

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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图为中国市政工程中南设计研究总院有限公司设计的宝鸡市联盟路渭河大桥新建工程项目

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

- 韧性道路建设
- 摩擦摆球型支座对斜拉桥抗震性能的影响
- 深层排水调蓄隧道系统集约化布置关键技术研究
- 中心城区地下道路建设风险分析及对策



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封面工程

本期封面工程为宝鸡市联盟路渭河大桥新建工程项目。建设单位为宝鸡市住房和城乡建设局,由中国市政工程中南设计研究总院有限公司设计。

宝鸡市联盟路渭河大桥工程项目位于宝鸡市渭滨区及金台区,南起渭滨大道,北至陈仓园二路,是沟通渭河南北两岸的重要通道,全长 1.4 km。

该项目是宝鸡市政府在响应国家西部大开发,建设关中-天水经济区和丝绸之路枢纽城市的大背景下开展的,是宝鸡市跨越渭河、连通南北的一条重要通道,是宝鸡市“东西快,南北畅”交通布局中的重要一环。项目的实施对增强宝鸡市渭河南北两岸的交通联系、完善宝鸡市区路网、助力当地经济发展具有重要意义。

宝鸡市联盟渭河大桥主线桥设计全长 1 390 m,主桥采用空间双索面自锚式悬索桥,全长 490 m(50 m+95 m+200 m+95 m+50 m),桥面宽 29 m,设置两座 70 m 高(桥面以上高度)欧式风格混凝土桥塔,是目前渭河上单跨跨径最大的悬索桥。主桥主梁采用钢箱梁,锚固跨为混凝土箱梁。河道内引桥按不小于 40 m 跨径布置,河道外引桥按 30~35 m 基本跨径布置。

该项目于 2016 年 12 月正式开工,2019 年 1 月完成主桥合龙,2019 年 9 月竣工启用。项目建成后已成为宝鸡市一个新的地标性建筑。

Urban Roads, Bridges & Flood Control

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ROADS & COMMUNICATION

Construction of Resilient Roads SAI Wanyin (1)

Abstract: With the advance of urbanization in Chan, the cities are growing in size, the urban systems are becoming more complex, and at the same time, the emergencies are occurring frequently. In order to enhance the ability of urban system to deal with the emergencies, the United States, Japan and other countries and regions put forward to build resilient cities, and carry out the relevant explorations. The roads are the important part of urban infrastructure. The construction of resilient cities should include the construction of resilient roads. The construction of resilient roads mainly includes the construction of the hardware facilities such as ecological roads, intelligent roads and utility tunnels, and the establishment of disaster prevention emergency plans, the use of fabrication technology and BIM technology, and the popularization of emergency culture education for the public and so on.

Keywords: traffic engineering, resilient roads, resilient city, emergencies

Discussion on "Street Design" for Comprehensive Promotion of "One-ring Ten-vertical Ten-horizontal" Street in Zhengzhou WANG Kun (5)

Abstract: As the important spatial carrier of urban public life, the urban street is required to extend from the traditional engineering technical design to the spatial stereotaxis, plane harmony, style integrality and context continuity at the planning and design levels. The spatial category of street should be fully expanded and the overall spatial environment of street should be paid attention. Combined with *Zhengzhou Street Design Guideline* and the planning and design practices of Zhengzhou "One-ring Ten-vertical Ten-horizontal" Street Comprehensive Promotion Phase I Project, starting from the promotion of street environment and functional quality, the relative contents of "street design" of urban road are discussed from many aspects of planning, design, target and control.

Keywords: urban road, street, planning, design

Research on Expressway Scheme of Liangjiang New Area – Changshou District in Chongqing
..... RAO Youping (9)

Abstract: Liangjiang New Area – Changshou District Expressway of Chongqing is the only expressway connecting the core area of the main urban area and Changshou District. By analyzing the natural conditions and construction conditions along the route of the project area, the design of Liangjiang New Area – Changshou District Expressway is comprehensively introduced from the aspects of the project background, the

comparison of traffic corridors, the overall project plan and the node design scheme. The project will perfect the road network structure, intensify the contact between surrounding areas and counties and make for the promotion of development of urban integration.

Keywords: expressway, overall layout scheme, node design scheme

Brief Analysis on Design of New Fast Channel in Mountainous City FENG Pei, WANG Liyong (12)

Abstract: A mountainous city is different from a plain city because of its complex topography and variable elements. The complicacy and difficulty in the design of roads in the mountainous cities are obviously larger than the plain cities, especially in the design of new fast channels in the super-large mountainous cities. Taking Zengjiayan North Extension Crossing Inner Ring New Channel Project – an major project in Chongqing as an example, the problems for attention in the design of new fast channel in mountainous city are put forward.

Keywords: mountainous city, new added, fast channel, design

Construction of Compound Corridor in Shanghai Central Urban Area – Yanggao Road (Pujian Road – Century Avenue) Reconstruction Project DAI Wei (15)

Abstract: Since issuing the *Overall Urban Planning of Shanghai (2017–2035)*, the urban construction idea of Shanghai has changed from the rapid development to the refined management and comprehensive reconstruction. According to the engineering background of the latest reconstruction of Yanggao Road in Pudong New District of Shanghai, the construction achievements of compound corridor in the central urban area of Shanghai are discussed and summarized from the overall scheme of road reconstruction, utilization of underground space, design of slow traffic and important nodes, and the perfection of the periphery road network. By studying the system functions and implementing the advance measures for the compound corridor, the functions are maximized in the limit space.

Keywords: compound corridor, road reconstruction, overall scheme, slow traffic, underground space

Study on Urbanization Reconstruction of Expressway Connecting Line LI Rutao, JIANG Minghui (18)

Abstract: With the promotion of urbanization process, the expressway connecting lines around city are more and more unsuitable to the need of city development. Combined with the urbanization reconstruction of Hezhou Connecting Line of Guilin–Wuzhou Expressway in Guangxi, through the present situation study and traffic flow prediction analysis, and based on the relative urban planning and the relative design standards, the matters needing attention and the common design problems in the plane, vertical section, cross section, pavement structure, toll gate reconstruction and extension, and landscape greening of the urbanization reconstruction of expressway connecting line are expounded, and the technological essentials are summarized, which can be referred for the similar projects.

