# Generate
# Origin-Destination Matrices
# Interactively

*Using Raw Probe Data to Understand Vehicle Routing*

TRB AppCon, Portland, OR, June 4, 2019
Anita van Asperdt, Moonshadow Mobile
Amanda Deering, DKS Associates

The following presentation is based on the DB4IoT with INRIX Trips analytics platform
for a project for RTC in Clark County, WA by DKS Associates in Portland, OR.

DKS

Moonshadow

# Presentation Overview

- Review OD study data needs

- Overview of DB4IoT and waypoint data

- Data applications for RTC OD study

DKS

Moonshadow

# RTC Regional OD Study
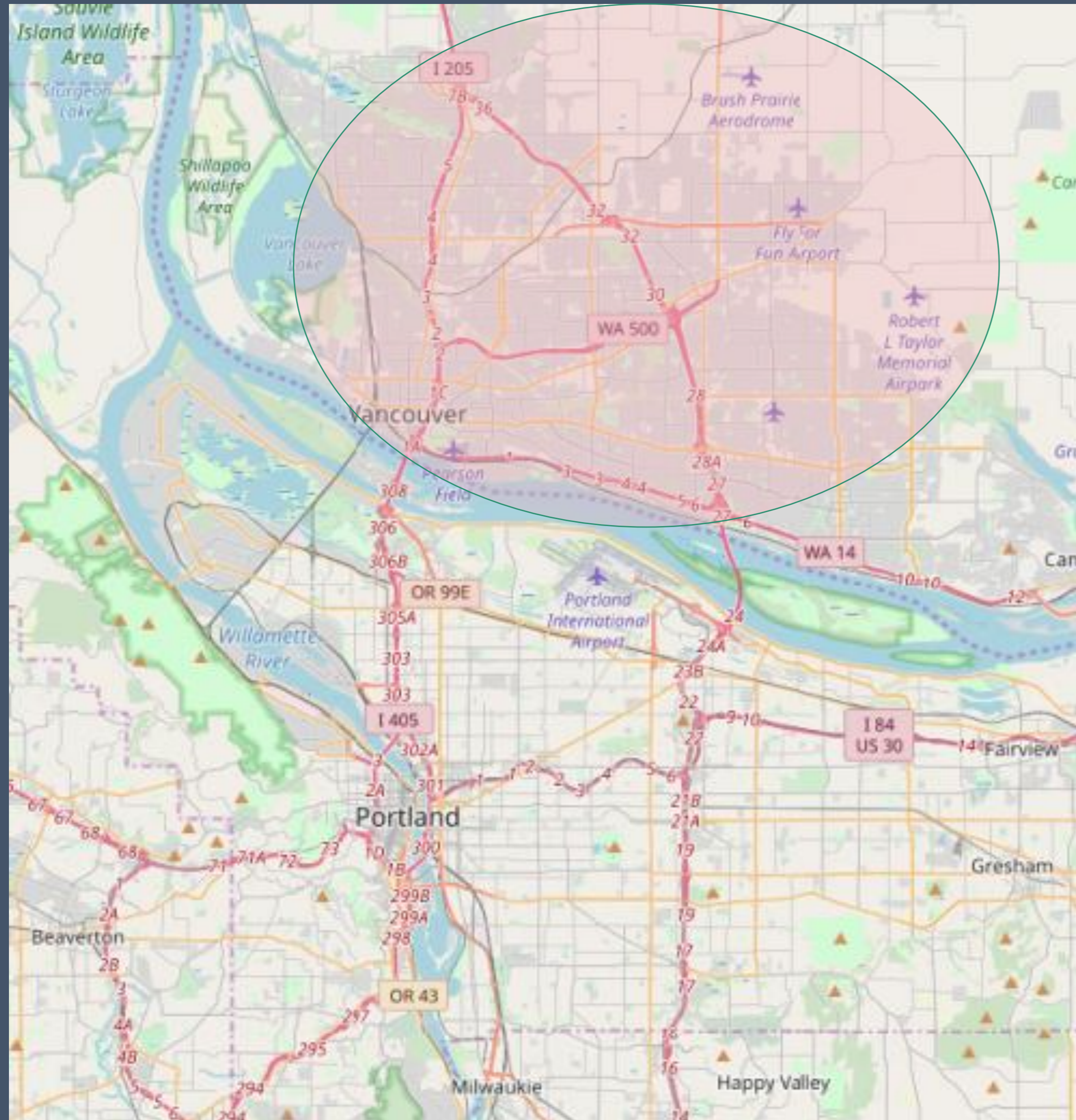


- SW Washington Regional Transportation Council (RTC) is the MPO for Washington portion of Portland-Vancouver TMA

- Covers Clark County, Washington

- Need to understand regional OD flows on freeway and other transportation system

- Project prepares for Urban Freeway Corridor Operations Study

- Project reviewed potential data sources

DKS

Moonshadow

# Data Source Criteria Considered

- Technical Criteria
  - Critical features for UFCO (Resolution, Time of Day, Day Type)
  - Additional features for UFCO (Sample Size, Travel time, routing details)
  - Additional features for other applications (trip distance, trip purpose, trip details)

- Logistical Criteria
  - Data format
  - User interface
  - Schedule
  - Cost
  - Contracting process

- Flexibility for other application
  - Data customization
  - User accessibility

DKS

Moonshadow

# Data Review and Selection

- Traditional manual Bluetooth data collection did not scale well and was infeasible due to cost, schedule, and limited data periods
- Several probe data products are applicable for other uses but offered limited application to RTC due to:
  - Lack of user interface
  - Inability to run subsequent data queries
  - Limited zone size/count
  - Precision of location data
  - Lack of routing information
- INRIX Waypoint data in Moonshadow's DB4IoT was the recommended data source:
  - Detailed waypoint data (can achieve routing)
  - DB4IoT platform
  - County-wide coverage

