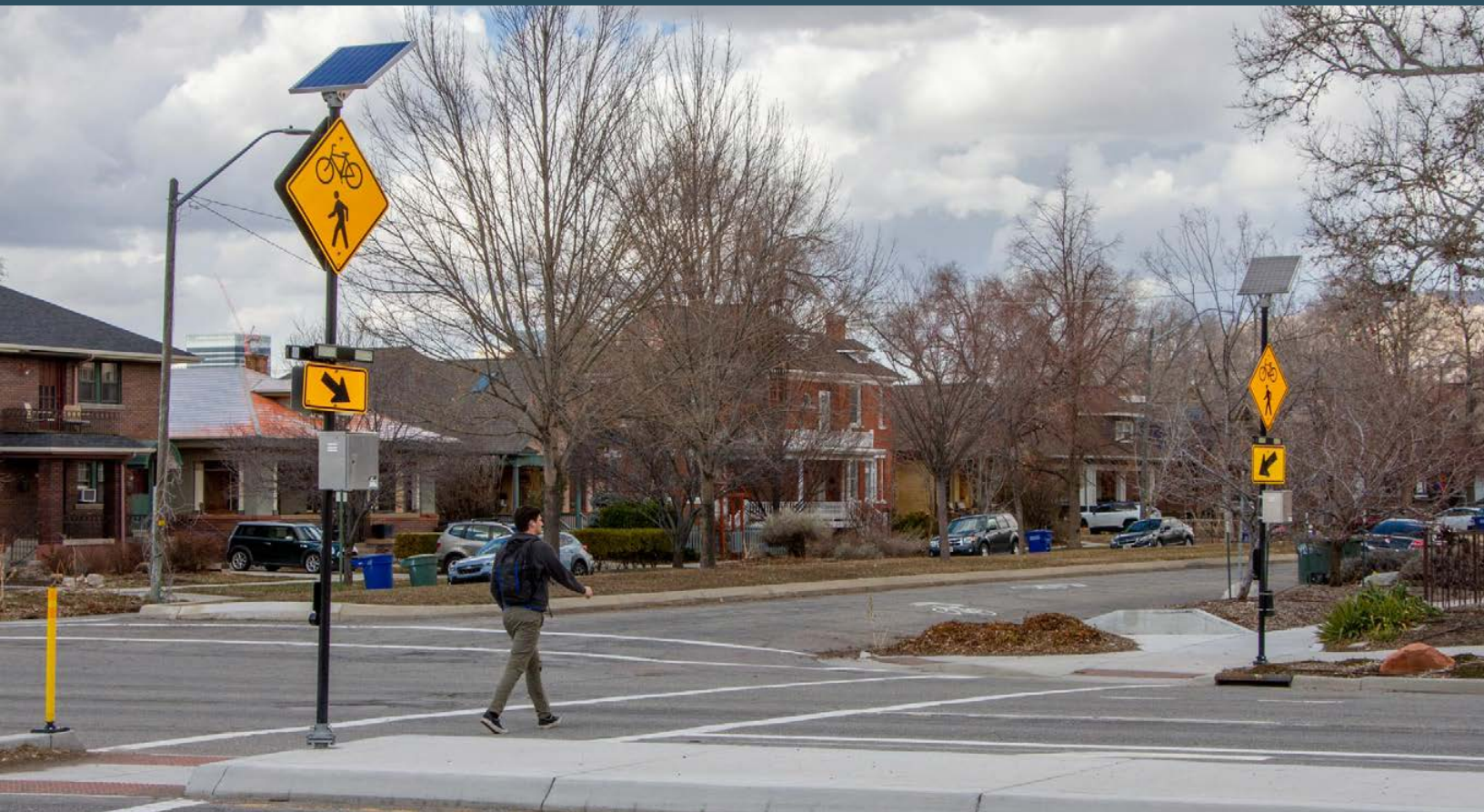


Salt Lake City

Neighborhood Byways



NEIGHBORHOOD BYWAY FACILITY GUIDELINES

May 2024



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WHAT IS A NEIGHBORHOOD BYWAY?
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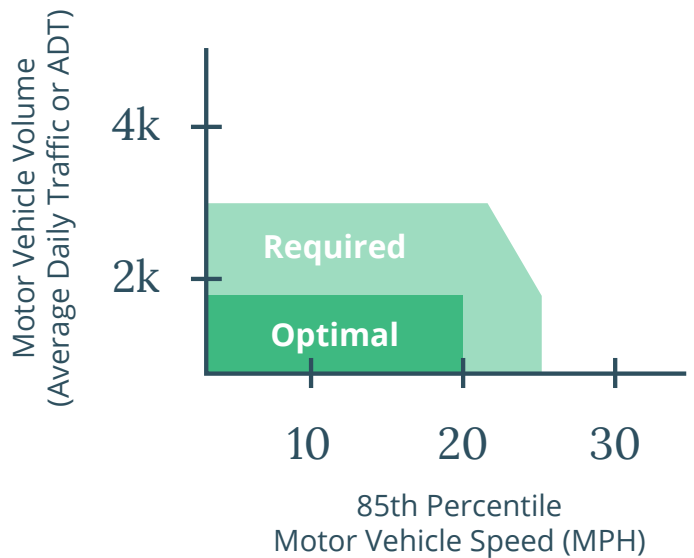


INTRODUCTION

Neighborhood Byways are neighborhood streets where transportation priority is given to those biking, walking, or using other active modes. Neighborhood Byways purposely create pleasant and convenient routes for walking and biking by encouraging safe motor vehicle traffic speeds, discouraging through traffic, and providing safe crossings of larger streets.

Byways are appropriate on local streets with low motor vehicle volumes and low speeds (See graph at right). While a corridor that already has these operational characteristics represents a clear Neighborhood Byway candidate, corridors with higher motor vehicle speeds and volumes can be retrofitted to become a Neighborhood Byway with the addition of the right traffic-calming and traffic-reducing elements.

Additional typical Neighborhood Byway characteristics include a narrow street, numerous street trees, connections to community destinations, connections to transit options, and seamless connectivity to the broader bicycle network.



HISTORY OF NEIGHBORHOOD BYWAYS

There are many different terms used across the country to describe the concept of a Neighborhood Byway. These include Bicycle Boulevards, Quiet Streets, Neighborhood Greenways, and Bicycle Priority Streets. Numerous cities have found coordinated investments in these low-speed, low-traffic streets serve a valuable role in each city's active transportation network.

Berkeley, California is considered the birthplace of the Bicycle Boulevard after it was conceived in the 1999 Berkeley Bicycle Plan. A year later, Berkeley authored their Bicycle Boulevard: Design Tools and Guidelines document to guide implementation of these facilities. Berkeley boasts one of the highest bicycle mode shares in the country.

Neighborhood Greenways have been a part of Portland's street network since the 1980s, and there are over 100 miles of routes throughout the city. Neighborhood Greenways serve as the backbone of the city's Safe Routes to School network. In Portland, green infrastructure such as rain gardens are often incorporated into the design of Neighborhood Greenways.

Tucson's first Bicycle Boulevard was implemented before the concept was commonly known, but once in place, the desire for a greater network of Bicycle Boulevards and safety improvements along existing local corridors became apparent. Tucson pioneered many innovative traffic signals used along Bicycle Boulevards to cross major streets, including the HAWK signal and Toucan signal.

While numerous names exist to describe quiet, local streets that have been improved for bicyclists and pedestrians, Salt Lake City chose to use the term "Neighborhood Byway" in its 2015 Pedestrian



Berkeley, CA Bicycle Boulevard



Portland, OR Neighborhood Greenway



Tucson, AZ Bicycle Boulevard

and Bicycle Master Plan. The plan identified approximately 50 miles of Neighborhood Byways and highlighted their role in supporting the City’s low stress, high comfort bike network. The term “Neighborhood Byway” speaks to the utility of the corridor for both bicyclists and pedestrians. Because Salt Lake City has a more arid climate, it chose to avoid the word “Greenway” in order to manage expectations about the amount of green landscaping that can be installed with these projects. However, the City has sought to collaborate with neighborhoods and other City departments to install climate appropriate landscaping with low-water needs where budget and maintenance needs can be met.

WHAT A NEIGHBORHOOD BYWAY IS NOT

While Neighborhood Byways can look and feel different when applied in different locations, it is important to clarify potential misconceptions when discussing Neighborhood Byways.

NOT BICYCLE HIGHWAYS

While Neighborhood Byways are designed to easily accommodate people on bicycles, they do not

replace other bicycle routes and facilities, and are not exclusively for bicycle travel. Neighborhood Byways should be equally comfortable and convenient for pedestrians.

NOT CAR-FREE STREETS

While Neighborhood Byways prioritize the safety of people bicycling, walking, or using active modes of travel, they are not meant to be fully car-free streets. To deter large volumes of motor vehicles from driving on Neighborhood Byways, treatments like traffic diverters may be applied where needed, but motor vehicles are still able to drive on Neighborhood Byways.

NOT ON COLLECTOR OR ARTERIAL STREETS

Neighborhood Byways are intended to take advantage of existing local streets that are already good places to bike and walk. Improvements on Neighborhood Byways seek to leverage the streets’ existing bike and pedestrian-friendly qualities by improving crossings and addressing specific areas with higher traffic volumes and speeds. Short segments of Neighborhood Byways may use collector or arterials streets to link together lower traffic local streets but in general, the majority of the Neighborhood Byways should occupy local, residential streets.

Sample Neighborhood Byway definitions from peer cities

<p>BERKELEY, CA BICYCLE BOULEVARD</p>	<p>PORTLAND, OR NEIGHBORHOOD GREENWAY</p>	<p>TUCSON, AZ BICYCLE BOULEVARD</p>
<p>A roadway that has been modified as needed to enhance bicyclists’ safety and convenience.</p>	<p>A low-traffic and low-speed street that gives priority to those that are walking, bicycling, and rolling.</p>	<p>A shared roadway that has been modified with traffic calming, safer intersection crossings, signs, pavement markings and other amenities to prioritize the safety, comfort, and convenience of people biking and walking.</p>

PROJECT BACKGROUND

Salt Lake City has been working to implement a network of Neighborhood Byways throughout the city, leveraging the existing local street network. Lessons learned locally combined with peer city best practices were used to create guidance for common design challenges along existing and future Neighborhood Byways. The Neighborhood Byway Facility Guidelines will guide future implementation of the Byway network to increase active transportation options and connectivity across neighborhoods.

The guidance in this document includes bicycle- and pedestrian-oriented infrastructure elements that create a safer and more comfortable experience for active transportation users. Implemented Byways should meet or exceed the minimums set by the Americans with Disabilities Act (ADA) and the Public Right of Way Accessibility Guidelines (PROWAG).

These elements include:

- **Corridor-Wide Treatments:** Byway signage & marking, street trees, landscaping, and art
- **Intersections and Crossings:** Curb extensions/bulbouts, traffic calming rings, median refuges, raised crosswalks, mini traffic circles, protected intersection corners, roundabouts, RRFB Neighborhood Byway crossings, toucans, hybrid beacons (HAWK), traffic signal Byway improvements, and offset intersection improvements
- **Traffic Calming & Diversion:** Speed cushions, raised intersections, chicanes, one-way diverters, and diagonal diverters

GUIDE PURPOSE

This guide is intended to serve a variety of purposes in the development of Salt Lake City's Neighborhood Byway network. First, the guide is intended to build consistency in the design and planning of Neighborhood Byways by formalizing treatments and approaches for various street contexts. Designers, engineers, and planners will be able to reference the guide to apply consistent treatments when working on Neighborhood Byway corridors or when working on projects that cross Neighborhood Byways.

Second, the guide will support future public engagement efforts by providing graphics and collateral that describe commonly used Byway treatments and their intended functions. By educating the public and developing a consistent vernacular of Byway treatments, the City can more effectively engage the public in the planning and design of these corridors.

Last, the guide is intended to enhance the standard for Neighborhood Byways throughout the city by establishing a progressive design standard that will allow Neighborhood Byways to efficiently serve users of all ages and abilities. While there is some national guidance available on the design of Neighborhood Byways, such as the NACTO Urban Bikeway Design Guide, there are a variety of unique situations and contexts to account for. This guide is designed to specifically respond to Salt Lake City's unique context, physical constraints, maintenance concerns, and organizational structure.

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PLANNING CONSIDERATIONS



PLANNING CONSIDERATIONS

ROUTE SELECTION

Selecting an appropriate route for a Neighborhood Byway is the first step in creating a functional and comfortable corridor for walking and biking. Salt Lake City's Pedestrian and Bicycle Plan identifies approximately 50 miles of Neighborhood Byways throughout the city. These routes should be considered a baseline for development of the Neighborhood Byway network. Deviation from the alignments shown in the Pedestrian and Bicycle Master Plan may be appropriate based on corridor-level analysis and community feedback. Additionally, new Neighborhood Byway connections not identified in the Pedestrian and Bicycle Master Plan may also be justified as new community destinations emerge and the transportation system matures in Salt Lake City. Neighborhood Byway routes should respond to a range of transportation and land use influences in order to create a functional and efficient route for bicyclists and pedestrians. Careful analysis of a Byway's alignment will seek to balance the following primary objectives:

CONNECTIVITY

Neighborhood Byway routes should provide a continuous route connecting multiple destinations including neighborhoods, schools, employment centers, commercial centers, recreational amenities, transit connections, and a broader bikeway network. Identifying a Neighborhood Byway route that connects to a variety of community destinations will often need to be balanced by the need for a direct and efficient route, described next.

DIRECTNESS AND EFFICIENCY

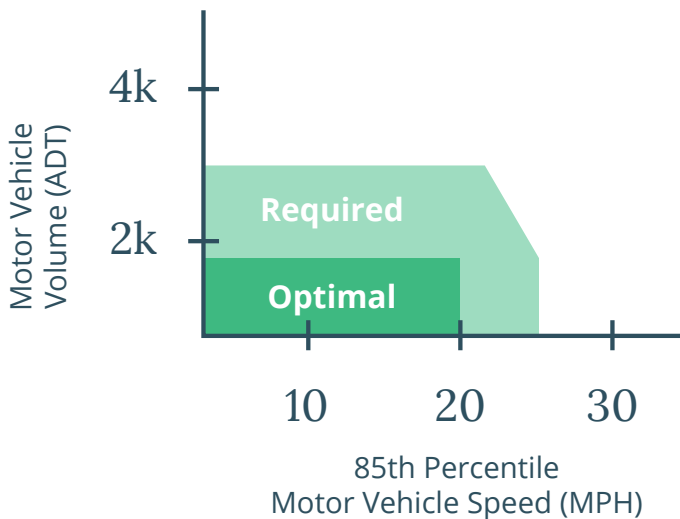
Byway routes should maintain a relatively direct alignment while connecting to destinations and supporting the Byway's role in the broader pedestrian and bicycle network. Jogs in the Byway's alignment should be avoided where possible but may be required to navigate the street layout or provide connectivity to key community destinations. Byway alignments should target a maximum of 10% out of direction travel (out of direction travel divided by total length of the route) where feasible. In addition to a direct route, planners should seek to identify routes where bicyclists do not have to stop frequently and can maintain their momentum. Achieving this goal may support the conversion of stop signs to yield signs; or flipping stop signs to control the intersecting non-Byway street. However, it is important to balance efficiency and maintained momentum for people riding bicycles with the potential for increased motor vehicle speeding.



Neighborhood Byway in Fort Collins, CO

MOTOR VEHICLE SPEEDS + VOLUMES

Streets designated as Neighborhood Byways should meet targets for speed and volume. Traffic volumes should not exceed 3,000 motor vehicles per day and an 85th percentile speed should be no more than 25 mph. When project conditions allow, Byways should be designed to limit volumes below 1,500 motor vehicles per day and speeds at 20 mph. Streets that exceed these thresholds may still be Neighborhood Byway candidates IF traffic calming improvements will be implemented to bring down volumes and motor vehicle speeds under required limits.



SECONDARY CRITERIA

In addition to the primary alignment criteria listed above, the following secondary criteria should also be considered while determining the Byway route. These include:

DETOURS ON HIGHER ORDER STREETS

Neighborhood Byways should be predominantly routed along local streets with low traffic speeds and volumes; however, short detours on higher order (higher speed and volume) streets may be necessary to link together streets that meet Neighborhood Byway criteria. These detours on

collector and arterial streets should be minimal, and most of the route should occupy local streets. Where a Byway route must travel along a short segment of street that falls outside the threshold of a Neighborhood Byway, a comfortable and low-stress facility should support bicycle and pedestrian travel. On higher order streets, this may require facilities such as separated bike lanes. The [FHWA Bicycle Facility Selection Guide](#) should be used as a starting point to determine what type of bikeway facility is appropriate on these streets.

CONNECTIONS TO DESTINATIONS OFF OF THE BYWAY ROUTE

Creating a direct and efficient route for bicyclists and pedestrians may limit the Byway's ability to directly connect to all destinations within a neighborhood. In these instances, consideration should be given as to how a pedestrian or bicyclist would navigate from the Byway route to an off-corridor destination. If a destination is accessible via a low-volume, low-speed local street, then no additional accommodations may be required to facilitate comfortable access to that destination. In other cases, creating parallel Neighborhood Byway routes may be an option to facilitate access to multiple off-corridor destinations.



Bicycle Boulevard in Berkeley, CA
Source: NACTO

Creation of parallel Byways should be balanced against budgetary constraints and may be more appropriate when development of a parallel Neighborhood Byway corridor only requires economical improvements such as signage and pavement striping.

DATA COLLECTION

Collection of traffic data is an important step in determining the justification for traffic calming and crossing infrastructure along the Byway corridor. Traffic data can also help quantify any anticipated delay or operational impacts that could result from proposed intersection modifications such as signals or roundabouts.

