airsage

THE POWER OF WHERE AND WHEN

SOUTHEAST FLORIDA FSUTMS USERS GROUP

OD Data | GPS Update | Travel Time Validation

Bill King, P.E.
Sr. Director of Business Development

AirSage

The Leading Solutions Provider in Location Intelligence and Population Movement

- Founded in 2000 and headquartered in Atlanta, GA
- Executive team has deep experience in mobile technology and location data industries
- 8 patents covering "the use of wireless data to support transportation planning and engineering"
- Anonymously analyze the movement of mobile devices
- High-volume, high-quality geo-location data processing solutions
- Largest and most accurate panel of where people go in the U.S.
- Evaluate over 50 billion location-based events every month
- Provide the most powerful mobility insights available on the market today

Location Data Solutions

Industry leader in source agnostic high-volume, high-velocity, high-quality, geo-location data processing solutions

Providing mobility intelligence and analytics to customers in transportation, media, travel & tourism, retail, research and many other verticals

Understanding US population movement at scale and providing answers to the most complex and demanding geo-location questions

Comprehensive solution suite to service all types of mobility-based use cases

- Trip Matrix (Origin-Destination)
- Target Location Analysis (Point-of-Interest)
- Activity Density (Population)
- Audience Insights
- Event-Based Research
- Custom Insights

Data Quality

✓	Trusted	1st party data from on-device apps, not gathered from ad exchanges
✓	Direct	Location-based data collected real-time direct from the device
✓	Unique	Source data from hundreds of publishers and app-direct partners
✓	Accurate	Validate Lat / Lon for <10M geo-spatial precision
✓	Dense	Capture +100 data points per device per day
✓	Scale	Process billions of location events per day
✓	Diverse	Geospatial, Geographic and Temporal panel distribution
✓	Process	Curate and cleanse to ensure that we use only the highest quality data
✓	Anonymous	Neither access personally identifiable information nor associate it with device ID
✓	Private	Products are compliant with all industry privacy regulations and guidelines

Data Processing

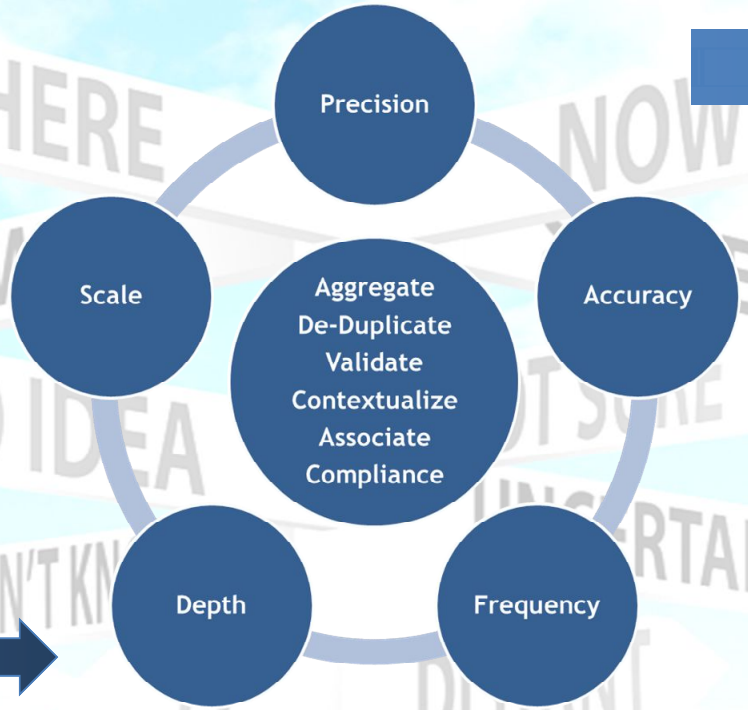
- ✓ Process 1st party geo-location data on over 100 million unique mobile devices per month
- ✓ Compile and convert billions of location events into useful information about mobility activity
- ✓ Diverse panel assembled from pre-qualified high-quality sources including: Wireless Carriers, Smartphone App SDKs, Bluetooth Beacons, Fleet and Navigation Systems, and Connected Car
- ✓ Ongoing evaluation of new data types and providers to ensure the best resources available
- ✓ Archival historical data from prior months and years available to track trends
- ✓ Patented WiSE™ technology anonymizes data to ensure user privacy and performs a multi-stage analysis to monitor and validate the location and movement of mobile devices
- ✓ Providing unprecedented visibility into where groups of people are, where they were, where they are likely to be, and how they move from one area to another

Data Processing

Location Data Input

- GPS Coordinates
- Time
- Velocity
- Roadway
- Points of Interest
- Context
- Demographic

WiSE™ Technology Platform



Proprietary Output

- Trip Matrix
- Target Location
- Activity Density
- Audience Insights
- Event Research

