

城市道桥与防洪

主管：中华人民共和国住房和城乡建设部
主办：上海市政工程设计研究总院(集团)有限公司

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图为四川公路桥梁建设集团勘察设计公司设计的G4216线宁南至攀枝花段高速公路钒钛高新区大桥工程

因为我们专心,所以我们专业!

——《城市道桥与防洪》

学术联盟：上海市城市科学研究会

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- 带状组团型城市快速路规划技术要点
- 桥梁结构损伤识别研究现状与展望
- 城市更新场景下老旧小区污水系统提质增效研究
- 城市地下道路综合管控平台架构设计研究与应用



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封面工程

本期封面工程为G4216线宁南至攀枝花段高速公路钒钛高新区大桥项目,由四川公路桥梁建设集团勘察设计分公司设计。

G4216线宁南至攀枝花段高速公路是G4216线成都至丽江高速公路的重要组成部分,是国内高速公路建设史上单体投资规模最大的高速公路项目,是国家“一带一路”倡议和“长江经济带”的重大项目。

钒钛高新区大桥是G4216线宁南至攀枝花段高速公路的重要控制性工程。大桥主桥跨越金沙江,为128m+245m+128m矮塔斜拉桥,主梁为C60全预应力混凝土结构,高墩引桥采用钢桁-混凝土组合梁。主塔采用C50矩形钢筋混凝土结构。主塔横桥向为2.5m,纵桥向由有索区段的5.0m渐变为塔底的8.5m,塔高34.9m。

主墩采用单箱双室钢筋混凝土空心薄壁墩、桩基承台结构。宁南岸墩高115m,攀枝花岸墩高116m。承台采用19m×19m矩形截面,承台厚度6m。每墩16根桩,桩径2.50m。

钒钛高新区大桥于2020年5月1日开工建设,主桥每个T构单侧31个标准梁段,其中宁南岸主梁已悬浇至26#块件,攀枝花岸主梁已悬浇至25#块件,主桥合拢在望。

大桥建成后,有利于区域公路物流与长江沿线港口的联系,是辐射带动川、滇、渝、黔的又一通道,是G5京昆高速四川境内的辅助通道。

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Urban Roads, Bridges & Flood Control (Monthly)

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Abstract: With the improvement of urbanization level and continuous expansion of urban space scale in China, many cities have been evolved into the banded group spatial structural cities. Fewer axial traffic trunks, severe traffic congestion, and lack of large and medium-sized public transport have become the important problems to puzzle the urban traffic operation and hinder the urban development. The development history and traffic characteristics of banded group cities are specially sorted out. The key contents and solutions needing to be considered for the similar cities in the planning of urban expressway network are put forward.

Keywords: banded group city; urban expressway; axial traffic trunk; expressway planning

Study on Overall Scheme for Changhe Section of Zuoan Avenue in Principal Axis of Yangtze River in Wuhan
..... LIU Yong, XIE Yihong, YIN Zuchao (5)

Abstract: Changhe Section of Zuoan Avenue in Wuhan is an important part of Zuoan Avenue in the principal axis of the Yangtze River. It is a waterfront expressway with the traffic function as mainly and both with the comprehensive function of sightseeing and recreation. The bridge form is mainly adopted. Based on the urban planning, combined with the functional orientation of the main traffic axis of Yangtze River, on the basis of fully considering the controlling factors such as Lannihu Embankment, Tongshun River, Ring IV Road (Zuankou Yangtze River Bridge), the natural highland of Xiaojun Mountain, Helenbergh Town, Junshan Embankment, basic farmland, Yangtze River, Metro Line 16, Zhuankou Railway Special Line, etc., the overall design scheme of the Changhe Section of Zuoan Avenue is studied, which provides a reference for the planning and design of the urban waterfront expressways.

Keywords: changhe section of Zuoan Avenue; overall design; expressway; embankment

Research on Extension and Reconstruction Scheme of Expressway Interchanges in Suburbs of City for Xian Ring Expressway North Passenger Station Interchange Project FAN Yan (9)

Abstract: The new traffic distribution function of the urban road city needs to be connected to the external expressway through an interchange. But the high density of interchanges in the ring expressway section of the suburbs and the small clear distance between the adjacent interchanges often make it difficult to establish the new interchange exit. To meet the demands of the new interchange functions, the existing interchanges are considered to use for reconstruction and expansion. In other words, the reconstruction and extension of the existing interchange meet the ramps with the demand of capacity extension function. The problems existing in the reconstruction and extension of interchange, the scheme formulation, the traffic flow check and the related considering factors are studied and discussed, the detailed design flow and the referred standard rules are described in order to provide the reference for the reconstruction and extension of interchanges under the similar construction conditions.

Keywords: interchange; capacity extension and reconstruction; clear distance; ramp; traffic flow; design speed

Study on Node Scheme of Dafapu Interchange in Baopeng Channel of Shenzhen HAN Baoxin (13)

Abstract: The construction of new urban expressways is easily limited by various construction conditions in the urban area, especially the interchange node. The problems existing in the engineering construction are particularly prominent due to the large floor area of node. The construction conditions and planned interchange scheme for the node of Dafapu Interchange in Baopeng Channel of Shenzhen are analyzed in detail. Three interchange schemes are proposed on the premise of minimizing the impact on the intersected roads. The three schemes are comprehensively compared from the aspects of traffic capacity, engineering cost, land acquisition and demolition, pipeline relocation and so on. Finally the optimal design scheme is determined, and the analysis method of interchange nodes under the complex urban construction conditions is summarized.

Keywords: interchange; complex construction conditions; reconstruction; comprehensive comparison

Analysis on Form and Applicability of Expressway Interchange for Jiuzhou East Extension Expressway in Nanchang SHEN Jiali (17)

Abstract: Urban expressway interchange is not only the key to realize the rapid traffic conversion, but also a difficult problem in the expressway planning and design. Several common forms of expressway interchange are summarized. By analyzing the advantages and disadvantages of each interchange form, its scope of application is analyzed, and the applicability of different forms of interchange is summarized. The steps of interchange planning and design are concluded, and the general methods of expressway interchange design are explored. Finally, Nanchang Jiuzhou East Extension Expressway is analyzed and verified.

Keywords: expressway; selection of interchange type; functional analysis; application cases

Study on Interchange Reconstruction Scheme of East Mingxiu Road – Yongwu Road ZHOU Lang (21)

Abstract: The project is located at the intersection of East Mingxiu Road and Yongwu Road. The surrounding land conditions are limited, the buildings are dense, and there are many factors restricting the high-voltage lines, subways and utility tunnels, which make the construction of the project extremely difficult. Combined with the functional positioning and the surrounding status, a three-story diamond-shaped interchange scheme is proposed. By appropriately raising the elevation of the ground intersection, a common structural tunnel with the subway station is set up to separate the east-west straight traffic, and an overpass is set up in Yongwu Road to span the subway station to achieve the separation of a north-south straight traffic and to realize the turning traffic through the ground intersection, which ensure the smooth flow of traffic in the north – south and west – east mainstreams.

Keywords: interchange; reconstruction; rhombus; overpass; subway station

Philosophical Thinking of Urban Road Engineering Design SAI Wanyin (25)

Abstract: The design method of modern urban road engineering should start from the requirements of the overall engineering structure, functional efficiency, environmental adaptability and social harmony. At the same time, it also focuses on the integration, innovation, scientificity, empiricism, sociality, publicity, efficiency and risk of the engineering system. On the basis of inheriting, sublating and developing the traditional design methods, the modern design method will be deepened and sublimated into the overall design method that is open, dynamic and systematic. The research on the philosophy method of urban road engineering design is carried out to help the designers more deeply understand a series of important issues such as the essence, source, effectiveness, rationality and growth model of the urban road engineering, and the relationship between knowledge and practice of urban road engineering, which also helps the builders more consciously grasp and apply the systematic concepts, tools and philosophical ways of thinking in the design process.

