

Making Signals Work for Bicyclists and Pedestrians



Peter Koonce, PE

Portland, OR

October 18, 2017

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Re-Load the webpage and log back into the webinar. Or send note of an issue through the Question box.

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- ⇒ Recording (within 1-2 days)
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The screenshot shows the PBIC website's 'Webinars' page. The header includes the PBIC logo and navigation links: Data & Resources, Community Support, Planning & Design, Training & Events, and Behavior Change. The main content area is titled 'Webinars' and contains the following information:

- Webinars:** The Pedestrian and Bicycle Information Center (PBIC) offers webinars on a variety of topics related to pedestrian and bicycle safety. Sign up for our [newsletter](#) to receive webinar announcements, and follow us on [Facebook](#) and [Twitter](#).
- Upcoming Webinars:**
 - 04/18/2017 – Getting from Vision Zero Plan to Vision Zero Progress**
Presented by: Rob Viola, New York City Department of Transportation; Luis Montoya, San Francisco Municipal Transportation Agency; and Cathy Tuttle, Seattle Neighborhood Greenways.
 - Designing for Bicyclist Safety Webinar Series**
Presented by: Brooke Struve, Federal Highway Administration; Peter Lagerwey, Toole Design Group; and Michael Cynecki, Lee Engineering
- Recently Delivered Webinars:**
 - 03/14/2017 – Preparing for Successful Education and Enforcement Efforts**
Presented by: Laura Sandt, UNC Highway Safety Research Center; Kara Masak, Governors Highway Safety Association; Shannon Purdy, National Highway Traffic Safety Administration; Lt. Joe Raulerson, Gainesville Police Department; and Lt. Michael Montanye, Greenville (NC) Police Department.



The screenshot shows the PBIC Facebook page. The header includes the PBIC logo and the text 'Pedestrian and Bicycle Information Center' with the website URL www.pedbikeinfo.org. The page features a 'VISION ZERO STRATEGIES SERIES' photo gallery with a 'Webinar' and 'Twitter #VZChat' caption. The page also displays the organization's mission: 'Our mission is to improve the quality of life in communities through the increase of safe walking and bicycling as a viable means of transportation and physical activity.' The page has 3,509 likes and 3,446 followers. Contact information includes the phone number 888-823-3977 and the website www.pedbikeinfo.org.



Making Signals Work for People Cycling and Walking

***Peter Koonce, P.E.
Portland, OR
October 18, 2017***

Webinar Outcomes

Use traffic signals to make intersections safer and more comfortable for nonmotorized road users.

Understand strategies for improving intersections through signal timing, cycle lengths, speed management, protected phasing, and more.

Discussion period featuring questions submitted by webinar attendees.

Users of the
“traffic signal”
vary
depending on
land use &
transportation
context



Measuring Comfort:

Levels of Traffic Stress (LTS)

LTS 1: Physically separated or mixed flow (<25 mph), comfortable for children

LTS 2: Bike lanes 5.5 feet wide or less, 30mph traffic and unsignalized crossings

LTS 3: Bike lanes next to 35 mph traffic

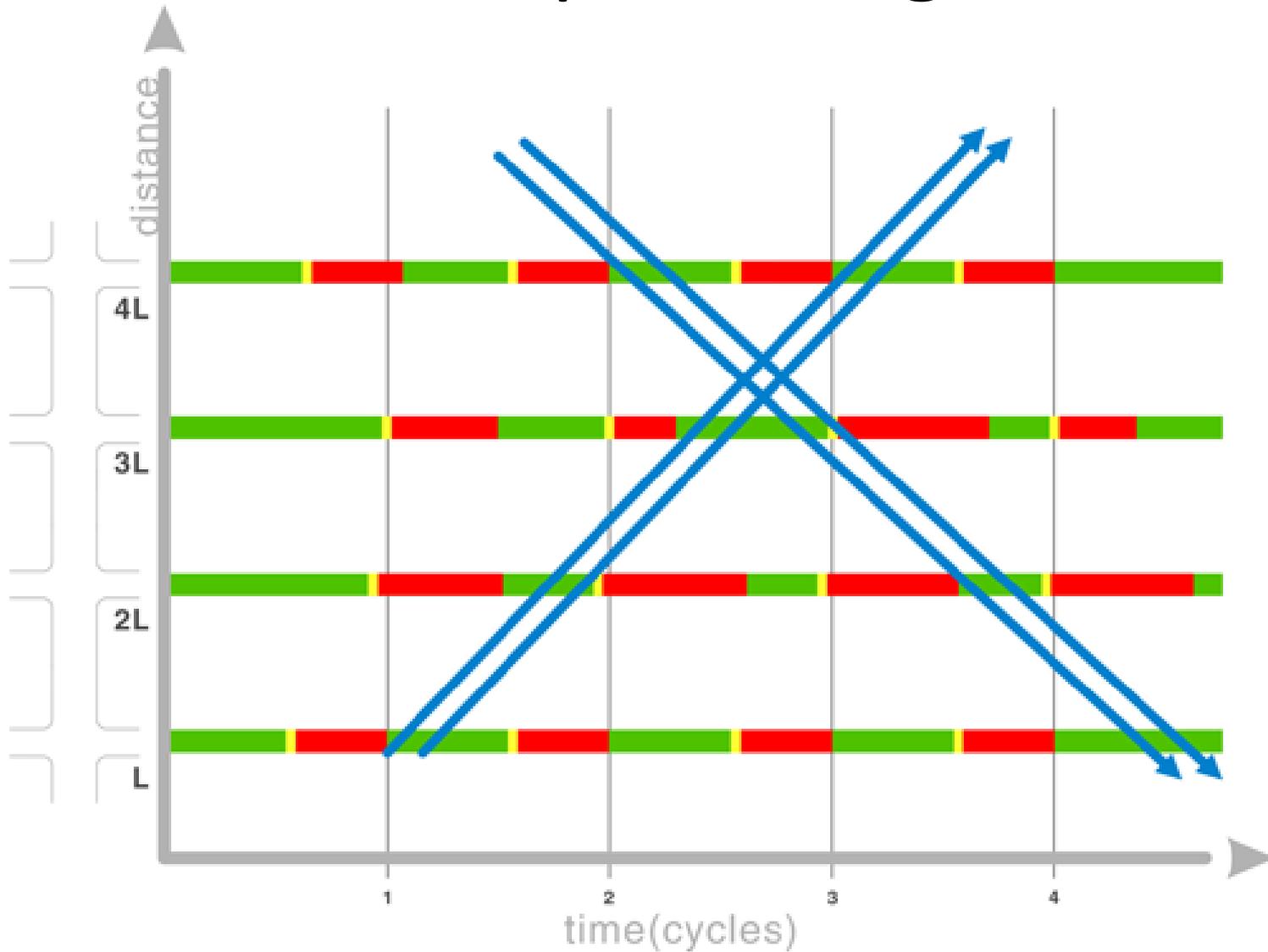
LTS 4: No facilities & 40 mph

Research needed on intersection treatments

Bike/Walk to School Day



Time-Space Diagram



Outline

- Traffic signals are built to stop people
- Speed is a critical assumption
- Policy and context are important
- All of us have bias





...ument either
...tract of insurance
...finite course of a
...adopted for the sake
...expediency, for
pol·i·cy
...adopted and pur
...government, rul
...party - action
...conforming to
...with reference to
...expediency

A close-up photograph of a hand holding a red pencil, pointing it towards the word "policy" in a printed document. The word "policy" is bolded and has dots above each letter. The document text is slightly blurred, showing various words and phrases related to insurance and government. The hand is positioned on the right side of the frame, with the pencil tip resting on the paper.

