TRANSPORTATION ANALYTICS WITH LOCUS

TURNING DATA INTO HUMAN DECISIONS

presented by

Cambridge Systematics, Inc.

CAMBRIDGE SYSTEMATICS

Cambridge Systematics: 50 Years of Insights through Innovation

Policy + Strategy

Planning + Operations

Modeling + Analytics

Software + Tools

We are **transportation specialists**, providing **innovative solutions** and **trusted insights** that help our clients **quickly and confidently interpret complexity** to provide meaningful services to their communities.

- Founded in 1972
- Independent, employee owned
- 200+ staff in 12 nationwide offices
- Committed to DEI

DATA & TECHNOLOGY ARE FUELING RAPID INNOVATION IN TRANSPORTATION

The private sector is crafting new and better experiences for customers and the public: More personalized, targeted, and productive outcomes than ever before.

- E-COMMERCE
- TNCs
- MICROMOBILITY
- CONNECTED CARS
- MaaS
- FOOD DELIVERY

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WITH THIS INCREASED DYNAMISM….

CITIZENS NOW HAVE NEW EXPECTATIONS FROM PUBLIC SECTOR TRANSPORTATION AGENCIES

HUMAN-CENTRIC
Not speed, but safe, livable, & reliable

MULTIMODAL & GREEN
Not just automobile

EQUITABLE
Not one-size-fits-all

INTELLIGENT AND DYNAMIC
Not reactive, but strategic

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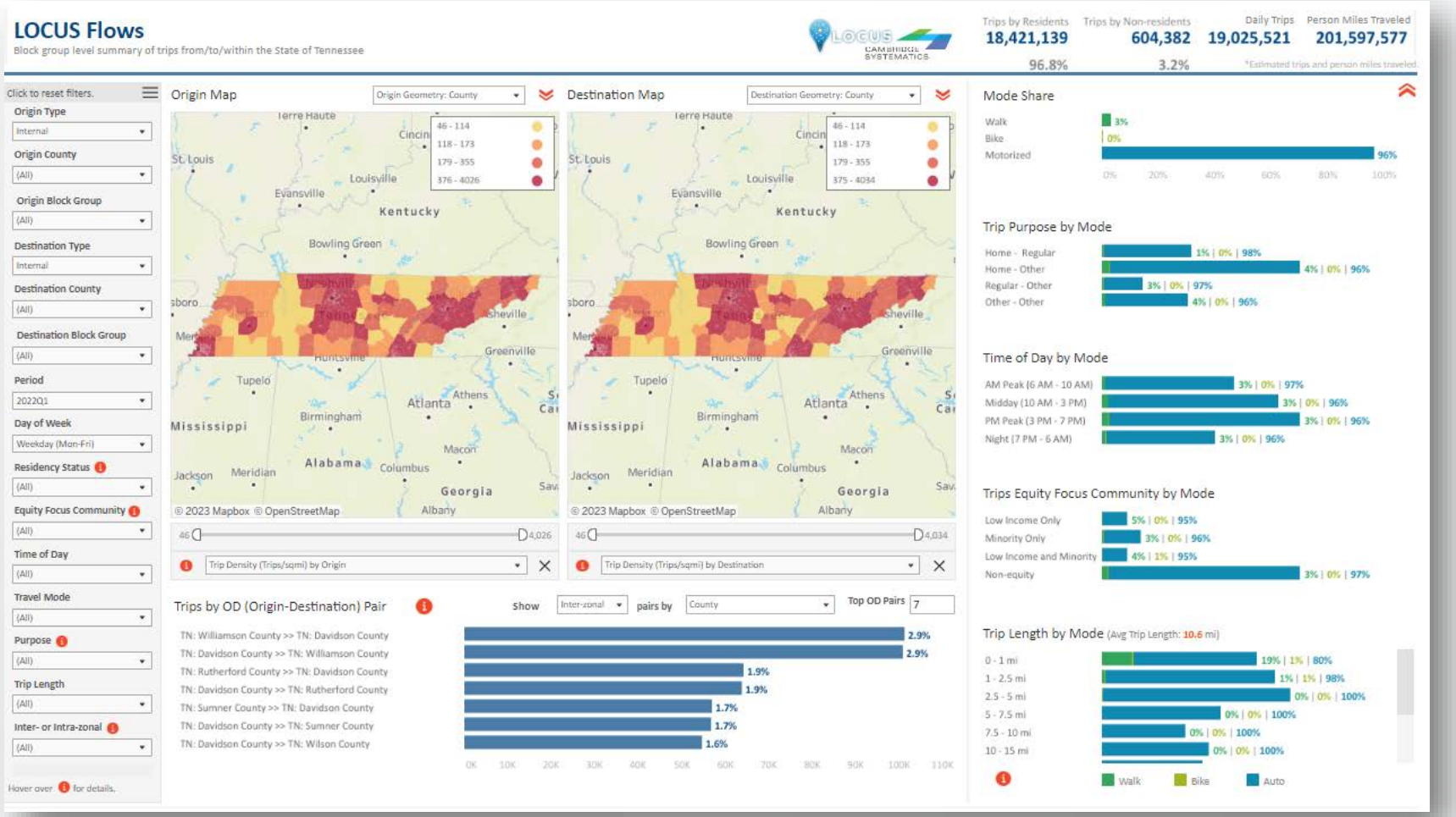
Agencies must become more data-driven

- **Utilize Passive Data**
  Emerging passive data sources that allow tracking travel in new ways
- **Adopt New Analytic Methods**
  New computing systems, advanced algorithms, and new display methods which make it easy to handle and understand large data systems
- **Incorporate New Applications**
  Greater focus on short term forecasting, equity, risk assessments, safety, localized improvements

BUT, SIMPLY ADOPTING DATA & TECHNOLOGY IS NOT ENOUGH…

What is LOCUS?

» LOCUS is a flexible and customizable big data analytics platform that captures the movement of travelers / vehicles and performance of the transportation system across a region.



The CS #makedatahuman Approach

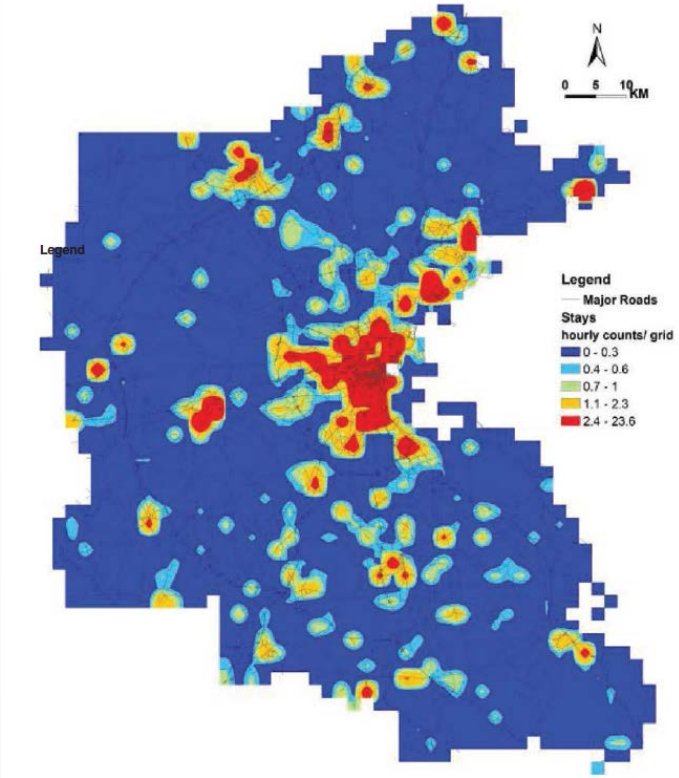
	Software Approach	#makedatahuman Approach
VERACITY	Data is ground truth	**Clean, validate, expand to minimize bias**
EFFECTIVENESS	Product-driven generalization	**Client-driven customization**
EXPERTISE	Data science and software	**+ transportation, policy, and equity**
COLLABORATION	Do-It-Yourself integrations	**End-to-end trusted advisors**
INTELLIGENCE	Data outputs & visualizations	**Story-telling using the right KPIs**
SUBSCRIPTION	Standard Products – Standard Pricing	**Right-sized solution to fit needs + budget**

Product Background

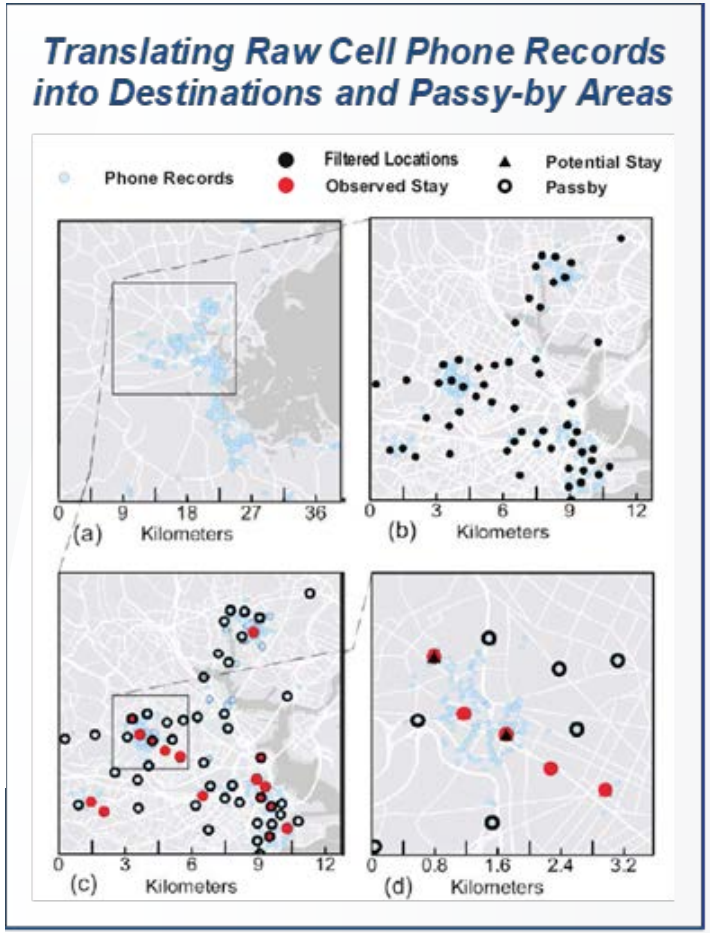
Where did it all begin…..

