同行专家业内评价意见书编号：20250859012

附件1

浙江工程师学院（浙江大学工程师学院）
同行专家业内评价意见书

姓名：郑哲溢

学号：22260481

申报工程师职称专业类别（领域）：土木水利

浙江工程师学院（浙江大学工程师学院）制

2025年03月26日

填表说明

一、本报告中相关的技术或数据如涉及知识产权保护、军工项目保密等内容，请作脱密处理。

二、请用宋体小四字号撰写本报告，可另行附页或增加页数，A4纸双面打印。

三、表中所涉及的签名都必须用蓝、黑色墨水笔，亲笔签名或签字章，不可以打印代替。

四、同行专家业内评价意见书编号由工程师学院填写，编号规则为：年份4位＋申报工程师职称专业类别(领域)4位+流水号3位，共11位。

一、个人申报

（一）基本情况【围绕《浙江工程师学院（浙江大学工程师学院）工程类专业学位研究生工程师职称评审参考指标》，结合该专业类别(领域)工程师职称评审相关标准，举例说明】

1.对本专业基础理论知识和专业技术知识掌握情况(不少于200字)

本科土木工程的学习，为我积累了扎实的专业知识基础。我系统掌握了结构力学、材料力学、土木工程施工等核心课程内容，熟悉各类建筑结构的设计与施工要点。
在浙江大学工程师学院土木水利专业攻读研究生期间，我进一步拓展和深化了专业知识体系，并将其应用于学位论文《考虑海－
海转运的干散货码头储运系统建模优化研究》中。在研究干散货码头的过程中，我凭借本科所学的土木工程专业知识，理解码头的整体结构和各类设施的功能。同时，结合土木水利专业的知识，对码头的水运作业流程、堆场规划等进行深入分析。通过构建数学模型和设计求解算法，综合考虑船舶作业、设备调度、堆场分配和传送带路线规划等因素，实现码头运营成本的优化。这一过程不仅加深了我对专业知识的理解，还提升了我运用专业知识解决实际工程问题的能力。
综上，我熟练掌握了结构设计的理论知识，并能熟练使用数学建模、Python编程、求解器计算、CAD设计等技能。

2.工程实践的经历(不少于200字)

在攻读浙江大学工程师学院土木水利专业学位期间，我积累了丰富且具深度的工程实践经历，主要围绕舟山六横煤炭中转码头展开。
参与舟山六横煤炭中转码头项目时，我深入码头现场，实地调研装卸工艺流程、设备运行状况以及堆场布局。在调研过程中，详细记录各环节数据，如船舶装卸时间、设备作业效率等，为后续研究提供了坚实的数据基础。
基于调研数据，我负责构建煤炭中转码头综合调度优化模型。在建模过程中，充分考虑船舶等待时间、港口机械作业成本和传送带路线重组成本等因素，以设备分配、堆场分配、传送带路线等作为决策变量，运用专业知识进行复杂的数学建模。模型构建后，利用 Gurobi 求解器对小规模问题进行求解验证，并设计基于启发式算法的热启动方法解决大规模问题，最终成功为码头提供了一套优化的作业计划方案，有效降低了运营成本，提升了码头作业效率，在实际工程应用中取得了良好的效果。

3.在实际工作中综合运用所学知识解决复杂工程问题的案例（不少于1000字）

在申请浙江大学工程师学院工程类专业学位研究生工程师职称的过程中，我深刻认识到，作为一名土木水利工程领域的从业者，不仅需要扎实的理论基础，还需要在实际工作中灵活运用所学知识，解决复杂的工程问题。以下是我在实际工作中综合运用所学知识解决复杂工程问题的一个典型案例。

我负责一个大型干散货码头的储运系统优化项目。该码头主要处理煤炭、铁矿砂等大宗商品的装卸和转运任务。随着全球贸易的不断增长，码头的货物吞吐量逐年增加，导致码头在船舶作业计划和堆场作业计划方面面临诸多挑战。如何平衡船舶等待时间和港口作业成本，充分发挥“海-海”直驳型转运的成本优势，成为码头运营中的关键问题。
在项目初期，我通过对码头的实地调研和数据分析，发现以下几个主要问题：
1.
船舶等待时间长：由于码头泊位和装卸设备的数量有限，船舶在港口的等待时间较长，导致船舶延误成本增加。

