Rethinking Light Rail Transit in the Mile High City:

Assessing the Livability Benefits of Better Integrating Light Rail Transit into the Fabric of a Community

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Active Communities / Transportation Research Group

What do we look for in a good TOD?

Compact

Mix of Uses

Housing Choices

Travel Options

Public Spaces

Placemaking

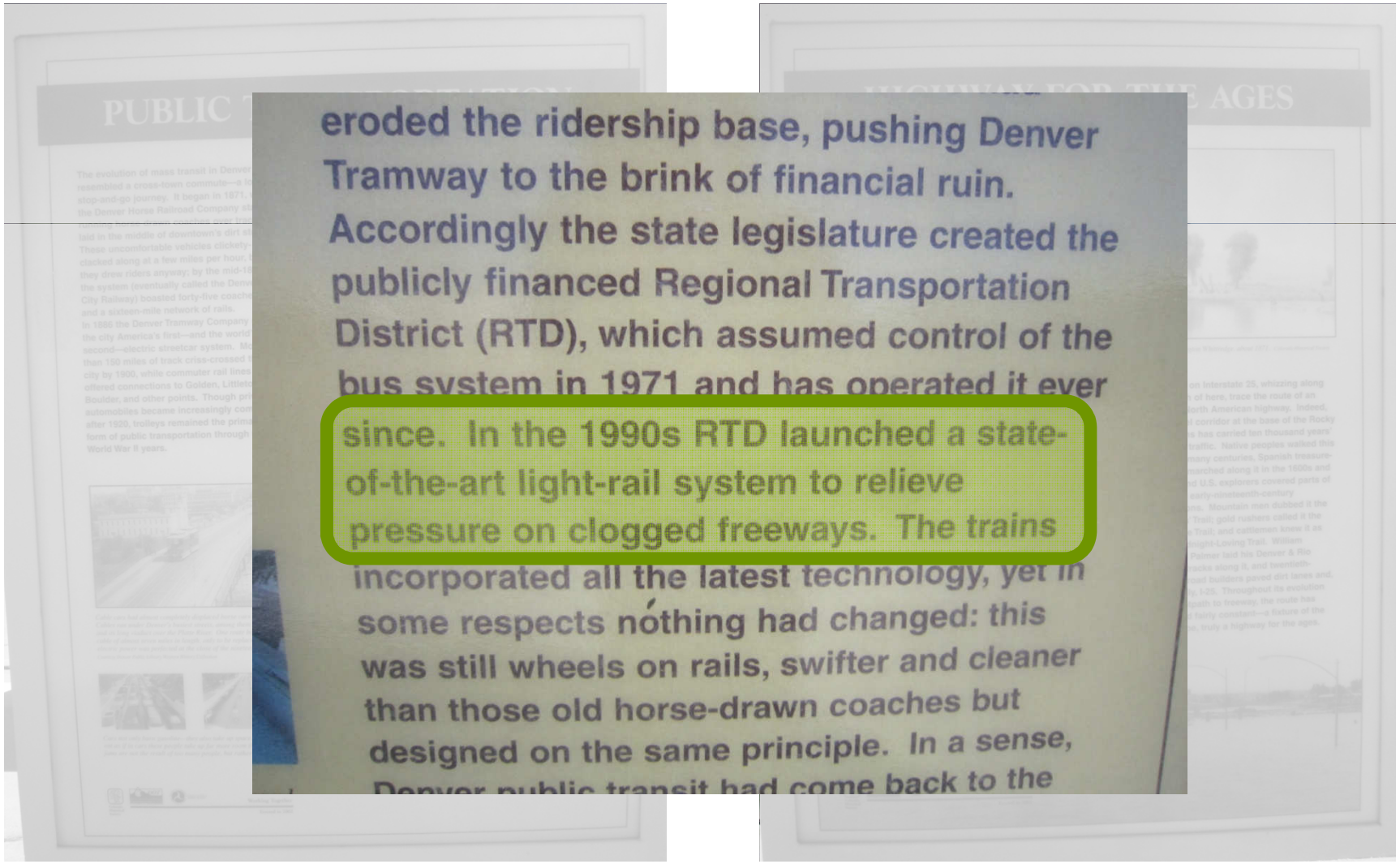
Location Efficiency

How do we measure success?

It depends upon your perspective…

From the perspective of a… Regional MPO

- Congestion Mitigation

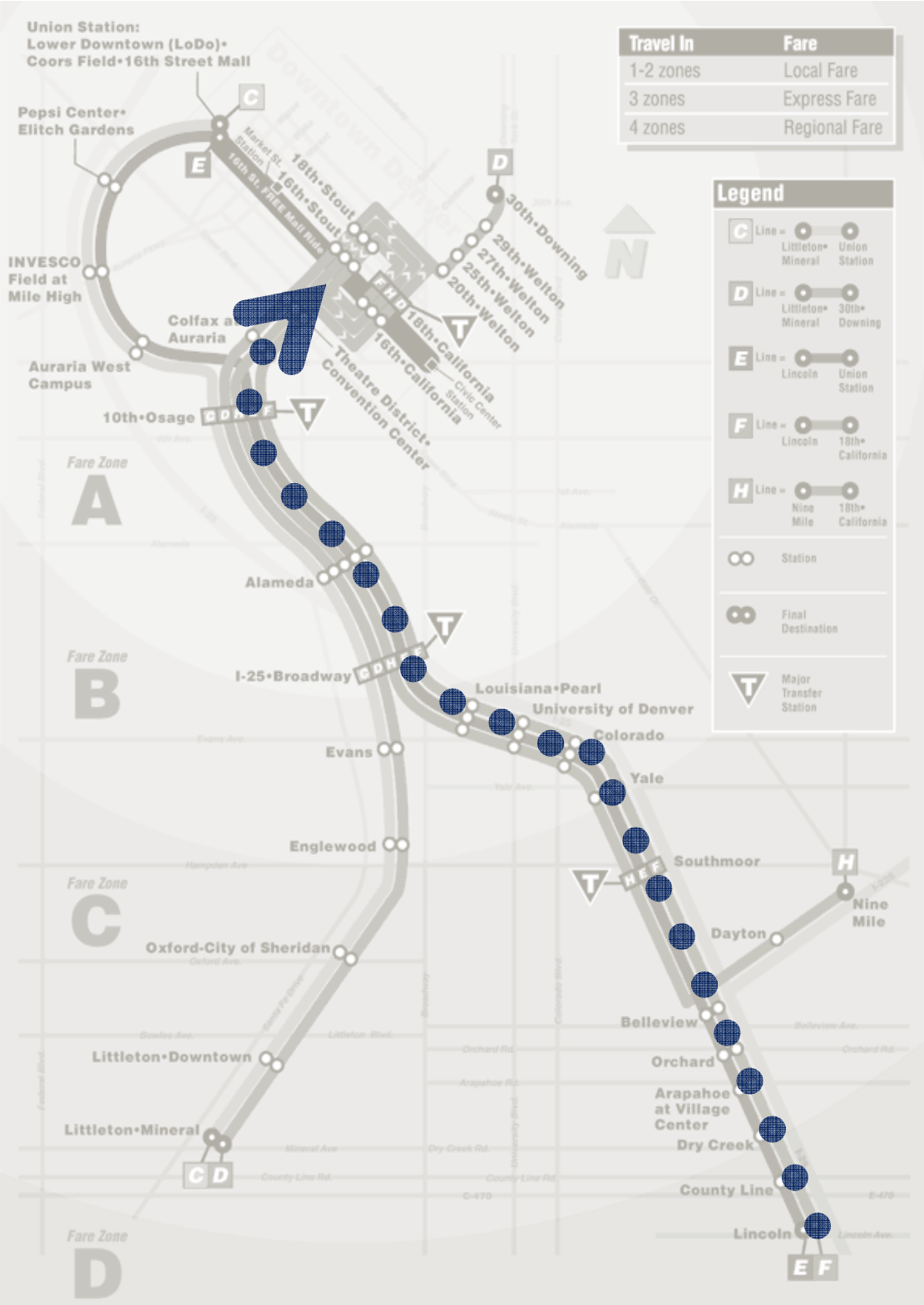


eroded the ridership base, pushing Denver Tramway to the brink of financial ruin. Accordingly the state legislature created the publicly financed Regional Transportation District (RTD), which assumed control of the bus system in 1971 and has operated it ever since. In the 1990s RTD launched a state-of-the-art light-rail system to relieve pressure on clogged freeways. The trains incorporated all the latest technology, yet in some respects nothing had changed: this was still wheels on rails, swifter and cleaner than those old horse-drawn coaches but designed on the same principle. In a sense, Denver public transit had come back to the

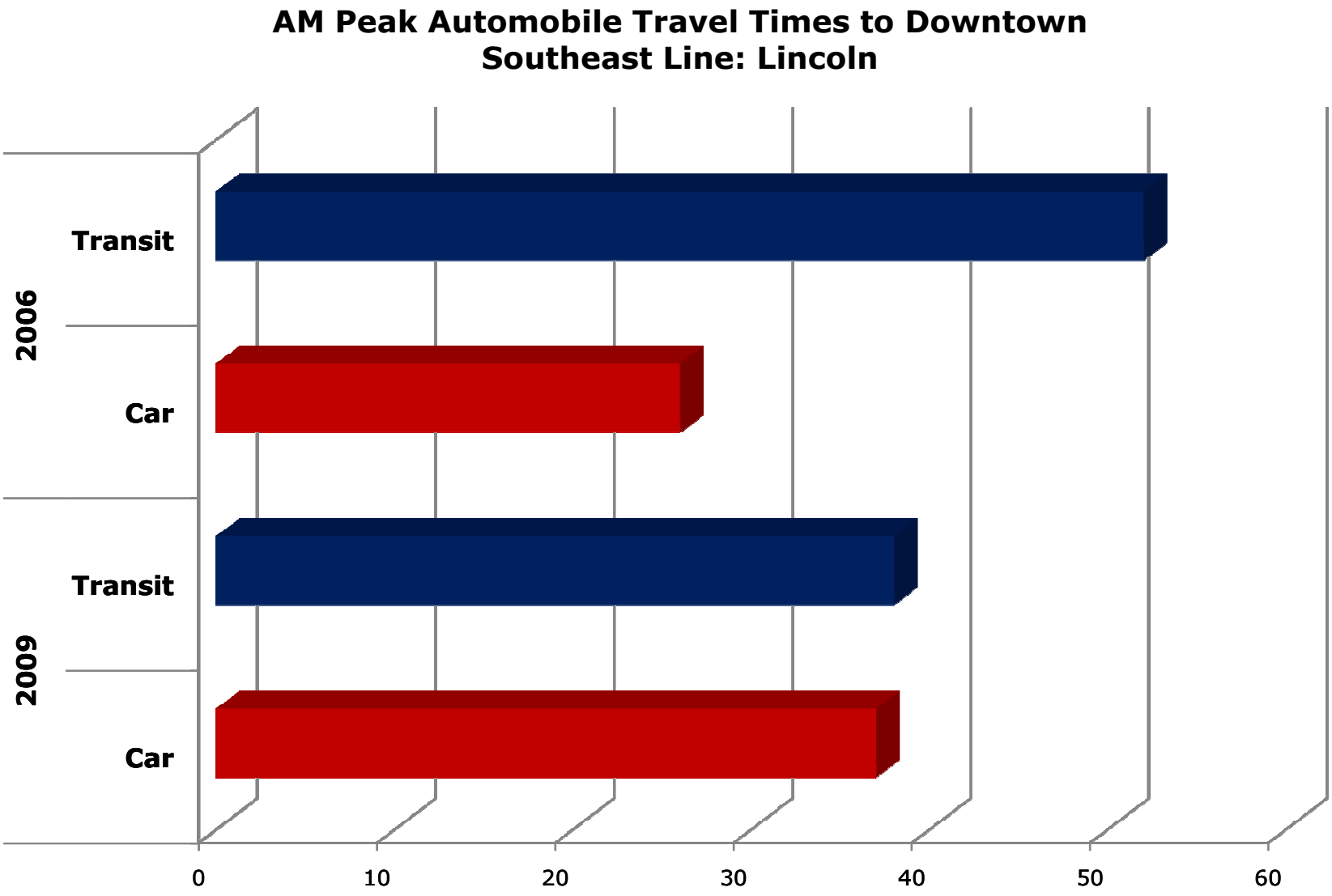
FedEx

DENVER LIGHT RAIL

Corridor	Opening Date	Length (miles)	Number of Stations
Central Corridor	1994	5.3 miles	14 stations
Southwest Corridor	2000	8.7 miles	5 stations
Central Platte Valley Spur	2002	1.8 mile	4 stations
Southeast Corridor	2006	19 miles	13 stations
TOTAL		35 miles	36 stations



From the perspective of a… Regional MPO



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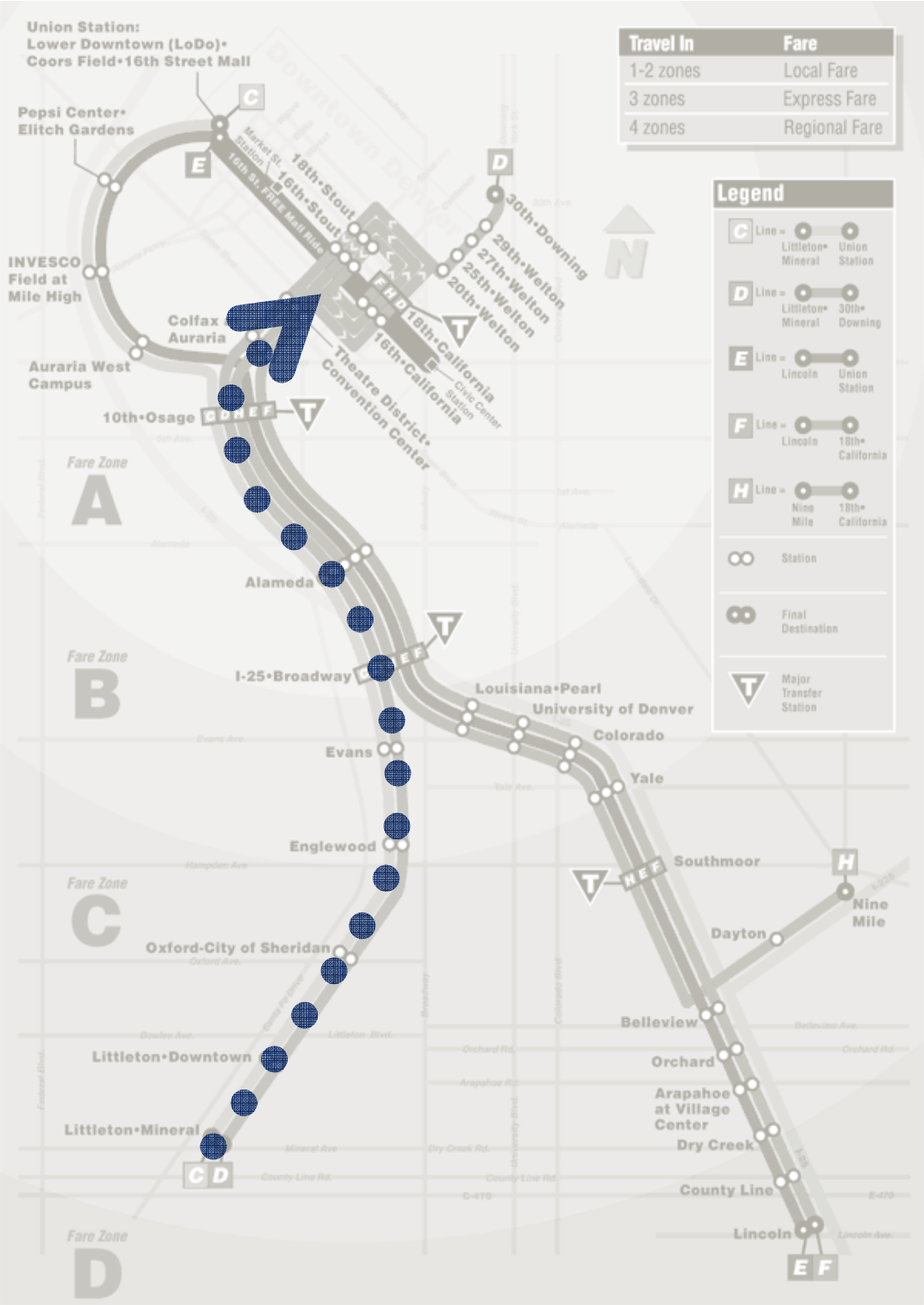
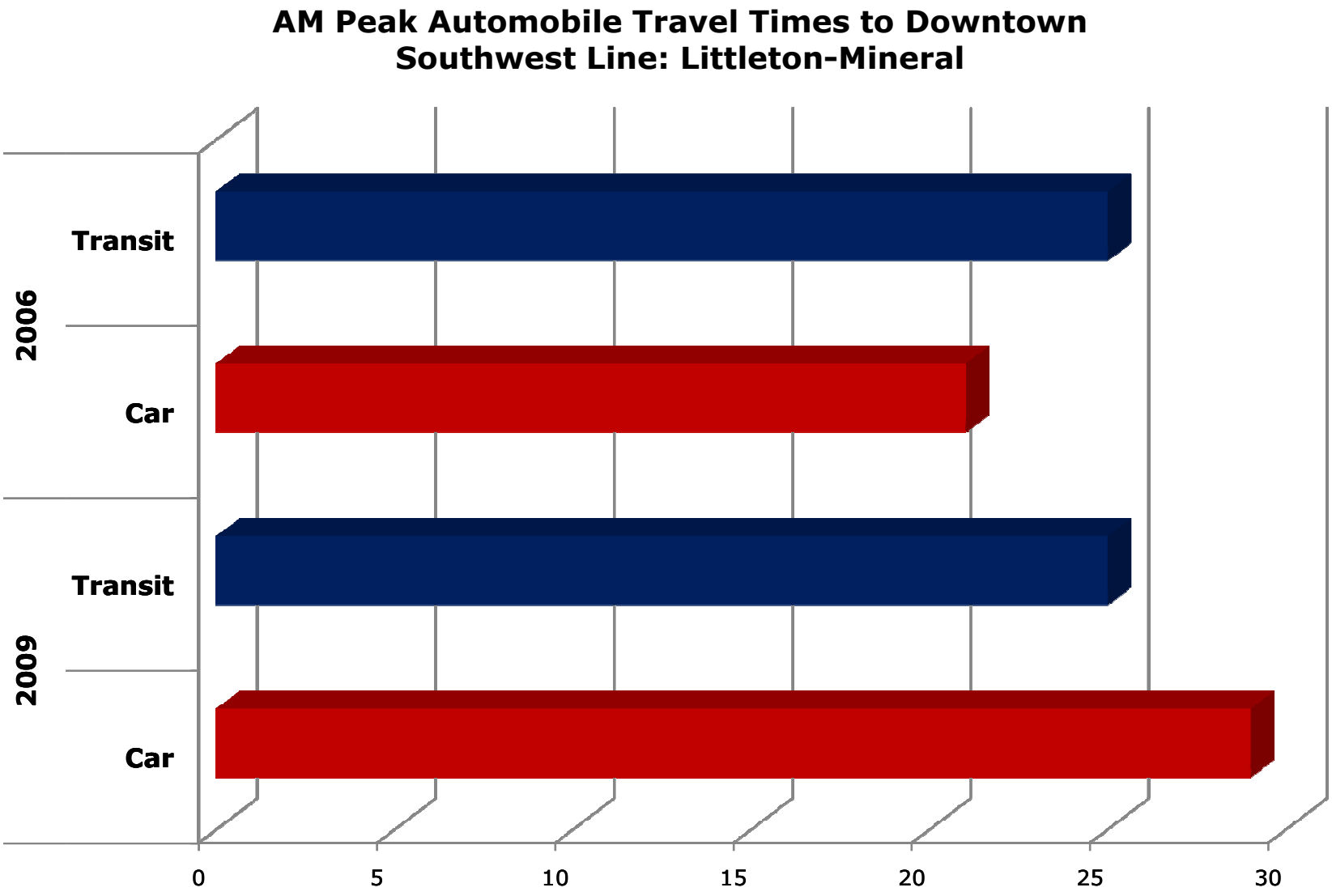
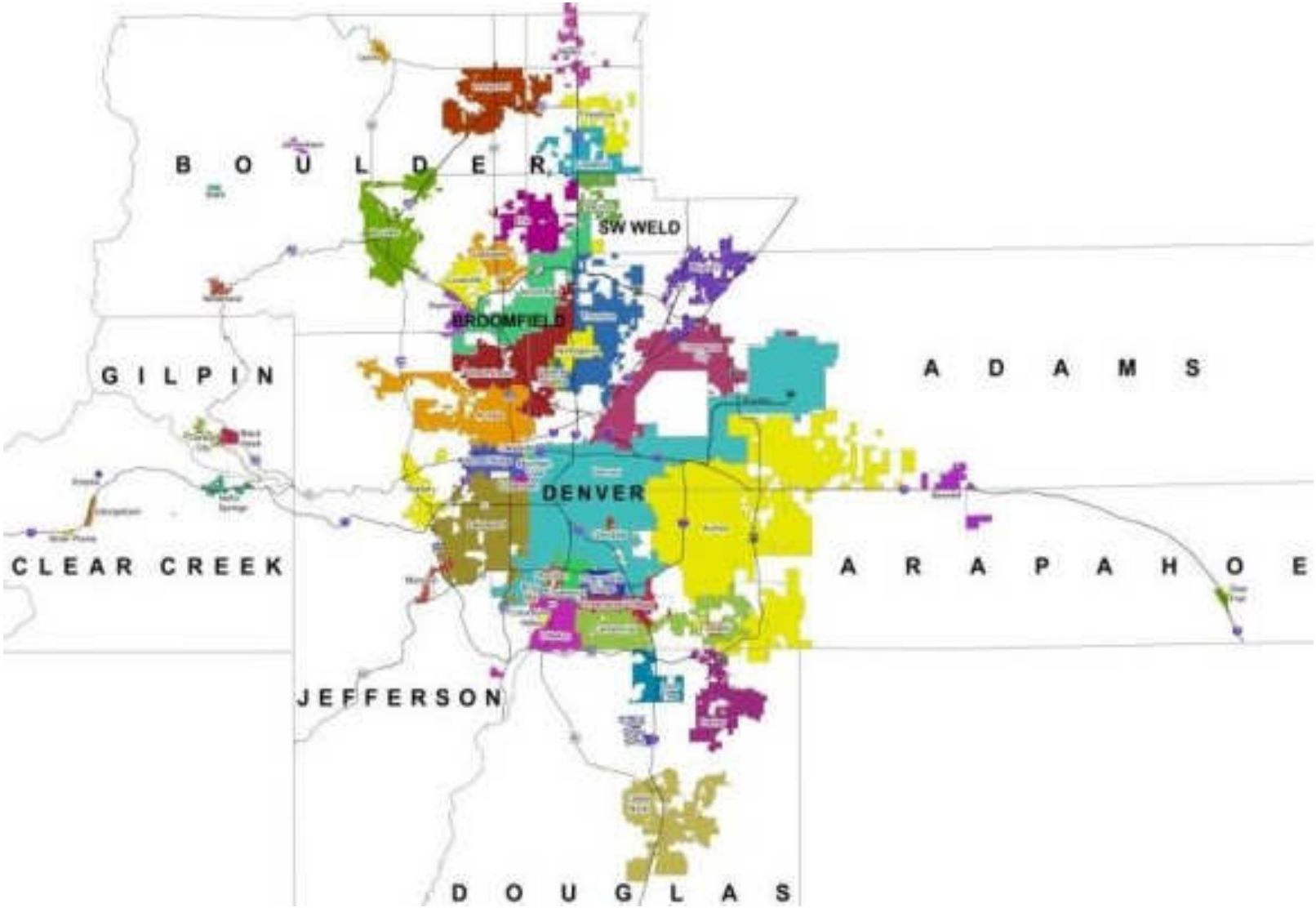


From the perspective of a… Regional MPO



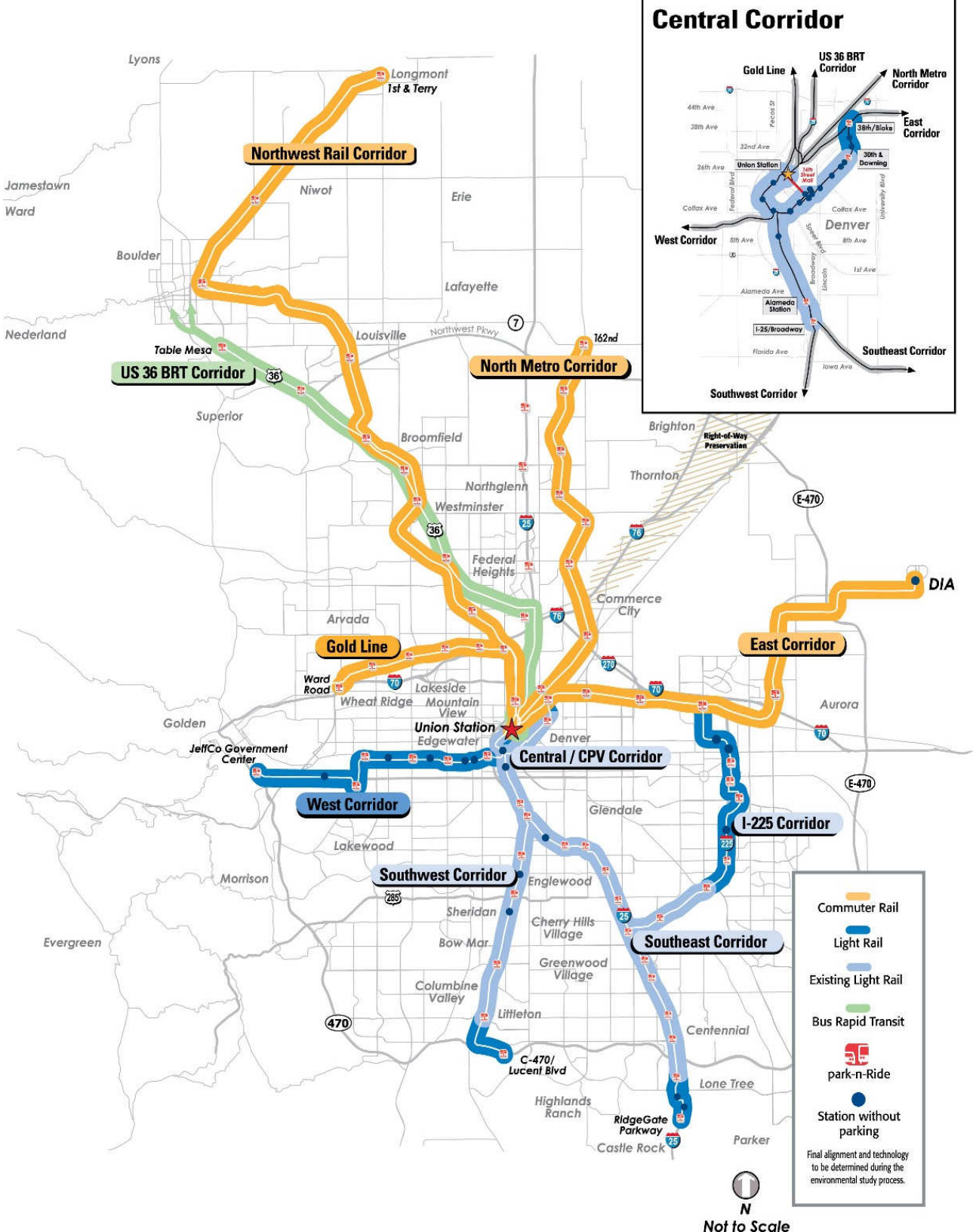
REGIONAL SETTING



FUTURE RAIL – FasTracks

COMPONENTS

- Total 122 miles of rail
  - Six new CR and LRT lines
  - Three extensions of LRT
- 18 miles of BRT
- 57 proposed new stations
- 21,000 new parking spaces
- Redevelopment of the historic Denver Union Station
- FastConnects program to provide connecting bus service to new transit facilities



From the perspective of a… Transit Agency

- Ridership

Long
AVE
7700S
Jackass Hill
ROAD

From the perspective of a… National Government

- VMT
  - Why is VMT important?
    - Because VMT is typically a proxy for:
      - Low automobile ownership
      - Higher walking, biking, and transit usage
      - Better proximity to jobs

But all VMT is not created equal… Low VMT could also be indicative of high unemployment rates, so it's not always a good thing

And even a TOD with very low VMT per capita does not necessarily mean there is a regional benefit…

If we want to see long-term, region-wide benefits, we need people that normally wouldn’t think they want to live in places like these to want to live in places like these….

