

# Protected Bicycle Lanes in NYC



# Protected Bicycle Lane Analysis

## Overview

Since 2007, the New York City Department of Transportation has installed over 30 miles of protected bicycle lanes throughout the city, including several parking protected bicycle lanes on various avenues in Manhattan. The following report contains an analysis of how some of these Manhattan routes have impacted safety, mobility, and economic vitality. Routes were chosen for inclusion if they had at least three years of “after” safety data available.



### ***Safety***

- Crashes with injuries have been reduced by 17%
- Pedestrian injuries are down by 22%
- Cyclist injuries show a minor decrease even as bicycle volumes have dramatically increased
- Total injuries have dropped by 20%
- 75% decrease in average risk of a serious injury to cyclists from 2001 to 2013
- Cyclist injury risk has generally decreased on protected bicycle lane corridors within this study as cyclist volumes rise and cyclist injuries decrease

### ***Mobility***

- Travel speeds in the Central Business District have remained steady as protected bicycle lanes are added to the roadway network
- Vehicle volumes on Columbus Ave were maintained
- Average peak hour taxi speeds on Columbus Ave improved by 17%, while average peak midday speeds decreased by 8%
- First Ave travel speeds remained level through project area
- Travel times on 8<sup>th</sup> Ave improved post-implementation by an average of 14%
- Daily vehicle speeds on 8<sup>th</sup> Ave improved except during the AM peak
- Bicycle volumes on corridors within the study increased by an average of 59%

### ***Economic Vitality & Quality of Life***

- When compared to similar corridors streets that received a protected bicycle lane saw a greater increase in retail sales
- 110 trees have been added to projects within this study area, enhancing the neighborhood through which they run
- Crossing distances have been shortened anywhere between 17' and 30'

## Overview



Non-Typical



# Overview

Typical: One-way Manhattan Avenues

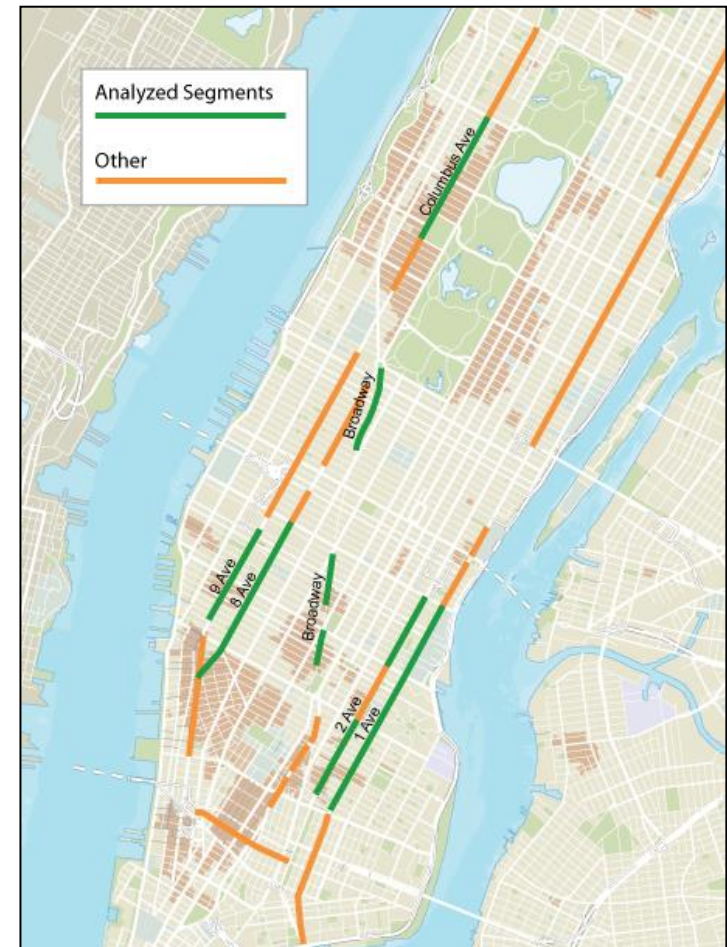


# Overview

- 7 miles of typical one-way avenue protected bicycle lanes now over 3 years old
- 12 projects on six avenues

Install Year	Corridor (Segments)
2007	9th Avenue (16th-23rd)
2008	9th Avenue (23rd-31st)
2008	8th Avenue (Bank-14th)
2009	8th Avenue (14th-23rd)
2009	Broadway (59-47)
2009	Broadway (33-26)
2010	1st Avenue (H-34)
2010	2nd Avenue (2-14)
2010	2nd Avenue (23-32)
2010	8th Avenue (23-34)
2010	Broadway (23-18)
2010/11	Columbus Avenue (96-77)

The following corridor analysis includes all portions of each corridor that received the protected bicycle lane treatment. Any portion of the corridor that did not receive the treatment was left out even if it received other upgrades at the same time. Analysis includes segments that have three years of after data.



# Overview - Design

Design of each protected bicycle lane looks similar but there are important distinctions when compared to “Before” condition

- Lane Removal (Y/N)
- Lane Narrowing (Y/N)
- Pre-Existing Basic or Buffered Bike Lane
- Remove or Curbside Rush Hour Vehicle Lane
- Major network change (Y/N)

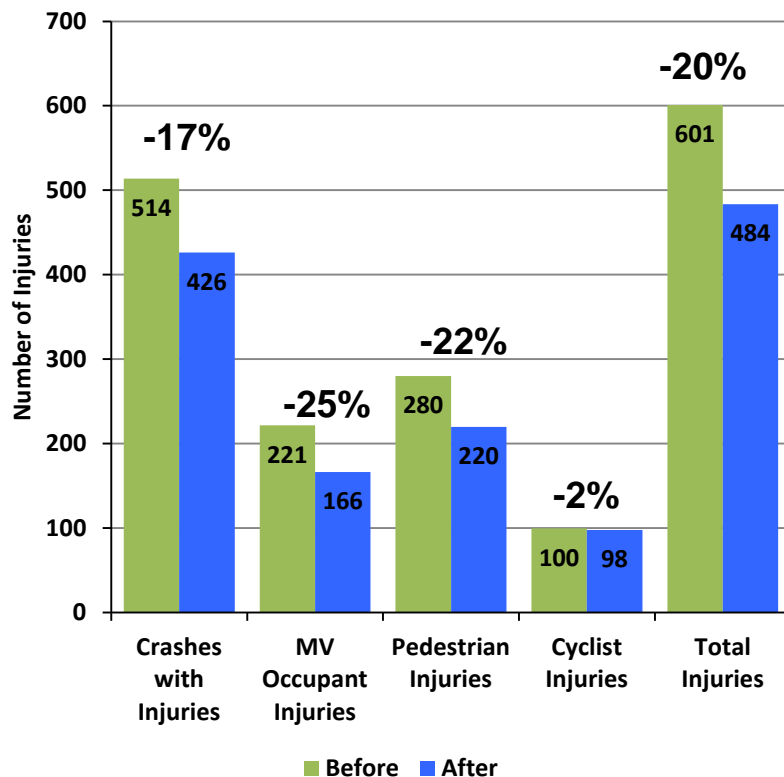
## Differences in Final Designs

- All Split-Phase Signals vs Primarily Mixing Zones
- Includes Bus Lane
- Concrete vs Painted Pedestrian Islands



