

Toole Design Group



INNOVATIVE BICYCLE FACILITY RESEARCH AND ANALYSIS

District Department of Transportation (DDOT)

Research conducted by: Kittelson & Associates, Inc., Portland State University, and Toole Design Group



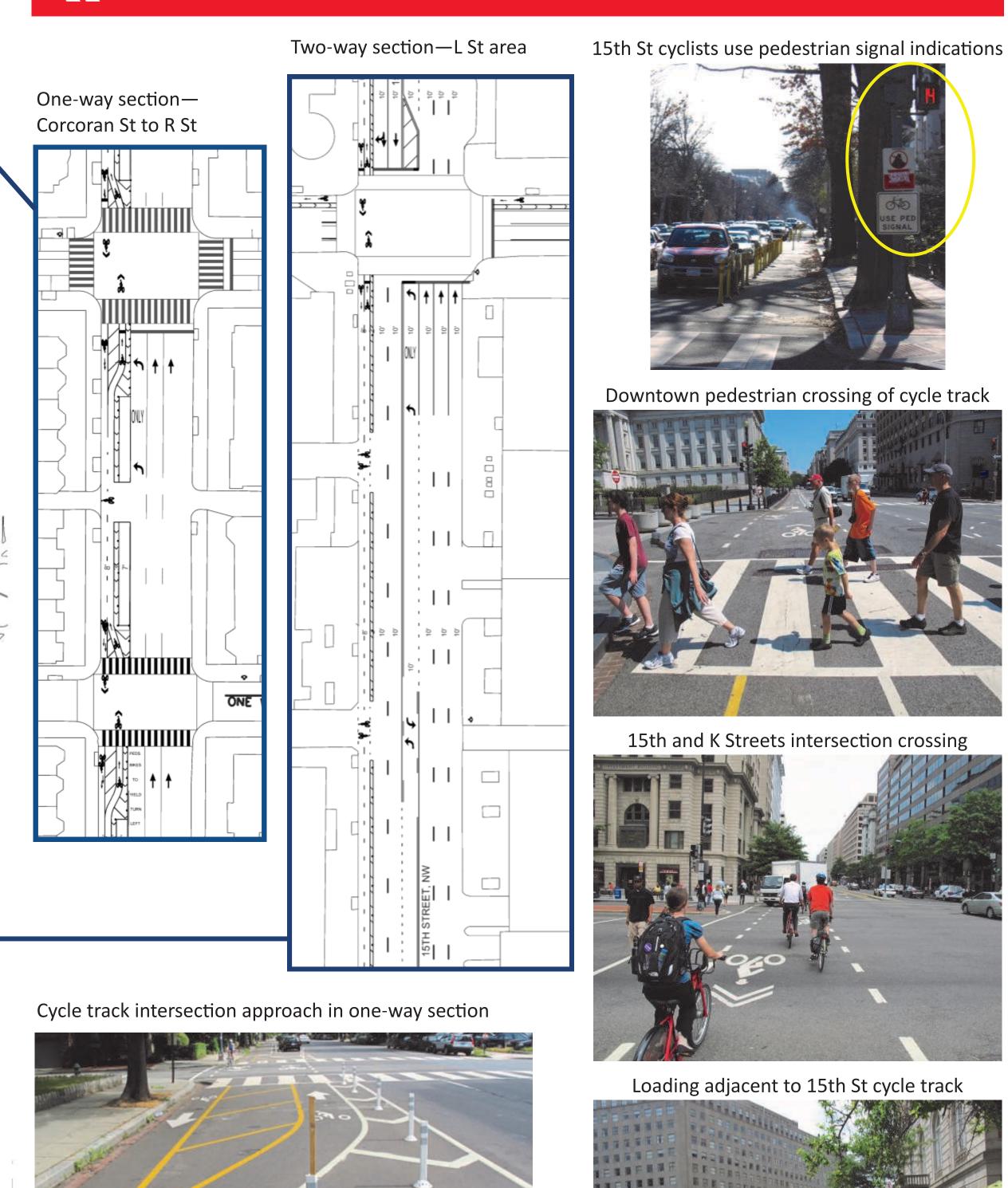
Project Summary

The District Department of Transportation (DDOT) has recently implemented several innovative bicycle facilities intended to improve cyclist comfort and safety by reducing cyclist-motorist conflicts, and has plans for many more. This project evaluated 3 new and innovative facilities before and after their implementation in 2009 and 2010:

- Two-way cycletrack on 15th Street NW (red on map)
- Center median bicycle lanes on Pennsylvania Ave NW (blue on map)
- Intersection treatments at 16th St / U St / New Hampshire Ave NW (green on map)
- This evaluation provided a unique opportunity to assess these innovative facilities from the perspective of all oadway users to understand both their benefits and drawbacks. The facilities generally performed well for all users and have proven very popular with cyclists.