From the perspective of… someone that lives there?

Livability

So what is… *Livability*?

U.S. DOT 6 Principles of Livability

1. Provide more transportation choices
2. Expand location- and energy-efficient housing choices
3. Improve economic competitiveness of neighborhoods
4. Target federal funding toward existing communities
5. Align federal policies and funding
6. Enhance the unique characteristics of all communities

"**Livability** refers to the degree to which a place, be it a neighborhood, town or city, supports **quality of life**, **health and wellbeing** for the people who live, work or visit. Cities considered to have a high degree of livability tend to have a high level of, and widespread accessibility to, **amenity**."

- Commission for Architecture and the Built Environment, London 2007

"**Livability** refers to **the subset of sustainability objectives** that directly affect community members. They generally share the same objectives, but often with somewhat differing perspectives and priorities."

- Todd Litman, *Well Measured*

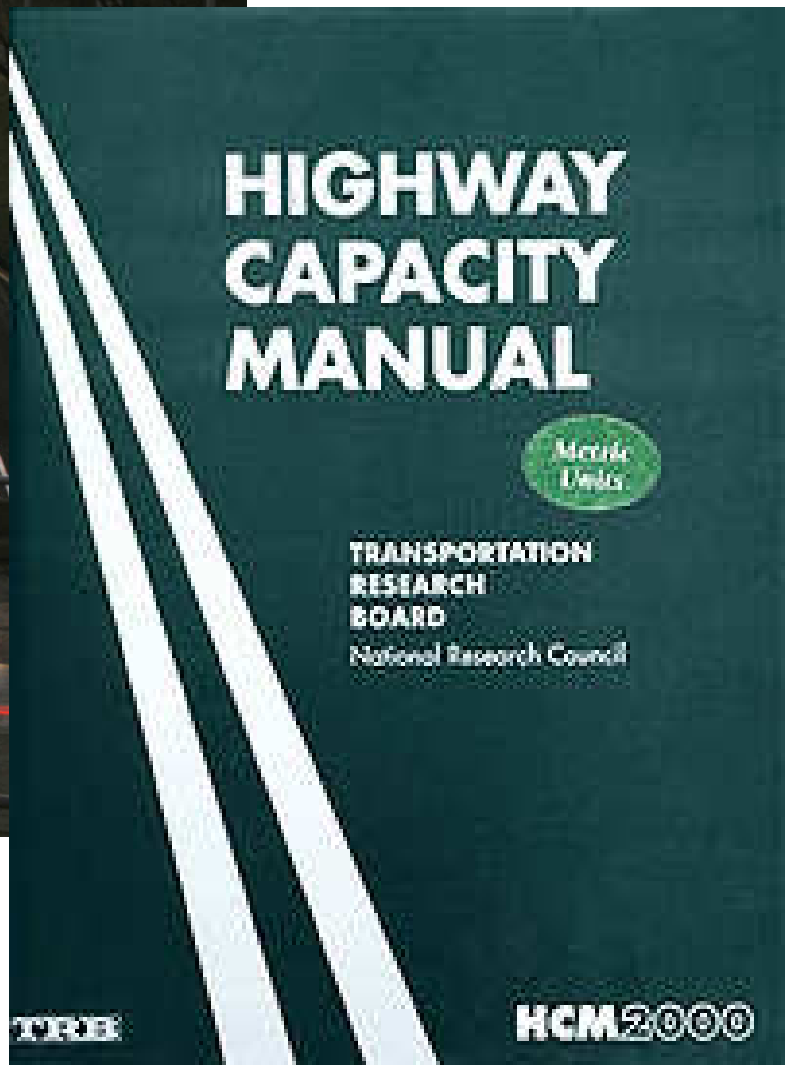
Transportation Index for Sustainable Places (TISP)

What is Transportation?

Commonly interpreted as mobility…

A → B

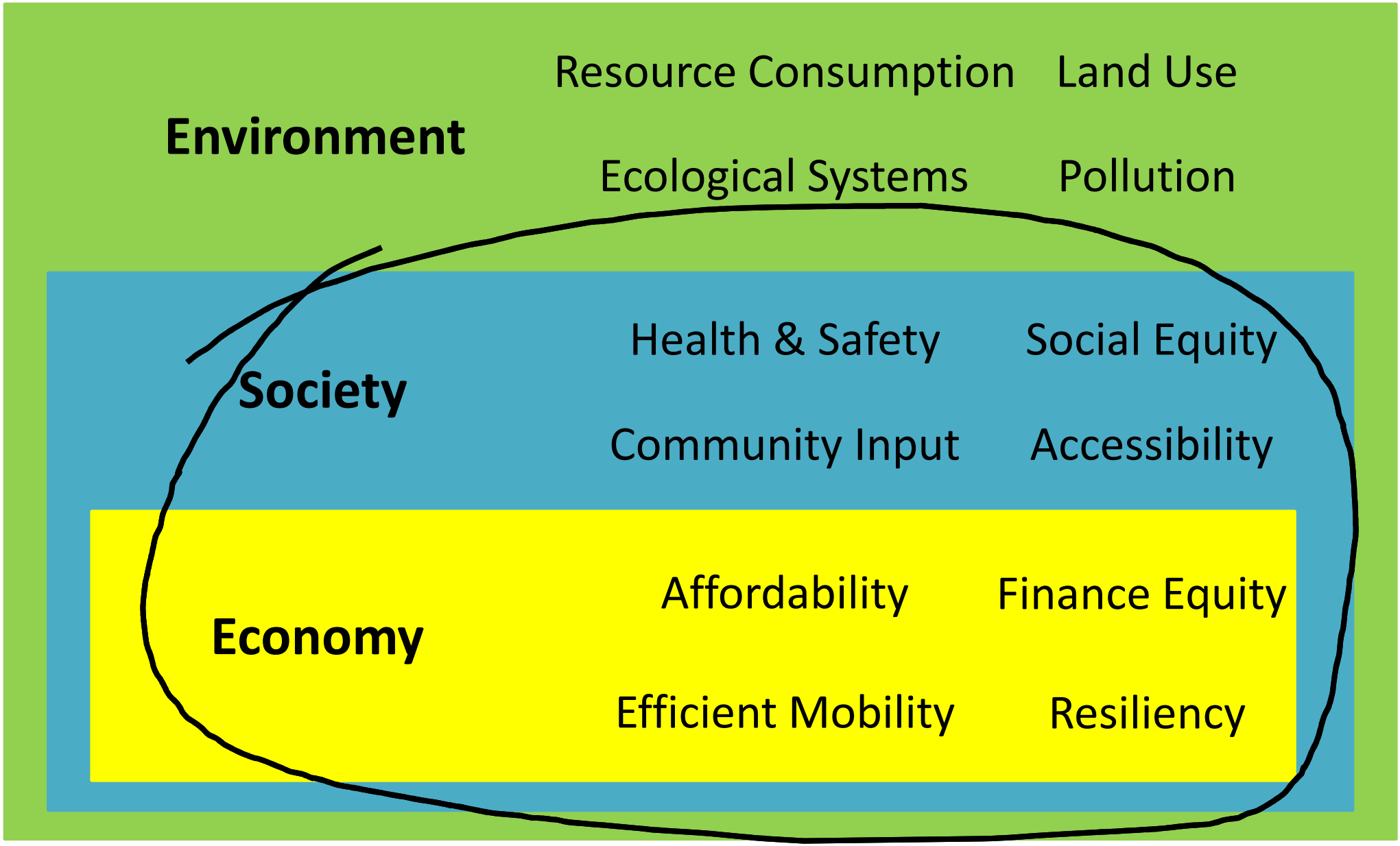
What is Transportation?



What is Transportation?

When it comes to transportation,
what gets measured,
gets managed…

Transportation Sustainability



Social Elements

Element
Provides Health and Safety
Promotes Social Equity
Includes Community Input
Meets Access Needs

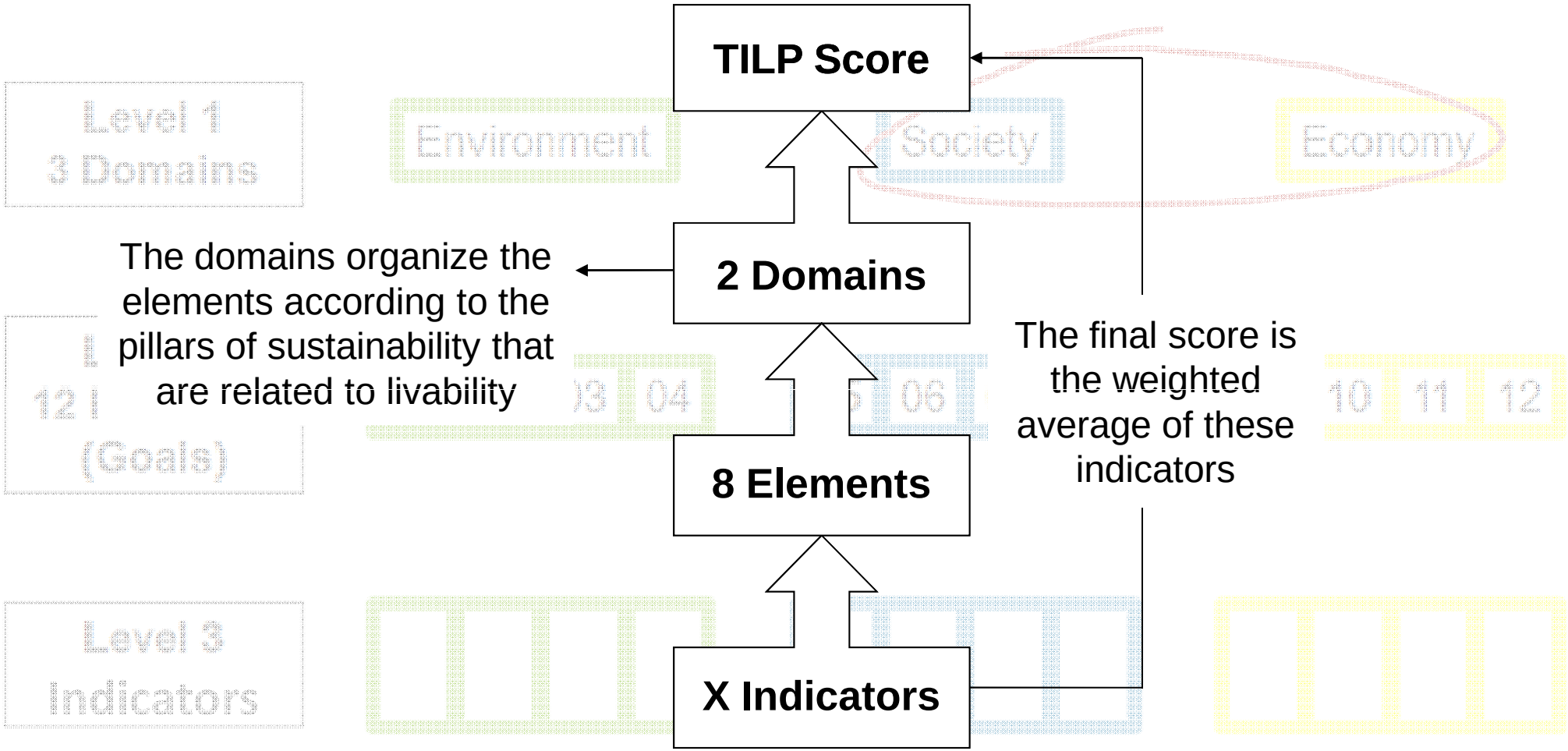
Economic Elements

Element
Affordable for Individuals
Financed in an Equitable Manner
Provides Efficient Movement for Economic Activity
Resiliency to Economic Fluctuations

Transportation Index for ~~Sustainable~~ Places ~~(TISP)~~

Livable TILP

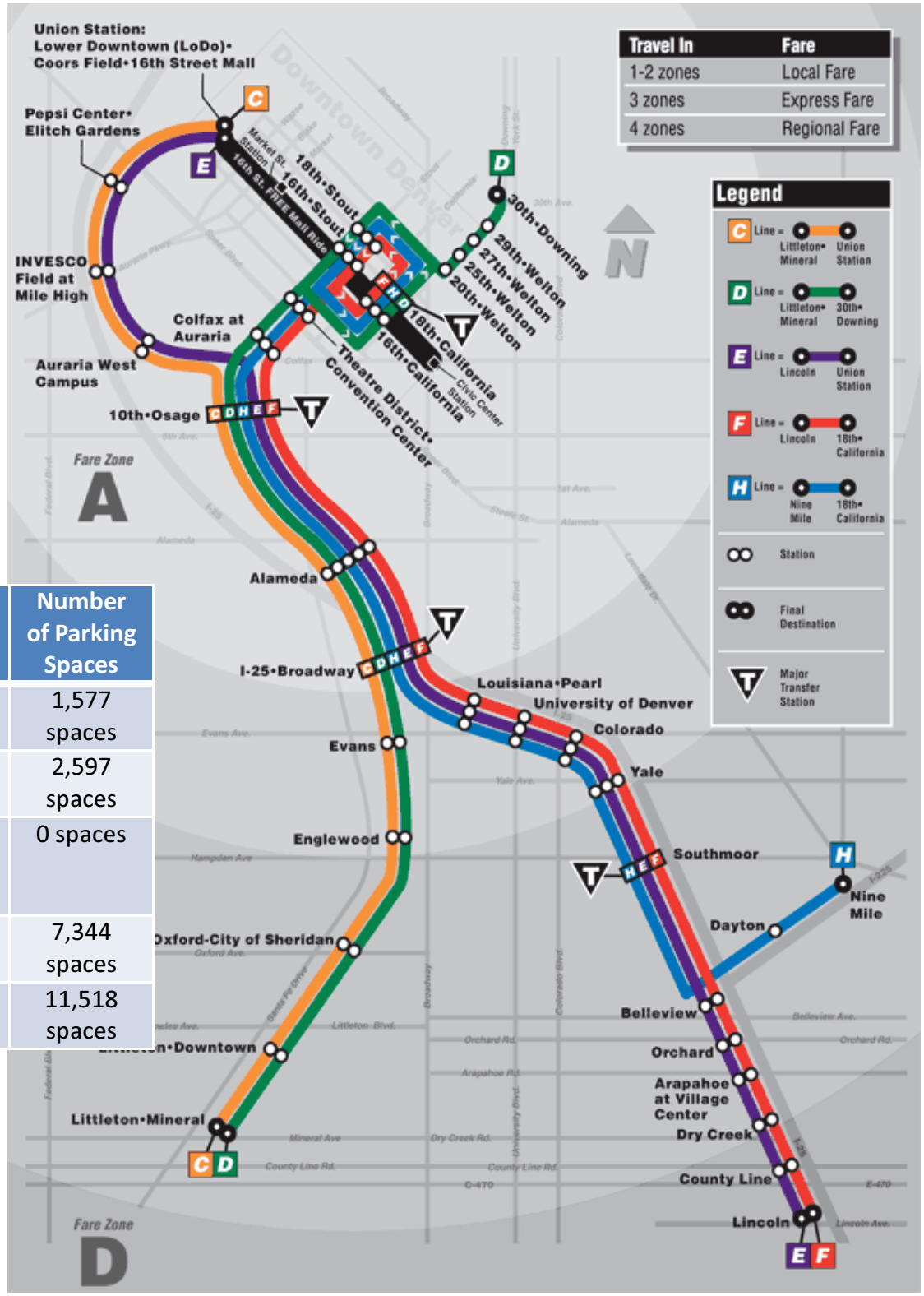
Structural Model of the Index



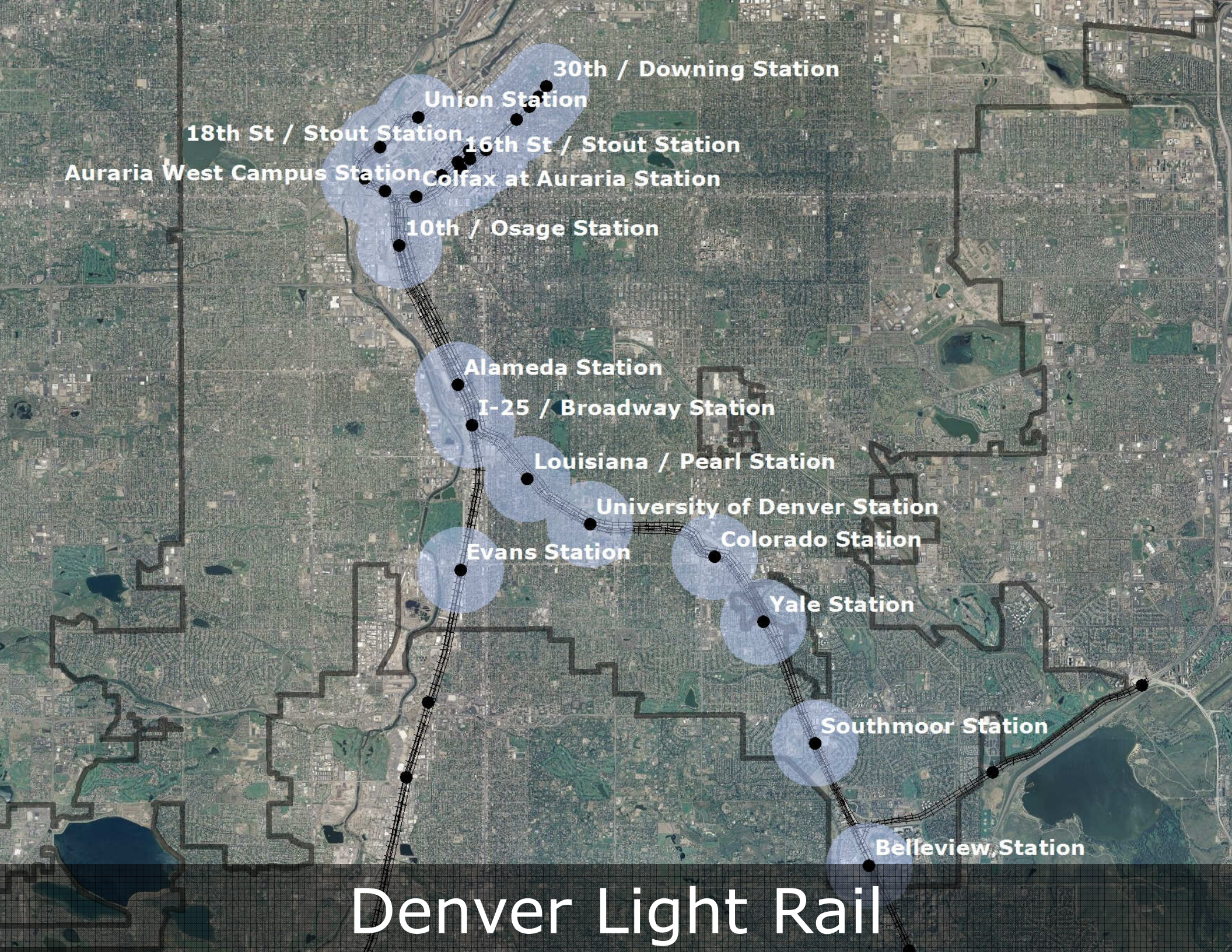
Scoring Livability for Light Rail Transit Stations in Denver, CO

EXISTING LIGHT RAIL

Corridor	Opening Date	Capital Costs (millions)	Length (miles)	Number of New Stations	Number of Parking Spaces
Central Corridor	1994	$116.5 (1994$)	5.3 miles	14 stations	1,577 spaces
Southwest Corridor	2000	$177 (2000$)	8.7 miles	5 stations	2,597 spaces
Central Platte Valley Spur	2002	$47.8 (2002$)	1.8 mile	4 stations	0 spaces
Southeast Corridor	2006	$879 (2006$)	19 miles	13 stations	7,344 spaces
TOTAL			35 miles	36 stations	11,518 spaces



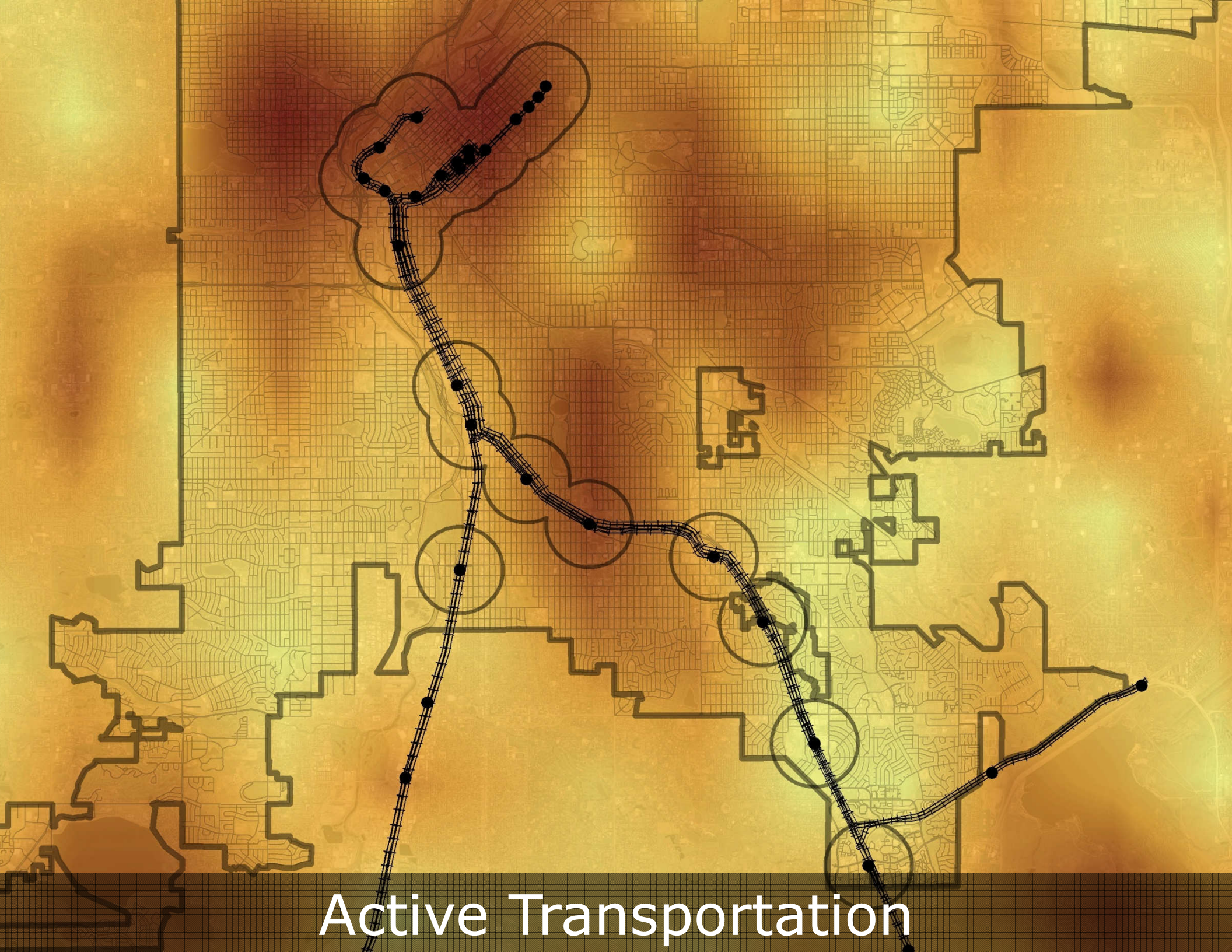
Denver Light Rail



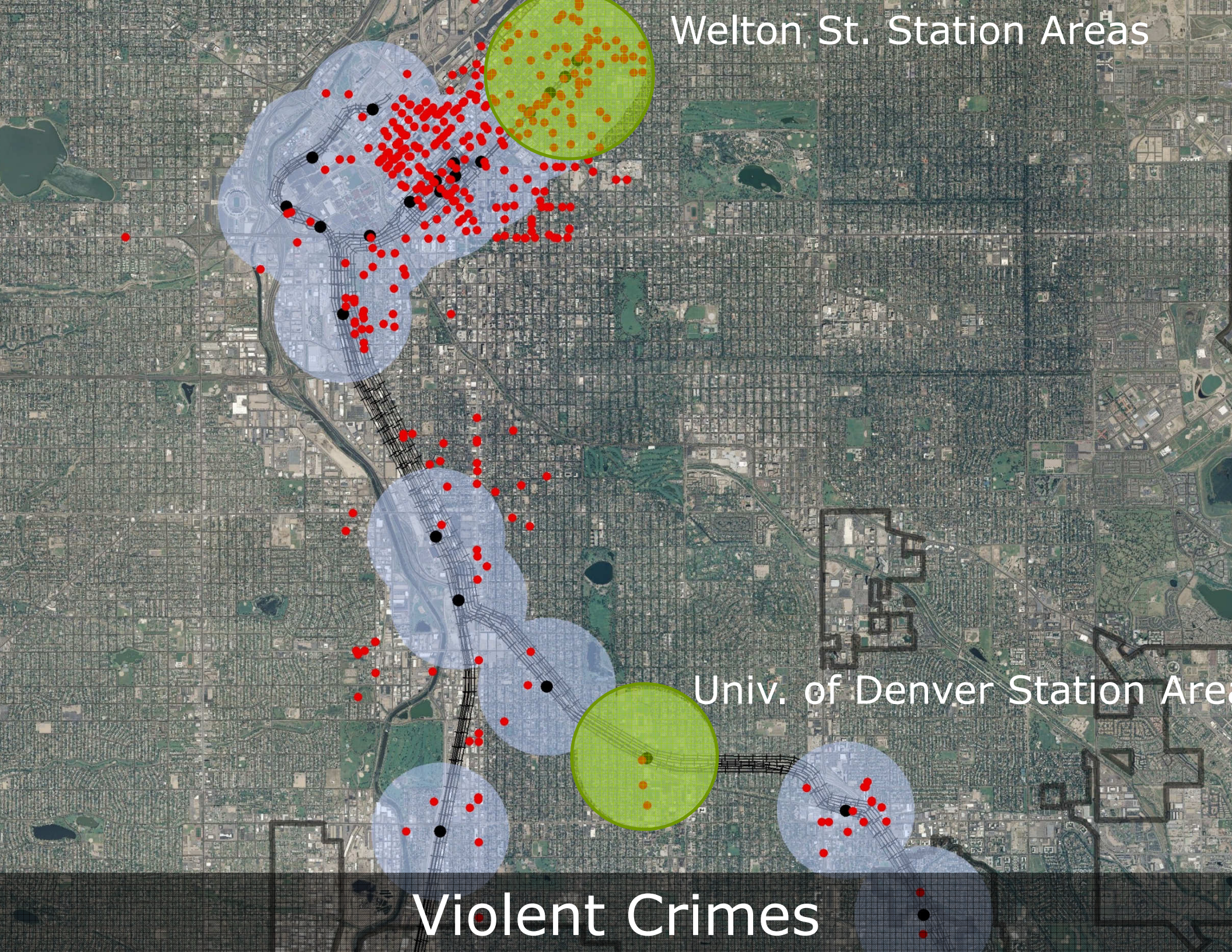
Denver Light Rail

Social Elements

Element	
Provides Health and Safety	Active Transport Crime Crashes
Promotes Social Equity	
Includes Community Input	
Meets Access Needs	

