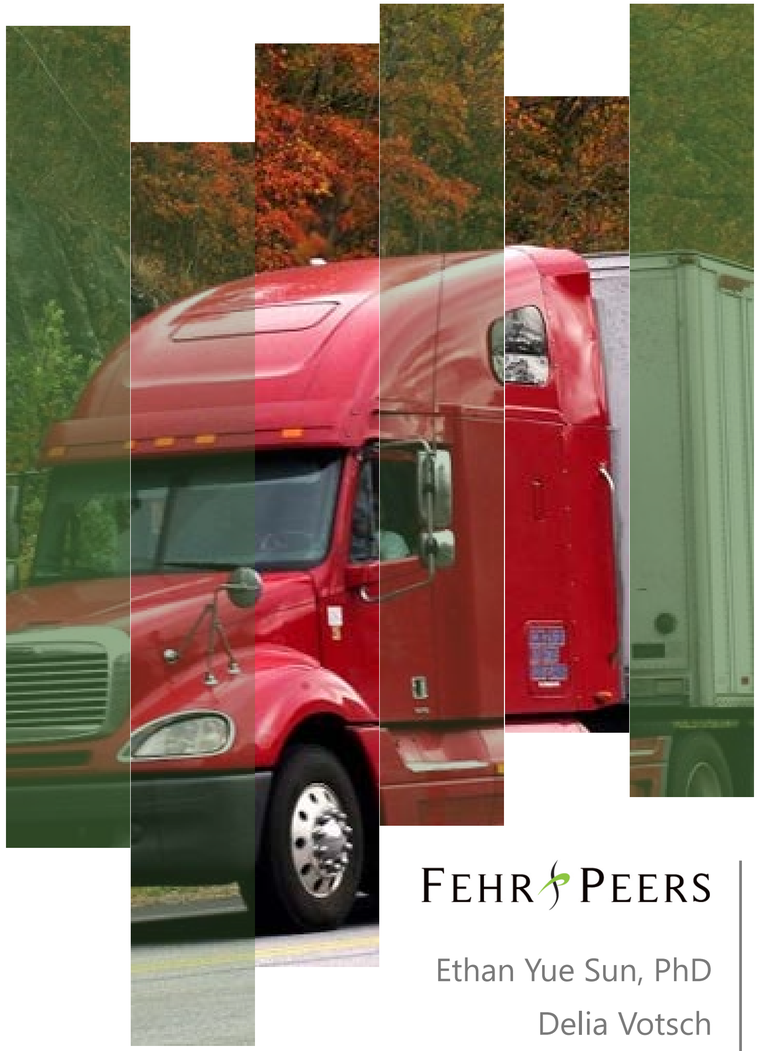

# TRB 2019 Innovations in Freight Data Workshop: On-Demand Goods Delivery

FEHR & PEERS

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# Motivation

- One out of 25 people in the US produce one e-commerce delivery per day, and this rate is expected to increase, especially in urban areas
- Home deliveries per person, stable prior to 2009, double between 2009 and 2017 and are projected to double again by 2023
- It's neither clear how the frequency of delivery vehicles and people's travel choices will change as on-demand goods delivery become more prevalent, nor is it clear how predictive tools will need to evolve
- Are traditional MPO travel demand models capable of capturing and evaluating on-demand goods delivery services?
- What other tools, analysis, and data could be used to evaluate on-demand goods delivery services?
- **Develop a model to forecast daily deliveries that is responsive to demographics, shop location, and delivery location.**


Photo by Gene J. Puskar/AP


Photo by Maarten van den Heuvel on Unsplash

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# Literature Review

| Title | Source | Topics Addressed | | | |
|---|---|---|---|---|---|
| | | VMT | First Mile/ Last Mile | Curbspace Management | Infrastructure (that supports technology) |
| The Delivery Economy Changes Everything: New Requirements for Urban Freight Research | University of Washington Urban Freight Lab | X | X | X | X |
| Delivery Process for an Office Building in the Seattle Central Business District | University of Washington Urban Freight Lab | | X | X | |
| Preparing cities for package demand growth: predicting neighborhood demand and implementing truck VMT reduction strategies | University of Washington Urban Freight Lab | X | | | |
| An analytical model for vehicle miles traveled and carbon emissions for goods delivery scenarios | University of Washington Urban Freight Lab | X | | | |
| Shared mobility workshop white paper | UC Berkeley | | X | | |
| Inventory in Motion - a direct alternative to global fulfillment | UPS | | | | X |
| USCF Innovation Briefs - Autonomous Delivery Technologies | Fehr & Peers | | X | | |
| Freight Costs at the Curbside | The City College of New York; Renessalaer Polytechnic Institute | | | X | |
| Evaluating The Environmental Impacts Of Online Shopping: A Behavioral Analysis Using The American Time Use Survey (ATUS) Data | TRB | X | | X | |

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# Freight Demand Options

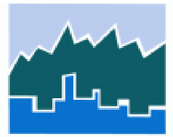
- Option 1: Regional Travel Demand Modeling
  - Data needed on factors influencing on-demand orders:
    - Number of trips made per order
    - Population demographics
  - Potential performance measures or results for scenario comparison such as
    - Truck volumes
    - Truck VMT
    - Curb\parking demand
  - Travel models capable of evaluating the factors and producing results:
    - **No models reviewed were capable**

- Option 2: Supply and Demand Suitability\Hot-spot Analysis
  - Data needed on factors influencing on-demand orders:
    - Number of trips made per order
    - Population demographics
  - Statistical relationship between the factors for supply and demand
  - Use the relationships to identify hotspot\suitability index by scenario

# Methodology

## Data Analysis | Survey Data

- National Household Travel Survey (NHTS)
  - Number of Shopping Trips
  - Number of Deliveries
- American Time Use Survey (ATUS)
  - No differentiation between in-store trips and online deliveries



**2017 National Household Travel Survey Data Explorer User's Guide — Public Use Version**

Prepared by the Federal Highway Administration
Revised November 2018


**For release 10:00 a.m. (EDT) Thursday, June 28, 2018** USDL-18-1058

Technical information: (202) 691-6339 • atusinfo@bls.gov • www.bls.gov/tus
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**AMERICAN TIME USE SURVEY — 2017 RESULTS**

In 2017, 82 percent of employed persons worked on an average weekday, compared with 33 percent on an average weekend day, the U.S. Bureau of Labor Statistics reported today. Multiple jobholders were more likely to work on an average weekend day than were single jobholders—57 percent, compared with 30 percent.

