FDOT

D7 LOCAL AGENCY

TRAFFIC SAFETY ACADEMY

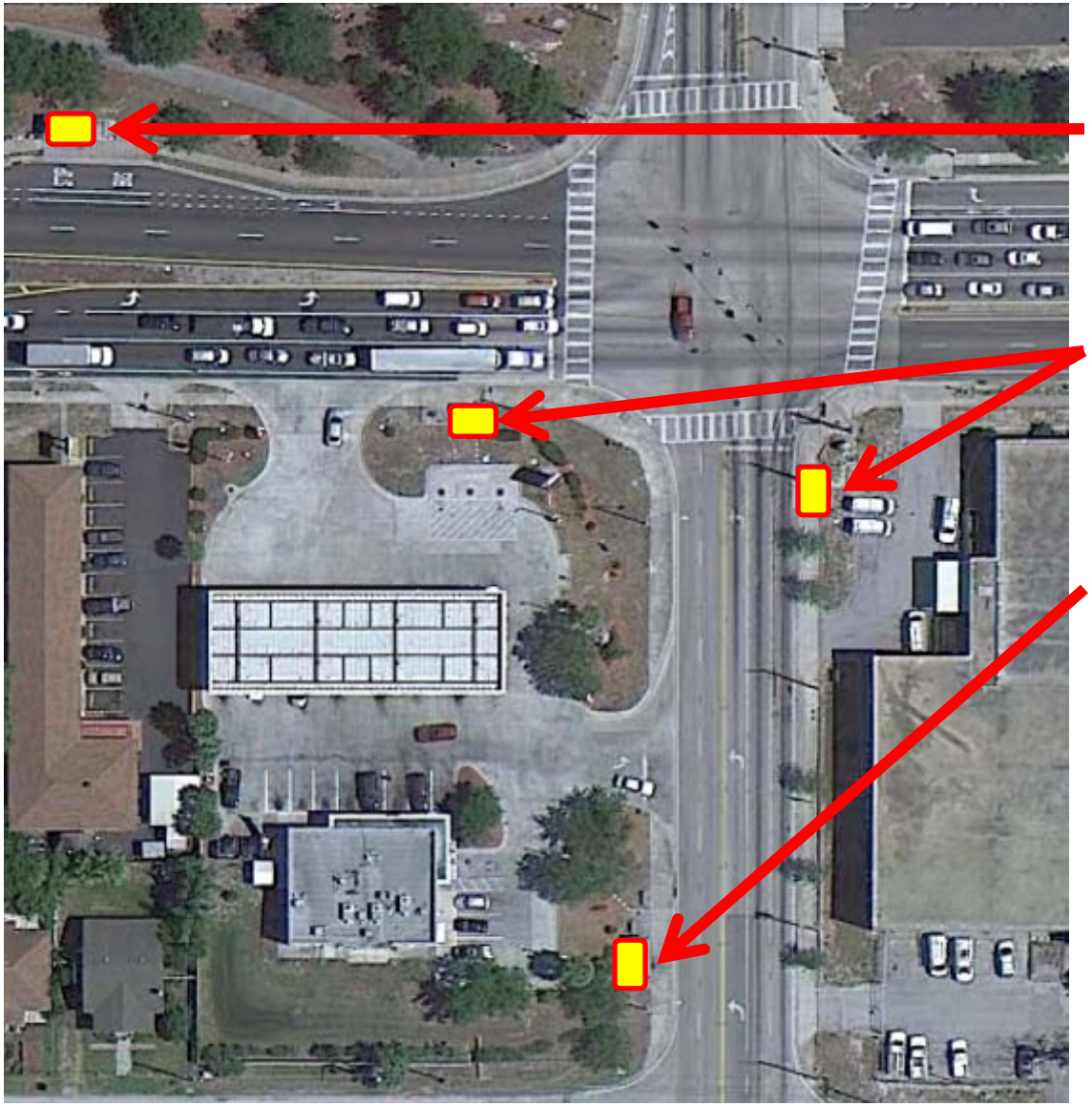
2014

# Integrating Transit Operations and Traffic Operations


Demian Miller, AICP

*"Driving Down Fatalities Through Knowledge Sharing"*

# Stops at Signalized Intersections: Near-side vs. Far-side

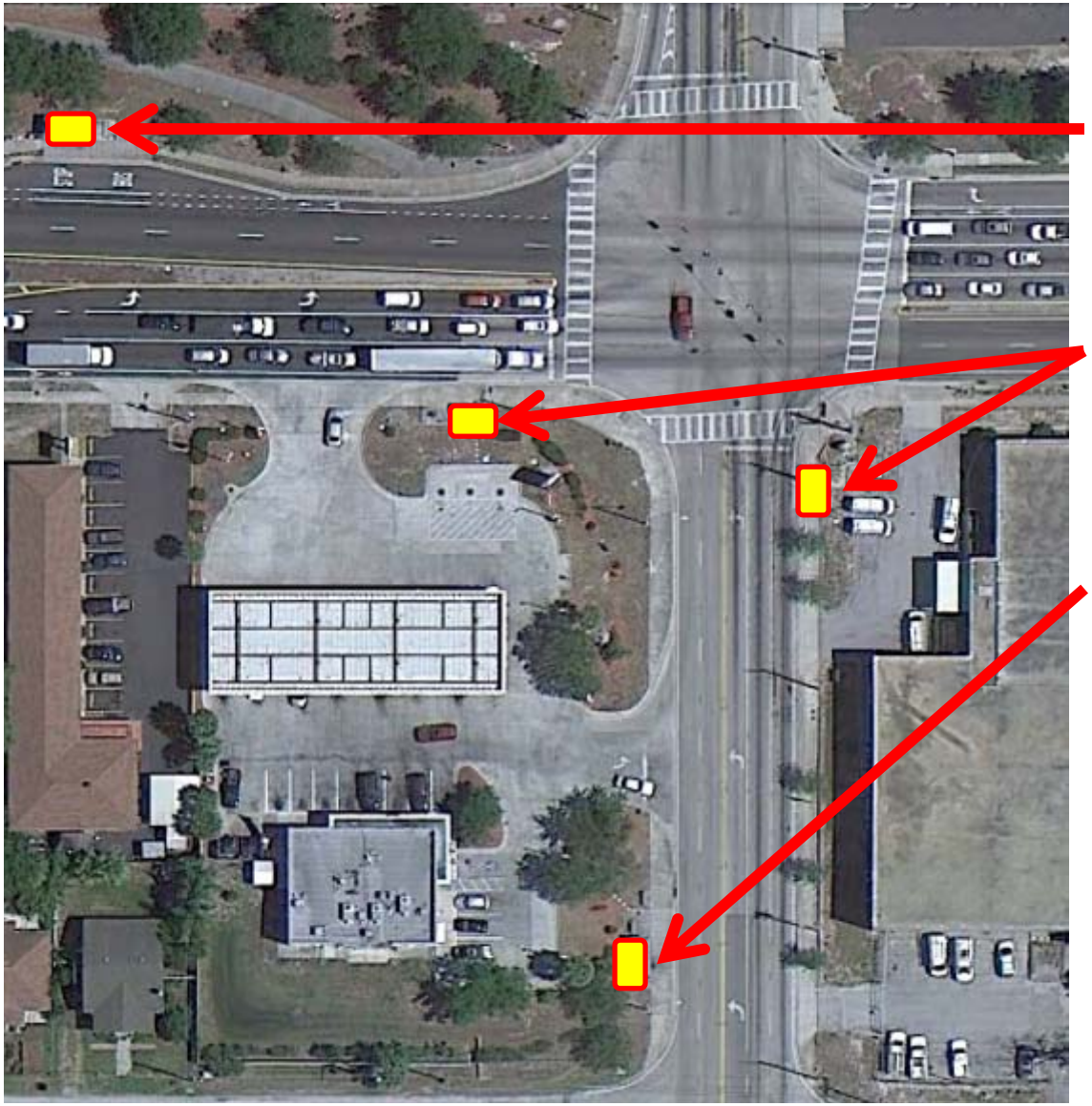


Far-side with bus bay

Near-side

Far-side, no bus bay

# Stops at Signalized Intersections: Near-side vs. Far-side

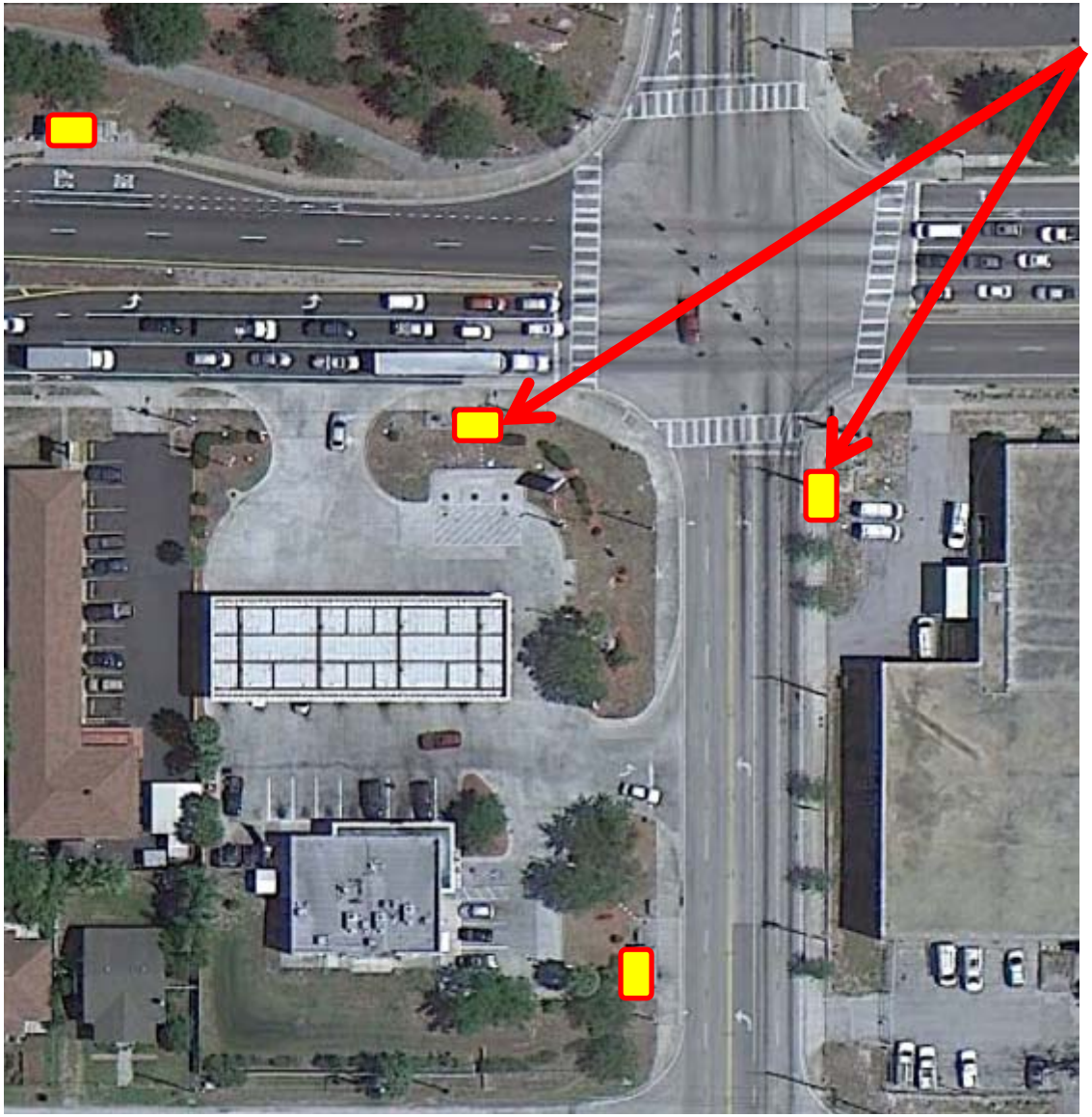


Far-side with bus bay

Near-side

Far-side, no bus bay

# Stops at Signalized Intersections: Near-side vs. Far-side



**Near-side**

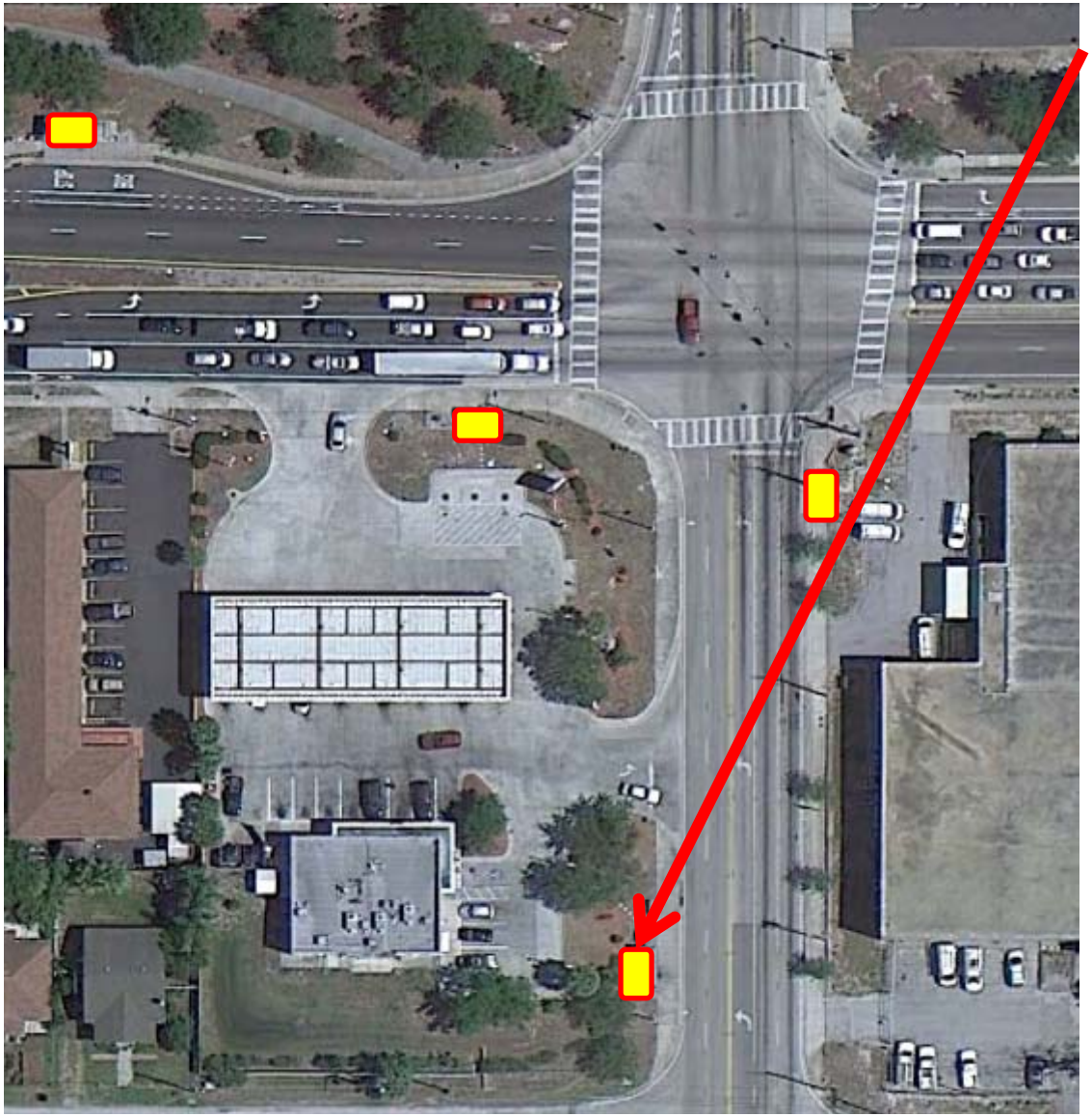
Advantages:

- Stops are closest to signal/crosswalks
- Bus leaves signal at the head of the "platoon"
- Bus *may* board/alight during red – no wasted time

Disadvantages:

- Conflict with right turning vehicles
- When bus stops on green, thru vehicles are blocked
- Bus approaching on green is likely to miss the signal

# Stops at Signalized Intersections: Near-side vs. Far-side



**Far-side**

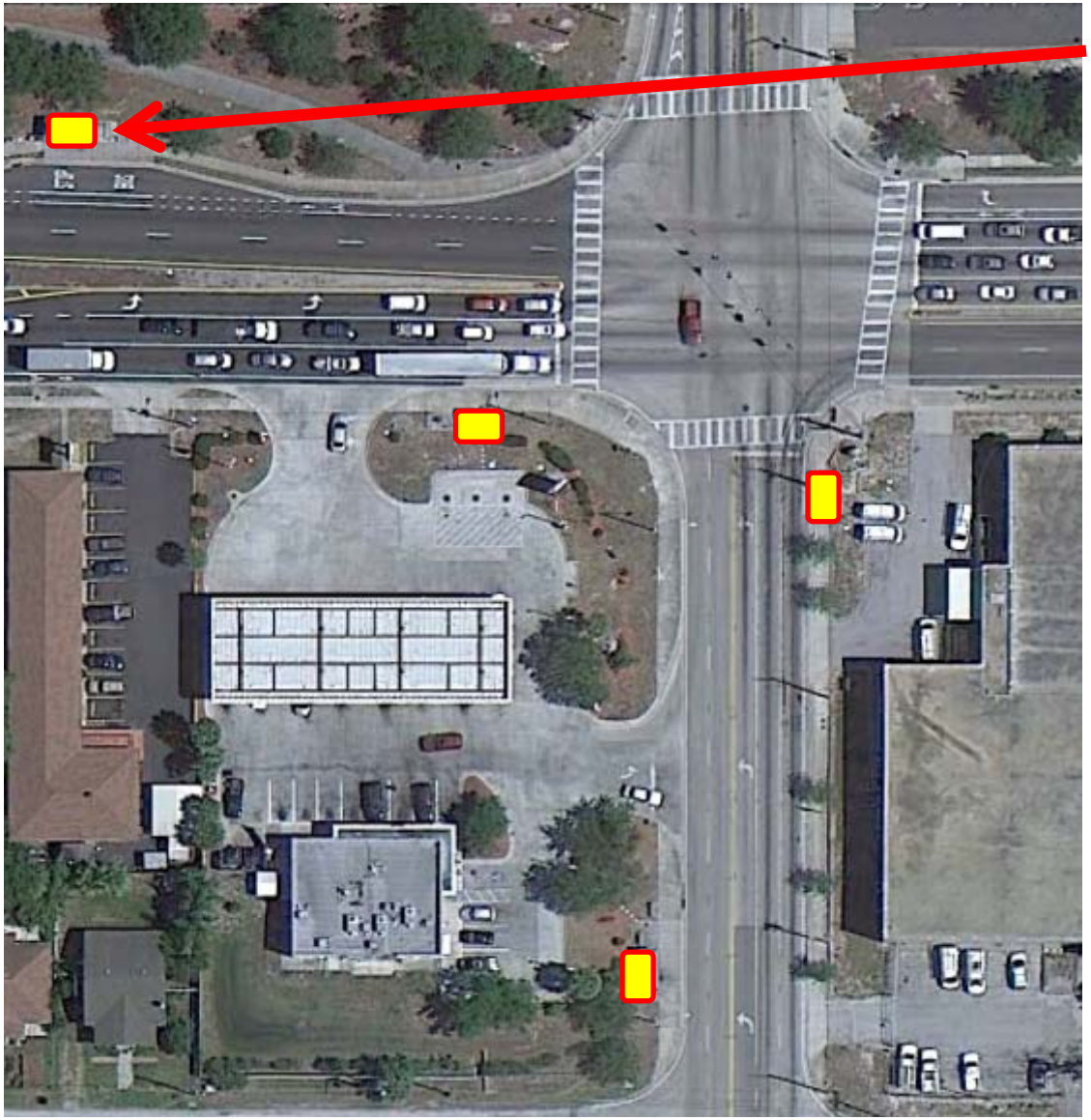
Advantages:

- Does not impact right-turning traffic
- Thru queue can proceed thru light (depending on distance to intersection)
- Bus may proceed thru when approaching a green signal

Disadvantages:

- Stop is further from signal/crosswalks
- Bus cannot use red signal to effect boarding/alighting

# Stops at Signalized Intersections: Near-side vs. Far-side



**Far-side, with bus bay**

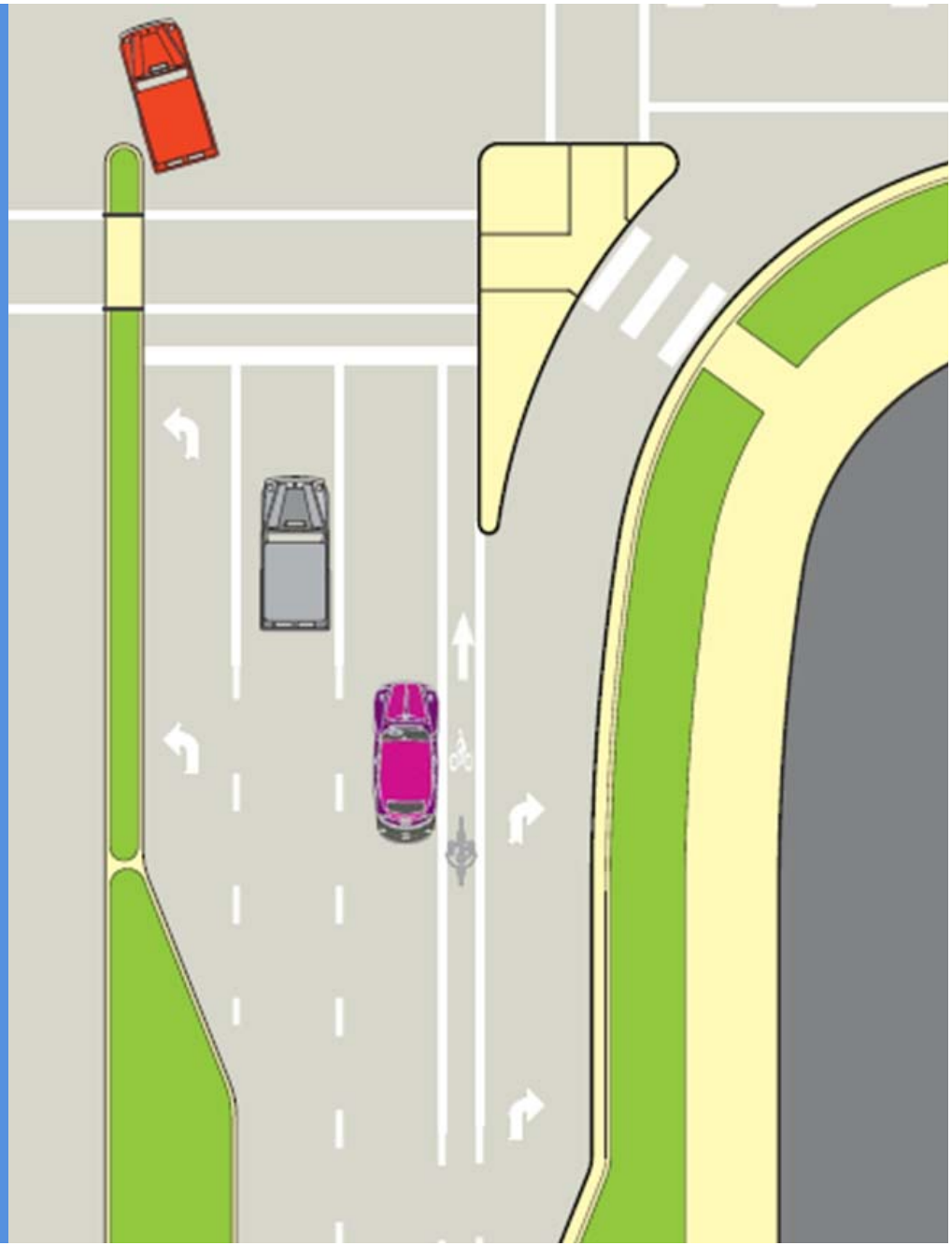
Advantages:

- Does not impact right-turning traffic or thru traffic
- Bus may proceed thru when approaching a green signal
- May be positioned closer to signal than typical far-side stop

Disadvantages:

- Bus cannot use red signal to effect boarding/alighting
- Thru traffic often does not yield to bus resulting in bus delays

# PEDESTRIAN (AND BICYCLE) SAFE ACCESS TO TRANSIT



# Pedestrian (and Bicycle) Safe Access to Transit

- Purpose/Need
- Districtwide Ped/Bike Safe Access to Transit Project
- Bus-stop Siting Considerations
- Intersection and Mid-Block Safety Tools

# Purpose/Need

- Every bus stop is a pedestrian crossing, whether designed accordingly…

# Purpose/Need

- Every bus stop is a pedestrian crossing, whether designed accordingly…

  or not.

