

# 城市道桥与防洪

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——《城市道桥与防洪》

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### ● 本期看点

- 上海市海绵城市试点规划及适用技术研究
- “十三五”中国天津城市道路交通
- 组合结构桥梁的发展与应用前景
- 城市地下综合管廊路径适建性评价体系研究



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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# 目次

## 2016城市道桥与防洪第十届全国技术论坛专辑

上海市海绵城市试点规划及适用技术研究 ...

... 张辰, 邹伟国, 吕永鹏, 陈嫣, 莫祖澜(1)

“十三五”中国天津城市道路交通 .....

... 朱兆芳, 刘锐晶, 张欣红(4)

组合结构桥梁的发展与应用前景 ... 邵长宇(11)

海绵城市建设中城市道路雨水系统设计探讨 ...

... 黄维让(15)

城市道路低影响开发设计技术的探讨 .....

... 和坤玲(18)

海绵城市相关措施在青山港综合整治工程中的

应用 ... 向浩(23)

《天津市中心城区排水防涝综合规划》编制要点

解析 ... 李波, 孙杰, 韩振勇, 付小琳(27)

城市雨洪管理理念演进对海绵城市规划建设

作用及影响 ... 马翔(32)

建设智慧城市 打造桥梁强国 ... 穆祥纯(37)

广州从化大桥工程主桥空间拱梁组合桥结构

设计及关键技术 ... 宁平华, 郭钰瑜(43)

重庆的城市立交——山地特色的立体交叉工程

... 杨斌(46)

广州国际金融城起步区地下道路系统总体设计

... 陈伟, 江世荣, 连莹(50)

沿江地下道路总体设计及关键技术 .....

... 邹峻, 王盛集(56)

城市地下综合管廊路径适建性评价体系研究 ...

... 徐波(61)

成都市综合管廊建设工业化和模块化的探讨 ...

... 钟翔, 张章(65)

泥浆固化轻质土应用技术与展望 .....

... 王新岐(69)

武汉市绿色交通建设的思考 .....

... 周俊, 杜先汉(75)

基于地铁接驳的公共自行车系统研究 .....

... 吕麦霞, 刘艳妮(79)

国道109线(忠和傅家窑立交—八里湾)改扩建工程

设计研究 ... 魏朋, 马国纲(82)

兰州市西新线河堤加固工程设计浅析 .....

... 刘静, 周文博(88)

## 道路交通

城市商务区地下交通隧道的应用研究 .....

... 熊鲲(91)

期刊基本参数: CN 31-1602/U \* 1984 \* m \* A4 \* 234 \* zh \* P \* ¥25.00 \* 10000 \* 65 \* 2016-09



- 基于排队论的停车库出入口设置与服务水平分析 ...  
 ..... 孙 峰(95)
- 企事业建筑物周边停车位生态型改造设计初探 .....  
 ..... 康丽娟,耿 杨,付融冰(99)
- 沧州市黄河路(迎宾大道—解放东路)改造提升工程  
 方案设计 ..... 宋晓明(102)
- 城市道路软弱地基的设计对策和方法 ... 刘志平(105)
- 高速公路的高边坡设计及稳定性评价 ... 屈海军(108)
- 半柔性沥青混合料在农村公路水泥路面改造中的  
 应用 ..... 成相飞,张 雪(111)
- 中国城市化发展中城市道路交通碳排放研究 .....  
 ..... 黎仕国(116)

### 桥梁结构

- 惠州下角东江大桥主桥设计 ..... 罗喜恒(118)
- 哇加滩黄河特大桥选型与设计 .....  
 ..... 任 蒙,张 军,黄古剑(122)
- 不等跨连拱桥结构设计 ..... 谢 雄(126)
- 波形钢腹板PC桥结构设计探讨 ... 肖海波,朱越峰(129)
- 宽体矮塔斜拉桥设计与计算 .....  
 ..... 贾 栋,王建光,黄 峰(132)
- 悬臂下置的悬浇连续箱梁桥设计实践 .....  
 ..... 郭红敏,李 雷,梁送春(135)
- 跨越铁路的市政桥梁设计技术 ..... 乐小刚(138)
- 城市人行天桥造型构思 ..... 罗美辉,彭崇乾(140)
- 体外预应力加固技术在某桥梁简支梁中的算例分析  
 ..... 张 新(142)
- 单边日照对薄壁高墩偏位的有限元分析 ... 夏文敏(145)
- 某特大桥健康监测系统设计与评估 .....  
 ..... 陈 泉,陶 华,王 超(147)
- 某矮塔斜拉桥主梁施工期开裂原因及影响参数分析  
 ..... 李元兵(151)
- 浅谈方案设计师在公路桥型图设计中的应用 .....  
 ..... 洪 全,徐建军,刘 靖,刘冬冬(156)

### 防洪排水

- 低影响开发雨水系统在市政道路设计中的应用 .....  
 ..... 张 翼(158)
- 城市竖向规划若干问题研究——以奉化市中心城竖向  
 规划为例 ..... 郑越之,蔡叶红,赵 赞(161)
- 浅析线路坡度对区间洞口雨水泵站设计的影响 .....  
 ..... 范太兴,周金忠,渐明柱,杜金海(164)
- 深水软土地基上一种直立式沉箱新型海堤结构分析  
 与探讨 ..... 卢育芳,田利勇(166)
- 基于内涝风险评估的城市低洼积水地段治理规划研究  
 ——以宁波市为例 ... 张亚朋,蔡叶红,胡 红(170)

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## 管理施工

- 研究公路施工安全事故诱因与预警管理 ..... 冯建良(174)
- 公路桥梁隧道工程施工中灌浆法加固技术的应用 ..... 彭先祥(176)
- 浅谈桥梁桩基标准化施工的质量控制 ... 陈晓第(178)
- 连续箱梁桥体外预应力施工模拟与监控 ..... 李建波(181)
- 杭申线沪杭高速公路桥顶升改造工程实践 ..... 鄢余文, 阮杰(186)
- 路基软基处理中水泥深层搅拌桩的应用研究 ..... 曾一峰(190)
- 盾构区间联络通道融沉注浆施工对管片沉降的影响 ..... 何山(192)
- 水泥稳定碎石基层的质量控制 ..... 朱玲娇(195)
- 三板溪库区航运建设合同管理、信息管理和组织协调研究 ..... 陈祥勇(197)

## 科技研究

- 低冲击开发模式在城市道路设计中的应用研究 ..... 吴炫, 崔娟(200)
- 人行天桥技术状况评价模型研究 ..... 朱洁, 陈长(203)
- 兰州及周边地区灌溉对于黄土滑坡微结构的变化研究 ..... 王健, 侯小强, 李小强, 姚正学(208)
- 基于AHP-TOPSIS模型的岩土边坡稳定性评价 ..... 姜廷文, 靳春玲(211)
- 掺加萘系减水剂的SCC配合比设计方法研究 ..... 陈成芹, 余意恒(216)

## 成果应用

- 自由设站技术在基坑监测中的应用 ..... 王佳卿, 史晓忠, 谭东林(221)