# 1. Safety – 3yr After Data

**Protected Bicycle Lanes with  
3 yrs of After Data:  
Before vs After**



Looking at all corridors combined with at least three years of after data, we find that:

- Crashes with injuries have been reduced by 17%
- Pedestrian injuries are down by 22%
- Cyclist injuries show a minor improvement even as bicycle volumes have dramatically increased
- Total injuries have dropped by 20%

Protected bicycle lane projects with 3 years of after data include the following: 9<sup>th</sup> Ave (16<sup>th</sup>-31<sup>st</sup>), 8<sup>th</sup> Ave (Bank-23<sup>rd</sup>, 23<sup>rd</sup>-34<sup>th</sup>), Broadway (59<sup>th</sup>-47<sup>th</sup>, 33<sup>rd</sup>-26<sup>th</sup>, 23<sup>rd</sup>-18<sup>th</sup>), 1<sup>st</sup> Avenue (Houston to 34<sup>th</sup>), 2<sup>nd</sup> Ave (Houston-34<sup>th</sup>), Columbus Ave (96<sup>th</sup>-77<sup>th</sup>) Note: Only sections of projects that included protected bicycle lanes were analyzed

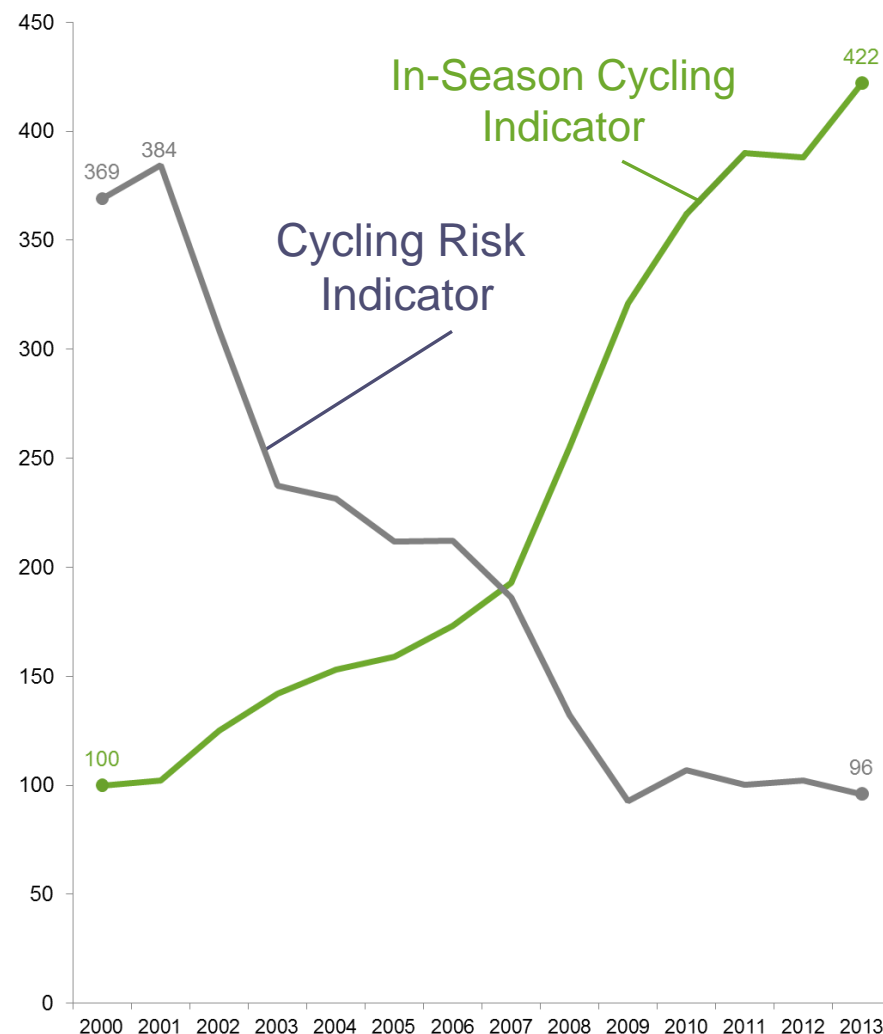
Source: NYPD AIS/TAMS Crash Database  
NEW YORK CITY DEPARTMENT OF TRANSPORTATION

## 1. Safety – NYC Cycling Risk

- 75% decrease in average risk of a serious injury to cyclists from 2001 to 2013

The **New York City Cycling Risk Indicator** is calculated as the number of bicyclists killed or severely injured in motor vehicle traffic crashes, divided by the **NYC In-Season Cycling Indicator**, multiplied by 100.

**New York City Cycling Risk**  
as of 8/14/2014\*



**Sources:**

NYC In-Season Cycling Indicator. The Indicator is based on weekday 12-hour counts taken between April and October at 6 key cycling locations, indexed to the year 2000 count:

<http://www.nyc.gov/html/dot/downloads/pdf/2013-isci-2-25-14.pdf>

Bicyclist fatalities: NYCDOT-NYPD Reconciled Traffic Fatality Database

Bicyclist severe injuries: NYSDOT SIMS/ALIS Crash Database (as of 8/14/14) Type A injuries reported in crashes involving bicycles.

