Urban Roads Bridges & Flood Control

城市道桥与防洪

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图为由南京市水利规划设计院股份有限公司设计的山西省长治市“三河一渠”工程

因为我们专心，所以我们专业！
——《城市道桥与防洪》

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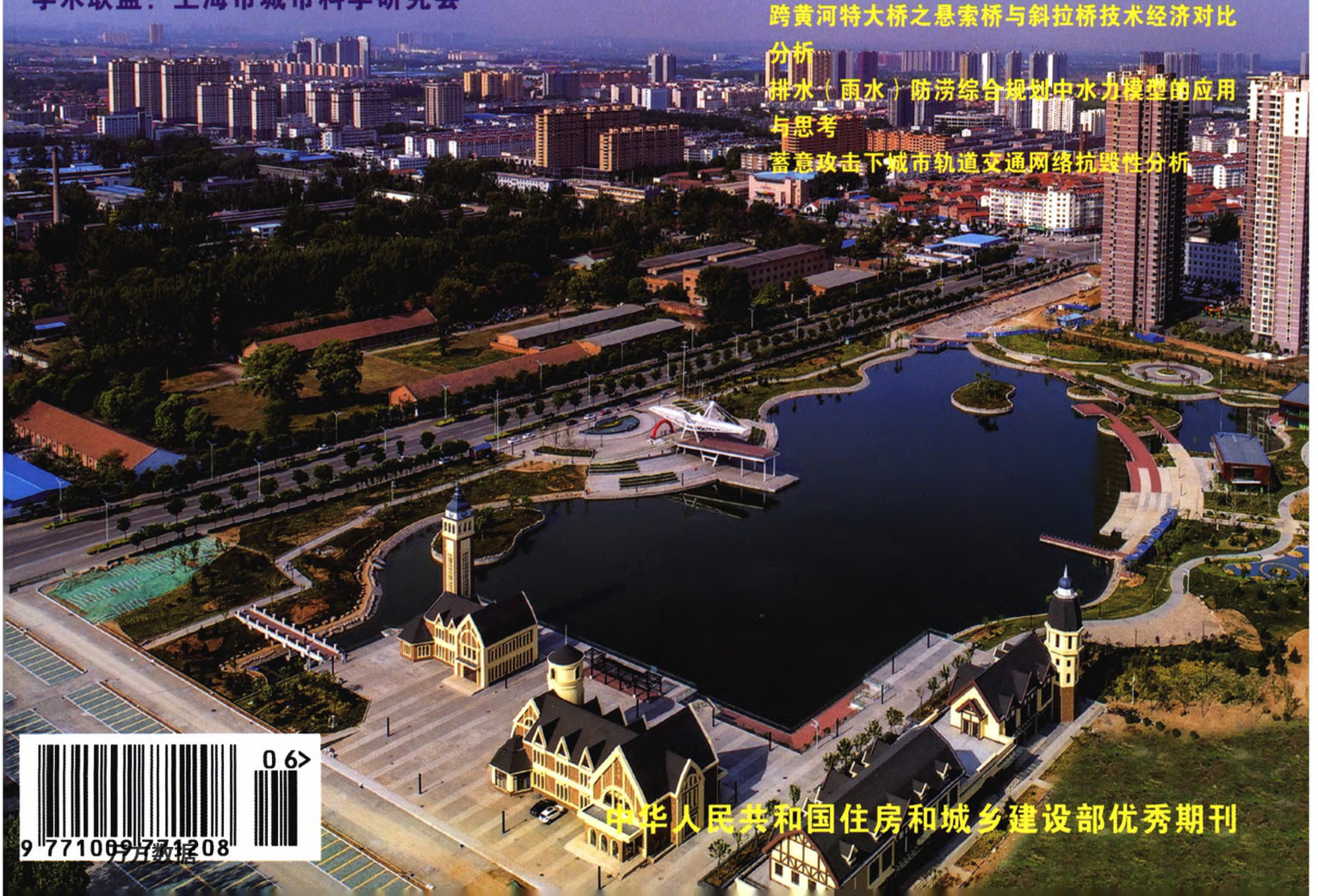
● 本期看点