TRAFFIC SPEED AND VOLUME COLLECTION

Speed surveys and Average Daily Traffic (ADT) counts should be collected for each logical segment of the proposed Byway route and potential alternative routes under consideration. Route segments should be selected based upon contiguous and similar land use characteristics, street dimensions, and location between higher order streets. Documented public concerns may also warrant additional data collection at key locations where speeding or traffic issues have been identified in the past.

TURNING MOVEMENT COUNT COLLECTION

Turning movement counts (TMCs) for the peak four hours (AM/PM) should be collected at intersections with higher order streets and/or where operational changes are anticipated to support the creation of the Neighborhood Byway. These changes could include the addition of a new signal, lane reconfigurations (such as the removal of a right turn lane), or traffic diversion. TMCs will

be useful in assessing and modeling operational changes at these locations as well as understanding traffic volumes on the cross-street.

POST IMPLEMENTATION MONITORING

Collecting traffic data is also important following implementation to monitor and verify that proposed traffic calming interventions are performing as anticipated. Traffic speeds and volumes should be collected at the same locations, or a subset of the same locations, identified during the planning/design phase. Post implementation traffic data should be collected every two years or when major modifications are made to the broader transportation network that may influence the Neighborhood Byway. If traffic speeds or volumes are documented above the levels desired for a Neighborhood Byway, additional route improvements should be considered.

Benefits of post implementation monitoring of the Byway corridor include:

- Local and quantifiable data documenting the efficacy of specific traffic calming strategies.
- Supports the continued performance of the Neighborhood Byway and in response to broader changes to the transportation network.
- Supports data-driven decision making for the ongoing development of the Neighborhood Byway program.

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CORRIDOR-WIDE TREATMENTS
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INTRODUCTION

While many of the Byway treatments included in this document are only applicable in certain locations along a Byway, there are several treatments that should be used along the entirety of the Byway corridor.

BYWAY SIGNAGE & MARKING

Signs and pavement markings are the minimum treatments necessary to designate a street as a Neighborhood Byway. Together, they indicate that a roadway is intended as a shared, slow street, and reinforce the intention of prioritizing the safety of people walking, bicycling, and rolling. Signs and pavement markings alone do not create a safe and effective Neighborhood Byway, but act as reinforcements to other traffic calming and operational changes made to the roadway.

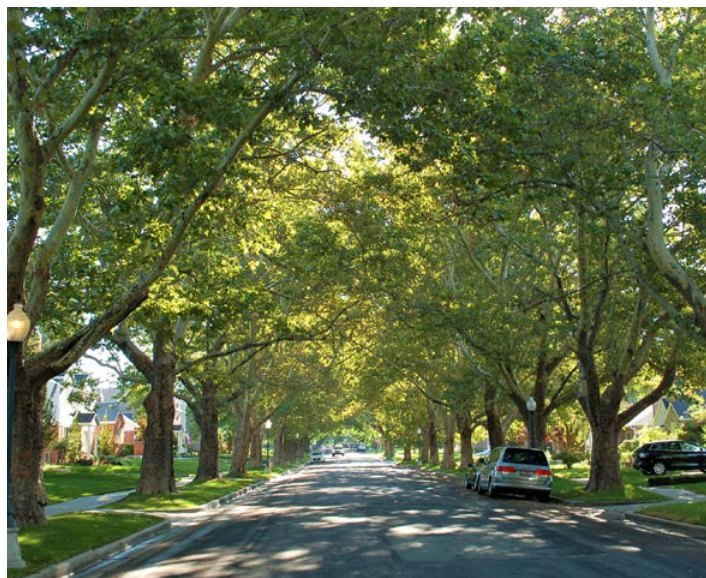
Primarily, these tools provide wayfinding to help Byway users remain on the designated route.

STREET TREES, LANDSCAPING, + ART

Street trees provide a variety of benefits to a Neighborhood Byway, including the provision of shade, visual appearance of the roadway, and a traffic calming effect due to the perceived narrowing of the roadway. Salt Lake City has many current initiatives directed at increasing the urban tree canopy throughout the city, but is particularly focused on incorporating more street trees along designated Neighborhood Byways. Additional features like landscaping and public art enhance the experience of the Byway and give it a distinctive identity.



Neighborhood Byway signage on 600 E in Salt Lake City, UT



Street trees in Salt Lake City, UT

Source: SLC Green Blog

BYWAY SIGNAGE AND MARKING

NEIGHBORHOOD BYWAY SIGNAGE + MARKING provides indication to motorists that bicyclists will be present, and helps guide bicyclists along the Byway corridor. Neighborhood Byway signage also gives the corridor a unique identity as a Salt Lake City Neighborhood Byway.



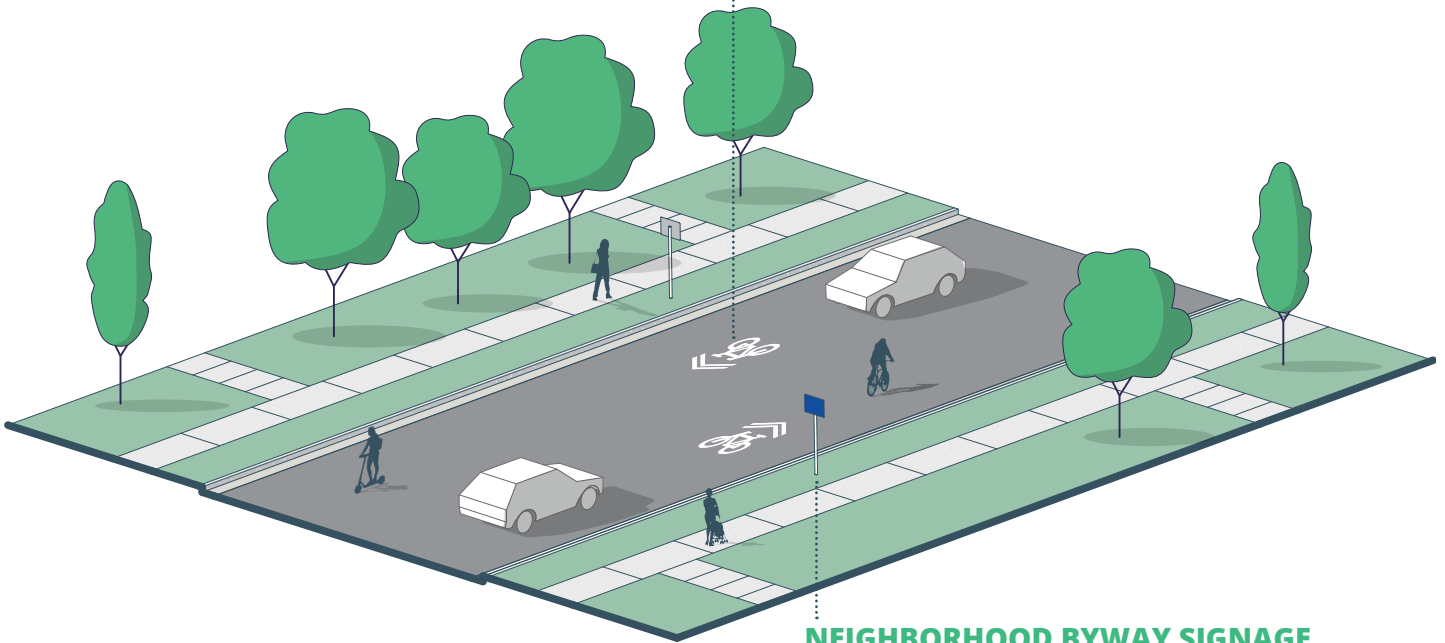
Route
Wayfinding



Increased
Awareness

SHARED LANE MARKINGS (SLM)

SLMs should be placed at the beginning and end of every block, and every 400' along the corridor in the center of the lane of travel to encourage proper positioning of bicyclists within the lane



NEIGHBORHOOD BYWAY SIGNAGE

Neighborhood Byway signage is placed frequently enough to keep bicyclists and pedestrians informed of changes in route direction, and to remind motorists of the presence of bicyclists



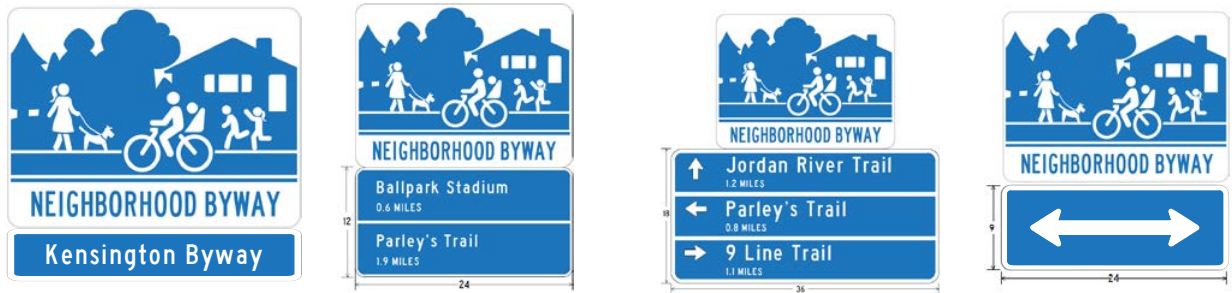
SLM positioning in the lane



SLM positioning when used with a ramp



Neighborhood Byway signage in Salt Lake City, UT



	IDENTIFICATION	CONFIRMATION	DECISION	TURN
PURPOSE	To notify people of the type of route they are on and the name of the route.	To inform people of the distance remaining to upcoming destinations along the route.	Marks the junction of two Byway routes; provides direction, distance, and mileage to locations of importance off the current Byway route.	To direct people to turn onto different roadways when required to remain on a Byway route.
LOCATION	At the beginning of the route or up to 100' from the intersection; after junction of another bikeway or Byway; along the route between long gaps of decision signs.	At the beginning of the route or up to 100' from the intersection; after junction of another bikeway or Byway; along the route between long gaps of decision signs.	Prior to a point of divergence (intersection of another bikeway, Byway, or trail) to reach a key destination.	Installed at the intersection or up to 50' prior to the intersection.
MESSAGE	Route Name	Route name; destination and mileage	Direction; destination and mileage	Direction
DIMENSIONS	18" x 24"	12" x 24"	18" x 36"	9" x 24"

DESIGN GUIDELINES

TYPICAL USES

- To be used consistently and frequently along all designated Byways
- Provides route identification and name of a Neighborhood Byway, promotes awareness, and assists with navigation

SHARED LANE MARKING DESIGN FEATURES

- SLMs indicate proper lane position and also identify the route as a Byway
- Through jogs and crossings, SLMs can provide a wayfinding element
- SLMs can be used in conjunction with bike ramps to direct bicyclists off of the street and onto a shared facility. When used with ramps, the SLM should be oriented toward the bike ramp

BYWAY SIGNAGE DESIGN FEATURES

- Wayfinding signs add branding and provide helpful information like nearby destinations and navigational information at jogs and discontinuities
- Utilize customized Salt Lake City Neighborhood Byway and wayfinding signage; reference Salt Lake City's Bikeways & Neighborhood Byways Sign Guide
- Placing signs in consistent locations provides predictable guidance and reassurance to people riding bicycles (and driving)
- Four basic sign types should be used for Byways: identification, confirmation, decision, and turn

FURTHER CONSIDERATIONS

- Additional branding elements can be added to a Byway such as pavement murals, customized street signs, public art, and other treatments

REFERENCES

- [NACTO Urban Bikeway Design Guide](#)
- [FHWA Achieving Multimodal Networks - Slow Streets](#)
- [Bikeways & Neighborhood Byways - Salt Lake City Sign Guide](#)

STREET TREES, LANDSCAPING, AND ART

Additional key elements of a Neighborhood Byway include **STREET TREES, LANDSCAPING, + ART**. Trees and landscaping not only provide shade and visual interest to a street, they also provide a traffic calming effect by creating the feeling of a narrowed roadway, called the “edge effect”. This narrowing effect can be made even more effective by planting street trees in curb extensions, medians, and other speed-management treatments. Public art can also be included to add visual interest and identity for the Byway.



Lower
Speeds



Environmental
Benefits



Street trees on 1500 E 1000 S in Salt Lake City, UT
Source: Salt Lake Tribune



Landscaped curb extension



Obelisk along Tucson, AZ Neighborhood Byway
Source: Arts Foundation for Tucson and Southern AZ

DESIGN GUIDELINES

TYPICAL USES

- Salt Lake City Planners should work with the Urban Forestry Division to identify opportunities to incorporate street trees. The Urban Forestry Division maintains requirements for tree plantings in park strips such as spatial standards, approved species, and other requirements

STRATEGY

- As Neighborhood Byway projects are implemented, Salt Lake City Transportation and Urban Forestry should promote the City’s street tree program via targeted outreach to property owners along the Byway corridor. This could include postcards, door hangers, or other promotional strategies to support

the development of a robust tree canopy along Neighborhood Byways

- Landscaping in park strips can be tricky since it is typically managed by the adjacent property owner. However, planners should coordinate with public utilities to identify opportunities to include LID landscaping (new bulb-outs), and public lands if they will be involved in deciding appropriate types of plants and responsible for maintenance
- Planners should consider implementing art where appropriate - like on traffic calming rings, traffic circles, etc. Coordinate with the SLC Arts Council on funding and implementation, and include public input

REFERENCES

- [Salt Lake City Urban Forestry Street Tree Requirements](#)
- [Salt Lake City Urban Forest Action Plan](#)
- [Salt Lake City Arts Council](#)

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INTERSECTIONS AND CROSSINGS
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INTRODUCTION

Crossing major streets can pose a significant barrier to the safety, comfort, and quality of a Neighborhood Byway. Crossings should be direct and intuitive for all users. Crossing treatments may vary depending on how many lanes need to be crossed and the speed and volume of motor vehicle traffic traveling along the intersecting street. Designers should consider the comfort and safety of not only people traveling along the Neighborhood Byway, but also those who are crossing the Byway on an intersecting street. The following types of treatments should be considered based on the characteristics of the intersection.

GEOMETRIC / SIGNAGE & MARKING ENHANCEMENTS (TIER I)

The size, volume, speed, and other characteristics of an uncontrolled intersection will determine which crossing treatments should be considered. Where crossing complexity is low and signalization is not required, the following treatments can be considered:

- Curb extensions/bulbouts
- Median refuge islands
- Mini traffic circles
- Protected intersection corners
- Roundabouts
- Raised crosswalks

RECTANGULAR RAPID FLASHING BEACONS (TIER II)

Rectangular Rapid Flashing Beacons (RRFBs) are proven to be effective in instances where intersections may require additional treatments beyond physical changes to the street, but may still not warrant signals or hybrid beacons. They may be used on streets with more than two travel lanes to cross if combined with a median refuge island and additional RRFB signal to ensure the byway user is not crossing more than two travel lanes at a time.

SIGNALIZED INTERSECTION FEATURES (TIER III)

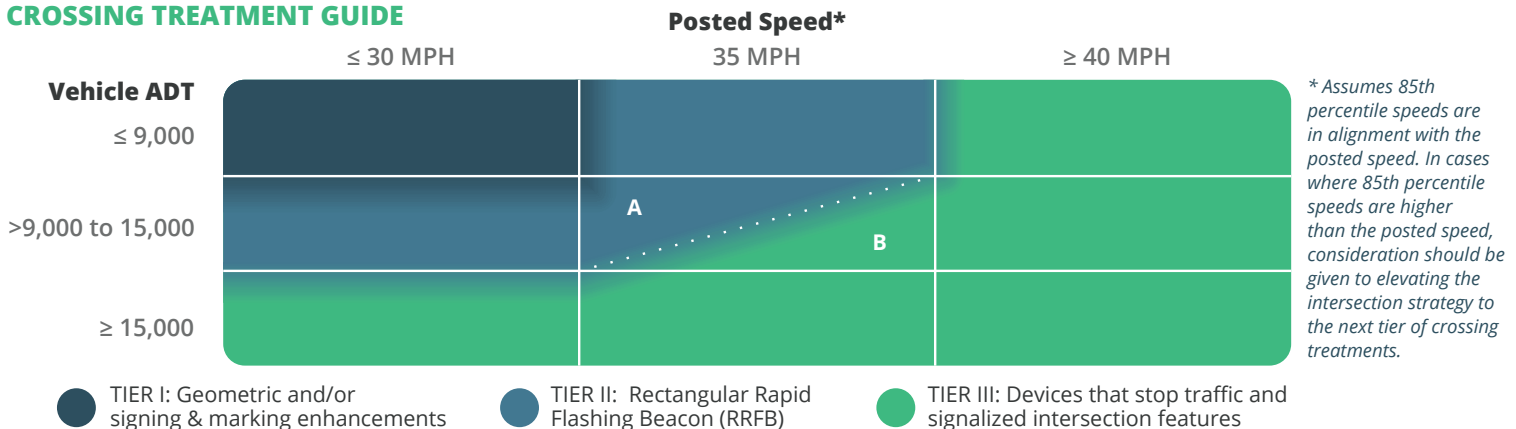
At intersections with numerous lanes, high vehicular travel speeds and/or volumes, stopping traffic will be necessary to ensure safety. Here, the following signal treatments should be considered:

- Hybrid beacons, also known as a High-Intensity Activated Crosswalk (HAWK)
- Toucans
- Traffic signal improvements

OFFSET INTERSECTION IMPROVEMENTS

Regardless of the scale of an intersection, offset intersections create unique routing challenges. Several methods, highlighted in this section, can be used to make these crossings safer and more comfortable for all roadway users.

CROSSING TREATMENT GUIDE



Configuration A: Where byway users are crossing *no more* than two vehicular lanes at time without the support of a median refuge. Examples would include a two-lane road, a three-lane road with median refuge, or five-lane road with median refuge.

Configuration B: Where byway users are crossing *more* than two vehicular lanes at a time without the support of a median refuge. Examples would include a three-lane road (no median refuge), a four-lane road, or five-lane road (no median refuge).

