Separated Bike Lanes Webinar Series (Part II)

Design Considerations for Separated Bike Lanes

Dan Goodman
Federal Highway Administration
Carl Sundstrom
UNC Highway Safety Research Center
Ben Rosenblatt
Sam Schwartz Transportation Consultants
Mike Amsden
City of Chicago

Today's Presentation

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

Design Considerations for Separated Bike Lanes (Part II)

June 14, 2016

U.S. Department of Transportation
Federal Highway Administration

Context

Policy Statement on Bicycle and Pedestrian Accommodation

The DOT **policy is to incorporate** safe and convenient walking and bicycling facilities into transportation projects. **Every transportation agency, including DOT, has the responsibility to improve conditions and opportunities for walking and bicycling** and to integrate walking and bicycling into their transportation systems. Because of the numerous individual and community benefits that walking and bicycling provide — including health, safety, environmental, transportation, and quality of life — transportation agencies are encouraged to **go beyond minimum standards to provide safe and convenient facilities** for these modes.

Context

Mayors' Challenge for Safer People, Safer Streets

- Complete Streets
- Fix Barriers
- Gather Data
- Design Right
- Create Networks
- Improve Laws
- Educate and Enforce

Context

FHWA Support For:

- An integrated, safe, and convenient transportation system for all users
- Sustainable transportation policies and practices
- Design flexibility
- Connected pedestrian and bicycle *networks*
- Pedestrian and bicycle data
- Equity and Ladders of Opportunity
- Quality of life and livability

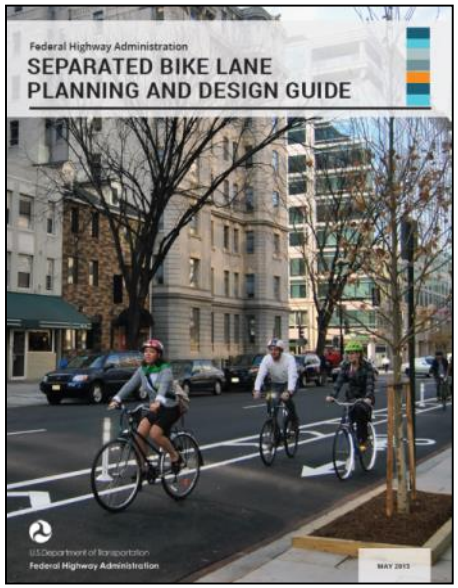




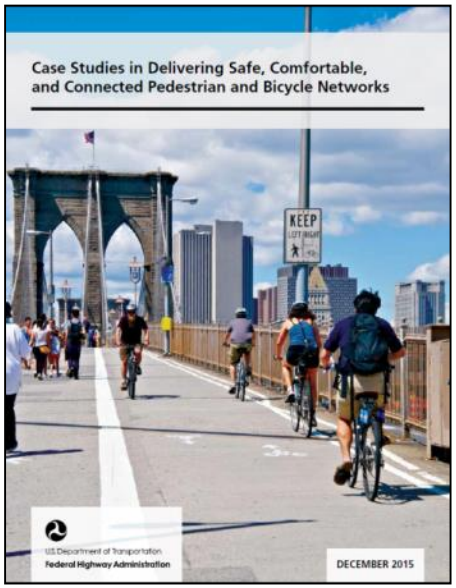

CITY OF CARY

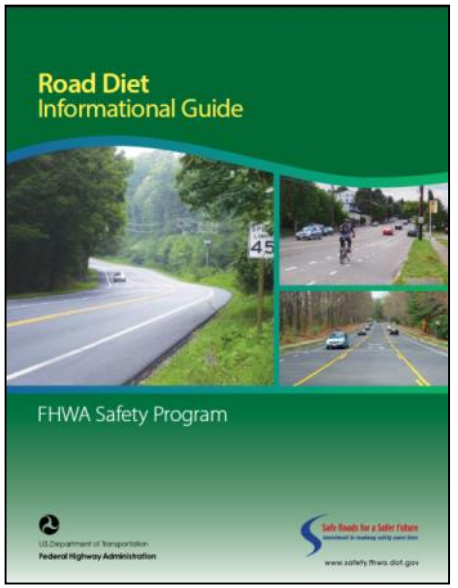


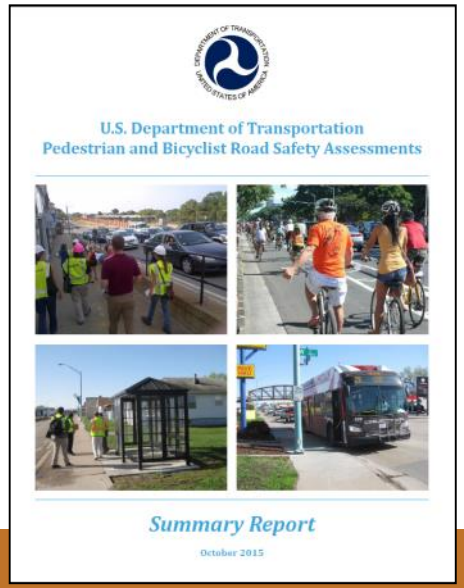
Context


Federal Highway Administration
SEPARATED BIKE LANE
PLANNING AND DESIGN GUIDE
U.S. Department of Transportation
Federal Highway Administration
MAY 2015


Incorporating
On-Road Bicycle Networks
into Resurfacing Projects
U.S. Department of Transportation
Federal Highway Administration
MARCH 2016


Case Studies in Delivering Safe, Comfortable,
and Connected Pedestrian and Bicycle Networks
KEEP
U.S. Department of Transportation
Federal Highway Administration
DECEMBER 2015


Road Diet
Informational Guide
FHWA Safety Program
U.S. Department of Transportation
Federal Highway Administration
Safe Roads for a Safer Future
www.safety.fhwa.dot.gov


U.S. Department of Transportation
Pedestrian and Bicyclist Road Safety Assessments
Summary Report
October 2015


U.S. Department of Transportation
Federal Highway Administration
GUIDEBOOK
FOR DEVELOPING PEDESTRIAN &
BICYCLE PERFORMANCE MEASURES
MARCH
2016


Bicycle Network Planning &
Facility Design Approaches
in the Netherlands and
the United States
FHWA Global Benchmarking Program
U.S. Department of Transportation
Federal Highway Administration

U.S. Department of Transportation
Federal Highway Administration

About Programs Resources Briefing Room Contact Search FHWA

Office of Planning, Environment, & Realty (HEP)
Planning • Environment • Real Estate

HEP | Events | Guidance | Publications | Awards | Contacts

Bicycle & Pedestrian

- Overview
- Legislation
- Guidance & Information
- Funding
- Publications
- Meetings & Events
- Resources

FHWA Contact

For more information, please contact Daniel Goodman, 202-366-9064.

State Coordinator Contact Information

Each State administers its own program. Contact your State Bicycle and Pedestrian Coordinator for guidance on State policies and project eligibility requirements.

FHWA → Environment → Bicycle & Pedestrian Program → Funding

Bicycle and Pedestrian Funding Opportunities: US Department of Transportation, Federal Transit, and Federal Highway Funds

Revised **December 4, 2014**, to incorporate programs authorized under the Moving Ahead for Progress in the 21st Century Act (MAP-21).

This table indicates potential eligibility for pedestrian and bicycle projects under Federal Transit and Federal Highway programs. Specific program requirements must be met, and eligibility must be determined, on a case-by-case basis. For example: transit funds must provide access to transit; CMAQ must benefit air quality; HSIP projects must be consistent with the State Strategic Highway Safety Plan and address a highway safety problem; NHPP must benefit National Highway System (NHS) corridors; RTP must benefit trails; the Federal Lands and Tribal Transportation Programs (FLTTP) must provide access to or within Federal or tribal lands. See more information about Bikes and Transit and Eligibility of Pedestrian and Bicycle Improvements under Federal Transit Law.

Bicycle and Pedestrian Funding Opportunities / Federal Transit and Federal Highway Funds

Activity	TIGER see note below	FTA	ATI	CMAQ see note below	HSIP	NHPP NHS	STP	TAP TE	RTP	SRTS until expended	PLAN	402	FLTTP
Access enhancements to public transportation	$	$	$	$			$	$					$
ADA/504 Self Evaluation / Transition Plan	$plan						$	$	$		$		$
Bicycle and/or pedestrian plans	$plan	$					$	$			$		$
Bicycle lanes on road	$	$	$	$	$	$	$	$		$			$
Bicycle parking	$*	$	$	$		$	$	$	$	$			$
Bike racks on transit	$	$	$	$			$	$					$

Safety education positions							$ as SRTS	$ as SRTS		$	
Separated bicycle lanes*	$	$	$	$	$	$	$	$		$	
Shared use paths / transportation trails	$	$	$	$*	$	$	$	$	$	$	
Sidewalks (new or retrofit)	$	$	$	$	$	$	$	$	$	$	

http://www.fhwa.dot.gov/environment/bicycle_pedestrian/funding/funding_opportunities.cfm

Addressing Common Misconceptions

3. Separated bike lanes cannot be built with Federal funds.

This is false. Federal funds can be used to plan and build separated bike lanes, which can include cycle tracks and protected bike lanes. The FHWA recently published a *Separated Bike Lane Planning and Design Guide*, which includes planning considerations and design options for separated bike lanes. In addition, separated bike lanes are included in the Bicycle and Pedestrian Funding Opportunities: US Department of Transportation, Federal Transit, and Federal Highway Table.

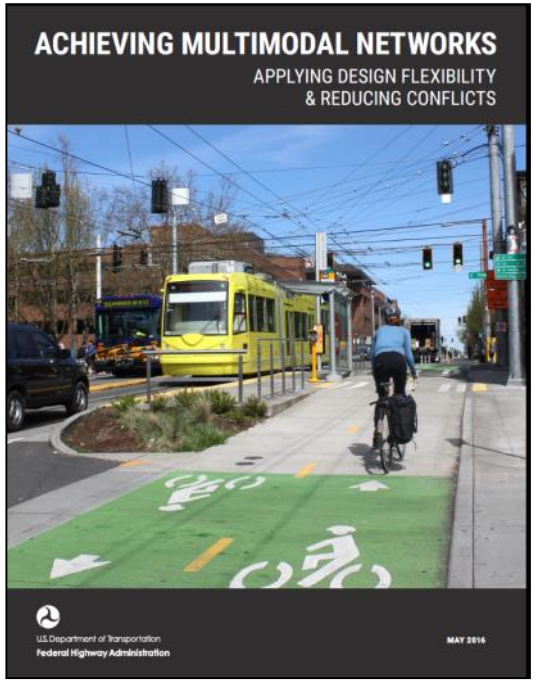
Minimum Data Collection Before and After Construction of Separated Bike Lane

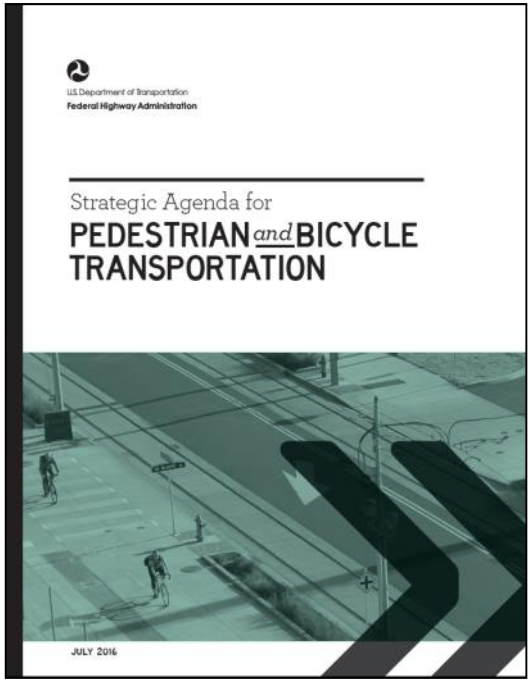
Before and After Construction of Separated Bike Lane	Data Element	Minimum	Preferred	After Construction Data Consideration	Notes
Volume of Bicyclists	Manual count duration/day	4 hours/day	All Daylight Hours	Ensure compatible time periods as before counts	Suggested times: 4 hours in split mo evening
	Manual count days	3 days	14 Days	Ensure comparable weather conditions and days of the week as before counts	
	Automatic count duration	24 hours/day	24 hours/day	Ensure compatible time periods as before counts	
	Automatic count days	7 days	14 Days	Ensure comparable weather conditions and days of the week as before counts	
	Documentation of count locations	All	All	Same count locations as before counts	Adequa docume count l docume
Travel Characteristics	Traveling direction	All bicyclists in any direction	Each direction separately		
	Wrong way riding	Not counted separately	"Wrong" and "Right" directions separately		Which the wrc were o there m counts each di
	Facility on which bicyclists are traveling	All lanes together	Each lane separately		e.g. Sha Lane, S
Crashes	Identify and compile all available crash records in the project vicinity	All available	All available		Ideally coded l crashes crashes crash, and documentation of circumstances

Before and After Construction of Separated Bike Lane	Data Element	Minimum	Preferred
Volume of Bicyclists	Manual count duration/day	4 hours/day	All Daylight Hours
	Manual count days	3 days	14 Days
	Automatic count duration	24 hours/day	24 hours/day
	Automatic count days	7 days	14 Days
	Documentation of count locations	All	All

Coming Soon!

- Achieving Multimodal Networks: Applying Design Flexibility & Reducing Conflicts
- Strategic Agenda for Pedestrian and Bicycle Transportation
- Multimodal Networks in Small Town and Rural Communities
- FTA Guidebook for Enhancing Pedestrian and Bicycle Connections to Transit