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广告索引

封面工程

本期封面工程为山西省长治市“三河一渠”工程，由南京市水利规划设计院股份有限公司设计。

“三河一渠”是山西省长治市主城区的环城水系，是区域行洪、排涝的主要通道，是城市环境、景观的重要载体。工程治理总长度为 14.63 km，其中石子河 4.96 km，黑水河 3.02 km，南护城河 3.92 km，东防洪渠 2.73 km。石子河与黑水河按 50 a 一遇标准设防，并做好 100 a 一遇的防洪预案；南护城河及东防洪渠按 50 a 一遇标准设防。

主要建设内容：(1)河道防洪达标建设。疏浚、拓挖河道，以满足行洪要求；对河床、岸坡进行护砌，以满足防冲要求；拆建并加高堤防，使之满足挡洪要求。(2)调蓄水系统建设。新建蓄水坝、跌水堰等建筑物，使河道能够蓄水，部分段满足行船要求，结合沿岸景观治理提升河道景观。(3)风景园林景观提升。河道沿线风景改造，重点对滨河公园、太行公园、紫坊游园、黑水河游园等节点进行景观提升，同时修建沿河商业建筑等。(4)监测、运行管理系统建设。主要是建设水质监测系统和运行管理系统。

“三河一渠”工程于 2012 年 12 月开始设计，2014 年 7 月设计完成，2017 年 3 月项目建成并投入运营。该工程集“水安全、水生态水环境、水文化水景观、水经济”为一体，受到市民欢迎，建成以来已成为山西长治市一张崭新的城市名片，在山西省乃至全国起到了一定的城市河道综合治理示范作用，发挥了巨大的经济效益、社会环境效益和生态效益。

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CONTENTS

ROADS & COMMUNICATION

Abstract: The systematic thinking should be set up for the urban work should set up the systematic thinking. The major issues related to urban development should be further studied and carefully deployed, and all aspects of work are systematically promoted from many elements of urban structure, urban function and urban composition. The urban structure is determined by the road network structure. From the ring to improve the accessibility of the road network structure, the basic function of the ring and the functions derived from it are analyzed. The influence of the relative position relationship between the ring and the node on the function is analyzed. It is concluded that the close connection between the ring and the node is the guarantee to give play to the basic liaison function. Taking the Middle Ring of Wuxi City as an object, the influence of the function and alignment of North Outer Ring on the function are analyzed in detail. by comparing the alignment, it is concluded that the alignment of Zhonghui Avenue can meet the functional requirements of the Middle Ring.

Keywords: ring network, Middle Ring Line, accessibility, basic functions, alignment

Abstract: The current urban road traffic in China is almost the traditional mode of "thin road network, big block and wide road". Its disadvantages are increasingly exposed. Compared with the traditional planning mode, the different technical means are adopted for the planning mode of "small block and dense road network" in the aspects of road network planning, road design, land utilization and city design to inspire the vitality of street and to improve the economic benefits of city. Taking the core area of Jiangbei New Area in Nanjing as an example, the planning control measures of "small block, dense road network", the land development conditions and the coordination of the relationship between the road construction and the traffic organization are explored. The traffic organization is optimized. The road construction in the future is guided. The reference can be provided for the implementation of "small block, dense road network" planning.

Keywords: small block, dense road network, road planning, traffic organization, traffic design

Abstract: How to integrate the concept of sustainable development in the design of urban roads, the spatial resource allocation of motorized traffic and green traffic should be fully balanced, and the convenience, safety

Abstract: Combined with the example of Tongliao City Daxing Road Reconstruction Project and according to the scheme design, under the conditions of meeting the relative technical standards and not increasing the investment, it is as far as possible to use the higher alignment design indexes within the reasonable range. The design of road longitudinal section should conform to the natural slope direction, and should link up with the adjacent urban roads and surrounding lands well. The height change should be as smooth and gently as possible. The regional drainage requirements should be satisfied. The nodes of the present railway and expressway should be designed with emphasis. The scheme designs are carried out for the plane, longitudinal section, cross section and node of Daxing Road. The reconstruction of Daxing Road has perfected the structural system of road network in Tongliao City, which can provide the beneficial reference for the construction of the similar projects.

