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Racial Bias in Driver Yielding Behavior at Crosswalks

Kimberly Kahn
Portland State University

Peter Koonce
Portland Bureau of Transportation

George Stern
Deafblind Citizens in Action

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Street Lighting & Crosswalk Equity Analysis

PETER KOONCE, PE

@PKOONCE

APRIL 2, 2021

FRIDAY TRANSPORTATION SEMINAR

Outline

Street Lighting and Equity

PBOT Strategic Plan

Equity Analysis Dashboard

- Street Lighting
- Crosswalks and Traffic Signals

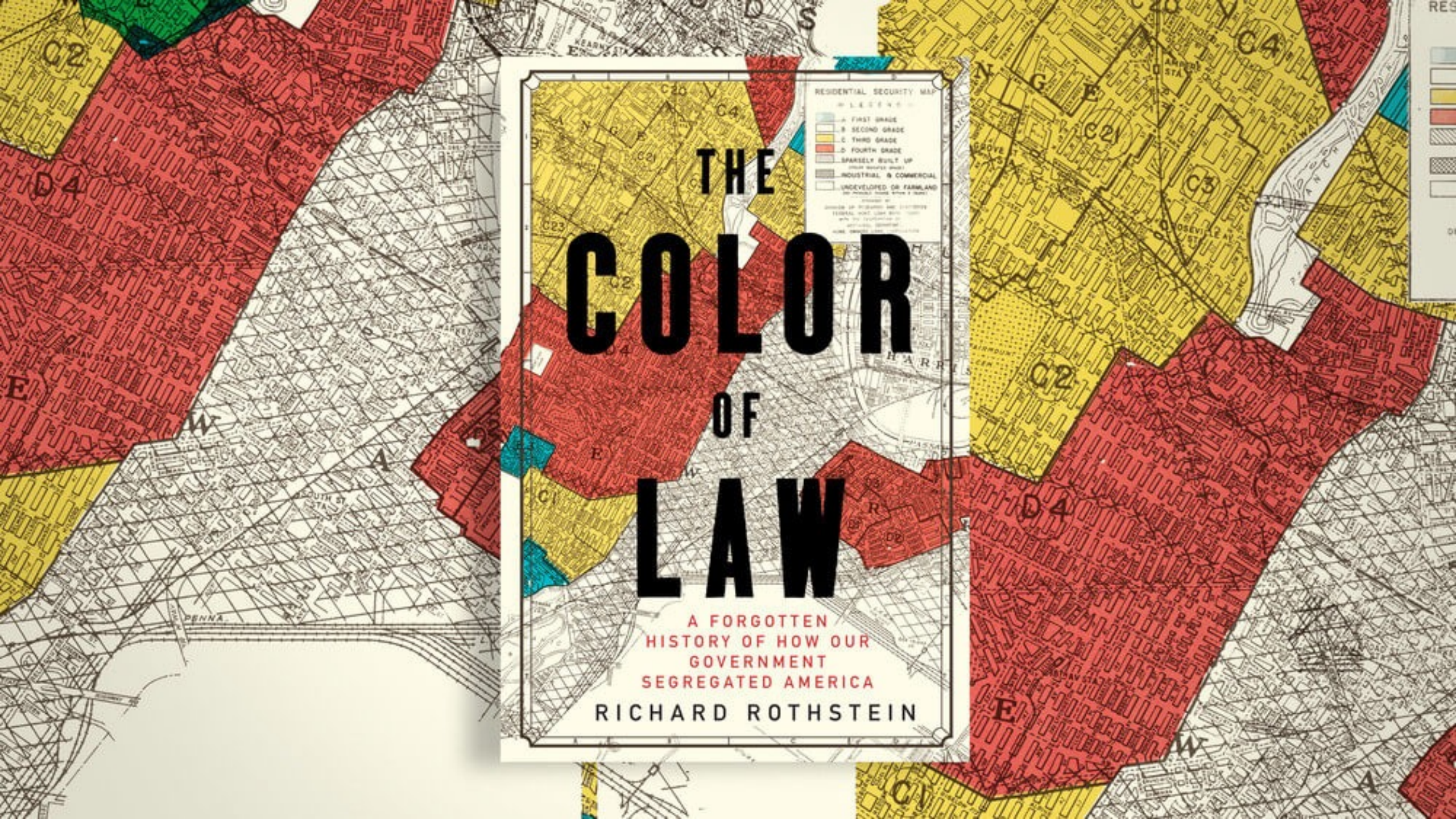
Street Lighting History

In 1912, the Greater Portland Plan stated:

"Portland is second to no city in the world in the matter of street lighting"

In 1925, the ornamental street lighting program was launched

In 1956, Portland celebrated Mercury Vapor street lighting being installed


THE
COLOR
OF
LAW
A FORGOTTEN HISTORY OF HOW OUR GOVERNMENT SEGREGATED AMERICA
RICHARD ROTHSTEIN

pdx.maps.arcgis.com/apps/MapSeries/index.html?appid=2e2252af23ed4be3a666f780cbaddfc5

Apps | Weather NOAA | Interim Approval fo... | PBOT Equity Matrix... | City of Portland Sec... | SLRP 2.21 - Street L... | CIP Prod - Tableau...

PBOT Equity Matrix + demographic indicator maps

Portland Bureau of Transportation

PBOT
PORTLAND BUREAU OF TRANSPORTATION

Equity Matrix | Equity + Inclusion | The City of Portland, Oregon

PBOT's Equity Matrix

To inform our work, guide our investments and work to achieve the Citywide Racial Equity Goals and Strategies, PBOT has created a simplified version of an **Equity Matrix**, or equity ranking index, that can be used to help rank many of our internal lists that relate to projects, programs and even procedures.

PBOT has standardized an **Equity Matrix** based on national best practices, so that moving forward we can have more consistency in how we use an equity matrix, and what the equity matrix measures.

National best practice and the City's Office of Equity and Human Rights say to use only three demographic variables in an equity matrix: **Race**, **Income**, and **Limited English Proficiency** (LEP). LEP was not included in the calculation of the matrix due to a relatively high level of uncertainty and error in the underlying data. Instead, Census Tracts with higher than citywide average populations with LEP are outlined on the map.

Racial categories and the percentage of the population that identifies as Hispanic/Latino were estimated separately by the US Census Bureau. The numbers in the racial population categories may not add up to the total number of people of color used to calculate the Racial Equity Score.

PBOT Equity Matrix - Composite Score

Income Equity Score	5
Racial Equity Score	3
Combined Equity Score	8
Most Common Non-English Language	Spanish
2nd Most Common Non-English Language	
3rd Most Common Non-English Language	
Median Income	13,831
Total Population	2,932

Equity in Street Lighting

Considered the perspective of equity in how to deliver a Citywide LED program

Measured rollout to prioritize areas within census tracts

ORIONTRAIL/SHUTTERSTOCK

Inclusion of Equity in an LED Citywide Street Lighting Replacement Program

By Peter Koonce, P.E.

Equity is a topic that's emerging in cities across the United States. As cities become more racially, ethnically, and age diverse, transportation practitioners should evolve practices that consider the needs of the community. Like other cities, there are

Walking While Black

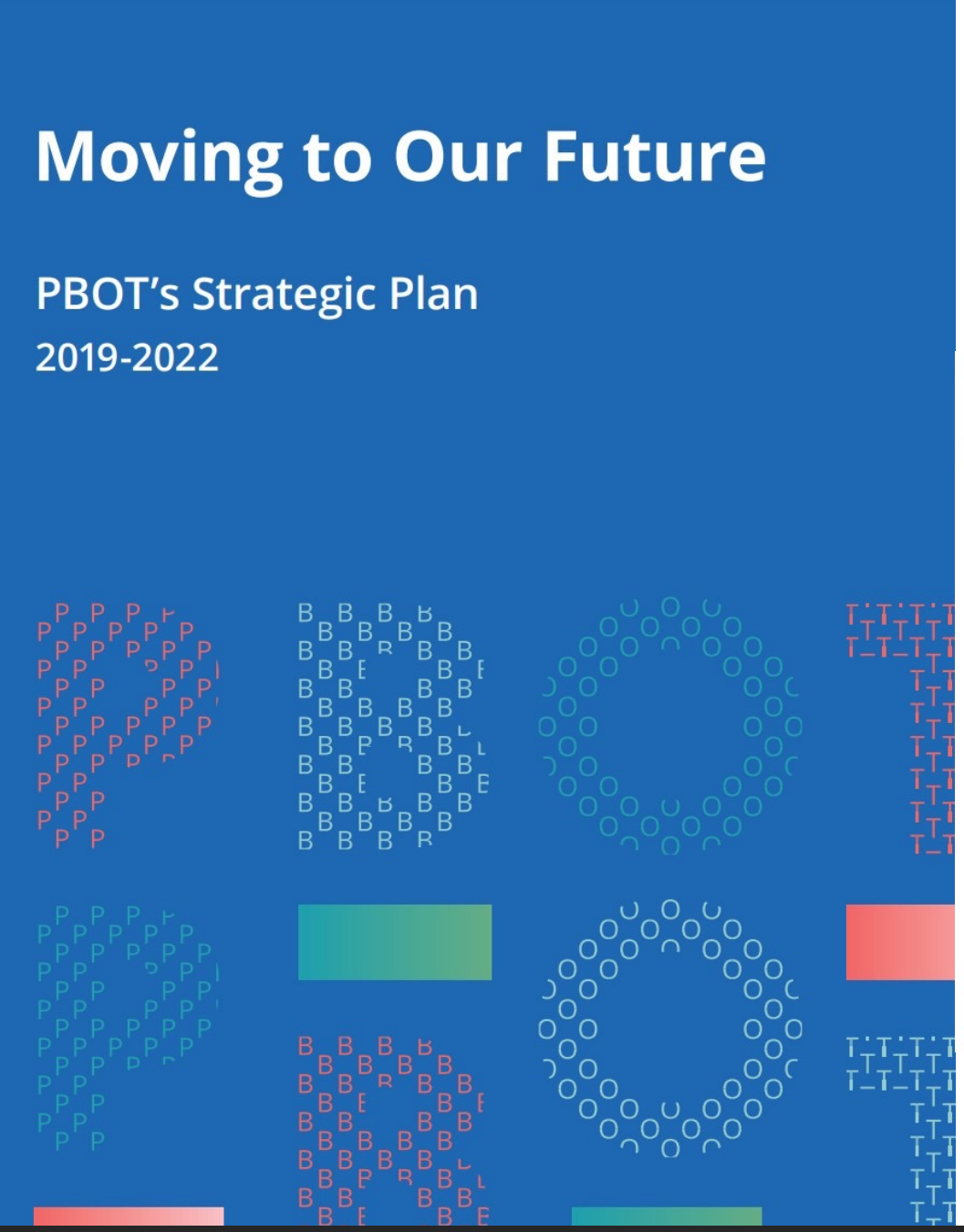
PED PDX

PORTLAND'S CITYWIDE PEDESTRIAN PLAN

Places to Improve - Average Point Value (from 1-6)

WHAT MAKES WALKING DIFFICULT IN PORTLAND?	WALKING WHILE BLACK	CITYWIDE
Poor Lighting	5.00	3.62
Sidewalks / walking paths missing on BUSY Streets	4.94	4.66
People driving too fast on BUSY streets	4.82	4.29
Not enough safe places to cross busy streets	4.78	4.46
People driving too fast on RESIDENTIAL streets	4.74	4.44
Sidewalks / walking paths missing on RESIDENTIAL streets	4.71	4.29
Drivers not stopping for pedestrians crossing the street	4.47	4.29
Buckled / cracked / uplifted sidewalks, or other tripping hazards	4.47	3.46
Missing curb ramps at intersections	4.00	3.22
Not enough time to cross the streets	3.91	3.08

Figure 1. Which kinds of places are the most important to improve for walking in Portland?



