

# 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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——《城市道桥与防洪》

### ● 本期看点

- 关于大型公建项目交通规划设计体系的探讨
- 预制节段拼装连续梁上部构造特点
- 关于河道生态治理中生物群落设计的探究
- 信息化技术在隧桥工程养护中的应用



中华人民共和国住房和城乡建设部优秀期刊

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# 城市道桥与防洪 (月刊)

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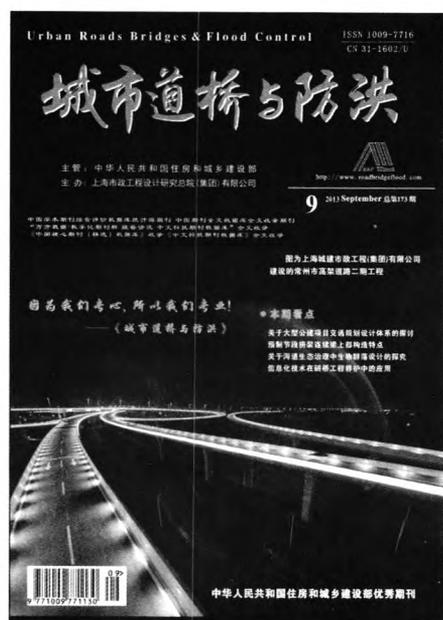
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**Abstract:** The transport planning of the traditional large-scale public works is generally implemented synchronously with the regulatory detailed planning. If lack of the engineering deepening, the adjustments involving the main transport system can not meet the requirements of planning control and implementation. Taking the transport planning design of Mingjiang Central Business Center as an example, the article discusses the transport planning design system of the large-scale public works.

**Keywords:** large-scale public works, transport planning, design system

Summary on Reconstruction Design of Highway out of Town ..... Feng Hua (4)

**Abstract:** The highway out of town is the transitive road to link up the dual structure of town and village, and has the double functions of urban traffic and transiting traffic. With the further development of urbanization construction in China, the urban traffic characteristics of highway out of town are more obvious, and the problems of traffic safety and road landscape become increasingly prominent. According to the construction experience of many highways out of town, the article discusses the master design ideas and technical gist of these highways.

**Keywords:** highway out of town, urban, highway, design, safety, function

Application of Super-elevation Flexibility Design of Urban Road Curve ..... Cheng Shiyang, Li Yan (9)

**Abstract:** On the basis of understanding the current *Urban Road Engineering Design Code* (CJJ 37-2012) in China, the article analyzes the calculation mode of super-elevation transverse slope and the determination of calculation parameters, and according to the engineering cases, analyzes and applies the super-elevation flexibility design of urban road curve. The good economical benefit is achieved under the premise to ensure the safety.

**Keywords:** super-elevation, transverse force coefficient, minimum super-elevation transverse slope, design speed

Discussion on Cross Section Planning and Design of Urban Road ..... Ge Wen (11)

**Abstract:** With the speed up of urbanization process and the increment of auto possessive quantity, the traffic composition of urban road changes greatly. Also with the continuous improvement of the people's living level, the functions of road walking and leisure are more required. Under the premise of guaranteeing the cross section of urban road to satisfy the basic using function, the article puts forward that the cross section planning and design of urban road should comprehensively consider the factors of urban landscape greening, intersection channelization, human value and etc., which can be valuable to guide the planning, design, construction and management of cross section of urban road.

**Keywords:** urban road, layout of cross section, width of greening area, man-bicycle-one-plane, combination of short term and long term

Design of Master Scheme for Guiyang Sanqiao Interchange Reconstruction and Extension Project ... Gong Lei (14)

**Abstract:** Guiyang Sanqiao Interchange is required to reconstruct and extend because of Mawang Road

proposed to join up. In line with the principle not to make the massive changes to the existing interchange, the key factors of the interchange reconstruction and extension are determined to propose the join-up method of Mawang Road. This paper analyzes the key factors to reconstruct and extend Guiyang Sanqiao Interchange, and introduces its main technical indexes and the master scheme design of its reconstruction and extension.

**Keywords:** Guiyang Sanqiao Interchange, reconstruction and extension, master design

Selection of Longdong Avenue Interchange in Pudong Section of Middle Ring Line ..... Li Shuxun (17)

**Abstract:** The total length of the new built project in Pudong Section (Jungong Road Cross-river Tunnel ~ (M) Gaoke Road) of Middle Ring Line is 9.44 km, and is also the last section of the Middle Ring Line left over to now in Shanghai. The Longdong Avenue Interchange is also one of the last two interchanges left in the Middle Ring Line. It has the characteristics of high technical standard and many control factors. The article puts forward the suitable selection scheme of interchange according to the analysis of the construction condition and functional composition and the determination of the main line level and the boundary condition of the project.