Keywords: urban traffic; design method; philosophical thinking; urban road; systematicness

Research on Traffic Layout of High-speed Railway Stations in Typical Small and Medium-sized Cities

..... WANG Yong, CAI Wenyuan, FENG Jian (30)

Abstract: From the perspective of station infrastructure layout, the spatial layout mode and plane function arrangement of infrastructure are analyzed, and the common mode of small and medium-sized cities is given. From the perspective of station infrastructure design, the station house and the transfer facilities of the hub are explored, and the common design forms of small and medium-sized cities are provided. Finally, through the analysis of high-speed railway cases in small and medium-sized cities, the advantages and disadvantages of traffic function layout modes and traffic organization methods of small and medium-sized cities are summarized, and the traffic connection strategy of high-speed railway station is proposed, which provide the design ideas for the traffic layout of high-speed railway stations in small and medium-sized cities.

Keywords: small and medium-sized cities; high-speed railway station; spatial layout; traffic organization

Design Essentials of Connection Scheme for River-crossing Bridge in Traffic Urban Arterial Road

..... FANG Zengyao, SHEN Junyi, ZHU Yinle (34)

Abstract: The connection engineering of bridge is an essential constituent part for a bridge playing its traffic function. Due to the conditionality of planning, field condition, investment scale, environment and the other factors, the complexity of bridgehead connection scheme is high and its independence is strong. For the urban expressways and arterial roads exceeding the 100 m-wide river system, the bridgehead connection is divided into three types of interchange, separation and at-grade crossing. The applicable occasions of the three bridgehead connection types are studied. The main factors affecting the above three connection schemes are the planning, traffic, road and site. A set of design process is formed by the quantitative description and qualitative analysis, which aims to reduce or avoid the randomness and blindness of the design. The summary of design essentials and design flow can provide the reference for the similar projects.

Keywords: traffic arterial road; river-crossing bridge; connection type; influencing factor; design flow

Study on Traffic Improvement Scheme of Yingbin Avenue - Taihang Street in Changzhi City

..... CHEN Yanmei (38)

Abstract: With the development of economy and society of Changzhi City, as an important external traffic trunk road to the west, the traffic congestion of Yingbin Avenue - Taihang Street is becoming more and more serious, and the traffic volume tends to be saturated during peak hours. By investigating the current situation of the road and traffic operation of Yingbin Avenue - Taihang Street, the existing problems of the current situation of Taihang Street are analyzed. Whether Yingbin Avenue - Taihang Street is suitable for the construction of viaduct is expounded from the functional positioning of Yingbin Avenue - Taihang Street, the current traffic analysis, the impact of viaduct on the road network in the core area, the influence of viaduct on landscape and traffic and the other aspects. Finally, according to the analysis of current problems, the traffic improvement scheme of Yingbin Avenue - Taihang Street is put forward to alleviate the current situation of traffic congestion in Taihang Street.

Keywords: viaduct; expressway; flyover; variable lane

Planning and Design of Greenway around Lake Based on Cultural Travel Orientation

..... ZHANG Yao, XU Yeming, FAN Liangping, SHEN Yanbin (44)

Abstract: According to Zhengjiang Provincial Greenway Network Planning (2021-2035), Zhejiang Province will launch the action program for the overall construction of "greenway 2.0". Greenway construction is not only the specific implementation to realize the demonstrative two-mountain transformation project, but also an important measure to construct the jointly enriched demonstration area

in Zhejiang Province. The master planning and construction conditions of the greenway around Xianxia Lake are analyzed. Based on the layout of residential villages and the context of cultural and tourism resources in Hushan Town, the function orientation of greenway is determined by combining leisure tourism with mountain sports events, and the design scheme of the overall line and section along the reservoir area in series with vacation attractions is proposed so as to provide the reference for the design of characteristic greenways with similar basic conditions.

Keywords: greenway construction; greenway network; greenway around lake; cultural tourism resource; planning analysis; overall design

Brief Analysis on Spongy Design of Urban Road Sidewalk YOU Qiangsheng (48)

Abstract: Facing the two challenges of rapid urbanization and extreme weather, a new strategy is being adopted in China, which will turn the cities into giant "sponges". The urban "sponge" reconstruction has been put on the construction agenda, and the construction of "sponge city" to promote the utilization of rainwater resources and the protection of ecological environment is getting more and more attention. Sponge city plays an important role in systematically solving the water problem in urban development. Referring the construction experience of Pingxiang City, the first batch of pilot cities for the construction of the national sponge cities, and combined with the relevant specifications, standards and atlas, the sponge design of sidewalks is carried out according to the local conditions, which can be referred for the follow-up low-impact development and construction of the projects.

Keywords: sponge; LID facilities; pervious pavement; biological retention zone; ecological tree pond

BRIDGES & STRUCTURES

Study on Overall Design and Key Technology of Single-pylon Hybrid Beam Cable-stayed Bridge

..... HUANG Yongfu, FENG Yangbin, LIU Bin, BAI Hongtao, YI Zhiyong (52)

Abstract: Taking a single-pylon hybrid beam cable-stayed bridge as the engineering background, the bridge has the design characteristics and difficulties of the high degree of structural asymmetry, complex stress of steel-concrete composite segment, various anchoring modes of stayed cable, and high seismic intensity. By using the new materials of UHPC concrete, PSB930 high-strength threaded steel bar and low-retraction anchorage, by using the technological means of comprehensive cable adjustment method, finite element analysis method and seismic measures, by adopting the prestressed secondary tensioning construction technology, many key technical problems of single-pylon hybrid beam cable-stayed bridge are scientifically solved so as to achieve the purpose of structural stress reasonable, safe and reliable, which provide the ideas for design and research of the similar bridges.

Keywords: overall design; high degree of asymmetry; steel-concrete composite segment; anchoring mode of stayed cable; seismic performance

Analysis on Mechanics Characteristics of Vertical Rotating Structure for Main Pylon of Cable-stayed Bridge

..... XIE Shuhui (56)

Abstract: In order to research the influence of the "horizontal assembly and vertical rotation" process of the main pylon of cable-stayed bridge on the structural stress, through the full-process simulation analysis of finite element, the stress, cable force, deformation and stability of vertical rotating structure are calculated. The results show that the most unfavorable stress state of the structure is the stage when the main pylon is just out of the tire frame. In this state, the structural stress, cable force and deformation are much large, and the structural stability safety factor is relatively small. The structural monitoring at this stage shall be strengthened during the construction process.

Keywords: cable-stayed bridge; main pylon; horizontal assembly; vertical rotation; finite element analysis

Design of Double-way Asymmetric Single-pylon Cable-stayed Bridge in West Extension of Pingcheng Street in Datong City WU Yongxian (59)

Abstract: The background project is the main bridge in the main west extension of Pingcheng Street in Datong City, Shanxi Province. This bridge spans the existing railway marshalling yard and several important railway lines. The structural design and calculation of the over-large bridge are specially introduced. It is a double-way asymmetric single-pylon central-plane cable-stayed bridge. Its span layout is 41 m+50 m+163 m, and its pylon column and main beam are the steel concrete composite structure. In order to reduce the influence on the railway, the rotation construction is adopted. The results of overall static, local and dynamic computational analysis show that the structure design of the bridge is reasonable, and its construction is safe and reliable, which can provide reference for the design and construction of similar bridges.