DKS

Moonshadow

# Overview of Waypoint Data
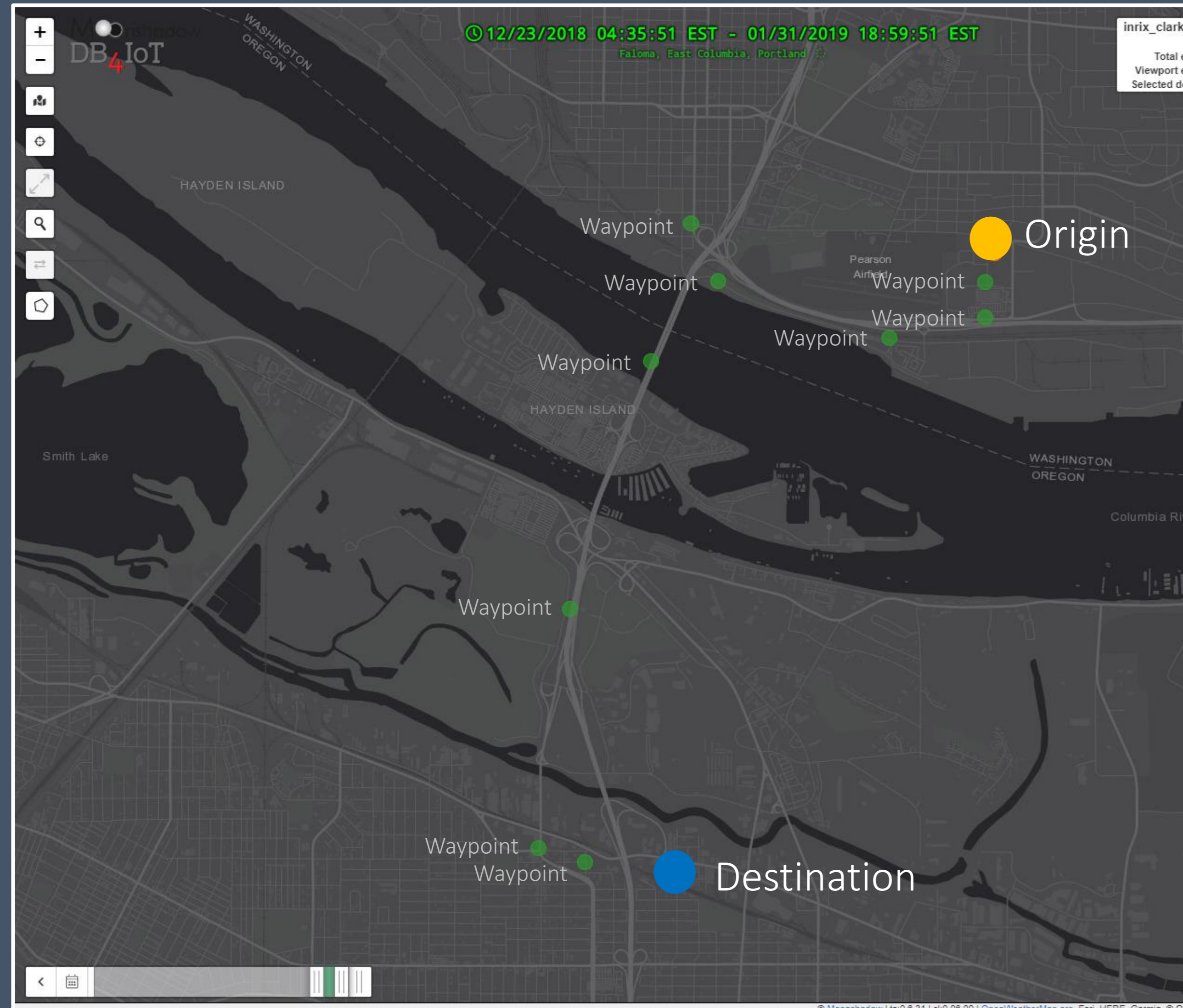


This is what connected-vehicle data for a single trip looks like: an origin, a series of waypoints and a destination.

