



SUSTAINABILITY & MULTIMODAL PLANNING WORKSHOP

#APTAsmp19



Refining Ridership Propensity Estimations

A. Xaevier

Valley Metro

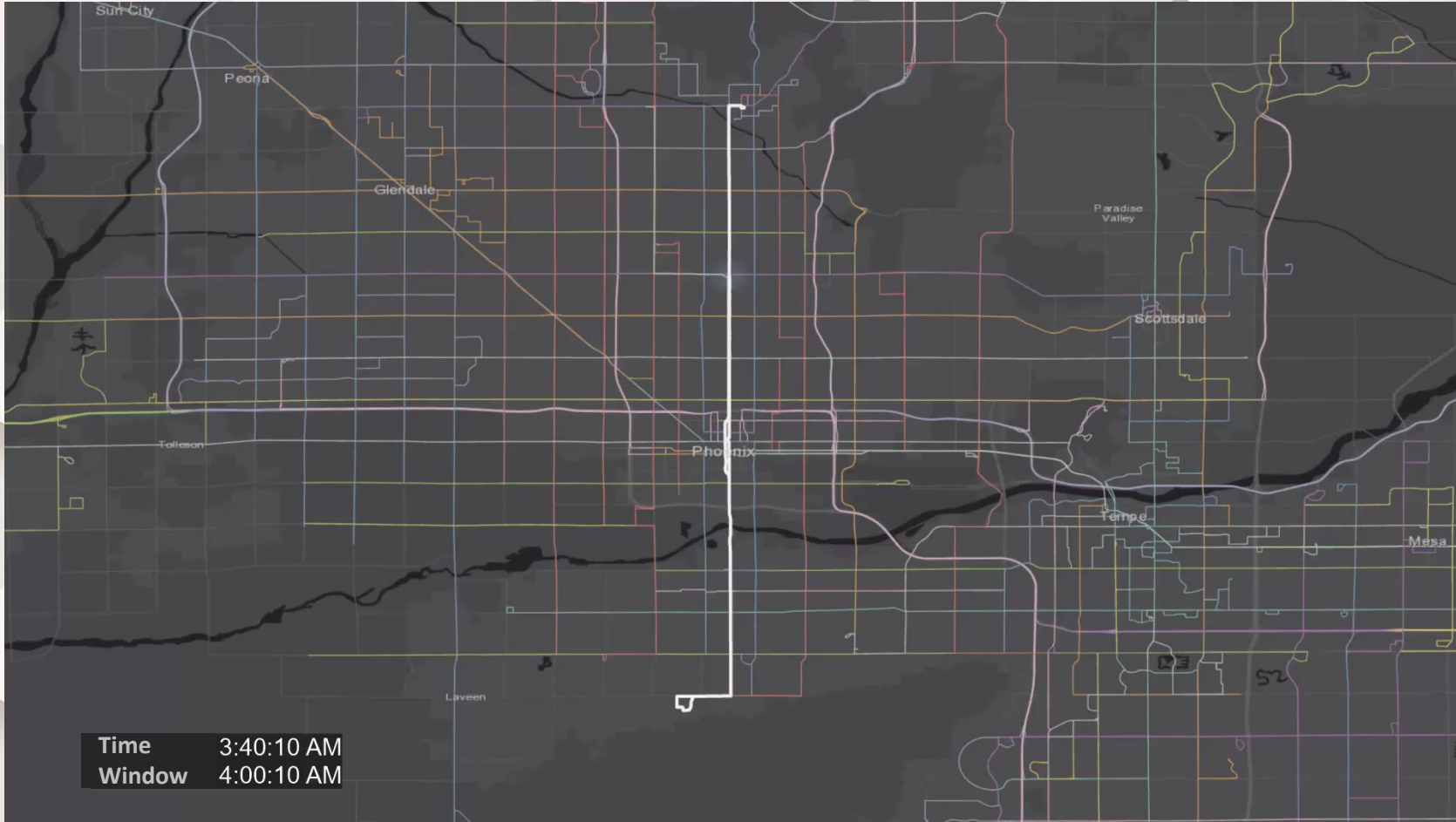


The problem...

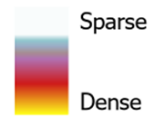
Limitless proposals, limited funding

- Need to discern merit in a manner that's
 - Objective
 - Replicable
 - Performance driven

