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Pursuing Vision Zero in Seattle – Results of a Systemic Safety Analysis

Rebecca Sanders
Toole Design Group

Systemic Safety Analysis and Vision Zero

Rebecca Sanders, PhD, Toole Design Group

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Who Am I?

- Head of Research at Toole Design Group
- PhD in planning
- Focus on bicycle and pedestrian safety
- Years at UC Berkeley SafeTREC
- Now working on
  - Boston Vision Zero
  - Portland Vision Zero
  - Denver Vision Zero
  - **Seattle's Bicycle & Pedestrian Safety Analysis**

Acknowledgements

- UNC
  - Libby Thomas, Dr. Bo Lan - Analysis
- Toole Design Group
  - Michael Hintze – Project Manager
  - Spencer Gardner, Alexandra Frackleton - Maps
  - Courtney Ferris - Graphics
- SDOT
  - Monica Dewald – Project Manager
- Advisor
  - Dr. Robert Schneider

Overview

- Vision Zero overview
- Seattle case study
- Key takeaways
- Conclusions

What is Vision Zero?

Audacious?

What is Vision Zero?

“Ludicrous”?

An Idea Whose Time Has Come

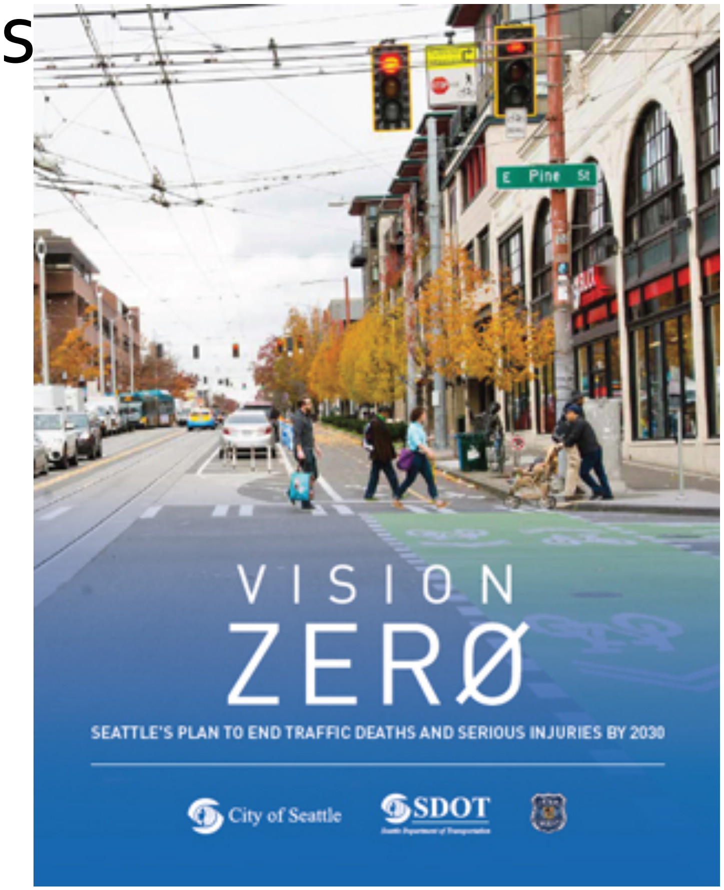
Photo credit: NYCDOT

Nuts & Bolts of Vision Zero

- Goal of zero traffic fatalities
- Driven by families, community organizations
- Counter to traffic death as acceptable
- Push for data-driven methods
- Push for equity considerations

Vision Zero in Seattle

- 668, 342 people in 83.9 sq. miles
- Nearly 20 deaths & 150 serious injuries/year
- **End traffic deaths & serious injuries by 2030**
- Bicycle & Pedestrian Safety Analysis



Bicycle & Pedestrian Safety Analysis

Proactively identify locations and prioritize safety improvements with the goal of preventing future crashes

Bicycle & Pedestrian Safety Analysis

- Summary statistics (2007-2014 SDOT data)
- Identification of crash types
- Multivariate analysis to understand risk factors
  - Exposure estimation
- Crash type-based countermeasure development
- Prioritization/ranking of high risk locations (Safety Performance Functions)
- Analytical tool development

Safety Analysis

Hotspot Analysis

- Explores patterns between crashes
- Uses crash-based database
- Benefits from control for exposure

Systemic Safety Analysis

- Investigates how combinations of features are associated with crashes
- Uses intersection- or segment-based database
- Needs exposure information

