Analytical Modeling Framework to Assess the Economic and Environmental Impacts of Residential Deliveries, and Evaluate Sustainable City Logistics Strategies Dataset

Dataset available at: https://doi.org/10.25338/B82K67

(This dataset supports report **Analytical Modeling Framework To Assess the Economic and Environmental Impacts of Residential Deliveries, and Evaluate Sustainable Last-Mile Strategies,** https://doi.org/10.7922/G21Z42PK**)**

This U.S. Department of Transportation-funded dataset is preserved by the University of California, Davis in the digital repository Dryad (https://datadryad.org), and is available at https://doi.org/10.25338/B82K67.

The related final report **Making Bicycling Comfortable: Identifying Minimum Infrastructure Needs by Population Segments Using a Video Survey**, is available from the National Transportation Library's Digital Repository at https://rosap.ntl.bts.gov/view/dot/55540.

Metadata from the Dryad Repository record:

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Abstract:

In the last decade, e-commerce has grown substantially, increasing business-to-business, business-to-consumer, and consumer-to-consumer transactions. As a result, there has been a continuous growth in last mile operations, especially deliveries to residential areas, bringing along externalities such as congestion, air and noise pollution, and energy consumption. This project aims to develop an analytical framework to model last mile operations based on continuous approximation techniques. The model will help estimate the economic and environmental impacts of residential deliveries, from a growth perspective, and through comparative analyses between consumer decisions (e.g., trip complementarity and substitution, trip-induced demand). The model will estimate impacts for freight operators (shipper, and carriers), and the community. Based on data from the National Household Travel Survey, and the American Time Use Survey, the researchers will conduct empirical analyses with the modeling framework. Moreover, to contend with the transportation issues, the team will evaluate a number of scenarios involving city logistics strategies such as the introduction of cargo consolidation facilities (CF), alternative delivery points, and the use of cargo bikes and zero emission vehicles for the last mile.

- Methods: The uploaded dataset is an Analytical Tool (.xlsm format) to model last-mile delivery and different city logistics measures in the context of e-commerce delivery. The objective here is to build an economic model for a last mile delivery service provider, serving N customers in a service region of size A in nr periods of time-window of length TTW from a depot located at a distance of ρx and ρy from the center of the service region. This depot – an e-commerce fulfillment center is serviced from a larger regional fulfillment center located at a distance of ρx', ρy' from the center of the service region. In addition, let there be NF randomly and uniformly distributed facilities within the service region, of which NMH operate as micro-hubs (consolidation facilities) and NCP are

collection point pick-up facilities, serving a market share of pMH and pCP respectively. The vehicles departing from depot serve the N(1-pMH-pCP) customers directly and service the facilities as well, and the vehicles departing from MHs serve the market, while customers drive to the CPs to pick-up their packages. This work employs Continuous Approximation (CA) techniques to model last-mile parcel delivery operations to better understand the impacts of different city logistics measures and last-mile strategies.

- Usage Notes
    - 2016 ATUS Data: This file contains ATUS data for 2016. Check out ATUS Activity CodeBook.csv for help. This dataset was employed to develop individual econometric shopping behavior models. Some variables have been removed to comply with legal and ethical guidelines. However the entire ATUS data can be accessed from https://www.atusdata.org/atus/about_atus.shtml
    - LA-city Census: Census data for LA. This data was employed to expand on the individual shopping behaviors to develop local/regional (in this case for LA) e-commerce demand. Note this data does not contain individual information but aggregated demographics for LA city.
    - Last-Mile Analytical Tool: This file contains essential information to use the Last-Mile Analytical Tool. This tool models last-mile delivery and different city logistics measures in the context of e-commcer delivery.
    - Based on the structure of last-mile distribution (described above) we have four types of tours:
        - Tour Type I: Inbound movement between Fulfillment center to E-commerce Fulfillment Facility
        - Tour Type II: Vehicle movement between E-commerce Fulfillment Center and service region
        - Tour Type III: Vehicle movement between micro-hubs and customers
        - Tour Type IV: Vehicle movement between customers and collection point
    - The Analytical Tool is a .xlsm file named "Lasy-mile Analysis.xlsm". This excel sheet contains the following sheets:
        - 1. Input: This is the main/starting page of the tool. The Input sheet comprises of all the required inputs for last-mile analysis that pertain to:
            - Service region characteristics: size of the service region, total e-commerce demand and more.
            - Demographics: Demographics in conjunction with the shopping behavior model (presented in "Demand Gen" sheet) are used to estimate the e-commerce demand \of the service region
            - Operator characteristics: type of distribution structure, type and number of facilities, planning horizon and more.
            - Vehicle characteristics: vehicle specifications
            - Tour-vehicle combination: Vehicle used corresponding to tour type.
            - Charging levels: EV charging levels power and price

    - In addition the Input file contains tools that help setting inputs for different last-mile structure and tools to set inputs from presets used in the case study.
    - 2. Results: This sheet contains the salient outputs for each tour type. These results include:
        - Tour length (time)
        - Tour length (distance)
        - Tours per vehicle
        - Customers per tour
        - Externalities (VMT and emissions)
        - Costs (Fixed, Operational, External, Total and per package)
    - 3. Output (Hidden): This sheet is where last-mile delivery operations are optimized. Values from this sheet are aggregated in the Results sheet.
    - 4. Calx (Hidden): Pre-processing and calculations to make optimization easier.
    - 5. Demand Gen (Hidden): Shopping behavior econometric model used to calculate e-commerce demand for the service region.
    - 6. Case Study: A copy of inputs sheet with case study presets.
    - 7. Reference Table: A table describing all the parameters and variables used in the analytical tool.
- Funding: California Department of Transportation,

Recommended citation:
Pahwa, Anmol; Jaller, Miguel (2020), Analytical Modeling Framework to Assess the Economic and Environmental Impacts of Residential Deliveries, and Evaluate Sustainable City Logistics Strategies, Dryad, Dataset, https://doi.org/10.25338/B82K67

Dataset description:
This dataset contains 1 .zip file collection described below.

doi_10.25338_B82K67_v2.zip:
This collection contains 3 .csv files and 1 .xlsm file listed below.

- Last-mile_Analysis.xlsm
- LA-city_Census.csv
- ATUS_DATA_2016.csv
- ATUS_Activity_CodeBook.csv

The .xlsm file type is a Microsoft Excel file, which can be opened with Excel, and other free available software, such as OpenRefine.

The .csv, Comma Separated Value, file is a simple format that is designed for a database table and supported by many applications. The .csv file is often used for moving tabular data between two different computer programs, due to its open format. The most common software used to

open .csv files are Microsoft Excel and RecordEditor, (for more information on .csv files and software, please visit https://www.file-extensions.org/csv-file-extension).

National Transportation Library (NTL) Curation Note:
As this dataset is preserved in a repository outside U.S. DOT control, as allowed by the U.S. DOT's Public Access Plan (https://doi.org/10.21949/1503647) Section 7.4.2 Data, the NTL staff has performed ***NO*** additional curation actions on this dataset.

NTL staff last accessed this dataset at https://doi.org/10.25338/B82K67. on 2021-04-16.

If, in the future, you have trouble accessing this dataset at the host repository, please email NTLDataCurator@dot.gov describing your problem. NTL staff will do its best to assist you at that time.