



National Association of City Transportation Officials (NACTO): Urban Bikeway Design Guide

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National Association of City Transportation Officials (NACTO)

- Founded in 1996
 - Exchange of transportation ideas, insights, and practices among large central cities
 - Sees city transportation departments as partners in regional and national efforts
- Member Cities:
 - Atlanta
 - Baltimore
 - Boston
 - Chicago
 - Detroit
 - Houston
 - Los Angeles
 - Minneapolis
 - New York
 - Philadelphia
 - Phoenix
 - Portland
 - San Francisco
 - Seattle
 - Washington, DC

Bikeway Design Guide

- Many members found existing design manuals inadequate
- Created through
 - ▣ Survey of expert knowledge
 - ▣ Existing guidelines throughout the world
 - ▣ Innovative projects in the US
- Guide provides
 - ▣ Plan drawings
 - ▣ 3D renderings
 - ▣ Photos of actual projects throughout the US
- Guide can be adopted by cities, counties or states
 - ▣ Stand alone document
 - ▣ Supplement

Bikeway Design Guide

- Most treatments are not directly referenced in
 - ▣ AASHTO Guide to Bikeway Facilities
 - ▣ MUTCD
- Many elements of treatments are found within these documents
- MUTCD Approval Status



Bike Signal still classified as experimental by FHWA

Bikeway Design Guide



- Treatments presented offer varying levels of guidance
- Types of elements presented
 - ▣ Required
 - ▣ Recommended
 - ▣ Optional
- Urban situations are complex
 - ▣ Treatments should be tailored to unique situations
 - ▣ Engineering judgment

Bikeway Design Guide Elements



Bike Lanes



Cycle Tracks



Intersections



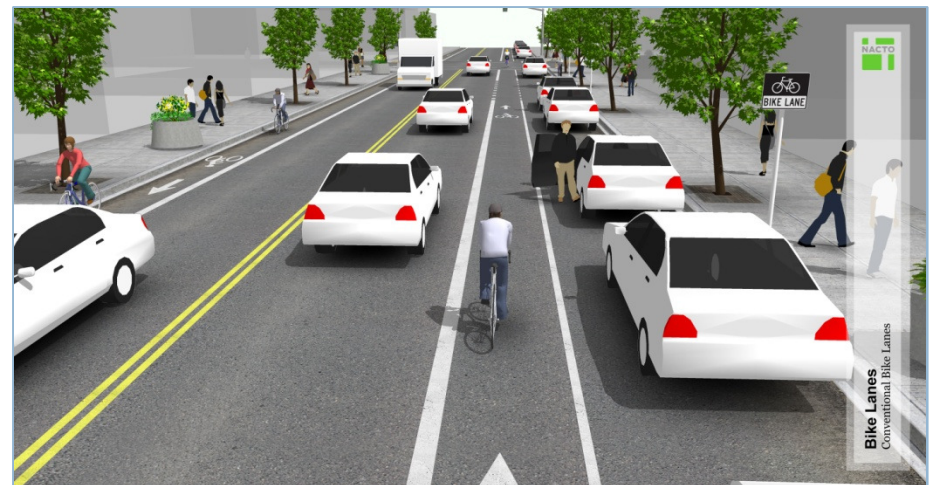
Signals



Signs & Markings

Bike Lanes - Overview

- Portion of roadway designated for bicyclists
 - ▣ Striping
 - ▣ Signage
 - ▣ Pavement markings
 - Enables cyclists to ride at preferred speed without interference
 - Facilitates predictable behavior with motorists
- Types
 - ▣ Conventional
 - ▣ Buffered
 - ▣ Contra-Flow
 - ▣ Left-Side



Conventional Bike Lanes

- Right side of street
 - ▣ Adjacent to curb or adjacent to parking
- Desired width to adjacent curb – 6ft
 - ▣ Width to longitudinal joint – 4ft
- Minimum width next to parking lane – 5ft
- Minimum widths need to consider illegal parking



Conventional Bike Lanes

- Distance from parking lane needs to account for “dooring”
 - ▣ 14.5ft desired (12ft absolute minimum)
 - ▣ Solid white line used next to bike lane to minimize encroachment of parked cars
- Consideration for
 - ▣ Gutter seams
 - ▣ Drainage inlets
 - ▣ Utility covers



Buffered Bike Lanes

- Applications
 - ▣ Streets with high speeds, high volumes, large truck traffic
 - ▣ Streets with extra lane width or extra lanes
- Encourages cyclists to ride outside of door zone
- Space for bicyclists to pass each other
- Increases cyclist's perception of safety



