

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：上海市市政工程设计研究总院(集团)有限公司



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——《城市道桥与防洪》

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● 本期看点

基于轨道站点的市政交通设施结合建设探讨
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面向生态化发展的城市滨江岸线利用详细规划
方法研究
上海污水干线总管网络模型构建与调度研究



万方数据

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封面工程

本期封面工程为嵊州市杨港路东延工程，由杭州市城建设计研究院有限公司设计。

嵊州市杨港路东延工程是集道路、桥梁、隧道、市政管线、景观为一体的综合性项目，同时也是浙江省重点工程。工程西起嵊州市官河南路，东至雅戈尔大道，先后上跨常台高速—甬金高速互通立交区域，穿越亭山，全长3.644 km。

设计内容主要包括立交桥一座、隧道一座以及道路、市政管线、景观工程等。立交上跨常台高速—甬金高速互通立交区域，由于受现场条件限制，结构设计复杂，跨径种类繁多，施工难度大。亭山隧道由于埋深较浅，采用先明洞开挖施工后覆土绿化恢复的方案，既保证了隧道结构的工程质量，有效控制了施工风险，又最大限度地避免了隧道施工对环境的破坏。

杨港路东延工程的建设，完善了嵊州市路网骨架，可使“三环五纵五横”的中环早日形成，使城南区与城东开发区、农牧产品加工园区连成一片，对优化城市功能格局，促进各片区的联通融合，并发挥集群效应具有重要作用。

工程于2016年8月完成施工图设计，2016年10月开工建设，2019年10月竣工并投入使用。

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Discussion on Combining Construction of Municipal Traffic Facilities Based on Rail Stations
..... Chen Yun, Guo Kuang (1)

Abstract: Taking Hangzhou City as an example, this paper analyzes the present combining situations of rail stations and pedestrian crossing-street facilities, ground transferring traffic facilities, underground (ground) space connection, urban traffic sign and other municipal traffic facilities, analyzes the crux of problems, discusses the necessity of combining construction of rail stations and municipal facilities, and puts forward the countermeasures and proposals from the multiple dimensions of planning, design, construction and management in order to provide the reference for the priority development of urban rail transit.

Keywords: rail station, municipal traffic facilities, combining construction, countermeasures

Analysis on Traffic Organization of Underground Parking in High-speed Railway Business District
..... Zhang Weifeng (5)

Abstract: The high-speed railway business district is an important economic activity center of a city and there is a lot of business transportation demand, which often brings a lot of parking demand. Taking Suqian City as an example, this paper finds that the existing specifications cannot better support the calculation of parking space number from the analysis of parking demand, and puts forward the use of the method estimating the traffic volume and parking space turnover to estimate the parking space number again. In the detailed traffic organization scheme, the opening scheme of underground parking lot is obtained under the condition of considering the traffic capacities at entrance and exit, and the restrictions on entrance and exit at intersections. The "one-vertical and four-horizontal" linking roads are used to realize the interconnection of parking lots and to improve the convenience of parking lots in the design.

Keywords: high-speed railway, parking traffic, traffic organization, linking road

Reasons and Solutions of Urban Traffic Congestion in Harbin Ding Yincheng (8)

Abstract: The problem of urban traffic congestion is reflected in urban road traffic, and its origins are affected by the natural environment, climate, history, planning and the travel habits of citizens of a city. This

paper comprehensively and objectively analyzes and summarizes the reasons influencing the urban traffic congestion in Harbin, gives some thoughts to solve the problem of urban traffic congestion, and puts forward the proposals and detailed measures.

Keywords: Harbin, traffic congestion, solution, municipal road and bridge

Study on Setup Standard of Bus Transit Lane Wang Jin, Wei Xing, Gao Yanchao (12)

Abstract: Taking Nanchang City as an example, the traffic engineering analysis is made on the important influencing factors of setting up the bus transit lane, and the basic threshold value of each factor is determined. Taking the setup scale as the constraint condition, the traffic model of Nanchang City is established and the influence factors are analyzed in combination. For this reason, the threshold values of various combination conditions are determined to form the setup standards of bus transit lane in Nanchang.

Keywords: bus transit lane, setup standard, traffic planning, traffic model

Comparison of Design Specifications of Urban Elevated Roads between China and Japan
..... Lin Kang, Wang Dejun (15)

Abstract: By comparing the design specifications of urban elevated roads between China and Japan, this paper analyzes various methods different from the highway bridges adopted by Japan to construct urban elevated roads under extremely difficult conditions of land use, and explores the methods of seeking benefits and avoiding disadvantages in planning and design. This paper puts forward some ideas of guaranteeing the building limit on bridge, increasing the width of marginal strip and reducing the size of guardrail structure, and discusses the maximum longitudinal slope of bridge and the minimum width of ramp.

Keywords: elevated road, design specifications, China, Japan, building limit of bridge, guardrail, longitudinal slope of bridge, ramp

Analysis on Safety Evaluation of Rural Highway Alignment Design Based on Vissim Traffic Simulation
..... Li Li (21)

Abstract: Rural highway is an important basic condition for the development of rural economy and the improvement of people's living conditions. At the same time, it plays an important role in strengthening the urban-rural links, adjusting the agricultural structure and promoting the development of rural land resources. However, with the further development of rural highway, its traffic safety problems seriously affect and restrict the development trend of rural highway. By studying the relationship between the alignment of rural highway and the traffic safety, this paper simulates and evaluates the safety of rural highway alignment design by using the traffic simulation software, and puts forward the main technical means of traffic safety guarantee in view of its safety problems.

Keywords: rural highway, vissim traffic simulation, highway alignment, safety evaluation

Analysis on Stability and Study on Reinforcement Measures of Highway High Slope Ji Weijie, Zhang Xi (24)

Abstract: With the continuous advancement of the infrastructure construction to remote mountainous area in China, the high-filled and deep-excavated side slope is often encountered. Under various factors, this kind of side slope is prone to instability, and the geogrid is the most effective method to improve the stability of high slope. This paper systematically sets forth the influencing factors of slope stability and analyzes the reinforcement theory of geogrid. The numerical analysis model of engineering case is established by using Midas GTS to prove the effectiveness of the geogrid to reinforce the high-filled side slope.