## 相关专业

- 基于违法要素的电子警察车辆视频检测技术研究 ... 张佳(223)
- 苏通科技产业园启动区景观绿化设计理念 ..... 张雯雯, 方可, 曹磊(226)
- 兰州北绕城高速盐什公路隧道工程测量方法 ..... 包二虎(229)
- 宁波地区扁铲侧胀试验计算不排水抗剪强度的探讨 ..... 赵冬(231)

## 广告索引

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## 封面工程

本期封面工程为南宁市良庆大桥, 由上海市政工程设计研究总院(集团)有限公司设计。

南宁良庆大桥采用单跨420 m的迭合梁地锚式悬索桥, 是目前南宁市最大跨度的跨江大桥, 也是广西第一座采用钢-混凝土迭合桥面的悬索桥。大桥桥塔采用混凝土门式塔, 呈微微内倾、上窄下宽姿态, 配以橙色, 整体造型简洁、稳重、大方、亮丽。主缆采用防腐性能更好的锌铝合金钢丝, 确保大桥主缆更安全、更可靠。大桥锚碇基坑为超大超深基坑, 采用边坡锚杆支护、基坑钻孔注浆进行帷幕止水等方式, 确保基坑安全。车行道桥面采用混凝土桥面板, 避免了钢桥面铺装工程难题, 提高了铺装的使用寿命和道路通行效率。人非桥面采用超薄、超轻的薄层铺装体系, 达到优良的防水性、防滑性和耐磨性, 最大限度减轻桥面重量, 降低工程造价。

大桥于2013年11月开工, 2016年4月建成通车。参建各方精诚合作, 克服了地质岩溶发育、超大超深基坑支护及止水、预制混凝土桥面板安装连接、超长钢束穿束及张拉等技术难题, 在邕江之上增添了一座亮丽的地标性建筑。

# Urban Roads, Bridges & Flood Control (Monthly)

Number 9, 2016(Total Number 209)

## CONTENTS

### 2016 Urban Roads, Bridges & Flood Control Special for the Tenth National Technical Conference

Study on Pilot Planning and Suitable Technology of Shanghai Sponge City .....

..... Zhang Chen, Zou Weiguo, Lü Yongpeng, Chen Yan, Mo Zulan ( 1 )

**Abstract:** As one of the national sponge city construction pilot cities in 2006, Shanghai insists on the problem and aim - oriented principle in the selection of its pilot area, and focuses the problems of lower drainage standard, initial rainwater pollution and severe waterlogging prevention. The representative area of Lingang is selected as the pilot area, and is divided into seven demonstration zones. Each zone has its own demonstration content and direction. Furthermore, 25 appropriate technologies are scientifically selected according to local conditions and are integrated into 15 project packages, which will demonstrate the comprehensive technical route of “source reduction, process control and systemic treatment”, have the wide representative and demonstrative values, and can be referred for the other similar cities.

**Keywords:** sponge city, technical scheme, Shanghai, Lingang New City

Urban Road Traffic in Tianjin of China in “13th Five-Year” Plan .....

..... Zhu Zhaofang, Liu Ruijing, Zhang Xinhong ( 4 )

**Abstract:** The article discusses the development of urban road traffic in Tianjin during the “13th Five-Year” period, and introduces the new situation of Tianjin and the present world. On this basis, the article studies and discusses the “13th Five-Year” urban road traffic of Tianjin according to five great development concept stipulated in the “13th Five-Year” plan of China, and puts forward the concept and suggestion of innovation road traffic design.

**Keywords:** “13th Five-Year” plan, road traffic, green traffic, new energy automobile, Internet +, Tianjin

Development and Application Prospect of Combined Structural Bridge .....

Shao Changyu ( 11 )

**Abstract:** The article briefly introduces the application of combined structural bridge internationally and its technical development of design theory and construction method, analyzes the technical characteristics and application situation of beam bridge and long-span bridge, and describes the application prospect of the combined structural bridge in China. The article points out that the beam combined structural bridge has the

basis of economic competitive power, has the wide popularization and application prospects. The combined beam cable-stayed bridge has the greater development space. The reasonable span of technology and economy can be up to over 8 000 m. The economic efficiency of combined beam suspension bridge will drop with the increment of its span, and this kind of bridge can emerge the technical and economic superiorities if the construction and environmental conditions are suitable, and has a certain application prospect. The combined beam bowstring arch bridge has the strong competitive power in the range of 200-m span. The combined structures of deck and half through arch bridges also have the developing space of application.

**Keywords:** combined structural bridge, development situation, application prospect

Discussion on Design of Urban Road Rainwater System in Construction of Sponge City ..... Huang Weirang ( 15 )

**Abstract:** At present, the construction departments, design units and construction units of every city are actively investigating the formulation and implementation of the relative technical measures for the construction of sponge city, but have the fuzzy understanding and mistakes on the concept of sponge city. The urban road is an important part in the construction of sponge city. There is no the detailed control indexes of low-impact development for the construction of urban road before the special planning and the detailed planning of sponge city are issued. The article puts forward the investigating view on the relative concept of sponge city in the design of urban road rainwater system, which can be referred for the similar projects.

**Keywords:** sponge city, road rainwater, low-impact development, control index

Discussion on Low-impact Development Design Technology of Urban Road ..... He Kunling ( 18 )

**Abstract:** At present, the construction of sponge city initiated in China is required to fully play the role of the ecological systems of building, road, greenbelt and water system to absorb, store and slowly release the rainwater, which puts forward the new requirements for the construction of urban road. The road construction not only satisfies its function, but also utilizes its facilities to effectively control its caused rainwater runoff and non-point source pollution. According to the analysis on the basic function and main technical condition of road, based on the relative requirements of low-impact development construction of roads in the construction of sponge city, and under the guidance of sponge city construction concept, the article discusses the design principle and method of urban road, and puts forward the technical gist for the design of low-impact development of urban road, which can be referred for the design of low-impact development of urban road.

**Keywords:** urban road, low-impact development, design technology

Application of “Sponge City” Measures in Qingshan Port Comprehensive Reconstruction Project ... Xiang Hao ( 23 )

**Abstract:** Wuhan City is one of the “sponge city” construction pilot cities. Qingshan Port is located in Qingshan Demonstration Zone. The multi-level “sponge city” ecological measures are taken for the important drainage channel of this demonstration zone. This port channel is reconstructed. Based on the assessment, the port channel after reconstructed can satisfy the main control index requirements of the “sponge city” in Wuhan.

**Keywords:** Qingshan Port, sponge city, control index, “sponge” measures

Analysis on Compilation Gist of *Tianjin Central City Area Drainage Waterlogging Prevention Planning* .....

..... Li Bo, Sun Jie, Han Zhenyong, Fu Xiaolin ( 27 )

**Abstract:** Based on the rainfall characteristic of Tianjin City, the article analyzes the underlying surface. Combined with the land utilization property of city area, and referring the experience of the other areas, the article sets forth the present situation of drainage and waterlogging prevention, the capacity of drainage and waterlogging prevention, the waterlogging risk assessment, the planning standard, the urban waterlogging prevention system scheme, the control of rainwater runoff and utilization of resources, the planning of drainage pipeline network system, the comprehensive treatment of inland water system and the management planning, and puts forward the relevant treatment measures.

