Evaluation of Bike Boxes at Signalized Intersections: Initial Findings

Tom Maze Transportation Seminars
InTrans, Iowa State University

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ibpi
Initiative for Bicycle & Pedestrian Innovation

Portland State UNIVERSITY

OTREC
OREGON TRANSPORTATION RESEARCH AND EDUCATION CONSORTIUM

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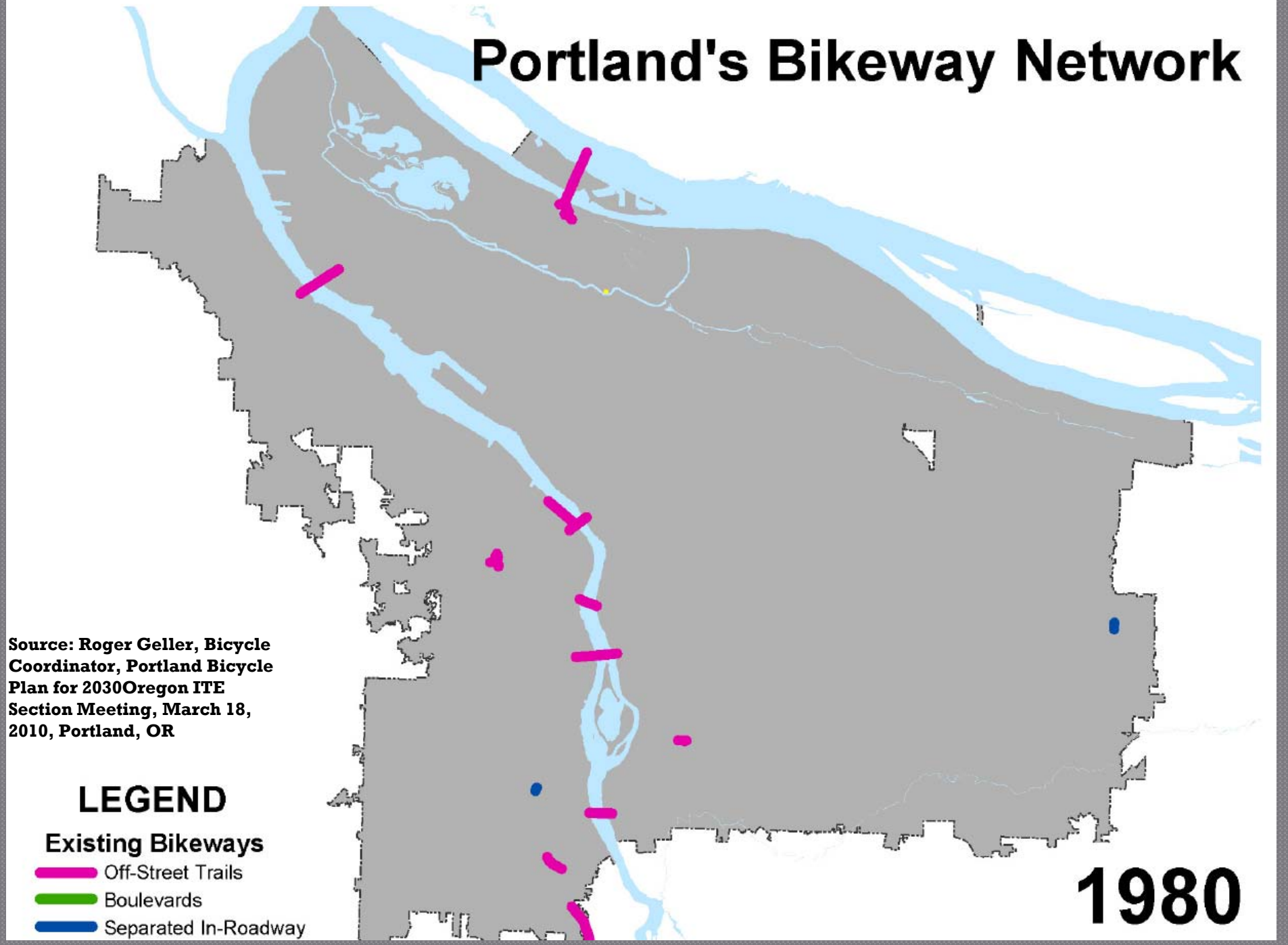
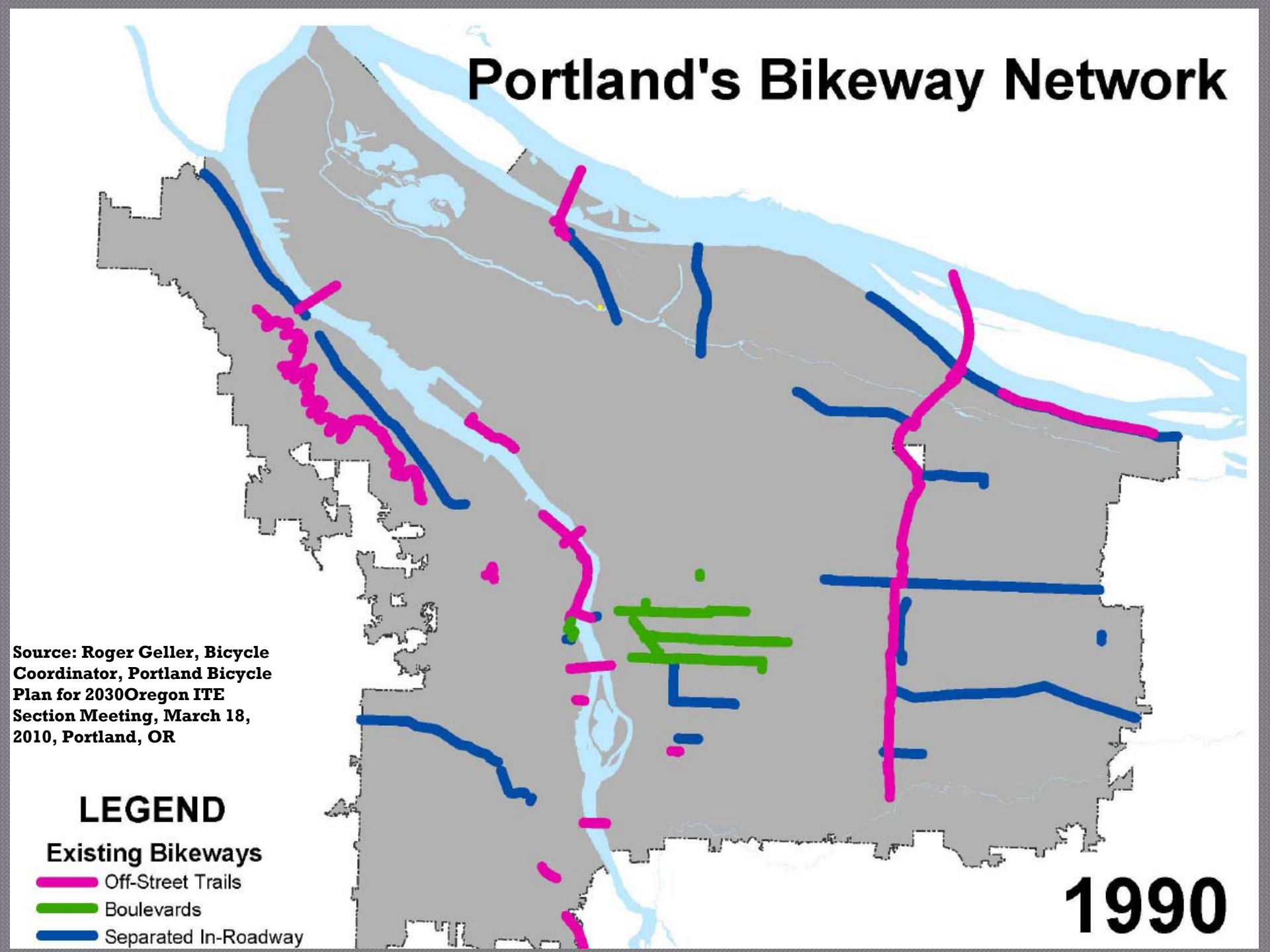
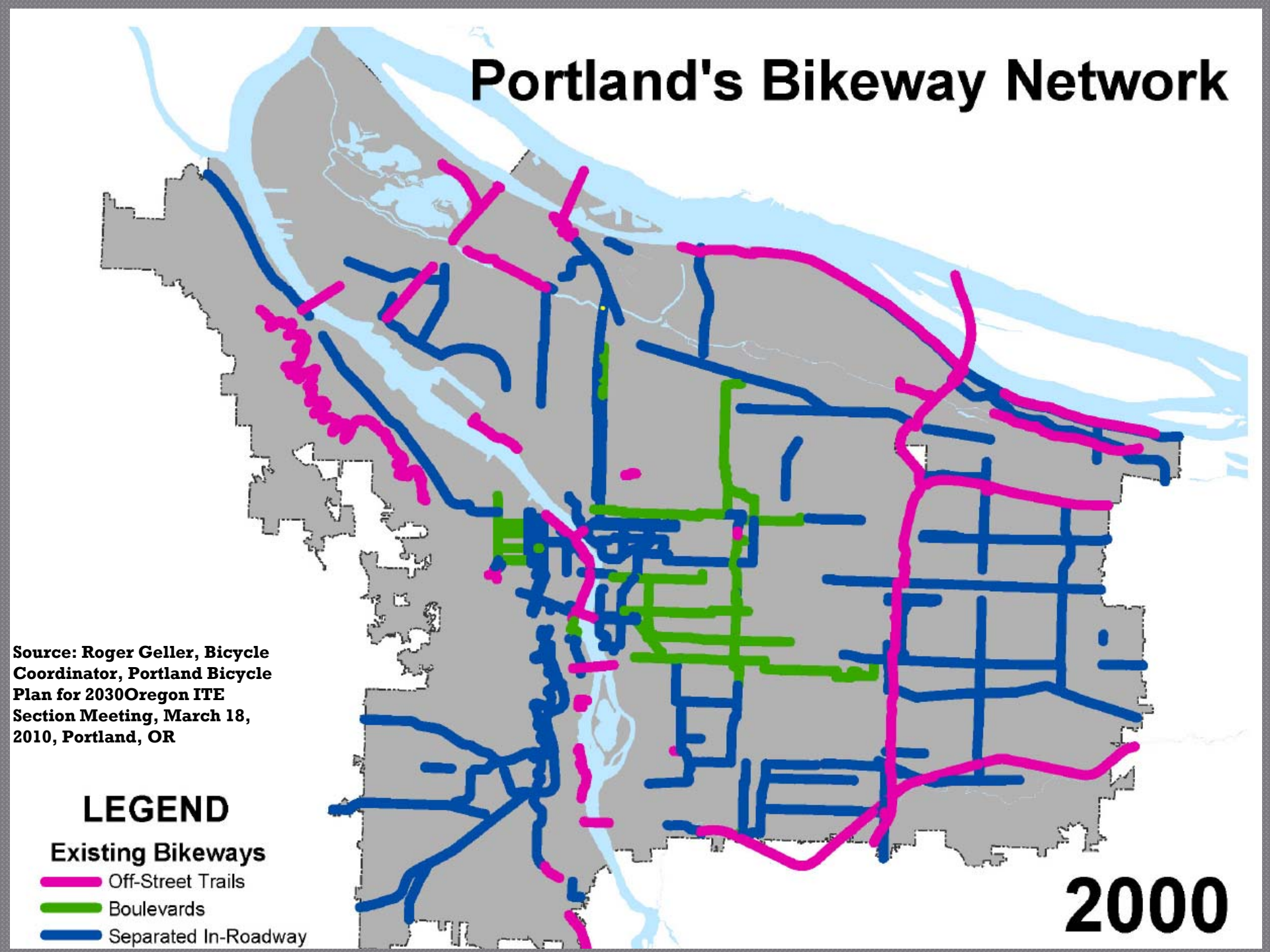
Outline