# Coverage of RTC Dataset
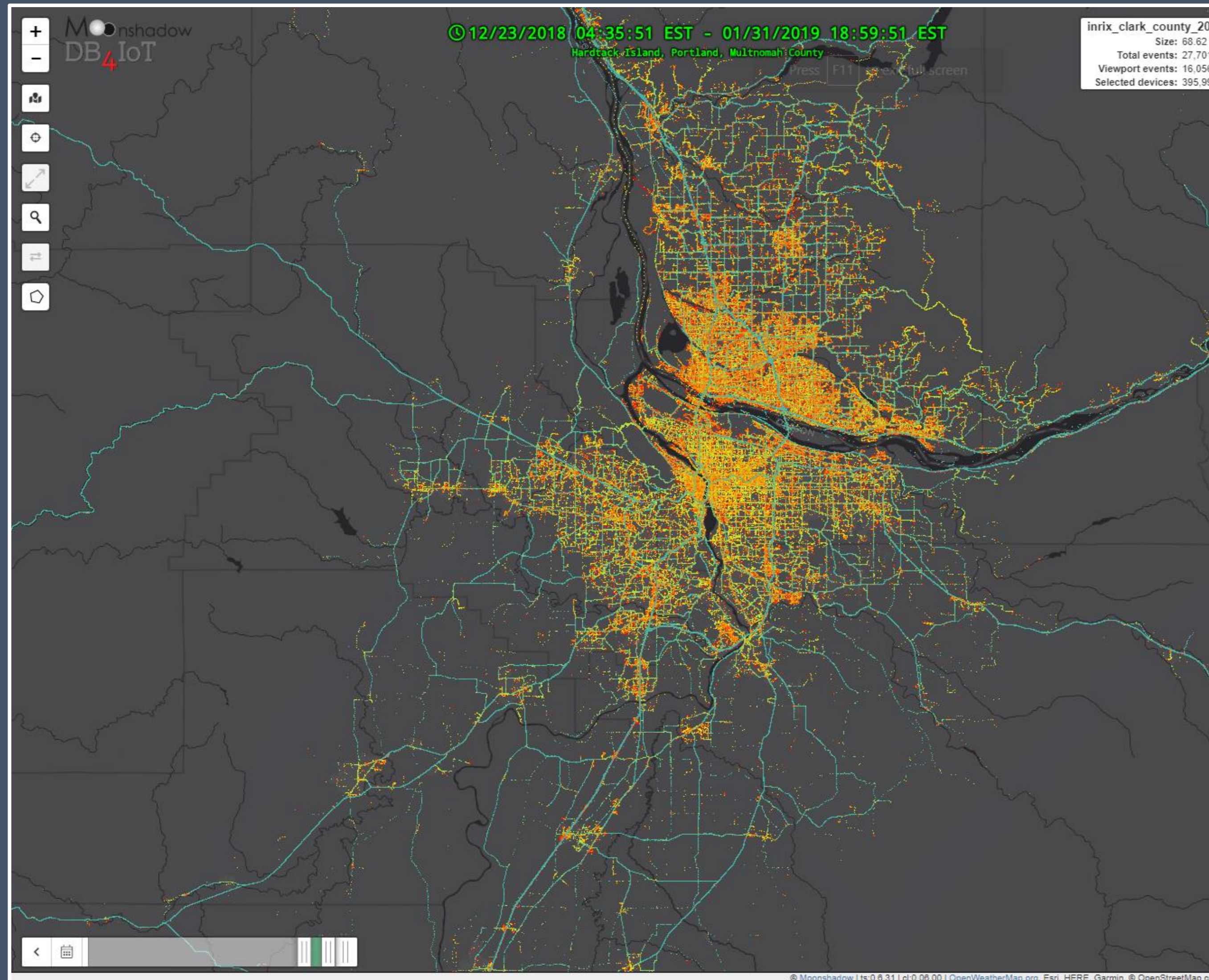


- One year of data

- 5 million trip sample

- 400+ million waypoints (each dot)

- All portions of trips beginning in, ending in, or passing through Clark County

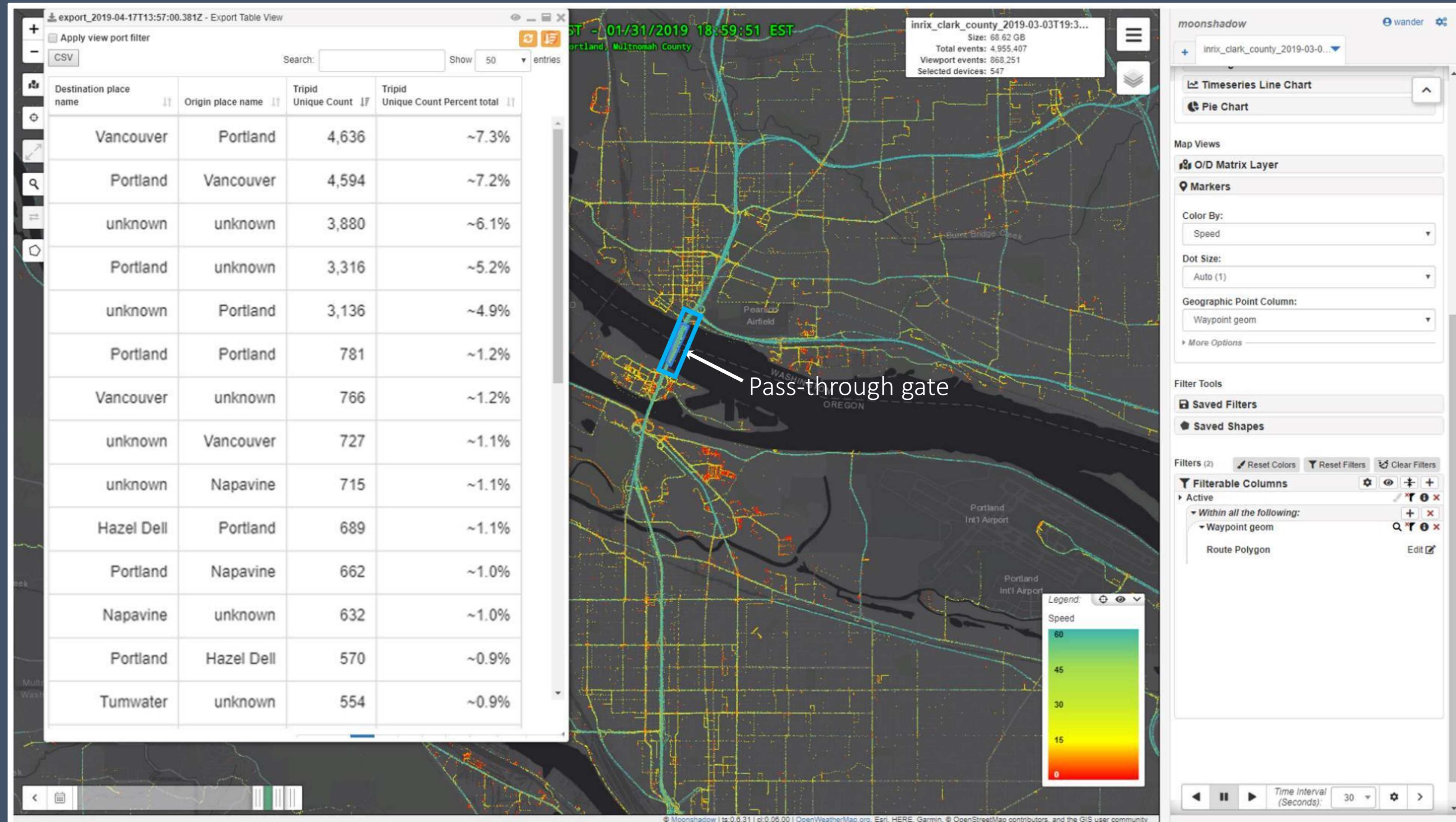- Zoom in or out interactively to view millions of trips

# Waypoint Data



Each individual waypoint has associated data measurements including timestamp, GPS location, day of the month and more.