# How far are you willing to go out of your way for an “improved” crossing?

**Would you walk:**

# How far are you willing to go out of your way for an “improved” crossing?

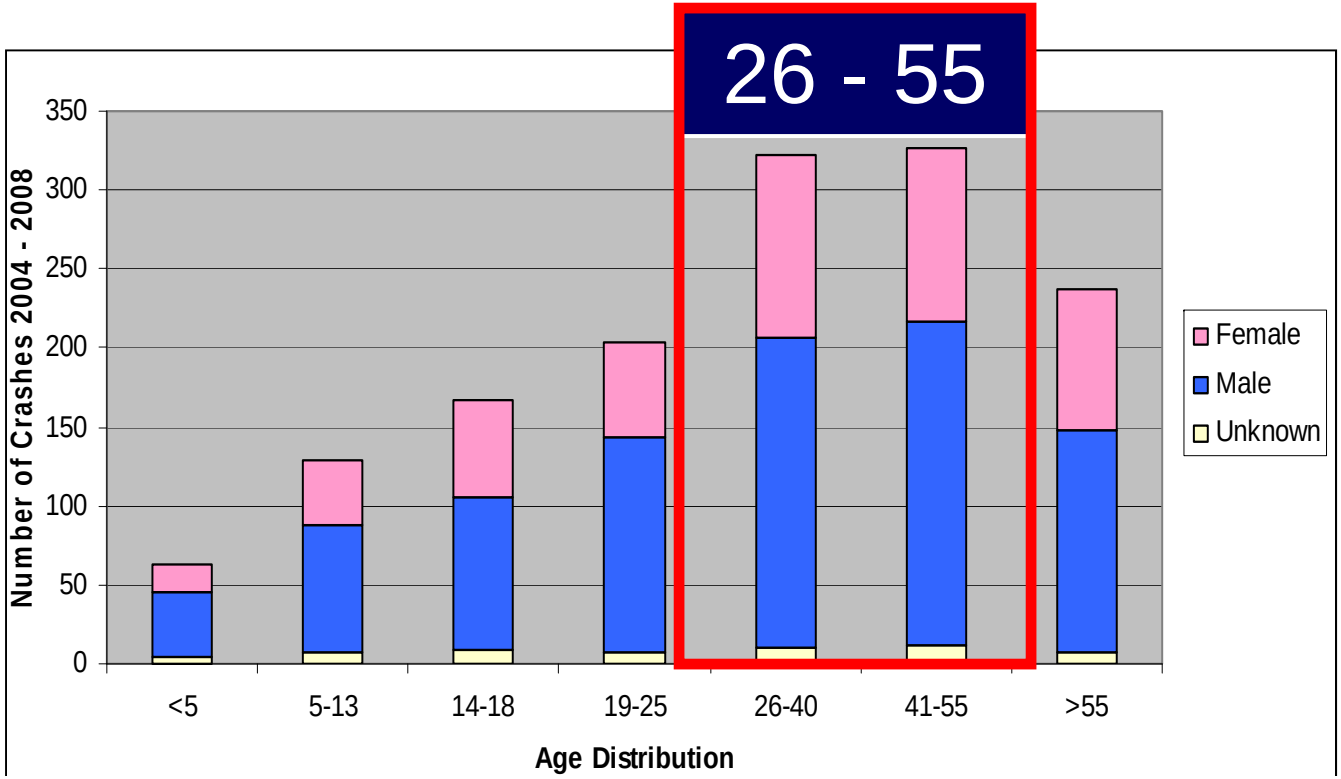
**Would you walk:**

# Purpose/Need

- Most pedestrian crashes occur when pedestrians attempt to cross major roadways

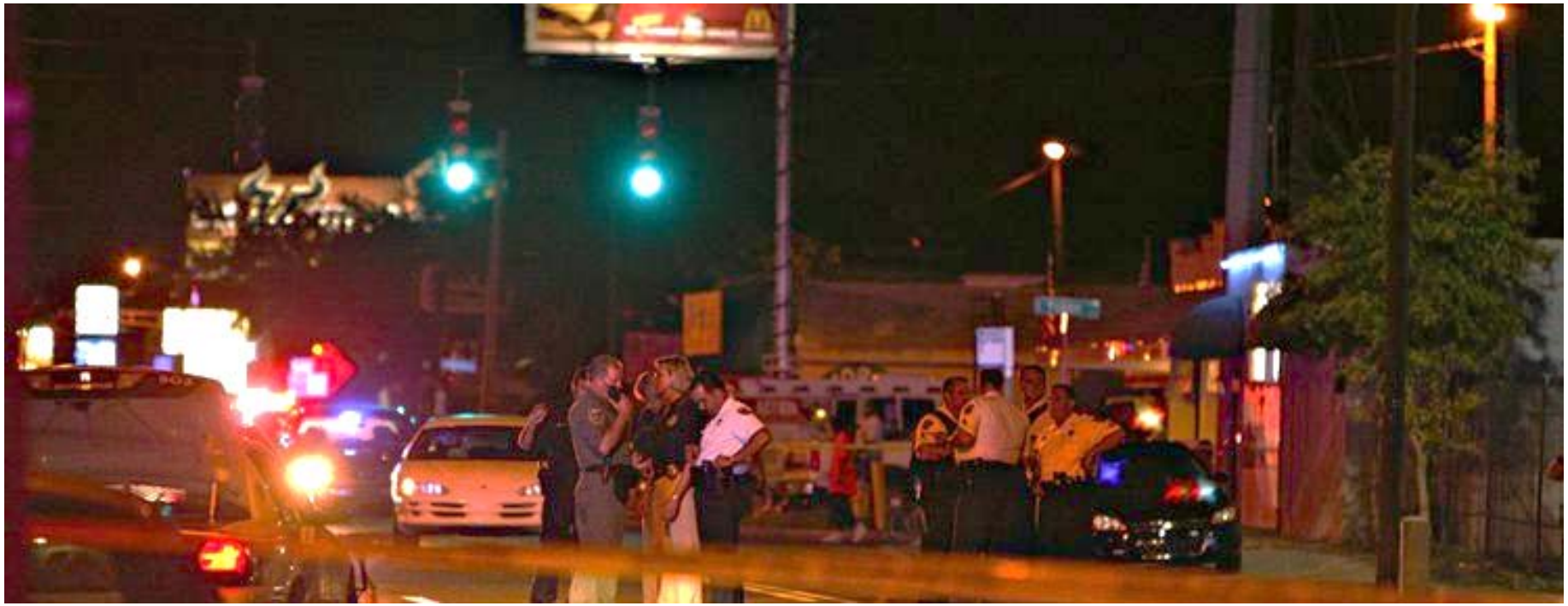
# Purpose/Need

- Most pedestrian crashes…
  - Occur when pedestrians attempt to cross major roadways
  - Involve adult pedestrians

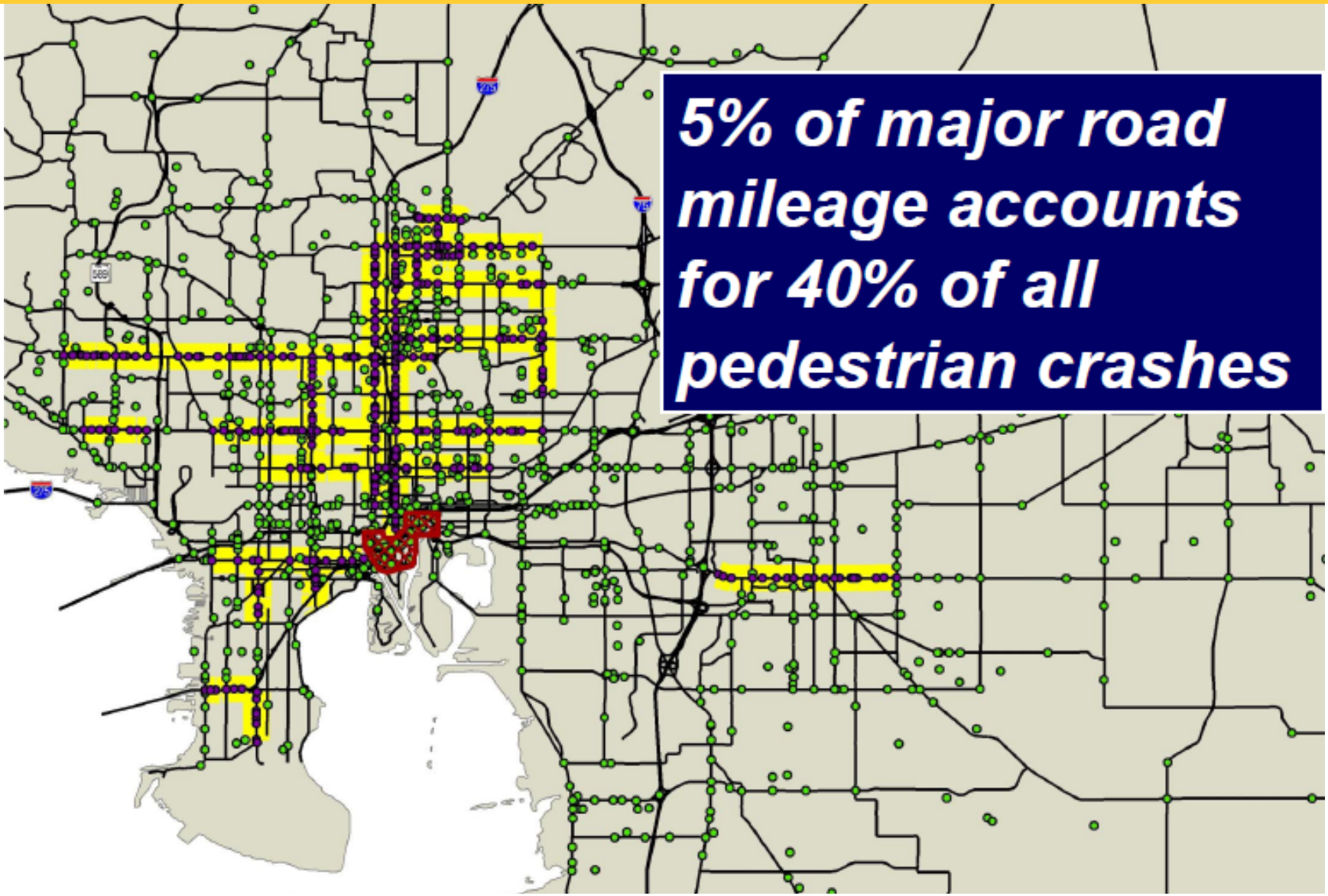


# Purpose/Need

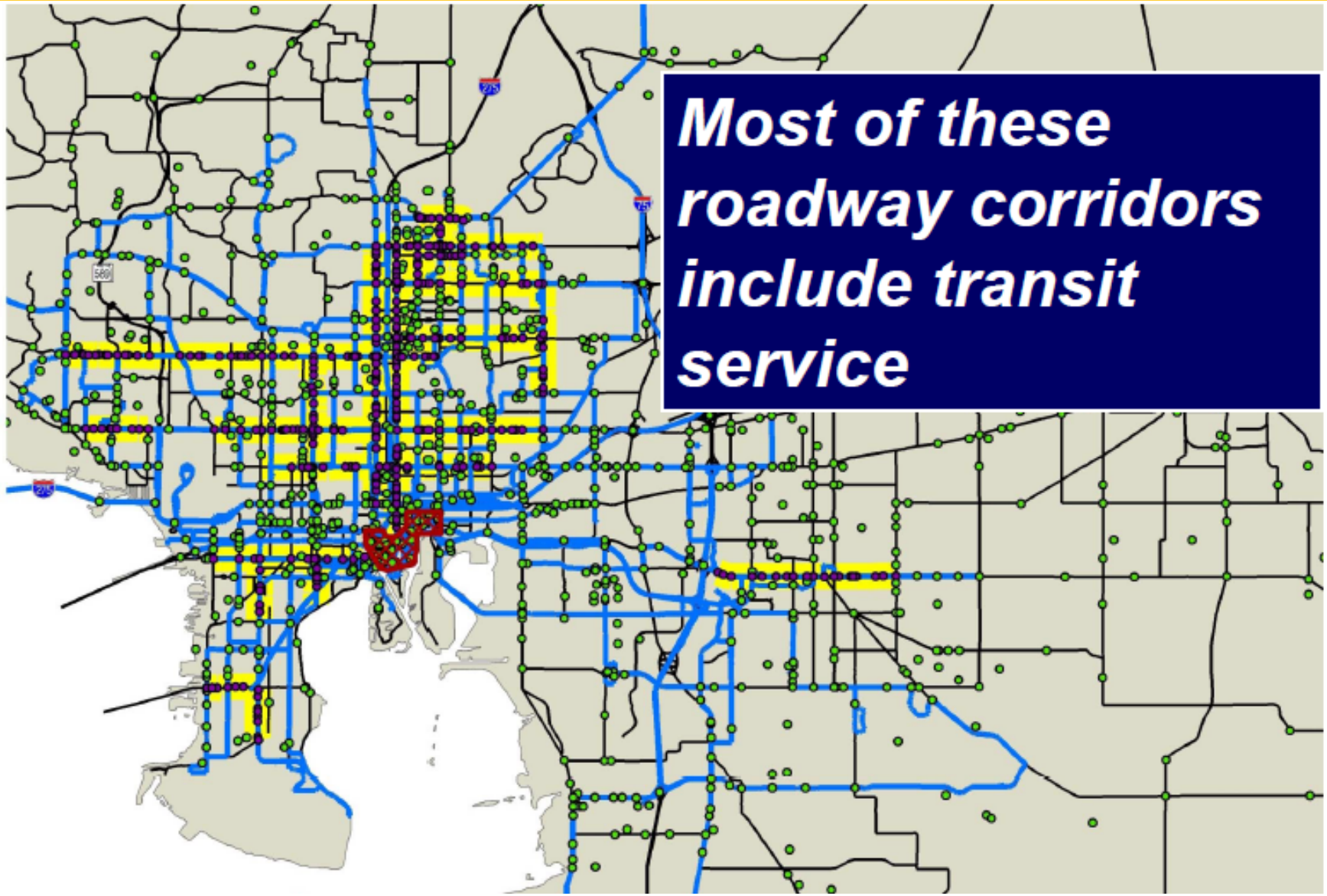
- There is an over-representation of pedestrian crashes…
  - At night (about 40%)
  - In low income/auto-ownership areas



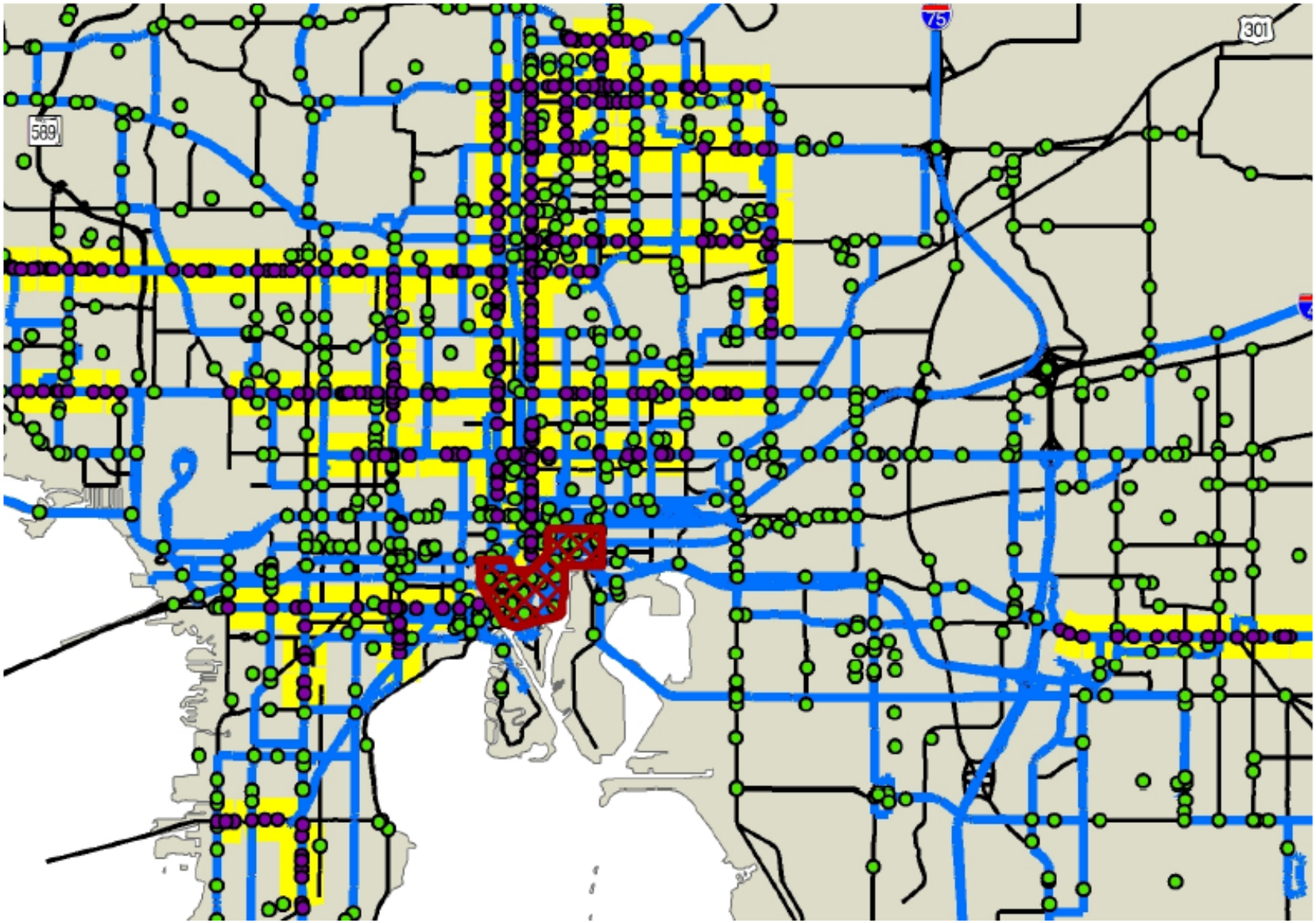
# Purpose/Need



# Purpose/Need



# Purpose/Need



# Purpose/Need

- Pedestrian safety and transit correlate:
  - Geographically
  - Demographically

- Providing safe access to transit
  - Benefits transit riders
  - Provides focal points for pedestrian safety investment along corridors—a benefit to all pedestrians!
  - Can improve route and roadway performance

