# Examining the Equity Impacts of AVs – A Travel Demand Model Approach
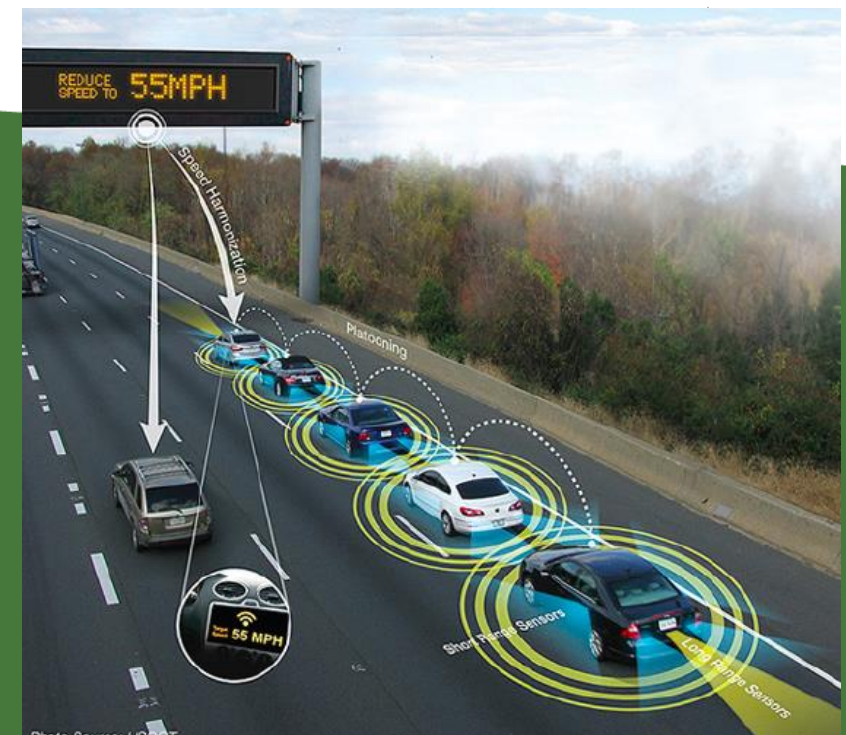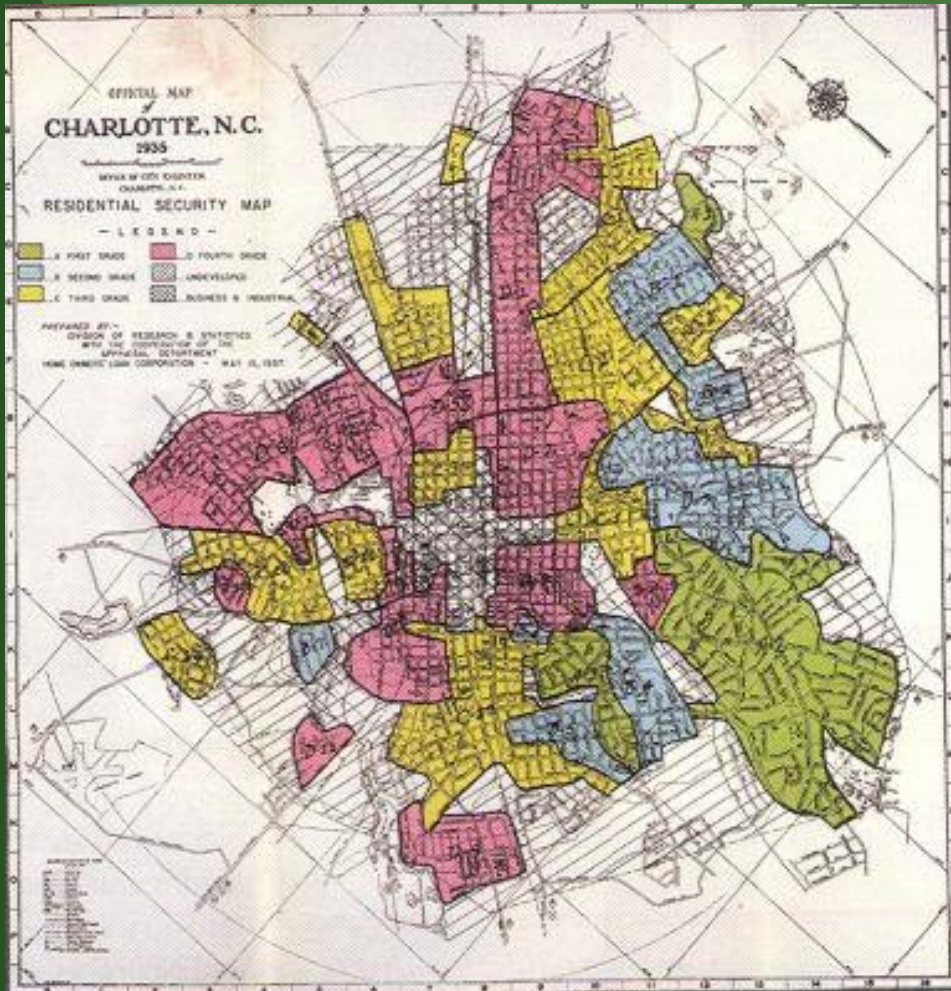
Jesse Cohn, AICP

# Discrimination & Disparate Outcomes



OFFICIAL MAP of CHARLOTTE., N.C. 1935 — RESIDENTIAL SECURITY MAP

**PEOPLE KILLED WHILE WALKING**

LOW INCOME **2X AS LIKELY**

HIGH INCOME

Governing, 2014

**CHILDREN KILLED WHILE WALKING**

AFRICAN AMERICAN **2X AS LIKELY**

LATINO **40% MORE LIKELY**

WHITE

Dangerous by Design, 2011

**STREETS WITH SIDEWALKS**

HIGH INCOME COMMUNITIES **90%**

LOW INCOME COMMUNITIES **50%**

Bridging the Gap, 2012

**CHANCE OF BEING STOPPED AND SEARCHED**

AFRICAN AMERICAN DRIVERS **5X AS LIKELY**

WHITE DRIVERS

New York Times, 2015

Equity refers to the fairness with which impacts – both benefits and costs – are distributed.

Equality

Equity

# Key Questions

- How will AVs impact travel in the region?

- Are outcomes different in underserved communities – both today and under different AV futures?

- Do AVs mitigate, maintain, or exacerbate existing differences?