FHWA Contacts

Dan Goodman

Office of Planning, Environment, and Realty

daniel.goodman@dot.gov

Christopher Douwes

Office of Planning, Environment, and Realty

Christopher.Douwes@dot.gov

Gabriel Rousseau

Office of Safety

Gabe.Rousseau@dot.gov

Elizabeth Hilton

Office of Infrastructure

Elizabeth.Hilton@dot.gov

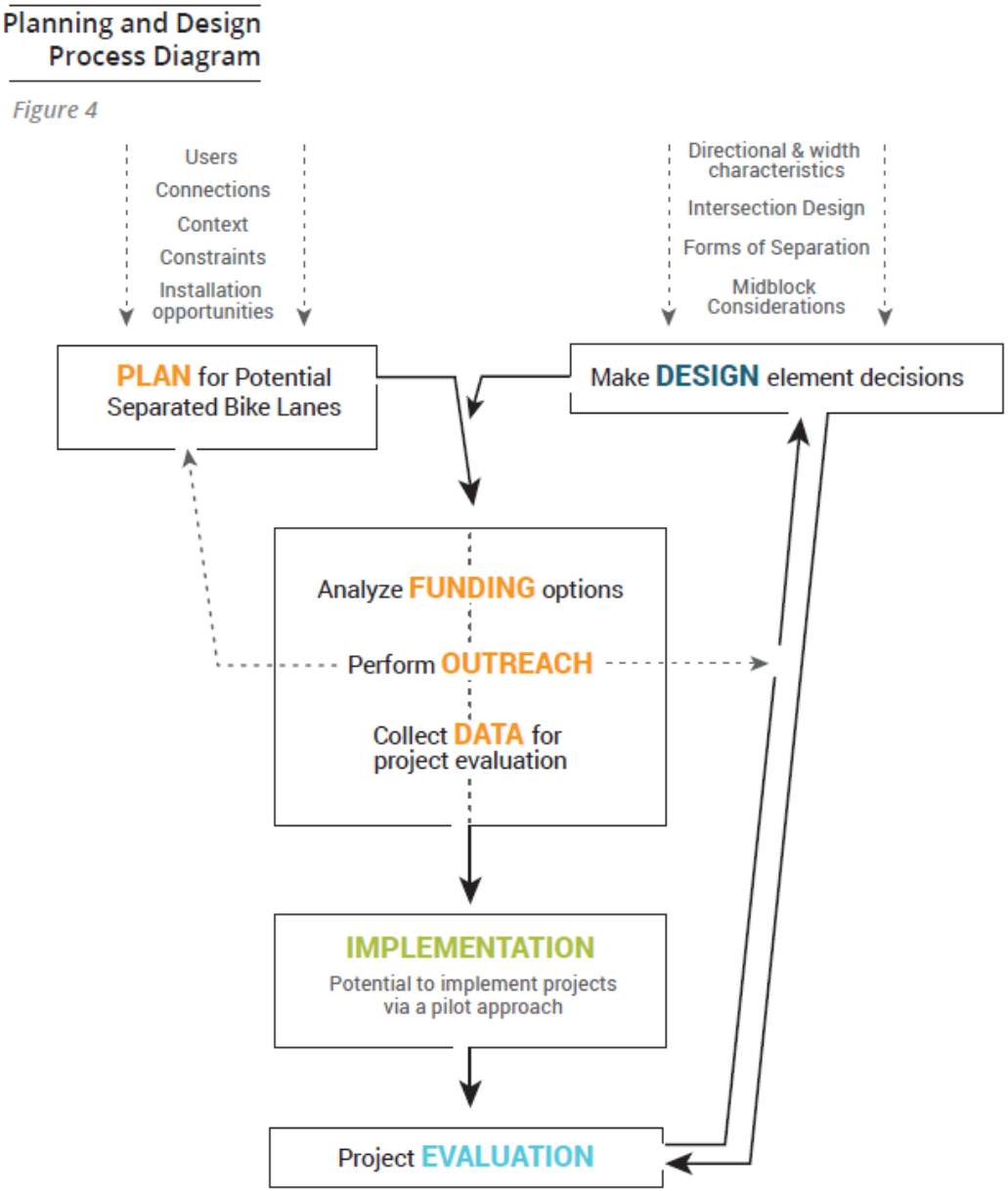
Dave Kirschner

Office of Operations

David.Kirschner@dot.gov

For More Information:
www.fhwa.dot.gov/environment/bicycle_pedestrian

From Planning to Design



Design Options

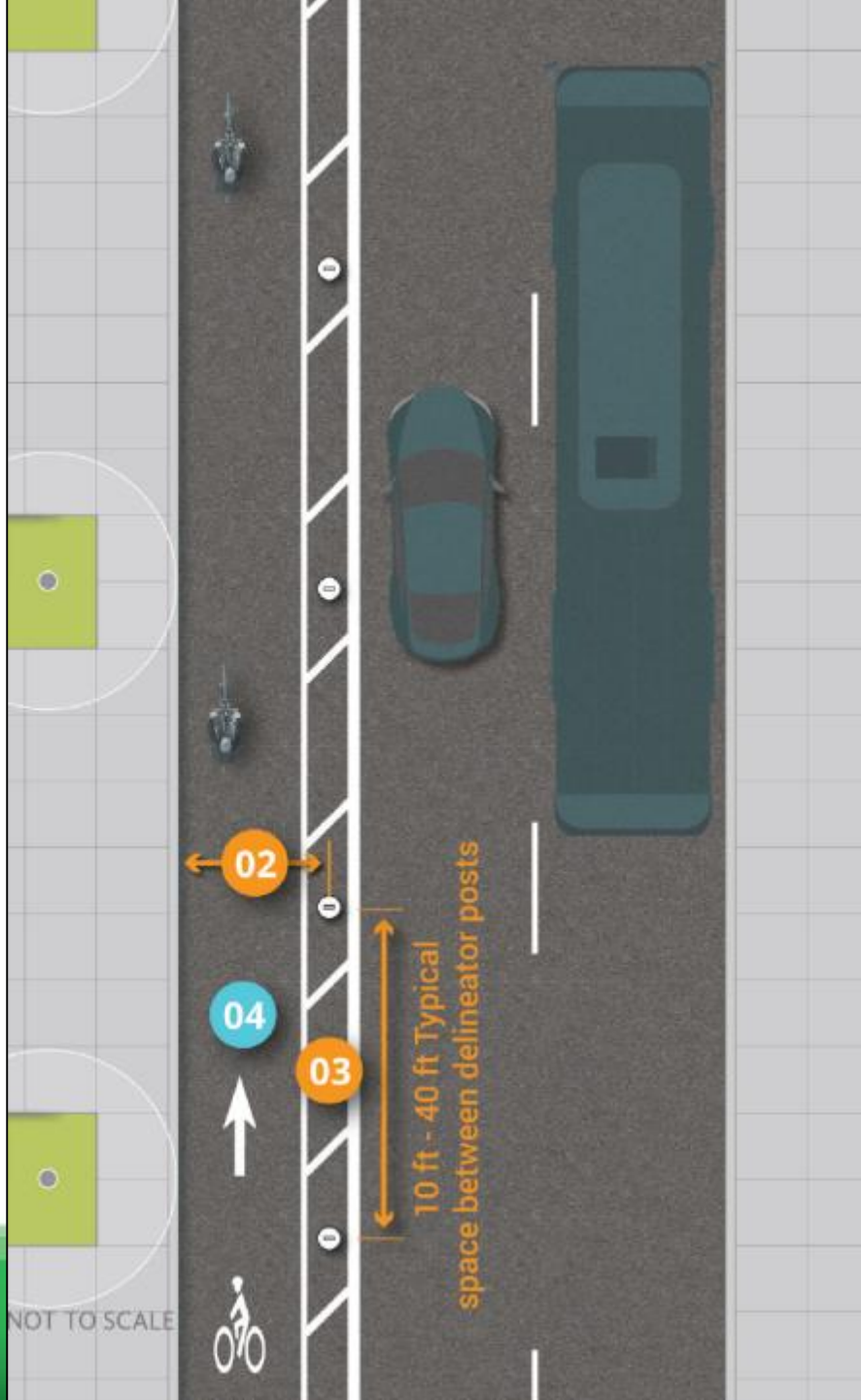
Four Step Design Process

1. Establish Directional and Width Criteria
2. Select Forms of Separation
3. Identify Midblock Design Challenges and Solutions
4. Develop Intersection Design