Contra-Flow Bike Lanes

- Allow cyclists to ride on one way street in opposite direction of motorized traffic
- Applications
 - ▣ Large number of cyclists already riding wrong way
 - ▣ Corridors without adequate alternate routes
 - Unsafe or excessive extra travel
 - ▣ Works best on low-speed, low volume streets
 - Allows cyclists to use safer less trafficked streets



Contra-Flow Bike Lane



Left-Side Bike Lanes

- Placed on left side of one-way or two way median divided streets
- Applications
 - ▣ Areas with frequent bus stops or truck loading zones
 - ▣ High parking turnover
 - ▣ High right turn movements
 - ▣ Rush hour parking restrictions



Cycle Tracks - Overview

- Exclusive bike facility that combines
 - ▣ User experience of separate path
 - ▣ On-street infrastructure of conventional bike lane
- Can be at
 - ▣ Street level
 - ▣ Sidewalk level
 - ▣ Intermediate level

- Types
 - ▣ One-Way Protected Cycle Tracks
 - ▣ Raised Cycle Tracks
 - ▣ Two-Way Cycle Tracks



One-Way Protected Cycle Track

- Street level
- Prevents double-parking
- Eliminates risk and fear of collisions with over-taking vehicles



- Applications
 - ▣ Streets which bike lanes would cause many bicyclists to feel stress due to
 - Multiple lanes
 - High traffic volumes
 - High speed traffic
 - High demand for double parking
 - Large parking turnover

One-Way Protected Cycle Track



Raised Cycle Track

- Vertically separated from motor vehicle traffic
 - ▣ Sidewalk level or intermediate level
- Keeps motorists from easily entering
- Can visually reduce street width
- Applications
 - ▣ High speed streets with few driveways/cross streets
 - ▣ Streets where vehicle encroachment can be a concern



Two-Way Cycle Track

- Applications
 - ▣ One-way streets where contra-flow bicycle travel is desired
 - ▣ Along streets with high motor vehicle volumes and/or speeds
 - ▣ Streets with few intersection and driveway conflicts
 - ▣ Streets with extra ROW



Two-Way Cycle Track



<http://www.flickr.com/photos/goodcough/5585685113/in/pool-1690942@N22/>

Intersection Treatments - Overview

- Intersection design should reduce conflicts between bicyclists and vehicles
 - ▣ Heightening level of visibility
 - ▣ Denoting right of way
 - ▣ Facilitating awareness
- Treatments resolve queuing and merging maneuvers



Bike Boxes

- Provides cyclists with a safe and visible way to get ahead of queuing traffic during red signal phase
- Benefits
 - ▣ Increases visibility
 - ▣ Facilitates left turn positioning
 - ▣ Helps prevent “right-hook” conflicts
 - ▣ Groups bicyclists together to clear an intersection quickly
 - ▣ Pedestrians benefit from reduced vehicle encroachment



<http://www.flickr.com/photos/gregraisman/4942399298/in/faves-metro/la/>

Bike Boxes

- Applications
 - High bicycle left turns/motor vehicle right turns
 - Desire to better accommodate left turning bicycle traffic
 - When dominant motor vehicle traffic flows right and bicycle traffic continues through



Intersection Crossing Markings

- Indicate intended path of cyclists
- Raises awareness of conflict areas
- Reinforces that through bicyclists have priority
- Makes bicycle movements more predictable
- Guidance covers a wide variety of markings currently in use
 - ▣ Cities should consider standardizing future designs