Keywords: double-way asymmetry; composite beam cable-stayed bridge; steel pylon; rotation construction

Design of Integral Precast Composite Beam and Study of Key Technology WEI Yihang, SHI Faming, DENG Jiacheng (63)

Abstract: The viaduct in Moganshan Road of Hangzhou is designed and constructed by the full prefabrication and assembly technology. Its superstructure is mainly the multi-span continuous integral precast composite beam. Taking this project as the research object, the technology of integral precast composite beam for the viaduct in Moganshan Road is introduced, and its detailed design contents are discussed. According to the particularity of the project, the treatment schemes of the negative moment area of the integral precast composite beam are compared and selected in order to provide some reference for the design and construction of the similar projects.

Keywords: full prefabrication and assembly; integral precast composite beam; finite element calculation; design; construction

New Scheme of Aseismic Design for Urban Double-deck Elevated Bridge in High-intensity Area FU Jixing, WANG Mingye, XU Jun (66)

Abstract: The double-deck bridges are more and more applied for river-crossing and sea-crossing bridge, and urban elevated bridges. Combined with the design of the double-deck elevated bridge project in the terminal of an airport, the factors of high-intensity area, large deck width, demanding clearance requirements and fast construction requirements are specially solved. Many schemes are compared and selected from the structural material, structural system, shock insulation design and other aspects. The spatial modeling calculation is carried out. The new design scheme of double-deck frame coordinated with shock insulation is put forward, which provides the beneficial reference for the design of the similar bridges in the future.

Keywords: double-deck elevated bridge; aseismic design; shock insulation system

Research on Seismic Reinforcement Evaluation Method of Bridge Based on American Standard CHENG Xianjie, TIAN Jing (70)

Abstract: The evaluation analysis method of seismic reinforcement design of bridge by American standard is discussed in detail. Two quantitative preliminary evaluation methods of index method and damage assessment method are put forward, in which the index method can quantitatively evaluate the urgency of seismic reinforcement of the old bridges so that the relevant departments formulate a priority list of seismic reinforcement and maintenance of the old bridges in the regions. By establishing the vulnerable curve, the damage assessment method specially evaluates the direct cost of seismic reinforcement of bridges, and evaluates the rationality of seismic reinforcement of the old bridges in combination with indirect costs. Through the conversion of the design response spectrum of the Chinese and American standards, both methods can be used as reference for the seismic reinforcement of old bridges in strong

earthquake areas in China or the priority of seismic reinforcement of bridges, in which the damage assessment method can be also as the reference for evaluating the direct cost of seismic reinforcement of bridges in China. Finally, combined with the engineering examples, the index method and the damage assessment method are used for specific analysis and application, which has the positive significance for the rapid seismic assessment of a large number of old bridges in China.

Keywords: seismic reinforcement; preliminary evaluation; index method; damage assessment method; vulnerability curve

Study on Value of Effective Length Coefficient of Full-wide Double Main Piers of Super-high Pier Long-span Continuous Rigid Frame MAO Yuanwen, REN Ke, WANG Hailong (75)

Abstract: The effective length is an important parameter for calculating the bearing capacity of compressed components. However, for the simplified design method to specifications, the component is analyzed separately, which is divorced from the constraints of the original overall structural environment and cannot meet the actual needs of pier calculation. The full-width double main piers are adopted for Wachang Bridge. The left and right spans are connected by setting the cross braces, and the overall stiffness is large. The critical load of the component is obtained by establishing the spatial finite element compression bar model, and the effective length coefficient of the pier is deduced from the Euler formula so as to obtain a numerical value closer to the actual situation of the project, which has certain guiding significance for similar bridges.

Keywords: effective length; super-high pier; Euler formula; critical load; constraint

Comfort Analysis and TMD Vibration Reduction Control of Long-span Special-shaped Pedestrian Arch Bridge TONG Hanyuan, YOU Kehua (78)

Abstract: The requirements of the existing specifications for comfort are comprehensively analyzed. The comfort analysis process of long-span special-shaped pedestrian arch bridge is determined in combination with the domestic and foreign specifications. At the same time, the TMD vibration reduction control analysis of the bridge structure is carried out to compare and analyze the influence of the quality, stiffness and layout form of the damper on the comfort, and the reasonable scheme of the damper layout is put forward, which can provide a certain reference for similar projects.

Keywords: footbridge; comfort; natural vibration frequency; dynamic design

Design and Construction of Ultra-high Performance Concrete (UHPC) π -shaped Beam Footbridge WU Liang, CHEN Hongwei (83)

Abstract: The ultra-high performance concrete (UHPC) has the performance features of ultra-high strength, ultra-high tenacity, low permeability and high-volume stability, can greatly lighten structure weight and improve the durability. In the rapid reconstruction project of two trunks of Tanzhou Avenue (Xiangtan Section) and Furong Avenue (Xiangtan Section) in Xiangtan City of Hunan Province, UHPC material is adopted for 18 newly built footbridges, which belong to UHPC footbridges with the π -shaped beam section applied by large scale in the main structures of bridge firstly in China. The design and construction essentials of this bridge are specially introduced, which show that the UHPC π -shaped beam has the application value of large-scale promotion in the similar bridges.

Keywords: ultra-high performance concrete (UHPC); π -shaped beam; footbridge

Study on Design of Anchor Cable Tie Rod Replacement of Suspension Bridge ZHANG Jianping, HU Linzhou (87)

Abstract: In order to improve the safety protection capacity of operating bridges, taking a single-span steel truss suspension bridge with a span of 636 m as an example, the replacement of anchor cable tie rods of the main cable anchoring system of the suspension bridge is designed and studied. The construction and monitoring requirements, anti-corrosion measures and material performance

requirements in the design of tie rod replacement in the cable strand connector of anchoring system of suspension bridge are mainly discussed, which has the great reference value for the preventive maintenance engineering of operating bridges and improving the safety protection ability of operating bridges. And the guiding reference function is obvious.

Keywords: suspension bridge; replacement of anchor cable tie rod; anchoring system; design

FLOOD CONTROL & DRAINAGE

Study on Improvement of Quality and Efficiency of Sewage System in Old Community under Urban Renewal Scenario LYU Yongpeng, WANG Jinbing, YANG Siming, XIE Sheng, WANG Pan, ZHI Lifeng, LIN Yuanliang, CAO Wenzhang, MEI Jiayu, CHEN Jian, JIANG Zhuwu, GAO Shang (91)

Abstract: Due to the long history of construction and poor maintenance of the old community in the high-density built-up area, there are many problems in the drainage system, which have a serious impact on the operation of the urban wastewater treatment plants (WWTP) and the urban water environment. Therefore, the reasonable and effective control of the sewage discharge in the old community is the most important link in the work of improving the quality and efficiency of sewage. Taking an old community in Xiamen as a specific research case, analyzing its current drainage situation and comprehensively considering the urban renewal planning and technical, economic and other factors, the technical route and implementation strategy for improving the quality and efficiency of the sewage system in the old communities under the urban renewal scenario are studied, which can be referred for the subsequent reconstruction.

Keywords: old community; improvement of quality and efficiency of sewage system; urban renewal

Exploration and Practice of Landscape Design for Rural Water System and Rural Revitalization Construction ZHANG Xurong, FU Dongwang, GUAN Guiling (96)

Abstract: With the development of rural revitalization, the comprehensive improvement of rural water system is also an important work of building and developing the ecological civilization and rural revitalization. In order to explore the method of special landscape design of rural water system in the rural revitalization and construction, the exploration and practice of human landscape design are carried out in combination with the pilot county project of Gaochun water system connection and comprehensive improvement of rural water system. The regional characteristics of Gaochun are fully explored in the project, which are skillfully integrated with the artistic conception of the relevant chapters of the Book of Songs. The Book of Songs is taken as the pulse to connect the water system connection in Gaochun District and the humanistic landscape design of the rural water system comprehensive renovation project, which depicts a picture scroll of "the water town of the Book of Songs" with the unique characteristics of Gaochun. After the implementation of the project, the social and ecological benefits are significant, which provides a useful reference for the landscape construction of rural water system from the perspective of rural revitalization and development.

