

# Real-Time Decentralized Framework for Technology-Enabled Intermodal Freight Transport

## Technology Transfer Activities

by

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October 2023



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## ACKNOWLEDGEMENT

*This study is partially supported by the Center for Connected Multimodal Mobility (C2M2) (USDOT Tier 1 University Transportation Center) headquartered at Clemson University, Clemson, SC. Any opinions, findings, conclusions, or recommendations expressed in this paper are those of the authors and do not necessarily reflect the views of C2M2, and the official policy or position of the USDOT/OST-R, or any State or other entity, and the U.S. Government assumes no liability for the contents or use thereof.*

## Table of Contents

DISCLAIMER .....	2
1 Outputs .....	5
2 Outcomes.....	5
3 Impacts .....	5

# Technology Transfer Activities

## 1 Outputs

The project outputs include two conference presentations, one Ph.D. dissertation, and codes that implement the dynamic decentralized carrier collaboration.

### 1.1 Output #1

Findings from this project were presented at the 102<sup>nd</sup> Transportation Research Board Annual Meeting and Center for Connected Multimodal Mobility (C2M2) Fall Conference.

1. Bhavya Padmanabhan and Fahim Ahmed presented a paper titled “Multiple Bundles Combinatorial Auction for Job Exchange in Dynamic Pickup and Delivery Problem” in Transportation Research Board 102nd Annual Meeting, 2023.
2. Bhavya Padmanabhan presented a paper titled “Multiple Bundles Combinatorial Auction for Job Exchange in Dynamic Pickup and Delivery Problem” in Center for Connected Multimodal Mobility (C2M2) Fall Conference, 2022.
3. Bhavya Padmanabhan added the paper titled “Multiple Bundles Combinatorial Auction for Job Exchange in Dynamic Pickup and Delivery Problem” as one of the chapters in her Ph.D. dissertation.

### 1.2 Output #2

Codes for solving the dynamic decentralized carrier collaboration models. The codes will be submitted as a project deliverable and will be available on the center’s website.

## 2 Outcomes

The primary outcome of this research is a framework for dynamic decentralized carrier collaboration based on iterative combinatorial auction. This framework can be used by carriers to collaborate in real time by exchanging jobs through an auction process.

### 2.1 Outcome #1

Development of two mathematical programming models and solution methods that implement the framework.

## 3 Impacts

The developed framework has the potential to reduce empty truck trips and increase revenue for carriers.

### 3.1 Impact #1

The developed framework can be used by small to medium-sized carriers to gain an understanding of ways to outsource jobs and bid for jobs to increase profit.