# ISTTCA 2024

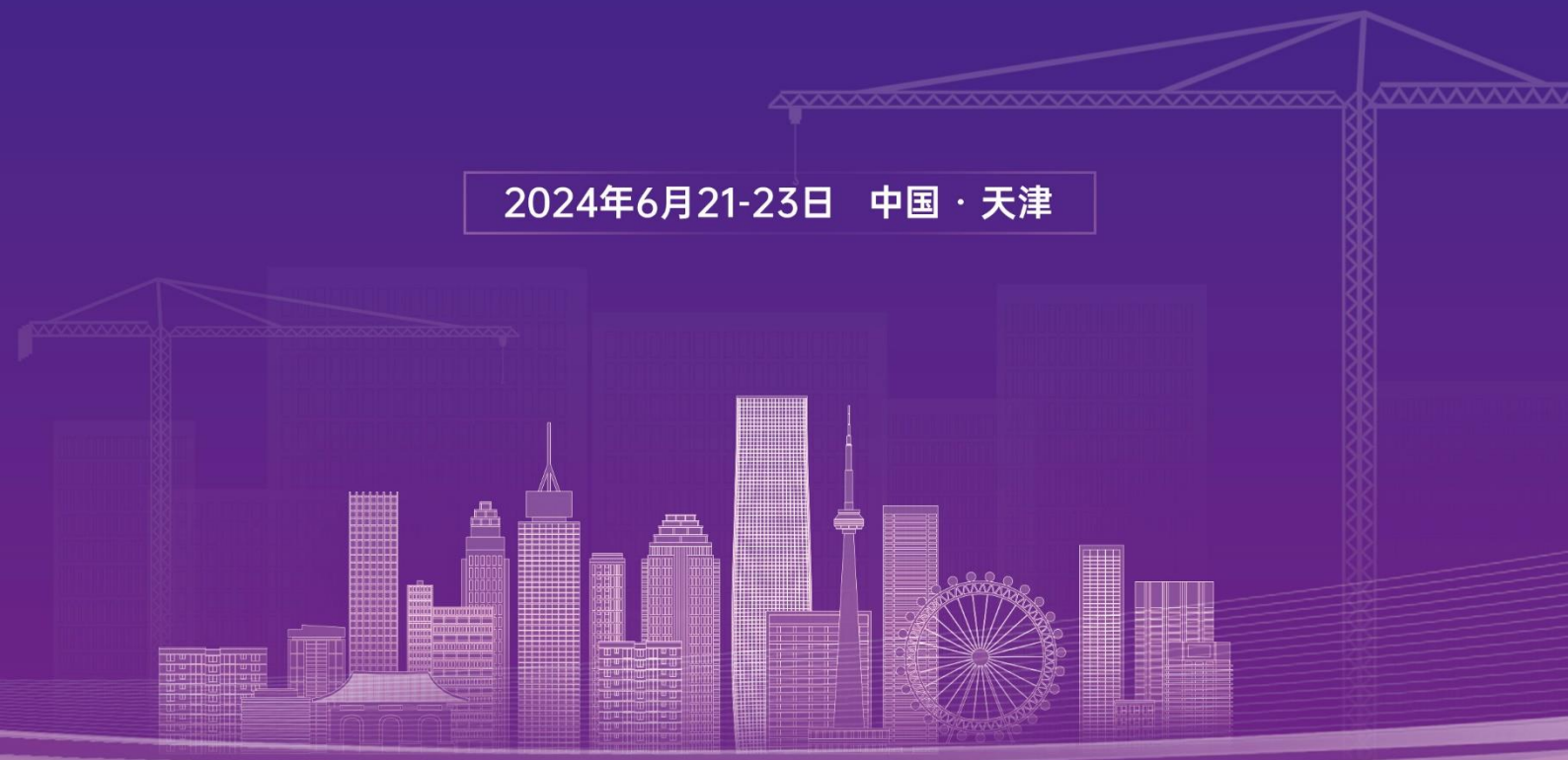
# 第七届交通运输与土木建筑国际学术论坛

# 2024 7th International Symposium on Traffic Transportation and Civil Architecture

# 会议手册

# Conference Manual

2024年6月21-23日　中国 · 天津



## 会址信息

天津1958国际酒店(国家会展中心津南大学城店)

6月21日（报道注册） 1楼大堂

6月22日 上午（大会报告） 1楼凡尔赛厅

6月22日 下午（分会场报告）土木工程与材料科学专场：1楼凡尔赛厅

交通运输与物流管理专场：1楼加来厅

## 交通信息

距离港研院：约7.5公里，15分钟

距离天大北洋园校区：约7公里，15分钟

距离天津滨海国际机场：约20公里，35分钟

距离天津站：约23公里，40分钟

距离天津西站：约29公里，55分钟

距离天津之眼摩天轮：约28公里，45分钟

距离天津古文化街（津门故里）：约20公里，40分钟

# 目录
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# 组织单位 Organizations

**主办单位 Hosts**

天津大学
Tianjin University

中交天津港湾工程研究院有限公司
Tianjin Port Engineering Institute Co., Ltd. of CCCC First Harbor Engineering Co., Ltd.