CURB EXTENSIONS/BULBOUTS

CURB EXTENSIONS or **BULBOUTS** minimize pedestrian exposure during crossing by shortening crossing distance and giving pedestrians and bicyclists a better chance to see and be seen before committing to crossing. They are appropriate for an intersection where it is desirable to shorten crossing distance and there is a parking lane or shoulder adjacent to the curb.



Lower
Speeds



Improved
Crossings



Better
Visibility

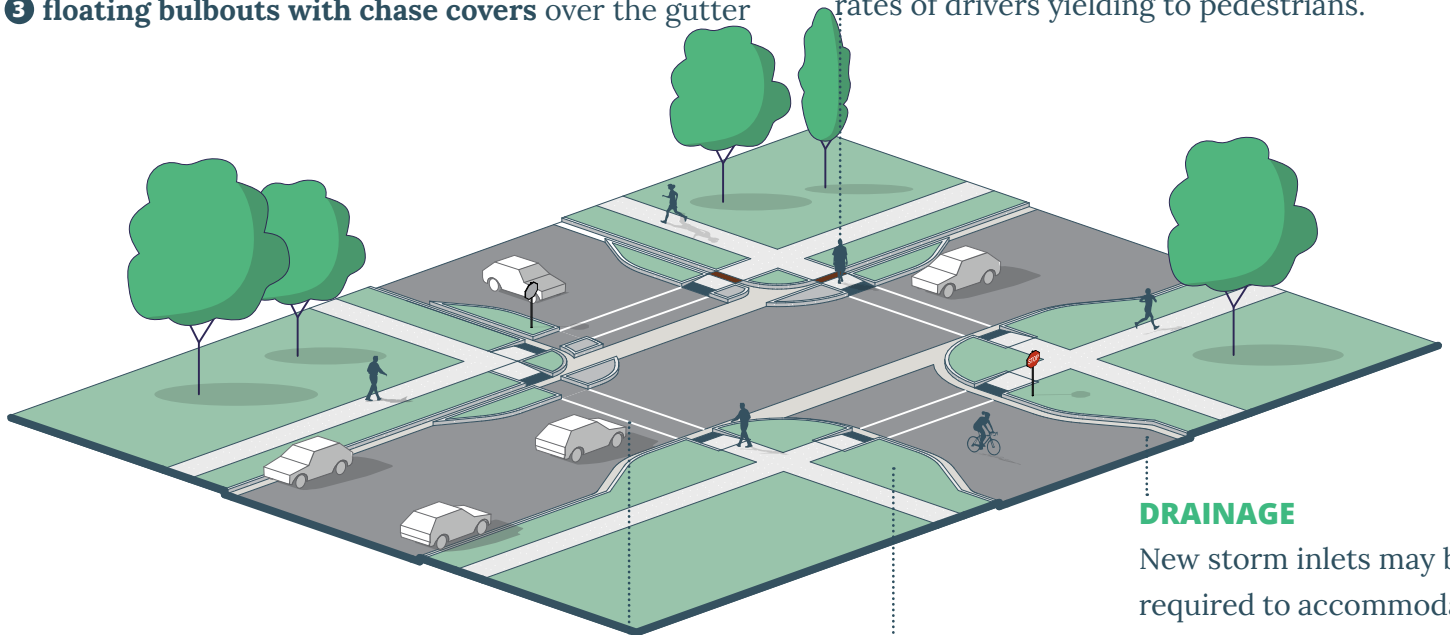
THREE STYLES OF CURB BULBOUTS

Three styles of curb bulouts typically used include:

- 1 **standard bulouts** that extend the existing curb
- 2 **floating bulouts** that leave the existing gutter open
- 3 **floating bulouts with chase covers** over the gutter

PEDESTRIAN VISIBILITY

Pedestrians waiting to cross the street are more visible to drivers, clarifying their intent to cross. This results in higher rates of drivers yielding to pedestrians.



NARROWED INTERSECTION

A narrowed intersection creates a shorter crossing distance for pedestrians and causes drivers to slow down through the intersection

DRAINAGE

New storm inlets may be required to accommodate drainage

MORE USABLE SPACE

Curb bulouts create more space for landscaping, streetscape amenities, and bike ramps



Landscaped curb extension



Floating curb extension in St. Petersburg, FL



Curb extension with chase cover
Source: NACTO



Curb extensions at 900 S & Lincoln St in Salt Lake City, UT. Source: Google Earth

DESIGN GUIDELINES

TYPICAL USES

- At signalized or unsignalized intersections where pedestrian and bicycle visibility and crossing safety are prioritized
- At an intersection with visibility constraints, to position people walking or bicycling where they can best be seen by oncoming traffic
- At an intersection within a Safe Routes to School (SRTS) walking route

DESIGN FEATURES

- In most cases, the curb extensions should be designed to transition between the extended curb and the running curb to approximately match the existing no parking/no standing area found in the street design standards
- For purposes of efficient street sweeping, the minimum radius for the reverse curves of the transition is 10 feet and the two radii should be balanced to be nearly equal

- Curb extensions should terminate 1 foot short of the prevailing travel or bike lane (if present) to provide an additional buffer, or shy distance
- Curb extensions may be designed to incorporate landscaping or a bioswale, which is a vegetated system for stormwater management

FURTHER CONSIDERATIONS

- Curb extensions are only appropriate where transit and bicyclists would be traveling outside the curb edge for the length of the street.
- The turning needs of larger motor vehicles, such as school buses or emergency vehicles, need to be considered in curb extension design, especially at intersections with significant truck or bus traffic
- Curb extension design should facilitate adequate drainage
- Curb extensions should not block bicycle lanes or shoulders being used by bicyclists

REFERENCES

- [NACTO Urban Street Design Guide](#)
- [FHWA Pedestrian Safety Guide and Countermeasure Selection System](#)

TRAFFIC CALMING RINGS

TRAFFIC CALMING RINGS are concrete manhole collars with object warning markings that are placed at intersections to calm traffic by narrowing the roadway and providing vertical and horizontal friction. They can serve as a low-cost temporary or permanent improvements and provide an opportunity for Byway beautification with the addition of murals and plantings.



Lower
Speeds



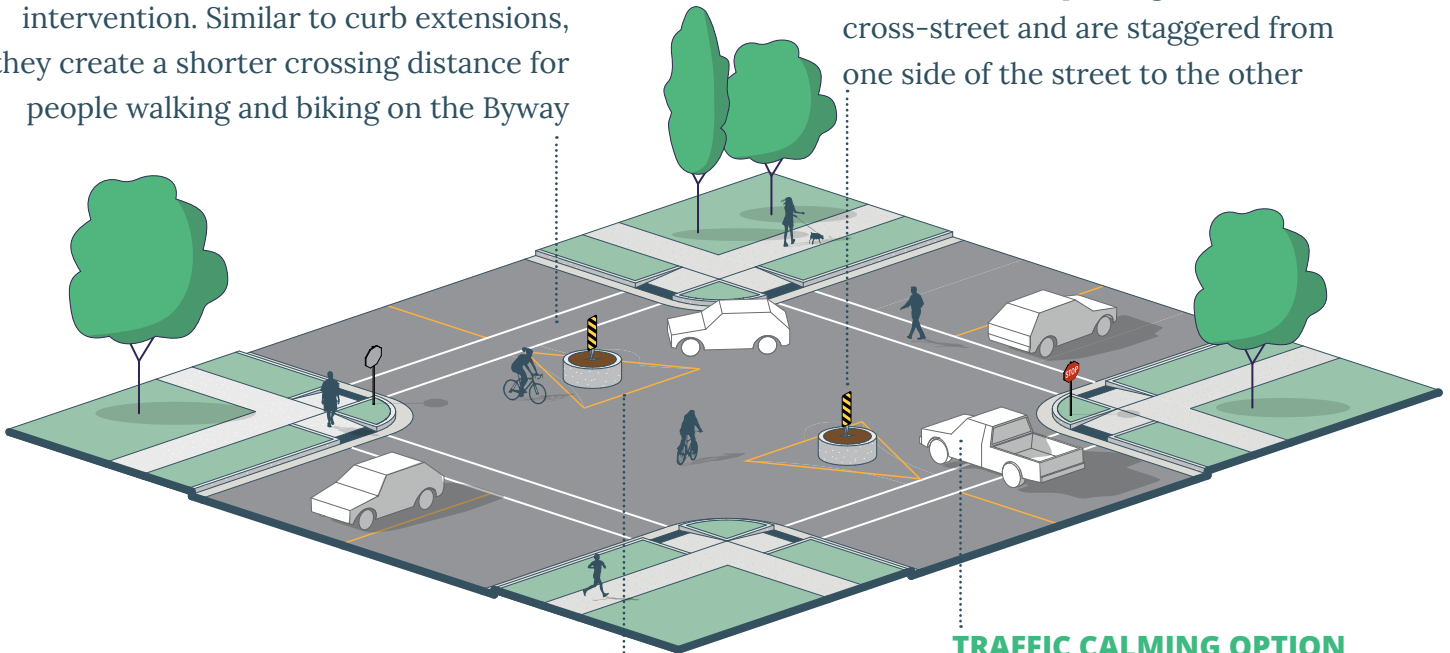
Better
Visibility

APPLICATION

Traffic calming rings may be used as a relatively low-cost traffic calming intervention. Similar to curb extensions, they create a shorter crossing distance for people walking and biking on the Byway

PLACEMENT

Traffic calming rings should be located in-line with the parking lane on the cross-street and are staggered from one side of the street to the other



STRIPING

Yellow striping should frame the ring. Centerline striping approaching the ring helps to align vehicles and encourages proper turning movements around the ring.

TRAFFIC CALMING OPTION

Traffic calming rings may be used where other traffic calming strategies like curb extensions or mini traffic circles are not feasible



Traffic calming rings in Portland, OR
Source: All images from Jonathan Maus/BikePortland



Similar ring and public art at SLC's protected intersection



Traffic calming ring pilot project at 1000 E & Ramona Ave in Salt Lake City

DESIGN GUIDELINES

TYPICAL USES

- As a traffic calming treatment option along Neighborhood Byways
- At Neighborhood Byway crossings of smaller minor arterials
- As a quick-build treatment where providing curb extensions or other permanent elements is not feasible in the near-term
- At select local street crossings where the Neighborhood Byway approach is stop controlled

DESIGN FEATURES

- Repurposed manhole risers or purpose-built devices; may have opportunities for public art around the outside of the ring
- May be combined with traffic diversion such as right in/out configurations
- Yellow striping should delineate the area where the traffic calming ring is placed, and may be filled with a solid paint color to create an island effect

- A 25' section of centerline striping should be added to discourage left turns in front of the barrier
- May have bicycle intersection crossing markings applied to further highlight the Byway crossing
- To improve visibility at night, reflectors should be included around the top of the rings and object marker signs should be installed around the rings

FURTHER CONSIDERATIONS

- May impact ability for some motor vehicles to turn left

MEDIAN REFUGE

MEDIAN REFUGES or “islands” are protected areas across a roadway or in an intersection that allow pedestrians and/or bicyclists to cross a street in stages, reducing exposure, increasing visibility, and improving overall safety.



Lower
Speeds



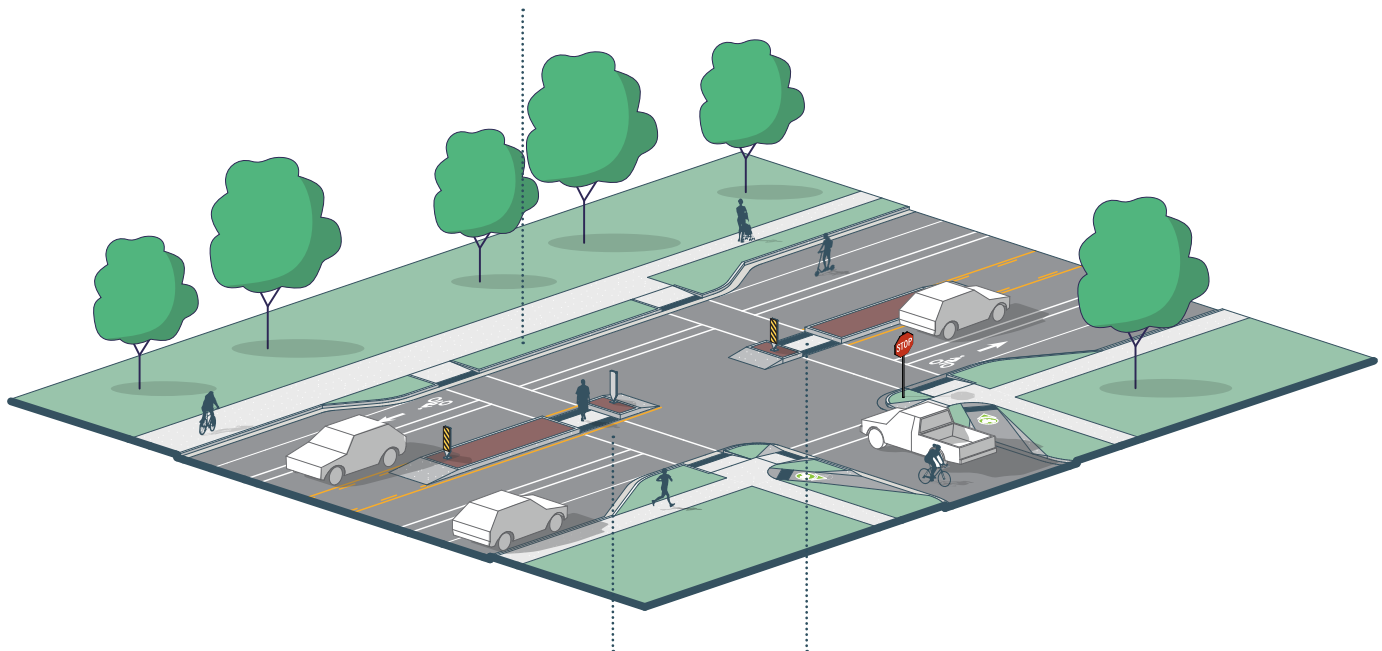
Improved
Crossings



Better
Visibility

COMBINE WITH CURB EXTENSIONS

Curbside extensions can be paired with median refuges for additional benefits (see treatment)



MARKINGS

Crosswalk markings are required where a median refuge is installed

SIMPLIFIES CROSSING

The median refuge island reduces the amount of distance that pedestrians and bicyclists are exposed to conflicting traffic and allows them to cross one direction of traffic at a time



Median in Salt Lake City (1000 N 1300 W)



Median refuge with crosswalks in Wichita, KS



Full median refuge with closure in Minneapolis (17th Ave & 42nd St)



Median refuge with RRFB at 800 S 600 E in Salt Lake City, UT. Source: Google Earth

DESIGN GUIDELINES

TYPICAL USES

- At lower volume uncontrolled Byway intersections that may not justify signalization
- Where center turn lanes or raised medians already exist
- Where lower volume Byway crossings would benefit from additional gaps by breaking the crossing into two stages

DESIGN FEATURES

- Refuge islands can be applied on any roadway with a center turn lane or median that is at least 6' wide (to accommodate wheelchair users) and at least 20' long (40' minimum preferred)
- For bicycles, 10' of storage is desirable as some bikes may be longer than 6'. Angled refuges may be used to increase storage length in medians < 10' wide.
- For pedestrians, the refuge island must be accessible, preferably with an at-grade passage through the island rather than ramps and landings
- Medians may be carried through the intersection to provide traffic restrictions that reduce the volume along the Byway
- Appropriate at signalized or unsignalized crosswalks

- Portland uses narrow medians (not wide enough to provide a refuge area) across busier streets that intersect Byways to divert vehicle traffic

FURTHER CONSIDERATIONS

- Refuge islands may be configured to prohibit vehicular through travel and left turns from the cross-street and typically also prohibit left turns off of the Byway
- Refuge islands should always be paired with crosswalks and should include advance pedestrian warning signage when installed at uncontrolled crossings
- When crossing multi-lane roadways, consider configuration with RRFBs for improved yielding compliance
- Turning motor vehicles should be able to navigate around the refuge without mounting it
- Per Salt Lake City design standards, plowable end sections should be applied on all refuge islands

REFERENCES

- [NACTO Urban Bikeway Design Guide](#)
- [FHWA Proven Countermeasures](#)

RAISED CROSSWALK

RAISED CROSSWALKS give priority to pedestrians and bicyclists, allowing them to cross at sidewalk level, and require motor vehicles to slow down. They can be implemented at mid-block crossings, intersections, or along the major street at side streets.