**Keywords:** drainage and waterlogging prevention, risk assessment, rainfall rule, planning standard, runoff control, runoff pollution, comprehensive treatment

Evolution of Urban Rainwater and Flood Management Concept to Effect and Influence Planning and Construction of Sponge City ..... Ma Xiang (32)

**Abstract:** Aiming at the global problems of urban waterlogging, rainwater resource loss and serious urban non-point source pollution brought from city expansion, and according to the development trend of urban rainwater and flood management concept, and the connotation, objective and practice of sponge city, the article puts forward the important implementation path of sponge city at the present stage, and from the angle of sustainable development, proposes that the multi professional depth participation of urban system and the establishment of interactive, scientific and unified land development and rainwater flood management platform as well as the concept sharing for the whole people are the sustainable development way of sponge city.

**Keywords:** sponge city, urban rainwater and flood management, low-impact development (LID), sustainable development

Constructing Intelligent City and Building Powerful Bridge Country ..... Mu Xiangchun ( 37 )

**Abstract:** The article explains the connotation of intelligent city, and sets forth the important role of urban bridge in the construction of intelligent city, the achievements and problems in the construction of urban bridge in China, and the study trend of urban city in the construction of intelligent city at home and abroad. The relative countermeasures and suggestions are put forward for the relative problems. A more efficient urban operation and management environment is strived to build in the construction of the state intelligent city and in the process of marching toward the powerful bridge country of the world, which realizes the goal of becoming from bridge construction country to powerful bridge country.

**Keywords:** intelligent city, powerful bridge country, study trend, countermeasures and suggestions

Design and Key Technology of Main bridge for Conghua Bridge of Guangzhou ..... Ning Pinghua, Guo Yuyu ( 43 )

**Abstract:** Conghua Bridge of Guangzhou is a large urban bridge crossing Liuxi River for Conghua District of Guangzhou. Its main bridge is a single-span through spacial arch beam combined system bridge. Its span is

136 m and the bridge width is 40 m. The arch ring is composed of inverted triangle truss beam combined arch formed by three steel tubes going through the cross bracing and inclined bracing. Its modeling is special and its structural design is novel. It is the first collinear project of bridge and metro in China with the high technical content. The article introduces the structural design and key technology of this bridge.

**Keywords:** through, spacial combined arch, arch and beam combined system, metro

Urban Interchange in Chongqing—Grade Separation Project with Mountainous Characteristic ..... Yang Bin ( 46 )

**Abstract:** Chongqing is the largest mountainous city in China. Owing to the restrictions of the terrain condition and the road network structure, the urban interchange of Chongqing has the unique style and charm. The article introduces 7 interchange projects of Chongqing in detail, analyzes the convenience and negative effects of urban interchange to a city, and looks forward to the development of the future urban interchanges.

**Keywords:** urban interchange, design, intersection, mountainous city

Overall Design of Underground Road System in Starting Area of Guangzhou International Financial City .....

..... Chen Wei, Jiang Shirong, Lian Ying ( 50 )

**Abstract:** The green transport of electric vehicle + slow traffic is completely realized on the ground of core area in the starting area of Guangzhou International Financial City. The vehicle traffic is all through the underground road system. The underground three-layer road system is composed of the two-cross and two-ring framework. The underground road is connected with block garage by two modes of second ring and connection way. The simulation software is used to simulate and calculate the fire field and smoke spreading in tunnel, which demonstrates the safety of fire control and evacuating system. The areal longitudinal or horizontal ventilation and smoke discharge modes are used. The bubble-water spray combined automatic extinguishing system and intelligent transportation system are used in tunnel.

**Keywords:** international financial city, green transportation, underground road, underground business, horizontal ventilation, intelligent transportation, Guangzhou

Overall Design and Key Technology of Underground Road along River ..... Zou Jun, Wang Shengji ( 56 )

**Abstract:** With the speeding up of urbanization in China, the development along river is gradually becoming the main development strategy of many local cities. The comprehensive development on both sides of a river, and the construction of underground space have become the main acting point to perfect the structure space of city and to improve the overall image and competitive power of city. Combined with Guangzhou International Financial City Lingjiang Avenue Project, the article studies the overall layout, functional design and key technology of underground road along river, and puts forward the issues for attention and the solving scheme in the similar projects.

**Keywords:** underground road along river, Guangzhou International Financial City, Lingjiang Avenue, key technology

Study on Constructability Evaluation System of Urban Underground Comprehensive Municipal Tunnel Path .....

..... Xu Bo ( 61 )

**Abstract:** In order to solve the science, rationality and implementation in the layout of urban underground



comprehensive municipal tunnel and to avoid the blind and disorderly construction, the constructability of comprehensive tunnel path should be analyzed and studies in the planning and design stages. According to the analysis and study, the influence factor on the constructability of comprehensive municipal tunnel path is found, the appropriate evaluation system is established, the suitable evaluation index, weight and factor are selected, the evaluation criterion of municipal tunnel path is determined, and the proposed path in layout of municipal tunnel system is evaluated term by term so as to optimize the layout of tunnel system.

**Keywords:** underground comprehensive municipal tunnel, influence factor, weight, evaluation factor index, selection of municipal tunnel path

Discussion of Industrialization and Modularization in Construction of Comprehensive Municipal Tunnel in Chengdu ..... Zhong Xiang, Zhang Zhang ( 65 )

**Abstract:** The article introduces the planning and construction plan of comprehensive municipal tunnel in Chengdu, analyzes the hydrogeological condition and general construction difficulties of Chengdu, and puts forward the scheme of industrialization and modularization to construct the comprehensive municipal tunnel. The article analyzes the necessity and feasibility of industrialization and modularization, compares the difference of the modern industrialization from the traditional industrialization, and gives the conclusion of having to vigorously promote the industrialization and modularization.

**Keywords:** comprehensive municipal tunnel, industrialization, modularization, Chengdu

Study and Expectation of Slurry Curing Light Soil Application Technology ..... Wang Xinqi ( 69 )

**Abstract:** Aiming at the local utilization of huge waste mud, waste slurry, waste sludge and waste tailings mud, and the special soil of soft soil, red clay, collapsible loess, expansive soil and salinized soil in the projects, the article puts forward these waste muds or special soils to prepare as the slurry. Through the adding of the environmental curing materials and foaming agent, the slurry is modified as the light (lighter than water), high-strength (higher than cement) and stable (better than water stability) environmental protective engineering material - curing light soil. According to the tests of indoor unconfined compressive strength, water stability, dry-wet cycle, fatigue resistance and freezing thawing resistance, the results show that the engineering property of curing light soil is excellent. On this basis, this technology has the good application prospect in the future engineering.