**Keywords:** Longdong Avenue, construction condition, functional composition, interchange selection

Discussion on Design of T-type Hub Interchange Ramp ..... Liu Chao, Ke Shuiping, Xi Huicai (20)

**Abstract:** On the basis of analyzing the traffic character at the end of T-type hub interchange ramp, the article puts forward the different design vehicle speed standards of ramp. Combined with the design vehicle speed requirements, the article puts forward the determination principles of speed change lane type and transition section length, and introduces the application of the above results in the practical engineering cases.

**Keywords:** interchange, T-type, ramp design, speed change lane

Elementary Analysis on Influence of Reflection Angle Performance and Visual Cognition of Reflecting Material on Traffic Safety ..... Zhao Zhaosheng (22)

**Abstract:** The traffic signs are the effective protection measures for the traffic safety. The visual cognition of traffic signs is the basic performance of road user to achieve the road management language in all weather conditions. The article introduces the influence of reflection angle performance and visual cognition of reflecting material on traffic safety. The relative experience can be referred for the similar projects.

**Keywords:** reflecting material, reflection angle, visual cognition, traffic safety

Study on Key Technology of Hillside Soil Filling of Expressway Roadbed ... Zhen Xi, Han Shujie, Ma Weidong (26)

**Abstract:** Taking Tangcheng Expressway Phase II Project as an example, the article introduces the hillside soil used for the roadbed filling of expressway according to the material source status of Tianjin Ji County where the project is located in order fully to utilize the local resources and to decrease the land damage. The article studies the material source, construction technology, mechanical combination, laying thickness and inspection method in the key issues of hillside soil roadbed filling, which can be referred for the design and construction of the hillside soil roadbed filling of the high-class roads in the regions with more mountains, but the lack of soil source.

**Keywords:** hillside soil, roadbed filling, inspection

Organization and Management of High-grade Cement Concrete Pavement Overlaying Engineering ..... Zhang Haidong (28)

**Abstract:** This paper discusses the organization and management of evaluation, material, design and construction in the high-grade cement concrete pavement overlaying asphalt concrete project. According the national specifications of China and the local consideration of Shanghai, the paper defines the investigation contents and evaluation standards of the local old cement concrete pavement. Based on the evaluation result, the paper proposes the different overlaying countermeasures. The reasonable utilization scheme is used for the old cement concrete pavement. The high-performance asphalt concrete overlaying countermeasures are firstly used for the more seriously damaged pavements. Following the sustainable development concept, the paper

describes the characteristics of the high-grade cement concrete pavement overlaying engineering and its construction organization principle, and defines the guiding ideas of traffic organization and quality control, and the technological requirements of each construction link. The paper analyzes the construction process and requirements of high-grade cement concrete pavement overlaying engineering in detail by the Huqingping Highway Reconstruction Extension Phase I project. The observation shows that the implementation effect of this project is excellent, and the adopted overlaying technical scheme is reasonable and feasible.

**Keywords:** high-grade highway, cement concrete pavement, overlaying, design, construction

Discussion on Drainage Construction of Porous Asphalt Concrete Pavement ..... Shao Jianhui, Hang Fei (33)

**Abstract:** The article puts forward many side ditch construction methods and the expansion joint edge drainage construction, analyzes and compares the discharge capacities of many side ditches, which can be referred for the similar projects.

**Keywords:** porous asphalt concrete, side ditch, expansion joint edge drainage

Summarization on Design of Permeable Pavement and Application of Materials .....

..... Wang Demi, Jiang Di, Di Shengguan (35)

**Abstract:** Aiming at the increasingly severe ecological environment in China, the article puts forward the ecological permeable pavement structure of road, and focuses analysis on the classification of permeable pavement and the application of materials. The article studies the strength characteristics and the weather abilities of various permeable pavement materials from the angle of engineering application, and puts forward the proposals for the material selection and the design gist of permeable pavement.

**Keywords:** permeable pavement, design, material application, noise reduction, asphalt mixture, permeable brick

Application of Composite Road Grouting Reinforcement Technique in Road Repair Engineering .....

..... Liu Bo, Yang Ge (39)

**Abstract:** Relying on the main project of Shanghai Fengxian Daye Highway and Tuanqing Highway Repair Project, the article sets forth and analyzes the mixing ratio design of the new road grouting material, the design and action mechanism of the new composite grouting technology, and the supporting construction technology and scheme design researched and developed in the subject. The test result shows that the grouting effect of the new fast hardening inorganic road grouting material used in this project is more excellent than the traditional polymer grouting material, and the composite grouting reinforcement technology is more excellent than the conventional bulkhead pipe grouting reinforcement technology, which can greatly improve the grouting efficiency and satisfy the request of fast opening the traffic after the road repair. The article puts forward the recommended grouting scheme design based on the new grouting material and the composite grouting technology.

**Keywords:** mixing ratio design of grouting material, road using performance of grouting material, composite grouting sprinkler-shaped pipe, recommended scheme design

Analysis and Treatment Measures for High Slope Landslide ..... Ma Zhishan (44)

**Abstract:** The article analyzes the causes of mountain landslide by the engineering practices. Based on the characteristics of landslide site and the rock soil, and after calculation, the article describes the reinforcement measures combining the retaining system and the anchor system, and the drainage design at the inside and outside of slope. Its contents can be referred for the similar projects.