Recommendations were developed for improving these facilities, as well as design considerations for future facilities. The results of this study are already seen in the new L St and M St lanes installed during 2013/4.

« 15th Street Cycle Track



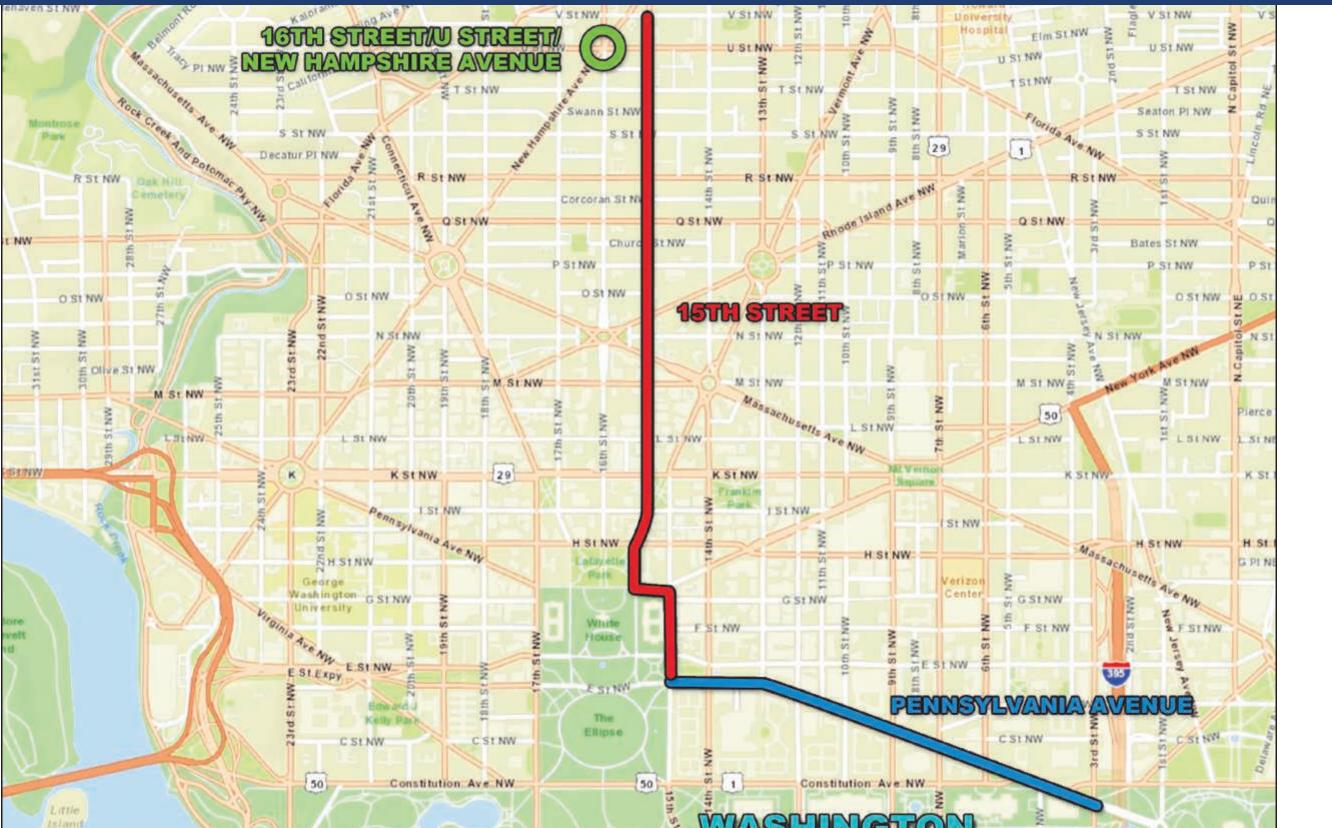
NEW HAMPSHIRE AVENUE, NW

Note: Green pain was added

after the initial installation

16th St / U St / New Hampshire Ave Intersection

Facilities Studied Methodology



5 areas were evaluated for conditions before and after installation: Facility Use

Bicycle volumes, before and after

Motor vehicle volumes, before and after

Efficient Operations

Levels of service (LOS) for all modes:

- Multimodal Level of Service (MMLOS)—analysis for bicyclists, pedestrians, and motor vehicles using the Highway Capacity Manual 2010 method.
- Danish Bicycle LOS— Predicts 6 levels of satisfaction along road segments and LOS based on the splits; calibrated using data from Denmark.
- Bicycle Environment Quality Index (BEQI)—Scores facilities by quintiles rated from poor to highest quality. Based on survey respondents' ranking of importance of indicator values for bicycle quality.

