



# Comprehensive Travel Insights

streetlytics™



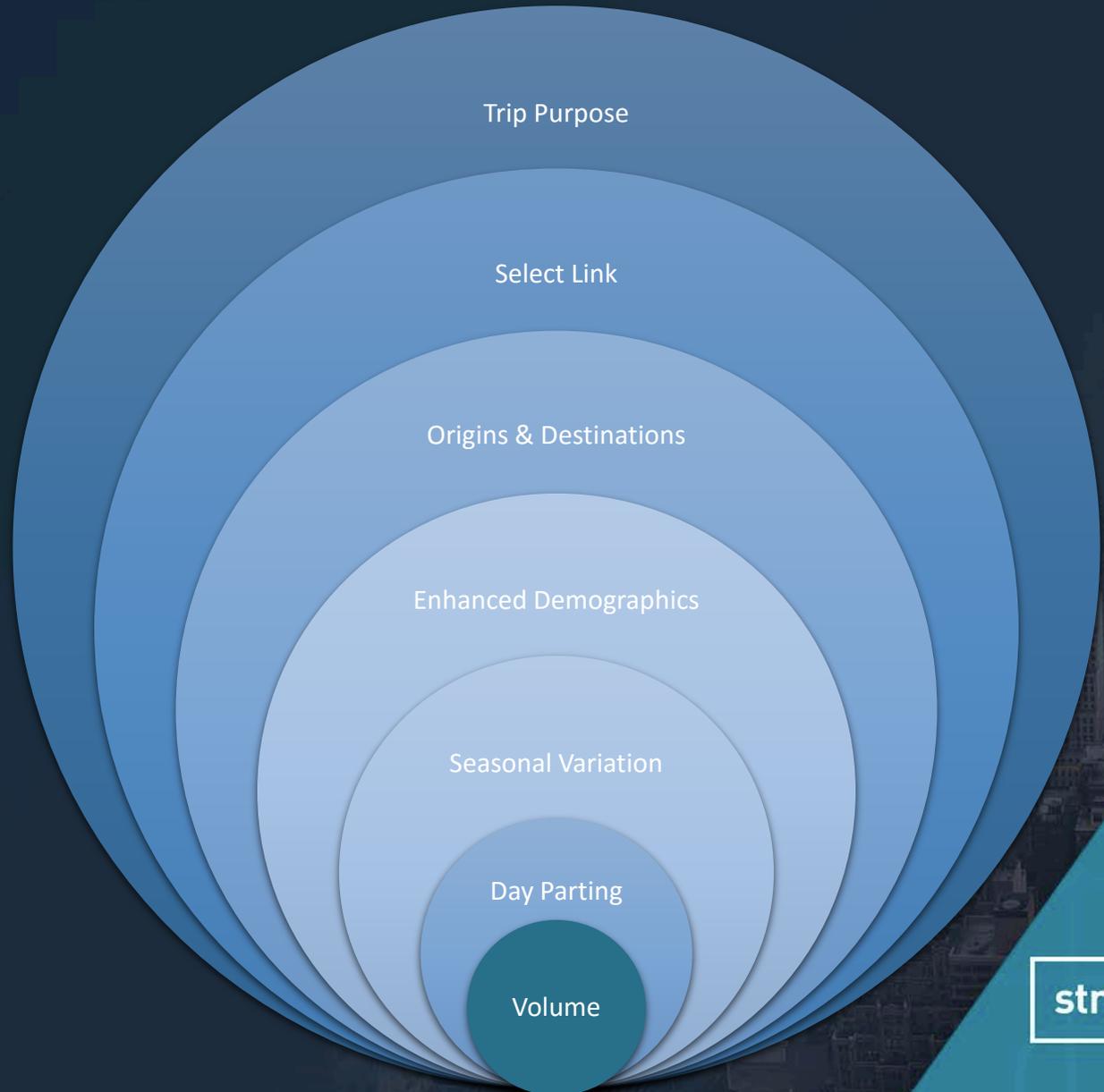
CITILABS



airrage

# A New Reality

- Today's Information
  - Volumes
- New from Streetlytics
  - Hourly Day Parting
  - Seasonal Variation
  - Demographics
  - Market Segmentation
  - Origins/Destinations
  - Select Link
  - Trip Purpose
    - Commuting/Education/Other