**Keywords:** natural landslide, slope stabilization, treatment measures, drainage design

## BRIDGES & STRUCTURES

Characteristics of Superstructure for Prefabricated Segmental Assembly Continuous Beam .....

..... Yu Gang, Zhang Wenqing, Zhang Chunlei (47)

**Abstract:** The article analyzes the construction characteristics of the superstructure of the urban elevated continuous beam bridge used of the prefabricated segmental assembly technology, and describes the structure design method and the construction proposal. The relative experience can be referred for the similar projects.

**Keywords:** elevated bridge, prefabricated segmental assembly, outer pre-stressing, prefabricated component

Analysis on Static Load Test of Variable Width Curve Box Beam Bridge Based on Grillage Method .....  
..... Lin Ping, Pang Biao, Yang Bin (51)

**Abstract:** The article points out that the grillage method is a similar method of space calculation, has the characteristics of clear conception and easy understanding, and is more widely used for the calculation and analysis of the special structural beam bridges. Based on the basic principle of the grillage method, the article introduces the structural modeling of a steel reinforced concrete variable width curve box beam bridge, calculates and analyzes the static response of structure in the design load and test load, and evaluates the structure according to the filed test results.

**Keywords:** bridge engineering, static load test, grillage theory, curve beam bridge, structure analysis

Elementary Discussion on Balance Design Gist of Curved Beam ..... Zhong Zhaohong (54)

**Abstract:** The article discusses the studying status of curved beam bridge, introduces its calculation method and stress feature, sets forth its stress characteristics from the aspects of bearing mode, pre-stressing tendon, curvature radius and temperature stress level, and sums up its design gist to make the curved beam bridge safe and reliable.

**Keywords:** curved beam bridge, lateral torsional coupling, bearing mode, temperature stress level

Analysis of Sectional Shear Lag Effect in Single-box Simply Supported Box Beam Span .....  
..... Qi Yanping, He Yubao, Lu Huazhen (57)

**Abstract:** Box section has wide applications in bridge engineering due to its special stress characteristics. The analysis of shear lag is inevitable during the bending design of box beam. There are plenty of analysis methods for the shear lag. Taking the single-box simply supported beam of a direct web as an example, the article compares and analyzes the calculation results by the different calculation methods.

**Keywords:** box beam, shear lag effect, bending design

Elementary Analysis on Calculation of Bridge Shaped Plate ..... Chen Jieming (61)

**Abstract:** The article introduces the simple application of grillage method, and analyzes the modeling, calculation and result of the shaped plate. The relative experience can be referred for the similar projects.

**Keywords:** shaped plate, grillage method, unit division

Evaluation on Expansion Joint Performance of Cable-stayed Bridge Based on Long-term Health Monitoring Data  
..... Li Xuelian, Sun Limin (63)

**Abstract:** Based on the long-term health monitoring data of Donghai Bridge, the article calculates the length variation of the main channel of bridge by the displacement monitoring data of expansion joint, and analyzes the relationship between the length variation of the bridge and the temperature and wind load in the environmental factors. The analysis result shows that the temperature is the main influence factor on the length variation of the bridge, the relativity of wind load and expansion joint displacement is weak, and its influence on the length variation of the bridge can be negligible. The built-up linear regression model between the length variation of the bridge and the effective temperature of the structure can be used to inspect the reliability of monitoring value of expansion joint displacement. The built-up regression model of the cumulative process and time of expansion joint displacement can be referred for the selection, maintenance and replacement of expansion joint.

**Keywords:** health monitor, displacement of expansion joint, length variation of bridge, environmental factor, effective temperature

Inspection and Evaluation on Structure of Long-span Cable-stayed Bridge in Operation Period ..... Liu Yan (68)

**Abstract:** A long-span cable-stayed bridge has four characteristics of high pier, long span, deep ditch and difficult construction conditions in the boundary of Hubei. In order to ensure the operation safety of the bridge, the bridge is required to periodically inspect and evaluate. According to the inspection of the stayed cable force, deck alignment, main beam stress and vibration mode, the conclusion shows that the working conditions of dead load, live load and temperature load of this bridge are normal, and the overall rigid and overall dynamic characteristics of the bridge are better.

**Keywords:** cable-stayed bridge, structure inspection, cable force, alignment

Brief Introduction of Master Design of Steel Ring Truss Overpass ..... Li Jiequn (70)

**Abstract:** The main structure of a pedestrian overpass at the intersection of Dali and Guangyun is a steel oval truss. The long axis of the overpass centerline is 95.3 m and its short axis is 79.2 m. The article introduces the overall ideas of the overpass design, discusses the main factors required to consider for the determination of overpass scheme, analyzes some key issues in the design of overpass, and finally introduces the space calculation of the external load subjected to the steel truss, and the static and dynamic analysis of the overpass.

