



Traffic Signal Design for Better Bicycling

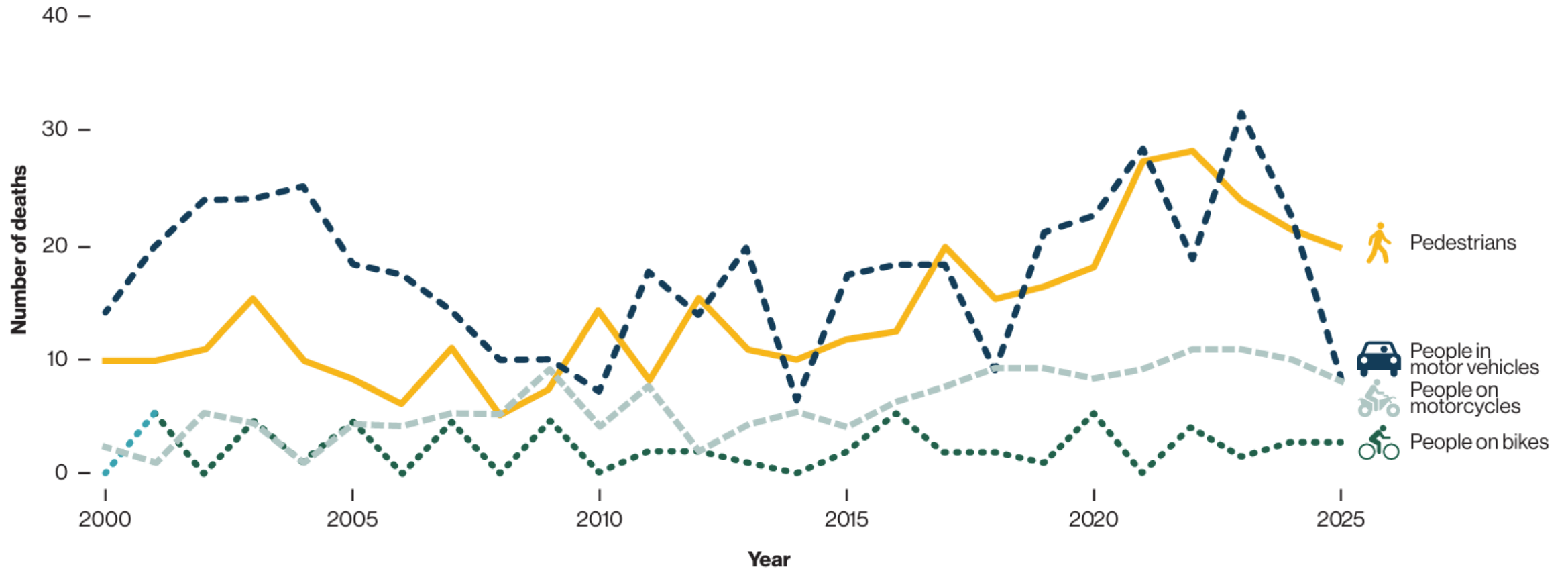
Peter Koonce, P.E.

