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
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
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
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-metrola/
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

Brooklyn, NY

Seattle, WA
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.

*Portland, OR*
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

http://azbikelaw.org/blog/sharrow-shared-lane-marking-slm/
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.