Streetlytics – A Mobility Analytics System

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Citilabs

22 Feb 2017

Session ws-1

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Mobility Insights

On Any Street

ITS SEMINAR AND EXHIBITION 2017

DRIVING ITS TO A NEW NORMAL

ITS MALAYSIA
INTELLIGENT TRANSPORT SYSTEM ASSOCIATION OF MALAYSIA

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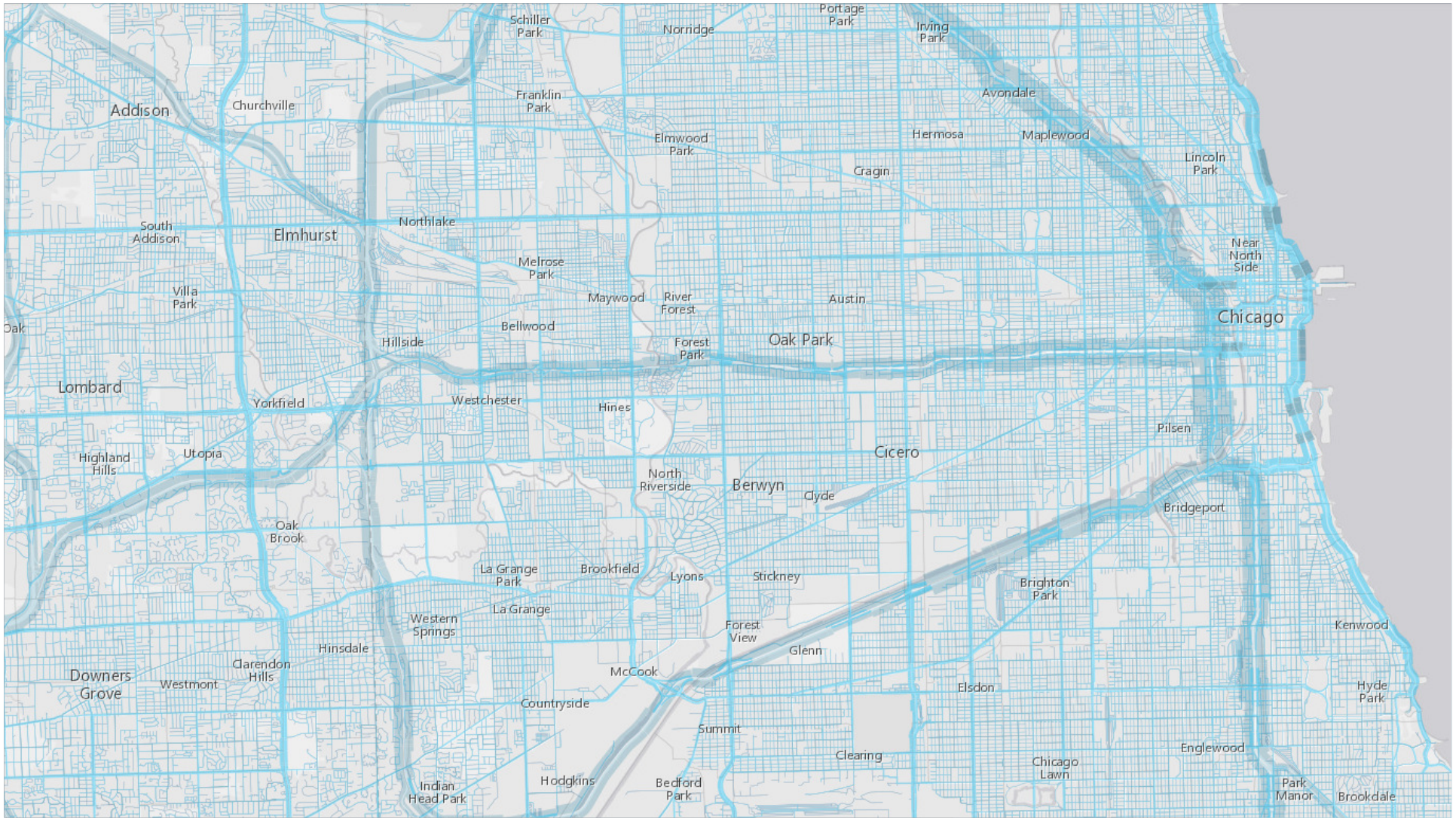
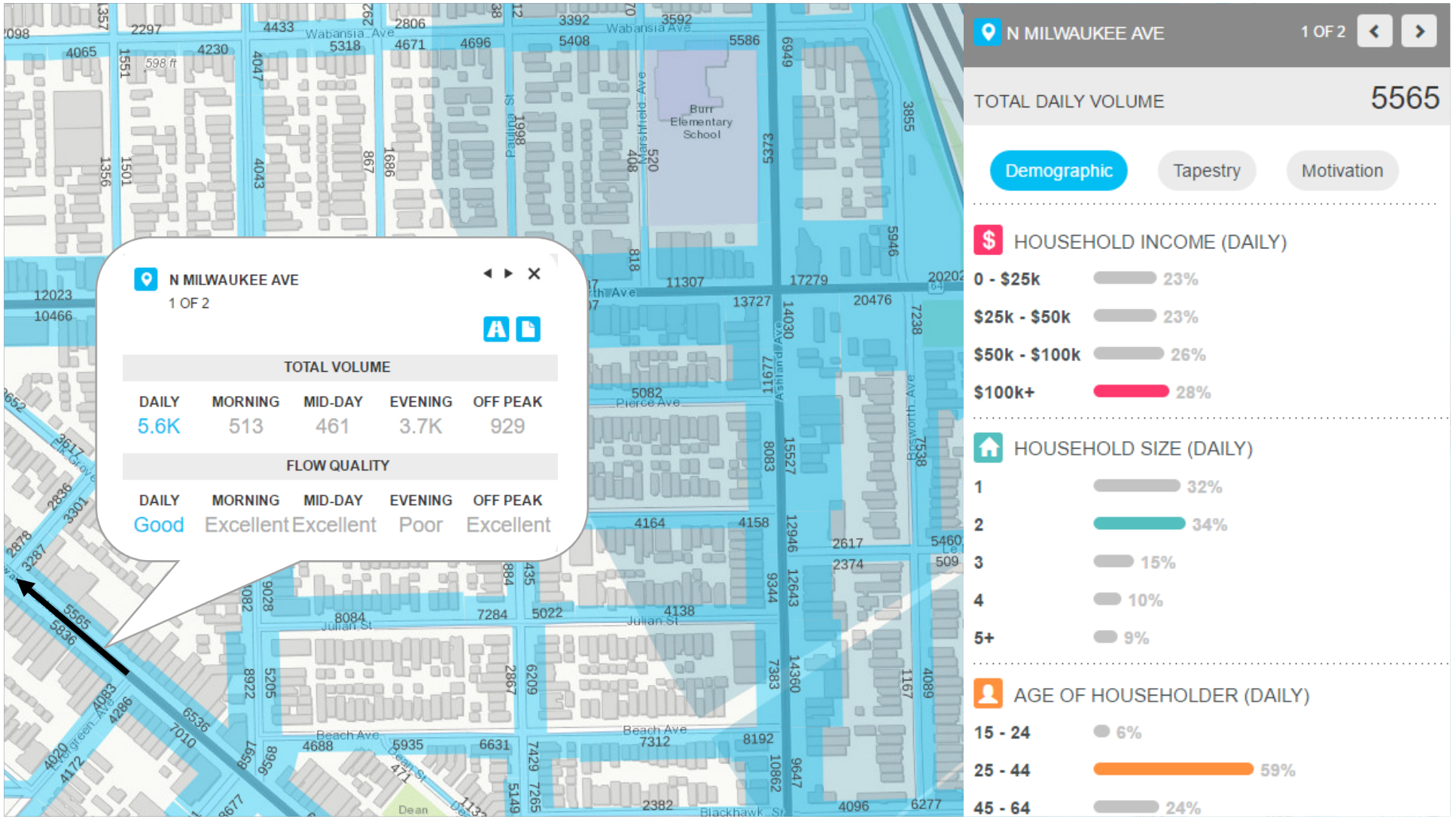

Schiller Park
Norridge
Portage Park
Irving Park
Addison
Churchville
Franklin Park
Avondale
Elmwood Park
Hermosa
Maplewood
Lincoln Park
Cragin
South Addison
Elmhurst
Northlake
Near North Side
Melrose Park
Villa Park
Maywood
River Forest
Austin
Chicago
Bellwood
Hillside
Forest Park
Oak Park
Lombard
Yorkfield
Westchester
Hines
Pilsen
Highland Hills
Utopia
Cicero
North Riverside
Berwyn
Clyde
Bridgeport
Oak Brook
La Grange Park
Brookfield
Lyons
Stickney
Brighton Park
La Grange
Western Springs
Forest View
Kenwood
Hinsdale
Glenn
Clarendon Hills
Downers Grove
Westmont
McCook
Elsdon
Hyde Park
Countryside
Summit
Englewood
Clearing
Chicago Lawn
Hodgkins
Bedford Park
Indian Head Park
Park Manor
Brookdale


