Study on unfavorable Engineering Geological Condition and Risk Response of Huangyan Tunnel

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Abstract

Through the investigation of the topography and geomorphology of the tunnel area of the Huangyan tunnel, the lithology of the stratum, the geological structure, and the engineering geological characteristics of the rock and soil, the results of geophysical exploration, drilling, hydrogeological tests and physical and mechanical tests of the rock mass are used. The engineering geological conditions and risk response measures of the Huangyan tunnel are summarized. The geological complexity and engineering of the Huangyan tunnel in the unfavorable geological sections such as the fault fracture zone, the fold joint development zone, the water inrush, the weak fractured rock and the fissure water are mainly introduced, geological condition. Point out the engineering geological problems that may be encountered during tunnel construction, as well as related construction measures, risk response measures and recommendations.

Keywords

Bad engineering geological conditions,risk response,extra-long tunnel,fault fracture zone.

1. Project Overview

The Huangyan tunnel runs along the northwest. The northwest of the tunnel starts from Yangcun Village, Huangyan Township, Huaihua City. The southeast stops at Shuiwei Village, Anjiang Town, Hongjiang City. The imported mileage is DK17+828, the export mileage is DK34+858, the length is 17030m, and the tunnel has a maximum depth of 700m. It is a single-hole two-line tunnel. There are five inclined wells in the tunnel: Tangjiawuchang is 660m long, Ganzishan is 2149m long, Meiziniangchong is 2686m long, Sishuiwan is 1208m long, and Changxikeng is 636m long.

Fig1 railway route map from Huaihua to Shaoyang to Hengyang

The engineering geological and hydrogeological conditions of the tunnel area were ascertained, and the engineering geological problems of the tunnel area were comprehensively evaluated. On this basis, the geotechnical engineering problems and treatment suggestions that should be paid attention to during tunnel design and construction are proposed.

2. Engineering geological conditions

2.1 Topography

The survey tunnel area is Xiangxi Mountain, the terrain is complex, and the terrain is steep and changeable. The mountain range is affected by the regional structure, and the northward trend is generally carried out. The tunnel crossing area is a low-lying mountainous area with tectonic erosion. The terrain is undulating. The elevation of the mountain is between 260 and 960m, and the relative height difference is about 700m. The overall terrain is high along the central line of the tunnel. The ends are gradually lowered. Most of the mountains extend in the north-east direction. The natural slope of the mountain ranges from 30° to 65°. The vegetation is dense and the vegetation coverage rate is over 90%. It is difficult to pass. The entrance and exit of the tunnel is relatively slow, and the natural slope is 30°~40°, and the vegetation is developed. There are landform units such as mountain valleys and middle and low mountains.

2.2 Meteorological characteristics

The tunnel area is a warm and humid subtropical climate with four distinct seasons, abundant rainfall, long winter and summer, and short spring and autumn. The extreme maximum temperature is 39.6°C, the extreme minimum temperature is -8.5°C, and the average annual temperature is 16.6°C. The rainfall is mostly concentrated in April to July, the freezing time is short, and the depth of frozen soil is generally not more than 30 cm. The monsoon changes significantly, from June to September, it is the southwesterly wind season, and the rest is the northeast wind season. In a year, the probability of calm and windless is large, with an average of 28% over the years, the northeast wind frequency is 16%, the southwest wind frequency is 6%, and the maximum instantaneous wind speed is 22m/s. When the wind is strong, thunderstorms often occur, and the wind is fierce and the damage is great. The maximum annual rainfall is 1734.1 mm (1970), the annual rainfall is 1268.9 mm, the annual evaporation is 1371.0 mm, the annual sunshine hours are 1421.4 hours, the annual average humidity is 80-83%, the frost-free period is 355 days, and the annual rainfall is 24 hours. 269.0 mm.