These and other results from the American Time Use Survey (ATUS) were released today. These data include the average amount of time per day in 2017 that individuals worked, did household activities, and engaged in leisure and sports activities. Additionally, measures of the average time per day spent providing childcare—both as a primary (or main) activity and while doing other things—for the combined years 2013-17 are provided. For a detailed description of ATUS data and methodology, see the Technical Note.

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# Methodology

## Data Analysis | InfoGroup Land Use

- Demographic data by census block/tract
- Households
  - Income Level
  - Children (0-18)
- Employment
  - Total employees
  - Employer type (NAICS code)

## Possible for Future Analysis

### Household

| | |
|---|---|
| Purchasing Power Income | Estimate of relative purchasing power of a household, derived by adjusting estimated household income (FIND) with the appropriate cost of living index for the county in which the household resides. |
| Internet User (*DM High Tech Household*) | Interest in new, cutting edge products (early adopters of new gadgets and technology). Information gathered from product purchases, subscriptions or survey response as well as blended with modeled data. |
| InfoPersona SuperCluster | The 42 Info Persona Clusters are further grouped into 9 larger groupings or super Clusters. For more information regarding the definition for each clusters see marketing materials on InfoPedia. |
| Education Level | Education level of adults |
| Auto Ownership | Vehicles owned and number of driver age people in household |