# Data Assimilation Overview

Streetlytics Fusion Engine



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TRAFFIC COUNTS



MOBILE DATA



DEMOGRAPHICS



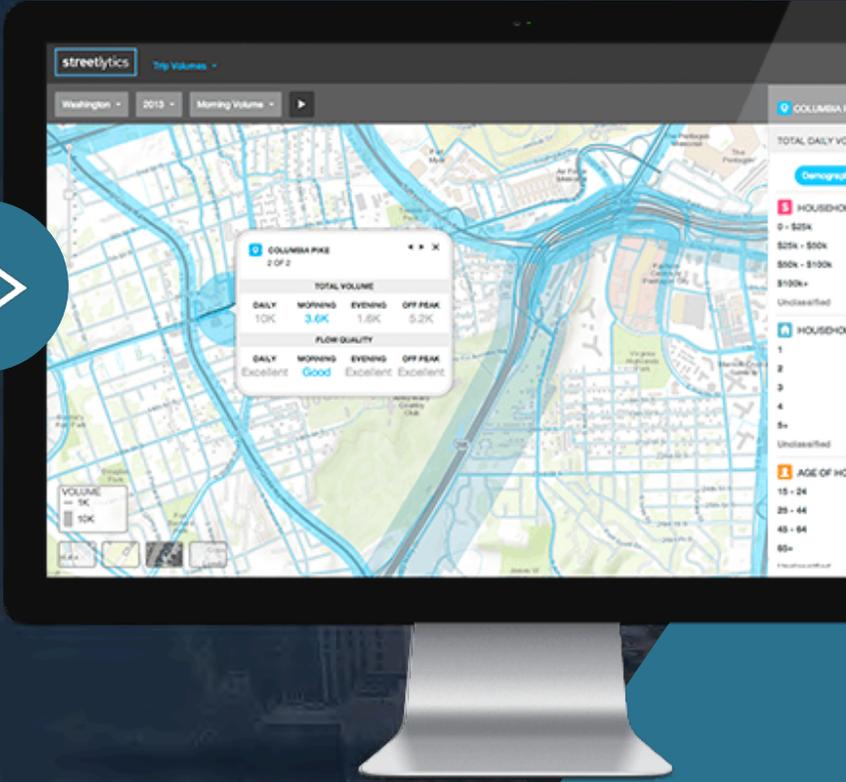
CONFIDENCE METRICS



CONGESTED SPEED ROUTES



FUTURE DATA SOURCES



TOTAL VOLUME			
DAILY	MORNING	EVENING	OFF PEAK
1.0K	3.6K	1.8K	0.2K

FLOW QUALITY			
DAILY	MORNING	EVENING	OFF PEAK
Excellent	Good	Excellent	Excellent



FUSION ENGINE



# Data Assimilation Overview

At the heart of the Fusion Engine is a Data Assimilation Process that serves to bring together all available data sets that contribute to the “full story”

- Allows each data set to be leveraged only for its strengths
- Each data set is enhanced by the next
- Allows flexibility to add, update, change or remove any one source of data

Disparate Data Sources



Proprietary Confidence Assignment Process



Transportation Network



Best Possible Understanding of Population Movements



## FUSION ENGINE



- (4D-var Data Assimilation) Minimizes squared deviations of observations
  - Disparate data sources
- Weighted by accuracy of observations
  - Proprietary confidence assignment process
- Validation

This has the effect of making sure that the analysis does not drift too far away from any one observations.