2.3 Stratigraphic lithology and physical and mechanical parameters

The survey area is widely distributed in the Paleozoic Banxi Group and the Sinian metamorphic slate. The carboniferous thick layered dolomite and dolomitic limestone develop in the syncline core. The new and old exposed ground layers along the line are shown in the engineering geological histogram.

The statistical values of the physical and mechanical indicators of the various layers in the site, as well as the identification, on-site geotechnical tests, combined with the results of the indoor geotechnical test, the classification of each surrounding rock project provided by the tunnel core site according to the site geotechnical core is as follows:

Table 1 Suggestions for classification and physical and mechanical parameters of geotechnical construction

Rock soil name	Rock and soil state	Geotechnical engineering classification	Note
Silty clay	Hard plastic	III ordinary soil	
Sandy slate	W4	III hard soil	
Sandy slate	W3	IV soft stone	
Sandy slate	W2	V secondary stone	saturation
Carbonaceous slate, sericite slate	W4	III hard soil	
Carbonaceous slate, sericite slate	W3	IV soft stone	
Carbonaceous slate, sericite slate	W2	V secondary stone	saturation
Siliceous slate, quartz andstone	W4	III hard soil	

Siliceous slate, quartz andstone	W3	IV soft stone	
Siliceous slate, quartz andstone	W2	V secondary stone	
Dolomite, limestone	W4	III hard soil	
Dolomite, limestone	W3	V secondary stone	
Dolomite, limestone	W2	V secondary stone	dry

The V-class surrounding rock has a total length of 815m, accounting for 4.8 % of the total length; the Grade IV surrounding rock is 6115 m, accounting for 35.9 % of the total length; the Grade III surrounding rock is 10100 m, accounting for 59.3 % of the total length.

2.4 Geological structure

(1) Folds

The basic framework of fold is composed of huangyan syncline and jigongjie-louxi syncline. The tunnel mainly passes through huangyan syncline. The complex slant is composed of the Huangyan slant, the triangular pond anticline and the white horse cave slant. The pleats are mostly gentle-widely sloping folds, and the superimposed interference is obvious, and the secondary folds of the complex folds develop. The pleat deformation mechanism is the bending and pleating deformation. The axis of the slanting axis of the Huangyan is near NE, and the plane is 'S'-shaped. The latest stratum of the trough is the Upper Jurassic Bay Formation of the Carboniferous system. It is longer than 10 Km and the axial surface is developed. It is a composite of Caledonian and Indosinian. Superimposed folds. The Baimadong is NE50° to the oblique axis, and the curve is spread on the plane, which rises to the both sides. The latest layer of the trough is the Upper Taihu Formation of the Carboniferous system. The inclination angle is 20°, the axial surface is developed, and the length is 5Km, which is the fold of the Indosinian period.

(2) Joint Fissure

The joints and fissures in the Huangyan tunnel area are relatively developed. According to the statistics of this survey, the main tendencies are 95°, 135°, 205° and 296°, and the extension length of joint fissures ranges from 0.5 to 3 meters. The minimum spacing is 0.1 m and the maximum spacing is 0.5 m. The joint fissures extend in a straight line. The crack faces are mostly straight and partially curved (wavy). The closed ~ micro-sheet type is mainly composed, and some are opened and filled with mud.

