

Seattle Mobility Index Project



UNIVERSITY of WASHINGTON

eScience Institute

DATA SCIENCE FOR SOCIAL GOOD



Seattle
Department of
Transportation

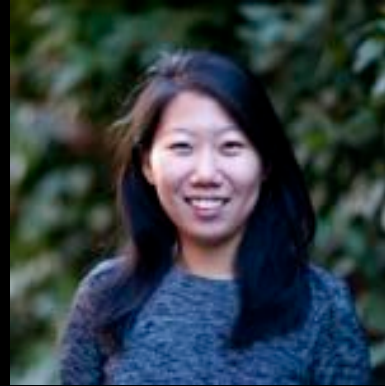
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Steve Barham



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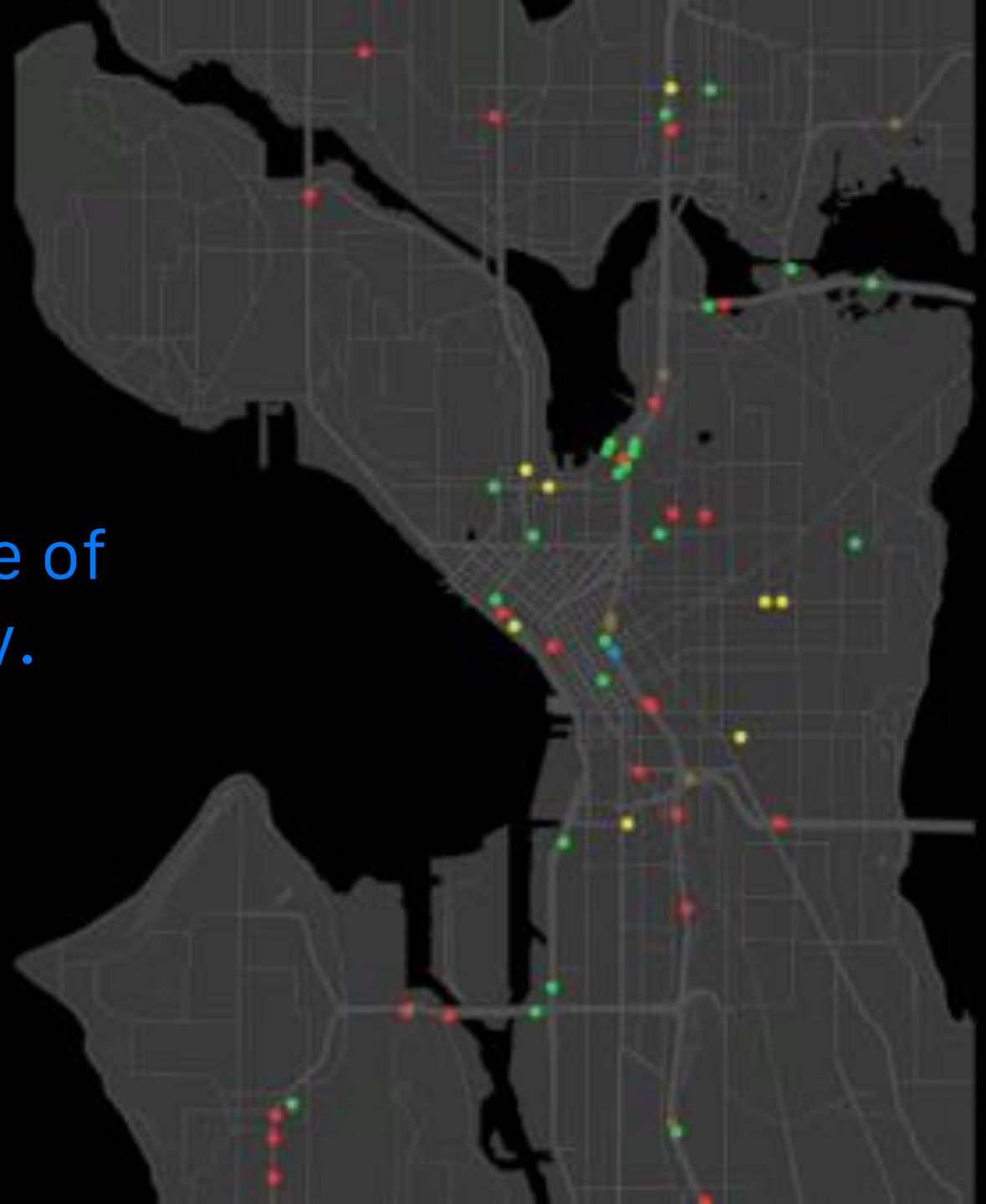


Ryan Maas



What is mobility?

The ability to reach everyday destinations with **your choice of mode, affordably and reliably.**



From mobility **data** to mobility **indices**



**Google
Distance
Matrix API**

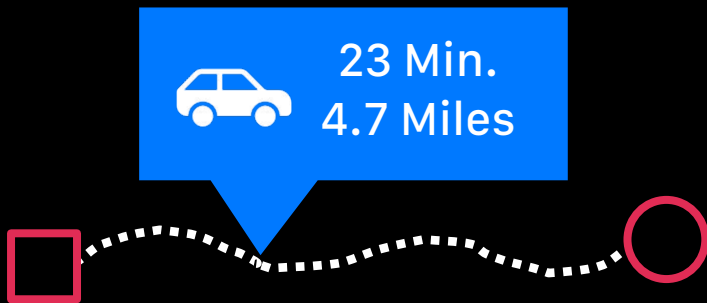
**PSRC
Household Travel
Survey**

**Census
Employment
Data**

**City of Seattle
Open Data**

Raw Mobility Data: Google Maps API

Distance & duration for multiple destinations and transport modes



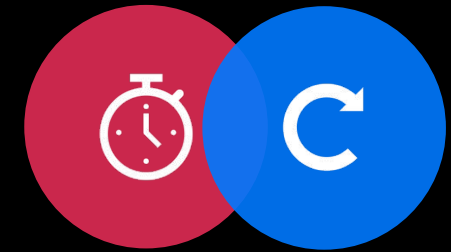
Duration and Distance

Estimate travel time and distance based on a recommended route.



Modes of Transport

Specify the mode of transport to use when calculating distance and travel time.



Traffic

Use current and historical traffic to predict travel times.

Calibration and Training Data: **PSRC Survey**

Puget Sound Regional Council 3,000 households
Household Travel Survey 30,000 trips

Trip Attributes

Time
Distance
Purpose
Mode
Block Group

Household Attributes

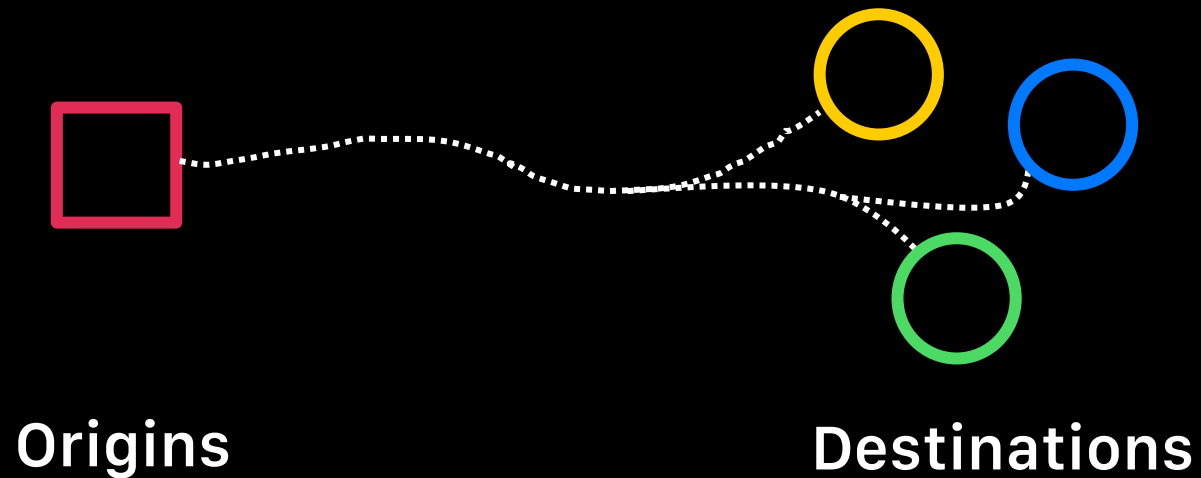
Income
Homeownership
Race
Gender
Distance

**Measure and identify disparity in
mobility to drive policy**

Measure and identify disparity in mobility

- Understand mobility at a granular level
- Provide baseline mobility measures
- Quantify impact of changes in transportation systems