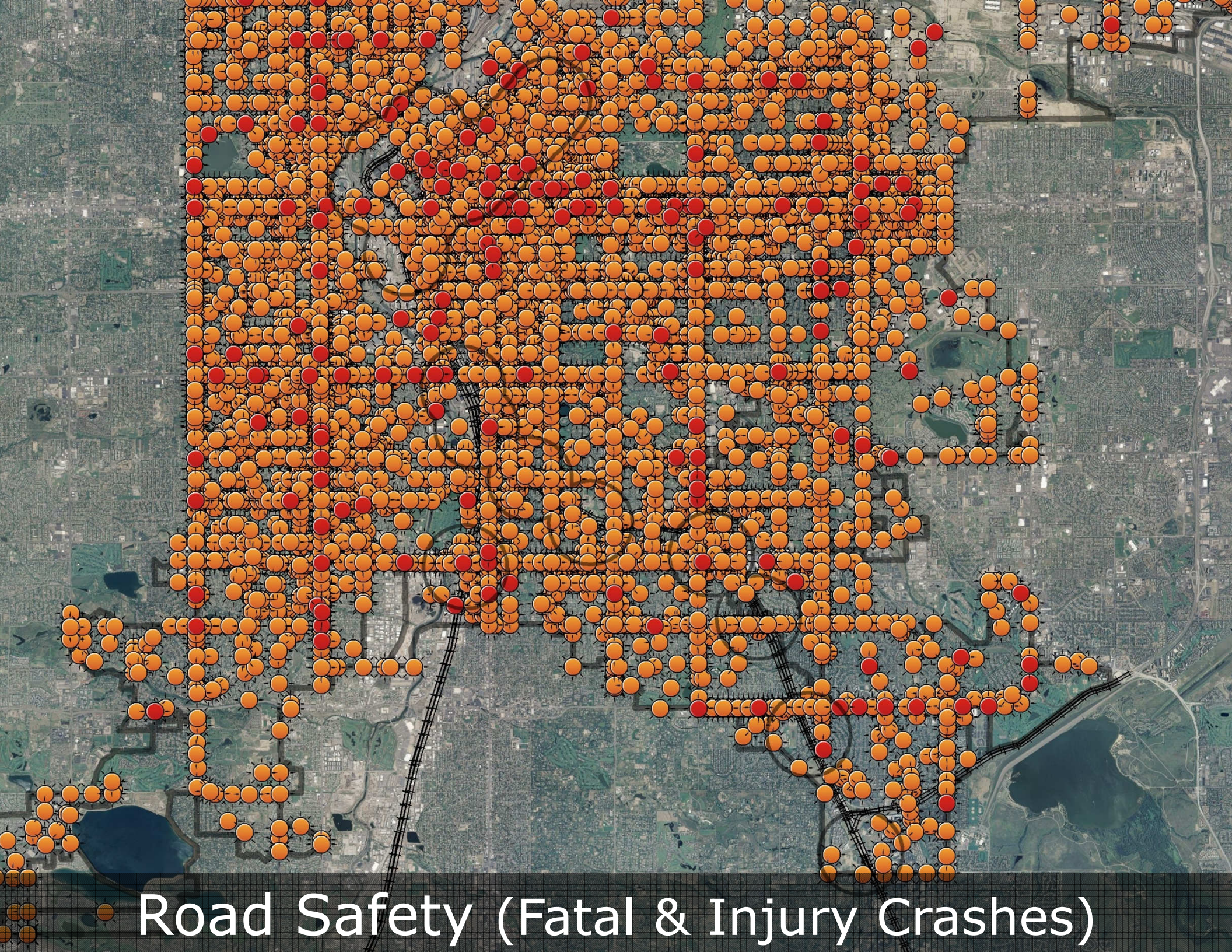


Active Transportation


Welton St. Station Areas
Univ. of Denver Station Area
Violent Crimes

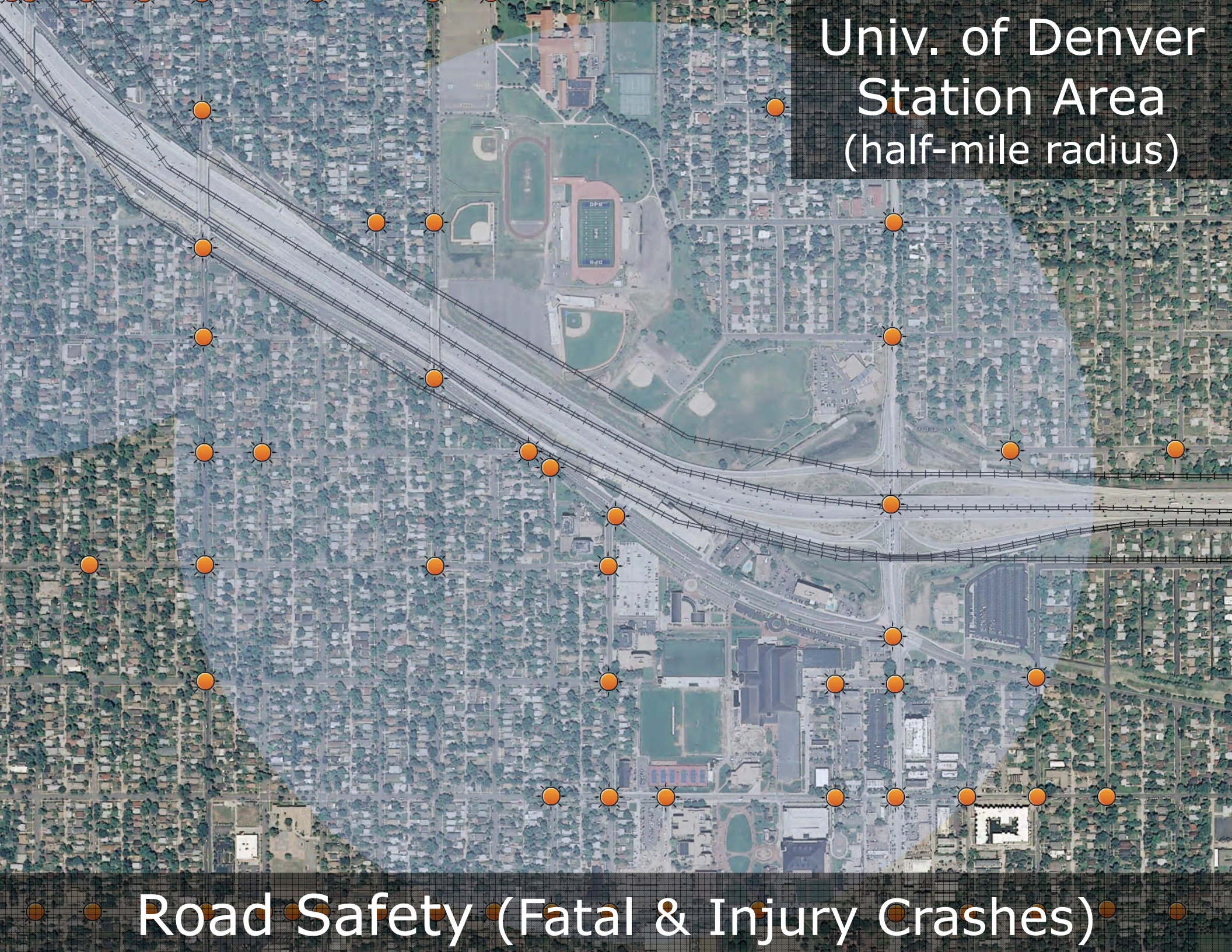
Welton Street
Station Areas
(half-mile radius)
Violent Crimes

Violent Crimes



Road Safety (Fatal & Injury Crashes)

Welton Street
Station Areas
(half-mile radius)
Road Safety (Fatal & Injury Crashes)

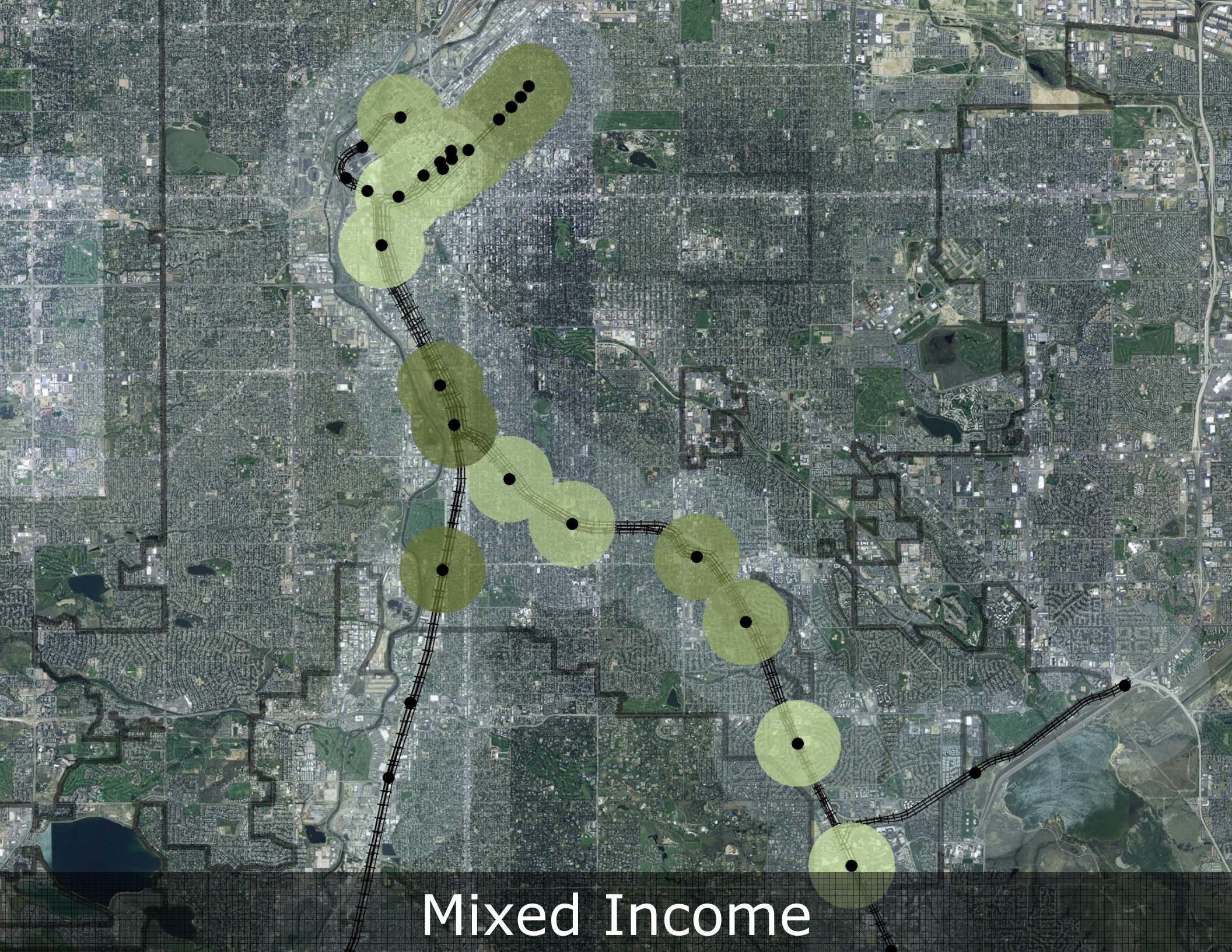

Univ. of Denver
Station Area
(half-mile radius)
Road Safety (Fatal & Injury Crashes)

Social Elements

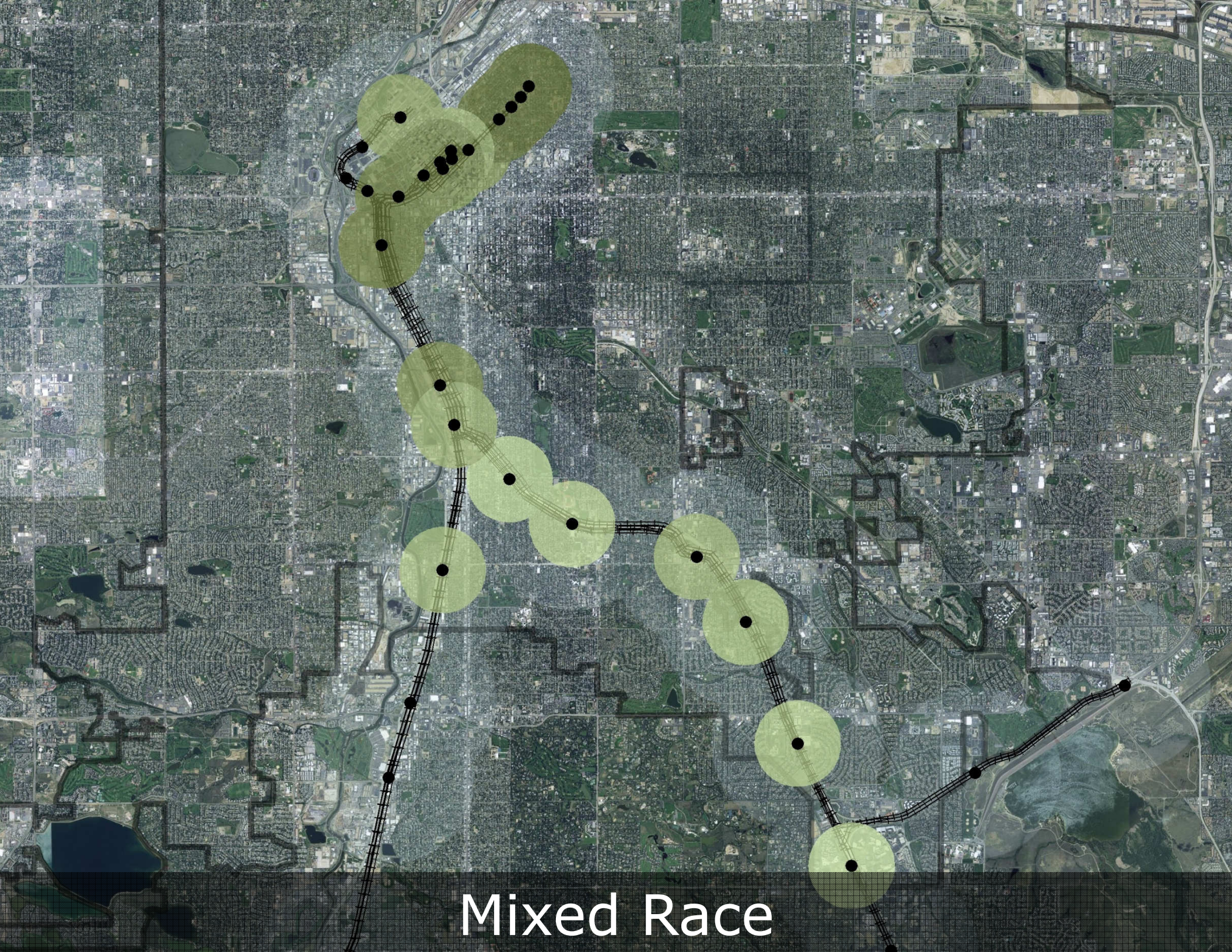
Element	Variable
Provides Health and Safety	Active Transport Crime Crashes
Promotes Social Equity	Mixed Income Mix of Races
Includes Community Input	
Meets Access Needs	

Mixed Income / Mixed Race

- Shannon-Weiner Bio-Diversity Index
  - Measures the diversity of an eco-system
    - Adapted outcome to represent a measure of “evenness” that ranges from zero to 1 with the higher number representing a better mix of incomes or races



Mixed Income

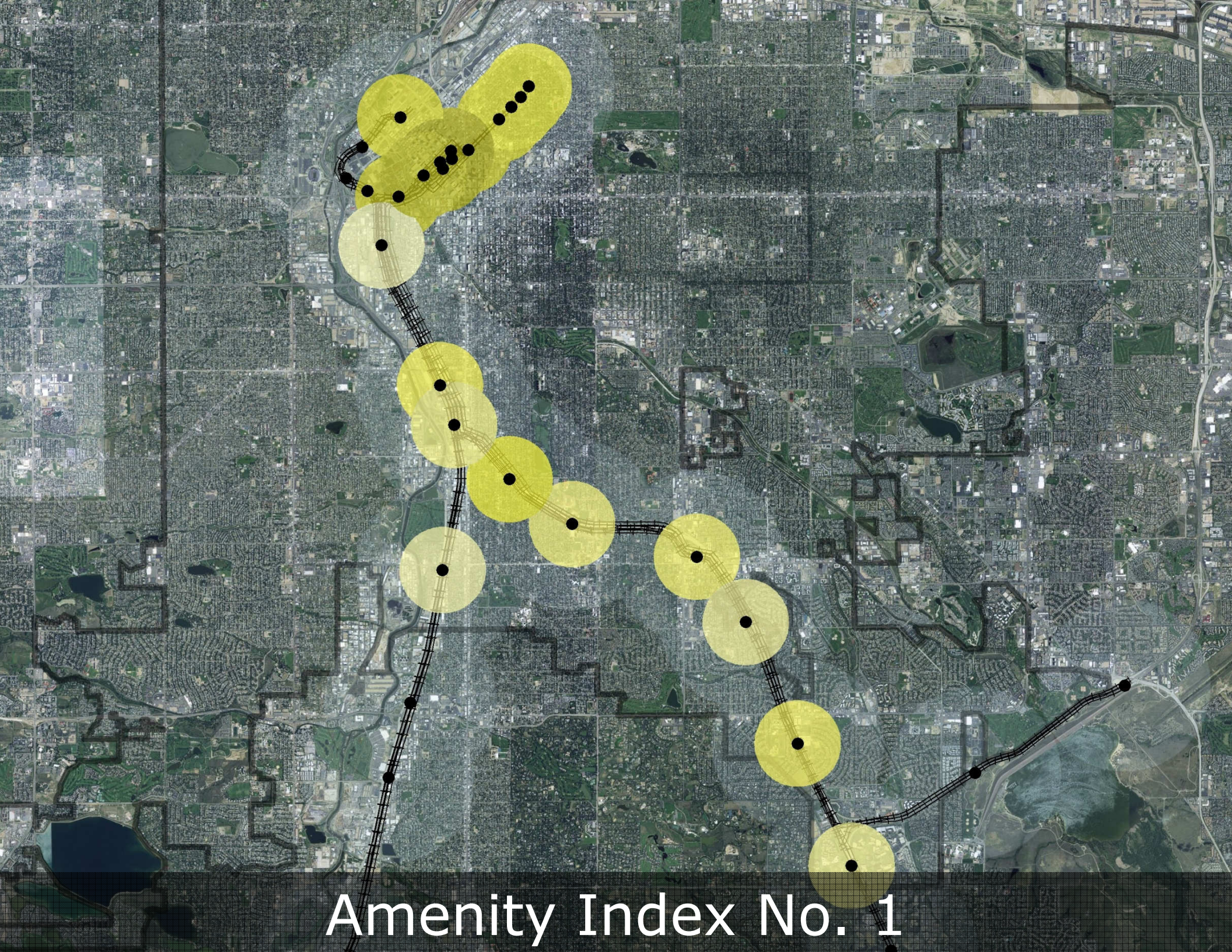

Mixed Race

Social Elements

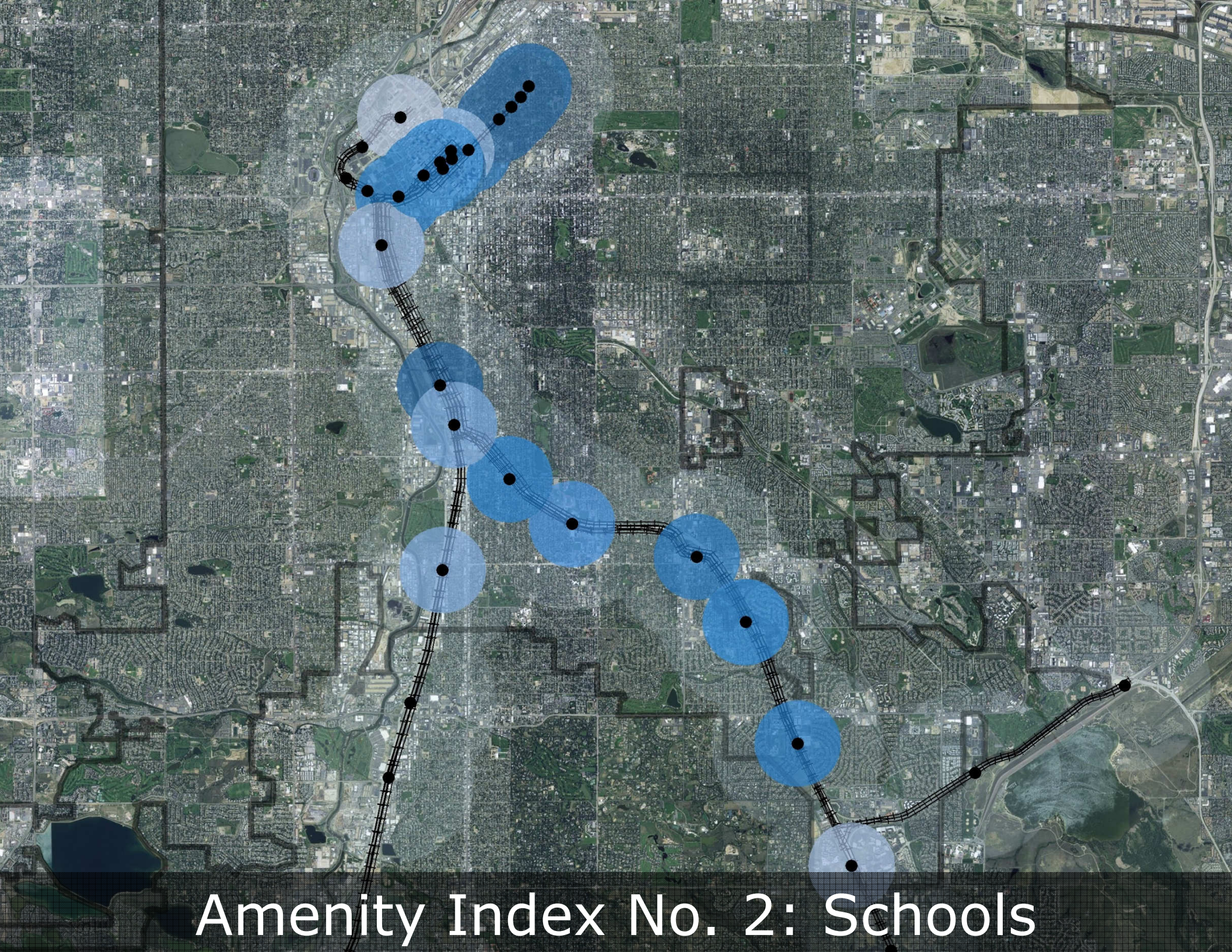
Element	Variable
Provides Health and Safety	Active Transport Crime Crashes
Promotes Social Equity	Mixed Income Mix of Races
Includes Community Input	-
Meets Access Needs	Access Amenities Local Walkability Access to Parks and Recreation Centers

Access to Amenities

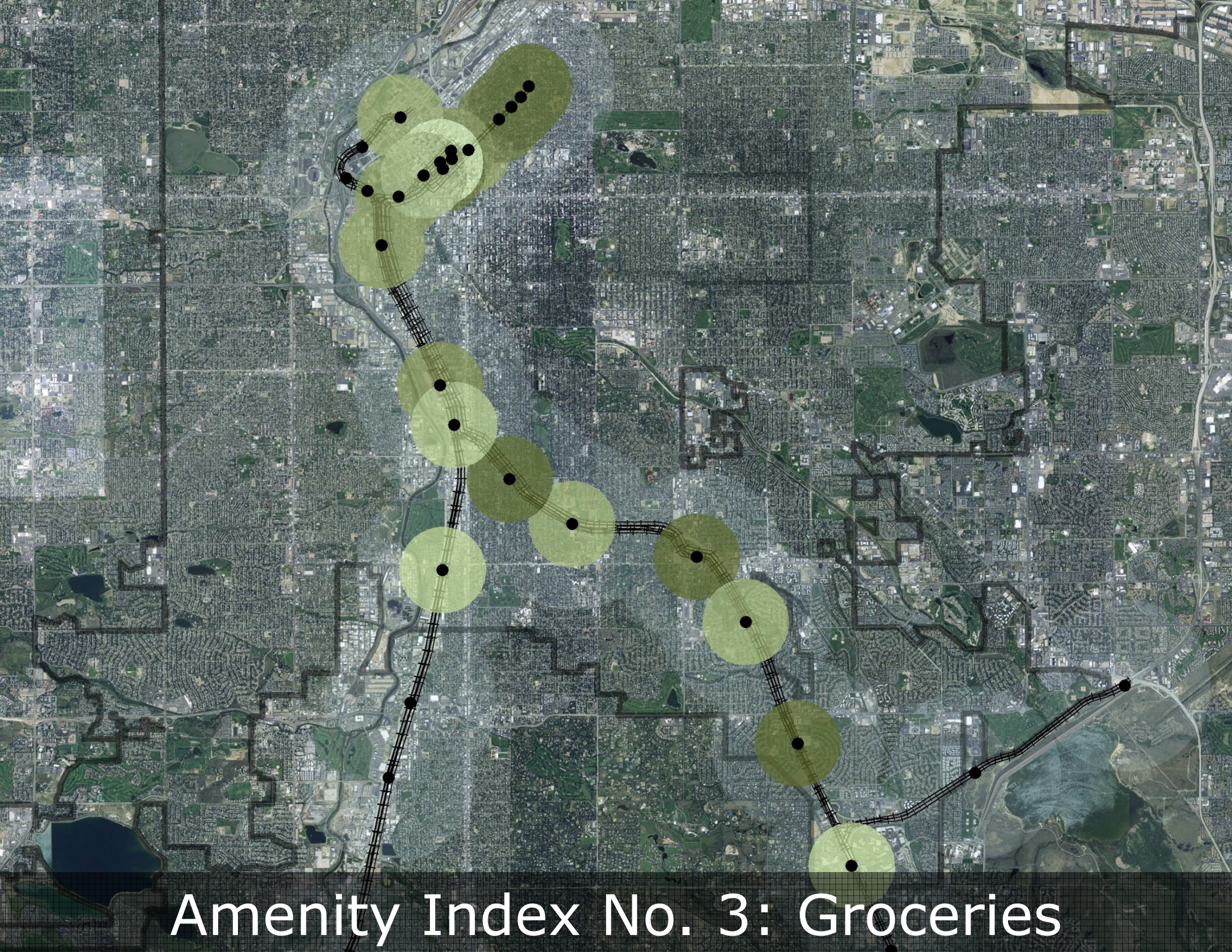
- Index No. 1
  - Restaurants
  - Shopping
  - Coffee
  - Parks
  - Books
  - Entertainment
  - Banking
- Index No. 2
  - Schools
- Index No. 3
  - Groceries