**Keywords:** curing light soil, slurry, mud, GURS curing agent, GURS foaming agent, waste soil curing

Reflections on Construction of Green Transportation in Wuhan ..... Zhou Jun, Du Xianhan ( 75 )

**Abstract:** With the rapid increment of urban economy and quick advance of traffic mobility, the large cities are commonly suffering from the problems of traffic congestion, traffic pollution and traffic safety. As a new traffic development direction, the green transportation will become a life-saving straw to solve the problem of urban transportation. The article analyzes the traffic status and problems in Wuhan, puts forward the construction of green transportation in Wuhan must build the traffic travel mode dominated by the public traffic and slow traffic, and gives the development proposal of public traffic and non-motored vehicle traffic,

which can be referenced for the construction of urban transportation in Wuhan.

**Keywords:** traffic congestion, green transportation, traffic construction, public traffic, non-motored vehicle traffic

Study of Public Bicycle System Based on Metro Shuttle ..... Lü Maixia, Liu Yanni ( 79 )

**Abstract:** According to the using feature survey of public bicycle based on metro shuttle in Xian, the article analyzes the factors influencing the rental behavior of public bicycle. Based on the target of constructor and traveller, the article analyzes the layout of public bicycle services sites, the construction of bicycle way and the operation management mode of public bicycle, and puts forward the relative suggestions in order to improve the intention of traveller to select the traffic mode of “metro + public bicycle”.

**Keywords:** metro shuttle, public bicycle traffic, services sites, bicycle way

Study on Design of National Highway 109 Reconstruction Extension Project ..... Wei Peng, Ma Guogang ( 82 )

**Abstract:** The National Highway 109 (Zhnghe Fujiayao Interchange - Baliwan) Reconstruction Extension Project is located in the urban suburban of Lanzhou. The social environment surrounding the project field is complex. The formulation of project design scheme is restricted by many factors. According to the utilization of old bridge, and the comparison of cross section schemes, the article analyzes and discusses three design nodes of elevated bridge overpassing Lianyungang - Khorgas Expressway. The relative experience can be referred for the design of the similar projects.

**Keywords:** utilization of old bridge, comparison and selection of cross section, bridge scheme, structural calculation

Elementary Analysis on Design of River Embankment Reinforcement Project in Xixin Line of Lanzhou .....

..... Liu Jing, Zhou Wenbo ( 88 )

**Abstract:** In recent years, the Yellow River Embankment Project of Lanzhou goes into the peak period of reinforcement and maintenance. Owing to Binhe Road mostly closing to the embankment of Yellow River, the demolition and reconstruction of the old retaining wall will be not only huge investment and long time consuming, but also seriously influence the flood control safety of city and the normal use of the road. It is extremely urgent to seek the reinforcement scheme more economically, safely and suitable for the local practical condition. Combined with the engineering cases and on the basis of comparing the anchor cable reinforcement schemes of retaining wall, the reinforcement scheme of increasing the section before the wall to increase the stability of retaining wall is fished out. The maximum characteristic of this scheme is the simple and quick construction technology, which provides the theoretical basis for the reinforcement of the old river embankment of Lanzhou.

**Keywords:** reinforcement of river embankment, grouted block stone embankment retaining wall, stability calculation, water level difference

## BRIDGES & STRUCTURES

Study on Application of Underground Traffic Tunnel in Urban Business Core Area ..... Xiong Kun ( 91 )

**Abstract:** With the continuous development of urban underground space development and utilization, there is the underground traffic corridor specially used for linking up with the underground garage and ground road in a new round of planning and construction of underground space in business area. This kind of project can efficiently decrease the traffic load of ground road and improve the traffic environment of business area at the same of time connecting and integrating the underground parking resource of business core area. The article introduces the built or planned cases of the relative business area in China, and summarizes the characteristics of functional position and traffic organization of underground traffic corridor. Taking the design of underground traffic corridor in Beijing Lize Finance Business Area as an example, the article illustrates its important significance to develop the business area, to ease the traffic congestion and to optimize the road network of business area, which provides the benefic reference for the development of the similar underground traffic corridors in the other cities.

**Keywords:** business core area, underground traffic corridor, underground space

Setup of Entrance and Exit and Analysis of Service Level for Parking Garage Based on Queuing Theory .....

..... Sun Feng ( 95 )

**Abstract:** The *Architectural Engineering Traffic Design and Parking Garage Setup Standard* stipulates a minimum of entrance and exit for the different scales of parking garage (parking lots). For the parking garage (lots) of parking greater than or equal to 700 vehicles, it is required to provide the service level assessment and to determine the amount of entrances and exits. Combined with the practical cases, the queuing theory is applied to provide the calculation method of setting up the entrances and exits of parking garage and to analyze its relative service level.

**Keywords:** parking garage, entrance and exit, queuing theory, service level

Elementary Discussion on Reconstruction Design of Ecological Parking Spaces around Buildings of Enterprises and

Institutions ..... Kang Lijuan, Geng Yang, Fu Rongbing ( 99 )

**Abstract:** With the increment of car ownership, the parking contradiction is highlighted in enterprises and institutions. In order to ease the parking difficulty, the original pavement is proposed to reconstruct as the parking space. In order to minimize the negative environmental impact of parking, and according to the principle of safety first, ecological priority, multifunctional integration and people oriented, the article discusses the ecological reconstruction technology of parking spaces. Based on the characteristics of the site, the permeable pavement is recommended to use in the reconstructed area. At the vertical scale, the hollow grass brick pavement, cement mortar bonding layer, breakstone base and permeable concrete cushion are paved from up to down. At the plane, the boulder strip is used to divide the parking spaces, and the grasses of humi fusa, sagina and so on are planted at the hollow place of grass brick. In order to meet the needs of parking safety and drainage within parking space, the slope of the parking lot is controlled between 0.2%~

0.5%. This project is as reconstruction project, which can be referred for the construction of ecological parking spaces.

**Keywords:** ecological parking spaces, reconstruct, permeable pavement

Scheme Design of Cangzhou Huanghe Road Reconstruction Upgrading Project ..... Song Xiaoming ( 102 )

**Abstract:** Huanghe Road (Yingbin Avenue - East Jiefang Road) mainly serves the passenger transportation. This road is linked up with the new area in the west and is connected with the development area in the east. It is the important passage linking up with three cities. As the important component of transverse frame road network of Cangzhou City, this road plays the key role to lead the economic development, and at the same time serves the travel traffic of express passenger passage along the line.

**Keywords:** Huanghe Road, frame road network, express passenger passage

Design Countermeasures and Methods for Weak Foundation of Urban Road ..... Liu Zhiping ( 105 )

**Abstract:** Weak foundation is a critical issue for the design and construction of urban road. Many urban roads are now suffering with pavement collapse and differential settlement because of not to solve the problem of soft roadbed, which brings a lot of influences to the city transportation and infrastructural safety. This paper discusses the main types and the basic characteristics of weak foundation of urban road, analyzes the main faults and forming process of weak foundation, summarizes the design measures and treatment technique of weak foundation, and puts forward the reinforcement design method of cement mixing pile for weak foundation by the background of an urban expressway construction and introduces the arrangement, dimension and construction requirements of mixing pile. The study result can be referred for the similar projects.