## TRAFFIC COUNTS



### SOURCED TRAFFIC COUNT DATA

ALL IDENTIFIABLE SOURCES  
ANY TYPE OF COUNT  
COLLECTED SINCE 2012



### COUNT NORMALIZATION

COUNT ANALYST TEAMS  
DUPLICATE INDEPENDENT  
ENTRY AND VERIFICATION



### FLOW CONSISTENCY CHECKS

COUNT DIRECTIONALITY  
REASONABLE VALUES  
FLOW CONSISTENCY

### SOURCED TRAFFIC COUNT DATA

CERTIFICATION OF SOURCE COUNTS  
CERTIFICATION OF ROADWAY  
ATTRIBUTES



### COUNT NORMALIZATION

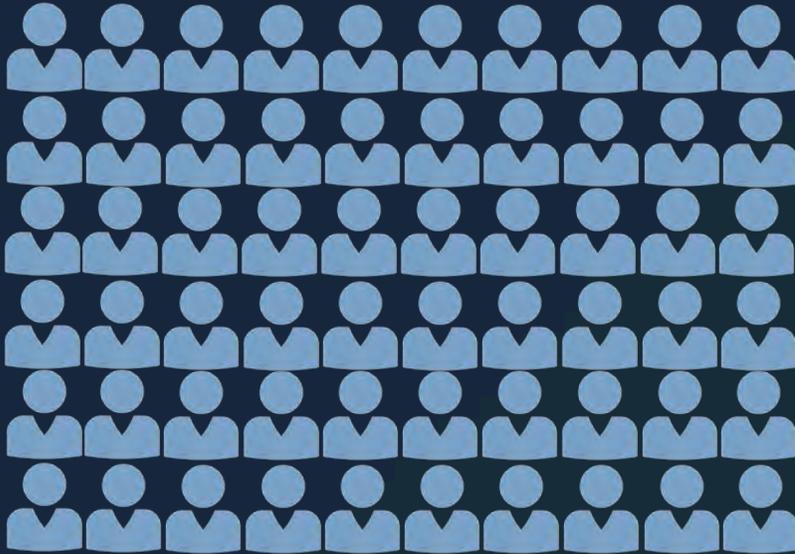
CERTIFIED  
DIRECTIONAL COUNTS



TRAFFIC COUNTS



# Count Support Infrastructure



“Count Team” of 60 Traffic Analysts for support



4x Verified Count Collection and Dispute Resolution Methodology and Management system

IMPORTANT TRUSTED DATA POINTS	
	VEHICLE
	TRANSIT
	PEDESTRIAN

Any available counts will be used as inputs for each mode



# MOBILE DATA



## AIRSPACE OBSERVED TRIP MATRICES

- # OF TRIPS/DAY
- TRIP PATTERNS
- HOME LOCATIONS



## LAND-USE INFORMATION

- HOUSING UNITS
- POINTS OF INTEREST
- EMPLOYMENT



## DEMOGRAPHIC DATA

- POPULATION
- HOUSEHOLD CHARACTERISTICS

## MODE IDENTIFICATION

- DRIVING
- WALKING/BIKING
- PUBLIC TRANSPORT



## ORIGIN-DESTINATION TRIPS

- BY MODE
- BY RESIDENT/VISITOR
- BY TIME OF DAY

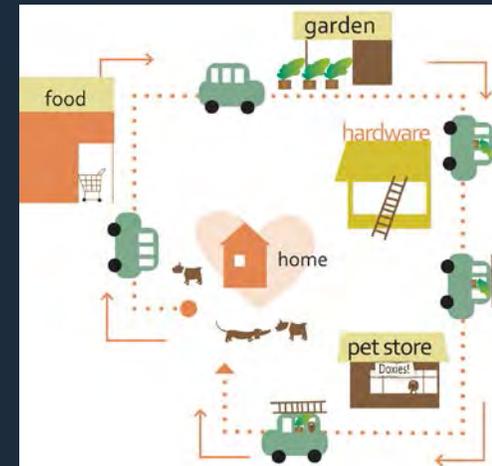


## MOBILE DATA



- Leverages key insights (Persistence! – Always “On”):

- Activity Pattern Data
- Trip Chaining (what is a trip?)
- Home Locations
- Mode Flags



