



MEMORANDUM

Date: November 17, 2014
To: David Anspacher, AICP
Organization: Montgomery County Planning Department
From: Lauren Kaufmann
Bill Schultheiss, PE
Toole Design Group
Re: Connecticut Avenue Cycle Track Conceptual Design

Toole Design Group (TDG) has developed two conceptual designs for the Connecticut Avenue Cycle Track between Manor Road and Chevy Chase Lake Drive.

Study Area

Connecticut Avenue will be a major connection point to the future Capital Crescent Trail. To accommodate this new connection point, as well as to serve the demand for bicycle access to the Connecticut Avenue Purple Line station and the new development anticipated as a result of the station, the 2013 Chevy Chase Lake Sector Plan recommends a shared-use path on the east side of Connecticut Avenue transitioning to a separate sidewalk and cycle track in the vicinity of the Connecticut Avenue Purple Line Station (between Chevy Chase Lake Drive and Manor Road). Separating bicycles and pedestrians in this area is important due to the substantial activity that is anticipated.

Cycle Tracks

A cycle track is a bicycle-only facility with physical separation from vehicular and pedestrian traffic. The physical separation greatly increases the comfort and safety for bicyclists compared to a bicycle lane or shared travel lane. Cycle tracks can operate in one or two directions and can be at street level, sidewalk level, or at a level in between the street and sidewalk. Vertical separation can include a curb, tree buffer, vegetated buffer, parking lane, or other form of vertical buffer. Cycle tracks are preferred over shared-use paths at locations with high pedestrian volumes to ensure bicyclist and pedestrian safety. The proposed Connecticut Avenue facility is a two-way cycle track on the east side of the roadway at sidewalk level, similar to those shown below.



Indianapolis, Indiana (from left to right): travel lanes, vegetated street buffer, two-way cycle track, landscaped buffer, sidewalk



Rotterdam, Netherlands (from left to right): travel lanes, tree and parking street buffer, two-way cycle track, tree or fence sidewalk buffer, sidewalk

Proposed Alternatives

The conceptual designs include a preferred alternative and a constrained alternative for the cycle track and buffers. The designs do not illustrate sidewalk widths.

Both Alternatives

The following features apply to both of the proposed alternatives:

- At the major intersections of Manor Road and Chevy Chase Lake Drive, which bound the study area to the north and south, the cycle track crosses at the roadway elevation.
- On the far side of the major intersections with Manor Road and Chevy Chase Lake Drive, the cycle track and sidewalk merge at a wayside to connect to the proposed shared-use paths to the north and south of the study area.



Newly Constructed Wayside; Columbia, Maryland

- At the minor intersections with the proposed redevelopment, the driveways have a raised crosswalk with the cycle track and sidewalk at sidewalk level.



Raised Crosswalk at Cycle Track and Sidewalk Crossing of Minor Roadway; Amsterdam, Netherlands

- A pedestrian crossing of Connecticut Avenue on the south side of Laird Place with a pedestrian signal, subject to approval by the Maryland State Highway Administration. A median refuge allows users to cross the street in two stages.



Median Refuge Island; Boulder, Colorado

- A paved connection in the sidewalk buffer on each side of the station provides bicycle access to the station. The northern connection is shared with pedestrians at the crosswalk. In the preferred and constrained alternatives, these connections provide space in the 6' buffer for bicyclists to wait to merge to or from the sidewalk.
- Fences in the sidewalk buffer improve pedestrian and bicycle safety at potential conflict points by channelizing pedestrian traffic at pedestrian crossings, bus stops, and at the Purple Line Station where pedestrians might otherwise overflow into the cycle track.
- The decision to locate a bus stop on the east side of Connecticut Avenue will be made by the bus operators. A design for a typical bus stop is provided in the event that a bus stop is desired.



Bus Stop with Shelter Adjacent to Cycle Track; Indianapolis, Indiana



Bus Stop with Shelter and Cycle Track Crosswalk; Rotterdam, Netherlands

- Green-colored pavement differentiates the cycle track from the sidewalk.



Green-Colored Pavement; Washington, DC

Preferred Alternative Only

The preferred alternative typical section includes a 6-foot tree street buffer (between the street and cycle track), a 12-foot two-way cycle track, and a 6-foot tree sidewalk buffer (between the cycle track and sidewalk). The typical bus stop includes a 34'x10' waiting area and a bus shelter.

Constrained Alternative Only

The preferred alternative typical section includes a 3-foot vegetated street buffer (between the street and cycle track), an 11-foot two-way cycle track, and a 6-foot tree sidewalk buffer (between the cycle track and sidewalk). The typical bus stop includes a 28'x8' waiting area. Reducing the typical dimensions of the cycle track below this alternative will severely limit its functionality, though reductions in the dimensions at the Purple Line Bridge, as discussed below, are acceptable.

Purple Line Bridge

As the cycle track passes underneath the Purple Line bridge, both the preferred and constrained alternatives would require changes to the station design and bicycle parking as detailed on the Preliminary Engineering Plans for the Purple Line Light Rail, dated October 2013. Given the anticipated high volumes of bicyclists and pedestrians, it is recommended the station be redesigned, shifting some elements to the east, to accommodate the preferred cycle track alternative.

In the event the station design does not change, a “Purple Line Bridge Very Constrained” option was developed for both alternatives to accommodate a narrow cycle track and sidewalk with minimal buffers. While this design would severely limit the function of the cycle track if applied along the entire alignment, for the short distance under the Purple Line bridge, it is acceptable. However, even with the Purple Line Bridge Very Constrained option, some of the bicycle parking at the station would need to be relocated.