Keywords: water town; Book of Songs; rural vitalization; fusion

Comparison of Rural Domestic Sewage Treatment Schemes on Island TAN Jingjing, XU Ming (100)

Abstract: Aiming at the present situation and characteristics of the rural domestic sewage treatment in Dingan County of Hainan Province, four feasible modes suitable for the rural domestic sewage treatment on island are proposed, that is "connecting municipal pipeline network, centralized facilities, separated facilities and large centralization + small separation". By comparing the schemes, the sewage treatment process of A/O bio-contact oxidation is determined, which provides the effective reference for the follow-up rural domestic sewage treatment.

Keywords: rural domestic sewage; sewage characteristic; treatment mode; technology

Design of Wastewater Treatment Plant with High Effluent Standard LI Qinggui (104)

Abstract: As the state attaches great importance to the cause of environmental protection, the effluent standards of wastewater treatment plant (WWTP) are also gradually improving. Taking a WWTP in Wenling City of Zhejiang Province as an example, the design of WWTP under the condition of high effluent standard is introduced in order to provide a reference solution for the design of the same type of WWTP. The design scale of the project is 50 000 m³/d, and the effluent will comply with the surface water standard Class IV in *Taizhou Town Wastewater Treatment Plant Effluent Index and Standard Limits* (for trial). The all-round and multi-angle analysis on the previous water qualities of influent and effluent are carried out in the design. Aiming at the characteristics of low carbon and high nitrogen and phosphorus in the influent of the plant, in order to make full use of the carbon source in the sewage and minimize the competition for carbon source by denitrification and phosphorus removal, the modified A/A/O process is proposed to use in the project. In view of the high requirements for total phosphorus and SS in the effluent, the combined process of "air flotation + air-water backwashing filter" is innovatively adopted in the project.

Keywords: high standard for effluent; technological process; overall design; process design; deodorizing design

Discussion of Disinfection Treatment Technology in Municipal Wastewater Treatment Plant

..... XU Ying, LI Yang, MIAO Yi (109)

Abstract: On February 1, 2020, the Ministry of Ecology and Environment issued the Notice on Doing a Good Job in the Supervision of Medical Sewage and Urban Sewage in the Pneumonia Epidemic of Novel Coronavirus Infection (EOWBL [2020] No.52), which specifically points out that the local ecological and environmental departments should supervise and urge the municipal wastewater treatment plants practically to strengthen the disinfection work and to ensure that the number of fecal coliforms in the effluent meets the requirements of the *Pollutant Discharge Standards for Municipal Wastewater Treatment Plants* (GB 18918—2002). At present, the disinfection treatment technologies used in municipal wastewater treatment plants in China mainly include the ultraviolet, ozone, sodium hypochlorite, chlorine dioxide, and the combination of these treatment methods, in which the sodium hypochlorite disinfection is currently the most widely used disinfection treatment technology in municipal wastewater treatment plants. However, there is still a lack of unified understanding of the process parameters and operating effects of sodium hypochlorite disinfection, and there are problems in key parameters such as sodium hypochlorite dosage and disinfection contact time. Therefore, the effects of sodium hypochlorite dosage, disinfection contact time, water temperature, oxidation reduction potential (ORP), ammonia nitrogen concentration and other parameters on the disinfection effect of sodium hypochlorite in order to provide the theoretical guidance for the disinfection and sterilization of municipal wastewater treatment plants.

Keywords: municipal wastewater treatment plant; disinfection; fecal coliforms; sodium hypochlorite; influencing factors

Research on Upgrading Reconstruction Scheme for Branch of Xishan District Wastewater Treatment Plant in Wuxi

..... WU Xiaobo, LEI Wenjiang, YANG Guang, TAN Yunpeng (113)

Abstract: On the basis of the treatment capacity of the branch of Wuxi Xishan District Wastewater Treatment Plant, the upgrading reconstruction is carried out. The technological design of each structure is introduced, in which, the emergency tank, buffer tank, medium grid and shallow air flotation tank are adopted in the pretreatment process, and the catalytic ozonation tank, nitrification filter, cloth filter tank and denitrification filter are used in the advanced treatment process. The project was completed in September 2019, and the operation effect meets the discharge requirements up to now.

Keywords: wastewater treatment plant (WWTP); upgrading reconstruction; pretreatment; advanced treatment

Cause Analysis and Prevention Suggestions of Rainstorm Waterlog in 100 Years in an Area

..... JIANG Youlei, ZHANG Weiping (116)

Abstract: In recent years, the waterlogging disasters in the flood seasons of various regions have caused the heavy casualties and property losses. Urban drainage and waterlogging prevention has gradually become the focus of attention. The situation and the main causes of the rainstorm waterlog on October 10, 2021 in an area of Suzhou are expounded. And the preventive suggestions to improve the rainstorm waterlog are put forward specially from the aspects of planning, design, construction, maintenance and management, which is favorable for the economic and social development in this area.

Keywords: once-in-a-century; extraordinary rainstorm; waterlogging analysis; waterlogging prevention

Summary of Design Experience for Municipal Drainage Pipeline Network of Xiong'an High-speed Railway Station Area XUE Bailiang (120)

Abstract: The municipal drainage pipeline network is an important urban infrastructure and is generally built along with the construction of municipal roads at the same time, which is a basic project to ensure the normal operation of the city. The municipal drainage pipeline network mainly includes the rainwater pipe network and the sewage pipe network. The design of municipal drainage pipe network should be based on the upper level planning. Combined with the actual situation of the site, the appropriate drainage system and design parameters are selected. The layout of pipeline should be closely cooperated with the other projects to achieve the scientific and rational design of drainage pipeline network. Combined with the design of the drainage pipeline network of high-speed railway station area of Xiong'an New Area, the problems existing in the design of this area and the solutions are introduced from the aspects of design parameters, hydraulic calculation, pipeline buried depth, structure layout, professional cooperation and construction sequence in order to provide the reference for the related design.

Keywords: drainage pipe network; rainwater pipeline; sewage pipeline; design

Study on Calculation of Waterproofing Level of Construction Projects in Urban Center of Suzhou

..... YANG Ye, HE Jian, ZHOU Ying, XIE Liuyang (123)

Abstract: Based on the measured maximum water level data of Fengqiao Hydrological Station from 1977 to 2016 and Suzhou Hydrological Station from 1952 to 2009 in the urban center of Suzhou, and the measured maximum rainfall data of Fengqiao Station from 1983 to 2017 at 1 h, 6 h and 24 h, the waterlogging water level in 100 a and 24 h rainstorm in 100 a in urban center of Suzhou are calculated by using P-III frequency curve-fitting method and waterlogging calculation. The results show that the flood control water level in 100 a in the northwest and southeast areas of the urban center is 4.86 m and 4.38 m respectively, the waterlogging water level is 4.70 m and 4.38 m respectively, and the waterproofing level is 4.70 m and 4.38 m respectively.

Keywords: urban center of Suzhou; construction engineering; waterproofing level

Study on Pollution Characteristics of River Discharge from Pumping Station in Separate System

..... LIU Lei (126)

Abstract: Taking four separated drainage systems in the central area of Shanghai as the research object, taking COD, NH₃-N and SS as the main indicators, the pollution characteristics of river discharge from pumping station and the initial stage effect of each drainage system during light rain, moderate rain and heavy rain are studied. The results show that the pollutant concentrations of river discharge from four drainage system pumping stations seriously exceed the standard. The concentration of river discharge is close to the concentration of domestic sewage in dry days during light rain. The concentration of COD and SS increases due to the scouring effect of sediments in dry days in the pipeline during the moderate rain and heavy rain, and the concentration of NH₃-N decreases due to the dilution effect. Through the analysis, it is found that the initial stage effect of river discharge from four drainage system pumping stations in rainy days is not obvious. The above is related to the combined effect of the discharge of pipe storage sewage and the scouring discharge of pipeline

sedimentary pollutants of river discharge. The former is mainly in light rain, the latter is mainly in heavy rain, and both effects are related in moderate rain. The discharge characteristics and impact mechanism of municipal pumping stations in rainy days are revealed, which can be used to support the formulation of pollution control strategy of river discharge from the separated drainage system pumping station in rainy days in Shanghai.