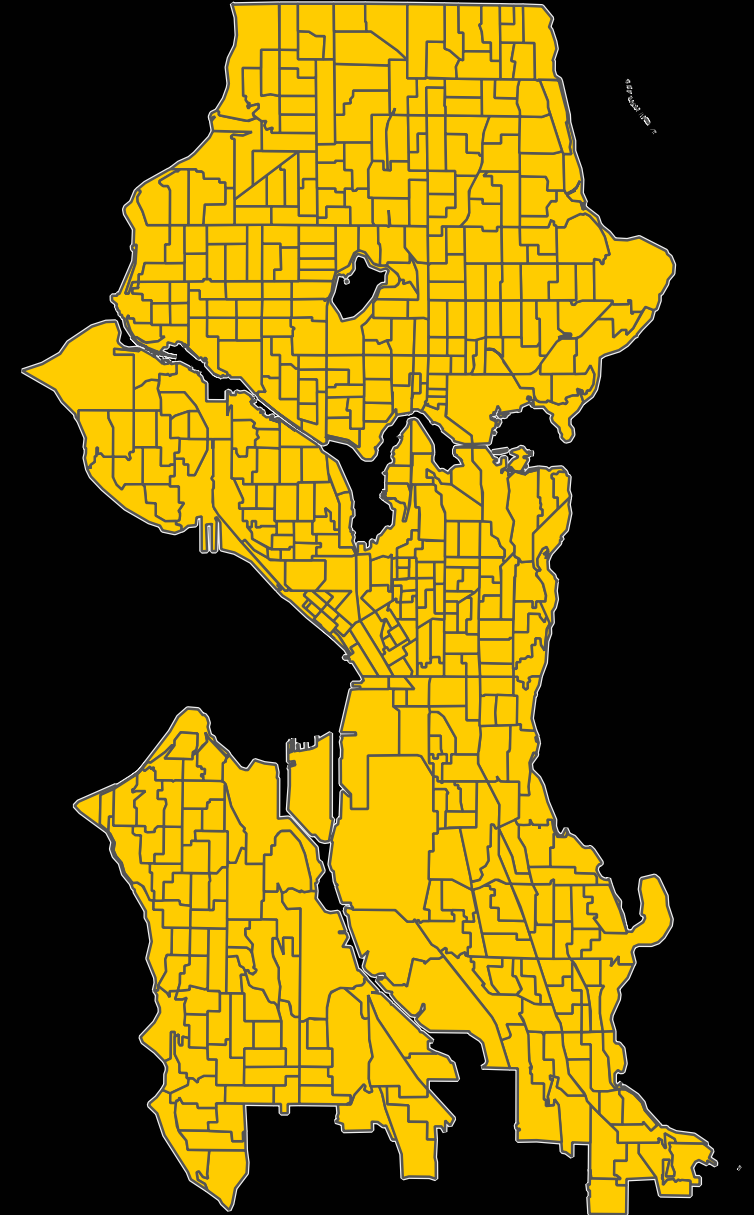
Where do people go?



Origins

Unit of Analysis: Census Block Group

- Granular geographic division
- Typically 600–3000 people
- Seattle: 481 block groups



Destinations

LOCAL LOCATIONS



school



supermarket



destination
park



urban
village



hospital



library



post office



pharmacy



cafe

CITYWIDE LOCATIONS



employment
center



public college

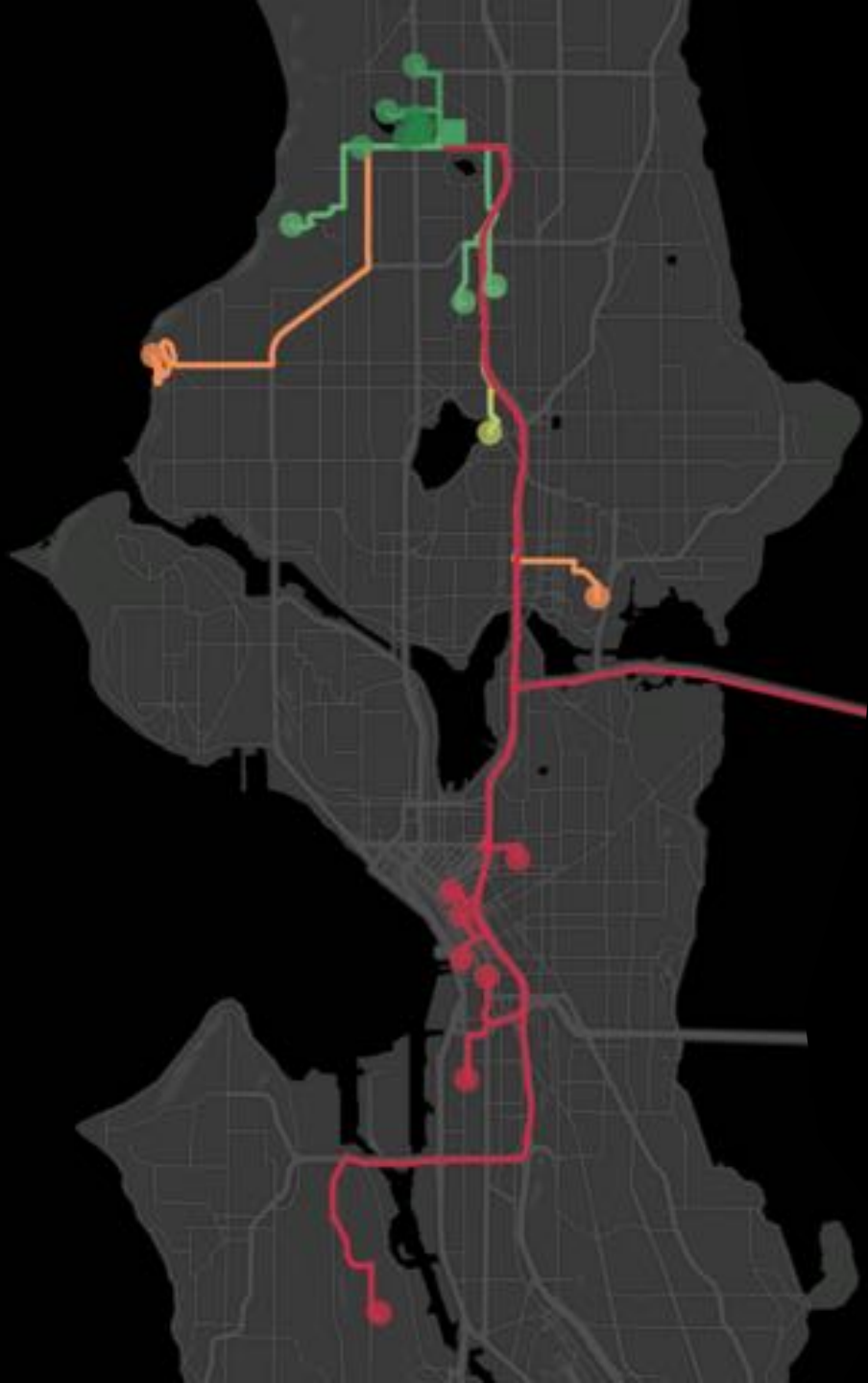


point of
interest

Market Basket of Destinations

- **Best-scoring combination of destinations** informed by PSRC Household Travel Survey and Census employment data
- Final basket: 12 local and 13 citywide destinations