Keywords: high-filled slope, stability, reinforcement measures, geogrid, Midas GTS

Brief Analysis on Retaining Form of Filling Subgrade in Steep Slope Section Zou Qing (27)

Abstract: This paper expounds the main causes of engineering accidents in the filling subgrade of steep slope section through individual engineering cases. The main causes are the improper retaining forms and poor drainage in heavy rain season, and thus educe two subgrade retaining forms more appropriate the filling subgrade in steep slope, namely the prestressed anchor cable slab-pile wall and pile foundation rest-beam retaining wall. Then through two concrete engineering examples, this paper analyzes the mechanical characteristics, construction technology and monitoring of two structural forms, compares two structural forms from the aspects of calculation theory, application scope, advantages and disadvantages, and finally concludes that the priority should be given to the prestressed anchor cable slab-pile wall structure and the structure of pile foundation rest-beam retaining wall should be carefully calculated and adopted.

Keywords: steep slope, filling subgrade, subgrade retaining, prestressed anchor cable slab-pile wall, pile foundation rest-beam retaining wall

Construction Waste Subgrade Filling Technology Gao Zhixing (30)

Abstract: In the process of expressway construction, large quantity of construction waste is produced in the demolition along the line. The recycle and utilization of construction waste can not only save the engineering cost and natural resources, but also solve the environmental problems caused by the piling up of construction waste and ensure the sustainable development of expressway construction. The construction waste is mainly composed of brick, concrete block, broken stone and etc., and is the good subgrade filling material. After the simple separation and picking, the construction waste can be directly used to fill the expressway subgrade. The construction waste particles vary in size and are required to crush. This paper proposes that the construction waste is rolled and crushed by the sheep foot roller at the subgrade filling level. Combined with the vibration rolling and iron three-wheel static pressing, the construction waste subgrade is realized to roll and compact. The construction waste is transported to the subgrade filling site by truck. The lay-down thickness of site does not exceed 40 cm. After dumped, the construction waste is paved backwards from front to back by bulldozer. As far as possible, the large grain of construction waste is laid on the bottom and the fine grain is paved on the top. Firstly, the construction waste is rolled and compacted for 6~10 times by 21-t sheet foot roller in order to ensure the surface particle size of subgrade not exceeding 10 cm. Then 21-t vibratory roller is used to roll for 3~6 times and 22-t steel three-wheel road roller is used to roll for 3 times. This paper puts

forward the quality control index and detection method of construction waste subgrade.

Keywords: construction waste, expressway, subgrade, filling, rolling compaction

Research on Rapid Road Construction Technology in Shallow Sea Reclamation Area Wang Rongfang, Hao Zhangang (34)

Abstract: Based on the municipal infrastructure construction project in the area of Tianjin Dongjiang Port, this paper studies the roadbed, pavement structure, drainage pipelines and other facilities in the shallow sea reclamation area, and proposes the rapid road construction technology adapting the reclamation area so as to provide the theoretical basis for the rapid construction of roads in the shallow sea reclamation area. The result shows that the roadbed applying the reinforced subgrade, the "rigid-flexible combined" pavement structural form and the pipe joint anti-seepage measures basically achieves the good pavement evaluation and the better comprehensive benefits.

Keywords: shallow sea reclamation, reflective crack, reinforced subgrade, differential settlement

Discussion on Liquidity of 3D Printed Concrete Materials Tu Qiaoyu, Tu Gang (37)

Abstract: With the development of 3D printing technology, the application of 3D printing technology in the civil engineering has become a current and future research direction. But the traditional building materials may not be suitable for 3D printing environments. Therefore, it is required to modify on the basis of the common concrete to make it suitable for 3D printing technology. This paper mainly discusses the scheme of making 3D printed concrete suitable for liquidity including the selection and optimization of cement-based materials, additives and mineral admixtures. Based on the experience of the predecessors, this paper puts forward the idea and preliminarily proposes the proportion of 3D printed concrete in order to realize and prepare the concrete suitable for 3D printing environment.

Keywords: 3D printed concrete, liquidity, cement-based materials, additives, mineral admixtures

BRIDGES & STRUCTURES

Comparison and Selection on Superstructure and Bridge Type Schemes of Steel-concrete Composite Girder and Pre-stressed concrete Prefabricated Box Girder Wang Xiaoli (40)

Abstract: Based on the background of the construction drawings of the practical project G1816 from Wuhai City to Jingtai, Maqin National Expressway to Zhongchuan Airport, combined with the successful experience of similar projects, by comprehensively considering the time limit for project, safety cost, and also in order to carry out the relative documents of resolving the excess production capacity of iron and steel industry, two bridge type schemes of steel-concrete composite girder and the pre-stressed concrete prefabricated box girder are compared and selected, which provide the technical reference for the bridge schemes under the similar construction conditions.

Keywords: steel-concrete composite girder, pre-stressed concrete prefabricated box girder, comparison and

selection of schemes

Study on Superstructure Selection of Elevated Bridge Newly Built in Central Urban Area Ren Cai (43)

Abstract: With the rapid development of a city, the construction of perfect rapid transportation system is the most important guarantee for the urban function. However, the restrictions on the construction of elevation expressway in central urban area are more complex. Combined with Nanchang City Hongdu Avenue Expressway Reconstruction Project, the mechanical properties, construction technologies and landscape effects commonly for the elevated superstructure forms are compared. Finally, the segmental prefabricated assembled box girder scheme is selected. At the same time, the construction process of segment assembly is introduced in detail. The effect of using the segmental prefabricated box girders in Hongdu Avenue is better, which can provide reference for structure selection in the other central urban areas.

Keywords: central urban area, elevated bridge, prefabrication and assembly, segmental bridge, rapid construction

Comparison and Study on Steel Truss Beam Structure of Bahe River Bridge in Xianghuai Road VI of Xian Wang Yalu (47)

Abstract: Bahe River Bridge in Xianghuai Road VI is a large double-deck bridge in an urban main road. The main bridge adopts the six-span 57.5 m + 71 m + 120 m + 120 m + 70 m + 57.5 m variable height continuous steel truss girder structure. The bridge adopts the double decks. The upper deck is a motor vehicle lane with a width of 25 m, and the lower deck of is a pedestrian path with a width of 11 m. This bridge has the characteristics of long span, wide truss, variable height continuous and double decks. This paper mainly introduces the comparison and selection of bridge design schemes and finally determines the application of double-deck variable height continuous steel truss girder structure. This scheme has the features of reliable structure, useful function and simple construction, which provide the references for the scheme design of the similar bridges.