Design Options

Directional and Width Characteristics

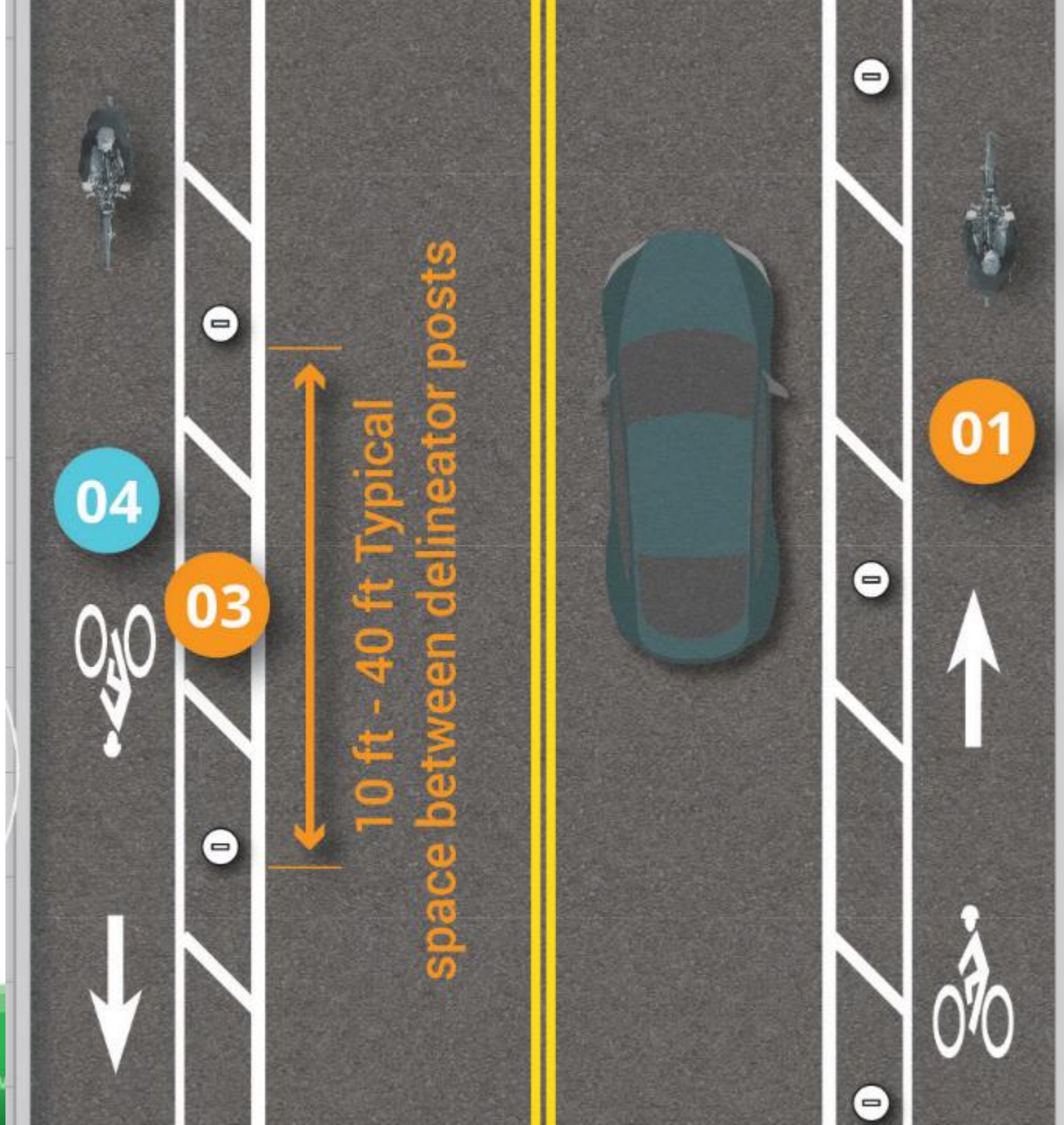
One-Way SBL on a One-Way Street



Design Options

Directional and Width Characteristics

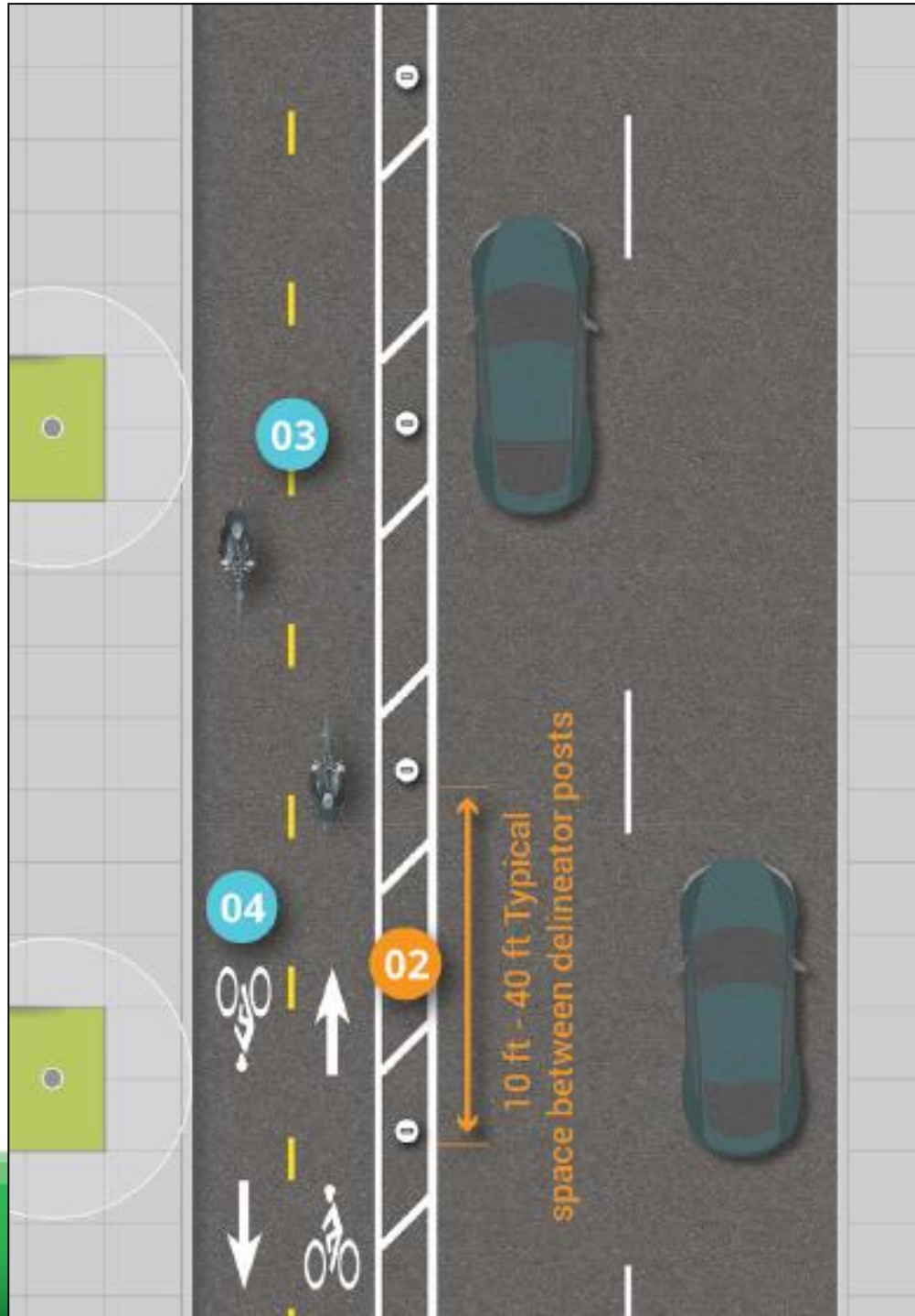
One-Way SBL on a Two-Way Street



Design Options

Directional and Width Characteristics

Two-Way SBL on a One-Way Street



Design Options

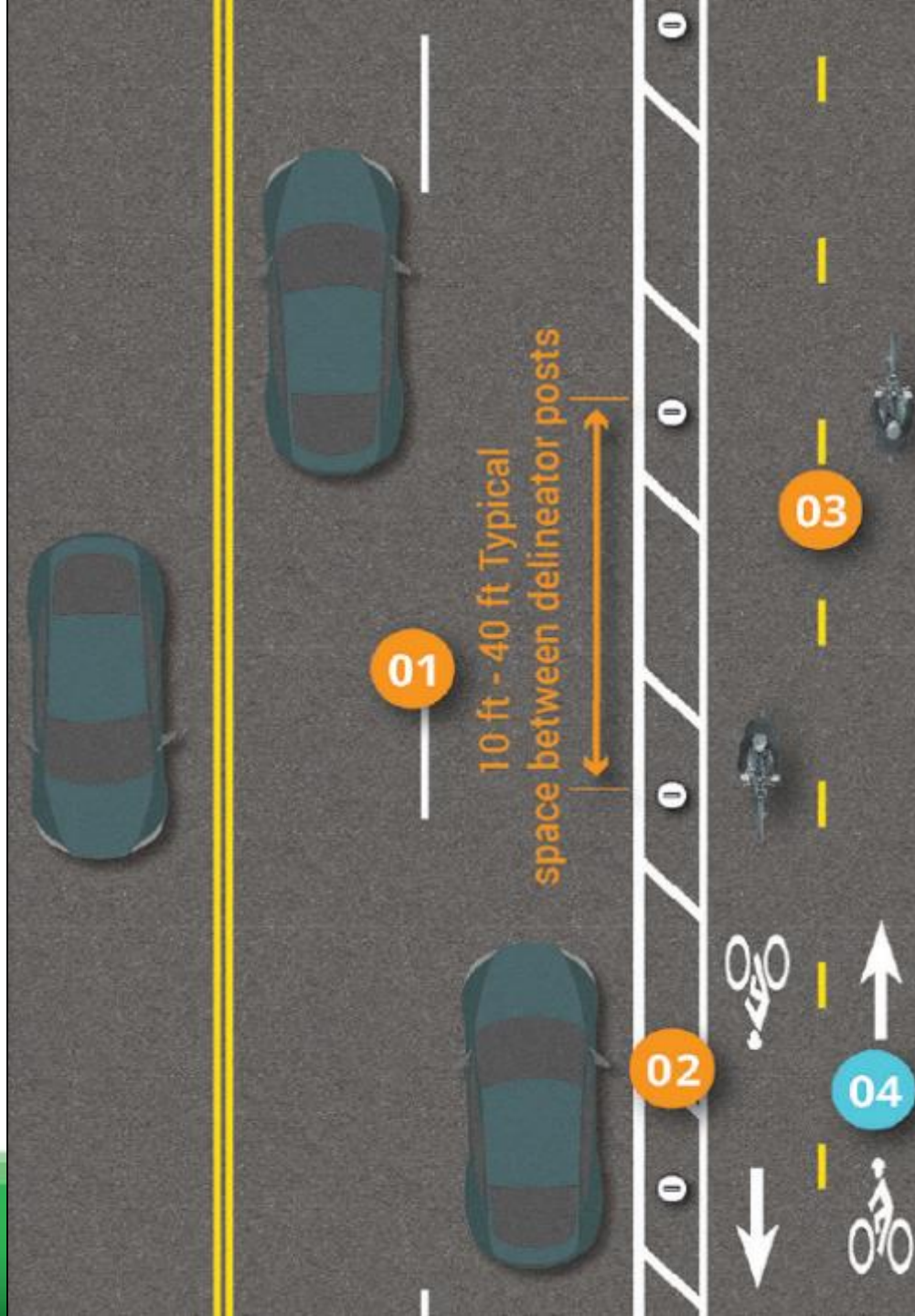
Directional and Width Characteristics

Two-Way SBL on a One-Way Street

Design Options

Directional and Width Characteristics

Two-Way SBL on a Two-Way Street

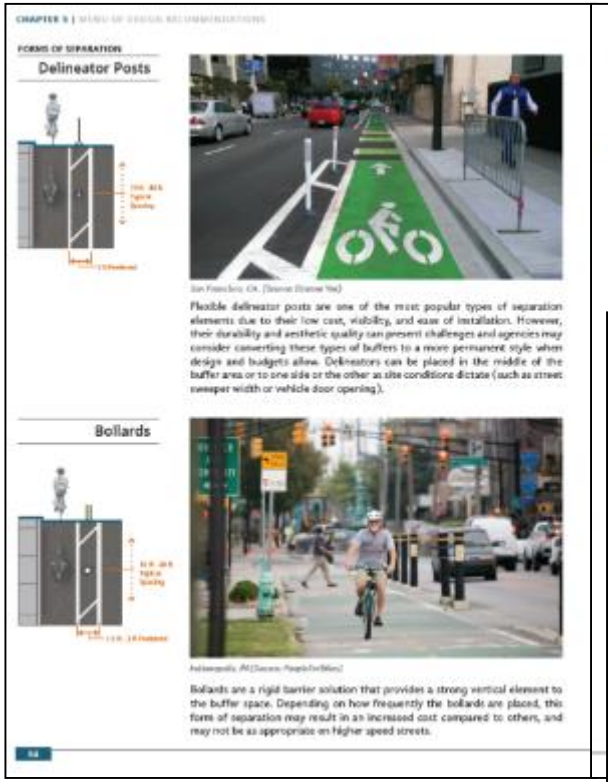


Width

One-way: 5 ft min, 7 ft preferred

Two-way: 12 ft preferred

Forms of Separation



CHAPTER 5 | MENU OF DESIGN RECOMMENDATIONS

FORMS OF SEPARATION

Delineator Posts

San Francisco, CA. (Source: Dianne Yee)

Flexible delineator posts are one of the most popular types of separation elements due to their low cost, visibility, and ease of installation. However, their durability and aesthetic quality can present challenges and agencies may consider converting these types of buffers to a more permanent style when design and budgets allow. Delineators can be placed in the middle of the buffer area or to one side or the other as site conditions dictate (such as street sweeper width or vehicle door opening).

Bollards

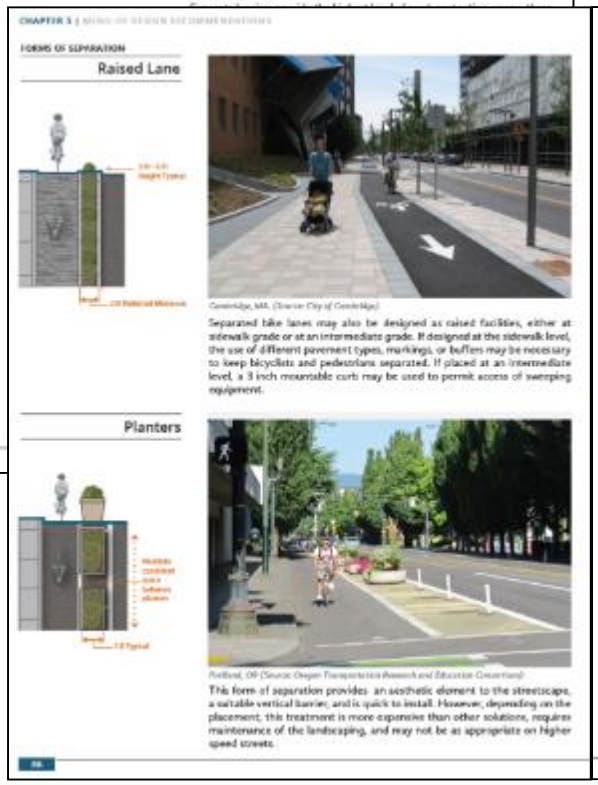
Bollards are a rigid barrier solution that provides a strong vertical element to the buffer space. Depending on how frequently the bollards are placed, this form of separation may result in an increased cost compared to others, and may not be as appropriate on higher speed streets.

CHAPTER 5 | MENU OF DESIGN RECOMMENDATIONS

FORMS OF SEPARATION

Concrete Barrier

Seattle, WA. (Source: Seattle DOT)



CHAPTER 5 | MENU OF DESIGN RECOMMENDATIONS

FORMS OF SEPARATION

Raised Lane

Cambridge, MA. (Source: City of Cambridge)

Separated bike lanes may also be designed as raised facilities, either at sidewalk grade or at an intermediate grade. If designed at the sidewalk level, the use of different pavement types, markings, or buffers may be necessary to keep bicyclists and pedestrians separated. If placed at an intermediate level, a 3 inch mountable curb may be used to permit access of sweeping equipment.

Planters

Portland, OR (Source: Oregon Transportation Research and Education Consortium)

This form of separation provides an aesthetic element to the streetscape, a suitable vertical barrier, and is quick to install. However, depending on the placement, this treatment is more expensive than other solutions, requires maintenance of the landscaping, and may not be as appropriate on higher speed streets.

CHAPTER 5 | MENU OF DESIGN RECOMMENDATIONS

FORMS OF SEPARATION

Parking Stops

Boulder Road separated bike lane in Boulder, CO. (Source: City of Boulder)

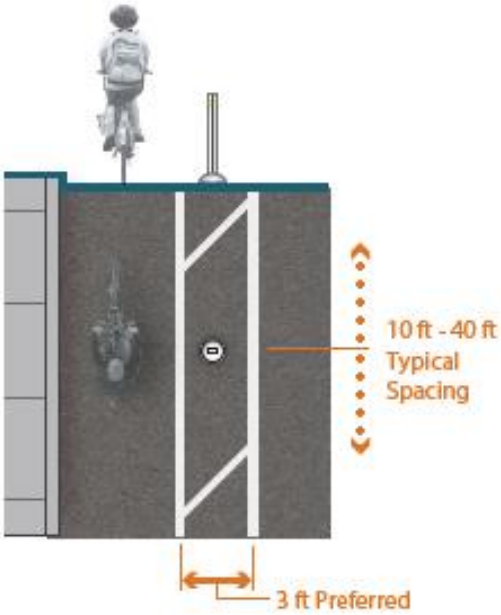
Parking stops and similar low linear barriers are inexpensive buffer solutions that offer several benefits. These barriers have a high level of durability, can provide near continuous separation, and are a good solution when minimal buffer width is available. However, using the minimum width will not provide the same level of comfort and protection due to their low height and bicyclists' proximity to traffic.

Parked Cars

Parked cars provide separation in Seattle, WA. (Source: Seattle DOT)

While not a barrier type on its own, parked cars can provide an additional level of protection and comfort for bicyclists. A minimum buffer width of 3 feet is required to allow for the opening of doors and other maneuvers. Additional vertical elements such as periodic delineator posts should be paired with this design. Barrier types that obstruct the opening of car doors or create tripping hazards should be avoided.

Delineator Posts



San Francisco, CA. (Source: Dianne Yee)

Flexible delineator posts are one of the most popular types of separation elements due to their low cost, visibility, and ease of installation. However, their durability and aesthetic quality can present challenges and agencies may consider converting these types of buffers to a more permanent style when design and budgets allow. Delineators can be placed in the middle of the buffer area or to one side or the other as site conditions dictate (such as street sweeper width or vehicle door opening).