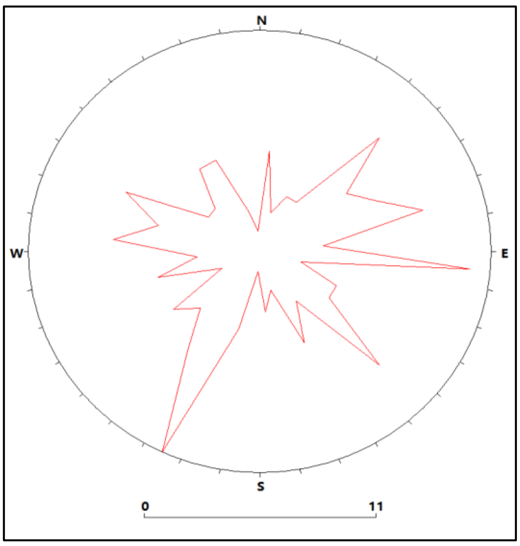

Fig2 Joint crack orientation rose diagram

(3) Fault

The fracture structure of the tunneling area is very developed. According to the distribution direction and combination form of the fault, it can be roughly divided into the northeastern eastward fault; the northeastern northward fault; the northwestward fault. According to the main properties of the fracture, it can be divided into positive slip fracture, reverse fracture, and slip and translation fracture. The tunnel crossing area is based on the positive slip and fracture, and runs northeast to northeast, tending to the southeast or northwest, with a dip angle of 50° to 70°.

The main faults are:Tuanposhan-Zhupozhai fault, Miepo fault, Heiedong fault, Liangzhu fault ,Bengtu-Huangtuqiao fault, Jingangtian-Yanao fault, Pingyi fault.

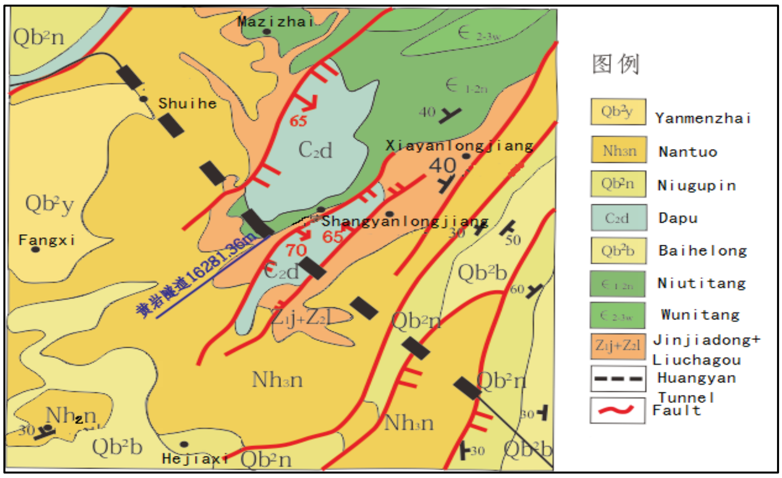

Fig3 Geological structure of the tunnel body area

Table 2-1 Classification of faults in the tunnel body area

number	position (m)	Occurrence	scale		nature
			width(m)	long(m)	
F1	DK18+150~+180	Prone to small mileage, aparent dip82°	30	140	Geophysical inference
F2	DK19+705~+760	Prone to small mileage, aparent dip 82°	55	810	Geophysical inference
F3	DK22+630~+720	Prone to large mileage, aparent dip 48°	90	1200	Geophysical inference
F4	DK22+720~+810	Prone to small mileage, aparent dip 68°	90	1200	Geophysical inference
F5	DK23+900~+975	Prone to large mileage, aparent dip 66°	65	7000	normal fault
F6	DK24+225~+280	Prone to large mileage, aparent dip 80°	55	2000	Geophysical inference
F7	DK25+650~+730	Prone to large mileage, aparent dip 68°	80	2500	Geophysical inference
F8	DK25+860~+940	Prone to small mileage, aparent dip 54°	55	5000	reverse fault
F9	DK27+580~+640	320°∠68°	100	15000	normal fault
F10	DK28+590~+620	Prone to large mileage, aparent dip 86°	30	2800	Geophysical inference
F11	DK29+300~+340	Prone to small mileage, aparent dip 78°	30	5000	Geophysical inference
F12	DK30+620~+670	Prone to large mileage, aparent dip 62°	50	>500	reverse fault
F13	DK31+120~+185	Prone to small mileage, aparent dip 86°	60	9000	normal fault
F14	DK32+815~+845	345°∠55°	30	>500	normal fault
F15	DK33+480~+520	Prone to small mileage, aparent dip 54°	40	400	Geophysical inference

2.5 Hydrogeological conditions

(1) Type of groundwater

According to the aquifer geotechnical category, rock combination relationship, groundwater occurrence conditions and hydrodynamic characteristics, the investigation area can be divided into four types: groundwater, loose bedrock, pore water, tectonic fissure water and karst water. . The level of erosion of groundwater is H1, and the level of carbonization is T2.

