Traffic Engineering Fundamentals

Session 3 – Traffic Operations

Larry Hagen, P.E., PTOE, RSP

Course Instructor:

Larry Hagen, P.E., PTOE, RSP
Larry@LarryHagen.com
Phone: 229-237-3269

FloridaLTAP@cutr.usf.edu

Traffic Engineering Fundamentals

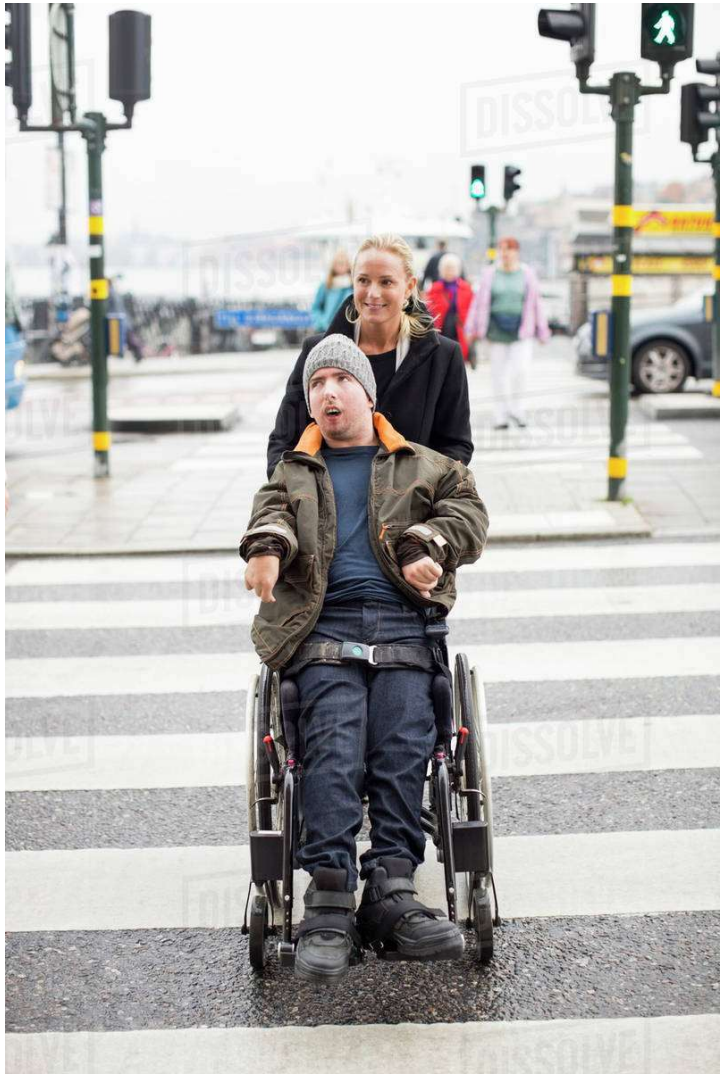
Basics of Traffic Operations

Question #1 you MUST ask yourself:

Who are the USERS?

Children?

Person in a wheelchair?



Person using mobility assistance?

Elderly?

Sight impaired?

Bicycles?

Bicycles with trailers?

Recumbent Bicycles?

Tricycles?

Motorcycles?

Cars?

Trucks – Freight – Logistics?

Pick-up truck with horse?

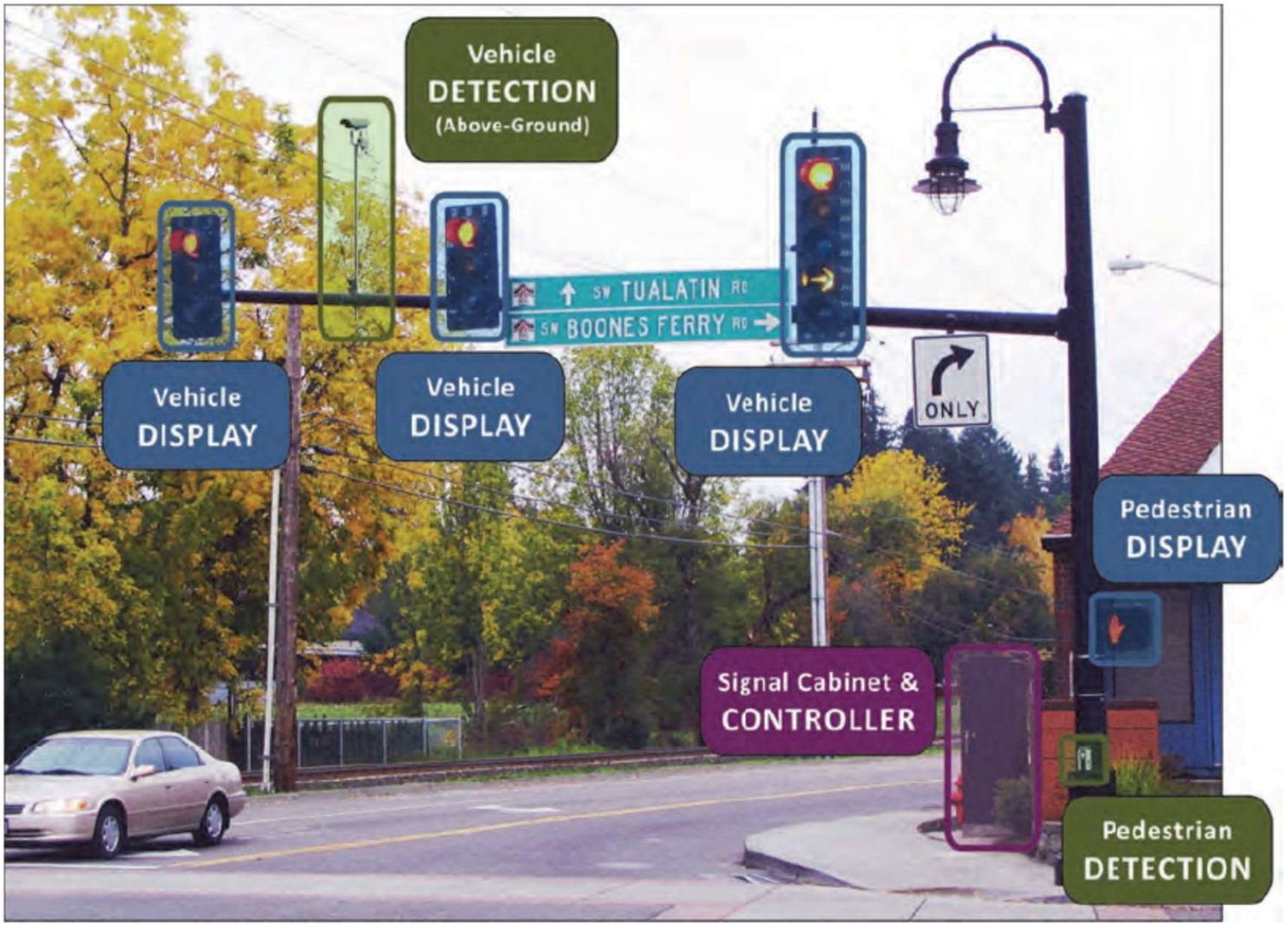
Light Rail?

Micromobility – e-scooters?

Who is your design user?

Questions?

Traffic Signal Terminology


Vehicle
DETECTION
(Above-Ground)
SW TUALATIN RD
SW BOONES FERRY RD
ONLY
Vehicle
DISPLAY
Vehicle
DISPLAY
Vehicle
DISPLAY
Pedestrian
DISPLAY
Signal Cabinet &
CONTROLLER
Pedestrian
DETECTION

Traffic Signal Terminology

- Cycle
- Cycle Length
- Phase
- Interval

Cycle

- A signal cycle is one complete rotation through all of the indications provided. In general, every legal vehicular and pedestrian movement receives a “green” or “walk” indication during each signal cycle (some exceptions exist).

Cycle Length

- The cycle length is the amount of time it takes (in seconds) to complete one full cycle of indications. It is typically given the symbol “C”.

Phase

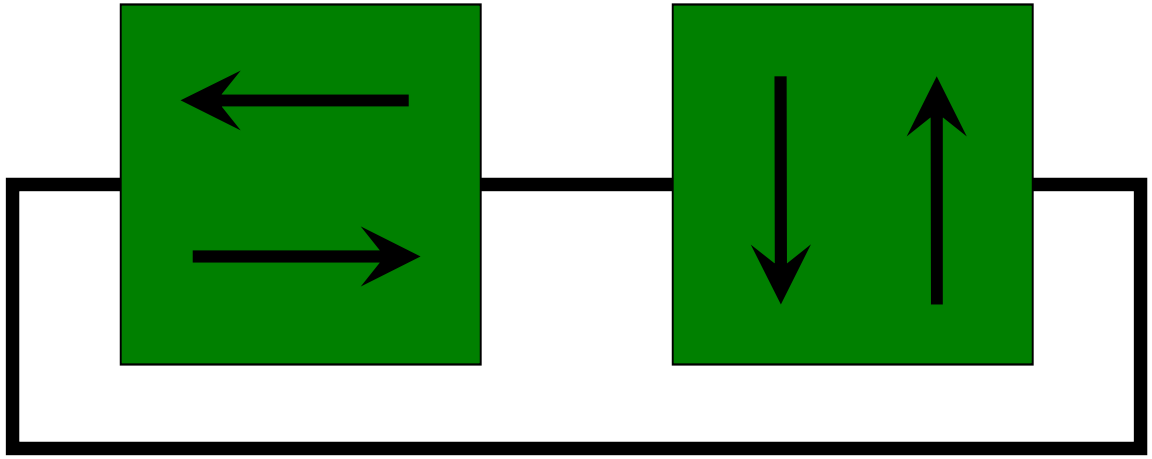
- A signal phase consists of a green interval, plus the change and clearance intervals that follow it. It is a set of intervals that allows a movement or set of movements to flow and be safely handled before the release of conflicting movements.

Interval

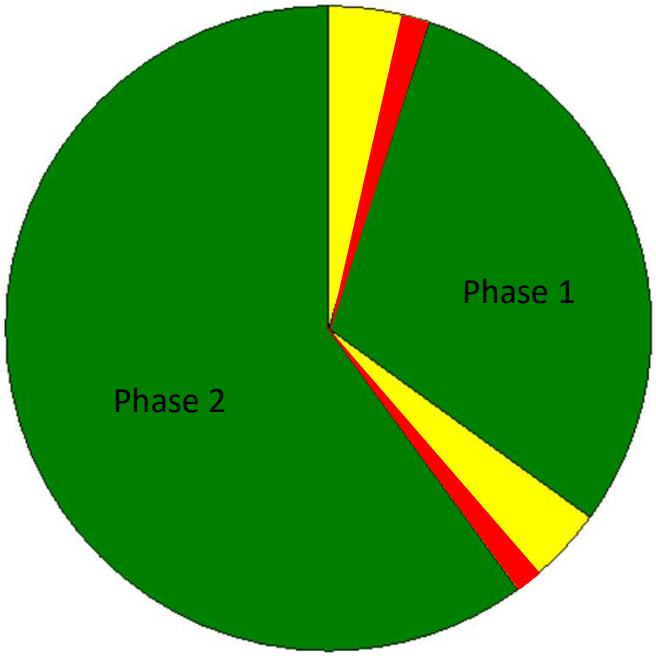
- A signal interval is the smallest unit of time described in a signal cycle. It is a period of time in which no signal indication changes. A signal cycle is made up of several different types of intervals.