# General Approach

DC regional travel demand model

↓

Adjust auto mode to mimic AVs

↓

Adjust transit & vehicle occupancy to develop different AV scenarios

↓

Assess regional, equity areas, and affluent area outcomes for key performance measures

# Assumptions

## AUTONOMOUS VEHICLES

- Roadway Capacity
- Auto Access and Park Time
- Parking Cost
- Value of Time
- Auto Availability
- Discretionary Trips
- Zero-Occupancy Trips
- Vehicle Occupancy

## TRANSIT SERVICE & OPERATIONS

- Transit Fares
- Speeds
- Frequencies
- Number of Routes

# Scenarios

1. 2017 Unmodified

2. 2040 Unmodified

3. 2040 Single-Occupancy AVs

4. 2040 Shared AVs

5. 2040 Single-Occupancy AVs + Limited Transit

6. 2040 Shared + Limited Transit

7. 2040 Single-Occupancy + Enhanced Transit

8. 2040 Shared+ Enhanced Transit

# Equity Emphasis Areas

Census tracts meeting one of three criteria:

1) high concentration of low-income individuals,

2) high concentration of two or more minority population groups

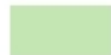3) high concentration of one or more minority population groups and low-income concentration

**Concentration:** between 1 and 1.5 times the regional average

**High Concentration:** greater than 1.5 times the regional average

# Equity Emphasis Areas

| Location Characteristics | | Region | Equity Emphasis Areas | Non-Equity Emphasis Areas |
|---|---|---|---|---|
| Land Use | Population | 6,820,772 | 1,769,589 | 5,051,183 |
| | Population Density | 2,197 | 7,451 | 1,762 |
| | Employment | 4,186,373 | 1,096,084 | 3,090,289 |
| | Employment Density | 1,349 | 4,615 | 1,078 |
| Income | < $50,000 | 29% | 43% | 24% |
| | $50,000-$100,000 | 31% | 32% | 30% |
| | $100,000-$150,000 | 20% | 16% | 22% |
| | > $150,000 | 21% | 10% | 25% |
| Vehicle Availability | 0 vehicles | 14% | 25% | 10% |
| | 1 vehicle | 33% | 36% | 32% |
| | 2 vehicles | 35% | 30% | 36% |
| | 3+ vehicles | 18% | 10% | 21% |

**Legend**

Equity Emphasis Areas
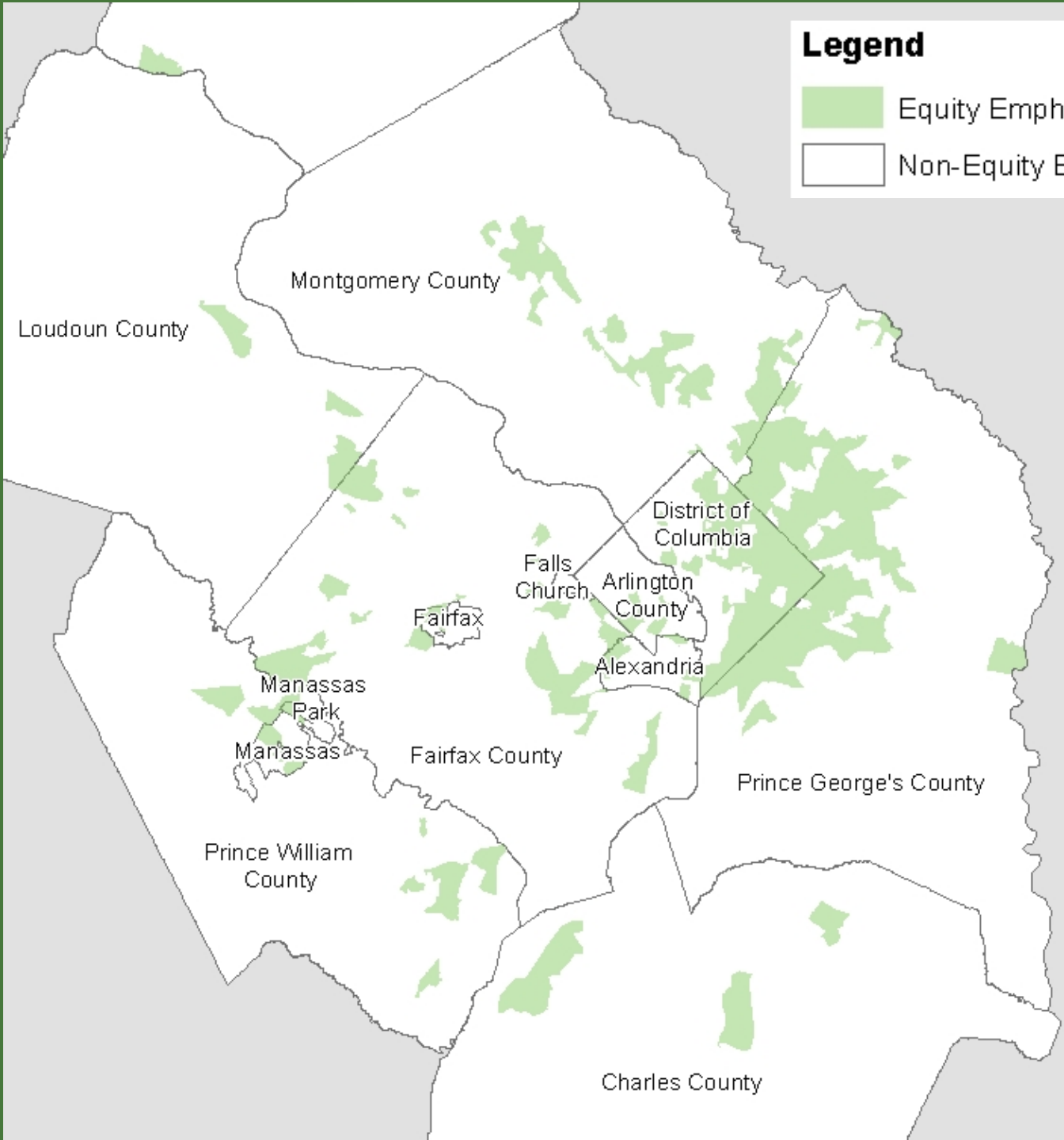
Non-Equity Emphasis Areas

