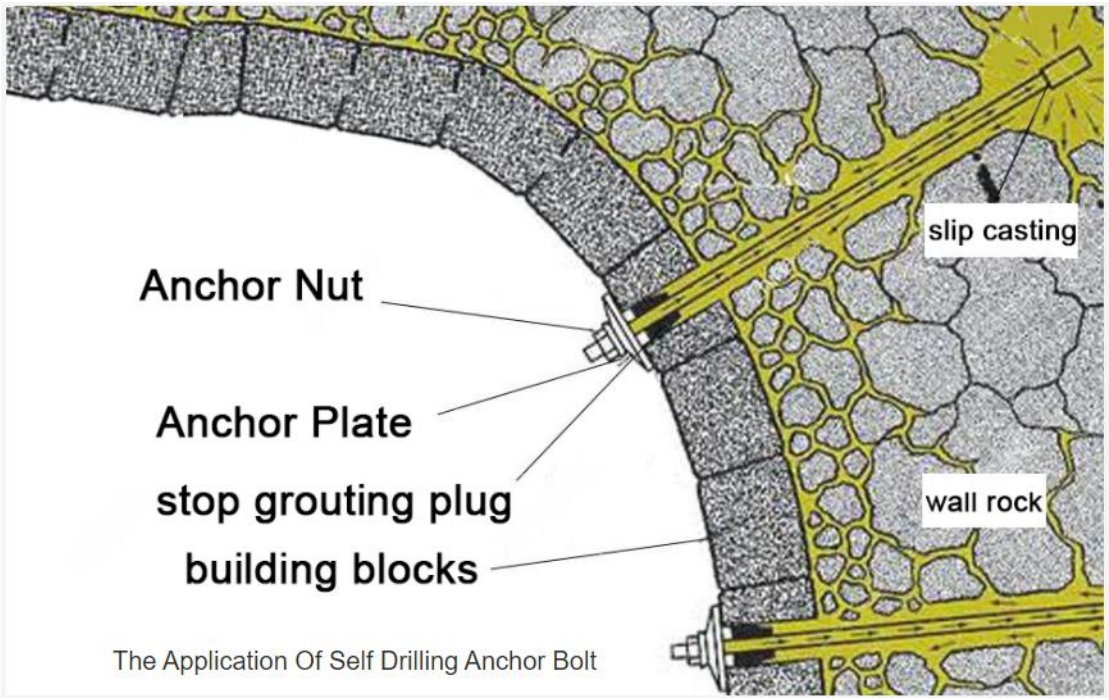
Technical Data

Out D Inner D 直　　径 （mm）	Tensile Load（KN）	Cross Area（mm2）	Tensile Strength（MPa）	E-Mouldus（GPa）	Shearing（MPa）	Breaking load of thread（KN）
32/15	350	495	700	≥45	≥150	120
38/20	500	704	700			140
51/33	700	1000	700			140

Hollow Rockbolt

The glass fiber hollow anchor rod mainly uses bamboo pulp anchor rod or mortar or material as the igniting agent, and combines the main body and the anchor rod to support the cement and the supporting effect.

Brief Introduction of Construction：



INSTALLATION PROCESS

1. The self-advancing anchor rod shall be drilled according to the designed depth, and cooling water shall be added when drilling.

2. Unload the drilling rig, insert the grout stop plug into the rod body, and insert it into the hole to prepare for grouting.

3. Connect the quick grouting joint with the tail end of the anchor rod, and connect the other end of the grouting joint with the grouting machine.

4. Start the grouting machine for grouting, and shut down when the grouting is full and the pressure reaches the design value.

5. Install the backing plate and nut, and tighten the nut, and the installation is finished.

FRP Cable bolts

Advantages of fiberglass anchor cable:

The glass fiber parallel anchor cable is a composite of 7 glass fiber bars with a diameter of 6.5. After the composite, the tensile strength is greatly improved, and the reliability of the foundation pit support is more fully guaranteed.

Transportation: The glass fiber parallel anchor cable is composed of 7 glass fiber bars with a diameter of 6.5. During the transportation, the glass fiber parallel anchor cable can be coiled into a circle like a steel strand for transportation.

Prestress: After the glass fiber parallel anchor cable and the steel strand are connected, the normal construction can be carried out according to the method of prestressing the steel strand.