N MILWAUKEE AVE
1 OF 2
TOTAL VOLUME
DAILY MORNING MID-DAY EVENING OFF PEAK
5.6K 513 461 3.7K 929
FLOW QUALITY
DAILY MORNING MID-DAY EVENING OFF PEAK
Good Excellent Excellent Poor Excellent
N MILWAUKEE AVE
1 OF 2
TOTAL DAILY VOLUME
5565
Demographic
Tapestry
Motivation
HOUSEHOLD INCOME (DAILY)
0 - $25k 23%
$25k - $50k 23%
$50k - $100k 26%
$100k+ 28%
HOUSEHOLD SIZE (DAILY)
1 32%
2 34%
3 15%
4 10%
5+ 9%
AGE OF HOUSEHOLDER (DAILY)
15 - 24 6%
25 - 44 59%
45 - 64 24%

Month over Month Variation

Commuter Alert: Northbound Lane Of Major Deegan Expressway To Close For Construction

July 16, 2015 3:42 PM

Filed Under: Construction, Department of Transportation, Major Deegan Expressway, Traffic

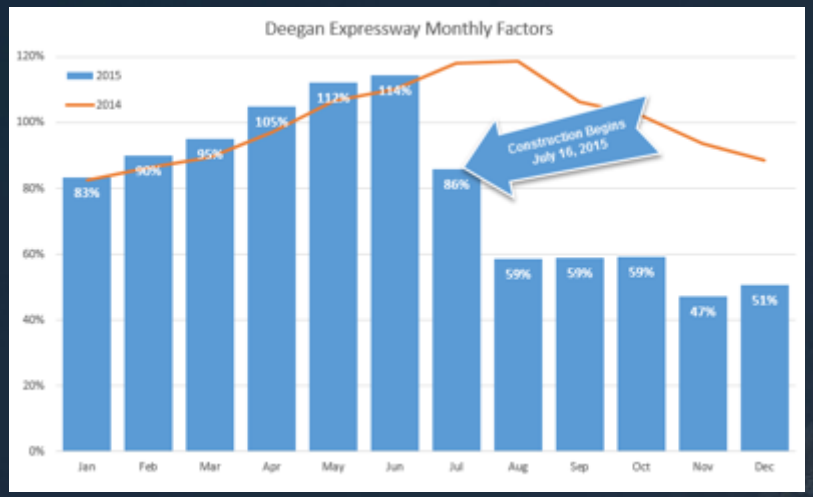
NEW YORK (CBSNewYork/AP) — Major construction will be starting on the Major Deegan Expressway in the Bronx on Thursday.

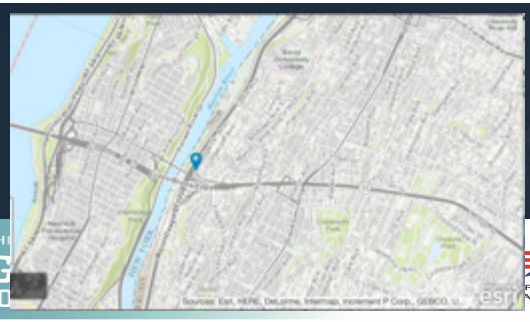
The state Department of Transportation said the construction project will tie up the expressway for about two years.

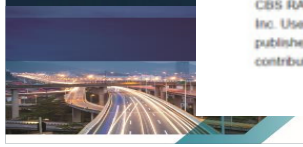
Beginning after rush hour Thursday evening, part of the roadway will be reduced from three northbound lanes to two.

The bottleneck will start at Exit 3 — also known as East 138th Street and the Grand Concourse — and will extend beyond Exit 5, which goes to 161st Street and the Macombs Dam Bridge.

The Major Deegan Expressway connects West 155th Street in Manhattan with East 161st Street and Jerome Avenue in the Bronx, and is a major route from Manhattan to Yankee Stadium.







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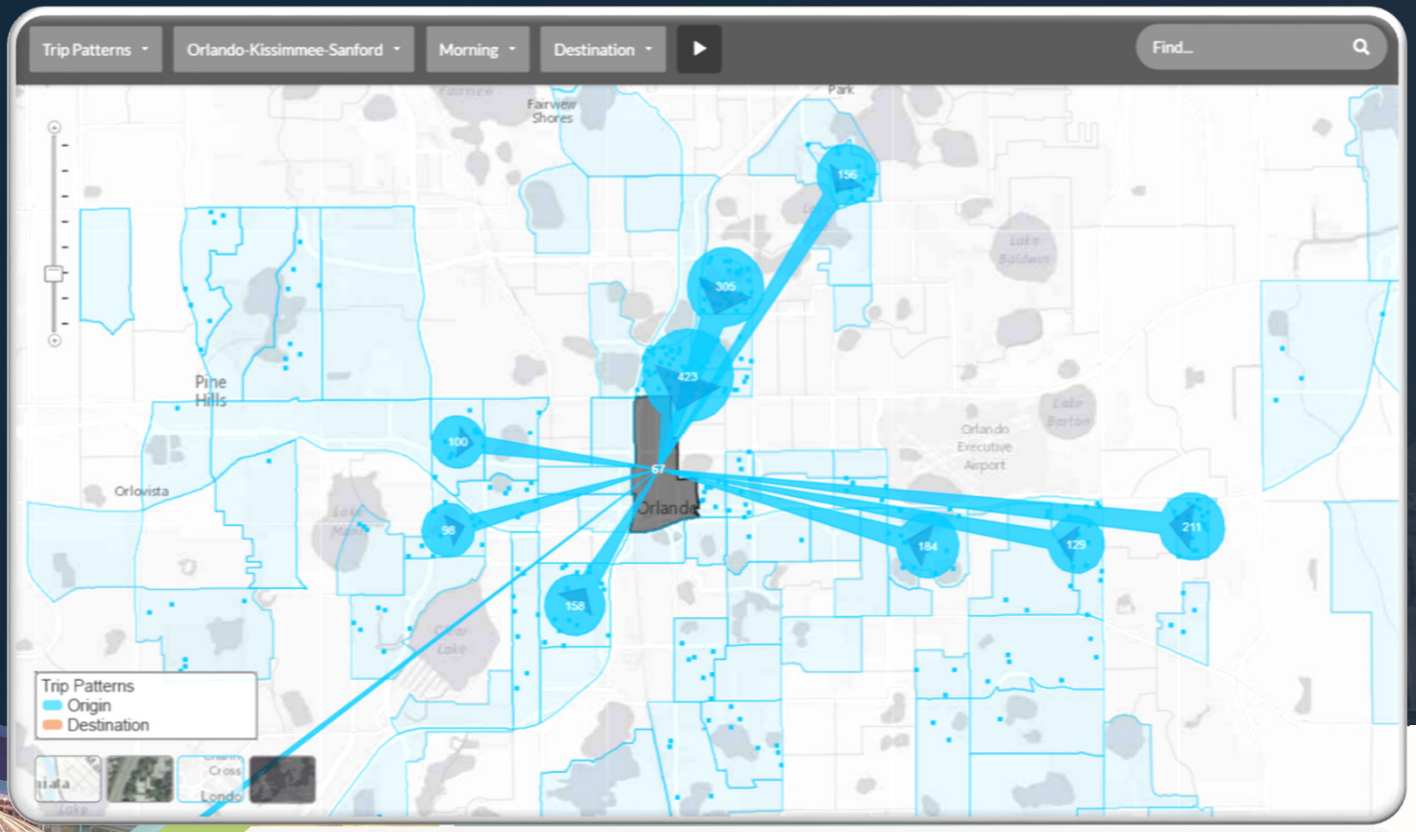
Real-Time Demand Management