\* Preliminary Results - final numbers are subject to change

# 1. Safety – Individual Project Risk

- Cyclist injury risk has generally decreased on protected bicycle lane corridors within this study as cyclist volume rises and cyclist injuries decrease

Project Corridor	Miles	Cyclist Risk Change
9th Avenue (16th-23rd)	0.33	-64.9%
Broadway (59th-47th)	0.60	-36.4%
1st Avenue (1st-34th)	1.62	-53.9%
2nd Avenue (2nd-14th)	0.59	-43.8%
2nd Avenue (23rd-34th)	0.54	-54.1%
8th Avenue (23rd-34th)	0.54	-2.4%
Broadway (23rd-18th)	0.25	11.2%
Columbus Avenue (96th-77th)	0.96	-37.6%

For volume and safety details for each of the above corridors see appendix

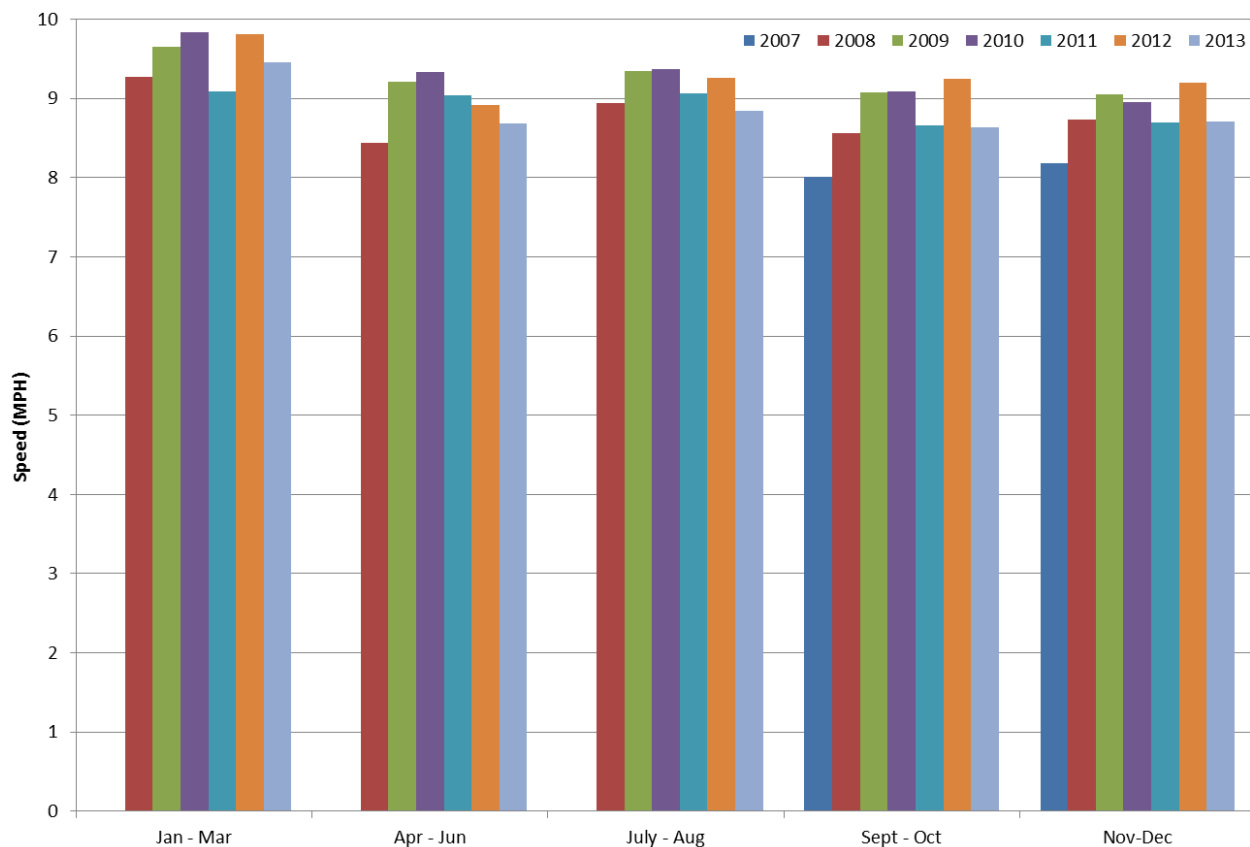
The cyclist risk measure was calculated as a relative rate of injury per cyclist during the 3-year before period and the 3-year after period. To generate the cyclist risk measure, the number of injuries recorded in the project area over the entire investigation period was normalized by the number of cyclists measured on the facility over a 12-hour period representative of April-October cycling conditions. The percent change of the cyclist risk measure between the before period and the after period provides the effect of the individual project on the cyclist risk of injury. See individual project slides in appendix for data sources.

## 2. Mobility – Central Business District

- Travel speeds in the Central Business District have remained steady as protected bicycle lanes are added to the roadway network

### Weekday Manhattan CBD Taxi Speeds

8:00a-6:00p



Between 2009 and 2012 Manhattan saw a 9% increase in private sector jobs, with increases projected to continue

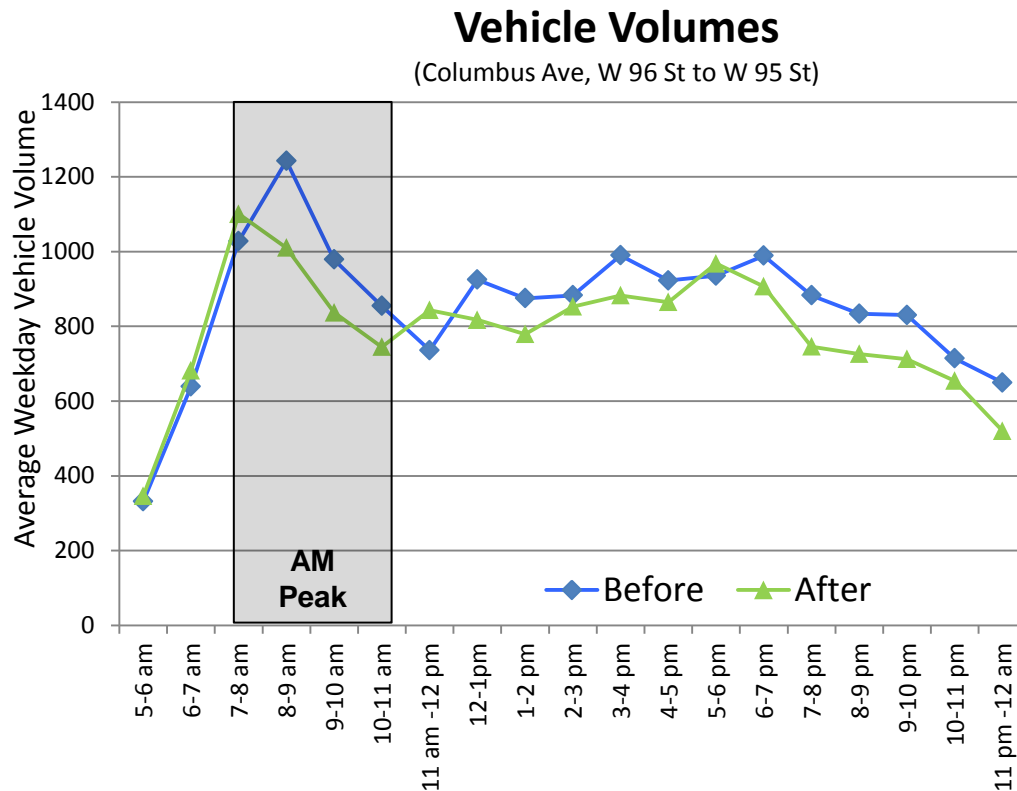
Note: CBD includes all projects in study except Columbus Avenue

Source: NYC TLC – Data includes all weekday yellow taxi trips from 8am-6pm taken in the Manhattan CBD (from Bowling Green to 59th St, river to river), excludes New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving and Christmas.

