Using Big Data for Statewide Models: Learnings from Colorado

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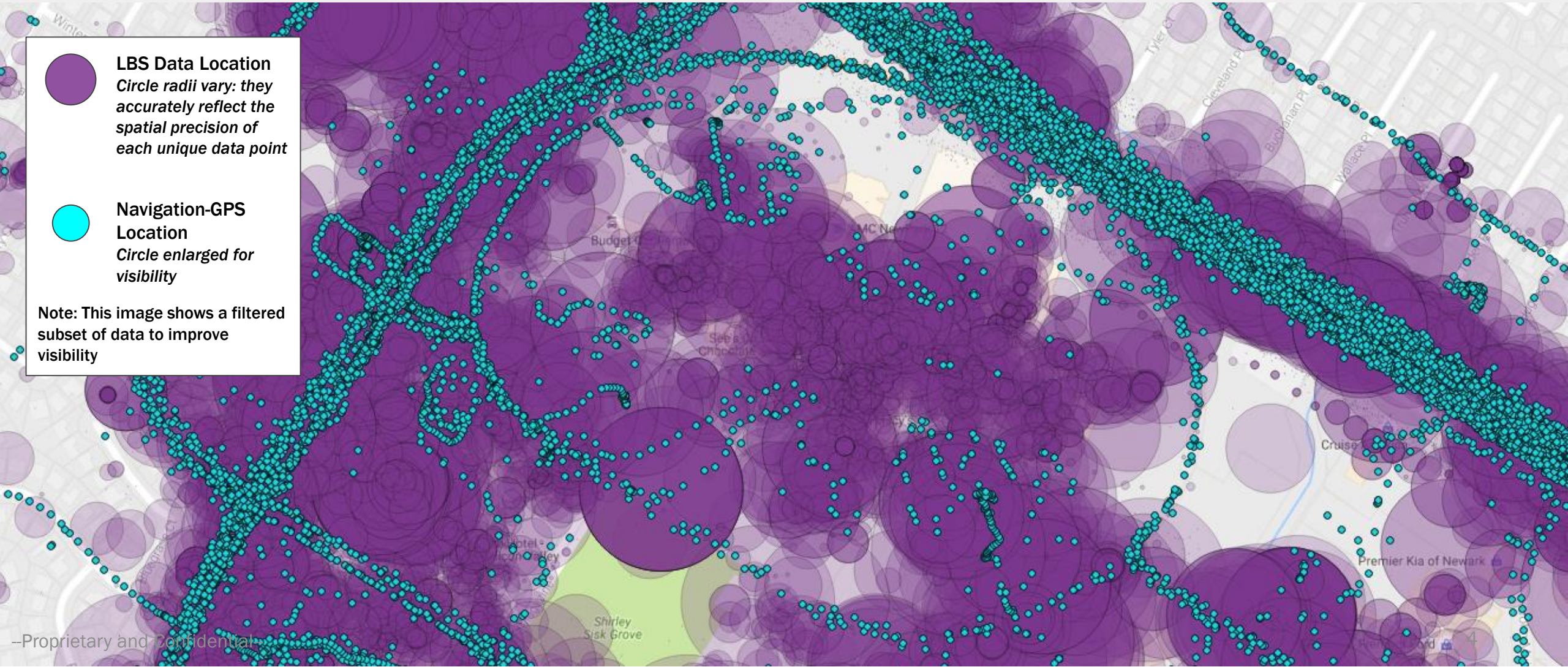
Outline

I. Big Data: What Is It?
   I. Types of Location Data
   II. Technical Characteristics
II. Colorado's Statewide Model
III. Q&A

Big Data: What Is It?

Big Data is Just a Buzz Word…But Location Records Created by Mobile Devices are Valuable for Modeling

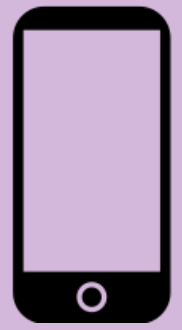


Key Advantages of Big Data for Statewide Models

1. Comprehensive, Current, and **Empirical**
2. Study Travel Patterns in Very **Large** Areas
3. Study Travel Patterns in Very **Small** Areas