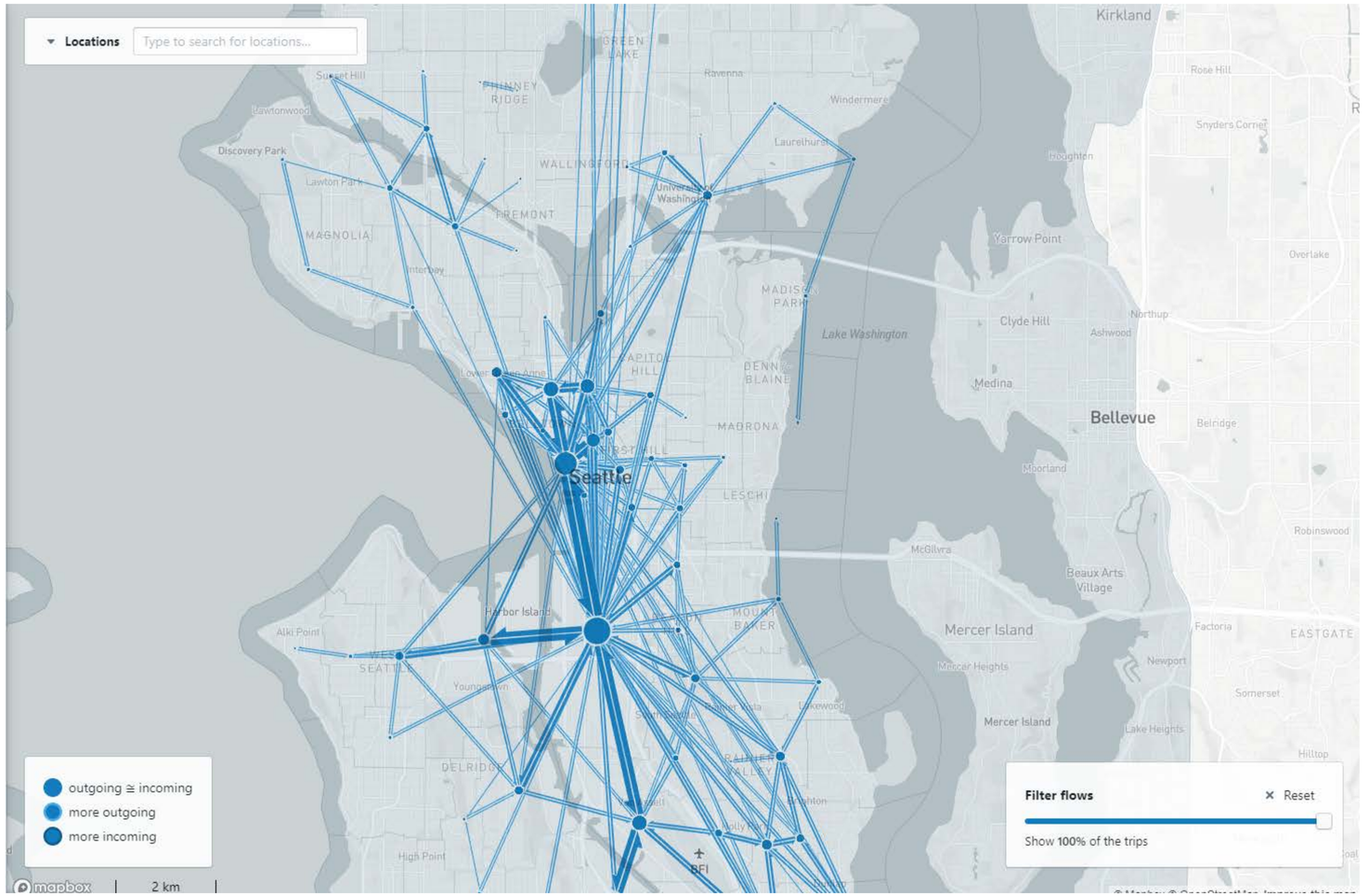
### Employment

| | |
|---|---|
| ACTUAL LOCATION EMPLOYMENT SIZE | This field contains the number of employees who work at this location of the business. |
| ESTIMATED LOCATION SALES VOLUME | A modeled figure derived from employment size and other factors to indicate the annual sales volume of the business. |
| GROWING/SHRINKING INDICATOR | The growing business flag is provided by comparing employment sizes gathered over several cycles of telephone verification. |
| WHITE COLLAR PERCENTAGE | Percentage of white collar employment at business as derived from a model. |
| WHITE COLLAR INDICATOR | '1' Indicates over 50% white collar employment. |

# Methodology

## Data Analysis | Teralytics Observed Activity

- Based on cellular devices
- Observed travel behavior
- 1 month of data
- Number of trips, distance, stops, and stop duration
- Excludes passenger Transportation Network Companies (TNCs)
- Can filter by day of week, time of day, trip distance
- Aggregated trip ends to Census geography



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# Methodology

## Model Formulation

- NHTS and InfoGroup Data
  - Household data grouped into six clusters
    - Cluster 1: Household income between 0-75K, Without Children
    - Cluster 2: Household income between 0-75K, With Children
    - Cluster 3: Household income between 75-150K, Without Children
    - Cluster 4: Household income between 75-150K, With Children
    - Cluster 5: Household income between 75-150K, Without Children
    - Cluster 6: Household income between 75-150K, With Children
  - Summarized the Employment data to get the total employment
- Summarized the weighted number of deliveries and number of shopping trips for each cluster
- Calculated the average number of deliveries and average number of in-store trips
- Applied rate to the household and employment in each census block