Forms of Separation

Forms of Separation

Forms of Separation

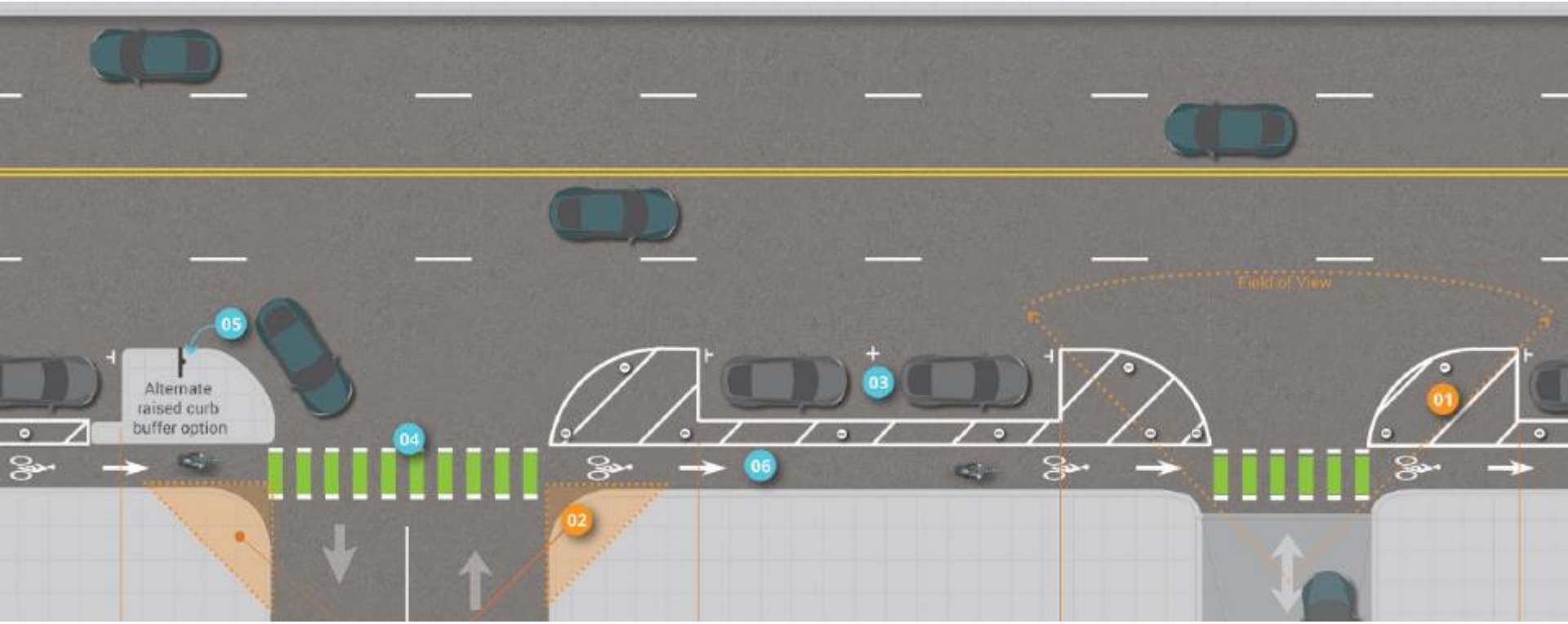
Forms of Separation

Forms of Separation

Design Options

Midblock Considerations

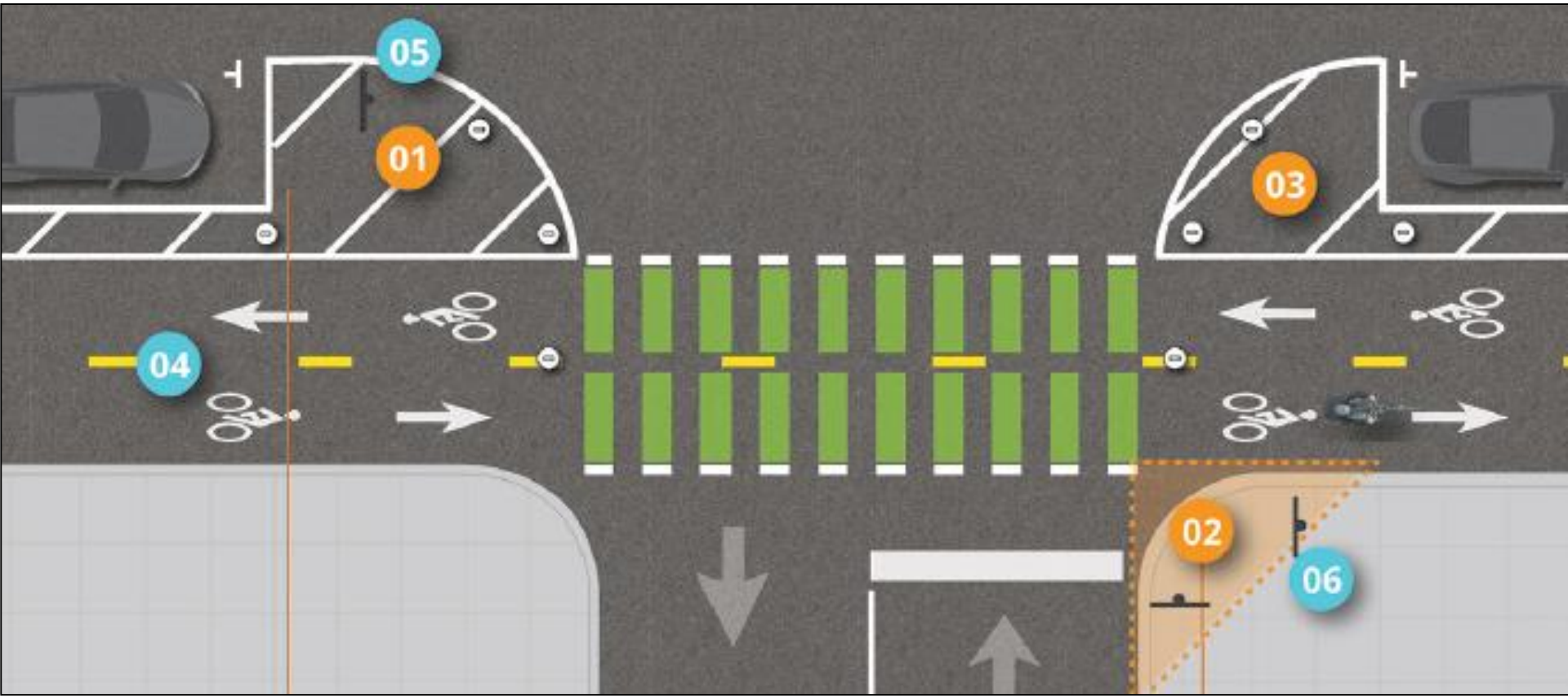
Driveways, One-Way SBL



Design Options

Midblock Considerations

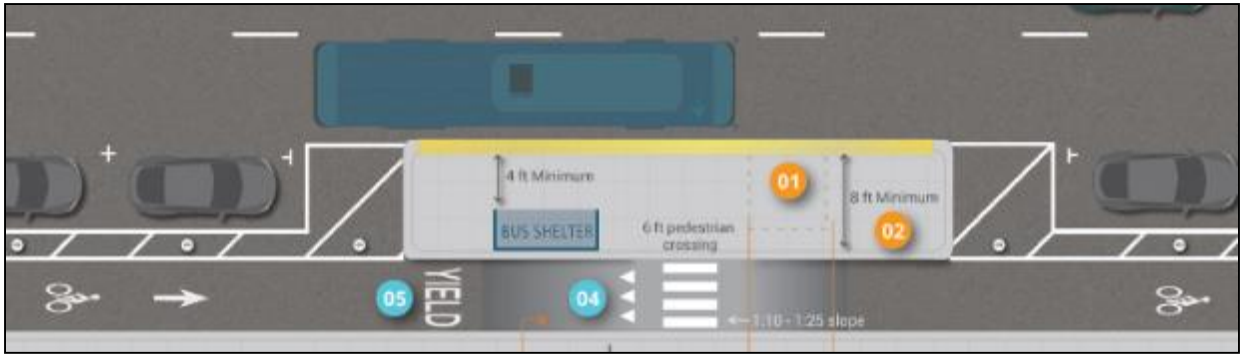
Driveways, Two-Way SBL

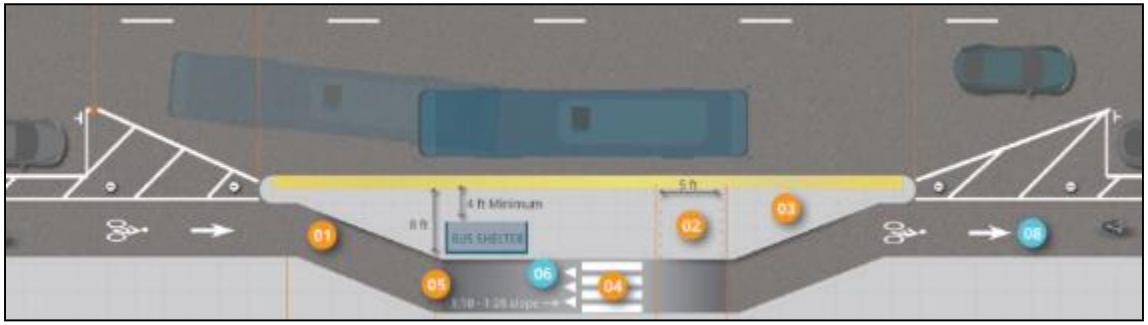


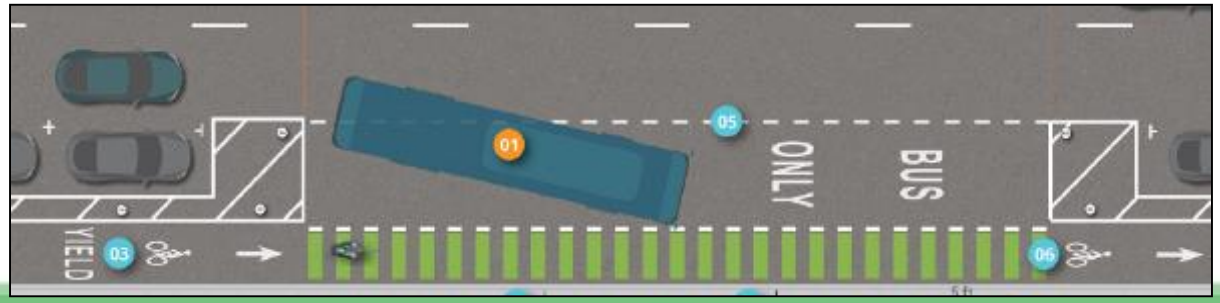
Design Options

Midblock Considerations

Transit Stops







Design Options

Midblock Considerations

Transit Stops

Managing bus-bike conflicts

Design Options

Midblock Considerations

Transit Stops

Design Options

Midblock Considerations

Transit Stops

Design Options

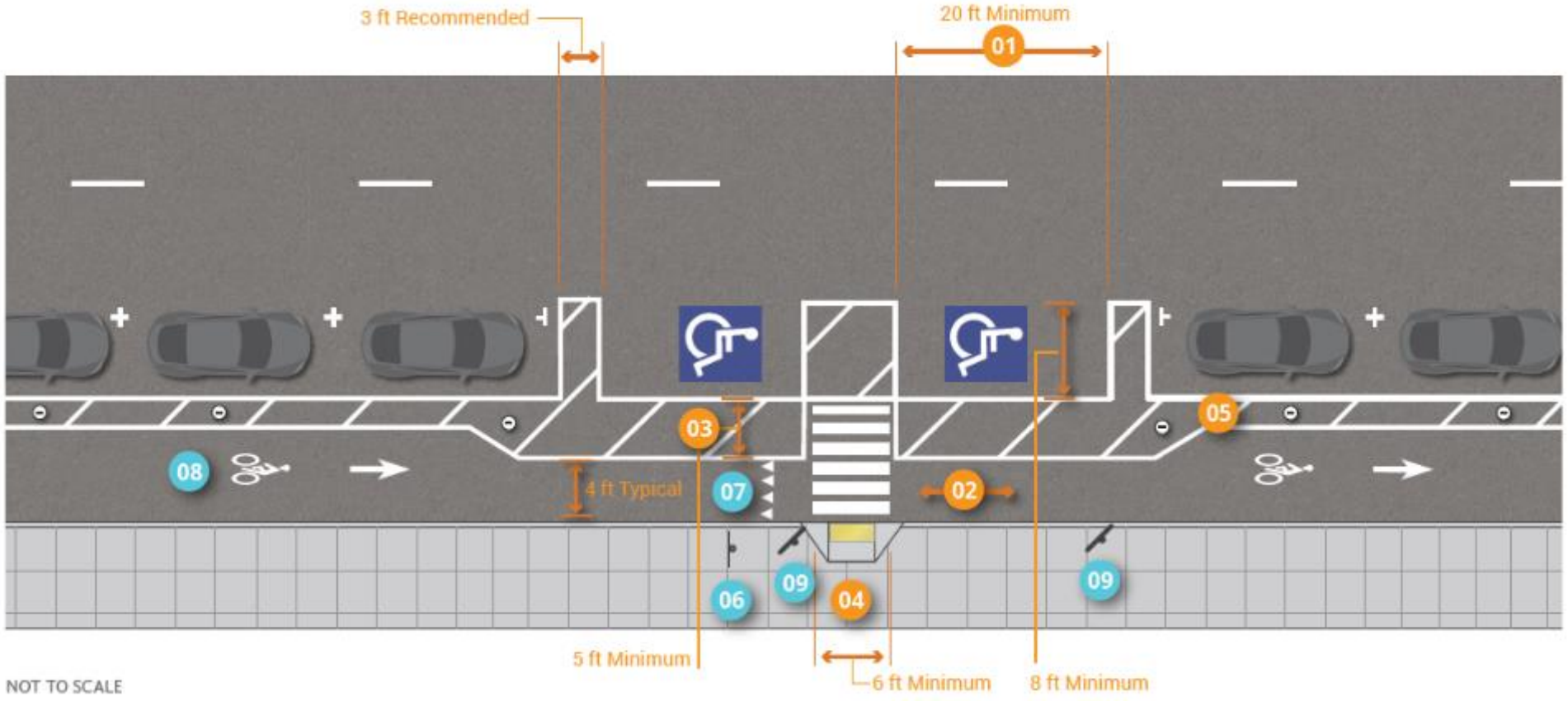
Midblock Considerations

Transit Stops

Design Options

Midblock Considerations

Accessible Parking, Located Midblock within Parking Lane

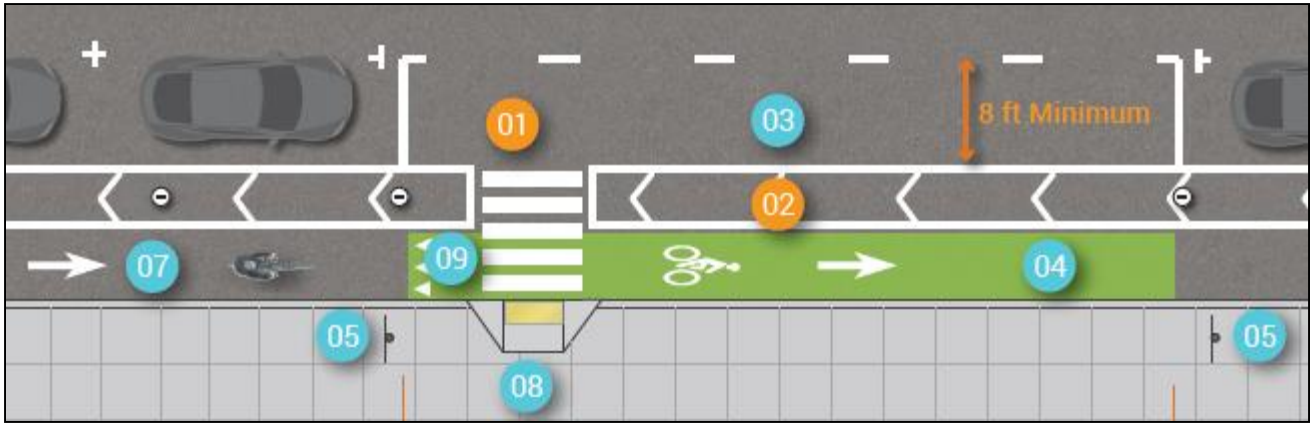


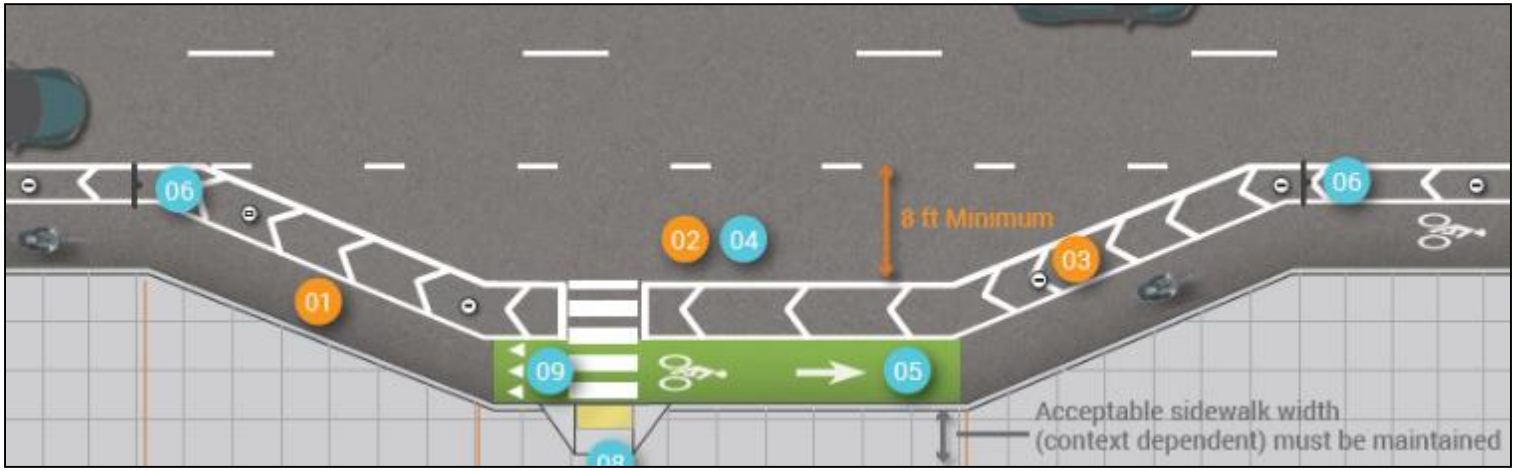
Design Options

Design Options

Midblock Considerations

Loading Zones





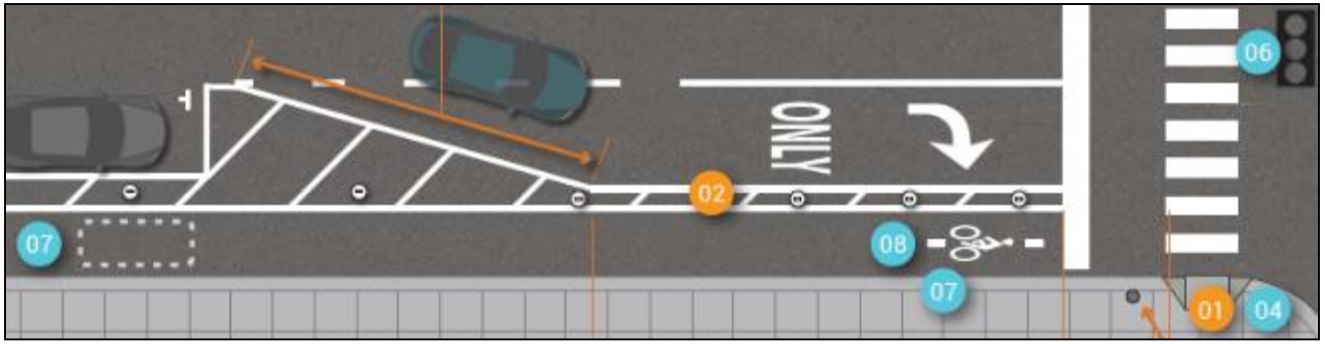
Design Options

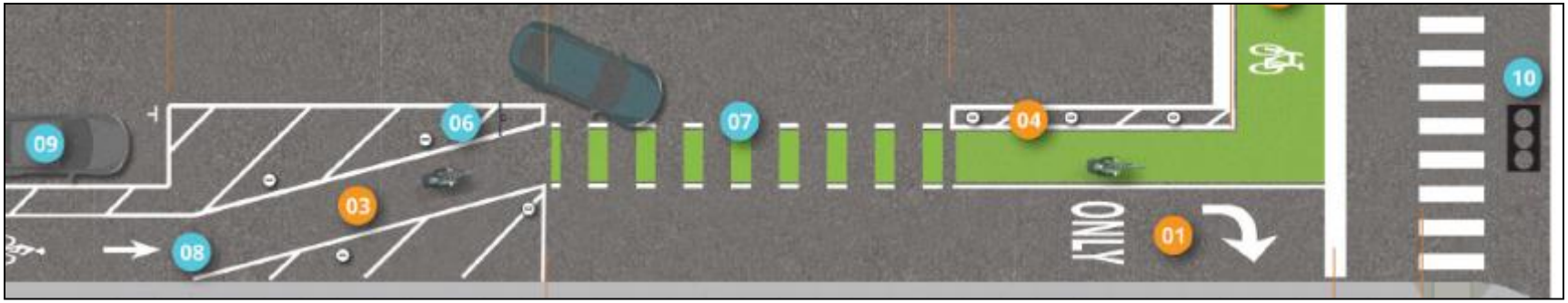
Midblock Considerations

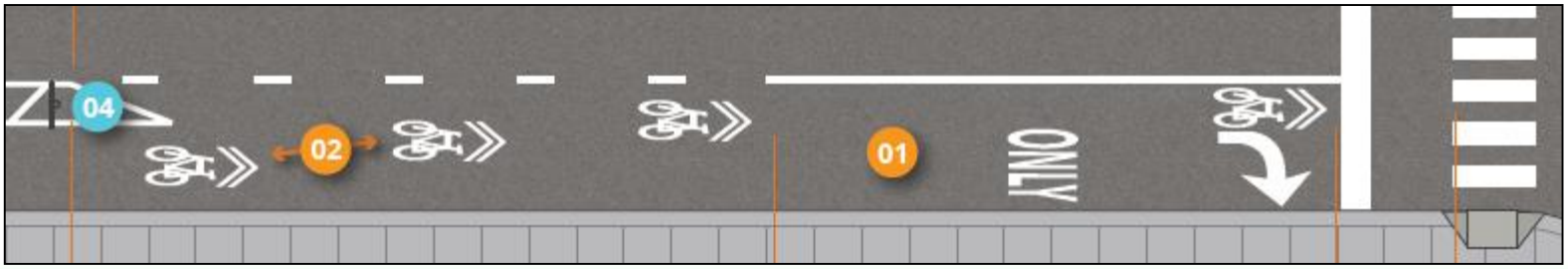
Loading Zones

Design Options