**Keywords:** steel truss, overpass, scheme design

Scheme Design of Super-long Rigid Frame Bridge with Main 198-m Span ..... Ai Fuping, Tao Xing (75)

**Abstract:** The article introduces the scheme design of a super-long rigid frame bridge with the span layout of 131 m+198 m+131 m. According to the comparison of the construction parameters of 15 built continuous rigid frame bridges, the article demonstrates the structural dimensions. The pre-stressing is multiple and small models of the form. Aiming at the mid span deflection and structural crack of the newly built long-span pre-stressed concrete continuous box-beam bridge in the operation stage, the spare pre-stressed strands are set up.

**Keywords:** continuous rigid frame, design, external pre-stressing

Master Design of Jiangbu Bridge on Qiandao Lake ... Ma Wenbin, Ye Weijian, Zheng Yongwei, Shen Xudong (79)

**Abstract:** Jiangbu Bridge on Huanhu Highway in Chunan County of Zhejiang Province crosses the reservoir area of Qiandao Lake. The main bridge of Bridge No.1 is a rigid frame continuous beam combination system. Its span combination is 77.5 m+7 × 130 m+77.5 m. The bridge location is at the water depth of 50~69 m. The range of the deepwater area is 1240 m, the lake water heads are greatly changed in the store water period and the low water period, and it is hard to design and construct. The article analyzes the geology, hydrology, shipping and construction condition in the bridge location area, introduces the design concept and the design construction gist of Jiangbu Bridge, and focuses discussion on the design construction scheme of the 60-m deepwater foundation and the closure sequence of the multi-span continuous rigid frame bridge, which can be referred for the construction of the similar bridges.

**Keywords:** multi-span, combination system, deepwater foundation, design, double nonlinear

Construction Condition and Selection of Bridge Scheme of Fuyuan Road Xiangjiang River Bridge in Changsha ..... Li Yao (83)

**Abstract:** This paper introduces the construction background, the construction conditions, and the comparison and determination of bridge scheme of Fuyuan Road Xiangjiang River Bridge in Changsha according to the engineering feasibility study and the engineering survey design.

**Keywords:** bridge, construction condition, comparison and selection of scheme, Xiangjiang River Bridge

Finite Element Analysis of a Large Expressway Continuous Rigid Frame Bridge in Guangxi ..... Tao Xing (87)

**Abstract:** The article mainly introduces the design and calculation of a large expressway bridge in Guangxi. This bridge is a continuous rigid frame bridge with the span layout of 131 m+198 m+131 m and the sidespan and midspan proportion of 0.66 larger than the general same bridges. The article introduces the finite element

static and seismic analysis by MIDAS/Civil. The back-up prestressed strand is set up for the span deflection and structure crack of the newly built long-span prestressed concrete continuous box girder bridge in the operation period.

**Keywords:** continuous rigid frame, finite element, static, external prestressing

Scheme of Chongqing Huangjue Interchange Phase II Project Crossing Bridges in Inner Ring ... Zhou Tingting (91)

**Abstract:** The article introduces the comparison and selection of interchange scheme in the design of Chongqing Huangjue Interchange crossing Inner Ring, and its relative construction procedure. The relative experience can be referred for the similar projects.

**Keywords:** interchange, comparison of interchange scheme, construction procedure

Elementary Analysis on Split Joint and Widening Design of Expressway Bridge ..... Li Junling (96)

**Abstract:** With the obvious achievements of the economical development in China in recent years, it directly brings the rapid development in all aspects of the society. Especially, the development speed of the traffic industry is more exalted. Owing to the increasing increment of expressway traffic volume, the old bridges are hard to satisfy the current traffic demand and the deck widths are much hard to meet the increment of vehicles. It is urgently to widen and reconstruct the bridge deck so as to relax the traffic pressure of bridge. The article analyzes the present situation of expressway bridge reconstruction, and sums up the practical experience and achievements of bridge widening, which can be better referred for the expressway bridge widening projects in China. At present, its effect is more obvious and its technology is more well-known in China. The article introduces several successful cases.

**Keywords:** expressway, reconstruction of old bridge, widening, split joint, settlement analysis

Design of a Wall Pedestrian Overpass ..... Li Xiaogang, Wei Hua, Xi Lingzhi, Wen Weiyong (99)

**Abstract:** The article introduces the design of Yujie Pedestrian Overpass in Southern Song Dynasty in Hangzhou, and from the aspects of scheme conception, overall layout, structure design and architectural aesthetics, sets forth the design gist of the bridge, and demonstrates the significance of structure and landscape combination in urban bridges. The relative experience can be referred for the similar pedestrian overpasses.