Keywords: bridge scheme, double deck, variable height, steel truss continuous girder

Study on Node Scheme of Nanjing Road Yihe River Bridge and Cross-strait Interchanges in Linyi City Jin Zhehu (51)

Abstract: Linyi City Nanjing Road Yihe Bridge and Cross-strait Interchange Project is an important part of Linyi City "three-ring and fifteen-ray" backbone road network planning. The construction of Nanjing Road Yihe River Bridge Project mainly solves the demands of river-crossing traffic, and the inter-district roads connecting Hedong District and Beicheng New District. The construction of this project will further perfect the backbone road network of Linyi City, improve the transportation conditions of Linyi City, build the urban backbone road network, promote the development of areas along the line, and have an important significance. At the same time, the overall layout of the interchanges among the urban river-crossing roads and the riverside roads on both sides of the river meets the basic traffic function and the urban riverfront landscape

functions should be taken into consideration, which can be of significance for building the distinctive urban waterfront roads.

Keywords: Yihe River Bridge, riverside interchanges, ramp

Design and Features of Juzizhou Bridge in Guangze County of Fujian Xu Li, Zhu Yi (55)

Abstract: Its main bridge is an 80 m+60 m single-pylon single-plane cable-stayed bridge. This paper analyzes the special geographic position and its traffic function significance of this bridge. For this reason, the design scheme of this bridge is determined. This paper introduces the technical standard, overall layout, main bridge design and construction organization of this bridge in detail, and summarizes the main design characteristics of this bridge.

Keywords: bridge design, single pylon, special-shaped cable-stayed bridge, consolidation of pier and beam

Discussion on Master Design and Design Essentials of Overpass in North Area of Urumqi International Airport Lu Chuanan, Meng Xudong, Yin Jincun(58)

Abstract: This paper mainly introduces the master design of overpass in Urumqi International Airport North Area Reconstruction and Extension Project, and puts forward some design essentials and detailed scheme optimization design according to the actual characteristics of the project.

Keywords: international airport, overpass, master design, design essentials

Study on Structural System Design of Single-pylon Parallel-plane Wide Steel Girder Cable-stayed Bridge Shen Yang (62)

Abstract: Taking Xinxiao Bridge in Foshan of Guangdong Province as the engineering background, this paper mainly introduces the study on the structure constraint system of the single-pylon parallel-plane super-wide steel girder cable-stayed bridge from the selection of structural system and main girder form. The application of adjustable support successfully realize the hinged structure system of concrete pylon and steel girder of Xinxiao Bridge, which simplifies the complex structural relationship between the super-wide steel girder and the pylon of parallel-plane cable-stayed bridge, and provides the reference for the similar projects.

Keywords: parallel plane, super-wide steel box girder, adjustable support, hinge system of concrete pylon and steel girder

Application of Pitch Line Method in Main Cable Alignment Analysis of Unequal Three-pylon Long-span Suspension Bridge Liu Xiaohong, Wang Jian(65)

Abstract: Combined with an unequal three-pylon long-span suspension bridge, on the basis of the pitch line method theory, the common Excel software is used to calculate the initial equilibrium position of its main cable and the tension of the main cable iteratively in order to verify the feasibility and engineering accuracy of this algorithmic. Based on this, the Midas finite element model of the whole bridge structure is established, and the Midas catenary cable unit is utilized to carry out the more precise analysis in order to obtain the

initial equilibrium position of suspension bridge and the tension of the main cable. After comparison, the results of two calculation methods show that this approximate calculation method of pitch line method can satisfy the engineering demands and is convenient to use. No complicated programming calculations are required. This method has a certain practical significance and can be referred for the main cable alignment analysis of the similar bridges.

Keywords: pitch line method, suspension bridge, main cable alignment analysis

Discussion and Study on Influences of Different Optimization Methods on Completion State of Cable-stayed Bridge Liu Feng (68)

Abstract: Referring to the practical data of engineering cases, with the help of the finite element mathematic calculation mode, based on the zero displacement method and the minimum bucking strain energy method, this paper thematically analyzes and studies the mathematic calculation of the completion state of cable-stayed bridge. According to the comparison of the related cable forces, bending moments and alignments, this paper analyzes the influences of the different optimization calculation methods on the completion state of the cable-stayed bridge in order to provide the study and technical references for the similar projects of cable-stayed bridge, and to help the construction of the safe and strong cable-stayed bridges.

Keywords: cable-stayed bridge, completion state of bridge, optimization method, finite element, mathematic calculation, analysis and study

Calculation and Analysis on Vertical Rotation Construction of Steel Pylon for Single-pylon Cable-stayed Bridge Dong Tao, Qian Ying, Zeng Xiangwang (72)

Abstract: The vertical rotation construction method can reduce the difficulty to assemble the cable and pylon structure in high altitude, which is easy to control the dimensional accuracy of structure, to improve the welding quality and work efficiency, and is widely applied in the construction of cable-stayed bridge. In order to analyze the stress state during the vertical rotation construction of steel pylon of single-pylon cable-stayed bridge, the ANSYS software is used to simulate the vertical rotation construction process of single-pylon cable-stayed bridge and to calculate the stresses, deformations and stabilities of steel pylon at the different stages. The results show that the stress states of the steel pylon is the most unfavorable in the starting and ending stages of the rotating body, which should be specially monitored. The deformation of steel pylon is larger during the starting stage, and should be taken as the main control and monitoring index.

Keywords: single-pylon cable-stayed bridge, vertical rotation construction, calculation and analysis

FLOOD CONTROL & DRAINAGE

Engineering Design of Underground Wastewater Treatment Plant in Industry Zone Ruan Lifeng (75)

Abstract: The small-sized underground wastewater treatment plant (WWTP) is used more and more in the

sewage treatment of industry zone. Taking a WWTP of opto-electronics zone as an example, the construction scale of this WWTP is 30 000 m³/d, is fully underground and uses the efficient sedimentation + A₂/O + MBR technology. Its effluent executes the Level A standard of *Municipal Wastewater Treatment Plant Pollutant Discharge Standard* (GB18918-2002). This paper introduces the design parameters of sewage and sludge treatment technologies, and the main treatment structures of this WWTP, and summarizes the engineering characteristics.

Keywords: industry zone, underground wastewater treatment plant, A/A/O technology, MBR

Effect of Effective Volume of Catchment Pool of Waterlogging Control Pumping Station on Waterlogging of Urban Underpass Tunnel Zhang Zehui (78)

Abstract: Firstly, this paper analyses the main causes of waterlogging in urban underpass tunnel and its impact probability, then expounds the effect of the effective volume of the catchment pool of waterlogging control pumping station on the waterlogging risk in the urban underpass tunnel, and finally illustrates the important role of improving the effective volume of the catchment pool of waterproof pumping station to prevent the waterlogging in the urban underpass tunnel through practical examples.