Keywords: pollutant; separate system; discharge characteristics; impact mechanism

Design of Drainage Pumping Station in Urban Underpass Tunnel under New Specifications GU Yuhan, LI Jiayu (130)

Abstract: Through the design example of the rainwater pumping station in Donghe Road of Zhongshan, the design of pumping station in underpass tunnel according to outdoor drainage design standards is described, and the rationality of setting the second transverse ditch is demonstrated so as to adopt the collecting water methods of "high water level and high drainage" and the combination of transverse slope and longitudinal slope to collect water, which can effectively reduce the water collection pressure at the lowest point of flood peak tunnel. The delineation of the design catchment range and the selection of recurrence interval are studied and discussed. The new calculation formula of ground catchment time is put forward. In addition to this, the scale of rainwater pumping station of under interchange should reserve 20% safety space to effectively decrease the number of pumps for starting and reduce the operation cost. Finally for the requirements of waterlogging check, SWMM model is established to simulate and analyze the capacity of drainage system under continuous 3 h rainfall in 10a, 20 a and 30 a recurrence intervals. The result shows that there is no water accumulation in the tunnel. One pump to be started can cope with a once-a-year rainstorm. The multiple operation of two pumps can cope with the rainfall with a recurrence interval of 5~10 years. Three pumps simultaneously to be started can meet the heavy rainfall with once-30-year waterlogging check. The simulation and design for the different conditions can decrease the number and frequency of starting the pumps under the same rainstorm intensity and reduce the costs of follow-up operation and maintenance, which has the referring significance for the design of the other projects.

Keywords: underpass tunnel; drainage pumping station; SWMM model; engineering example

Application of Micro-pipe Jacking Technique in Drainage Pipeline Engineering under Complex Environment SUN Jinzhao, ZHOU Haoxue, JI Chi, NIE Junying (134)

Abstract: The micro-pipe jacking technique is a pipe jacking construction technology for the trenchless construction of small-diameter pipes, which matures in Germany and Japan. Because of its characteristics of small construction area, short construction period and high implementing precision, the technique has been widely applied in the municipal drainage pipeline projects under the complex environmental conditions in recent years. The technological principle of the micro-pipe jacking technique is expounded in detail. And combined with the practical engineering cases, the construction technology of micro-pipe jacking technique in municipal drainage pipeline engineering is introduced.

Keywords: micro-pipe jacking technique; drainage pipeline; complex environment

MANAGEMENT & CONSTRUCTION

Problems in Construction of Foreign Highway Projects and Solutions DUAN Jiang (137)

Abstract: Based on the construction of the national highway projects in Kazakhstan, the common problems of environment, personnel, machinery and materials met in the contract projects in overseas markets by the enterprises of China are expounded and analyzed to put forward the solutions in order to provide the valuable experience for more enterprises involving the foreign projects in highway construction.

Keywords: foreign highway construction; problem; solutions

Research on Cast-in-place Construction Technology of Water-based Mortar Blind Road

..... LIU Yan, YAN Dongbo, WANG Jie, YANG Junyi, SHI Jiangan (142)

Abstract: The key control parameters of cast-in-place construction of water-based mortar blind road are studied from the aspects of environmental conditions, construction workability, formwork treatment, demoulding timing, corner treatment and surface coloring to lay the test section. The test section includes the pre-construction preparation, base surface retreatment, mortar mixing, mortar leveling, demoulding, corner treatment, maintenance, surface coloring and other construction processes. The application effect of the test section shows that the construction of the cast-in-place water-based mortar blind road is simple and convenient. And the mechanical properties, durability and appearance are good.

Keywords: urban road; blind road; water-based mortar; cast-in-place; construction technology

Key Technology of Rapid Prefabrication Assembly Construction of Urban Bridge JIN Guohai (146)

Abstract: In order to solve the problems of long construction period, poor civilization construction, high safety risk, long road occupation time and great influence on surrounding traffic environment in the conventional erection method of urban bridge, taking the construction of prefabricated assembled bridges in Moganshan Road Upgrading Reconstruction (Shixiang Road - Ring City North Line 104 National Highway Toll Station) Project as an example, the methods of standardized prefabrication of components, transportation of multi-wheel 18-axis hydraulic balanced platform lorry, mechanized centralized hoisting, precise and rapid construction, rapid and accurate installation of prefabricated stand columns, precise location of double-column integrated bent caps, rapid installation of super-long and overweight bent caps, prefabrication of long multi-segment bent caps and precise installation of dry joint, and quality assurance of sleeve grouting are used to solve the problem of bridge construction on busy roads in cities, which has the strong practical significance and can provide the reference for the construction of similar urban bridges.

Keywords: bridge; prefabricated assembly; grouting; dry joint

Analysis on Influence of Pile Foundation Construction of a Bridge on High-speed Railway Tunnel

..... LI Lian (149)

Abstract: With the development of social economy, more and more cities begin to build large-sized viaducts. However, due to the limited location of land in cities, many viaducts are faced with the phenomenon of being close to or even in conflict with the surrounding structures in the layout of bridge span and the selection of substructure. Therefore, how to analyze the impact of bridge substructure on the existing structures is becoming more and more prominent in the actual construction of urban bridge. By using the finite element software GTS, combined with the practical engineering examples, a three-dimensional soil element is established and the nonlinearity of soil mass is considered to analyze the influence of the pile foundation construction of bridge on the adjacent high-speed railway tunnel.

Keywords: constitutive model; high-speed railway tunnel; internal force; deformation

Numerical Simulation of Super-long Span Tunnel under Construction of Double-side Drift Method

..... LI Haipeng, PENG Hui (154)

Abstract: Relying on an actual project, FLAC3D is used for post-treatment to simulate the construction of Class V surrounding rock by double-side drift method, which comprehensively shows the variation law of staged excavation of the right tunnel of the underground excavated tunnel on the initial support stress of the left tunnel and the deformation of surrounding rock around the right tunnel. The results show that the axial stress law of the excavation tunnel on the initial support of the existing tunnel by the double-side drift method is basically consistent with the whole section excavation theory law. By the construction method of double-side drift method, the effect of the lower drift heading on the surface settlement of the

excavation tunnel is greater than that of the upper drift heading. Under the condition of bias pressure, the ground surface settlement caused by excavation is smaller on the large bias pressure side and more obvious on the bias pressure side. The drift heading method will produce the superposition effect of peck curve on ground settlement, but the final settlement curve meets the peck settlement theory.

Keywords: super-long span tunnel; double-side drift method; numerical simulation; FLAC3D

Analysis on Influence of Shield Tunneling Construction on Adjacent Buildings XIE Xin (157)

Abstract: The shield tunneling construction will cause the displacement of surrounding strata, thus, which has an adverse effect on the surrounding buildings. In order to guarantee the safety of surrounding buildings in the construction, the safety evaluation should be carried out before project implementation. Based on a shield tunneling project under construction in Ningbo, Zhejiang Province, the tunneling process of shield tunnel is simulated by three-dimensional finite element analysis software MIDAS GTS to analyze the settlement and displacement of the buildings during the different degrees of construction disturbance. Combined with the ground surface settlement monitoring data of the local shield tunneling construction, the safety of superstructure is assessed and the key control indexes of shield construction monitoring data are proposed. The analysis result shows that the buildings above the project are safe and reliable during the shield tunneling construction. This method can be used to predict the settlement of the buildings with the existing construction monitoring data, which provides the method for guiding the related projects.