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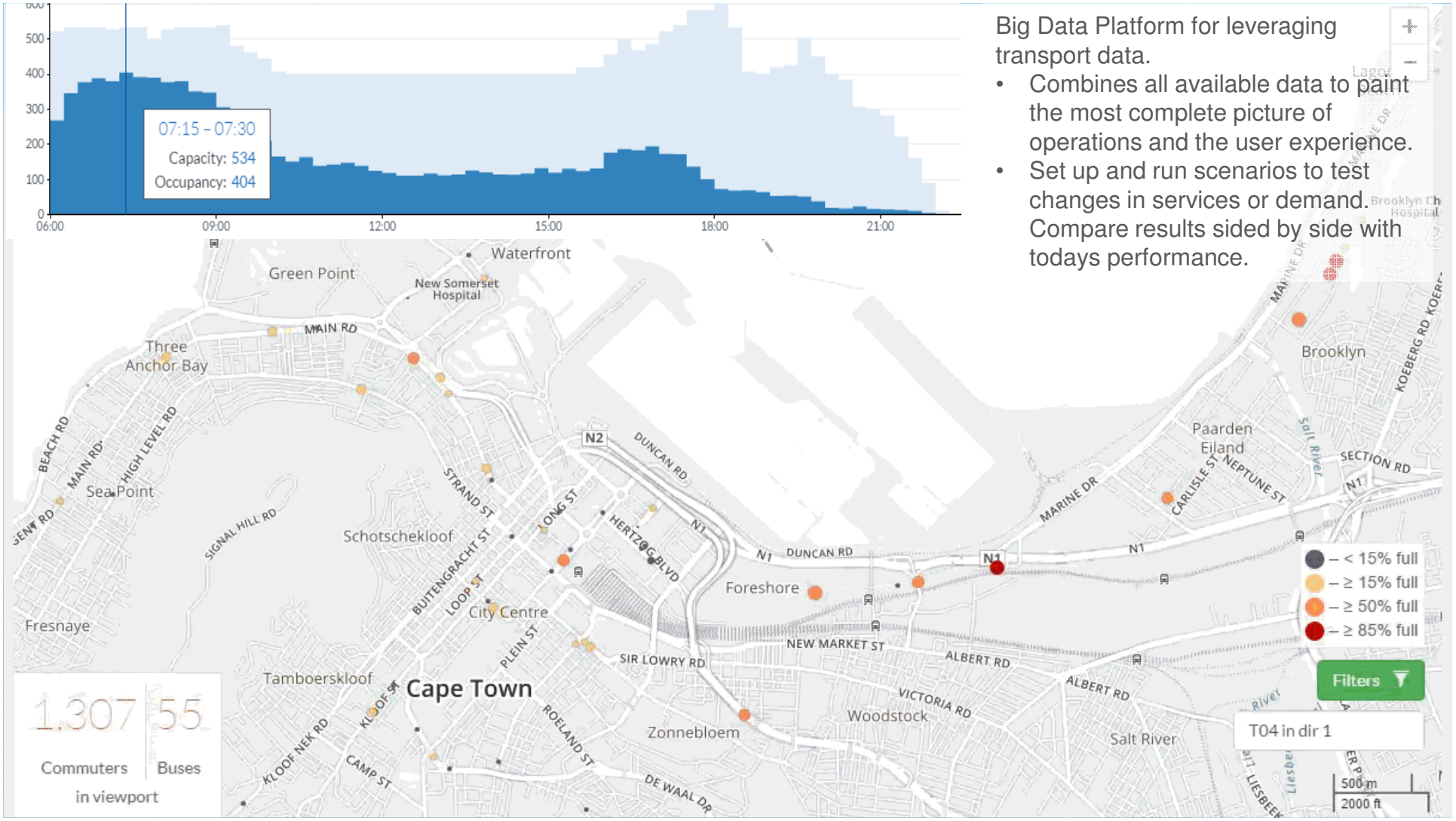

Big Data Platform for leveraging transport data.

- Combines all available data to paint the most complete picture of operations and the user experience.
- Set up and run scenarios to test changes in services or demand. Compare results sided by side with todays performance.

Data Fusion

Leveraging the Strengths of All Available Data

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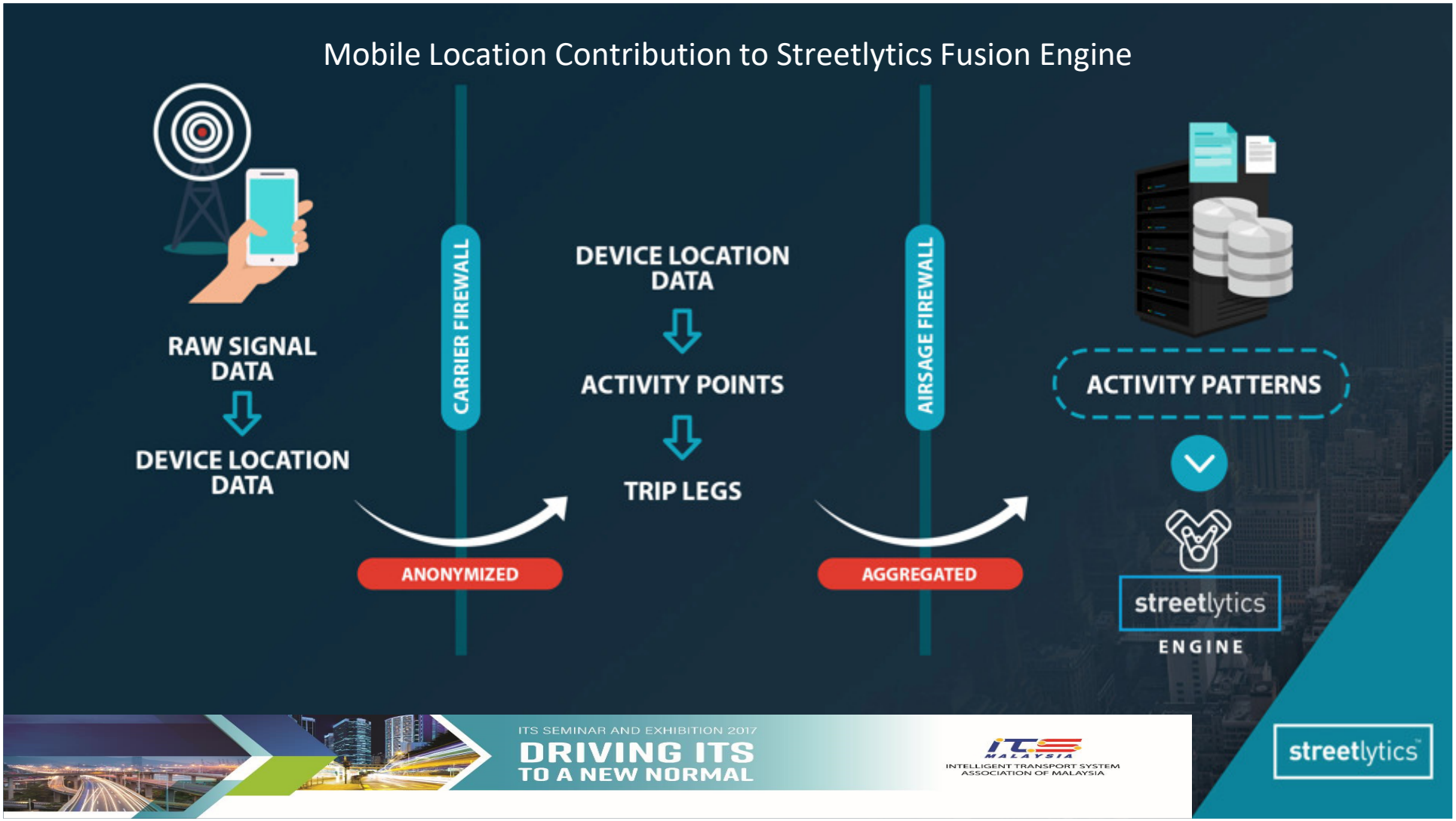
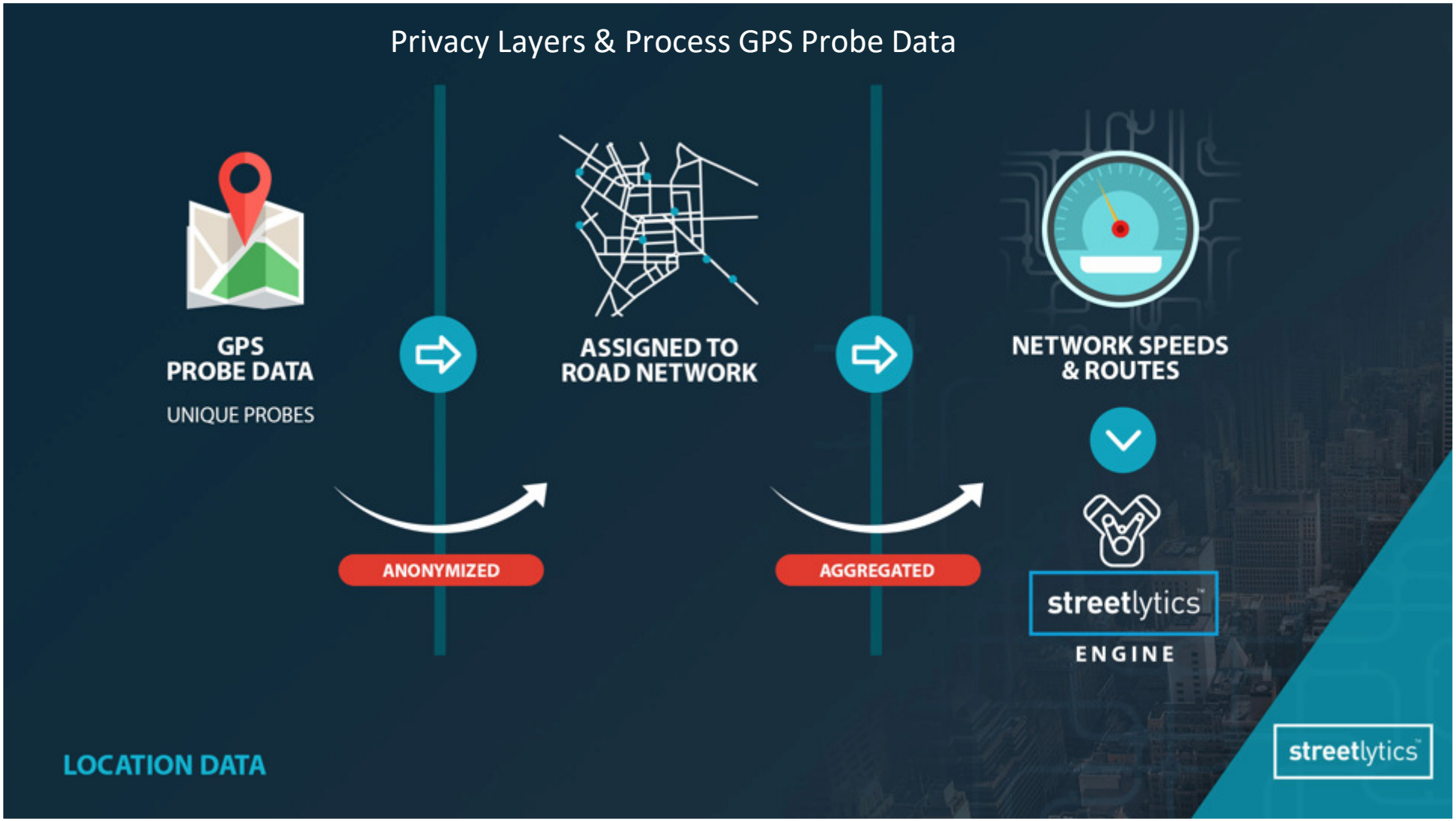
Mobile Location Contribution to Streetlytics Fusion Engine