GPS Source Data

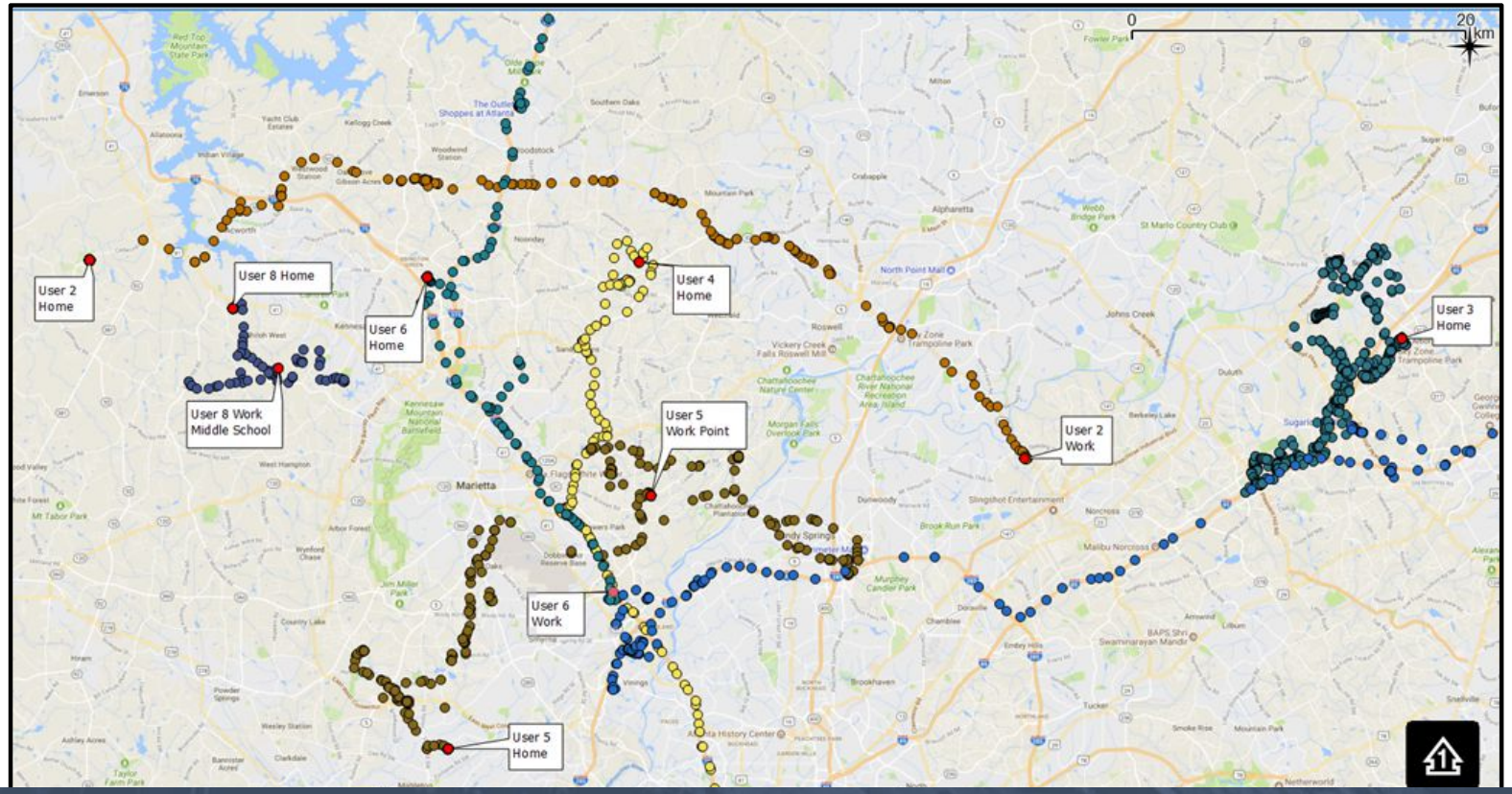
Source Data Examples: Atlanta, GA

One Day | 1 Location

GPS Source Data

Source Data Examples: Atlanta, GA

One Day | 10 Unique Mobile Devices | Activity Points



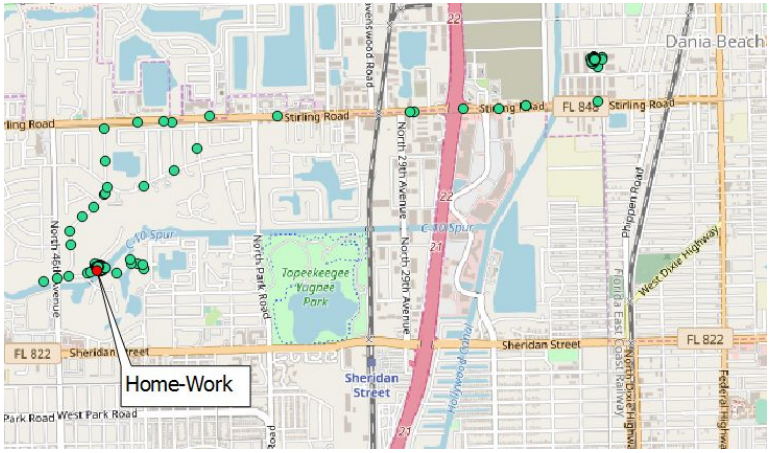
Basic Source Data Analysis

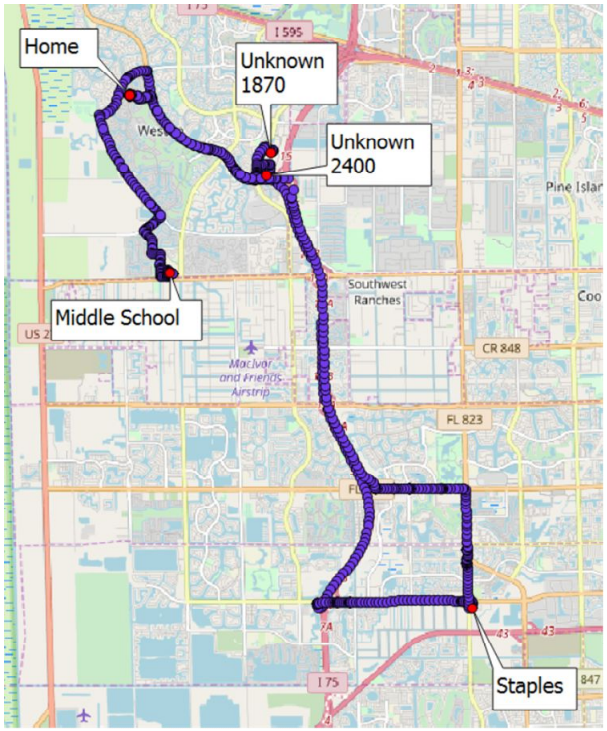
Modular, multi-step methodology to derive useful information and analytics from GPS data

Data collection, processing, and delivery

Core components:

- **Activity Pattern Analysis**
- **Activity Point Generation**
- **Penetration Analysis**
- **Population Synthesis**





Population Synthesis: All Products

Devices remaining at the same location generate "Activity Points" whose location is then analyzed for: Arrival time at location, Departure time from location and Activity duration

Activity Patterns for each device are summarized by frequency and schedule to determine the most common nighttime location – this is deemed the "Home Location"

A penetration analysis is done at the Census Tract level to determine the extrapolation factor for each device

The sample is then scaled to represent the movements of 100% of the Population of the Census Tract