Keywords: expressway connecting line, traffic flow prediction, urbanization reconstruction, overall scheme

Design of Overall Scheme for Mianyang Ring Road I South Section East Extension Line ZHU Yazhou (23)

Abstract: Ring Road I South Section East Extension Line is an important component of the "two-horizontal line" in the planned road network of Mianyang, and is also an important component of the

urban ring line of Ring Road I of the city. Its construction can perfect the layout of urban road network, shield the periphery traffic of the central city and ease the urban congestion. From the project situation and road functional orientation, the overall scheme of Ring Road I South Section East Extension line is systematically introduced, and the segmental construction mode and node construction scheme are specially discussed, which can be referred for the design of the other similar projects.

Keywords: urban expressway, overall scheme, construction mode, node scheme Provide reference for other similar projects

Discussion on Design Practice of Highway (Road) Reconstruction and Expansion in Process of Urbanization

..... SHI Longbin (26)

Abstract: With the rapid economic development brought about by the reform and opening up in China, as connecting the cities and the urban and rural areas with the motor vehicle traffic function as the main, the highways are gradually included in the scope of urban planning in the process of urbanization. Starting from the functional change, practical demands and construction conditions, combined with the examples, the problems required for attention and the solution ideas in the stage of reconstruction and expansion are analyzed and discussed.

Keywords: urbanization, highway (road) reconstruction and expansion, design discussion

Research on Systematic Design of Urban Road Based on Concept of Sponge City ZHOU Wenbo (30)

Abstract: Traditional urban roads often have problems such as high pressure of flood discharge and loss of rainwater resources, which are easy to cause rainstorm and waterlogging disasters. The concept of sponge city can effectively solve these problems. In view of this, the concept of sponge city and the basic connotation of LID technology are firstly introduced, and the planning principles and design ideas of the road system of sponge city are put forward. And then combined with a traffic trunk road in Lanzhou, the systematic optimization design methods of the road are analyzed from two aspects of the cross-section optimization (motorway and non-motorway, sidewalk, side ditch, rainwater inlet, etc.) and interchange optimization. Finally, the SWMM model is used to simulate and evaluate the runoff process before site development and after road optimization in order to provide some theoretical guidance for the design of the similar sponge city roads.

Keywords: urban road, sponge city, design concept, optimization method

Reconstruction Scheme of Integrated Transportation Hub in Fangchenggang North Station

..... ZENG Hongdan, ZHOU Junjie (34)

Abstract: The integrated transportation hub of Fangchenggang North Station is the collecting and distributing core of Fangchenggang City and is an urban gateway to this city. The bus station and long-distance passenger station have been built at both sides of the station square. Aiming at the realization of the "zero-distance transfer" between the highway and railway passenger transportations, and the effective connection of each transportation mode, the overall advantage of the integrated passenger transportation hub is fully played, and the traffic congestion in Fangchenggang City is improved. By surveying and studying the present situation, combined with the planning, the traffic volume is predicted, the layout design is optimized, and finally the scheme of "parking lot separation and driving counter

clockwise + double-way traffic organization of North Station Road (W)" is put forward. The scheme is discussed from the aspects of scale demonstration, traffic organization and intersection service level. The conclusion is that the scale of this scheme can meet the demand of the integrated transportation hub of Fangchenggang North Station.

Keywords: integrated transportation hub, prediction of traffic volume, traffic organization, reconstruction scheme

Brief Analysis on Technical Design Scheme of Pingsha Interchange and North Ring II Interchange in Rapid Reconstruction of Guanghua Class I Highway YANG Hongzhu, BIN Yongquan (38)

Abstract: Based on the overall scheme design of rapid reconstruction of Guanghua Class I Highway, through the node traffic predictive analysis, combined with the planning, current interchange and surrounding construction conditions, two reconstruction schemes of current interchange nodes of high expressway are compared, selected and determined. The reconstruction of high expressway with the main road and expressway interchange is required to combine the planning and traffic travel demand. The traffic is qualitatively and quantitatively analyzed. The reconstruction should be combined with the overall scheme of upgrading reconstruction of the intersected road. It is made the best use of the current interchange nodes to decrease the influence on the reasonable traffic functions.

Keywords: overall scheme of rapid reconstruction, analysis on current construction conditions of traffic, reconstruction of current interchange

Study on Node Reconstruction Scheme of Jiahe Road and Haidi Road in Xiamen ZHOU Huabao, LIU Xizheng (43)

Abstract: In order to alleviate the severe congestion at the intersecting node of Jiahe Road, Haidi Road and Gaoqi North Third Road in Xiamen and improve the traffic capacity of Jiahe Road as the south connection of Xiamen Bridge, the traffic flow of in/out channel in Xiamen, the traffic characteristics of Xiamen Bridge and the causes of congestion at this node are analyzed and demonstrated. The reconstruction scheme of this node is put forward. After reconstruction, the traffic capacity and the collecting and distributing capacity of this node are improved significantly. This can meet the increasing demand for the external traffic inside and outside Xiamen.

Keywords: traffic analysis, node reconstruction, overpass bridge

Study on Scheme of Sanxia Expressway and Gangyao Road Interchange SUN Xu, DAI Darong, WEN Hongcheng (47)

Abstract: Due to the short distance to the road network, an urban interchange often needs to adopt the compound interchange. And a hub interchange has the higher requirements on the access control and linear standards. Taking Yichang Sanxia Expressway and Gangyao Road Interchange as the engineering background, the scheme study process of compound interchanges in the mountainous cities is systematically expounded from the node functional orientation, control elements, interchange type selection, scheme comparison and scheme evaluation, which can accumulate the valuable experience for the study of the similar urban interchanges.

Keywords: urban compound interchange, mountainous interchange, hub interchange, interchange type selection

Analysis on Design Essentials of Terminal Interchange WANG Wei, KOU Wei (50)

Abstract: On the basis of investigation and analysis, the characteristics of terminal interchange are generalized, and the design problems commonly in the built interchanges are summarized. The key essentials and the matters need attention in the design of terminal interchange are proposed from the aspects of factor analysis, interchange configuration, indicator application and scheme evaluation.