Keywords: waterlogging control pumping station, catchment pool, effective volume, urban underpass tunnel, waterlogging

Research on Detailed Planning Methods for Utilization of Urban Riverside Coastlines Oriented to Ecological Development Wu Lian (83)

Abstract: The urban riverside coastline is an important resource that is scarce and non-renewable in the city. In order to realize the sustainable utilization and ecological development of coastline resource, the planning and control of coastline resource must be done well. On the basis of the analysis on the functional classification, section and scope of riverside coastlines, this paper puts forward the detailed control method of utilizing the urban riverside coastline. The combination of "line-point-surface" is adopted, and the river blue lines and water level lines are used as the benchmark. The intersection point of the coastline function section from the end point to the baseline is used as the reference point. The area enclosed by the reference points serves as the control range corresponding to each type of coastline. The whole coastline is planned and controlled in the form of "general map + plan", and the plan location, coastline function, coastline information, control requirements and detailed contents are determined in each sub-plan. Taking the riverside coastline of Nanjing as an example, this paper studies the functional distribution and planning control of the riverside coastline utilization in the whole city by this method. The research results have the positive significance for the coordination of urban riverside coastline utilization and the land urban function, and the subsequent overall planning management of the relevant departments.

Keywords: riverside coastline utilization, ecological development, detailed control, river blue lines, water level lines

Study on Flood Control and Waterlogging Drainage Scheme for Waterlogging Points in Zhongshan Park of Sanmei City Xiang Feifei, Wang Sining, Wang Jianjin (87)

Abstract: The urban waterlogging is caused often by multiple factors mainly involving the vertical elevation, pipe network system, drainage organization mode and external influences. Therefore, the treatment scheme of waterlogging points should be systematically considered. This paper analyzes the waterlogging causes of the waterlogging points in Zhongshan Park of Sanmei City, and puts forward the treatment scheme separately from three systems of peripheral flood control, upstream mountain torrent control and regional waterlogging control, which have the important guiding significance for planning the typical strip urban drainage systems in mountainous area.

Keywords: flood drainage channel, waterlogging, mountain torrents

Numerical Simulation and Analysis on Morphology Optimization of Artificial Lake Bottom Yan Yajun, Liu Chenyu (93)

Abstract: In order to reasonably determine the lake bottom morphology of artificial landscape lake, the Mike Flood one-dimensional and two-dimensional coupled model developed by Danish Institute of Water Resources and Mike 3 three-dimensional hydrodynamic model are used to study the lake bottom morphology. The influences of the different lake bottom morphologies on the hydrodynamic force are obtained. The results show that the flow field of the lake area under the arc-shaped deep-trough lakebed morphology is more uniform, and the area of water with low velocity is smaller.

Keywords: artificial lake, morphology design, numerical simulation, water flow analysis

Calculation and Numerical Simulation of Sluice Dock Structure Qu Di (97)

Abstract: The structural analysis of the overall engineering safety of dock structure has been relatively mature by conventional calculation methods, but it lacks the detailed analysis of the influence of all external conditions on the special joints. In this paper, SAP2000 series of software is used to carry out the overall 3D calculation and 2D simplified calculation of the dock structure, which are compared and validated with the conventional calculation methods so as to prepare for the effective analysis of the structure by the finite element method in the future.

Keywords: sluice engineering, dock structure, finite element, numerical simulation

MANAGEMENT & CONSTRUCITON

Analysis on Vertical Turning Construction and Structure of Main V-shaped Steel Pylon of Long-span Short-pylon Cable-stayed Bridge Zhang Bo (100)

Abstract: Due to the aviation limit of 60 m at airport, the main bridge of Zhongxing Bridge in Ningbo adopts the design scheme of long-span short-pylon cable-stayed bridge. Its V-shaped steel pylon is constructed by the method of assembly at bridge deck and then vertical turning to forming. The vertical turning construction

of main steel pylon is a key point and difficulty in the construction of main bridge. This paper specially introduces the division of hoisting segments and the main steps of vertical turning construction of the main steel pylon. Based on the construction steps, the whole structure of main pylon vertical turning process is analyzed. The whole mechanical characteristics of main steel pylon and temporary structures are obtained. In order to further verify the safety of structure in the vertical turning process of the main steel pylon, the key nodes of vertical turning the upper hinges and lower hinges as well as upper butt hinges are carried out of finite element simulation analysis to know the local stress and deformation of the key nodes. The whole analysis and local analysis of the structure efficiently verify that the strength and rigidity of the structures can satisfy the relative specifications and requirements in the vertical turning process of the main steel pylon.

Keywords: long-span short-pylon cable-stayed bridge, main V-shaped steel pylon, key node, simulation analysis

Key Construction Technique of Steel Truss Arch Bridge Crossing Paihe River in Jixian Road Wang Peng, Lv Zhengdong, Chen Wenqiang (104)

Abstract: The main bridge of the bridge crossing Paihe River in Jixian Road is a combining form of 53.9 m+132 m+53.9 m three-span continuous truss box. The steel girder structure of the main bridge is complex, the accuracy control requirement of bolting structure is high and the control difficulty of the overall alignment is large. Aiming at the different positions of component, the in-plant manufacture separately determines the different manufacturing processes. The site installation adopts the support method of erecting from two ends to the middle of span. The corbels at support section, deck system and steel truss arch rings are erected separately by the different methods, and finally are closed at the middle of main span.

Keywords: truss box combined three-span continuous steel truss arch bridge, matching drilling, long-line method assembly, cantilever erection

Study on Application of Cable Installation and Construction Technology of Single-pylon Cable-stayed Bridge - - - Pan Bin (108)

Abstract: The stayed cable is the bearing member of cable-stayed bridge. After the beam construction of cable-stayed bridge is completed, the main pylon is constructed by vertical rotation, and then the stayed cable is installed and constructed, which makes the hanging of stayed cable become the construction difficulty of the whole bridge. Taking Jinhui Port Bridge as the engineering background, this paper analyzes the construction difficulties of stayed cable. Aiming at the treatment countermeasures and the construction technical essentials for the difficulties, this paper studies the application of cable installation and construction technologies of single-pylon cable-stayed bridge.