- Minimizes

- Locations understood at a neighborhood level
- Noise correction with Demographics, Employment, POIs
- Mode Expectations by Market Segment and Trip Characteristics



# DEMOGRAPHICS



**NHTS & LOCAL TRAVEL SURVEY DATA**



**LAND-USE INFORMATION**



**DEMOGRAPHIC DATA**

- # OF TRIPS/DAY
- MODE CHOICES
- TRIP PURPOSES
- DEMOGRAPHIC DETAILS

- HOUSING UNITS
- POINTS OF INTEREST
- EMPLOYMENT

- POPULATION
- HOUSEHOLD CHARACTERISTICS

**MODE IDENTIFICATION**



**EXPECTED ACTIVITY DENSITY & TRIP ENDS**

- DRIVING
- WALKING/BIKING
- PUBLIC TRANSPORT

- BY MODE
- BY RESIDENT/VISITOR
- BY TIME OF DAY



## DEMOGRAPHICS



- ESRI Updated Demographics and Employment
  - Available to us through our relationship with ESRI/investment in Citilabs
  - Improves accuracy by using variety of sources includes
    - IRS County to County Migration
    - Building Permits
    - Housing Starts
    - Residential Postal Delivery Volumes
    - County Level Census Forecast
    - Infogroup Business Data