Traffic Signal Timing Basics – Cycle

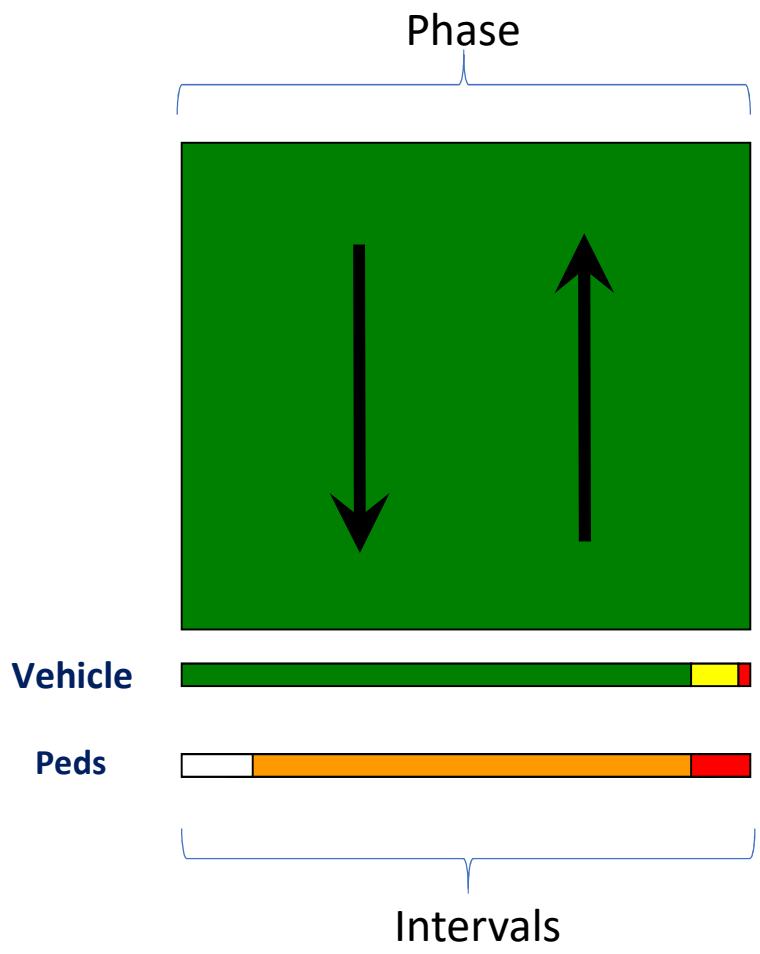
2 – Phase operation



Traffic Signal Timing Basics - Cycle

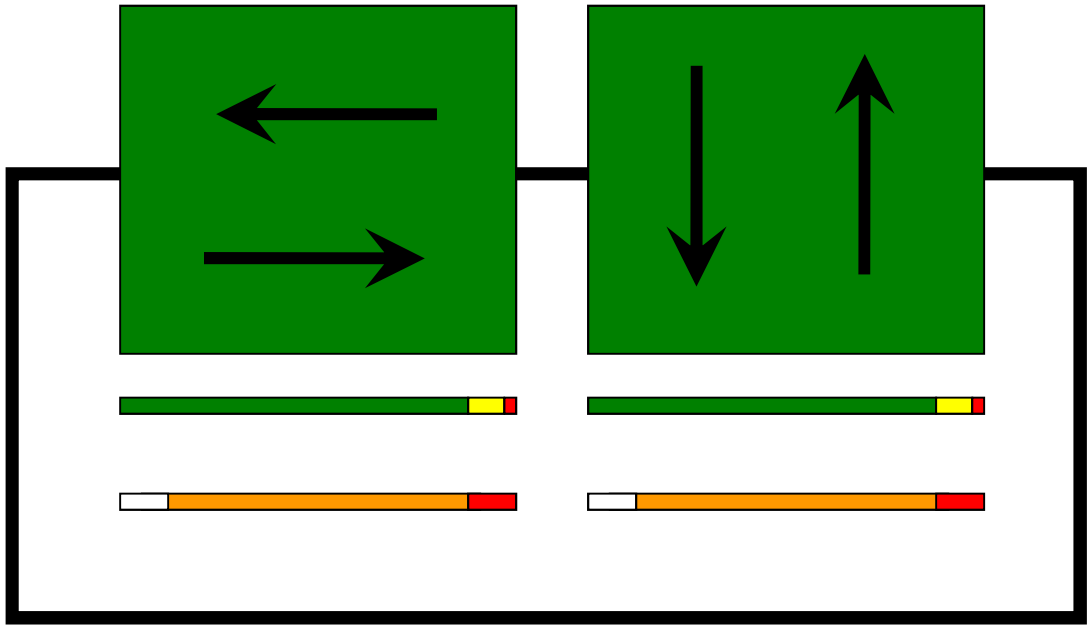


Traffic Signal Timing Basics



Traffic Signal Timing Basics

2-Phase operation

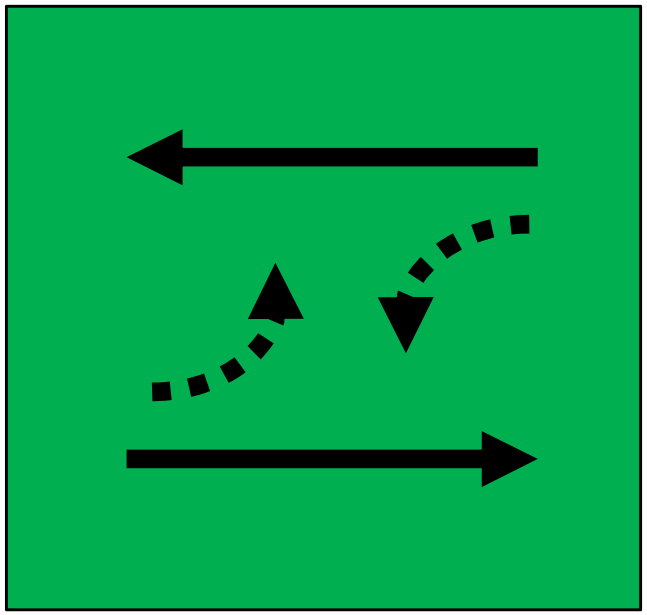


Traffic Signal Phasing Choices

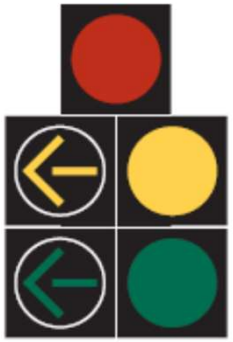
It's primarily about the left turns!

