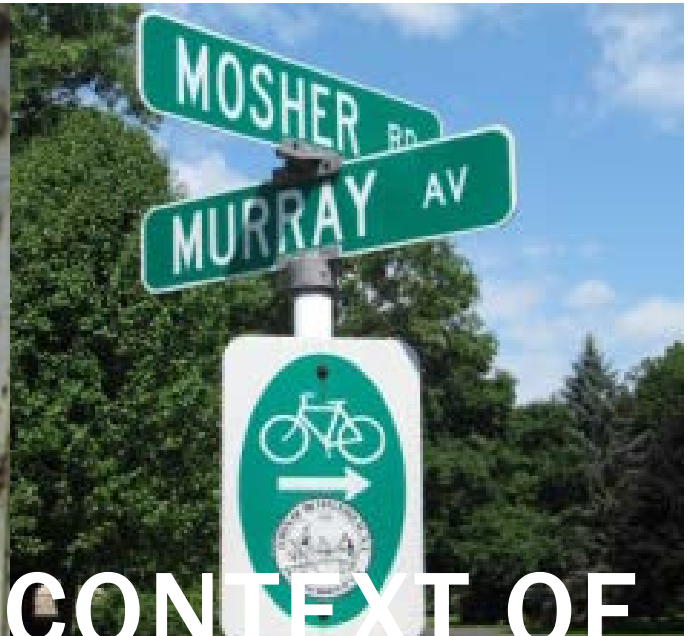


DESIGNING IN CONTEXT OF COMPLETE STREETS

BICYCLE FACILITIES

Module 4

BICYCLE FACILITIES

FHWA Memorandum – August 20, 2013
"Bicycle and Pedestrian Facility Design Flexibility"

Support for taking a flexible approach

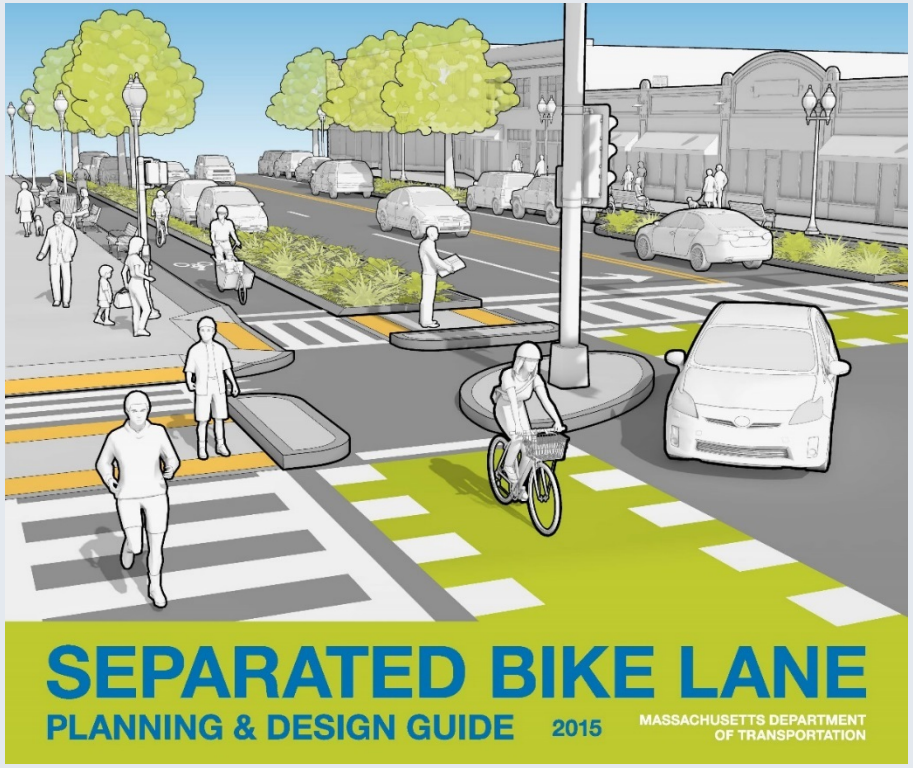
Guide for the Development of Bicycle Facilities (AASHTO)
Designing Urban Walkable Thoroughfares (ITE)
Urban Bikeway Design Guide (NACTO)

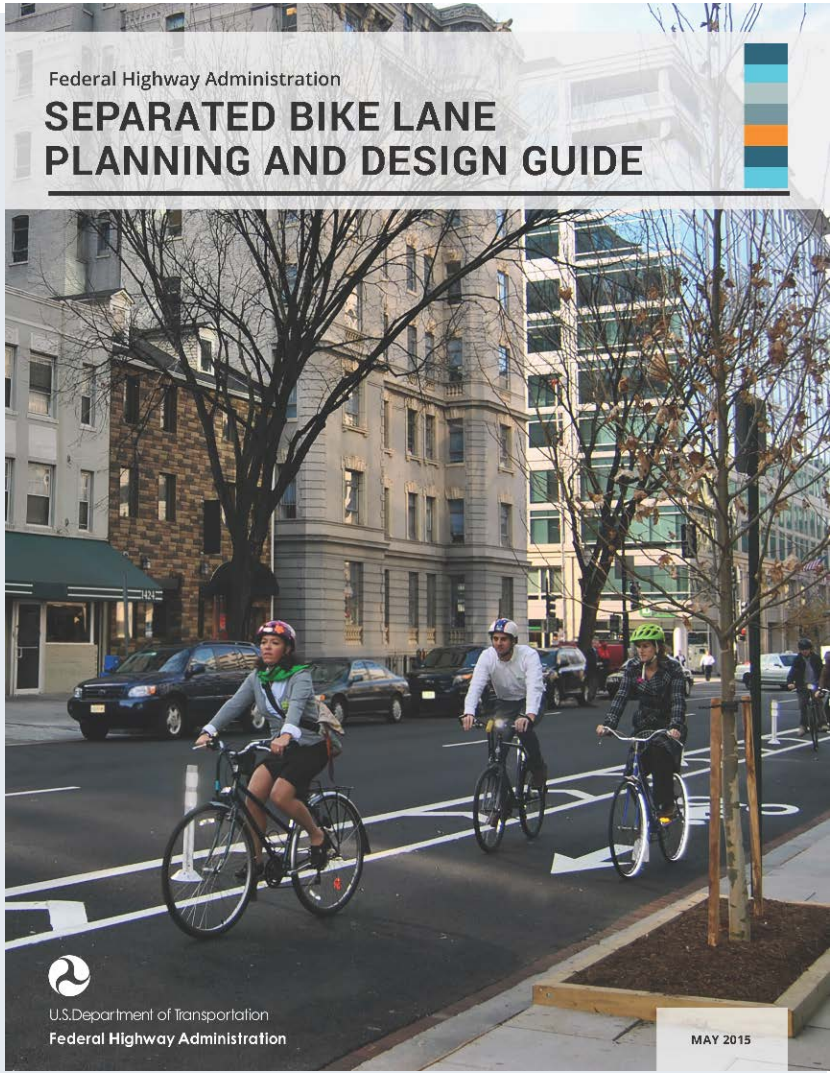
New 2015
Separated Bike Lanes Planning & Design Guides (FHWA)

http://www.fhwa.dot.gov/environment/bicycle_pedestrian/overview/policy_accom.cfm
http://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/separated_bikelane_pdg/

REFERENCES

- FHWA Separated Bike Lane Planning and Design Guide, 2015
- MassDOT, 2015 – Frequently referenced

