PBIC Webinar

ITE Recommended Practices on Accommodating Pedestrians and Bicyclists at Interchanges

Matthew Ridgway, Principal, Fehr & Peers
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Mariana Parreiras, Snr. Planner/engineer, Fehr & Peers

June 25, 2 pm

Today's Presentation

- **Introduction and housekeeping**
- **Audio issues?**
  Dial into the phone line instead of using "mic & speakers"
- **PBIC Trainings and Webinars**
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- **PBIC News and updates on Facebook**
  www.facebook.com/pedbike
- **Questions at the end**

Design Guidelines to Accommodate Peds and Bikes at Interchanges

Matthew Ridgway, AICP, PTP
Meghan Mitman, AICP
Mariana Parreiras

June 25, 2013

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Outline

- Background
- Guiding Principles
- Crosswalk Treatments
- Interchange Cases

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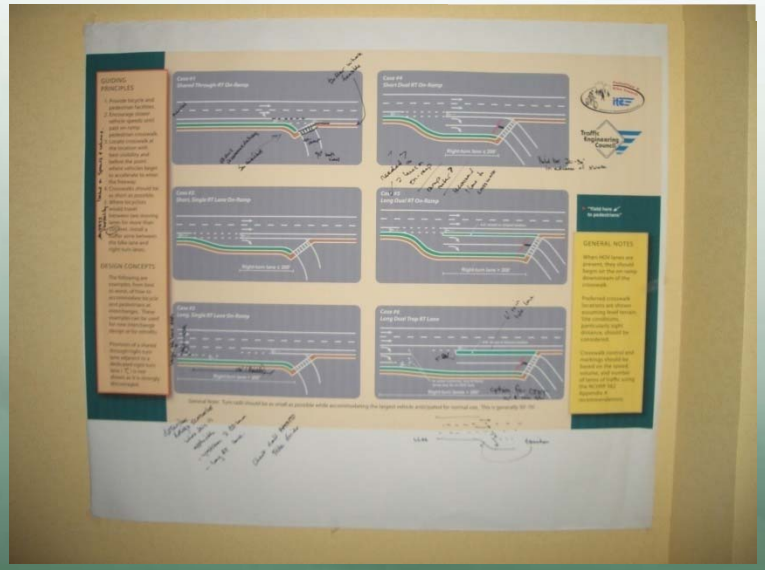
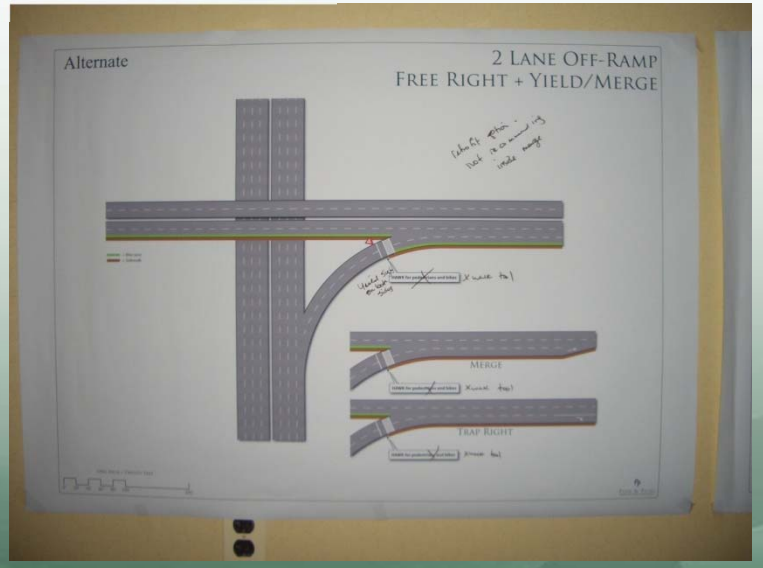
Background

Pedestrian & Bike Council

ite

INSTITUTE OF TRANSPORTATION ENGINEERS





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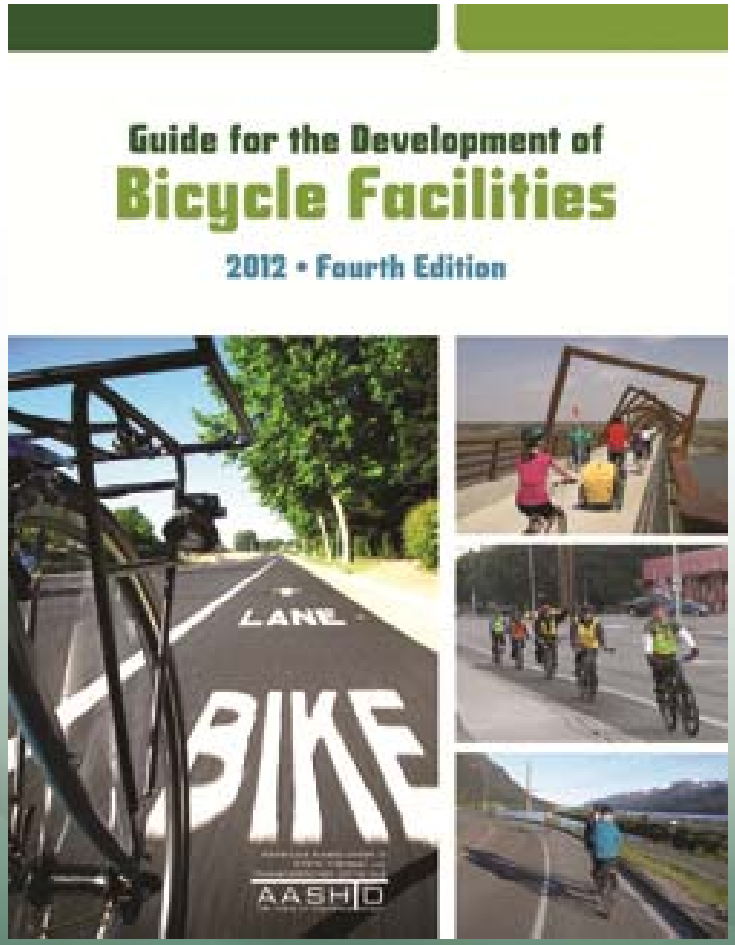
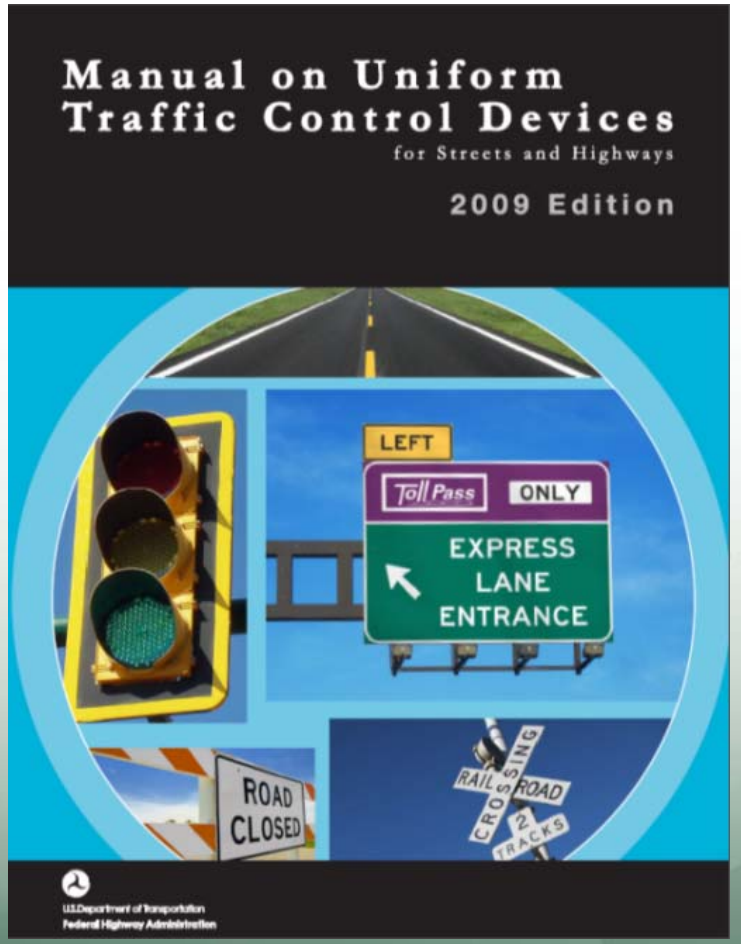
National Guidance





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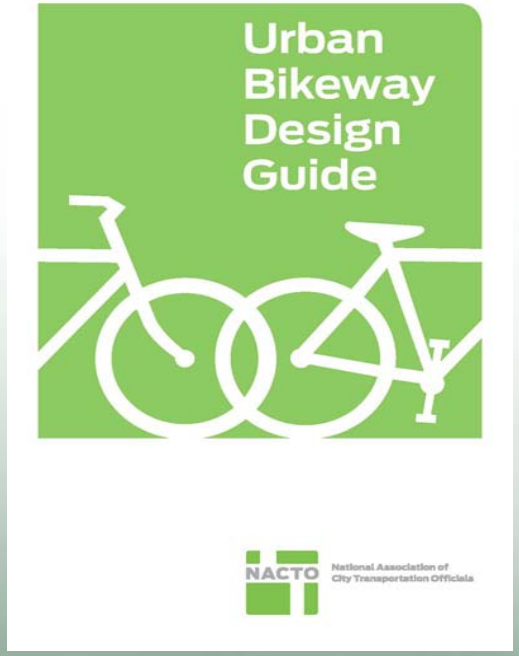
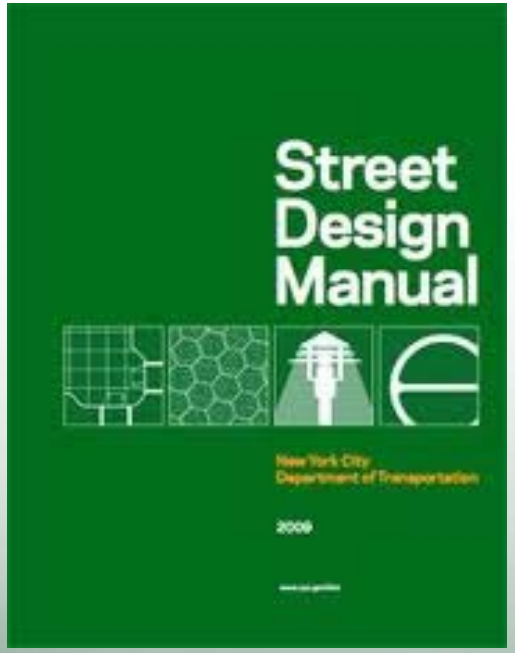
Other Guidance





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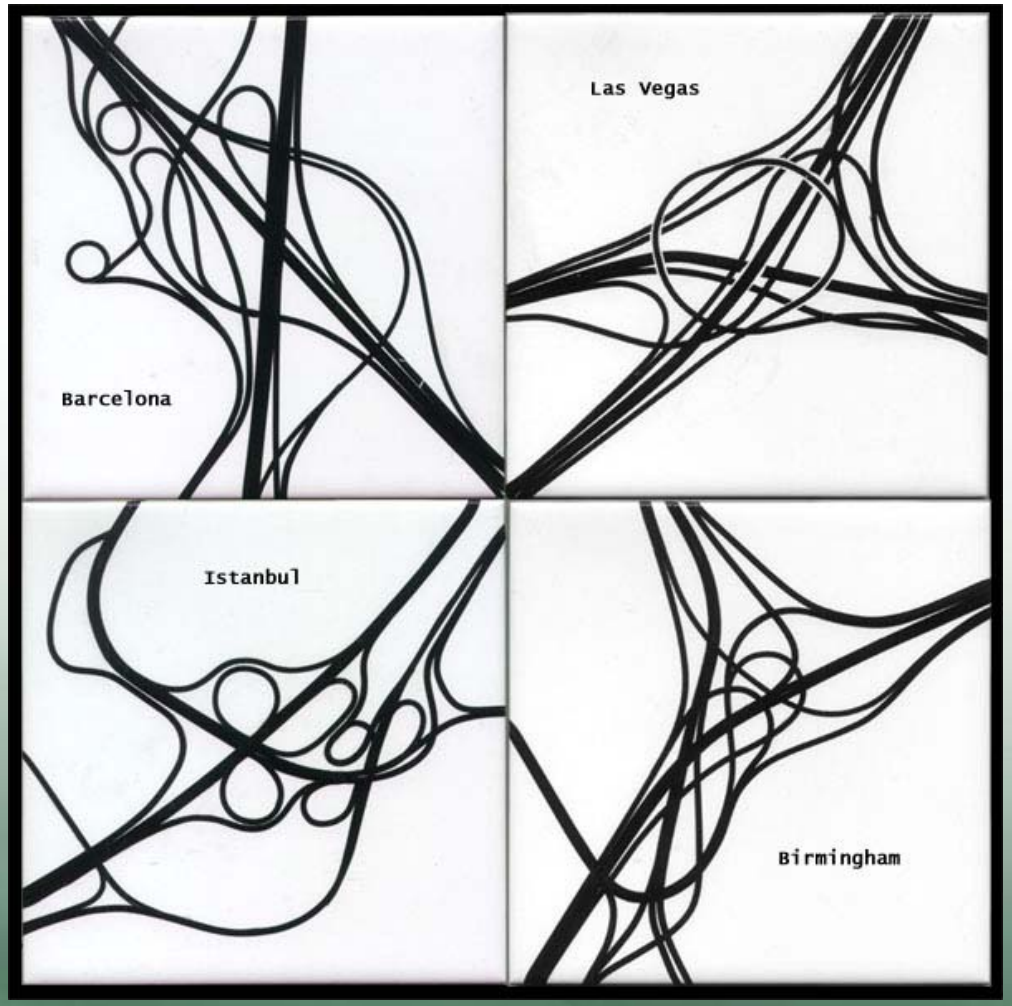
Problem Statement



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Where does the freeway end?