Keywords: main road, traffic volume forecast, overall design, node scheme

Abstract: Upper and lower ramps connect the urban elevated expressway and the ground road network, and are a necessary means to fully play the role of expressway function and relieve the traffic pressure of ground road network However, the bridge approach of ramp road often causes much effect on ground traffic organization. If it is not improperly arranged, the ground traffic situation could be in chaos, the travel in the areas along the route would be blocked, the key junctions might be jammed and even the service capacity of expressway would be reduced. Therefore, it is necessary to reasonably select the arrangement of ramp landing section and optimize the design of traffic organization at the relevant ground crossings in combination with the actual situation and traffic demand.

Keywords: elevated expressway, ramp, landing section, intersection, ground traffic organization

Abstract: With the rapid development of economy in China, the traffic volume and traffic load of road have rapidly increased. The highways built in the early days are congested. The pavements are damaged in the large scale. Many grades of highways are gradually entering the stage of reconstruction and extension. Due to the lower standard of construction at an initial stage, the low-grade highways are seriously damaged. The extension design of these highways is more complex. Now based on the principle of the least square method, the plane fitting design and error design are carried out for the old roads. The reference can be provided for the reconstruction and extension of cement pavements of the low-grade highways.

Keywords: reconstruction and extension, single-side widening, plane fitting, least square method

Abstract: In order to prevent the diseases of pavement longitudinal cracking due to uneven settlement of the

Abstract: Asphalt Pavement crack is a kind of road damage form, such as reflection crack of asphalt pavement with semi-rigid base, temperature crack of asphalt pavement in cold area, etc. At the present, there are no efficient measures to avoid it completely. After cracks appear on the pavement, the rainwater, snow water and so on seep into the surface layer and the base layer along the cracks to make the base layer or even the roadbed soften, to reduce the strength of the base layer and roadbed, and to damage the road surface locally or in pieces, thus to result in the rapid reduction of driving speed, comfort and safety, and the reduction of road life. Based on the investigation and analysis of the present situation and problems of crack treatment in highway asphalt pavement, combined with the characteristics of crack treatment materials in current highway asphalt pavement, the influence factors on crack treatment of asphalt pavement are analyzed and studied.

Keywords: asphalt pavement, crack treatment, treatment method, crack pouring material, influence factor

BRIDGES & STRUCTURES

Abstract: At present, the decks of some municipal bridges are designed to be wide because of the traffic capacity needs in China. Wider decks need more main girders or increase the section dimension of the main girder. For the bridges with a certain design height requirement, the multi-girder structure is generally adopted. According to the practical application of small-span and middle-span multi-beam steel-concrete composite girder bridges in the present stage, and based on the design construction specifications, some brief design guides and the relative proposals are put forward for the design and construction of the bridges.

Keywords: small span and middle span, multi-girder steel-concrete composite girder, layout of main girder, prepared structural and section dimensions

Abstract: By studying the typical floating bridge cases at home and abroad, the differences in the construction of floating bridges at home and abroad are compared and analyzed, the basic composition and classification of floating bridge are expounded, the characteristics and application conditions of floating bridge are comprehensively analyzed, and the current situation and application prospect of floating bridge are discussed and explored. According to the work experience and combined with the characteristics of floating bridge, the application prospect of floating bridges in China is expected. The problems faced by the construction of permanent heavy floating bridges at present in China are put forward. The corresponding countermeasures and suggestions are given. The research and technical reference are provided for the construction of floating bridges.

Keywords: civil floating bridge, basic composition, structural classification, scope of application, application prospect

Abstract: The anchorage zone for cable and pylon of cable-stayed bridge is an important structure bearing the cable anchorage force, and is also a key position in the pylon design of cable-stayed bridge. The steel anchor beam cable-pylon anchoring structure is a structure able to better play the tensile strength of steel structure. But this kind of anchoring form is mainly adopted for the vertical-plane cable-stayed bridge, and few studies have been made on the application of spatial plane cable-stayed bridge. In order to study the stress characteristics of steel anchor beam structure under the action of spatial cable plane, relying on a spatial plane cable-stayed bridge, the stress characteristics of steel anchor beam in anchorage zone are studied by the methods of numerical simulation and theoretical analysis. The study result shows that the horizontal component along bridge of spatial plane cable to the anchor beam is relatively small. The lateral spacing device is used to provide the controllable support along bridge. The stress of anchor beam pull plate is obviously concentrated in the position of tiger mouth. Attention should be paid to strengthening the smooth transition of this zone. The inspection of bearing capacity should be strengthened under the condition of cable breaking in the design of concrete pylon wall.