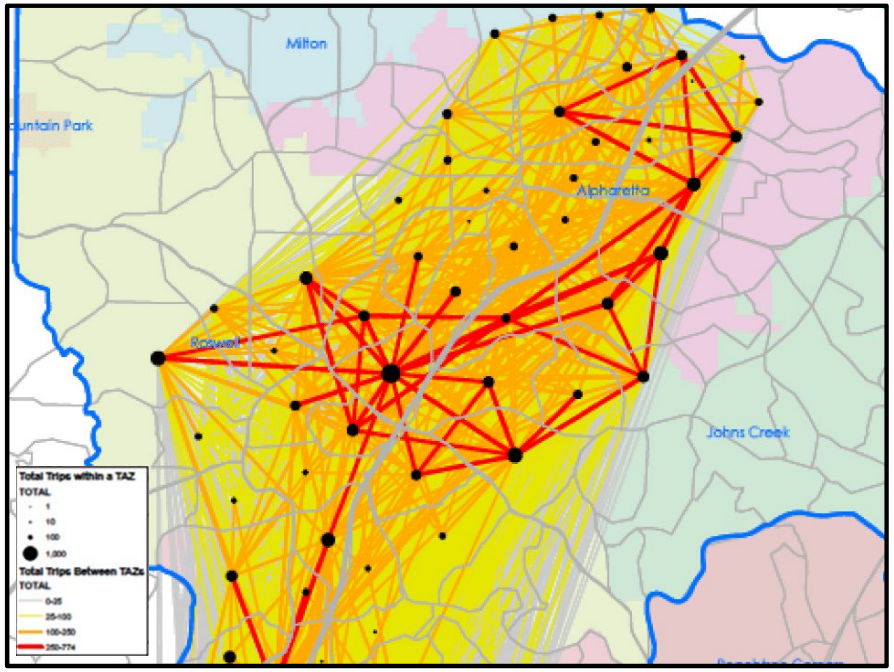
For each Project: Activity Points for each device are then Linked to generate Trips by Daypart and by Type (Home, Work, Other), Time of Day Information (Minimum 3-hour bracket), Resident Classifications

O-D Trip Matrix

O-D Trip Matrix product has wide ranging utility

Through advanced pattern recognition algorithms, AirSage understands all travel in the United States from a national down to a local level

Observing more than a third of the trips being in made in the country allows AirSage to provide valuable information for travel demand modeling, scenario planning and many other applications within and outside the transportation realm



O-D Trip Matrix

Leveraging a massive amount of source data and patented algorithms to understand the movement of population and trips from origin to destination for the entire country

We know the where and when of more than a billion trips made every day in the US

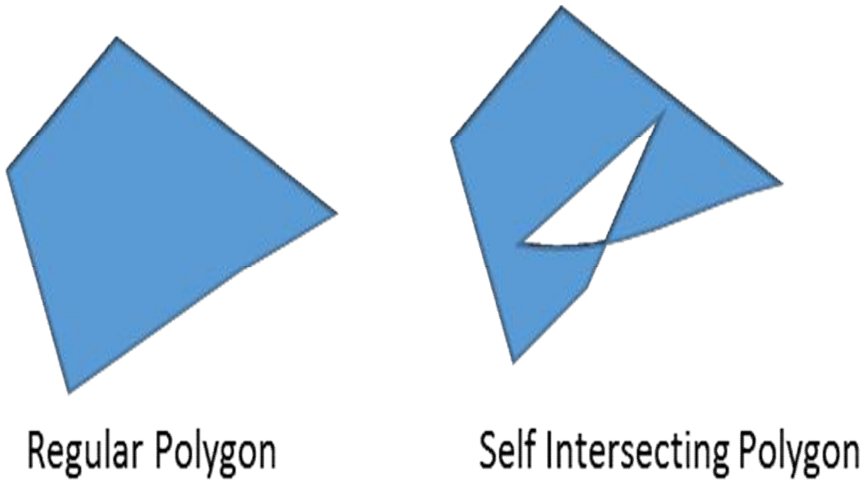
Origin – Destination Trip Matrix Output attributes include:

- Time-of-Day / Day-Part Segmentation
- Resident / Visitor Classification
- Trip Purpose Classification
- Average Weekday Aggregation
- External / Internal Trajectories
- Long Distance Trip Filters
- Home / Work Block Group Designation
- Demographics

O-D Trip Matrix

Shapefile Format Requirements

The shapefile format is a popular geospatial vector data format for geographic information system (GIS) software. It is developed and regulated by Esri as a (mostly) open specification for data interoperability among ESRI and other GIS software products. ["ESRI Shapefile Technical Description“ July 1998]



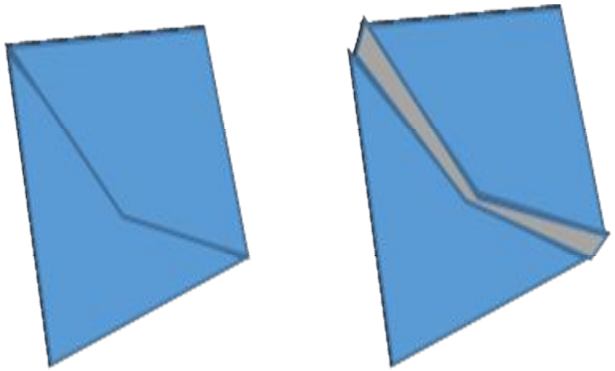
The shape file must be projected to World Geodetic System (WGS) 84 (EPSG 4326)

A unique numeric identifier in a field named TAZ_ID must identify each zone. This numeric identifier cannot be null or 0 (zero).

Each zone must be classified as an internal or external zone , explicitly stated in a string format as: internal or external in a field named Int_Ext

O-D Trip Matrix

Shapefile Format Requirements



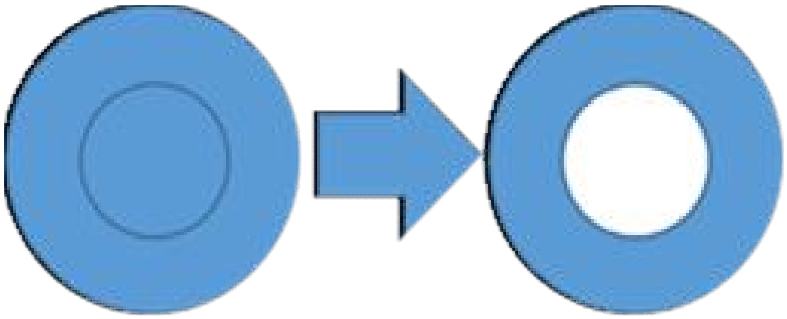
Regular Shape File Shape File with Sliver Polygons

The shape file must not have any self-intersections or slivers. Please check your file for geometric validity to look for these cases