Intersection Design
Turning Movements







Design Options

Intersection Design
Turning Movements

Design Options

Intersection Design
Turning Movements

Design Options

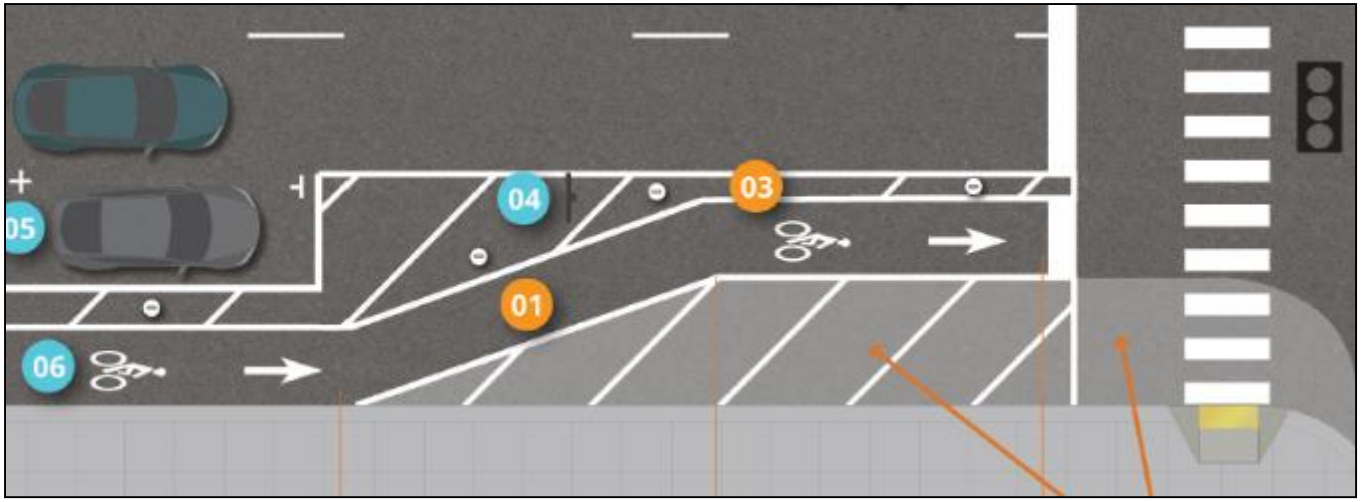
Intersection Design
Turning Movements

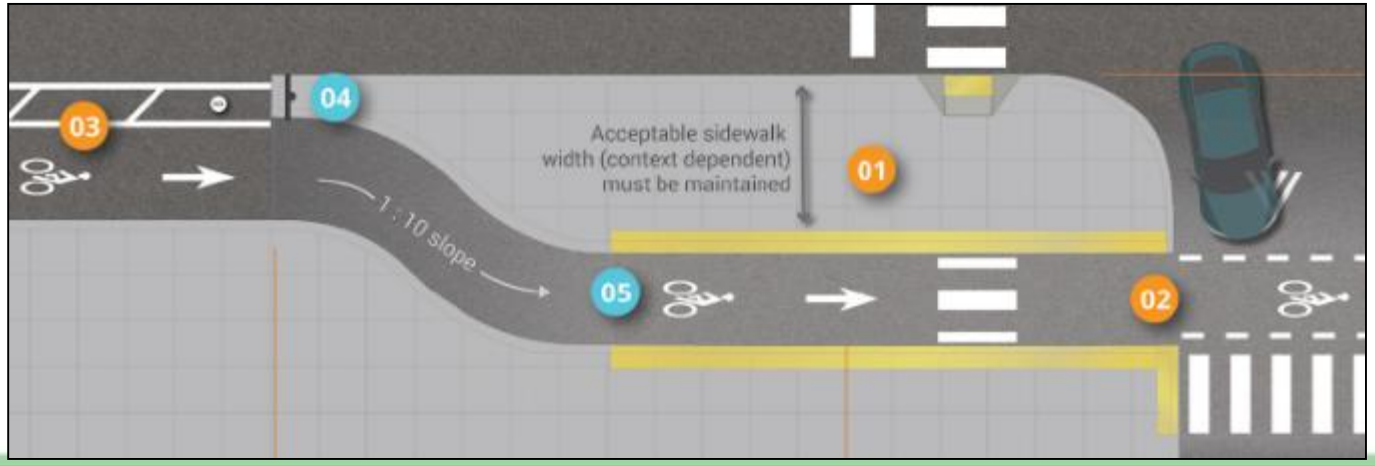
Design Options

Intersection Design
Turning Movements

Design Options

Intersection Design
Turning Movements





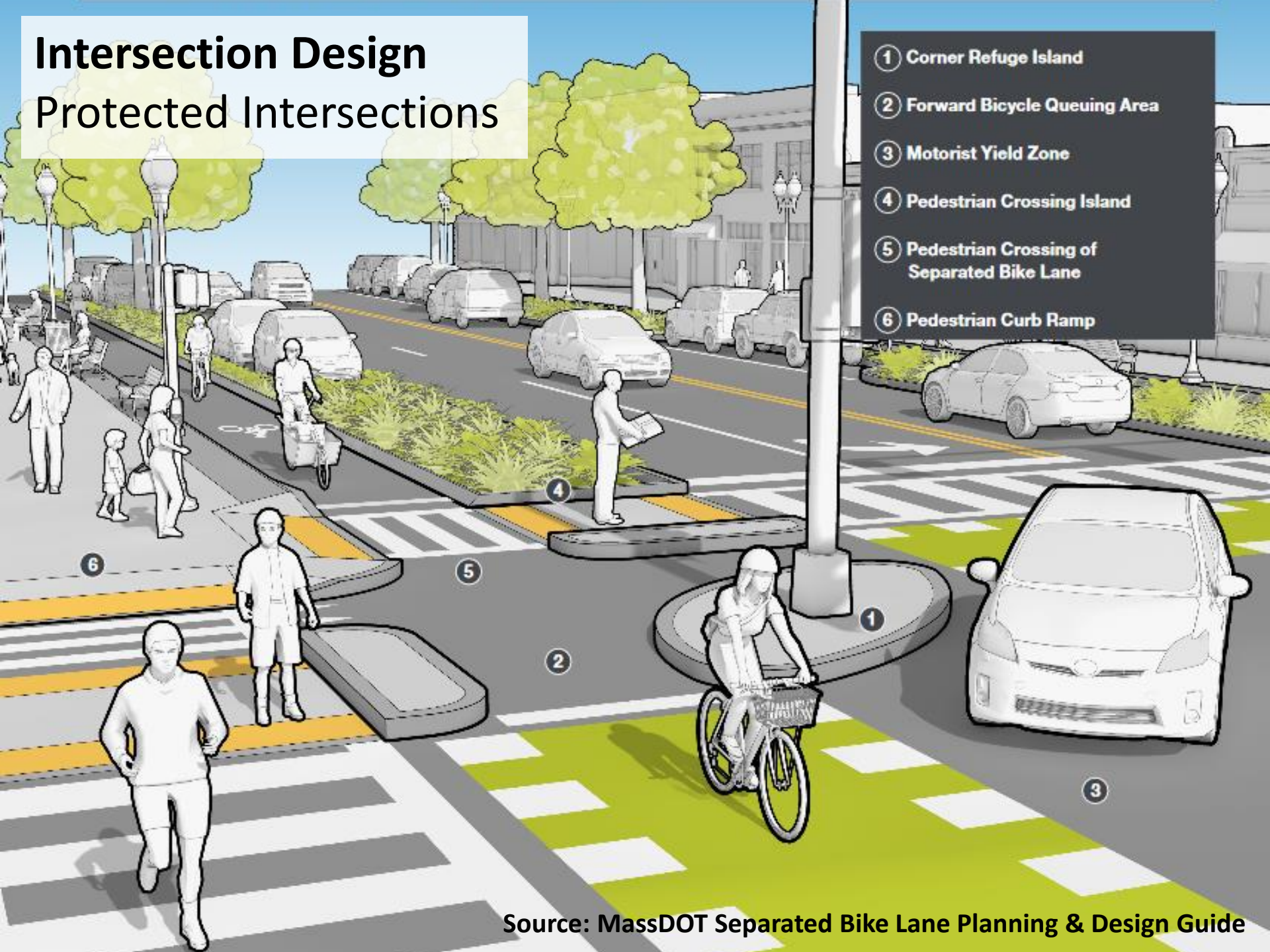
Design Options

Intersection Design
Turning Movements

Design Options

Intersection Design
Two-stage Turns

Intersection Design
Protected Intersections



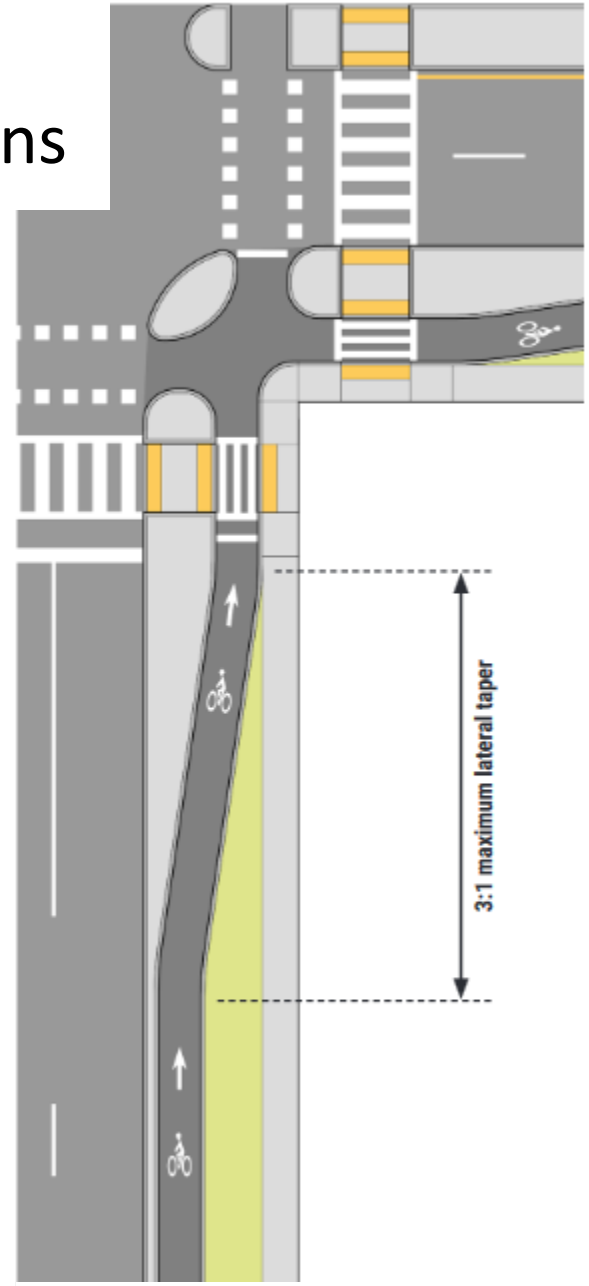
Source: MassDOT Separated Bike Lane Planning & Design Guide

Source: Salt Lake City's Transportation Division

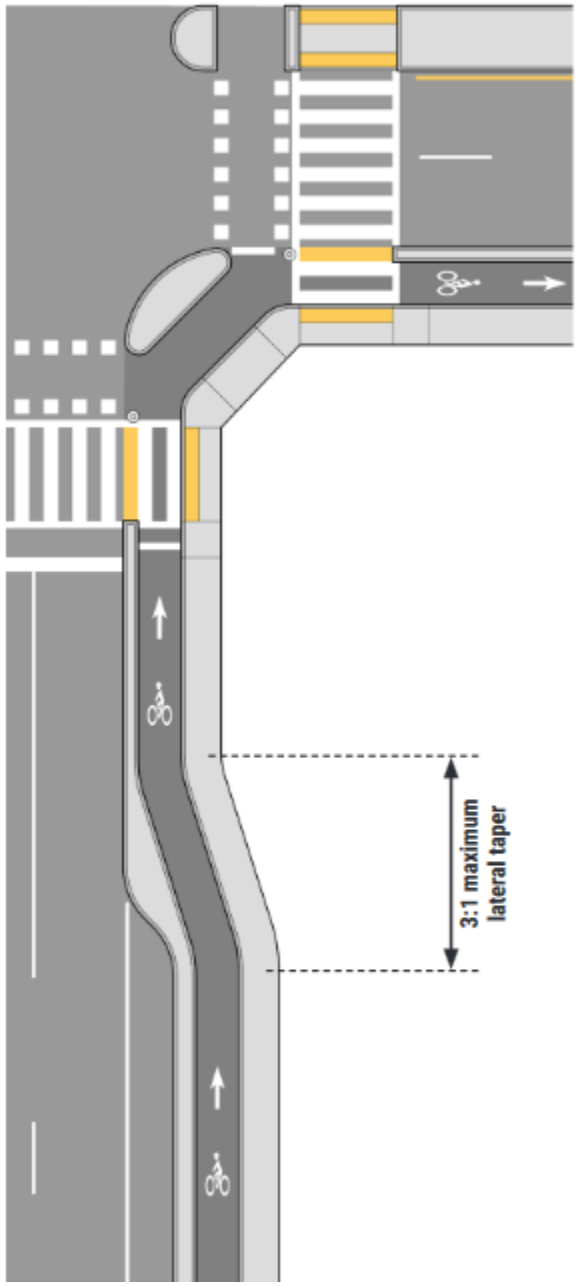
Intersection Design

Protected Intersections

Source: MassDOT Separated Bike Lane Planning & Design Guide



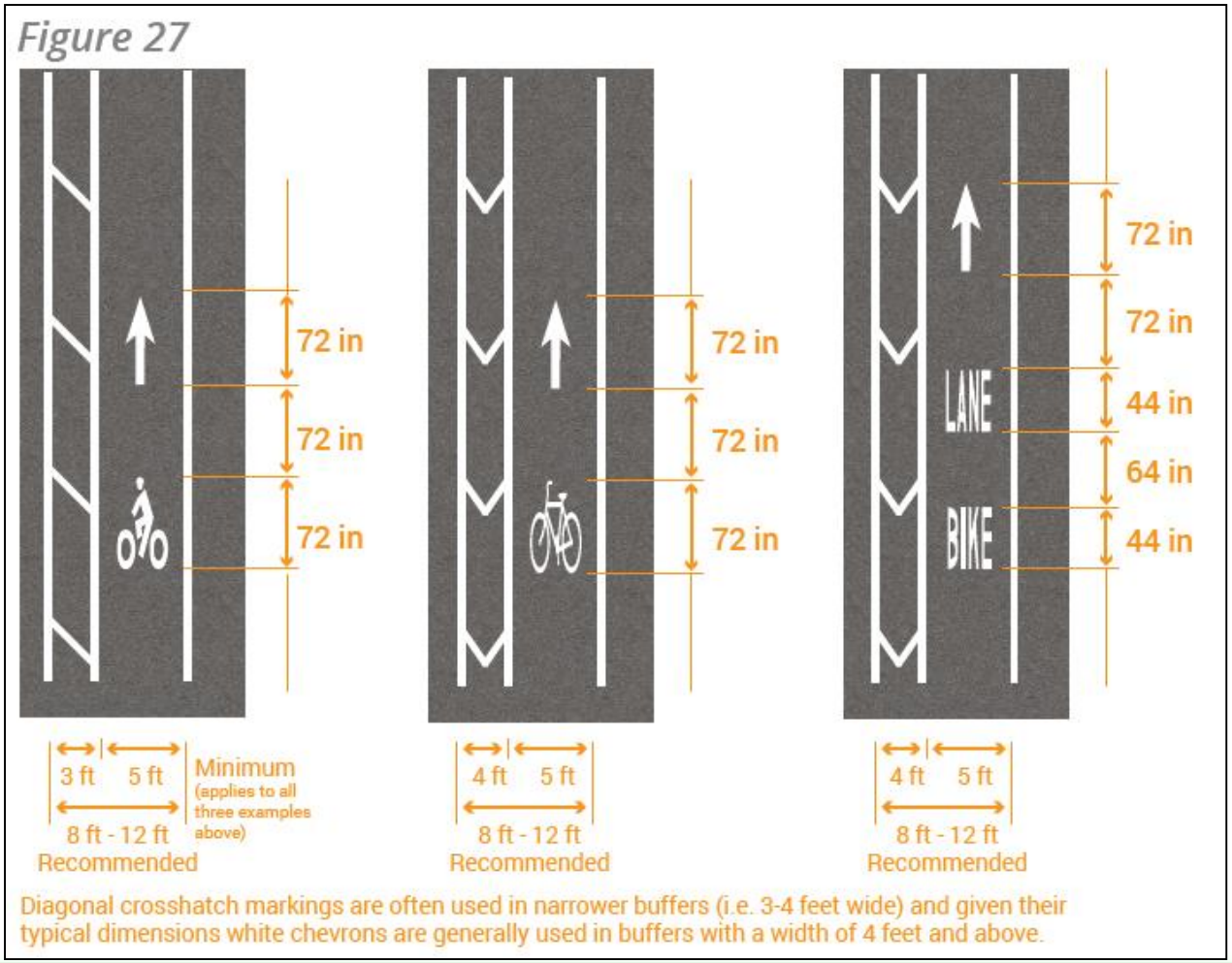
Bend-out Example

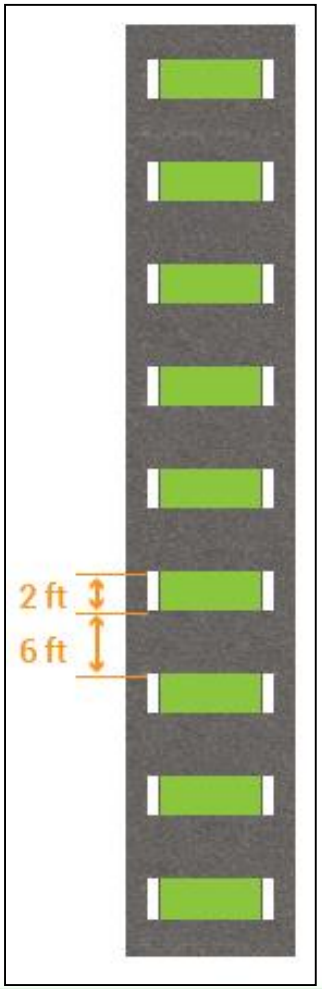


Bend-in Constrained Example

Design Options

Intersection Design
Intersection Markings





Design Options

SIGN GUIDANCE

Bike lane
MUTCD Sign R3-17

No turn on red
MUTCD Sign R10-11

Turning vehicles yield to bikes
MUTCD Sign R10-15 (Mod.)