Keywords: terminal interchange, scheme selection, technical indicator, scheme evaluation

Brief Discussion on Design Essentials of Railway Related Road YU Lijia (54)

Abstract: In recent years, the number of railway related road projects is increasing. The design of the general conventional railway related road is mainly to consider the design of the road and railway intersecting node. Taking the design of Zhongche Avenue in Zhuzhou City of Hunan Province as an example, it is proposed that the influence of railway related large-sized factories surrounding the roads on the design schemes should be considered besides the design scheme of road and railway node during the design of the overall scheme for railway related road. Combined with the truckload transport information of railway locomotive provided by the railway related factory, the design of road clearance and pavement structure under the premise of meeting the demand of railway transportation is introduced. The design requirements and schemes of road and railway nodes (overpass testing line, underpass interurban railway) are introduced. The utilization of railway variable cross-section beam height is proposed in the underpass interurban railway scheme to meet the special design of the clearance requirement of Zhongche Avenue for railway truckload transport and to save the investment. The design requirements of railway safety protection in the node design of road and railway are introduced.

Keywords: railway related project, overall design, testing line, road design

Brief Analysis on Formulation Design and Performance of High Viscosity Modified Asphalt
..... QI Wenyang (57)

Abstract: Nine kinds of formulations of high viscosity modified asphalt are designed. The laboratory preparation processes are given. Various properties of high viscosity modified asphalt are analyzed by the conventional asphalt performance test and Japanese low temperature bending test. The results show that the properties of high viscosity modified asphalt depend on the ratio of SBS and light oil. The ratio of the both can be determined according to the demands during the formulation design. The optimal proportion of light oil is 9% and SBS is 13%. The reference can be provided for the development of the similar high viscosity modified asphalts and the basis for the establishment of relevant technical standards.

Keywords: road engineering, asphalt mixtures, high viscosity modified asphalt, formulation design, performance

BRIDGES & STRUCTURES

Analysis of Dynamic Characteristics of Short Suspenders of Arch Bridge under Vehicle Bump Condition
..... GU Rui, CHEN Weizhen, XU Jun (59)

Abstract: Because of the stiffness difference between the arch column and the suspender crossgirder, the "bump" phenomenon usually happens at the arch rib crossgirder of long-span half-through

concrete-filled steel tube arch bridge. The bump impact effect caused by vehicles here not only increases the live load internal force of short suspender, but also induces the violent vibration of bridge deck and arch rib near the suspenders. Taking an existing half-through concrete-filled steel tube arch bridge as the background, the ANSYS is used to establish the finite element model for the bridge. The rectangular pulse load is used to simulate the impact load of vehicle bump. The results of the calculation and study show that the arch rib and deck systems will vibrate violently. The non-synchronous vibration of arch rib and deck systems will make most of deed load internal forces of short suspenders unloaded, which will be easy to cause the anchorage device to drop anchor. The maximum value of structural vibration is after a vehicle passes, and in the free vibration period, the short suspender also has several large stress peaks.

Keywords: short suspender, vehicle load, vibration, dynamic response

Study on Seismic Optimization Design of Concrete Hingless Arch Bridge Foundation in Hilly Area

..... LI Ke, WEN Jitao, ZHANG Kang (61)

Abstract: For the different foundations of concrete hingless arch bridge used in the hilly area, the relative displacement between the arch foots is larger than that of the same foundation and the stress state is worse under earthquake. The arch foot displacement at one side of group pile foundation is mainly controlled by the layout type of group pile and the back filling. It is a key to determine the reasonable layout type of pile foundation, the calculation model and the boundary conditions for the seismic design of this kind of arch bridge. According to the practical engineering examples, Midas civil is used to establish a 3D model of girder element and solid element for comparing and counting the deformations of pile top and arch foot with the different foundation types and the different filling constraints under the cavity height and earthquake. Some relative beneficial conclusions are obtained. On this basis, the suggestions and measures for foundation optimization design of concrete hingless arch bridge in hilly area are put forward.

Keywords: hilly area, concrete hingless arch bridge, foundation, anti-seismic, optimization design

Calculation of Structural Performances of Single-box Multi-chamber Continuous Girder Bridge in Service

..... MA Xinhua (66)

Abstract: The bearing capacity of some pre-stressed concrete bridges decreases after many years of operation. The main disease is the cracks of different natures in the concrete box girders. The finite element model is established with reference to the original drawings to determine the design load and parameters. The appropriate combination of control section and load effect is selected to simulate the structural calculation before the bridge is reinforced. The bending resistance bearing capacity of the normal section and the anti-split bearing capacity of the oblique section of the main girder of the original bridge are checked and calculated. After the checking and calculation, it is known that the structural design of the original bridge meets the standard requirements.

Keywords: concrete continuous box girder, crack, structural performance, structural calculation

Study on Design of Cable Saddles for Spatial Cable Pedestrian Suspension Bridge

..... WU Yadong, XU Yangmin (70)

Abstract: Under the engineering background of the pedestrian bridge at Shangjiangbu of Chun'an, the construction design of the cable saddles for spatial cable pedestrian bridge is introduced. The

stress characteristics of the cable saddles for spatial cable suspension bridge are expounded by the calculation and analysis. The analysis result shows that the main cable of spatial cable suspension bridge will produce the horizontal force action on the cable saddles under the flat bending effect. The stress of the outer wall is greater than that of the inner wall. Therefore, the outer wall can be reinforced during the design, which can be referred for the design of the similar bridges.

Keywords: spatial cable, cable saddle, stress analysis

Effect of Friction Pendulum Ball Support on Seismic Performance of Cable-stayed Bridge ZHANG Zhongwei, GUAN Qingjie, LIU Yan (73)

Abstract: Starting with the development trend of bridge seismic resistance, the basic information of Yandu Bridge is briefly introduced. The dynamic time history analysis is carried out for the use of ordinary support and friction pendulum ball support respectively. The results are compared and analyzed. Through the comprehensive discussion including the comparative analysis of dynamic characteristic parameters, comparative analysis of acceleration, comparative analysis of bridge pier displacement and comparative analysis of the internal force influence after seismic isolation, it is finally determined to use the earthquake isolation and resistance measures of friction pendulum ball support and etc., which are beneficial to the anti-seismic calculation of bridges.