2.
堆场作业效率低：堆场的堆取料机和取料机的作业效率不高，导致货物在堆场的停留时间过长，增加了堆场的空间占用成本和库存维护成本。

3.
传送带路线切换频繁：码头内的传送带路线切换频繁，导致路线切换成本增加，影响了整体作业效率。

针对上述问题，我综合运用了在浙江大学工程师学院所学的知识，提出了以下解决方案：

1.
构建混合整数规划模型：为了优化码头的作业计划，我构建了一个混合整数规划模型，将船舶等待时间、港口机械作业成本和传送带路线重组成本等纳入考量。模型以设备分配、堆场分配、传送带路线等作为决策变量，并考虑了大型船舶多个船舱运载不同类型货物的情景。

2.
线性化处理非线性约束：针对模型中的若干非线性约束，我进一步进行了线性化处理，提升了求解工具对模型的求解效率。通过线性化处理，模型能够被现有的求解器（如Cplex或Gurobi）高效求解。

3.
设计启发式算法及“热启动”方法：为了进一步提高模型的求解效率，我设计了一种基于直驳部分货物量大先处理、非直驳部分紧急任务先处理、尽量沿用上一时刻路线等规则的启发式算法。该算法将所有船舱分为直驳舱、半直驳舱和非直驳舱依次处理，将启发式算法得到的解作为较好的可行解输入求解器，作为初始解以对改进后的模型进行更高效地求解。

在实施过程中，我按照以下步骤进行了优化：

1.
数据收集与预处理：我收集了码头的历史作业数据，包括船舶到港时间、装卸设备作业效率、堆场容量等。通过对数据的预处理，我确定了模型的输入参数。

2.
模型求解与验证：我使用Gurobi求解器对模型进行求解，并通过舟山六横煤炭码头的实际案例进行了验证。实验结果表明，本文提出的模型和方法能够对相应规模的干散货码头作业计划进行优化，且计算时间满足港口的实际作业需要。

3.
结果分析与优化：通过对模型求解结果的分析，我发现直驳作业模式能够显著降低堆场设备的运行成本，但也会增加船舶的等待时间。因此，我在优化过程中充分考虑了直驳作业可能带来的绩效停反，设计了全局最优的作业方案。

通过上述优化措施，我取得了显著的成果和效益：

1.
降低船舶等待时间：通过优化船舶作业计划和设备分配，船舶在港口的等待时间显著减少，船舶延误成本降低。

2.
提高堆场作业效率：通过优化堆场作业计划和传送带路线，堆场的堆取料机和取料机的作业效率提高，堆场的空间占用成本和库存维护成本降低。

3. 减少路线切换成本：通过优化传送带路线，路线切换成本减少，整体作业效率提高。

在实际工作中，我深刻体会到综合运用所学知识解决复杂工程问题的重要性。通过构建混合整数规划模型、线性化处理非线性约束、设计启发式算法及“热启动”方法，我成功优化了干散货码头的储运系统，显著提高了码头的作业效率和经济效益。这一案例不仅展示了我在

土木水利工程领域的专业能力，也为我申请浙江大学工程师学院工程类专业学位研究生工程师职称提供了有力的支持。

（二）取得的业绩（代表作）【限填3项，须提交证明原件（包括发表的论文、出版的著作、专利证书、获奖证书、科技项目立项文件或合同、企业证明等）供核实，并提供复印件一份】					
1. 公开成果代表作【论文发表、专利成果、软件著作权、标准规范与行业工法制定、著作编写、科技成果获奖、学位论文等】					
成果名称	成果类别 [含论文、授权专利（含发明专利申请）、软件著作权、标准、工法、著作、获奖、学位论文等]	发表时间/授权或申请时间等	刊物名称/专利授权或申请号等	本人排名/总人数	备注
Optimization of Sea-Land Integrated Scheduling in Coal Terminal	会议论文	2024年05月07日	The 6th Y-RIB international conference in collaboration with UNESCAP on “Sustainable Inland Waterway Transport Development”	1/3	
Optimization of Coal Terminal Storage and Transport System considering Transshipment	会议论文	2024年11月27日	The 2nd International Conference on Innovation of Smart Port and Logistics	1/3	

2. 其他代表作【主持或参与的课题研究项目、科技成果应用转化推广、企业技术难题解决方案、自主研发设计的产品或样机、技术报告、设计图纸、软课题研究报告、可行性研究报告、规划设计方案、施工或调试报告、工程实验、技术培训教材、推动行业发展中发挥的作用及取得的经济社会效益等】