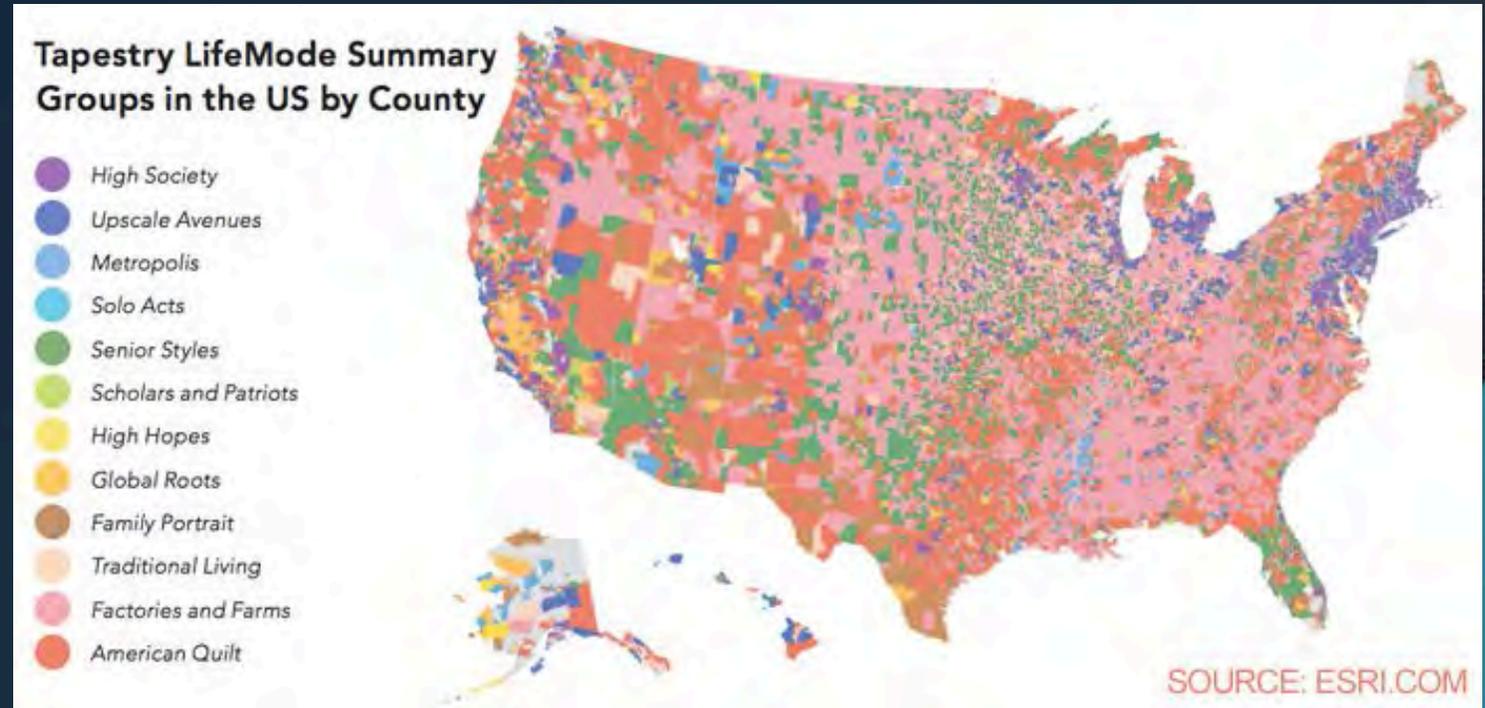
## DEMOGRAPHICS



# Tapestry

67 Distinct Segments based on socioeconomic and demographic composition

- Grouped into 14 LifeMode groups
- Grouped into 6 Urbanization groups



# TAPESTRY SEGMENTATION

The Fabric of America's Neighborhoods



## UNITED STATES OF AMERICA

Total Population: 313,488,000  
 Total Households: 119,879,000  
 Median Age: 35.4  
 Median Income: \$37,000  
 Median Net Worth: \$17,000  
 Median Rent: \$622  
 Home Ownership: 68%  
 New Age: 14.6%  
 Household Size: 2.58  
 Home Value: \$177,000



<b>1A</b> Top Tier	<b>1B</b> Urban Chic	<b>1C</b> Laptops and Lattes	<b>1D</b> Newcomers	<b>1E</b> Comfortable Empty Nests	<b>1F</b> Green Acres	<b>1G</b> Up and Coming Families	<b>1H</b> City Lights	<b>1I</b> Men & Girls	<b>1J</b> Southern Settlers	<b>1K</b> City Singles	<b>1L</b> Family Foundations	<b>1M</b> International Markings	<b>1N</b> Military Presence
<b>2A</b> Professional Style	<b>2B</b> Pleasantville	<b>2C</b> Metro Centers	<b>2D</b> Home Improvement	<b>2E</b> In Style	<b>2F</b> Safe of the Earth	<b>2G</b> Urban Villages	<b>2H</b> Emerald City	<b>2I</b> Golden Years	<b>2J</b> Rusted Rural	<b>2K</b> Young and Thrives	<b>2L</b> Dreamland Living	<b>2M</b> Low Costs	<b>2N</b> College Towns
<b>3A</b> Millennials	<b>3B</b> Pacific Heights	<b>3C</b> Trendsetters	<b>3D</b> Millennial	<b>3E</b> Parks and Rec	<b>3F</b> The Great Outdoors	<b>3G</b> American Dreamers	<b>3H</b> Bright Young Professionals	<b>3I</b> The Elders	<b>3J</b> Downs & Moves	<b>3K</b> Metro Fusion	<b>3L</b> Small Town Simplicity	<b>3M</b> North Star	<b>3N</b> Downs to City Centers
<b>4A</b> Savvy Suburbanites	<b>4B</b> Entertaining Professionals	<b>4C</b> Nestled Traditions	<b>4D</b> Green Living	<b>4E</b> Service Urbanites	<b>4F</b> Downtown Making Pals	<b>4G</b> Small Estates	<b>4H</b> Down the Road	<b>4I</b> Sell to Progress	<b>4J</b> Modest Income Homeers	<b>4K</b> Family Structures	<b>4L</b> High Rise Residents	<b>4M</b> Unidentified	