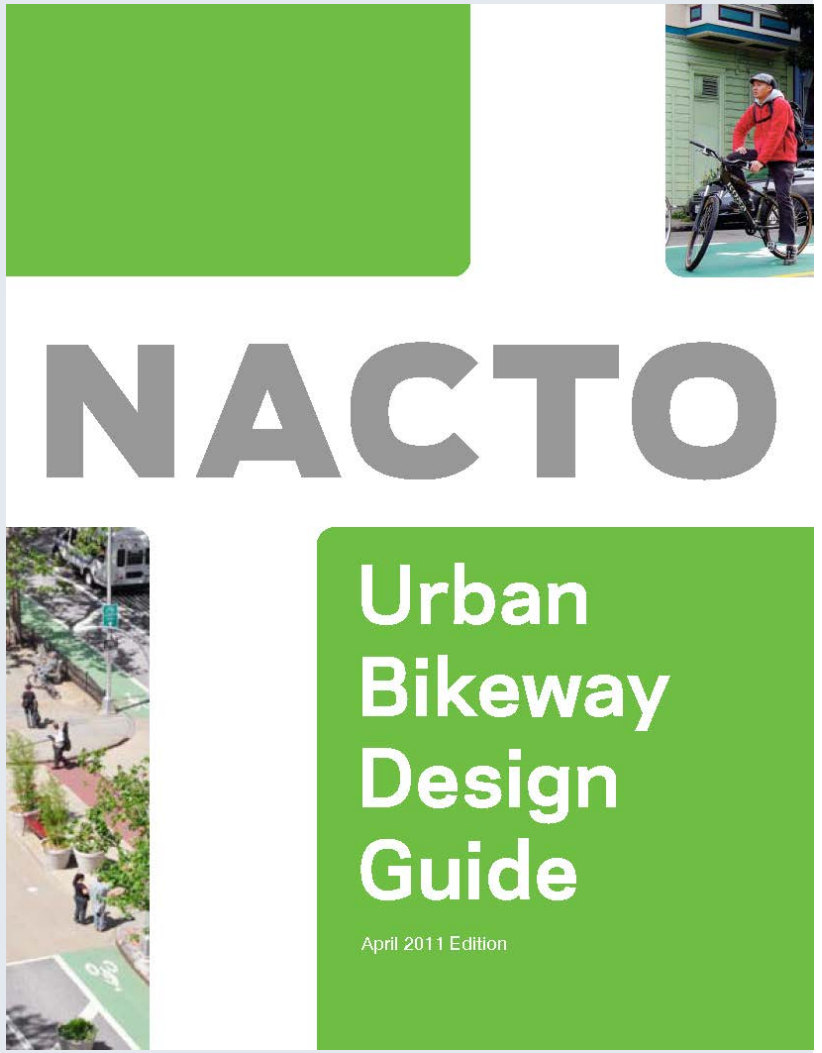




REFERENCES

- The vast majority of NACTO *Guide* is either allowed or not precluded but non-compliant TCD's may be piloted through the MUTCD experiment process.
- Some treatments are compliant, some are experimental, some are actually currently prohibited by FHWA. Guide doesn't distinguish which is which.

CHECK the MUTCD Website



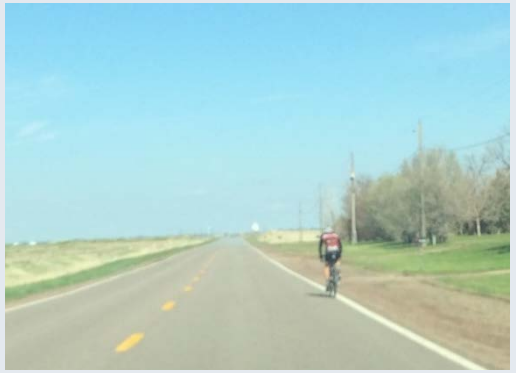
BICYCLE FACILITY TYPES

- Wide lanes
- Shared lanes
- Shoulders
- Bike lanes
- Separated bike lanes
- Shared use paths

Wide lane: 14’ provides minimum width for a car to pass a cyclist without encroaching into the adjacent lane

SHARED LANES

- Good design features
  - Pavement quality
  - Sight distance
  - Lower speed & volume
  - Bicycle compatible grates, railings, tracks, & expansion joints
- Supplemental features
  - Pavement markings or “sharrows”
  - Detectors & signal timing



SHARED LANES

SHARED LANES

Shared Lane Marking

- 35 mph or less
- 4’ min from curb
- 11’ min from curb with on-street parking *(Guidance changing to 12’ from curb)*

SHARED LANE MARKINGS

- Minimum longitudinal spacing of 50’
- May place in center of a narrow travel lane
- Use of green color (currently experimental)
- Use of SLM in turn lane (current compliant use with EXCEPT BIKES plaque)
- Provide SLM on receiving (far) side of intersection

San Francisco

PAVED SHOULDERS

- Useful for higher traffic volume and/or speed
- Frequently used for rural
- Not a travel lane – intersection conflicts
- Uphill direction when constrained

BIKE LANES

- Preferred in urban/suburban
- Rural for high demand for bicycle travel
- Preferential space for bicyclists delineated
- Priority for uphill

BIKE LANES

Bike Lane next to Back-in Angled Parking

BUFFERED BIKE LANES

Buffer may be used to separate bicycle lane from adjacent travel lane and/or parking lane.

Crosshatch pattern should be consistent with Section 3B.24

SEPARATED BIKE LANES

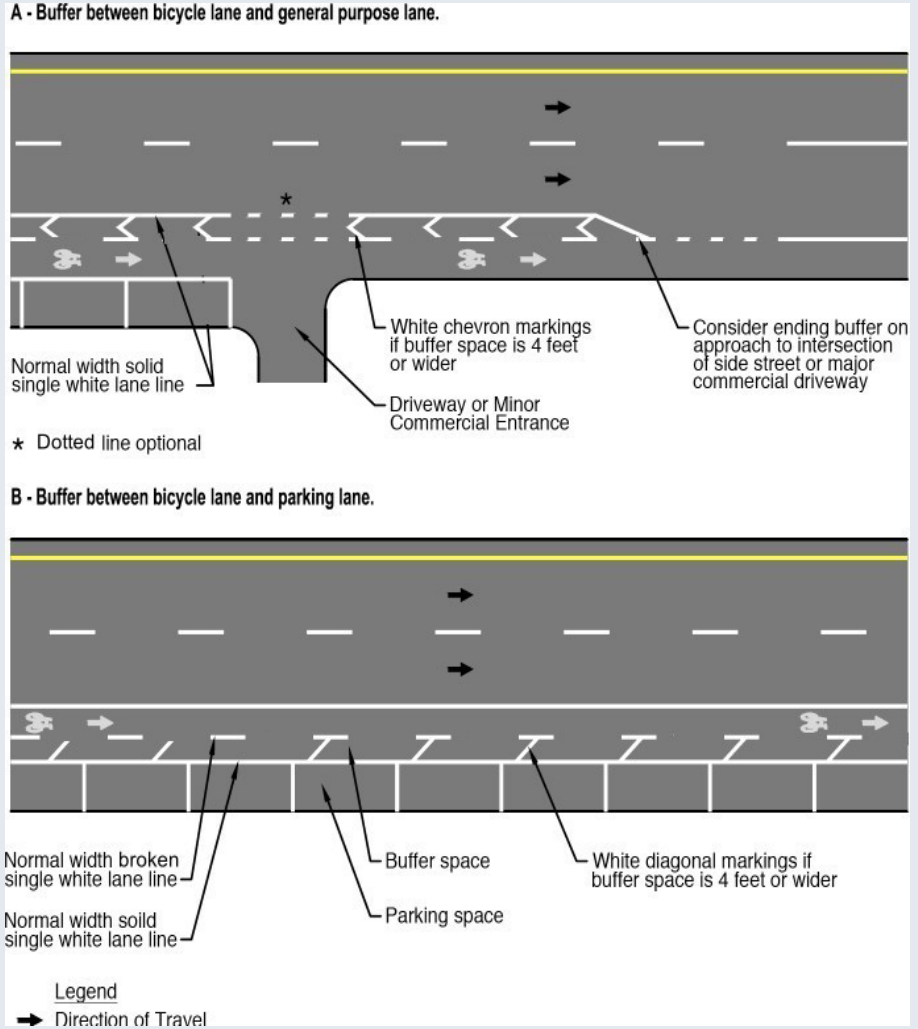
Bike Lane buffered from Parallel Parking

SEPARATED BIKE LANES

Bike Lane buffered from Parallel Parking

BUFFERED BIKE LANES

- The longitudinal marking on the bike lane side of the buffer shall be broken to denote crossing is permitted. Consistent with Section 3D
- Buffer width >4’ should have cross hatch markings (chevrons next to travel lane, diagonals next to parking. Consistent with Section 3B.24)



