

# Protected Bikeway Design

## NACTO Urban Bikeway Design Guide

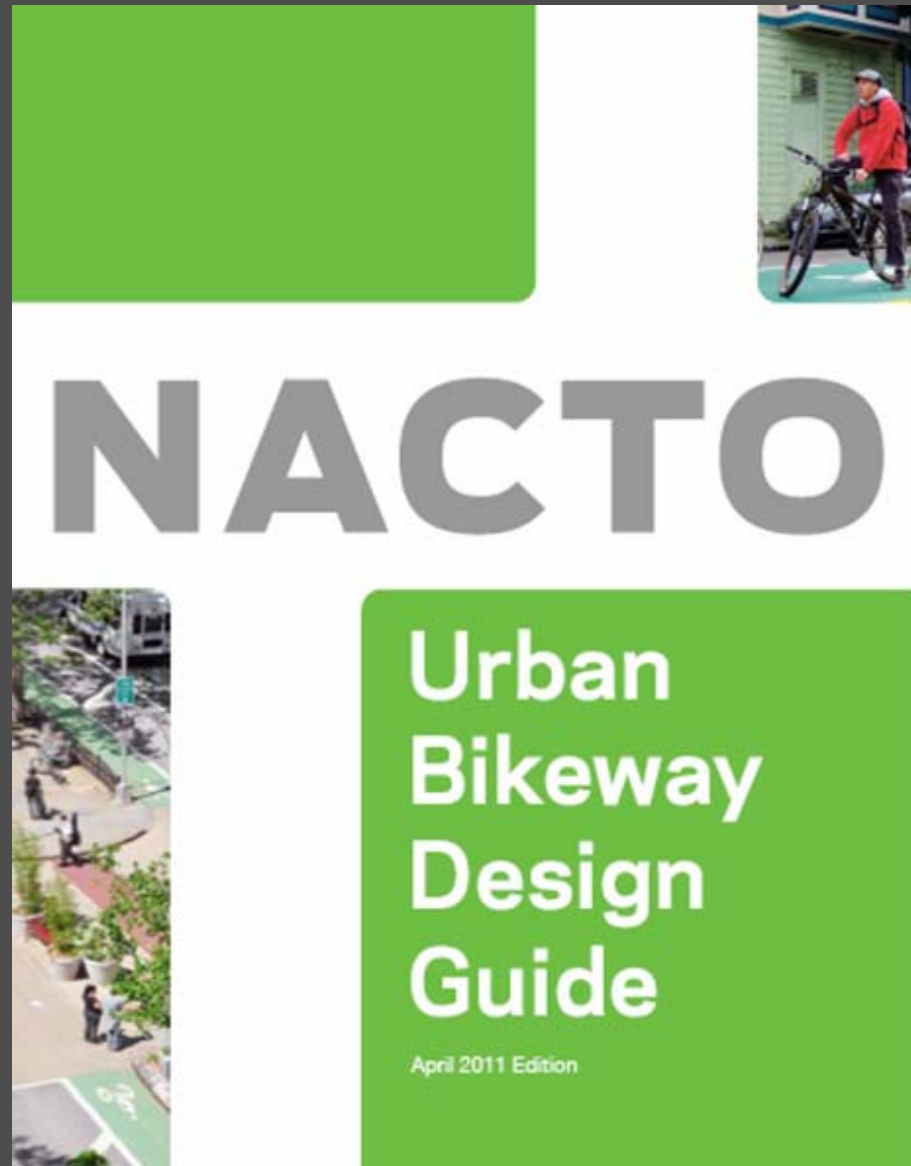


Chicago, Oct. 2011

# 21 Treatments

## 5 Categories

Bike Lanes  
Cycle Tracks  
Intersections  
Signals  
Signing & Marking



# Bikeway Design Treatments

## BIKE LANES

- Conventional Bike Lanes
- Left-side Bike Lanes
- Contra-Flow Bike Lanes
- Buffered Bike Lanes

## CYCLE TRACKS

- One-way Protected Cycle Tracks
- Raised Cycle Tracks
- Two-way Cycle Tracks

## SIGNING & MARKING

- Bike Route Wayfinding Signage and Markings System
- Colored Bike Facilities
- Shared Lane Markings

## SIGNALS

- Bicycle Signal Heads
- Signal Actuation and Detection
- Active Warning Beacon for Bike Route at Unsignalized Intersection
- Hybrid Signal for Bike Route Crossing of Major Street

## INTERSECTIONS

- Bike Boxes
- Intersection Crossing Markings
- Two-stage Turn Queue Boxes
- Median Refuge Island
- Through Bike Lanes
- Combined Bike Lane
- Cycle Track Intersection Approach

# Online Guide & Slideshow



## One-Way Protected Cycle Tracks



### Urban Bikeway Design Guide

Bike Lanes

Cycle Tracks

■ One-Way Protected Cycle Tracks

■ Raised Cycle Tracks

■ Two-Way Cycle Tracks

Intersections

Signals

Signing & Marking

City Projects

Master Reference Matrix



# Print & PDF Guide

## CYCLE TRACKS

A cycle track is an exclusive bike facility that combines the user experience of a separated path with the on-street infrastructure of a conventional bike lane.

A cycle track is physically separated from motor traffic and distinct from the sidewalk. Cycle tracks have different forms but all share common elements—they provide space that is intended to be exclusively or primarily used for bicycles, and are separated from motor vehicle travel lanes, parking lanes, and sidewalks. In situations where on-street parking is allowed cycle tracks are located to the curb-side of the parking (in contrast to bike lanes).

Cycle tracks may be one-way or two-way, and may be at street level, at sidewalk level, or at an intermediate level. If at sidewalk level, a curb or median separates them from motor traffic, while different pavement color/texture separates the cycle track from the sidewalk. If at street level, they can be separated from motor traffic by raised medians, on-street parking, or bollards. By separating cyclists from motor traffic, cycle tracks can offer a higher level of security than bike lanes and are attractive to a wider spectrum of the public.

### RECOMMENDED (CONTINUED)



When configured next to a motor vehicle travel lane, 1.5 feet is the desired minimum width for a buffer to provide safety and comfort for bicyclists in the cycle track. The buffer areas should exist as either a raised or mountable curb or be suitable for street furniture, low vegetation, and/or trees.

	Desirable minimum width (m) (see note 1)	Absolute minimum width (m) (see note 1)	Safety strip to carriageway kerb edge minimum width (m) (see note 2)
One Way	2.0	1.5	0.5
Two Way	3.0	2.0	0.5

#### Notes:

- 0.5m should be added for each side of the track that is bounded (e.g. by a wall, railings fence or hedge).
- Safety strip to carriageway kerb edge minimum width should be 1.0m adjacent to frequently accessed parked cars.

Transport for London. (2008). London Cycling Design Standards.



Driveways and minor street crossings are a unique challenge to cycle track design. A review of existing facilities and design practice has shown that the following guidance may improve safety at crossings of driveways and minor intersections:

- If the cycle track is parking protected, parking should be prohibited near the intersection to improve visibility. The desirable no-parking area is 30 feet from each side of the crossing.

**“** *Parking must be banned along the street with the bike path for a distance long enough to ensure adequate stopping sight distances for motorists crossing the path.*

Velo Québec. (2003). Technical handbook of bikeway design. 2nd ed. Québec: Ministère des Transports du Québec and the Secrétariat au Loisir et au Sport.

- For motor vehicles attempting to cross the cycle track from the side street or driveway, street and sidewalk furnishings and/or other features should accommodate a sight triangle of 20 feet to the cycle track from minor street crossings, and 10 feet from driveway crossing.



National Association of  
City Transportation Officials

# CYCLE TRACKS





# One-way Cycle Track

Long Beach, CA

Credit: Bikeable Communities





# Raised Cycle Track

Cambridge, MA





## Two-way Cycle Track

Montreal, Quebec





**Two-way Cycle Track**  
New York, NY

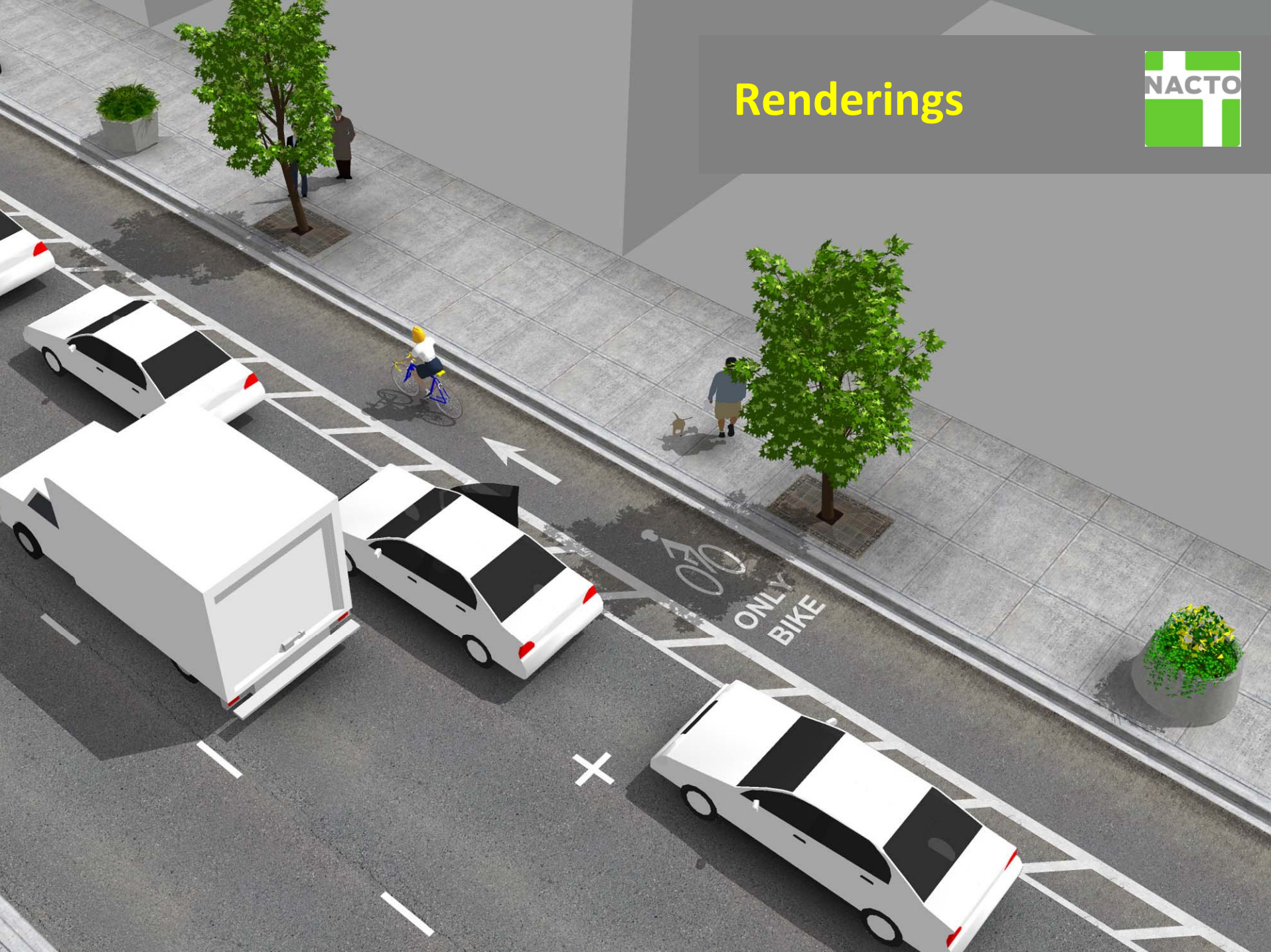




**One –Way Protected Cycle Tracks**



# Renderings





















# Technical Guidance



A cycle track, like a bike lane, is a type of preferential lane as defined by the MUTCD.

See MUTCD advice on diagonal striping Section 3B.24 05

4 in Normal white line  
8 in Wide white line

Bicycle lane word, symbol, and/or arrow markings (MUTCD Figure 9C-3) shall be placed at the beginning of a cycle track and at periodic intervals along the facility based on engineering judgment.

When using a pavement marking buffer, desired parking lane and buffer combined width is 11 feet to discourage motor vehicle encroachment into the cycle zone.

A BIKE ONLY legend (MUTCD 3D.01) may be used to supplement the preferential lane word or symbol marking.