Keywords: bridge seismic resistance, dynamic characteristic, friction pendulum ball support, acceleration, dynamic time history analysis

Finite Element Calculation and Analysis in Construction Stage of Long-span Continuous Composite Crossbeam ZHANG Yu(76)

Abstract: The center fulcrum hogging moment of continuous composite beam is a factor to cause the cracking of concrete deck slab. The center fulcrum hogging moment can be effectively decreased by the construction method of adjusting the height of support. The compressive stress reserve of concrete deck slab is increased. The long-span crossbeam system is used for the construction of center fulcrum crossbeam according to the layout of supports. The concrete deck slab presents the state of double-way stress of tension and pressure under this system. The structure complexity and construction steps have the obvious spatial effects on the steel girder and concrete deck slab. The stress state is more complex. The full bridge spatial model is used to calculate and analyze the whole construction process of continuous composite beam. The stress performances and characteristics of steel beam and concrete deck slab in the center fulcrum hogging moment zone of long-span continuous composite crossbeam are summarized. The achievements can be referred for the design of the long-span center fulcrum crossbeams of the similar continuous composite beams.

Keywords: composite beam, concrete deck slab, long-span crossbeam, construction stage

Application of Design of Full Width Bridge HUANG Qing (80)

Abstract: The superstructure of Yingbin Avenue Bridge in Xinpu New District of Zunyi City is a pre-stressed variable height continuous box girder. Its full width of bridge is 35 m and a 10-meter wide green belt is set up in the middle of the bridge deck. The design features of this wide bridge are analyzed.

The structural calculation is based on the optimization calculation of half-width bridge. One meter in the middle of the bridge width is the concrete post-pouring belt, and the special structural treatment is carried out for the green belt on the bridge, which can provide reference for the design and construction of the similar projects in the future. Piercing

Keywords: wide bridge, overpass bridge, post-pouring belt, greenbelt, root-resistant piercing waterproof roll

Brief Introduction on Design of Curve Steel Box Beam Bridge in Urban Interchange XU Jianqing (82)

Abstract: The steel box beam bridge has the advantages of low structure height, large spanning capacity, light dead weight, high strength, fast construction speed and less environmental pollution. From the development tendency, the steel structural bridge is also the development direction of small-span and medium-span bridges in the future in China. The steel box beam arranged on the curve is the curve steel box beam. Therefore, the design and application of steel box beam adopted on the minor radius curve of urban interchange ramp are analyzed.

Keywords: curve steel box beam, support spacing, pre-eccentricity setting, overturning resistance, joint action of bending and twisting

Application of Integrated Pile Pier in Road Reconstructed to Bridge Project ZHANG Yuna (86)

Abstract: The scheme of a road project in Shenzhen when underpasses an existing expressway by roadbed reconstructed to bridge is introduced in detail. In order to decrease the excavation depth, reduce the amount of support work and save the engineering cost, the integrated pile pier design is used in the pier design and the technical essentials required for attention are discussed. The scheme has certain requirements on the vertical degree of built pile, and the exposed part of the pile is required to use the follow-up mode of steel casing in order to guarantee the appearance quality. The relative experience can be referred for the similar projects.

Keywords: integrated pile pier, roadbed reconstructed to bridge, follow up of steel casing

FLOOD CONTROL & DRAINAGE

Research on Key Intensive Layout Technology of Deep Drainage Storage Tunnel WANG Xiaopeng (88)

Abstract: Aiming at the problems of land shortage in Shanghai Suzhou Creek Deep Drainage Storage Pipe System Project, from two aspects of the overall intensive layout of the system and the intensive layout of integrated facilities, and relying on Suzhou Creek Deep Tunnel Test Section Project, the intensive layout technology of deep storage tunnel is studied in order to provide the technical support for perfecting the urban drainage waterlogging prevention system, realizing the runoff pollution control and promoting the comprehensive development level of urban deep underground space. The study results show that the spacing of the integrated facilities in the main tunnel is affected by the land use conditions and tunnel operation safety. The spacing can be appropriately enlarged to 2~3 km. The vertical development should be adopted for the layout of the integrated facilities so as fully to utilize the underground space. The multi-point interception mode should be considered for the deep tunnel pre-treatment mode.

Keywords: Suzhou Creek Deep Tunnel Project, test section, general layout, integrated facilities, intensive layout

Analysis on Groundwater Flow Field and Design of Water Level Control of Urban Communities

..... LIU Jingyue, PENG Weijun (92)

Abstract: With the getting scarce land for city construction plus the requirements for enhancing the urban landscaping, beautifying, afforestation and sponge, the possibilities of the buildings encountering the high underground water level stratum are also much higher, which will increase the difficulties of the waterproof and drainage design of the underground buildings. Through the treatment of the basement water seepage of the existing buildings, the methods of survey, analysis, calculation and design are expounded. It is considered that the adverse effect brought about by the high groundwater level can be completely controlled within the intended target range according to the engineering geology and hydrogeological investigation fully carried out beforehand, earnest analysis and study on the conditions of groundwater recharge and drainage, and combined with elaborate design and construction, which can be referred for the design and construction of the similar projects.

Keywords: high groundwater level, basement water seepage, intercepting drainage closed conduit

Study on Application of Water Retaining Weir Plate in Bioretention Facilities

..... XU Wei, LIU Huachao, ZHao Rixiang, LIANG Fengchao (95)

Abstract: Based on the analysis of the problems existing in the application of water retaining weir plate in the current bioretention facilities, the study clarifies that the minimum width of the sunken tree pond belt of sponge city road project should not be less than 2.0 m and the maximum longitudinal slope requirement should be met. The structure type of water retaining weir plate applied to the different types of bioretention belt is constructed. The different types of water retaining weir plate component and engineering application BIM model are established for the finite element analysis.

Keywords: sponge city, road engineering, bioretention facilities, water retaining weir plate

Design of Side Zoned Sunken Greenbelt of Road Based on Quantitative Calculation

..... FENG Yingying, LIU Lei, ZHENG Shuhang, ZHANG Jiaqi, YANG Shuai, HU Zongying, WANG Ping(98)

Abstract: With the popularization and application of the concept of the sponge city, the sponge city measures are required in the construction of most new municipal roads in various places. Taking a new road construction project in Laoling City of Shandong Province as an example, the design scheme of sunken greenbelt is introduced from the aspects of action principle, layout details, design and calculation, design of other ancillary facilities, maintenance and management. The quantitative design method of road sponge measures based on hydrology and hydraulics is proposed to ensure that the designed sponge city measures can not only realize the storage and seepage retention function of rainwater, but also meet the drainage capacity of drainage facilities, which provides a useful reference for the colleagues.