Bicyclists yield to pedestrians
MUTCD Sign R9-6

Bicyclists may use full lane
MUTCD Sign R4-11

No Parking Bike Lane
MUTCD Sign R7-9

MARKINGS GUIDANCE

Standard arrows for pavement markings (example shown)
MUTCD Fig. 3B-24

Bicycle pavement marking: bike symbol
MUTCD Fig. 9C-3

Bicycle pavement marking: helmeted bicyclist symbol
MUTCD Fig. 9C-3

Bicycle pavement marking: word legends
MUTCD Fig. 9C-3

Pavement marking
MUTCD Fig. 9C-5

Shared lane marking
MUTCD Fig. 9C-9

Bike detector pavement marking
MUTCD Fig. 9C-7

Recommended yield line pavement markings layout
MUTCD Fig. 3B-16

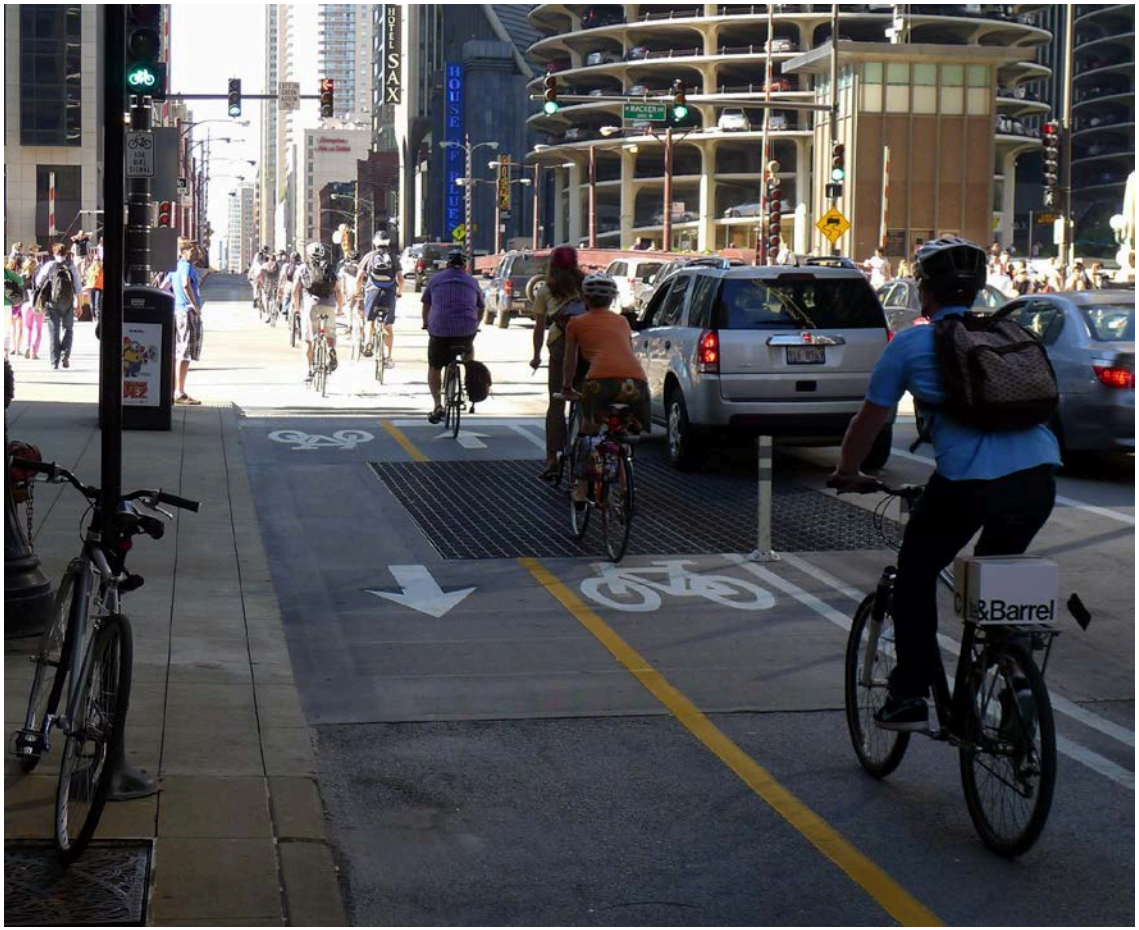
Design Considerations for Separated Bike Lanes

Mike Amsden, AICP
Assistant Director of Transportation Planning
Chicago Department of Transportation

June 14, 2016

Presentation Focus Areas

- Chicago Introduction
- Bike Signals
  - Two-way separated bike lanes
  - Bike lane
  - Contraflow bike lane
  - Increased compliance
- Loop Link
  - One-way and two-way separated bike lanes
  - Bike signals
  - Green bike lanes
  - Floating bus stops
  - Protected intersection

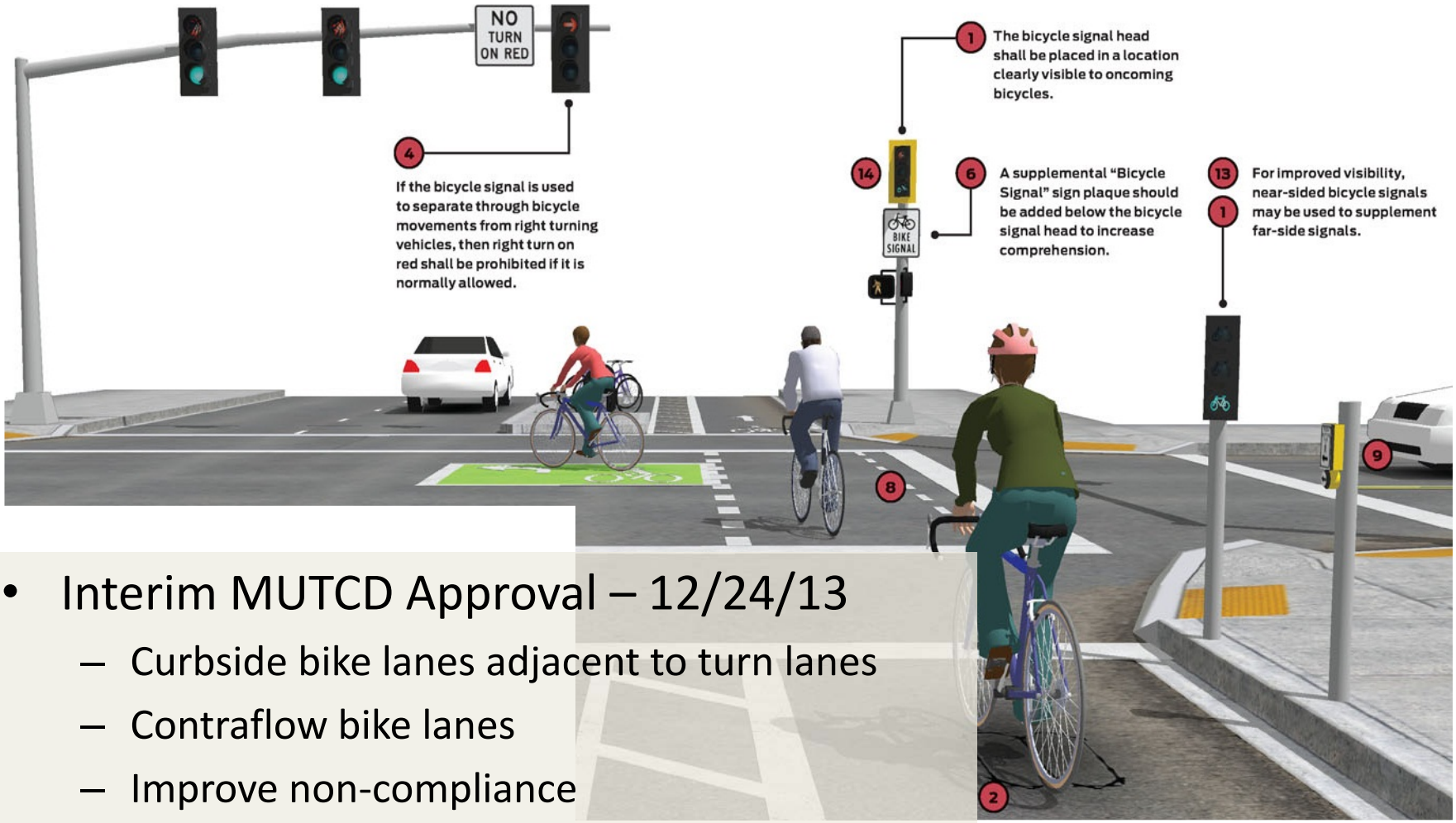


Where We're at Today

Mayor Emanuel's Transition Report – May 2011

- Improve street safety by reducing fatalities and crashes
- Complete the City's first Pedestrian Plan
- Build 100 miles of protected bike lanes and bikeways that are comfortable for all ages and abilities

Bicycle Signals



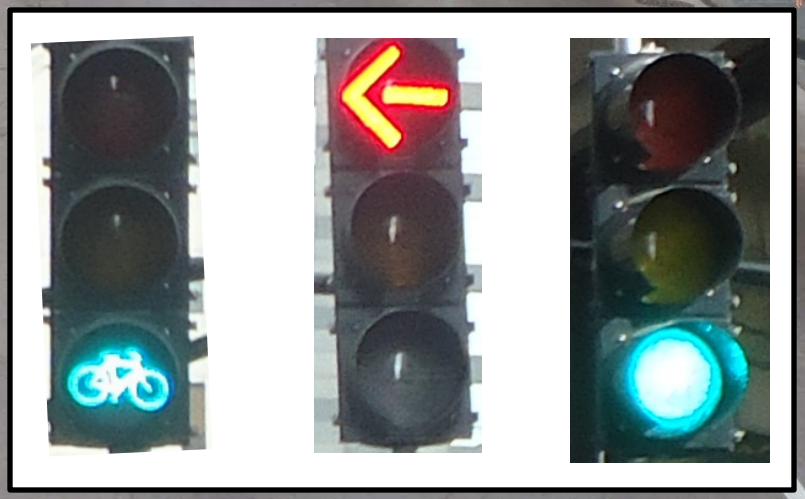
- Interim MUTCD Approval – 12/24/13
  - Curbside bike lanes adjacent to turn lanes
  - Contraflow bike lanes
  - Improve non-compliance
  - Leading or lagging bicycle movement
  - Increase safety through complex intersections