Keywords: cable-stayed bridge, anchorage zone, spatial plane, steel anchor beam, stress analysis

Abstract: Taking a bridge of Changchun as an example, the static pressure test of support is carried out for the hanging hole of mid-span steel box girder with abnormal vibration, the suspender cable force of the main bridge is tested and the vertical mode of the main bridge is tested. The disease causes are analyzed. The maintenance measures are provided. The basis is provided for reasonably treating the same diseases in the detection and maintenance process of the similar bridges in the later period.

Keywords: steel box girder, test, cable force, mode

Abstract: In the construction of urban bridges, the traditional cast-in-place construction schemes have a large impact on the environment and traffic. The prefabricated bridges have a fast construction speed and low environmental pollution, which is a reflection of green construction. A prefabricated scheme is adopted for a viaduct in Changchun. The prefabricated prestressed concrete small-box girder and fabricated steel box girder are adopted for the superstructure, and the prefabricated three-segment bent cap and sectioned prefabricated pier are adopted for the substructure. The green engineering construction is realized. The design and construction essentials of superstructure and substructure for prefabricated bridge are specially introduced.

Keywords: prefabrication assembly, small box girder, steel box girder, three-segment bent cap, sectioned prefabricated pier

Abstract: The Yellow River Bridge of Zhongwei South Station crosses the main stream of the Yellow River at the upstream of Zhongwei South Station, and is an important traffic node connecting Shapotou Airport and

Abstract: Taking a river-crossing bridge of Zhengzhou as the engineering background, based on the current specifications, a model is established by the finite element software MIDAS. Combined with the response spectrum method, the anti-seismic checking calculation of this bridge pier is carried out under the action of E1 and E2 earthquakes. The result of anti-seismic checking calculation shows that this bridge meets the earthquake fortification target and code requirements. This method can provide the reference for the anti-seismic checking calculation of the similar bridges.

Keywords: bridge pier, response spectrum, anti-seismic checking calculation

Abstract: In recent years, the steel structural bridge is used more and more for the highways, and the municipal small-span and middle-span bridges in China. At the same time, the accidents of bridge damage, lateral overturning and instability until collapse caused by the overload and heavy load occur one after another, which have become the important damage forms of bridge. The overturning accidents of bridge in China in recent years are summarized. The anti-overturning design concept is discussed. An anti-overturning anchor bolt structure of bridge has been developed, and is mainly used for the small-span and middle-span steel structural bridges. Its structural characteristics and application examples are introduced.

Keywords: anti-overturning, anchor bolt, steel structural bridge, small span and middle span

Abstract: Taking B Ramp of an interchange in Nanchang as an example, the anti-overturning stability checking calculation and reinforcement design are carried out for it through the establishment of finite element model. The influence of the space between the reinforced pier number, newly increased support and original support on the anti-overturning stability of bridge and the stress of middle pier in the reinforcement method of changing the single-point support of middle pier into the multi-point support is studied. Finally, comprehensively considering the reinforcement effect and reinforcement cost, the reliable anti-overturning reinforcement scheme is proposed. The reference can be provided for the anti-overturning reinforcement design of the similar single-pier bridges.

Keywords: single-pier bridge, anti-overturning checking calculation, reinforcement design

Abstract: In recent years, with the rapid development of urban construction and transportation industry, the overloading of cars is becoming more and more serious. There are many cases of box girder bridge overturning, instability and collapse occurred in the different places, which have had a serious social impact. Combined with an engineering example, through the finite element analysis and based on the requirements of the latest standards for the anti-overturning check calculation of bridge, the influence of support layout of curved box girder bridge on the overturning stability is studied. Based on the analysis result, several

FLOOD CONTROL & DRAINAGE

Abstract: The development of hydraulic model provides a new technical means for the development of urban drainage waterlogging prevention. The urban drainage waterlogging planning should be guided by the hydraulic model defined in *Outline of Comprehensive Urban Drainage (Rainwater) Waterlogging Prevention Planning*. But at present, there are many problems still in the use of the model. These problems of collecting the model base data, checking the parameters and dividing the use boundary are required to consider for the model use in the planning.