Keywords: side zoned sunken greenbelt, road sponge city, quantitative calculation, rainwater drainage

Study on Upgrading and Reconstruction Effects of A Wastewater Treatment Plant in Shanghai

..... LI Jing (102)

Abstract: The Design scale of a wastewater treatment plant (WWTP) upgrading and reconstruction project in Shanghai is 2 800 000 m³/d. Its upgrading and reconstruction are carried out by the multimode AAO of reducing load and increasing capacity assisted with the chemical phosphorus removal process and the efficient coagulating sedimentation technology. The effluent quality is upgraded to Class I A standard after upgraded and reconstructed. The pollutant concentration of the effluent is more obviously reduced than before the upgrading and reconstruction, in which the reduction of ammonia nitrogen, total nitrogen and SS is most significant. At the same time, the upgrading and reconstruction project can make the stability of pollutant treatment load of WWTP also obviously upgraded.

Keywords: wastewater treatment plant (WWTP), upgrading and reconstruction, technology, pollutant

Thinking on Application of Super Levee in Levee Engineering SHI Yongchao (106)

Abstract: Super levees create a new idea of urban flood control. Combined with the characteristics of super levee, three aspects of its application in the levee engineering are thought and expounded. The super levee structure can trade the width for the height and the bottom mud can be utilized. It can be combined and comprehensively utilized in multiple functions. And it can break down barrier and be flexible in implementation. It is hoped to provide the reference for the application of super levee. The super levee scheme selected for the overall planning of a flood control project also illustrates its application superiority in the levee engineering.

Keywords: super levee, trading width for height, comprehensive utilization, flexible

Baseplate Design of Dry Dock Based on British Standard & European Standard WANG Lulu (108)

Abstract: Combined with a dry dock in the Middle East, according to the load combination and load design required in British standard and European standard, the bending moment, pile force and reinforcement of the dock baseplate are calculated by using the finite element mode of Robot 2013. The calculation processes and methods of dock baseplate in British standard and European standard are introduced in order to provide the reference for the domestic technicians to learn and use British standard and European standard.

Keywords: dock, baseplate, British standard, European standard

MANAGEMENT & CONSTRUCTION

Analysis and Countermeasures for Construction Risk of Underground Roads in Central Urban Area

..... JIANG Hong (111)

Abstract: Lots of risks are encountered in the construction of the underground roads in the central urban area because of the long construction period and the complex crossing nodes. Therefore, it is to carry out the systematic risk management. The necessity of the risk management in the construction of the underground roads is expounded. The risk occurrence mechanism and the risk identification methods are introduced. The risk control strategies are summarized. The construction countermeasures are discussed. At last, taking Shanghai Beiheng Channel Project as an example, the engineering difficulties of some key nodes of the project are analyzed and the relevant technical measures are given to ensure the construction

safety of the project.

Keywords: underground road, construction risk, risk analysis, technical measures

Research on Comprehensive Quantitative Evaluation Management System and Measures for Maintenance of Network-level Urban Road YANG Yang, GAN Feng, YAN Pengcheng (117)

Abstract: Relying on the urban road maintenance and management practices of Beijing Municipal Administration, guided by the target assessment, the specific targets of urban road service, road network, single road and bridge, and various economic indicators are put forward. The comprehensive quantitative evaluation management system for the maintenance of network-level urban road is established by optimizing the inspection and maintenance work mechanism, classifying the facilities, grading the maintenance and creating the dynamic work ledger etc. The maintenance refining level and the service precision level are fully improved by quantitatively assessing the management targets, optimizing the management measures, fully mobilizing the subjective initiative of the maintenance units and effectively intensifying the maintenance resource allocation.

Keywords: network-level road, urban road, maintenance management, target assessment, quantitative evaluation

Study on High Precision Formwork System of Three-web Prefabricated U-shaped Segmental Girder JIANG Haili (123)

Abstract: The prefabricated U-shaped segmental girder as a new bridge structure of rail traffic is innovative in structure. Therefore, the higher requirements are also proposed for the prefabricated formwork. Relying on the scientific research projects of Shanghai Science and Technology Commission, on the basis of the common short-line method of prefabrication technology, the formwork design principle and the special construction requirements of three-web prefabricated U-shaped segmental girder are analyzed. The overall construction and working process of the formwork for three-web prefabricated U-shaped segmental girder are studied in detail. A set of high precision formwork system meeting the design and construction requirements is designed, which lays a solid foundation for the popularization and application of three-web prefabricated U-shaped segmental girder in the construction of rail transit projects.

Keywords: three-web, prefabricated U-shaped segmental girder, formwork system

Construction Control and Technical Analysis on Demolition of Concrete Continuous Rigid-frame Arch Bridge LIU Zhifeng, WANG Tongzhen, TIAN Hongbin (127)

Abstract: Taking the demolition of Langxi River Bridge in G220 Dongzheng Line of Jinan as an example, the demolition construction control technology of concrete continuous rigid-frame bridge is studied, and the application of static cutting and hoisting technology in the bridge demolition is introduced in detail. The result shows that this demolition scheme has the advantages of high safety, controllable construction process, lower engineering equipment requirements and small influence on environment. Its effect can be referred for the demolition construction of the similar structures in the future.

Keywords: concrete continuous rigid-frame arch bridge, static cutting, hoisting technology, demolition

Study on Case and Key Technology of Cable Clamp Replacement for Suspension Bridge
..... DOU Yongzhi (131)

Abstract: There are few engineering cases involving cable clamp replacement in the treatment of cable clamp slippage of suspension bridge in China, and its replacement of cable clamp faces many engineering problems to be solved urgently. Based on the study background of the cable clamp replacement project of a single main cable suspension bridge, the structural response of the cable clamp replacement process is analyzed by using the finite element software. In order to provide the theoretical guidance for the determination of the construction scheme, the selection and design essentials of the temporary facilities are introduced in detail. In addition, the construction technology of rapid cable clamp replacement is specially introduced. The engineering practices have proved that this replacement technology of cable clamp safely and effectively realizes the rapid replacement of cable clamp, which can be referred for the replacement of cable clamp of the similar suspension bridges.