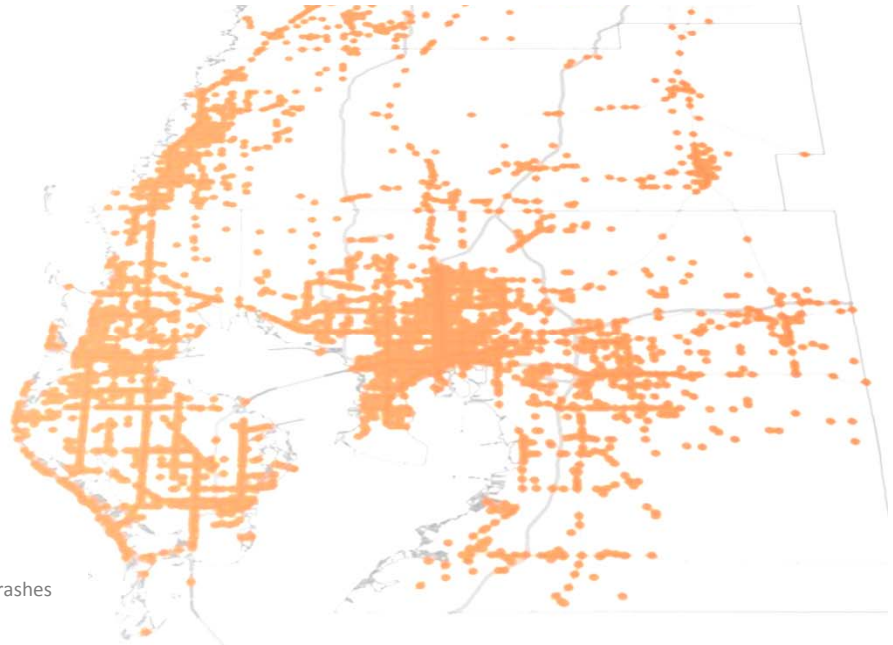
# Pedestrian (and Bicycle) Safe Access to Transit

- Purpose/Need
- **Districtwide Ped/Bike Safe Access to Transit Project**
- Bus-stop Siting Considerations
- Intersection and Mid-Block Safety Tools

# Project Overview

## Why?

- Recognition of **relationship** between higher ridership **transit routes** and higher-frequency bicycle and pedestrian **crash corridors.**

# Project Overview

**Objectives:**

- **Promote** regional bike/pedestrian **safety** on roadways and transit corridors
- Identify short-term enhancements and long-term practices to **create safe**, **comfortable**, **accessible**, and **welcoming** bicycle/pedestrian **environments**
- **Encourage multi-modal activity** to generate economic vitality

# Progress To-Date

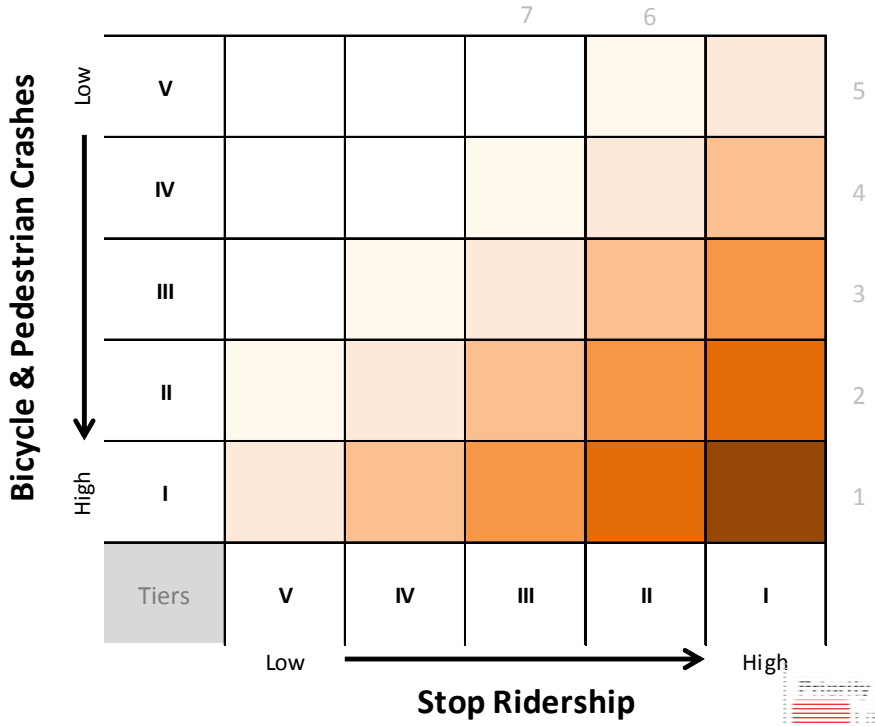
- Conducted initial field reviews/assessments
- Developing initial recommendations
- Identified locations for more detailed analysis

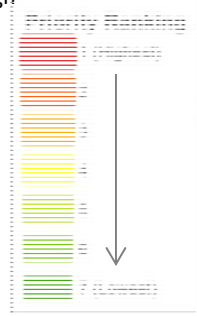
# Identifying Locations

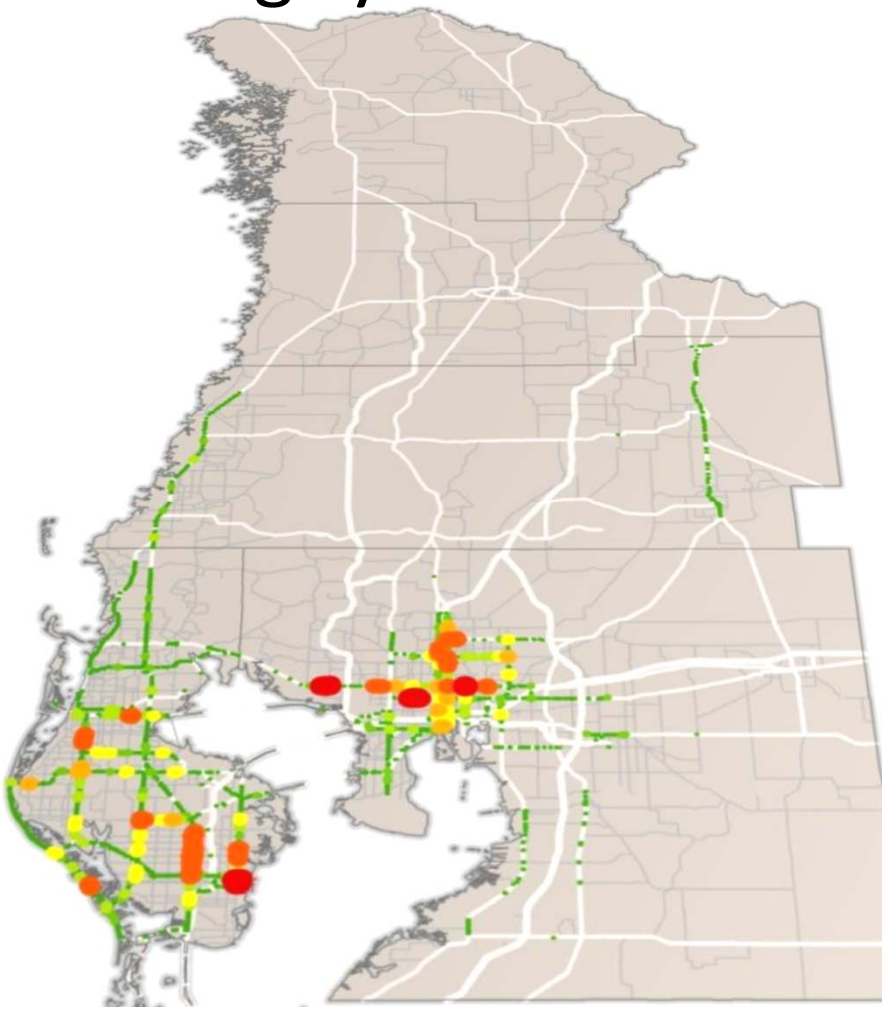
- Identify & prioritize locations based on:
  - History of bicycle and pedestrian crashes
  - Land use information/pedestrian attractors
  - High-stop-level ridership transit agency input
  - ➢ *Initially focused on "on-system" stop locations*

# Prioritizing Locations

- Developed a quantifiable ranking system:





# Identifying Review Locations

- Solicited transit agency input
- Additional considerations:


**Roadway Projects**

- FDOT Work Program
- Local Capital Projects

**Roadway Data**

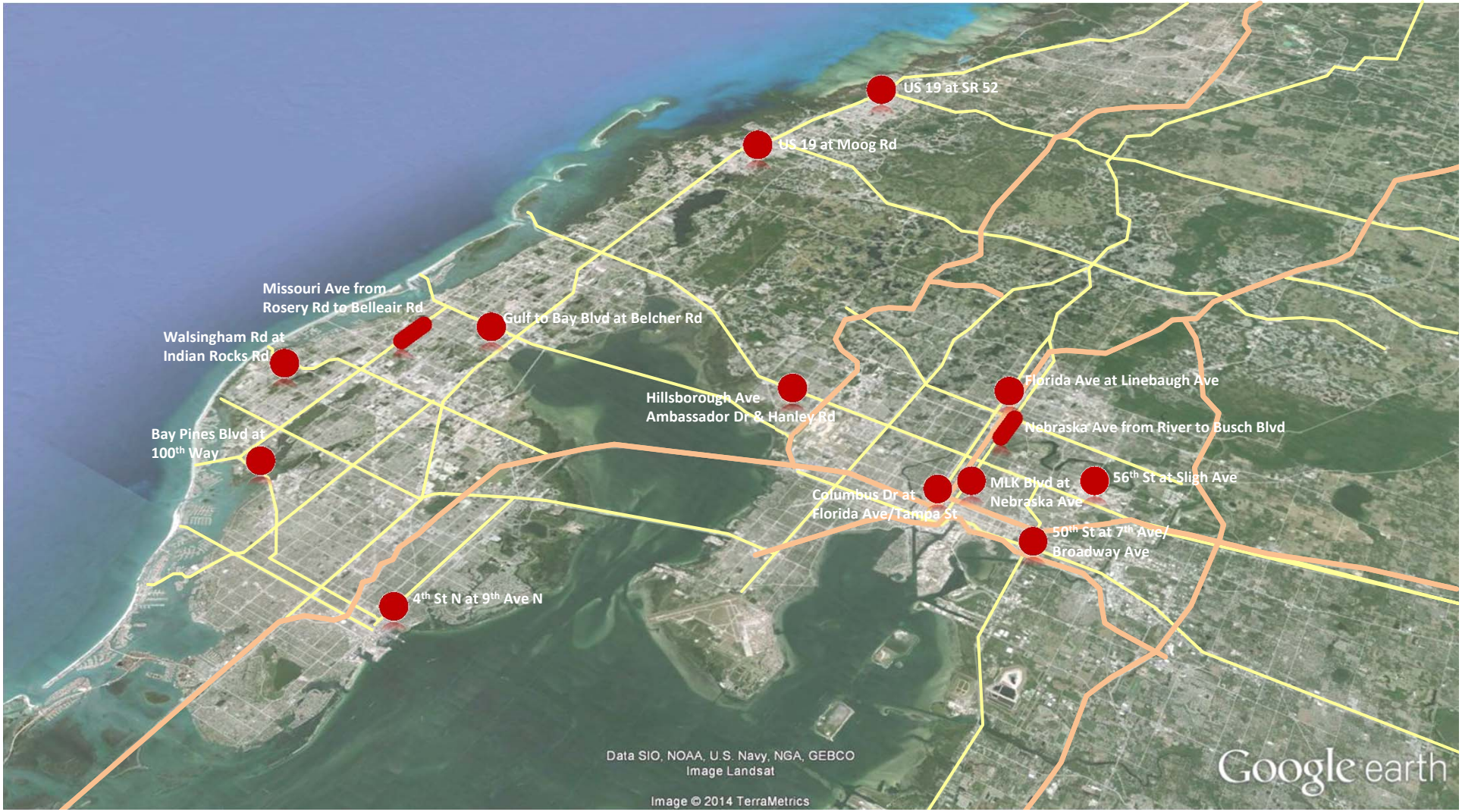
- AADT
- Pavement Conditions
- Number of Lanes
- Speed
- Existing Lighting
- Existing Sidewalks/Bike Lanes

**Land Use**

- Planning Areas (CRAs)
- Activity Centers

# Selected Locations

- Locations Selected for Initial Field Reviews:



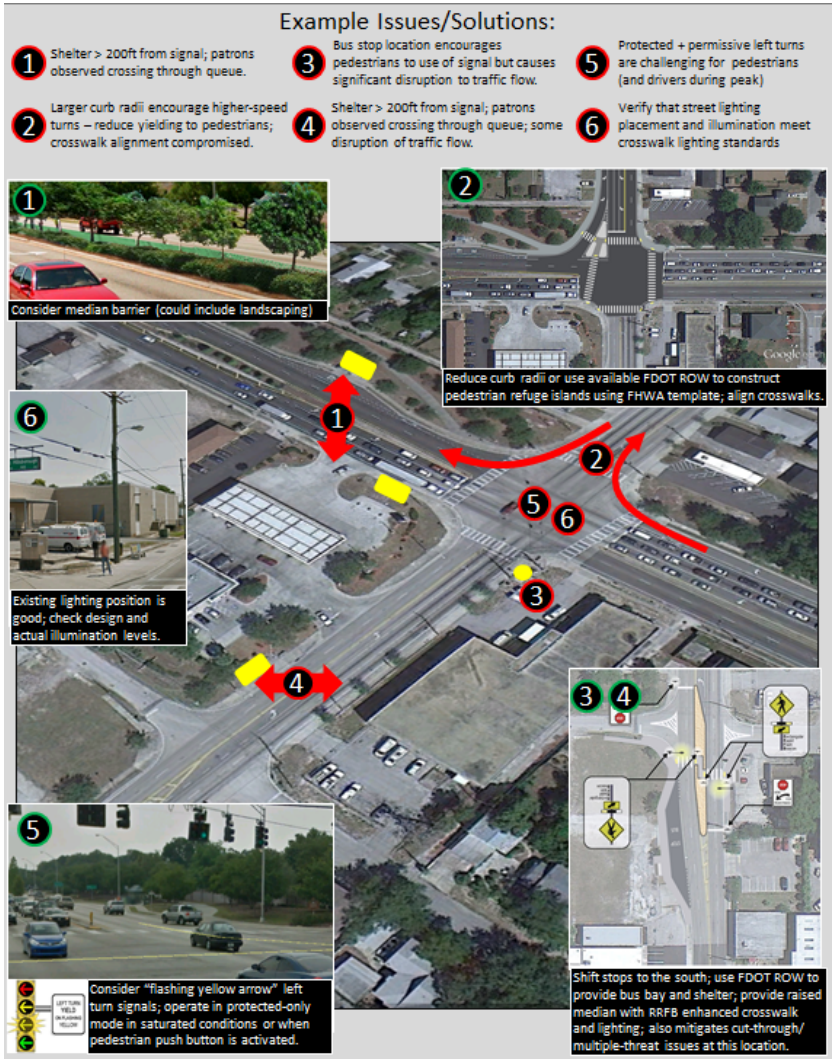
# Field Reviews

- **Identify** contributing safety **deficiencies impacting** bicycle/pedestrian **movement** and **access** to transit
- **Assessment** of existing bicycle/pedestrian/ transit **facilities** and transit/traffic **operations**
- **Observation** of general travel **patterns** and **behavior** (traffic/pedestrian/bicycle/transit)

# Observations/Considerations

Most recommendations fall into the following categories:

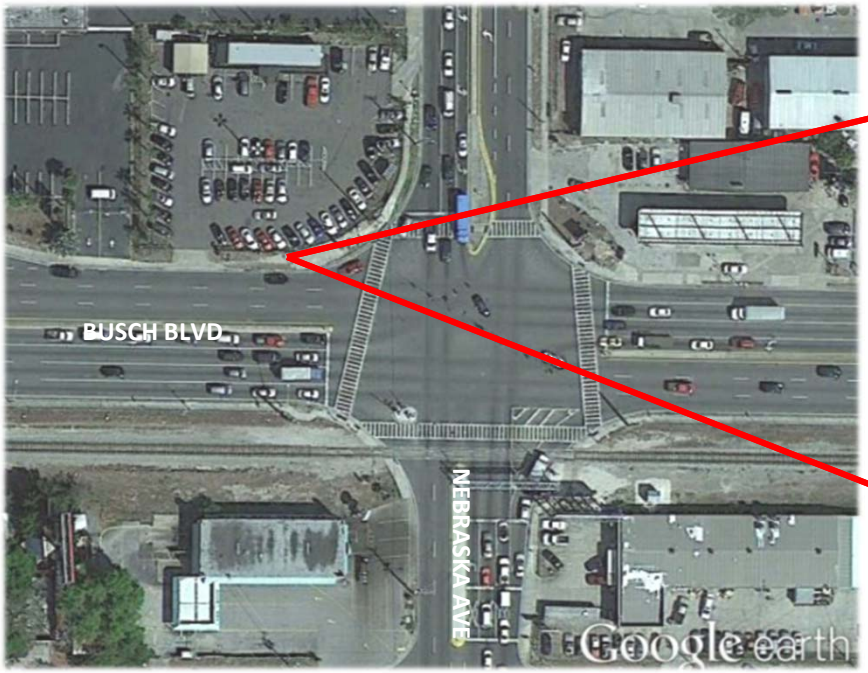
- Pedestrian Facilities
- Bicycle Facilities
- Transit Facilities
- Lighting
- Access Management
- Education/Enforcement
- Geometric design
- Signal modifications



# Observation/Consideration Examples

## Busch Blvd at Nebraska Ave:

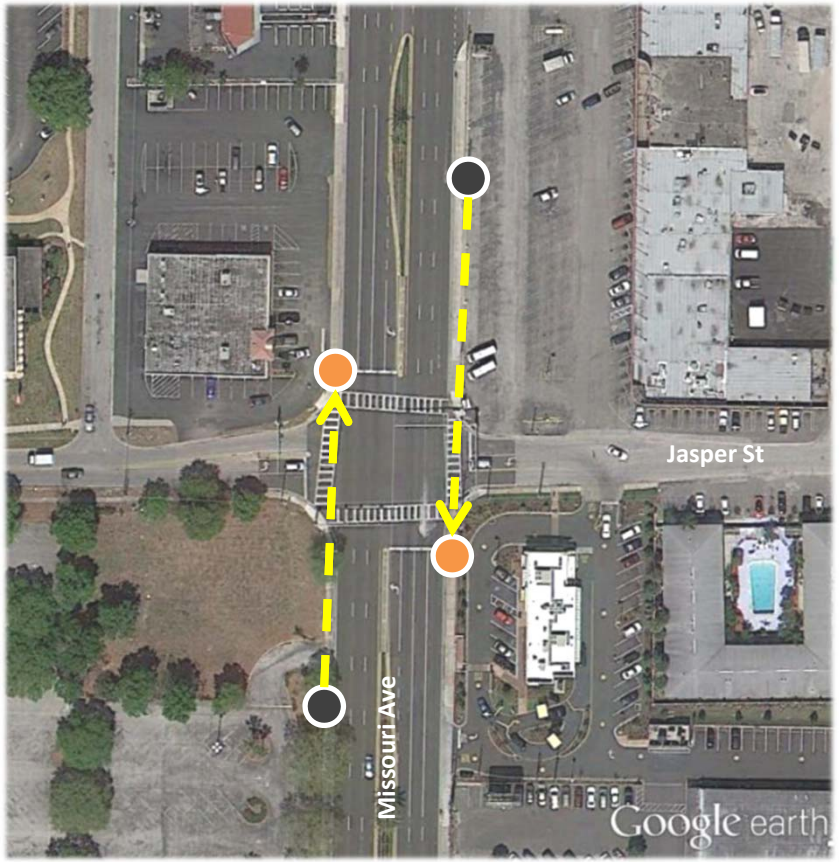
- Install/complete sidewalk




# Observation/Consideration Examples

- Relocate bus stops
  - Close to signalized intersections/protected crossings

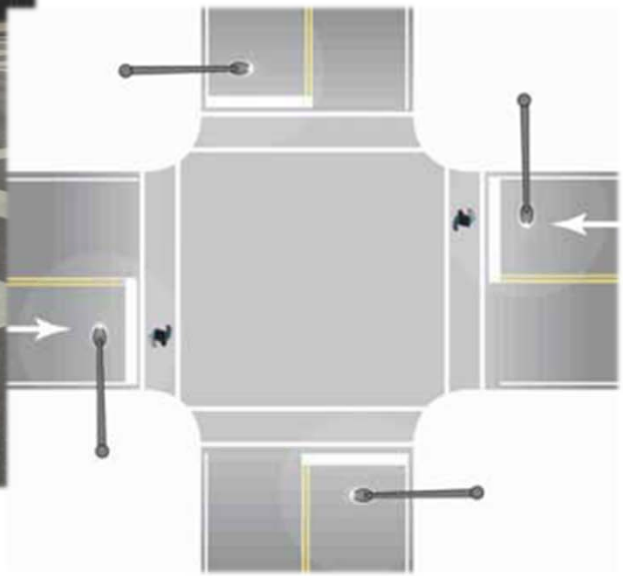
Nebraska Ave at Waters Ave



# Observation/Consideration Examples

- Enhance Intersection Lighting:

Nebraska Ave at Yukon St, Tampa



# Observation/Consideration Examples

- Enhance Corridor Lighting:
  - Maintenance


Missouri Ave, Largo


4th St N, St Petersburg

# Still To-Come

- Finalize recommendations
  - Some may require further analysis
- Work program coordination
  - Incorporate strategies into the “scoping” process
- Project funding strategies
  - Identify potential funding sources
- Community engagement, input, and education