**协办单位 Co-organizers**

天津市水运工程学会
Tianjin Water Transport Engineering Association

中国航海学会水运工程专业委员会
Water Transport Engineering Committee of the China Institute of Navigation

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Key Laboratory of Port Geotechnical Engineering, Ministry of Communications

交通运输部天津水运工程科学研究院
Tianjin Research Institute for Water Transport Engineering, M.O.T.

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Tianjin Chengjian University

天津理工大学
Tianjin University of Technology

西安理工大学
Xi`an University of Technology

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Jinfang Hou, Professor-level Senior Engineer, Tianjin Water Transport Engineering Association, China

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# 大会报告议程-1楼凡尔赛厅
## Keynote Speeches

| | | |
|---|---|---|
| 9:00-9:15 | 领导致辞 大会合影 | **Opening Ceremony & Group Photo** |
| 9:15-9:45 | 吕玺琳 教授 同济大学<br>《复杂条件下砂层盾构隧道开挖面失稳模型试验及数值模拟研究》 | **Xilin Lü, Professor, Tongji University**<br>*Experimental Study and Numerical Simulation of the Instability of Shield Tunnel Face in Sand Under Complex Conditions* |
| 9:45-10:15 | 王乐 副研究员/正高级工程师，天津大学<br>《漂浮式风电大型螺旋锚基础非定常旋压安装过程受力机理研究》 | **Le Wang, Associate Researcher and Senior Engineer, Tianjin University**<br>*Study on the Force Mechanism of Non-steady Rotational Installation Process of Large-scale Helical Anchor Foundations for Floating Wind Turbines* |
| 10:15-10:30 | 茶歇交流 | **Tea Break** |
| 10:30-11:00 | 梁超 高级工程师 天津大学<br>《变径井筒复合桩承载力及结构完整性研究》 | **Chao Liang, Senior Engineer, Tianjin University**<br>*Research on Bearing Capacity and Structural Integrity of Composite Piles with Variable-Diameter Shafts* |
| 11:00-11:30 | 董智超 高级工程师 中交第一航务工程局有限公司、中交天津港湾工程研究院有限公司<br>《复杂条件下曲线柔性管节海底隧道设计施工关键技术研究》 | **Zhichao Dong, Senior Engineer, Tianjin Port Engineering Institute Co., Ltd of CCCC First Harbor Engineering Co., Ltd.**<br>*Key Design and Construction Technologies for Curved Flexible Pipe-Jointed Undersea Tunnels under Complex Conditions* |
| 11:30-12:00 | 刘旭 工程师 中交第一航务工程局有限公司<br>《深中通道岛隧工程建设成套关键技术及应用》 | **Xu Liu, Engineer, CCCC First Harbor Engineering Co., Ltd.**<br>*Comprehensive Key Technologies and Applications in the Construction of the Shenzhen-Zhongshan Bridge Island-Tunnel Project* |
| 12:00-14:00 | 午餐&休息 | **Lunch Break** |

# 土木工程与材料科学专场-1楼凡尔赛厅
## Session on Civil Engineering and Material Science

| | | |
|---|---|---|
| 14:00-14:15 | 张瑞棋 中交天津港湾工程研究院有限公司<br>《深厚软土地基围堰填筑对桥梁桩基侧向挤压影响分析》 | **Ruiqi Zhang, Tianjin Port Engineering Institute Co., Ltd. of CCCC First Harbor Engineering Co., Ltd**<br>*Analysis of the Influence of Deep Soft Soil Foundation Cofferdam Filling on Lateral Compression of Bridge Pile Foundations* |
| 14:15-14:30 | 周桥 南昌职业大学<br>《公路隧道工程超前锚杆支护机理研究及应用》 | **Qiao Zhou, Nanchang Vocational University**<br>*Research and Application of Advance Bolt Support Mechanism in Highway Tunnel Engineering* |
| 14:30-14:45 | 江佳正 中交天津港湾工程研究院有限公司<br>《回收碳纤维对高强混凝土力学性能及微观结构的影响》 | **Jiazheng Jiang, Tianjin Port Engineering Institute Co., Ltd. of CCCC First Harbor Engineering Co., Ltd.**<br>*Effect of Recycled Carbon Fiber on Mechanical Properties and Microstructure of High Strength Concrete* |
| 14:45-15:00 | 刘桂泽 中交天津港湾工程研究院有限公司<br>《软岩大变形隧道二衬受力研究》 | **Guize Liu, Tianjin Port Engineering Institute Co., Ltd. of CCCC First Harbor Engineering Co., Ltd.**<br>*Study on the Secondary Lining Force of Soft Rock Tunnel with Large Deformation* |
| 15:00-15:15 | 赵彦虎 长安大学<br>《考虑主应力轴旋转的含盐冻土本构模型》 | **Yanhu Zhao, Chang'an University**<br>*A Bounding Surface Model for Frozen Sulfate Saline Silty Clay Considering Rotation of Principal Stress Axes* |
| 15:15-15:30 | 陈之淋 西南科技大学<br>《涪江流域青义段地质构造条件下基础选型与优化研究》 | **Zhilin Chen, Southwest University of Science and Technology**<br>*Study on Foundation Selection and Optimization in Qingyi Section of Fujiang River Basin Under Geological Structure Condition* |
| 15:30-15:45 | 张帆 河海大学<br>《抽水蓄能电站厂房爆破开挖围岩稳定性分析》 | **Fan Zhang, Hohai University**<br>*Analysis of Stability of Surrounding Rock in the Blasting Excavation of Pumped Storage Power Station Powerhouse* |
| 15:45-16:00 | 何卓岭 西南交通大学<br>《基于DEM的土石混填路基压实质量控制》 | **Zhuoling He, Southwest Jiaotong University**<br>*Compaction Quality Control of Soil-Rock Mixture Subgrade Based on DEM* |
| 16:00-16:15 | 王家兴 重庆大学<br>《光伏阵列风荷载特性及荷载分布研究》 | **Jiaxing Wang, Chongqing University**<br>*Wind Load Characteristics and Load Partition Study of Photovoltaic Array* |
| 16:15-16:30 | 曾正强 同济大学<br>《数字图像地层模型的生成和应用》 | **Zhengqiang Zeng, Tongji University**<br>*Modeling and Application of Digital Image Stratigraphy* |
| 16:30-16:45 | 龚诗灿 上海海事大学<br>《县道X917洋洲村大浣段公路施工图设计》 | **Shican Gong, Shanghai Maritime University**<br>*County Road X917 Yangzhou Village Dahuan Section of Highway Construction Drawing Design* |
| 16:45-17:00 | 卢冰 重庆大学<br>《长寿区岩石工程性质的统计特征》 | **Bing Lu, Chongqing University**<br>*Statistical Characterization of the Geotechnical Properties of Changshou Rock* |

