



## I-45 North Houston Highway Improvement Project

# PEDESTRIAN & BICYCLIST ACCOMMODATIONS



The North Houston Highway Improvement Project (NHHIP) project provides a once in a lifetime opportunity to expand the walkability and connectivity of our great city. Through close coordination with local agencies and stakeholders, the project has evolved into a network of existing and future trails, bike paths, enhanced bridges that encourage multimodal transportation.

The Texas Department of Transportation (TxDOT) consulted with the Texas A&M Transportation Institute (TTI) and developed a design toolbox of bicycle and pedestrian improvement options for the NHHIP. These options are safe, accessible and comfortable accommodations for bicyclists and pedestrians. The design for particular locations will be developed and refined at the detail design phase to address site specific conditions. Artistic renderings and real world examples are not drawn to scale and are provided to illustrate what implementation of the options could look like.

## Pedestrian and Bicycle Improvement Options

### One-way Elevated Bike Lanes

A one-way elevated bike lane is separated by a curb from the vehicular lane and is typically elevated to curb/sidewalk height to provide the bicyclist a level of comfort typically on higher volume and speed roadways in an urban or suburban setting. Simply put, they are much like sidewalks for bikes.

They protect cyclists from vehicular traffic by separating and elevating the bike lane above and away from the road. One-way elevated bike lanes provide a safe and convenient path for riders of all skill levels. The sidewalks and off street bike lanes can add visual appeal to our streets, promote multimodal travel, and encourage healthy lifestyles. A one-way elevated bike lane is consistent with the City of Houston Bike Plan<sup>1</sup> and complies with ADA standards as well.

### Details on Elevated Bike Lanes

The purpose of elevated one-way bike lanes is for bicyclists and motor vehicles to travel safely on separate byways.

A variety of factors are used to determine the best approach, including roadway functional class (which incorporates traffic volume), number of lanes, design speed, land use, intersection density, driveway density, local context, and site specific constraints.

Illustrations provide examples of one-way elevated bike lanes and are not drawn to scale. Additional dimensions are presented for specific facility types, and these parameters may change based on local context and site specific constraints.



Artistic rendering depicts one-way elevated bike lane behind the curb with buffer between pedestrians and bikes, allowing for tree plantings. Illustration is not to scale and is subject to change.

*Not every option is available and each one requires specific conditions be present to make it feasible.*

<sup>1</sup> Houston Bike Plan, Chapter 4. Bike ToolBox page 4.8, Figure 4.5: Facility Decision Tree For Street Right-of-way Bike Flowchart: "Consideration should be given to designating side paths as one-way bikeways and providing them on both sides of a street corridor."

Benefits

- The curb separates pedestrians and bicyclists from high vehicle speeds and volume.
- Pedestrian and bicyclist paths are separated with pavement markings to reduce conflicts. The paths are traversable and allow for passing.
- Used by bicyclists of all experience levels.
- Potentially fewer conflicts with side streets and driveways, because it is a one-way bike lane in the same direction as vehicular traffic.
- Consistent with the City of Houston Vulnerable Roadway User Ordinance (3' Passing Law).
- Consistent with City of Houston Bike Plan.<sup>2</sup>
- Reduced debris because the facility is raised.
- Less ponding and flooding, because the bike facility is elevated and slope of facility helps with runoff.
- Fewer potholes due to no wear and tear from vehicular traffic.



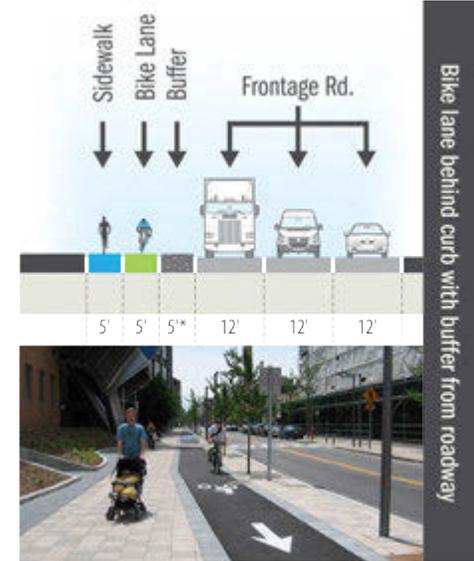
The NHHIP project will connect pedestrian and bike paths under, over and across highways creating a safer environment that encourages walking and biking.

Off-street bike paths and sidewalks at underpasses improve mobility by creating a comfortable and convenient path that maintains connectivity across highways while eliminating potential conflicts with vehicular traffic under lower light conditions.