Left turn phasing choices

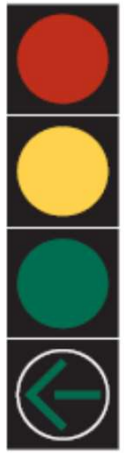
Permitted Left Turns

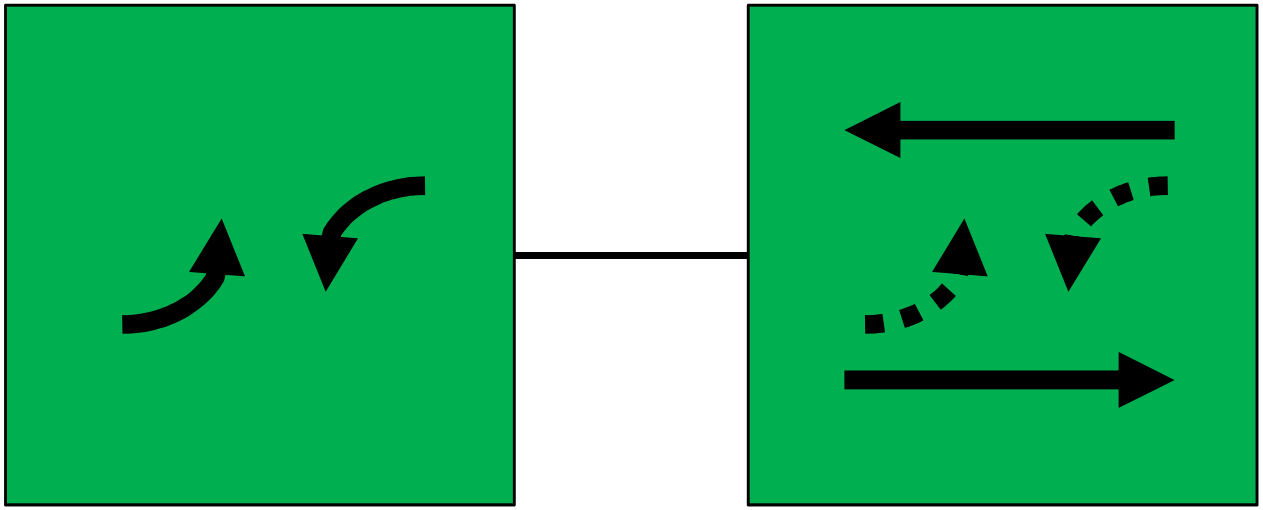


Left turn phasing choices



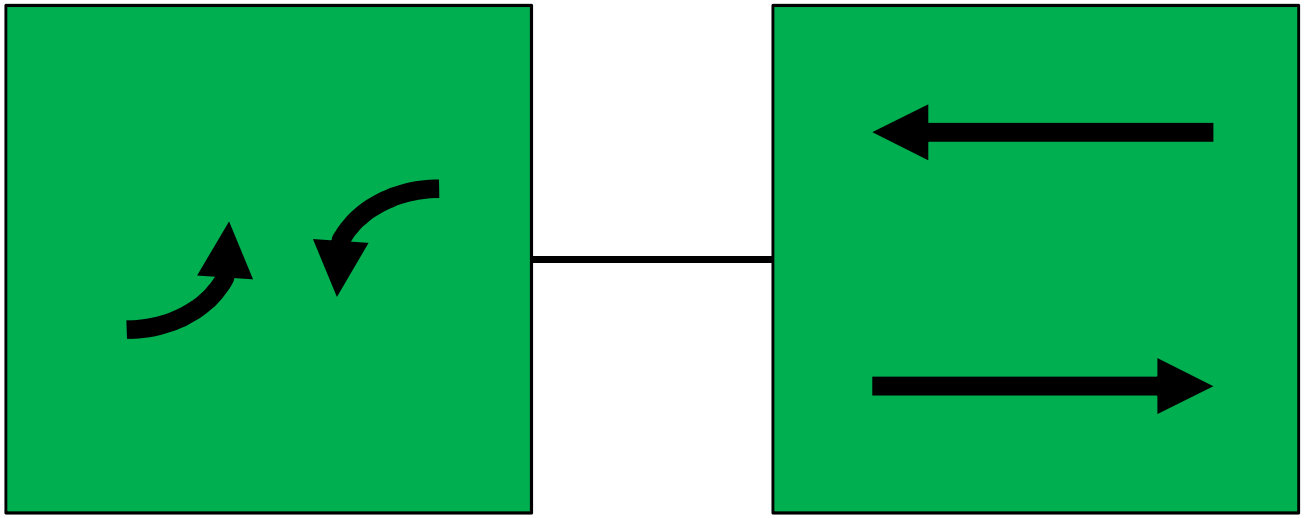
Protected + Permitted Left Turns





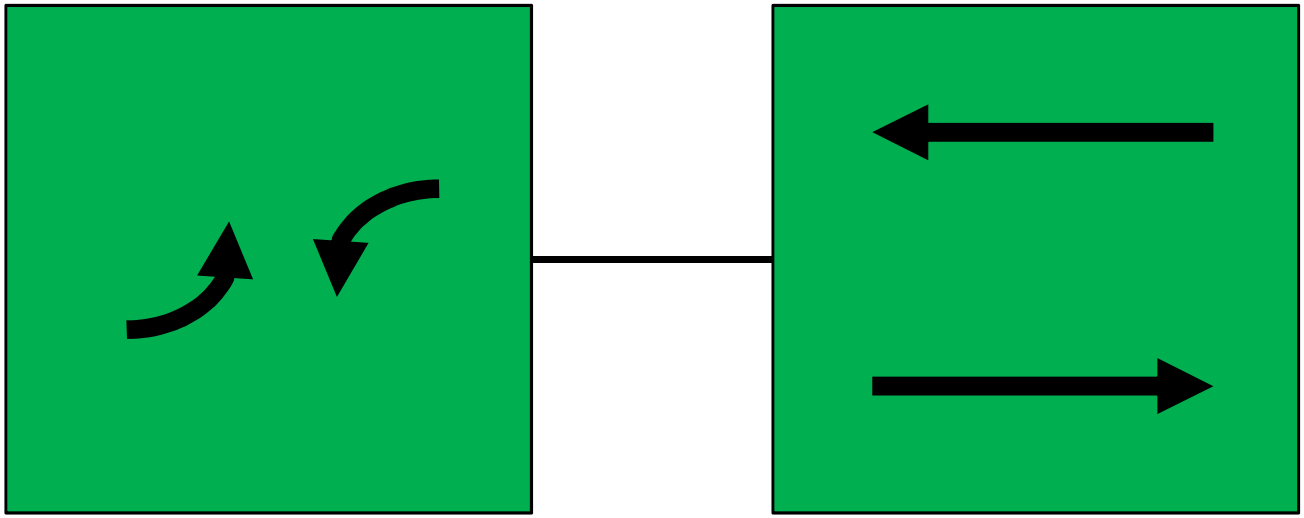
Left turn phasing choices

Protected Left Turns



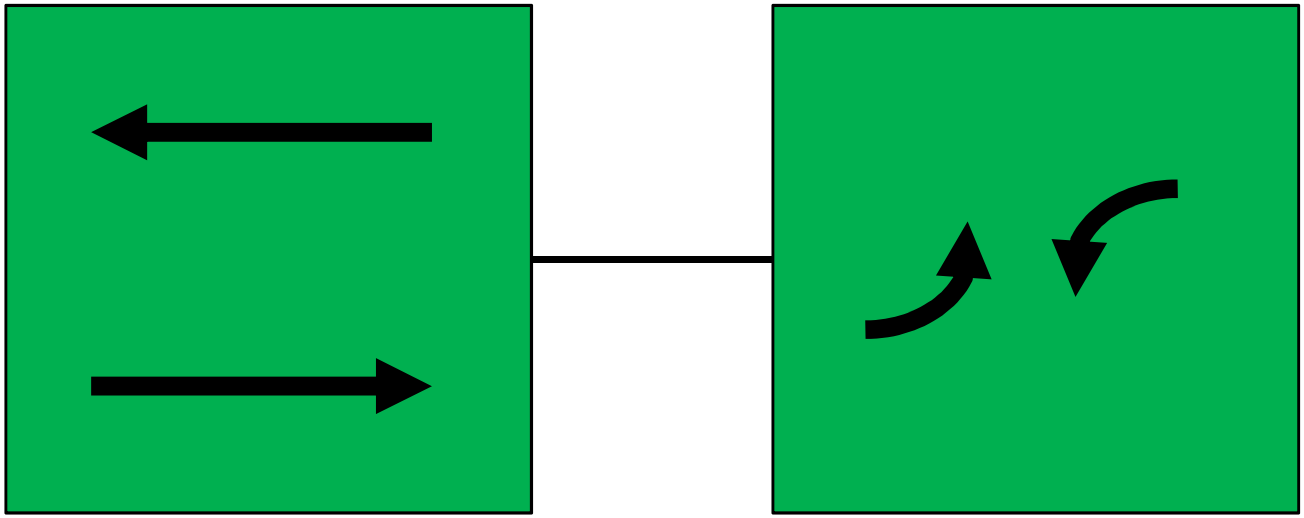
Left turn phasing choices

Leading Left Turns



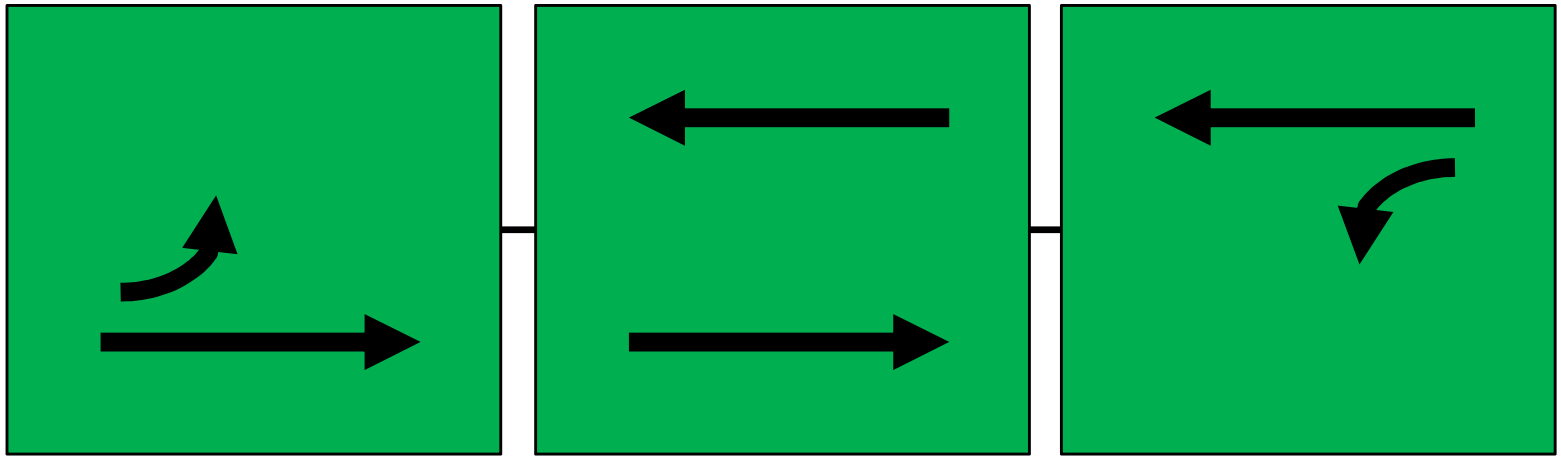
Left turn phasing choices

Lagging Left Turns



Left turn phasing choices

Lead-Lag Left Turns



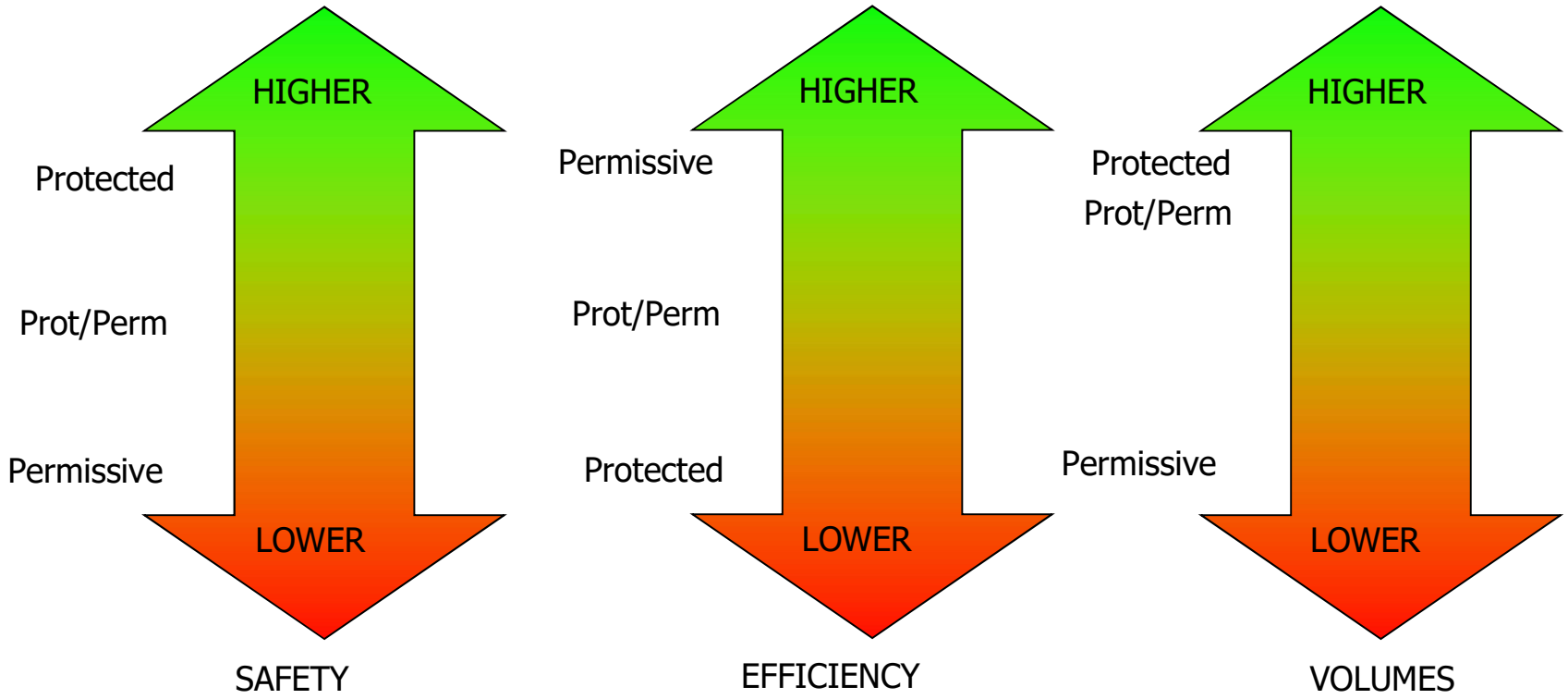
Permissive Left Turns

- Requirements
  - Sight distance
  - Adequate gaps in opposing traffic

Permissive Left Turns

- Considerations
  - Number of opposing lanes
  - Left turning volume
  - Opposing through volume
  - Opposing traffic speed
  - Road user demographics
  - Conflicts with pedestrians
  - Number of Turn Lanes
  - Left Turn storage

Left Turn Phasing Choices - Considerations



Types of Traffic Signal Control

- Pretimed Control:

  Duration of red, green, and yellow intervals are predetermined and fixed

- Traffic-Actuated Control:

  Duration of green intervals vary according to detected vehicle demand

Advantages of Pretimed Control

- **Easy to coordinate with other intersections.**
- **Can easily handle large pedestrian volumes.**
- **Does not rely on detectors.**
- **Costs less.**
- **Less maintenance.**

Advantages of Actuated Control

- **More efficient where traffic demand fluctuates.**
- **Greater efficiency at complex intersections.**
- **Maximum efficiency at major/minor intersections.**
- **Do not need to flash at night.**

Traffic Actuated Control

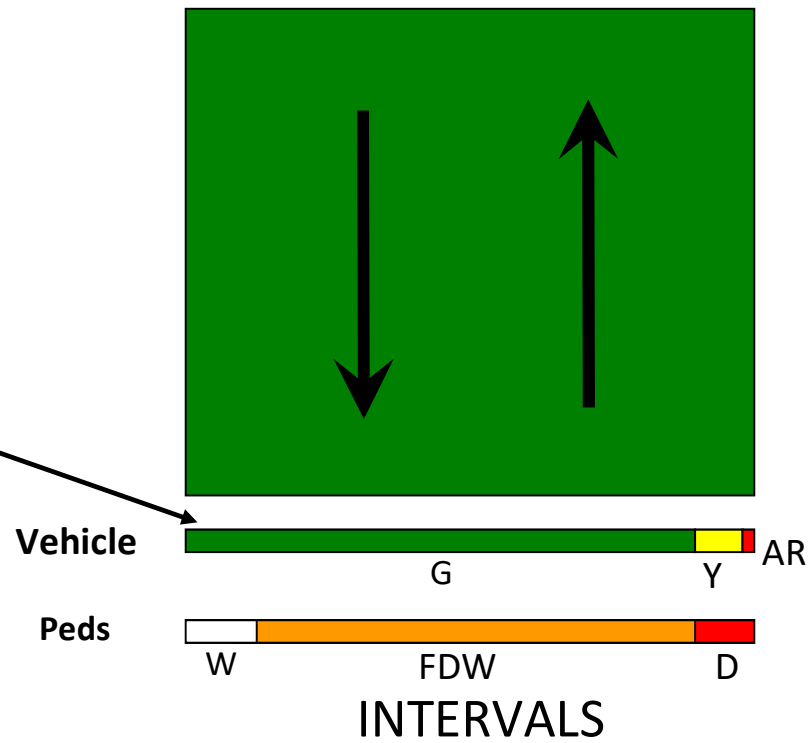
- Adjusts green time continuously based on detected demand.
- Can skip phases if no demand.

Actuated Signal Controller Parameters

- Yellow
- All-red
- Minimum
- Extension
- Maximum
- + FDW

Actuated Traffic Signal Controller Intervals

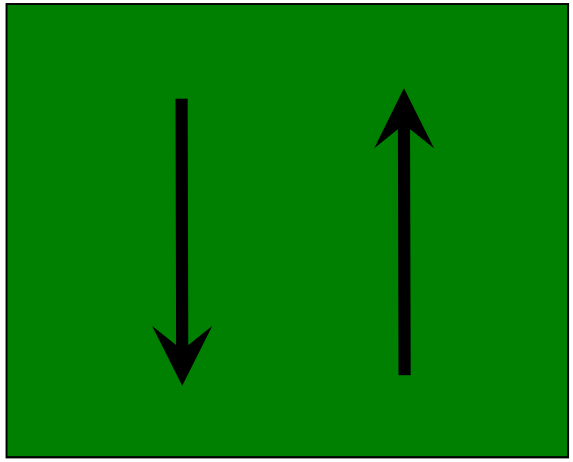
The only interval that changes is the vehicular green time

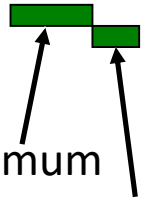


Phase

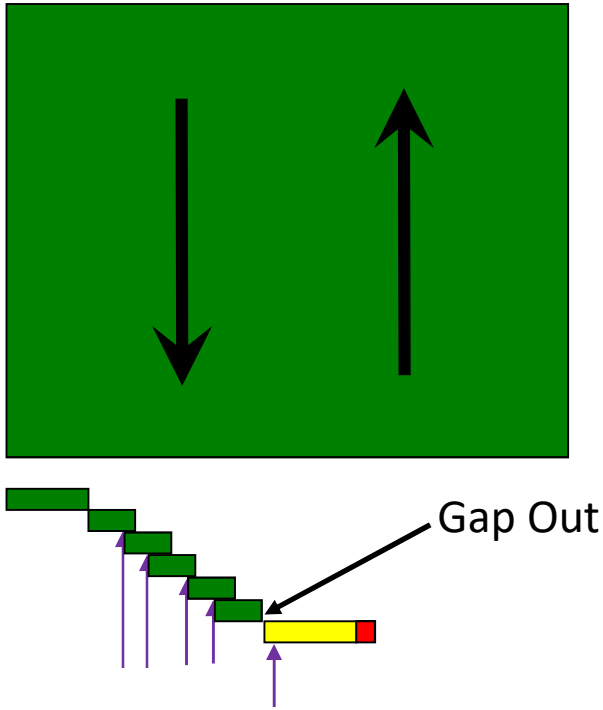
How Actuated Controllers Work:

It Starts With The
Minimum and Extension

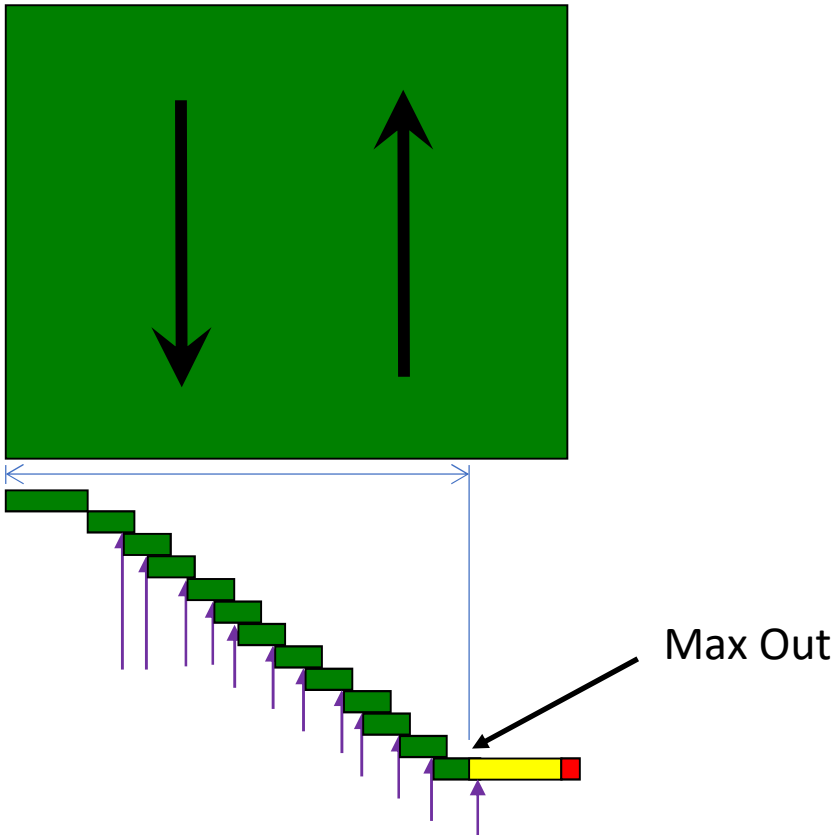




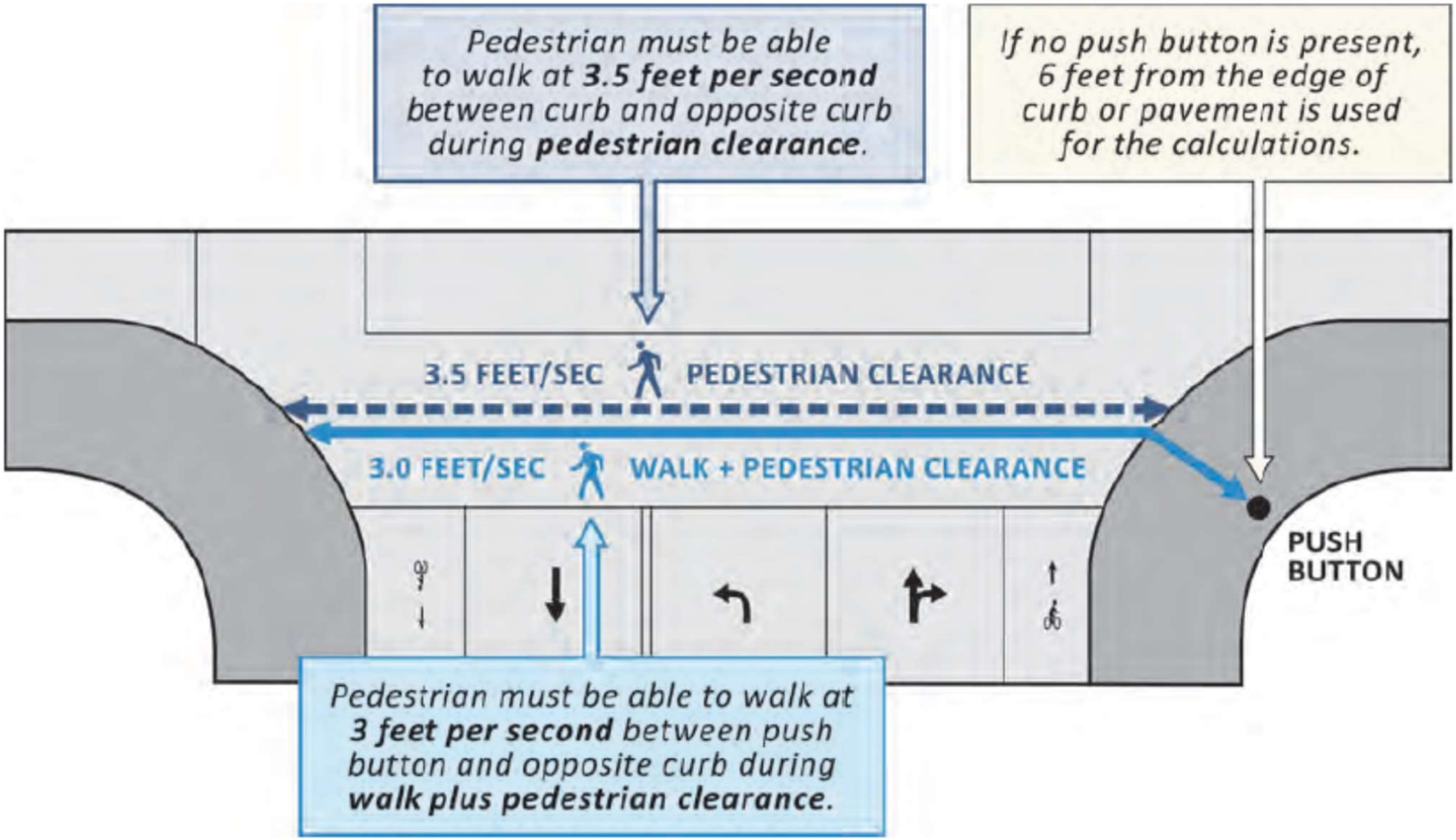
How Actuated Controllers Work:



How Actuated Controllers Work:



Pedestrian Crossing Time



Questions?