① Loose layer rock soil pore water

It is mainly distributed in the residual layer of the top of the mountain to the semi-slope and the all-weathered layer and the alluvial layer of the mountain valley. It mainly receives atmospheric precipitation replenishment, with high terrain, rapid excretion and small amount of water, but it is obviously affected by the season.

② Bedrock fissure water

The bedrock fissure water is mainly rich in the bedrock of the joints and fissures in the low mountains and hilly areas. Generally, the metamorphic rock zone is not rich in water content.

③ Construction of fissure water

The structural fissure water mainly depends on atmospheric precipitation, upper mountain surface water, and adjacent bedrock fissure water replenishment. The runoff conditions are related to the nature and scale of the fault structure, and are discharged to the surface water system or surface at the low-lying area. The water system is connected. It is easy to form water inrush and mud and strengthen water and drainage measures during construction.

④ Carbonate karst water

Carbonate-like karst water is distributed in limestone, dolomitic limestone and argillaceous limestone karst development belts. It is rich in water, and is subject to atmospheric precipitation, Quaternary pore submerged vertical recharge and lateral recharge of bedrock fissure water. Excreted in the form of spring water on the surface.

(2) Groundwater replenishment row characteristics

The entrance and exit section of the tunnel is steep and steep, and it is a metamorphic rock area. The surface water runoff is rapid, the precipitation has rapid runoff along the surface, and the amount of water infiltrated into the ground is limited. The surface precipitation mainly flows along the surface of the mountain in the form of scattered water, and is discharged to the low and low places around the mountain by means of scattered water. It is collected in the surface water system of the gully and low-lying area. In the local structure of the tunnel and the development of the fracture, part of the surface water infiltrates along the fault or fissure to form tectonic fissure water, which is mostly excreted in the form of concealed descending spring.

The elevation of the lowest drainage datum of the Huangyan karst area is about 500 m. The tunnel is buried about 300m deep and is located in the non-soluble rock stratum below the deep karst water circulation zone, with structural fissure water or bedrock fissure water as the main structure. The dip structure of the two-wing rock formation is relatively slow, the rock mass fissures are separated by heavy and heavy rock layers, and the penetration to the deep is inhibited. Generally, there is a difficult gap water; the clastic rock is muddy and is a good aquifer. Therefore, there are not many deep fissure waters, and there is less possibility of water inrush from high-pressure fissures; large-scale fault zones may have through-fractures due to fracture of rock mass, and the possibility of high-pressure fissure water in deep tunnels is not excluded.

3. Analysis of engineering geological conditions

(1)DK17+828~DK23+840

The middle and low mountainous landforms pass through the rock and soil of the Quaternary and Sinian Hongjiang Formation. The stability of the tunnel mouth is relatively good, the joint cracks of the rock formation develop, the rock is blocky, and the full-strong weathering layer is thick. Pay attention to strengthening the support measures. The tunnel passes through the fault, the fault fracture zone and its influence range are poor in mechanical properties and overall stability of the rock; the excavation is prone to blockage, collapse and other phenomena, as well as water inrush and mud.

