

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



2022



第3期 总第275期 月刊
2022年3月

万方数据-数字化期刊群
清华同方-中国期刊全文数据库
维普资讯-中文科技期刊数据库
中国核心期刊(遴选)数据库
中国学术期刊综合评价数据库
日本科学技术振兴机构数据库(JST)

全文收录
全文收录
全文收录
收录期刊
统计源期刊
收录期刊

图为济南市市政工程设计研究院(集团)有限责任公司设计的济南市望岳快速路工程

因为我们专心，所以我们专业！

——《城市道桥与防洪》

学术联盟：上海市城市科学研究会

● 本期看点

- 路轨共建的城市地下快速路系统方案研究——以济南市黄河大道快速路为例
- 800 m级变截面钢管混凝土飞燕拱与自锚悬索组合桥研讨
- 调蓄设施布局设计模型研究
- 郭家沱长江大桥锚碇大体积混凝土水化热研究



中华人民共和国住房和城乡建设部优秀期刊

中华人民共和国住房和城乡建设部优秀期刊

城市道桥与防洪 (月刊)

CHENGSHI DAOQIAO YU FANGHONG

2022年 第3期(总第275期)

2022年 3月15日出版

1984年创刊

主管单位: 中华人民共和国住房和城乡建设部

主办单位: 上海市政工程设计研究总院(集团)有限公司

出版单位: 《城市道桥与防洪》编辑部

编辑委员会(第九届)

主任委员: 徐健

副主任委员: 刘旭锴 和坤玲

委员(排名不分先后):

马国纲	宋华茂	卢永成	宁平华	李建民
李军代	李克平	李东	徐一峰	朱晓东
朱海鹏	王永新	杨红卫	陈翰新	陈伟
陈强	王建光	张澎涛	杨斌	蒋海里
周松国	陆阳	钟翔	骆燕妮	赵乐军
赵林强	徐波	高中俊	黄永春	童景盛
蒋乐	蒋中贵	潘怡宏	徐辉	汪勇

编辑出版: 《城市道桥与防洪》编辑部

总编辑: 骆燕妮

责任编辑: 叶露

编辑: 赵晓燕 龚雪菲

美术编辑: 杨建华

英文校审: 孙宁萍

地址: 上海市中山北二路901号 邮编: 200092

电话: (021)55008850 传真: (021)55008850

投稿网址: <http://www.csdqyfh.com>

联系邮箱: cdq@smedi.com

国内发行: 《城市道桥与防洪》编辑部

国外发行: 中国国际图书贸易总公司 代号: BM 1859

排版印刷: 上海商务联西印刷有限公司

地址: 上海市春和路1350号7号楼

中国标准连续出版物号: ISSN 1009-7716
CN 31-1602/U

广告发布登记号: 3101020130030

目次

道路交通

- 路轨共建的城市地下快速路系统方案研究
——以济南市黄河大道快速路为例 张春光(1)
- 城市核心区地下道路规划设计研究——以成都市
高新南区益州大道为例 胡昌君(6)
- 基于规划设计协同山区城市道路建设要点
分析——以贵阳市花冠路南段为例
陈雍春, 赵建新, 黄捷, 林洋(12)
- 组团城市快速通道体系研究——以太仓市为例
..... 汪勇, 杨凯健, 王啸君(16)
- 恩施市金龙大道(北段)道路工程总体设计
魏顺波, 王明刚(20)
- 城市道路改建工程路面结构设计探讨
阮铁锋(24)
- 张家口市崇礼区城市道路提升改造设计
杨阳, 董平洋(26)
- 城郊公路市政化改造横断面设计研究
罗佳(29)
- 市政道路沥青路面纤维封层养护技术
王昶(32)

桥梁结构

- 800 m级变截面钢管混凝土飞燕拱与自锚悬索
组合桥研讨 王国华, 徐金法, 陈凯(35)
- 基于卵形拱桥塔的空间索网景观斜拉桥设计
..... 李碧卿, 陈凯(41)
- 钢箱-混凝土组合曲线梁桥长期爬移分析方法
..... 杨祥, 李雨默, 朱劲松, 王震阳(45)
- 210 m下承式钢箱提篮系杆拱桥总体设计
张志坚, 李亮, 田卿(51)
- 济南齐鲁黄河大桥总体方案研究
王伟(55)
- 系杆拱桥合理成桥状态研究分析
焦明东, 高敏, 宋玉, 司奎(60)
- 钢筋交叉搭接桥面板湿接缝轴拉试验研究
李洞明(64)
- 城市独柱墩桥梁抗倾覆加固改造设计探讨
杜军(69)
- 跨断裂带简支梁桥三级防落梁系统设计
刘洋(74)
- 预制混凝土小箱梁结构中横隔板的作用分析
..... 黄洁(77)
- 运营地铁上方桥涵设计 邓霞, 徐慧(80)

防洪排水

- 调蓄设施布局设计模型研究 柯杭(83)

期刊基本参数: CN 31-1602/U * 1984 * m * A4 * 262 * zh * P * ¥25.00 * 5000 * 65 * 2022-03

- 一体化预制雨水泵站及其调蓄池设计 邓卫东(86)
- 天津市快速路排水工程设计要点分析 黄俊,史如萃,乔建刚(90)
- 郎溪县钟桥水库建设方案研究 李结华,杨勇,王丽君,邢少佳(93)
- 泵闸工程折线形底板基底应力分布特性分析 任华春,陈在连(97)
- 污水厂污泥产率随季节变化研究 刘锐,郁志杰,林敏,徐强,郭松杰,金飞(101)
- 某大型污泥填埋场不揭膜取泥技术研究 叶源新,杜炯,刘若元(104)
- 基于1D水流特征隐式格式的水工隧洞过流能力分析 侯捷,王珏,顾威,曹坤,周雅(108)
- 跨水源地保护区的桥面径流收集处理设计方案研究 周铖(111)

管理施工

- 郭家沱长江大桥锚碇大体积混凝土水化热研究 谭双全,黎人亮,熊桂开,祝小龙,胡奇(114)
- 上海市龙东大道快速化外环立交施工筹划方案研究 刘海峰(119)
- 城市高架桥无支架施工研究分析 郑建文(124)
- 基于自适应卡尔曼滤波法的悬臂施工挠度控制 张付林,汪东,景浩,王银辉,肖广良(127)
- 中心城区承插型盘扣式钢管支架施工技术研究 邓鑫伟,张鹏飞,王磊(131)
- 上海市中环高架病害支座顶升更换施工技术 蒋岩峰(134)
- T梁桥横向加固方法及应用 严国齐(139)
- 双排桩在邳州高铁站地下车库基坑中的应用 杨上清(141)
- 在役轨道交通矮塔斜拉桥检测与评估 张智力,崔鑫(144)
- 滞洪区高速公路生态边坡监测研究 张俊峰,陈永昊,薛丹璇,朱晓东(147)
- 潜在滑坡体对桥梁桩基安全影响的评价分析 杨凯(152)
- 预制节段拼装结构套筒连接检测方法综述 朱骏(156)
- 上海某商办楼基坑开挖施工监控量测分析 周炜(160)
- 高铁盾构隧道施工对邻近桩基影响数值分析 张杰(164)
- 盾构隧道下穿软弱土层既有人行天桥桩基设计探讨 徐树斌,万送(168)
- 小净空、上软下硬地层盾构始发技术研究 李作仁,周胡蒙,金立(172)

科技研究

- 土体相对密度对土工格室加筋砂土地基性能的影响 杨晖,丁志辉,蔡源介(177)

编委成员单位(排列不分前后)

主任编委单位:

上海市政工程设计研究总院(集团)有限公司

副主任编委单位:

北京市市政工程设计研究总院有限公司

天津市政工程设计研究总院有限公司

编委单位:

南京市水利规划设计院股份有限公司

中国市政工程西南设计研究总院有限公司

同济大学交通运输工程学院

上海市市政规划设计研究院有限公司

广东省建筑设计研究院有限公司

广州市市政工程设计研究总院有限公司

沈阳市市政工程设计研究院有限公司

中国市政工程西北设计研究院有限公司

中国市政工程华北设计研究总院有限公司

中国市政工程中南设计研究总院有限公司

上海市城市建设设计研究总院(集团)有限公司

武汉市政工程设计研究院有限责任公司

西安市政设计研究院有限公司

重庆市设计院有限公司

重庆市勘测院

林同棧国际工程咨询(中国)有限公司

济南市市政工程设计研究院(集团)有限责任公司

成都市市政工程设计研究院有限公司

上海公路桥梁(集团)有限公司

上海城建市政工程(集团)有限公司

杭州市市政工程集团有限公司

深圳市市政设计研究院有限公司

杭州市城建设计研究院有限公司

兰州市城市建设设计院

上海浦东路桥(集团)有限公司

上海市政交通设计研究院有限公司

上海弘路建设发展有限公司

上海奉贤建设发展集团市政公路工程有限公司

上海市市政工程建设发展有限公司

大连市市政设计研究院有限责任公司

随机车辆荷载流下 UHPC 加固正交异性钢桥面板
疲劳性能评估 尤永学(182)

热养护下矿物掺合料高性能混凝土强度损失和孔
结构研究 王晓琰,李峰,岳阳,方顺(186)