The Yellow Interval

Poll Questions

The Yellow Change Interval

Vehicular traffic facing a steady CIRCULAR YELLOW signal indication is thereby warned that the related green movement or the related flashing arrow movement is being terminated or that a steady red signal indication will be displayed immediately thereafter when vehicular traffic shall not enter the intersection.

The Yellow Change Interval

The computed yellow time is based on a vehicle that at the critical point (stopping distance + reaction time travel distance) decides to “GO” rather than stop. The yellow time is the reaction time plus the time required to transverse the stopping distance at the presumed speed (typically speed limit). The yellow time does NOT give you time to stop.

The Yellow Change Interval

Table 3.6-1. Florida Yellow Change Interval (0.0 % Grade) Standards*

APPROACH SPEED (MPH)	(fps)	YELLOW INTERVAL (SECONDS)	
25	36.7	3.67	3.4
30	44.0	4.40	3.7
35	51.3	5.13	4.0
40	58.7	5.87	4.4
45	66.0	6.60	4.8
50	73.3	7.33	5.1
55	80.7	8.07	5.5
60	88.0	8.80	5.9
65	95.3	9.53	6.0

* For approach grades other than 0%, use ITE Formula.

Conversation with an Engineer

YouTube Video

https://youtu.be/_-6X1-SLOXM

Question you MUST ask yourself:

Which person are you?

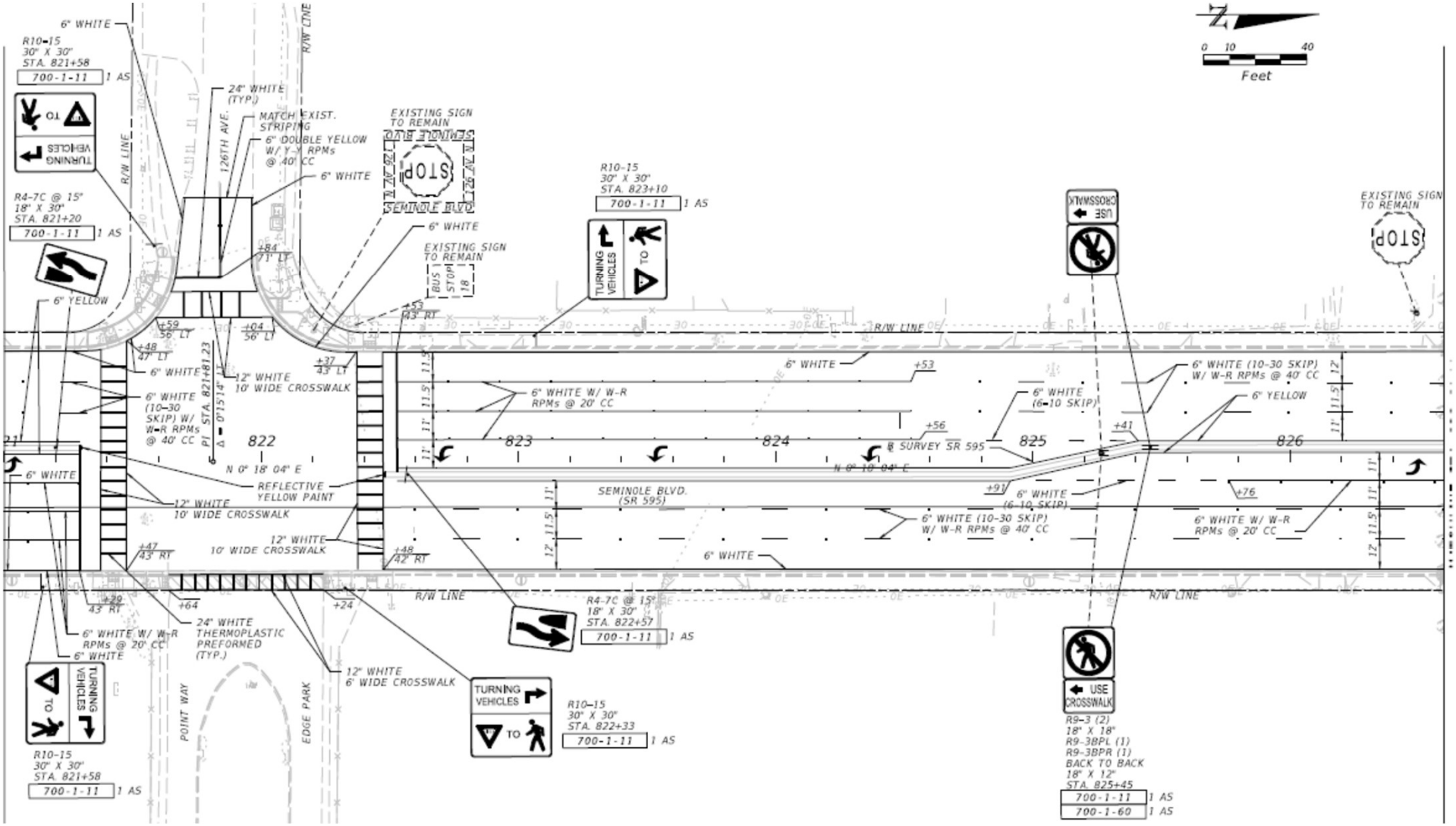
What do you see when you look at this?

STROADS – Florida is #1

YouTube Video

https://youtu.be/F6jFnOnjzrk

Is this a STROAD? Looks like it.



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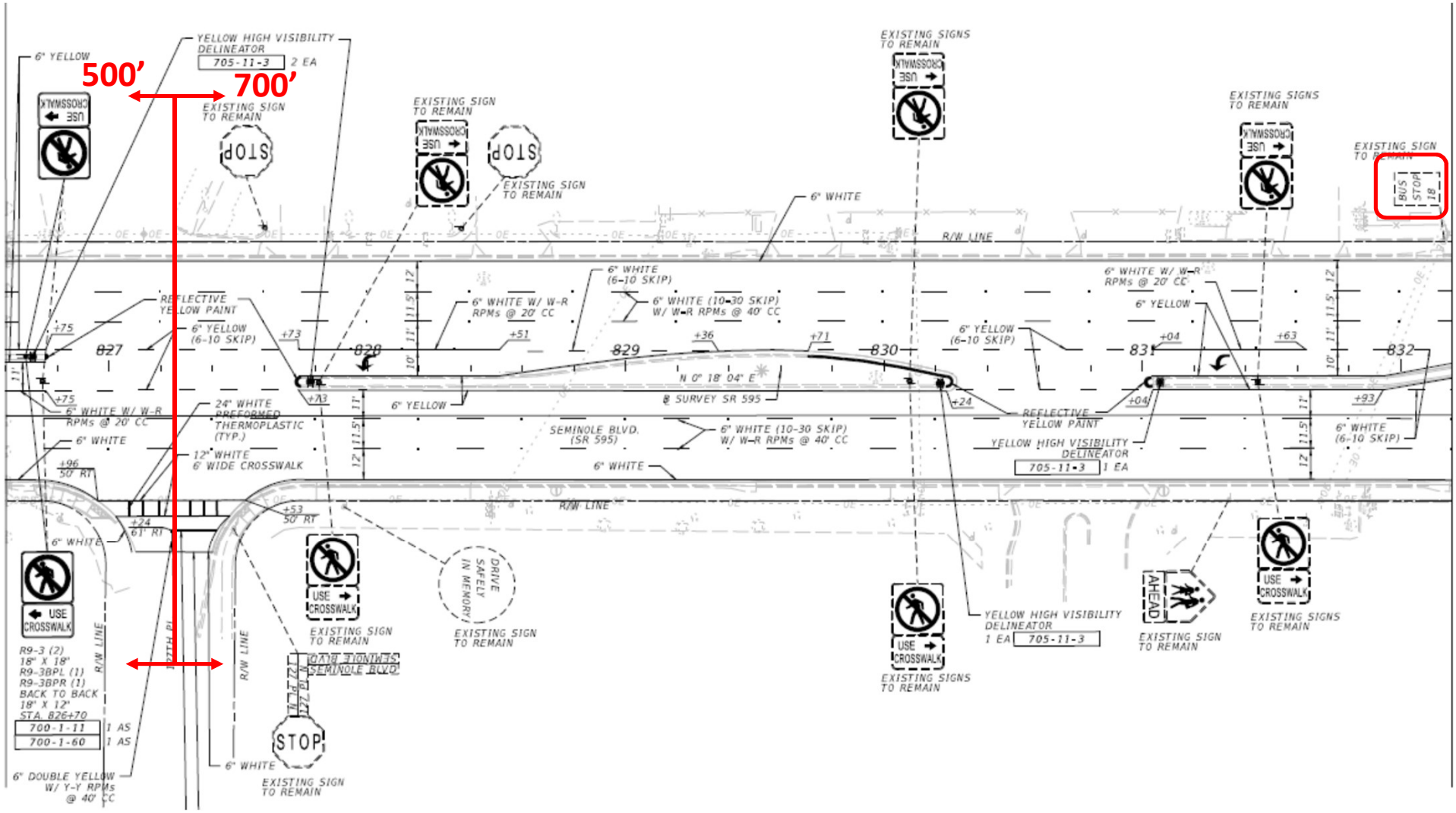

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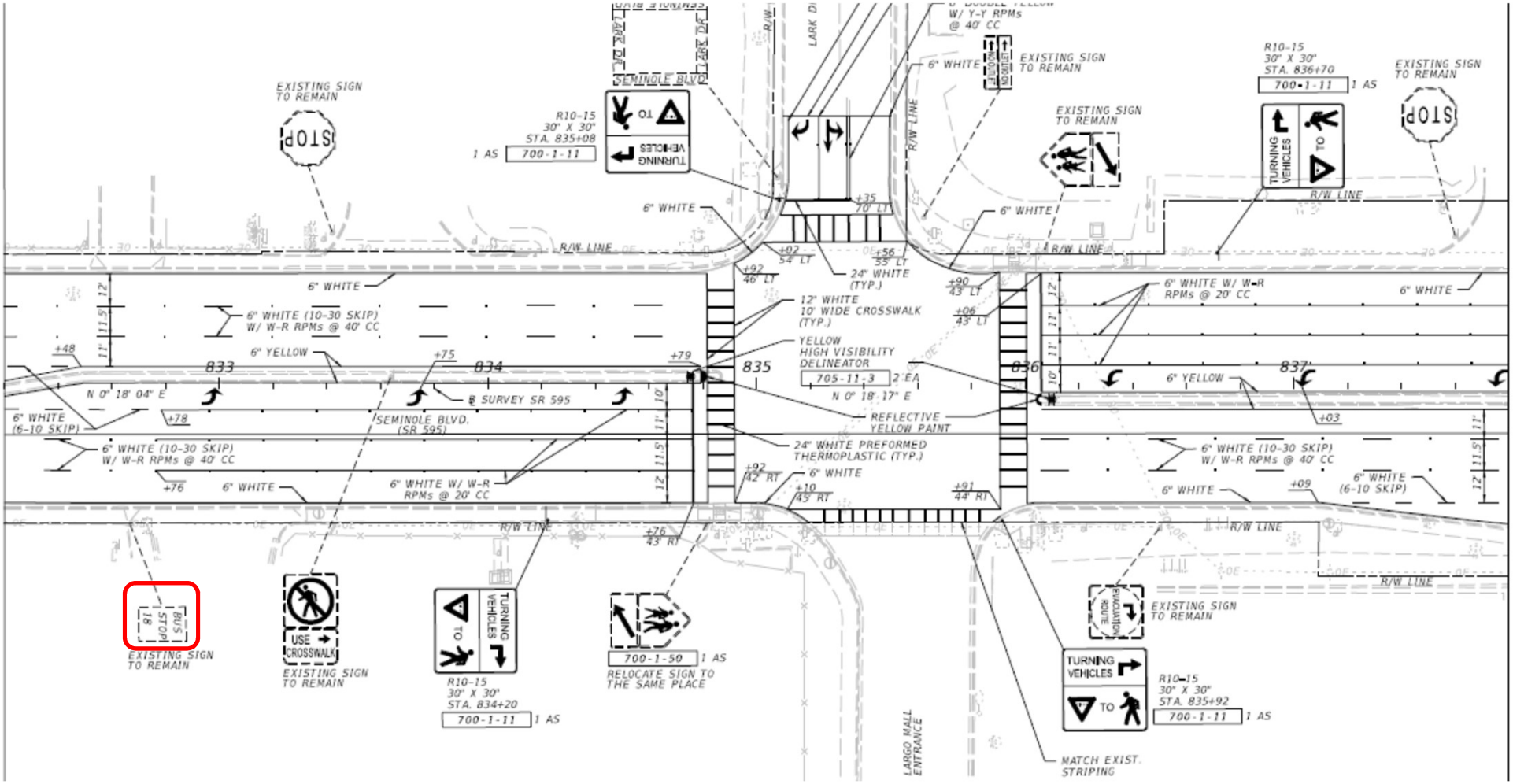


Is this a STROAD? Looks like it.