# Further Information

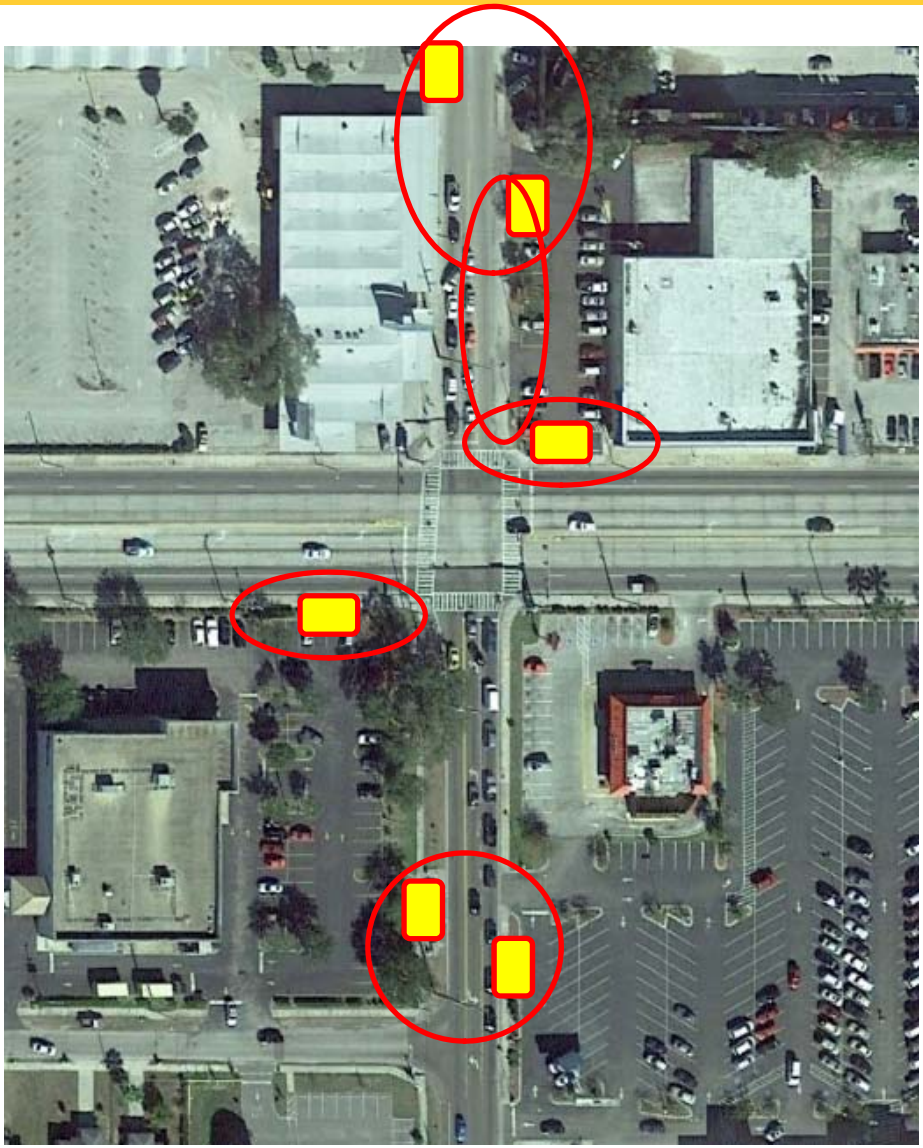
- Project website:
  www.tampabaytrafficsafety.com/D7BPAT

Elba Lopez
Regional Transit/Intermodal Systems Planning
Florida Department of Transportation District Seven
813-975-6403
Elba.lopez@dot.state.fl.us

# Pedestrian (and Bicycle) Safe Access to Transit

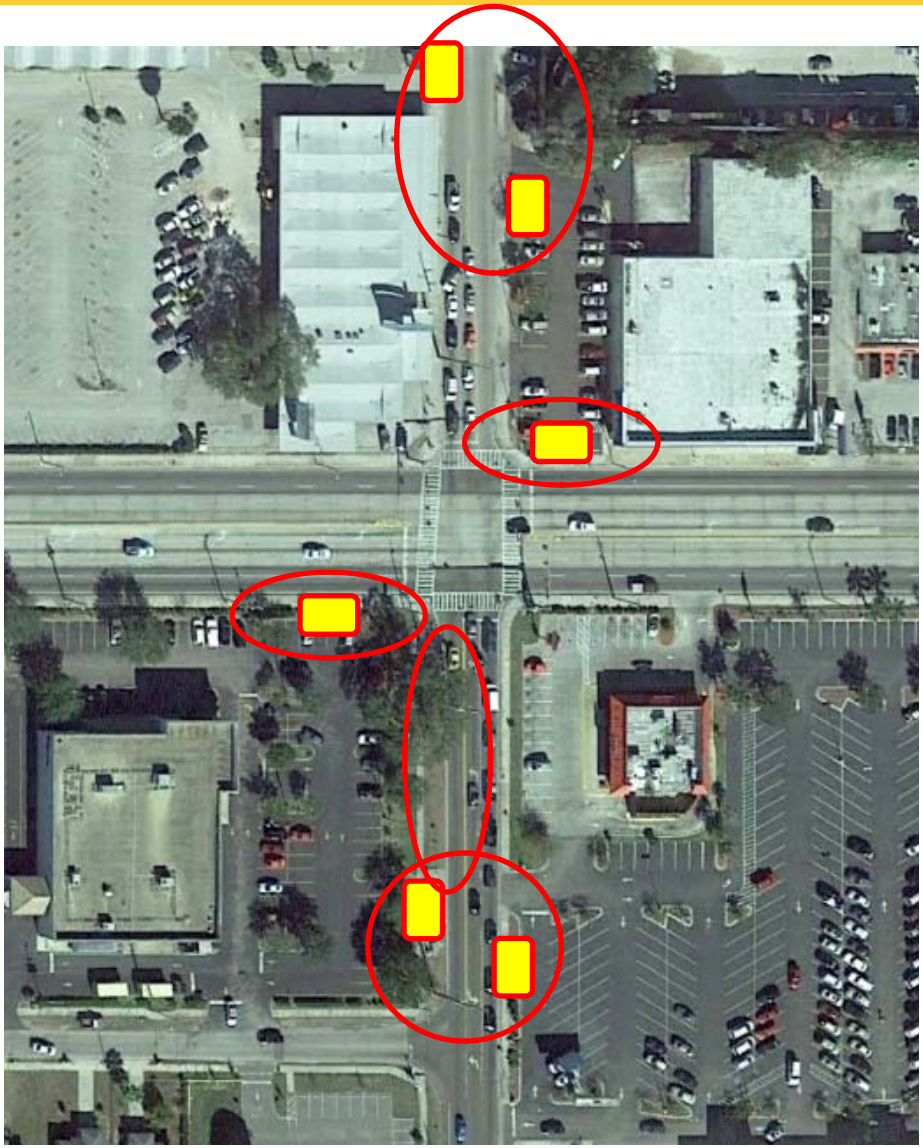
- Purpose/Need
- Districtwide Ped/Bike Safe Access to Transit Project
- **Bus-stop Siting for Pedestrians**
  - Near-side/far side (pedestrian and traffic interactions)
  - Mid-block considerations
  - Other locational considerations
- Intersection and Mid-Block Safety Tools

# Stop Placement Discussion



- What's good?
  - Nearside stops on arterial close to signal
  - Nearside and farside option on collector reduces need to cross arterial
  - Extra pavement acts as bus bay for northbound farside stop

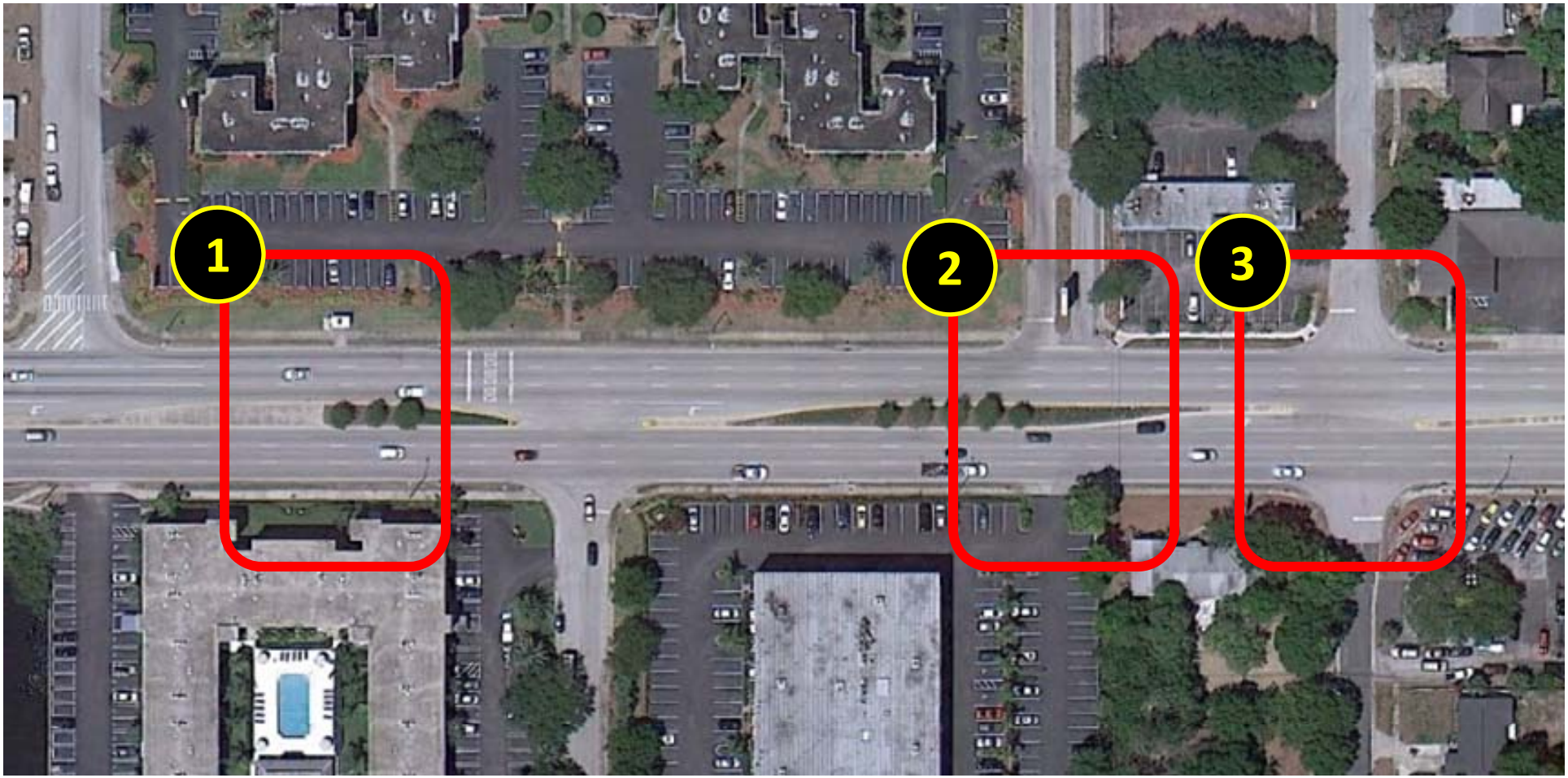
# Stop Placement Discussion



- Challenges?
  - Stops close to signal may not be accessible to bus until after signal turns green
  - Collector stops encourage influence area crossing
  - Southbound farside stop blocks thru and eastbound right turn

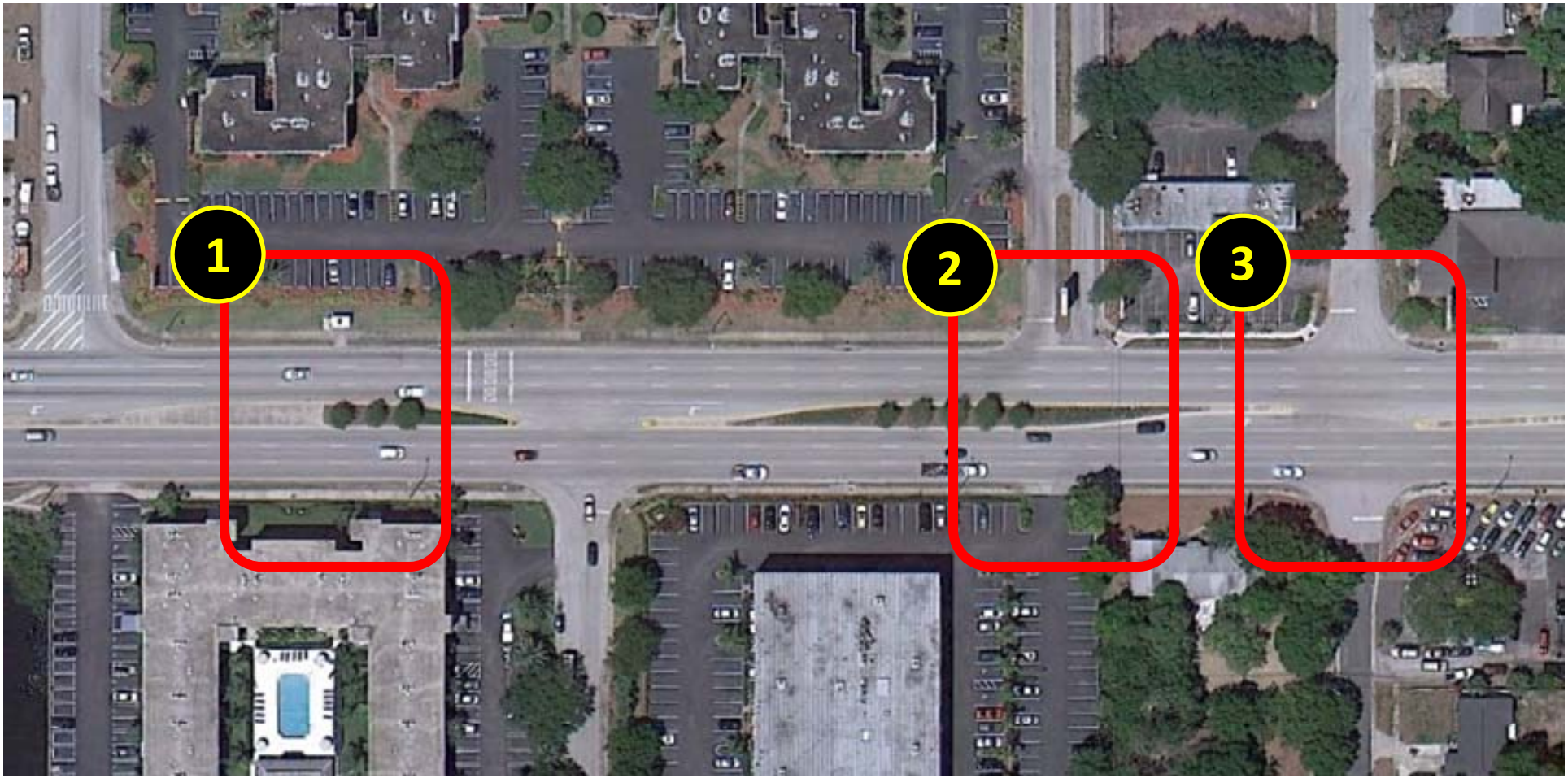
# Mid-block locations

- What is a “mid-block” location?



# Mid-block locations

- Which location is likely to be the safest crossing?

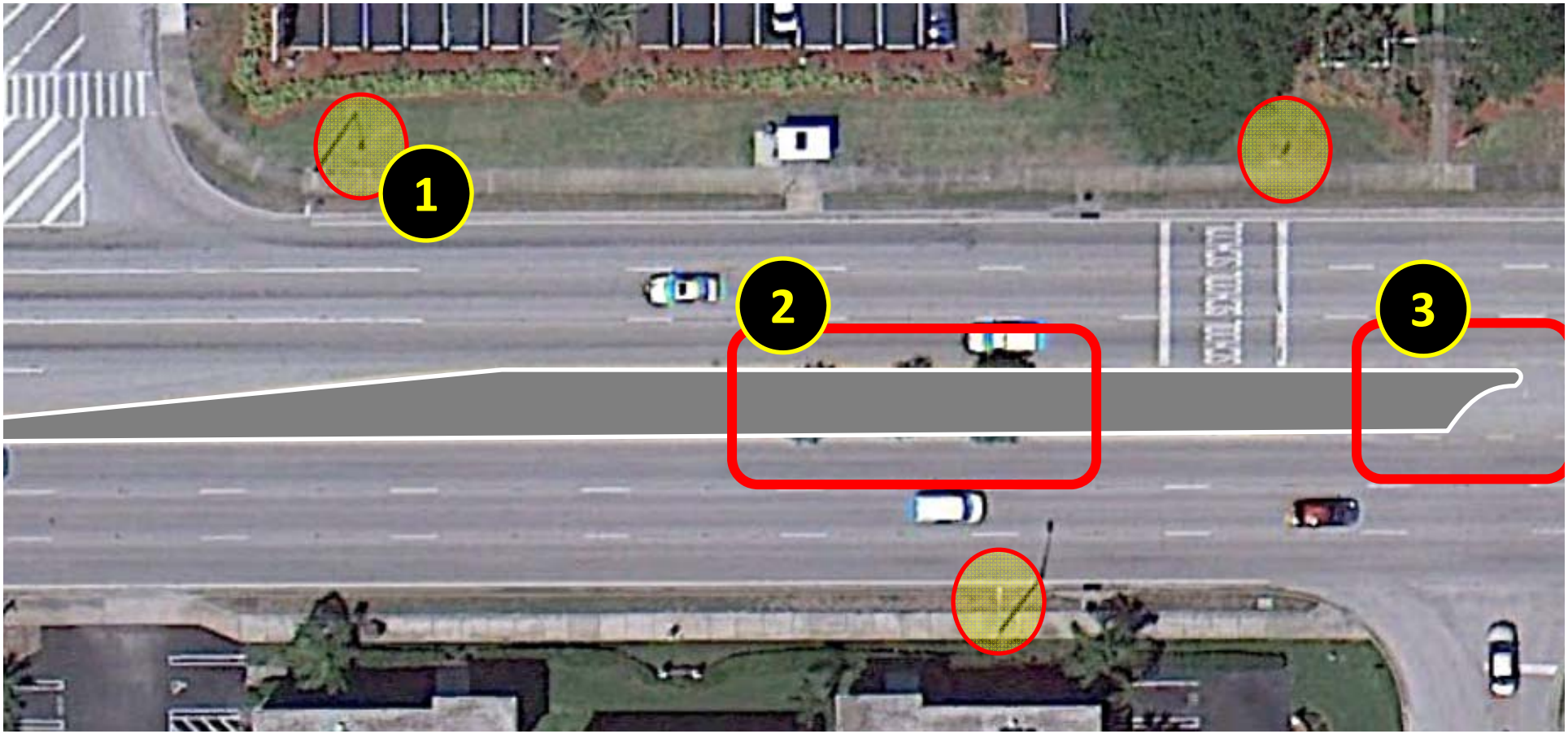


# Mid-block locations

- Why?
  - Median Refuge; Reduced threats from turning traffic

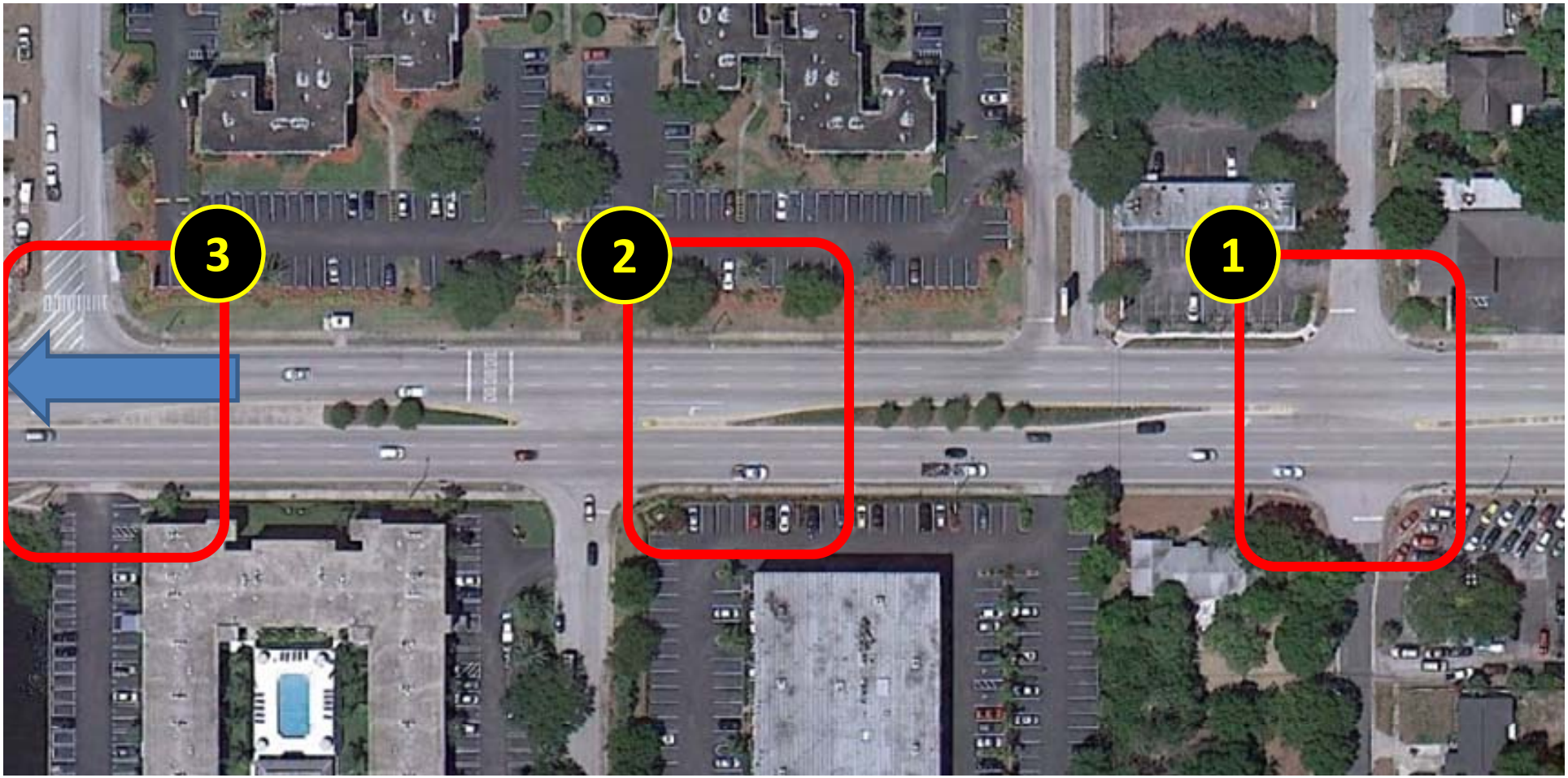
# Mid-block locations

- What could make it better?
  - 1. Lighting; 2. consider cutting trees; 3. prohibit direct lefts