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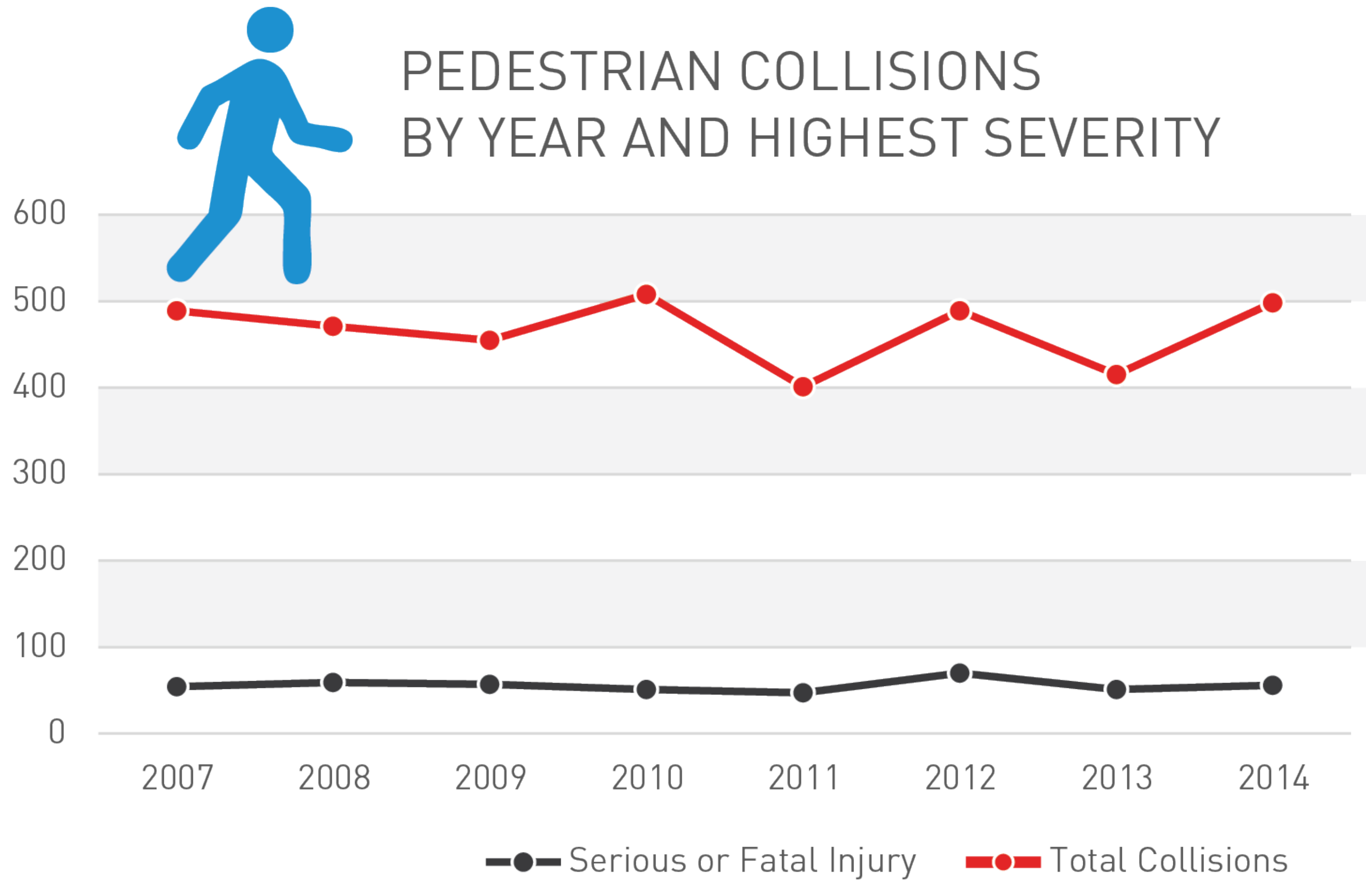
Seattle's Pedestrian Crashes

2007-2014

- 3,726 pedestrian crashes
- 445 serious or fatal crashes



Actions for Pedestrian Crash Types

Pedestrian

- Intersection crossing
  - With signal
  - No signal
  - Against signal
- Midblock crossing
- Walking in roadway
  - With traffic
  - Against traffic