Keywords: cable-stayed bridge, construction technology, stayed cable, hanging cable

Design and Practice on Freezing Reinforcement of Circular Connecting Channel in Large Diameter Highway Tunnel Fang Wei (111)

Abstract:Artificial freezing technology is a common method for strengthening the connection channel in soft soil stratum, and the structure form of the connection channel is an important factor affecting the design and construction of freezing reinforcement. Relying on the channel projects along river in Shanghai, and based on the engineering characteristics and geological conditions of the large diameter tunnel under the river, the design method and construction process of the circular freezing reinforced body are introduced, and the variation rules of stratum temperature and tunnel deformation are analyzed. The following conclusions are obtained that there is no tensile stress inside the circular frozen wall under the action of soil and water pressure, which can give full play to the advantage of high compressive strength of the frozen wall. The layout form of double-loop freezing hole along the axis of the connecting channel can make the formed freezing wall more even, and the strengthened freezing mode of the cold discharge pipe laid on the inner surface of segments can also avoid the weak links in the freezing wall. The frost heaving effect produced during the formation of the circular frozen wall structure has little influence on the large diameter tunnels on both sides, which can ensure the safety and stability of the tunnel. The study results show that the frozen strengthening form of circular connection channel has obvious advantages over the traditional straight-wall arch section. The study results can be referred for the freezing design and construction of connecting channels in the similar stratum.

Keywords: artificial freezing technique, highway tunnel, circular connecting channel, freezing temperature field, monitoring analysis

Study on Construction Technique of Shield Long-distance Crossing under Artificial Lake in Sandy Stratum Qian Xiaohua (116)

Abstract: With the continuous development of urban metro, the construction environment of shield method is more and more complex, and the control requirements of risk is also more and more strict. Taking the shield tunneling construction of Zhengzhou Metro Line 4 Project as the background, and relying on the engineering construction example of shield tunneling machine crossing under an artificial lake – Long Lake in an area, this paper analyzes the risk of shield tunneling machine crossing under Long Lake in long distance in sandy stratum, studies and optimizes the construction technique of shield tunneling machine crossing under Long Lake and puts forward a set of construction technical measures for shield tunneling machine crossing under artificial lake in order to ensure the shield tunneling machine safely and smoothly crossing under Long Lake and to achieve the good construction effect, which can accumulate the experience and provide the technical reference for the similar projects in the future.

Keywords: sandy stratum, shield construction, long distance, crossing under artificial lake

Hydraulic Blasting Construction Technology in Tunneling Process of Urban Rail Transit Hu Weidong (121)

Abstract: Taking an engineering line as the background, this paper discusses the hydraulic blasting construction technology and sets forth its application demand in the tunneling of urban rail transit. By comparing with the traditional blasting technologies, its advantages are clarified. And its detailed construction

design, technological process and construction notes are analyzed. Finally, the experimental result shows that the construction effect is good.

Keywords: hydraulic blasting, tunneling, blast hole, water bag

Classification of Maintenance Safety Accidents and Revelation of Safety Management of Expressways Based on Probability Yin Feng (124)

Abstract: In view of the problem of disconnection between the strict control of expressway operation and the effect of actual accident reduction, this paper points out that its cause is the lack of a unified understanding model for the object of highway maintenance safety, that is, accidents. And this paper focuses on the nature of accident probability, and then identifies the person and event of the accident. An accident is described as the activity range of human activity $R(A)$ in the range affected by the accident $R(B)$. A and B are further described as the time interval for Δt random variable sequences. It is pointed out that B is subject to geometric distribution, and A and B are conditional probabilities of each other. $P(AB)$ expression is obtained. Based on the maintenance operation, six kinds of working conditions are actually concluded. This paper further analyzes the variation of $P(AB)$ value characteristics, discovers the hidden dangers, confirms the scientificity of six kinds of working conditions, and gives the exact countermeasures for improving the safety management.

Keywords: high filling embankment slope, reinforced soil, strength reduction method, geogrid, safety coefficient

STUDY ON SCIENCE & TECHNOLOGY

Stability Analysis on High Slope of Highway Reinforced Filling Embankment Based on Strength Reduction Method Li Yanling (127)

Abstract: In this paper, relying on a highway reconstruction and extension project in southwest China, the stability evolution processes of the high reinforced soil embankment slope and the high plain fill embankment slope in the layering construction process are compared and analyzed by the strength reduction method based on the finite element software. Some suggestions on the design of high slope of reinforced soil embankment are given. For the stability analysis of embankment, it is basically feasible to take the reduction coefficient of calculation termination as the stability safety coefficient no matter what is the position and magnitude of the calculated maximum plastic strain and the maximum displacement. The plain fill is used to construct the high filling embankment. Three slope ratio schemes (1:1.5, 1:1 and 1:0.58) cannot meet the stability requirements. The reinforcement measures should be taken for the filling slope. TDGD200 geogrid is used, and the vertical spacing is 2-m full layout. The effect of moderate slope ratio (1:1) filling scheme is better than the larger (1:0.58) and smaller (1.1.5) slope ratios under the condition of no slope foot reinforcing measures. Finally, based on the optimization scheme, the influence of road traffic load on the stability of high filling embankment slope is analyzed. The results show that the road traffic load has little influence on the stability of the high-filling

slope of reinforced soil embankment.

Keywords: high filling embankment slope, reinforced soil, strength reduction method, geogrid, safety coefficient

Actual Measurement and Attenuation Analysis of Deep Underground Soil Vibration Caused by Highway Traffic ...
..... Xie Yongjian, Li ning, Xu Hongwen (133)

Abstract: In order to study the attenuation law of vibration with depth caused by highway traffic, the measuring points in the holes of 5.5 m, 19.5 m, 34.5 m and 39.5 m, and the ground measuring points nearby the holes are measured synchronously of displacement vibration, and the measured data in the vehicle and non-vehicle conditions are analyzed respectively in the time domain and frequency domain. The results show that the high frequency part in the traffic vibration decays rapidly and the low frequency part decays slowly as the depth increases. The vertical displacement attenuation factor decays faster than the horizontal attenuation factor. In the condition of vehicle, the vertical displacement amplitude at depths of 40 meters is only 15% of that on the ground, and the vibration attenuation has been obvious.

Keywords: highway traffic vibration, soil vibration, attenuation

Parametric Analysis on Composite System Bridge of Fish Ridge Beam and Partial Cable-stayed Bridge
..... Lu Yuanchun, Fu Mei, Xu Liping, Yin Ziyu (137)

Abstract: The fish-ridge continuous girder bridge has some mechanical characteristics of large structure stiffness, large negative bending moment at the support, and small moment and down deflections at mid-span, and moreover, the partial cable-stayed bridge needs the large stiffness of stiffening girder. Therefore, two types of bridge can be combined by the advantages of using the fish-ridge continuous girder bridge and the partial cable-stayed bridge. In order to obtain the application range and mechanical characteristic of this composite system, this paper carries out the parametric analysis on a series of composite structural bridges of fish-ridge girder bridge and partial cable-stayed bridge.