- Background
- Methods and Results
  - Video observation
  - Surveys
- Preliminary Conclusions

Portland's Bikeway Network




Portland's Bikeway Network
Source: Roger Geller, Bicycle Coordinator, Portland Bicycle Plan for 2030Oregon ITE Section Meeting, March 18, 2010, Portland, OR
LEGEND
Existing Bikeways
Off-Street Trails
Boulevards
Separated In-Roadway
1990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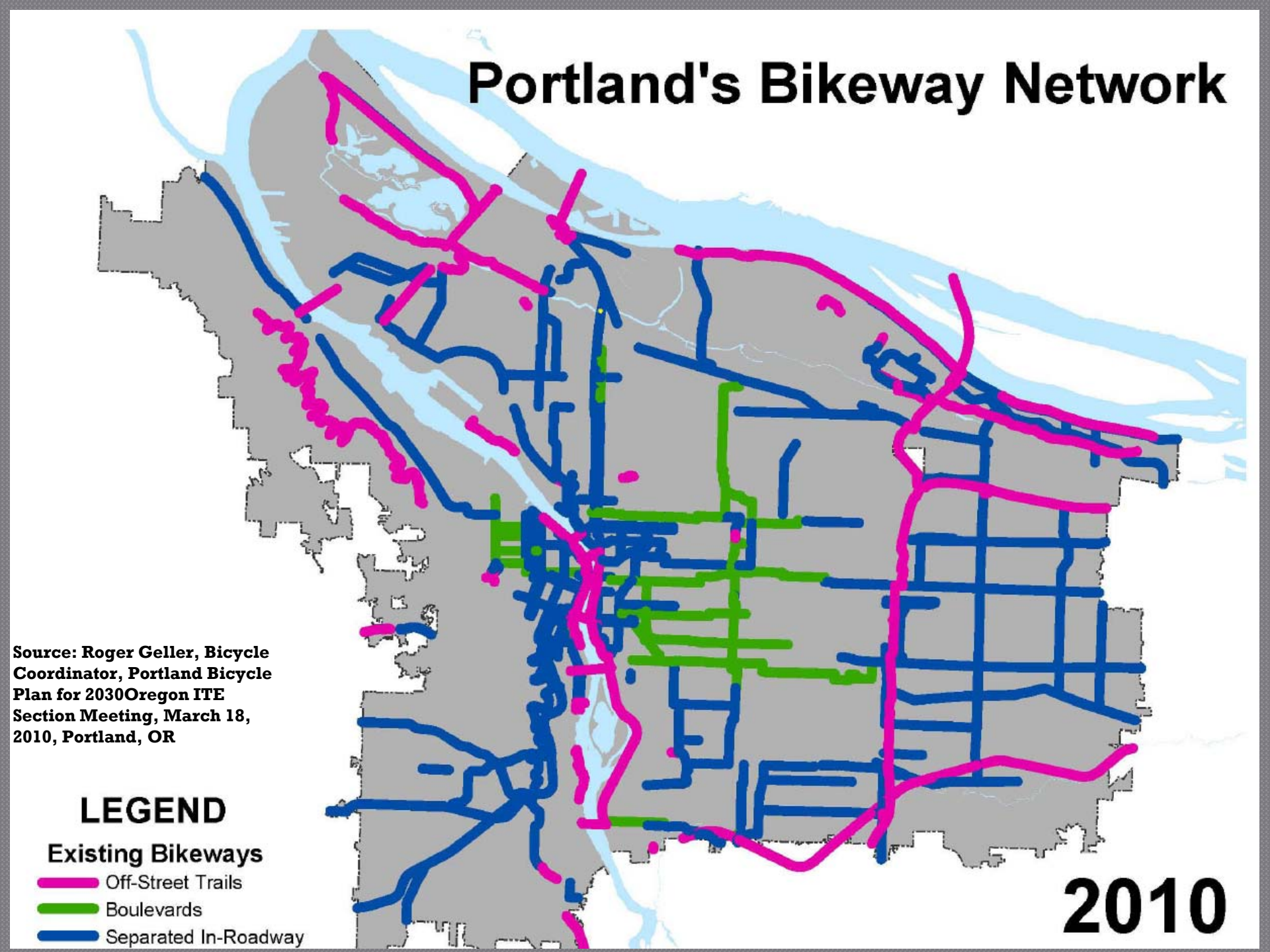
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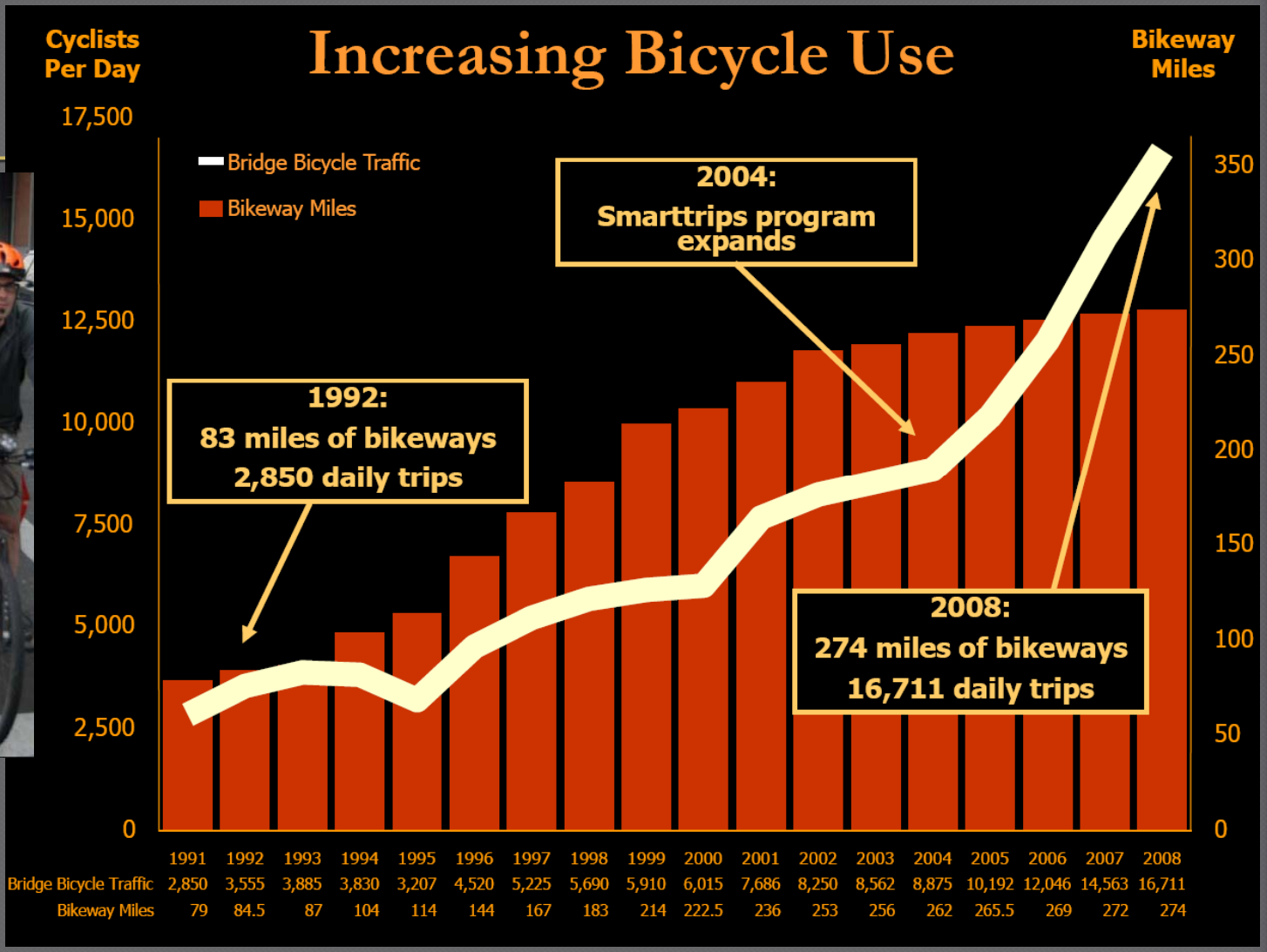
2010

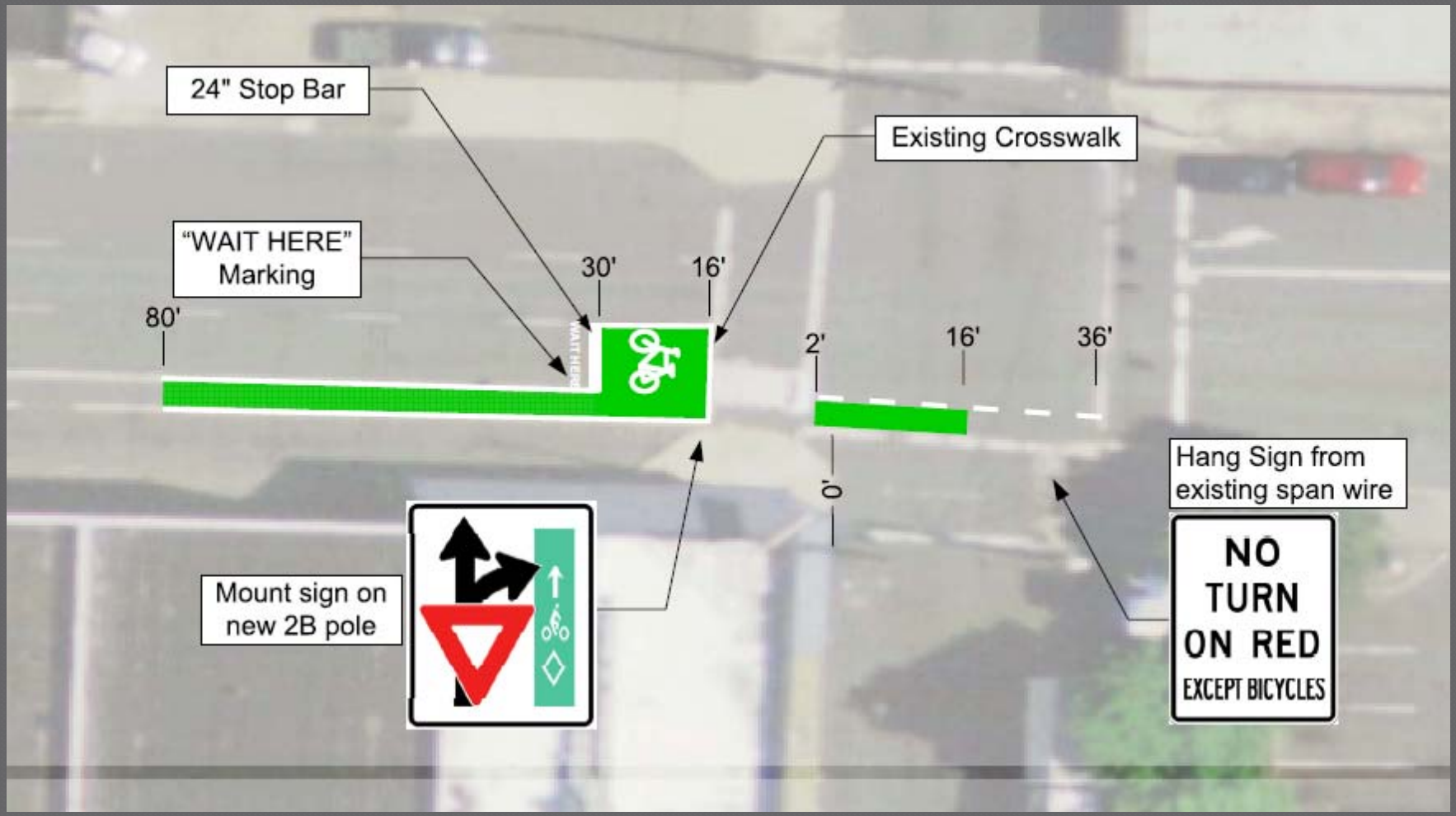
Increasing Bicycle Use



	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Bridge Bicycle Traffic	2,850	3,555	3,885	3,830	3,207	4,520	5,225	5,690	5,910	6,015	7,686	8,250	8,562	8,875	10,192	12,046	14,563	16,711
Bikeway Miles	79	84.5	87	104	114	144	167	183	214	222.5	236	253	256	262	265.5	269	272	274