# Trip Data allows Interactive OD Analysis



* Presentation based on sample data
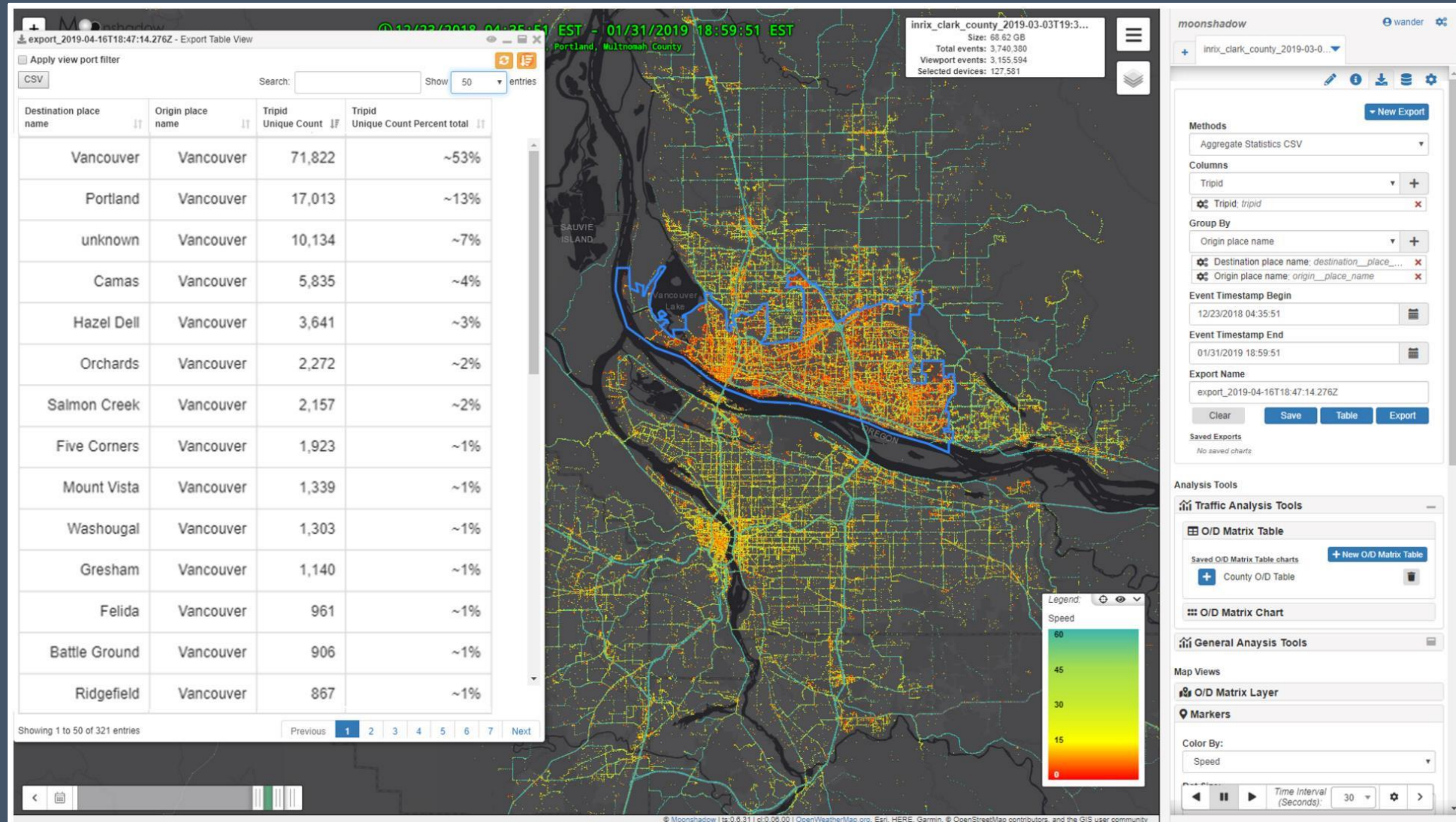
# OD using a Pass-Through Gate



Pass-through gate

* Presentation based on sample data

# Data Bias Example

- Bias: In INRIX' data Truck traffic is over represented

- Solution: create O/D matrices per vehicle weight class



**▼ Vehicleweightclass**

☑ Include unknown   ☐ Hide empty rows
☑ Include undefined

| | | Devices | |
|---|---|---|---|
| | Light Duty Truck/Passenger Vehicle: Ranges from 0 to 14000 lb. | 20,520,051 | 26.72% |
| | Medium Duty Trucks / Vans: ranges from 14001-26000 lb. | 23,728,167 | 30.90% |
| | Heavy Duty Trucks: > 26000 lb. | 32,537,496 | 42.37% |
| | Unknown | 0 | 0.00% |