# 交通运输与物流管理（6月22日） -1楼加来厅
## Session on Transportation and Logistics

| | | |
|---|---|---|
| 14:00-14:15 | 李琳 交通运输部路网监测与应急处置中心<br>《基于多源数据融合的分层复合式高速公路车辆精准识别》 | **Lin Li, Highway Monitoring & Response Center, Ministry of Transport of the PRC**<br>*Hierarchical Composite Highway Vehicle Precise Identification Based on Multi-Source Data Fusion* |
| 14:15-14:30 | 郭晶晶 湖南大学<br>《基于深度学习和RGBD摄像机的钢筋间距的自动质量检查》 | **Jingjing Guo, Hunan University**<br>*Automatic Quality Inspection of Rebar Spacing Using Vision-Based Deep Learning with RGBD Camera* |
| 14:30-14:45 | 李成谦湖南大学<br>《基于人工智能的施工安全风险管理》 | **Chengqian Li, Hunan University**<br>*AI-Based Construction Safety Risks Management* |
| 14:45-15:00 | 刘春燕 北京建筑大学<br>《感应磁场作用下水凝胶流体的输运与磁扩散数值模拟》 | **Chunyan Liu, Beijing University of Civil Engineering and Architecture**<br>*Numerical Simulation on Transport and Magnetic Diffusion of Hydrogel Fluid under Induced Magnetic Field* |
| 15:00-15:15 | 刘振亮 石家庄铁道大学<br>《交通网络应急响应韧性智能评估与调度方法》 | **Zhenliang Liu, Shijiazhuang Tiedao University**<br>*Intelligent Emergency-response Resilience Assessment and Recovery Scheduling of Transportation Networks* |
| 15:15-15:30 | Shilimi Moono 长安大学<br>《Smart Road Network in Urban Freight Transport for Sustainable City Logistics》 | **Shilimi Moono, Chang'an University**<br>*Smart Road Network in Urban Freight Transport for Sustainable City Logistics* |
| 15:30-15:45 | 李墨琦 北京交通大学<br>《中美交通运输方式的国际比较分析》 | **Moqi Li, Beijing Jiaotong University**<br>*International Comparative Analysis of Transport Modes in China and the United States* |
| 15:45-16:00 | 石赟 兰州交通大学<br>《考虑跨线列车的运行图与天窗一体化模型与算法》 | **Yun Shi, Lanzhou Jiaotong University**<br>*Integrated Optimization Model and Algorithm for Timetable and Maintenance Window Considering Cross-Line Trains* |
| 16:00-16:15 | 孟帅杰 上海海事大学<br>《基于系统动力学的无动力船拖带评估》 | **Shuaijie Meng, Shanghai Maritime University**<br>*System Dynamics-Based Towing Assessment for Unpowered Vessels* |
| 16:15-16:30 | 张宪艺 上海海事大学<br>《基于船舶领域及碰撞危险度的避碰研究》 | **Xianyi Zhang, Shanghai Maritime University**<br>*Research on Collision Avoidance Based on Ship Domain and Collision Risk* |
| 16:30-16:45 | 杨凯 上海海事大学<br>《基于 NSGA-II 算法的海运空箱调运优化》 | **Kai Yang, Shanghai Maritime University**<br>*Optimization of Maritime Empty Container Repositioning Based on NSGA-II Algorithm* |
| 16:45-17:00 | 罗文杰 宁波诺丁汉大学<br>《沸石基原位碳化技术的环境可持续性评价》 | **Wenjie Luo, University of Nottingham Ningbo China**<br>*Environmental Sustainability Evaluation on Multiple Zeolites Based In-Situ Carbonation in Portland Cement Composite* |
| 17:00-17:15 | 岳亮 大连海事大学<br>《基于自动靠离泊场景的激光雷达目标检测》 | **Liang Yue, Dalian Maritime University**<br>*LiDAR Target Detection for Automatic Berthing and De-berthing Scenarios* |