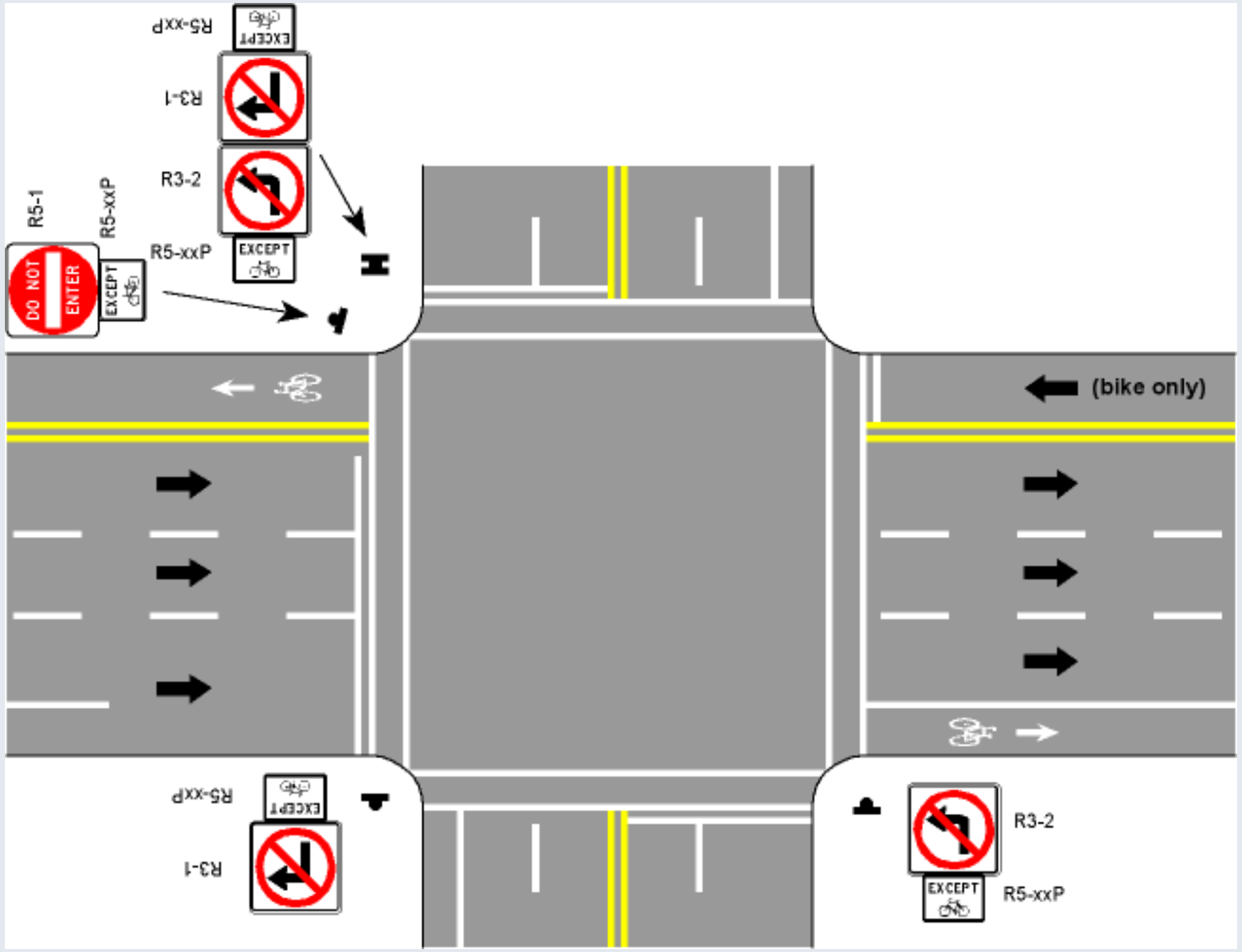
SEPARATED BIKE LANES

Bike Lane right of the Bus Stop

CONTRAFLOW BIKE LANES

Allows lawful use by bicyclists to travel in opposite direction on 1-way roadways

EXCEPT BIKES PLAQUE – CONTRAFLOW LANE



R5-xxP
Except Bicycles (plaque)
24" x 18", 4D text, 7" bicycle symbol

BIKE LANE EXTENSIONS

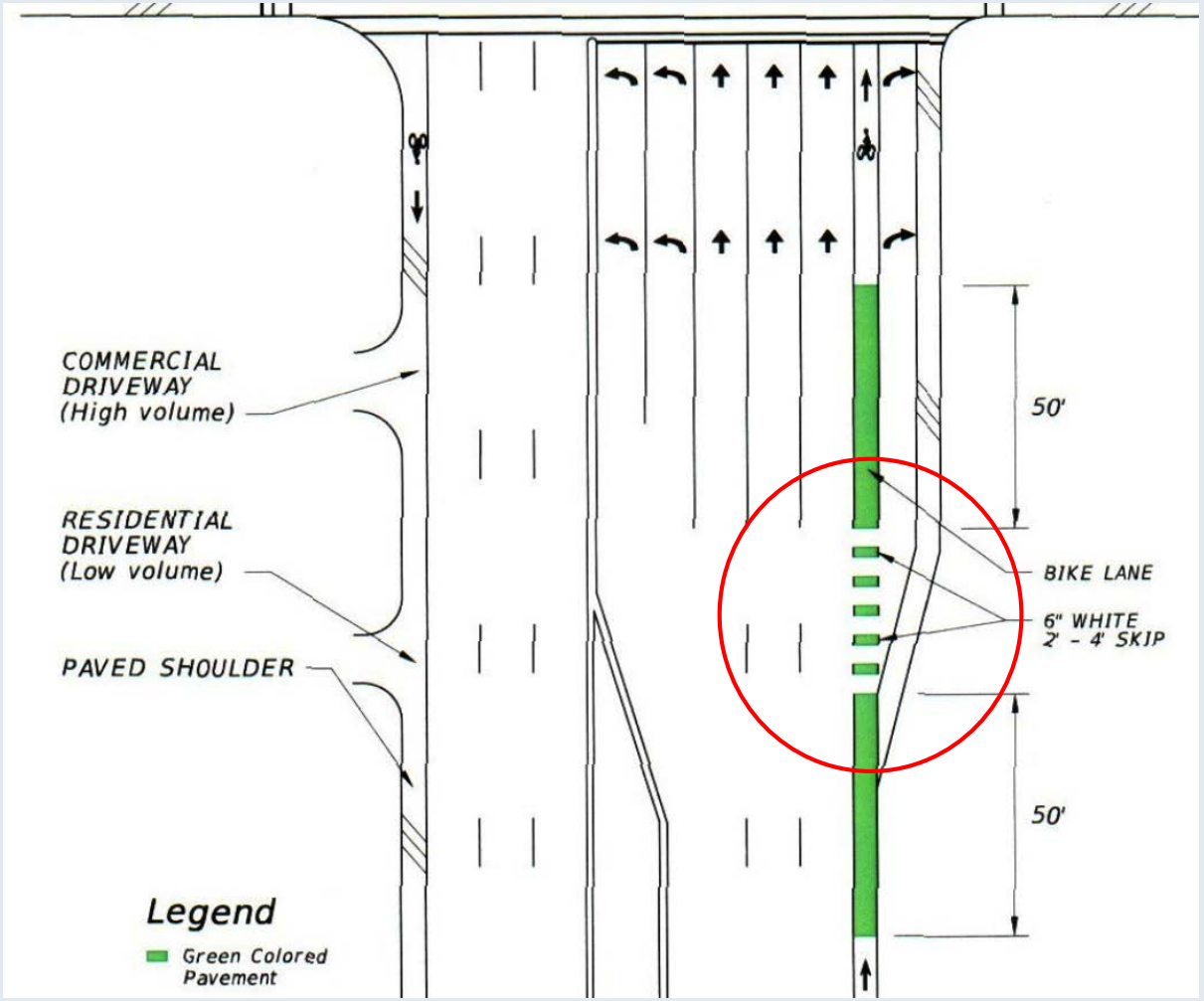
Note in both of these photos that the green markings are not correct. The green should be broken to match the white markings as shown in the next slide.