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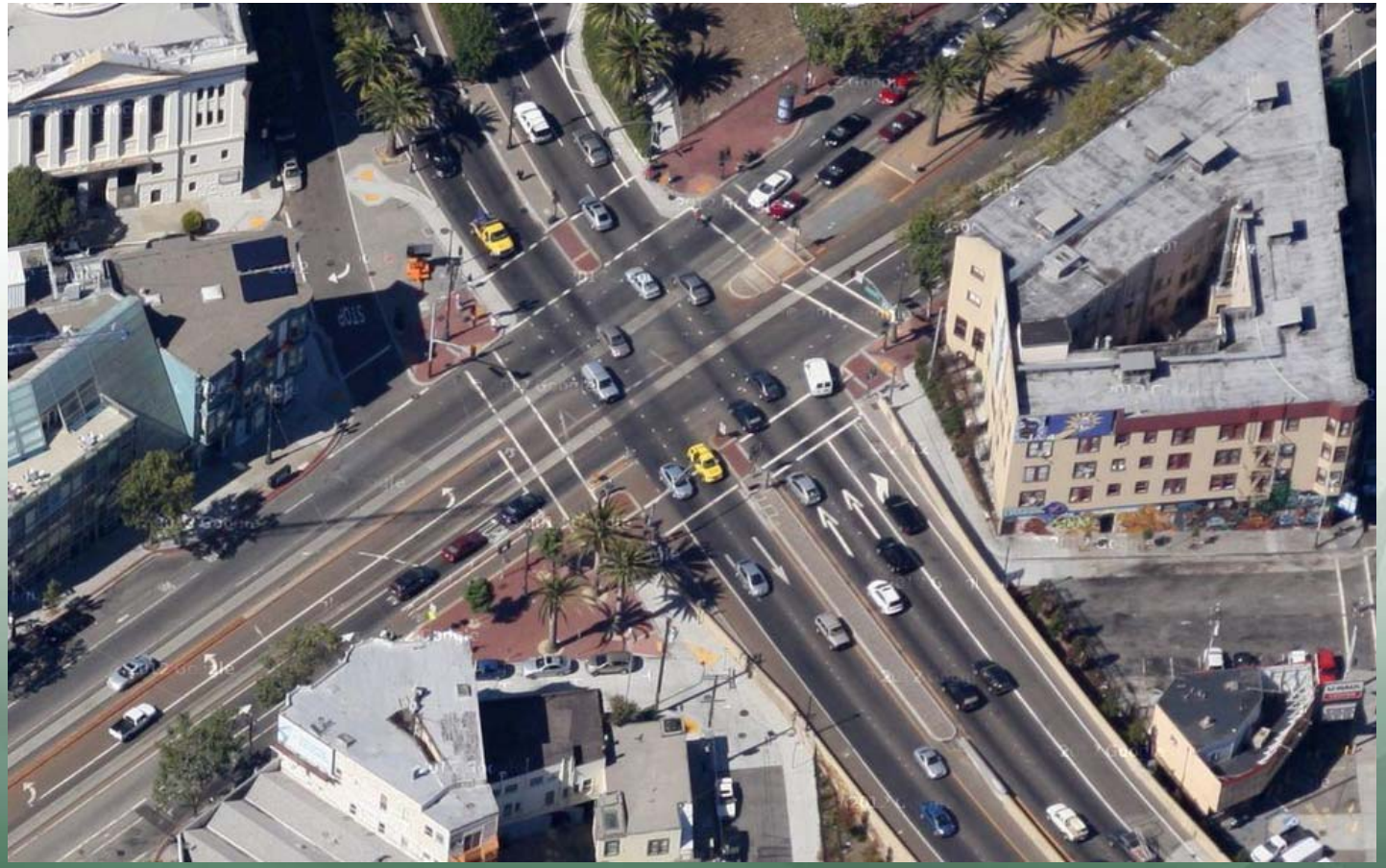
The edge between the freeway and the neighborhood



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Guiding Principles

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Guiding Principles (cont'd)

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High Speeds, Poor Visibility

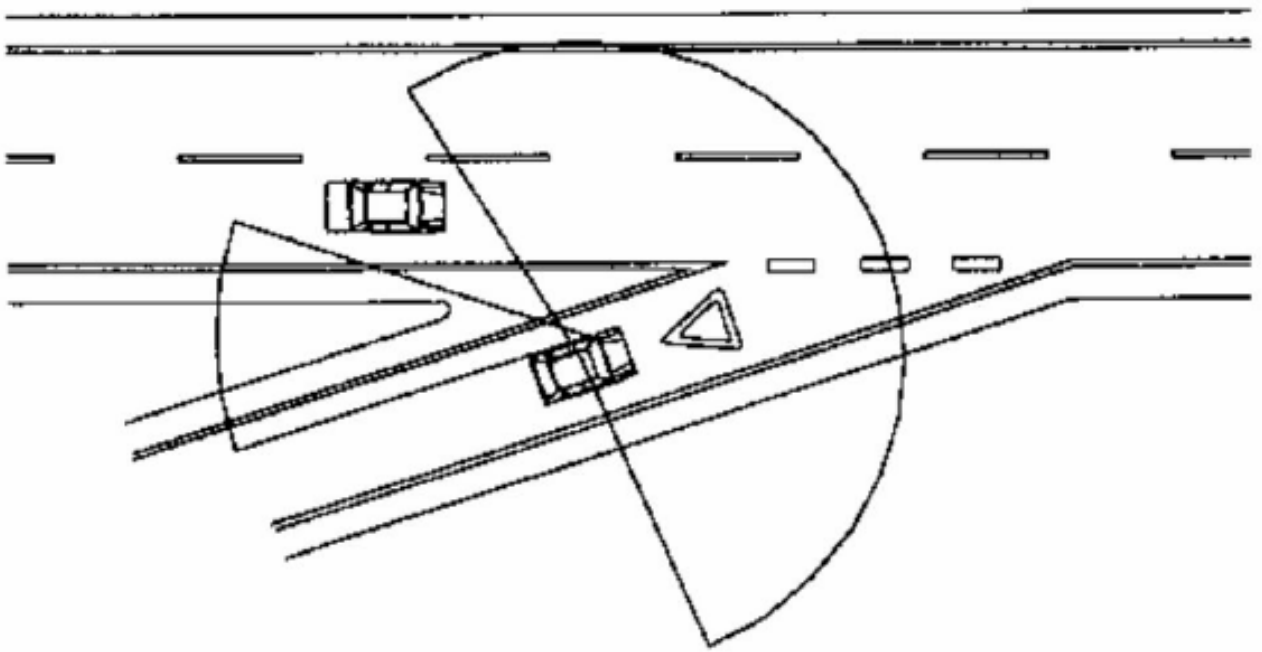

FIGURE 2 Visibility problem at merging areas

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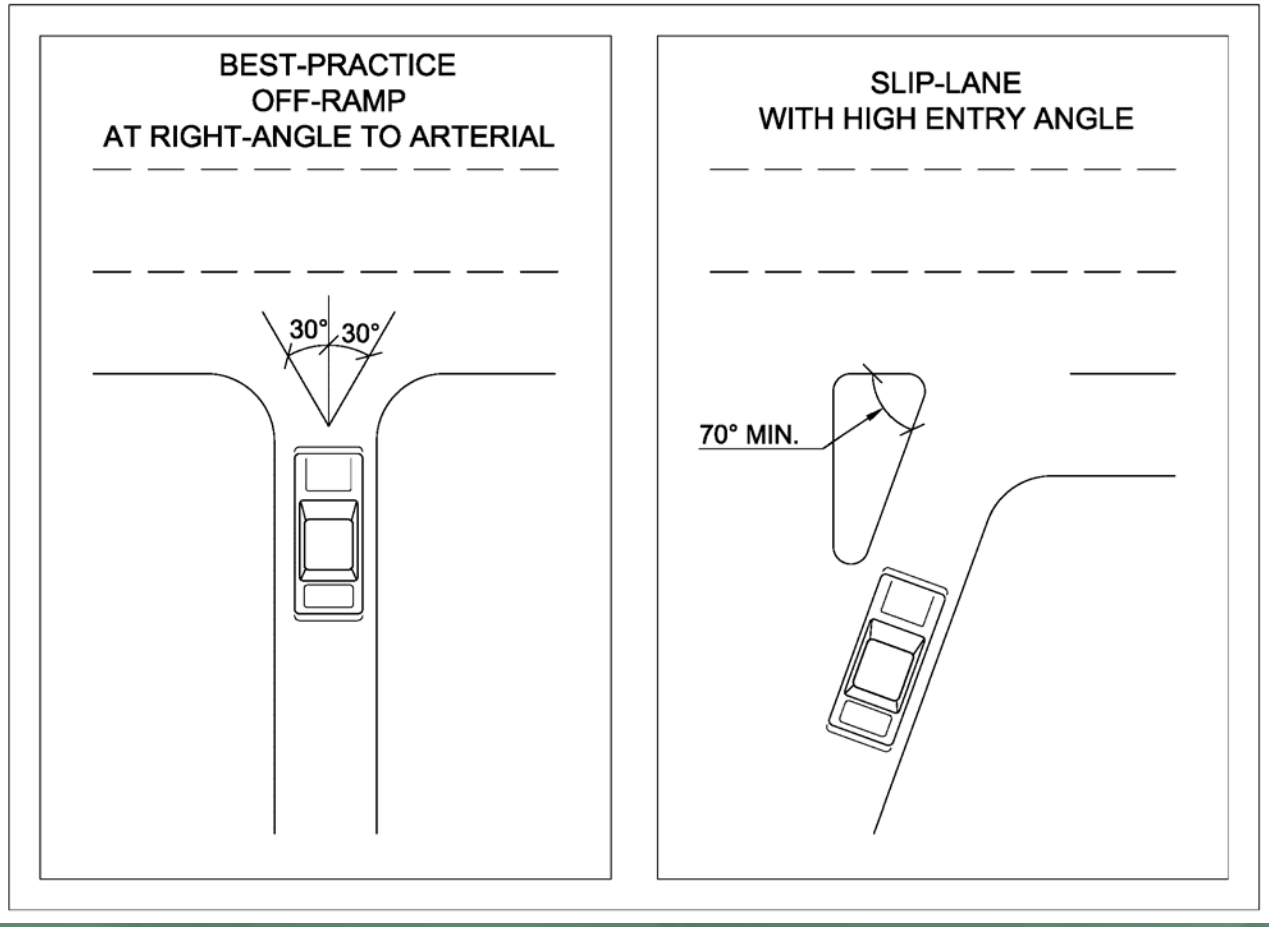
Prefer Slow Speed, Right Angle Urban Designs



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Positive example: reconfigured ramp terminus

Flat angle = wide crossing & high-speed turns

Tight angle = short crossing & slow speed turns

Springfield OR

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- Red line = old crosswalk
- Green line = new crosswalk

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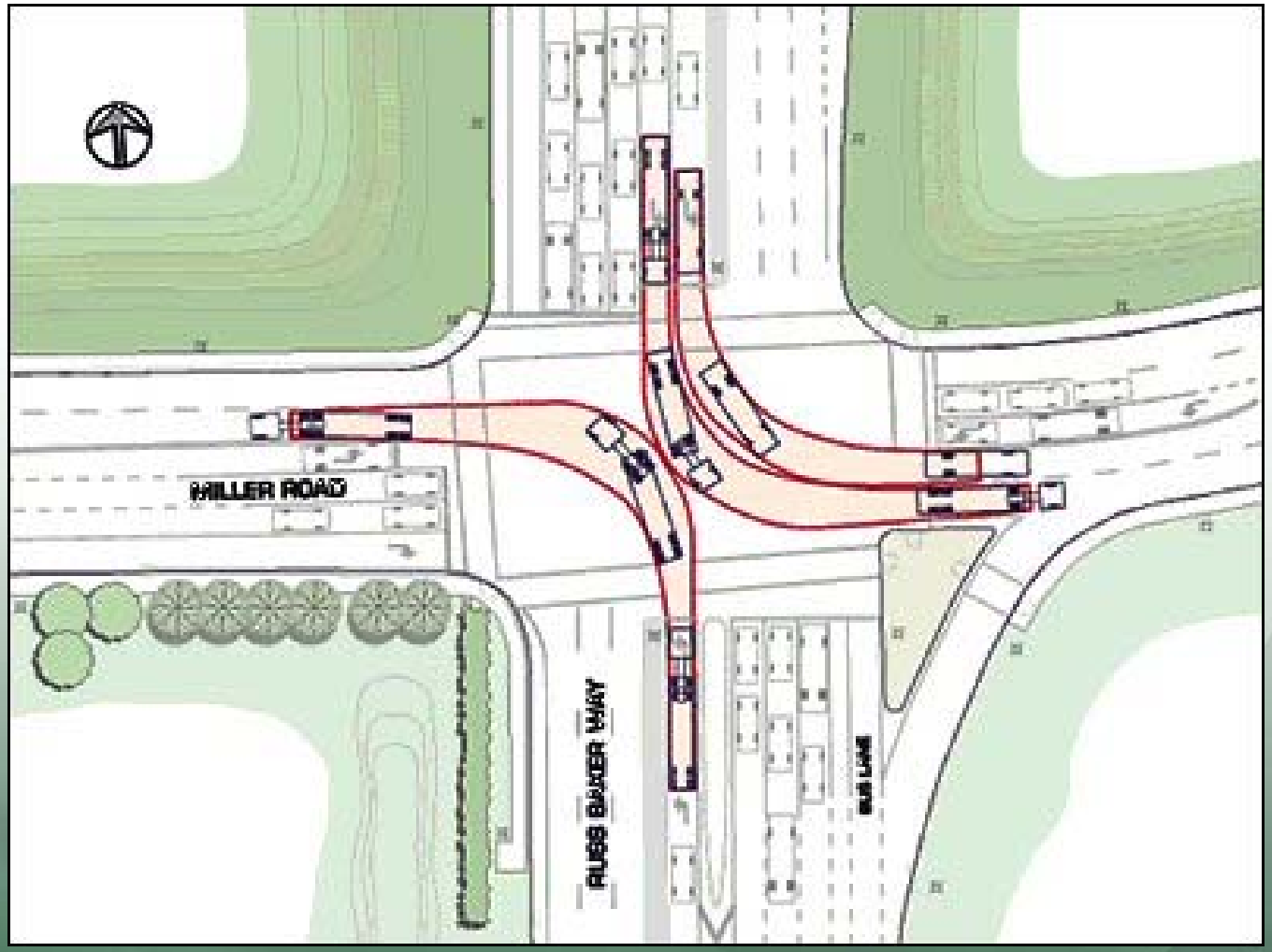
Springfield OR

Design Assumptions



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Determining Crosswalk Treatments

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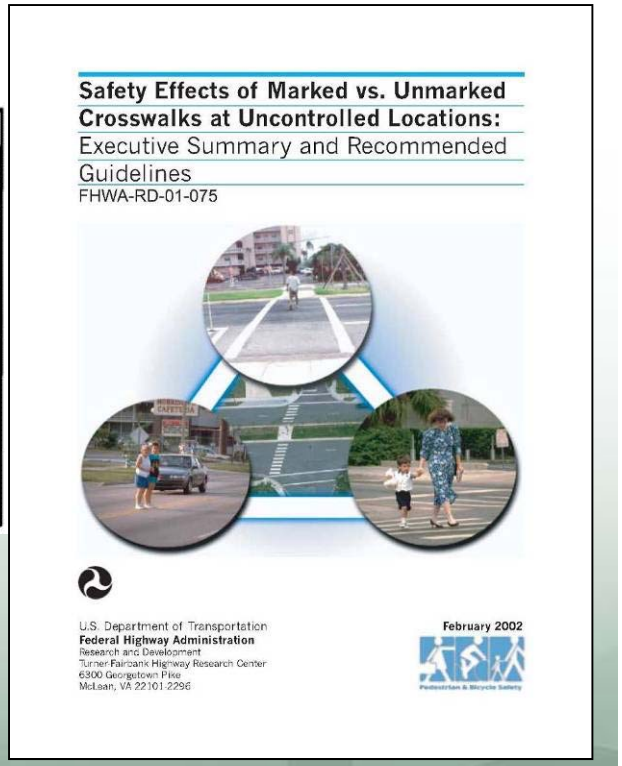
To mark or not to mark?