## 交通运输与物流管理（6月22日）-1楼加来厅
## Session on Transportation and Logistics

| | | |
|---|---|---|
| 17:15-17:30 | 吉鑫淼 上海海事大学<br>《碳税和政府补贴背景下的船公司减排策略研究》 | **Xinmiao Ji, Shanghai Maritime University**<br>*Research on Emission Reduction Strategy of Shipping Companies Under the Background of Carbon Tax and Government Subsidies* |
| 17:30-17:45 | 李永佳 上海海事大学<br>《医药冷链物流库存与配送协同优化设计——以上海国药冷链物流为例》 | **Yongjia Li, Shanghai Maritime University**<br>*Collaborative Optimization Design of Inventory and Distribution in Pharmaceutical Cold Chain Logistics——taking Shanghai Guoyao Cold Chain Logistics as an Example* |
| 17:45-18:00 | 张延凯 北京航空航天大学<br>《一种考虑异质客户行为生鲜品配送车辆路径问题的进化算法》 | **Yankai Zhang, Beihang University**<br>*A Memetic Algorithm for Vehicle Routing Problem with Fresh Food and Heterogeneous Customer Behavior* |

# 专家简介
## Brief Introduction

## 吕玺琳 教授
## 同济大学

Xilin Lü, Professor, Tongji University

同济大学地下建筑与工程系教授、博导、地基基础工程研究所所长，入选国家高层次人才青年计划。主要从事软土地下工程、数字化智能施工、岩土体渐进破坏、高性能数值算法等方面研究。主持国家重点研发计划国际合作项目、国家自然科学基金项目5项，承担其他国家及省部级项目等20余项。获省部级及全国行业学（协）会科技进步一、二等奖10余项，获黄文熙-陈宗基岩土力学奖青年奖。发表SCI、EI论文100余篇，主编著作教材2部，获国际国内专利30项，参编国家、地方及行业标准规范4部。兼任美国土木工程师学会（ASCE）计算岩土专委会委员，国际土协（ISSMGE）-TC214、TC222通讯委员，中国岩石力学与工程学会岩土地基与结构工程分会常务理事，中国建筑学会工程诊治与运维分会理事等。担任《Geoenvironmental Disasters》副主编、《应用基础与工程科学学报》、《地基处理》编委、《中国公路学报》等期刊青年编委。

Xilin Lü is a professor, a doctoral advisor at the Department of Underground Construction and Engineering of Tongji University, the director of the Institute of Foundation Engineering as well as a national high-level young talent. Professor Lü is mainly engaged in soft soil underground engineering, digital intelligent construction, progressive failure of geotechnical bodies, and high-performance numerical algorithms. He has presided over five national key projects, including National Key Research and Development Programs for International Cooperation and the National Natural Science Foundation of China, and has undertaken more than 20 other national and provincial projects. He has been recognized with plentiful awards, such as over 10 first and second prizes for scientific and technological progress from provincial and ministerial levels and national industry associations and the Huang Wenxi-Chen Zongji Youth Award in Geotechnics. Boasting over 100 publications to his credit, Professor Lü has authored two books, obtained 30 international and domestic patents, and contributed to the editing of four national, local, and industry standards and specifications. He is a member of the Computational Geotechnical Committee of the American Society of Civil Engineers (ASCE), a communication committee member of the International Society of Geotechnical Engineering (ISSMGE) - TC214 and TC222, an executive director of the Geotechnical Foundations and Structural Engineering Branch of the Chinese Society of Rock Mechanics and Engineering, and a director of the Engineering Diagnosis, Treatment, and Operation & Maintenance Branch of the Architectural Society of China. Additionally, Professor Lü also serves as an associate editor of Geoenvironmental Disasters, an editorial board member of the Journal of Applied Basic and Engineering Sciences and Foundation Treatment as well as a youth editorial board member of journals such as the China Journal of Highway and Transport.

# 专家简介
## Brief Introduction

题目：复杂条件下砂层盾构隧道开挖面失稳模型试验及数值模拟研究
Title: Experimental Study and Numerical Simulation of the Instability of Shield Tunnel Face in Sand Under Complex Conditions

摘要：盾构隧道工法在软土地区得到广泛采用。在盾构隧道施工过程中，维持开挖面稳定性至关重要。一旦开挖面失稳，将引起地层变形过大甚至坍塌，进而影响邻近设施。报告针对盾构隧道穿越的砂性地层存在初始各向异性、地下水渗流以及土性劣化等复杂条件下，通过模型试验和数值数值模拟，对盾构隧道开挖面稳定性进行深入研究，系统性分析了这些因素导致的开挖面失稳破坏模式改变及极限支护压力变化等，研究成果可为相关工程的设计和施工安全控制提供理论支撑。
Abstract: The shield tunneling method is widely adopted in soft soil areas. Maintaining the stability of shield tunnel faces is crucial during the tunneling process because the instability of excavation surfaces may lead to excessive soil deformation or even collapse, thereby affecting nearby facilities. Therefore, this report focuses on the stability of shield tunnel faces under complex conditions, including initial anisotropy, groundwater seepage, and soil degradation in the sandy strata. Through model tests and numerical simulations, we systematically analyzed the destabilization damage modes of shield tunnel faces and the changes in ultimate support pressure caused by these factors. The research results provide theoretical support for the design and construction safety control of related projects.