# Methodology

## Scenario 1 | Existing Land Use

*Baseline*

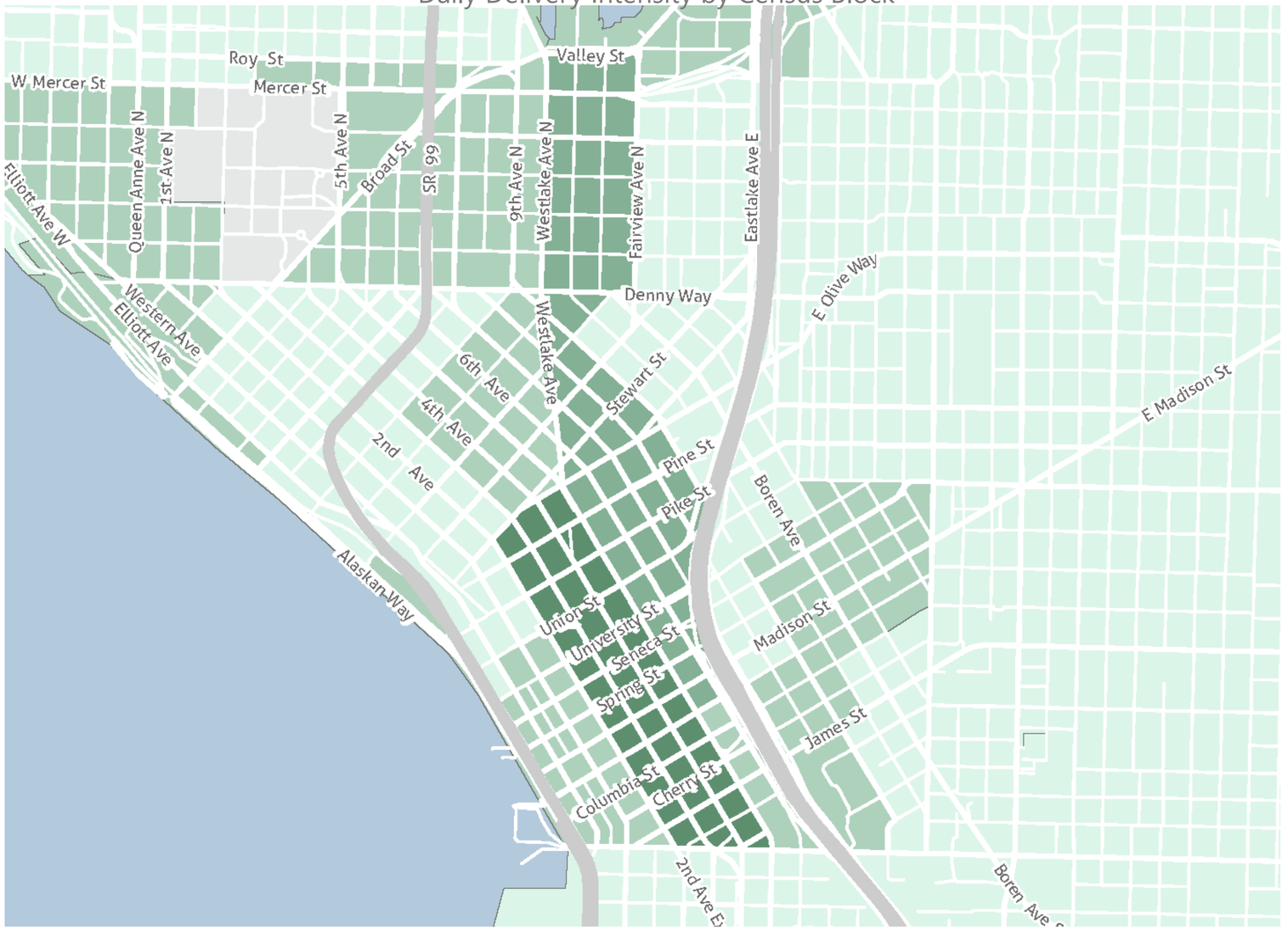
*Average Daily Activity*

Shopping Location


Delivery Location



Daily Delivery Intensity by Census Block



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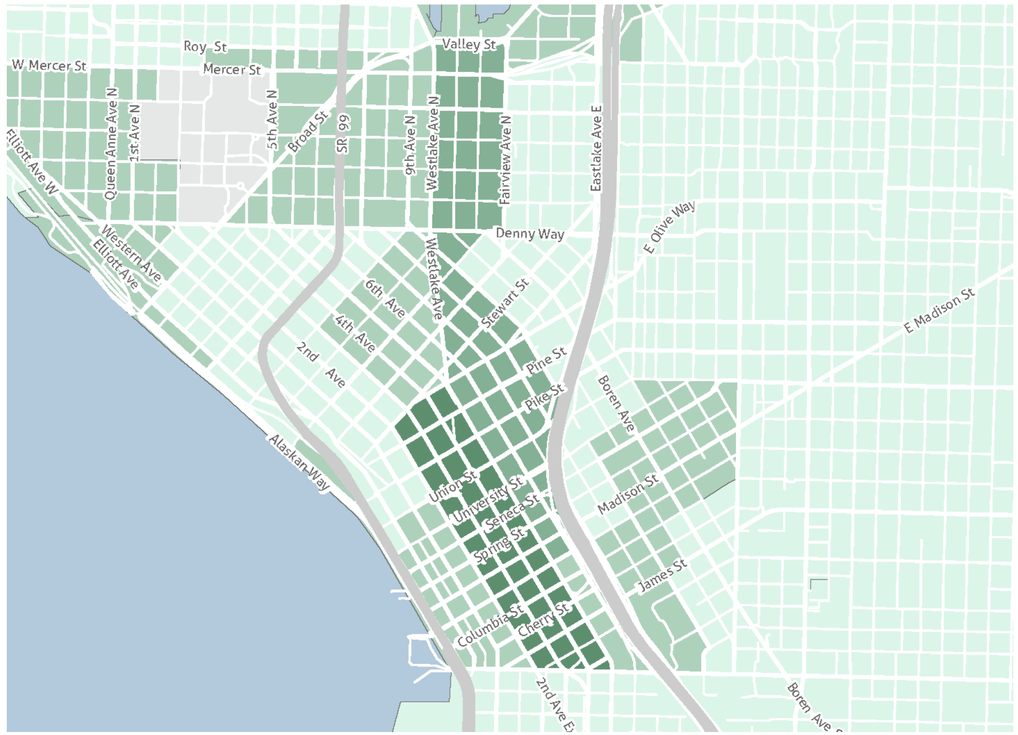
# Methodology

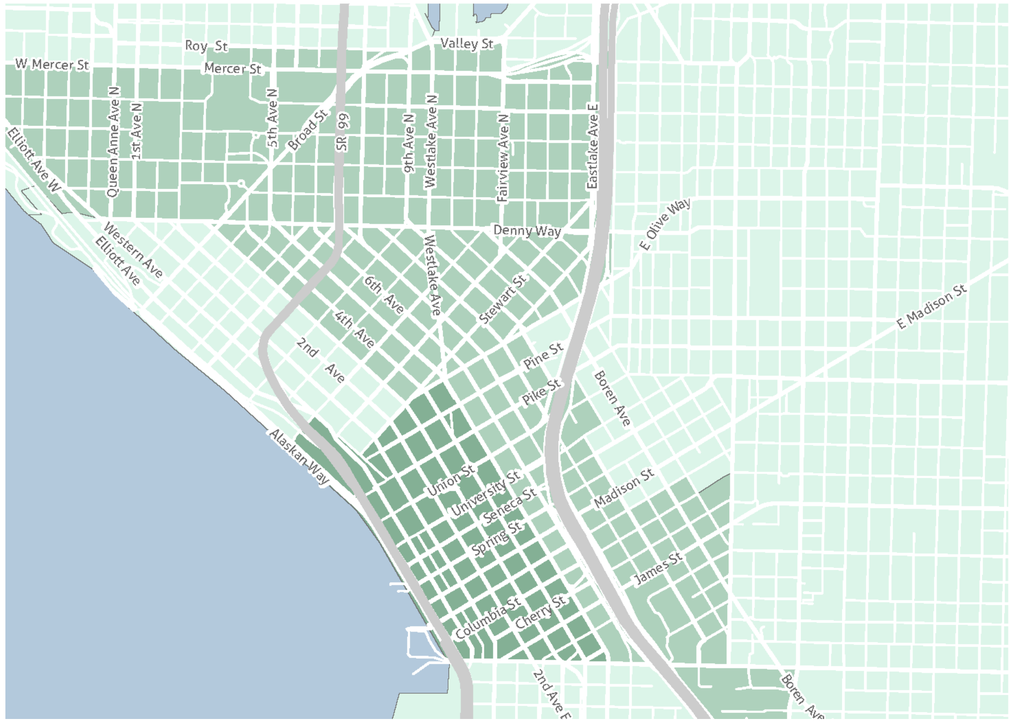
## Model Results

Daily Delivery Intensity by Census Block

### Model Estimated




### Observed



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# Methodology

## Scenario 2 | Existing Land Use

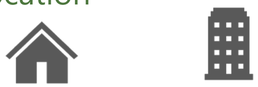
*Increased Online Shopping and Reduce In-Store Shopping*