混凝土界面黏结性能有限元分析
..... 李云虎,熊诚,潘诚(190)

界面污染对沥青小梁疲劳性能的影响研究
..... 张逸琳(194)

大跨“槽型+箱型”连续混凝土梁受力与设计研究
..... 颜晓伟(197)

多排组合剪力连接件承载力有限元分析
..... 张成,吴沛峰,张艺淳,张若瑜(201)

盾构法预制拼装隧道超前探水预报研究与实践
..... 胡新涛,徐树军,周昆,刘成龙,姚琦发(205)

城市地下通道畅通可靠度算法研究
..... 阳丹,王富(209)

成果应用

城市复杂环境地下互通立交工程数字化应用
..... 刘攀攀,李倩文(213)

基于达索 3DE 平台的组合梁拱桥 BIM 设计应用
..... 熊淑华(217)

BIM 技术在机场市政配套工程设计中的应用
..... 刘华杰(223)

BIM 技术在城市泵闸 EPC 工程设计中的应用
..... 游孟陶,潘飞(228)

相关专业

城市地下综合管廊规划布局研究——以江苏省
兴化市为例 王爱恒(232)

利用废弃铁路建设综合管廊的新思路——以江南
中心绿道武九线综合管廊工程为例
..... 刘长庚,王海亮,张斌(237)

施工及环境因素诱发污水处理池差异沉降及渗漏
风险 王颖轶,徐伟忠,刘祥龙(241)

楼板变形对地下大空间外墙结构设计的影响分析
..... 柏炯,迟恒(246)

大型全地下刚性填埋场结构设计 李砚(250)

城市隧道防汛应急系统分析与技术探讨
..... 吴远志,张国权(253)

深浅基坑设计分析及分析 肖敏(256)

政策规范

提升施工方案编制水平 防范化解重大安全风险
——住房和城乡建设部工程质量安全监管司
相关负责人解读《危险性较大的分部分项工程
专项施工方案编制指南》 (260)

2022年2月实施的工程建设标准 (261)

常任理事单位名单 (前插2)

理事单位名单 (前插3)

编委成员单位名单 (目次2)

封面工程 (目次3)

广告索引

广1 武汉市政工程设计研究院有限责任公司(封2)

广2 济宁聚丰机械有限公司(前插1)

广3 南塑建材塑胶制品(深圳)有限公司(后插1)

广4 《城市道桥与防洪》杂志公益广告(封3)

广5 青岛润邦防水建材有限公司(封4)

广6~26 《城市道桥与防洪》杂志(补白)

封面工程

本期封面工程为济南市望岳快速
路建设工程,由济南市市政工程设计
研究院(集团)有限责任公司设计,由
济南城建集团有限公司、济南黄河路
桥建设集团有限公司、中国电建市政
建设集团有限公司、中建八局第二建
设有限公司承建。

工程全长约 5.7 km,采用“隧道 +
高架桥 + 地面快速路”的组合形式,主
路采用双向 6 车道,辅路采用双向 6~8
车道,工程总投资 36.41 亿元。

该工程是完善济南市快速路网骨
架体系、支撑强省会战略的重大基础
设施建设工程。工程涉及道路、桥梁、
隧道、管廊等十多个专业,同时考虑隧
道与轨道、综合管廊等地下空间的统
筹,综合性强。其中:隧道为城市复杂
环境下的大跨度超浅埋超小净距隧
道;高架桥梁整体实现上部预制拼装,
节约工期;地面道路通过与绿道、园
林、驿站融合设计,构建了生态融合、
环境友好的设计典范。工程实施过程
中建立了城市道路工程 HSE 管理体
系,搭建了“人文关怀、智慧管理”平
台。建设过程中发布了国内第一部城
市道路工程文明施工规范,填补了国
内空白。

工程于 2018 年 11 月开工建设,
2020 年 5 月建成通车。

本刊声明

1. 来稿文责自负;对录用文章,本刊有权进行文
字性修改或文字、图片、表格删节,如有异议,
请事先声明。
2. 来稿一经刊用,视为作者已将其复制权、发
行权、信息网络传播权、汇编权等相关权利
授予本刊,如有异议,请事先声明。
3. 凡被本刊录用的文章,本刊均已通过万方检
测系统进行查重。如本刊发表之文章涉及版
权问题,请版权人与本刊联系。

Urban Roads, Bridges & Flood Control

(Monthly)

Number 3, 2022(Total Number 275)

CONTENTS

ROADS & COMMUNICATION

Study on Systematical Scheme of Road-Rail Co-constructed Urban Underground Expressway for Huanghe Avenue in Jinan ZHANG Chunguang (1)

Abstract: Taking Huanghe Avenue Expressway with the composite functions in Jinan as an example, from the perspectives of intensive utilization of underground space resources and service for urban development, the line direction, laying form, entrance and exit layout, and standard cross-section layout of road-rail co-constructed urban underground expressway are systematically studied, and the key nodes, structural engineering, disaster prevention and rescue, and intelligent transportation are specially analyzed and designed, which can provide some reference for the similar projects.

Keywords: road-rail co-construction, underground expressway, tramway, tunnel disaster prevention and rescue, intelligent transportation

Study on Planning and Design of Underground Road in Urban Core Area for Yizhou Avenue in Chengdu HU Changjun (6)

Abstract: With the continuous expansion of the city scale, the traffic demand in the core areas of the mega cities is strong, and the structural defects of the road network in the core area lead to the objective contradiction between the traffic demand and the road supply. By analyzing the connotation of urban core area, the land development characteristics and typical traffic problems of urban core area are studied and judged, and the planning strategy of underground road in the urban core area is put forward. Finally, taking the planning and design of the underground road in Yizhou Avenue in High-tech South District of Chengdu as an example, the planning and design schemes of underground roads in urban core area are formulated in order to provide the reference for the development of underground roads in the megalopolis core areas.

Keywords: urban core area, underground road, planning and design

Analysis on Construction Essentials of Urban Road in Mountainous Area Based on Planning and Design Collaboration for Huaguan Road in Guiyang CHEN Yongchun, ZHAO Jianxin, HUANG Jie, LIN Yang (12)

Abstract: In response to the national new-type urbanization strategy, mainly focusing on the urban construction projects, the construction of urban infrastructure is deeply promoted in the southwest urban area, the urban functions are put forth effort in the perfection, the urban quality is improved and the comprehensive carrying capacity of cities is reliably enhanced. Thus, the problems in the editing and revision of urban road planning, and the inconsistency of urban strategy development step are caused. Taking the south section of Huaguan Road in Guiyang City as an example, by analyzing and comparing the construction conditions and different schemes of the project, the design essentials of the road are further discussed under the synchronous condition of planning and design of urban roads in the mountainous areas.

Keywords: mountainous city, road design, planning and design collaboration

Research on Fast-track System of Cluster Cities for Taicang City

..... WANG Yong, YANG Kaijian, WANG Xiaojun (16)

Abstract: Based on the background of the integrated development of the Yangtze River Delta, taking Taicang City as an example, the fast-track distribution system of cluster cities is studied. Research shows that compared with the single-center cities, the traffic travel characteristics of cluster-type cities are significantly different. The cluster connections and intra-cluster traffic are the main features. The large-flow corridors basically follow the OD (origin destination) direction of the cluster, but there are a large number of suburb sections accompanied with certain tidal traffic phenomena in the middle. Studies have shown that it is completely feasible to construct the expressways in cluster cities. The route selection of expressways should take into account the group connection, and the main form is to serve the OD of large passenger transport. In addition, the end of the expressway can be connected with the express road (or trunk road) to extend the laying range of the express road, which can maximize the benefit of the facilities in the short term, and also quickly reconstruct the express road in the long term in order to realize the networked layout of the urban expressways.

Keywords: urban traffic, fast lanes, cluster cities, integration of the Yangtze River Delta, expressway, express road

Overall Design of Enshi City Jinlong Avenue (North Section) Road Project

..... WEI Shunbo, WANG Minggang (20)

Abstract: In order to build the north section of Jinlong Avenue (connecting line of Shanghai - Chengdu Expressway - Longfengba National Highway 318) located at the north of the central urban area of Enshi into a core infrastructure to guide and drive the development of the surrounding areas, firstly, the functional positioning and design concept of the road are determined according to the requirements of "ecology, modernity, smoothness and characteristics". On this basis, the horizontal and vertical designs of the road is introduced, the different cross-sectional layout forms adopted in the different sections of the road are specially introduced. The methods and design ideas adopted have the reference significance for the design of high-standard urban road in the mountainous areas.

Keywords: urban trunk road, ecological avenue, overall design

Discussion on Design of Pavement Structure of Urban Road Reconstruction Project

..... RUAN Tiefeng (24)

Abstract: Due to the huge change of environment before and after construction, the treatment of subgrade structure becomes a key point in the reconstruction design of the coastal urban roads, especially the secondary roads and arterial road with the large volume of traffic. Aiming at this situation, from the perspective of urban traffic situation analysis and the roadbed material intensity change, the design of pavement structure is analyzed, and combined with the examples, the treatment methods are put forward.