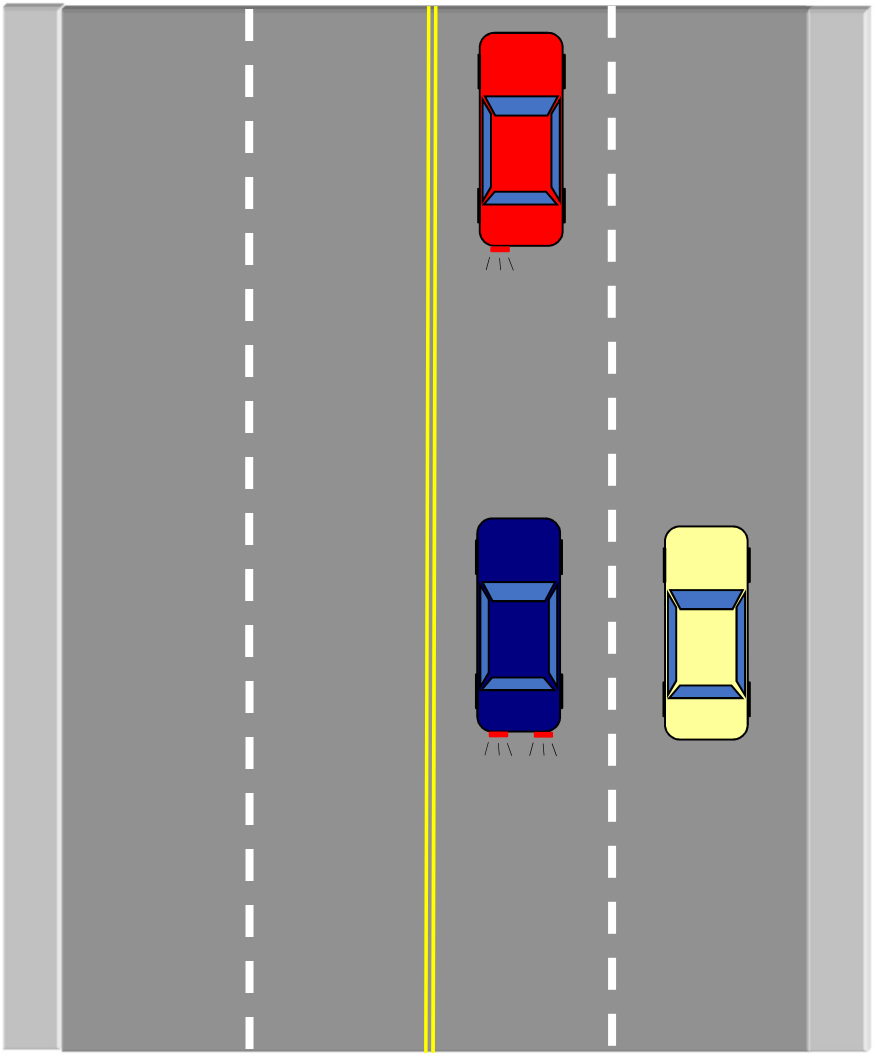
- Looking South

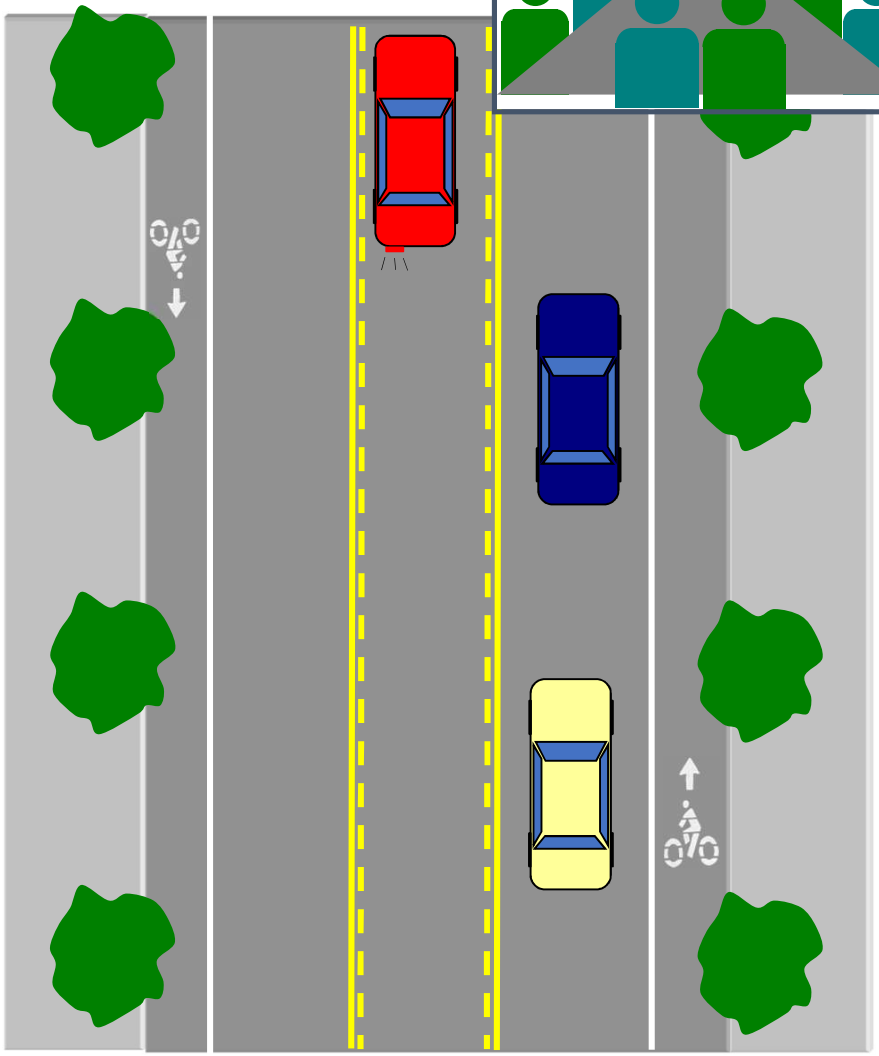
Is this a STROAD? Looks like it.

- Looking North

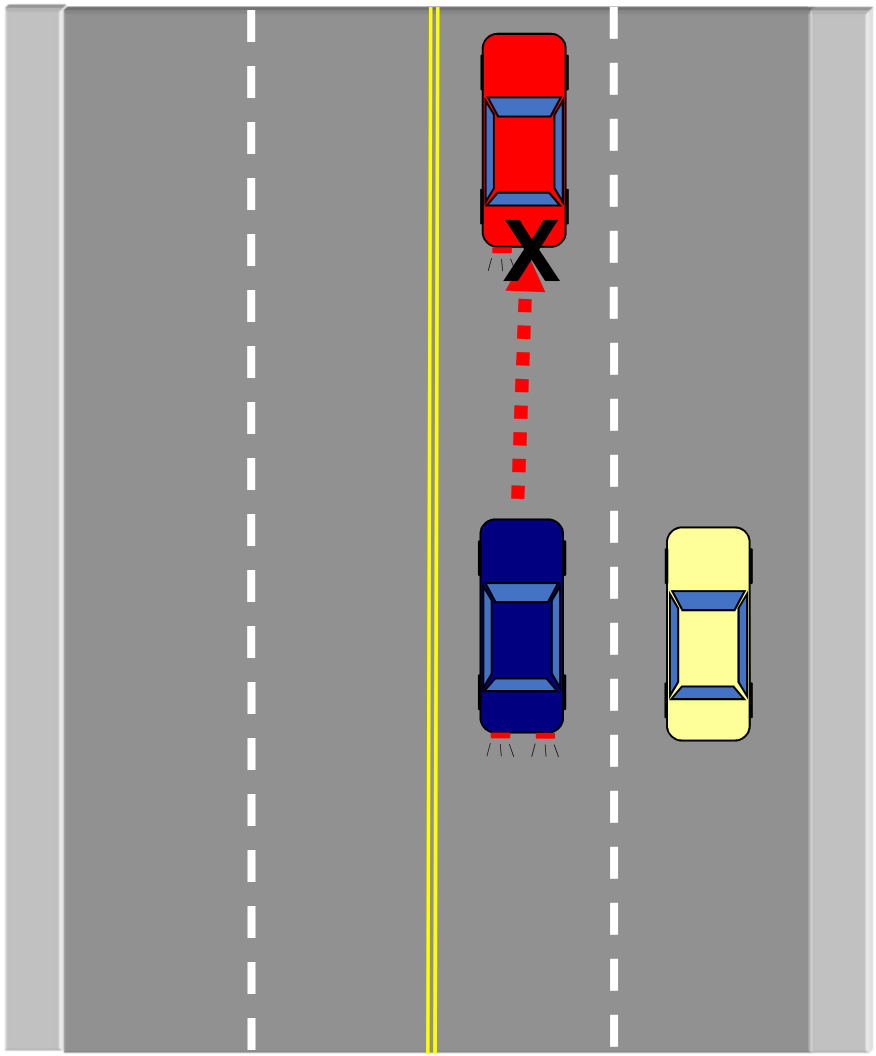
Lane Elimination (Road Diets)

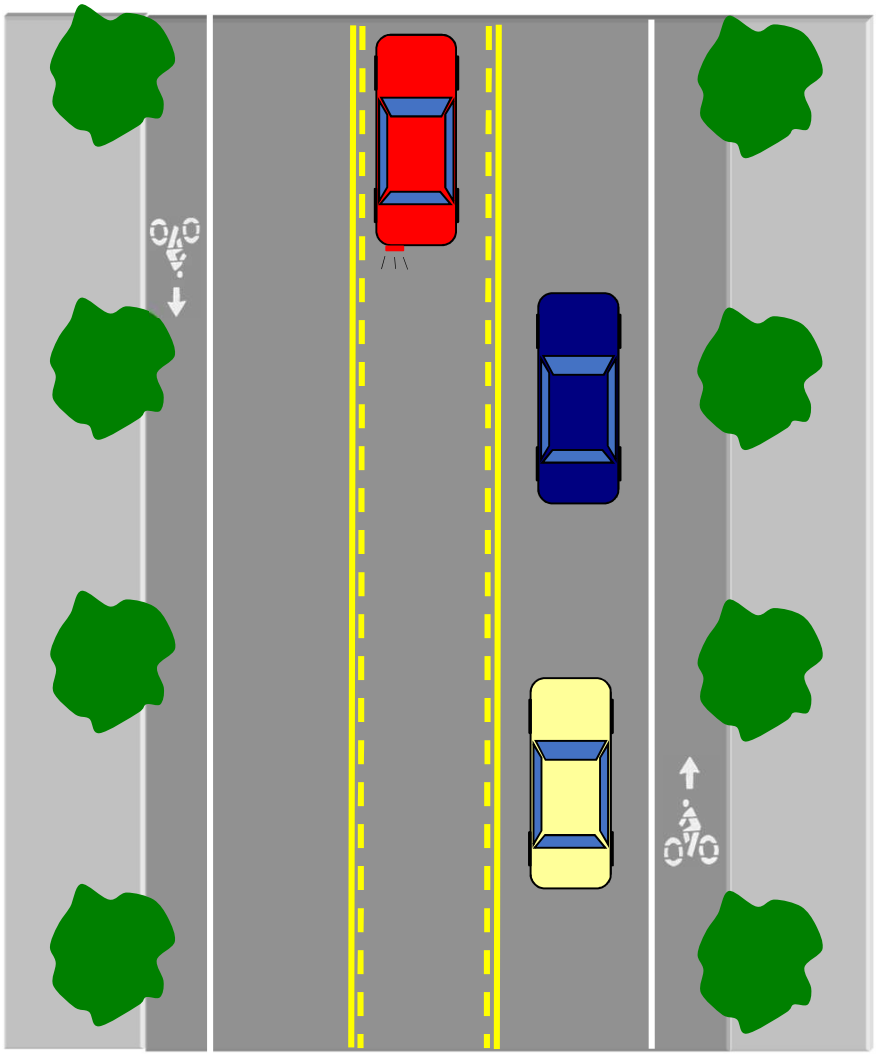
3 crash types can be reduced by going from 4 to 3 lanes: which ones?