**Keywords:** urban road, weak foundation, soft foundation, design countermeasures

Evaluation on Design of High Slope and Stability of Expressway ..... Qu Haijun ( 108 )

**Abstract:** The stability and design of high slope are the key issues in the expressway engineering construction. The article discusses the stability factor of high slope. The failure pattern of slope is used to determine its checking method. And the article analyzes the stability discrimination and protective design method of slope by an engineering case in order to provide the reference for the high slope design, stability evaluation and reinforcement method of the similar expressways.

**Keywords:** expressway, design of high slope, affect factor on stability, evaluation of stability

Application of Semi-flexible Asphalt Mixture in Reconstruction of Rural Highway Cement Pavement .....

..... Cheng Xiangfei, Zhang Xue ( 111 )

**Abstract:** The bearing capacity of the partial pavement structures of rural highway cement pavement is poor because of its relatively backward construction level. It is required to carry out a certain degree of reinforcement to the original structures. But the formerly overlaid layer below the structure was usually selected by No.70 road asphalt AC-20C mixture. At present, in order to improve the economic benefit and

environmental benefit, and comprehensively considering the abilities of its structural reinforcement and resisting reflective crack, the semi-flexible foam asphalt cold recycled mixture is applied in the overlaying of lower structure. The article analyzes the test of its mix ratio design and material performance, introduces the paving and pavement performance of tested road, and evaluates its technical economy for its popularization and application.

**Keywords:** semi-flexible asphalt mixture, rural highway, cement pavement

Study on Carbon Emission of Urban Road Traffic in Urbanization Development of China ..... Li Shiguo ( 116 )

**Abstract:** With the acceleration of urbanization development process in China, it is not to despise the road traffic on the urbanization development. The development of urbanization makes the urban population more and more, and the demand for the traffic is naturally large, and the negative impact is also caused, i.e. the increment of carbon emission. The study on the carbon emission of urban road traffic shows the issues for attention in the relative urbanization process, and is expected to make for the development of urbanization health and stability.

**Keywords:** urbanization process, traffic, carbon emission, transportation energy

## BRIDGES & STRUCTURES

Design of Main Bridge For Xiaojiao East River Bridge of Huizhou ..... Luo Xiheng ( 118 )

**Abstract:** The main bridge of Xiaojiao East River Bridge in Huizhou is a 180-m main span of single-pylon double-plane concrete cable-stayed bridge. Its concrete cable pylon is designed as the imitated swan modeling. The article introduces its overall design and key structural design. the relative experience can be referred for the similar projects.

**Keywords:** cable-stayed bridge, single pylon, special shaped pylon, structural design

Selection and Design of Yellow River Bridge in Wajiatan ..... Ren Meng, Zhang Jun, Huang Gujian ( 122 )

**Abstract:** Aiming at the characteristics of inconvenient transportation and deeper water in the place where Yellow River Bridge of Wajiatan is located, the double-pylon double-plane open section composite beam cable-stayed bridge with the 560-m span is used after the comparison and selection. Specific to the characteristics of higher fatigue stress amplitude of parallel cable beam anchorage stayed slab of cable-stayed bridge, the main beam at the side of composite beam is optimized from the I shape to the glyph shape in order to improve the fatigue strength of welding joint, which can be referred for the construction of bridges in the inconvenient transportation of the mountainous areas.

**Keywords:** deep water foundation, cable-stayed bridge, open section composite beam, fatigue, wind resistance and seismic resistance

Structure Design of Unequal-span Continuous-arch Arch Bridge ..... Xie Xiong ( 126 )

**Abstract:** This article introduces and analyzes the bridge scheme conception, proposed structure dimension



and structure calculation of an unequal-span continuous-arch bridge. The m-method is applied to consider the combined action of pile and soil, to calculate the anti - push rigidity of group pile foundation, and to simulate the elastic restraint boundary conditions. A three-dimensional model is established by the finite element software to calculate and analyze the carrying capacity and stability of the structure.

**Keywords:** unequal span, continuous-arch bridge, m-method, anti-push pier

Discussion on Design of Corrugated Steel Web PC Bridge Structure ..... Xiao Haibo, Zhu Yuefeng ( 129 )

**Abstract:** The article introduces the stress characteristics of corrugated steel web PC box beam bridge, summarizes the structural design gist of corrugated steel web bridge, and combined with an engineering case, analyzes the mechanical property of corrugated steel web PC box beam bridge, which can be referred for the design of the similar bridges.

**Keywords:** corrugated steel web, box beam bridge, mechanical property

Design and Calculation of Wide Low-pylon Cable-stayed Bridge ... Jia Dong, Wang Jianguang, Huang Feng ( 132 )

**Abstract:** The low-pylon cable-stayed bridge has the wide development space in the construction of urban bridge in China because of its beautiful modeling and good economic indexes. Taking Pan River Bridge in Taian Culai Mountain Wenhe Scenic Spot as the background, the article describes the design and calculation experience of wide low-pylon cable-stayed bridge. The relative experience can be referred for the similar projects.

**Keywords:** low-pylon cable-stayed bridge, wide bridge, design of box beam, design of cable pylon, design of stayed cable

Design Practice of Cast-in-cantilever Continuous Box Beam Bridge of Low-installed Cantilever .....

..... Guo Hongmin, Li Lei, Liang Songchun ( 135 )

**Abstract:** In order to solve the problem of pedestrian and non-motored vehicle lane longitudinal slope hard to satisfy the design standards and requirements, the article describes a cast-in-cantilever pre-stressed concrete continuous box beam structure with a cantilever installed at the lower of web. This cantilever is specially used for the traffic of pedestrian and non-motored vehicle. The article analyzes the integral and detail calculations. The result shows that its stress is greater different from the conventional section box beam. The article calculates and analyzes the space stress of form traveler. The relative experience can be referred for the similar projects.

**Keywords:** low-installed cantilever, cast-in-cantilever, box beam, structural analysis, form traveler

Design Technology of Municipal Bridge Crossing Railway ..... Le Xiaogang ( 138 )

**Abstract:** The article introduces the design principle, restraining factor and construction method of urban bridge crossing railway, and introduces the engineering case of the elevated bridge crossing railway in the Inner Ring to Sanyuanli Project, which can be referred for the design of the similar projects.

**Keywords:** bridge crossing railway, design technology, design principle

Modeling Conception of Urban Pedestrian Overpass ..... Luo Meihui, Peng Chongqian ( 140 )

**Abstract:** The bridge axis of the conventional pedestrian overpass types, i.e. rigid suspension bridge, double-pylon cable-stayed bridge, single-pylon cable-stayed bridge, half-through bowstring arch bridge, slant-lagged rigid frame bridge, variable cross-section continuous plate bridge, steel box beam and steel truss is mostly designed as the straight line, which belongs to the 2D structure. The 3D space modeling of bridge is not considered. Therefore, the modeling of overpass is relatively drab. The article describes the introduction of the 3D space system on the basis of the above several 2D structures, and introduces several novel type conceptions of pedestrian overpass.