Improved Crossings



Lower Speeds

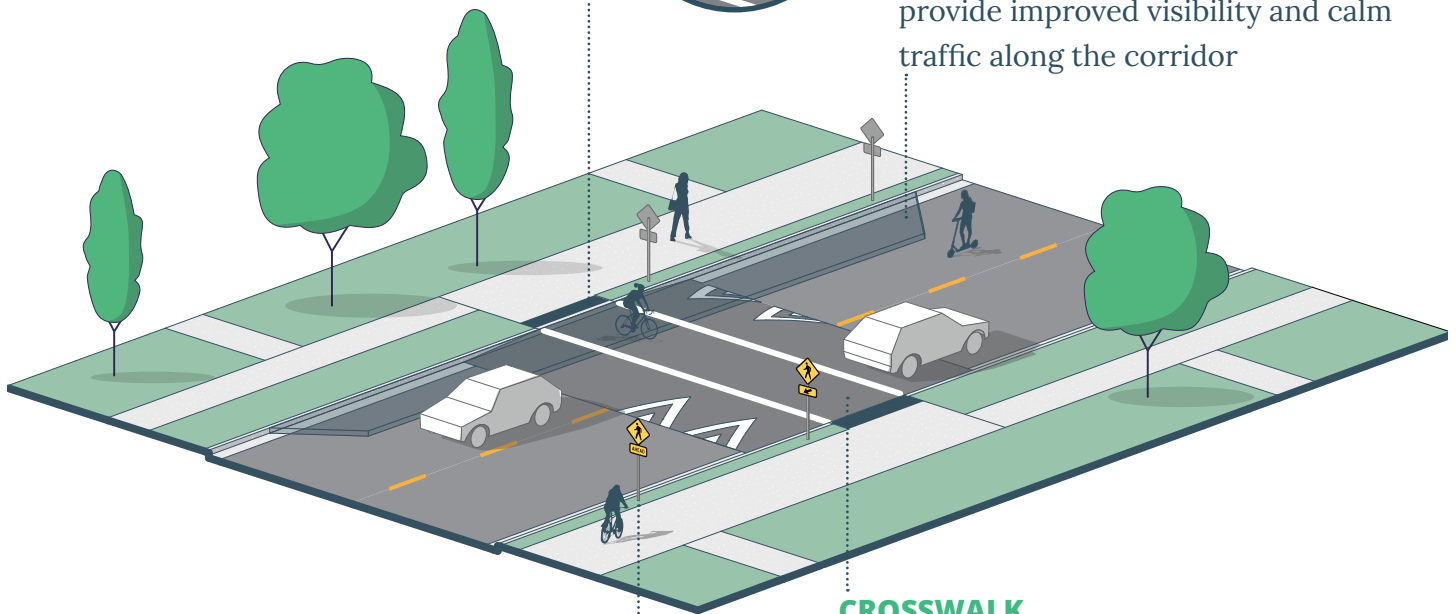
DRAINAGE STYLE

Crosswalk can either be flush with the curb, or a gap can be left with a chase cover depending on drainage needs



OPTIONAL CURB EXTENSION

A curb extension can be added to a raised crosswalk to lessen crossing distance, provide improved visibility and calm traffic along the corridor



SIGNAGE ahead of the raised crosswalk alerts drivers to slow down and yield to pedestrians using the crosswalk

CROSSWALK

The top of the raised crossing should be ADA compliant. Crosswalks are required at any midblock location



Raised crosswalk with chase cover
Source: FHWA via Jeff Gulden



Raised striped crosswalk
Source: New York City DOT Street Design Manual



Curb extension with raised Crosswalk in Hayward, CA



Raised crosswalk along the S-Line Trail in Sugar House, Salt Lake City, UT

DESIGN GUIDELINES

TYPICAL USES

- Along Byways where speed management is needed or requested by the neighborhood
- At an intersection within a school zone, local business district, or on a walking route
- Can be placed midblock or at an intersection

DESIGN FEATURES

- Crosswalk markings will depend on context. Per the Utah MUTCD, continental crosswalks may only be used at school crossings. In other cases, a standard or special emphasis crosswalk should be used
- Drainage must be adequately accommodated through inlet relocation or open channels along the sides. This allows for a fully raised crosswalk, which is preferable for pedestrians with disabilities
- Where necessary, raised crosswalks can ramp down to the gutter and use a conventional pedestrian curb ramp. However, this is not the preferred design, and does not provide all of the benefits of a fully raised design

- Raised crosswalks may be paired with curb extensions or chokers that also narrow the traversable roadway and provide improved sight distance to pedestrians

FURTHER CONSIDERATIONS

- May help accessibility for crosswalks across roads with steep cross-slopes
- May not be appropriate for primary emergency vehicle routes or streets that provide access to emergency medical services
- May be used on transit routes with appropriate coordination with UTA
- Avoid using raised crosswalks on steep streets as they can act as ramps for bicyclists and motor vehicles

REFERENCES

- [NACTO Urban Street Design Guide](#)
- [FHWA Traffic Calming e-Primer](#)

MINI TRAFFIC CIRCLE

MINI TRAFFIC CIRCLES are raised or delineated islands placed at minor street intersections. They encourage slower motor vehicle movements and manage conflicts at the intersection so that users may enter in all directions with a yield on entry control. Raised island design can vary and may include mountable curbs or aprons, landscaping, and signage.



Continuous
Travel



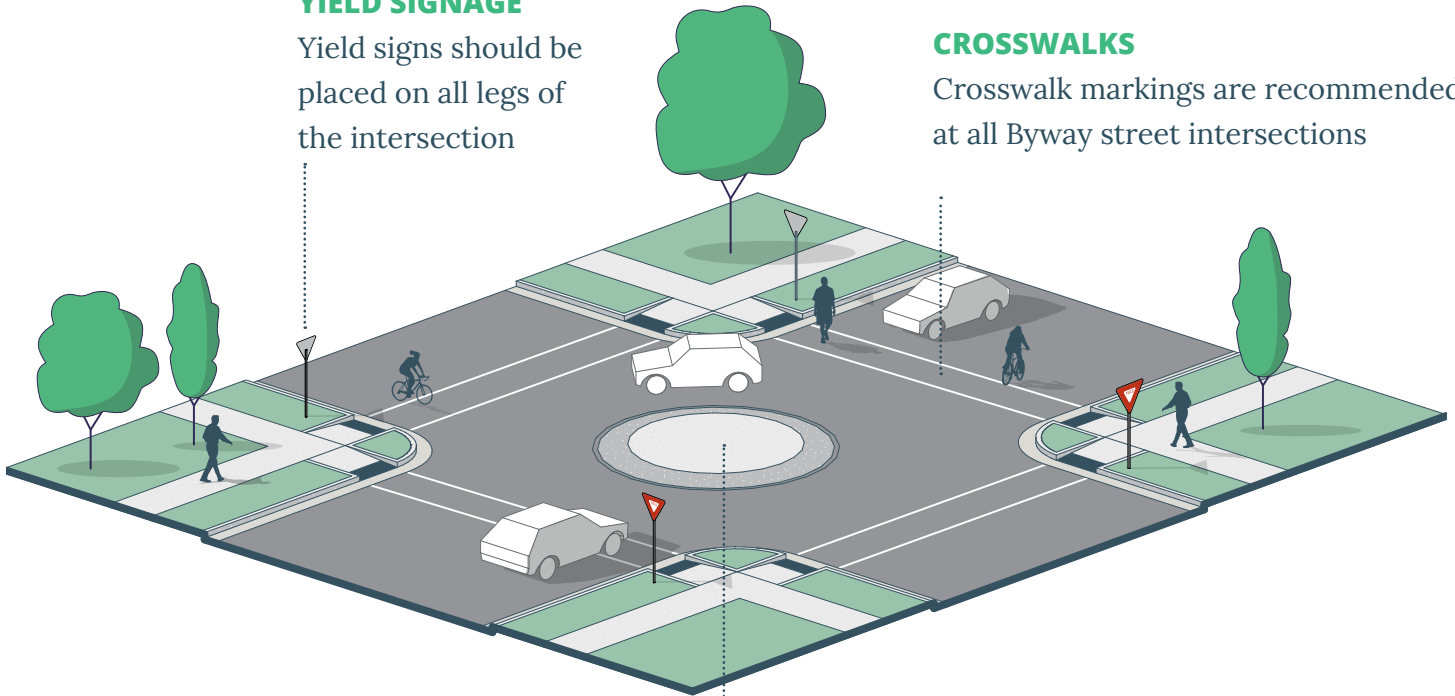
Lower
Speeds

YIELD SIGNAGE

Yield signs should be placed on all legs of the intersection

CROSSWALKS

Crosswalk markings are recommended at all Byway street intersections



DESIGN ELEMENTS

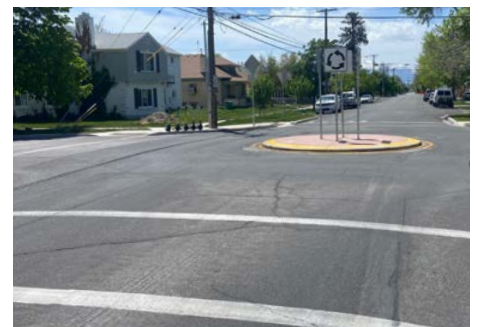
Raised island design can vary and may include mountable curbs or aprons, signage, or landscaping. Any design elements included in the traffic circle (plants, public art, etc.) should consider and limit impacts to visibility from all directions



Yield signage at mini traffic circle in Baltimore, MD
Source: NACTO



Example of an oval traffic circle at the intersection of 4th + Hazel St in Missoula, MT



Crosswalks at mini traffic circle in Provo, UT



Mini traffic circle at 500 N 1300 W in Salt Lake City, UT

DESIGN GUIDELINES

TYPICAL USES

- At lower volume uncontrolled Byway intersections that may not justify signalization
- At junctions of multiple Neighborhood Byways where slowing motor vehicles in all directions is desirable
- Where it is desirable to maintain bicycle momentum and a stop sign would otherwise be needed

DESIGN FEATURES

- Most designs feature 15' clear from the corner to the edge of the circle
- Crosswalks should be marked on Byway intersections even though they are not typically marked at most local-to-local street intersections
- The island may be fully mountable if needed at constrained intersections

FURTHER CONSIDERATIONS

- Traffic circles can also include a paved apron to accommodate the turning radii of larger motor vehicles like fire trucks, school buses, or snow plows
- Consider drainage and if there is a valley waterway along one of the side streets; this may make the motor vehicle path uncomfortable
- Landscaping within the traffic circle should be low level and preserve sight distance
- The circle may be oval if needed to fit intersection geometry (a mismatch in intersecting street widths/configurations). These should be more carefully checked with design vehicles before construction
- Shared lane markings may be provided within the intersection in the center of the circulating lane to encourage proper bicyclist lane positioning and discourage motor vehicle passing
- May be constructed out of temporary materials as an initial installation

REFERENCES

- [NACTO Urban Bikeway Design Guide](#)
- [FHWA Traffic Calming e-Primer](#)

PROTECTED INTERSECTION CORNERS

PROTECTED INTERSECTIONS are an intersection feature where the bikeway is set back from parallel motor vehicle traffic. This area provides a protected waiting area at the intersection where motor vehicle traffic may not encroach. This treatment can offer additional advantages of aiding the transition from a cross-street with bike lanes to a Byway.



Dedicated Space



Improved Crossings

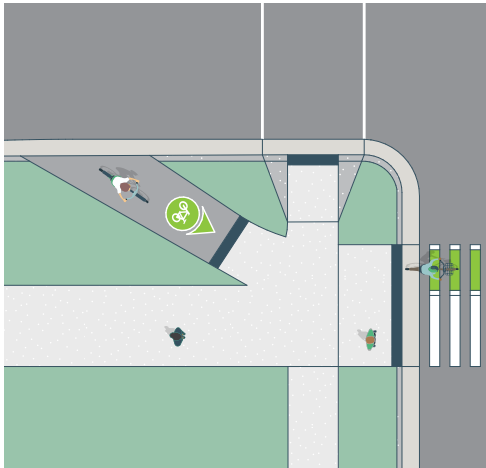


Better Visibility

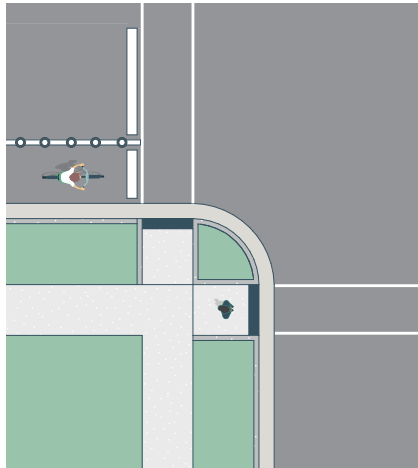


Bike/Pedestrian Crossing Priority

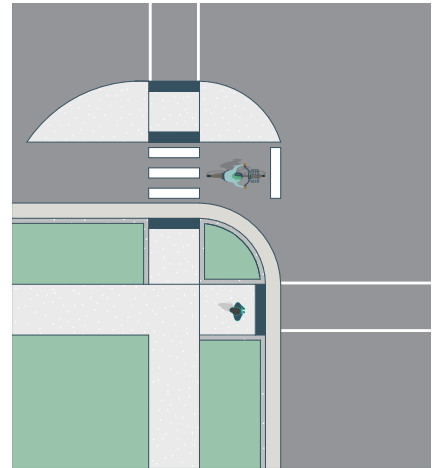
RAMP UP TO CORNER



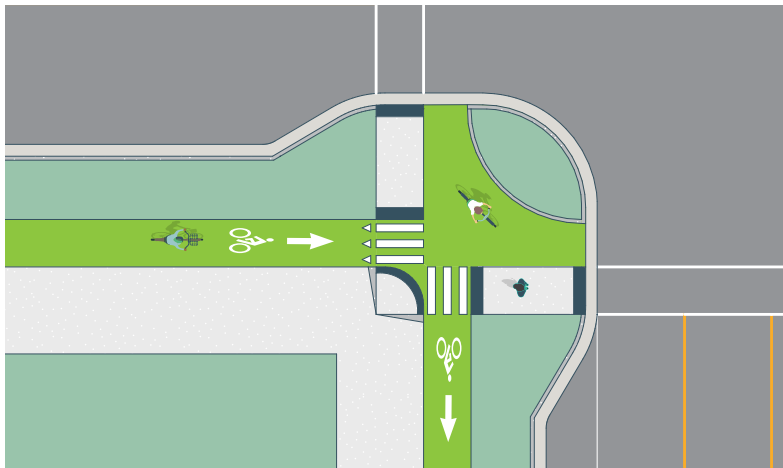
QUICK BUILD BARRIER



PROTECTED CORNER



FULL PROTECTED INTERSECTION



Ramp up to corner in Salt Lake City, UT
Source: Google Earth



Quick build barrier in Tucson, AZ



Protected corner in Fort Collins, CO



Full Protected Intersection (300 S 200 W) in Salt Lake City, UT

DESIGN GUIDELINES

TYPICAL USES

- At uncontrolled or controlled intersections along bikeways where it is desirable to provide a protected waiting area for bicyclists to queue before crossing

DESIGN FEATURES

- Use clear markings and signs to direct riders into the separated bike lane portion of the intersection
- The entrance to the protected intersection should be located to avoid obstruction by parked motor vehicles and also dissuade drivers entering the queuing area. Preventing motor vehicles from entering the protected area can be achieved using the following methods:
 1. Carry seamless protection upstream so as to not allow vehicle encroachment
 2. Design corner with colored concrete or surface treatments so that it does not look like a drivable surface

3. Design ramps/access points from the bike lane to the intersection between 5 and 6.5 feet in width to make the opening too narrow to drive into. This is more important if 1 and 2 above are not achievable
- May feature pedestrian refuges to shorten the distance and amount of time pedestrians are exposed to vehicle traffic when crossing
 - May keep bicyclists in-street behind a barrier or ramp them up to sidewalk level to wait next to pedestrians

FURTHER CONSIDERATIONS

- The turning needs of larger motor vehicles, such as school buses or emergency vehicles, may need to be considered around the corner
- Curb extensions (if used) must be designed to provide adequate drainage. Floating islands may be used to maintain existing drainage.
- Locate any signal detection or actuation devices so that they can easily detect bicyclists waiting to cross the street if the intersection is signalized

REFERENCES

- [NACTO Don't Give Up At The Intersection](#)
- [Evolution of the Protected Intersection \(Alta\)](#)

ROUNABOUTS

ROUNABOUTS are unsignalized intersection treatments that involve a raised island that slows and manages interactions. Roundabouts can be used with bicycle facilities where bicyclists stay in the lane or exit onto a shared use path around the perimeter of the intersection and cross at crosswalks. They differ from traffic circles in that a roundabout has geometry that forces slower speeds and features islands at the approaches and yield signs.