NCHRP Project 08-95—Cell Phone Location Data for Travel Behavior Analysis

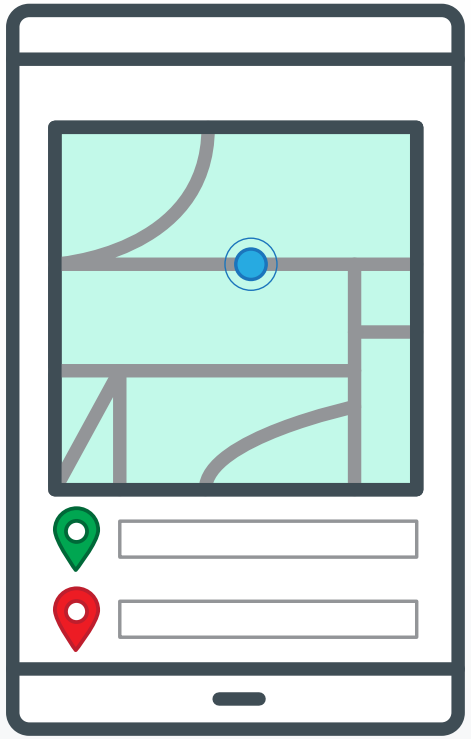
- » Used traces from cell phone uses to infer travel
- » Evaluated the extent to which cell phone data accurately reflects daily travel; how to better understand how to utilize these data to understand and model travel behavior

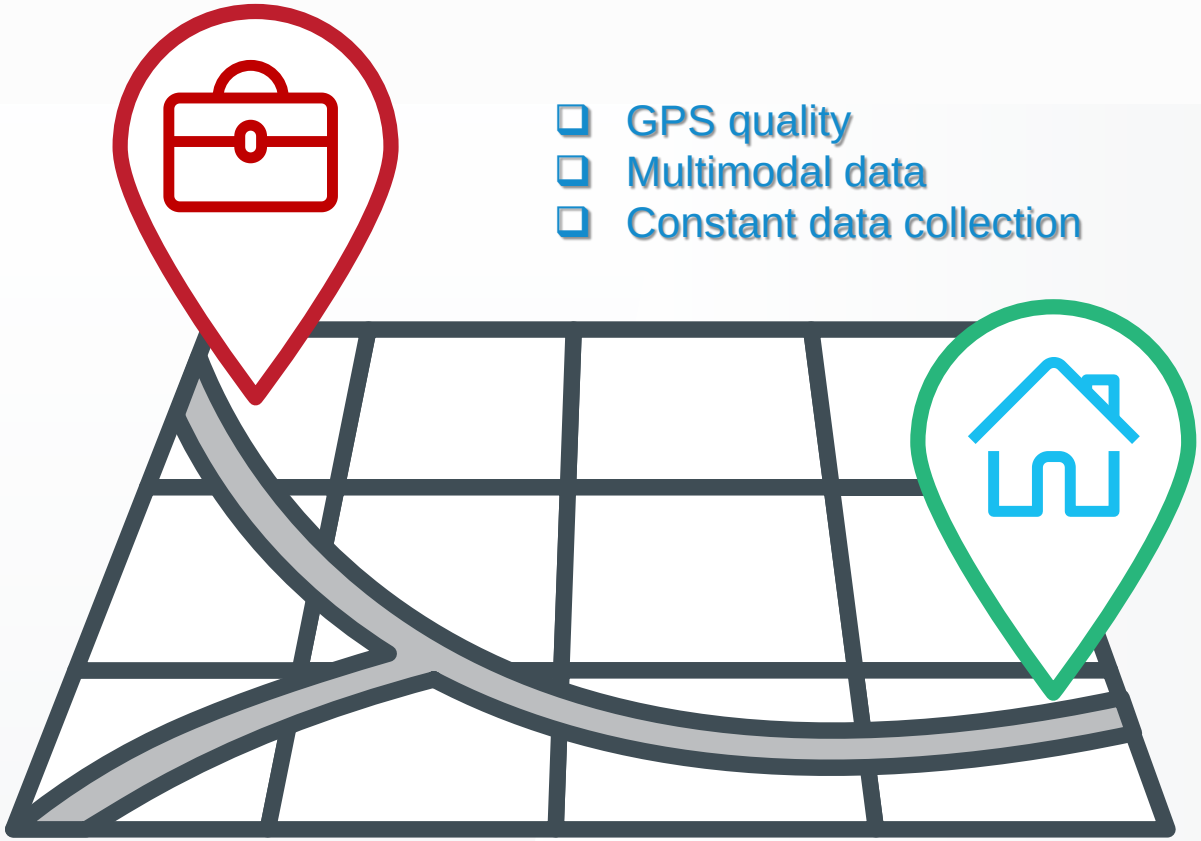


Stay locations and their spatial distribution in the region



Input Data





- GPS quality
- Multimodal data
- Constant data collection

LOCATION-BASED SERVICES DATA

DATA PROCESSING

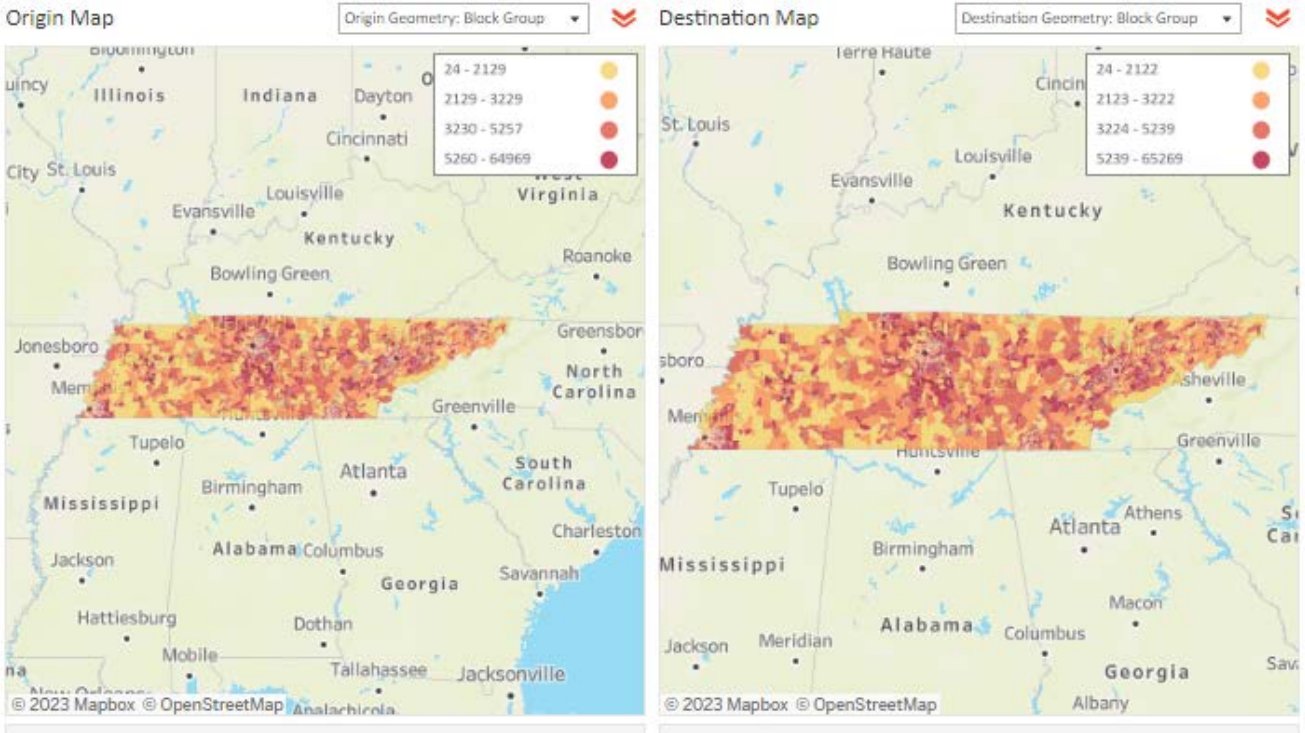
- Impute activities & trips
- Home/work location imputation
  - Identify trip purpose
- Spatial/temporal patterns
- Expansion

Why do we use LBS?

» **Multimodal**
LBS data provides information about ALL trips taken in a region across ALL modes

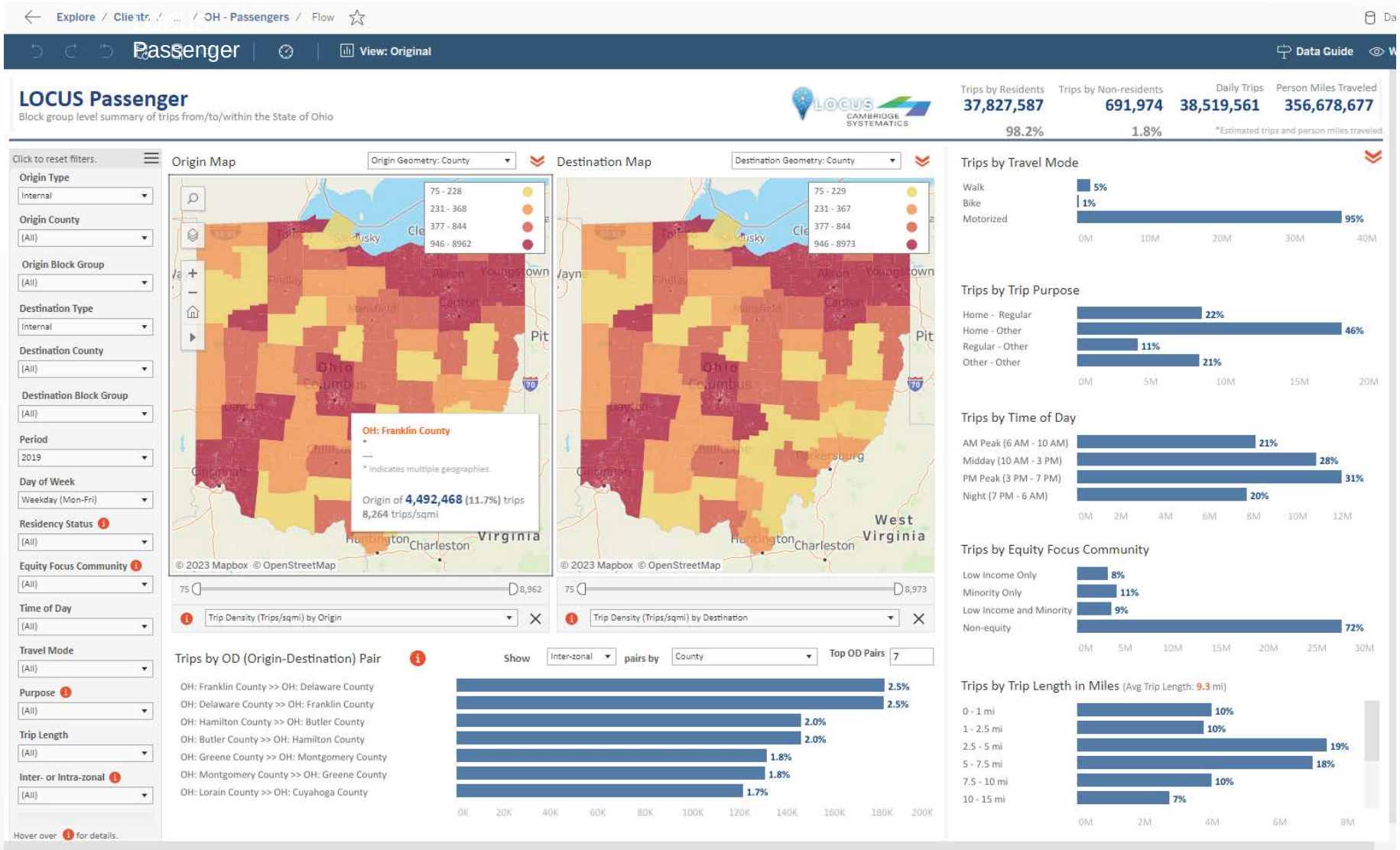
» **Equity-First**
Smartphone penetration rates are high across all income levels

» **Trend Assessments**
Access to granular data allows us to document and assess trends in travel patterns.



