Urban Roads Bridges & Flood Control

城市道桥与防洪

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因为我们专心，所以我们专业！
——《城市道桥与防洪》

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● 本期看点

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封面工程

本期封面工程为重庆市学堂堡组合立交,由重庆市设计院设计。

重庆市学堂堡组合立交是重庆主城快速路一纵线与渝遂道高速G93相交形成的一座大型立交。其中,快速路一纵线由北向南串联了北碚、沙坪坝、九龙坡和江津四区,是主城西部片区南北向快速通道。G93属于国家高速公路网成渝环线,因此该立交节点非常重要。

一纵线主线设计车速为80 km/h,双向8车道;渝遂高速公路设计车速为100 km/h,双向4车道。由于该项目与相邻的物园区中心站立交距离只有600 m,因此将两个立交进行组合设计。一纵线主线依次上跨渝遂高速和中心站北线,学堂堡采用"8"字型立交,中心站采用蝶式立交,在一纵线主线外侧增设双向4~6车道辅道来实现两个立交的交通转换。既实现了快速路与高速公路的交通转换,又解决了重庆西部物流园区对外的交通。

该组合立交于2009年11月开工,2012年12月竣工。其造型优美、线形流畅,为重庆自由贸易区建设提供了重要保障。

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CONTENTS

ROADS & COMMUNICATION

Abstract: With the increment of non-motor vehicle and motor vehicle ownership in the city, the urban island, especially the five-road ring intersection has been not suitable for the traffic operation demand of city now. This paper analyzes the traffic causes of the five-road ring intersection, and finds the reconstruction schemes and concepts suitable for the different intersections according to many ring intersection reconstruction schemes at home and abroad. Taking the reconstruction of Changcheng Island in Miyun District of Beijing as the engineering background, this paper provides the theoretical basis for the reconstruction of five-road ring intersection.

Keywords: five-road intersection, island reconstruction, traffic improvement

Abstract: Xipu Road - Rencheng Avenue Interchange is an intersection of the " + "-shaped skeleton of the urban expressway network in Jining City. Its oblique crossing angle is smaller and its north side is closely adjacent to Rihe Railway. According to the comprehensive analysis of planning condition, functional location, traffic demand and surrounding construction condition of this node, the article puts forward to retain the existing crossing-railway interchange and ramp taken as the auxiliary road system of Xipu Road Expressway to serve the traffic contacts surrounding Rihe Railway, and to newly construct the main road bridge and hub interchange of Xipu Road Expressway to serve the express traffic contacts among the long-distance groups. On this basis, two schemes of alfalfa leaf shape + semi-directional ramp and full semi-directional ramp are proposed for the main line hub interchange of expressway. The alfalfa leaf shape + semi-directional ramp scheme is recommended after the factors of planning, traffic, status and land are comprehensively considered, which can be referred for the similar projects.

Keywords: expressway, interchange, railway, comparison and selection of scheme

Abstract: Luoshan Road - Outer Ring Line Interchange is a traffic conversion hub of Luoshan Road with two expressways of Outer Ring Line in Shanghai. Based on the location analysis of node traffic and the

Abstract: In recent years, the old cement concrete pavements used for some years are seriously damaged, and cannot meet the increasing traffic volume and the development demand. The reconstruction engineering of old road is particularly urgent and important. According to the application of overlaying the asphalt and lean concrete in Hainan Province Sanya City Haitangwan Haiyu East Line Municipal Road (from Tengqiao West River to Intersection of Haian Avenue) Reconstruction Project, the article sets forth the delay and prevention of the cracks caused by the pavement overlaying, and the function of improving the service life of urban old cement concrete pavement in the design.

Keywords: reconstruction of old cement pavement, overlaying, reflection crack, flexible surface course, roller compacted concrete

BRIDGES & STRUCTURES

Abstract: The separated box section is widely used in steel bridges. Owing to the ground road traffic and landscape demand under bridge, this structural style will often form the large horizontal cantilever structure when used for the urban viaduct, and its mechanical space effect is obvious. According to a two-span continuous steel box girder in Taiyuan Wohu Mountain Expressway Construction Project, the Abaqus finite element engineering simulation software is used to establish a three-dimensional shell element model of the whole bridge in order to analyze its space mechanical property under the typical load including the shearing lag effect, live load unbalance load effect and pivot crossbeam stress by the comparison with the single girder model, which can be referred for the design and simplified analysis of the similar bridges.