(2)DK23+840~DK28+200

The low-mountain geomorphology is characterized by erosion. The rock mass in the upper part of the cave is the Carboniferous Taipu Formation (Cd) dolomite and dolomitic limestone. After the atmospheric precipitation infiltration into the groundwater, the groundwater flows along the interlayer fissures and joints to the lower part. With the occurrence and dissolution of groundwater in carbonate rocks, the degree of openness in structural fissures and interlaminar fissures is enlarged, and the channels of movement are opened, which promotes the development and development of various karst forms. In addition, the rainfall is abundant, the stratum is gentle, and the groundwater is fully dissolved by the rock, which is very beneficial to the development of karst and forms numerous surface karst forms. Cambrian, Sinian, thin ~ medium thick layered, weakly weathered, lithologic soft; horizontal layering in the local layer, easy to soften in case of water, poor rock integrity; this section through the Huangyan syncline And the Baima inclined, and the occurrence is changeable; the main body of the cave is the sandy slate of the Hongjiang Formation. The fault is developed in this section, the mechanical properties and overall stability of the faulted rock are poor; the excavation is prone to falling, collapse, water inrush and mud.

Analysis of the influence of Tuanshanpo Reservoir on the tunnel: about 1000m on the right side of the proposed DK24+000~DK24+700 section is the Tuanshanpo Reservoir with a storage capacity of 1.25 million m3. The elevation of the dam crest is 896~897m, and the elevation of this section is about It is 317m, the height difference is more than 575m, and the fault is developed along the lower reaches of the valley to the cave. The results of the geophysical exploration of the section indicate that the DK23+900~DK24+460 section is the fault zone and its influence range. The rock mass of the cavern is broken, the geotechnical properties of the rock are poor, and the water richness is high. The local rock mass softens with water, the reservoir The water and the body may have a hydraulic connection, causing the reservoir to be drained, and the tunnel body is prone to water inrush. Due to the carbonaceous slate in the Cambrian and Sinian strata, the carbon content is high, and there may be bad geological gases such as gas.

(3)DK28+200~DK34＋858

In the middle and low mountainous landforms, this section is developed through the joints and fissures of the Quaternary and Sinian rocks and soils. The rocks are massive, the rock is hard, and the integrity and overall stability are better. The surrounding rock of the cave is mainly composed of Hongjiang Formation and Yanmenzhai Formation. The faults in this section, the fracture zone and its affected area, the mechanical properties and overall stability of the rock are poor; the excavation is prone to falling off, collapse, etc., water, mud, support lining should follow up in time, and have anti-seepage diversion Measures.

Analysis of the impact of the Peace Reservoir on the tunnel: The proposed DK32+500~DK33+200 section is about 1000m on the right side of the Peace Reservoir. The normal storage capacity is 3.926 million m3, and the total storage capacity is 4,485,400 m3. The water level elevation of the reservoir is about 276m. It is about 234m and the height difference is about 42m. The fault is developed along the valley near the reservoir to the cave. The results of the geophysical exploration of the section indicate that the DK32+775~DK32+885 sections are faults and influence zones, the rock mass of the cavern is broken, the geotechnical properties of the rock are poor, the local rock mass is softened by water, and the reservoir water and the tunnel body may generate hydraulic power. Contact, leading to the dewatering of the reservoir, the water in the tunnel hole suddenly.

4. Bad geological phenomena in the tunnel

The main engineering geological problems are fracture fracture zone, uranium ore body radiation, high ground stress and ground temperature.

(1) Fault fracture zone

The tunnel passes through the 'Huangyan-Zhapu fault zone' composed of multiple faults. The tunnel has passed 15 faults. The surrounding rock of the tunnel is mostly broken and massive, and the mechanical properties and overall stability of the rock and soil are poor. At the same time, fault development The location is easy to become a water guiding channel, and the groundwater is introduced into the tunnel body, causing water inrush, mud, and landslide. According to EH-4 geophysical exploration and deep hole drilling, the white horse is inclined, and the limestone is located about 250m above the tunnel. The tunnel is at In the Sinian strata, karst and karst water have little effect on the tunnel. Local rupture may introduce the upper karst water into the tunnel. During construction, the support and attention should be strengthened to strengthen the advanced geological prediction and drainage measures.