# 专家简介
## Brief Introduction

## 王乐 副研究员/正高级工程师
## 天津大学

Le Wang, Associate Researcher and Senior Engineer

Tianjin University

王乐博士毕业于天津大学，获得博士学位；现任天津大学建筑工程学院副研究员，正高级工程师；主要从事海洋基础与土体相互作用方面研究，包括非定常旋压安装下螺旋锚基础的受力机理、倾斜循环荷载作用下螺旋锚基础的承载性能、分层土中的大直径单桩溜桩机理等研究。

Le Wang earned his Ph.D. from Tianjin University, where he currently serves as an Associate Researcher and a Senior Engineer at the School of Civil Engineering. Dr. Wang's research is dedicated to the interaction between marine foundations and soil, with a particular emphasis on the force mechanisms of helical anchor foundations during non-steady rotational installation, the load-bearing performance of these anchors under inclined cyclic loads, and the behavior of large-diameter single piles and group piles in stratified soils.

题目：漂浮式风电大型螺旋锚基础非定常旋压安装过程受力机理研究
Title: Study on the Force Mechanism of Non-steady Rotational Installation Process of Large-scale Helical Anchor Foundations for Floating Wind Turbines

摘要：非定常旋压安装是大幅降低螺旋锚安装扭矩及压力的创新手段，揭示非定常旋压安装过程中螺旋锚受力机理，是确保其在漂浮式风电工程中成功应用的核心科学问题。
本次汇报将介绍团队近期关于该问，开展的物理模型试验及数值模拟工作，同时汇报未来计划开展的相关研究工作。研究成果将为漂浮式风电工程中大型螺旋锚基础的精细化设计提供理论支撑和有效解决策略。
Abstract: The non-steady rotational installation method offers an innovative technique aimed at substantially reducing the torque and pressure during the installation of helical anchors. Revealing the force mechanisms involved in this process is a critical scientific issue for the effective deployment of helical anchors in floating wind turbine projects.
This presentation discusses the team's recent work, including physical model experiments and numerical simulations related to this technique, highlighting future research directions. The outcomes of this research provide essential theoretical support and practical strategies for the optimized design of large-scale helical anchor foundations in floating wind turbine applications.

# 专家简介
## Brief Introduction

## 梁超 高级工程师
## 天津大学

Chao Liang, Senior Engineer, Tianjin University

天津大学建筑工程学院博士后，助理研究员/高级工程师。主要从事海洋工程桩基承载特性、海洋岩土与结构物相互作用方面的研究工作。以第一/通讯作者身份，发表SCI/EI期刊论文13篇，授权专利10项。主持国家重点研发计划项目子课题、天津市自然科学基金在内的国家/省部级课题3项及工程类项目4项。参编2部行业规范编写，相关研究成果获得省部级科技进步奖2项。

Dr. Chao Liang is a postdoctoral researcher and Assistant Researcher/Senior Engineer at the School of Civil Engineering, Tianjin University. His primary research interests include the load-bearing characteristics of marine engineering pile foundations and the interaction between marine geotechnics and structures. As the first or corresponding author, he has published 13 papers in SCI/EI-indexed journals and holds 10 authorized patents. He has led three national and provincial projects, including sub-projects of the National Key Research and Development Program of China and the Tianjin Natural Science Foundation, as well as four engineering projects. Additionally, he has contributed to the drafting of two industry standards and has been awarded two provincial science and technology progress awards for his research achievements.

题目：变径井筒复合桩承载力及结构完整性研究

Title: Research on Bearing Capacity and Structural Integrity of Composite Piles with Variable-Diameter Shafts

摘要：我国具有“边、小、碎”特点的边际油田总体储量高，但受成本制约尚未得到全面开采。井筒作为平台支撑结构时附加轴向荷载与井筒内采油热载耦合作用下的桩-土相互作用机制与荷载传递机理尚不明确，导致井筒承载性能无法有效评估，制约了其在边际油田平台建造中的应用。针对由隔水导管、表层套管与固结水泥组成的超长变径复合桩结构，开展了附加荷载作用下的桩身荷载传递机制研究，揭示了桩身应力及承载力的演化规律；建立了考虑变截面效应的井筒复合桩承载力计算方法和桩-土非线性作用曲线，同时探讨了轴压-热载耦合作用对井筒复合桩承载力的影响；最后基于承载力现场静载试验，验证了井筒复合桩承载力计算方法的适用性。

Abstract: China’s marginal oil fields, characterized by their “marginal, small, and fragmented” nature, have substantial total reserves but remain underdeveloped due to cost constraints. When wellbores serve as support structures for platforms, the interaction mechanisms between the pile and soil and the load transfer mechanisms under additional axial loads and coupled thermal loads within the wellbore are not well understood. This lack of clarity hinders the effective evaluation of the load-bearing performance of wellbores, limiting their application in the construction of marginal oil field platforms. This study focuses on composite piles with ultra-long variable-diameter shafts, which are composed of conductor pipes, surface casings, and cement grout. We investigated the load transfer mechanisms within the pile shaft under additional loading, uncovering the stress and bearing capacity evolution patterns of the pile shaft. We developed a method for calculating the bearing capacity of composite piles considering the variable cross-section effect and established a non-linear pile-soil interaction curve. Additionally, we explored the impact of coupled axial and thermal loads on the bearing capacity of composite piles. Finally, through static load testing in the field, we validated the applicability of the bearing capacity calculation method for wellbore composite piles.