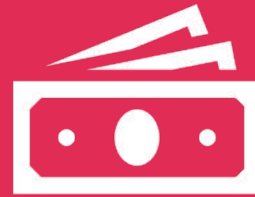


Mobility Indices



**Mode Choice
Index**

Availability of Options



**Affordability
Index**

Transportation Costs



**Reliability
Index**

Statistical Variation



Mode Choice Index

Availability of modes to reach each destination in the market basket

Travel Time
Threshold



30 minutes



60 minutes



45 minutes



45 minutes



Mode Choice Index



0



100



Affordability Index

Relative cost to reach destinations in the market basket



\$0.56 / mile
+
Parking Cost



\$2.75 / trip



\$0.15 / mile



\$0 / mile



\$14.10 / hr

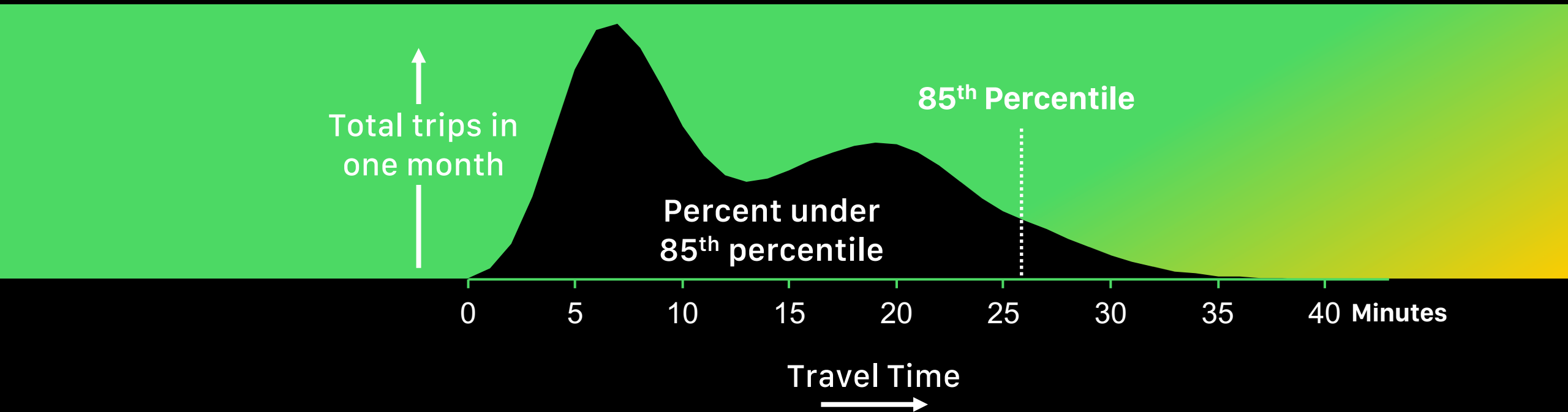


Affordability Index



Reliability Index

Consistency in travel duration at a given time



Reliability Index



0



100



Seattle Mobility Scores



72

Average



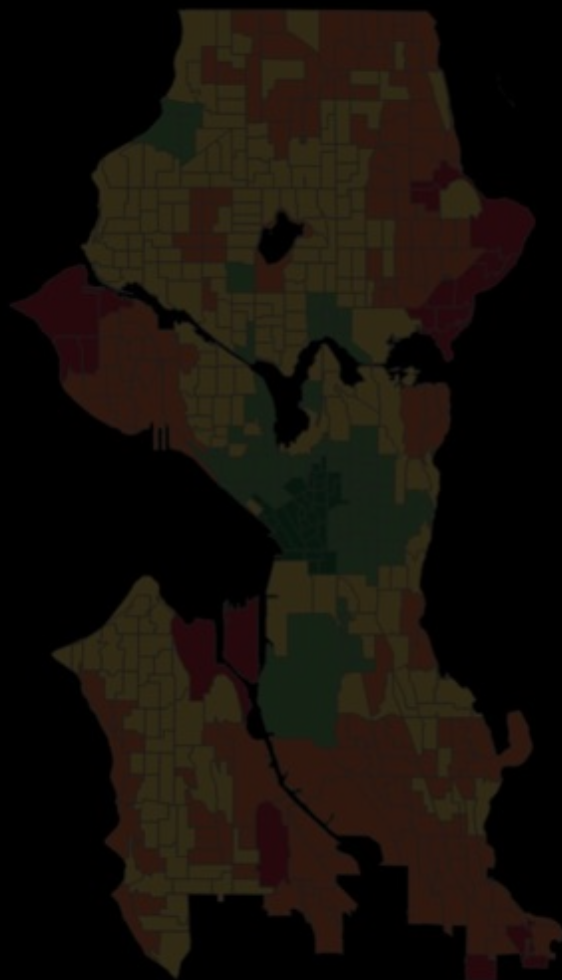
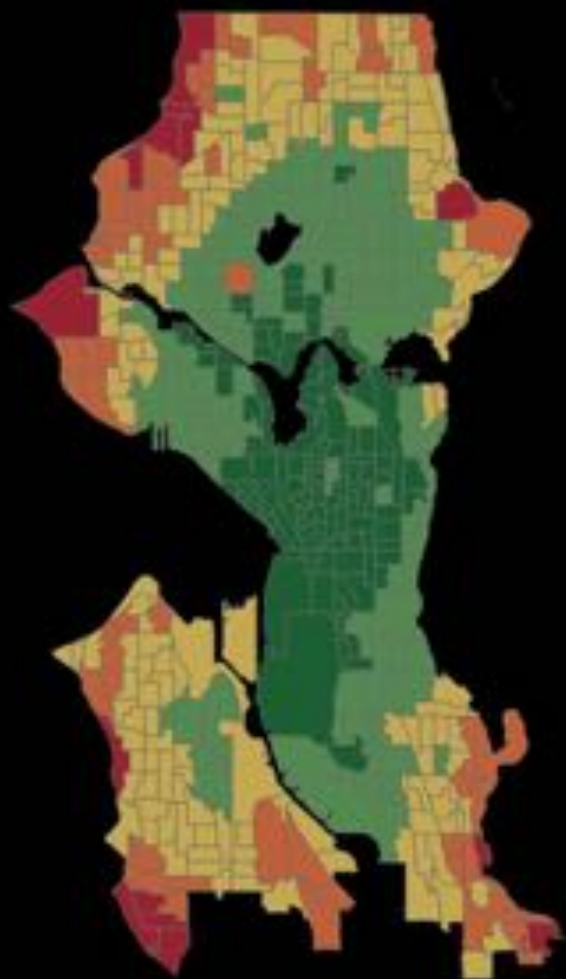
48

Average



24

Average





72

Average



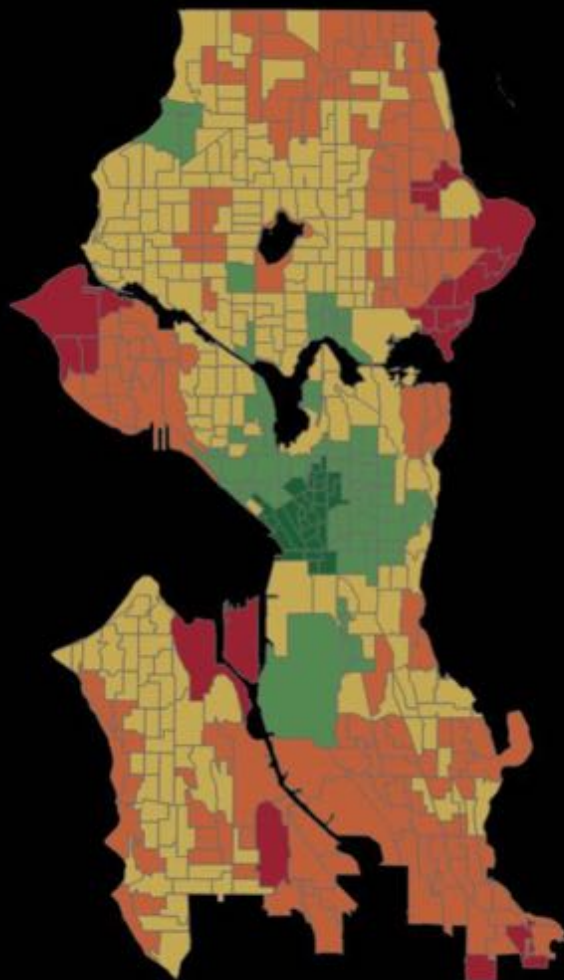
48

Average



24

Average



0



100



72

Average



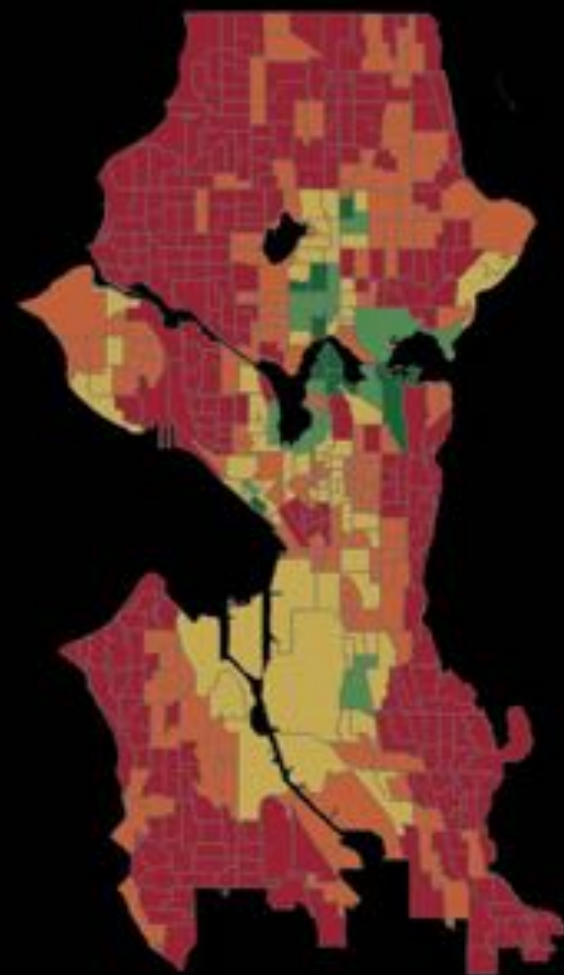
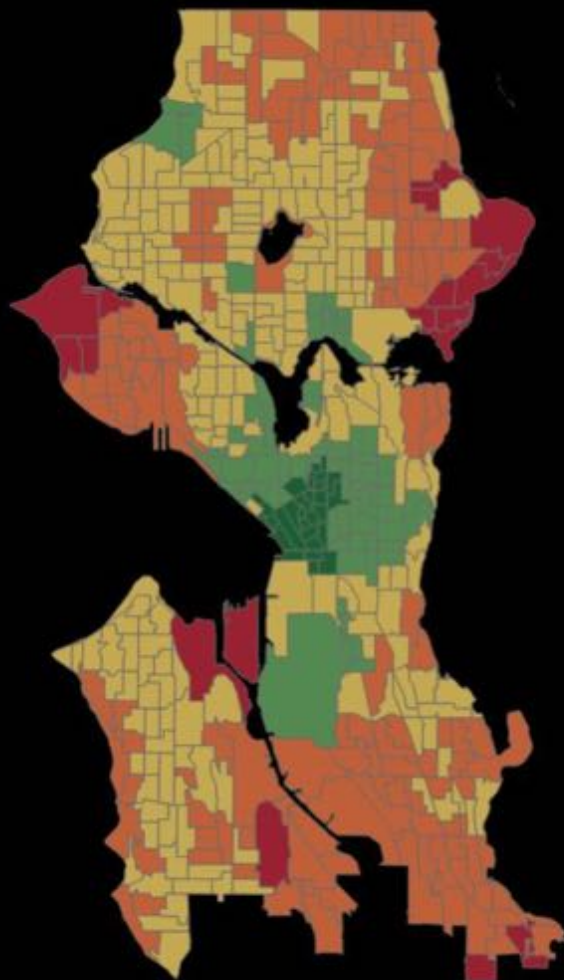
48