Keywords: suspension bridge, cable clamp replacement, key technology

Segmental Prefabrication and Installation Technology of Assembled Large Cantilevered Bent Cap
..... SHI Jian (135)

Abstract: Based on the practice of Wuxi Fengxiang Road Rapid Reconstruction Project, the technological processes and key control points of each working procedure of bent cap segmental prefabrication and wet joint connection in the assembled municipal bridge construction are introduced in detail, which provide the reference for the construction of the similar assembled municipal bridges.

Keywords: assembled, large-cantilevered bent cap, grouting anchorage, wet joint, prefabricated installation

Construction Supervision of Key Procedure of Pre-stressed Concrete Single-pylon Cable-stayed Bridge
..... GUO Sucheng (139)

Abstract: The pre-stressed concrete single-pylon cable-stayed bridge is the most common type in the cable-stayed bridge system. The site construction procedure and control have the great influence on the quality of the completed bridge because its main structures are mostly for the site casting. It is necessary to analyze this. Therefore, taking Lingfeng Bridge in Hezhou of Guangxi as an example, the supervision work of several key construction procedures of the cable-stayed bridge is introduced and analyzed in order to provide the reference for the similar bridge projects in the future.

Keywords: cable-stayed bridge, key procedure, construction supervision, CFG pile cofferdam, bracket pre-pressure

Practical Application of Stability Analysis in Construction Supervision of Cable-stayed Bridge
..... WANG Shijie (143)

Abstract: Taking a cable-stayed bridge under construction in Boffa Province of Guinea as an example, the construction process of the cantilever assembly of the main girder of its middle span is analyzed, and the practical application of the stability analysis of the bridge structure in construction supervision is introduced. Through the simulation of different welding progress conditions, the first and second types of stability coefficients of the main girder structure under the long cantilever conditions are analyzed, and

the minimum welding speed of structure without loss of stability to meet the specification is obtained, which guides the actual construction and clarifies the supervision objective.

Keywords: stability, construction supervision, cable-stayed bridge

Design and Analysis on Foundation Underpinning Structure of Viaduct by Mining Method Interval Crossing in Guiyang Metro Line 3 WANG Xiang, TANG Xiang (145)

Abstract: Guihuang Road Viaduct Pile Foundation Underpinning Project of Guiyang Metro Line 3 Phase I Project has the difficulties of small construction space, high engineering risk and large technical difficulty. Under the condition of not affecting the normal traffic of viaduct, the passive underpinning technology is used to carry out the structure underpinning of the viaduct in this project. Based on the finite element analysis result, the overall stress level of the interface zone of base slab, pile foundation, and old and new base slabs is lower. The checking calculation result of pile foundation and base slab according to the standards shows that the safety is higher. The maximum vertical deformation at the top of bridge pier is 3 mm, which meets the deformation requirements in the period of pile foundation underpinning and interval crossing construction.

Keywords: mining method interval, viaduct, foundation underpinning, finite element analysis

Analysis on Application Status of Prefabricated Beam Curing System for Expressways in Guizhou TAN Wanbo, LEI Jianqiang (149)

Abstract: The curing of prefabricated beam production process is very important. The quality of the pre-construction curing work will directly affect the strength and durability of the prefabricated beam and even threaten the subsequent safe use of the highway bridge structure. Combined with the requirements of curing the prefabricated beam involved in the existing engineering standards and specifications, the application of the curing system in the current expressway prefabricated beam yard of Guizhou is surveyed and studied. The application status and shortcomings of the curing system are analyzed. Some suggestions for improvement are proposed. At the same time, the latest measures of Guizhou Provincial Transportation Department to improve the quality, technology and management requirements of prefabricated T-beams involving the curing aspect in the province are introduced in order to provide the reference for the application perfection of prefabricated beam curing system in the future.

Keywords: expressways in Guizhou, prefabricated T-beam, curing system, manufactured sand, control system

Design and Application of Lightweight Deck Crane for Zhongxing Bridge in Ningbo WANG Wenjiong, WU Bo, LOU Dongdong, ZHANG Haoran (154)

Abstract: Zhong Xing Bridge in Ningbo is a short-pylon cable-stayed bridge with one span across the river. Its main span is 400m and its main girder is a variable-section steel box girder. Each construction girder section has the large volume and heavy tonnage. In order to ensure the construction accuracy and quality of the main girder and comprehensively consider the characteristics of the structure system, the lightweight bridge deck crane is used for hoisting construction in this project. The truss structure is used for the main load bearing structure of crane. The hydraulic jack is used for the lifting system. The cranes work in pairs. The results of the theoretical calculation, analysis and engineering practice show that the

lightweight bridge deck crane is safe and feasible. The equipment is simple to install and the construction precision is controlled better, which can be further applied to the construction of long-span bridges across rivers and seas.

Keywords: steel box girder, lightweight, truss structure, deck crane, precision control

Analysis on Reinforcement Construction of Extra-long Distance Horizontal MJS Subgrade
..... CHEN Shuai, LIANG Jie (157)

Abstract: Japan has a small land area and dense urban buildings. In order to adapt the needs of urban construction and development, early in 1980, a more nature method of underground excavation for pipe curtain has been studied. The method of underground excavation for pipe curtain is firstly used in Guiqiao Road Station of Shanghai Metro Line 14 to construct the main structure of the station. The quality control of reinforcement construction of extra-long distance horizontal MJS pile subgrade by the method of underground excavation for pipe curtain is mainly introduced. The level degree, water cement ratio and pressure in ground during the construction are the key to the success or failure of horizontal MJS construction. Because MJS method has the function of forced grouting in the hole, in order to reasonably control the discharge amount and to keep the pressure in the ground in balance, therefore, the ratio of the pressure control value in the ground to the construction depth is set so as to efficiently control the reinforcement quality of subgrade and to ensure the safety of the surrounding environment.