Loudoun County

Montgomery County

District of Columbia

Falls Church

Arlington County

Fairfax

Alexandria

Manassas Park

Manassas

Fairfax County

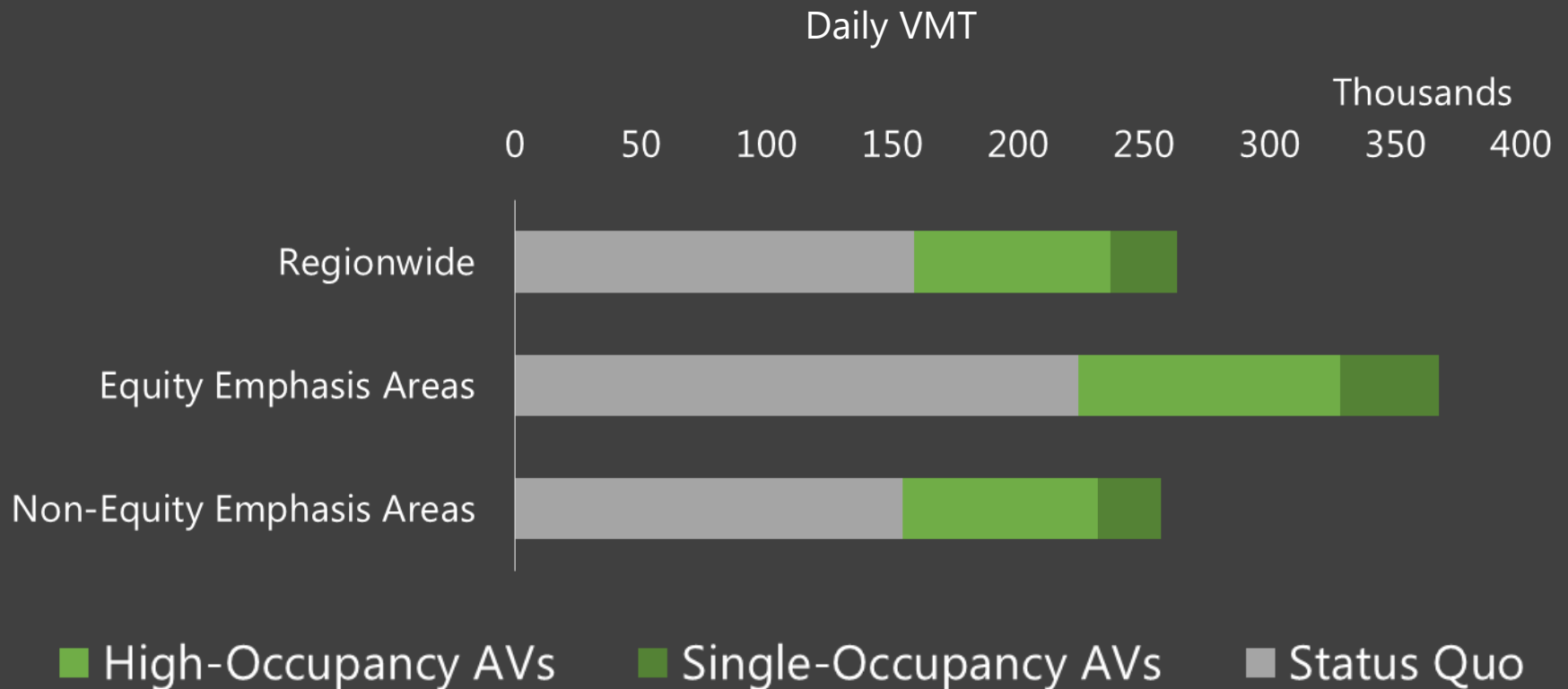Prince George's County

Prince William County

Charles County
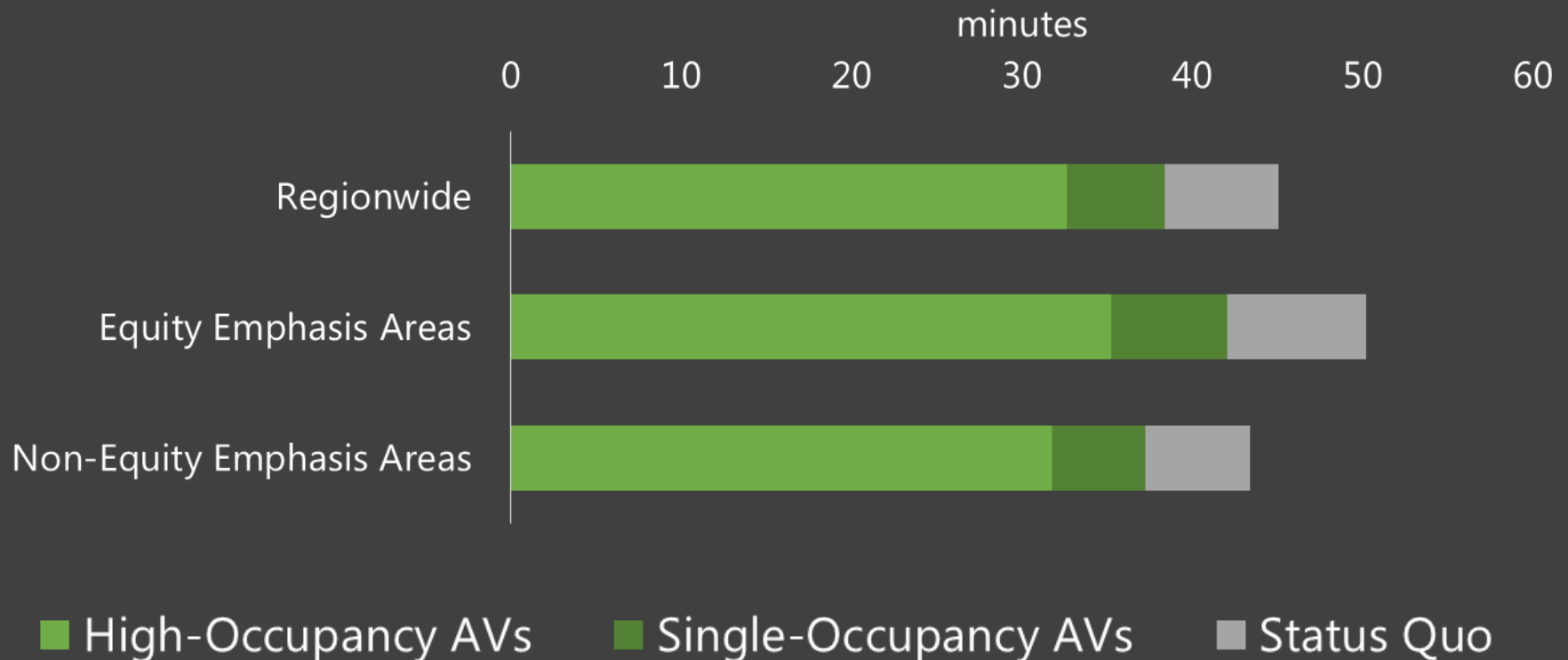
# Auto Job Accessibility

Equity Emphasis Areas have better job accessibility given their centrality; their advantage increases with AVs



jobs

Millions

| | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 |

Regionwide

Equity Emphasis Areas

Non-Equity Emphasis Areas

■ High-Occupancy AVs      ■ Single-Occupancy AVs      ■ Status Quo

FEHR PEERS|DC

# Exposure

AVs could increase vehicle miles traveled, increasing collision exposure, as well as exposure to noise and air pollution

## Daily VMT

Thousands

| | High-Occupancy AVs | Single-Occupancy AVs | Status Quo |
|---|---|---|---|

Categories (vertical axis): Regionwide, Equity Emphasis Areas, Non-Equity Emphasis Areas