Job Data Source: NYC Economic Development Corporation

## 2. Mobility – Columbus Avenue

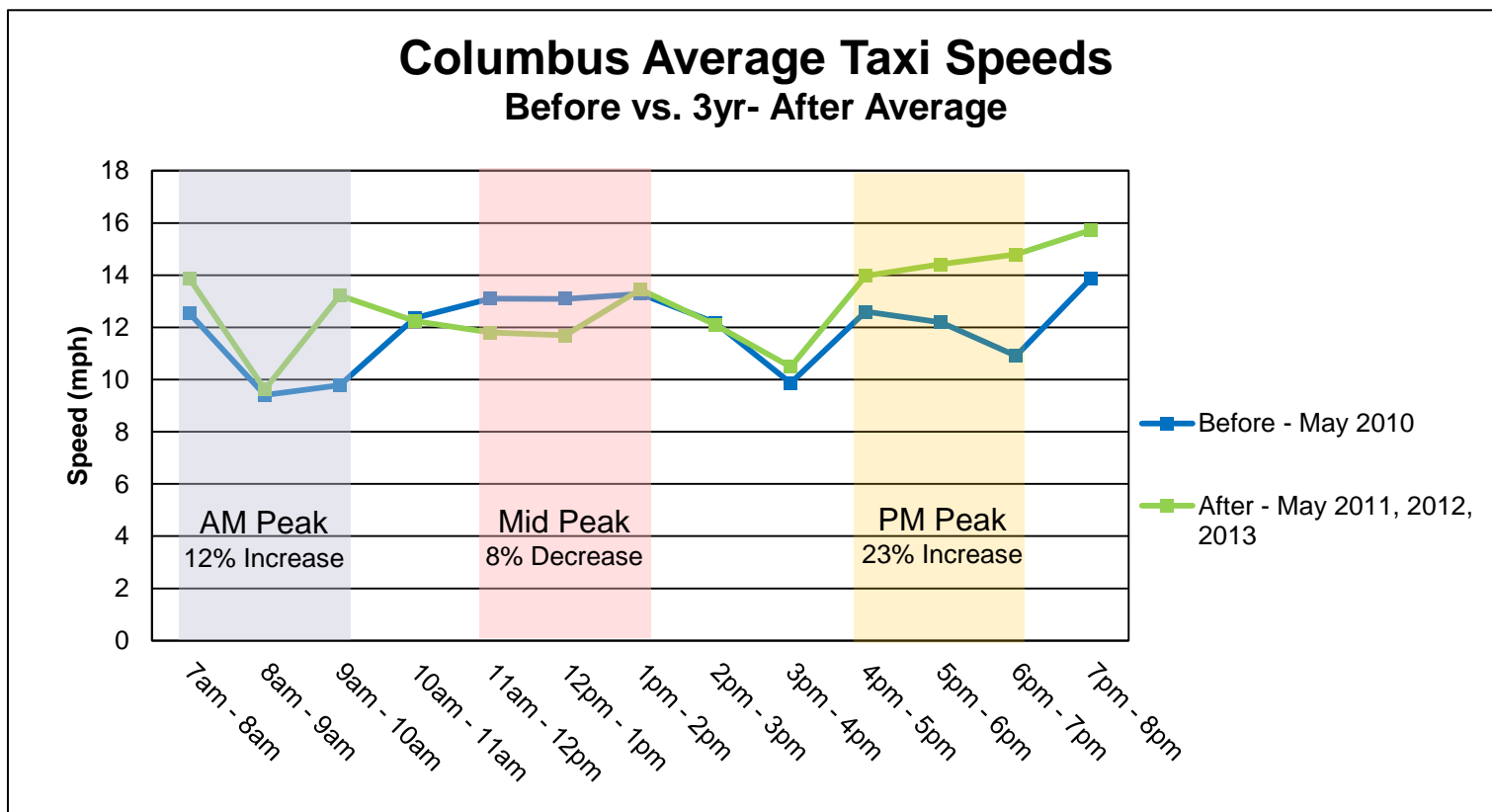
- Vehicle volumes on Columbus Ave were maintained



Note: Before volume data collected June 4-10, 2010. After data collected February 23-March 1, 2011.