Driver

- Going straight
- Turning left
- Turning right
- Backing
- Stopped in roadway

Common Pedestrian Crashes

VEHICLE GOING STRAIGHT / PEDESTRIAN CROSSING

Approximately

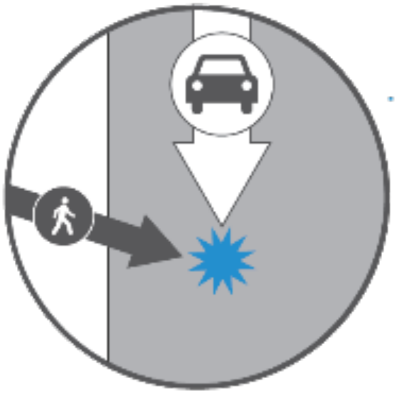
1 in 4

total crashes

1 in 3

Serious or fatal crashes

VEHICLE GOING STRAIGHT / PEDESTRIAN CROSSING MIDBLOCK



Approximately

1 in 5

total crashes

1 in 3

Serious or fatal crashes

LEFT HOOK

Approximately

1 in 3

total crashes

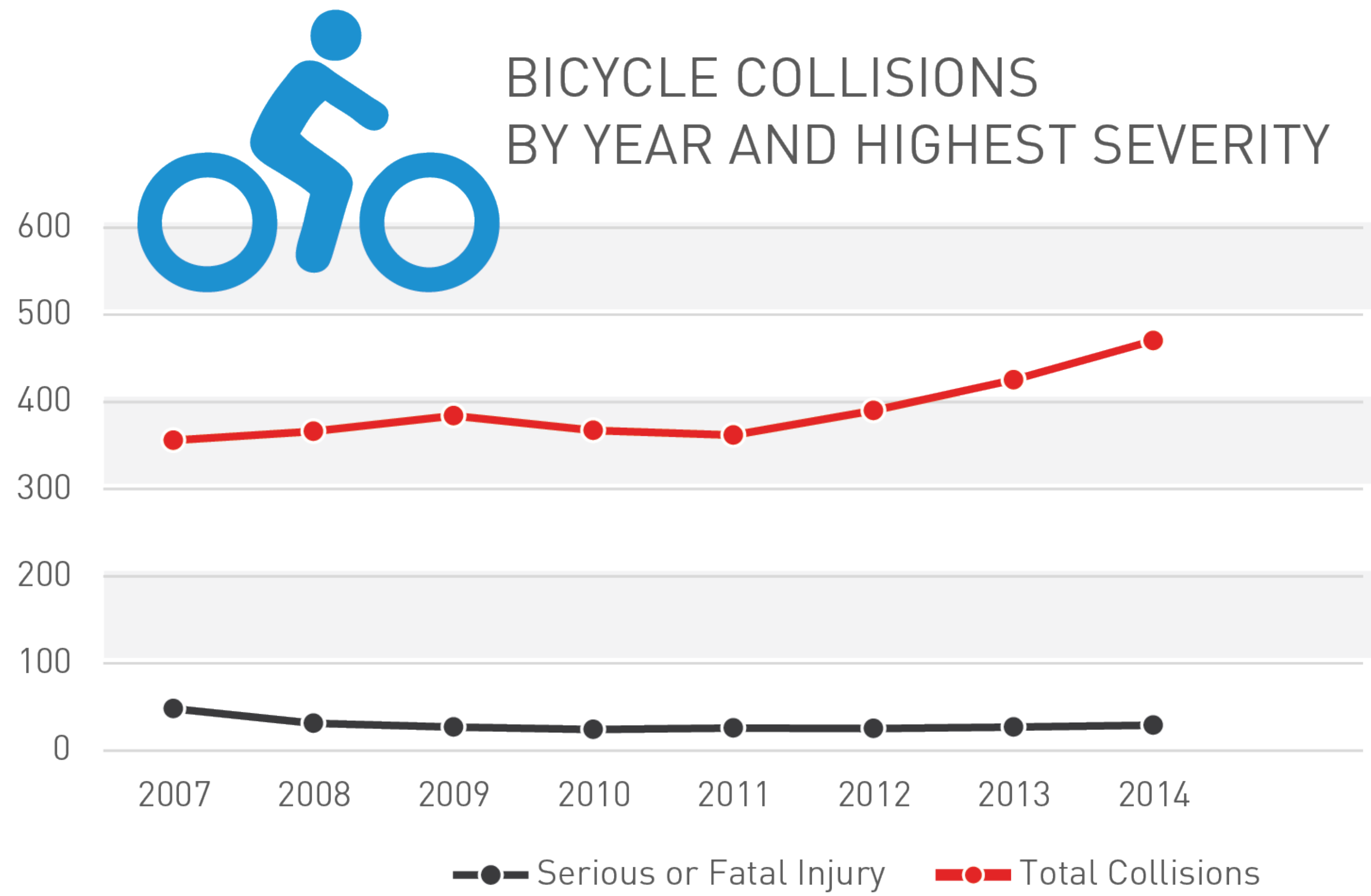
1 in 5

Serious or fatal crashes

Seattle's Bicycle Crashes

2007-2014

- 3,120 bicycle crashes
- 237 serious or fatal crashes



Actions for Bicycle Crash Types

Bicyclist

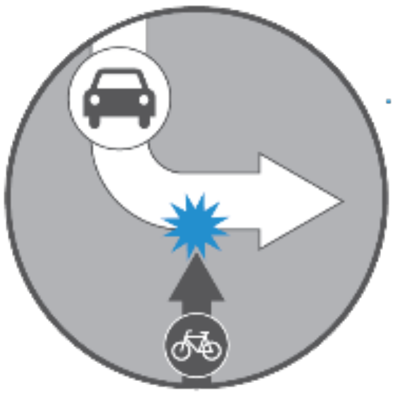
- Riding with traffic
- Riding against traffic
- Entering/crossing roadway
- Crossing diagonally
- Turned into vehicle path
  - Same direction
  - Opposite direction