Portland, OR

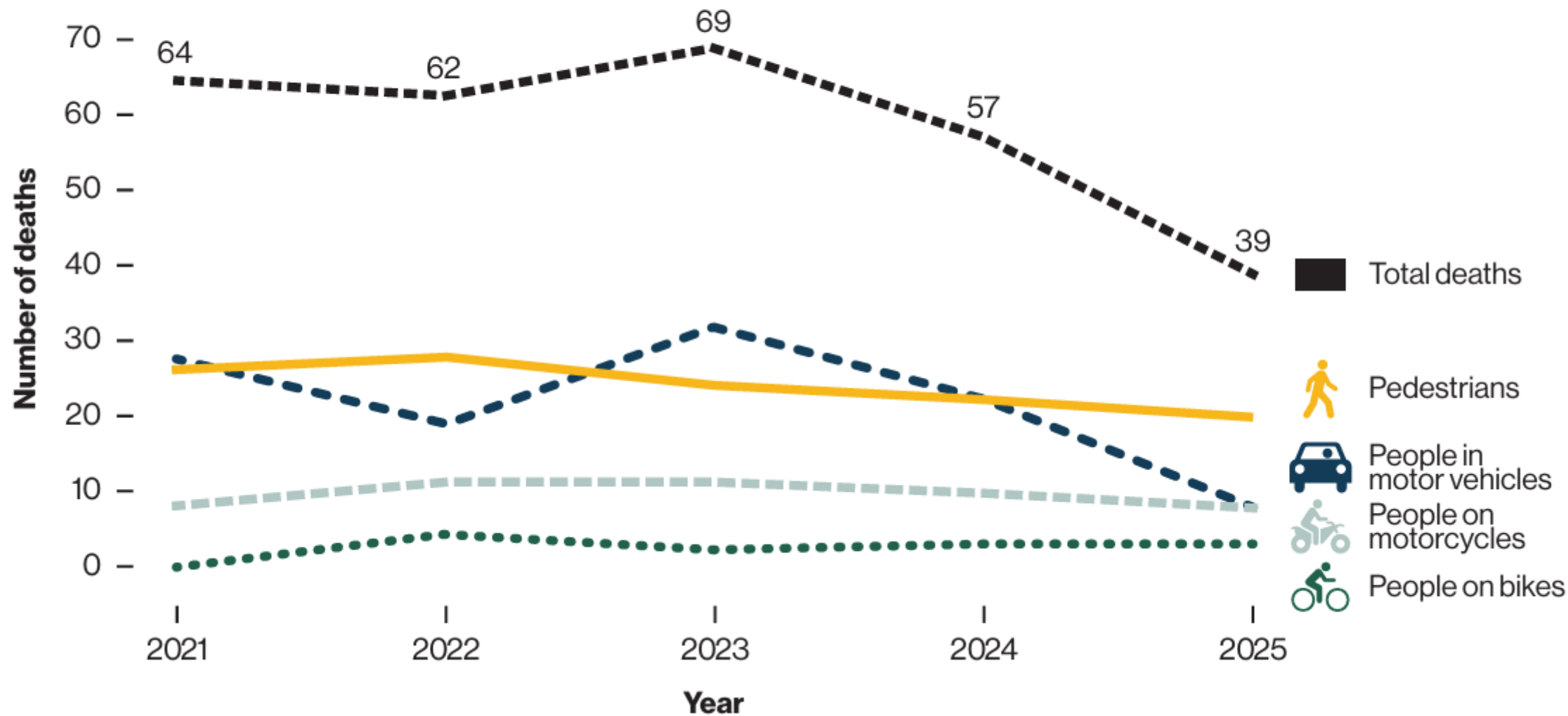




Traffic Deaths by Mode of Travel

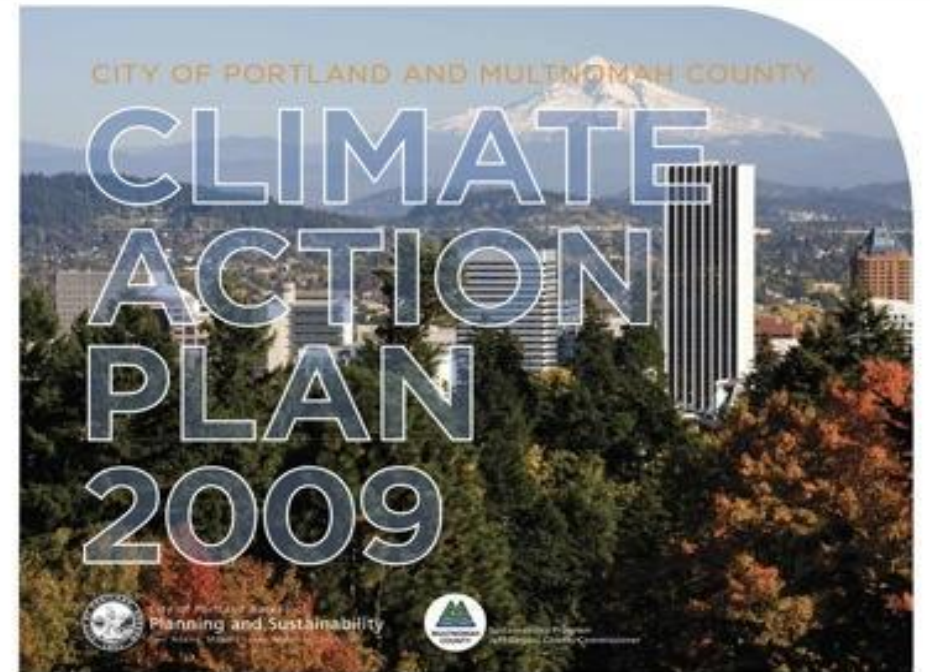


Traffic deaths by mode of travel, 2021-2025



Policy Directives

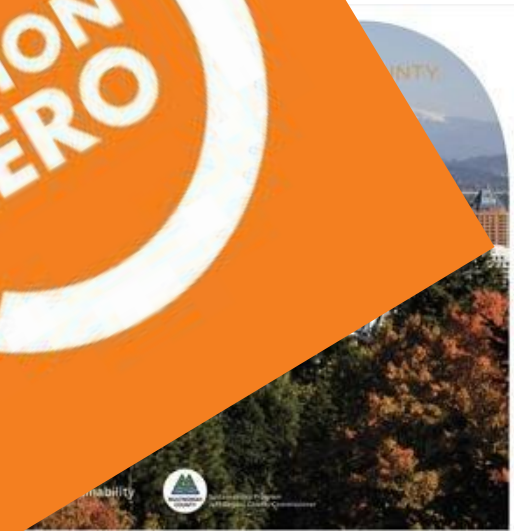
- **Regional Transportation Plan, Metro**
 - TSMO Plan
- **Climate Action Plan**
- **City Transportation Plan**
 - Bicycle Master Plan
 - Freight Master Plan
- **Transit Investment Plan, TriMet**