PBOT Strategic Plan

Will it advance equity and address structural racism?

Will it reduce carbon emissions?

NON-INSULATING

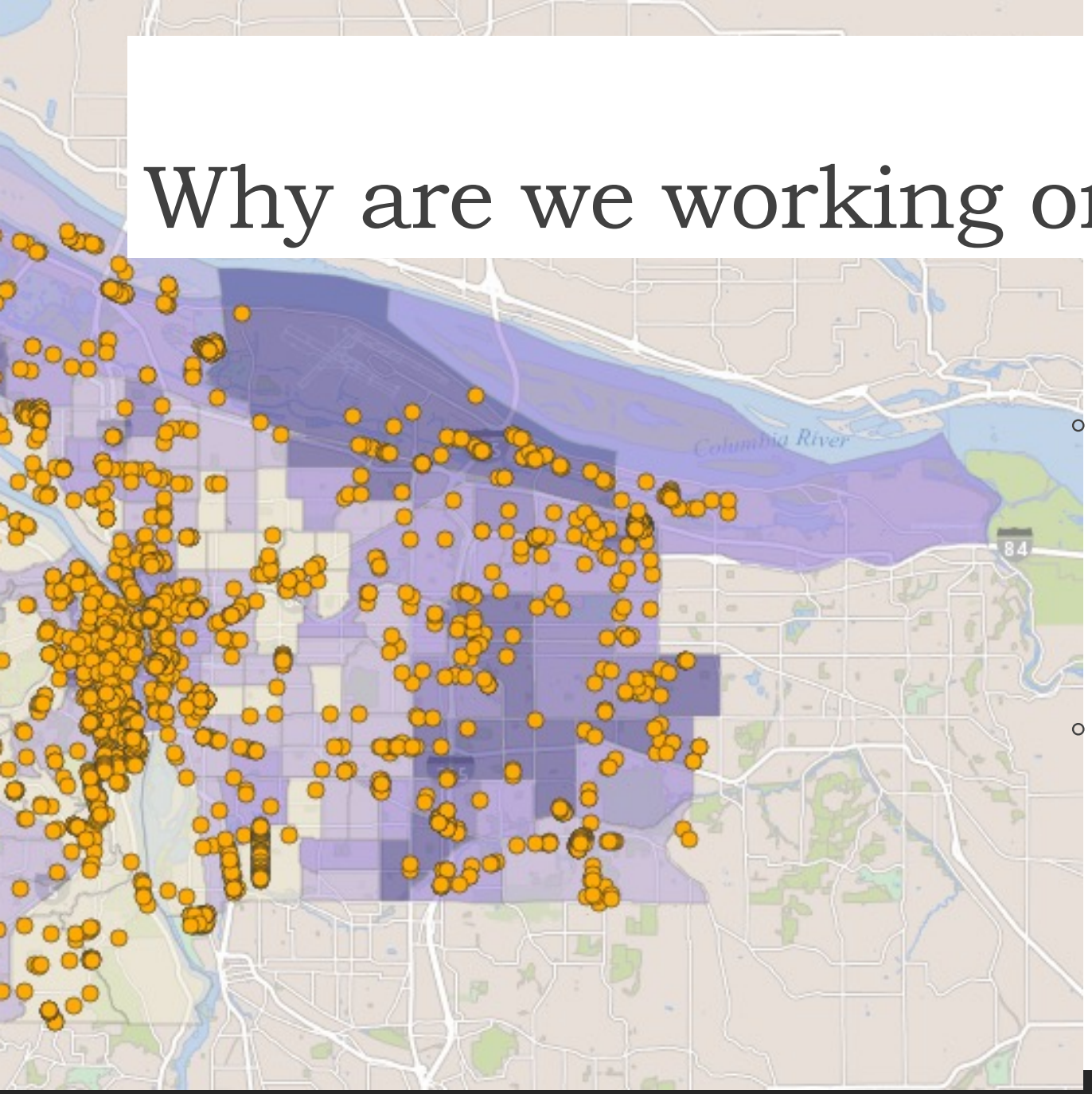
Altec

Street Lighting Knock Downs

Is our response time influenced by neighborhood?

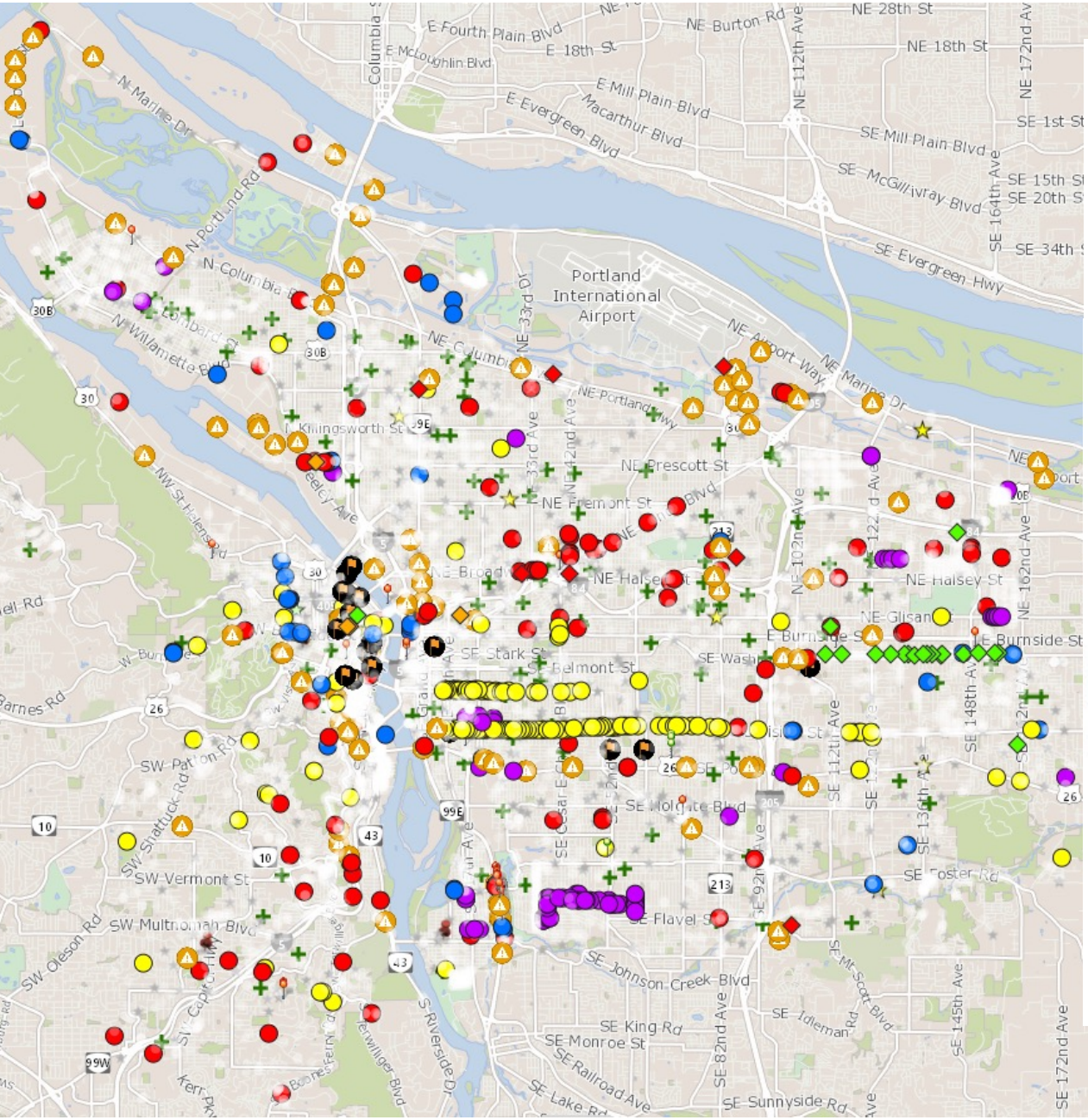
Why Aren’t Cities Doing This Already?

Why are we working on SLRP Tracking?

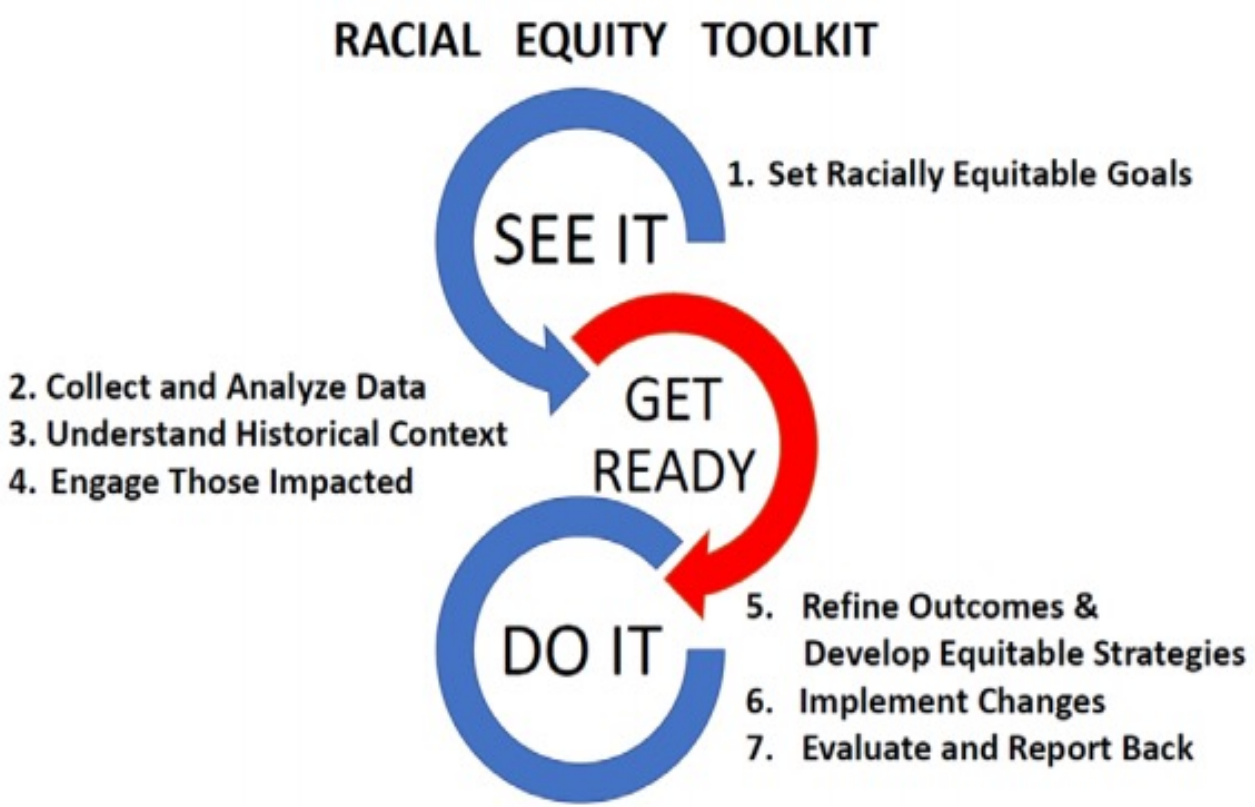


Completed SLRP Items & Equity Matrix Score

- **Implementation of strategy**
  - Use time & equity score to determine scheduling
  - We need good data and reporting to eliminate/decrease disparities
- **Ensure accountability and help communicate and evaluate the results**



Which repair/action is next?