O-D Trip Matrix

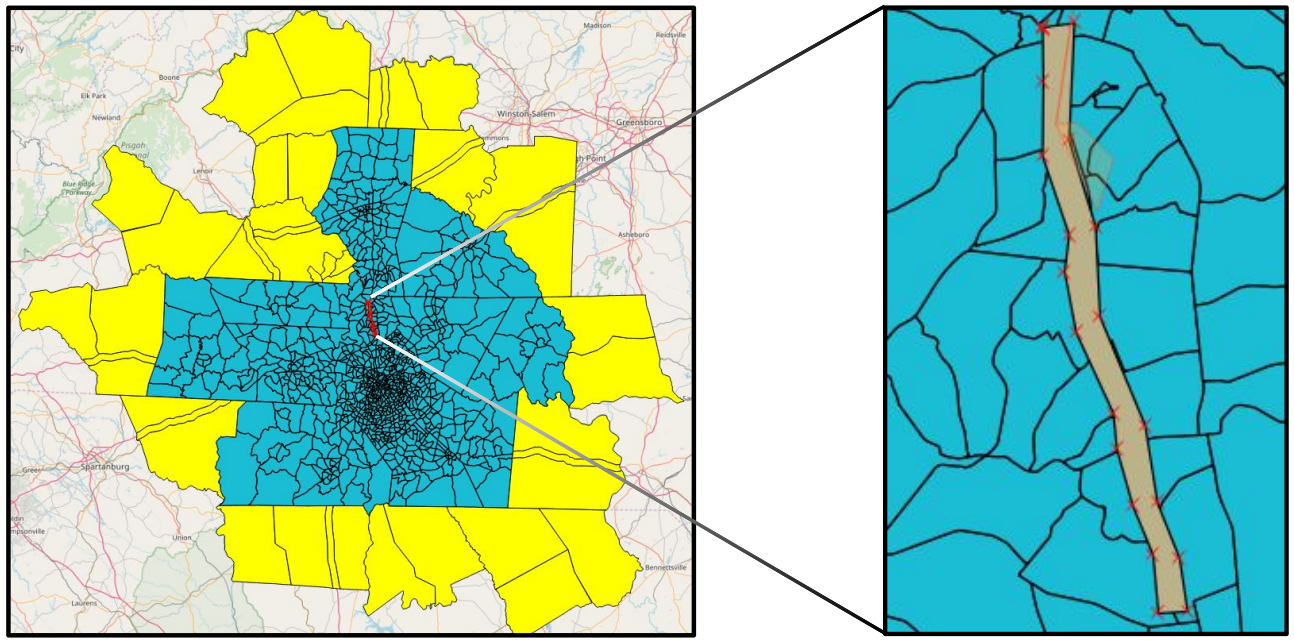
Shapefile Format Requirements

Each zone must be mutually exclusive. The outer (encompassing) zone must not cover/overlap the region represented by the inner (encompassed) zone. This means, the outer zone must have a hole (like a donut) in the area represented by the inner zone.



O-D Trip Matrix

External / Internal Example: Charlotte, NC



Zone and Sub-Zone Structure for Regional Analysis

O-D Trip Matrix

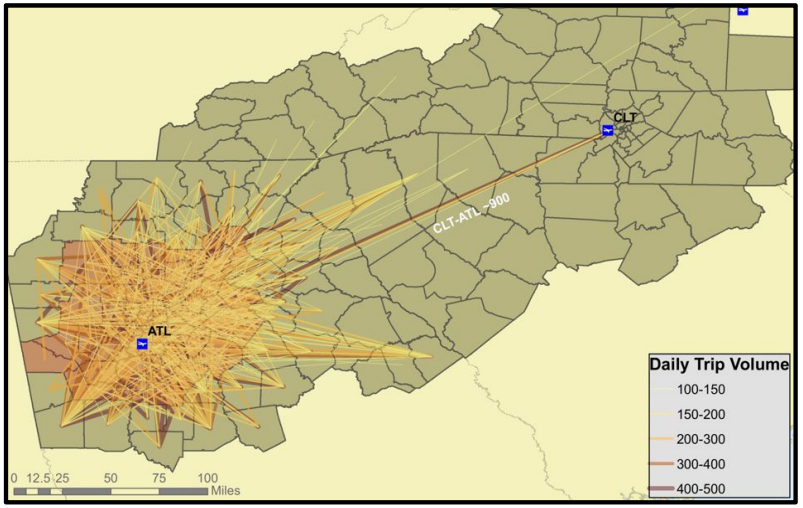
Output Example:

The origins / destinations between zonal pairs of all devices seen within the predetermined study area will be assigned with the appropriate fields and attributes

The zonal structure (zips, tracts, blocks, grid, etc.) is determined by the consulting parties in coordination with AirSage

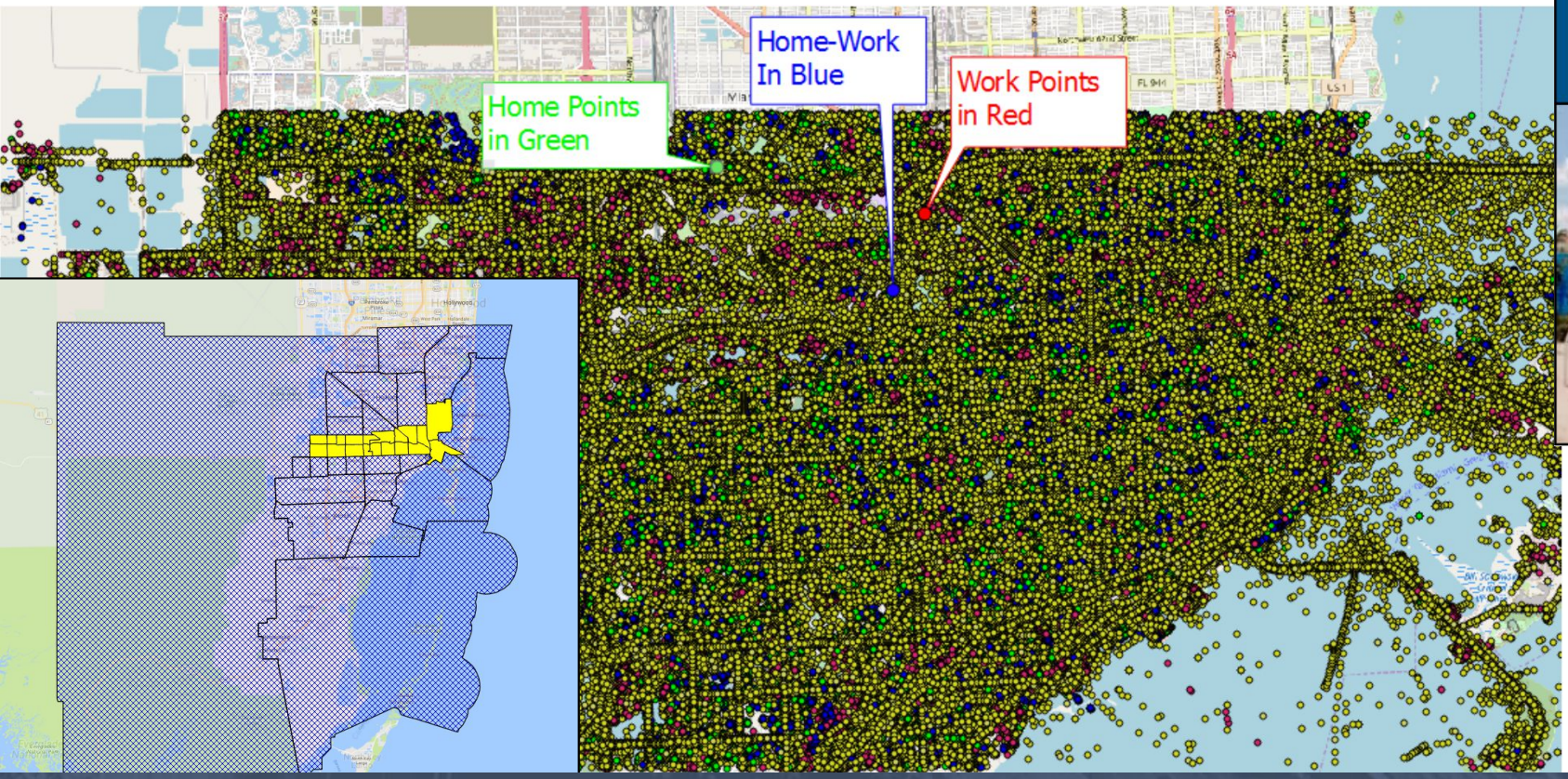
Data provided in a CSV file that is Excel- and Tableau-friendly and can be easily input into a number of geo-analytic or statistical software platforms for evaluation and visualization