Today's Message

- Traffic signals help shape places
- Research is needed to improve design, operations, and meet new challenges

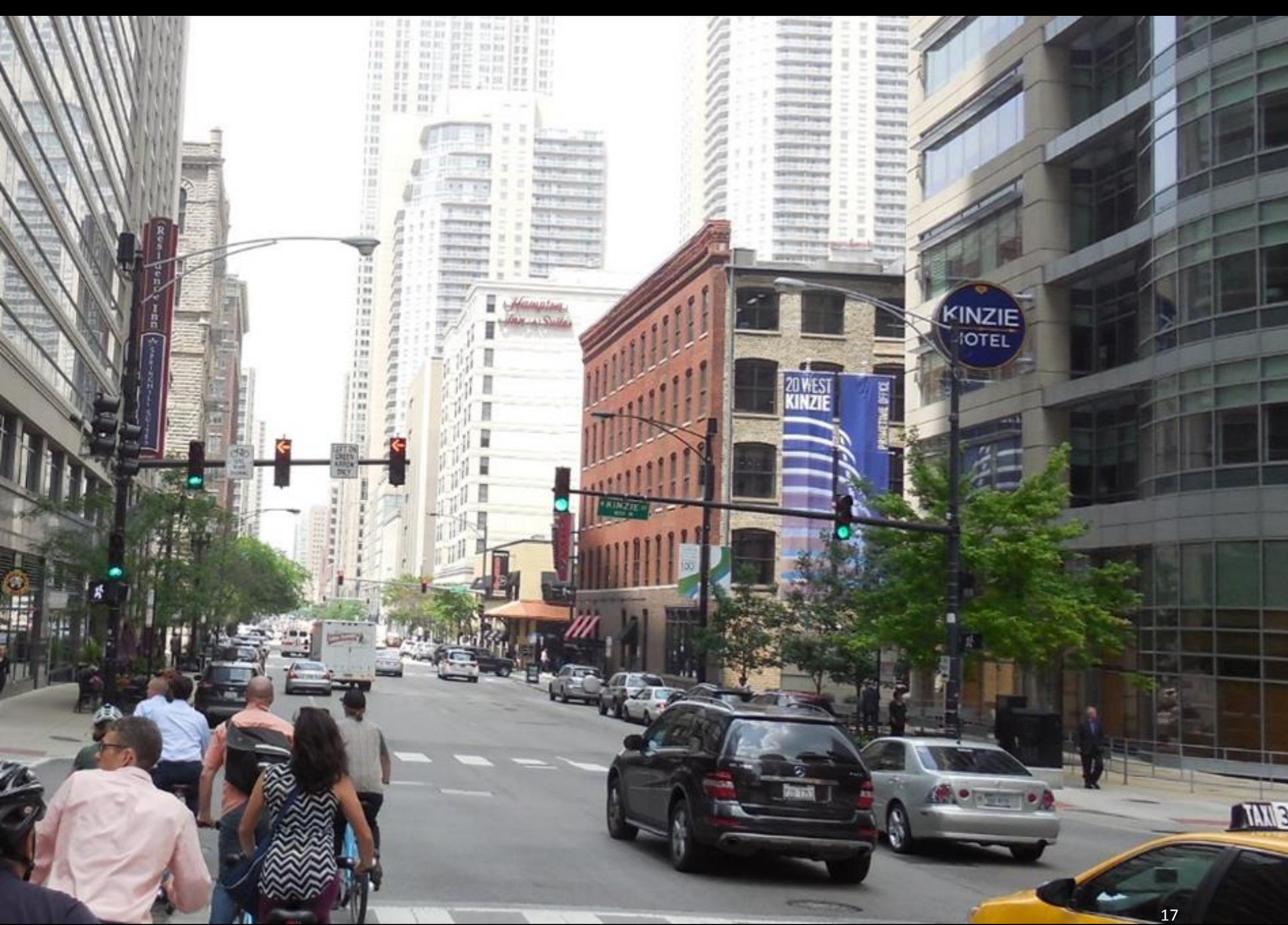


Integrate Time & Space

“Balance needs of and functions of different time periods”

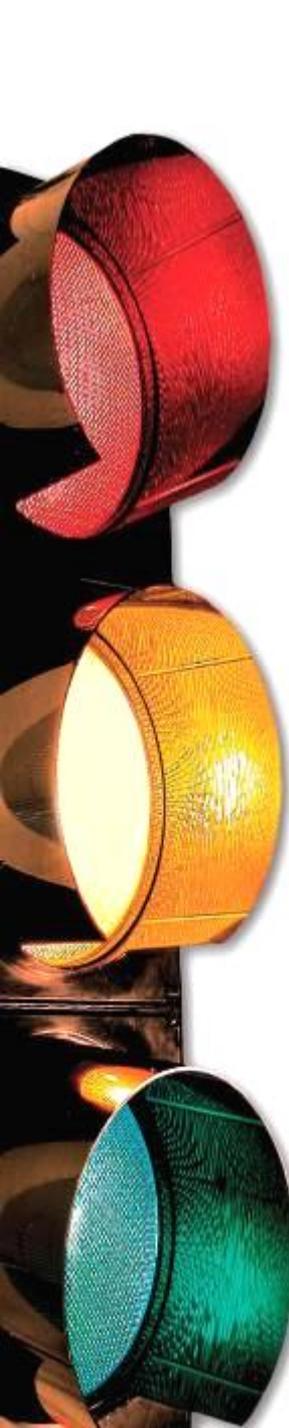
“Streets designed for peak intervals may fail to provide a safe and attractive environment”





Signalization Principles





Signalization Principles

- Shorten signal cycles
- Prioritize multimodal travel
- *Minimize number of signal phases*
- Set Slow progression speeds
- Adjust timing for off-peak
- Consider fixed time signals

Source: NACTO Urban Street Design Guide, 2013



Signalization Principles

- Shorten signal cycles
- Prioritize multimodal travel
- *Minimize number of signal phases*
- Set slow progression speeds
- Adjust timing for off-peak
- Consider fixed time signals
- Employ advanced logic & detection



Transit may also benefit from shorter cycle lengths because dwell times are variable

Set Slow Progression Speeds

Synchronize signals to maintain safe vehicular travel speeds and discourage speeding



MUTCD 2H-



Progression Speed: Cycling Streets

- Signals timed for 12–15 mph focused on bicycle traffic



Green Wave

SFMTA has set reduce traffic signal speeds using the following criteria:

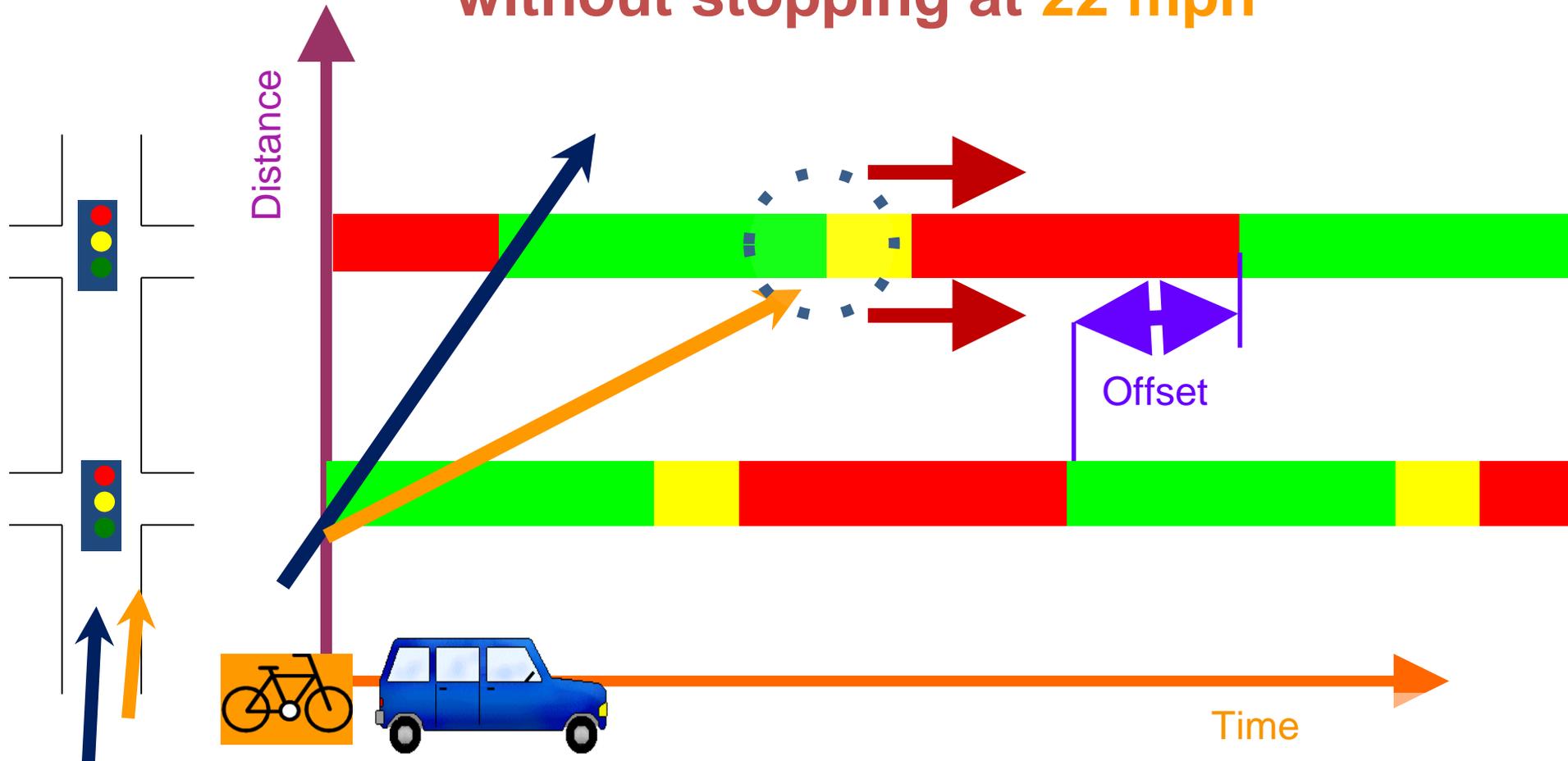
- more than 3 signals
- on City bike network
- With bike lane
- Same signal cycle
- Outside grid