Street Lighting Equity Analysis Dashboard

Response Date | Responder: ALL

Completed Responses

6,993

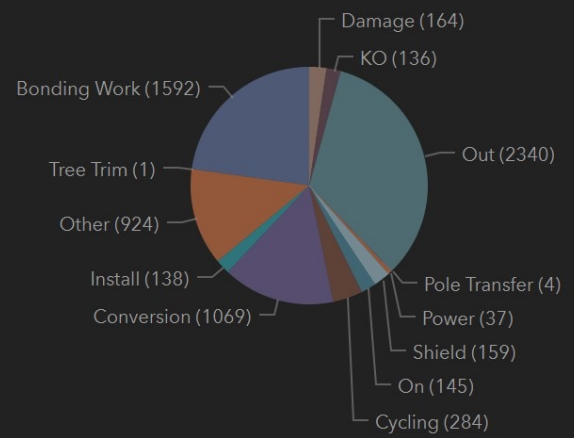
Last update: a few seconds ago

Average Response Time

32.09 Days

Last update: a few seconds ago

Response by Type



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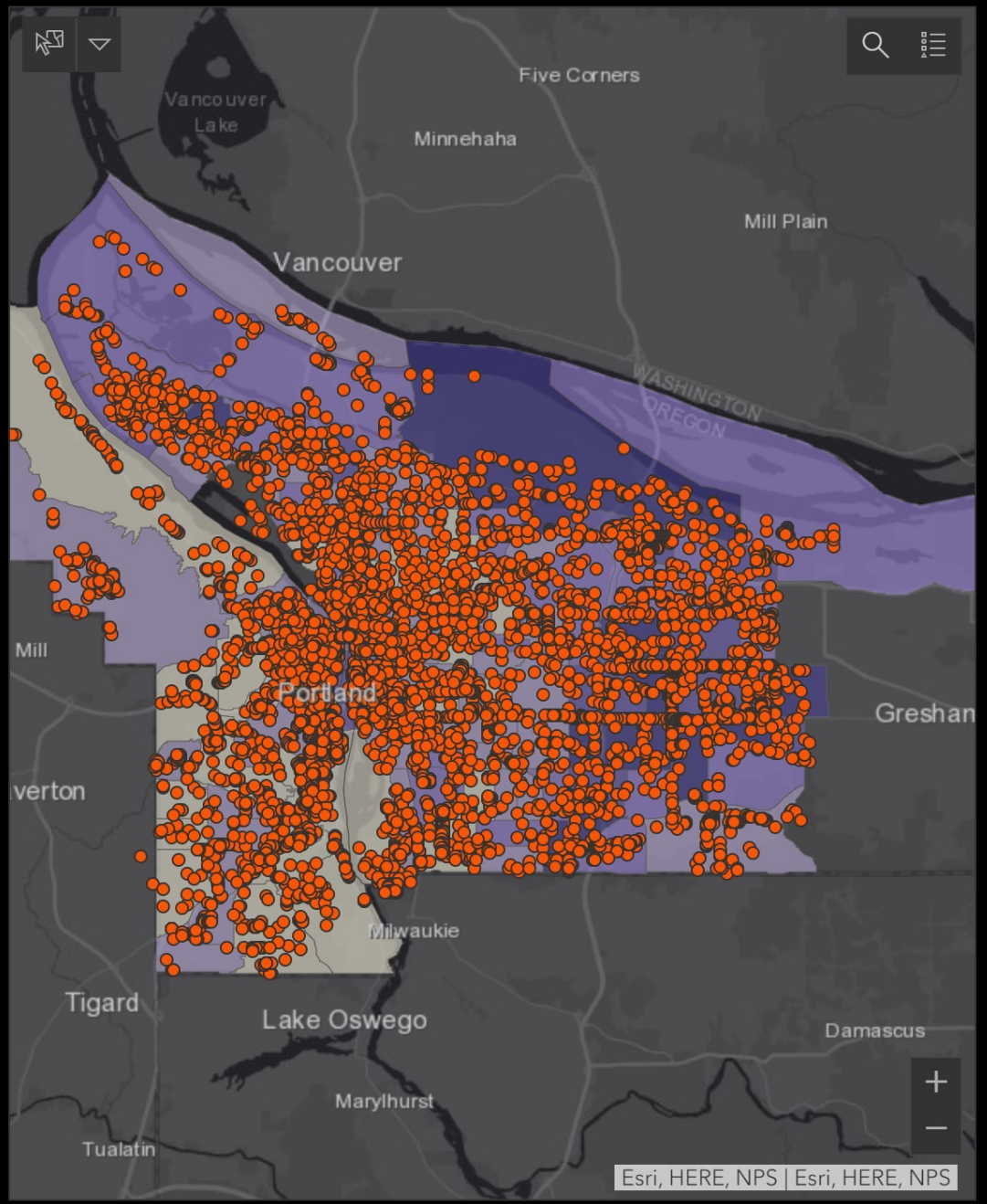
Response by Type | Response by Report Type



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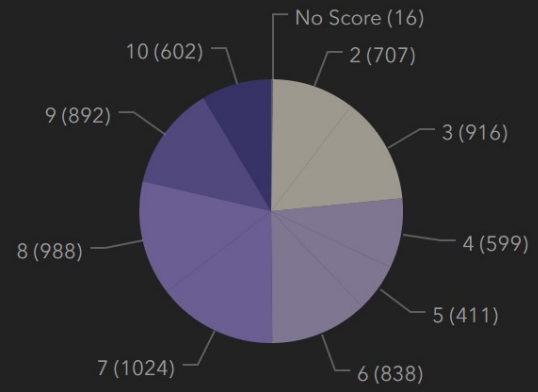
Average Equity Score

Last update: a few seconds ago

Response by Equity Score



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Click here to learn more about PBOT's Equity Matrix and Demographic Indicators

Entire City vs. High Equity Score

ARE OUR HIGHEST EQUITY SCORE AREAS >5

BEING SERVED SLOWER ON AVERAGE?

Street Lighting Equity Analysis Dashboard

Response Date | Responder: ALL

Completed Responses

3,356

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Average Response Time

26.93 Days

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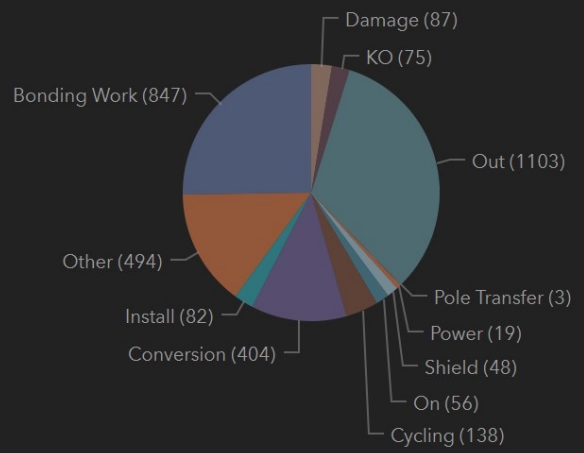
Response by Type



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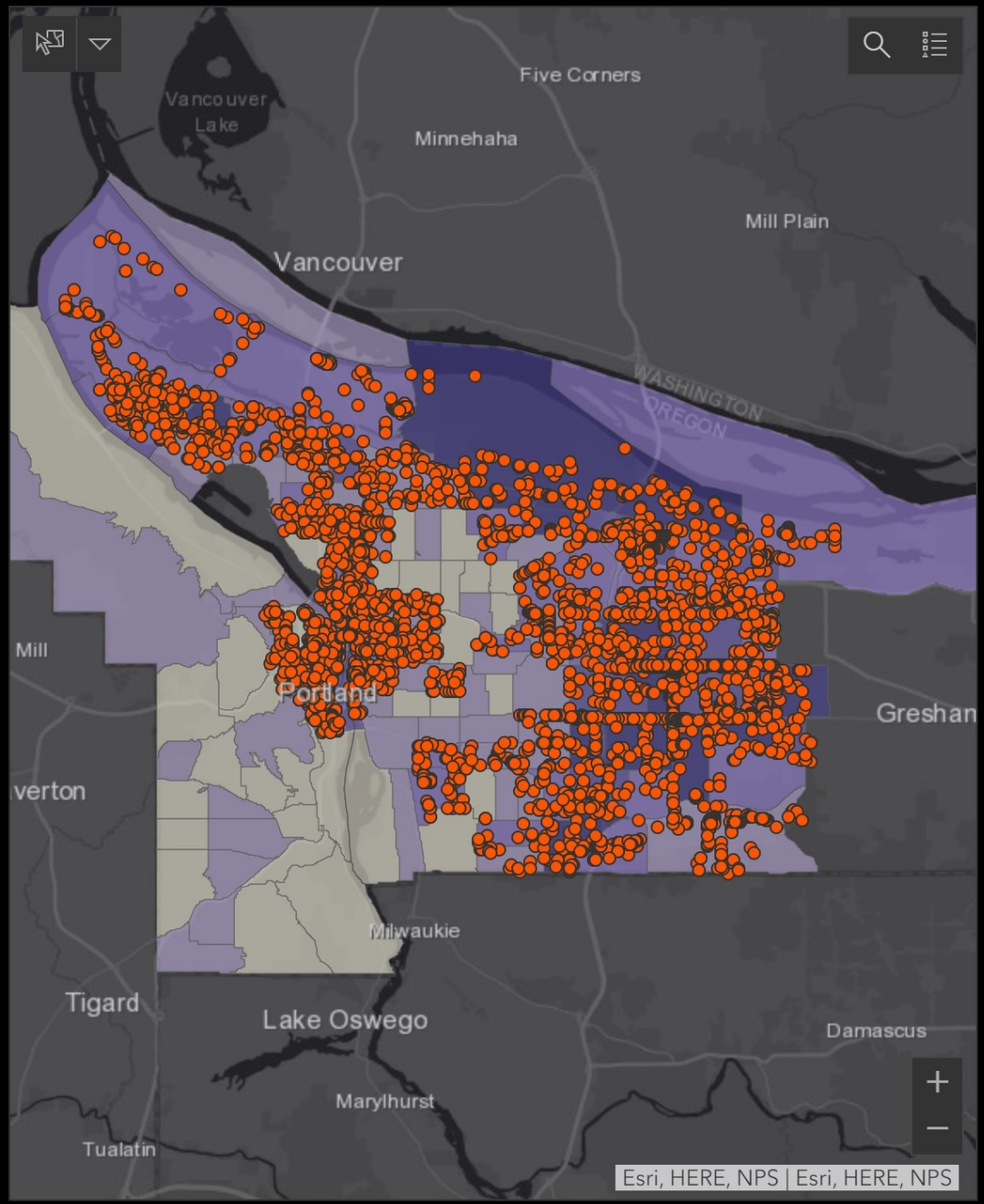
Response by Type | Response by Report Type



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Average Equity Score

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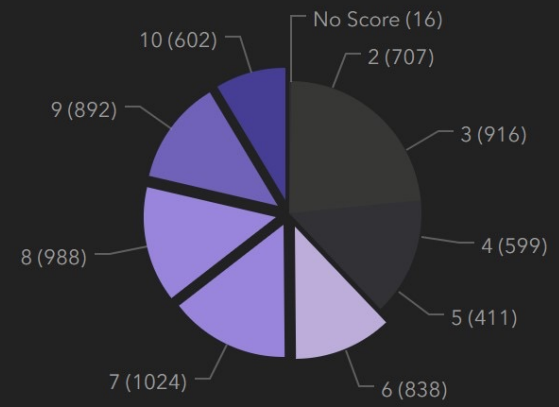
Response by Equity Score



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Street Lighting Equity Analysis Dashboard

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Completed Responses

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Average Response Time

40.46 Days

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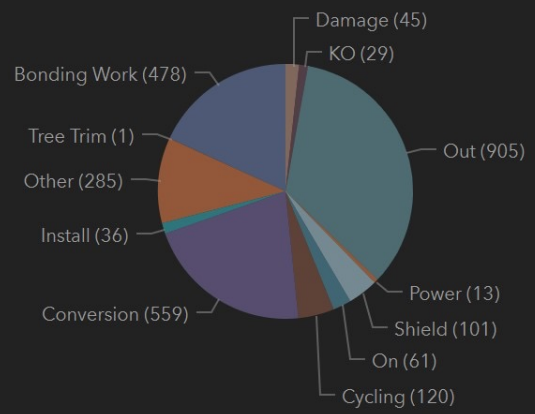
Response by Type