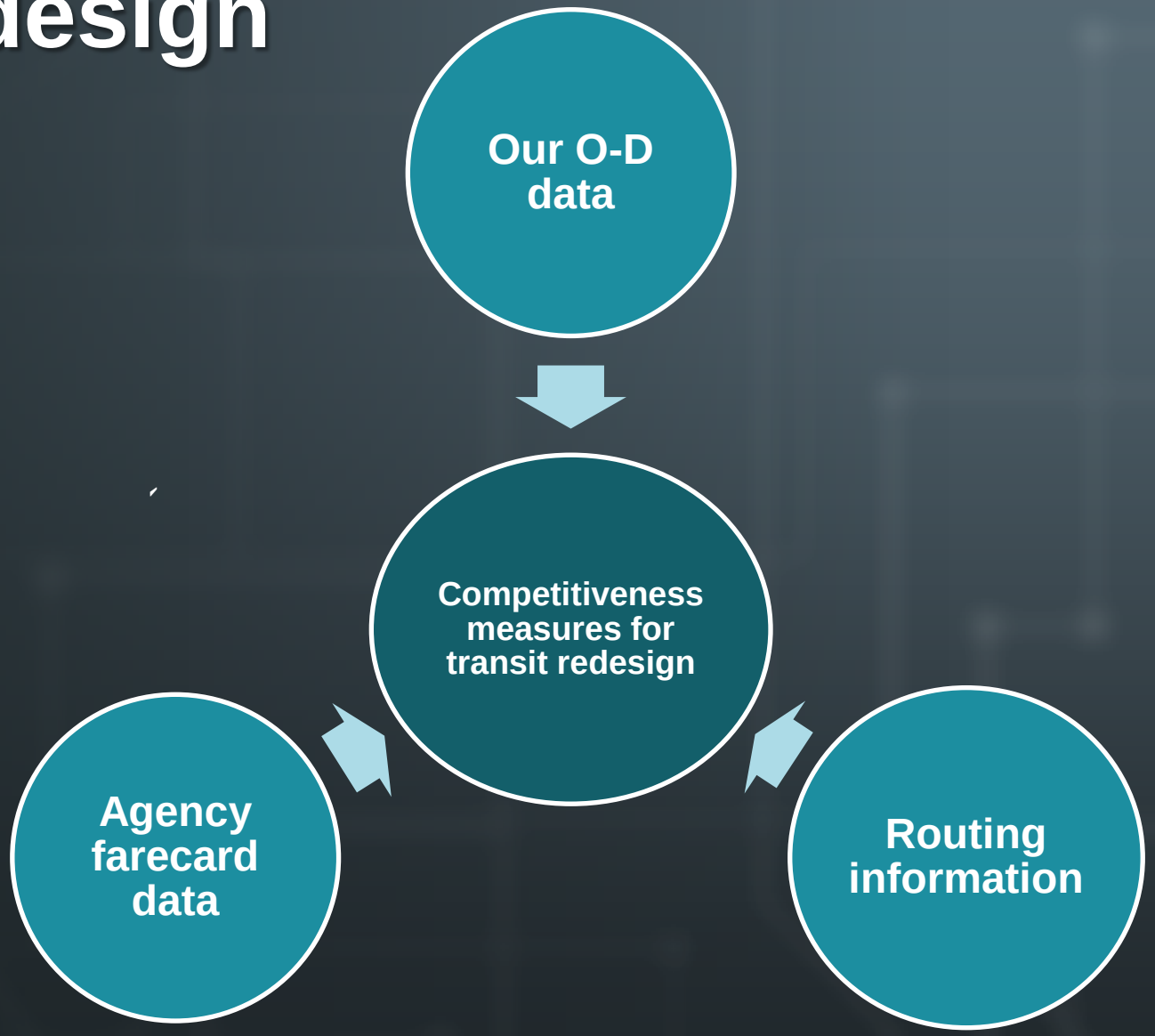
Designed by Clients…
Built by us

O-D Flows



- Expanded and validated OD information at county or block group level
- Filters: origin and destination, day of week, time period, residency status, equity focus, travel mode

Transit redesign



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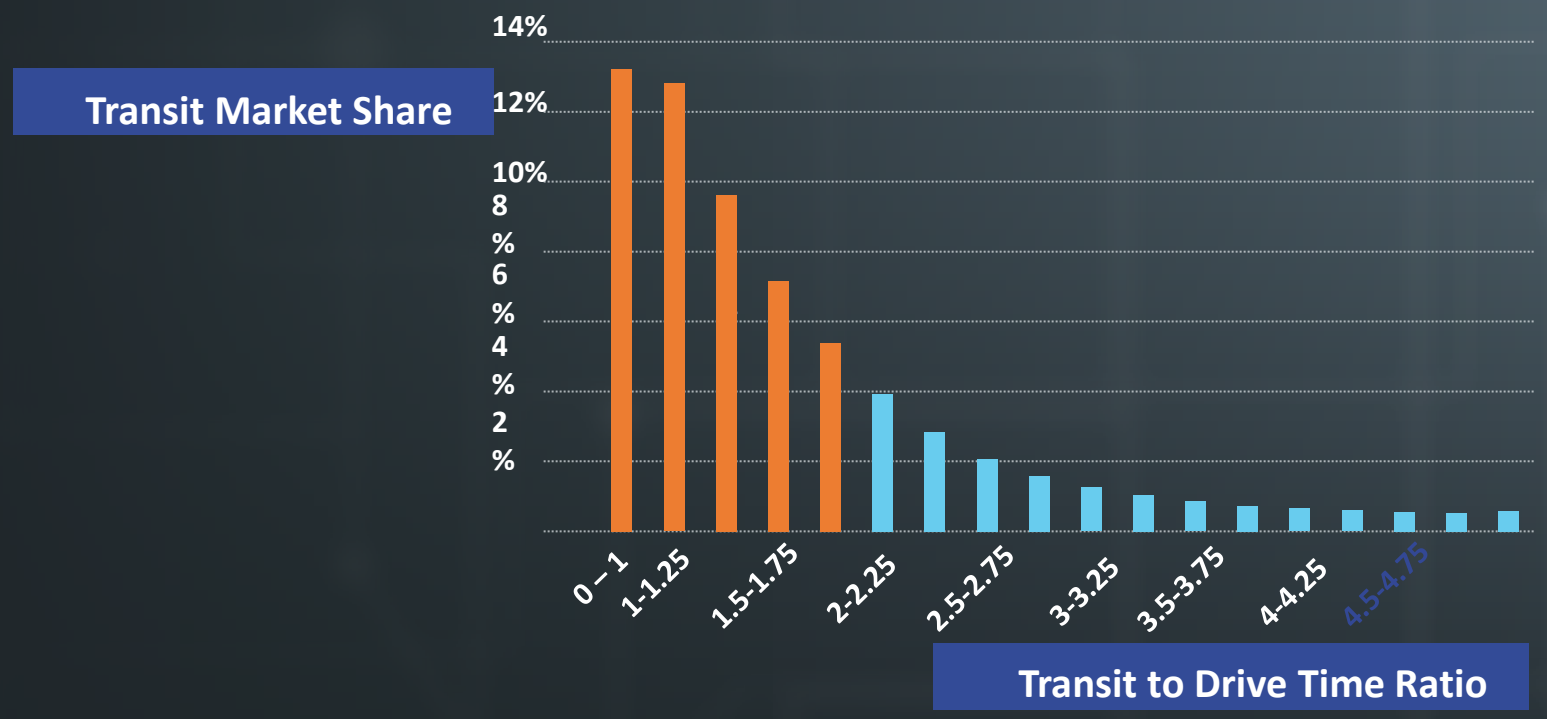
Competitiveness of Relative Travel Times

Travel Time Comparison with Auto



When driving is over twice as fast, transit is less competitive.

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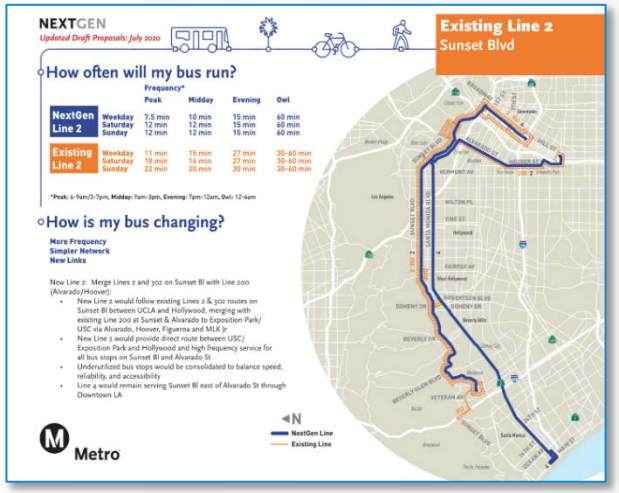
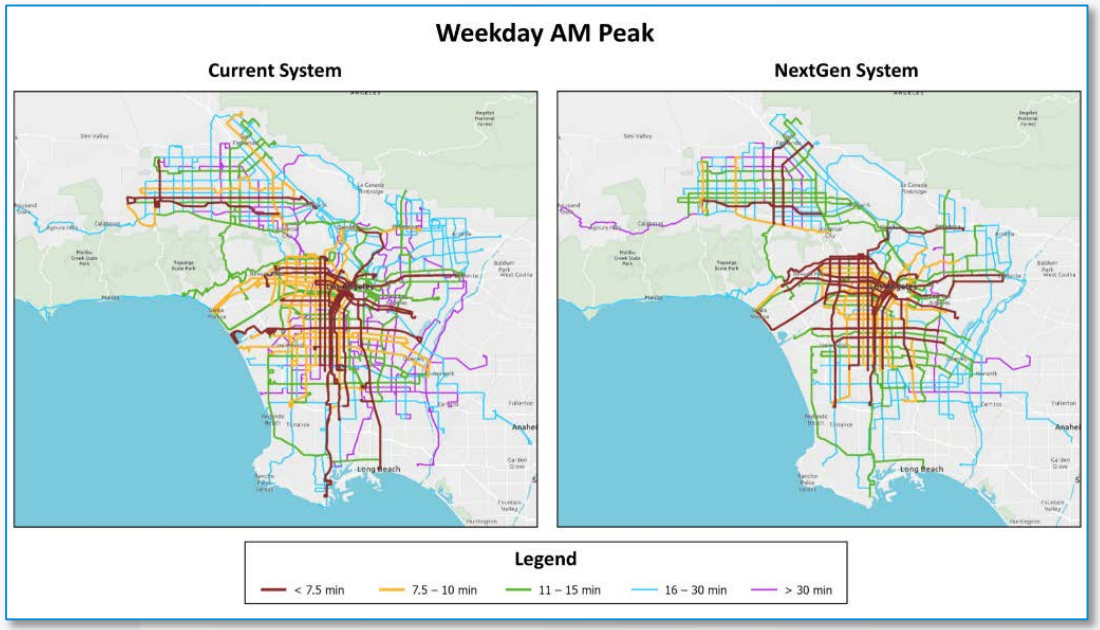
Transit Bus Network Redesign

LOCUS Passenger

LA Metro NextGen Bus Study

- Used LBS data together with survey results and farecard data to identify gaps in bus service and competitiveness
- Calibrated and expanded origin-destination flow table that shows travel patterns of the residents of Los Angeles County
    - Allowed Metro to right size transit service
- Results:
    - 90 new bus lines, 150 bus lines merged, and 24 lines discontinued
    - bus ridership increased 10% from Feb ‘22 to Feb ‘23