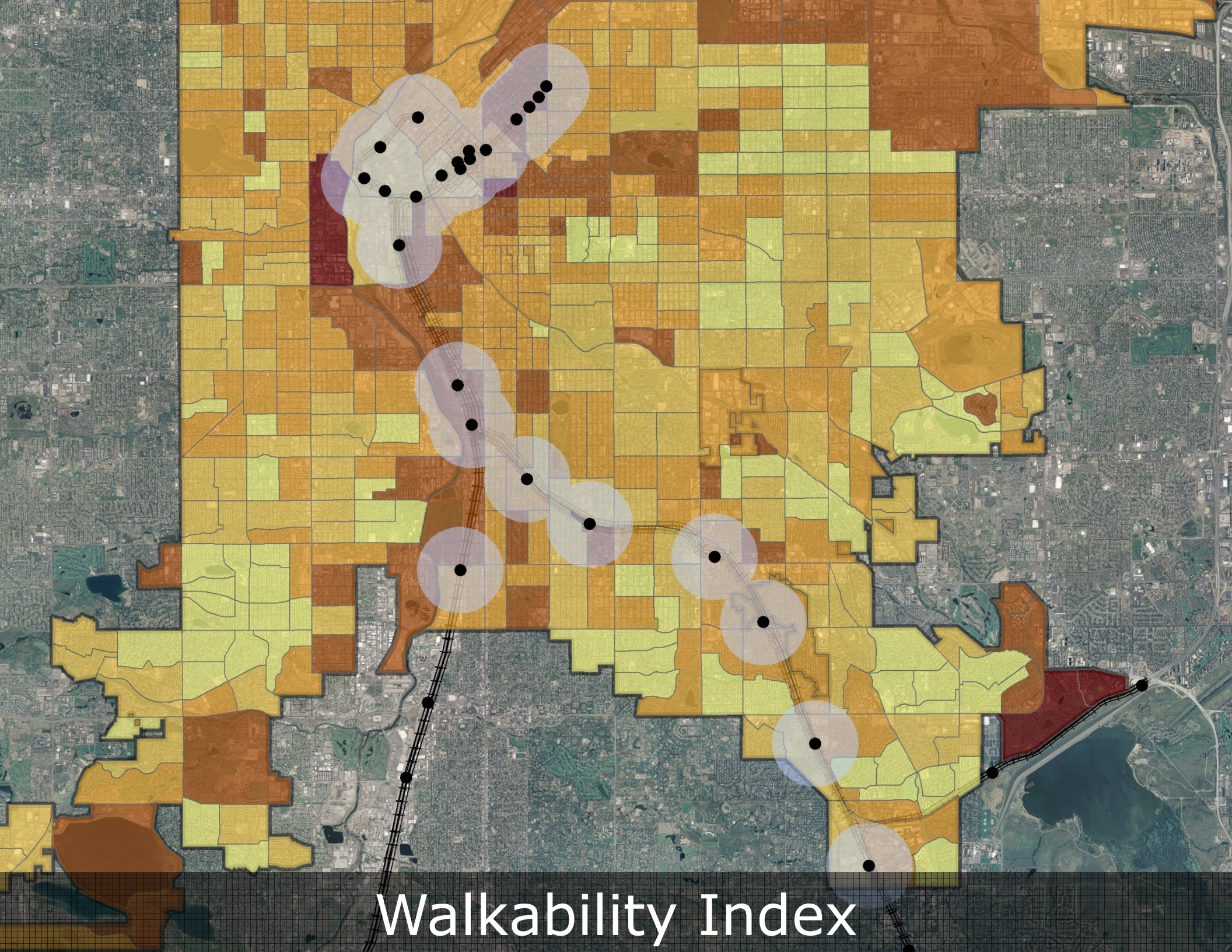
Amenity Index No. 1



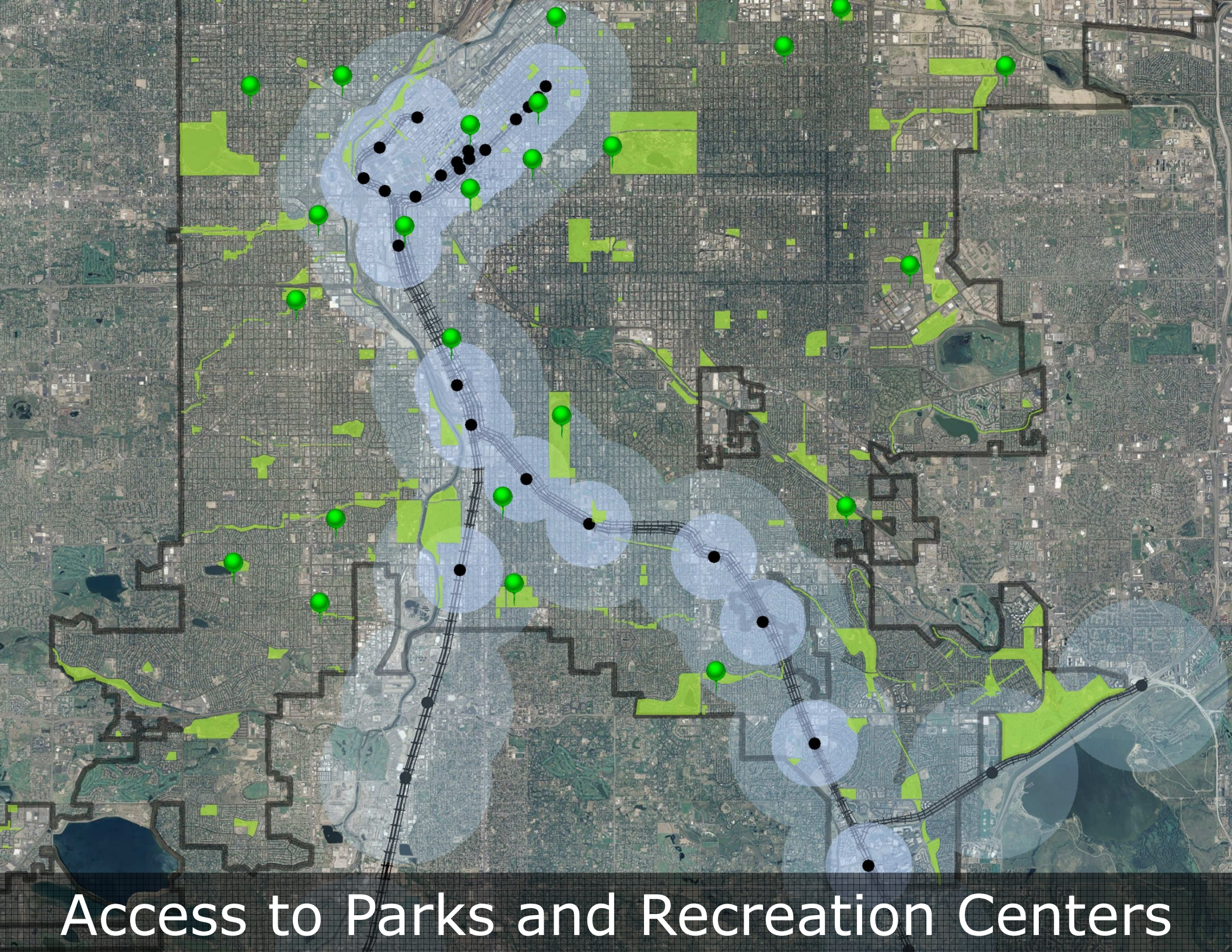
Amenity Index No. 2: Schools



Amenity Index No. 3: Groceries

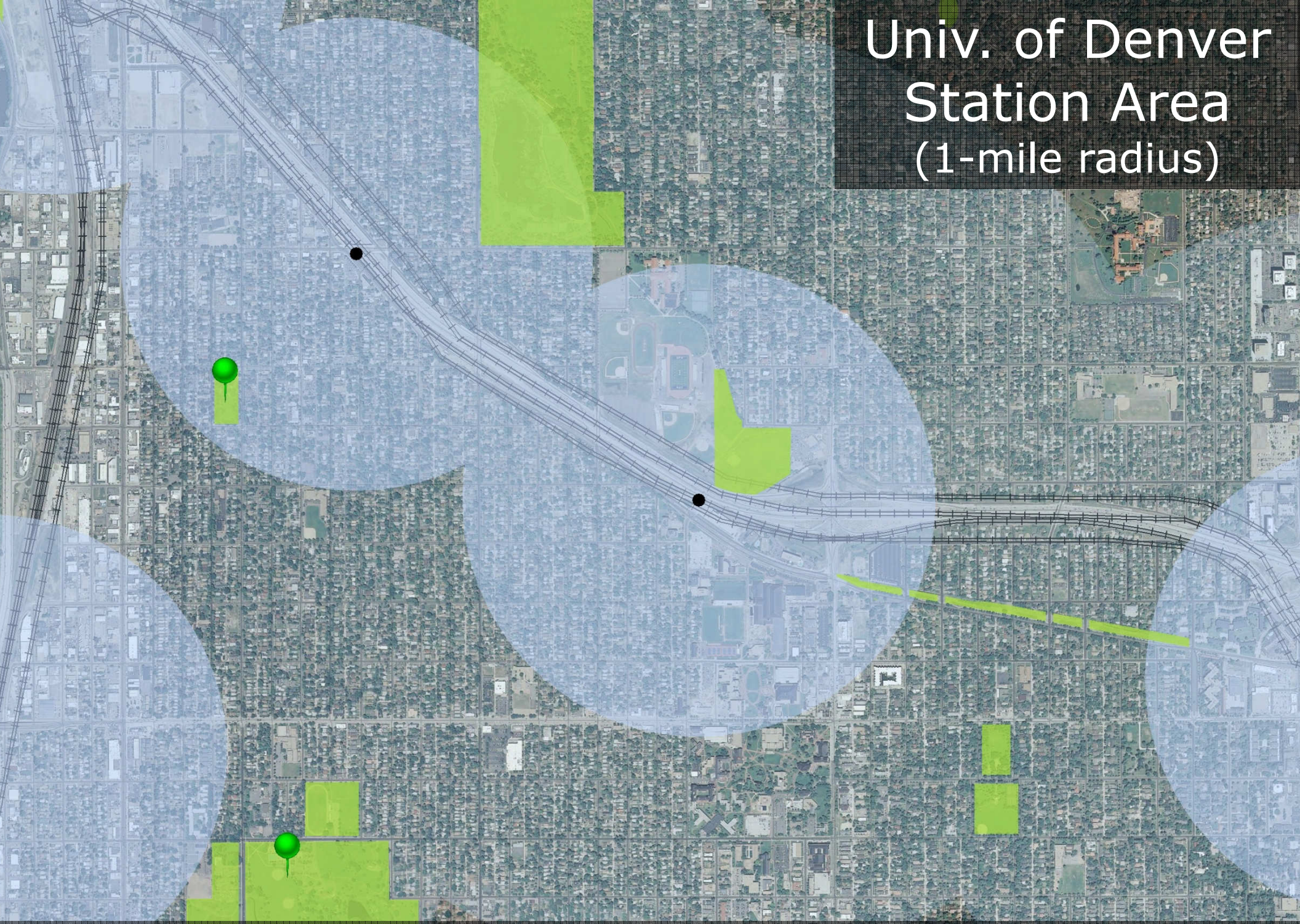


Walkability Index



Access to Parks and Recreation Centers

Welton Street
Station Areas
(1-mile radius)
Access to Parks and Recreation Centers



Access to Parks and Recreation Centers

Economic Elements

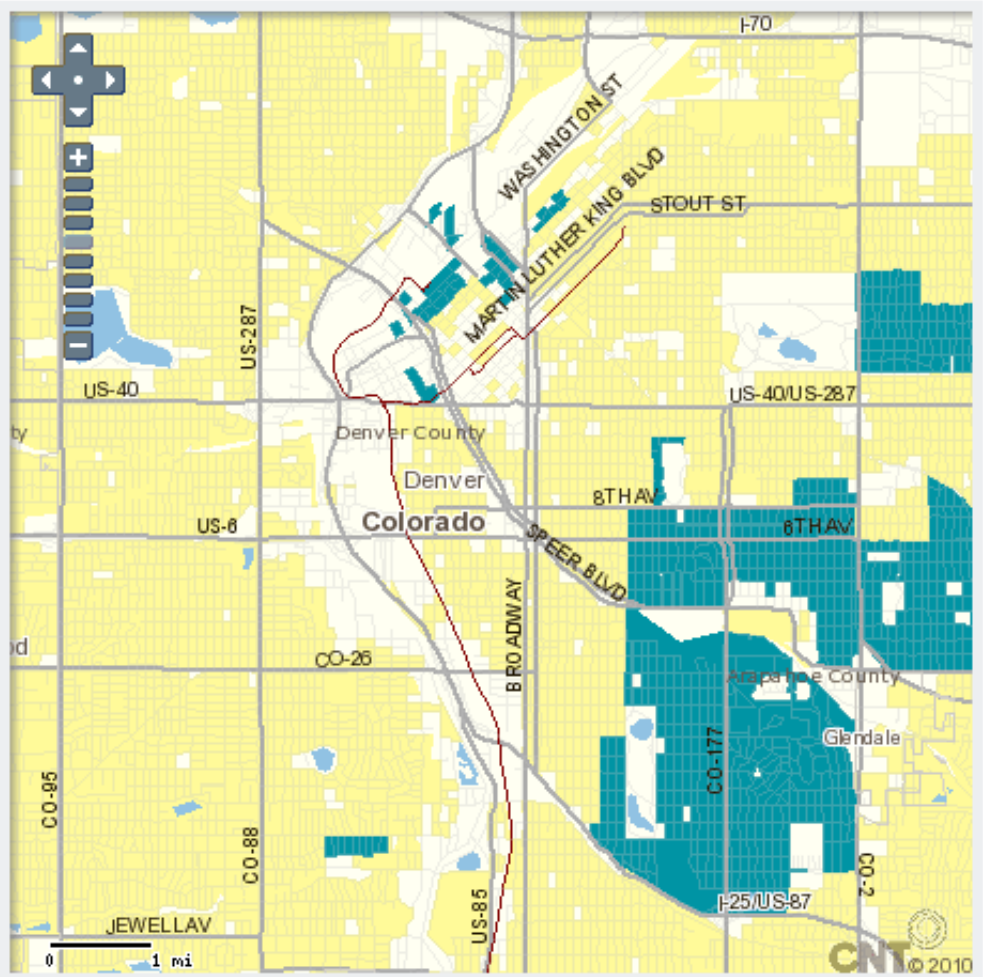
Element
Affordable for Individuals Housing & Trans Creation of Affo
Financed in an Equitable Manner
Provides Efficient Movement for Economic Activity
Resiliency to Economic Fluctuations

Housing Costs - % Income

Change

- Data Not Available
- Less than 30%
- 30% and Greater

Housing Costs factored as a percent of income has widely been utilized as a measure of affordability. Traditionally, a home is considered affordable when the costs consume no more than 30% of household income.



Transportation Costs, % Income

Change

- Data Not Available
- Less than 15%
- 15 to 18%
- 18 to 20%
- 20 to 28%
- 28% and Greater

Household Transportation Costs are calculated as the sum of Auto Ownership Costs, Auto Use Costs, and Public Transit Costs. Dividing these costs by Representative Regional Incomes illustrates the Cost Burden placed on a Typical Household by Transportation Costs.

Housing and Transportation Costs

Welton Street Station Areas

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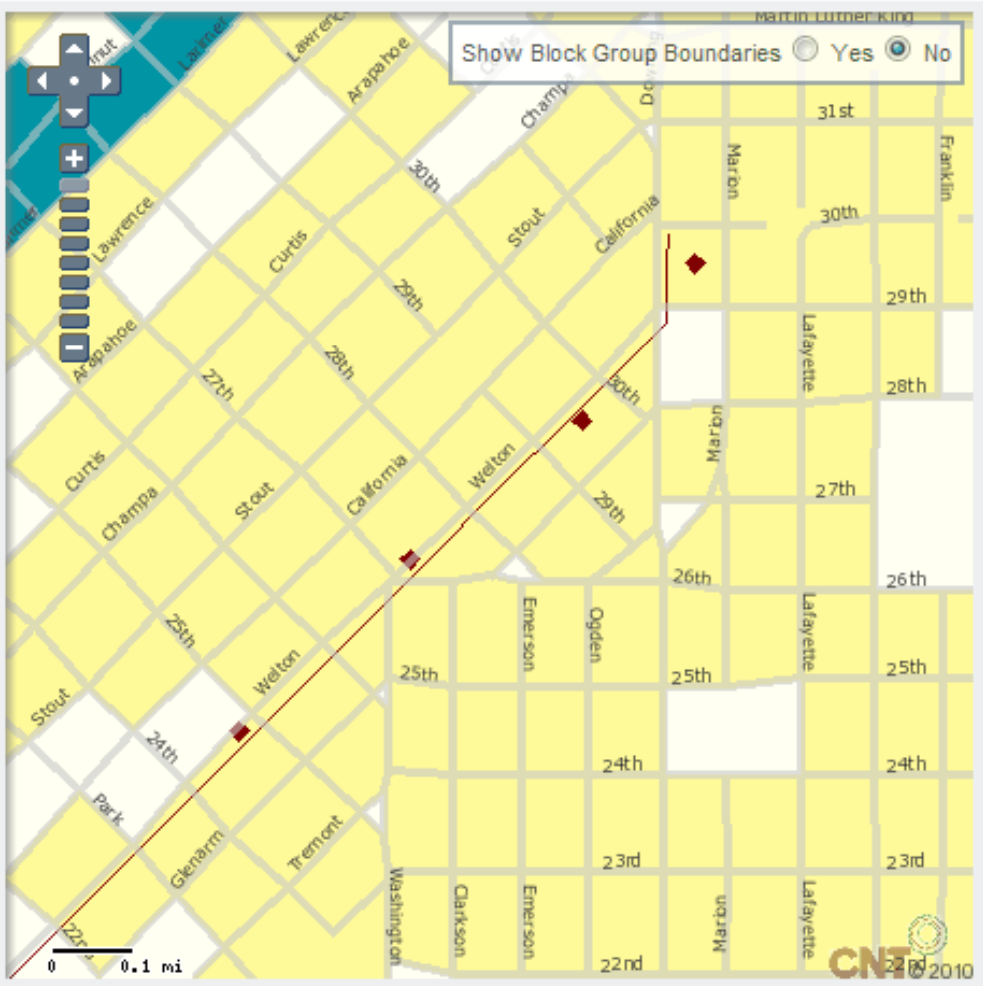

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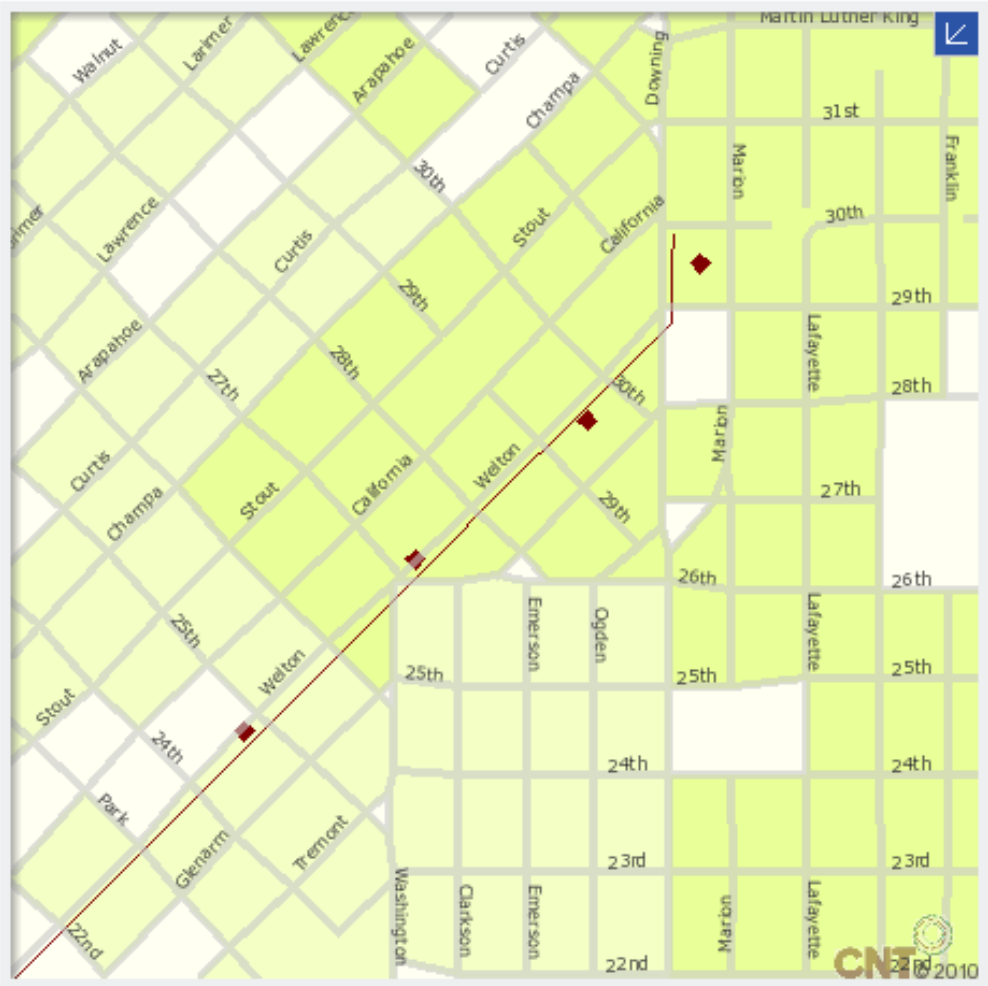

Housing and Transportation Costs

Univ. of Denver Station Area

Housing Costs - % Income

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Transportation Costs, % Income

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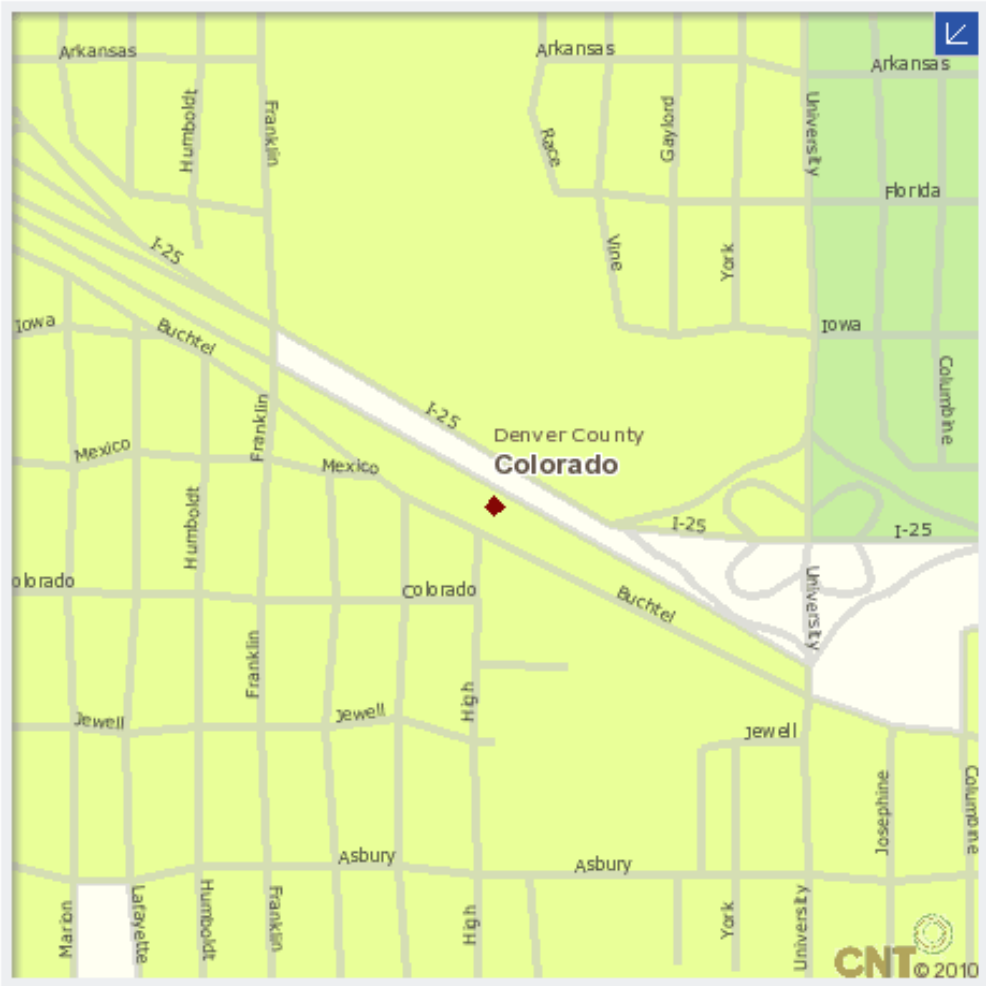