(2) uranium ore body radiation

Huangyan Tunnel is a key control project of the whole line. The geology is complex and the radioactivity of uranium mine is particularly prominent. To strengthen the safety of the construction of the Huangyan Tunnel, the radioactive investigation and evaluation of the key sections of the Huangyan Tunnel (East and West Line Scheme), the surface gamma radiation dose rate measurement, Measurement of radionuclide (238U, 232Th, 40K) concentration in surface soil, soil radon concentration measurement, air radon concentration measurement, uranium and thorium concentration in water, total α, total β measurement, drilling core sampling measurement, analysis, drilling U, Rn and total α in the water, total β measurement, drilling γ integrated logging and other investigations.

After comprehensive analysis, the radioactivity of the Huangyan (Liangshan) tunnel through plan (West Line) has no impact on the overall tunnel construction, but the relevant survey results are limited to surface survey tests and local deep hole exploration tests, given the complexity of the geological conditions and uranium. The non-uniformity and particularity of the radioactive distribution of the mine can not completely rule out the possibility of small, chicken-like radioactivity exceeding the standard in the sporadic area of the tunnel. It is necessary to carry out relevant monitoring by the relevant qualified units during construction, mainly for the γ radiation dose of tunnel construction. Rate, radionuclide concentration, and air radon concentration shall be tracked and monitored, and relevant protective shielding shall be carried out when necessary to enhance ventilation.

(3) Ground stress

According to the tunnel deep hole in-situ stress test, the maximum horizontal principal stress in the test area is 5.2 to 16.8 MPa, the minimum horizontal principal stress is 3.7 to 12.4 MPa, and the vertical stress z is 3.6 to 14.9 MPa. The stress magnitude of the rock mass is medium to high stress level, and the stress field of the hole is mainly characterized by $\sigma H > \sigma z > \sigma h$, and the stress field is dominated by horizontal stress. The maximum horizontal principal stress direction of the borehole is between N63°W and N72°W, and the angle between the maximum horizontal principal stress direction and the tunnel axis direction (about N40oW) is about 27°. Weakly weathered pebbled sandy slate, the rock is hard, affected by the nearby structure, the joint fissure is developed, the rock mass may be cut by the unfavorable structural surface, the joint surface is opened, the structural strength is reduced, and it is easy to form during tunnel excavation. The "wedge-shaped" unstable rock mass is affected by construction blasting, groundwater infiltration, etc., and it is easy to produce engineering problems such as falling blocks and small collapse after excavation.

(4) Gas (shale gas)

The Huai-Shaoheng Railway runs through the 'Preliminary Jiangnan Ancient Land' Xuefeng Mountain Area. The terrain and geology are complex. According to the field test, analysis and research related data, and the investigation of the same type of stratum in the Shanghai-Kunming high-speed railway, the Huangyan Tunnel passes through the Xuefeng Mountain area in Xiangxi. Shale gas source rocks and gas-bearing strata may have shale gas (gas). The conclusions of the special test, analysis and evaluation report of shale gas in Huangyan Tunnel of Xuefeng Mountain Area are as follows:

①For the existence of flammable gas detected in the borehole of the Xuefengshan section tunnel, through the geological survey and comprehensive analysis of the tunnel passing through the Xuefengshan area, it is found that the main source rock that produces flammable gas is the Lower Cambrian. The Niutitang Formation, the Upper Ordovician Wufeng Formation and the Lower Silurian Longmaxi Formation.

② Through comprehensive survey and testing and analysis of the gas reservoir, composition and content of the borehole, it is clarified that the combustible gas is derived from the shale gas of the above three sets of source rocks.