- Corridor travel times and progression for bicyclists.
- Corridor travel and stoppage time for motor vehicles on 15th Street.

 Crashes before and after installation using police department reports.

Video analysis to determine bicyclist, pedestrian, and driver compliance with traffic laws, traffic control devices, and interactions between modes. >>

 Surveys to understand experiences, behaviors, attitudes, and perceptions. -Users—online survey via intercept (45% response rate)

-Residents—mail survey (18-26% response rate)

Businesses—online survey via business improvement district (37% response

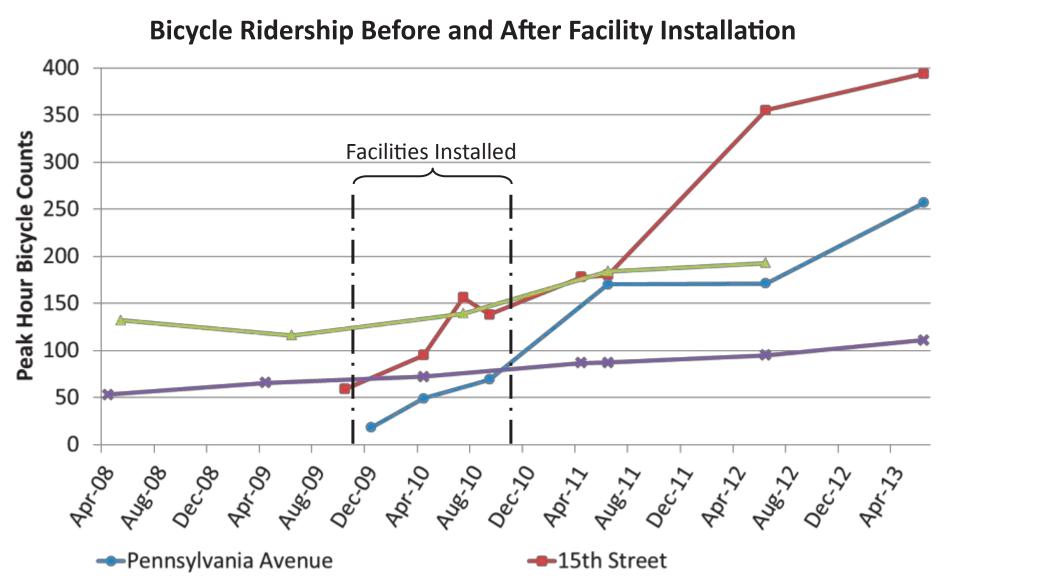
-Motorists—from resident survey, considered only those who owned

Outcomes

Facility Use and Safety

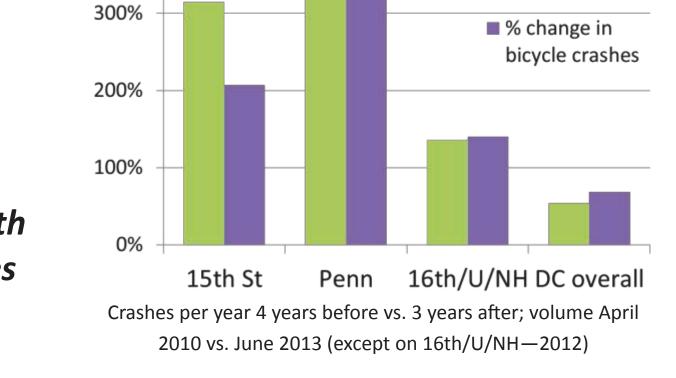
Peak hour bicycle volumes increased dramatically on both lanes and steadily increased near the intersection.

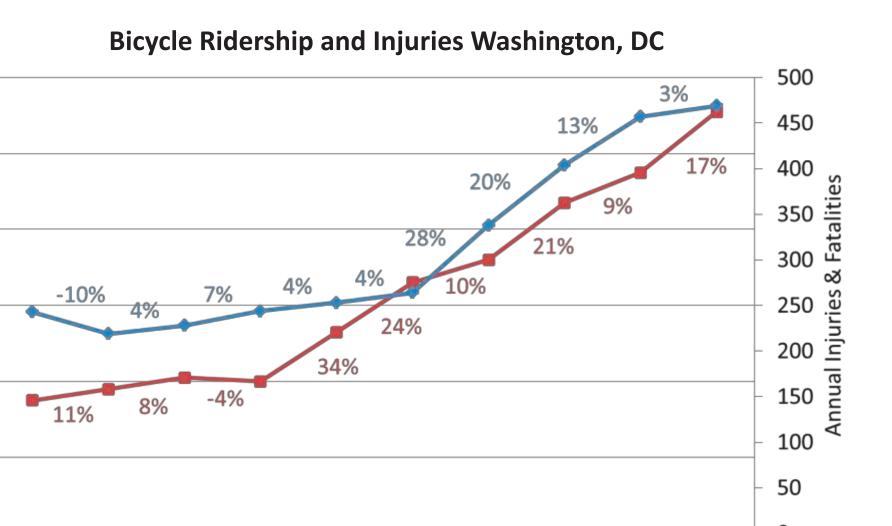
Motor vehicle volumes changed minimally for all facilities.