- LIFEMODE SUMMARY GROUPS**
- 1. Affluent Estates
  - 2. Upscale Avenues
  - 3. Uptown Individuals
  - 4. Family Landscapes
  - 5. Gen X Urban
  - 6. Cozy Country Living
  - 7. Ethnic Enclaves
  - 8. Middle Ground
  - 9. Senior Styles
  - 10. Rustic Outposts
  - 11. Midtown Singles
  - 12. Hometown
  - 13. Next Wave
  - 14. Scholars and Patriots
- URBANIZATION SUMMARY GROUPS**
- 1. High Density Urban
  - 2. Medium Density Urban
  - 3. Low Density Urban
  - 4. Suburban
  - 5. Rural
  - 6. Unidentified
- DEFINITIONS IN THE SEGMENT DISCUSSIONS**
- 1. Family: Single parent, two parents
  - 2. Family: Two parents, one child
  - 3. Family: Two parents, two children
  - 4. Family: Single parent, one child
  - 5. Family: Single parent, two children
  - 6. Family: Two parents, one child, one grandchild
  - 7. Family: Two parents, two children, one grandchild
  - 8. Family: Two parents, one child, one grandchild
  - 9. Family: Two parents, one child, one grandchild
  - 10. Family: Two parents, one child, one grandchild
  - 11. Family: Two parents, one child, one grandchild
  - 12. Family: Two parents, one child, one grandchild
  - 13. Family: Two parents, one child, one grandchild
  - 14. Family: Two parents, one child, one grandchild