Progression Speed: Cycling Streets

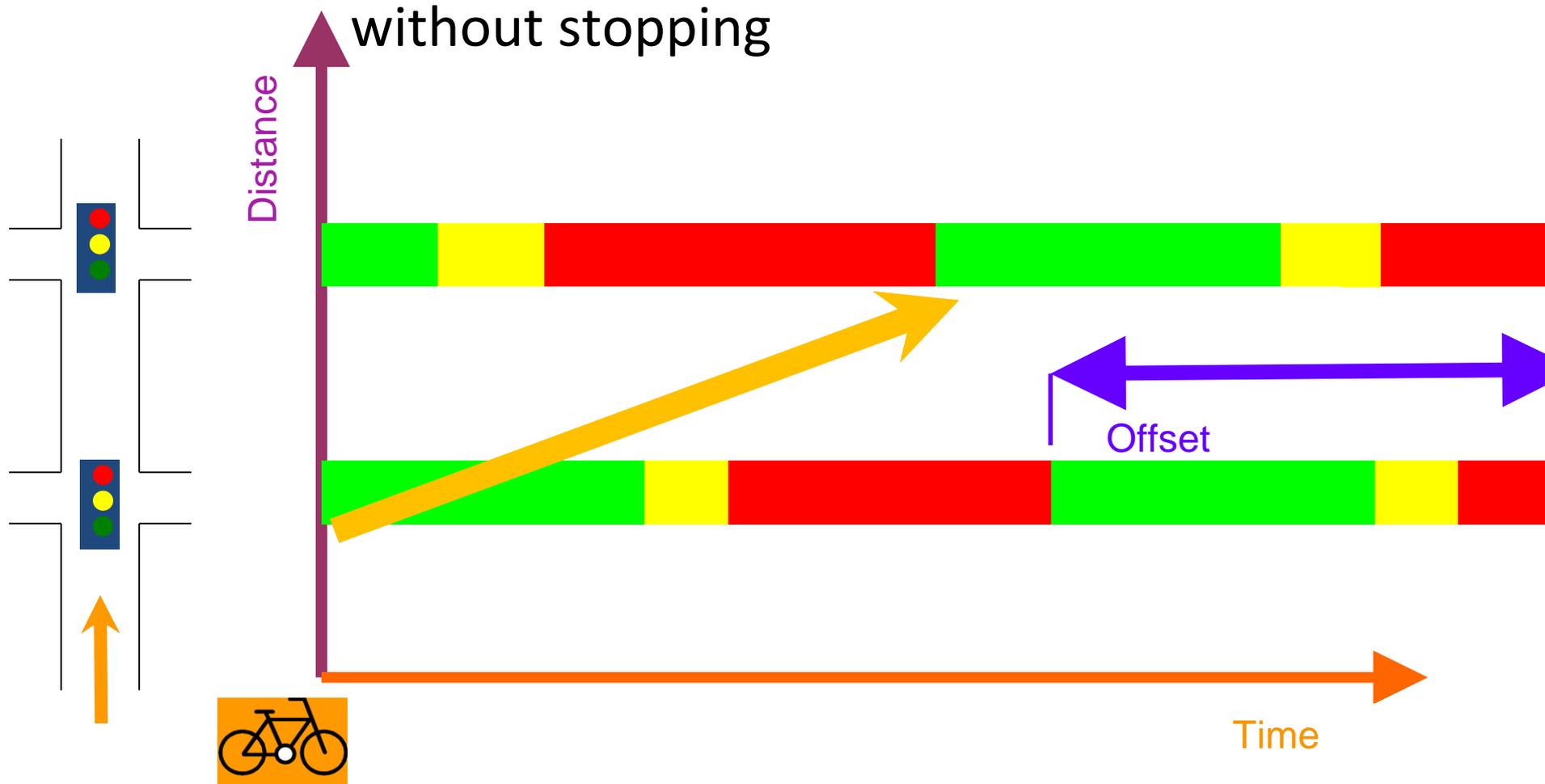
- Signal timing set to speed limit - 30 mph

bicycle traffic “could” get through without stopping at **22 mph**



Progression Speed: Cycling Streets

- Delay green at downstream = Increased offset
Bicycle traffic travels through at 13 mph
without stopping

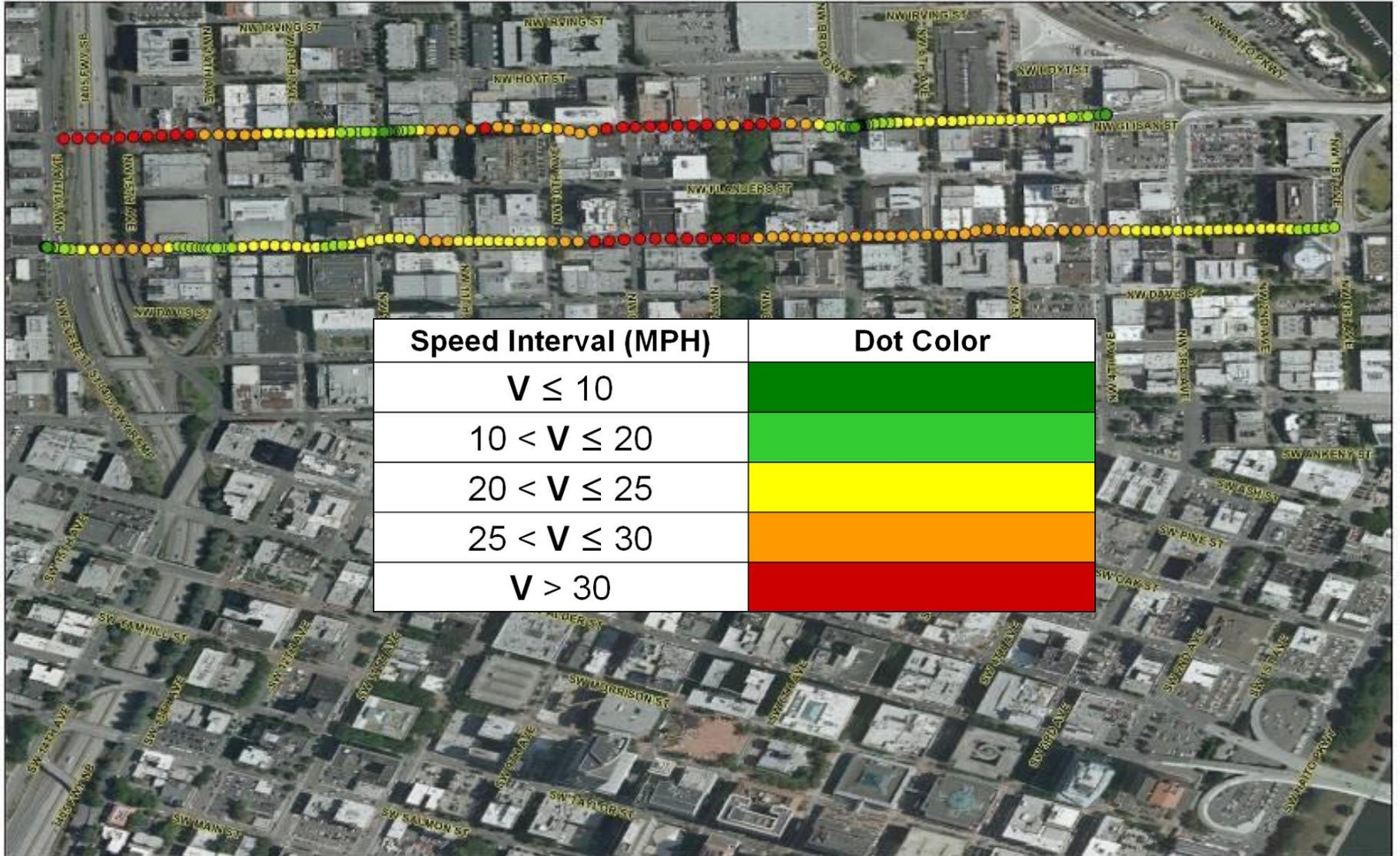


Progression Speeds: Downtowns

- Coordinate signal timing to prioritize pedestrian or bicycle travel
- Set signal timing for 15–25 mph (LTS 1)