Keywords: urban drainage waterlogging prevention, hydraulic model, model checking

Abstract: Taking the sewage treatment process of a large-scale wastewater treatment plant (WWTP) as an example, the quantity and quality of sludge liquid produced by sludge treatment system are analyzed. At the same time, the engineering parameters of phosphorus removal tank built to avoid the backflow of sludge liquid and increase the load of sewage treatment system are introduced. The relevant experience can be referenced for the similar projects.

Keywords: wastewater treatment plant (WWTP), sludge liquid, phosphorus removal tank

Abstract: The Design of the drainage engineering for the vehicle depot of the mass rapid transit (MRT) of Shanghai Pudong Airport is introduced. Combined with the change of boundary conditions, the original design is optimized in the construction process including the construction of integrated rainwater pumping station, the application of trenchless road-crossing technology and the other measures. The key control measures in the engineering construction process are summarized. Some suggestions are put forward for the similar projects in future.

Keywords: mass rapid transit (MRT), drainage, trenchless, integrated pumping station

Abstract: The present water system layout and drainage system in the east area of Hongqiao Airport are great different from the east area planning of the airport. Due to the needs of the area development, it is proposed to landfill the present water system. The river landfilling scheme is discussed. And the influence of landfilling river on the water safety, water environment and water resource of the area is expounded in detail.

Keywords: landfilling river, balance of excavation and landfill, influence analysis

Abstract: The three-year action plan for improving the quality and efficiency of municipal sewage treatment in Shanghai is proposed to speed up and supplement the shortfalls in sewage collection and treatment facilities, and optimize and perfect the sewage treatment system and mechanism. Taking Qingpu District of Shanghai as an example, by analyzing the characteristics, current treatment mode and existing problems of its

MANAGEMENT & CONSTRUCITON

STUDY ON SCIENCE & TECHNOLOGY

assessment of tunnel structure are systematically studied. The division principle of tunnel assessment unit, the scoring index of subcomponent, the scoring method of component unit and the overall assessment method of tunnel structure are proposed. Combined with the actual test data on site, these methods are applied in the actual tunnel detection and technical condition assessment. The beneficial technical support can be provided for the performance assessment of urban shield tunnel structure and the decision of the subsequent maintenance measures.

Keywords: shield, tunnel, technical condition, assessment

Abstract: From the perspective of bridge structure safety, the influence of bridge foundation settlement and lateral displacement caused by the construction of deep foundation pit on the bridge structure is analyzed through an analytical method. The additional bending moment and additional stress of bridge structure caused by the bridge foundation displacement are solved. The allowable values of bridge foundation settlement and lateral displacement are proposed in the construction of deep foundation pit. The analysis results can provide the theoretical basis for the real-time monitoring and early warning of the bridge in the construction of foundation pit.

Keywords: construction of deep foundation pit, allowable value of bridge foundation displacement, structural safety

Abstract: In the design of urban expressway, the multi-directional ramp bridge is often constructed at the node of urban interchange according to the traffic functional requirements. Due to the design constraint of mainline bridge and ground auxiliary roads, and the influence of urban underground pipelines, it is necessary to adopt the middle crossbeam structure with overhanging large-span cantilever for the superstructure pre-stressed concrete box beam of the bridge in the structural design of ramp bridge in order to form a special structure. Aiming at the mechanical characteristics of this special structure in the practical project, the finite element analysis method is used to carry out the overall structure and local numerical analysis for the typical construction conditions. The dynamic performance of integrated bridge is analyzed. The mechanical state of this structure is more completely obtained. The powerful technical support is provided for the design and construction of the engineering projects, and some references are valuable for the application of the same structures.

Keywords: urban interchange, pre-stressed concrete box beam, numerical calculation

Abstract: Taking the internal structural system of "plate-beam-column" double-layer tunnel as an example, the connection form of double-layer vehicle structure and shield segment is studied by means of numerical simulation including four connection modes of fixed connection, hinged connection, chain link

APPLICATION OF ACHIEVEMENTS

Abstract: The rock compound modified additive (RCA) asphalt is used to replace the SBS modified asphalt in a heavy load road for curing the pavement and treating the diseases. The experimental analysis shows that this technology can greatly improve the pavement construction quality, perfect the pavement performance and prolong the curing period.