Driver

- Going straight
- Turning left
- Turning right
- Backing
- Stopped in roadway

Common Bicycle Crashes

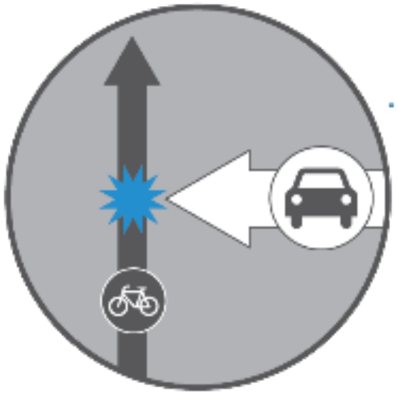
LEFT HOOK



Approximately
1 in 7
total crashes

1 in 5
Serious or fatal crashes

ANGLE



Approximately
1 in 11
total crashes

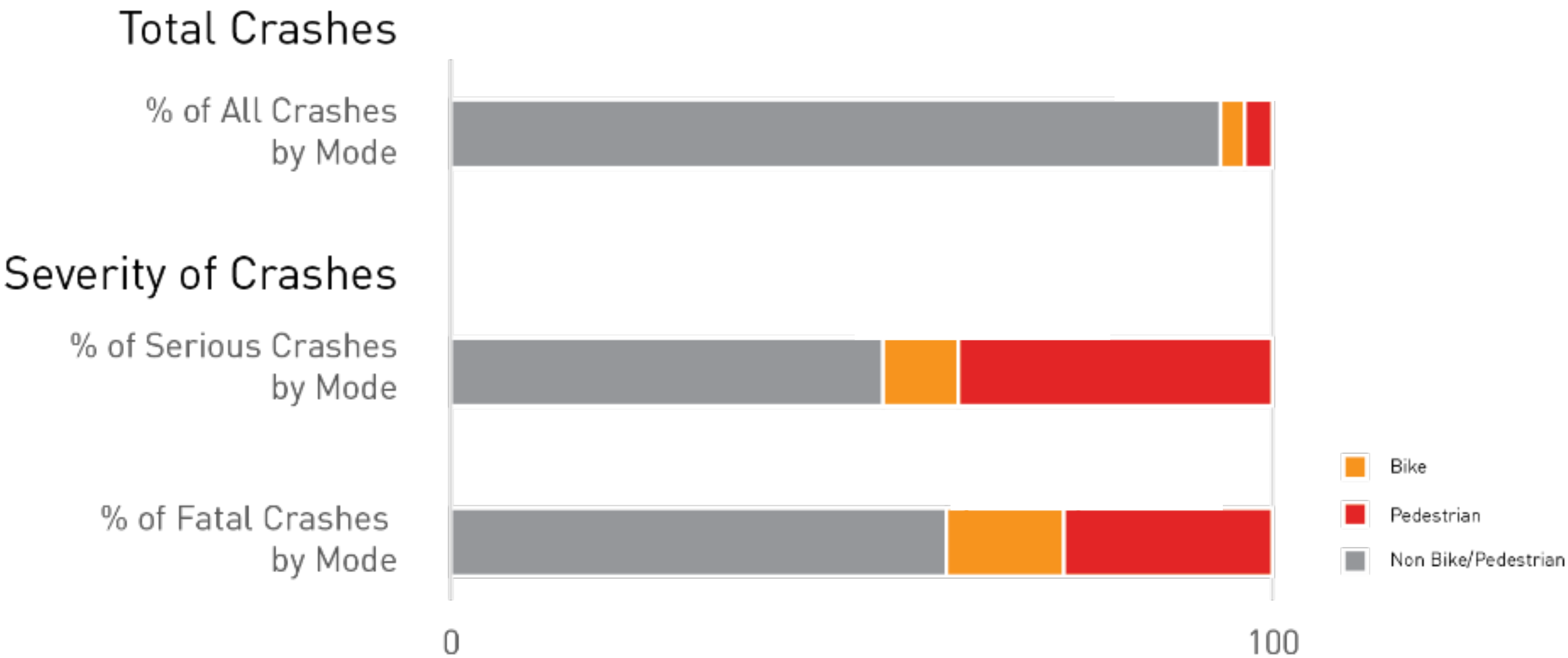
1 in 10
Serious or fatal crashes

RIGHT HOOK

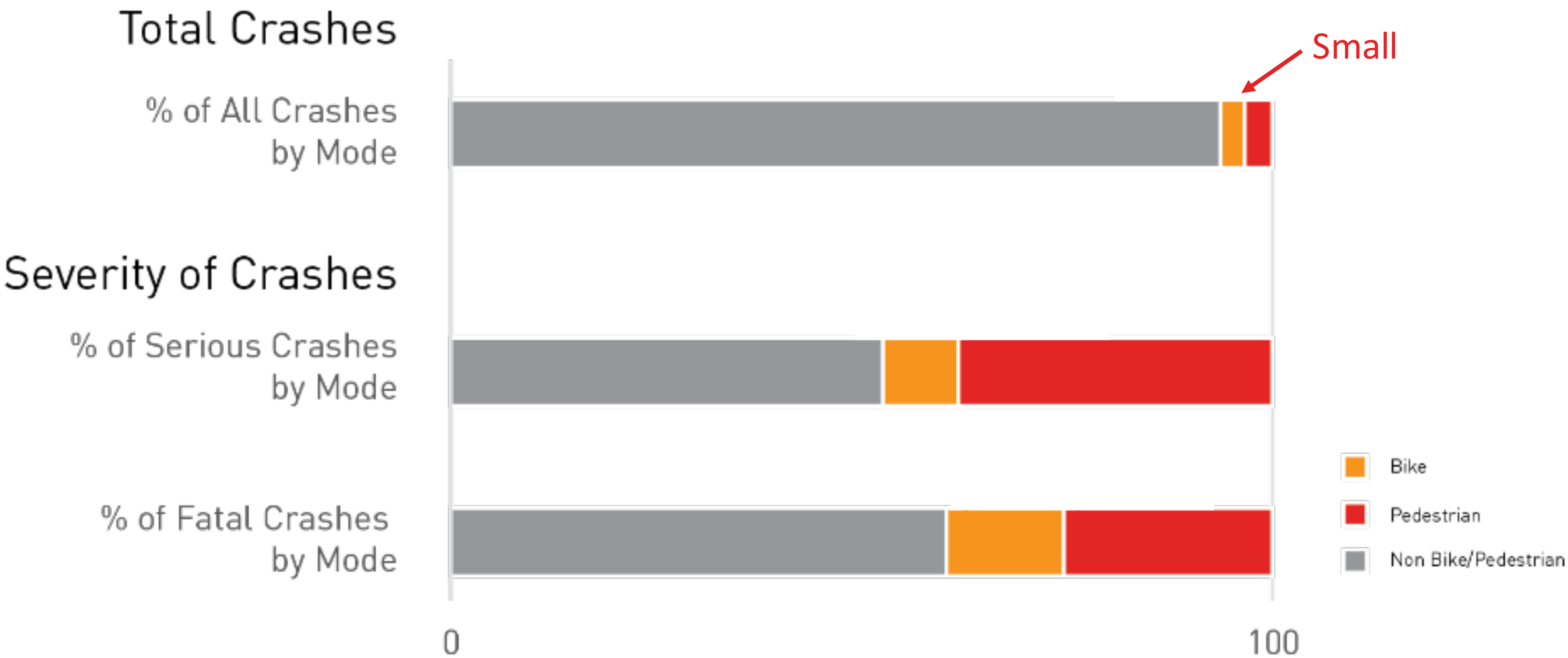
Approximately
1 in 14
total crashes

1 in 36
Serious or fatal crashes

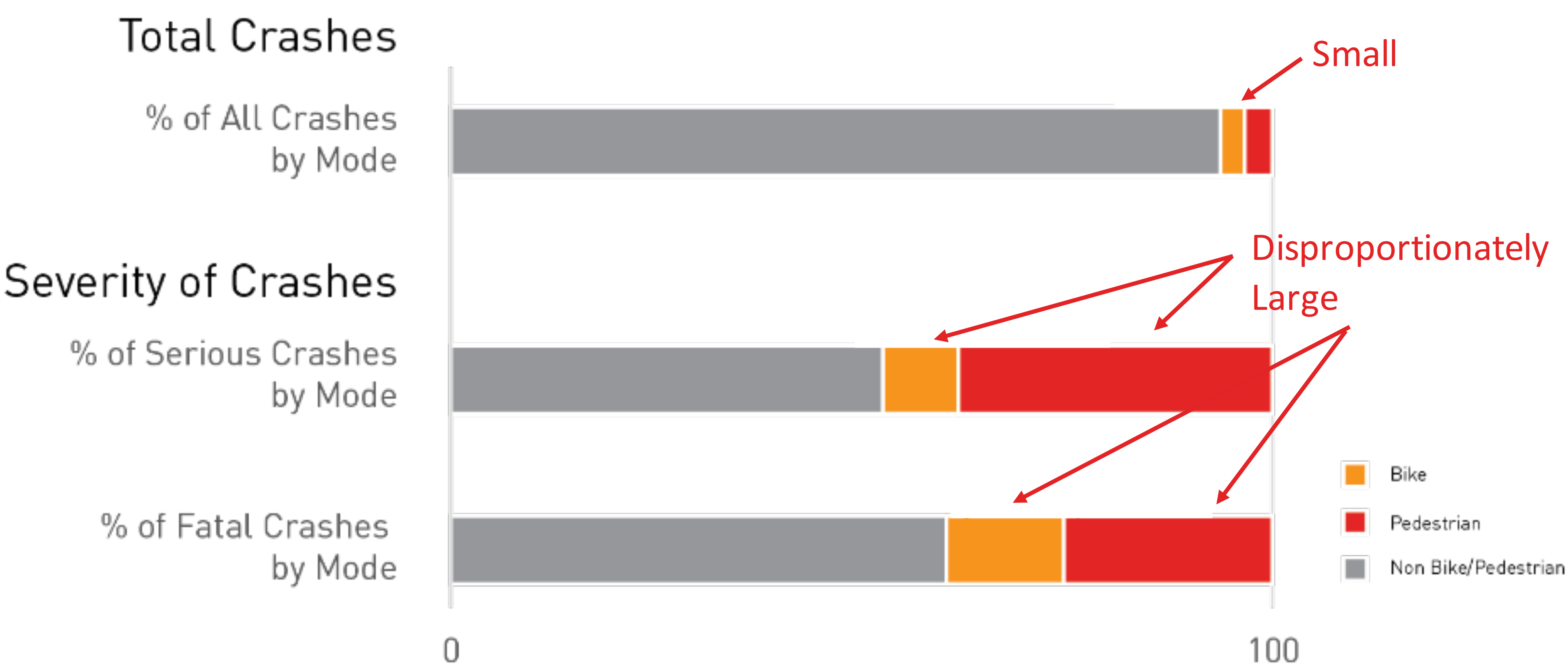
Bike & Pedestrian Crashes in Context



Bike & Pedestrian Crashes in Context



Bike & Pedestrian Crashes in Context



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Variables of Interest

- Roadway classification
- Number of lanes
- Land uses
- Pedestrian and bicycle volumes
- Topography
- Roadway operations

Ballpark Exposure Estimation

- Pedestrian model
  - # HH in 0.25-mi radius of intersection
  - # commercial properties in 0.25-mi radius of intersection
  - Intersection located w/i 0.25 mile of university

Ballpark Exposure Estimation

- Bicyclist model
  - # bike lanes on street segment
  - Sq. root of network distance to a university

Ballpark Exposure Estimation

- Bicyclist model
  - # bike lanes on street segment
  - Sq. root of network distance to a university
  - **AADT Strava count**

Exposure Estimation

Cyclist
exposure & crashes

Pedestrian
exposure & crashes

Systemic Safety Analysis

Intersection Models for:

- Total bike crashes
- Opposite direction bike crashes
- Angle bike crashes
- Total pedestrian crashes
- Pedestrian crossing, driver straight

Systemic Safety Analysis

- Produced safety performance functions

$$Y = Exp(B_0 + x_1B_1 + x_2B_2 + \ldots + x_kB_k)$$

- Used to predict where crashes are most likely to occur in the future*

*Standard caveats apply!

