**Grantee:** Northwestern University  
**Center Name:** Tier I University Transportation Center on Telemobility  
**Research Priority:** Improving Mobility of People and Goods  
**Research Project Funding:** $150,000  
**Project End Date:** March 31, 2022

**Project Description:** In this project we consider an omnichannel retailer that operates both brick-and-mortar stores and super warehouses. The retailer’s objective is to meet traditional and eCommerce fulfillment demands that can be group into three representative modes: shopping in store, ordering on-line and delivering from warehouse or store, ordering on-line and picking up at store. On the supply side, the retailer must decide the inventory at the store, the express delivery capacity, the delivery premium, and the just-in-time inventory replenishment for stores. On the demand side, a consumer must consider in her utility of each fulfillment mode such factors as the cost of transportation, the delivery fee, the cost/risk of shopping in store, and the likelihood of unsatisfactory on-line purchase. We formulate this omnichannel fulfillment model as a leader-follower game, in which the leader maximizes the retailer’s profits, and the follower allocates consumer demands between the three channels according to utility maximization. The properties of the problem will be analyzed, and the solution methods will be developed. A case study will be constructed by calibrating a stylized model using empirical data.

**Outputs:** The project will create new analytical tools, including parsimonious mathematical models, analysis techniques, and numerical solution methods, for studying transportation, inventory, and other aspects in omnichannel retail. It will identify potential data sources and develop necessary procedures that can be used to calibrate (hence operationalize) the proposed tools.

**Outcomes/Impacts:** The results of this project will help us understand the fundamental trade-offs between inventory, transportation, and pricing decisions in omnichannel retail. It will shed light on the impact of these decisions, as well as the market conditions and localities, on vehicle miles travelled by both the consumers (for their store-visit trips) and by retailer (for its delivery trips).