Privacy Layers & Process GPS Probe Data
GPS
PROBE DATA
UNIQUE PROBES
ANONYMIZED
ASSIGNED TO
ROAD NETWORK
AGGREGATED
NETWORK SPEEDS
& ROUTES
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ENGINE
LOCATION DATA
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Using ALL data to its Fullest

Cellular Activity Patterns:

- Persistence! (always on – home, work, mundane)
- Amazing Activity Pattern Data
- Trip Chaining (what is a trip?)
- All Person Trips – Little Mode Information
- Less Locational Accuracy (300+ m)

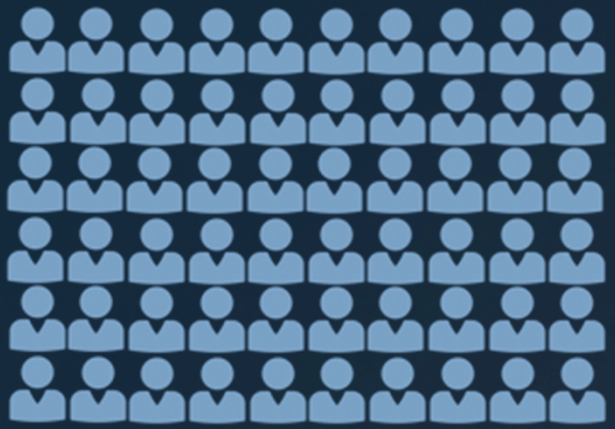
GPS Data to Identify:

- Little Persistence… little information on “who?”
- High Locational Accuracy (easily identify exact routes)
- Speed/Flow Relationships
- Information of Vehicle Class and Inferred Mode
- Often Requires User Interactions (origin on Freeway)

TRAFFIC COUNTS

Ground Truth

2m+ collected and cleansed ground counts



“Count Team” of 60 Traffic Analysts for support

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

Any available counts will be used as inputs for each mode

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Other Datasets to Expand and Validate

Fault Tolerant Design: data insight redundancy ensures no single point of failure

Population Patterns Data Suite

- National
  - Census Demographics & Population
  - CTPP (Census Transportation Planning Product)
  - LEHD (Longitudinal Employer-Household Dynamics)
  - NHTS (National Household Travel Survey)
- Local & Regional
  - Household Travel Surveys
  - Airport enplanements
  - School enrollment
  - Traffic & Turn movement counts
  - Transit Ridership
  - Land Use/Zoning
- GPS Probe Speeds & Routes
- Mobile Activity Patterns

Population Composition Data Suite

- Demographics and Employment
  - IRS County to County Migration
  - Building Permits
  - Housing Starts
  - Residential Postal Delivery Volumes
  - County Level Census Forecast
  - Infogroup Business Data

Place Based Data Suite

- Transportation Network Data
  - GTFS Transit Networks & Schedules
  - Road & Lane Closures
  - Incidents
  - Speeds
  - Road classification
    - Lanes and Functional classification
    - Use Restrictions/Prohibitions
- Point of Interest Data

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Streetlytics Process

From Data to Insights

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 observation.

$$J(\mathbf{x}) = (\mathbf{x} - \mathbf{x}_b)^{\mathrm{T}} \mathbf{B}^{-1} (\mathbf{x} - \mathbf{x}_b) + \sum_{i=0}^{n} (\mathbf{y}_i - H_i[\mathbf{x}_i])^{\mathrm{T}} \mathbf{R}_i^{-1} (\mathbf{y}_i - H_i[\mathbf{x}_i])$$

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Streetlytics Transit and Pedestrian Insights

- Methodology
  - Trips are Assigned to Transit and Pedestrian Networks Nationwide
- Data Inputs
  - Pedestrian Definition/Counts
  - Transit Routes/Schedules (GTFS)
  - Vehicle Telemetry (AVL)
  - Survey Data (on-board – transfer)
  - Payment Systems (ticketing – farebox – smartcards)
  - Automated Passenger Counts (samples)

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Performance Measures that Matter

Auto/Drive

- Speed
- Delay
- Level of Service
- HCM

Public Transit

- Ridership
- Revenue

Walk/Bike

- Facility Conditions
- Complete Streets

← Connectivity/Accessibility →

Can understanding “Why” people travel, impact “How Much” people travel?

A true multimodal performance measure?

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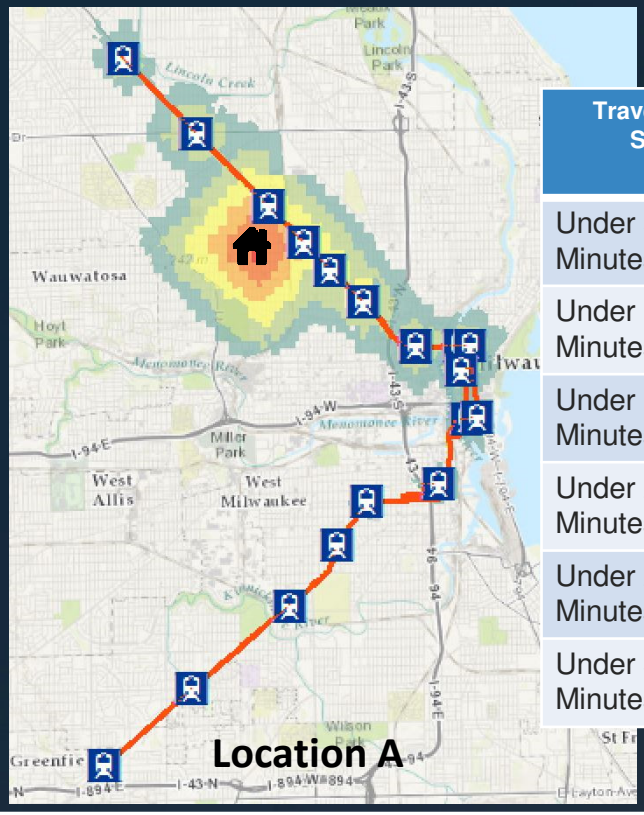
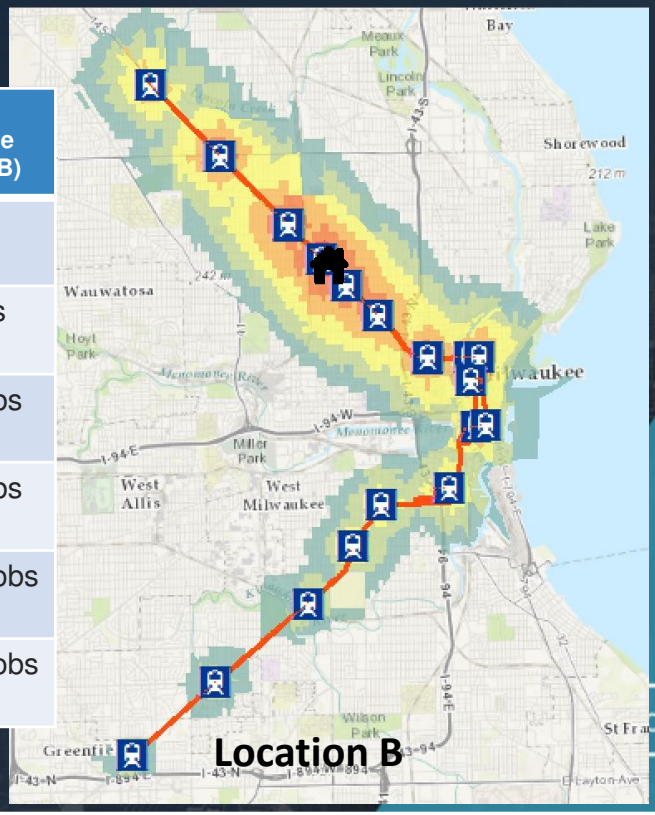
Understanding Access Scores