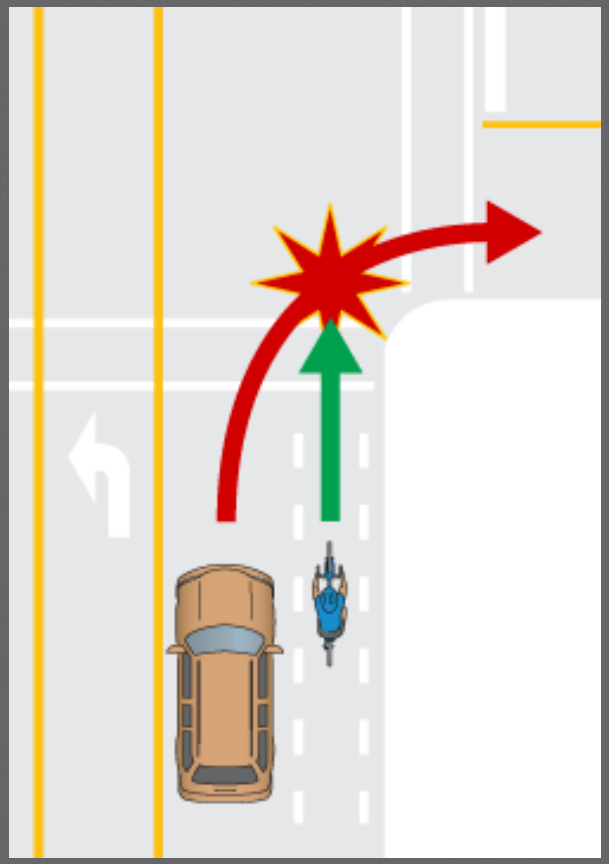
Source: Roger Geller, Bicycle Coordinator, Portland Bicycle Plan for 2030Oregon ITE Section Meeting, March 18, 2010, Portland, OR

Typical Plan (Colored)



Why Bike Boxes?

Right Hook Collision



Bike Box Layout

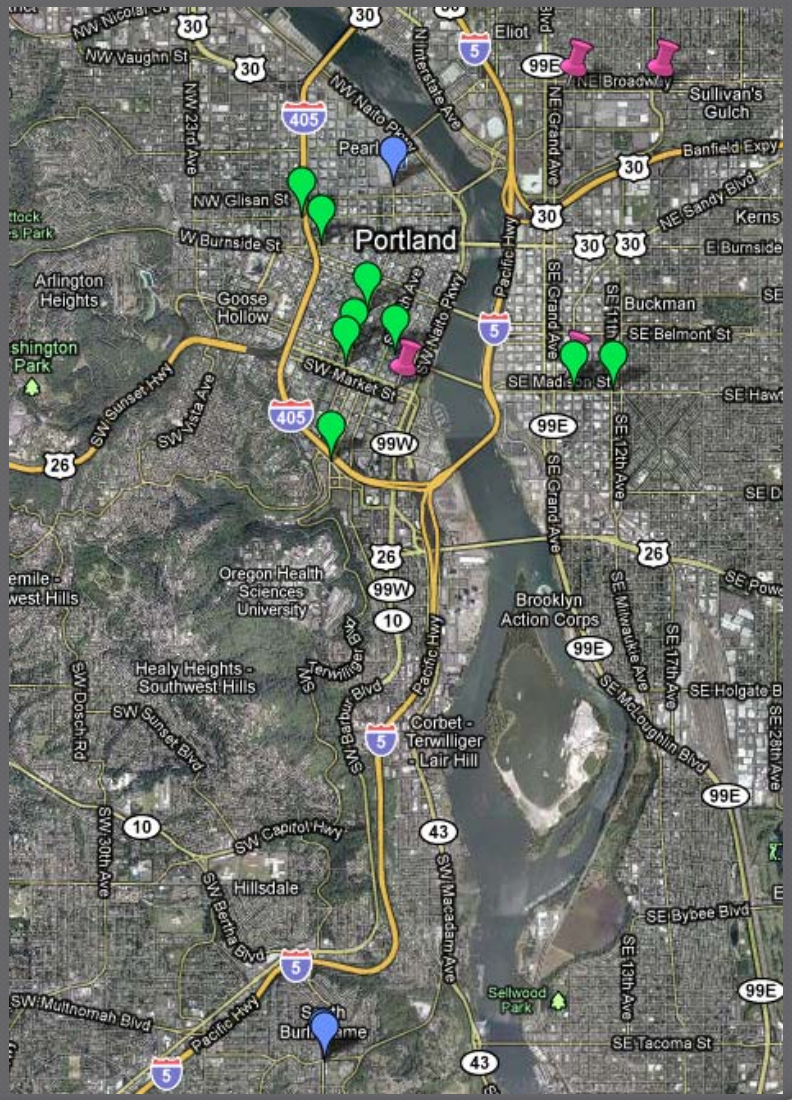
4 Types of Transportation Cyclists

Source: Roger Geller, Bicycle Coordinator, Portland Bicycle Plan for 2030, Oregon ITE Section Meeting, March 18, 2010, Portland, OR