Speeds Before Changes



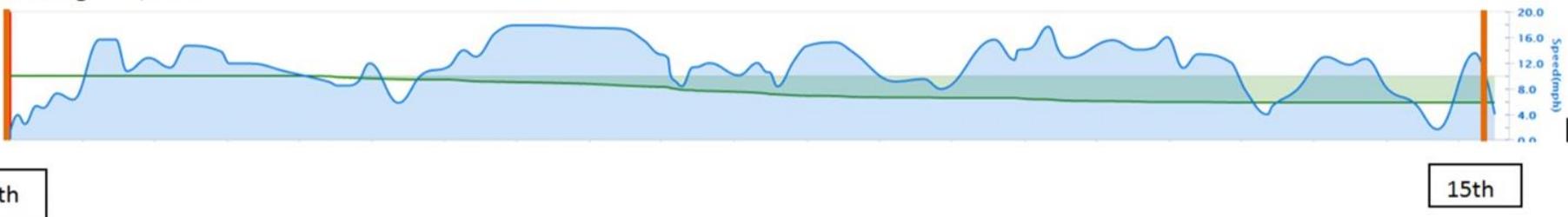
Before and After Cycling Speed

FOLSOM (After)

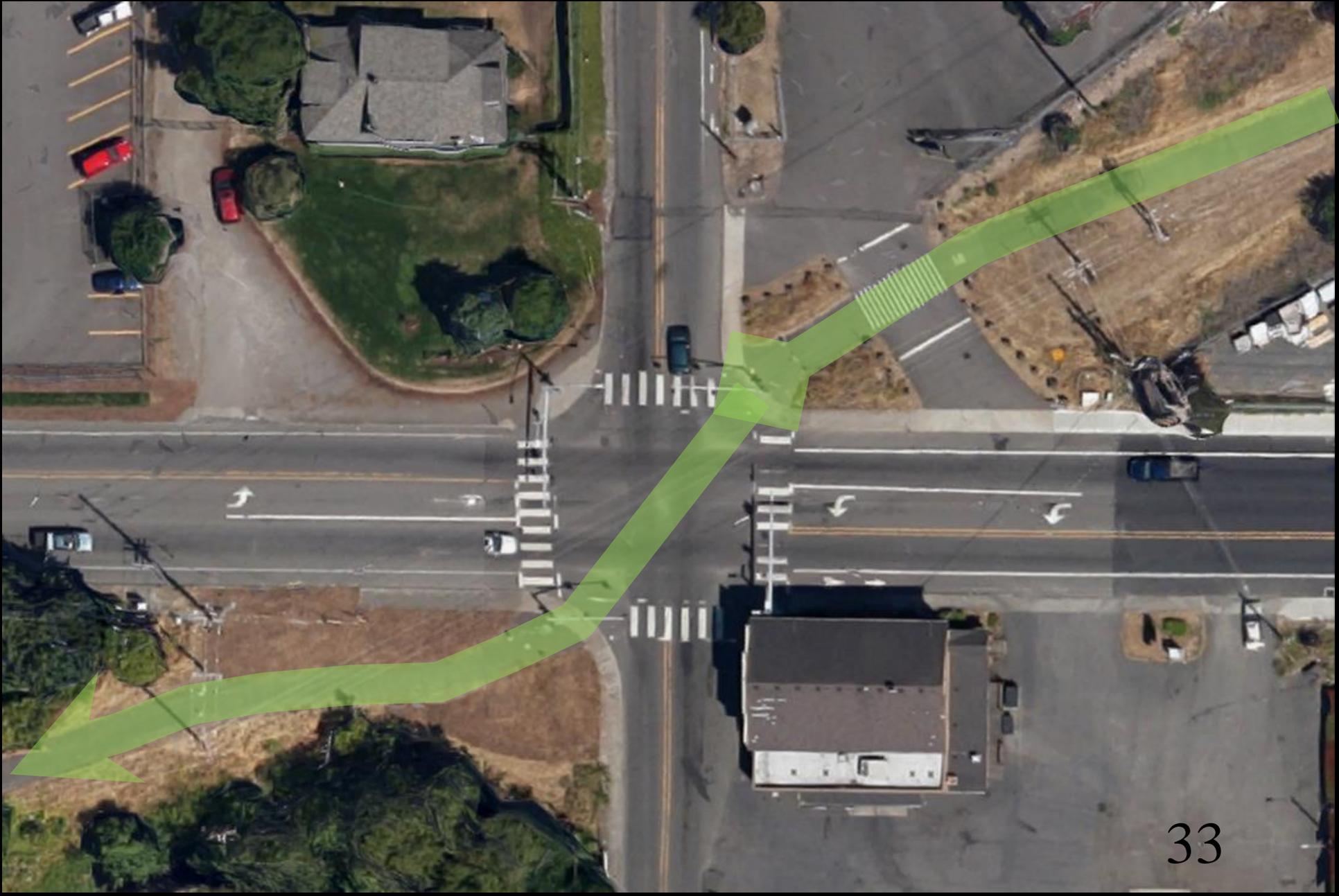
Southbound- (3:20 pm, 111, All other times) Travel Time 5:18 min, Distance .98 miles, Average speed = 10 mph
Hit 10 green / 0 red (slowed down once for right turning vehicle)



Northbound- (3:28 pm, 111, All other times) Travel Time 4:21 min, Distance .98 miles, Average speed = 14 mph
Hit 10 green / 0 red