# Mid-block locations

- Areas to Avoid:
  - 1. Median openings; 2. turn lanes; 3. standing queues



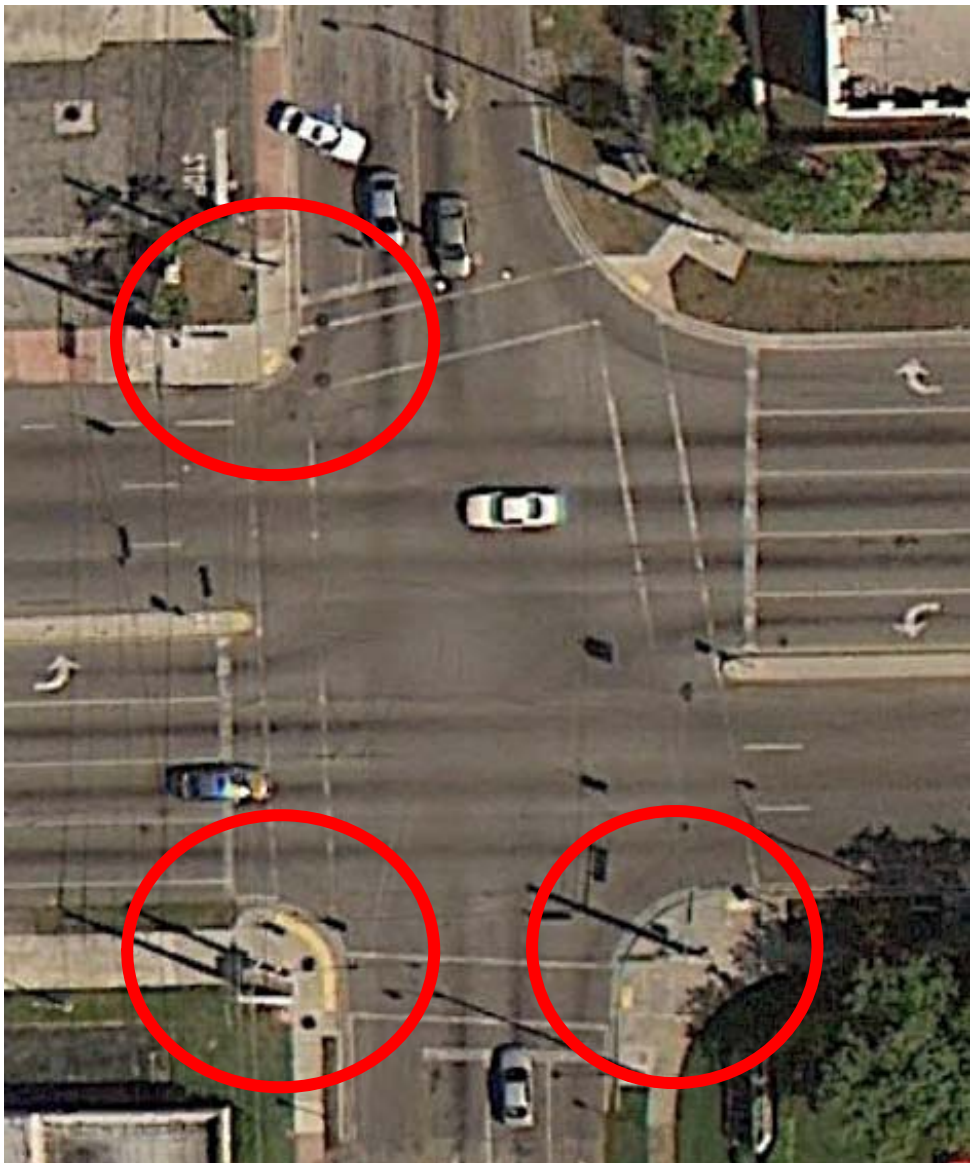
# Other Considerations

- Proximity to generators attractors
- Ease of transfers
- Driveway conflicts
- Right-of-way/easements
- Drainage inlets

# Pedestrian (and Bicycle) Safe Access to Transit

- Purpose/Need
- Districtwide Ped/Bike Safe Access to Transit Project
- Bus-stop Siting for Pedestrians
- Intersection and Mid-Block Safety Tools
  - Intersection Geometry
  - Pavement Markings & Signs
  - Signalization
  - Lighting
  - Mid-Block Crossing
  - Queue Jump and Bus Islands

# Intersection Geometry: Curb Radii



Narrow radii preferred.

Wide curb radii:

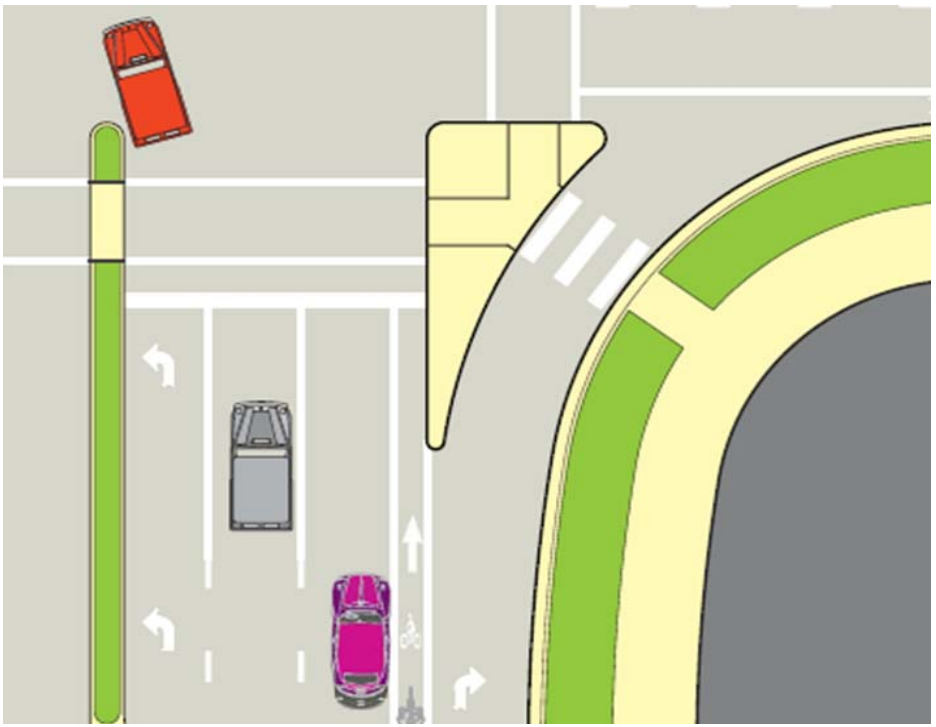
- Allow for higher speed turns which
- Reduce drivers' ability/willingness to yield, and
- Increase pedestrian crossing distance

# Intersection Geometry: Curb Radii

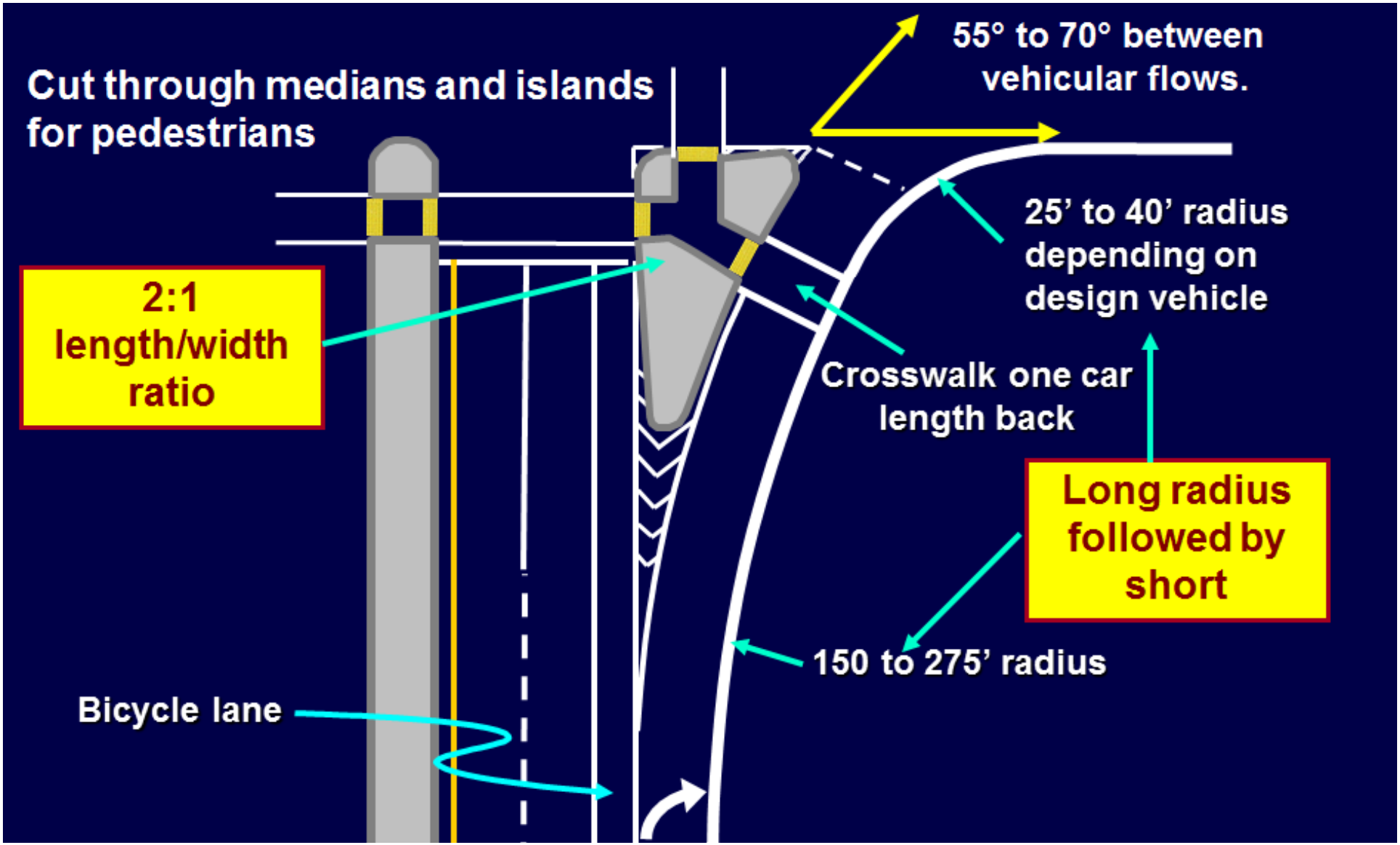
Why not this one?

# Intersection Geometry: Curb Radii

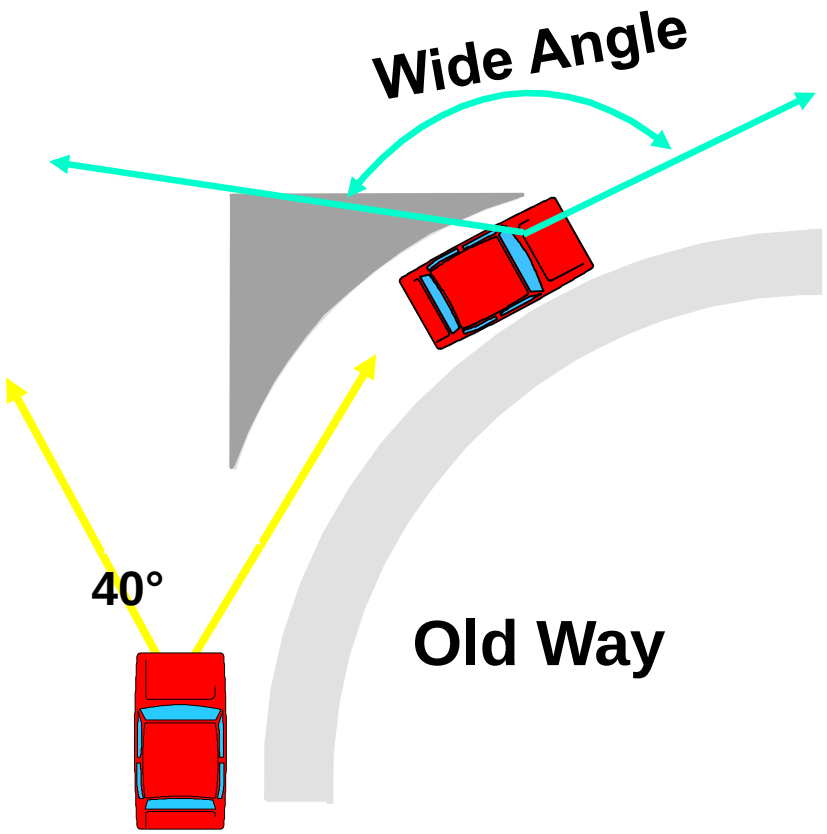
When large vehicles cannot be made to turn into inner lanes, consider right turn islands.