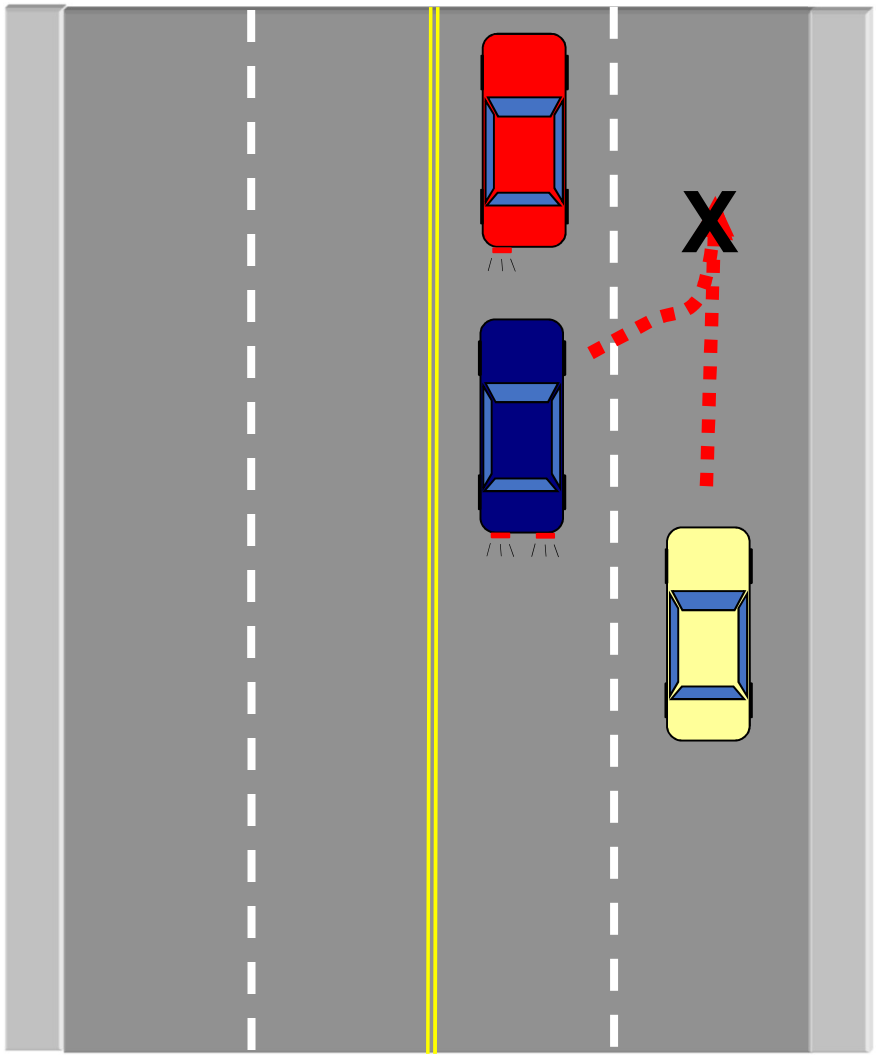


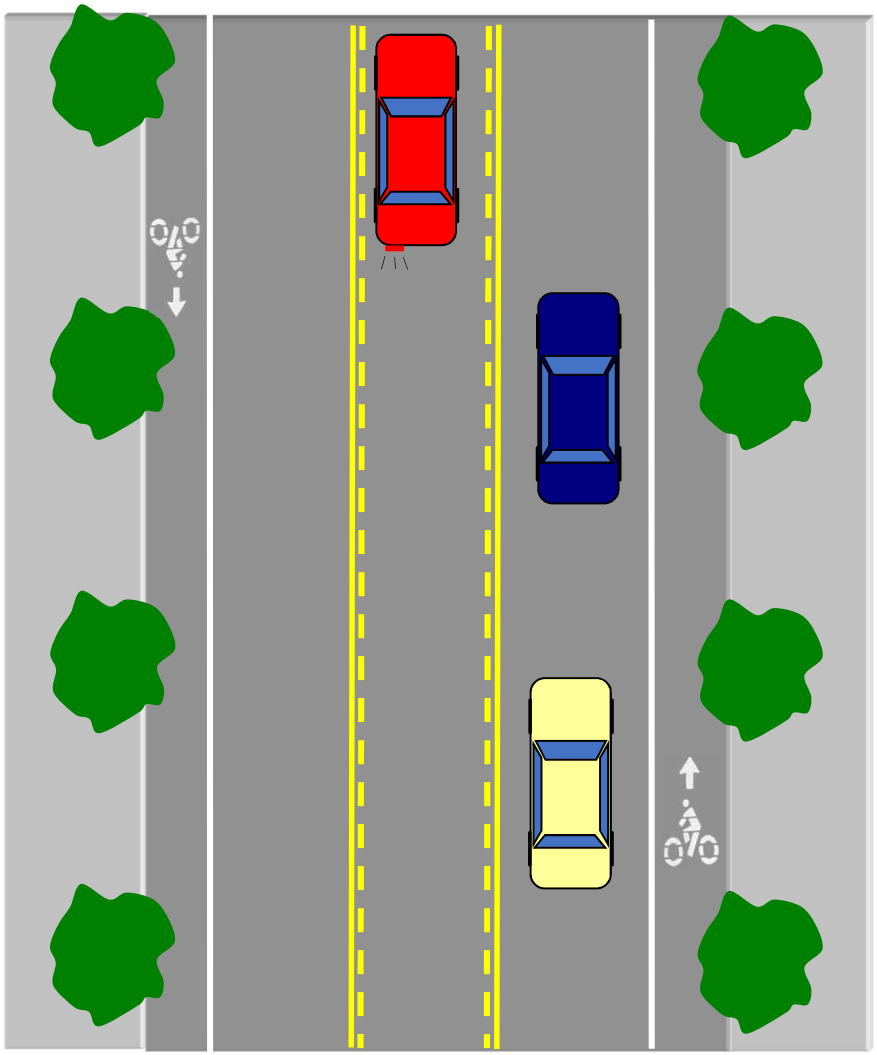
3 crash types can be reduced by going from 4 to 3 lanes: 1 – rear enders



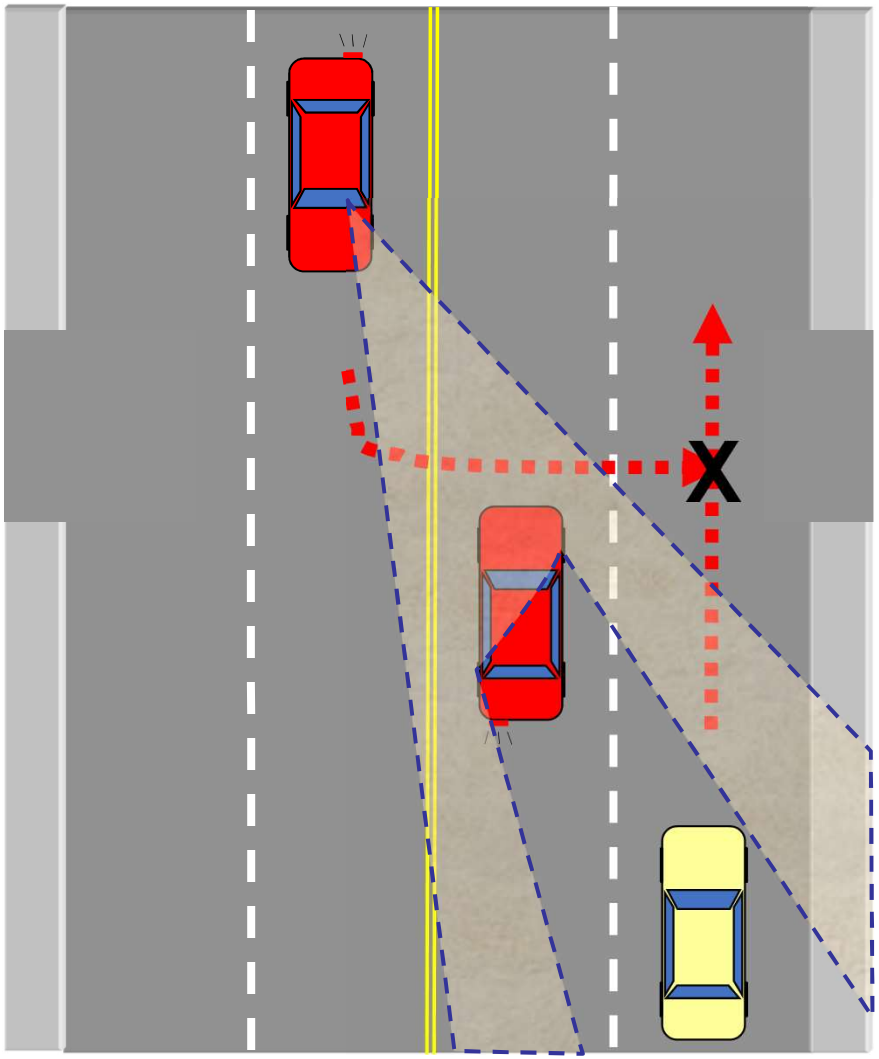


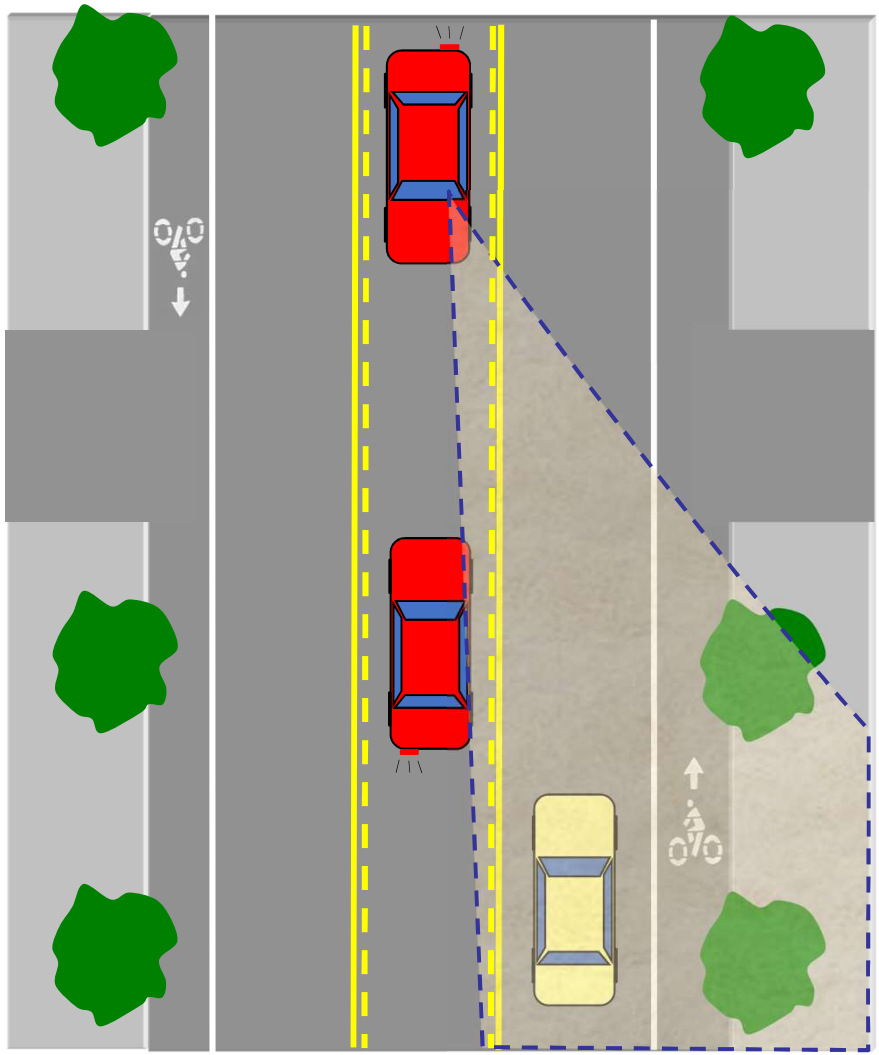
3 crash types can be reduced by going from 4 to 3 lanes: 2 – side swipes





3 crash types can be reduced by going from 4 to 3 lanes: 3 – left turn/broadside





Case study: Edgewater Drive Resurfacing Project (Orlando FL)

- **$589,000 project scheduled in FDOT 5-year work plan**
- **FDOT open to 3-lane option if City takes over jurisdiction**
- **Changes must be accepted by neighborhood and business associations; before/after studies**