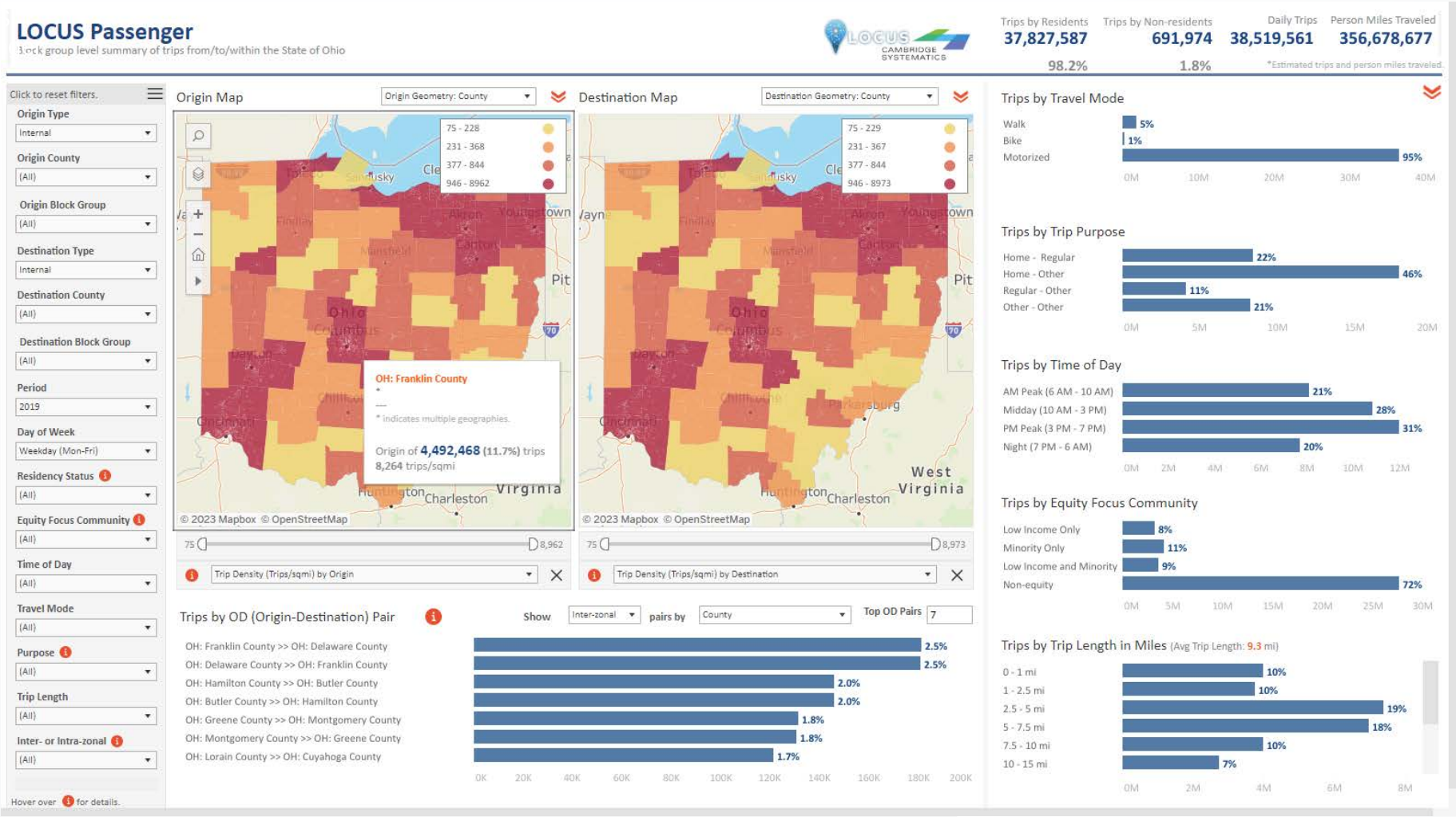


LOCUS Products

LOCUS Products

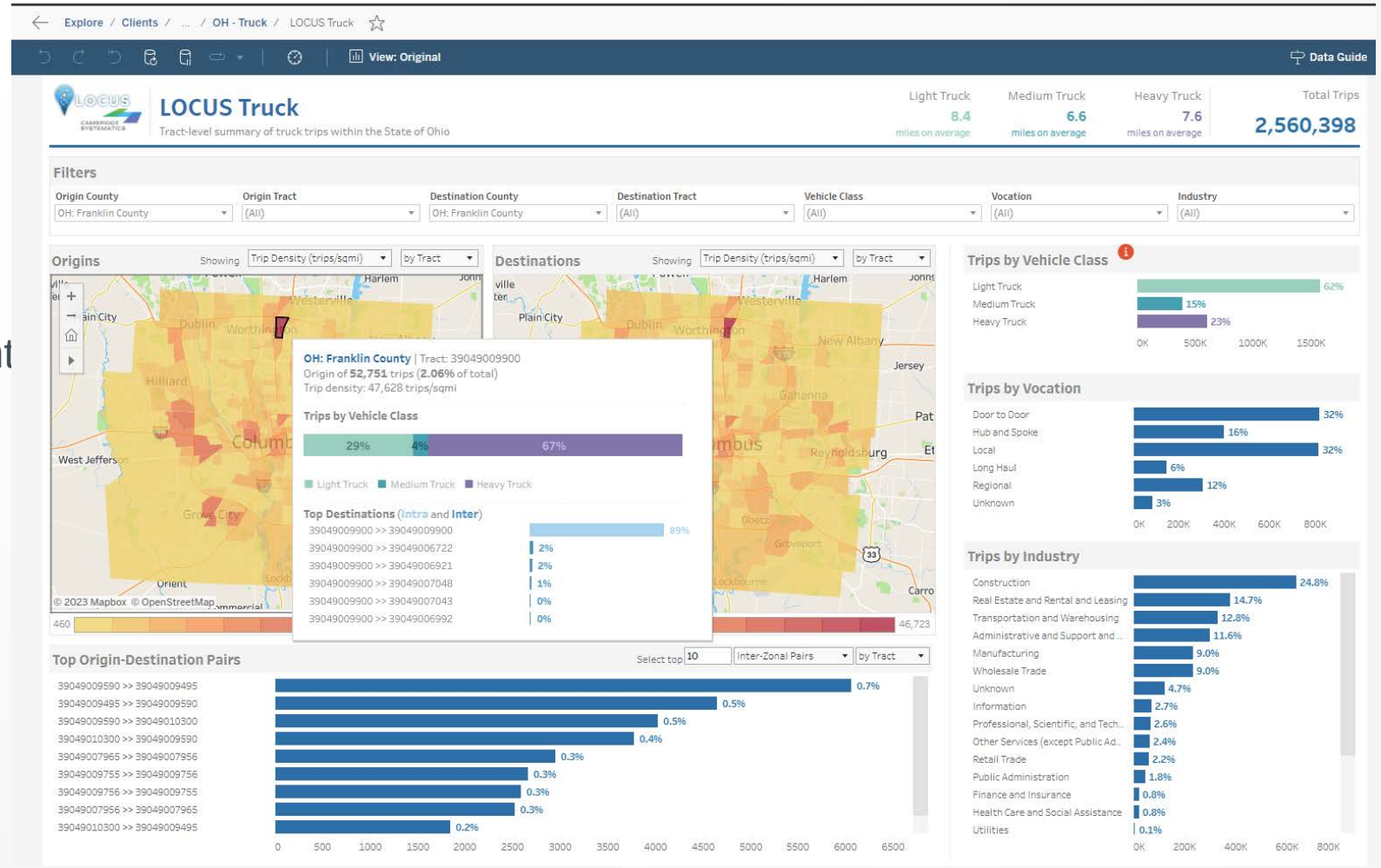
LOCUS Passenger	Queries expanded and validated Origin-Destination passenger flows by mode, travel purpose, time, and more.
LOCUS Truck	Integrates truck movements and commodity flows for a one-stop tool for freight plans and truck parking efforts.
LOCUS Performance	Shows speeds, patterns, and volumes, external station, select-link analyses, and pass-through zones on specific event days.
LOCUS Charge	Identifies ideal locations for public charging stations for passenger and truck EVs to help municipalities and planning agencies.
LOCUS Safe	Indicates areas with higher exposure to crashes by linking crash data with LOCUS Passenger and Truck flows.

LOCUS Passenger



LOCUS Truck

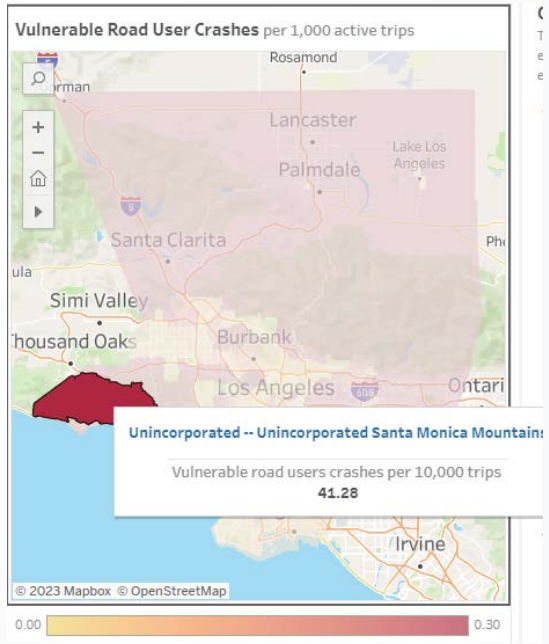
- Commercial vehicle data providing information on class, vocation and industry
- Routing information to calibrate and validate the truck assignment to the model roadway network
- Trip duration, length and speed metrics to calibrate the truck trip distribution model
- Analytics for stops that trucks make along the route

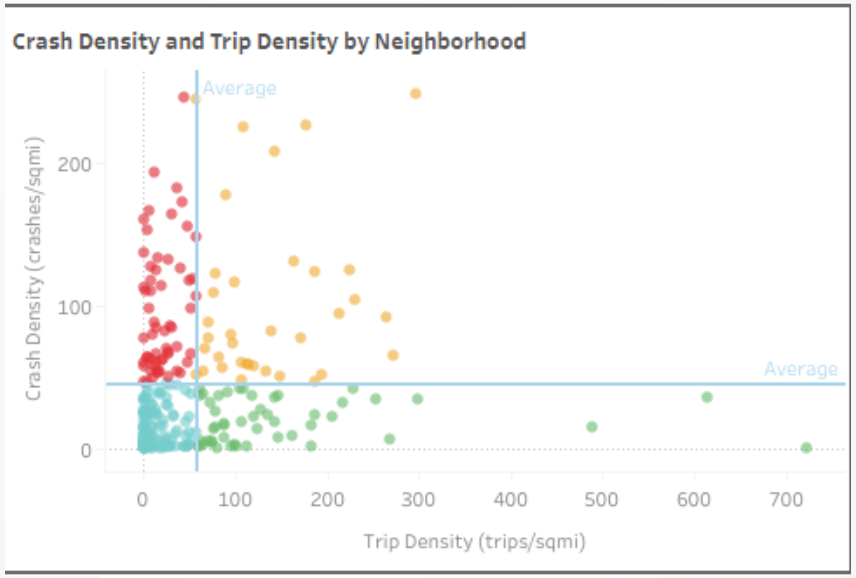


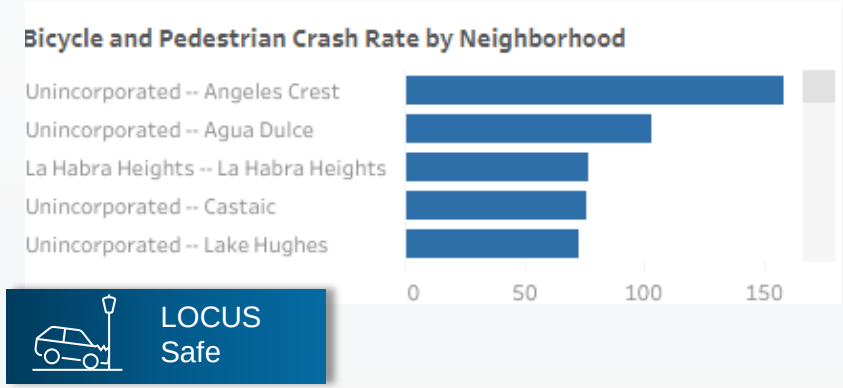
LOCUS Truck

LOCUS Safe

- Shows number of total crashes and number of vulnerable road user crashes by number of trips, down to neighborhood level
- Allows analysis focusing on equity communities, time of day patterns, and multiple crash thresholds
- Immediately identifies neighborhoods with highest crash rates
- Allows before-and-after comparison to understand the impact of safety actions