Binney St Cambridge, MA

Used to extend bicycle lanes through intersections consistent with Section 3B.08

Northampton, Mass

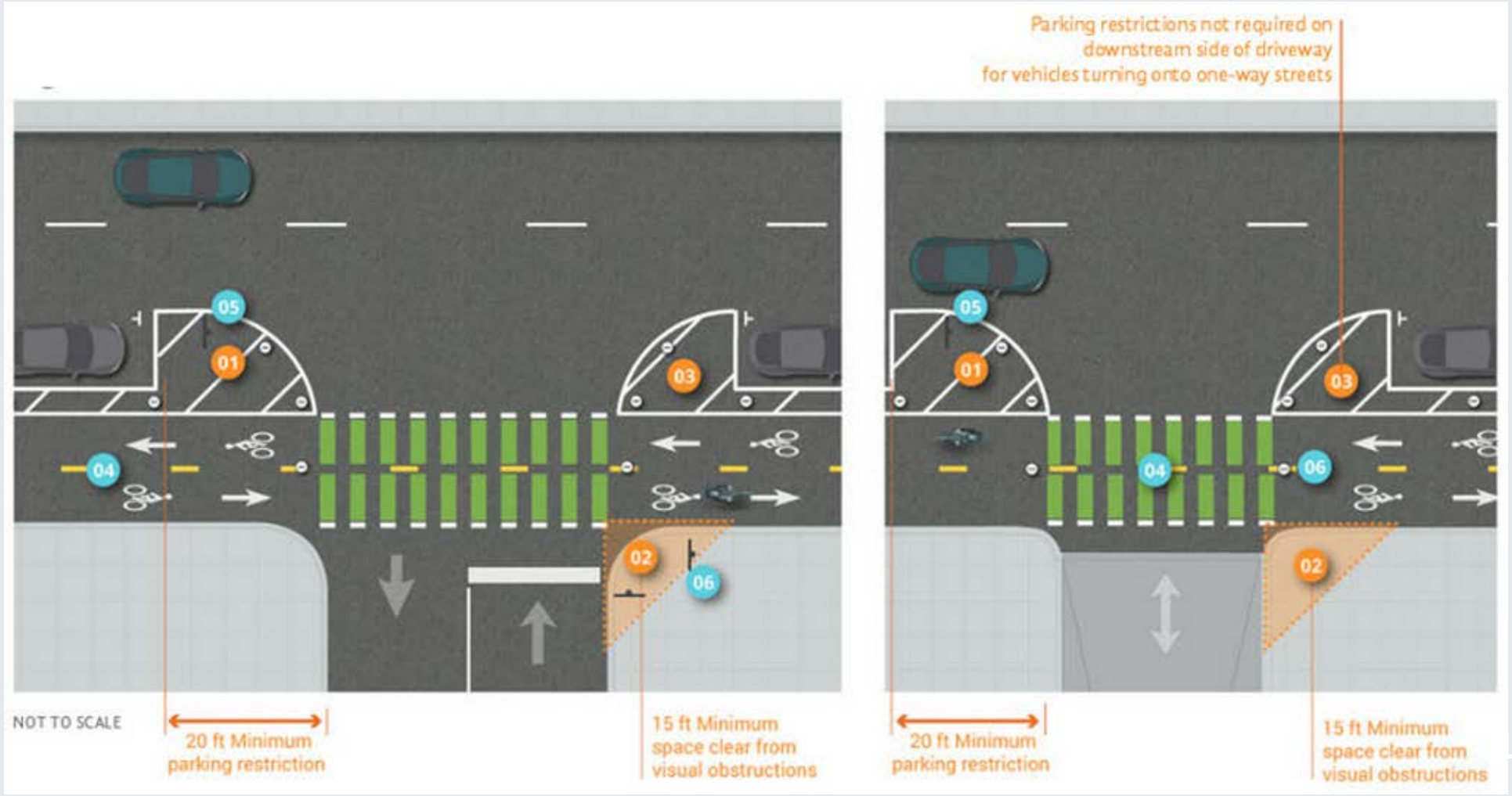
BIKE LANE EXTENSIONS



SEPARATED BIKE LANE

Bike lane separated from Motorized Vehicles by horizontal and vertical elements

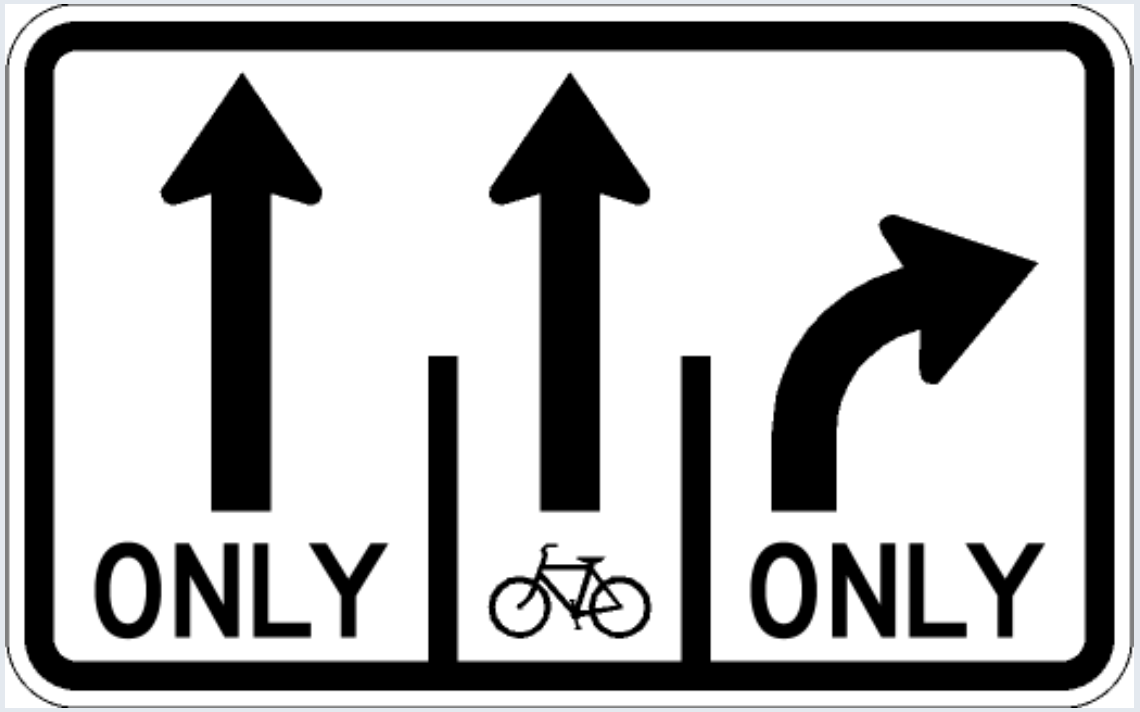
TWO-WAY SEPARATED BIKE LANE



NEW LANE CONTROL SIGNS

R3-5Xp BIKE PLAQUE FOR LANE SIGN

R3-8 ADVANCE INTERSECTION LANE CONTROL SIGN



BIKE - MODIFIED R10-15

R10-15a

R10—15b

EXCEPT BIKES WARNING PLAQUE

- Used beneath warning signs where it is desired to alert bicyclists that the specific condition depicted on the warning sign is not applicable to them.
- All text version is compliant with current MUTCD

BIKE LANE WARNING SIGNS - TRANSITIONS

- Warning signs for bike lane endings and subsequent bike merge.
- Similar to standard roadway lane drop warning signs.
- Applicable distance or “AHEAD” plaques may be added.

W9-XX Bike Lane Ends Sign
(30" panel, 9" tall bicycle symbol, 5" D & C text)

W9-XX Bike Merge Sign
(30" panel, 9" tall bicycle symbol, 5" D & C text)

BICYCLE SIGNAL FACE

Allowed under IA-16:

- Bicyclist non-compliance
- Provide a leading or lagging bicycle interval
- Continue the bicycle lane on the right-hand side of an exclusive turn lane
- Augment the design of a segregated counter-flow
- Unusual or unexpected arrangements of the bicycle movement through complex intersections, conflict areas, or signal control.