The Purple Line Bridge Very Constrained option narrows the facility to a 3-foot hardscape street buffer, an 11-foot cycle track and a 3-foot hardscape sidewalk buffer with a fence to prevent pedestrian overflow into the cycle track.

Treatments – Benefits and Limitations

As described above, the proposed alternatives combine numerous treatments, each with their own benefits and limitations. The attached Treatments Matrix describes several of the treatments included in this conceptual design, including the benefits and limitations of each as they pertain to this location. These benefits and limitations should be considered when evaluating the alternatives.

Two-Way Cycle Tracks – Minimum Widths

Limited guidance exists in the United States presently regarding cycle track design; however, related guidance exists domestically for shared-use paths as well as strong cycle track design guidance from the Netherlands found in the CROW Manual. The following guidance was used to determine preferred and constrained widths:

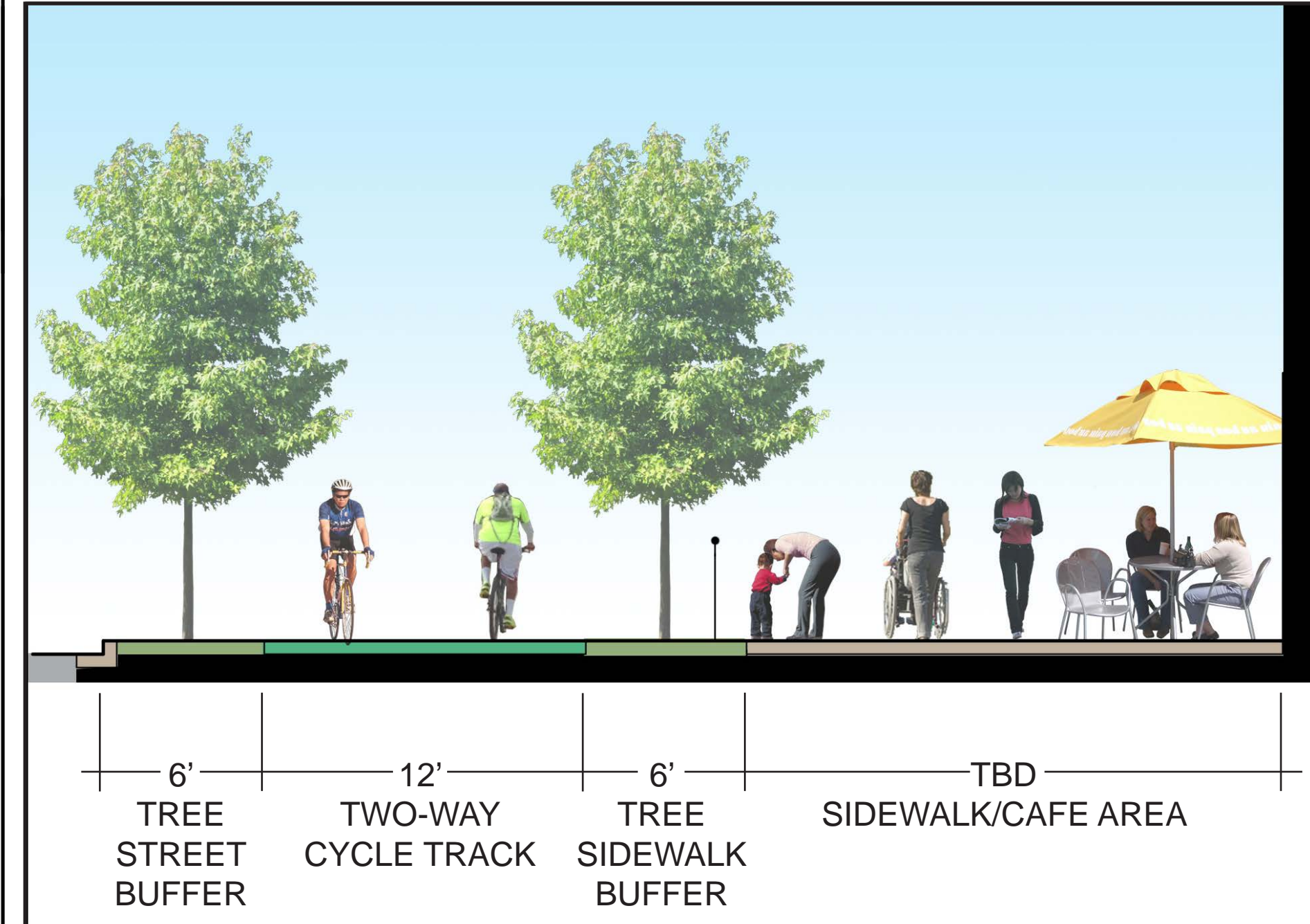
- The *2012 American Association of State Highway and Transportation Officials Guide for the Development of Bicycle Facilities* recommends a minimum 11-foot wide bi-directional shared-use path to allow bicyclists to pass one another while a bicyclist is traveling in the opposite direction.
- The *National Association of City Transportation Officials Urban Bikeway Design Guide* recommends a desirable width of 12’ and a minimum width of 8’ in constrained conditions.
- The *Dutch CROW Manual* recommends the following widths based on anticipated volume thresholds:
 - >150 bicyclists/hour = 12’ two-way cycle track
 - 50-150 bicyclists/hour = 10’ two-way cycle track
 - <50 bicyclists/hour = 8’ two-way cycle track

The planned urban context of the study area indicates that bicycle traffic is likely to exceed 150 bicyclists per hour after completion of the Purple Line and Capital Crescent Trail, full build-out of the Sector Plan area, the proximity to Downtown Bethesda, the National Institutes of Health and the Walter Reed National Military Medical Center, and the completion of the bikeway network in the vicinity of Chevy Chase Lake. Based on the surrounding land use, network connections, and existing and future ridership on the adjacent trail, the 12’ width is preferred.