Keywords: separated, large cantilever, steel box girder, space effect, finite element

Abstract: According to the engineering background of a cable-stayed bridge in Wuqi County of Yan'an City, a space member system finite element model is established to analyze the change rule of stayed cable force of this bridge under the influence of overall temperature variation, gradient temperature and cable-beam temperature difference. The results show that the temperature effect has an obvious influence on the cable force, and the sensitivities of the cable force to the temperature effect are different in the different positions. The results can be referred for the cable adjustment in the design stage of this bridge, the monitor in the construction stage and the health inspection and maintenance of the bridge in the service stage, and can be also referred for the construction of the similar cable-stayed bridges.

Keywords: asymmetric cable-stayed bridge, temperature gradient, cable-beam temperature difference, overall temperature variation, cable force

Abstract: To study the natural vibration characteristics of steel truss web member PC composite box girder bridge, and based on the background engineering of a three-span continuous waveform steel web PC composite box girder bridge, the steel truss web member is used to replace the waveform steel web in the original box girder and the steel truss web member PC composite box girder bridge is designed. Two analysis software ANSYS and Midas Civil are used to establish a three-dimensional finite element model to analyze the natural vibration characteristics of this bridge. The influences of diaphragms set up as the parameter on the natural vibration characteristics of steel truss web member PC composite box girder bridge are studied. The results show that the vertical bending stiffness of the steel truss web member PC composite box girder bridge is small, and the torsional stiffness is large. The setup of the diaphragm has a little influence on the vertical bending stiffness of this bridge, but has a certain influence on the cross bending stiffness and torsional stiffness of the box girder. Moreover, the torsional stiffness of box girder is obviously improved when the diaphragm is reasonably set up.

Keywords: steel truss web member PC composite box girder, natural vibration characteristic, diaphragm, finite element method

Abstract: The prefabricated and assembled bridge to realize the industrialization can improve the bridge construction level of China and decreases the construction influence on the environment and traffic, which certainly will bring the good social benefit and economic benefit. Aiming at the development of urban viaduct assembly at home and abroad, the article summarizes and puts forward the bridge assembly design scheme suitable for the situation of China at the present stage, and especially studies the inverted T-shaped bent cap prefabrication scheme with six-lane and eight-lane sections more difficultly treated.

Keywords: prefabricated and assembled, bent cap, viaduct

Abstract: Aiming at the problems existing in the design of box girder for continuous rigid-frame bridge now, the article analyzes the design characteristics of the box girder structure for continuous rigid-frame bridge by the practical cases, and puts forward the design gist of detailed problems. The result shows that the design effectiveness of box girder for continuous rigid-frame bridge will be effectively controlled according to the geological and climate conditions of the project location.

Keywords: continuous rigid-frame box girder, form traveler structure, design of closure segment of main girder, friction resistance coefficient of steel strand pipe

Abstract: Combined with the design of a (60+105+60)-m prestressed concrete variable cross-section

Abstract: The Yanhe River Bridge Reconstruction Project includes two parts of old bridge reconstruction and new bridge extension. The main aim of reconstruction design is to construct the beam and bridge into a bridge, and to construct the new as the old. The new bridge is constructed by the integral prefabricated bridge deck slab, lattice arch architecture and new shaft underground diaphragm wall abutment. The deck system of old bridge is reconstructed by the integral deck slab structure, the new light ceramsite concrete material to replace the arch stuffing, the re-layout of arch waterproof and drainage system, and the treatment of stone surface weathering and cracks of old bridge structure. Aimed at the design difficulties, the monographic study of the shaft underground diaphragm wall abutment and concrete structural surface coating system is carried out.

Keywords: Yanhe River Bridge, overall design, lattice, underground diaphragm wall, preventive coating

Abstract: Taking a span (80+102+88+110)-m oval space variable high truss pedestrian overpass as the design background, and according to the overall layout and structural style, the article introduces the key technologies of support arrangement, pedestrian-induced vibration control, joint structure, wind resistance and seismic resistance.

Keywords: space variable high truss, TMD, viscous fluid damper, cast steel joint

Abstract: With the development of economy and society, the structural form of urban viaduct also tends to be diversified. Based on Zhengzhou South Ring III East Extension Project, this paper compares the construction costs, construction technologies and later maintenances of pre-stressed reinforced concrete continuous beam, cast-in-situ corrugated steel web continuous beam, prefabricated corrugated steel web continuous beam and prefabricated small-box beam. The prefabricated small-box beam as the main structural type is determined to use for the main line. The cast-in-situ corrugated steel web continuous beam bridge is used at the node of long-span bridge required to spam the intersection, which can be referred for the selection of superstructure type of urban viaduct.