Keywords: road reconstruction, roadbed, concrete base

Upgrade and Reconstruction Design of Urban Roads in Chongli District of Zhangjiakou

..... YANG Yang, DONG Pingyang (26)

Abstract: Combined with Zhangjiakou City Chongli District Urban Road Upgrade and Reconstruction Project, the principles, implementation details and reconstruction scheme of upgrading the urban roads are introduced in detail, which can provide the reference for the similar reconstruction projects.

Keywords: urban road, upgrade and reconstruction, design principle

Research on Cross Section Design of Urbanization Reconstruction of Suburban Highway

..... LUO Jia (29)

Abstract: On the basis of analyzing the difference of service function between the suburban highway and municipal road, the basic principle of cross section design stage and the main influencing factors of decision making in the implementation of urbanization reconstruction of suburban highway are discussed. It is clear and definite that the highways after urbanized and reconstructed should be dominated by the

municipal use. And at the same time, it is suggested that Grade I and above highways are determined to be the four-carriageway roads and tow-carriageway roads, and Grade II and below highways to be the three-carriageway roads and single-carriageway roads after reconstructed in the stage of cross section design. Finally, each carriageway width is recommended.

Keywords: urbanization road, highway, carriageway width, urbanization reconstruction, cross section design

Maintenance Technology of Fiber Seal Coat on Asphalt Pavement of Municipal Road WANG Chang (32)

Abstract: In view of the continuous occurrence of asphalt pavement diseases of municipal road, the service life of the pavement is getting shorter and shorter. The properties of different kinds of materials in the fiber seal coat in the preventive maintenance technology of asphalt pavement are analyzed. The best selection principles for various materials are given. The technical properties and construction technological process of the fiber seal coat are analyzed. The reference is provided for the maintenance and repair of asphalt pavement of municipal roads.

Keywords: municipal road, asphalt pavement, fiber seal coat, preventive maintenance

BRIDGES & STRUCTURES

Study and Discussion on 800-m Variable Cross-section Concrete Filled Steel Tube Swallow-type Arch and Self-anchored Suspension Cable Composite Bridge WANG Guohua, XU Jinfa, CHEN Kai (35)

Abstract: In view of the demand of 800-m oversized span concrete filled steel tube (CFST) arch bridge, the composite bridge of single-plane double-curved variable cross-section CFST swallow-type arch and self-anchored suspension cable is proposed. The thrust of swallow-type CFST arch bridge and the tension of self-anchored suspension bridge are balanced, which forms a self-balanced structure system. The arch rib structure is the main force, and the self-anchored suspension cable system is the auxiliary force. The both work cooperatively and complement to each other. In addition, using the four-limb spatial truss arch rib structure with the single-plane double-curved variable cross-section CFST, the self-weight of arch rib segment in mid span is reduced, the risk and difficulty of mid-span segment hoisting construction are reduced, and the section size at the arch foot is increased so as to effectively reduce the mass center and stiffness center of the arch bridge structure, and to increase the stability of the composite bridge. This structural type of composite bridge is applied in the actual projects to carry out the engineering parameter design. Based on the established Midas finite element model, the internal force analysis and calculation, the modal analysis and the buckling analysis are carried out to verify the superiority of the structural technical measures.

Keywords: 800-m CFST arch bridge, single-plane double-curved variable cross-section CFST arch rib, swallow-type arch bridge, self-anchored suspension bridge, composite bridge

Design of Spatial-plane Landscape Cable-stayed Bridge Based on Egg-shaped Arch Pylon

..... LI Biqing, CHEN Kai (41)

Abstract: Aiming at the landscape design requirement of cable-stayed bridge, an egg-shaped arched pylon spatial-plane landscape cable-stayed bridge is proposed by using the mathematical equation of egg-shaped curve. Compared with the traditional parabolic arched pylon cable-stayed bridge, two arch legs of the egg-shaped arch bridge are closed, which reduces the size of the foundation, the top is wide, and three-dimensional spatial cables are distributed so that the landscape effect of the cable-stayed bridge is better. Combined with the actual project, the engineering parameters are designed. Midas finite element analysis model is established to carry out the static analysis and modal study. The result shows that the egg-shaped arched pylon spatial plane cable-stayed bridge has the good spatial structural stiffness.

Keywords: landscape cable-stayed bridge, egg-shaped arched pylon, spatial plane, stiffness of spatial structure

Analysis Method of Long-term Creep for Steel Box – Concrete Composite Curved Girder Bridge YANG Xiang, LI Yumo, ZHU Jingsong, WANG Zhenyang (45)

Abstract: In order to analyze the long-term creep law and its influencing factors of steel box – concrete composite curved beam bridge, the possible prevention and control measures are put forward. The finite element analysis model of steel box – concrete curved composite beam bridge is established by using ABAQUS finite element software. The simulation methods of support friction and slippage, long-term fine temperature field and vehicle centrifugal force are proposed respectively. The variation laws of tangential and radial displacement of the supports of curved beam bridge for two consecutive years under the combined action of these factors are analyzed. The theoretical basis is provided for the creep prevention of steel box – concrete composite curved girder bridge.

Keywords: steel box – concrete composite curved girder bridge, long-term fine temperature field, support friction slippage, creep

Overall Design of 210-m Through Steel-box Basket-type Bowstring Arch Bridge ZHANG Zhijian , LI Liang , TIAN Qing (51)

Abstract: The Tongshun River Bridge in Zuoan Avenue in Wuhan is a 210-m through steel-box basket-type bowstring arch bridge, and is an urban expressway bridge with the double-way six-lane traffic for pedestrians and non-motor vehicles. The main arch is a basket-type steel-box arch. The main girder is a "steel vertical and horizontal lattice beams + concrete deck slab" composite girder system. The main vertical beam is concurrently as the rigid tie beam. The flexible tie bar cables of steel strand are set in the box of the main vertical beam. The main structure is constructed by the incremental launching method. The design concept of the bridge scheme can provide the reference for similar projects.

Keywords: through, steel-box arch, composite beam, incremental launching method

Research on Overall Design of Qilu Yellow River Bridge in Jinan WANG Wei (55)

Abstract: The Qilu Yellow River Bridge is one of the "three-bridge and one-tunnel" strategic channels for the "northward crossing-river" development of Jinan, which directly connects the south bank group and the Sangzidian regional center in the north bank. The construction of the project is of important meaning for Jinan to realize the northward crossing development for the construction of the Yellow River New District, and the construction of the pilot area of new and old kinetic energy conversion. Based on the construction conditions and constraints of the bridge location, the technical conditions, engineering cost, environmental influence and the other factors are comprehensively considered. The route scheme, highway-railway co-construction mode and crossing-river scheme of Qilu Yellow River Bridge are compared and designed. The relevant experience and conclusions can be used as references for related projects.

Keywords: overall scheme, bridge crossing Yellow River, route comparison, highway-railway co-construction, comparison of bridge type

Research and Analysis on Reasonable Completion State of Bowstring Arch Bridge JIAO Mingdong, GAO Min, SONG Yu, SI Kui (60)

Abstract: The rationality of the completed state of bowstring arch bridge is directly related to the determination of the reasonable construction stage of the bridge and the safety of the operation stage of the completed bridge. By introducing the application of rigid supported continuous beam method, the minimum bending energy method and relative stiffness change method in the determination of reasonable completion state of bowstring arch bridge, and through the finite element analysis of a concrete filled steel tube bowstring arch bridge, the internal forces of suspender, tie bar and arch rib, and the displacement state of tie bar under the different calculation theories are compared and analyzed. The results show that compared with the other two methods, the relative stiffness change method can achieve the most reasonable state of arch bridge structural performance.

Keywords: bowstring arch bridge, reasonable bridge completion state, rigid supported continuous beam method, minimum bending energy method, relative stiffness change method

Study on Axial Tension Test of Wet Joint of Rebar Cross Lapped Deck Slab LI Dongming (64)

Abstract: The transverse joint of prefabricated bridge girder usually adopts the wet joint form of rebar cross lapped deck slab. But the calculation method of this connection mode needs to be improved, and there is no test data basis for its normal service performance. Therefore, the performance of wet joint of bridge deck under the different joint widths, reinforcement forms and joint material combinations is revealed through the axial tension test, which provides the test data for theoretical calculation methods and the reference for design.

Keywords: wet joint, rebar cross lap, prefabricated assembly

Discussion on Design of Anti-overturning Reinforcement and Reconstruction of Urban Single-pier Bridge
..... DU Jun (69)

Abstract: Single-pier bridge has the light structure, less land occupation and other advantages, and is widely used in urban interchanges and viaducts. In recent years, the overturning accidents of single-pier bridges occur frequently. The bridge managers pay more and more attention to the stability problems of single-pier bridge structure. Combined with the engineering practices of the anti-overturning reinforcement and reconstruction of single-pier bridges in Nanjing, the reinforcement and reconstruction principles of single-pier bridge are firstly determined, then the reinforcement and reconstruction schemes of the different bridge types are compared, and the design of anti-overturning reinforcement is optimized, and finally, how to reconstruct the bridges under the conditions of feature state 1 and feature state 2 is summarized.