Horizontal axis: 0, 50, 100, 150, 200, 250, 300, 350, 400

# Where Are Self-Driving Cars Taking Us?

*Pivotal Choices That Will Shape DC's Transportation Future*

# Every Neighborhood is Different....

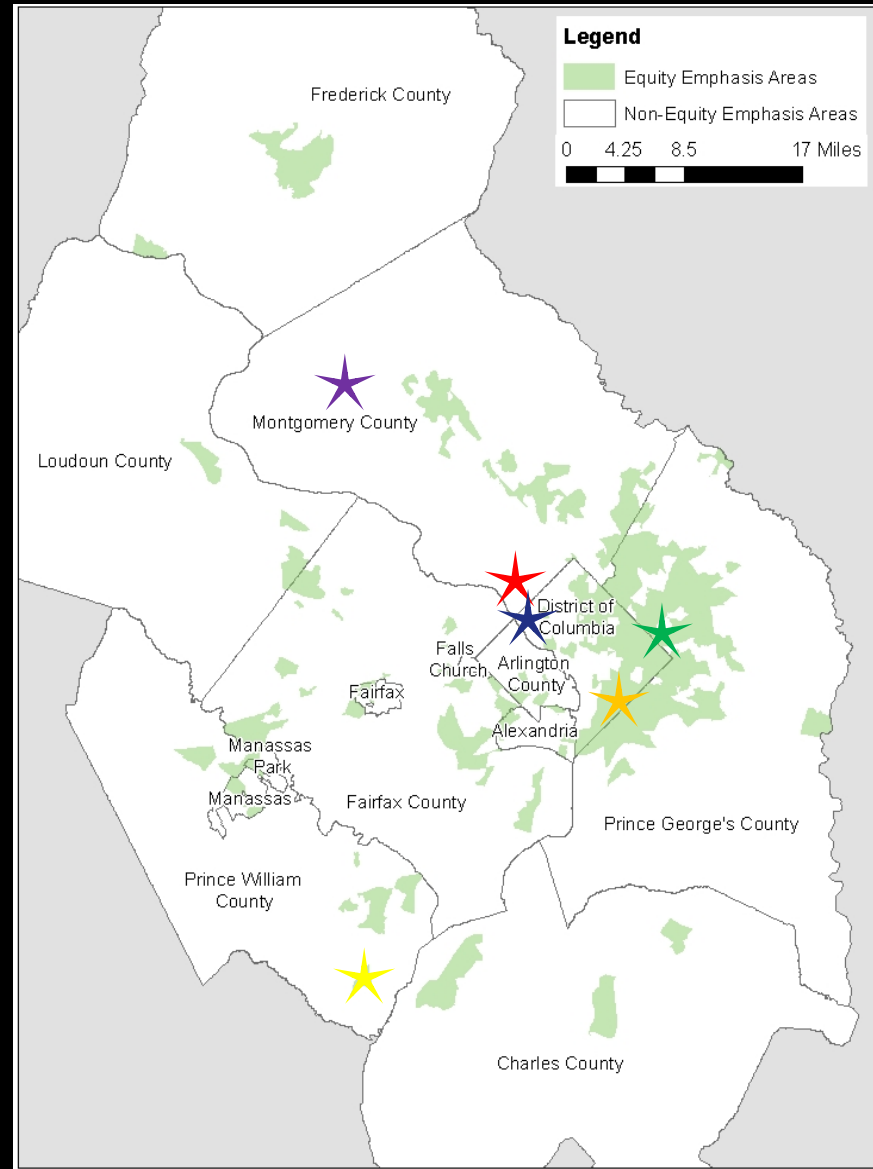# The East-West Divide

Change in Job Accessibility within a 45
Minute Commute from 2017 to 2040
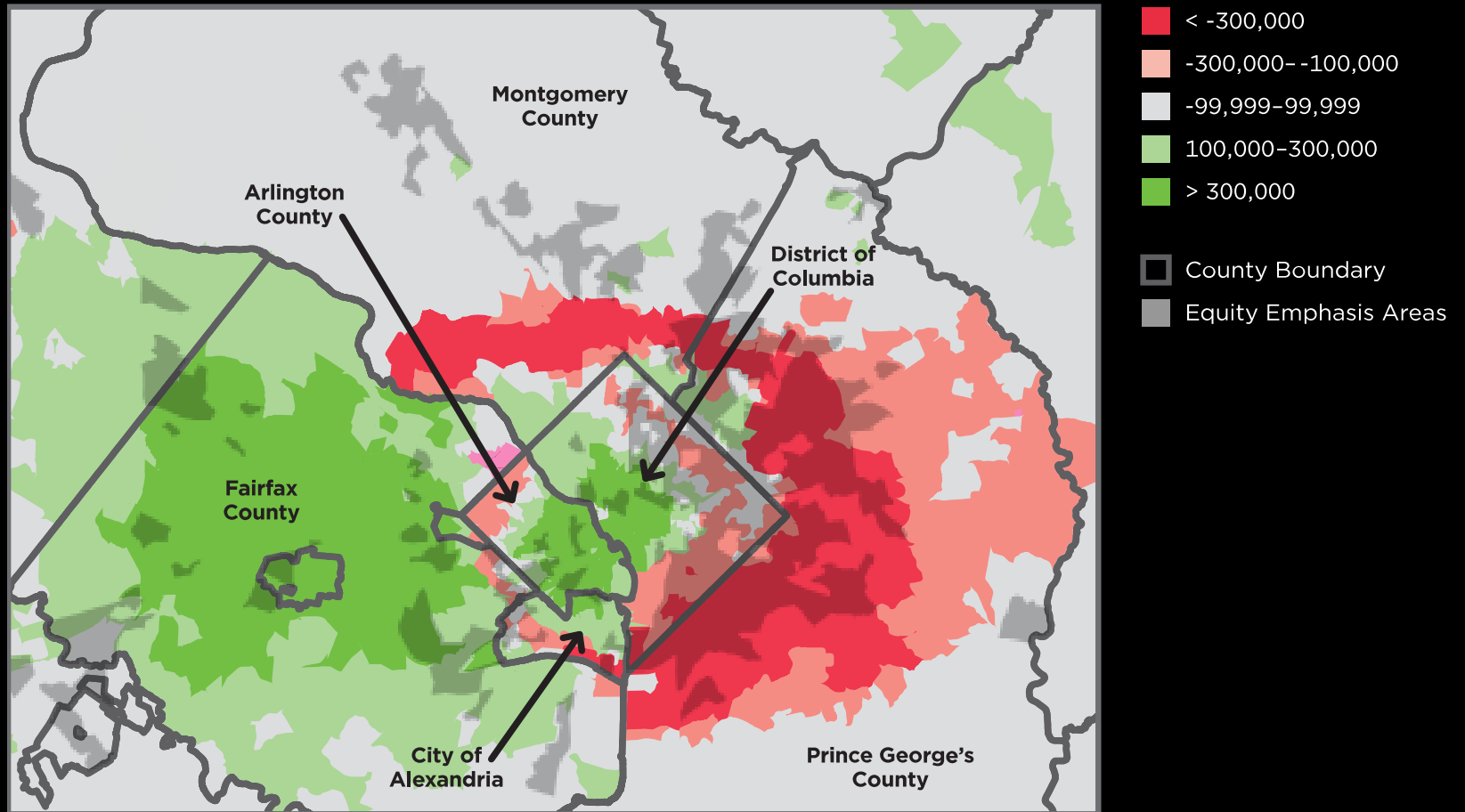
# Pairwise Comparisons

– <span style="color:green">Landover, MD</span> to <span style="color:red">Bethesda, MD</span>

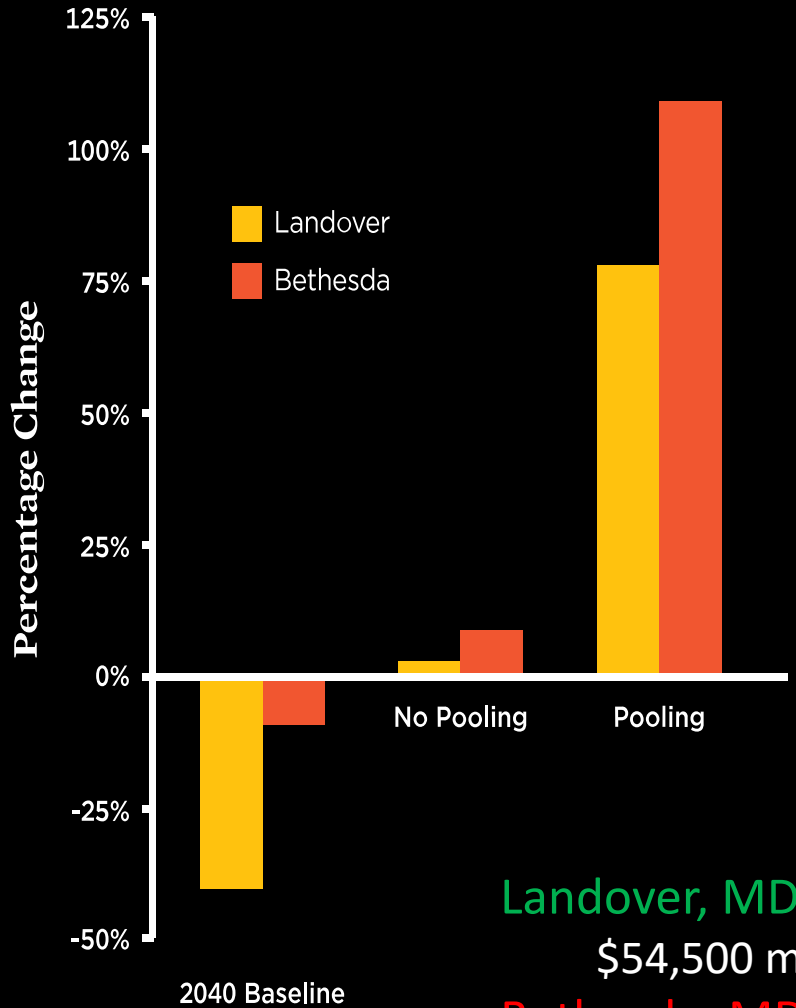– <span style="color:orange">Historic Anacostia, DC</span> to <span style="color:blue">Cleveland Park, DC</span>