Policy Directives

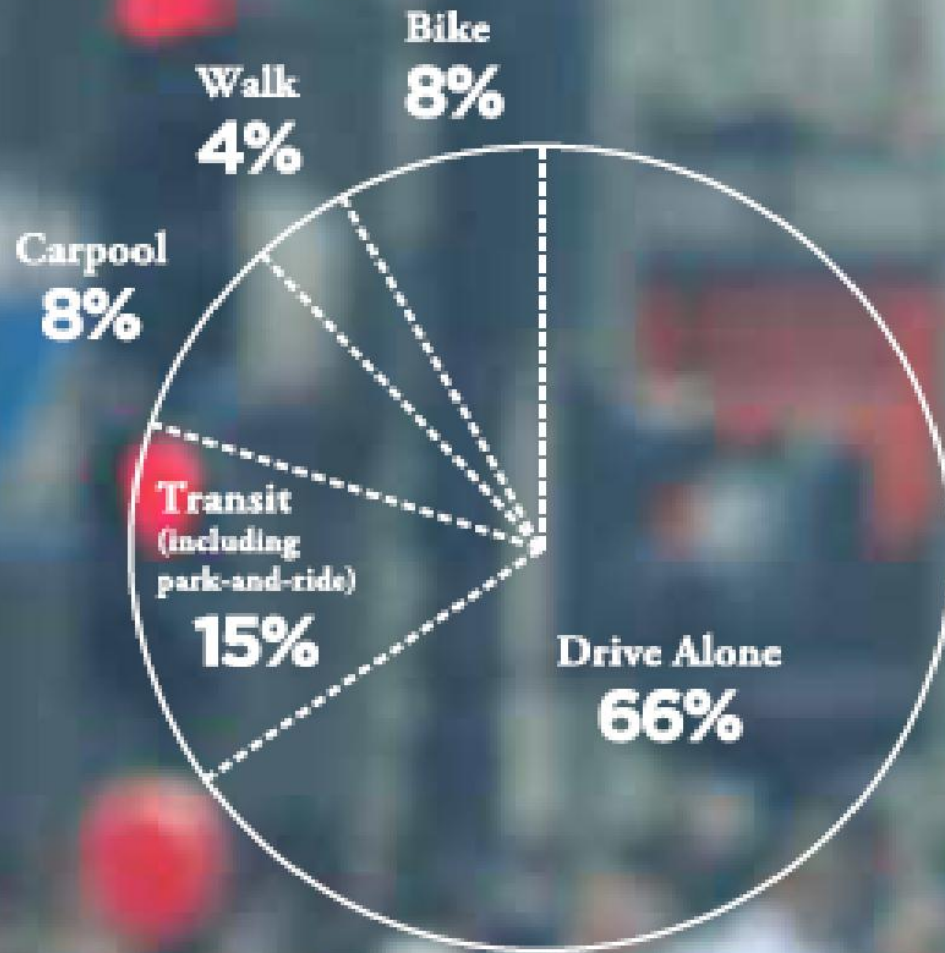
- **Regional Transportation Plan**
 - TSMO Plan
- **Climate Action Plan**
- **City Transportation Plan**
 - Bicycles
 - Freeway
- **Transit**