If pavement markings are used to separate motor vehicle parking lanes from the preferential bicycle lane, solid white lane line markings shall be used. Diagonal crosshatch markings may be placed in the neutral area for special emphasis. See MUTCD Section 3B.24. Raised medians or other barriers can also provide physical separation to the cycle track.

Three feet is the desired width for a parking buffer to allow for passenger loading and to prevent door collisions.

Travel lanes

Parking lane

Cycle Track 5-7 foot minimum

The desired width for a cycle track should be 5 feet. In areas with high bicyclist volumes or uphill sections, the desired width should be 7 feet to allow for bicyclists passing each other.



A BIKE LANE sign (MUTCD R3-17) may be used to designate the portion of the street for preferential use by bicyclists. A supplemental "No Cars" selective exclusion sign may be added for further clarification.

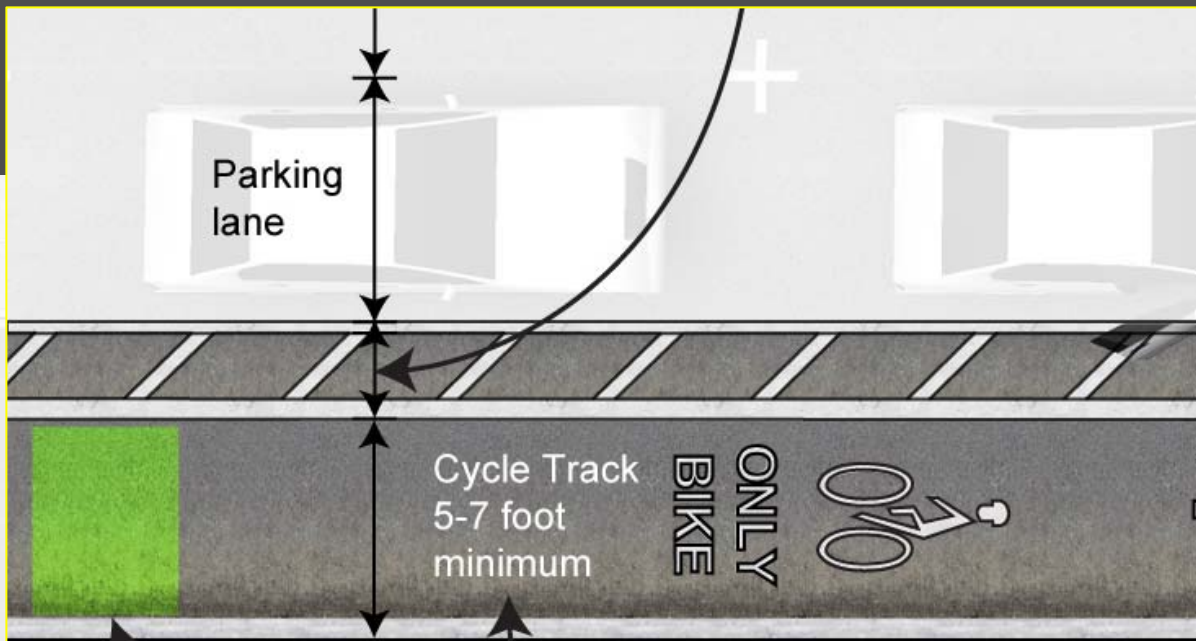
Sidewalk curbs and furnishings should be used to prevent pedestrian use of the cycle zone.

Gutter seams, drainage inlets, and utility covers should be configured so as not to impede bicycle travel and to facilitate run-off.

Cycle tracks may be shifted more closely to the travel lanes on minor intersection approaches to put bicyclists clearly in the field of view of motorists. (Not Shown).

Colored pavement may be used to further define the bicycle space.

**Cycle Tracks**  
One-Way Protected Cycle Track with Parking Buffer



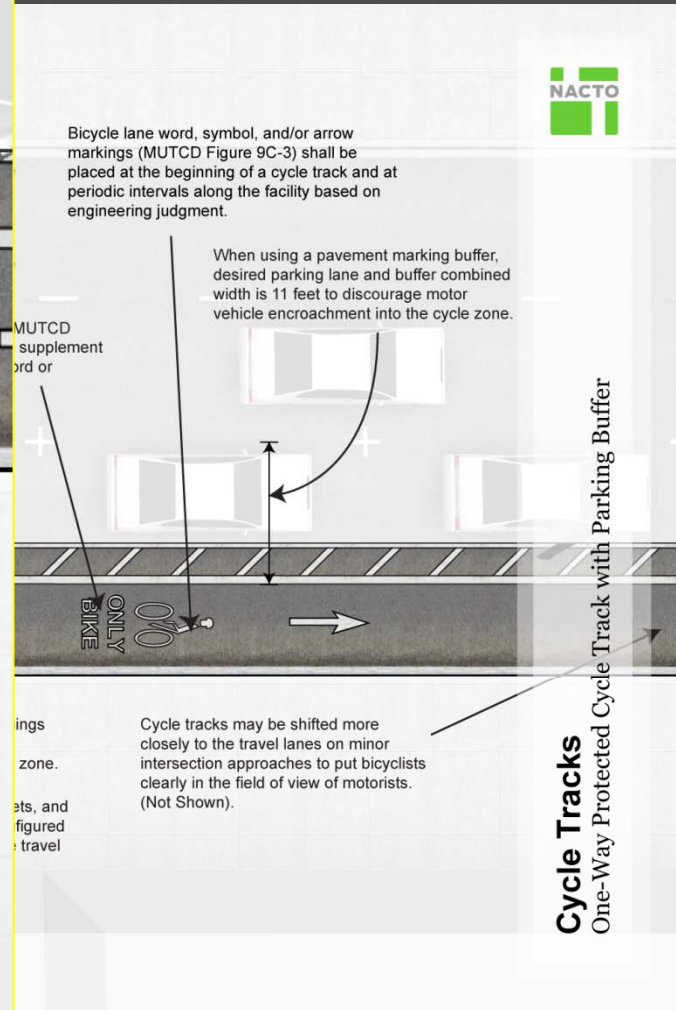
Cycle Track  
5-7 foot  
minimum

BIKE  
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**Cycle Tracks**  
One-Way Protected Cycle Track with Parking Buffer

# Two-way Cycle Tracks





# Two-Way Protected Cycle Track with Parking Buffer



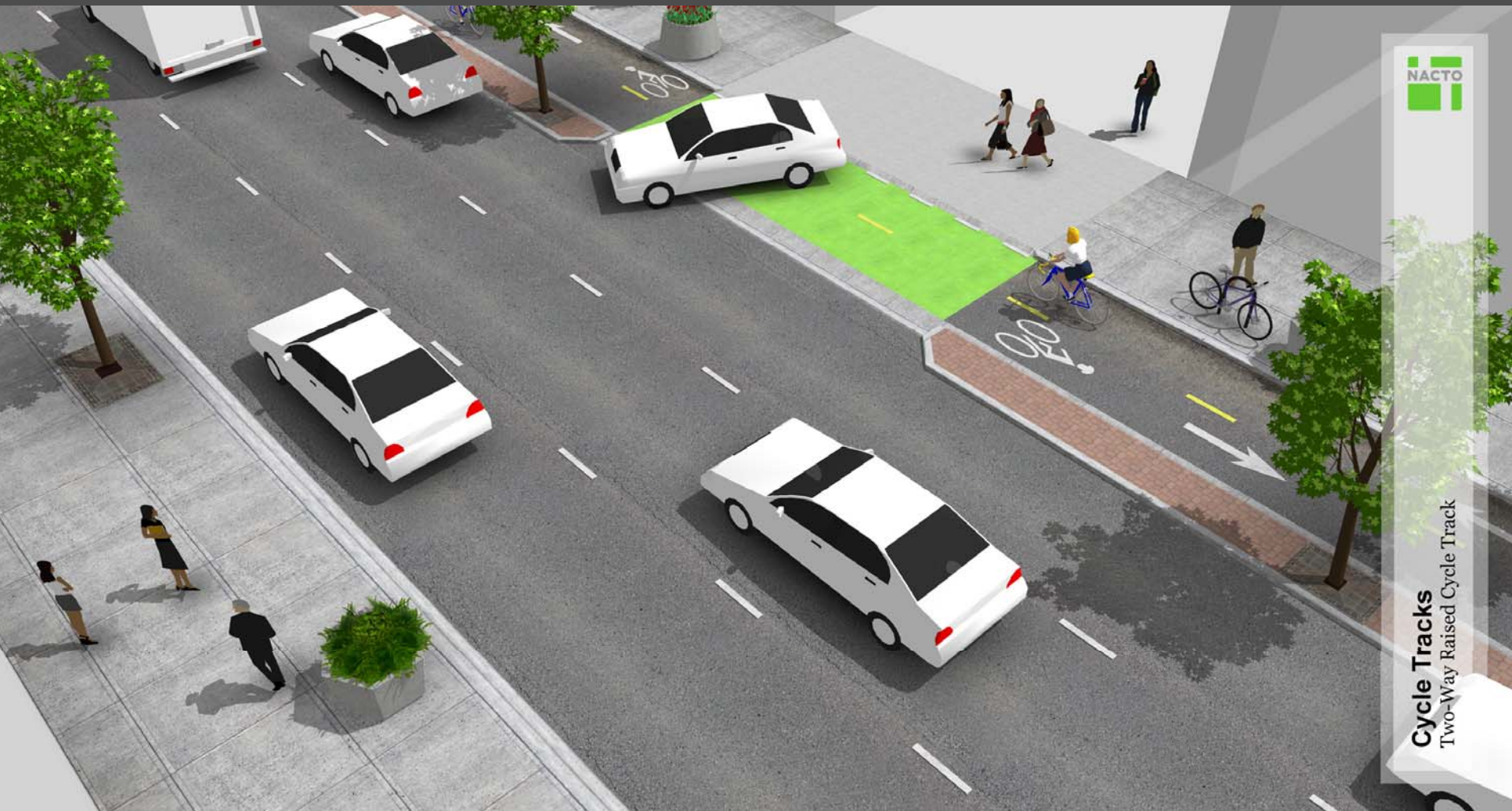
**Cycle Tracks**  
Two-Way Protected Cycle Track with Parking Buffer

# Two-Way Cycle Track





# Two-Way Cycle Track With Raised Median



**Cycle Tracks**  
Two-Way Raised Cycle Track



# Two-Way Cycle Track With Parking Buffer





# Two-Way Cycle Track with Barrier





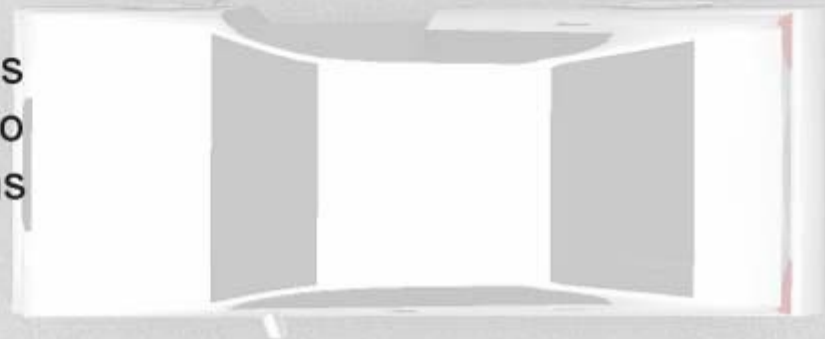
The desirable two-way cycle track width is 12 feet. Minimum width in constrained locations is 8 feet.

A dashed yellow line should be used to separate two-way bicycle traffic and to distinguish the cycle track from any adjacent pedestrian area.