Keywords: urban viaduct, corrugated steel web, cast-in-situ, prefabricated

Abstract: The tramcar Line T2 in Songjiang crosses over G60 Shanghai-Kunming Expressway. Its main span bridge located on the radius 350 m of circular curve in plane is constructed by the rotation method. The article introduces the structural design and rotation system of this bridge, and analyzes the design gist of the pre-eccentricity of rotation, the stress of upper turntable and the static wind stability of rotation construction in detail.

Keywords: rotation, minor radius curve, tramcar, static three-component force

Abstract: The beam arch combination system is composed of continuous structure and decorative arch. Both the continuous structure and the arch rib have own substructure, but the both are connected with each other through suspender. In this paper, the modal analysis of this structure is carried out, and the first six structural periods are obtained. At the same time, this paper analyzes the arch rib stress, deformation and foundation stress under the earthquake action, and the earthquake horizontal force of bridge pier in the continuous structure, and compares with the single-beam model of continuous structure so as to have some reference for the seismic analysis of beam arch combination system in the future.

Keywords: beam arch combination, single-beam model, seismic effect, arch rib

Abstract: With the continuous improvement of the social economic standard and the flourishing development of the socialist construction cause, the construction of road traffic is also developing rapidly. The more and more construction number of long-span bridge greatly satisfies the travelling demand of the people. At the same time, the construction quality of long-span bridge is also becoming more and more attention. The steel deck pavement is the important technical component of long-span bridge construction not only relating to the aesthetic measure of bridge, but also relating to the quality and safety of long-span bridge. Therefore, the professionals should pay high attention to the design of steel deck pavement. Based on the practical condition of bridge engineering, the design level should be improved to promote the further development of long-span bridge. The design of steel deck pavement of long-span bridge is analyzed. The relative experience can be referred for the similar projects.

Keywords: long-span bridge, steel deck, pavement design

Abstract: Taking the project background and landscape scheme of seascape bridge as an example, the article introduces the design concept and flow of bridge landscape, introduces the landscape design of the local components and overall bridge, and discusses the design concept of urban bridge landscape, which can be referred for the landscape design of the similar bridges.

Keywords: bridge landscape design, scheme, concept

Abstract: The adoptive probability of two-span continuous girder bridge is relatively smaller in the practical bridge engineering construction. Its economical indexes are lower than the multi-span continuous girder bridges. According to the background of a two-span 36-m pre-stressed concrete continuous box girder bridge in the approach bridge of Zhoushan Xiaogan Bridge II Project, the article introduces the design and longitudinal calculation of its main girder from the design criteria of main girder, the proposal of main girder

FLOOD CONTROL & DRAINAGE

MANAGEMENT & CONSTRUCITON

Abstract: The highway roadbed defect will directly affect the service life of highway, and bring many inconveniences to the normal operation of vehicle and the maintenance of highway. Therefore, it is very necessary to strengthen the highway construction maintenance management, to prevent the highway roadbed defect, to guarantee the driving safety and to extend the service life of highway. The article mainly studies and analyzes the preventive measures of highway roadbed defect in the mountainous areas.

Keywords: mountainous highway, roadbed defect, cause, treatment measures

Abstract: The main causes of side slope collapse of mountainous highway are summarized, and the mechanical mechanisms of various causes are also analyzed. Design principles and methods for the stability prevention of side slope are also proposed. The surface protection and deep reinforcing mode are required to summarize. The stability of side slope is improved. Finally, the disposal scheme is proposed by the practical projects on the basis of analyzing the basic characteristics and topographical geological characteristics of side slope, and the good reinforcement effect is achieved. The relative effects can be referred for the design and prevention of side slope collapse.

Keywords: mountainous highway, side slope, collapse, causes analysis, disposal measures

Abstract: In recent years, with the fast development of the national economy, the highway construction is advanced rapidly, and plays the important role in the national economy and social development. But the early damage of many highways is more serious after the completion and operation, especially the asphalt pavement. The article analyzes the cause of water damage of asphalt pavement, and sets forth the preventive measures for the water damage of asphalt pavement. The relative experience can be referred for the similar projects.

Keywords: asphalt pavement, water damage, preventive measures

Abstract: The article analyzes the control problem of expressway greening construction, describes the greening work of Liuliu Expressway, summarizes the engineering situation, and puts forward the problems existing in the construction process including the expressway field construction, insufficient construction workers and external relationship. According to these contents, the article summarizes the greening engineering construction technical management, and summarizes the problems for attention in the expressway greening construction. The relative experience can be referred for the similar projects.

Keywords: expressway, greening construction, soil improvement

Abstract: Chunxiao Bridge of Ningbo is a three-span (80 m+336 m+80 m) continuous half-through steel

high-concentration bentonite slurry is added to solve the above problems. The good effect is achieved after the practical engineering application. The article introduces the proportion and characters of high-concentration bentonite slurry in detail, then sets forth its application value in the projects, and finally discusses itself defect of this slurry.