There Are Three Main Types of Location Data for Travel Demand Modeling Projects

Navigation-GPS



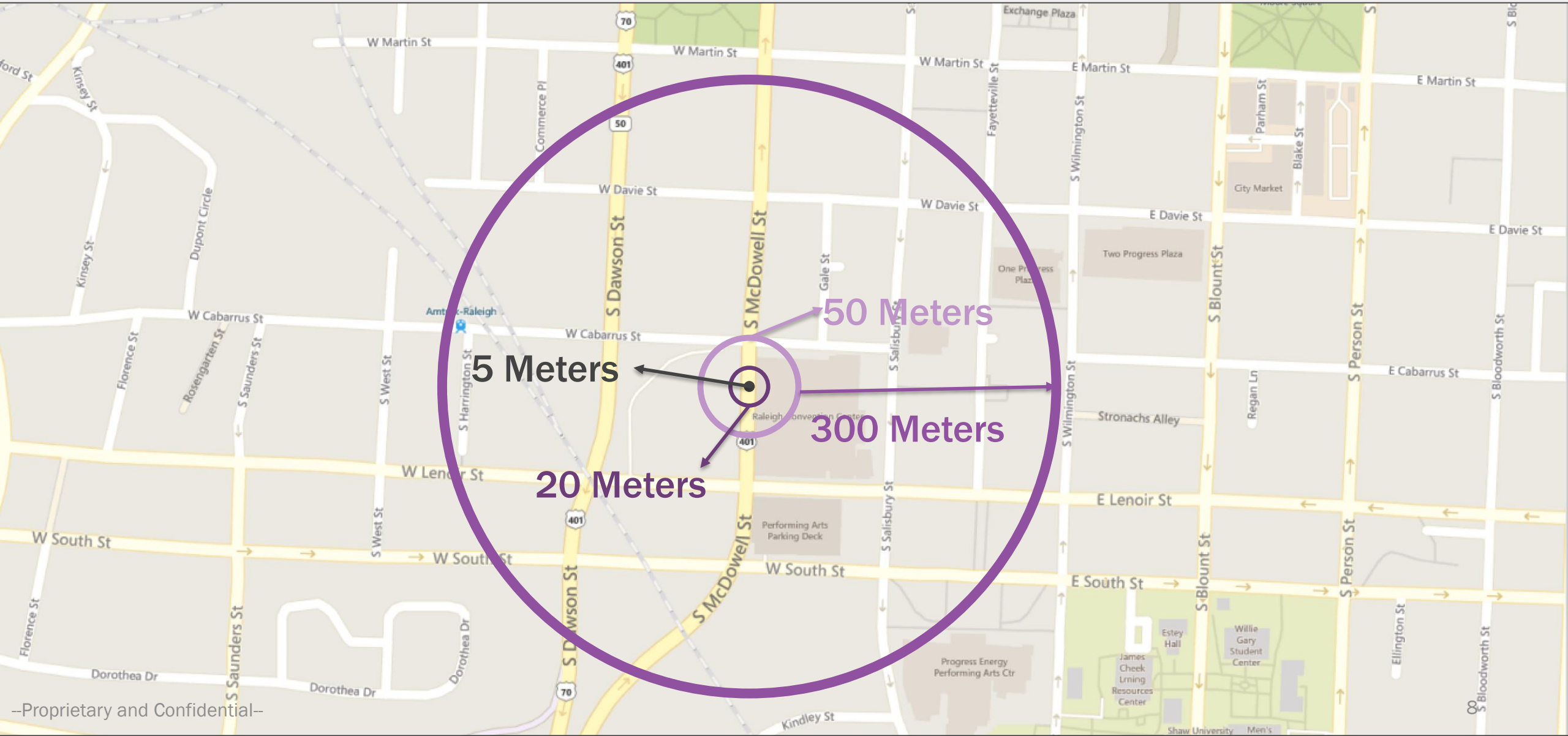
Location-Based Services

Cellular Tower

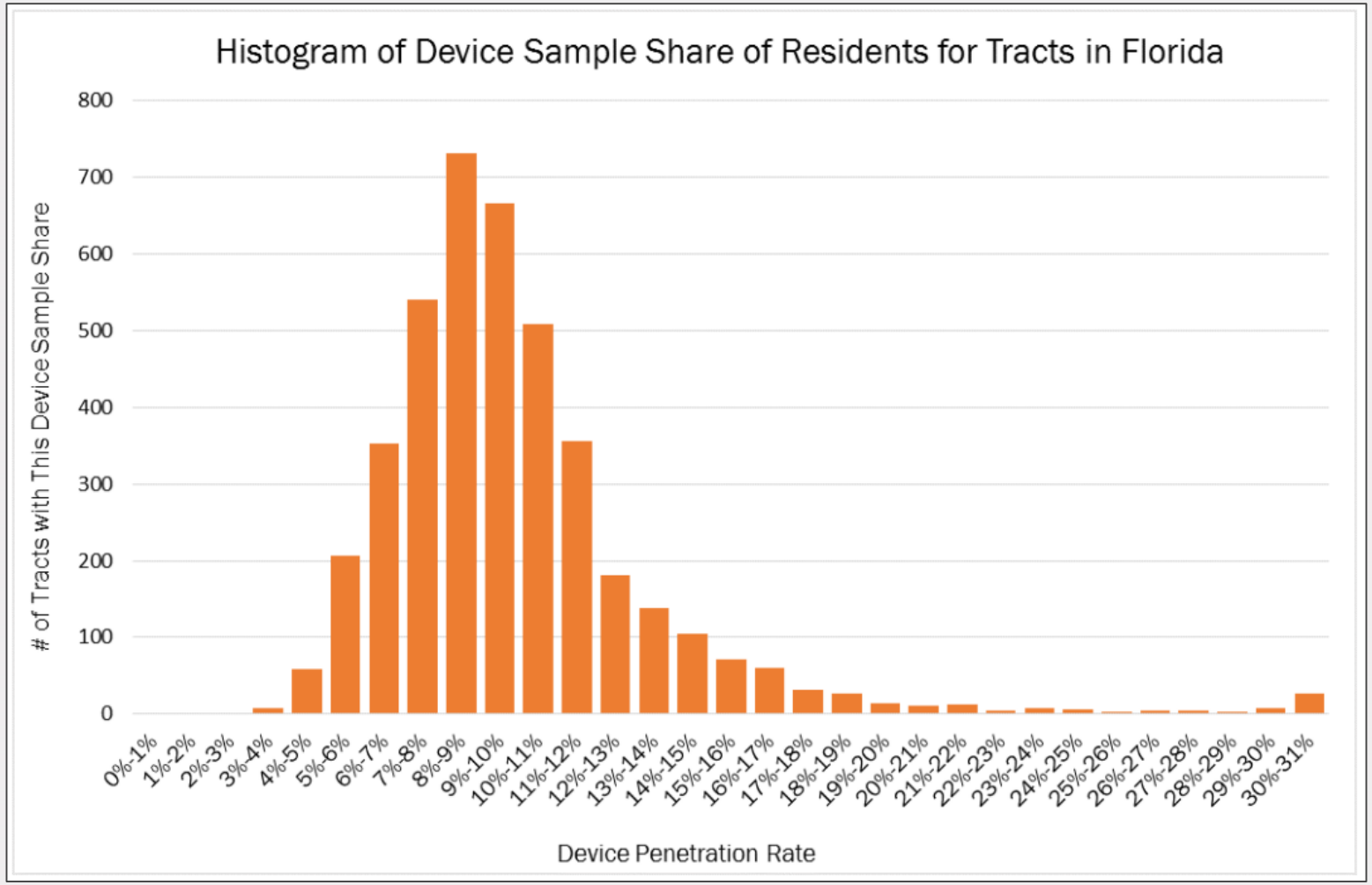
Items to Consider When Evaluating Big Data Resources

1. Spatial Precision
2. Sample Size and Bias
3. Type of Trip
4. Pinging Frequency

The Impact of Spatial Precision is Significant