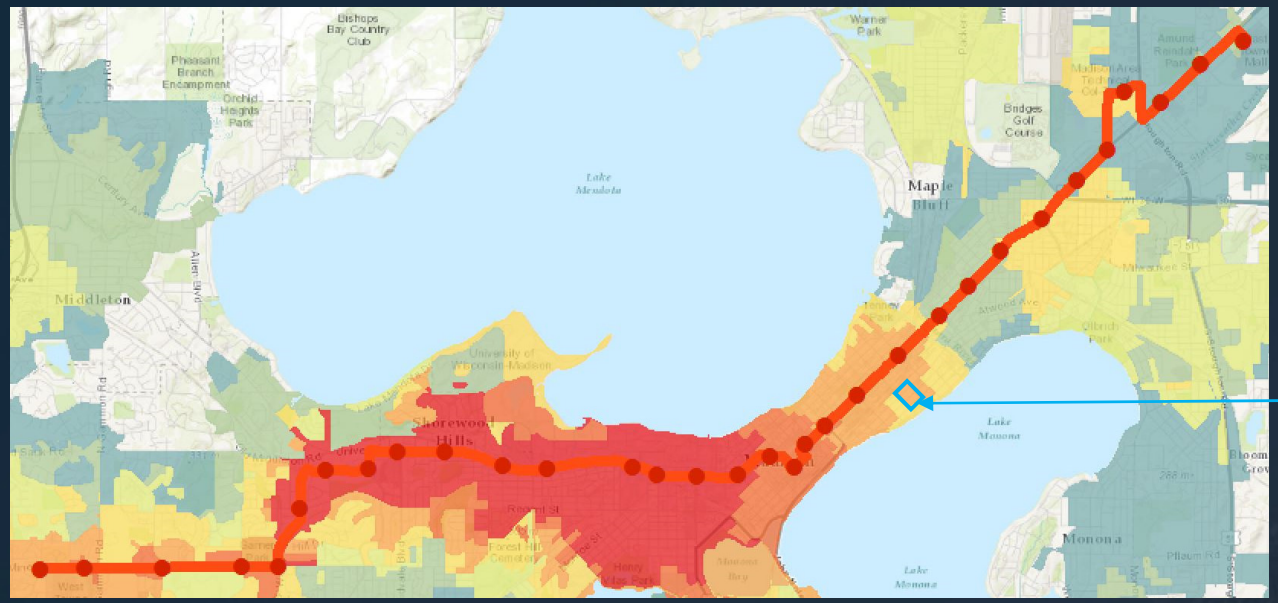


Travel Time Shed	Jobs Accessible (Location A)	Jobs Accessible (Location B)
Under 5 Minutes	4 Jobs	156 Jobs
Under 10 Minutes	136 Jobs	6,667 Jobs
Under 15 Minutes	579 Jobs	30,328 Jobs
Under 20 Minutes	10,319 Jobs	93,197 Jobs
Under 25 Minutes	33,689 Jobs	115,290 Jobs
Under 30 Minutes	89,422 Jobs	145,477 Jobs



Comprehensive Access Scores for ALL Modes

- Walking times to get to transit stop along pedestrian network
- Transit times from originating stop to destination stop



New Accessibility Metric:
38,000 average jobs accessible within 30 minutes using public transportation within service area.

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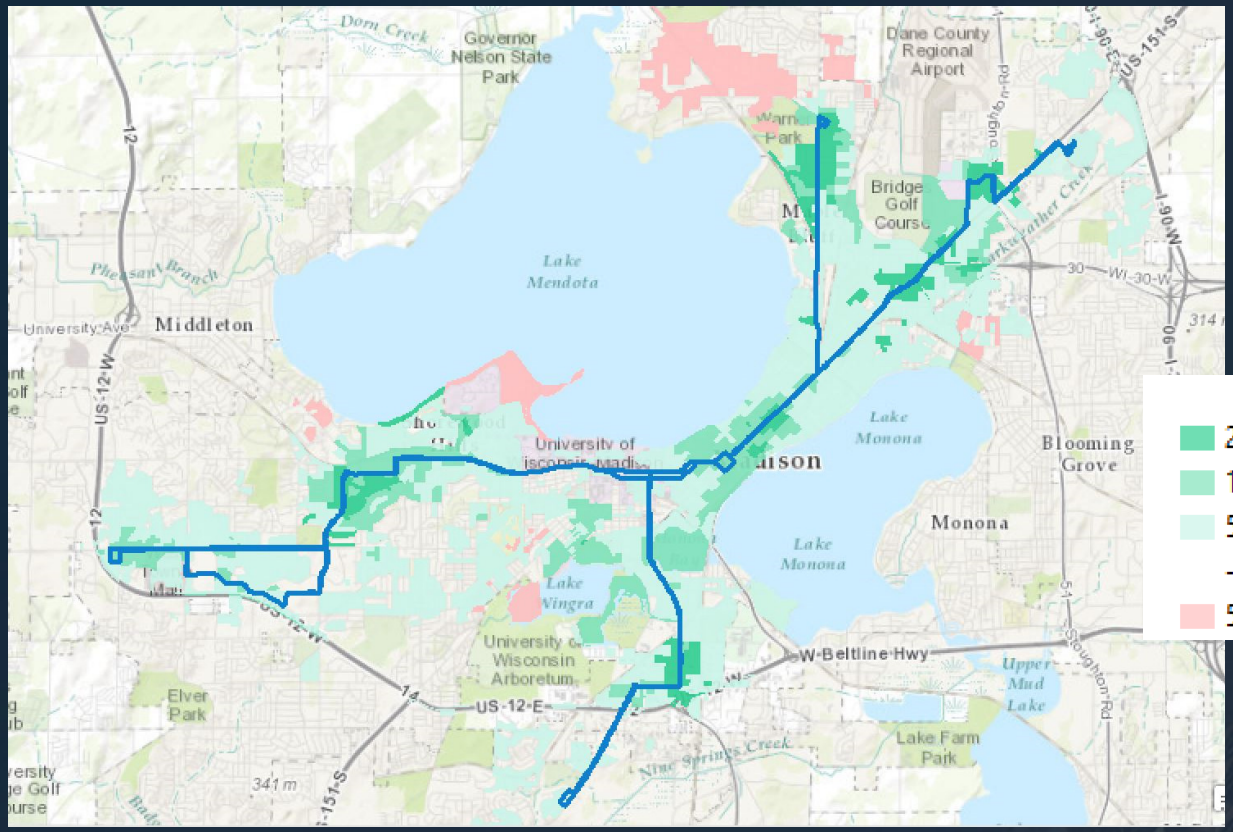
Quantifying Benefits of Future Projects

AND
Mode Shifts!



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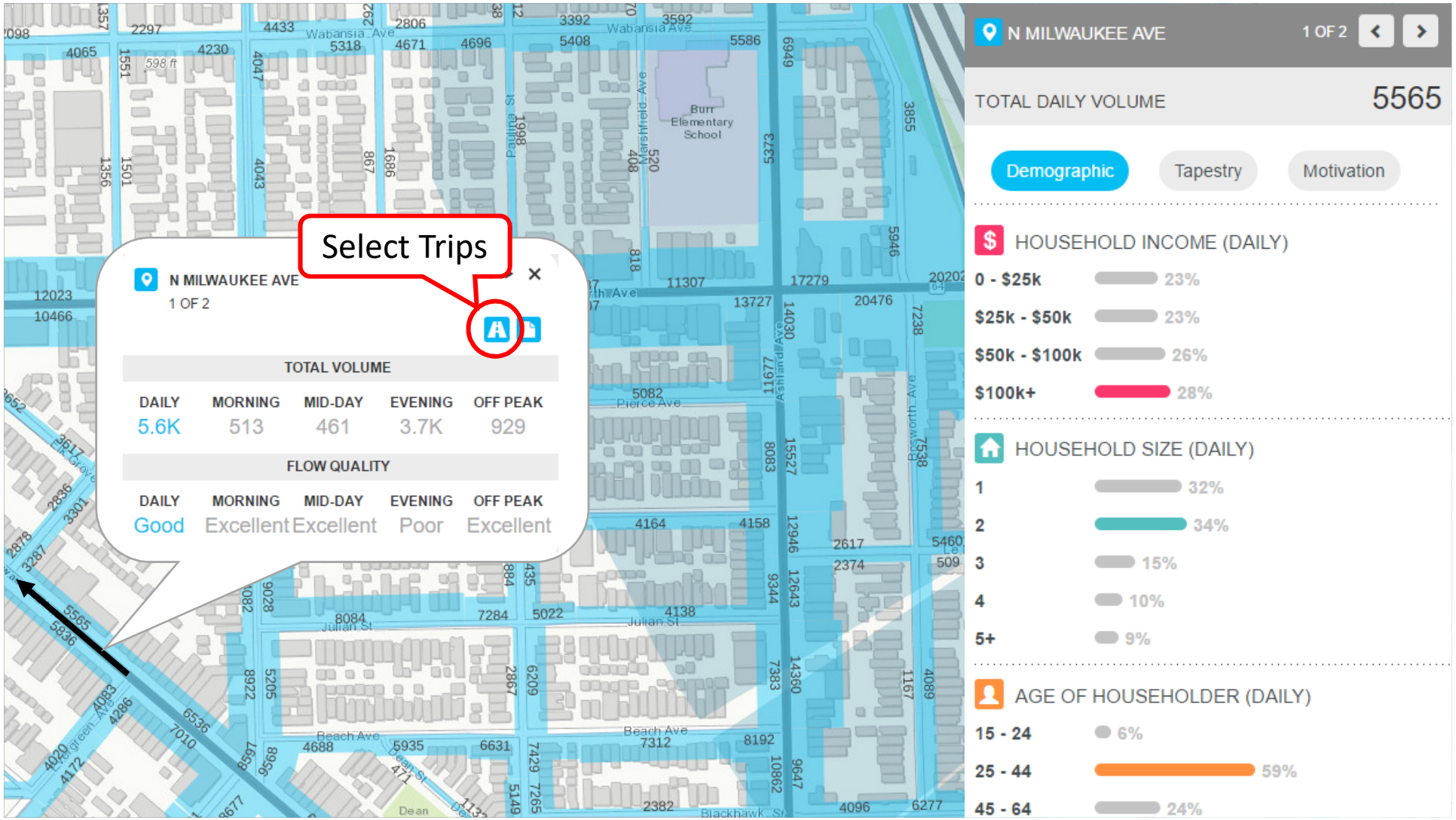
Select Trips
N MILWAUKEE AVE
1 OF 2
TOTAL VOLUME
DAILY MORNING MID-DAY EVENING OFF PEAK
5.6K 513 461 3.7K 929
FLOW QUALITY
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4 10%
5+ 9%
AGE OF HOUSEHOLDER (DAILY)
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25 - 44 59%
45 - 64 24%