Bike Boxes in Portland

9 - Green Bike Boxes

3 - Uncolored Bike Boxes



International Bike Boxes

Amsterdam

United Kingdom

Christchurch, NZ

British Columbia and Ontario

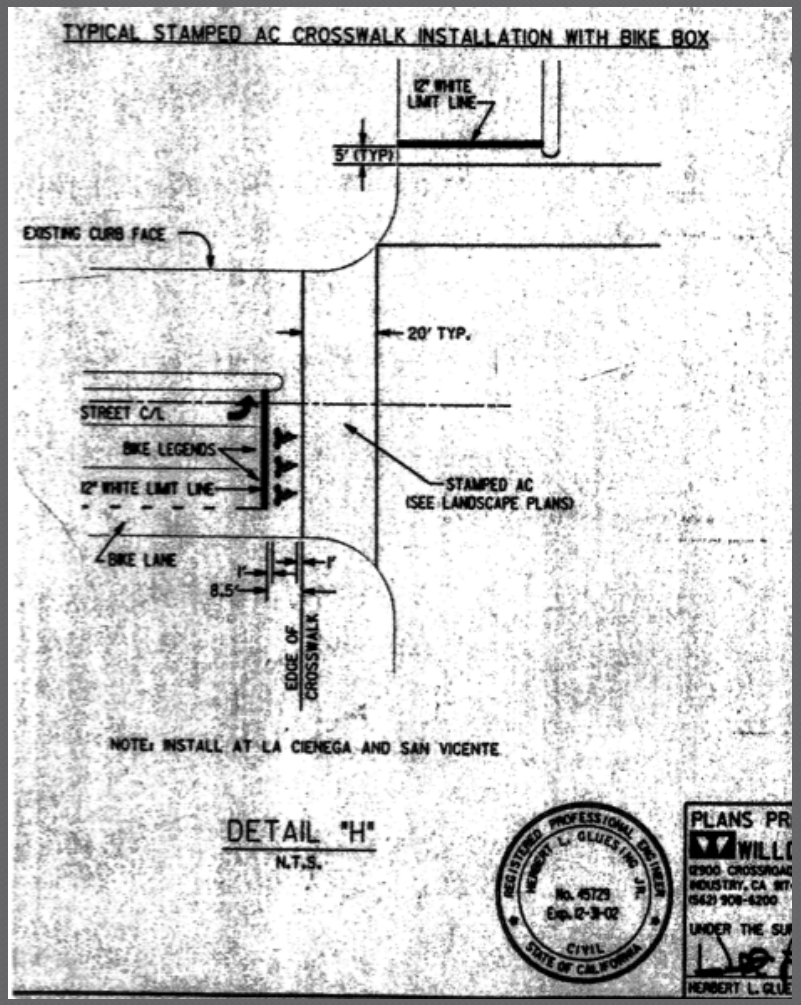
Vancouver, BC

Toronto, CA

Victoria, BC

West Hollywood, CA

Installed ~1998



San Francisco, CA

New York, NY

Tucson, AZ

Long Beach, CA

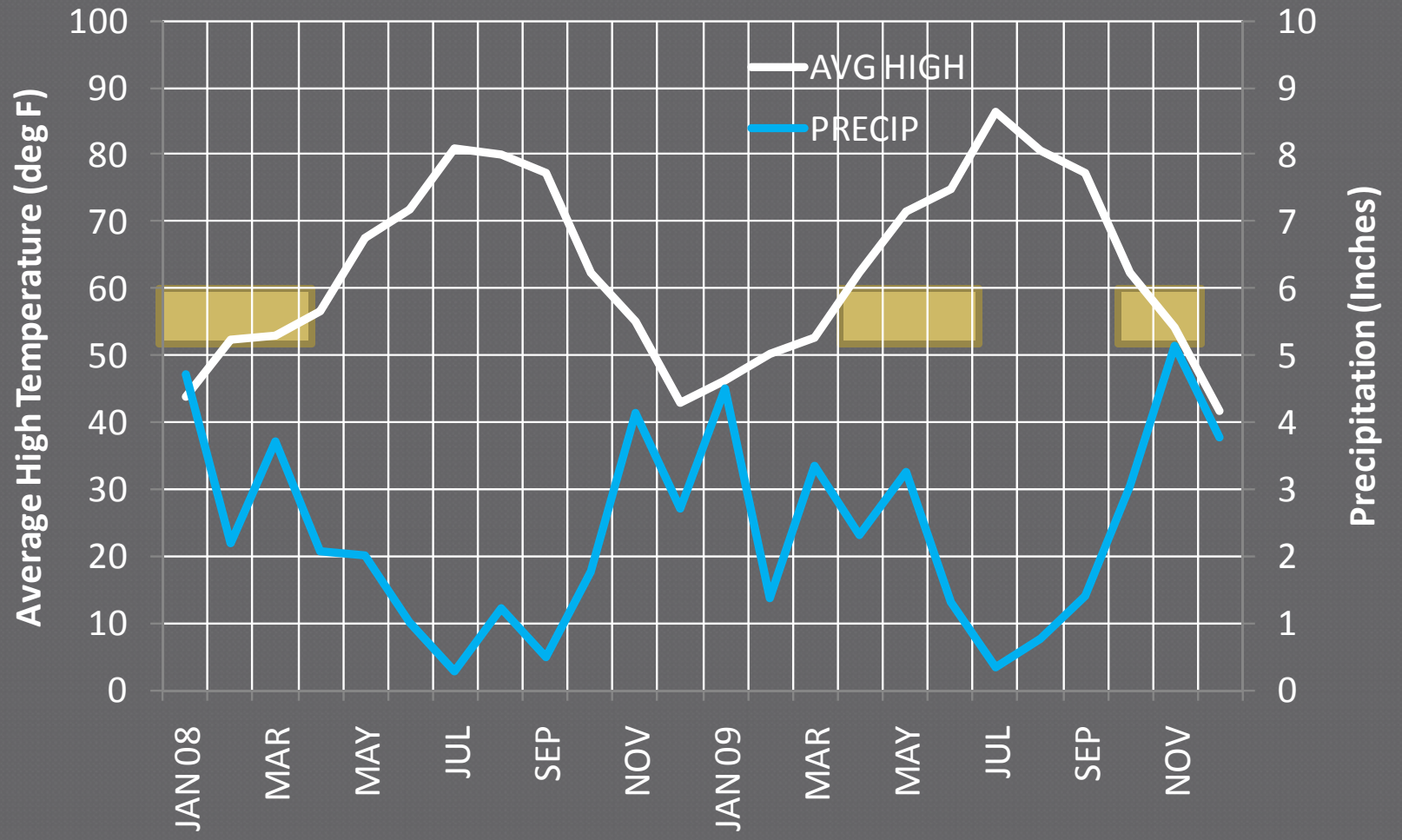
Courtesy of City of Long Beach

Video Data Collection Summary

- 936 hours of video collected
  - ~48 hours per location
- Before video
  Jan to March 2008
- After video
  April to June 2009

- Both Pre-Post video
  - 10 bike box (7 green, 3 uncolored)
  - 2 control

Weather


Average High Temperature (deg F)
Precipitation (Inches)
AVG HIGH
PRECIP
100
90
80
70
60
50
40
30
20
10
0
10
9
8
7
6
5
4
3
2
1
0
JAN 08
MAR
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JAN 09
MAR
MAY
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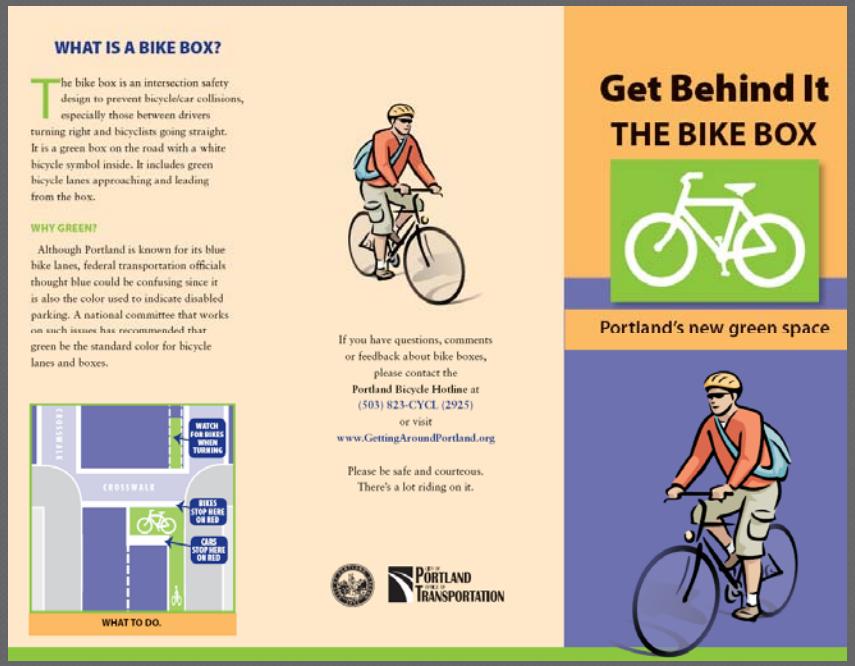
NOV

Education and Enforcement



WHAT IS A BIKE BOX?

The bike box is an intersection safety design to prevent bicycle/car collisions, especially those between drivers turning right and bicyclists going straight. It is a green box on the road with a white bicycle symbol inside. It includes green bicycle lanes approaching and leading from the box.

WHY GREEN?

Although Portland is known for its blue bike lanes, federal transportation officials thought blue could be confusing since it is also the color used to indicate disabled parking. A national committee that works on such issues has recommended that green be the standard color for bicycle lanes and boxes.

WHAT TO DO.

If you have questions, comments or feedback about bike boxes, please contact the **Portland Bicycle Hotline** at (503) 823-CYCL (2925) or visit www.GettingAroundPortland.org

Please be safe and courteous. There's a lot riding on it.

CITY OF PORTLAND BUREAU OF TRANSPORTATION

Get Behind It
THE BIKE BOX

Portland's new green space

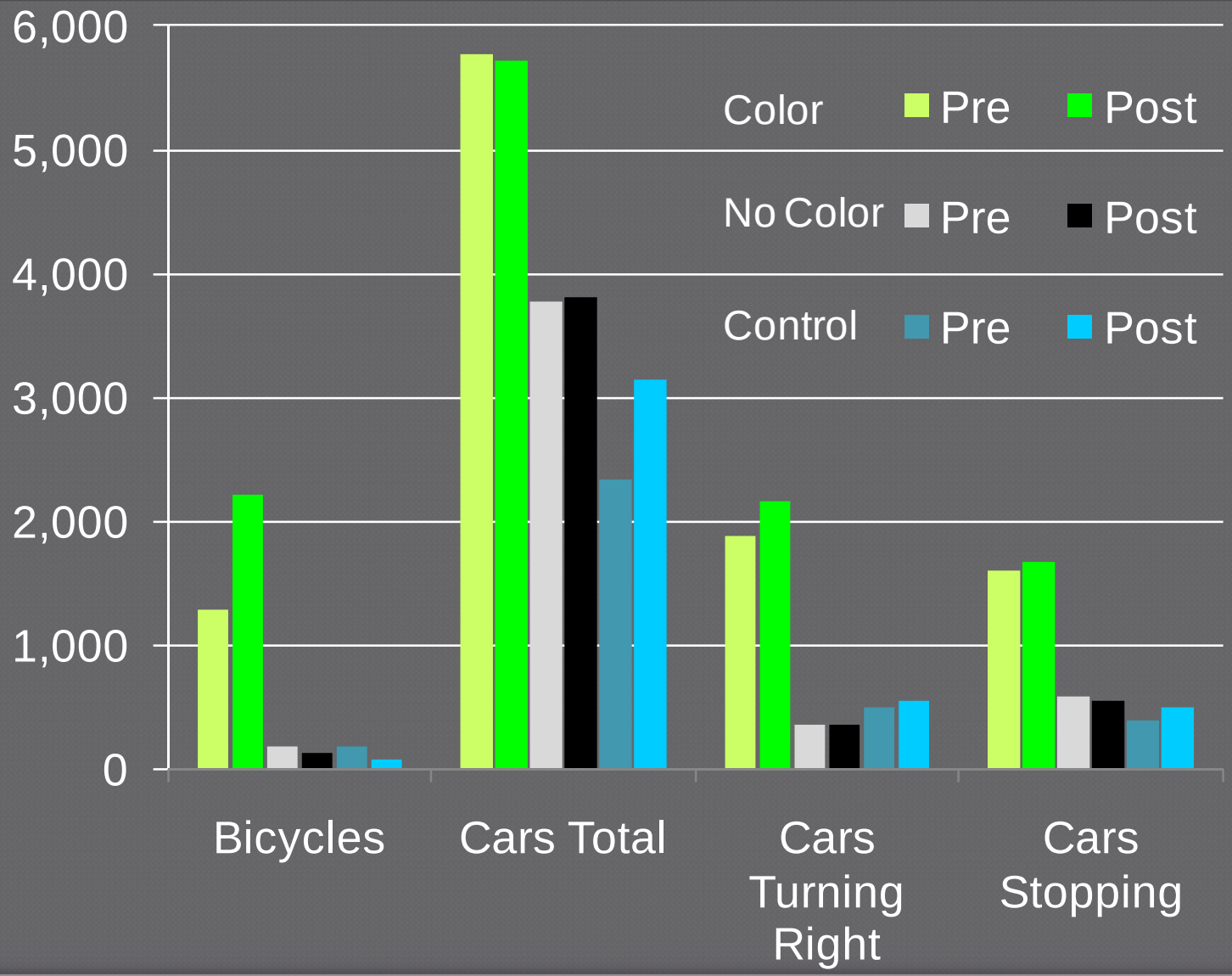
Video Data Analysis

- All video digitized and stored on central server (after video was digital)
- For each location
  - 2 peak hours
  - 1 off-peak hour
- Three research assistants viewed and coded video
- 7 hours of video randomly selected to test for reliability among the reviewers

Preliminary Results

- Counts
  - Total Cars
  - Observed Bicycles
  - Total Cars Turning Right
  - Total Cars Stopping
- Behaviors
  - Motor vehicle and cyclist encroachment in crosswalk
  - Motor vehicle encroachment in bike box and bike lane
  - Cyclist location stopping in bike box
  - Preliminary conflict analysis