③ After an in-depth analysis of regional source rocks and their distribution characteristics, structural types and formation mechanisms in the area, it is considered that the implementation of shale gas to the Huangyan (Liangshan) tunnel east line, the Cangjialing tunnel and the wax tree foot tunnel is relatively large. The impacts correspond to the shale gas source rock strata of the Niutitang Formation, Wufeng Formation and Longmaxi Formation, respectively. Refer to the current Technical Specification for Railway Gas Tunnels for temporary design according to low gas tunnels; Huangyan (Liangshan) Tunnel West The line plan and the shale gas of the South Xuefengshan tunnel have little effect on the tunnel implementation.

5. Risk response research

The engineering geological conditions of the DK23+840~DK26+050 section of the Huangyan Tunnel are the most complicated. Taking this section as an example, the risk response research is carried out. As shown in the figure, the fractured rock mass of the F5~F6 fault zone is massive, and the mechanical properties and overall stability of the rock are poor. The maximum water inflow from the DK23+850~DK24+330 section is predicted to be 12672m^3/d. In the water zone, the elastic wave velocity is 2600-3650m/s. This section passes through the slanting core of Huangyan, the rock formation is relatively broken, and the maximum water inflow is predicted to be 2178m^3/d in the DK24+330~DK25+600 section, which is a medium-rich water area with elastic wave velocity of 2250~4350m/s. The main rock mass of the surrounding rock of F7~F8 fault zone is massive, and the mechanical properties and overall stability of the rock are poor. The maximum water inflow of DK25+600~DK26+050 is 10008m^3/d, which is a strong water-rich zone. The elastic wave velocity is 2300 to 4450m/s.

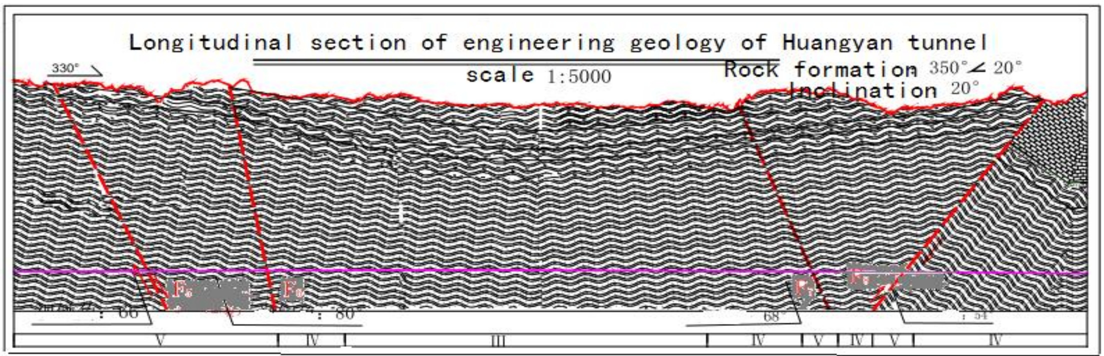

Fig4 Engineering geological section of Huangyan Tunnel DK23+840~DK26+050

The shale gas exists in the carbonaceous slate section of the Niushaotang formation in the upper part of the tunnel, and the shale gas may penetrate into the tunnel cavity through the fracture channel such as fault fracture zone and joint dense zone.

5.1 Landslide risk study

From the Guide to Safety Risk Assessment for Highway Bridge and Tunnel Engineering Design, we can derive the results of the segment assessment for a single risk event and use certain principles to determine the risk level of a single risk event. According to the surrounding rock lithology, integrity and physical and mechanical indexes of the Huangyan tunnel, the risk level of the collapse of the special highway tunnel is judged to be Grade II, which is moderate risk.

The paper proposes the prevention and treatment of landslide risk as follows:

(1) The mechanical properties and overall stability of the surrounding rock mass of the tunnel body are poor. The mechanical strength after water contact decreases rapidly, the excavation is easy to collapse, the rainy season should be avoided during construction, and the waterproof and drainage design should be done to make the tunnel palm during excavation. There is no water in the face.