Diagonal Crossing



Digaonal Crossing



Bicycle Signal

N Interstate Ave & Oregon St

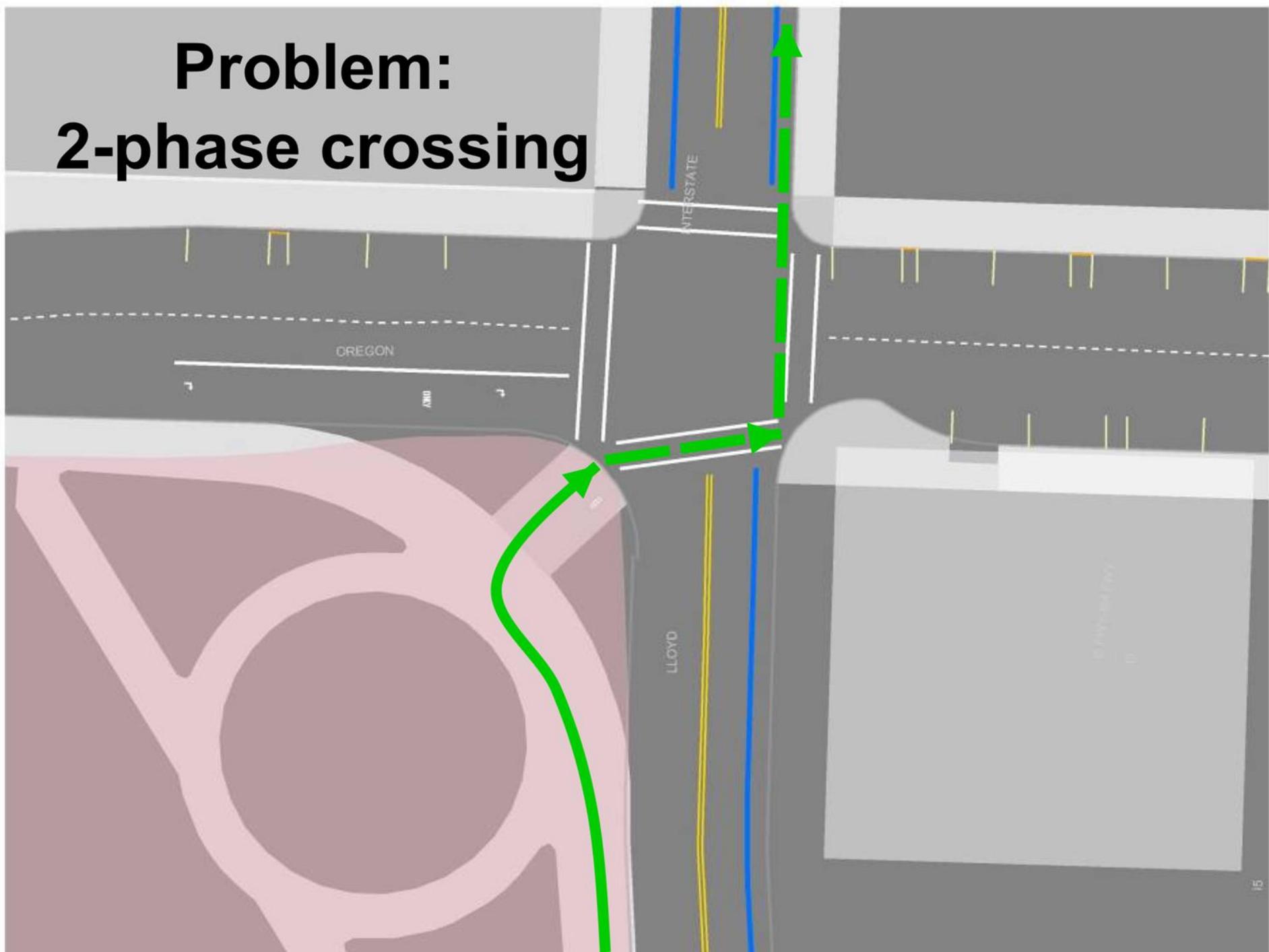
Exclusive bike & pedestrian phase

Bikes cross diagonally from southwest to northeast

Movement controlled by a bike signal

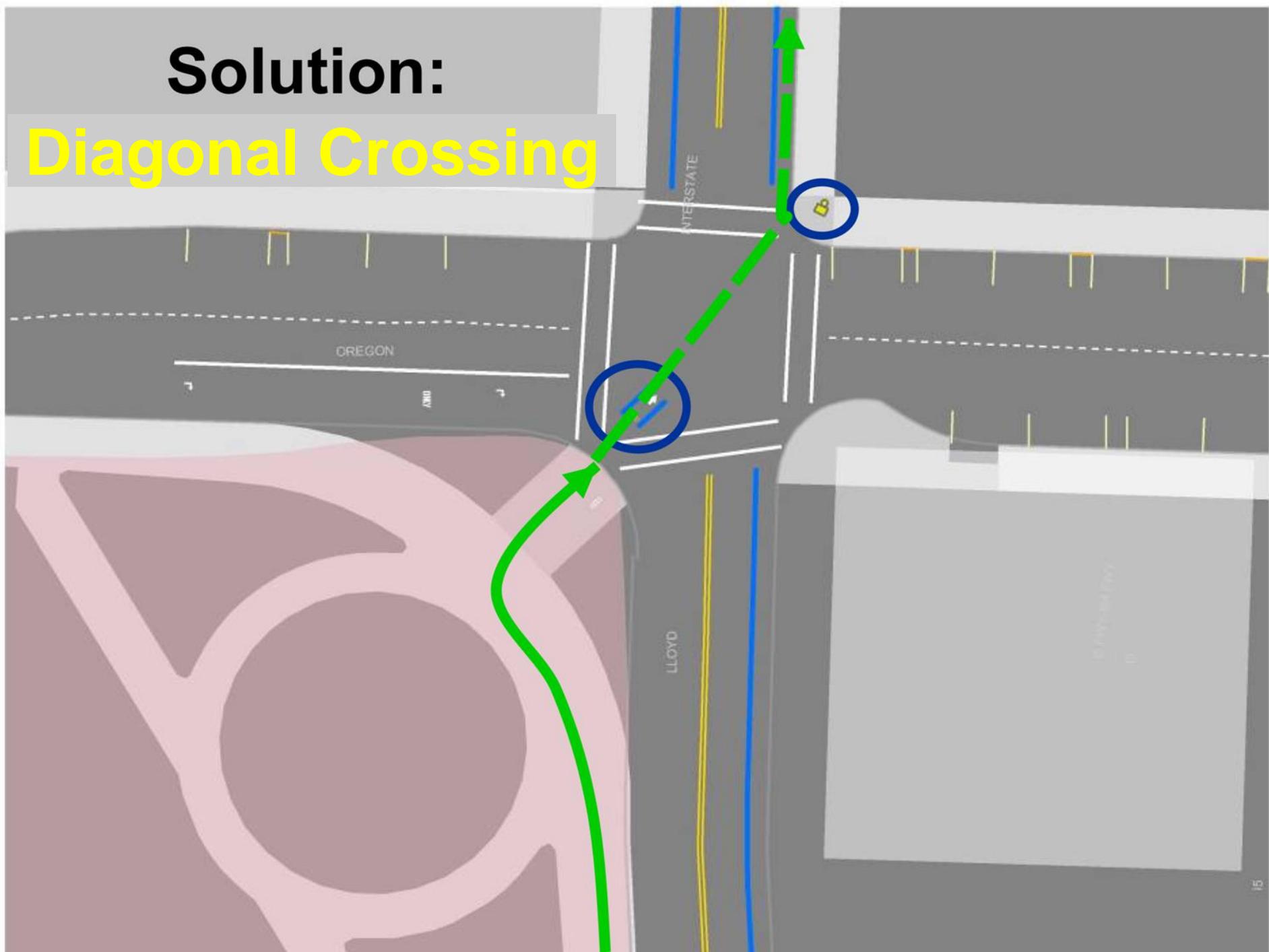


Problem: 2-phase crossing



Solution:

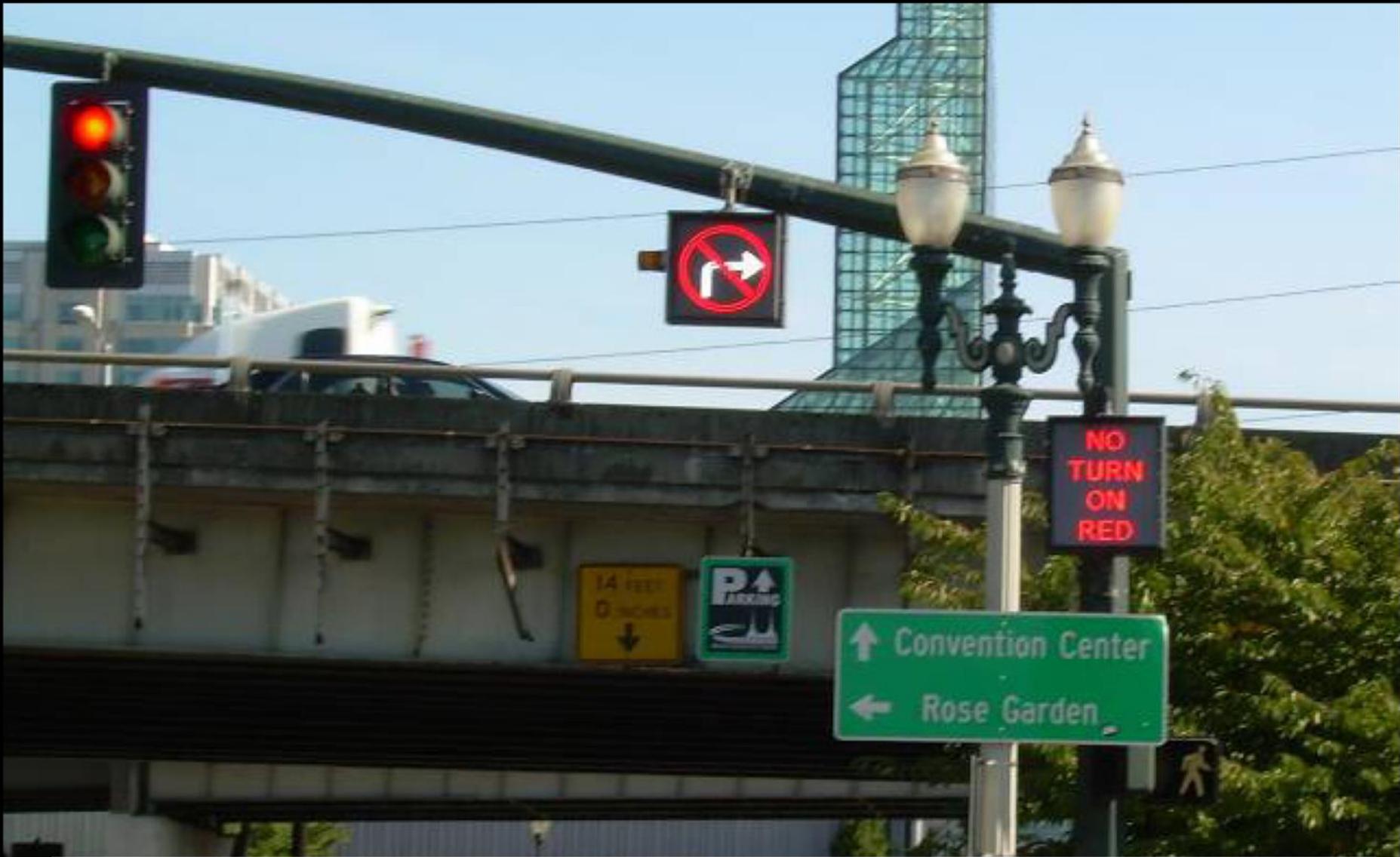
Diagonal Crossing



Diagonal Bicycle Movement

N Interstate Ave & Oregon St





No right turn on red display during green bike signal phase

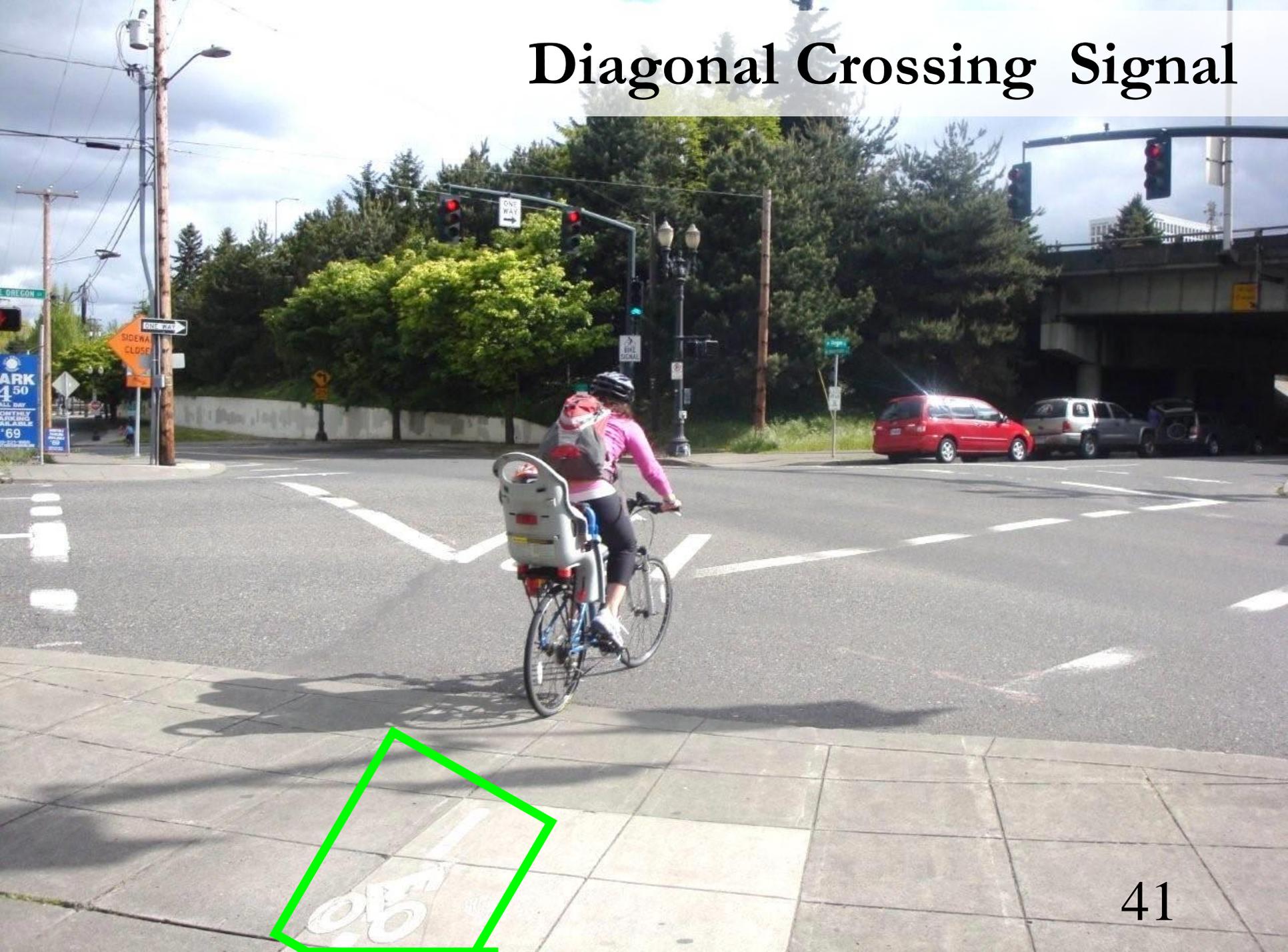
Designing for bicycle travel



Build it and they will come



Diagonal Crossing Signal





ONE WAY
→

ONLY
↶

NO TURN ON RED

ONLY
↶

BIKE SIGNAL

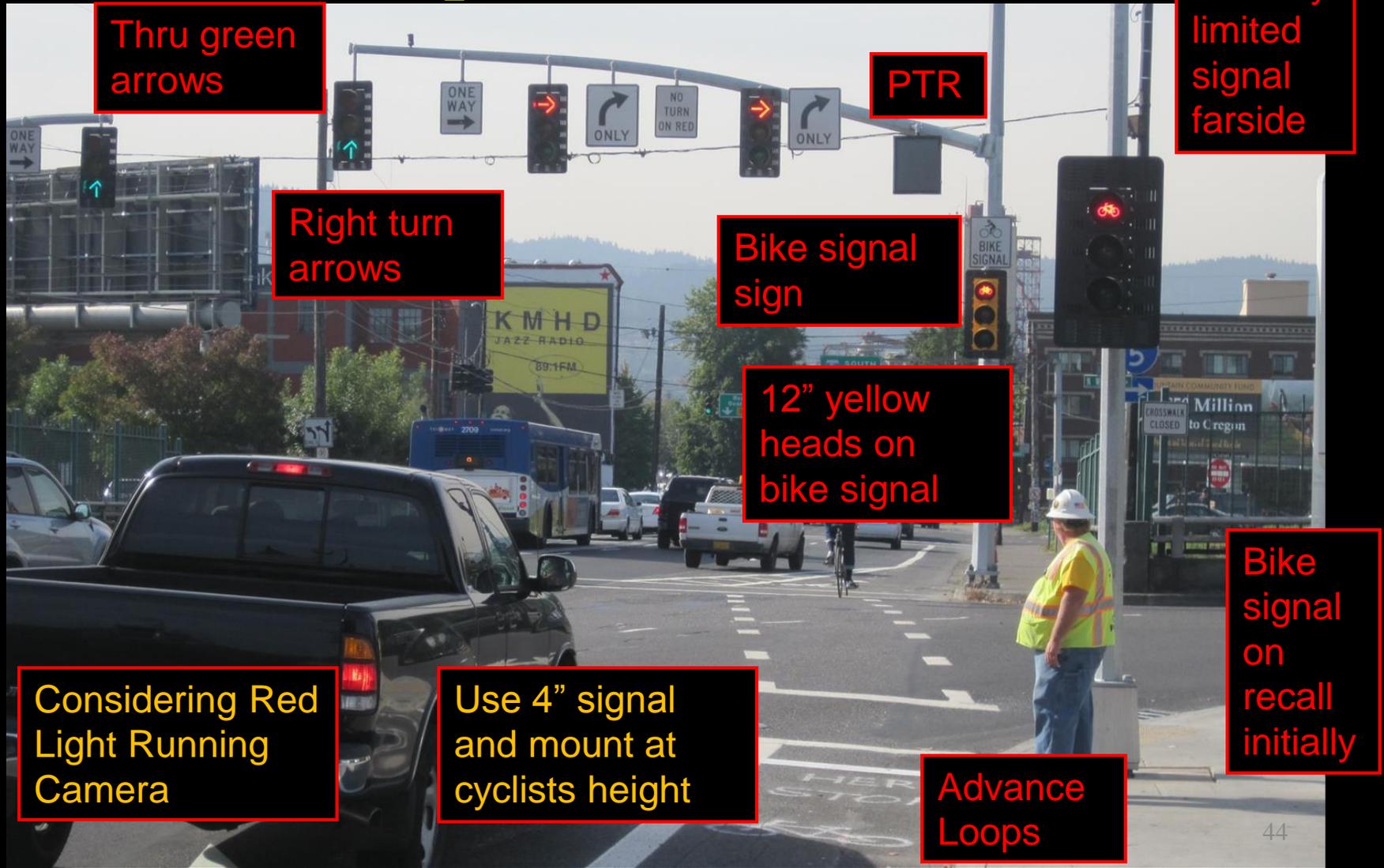
CROSSWALK CLOSED

Millinn
to Oregon

HERE STOP



N Broadway & Williams Improvements



Thru green arrows

Right turn arrows

Bike signal sign

12" yellow heads on bike signal

Visibility limited signal farside

PTR

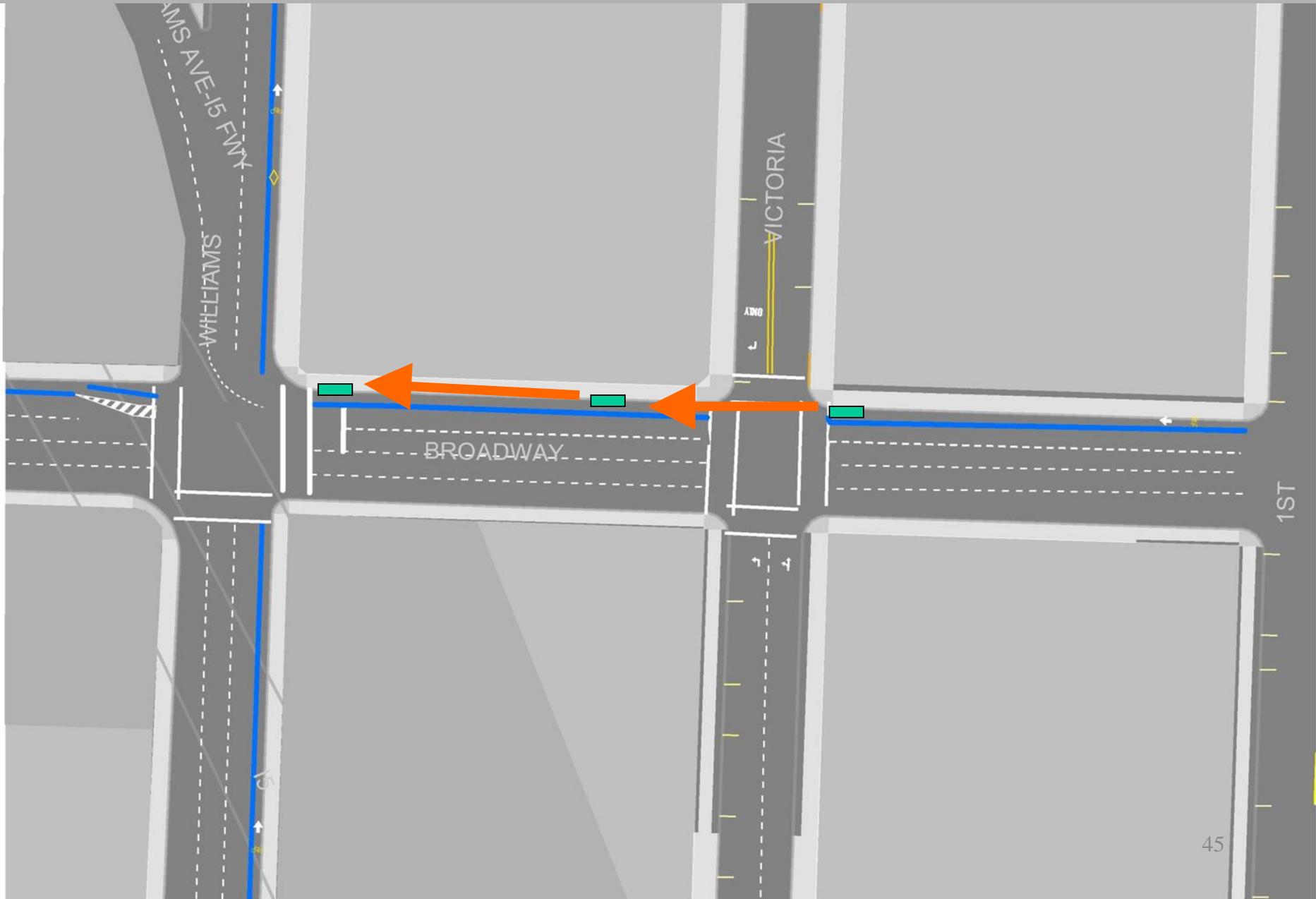
Bike signal on recall initially

Considering Red Light Running Camera

Use 4" signal and mount at cyclists height

Advance Loops

Best Treatment



Nearside 4" Bike Signal

- Additional indication to improve awareness of traffic control



NORTH  SOUTH




BIKE
SIGNAL



SW Naito Parkway & Lincoln

Detector marking
(more on this later)





Protected Signal Phasing



Part-Time Restriction of Turns

- No Turn on Red if bicycle phase detected



Turning Vehicle Yield to Bikes