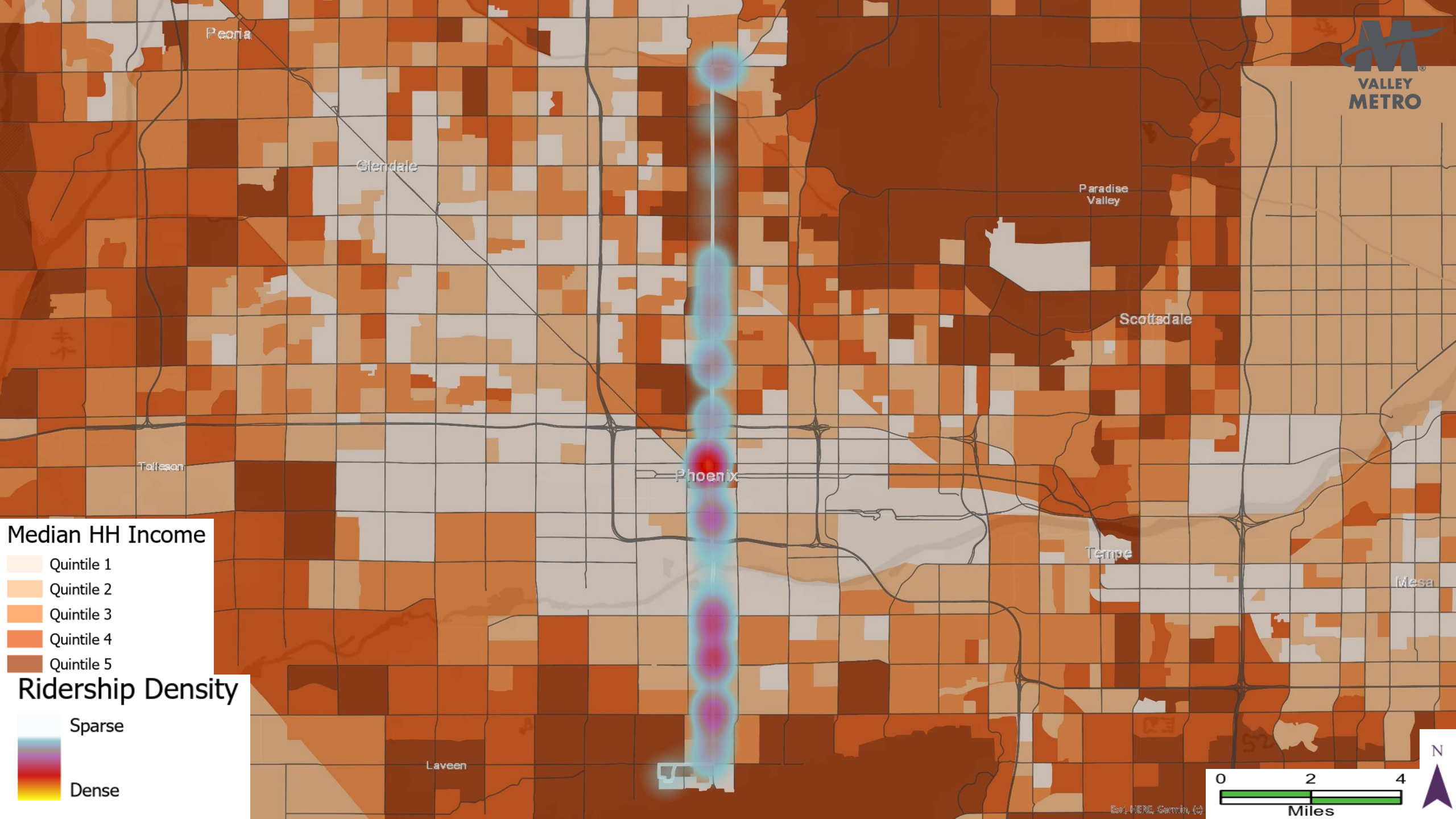




Ridership Density







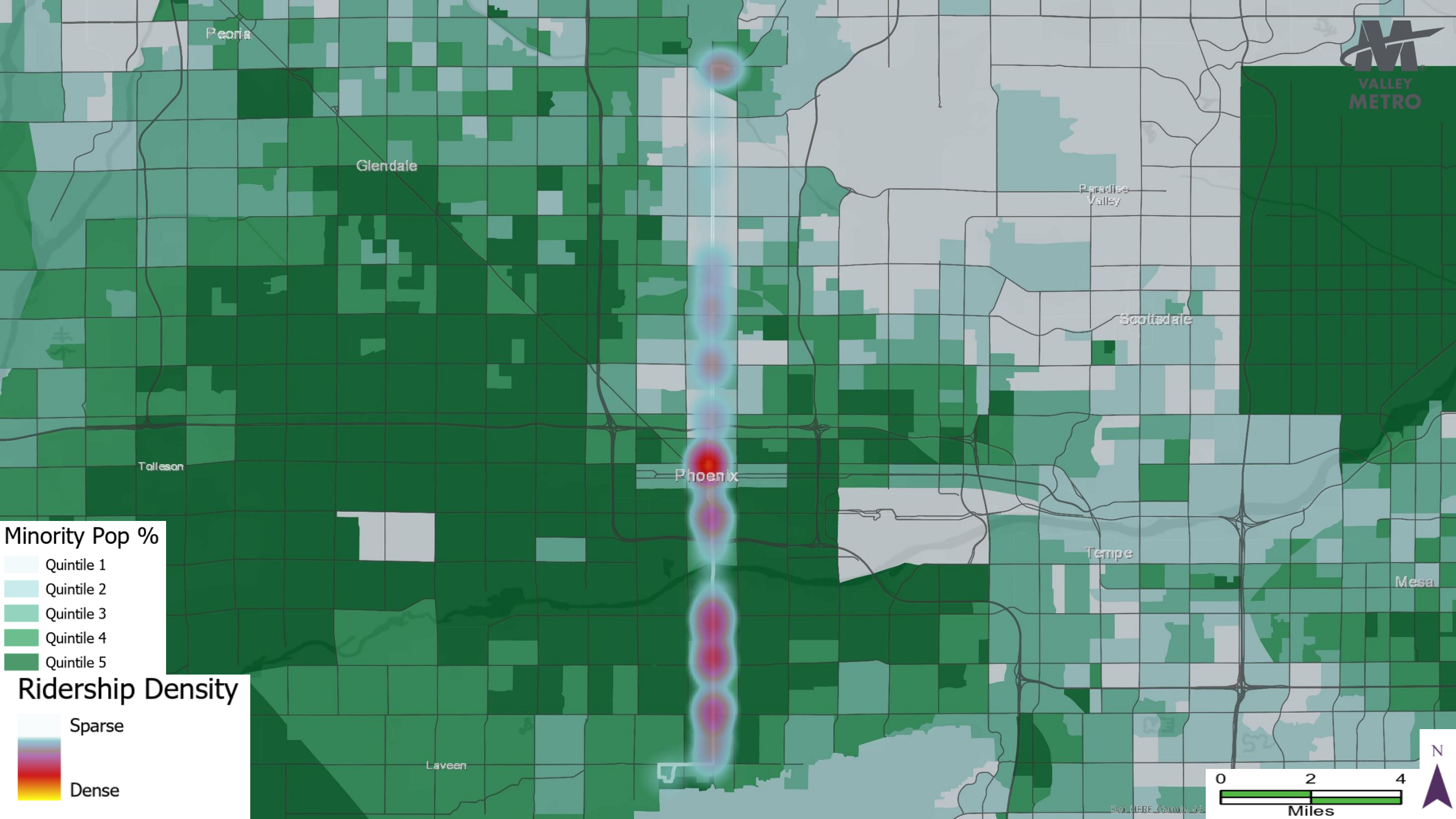
Median HH Income

- Quintile 1
- Quintile 2
- Quintile 3
- Quintile 4
- Quintile 5

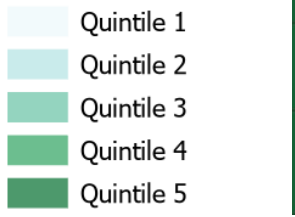
Ridership Density

- Sparse
- Dense



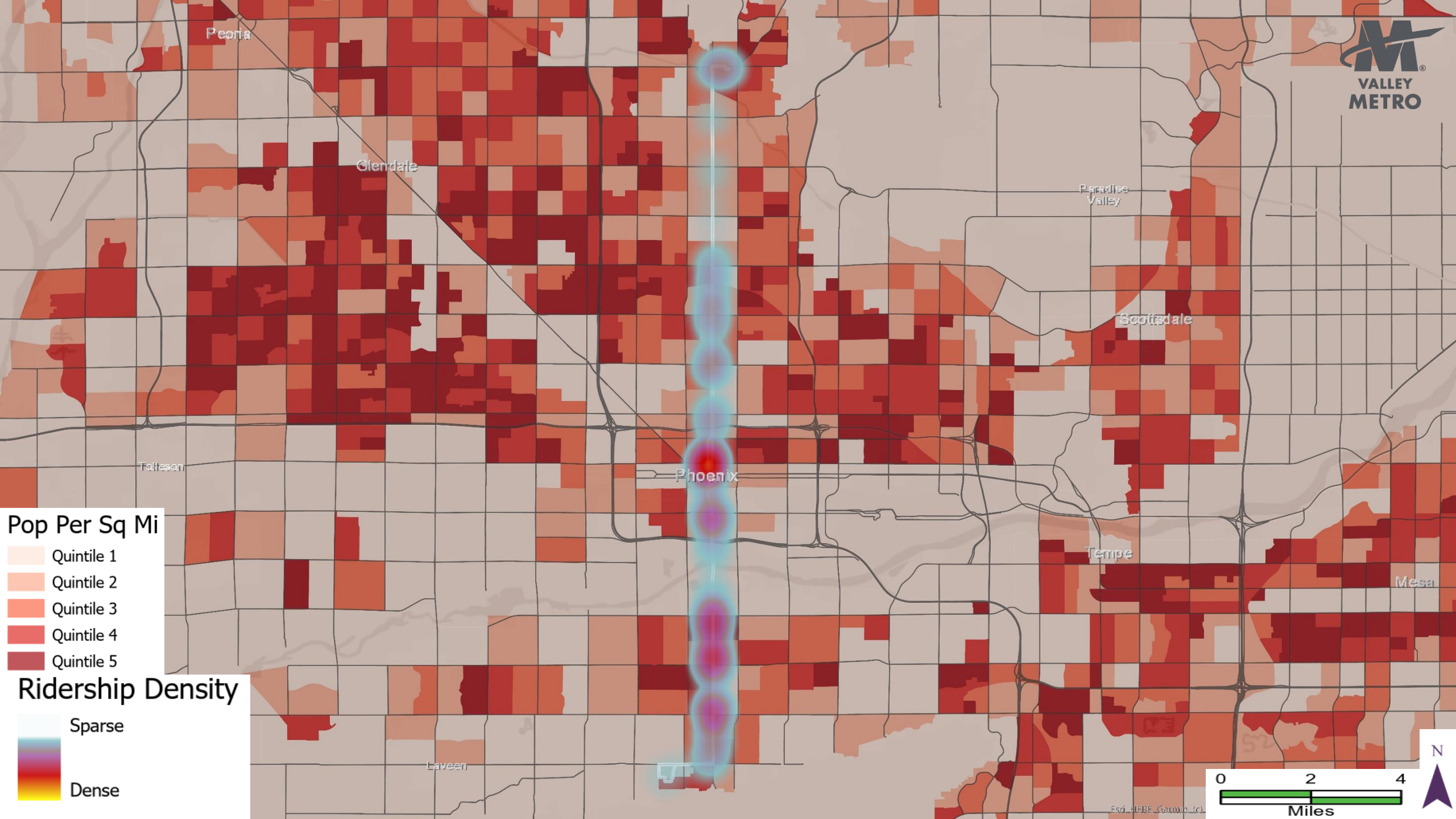


Minority Pop %

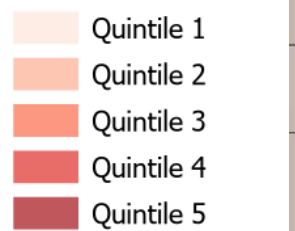