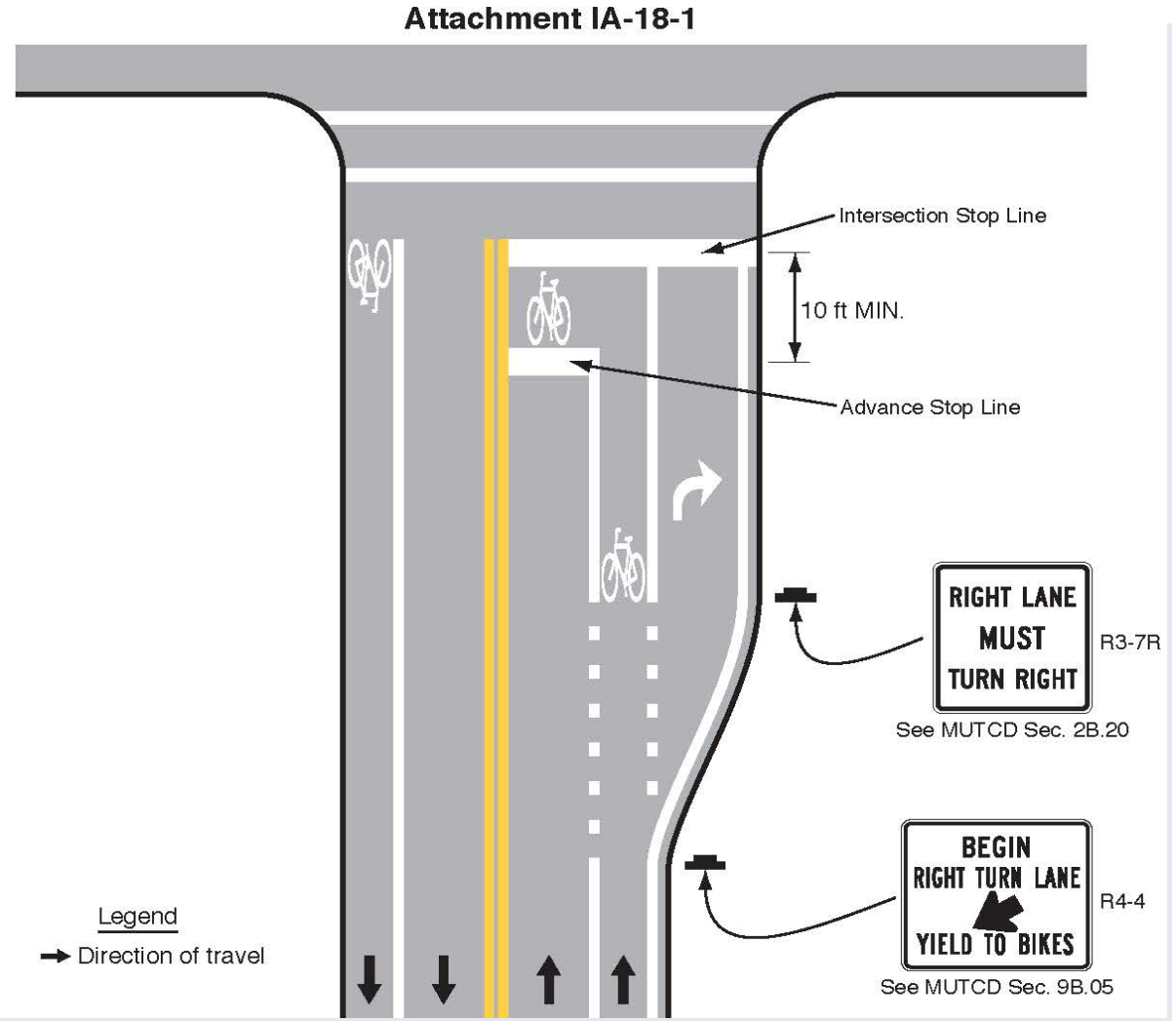
BIKE BOX

- Reduced conflicts between bicyclists and turning vehicles
- Reduced avoidance maneuvers
- Reduced encroachment into crosswalks
- Use clearly understood by motorists and bicyclists

BIKE BOX

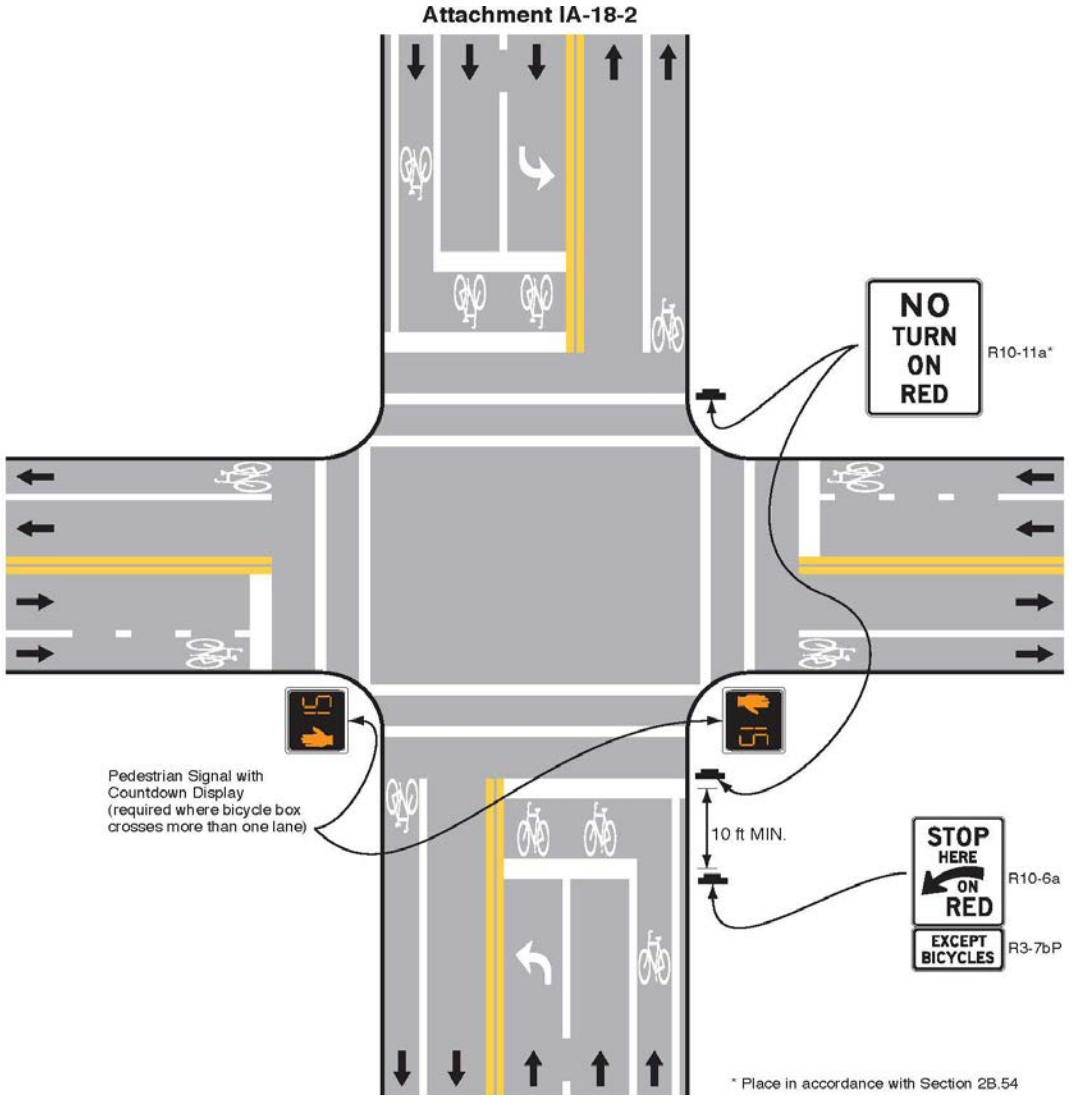
- Allowed under IA-18. Required elements:
  - Advance stop line at 10’
  - Bike symbol in the box
  - RTOR prohibited
  - Setback from crosswalk
  - 50 feet of bike lane on approach
  - STOP HERE ON RED (R10-6/R10-6a)

    with EXCEPT BICYCLE text plaque
  - Countdown ped signal if box crosses multiple lanes
  - Yellow change & red clearance



BIKE BOX

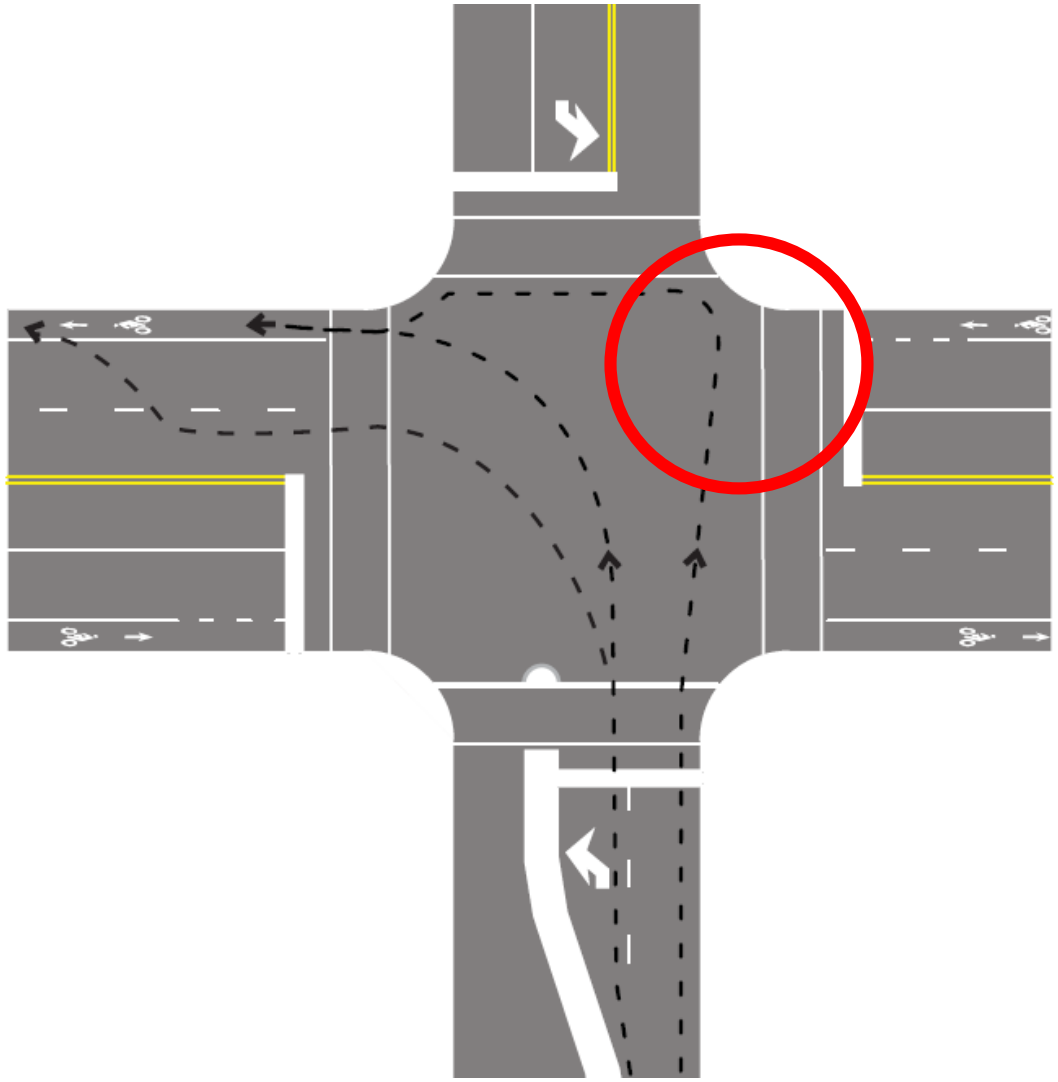
- Green pavement is optional (Need separate approval for Green color under IA-14)
- Countdown ped signal if box crosses multiple lanes