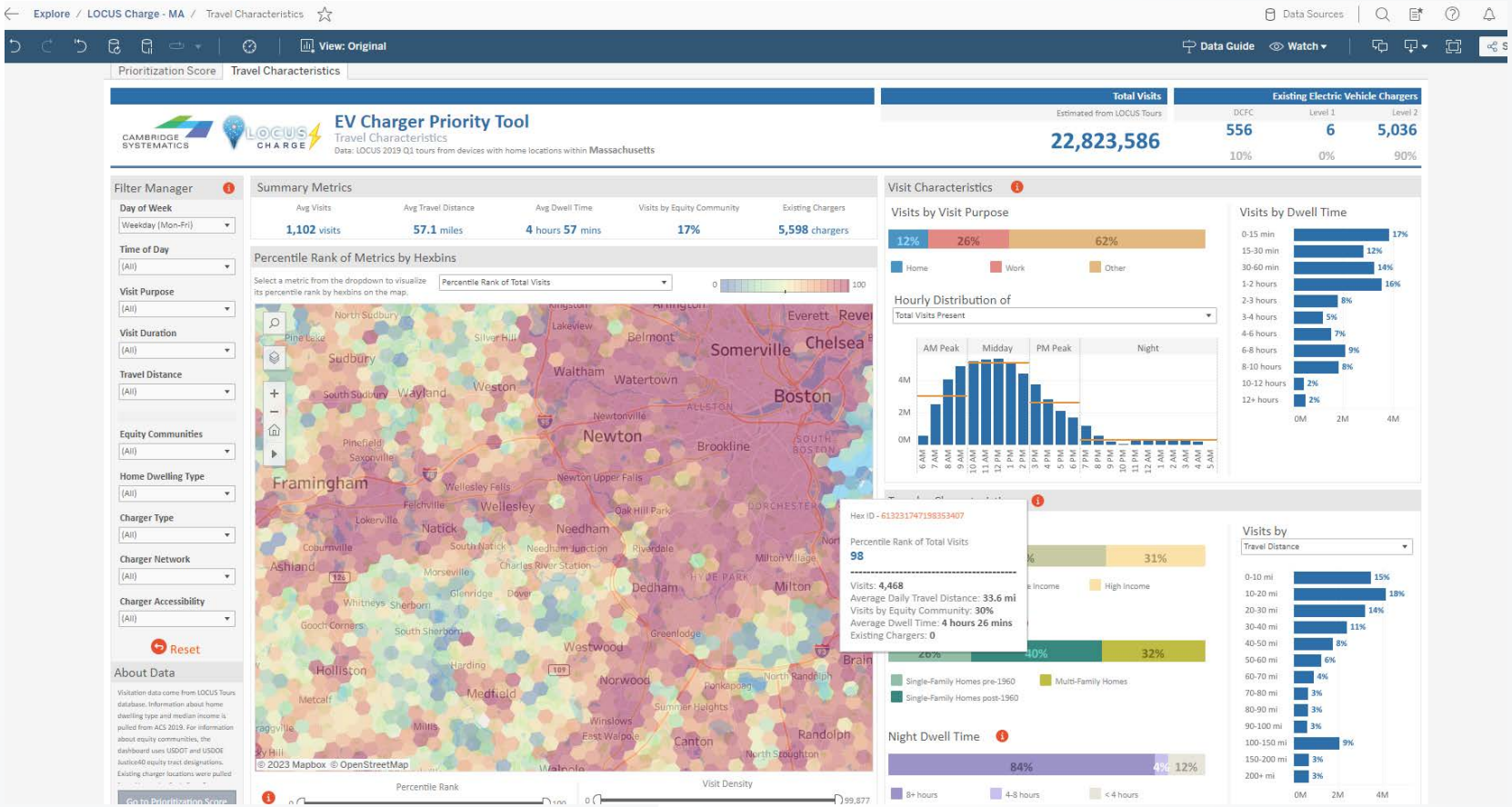




LOCUS Charge

LOCUS Charge

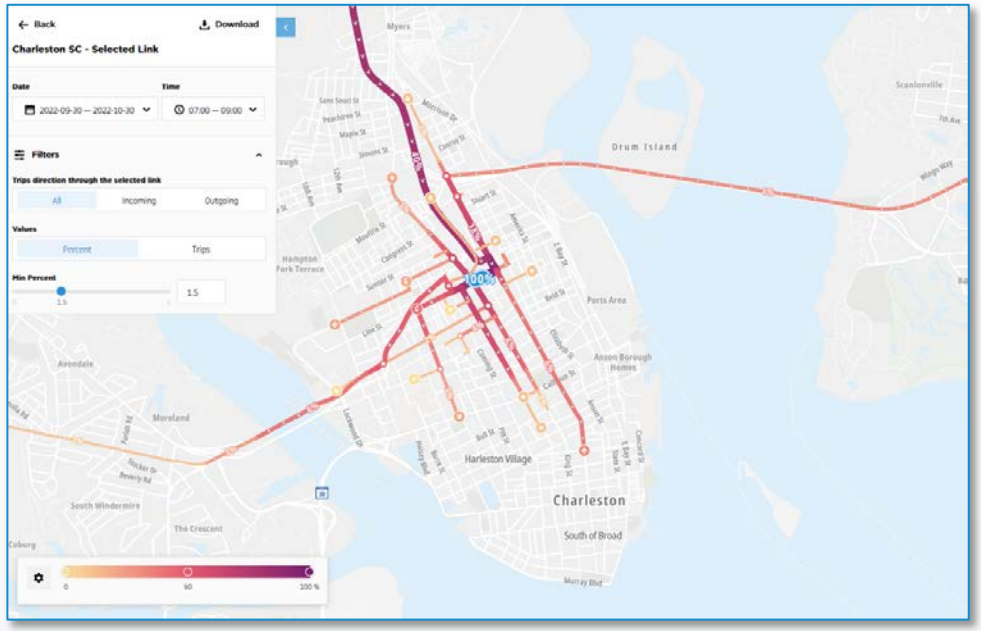
- Determines number of vehicles traveling into a certain area
- Why hex-bin? Used by utilities for each generator / service sector
- Create prioritization score using weights for visitation, dwell time, distance, equity, existing chargers
- Provides input to: Which areas are best candidates for new charge stations

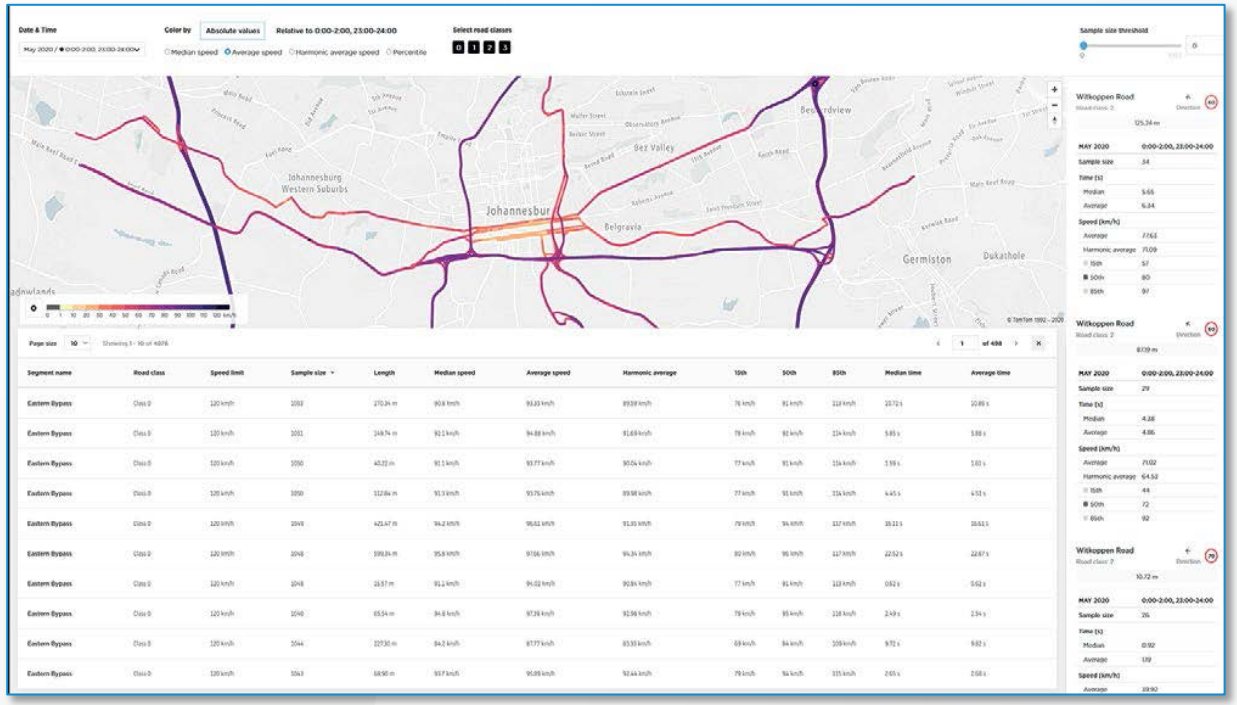


Select Link Analysis

LOCUS Performance

» Statistical traffic analysis and O-D analysis of travelers on specific links (inbound and outbound)





LOCUS Use Cases

Orange County, NY Model Update

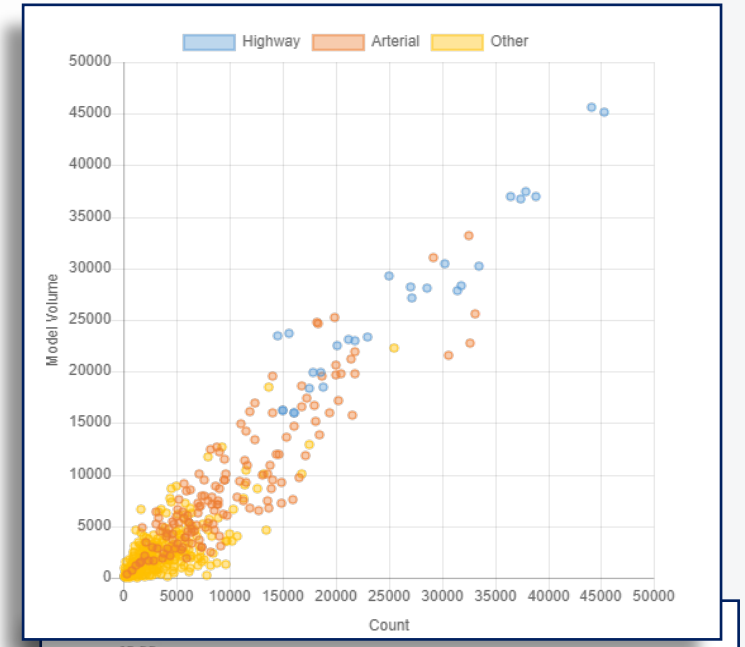
Evolving regional travel needs resulted in the need for a faster, adaptive travel demand model