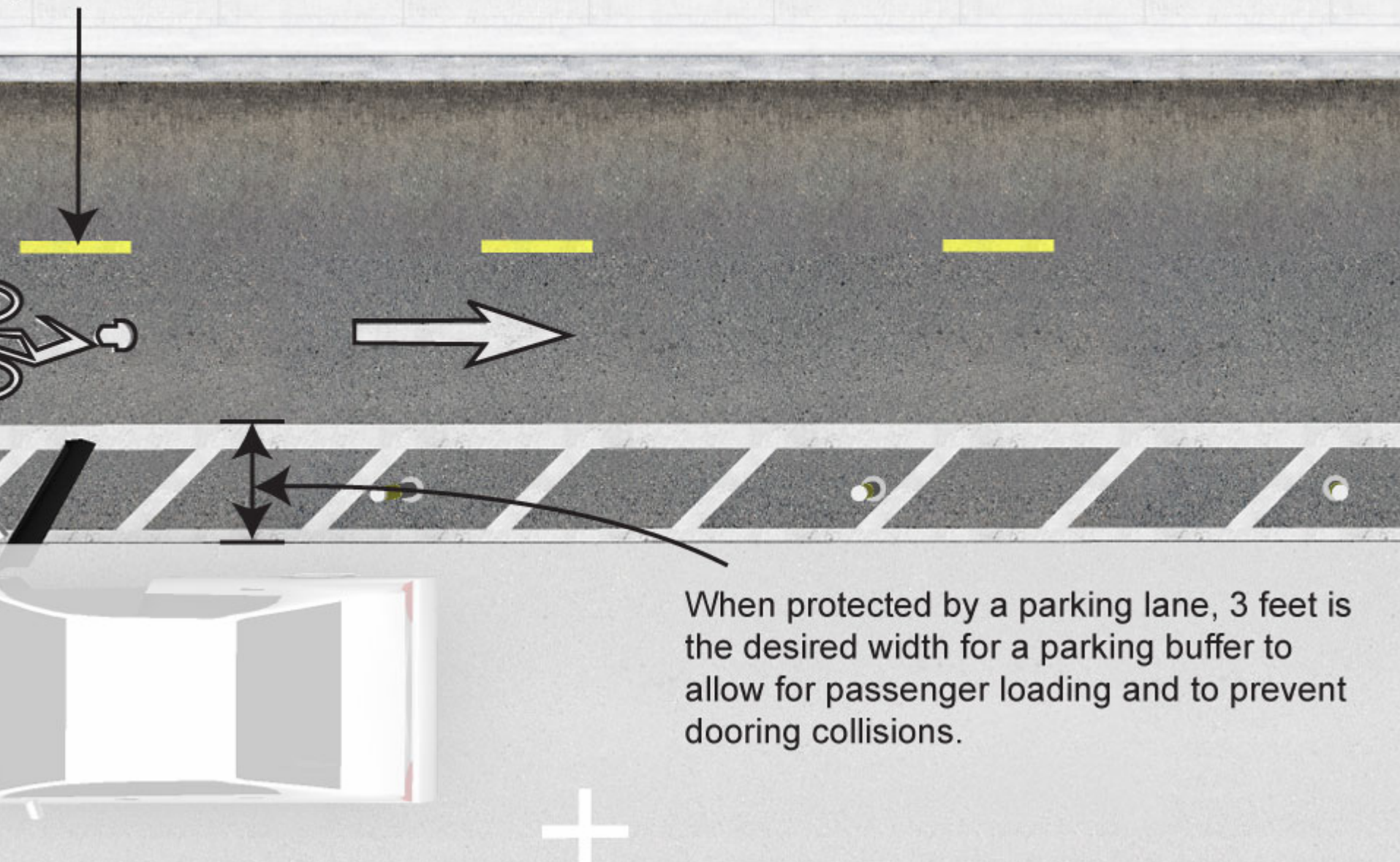
12 Feet desired  
minimum.



Two-stage turn boxes should be provided to assist in making turns from the cycle track facility.



A dashed yellow line should be used to separate two-way bicycle traffic and to help distinguish the cycle track from any adjacent pedestrian area.

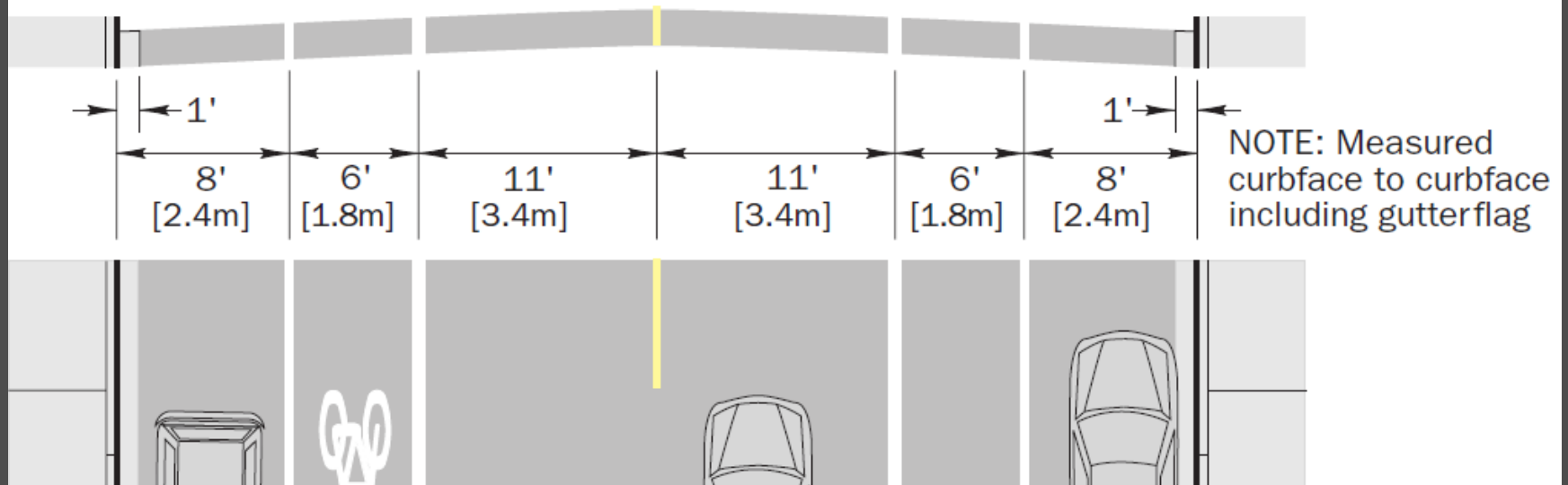


When protected by a parking lane, 3 feet is the desired width for a parking buffer to allow for passenger loading and to prevent dooring collisions.



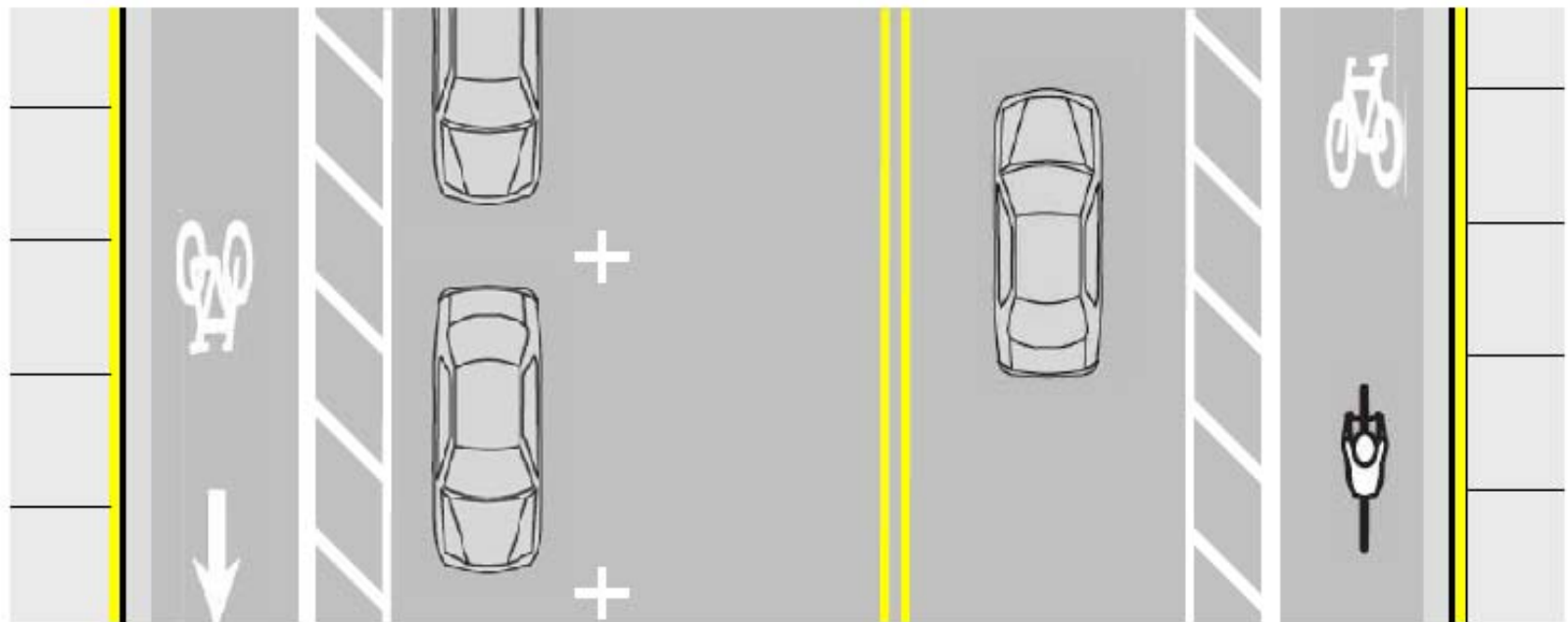
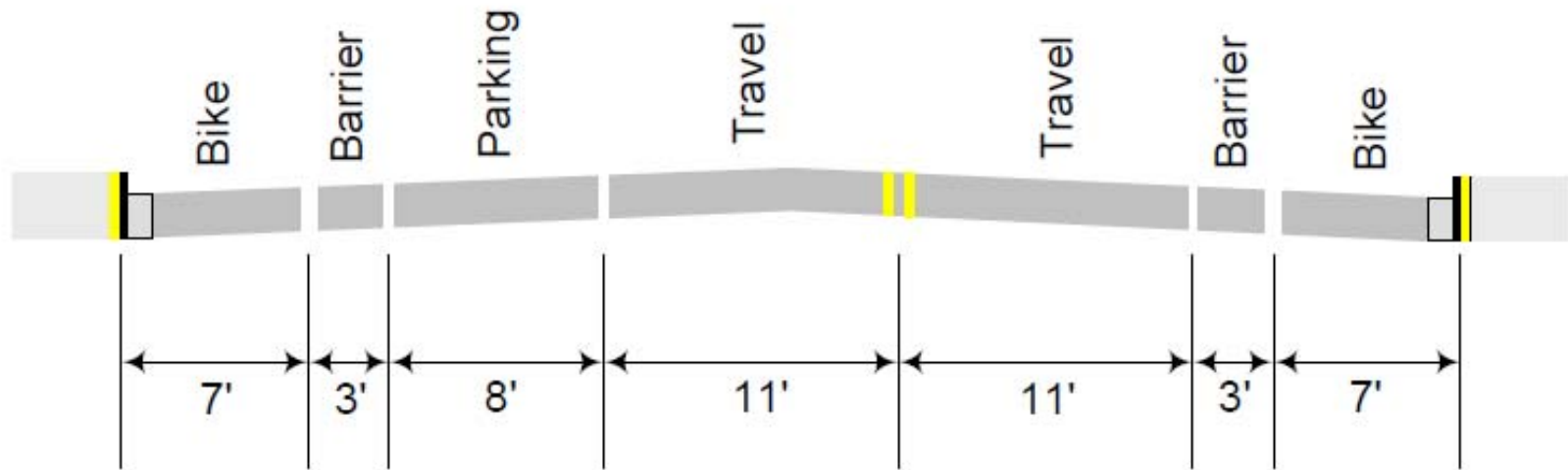
# Cross Section Design