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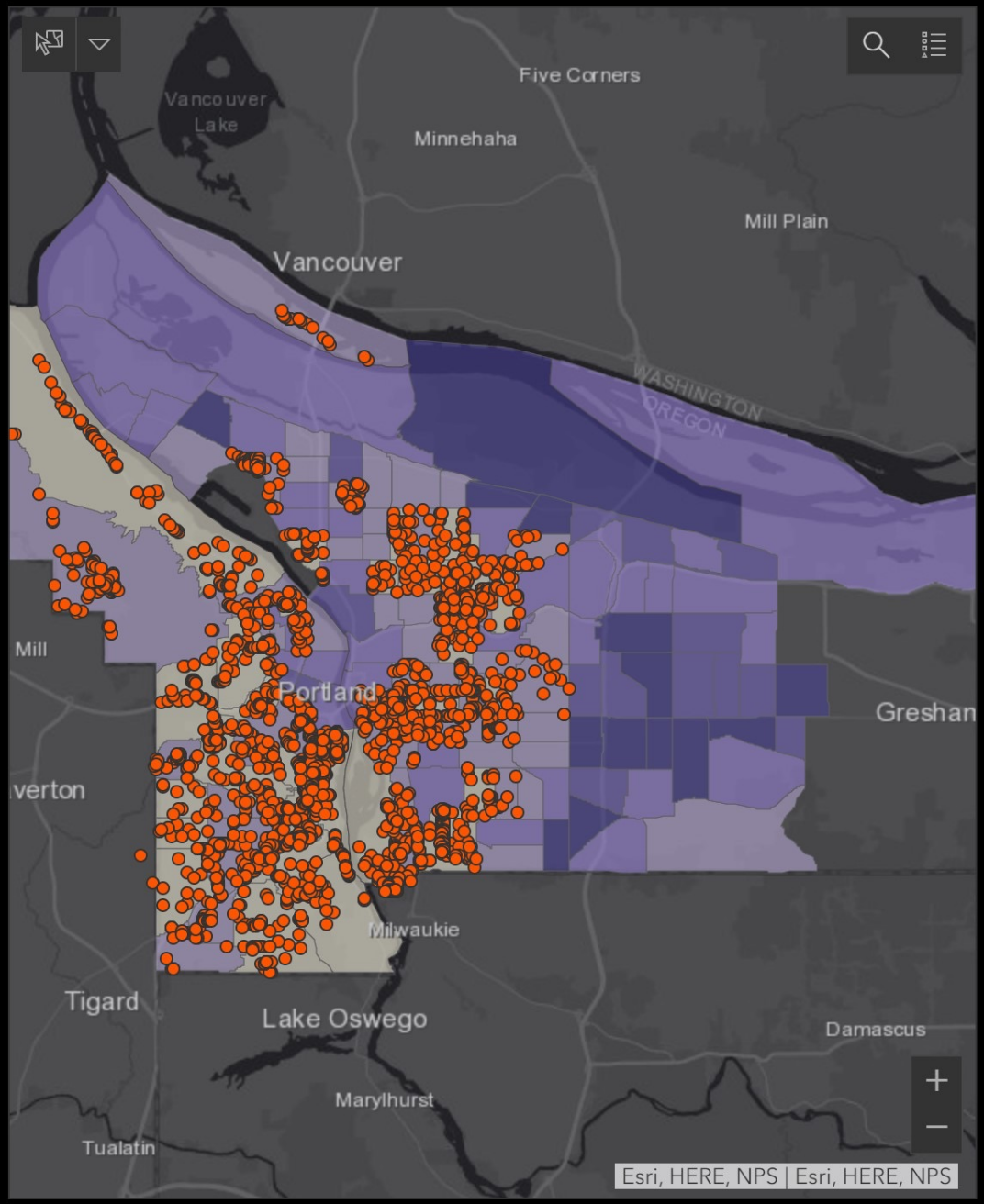
Response by Type | Response by Report Type



PBOT
PORTLAND BUREAU OF TRANSPORTATION

Average Equity Score

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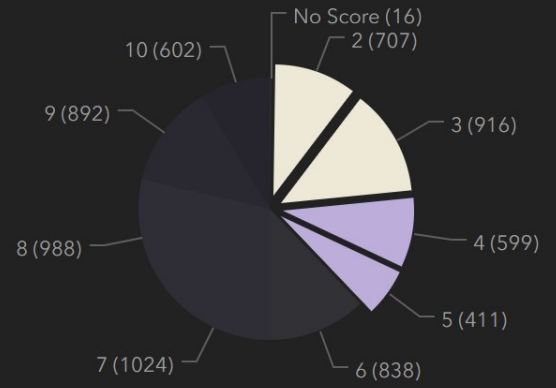
Response by Equity Score



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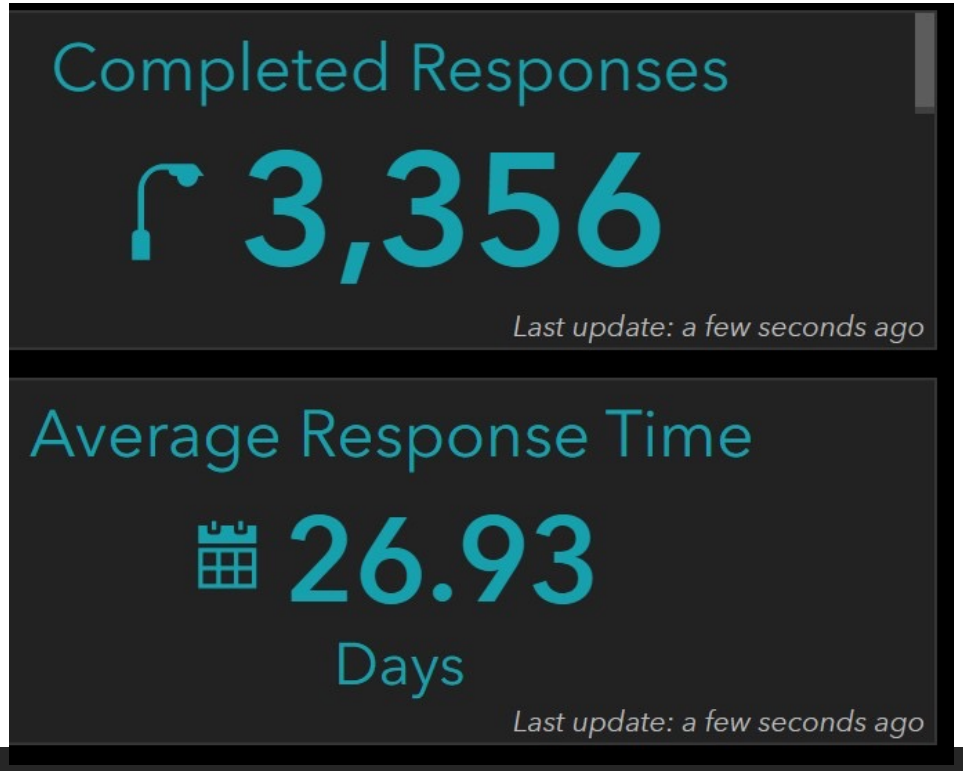
Click here to learn more about PBOT's Equity Matrix and Demographic Indicators

High vs Low Equity Score

EQUITY SCORE 6-10



EQUITY SCORE 2-5

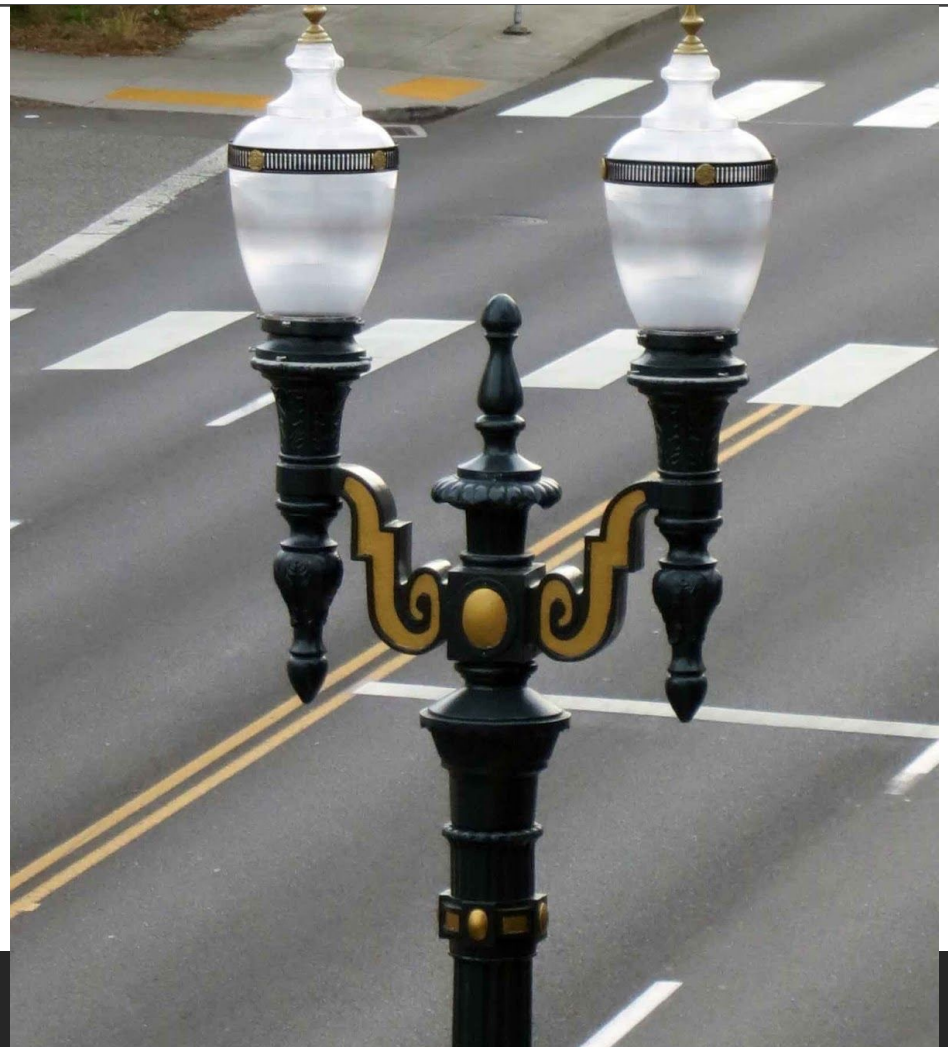
Issues with the Data

Organized by Census Track

Issues with age of infrastructure

Precision of Equity Score

Street Lighting Investment & Equity



Special District Lighting

Every unique fixture associated with street lighting offers substantial costs for PBOT