TWO-STAGE TURN BOXES

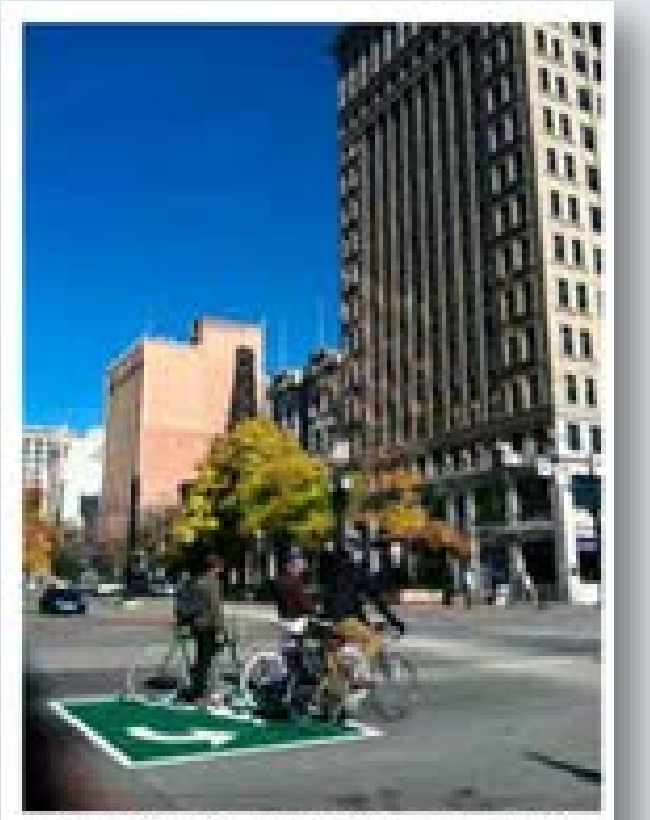
Typical left turn movements by cyclists through an intersection

2- Stage Turn Box formalizes left turn movement currently allowed by traffic laws



TWO-STAGE LEFT-TURN BOXES

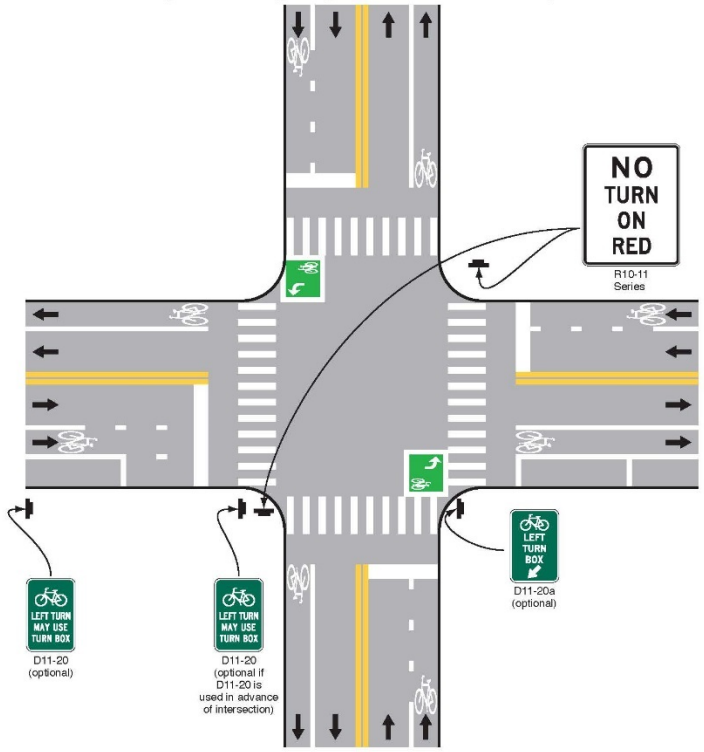
- Allowed under IA-20. Required design elements include:
  - Bicycle symbol
  - Turn arrow
  - Solid white line on all sides
  - Turn on red prohibition if turning vehicles cross box
  - Passive detection of bicycles
  - Queued bicyclists outside path of moving traffic
  - Avoid crosswalk conflicts
- Size to prevent conflicts



SALT LAKE CITY, UT (PHOTO: SALT LAKE CITY PUBLIC WORKS)

TWO-STAGE TURN BOXES OPTIONAL USE

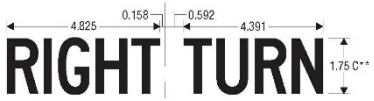
Attachment IA-20-1
Example of Two-Stage Bicycle Turn Box when Use is Optional



D11-20
Issued 7/13/2017

D11-20L
LEFT (RIGHT) TURN MAY USE TURN BOX

D11-20R



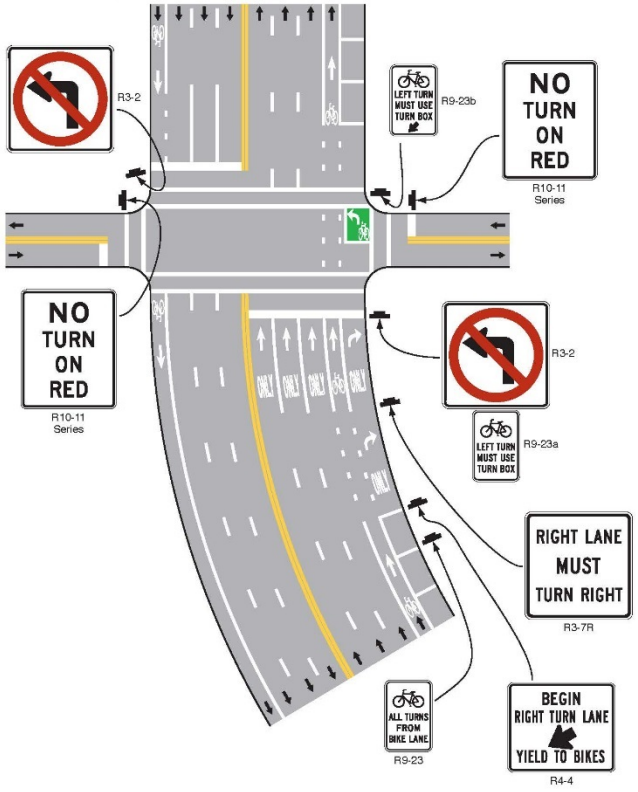
* Reduce character spacing 20%.
** Reduce character spacing 40%.