（三）在校期间课程、专业实践训练及学位论文相关情况	
课程成绩情况	按课程学分核算的平均成绩： 86 分
专业实践训练时间及考核情况(具有三年及以上工作经历的不作要求)	累计时间： 1.1 年（要求1年及以上） 考核成绩： 84 分
本人承诺	
个人声明：本人上述所填资料均为真实有效，如有虚假，愿承担一切责任，特此声明！ **申报人签名：** 郑哲瑜	

22260481

二、日常表现考核评价及申报材料审核公示结果

日常表现考核评价	非定向生由德育导师考核评价、定向生由所在工作单位考核评价： ☑优秀 ☐良好 ☐合格 ☐不合格 德育导师/定向生所在工作单位分管领导签字（公章）：　　年 3 月 24 日
申报材料审核公示	根据评审条件，工程师学院已对申报人员进行材料审核（学位课程成绩、专业实践训练时间及考核、学位论文、代表作等情况），并将符合要求的申报材料在学院网站公示不少于5个工作日，具体公示结果如下： ☐通过 ☐不通过（具体原因：　　） 工程师学院教学管理办公室审核签字（公章）：　　年　月　日

浙 江 大 学 研 究 生 院

攻读硕士学位研究生成绩表

学号：22260481	姓名：郑哲溢	性别：女	学院：工程师学院	专业：土木水利	学制：2.5年
毕业时最低应获：27.0学分		已获得：29.0学分		入学年月：2022-09	毕业年月：
学位证书号：			毕业证书号：		授予学位：

学习时间	课程名称	备注	学分	成绩	课程性质	学习时间	课程名称	备注	学分	成绩	课程性质
2022-2023学年秋季学期	工程技术创新前沿		1.5	91	专业学位课	2022-2023学年春季学期	港口设施规划与布局		2.0	84	专业学位课
2022-2023学年秋季学期	工程数值分析		2.0	79	专业选修课	2022-2023学年春季学期	研究生论文写作指导		1.0	89	专业选修课
2022-2023学年秋季学期	创新设计方法		2.0	通过	专业选修课	2022-2023学年春季学期	新时代中国特色社会主义理论与实践		2.0	85	专业学位课
2022-2023学年秋季学期	自然辩证法概论		1.0	92	公共学位课	2022-2023学年夏季学期	研究生英语基础技能		1.0	免修	公共学位课
2022-2023学年秋季学期	工程伦理		2.0	88	专业学位课	2022-2023学年夏季学期	数据科学前沿技术导论		2.0	86	专业学位课
2022-2023学年冬季学期	产业技术发展前沿		1.5	93	专业学位课	2022-2023学年春夏学期	高阶工程认知实践		3.0	88	专业学位课
2022-2023学年冬季学期	机器视觉及其应用		2.0	81	专业学位课	2022-2023学年夏季学期	研究生英语		2.0	免修	专业学位课
2022-2023学年冬季学期	海洋管理学		2.0	87	专业选修课		硕士生读书报告		2.0	通过	

说明：1. 研究生课程按三种方法计分：百分制，两级制（通过、不通过），五级制（优、良、中、及格、不及格）。

2. 备注中“*”表示重修课程。

学院成绩校核章：

成绩校核人：张梦依

打印日期：2025-03-20

浙江大学研究生（60）成绩审核章

ESCAP

ADDRESS:ZHOUSHAN CAMPUS NO.1 ZHEDA ROAD DINGHAI DISTRICT,
ZHOUSHAN,ZHEJIANG,316021,
P.R.CHINA
TEL:0086-0580-2092277
MAIL: Y-RIB.OFFICE@ZJU.EDU.CN

8 June 2024

Dear Zheyi Zheng,

The 6th Y-RIB international conference in collaboration with UNESCAP on "Sustainable Inland Waterway Transport Development", was held in Zhoushan, China, from the 6th to 8th June 2024.

The 6th Y-RIB aims to review the business environment in the inland waterway transport sector, develop cooperative partnership for maximizing its potential and discuss their broad implications for promoting sustainable inland waterway transport in Asia and the Pacific.

Thank you for your presentation on June 8, titled *Optimization of Sea-Land Integrated Scheduling in Coal Terminal*. Your work is highly regarded for its quality and contribution to the field.