Keywords: high-concentration bentonite slurry, pipe jacking engineering, slurry proportion, application

Abstract: In order to guarantee the smooth holing of large-diameter steel jacking pipe in the high confined water drift sand layer in Shanghai Huangpu River Upstream Water Source Communicating Pipe Project, and aimed at the geological characteristics of this project, the article puts forward the key holing technology of large-diameter steel jacking pipe composed of open caisson subgrade reinforcement, dewatering, high-pressure rotary jet grouting reinforcement at hole opening, deep well dewatering, pipe jacking machine head reconstruction and pipe jacking construction control in the high confined water drift sand layer. This technology is successfully used in the engineering practices. The engineering practical result shows that the proposed pipe jacking holing technology better guarantees the slurry balance pipe jacking smoothly under the conditions of high confined water and drift sand layer, better solves the construction technical difficulties of Shanghai Huangpu River Upstream Water Source Communicating Pipe Project in the complex stratum, has the good technical promotion value, and also provides the practical reference for the construction of the other similar projects.

Keywords: high confined water, drift sand layer, jacking pipe, dewatering, high-pressure jet grouting

Abstract: The section form of normal shield tunneling method is round, which is easy to realize the whole section cutting and the relative reasonableness of structure stress system to cover up the deficiencies of low space utility rate and large occupied underground space. The rectangular shield tunneling method has the greater superiority in the utility rate of sectional space and the travelling capacity in the narrow road, but cannot be effectively developed because of its structure stress and deformation, shield machine tunneling control, rectangular segment assembly and the other difficulties. The article systematically sets forth the study on the tunnel construction technology of urban rail transit by quasi-rectangular shield method. According to the analysis of the difficulties in the quasi-rectangular shield tunneling construction, the article studies and discusses the relative technological aspects of the whole section cutting, segment assembly, axis control and monitoring technology in order to provide the more reliable basis and proposal for the further development of rectangular shield tunneling method.

Keywords: quasi-rectangular shield, whole section cutting, segment assembly, axis control, monitoring technology

Abstract: The large deformation of tunnel in weak rock is the difficulty in the tunnel construction. The primary support deformation will cause the confined arch replacement, even landslip, which will bring the huge economic loss to the construction units. Therefore, it is very important to control the primary support deformation in the construction of weak rock tunnel. Taking the construction of Yuanbao Mountain Tunnel 3# Transverse Gallery Area in Lijiang - Shangri-La Railway as an example, on the basis of field engineering practice, the article focuses introduction on the construction technology of single-line railway tunnel in the weak surrounding rock area, and the taken technology parameters, and analyzes the monitoring measurement and stress data in order to provide the reference for the similar projects.

Keywords: large deformation in weak rock, arch replacement, railway tunnel, treatment technology

Abstract: The great deformation of tunnel surrounding rock means an extreme deformation damage of surrounding rock causing under the condition of high ground stress, and belongs to the category of plastic flow and plastic damage, which has the greater impact on the normal construction of tunnel engineering. Taking the practical project as an example, the article introduces the geological situation of triple souring rock, analyzes the cause of great deformation of surrounding rock, finds the deformation cause of support result, and then formulates the relevant treatment measures according to the practical conditions so as to guarantee the smooth construction of tunnel engineering.

Keywords: triple tunnel, bench excavation method, surrounding rock deformation treatment technology

Abstract: The economic excavation mode of short and middle tunnels is the one-way tunneling and the tunneling through at the portal. Taking Guanghzou - Foshan - Zhaoqing Expressway Luorimian Tunnel Project as an example, the article introduces the "zero-excavation one-way out-of-portal" construction technology, and especially the application of the double-layer small conduit advanced support to replace the long pipe shed portal project, which breaks the traditional tunneling through mode, realizes the safe tunneling out of portal, and achieves the better economic value. The experience can be referred for the similar projects.

Keywords: double-layer advanced small conduit, short and middle tunnels, one way out of portal, construction application

Abstract: Taking the south anchored foundation pit for Wufeng Mountain Changjiang River Bridge in the railway from Lianyungang to Zhenjiang as the study object, the article discusses two construction stages of foundation pit supporting and excavation. The supporting stage of foundation pit is mainly to compare and select the construction scheme of underground diaphragm wall for the practical engineering situation. The

STUDY ON SCIENCE & TECHNOLOGY

Abstract: SAP2000 is used to carry out the numerical analysis. The article compares the energy dissipation effects of setting up the seismic isolation support and steel damper, and combining these two devices together, and analyzes the parameters of interlaminar shear and structural top displacement curve. The results show that the combined energy dissipation damping structure has the good energy dissipation effect, and has the more superior damping effect than the structure with a single energy dissipation component, which can make the seismic property of the targeted building structure obviously improved.