Table 1. Recommendations for installing marked crosswalks and other needed pedestrian improvements at uncontrolled locations.*

Roadway Type (Number of Travel Lanes and Median Type)	Vehicle ADT ≤ 9,000			Vehicle ADT >9000 to 12,000			Vehicle ADT >12,000 - 15,000			Vehicle ADT > 15,000		
	Speed Limit**											
	≤ 30 mi/h	35 mi/h	40 mi/h	≤ 30 mi/h	35 mi/h	40 mi/h	≤ 30 mi/h	35 mi/h	40 mi/h	≤ 30 mi/h	35 mi/h	40 mi/h
2 Lanes	C	C	P	C	C	P	C	C	N	C	P	N
3 Lanes	C	C	P	C	P	P	P	P	N	P	N	N
Multi-Lane (4 or More Lanes) With Raised Median***	C	C	P	C	P	N	P	P	N	N	N	N
Multi-Lane (4 or More Lanes) Without Raised Median	C	P	N	P	P	N	N	N	N	N	N	N



Key: C = Candidate sites for marked crosswalks;

P = Possible increase in pedestrian crashes may occur if crosswalks are marked without other pedestrian enhancements;

N = Marked crosswalks alone are insufficient.

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NCHRP Report 562

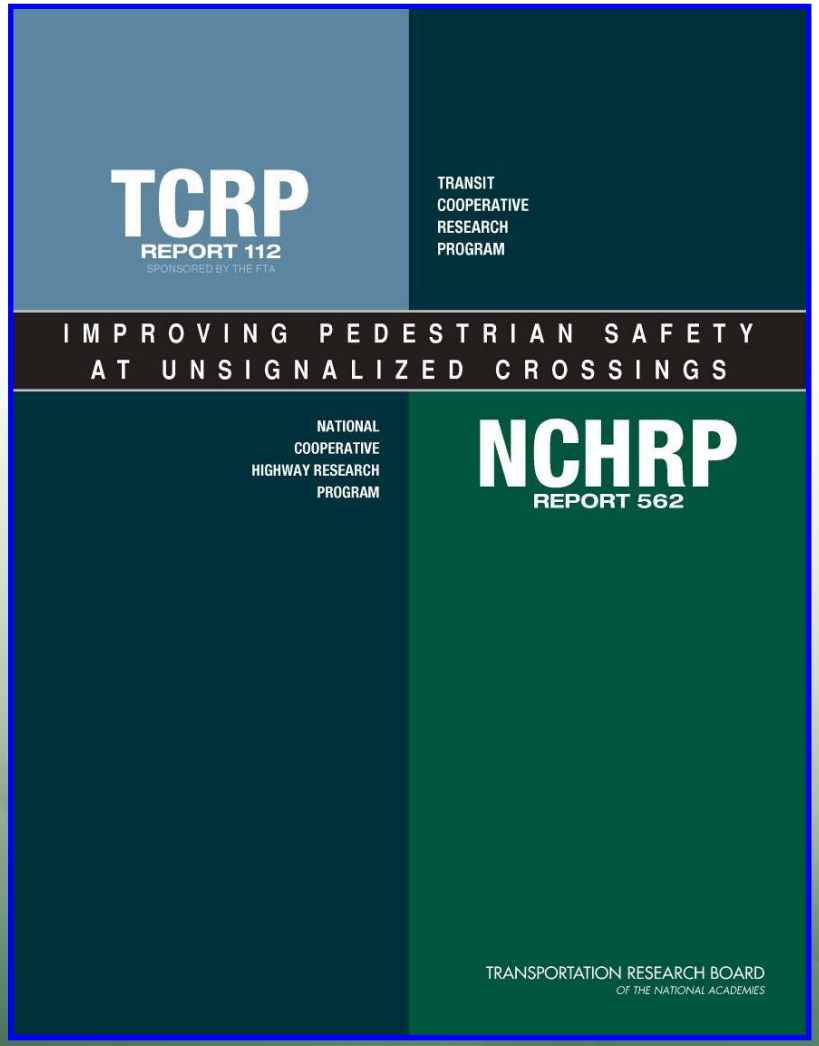

TABLE D-1. Summary of Treatments for Major Street Crossings at Uncontrolled Locations.

Treatment Type	Picture of Treatment
Roadway Signing Description – Special signs are placed in the roadway within or near the crosswalk. • Application – Crossing on higher volume multilane roads • Cost (Including Labor) in U.S. Dollars – $200–$300 per sign • Studies of Effectiveness – Field Evaluation Report (*45*), *Pedestrian Facilities Guidebook* (*46*) • Countries Where Treatment is Used – U.S.A., France, Sweden	 **New York, U.S.A.**
High-Visibility Markings Description – This method uses ladder- or "zebra"-style crosswalk pavement markings. • Application – Crossings on higher-volume multilane roads • Cost (Including Labor) in U.S. Dollars – $500-$1,000 per crossing • Studies of Effectiveness – See section 6.2 of ITE Informational Report (*44*) • Countries Where Treatment is Used – U.S.A., Europe, Australia, New Zealand	 **Puget Sound Area, Washington, U.S.A.**
Double-Posted Pedestrian Crossing Signs Description – Standard pedestrian crossing signs are installed on both sides of the approaching roadway at an uncontrolled crosswalk in addition to the near-side pedestrian warning signs posted at and in advance of the crosswalk. • Application – Uncontrolled marked crosswalk • Cost (Including Labor) in U.S. Dollars – $200 per sign • Studies of Effectiveness – None found • Countries Where Treatment is Used – U.S.A., Canada	 **Near Downtown Los Angeles, California, U.S.A.**

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Xwalk Tool Inputs

INPUTS				
FIELD	CATEGORY	INPUT	UNITS	DESCRIPTION/ NOTES
1	Speed Limit	40	mph	Posted or statutory speed limit or the 85th percentile speed on the major street
2	Peak Hour Pedestrian Volume	25	ped/h	Number of pedestirans crossing the major roadway in a peak hour
3	Major Road Peak Hour Volume (Total)	1500	veh/h	Total number of vehicles and bicylists on both approaches during the peak hour
4	Major Road Peak Hour Volume Direction 1	250	veh/h	Include only if a painted or raised median is present (min of 6 feet wide)
5	Major Road Peak Hour Volume Direction 2	250	veh/h	Include only if a painted or raised median is present (min of 6 feet wide)
6	Average Pedestrian Walking Speed	3.5	ft/s	Average pedestrian walking speed, default speet = 3.5 feet/second
7	15th Percentile Crossing Speed	3	ft/s	Speed for the slowest 15% of pedestrians; default speed = 3 feet/second
8	Pedestrian start-up time and end clearance time	3	s	The *Highway Capacity Manual* suggests 3 seconds
9	Pedestrian Crossing Distance (curb to curb)	40	ft	Distance between the near and far curbs
10	First Half Crossing Distance	15	ft	Distance between the near curb and a painted or raised median refuge island
11	Second Half Crossing Distance	15	ft	Distance between a painted or raised median refuge island and the far curb
12	Number of Lanes (total both directions)	2	Lanes	Number of lanes on major roadway
13	Expected Motorist Compliance	Low		Typical motorist compliance, default = Low
14	Is frequent at-grade transit present?	No		Does frequent surface transit run along major or minor road at the intersection?
15	Are bicycle lanes present?	Yes		
16	Is there heavy bicycle traffic?	No		
17	Is there a clear major and minor road?	Yes		Is there a clear differentiation in the traffic volume between the two roads?
18	Is this a midblock location or off-set intersection?	No		
19	Is there heavy truck traffic?	Yes		
20	Does existing infrastructure limit potential treatments?	No		Are there storm drains, poles, or other permanent structures at any corner of the intersection?
21	Is there on-street parking at the location?	No		
22	Is the location in a downtown area?	No		
23	Is it located within the built-up area of an isolated community?	No		Does the community have a population of less than 10,000?
24	Is a median refuge island present?	No		Does the refuge island have a width of at least 6 feet to accommodate pedestrian queues?
25	Is there sufficient width to accommodate a median?	No		At least 4 feet (with lane widths reduced to 10 or 11 feet)
26	Actual Total Pedestrian Delay		s	Optional (if calcuated at the site)

Xwalk Tool Output

OUTPUTS

Signalized Crossing or Unsignalized Crossing?	HAWK* Signal
Pedestrian LOS	F
Candidate Pedestrian Treatment Identified	**HAWK* Signal**
Candidate for Median Refuge Island?	NO
Candidate for Road Diet?	NO
Other Treatments for Consideration**	NA
Paired Treatments for Consideration**	NA

TREATMENT IDENTIFICATION MATRIX FOR UNCONTROLLED LOCATIONS

PEDESTRIAN LEVEL OF SERVICE	EXPECTED MOTORIST COMPLIANCE		
	LOW (or Speed > 35 MPH)	MODERATE	HIGH
LOS A-D (average delay up to 30 seconds)	**LEVEL 3** 2 Lane Road: In-Pavement Flashers, Overhead Flashing Beacons Multi-Lane Road: RRFB Plus LEVELS 1 and 2	**LEVEL 2** Curb Extentions, Bus Bulb, Reduced Curb Radii, Staggered Pedestrian Refuge Plus LEVEL 1	**LEVEL 1** High Visibility Crosswalk Markings, Advanced Yield Lines, Advance Signage
LOS E-F (average delay greater than 30 seconds)	**LEVEL 4** HAWK*, RRFB, or Direct Pedestrians to Nearest Safe Crossing Plus LEVELS 1, 2, and 3	**LEVEL 3** 2 Lane Road: In-Pavement Flashers, Overhead Flashing Beacons Multi-Lane Road: RRFB Plus LEVELS 1 and 2	**LEVEL 2** Curb Extentions, Bus Bulb, Reduced Curb Radii, Staggered Pedestrian Refuge Plus LEVEL 1

* Treatment has provisional approval under the CaMUTCD
* * Note that not all treatments are appropriate for multi-lane roads; refer to suitability notes in treatment fact sheets. Check local codes for each treatment.
** Note that curb extensions should not be used in instances where bicycle lanes are present and no on-street parking is available.

DRAFT TREATMENT IDENTIFICATION TOOL, FEHR & PEERS, VERSION 2.1 (February 23, 2012)

NOTE: This worksheet should be used in conjunction with the User's Guide and Treatment Descriptions. This worksheet provides general recommendations; in all cases, engineering judgment and site review should be used in selecting a specific treatment for installation. This worksheet does not apply to school crossings.

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Rectangular Rapid Flashing Beacon (RRFB)