## 2. Mobility – Columbus Avenue

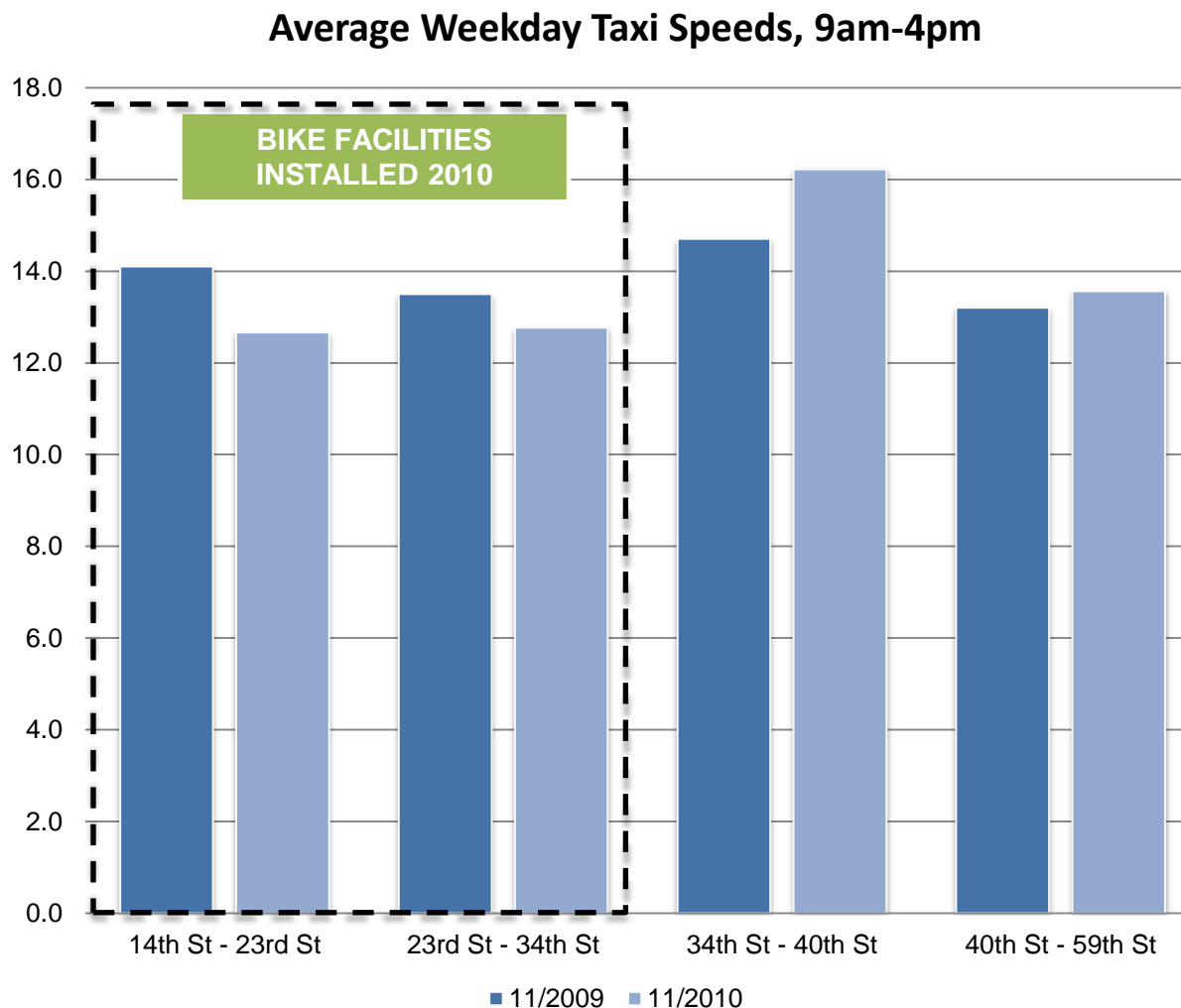
- Average peak hour taxi speeds on Columbus Avenue improved by 17%, while average peak midday speeds decreased by 8%



Note: Taxi data includes all trips that began or ended on Columbus Avenue and was collected on Tuesdays, Wednesdays, and Thursdays from 7am to 8pm in May 2010, May 2011, May 2012, and May 2013. The before study included 620 taxi trips in May 2010, the after study included an average of 955 taxi trips per year period in May 2011, May 2012, and May 2013.

## 2. Mobility – First Avenue

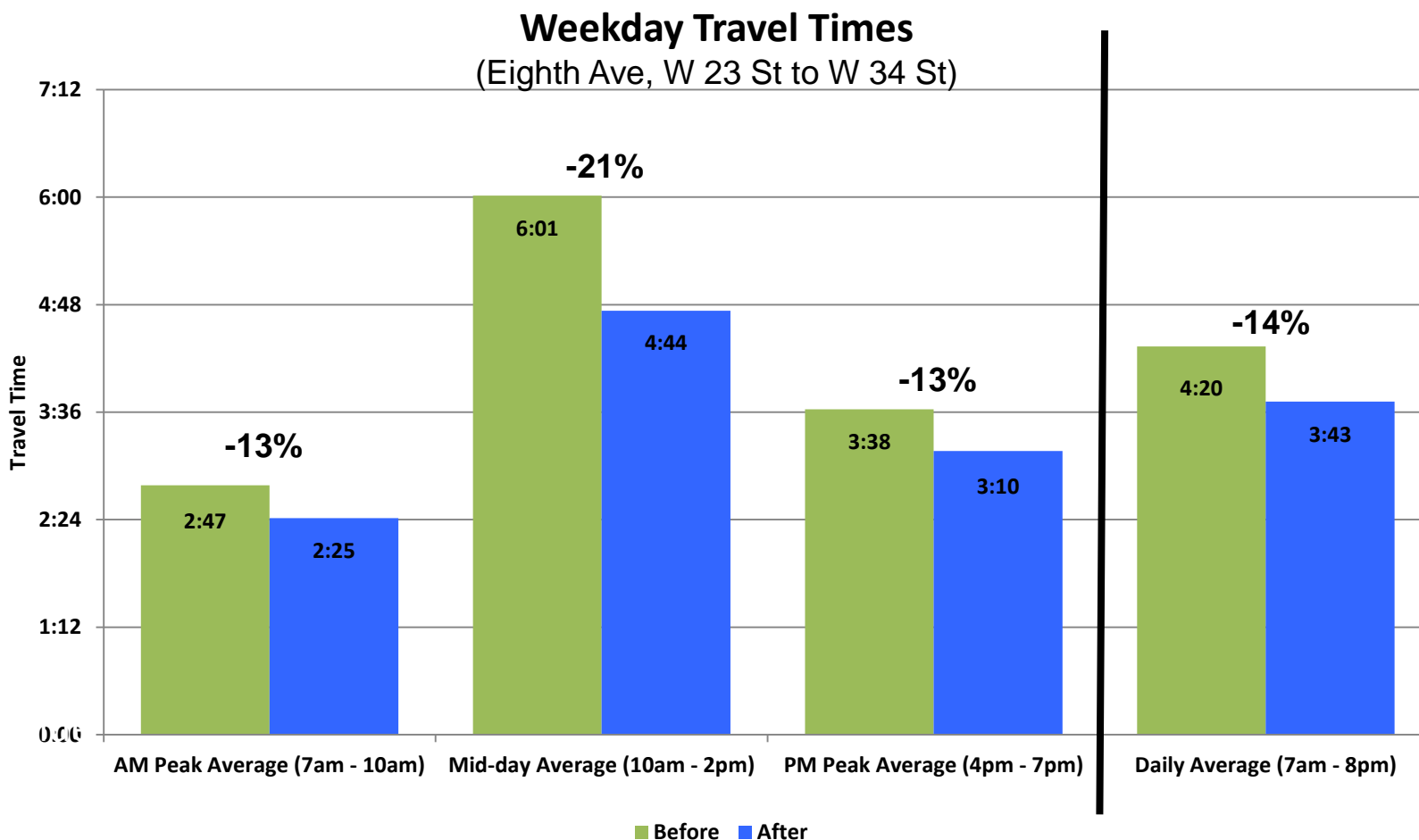
- First Avenue travel speeds remained level through project area



Source: NYC TLC – All weekday trips taken where at least 80% of trip was on stated route. Weekdays 9a-4p, November 2009 vs November 2010  
NEW YORK CITY DEPARTMENT OF TRANSPORTATION