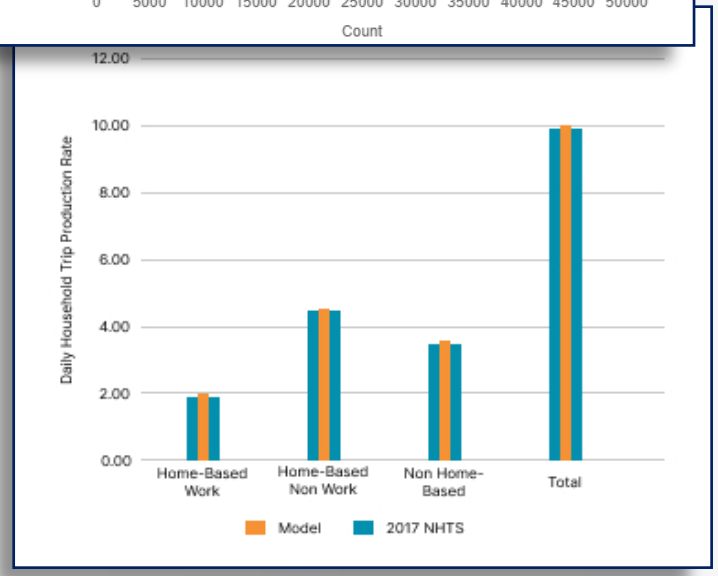
LOCUS dataset and socioeconomic data were used in the absence of household survey data for **model estimation**

Delivered a fully functional and accurate TDM using LBS data → high time and cost savings

This is the first time LBS data has been successfully used for model estimation, replacing the need for a household travel survey

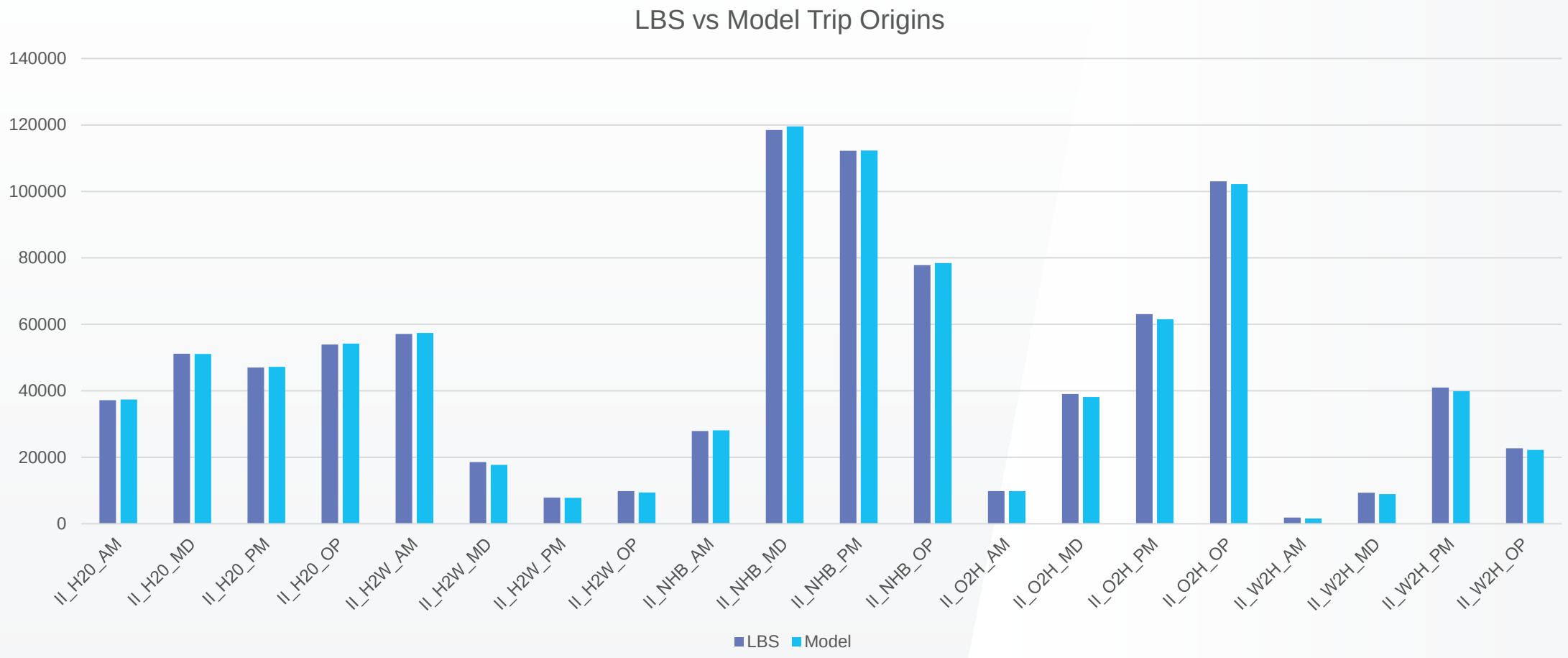
LOCUS Passenger





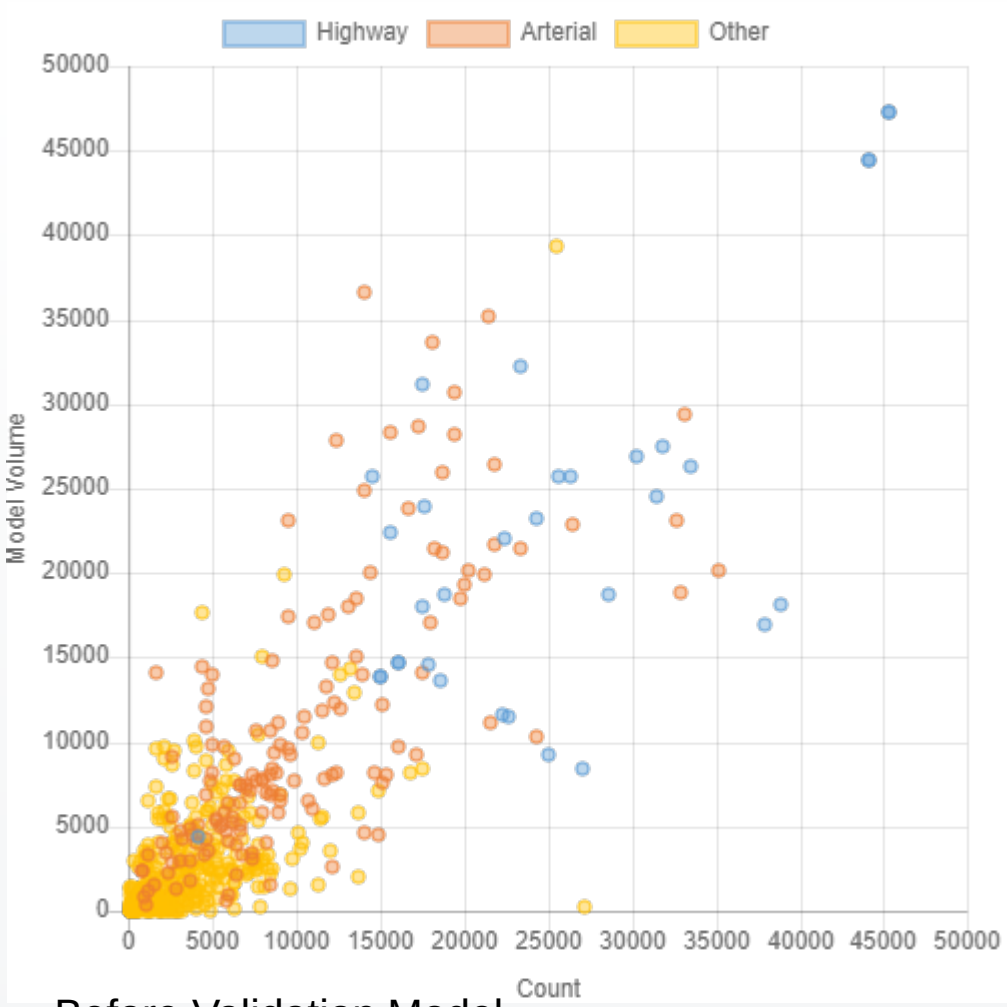
Orange County, NY Model Update
Total Trips (Origin) – LBS vs Model