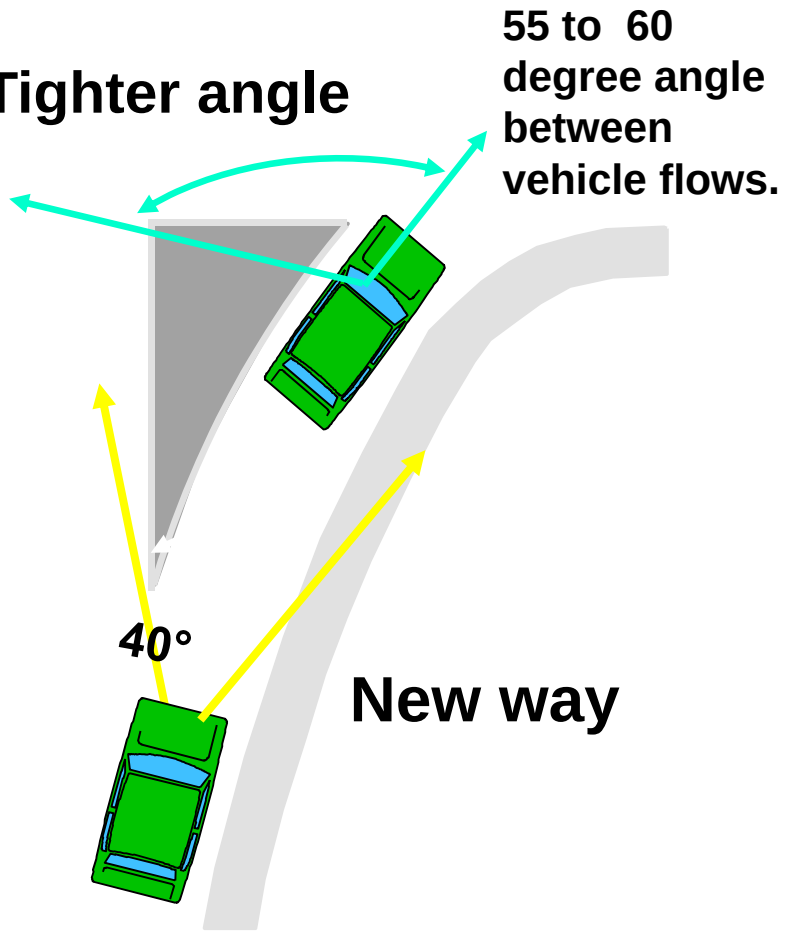
# Right-Turn Island Design Details



# Low-Speed Pedestrian Design Compared to Conventional Higher-Speed Design

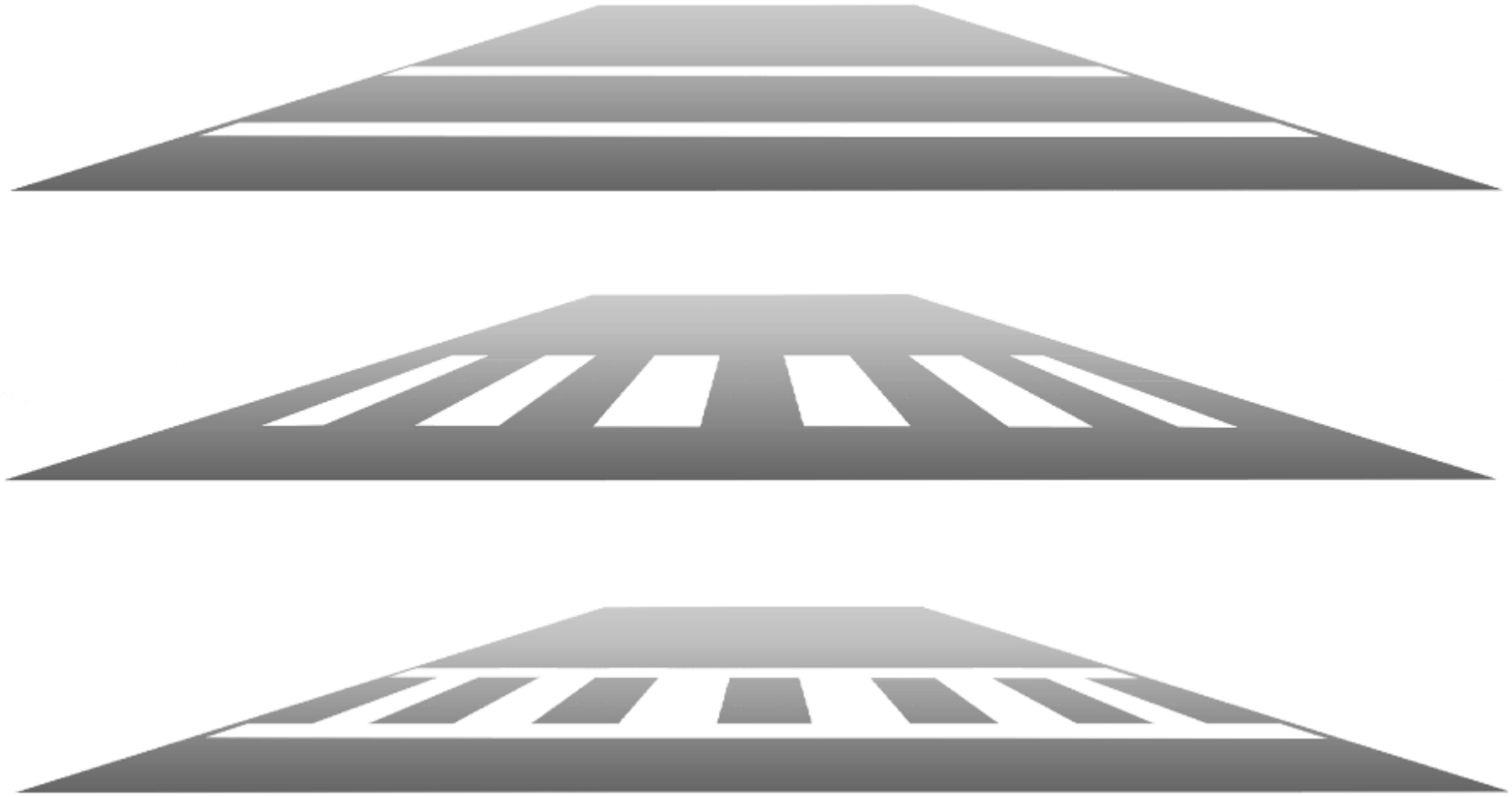



**High speed, head turner = low visibility of pedestrians**

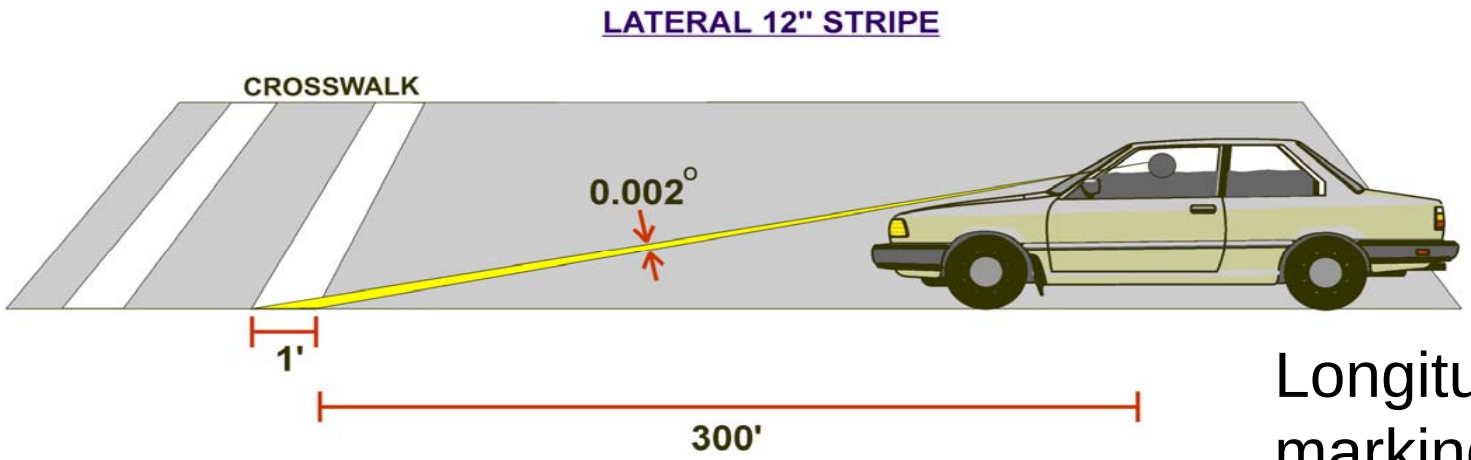



**Slow speed, good angle = good visibility of pedestrians**

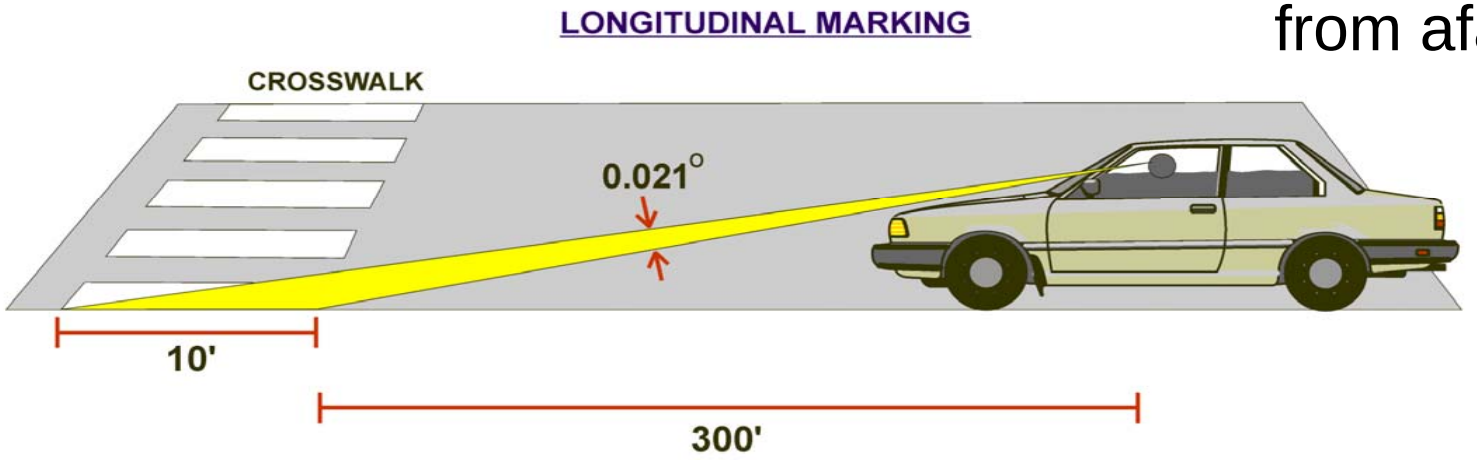
# Sign and Pavement Markings



# Crosswalk Visibility




Longitudinal markings are more visible to driver from afar



# Crosswalk Visibility

Longitudinal markings with transverse markings – very visible

# Textured Crosswalks:  Effective?

What Pedestrian Sees

# Textured Crosswalks:  Effective?

What the driver sees

# Retrofitting Textured Crosswalks

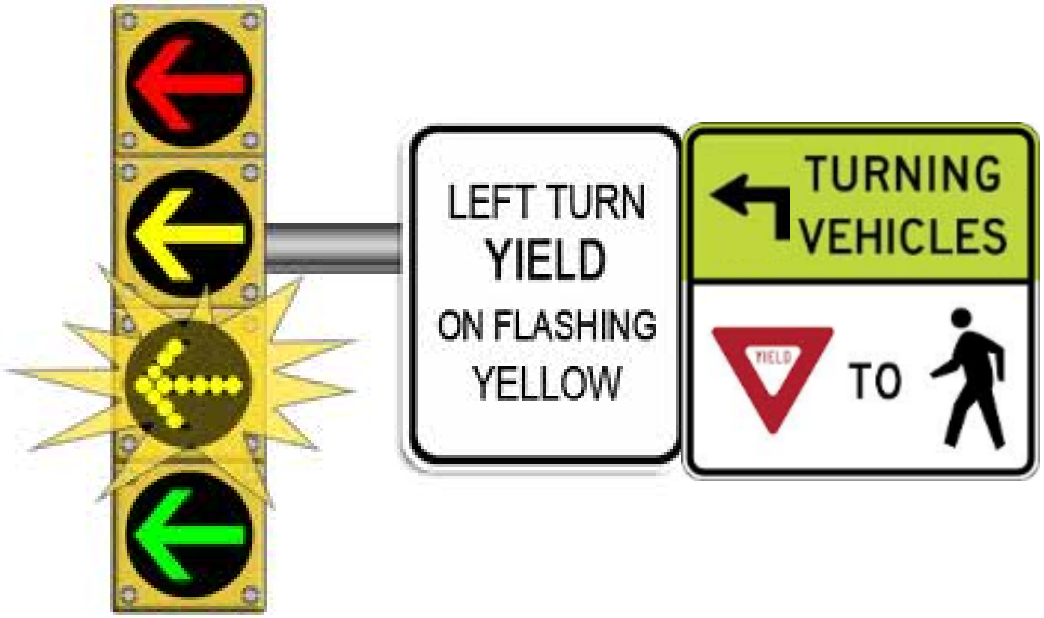


Supplement with white lines to increase visibility

# Yield to Pedestrians Signs


R10-15R

Right turn yield-to-pedestrians



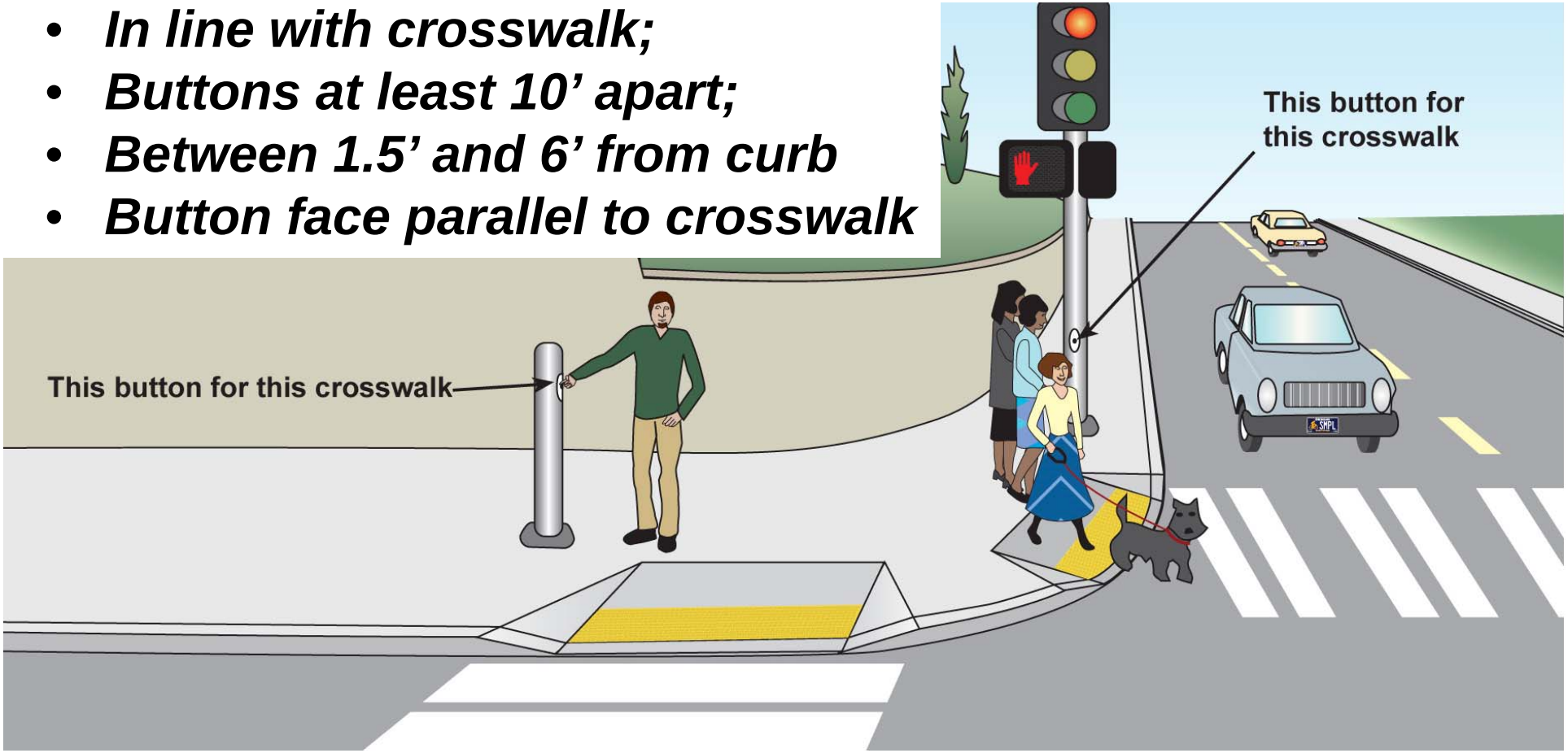

R10-15L

Left turn yield-to-pedestrians

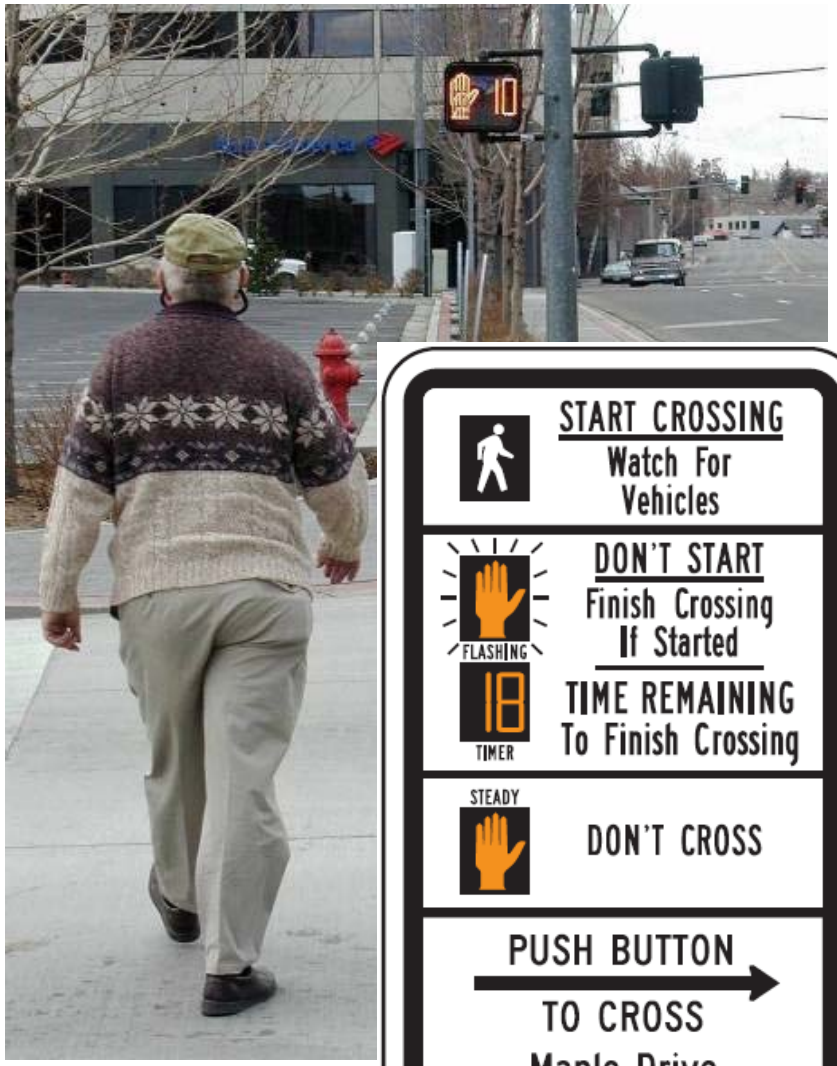
# Proper Push-Button Placement

***MUTCD Recommendations:***

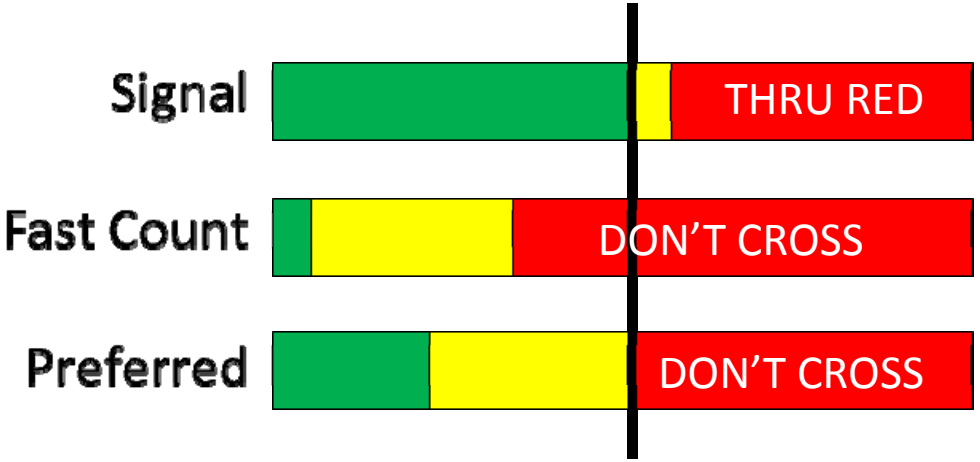
- ***In line with crosswalk;***
- ***Buttons at least 10’ apart;***
- ***Between 1.5’ and 6’ from curb***
- ***Button face parallel to crosswalk***



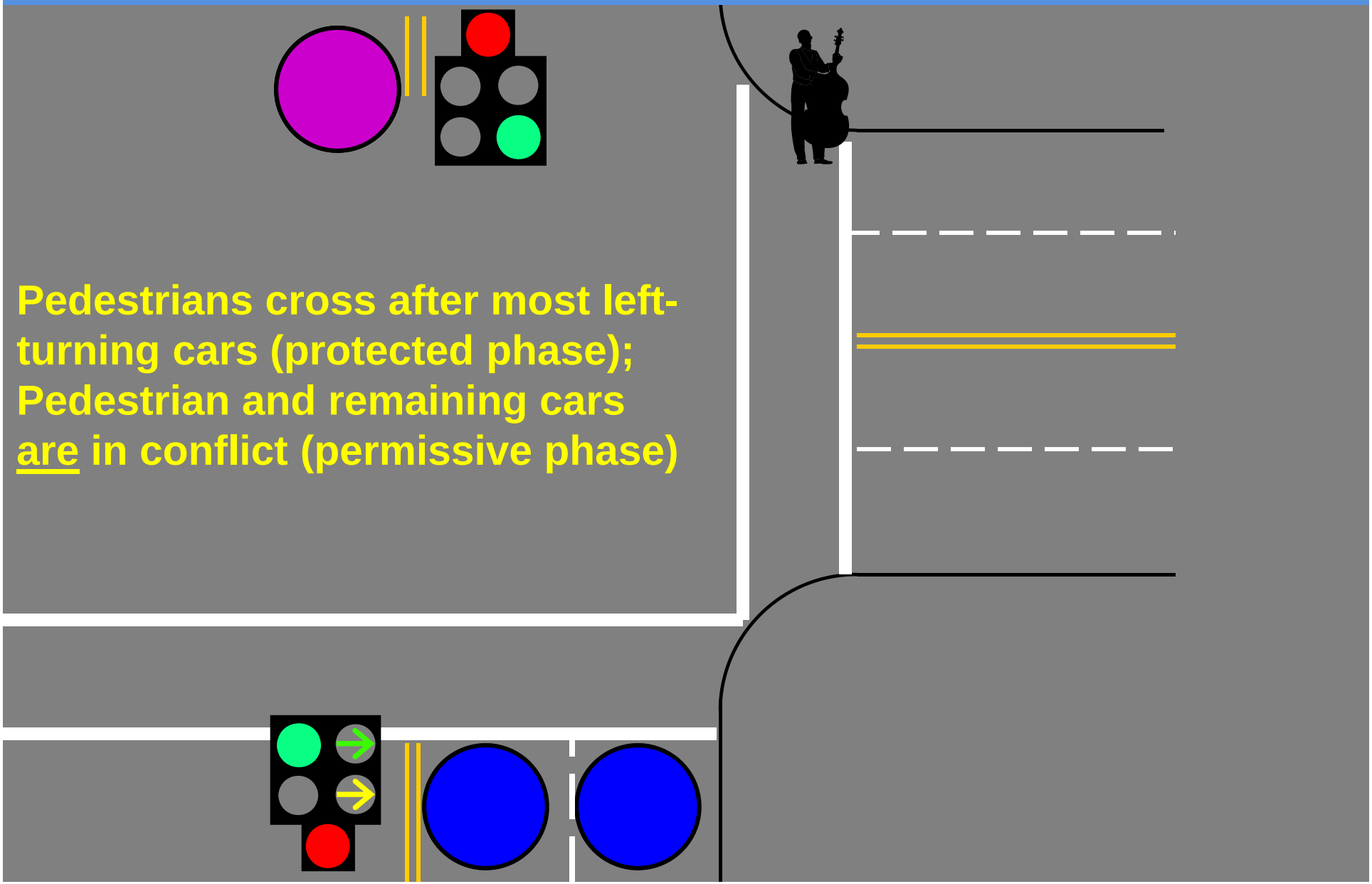
# Signalization: Countdown Signal Operation




- Provide countdown signals throughout – easier to understand
- Recall to WALK
  - Default along major road
  - When both roads are "major"
- Provide max available time

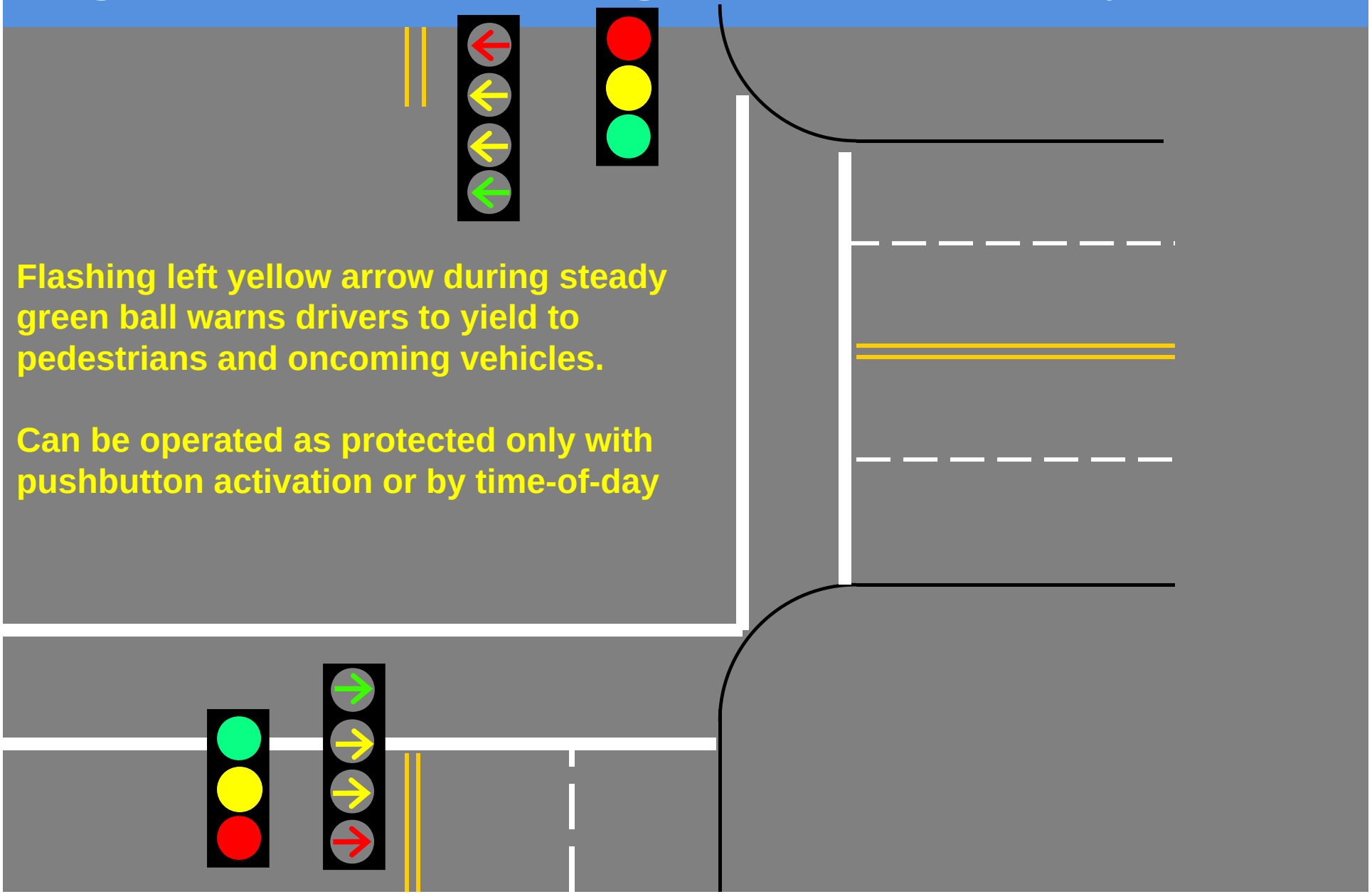


# Signalization: Protected-Permissive Left Turns



**Pedestrians cross after most left-turning cars (protected phase); Pedestrian and remaining cars <u>are</u> in conflict (permissive phase)**