Improved Crossings



Better Visibility



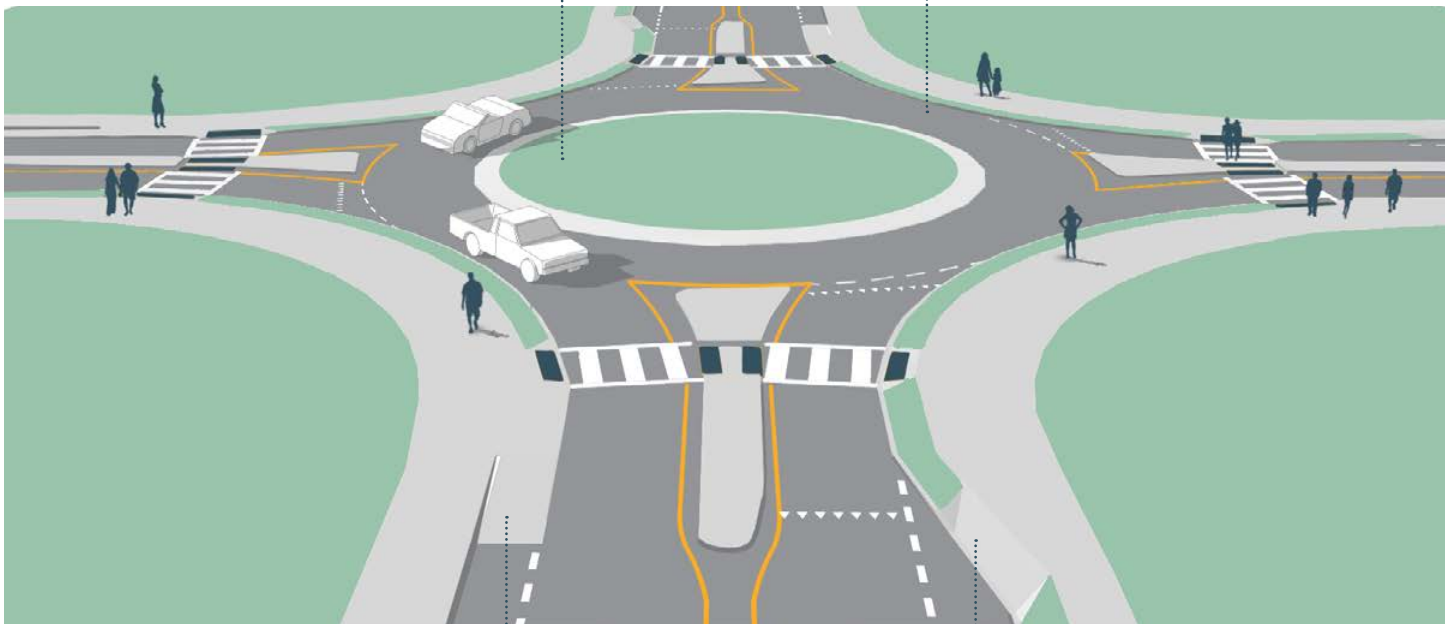
Increases Yielding Behavior

CENTER ISLAND

May be landscaped if large enough or fully mountable if turning motor vehicles require

ROUNABOUT SIZE

A variety of sizes of roundabout are possible with a Neighborhood Byway



EXIT RAMP FOR BIKES

Ramps bicyclists back into travel lane or bike lane from shared path

ENTRY RAMP FOR BIKES

Ramp gives bicyclists option to traverse roundabout as a pedestrian or a motor vehicle by staying in-lane



Roundabout in Palo Alto, CA



Roundabout with brick detailing



Roundabout with bike ramp in Canyons Village, UT



Roundabout in Palo Alto, CA

DESIGN GUIDELINES

TYPICAL USES

- At lower volume uncontrolled Byway intersections that intersect a collector roadway and signalization is not desirable

DESIGN FEATURES

- In order to accommodate trucks, emergency vehicles, school buses, and motor vehicles towing trailers, the splitter islands can be either mountable or at-grade
- For mini-roundabouts, large motor vehicles may be permitted to turn left in front of the center island if a turn around it is not feasible
- Neighborhood Byway markings within the circulating lane are optional
- To accommodate snowplows, mountable aprons should have a smooth transition with the street surface and must avoid being designed with a lip (blunt edge) that will catch a plow blade

FURTHER CONSIDERATIONS

- Will reduce traffic speeds within the roundabout and in the vicinity (approximately 200' upstream and downstream)
- Some larger motor vehicles will avoid the intersection if alternative routes are available

TECHNICAL GUIDANCE

- Depending on overall right of way, the intersection may be designed as a mini-roundabout (45-90 ft diameter with a fully traversable island), a compact roundabout (65-120 ft diameter with a partially traversable island) or a single-lane roundabout (90-180 ft diameter and a non-traversable island). All are designed so that all traffic can circulate counterclockwise around or partially over the center island
- Single-lane roundabouts will always have fully protected splitter islands with pedestrian refuges; this feature may not be present on a compact or mini-roundabout

REFERENCES

- [NCHRP 762: Roundabouts an Informational Guide](#)
- [FHWA Traffic Calming e-Primer](#)

RRFB NEIGHBORHOOD BYWAY CROSSING

RECTANGULAR RAPID FLASHING BEACONS

(RRFBs) are placed as a supplemental feature to a combined bicycle/pedestrian crossing and are generally used on streets with two to three lanes. The beacons are activated by a push button and flash when activated to increase awareness that drivers must yield to crosswalk users.



Improved Crossings



Better Visibility



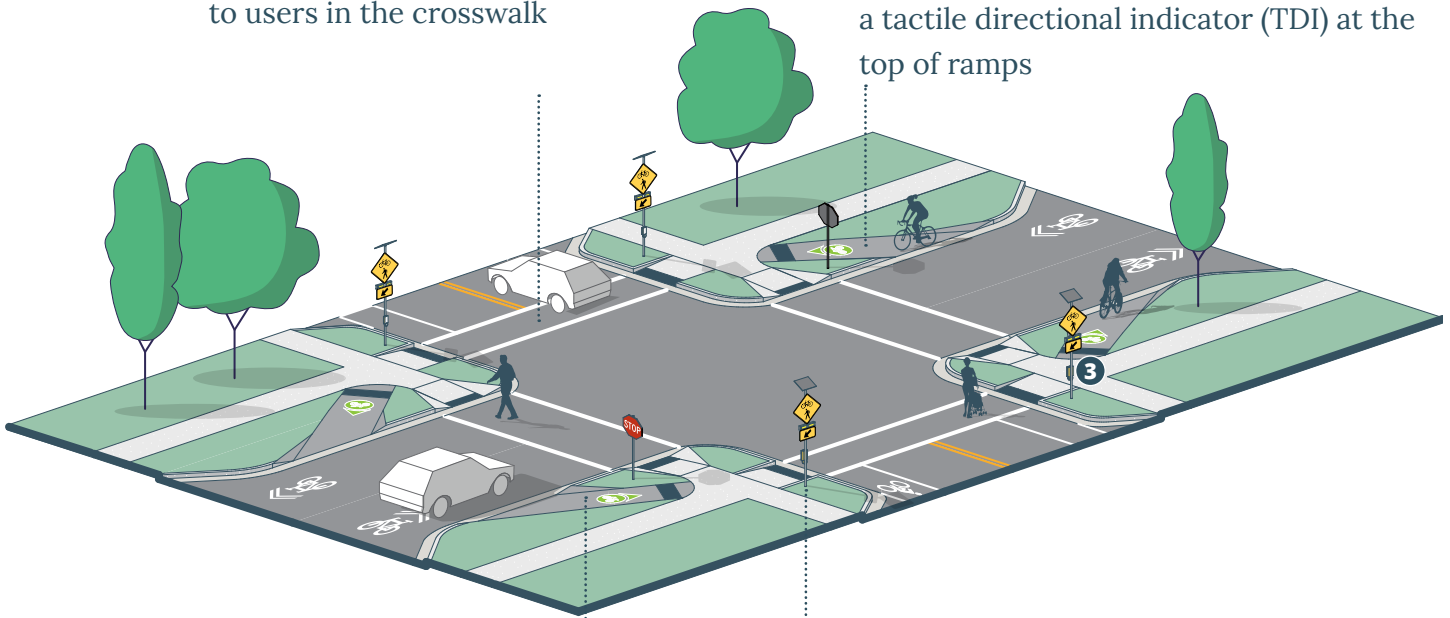
Increases Yielding Behavior

CENTER ISLAND INSTALLATIONS

If center islands or medians are present, a supplemental center RRFB should be used to promote motor vehicles yielding to users in the crosswalk

BIKE RAMP DESIGN

Bike ramps should be highlighted with bright green (textured paint, MMA, or thermoplastic), pavement markings, and a tactile directional indicator (TDI) at the top of ramps



BIKE RAMP PURPOSE

Bike ramps bring bicyclists to sidewalk level, creating a consolidated crossing for bicyclists and pedestrians

RRFB

When activated by a push button, beacons flash to indicate to motor vehicle drivers that they must yield since the crosswalk is in use



Bike ramp in Salt Lake City, UT (1000 N 1300 W)



RRFB Signage & flashing beacons in Salt Lake City, UT



RRFB push button signage



RRFB Neighborhood Byway crossing at 800 S 600 E in Salt Lake City, UT

DESIGN GUIDELINES

TYPICAL USES

- At lower volume uncontrolled Byway intersections that may not justify signalization
- May also be considered to cross lower speed (<35 MPH) streets with up to two travel lanes in each direction with the presence of a median refuge

DESIGN FEATURES

- Properly-treated bike ramps communicate their intended use for bicyclists and properly direct people that are blind or have visual impairment
- Bicyclists are directed to mount the corner using a dedicated bicycle ramp and to cross using the existing crosswalk
- Bicyclists and pedestrians use the same push button

- Within Salt Lake City municipal code 12.80.105 Bicycles operating in a crosswalk must travel at a speed that is reasonable and prudent. Bicyclists operating in a crosswalk have the rights and duties applicable to a pedestrian under the same circumstances

- SLMs should be located and oriented to direct bicyclists towards bike ramps to access RRFBs

FURTHER CONSIDERATIONS

- Median refuge islands may be paired with RRFB crossings

REFERENCES

- [NACTO Urban Bikeway Design Guide](#)
- [FHWA Proven Safety Countermeasures](#)

TOUCAN

TOUCAN CROSSINGS provide crossing improvements for bicyclists and pedestrians so that “two can” cross without a full signal that could lead to more vehicular Byway traffic. On a Neighborhood Byway, Toucan crossings are usually placed where side-street volumes do not justify a full signal, and are accompanied by turn restrictions to reduce vehicular conflicts and prioritize pedestrian and bicycle crossings.



Dedicated Space



Improved Crossings



Increases Yielding Behavior



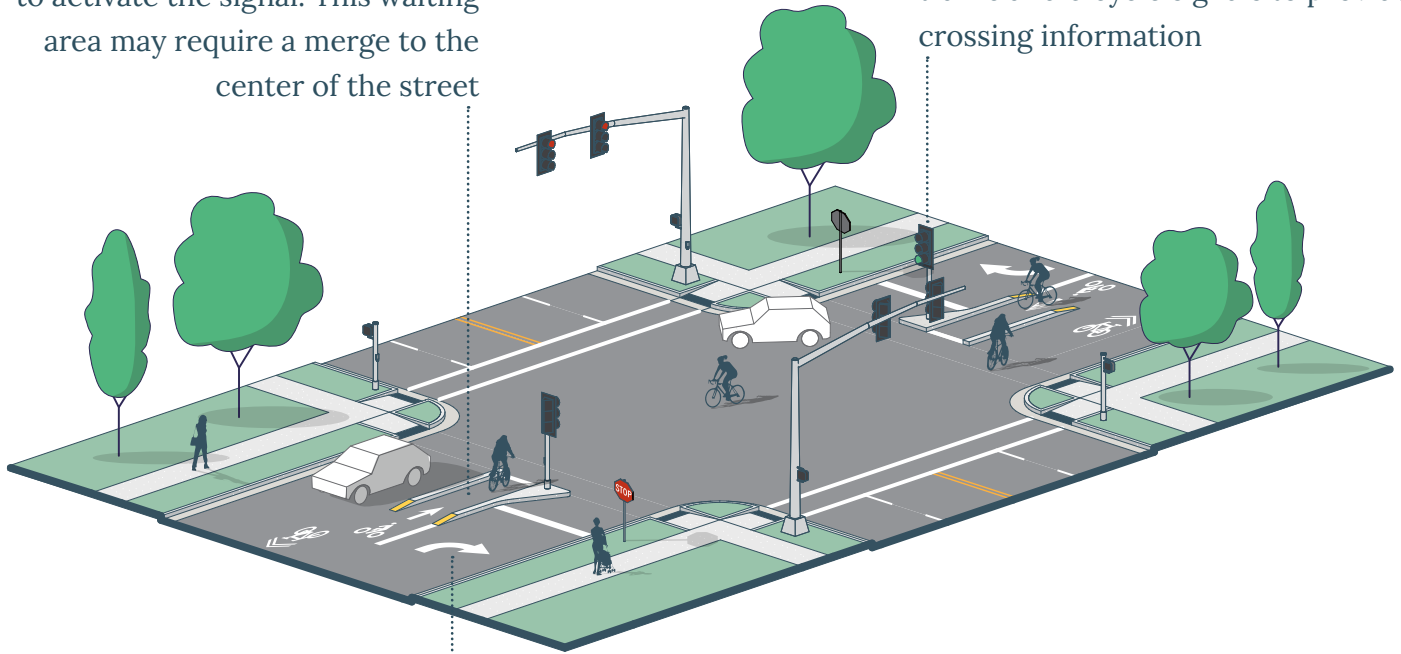
Bike/Pedestrian Crossing Priority

PROTECTED WAITING AREA

Toucan crossings provide a protected waiting area for bicyclists to activate the signal. This waiting area may require a merge to the center of the street

BIKE SIGNAL

Toucan crossings make use of conventional traffic signals to stop traffic and bicycle signals to provide crossing information



MOTOR VEHICLE RESTRICTIONS

Most Toucan crossings restrict motor vehicle through and left turning movements, further reducing conflicts and lowering Byway vehicle volumes



Toucan in Palo Alto, CA



600 E toucan in Salt Lake City, UT



Bi-directional toucan in Tucson, AZ



Toucan crossing at 1300 S & 600 E in Salt Lake City, UT. Source: Google Earth

DESIGN GUIDELINES

TYPICAL USES

- As modification to an existing signal or as a new build signal
- At intersections where traffic diversion off of the Byway is a desirable outcome to avoid attracting additional motor vehicle traffic
- To improve intersection safety by prohibiting left and through movements which contribute to more severe right angle collisions
- At an intersection within a school zone on a walking route

DESIGN FEATURES

- Toucan crossings most often feature a single direction protected area; however, if space allows, a bi-directional protected area can be provided
- Pedestrian crossings can be on the corners or may also utilize the center area if space allows

FURTHER CONSIDERATIONS

- As many Toucan crossings include volume management, careful coordination with the adjacent neighborhoods is recommended
- The turning needs of larger motor vehicles, such as school buses or emergency vehicles, may need to be considered in Toucan crossing designs, especially at intersections with significant truck or bus traffic
- Close coordination with UDOT is needed when crossing state roads

REFERENCES

- [NACTO Urban Bikeway Design Guide](#)

HYBRID BEACON (HAWK)

HYBRID BEACONS, also called High-intensity Activated Crosswalks (HAWKs), are used to improve non-motorized crossings at major streets where Toucans are not feasible due to street width or the need to maintain all motor vehicle turning movements. They also provide a lower-cost signalization option than a full signal, and do not attract additional unwanted motor vehicle traffic to the Byway.



Improved Crossings



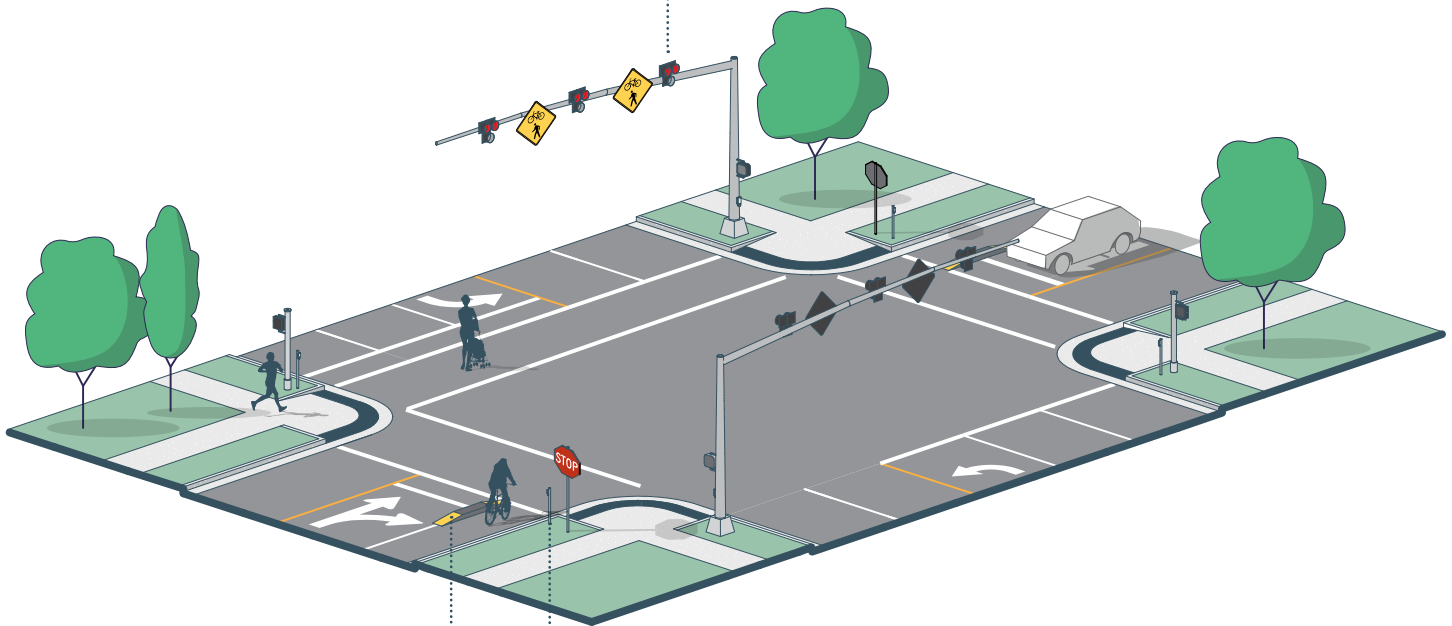
Better Visibility



Increases Yielding Behavior

HYBRID BEACON

When the beacon is activated by a bicyclist or pedestrian, the lights first flash yellow to signal to motorists to slow down, then they turn solid red. This is when a bicyclist or pedestrian can cross



BIKE LANE PROTECTION

A traffic divider provides protection for people bicycling as they wait to cross

BICYCLIST PUSH BUTTON

A push button adjacent to the bicyclist's position on the roadway makes it easy for those on bikes to activate the beacon



HAWK with bike lane protection



HAWK bike push button in Salt Lake City, UT
Source: Google Earth (2100 S & McClelland St)



HAWK with traffic calming elements



Hybrid beacon crossing in Tucson, AZ

DESIGN GUIDELINES

TYPICAL USES

- At existing uncontrolled intersections with sufficient complexity that stopping traffic to provide safe crossings is desirable
- To provide pedestrian and bicycle priority at a minor street crossing without incentivizing or attracting additional through motor vehicle traffic
- At an intersection within a school zone on a walking route

DESIGN FEATURES

- Hybrid Beacons stop vehicular traffic along the major street to provide crossing opportunities for pedestrians and bicyclists
- Motor vehicles on the Byway will not receive any signal indication and are controlled by a stop sign
- Bicycle crossings are typically directional and adjacent to the curb; however, it is also possible to consolidate both directions of bicycle travel to one side of the intersection if geometry is advantageous

FURTHER CONSIDERATIONS

- Per the Federal Highway Administration (FHWA), bicycle signals may not be combined with a Hybrid Beacon. Bicycles must use the pedestrian signal indication.
- Blankout signs that restrict conflicting motor vehicle movements from the minor cross-street are recommended to be present and active during beacon operation to reduce potential conflicts
- MUTCD phasing requirements may not fully protect bicycle crossings as they may encourage people bicycling to enter the intersection during the 'wig-wag' phase. Some cities have minimized or eliminated this phase to mitigate this issue.
- Pedestrian crossings may be on both sides of the street as there is no FHWA prohibition

REFERENCES

- [NACTO Urban Bikeway Design Guide](#)
- [FHWA Proven Safety Countermeasures](#)

TRAFFIC SIGNAL BYWAY IMPROVEMENTS

TRAFFIC SIGNAL BYWAY IMPROVEMENTS

includes a variety of strategies to make crossing streets with existing traffic signals easier and safer for people walking and bicycling on the Neighborhood Byway. Specific infrastructure strategies may include leading pedestrian intervals (LPI's), bike boxes, striping for bicyclists traveling through intersections, or protected intersections.