Average



24

Average



0



100

Case study: University District



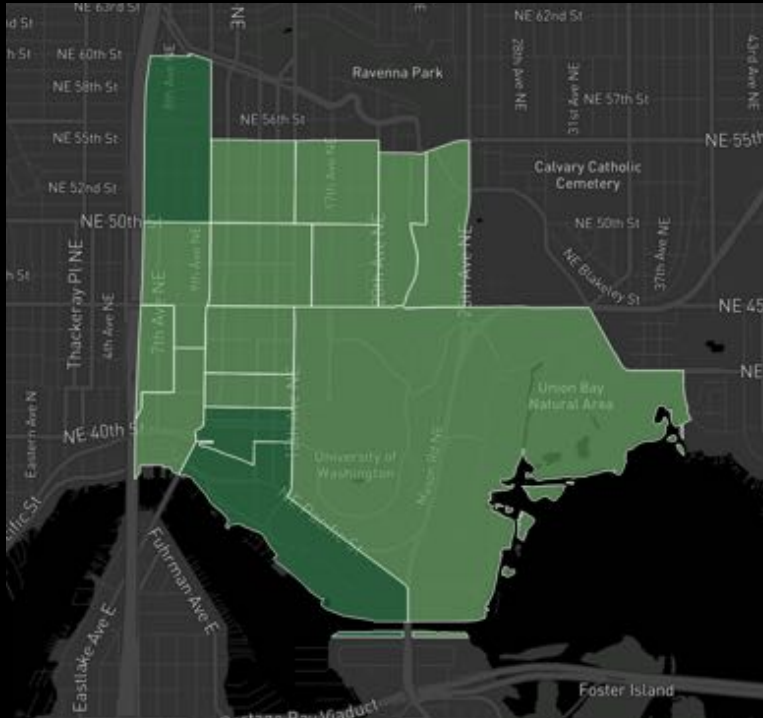
78 | 72
Average City Average

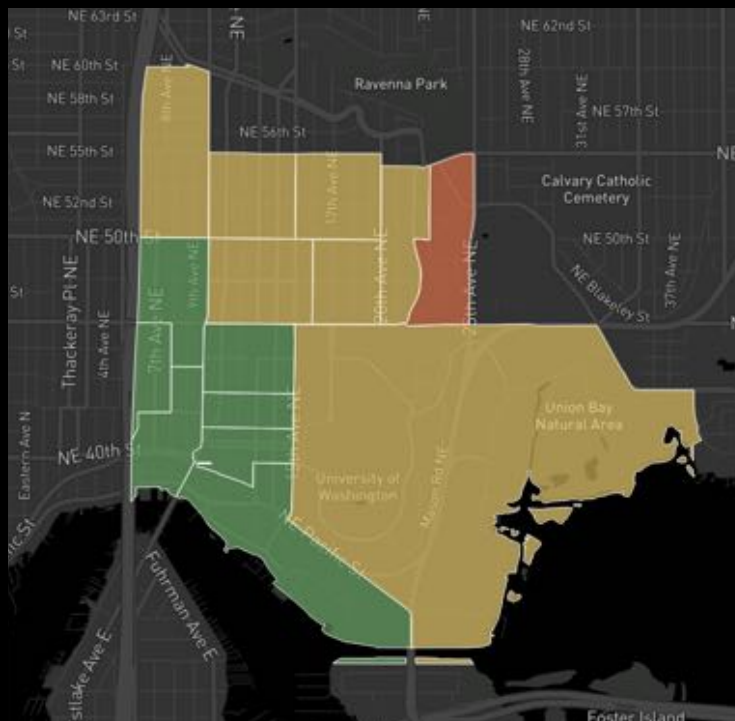


57 | 48
Average City Average



47 | 24
Average City Average







78

72

Average

City Average



57

48

Average

City Average

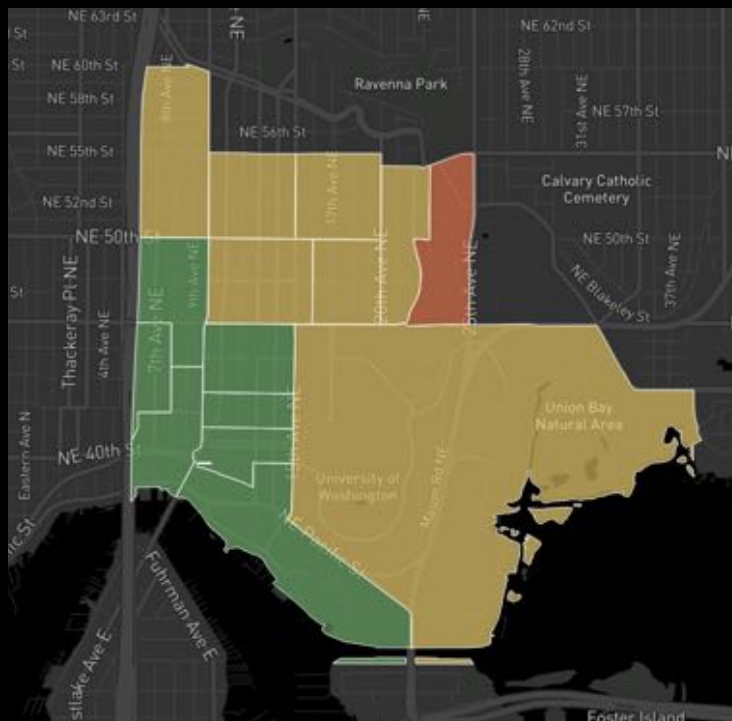
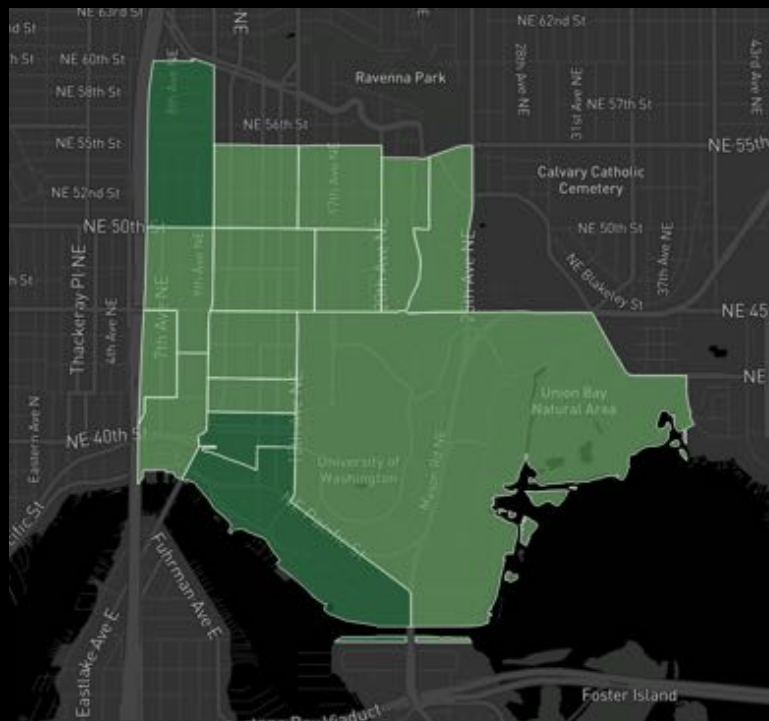


47

24

Average

City Average



0



100

Using indices to make predictions

Can we predict drive-alone behavior?