Sample Size Matters. How Do You Measure It?



Putting it All Together:
Data Selection Should Depend on Your Priorities

Combine Nav-GPS and LBS Data Sources for AADT		Cellular Data
Spatial Precision	Spatial Precision	
	Sample Size and Bias	Sample Size and Bias
Trip Type		
Pinging Frequency	Pinging Frequency	

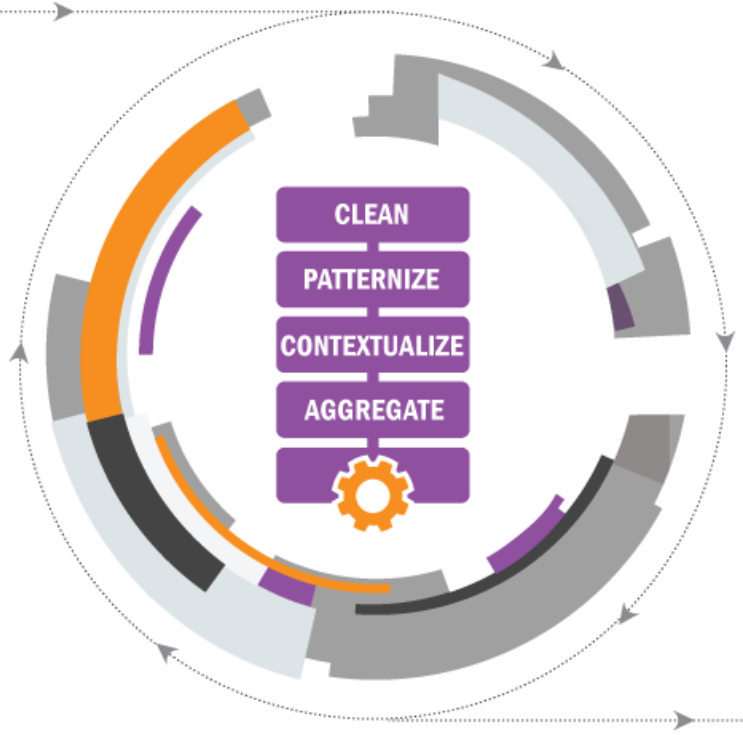
Data Processing Engines Can Turn this Messy Data into Useful Metrics for Travel Demand Modeling