Sincerely yours,

冯智皓

No.1 Zheda Rd, Zhoushan Campus, Zhoushan, 316021, Zhejiang, P.R. China
0086- 0580-2092277

Submission code: 057

Optimization of Sea-Land Integrated Scheduling in Coal Terminal

Zheyi Zheng[a], Xuehao Feng[b] , Yanjie Zhou[c,*]

[a] Polytechnic College, Zhejiang University, Hangzhou, China. Email address: 22260481@zju.edu.cn
[b] Ocean College, Zhejiang University, Zhoushan, China. Email address: fengxuehao@zju.edu.cn
[c] College of Management Engineering, Zhengzhou University, Zhengzhou, China; * Corresponding author, Email address: ieyjzhou@zzu.edu.cn

Abstract

Coal plays a pivotal role in ensuring the stable development of the national economy, and the rapid development of industry has made China the world's largest importer of coal. Ports are the key nodes in the supply chain of imported coal, and the significant increase in coal imports has put forward higher requirements for their loading and unloading efficiency. Therefore, how to improve operational efficiency on the basis of existing operational resources has become a focal issue to reduce costs and increase efficiency of coal terminals.

As a significant part of the coal inbound operation system, the quay crane, yard and belt conveyor interact with each other, and it is difficult to optimise a single part of the system to achieve the overall system optimisation. At the same time, the quantity, size and location of the stockpiles in the ore terminal yard are all under dynamic change, therefore, in order to achieve efficient and low-cost operation of coal terminal operations, it is necessary to consider these factors in a comprehensive manner.

This study is based on the Liuheng Coal Terminal to investigate the integrated scheduling co-optimisation problem of yard, equipment, berths and other resources in coal import and export terminals. The various resource scheduling problems in coal terminals are closely related, and if the relationship between them is ignored and these problems are solved independently, it often leads to a poor quality plan that cannot be applied in practice. Therefore, it is necessary to integrate these problems and consider them in one system. On the other hand, the scale of the integrated model is often too large to be solved in a real-world environment, so it is necessary to seek an algorithm that can solve the large-scale problem of joint optimisation of dry bulk terminals, and find an acceptable decision scheme that can be applied in practice within a reasonable time frame.

In the problem presented in this paper, the arrival and latest departure times of the vessels are obtained in advance and the research objective is to minimise the terminal operating costs, which include equipment operating costs, vessel delay costs and belt conveyor route switching costs. Belt conveyors are an important feature of bulk terminals compared to container terminals. Belt conveyors routes in bulk terminals consist of a combination of several sections of belts that can be switched between different routes. Switching belt conveyor routes causes additional power loss but may result in higher operational efficiency of the terminal, therefore, this paper attempts to make a trade-off between the power loss of belt conveyor switching and the efficient operation it may bring.

In this study, the mathematical model is divided into three parts: vessel sequencing, yard allocation, and equipment scheduling problems. A two-stage heuristic algorithm based on the

mathematical model is first used to solve the vessel sequencing problem by determining the operating sequence and operating moments for each unloading vessel and the loading vessel in the first and second stages, respectively. Once the vessel's sequence of operations is determined, the yard allocation and equipment scheduling problems can be solved easily by a commercial solver.

Keywords: Coal terminal, Co-optimisation, Sea-land integrated scheduling

References

Cao, Z., Wang, W., Jiang, Y., Xu, X., Xu, Y., & Guo, Z. 2022. Joint berth allocation and ship loader scheduling under the rotary loading mode in coal export terminals. Transportation Research Part B: Methodological, 162, 229-260.

Guo, L., Zheng, J., Du, J., Gao, Z., & Fagerholt, K. 2024. Integrated planning of berth allocation, quay crane assignment and yard assignment in multiple cooperative terminals. Transportation Research Part E: Logistics and Transportation Review, 183, 103456.

Guo, Z., Cao, Z., Wang, W., Jiang, Y., Xu, X., and Feng, P. 2021. An integrated model for vessel traffic and deballasting scheduling in coal export terminals. Transportation Research Part E: Logistics and Transportation Review, 152, 102409.

Iris, Ç., Pacino, D., Ropke, S., & Larsen, A. 2015. Integrated berth allocation and quay crane assignment problem: Set partitioning models and computational results. Transportation Research Part E: Logistics and Transportation Review, 81, 75-97.

Menezes, G. C., Mateus, G. R., & Ravetti, M. G. 2016. A hierarchical approach to solve a production planning and scheduling problem in bulk cargo terminal. Computers & Industrial Engineering, 97, 1-14.

Certificate of Participation

Information			
Event	The 2nd IISPL		
Date	November 27(Wed.)	**Venue**	Pusan National University
Participant			
Name	Zheyi Zheng	**Affiliation**	Zhejiang University

This certifies that *Zheyi Zheng* has participated in the 2nd IISPL.