Predictors

PSRC Travel
Survey

80% Accuracy

Can we predict drive-alone behavior?

Predictors

PSRC Travel
Survey

80% Accuracy

Mode choice &
affordability

77% Accuracy

Different people, different needs

5 Travel Personas

GOAL Understand people with different mobility patterns

METHOD K-Means clustering

DATA PSRC household travel survey data

RESULT Identified 5 different personas



A



B



C



D



E



Persona A



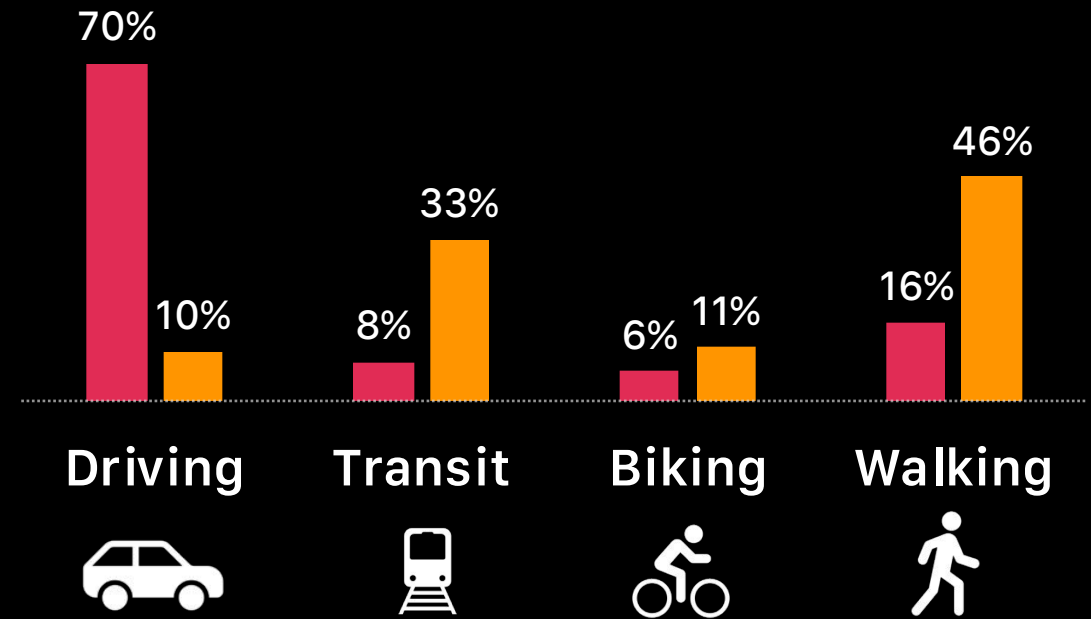
Persona B



Persona A



Persona B





Persona A

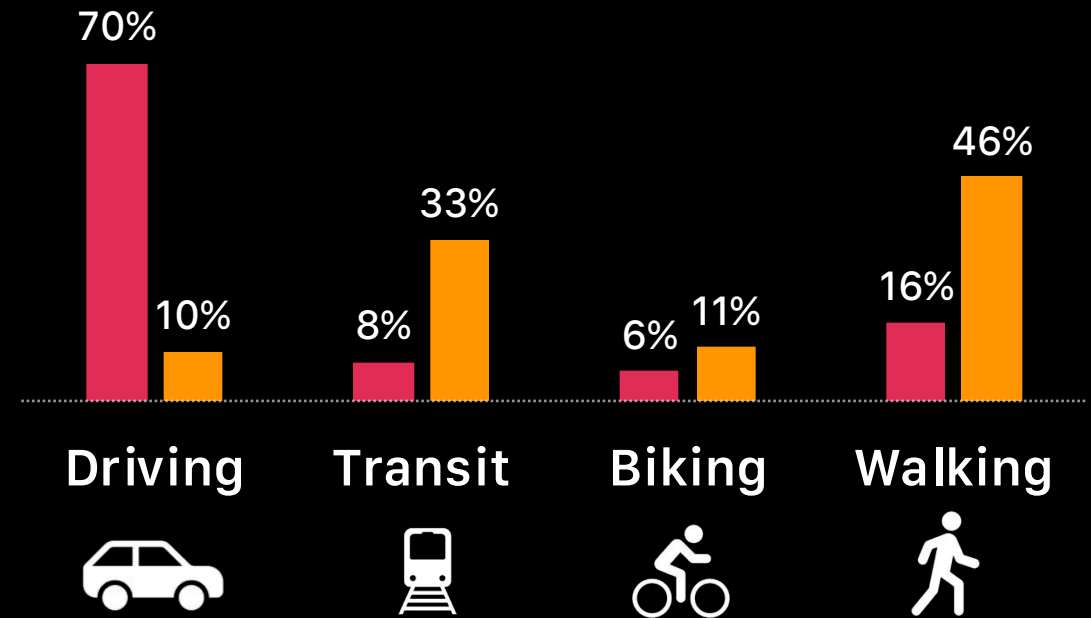


Persona B

Household Income Over \$75,000

67%

28%



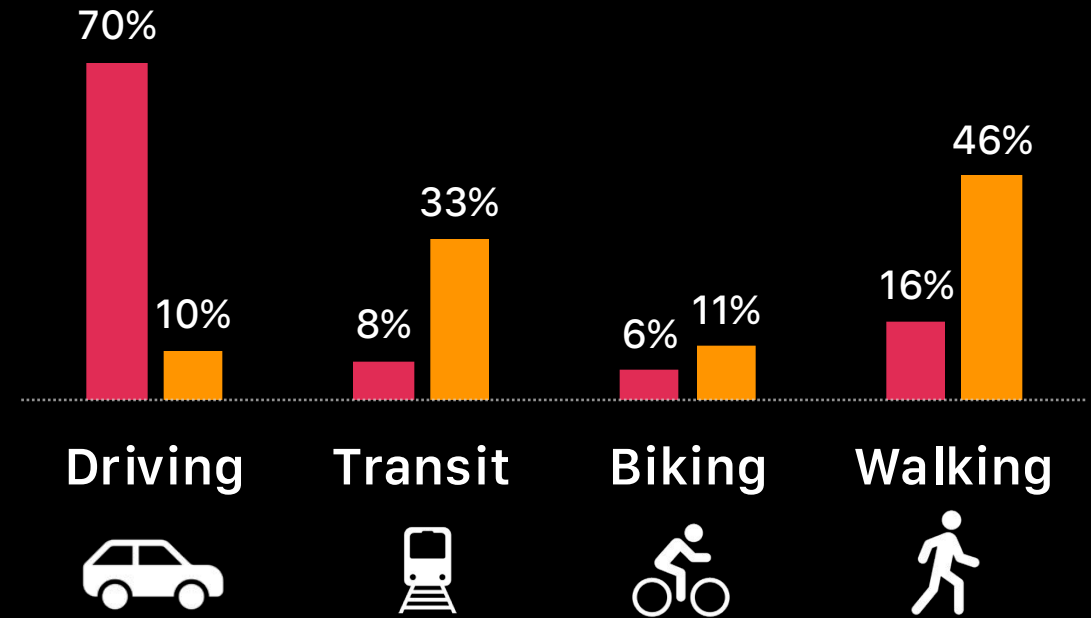
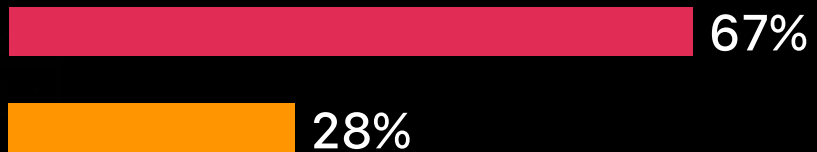