Keywords: single-pier bridge, anti-pull-out device, anti-overturning stability coefficient

Design of Three-level Fall-proof System of Simple-supported Beam Bridge Spanning Fault Zone
..... LIU Yang (74)

Abstract: More than 40 percent of the land in China is located in the regions with the earthquake intensity 7 degrees and above. With the rapid development of traffic infrastructure construction, the bridge construction is inevitably to span the high earthquake intensity of regions, even the active fault zones. The fall beam has become one of the most common and serious bridge damages during the earthquake. Therefore, the fall-proof design must be carried out for the bridges spanning the fault zones on the basis of fully analyzing the earthquake resistance of structures. Combined with the fall-proof design of a large bridge in Wangjiacun Village, the three-level fall-proof system of simple-supported beam bridge spanning the fault zone is put forward including the three parts of the support system, the inhibiting device system and fall-proof length system. The "three-level fortification" strategy of the system is adopted to prevent the main girder falling, which can provide the reference for the fall-proof design of the simple-supported beam bridges in the high-intensity regions, especially spanning the fault zones.

Keywords: bridge spanning fault zone, fall-proof system, inhibiting device

on Effect of Middle Diaphragm in Precast Concrete Small-box Girder Structure HUANG Jie (77)

Abstract: With the rapid development of prefabrication technology in China, the precast concrete small-box girders have been widely used. The middle diaphragm in precast concrete small-box girder greatly increases the on-site construction difficulty, construction time and engineering cost. The necessity of the middle diaphragm is to be further discussed. Based on an engineering example of 30 m+30 m simple-supported variable continuous pre-stressed concrete small-box girder, the virtual beam element method is used to establish a three-dimensional Midas Civil finite element model to analyze the influence of the middle diaphragm on the internal force of the structure. The results show that the installation of the middle diaphragm has little effect on the deflection under live load and bending moment of the side beam of the small-box girder, which makes the thickening place of the side beam web of small-box girder produce the adverse shear force and corresponding torque. Therefore, it is more unfavorable to check the shear and torsion bearing capacity of the minimum section of small-box girder.

Keywords: middle diaphragm, prefabricated concrete small-box girder, side beam, checking calculation, shear and torsion bearing capacity, minimum section

Design of Bridge and Culvert above In-operation Subway DENG Xia, XU Hui (80)

Abstract: Based on the situation of the design of the new bridge above the in-operation subway in the design of the Jieyun Avenue (Jingjiu Road – Jiuxiang River East Road), the problems met in the design and the response methods are sort out and summarized, and the requirements are put forward for construction so as to provide the reference for the other projects. Considering the reduction of the construction difficulties in the bridge design, the detours are avoided, and the design is continuously supplemented and perfected on the basis of the project.

Keywords: bridge design, above subway, construction requirement

FLOOD CONTROL & DRAINAGE

Study on Layout Design Model of Storage Facilities KE Hang (83)

Abstract: In order to determine the layout method of storage facilities up to standard, three drainage systems with the different drainage characteristics are selected, and the general rules of the layout of storage facilities are studied. The calculation results of the model show that the layout of storage facilities up to standard mainly depends on the location of the waterlogging in the drainage system. The layout of storage facilities at the upstream of the waterlogging location can obtain a good effect of waterlogging reduction. According to the research results, the evaluation index of the storage facility layout and the corresponding layout planning and design method of storage facilities based on the potential of waterlogging reduction are put forward, which provides a reference for the planning, layout and design of storage facilities up to standard.

Keywords: storage facilities, layout design, waterlogging reduction, drainage system model

Design of Integrated Prefabricated Rainwater Pumping Station and Its Storage Tank DENG Weidong (86)

Abstract: The integrated prefabricated rainwater pumping station has the advantages of small floor area, short construction period and high integration degree. At present, it is widely used in municipal engineering, especially in the engineering construction of urban prosperous areas. Due to the shortage of land and relatively high requirements of ground landscape, this kind of rainwater pumping station shows its unique advantages. As a rainwater drainage pumping station, the construction of storage tank is an effective way to improve its drainage standard. In the actual operation, the discharge of the pumping station can be adjusted according to the rainfall to avoid the impact of the concentrated flow of the pumping station on its downstream drainage system, which reflects the design concept of "sponge city and low-impact development". In the specific design, the relationship between the water levels of the collecting tank and the storage tank of the pumping station is used to design the runoff distribution facilities, and comprehensively utilize the space of storage tank, which is the key design point of integrated prefabricated rainwater pumping station.

Keywords: integrated, rainwater pumping station, storage tank, design

Analysis on Design Essentials of Tianjin Expressway Drainage Project

..... HUANG Jun, SHI Rucui, QIAO Jiangang (90)

Abstract: Taking the Tianjin Outer Ring Northeast Line Drainage Project as an example, combined with the characteristics of expressways in Tianjin, the division principle of expressway drainage system, and the selection principle of rainwater system design standard are introduced. The design schemes of water outlet, water collection at bridge head sloping point, drainage of the viaduct area, drainage pipeline crossing highway and the other key points are analyzed so as to provide the reference for improving the design of the expressway drainage in Tianjin.

Keywords: Tianjin, expressway, drainage design, water outlet, drainage of viaduct area

Study on Construction Scheme of Zhongqiao Reservoir in Langxi County

..... LI Jiehua, YANG Yong, WANG Lijun, XING Shaojia (93)

Abstract: The proposed Zhongqiao Reservoir is a small-sized reservoir. The necessity and task of the project construction are analyzed. The method of earth excavation and backfill in the reservoir area to decrease the engineering land is put forward. By comparing and selecting the land, sediment accumulation, hydraulic layout, water supply, flood control, investment and the other factors, the water level characteristics of the reservoir are determined in order to provide the reference for the construction of the similar reservoirs in the other areas.

Keywords: Langxi County, Zhongqiao Reservoir, flood control, water supply

Analysis on Stress Distribution Characteristics of Folded-line Baseplate of Pump Gate Project

..... REN Huachun, CHEN Zailian (97)

Abstract: Taking a largest-scale drainage pump gate built for operation in Shanghai as an example, the material mechanics method, the combinatorial algorithm of material mechanics and rigid body balance, and the finite element method are used to calculate and study the stress concentration phenomenon of the base stress of folded-line baseplate in soft soil area is studied at the folded place. The stress distribution characteristics of base stress of the folded-line baseplate are analyzed and obtained. Through the sensitivity analysis of the base stress under the different upper loads, the folded-line inclination, subgrade elastic modulus and other influencing factors, the change law is summarized, which provides a reference for the optimization design of similar engineering structures.

Keywords: drainage pump gate, folded-line baseplate, base stress, formula method, elastic-plastic finite element

Research of Sludge Yield in WWTP with Seasonal Variation

..... LIU Rui, YU Zhijie, LIN Min, XU Qiang, GUO Songjie, JIN Fei (101)

Abstract: Sludge yield can be calculated by the empirical sludge yield and sewage treatment volume. Due to the change of influent quality and the difference of operation control, the sludge yield of the same WWTP will be different with the seasonal variation. By the investigation, survey and study of four typical wastewater treatment plants (WWTP) in Hangzhou, the rule of sludge yield with the seasonal variation is analyzed at first, and then the specific influencing factors on the sludge yield are further explored from three aspects of influent COD concentration, influent SS concentration and operating water temperature. Research results show that the sludge yield in spring of WWTPs is higher than in the other three seasons, and the sludge yields in summer and autumn are relatively lower. There is a great correlation between sludge yield and influent COD. The sludge yield increases with the increment of COD value. When the influent SS concentration is high, the sludge yield is relatively higher.

Keywords: sludge yield, seasonal variation, influencing factor

Study on Technology of Sludge Extraction without Removing Membrane in a Large Sludge Landfill

..... YE Yuanxin, DU Jiong, LIU Ruoyuan (104)

Abstract: During the period of non-standardized landfill of sewage sludge in WWTP, a large amount of WWTP sludge is dumped into in a simple landfill. As time goes by, the stability of landfill and the environmental pollution have been concerned. How to safely and stably dispose the landfill sludge to the other places has become a new environmental problem. Aiming at this problem, the technology of desilting robot to desilt under membrane is used to carry out the pilot test of desilting sludge in the sludge library. The feasibility of the technology of desilting robot under membrane to treat the landfill sludge is discussed. The study result shows that the technology of desilting robot under membrane can be applicable to the desilting process of landfill sludge. If the landfill sludge library is overlarge, the desilting can be carried out by subareas. The transition of intermediate buffer pool can be used to improve the desilting stability. The desilting under membrane is required with the process of multiple removing impurities convenient for the conveyance and follow-up disposal. The technology of desilting robot under membrane is one of the effective ways to dispose the landfill sludge to other place. The technical requirements of deep sludge desilting need to be further studied.

Keywords: sludge, landfill, sludge desilting

Analysis on Discharge Capacity of Hydraulic Tunnel Based on Implicit Scheme of 1D Flow Characteristics
..... HOU Jie, WANG Jue, GU Wei, CAO Kun, ZHOU Ya (108)

Abstract: Based on the characteristic implicit scheme method suitable for the combined simulation of unpressurized flow and pressurized flow in the water conveyance system, considering the hydraulic characteristics of the inlet box culvert section, the box culvert transition section, the tunnel section and the outlet box culvert section, the corresponding characteristic boundary is derived. The transient flow analysis model of the current tunnel system is established to calculate and analyze the steady flow and unsteady flow of the system. The discharge capacity of the system under the typical water level combination and the hydraulic characteristics of the typical section are specially analyzed.