Keywords: shield construction; finite element analysis; safety assessment; settlement monitoring

Research on Mass Concrete Underwater Pouring Method of Ultra-deep Underground Diaphragm Wall NING Wenxiang (161)

Abstract: Based on an ultra-deep foundation pit enclosure project in Kunming, the control essentials of mass concrete underwater pouring in the construction of the underground diaphragm wall enclosure structure exceeding 96 m during the construction process of the project are studied. According to the actual construction experience, combined with theoretical analysis, the preparation work before pouring, the pouring process control and the abnormal pouring situation are analyzed and set forth in detail. The results show that the transportation route of the concrete tank truck should be planned before pouring the mass concrete so as to ensure that the pouring is not interrupted. And the amount of the first poured concrete also needs to be calculated to ensure that the depth of the pouring bottom pipe is not less than 2.5 m and to ensure the quality of the pouring.

Keywords: ultra-deep foundation pit; underground diaphragm wall; mass concrete; underwater pouring

Overview and Application of Construction Technology of Ultra-deep Geo-membrane Composite Impermeable Wall DING Ling (165)

Abstract: The construction technology of geo-membrane composite impermeable wall is a high impermeable and environmental construction technology. Its key technologies include the grooving, vertical membrane laying, stuffing backfill and joint construction of impermeable wall. The grooving construction equipment includes the hydraulic grab, slot milling machine, TRD, groove sawing machine and so on. The membrane laying methods are the gravity membrane deposition method and vibrating insertion method. The stuffing is the soil mixed with bentonite, low-grade concrete, self-solidified mortar and plasticity concrete. The joint type includes the overlap joint and latch joint. Three construction technologies of geomembrane composite impermeable wall are introduced and the application ranges are also introduced.

Keywords: geomembrane composite impermeable wall; gravity membrane deposition method; vibrating insertion method; TRD construction method; self-solidified mortar

Brief Discussion on Key Construction Technology of Low-clearance Diaphragm Wall DU Wenchan (169)

Abstract: Low-clearance environment is one of the inevitable difficulties in the construction of foundation pit enclosure structure. This construction problem is common in the viaduct, high-voltage line and other infrastructure. According to Nanchang Danxia Road Utility Tunnel Project, the key technology in the construction of low-clearance diaphragm wall enclosure structure under the high-voltage line is studied. The results show that the segmental section of reinforcement cage should be equipped with the multiple sections in the process of segmental hoisting. The grab-milling combined process can effectively shorten the construction period. The inner side of the I-steel joint needs secondary treatment to avoid the failure of the reinforcement cage to lower effectively.

Keywords: low clearance; segmental hoisting; segmental composite section; crab-milling combination

Research on Key Construction Technology of Magnetic Impermeable Membrane Cut-off Wall

..... DU Dingchan (172)

Abstract: HDPE impermeable membrane cut-off wall has not been widely promoted yet, but its good anti-seepage performance has been verified in the practical projects. According to a magnetic impermeable membrane cut-off wall project, the optimization of impermeable membrane cut-off wall and the key construction technology of magnetic impermeable membrane cut-off wall are studied, including the magnetic rubber paste, anti-seepage membrane rolling, membrane laying, treatment of lap joints of anti-seepage membrane, loosening and pulling of locking tube. The results show that the magnetic rubber pasting position must be set in advance during the construction of the magnetic impermeable membrane cut-off wall. The rolling of anti-seepage membrane must be adjusted according to the laying order of the anti-seepage membrane. The membrane laying process must be set with the reasonable counterweights. The lap joint of the anti-seepage membrane must be treated with membrane pressing to ensure the effect of lap joints. The loosening treatment time before the locking tube pulled out must be effectively controlled to avoid the wall damage or difficulty in pulling out. Combined with the key construction techniques in the construction process, some reasonable construction suggestions are given in order to provide the references for the similar projects.

Keywords: HDPE anti-seepage membrane; magnetic impermeable membrane cut-off wall; rolling of membrane; treatment with membrane pressing; jacking and pulling of locking tube

Research on Construction Technology of Super-large and Ultra-deep Cast-in-place Pile in Soft Soil

..... XIONG Wei (175)

Abstract: Taking the airport hub of the TJ03 Bid Section of Wenzhou Jinliwen Expressway East Extension Line Project as an example, the control essentials and guarantee measures for the construction process, equipment selection, work efficiency analysis, construction quality of the super-large and ultra-deep cast-in-place pile under the soft soil geological condition in the reclamation area are mainly analyzed. And the different pore-forming equipment and devices are compared and demonstrated from several aspects of energy consumption, work efficiency and pore-forming quality. The equipment and devices are configured according to the practical situation of project implementation.

Keywords: soft soil geology; cast-in-place pile; pore-forming construction; control essentials; equipment selection

Influence and Protection of Foundation Pit Engineering on Underpass Railway Interchange

..... XU Xin (178)

Abstract: Combined with the interchange node project of underpass Beijing - Shanghai Railway and Shanghai - Nanjing High-speed Railway in Suzhou Chengbei Road Reconstruction Project, the influence of foundation pit engineering on the underpass railway interchange is analyzed and the measures are proposed. Various protection measures taken for ensuring the operation safety of railway interchange during the construction of foundation pit are discussed specially from the design, construction, monitoring and the other aspects. By analyzing the construction process and monitoring data, it is found that various protection measures of foundation pit enclosure scheme and slow railway running are necessary and

implementable. The monitoring data can be used to guide the construction of foundation pit in real time, which can ensure the safe operation of Beijing–Shanghai Railway and Shanghai–Nanjing High–speed Railway.

Keywords: foundation pit engineering; underpass; enclosure structure; railway interchange; monitoring

Analysis on Advantages and Disadvantages of Shotcreting Method and Modeling Method in Waterproofing of Subway Station Foundation Pit LIU Huanqi (183)

Abstract: Combined with the related scientific payoffs and the engineering application examples of some foundation pits in Xiamen Metro Line 2 and Line 3, two schemes of shotcreting method and concrete modeling method are compared and analyzed from the aspects of engineering quality, economic benefit, construction duration and social benefit, and the applicable conditions and applied ranges of two schemes are studied in order to provide the reference for selecting the optimized scheme for the similar projects.

Keywords: subway station; modeling method; mesh shotcreting method; waterproofing; analysis of advantages and disadvantages

Design of Foundation Pit and Enclosure for Xiamen North Creek Diversion Trunk Channel Reconstruction Project XU Ligeng (188)

Abstract: Taking the Xiamen North Creek Diversion Trunk Channel Reconstruction Project as the background, the different support schemes of foundation pit according to the different engineering sections are compared and selected. The obtained design scheme of foundation pit by sections is to use the sloping excavation method in the sloping excavation interface, to use the plate–type support system + inner support mode in the non–sloping excavation interface for construction, and to use the cast–in–site pile + triaxial mixing pile water stop for the supporting of foundation pit in the crossing–river section. At the same time, there is the function of future protection of inverted siphon.

Keywords: foundation pit, enclosure design, by sections, scheme comparison

STUDY ON SCIENCE & TECHNOLOGY

Status Research and Prospect of Structural Damage Identification of Bridge LIU Qi, NIE Peng, DAI Hualin, WANG Yafeng, HONG Jiao (193)

Abstract: With the rapid development of economy, the structural damage identification as the core of bridge health monitoring has been developed rapidly. In order to comprehensively summarize the exiting identification methods of bridge structure damage, the detailed analysis and summary are carried out from three levels of the damage identification methods based on the structural response types, the analysis of process and the structure intelligence to clarify the relationship of various structural damage identification methods and to ravel out the technical evolution processes. Through the systematic analysis, the mainstream algorithms of the above three types of damage identification methods are summarized, and the advantages and disadvantages of each algorithm are analyzed. Finally, the future research direction and trend of bridge structural damage research are prospected.