**SAVING LIVES
WITH SAFE
STREETS**



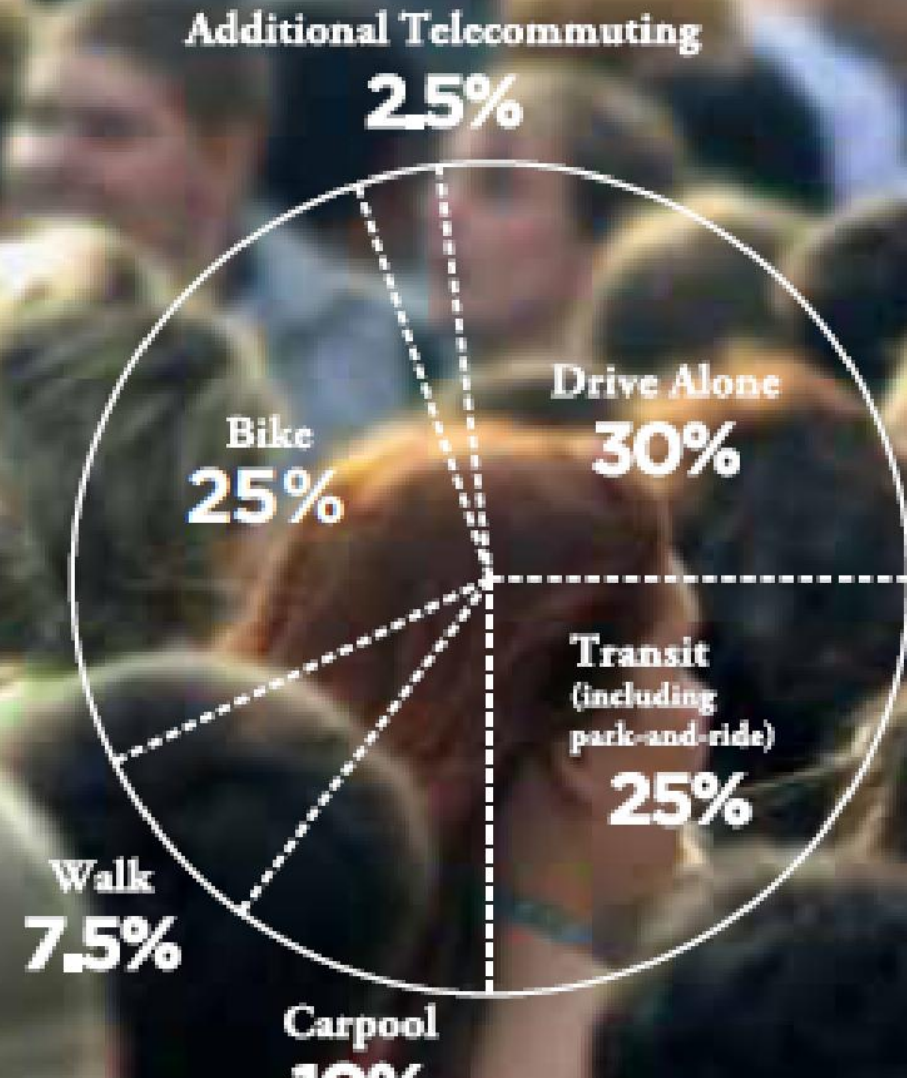
Why? Mode Split Targets

**CURRENT COMMUTE MODE SHARE
FOR PORTLAND**

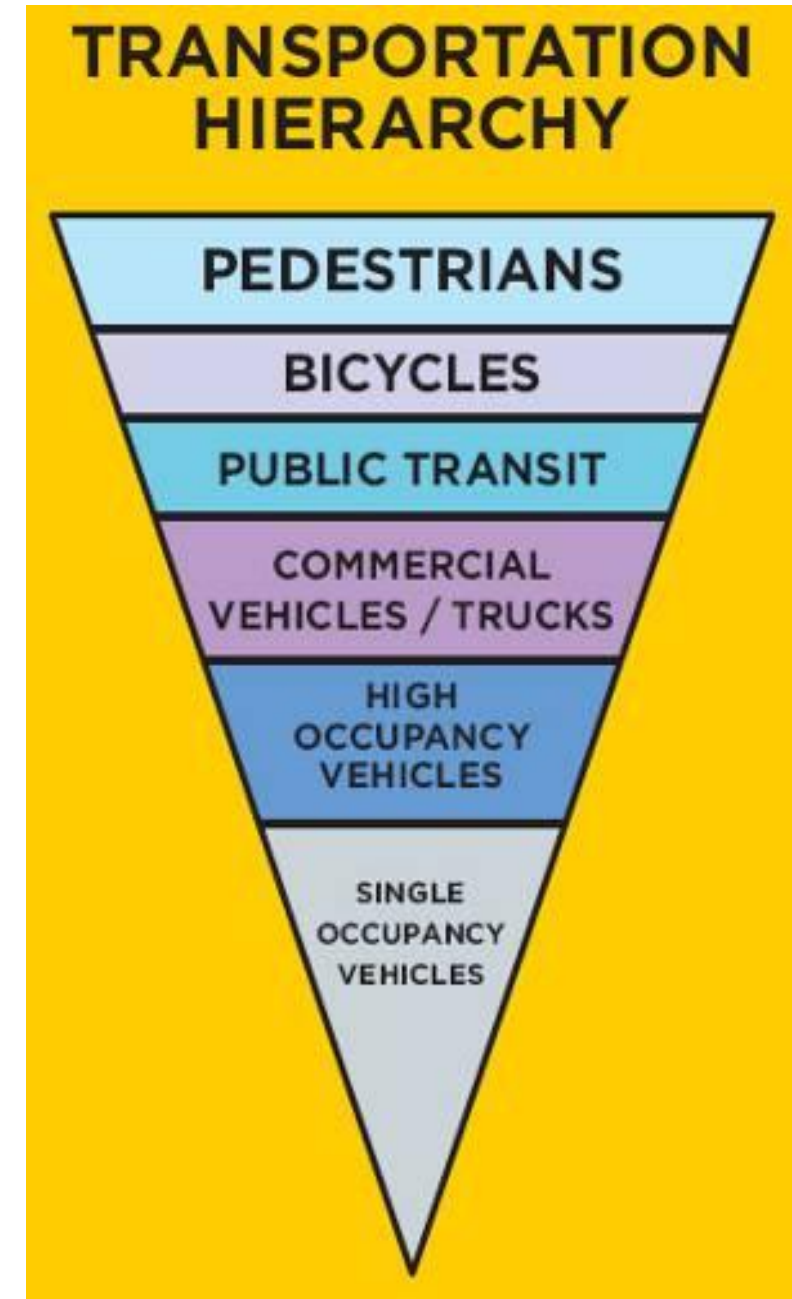


Source: City of Portland Auditor, Service Efforts and Accomplishments: 2007-08

**2030 TARGET COMMUTE MODE SHARE
FOR PORTLAND**



Why? Transportation Hierarchy



Why? To Meet Demand



How to make Traffic Signals Better?