Keywords: hydraulic tunnel, discharge capacity, transient flow, 1D water flow characteristics

Study on Design Scheme of Bridge Deck Runoff Collection and Treatment across Water Source Protection Area
..... ZHOU Cheng (111)

Abstract: The higher requirements are put forward for the design of bridge deck drainage in the water source protection area. The design process of the bridge deck runoff collection and treatment system across the water source protection area is illustrated through the engineering design example. The comparison scheme for the bridge deck runoff collection and treatment system of the super large bridge is put forward. At the same time to solve the problems of drainage and environmental protection, the reasonable design suggestions for the bridge deck longitudinal slope and structural form are proposed, which plays a certain reference role for the design of similar projects.

Keywords: water source, bridge deck runoff, drainage, design

MANAGEMENT & CONSTRUCTION

Study on Hydration Heat of Massive Concrete of Anchorage of Guojiatuo Yangtze River Bridge
..... TAN Shuangquan, LI Renliang, XIONG Guikai, ZHU Xiaolong, HU Qi (114)

Abstract: Gravity anchorage is a typical massive concrete structure. The hydration heat during construction should be strictly controlled to avoid the temperature cracks. Taking the anchorage of Guojiatuo Bridge as an example, the hydration heat is analyzed out before construction and the corresponding temperature control measures for massive concrete are formulated. Through the field monitoring, all indexes meet the standard limits, and no concrete temperature cracks are found, which proves the efficiency of temperature control measures and ensures the quality of concrete.

Keywords: anchorage, massive concrete, hydration heat, temperature control

Research on Construction Planning Scheme of Longdong Avenue Expressway Outer Ring Interchange in Shanghai
..... LIU Haifeng (119)

Abstract: Longdong Avenue is located in Pudong New District, Shanghai, and is an important east-west passage in the expressway network system of Shanghai, in which the node of Outer Ring Road is the important traffic node of Longdong Avenue. It is proposed to reconstruct it into a hub-type full interchange. Based on the traffic flow survey before the reconstruction of this node and the design scheme of the interchange reconstruction, two construction schemes of staging closing and full closing are designed, and are compared and selected from the perspective of the influences on the construction period and traffic. Finally, the full-closed construction scheme with the largest benefits is selected. At the same time, based on the construction scheme, and aiming at the traffic flow into and out of Outer Ring, the traffic organization in the construction period is designed.

Keywords: Longdong Avenue, Outer Ring Road, construction planning, comparison and selection

Study and Analysis on Construction of Urban Viaduct without Supports ZHENG Jianwen (124)

Abstract: In recent years, the urban population has shown an increasing trend due to the continuous development of urbanization. In the meantime, since the number of motor vehicles increases with the

population, the congestion of urban traffic is getting serious. The elevated expressway is widely used because of its small land occupation, powerful three-dimensional traffic function and other advantages. The construction of urban viaducts will inevitably have negative influences on the current traffic. As a result, it is necessary to carry out the research on the construction and design of the viaduct structure without supports, which is aimed at the study on application characteristics of the different structural forms and construction schemes in the construction of elevated bridges. The reference can be provided for the design and construction of the similar structures in the future.

Keywords: urban transportation, elevated expressway, three-dimensional traffic, construction without support, structural design

Deflection Control of Cantilever Construction Based on Adaptive Kalman Filtering

..... ZHANG Fuling, WANG Dong, JING Hao, WANG Yin-hui, XIAO Guangliang (127)

Abstract: Deflection is an important object controlled in the cantilever construction of continuous rigid-frame bridge. Its measured value is affected by many factors. It is of great significance to obtain the actual deflection of reflecting the structural stress from the measured deflection values in the construction control. Real signals are extracted from the measured deflection values by the improved adaptive Kalman filtering algorithm method to predict the deflection change of girder section to be poured. The construction camber is adjusted to make the actual state of construction approximate the theoretical calculation track and to achieve the construction monitoring. The application of practical engineering proves that this method has the good applicability.

Keywords: cantilever construction, continuous rigid-frame bridge, adaptive Kalman filtering, construction control, deflection

Research on Construction Technology of Socket-type Disc-buckle Steel Pipe Scaffold in Central Urban Area

..... DENG Xinwei, ZHANG Pengfei, WANG Lei (131)

Abstract: With the rapid development of economy and society, the society has put forward higher requirements for the construction of bridges in central urban areas, especially in terms of landscape coordination, environmental protection and construction efficiency. The conventional bracket construction methods have been difficult to meet the requirements, and it is necessary to research and develop a construction technology with higher efficiency, environmental performance and better landscape performance. The socket-type disc-buckle steel pipe scaffold has the advantages of high rigidity, high strength, good landscape and environmental protection performance, and is the direction of the future development of the scaffold construction in the central urban areas. Based on the main line elevated bridge project in Puzhou Road of Pukou District in Nanjing, the construction technique and technology of the socket-type disc-buckle steel pipe scaffold in the central urban area are studied.

Keywords: central urban area, bridge, scaffold

Jacking Replacement Construction Technology of Damaged Support in Shanghai Middle Ring Elevated Bridge

..... JIANG Yanfeng (134)

Abstract: After on-the-spot survey, it is found that various diseases appear in the supports of Shanghai Middle Ring Elevated Bridge. The diseases of bridge support if allowed to develop further may affect the safe traffic of vehicles. In order to solve the hidden safety hazards of bridge structure, the 500-t three-link ultra-thin jack single-pier jacking technique is used quickly to replace the damaged supports. This method can more adapt to the characteristics of low clearance from the cushion to pier top, narrow layout area of jack at pier top and large jacking force demand on the Middle Ring Elevated Bridge. And this method can effectively save the cost, and minimize the damage of the original bridge structure, and even the influence on traffic organization.

Keywords: urban elevated bridge, damaged support, jacking, 500-t three-link ultra-thin jack

Transverse Strengthening Method of T-girder Bridge and Its Application

..... YAN Guoqi (139)

Abstract: The transverse strengthening method of T-girder bridge is introduced. Combined with a bridge

strengthening case of Wuhan, the application of the transverse strengthening method how to change the flange pin joint of old T-girder bridge to rigid joint, how to strengthen the diaphragm and how to add the pre-stressed crossgirder, and the strengthening effects are introduced in details, which can be referred for strengthening the similar T-girder bridges.

Keywords: T-girder bridge, transverse strengthening, Civil/Midas software, Dr. Bridge Computing Software

Application of Double-row Piles in Foundation Pit of Underground Garage of Pizhou High-speed Railway Station YANG Shangqing (141)

Abstract: With the development of the national high-speed railway construction, the construction number of high-speed railway stations is constantly increasing. When the high-speed railway station house is implemented before the underground garage, the construction of foundation pit of underground garage must ensure the construction space and structural safety of early implemented station house. The basic situation of Pizhou Railway Integrated Hub is analyzed, and the enclosure of underground garage is discussed. Finally, the double-row pile enclosure scheme is determined. By analyzing the influence of different pile lengths, pile diameters and pile spacing on the lateral displacement of pile top, the appropriate parameters of retaining pile are determined. The practical application result shows that the double-row piles meet the engineering needs of underground garage and can provide a good reference for similar projects.

Keywords: high-speed rail station, underground garage, foundation pit, double-row piles

Inspection and Evaluation of Low-pylon Cable-stayed Bridges in In-service Rail Transit ZHANG Zhili, CUI Xin (144)

Abstract: Taking the detection and evaluation of a low-tylon cable-stayed bridge in in-service rail transit as an example, the loading features of the low-tylon cable-stayed bridge are analyzed and the key points of the regular inspection of the low-tylon cable-stayed bridge are determined. The measurement of the dead-load geometry of the main girder, main pylon and pier column shows that the low-tylon cable-stayed bridge remains stable as a whole, and there is a tendency to settle in the middle of main girder. The dynamic features and dynamic response of the bridge are defined through the tests of natural vibration characteristics, stayed cable force and dynamic displacement of the bridge. Through the visual inspection, the defects of the concrete structure of the main girder and the main pylon, and the present situation of the anchor head of the stayed cable are clarified. The inspection process and methods of this project can provide a reference for the inspection and evaluation of similar rail transit bridges.

Keywords: low-tylon cable-stayed bridge, detection and evaluation, geometry, dynamic feature, visual inspection

Research on Monitoring Ecological Slope of Expressway in Flood Detention Area ZHANG Junfeng, CHEN Yonghao, XUE Danxuan, ZHU Xiaodong (147)

Abstract: Relying on an actual project of ecological slope protection project in the western section of Tianjin-Shijiazhuang Expressway, the subgrade slope stability test and ecological monitoring test in the flood detention area are designed and carried out to verify and analyze the slope stability and ecological effect, which provides the technical reference and practical experience for the design and construction of ecological slope protection for subgrade slopes in flood detention areas. The research results show that the stability and ecological effect of the new ecological slope protection are better than the traditional slope protection, and the new ecological slope protection technology has a wide range of application prospects.