Persona A



Persona B

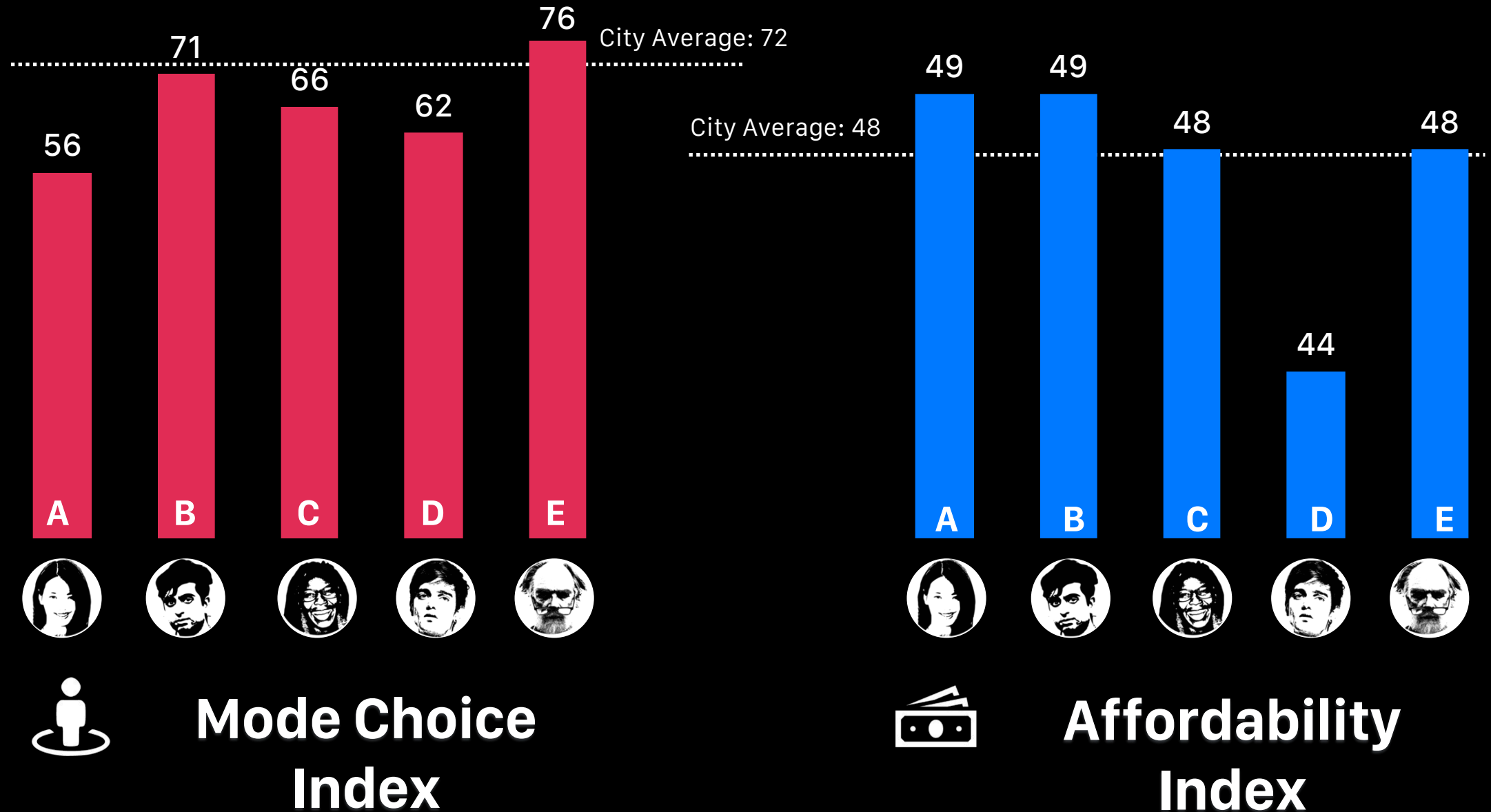
Household Income Over \$75,000



Going to work



Persona-Tuned Indices



Case study: University District

Mode choice comparison

Baseline

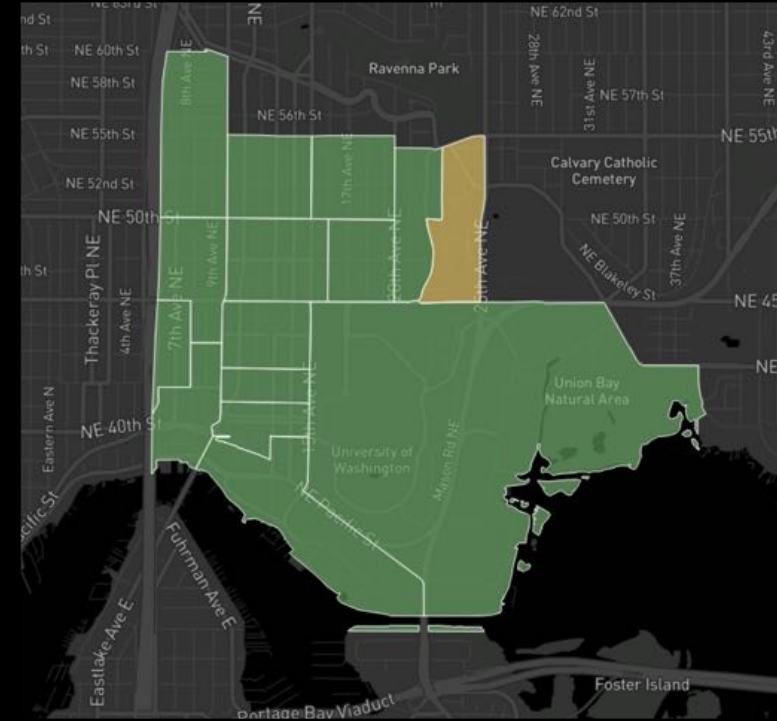
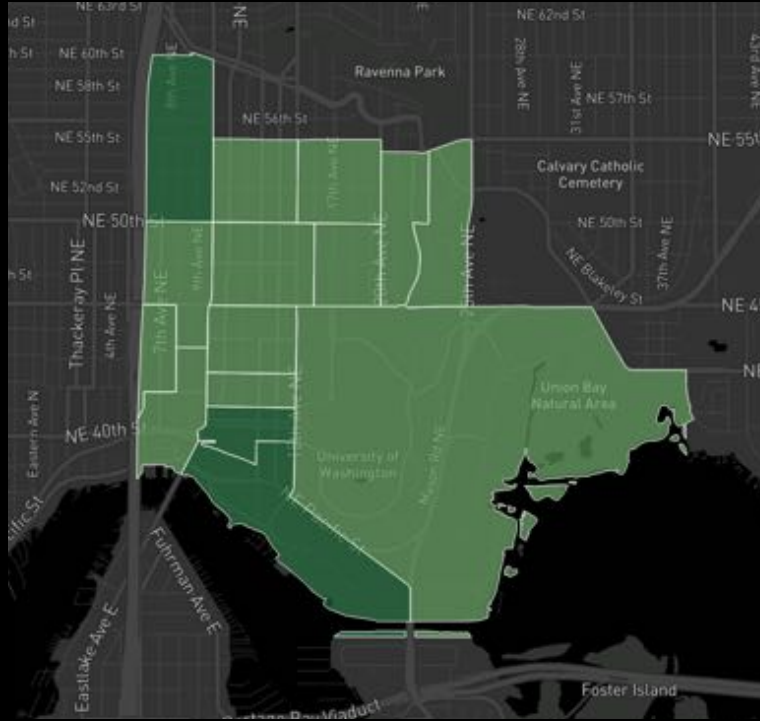
78