## 2. Mobility – Eighth Avenue

- Travel times on 8<sup>th</sup> Avenue improved post-implementation by an average of 14%

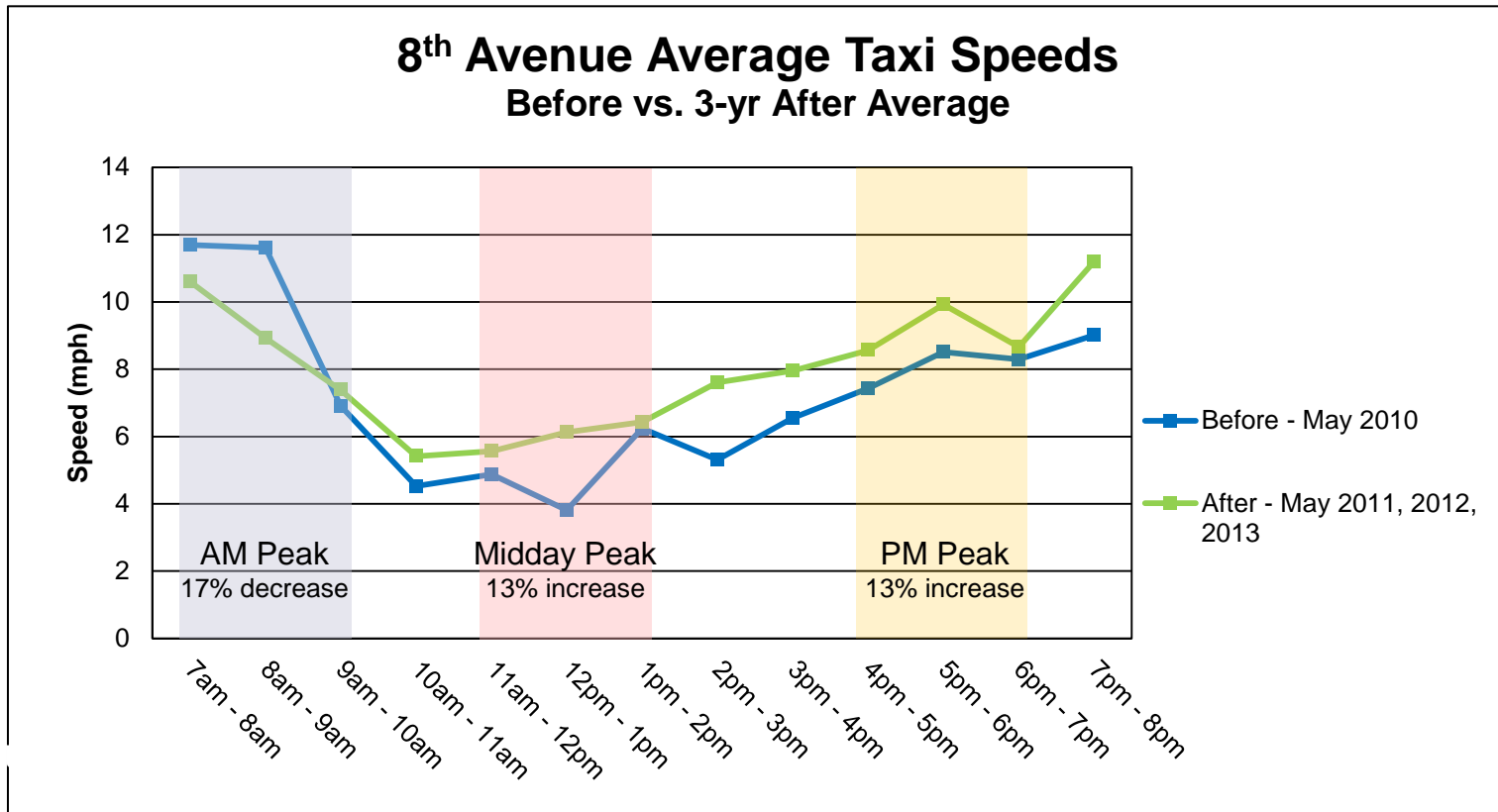


Before data collected September 30 to October 1, 2009 and October 6 to October 8, 2009.

After data collected November 16 to November 18, 2010.

## 2. Mobility – Eighth Avenue

- Daily vehicle speeds on 8<sup>th</sup> Avenue improved except during the AM peak



Note: Taxi data includes all trips that began or ended on 8th Avenue and was collected on Tuesdays, Wednesdays, and Thursdays from 7am to 8pm in May 2010, May 2011, May 2012, and May 2013. The before study included 299 taxi trips in May 2010, the after study included an average of 321 taxi trips per year period in May 2011, May 2012, and May 2013.