Dedicated Space



Improved Crossings



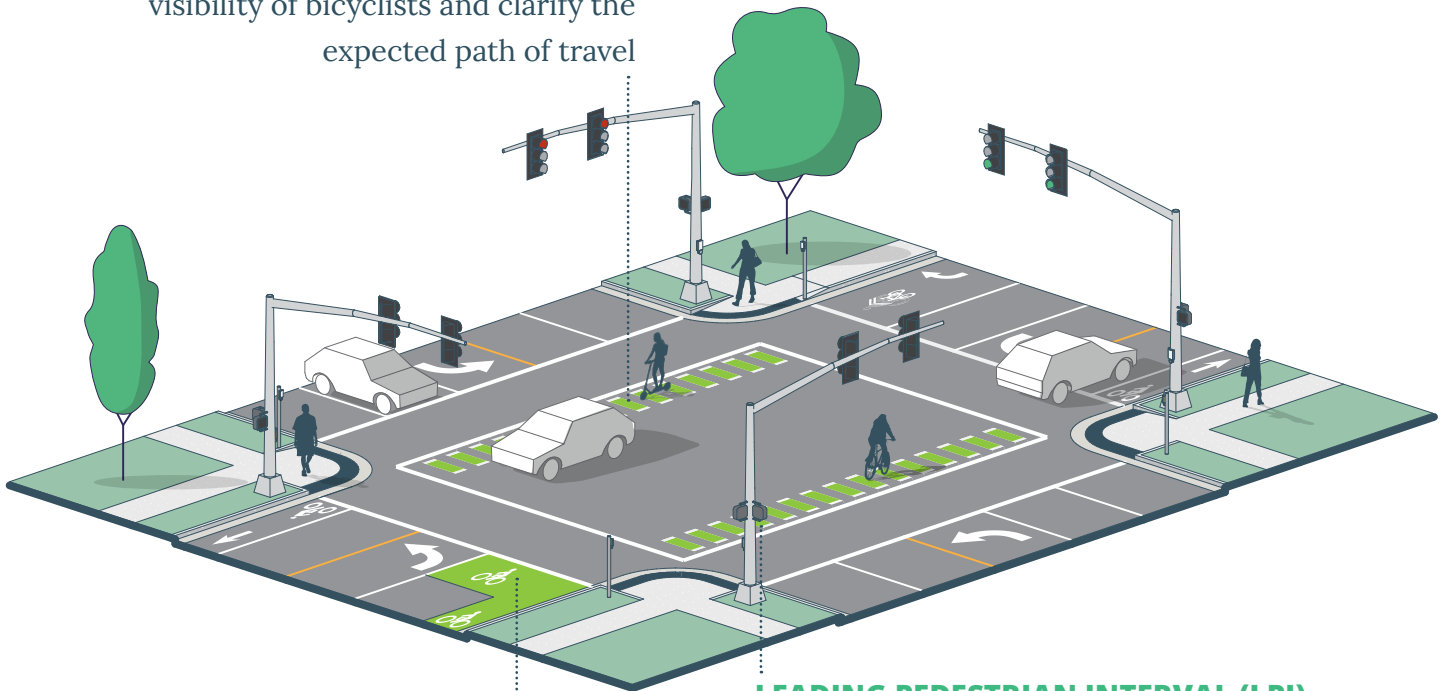
Better Visibility



Bicyclist/
Pedestrian
Crossing Priority

INTERSECTION CROSSING MARKINGS

Green dash markings enhance the visibility of bicyclists and clarify the expected path of travel



BIKE BOX

A 14' deep bike box provides space for a bicyclist to line up in order to enter the intersection first on a green light. A 25-50' ingress lane can be included

LEADING PEDESTRIAN INTERVAL (LPI)

An LPI activates the pedestrian crossing signal in advance of the light turning green to allow pedestrians (and bikes in some cases) to begin crossing before motor vehicles, enhancing their visibility



Leading Pedestrian Interval in Bellevue, WA
Source: Municipal Magazine



Bike box in Richmond, CA



Intersection crossing markings in Decatur, GA



Intersection crossing markings and protected waiting area in Seattle, WA

DESIGN GUIDELINES

TYPICAL USES

- To improve an existing traffic signal along a Neighborhood Byway for bicyclist and pedestrian comfort
- May be minor in nature to clarify bicyclist priority, or more major to include traffic movement restrictions, signal upgrades, and geometric elements

DESIGN FEATURES

Potential minor and traffic operations features include:

- Bike boxes
- Protected waiting area
- Intersection crossing markings
- Leading Pedestrian Intervals (LPI)

Potential geometric enhancement features include:

- Protected corners
- Curb extensions
- Median diverters
- Right turn diverters

Potential signal configuration changes include:

- Bicycle signal separation
- Toucan signal (see treatment description)
- Conversion to half signal or Hybrid Beacon

FURTHER CONSIDERATIONS

- Locate signal detection or actuation devices so that they can easily detect or be activated by bicyclists waiting to cross the street if the intersection is signalized

REFERENCES

- [NACTO Urban Bikeway Design Guide](#)
- [FHWA Achieving Multimodal Networks - Signalized Intersections](#)

OFFSET INTERSECTION IMPROVEMENTS

Due to local street discontinuity, many Neighborhood Byways include offset intersections, or junctions where a Neighborhood Byway aligns asymmetrically across an intersecting roadway. These connections require specific treatments, or **OFFSET INTERSECTION IMPROVEMENTS** to maintain the level of comfort and to provide awareness of how to follow the route.



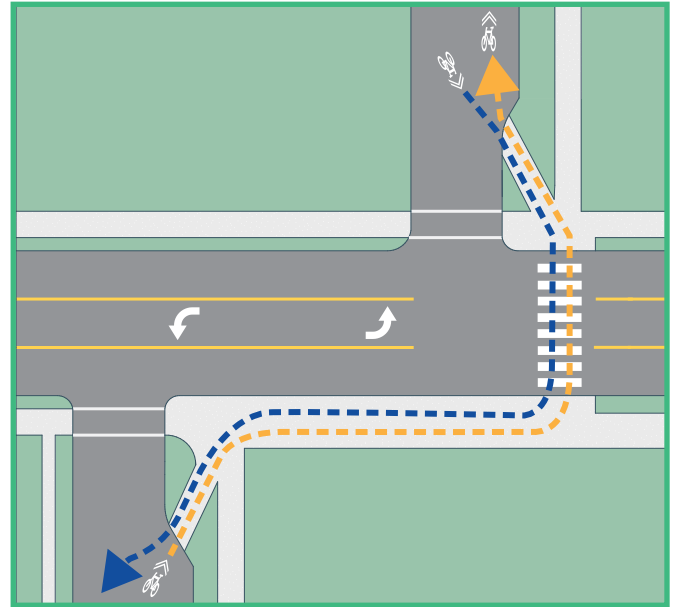
Improved Crossings



Route Wayfinding

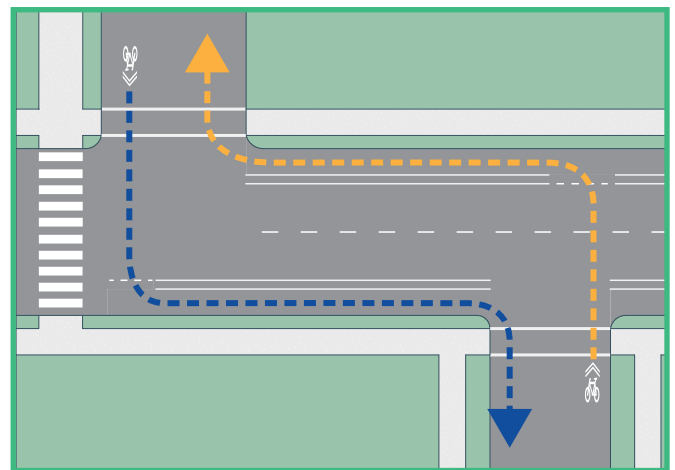
1. OPTION 1: SIDEPATH OR RAISED SEPARATED TWO-WAY BIKE LANE

Sidepaths or raised two-way separated bike lanes provide comfortable transitions to the Byways on both sides of the offset and would separate users from traffic on the intersecting street. This option maintains the highest degree of separation and level of comfort, but may not be necessary for offsets across lower volume streets. This treatment requires bicyclists to cross over in one direction and typically crosses bicyclists and pedestrians together at one shared crossing.



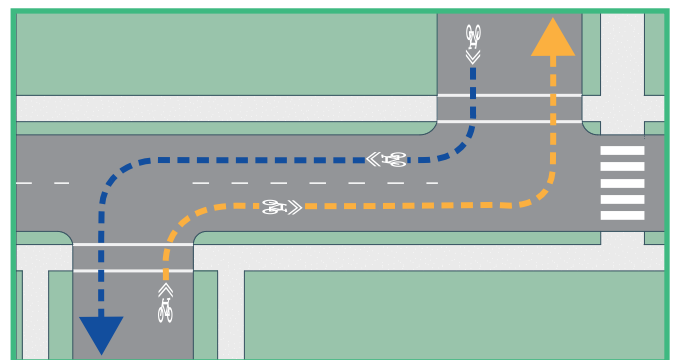
2. OPTION 2: ON-STREET BIKE LANES

Using existing or adding short sections of on-street bike lanes may be used. Left offsets often work better with existing/created bike lanes. Byway users cross straight on the intersecting street, then continue in the bike lane before turning right onto the Byway. With a right offset, users immediately turn right, then turn left after the first intersection. This angle is difficult to manage and may require a queuing space or other crossing assistance.



3. OPTION 3: SHARED LANES

Shared lanes can be used on intersecting streets that meet Neighborhood Byway requirements for traffic speed and volume limits.



DESIGN GUIDELINES

TYPICAL USES

- Along any Neighborhood Byway that experiences breaks in continuity along its route

DESIGN FEATURES

- Wayfinding signs and pavement markings should be provided to legibly indicate the expected path of riders through the offset
- The type of offset treatment to be implemented will depend on the complexity of the side street and the length of the offset. Busier intersecting streets and longer offsets generally will require a higher level of comfort to be maintained
- Crossing treatments may require selection of appropriate countermeasures covered in the preceding section of this document

FURTHER CONSIDERATIONS

- If the intersecting street is also a bikeway, transitions should be considered between the two streets in addition to providing a comfortable offset treatment along the Neighborhood Byway route
- Riders positioning to turn across the intersecting street should not impede bicyclists traveling along that street

TECHNICAL GUIDANCE

- The table below provides an estimate of the level of traffic stress (LTS) for riders using the described offset intersection improvement strategies across different street types. A higher LTS score indicates a higher level of stress, so LTS 1 is the least stressful while LTS 3 is the most stressful

LEVEL OF TRAFFIC STRESS (LTS) TABLE		
CROSSING TREATMENT TYPE	LEFT OFFSET	RIGHT OFFSET
Sidepath with Transitions	1	1
Median Path with Transitions	2	2
Bike lanes on major street	2	3
Bike Lanes on a minor collector	1	1
Shared Lane on minor collector	2-3	2-3
Shared Lane on intersecting Byway or local street (meets Byway volumes)	1	1

REFERENCES

- [NACTO Urban Bikeway Design Guide](#)

PRIORITIZING BYWAY INTERSECTION AND CROSSING IMPROVEMENTS

Intersection and crossing improvements along Neighborhood Byways support a safe and efficient corridor for biking and walking, however, not all improvements are equally critical. Funding availability may necessitate a phased implementation approach or value engineering to bring costs within available budgets. Therefore, a general strategy for prioritizing Neighborhood Byway intersection and crossing treatments can be useful to project managers and decision-makers.

HIGH-PRIORITY NEIGHBORHOOD BYWAY INTERSECTION AND CROSSING TREATMENTS

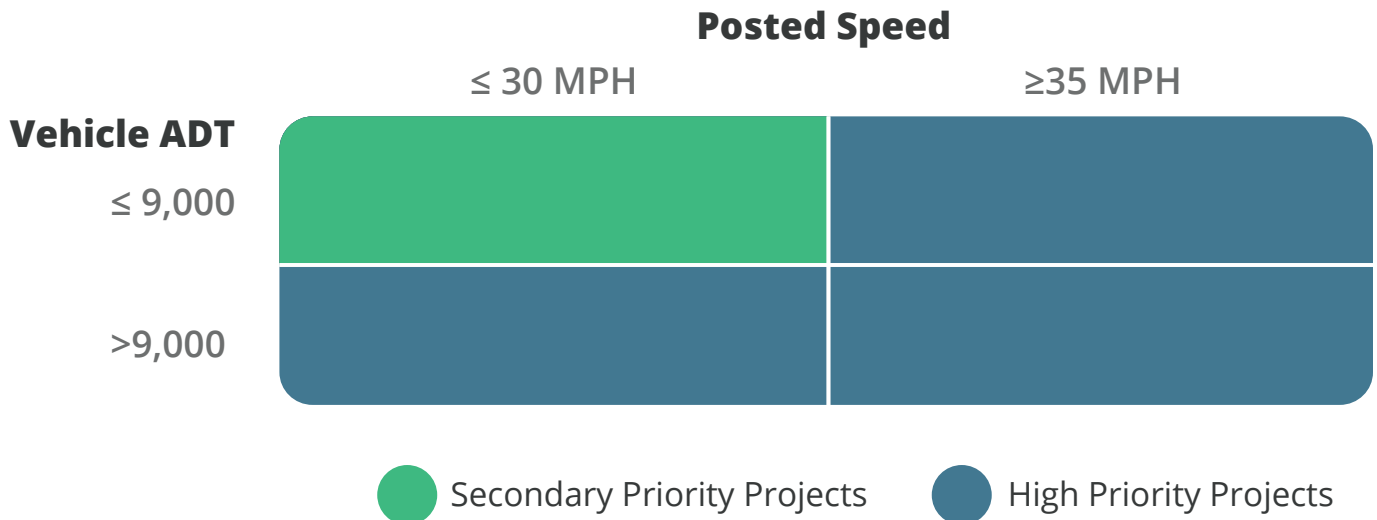
High priority intersection and crossing treatments should include improvements that are critical to developing a safe and functional Neighborhood Byway route. This would include crossing accommodations at higher speed (at or above 35

mph) and higher volume (at or above 9,000 ADT) streets. Without these improvements, user safety along byways may be significantly compromised, or users may choose to travel along other routes .

SECONDARY PRIORITY NEIGHBORHOOD BYWAY INTERSECTION AND CROSSING TREATMENTS

Secondary priority treatments add additional safety and comfort to Byway routes, but may not be necessary to meet the defined criteria for intersection intervention (see pg. 21). Lower priority crossing improvements typically occur at local street intersections along the Neighborhood Byway where users can comfortably find gaps in traffic and cross using existing infrastructure.

INTERSECTION AND CROSSING PROJECT PRIORITIZATION



Reference Crossing Treatment Guide on page 21 for speed and ADT information

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5

////////////////////////////////////
TRAFFIC CALMING AND DIVERSION
////////////////////////////////////

INTRODUCTION

NEIGHBORHOOD BYWAY COMFORT

Comfort along a Neighborhood Byway can often be distilled down to the number and type of passing events by motorists that occur during a typical trip. Motor vehicle speeds affect the frequency at which automobiles pass bicyclists as well as the severity of crashes that can occur. Maintaining motor vehicle speeds closer to those of bicyclists' greatly improves bicyclists' comfort on a street. Slower vehicular speeds also improve motorists' ability to see and react to pedestrians and bicyclists, and minimize conflicts at driveways and other turning locations.

Neighborhood Byways should have a maximum posted speed of 20 mph. Traffic calming features should be applied to maintain an 85th percentile speed below 25 mph. When funding and other constraints allow, more aggressive traffic calming strategies should be applied to further reduce 85th percentile speeds to 20 mph.

Motor vehicle volumes also impact the number of passing events that occur. Salt Lake City establishes a target of no more than 1,500 motor vehicles per day (prioritizing local over through traffic) on Neighborhood Byways.



Speed cushion (vertical deflection) in Salt Lake City

TRAFFIC CALMING

The Institute of Traffic Engineers defines traffic calming as “physical measures that reduce the negative effects of motor vehicle use, alter driver behavior, and improve conditions for non-motorized street users.”

VERTICAL TRAFFIC CALMING

Vertical speed control measures are composed of slight rises in the pavement, on which motorists must reduce speed to cross. Common treatments include speed humps/cushions, speed tables, raised intersections, and raised crosswalks.

HORIZONTAL TRAFFIC CALMING

Horizontal traffic calming measures cause drivers to slow down by constricting the roadway space or by requiring careful maneuvering. Such measures may reduce the design speed of a street and can be used in conjunction with reduced speed limits to reinforce the expectation of lowered speeds. Common treatments include curb extensions, traffic calming rings, pinch points, and traffic circles.

TRAFFIC DIVERSION

In limited circumstances, non-residential through motor vehicle traffic may increase volumes beyond the target. In such instances, it may be desirable to divert this traffic to parallel major streets to increase the comfort of the Neighborhood Byway. However, diverting traffic may create concerns from residents that the displaced motor vehicles will increase traffic on adjacent residential streets. It is important to study the anticipated impacts and communicate the results. Typically, impacts will be minor since a relatively low volume of motor vehicle traffic is being diverted.