Ridership Density





Pop Per Sq Mi



Ridership Density



The solution

A Ridership Propensity Estimation Tool

Simple ridership estimating equation

- ✓ Accuracy is reasonable
- ✓ Requires common programs/data
- ✓ Easily replicated
- ✓ Inputs are flexible
- ✓ Output is intuitive

The solution

A Ridership Propensity Estimation Tool

A multivariate equation that incorporates geographically calculated inputs and ridership figures to estimate how variations in alignment and service level correlate with ridership.

Usage at Valley Metro

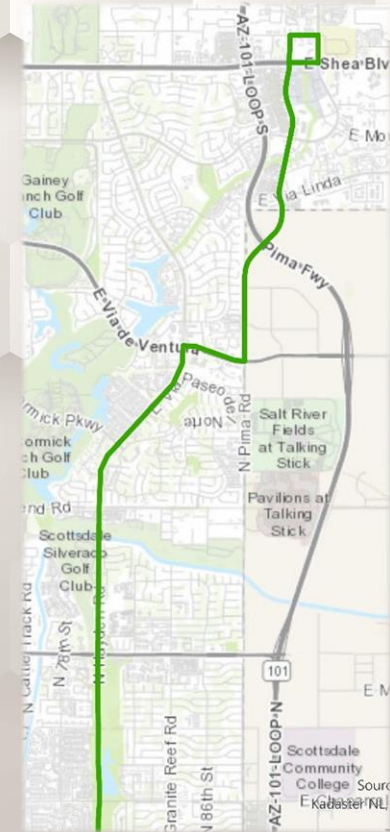
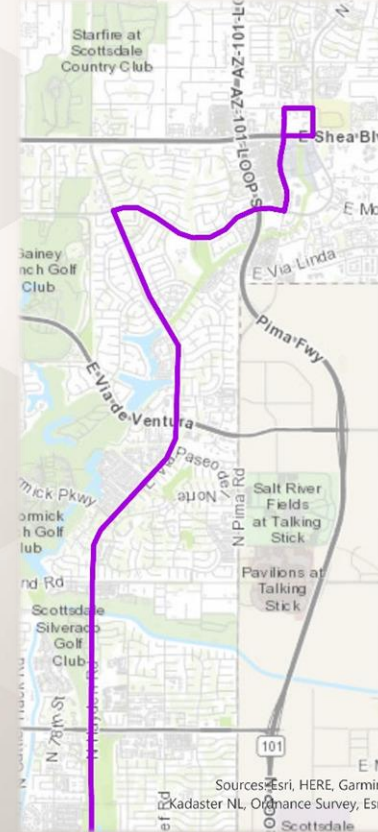
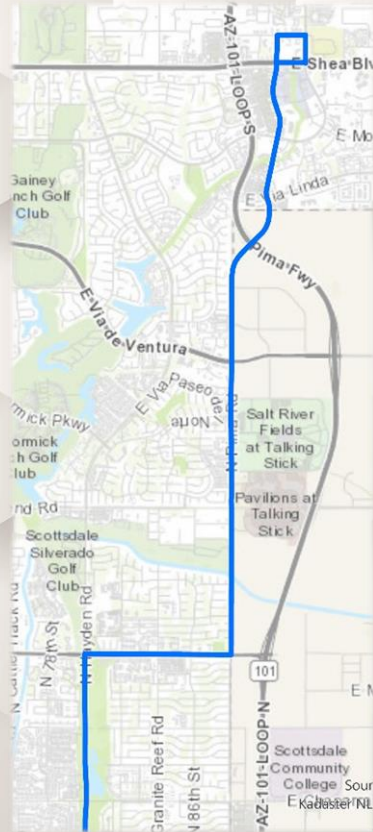
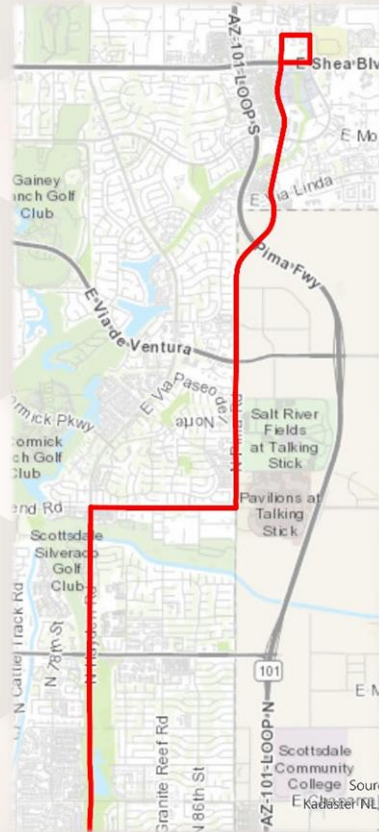
Ranking proposals in fleet investment prioritization