*Average Daily Activity*

Shopping Location

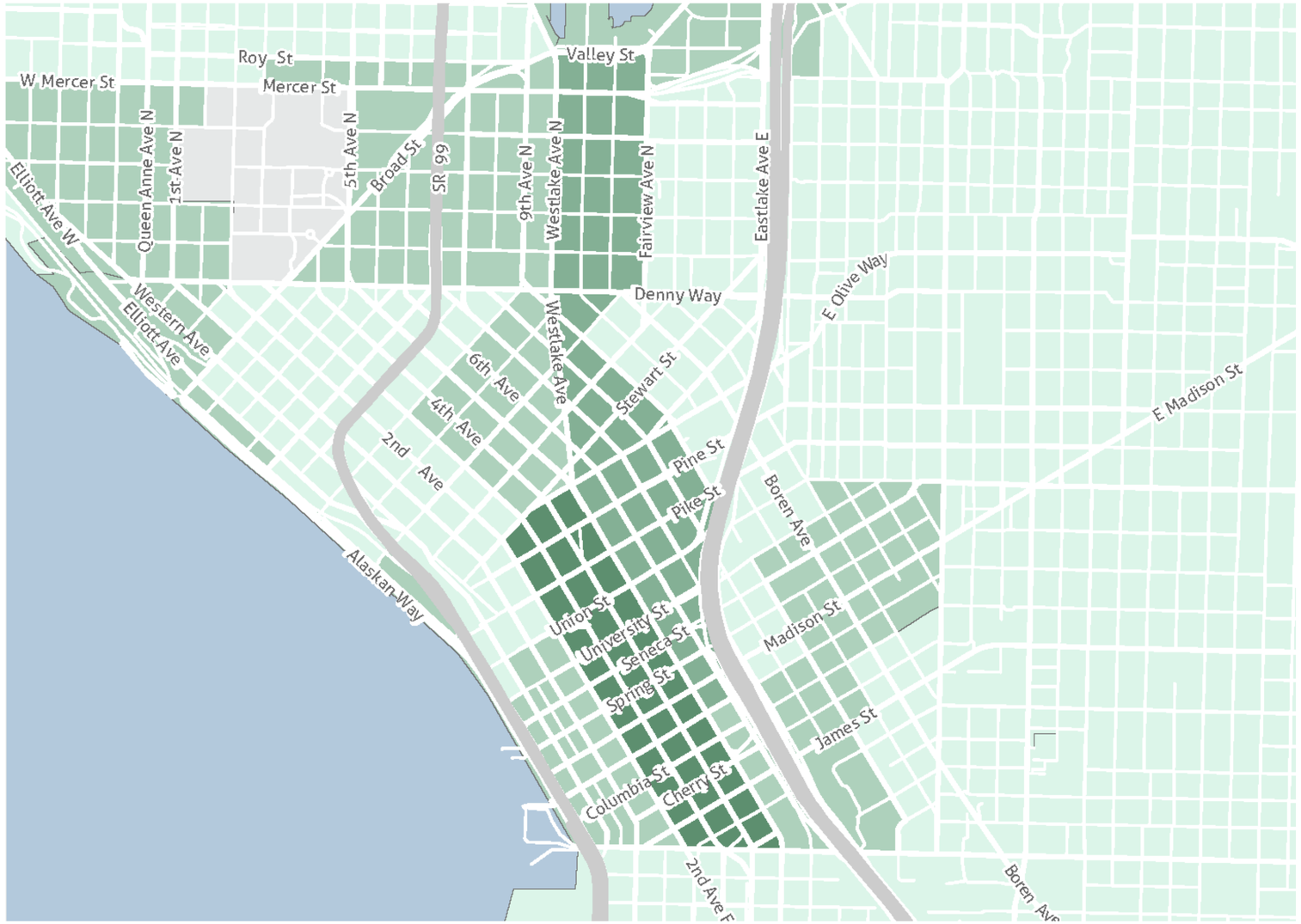
26% 74%

Delivery Location



39% 61%


Daily Delivery Intensity by Census Block



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# Methodology

## Scenario 3 | Existing Land Use

*Increased Online Shopping Demand and Retain In-Store Demand*

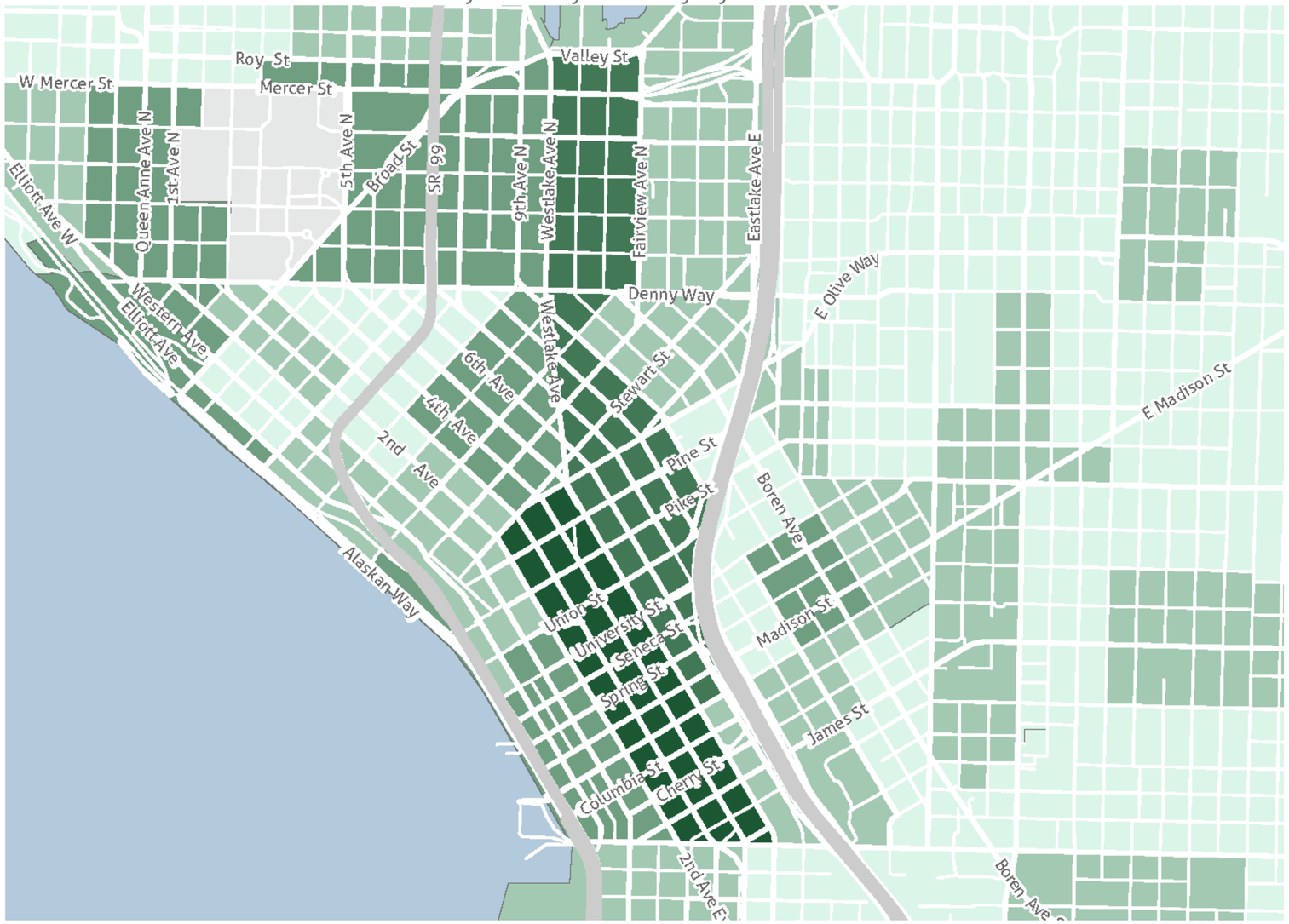
*Average Daily Activity*

Shopping Location


Delivery Location



Daily Delivery Intensity by Census Block



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# Methodology

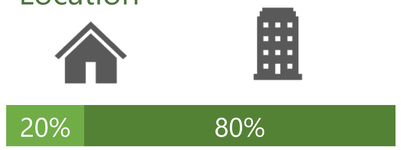
## Scenario 4 | Existing Land Use

*Increased Work Deliveries*

*Average Daily Activity*

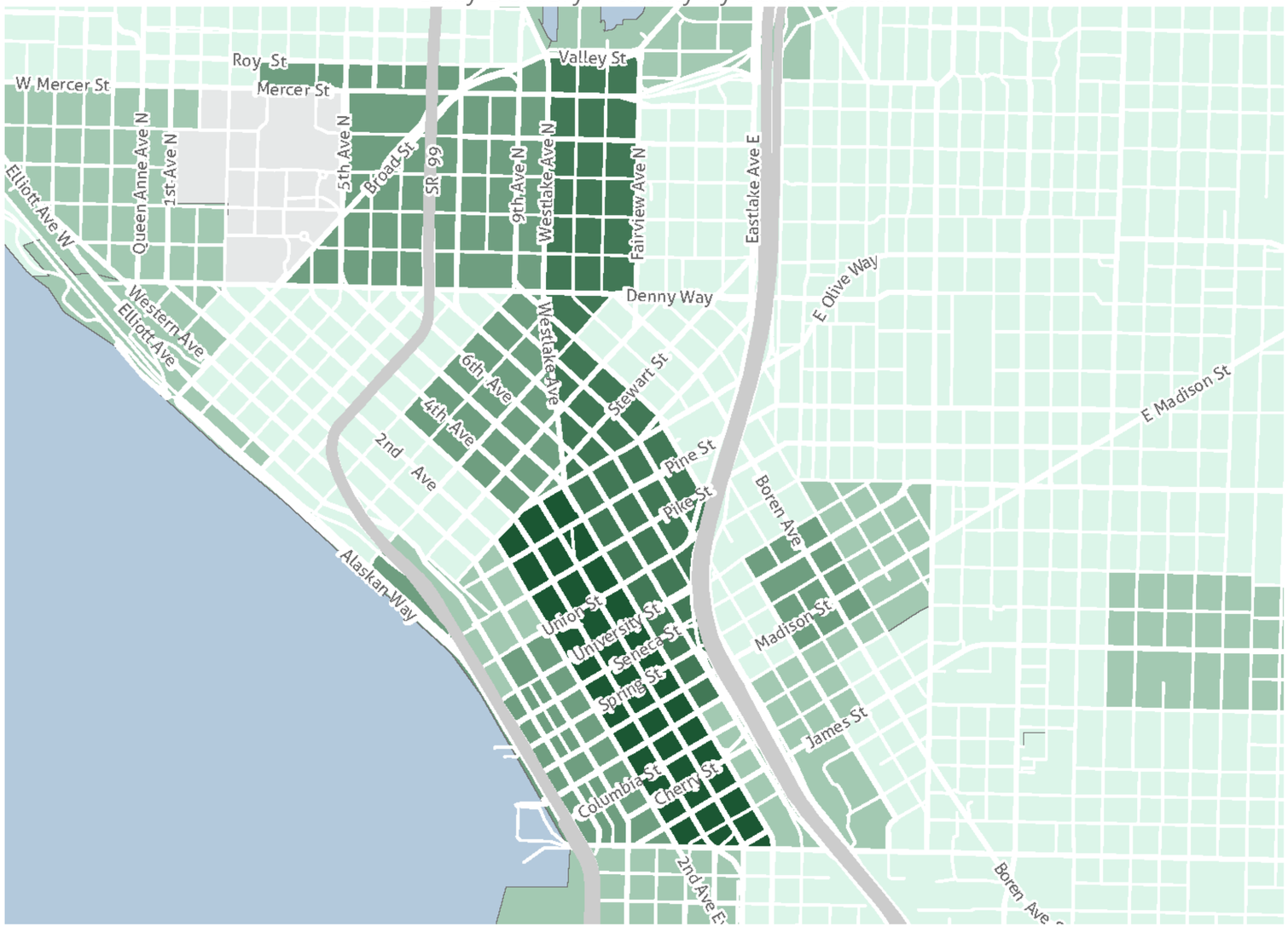
Shopping Location