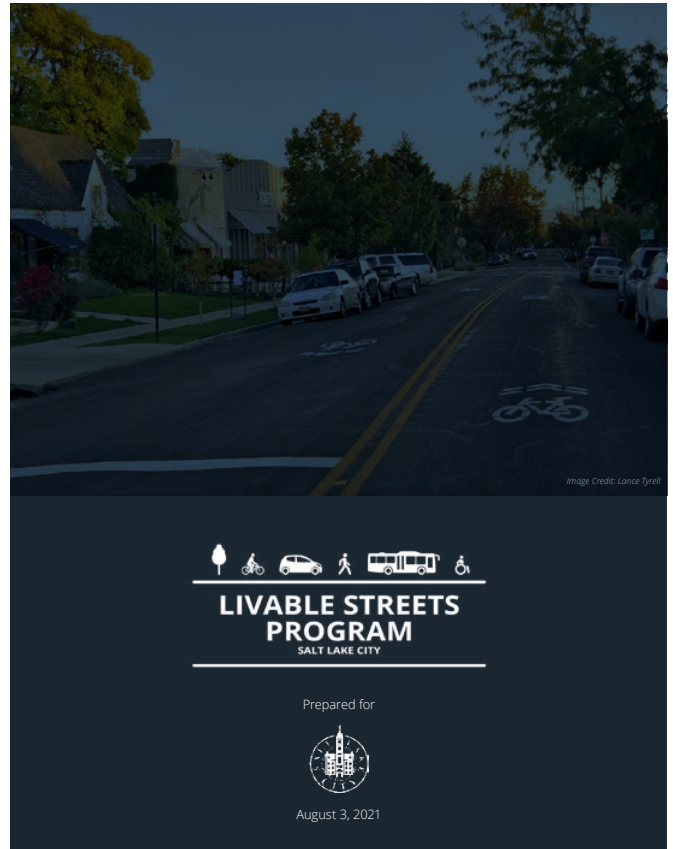
Common traffic diversion treatments include turn restrictions at major street intersections, or diverters established along the route. This document describes these features.



Choker with crosswalk (horizontal deflection) at Ramona & 900 E in Salt Lake City, UT

LIVABLE STREETS PROGRAM COORDINATION

Salt Lake City's Livable Streets Program is designed to provide a data-driven, transparent, and equitable system to implement traffic calming improvements citywide. This program aims to improve the overall safety, livability, and attractiveness of streets by identifying candidate areas that traffic calming would benefit. These streets may sometimes align with existing or future Neighborhood Byways. In these situations, the Livable Streets Program and the Neighborhood Byways program will need to coordinate efforts to meet their shared goals. While both programs include traffic calming components, it is important to acknowledge that Neighborhood Byways have a slightly different focus in creating convenient, low stress routes for people of all ages and abilities walking and bicycling. As such, it is critical that Livable Streets improvements not only calm traffic, but also support this unique objective.



SPEED CUSHIONS

SPEED CUSHIONS provide vertical deflection requiring motor vehicles to slow down. Speed cushions are speed humps with cut-throughs that allow bicycles and emergency vehicles to pass through unimpeded while still requiring typical passenger vehicles to slow down (emergency vehicles have wider wheel bases than typical motor vehicles).



Continuous
Travel



Lower
Speeds



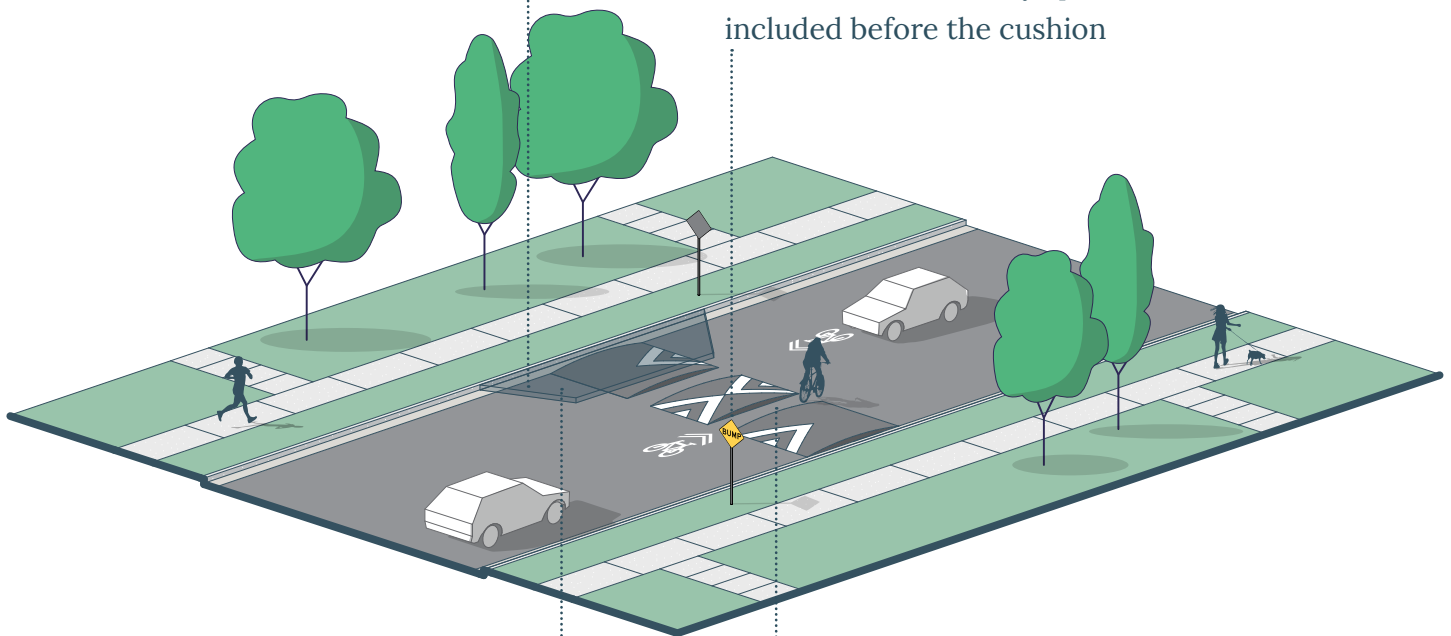
Maintained
Emergency
Access

PINCH POINT CURB EXTENSION

Pinch point curb extensions can be added to provide horizontal traffic calming to the design and narrow the street

SIGNAGE

A sign warning drivers of the speed cushion and a desired, advisory speed should be included before the cushion



PLACEMENT

Pinch point curb extensions may be combined with vertical traffic calming or placed independently along the Neighborhood Byway

GAPS

Gaps in the speed cushion allow emergency vehicles to pass through unobstructed. These gaps also allow a cut-through area for bicyclists.



Speed cushions with curb extensions, Palo Alto, CA



Speed hump signage
Source: FHWA via Lewis Grimm



Speed cushion in Missoula, MT with center posts



Speed cushions along 600 E Neighborhood Byway in Salt Lake City, UT

DESIGN GUIDELINES

TYPICAL USES

- Along Byways where speed management is needed or requested by the neighborhood
- A speed cushion is often a preferred alternative to a speed hump on a primary emergency response route or on a transit route with frequent service

DESIGN FEATURES

- The cutouts in the speed cushions are positioned such that a passenger vehicle cannot pass it without traveling over a portion of the raised pavement
- Short centerlines and/or traversable features such as flexposts will allow emergency vehicle passage while preserving the full impact of the hump to non-emergency vehicles

- Speed cushions may be paired with curb extensions or chokers that also narrow the traversable roadway for greater impact

FURTHER CONSIDERATIONS

- A speed cushion is typically designed with sides that taper off at the gutter for drainage. This design may be modified to end the taper further from the gutter to create a wide, flat surface for a bicycle bypass lane, if desired
- Speed reduction for large commercial vehicles is minimal because the larger vehicles can straddle the cushions
- Appropriate for bus routes

REFERENCES

- [NACTO Urban Bikeway Design Guide](#)
- [FHWA Traffic Calming e-Primer](#)

RAISED INTERSECTION

RAISED INTERSECTIONS provide vertical deflection at an entire intersection, requiring motor vehicles to slow down. The road level is raised to the sidewalk level and the surface can be built with a variety of materials such as asphalt, concrete, or pavers. The crosswalks are also elevated. The pedestrian space is often differentiated with bollards, materials, and detectable warnings.



Improved Crossings



Lower Speeds



Better Visibility



Increases Yielding Behavior

RAISED CROSSING ON ALL LEGS

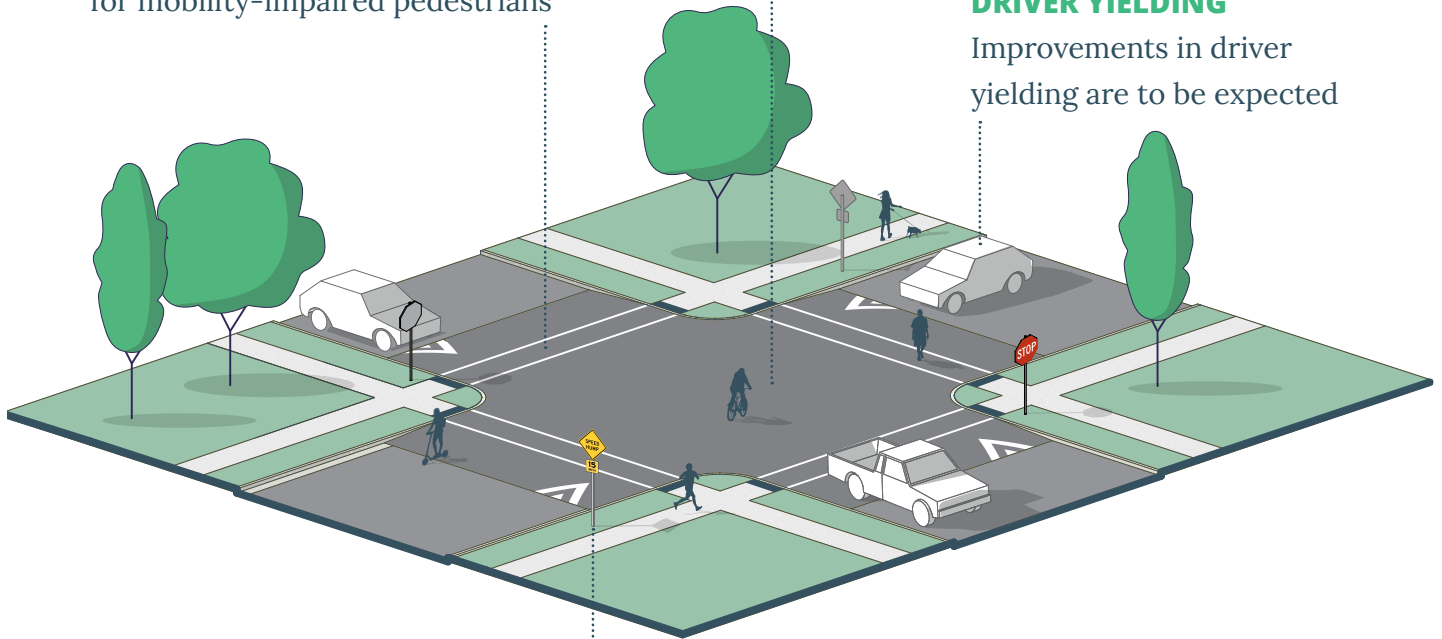
Marked crosswalks are optional, but recommended on all legs. Crosswalks are part of the raised area, offering benefits for mobility-impaired pedestrians

AESTHETIC FOCAL POINT

The raised area can be highlighted with a variety of materials, colors, and patterns to visually distinguish it as a focal point along the Byway

DRIVER YIELDING

Improvements in driver yielding are to be expected



SIGNAGE

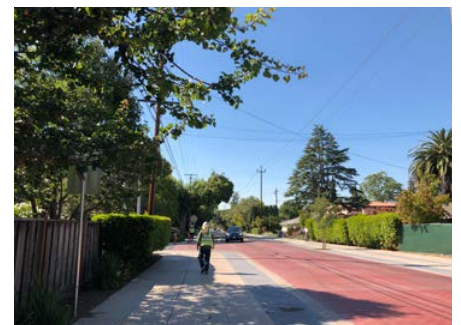
A sign warning drivers of the raised intersection should be included before the hump



Asphalt raised intersection in Palo Alto, CA



Brick raised intersection in Palo Alto, CA



Raised intersection used in an offset intersection



Raised intersection. Source: NACTO

DESIGN GUIDELINES

TYPICAL USES

- At smaller signalized or unsignalized intersections
- At residential and smaller business district contexts
- At offset intersections as a shared lane/street treatment
- At junctions of multiple Neighborhood Byways where slowing motor vehicles in all directions is desirable
- At an intersection within a school zone on a walking route

DESIGN FEATURES

- In most cases, the vertical transition will be designed similar to a speed table

- Crosswalks are not required to be marked unless they are not at-grade with the sidewalk; however, they may be marked to clarify where pedestrians should cross and that they have priority

FURTHER CONSIDERATIONS

- Users with visual impairments may have trouble if they cannot detect the edge of the pedestrian space; to prevent this challenge, tactile warning strips should be used
- The turning needs of larger motor vehicles, such as school buses or emergency vehicles, may need to be considered in raised intersection design, especially at intersections with significant truck or bus traffic
- The raised transitions must be designed to provide adequate drainage

REFERENCES

- [NACTO Urban Street Design Guide](#)
- [FHWA Traffic Calming ePrimer](#)

CHICANES

CHICANES are a series of raised or delineated curb extensions, or parking bays, on alternating sides of a street forming an S-shaped travel way. Speed is reduced for motor vehicles by requiring drivers to shift horizontally through narrowed travel lanes. Chicanes can allow for both directions of traffic to pass at a time or just one direction.



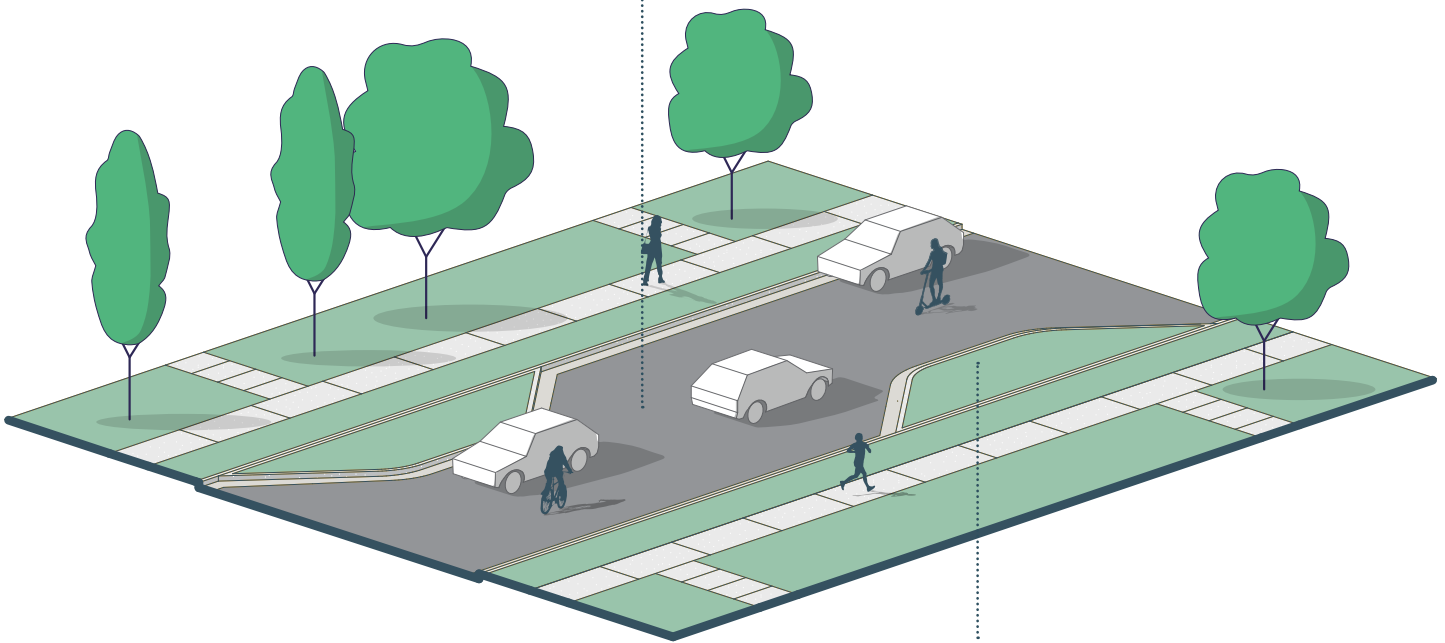
Lower
Speeds



Better
Visibility

S-CURVE

Forces motorists to steer back and forth between alternating objects to maintain a straight travel path



OBJECTS

Can be curb extensions, floating islands, or alternating parking lanes to define the S-Curve



Chicane through on-street parking in Boston, MA
Source: NACTO



Chicane designed to retain drainage
Source: FHWA via Google Street View



Chicane along 800 E in Salt Lake City, UT



Chicane on McClelland St in Salt Lake City, UT

DESIGN GUIDELINES

TYPICAL USES

- As a traffic calming treatment option along a mid-block section of Neighborhood Byway
- Can be used on a one-lane and two-lane, two-way road
- Can be installed with urban (curb/gutter) or rural (ditch) contexts
- Chicanes could include stormwater collection features

DESIGN FEATURES

- Integrate trees/landscaping to improve aesthetics
- On wider streets, bicycle bypasses in one or both directions could be added to the outside
- Mountable curbs may be desirable for the curb extensions (if used)

FURTHER CONSIDERATIONS

- The turning needs of larger motor vehicles, such as school buses or emergency vehicles, may need to be considered through the chicane
- Curb extensions (if used) must be designed to provide adequate drainage. Floating islands may be used to maintain existing drainage
- Not a good location to include crosswalks as motorists should be only concerned with horizontal deflection
- May impact on-street parking if curb extensions displace parking

REFERENCES

- [NACTO Urban Bikeway Design Guide](#)
- [FHWA Traffic Calming e-Primer](#)

ONE-WAY DIVERTERS

ONE-WAY DIVERTERS also known as “half closures” block motor vehicle travel in one direction while preserving two-way bicyclist access. This treatment may help reduce the number vehicles traveling along the Byway where they exceed target volumes.