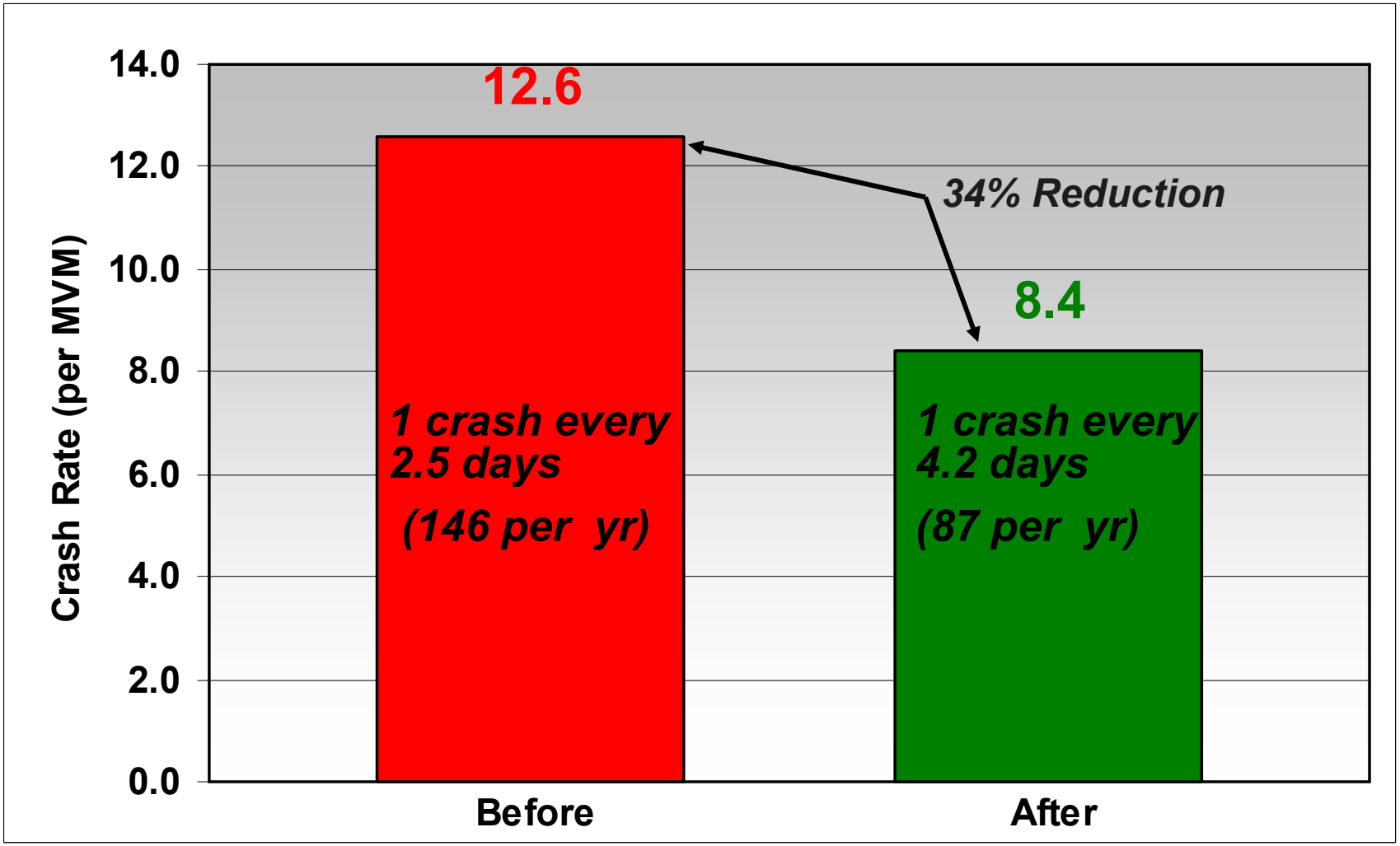
Before

Concept

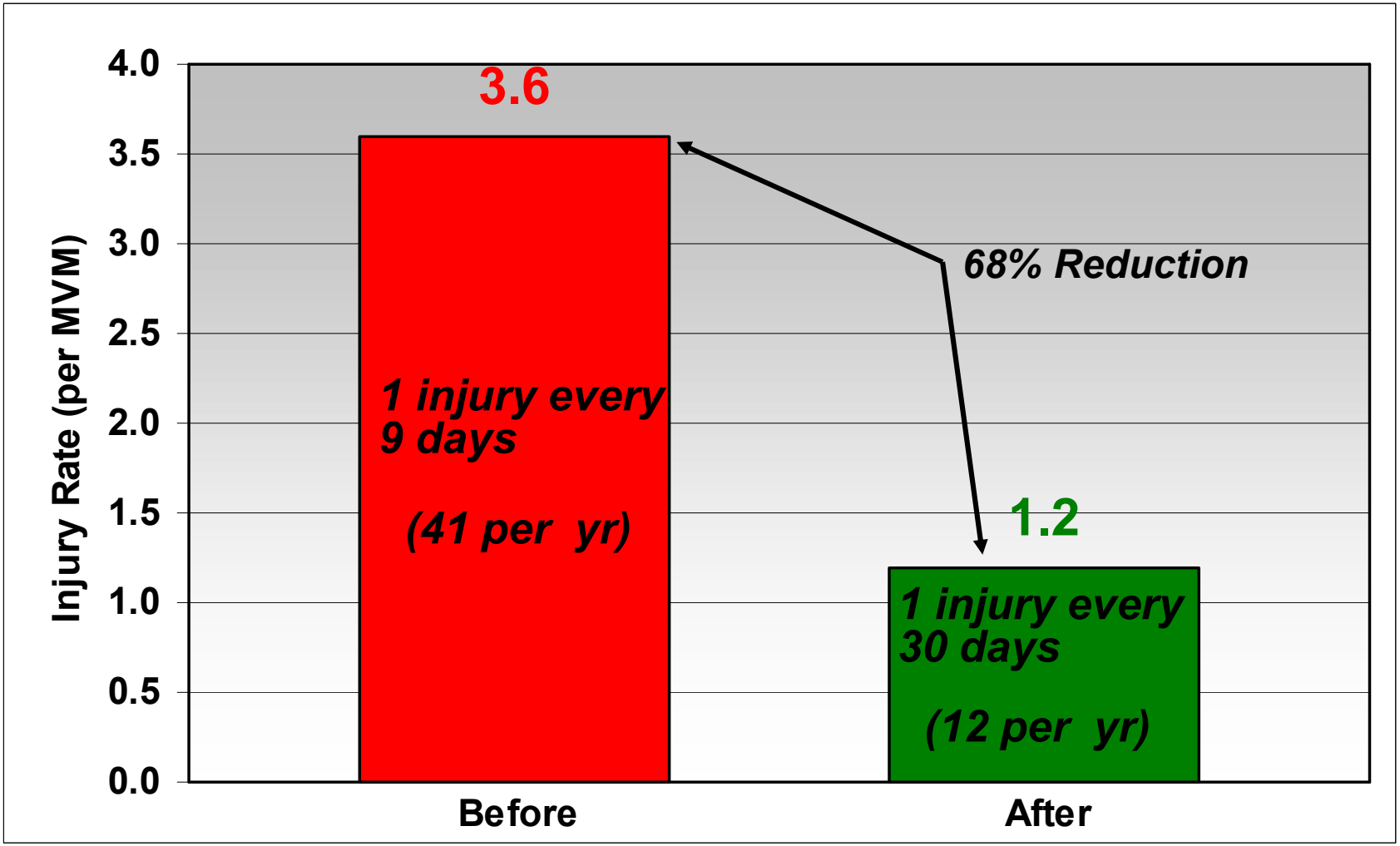
Reality: Before

Reality: After

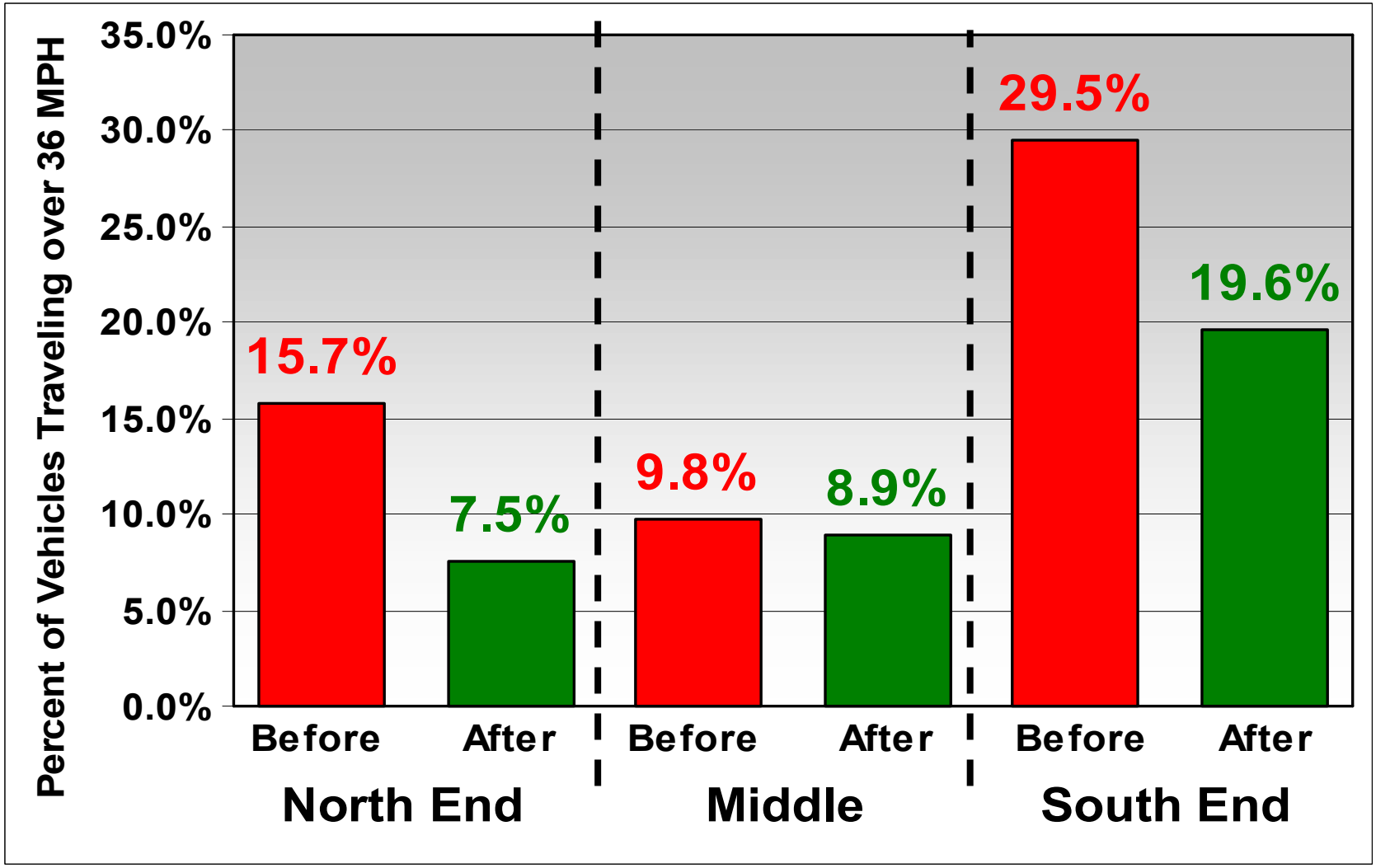
Before/after studies: 1. Crash rate



Before/after studies: 2. Injury rate

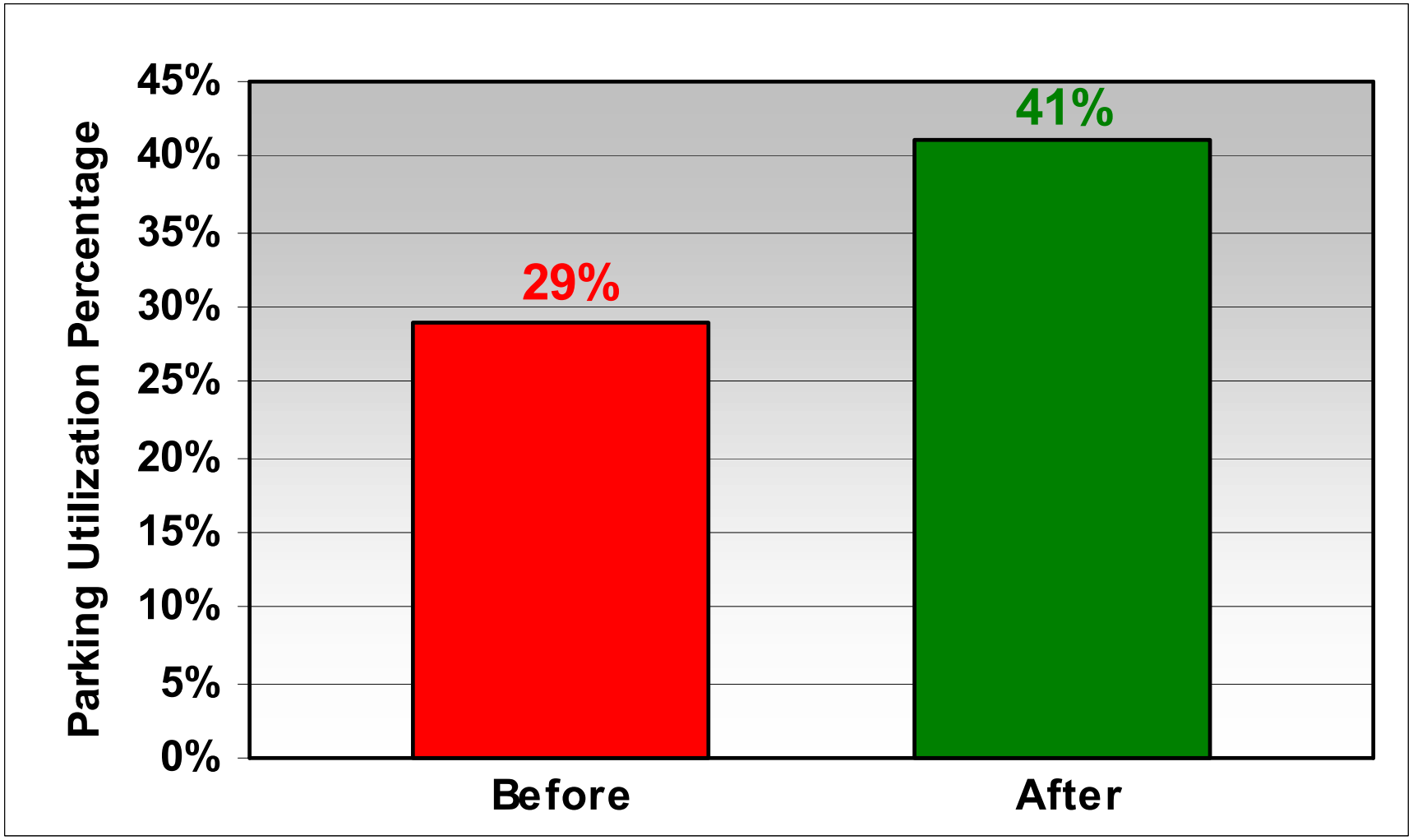


Before/after studies: 3. Speeding analysis

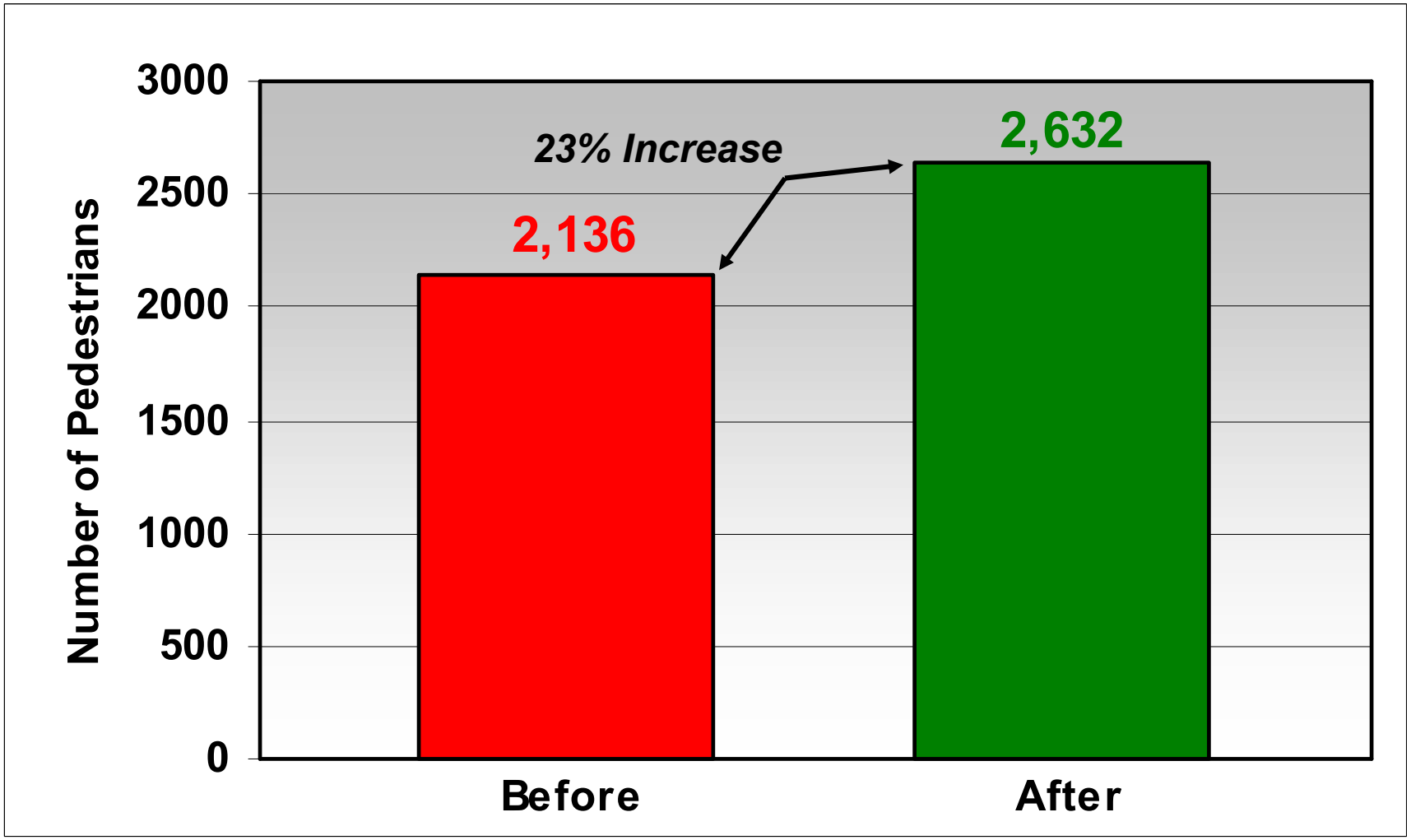


Before/after studies: 4. Traffic volumes

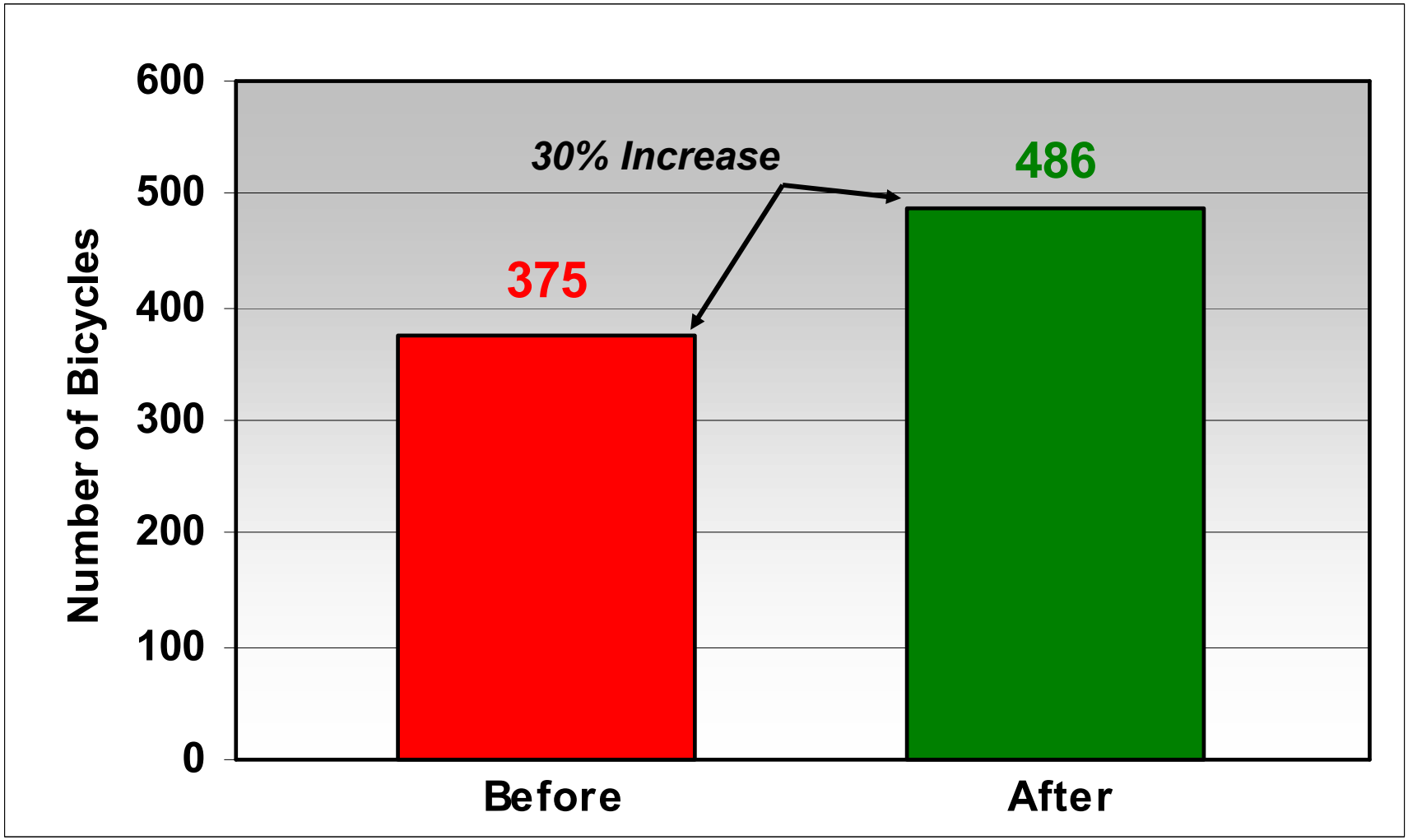
Before/after studies: 5. On-street parking utilization



Before/after studies: 6. Pedestrian volumes



Before/after studies: 7. Bicyclist volumes



Edgewater Drive – before / after:

Before/after studies: Evaluation matrix

Avoid Increasing Traffic On Neighborhood Streets	YES
Reduce Speeding on Edgewater Dr	YES
Increase Bicyclist Volumes	YES
Increase Pedestrian Volumes	YES