Select Trips Analysis

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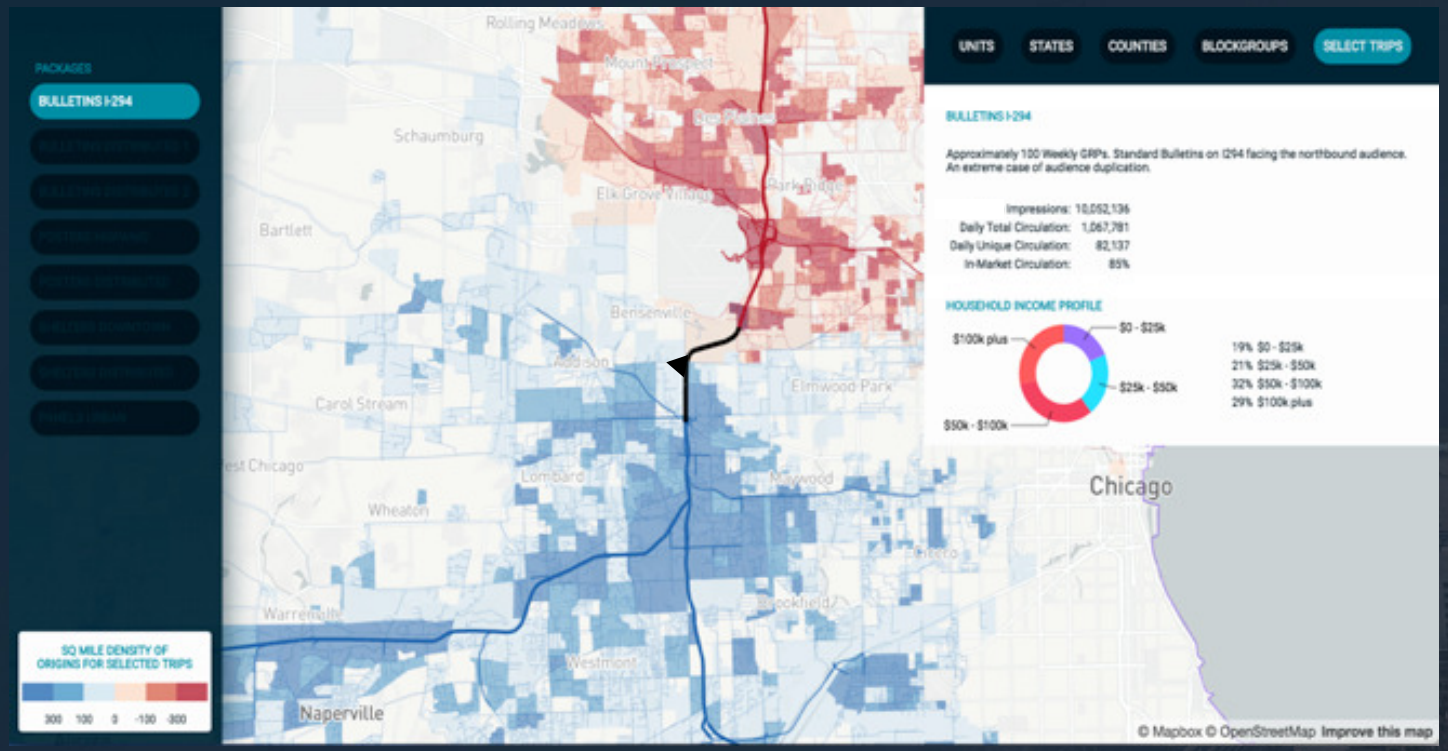
Identifying the Path of the User

Trip Origins & Destinations of Audience by Direction for Every Roadway



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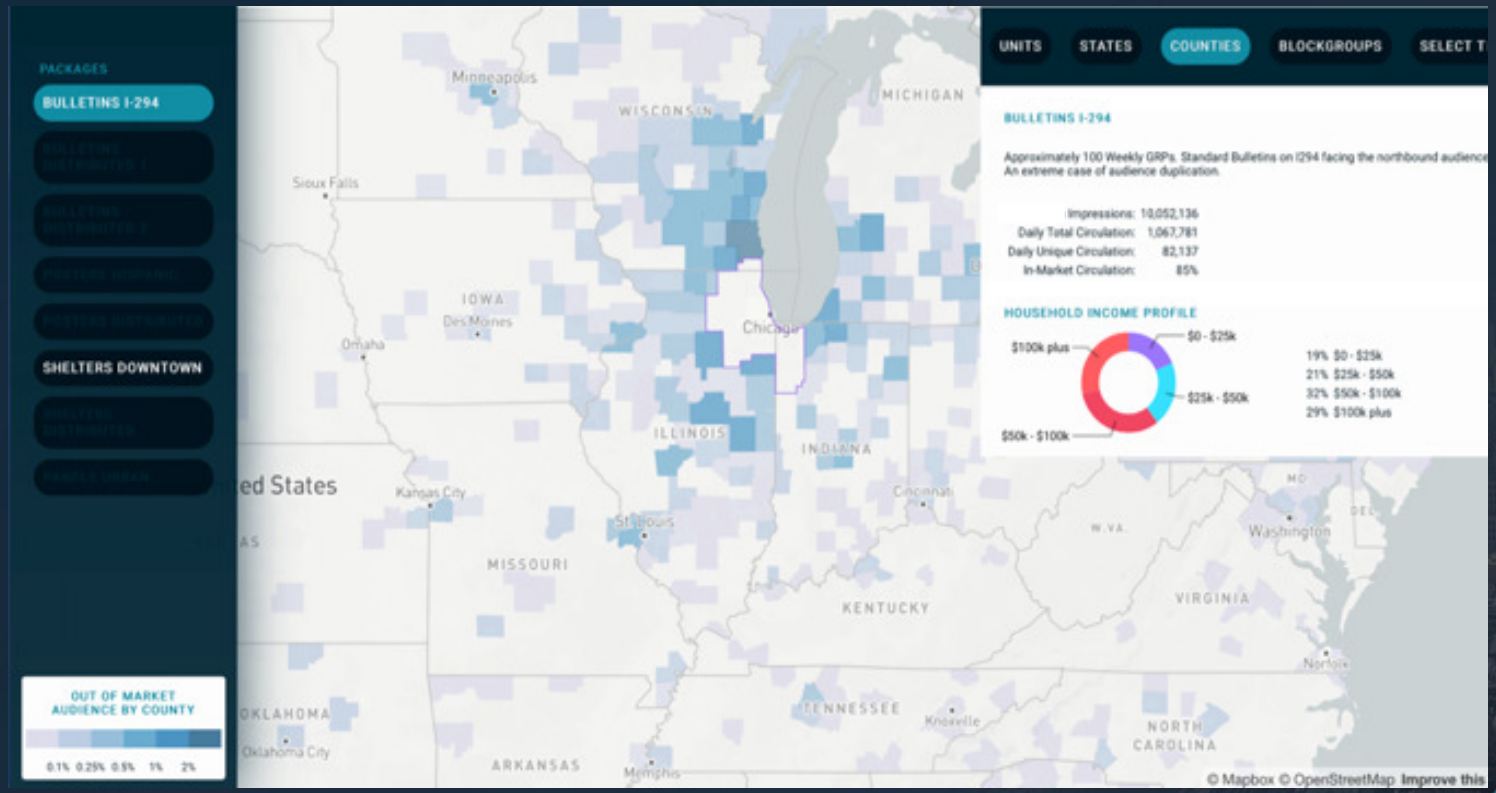
Home Location Analysis