- Fix the MUTCD
- Describe expectations
- Send designers to Europe





2011 MUTCD Wishlist for Bike Signals

- | | |
|---|-------------|
| 1. Allow 4" nearside as a primary bike signal face | 1. No |
| 2. Allow backplates with legend – per Long Beach | 2. No |
| 3. Allow flashing bike signal face if needed, Flashing yellow | 3. No |
| 4. Modify IA 16-2 figure, yes but with restrictions | 4. Yes, but |
| 5. Eliminate “no sign” provision for restricting turns | 5. Yes |
| 6. Reduce requirement of regulatory Bicycle Signal sign | 6. No |
| 7. Eliminate PHB Restriction | 7. No |
| 8. Eliminate Exclusive Bike Scramble | 8. No |
| 9. Remove Bicycle Signal flashing Green as an option | 9. Yes |
| 10. Eliminate requirement of 3 feet separation between signal heads | 10. No |

**Farside Signal
is still required**

1



**Allow backplates
with legend**

2

**No Turn on
Red Required**



3. Allow Flashing Bicycle Signal

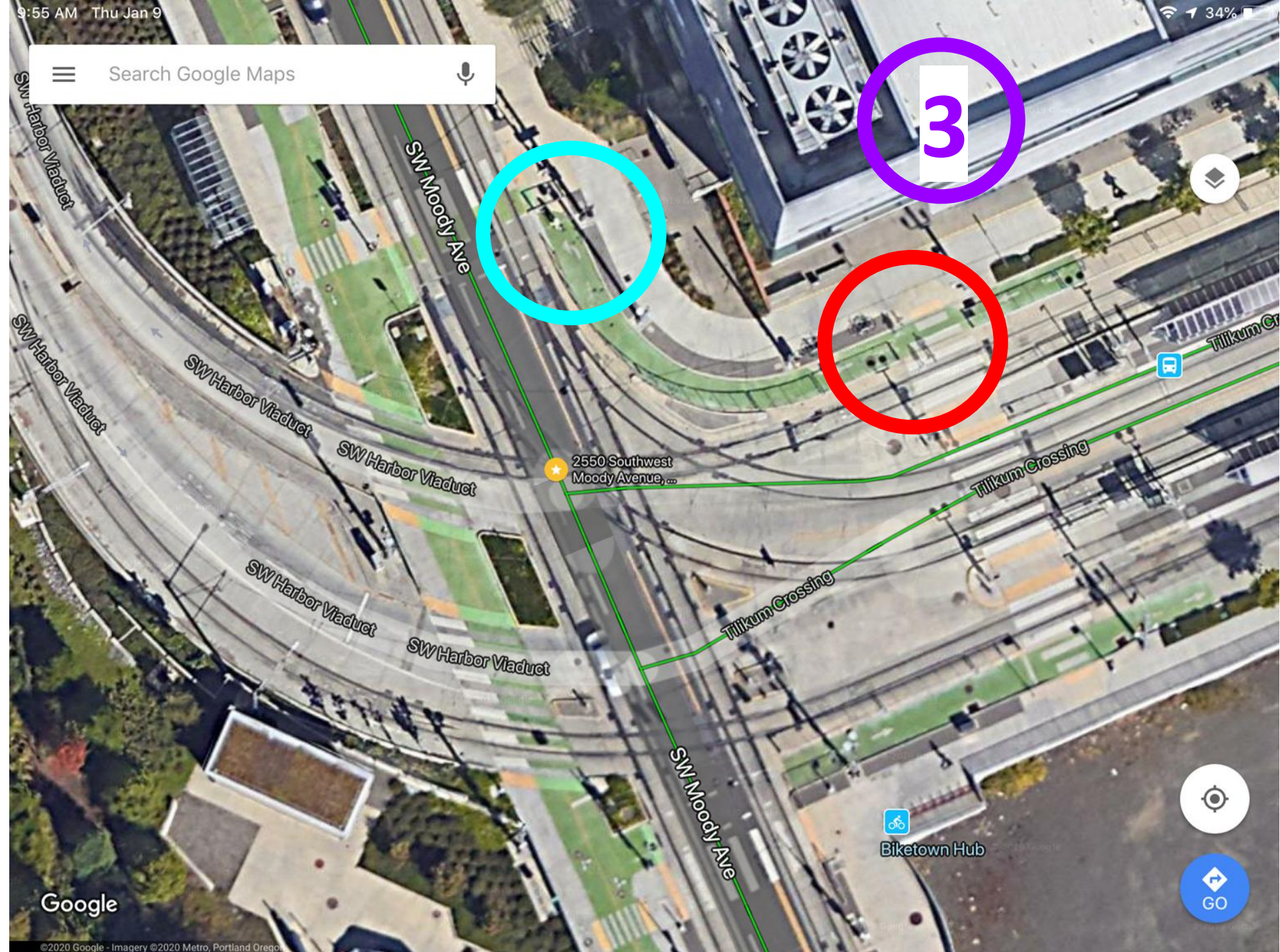
Request to Experiments include
Flashing Yellow in Minneapolis

Portland uses Flashing Red (example)

SW Moody & Porter

Flashing **red**
during WALK at
entry to
intersection

Standard Green,
Yellow, Red for
rail crossing
(around the
corner)



SW Moody & Porter Signal Example (Northbound)



SW Moody & Porter Signal Example (North)

Farside signal with bike signal sign

No right turns allowed on this bicycle signal face (intended)

No left turns allowed



A photograph of a city intersection. In the top right corner, there is a red circle with a white number '6' inside. The intersection features traffic lights, street signs for 'NE 102nd Ave' and 'Halsey St', and various commercial buildings and trees in the background. A silver car is on the left, and a red car is on the right. A pedestrian is visible on the sidewalk on the right.