**SEGMENT LEGEND**

**1** Segment Name

**2** Household Type

**3** Household Size

**4** Household Income

**5** Household Net Worth

**6** Household Rent

**7** Household Home Value

**8** Household Age

**9** Household New Age

**10** Household Home Ownership

**11** Household Urbanization

**12** Household Life Mode

**13** Household Life Mode

**14** Household Life Mode

**15** Household Life Mode

**16** Household Life Mode

**17** Household Life Mode

**18** Household Life Mode

**19** Household Life Mode

**20** Household Life Mode

**21** Household Life Mode

**22** Household Life Mode

**23** Household Life Mode

**24** Household Life Mode

**25** Household Life Mode

**26** Household Life Mode

**27** Household Life Mode

**28** Household Life Mode

**29** Household Life Mode

**30** Household Life Mode

**31** Household Life Mode

**32** Household Life Mode

**33** Household Life Mode

**34** Household Life Mode

**35** Household Life Mode

**36** Household Life Mode

**37** Household Life Mode

**38** Household Life Mode

**39** Household Life Mode

**40** Household Life Mode

**41** Household Life Mode

**42** Household Life Mode

**43** Household Life Mode

**44** Household Life Mode

**45** Household Life Mode

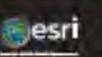
**46** Household Life Mode

**47** Household Life Mode

**48** Household Life Mode

**49** Household Life Mode

**50** Household Life Mode





SPEED

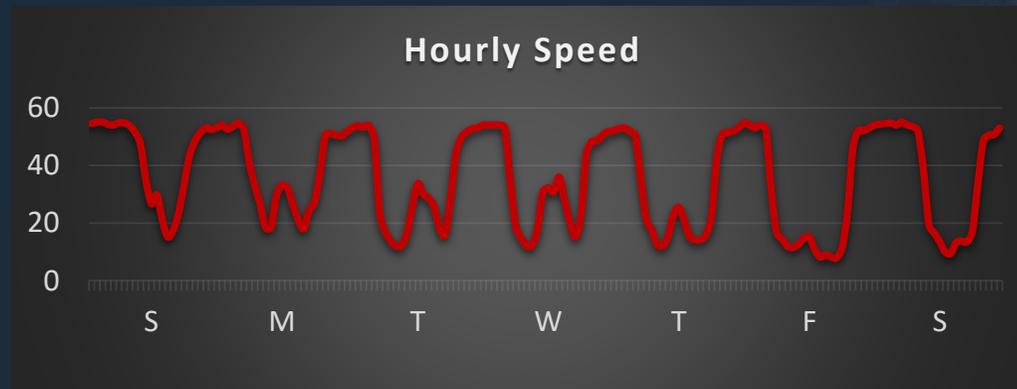


## GPS Probe Data

- Route Choice
- Speed
- Time of Day
- Travel Times

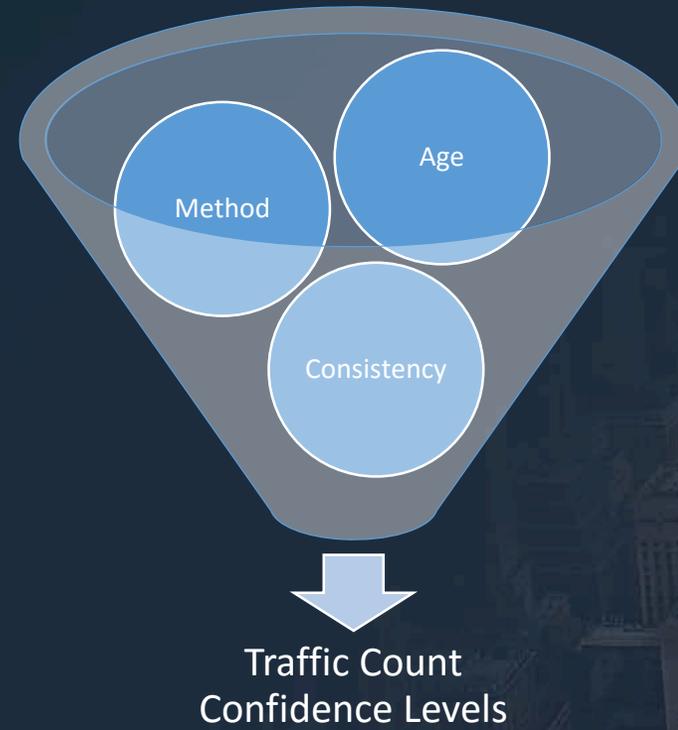
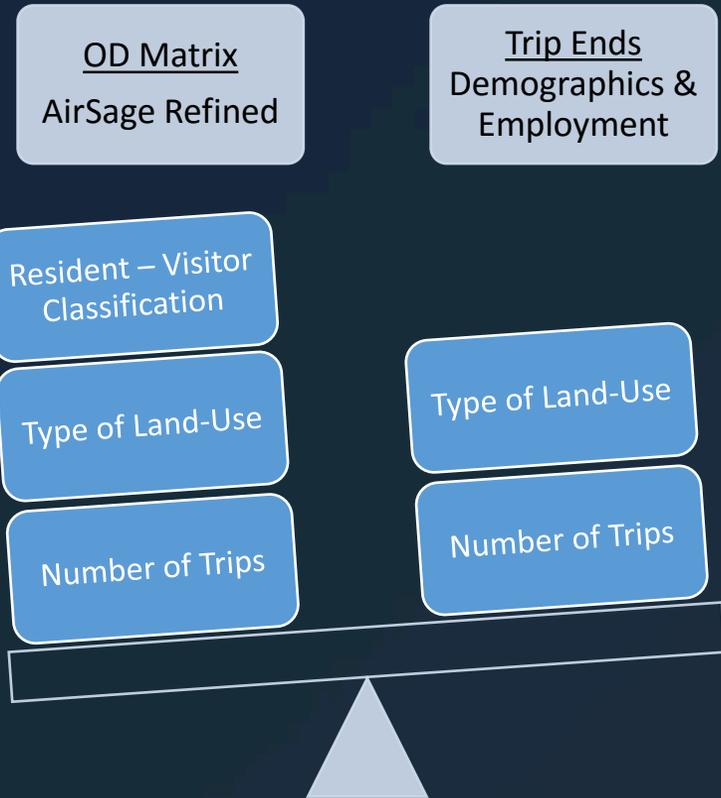
## Validation

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## CONFIDENCE METRICS





# FUTURE DATA



- App/Ad Exchange Data
  - Reason: Enhanced Segmentation/Calibration
- Additional Segmentation/ Syndicated Audience Profiles (Experian, Acxiom)
  - Expendable Income
  - Purchase Intent
- Point of Interest Data
  - Reason: Granular Trip Purpose
  - Expand Coverage of Audience Insights (Venues, Etc)
- Sensor Data
  - Beacon Data BLE, Computer Vision (Camera Counting) & Wifi
  - Reason: Direct Feed, Data Calibration
- Transaction (Credit Card)
  - Reason: Intent & Calibration
  - Enhanced Audience Profiles
  - Value/Output
- New Sources yet to be identified