✓ Codified in Transit Standards Manual, Short Range Transit Program

Route Name	Route #	Service Type	Impacted City	Operator	Change Type	Change Month	Change Year	Fiscal Year	Potential Service Change Concept	Additional Fleet	Ranking
McDowell	17	Local	Avondale, Phoenix, Goodyear	Phoenix	Service Change	October	2023	FY24	Add Sunday service beyond 99th Ave. into Avondale & Goodyear.		
75th Av	75	Local	Peoria, Glendale	Phoenix	Extension	October	2023	FY24	Extend 75 to Arrowhead Town Center.	4	1
Baseline	77	Local	Mesa, Gilbert	Valley Metro	Extension	October	2023	FY24	Extend to Juanita park-and-ride.	1	3
Hayden/McClintock	81	Local	Chandler, Tempe	Valley Metro	Service	October	2023	FY24	Weekday, improve service in Chandler by extending current service to add two evening round trips.		
Dunlap/Cave Creek	90	Local	Peoria	Phoenix	Extension	October	2023	FY24	Extend route 90 to 99th Avenue.	1	2
Dobson	96	Local	Chandler, Mesa	Valley Metro	Service	October	2023	FY24	Weekday, improve service in Chandler by extending current service to add one evening round trip.		
Country Club/Arizona Ave	112	Local	Chandler	Valley Metro	Extension	October	2023	FY24	Extend Route 112 to Hamilton High School.	2	6
Mesa Dr/McQueen	120	Local	Chandler, Mesa, Gilbert	Valley Metro	Extension	October	2023	FY24	Extend to Warner Road in Gilbert.	1	5
Ray Rd	140	Local	Chandler, Phoenix, Gilbert	Valley Metro	New Route	October	2023	FY24	Extend 140 from Gilbert Rd to Power Rd on Warner.	2	4
Val Vista	New	Local	Gilbert	Valley Metro	New Route	October	2023	FY24	New local route on Val Vista Dr. from Greenfield on Baseline Rd. to south of Pecos Rd. to Gilbert Mercy Hospital, replacing deviation of Route 156.	3	7
Luke Circulator	New	Circulator	Surprise	Valley Metro	New Route	October	2023	FY24	Consider local circulator down to Luke Air Base.	3	8