Keywords: damping structure, damper, pencil lead rubber support, combined energy dissipation, time-history analysis

Abstract: Aiming at the randomness characteristic of ecological concrete carbonation depth, the article puts forward the combined method of fit goodness test and Bayesian theory to carry out the model analysis of ecological concrete carbonation depth probability. The fit goodness test is used to identify the optimal probability distribution pattern of ecological concrete carbonation submission. The Bayesian theory is used to estimate the parameters in the optimal probability distribution pattern. On this basis, the carbonation reliability is analyzed. Three groups of test data illustrate the application process of the combined method of fit goodness test and Bayesian theory in the study of ecological concrete carbonation depth probabilistic model and the analysis of carbonation reliability. The results show that this combined method to carry out the ecological concrete carbonation depth probabilistic model and carbonation reliability analysis is more conformed to the engineering practices and more convenient for the engineering application by comparing with the traditional method.

Keywords: ecological concrete, carbonation depth, probabilistic model, fit goodness test, Bayesian theory

Abstract: Aimed at the steel bridge deck pavement of epoxy asphalt concrete, the three-dimensional mechanical model of orthotropic steel deck pavement is established to study the mechanics characteristics of steel bridge deck pavement under the low-temperature and overload coupling conditions, and to compare and analyze the results without considering the temperature condition. The results show that the tensile stress of steel bridge deck pavement under the low-temperature and overload coupling conditions increases significantly and the maximum tension stress can be up to four times of the overload alone.

Keywords: steel bridge deck pavement, epoxy asphalt concrete, low-temperature and overload, mechanics characteristic

Abstract: The cold mixed modified asphalt is used to compare and test the pavement performances of the

APPLICATION OF ACHIEVEMENTS

Keywords: sacrificial anode, electrochemical corrosion prevention, bridge, concrete, durability, corrosion prevention, corrosion control

Abstract: In recent years, the UAV aerial photogrammetry technology is more and more widely used in the surveying and mapping industry with the advances in technology. As the study objective of the small-sized UAV application in the surveying and mapping of large scale topographical map and combined with the production practices, the UAV aerial survey experiment is carried out. According to the study on the mapping flow and key technology of small-sized UAV, the field measured data are used to evaluate the aerial survey accuracy, which provides the reference for the application of small-sized UAV in the surveying and mapping field.

Keywords: UAV, photogrammetry, large scale topographical map

THE RELATIVE SPECIALITIES

Abstract: In recent year, the surrounding conditions faced by the construction of deep foundation pit are complicated. A lot of engineering co-construction problems is inevitably encountered. According to the co-construction project of the foundation pit for Caochangmen Station in Nanjing Metro Line 4 and the municipal tunnel, the article studies the design and construction of deep foundation pit under many adverse conditions of deep excavation depth, complicated surrounding conditions, high deformation requirements and poor geological condition. The Venus and the finite element calculation results show that the scheme of underground diaphragm wall containment combined with six inner bracings can better solve a series of engineering difficulty, which can be referred for the design and construction of the similar projects.

Keywords: tunnel co-construction, metro station, deep foundation pit, soft soil

Abstract: Taking a shield tunnel side crossing the viaduct pile foundation of the Inner Ring of Shanghai Metro as the background, and according to the finite element numerical simulation, the article analyzes the vertical displacement, the horizontal displacement and the inclination ratio of the pile foundation caused by the crossing construction of shield tunnel. The results show that the use of the finite element software to simulate the shield crossing construction can better achieve the deformation of the adjacent piles caused by shield tunneling, and the deformation and variation trend of pile foundation. The calculation results after comparison with the field test data show that the vertical deformation and the inclination of the adjacent pile foundation

Abstract: With the speeding up of urban economic development and the demand for the higher quality life of the people in China, the landscape design of waterfront area has become one of indispensable and important elements in the modern urban planning and design. The article sets forth the landscape design of waterfront area in the riverside block W7 of Yangpu District in Shanghai in detail, discusses the combination of the cultural feature and the history of the landscape and site in the waterfront area, introduces the contents, method and process of building the waterfront landscape with the characteristics, and summarizes the design difficulties and highlights in order to provide the relative experience and reference for the design of waterfront landscapes in many cities.

Keywords: waterfront area, landscape design, site memory, scheme design of subareas, image display

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