Ped scale Street Lighting fixture: $1,400

Wood pole (cobra head) fixture: $250

Bright Ideas for Street Lighting

Innovate to reduce costs

- LED Street Lighting upgrades
- Developer requirements

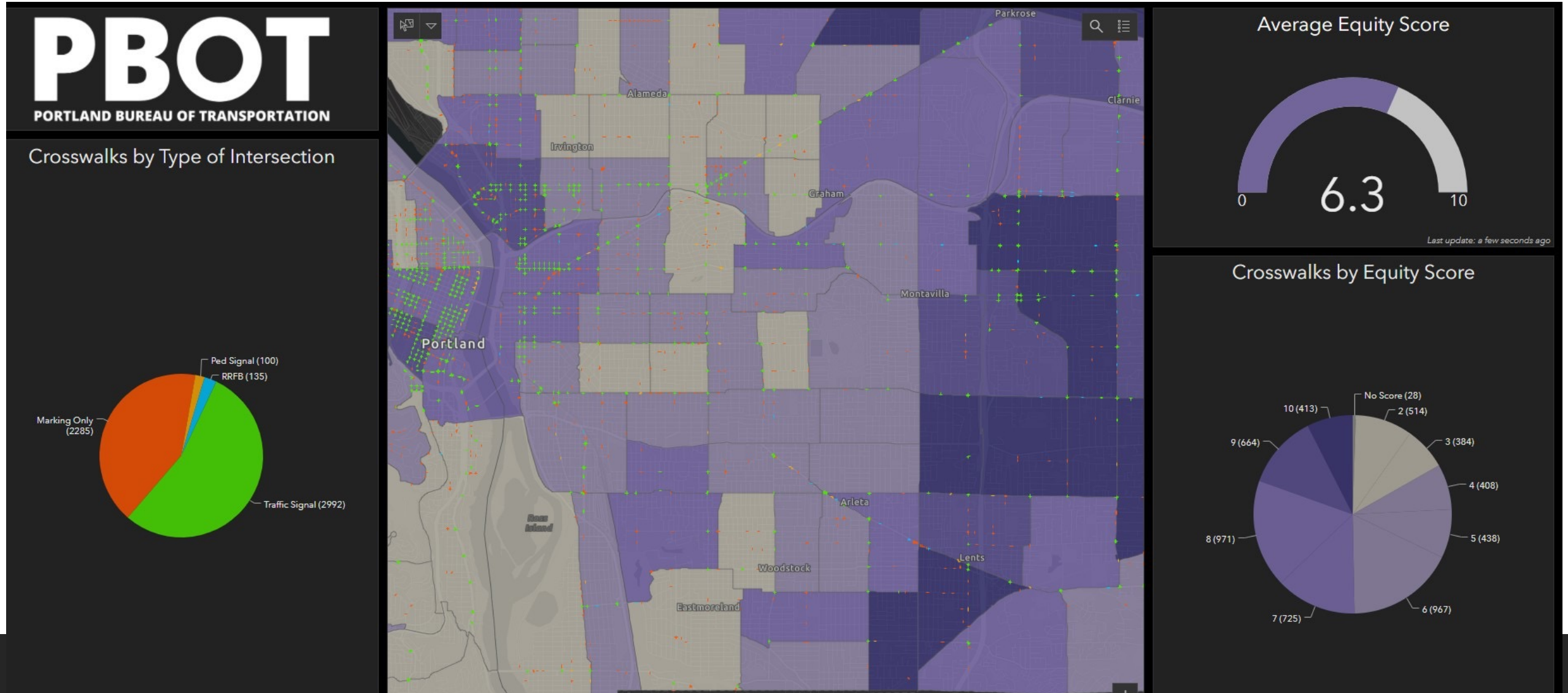
The Costco approach: Only stock so many products

- Reduce number of fixtures and different poles where possible
- Reduce trend of increasing amount of pedestrian scale districts (lower cost ped scale options?)

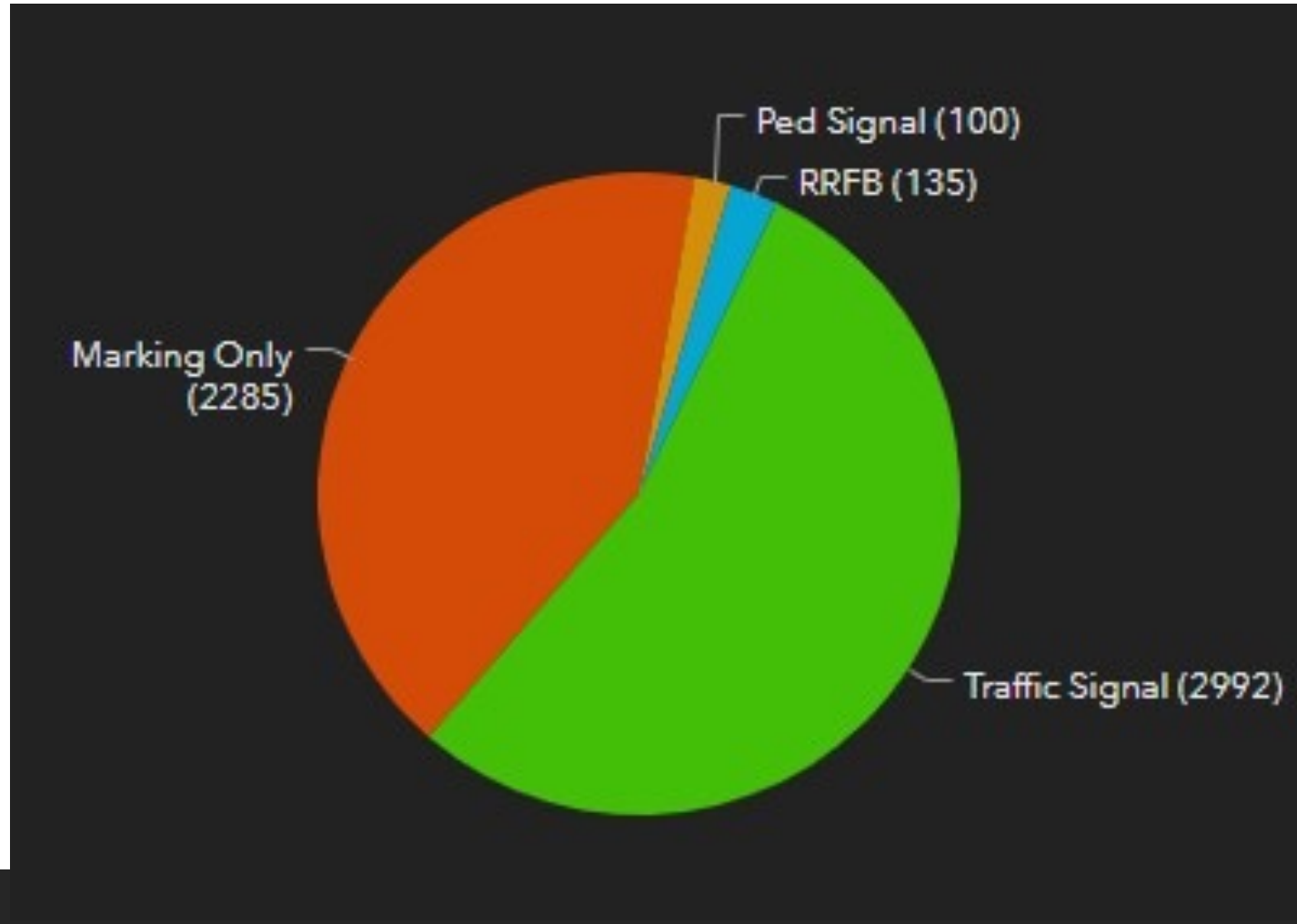
Measure what Matters

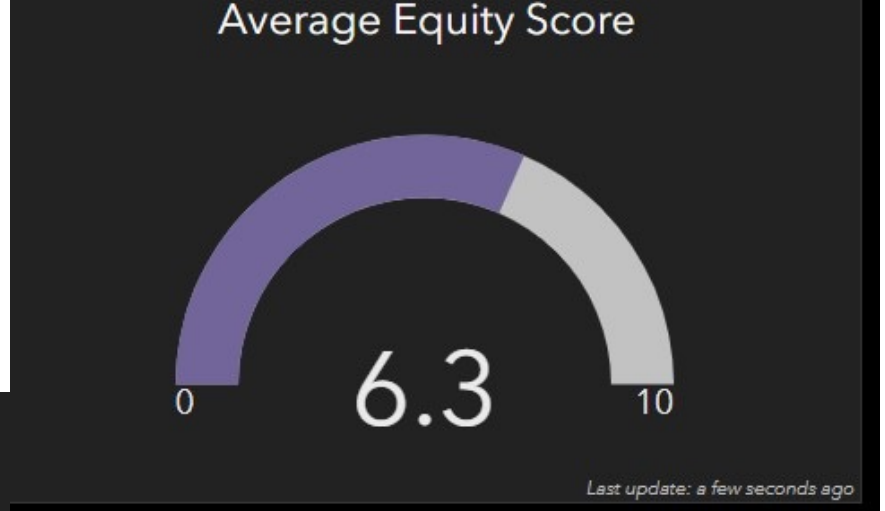
- Equity focused approach
- Reduce response times by managing other “optional” work

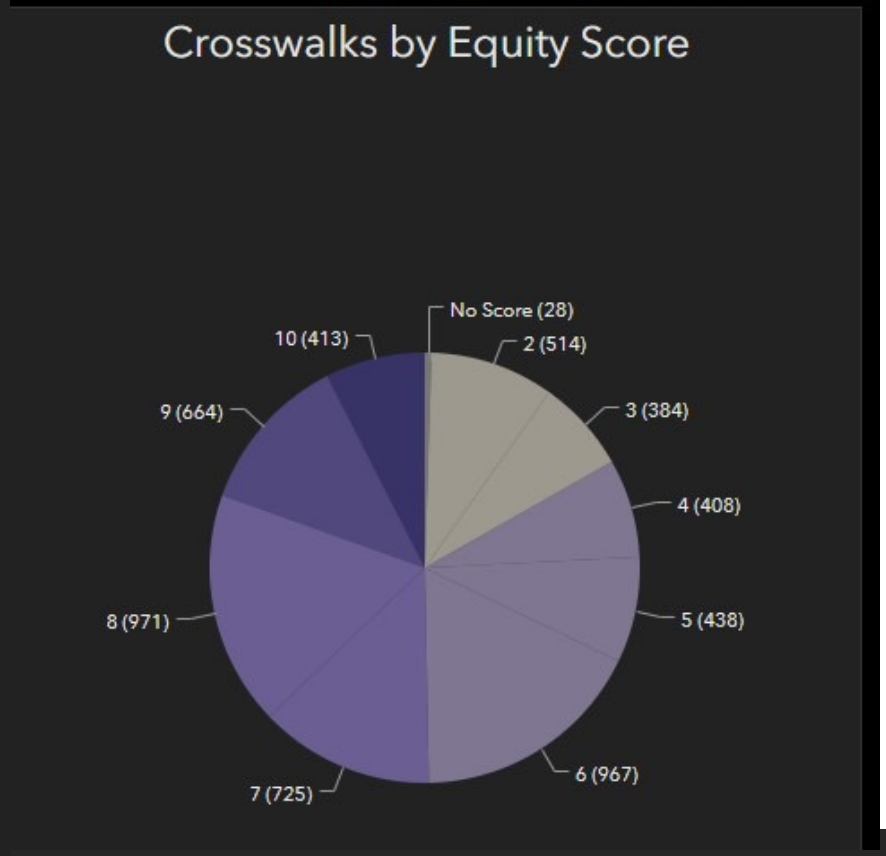
Applying this Concept to Crosswalks



All Crosswalks







Case Study: PSU Campus

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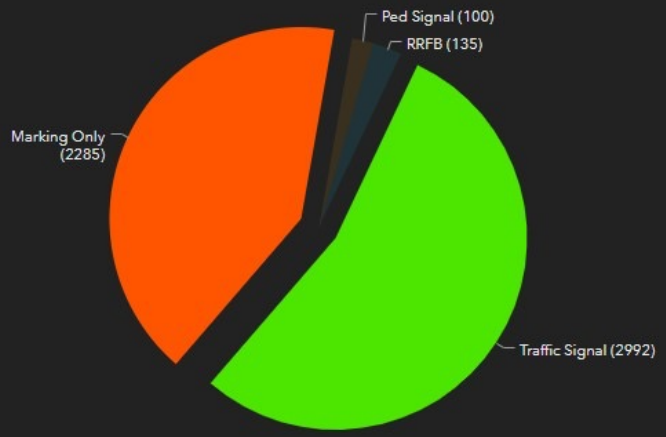
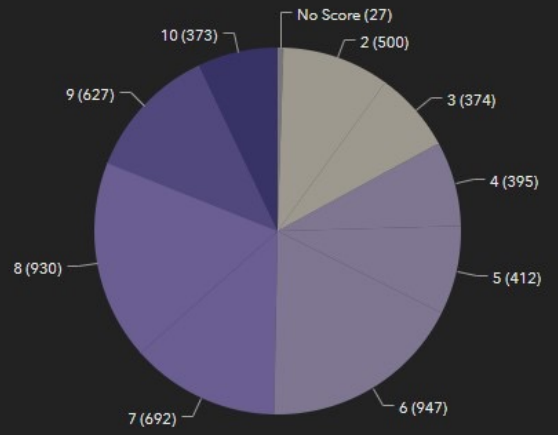
Crosswalks by Type of Intersection