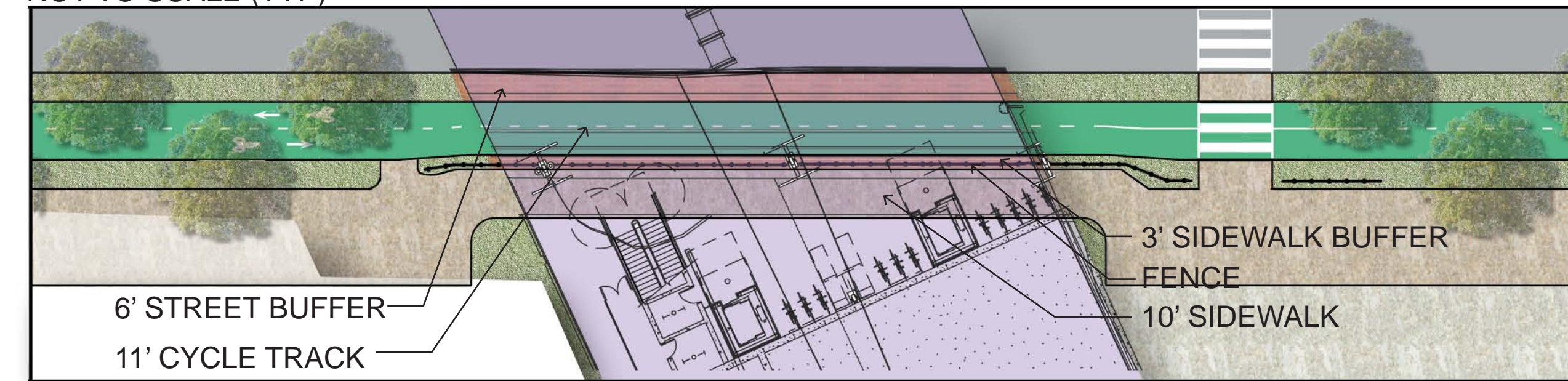
As such high bicycle traffic is anticipated, the 11’ cycle track is the minimum recommended width in the constrained alternative so that passing is possible.

For more information on the benefits and limitations of various cycle track widths, see the attached Treatments Matrix.