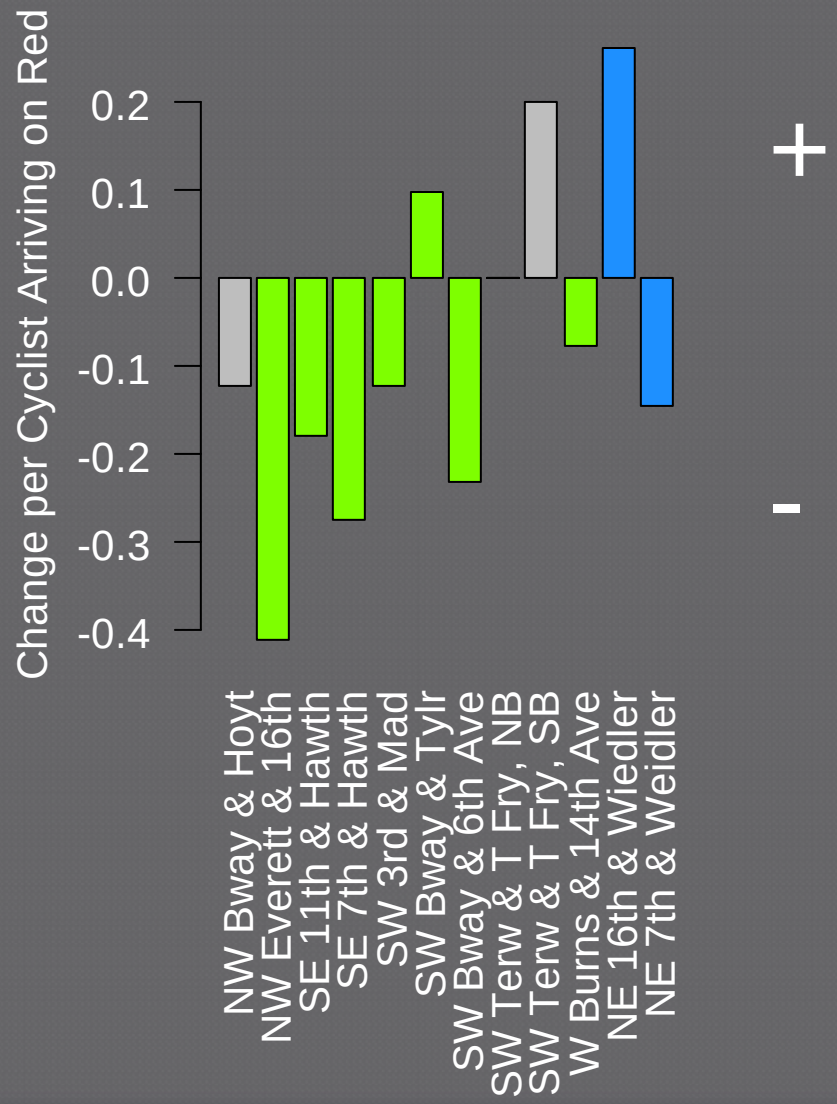
Count Changes



Pre-Post Behaviors

- Figures
  - (Post count/normalizing) – (Pre count/normalizing)
  - Y-axis label gives normalizing value
- Color legend
  - Grey – Uncolored bike box
  - Green – Colored green bike box
  - Blue – Control

Cyclist Stopping in Crosswalk



Motor Veh. Encroachment in Crosswalk

Up to 25% of vehicle across line

Minor

Up to 50% of vehicle across line

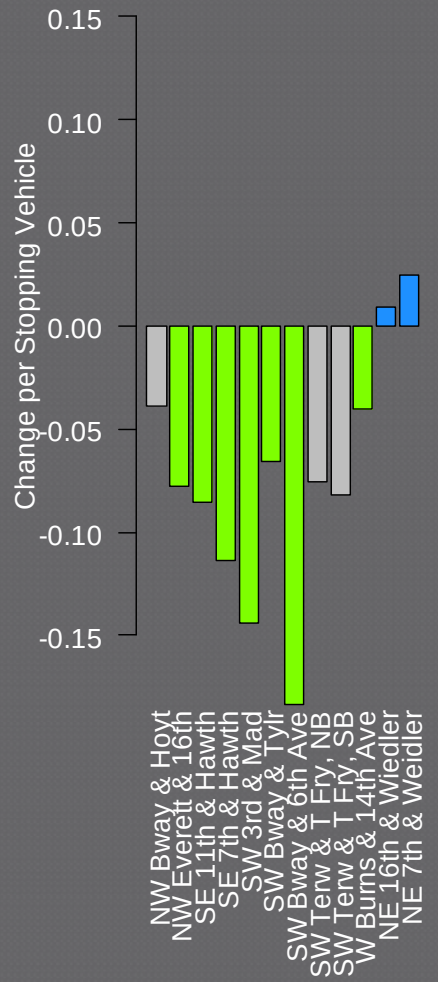
Moderate

More than 50% of vehicle across line

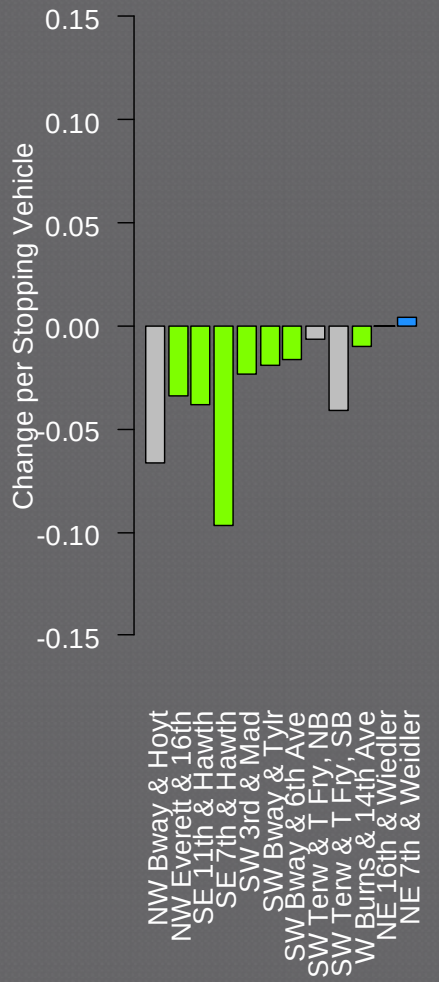
Major

Motor Veh. Encroachment in Crosswalk

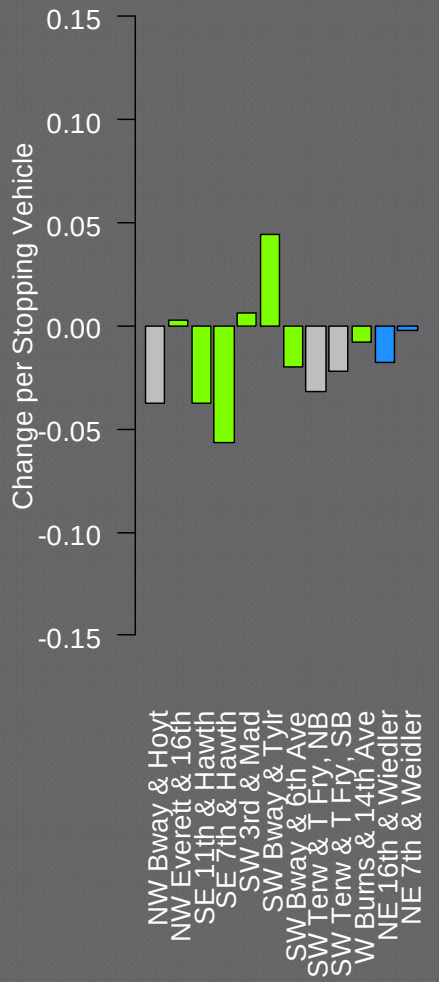
Up to 25% of vehicle across line



Up to 50% of vehicle across line



More than 50% of vehicle across line



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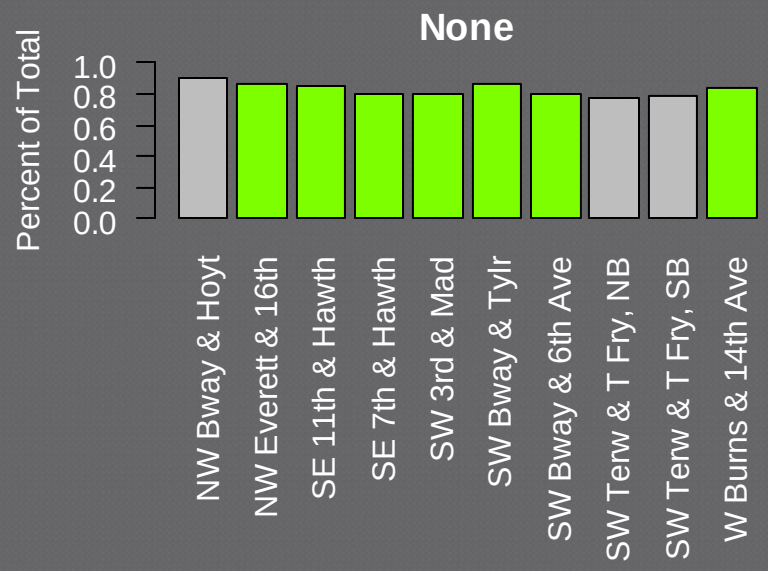
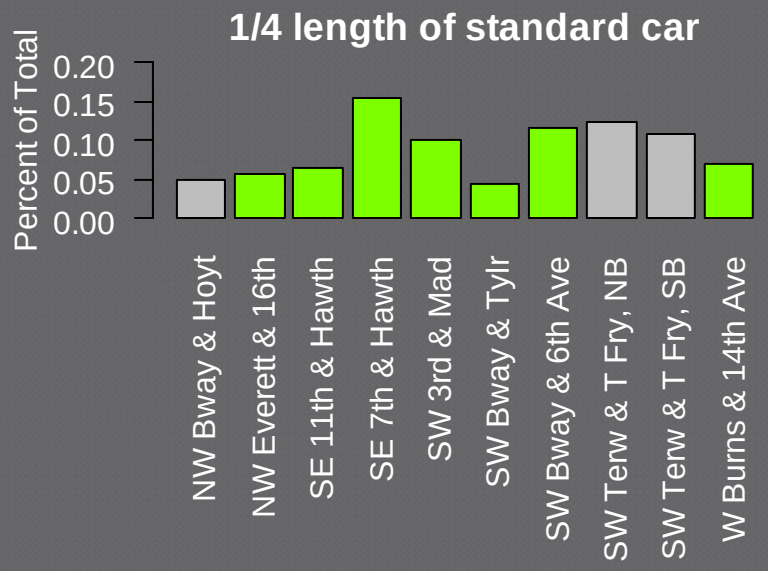
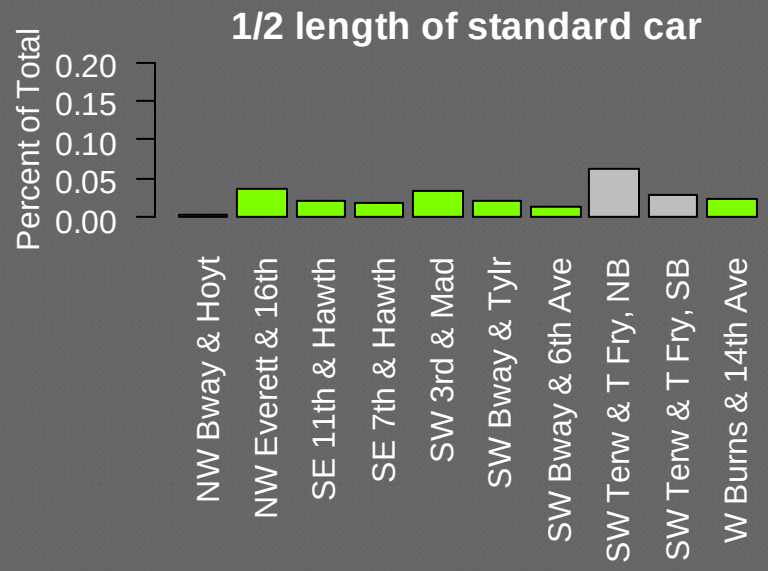
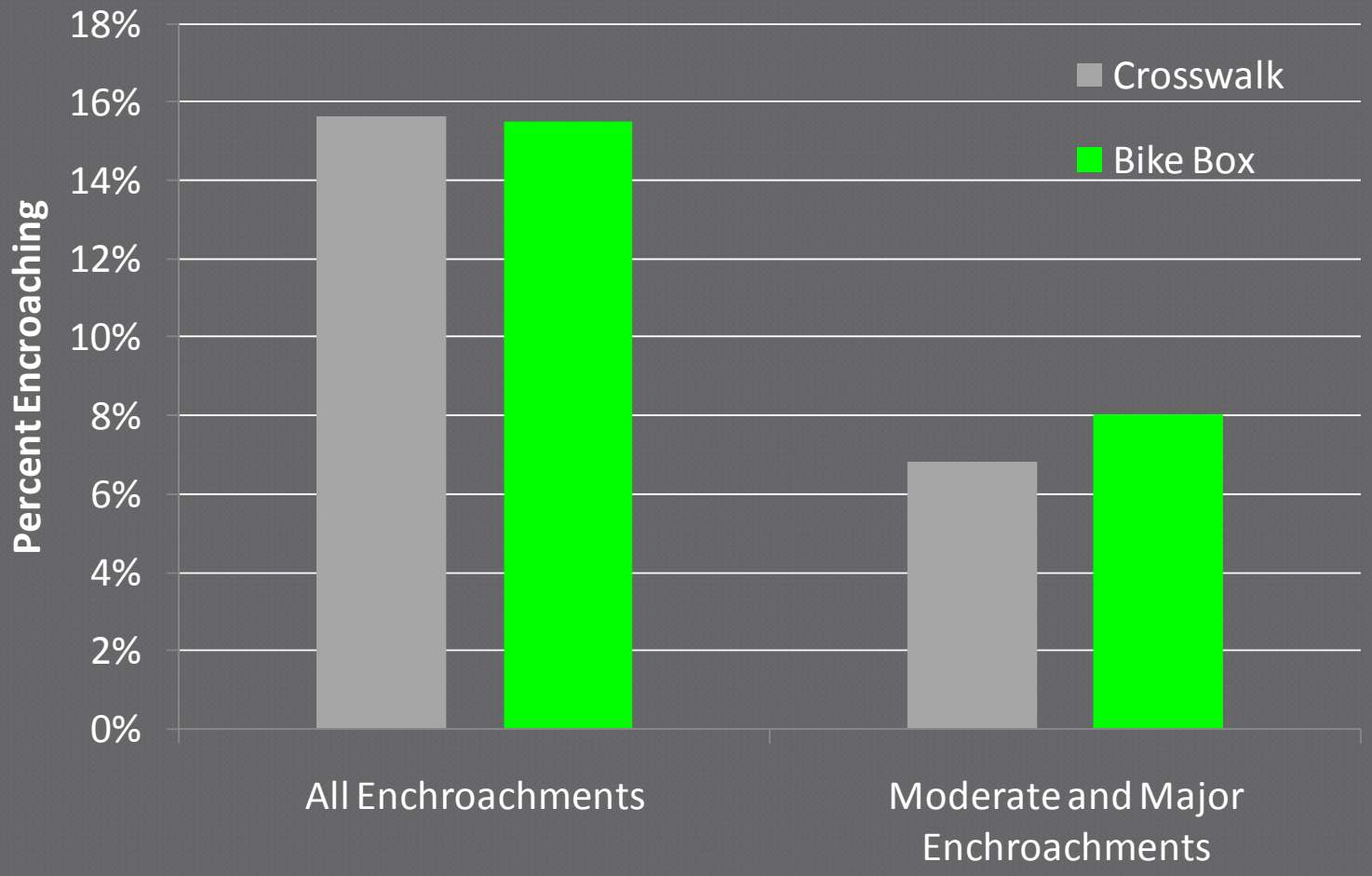
Motor Vehicle Encroachment in Bike Box