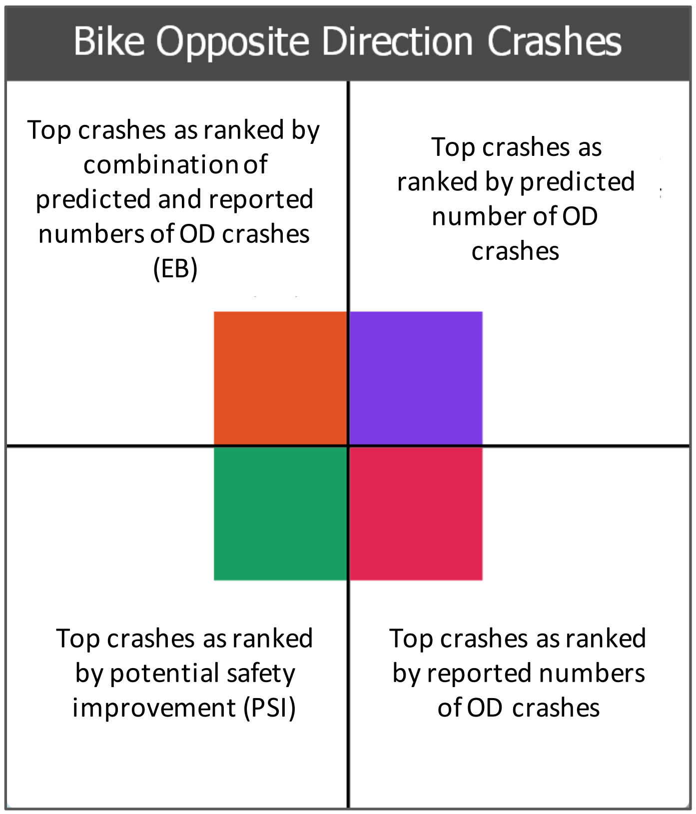
Site rankings

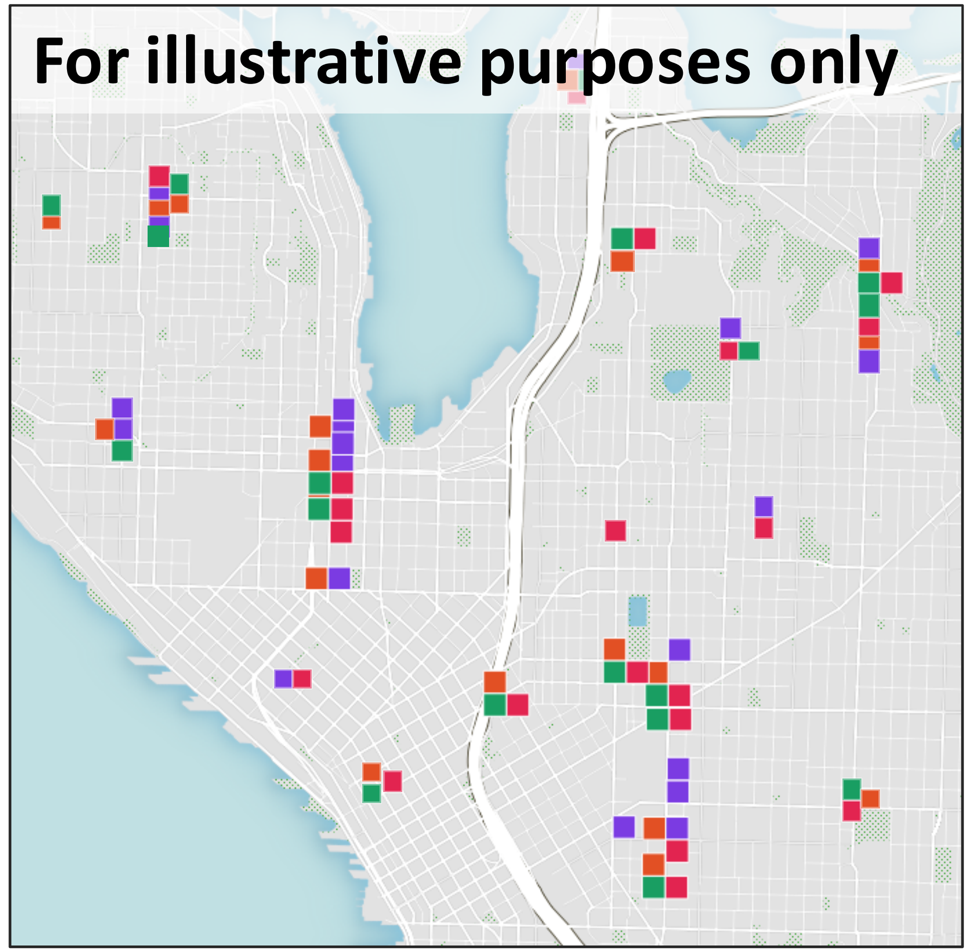
Ranked four ways:

- Crash history
- Predicted crashes
- Empirical Bayes (50/50)
- Potential Safety Improvement (EB - predicted)