– <span style="color:yellow">Dumfries, VA</span> vs <span style="color:purple">Damascus, MD</span>
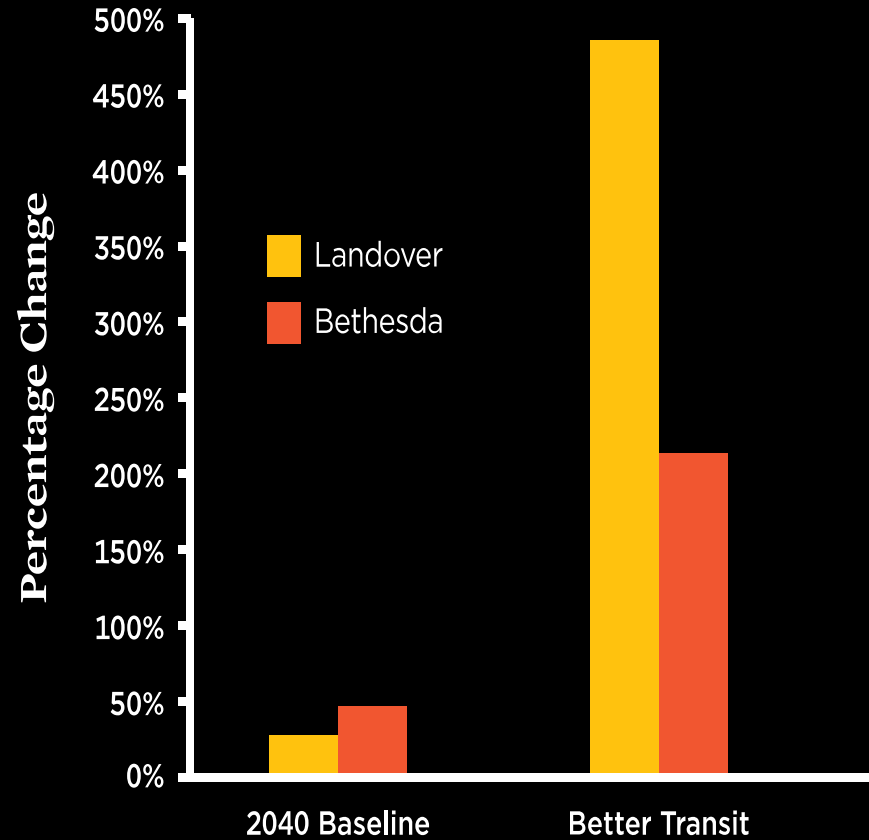
Job Accessibility by Car Percentage Change from 2017 Baseline

Job Accessibility by Transit Percentage Change from 2017 Baseline

**Percentage Change** (y-axis, left chart)

125%
100%
75%
50%
25%
0%
-25%
-50%

Landover
Bethesda

No Pooling
Pooling
2040 Baseline

**Percentage Change** (y-axis, right chart)

500%
450%
400%
350%
300%
250%
200%
150%
100%
50%
0%

Landover
Bethesda

2040 Baseline
Better Transit

Landover, MD
$54,500 median income, 88 percent people of color
Bethesda, MD
$124,400 median income, 19 percent people of color

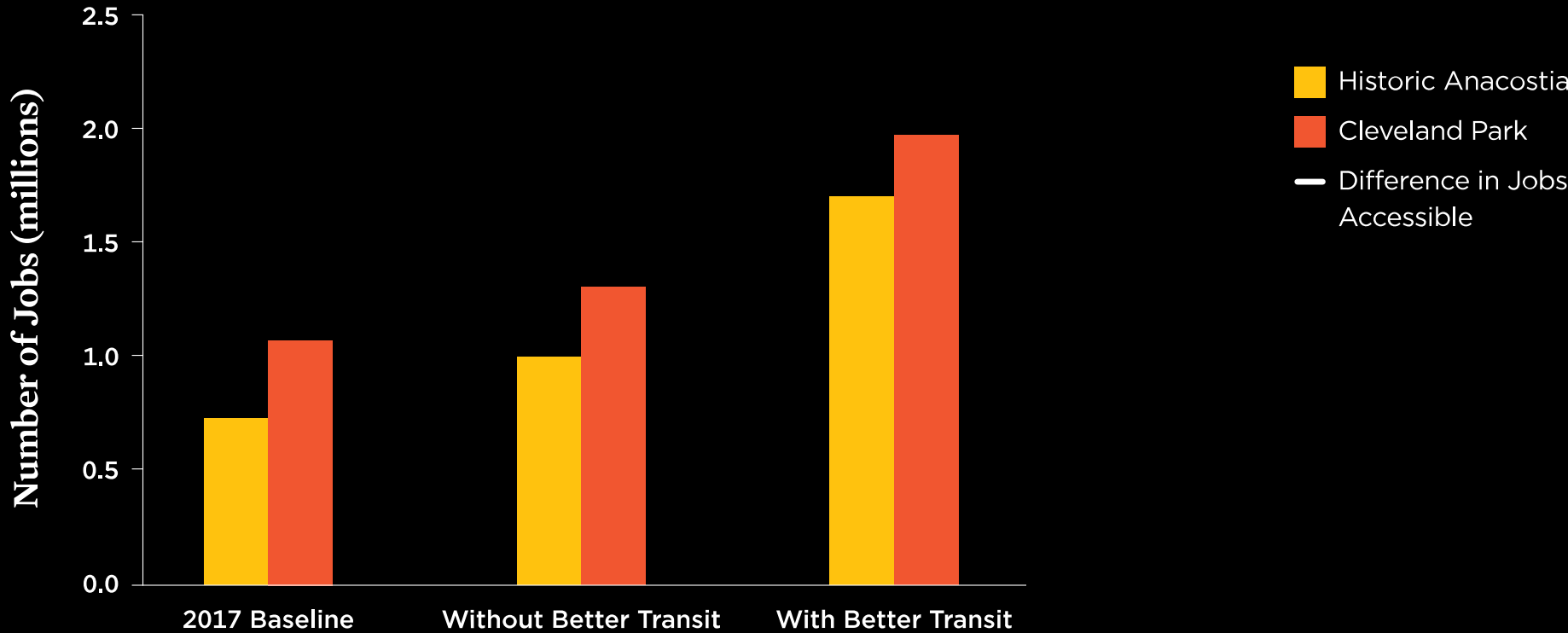Disparities in Jobs Accessible by Transit, Historic Anacostia vs. Cleveland Park