Dearborn Street Before

Dearborn Street After

Curbside Bike Lanes

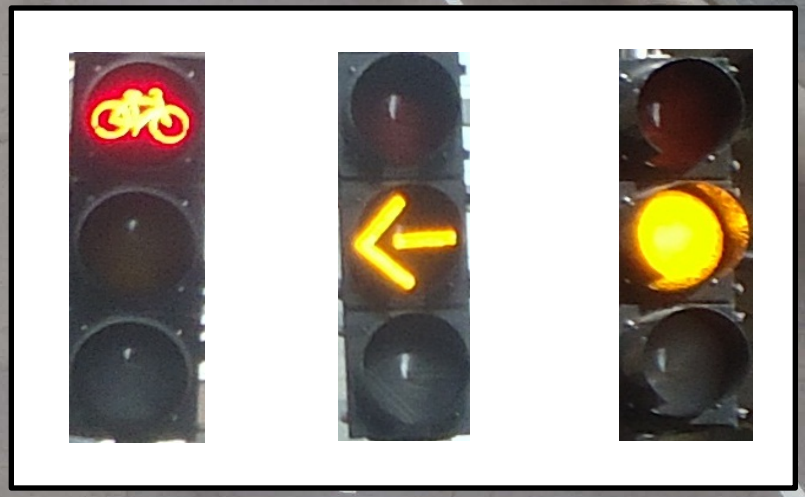
Traffic Signal Phasing – Phase A



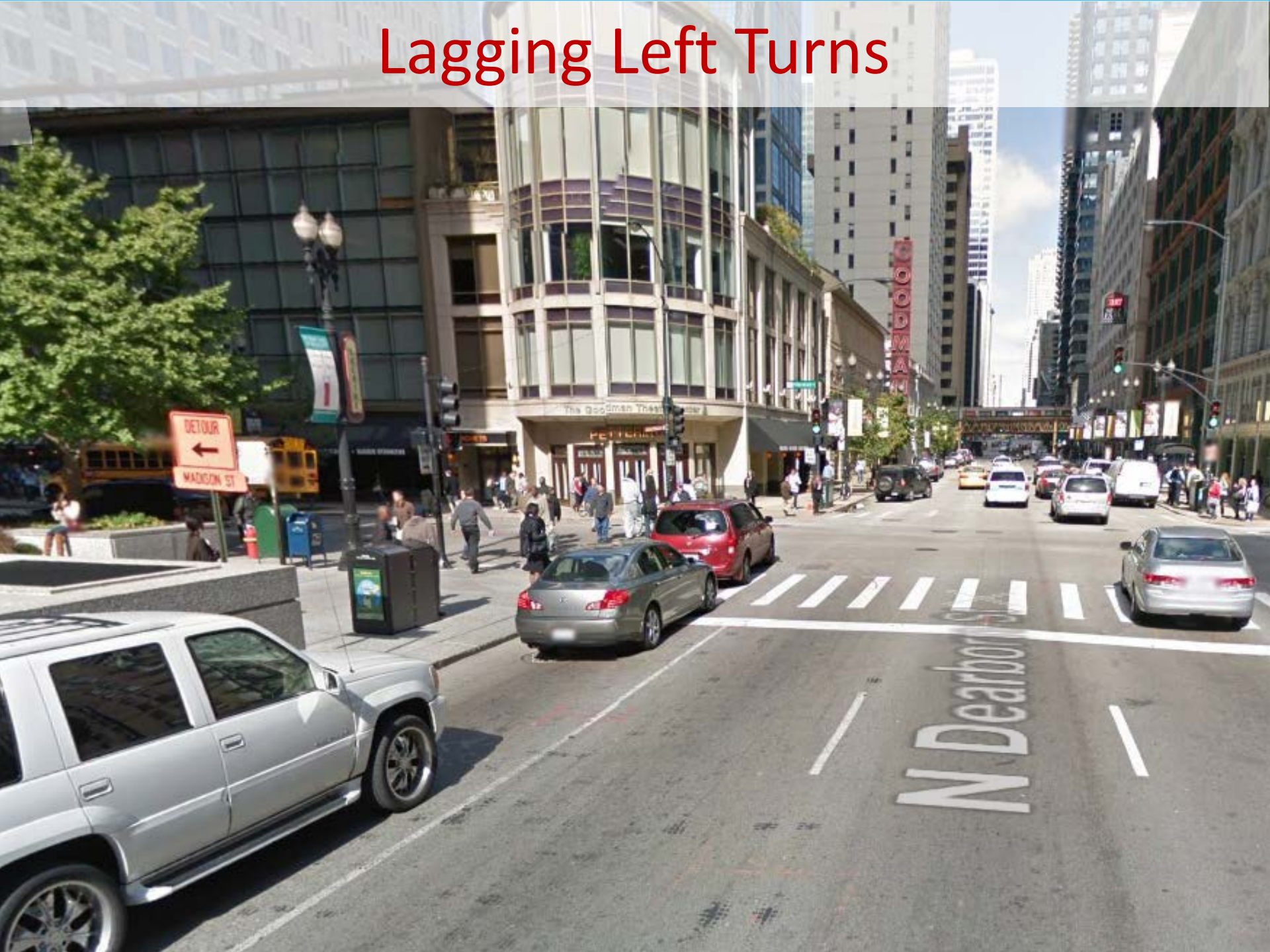
Traffic Signal Phasing – Phase B

Traffic Signal Phasing – Phase C

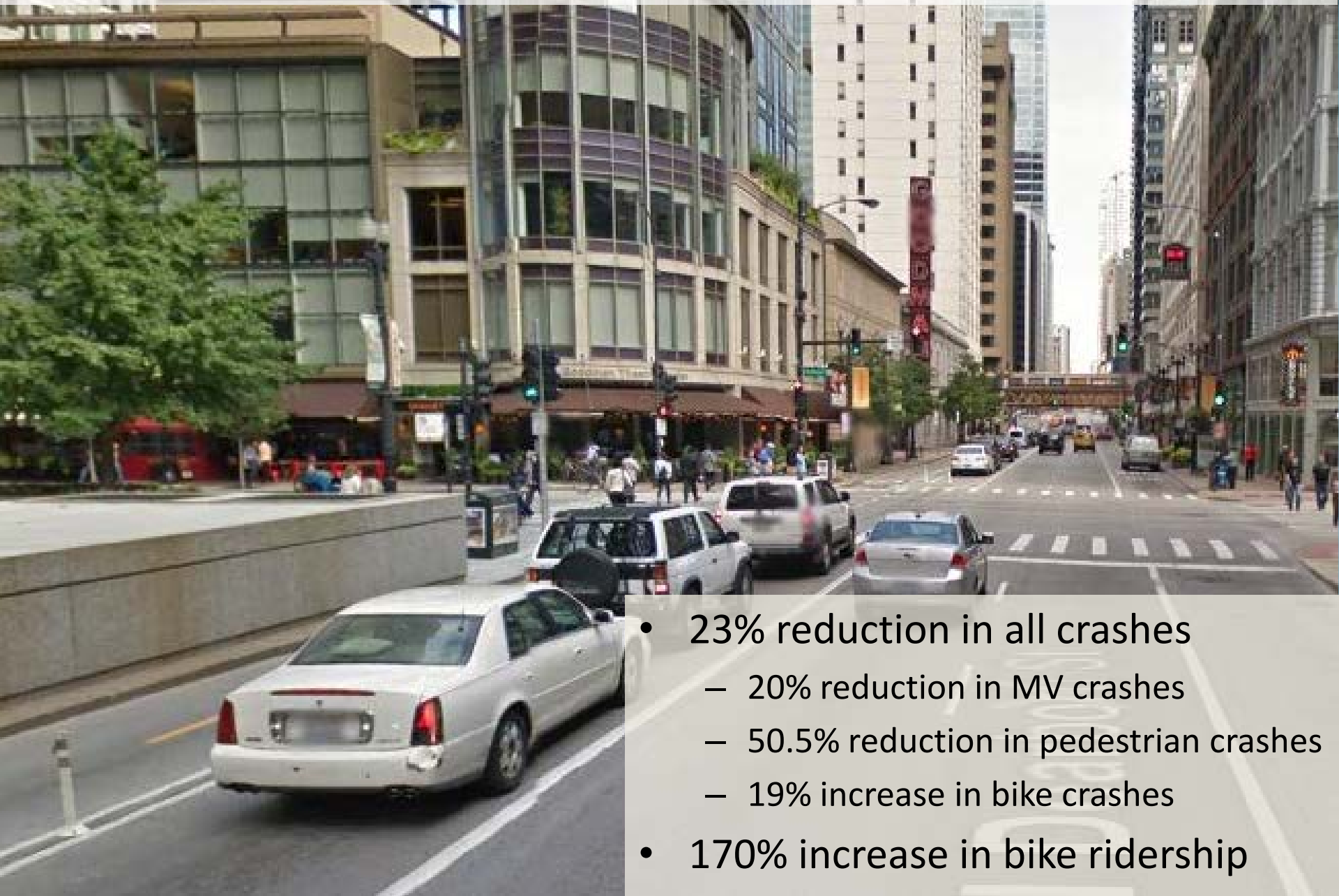
Traffic Signal Phasing – Phase D



Lagging Left Turns



Lagging Left Turns



- 23% reduction in all crashes
  - 20% reduction in MV crashes
  - 50.5% reduction in pedestrian crashes
  - 19% increase in bike crashes
- 170% increase in bike ridership