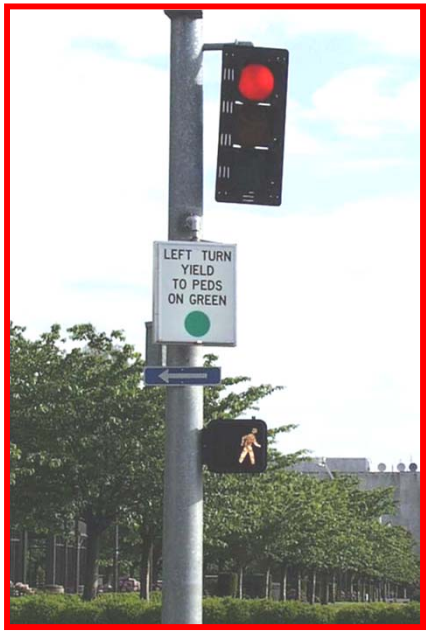
# Signalization: Flashing Yellow Arrow Operation



**Flashing left yellow arrow during steady green ball warns drivers to yield to pedestrians and oncoming vehicles.**

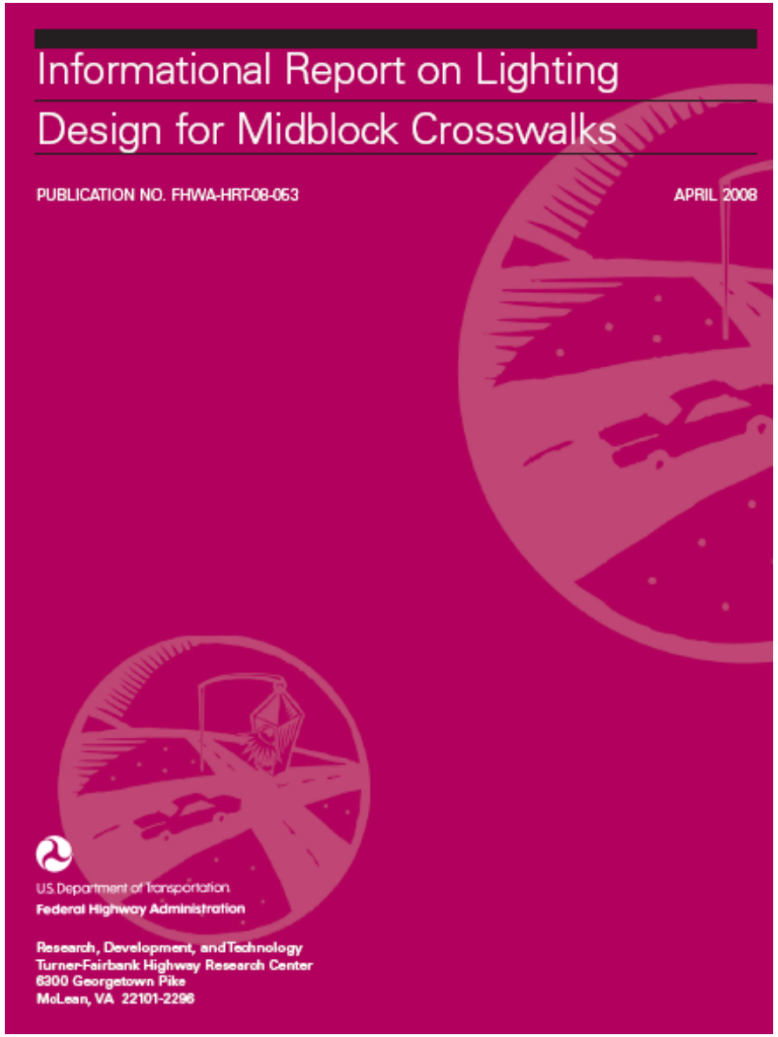
**Can be operated as protected only with pushbutton activation or by time-of-day**

# Signalization:  Leading Pedestrian Interval




*WALK comes on at least 3 seconds prior to the green signal; pedestrians enter crosswalk before turning vehicles compete for right-of-way.*

# Lighting:  Midblock Crosswalk Design




Informational Report on Lighting Design for Midblock Crosswalks

FHWA-HRT-08-053
April 2008

Available at http://www.tfhrc.gov/safety/pubs/08053/08053.pdf

# Lighting: Midblock Crosswalk Design

Fig 11. Traditional midblock crosswalk lighting layout

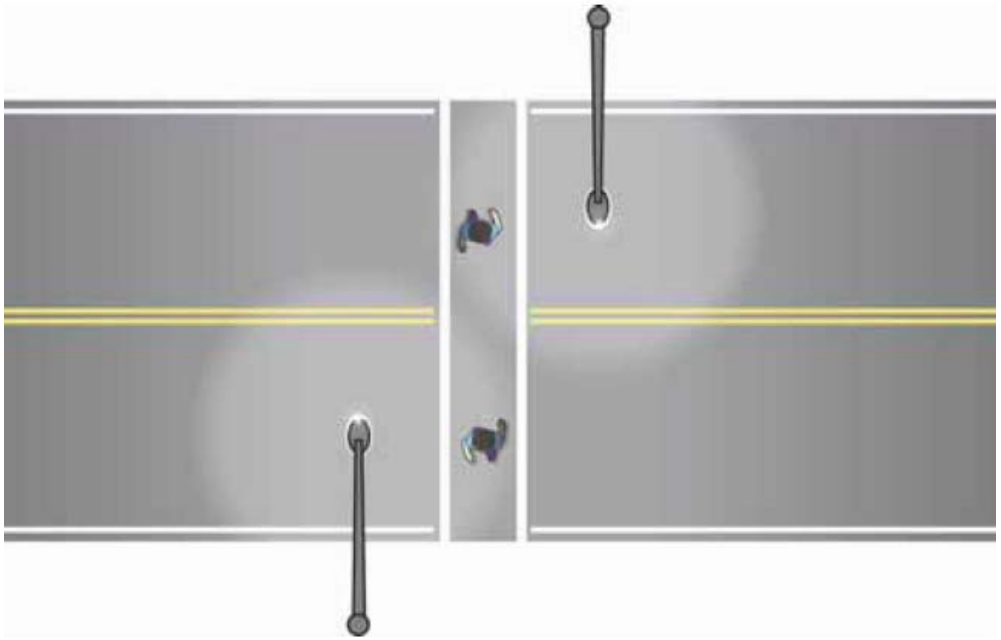


Fig 12. New design for midblock crosswalk lighting layout

Recommended lighting level: 20 lux at 5’ above pavement

# Lighting:  Intersections

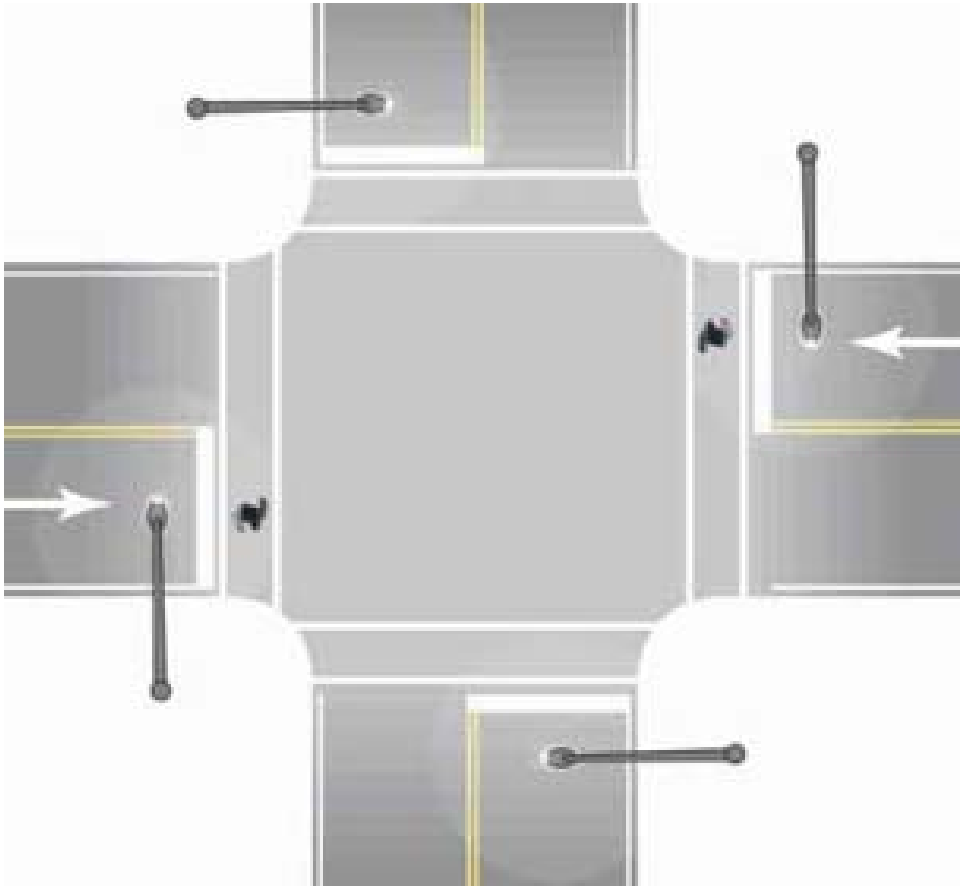
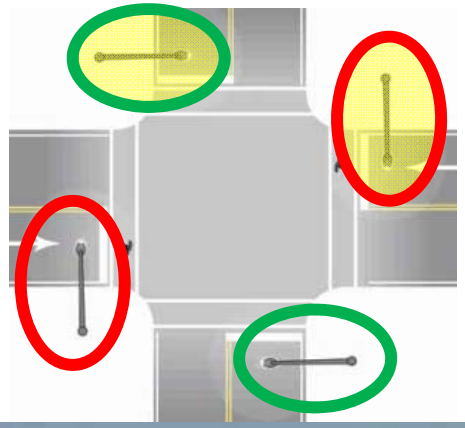


**Fig 14. New design for intersection lighting layout for crosswalks.**

Apply same basic principals:

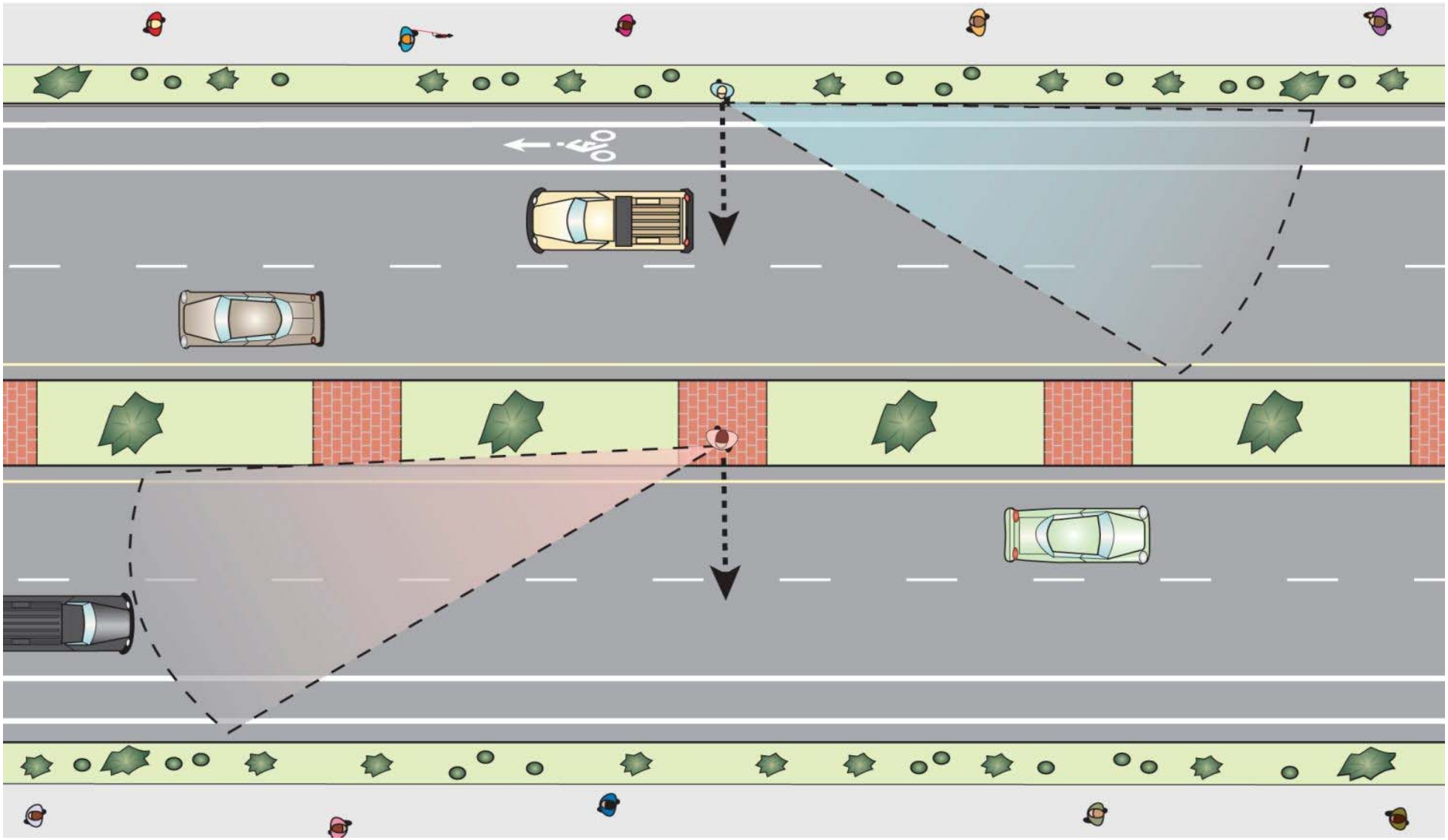
Sufficient illumination & Correct Placement

# Lighting:  Intersections



# Mid-Block Crossing – Medians & Islands

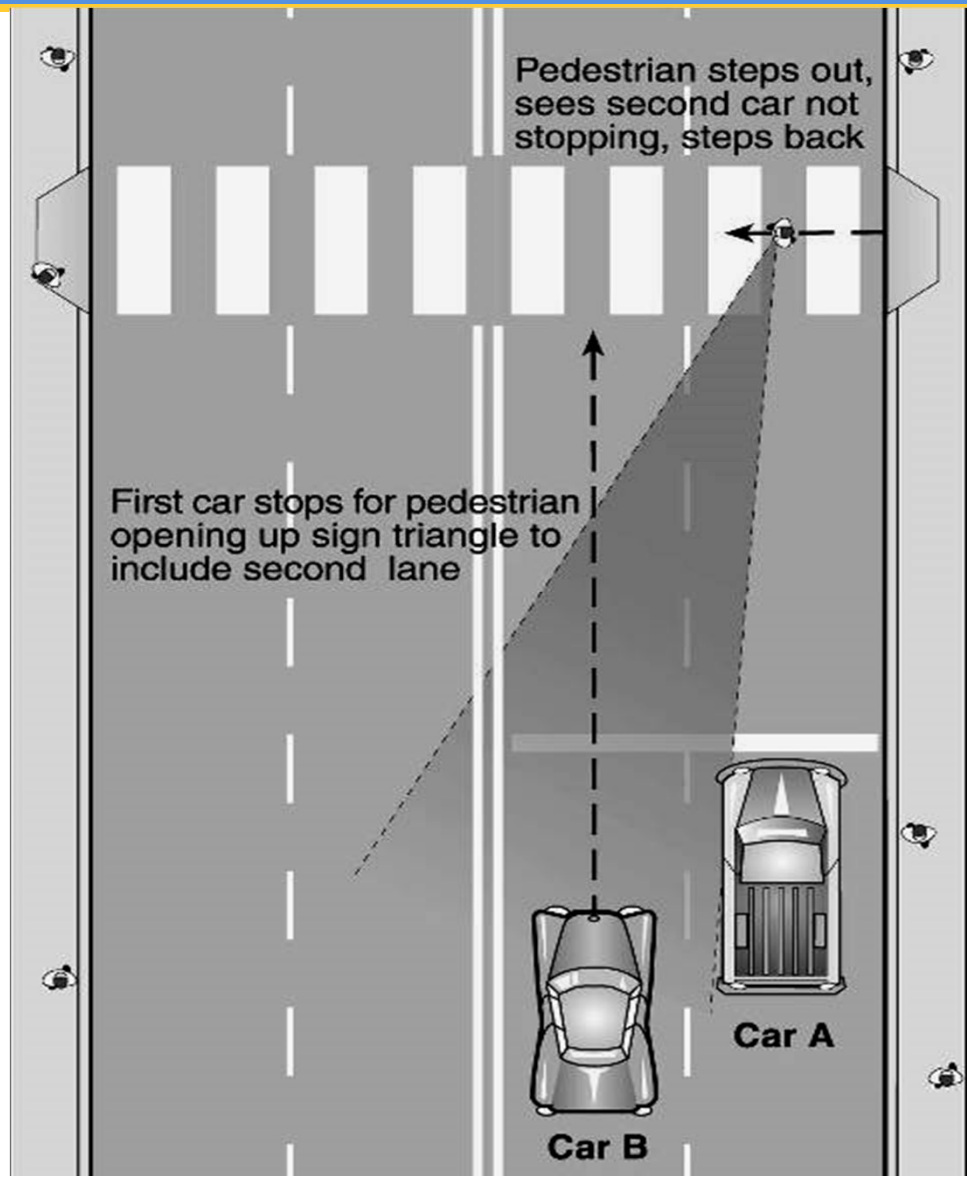
## Break Crossing Up; Simplify Challenge



# Mid-Block Crossing: RRFB
## (Rectangular Rapid Flashing Beacon)

# Mid-Block: Crosswalk Design
# Mulitple Threat Crash Solution

- Advance stop or yield line
  - 1st car stops further back, opening up sight lines
  - 2nd car can be seen by pedestrian
  - car also has better chance of seeing pedestrian and stopping

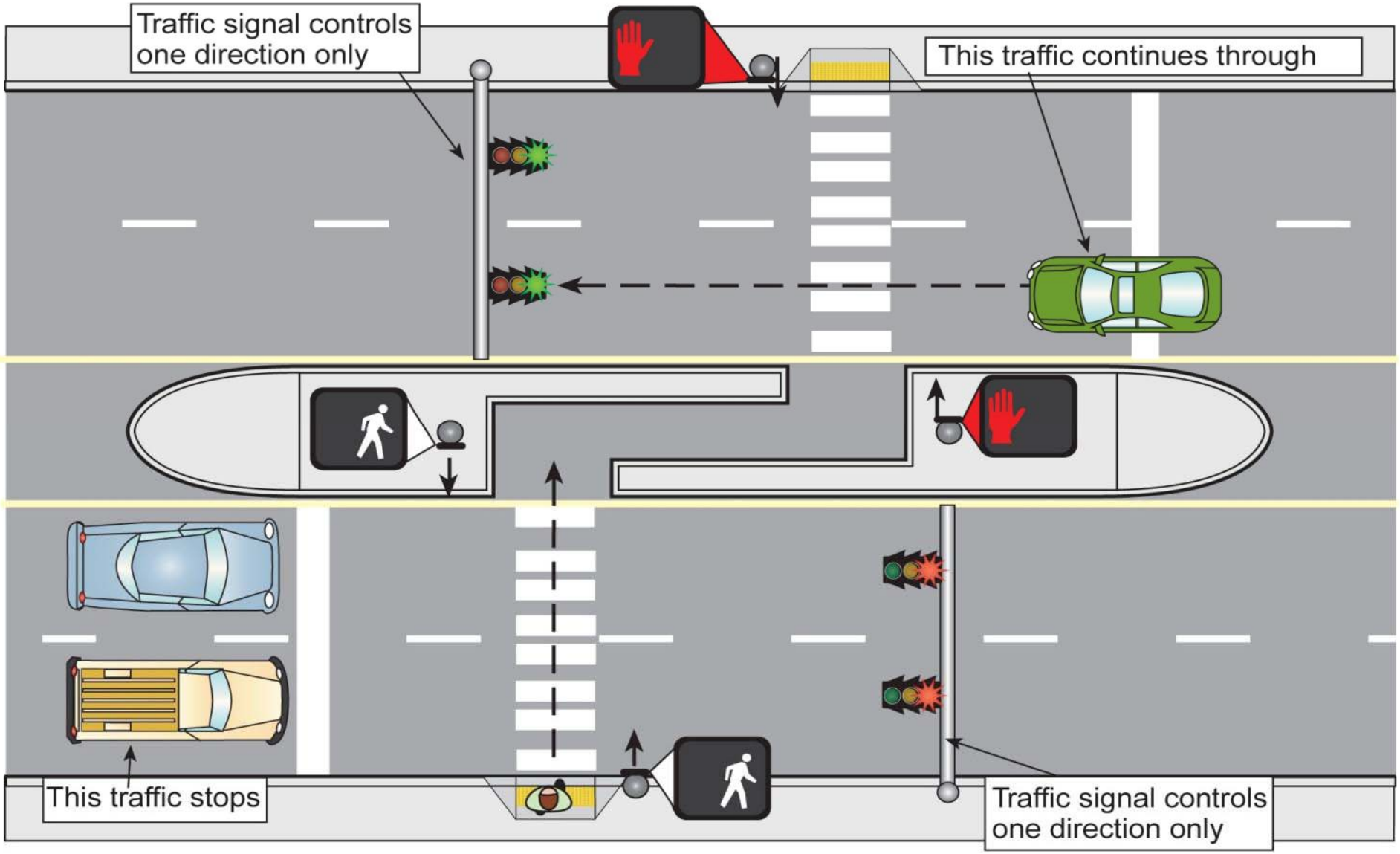


# Mid-Block Crossing: HAWK (High-intensity Activated crossWalK)


- Pedestrian Hybrid Beacon
- Sanctioned by FHWA/MUTCD
- Limited Experience in Florida – Driver Expectations