Average Equity Score

Last update: 13 minut

Crosswalks by Equity Score



Case Study: PSU Campus Area

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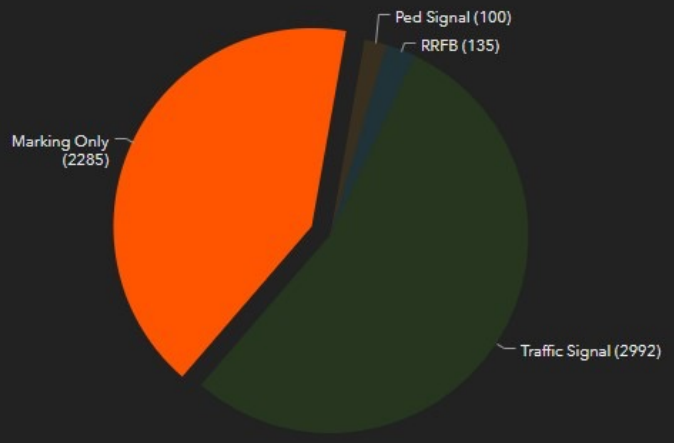
Crosswalks by Type of Intersection



Average Equity Score

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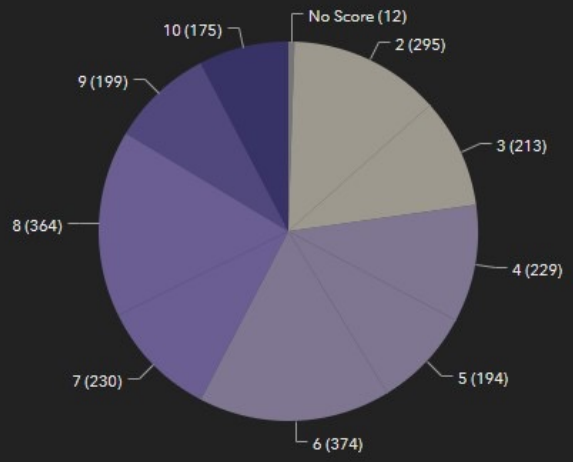
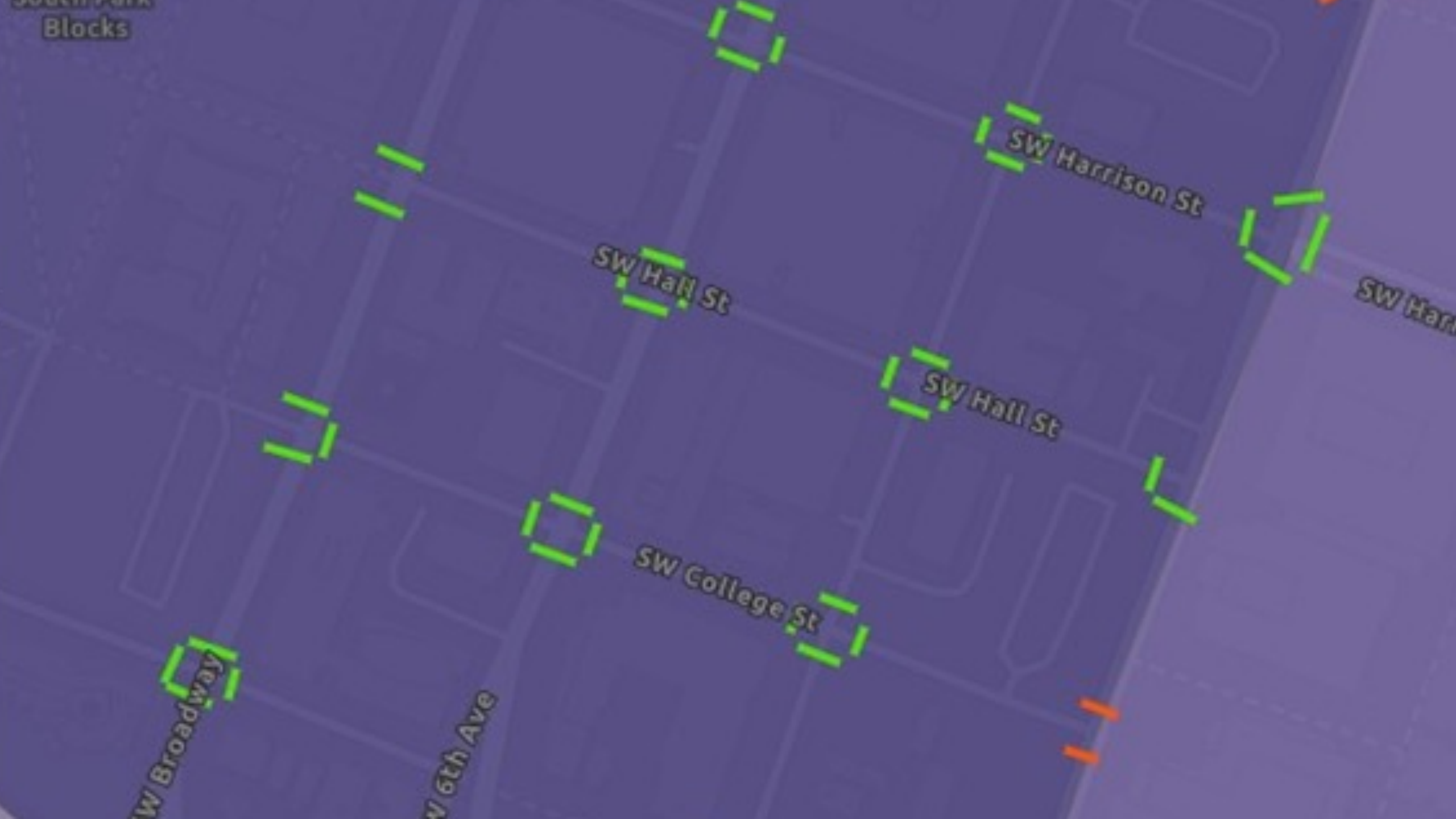
Crosswalks by Equity Score

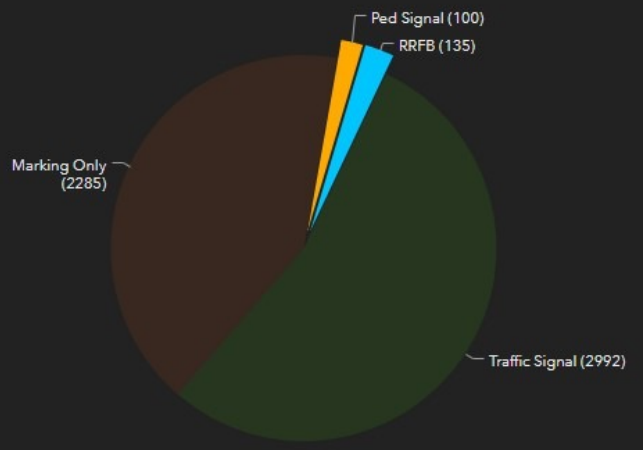



Blocks
SW Harrison St
SW Hall St
SW Hall St
SW College St
SW Broadway
SW 6th Ave

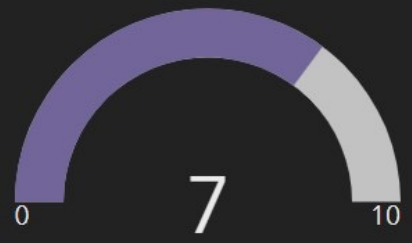
Case Study: SE 122nd Avenue

PBOT
PORTLAND BUREAU OF TRANSPORTATION

Crosswalks by Type of Intersection



Average Equity Score



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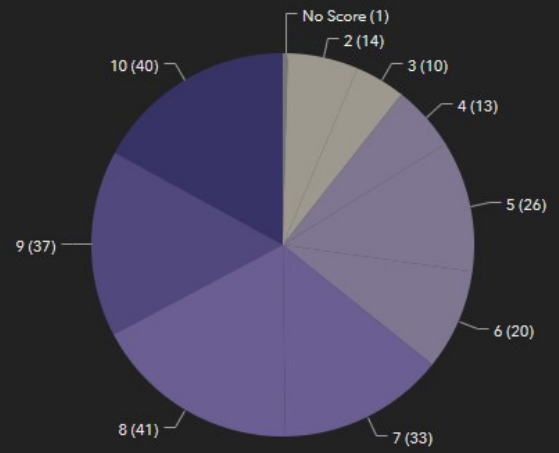
Crosswalks by Equity Score



Case Study: SE 122nd Avenue

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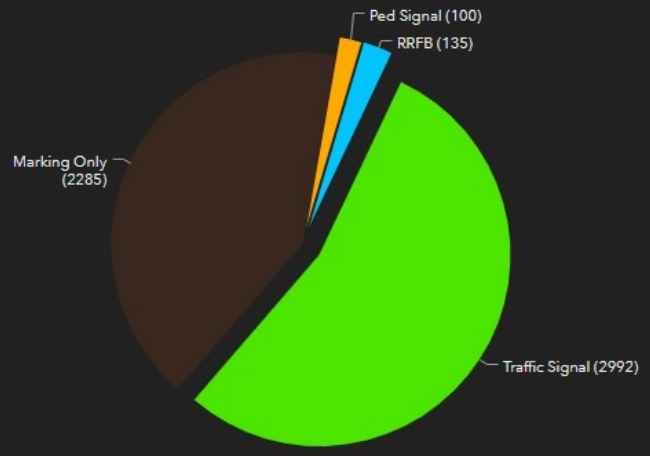
Crosswalks by Type of Intersection



Average Equity Score

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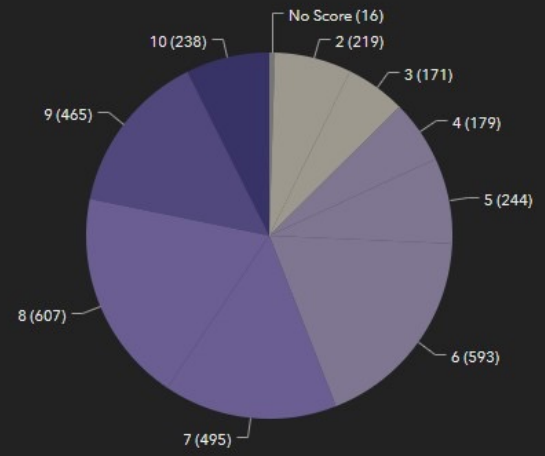
Crosswalks by Equity Score



Issues with Crosswalk Data

Incomplete data between PBOT and ODOT

Coding issues within GIS

Historic inequities in crosswalk requests?

Questions

Portland State UNIVERSITY

Subtle Bias in Driver Yielding Behavior at Crosswalks

Dr. Kimberly Barsamian Kahn
Portland State University

NITC NATIONAL INSTITUTE for TRANSPORTATION and COMMUNITIES

TREC *Transportation Insight for Vibrant Communities*

Collaborators

- Tara Goddard, Ph.D.
  - *Texas A&M*
- Arlie Adkins, Ph.D.
  - *University of Arizona*
- Jean McMahon, Ph.D.
  - *Portland State University*

Pedestrian experiences at crosswalks

- Potential point of conflict with drivers
- Racial minorities overrepresented in pedestrian fatalities (CDC, 2013)
- Are racial minorities being treated differently by drivers at crosswalks?