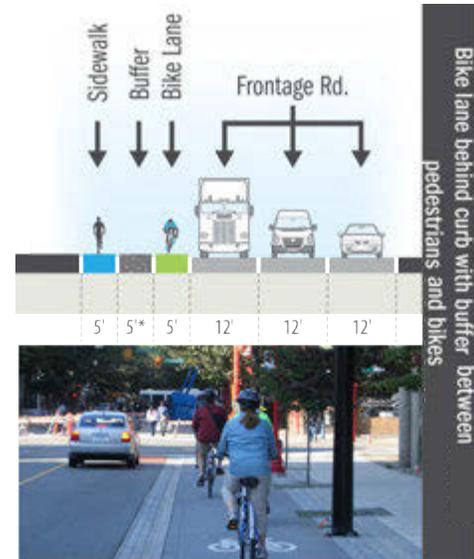


Artistic rendering depicts Southmore Blvd. across SH 288 and separate pedestrian/cyclist byway.

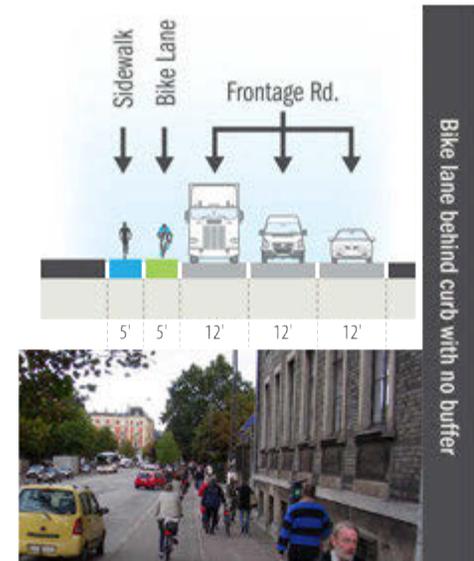
<sup>2</sup> Houston Bike Plan, Chapter 4. Bike ToolBox page 4.8, Figure 4.5: Facility Decision Tree For Street Right-of-way Bike Flowchart: "Consideration should be given to designating side paths as one-way bikeways and providing them on both sides of a street corridor."



Cambridge, Massachusetts: Real world example Source: FHWA Separated Bike Lane Planning Design.



Vancouver, Canada: Real-world example Source: www.pedbikeimages.org Carl Sundstrom.

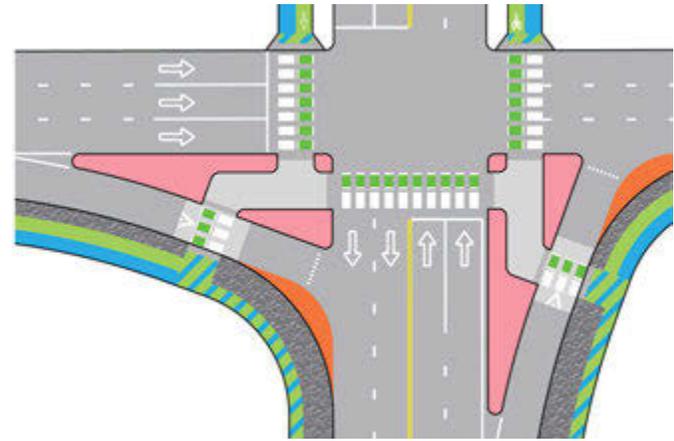


Copenhagen, Denmark: Real-word example Denmark Source: www.pedbikeimages.org, Ryan

## Intersection Improvements

At some point during a trip, pedestrians and bicyclists are all bound to cross an intersection. Intersections are where turning motorists, pedestrians and bicyclists merge. Conflicts between the different roadway users can occur, because vehicles are looking for other oncoming vehicles and gaps in traffic, not for bicyclists and pedestrians. Therefore, design features need to be implemented for each user type.

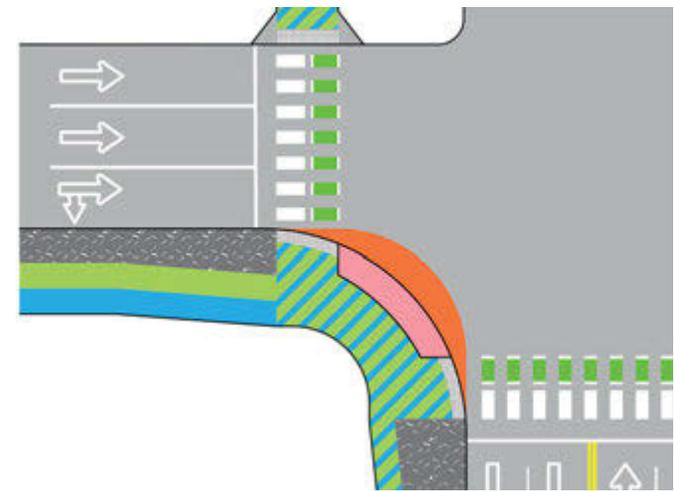
TxDOT, in coordination with TTI, identified best practices for intersection improvements. Three areas of opportunity have been identified to enhance pedestrian and bicyclists safety: visibility, reduced vehicle speeds, and shorter road crossings.