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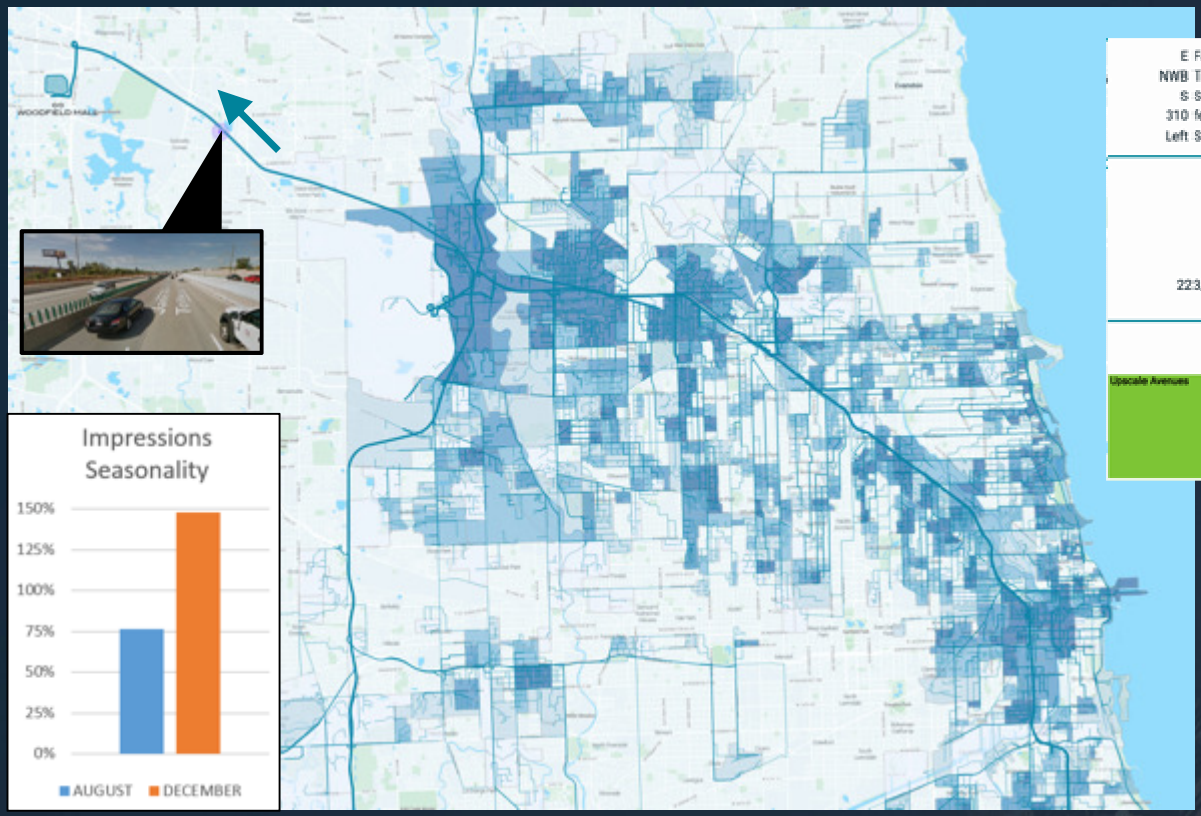
Complete Travel Insights



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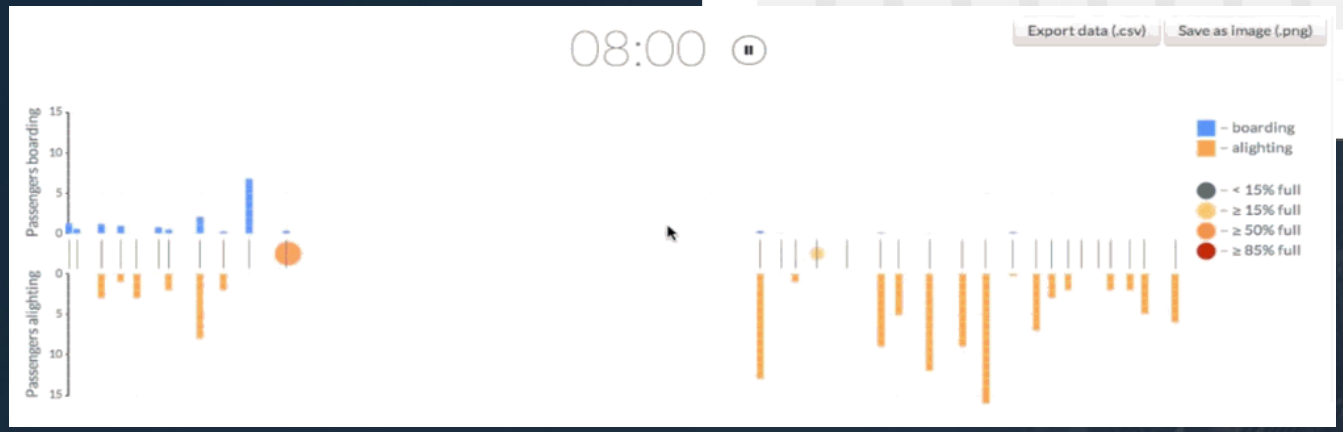
urban engines

Corridor Reporting and Performance

- What is the distribution of services and vehicles along the corridor?
- What can be done to reduce bunching and dwell time across vehicles?
- What is the on-time performance across all services?



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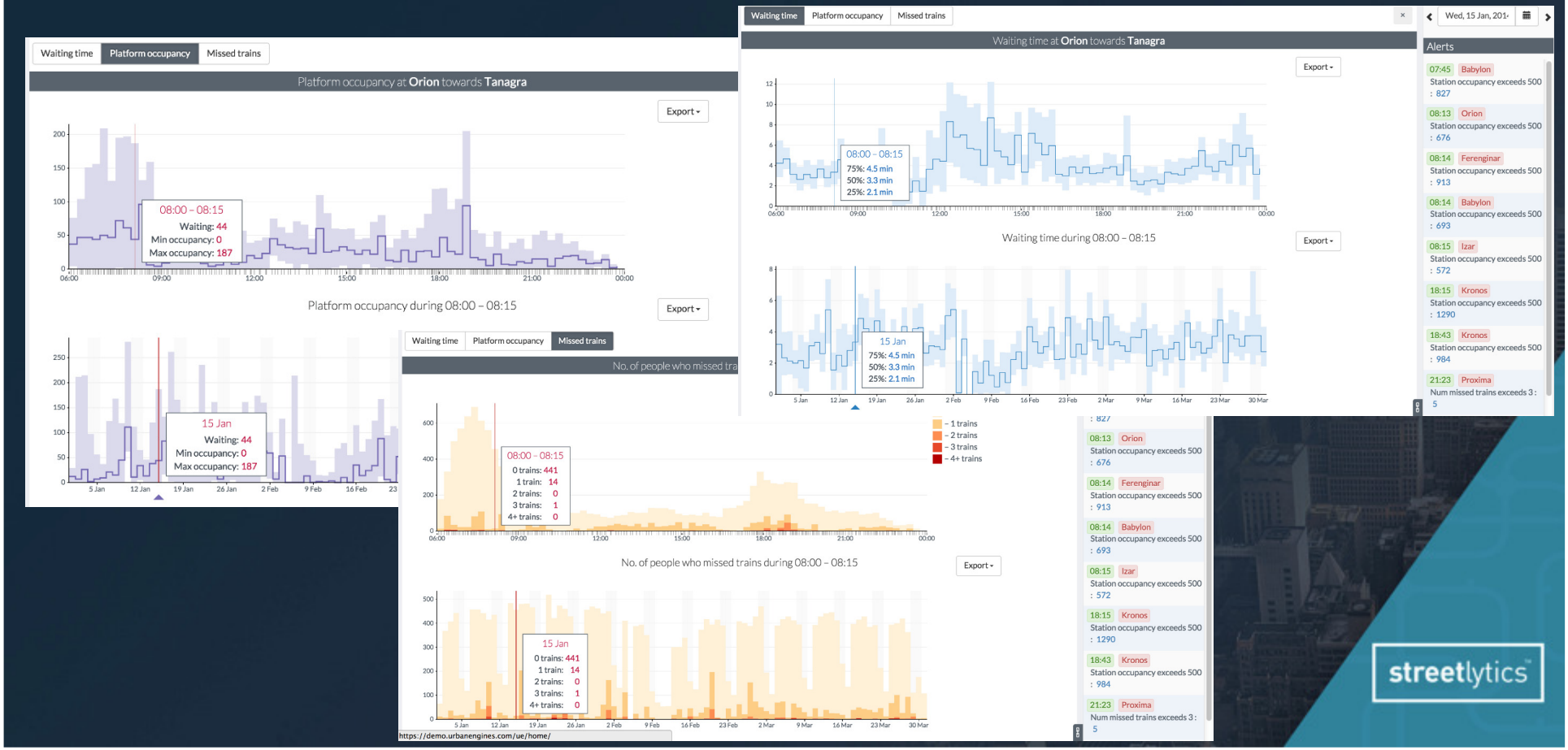
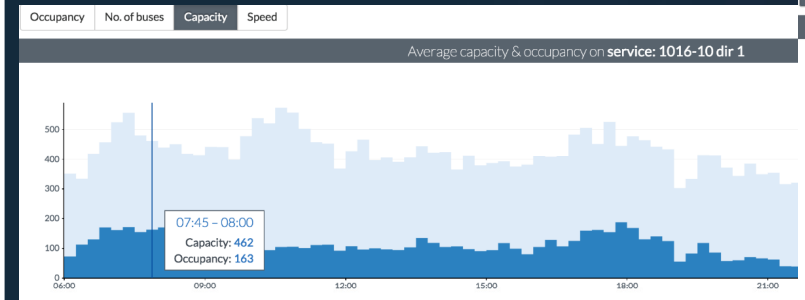
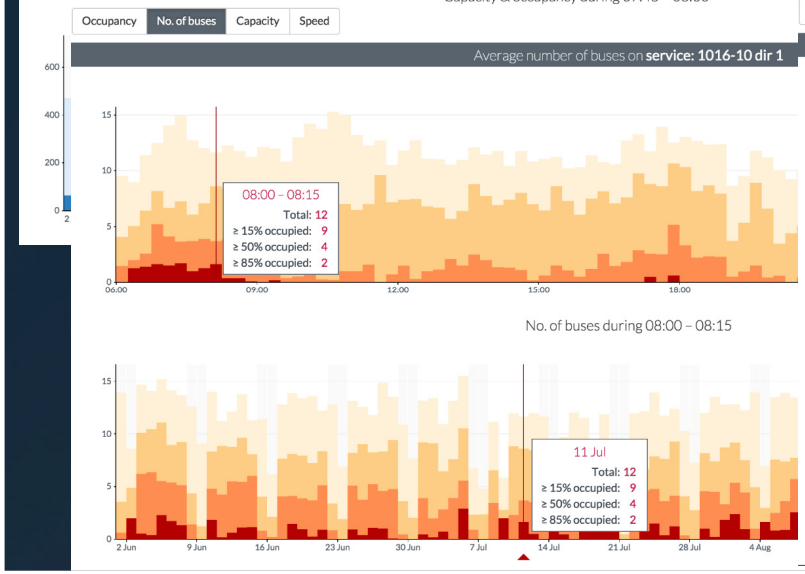
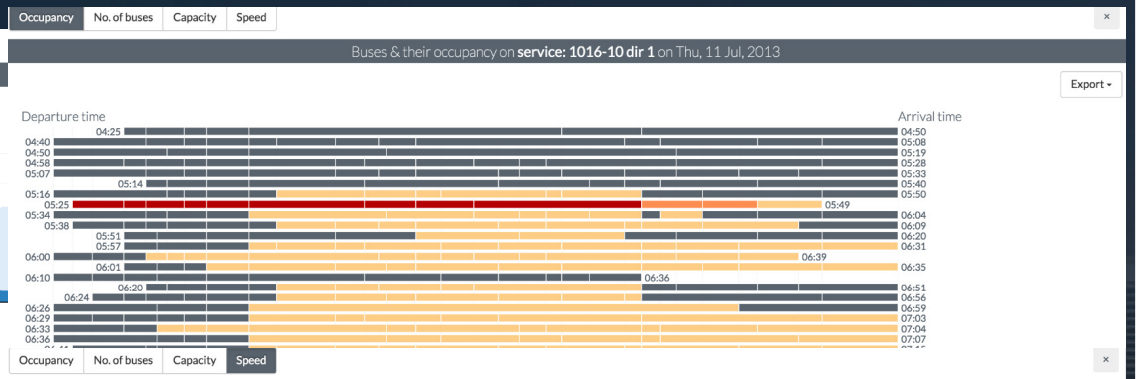
System and Platform Reporting