**Keywords:** urban pedestrian overpass, architectural aesthetics, bridge function

Analysis on Engineering Cases of Anchor Cable Reinforced Sheet-pile Retaining Wall .....  
..... Wen Jitao, Yan Chao, Li Ming (102)

**Abstracts:** The sheet-pile retaining wall of a project is deformed with cracks due to landslide affecting. The good effect is achieved by the anchor cable reinforcement. The article analyzes this project in detail to give the stress change and design gist before and after the reinforcing of sheet-pile retaining wall, and sums up the valuable experience for the similar projects.

**Keywords:** anchor cable, reinforcing, sheet-pile retaining wall, stress change

## FLOOD CONTROL & DRAINAGE

Analysis on City Waterlogging Cause and Preventive Countermeasures ..... Xu Guofeng He Xiaohong (107)

**Abstract:** The article systematically analyzes the causes of city waterlogging in China, and scientifically evaluates the overall drainage capacity of the local rainwater system. According to the concept of low-influence development, the article puts forward the modes of permeation, storage and reuse to solve the waterlogging problem in many links of the headwaters, and the middle and the end of pipe network system.

**Keywords:** city waterlogging, drainage system, countermeasures

Analysis of Rainfall Durations in Rainwater Storm Intensity Formula ..... Yu Haiyan (111)

**Abstract:** The premise of better urban drainage should be clearly to cognize and study the situation and law

of urban storm. The storm intensity formula is the important basis for planning and designing the urban rainwater drainage system. According to a specific case and based on the storm intensity formula of Xinxiang City, the article puts forward the analysis methods of rainwater runoff in two separate drainage regions, including the rainfall duration options and statistical analysis, the spatial and temporal distributions of rainfall and the process of rainfall design, etc, which can be referred for the planning and design of urban rainwater utilization engineering and municipal drainage engineering.

**Keywords:** rainwater storm intensity, formula, rainfall durations, ultimate strength theory

Research of Bio-community Design in Ecosystem Management of River ..... Zuo YuLin, Chen JunYi (114)

**Abstract:** Based on the research of the present situation of river ecosystem management in Shanghai, the article puts forward the basic principles and emphasis fitting for the bio-community design in the river ecosystem management in Shanghai, classifies and analyzes the terrestrial and hygrophyte biological communities separately, studies the key gist and the optimized scheme of the bio-community design in the river ecosystem management in Shanghai, and puts forward the constructive opinions for some other factors involved in the design process in order to provide the technical support for the promotion of the river ecosystem management in Shanghai.

**Keywords:** river ecosystem management, bio-community, terrestrial plants, hygrophyte plants, community recovery, water ecosystem construction

Discussion on Seepage Prevention and Reinforcement Technology of Reservoir Dam ... Xu Jiacun, Zhong Jingwen (118)

**Abstract:** The seepage is the most common problem in the reservoir embankment project. The seepage prevention and reinforcement technology of dam is an important aspect in the design and construction of water conservancy project. According to the case of Nanjing City Jiangning District Zhaoku Reservoir Seepage Prevention and Reinforcement Project, the article discusses the seepage prevention and reinforcement technology of dam. The relative experience can be referred for the similar projects.

**Keywords:** dam, seepage prevention, reinforcement

Brief Introduction on Pollution Treatment Scheme of Zhufu Harbor Dishui Heavy Metal Residue Area .....

..... Zhang Yunxia, Duan Kuan (120)

**Abstract:** About 1 000 000-t residue is piled up in Zhufu Harbor Dishui Heavy Metal Residue Area for a long time. Its environmental damage is serious due to no management in the area. The test of toxicity infusing from the residue of the project finds that the residue belongs to the "Class I solid waste" of the general industrial solid waste. Based on the principle of thorough treatment and safe disposal, the residue has to be treated as far as possibly according to the "Class II solid waste" of *Pollution Control Index of General Industrial Solid Waste Storage and Disposal Areas* (GB18500-2001) owing to the geographic position of Dishui Residue Area. The relative experience can be referred for the similar projects.

**Keywords:** general industrial solid waste, landfill, leachate

## MANAGEMENT & CONSTRUCTION

Study on Field Hot Recycling Construction Technology of Municipal Road Asphalt Pavement ... Wang Ying (122)

**Abstract:** With the development of urbanization process in China, many cities are at the development period of the municipal roads under the large-scale construction, extension and reconstruction now. Many roads are required to maintain in the large scale because of the different faults. Compared with the traditional asphalt pavement repair method, the field hot recycling construction technology can fully utilize the old materials without the wastes. Its construction speed is fast, and its construction period is short. The traffic can be quickly opened. It is the most directly effective technological method to repair the surface functional fault of municipal road. Therefore, it is necessary to further study the field hot recycling technology. Referring the principle of field hot recycling construction technology and according to the engineering cases, the article studies the mixing ratio design of field hot recycling asphalt mixture, and puts forward the construction

management and quality control gist of field hot recycling technology.