LOCUS Passenger

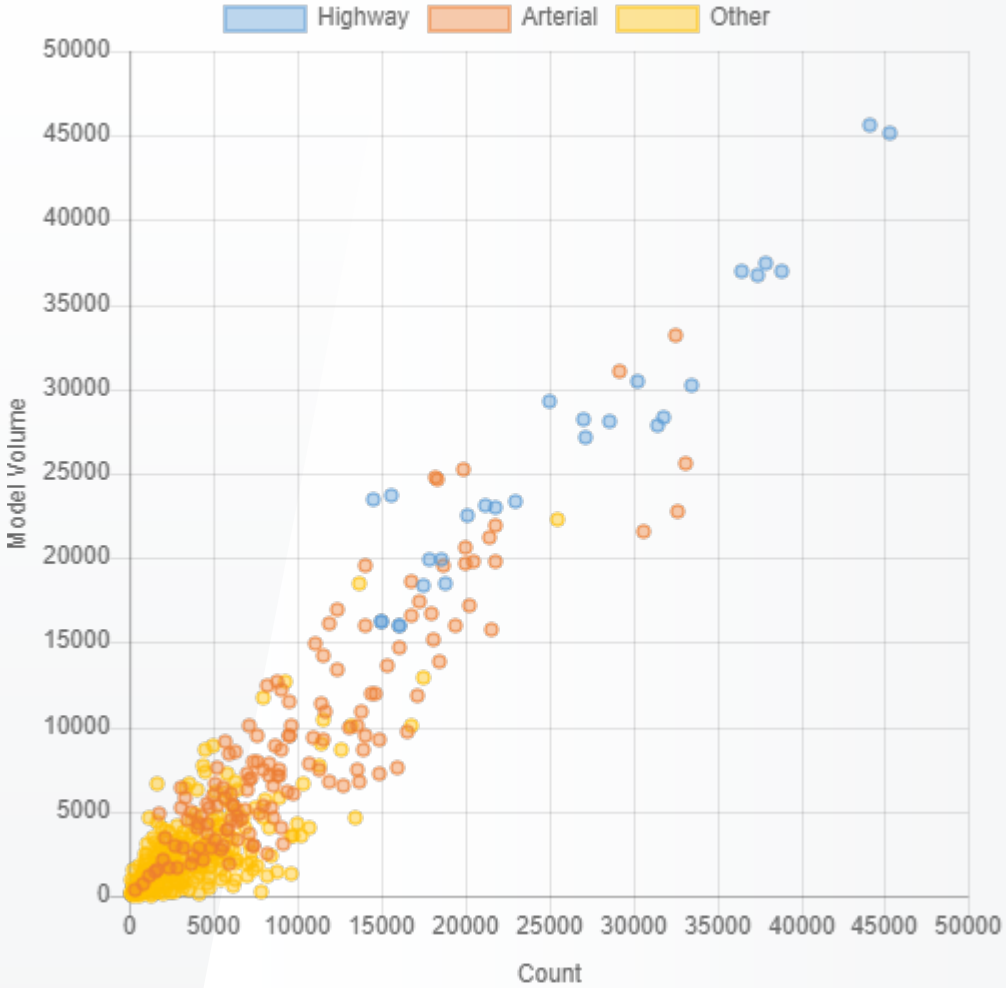


Model Volume vs Count

LOCUS Passenger



Before Validation Model



Final Validation

Calibration and Validation of Transportation Models

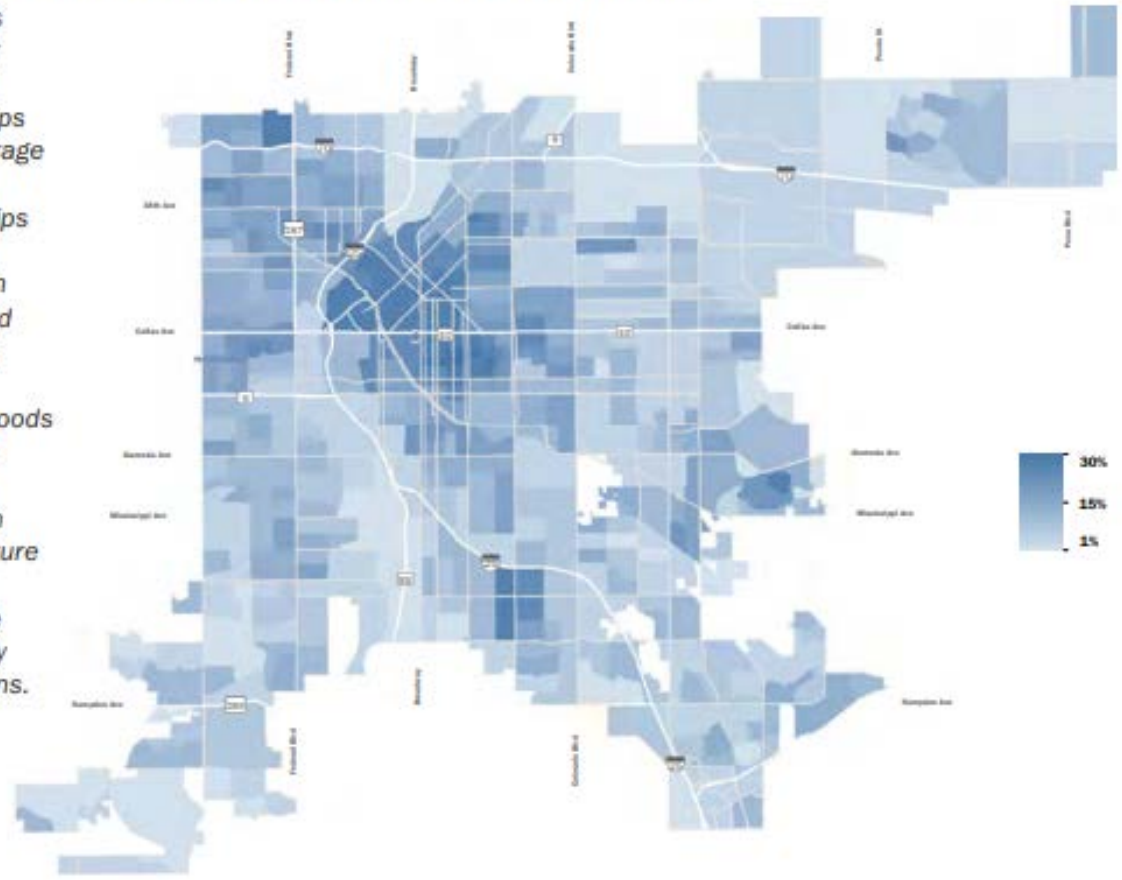
Denver Strategic Transportation Plan

- Use of LBS data to
  - Understand the State of the System (LBS data quantified origin-destination travel patterns as well as bike/walk mode shares at a block group level)
  - Calibrate and validate a travel demand model
  - Prioritize programs and projects

LOCUS Passenger

MAP 3.1.4: Share of All Trips Made by Walking, 2019

Denverites make over 220,000 walking trips on an average weekday. Walking trips are most common in and around downtown and in neighborhoods with more complete pedestrian infrastructure and more accessible community destinations.

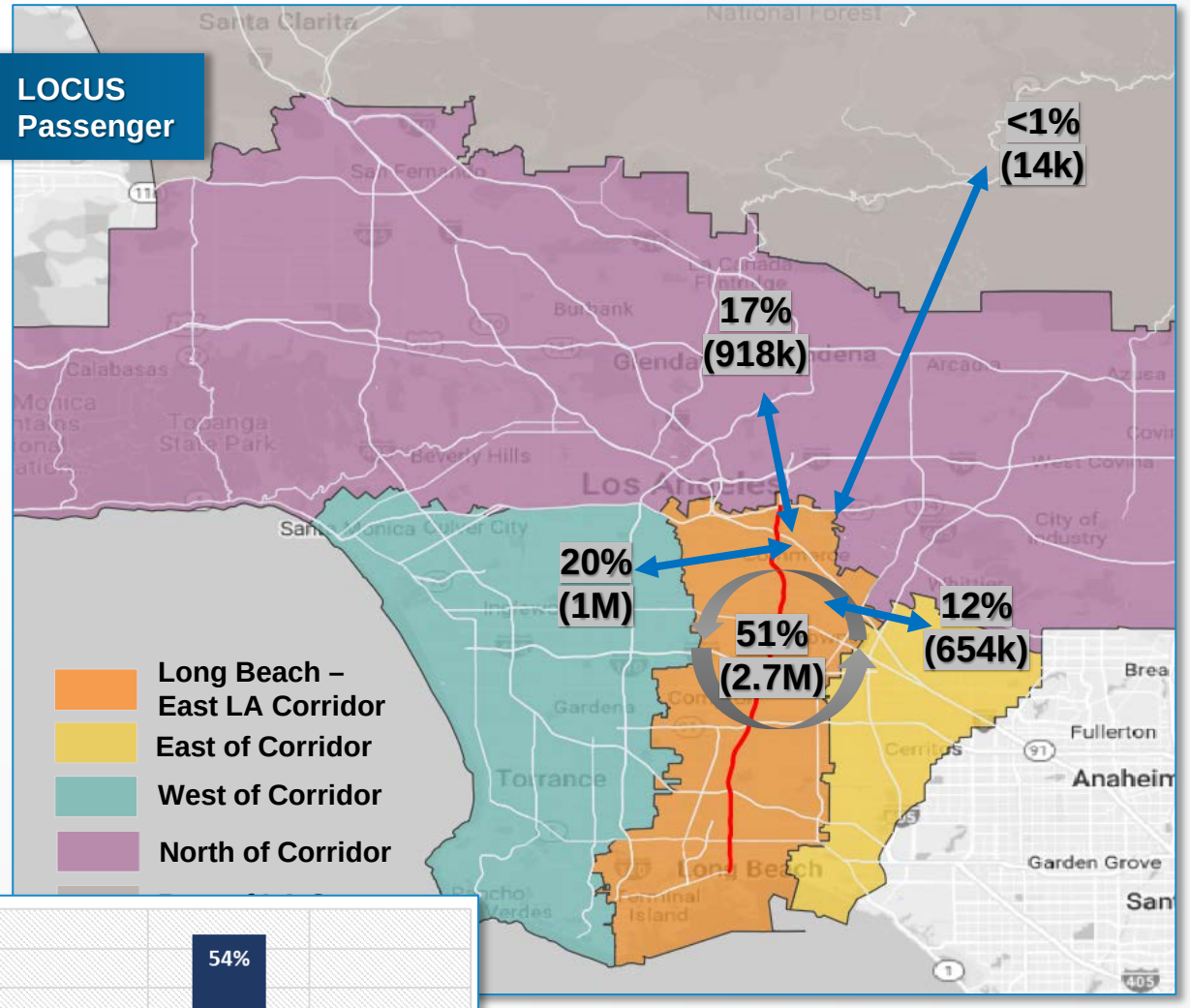


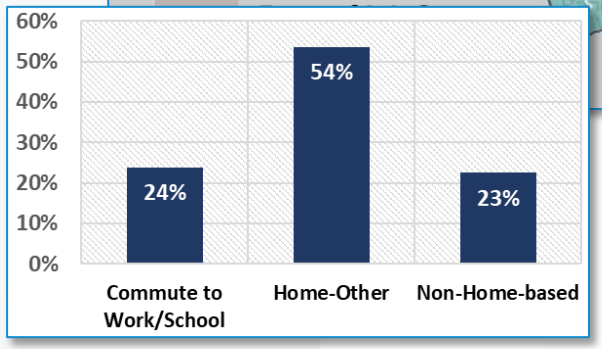
Corridor Studies

LOCUS Passenger

CA I-710 Long Beach-East LA Corridor Project

- Analysis of trip purpose (commute, home based, non-home based) and trip type (inbound, outbound, within corridor)
- Integration with transit travel estimates using Metro and regional transit agency ridership data
- Analysis of trips by equity focus communities
- Analysis of transit market share