# Streetlytics Transit and Pedestrian Insights

- Methodology
  - Trips are Assigned to Transit and Pedestrian Networks Nationwide
- Data Inputs
  - Pedestrian Counts
  - Transit Routes
  - Transit Schedules
  - Ridership Information
  - Mobile Data
  - Demographic Information



# Streetlytics Provides

Answers to...

- How many?
- Where?
- When?
- Who?
- Why?

<http://www.streetlytics.com/app>

# Past & Future Proof Solutions

- Initial Solution Builds off of Current Data
  - Allows control how quickly we transition from one source to another
- Solution is flexible
  - Built to add new data as available
  - If one source goes away there is minimal disruption and the solution can control how quickly, if at all, changes are seen through the industry
- More Data Less Model
  - Allows controlled levels to shift to more data/ground truth less analysis whereby modeling is used only as the glue to bring together disparate data
- Leveraging Data Management Partners
  - Leverages vendor support infrastructure, experience around privacy protection and compliance as well as inherent separation from PII



# Thank you!

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# AirSage Core Competencies

## THE POWER OF WHERE AND WHEN

### Carrier, GPS, Credit Card Transactional Data Access

- Access to Carrier Individual Device Data
- Solutions inside Carrier Datacenters to Harvest Data
- Access to Aggregated GPS and Transactional Data
- Solutions inside AirSage Datacenters to Generalize ANY Location Data
  - Plug and play ready to leverage Ad Exchange, beacon, etc.
- Solutions to meet privacy and Service Level Requirements

### Operational BIG Data Processing

- Fault tolerant systems to scale the processing of High Volume/High Velocity Data
- Custom scheduling to prioritize data processing and normalize workloads
- Patented throttling and filtering to differentiate desirable data
- Proprietary Data storage processes for cost reduction/value retaining
- Support and infrastructure for an “always on” system
  - Meets 99.999% SLAs

### Software Methods for Analyzing BIG Data

- Device Activity Pattern Identification Considering 100s of Millions of Devices and Trillions of Locations
- Identification of Trip End vs. Transient Locations
- Flexible processing to calculate trips versus tours
- Processes to synthesize missing data and account for locations and trips that were not directly observed
  - 15 years of research
- Identification and filtering of devices and sightings that do not represent person movements
- Dynamic Methods to expand samples to full population movements
  - Movement Data (trip matrix extrapolation) 5 years research
  - Point Present Data (target location data extrapolation) 3 years research
- Long distance trip identification

# Citilabs Core Competencies

TRANSPORTATION & LAND-USE SOLUTIONS  
MODEL. ANALYZE. VISUALIZE.

## Software Methods for Modeling

- 40 years of predictive modeling software development
- Software for modeling populations and households' daily activities
- Software for modeling destination, mode, and route choices
- Software for modeling freight and service vehicle movements (taxis, uber, delivery, and construction)
- Software for distributed computing of complex problems.
- Experience using and providing Amazon AWS and Esri solutions
- Provider of Software as a Service platforms for scalable hosting of the most complicated models
- Provider of hosted mapping, visualization and REST APIs for data delivery and collaboration

## Services group staffed with experts in:

- Geospatial Data Science, Analytics, Storage, and Hardware Solutions
- Travel Demand Modeling
- Activity-Based Modeling
- Freight and Commodity Flow Modeling
- Land-Use Modeling
- Accessibility and Bike/Ped Modeling and Scoring
- Software Development
- Computational Mathematics and Distributed Computing

## Data Collection and Quality Assurance

- Scalable Team of Traffic Analysts to collect data and results

## Global Customer Footprint

- Solving problems in 3500 Cities Worldwide