January 14, 2025

The 2nd IISPL Secretariat

The 2nd IISPL

CONFERENCE

The 2nd International Conference on Innovation of Smart Port and Logistics

November 26-28th, 2024

Pusan National University, Busan, Korea

Host BPA 부산항만공사 BUSAN PORT AUTHORITY Organizer 부산대학교 PUSAN NATIONAL UNIVERSITY BK21 IBD-GSC Pusan National University Sponsor BRIP 부산지역혁신플랫폼

[Session A-2] Data-Driven Logistics Optimization	
Session Chairman : Dr. Bonggwon Kang (Pusan National University)	
A-2-1	**Refining Container Relocation Operations through Deep Reinforcement Learning Optimization** Qiyao Yan, Rui Song, Kap Hwan Kim, Yan Wang, Xuehao Feng
A-2-2	**Forecasting Container Throughput at Busan Port with Large Language Models** Jaeeun Kwon, Minseop Kim, Hyerim Bae
A-2-3	**Optimization of Coal Terminal Storage and Transport System considering Transshipment** Zheyi Zheng, Xuehao Feng, Yanjie Zhou
A-2-4	**Hydrokinetic Energy Converter for Underwater Systems** Jun Kim, Yeonkang Choi, Kyuin Shin, Jimin Hyun, Eun Soo Kim
A-2-5	**Simulation Optimization of Collaborative Handshake Operations for Twin Overhead Shuttle Cranes in a Rail-Based Automated Container Terminal under Demand Uncertainty** Bosung Kim, Bonggwon Kang, Soondo Hong

The 2nd International Conference on Innovation of Smart Port and Logistics (2nd IISPL)

Optimization of Coal Terminal Storage and Transport System considering Transshipment

Zheyi Zheng[1,*], Xuehao Feng[2], Yanjie Zhou[3]

[1]*Polytechnic College, Zhejiang University, Hangzhou 310000, China*
[2]*Ocean College, Zhejiang University, Hangzhou 310000, China*
[3]*College of Management Engineering, Zhengzhou University, Zhengzhou 450000, China*

**Corresponding author. E-mail: 22260481@zju.edu.cn*

Abstract

Coal plays a pivotal role in ensuring the stable development of the national economy, and the rapid development of industry has made China the world's largest importer of coal. Ports are the key nodes in the supply chain of imported coal, and the significant increase in coal imports has put forward higher requirements for their loading and unloading efficiency. Therefore, how to improve operational efficiency on the basis of existing operational resources has become a focal issue to reduce costs and increase efficiency of coal terminals.

As a significant part of the coal inbound operation system, the quay crane, yard and belt conveyor interact with each other, and it is difficult to optimize a single part of the system to achieve the overall system optimization. At the same time, the quantity, size and location of the stockpiles in the ore terminal yard are all under dynamic change, therefore, in order to achieve efficient and low-cost operation of coal terminal operations, it is necessary to consider these factors in a comprehensive manner.

This study is based on the Liuheng Coal Terminal to investigate the integrated scheduling co-optimization problem of yard, equipment, berths and other resources in coal import and export terminals. The various resource scheduling problems in coal terminals are closely related, and if the relationship between them is ignored and these problems are solved independently, it often leads to a poor quality plan that cannot be applied in practice. Therefore, it is necessary to integrate these problems and consider them in one system. On the other hand, the scale of the integrated model is often too large to be solved in a real-world environment, so it is necessary to seek an algorithm that can solve the large-scale problem of joint optimization of dry bulk terminals, and find an acceptable decision scheme that can be applied in practice within a reasonable time frame.

In the problem presented in this paper, the arrival and latest departure times of the vessels are obtained in advance and the research objective is to minimize the terminal operating costs, which include equipment operating costs, vessel delay costs and belt conveyor route switching costs. Belt conveyors are an important feature of bulk terminals compared to container terminals. Belt conveyors routes in bulk terminals consist of a combination of several sections of belts that can be switched between different routes. Switching belt conveyor routes causes additional power loss but may result in higher operational efficiency of the terminal, therefore, this paper attempts to make a trade-off between the power loss of belt conveyor switching and the efficient operation it may bring.

In this study, the mathematical model is divided into three parts: vessel sequencing, yard allocation, and equipment scheduling problems. A two-stage heuristic algorithm based on the mathematical model is first used to solve the vessel sequencing problem by determining the operating sequence and operating moments for each unloading vessel and the loading vessel in the first and second stages, respectively. Once the vessel's sequence of operations is determined, the yard allocation and equipment scheduling problems can be solved easily by a commercial solver.

Keywords: Coal terminal, Co-optimization, Sea-land integrated scheduling