Ridehailing, Congestion and Context:

How Big Data Can Help Understand the Impacts of Ridehailing in the Context of Other Transportation and Land Use Elements

STREETLIGHT DATA

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1 WHY IT MATTERS

The ridehailing phenomenon kickstarted by Uber and Lyft less than 10 years ago is widely prevalent in several communities across the US. Many communities are asking the questions about the impact of ridehailing on the other transportation aspects such transit ridership, curb space management, and roadway congestion.

Data from ridehailing companies has been hard to come by, which makes it challenging to conduct analysis to answer some of these questions.

Focusing on the roadway congestion, we had the following goals in conducting this study:

1. Find a way to measure gig driving that doesn't rely on waiting for data sharing by private companies.

2. Measure "gig mode share" - or the percent of vehicle trips on a given road segment at a given time that is a gig vehicle - on all roads within a single MSA.

3. Combine this "gig mode share" analytic with core transportation metrics around total vehicle volume and congestion to explore the interaction between gig share and congestion in different urban contexts.

2 METHODOLOGY

StreetLight analyzes mobility patterns from millions of mobile devices every day. Analyzing congestion and driving characteristics for the full population is part of the core transportation metrics that are produced monthly. Measuring our Free Flow Factor is a part of these core metrics and is a representation of congestion on a roadway segment.

Free Flow Factor is the ratio of the average trip speed for a segment for the hour of the day to the maximum average trip speed for the segment in any hour during the entire data period.

STREETLIGHT DATA: BIG DATA ANALYTICS

365 DAYS OF LBS DATA + CONTEXTUAL DATA

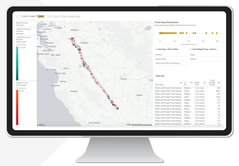
- Passively collected anonymous data in U.S and Canada
- 28B+ data points/month
- More accurate than cell-tower based data

ANALYTICS COMPLETED IN MINUTES

- Ability to do pass-through trip (external to external) studies
- Compare days of the week, times of day, and more
- Available as interactive visualizations and csv files

SPEED & TRAVEL TIME ANALYSIS

- Speed is calculated based on the observed pings along a segment
- Free Flow Factor is based on the maximum average speed observed over an hour for a segment for the defined data period



To create gig driving analytics, we worked with our data partners to segment anonymous users as having gig driving apps installed on their devices. Then we analyzed how those segments different from the norm.

Their patterns include more miles traveled per day, irregular routes without fixed favorite places, and more. We used machine learning and probabilistic modeling to identify when a mobile device is in "gig driving" mode, and not - then applied those insights to our existing database.

For this study, we analyzed over 15,000 gig drivers, and several million personal driving trips from 2018.

3 RESULTS

GEOSPATIAL TRIP DISTRIBUTION

As shown in Figure 1 - gig mode share (gig trips as percent of all trips on the road segment) is higher in certain parts of town, notably tourist- and hotel-heavy areas like Miami Beach, downtown Miami, and at Transportation Network (TNC) ramps into Miami-Dade Airport. This matches intuition and helps build confidence in this hard-to-validate analytic.

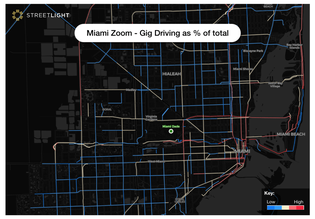


Figure 1 - Gig mode share, gig driving as percent of all trips on road segments in greater Miami (weekday, all day).

TEMPORAL TRIP PATTERNS

In general, gig driving patterns follow temporal patterns. We see morning and evening peaks on weekdays for example. However, gig mode share goes up on evenings, late night, and weekends. These are times with low congestion, when a few extra gig cars won't make a big difference. If the roads are congested in the first place, if gig creates more trips than would have existed otherwise, gigs do make a difference (like any type of marginal additional). Thus, the relationship between gig mode share and time of day is neutral.

ROADWAY CLASSIFICATION DISTRIBUTION

The bigger opportunity for policy makers is on non-highway roads. On arterial roads, we see 6x the impact as on highways: a 0.6 - 0.7% increase in congestion with each precent increase in gig mode share. Thus, we find that, in general, gig mode share has more variability, and more of an impact, on congestion, on non-highway roads. Policy makers can use this to find local roads to focus on for interventions.

LAND USE TRIP DISTRIBUTION

In commercial areas (as opposed to residential areas) is where the results are more interesting. In greater Miami, in the very dense neighborhoods (top 10% of points-of-interest density, see map below) a high gig mode share is correlated with a lower congestion.

However, in the mid-dense commercial areas, high gig mode share is correlated with higher congestion. We interpret this to mean that in greater Miami there's a threshold of actvity density above which gig mode share increases are associated with less congestion, and below which gig is associated with more congestion.

Perhaps this is because of reduced parking-searching in the very popular neighborhoods. But in medium-density neighborhoods, the gig vehicles may be adding trips or stopping the blocking traffic. Other Miami-neighborhood-specific factors like road width may come into play as well.

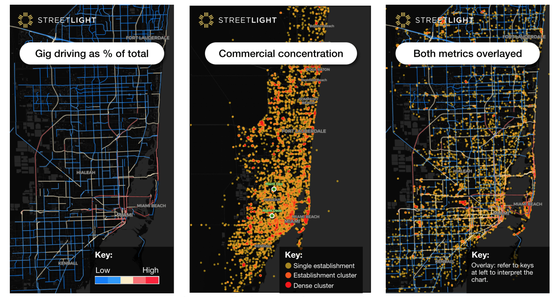


Figure 3 - Gig driving as percent of total traffic, location of commercial points of interest (restaurants, bars, etc...) and a mashup of the two of them.

Specifically, Figure 4 below shows the neighborhoods near downtown Miami. All of them are in the top 20th percentile in terms of gig mode share as a percent of all driving on weekdays. Orange neighborhoods, like Little Havana, have both high gig mode share and high congestion. Green Neighborhoods, like Bay Shore, have high gig mode share but very low congestion.

Even within the orange neighborhoods, the ones with a star, like Brickell, representing "top activity density" are likely to have lower congestion than one with no star.

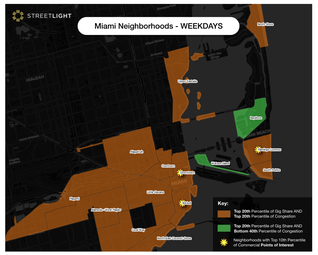


Figure 4: Top 20th percentile and bottom 40th percentile of neighborhoods with gig trips