The glass fiber parallel anchor cable does not need to recycle the anchor cable. Because the outer wall of the glass fiber reinforcement is fiber and the inner core is resin, it should be cut off. Therefore, it can surpass the red line of the ground and will not affect the later construction of shields, pipe jacking and other underground projects, instead of hot melt The steel strand anchor cable of the formula type is not required to be recycled during the construction process, which saves the construction period, has obvious advantages and is worthy of application.

Brief description of construction:

Drilling →

anchor cable installation →

grouting →

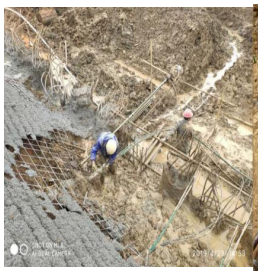
maintenance →

anchor cable tension test →

installation

Technical Data

产品名称	锚索束数(束)	施加应力(KN)	锚索承载力	锚索根数
ZL-15T	1	100	200	7
ZL-30T	2	150	400	14
ZL-45T	3	200	600	21
ZL-60T	4	300	800	28
ZL-90T	6	400	1200	42
以上产品可以根据客户要求定制长度及性能要求				


Application

3.1、Mining Support——GFRP Solid Anchor Bolt

Due to the advantages of FRP bolts, such as light weight and easy cutting, the coal mine roadway support adopts FRP bolt support, which can directly break the coal body supported by FRP bolts with the coal mining machine during the working face, which improves the mining efficiency and guarantees The succession of the mine is realized, safety and efficiency are realized, and the efficiency of coal mine excavation is further improved.

Description of Construction:

(1) Use a drilling rig to connect the ordinary drill pipe to drill the bolt hole after delineating the position on the roadway wall;

(2) Remove the ordinary drill pipe, replace the reaming drill pipe with the drill rig, and push the reaming drill pipe into the bolt hole to advance to the bottom of the bolt hole; perform the reaming operation, and exit after the reaming operation is completed. Reaming drill pipe;

(3) Clean up coal and rock debris in the bolt hole;

(4) Insert the anchor rod into the anchor rod hole, and inject the anchoring agent into the anchor rod hole;

(5) After anchoring agent is solidified, put a backing plate on the bolt and screw on nut to make the backing plate press against the roadway wall.

Project Case

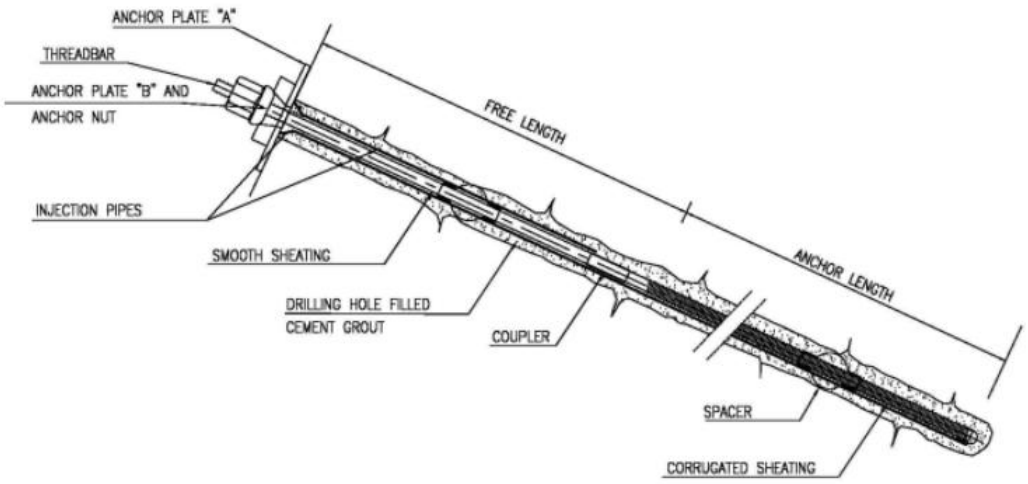
Project Name: Daliuta Coal Mine Project

Project Overview: Daliuta Mine of Liuta Coal Mine is located in the northern part of Shenmu County, Shaanxi Province, and the administrative division is under the jurisdiction of Daliuta Town, Shenmu County, Shaanxi Province.The minefield is about 9.03-12.30 kilometers long from north to south, 10.10-14.63 kilometers wide from east to west, and the width of the minefield is about 126.53″～39°21′32″. The original gross production value of Daliuta Coal Mine was 860 tons/year, of which the construction scale of the big tower shaft was 360 tons/year, the construction scale of Huojitujing was 500 tons/year, and the scale of Daliuta coal washing plant was 960 tons per year.