Continuous Travel



Increased Awareness



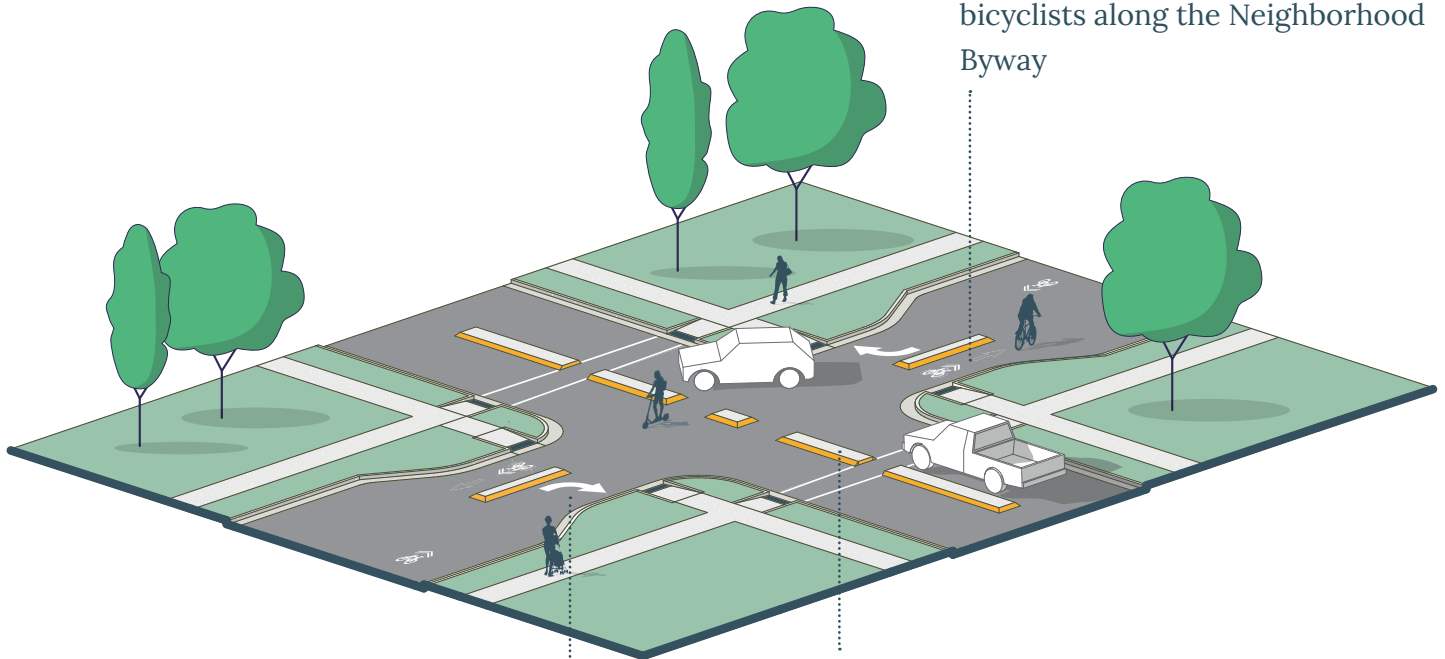
Improved Crossings



Lower Speeds

CONTRA FLOW BICYCLE ACCESS

Designs include an obvious entry supported by signage for bicyclists along the Neighborhood Byway

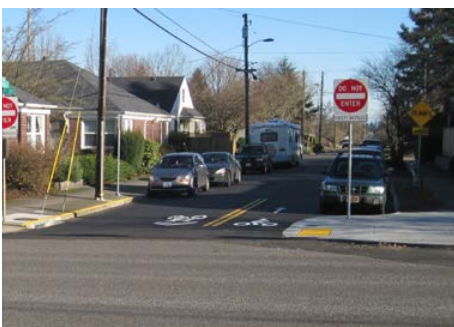


ONE-WAY FOR MOTORISTS

The Neighborhood Byway intersection is narrowed to allow for only exiting motor vehicle traffic

OPTIONAL MEDIAN

An optional median can reinforce traffic turning restrictions and improve crossing safety for pedestrians and bicyclists



Curb extension variant in Portland



Channelizing island variant in Minneapolis



Channelizing island variant in Minneapolis

Source: Twin City Sidewalks Blog



Partial traffic diverter in Vancouver BC

DESIGN GUIDELINES

TYPICAL USES

- Along Byways at local streets/collectors or minor arterial intersections
- Where motor vehicle volume reduction may be desirable to meet thresholds
- To increase comfort and bicycle priority along the Neighborhood Byway

DESIGN FEATURES

- Crosswalk markings will depend on context
- The island or curb extension may be partially or fully mountable if needed at constrained intersections
- May be combined with an optional median diverter on the major street to further physically restrict motor vehicle access
- Integrate trees/landscaping to improve aesthetics

- May include a large curb extension or a median island to channelize entering bicyclists and exiting motor vehicles
- Should be long and wide enough to deter illegal motor vehicle entry maneuvers with a length as long as or longer than a typical motor vehicle
- Pedestrian exposure crossing in front of the closure is reduced
- Emergency response vehicles can maneuver around a one-way diverter when responding to an emergency
- Islands and curb returns should be designed to accommodate snowplow blades

FURTHER CONSIDERATIONS

- Motorists may not fully comply with restrictions. Consider width of opening and type of access in design
- May shift traffic to adjacent streets

REFERENCES

- [NACTO Urban Street Design Guide](#)
- [FHWA Traffic Calming e-Primer](#)

DIAGONAL DIVERTERS

DIAGONAL DIVERTERS may be placed at a local/local four-way intersection and require all motor vehicle traffic to turn, while allowing bicyclist and pedestrian through movements. This treatment creates two smaller unconnected intersections.



Continuous Travel



Increased Awareness



Improved Crossings



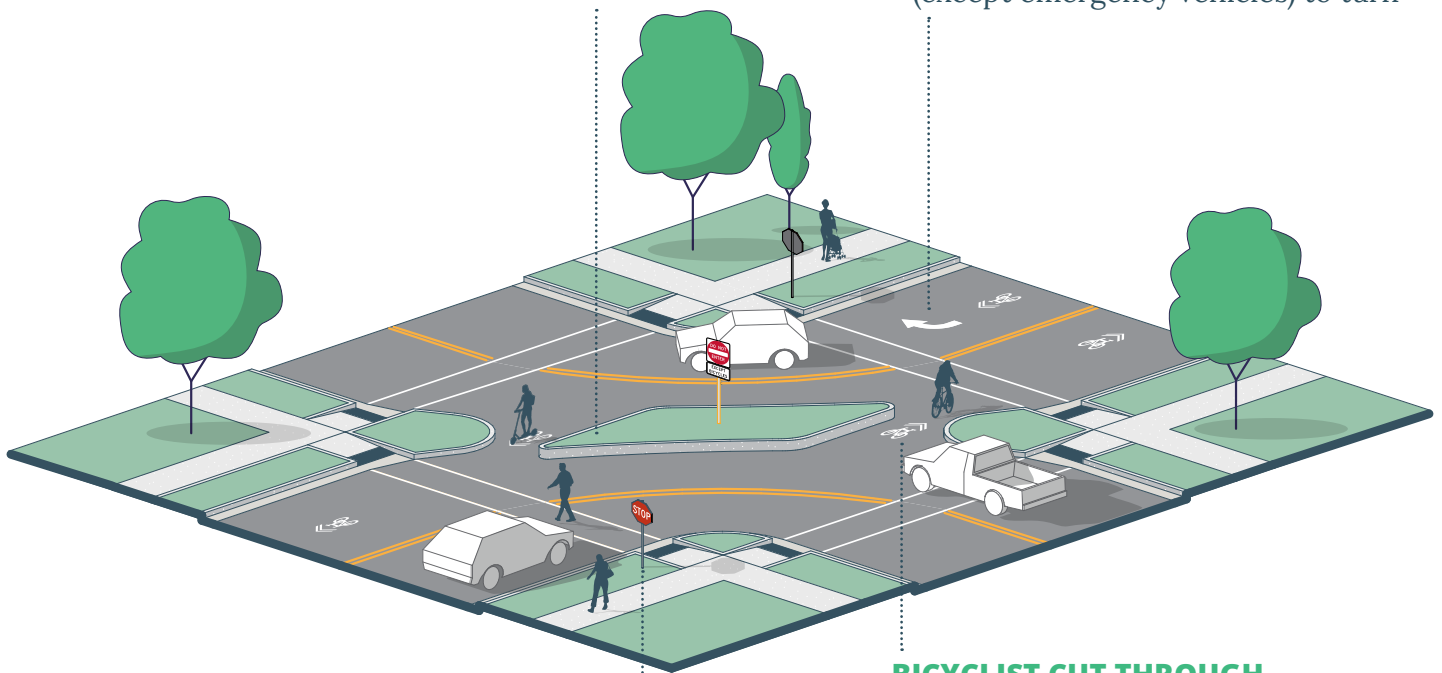
Lower Speeds

PLACEMAKING

Adds opportunities for neighborhood placemaking and landscaping

FORCED TURN FOR MOTORISTS

Diverter forces all motor vehicle traffic (except emergency vehicles) to turn



SIGNAGE

Recommend stop control on approach to the turn for motor vehicles

BICYCLIST CUT THROUGH

Cut through should be in line with the natural path of a bicyclist



Diagonal diverter in Madison, WI
Source: NACTO



Diagonal diverter in Portland, OR



Diagonal diverter in Berkeley, CA



Diagonal diverter at Roosevelt Ave and Channing Way in Berkeley, CA

DESIGN GUIDELINES

TYPICAL USES

- Along Neighborhood Byways at local street/local street intersections with sufficient width
- At intersections of two Neighborhood Byways where traffic diversion is desirable
- Where motor vehicle volume reduction may be desirable to meet thresholds
- To increase comfort and bicycle priority along the Neighborhood Byway
- Integrate trees/landscaping to improve aesthetics
- May include a large curb extension or a median island to channelize entering bicyclists and exiting motor vehicles
- Bike access channels may be designed to be traversable by emergency response vehicles

DESIGN FEATURES

- Crosswalk markings (if provided) will depend on context
- Bicycle cut-throughs may be directional on the sides or central in the middle
- Stop controlled approaches recommended in all directions for neighborhood safety

FURTHER CONSIDERATIONS

- Bicyclist access through the diagonal diverter can be level with or ramped to the pavement
- May shift traffic to adjacent streets
- Diverter reduces overall network connectivity for motor vehicles

REFERENCES

- [NACTO Urban Street Design Guide](#)
- [FHWA Traffic Calming e-Primer](#)

PRIORITIZING BYWAY TRAFFIC CALMING IMPROVEMENTS

Traffic calming along Neighborhood Byways are typically composed of a series of coordinated improvements to maintain comfortable traffic speeds for target byway users including bicyclists and pedestrians. Neighborhood Byway projects may necessitate a phased implementation approach or value engineering to bring costs within available budgets. The following general strategy for prioritizing Neighborhood Byway treatments can be useful to project managers and decision-makers.

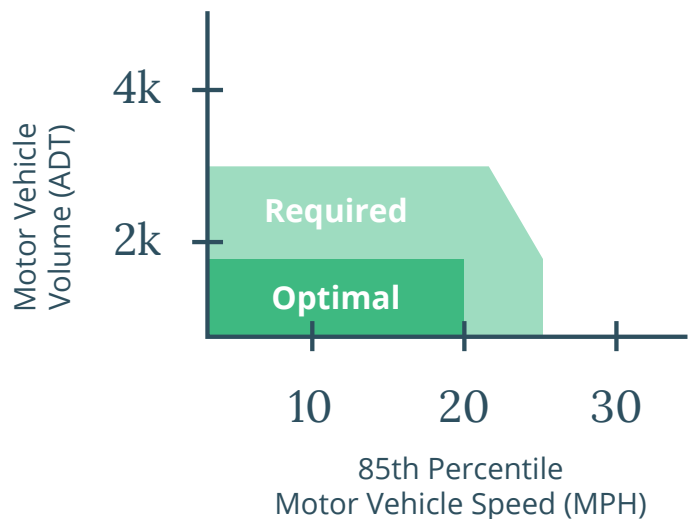
HIGH-PRIORITY NEIGHBORHOOD BYWAY TRAFFIC CALMING TREATMENTS

High priority traffic calming improvements should include the essential infrastructure intended to address traffic speeds and volumes that are beyond the maximum thresholds required for Neighborhood Byway designation. This would include any improvements that address areas of the corridor that exhibit 85th percentile speeds above 25 mph or traffic volumes above 3,000 ADT.

SECONDARY PRIORITY NEIGHBORHOOD BYWAY TRAFFIC CALMING TREATMENTS

Secondary priority traffic calming improvements, while beneficial, are not essential to achieving the vision of Neighborhood Byways. Traffic calming improvements that would reduce traffic speeds or volumes that are already operating within the “required” range would constitute a secondary priority. Within this secondary tier of priorities, more costly improvements that impact drainage or other utilities may be good candidates for value engineering or later phasing.

NEIGHBORHOOD BYWAY SPEED AND VOLUMES PARAMETERS



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CONCLUSION

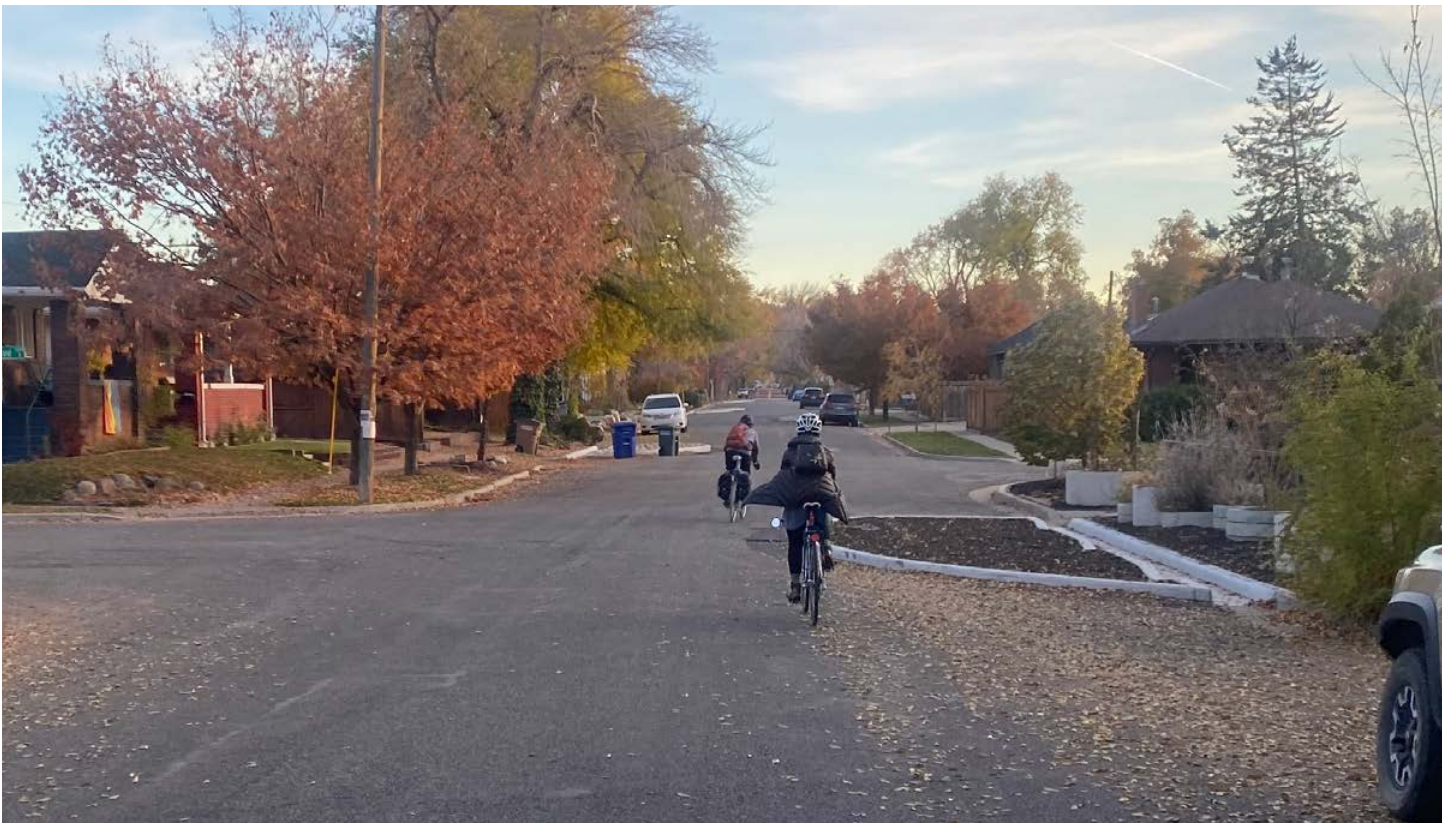


CONCLUSION

A LIVING DOCUMENT

The Salt Lake City Neighborhood Byways Guide should be a living document that is updated periodically to reflect the evolution of the City's Neighborhood Byway network. This may include updates that respond to new information and lessons-learned on a variety of topics such as maintenance, user comfort, safety, and changes to national standards and guidance documents.

This document also specifies best practices for collecting pre- and post-implementation data. These findings should also inform future updates to this guide that promote proven infrastructure strategies that will best achieve the goals of Salt Lake City's Neighborhood Byway program.



Chicanes along the 800 E Neighborhood Byway