Input:
Big Data

Anonymous and accurate **Locational Big Data**

Road network, land use, parcel, census and more **Contextual Data**

Processing:
RouteScience®

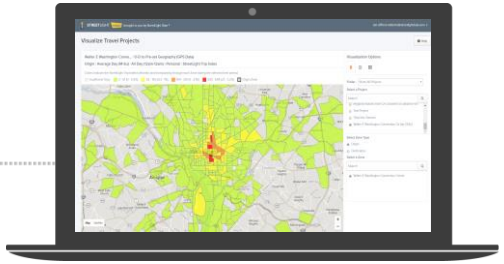


Output:
StreetLight InSight Metrics

Basic Metrics:
Origin-Destination, Select Link, Zone Activity

Premium Metrics:
AADT, Trip Purpose, Demographics, Commercial Tours, Home/Work Analysis

Customization:
Day Parts, Day Types, Data Period



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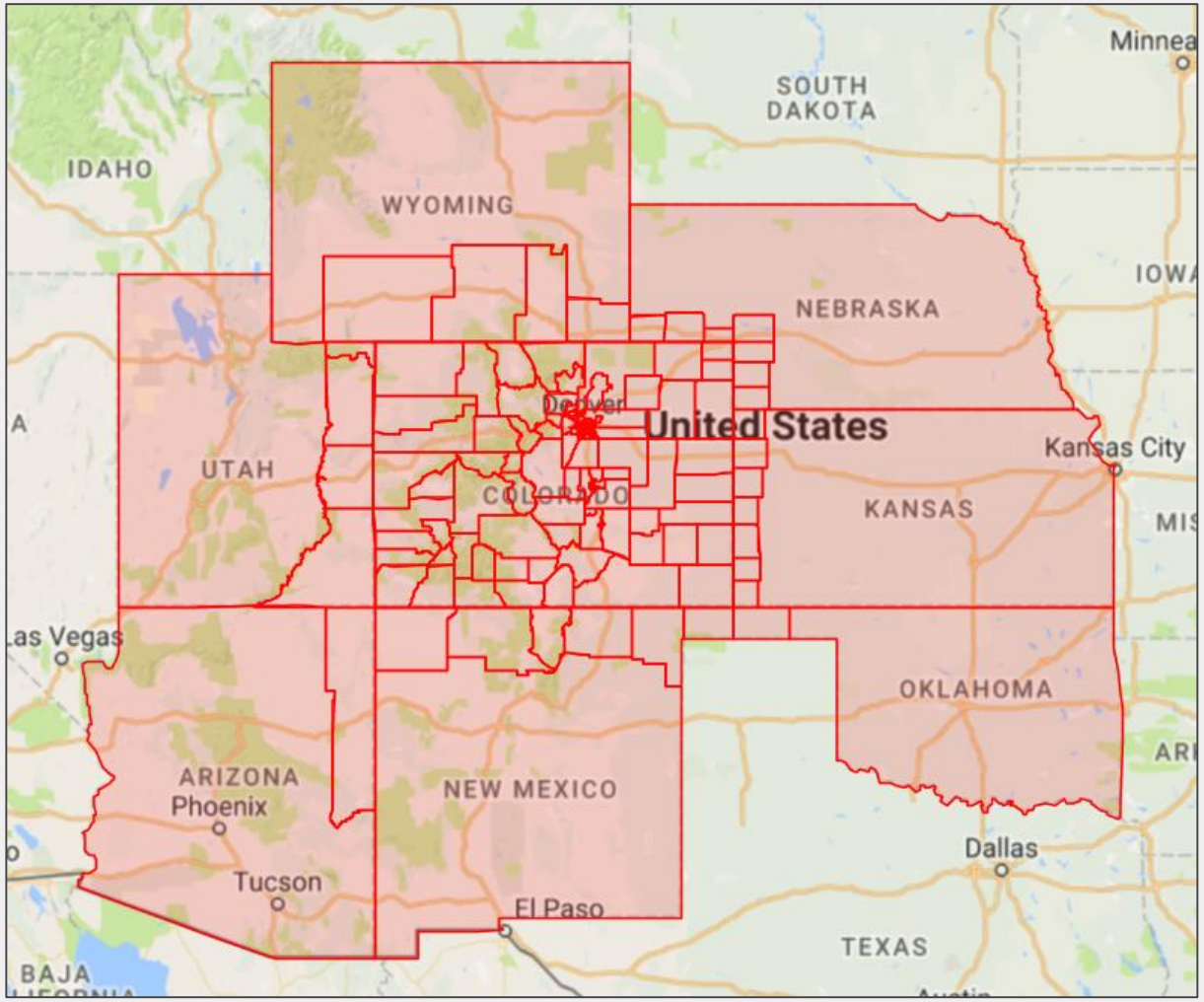
Results in Colorado

Colorado DOT Used StreetLight Data's Analytics to Build its Statewide Travel Demand Model

What Data was Important to Colorado DOT?