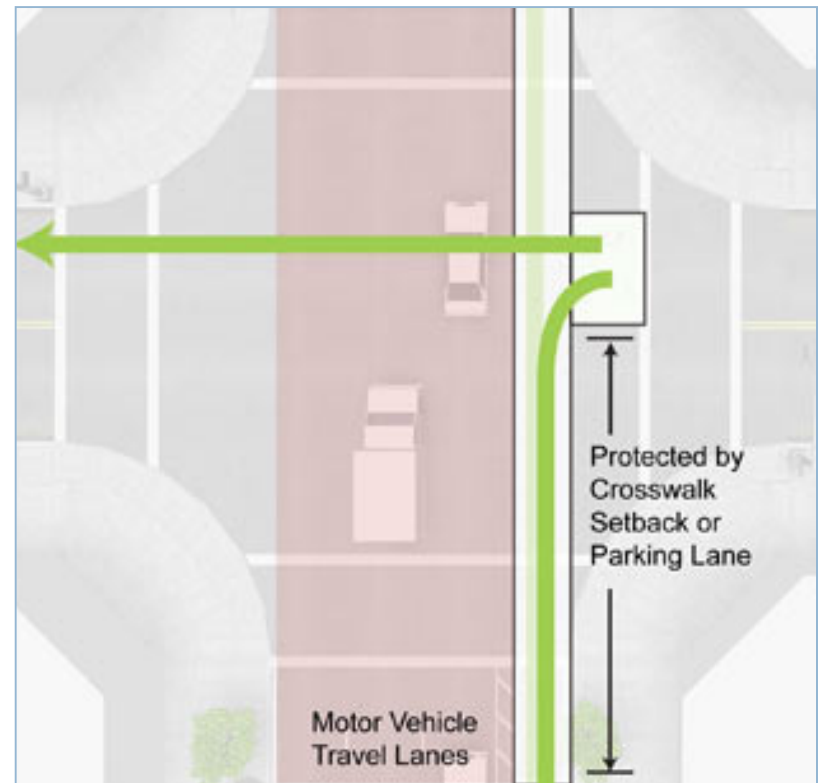


Intersection Crossing Markings



Two-Stage Turn Queue

- Offer bicyclists a safe way to make left turns
- Increases comfort but may increase signal delay
- Reduces turning conflicts between bicyclists and motor vehicles
- Applications
 - ▣ Significant number of left turns from right hand facility
 - ▣ Assist navigating streetcar tracks



Two-Stage Turn Queue



Median Refuge Island

- Placed in center of the street to facilitate crossings
- Provides a protected space for bicyclists to wait for gap in traffic
 - ▣ On two-way streets allows time to look for gaps in one direction at a time
- Decreases cyclist delay in crossing street
- Typically applied when bikeway crosses high volume or high speed street