## Standard Road Striping **Bike Lane on 50' Wide Street**



# One-way Cycle Track

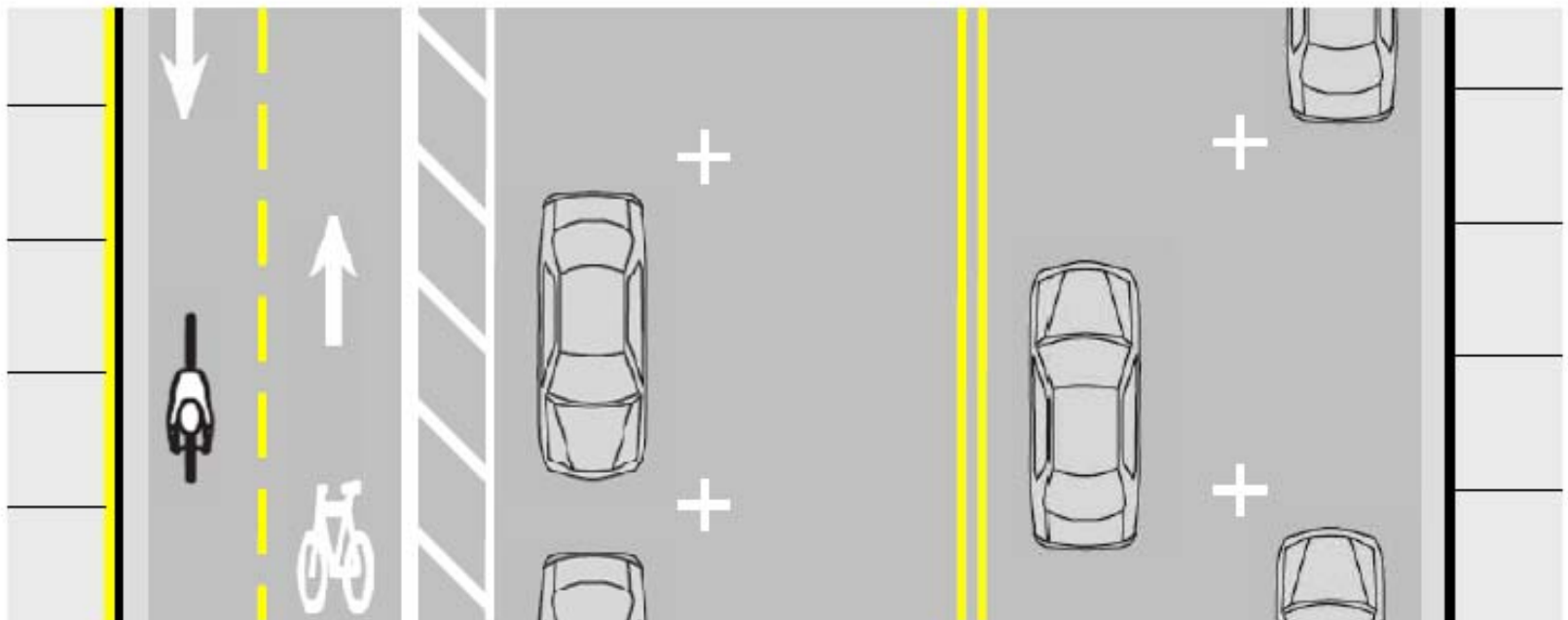
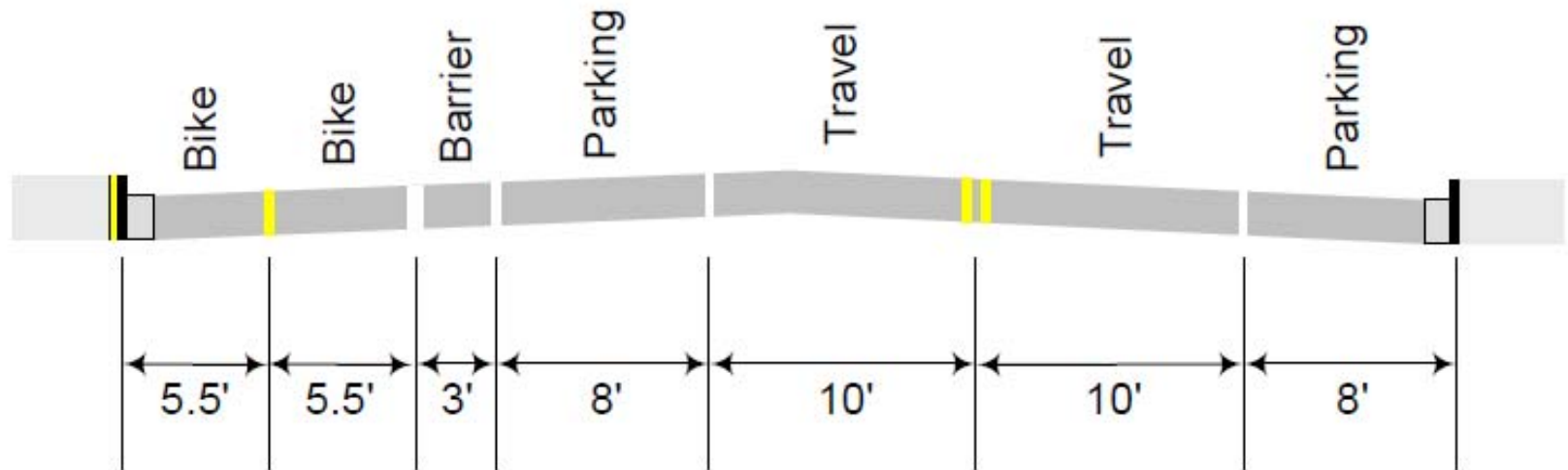
## 50' Wide Two-way Two-lane Street





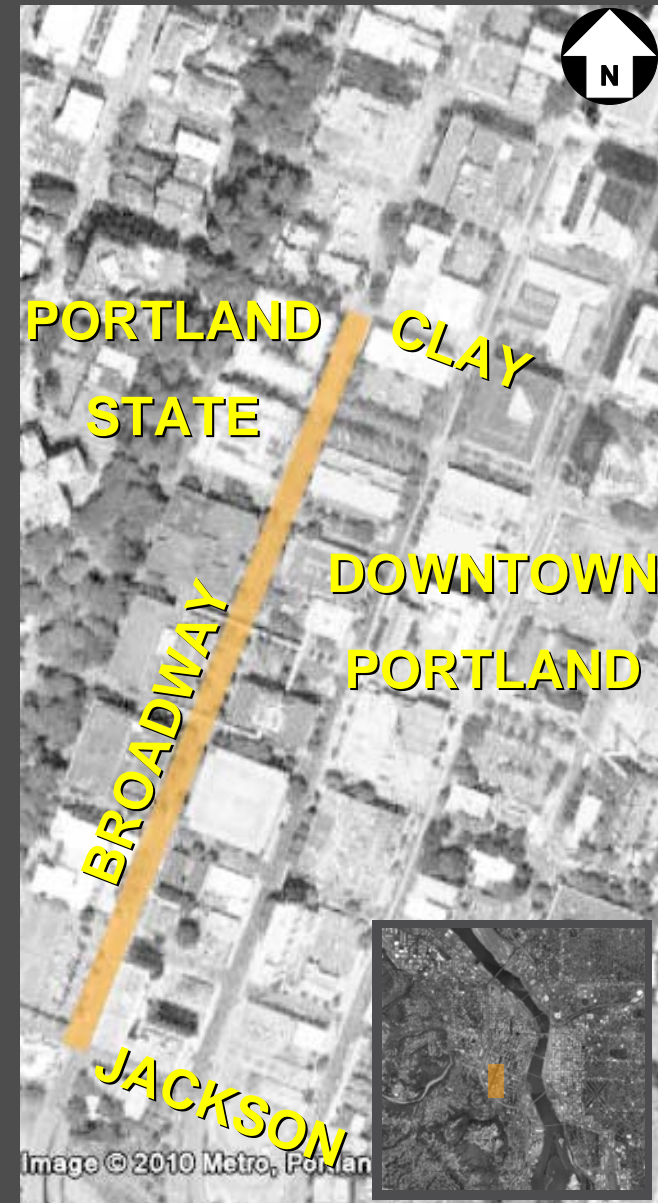
# Two-way Cycle Track

## 50' Wide Two-way Two-lane Street



# Portland Case Study

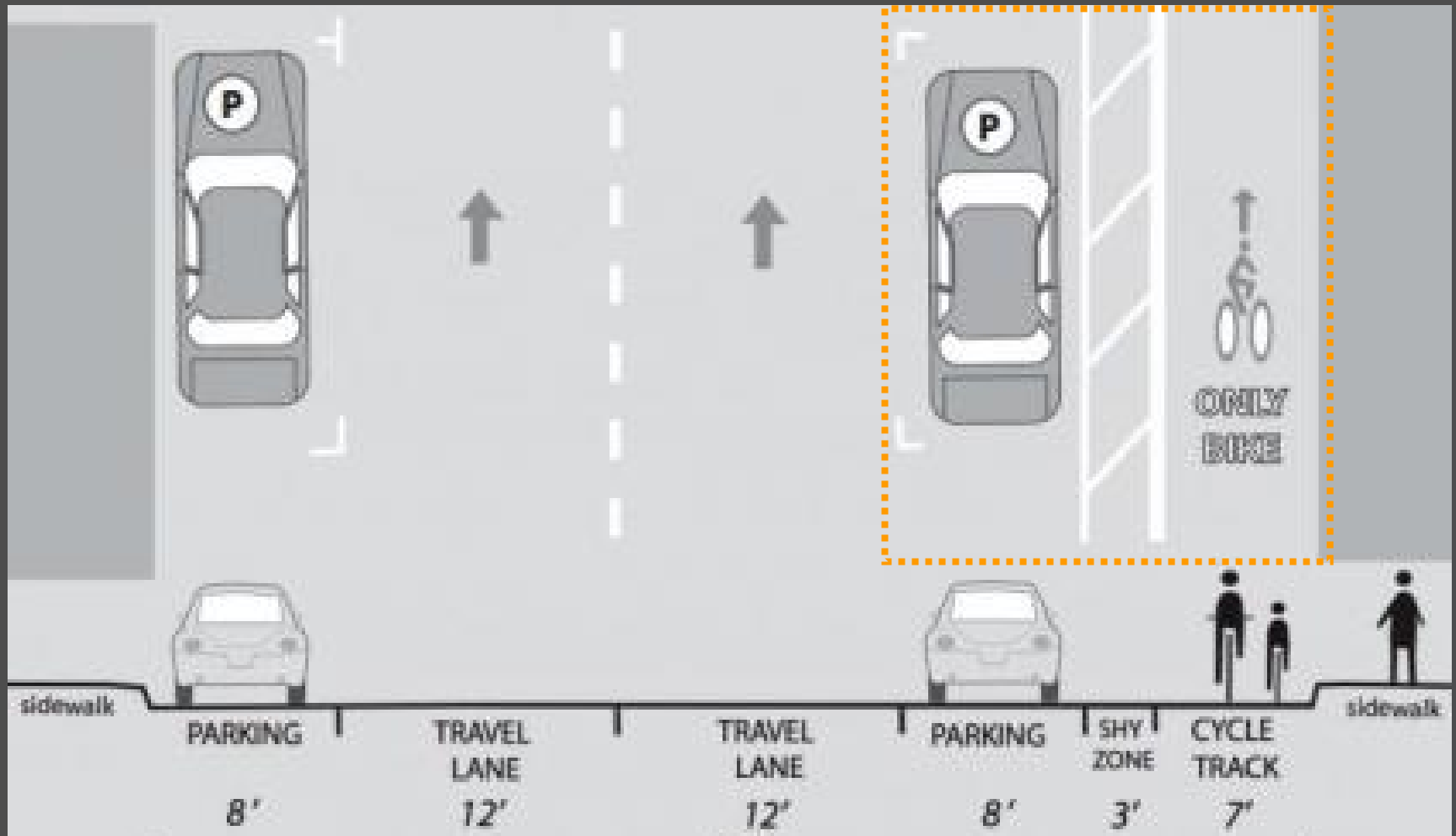
- Cycle track project stretches **seven blocks** along SW Broadway on the PSU campus
- Originally 3 lanes one-way southbound with bike lane and parking on both sides
- **Outside southbound lane** converted to on-street parking
- **Seven foot wide bike lane** at curbside
- **Three foot shy zones** separate cycle track from parking stalls