Example of major intersection with off-street bike path and buffer (additional “smart-right” turn lanes with truck aprons, raised crosswalks, and islands).

## Visibility and Shorter Crossings

Increased visibility puts pedestrians and bicyclists in a more prominent view to motorists. Improving visibility between drivers, pedestrians and bicyclists may require additional pavement markings that are retroreflective. This increases visibility under all conditions and raises awareness for both people and motorists while helping pedestrian and bicyclist movements be more predictable at intersections.



Example of ‘T’ intersection with off-street bike path and buffer (additional “smart-right” turn lanes with truck aprons).

Enhanced highly visible crosswalks:

- Crosswalks will be well marked for contrast with retroreflective material that provides visibility in low light and at night. High visibility crosswalk markings provide additional information showing where drivers should expect to see people walking under all types of visibility conditions.
- Signalized crosswalks should be marked per the Texas Manual on Uniform Traffic Control Devices (TMUTCD).<sup>3</sup>
- Ladder style marked crosswalks are an example of highly visible pavement markings that alert drivers to watch out for pedestrians and bicyclists crossing the road by making the crosswalk more visible to motorists.

Protective islands of pedestrian refuge:

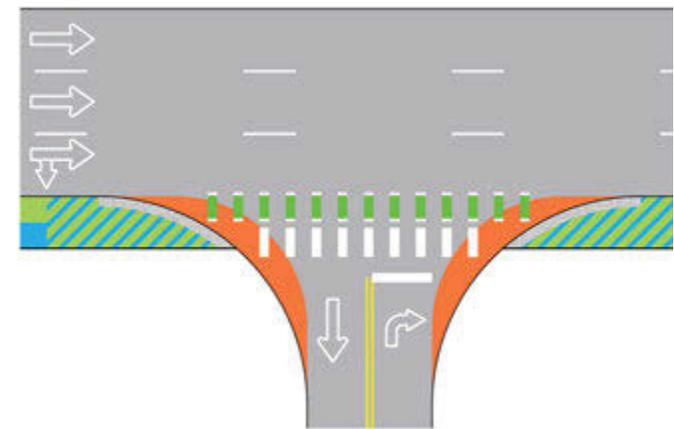
- Reduce crossing distance for pedestrians.
- Increase waiting space to accommodate both pedestrians and bicyclists.
- Can have the shared bike lane/sidewalk only on one side of roadway to reduce overall right of way requirements, but is less convenient and accessible to people on the opposite side of the roadway.

Wider crosswalks that accommodate both pedestrians & cyclists:

- When applicable at protective islands, a pedestrian crosswalk is raised to sidewalk height. This indicates the priority of path travel over turning vehicles and reminds drivers to reduce speed.

Yield for pedestrians:

- Advanced yield line pavement markings are an example of markings that reinforce the need for drivers to reduce speed when approaching crosswalks and to stop for pedestrians. Pedestrians have the right of way to cross, and drivers must yield the right of way to pedestrians.



Example of minor street crossings: ‘T’ intersection with off-street bike path and buffer.



<sup>3</sup> City of Houston Pedestrian and Bicycle Road Safety Audit, conducted January 28-February 1, 2019 at the request of City of Houston, facilitated by the Safety and Traffic Operations Specialists FHWA Texas Division and the Transportation Specialist FHWA Resource Center Safety and Design Technical Service Team.

### Slow Down Turning Vehicles

For vehicles, narrower turns equal slower speeds.

**Curb radius reduction:**

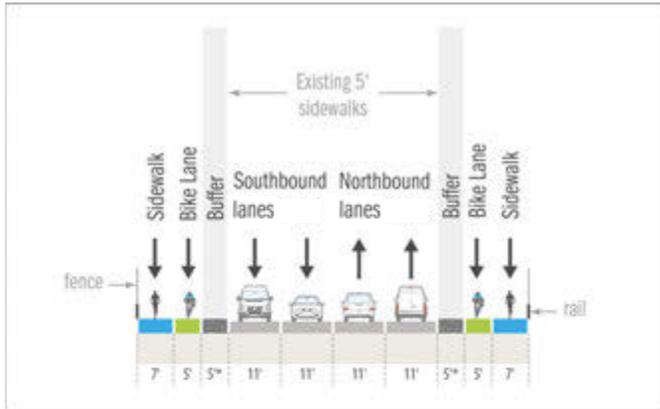
A reduced curb radius forces cars to make these narrower turns and to slow down significantly.