Average

Persona B

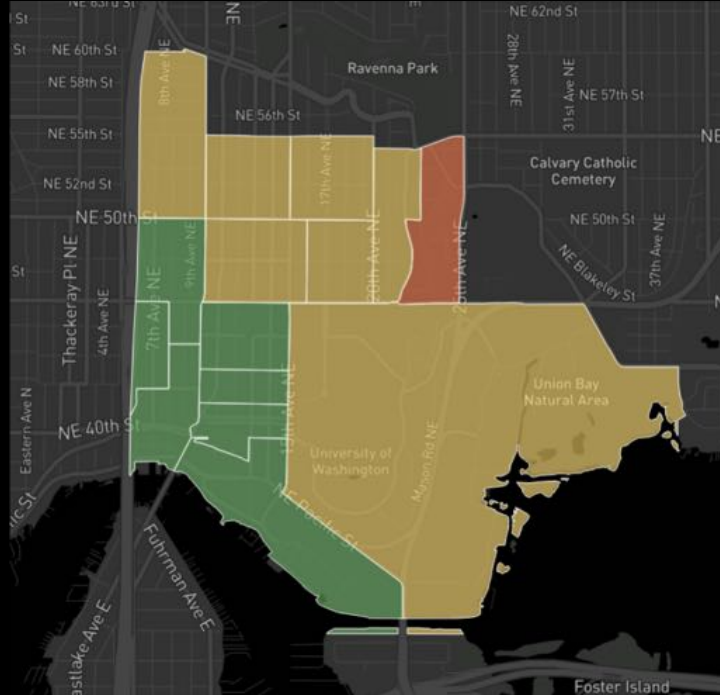
64

Average

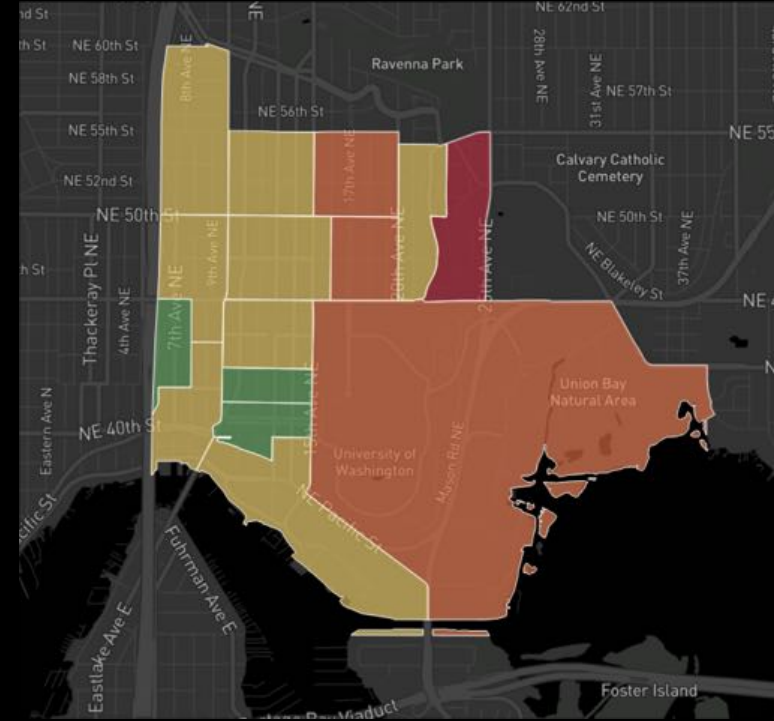


Affordability comparison

Baseline **57**
Average




Persona B **48**
Average



Contributions


Status Quo

Frontier

Isolated measurement  Granular and comprehensive measurement

Status Quo


Frontier

Isolated measurement  Granular and comprehensive measurement

Expensive  Low cost, scalable, and reproducible

Status Quo

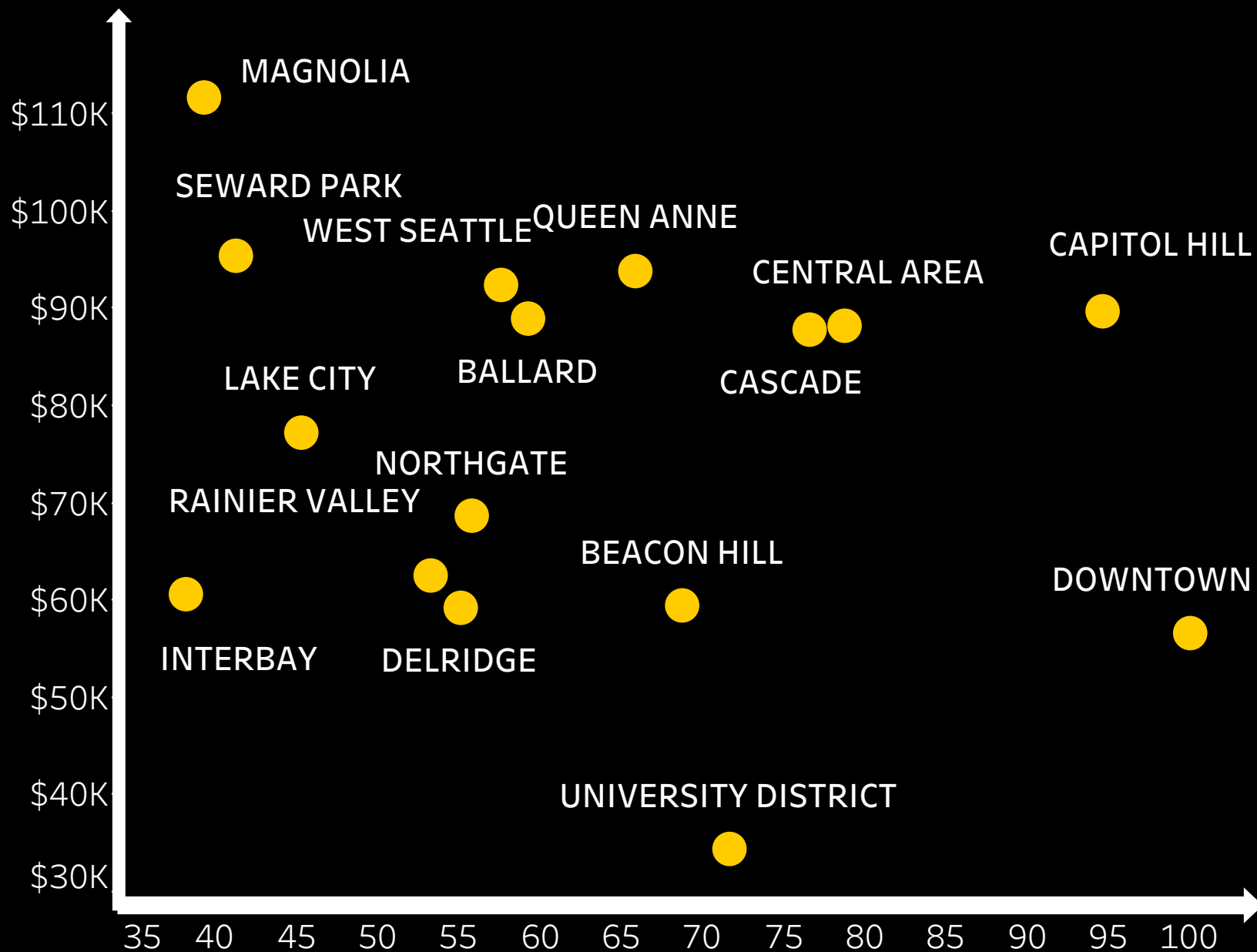
Frontier

Isolated measurement  Granular and comprehensive measurement

Expensive  Low cost, scalable, and reproducible

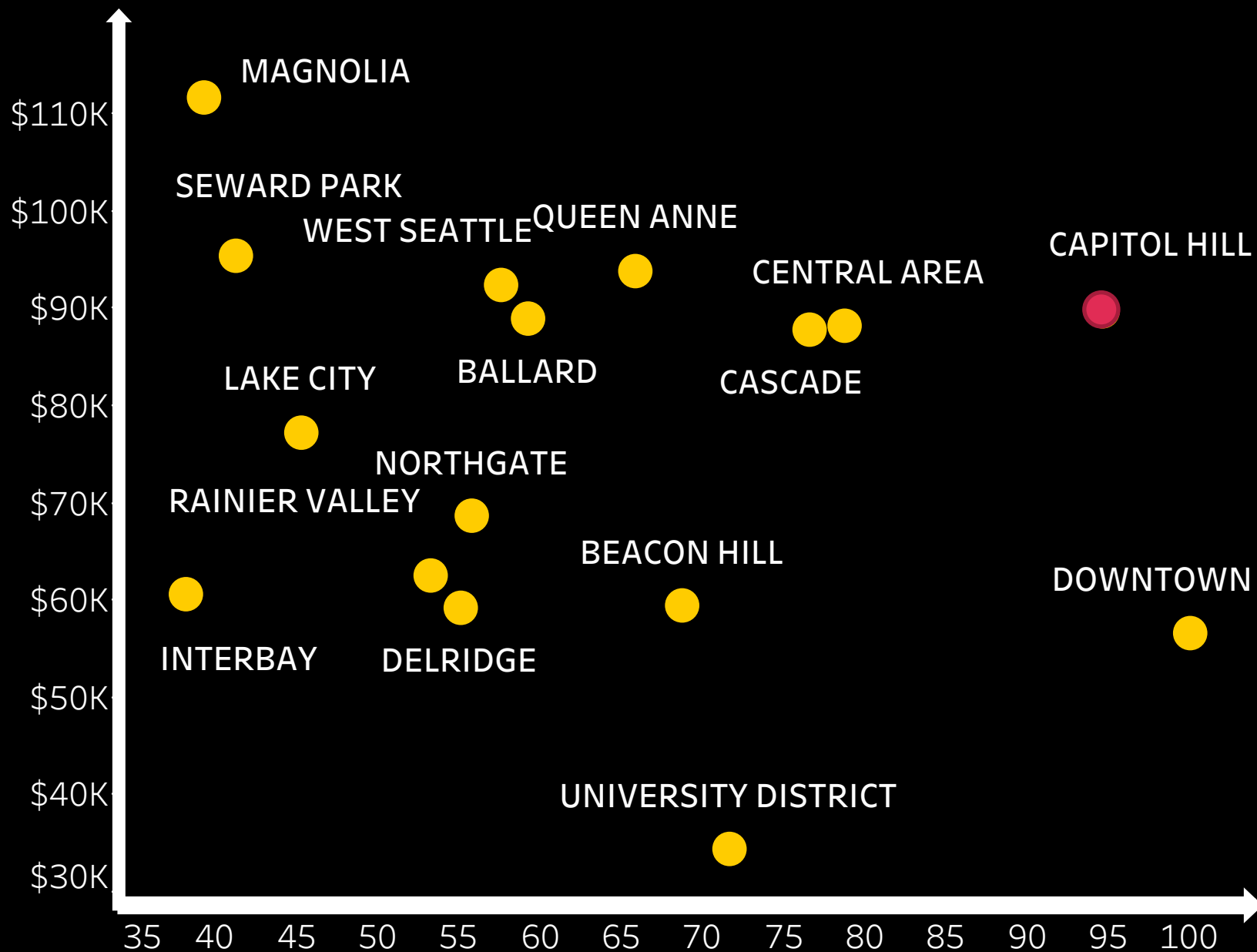
Difficult cross-domain collaboration  Data designed for collaboration and correlation

