

MICHIGAN DEPARTMENT OF TRANSPORTATION

**REVIEW OF NATIONAL ASSOCIATION
OF CITY TRANSPORTATION OFFICIALS
(NACTO) BICYCLE FACILITIES**

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INTRODUCTION

As bicycle facilities are installed on more streets in more cities across the country, innovative solutions have been introduced into the toolbox of facilities to address a wide range of contexts and serve bicyclists of all ages and abilities. These treatments range from minor adjustments to common existing bicycle facilities or entirely new facilities for which only preliminary design guidance exists. For many of these, standards are still being developed as part of research projects in bicycle facility design.

The purpose of this report is to provide a summary of contemporary bicycle facilities recommended by the National Association of City Transportation Officials (NACTO) in the *NACTO Urban Bikeway Design Guide*.

This summary was prepared by compiling information from the most advanced cities for bicycling around the world into a document that provides a state-of-the-practice guidance for the installation of bicycle facilities within urban street and intersection environments. The online guide is hyperlinked, which provides added functionality by explaining which treatments can work together for added benefits for bicyclists, motorists, and pedestrians.

The bicycle facilities covered in this report are grouped into three categories: corridor improvements, signalized intersection improvements, and unsignalized intersection improvements.

CORRIDOR IMPROVEMENTS

Facilities that are installed for most or the entire length of a street are grouped into corridor improvements. They are presented below.

DIRECTIONAL SIGNS AND ROUTE MARKERS

Directional signs and route markers help to identify a bicycle facility and provide information on direction, destination, and distance. This includes signs identifying the route, upcoming turns, and distances to major destinations. This has the benefit of steering bicyclists to the most direct and desirable routes while also reminding motorists of the presence of bicyclists.



PORTLAND, OR



PORTLAND, OR



SAN FRANCISCO, CA

Image: www.nacto.org

BUFFERED BIKE LANES

Buffered bike lanes are lanes for exclusive use by bicyclists that are physically separated from automobile traffic. Buffered bike lanes travel in the same direction as the adjacent automobile travel lane, are subject to the same traffic control devices as the adjacent automobile travel lanes, and are separated from travel lanes with pavement markings or collapsible reflective posts.



Image: Steven Faust, www.pedbikeimages.org

LEFT SIDE BIKE LANES

Left side bike lanes are bike lanes placed on the left side of a one-way street or on the left side of a two-way street that has a barrier median. Left side bike lanes are useful on roadway networks with multiple one-way pairs, or where frequent transit service would cause conflicts between approaching bicyclists and pedestrians entering or exiting buses at bus stops. Left side bike lanes reduce the need to cross potentially wide multilane roadways for bicyclists wishing to turn left or on roadways where there are few left-turn opportunities for automobiles, such as along a park or waterway. However, right turns for bicyclists are made more difficult as a result.



Image: Left side bike lane in Naples, Florida. Dan Burden, www.pedbikeimages.org

CONTRA-FLOW BIKE LANES

Contra-flow bike lanes are bike lanes that run the opposite direction of automobile traffic. The most frequent applications are on one-way streets where a short segment of contra-flow bike lane may be needed to provide bicyclists with a link to another bicycle facility or to avoid placing bicyclists on a high volume, high speed arterial roadway.

Contra-flow bike lanes are advantageous on roadways where there is evidence or concern that bicyclists are riding the wrong way, where sidewalk riding is observed, or where few suitable alternate routes exist for bicyclists.



Image: Seattle Department of Transportation

CYCLE TRACKS

A cycle track is a dedicated bicycle facility for bicycles that is physically separated from traffic. It consists of a one or two-way facility for bicycles and is separated from automobile traffic with a pavement marking buffer with collapsible posts, a curb, a change in elevation, or a combination of these items. Cycle tracks generally are wider than buffered bike lanes and differ from buffered bike lanes because they often are behind parked cars and can be accompanied by bike signals.

Cycle tracks help to eliminate certain conflicts, particularly “dooring”, which is a crash that occurs when a car door opens unexpectedly into a bicyclist’s path of travel. Separating bicycle and automobile traffic also reduces conflicts that arise in bike lane or shared lane conditions such as parked vehicles blocking the bike lane and vehicles uncomfortably overtaking bicyclists in high traffic volume or high speed corridors. However, special treatment and signalization are required at intersections to mitigate conflicts between bicyclists and turning automobiles.

Cycle tracks are applicable as one-way or two-way facilities and generally are designed to be wide enough so that street sweeping, snow clearance, and other maintenance activities require no additional or special equipment to maintain. Cycle tracks do not perform well on streets with many driveways.



Images: www.nacto.org

SIGNALIZED INTERSECTION IMPROVEMENTS

The next category describes improvements that are recommended at signalized intersections to accommodate bicyclists.

INTERSECTION PAVEMENT MARKINGS

Pavement markings through an intersection helps reaffirm the presence of a bicycle facility and help guide bicyclists through intersections. This is useful for wide intersections or where there is a lateral shift in a bike lane or other bicycle facility.