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Advance Yield Limit Line

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Pedestrian Hybrid Beacon

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Hybrid Beacon Sequence

1

Blank for drivers

4

Steady red

2

Flashing yellow

5

Wig-Wag

3

Steady yellow

Return to 1

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Interchange Cases

- On-Ramp Cases
- Off-Ramp Cases
- SPUIs

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On-Ramps

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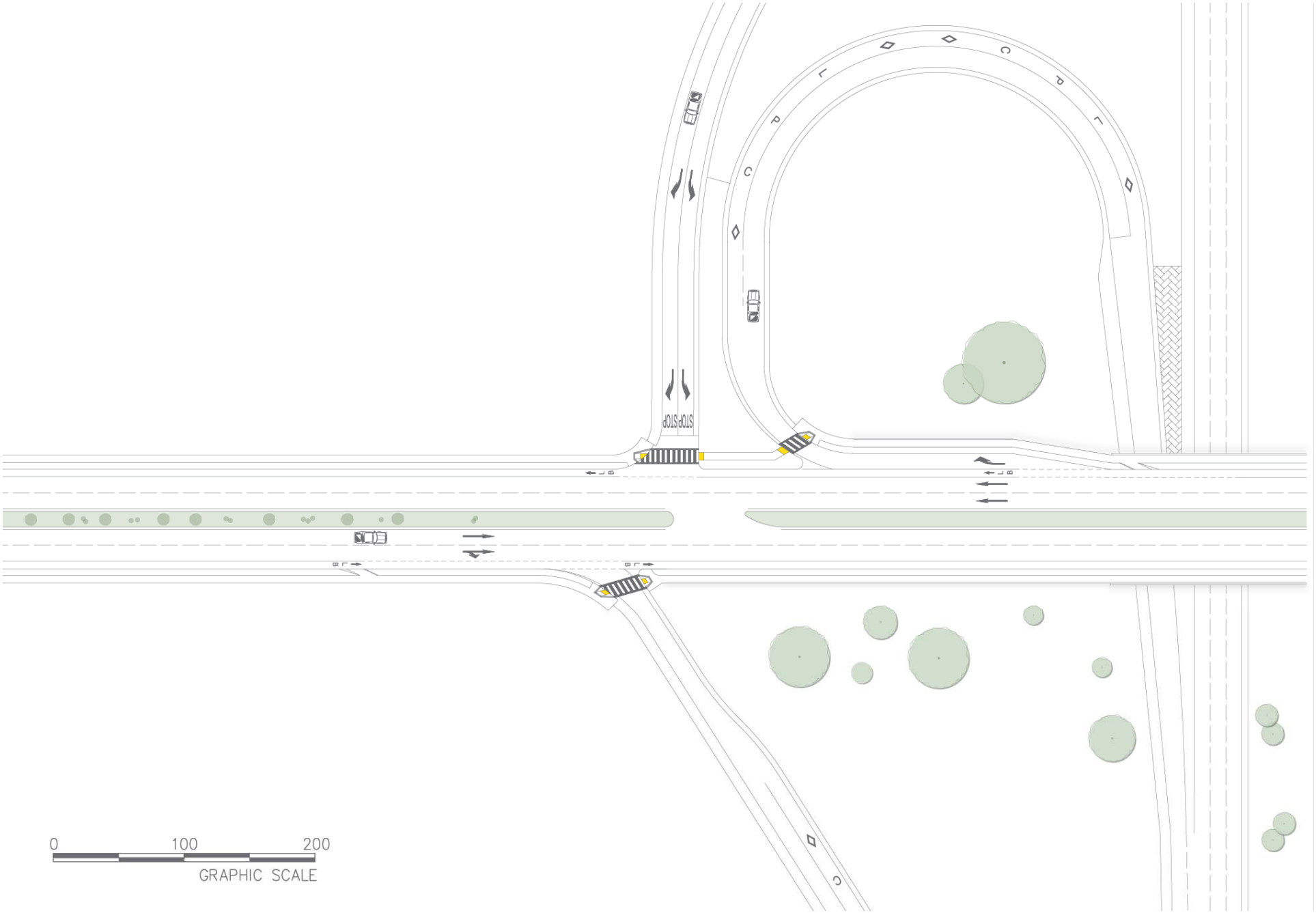
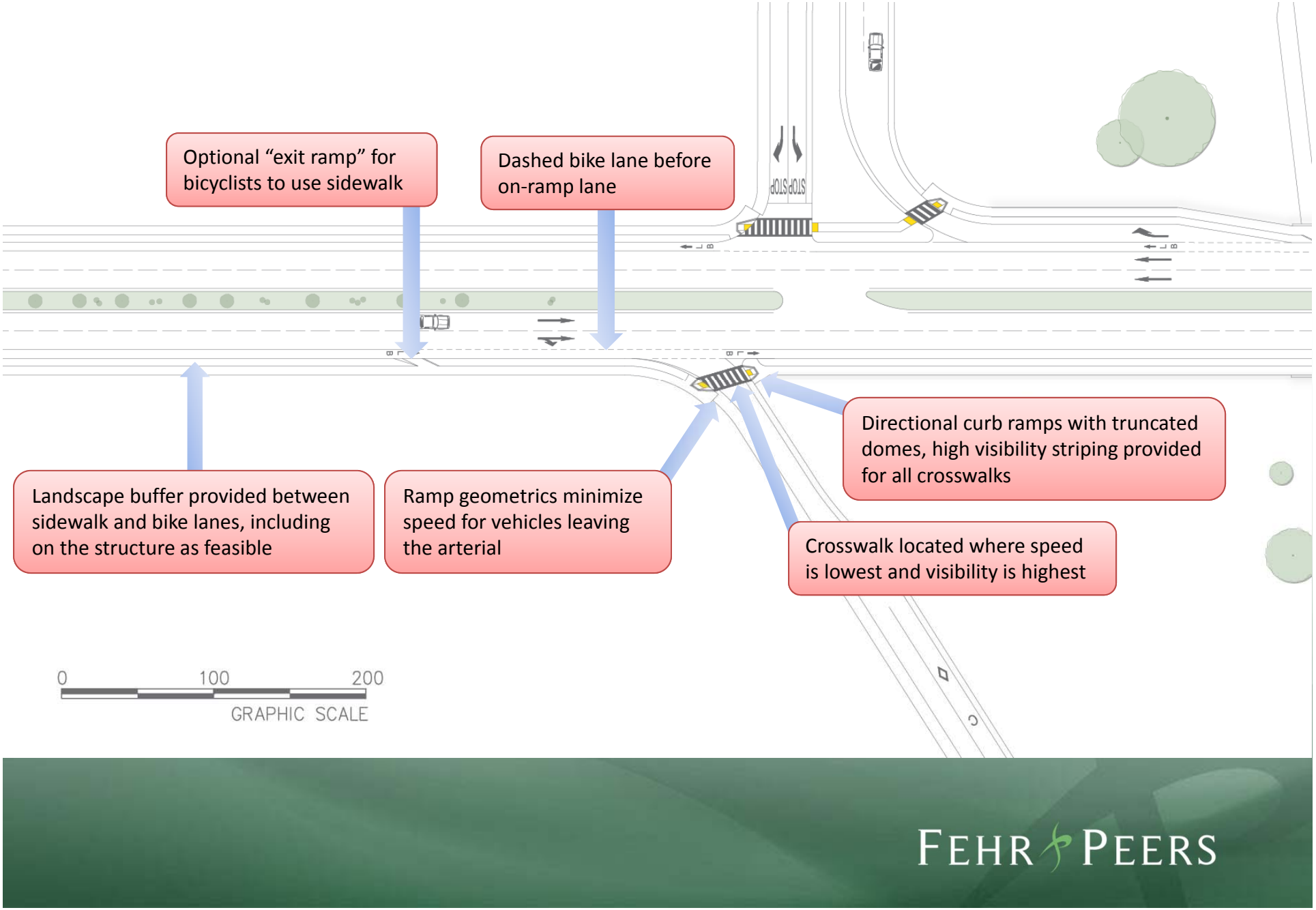
1. On-Ramp Entered from Shared Through Right Lane



1. On-Ramp Entered from Shared Through Right Lane



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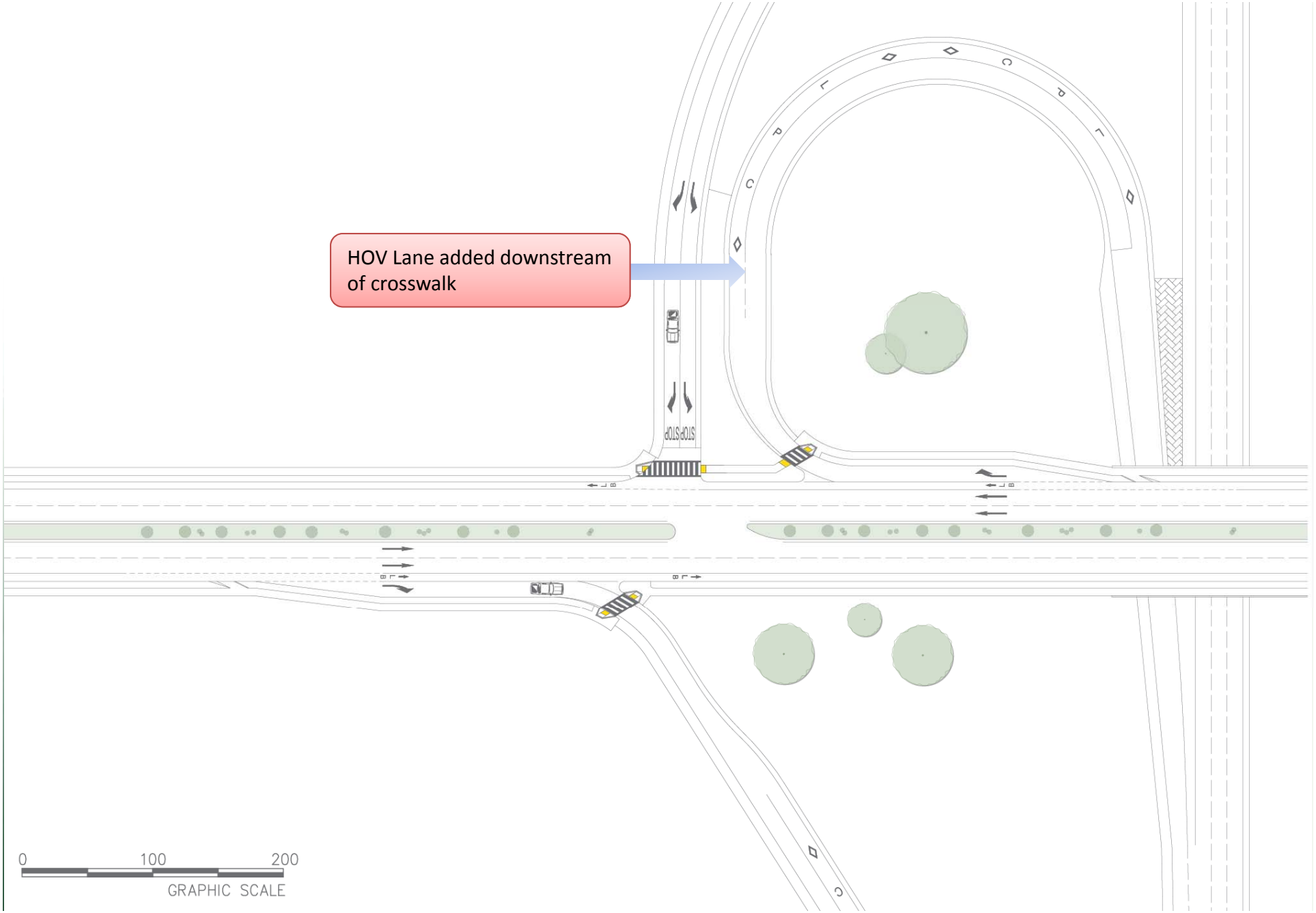
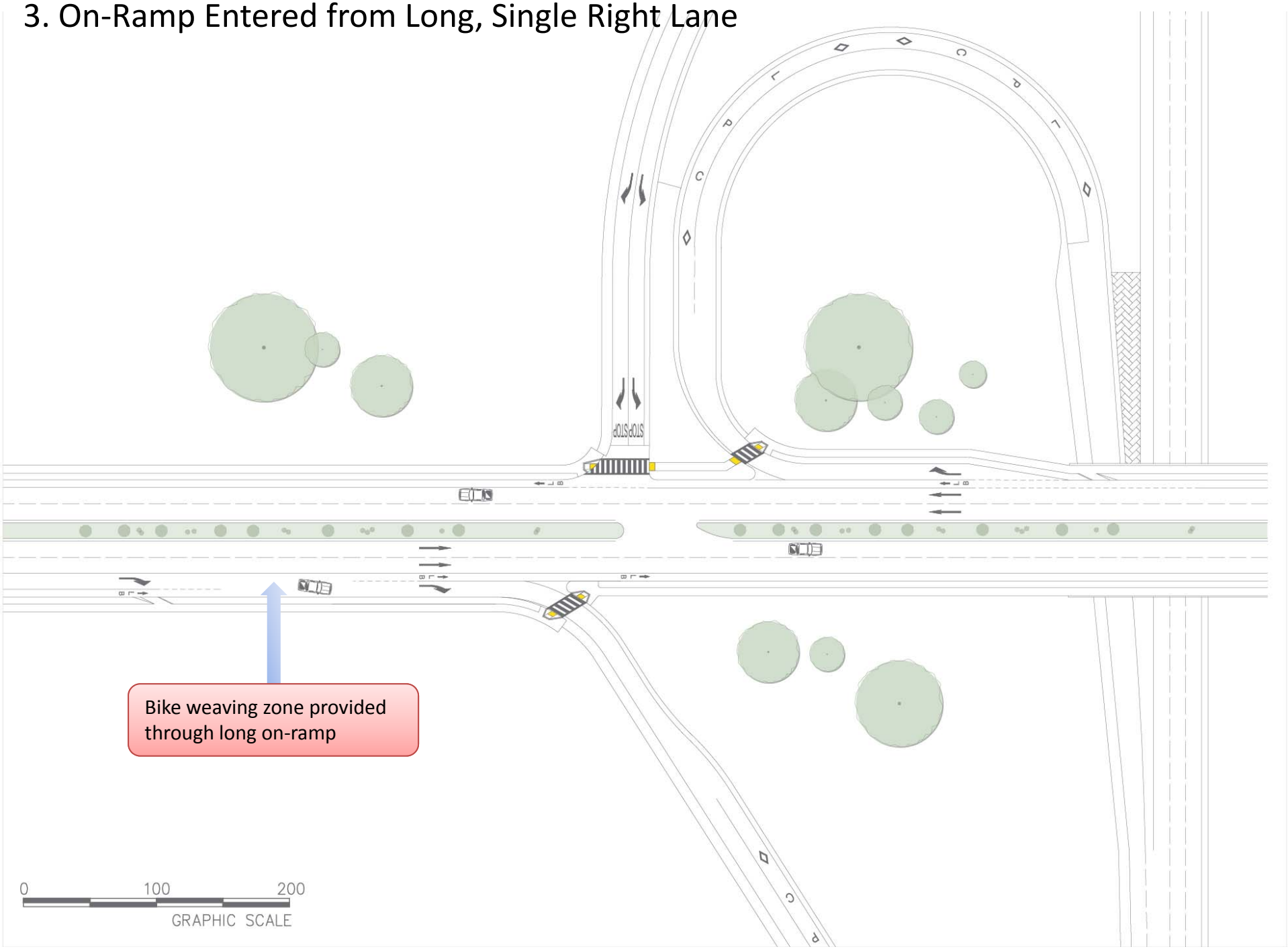
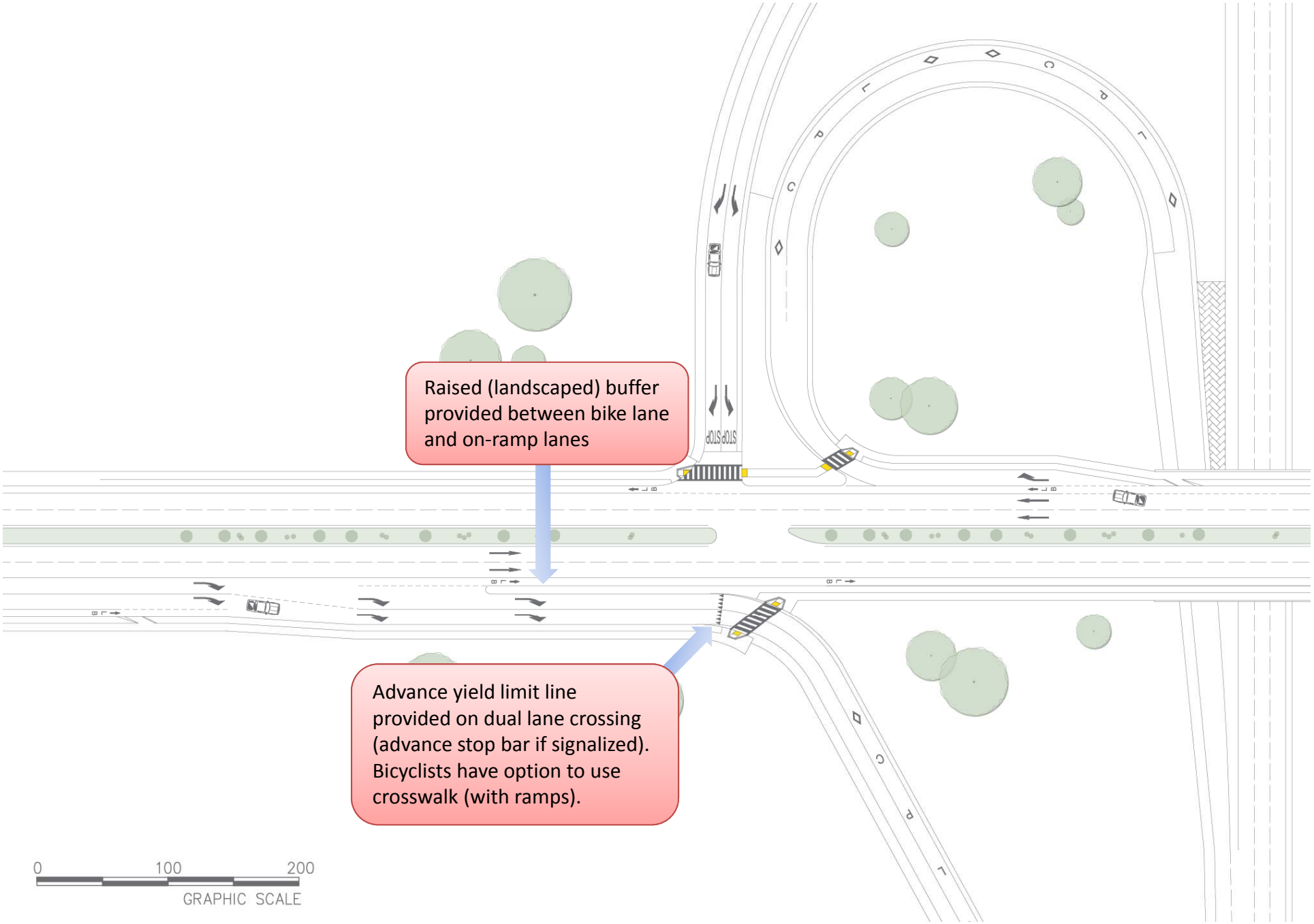
2. On-Ramp Entered from Short, Single Right Lane