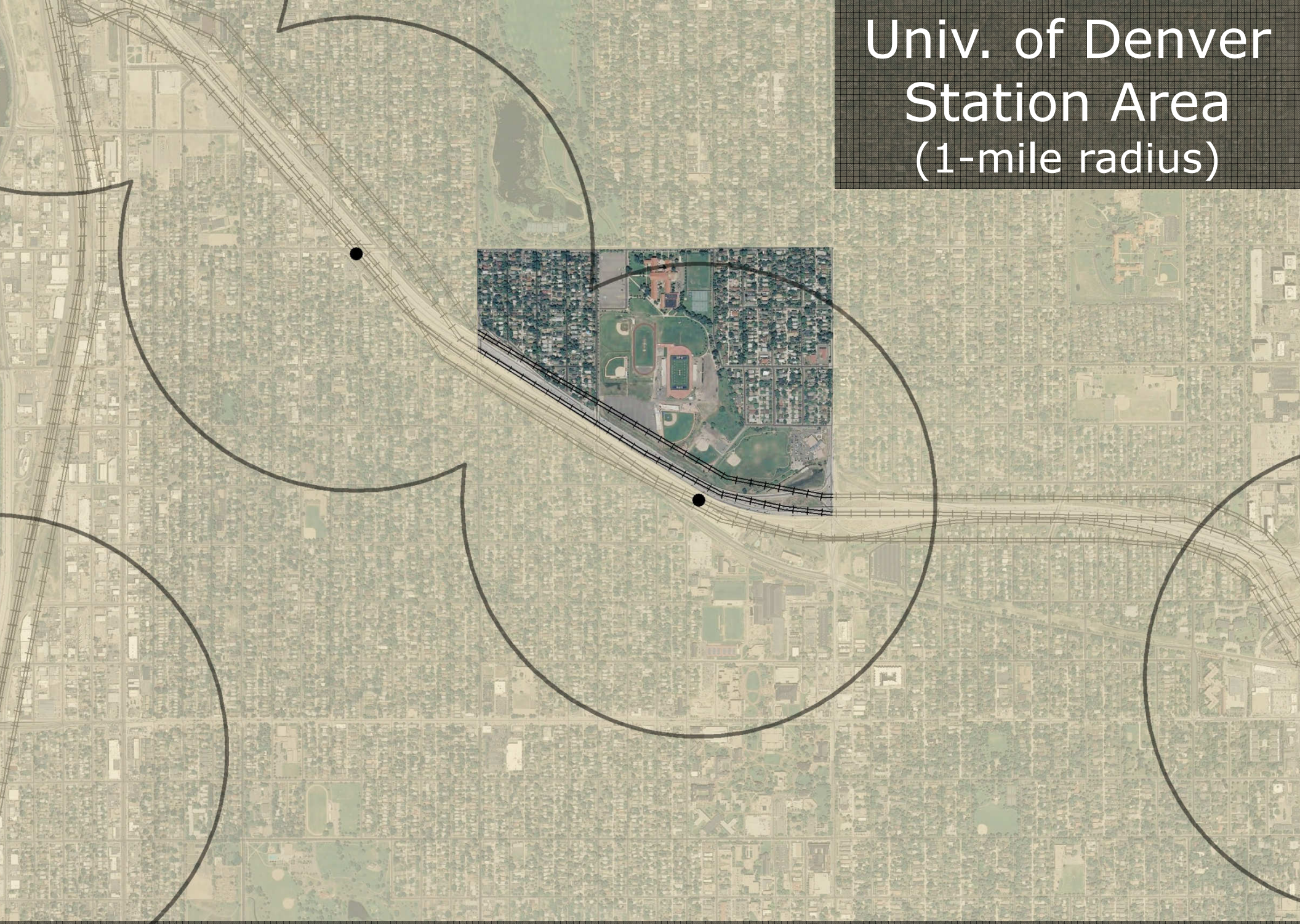
Housing and Transportation Costs

Economic Elements

Element	Variable
Affordable for Individuals	Housing & Transport Costs Creation of Affordable Housing
Financed in an Equitable Manner	-
Provides Efficient Movement for Economic Activity	Broadening Access to Local Job Opportunities
Resiliency to Economic Fluctuations	Regional Access to Jobs by Transit Vulnerability to Gas Prices

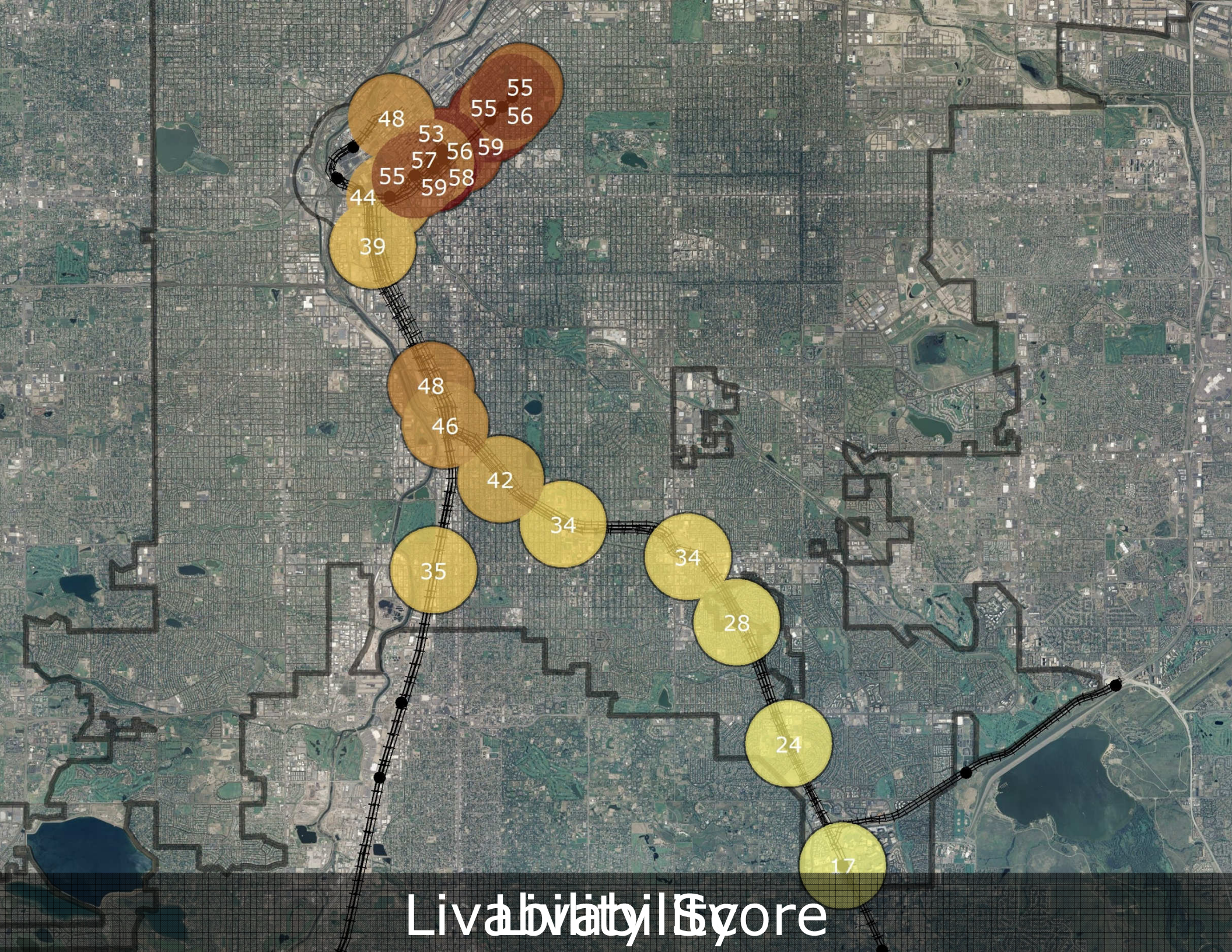
Regional Transit Access to Jobs

Welton Street
Station Areas
(1-mile radius)
Regional Transit Access to Jobs

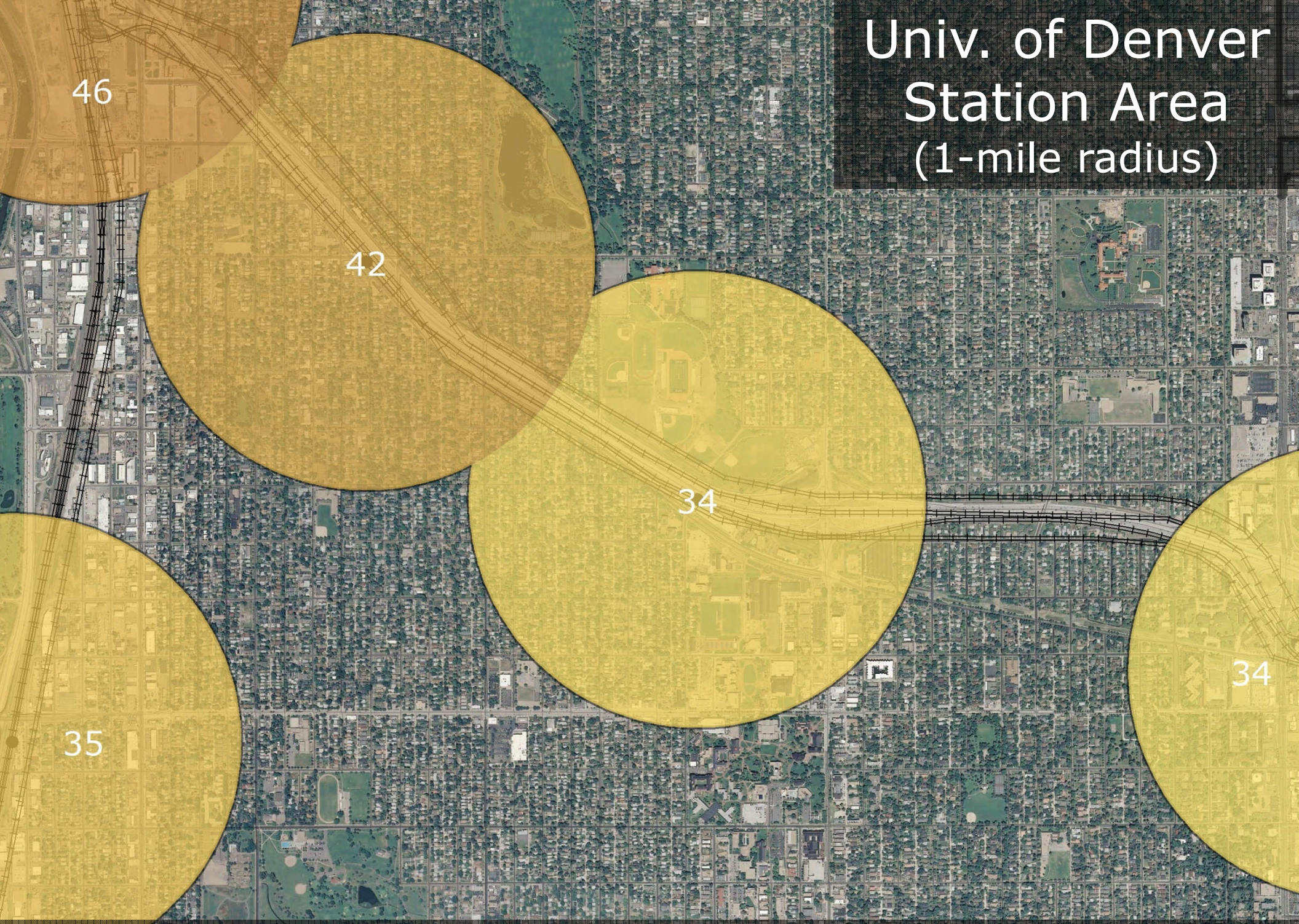


Regional Transit Access to Jobs

Livability

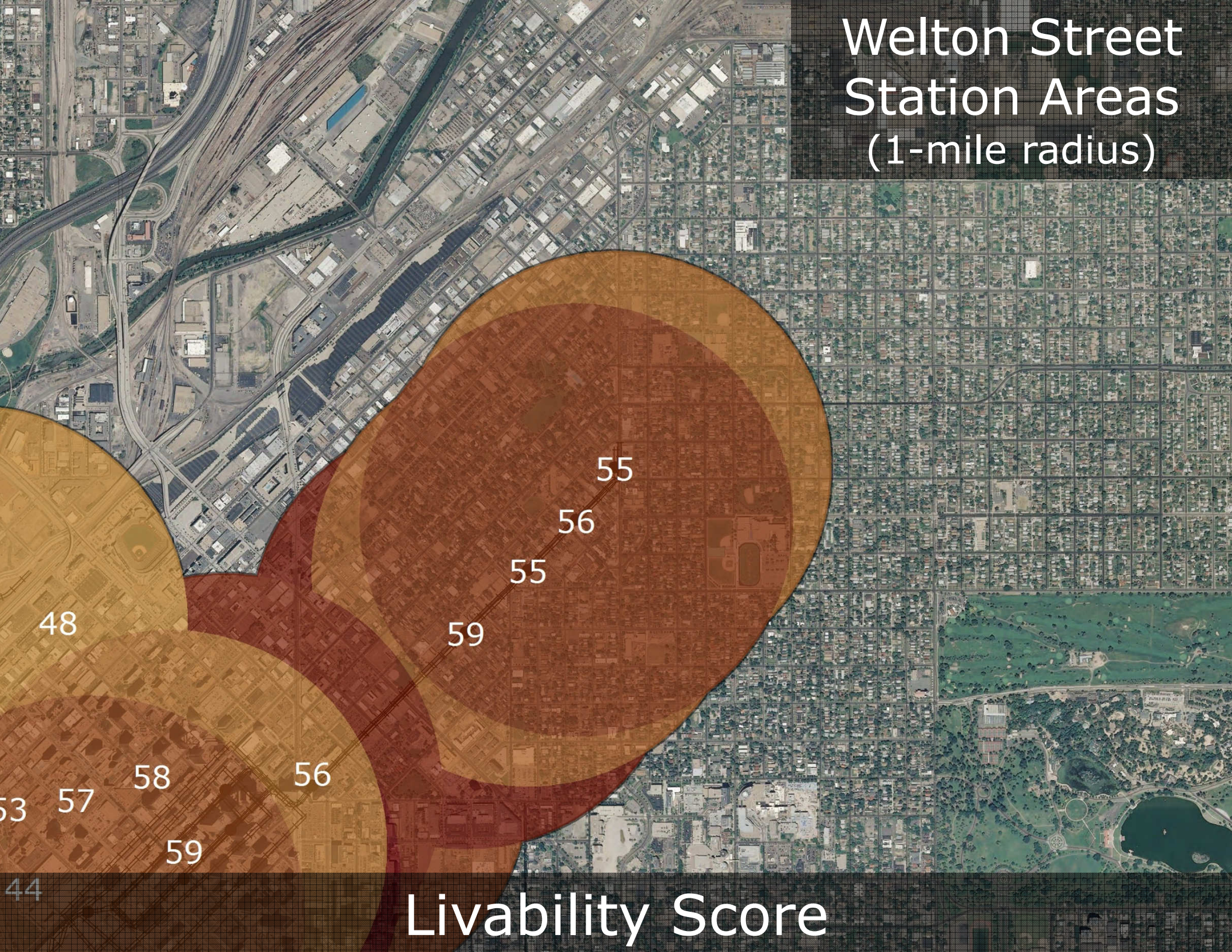


Livability Score



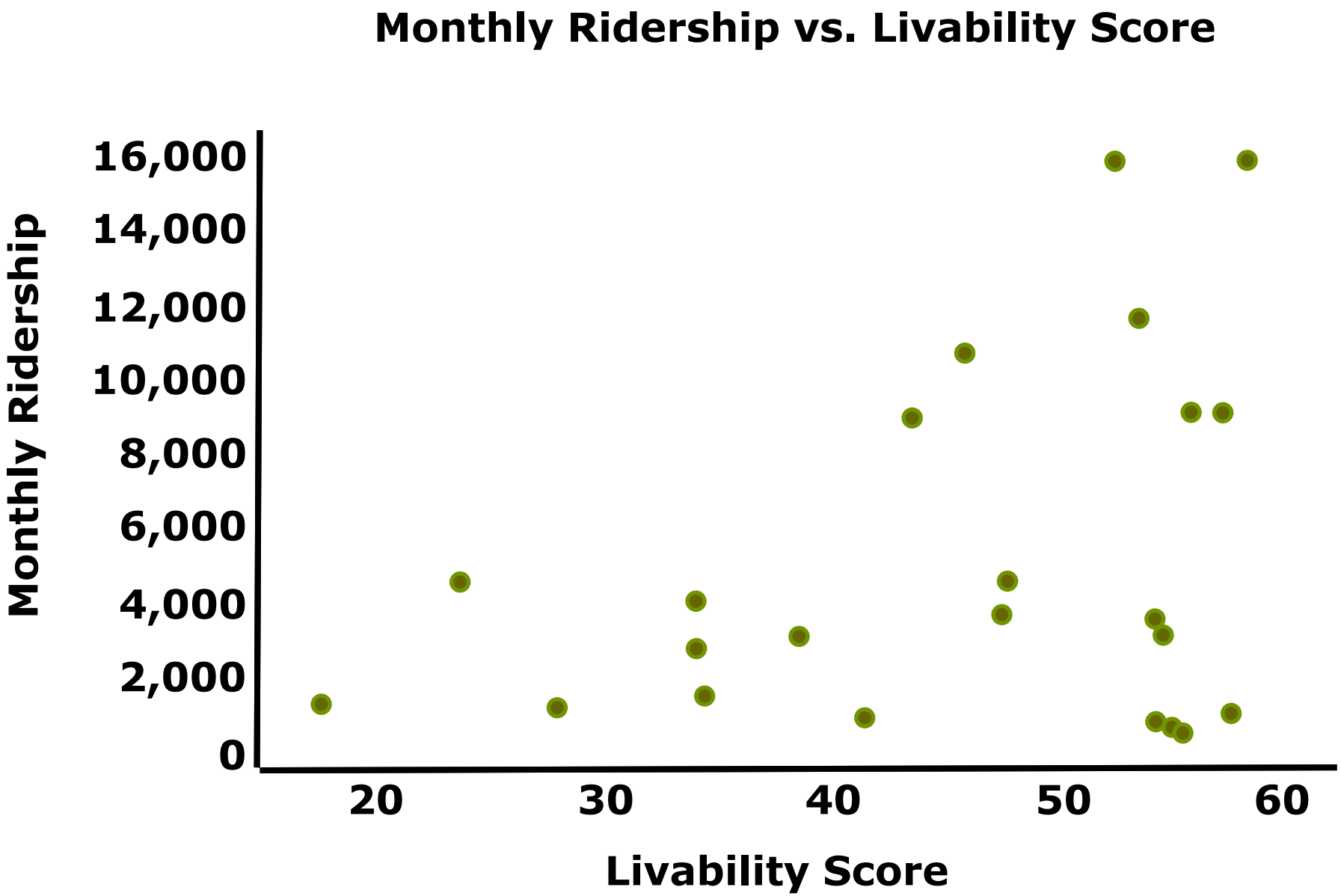
Livability Score

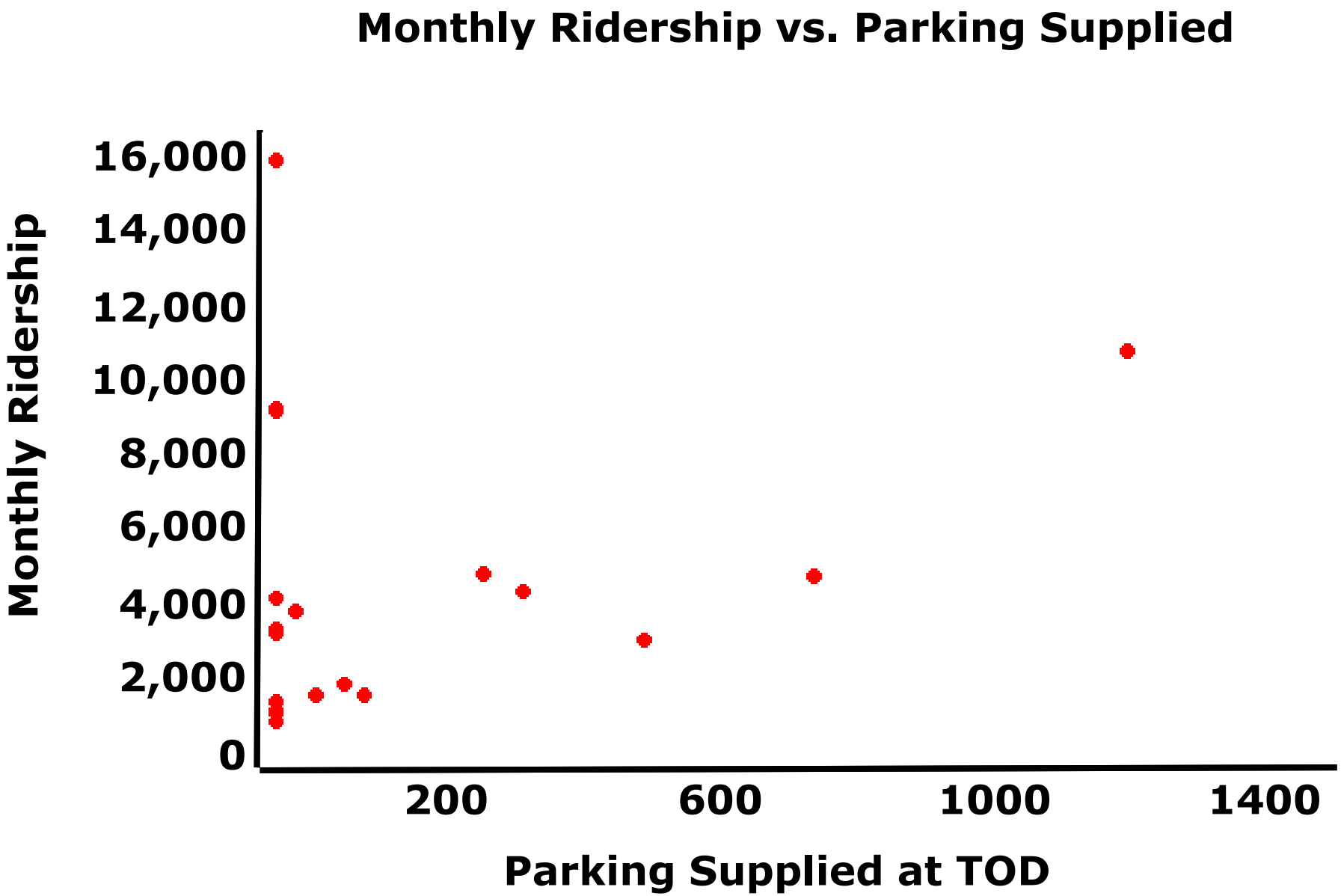
Welton Street Station Areas
(1-mile radius)