# Data Anomalies Can be Identified
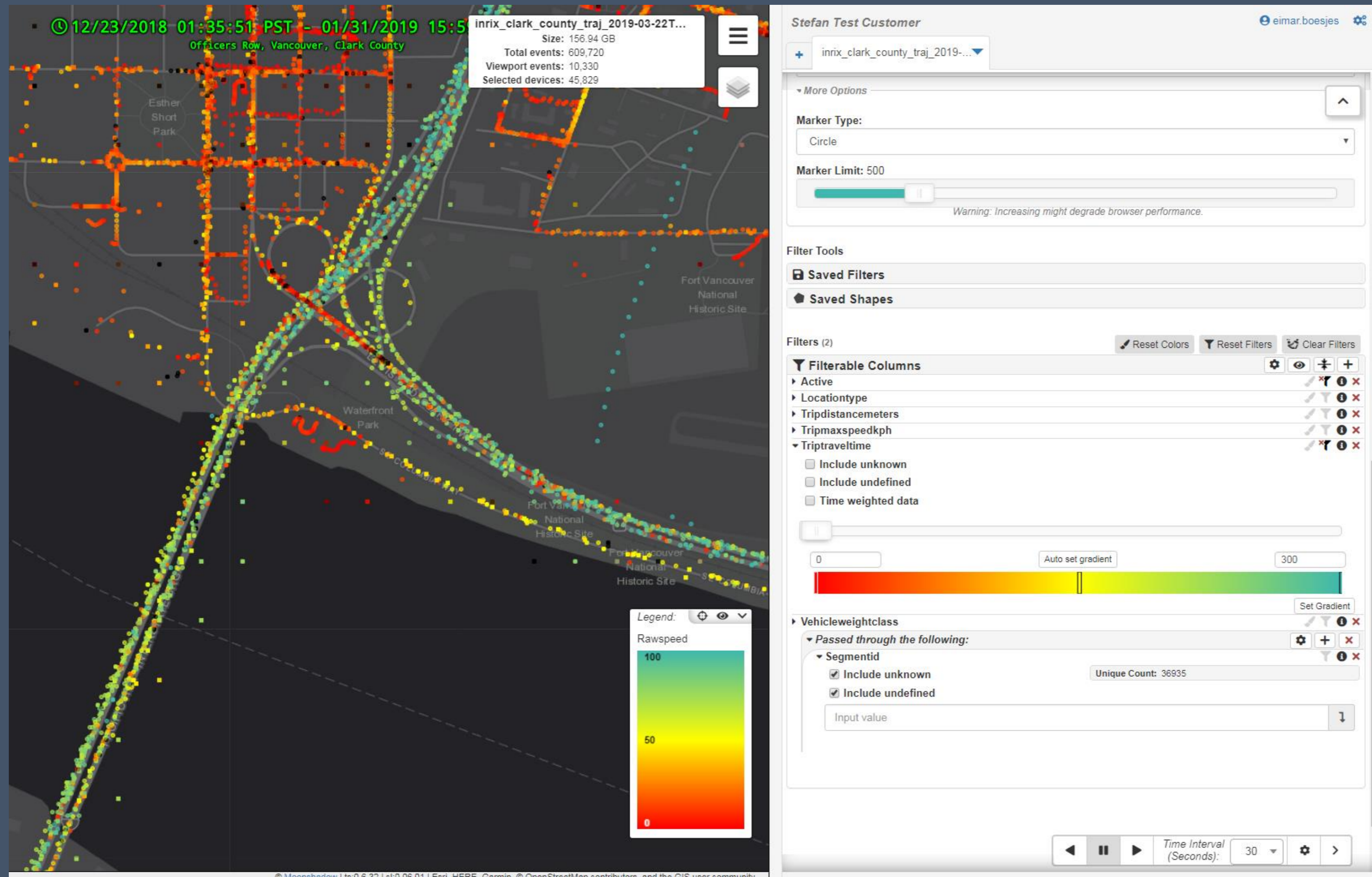


- Examples: Trips shorter than five minutes & GPS Anomalies

- Data anomalies and bias can not be seen in aggregated data

- Transportation engineers need access to the original data.

# Aggregating Data to Road Segment
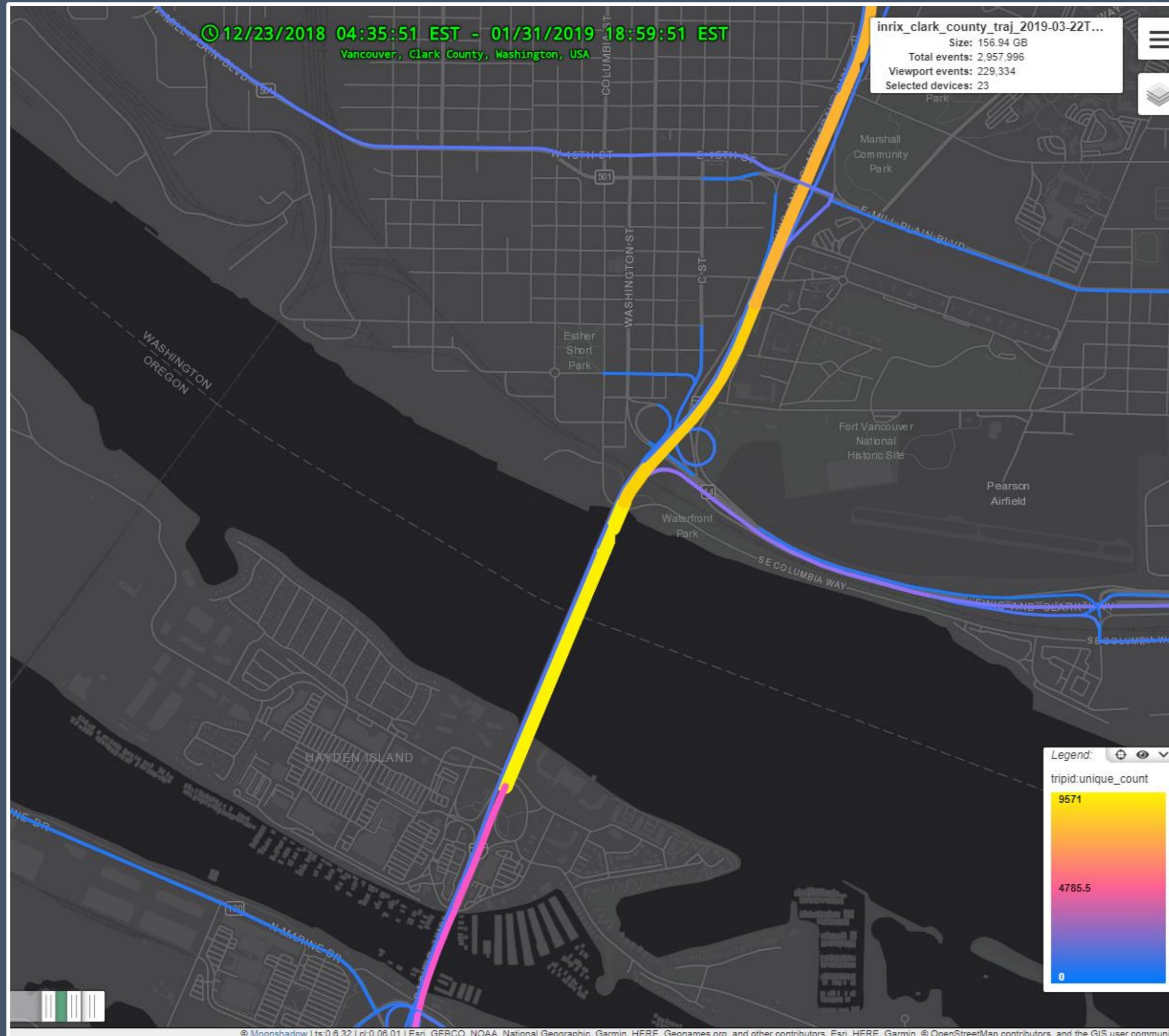


Data that is aggregated per road segment is easier to work with but data anomalies and bias are not visible anymore