Drivers' treatment of pedestrians

- Drivers treat pedestrians differently
  - High-status cars are less likely to yield than low-status cars (Piff et al., 2012)
  - More likely to yield to people in own age group (Rosenbloom, Nemrodov and Ben Eliyahu, 2006)
  - More likely to yield to disabled individuals (Harrell, 1992)

What about race?

- May reflect implicit biases, subtle discrimination
- Face paced, discretion, distraction

Study 1: Drivers' treatment of pedestrians by race

- Controlled field experiment in downtown Portland
  - 2 lane, one way street, downstream from stop light
  - Marked zebra stripe crossing pattern
  - Off peak hours, morning and afternoon
  - Clear visibility
- Pedestrians:
  - 3 White males, 3 Black males, mid 20 yrs old
  - Standardized appearance, similar build/height
  - Trained in crossing procedure
- Trained coders recorded outcomes of crossing trials

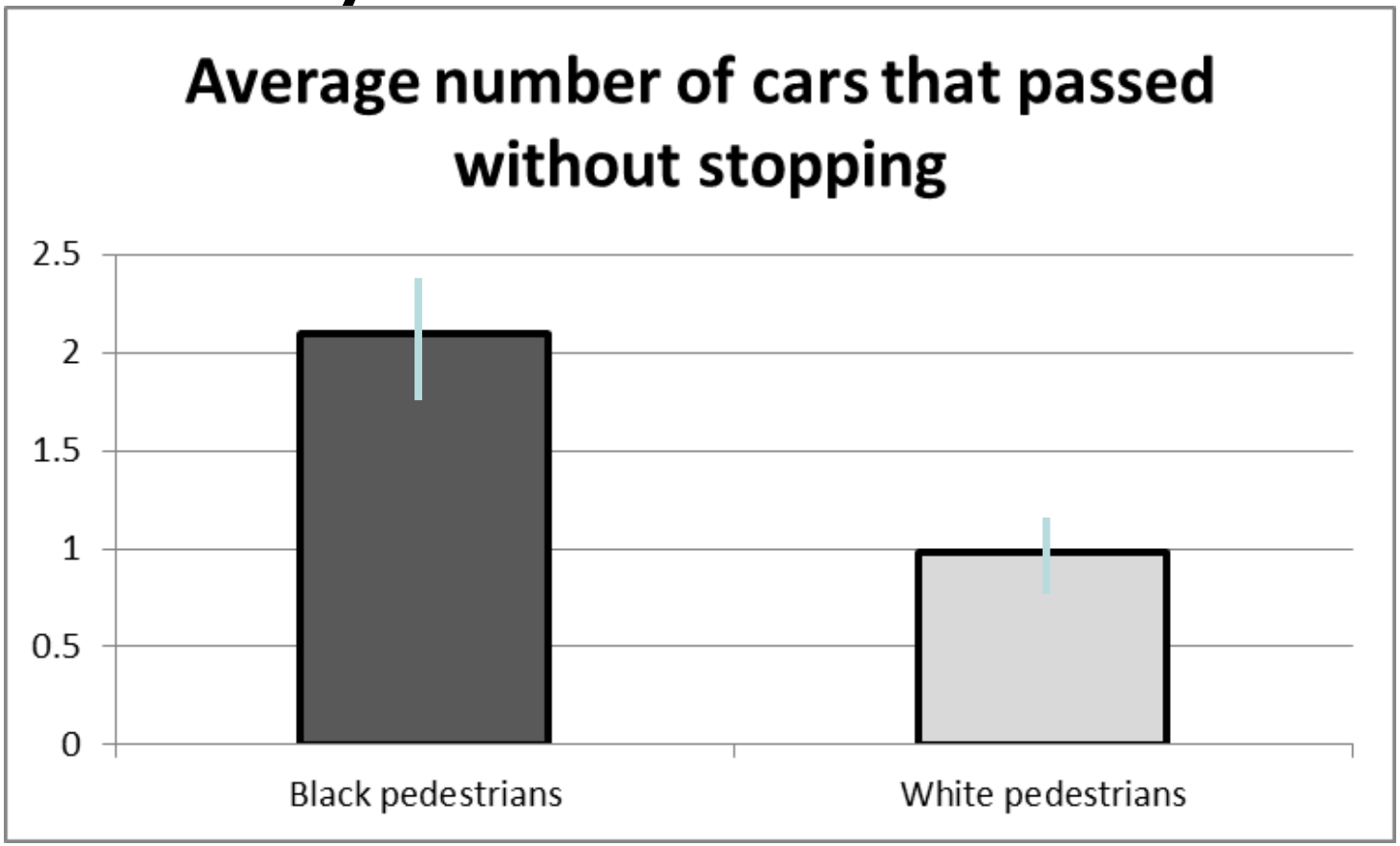
Field Experiment: Trials

- Trial began when first car from traffic light change hit designated spot
- Pedestrian approach edge of crosswalk, intent to cross
- Trial ended when:
  - 1) car clearly yielded
  - 2) entire platoon passed without yielding
- Pedestrian crossed and next cued when out of sight
- Pedestrians given randomized order, crossed individually

Study 1 Field Experiment

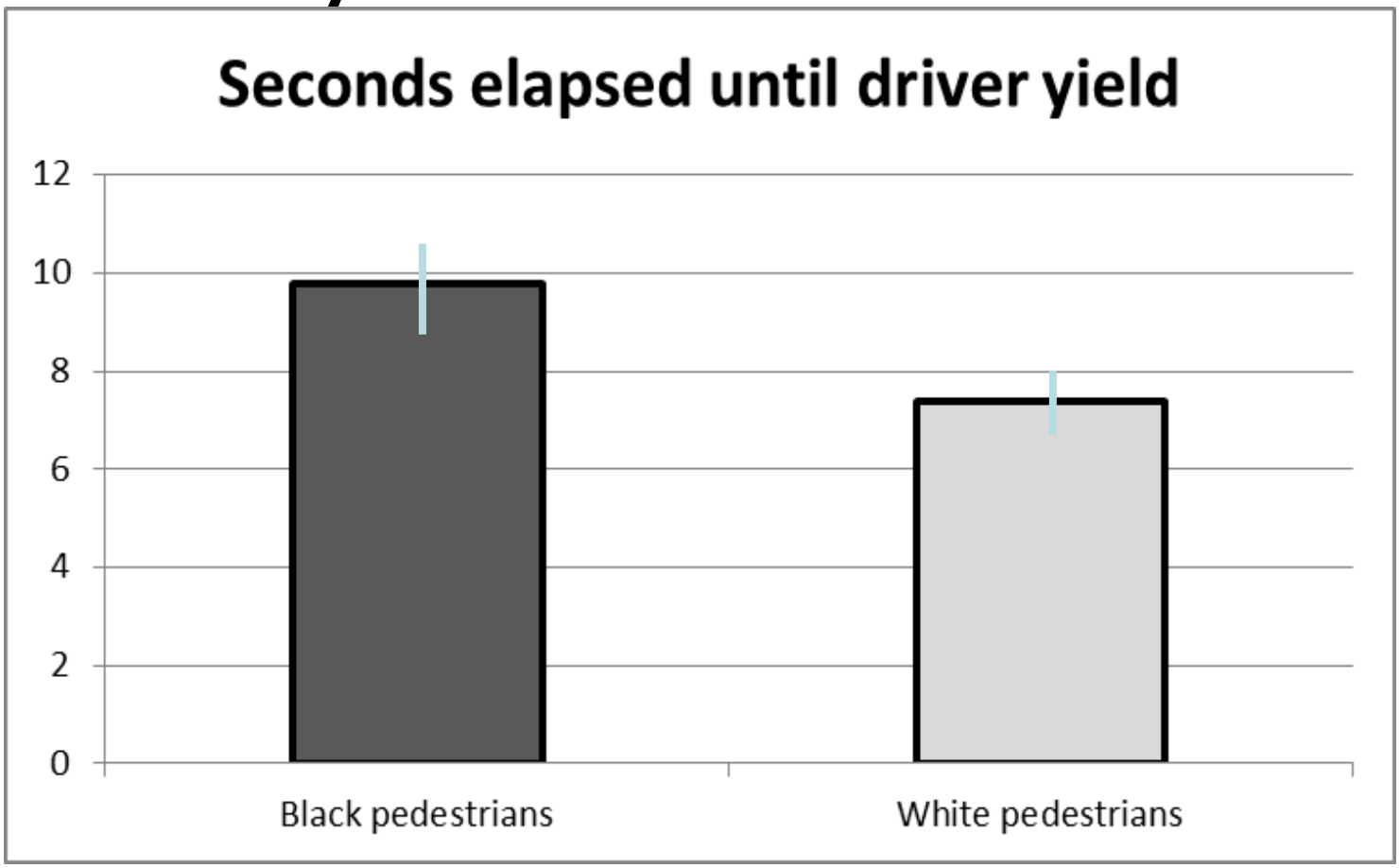
- 88 trials, 173 Driver subjects

Study 1 Results



Black pedestrians passed by more than twice as many cars *(2.02 to .98)* *F*(1,87)= 5.95, p= .017

Study 1 Results



Black pedestrians waited 32% longer *(9.79 to 7.40)* *F*(1,87)= 5.31, p= .02

Study 2 & 3: Field Experiment

- Twice at new location:
  - 2 lane, one way road
  - Before and after city marked crosswalk at intersection

- Race and gender of pedestrians
  - 12 pedestrians/study: 3 Black men, 3 White men, 3 Black women, and 3 White women