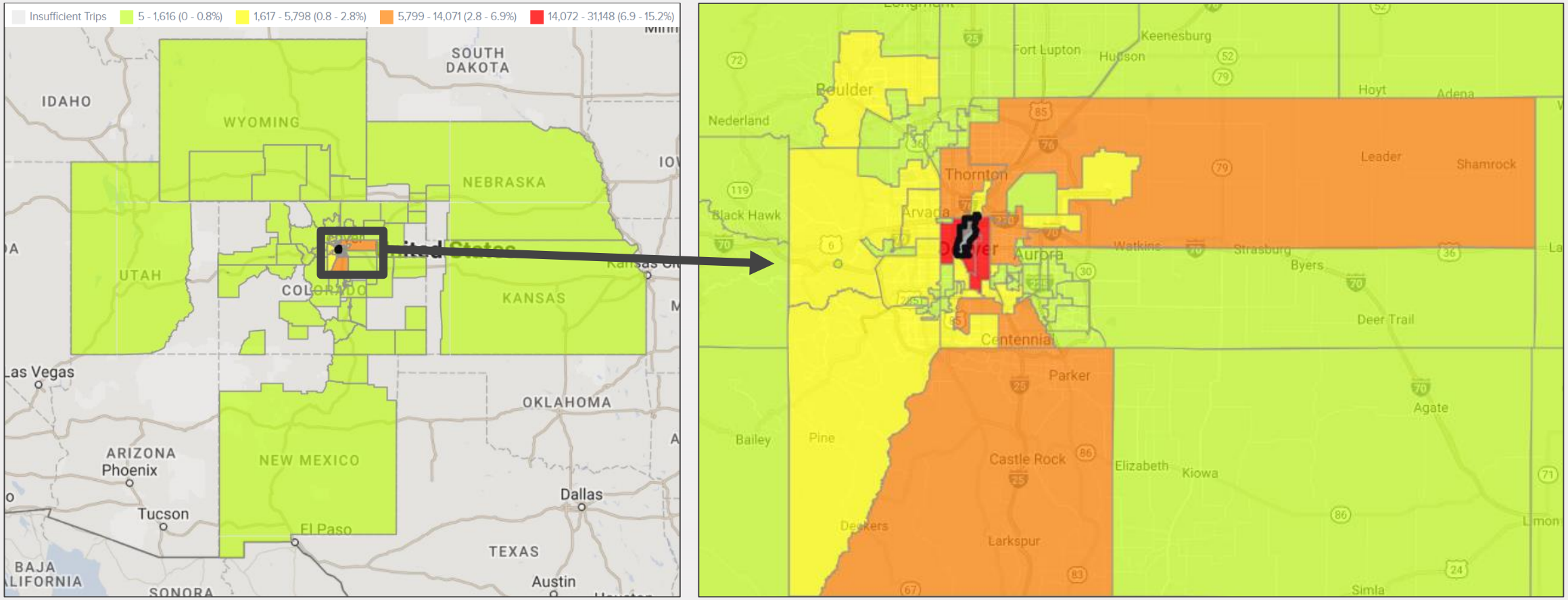
1. Regional Flows within Colorado and with neighboring states, deep dive into the rural area
2. Understanding traffic flow during various season, especially during winter season
3. I-25 corridor flow during peak hour

Regional Flows in Colorado and Neighboring States



- Origin-Destination Matrices
  - Full year
  - Summer vs. Winter
- All Colorado TAZs
- External Zones – neighboring states

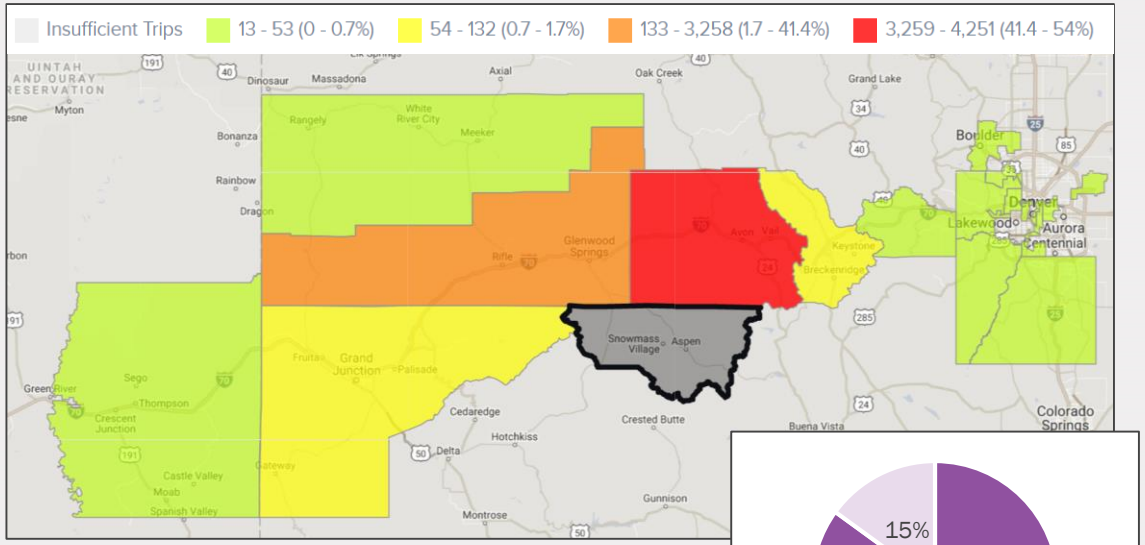
Regional Trips Flows in Colorado – Full Year of Travel, All-Day, Average Day