Change in Ridership vs. Crashes Mixed outcomes for safety: Total number of crashes increased, but *at a slower*

rate than volume. D.C.-wide, ridership and crashes have increased in union, but *ridership growth* may be overtaking crashes





Comfort

Who likes the Pennsylvania Avenue lanes? Survey responses Cyclists: 94%

The center bike lanes have made cycling on Pennsylvania Ave easier for me as a **Motorists: 83%**

Overall, I like that bicycles are separated from the motor vehicle traffic. Residents: 71%

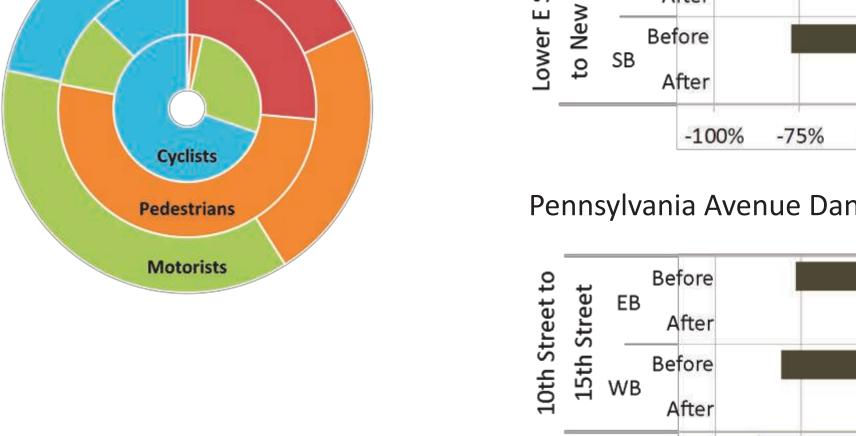
The center bike lanes on Pennsylvania Ave are a valuable asset to my neighbor-

Who feels safer with the 15th Street lanes? Survey responses Cyclists: 97%

Motorists: 58.9% I feel safer driving on 15th Street because of the cycle track.

I feel safer cycling on 15th Street. because of the cycle track.

Pedestrians: 45% I feel safer crossing 15th Street now because of the cycle track.



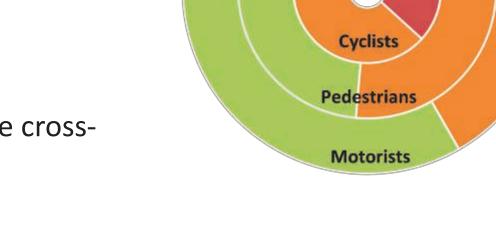
Who finds the facilities at 16th St/U St/New Hampshire Ave useful? Cyclists: 22%

It's not worth my time to wait for the bike signal. (disagree)

walks now than before changes were made.

Motorists: 58%

It seems that cyclist behavior when using the intersection is more predictable now with the new bike facilities. When walking through this intersection, I encounter fewer cyclists in the cross-



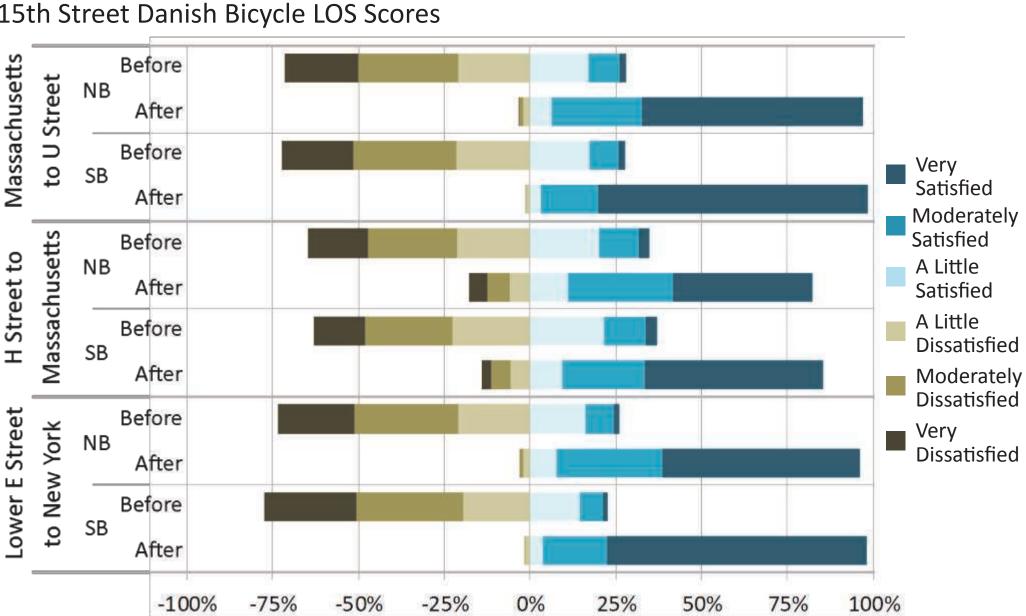
Who Likes the Penn Ave Lanes?