Usage at Valley Metro

Service change and transit study service optimization inquiries

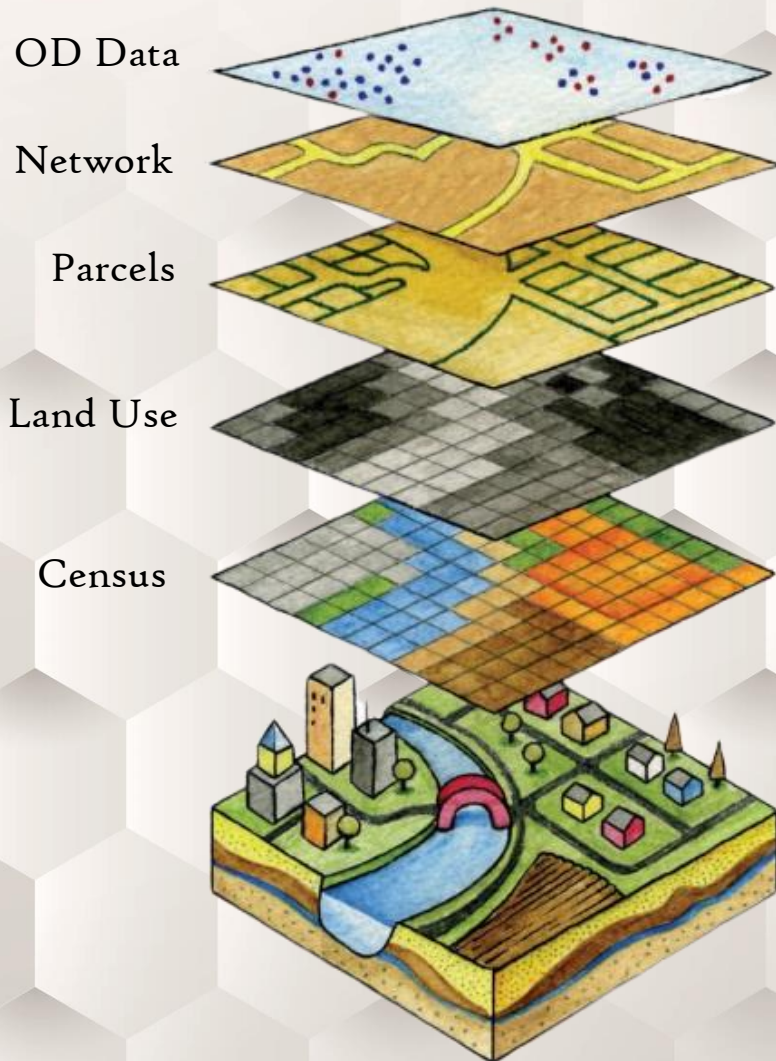


Sources: Esri, HERE, Garmin, Kadaster NL, Ordnance Survey, Esri

Method Overview

- ✓ Aggregate neighborhood and network data
 - ✓ Demographics, land-use, service level, etc.
- ✓ Automate the geoprocessing
- ✓ Correlate your variables

Method Overview-Aggregate



✓ Start with Census/ACS Data

✓ Supplement with...

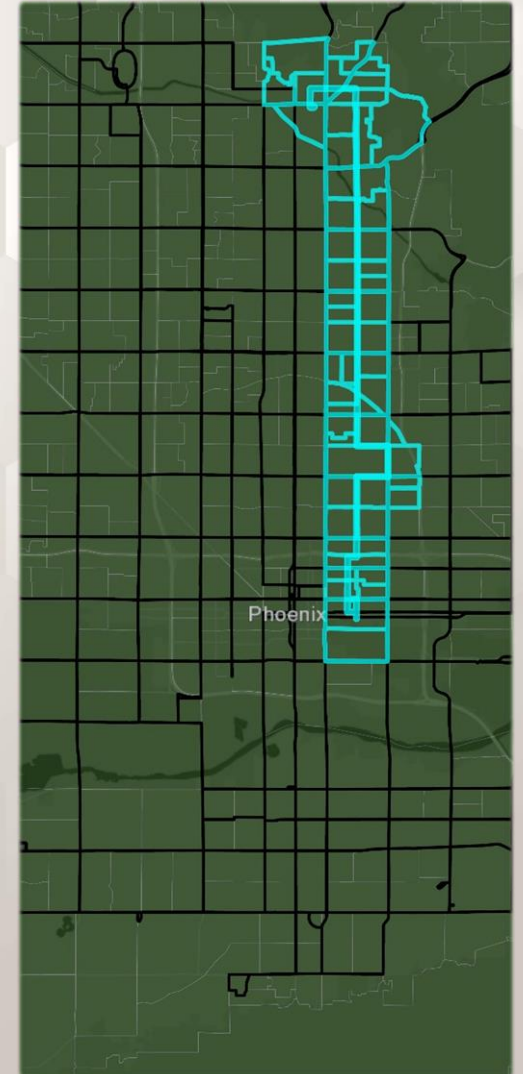
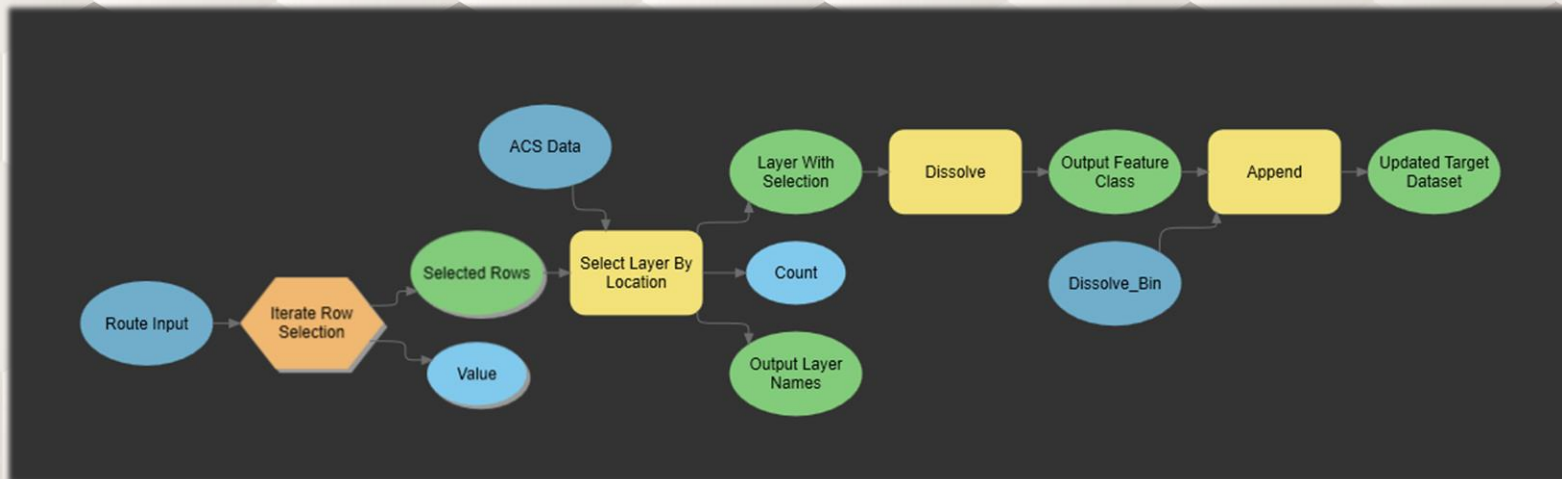
✓ Local data