3. On-Ramp Entered from Long, Single Right Lane



4. On-Ramp Entered from Long, Dual Right Lane



Off -Ramps

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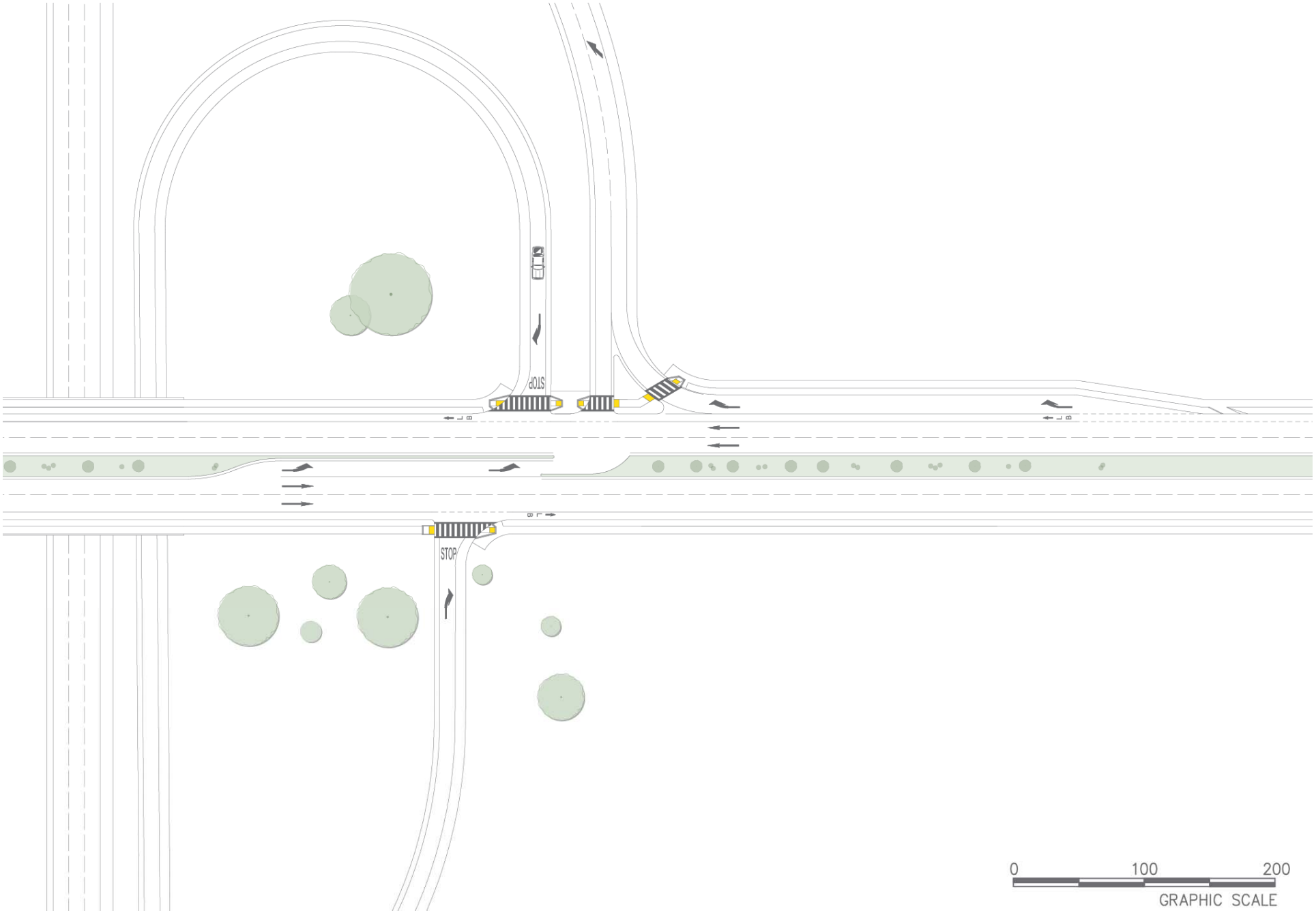
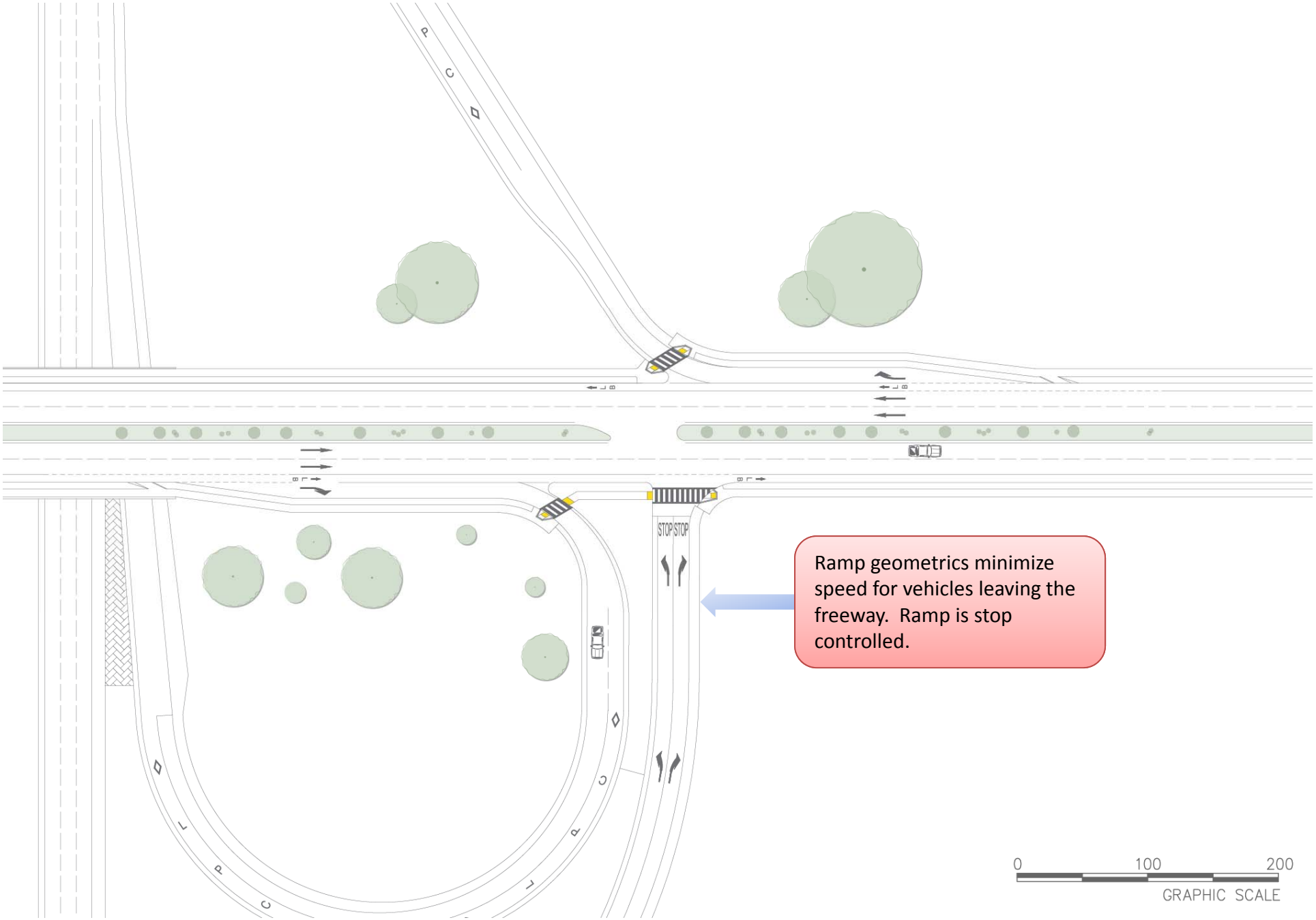
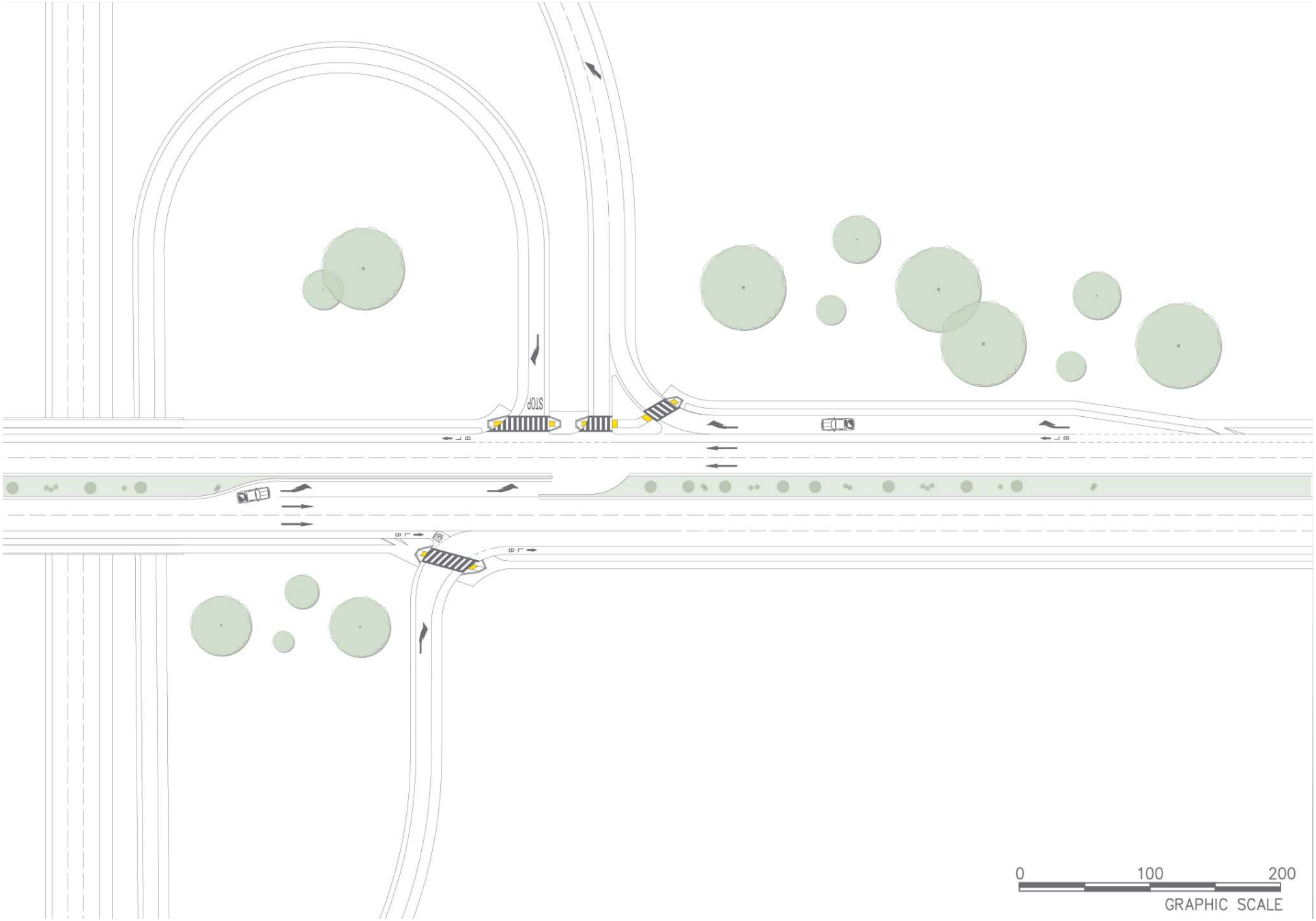
1A. Arterial Entered from Stop/Merge Off-Ramp (Split Ramps)



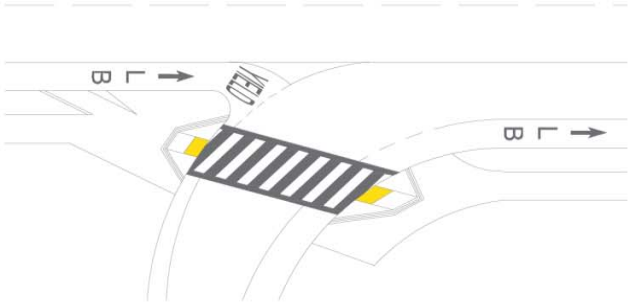
1B. Arterial Entered from Stop/Merge Off-Ramp (Combined Ramps)