## 2. Mobility – Bicycle Volumes

- Bicycle volumes on corridors within the study increased by an average of 59%

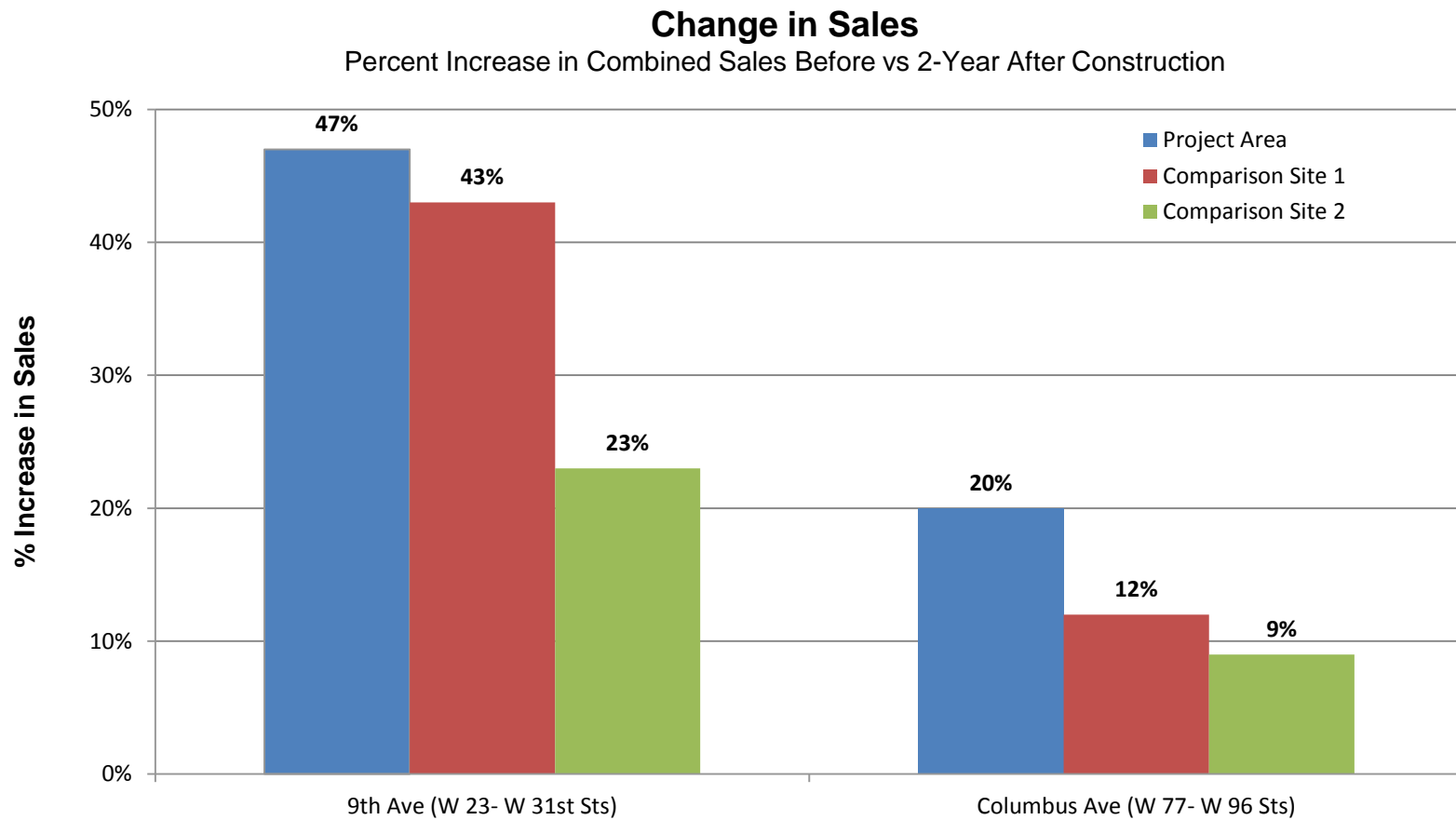
Project Corridor	Average Before Volume	Average After Volume*	Percent Change
9th Avenue (16th-23rd)	782	1291	+65%
Broadway (59th-47th)	525	1093	+108%
Broadway (23rd-18th)	1150	1473	+28%
1st Avenue (1st-34th)	787	2046	+160%
2nd Avenue (2nd-14th)	1226	1832	+49%
2nd Avenue (23rd-34th)	1627	2607	+60%
8th Avenue (23rd-34th)	1201	1307	+9%
Columbus Avenue (96th-77th)	383	577	+51%
<b>All Corridors in Study</b>	<b>960</b>	<b>1528</b>	<b>+59%</b>



\*After data includes only data collected up to three years after project implementation in order to remain consistent with safety data analysis. For full citation of count locations and collection dates see appendix

# 3. Economic Impact – Retail Sales

- When compared to similar corridors streets that received a protected bicycle lane saw a greater increase in retail sales



Source: NYC DOT (December 2013), "The Economic Benefits of Sustainable Streets". 9<sup>th</sup> Ave Comparison Site 1 = 10<sup>th</sup> Ave (16-26 Sts), Comparison Site 2 = 7<sup>th</sup> Ave (16-23 Sts). Columbus Ave Comparison Site 1 = Amsterdam Ave (77-96 Sts), Comparison Site 2 = Columbus Ave (70-77 Sts).

# 3. Quality of Life

- 110 trees have been added to projects within this study area, enhancing the neighborhoods through which they run
- Crossing distances shortened anywhere between 17' and 30'



# Design – 2<sup>nd</sup> Avenue (14<sup>th</sup> Street to 23<sup>rd</sup> Street)

## The Evolution of a Parking Protected Bicycle Lane



Before: Four moving lanes,  
standard curbside bus lane

2010: Four moving lanes,  
curbside buffered bike lane,  
upgraded bus-only lane

2013: Three moving lanes,  
parking protected bicycle lane,  
refurbished bus lanes



# Design – 2<sup>nd</sup> Avenue (14<sup>th</sup> Street to 23<sup>rd</sup> Street)



Reduction of vehicle volumes as users apparently shifted to other modes allowed for the 2013 upgrade:

- AM vehicle volumes (-11.8%)
- PM vehicle volumes (-15.3%)
- M15 Bus Ridership (+9%)
- Bicycle Volumes (+60%)

# Design – 2<sup>nd</sup> Avenue (14<sup>th</sup> Street to 23<sup>rd</sup> Street)

## Final Design Elements

- Parking protected
- Mixing zones
- Painted pedestrian safety islands
- Bus only red lanes
- Bus only overhead guide signs

Painted pedestrian safety islands provide flexibility for maintenance and constructability



# Appendix



## 9<sup>th</sup> Avenue (16<sup>th</sup> Street to 23<sup>rd</sup> Street)

- 70' wide
- No Pre-Existing Bike Lane
- Lane Removal; Lane Narrowing
- Split Phase Signals at All Turning Conflicts

Crashes w/ Injuries

**-48%**

Bike Volume

**+65%**

Before



11' Parking lane    12' Travel lane    12' Travel lane    12' Travel lane    12' Travel lane    11' Parking lane

After



19' Combined parking/travel lane    11' Travel lane    12' Travel lane    10' Parking lane    8' Buffer    10' Bike lane



Left turn signal phase with bike signal on  
9<sup>th</sup> Avenue

Crash Data Source: NYPD AIS/TAMS Crash Database  
Count Data: 9<sup>th</sup> Ave btwn 18<sup>th</sup> and 19<sup>th</sup> St, average of before vs after  
12 hour counts taken between April and October

## 9<sup>th</sup> Avenue (23<sup>rd</sup> Street to 31<sup>st</sup> Street)

- 70' wide
- No Pre-Existing Bike Lane
- Lane Removal
- Split Phase Signals at All Turning Conflicts

Crashes w/ Injuries

**-43%**

Before



11' Parking lane    12' Travel lane    12' Travel lane    12' Travel lane    12' Travel lane    11' Parking/AM rush travel lane

After



11' Parking/PM rush travel lane    12' Travel lane    12' Travel lane    12' Travel lane    11' Parking lane    3'    9' Bike lane



Left turn signal phase with bike signal on  
9<sup>th</sup> Avenue

## 8<sup>th</sup> Avenue (Bank Street to 14<sup>th</sup> Street)

- 56' wide
- Pre-Existing Buffered Bike Lane
- No Lane Removal; No Lane Narrowing
- Split Phase Signals at All Turning Conflicts

