Delivery Deserts: Mapping, Understanding, and Overcoming Service Challenges – Project 7

Deliverables and Reporting Requirements for UTC Grants Awarded in 2023 (June 2023)

Exhibit D

Recipient/Grant (Contract) Number: The University of Tennessee, Grant No. 69- A3552348338

Center Name: Center for Freight Transportation for Efficient and Resilient Supply Chain (FERSC)

Research Priority: Improving Mobility of People and Goods

Principal Investigator(s): Marcella Kaplan (UTK), Kevin Heaslip (UTK)

Project Partners:

Research Project Funding: $100,000 Federal and $50,505 non-Federal funding

Project Start and End Date: 07/01/2024 – 06/30/2025

Project Description: The evolution of delivery services has reshaped consumer behavior and expectations for availability, speed, and cost. The delivery/logistics industry has not adopted business models to mitigate challenges in delivery services, creating "delivery deserts"—regions where accessibility and efficiency of delivery services are severely limited or non-existent. This research addresses the limited exploration of delivery deserts, a concept that diverges from the commonly studied "food deserts." These deserts, often found in rural areas, create disparities in service availability and efficiency, affecting the backbone of e-commerce and access to essential goods like groceries and medicines, especially for vulnerable populations. Our project employs a detailed, two-phase approach to tackle delivery deserts in America. It integrates identifying and understanding the problem, quantifying and mapping these deserts, and identifying barriers.

Innovations such as drones and delivery robots aim to mitigate the escalating costs of the last mile and improve the environmental impact of increased delivery. However, there needs to be more understanding of where to deploy these technologies. Further, despite the growing body of research on last-mile delivery issues, there are research gaps in comprehensively analyzing and locating delivery deserts, understanding their characteristics and types, and proposing quantifiable methods to evaluate them. This gap hinders the development of targeted solutions for each type of delivery desert and the establishment of regulatory frameworks that promote improved accessibility and fairness in delivery systems.

The proposed research involves two major phases to gain increased knowledge of delivery deserts and strategies to minimize and eliminate them. These two phases are discussed below:

Phase 1: Where are Delivery Deserts? The first phase involves developing a comprehensive methodology for identifying "delivery deserts." We propose a detailed definition of delivery deserts in three dimensions that capture their multifaceted nature, acknowledging that inadequate access is not always synonymous with total absence:

- Complete absence of any delivery service
- Partial availability (limited types or providers)
- Service inefficiency (extended delivery times)

Task 1: Collect Delivery Data
The methodology includes collecting and aggregating data from various sources, such as major delivery companies, crowd-sourced inputs, and USPS, to create an interactive map at the zip code level. This map will reflect the extent of service availability, categorized by complete absence, partial service, and inefficient service. The objective is to create a comprehensive database that provides insights into the extent and nature of service availability at the zip code level.

Task 2: Develop a Mapping Algorithm and Interactive Map
To maintain accuracy and relevance, we'll develop an algorithm for an automated mapping process, enabling regular

updates to the map based on changes in the delivery service landscape. The algorithm will be designed to handle large datasets efficiently while maintaining high accuracy in representing service availability across different regions.

Using this algorithm, the national coverage map will be generated. The map will be color-coded and indicate regions with varying levels of service availability based on the criteria defined in Task 1 (complete absence of service vs partial service vs inefficient service). This map will be made available to the public to allow companies, decision-makers, and individuals to understand areas where delivery deserts have been identified.

Recognizing that the landscape of delivery services is subject to change over time due to factors like market entry/exit or expansion/contraction by providers, improvements in infrastructure, etc., we will design an update mechanism within our system. This would allow automated updates based on periodic feeds from participating companies or crowd-sourced inputs, ensuring our map remains timely and relevant.

Phase 2: What Specifically Causes Delivery Deserts? The second phase of our research will be centered on a detailed analysis and understanding of the barriers that lead to the creation of delivery deserts across the nation. Building on the methodology established in Phase 1, this phase involves applying multi-dimensional criteria to the identified delivery deserts.

Task 3: Identify Barriers through Statistical Analysis
Once delivery deserts are identified, this step entails a comprehensive examination of these regions to understand their unique characteristics and challenges—particularly the barriers that hinder effective delivery services. The core of this task is a thorough examination of factors like population density, income levels, geographical constraints, and infrastructure status that contribute to service barriers in these delivery desert areas.

Task 4: Develop Documentation and Visuals
Our findings, capturing the landscape of delivery services and their associated barriers, will be effectively communicated through statistical analysis and dynamic maps, providing a clear visual representation of the complexities underlying these delivery deserts. Infographics and charts that simplify complex data will be designed to make conveying the key messages and findings easier. We will also develop detailed reports and publications that encapsulate the statistical findings, supported by clear narratives and interpretations.

US DOT Priorities: This research is well aligned with DOT strategic priorities and FERSC research objectives because it addresses delivery access expansion to all groups, especially underserved populations, and advises researchers and practitioners on how to improve last-mile access and cost for underserved areas to the freight system network. Exploring this topic will create mobility innovation knowledge that society can use by bringing together various datasets about geography, demographics, socio-economic factors, and industry practices. Our project employs a detailed, two-phase approach to tackle delivery deserts in America. It integrates identifying and understanding the problem by quantifying and mapping these deserts and identifying the specific barriers to delivery access.

Outputs: The results of this study will be broadly distributed through peer-reviewed journals, conferences, and seminars. The results will also be published in accessible white papers distributed to industry through FERSC, the University of Tennessee Global Supply Chain Institute, and other FERSC partnering institutions. The research could stimulate further interdisciplinary studies, inciting innovative solutions to address service gaps. This will also increase the student population involved in FERSC. This research will support FERSC outreach goals by publishing and presenting at TRB, the FERSC annual conference, and other outlets promoting broader stakeholder, community, and undergraduate engagement.

Outcomes/Impacts: This research aims to provide a comprehensive understanding of where these delivery deserts exist across the United States. Identifying these poorly serviced areas sheds light on existing disparities and paves the way for a better future. This information can guide delivery service providers and policymakers in strategic planning, fostering economic growth, and improving the quality of life for residents in these areas. This interdisciplinary research has potential implications for logistics, economics, geography, and urban planning.