Keywords: flood detention area, expressway, ecological slope, monitoring

Evaluation and Analysis on Impact of Potential Landslide on Safety of Bridge Pile Foundation YANG Kai (152)

Abstract: In order to rationally evaluate the impact of potential landslide on the engineering safety of bridge pile foundation in an expressway project, through the field survey, the human factors and natural factors affecting the engineering safety of bridge pile foundation in the gully area are put forward. These factors are

the position of pile foundation, the waste earthwork and waste slag around pile foundation, the degree of construction specifications, the monitoring awareness, the protective measures, the rock-soil properties around pile, the relative height difference, the slope, the vegetation coverage, the maximum daily rainfall, the seismic intensity and the others. By further combined with the analytic hierarchy process, the fuzzy comprehensive analysis method, the expert scoring method, etc., the safety evaluation of the bridge pile foundation is carried out, and the safety degree of the supporting project is determined to be "II", that is, the degree of danger is medium. The relevant conclusions can provide the targeted guidance for the supporting projects.

Keywords: gully area, bridge pile foundation, security technology, analytic hierarchy process, evaluation index

A Review on Detection Method of Sleeve Connection of Prefabricated Segmental Assembly Structure

ZHU Jun (156)

Abstract: With the gradual promotion of the application of prefabricated segmental assembly structures in China, as a reliable rebar connection of segmental assembly, the grouting sleeve is widely used in bridge construction. The defects easily caused in the current use of reinforced grout sleeve connection and its effects are introduced. In view of these problems, several main detection methods are introduced. The detection principles are briefly expounded. The detection effect and the application range are summarized. And the requirements for these detection methods in the existing specifications are concluded. Meanwhile, taking a practice project as an example, some monitoring measures are put forward for the quality control in the construction of sleeve connection.

Keywords: grout sleeve, ultrasonic, impact echo method, X-ray method, nondestructive testing

Monitoring, Measuring and Analysis of Foundation Pit Excavation and Construction of Commercial Office Building in Shanghai

ZHOU Wei (160)

Abstract: Taking the foundation pit project of a commercial office building in Shanghai as the background, aiming at the impact of foundation pit excavation on the surrounding ground settlement, ground diaphragm wall, water level and enclosure structure, the whole process of monitoring and measuring during the excavation process is carried out, and its rule is analyzed. The research results show that the surrounding ground settlement increases at different rates with different excavation depths of the foundation pit. The settlement of the upper part of the excavated foundation pit is slower, and the settlement rate increases at the middle and lower layers of excavation. The excavation of the foundation pit causes the less displacement at the up and down of the ground diaphragm wall and larger displacement at the middle, and the largest deformation is located at the lowest bottom of the foundation pit. The excavation of the foundation pit causes the surrounding groundwater level dropping rapidly. The water level outside the pit rises again and stabilizes until the end after the completion of closing construction of lining wall. The supporting axial force increases with the increment of excavation depth of foundation pit. The supporting axial force gradually stabilizes after the baseplate pouring of foundation pit.

Keywords: foundation pit monitoring, ground settlement, ground diaphragm wall, groundwater level, support

Numerical Analysis on Influence of High-speed Railway Shield Tunneling on Adjacent Piles

ZHANG Jie (164)

Abstract: Relying on Haihe Tunnel of Tianjin-Weifang High-speed Double-line Railway tunneling the existing municipal bridge, by studying the influencing rule of the shield construction process on the settlement of ground surface and the deformation of municipal bridge pile, the whole process of shield tunneling is simulated by using the finite element software Midas/GTS NX. The simulation results show that the settlement velocity of the ground surface increases when the high-speed railway tunnel is tunneled near the municipal bridges. The location of the maximum surface settlement is not near the pile foundation of bridge. The pile foundation is prone to inward inclination when the tunneling is through the end of the piles in bad geological conditions. The displacement value of the same row of piles is basically the same. The

horizontal displacement of the pile end is greater than the pile top. And the horizontal displacement of the front pile under the same pier abutment is less than that of the rear pile, and the vertical displacement is greater than that of the rear pile.

Keywords: high-speed railway tunnel, existing bridge, numerical analysis, horizontal displacement, settlement

Discussion on Design of Shield Tunneling under Pile Foundation of Existing Footbridge in Weak Soil Layer

..... XU Shubin, WAN Song (168)

Abstract: In the design of the subway shield tunneling under the reinforced concrete pile foundation of the existing footbridge in weak soil layer, the passive underpinning is carried out for the pile foundation of footbridge by expanding the foundation, and at the same time, the pine pile is used to reinforce the weak soft layer at the bottom of the expanded foundation in the limited space under the bridge. Combined with the measures of strengthening the reinforcement of shield segment and setting up the temporary ground underpinning support, After the shield machine directly cuts the pile foundation for tunneling, it is ensured that the ground footbridge meets the normal use, and the strength and rigidity of high-reinforced concrete segment all meet the requirements. The integrated treatment method avoids the demolition and secondary construction of the footbridge, and has great economic and social benefits, which provides a good reference for similar projects.

Keywords: passive underpinning, soil layer reinforcement, segment reinforcement, underpinning support, cutting pile foundation

Research on Tunneling Technology of Shield Machine in Small Headroom, Upper-soft and Lower-hard Stratum

..... LI Zuoren, ZHOU Humeng, JIN Li (172)

Abstract: Based on the segmental tunneling technology of shield machine in a subway area, its study is carried out. The segmental tunneling technology by four times can only be selected for the shield construction because of narrow space in this area for tunneling. The design length of the shaft as the only starting shaft for the shield construction in this area is 18 m. And this shaft is near a mountainous body and its construction space is limited. The site is hard to meet the requirements of the overall tunneling condition of conventional shield. It is required to adopt the segmental tunneling technology. The practice has proved that the segmental tunneling technology of shield machine can solve the difficulties of shield tunneling in the "small headroom, upper-soft and lower-hard stratum", reduce the restrictions of shield tunneling condition, optimize the design and decrease the land acquisition, which is beneficial to construct the urban rail transit. The segmental tunneling technology of shield machine can break the restrictions of the upper-soft and lower-hard silt geology and the narrow site, is the useful supplement of shield construction technology, and has the important reference for the shield construction of urban tunnel engineering.

Keywords: small headroom, segmental tunneling, semi-ring tunneling, upper-soft and lower-hard stratum

STUDY ON SCIENCE & TECHNOLOGY

Influence of Soil Relative Density on Performance of Geocell Reinforced Sand Foundation

..... YANG Hui, DING Zhihui, CAI Yuanjie (177)

Abstract: In order to study the influence of the relative density of the foundation on the reinforced performance of geocells, the loading tests are carried out on the models with five different relative densities (30%, 40%, 50%, 60% and 70%) of geocell reinforced sand foundations and unreinforced sand foundations to study the bearing capacity settlement curves, bearing capacity improvement coefficients, roadbed deformation and subgrade settlement, and the distribution of reinforced tensile strain for the different relative densities of soil foundations. And the mechanism action of geocell reinforced sand foundation is analyzed. The results of the tests show that the reinforced geocell can effectively improve the rigidity, bearing capacity and load distributing level of the foundation in the wide range of relative density. The deformation rule of the filling surface and sand foundation show that the relative dimensions of the used

model box and foundation can overcome the boundary effect so as to achieve the better test results.

Keywords: reinforced foundation, geocell, relative density, model test, bearing capacity

Evaluation on Fatigue Performance of Orthotropic Steel Bridge Deck Reinforced by UHPC under Random Vehicle Load Flow YOU Yongxue (182)

Abstract: Fatigue cracking is one of the common diseases of orthotropic steel bridge deck, which is closely related to the excessive stress amplitude of key details caused by the large stiffness of bridge deck pavement. Using UHPC to improve the stiffness of bridge deck pavement is an important means to alleviate fatigue stress. In order to study the fatigue performance of key details under the action of actual traffic flow, taking a cable-stayed bridge of highway spanning Luohe River as an example, the analysis on the stress influence surface of structural details of the steel-UHPC composite paved orthotropic steel deck is carried out, and the loading analysis on the structural details is carried out by the actual traffic flow of monitoring records to obtain its stress spectrum. Based on Miner fatigue damage equivalent principle, the maximum stress amplitude, equivalent stress amplitude and fatigue loading times are calculated and obtained. The results show that UHPC to reinforce the deck pavement can significantly reduce the stress of structural details, improve the mechanical behavior of structural details, and significantly reduce the stress amplitude of structural details on the deck slab so that the maximum stress amplitude recorded by the structural details of longitudinal rib - deck slab weld and the deck slab butt weld is less than the constant amplitude fatigue limit.

Keywords: orthotropic steel deck, fatigue life, UHPC, random traffic flow

Study on Strength Loss and Pore Structure of High-performance Concrete with Mineral Admixtures under Thermal Curing WANG Xiaoyan, LI Feng, YUE Yang, FANG Shun (186)

Abstract: In order to study the influence of thermal curing on the later strength and microstructure of high-performance concrete with mineral admixture, the strength test and pore structure analysis of high-performance concrete with mineral admixture are carried out in the different constant temperature durations and the different temperatures of curing. The results show that compared with the standard curing, the thermal curing can quickly increase the early strength of concrete, but the higher the thermal curing temperature, the longer the thermal curing time, the greater the damage to the later strength of the concrete and the greater the porosity. The strength loss at 80°C thermal curing for 48 h after transferring to standard curing for 28 d is 4.4 times that at 50° C, and the total porosity is 1.091 times. Compared with the standard curing and the natural curing, the post-curing method is to use Ca (OH)₂ saturated aqueous solution curing, which can improve the later strength and pore size distribution of the thermal cured concrete to a certain extent.