**Keywords:** municipal road, field hot recycling construction technology, mixing ratio design, construction quality control

Application of PCMW Method in Foundation Pit Supporting of Underground Passage for Dongcheng Avenue

..... Wang Weiguo, Qian Ye (127)

**Abstract:** The article briefly introduces several supporting methods of the underground passage in the soft soil regions. Combined with the engineering practice of the underground passage for Kunshan Dongcheng Avenue, the article sets forth the characteristics of PCMW method by the relative calculation, comparison and selection. The relative experience can be referred for the similar projects.

**Keywords:** PCMW method, underground passage, supporting of foundation pit

Application of Cement Mixing Pile Composite Foundation and Lime Fly-ash Backfilling in Construction of High-filled Embankment .....

Yao Hong (133)

**Abstract:** The treatment method of cement mixing pile reinforcement and soil backfill surcharge preloading is usually used in the foundation treatment and construction of high-filled embankment. Not only this method spends a long period of construction, but also the backfilling strength often does not meet the design requirement and the settlement of the later period is greater because of the objective environmental factors. Taking the Qiantan Avenue Project located at the bank of Huangpu River as the case, the article introduces the composite foundation treatment by the cement mixing pile reinforcement and lime fly-ash backfilling for the road section of backfilling height larger than 1.5 m, which overcomes the influences of short construction period, high settlement control requirement of later period and the plum rain season, and can achieve the good effect.

**Keywords:** cement mixing pile, lime fly-ash backfilling, high-filled embankment, treatment of composite foundation

Long-span Continuous Box Girder Adjustable Jacking Technique for Connection Line of Nantong Tonghu Avenue and Dongfang Avenue .....

Huang Yufeng (135)

**Abstract:** The connection line of Nantong Tonghu Avenue and Dongfang Avenue is the total length 180 m of six-span continuous box girder. This project is required to adjust and jack by the six-span continuous box girder because of the viaduct to be constructed. The article analyzes the technical difficulties of this project, sets forth the key technique of construction, and focuses introduction on the gist of the continuous box girder adjustable jacking technique. The relative experience can be referred for the similar projects.

**Keywords:** long-span continuous box girder, adjustable jacking, synchronously proportionally jacking, steel box pad, spacing

Dry Connection Pile Construction Technology of Cast-in-situ Pile under Deepwater Silt Geological Condition

..... Hou Shoufei (140)

**Abstract:** This paper focuses introduction on the construction method and the special construction measures of successfully connecting the pile to the design elevation under the deepwater and silt geological conditions because of the concrete supply disruption in the cast-in-situ pile construction of a super large bridge to cause the pile concrete not to cast to the design elevation of pile top. The successful use of this construction method gropes for the treatment of cast-in-situ quality and provides the reference for the treatment of the fault pile in the cast-in-situ pile engineering construction of bridge in the future.

**Keywords:** deepwater, silt, cast-in-situ pile, pile connection, construction

Analysis on Completion Inspection Quality of Shanghai - Nanjing Expressway (Shanghai Section) Widening Project

..... Liu Fang (142)

**Abstract:** Shanghai - Nanjing Expressway (Shanghai Section) is the first expressway organized by the competent departments of the government to test and accept the completion after the implementation of *Rules for Implementation of Highway Engineering Completion (Handing Over) Acceptance Method*. Taking this

pavement project as an example, the article introduces the guiding role and the detail implementation method of the quality appraisal for the completion inspection in the *Rules for Implementation*, and analyzes the inspection results of parameters, deflection, rut, smoothness and anti-slip (structural depth, friction coefficient) of pavement engineering. Combined with the appearance inspection, the article gives the final inspection conclusion and proposals and provides the powerful quality appraisal basis for the completion acceptance of Shanghai - Nanjing Expressway (Shanghai Section) Widening Reconstruction Project. The detail implementation method can be referred for the similar projects.

**Keywords:** completion (handing over) acceptance, quality appraisal, entity inspection

Evaluation on Safety Monitor and Quality Control of Embankment Engineering ..... Shi Minhui, Mao Wei (146)

**Abstract:** Based on the embankment engineering cases, according to the safety monitoring data, and analyzing the viewing data of construction period, the guidance of construction schedule in time can efficiently avoid the destructive deformation of subgrade soil possibly brought by the blind construction, which provides the scientific basis for the engineering safety and quality control.

**Keywords:** embankment engineering, safety monitoring, quality control

Construction Technology and Quality Control of Elevated 65-m-span Steel-concrete Combined Structure .....

Continuous Girder in Dongfang Avenue of Nantong ..... Zhang Yan (149)

**Abstract:** The main span of 65-m steel-concrete combined structure is used in Nantong Dongfang Avenue Fast Reconstruction Project spanning Tongqi Canal. The article mainly introduces the steel girder hoisting, combined girder concrete quality control and pivot adjusting construction method under the complex conditions of bridge location. The relative experience can be referred for the construction of the similar bridges.

**Keywords:** steel-concrete combined girder, installation of steel girder, concrete quality control, pivot adjustment

Settlement Control of Pipe Jacking Crossing Buildings and Underground Pipelines ..... Fan Yongqiang (152)

**Abstract:** Combined with the engineering cases, the article analyzes and sums up the causes of ground settlement in the pipe jacking construction, and the relative technical measures of settlement control taken for the pipe jacking to cross the buildings and underground pipelines.