6

Reduce requirement of Bicycle Signal sign

NE 102nd & Halsey Signal
Example (Eastbound)

NE 102nd & Halsey Signal Example (Eastbound)

Allow bike signal without
standard bike signal sign?

Modify Exhibit 16A-2 (no
arrows in bike signal head
needed)



Bike Signal Sign

- “Shall” requirement for these R10-40/41 signs
- Untested? signs placed into MUTCD



R10-40



R10-40a



R10-41



R10-41a



R10-41b



R10-41c

N Interstate & Oregon Bicycle Diagonal

Bicycle “scramble”

Multiple conflicting directions are possible



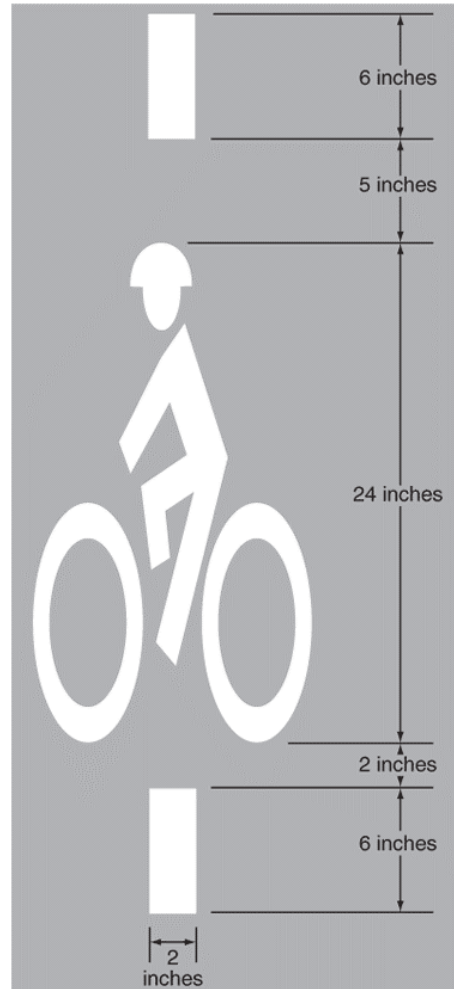
Other Options for Improvement

- Improved Detector Marking
- Detector Confirmation Device
- Improved Bicycle Detection
- Implement Bicycle Specific Signal Timing



Current Infrastructure

9C-7 Bicycle Stencil (2009)



R10-22 Bicycle Sign



PBOT Proposed Wait Here for Green

Request to Experiment
Approved – No formal
response from FHWA



A photograph of a traffic light pole. The traffic light has three circular lenses; the bottom lens is illuminated with a green light. Below the traffic light is a rectangular white sign with a black border and black text that reads "VEHICLE DETECTED WHEN BLUE LIGHT ON". The background shows bare trees and a blue sky with some clouds.