Geometric Changes at Signals

Curb extensions

Mixing zones

Dutch style “protected” intersections

Alternative intersection design (DDI, CFI)

Background on Signal Operations

Limited knowledge regarding signal control strategies focused on pedestrians

- Existing strategies focus on safety
- Other efficiency focused options

Even more limited knowledge for cycling

- Upcoming NCHRP projects

Leading Pedestrian Interval

Implementation should be based on:

- Crash history (frequency, severity)
- Volume of people walking
- Proximity to school
- Activity of elderly residents
- Impacts on vehicle delay
- Visibility issues
- Intersections with challenging geometry

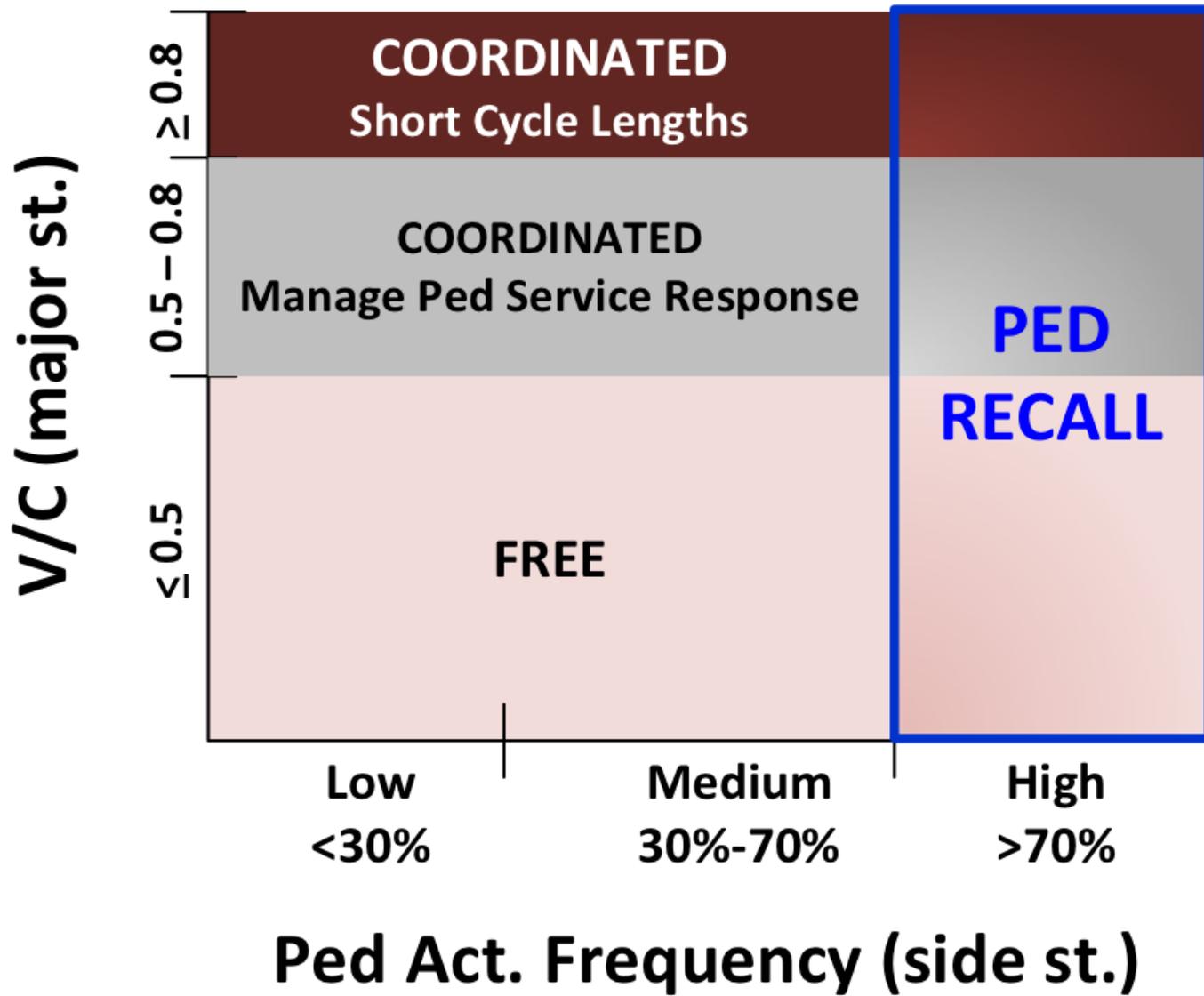
Leading Pedestrian Interval

- **ITE Toolbox: Modify signal phasing to implement LPI - associated with a 5% decrease in pedestrian crashes.**
- **Reference**
 - **Institute of Transportation Engineers (2004). Toolbox of Countermeasures and Their Potential Effectiveness to Make Intersections Safer, Briefing Sheet 8, FHWA.**
 - **Orlando, FL study (2000)**
 - **CMF Star Rating: “Cannot be rated – Insufficient information about study”**