Who Feels Safer on 15th Street?

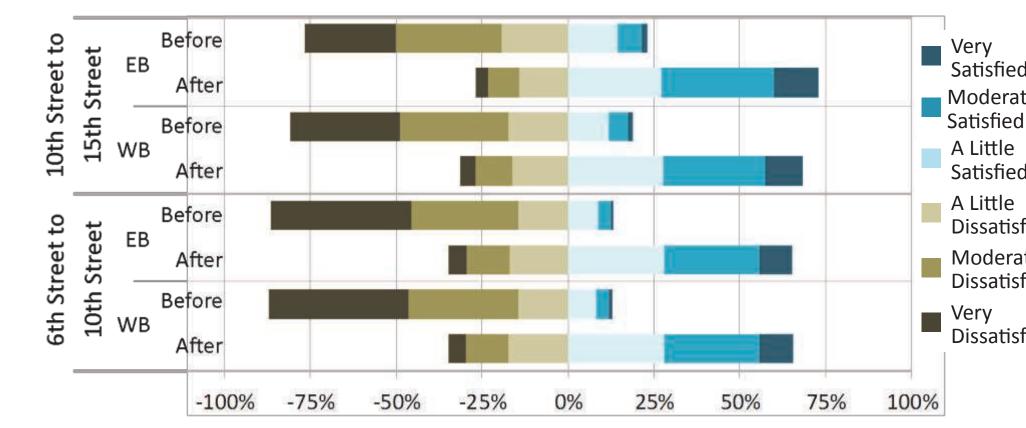
Somewhat Agree Strongly Disagree

Efficient Operations (lanes only)

Minimal impact on other modes—MMLOS remained largely unchanged for pedestrians (A or B) and motor vehicles (D or E) Bicycle LOS improved substantially when using the Danish Bicycle LOS and BEQI measures, which better capture the innovative facility types.