Origin	Destination	Homezone	Aggregation	Purpose	Daytime	Count
4013319401	4013216831	4013105004	Mon_Tue_Wed_Thu	OO	H11:H12	2.2771
4013216831	4013216831	4013216831	Sat	OO	H17:H18	8.1537
4013216831	4013216816	4013216847	Fri	OO	H17:H18	10.6697
4013216831	4013104802	4013104802	Mon_Tue_Wed_Thu	OH	H17:H18	4.3822
4013115200	4013216831	4013216830	Mon_Tue_Wed_Thu	OH	H15:H16	3.8632
4013216831	4013103303	4013103303	Mon_Tue_Wed_Thu	OH	H16:H17	9.192
4013116204	4013216831	4013216831	Fri	OO	H16:H17	10.2307
4013104215	4013216831	4013217002	Mon_Tue_Wed_Thu	OO	H15:H16	2.4812
4013216831	4013216826	4013216826	Sun	WH	H19:H20	12.9768



O-D Trip Matrix

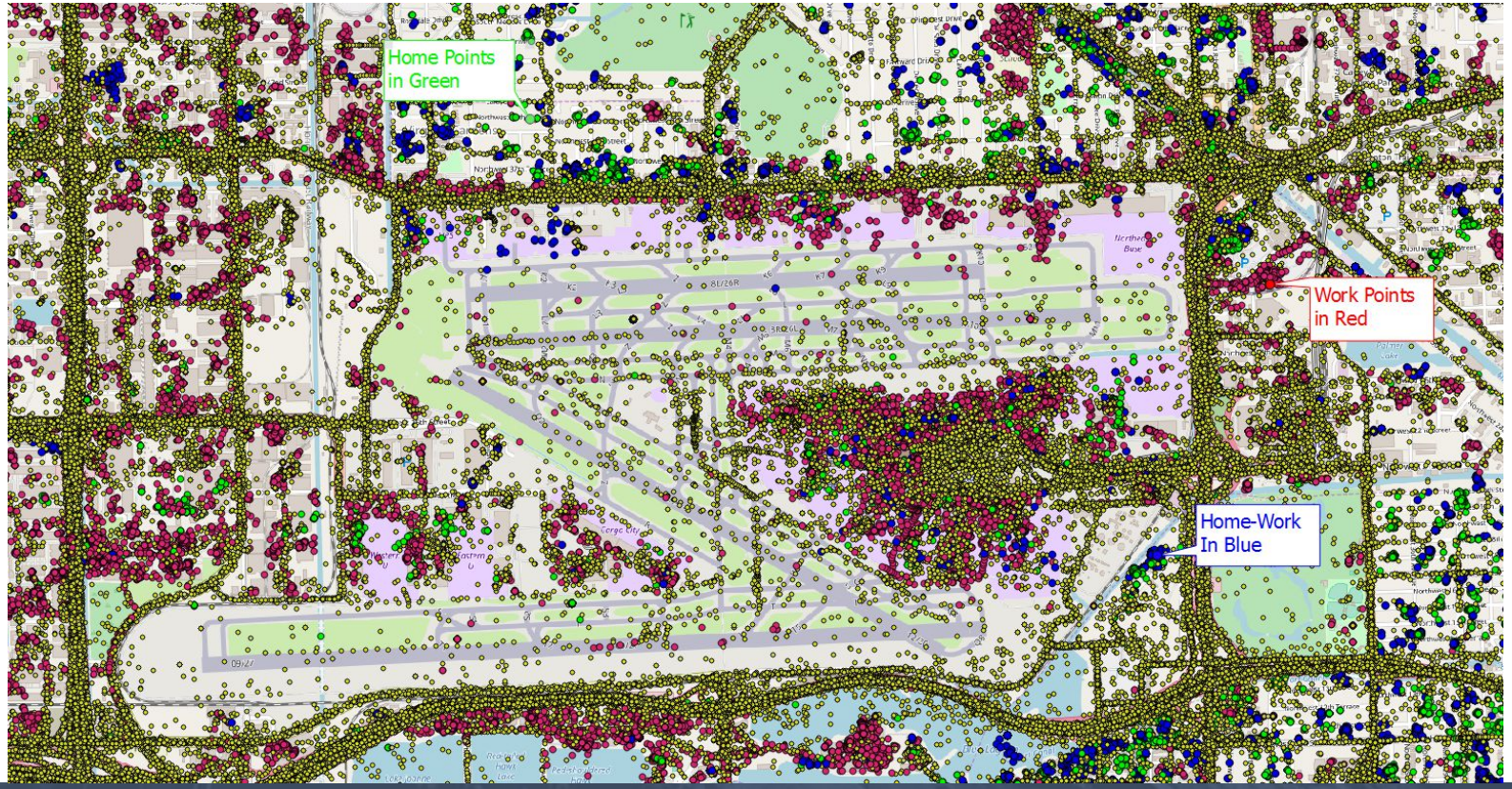
Example: Miami, FL East-West Corridor



Critical east-west commuter demand corridor

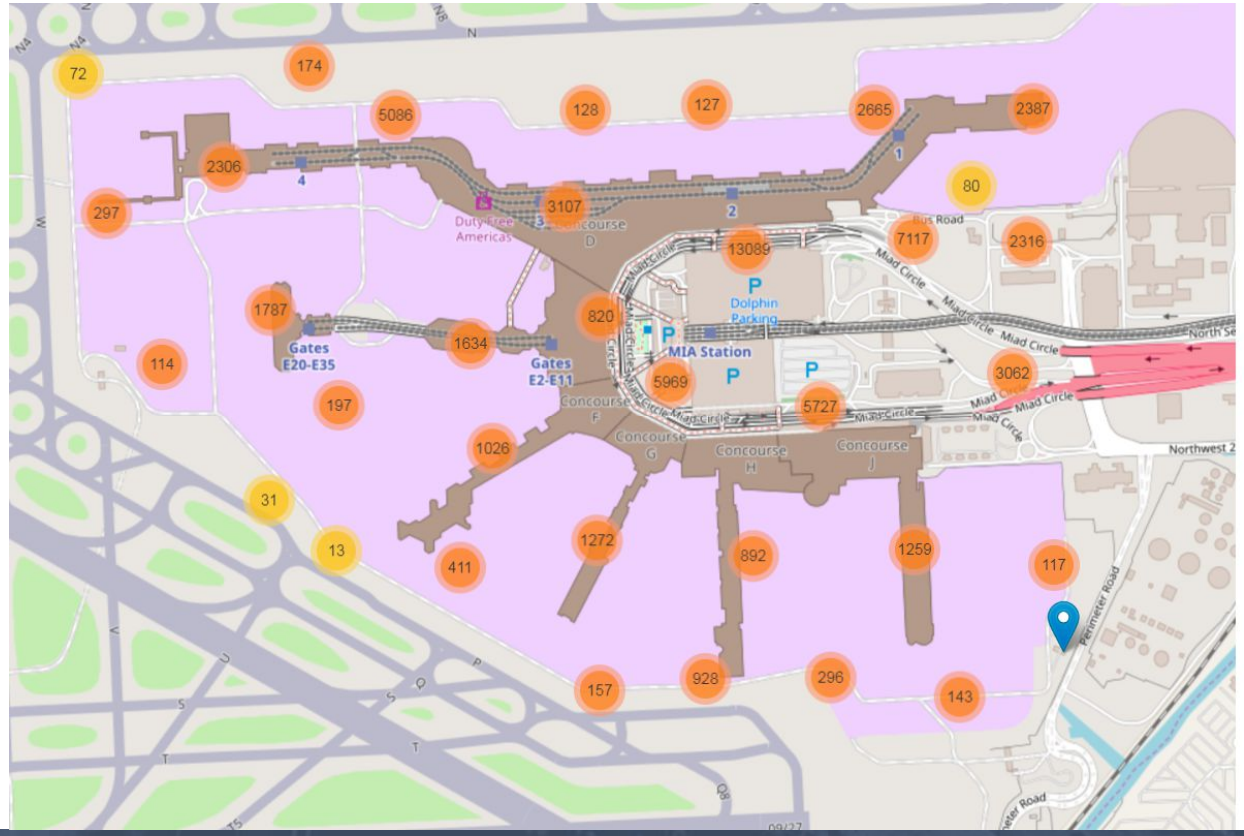
O-D Trip Matrix

Source Data Examples: Miami International Airport - Averages 30,000 Visitors per day



O-D Trip Matrix

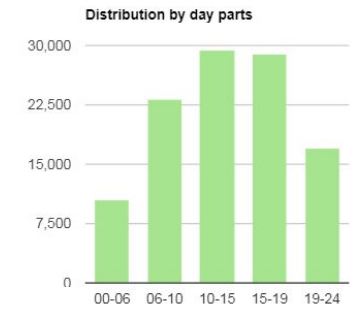
Source Data Examples: Miami International Airport – March 15, 2017