Signal-related Research Needs

- Connected vehicle concepts
- Bike signal phasing guidelines or warrants
 - Level of Traffic Stress (LTS) for intersections
 - Trade offs of delay and compliance (PSU research)
- Multimodal Signal Performance Measurement
- Traffic signal detection enhancement

Signal Operation Strategies



Pedestrian Priority Logic

- Two stages
 - Call the program
 - Call the pedestrian
- Options for calling program:
 - Delay threshold – Once pedestrian has waited “X” amount of time, call program
 - Specific time of day depending on local demand
 - Vehicular operational data
 - Use V/C to determine when to run ped algorithm
 - $X_i = \frac{v_i}{c_i} = \frac{v_i/s_i}{g_i/C} = \frac{v_i \cdot C}{s_i \cdot g_i}$
 - v_i = flow rate (veh/h)
 - C = cycle length
 - s_i = saturation flow rate
 - g_i = effective green time

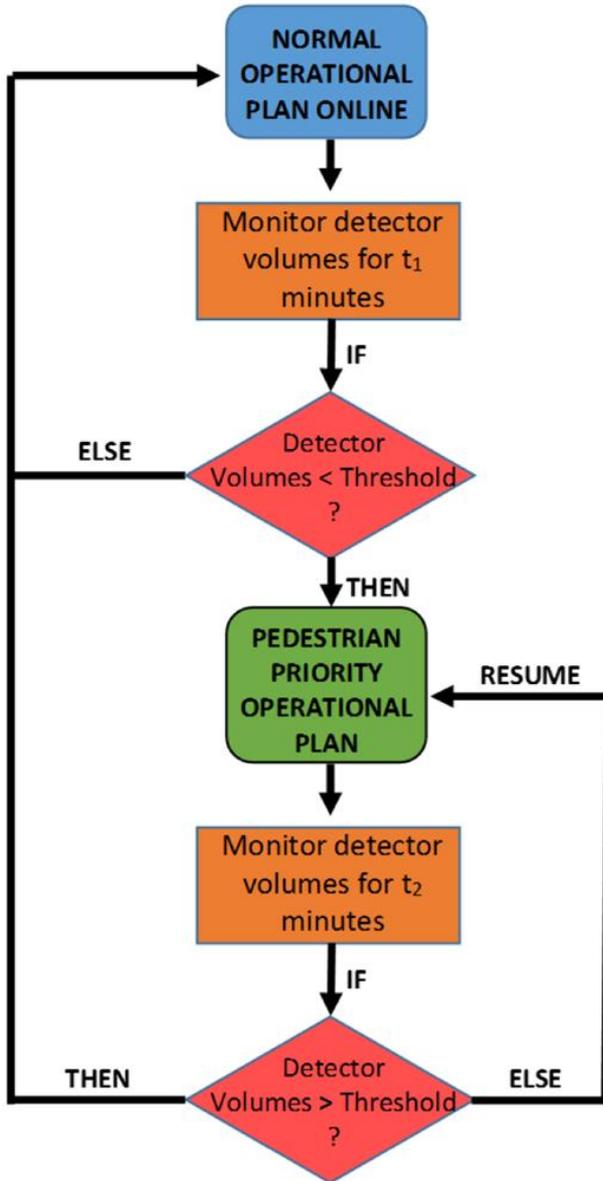
Signal Coordination

Apply permissive lengths

Employ advanced logic

Provide priority concepts

ASC/3 Logic Processor



Menu Configuration Controller Coordination Preempt Time Base Detectors

Logic Statement (MM) 1-8-2 Logic #: 14 Clear LP Sequence

If

	Assignment	#	IS	State
IF:	LP LOGIC FLAG	7	IS	ON
AND	LP LOGIC FLAG	8	IS	ON
AND	LP LOGIC FLAG	9	IS	ON
AND	LP LOGIC FLAG	10	IS	ON
AND	LP LOGIC FLAG	11	IS	ON

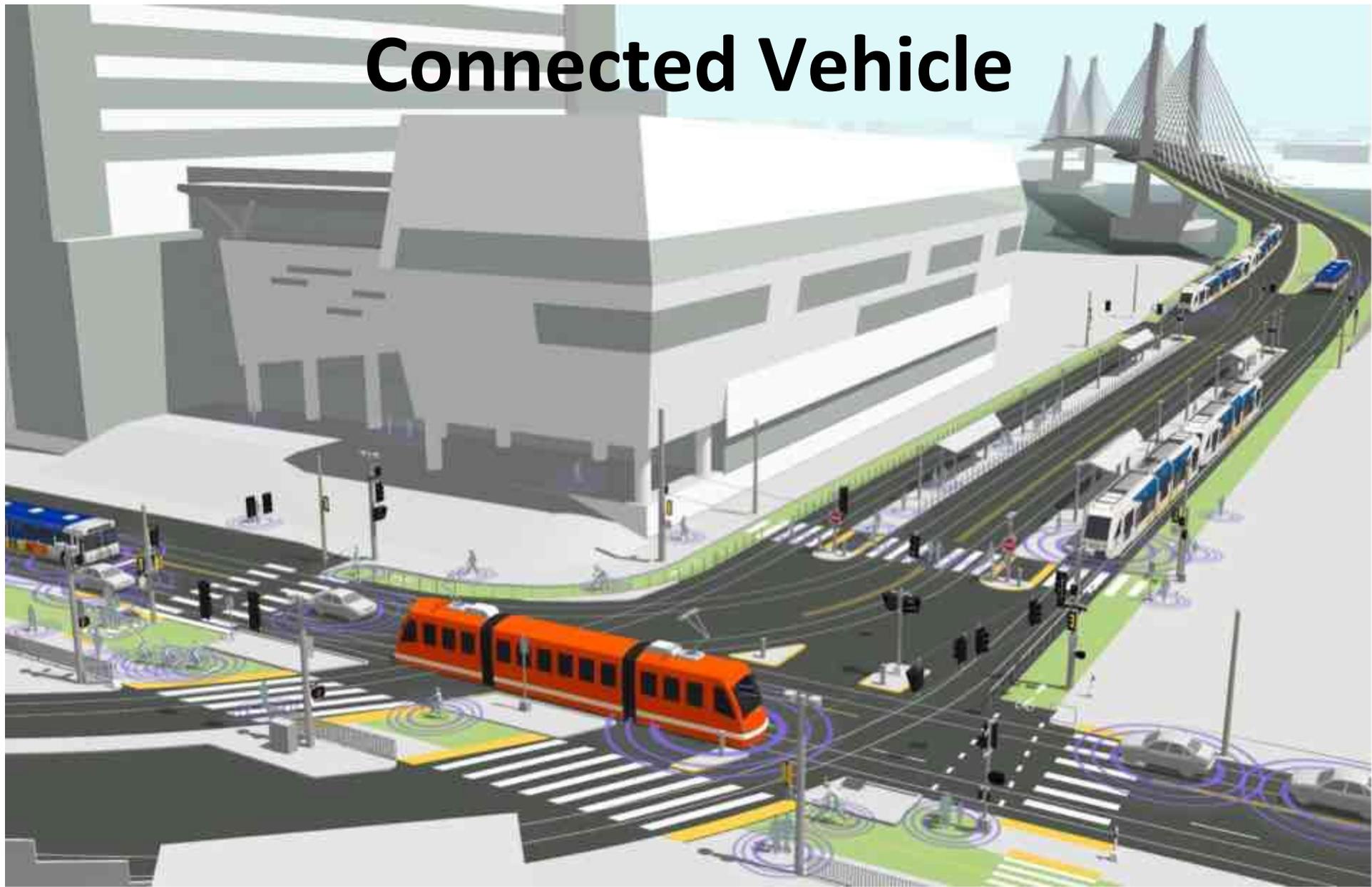
Then

	Assignment	#	State
	LP SET LOGIC FLAG	12	ON

Else

	Assignment	#	State

Connected Vehicle



Thank you for your time

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Discussion

⇒ Send us your questions



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