COLORS: LEGEND, BORDER – WHITE (RETROREFLECTIVE)
BACKGROUND – GREEN (RETROREFLECTIVE)

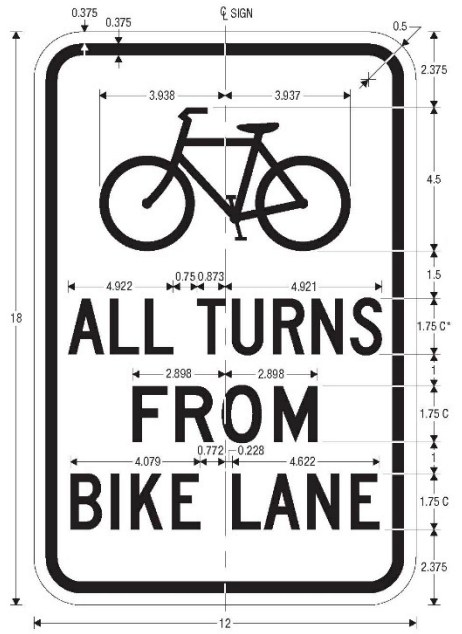
IA-20-3

TWO-STAGE TURN BOXES MANDATORY USE

Attachment IA-20-2
Example of Two-Stage Bicycle Turn Box when Use is Mandatory



R9-23
Issued 7/13/2017



R9-23
ALL TURNS FROM BIKE LANE

★ Reduce character spacing 20%.

COLORS: LEGEND, BORDER — BLACK
BACKGROUND — WHITE (RETROREFLECTIVE)

IA-20-5

SIGNING OPTIONS FOR TURN BOX

TWO-STAGE TURN BOX

Binney Sreet, Cambridge, MA

ALT SIGNAL WARRANT 7 – CRASH HISTORY

Current Warrant 7

"five or more reported crashes, of types susceptible to correction by a traffic control signal, have occurred within a 12-month period, each crash involving personal injury or property damage apparently exceeding the applicable requirements for a reportable crash."

ALT SIGNAL WARRANT 7 – CRASH HISTORY

IA-19 for Warrant 7

- The number of reported angle crashes and pedestrian crashes within a one-year period equals or exceeds the threshold number in Table IA-19-1 for total angle crashes and pedestrian crashes (all severities); or
- The number of reported fatal-and-injury angle crashes and pedestrian crashes within a one-year period equals or exceeds the threshold number in Table IA-19-1 for total fatal-and-injury angle crashes and pedestrian crashes ; or
- The number of reported angle crashes and pedestrian crashes within a three-year period equals or exceeds the threshold number in Table IA-19-2 for total angle crashes and pedestrian crashes (all severities); or
- The number of reported fatal-and-injury angle crashes and pedestrian crashes within a three-year period equals or exceeds the threshold number in Table IA-19-2 for total fatal-and-injury angle crashes and pedestrian crashes

ALT SIGNAL WARRANT 7 – CRASH HISTORY

Table IA-19-2. Minimum Number of Reported Crashes in a Three-Year Period

Urban Area

Number of through lanes on each approach		Total of Angle and Pedestrian Crashes (all severities)[a]		Total of Fatal-and-Injury Angle and Pedestrian Crashes[a]	
Major Street	Minor Street	Four Legs	Three Legs	Four Legs	Three Legs
1	1	6	5	4	4
2 or more	1	6	5	4	4
2 or more	2 or more	6	5	4	4
1	2 or more	6	5	4	4

ALT SIGNAL WARRANT 7 – CRASH HISTORY

Table IA-19-2. Minimum Number of Reported Crashes in a Three-Year Period

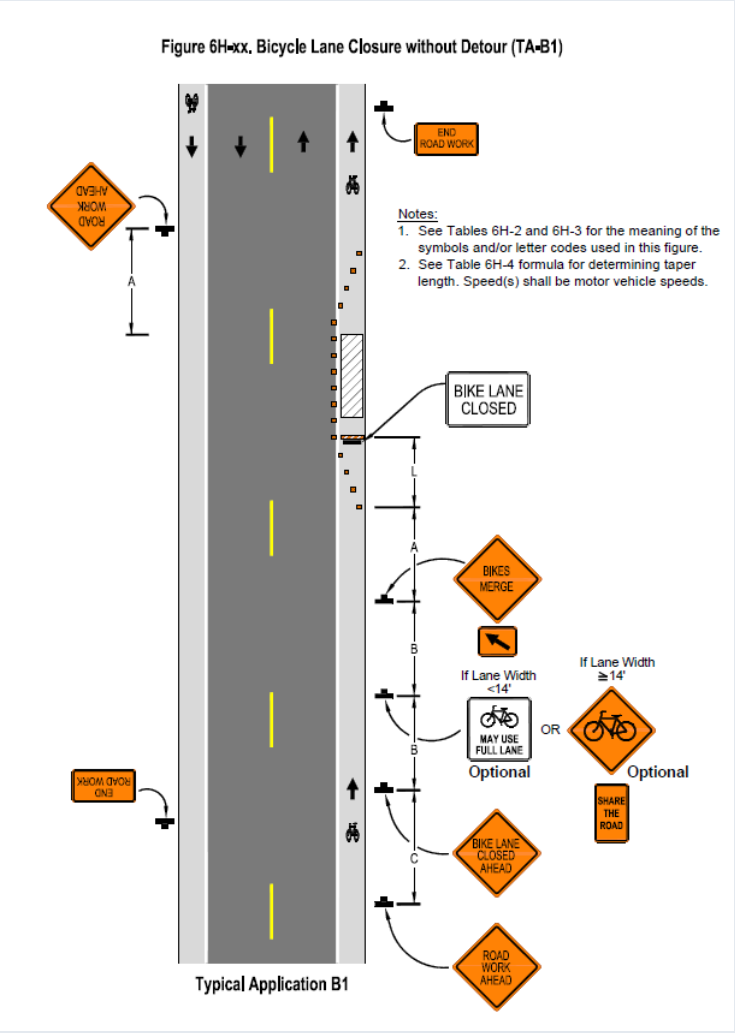
Rural Area

Number of through lanes on each approach		Total of Angle and Pedestrian Crashes (all severities)[a]		Total of Fatal-and-Injury Angle and Pedestrian Crashes[a]	
Major Street	Minor Street	Four Legs	Three Legs	Four Legs	Three Legs
1	1	6	5	4	4
2 or more	1	16	13	9	9
2 or more	2 or more	16	13	9	9
1	2 or more	6	5	4	4

[b] "Rural Area" values apply to intersections where the major-street speed exceeds 40 mph or intersections located in an isolated community with a population of less than 10,000

TEMPORARY TRAFFIC CONTROL FOR BIKES

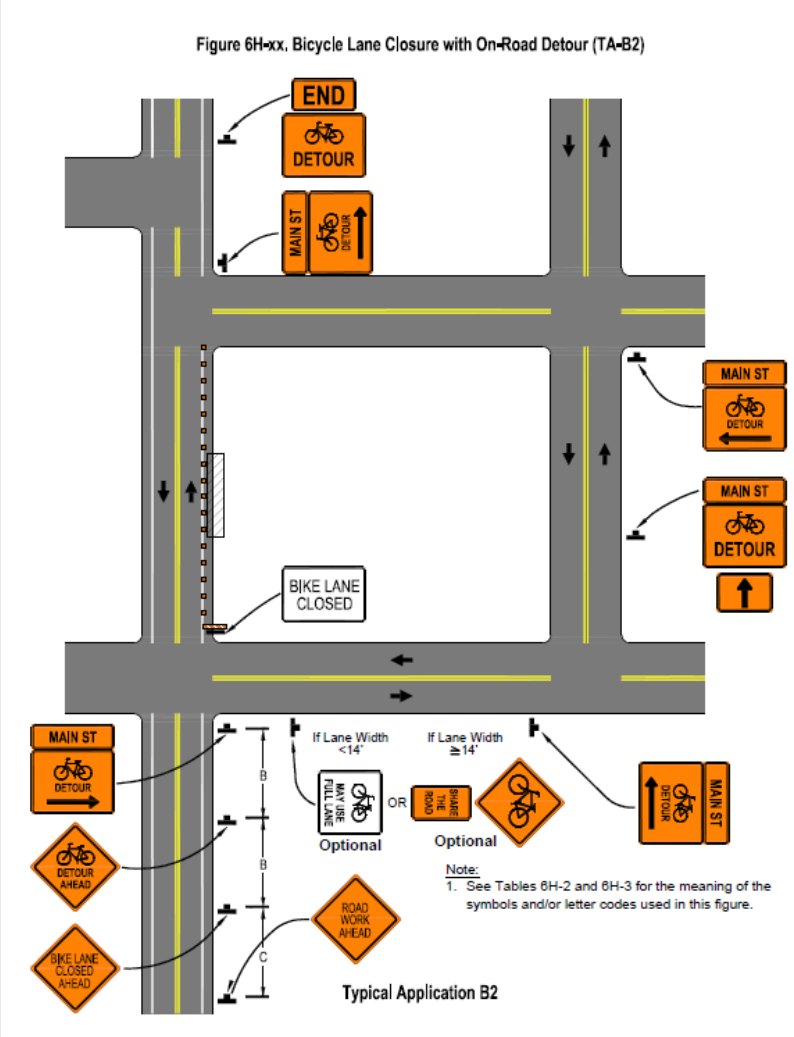
- Part 6 Typical Applications for Guidance and Support to provide bikeway continuity through or around a Temporary Traffic Control (TTC) zone.