**Keywords:** urban pedestrian overpass, 3D space system, bridge type conception

Analysis of External Pre-stressing Reinforcement Technology in Simple-supported Beam of Bridge .....

..... Zhang Xin ( 142 )

**Abstract:** Combined with a practical project, the article introduces the application of external pre-stressed reinforced simple-supported beam in a project. The result shows that the external pre-stressed reinforced simple-supported beam can efficiently improve the carrying capacity of structure, and also can improve the serviceability limit state of structure. The checking result is very reliable, and can be referred for the similar projects.

**Keywords:** external pre-stressing, bridge reinforcement, design, simple-supported beam, carrying capacity

Finite Element Analysis on Deflection of Thin Wall High Pier with Single-side Sunshine ..... Xia Wenmin ( 145 )

**Abstract:** Combined with the engineering cases, the finite element software MIDAS/CIVIL is used to establish the finite element model of Beam unit and Thick Plate unit. Under the single side sunshine, the article describes the finite element analysis on the construction deflection of thin wall high pier. The result shows that it is not to ignore the influence on the stability of high pier in the construction period of the longest cantilever under the single side sunshine.

**Keywords:** rigid frame bridge, high pier, stability, sunshine, finite element

Design and Evaluation of Bridge Health Monitoring System ..... Chen Quan, Tao Hua, Wang Chao ( 147 )

**Abstract:** The article introduces the design study result of large bridge health monitoring system. This system is composed of six subsystems of electronic manual inspection maintenance management subsystem, data storage and management subsystem, comprehensive warning and structural safety evaluation subsystem, user interface subsystem and video monitoring subsystem. According to the analysis on various data of environmental temperature and humidity, structural temperature, vehicle load, support displacement and main beam alignment collected by the monitoring system, the result shows that this system is operated better and the expected effect is achieved. The article discusses the topic required to deeply study for the health monitoring technology.

**Keywords:** health monitoring system design, large bridge

Analysis on Cracking Reasons and Influencing Parameters of Main Girder of a Low-pylon Cable-stayed Bridge under Construction ..... Li Yuanbing ( 151 )

**Abstract:** The typical U-shape cracks in the side cell of main girder and 45° inclined crevices at the bottom of top plate are spotted in the construction process of a low-pylon cable-stayed bridge with 88-m main girder. In order to study the cracking reasons and the main influence parameters in the construction main girder, the space analysis method is used to carry out the spatial finite element construction simulation analysis. The study result shows that the poor construction quality and insufficient bearing capacity of girder combined place are the direct reason to cause the U-shape cracks of girder, and the higher partial stress level is the potential reason to cause the cracking at the combined place. The excessive Z-direction stress is the main reason to cause the cracking at the bottom of flange plate, and the section weakening at flange is the secondary reason. Too high transverse prestressing of top plate is the main reason to cause 45° inclined cracks at the bottom of top plate. The transverse prestressing also has significant influence on Z-direction normal stress in bottom flange and principal tensile stress at the bottom of top flange.

**Keywords:** bridge engineering, low-pylon cable-stayed bridge, box girder, cracking reason, influencing parameters, spatial analysis

Application of Scheme Designer in Design of Highway Bridge Drawing .....  
..... Hong Quan, Xu Jianjun, Liu Jing, Liu Dongdong ( 156 )

**Abstract:** There are the characteristics often adjusting various design conditions of vertical section and etc. in the design of expressway bridge. The article briefly introduces the application of scheme designer software in the design of expressway bridge layout drawing. The application of scheme designer software can greatly decrease the drawing quantity of bridge design members, and improve the working efficiency of designer members.

**Keywords:** scheme designer, bridge master, adjustment design method, bridge layout, bridge width model

## FLOOD CONTROL & DRAINAGE

Application of Low-impact Development Rainwater System in Design of Municipal Road ..... Zhang Yi ( 158 )

**Abstract:** Based on the practice of low-impact development concept in the design of municipal road engineering, the article summarizes the main procedure of low-impact development design and the accounting method of the main indexes of the municipal roads the relative experience can be referred for the similar projects.

**Keywords:** low-impact development, comprehensive rainfall runoff coefficient, total control rate of rainwater runoff

Study on Several Issues of Urban Vertical Planning ..... Zheng Yuezhi, Cai Yehong, Zhao Zan ( 161 )

**Abstract:** The vertical planning is an important component in the city planning including the vertical planning design of urban road, bridge, block and etc. The vertical planning of city involves many factors of the present

vertical city, land property, flood control and waterlogging drainage standards, construction of water conservancy facilities and etc. The article studies some key issues in the vertical city planning by the vertical planning of the central area of Fenghua City.

**Keywords:** vertical planning, waterlogging water level, vertical road, Fenghua City

Elementary Analysis on Influence of Line Gradient on Design of Rainwater Pumping Station at Portal of Areas . . .

..... Fan Taixing, Zhou Jinzhong, Jian Mingzhu, Du Jinhai ( 164 )

**Abstract:** Taking the design of two rainwater pumping stations at the portal of areas in Nanjing Metro as an example, the article analyzes the influence of catchment area and ground collecting time on the design flow of rainwater pumping station, and points out the line gradient can directly influence the ground collecting time of rainwater so as to influence the calculation of design rainstorm intensity. Even under the condition of same return period and same rainstorm intensity formula, the calculation result of design rainstorm intensity also may be different. The design scale of rainwater drainage pumping station should be based on the practical condition to calculate and determine in order to ensure the safe operation during rainstorm.

**Keywords:** metro, pumping station at portal, design flow, collecting time, rainfall duration

Analysis and Discussion of a New Seawall Structure of Vertical Caissons on Deep Water Soft Soil Subgrade . . . . .

..... Lu Yufang, Tian Liyong ( 166 )

**Abstract:** By the effective subgrade treatment, the vertical caisson seawall is a new seawall structure adapting to the soft soil subgrade in deep water. It not only has the advantages of less land and less construction risk, but also can effectively ease the shortage of sand and gravel resources for embankment. The article discusses and analyzes its structure type, stability, structural internal force, deformation and construction method, and puts forward the problems to be further studied, which provides a reference for the application of the vertical caisson seawall in reclamation engineering.

**Keywords:** vertical caisson seawall, subgrade treatment, seawall body stability, structure internal force, construction method

Study on Treatment Planning of Low-lying Water Area in City Based on Assessment of Waterlogging Risk . . . . .

..... Zhang Yapeng, Cai Yehong, Hu Hong ( 170 )

**Abstract:** It is an important livelihood project to treat low-lying area in the city. Taking the central area of Ningbo as an example, according to the status survey, model simulation and landform elevation analysis, a division map of waterlogging risk area of city is drawn, and the distribution map of low-lying water area of city is formed on this basis. Combined with the waterlogging core influence factors of every section, the different key sections are selected to analyze with the treatment schemes so as to form the treatment guidance on city level in order to achieve the aim of effective and orderly treatment of low-lying waterlogging area.