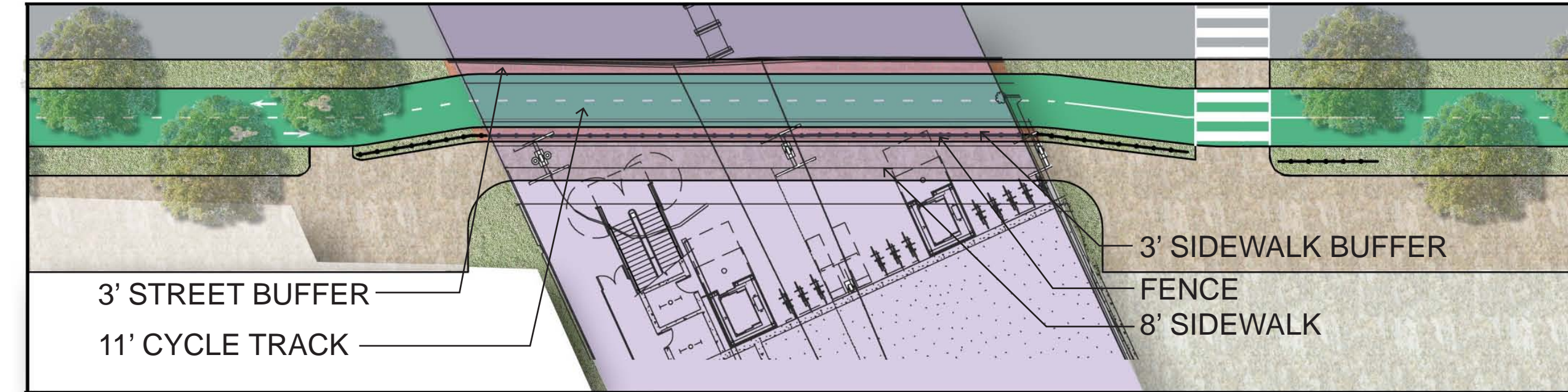
PREFERRED TYPICAL SECTION
NOT TO SCALE



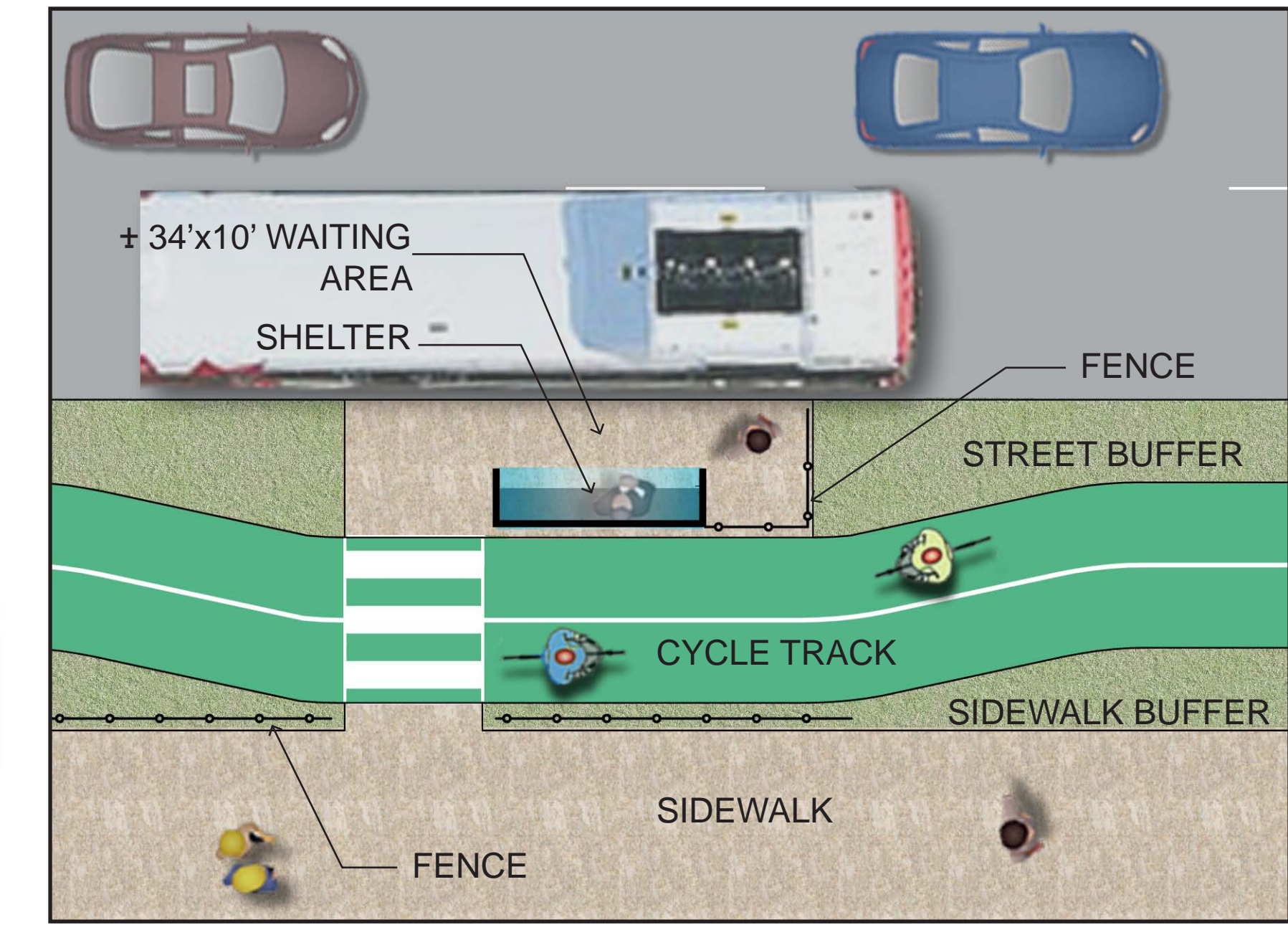
PURPLE LINE BRIDGE CONSTRAINED OPTION
NOT TO SCALE (TYP)