2. Arterial Entered from Free Off-Ramp



Bike lane crossing - detail



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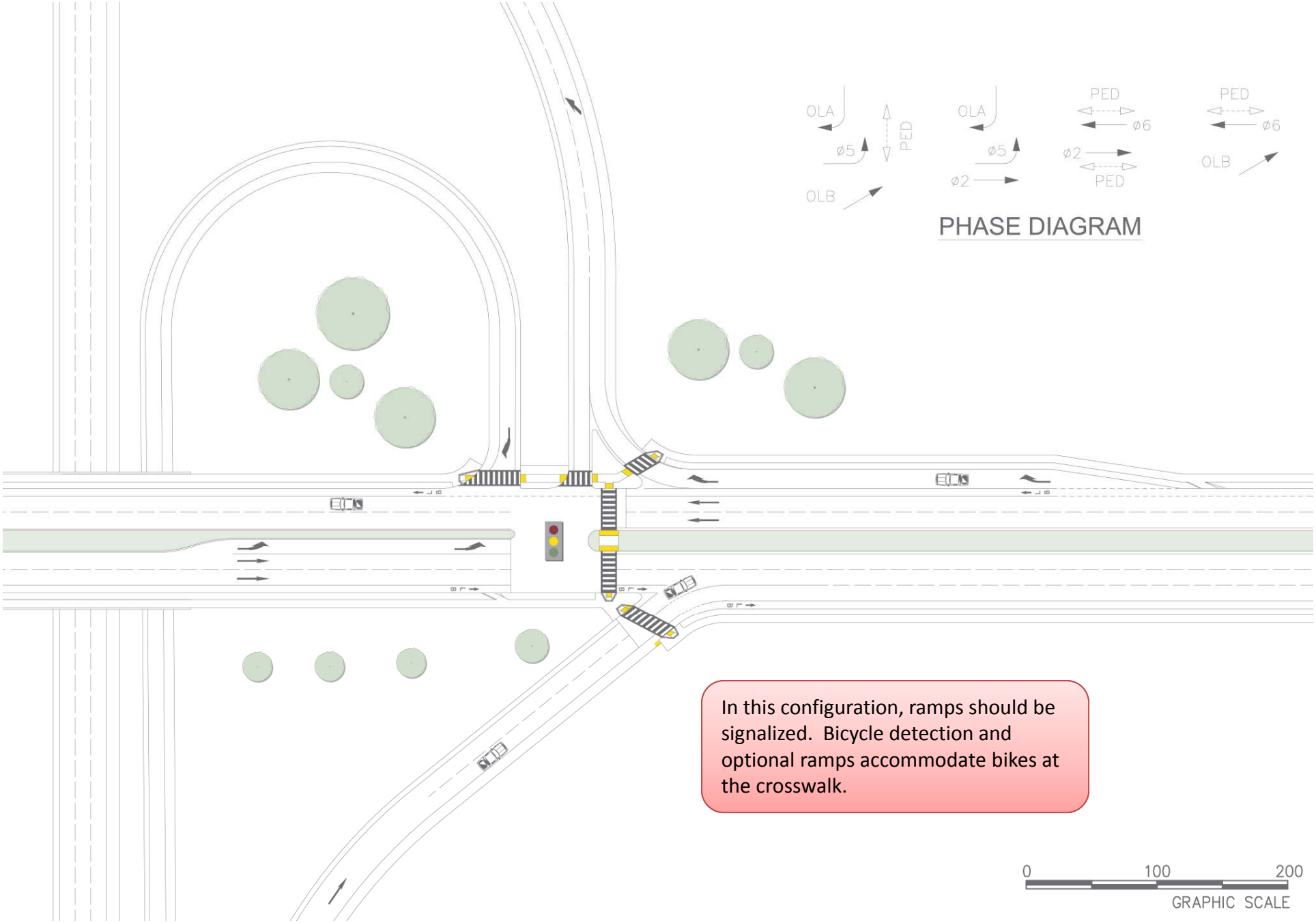
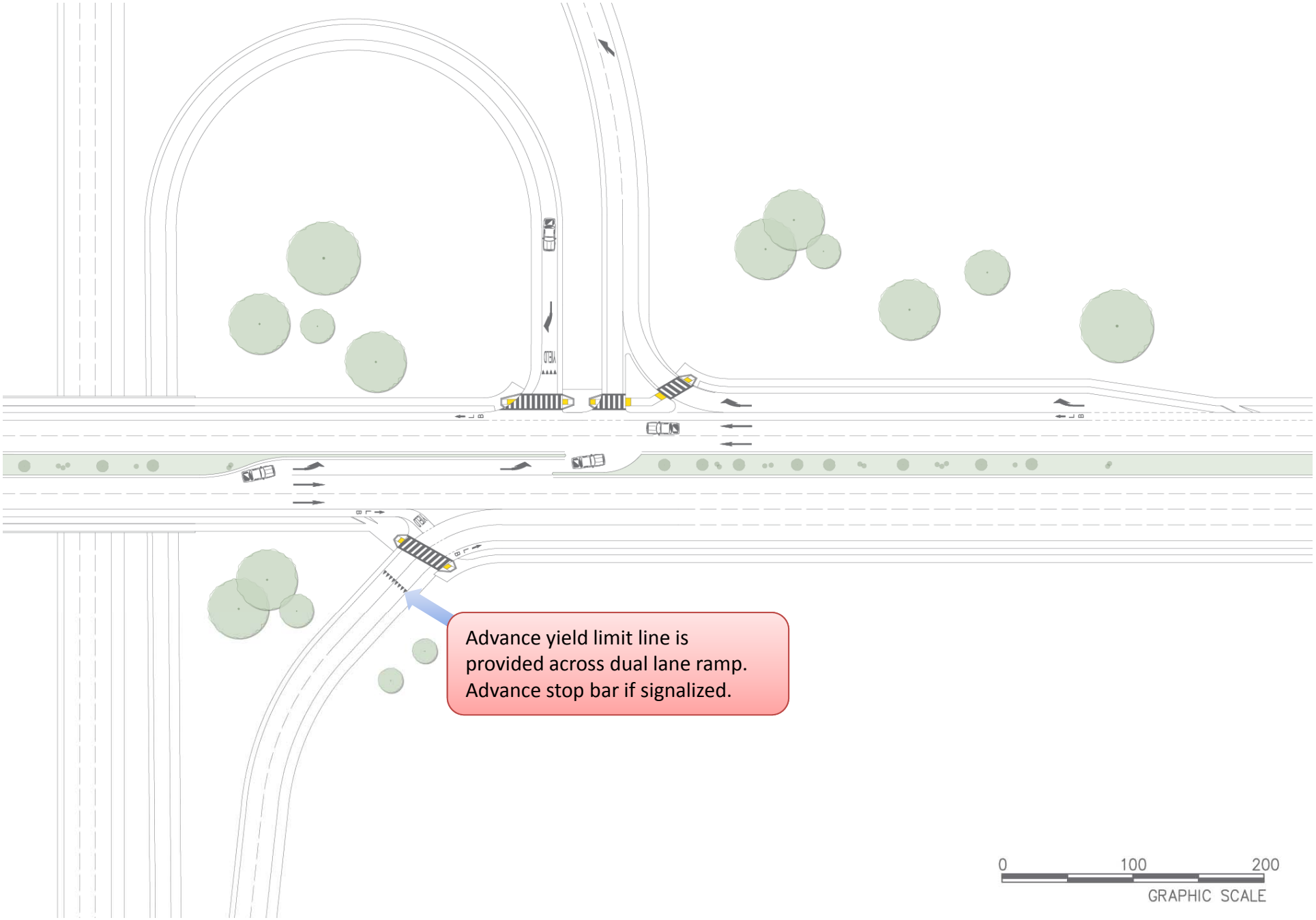
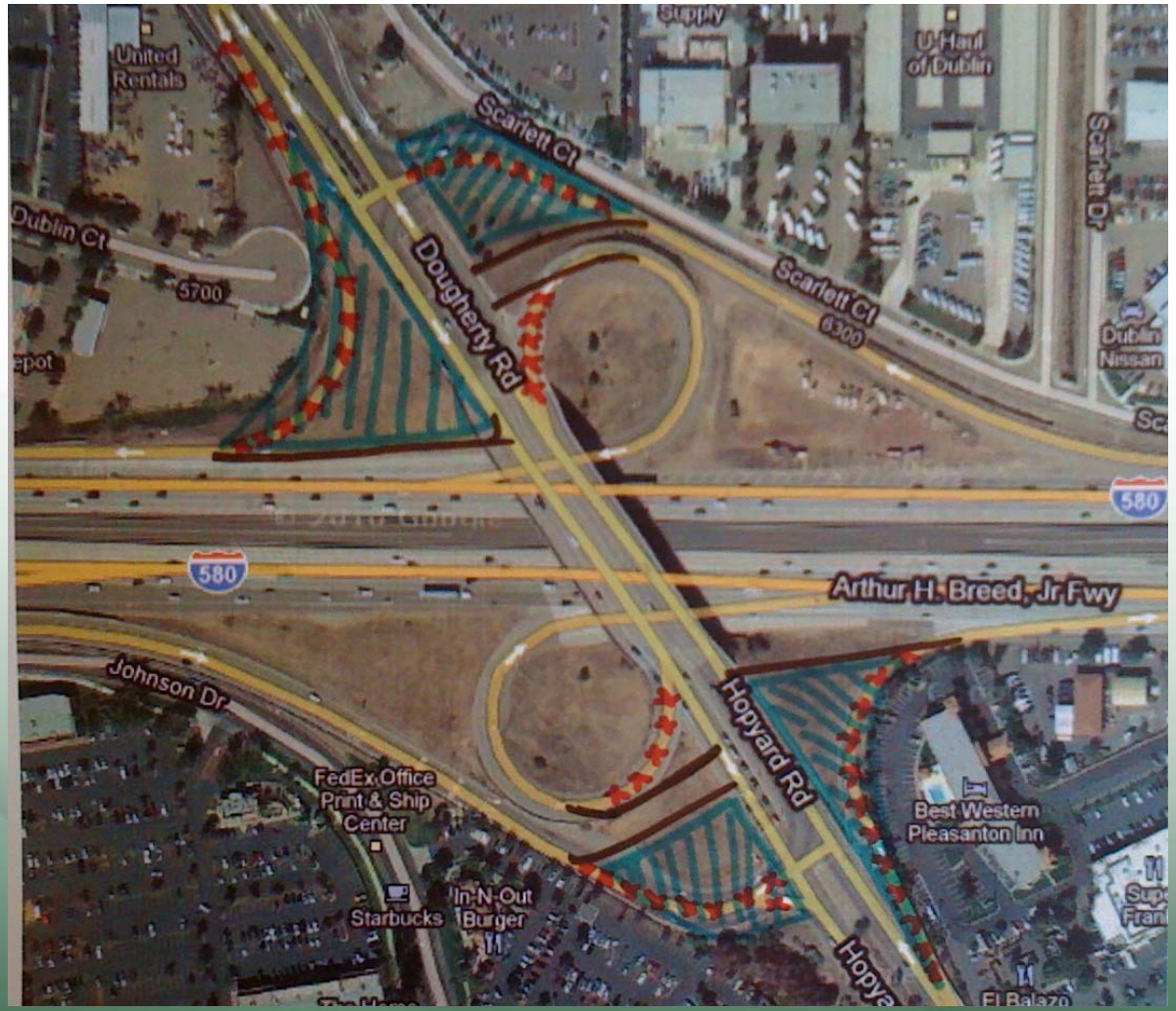
3. Arterial Entered from Two-Lane Off-Ramp, Signalized Right Turns

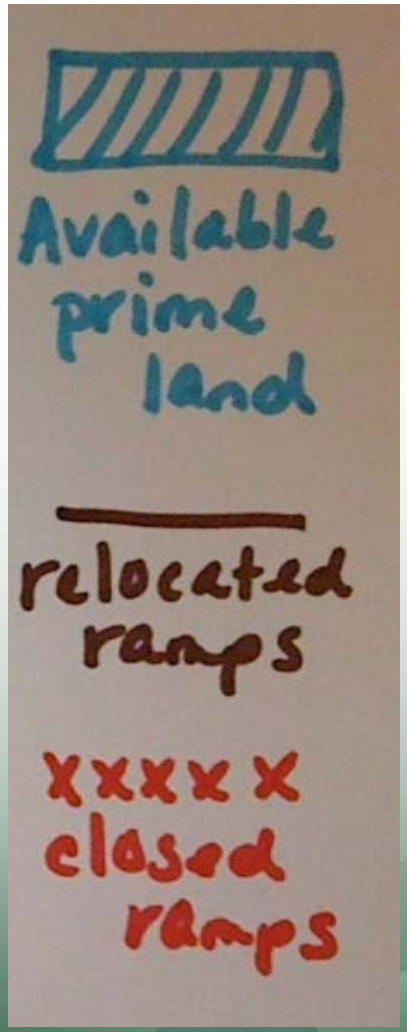


4. Arterial Entered from Two-Lane Off-Ramp, Two Free Right Turns



Savings in Land Area, Less Ped "Dead Zone"





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What you don't see in this presentation…

Right turn lane adjacent to shared right-thru

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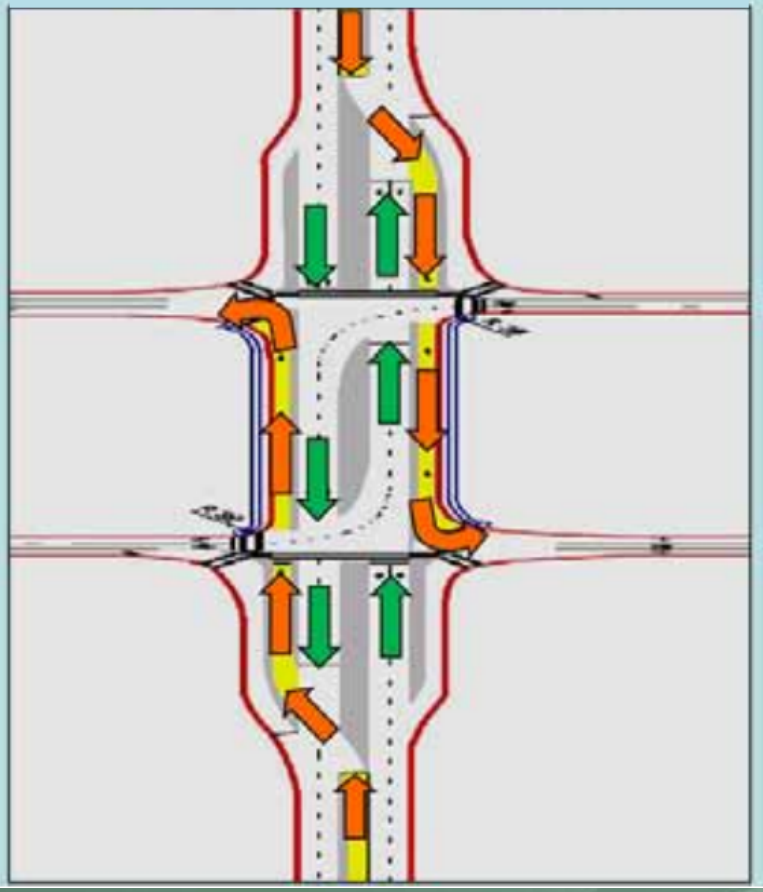
Designs not Discussed