**Keywords:** waterlogging risk assessment, low-lying waterlogging area, treatment planning Ningbo

## MANAGEMENT & CONSTRUCTION

Study on Safety Accident Cause and Early Warning Management of Highway Construction - - - Feng Jianliang ( 174 )

**Abstract:** The highway construction engineering is one of the important people's livelihood projects in China now. But in recent years, many safety accidents happen in highway construction. The appearance of each accident will all cause the different levels of property loss and casualties. The State Production Supervision Bureau pays more attention to the highway construction accidents, and asks every highway construction unit attach importance to the safety work. On the basis of summarizing various safety accident causes in the highway construction, the article puts forward the scheme of early warning management work in order to provide the reference for the highway construction.

**Keywords:** early warning management, accident cause, highway construction, typical case

Analysis on Application of Grouting Reinforcement Technology in Construction of Highway Bridge and Tunnel Engineering ..... Peng Xianxiang ( 176 )

**Abstract:** Aiming at the highway bridge and tunnel engineering according to the grouting reinforcement construction technology, combined with the practical conditions of Chishui - Wangmo Expressway, and on the basis of briefly introducing the technical functional mechanism, the article completely analyzes the technical application from three aspects of construction preparation, construction standard and construction technology. The conclusion shows that the application effect of grouting reinforcement technology is outstanding in this project and can improve the engineering quality.

**Keywords:** highway bridge and tunnel, grouting reinforcement technology, application

Elementary Discussion on Quality Control of Bridge Pile Foundation Standardization Construction ..... Chen Xiaodi ( 178 )

**Abstract:** The standardization construction is the important concept to promote the construction quality and efficiency. The pile foundation structure is simple. The design calculation theory is well known. It is important to carry out the standardization construction. According to the pile foundation construction of Tanshui River Bridge, the article puts forward the technological requirements and quality control standard of standardization construction, which can be referred for the standardization construction of pile foundation.

**Keywords:** bridge pile foundation, standardization construction, quality control method, construction gist

External Pre-stressing Construction Simulation and Monitor of Continuous Box Beam Bridge ..... Li Jianbo ( 181 )

**Abstract:** The construction monitor and analysis of long-span structure are the key links in the construction. Combined with an external pre-stressing reinforcement of a continuous box beam bridge, the article discusses the construction monitor contents and simulating analysis method of external pre-stressing. Taking the pre-stressed reinforcement cable force, strain test and deck deformation monitor as the main monitoring contents, the finite element software MIDAS is used to simulate and analyze the pre-stressing tension process. The monitor result shows that the measured data is better identical with the simulating analysis theoretical



value. This work and the study result is an important safety index in the external pre-stressing construction process of continuous beam bridge, and also is referred for the design and construction of the similar projects.

**Keywords:** continuous box beam, external pre-stressing, construction monitor, MIDAS

Jacking Reconstruction Engineering Practice of Shanghai-Hangzhou Expressway Bridge in Hangzhou-Shanghai Line  
..... Yan Yuwen, Ruan Jie ( 186 )

**Abstract:** The article summarizes the engineering practice experience in the jacking reconstruction of Shanghai-Hangzhou Expressway Bridge in Hangzhou-Shanghai Line. This project has the characteristics of large jacking area, long jacking link, high supporting system and jacking height, and jacking involved crossing railway under operation. The article introduces the design of jacking supporting system, measures of jacking limit, layout mode of jack, jacking scheme of adjusting slope, and reconstruction of base slab and upright column, which can be referred for the similar projects.

**Keywords:** jacking, supporting system, limit measures, jacking of adjusting slope

Study on Application of Cement Deep Mixing Pile in Soft Foundation Treatment of Roadbed ... Zeng Yifeng ( 190 )

**Abstract:** The soft foundation treatment becomes the technology the construction enterprises must master. The cement deep mixing pile technology is one of more common soft foundation treatment modes, and can make the soft foundation of roadbed reinforced. The article analyzes the practical application of deep mixing pile in construction from three aspects of construction before, during and after in order to make the construction members know this technology better and also make the application of this technology more commonly in construction so as to guarantee the whole construction quality of road engineering.

**Keywords:** soft foundation of roadbed, cement deep mixing pile, practical application

Influence of Thaw Settlement Grouting Construction of Shield Section Connecting Passageway on Segment Settlement  
..... He Shan ( 192 )

**Abstract:** The thaw settlement grouting construction of shield section connecting passageway has the obvious influence on the settlement of shield segment. The article sets forth the monitor of thaw settlement grouting construction leading to three grouting effects of segment settlement and analyzes the data, which can be referred for the thaw settlement grouting informatization construction of connecting passageway.

**Keywords:** connecting passageway, thaw settlement grouting, segment settlement, shield tunnel

Quality Control of Cement stabilized Crushed Stone Base ..... Zhu Lingjiao ( 195 )

**Abstract:** The cement stabilized crushed stone base is widely used in the construction of road engineering pavement base in China in recent years. Some faults are found in the using process. Its key cause is the construction quality. The article analyzes the basic construction procedure of cement stabilized crushed stone base, analyzes its construction technology and key quality, and describes the construction quality control method.

**Keywords:** road engineering, cement stabilized base, crushed stone base, quality control, control gist

Study on Contract Management, Information Management and Organization Coordination of Shipping Construction in

Sanbanxi Reservoir Area ..... Chen Xiangyong ( 197 )

**Abstract:** The inland river shipping is an ancient transport mode, and is also one of the most economic transport modes. In China, the inland river shipping also undertakes the transportation of key materials, i.e. petroleum, chemical industry, metallurgy, electrical power, machinery and building materials. According to the shipping construction practice of Sanbanxi Reservoir Area, the article discusses the issues in the contract management, information management and organization coordination for reference.

**Keywords:** Sanbanxi Reservoir Area, shipping, contract management, information management, organization coordination

## STUDY ON SCIENCE & TECHNOLOGY

Study on Application of Low-impact Development Mode in Design of Urban Road ..... Wu Xuan, Cui Juan ( 200 )

**Abstract:** With the accelerating urbanization process, the huge pressure is brought to the water environment, i.e. the increment of runoff coefficient, aggravation of non-point source pollution and gradual decline of underground water level. As a new urban rainwater and flood management mode, the concept of the low-impact development mode is gradually applied in the construction of urban road, and is formed to the detailed engineering design implementation. It is necessary to take a series of measures to handle the relationship between the implementation of low-impact development mode and the design of urban road.

**Keywords:** low impact, urban road, technology, measures

Study on Evaluation Model of Technical Condition of Pedestrian Overpass ..... Zhu Jie, Chen Zhang ( 203 )

**Abstract:** As an important road infrastructure, the pedestrian overpass is increasingly being used. The present study of bridge evaluation model focuses on the ordinary driving bridge. There is short of the study on the evaluation model of pedestrian overpass. According to the field survey of more than 50 pedestrian overpasses in Shanghai, the article compares the component division of pedestrian overpass and ordinary driving bridge, and defines the component division of pedestrian overpass. The pedestrian overpass is mainly for pedestrians. Therefore, the anti-slide performance of pedestrian overpass cannot be overlooked during determining the damage type of pedestrian overpass. After using the existing evaluation model of bridge to more than 50 pedestrian overpasses in Shanghai, the article finds that there are some disadvantages of various evaluation methods especially for the ordinary driving bridge to handle the multi-span and multi-pier structures. The field grading experiment combined with the analysis - calibration method can determine the calculation method suitable for the multi-span or multi-pier pedestrian overpass, and determine the weight of each position of pedestrian overpass. Taking a typical pedestrian overpass of Shanghai as an example, the article evaluates its technical condition by the above evaluation model.