# 专家简介
## Brief Introduction

董智超，高级工程师
中交第一航务工程局有限公司
中交天津港湾工程研究院有限公司
Zhichao Dong, Senior Engineer,
CCCC First Harbor Engineering Co. Ltd.,
Tianjin Port Engineering Institute Co., Ltd. of CCCC First Harbor Engineering Co., Ltd.

同济大学土木工程博士，中交集团第一届青年托举人才，就职于中交一航局技术中心。深入参与大连湾海底隧道及光明路延伸工程、深中通道项目、辽宁红沿河核电取水口项目等工程的技术服务和科技研发。首创了一种考虑风浪流作用的水下抛石漂移距离的预测方法，开发了小区域精细化海洋动力后报和预报系统，研发了一种基于RTK-GNSS中小振幅波浪观测装置，提出了一种新型纳米技术与传统软基处理工艺相融合的污泥脱水治理技术。先后主持和参与了中交集团青年创新项目等科研课题6项；参与国家自然科学基金项目、省部级科技项目、集团重点研发项目等科研课题9项；发表学术论文22篇，授权发明专利4项，获中国公路建设行业协会科技进步二等奖。

Zhichao Dong obtained his Ph.D. in Civil Engineering from Tongji University and is a distinguished young talent in the CCCC Corporation. He currently works at the Technical Center of CCCC First Harbor Engineering Co., Ltd. Dr. Dong has been deeply involved in several major projects, including the Dalian Bay Undersea Tunnel, the Guangming Road Extension, the Shenzhen-Zhongshan Bridge, and the water intake for the Hongyanhe Nuclear Power Plant. His innovations include a predictive method for underwater rock dumping drift considering wind, wave, and current effects, the development of a localized marine dynamic forecasting and hindcasting system, a wave observation device using RTK-GNSS for small amplitude waves, and a novel sludge dewatering technology combining nanotechnology with traditional soft ground treatment processes. Dr. Dong has led or participated in six youth innovation projects at CCCC and contributed to nine research projects funded by the National Natural Science Foundation of China, provincial and ministerial technology projects, and key CCCC R&D initiatives. He has published 22 academic papers, holds four invention patents, and has been awarded the second prize for scientific and technological progress by the China Highway Construction Association.

# 专家简介
## Brief Introduction

题目：复杂条件下曲线柔性管节海底隧道设计施工关键技术研究
Title: Key Design and Construction Technologies for Curved Flexible Pipe-Jointed Undersea Tunnels under Complex Conditions

摘要：该研究针对柔性管节、小曲率半径沉管隧道建设面临的地质条件软硬不均、外部环境复杂的难题，重点对节段结构、基础设计、曲线段基床整平和沉管安装等关键技术，通过理论研究、数值模拟、现场试验等方法，开展了复杂条件下曲线柔性管节海底隧道设计施工关键技术研究。创新提出节段接头剪力杆抗剪结构，优化了柔性管节结构设计，提高了沉管隧道适应软硬不均地基的能力，丰富了沉管隧道的结构体系。揭示了沉管隧道基础碎石垫层在竖向荷载作用下的受力变形机理，研究了软硬不均地质条件对结构受力和节段接头承载力的影响，为沉管隧道基础设计提供理论依据。提出了小曲率半径沉管隧道碎石基床布设方法，解决了因曲线沉管管节导致的管节边缘垄体间隙和垄高差较大的问题。揭示了曲线沉管拉合过程中的运动规律，推导了曲线沉管拉合过程最大偏转量的计算公式，提出了适用于先铺基床上小曲率半径沉管安装线形预控工艺及方法，实现了曲线沉管的精确对接。研究成果为大连湾海底隧道工程履约创效和成本控制提供有力支撑，为国内外沉管隧道的建设提供参考依据，对做优深化沉管隧道产业链链长地位具有重要意义。
Abstract: This research addresses the challenges posed by the construction of flexible pipe-jointed tunnels with small curvature radii undersea, specifically dealing with uneven geological conditions and complex external environments. The study focuses its attention on critical technologies, including segment structure, foundation design, bedding leveling for curved sections, and immersed pipe installation. Using theoretical research, numerical simulations, and field tests, it investigates the key design and construction technologies for curved flexible pipe-jointed undersea tunnels under these complex conditions. Innovative contributions include the introduction of a shear resistance structure for segment joints, enhancing the structural design of flexible pipe joints, improving the adaptability of immersed tunnels to varying ground conditions, and boosting its structure. The study reveals the deformation mechanisms of the gravel bed layer under vertical loads and examines how uneven geological conditions affect structural forces and the load-bearing capacity of segment joints, providing theoretical support for the foundation design of immersed tunnels. The research proposes a method for laying gravel beds for immersed tunnels with small curvature radius, addressing the issues of gap and height differences at segment edges due to the curved pipe sections. It also uncovers the movement patterns during the pulling and positioning process of curved immersed pipes and derives a formula to calculate the maximum deflection during this process. The study further proposes pre-control techniques for the installation of immersed tunnels with small curvature radius on pre-laid beds, achieving precise alignment of curved segments. The findings from this research provide robust support for the implementation and cost control of the Dalian Bay Undersea Tunnel project. They offer valuable references for the construction of immersed tunnels both domestically and internationally and significantly contribute to enhancing the immersed tunnel industry.