(2) Strengthen monitoring and measurement and reasonably set the amount of reserved deformation, and strictly control under-excavation, and the footage of each cycle should be shortened as much as possible to reduce the exposure time of surrounding rock. Avoid over-excavation and excessive deformation.

(3) As far as possible, the broken rock layer should be excavated by wind and so on. When it is necessary to blast, use shallow eyes and dense eyes, and strictly control the dosage.

(4)After each step of excavation, the initial support should be carried out in time and closed into loops. Adjust the support parameters to ensure sufficient strength of the support structure for the deformation of the surrounding rock. The lining work must be carried out in close proximity to the excavation face, and the lining should be completed as soon as possible.

(5)Diligent inspection, diligent measurement Encryption monitoring measurement frequency, find deformation or abnormality of surrounding rock, and immediately take effective measures to deal with hidden dangers in time. To ensure excavation, support quality and construction safety. The tunnel V-class surrounding rock adopts the short step and the core soil excavation method, and the fourth-grade surrounding rock adopts the short step method. During the excavation, the disturbance to the surrounding rock is reduced, and the advance support is carried out to improve the self-stability of the surrounding rock. Strengthen advanced geological prediction and construction monitoring of bad sections, timely feedback and analysis of monitoring information, so as to solve problems in time. After the tunnel is excavated, steel frames, anchors and shotcrete support measures shall be erected in time, and temporary invert arches shall be added if necessary.

5.2 Study on the risk of water and mud

According to the geological exploration and design data of the Huangyan tunnel, the main locations of the inrush water are the fault water in the fault fracture zone, the contact surface of different rock layers and the lithologic interface of the anticline structure. The other sections are mainly water seepage, fissure water and void water. A slight inadvertent construction will cause water and mud in the tunnel. Construction control is very difficult, and it is easy to cause serious consequences. The tunnel water and mud will seriously endanger the safety of construction technicians, and will also cause serious damage to construction machinery and equipment. damage. Through the analysis of engineering geology, hydrogeological conditions and preliminary design schemes of Huangyan Tunnel, combined with fuzzy comprehensive evaluation method, the recommendations for prevention and treatment of water inrush mud risk are as follows:

(1) According to the geological conditions revealed by the excavation of the face and the detection of the partially deepened blasthole, the hydrogeological conditions in front of the face are predicted. If there is an abnormality, comprehensive geophysical exploration methods should be used for prediction or for the advance exploration. Especially in the vicinity of the type fault zone, it is required

to take the advanced exploration hole to explore the water before the tunnel construction. Do a good job of forecasting the fault water, correctly locate and characterize it, strengthen the monitoring and warning work of the adjacent precursors and water inrush; take the advance support of the small pipe pre-grouting, short step excavation, and strengthen the branch of the I-beam arch The protection program passed.

(2) The use of advanced small duct grouting is mainly used for water blocking and pre-reinforcement of concentrated water inrush areas, loose rock layers or fault-breaking water-rich zones. The leading small conduits are arranged along the arches or along the gushing parts of the side walls and the broken belts. After the small pipes are installed, the excavation face should be squirted and sealed, with a thickness of 10~15cm. The closed range is the excavation face and the near-excavation work. Circumferential face of the 3m range.

6. Conclusion

In summary, the main engineering geological problems of the tunnel are fault fracture zone, the surrounding rock of the fault near the fault zone and its affected zone is weakly broken, and the block and collapse are prone to occur. The fault fracture zone may become the water guide channel of the upper karst water. For disasters such as water and mud, check the stability before construction, combine the site topography, do a good job of protection, establish a sound monitoring and measurement system, timely perform the subsidence of the dome, the surrounding displacement and the surface settlement measurement, and grasp the surrounding rock in time. Changes, if necessary, surface grouting measures can be taken. Reasonably determine the excavation footage and follow the construction procedures of 'pipe lead, strict grouting, short excavation, strong support, fast closure, diligent measurement'.

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