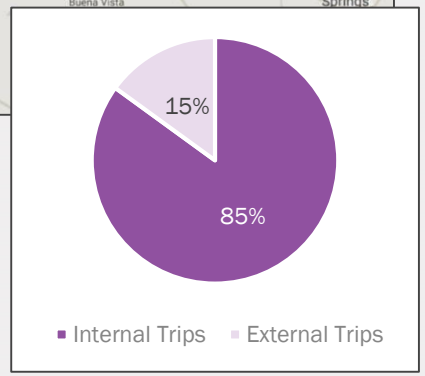


One example output is this heat map. It shows the relative volume of trips originating in a CO TAZ or neighboring state that end in central Denver.

Comparing Origins of Weekend Trips to Aspen-Snowmass TAZ in Winter vs. Summer

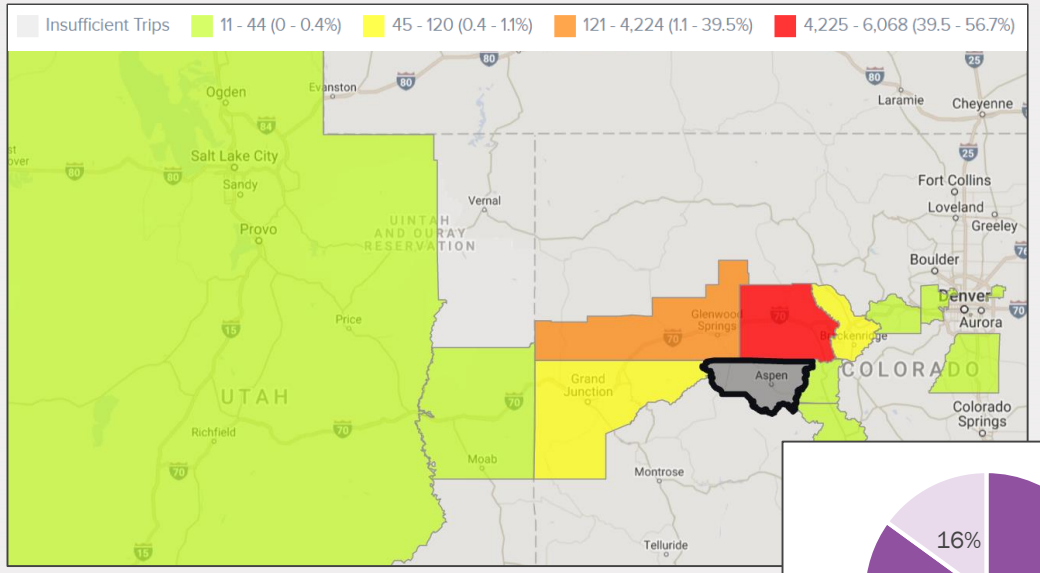
Winter 2016 (All-Day Average)

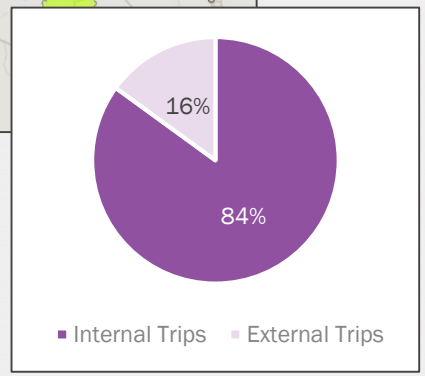




The heat map above compares origin locations by relative volume of trips. The pie chart compares the volume of trips that begin in the Aspen/Snowmass TAZ to trips that begin elsewhere.