**Keywords:** pipe jacking construction, ground settlement, control measures

Elementary Discussion on Construction Technology of Large-area Tile Road ..... Han Yongqiang (154)

**Abstract:** Taking the tested 8700-m<sup>2</sup> tile road section in the dynamic square road project of Shanghai General Motors Research & Development Center as the engineering background, aiming at the construction difficulties of the large-area tile road and combined with the engineering practices, the article sets forth how to ensure the engineering quality to satisfy the design requirements from the aspects of the fabrication of precast block mould, assembly of precast block, filling of grouting material and inspection in the construction process. Also the article discusses the construction technology of large-area tile road and sums up its experience.

**Keywords:** tile road, construction technology, roughness index, mould fabrication, assembly, filling of grouting material

Discussion on Regionalization Maintenance Management Experience of Municipal Facilities ... Wan Shangwu (157)

**Abstract:** The article introduces the present situation and the existing defects of the regionalization maintenance of the municipal facilities, puts forward the division of maintenance region according to the maintenance grade of the municipal facilities, and draws up the relevant regionalization maintenance standard. Taking the regionalization maintenance management implemented in Shanghai Railway South Station as an example of a pilot project, the article sets forth the advantages of regionalization maintenance management and the brought social effect in order to popularize and upgrade the refining maintenance.

**Keywords:** municipal facilities, regionalization, maintenance management

## STUDY ON SCIENCE & TECHNOLOGY

Research on Interchange Selection of “No Charge” Expressway ..... Liu Jun, Lian Xiangping, Dai Maohua (160)

**Abstract:** This paper puts forward the concept of “no charge” expressway. Focusing on the charge request and charge form of expressway, and taking the “no charge” expressway as the research object, this paper firstly compares and analyzes the charge situation and development trend of expressways at home and abroad, sets forth the characteristics of “no charge” expressway, and then further compares and analyzes the common interchange forms of the change expressway and “no charge” expressway at home and abroad. On this basis, this paper researches the common interchange form of “no charge” expressway. The aim is to provide the design ideas and references to select the interchange form of “no charge” expressway in the systematization process of expressway in China.

**Keywords:** trumpet-shaped, diamond-shaped, partial cloverleaf, interchange selection, “no charge” expressway

Three-dimensional Finite Element Analysis on Stress Characteristics of Circular Reinforced Concrete Pipe Culvert under Actual Working Condition in Road Engineering ..... Zhu Bin, Cao Gaoshang (165)

**Abstract:** Three-dimensional finite element model of circular reinforced concrete pipe culvert with inner diameter 1.5m is established. The main stress distribution is analyzed at four positions of the inner ring reinforcing bar, outer ring reinforcing bar, inner wall of steel reinforced concrete and outer wall of steel reinforced concrete. The main conclusions are: (1) the inner ring reinforcing bar and the inner wall of steel reinforced concrete at the top of the inner pipe culvert are tensioned, the outer ring reinforcing bar and the outer wall of steel reinforced concrete are pressured, and with the position down, the tensile and compressive stress converts; (2) the outer ring reinforcing bar and the outer wall of culvert show the compressional expansion at the beginning of the bottom constraint; (3) the critical load section is located at the top of circular pipe culvert.

**Keywords:** road engineering, circular reinforced concrete pipe culvert, three-dimensional finite element, stress characteristic

Analysis on Congestion Status of Expressway Toll Station in Tianjin and Solving Countermeasures .....

..... Han Min, Liu Jinliang (169)

**Abstract:** The congestion of toll station is the important cause of expressway congestion, and is also the biggest weakness to restrict the improvement of expressway service quality. On the basis of investigating the expressway toll stations in Tianjin, the article analyzes the status of expressway toll station congestion and its causes. Aiming at the congestion of expressway toll station, the article puts forward the countermeasures to solve the congestion from three aspects of improving the toll management service level, upgrading the emergency handling capacity and perfecting the civil construction facilities of toll station.

**Keywords:** expressway, toll station, congestion, countermeasures

Study on Mixing Ratio Design Method of Frost Resistance Airport Cement Concrete Pavement .....

..... Chen Shichang, Luo Yong, Li Ye, Tan Yue (172)

**Abstract:** Freeze-thaw diseases are very common in the airport cement concrete pavement of the frozen regions in China, seriously affect the service life of the pavement, significantly increase the maintenance costs of the airport, and constitute a hazard to safe operation of the airport. This paper analyzes the defects of airport pavement design method in China, puts forward method to improve pavement frost resistance by the concrete air-entraining technology, and analyzes the influence of air-entraining on the concrete performance from two aspects of the strength and construction workability. Through the establishment of design frost-resistance grade  $F_n$  as concrete frost resistance evaluation index, and combined with the existing mixing ratio design method of concrete, this paper puts forward an airport concrete pavement design method required to consider the frost resistance.