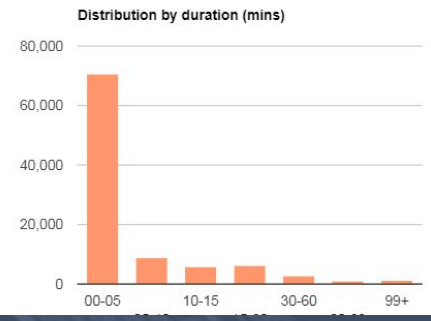


Unique devices seen: **7875**

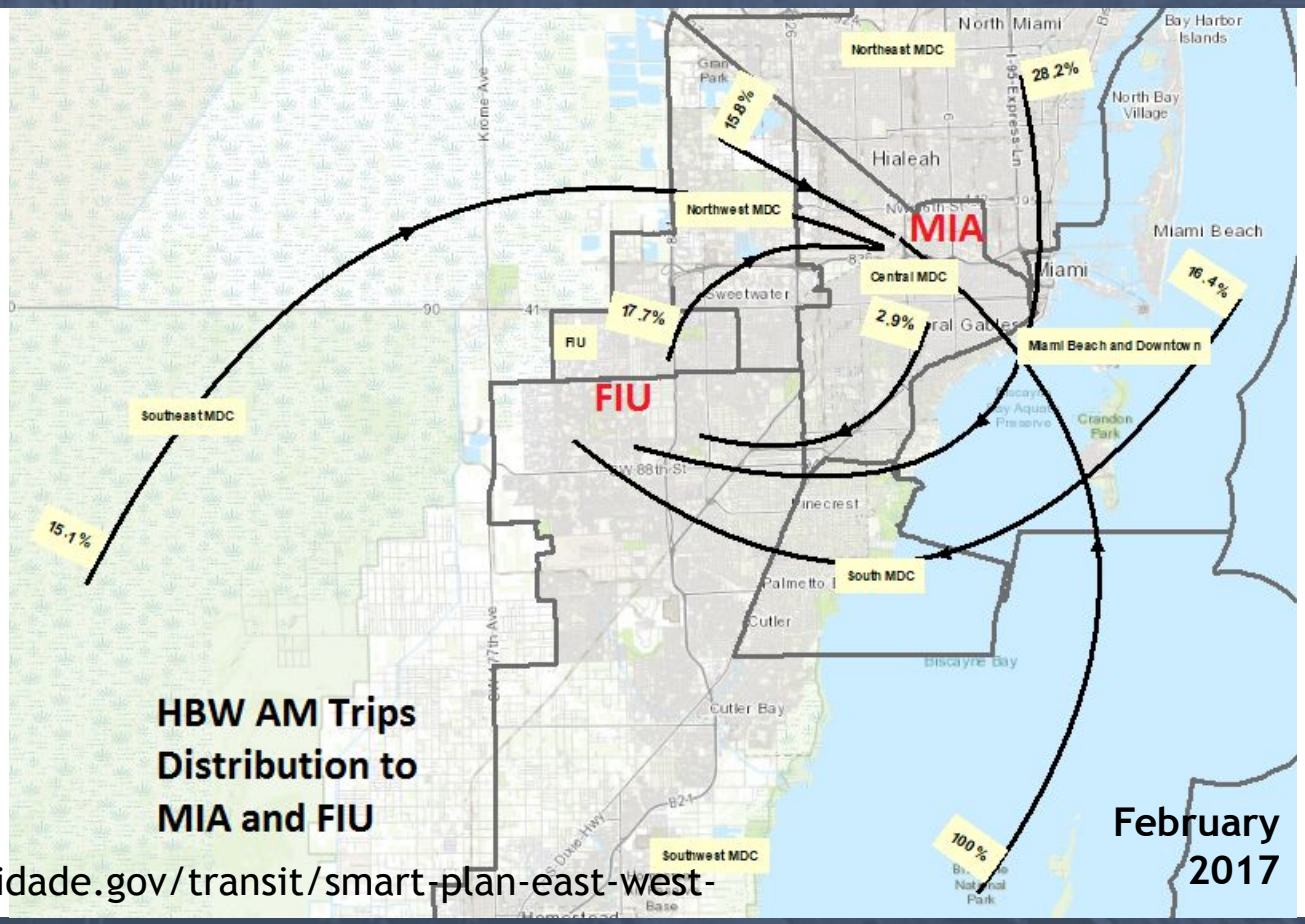
26 %

Total number of activties: **90997**





O-D Trip Matrix

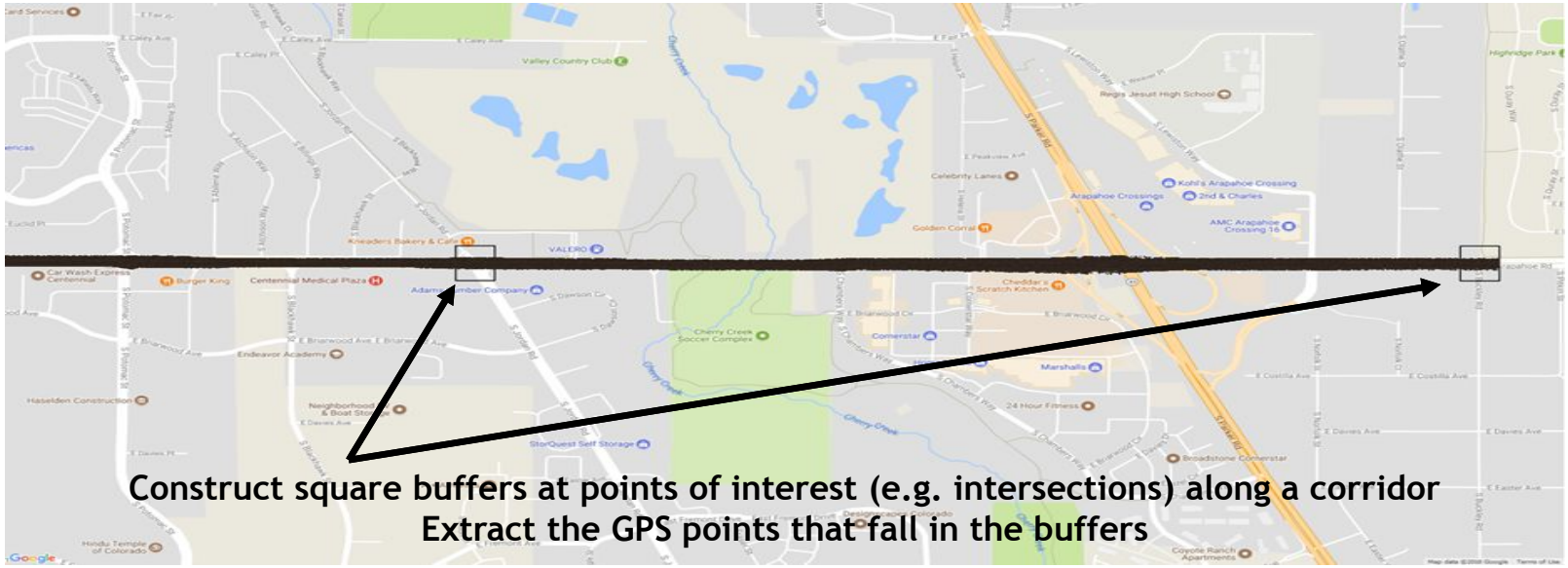


https://www.miamidade.gov/transit/smart-plan-east-west-corridor.asp