Comparing Compliance



Motor Veh. Encroachment in Bike Lane

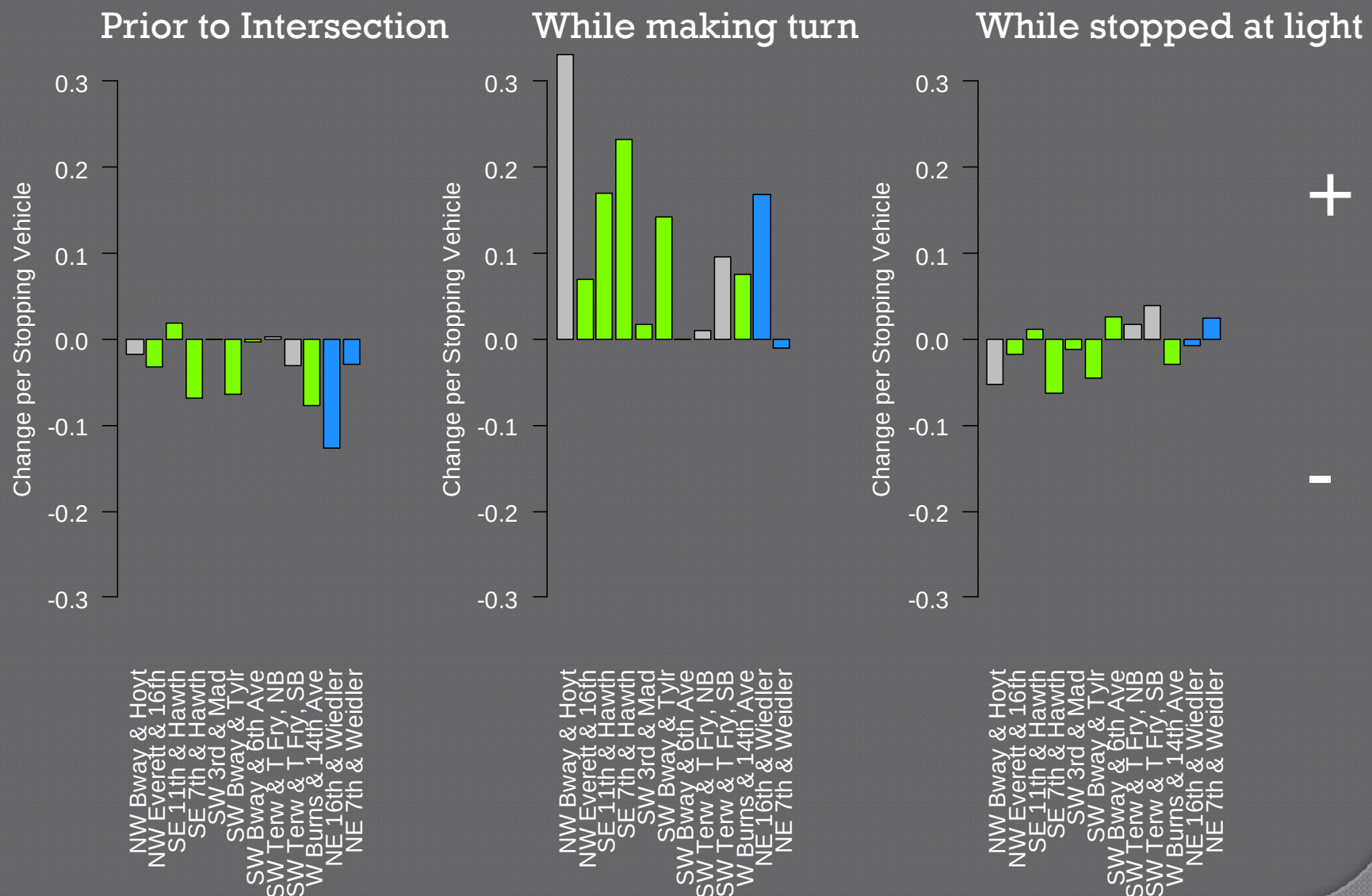
Prior to Intersection

While making turn

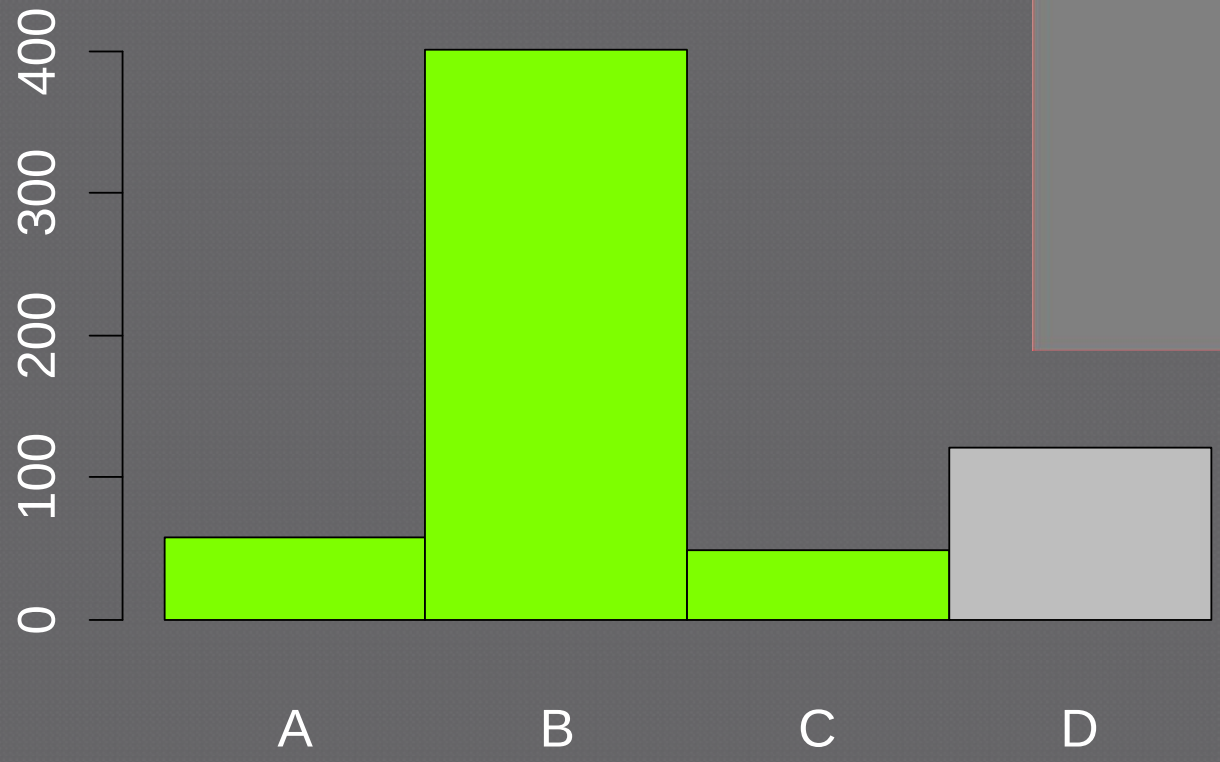
While stopped at light

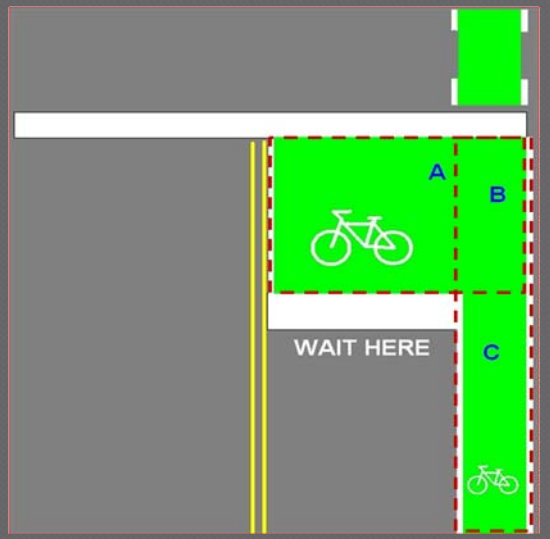
In post review we considered a "virtual" bike lane