- Right turning motorists face forward as they are crossing the pedestrian path. This positions motorists to see non-motorists more easily and consistently.

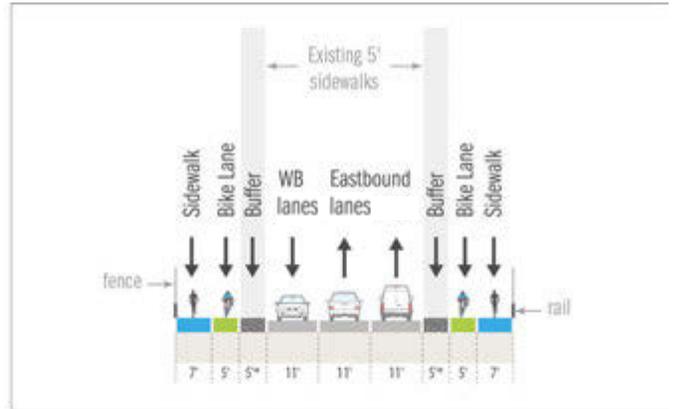
**Truck Aprons:**

Mountable area for oversized vehicles, like trucks and buses, that provides the additional space required for them to turn safely. Truck aprons are located between the road and the sidewalk curb.

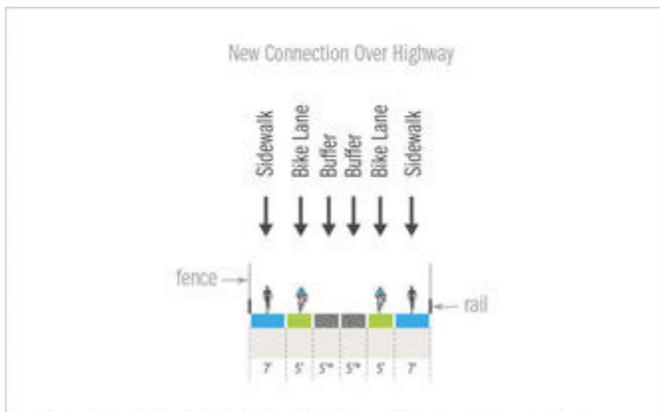
- The truck apron's footprint directs drivers of smaller vehicles to avoid the truck apron area, forcing vehicles to make narrower turns that slow them down.
- They position motorists to see non-motorists more easily and consistently.



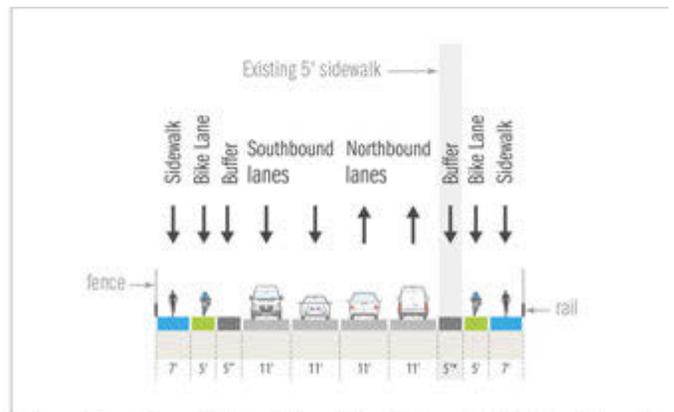
Main Street from Wentworth Street to Blodgett Street looking north.



Tuam Street from Hamilton Street to Chartres Street looking eastward.



Andrews Street from Heiner Street to Pease Street looking eastward.



Quitman Street from IH-45 southbound frontage road to IH-45 northbound frontage road looking eastward.

### Examples of Pedestrian and Bicyclist Facility Improvements in NHHIP Segment 3

TxDOT has collaborated with the City of Houston's Planning and Development Department and Public Works Department on nearly 45 cross streets that will either go over or under the highways around Downtown. The close coordination and collaboration show how the concepts described are being applied to specific situations and locations. The improvements below, although tailored specifically to each cross street, are examples of the kind of safe, accessible and high comfort pedestrian and bicycle accommodations proposed along the NHHIP project.

TxDOT will engage in the same collaborative effort to identify pedestrian and bike facility improvements to the cross streets in NHHIP Segments 1 and 2, which are along I-45 between Beltway 8 and I-10.

Content prepared and distributed by:

TxDOT Houston District  
7600 Washington Avenue  
Houston, TX 77007

To learn more about NHHIP, scan or click the QR code and watch the Change for the Better video.