# Use Cases – Freeway Ramp OD + Routes
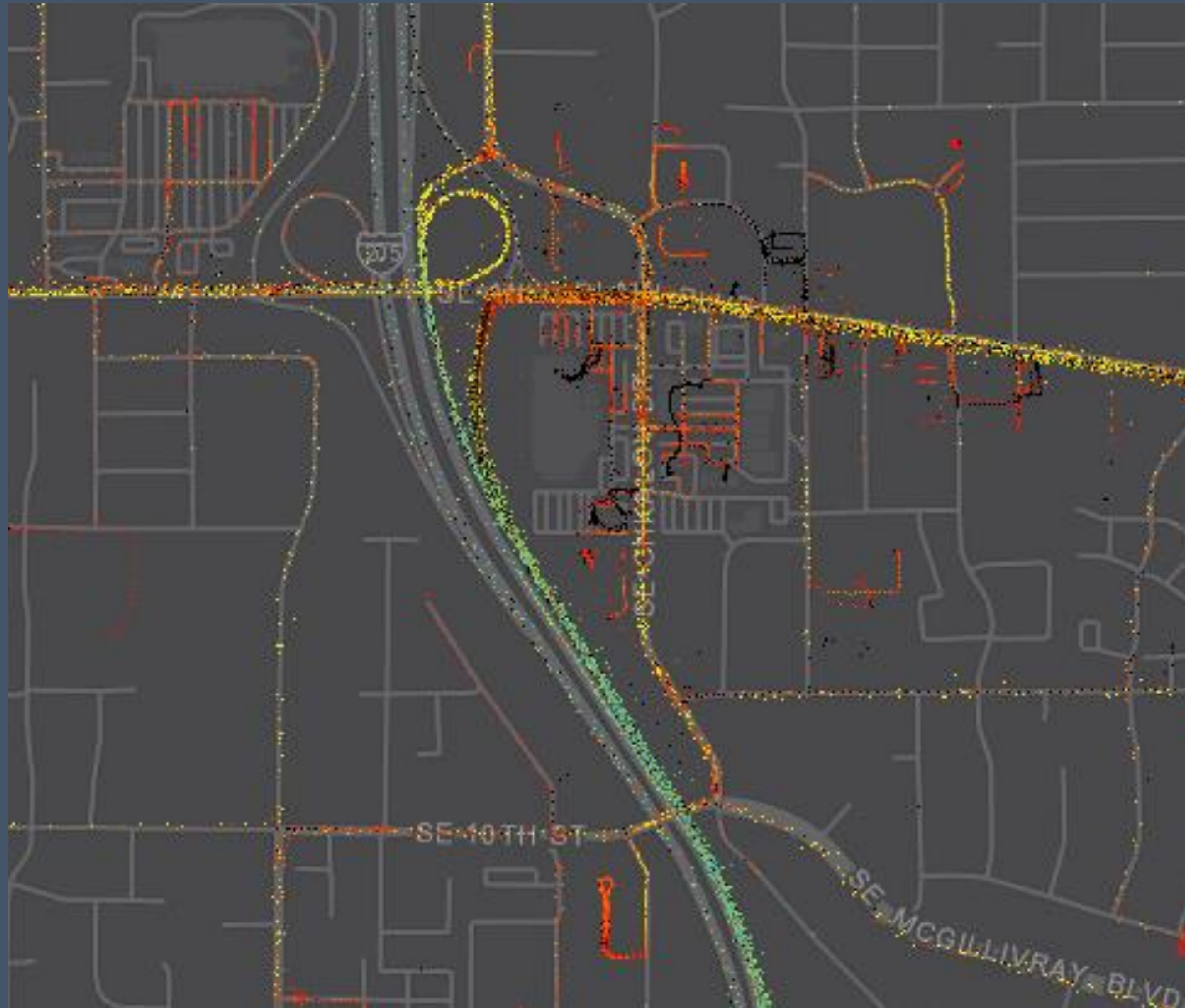


- Summarized for each on-off ramp on four freeways

- Filtered by day, time period, and vehicle class

- Data used to develop mainline OD tables for segment and operations analysis

DKS

Moonshadow

# Use Cases – Freeway Ramp OD

| Origin \ Destination | 153 4th/Mill Plain exit from I-5 NB | 156 78th St exit from I-5 NB | 157 99th St exit from I-5 NB | 160 179th St exit from I-5 NB | 161 SR 502 exit from I-5 NB | 162 I-5 NB gateway | 173 SB I-205 exit from I-5 SB | Grand Total |
|---|---|---|---|---|---|---|---|---|
| 101 I-5 Bridge NB gateway | 30 | 17 | 8 | 0 | 4 | 10 | 3 | 72 |
| 102 SR 14 entrance to I-5 NB | 518 | 408 | 130 | 0 | 2 | 12 | 1 | 1071 |
| 105 39th St/SR 500 entrance to I-5 NB | 2 | 24 | 13 | 0 | 0 | 5 | 0 | 44 |
| 109 NB I-205 entrance to I-5 NB | 0 | 0 | 1 | 220 | 142 | 7868 | 44 | 8275 |
| 110 179th entrance to I-5 NB | 0 | 0 | 0 | 17 | 5 | 26 | 0 | 48 |
| 121 I-5 SB gateway | 3 | 0 | 0 | 2 | 1 | 85 | 160 | 251 |
| 132 City Center entrance to I-5 SB | 7 | 4 | 2 | 1 | 0 | 1 | 1 | 16 |
| Grand Total | 560 | 453 | 154 | 240 | 154 | 8007 | 209 | 9777 |