# Broadway Cycle Track CROSS SECTION

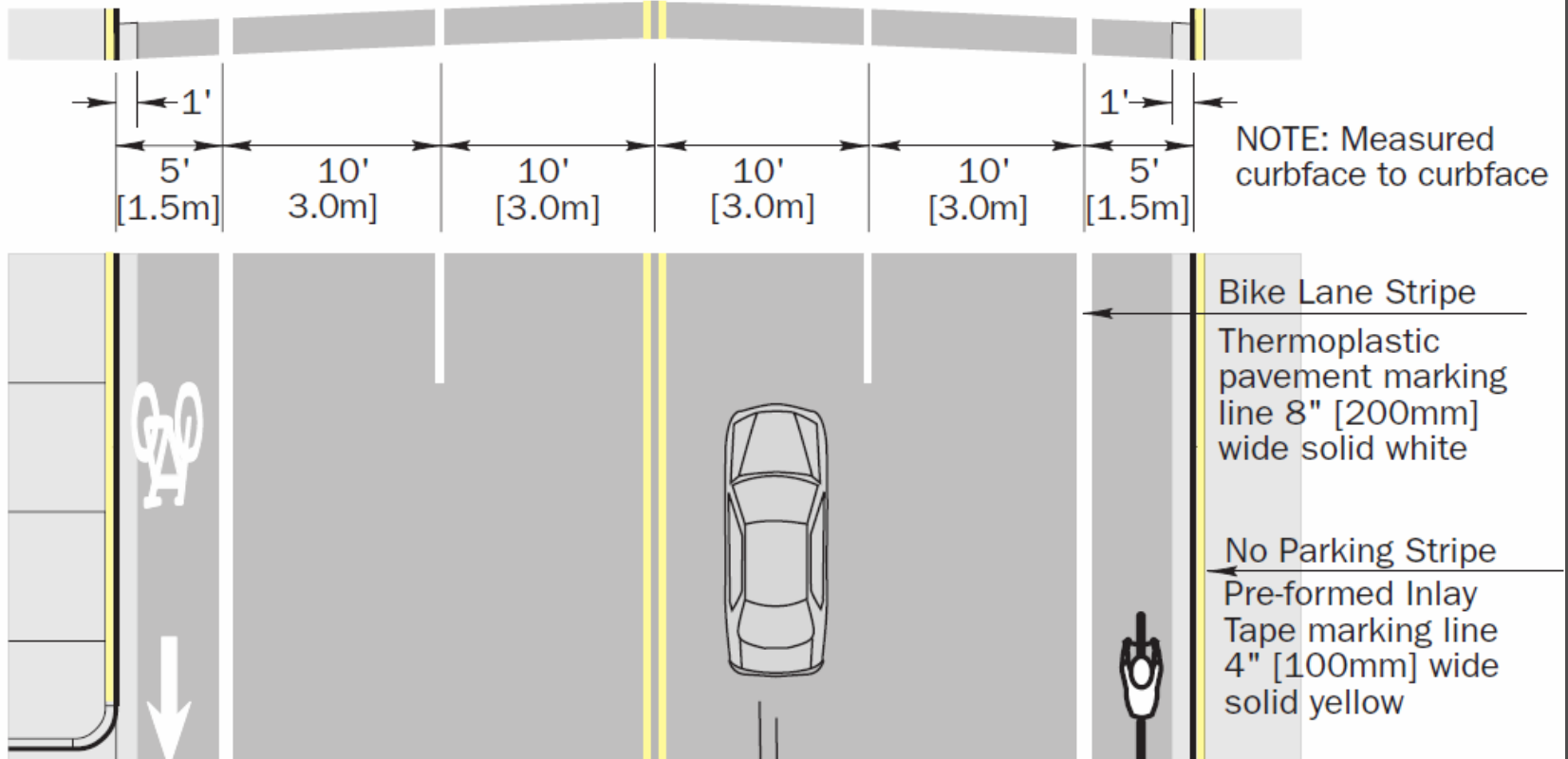
## SW Broadway Cycle Track – Portland, Oregon



50'

# Cross Section Design

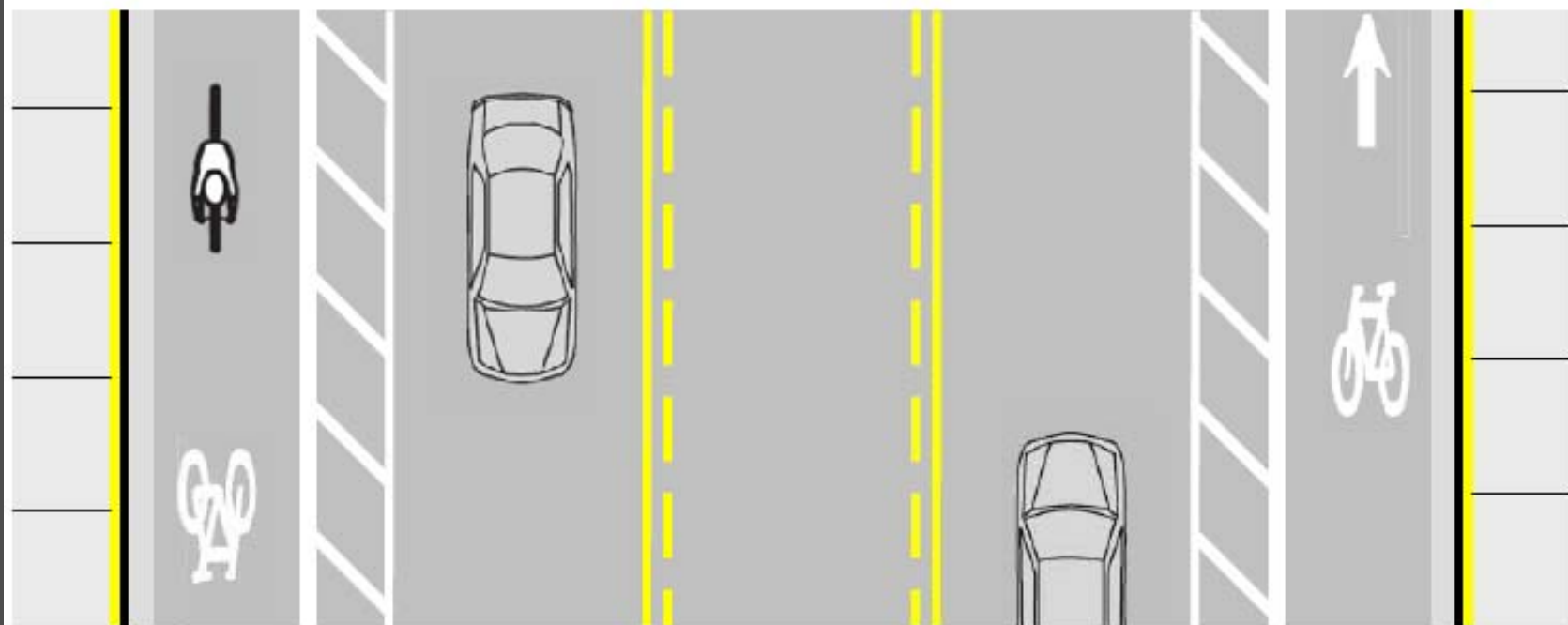
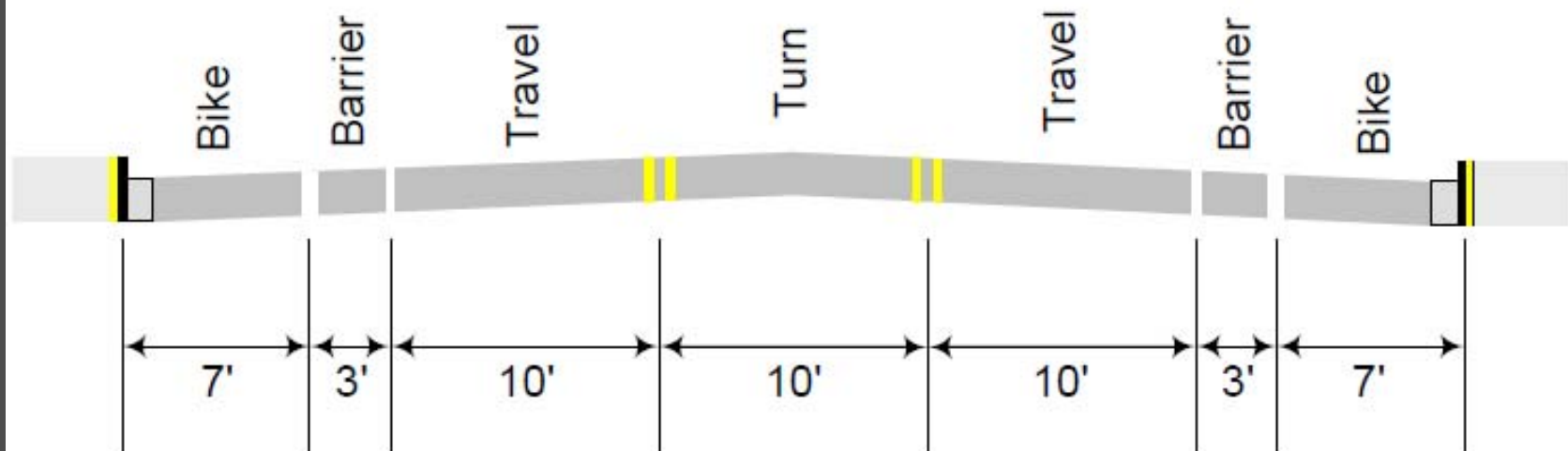
## Bike Lane on 50' Wide Street No Parking on Both Sides