Travel Time

Analysis performed using GPS data for October 2017

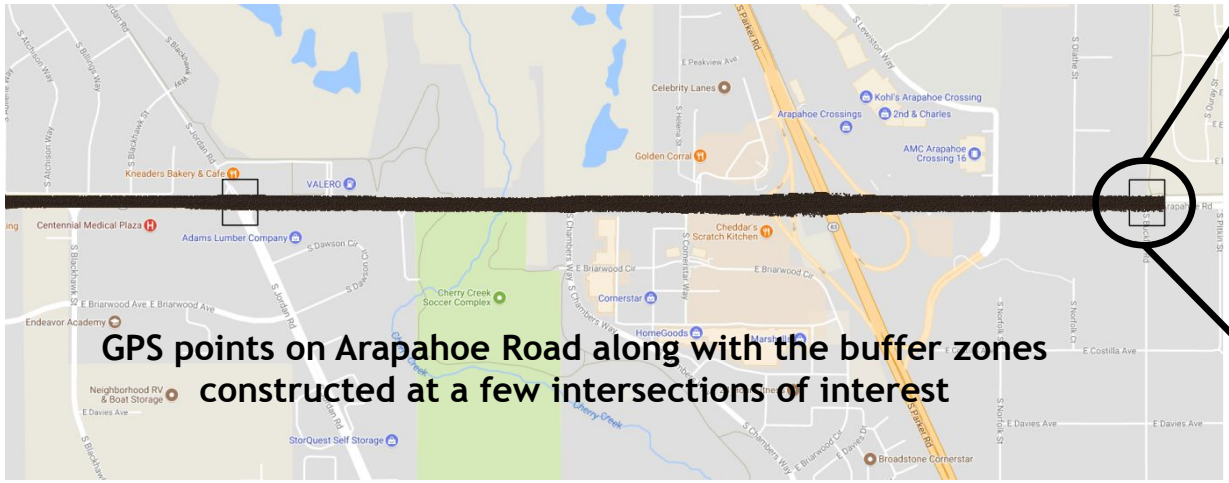
Though the analysis resulted in 38 unique segment/peak-period combinations, we are presenting results for only a few segments of interest.