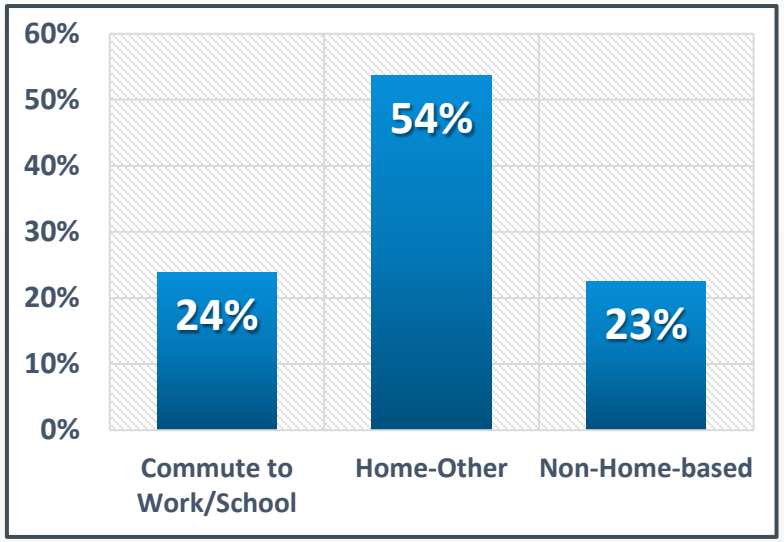


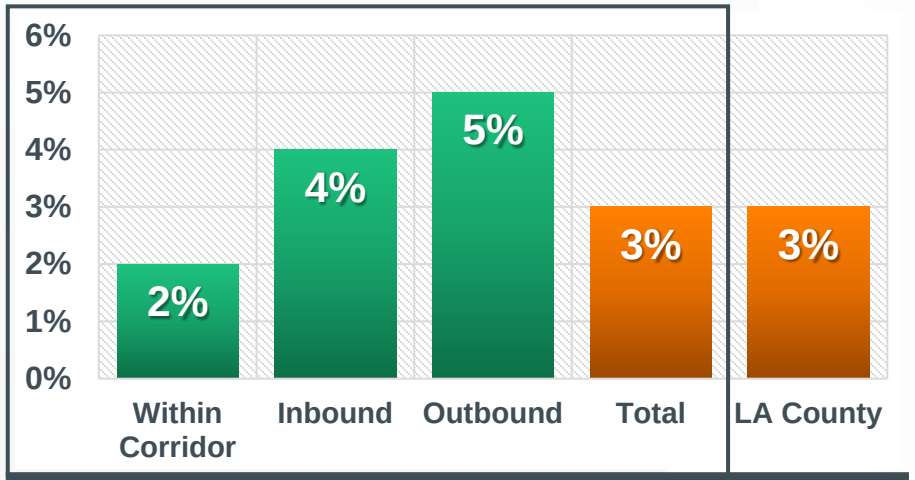
Corridor Studies

LOCUS Passenger

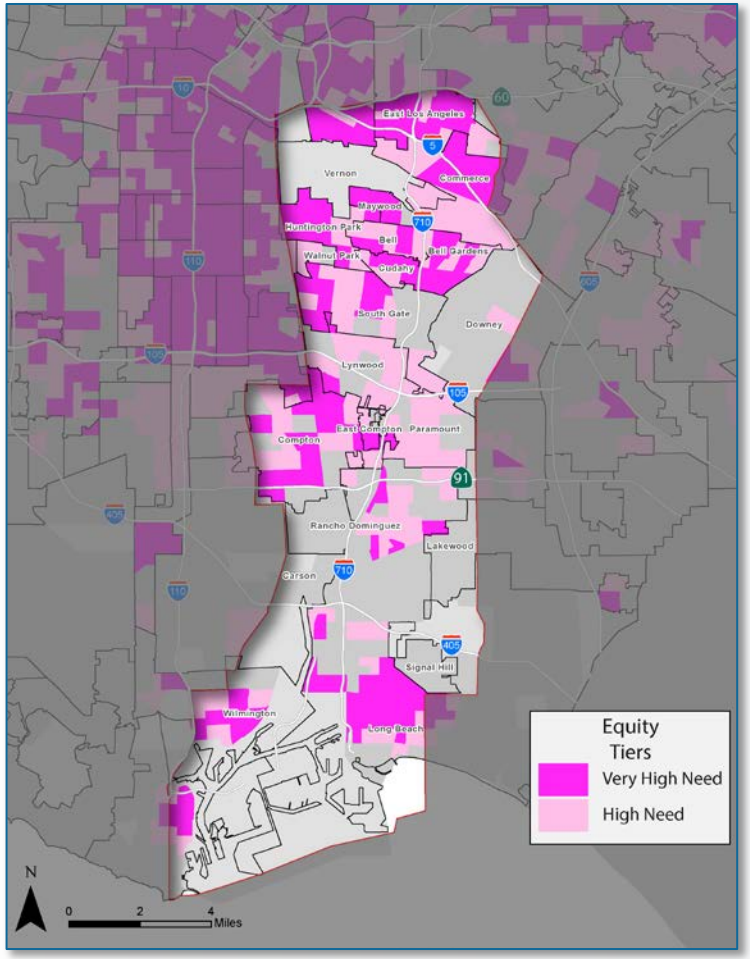
CA I-710 Long Beach-East LA Corridor Project

- Analysis of trips by equity focus communities – 2.4M on average weekday, with 2/3 of those staying within corridor
- Analysis of trip purpose and transit market share



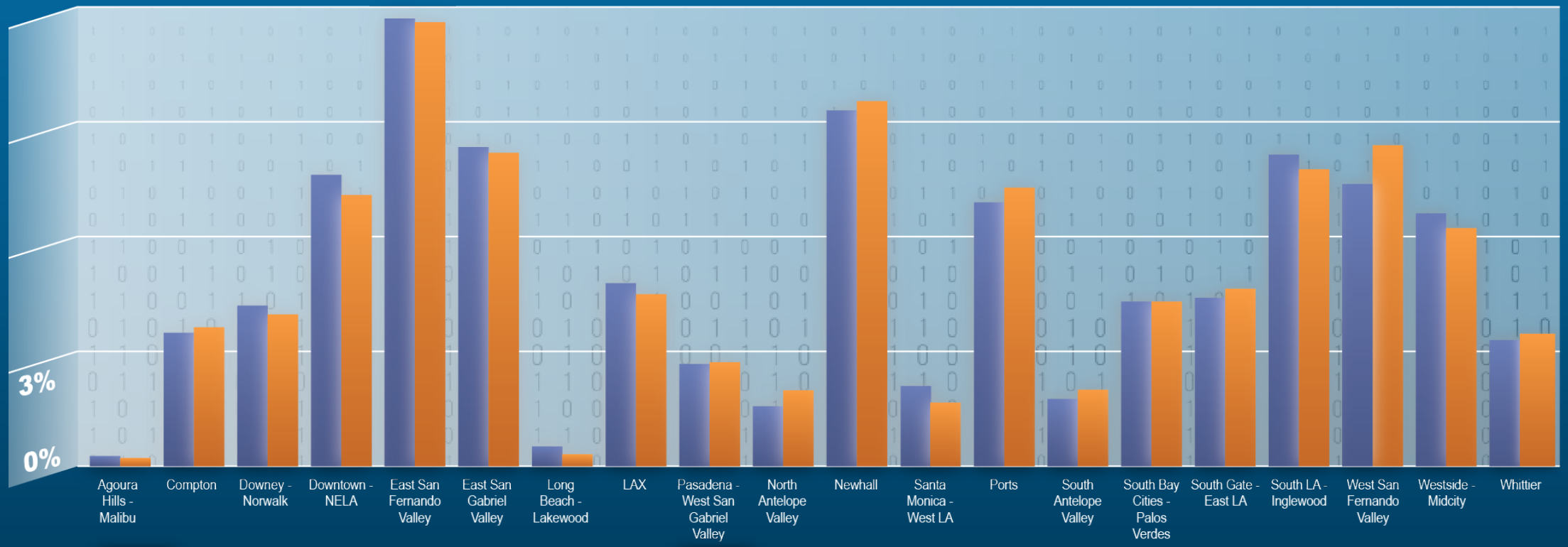


Long Beach – East Los Angeles Corridor



Trip Origins Compared To Regional Model

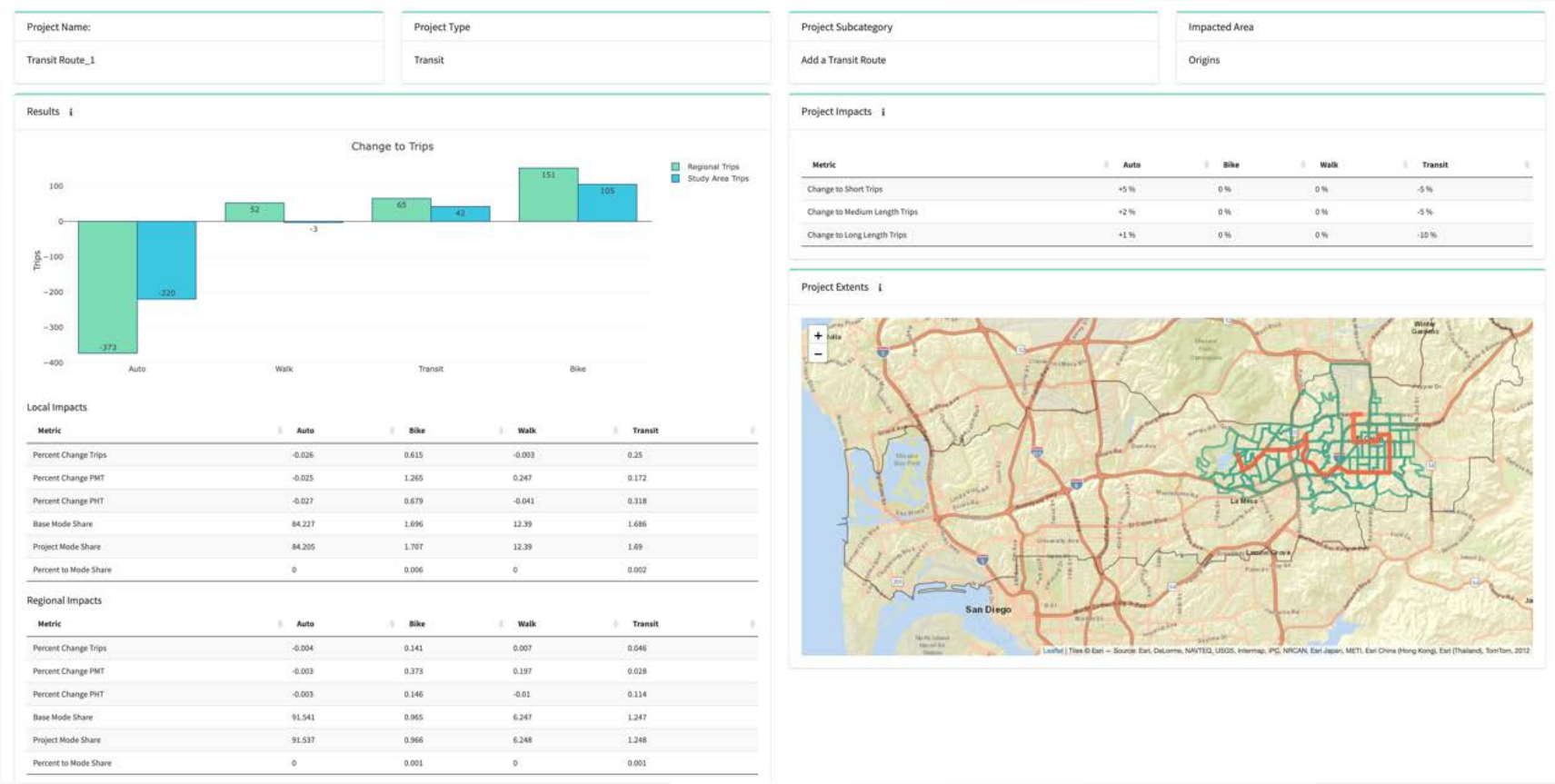
Trips by Origin District – LBS shares vs. SCAG model (for LA County)



LBS Weighted Shares **SCAG Assignment Vehicle Trip Shares**

SANDAG Performance Scanning Sketch Planning Tool

- Combining SANDAG's Activity Based Model data and LOCUS O-D data at block-group level
- Accommodates several project categories including highway improvement, bridges, walkways, transit stops and routes
- Assessment categories: accessibility, efficiency, air quality, multimodal, safety



Project Name:	Project Type	Project Subcategory	Impacted Area
Transit Route_1	Transit	Add a Transit Route	Origins

Results

Local Impacts

Metric	Auto	Bike	Walk	Transit
Percent Change Trips	-0.026	0.615	-0.003	0.25
Percent Change PMT	-0.025	1.265	0.247	0.172
Percent Change PHT	-0.027	0.679	-0.041	0.318
Base Mode Share	84.227	1.696	12.39	1.686
Project Mode Share	84.205	1.707	12.39	1.69
Percent to Mode Share	0	0.006	0	0.002

Regional Impacts

Metric	Auto	Bike	Walk	Transit
Percent Change Trips	-0.004	0.141	0.007	0.046
Percent Change PMT	-0.003	0.373	0.197	0.028
Percent Change PHT	-0.003	0.146	-0.01	0.114
Base Mode Share	91.541	0.965	6.247	1.247
Project Mode Share	91.537	0.966	6.248	1.248
Percent to Mode Share	0	0.001	0	0.001

Project Impacts

Metric	Auto	Bike	Walk	Transit
Change to Short Trips	+5 %	0 %	0 %	-5 %
Change to Medium Length Trips	+2 %	0 %	0 %	-5 %
Change to Long Length Trips	+1 %	0 %	0 %	-10 %

Project Extents

LBS DATA PROVIDE INNOVATIVE WAYS TO IMPROVE TRAVEL DEMAND MODELS

INTEGRATION WITH OTHER DATA SOURCES UNLOCKS POTENTIAL TO SOLVE KEY MOBILITY AND EQUITY CHALLENGES BY TELLING THE RIGHT STORY……

KEY TO SUCCESS APPLYING LBS DATA IS TO

WORK WITH PARTNERS WHO COMBINE DATA SCIENCE AND ANALYTICS KNOW-HOW WITH EXPERIENCE IN BEHAVIORAL SCIENCE AND TRANSPORTATION MODELING AND PLANNING

TO TURN DATA INTO HUMAN DECISIONS

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SOLUTION

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WHAT'S NEXT?

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