DKS

Moonshadow

* Presentation based on sample data

# Use Cases – TAZ OD
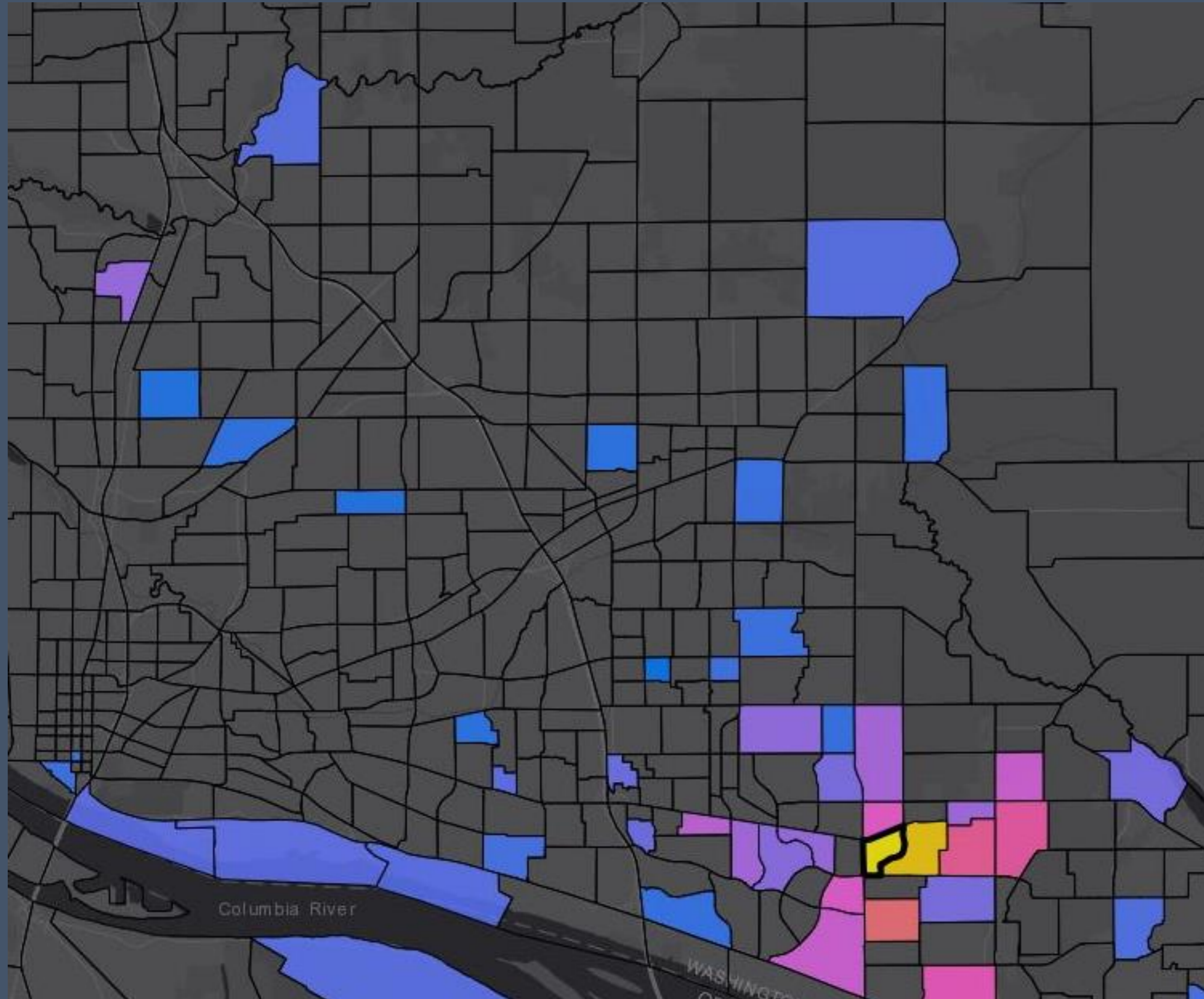


- Understand general travel patterns for any defined zone system

- Generate regional OD summaries

- Web interface provides ability to dynamically update visualization based on mouse position