Pennsylvania Avenue Danish Bicycle LOS Scores

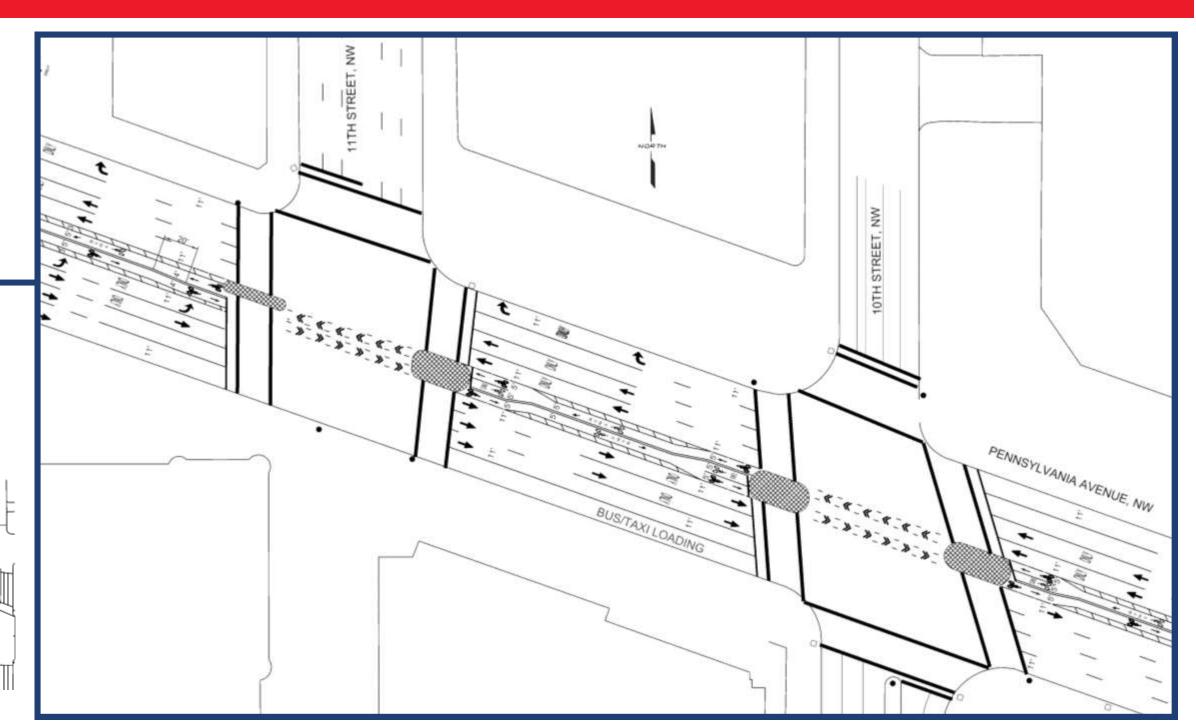


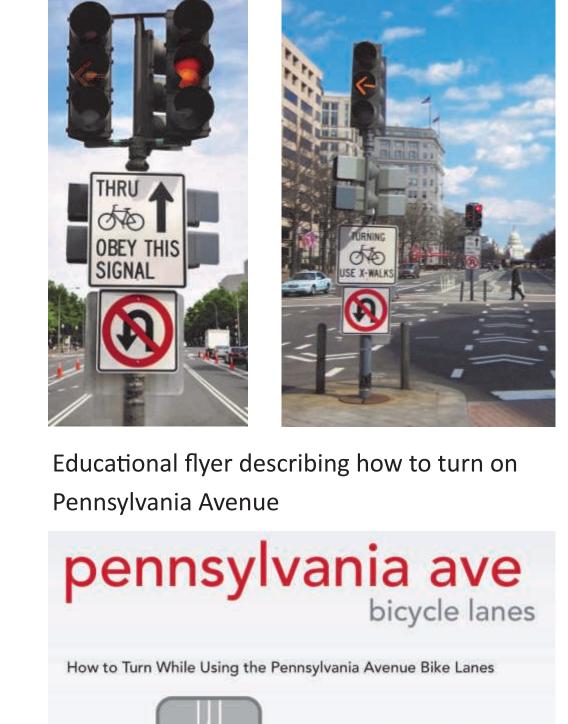
Convenience (lanes only)

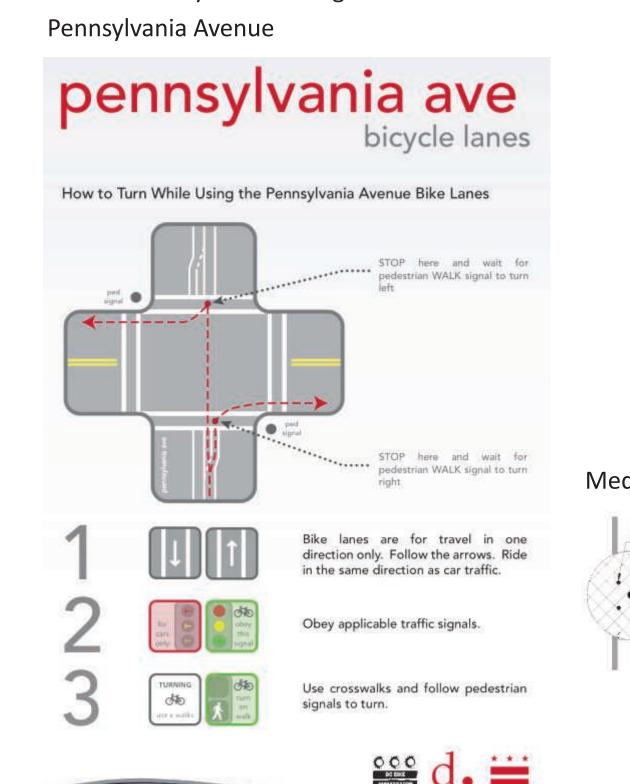
Signal timing causes significant delay for bicyclists on some sections of the corridors. This is particularly notable for bicyclists in the contraflow lane on 15th Street, but also for portions of Pennsylvania Avenue.