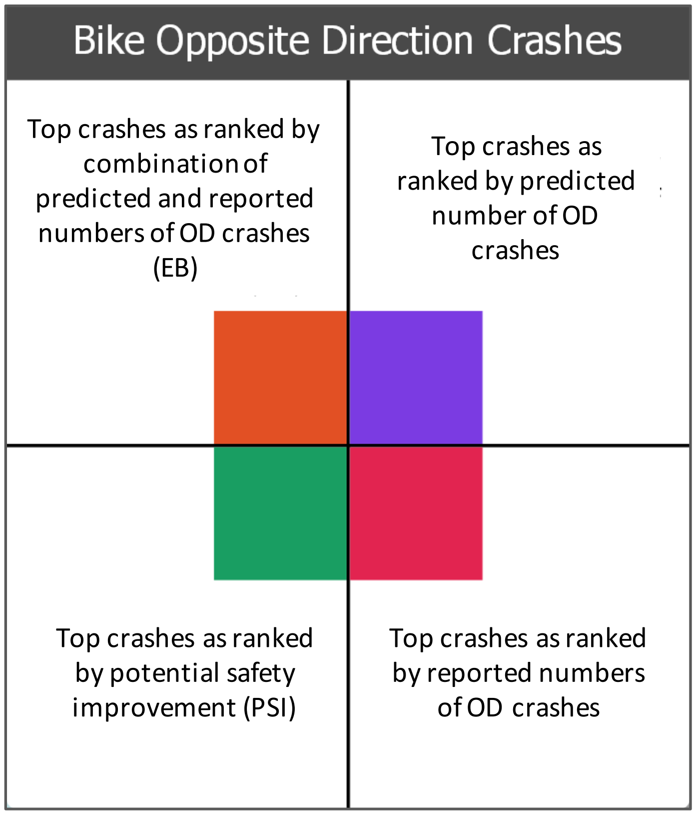
Why this Matters

EXAMPLE Ranking





EXAMPLE Ranking



EXAMPLE Interpretation

Bike Opposite Direction

- Protected left turns
- Prohibit left turns
- Pocket lefts

Ped Crossing, Driver Straight

- Signal
- RRFB

EXAMPLE Interpretation

Bike Opposite Direction

- Protected left turns
- Prohibit left turns
- Pocket lefts
- **Road diet**

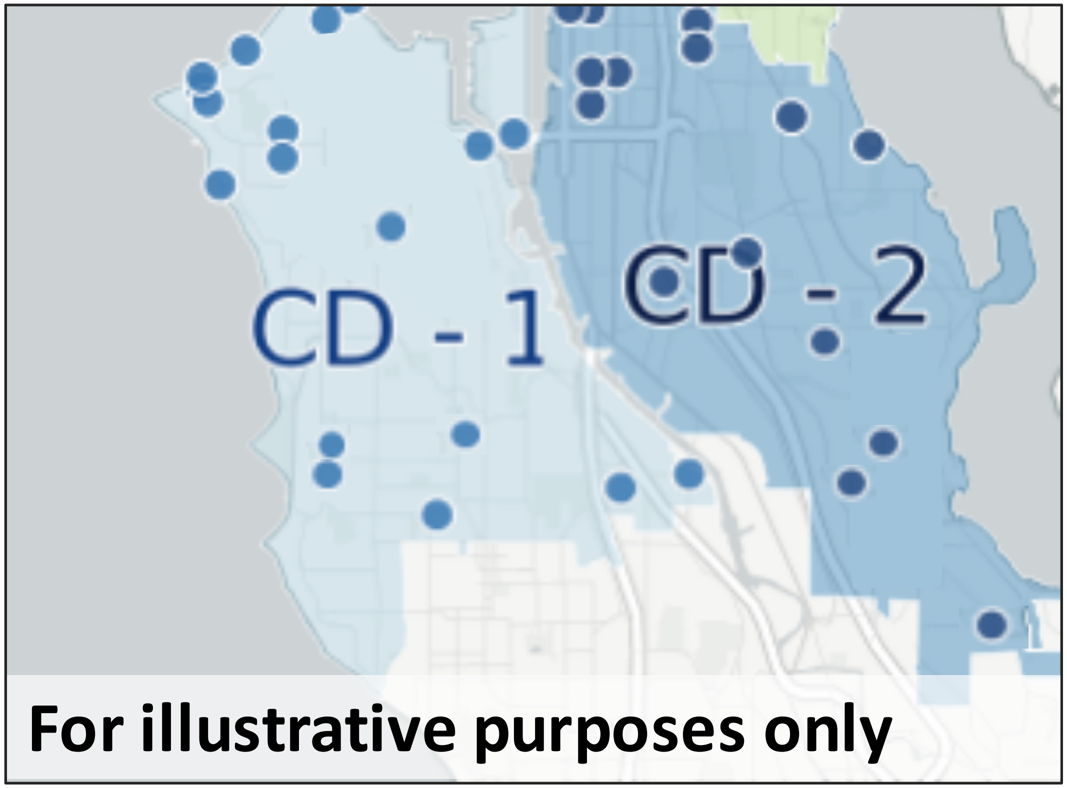
Ped Crossing, Driver Straight

- Signal
- RRFB
- **Traffic calming**
- **Road diet**

EXAMPLE Use for Geographic Equity

Geographies of Interest
- Council Districts
- Neighborhoods
- Census Tracts
- Communities of Concern

Example Rankings by Council District



Caveats for Crash Data

Overall, SDOT has very high quality data

- Many records were missing actions
- Ancillary codes not always explanatory
- Some codes displayed inconsistency
- Some codes not optimal

Key Takeaways for Other Cities

Critically important:

Data quality & availability

Time/resources to perform analyses

Knowledge to analyze data, interpret results

Also important:

Plan to use information

Conclusions

- Systemic analysis offers exciting potential
- Hotspot analysis still important
- Quality data more critical than ever
- Vision Zero is a potential game-changer