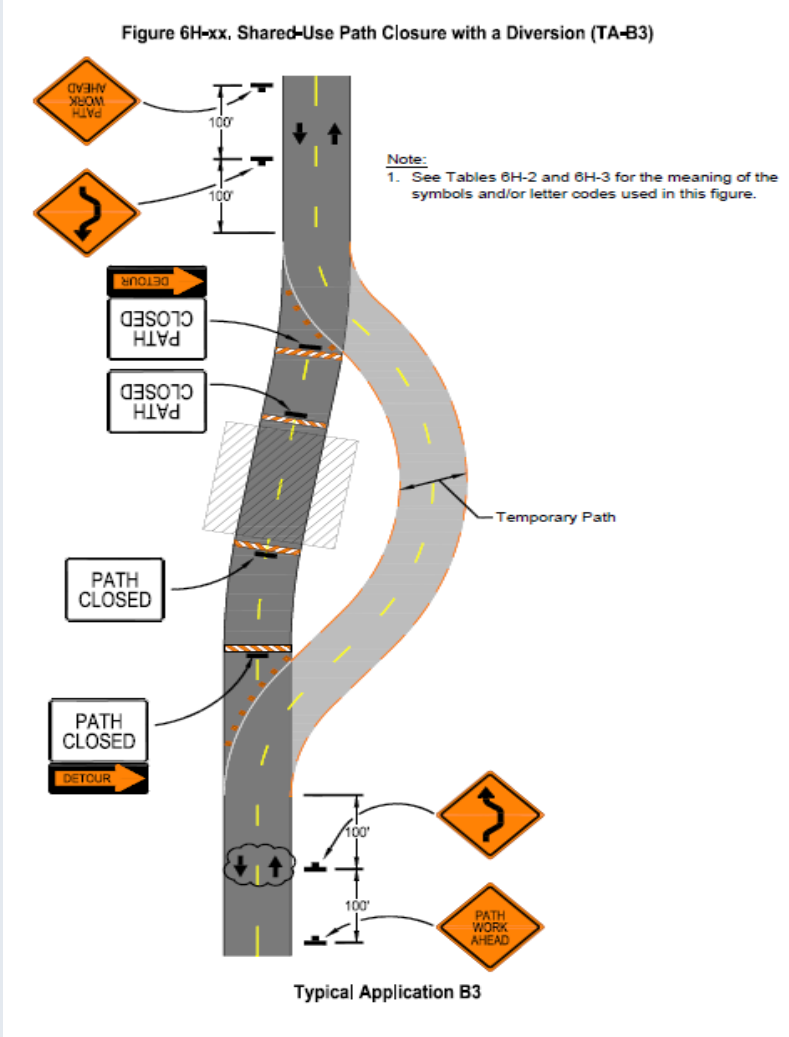


Bike lane closure with diversion into traffic lane

TEMPORARY TRAFFIC CONTROL FOR BIKES

Bike lane closure with on-road detour





Path closure with diversion

BIKE/PED DETOUR CONSIDERATIONS – IMPORTANT

Henderson Bridge Repair Providence, RI

COMBO TURN LANE - BIKE LANE

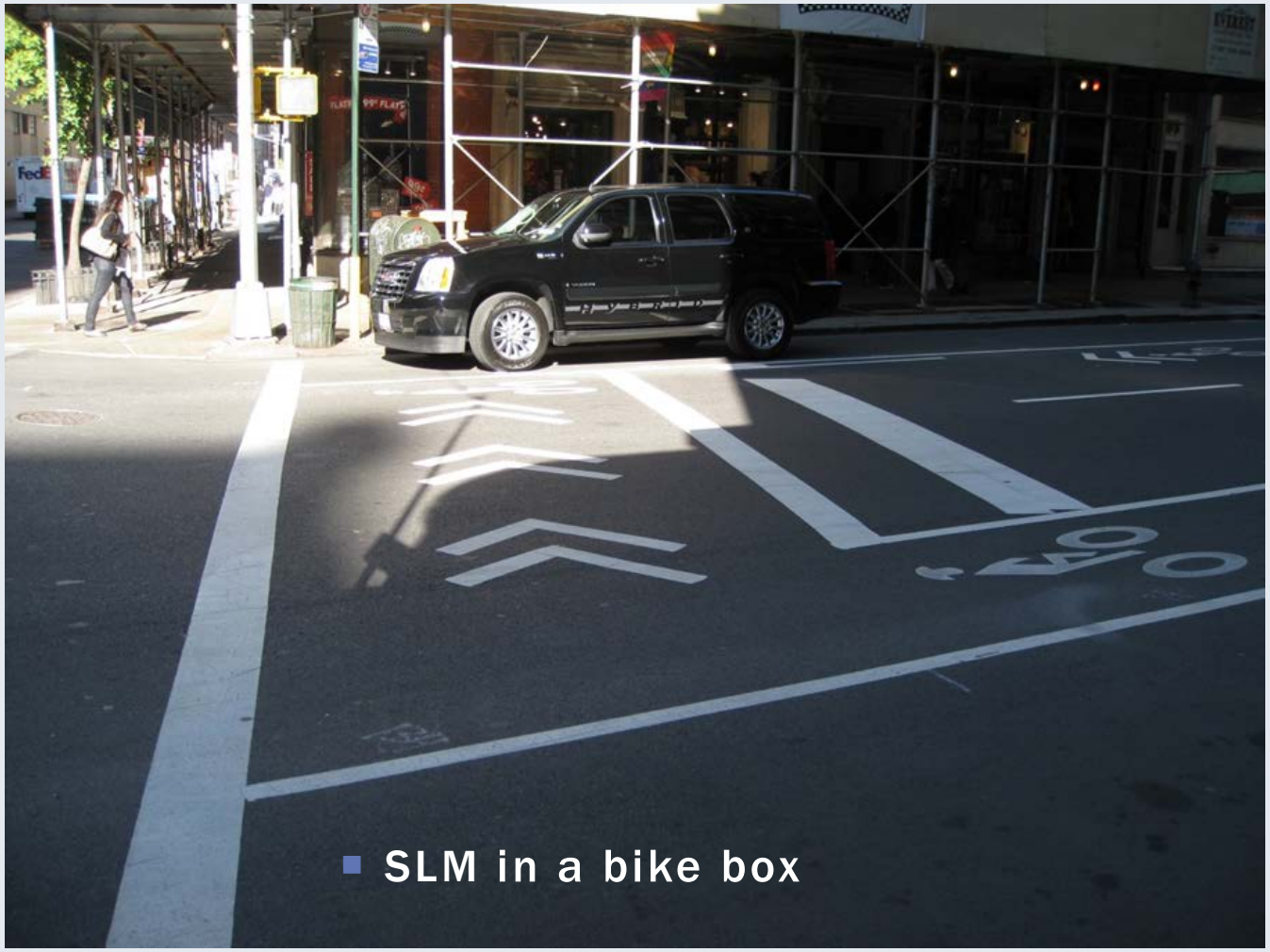
Lane within a Lane-not allowed

SLM in RTOL-allowed

CORRECT – KEYHOLE LANE

CURRENT DESIGNS PROHIBITED – INAPPROPRIATE USE OF SLM'S

New York City



- SLM in a bike box

CURRENT DESIGNS PROHIBITED – INAPPROPRIATE USE OF SLM'S

- With longitudinal markings ("priority bike lanes")

Brookline, Mass

CURRENT DESIGNS PROHIBITED – INAPPROPRIATE USE OF SLM'S

Excessive wear of dashed lines

RESOURCES

FHWA sponsored source for reports, data, case studies:

www.pedbikeinfo.com

www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/separated_bikelane

Information on status of new bike designs:

www.fhwa.dot.gov/environment/bicycle_pedestrian/guidance/design_guidance/mutcd_bike.cfm

Information on MUTCD, links to state supplements and Interim Approvals:

www.fhwa.mutcd.org

Information on the NCUTCD:

www.ncutcd.org