Keywords: bridge engineering; damage identification; health monitoring; identification algorithm

Research and Application of Architecture Design of Integrated Management and Control Platform for Urban Underground Road ZHANG Haicheng, LIU Yi, YOU Kesi (197)

Abstract: With the development of new generation information technology such as big data, cloud computing and the Internet of Things, more intelligent tools are provided for the operation control and safety improvement of urban underground roads. New technologies and new means can better energize the construction of intelligent urban underground roads. By analyzing the functional status quo of the conventional integrated monitoring system of underground roads and the problems in the technical

architecture, a new generation of urban underground road integrated management and control platform architecture, which is aimed to effectively promote the operation safety of underground road and improve the traffic efficiency.

Keywords: underground road; integrated control platform; technical architecture; system architecture; functional design

Research on Revision of Foundation Bearing Capacity by Pressuremeter Test in Tianjin Region

..... LIU Hao, ZHANG Jianguo (202)

Abstract: The mechanism of pressuremeter test in the foundation soil is similar to that of load test, which reflects the stress variation characteristics of soil elastoplastic body. The characteristic value of bearing capacity can be quickly and conveniently determined by two ways of plastic pressure p_f and limit pressure p_L of the pressuremeter test. The reasonable revision factor λ and safety factor K are selected in the process of determining the characteristic value of bearing capacity, which can guarantee the accuracy and applicability of the result application of the pressuremeter test. Through the comparison and analysis of the numerical values of bearing capacity determined by the index lookup method of geotechnical test and static penetration test, the revision factor λ and safety factor K are appropriately adjusted to obtain the more objective and reliable characteristic values of bearing capacity of pressuremeter test.

Keywords: foundation bearing capacity; pressuremeter test; physical index; static penetration test index

Application and Research of SWMM Model in Urban Waterlogging Prevention and Watershed Flood Control

..... WANG Yangyang (206)

Abstract: Under the background of the frequent occurrence of extreme rainstorms and the acceleration of urbanization construction in the world, the sponge city construction, urban waterlogging prevention and watershed flood control have become the important research directions. As a type of relatively well-known hydrological simulation software, the SWMM model has the free open-sourcing, wide application scenarios and other advantages, which have become the research hotspot of sponge city construction, urban waterlogging prevention and watershed flood control. SWMM and its derived models are briefly introduced. The latest applications and research directions of SWMM models are summarized from both domestic and foreign aspects. The future development trends of SWMM model are summed up.

Keywords: sponge city; urban flood control; watershed waterlogging prevention; SWMM model

Study on Stress and Calculation Method of Double-row Steel Sheet Pile Cofferdam

..... SHEN Yin, YOU Jiannan (209)

Abstract: The double-row steel sheet pile cofferdam has the advantages of small floor area, convenient construction and demolition, and little impact on river water quality. It has obvious advantages over the traditional earth rock cofferdam when the water retaining height is not too high. It has been widely used during the diversion and interception of water conservancy projects all over the country. However, because it is only a temporary structure, it is often designed according to experience, and there is a lack of research on the internal force calculation of this kind of structure. In order to obtain the accurate internal force of the structure, the finite element method needs to be used for analysis, which cannot meet the practical needs of the majority of designers. On the basis of the stress analysis of this type of structure, the calculation equation of double-row steel sheet pile cofferdam is calculated by using the traditional earth pressure theory and m method, and the calculation results are verified by comparing with the finite element calculation method.

Keywords: double row; steel sheet pile; cofferdam; calculation

APPLICATION OF ACHIEVEMENTS

Study on Application of Steel-plastic Grille in Expressway Widening Project

..... SONG Jun, JIA Weidong, LIU Junxia, ZHANG Mi (214)

Abstract: The junction of the old and new roadbeds is the weak position in the reconstruction and expansion of highways. The fracture surface is most likely to occur along the junction surface. Therefore, the steel-plastic reinforcement technology is widely applied in the junction engineering of old and new roadbeds. In order to study the treatment scheme and effect of steel-plastic grille to reinforce and widen the roadbeds, combined with the Beijing-Shanghai Expressway Widening Project, the application of steel-plastic grille in the splicing of old and new roadbeds is studied. The results show that the steel-plastic grille to reinforce and widen the roadbeds can improve the stress state at the splicing of the old and new roadbeds. The steel-plastic grille is reasonably laid at the splicing of the old and new roadbeds according to the practical engineering situation, which can effectively restrict the vertical and horizontal displacements of the soil mass of widened roadbed and optimize the reinforcement effect of steel-plastic grille.

Keywords: highway reconstruction and expansion; steel-plastic grille; differential settlement; finite element analysis; construction technology

Application of SMW Pile in Foundation Pit Engineering near Subway SONG Yuechen (217)

Abstract: The subway network increasingly dense in cities makes the municipal construction near a subway even more difficult. Through the enclosure example of foundation pit, the application of SMW pile in the foundation pit engineering near a subway is introduced. The design ideas are expounded and the construction essentials are analyzed. Finally, the advantages of SMW pile in this environment are summarized, which provides the reference for the similar projects.

Keywords: SMW pile; triaxial cement-soil mixing pile; foundation pit supporting; subway

Application of Centralized Power Supply System in Design of Intelligent Multifunctional Pole

..... YU Jianqing, CHU Tianshu (220)

Abstract: In the construction of intelligent transportation projects, there are more intelligent multifunctional poles to mount the equipment, and it is necessary to lay many pipelines to supply power for it. As a result, the already tight underground pipeline space is more crowded, which causes a lot of difficulties in engineering design and implementation. A modular centralized power supply system of intelligent multifunctional pole is proposed. Through the rectifier circuit and voltage regulating circuit, the 220 V AC power supply introduced into the municipal box transformer is translated into the voltages with different values, and is led out by the different modules to power various equipment mounted on the intelligent multifunctional poles. This system not only simplifies the power supply mode of the intelligent multifunctional pole, but also reduces the pipeline laying, and at the same time of saving the engineering cost, avoids the excessive occupation of the pipeline on the underground pipeline space, which is of great significance to the construction of the intelligent multifunctional pole project.

Keywords: lighting engineering; intelligent multifunctional pole; modular; centralized power supply; pipeline design

Application of UAV Orthophoto in Highway Engineering Construction

..... HU Xiaohui, XIE Yuyu, XU Feng (223)

Abstract: With the development of city, the construction of highway projects is more and more restricted by the influence of the surrounding environment. The traditional measurement methods and the work mode of personnel on-site surveys are becoming more and more difficult to meet the needs of engineering construction. The use of UAV technology can quickly obtain the orthophoto. And through the coordinate system conversion, high-precision fitting CAD drawings, based on the orthophotoes as the traced drawings, the construction survey, site planning, scheme design and other work are carried out, which can save a lot of manpower, material resources and time costs for site surveys. The orthophoto has the characteristics of high precision and rich information, which can be more refined to assist the decision

making of construction and design, and add the value to the construction of the project.

Keywords: UAV orthophoto; CAD coordinate matching; engineering construction

THE RELATIVE SPECIALITIES

Comparison of Different Methods for Measuring Refractive Index of Glass Beads Used in Pavement Marking by Oil-immersion Method WANG Deyi, WANG Heng (227)

Abstract: Based on the research of testing and detecting the glass beads for the indoor pavement marking in the highway and water transport engineering, the refractive index parameters of the products are tested. The refractive index of glass beads for pavement marking is measured by the two different oil-immersion methods of Backe-line method and oblique illumination immersion method. The test principle of oil-immersion method, the related steps of test and detection, and the judgment of test results are introduced. The differences in preparation, operation flow, observation and result judgment of the different methods of oil-immersed liquid are analyzed so as to further make the testing personnel improve the ability in the sample preparation, testing and detecting process, and related result judgment, which can ensure the reliability of refractive index test result of glass beads for pavement marking.