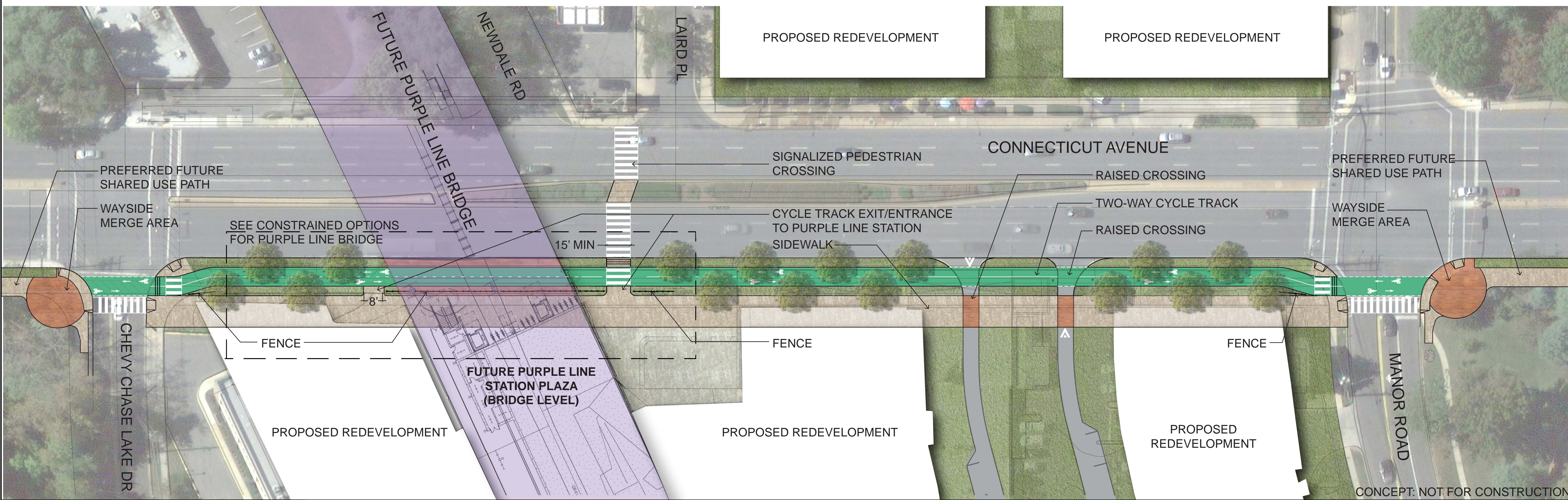
PURPLE LINE BRIDGE VERY CONSTRAINED OPTION
NOT TO SCALE



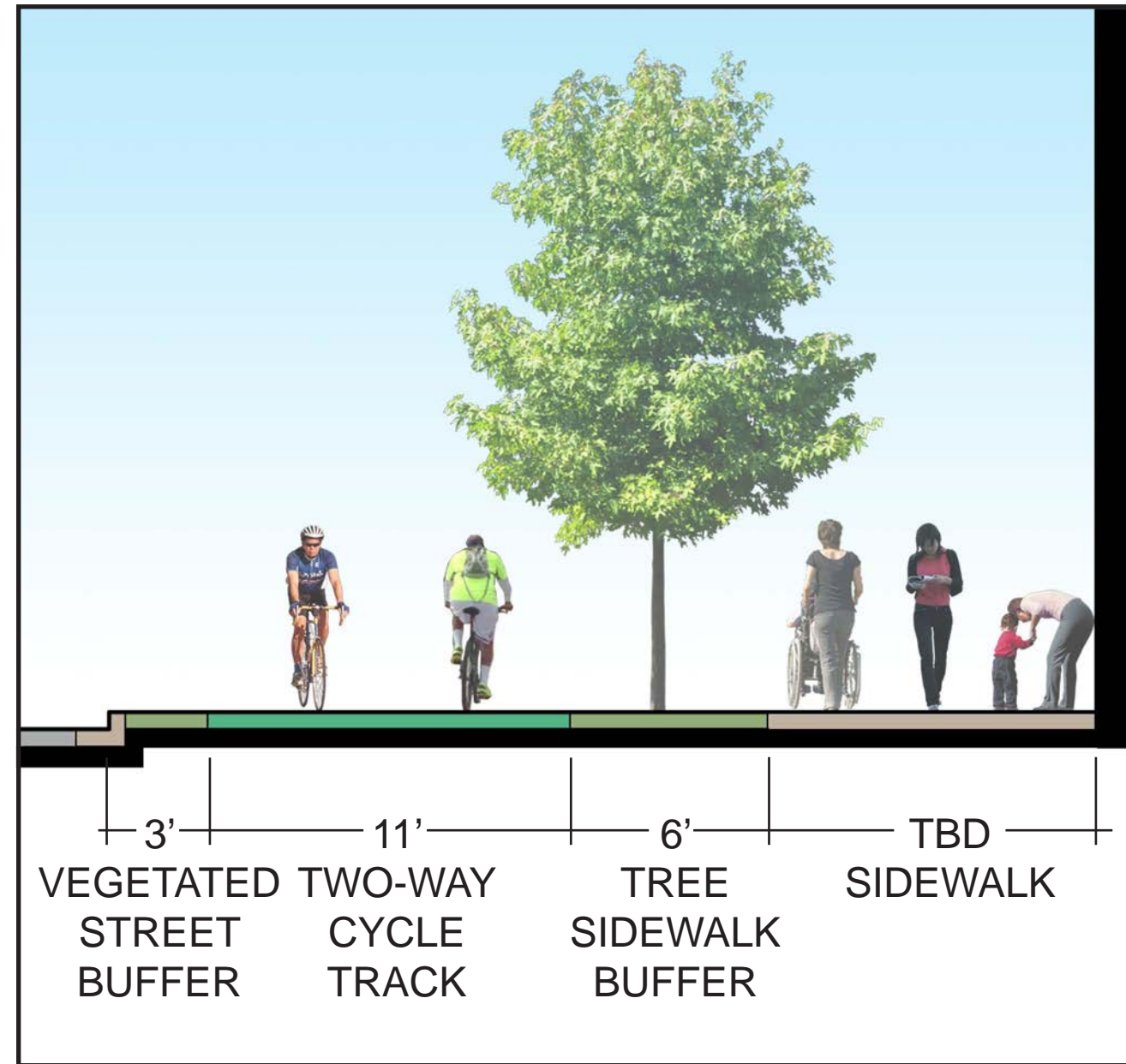
TYPICAL BUS STOP DETAIL