Motor Veh. Encroachment in Bike Lane



Location of Stopped Cyclist in Box*





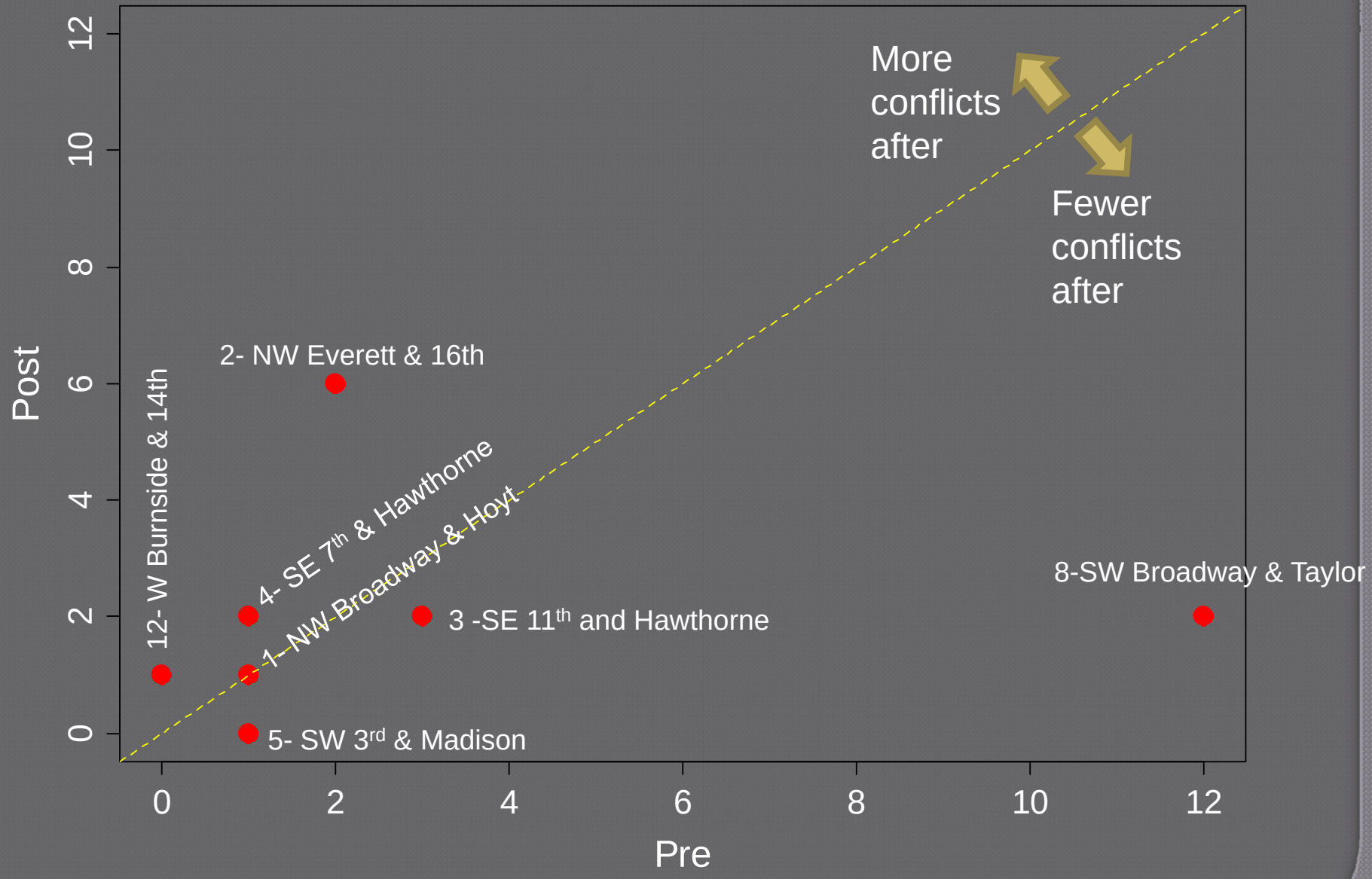
Conflict Analysis

Period	Conflicts	Cyclist	Vehicles Turning Rt.	Vehicles Thru
Pre	20	1,471	2,365	8,106
Post	14	2,301	2,711	8,855

- All potential conflicts were identified in video review
- Identified actions by cyclist and motorist
  - Precautionary braking, Precautionary change of direction, Emergency braking, Emergency change of direction, Full stop
- Rated severity of conflict (by panel)
  - Major (2); Substantial (5); Minor (27)

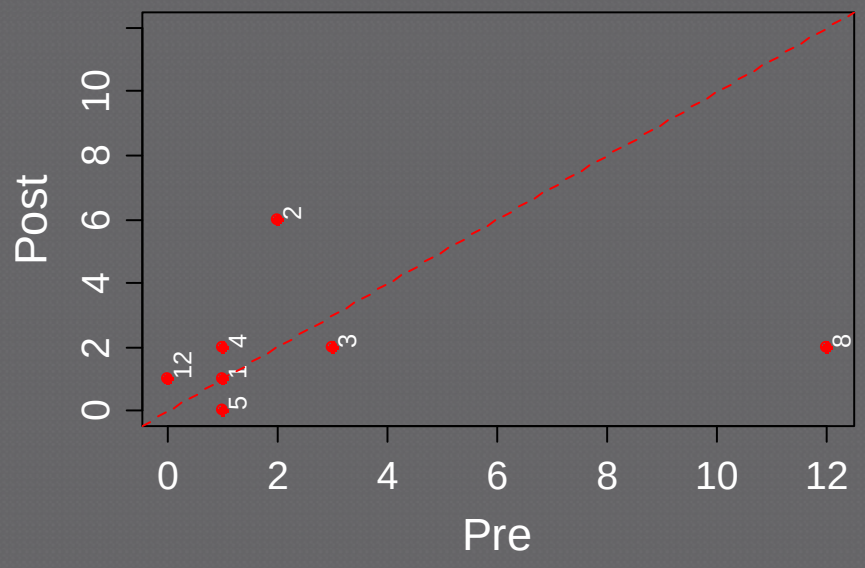
Video of conflicts

Conflicts

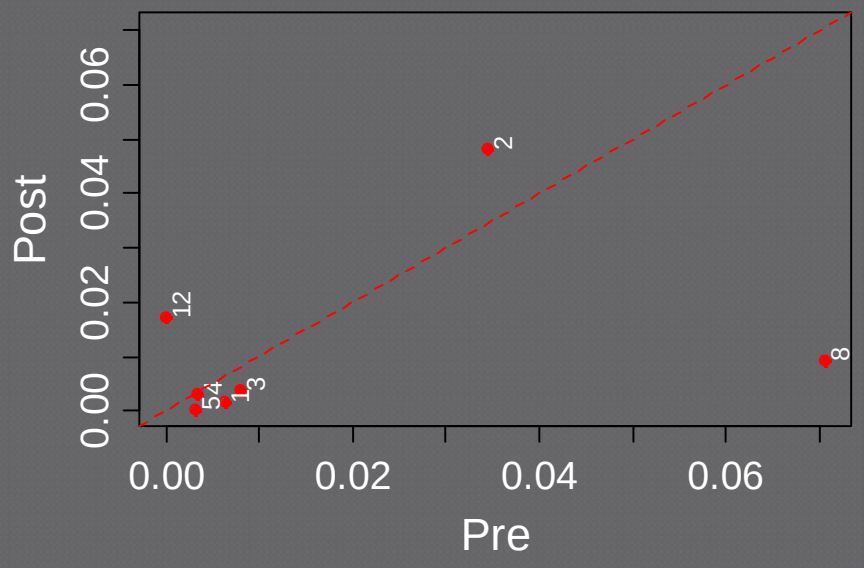


No conflicts - SW Broadway and 6th, SW Terwilliger & Taylors Ferry (NB and SB)