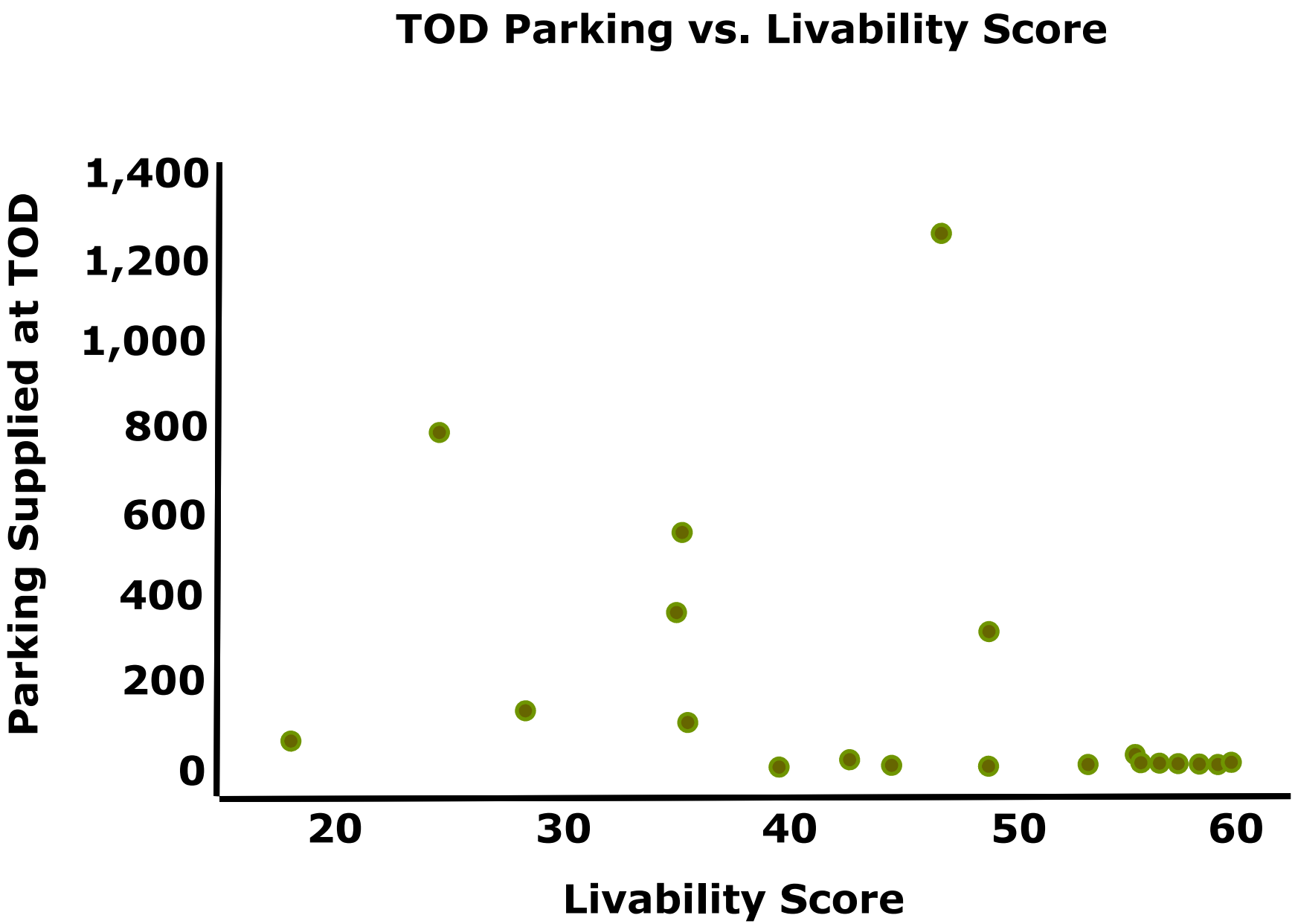


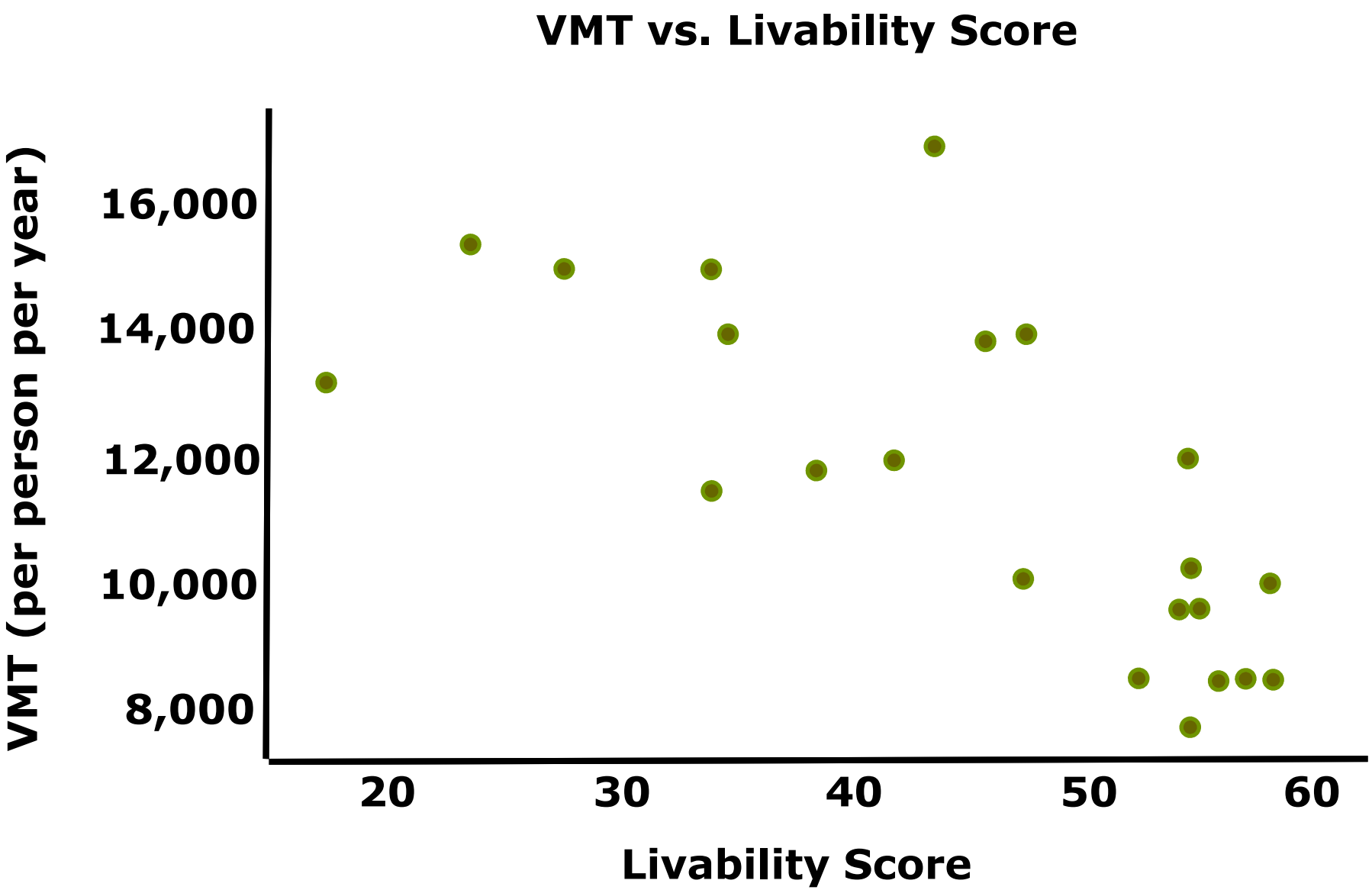
Livability Score

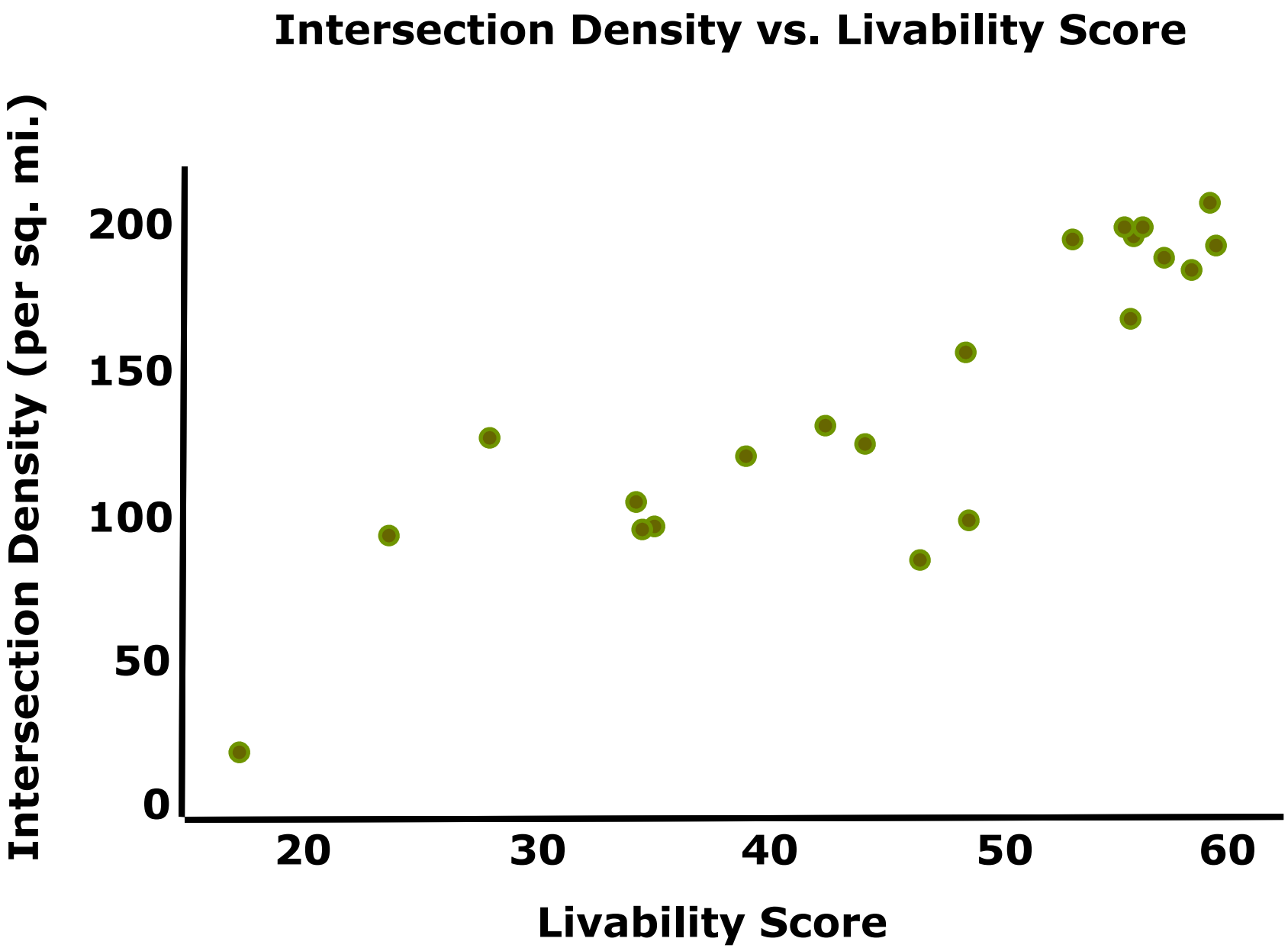
What can understanding
Livability
do for you?

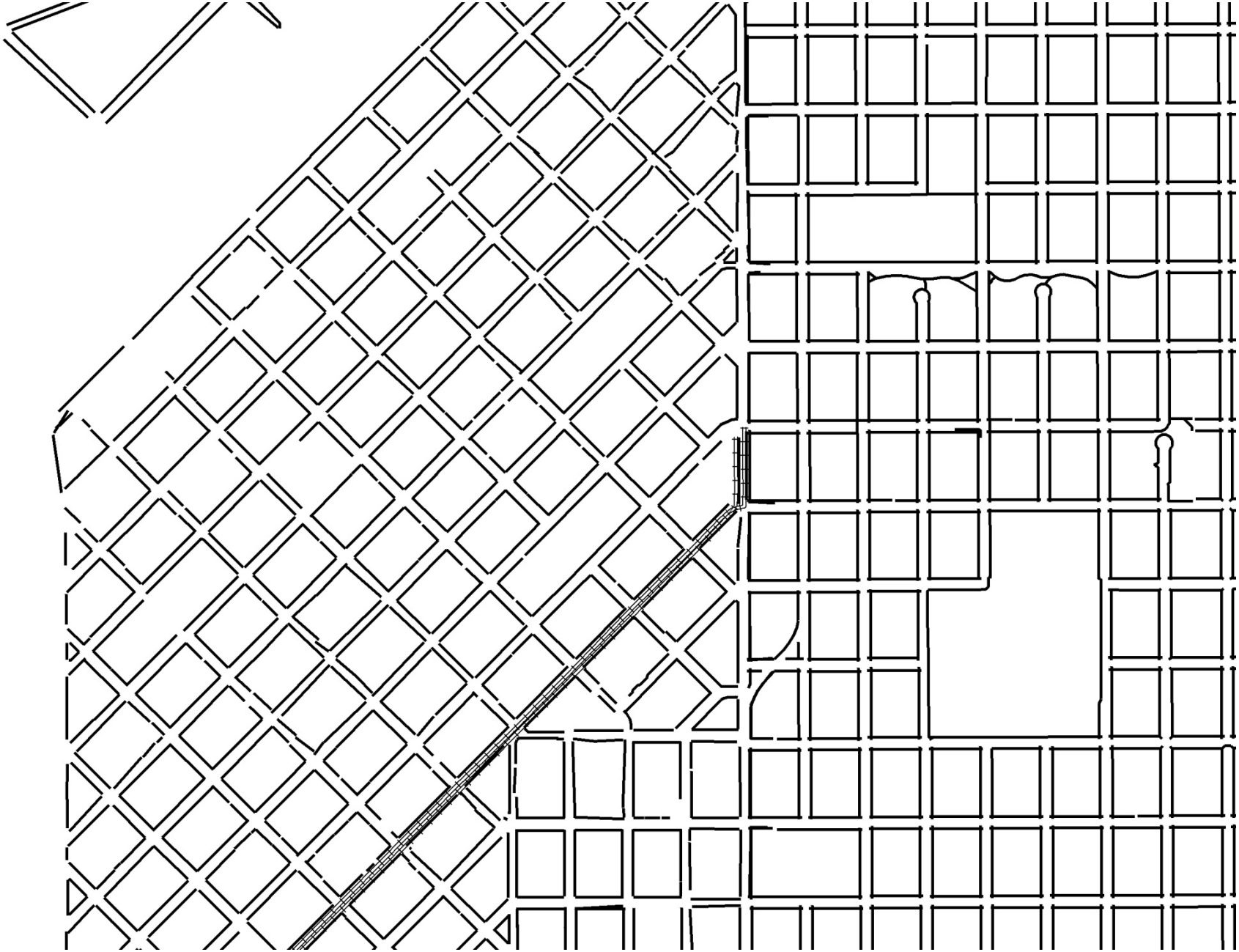

Monthly Ridership vs. Livability Score
Monthly Ridership
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
20
30
40
50
60
Livability Score

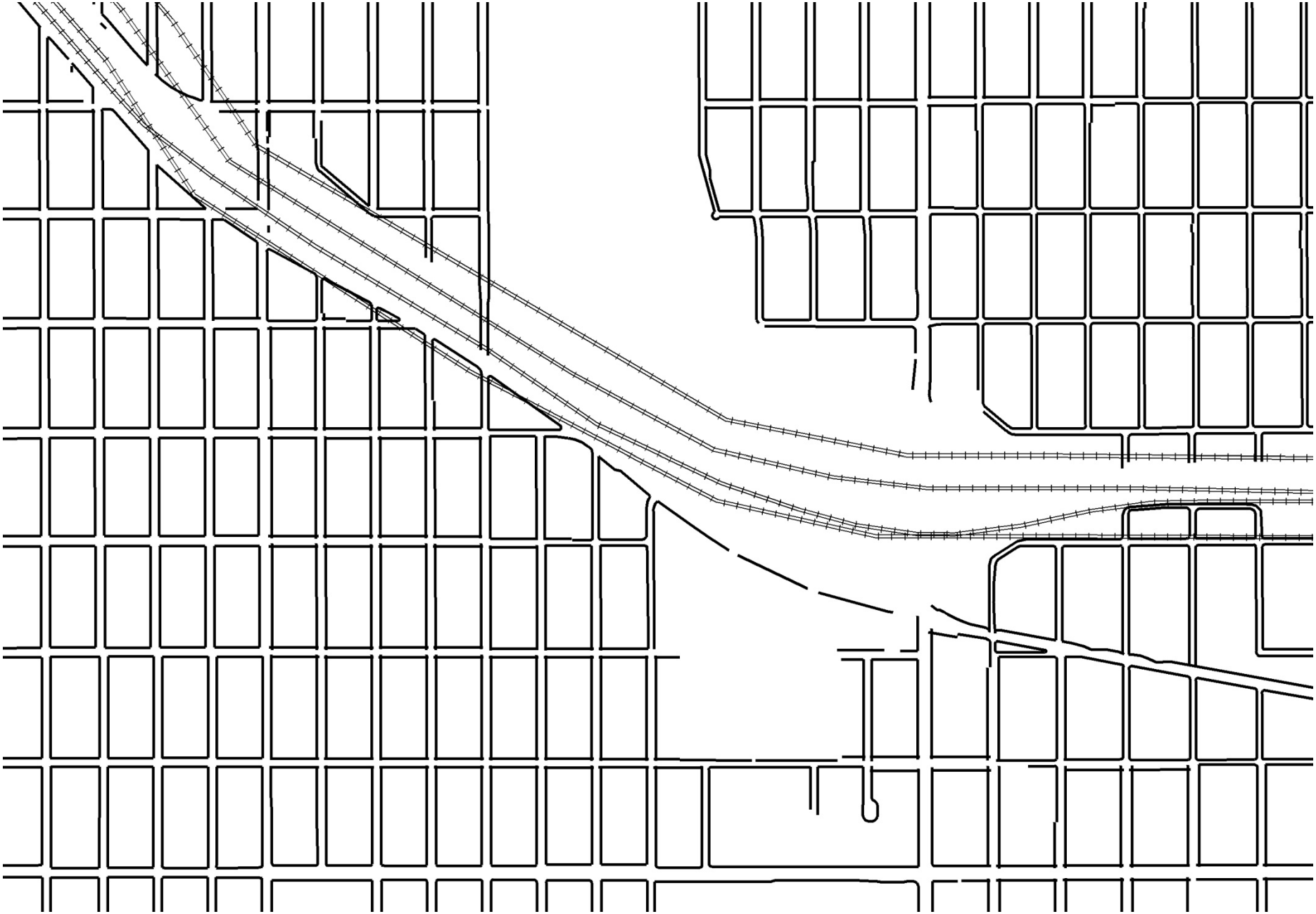

Monthly Ridership vs. Parking Supplied
Monthly Ridership
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
200
600
1000
1400
Parking Supplied at TOD

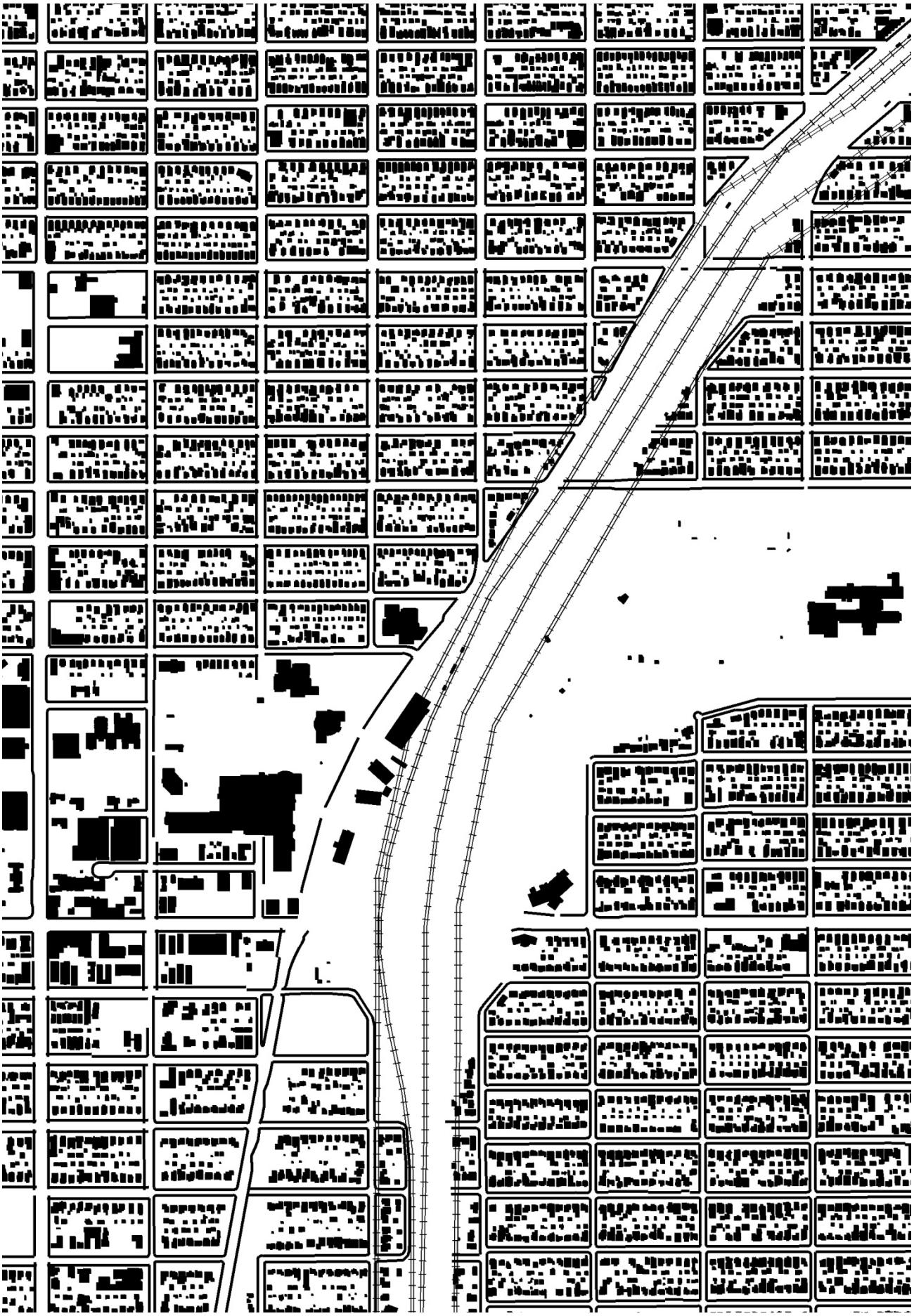

TOD Parking vs. Livability Score
Parking Supplied at TOD
1,400
1,200
1,000
800
600
400
200
0
20
30
40
50
60
Livability Score

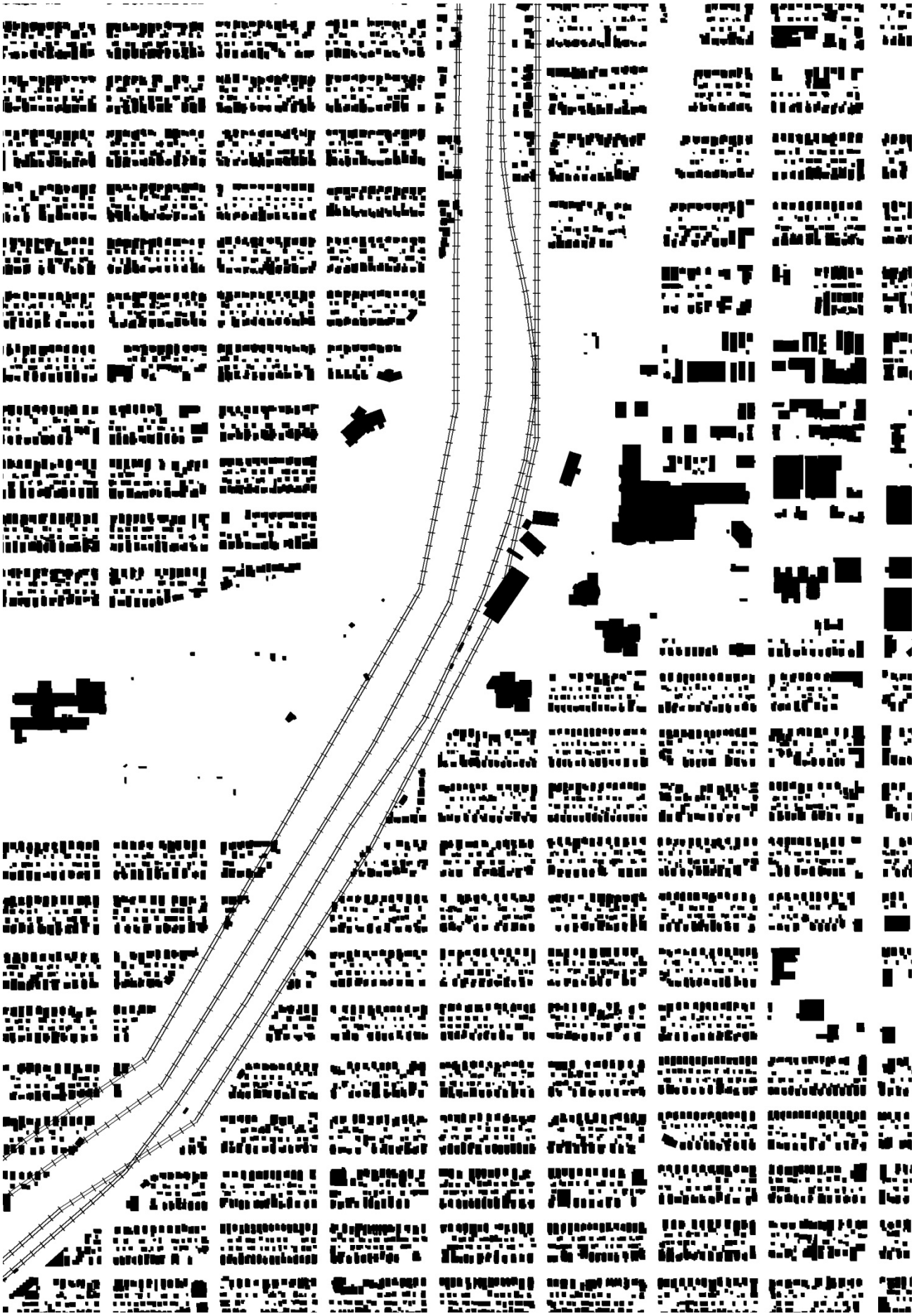

VMT vs. Livability Score
VMT (per person per year)
16,000
14,000
12,000
10,000
8,000
20
30
40
50
60
Livability Score

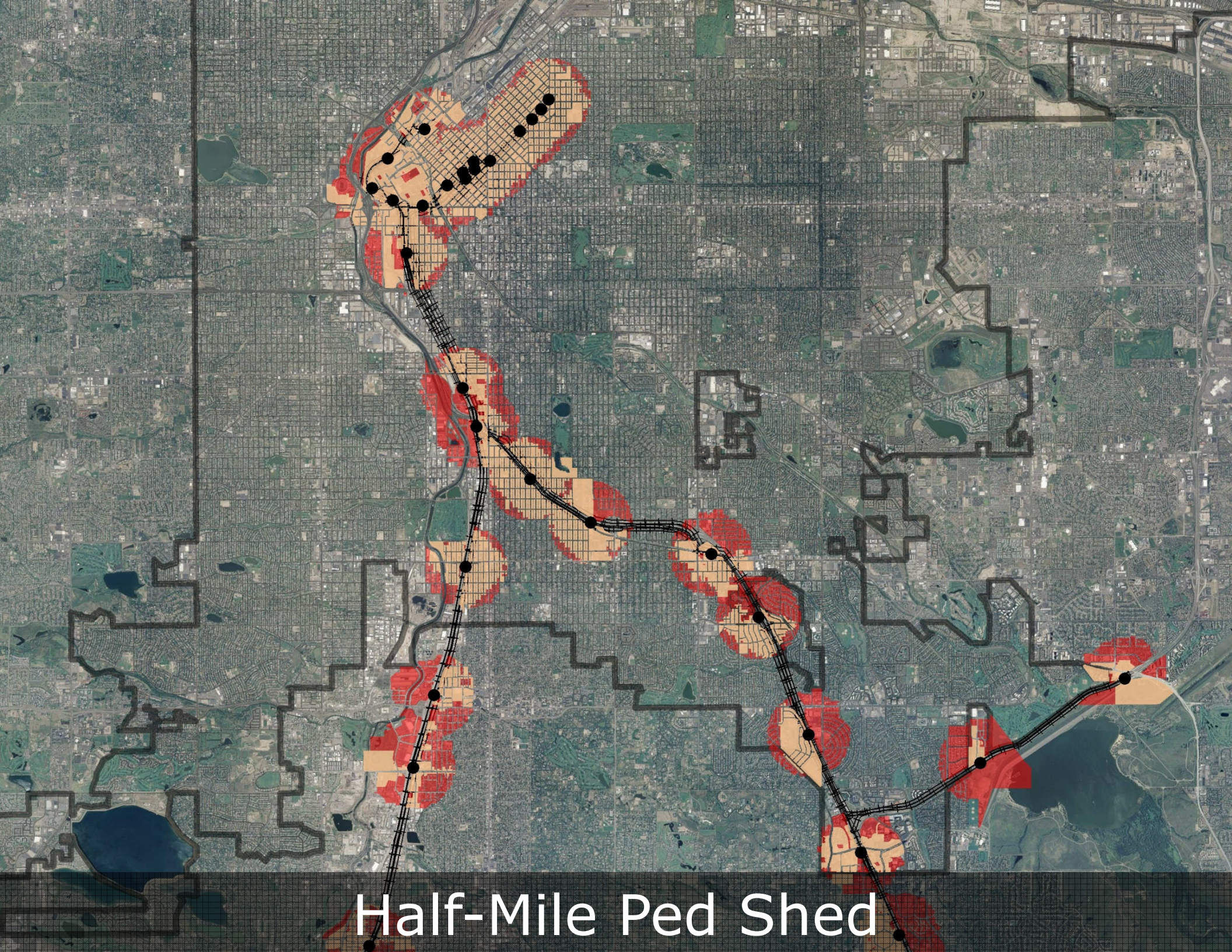

Intersection Density vs. Livability Score
Intersection Density (per sq. mi.)
200
150
100
50
0
20
30
40
50
60
Livability Score