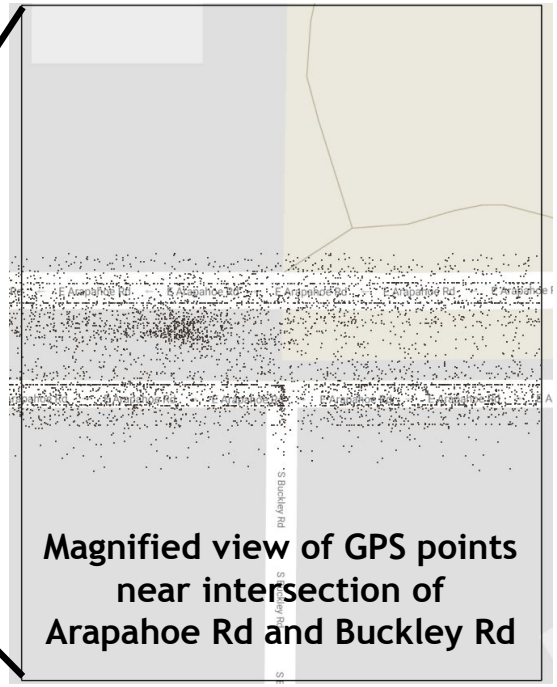
Travel Time

Using the GPS points and epoch times of unique device IDs, travel times can be estimated for all combinations of roadway segments along a corridor

Ex: corridor going from A-B-C, travel time estimates for segments A-B, B-C, A-C, C-B, B-A, C-A can be calculated



GPS points on Arapahoe Road along with the buffer zones constructed at a few intersections of interest



Magnified view of GPS points near intersection of Arapahoe Rd and Buckley Rd

Travel Time

Comparison of travel times obtained using GPS data (one day) and probe data (actual drivers) for the AM period.

		GPS		Probe	
Route Name	Time Period	Average Travel Time (minutes)	Sample Size	Average Travel Time (minutes)	Sample Size
Buckley-Revere	6-8AM	4.23	2	8.98	12
Havana-Jordan	6-8AM	12.16	3	4.79	12
Havana-Yosemite	6-8AM	3.88	28	3.42	12
Buckley-Jordan	6-8AM	4.61	42	6.59	12
Revere-Havana	6-8AM	3.17	54	2.85	12
Jordan-Revere	6-8AM	2.77	67	2.40	12

Travel Time

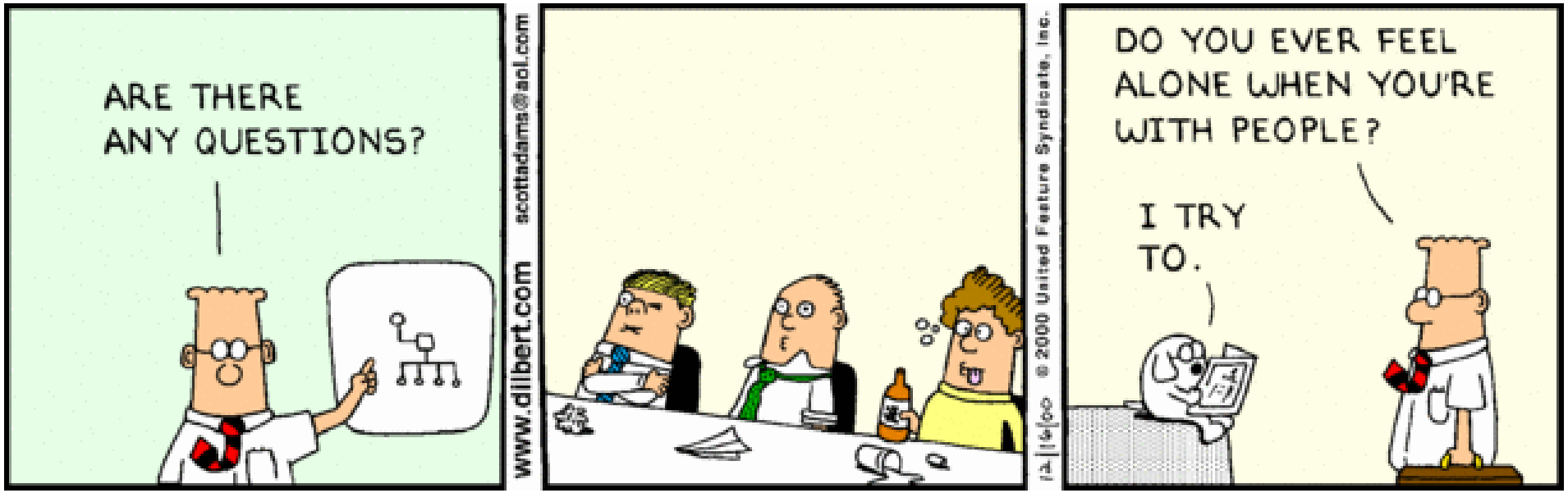
Comparison of travel times obtained using GPS data (one day) and probe data (actual drivers) for the PM period

		GPS		Probe	
Route Name	Time Period	Average Travel Time (minutes)	Sample Size	Average Travel Time (minutes)	Sample Size
Yosemite-Buckley	4-6PM	18.13	4	17.14	12
Buckley-Havana	4-6PM	13.30	5	8.22	9
Jordan-Buckley	4-6PM	4.95	54	5.19	11
Revere-Havana	4-6PM	3.94	66	3.10	9
Havana-Revere	4-6PM	3.83	77	2.99	11
Revere-Jordan	4-6PM	5.07	101	4.67	11

Travel Time

- Overall, our estimates of travel time based on the GPS data compared well with that of the Probe data. It should be noted that our confidence in the GPS estimated travel times varies with the sample size (higher with larger sample size).
- The difference in travel time estimates based on the GPS and Probe data could have been influenced by a variety of factors. Our GPS data is pertinent to the weekdays (Tuesday, Wednesday, and Thursday) in October 2017. The Probe data corresponds to observations on Tuesdays and Wednesday, although we are not sure of the year and month information for this data.
- Moreover, the travel time estimates from the GPS data are based on a generally larger sample size, thus accounting for a variety of driving habits. The probe data on the contrary may show little variance due to uniform driving habits.
- Finally, in addition to the analysis demonstrated in this memo, we can use the GPS data to analyze travel times on weekends and special events for different time periods of the day (as opposed to just the AM/PM peak periods).

Questions?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DO YOU EVER FEEL ALONE WHEN YOU'RE WITH PEOPLE?
I TRY TO.

Contact Information

AirSage

www.airsage.com

Bill King

E: bking@airsage.com

P: 770.329.0863

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WE UNDERSTAND POPULATION MOVEMENT AT SCALE AND ARE ABLE TO ANSWER THE MOST COMPLEX AND DEMANDING QUESTIONS YOU HAVE