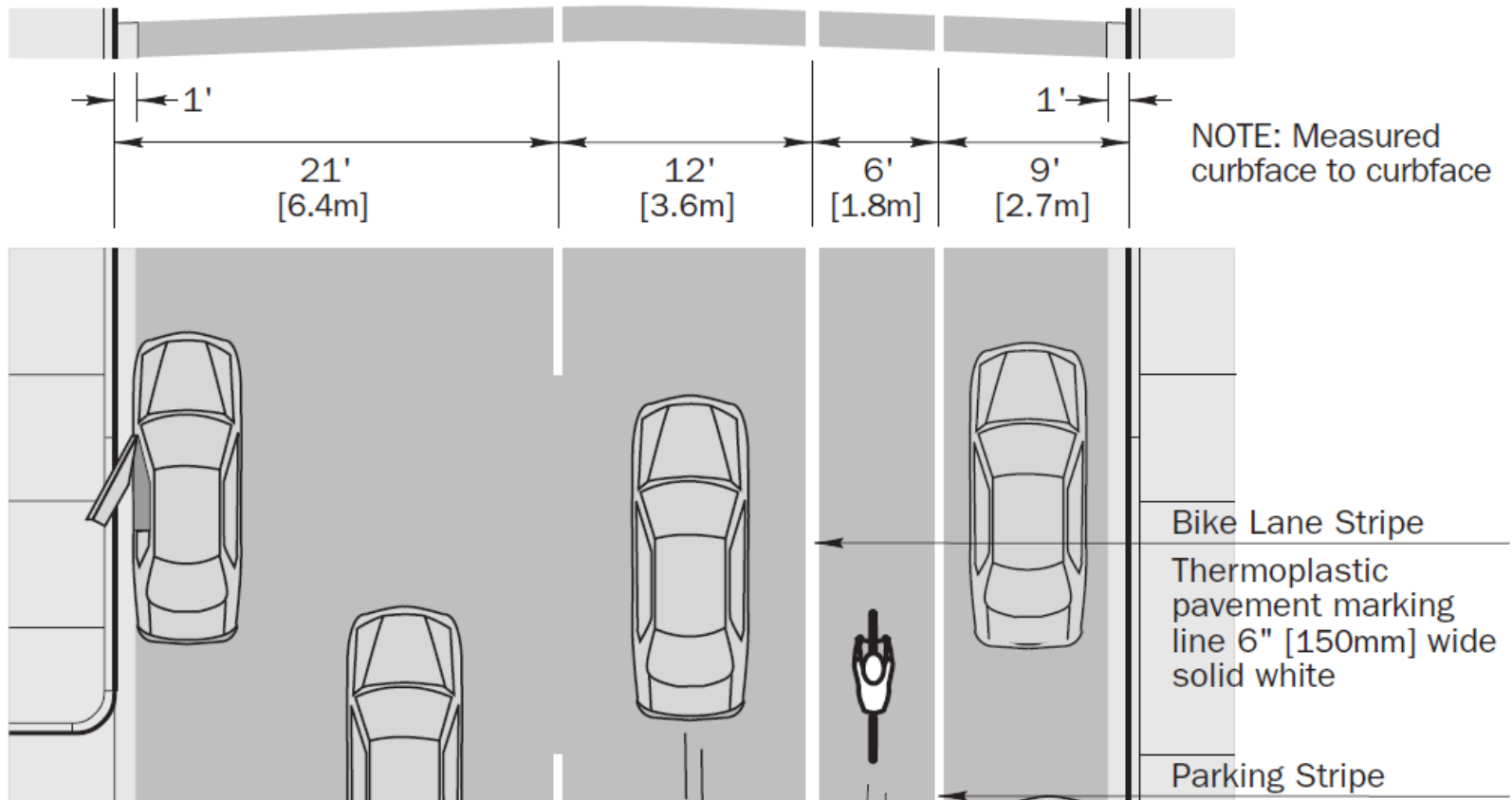
# One-way Cycle Track

## 50' Wide Two-way Street (No Parking Both Sides)



# Cross Section Design

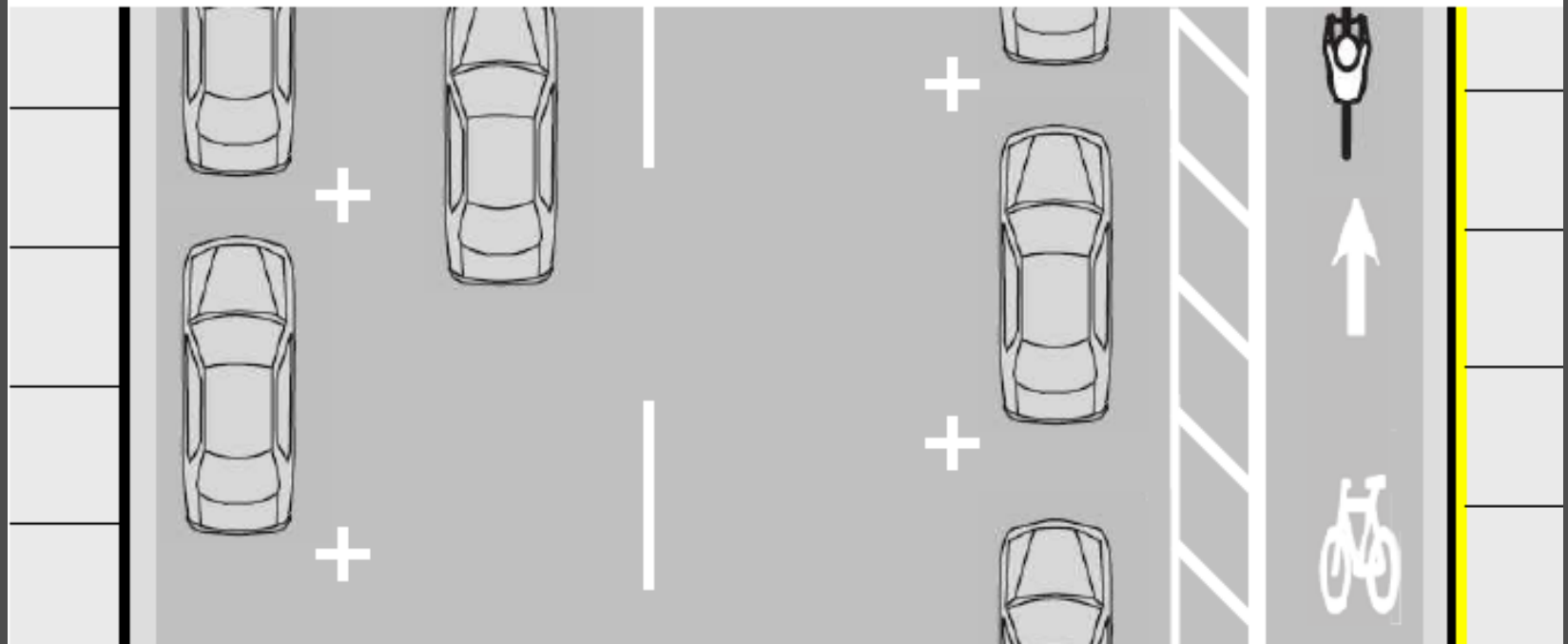
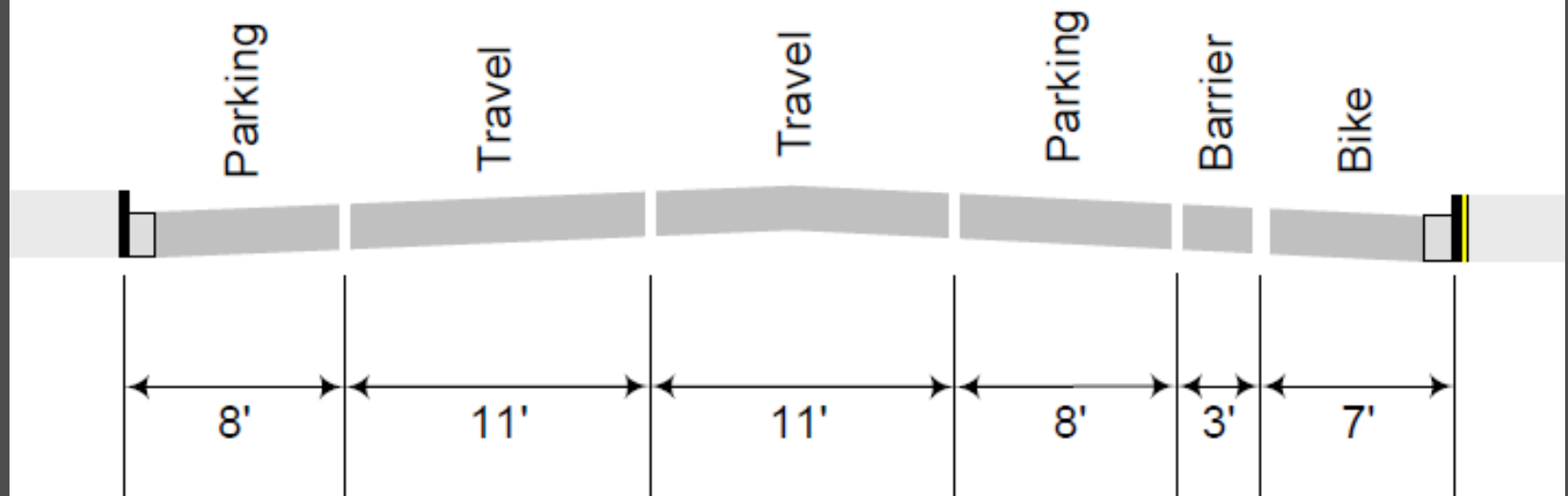
## 48' Wide One-way Street Parking on Both Sides





# One-way Cycle Track

## 48' Wide One-way Street (Parking on Both Sides)



# INTERSECTIONS





At driveways and minor intersections, color, yield lines, and “Yield to Bikes” signage should be used to identify the conflict area and make it clear that the cycle track has priority over entering and exiting traffic.



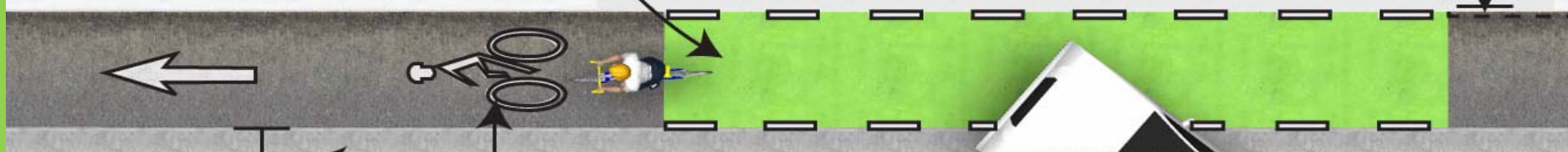
Variant of MUTCD R10-15  
or R1-5, 1-5a

Track shall be vertically  
flush with the street at an  
or sidewalk level.

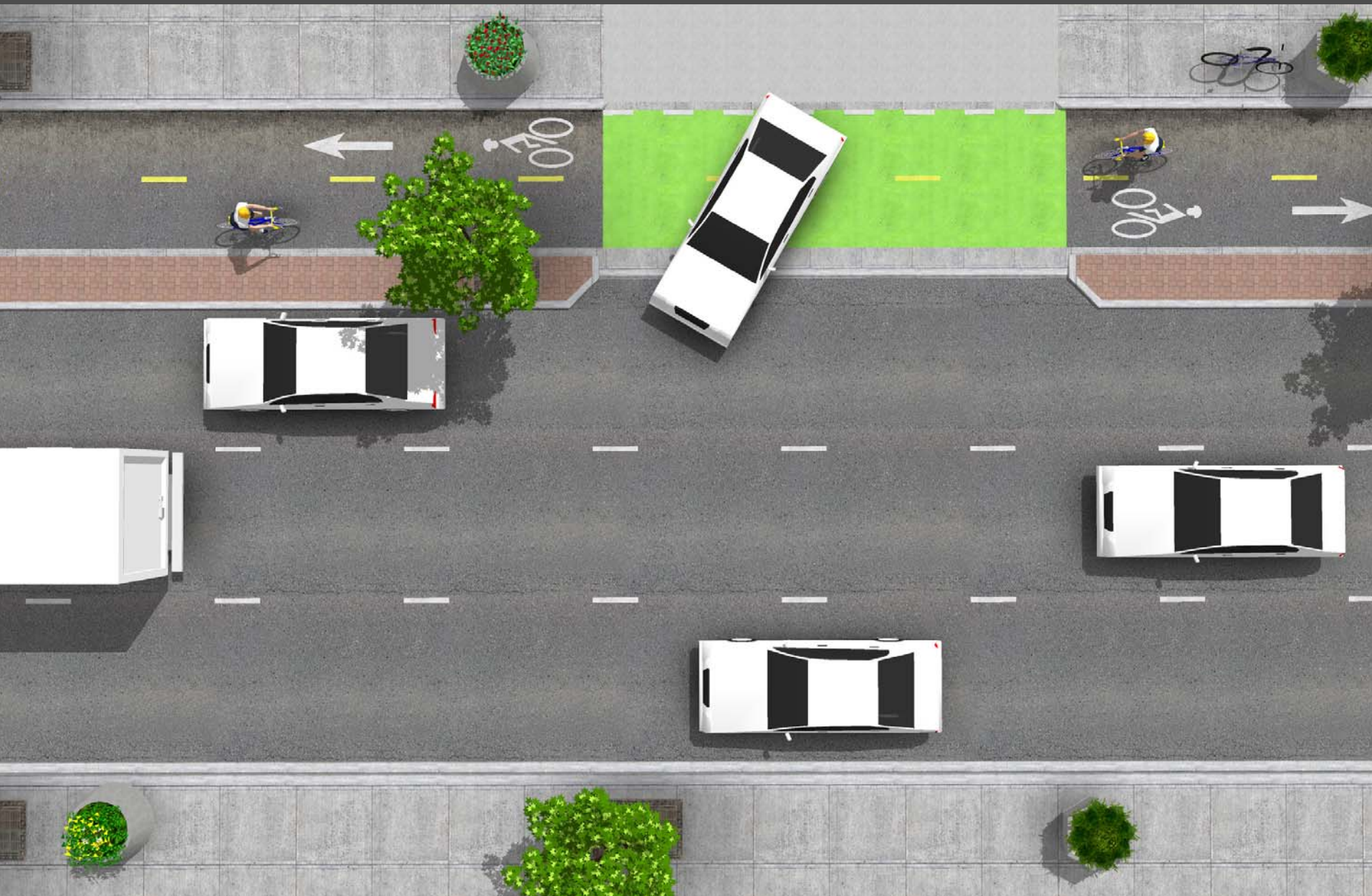
at a height flush with the  
color, pavement markings,  
curbs, landscaping, or other  
features should be used to discourage  
use of the cycle zone.

At driveways and minor intersections the crossing  
should be raised, in which the sidewalk and cycle track  
maintain their elevation through the crossing. Sharp in-  
clines on either side from road to sidewalk level serve  
as a speed hump for motor vehicles.

10 -  
Feet



# Driveway Crossing Treatment





## Driveway Conflict Areas

- In this Portland example we used bicycle symbols rather than color to mark the conflict area.



# Sight Triangle for Vehicle Approach

intersections, "Yield to Bikes" to identify make it clear priority over traffic.