Summer 2016 (All-Day Average)





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Key Benefits of GPS Data for Regional Flows

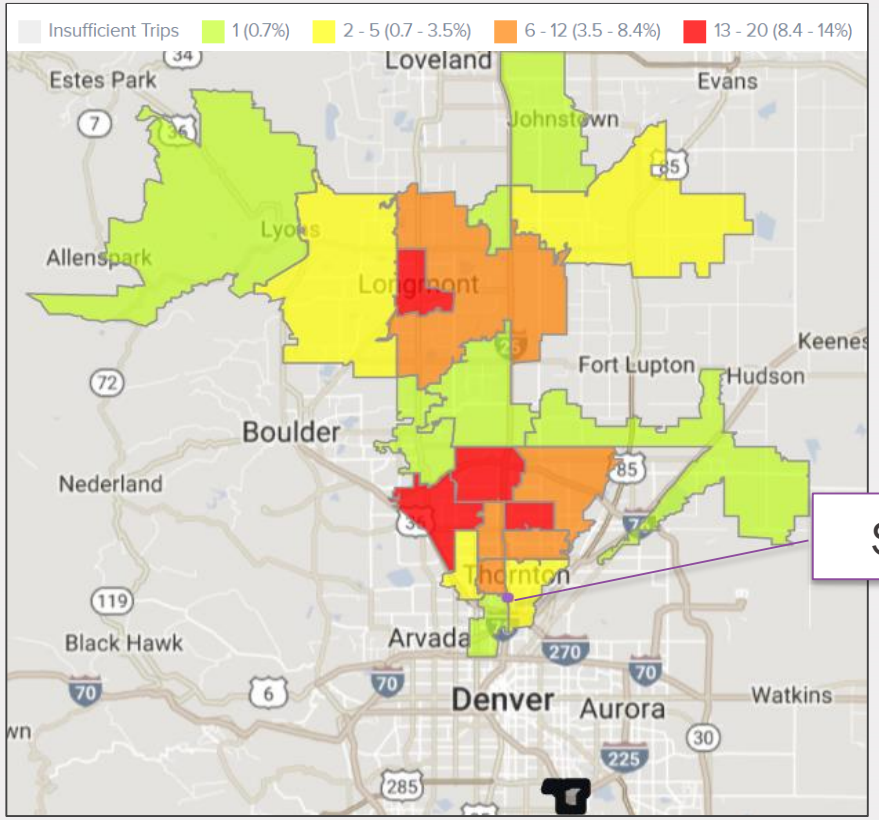
Summer vs. Winter

Temporal Precision (Weekends vs. Weekdays, Day Parts)

TAZ-Level Spatial Precision

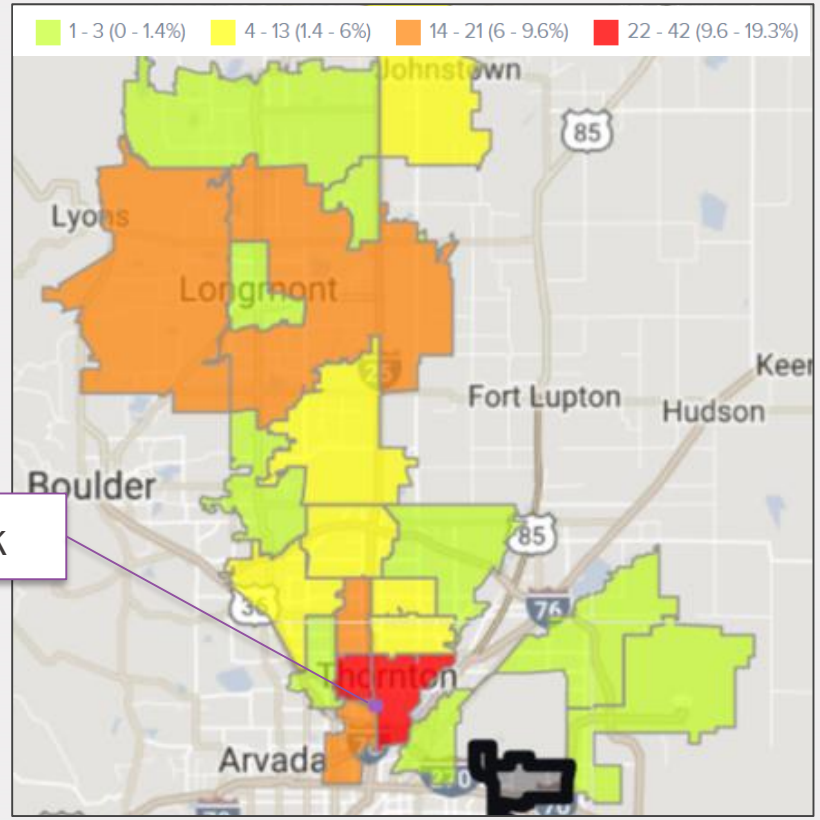
“True” Origins of External Trips

An Additional Modeling Application: Behavior on I-25 Corridor in Denver, Average Weekday, Peak AM



Relative volume of trips beginning in each Denver region ZIP, passing through I-25 at 84th St SB, and ending at Denver Tech Center ZIP.

Select Link



Relative volume of trips beginning in each Denver region ZIP, passing through I-25 at 84th St SB, and ending north of Tech Center.

Key Benefits of GPS Data for Modeling Corridor Flows

Corridor-Level Spatial Precision

Temporal Precision (Weekends vs. Weekdays, Day Parts)

"True" Origins and Destinations of Corridor Users

Commercial Truck Trips

Questions?