DOUBLE CROSSOVER DIAMOND

DISPLACED LEFT-TURN



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Single Point Urban Interchanges (SPUIs)

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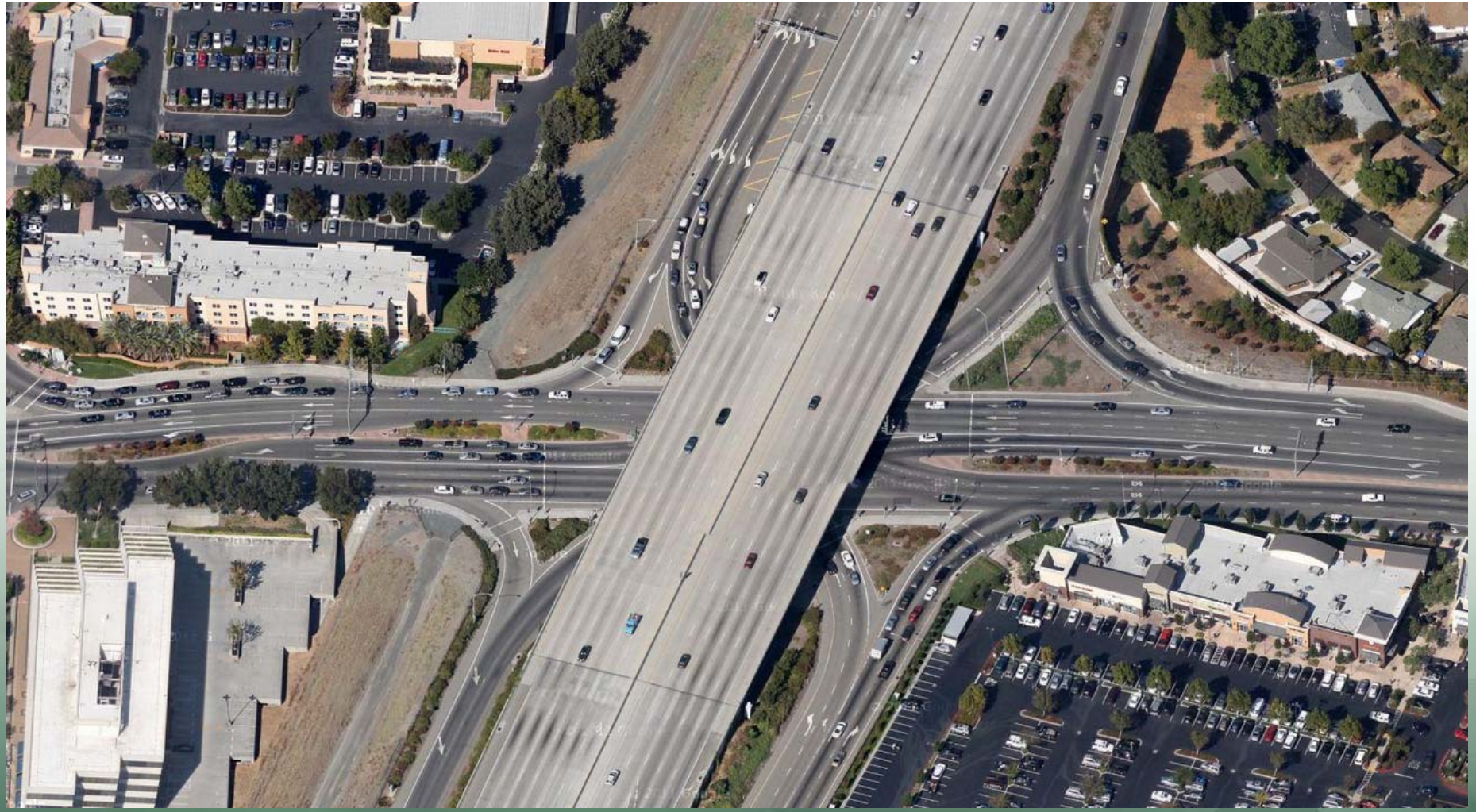
I-680 at Monument Blvd.



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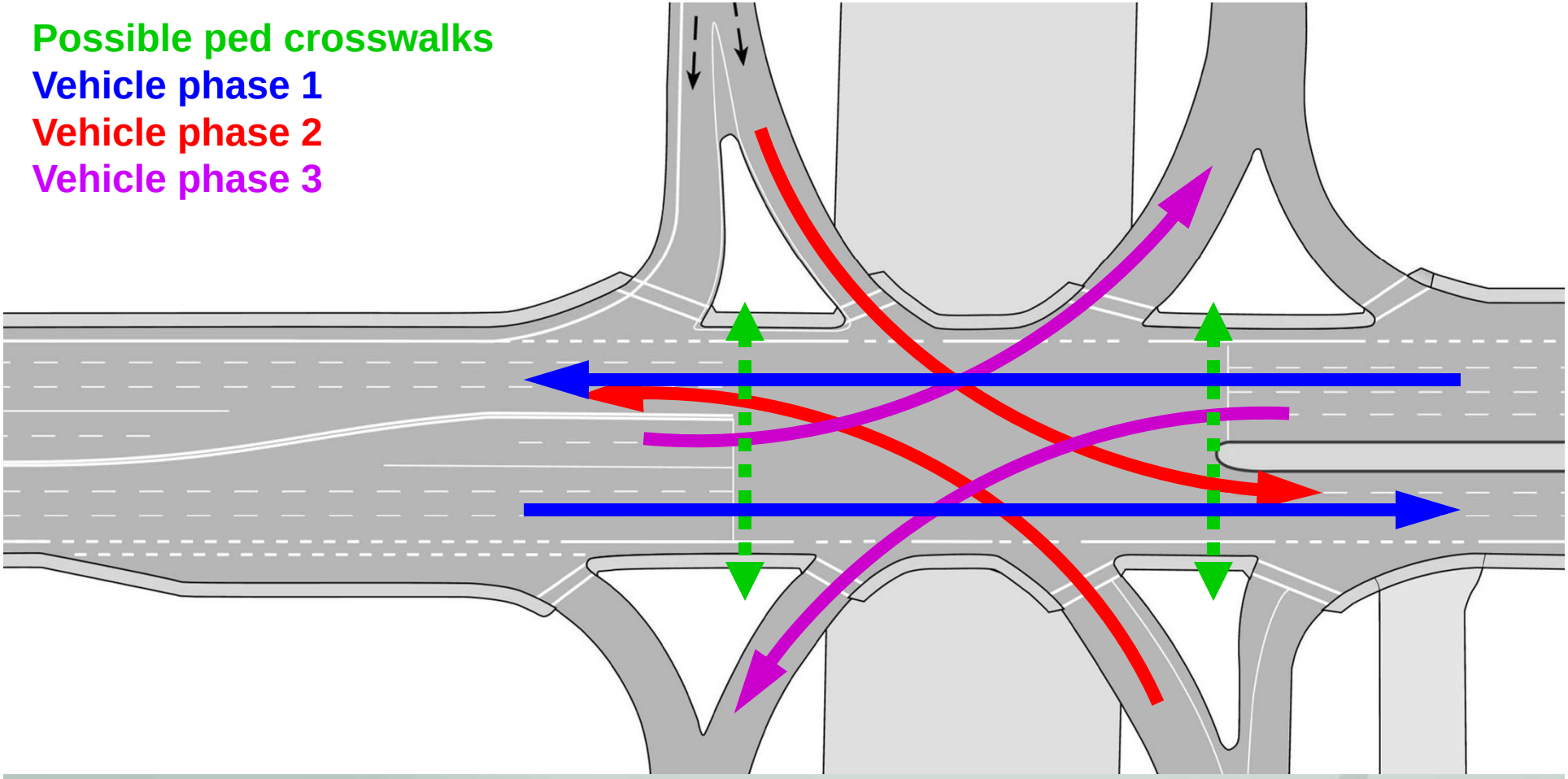
Possible ped crosswalks
Vehicle phase 1
Vehicle phase 2
Vehicle phase 3



With most SPUIs there is never a phase when pedestrians can cross the urban arterial without conflict

Solution: Two-step crossing (one step during vehicle phase 2 and the other during vehicle phase 3)

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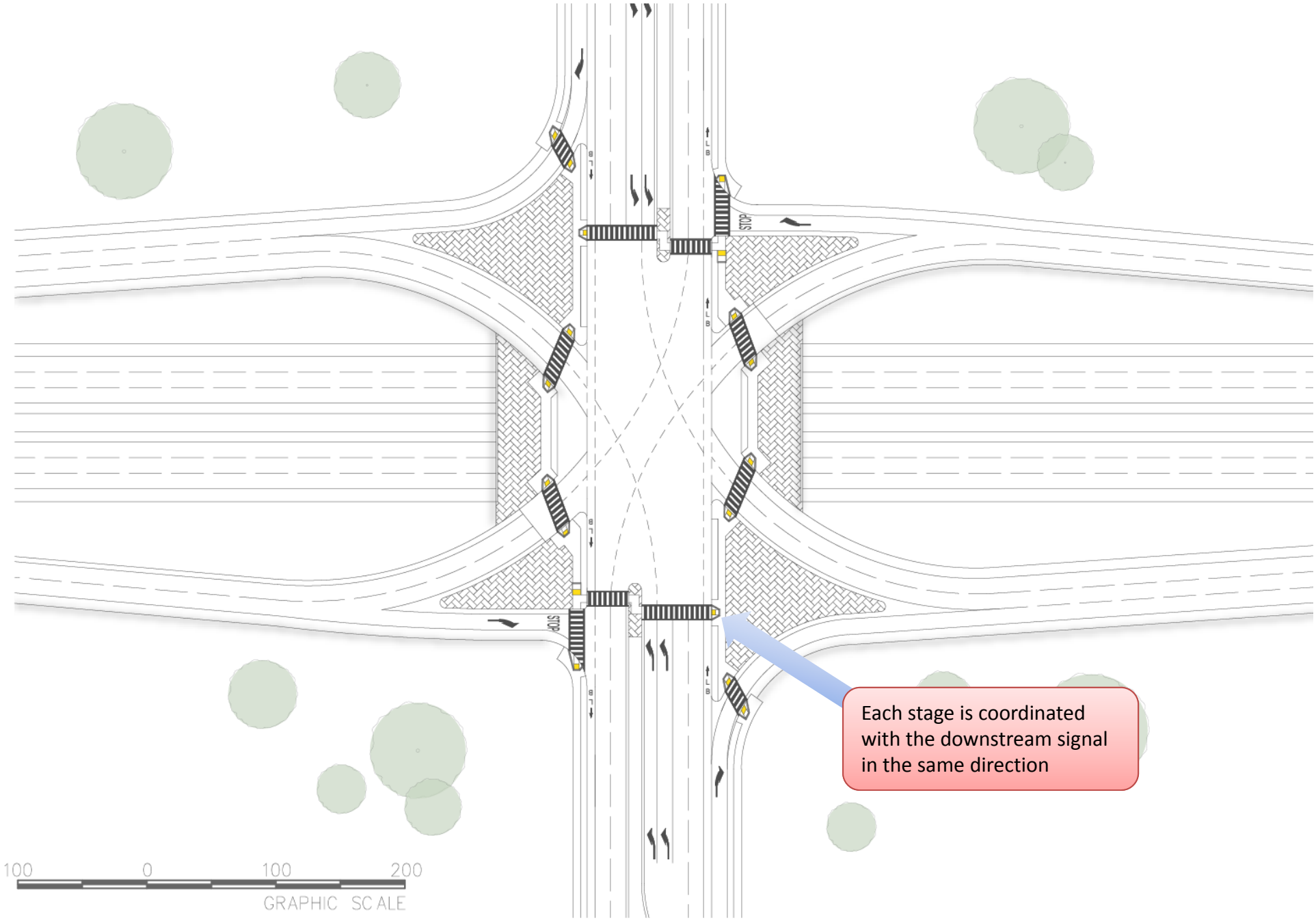
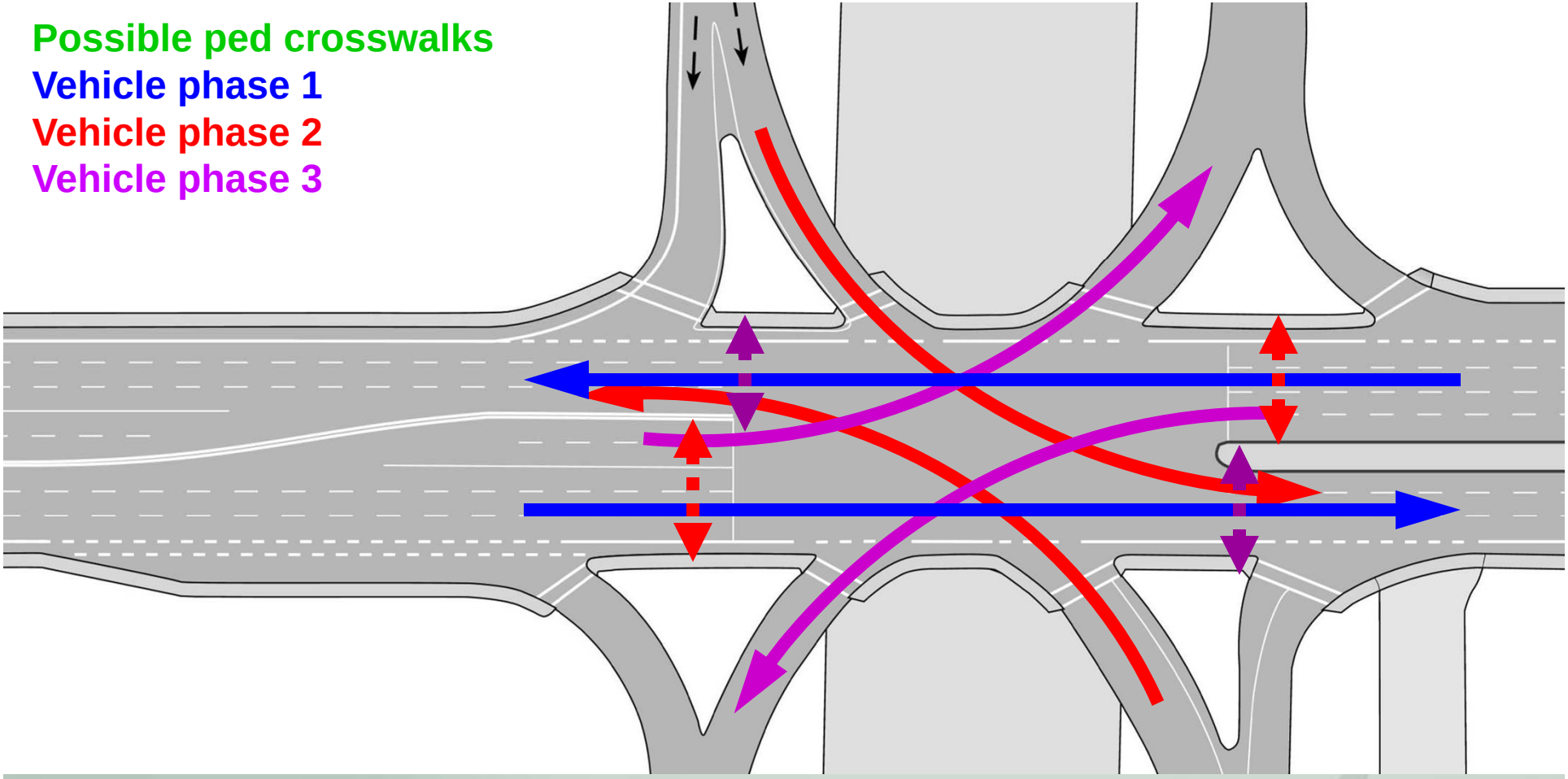
SPUI 1 – Two-Stage Crossing