Field Experiments 2 and 3

- Afternoon, off peak trials
- 319 Trials in Study 2, 409 trials in Study 3

Study 2 Results: Unmarked crosswalk

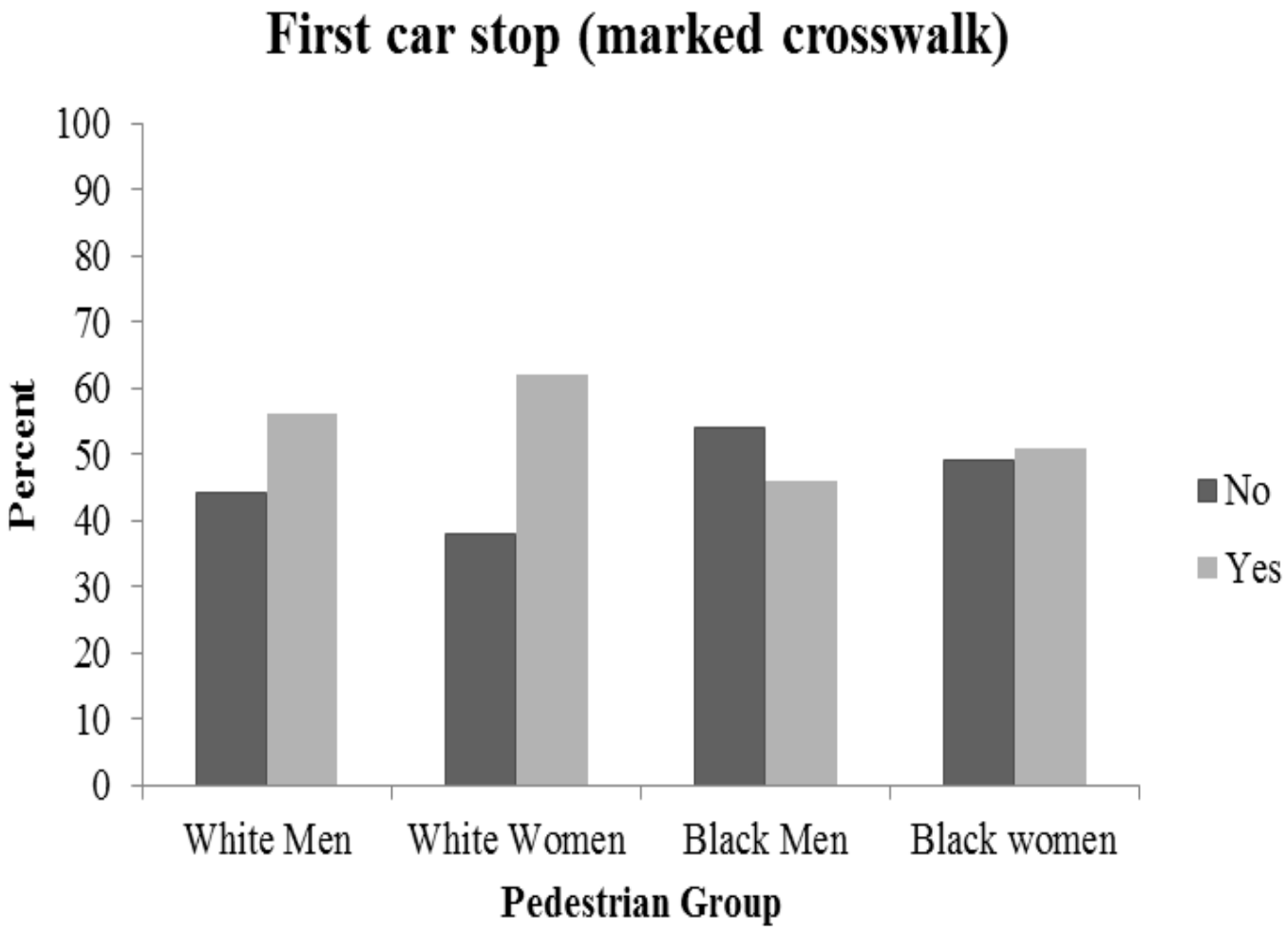
- Overall low stopping rates
  - 18% of trials in which any car stopped, 2.8% first car stop
- Drivers did not differentiate among Black and White men and women at the unmarked crosswalk

Study 3: Same crosswalk after receiving markings

12 new Black/White male/female pedestrians*

First car stopped on 208 out of 380 trials (55%)

Study 3 Results: First Car Stop



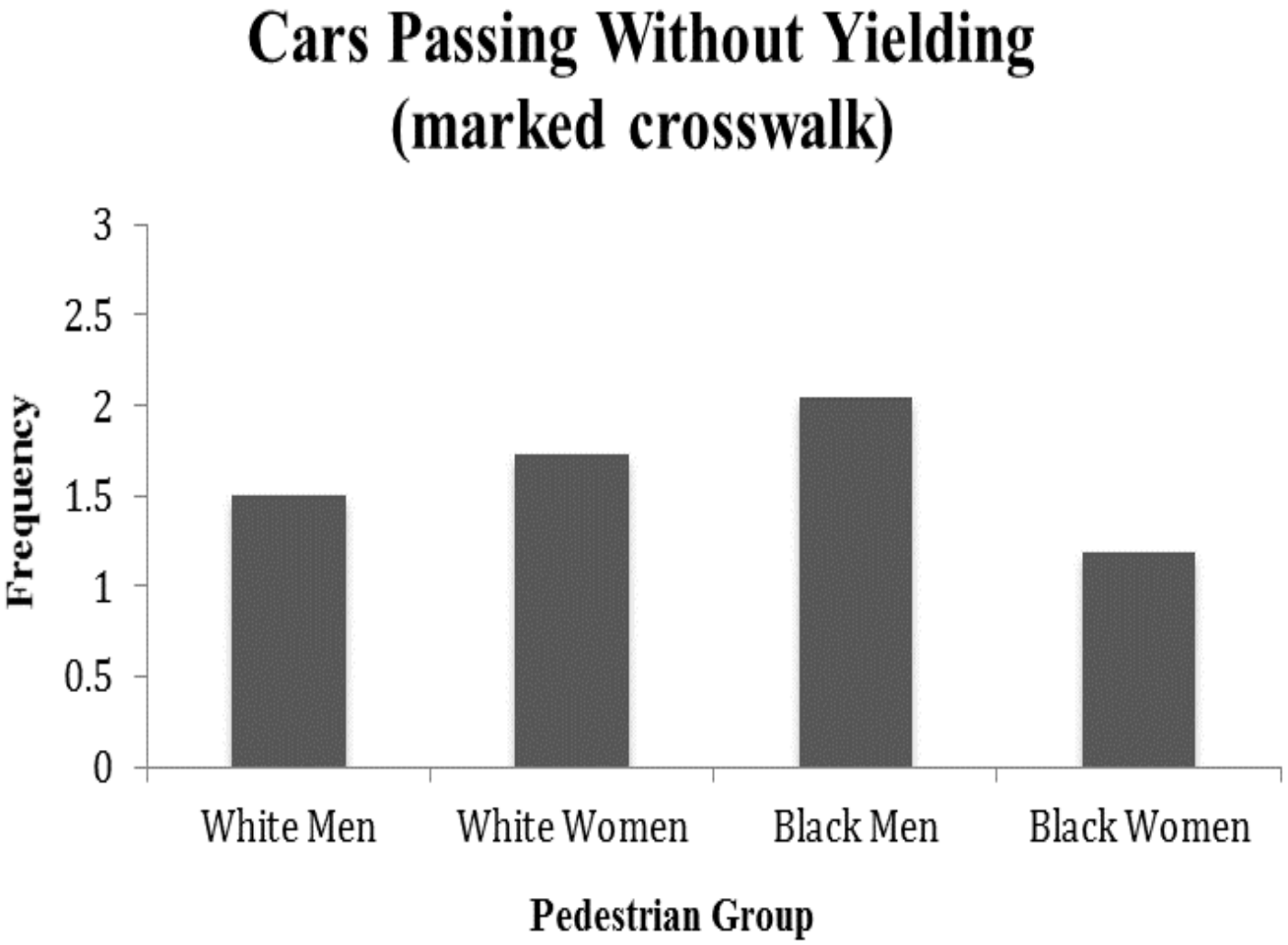
- $\chi^2(3, N=380) = 6.25, p=.10$

More likely to stop for Whites than Blacks (59% to 49%) $\chi^2(1, N=378) = 3.87, p=.05$.

More likely to stop for females than males (61% to 51%) $\chi^2(1, N=378) = 4.06, p=.04$

Most likely to stop for White Women, least likely for Black men

Study 3 Results: Cars Passed



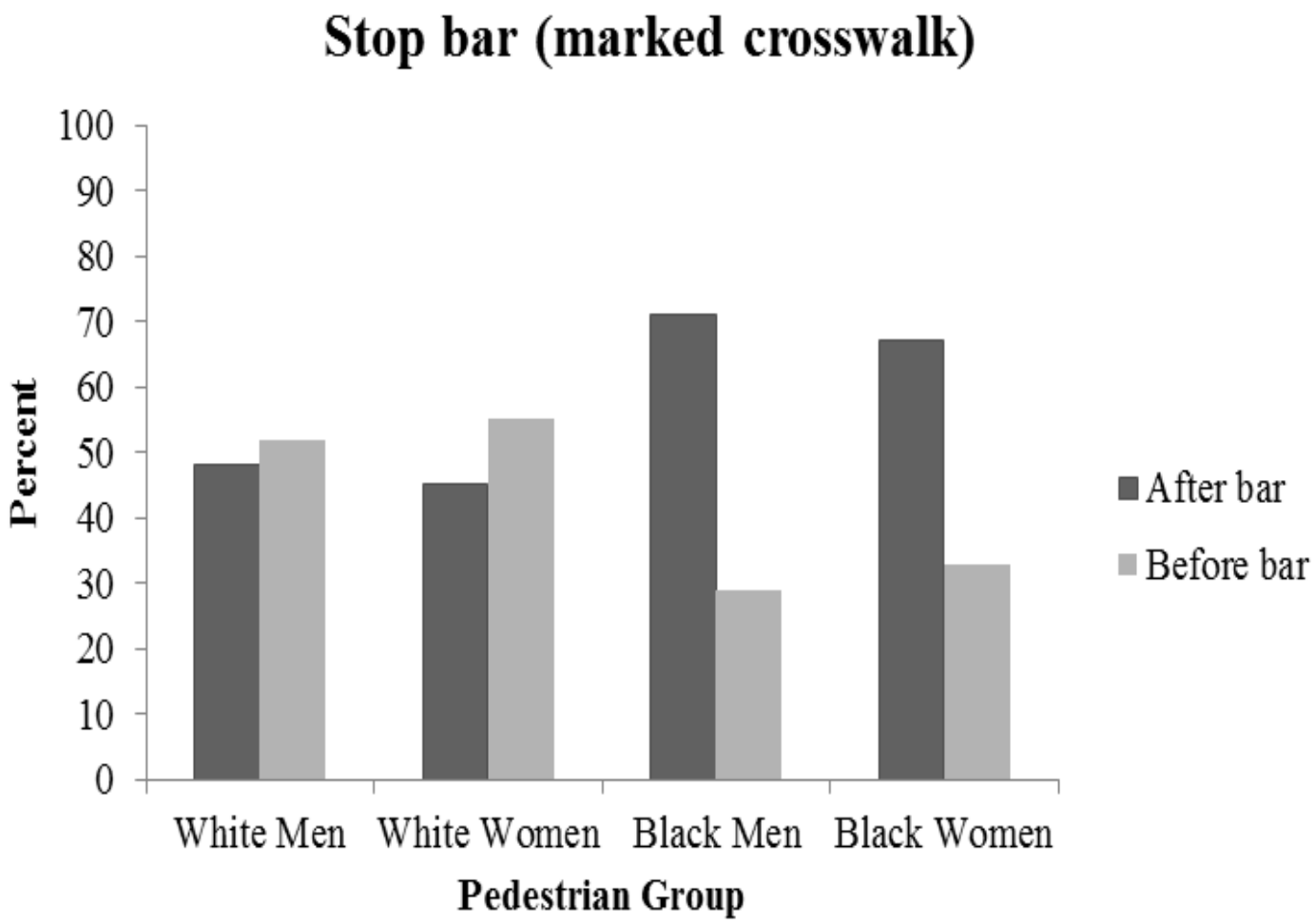
- Race*Gender interaction: $F(1, 373) = 2.99$, $p=.09$
- **Black men had more cars passed than Black women (M=2.05 to M=1.19),** $t(128.59)= -2.30$, $p=.02$.

Study 3 Results: Stop Bar

Stop bar: coded as before or after

- Before the stop bar: obeying signage, more space to cross
- After the stop bar: closer to pedestrian, infringing on crossing space

Study 3 Results: Stop Bar



- $\chi^2(3, N=381) = 21.56, p<.001$
- **Black males & Black females: more likely to stop *after* bar**
- **White males & White females: more like to stop *before* bar**

Focus group themes: Black pedestrians

- Black participants reported that their interactions with drivers were perceived to be affected by race.

"*I will come to an intersection on one side and waiting because there's cars, and then as soon as a white person steps on the other side, oh, car stops. I'm like, this is magic, what's going on? It was you. It wasn't me.*"

Focus group themes

Participants noted the stress caused by these racially charged interactions.

"I think it's stressful. It's just an added stress to your commute whenever—even when it's a leisurely commute. Stuff like that it's, like, you just have to, you know, I guess, just part of the black experience of being more aware and cautious of everything that we do."

Overall findings & recommendations

- Marking crosswalks effective in increasing stopping
  - But also unequitable stopping
- Reducing perceived discretion in stopping may increase stopping rates for all pedestrians
  - Additional signage, flashing lights
- Consider equity impact in planning

Thank you!

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Citations: Goddard, Kahn, & Adkins (2015); Kahn, McMahon, Goddard, & Adkins (2017)

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