Number of Jobs (millions)

Legend:
- Historic Anacostia
- Cleveland Park
- Difference in Jobs Accessible

Categories: 2017 Baseline, Without Better Transit, With Better Transit

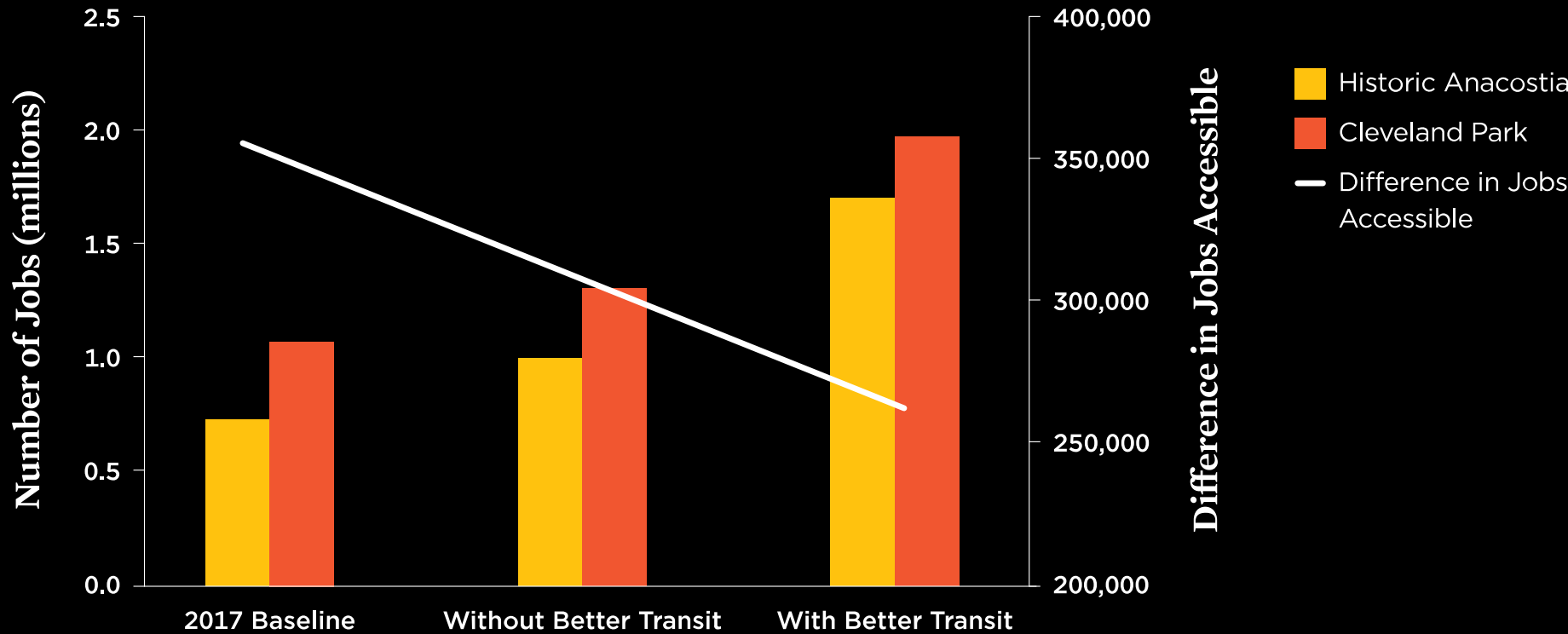Historic Anacostia, DC
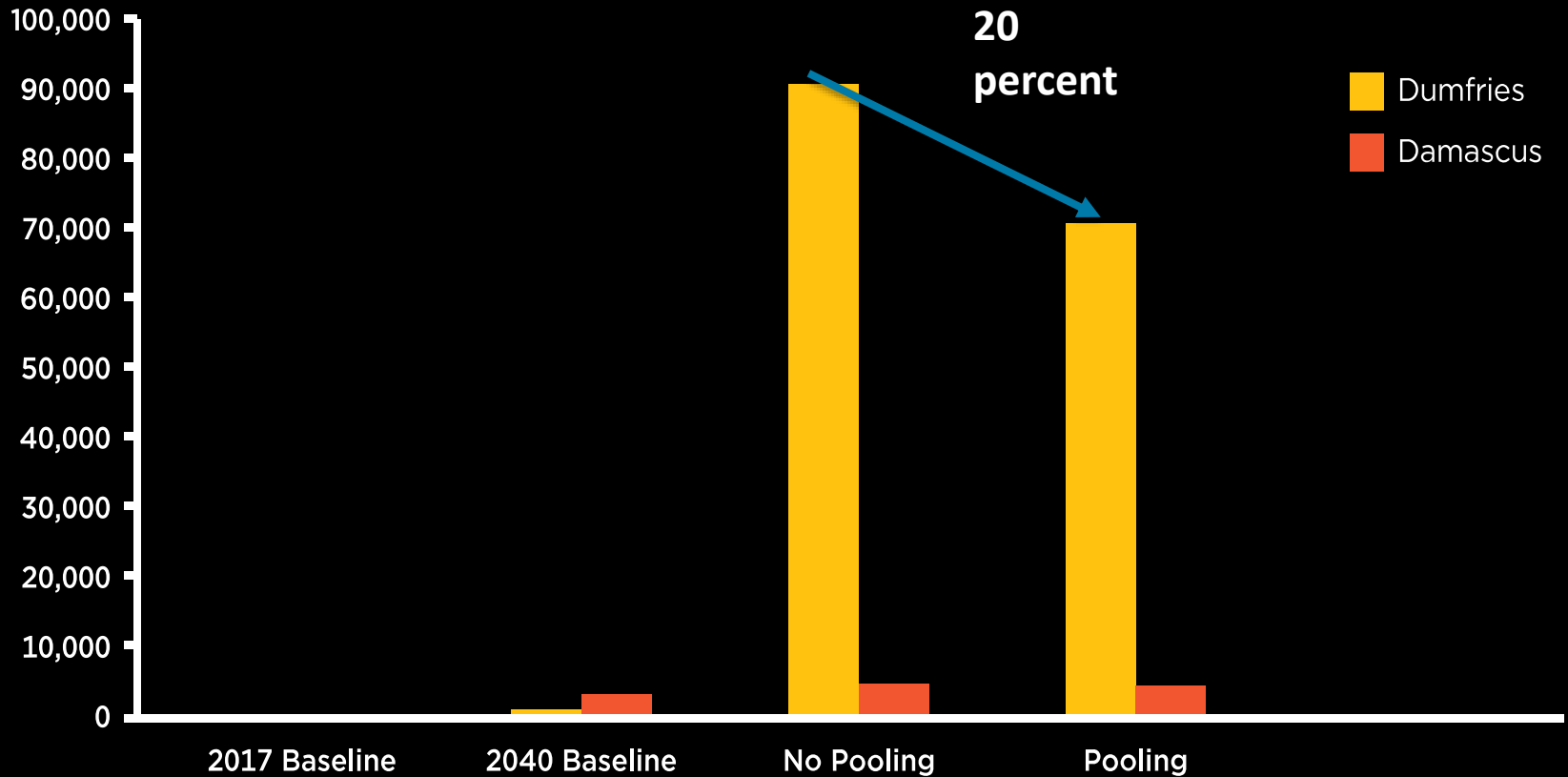$23,700 median income, 98 percent people of color
Cleveland Park, DC
$89,700 median income, 13 percent people of color