Thank You!

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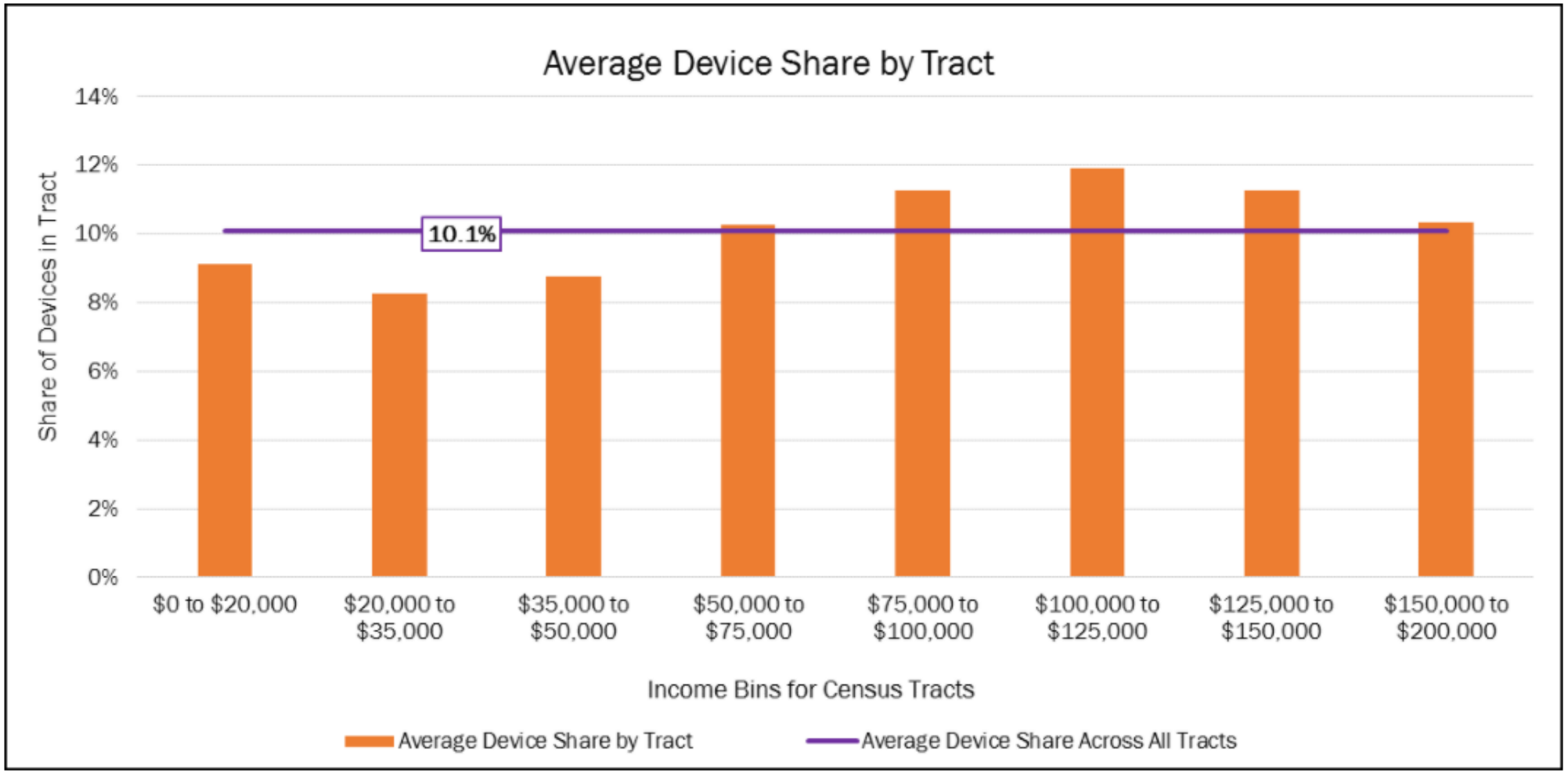
Different Types of "Big" Geospatial Data Offer Different Benefits for Modelers

	Cellular	Navigation-Based GPS	Location-Based Services
Spatial Precision	200-1000 meters	5 meters	5 meters – 50 meters
Frequency of Data Pings	Irregularly; every 15 min – hours	Regularly; every 1 sec – 1 min	Variable; sometimes triggered by location change
Type of Trip	Blends personal and commercial trips	Differentiates personal and commercial trips	Blends personal and commercial trips (for now)
Sample Size	Varies by telco: ~10% of population for small telcos and ~25-30% for large telcos	Varies by region; ~1-4% personal trips; ~10-12% of commercial trips (for INRIX)	Medium – 30M+ US devices in our database (>10% of US adult population)

Bias Matters. How Do You Account for It?



This Is What You Get With 1000 meters