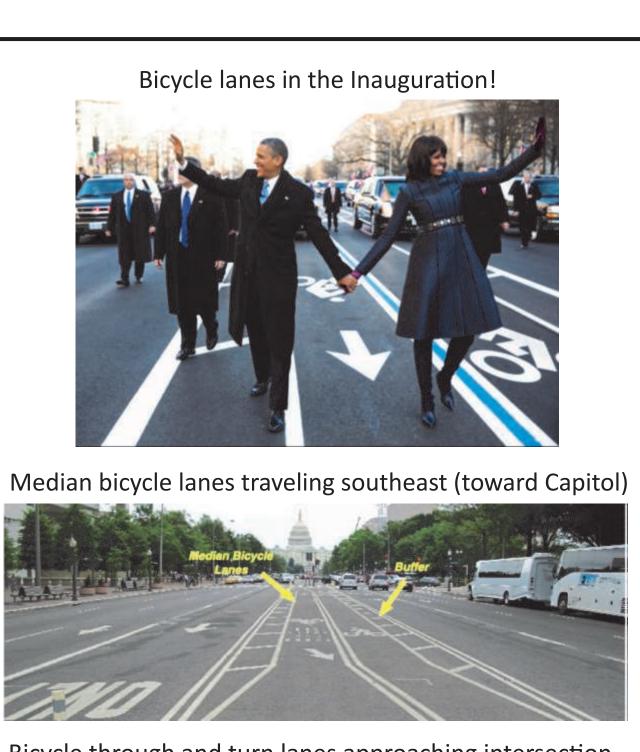
Motorists saw small increases in corridor travel time and stoppage time. Only 15th Street was measured and all runs were within 15% of pre-installation travel time. Pennsylvania Avenue had extensive signal retiming done concurrently with the lane installation, so impacts on travel time are expected to be minimal.

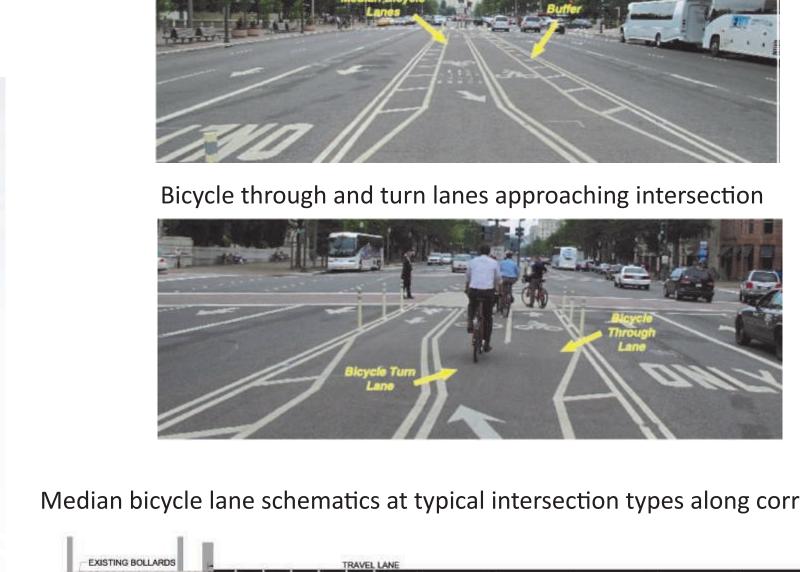
Pennsylvania Avenue Buffered Median Lanes

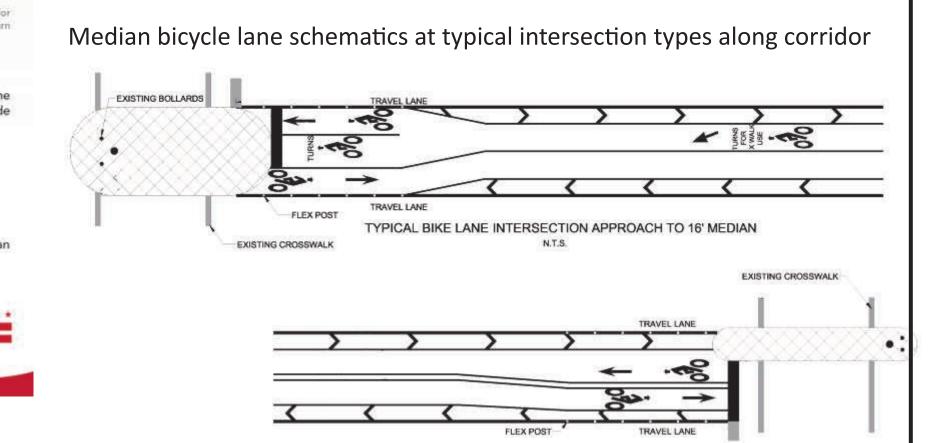












What We Did and Future Improvements

→Average Peak Hour Ridership →Annual Cyclist Injuries & Fatalities

Include cyclist progression as a factor in future signal re-timing.

Institute a cyclist education and enforcement campaign to encourage compliance with traffic signals



Educational campaign on U-turns.