Keywords: fish-ridge continuous girder bridge, partial cable-stayed bridge, mechanical characteristic, parametric analysis

Research and Analysis on Lateral Distribution Coefficient of Urban Steel-concrete Composite Beam
..... Zhou Qianru(140)

Abstract: Steel-concrete composite beam as a structure giving full play to the properties of material is widely used in the field of urban bridge construction. However, theoretical research and engineering practical application of the lateral distribution coefficient of steel-concrete composite beam are few. In order to provide a corresponding calculation reference for practical engineering applications, taking the simple-supported multi-chamber steel-concrete composite beam in the engineering cases of Shenzhen as an example, this paper analyzes the calculation method of the lateral distribution coefficient of steel-concrete composite beams, and summarizes the corresponding rules.

Keywords: steel–concrete composite beam, lateral distribution coefficient, torsional correction coefficient, grillage method

Study on Construction and Operation of Sewage Main Network Model in Shanghai
..... Peng Haiqin, Zhang Liuli (143)

Abstract: There are five sewage mains in the central urban area of Shanghai, respectively the west main, the south main, the header pipe of the Combined Sewage Project Phase I, the header pipe of the Combined Sewage Project Phase II and the header pipe of the Combined Sewage Project Phase III. The problems of weak ability to cope with emergencies, difficult to repair without water and poor capacity to receive incremental sewage exist in these sewage mains. The purpose of this study is to utilize InfoWorks ICM to establish the hydraulic model of the sewage main for the Combined Sewage Project Phase II in order to simulate and analyze the present situation of sewage conveying system. This paper puts forward the optimal operation scheme of key pumping station to improve the comprehensive service capacity of the mains in the Combined Sewage Project Phase II, to guarantee the safe operation of sewage system and to improve the water environmental quality.

Keywords: hydraulic model, drainage system, InfoWorks ICM, operation study

Size Effect Coefficient of Core Splitting Strength of Airport Pavement
..... Miao Tingli, Wu Yuanshou, Shen Yuansong, Hong Wenbao, Wei Yuping, Guo Dandan (147)

Abstract: By comparing the splitting strength between the laboratory standard molding cylindrical concrete specimen and the field test plate core standard core sample under the same mix proportion, this paper discusses the influence of core sampling test on the splitting strength. By comparing the splitting strengths of the different lengths of core samples, this paper studies the influence rule of sample length on the splitting strength of core sample. The results show that the splitting strength of concrete measured by the drill core method is 15.7% lower than the laboratory test because of the damage caused by the drill core process and the difference of concrete mixing, vibrating and curing conditions between the test plate and the molded cylinder specimen. In addition, as the length of the cylinder specimen increases, the stress plane of the concrete specimen also increases, and the number of micro–cracks and micro–holes in the plane also increases. As a result, as the length of the specimen decreases, the splitting strength of the measured specimen increases gradually. Finally, the correction coefficients of splitting strength and length of a new flying zone project at a general airport in China are obtained.

Keywords: airport engineering, core sampling, splitting strength, size effects, correction coefficient

Study on Low Temperature and Fatigue Properties of Warm–mixing SBS Modified Asphalt Mixture
..... Bai Yingqiang (151)

Abstract: In order to study the effect of warm–mixing agent on the low temperature and fatigue characteristics of SBS modified asphalt mixture, the SGC compactor forming specimen is used to test the void ratio and splitting strength of the warm–mixing asphalt mixture and to determine the mixing and compacting

temperatures. The mechanical properties of asphalt mixture are evaluated by low temperature trabecular experiment and four-point bending fatigue test. The results show that the mixing of warm-mixing agent can reduce the molding temperature of asphalt mixture and improve the compaction of SBS modified asphalt mixture. The warm-mixing agent can improve the failure strain of asphalt mixture and increase the flexibility of asphalt mixture. The curing can improve the low temperature performance of warm-mixing asphalt mixture. The fatigue life of warm-mixing asphalt (WMA) is greater than that of ordinary hot-mixing asphalt (HMA), and the fatigue life of WMA is less sensitive to temperature and strain.

Keywords: warm-mixing asphalt, molding temperature, low temperature performance, fatigue characteristics

Simulation of Fatigue Process of Concrete Inverted T-shaped Bent Cap

..... Liang Junsong, Jiang Changjiang, Ding Zhaodong (155)

Abstract: This paper introduces a bi-scalar elastic fatigue damage constitutive model to analyze the whole fatigue process of inverted T-shaped bent cap commonly in the bridge engineering. This model uses the internal variable of tensile damage and the internal variable of compression damage to describe the influence of microcosmic tension and compression damage mechanism on the deterioration of macro-mechanical properties of concrete. And based on the thermodynamic principle of effective stress space, the evolutionary rule of fatigue damage is determined. The combination of the fatigue damage constitutive model and the nonlinear finite element analysis method can accurately predicate the nonlinear behavior of concrete inverted T-shaped bent cap under the fatigue loading effect, especially the formation and expansion process of crack in the fatigue loading process, which provide the basis for the fatigue analysis and design of the practical projects.

Keywords: damage constitutive model, inverted T-shaped bent cap, whole fatigue process, nonlinear finite element analysis

Study on Runoff Pollution Reduction of Soil Heavy Metal Pollution in Land Treatment Facilities

..... Wang Weiqing (159)

Abstract: Through the sampling analysis on the water and soil samples in the runoff treatment facilities combined with a grassing trough and surface flow constructed wetland, this paper studies the relationship between the soil heavy metal pollution risk and the runoff interception purification mechanism in land treatment facilities. The study result shows that the water - soil translocation of heavy metals in runoff is the main way to remove it in the land treatment facilities, but this will bring the phenomenon of soil heavy metal enrichment which cannot be neglected. Compared with the surrounding natural soil, the average concentrations of the main metals (Fe, Mn, Pb, Cu, Zn and As) in the soil of runoff land treatment facilities go up 1.5 to 2.9 times, which bring the serious negative environmental risk, and are particularly serious in the land treatment facilities (i.e. constructed wetland) with the advanced water quality purification capacity. At the same time, the intensity of heavy metal water-soil translocation in the facilities is obviously affected by the physicochemical environment of water. Especially, the regulation of oxidoreduction level, and the anaerobic

and strong reducibility environment will further increase the secondary release of soil heavy metal and the risk of translocation to the surrounding environment.