Possible ped crosswalks
Vehicle phase 1
Vehicle phase 2
Vehicle phase 3



Peds with vehicle phase 2

Peds with vehicle phase 3

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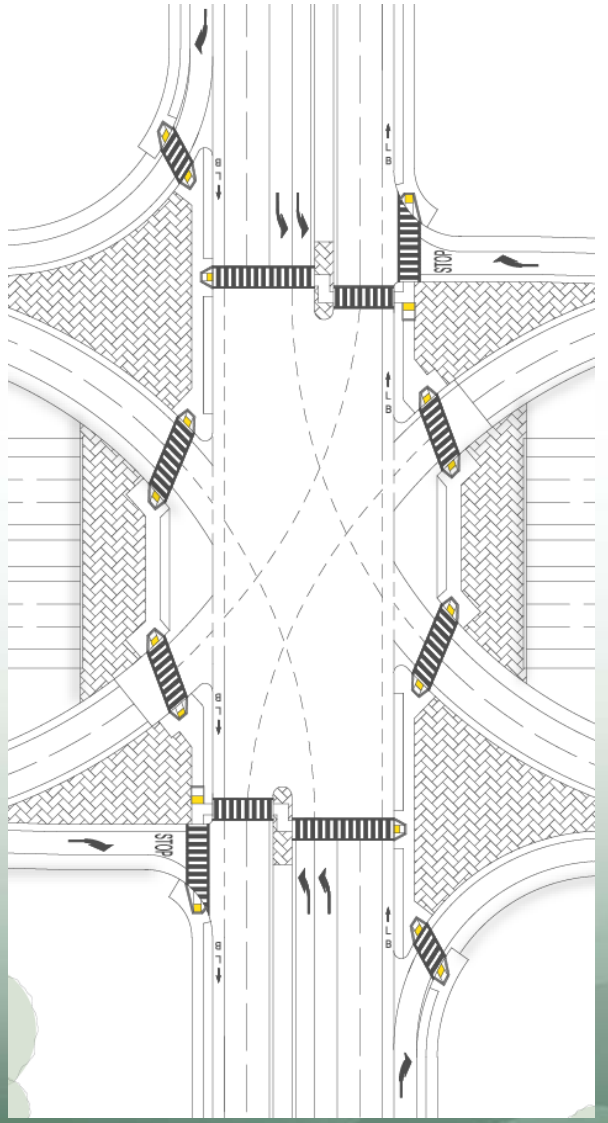
Skip Striping through Complex Intersections



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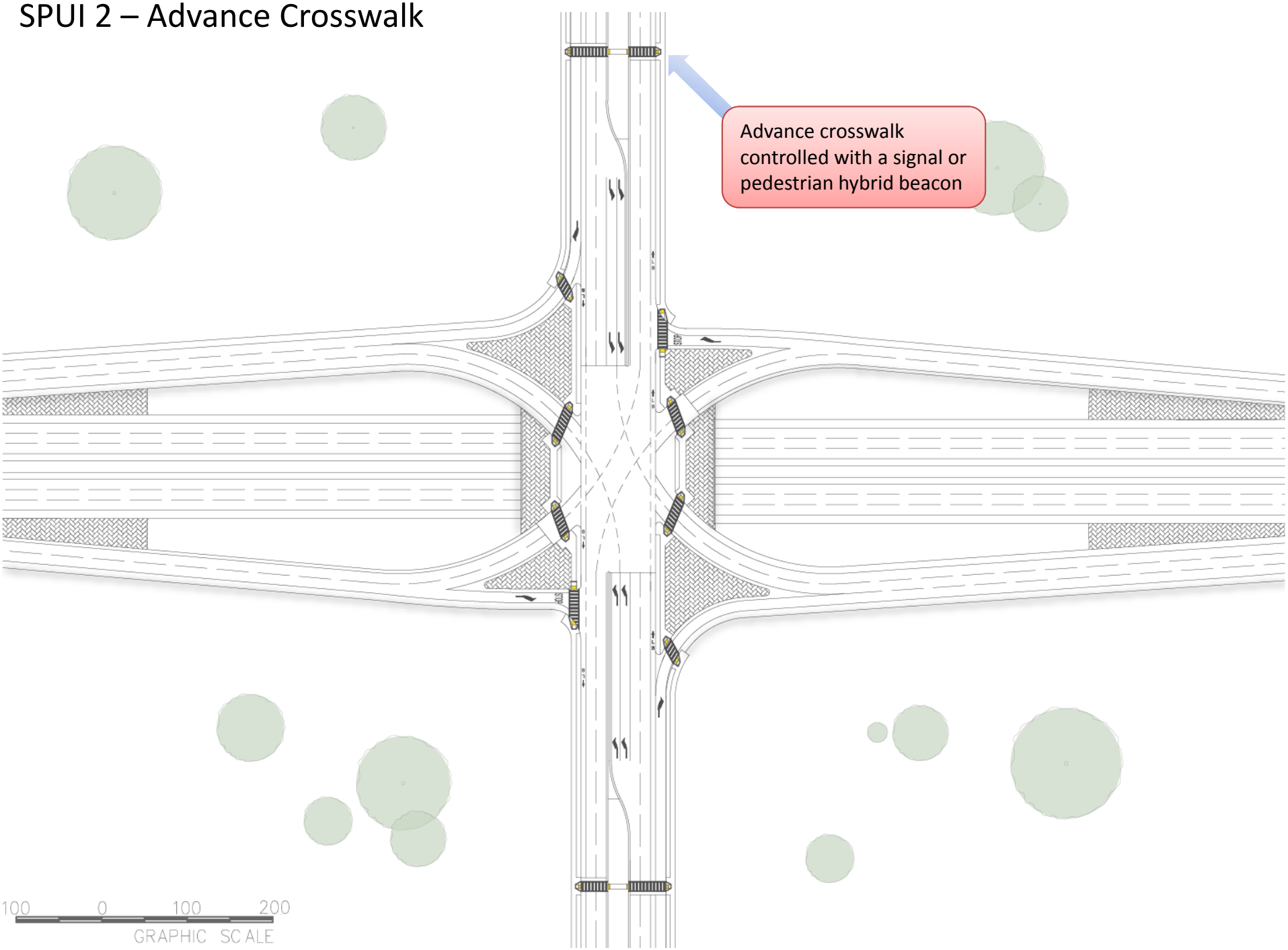
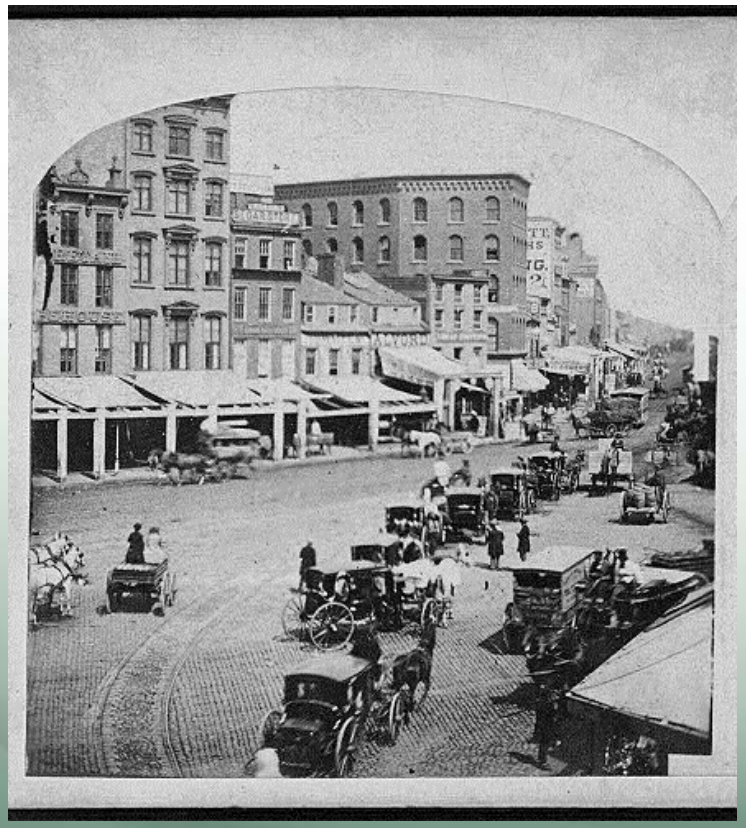
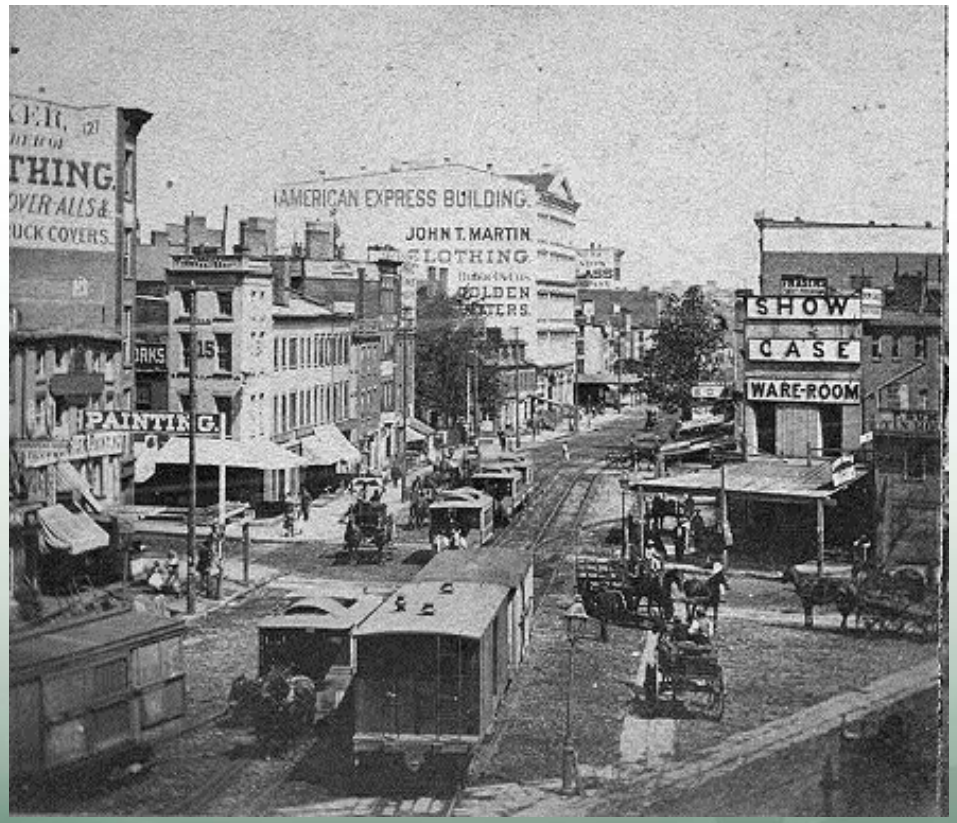
SPUI 2 – Advance Crosswalk



Colonial America (1630-1915)





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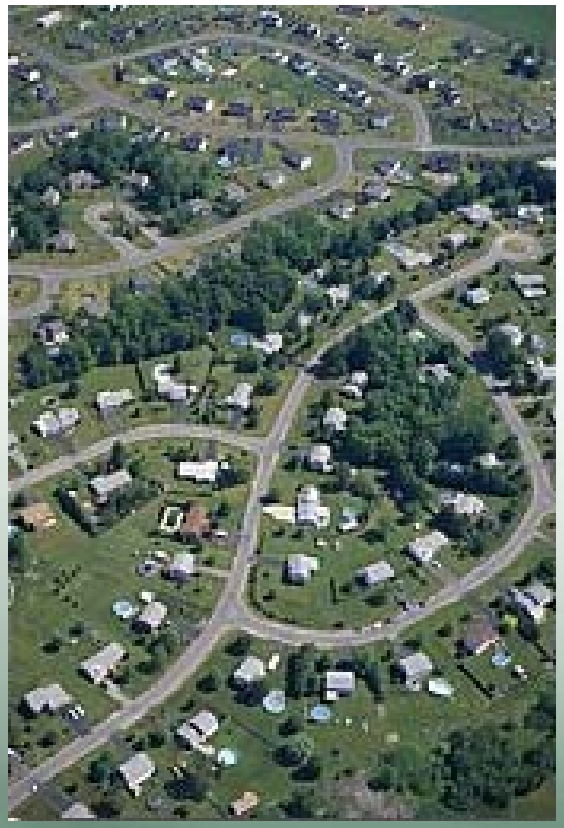
Post World War II (1940-1970)



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Questions

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Thank You!

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  - Downloadable and streaming recording, transcript, presentation slides
- **Questions?**
  - **Matthew Ridgway**
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