Disparities in Jobs Accessible by Transit, Historic Anacostia vs. Cleveland Park

- Improving the transit system in the DC metro area would reduce inequities in job accessibility by transit between Historic Anacostia and Cleveland Park

Congested Vehicle Miles Traveled:
Dumfries vs. Damascus

20 percent

Dumfries
Damascus

2017 Baseline   2040 Baseline   No Pooling   Pooling

Dumfries, VA
$76,700 median income, 56 percent people of color
Damascus, MD
$123,700 median income, 22 percent people of color

# Equity Emphasis Areas (DC)
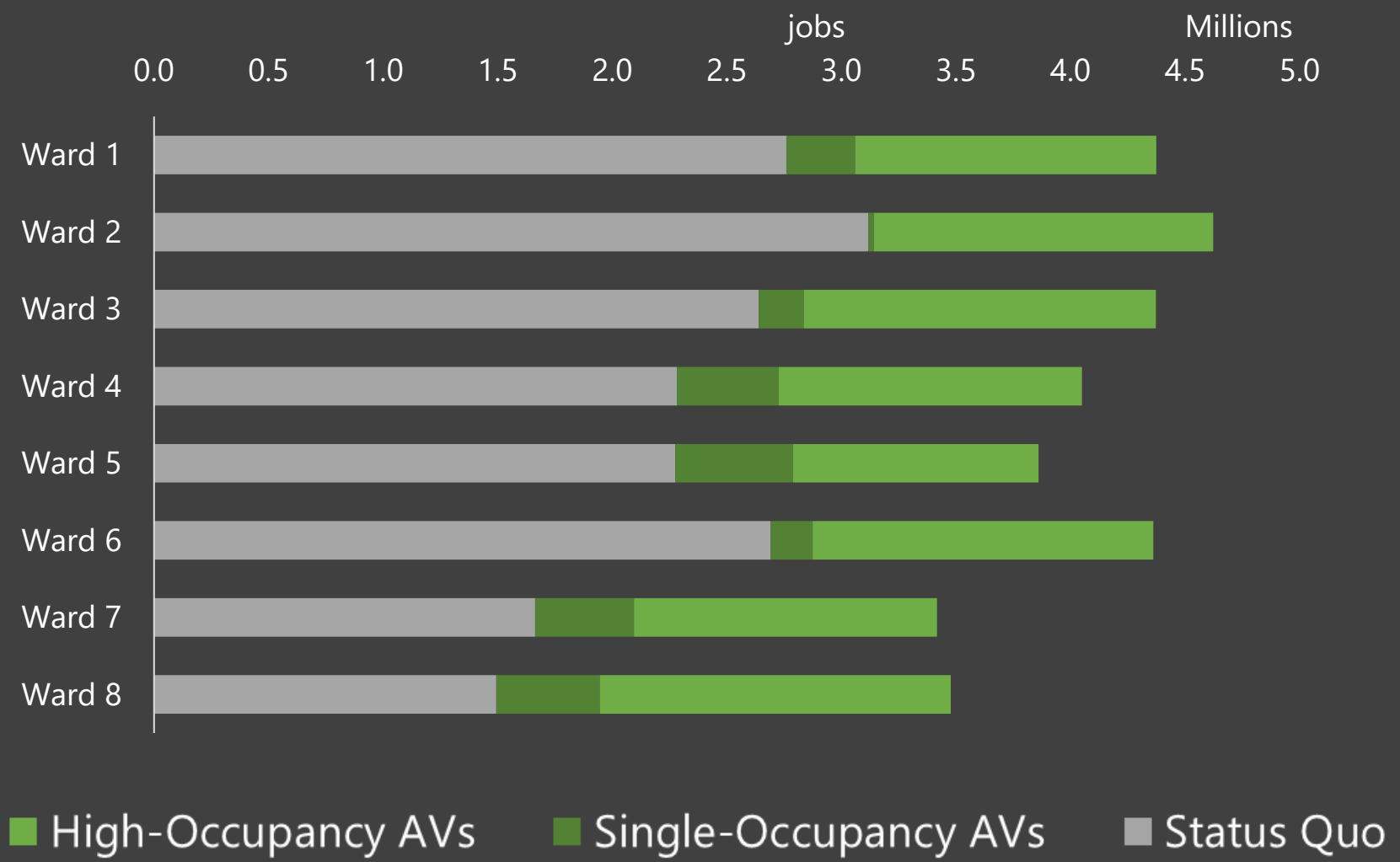
| Location Characteristics | | District | Equity Emphasis Areas | Non-Equity Emphasis Areas |
|---|---|---|---|---|
| Land Use | Population | 695,135 | 405,115 | 290,020 |
| | Employment | 817,462 | 335,564 | 481,898 |
| Income | < $50,000 | 48% | 59% | 36% |
| | $50,000-$100,000 | 29% | 27% | 30% |
| | $100,000-$150,000 | 13% | 9% | 18% |
| | > $150,000 | 10% | 5% | 16% |
| Vehicle Availability | 0 vehicles | 39% | 42% | 36% |
| | 1 vehicle | 39% | 36% | 42% |
| | 2 vehicles | 17% | 18% | 17% |
| | 3+ vehicles | 4% | 4% | 5% |
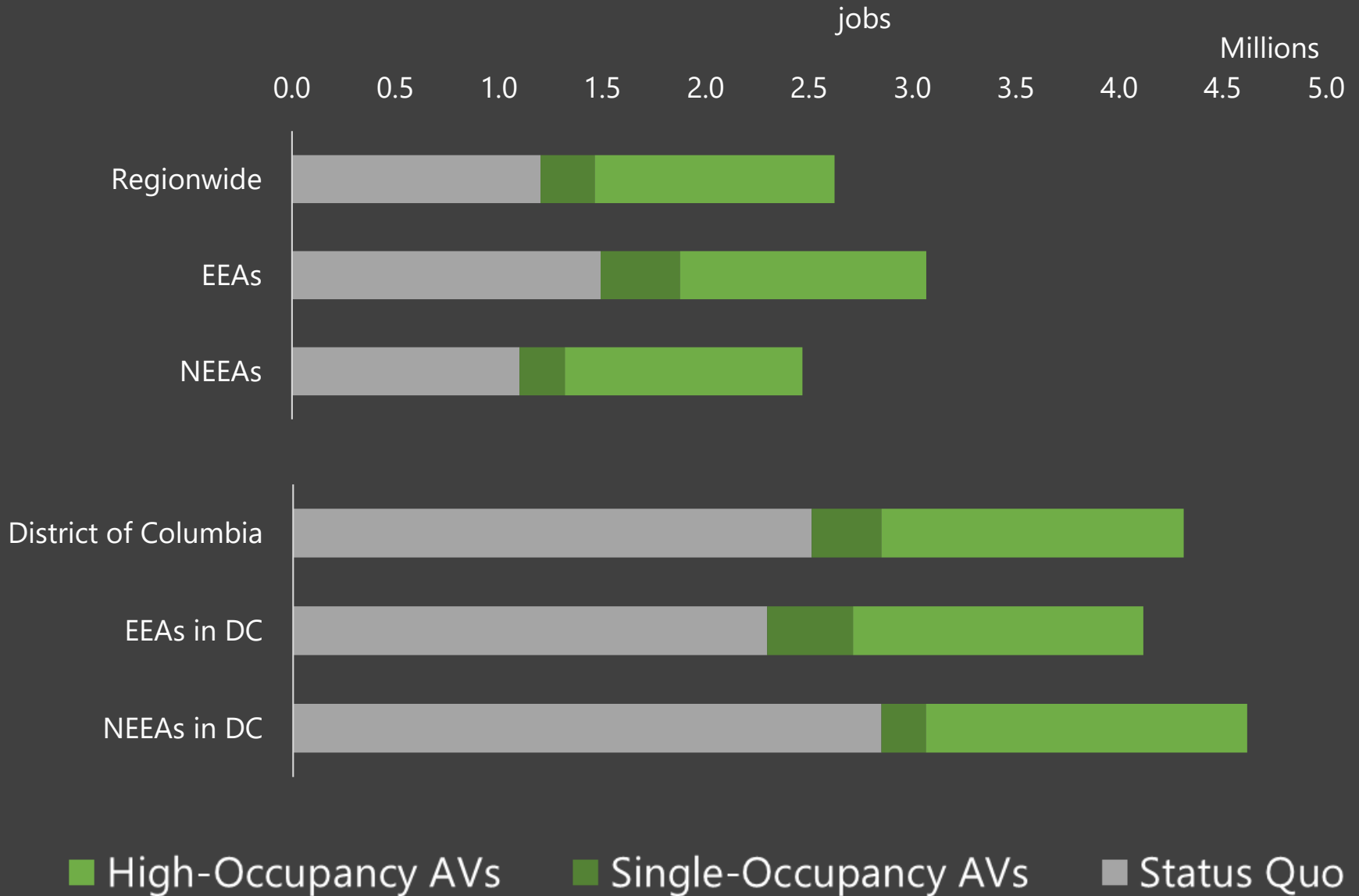
Auto Job Accessibility