Lagging Right Turns

Lagging Right Turns

Bicycle Signals

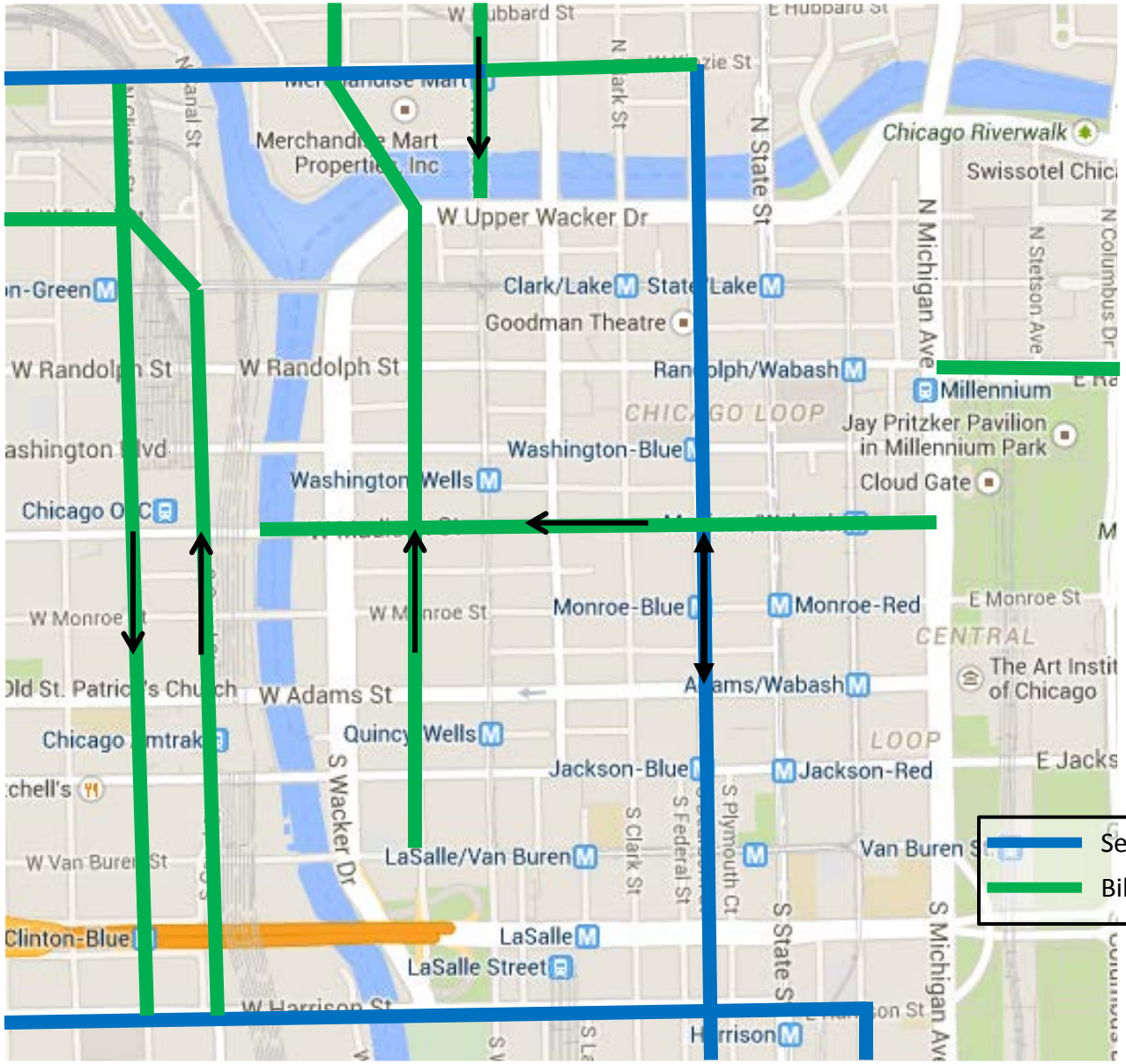
Compliance

- 31% before
- 90+% after

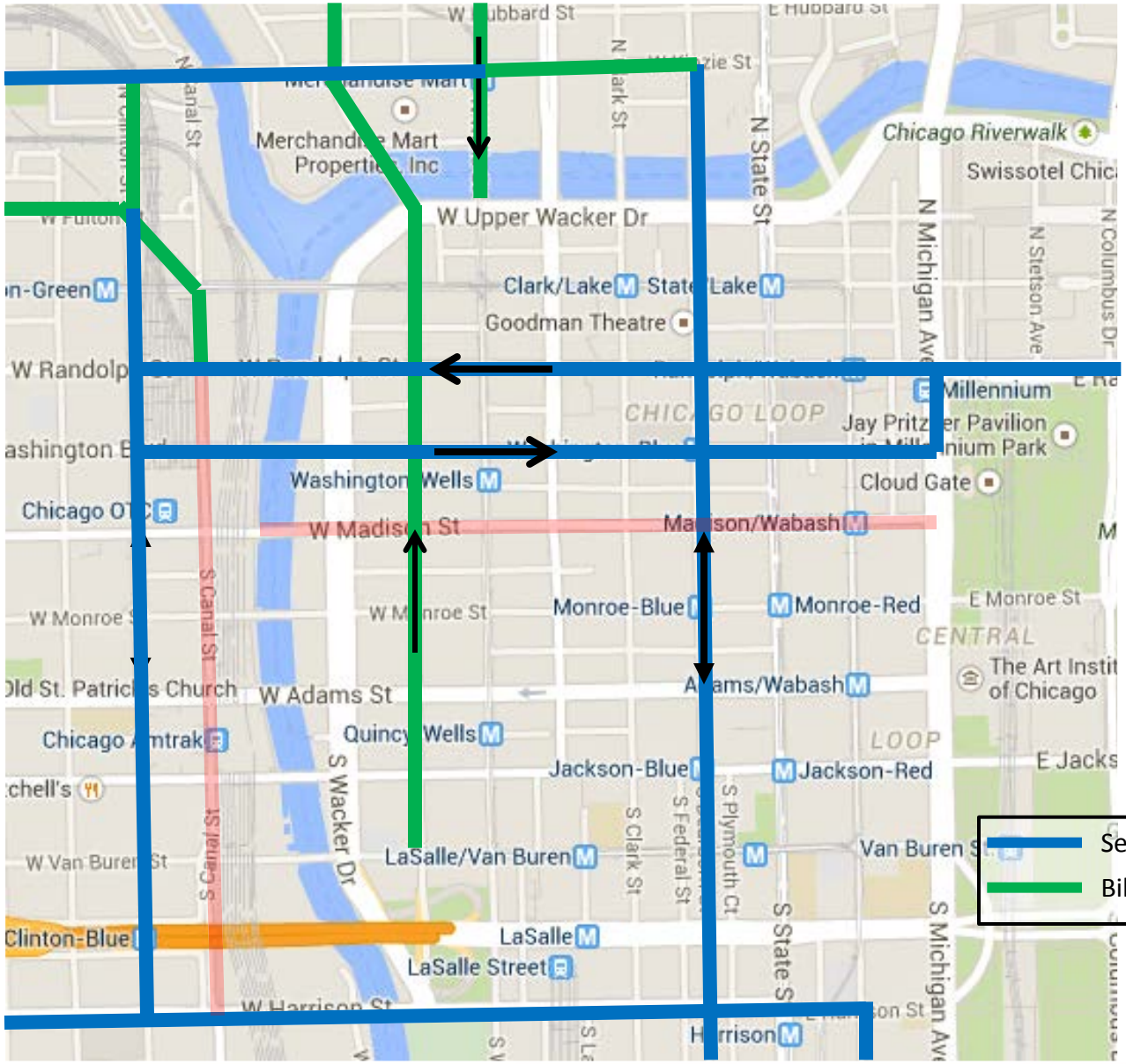
Contraflow Movements

Contraflow Movements

Loop Bike Lane Network – Pre Loop Link



Loop Bike Lane Network – Pre Loop Link



Washington – One-Way SBL

Clinton – Two-Way SBL

Clinton – Two-Way SBL

Bus Stop Interactions

Bus Stop Interactions

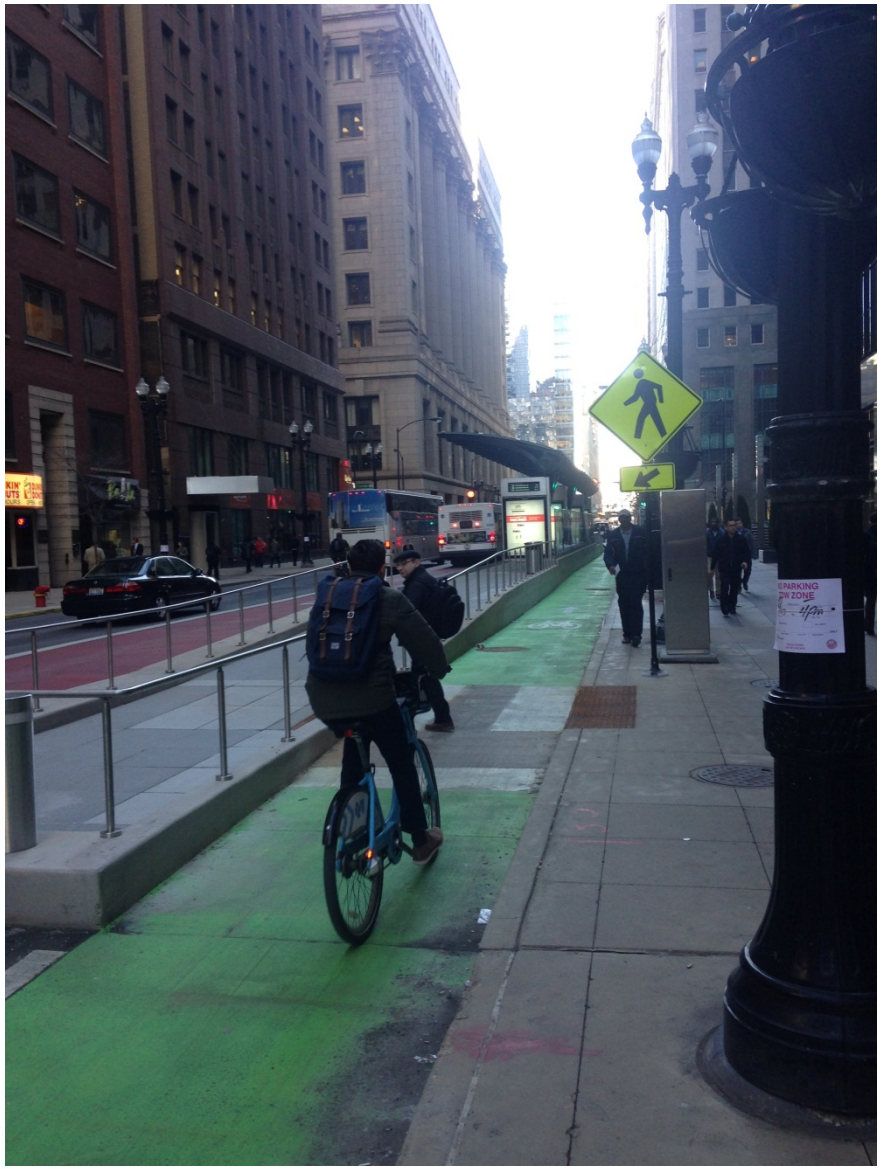
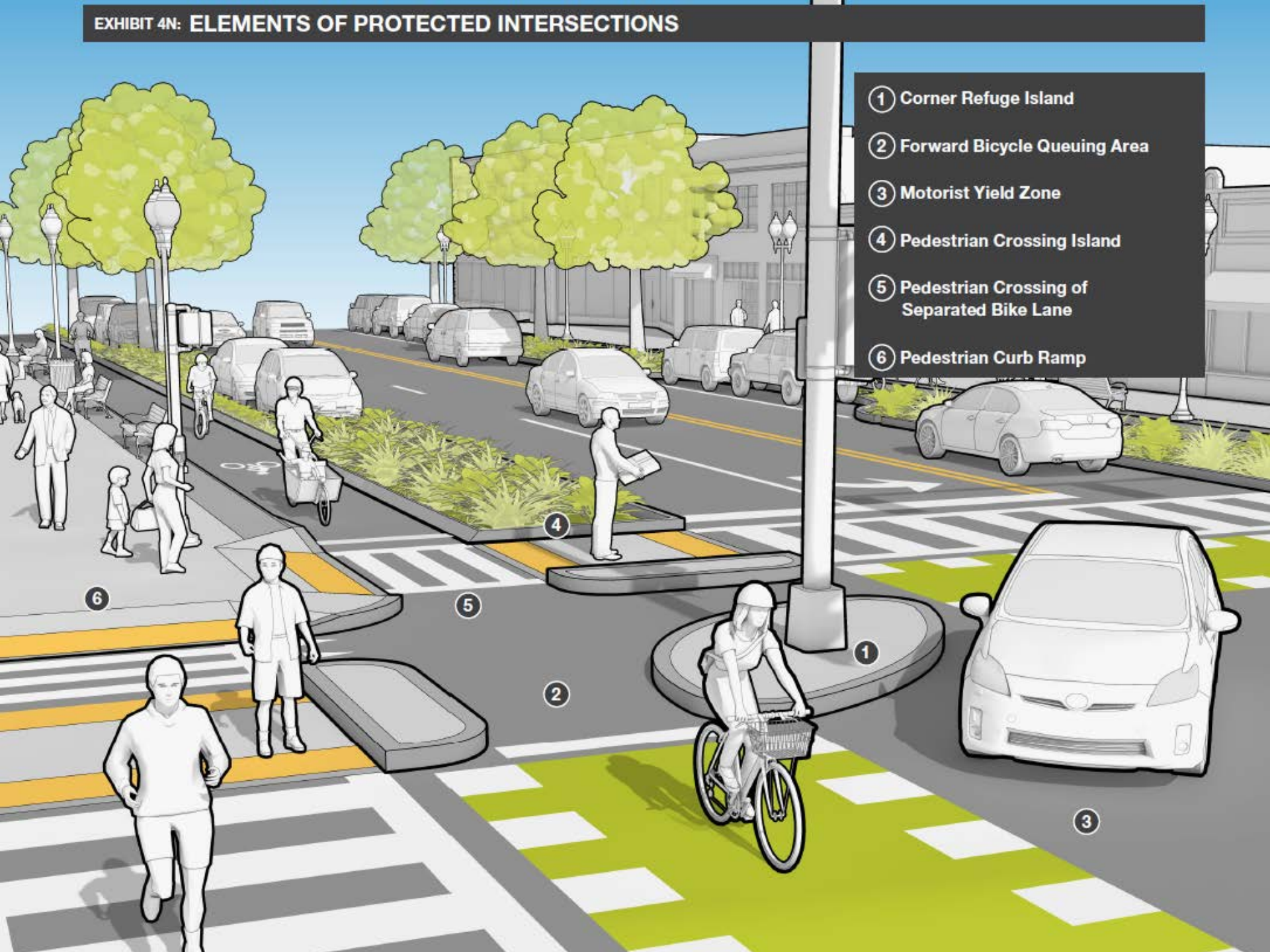
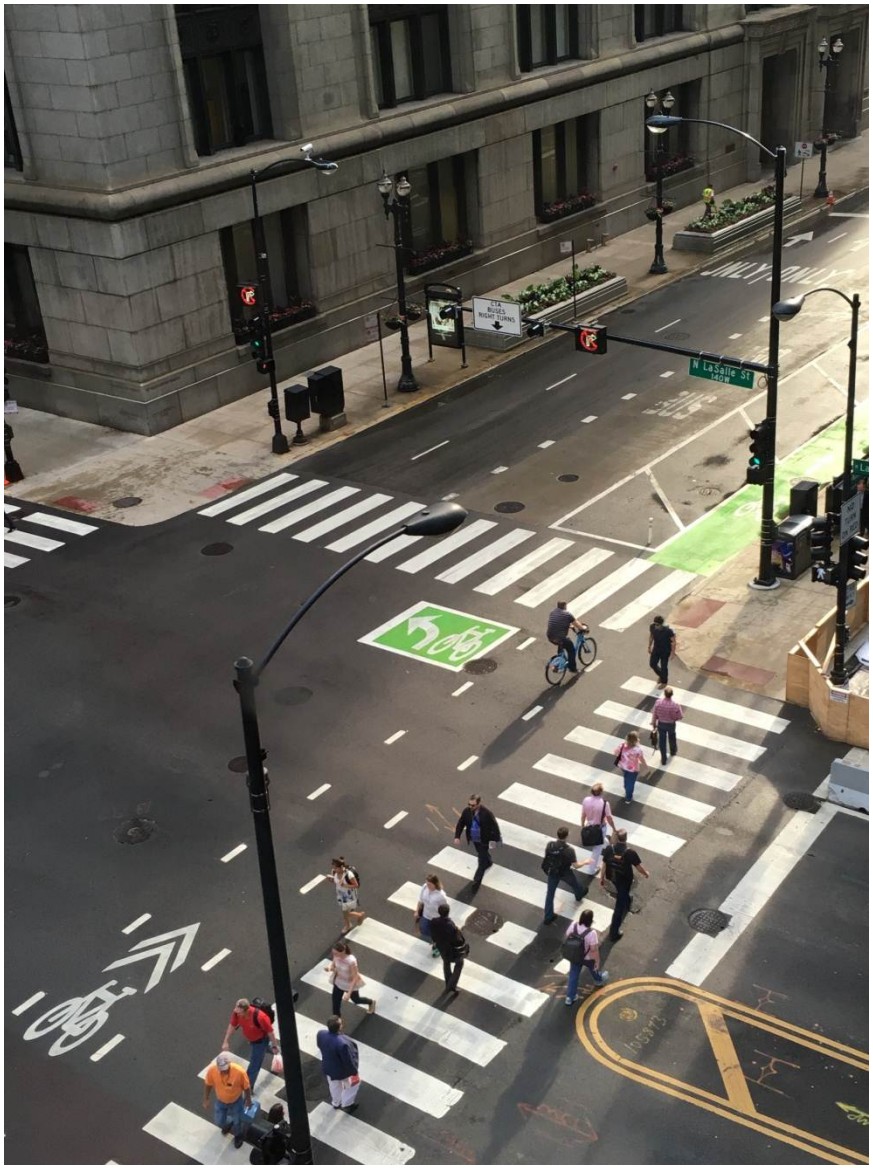


EXHIBIT 4N: ELEMENTS OF PROTECTED INTERSECTIONS



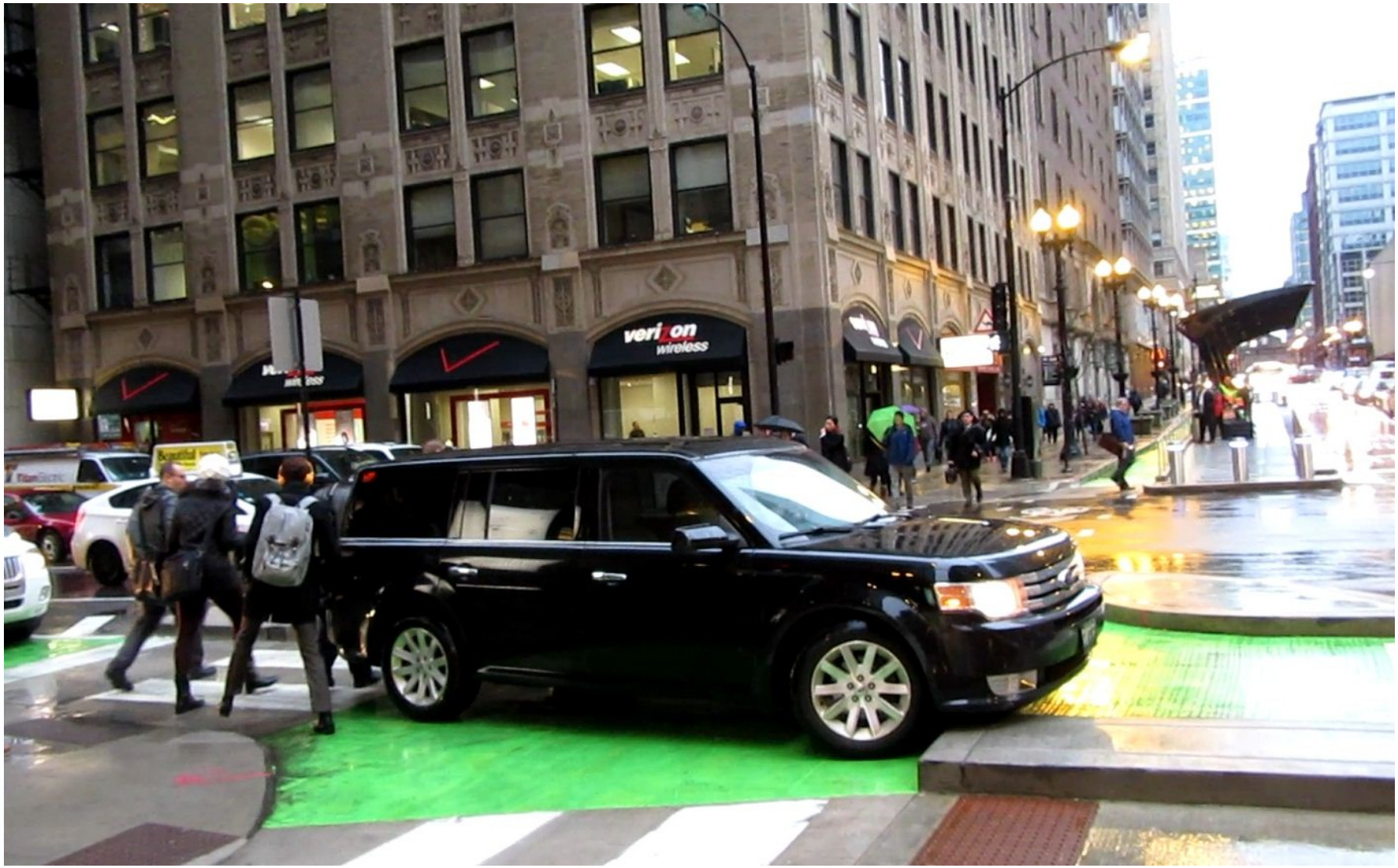
Protected Intersection

Protected Intersection

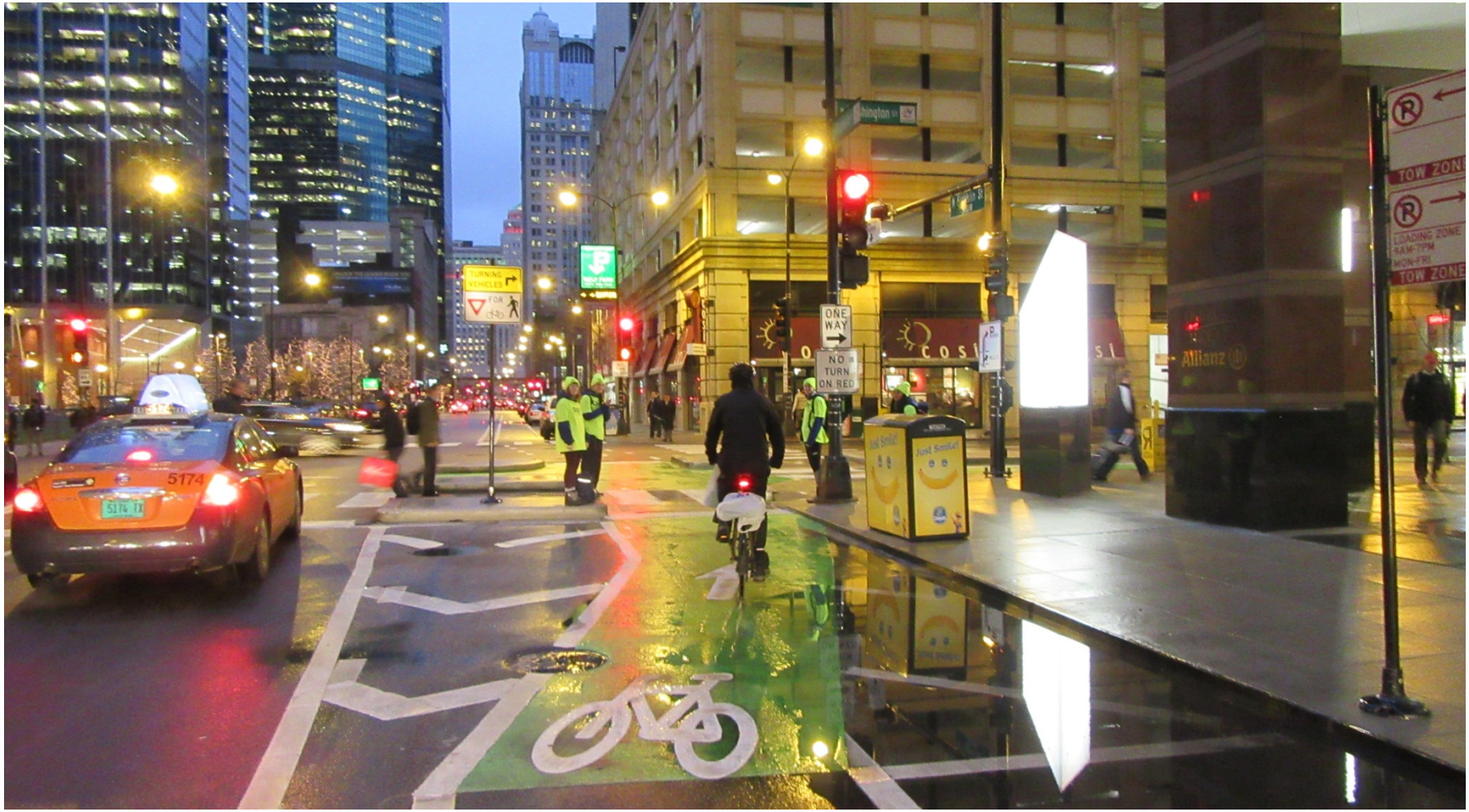


Protected Intersection

Protected Intersection



Protected Intersection



Protected Intersection

Questions?

Thank You!

mike.amsden@cityofchicago.org

www.chicagocompletestreets.org

Discussion

- **Archive at www.pedbikeinfo.org/webinars**
  - Downloadable/streaming recording and presentation slides
- **Questions?**

Dan Goodman

daniel.goodman@dot.gov

Carl Sundstrom

sundstrom@hsrc.unc.edu

Ben Rosenblatt

brosenblatt@samschwartz.com

Mike Amsden

Mike.Amsden@cityofchicago.org

General

webinars@hsrc.unc.edu