Image: Shane Sawyer, www.pedbikeimages.org

SHARED BIKE/TURN LANES

At intersections where turn lanes are provided, there often isn't enough room to provide turn lanes and separate bike lanes. Shared bike/turn lanes create a shared roadway condition at these locations to identify the intended path for bicyclists traveling through an intersection while also providing helpful information to turning motorists. Shared bike/turn lanes are most common in right-turn lanes, as bike lanes typically are located near the curb, whereas in a right-turn lane, bicycles should be directed to travel on the left side of the shared bike/turn lane. They may be placed on streets with dedicated right-turn lanes or on streets with shared through/turn lanes.



Image: www.nacto.org

SIGNAL DETECTION AND ACTUATION

At signalized intersections that are activated by the presence of automobiles, bicycles may not contain enough metal to be detected by the signal loop detector located in the pavement. Signal detection can be modified to detect the presence of bicycles by increasing the sensitivity of the detector, providing an additional loop detector in the pavement, replacing loop detectors with intersection cameras, or by providing push buttons at signalized intersections where bicycle traffic is frequent. However, if a push button is provided, it should be located where bicyclists can reach the button without requiring them to dismount.



Image: www.nacto.org

BIKE SIGNALS

Bike signals are signals designated specifically for bicyclists for use in areas where they may be subject to different traffic control than automobiles, or where additional guidance is needed for bicyclists in complex intersections. They follow the same design standards as automobile traffic signals with red, yellow, and green phases. They may be bicycle-actuated or pre-timed. Bike signals can be used with cycle tracks and bicycle boulevards to help clarify the separation of bicycle and automobile traffic.

Bike signals also are helpful where it is desirable to give bicyclists a head start in traffic, particularly in areas where one bicycle facility is transitioning to another type (e.g. bike lane drop to a shared lane).



Image: Dan Burden, www.pedbikeimages.org

TWO-STAGE TURN QUEUE BOXES

Two-stage turn queue boxes are a type of bike lane treatment that provides bicyclists with a means of turning left that does not require moving into the left turn lane at an intersection. Bicyclists making a two-stage left turn cross the first leg of the intersection parallel to the crosswalk and then wait for a signal change to cross the second leg to complete the left turn. This is helpful in areas where left-turning traffic volumes are high or to assist bicyclists who are not comfortable making a conventional “vehicular left turn.”



Image: www.nacto.org

BIKE BOXES

Bike boxes are treatments placed at signalized intersections that provide bicyclists with a highly visible position at the front of a stopped traffic queue. In areas where bicyclist traffic volumes are high, providing a bike box helps to clear the bike lane at intersections. This is particularly helpful if there are vehicles waiting or attempting to turn right. Bike boxes also can help when the pavement markings transition from one bicycle facility to another when passing through an intersection (e.g. the bike lane switches to a shared lane or a left side bike lane).



Image: Laura Sandt, www.pedbikeimages.org

UNSIGNALIZED INTERSECTION IMPROVEMENTS

The following section provides improvements that are recommended to improve bicycle accommodations at unsignalized intersections. These are particularly helpful for accommodating trail crossings of MDOT highways, which sometimes occur far from signalized intersections.

ACTIVE WARNING BEACON AT UNSIGNALIZED INTERSECTIONS

Active warning beacons are user-activated signals that flash at pedestrian and bicycle crossings. They can be used at bicycle route or trail crossings. The beacons have a flashing pattern that alerts approaching motorists to the presence of pedestrians or bicyclists in the crossing. One very effective type of beacon, known as a rectangular rapid flashing beacon (RRFB) uses high visibility light-emitting diodes (LED) with an irregular flashing pattern similar to emergency vehicle lights. They can be activated by push button, like signals, or can automatically detect the presence of bicyclists and pedestrians.

The RRFB is less expensive to install than a traffic control signal but are slightly less effective of getting motorists to stop for pedestrians and bicyclists (80-90% instead of 95% for a traditional traffic signal). It is an optional signal, as pedestrians and bicyclists are free to cross without using the beacon if traffic conditions permit.



Image: Michael Frederick, www.pedbikeimages.org

HYBRID BEACON

A hybrid beacon is a signal head with two red lenses and one yellow lens with a unique signal pattern that consists of a dormant phase when not in use and a solid red and then an alternating red “wig-wag” flash when activated by a bicyclist or pedestrian at the crossing. The hybrid signal can be activated by a push button or by automatic detection and can facilitate bicycle or pedestrian crossings. It provides flexibility as a traffic control device because it does not need to be activated every time a pedestrian or bicyclist wishes to cross. Similar to the RRFB, if traffic conditions permit an unsignalized crossing, the signal remains dark.



Image: Mike Cynecki, www.pedbikeimages.org

CONCLUSIONS

Bicycle facility design is changing rapidly. As such, existing design manuals and policies may not be able to stay current with the latest innovations and improvements. The NACTO Urban Bikeway Design Guide provides a valuable link between existing design standards currently in place in Michigan, and guidance for bicycle facilities for which standards which are new or are still being developed.

The guide expands the range of options that are available for implementing bicycle facilities to fit a variety of roadway situations and contexts. However, because many of these treatments are so new, the Federal Highway Administration (FHWA) may still be soliciting agencies for participation in experimental research installations. A request for experimentation may be needed for approval to install some of these improvements on Michigan streets and highways.

As technology is constantly changing, bicycle facilities will continue to evolve and there may be additional bicycle innovations not yet reviewed by FHWA or NACTO. It is helpful to review developing trends to identify bicycle facilities that may be considered in future years.

BIBLIOGRAPHY

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