**Keywords:** airport, cement concrete pavement, freeze-thaw, frost-resistance grade, air-entrained concrete, frost-resistance design, mixing ratio

Experimental Research on Deflection of External Pre-stressed Concrete Beam ... Chen Chunping, Li Yingtian (175)

**Abstract:** The article introduces an experimental research on the deflection of external pre-stressed concrete beam. Based on the static loading experiment of eight T-type section simple-supported beams, in which six beams are externally pre-stressed and two are not, the article mainly analyzes the influences of pre-stressing tendon, the number of different steering structure, tensioning mode and tendon form on the deflection of T-type section simple-supported beam. The experiment records the whole process of beam stressing, destroying form and deflection deformation. The experimental result shows that the external pre-stressing tendon can improve the bearing capacity of beam, efficiently prevent the development of crack and control the deformation of beam. The external pre-stressing efficiently decreases the deflection of beam. And the different numbers of steering structure, the mode of tension and the form of tendon will all have the influence on the beam deflection deformation.

**Keywords:** steel reinforced beam, external pre-stressing, static experiment, deflection deformation

Application and Study of Geopolymer Grouting Reinforcement in Road Repair Project ..... Yuan Bo (179)

**Abstract:** The geopolymer grouting reinforcement technology avoids the disadvantages of the former pavement excavation and the great disturbance on pavement structure by the superiority of “non-excavation” and rapid traffic opening. The article analyzes the road performance of geopolymer grouting by the tests. The test result shows that the pavement deflection after grouting is obviously improved efficiently to extend the service life of road with the obvious environmental protection and economical benefit.

**Keywords:** geopolymer grouting, construction technology, deflection improvement, road repair

Geotechnical Problems of Underground Space Development in High Density Built Urban Area - - - Lu Ying (181)

**Abstract:** With the development of urbanization, the development of underground space has become an important resource of sustainable development for high-density built urban area. Based on the development status of the underground space around the Guangzhou Railway Station, the article sets forth the layering development mode of underground space under the different depths, discusses the geotechnical problems encountered in the layers, puts forward the geotechnical problems for attention in the foundation pit engineering construction, ground settlement, karst and construction, and briefly puts forward the study countermeasures and proposals for the geotechnical problems in the development and operation of underground space.

**Keywords:** underground space, sustainable development, layering development, geotechnical problem

Research and Development of Urban Tunnel Engineering Construction Monitoring Long-distance Management System ..... Liang Jinjun, Xiao Bin, Fan Jun (185)

**Abstract:** Aiming at the practical safety management and construction monitor of urban tunnel engineering, the article researches the objective, overall structure and function of urban tunnel engineering construction monitoring long-distance management system, puts forward the design and application concepts of the data base for the system, and introduces its development and application in the practical projects. The relative results have the valuable popularization and application.

**Keywords:** urban tunnel engineering, construction monitoring, management system

Study on Construction of Shanghai Fengxian Beach Protection Project ..... Xu Xueming, Xu Shuangquan (188)

**Abstract:** The article studies and analyzes the fixed point observation data of the traditional longitudinal dike and the tubular pile longitudinal dike in Fengxian District of Shanghai to show the practical effects of the different structural beach protection projects to resist the tides and to silt up the beach, which can be referred for the design, curing, maintenance and management of beach protection projects.

**Keywords:** seawall, beach protection engineering, observation, Shanghai



Discussion on Personnel Relocation of Pudong New Area in Typhoon Season - - - Dong Xiongying, Ye Peng (202)

**Abstract:** Pudong New Area is located at the shore of the East China Sea and is attacked by the typhoons ever year. With the development and opening of Pudong, many projects are started one by one. But the foreign personnel participating in the construction all live in the temporary houses built by the color steel plate. The above personnel will be threatened by the housing fall wounding to the different extents once the typhoon comes. In order to ensure the security of the personnel, it is required to implement the emergent relocation. The smooth implementation of relocation is restricted by the factors of great mobility of foreign personnel, hard to master the time and range of evacuation transfer, not perfected supporting policies and measures, lack of anti-typhoon knowledge by the foreign personnel and etc. In order to further do the personnel relocation in the typhoon season well, the article considers that the relative functional departments of the local governments are required to closely cooperate, perfect the planning, define the responsibilities, scientifically make the decisions, strengthen the propaganda, perfect the systems and organize the personnel relocation in good order, which can be referred for the other relative departments.

**Keywords:** Pudong, anti-typhoon, personnel relocation, discussion

Elementary Description of Protection against Electric Shock ..... Zhao Yuexiang, Yuan Hang, Cao Yang (206)

**Abstract:** The article analyzes the protection against electric shock in the engineering design and the practical cases, and elementarily describes the safety protection (protection against electric shock) of electrical devices.

**Keywords:** protection against electric shock, Class II equipment, escape valve, ventricular fibrillation threshold, ground system, safe voltage, equipotential connection

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