# 专家简介
## Brief Introduction

刘旭 工程师
中交第一航务工程局有限公司

Xu Liu, Engineer, CCCC First Harbor Engineering Co., Ltd.

博士毕业于天津大学岩土工程专业，现就职于中交第一航务工程局有限公司技术中心，从事海洋工程领域的岩土理论分析与技术研发工作，主持/参与国家级、省部级等各级别课题十余项，研究成果涉及沉管隧道及人工岛的地基处理。

Dr. Xu Liu holds a Ph.D. in Geotechnical Engineering from Tianjin University and currently works at the Technical Center of CCCC First Harbor Engineering Co., Ltd. His work focuses on geotechnical theoretical analysis and technological development in marine engineering. Dr. Liu has led or participated in over ten research projects at various levels, including national and provincial projects. His research primarily addresses foundation treatment techniques for immersed tunnels and artificial islands.

报告题目：深中通道岛隧工程建设成套关键技术及应用
Title: Comprehensive Key Technologies and Applications in the Construction of the Shenzhen-Zhongshan Bridge Island-Tunnel Project

摘要：报告主要从项目概况、工程难点及挑战、相关技术成果及创新等方面对深中通道岛隧工程的关键技术与应用情况进行介绍。深中通道是继港珠澳大桥之后又一超级工程，地处粤港澳大湾区核心区域，是集海上桥梁、海中人工岛、沉管隧道和水下互通于一体的世界级超大型跨海集群工程。项目存在规模宏大、建设标准高，建设条件复杂，设计施工难度大，安全风险高、环保要求严，结构形式新、技术挑战大等问题。坚持传承和创新并重的原则，以解决现场问题为导向，以工业化、数字化和智能化为指导思想，在一航局牵头带领下，通过联合攻关形式，形成了复杂地质条件下超大直径钢圆筒快速成岛技术等9项关键技术，并取得良好的应用效果。

Abstract: This presentation provides an overview of the Shenzhen-Zhongshan Bridge Island-Tunnel project, detailing its scope, engineering challenges, technological achievements, and innovations. The Shenzhen-Zhongshan Bridge, following the Hong Kong-Zhuhai-Macao Bridge, is another monumental project situated in the core of the Guangdong-Hong Kong-Macao Greater Bay Area. It is a world-class mega-project combining offshore bridges, artificial islands, immersed tunnels, and underwater interchanges. The project boasts vast scale, stringent construction standards, complex conditions, and significant design and construction difficulties. Additionally, it poses high safety risks, strict environmental requirements, innovative structural forms, and substantial technological challenges. In adherence to the principle of balancing tradition with innovation, the project focuses on solving on-site issues under the guidance of industrialization, digitalization, and smart technologies. Under the leadership of CCCC First Harbor Engineering Co., Ltd, a collaborative effort has led to the development of nine key technologies to tackle these challenges, such as the rapid construction of large-diameter steel cylinder islands in complex geological conditions. These technological advancements have proven highly effective in their application.

## 海报展示 Poster Session

Title: Study on the Influence of Deep Foundation Pit Excavation on Existing Tunnels
Author(s): Yang Zhai, Longyan WANG, Qingyuan TAN , Jinchang WANG and Yazhen SUN

Title: Research on the Operational Safety of High-Speed Train in the Deep Gorge Wind Field
Author(s): Fan Wang

Title: Integration of Public Transport and Land Use: Progress in the Application of Node-Place Modelling and Implications
Author(s): Xian Yang, Yang Yu, Rui Zhou

Title: Spatial Evolution Characteristics and Planning Strategies of Chengdu Dujiangyan Railway Station Area
Author(s): GAO Yanan, CUI Xu, FEI Ningyuan, LIANG Pengpeng, FENG Huihui

Title: A Mini Review of Soundscape Research in Urban Public Spaces in Mainland China
Author(s): Shan Huang, Jisen Zhang

Title: Construction Risk Assessment of Biogas Layer Under Shield of Subway Tunnel
Author(s): Dongyin Qi, Fei Yu

Title: Road Military Transportation Path Planning Based on the A*Algorithm
Author(s): Weiye Zhang ,Yingshun Liu

Title: Analysis of Stress in Prefabricated Box Girders During the Tensioning Process of Pre Stressing Reinforcement
Author(s): Sha Shipeng

Title: Research on Container Demand Analysis and Volume Forecasting in the Hinterlands of Pinglu Canal
Author(s): Junsheng Li and Jiaqi Yang