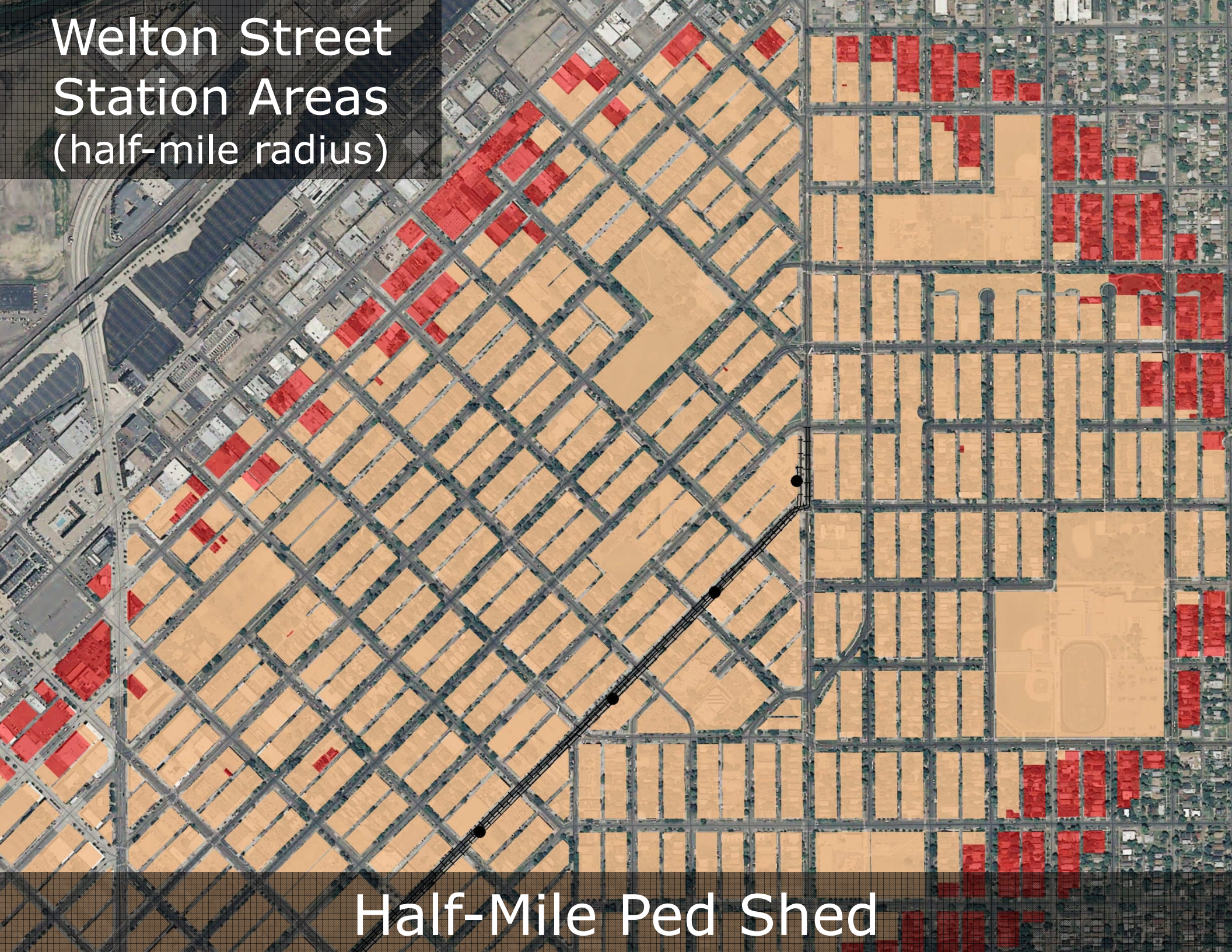




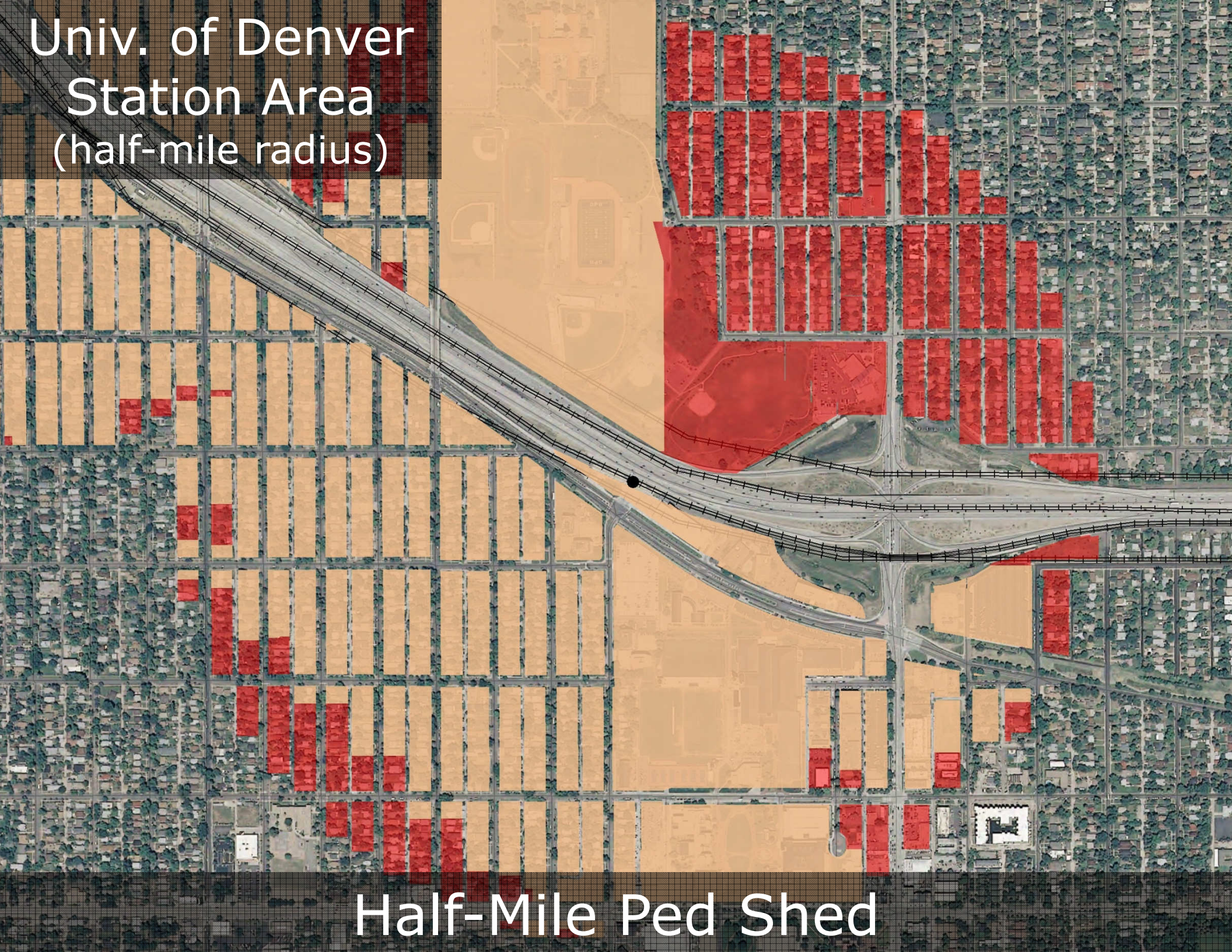



Half-Mile Ped Shed

Welton Street Station Areas
(half-mile radius)



Half-Mile Ped Shed


Univ. of Denver
Station Area
(half-mile radius)
Half-Mile Ped Shed

ENGLEWOOD
Englewood
Station
Littleton
Mineral

ENGLEWO

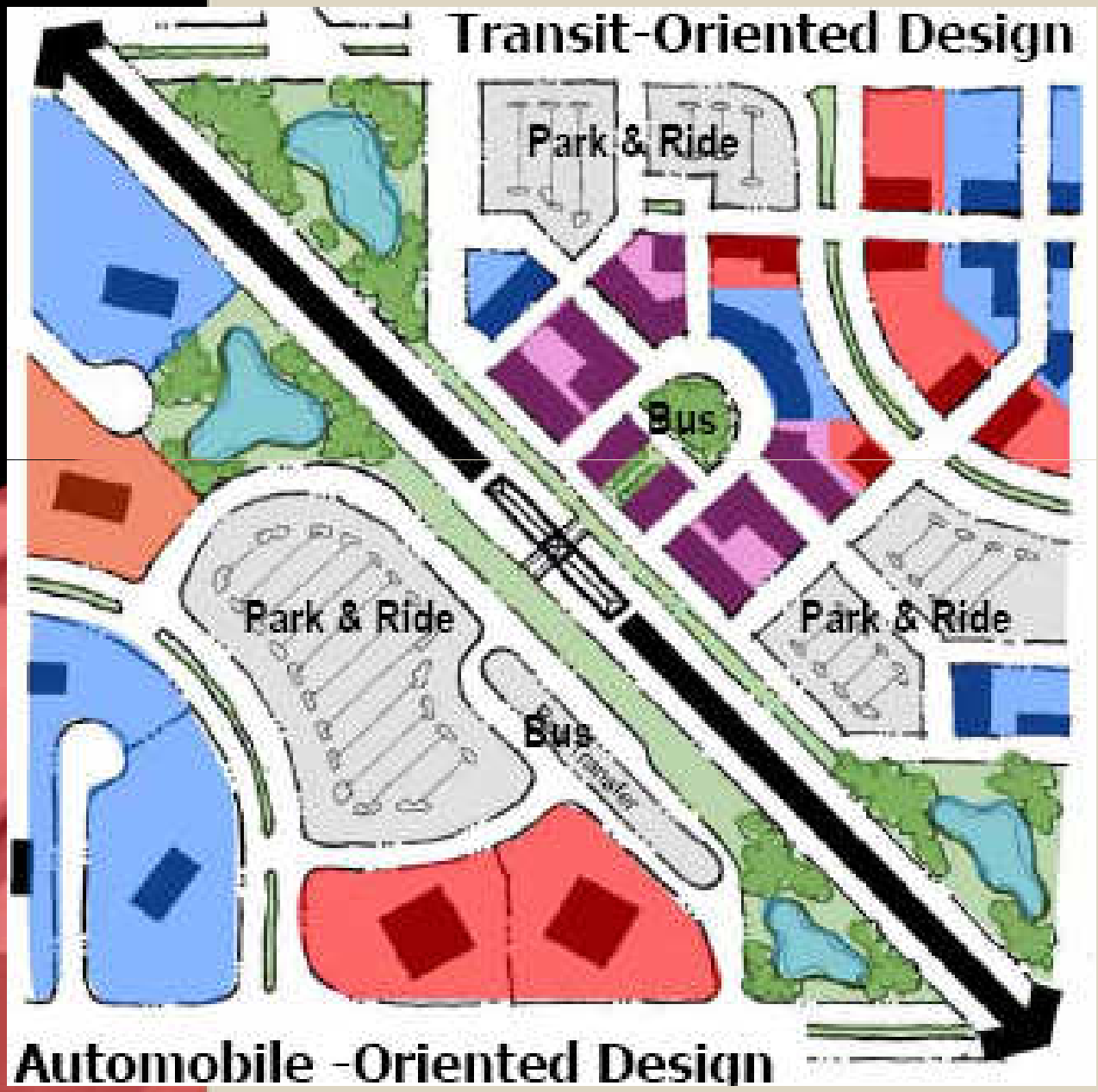
FedEx

CIVIC CENTER
Courts
Library
Museum of Outdoor Arts
City Offices
EMERGENCY SNOW ROUTE
NO PARKING
DURING SNOW 12 PM - 5 AM
TOW-AWAY ZONE
COLORADO ROADSIDE POSSE
2 HOUR PARKING 8AM - 6PM
STOP
JACKSON HEWITT
TAX SERVICE

102
Garage Parking Available
M
MILLER WEINGARTEN
W
SPACE
AVAILABLE
303.781.7100
www.weingarten.com
Short-term Leases Available

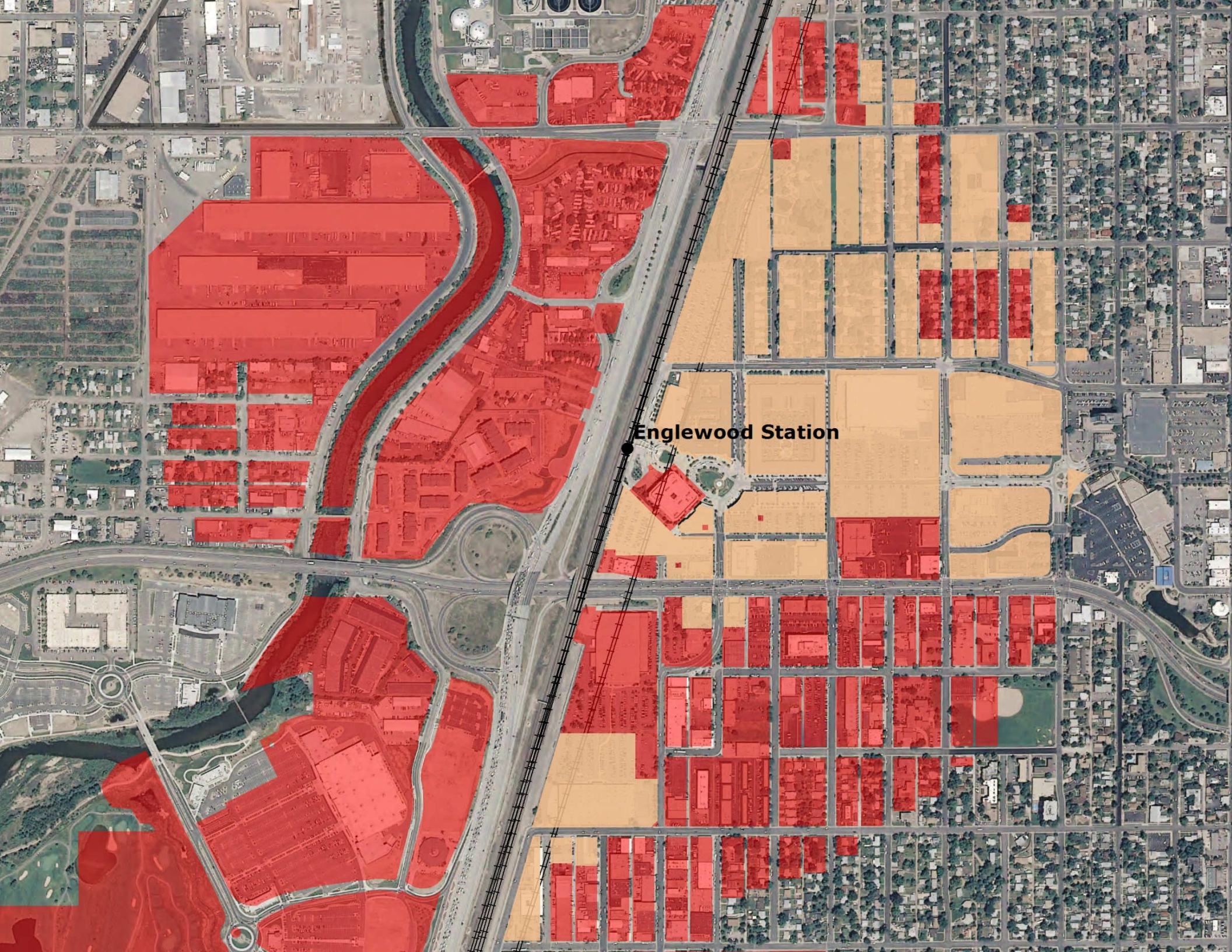
ALEXAN
CITYCENTER
Luxury Apartment Homes

More Than Building Transit



- Transit can do more than move people to and from downtown during weekdays
- Transit can be a cataylst for more walkable, sustainable, livable communities
- RTD is taking a larger role helping to shape station area development

WAL★MART


Englewood Station

MOVE IN
TODAY!
303-783-9600

Access Mode Share

Mode of Access to Station	SW Corridor (2006)	SE Corridor (2007)
Drove alone	35%	40%
RTD bus	29%	21%
Walked	28%	25%
Dropped off	5%	5%
Bicycle	3%	1%

Survey

SURVEY METHODS

- Mail-out/mail-back survey
  - Distributed in two counties that contain 34 of 36 stations
  - N=256 (14% response rate)
- Sampling
  - 1,000 – Random sample of households in two counties
  - 500 – Oversampled households within select station areas
  - 500 – Oversampled “matched” households outside of station areas
- Survey tool
  - Housing and household characteristics
  - Socio-demographic factors
  - Travel behavior before and after light rail
  - Attitudes
  - Choice-based conjoint analysis
- Preliminary Analysis

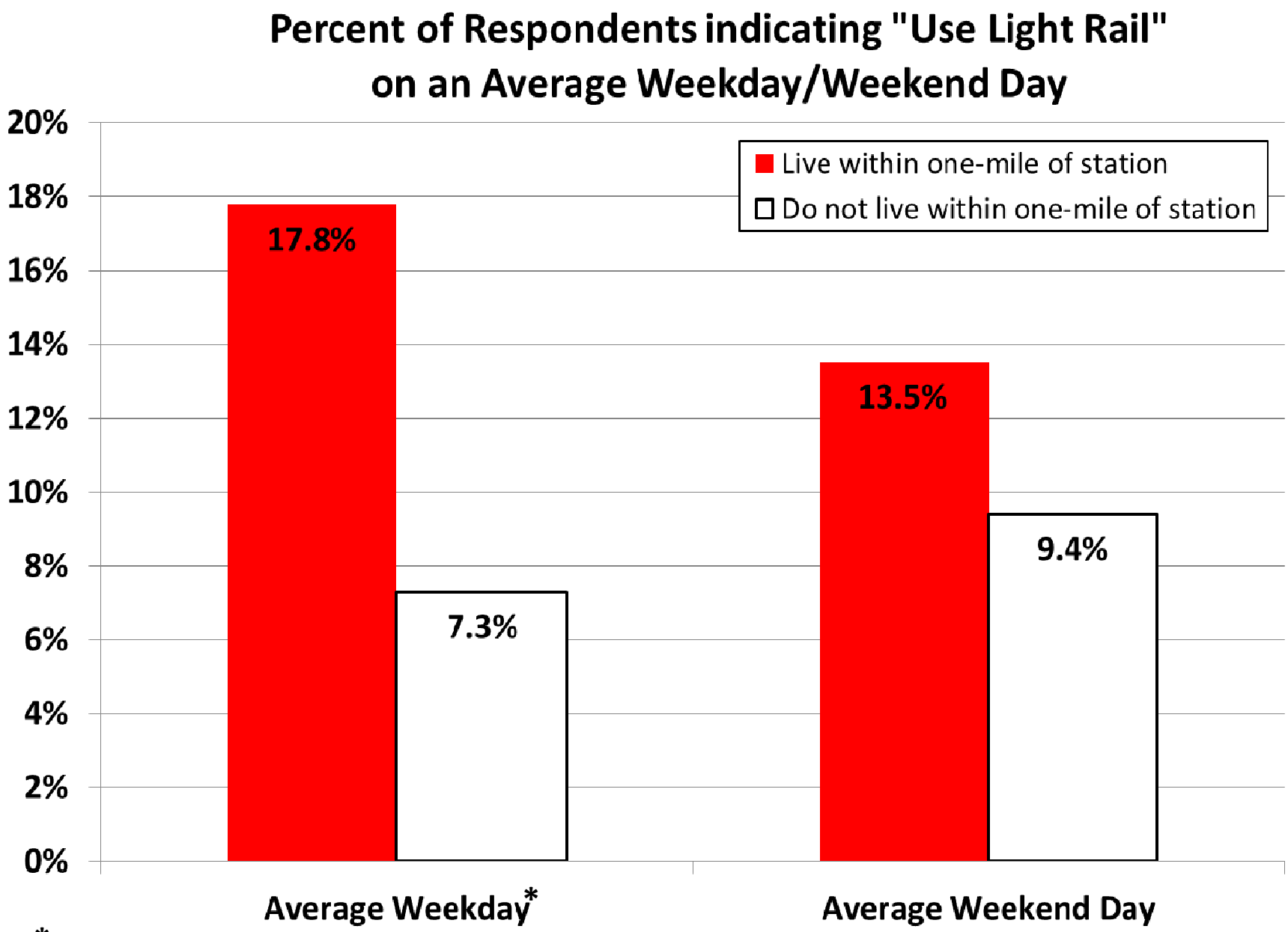
PRELIMINARY FINDINGS

✖ = Average of respondents living within one-mile of station area

✖ = Average of respondents living beyond one-mile of station area

	Strongly Disagree → Strongly Agree 1 2 3 4 5
*Significant at P<0.05, **Significant at P<0.01	✖ ✖
"It would be difficult for me to reduce the amount I drive"*	✖ ✖
"My schedule permits me to use public transportation"**	✖ ✖
"I feel safe or comfortable taking public transportation"**	✖ ✖
"I am concerned about issues related to climate change"*	✖ ✖
"The government should invest in environmental protection" **	✖ ✖
"The government should invest in public transportation instead of building more roads and highways" **	

Do station area residents report more <u>use of light rail</u>?



*Difference of the means is statistically significant (P=0.02)

Are there differences between station area residents and non-station area residents in terms of <u>access to cars</u>?

Respondents living within one-mile of light rail station

1.9 cars per household

Respondents living beyond one-mile of light rail station

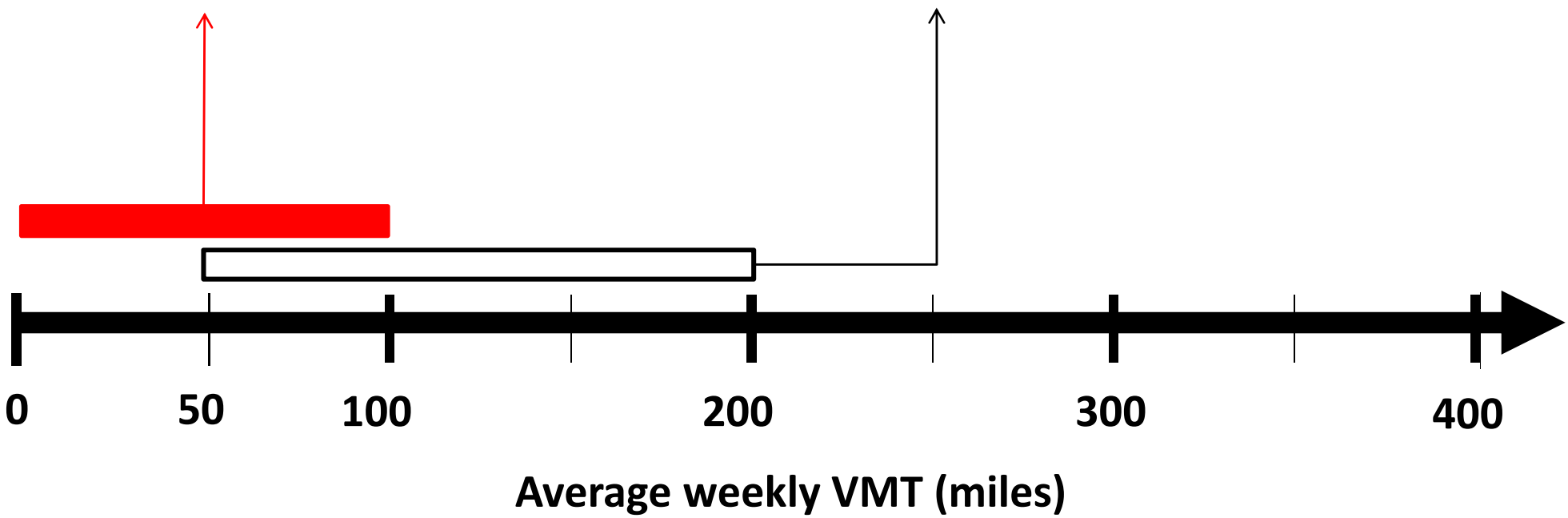
1.9 cars per household

Do station area residents indicate fewer <u>vehicle miles traveled</u> (VMT) per week than those living outside station areas?

Station area residents:
Average weekly VMT is between
0 and 100 miles

<

Outside of station area:
Average weekly VMT is between
51 and 200 miles

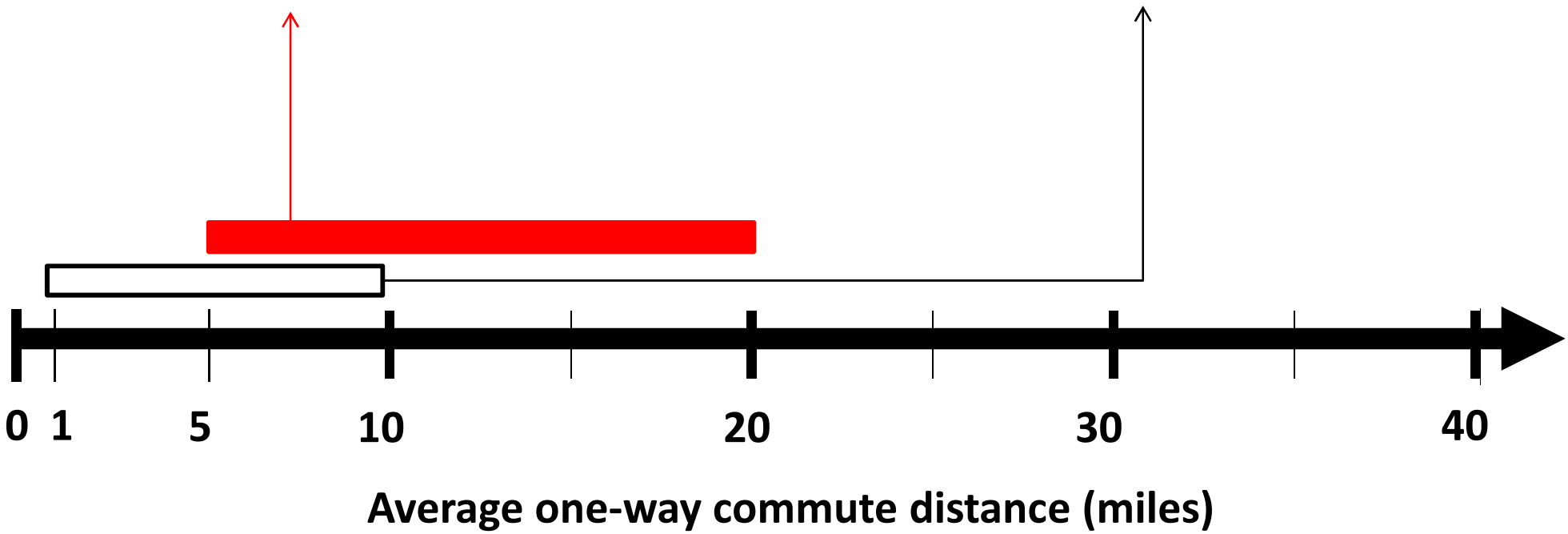


Are there differences in <u>one-way commute distance</u> between station area residents and those living outside station areas?

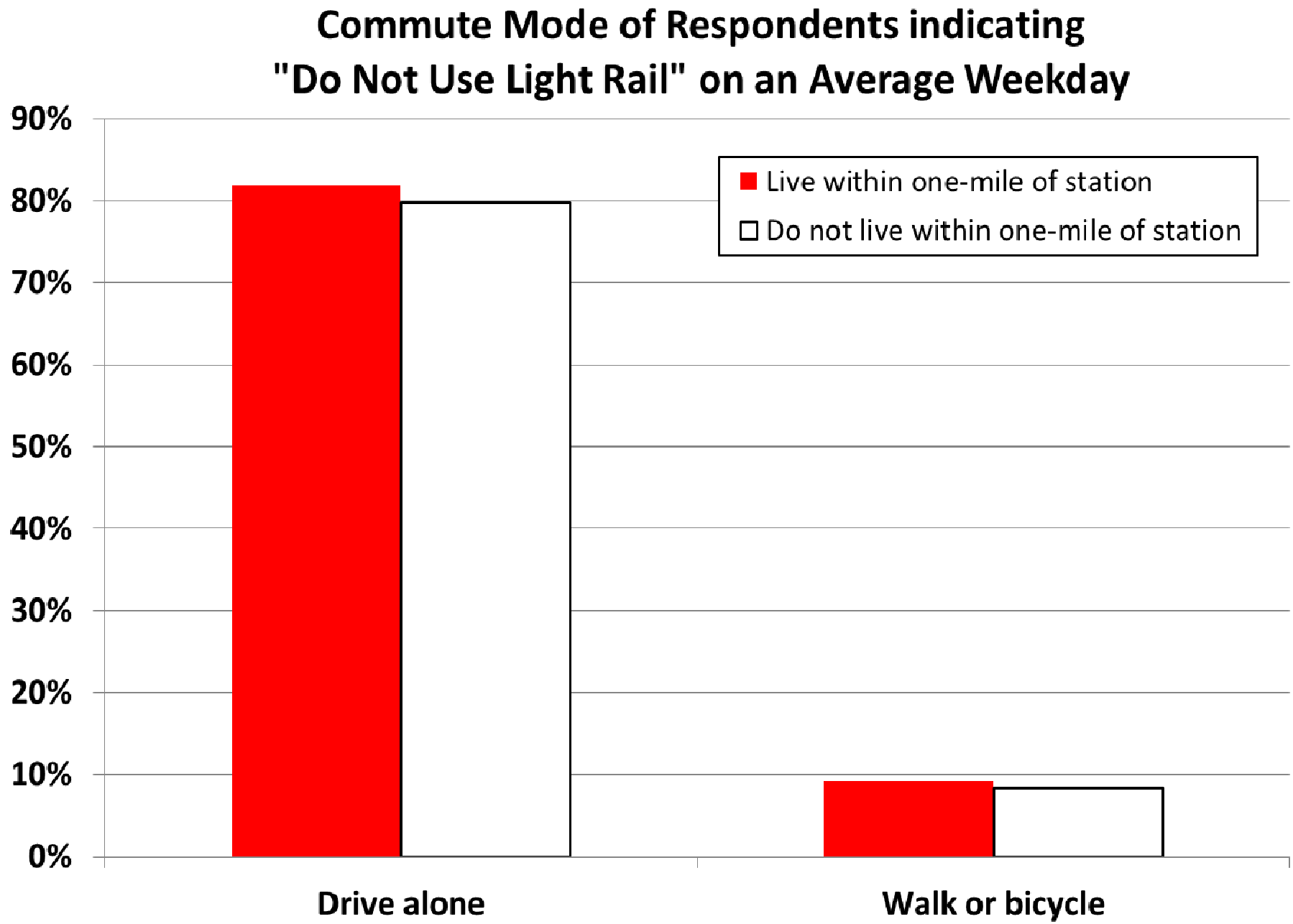
Station area residents:
Average commute is between
5 and 10 miles

>

Outside of station area:
Average commute is between
1 and 10 miles



For those who do not commute by light rail, does <u>mode choice</u> differ between station area and non-station area residents?