Greater protection for cyclists from illegal U-turning vehicles New "zebra" traffic separators

Future Recommendations

Independent vehicle and bicycle through phases would

improve motor vehicle progression. The bicycle lane is to the

• Decrease the size of signage to decrease the sight distance

For Bicycles: Pavement marking in advance of

crosswalk (e.g. "WAIT HERE") For Pedestrians: Bike stencils on crosswalk

Pedestrian pavement marking



New traffic separator ("zebras")

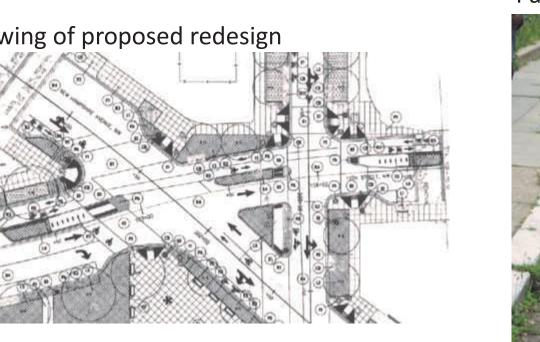
What We Have Done

 Improved pavement conditions along cycle track through resurfacing Added green pavement coloring, including at unsignalized conflict areas. What We Will Be Doing This Year

• Adding bicycle signal heads to some intersections to control bicycle movements and minimize confusion Adding pedestrian crossing islands north of Massachusetts Avenue.

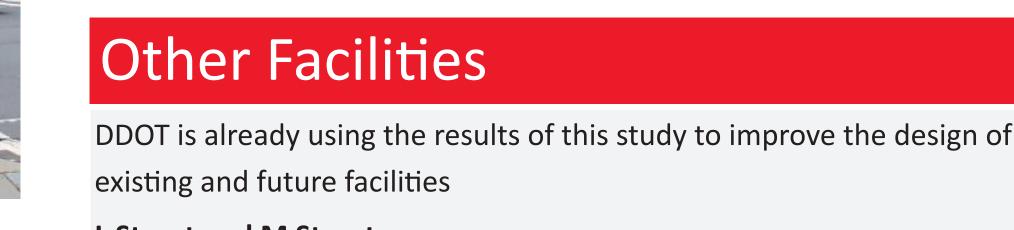
Future Recommendations Install a bicycle box at 15th/Pennsylvania for turning cyclists







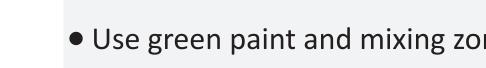




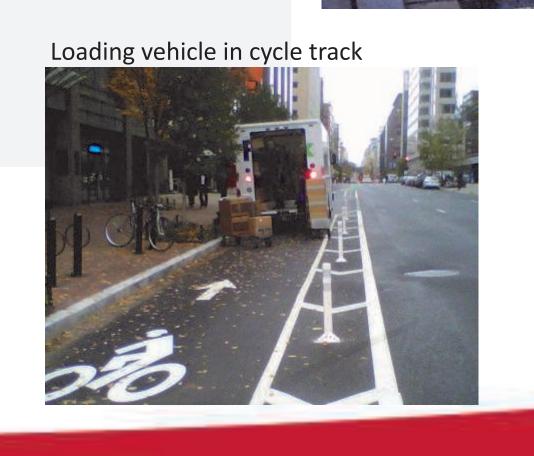
One-way couplets instead of two-way cycle tracks on one-way streets

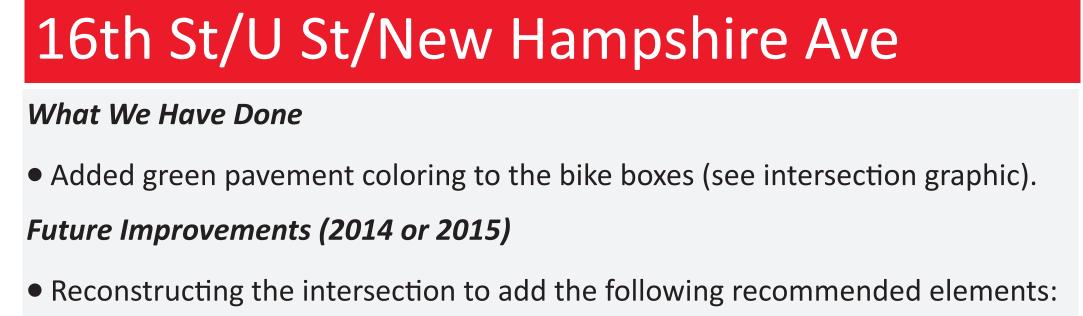
• Look at bicycle signals for intersections with high turn volumes, Widen the lane for higher volumes... except do not do that because the

cars try to drive in the lane. (Lesson for M Street from L Street) \









Adding medians on New Hampshire Ave contraflow lanes near 16th Street to form a permanent barrier between motorists and cyclists. Modifying signal timing to allow cyclists to cross 16th Street concurrently with the green time on U Street (much more time than current 12 seconds)

Adding protected left turns on U Street to eliminate conflicts with cyclists crossing 16th Street from New Hampshire Avenue