NOT TO SCALE



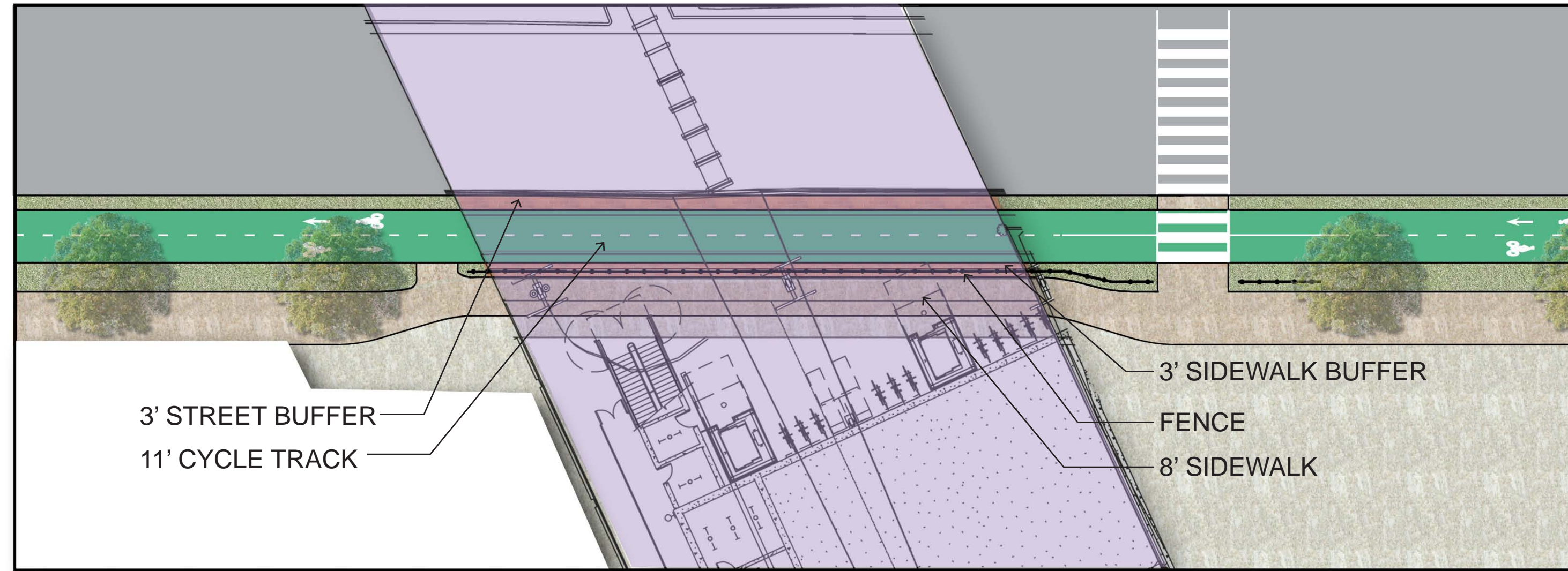
PREFERRED ALTERNATIVE



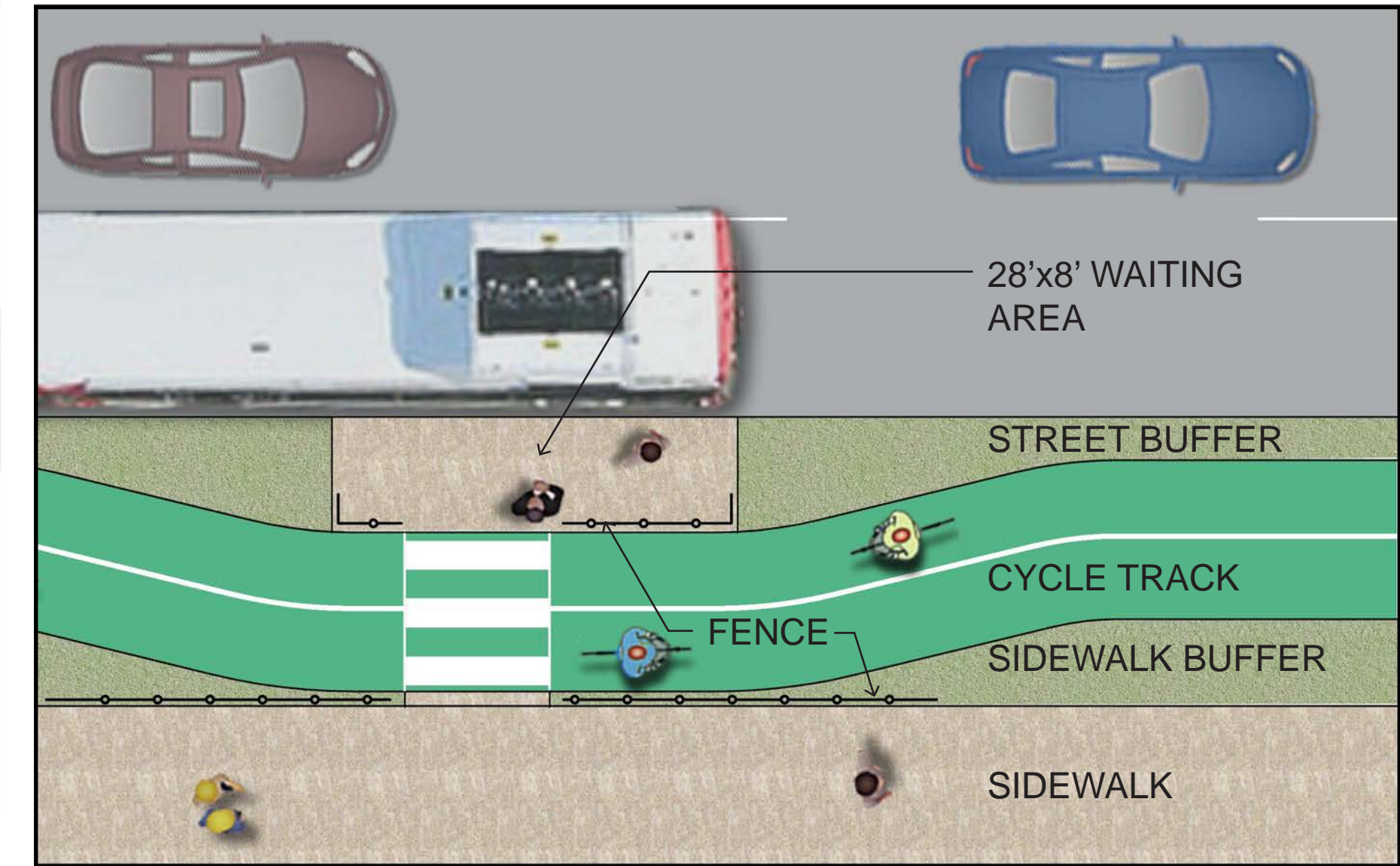
CONSTRAINED TYPICAL SECTION
NOT TO SCALE