✓ Service data

Method Overview-Automate

Modeling the process of *selection* and *addition*

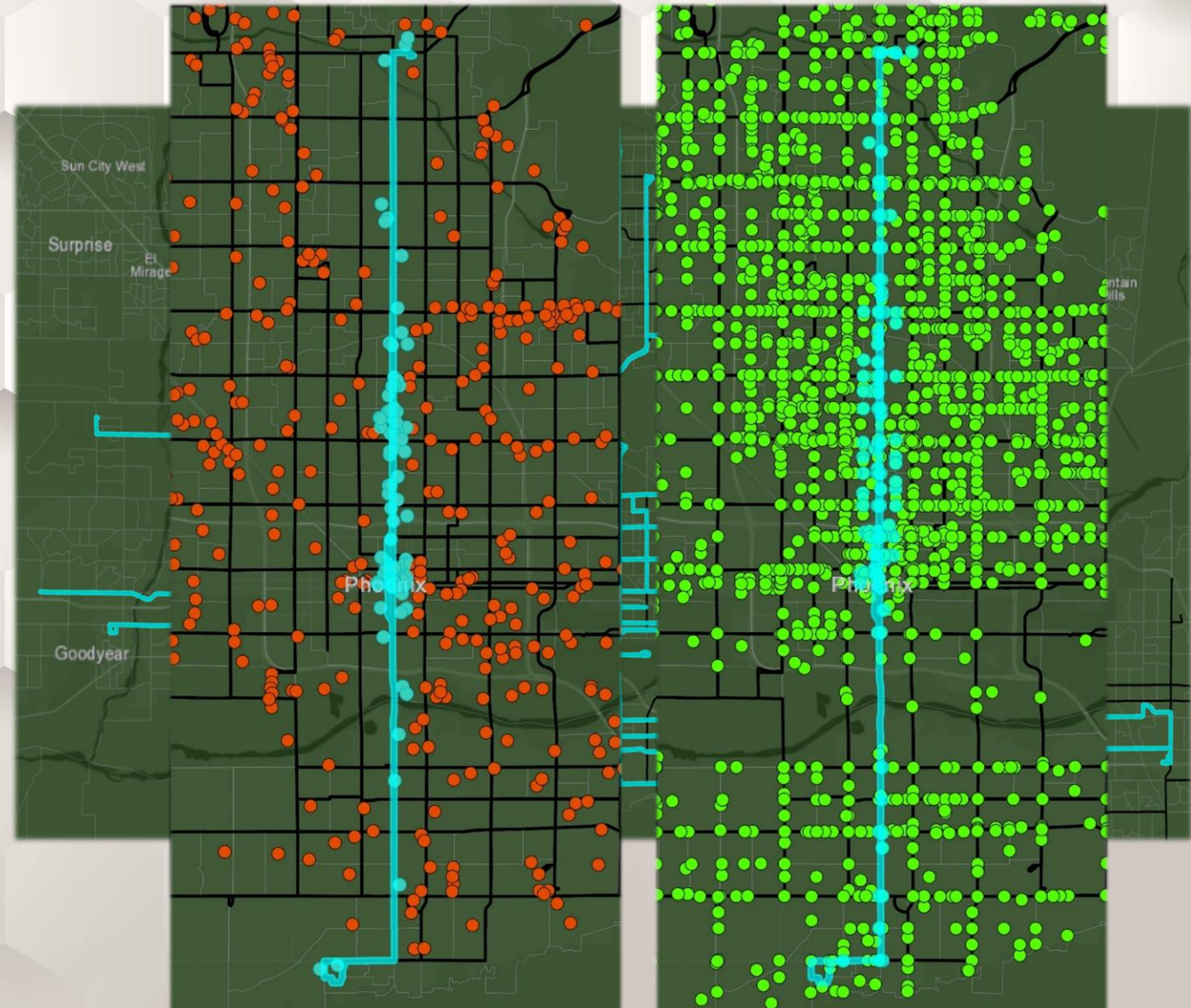
- ✓ *Selecting* with route alignment
- ✓ *Adding* all selections for a route based total