**Keywords:** pedestrian overpass, technical condition, component division, evaluation model, anti-slide performance

Study on Influence of Irrigation in Lanzhou and Its Surrounding Area on Microstructure of Loess Landslide .....

..... Wang Jian, Hou Xiaoqiang, Li Xiaoqiang, Yao Zhengxue ( 208 )

**Abstract:** The experiments of granularity test, SEM electron microscope scanning and chemical feature analysis are carried out for the loess at two places of landslide toe and landslide top of the representative Jiaojia Bay and Jiuzhoushi Narrows. The analysis result shows that the small granules and soluble matters in loess layer will move down in the transfusion process of hydrone from top to bottom during irrigation so as to form the distinctly different features of particle granularity, structural feature and soluble content of loess from landslide top to toe.

**Keywords:** loess, landslide, microstructure

Stability Evaluation of Rocky Slope Based on AHP-TOPSIS Model ..... Jiang Tingwen, Jing Chunling ( 211 )

**Abstract:** Seven influencing factors of rock quality index, rock mass integrity index, ground stress, cohesion, internal friction angle, slope height and daily maximum precipitation are selected as the slope stability evaluation indexes. The modified analytic hierarchy process (AHP) is used to calculate the weight vector of each evaluation index. The technique for order preference by similarity to ideal solution (TOPSIS) is combined to build the modified AHP-TOPSIS judging model. Based on the lower limit of the grade classification interval of single index, five different grades of critical value slope are constructed. The critical value of the stability index is brought into AHP-TOPSIS judging mode together with the measured data of four groups of slope stability index. The calculation of indexes and the closeness of ideal solution can divide the classification interval of stability grade so as to compare the slope closeness of four groups to be evaluated and to determine the stability grade of slope. The study result shows that the evaluation result of slope stability by the AHP-TOPSIS model are basically consistent with the results of grey correlation method and extension evaluation method. The feasibility of this model is proved, which provides a new analysis method of evaluating the slope stability.

**Keywords:** slope, stability evaluation, modified AHP, AHP-TOPSIS model.

Study on Design Method of SCC Mix Ratio Added with Naphthalene Series Water Reducers .....

..... Chen Chengqin, Yu Yiheng ( 216 )

**Abstract:** There is no unified method of the mix ratio design methods of self-compacting concrete (SCC) in China. In the design process, the work property of fresh mixed concrete is very sensitive and is greatly changed by the factor influence of raw material quality and batching accuracy so that the technical development of SCC is certainly limited. According to the introduction of the more advanced characteristics of six methods, i.e. the fixed sand gravel volume method, full calculation method, improved full calculation method, parameter design method, aggregate specific surface area method and simple mix ratio design method, the well-known fixed sand gravel volume method, improved full calculation method and parameter design method are selected to compare and test the work property and mechanical property of C60 SCC. The test result shows that the parameter selection of fixed sand gravel volume method is explicit, its design process is simpler, and its work property is more stable with certain applicability.

**Keywords:** self-compacting concrete (SCC), mix ratio design, work property, mechanical property

## APPLICATION OF ACHIEVEMENTS

Application of Free Setup Station Technology in Monitor of Foundation Pit .....

..... Wang Jiaqing, Shi Xiaozhong, Tan Donglin ( 221 )

**Abstract:** The article introduces the free setup station testing method of electronic total station and its practical application in the monitor of foundation pit, and discusses the measurement accuracy of this method, and the advantages and disadvantages of its practical application.

**Keywords:** free setup station, total station, monitor of foundation pit

## THE RELATIVE SPECIALITIES

Study of Electronic Police Vehicle Video Detecting Technology Based on Illegal Elements ..... Zhang Jia ( 223 )

**Abstract:** With the construction of safe city and intelligent transportation projects, and aiming at more and more study of electronic police, the snap photography of illegal elements is undoubtedly the important basis for the electronic police to affirm illegalness. Therefore, the detection of illegal elements is obviously important. The article elementarily discusses the application of several common vehicle video detecting technologies in the electronic police to affirm illegalness, analyzes and compares the technical characteristics and restrictions of various technologies to distinguish its applicable range, and puts forward that several vehicle video detecting technologies are organically combined in the design and practical application of electronic police projects in order to further improve the accuracy of capture rate and license plate recognition of vehicle illegalness.

**Keywords:** illegal elements, electronic police, vehicle video detecting technology

Design Concept of Landscape Greening in Starting Area of Sutong Science and Technology Industrial Park .....

..... Zhang Wenwen, Fang Ke, Cao Lei ( 226 )

**Abstract:** The stress of starting area originally undertook various functions and tasks in the city life. The stress of the modern city life space has been replaced by the activities and parking space required for the motored vehicles. A city is required to rebuild up the multi-functional life space, to set up and to strengthen the community characteristics around the street. Through establishing the guiding principle of the whole people street and satisfying the demands of all levels of users to city functions, a part of humanization in the built road network has the own feature. The improvement of life space quality will directly reflect the improvement of life quality, and also improve the usage of public space.

**Keywords:** road landscape, greening, Sutong Science and Technology Industrial Park, starting area

Measuring Method of Yanshi Highway Tunnel Project in North City Expressway of Lanzhou ..... Bao Erhu ( 229 )

**Abstract:** This paper mainly introduces the implementation method of expressway tunnel control

measurement, and the technical requirements of setting, observation and calculation of measurement control points, and at the same time, also introduces the implementation procedures and the relevant notices of tunnel construction measurement and breakthrough measurement, which provide the technical guarantee for the smooth holing-through of tunnel engineering.

**Keywords:** expressway, tunnel, engineering measurement

Discussion on Calculation of Undrained Shear Strength Using Flat Dilatometer Test in Ningbo ... Zhao Dong ( 231 )

**Abstract:** According to the statistics analysis of the  $\Delta p$  value of flat dilatometer test and the  $c_u$  value of the vane test, the empirical formulae of  $c_u$  calculated by the flat shovel  $\Delta p$  in Ningbo is given. Through comparative analysis, the result shows that the undrained shear strength calculated by the  $\Delta p$  value of flat dilatometer test is very consistent with the test result of the vane test.

**Keywords:** flat dilatometer test, vane test, undrained shear strength

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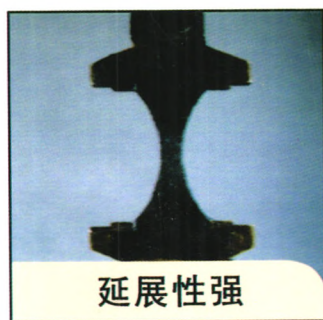


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