Delivery Location



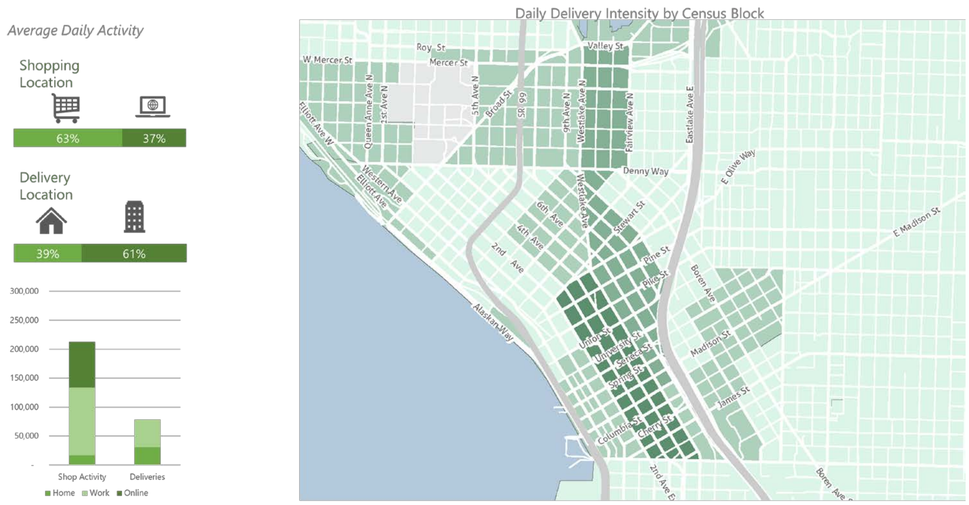


Daily Delivery Intensity by Census Block



# Conclusions

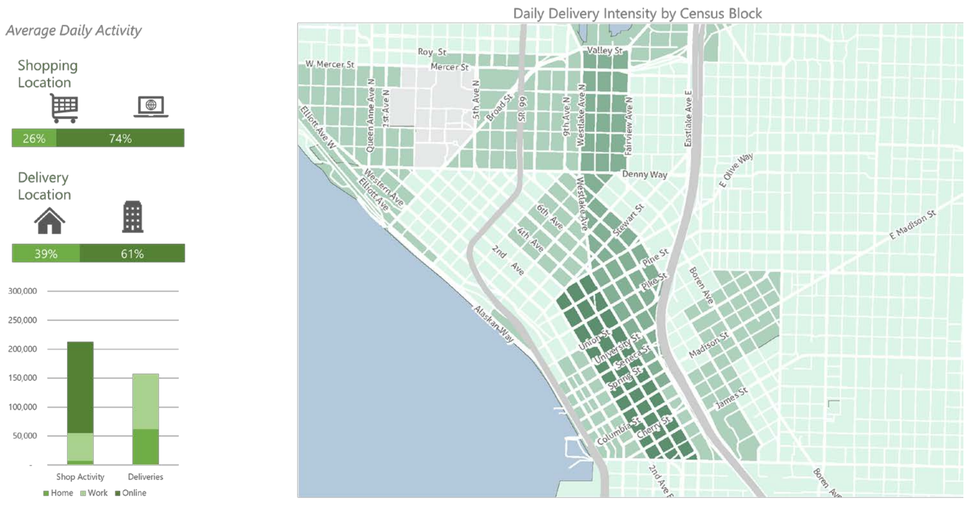
## Baseline







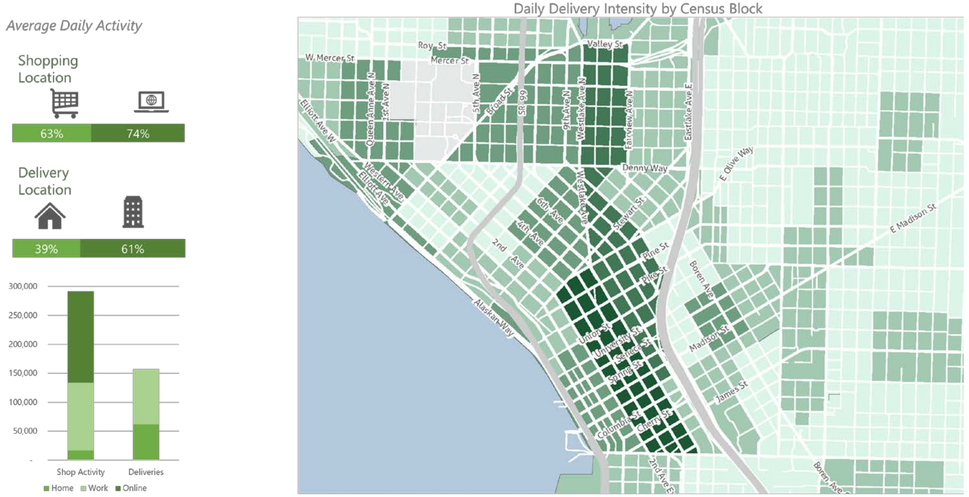
## Increase Online Shopping







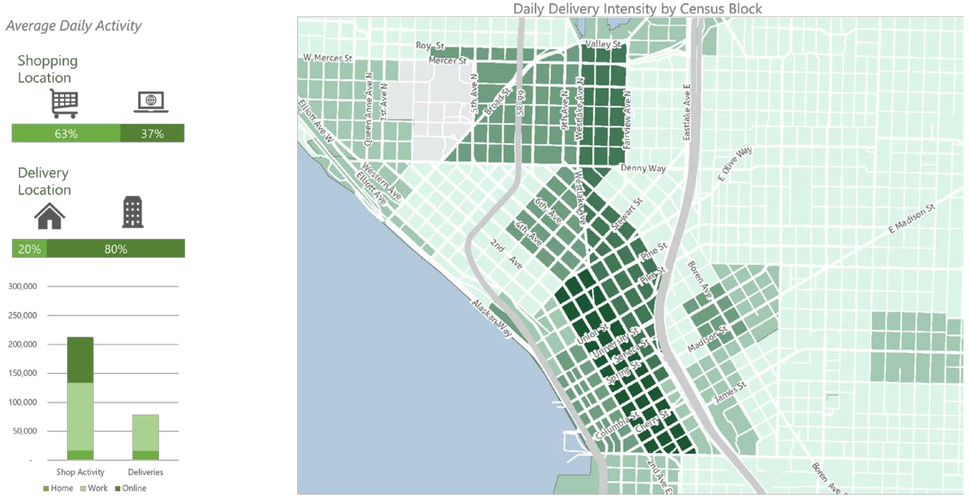
## Increase Shopping Demand







## Increase Workplace Deliveries



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# Conclusions

- Regional Travel Demand models are not currently able to accurately capture or measure on-demand goods delivery

- Available data can be used to identify demand for online and in-store shopping
    - Accurate and detailed data for the location of households and employment is key
    - Current data limitations include:
        - How many online shopping trips/orders per delivery
        - How many, if any, purchases made per in-store shopping trips
- Future considerations:
    - Include salary data for employment
    - Data analysis needed to identify home and work delivery trip ends
    - Impact on curb space: delivery duration and location, truck/vehicle size
    - Apply methodology to different area and place types
    - Model of supply (productions) to correlate with the demand (attractions) to create OD patterns

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# References


| | | |
|---|---|---|
| The Delivery Economy Changes Everything: New Requirements for Urban Freight Research | University of Washington Urban Frieght Lab | 2017 |
| Delivery Process for an Office Building in the Seattle Central Business District | University of Washington Urban Freight Lab | 2018 |
| Preparing cities for package demand growth: predicting neighborhood demand and implementing truck VMT reduction strategies | University of Washington Urban Freight Lab | 2018 |
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| Building the database - supporting logistics research initiatives | University of Southern California | 2015 |
| Biking for Goods is Good - an assessment of CO2 savings in Paris | University of Southern California | 2014 |

# Acknowledgements

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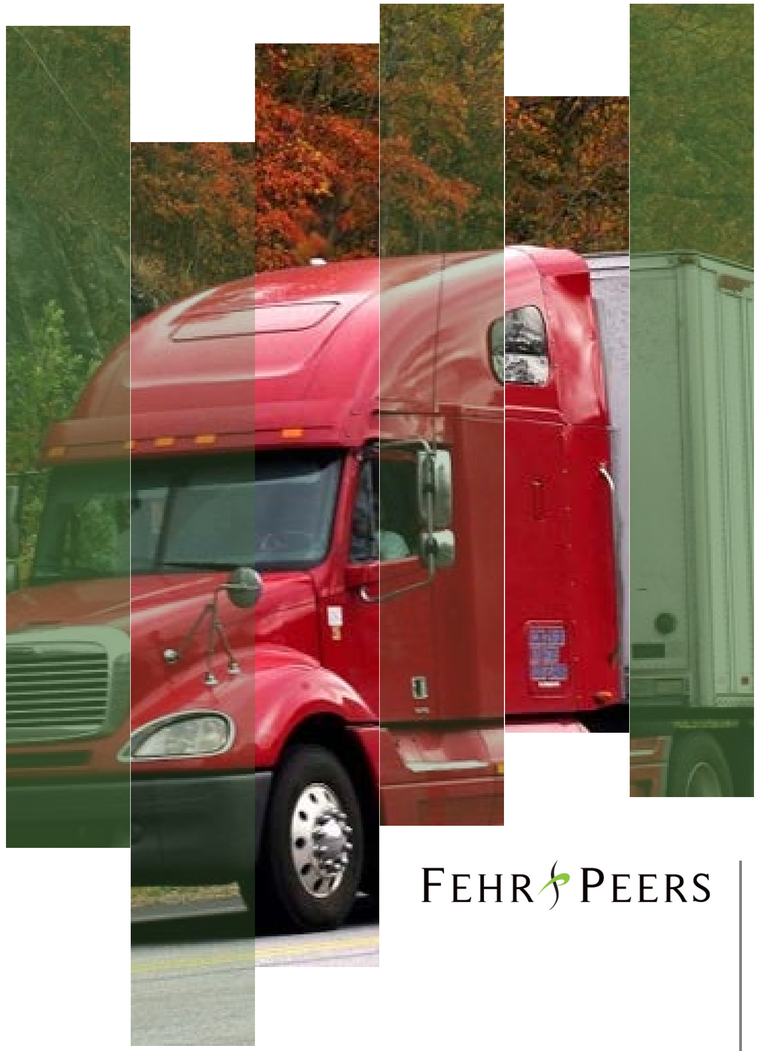
Government Division



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