DKS

MOonshadow

# Use Cases – Fwy Speed Differential
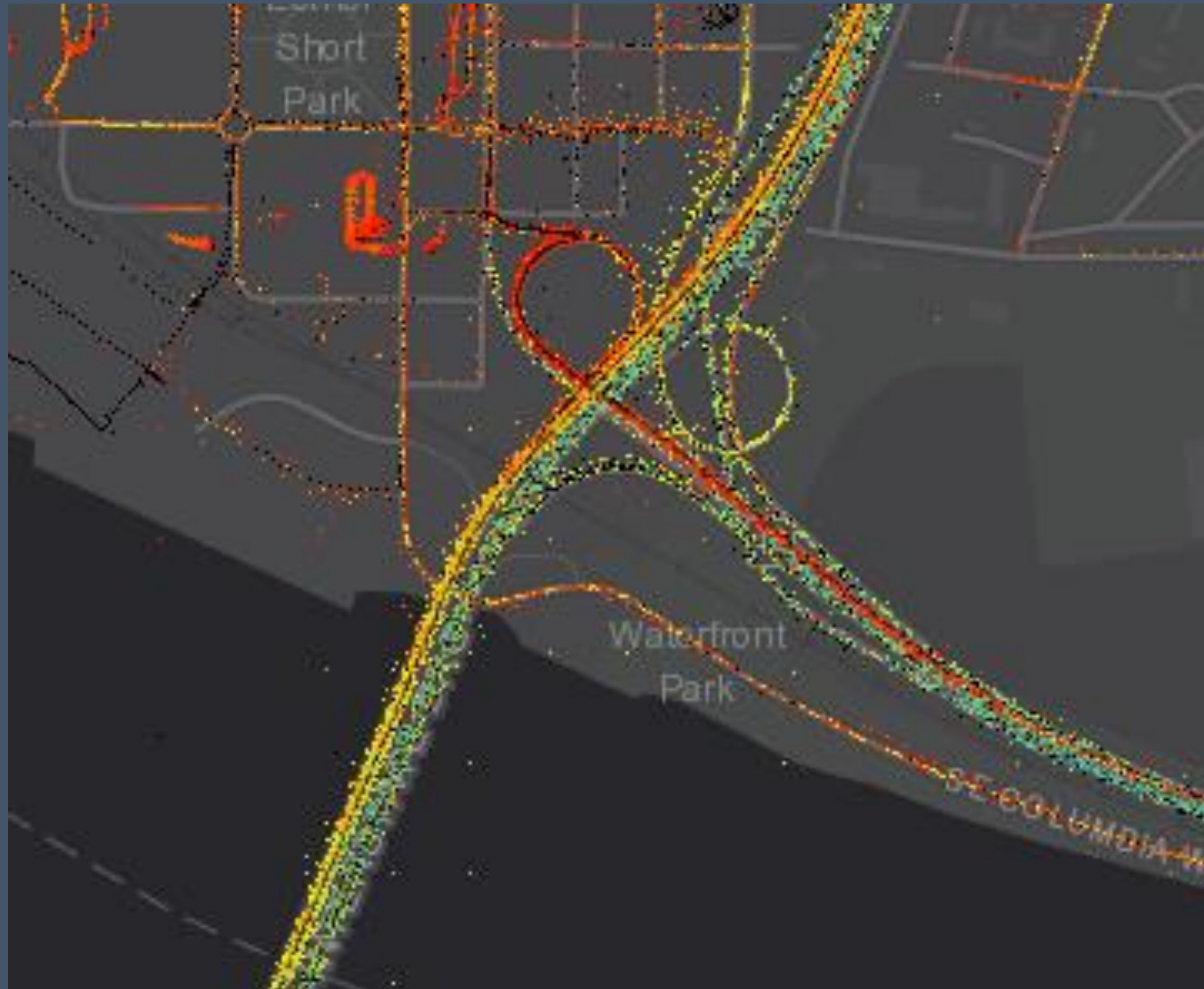


- Aggregated segment speeds do not account for differential

- Speeds by lane can vary due to specific movements, which is muted at the segment level

- Locations identified where some lanes may have lower speed

DKS

MOOnshadow

# Use Cases – Identify Diversion Routes
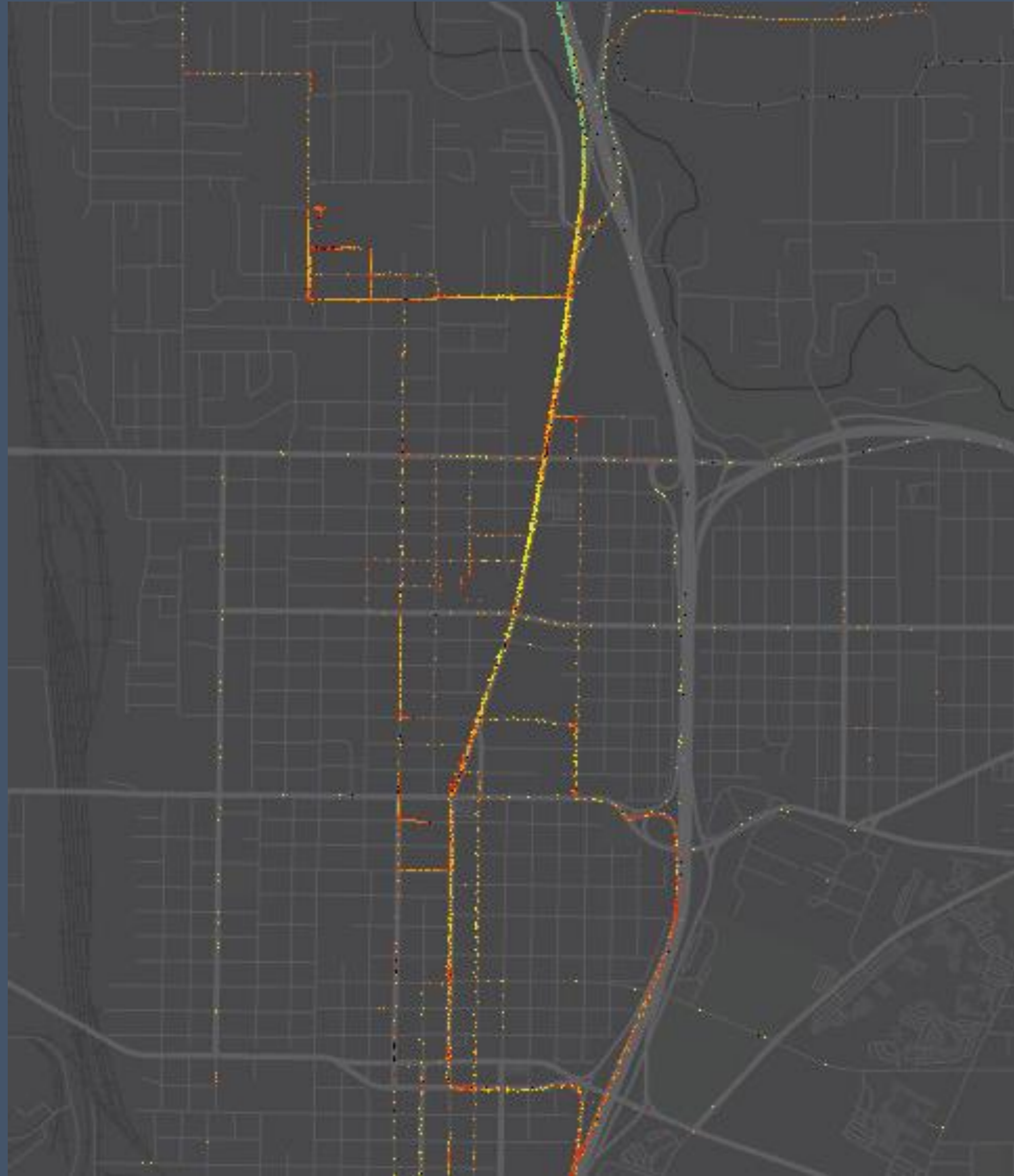


- Weekday AM peak period traffic on I-5 Southbound traffic

- Some trips exit freeway and use local system to bypass freeway congestion before re-entering freeway

- Diversion checks were performed in a workshop setting to verify diversion related to congested locations

DKS

MOOnshadow

# Summary

- Traditional Road Surveys provide a small sample for a small time period.

- Connected vehicle data can provide large data samples for long time periods.

- Origin/Destination matrices can be generated interactively using Waypoints

- Waypoint data provides detail and flexibility to enable several use cases including routing and diversion.

DKS

Moonshadow

## Moonshadow Mobile, Inc.
## Anita Van Asperdt

Business Development

anita@moonshadowmobile.com
541-343-4281
moonshadowmobile.com
db4iot.com

## DKS Associates
## Amanda Deering

Transportation Engineering Assistant

amd@dksassociates.com
503-243-3500
Dksassociates.com

DKS

DB4IoT

Moonshadow