Keywords: thermal curing, early strength, strength loss, pore structure

Finite Element Analysis on Bonding Properties of Concrete Interface LI Yunhu, XIONG Chang, PAN Cheng (190)

Abstract: There are many experimental studies on the bonding interface between ultra-high performance concrete (UHPC) and normal concrete (NC). However, there are still few researches on how to effectively simulate and analyze the relevant parameters in the finite element software. The large-scale finite element analysis software ABAQUS is used to establish a finite element model to simulate the bonding interface between UHPC and NC by the cohesion element. And the bonding properties of UHPC-NC interface at the different levels of interface roughness are analyzed by modifying the parameters of the cohesion model. The finite element models of direct shear and oblique shear tests are established, and the interfacial friction coefficient is deduced by using the Mohr Coulomb theory. The results show that the simulation of UHPC-NC interface by cohesion element can well reflect the actual mechanical performance.

Keywords: bridge, blasting load, dynamic response, damage, finite element analysis

Study of Effect of Interface Pollution on Fatigue Performance of Asphalt Beam ZHANG Yilin (194)

Abstract: To discuss the effect of interlayer interface pollution on the overall usability of asphalt

pavement, the asphalt beams composited of the different mixtures with interlayer interface are used to carry out the shear strength test and four-point bending fatigue test. Taking the machine oil pollution and loess pollution as the Pollution sources, the amount of pollution is adjusted to simulate the pollution conditions possibly existing in the construction. Its interlayer shear strength and the overall fatigue life are measured in the different construction conditions. The test results show that: (1) for the sensibility of various factors influencing the interlayer shear strength, the sensibility of machine oil pollution is higher than that of loess pollution. (2) Under the same test conditions, the fatigue life of composite beams decreases significantly with the increase of the amount of pollution, and gradually stabilizes after a certain extent. (3) Under the same amount of pollution, the effect of machine oil on the interlayer bonding performance is greater than that of loess pollution. (4) According to the loss of bending stiffness modulus, when the amount of pollution reaches a certain level, the interlayer adhesion of composite beams will be lost.

Keywords: road engineering, pollution source, asphalt beam, four-point bending test, loss of bending stiffness modulus

Study on Stress and Design of Long-span "Trough + Box" Continuous Concrete Girder

..... YAN Xiaowei (197)

Abstract: Aiming at the special structural system and the unclear stress behavior of the 35 m+50 m+35 m long-span "trough + box" compound section continuous concrete girder in a highway-rail co-construction project, a three-dimensional solid model is established by using ANSYS finite element software to study its stress behavior, and the suggestions are proposed for the design. The study shows that (1) the "trough + box" compound section satisfies the plane cross-section assumption. (2) There are significant differences in shear force distribution of the side/middle webs of trough and box compound sections in different sections and the same section. (3) The stress concentration is obvious at the junction between the side web and the bottom plate of the trough part. (4) The reinforcement at the junction between the side web and the bottom plate of the trough part should be strengthened, and the envelope design of the reinforcement at the cantilever root and the mid-span of the deck slab can be carried out.

Keywords: "trough + box" compound section, stress behavior, ANSYS finite element model, structure design

Finite Element Analysis on Bearing Capacity of Multi-row Combined Shearing Force Connector

..... ZHANG Cheng, WU Peifeng, ZHANG Yichun, ZHANG Ruoyu (201)

Abstract: In order to study the influences of stud diameter, cut-through rebar diameter, holing aperture and hole number of multi-row combined shearing force connector on the anti-shear bearing capacity and the load-slippage curve, ABAQUS software is used to establish the combined shearing force connector model to compare and validate its feasibility with the existing tests. On this basis, the multi-row combined shearing force connector model is established to carry out the parameter analysis. The result shows that the increment of hole number, holing diameter, cut-through rebar diameter and stud diameter can effectively improve the anti-shear bearing capacity of the combined shearing force connector. In which, if the hole number is below 4, there is no interaction between various holes, and the bearing capacity increases linearly with the number of holes. The diameter of cut-through rebar lower than 16 mm has little influence on the bearing capacity of combined shearing force connector. When its diameter increases from 16 mm to 20 mm, the bearing capacity of component is obviously improved. There is no relationship of linear increment between the stud diameter and bearing capacity. Based on the superposition principle the computational formula of bearing capacity for multi-row combined shearing force connector is established. The calculated values are in good agreement with the numerical calculation results.

Keywords: combined structure, multi-row shearing force connector, finite element model, load-slippage curve, anti-shear bearing capacity

Research and Practice of Advanced Water Exploration Prediction of Prefabricated Shield Tunnel

..... HU Xintao, XU Shujun, ZHOU Kun, LIU Chenglong, YAO Qifa (205)

Abstract: In order to solve the technical difficulties of making the advanced water exploration predictions in prefabricated shield tunnels, the theoretical research of geophysical field is systematically carried out to demonstrate the advantages and disadvantages of various methods. And the experiments are carried out for the segmental lining structure of shield tunnel to improve the advanced water exploration prediction method, which can be used as a reference for the other researchers. The experimental results show that through the improvement of the CFC observation method, the electromagnetic interference caused by the metal machines and tools in the tunnel can be avoided. The water content of the surrounding rock in front of the cutter head of the shield machine is comprehensively predicted.

Keywords: water gushing of shield tunnel, water gushing of subway tunnel, bad geology, advanced water exploration, segment tunnel water exploration, mud inrush prevention

Study on Algorithm of Unblocked Reliability of Urban Underpass YANG Dan, WANG Fu (209)

Abstract: The analysis and Calculation of unblocked reliability of urban underpass are very important to the accessibility and safety of the road network in the whole city. By analyzing the existing study results, the operation characteristics of urban underpass are studied. Several calculation methods of urban underpass reliability are proposed, which are based on the underpass functions, saturation, traffic flow density and traffic flow statistics. Taking East Lake Channel in Wuhan as an example, it is proved that the reliability of the East Lake Channel calculated by the algorithm is consistent with the traffic conditions obtained by the actual investigation. The result shows that it is practical to analyze the operation state of urban underpass by using unblocked reliability.

Keywords: traffic engineering, urban underpass, unblocked reliability, calculation model

APPLICATION OF ACHIEVEMENTS

Digital Application of Underground Interchange Engineering in Urban Complex Environment

..... LIU Panpan, LI Qianwen (213)

Abstract: Aiming at the characteristics of high technical difficulty, limited construction period, complex hydrogeological conditions, various surrounding important infrastructures and high requirements for construction personnel management in the construction of underground interchange projects in the urban complex environment, the overall implementation route of digital construction of the project is explored. And relying on Songhu Road – Sanmen Road Lower Grade Separation Project, the scheme planning, interference checking, key technological construction simulation and multi-source data integration application are carried out based on 3D refinement model, which provide the effective construction guidance for project construction. At the same time, the data integrated management platform of wisdom site is studied and developed to realize the intelligent supervision of site and effectively enhance the construction management level of project.

Keywords: underground interchange project, urban complex environment, digital application

Application of BIM in Design of Composite Girder Arch Bridge Based on Dassault 3DE Platform

..... XIONG Shuhua (217)

Abstract: With the continuous development of bridge technology, the form of arch bridge changes daily, which greatly increases the difficulty of the design. Taking the Shenshan Bridge Project as an example, based on the idea of parametric and template design in the deepening design stage, Dassault 3DE platform (2015x) is used to establish a complete set of composite girder arch bridge component library including the main arch, girder, suspender, pier and abutment foundation and deck accessories, and the BIM modeling of the whole line of bridges is completed. Based on BIM model, the design verification is aided. Docking with structural calculation and analysis, the model components are unified and coded, and the component information is extracted. Combined with the digital sand table of GIS, a complete set of digital deliverables is formed, which provides a basis for transferring data in the construction, operation and maintenance stages.

Keywords: parametric modeling, Dassault 3DE platform, composite girder arch bridge, design verification

Application of BIM Technology in Design of Municipal Supporting Project in Airport LIU Huajie (223)

Abstract: With the growing maturity of 5G, AI, cloud computing, Internet of Things and other high-tech, the infrastructure industry ushers in a period of rapid development of digital transformation. As a demonstration project of civil aviation type-4 airport, all participants are required to vigorously promote the digital construction of Ezhou Huahu Airport at the initial stage of project in order to accumulate the practical experience for the construction of the type-4 airport and assist the high-quality development of the airports in China in the new era. Taking the Ezhou Huahu Airport Municipal Supporting Project as an example, the application of BIM Technology in the design stage of the municipal supporting project is specially introduced to realize the full professional BIM forward design, and to carry out various applications based on the digital twin model, which provide the basic data support for the construction of the digital airport.