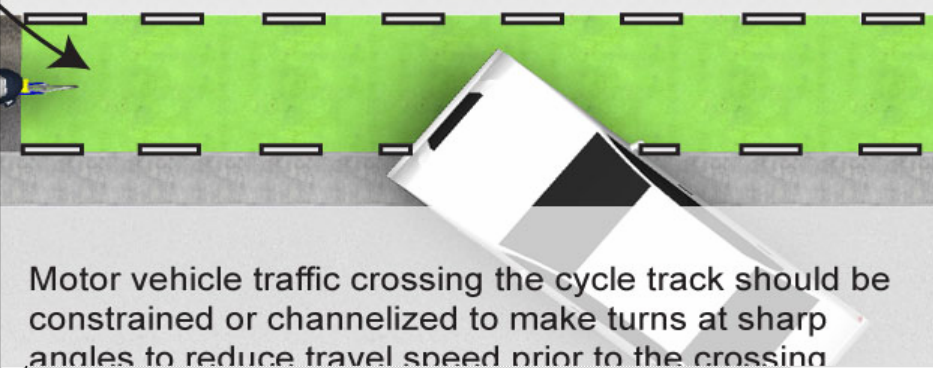
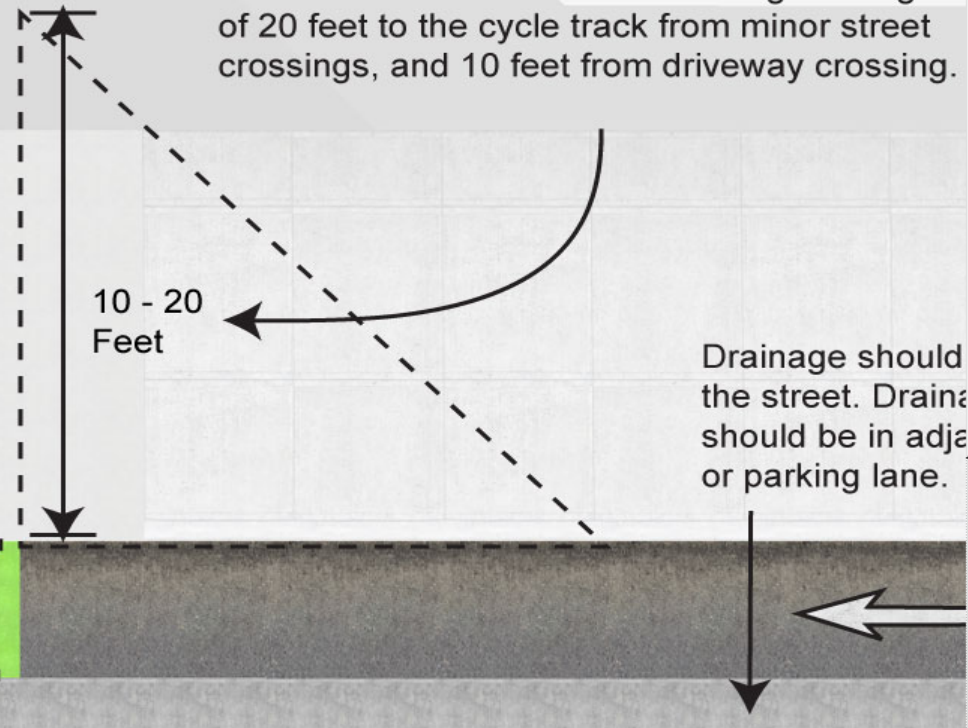


Variant of MUTCD R10-15 or R1-5, 1-5a



For motor vehicles attempting to cross the cycle track from the side street or driveway, street and sidewalk furnishings and/or other features should accommodate a sight triangle of 20 feet to the cycle track from minor street crossings, and 10 feet from driveway crossing.

At driveways and minor intersections the crossing should be raised, in which the sidewalk and cycle track maintain their elevation through the crossing. Sharp inclines on either side from road to sidewalk level serve as a speed hump for motor vehicles.

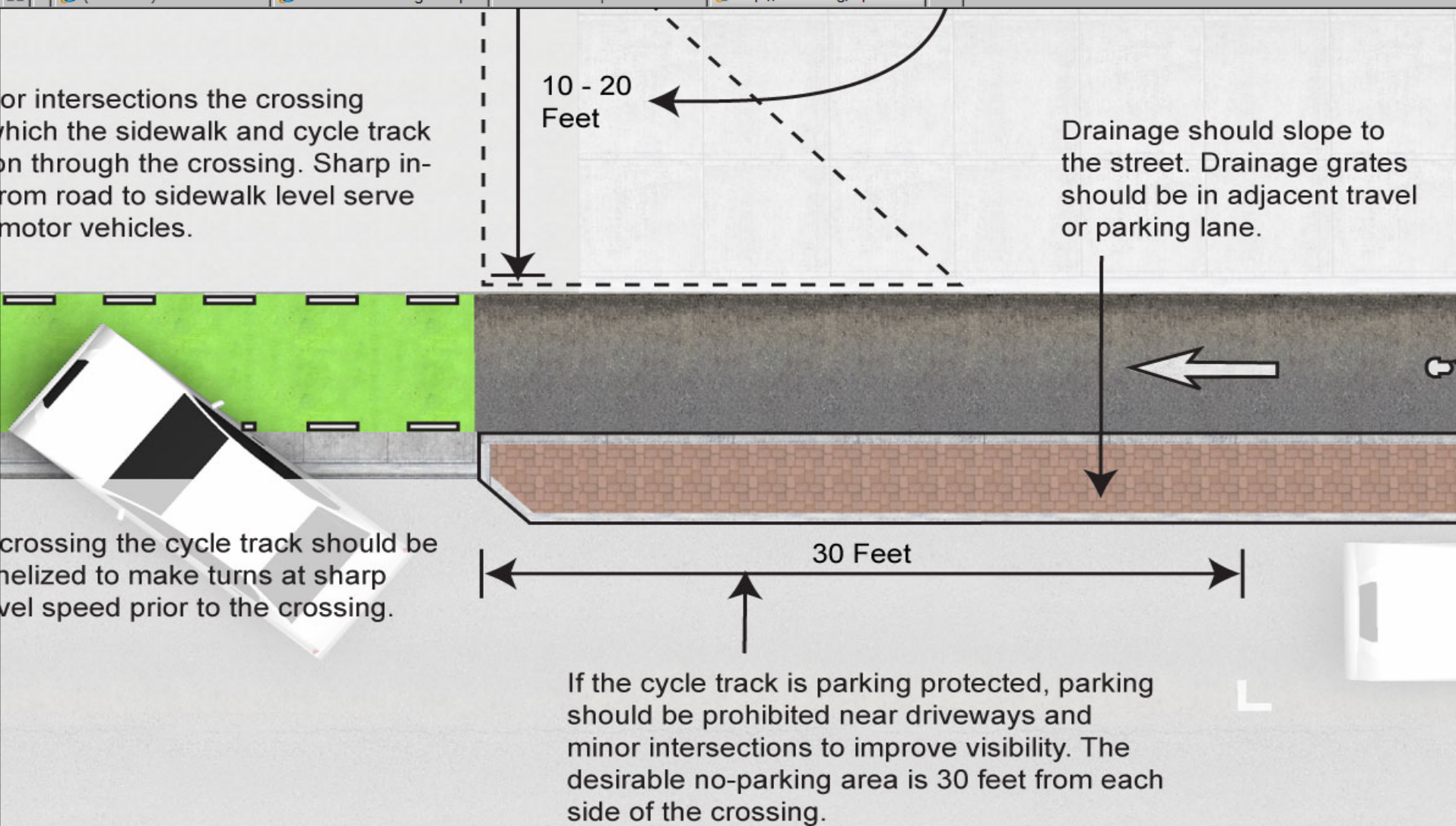


Motor vehicle traffic crossing the cycle track should be constrained or channelized to make turns at sharp angles to reduce travel speed prior to the crossing

When placed adjacent to a travel lane, one-way raised cycle tracks may be configured with a mountable curb to allow entry and exit from the bicycle lane for passing



## No Parking Area for Visibility



# Two-Stage Turn Queue Boxes



New York, NY

## Description

Two-stage turn queue boxes offer bicyclists a safe way make left turns at multi-lane signalized intersections from a right side cycle track or bike lane, or right turns from a left side cycle track or bike lane.

## Urban Bike Design Guide

Bike Lanes

Cycle Tracks

Intersections

■ Bike Boxes

■ Intersection  
Markings

■ Two-Stage Turn  
Boxes

■ Median Refuge

■ Through Bike

■ Combined Bike  
Lane/Turn Lane

■ Cycle Track  
Intersection

Signals

Signing & Markings

Master Reference

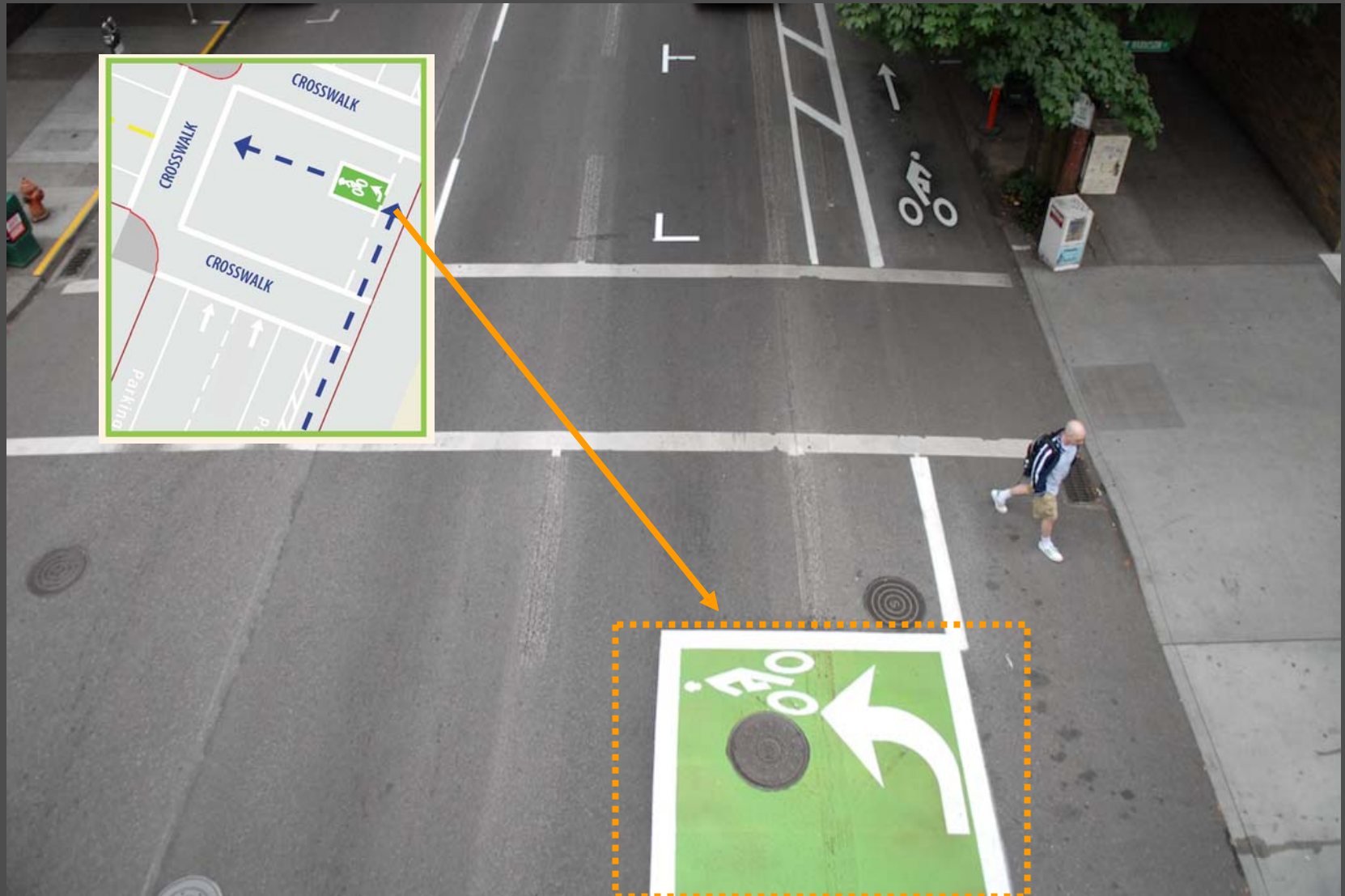


# Two-Stage Turn Queue Box

- Provides for safe bicycle turn movement that does not require cyclists to merge with overtaking traffic