3.2、Tunnel Protection——Solid Anchor Bolt

The main characteristics of glass fiber anchor rods are high tensile strength; flame retardant, antistatic, easy to cut without sparks, and can be directly cut by machinery; strong corrosion resistance, not easy to rust; non-conductive, non-thermal, and good impact resistance; quality Lightweight, can be excavated, etc., it is mainly used in difficult geological sections where the construction is difficult, and plays the role of pre-supporting the tunnel face in advance. Use glass fiber grouting anchor rods to pre-grouting reinforcement on the front face of the tunnel face. After reinforcement, full-face excavation is adopted, which can eliminate the secondary settlement and convergence problems in the stepped construction.

——ADECO-RS Approach in Tunneling



BAR ANCHOR DETAIL

Project Case：

Project Name: section 7 of Zheng-Wan high-speed railway

Project Overview: The Baokang Tunnel's entrance mileage is D1K499+420 and the exit mileage is D1K513+980, with a total length of 14560m. It is a dual-track tunnel with a design speed of 350km per hour. The maximum buried depth of the tunnel is 504m, the entrance is close to the abutment, and the exit is connected to the roadbed. The geological conditions of the tunnel are shale interbedded with sandstone. The whole tunnel is mostly composed of grade IV and grade V surrounding rocks, partially accompanied by grade III surrounding rocks. The rock mass is broken, the joints and cracks are developed, the weathering is relatively strong, and the self-stabilization ability is poor. Except for the entrance, exit and overhead section of the tunnel, the traditional construction method is adopted, and the other sections are constructed by the full-face method. At the same time, large-scale mechanized supporting operations such as three-arm rock drilling rig, three-arm arch installation machine, and wet spray manipulator are used. The total construction period is 66 months.

Design Overview: Combined with the "New Idea" construction concept, the use of glass fiber anchor rods has high strength, light weight, convenient anchoring, good reinforcement effects, and economical and practical characteristics, thereby achieving a good advance

pre-reinforcement in front of the tunnel face. ability. In addition, the coordinated use of three-arm rock drilling rigs, wet spray manipulators, mobile grouting work platforms and other machinery has laid a good foundation for the full-section tunnel excavation construction on the premise of increasing the stability of the tunnel face. It can achieve the purpose of convenient digging, reducing construction workers, reducing labor intensity, reducing construction safety risks, and fast and efficient construction.

——Ordinary Mining Method

The mining method refers to the construction method of constructing tunnels by excavating underground tunnels.

The mining method is a traditional construction method. Its basic principle is that after the tunnel is excavated, it is affected by blasting, causing the rock mass to rupture and form a relaxed state, which may collapse at any time. Based on the theoretical basis of this loose load, the construction method is to excavate piece by piece according to the order of divisions, and it is required to dig while supporting for safety, so the support is complicated and the wood consumption is high. With the advent of spray-anchor support, the number of branches was reduced, and the new Austrian method was developed.

Project Case：

Project Name: Guizhou Daoan Expressway (tunnel)

Project Overview: Dao'an Expressway is the third vertical line of the "678" network of Guizhou's expressway planning. The project starts at Fushouchang at the junction of Daozhen County in Guizhou Province and Nanchuan District of Chongqing City, passing Daozhen, Zheng'an, Meitan and Yu In Qing, Lujiazhai in Weng'an County connects with Guixin Expressway. It is understood that the total length of the project route is 248.118 kilometers, of which Daozhen branch line is 6.081 kilometers.