Title: Research on a Machine Learning-Based Subgrade Compaction Degree Prediction Model
Author(s): Feng LI, Jianfei ZHAO, Hongzhao LI, Bing HUI, Zhenkun Wang, Wenjun ZHANG, Guangbo LIU

Title: Research on Risk Assessment Technology for Fire Accidents in Long Tunnels of Mountainous Expressways
Author(s): Weili Wang, Yongguo Zuo, Xiaoming Zhong and Guopan Liu

Title: Research Review on the Influence of Hammering Pile Vibration on the Surrounding Environment
Author(s): Quanjie Chen, Shantong Liu, Yijie Wang, Yihua Gao

Title: Internal Settlement Moniotring of Pre-Embedded Flexible Pipes for Disaster Prevention: A Case Study of the Upper Reservoir Panel Rockfill Dam of Tianchi Pumped Storage Power Plant
Author(s): Jihong Xing, Yangyang Li, Zhipeng Chen, Ying Cai, Shiwang Lv, Kele Qin, Yu Yin, Xinyi Wang

Title: Optimization Study of Rockbolt Breakage Implementation in FLAC3D
Author(s): Wenhao Zhang

Title: Comprehensive Forecasting Model for Port Container Throughput Based on Hybrid Deep Neural Networks
Author(s): Qihao Tan, Hanyan Huang

Title: Marine Target Detection and Ranging Algorithm Based on Monocular Camera and YOLOv5 Algorithm
Author(s): Guoyu Shao, Hongyu Fu, Lei Zhao

Title: Research on the Bearing Characteristics of a New Type of Prefabricated Internal Anchor Head and Its Application in Transportation Engineering
Author(s): Biao GUO, Jing MING, Yu ZHANG, Jianxiong MA

## 海报展示 Poster Session

Title: Research on Continuous Berth-Quay Crane Joint Allocation Optimization Problem Based on Improved Multi-population Genetic Search Algorithm
Author(s): Lei Cheng, Guangru Li, Hangtian Guo

Title: Key Technology of Prefabrication Construction of Portal Pier Bent Caps with Large Cantilever
Author(s): Liang Xiang, Yin Xu, Lele Chen

Title: Study on the Coupling Coordination Development of Transportation and Tourism in ürümqi
Author(s): Yanyun Zhang , Yang Sun and Jinfu Zhu

Title: Analysis of Lining Damage and Verification of Control Measures Based on Two-Stage Analysis Method
Author(s): Xiang Ye, Fang He, Qingyuan Tan, Jinchang Wang and Yazhen SUN

Title: Study on Preparation and Properties of Polyurethane-Epoxy Composite Emulsion Modified Emulsified Asphalt
Author(s): Minghao Mu, Xinqiang Liu, Haisong Bi, Zheng Wang, Chengduo Qian, Xiufen Liu, Yifan Liu, Baojian Yao and Xue Li

Title: Research on the Implementation Path of Digital Transformation in Highway Survey and Design
Author(s): Chen Zhongzhi, Bai Yu, Guo Peng

Title: Numerical Study on the Hydrodynamic Characteristics of Floating Anti-Vessel Collision Facilities for Cross-Sea Bridges
Author(s): Tao Sun, Zhenbao Shao, Qiangqiang Wu, Yinguang Du, Chaolong Huang

Title: Application of Discrete Element Parallel Bond Model in Rod Structures
Author(s): Haitao Wang

Title: The Practices of Community Building in Rural Communities Under the Background of Urban-Rural Integration ——taking Fuhu Village as an Example
Author(s): Ying Chen

Title: Research on the Promotion of New Productivity Development in Shipping by Artificial Intelligence
Author(s): JIAXIANG E, CHANGSHUN DU

Title: Research on the Stratification and Mechanism of Factors Influencing Fire Resilience of Subway Stations
Author(s): Haijing Zhang; Lihong Yue; Mingyang Zhu; Yuxiang Wang

Title: Research on Safety Early Warning Technology for Road Sections with Poor Sight Distance Based on Acoustic Signals
Author(s): Xiaonan Cheng

Title: Evaluation of Vortex-Induced Vibration Performance for Single-Pylon Cable-Stayed Bridge with Large Span Composite BEAMS
Author(s): Aobo Zhai, Yahui Shao

Title: The Analysis of Characteristics and Response Spectrum of Far-Field Long-Period Ground Motion in Seismic Engineering
Author(s): Yiyang Guo, Qiang Ma, Quancai Xie, and Dongwang Tao

Title: Seismic Fragility Study of Rigid-frame Bridges with Varying Pier Heights
Author(s): Xuening Wu, Jinlong Liu, and Junqi Lin

Title: Risk Assessment of LNG Carrier Pilotage Due to secondary Pilotage Based on Improved SD
Author(s): Bohao LlU, Jinshan ZHU, Jingyi WEN and Fangi MENG

**主办单位：**

天津大学 | 中交天津港湾工程研究院有限公司

**协办单位：**

天津市水运工程学会 | 中国航海学会水运工程专业委员会 | 港口岩土工程技术交通运输行业重点实验室
交通运输部天津水运工程科学研究院 | 天津城建大学 | 天津理工大学 | 西安理工大学

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