Keywords: rock compound modified additive (RCA), curing, asphalt mixture, performance study

Abstract: In order to explore the mechanical properties, stability properties and fatigue properties of semi-flexible pavement materials under the different design porosities, the optimal design porosity is quoted to verify the properties of semi-flexible pavement materials. The results show that the semi-flexible pavement materials have the excellent properties. With the increase of design porosity, the mechanical properties of semi-flexible pavement material increase, but it will become more brittle, and is not conducive to the stability of the structure. In the practical engineering, through the strict control of raw material ratio and construction sequence, the mechanical properties of semi-flexible pavement material can achieve the test effect and greatly improve the anti-disease capacity of pavement.

Keywords: high-grade highway, semi-flexible pavement material, design porosity, practical engineering

Abstract: The asphalt pavement has many advantages of comfortable driving, low noise and convenient maintenance, and is widely used in high-grade pavement. However, when the flexible asphalt pavement is paved on the rigid cement concrete bridge deck, after the project is put into operation, the bridge deck will often be damaged by diseases such as displacement, pit slot, rebar corrosion, void between the upper and lower layers and water seepage. The high-quality development of pavement is always troubled by these problems in China. The promotion and application of BMP solvent reactive waterproofing material in bridge deck engineering have successfully solved the above diseases in bridge engineering. The engineering quality is improved, the service life of the project is extended, and the good economic and social benefits are achieved.

Keywords: bridge deck, BMP, solvent reaction, quality, application

THE RELATIVE SPECIALITIES

Abstract: First of all, through in-depth analysis of 372 articles included in the SCI database and EI database from 2009 to 2019, and 476 documents included in CNKI China Knowledge Network, the research status of utility tunnel is grasped from a macro perspective, and the relevant literatures are reviewed and categorized with three major research hot spots of life cycle management, financing and pricing of utility tunnel. And then on the basis of existing research, in view of the development status of utility tunnels in China, the suggestions

Abstract: Taking the National Highway 109 New Line Expressway as an engineering example, the method of theoretical analysis and engineering analogy is used to analyze and determine the design contents of durability of mountain tunnel. The design process of the secondary lining durability of mountain tunnel is proposed. At the same time, the tunnel durability is designed in detail according to the actual environmental conditions of the project. And the technical measures to improve the durability of secondary lining structure are put forward. The effective reference can be provided for the durability design of the similar mountain tunnels.

Keywords: mountain tunnel, durability design, structural disease, design process

Abstract: The structural design process of the working shaft at the south of river for the shield tunnel of West Jianning Road Crossing-river Channel is introduced. By comprehensively considering many aspects of surrounding area, buildings (structures), engineering geology, hydrogeology, foundation pit depth, safety and economy, the design scheme of composite structure is finally applied. A 3D finite element model is established by Midas Gen to simulate the different working conditions of structural construction period and operation period. After the analysis, the result shows that the mechanics characteristics of each stage of working shaft are given and the optimization proposal is put forward. The mutual checking process of the calculation result of the underground diaphragm wall and the settlement result of the composite structure is briefly described.

Keywords: West Jianning Road Crossing-river Channel in Nanjing, shield working shaft, ultra-deep, composite structure, design

Abstract: Relying on the first large-scale full underground refuse transfer station project in China, the supporting scheme of deep foundation pit of the transfer station is defined through the comparison, selection and program calculation of the supporting schemes for the foundation pit. The finite element analysis model is established by Plaxis software to study the influence of dynamic excavation of the foundation pit on the surrounding buildings and structures in order to provide a certain reference for the similar projects.

Keywords: full underground transfer station, deep foundation pit, surrounding environment, numerical simulation

Abstract: In order to study the forepoling of ultra-small clear distance tunnel in collapsible loess region, relying on Lanzhou South Ring Expressway Liuquan Tunnel 3#, GTS-NX finite element software is used to compare and analyze three forepoling schemes of leading pipeline shed, horizontal rotary shotcrete support and large shed with horizontal shotcrete pile. The calculation result shows that the vertical settlement of the ground is small within the influence scope of forepoling construction of large shed with horizontal shotcrete pile, and no obvious deformation and cracking are observed in the initial support, and the integrated stability is good, which can bear the upper soil and traffic load. This scheme has a good effect in the field engineering

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