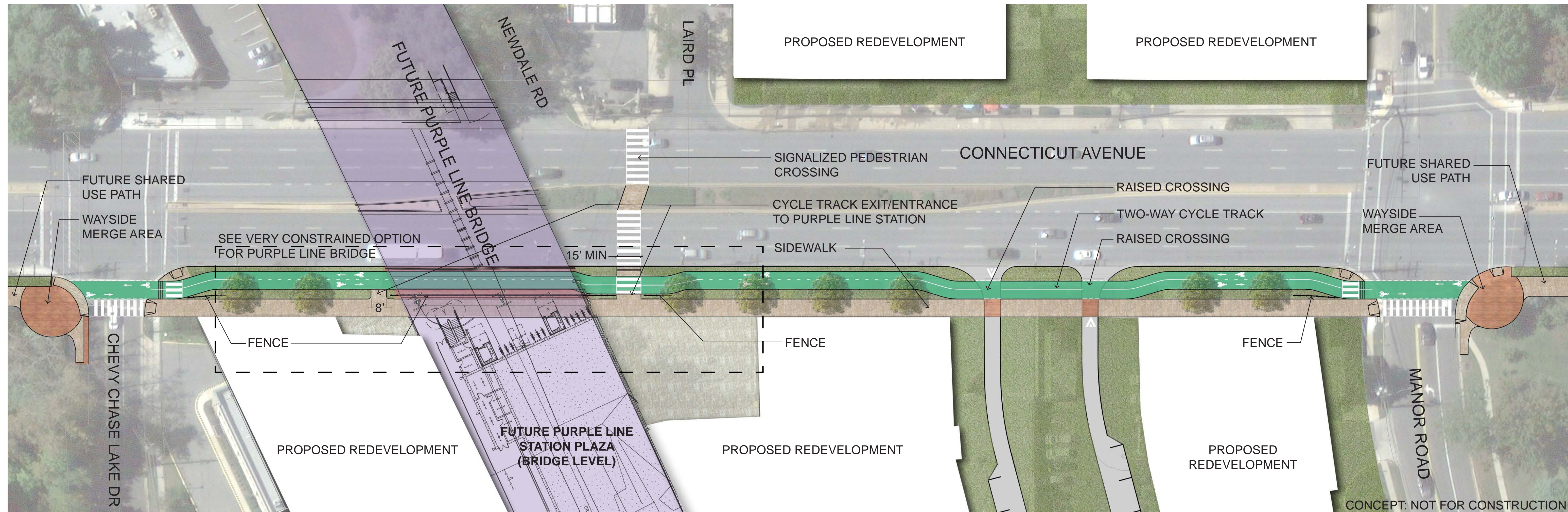
PURPLE LINE BRIDGE VERY CONSTRAINED OPTION
NOT TO SCALE



TYPICAL BUS STOP DETAIL
NOT TO SCALE



CONSTRAINED ALTERNATIVE



Cycle Track Design Treatments Matrix

Cycle Track Widths			
Treatment	Description	Benefits	Limitations
12' Two-Way Cycle Track	<ul style="list-style-type: none"> Per the Dutch CROW Manual, 12' width is suitable where bicycle traffic exceeds 150 bicycles per hour on a two-way facility. Per the NACTO Urban Bikeway Design Guide, 12' is the desirable width of a two-way cycle track. A 12' two-way cycle track is suitable (preferred width) for a new facility with moderate to high anticipated bicycle traffic. 	<ul style="list-style-type: none"> Increases comfort for bicyclists, particularly in locations with high bicycle traffic. Allows cyclists to pass one another while one cyclist is traveling in the opposite direction. 	<ul style="list-style-type: none"> Requires additional width. May not be feasible for retrofits in very constrained conditions.
11' Two-Way Cycle Track	<ul style="list-style-type: none"> Per the AASHTO Guide for the Development of Bicycle Facilities, 11' is the recommended minimum width of a shared-use path to allow passing. An 11' two-way cycle track is a suitable minimum (constrained width) for a new facility with low to moderate anticipated bicycle traffic. 	<ul style="list-style-type: none"> Allows cyclists to pass one another while one cyclist is traveling in the opposite direction. 	<ul style="list-style-type: none"> Requires additional width. May not be feasible for retrofits in very constrained conditions. Less comfortable than a 12' two-way cycle track, particularly in locations with high bicycle traffic.
10' Two-Way Cycle Track	<ul style="list-style-type: none"> Per the Dutch CROW Manual, 10' width is suitable where bicycle traffic is 50 to 150 bicycles per hour on a two-way facility. Per the AASHTO Guide for the Development of Bicycle Facilities, 10' is the recommended minimum width of a shared-use path. A 10' two-way cycle track is suitable for a retrofit. 	<ul style="list-style-type: none"> Most suitable for retrofits where available width is minimal. Increases comfort for bicyclists compared to an 8' cycle track, particularly in locations with moderate bicycle traffic. 	<ul style="list-style-type: none"> May not be feasible for retrofits in very constrained conditions. Does not allow cyclists to pass one another while one cyclist is traveling in the opposite direction. Less comfortable than an 11' or 12' two-way cycle track, particularly in locations with high bicycle traffic.
8' Two-Way Cycle Track	<ul style="list-style-type: none"> Per the Dutch CROW Manual, 8' width is suitable where bicycle traffic is less than 50 bicycles per hour on a two-way facility. Per the NACTO Urban Bikeway Design Guide, 8' is the recommended minimum width of a two-way cycle track in constrained conditions. An 8' two-way cycle track is a suitable minimum for a retrofit in constrained conditions or with very low anticipated bicycle traffic based on surrounding land use, alternate bicycle facilities, and existing and future bicycle connections. 	<ul style="list-style-type: none"> Can be accommodated in very constrained conditions. Is suitable in locations with very low bicycle traffic. 	<ul style="list-style-type: none"> Does not allow cyclists to pass one another while one cyclist is traveling in the opposite direction. Significantly less comfortable than a wider cycle track, particularly in conditions with moderate to high bicycle traffic.