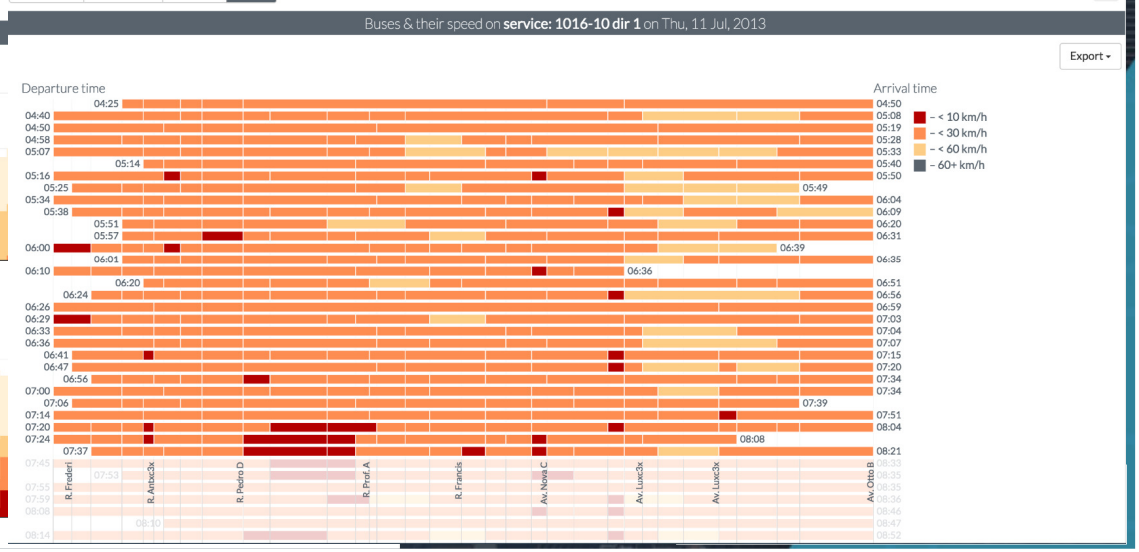


Line and Service Reporting

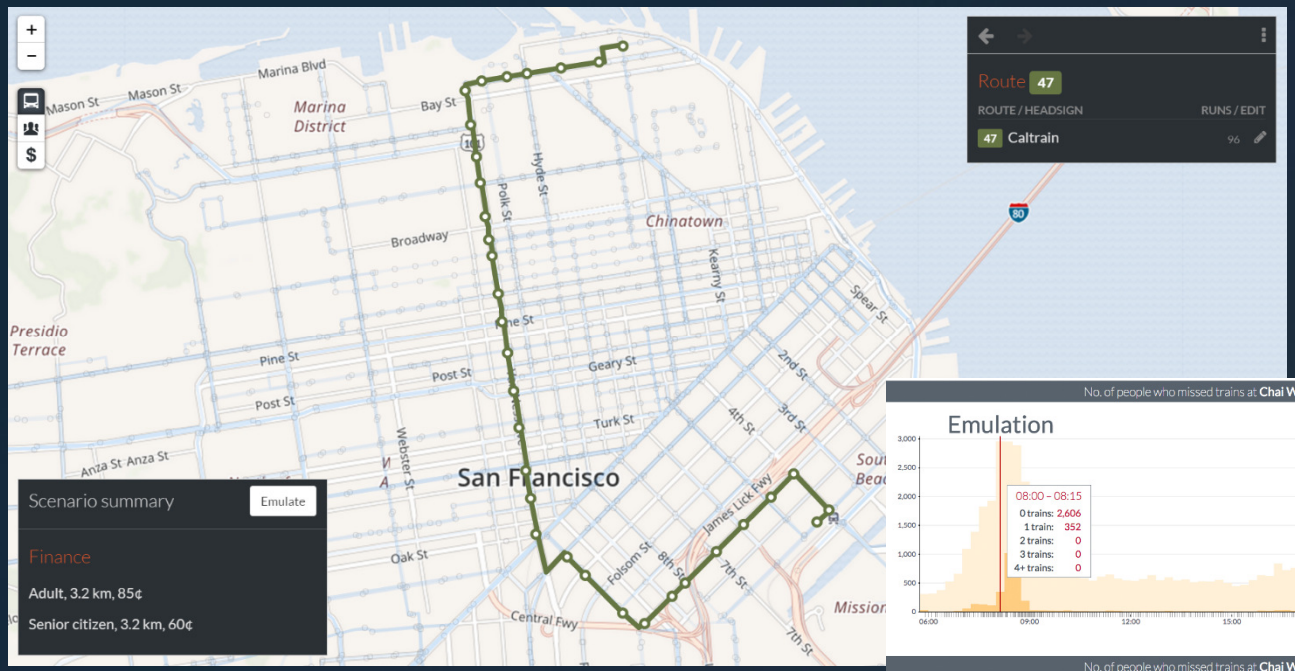






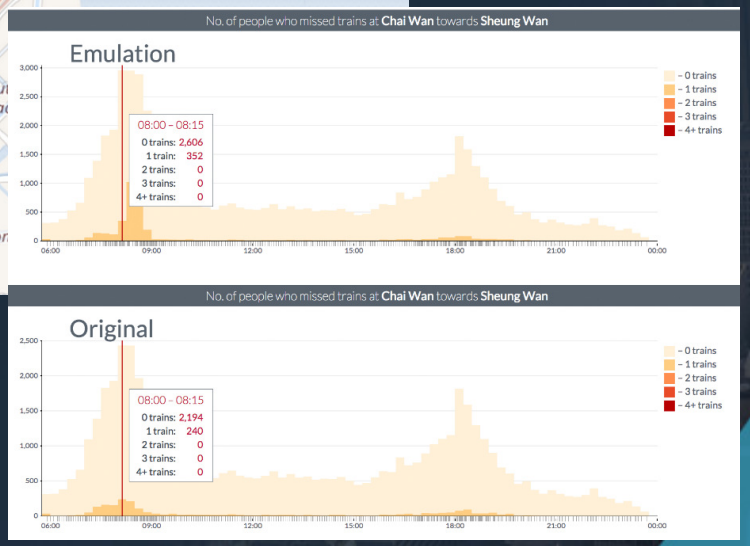


Scenario Planning



Use your system emulation to test and compare changes in demand and or services.

Scenarios are viewed and understood in the same way as the real-time performance or any other historic day.



- Edit demands in an area for a special event and test system response plans.
- Edit the system or service changes and play back demand from known days to test system impacts.

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THANK YOU !

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