Keywords: extra-long distance, horizontal MJS pile, subgrade reinforcement, water cement ratio, pressure in the ground

Brief Analysis on Application and Cost of Foundation Pit Supporting in Hydraulic Engineering
..... ZHU Yunjuan (162)

Abstract: Foundation pit supporting is the construction protection measures often taken in the hydraulic engineering. The selection of foundation pit supporting is firstly considered to protect the surrounding environment, secondly to meet the requirements of the underground structure construction in this project, and moreover, to reduce the engineering cost and be convenient for construction as far as possible. Taking a sea pump brake in Shanghai as an example, based on the characteristics of this project, the application of foundation pit supporting in the hydraulic engineering and its cost are expounded and analyzed.

Keywords: hydraulic engineering, foundation pit supporting, case analysis, cost analysis

STUDY ON SCIENCE & TECHNOLOGY

Study on Operation Optimization Model of Combined Sewage Pumping Station
..... KE Hang, CHEN Yan, WANG Pan, ZHANG Hui, CHEN Chen (166)

Abstract: In order to make full use of the pipe network capacity to reduce the amount of river discharge by the pumping station during rainfall, the drainage model of a combined sewage system in a urban area of Shanghai based on InfoWorks CS is established to study the feasibility of elevating the operating water level of the system and its corresponding benefits and risks of the combined sewage pumping station. The results of theoretical estimation and model calculation show that the utilization of the pipe network capacity can realize the pumping station not to discharge the river when the rainfall is less than 18.40 mm

to accomplish the dual tasks of drainage waterlogging prevention and non-point source pollution control. For the rainfall greater than the design return period, due to the limited capacity of the pipe network, the risk of elevating the operating water level is great. According to the study results, an operation strategy of the combined sewage pumping station based on rainfall control is proposed, which provides a reference for the operation optimization of the non-point source pollution control in the combined sewage pumping station.

Keywords: combined sewage pumping station, operating water level, drainage system model

Study on Laser Scanning Measurement and Overall Deformation Law of Metro Tunnel Adjacent to Deep Foundation Pit TAO Li (170)

Abstract: With the increasing degree of network of metro and municipal facilities, the excavation works of deep foundation pit adjacent to metro tunnel are increasing. The influence of foundation pit excavation on the environment, especially on the existing operated tunnels is always widely watched. Its core is to control the development of its deformation. However, limited by the test technology, there is no further discussion on the overall deformation law of tunnel in the excavation process of foundation pit. Taking an engineering example as the background, based on the laser scanning technology and through the point cloud ellipse fitting, the variation of the long and short axes of tunnel convergence ellipse before and after the excavation of foundation pit is analyzed. The development law of the overall deformation of metro tunnel caused by the excavation of adjacent foundation pit is studied. The monitoring physical quantity in the excavation of tunnel is put forward. The above provides the technical support for the follow-up monitoring and maintenance control of metro.

Keywords: shield tunnel, deep foundation pit, laser scanning, deformation

Study on Effect of Longitudinal Prestressing on Mechanical Properties of Through-type Composite Deck System Steel Truss Arch Bridge YU Hao, RUAN Jie(175)

Abstract: There are three kinds of design methods for the deck system of through-type composite deck system steel truss arch bridge, such as setting flexible tie bar, applying longitudinal prestressing of bridge deck and strengthening reinforcement to control the deck cracks. Based on a through-type composite deck system continuous steel truss arch bridge, compared with the scheme of not applying longitudinal prestressing, through the finite element model calculation of the whole bridge, the effects of longitudinal prestressing on the mechanical properties of arch rib, steel tie girder and concrete deck slab under various working conditions are analyzed. The study shows that the longitudinal prestressing significantly shares the thrust of arch foot, but enhances the temperature sensitivity of arch rib and steel tie beam. The longitudinal prestressing is mostly distributed to the steel structure. Under the condition of the action effect frequently encountering combination, the bridge deck is difficult to achieve the control requirements for Class A prestressed concrete members.

Keywords: steel arch bridge, truss arch bridge, composite deck system, mechanical property

Study on Simplified Calculating Method of Center Fulcrum Crossbeam of Steel Box Girder YOU Zhenhua (179)

Abstract: Based on the study object of one-couplet equivalent-width steel box girder, the grillage method

is used to establish the finite element model. The transverse stress characteristics of the center fulcrum crossbeam of steel box girder are analyzed. The simplified calculating method suitable for the crossbeam of steel box girder is obtained. Its results can be referred for the simplified calculation of the center fulcrum crossbeams of steel box girder in the engineering design.

Keywords: steel box girder, center fulcrum crossbeam, simplified calculation

Analysis on Necessity and Study on Influence of Connection with Adjacent Water Supply Area
..... LI Tong, WANG Weiqing (182)

Abstract: The urban water supply areas are relatively independent. There are some hidden dangers in the water for production and domestic use. In order to further strengthen the safety of water supply and achieve the mobilization of unified water resources, the setup of connecting pipe in the adjacent water supply areas can play a security role. Combined with a connecting pipe project in Chongming District, its influence on the adjacent water supply areas is studied by the pressure and flow calculation.

Keywords: adjacent water supply area, fault area, connecting pipe

Analysis and Study on Setting of Deformation Joint Spacing for Concrete Structure of Thin-wall Water Tank
..... ZHANG Zhenguang, JIANG Wei (185)

Abstract: Long and large thin-wall structures are prone to unloaded cracking in the early age, which not only affects the safe use of the structure, but also greatly affects the durability of the structure. Therefore, all kinds of specifications put forward the limitations of pouring length once for this kind of concrete structure. However, for the long and large concrete structures, more deformation joints will prolong the construction period and increase the excavation risk of foundation pits. Taking the sedimentation tank of Shanghai Zhuyuan Plant No.3 as an example, the numerical calculation method is used to calculate and analyze the risk of cracking in early age of concrete under four working conditions of pouring once of 30 m, 50 m, 70 m, and 90m. For this reason, the basis for decreasing the deformation joints and increasing the pouring length once of this kind of thin-wall structure is proposed.