**Detector
Confirmation
Indication:**

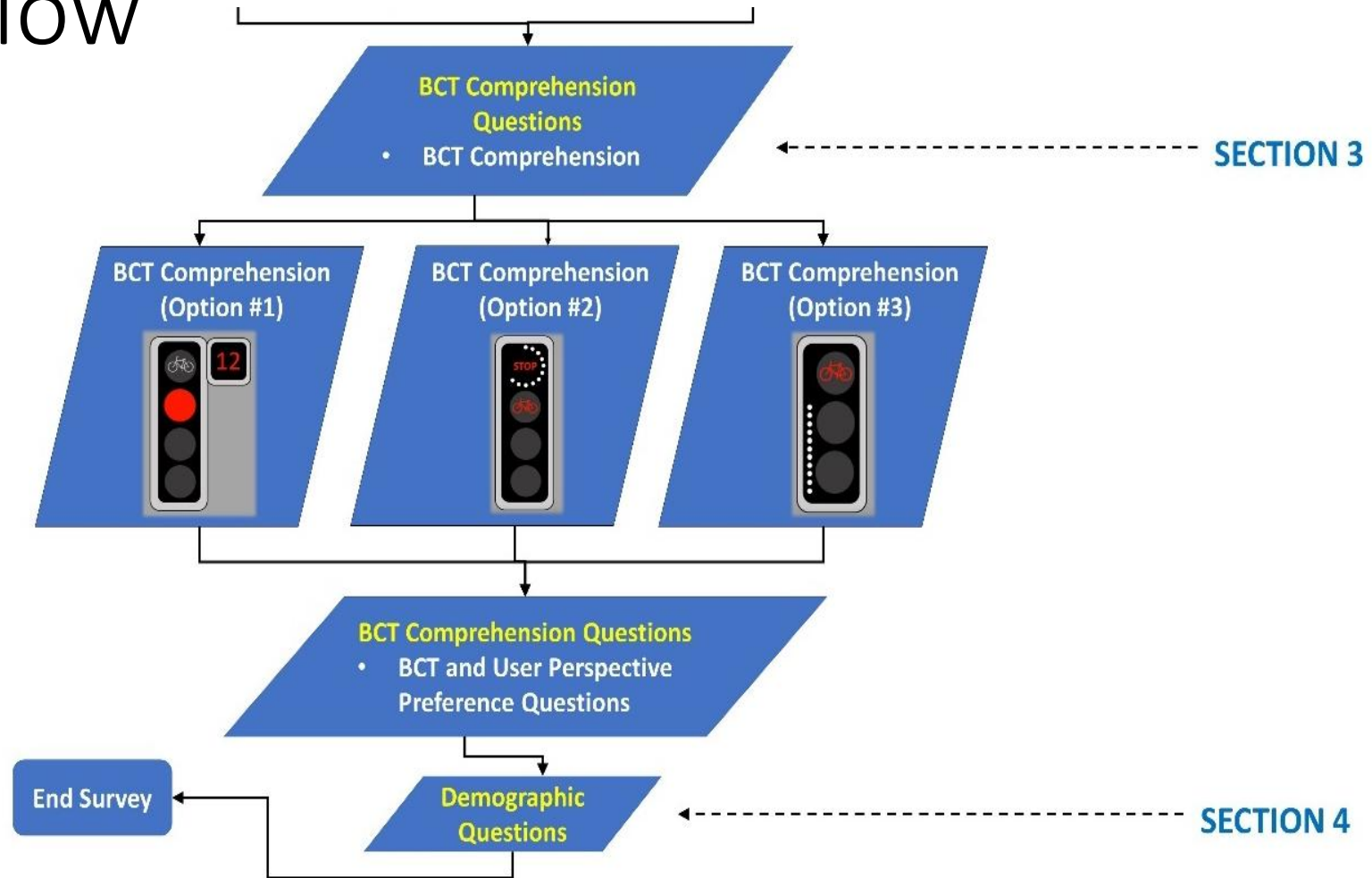
**Vehicle Detected
When
Blue Light On**

What is a Detector Confirmation device?

“You are being detected!”



Survey Flow



Multiple-Choice and Likert Scale

Bicycle Signage Options

 DETECTED WHEN BLUE LIGHT ON	 DETECTED WHEN  BLUE LIGHT ON	VEHICLE DETECTED WHEN  BLUE LIGHT ON
Option 1	Option 2	Option 3