Keywords: glass beads used for pavement marking; refractive index; Backe-line method; oblique lighting method; method comparison

Design of Qingfeng Road Tunnel Construction Project in Jiaying DONG Zhanyu, JI Yonghong (231)

Abstract: Qingfeng Road Tunnel is the first urban tunnel in Jiaying to cross two rivers at the same time. Its construction can perfect the regional road network, alleviate the regional traffic pressure and promote the interactive development of the area. The project background, construction conditions, technical standards, overall design scheme, tunnel design scheme and supporting ground road design scheme are comprehensively introduced so as to provide reference for the design of similar projects.

Keywords: tunnel; road engineering; river crossing; smart tunnel; utility tunnel

Analysis on Design of Foundation Pit Engineering in Guangzhou Design Capital YANG Kaibiao (236)

Abstract: Combined with an example of a large-scale deep foundation pit project in the complex environment of karst area of Guangzhou, the selection principles and design essentials of the foundation pit enclosure structure in the complex environment are discussed. The comprehensive analysis is carried out by using a variety of calculation software and is verified according to the monitoring results of the on-site foundation pit further to check the rationality of selecting the enclosure structure, which provides a certain reference for the other deep foundation pit projects under the similar conditions.

Keywords: foundation pit engineering; surroundings; selection of foundation pit support; karst treatment

Analysis on Structural Force and Optimization on Section Design of Excavated Oversized-span Layered Tunnel ZHANG Guangwei, SUN Chao, DA Wuqiang, YU Zufeng (241)

Abstract: In order to explore the reasonable section form and optimization ideas of excavated oversized-span layered tunnel, relying on Wanghai Road Expressway Reconstruction Project, with the help of numerical simulation method, the structural force characteristics of oversized-span layered tunnel are analyzed. The selection of section form, the span optimization and the influence of covered soil for oversized-span layered tunnel are studied. The results show that there are problems of too large bending moment of the roof and floor, and the tensile stress in medium plate existing in the oversized-span layered tunnel. The reasons of the medium plate at the eccentrically pulled are the span too large and the insufficient restraint of the lateral soil to the structure. The force performance of the micro-arch section of the long-span excavated tunnel is the best. The straight-wall flat-roof section is inferior to the straight-wall folded-plate section. By considering the force performance, section utilization rate and

economy of the structure, the straight-wall folded-plate section is recommended for the excavated long-span layered tunnel. For the structure of oversized-span layered tunnel, the span size contributes to the greater proportion of structural internal forces, decreases the structural span and the structural force is improved obviously, especially can greatly lighten the axial force and bending moment of the medium plate. Section 1 has the greatest comprehensive advantages in terms of force performance and engineering consumption. Under the condition of shallow burial, it is recommended to replace the overlying soil of roof with the foamed concrete to decrease the density of the overlying soil so as to reduce the internal force of the roof section of the tunnel structure and improve the force conditions of the roof plate.

Keywords: excavated tunnel; layered; oversized span; force characteristic; section design

Discussion on Design of Rectangular Pipe Jacking with Extra-long Distance Shallow Soil Cover and Large Section ZHOU Jianhua, DAI Huilan, GAO Jing (246)

Abstract: With the rapid development of urbanization, the urban space becomes more and more crowded. It is a development trend and tideway to adopt the trenchless technology in the underground engineering construction, which has little impact on the surrounding environment. Through the example analysis of a rectangular pipe jacking project of utility tunnel, the design key and difficult points and solutions of rectangular pipe jacking project with extra-long distance shallow soil cover and large section in the water-rich sandy soil layer are introduced. By monitoring the settlement of the buildings near the construction site, the scheme reliability is validated, the recommended value of friction resistance per unit area of pipe wall is given and the optimal arrangement of intermediate jacking station in the similar scale rectangular pipe jacking project is proposed.

Keywords: rectangular pipe jacking; extra-long distance; shallow soil cover; intermediate jacking station

Brief Analysis on Investment Control Strategy of Civil Engineering of Rail Transit Project GUO Rui, RONG Chen (249)

Abstract: The investment control of rail transit project is difficult because of its large investment and complex construction. The civil engineering is the largest part of the cost of rail transit project, and is also one of the keys for controlling the investment of rail transit projects. Combined with the engineering experience in the whole-process cost consulting service of rail transit projects, the essentials and methods of investment control of civil engineering in rail transit are analyzed and discussed in order to provide a reference for the control of project investment.

Keywords: rail traffic; civil engineering; investment control; dynamic control of whole process; change settlement

Analysis on Economic and Social Benefits of Power Cable into Utility Tunnel Based on Charging of Utility Tunnel JI Yonghong, ZHANG Qi, DU Lin, YIN Shirui (253)

Abstract: Combined with the typical case of underground utility tunnel in IT Avenue in the construction area of utility tunnel in Chengdu, the method suitable for calculating the paid use fee of underground utility tunnel in Chengdu is put forward, and the charging model of each pipeline fee into utility tunnel and daily maintenance fee is built. Based on this, the difference of economic and social benefits between the power cable into urban underground utility tunnel and the conventional pipeline laying lines is studied, and the influence law of power cable into utility tunnel on the cost of power pipeline unit in the whole life cycle is systematically analyzed, which provide a theoretical basis for the implementation of charging polity for power cable into utility tunnel in the future.

Keywords: utility tunnel; power cable; paid use fee

Study on Compiling Method of Supplementary Quota for New Equipment Installation HUO Teng (258)

Abstract: In recent years, relying on the design advantages, the EPC general contracting projects with the increased investment and key development basically involve the industrial projects. There are the great

differences in the quota acquisition of relevant new equipment during the early bidding, process financial evaluation and later audit settlement of the project. Supplementary quotas need to be prepared. The relevant work such as engineering budget, financial evaluation and audit can be completed only after confirmation and approval of relevant parties. In the process of preparing supplementary quota, due to the lack of on-site construction experience of budget personnel, the engineering budget quota is used incorrectly, which results in inaccurate engineering budget and huge losses to the units from time to time. Taking the non-metallic chain plate sludge scraper in Suining Chengnan No.2 Wastewater Treatment Plant Upgrading and Capacity Expansion Project as an example, and according to the relevant requirements of the quota station in Sichuan Province, the supplementary quota is prepared for the installation of this equipment, and the consumptions of manpower, materials and machines in the installation process are studied and analyzed to prepare the supplementary quota of non-metallic chain plate sludge scraper in order to provide the reference for pricing the installation of chain plate sludge scraper of the similar new equipment.

Keywords: engineering pricing; quota subitem; quota of budget; supplement quota

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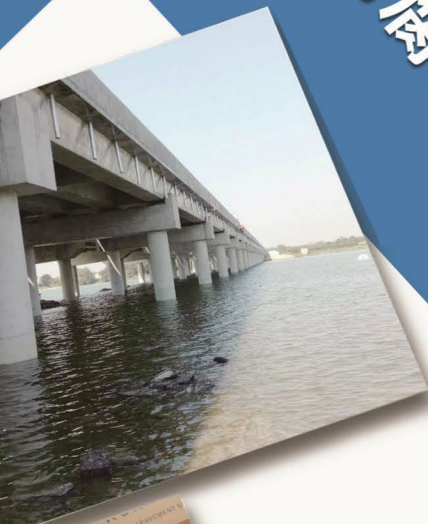
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