Keywords: structure of water tank, early-age concrete, numerical analysis, early-age crack control of concrete

Study on Preparation and Storage Stability of SBS-SBR Composite Modified Asphalt
..... WANG Jianjun (190)

Abstract: A kind of SBS-SBR composite modified asphalt is prepared by physical blending method. The influence of modifiers on the asphalt performance indicators is studied through the orthogonal test design and range analysis. The softening point index of SBS-SBR composite asphalt is tested. The storage stabilities of different asphalt formulations are evaluated. And the effects of furfural extracted oil and aromatic oil on improving the storage stability of asphalt are compared. The study results show that SBS has a greater impact on the softening point, penetration and viscosity of asphalt. SBR can effectively improve the low-temperature performance of asphalt, but has no obvious effect on high temperature performance. Sulfur can increase the softening point and viscosity of asphalt. Considering the construction workability of asphalt, sulfur content should not be greater than 0.2%. The effect of furfural extraction oil on the asphalt stability is better than that of aromatic oil. The best material composition of SBS-SBR

composite modified asphalt is that the ratio of asphalt, SBS, SBR, sulfur, furfural extracted oil is 100% : 7% : 4% : 0.20% : 3%.

Keywords: modified asphalt, physical blending, orthogonal test, pavement performance, storage stability

APPLICATION OF ACHIEVEMENTS

Study and Application of Finished Cable Anchoring System in Curved Line Anchorage Project

..... SU Qiang, WU Dongming(194)

Abstract: The finished cable anchoring system has been used more and more in the anchorage engineering of suspension bridge. Aiming at the anchorage projects of curved pre-stressed line section, the influence of curved line section on the anchoring system is analyzed. A multi-strand finished cable anchorage anchoring system consisting of sleeve structure is innovatively designed and experimentally studied. The experiment and engineering application show that this new type of anchoring system can solve the curved anchorage and replacement problems of the pre-stressed anchor cable in the tunnel anchor body, and is suitable for the anchorage engineering of curved pre-stressed line section.

Keywords: finished cable, anchoring system, curved, sleeves, anchorage engineering

Study on Overall Implementation Scheme of BIM Technology in Longdong Avenue XU Saiying (197)

Abstract: Longdong Avenue is located in Pudong New District of Shanghai, is an east-west tangent line from Inner Ring Line to the suburb ring line of G1503 and its current situation is an urban trunk road. It is planned as an urban expressway, and will play an important role in the improvement of expressway system in Shanghai after rapid reconstruction. The implementation route of BIM technology forward application according with the urban road construction projects of Pudong New District is explored by the application of BIM Technology in Longdong Avenue. In the initial period of construction of Longdong Avenue Project, the application target of BIM full life circle is put forward, the overall implementation solution of BIM technology forward application in line with the current technological environment is formulated, and the beneficial reference is also provided for the implementation of BIM technology in the similar urban roads.

Keywords: Longdong Avenue, BIM, implementation scheme

Study on Application of Ultrathin Wearing Course in Expressway Maintenance

..... LI Yijia, YUE Zonghao, GUO Lisen, YE Weixin (200)

Abstract: Based on the pavement repair project of an Expressway, the mix proportion design and construction control technology of ultrathin wearing course asphalt mixture are introduced. Through the laboratory test and field test, it shows that the pavement performance of ultrathin wearing course asphalt mixture meets the requirements of relevant technical indicators, which accumulates the experience for the promotion and application of ultrathin wearing course in expressway maintenance engineering in the future.

Keywords: ultra-thin wearing course, mix design, construction technology

THE RELATIVE SPECIALITIES

Technical Features of Modern Tram System YUAN Guozhu, LI Xuefeng (204)

Abstract: The modern trams are flexible and variable, and can be used as the secondary traffic in the large cities or the primary traffic in the medium-sized cities. Its scope of application is in small and medium-sized cities, between the large city periphery group and the main city, in the periphery group of large city, and between the large city periphery group and the surrounding towns. By studying the technical features of the different application modes of modern tram, the characteristics of modern tram are analyzed from seven aspects of line, track, power supply, right of way, line layout mode, traffic organization of intersection and vehicle. The suitable application mode can be selected according to the characteristics of city and line. The applicability of modern tram is macroscopically grasped. The reference can be provided for the decision makers for traffic construction.

Keywords: modern tram, definition, technical feature

Brief Discussion on Design of High-fill, Soft-foundation and Large-bias Open Tunnel

..... CAO Shuxue, LI Jie (208)

Abstract: Combined with an engineering example, the structure layout, foundation selection and structural calculation analysis of the high-fill, soft-foundation and large-bias open tunnel are discussed, which can be referred for the relative engineering technicians.

Keywords: high fill, soft foundation, large bias, open tunnel scheme

Finite Element Analysis of Influence of Load on Stress of Existing Metro Access Line

..... LUO Qingsong, SANG Zhongshun, WANG Qing (211)

Abstract: The load will change the stress state of surrounding soil body. The increase of internal force of the lower tunnel will affect the normal use and safety of metro. Taking a filling subgrade across the metro in Shenzhen as the background, the stress of the existing metro access line structure is analyzed by the 3D finite element analysis to guarantee the normal operation of the existing lines and reduce the risks in the construction process. The relative experience can be referred for the relevant specialized persons.

Keywords: metro, light soil, finite element analysis, stress

Application of Open Caisson and Jacking Pipe in Utility Tunnel Project in Rock Area ZHENG Lin (215)

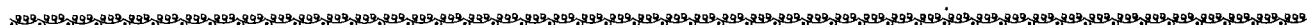
Abstract: The open caissons and jacking pipes are used more and more in the utility tunnel project. The relevant design and construction measures should be taken to ensure the structural safety and construction safety if more difficult in the rock areas. Firstly the definitions of utility tunnel, open caisson, jacking pipe and rock area are expounded. Then combined with the engineering examples, the open caisson and jacking pipe are discussed to analyze the possible engineering problems, and some feasible design and construction measures are proposed. And finally, the experience and measures to use the open caisson and jacking pipe in the utility tunnel projects of rock areas are summarized.

Keywords: open caisson, jacking pipe, rock area, utility tunnel

Design and Analysis of Towering Cantilever Special-shaped Steel Structural Pylon LIU Pan (219)

Abstract: The design and analysis of the towering cantilever special-shaped steel structure pylon are introduced by an engineering example of the completed pylon in entrance-exit image area of a science and technology innovation city. The main contents of the design are the upper two-layer cantilever structure and the 2.4 m-diameter steel column foot. The analysis and calculation mainly include the vibration mode analysis, strength checking calculation, structural deformation calculation, anti-floating checking calculation, node checking calculation and column foot checking calculation.

Keywords: steel structure, towering, cantilever, design



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