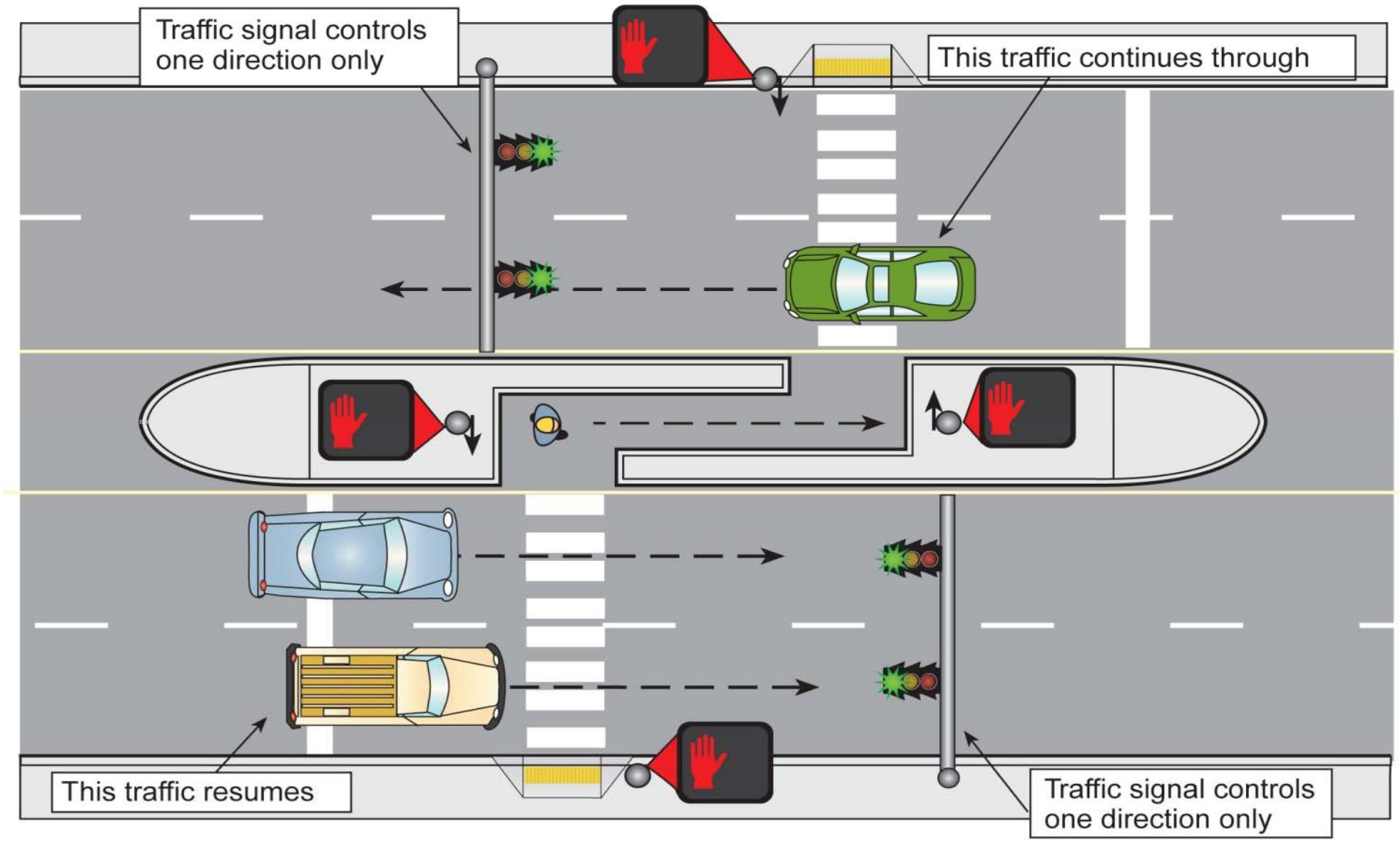
# Mid-Block Crossing: Two-Phase Signal

## 1. Pedestrian pushes button, waits, crosses to island



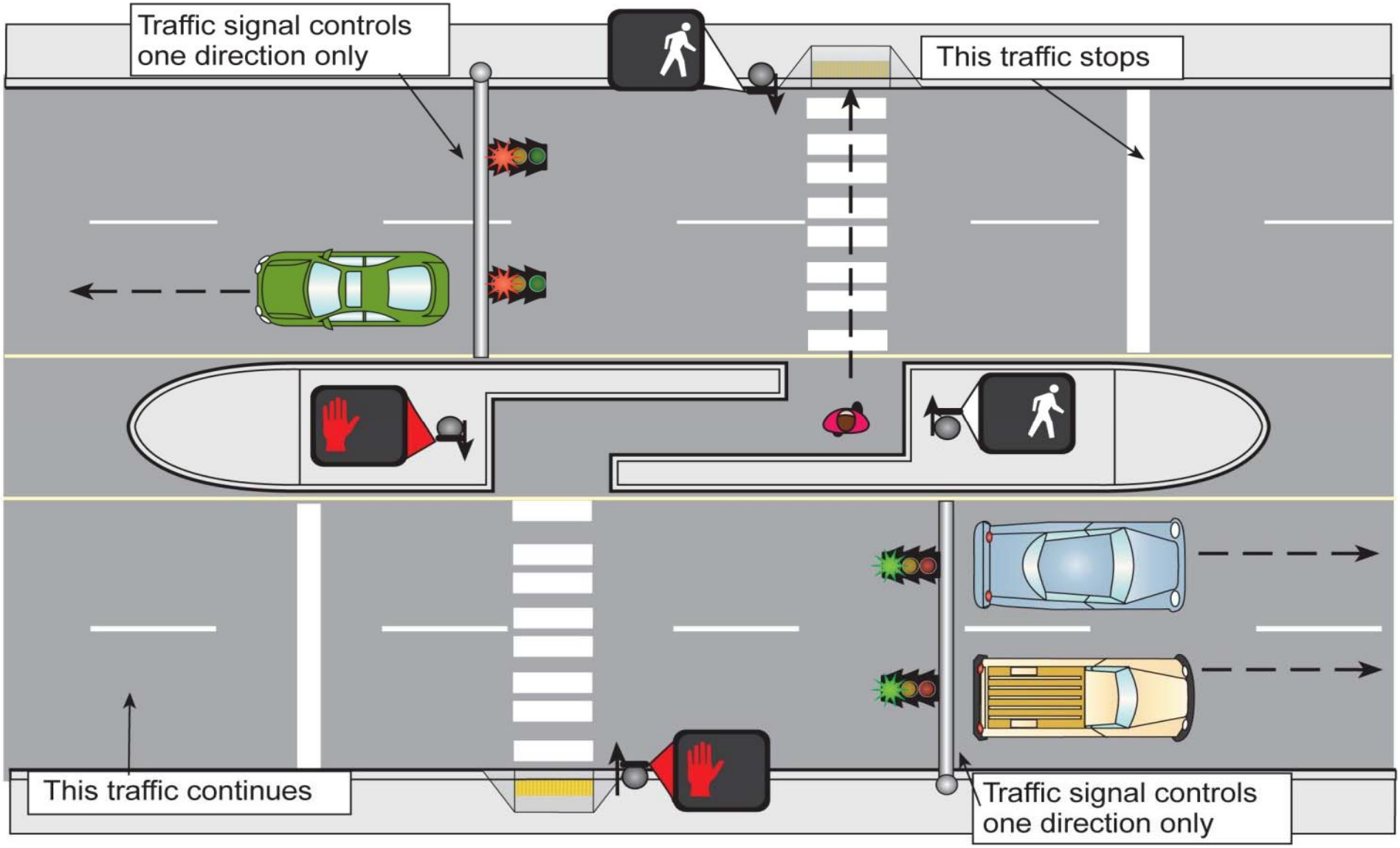
# Mid-Block Crossing: Two-Phase Signal

## 2. Pedestrian proceeds to 2nd button, traffic resumes

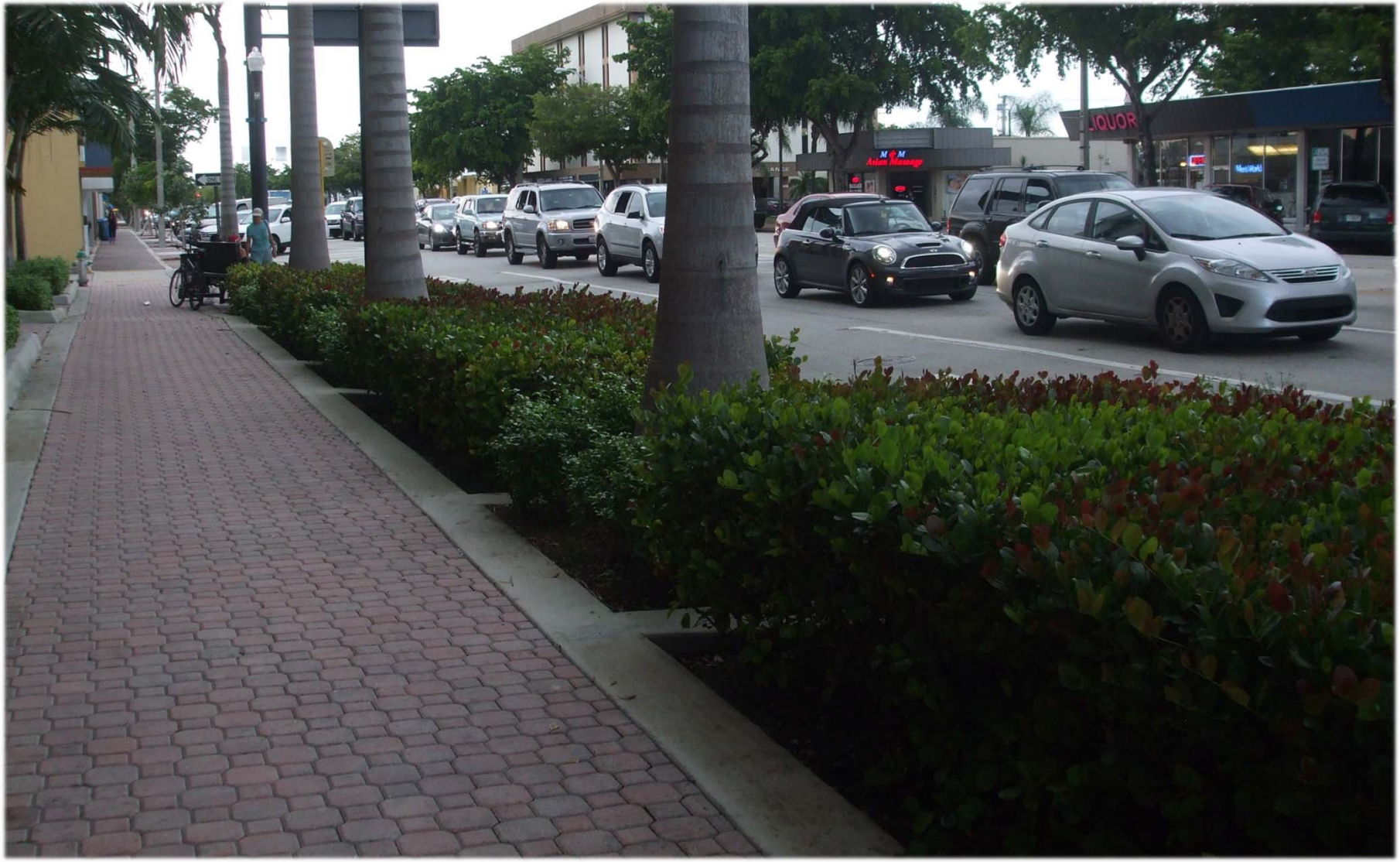


# Mid-Block Crossing: Two-Phase Signal

## 3. Pedestrian pushes button, completes crossing



# Mid-Block Crossings:  Channelization

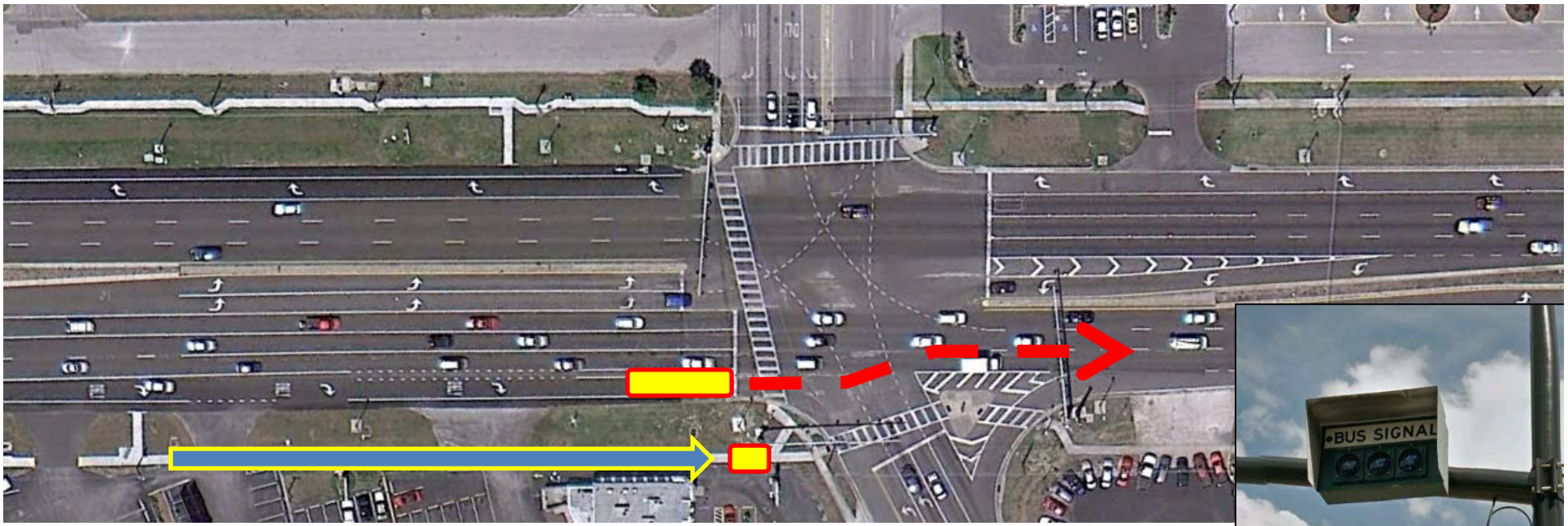


# Right-Turn Queue Jump Lanes

- What is a “right-turn queue jump lane?”
  - Normally, bus must merge back-into thru lane
  - Results in delay for bus and poor stop placement for pedestrians

# Right-Turn Queue Jump Lanes

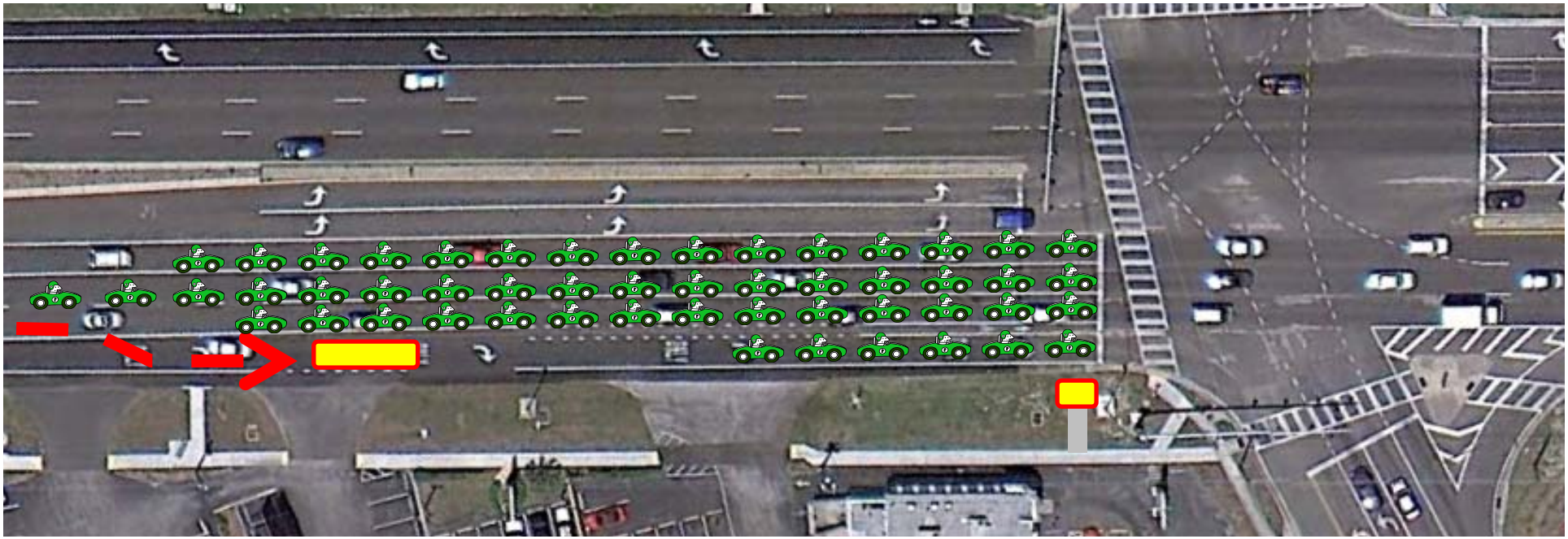
- With right-turn queue jump…
  - Bus proceeds to the stop bar in the right turn lane; conducts boarding/alighting
  - Bus get's special signal ahead of thru green




**0'**

# Right-Turn Queue Jump Lanes

- Design Constraints
  - Turn lane must extend beyond peak hour thru queues for bus to access
  - Bus must reach stop with sufficient time prior to “jump” phase to board and alight.



# Right-Turn Queue Jump Lanes

- Advantages
  - Buses “jump” the queue for travel time savings; boardings/alightings likely to occur during red phase
  - Stop placement can be optimized for safety and convenience of transfers
  - Queue jump phase can incorporate “leading pedestrian interval” phase for disembarked passengers

# Right-Turn Queue Jump Lanes

- Disadvantages
  - Potential impact to right turn movements
    - Mostly right-turn-on-red
  - Reduction in signal time available for automobiles
    - Similar to Leading Pedestrian Interval (LPI)
      - Hey wait… Why not provide an LPI concurrent for the queue jump phase for folks that just got off the bus?!
  - Limited citizen and agency experience in Florida

# Right-Turn Queue Jump Lanes

- FDOT District 4 Pilot Project
  - Pilot project in District 4 at SR-7/US 441 and Prospect Road (Tamarac)
  - Includes QPL for bus signal
  - Chosen because of simplicity/low volumes
  - Evaluation on-going
  - Driver behavior
  - Bus “if-then-else” analysis

# Bus Island Concept

- FDOT District 4 Oakland Park Boulevard Corridor Study

# Bus Island Concept

- HART MetroRapid Bus Island


Original Grass Right-Turn Island


Southbound MetroRapid Stop at Nebraska Ave. (US 41) and Twiggs St.


MetroRapid Pad Station Under Construction

# Bus Island Concept


Memorial Drive @ Rockbridge Road (DeKalb Co./Atlanta)
Bus Queue Jump

# Questions/Discussion

- Bus/Traffic Interaction
  - Stop Location
  - Bus Bays
- Ped/Bike Safe Access to Transit
  - Purpose
  - DW Project
  - Stop Placement
  - Safety Tools


FDOT
D7 LOCAL AGENCY
TRAFFIC SAFETY ACADEMY
2014

# PDH's for Florida P.E.'s

- Download the PDH form and complete it
  - Email to Safety Academy PDH coordinator: Larry@HagenConsultingServices.com
  - or you may Fax to 866-426-5153
- You will receive a certificate for 1 PDH
- Need a separate form for each session

HAGEN CONSULTING SERVICES, LLC


FDOT
D7 LOCAL AGENCY
TRAFFIC SAFETY ACADEMY
2014

# PDH's for Florida P.E.'s

- Download PDH form at: http://www.tampabaytrafficsafety.com/SitePages/Home.aspx then go to General Resources under the Safety Academy tab.


FDOT
D7 LOCAL AGENCY
TRAFFIC SAFETY ACADEMY
2014

# AICP CM Credit

"This session has been submitted for AICP CM credit."

(The American Institute of Certified Planners)


FDOT
D7 LOCAL AGENCY
TRAFFIC SAFETY ACADEMY
2014

# Questions? Need Assistance?

Dennis K. Filloon
D7 Safety Academy Coordinator
The Filloon Group, LLC
Tallahassee, Florida
Phone: (850) 510-0095
Email: dennis5846@earthlink.net