**Household
Income**



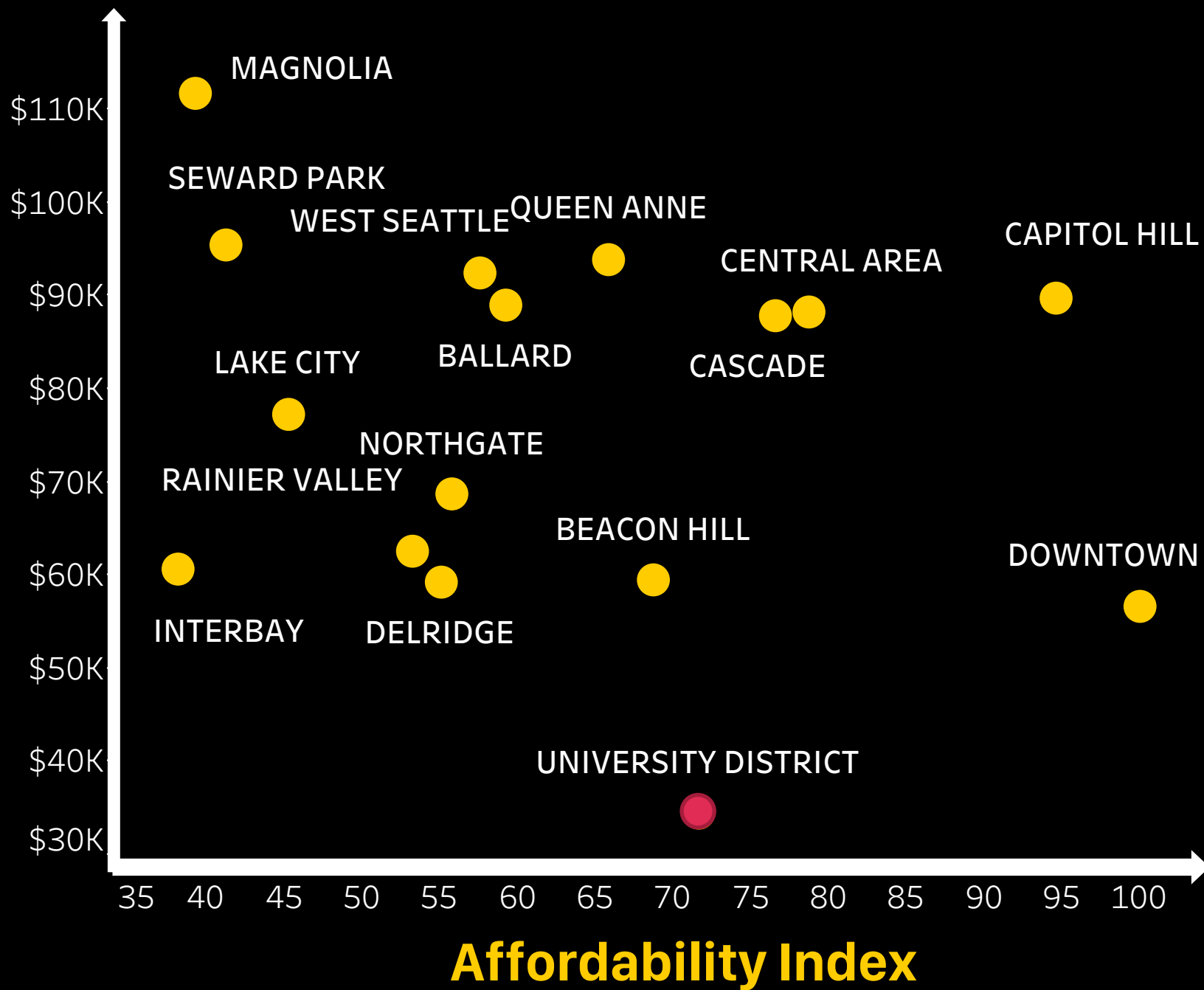
Affordability Index

**Household
Income**

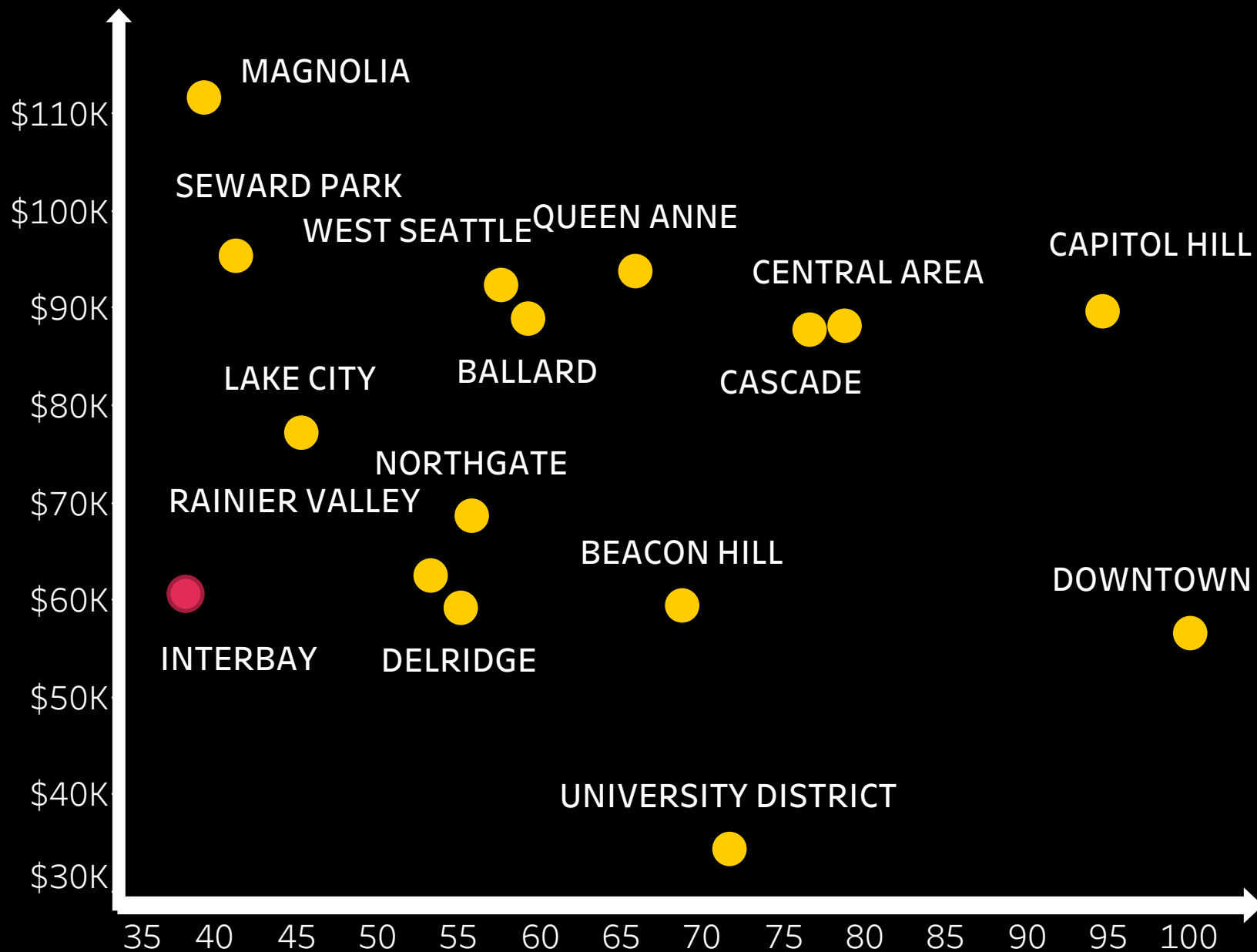


Affordability Index

**Household
Income**



**Household
Income**

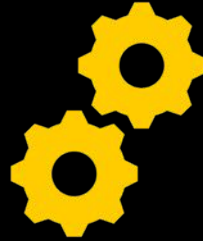


Affordability Index

Next Steps 🔍



Get full data set
for reliability index



Add new modes



Baseline

Who is this for and how can it be used?



City of Seattle



Other cities



Transportation researchers
&
policy analysts



Community organizations
&
Nonprofits

GORDON AND BETTY
MOORE
FOUNDATION



UNIVERSITY *of* WASHINGTON
eScience Institute

Urban@UW

CASCADIA URBAN
ANALYTICS COOPERATIVE