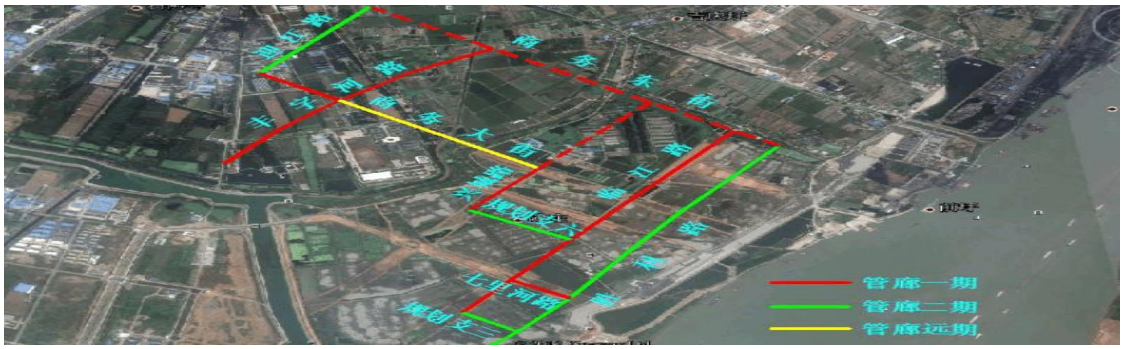
There are 162 bridges with a length of 53641 meters; 53 tunnels with a length of 47164 meters; 14 interchanges with a connecting line of about 25.4 kilometers.

Overview of the design: There are 53 tunnels on Dao'an Expressway. The construction method of the mining method is adopted. The advanced bolts of the tunnels use FRP bolts instead of the traditional iron bolts.

-----Comprehensive pipe gallery

Project name: Integrated pipe gallery project in the core area of Pukou New City, Nanjing

Project Overview: The integrated pipeline corridor project in the core area of Pukou New City, Nanjing is located in the core area of Pukou New City, from the Binjiang Coastline in the south, Qilihe in the east, Yingjiang Road in the north, and Business East Street in the south. The project design content includes the main structural works related to the underground comprehensive pipe gallery of Linjiang Road, Fengzihe Road, Xingcheng Road, Qilihe Road, Yingjiang Road, Shengli Road, Commercial Street, Planning Branch Road 3, and Planning Branch Road 6 , Drainage engineering, fire fighting engineering, etc. The total length of the integrated pipe gallery is about 10306m, and coverage is about 10km



3.3、Fundation Pit——Soil Nail

Uplift piles are widely used in large-scale basement anti-floating, high-rise buildings (structures) uplift, offshore terminal platform uplift, anchor pile foundations of suspension bridges and cable-stayed bridges, pile foundations of large dock bottom plates and static load test piles Anchor pile foundation, etc.

The original design of the uplift piles of the Golden Homestead is 15 meters high and 600mm in diameter, the main reinforcement of the steel cage is 20mm in diameter, the number is 16, the stirrup is 8mm, and the reinforcement and positioning bars are 14mm. Using GFRP material to replace the same amount, the direct cost is about 3135.2 yuan. Using strong substitution such as GFRP material (12 main ribs), the direct cost is about 3063.9 yuan. In summary, replacing steel bars with the same amount of GFRP material can reduce direct costs by about 12%. The overall cost can be saved by 17%. Equal-strong substitution can reduce direct costs by about 14%, and comprehensive costs can be saved by about 21%.

Brief description of construction:

Anchor rod construction process:

earthwork excavation →

trim side wall →

measurement and set-up →

drill rig in place →

drill rod connection →

hole position adjustment →

angle adjustment →

drilling (connecting drill rod) →

drilling to design depth →

inserting anchor rod →

Pressure grouting maintenance

Project case:

Project name: PPP project resettlement housing phase 1 of the new town construction of Chunhua street, Jiangning District Brief description of the project: The frame shear wall structure is adopted, and a full-floor basement is built. The area of the foundation pit is about 8350m2, the circumference is about 390m, and the excavation depth is about 6.05~6.95m. The safety level of the foundation pit is two, and the importance coefficient is taken as 1.0. The foundation pit support scheme uses ϕ800@1000 bored piles and a layer of concrete support for the foundation pit, and ϕ700@500 double-axle cement-soil mixing piles are used as water-stop curtains on the outside.

Project Case

Name: Foundation Pit Support for Block 02 of China Merchants Real Estate G67 Project

Overview：

1. The ABC section on the east side of the pit uses rotary excavated piles and two supports as the foundation support structure.

2. The secondary sloping soil nail wall with other reinforcement combination is used for supporting. The GFRP soil nail is 12 meters long and the skill is 1 meter.