Reduce Crashes	YES
Increase On-Street Parking Use Rates	YES
Increase Pedestrian Satisfaction (Residents)	YES
Increase Parking Satisfaction (Residents)	YES

Also: Noise levels went down…

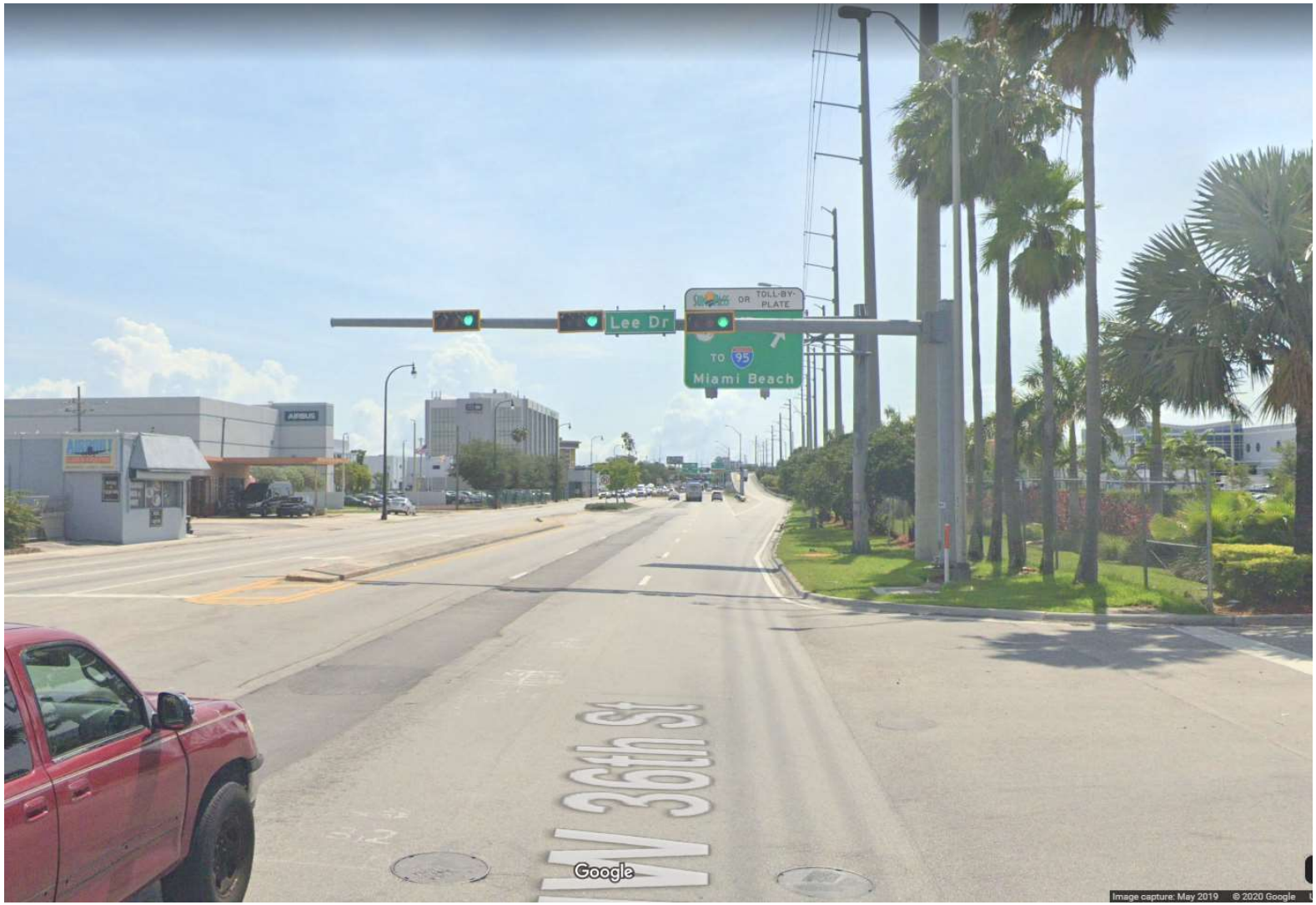
Questions or comments?

If we want things to operate well, we have to pay attention!

Are we giving consistent information?

Is the PCMS of any real use here?

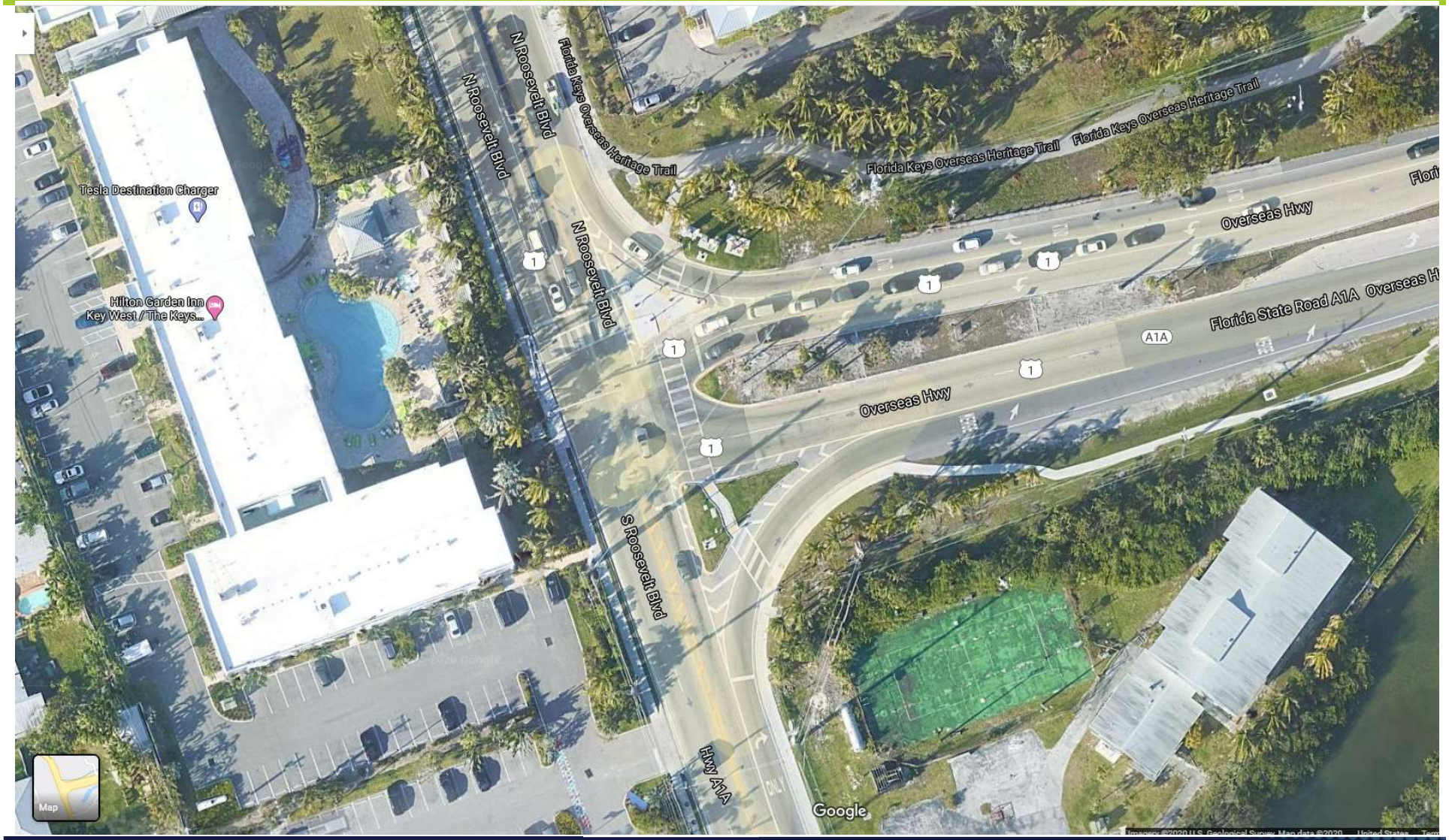
Are our TCD's on top of one another?



The three keys to good design:

- Keep it SIMPLE
- Keep it INTUITIVE
- Serve the USERS

Key West, FL – US 1



Questions?

Thank you for attending!

Florida LTAP Center
Center for Urban Transportation Research (CUTR)
University of South Florida
4202 E. Fowler Avenue, CUT100
Tampa, FL 33620-5375
www.FloridaLTAP.org
FloridaLTAP@cutr.usf.edu
(813) 974-4450
www.FloridaLTAP.org