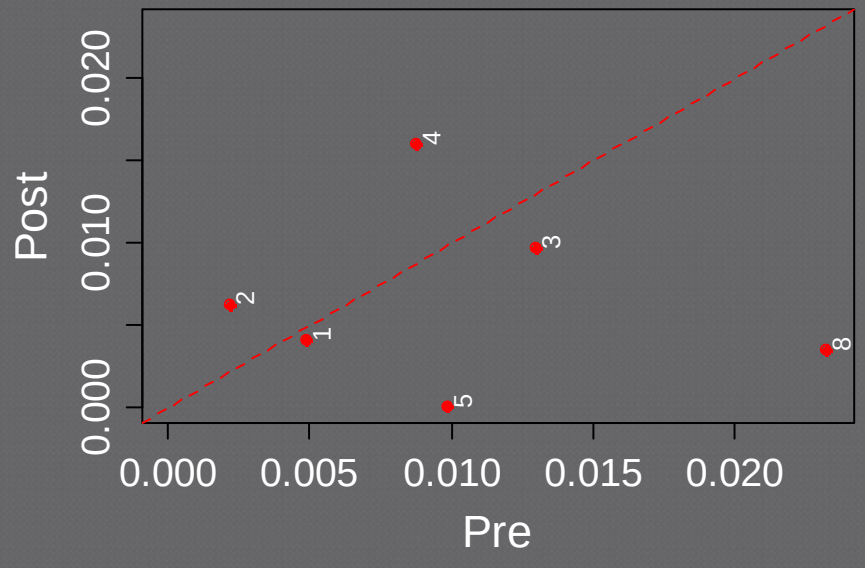
Conflicts



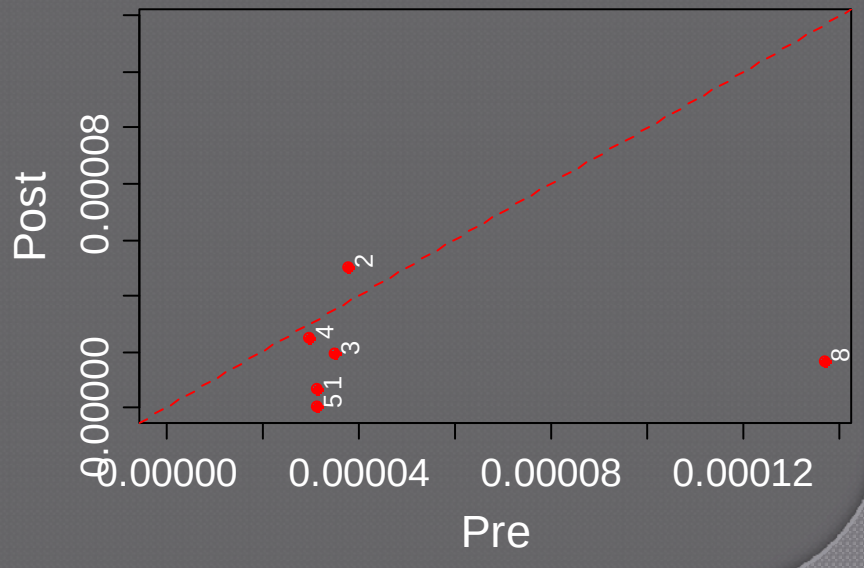
Conflicts/Cycle Volume



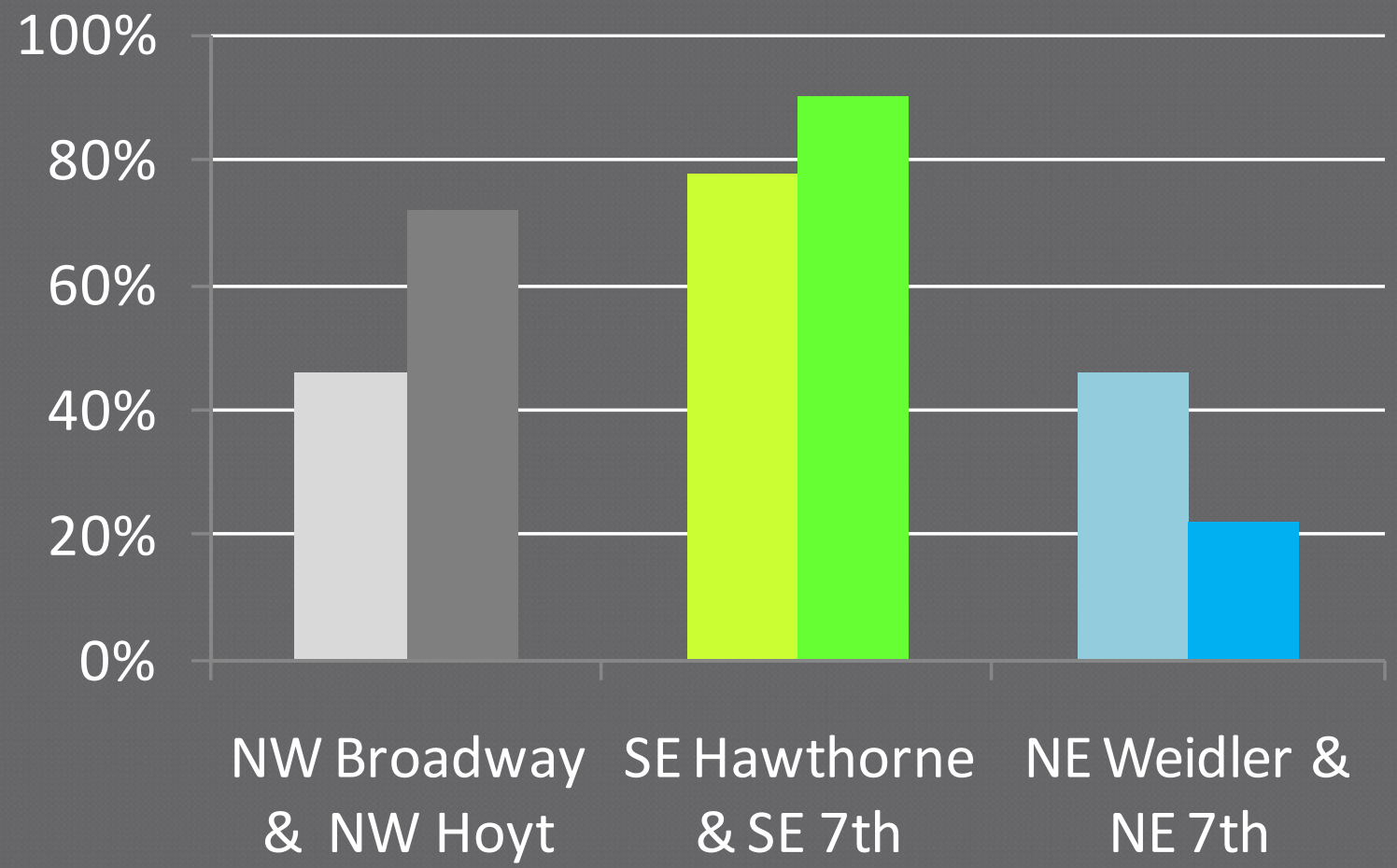
Conflicts/Cars Right



Conflicts/Cars Right*Cycle



Pre-Post % of Interacting Right-Trn Vehicles Yielding



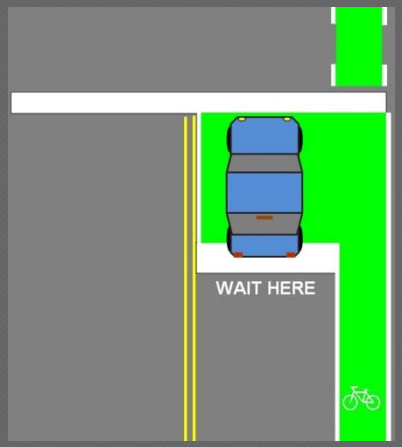
Methods: Surveys

- Intercept survey of bicyclists
  - 5 bike box intersections
  - 47% response rate (468 of 997)

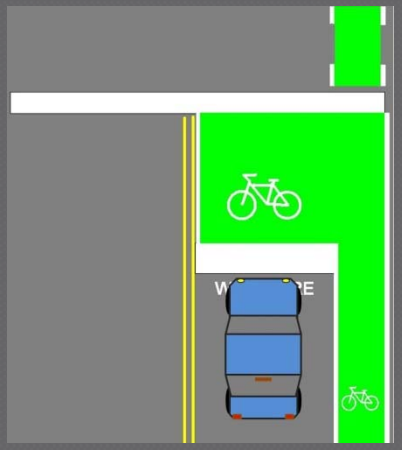
- On-line survey of motorists
  - 24% response rate (717 of 3,020)

Motorist Knowledge

If you approached an intersection with a red light where should you stop your car?

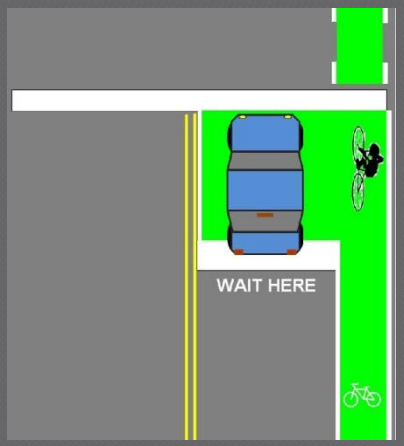


2%
1% either
3% don't know

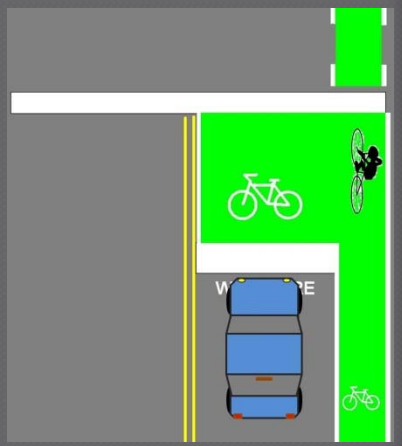


94%

9%
<1% either
1% don't know



89%



Motorist Survey

As a driver, do you think one of the pavement marking designs is better than the other?

6%

89%

Motorist Survey

Do you think the bike box has made driving safer or more dangerous at the intersections?)

	All motorists	Motorists who have never biked through bike box
A lot safer	16%	14%
A little safer	36%	31%
No difference	18%	19%
A little more dangerous	9%	10%
A lot more dangerous	3%	3%
Don't know	18%	22%
n	717	490

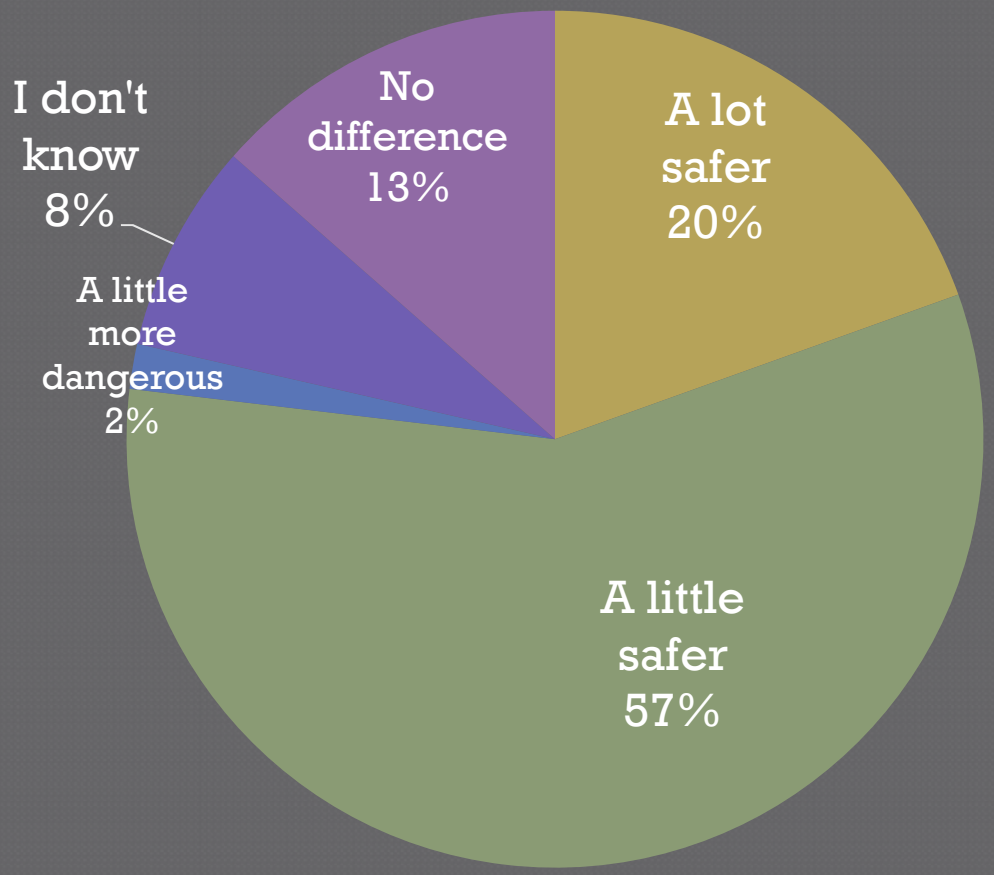
45%

Motorist Survey

- Of the motorists who have not biked in a bike box…
  - 40% think drivers drive more safely because of the bike boxes
  - 43% think the bike boxes make driving less convenient at the intersections
  - 37% feel more comfortable driving through the intersections (16% less comfortable)
  - 55% think the bike boxes make drivers more aware of bicyclists generally
  - 37% think the City should install more boxes
    13% think the City should remove some or all

Bicyclist Survey

- Do you think the bike box has made the intersection safer for you as a cyclist?



Bicyclist Survey

- 37% think most motorists understand the purpose of the box
  - 35% do not think they do
- 81% think motorists are more aware of cyclists because of the boxes
- 83% think the bike boxes make for a better environment for bicycling
- 72% think the City should install more

Preliminary Conclusions

- Most motorists understand and obey the boxes
- Pedestrians may benefit from reduced encroachment
- Fewer cars entering the bike lane prior to the intersection, but more are cutting the corner closer
- Very few conflicts before or after

Preliminary Conclusions

- Improved perceptions of safety on the part of both motorists and bicyclists
- More data analysis to come
  - Project report in the winter

Acknowledgements

- City of Portland
  - Rob Burchfield
  - Tom Jensen
  - Matthew Machado
  - Roger Geller
- Student Research Assistants
  - Nathan McNeil
  - Bob Kellett
  - Will Farley
- OTREC

Questions?