PRELIMINARY CONCLUSIONS

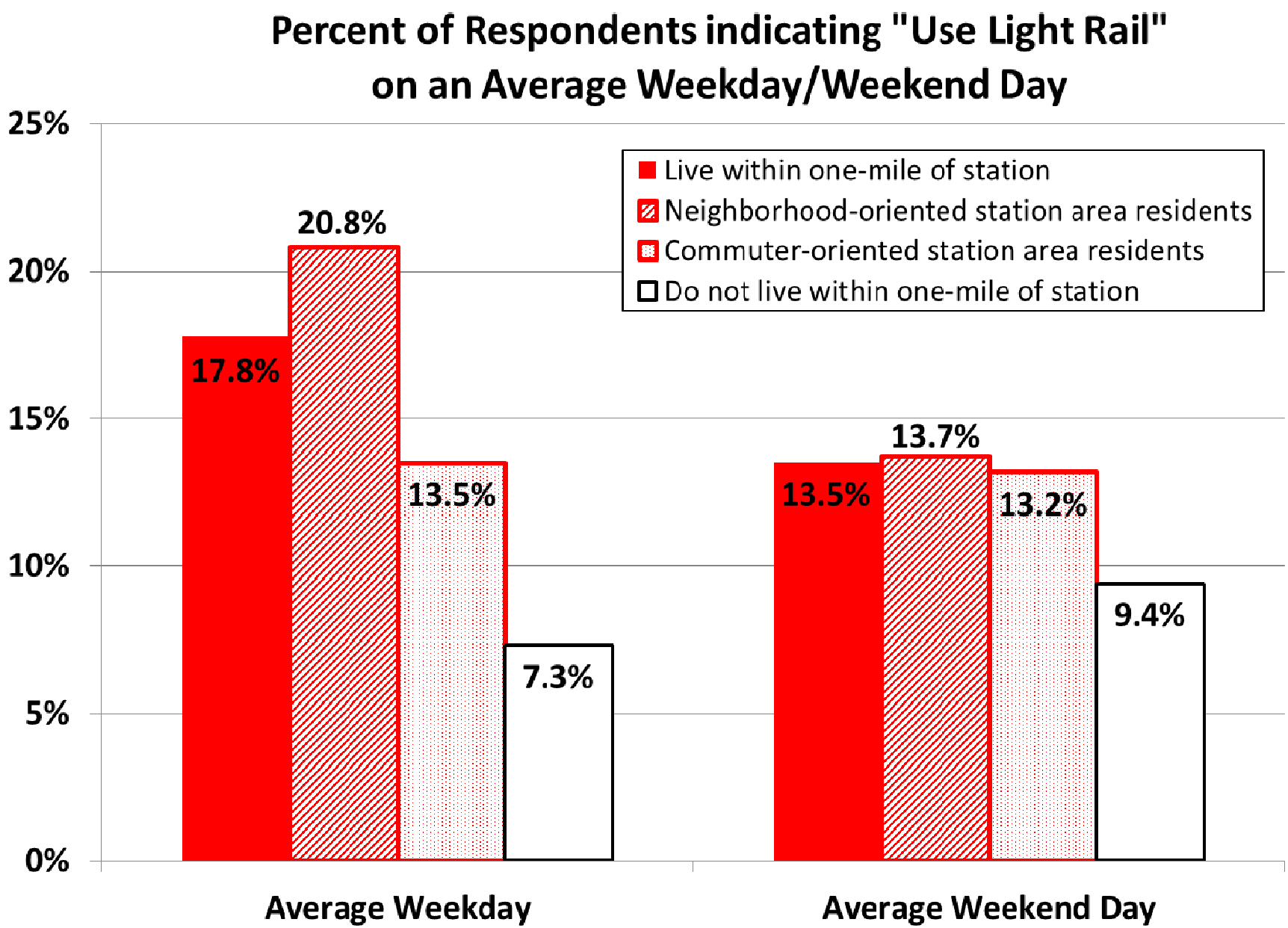
- Station area residents, compared to those living outside station areas:
  - **Do** use light rail more
  - **Do not** commute by car less
  - **Do not** commute by bike or foot more
  - **Do not** own fewer cars
  - **May tend** to drive significantly fewer vehicle-miles

How does station type influence outcomes?

"Neighborhood-oriented" stations

"Commuter-oriented" stations

Do neighborhood-oriented station area residents report more <u>use of light rail</u> than those in commuter-oriented station areas?



Are there differences between *neighborhood-* and *commuter-oriented* station area residents in terms of <u>access to cars</u>?

Respondents living within one-mile of light rail station

1.9 cars per household

Neighborhood-oriented station area residents

1.9 cars per household

Commuter-oriented station area residents

2.0 cars per household

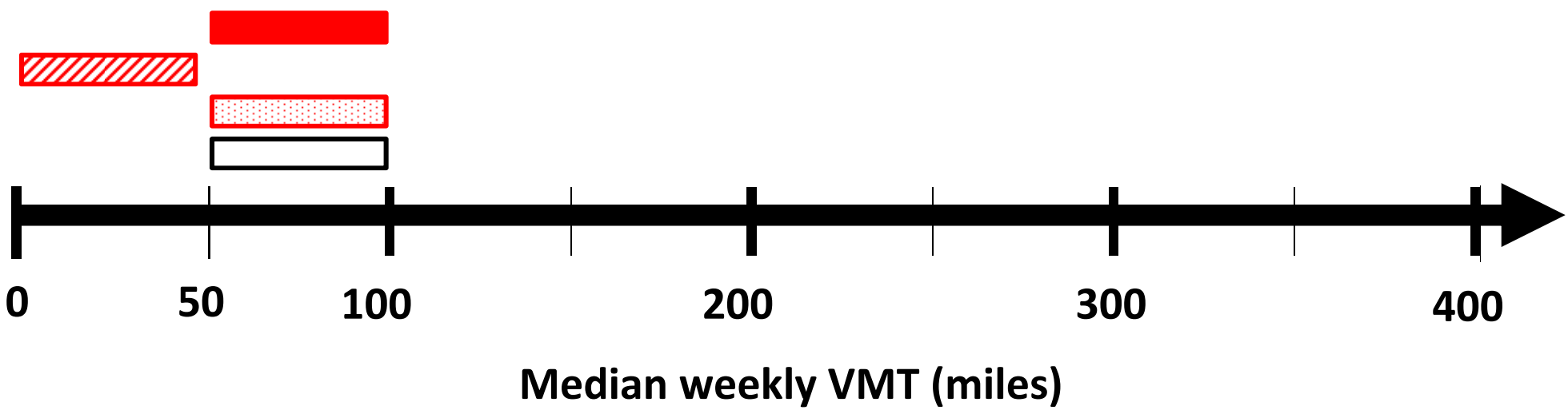
Respondents living beyond one-mile of light rail station

1.9 cars per household

Are there differences in <u>reported weekly VMT</u> between *neighborhood-oriented* and *commuter-oriented* residents?

Median weekly VMT:

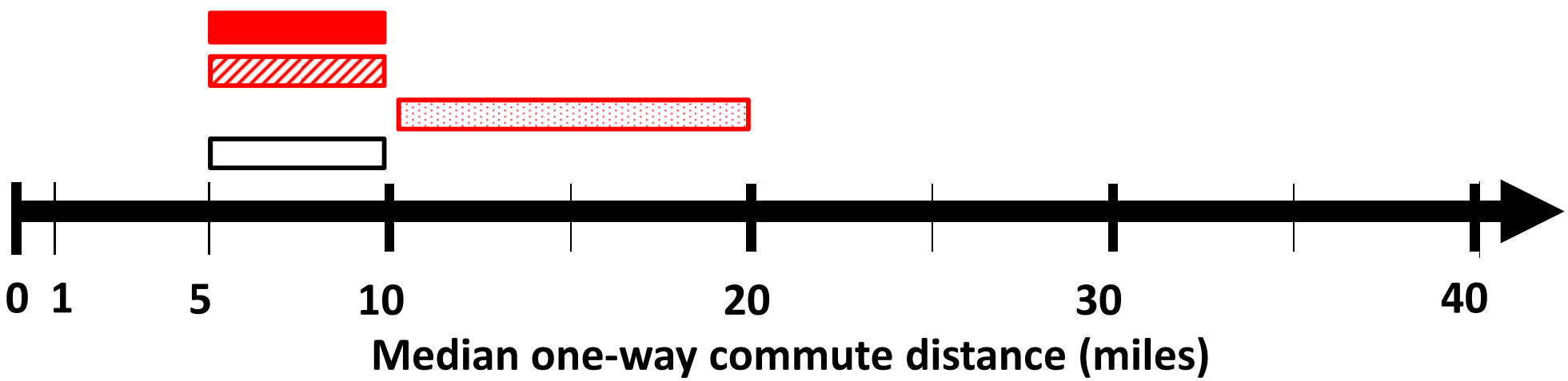
Station area residents:	**51 to 100 miles**
Neighborhood-oriented stations:	**0 to 50 miles**
Commuter-oriented stations:	**51 to 100 miles**
Outside of station area:	**51 to 100 miles**



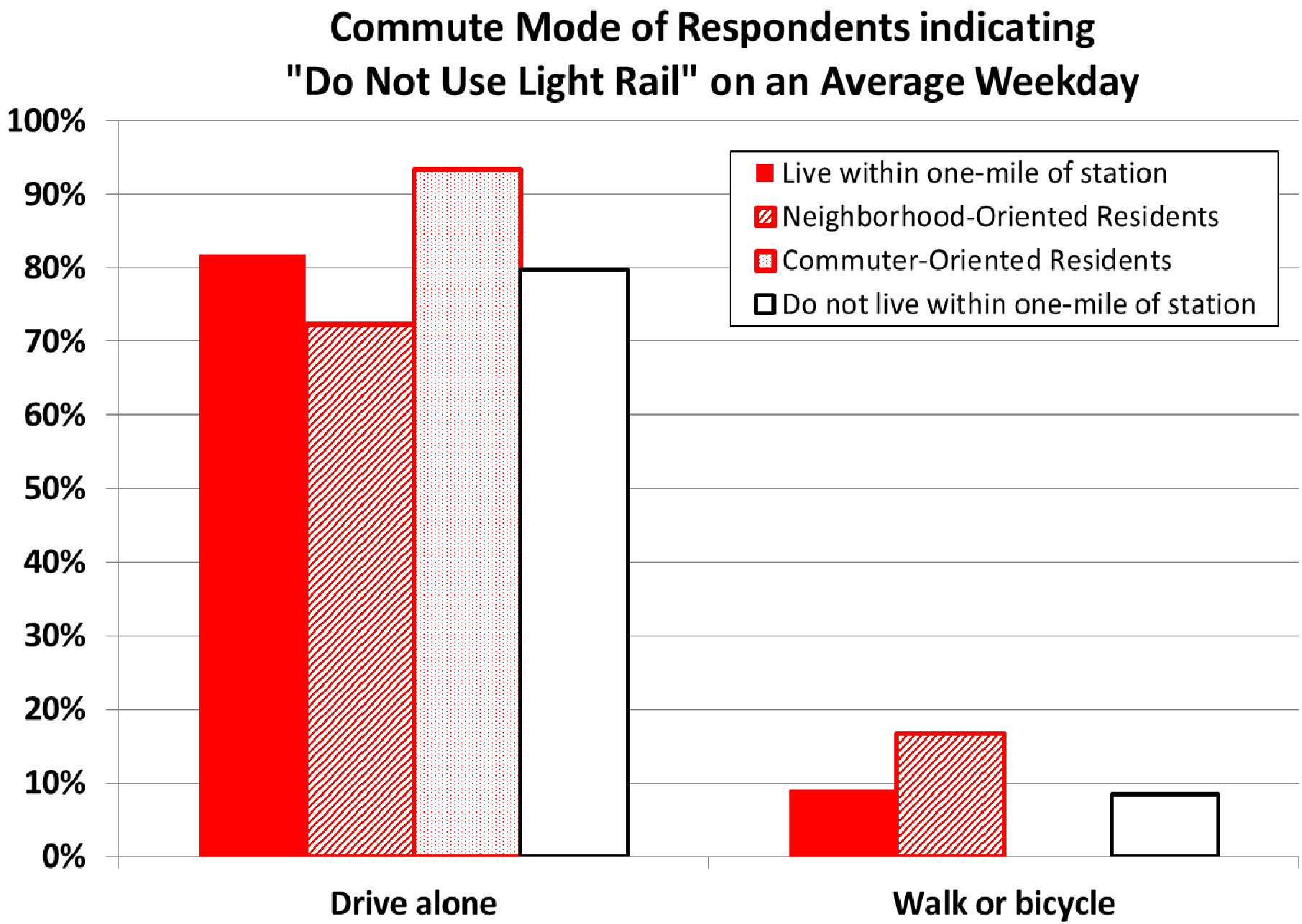
Are there differences in <u>one-way commute distances</u> between *neighborhood-oriented* and *commuter-oriented* residents?

Median commute distance:

Station area residents:	**5 to 10 miles**
Neighborhood-oriented stations:	**5 to 10 miles**
Commuter-oriented stations:	**10 to 20 miles**
Outside of station area:	**5 to 10 miles**



For those who do not commute by light rail, does <u>mode choice</u> differ between *neighborhood-* and *commuter-oriented* residents?



PRELIMINARY CONCLUSIONS

- **Differences in travel behavior of station area and non-station areas are not as great as expected**

- **However, differences between neighborhood- and commuter-oriented stations tell a more nuanced story**
  - Neighborhood stations are likely more able to achieve travel goals
  - Commuter stations show patterns more akin to non-station area residents

PRELIMINARY CONCLUSIONS

Two main findings:

1) Transit access alone is not likely to be “enough” to achieve station-level travel goals – level of integration is important

2) Disaggregating stations based on their level of integration tells us something interesting

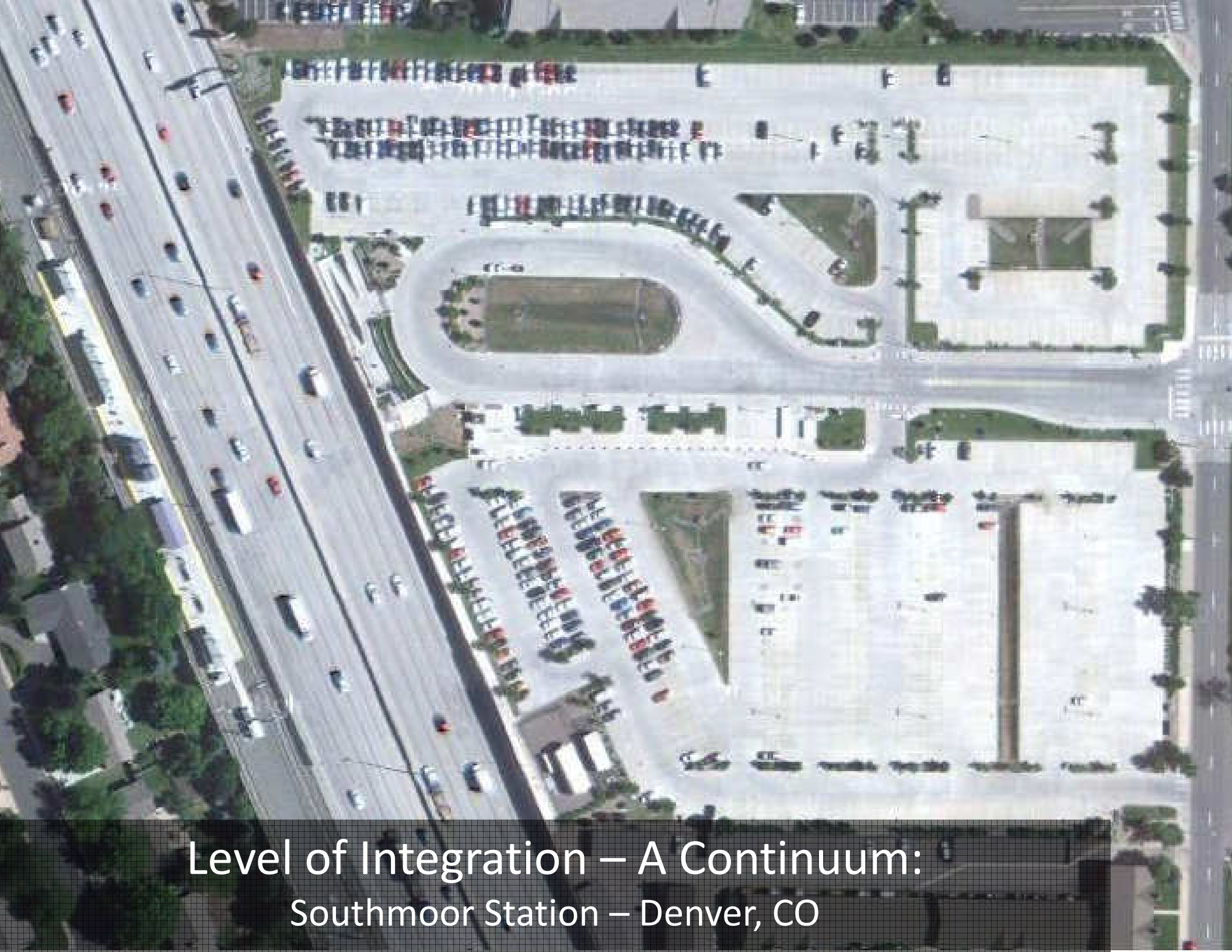
Livability Continuum

Level of integration between

transit service and community fabric

Low Integration

High Integration
"Transit-Enriched Communities"



Level of Integration – A Continuum:

Southmoor Station – Denver, CO

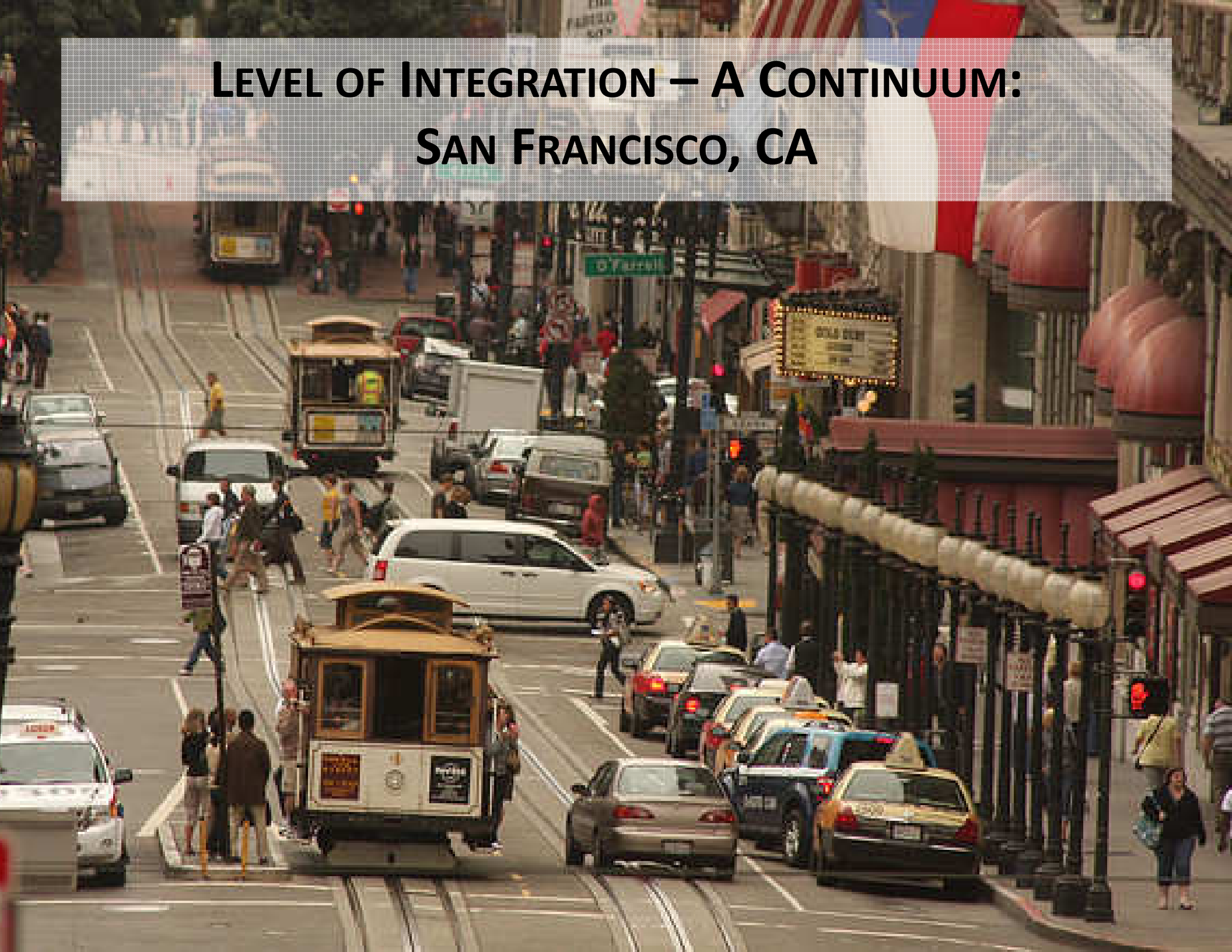
Level of Integration – A Continuum:

Orenco Station – Hillsboro, OR

Level of Integration – A Continuum:

Roslyn-Ballston Corridor – Arlington, VA

Level of Integration – A Continuum: San Francisco, CA



Level of Integration – A Continuum: Maeklong, Thailand

Shames Makovsky
AVAILABLE
303-534-5005
TCF BANK
TRAIN ONLY
DO NOT ENTER
30TH & DONNING
102
RTD
TJ maxx
STARBUCKS

How Do We Build Transit-Enriched Communities?

Healthy

Safe

Economic Activity

Social Equity

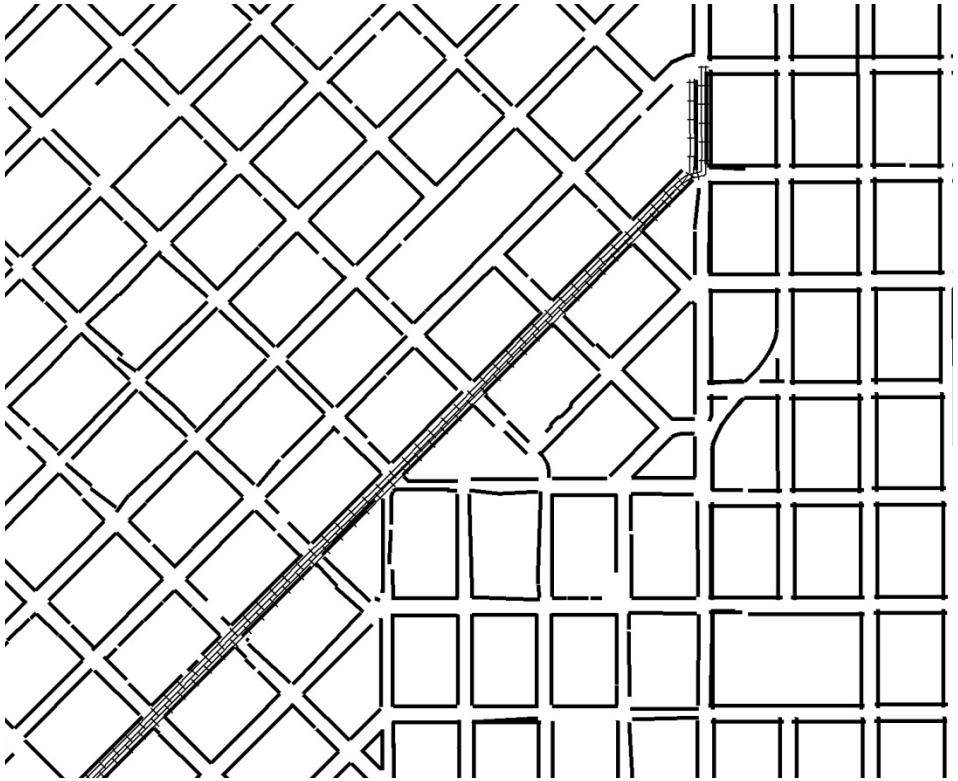
Accessible

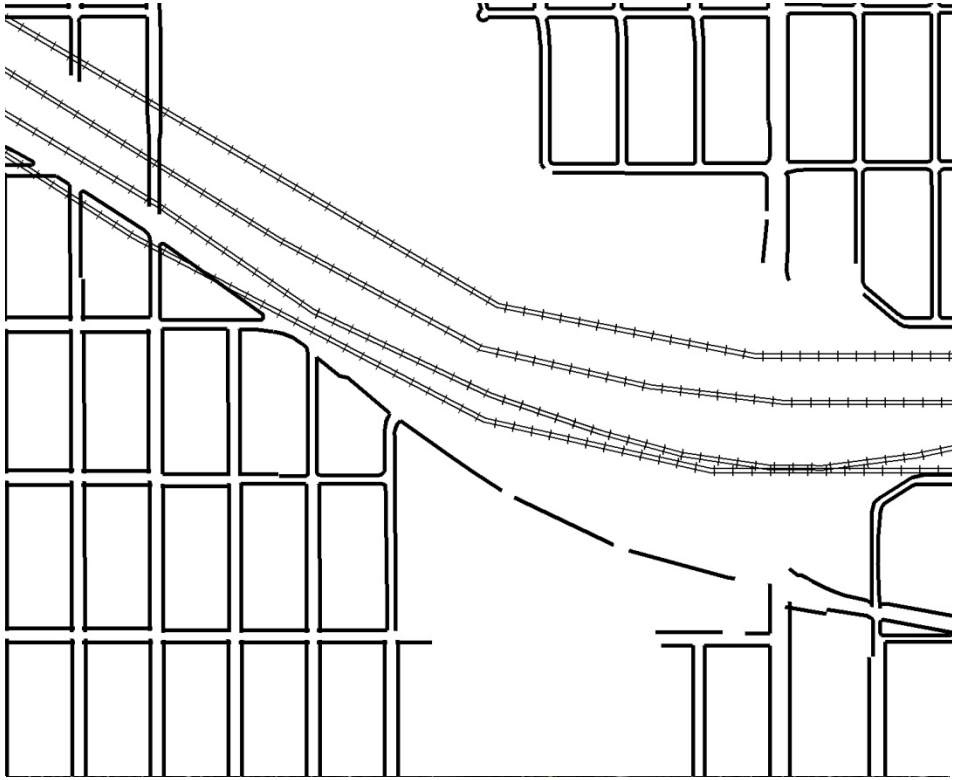
Efficient Mobility

Affordable

Community Input

Resilient





Rethinking Light Rail Transit in the Mile High City

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University of Colorado Denver

Active Communities / Transportation Research Group