Keywords: municipal engineering, BIM application, BIM technology, forward design

Application of BIM Technology in EPC Engineering Design of Urban Pump and Sluice

..... YOU Mengtao, PAN Fei (228)

Abstract: With the development of economy and society, the surrounding environment of urban pump and sluice is becoming more and more complex. The rationality, advantage and overall coordination of the design scheme are becoming more and more important. Combined with an EPC project of a large urban pump and sluice in Haikou City, BIM Technology is used to model the surrounding environment and pump and sluice engineering. And through the model data, the impact on the surrounding environment and the feasibility of the construction scheme are analyzed to verify the rationality of the design scheme, which provides a reference for the urban pump and sluice projects in other regions.

Keywords: BIM, urban pump and sluice, EPC engineering design

THE RELATIVE SPECIALITIES

Study on Planning and Layout of Urban Underground Utility Tunnel in Xinghua City of Jiangsu Province

..... WANG Aiheng (232)

Abstract: The specific construction conditions of the utility tunnel in Xinghua are deeply studied. The targeted long-term scheme and the short-term scheme as well as the pilot and flexible development strategies of the new district are put forward, which reduce the construction cost of utility tunnel to a certain extent, is closer to the actual situation of urban development and is more flexible, and have the stronger reference significance for the cities with the similar characteristics.

Keywords: utility tunnel, planning and layout, flexible development

New Thought about Utilization of Abandoned Railway to Construct Utility Tunnel for Wujiu Railway

..... LIU Changgeng, WANG Hailiang, ZHANG Bin (237)

Abstract: Taking Jiangnan Center Greenway Wujiu Railway Utility Tunnel as an example, the thought and method of constructing the large-sectional utility tunnel project in the central urban area are introduced and expounded. The relation of utility tunnel crossing the rail traffics, bridges and existing open channels is introduced, and the relevant countermeasures and suggestions are put forward in order to provide the reference for the similar engineering projects.

Keywords: utility tunnel, node, greenway, pipelines into utility tunnel

Differential Settlement and Leakage Risk of Sewage Treatment Tank Induced from Construction and Environmental Factors

..... WANG Yingyi, XU Weizhong, LIU Xianglong (241)

Abstract: In view of the deformation characteristics of foundation and its caused concrete structure rupture and leakage risks of large sewage treatment tank, the deformation characteristics of foundation under the artificial precipitation, excavation, pile foundation reinforcement and coast tidal groundwater infiltration are studied, and the basic equation of foundation deformation and the unified function expression under the comprehensive influence of multiple factors are established. Combined with Shanghai Bailonggang

Wastewater Treatment Plant Project, the foundation deformation possibly caused by the construction and environmental factors of the engineering area and its adverse effect on the structural stress are analyzed. The results show that the curvature of foundation deformation has a direct influence on the stress of the structure. The smaller the curvature radius is, the greater the additional stress and the higher the crack risk of the structure. The higher the structure height is, the more sensitive the response to foundation bending deformation is. And the stress concentration degree is high and the risk of local stress overrun increases at the abrupt change of bending stiffness of the structure.

Keywords: differential deformation of foundation, engineering and environmental factors, additional stress of structural deformation, crack and leakage risk

Analysis on Impact of Floor Deformation on Design of External Wall in Large Underground Space Structure BAI Jiong, CHI Heng (246)

Abstract: In the underground space structure, the rationality of the external wall design will directly affect the engineering cost and structural safety. In building the overall model, it is usually assumed that the large underground space slab is infinite rigid in the plane. But for these situations, such as floor slab with side span opening, discontinuities slab, smaller stiffness ratio of wall and slab, the articulation still used at the connection of external wall and floor slab does not conform to the practical stress of slab wall. If the in-plane stiffness of floor slab is smaller than the bending resistance of the external wall in practical engineering, the mid span bending deformation of the external wall in the underground structure and the in-plane deformation of support plates are larger, which will lead to the internal force redistribution of the external wall. In case not considering, the larger calculation error will be caused. Therefore, when the plate wall is calculated and analyzed, the boundary condition of the external wall is actually a spring support with stiffness variation. In the design, the corresponding reinforcement measures should be taken according to the results of finite element calculation. Based on the underground space construction project in the north square of Rizhao Integrated Passenger Station, the finite element calculation is carried out for its external wall. The optimization design scheme of exterior wall structure for deep buried large space structure is put forward.

Keywords: large underground space, in-plane stiffness of floor slab, internal force redistribution of external wall, structure design

Structural Design of Large-scale Full Underground Rigid Landfill LI Yan (250)

Abstract: Through an engineering example, the key points of structural design of a large full underground rigid landfill in Sichuan are analyzed. Combined with the design process, the buttress retaining wall and box section cantilever retaining wall are applied to the full underground rigid landfill. The stress states of the two retaining walls in the landfill are analyzed, which provides a sufficient basis for the design selection and reinforcement design of the cross section. Based on the site conditions, the bottom plate of landfill is designed by subzone according to the different stress conditions, and the economic efficiency and engineering reliability are also balanced.

Keywords: rigid landfill, buttress retaining wall, box section

Analysis and Technical Discussion on Flood Control Emergency System of Urban Tunnel WU Yuanzhi, ZHANG Guoquan (253)

Abstract: In recent years, the extreme weather events are frequently, and there are serious flood disasters in many cities. Guangzhou is located in the southernmost part of China and has the abundant rainfall all the year round. The rainstorm weather in Guangzhou is more frequent and destructive than in the past. And there are many instantaneous rainfalls exceeding the historical extremes, which cause the serious pressure on the road traffic in Guangzhou, especially for the safety of urban tunnels. The project team has made relevant research on the flood control emergency of the tunnel project under the municipal roads in Guangzhou. It is proposed that when the water in the tunnel reaches the warning water level, the signal light will be on, and the barrier gates will be automatically put down at both ends of the tunnel to prohibit the vehicle traffic. The brief introduction of tunnel drainage, and the objectives and principles of tunnel flood control emergency design

are proposed. Combined with the application analysis of the system, the necessity of flood control emergency system in the new urban tunnel projects and the existing urban tunnel projects are proposed, and its application is discussed.

Keywords: urban underpass tunnel, flood control, emergency system, principle, design, discussion of application

Design and Analysis of Deep and Shallow Foundation Pits XIAO Min (256)

Abstract: Taking the design of deep and shallow foundation pits in Shanghai Yanggao Road Tunnel Project as an example, the enclosure structure of foundation pit is modeled and analyzed by PLAXIS finite element software and Frws7 design software. The result shows that the calculated results of the internal force and deformation of enclosing piles of deep and shallow foundation pits obtained by the above two kinds of software are larger than the final measured results of the foundation pit. It is explained that the design method is safe and reliable.

Keywords: tunnel, deep and shallow foundation pits, finite element

.....

Excellent Journal of the Ministry of Housing and Urban-Rural Development, PRC

Urban Roads, Bridges & Flood Control

Monthly

Number 3, 2022 (Total Number 275)

Publication on March 15th, 2022

Start Publication in 1984 Issuance Scope: Domestic and International Issuance

Governing Body: Ministry of Housing and Urban-Rural Development, PRC

Sponsor: Shanghai Municipal Engineering Design Institute (Group) Co., Ltd.

Edition and Publication: Editorial Office of "Urban Roads, Bridges & Flood Control"

Editor-in-chief: LUO Yanni

Address: 901 Zhongshan Bei Er Road, Shanghai, China

P.C.: 200092

Tel.: (021)55008850

Fax: (021)55008850

Website: <http://www.csdqyf.com>

E-mail: cdq@smedi.com

China Standard Serial Numbering: $\frac{\text{ISSN } 1009-7716}{\text{CN } 31-1602/U}$

Domestic Price: RMB 25 Yuan

润邦®

桥梁防腐涂装 请找青岛润邦



»» 公司简介

青岛润邦防水建材有限公司是一家集科研、生产、施工、服务于一体的复合型发展的民营科技企业。拥有国家防水防腐保温工程专业承包一级资质，致力于建筑防水防腐材料、路面养护材料的研究开发和应用。公司以优质的防水材料为基础，积累了二十几年的防水施工经验，培养了大批防水施工专家。现可承接各种大型建筑防水防腐工程，以及公路、铁路桥梁防水防腐、路面养护等工程。

»» 主营产品

路桥防水养护材料：

- ◎ JBS环保型桥梁防水涂料
- ◎ JBS-C沥青路面养护涂料
- ◎ JBS-1500高渗透结晶型硅烷防水剂
- ◎ FYT-1改进型沥青防水涂料
- ◎ RBS速熔快通路面灌缝胶
- ◎ 牢巴路瓶装尖嘴式冷灌缝胶

硅烷防水防腐系列产品：

- ◎ GW-301异丁基三乙氧基硅烷浸渍液
- ◎ GW-302膏体硅烷
- ◎ 硅烷防腐防水涂料
- ◎ 环氧基硅烷改进型浸渍液
- ◎ SHJS高渗透改性环氧聚碳硅氧烷系列产品

邮编：266321
 传真：0532-86202378
 地址：青岛胶州市洋河工业区
 官网：<http://www.runbang.cn/>
 E-mail: runbang2008@163.com
 专家咨询：0532-86200474
 客服电话：0532-86200051
 0532-86201314

广告