Keywords: land treatment facility, heavy metals, rainwater runoff, soil enrichment

APPLICATION OF ACHIEVEMENTS

Exploration on Forward Design of BIM Technology in Small and Medium Municipal Engineering
..... Lu Gang, Zhang Ze (163)

Abstract: The forward application of BIM Technology in the municipal engineering of China is still in the exploratory stage now. The project of Yunwushan Road Underpass Tunnel adopts the BIM technology for forward design. The 3D model is established to realize the model parameterization and the automatic drawing to cooperate with the specialties of road, pipeline and structure to mold, and to obtain the forward design information flow of the project, which lay the foundation for the full life circle application of BIM in this project.

Keywords: municipal engineering, BIM technology, forward design

Application of Analytic Hierarchy Process in Comparison and Selection of Pavement Structure Schemes
..... Zhang Xu (166)

Abstract: The analytic hierarchy process (AHP) is introduced into the design process of pavement structure to calculate the weight coefficients of various evaluation indicators in order to quantify the comparison and selection of design schemes, thus make the selection of the final scheme more reliable. The relative experience can be referred for the similar projects.

Keywords: analytic hierarchy process (AHP), comparison and selection of pavement structure schemes, weight coefficient

Study and Analysis on Block Pavement Applied to Urban Roadway Li Xingfu, Li Xiang (169)

Abstract: The block pavement has a breathable structure and excellent surface properties, and is widely used in the urban sidewalks and landscape roads. In order to improve the urban heat island effect, solve the waterlogging problem and respond to the national "sponge city" construction requirements, this paper studies and analyzes the structural style of block pavement, the road functions and the urban ecological performance, and affirms the feasibility of block pavement applied to urban roadways. The application of block pavement to the urban motorway pavement has a positive effect on alleviating the urban ecological problems.

Keywords: block pavement, urban road, heat island effect, sponge city

THE RELATIVE SPECIALITIES

Influencing Factors and Engineering Application of "Multi-pole Integration" Design in Municipal Road Engineering
..... Kang Shibiao, Niu Muchun, Yin Guangyao, Liu Lulu (172)

Abstract: There are various kinds of poles on both sides of the municipal roads, which are various in varieties and complicated in layout. Adopting "multi-pole integration" can improve the urban landscape, ensure the structural safety and simplify the number of facilities. This paper introduces the implementation status and design influencing factors of "multi-pole integration" in various places. Taking the design case of Hohhot as an example, this paper describes the design principle of "multi-pole integration". The results of this study will provide reference for the design and construction of the "multi-pole integration" project in other cities in Inner Mongolia Autonomous Region.

Keywords: "multi-pole integration", municipal engineering, new road

Thinking on Construction of Intelligent Street Lamp Lu Chenliang (175)

Abstract: This paper introduces the design overview of intelligent street lamp in the design process of the characteristic town of Balihan. By introducing the overall structure of intelligent city, this paper expounds the important role of intelligent street lamp, and analyzes the construction mode and scheme design of intelligent street lamp in detail. The intelligent street lamp can greatly reduce the energy consumption of street lamp and avoid a huge waste of common resources and space resources. But it is required to carry out more thinking and exploration in its standard system, planning, construction and management.

Keywords: intelligent city, intelligent street lamp, urban infrastructure

Discussion on Business Model of Traffic Travel under MaaS Service System
..... Chen Gang, Yu Huaqiong(179)

Abstract: This paper discusses and summarizes the successful operation experience of "Internet of transportation travel industry" series products and transportation travel e-payment ride of BWTON Technology Co., Ltd. through the universally recognized business model reference model, and analyzes nine elements of value proposition, target customer segments, distribution channel, customer relations, value configuration, core competence, partner network, cost structure and win-win cooperation mode of transportation travel e-payment products. To find out the e-payment characteristics of transportation travel MaaS service, the difference from the current payment services of all walks of life and the brought lifting effect, this paper introduces the business model design of various travel e-payment products.

Keywords: electronic payment (e-payment), mobile payment, business model

Analysis of Temperature Stress on Super-length Structures in Underground Space of Suzhou Center
..... Wang Wei (183)

Abstract: The plane size of Suzhou Center is huge. The temperature stress due to excessive length has the obvious influence on the structures. By analyzing the possibility of temperature load on the underground structure during the whole process from construction to normal use, this paper calculates the temperature load on the buildings by the linear distributing method, and summarizes the calculation conditions for determining the temperature action. Taking the underground space structure of Suzhou Center as an example, this paper

introduces the calculation method of temperature stress. The practical calculation shows that the temperature reduction load will produce the larger tensile stress in the framed girder and floor slab. The tensile stress is concentrated at the opening position of floor slab. The temperature action will produce the shearing force and bending moment in the framed column, which must be fully considered in the engineering design.

Keywords: Suzhou Center, super-length structure, temperature action, temperature stress

Mechanical Response of Foundation Pit Close to Metro under Excavation of Foundation Pit in Deep Silt Area

..... Huang Fujie, Chen Haomin, He Zegan (188)

Abstract: In order to ensure the safety of foundation pit close to metro in the deep silt area during the process of excavation and support of newly built foundation pit, a fine 3D calculation model is established through the finite element software to calculate and analyze the mechanical response feature of metro foundation pit to the excavation and support of the newly built foundation pit. The study result shows that the displacement of foundation pit of metro station presents a "bulge shape" after the completion of excavation, which conforms to the general deformation law of diaphragm wall plus inner support foundation pit supporting type. The maximum sideway of the newly built foundation pit guard post is 24.5 mm and the vertical displacement is 6.54 mm, which are all less than the control value of guard post displacement, and shows that the design of newly built foundation pit support system is reasonable. The maximum displacement of the pit support structure of metro station is 12.16 mm, which is far less than the first displacement limit of foundation pit. At the same time, it is found that the displacement increments at both sides of its underground diaphragm wall are different. The displacement increment at the right side (close to one side of newly built foundation pit) is small. Its reason is that the excavation silt area of the newly built foundation pit makes the active earth pressure on the right underground diaphragm wall reduce.