# AV Policy Levers

- Transit Enhancements
- Congestion Pricing
- Freight/Goods Movement
- Technology
  - Virtual Reality
  - Micro-mobility

# AV Policy Lever Metrics

| Measure | VMT | Auto Trips | Transit Trips |
|---------|-----|------------|---------------|
| Transit Enhancements | -0.5% | -0.8% | +60.8% |
| Congestion Pricing | -0.3% | -0.1% | +0.9% |
| Freight Movement | -4.5% | +0.1% | +0.1% |
| Technology | -5.6% | -5.4% | -4.0% |
| Combined | -11.0% | -6.1% | +55.5% |

*Note: change from single-occupancy AV baseline*

# Many AV Futures
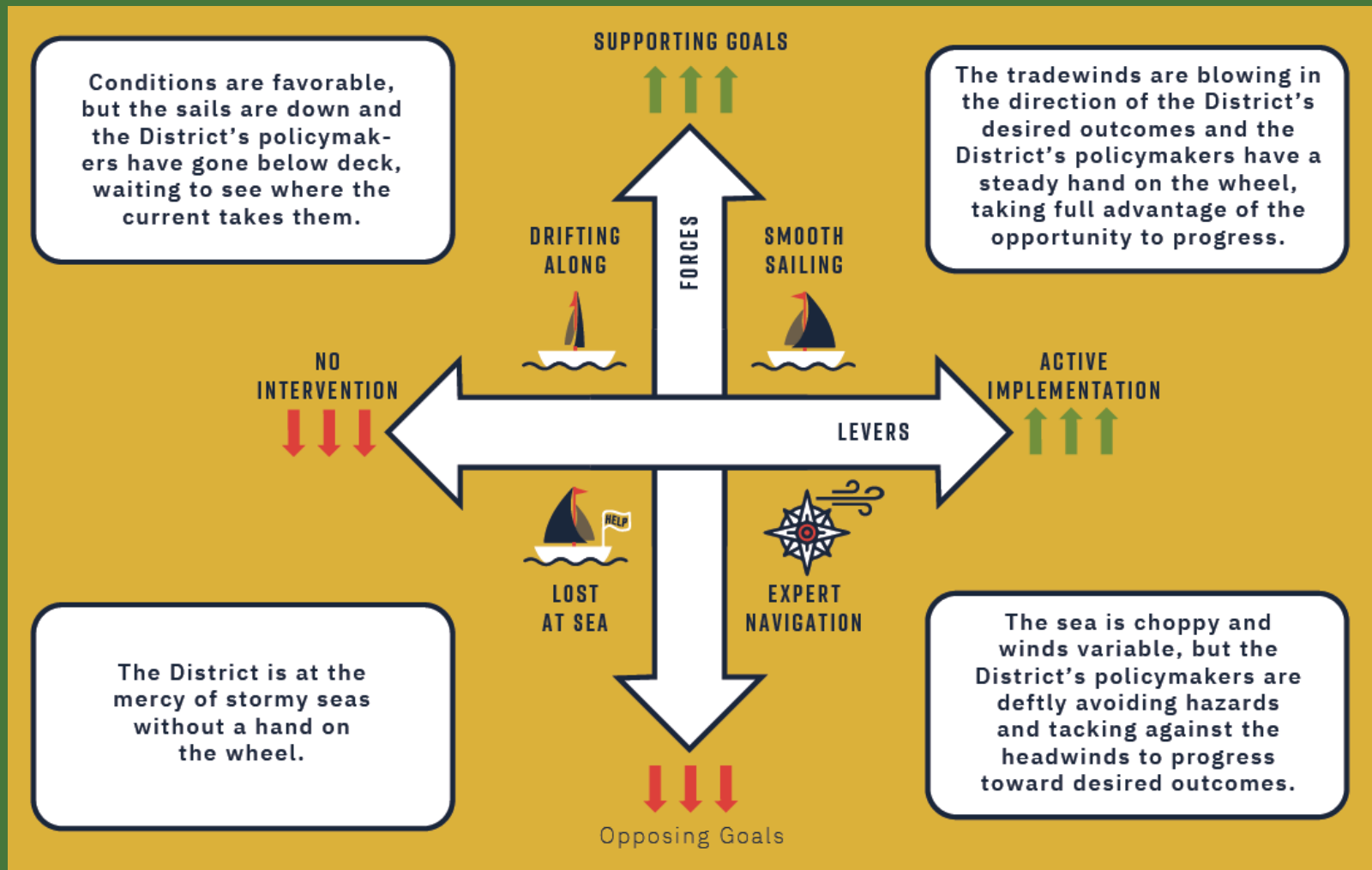
# Policy Recommendations

– To Avoid Congestion, AV Deployment Must Prioritize the Movement of People over Vehicles by Encouraging Pooling

– To Maintain Multimodal Access and Improve Equity, Mass Transit Must Be Modernized and Improved

– To Reduce Pollution Associated with Increased VMT, AVs Must Be Powered Primarily by Electricity

# Where Are Self-Driving Cars Taking Us?

*Pivotal Choices That Will Shape DC's Transportation Future*

Union of Concerned Scientists

ucsusa.org/AV-equity

- Cost-Effective For All Incomes
- Reduction in Criteria and GHG Emissions
- Invest in Public Transit
- Support Pooled Rides