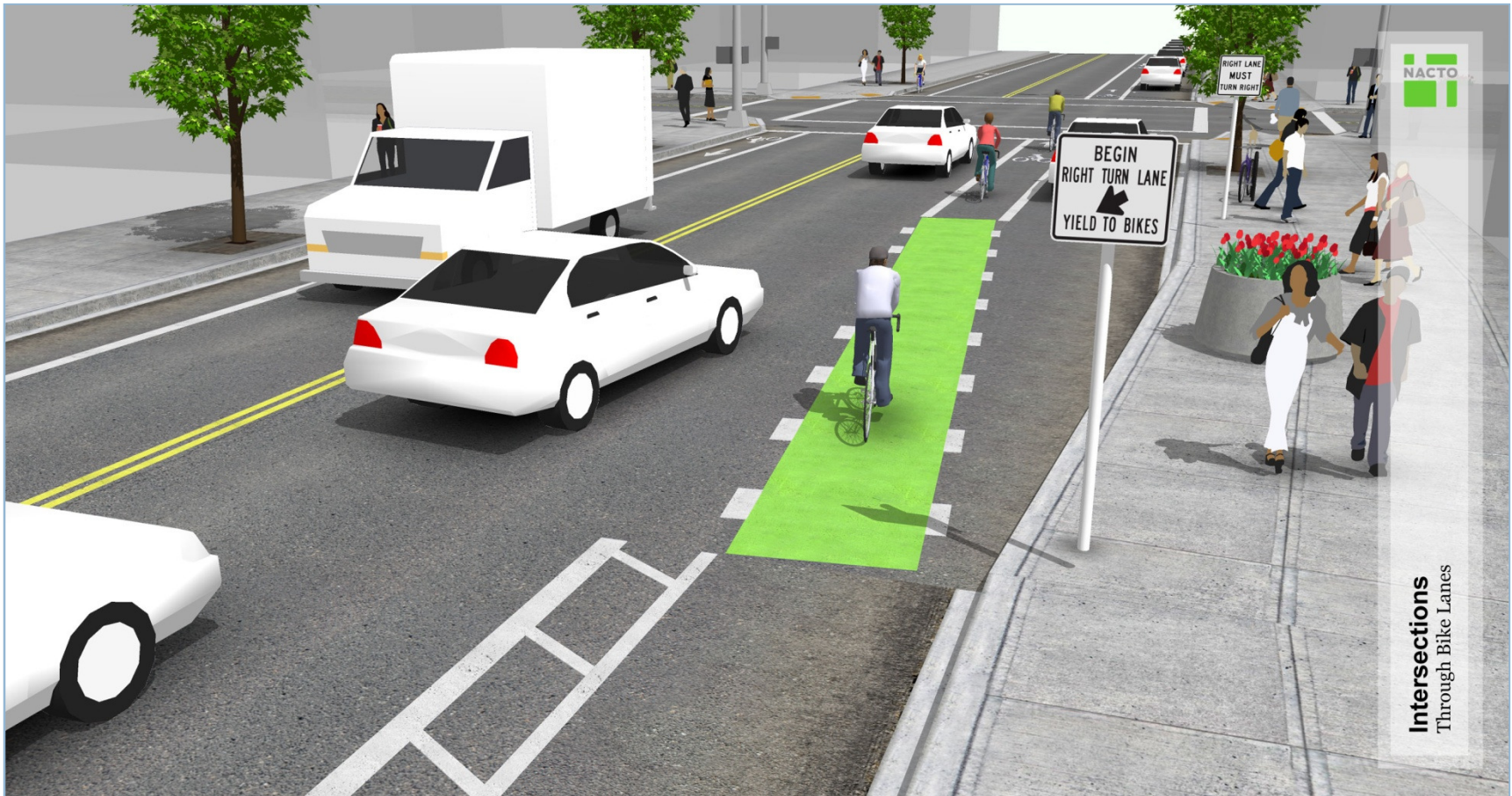


Through Bike Lanes

- Enables bicyclists to correctly position themselves to the left of right turn lanes or vice versa
- Alerts motorists to expect and yield to merging bicycle traffic
- Typically applied on streets with dedicated right and left hand turn lanes



Through Bike Lanes



Combined Bike Lane/Turn Lane

- Typically applied where there is a right turn lane but not enough space to maintain a standard-width bike lane
- Guidance for bicyclists in situation where the bicycle lane would otherwise be dropped



Cycle Track Intersection Approach

- Protective barrier removed
- Lowering raised cycle track
- Shifting bike lane to be adjacent or shared with motor vehicle travel
 - ▣ Cycle track may transition to a conventional bike lane or combined turn lane



Cycle Track Intersection Approach



Bicycle Signals - Overview

- Types of signals
 - ▣ Traditional three lens signal heads
 - ▣ Flashing amber warning beacons
 - ▣ Hybrid Signal Crossings
- Determining type depends on a variety of factors



Bicycle Signal Heads

- Installed at signalized intersections to indicate bicycle specific phases
 - ▣ Bicycle only movements
- Improves operation and provides appropriate information for cyclists as compared to pedestrian signals



Bicycle Signal Heads

- Applications
 - ▣ Split signal phases where bicycle movements conflict with motor vehicle movements
 - ▣ Intersections with contra-flow movements that otherwise would have no signal indication
 - ▣ To give bicyclists an advanced green
 - ▣ Complex intersections



Signal Detection and Actuation

- Push button or automated means
 - ▣ Induction Loop
 - ▣ Video Detection
 - ▣ Push-button
 - ▣ Microwave
- Induction loops calibrated to small metallic mass
 - ▣ Pavement markings to indicate cyclist positioning



Active Warning Beacon

- User-actuated flashing lights that supplement warning signs at unsignalized crosswalks
- Flash pattern similar to emergency flashers on police vehicles
- Lower cost alternative to traffic signals and HAWK signals



Hybrid Signal

- Also known as High-intensity Activated crossWalk (HAWK)
- Two red lenses over single yellow lens
 - ▣ No signal indications for motor vehicles on minor approach
- Can be implemented when a conventional signal warrant is not met



Bikeway Signing and Marking - Overview

- Signage includes way-find and route signage
- Markings are applied directly to pavement to designate
 - Right-of-way
 - Direction
 - Potential Conflict Area
 - Route option



Colored Bike Facilities

- Colored pavement increases visibility
 - ▣ Green color should be used
- Identifies conflict areas
 - ▣ Reduces bicycle conflicts with turning motorists
 - ▣ Increases motorist yielding behavior
- Applied in bike lanes and cycle tracks



Shared Lane Markings

- Also known as “sharrows”
- Help bicyclists position themselves safely in lanes too narrow to share
 - ▣ Keeps cyclists out of door zone
- Alerts motorists to the potential presence of bicyclists
- Reduces sidewalk and wrong way riding
- Applications where low speed differential exists
 - ▣ Downhill sharrow/uphill bike lane



Shared Lane Markings



Bike Route Wayfinding Signage

- Familiarizes users with bikeway network
- Overcomes a “barrier to entry” for infrequent bicyclists
- Signage with mileage and travel times may help minimize tendencies to overestimate bicycle trip times



Using the Guide

- Treatments presented are based on real-life experience
- Urban situations are complex
 - ▣ Treatments tailored to individual situation
- Some treatments may not be in MUTCD
 - ▣ FHWA allows for experimental projects
- Currently only available online:
 - ▣ <http://nacto.org/cities-for-cycling/design-guide/>
- Print edition available late summer 2011