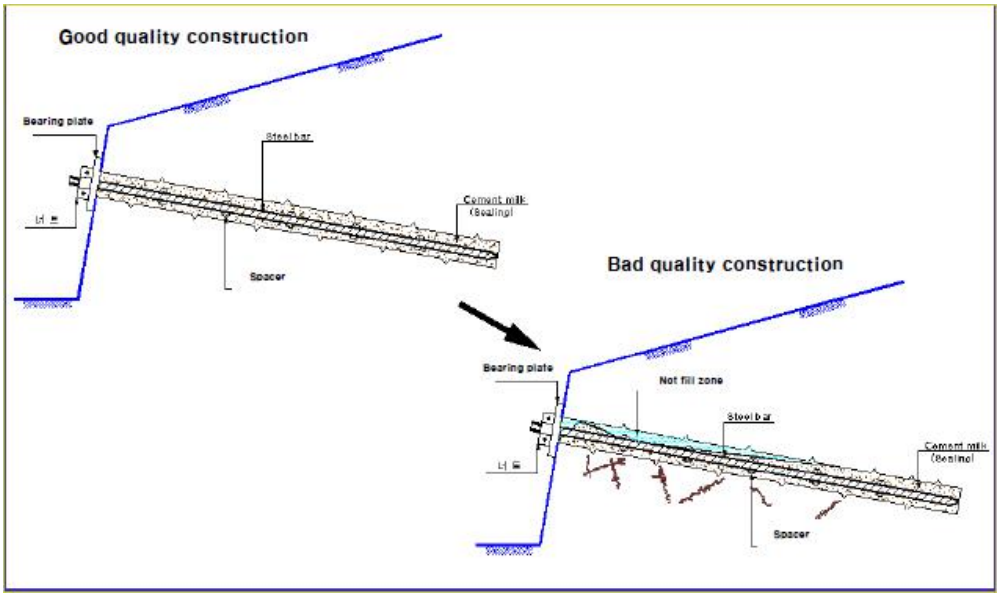
3. Open ditch + water collection pit is used for drainage in the pit.





3.4. Slope support

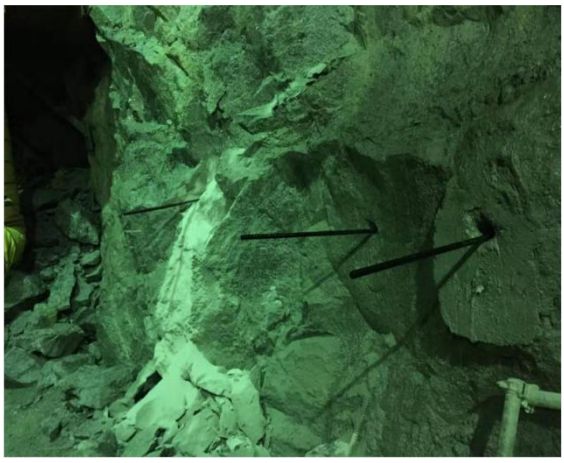
Fiberglass slope support is a slope reinforcement structure supported by fiberglass fiber prestressed soil nails. It includes a slope formed by excavation in the soil. The slope soil is equipped with oblique fiberglass fiber prestressed soil nails. When in use, glass fiber reinforced plastic prestressed soil nails are applied to the foundation pit support, which greatly improves the strength of the foundation pit soil, and effectively restrains the deformation of the slope soil through the prestress, and significantly improves the stability of the foundation pit. Moreover, the support of fiberglass fiber prestressed soil nails is adopted, and the soil nails do not need to be removed after the construction is completed. In other subsequent construction processes, the fiberglass fiber prestressed soil nails can be easily cut off, so that the subsequent work has no impact.



Project case

Project Name: T217 Napier Metro Tunnel Slope Support

Project Overview: Napier MRT Station is the future underground MRT station on Singapore's Tanglin Thomson East Coast. It is built at the junction of Napier Road, Holland Road and Clooney Road, and will be located at Gleneagles Hospital, Ministry of Foreign Affairs, Australian High Commission, British High Commission, U.S. Embassy, Interpol Global Innovation Center And the botanical garden near Donglingmen.



Project case

Project Name: River slope support----China Railway 20th Bureau Group Co., Ltd. Diversion Project from Yangtze River to Huaihe River (Anhui Section)

Project overview: The project of diverting water from the upper reaches of the Yangtze River to the Huaihe River will divert water to the middle reaches of the Huaihe River.

Main project content: 6.76km river canal excavation, treatment of expansive soil and bedrock slope in the canal, slope protection, road management and protection, etc. There are 8 water drops, Zhongwang drop water, Yangyuan water drop, Shixing water drop, Weir Gua water drop, and Yongqiao water drop; 1 anchorage under the Lujiang pivot gate and water and soil conservation projects.