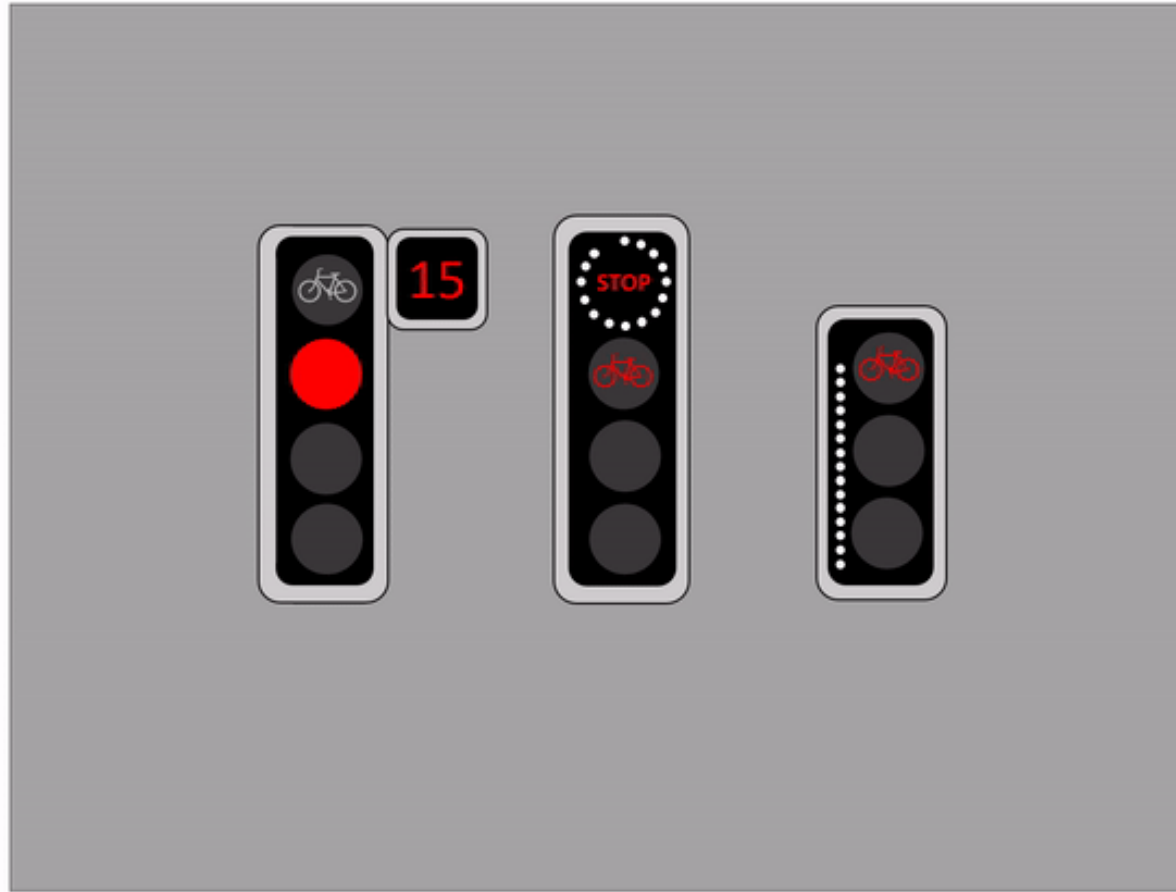
Vehicle Signage Options

 DETECTED WHEN BLUE LIGHT ON	 DETECTED WHEN  BLUE LIGHT ON	VEHICLE DETECTED WHEN  BLUE LIGHT ON
Option 1	Option 2	Option 3

Please choose the sign that conveys the best meaning for the Blue Light System.

Survey Open Ended

Bicycle Countdown Timer



*Imagine that you are stopped at an intersection on a bicycle on a red signal indication and you see the signal head above. What does the **DISPLAY** mean to you as a person on a bicycle? Please type your response in the box below and be as descriptive as possible.*

detectviewer.gemini.ouster.com/site=94ba03b0-cc85-11ef-acc2-a5202dd61a8&hostName=...

© 2025 Ouster, Inc. Client: v2.8.0 Perception: v2.8.0 LIVE (CLOUD) detectviewer.gemini.ouster.com VIEWER SETUP DIAGNOSTICS SETTINGS NETWORK

[VIEW NAVIGATION]

X Y Z
RESET

Processor Time: 7:36:29.32 AM

Left Click: Orbit - Middle Click: Zoom - Right Click: Pan

Counting Group Traj
Name Traj Num Class
E->N 10->4->3 155 C 6
S->N 11->4->3 729 C 15
N->N 9->4->3 299 C 0

PBOT

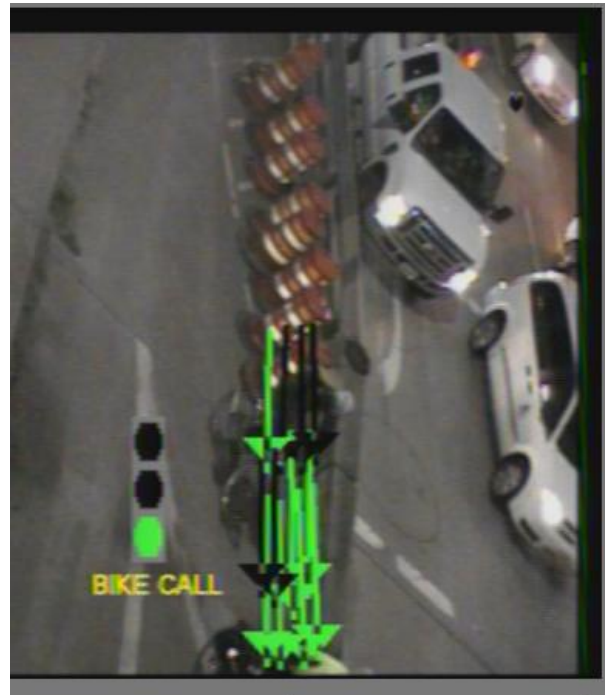
SE 26th & Powell
CAM 37

7:36 AM
1/23/2026



Innovation at various levels

- Traffic signals... but more multimodal
- Multimodal signal performance
- Technology based applications



Thank you!

Peter Koonce, P.E.
Portland, OR



References

- 2019. NCUTCD Proposal for Changes to the Manual on Uniform Traffic Control Devices. Bicycle Detector Symbol Marking. <https://ncutcd.org/wp-content/uploads/meetings/2019A/AttachNo17.18B-BIK-06.BikeDetectorMarking.Approved.pdf>
- Smith, Koonce, & Soto Padin, 2018. Bicyclist Positioning Behavior at Signalized Intersections in Portland, OR, USA. Presented at Transportation Research Board 97th Annual Meeting.
- Boudart, J., et al, 2015. "An Assessment of Bicyclist Behavior at Traffic Signals with a Detector Confirmation Feedback Device." Transportation Research Board: 13.
- Bussey, S., 2013. The Effect of the Bicycle Detector Symbol and R10-22 Sign on Cyclist Queuing Position at Signalized Intersections. Presented at Transportation Research Board 94th Annual Meeting. http://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1000&context=cengin_honortheses
- Koonce, Peter. Bicycle Countdown Signal - Time to Green. 10 July 2011. <http://koonceportland.blogspot.com/2011/07/bicycle-countdown-signal-time-to-green.html>