# Two-Stage Turn Queue Box





ACTO



# Transition to Bike Lane with Bike Box





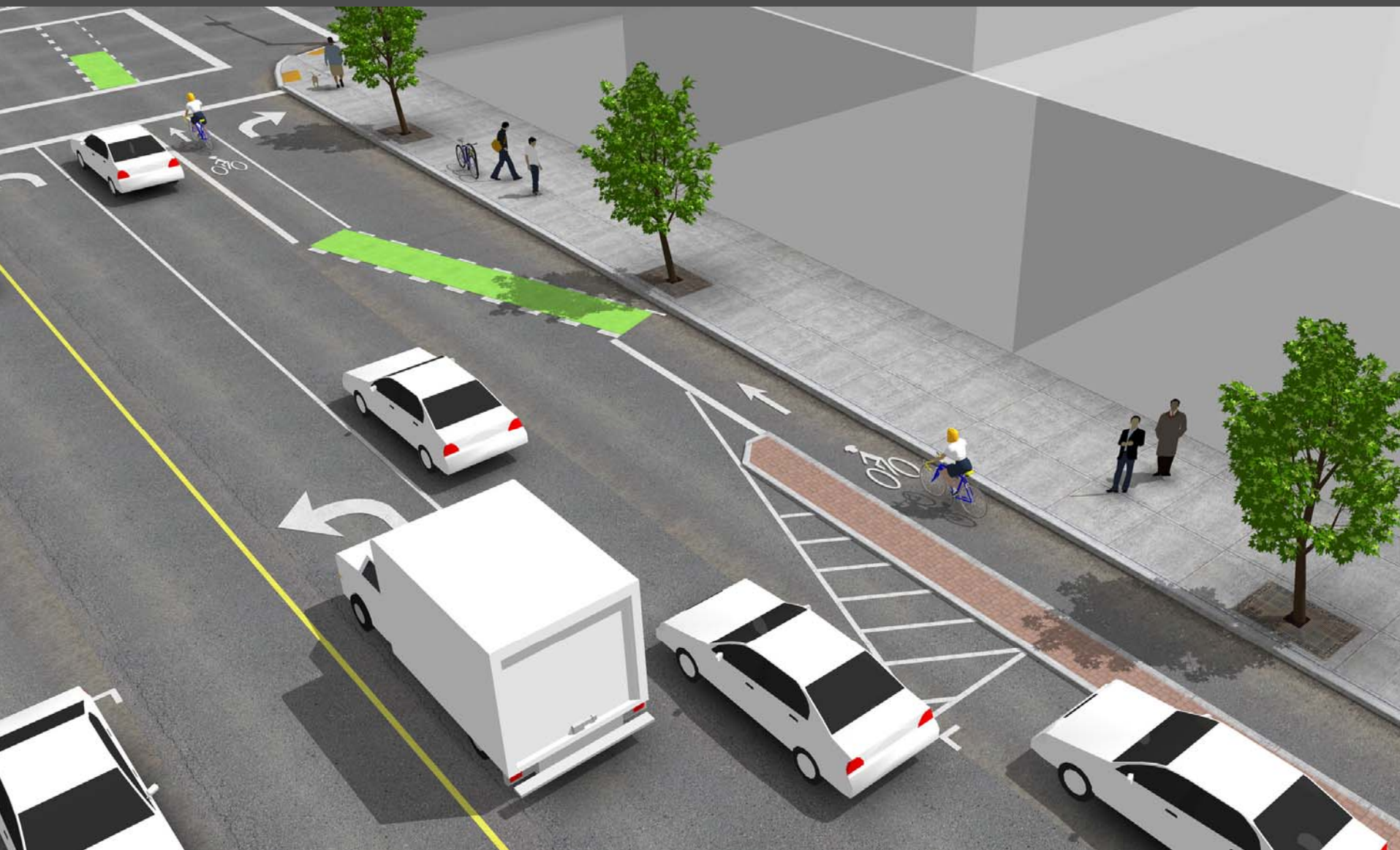


## Bike Box

San Francisco, CA

Credit: Joe Linton







# Merging Area



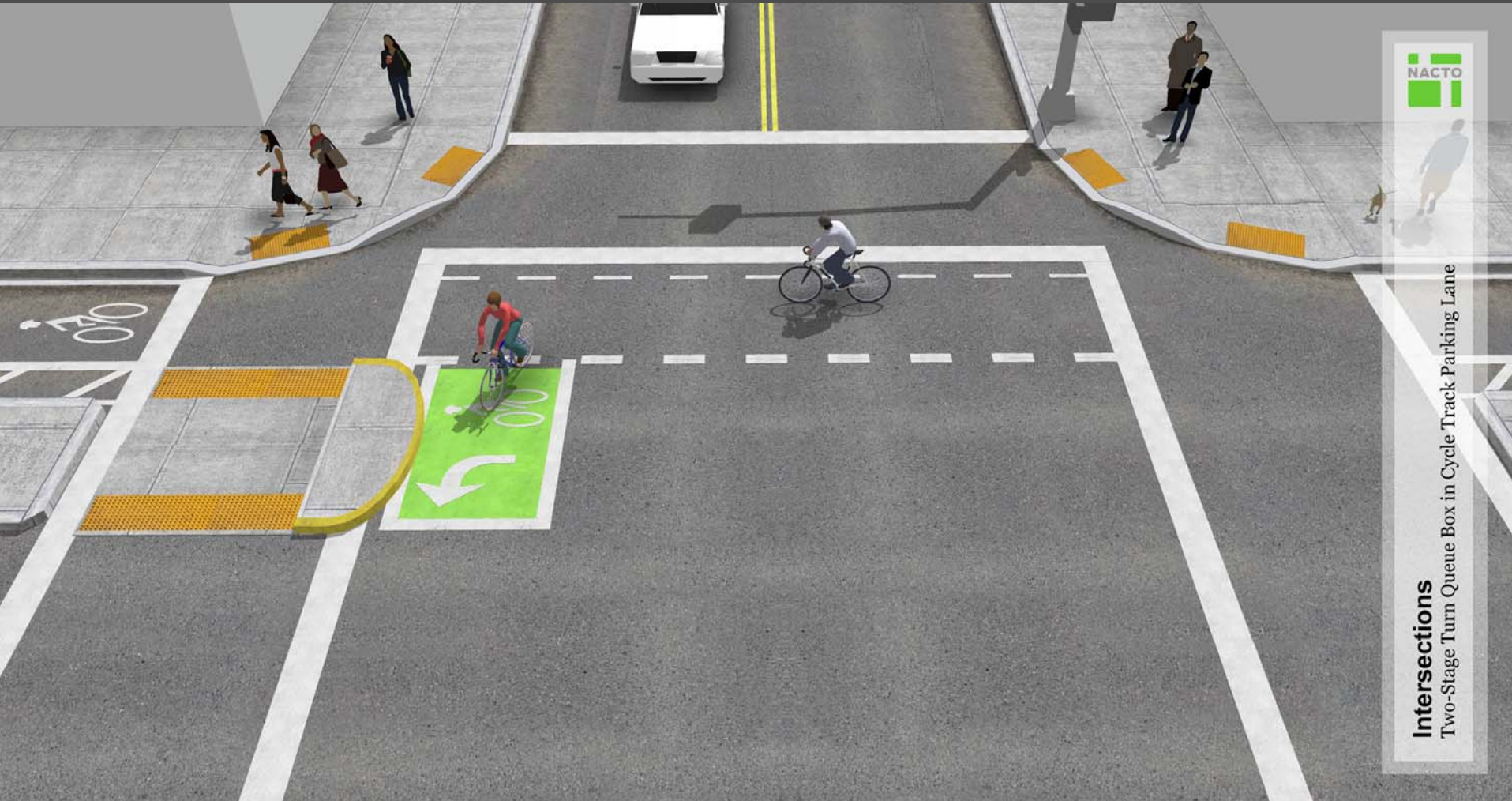


## Cycle Track Intersection Approach—Merging Area

New York City



# Two- Stage Queue Box with Median



**Intersections**  
Two-Stage Turn Queue Box in Cycle Track Parking Lane



# Two-Way Cycle Track Turning Treatment



Turning treatments



# Bicycle Signal Control



## Bicycle Signal Head

New York, NY





# Broadway Cycle Track MARKINGS



Typical mid-block marking



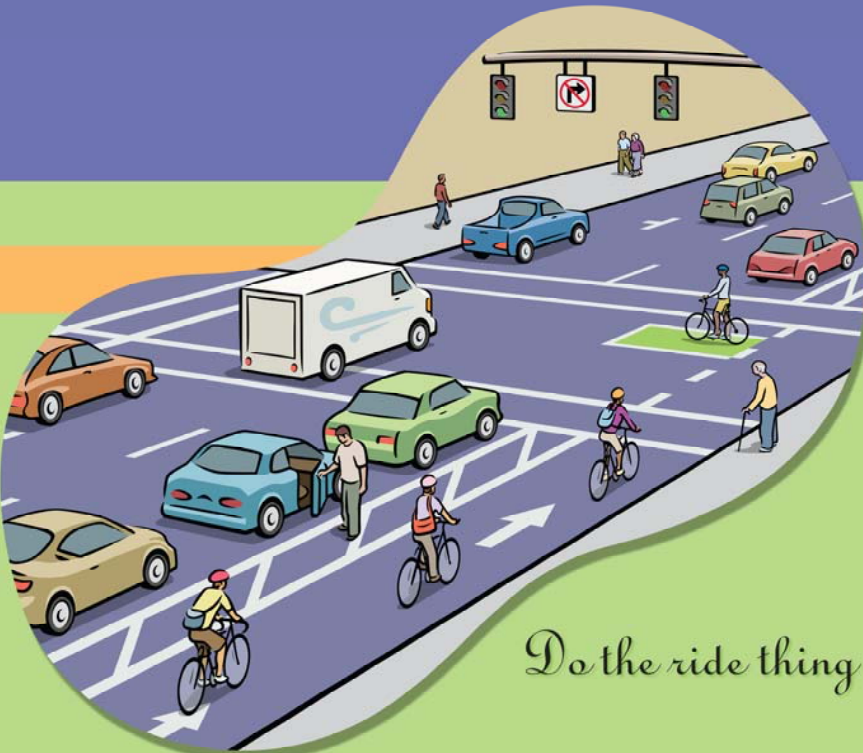
Looking south from SW  
Montgomery



Looking north from SW Clay

# Broadway Cycle Track PUBLIC OUTREACH

Portland Loves Cycling  
**CYCLE TRACK**



Do the ride thing



Portland Loves Cycling

## RIDING THE TRACK

**RIDING THE TRACK**  
Enter and leave the cycle track at street intersections and stay within the lane as you ride. Obey all traffic signals, yield to pedestrians using crosswalks, and stay clear of the safety median where people exit their vehicles.

### MAKING LEFT TURNS

**MAKING LEFT TURNS**

As you approach the street you wish to turn on, cross through the intersection and stop in the bike space designated for cyclists turning left. It's positioned next to the crosswalk.

When the signal indicates it's safe to go, complete your turn and ride onward.

A top-down diagram of a street intersection. A green bicycle icon is in the center of the intersection, facing left. A dashed blue arrow points from the bicycle towards the left crosswalk. The word 'CROSSWALK' is written vertically on both the horizontal and vertical streets. A red line indicates the curb.

## PEDESTRIAN SAFETY ZONE

**PEDESTRIAN SAFETY ZONE**  
This buffer zone is a narrow median between parked vehicles and the cycle track. It allows space for people to exit and access their vehicles safely. Bikes are not allowed in the pedestrian safety zone. Beware of pedestrians crossing the cycle track near you.

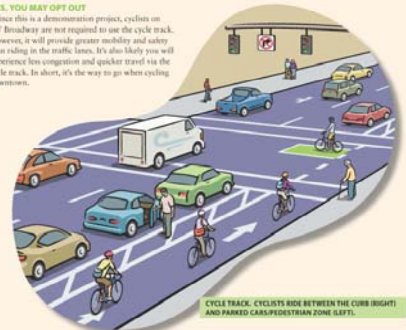
**GETTING OFF TRACK**  
To avoid collisions with vehicles or pedestrians, cyclists should leave the cycle track only at street intersections. Please do not exit at mid-block or cross through the pedestrian zone and parking space. At an intersection, you may leave the cycle track and merge with traffic in the direction you wish to go.

### TRIMET BUS INTERACTION

**TRIMET BUS INTERACTION**  
During morning peak hours, TriMet will continue bus service in two steps along the cycle track. That means buses will still pull to the curb, across the cycle track, during these times. If a bus is stopped in front of you, pass around carefully or wait behind for the bus to drive on.

**YES, YOU MAY OPT OUT**

Since this is a demonstration project, cyclists on SW Broadway are not required to use the cycle track. However, it will provide greater mobility and safety than riding in the traffic lanes. It's also likely you will experience less congestion and quicker travel via the cycle track. In short, it's the way to go when cycling downtown.



**CYCLE TRACK.** CYCLISTS RIDE BETWEEN THE CURB (RIGHT) AND PARKED CARS/PEDESTRIAN ZONE (LEFT).



# Broadway Cycle Track CHALLENGES

- Parking Enforcement
  - Pay Stations
  - Enforcement Officers use buffer area when placing citation
  - Temporary parking removal using magnetic base flexible posts
- Street Cleaning
  - Cycle Track plus buffer is wide enough to accommodate a street sweeper
  - Leaf fall is heavy in autumn-extra cleaning needed
- Wheel Chair User Access
  - Concerns from users regarding wheelchair van loading
  - Cycle Track may be used by wheelchairs
- Transit Stops???





# Q and A

Rob Burchfield

City Traffic Engineer; Portland OR