Keywords: excavation of foundation pit, foundation pit close to metro, deep silt, mechanical response, numerical simulation

Study on Implementation Scheme of Foundation Pit Close to Metro Shield Tunnel and Analysis of Its Influence on Tunnel Deformation Pan Qing (191)

Abstract: This paper studies the deformation of tunnel caused by the excavation of foundation pit around the metro shield tunnel. Combined with the engineering examples, the deformations of foundation pit and tunnel under the different reinforcement conditions are analyzed by using the finite element analysis software PLAXIS, and the auxiliary protection measures of soil reinforcement outside shield tunnel and surcharge inside tunnel are analyzed and demonstrated so as to select the economical and safe construction scheme, which provides a basis for solving the practical engineering problems.

Keywords: metro, foundation pit, shield tunnel, numerical simulation, tunnel deformation

Seam Waterproof Design and Experimental Study of Deeply Buried Large-diameter Shield Tunnel

..... You Guangming (196)

Abstract: Taking Shanghai Beiheng Channel and Zhoujiazui Road Tunnel as the background, this paper studies the seam waterproofing of large-diameter, high-hydraulic pressure and sharp-curve shield tunnel through the engineering analogy, numerical simulation, waterproofing performance test and structural construction. The study result shows that the elastic sealing gasket can resist the hydraulic pressure of 1.2 MPa when the seam is 6 mm open and 10 mm staggered. And it is applied in the above project, and its implementation effect is good.

Keywords: shield tunnel, sharp curve, waterproof design of seams, elastic sealing gasket, high hydraulic pressure

Mechanical Analysis on Different Connection Types of Double-deck Lane Structure and Segment in Shield Tunnel Liu Nian, Li Yilun (201)

Abstract: With the acceleration of social economy and urbanization process, the industrialization degree of building structure gradually increases, and the prefabrication and assembly technique gradually plays the important role in the construction field of urban tunnel. But how to optimize the structural stress system and the panel point construction, how to meet the anti-seismic and waterproof requirements and how to improve the prefabrication and assembly level are still the key problems in the urban tunnel prefabrication technique. Combined with the newly built Shanghai Zhuguang Road Channel Project, this paper analyzes the mechanical characteristics of segment-internal structure system by four connection methods of upper lane slab and prefabricated segment. According to the measures of panel point construction, this paper compares and analyzes the advantages and disadvantages of four connection methods of prefabricated lane slab and segment, which provide the technical support for the selection of the double-deck lane structure of shield tunnel.

Keywords: shield tunnel, double-deck lane structure, segment, connection, mechanical analysis

Analysis on Calculation Method of Hydraulic Reclamation Soil Settlement Jiang Hongjin, Zhao Zhang, Chen Hao (204)

Abstract: This paper introduces several common calculation analysis methods of subgrade settlement, analyzes the calculation characteristics and applicability of the different analysis methods, and finally points out the issues for attention in the practical application.

Keywords: hydraulic reclamation soil, settlement calculation, calculation method

Study on Key Technology of Long-distance River-crossing Pipe Jacking in Complex Stratum Sun An, Shi Huiting, Chen Weihong (207)

Abstract: The long-distance river crossing pipe jacking projects in complex stratum are often accompanied with the high risk and high difficulty because of unseen factors and long-distance jacking. The relevant technical measures are required to take for dealing with and avoiding the risks. Taking a river-crossing pipe jacking project as an example, this paper analyzes the general problems met in the construction process. The

targeted technologies of using the modified rock breaking headpiece, setting the relay room, reinforcing the hole, reasonably setting the mud drag reduction and correcting the jacking error are used to ensure the smooth completion of the project and to verify the rationality of technical measures, which provide the benefit reference for the long-distance river-crossing pipe jacking projects.

Keywords: slurry balance rock breaking headpiece, relay ring, thixotropic fluids, hole reinforcement, jacking error correction

Technical Measures and Effect Analysis on Environmental Protection Reconstruction of Asphalt Concrete Mixing Plant Wang Junrui (210)

Abstract: The targeted technical measures are taken for the smoke and dust pollution produced in the production process of asphalt concrete mixing machine. By the determination of the main discharging positions of smoke and dust in asphalt concrete mixing machine, this paper compares the main smoke and dust treatment methods, and selects the purification method which is relatively economic, efficient, low energy consumption and stably operated in order to meet the requirements of the current environmental protection policy after reconstruction and make the enterprise sustainable development.

Keywords: asphalt concrete mixing machine, smoke, dust

Analysis on Application of Energy-saving Technology of Centralized Heating in Urban Buildings Hu Qiang (214)

Abstract: The energy source is the indispensable content in the life and production of the people. There is an energy crisis all over the world now, which also makes the country take energy conservation seriously and needs to improve the energy use efficiency. The centralized heating of urban buildings will consume a lot of energy. Therefore, at present to improve the energy use efficiency and to save the energy source, it is required to take the centralized hearing mode of improving the heating efficiency and ensuring the heating effect. Based on this, this paper analyzes the application of centralized heating energy-saving technology in the urban buildings, which can be referred for the similar projects.

Keywords: urban building, centralized heating energy-saving technology, application analysis

Experimental Study on Groove Backfill Compactness of Large-diameter Buried Plastic Pipe Li Yingqi, An Ce, Yang Hao (216)

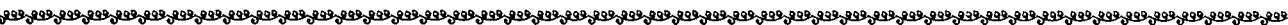
Abstract: As the flexible pipe, the large-diameter buried plastic drainage pipe has the structural stress characteristic of pipe-clay combined action. The groove backfill compactness has the large influence on the bearing capacity of pipe in the construction. According to the relative study result of large-diameter plastic pipe sand-box test, this paper discusses the influence of this key factor of groove backfill compactness on the construction quality of large-diameter buried plastic drainage pipe. The result shows that the improvement of groove backfill compactness of large-diameter buried plastic pipe plays an important role in the improvement of deformation modulus so as to decrease the pipe deformation.

Keywords: large-diameter buried plastic pipe, pipe-clay combined action, groove backfill compactness, vertical deformation rate

Analysis on Cost of Trenchless Repair Technology for Drainage Pipeline Shen Yun (221)

Abstract: Drainage pipe repair is an important part of municipal construction in China. This article introduces the advantages of trenchless technology, such as no influence on traffic, fast construction speed and low comprehensive cost. And also this article compares and analyzes the economies and technologies of several common trenchless repair technologies, and finally analyzes the relevant economic indicators in combination with the actual cases of trenchless repair project. The research results provide some references for the cost analysis and compilation of the drainage pipe trenchless repair technology.

Keywords: pipeline repair, trenchless repair, drainage pipeline, cost analysis



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