Cycle Track Design Treatments Matrix

<i>Buffers</i>			
Treatment	Description	Benefits	Limitations
6' Tree Buffer (Sidewalk or Street)	A 6' wide buffer can contain ornamental street trees in tree boxes. Laterally, between trees, the buffer may be vegetated with a low-growing vegetation. This can serve as a street buffer or a sidewalk buffer or both.	<ul style="list-style-type: none"> • Provides additional shade for cycle track and sidewalk. • As a sidewalk buffer, reduces likelihood that pedestrians will overflow onto cycle track, reducing potential conflicts between modes. • As a sidewalk buffer, increases pedestrian comfort with additional separation from faster-moving cyclists. • As a street buffer, trees can visually reduce the width of the street, which may slow vehicular speeds. • As a street buffer, increases bicycle comfort with additional separation from faster-moving motor vehicles. • As a street buffer where there is a parking lane, reduces likelihood of "dooring" incidents, where a parked car door opens into the cycle track and conflicts with cyclists. 	<ul style="list-style-type: none"> • Requires additional width.
3' Vegetated Buffer (Sidewalk or Street)	A 3' wide buffer can contain low-growing vegetation. This can serve as a street buffer or a sidewalk buffer or both.	<ul style="list-style-type: none"> • As a sidewalk buffer, reduces likelihood that pedestrians will overflow onto cycle track compared to a narrower buffer, reducing potential conflicts between modes. • As a sidewalk buffer, increases pedestrian comfort with additional separation from faster-moving cyclists compared to a narrower buffer. • As a street buffer, increases bicycle comfort with additional separation from faster-moving motor vehicles compared to a narrower buffer. • As a street buffer where there is a parking lane, 3' is the minimum buffer width to reduce "dooring" incidents. 	<ul style="list-style-type: none"> • Provides less comfortable buffer than 6' tree buffer. • Reduces shade, particularly as a sidewalk buffer. • As a street buffer, does not visually reduce the width of the street to slow vehicular speeds.
6" to 2' Buffer with Elevation Difference	The cycle track may be set at an intermediate level between the roadway and the sidewalk to improve comfort and to minimize pedestrian activity within the cycle track with a narrow buffer, or at street level with a raised street buffer. A 6" buffer is the minimum width for a curb buffering the street or sidewalk from the cycle track.	<ul style="list-style-type: none"> • Reduces the necessary width of the buffer in constrained locations. 	<ul style="list-style-type: none"> • Provides a significantly less comfortable buffer. • Reduces shade, particularly as a sidewalk buffer. • As a sidewalk buffer, pedestrians may be more likely to overflow into the cycle track if the sidewalk is crowded, increasing conflicts between bicyclists and pedestrians. • As a street buffer, does not visually reduce the width of the street to slow vehicular speeds. • As a street buffer where there is a parking lane, can increase "dooring" incidents.
<i>Bus Stops</i>			
Treatment	Description	Benefits	Limitations
Larger Bus Stop	Includes two landing areas for front and rear bus doors and bus shelter.	<ul style="list-style-type: none"> • Provides increased area for transit riders to wait and maneuver reduces likelihood of pedestrians overflowing into cycle track. • Bus shelter provides protection from wind and rain. 	<ul style="list-style-type: none"> • Requires additional width.
Smaller Bus Stop	Includes two landing areas for front and rear bus doors.	<ul style="list-style-type: none"> • Requires minimal width. 	<ul style="list-style-type: none"> • Limited area for transit riders to wait and circulate, potentially causing pedestrian overflow onto cycle track and conflicts between pedestrians and bicyclists. • Size is not adequate to provide bus shelter.

Cycle Track Design Treatments Matrix

<i>Crossing Treatments</i>			
Treatment	Description	Benefits	Limitations
Raised Crossing	This traffic-calming device extends the sidewalk and cycle track across the roadway at sidewalk level at an intersection.	<ul style="list-style-type: none"> • Reduces vehicular speeds at the crossing which can reduce number and severity of crashes and increase comfort for bicyclists and pedestrians. • Improves accessibility for pedestrians and comfort for cyclists by avoiding the need for a curb ramp. • Prioritizes pedestrians and bicyclists at minor roadway crossings. • May cue motorists to look for bicyclists in both directions. 	<ul style="list-style-type: none"> • Not feasible on arterial or collector streets with high volumes or posted speeds greater than 30 mph.
Pedestrian Signal	A pedestrian signal, or half signal, signalizes the major roadway but not the minor roadway at an intersection or midblock to facilitate pedestrian crossings. Both a pedestrian signal head and bicycle signal head is recommended. This can be designed to be visible at locations adjacent to a bridge by mounting signal at a height of 7 to 10 feet or placement of an actuated RED SIGNAL AHEAD warning sign in advance of the approach with a limited view.	<ul style="list-style-type: none"> • Provides a controlled pedestrian crossing to reduce potential conflicts or risk-taking behavior where a traffic signal is not warranted based on vehicular volumes. • Can be coordinated with nearby signals and only operate when actuated by a pedestrian or bicyclist (passive detection preferred) to reduce impacts to vehicular traffic flow on the major roadway. 	<ul style="list-style-type: none"> • May cause confusion for motorists on side street.
Median Refuge Island	This raised median island provides a refuge for pedestrians and bicyclists crossing Connecticut Avenue.	<ul style="list-style-type: none"> • Shortens crossing distance for bicyclists and pedestrians and allows these users to cross in two stages. • Increases comfort for bicyclists and pedestrians when crossing multi-lane roadways. 	<ul style="list-style-type: none"> • Requires additional width in the roadway.
<i>Other Treatments</i>			
Treatment	Description	Benefits	Limitations
Green Pavement	Green pavement highlights conflict zones between bicyclists and motorists.	<ul style="list-style-type: none"> • Increases visibility of the facility and reinforces priority to cyclists. • Highlights conflict areas between bicyclists and motorists. 	<ul style="list-style-type: none"> • May require additional maintenance.
Fences	Fences can be used in buffers as a vertical barrier.	<ul style="list-style-type: none"> • Limits pedestrian overflow onto cycle track. 	<ul style="list-style-type: none"> • In constrained conditions, fencing can be a vertical obstruction to bicyclists. A minimum of a 1 foot shy distance is required, with 2 feet clear zone recommended.