Method Overview-Automate

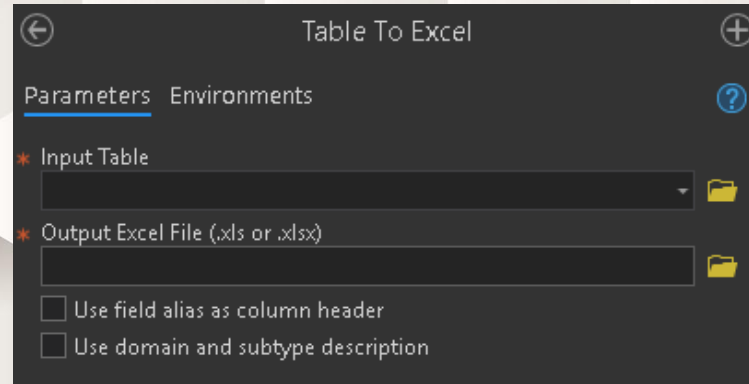
- ✓ Get creative with inputs
 - ✓ Point Pair Matching
 - ✓ Network intersection

- ✓ After correlation, calculation can be automated also



Method Overview-Correlate

- ✓ Transfer model outputs to statistics software



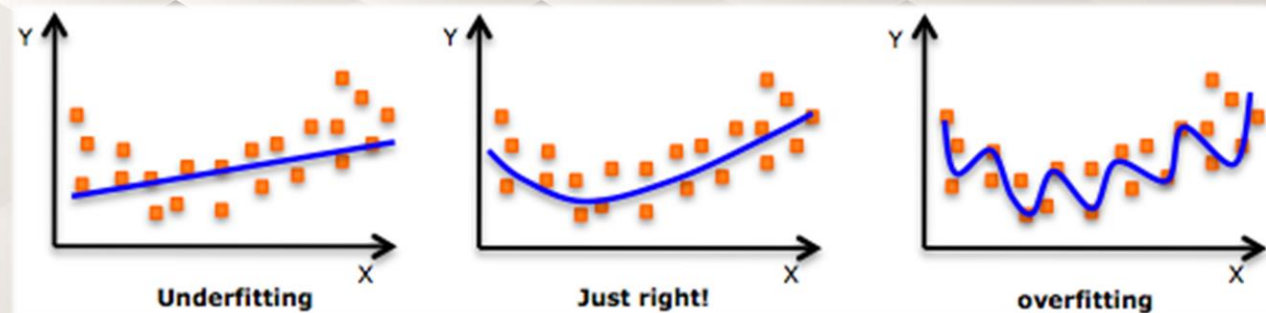
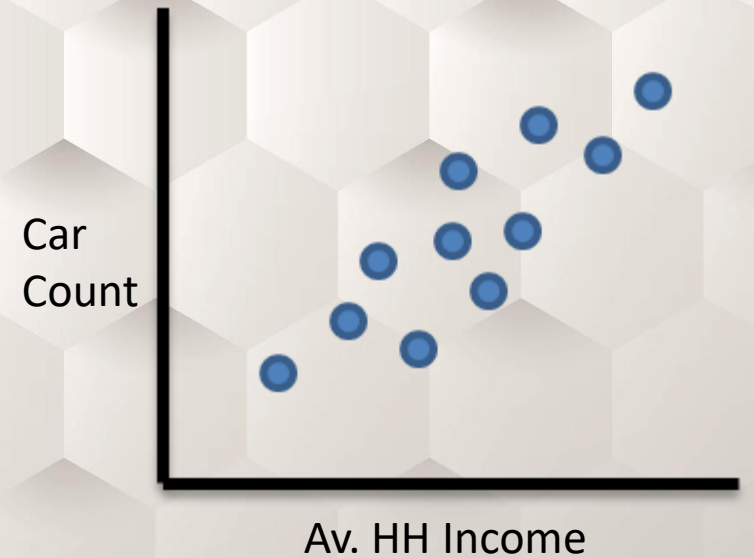
- ✓ Iterate through variable combinations, correlating to ridership to maximize R^2

OVERALL FIT	
Multiple R	0.980815
R Square	0.961998
Adjusted R Square	0.956979

Method Overview-Correlate

A few notes on iterating correlations:

- ✓ More \neq Better
- ✓ Beware of overfitting
- ✓ Proxies can work overtime
- ✓ Coefficient signs should map intuitions



Outcome

Variable	Current Coefficients
Total Pop	0.01278
Population Below Poverty	0.05774
Zero Vehicle Households	0.63462



Variables	Coefficients
Headway (Mins)	-26.84004
Route Miles (Weekday)	1.52376
Population	0.00236
Minority Population	0.02099
Car Count	-0.01882
Regional Commute Pattern Adherence	0.01626
Network Connectivity	0.44280

- ✓ Vast improvement in ridership prediction accuracy
- ✓ Low collinearity
- ✓ Requires just one extra input beyond census & network data

What's next?

- ✓ Automating correlation portion
- ✓ Stop based analysis
- ✓ Expansion beyond local bus
 - ✓ Getting into PnR dynamics

Thank you!

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