Crashes w/ Injuries

**-4%**

Before



After



8<sup>th</sup> Avenue at Bleecker Street

## 8<sup>th</sup> Avenue (14<sup>th</sup> Street to 23<sup>rd</sup> Street)

- 70' wide
- Pre-Existing Buffered Bike Lane
- Part-Time Lane Removal; Lane Narrowing
- Split Phase Signals at All Turning Conflicts

Crashes w/ Injuries

**-20%**

Before



11'	5'	7'	12'	12'	12'	11'
Parking lane	Bike lane	Buffer	Travel lane	Travel lane	Travel lane	Parking lane

After



8'	8'	10'	11'	11'	11'	11'
Bike lane	Buffer	Parking lane	Travel lane	Travel lane	Travel lane	Parking/AM rush travel lane



8<sup>th</sup> Avenue at 19<sup>th</sup> Street

## 8<sup>th</sup> Avenue (23<sup>rd</sup> Street to 34<sup>th</sup> Street)

- 70' wide
- Pre-Existing Bike Lane
- No Lane Removal; Lane Narrowing
- Primarily Mixing Zones

Crashes w/ Injuries

**-2%**

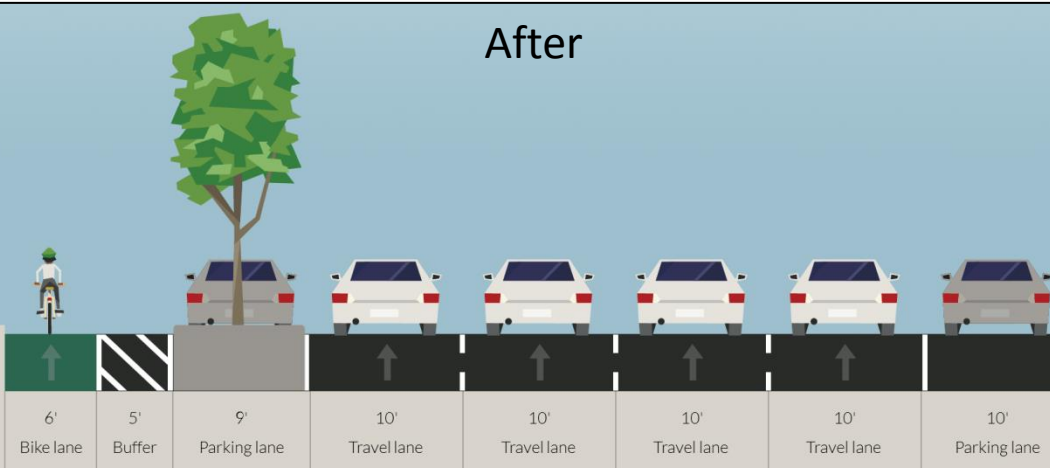
Bicycle Volumes

**+9%**

Before



After



8<sup>th</sup> Avenue at 26<sup>th</sup> Street

Crash Data Source: NYPD AIS/TAMS Crash Database  
Count Data: 8<sup>th</sup> Ave btwn 28<sup>th</sup> and 29<sup>th</sup> St, average of before vs after  
12 hour counts taken between April and October

## 1<sup>st</sup> Avenue (1<sup>st</sup> Street to 34<sup>th</sup> Street)

- 70' wide
- No Pre-Existing Bike Lane
- Lane Removal
- Primarily Mixing Zones
- Exterior Bus Lane

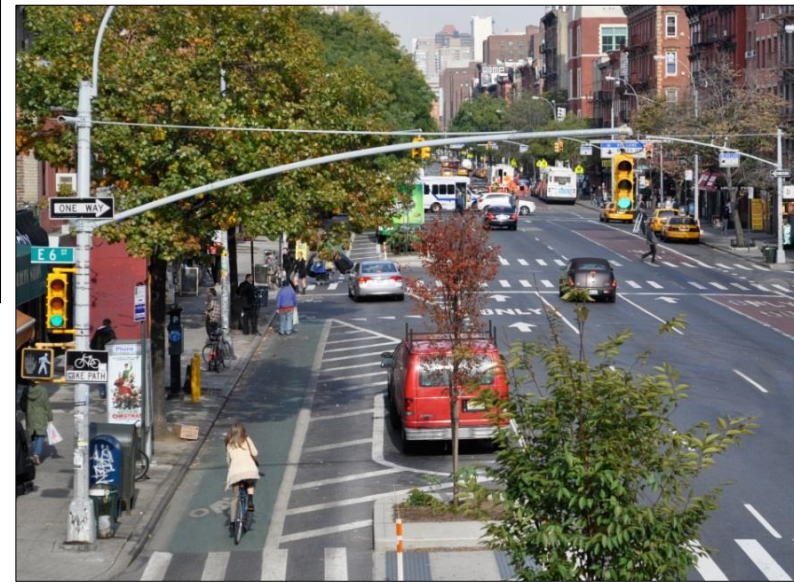
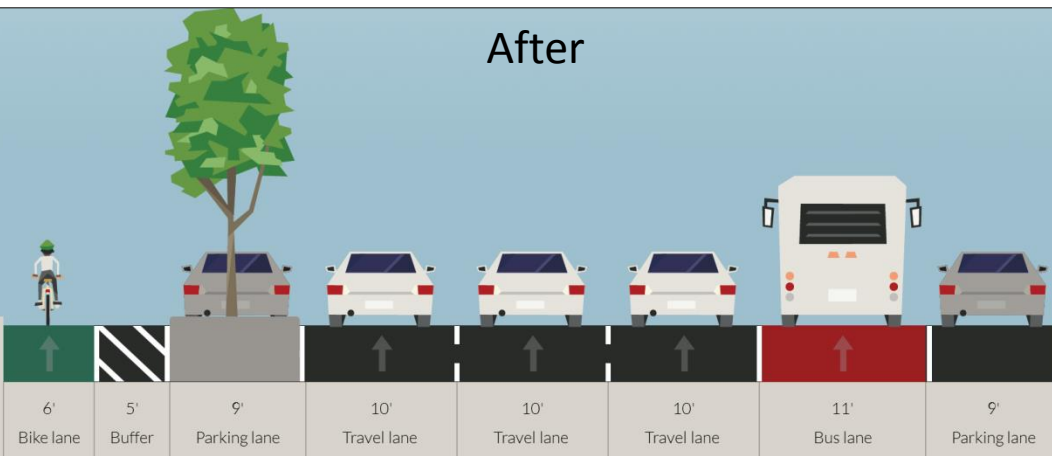
Crashes w/ Injuries  
**-7%**

Bicycle Volumes  
**+160%**

Before



After



1<sup>st</sup> Avenue at 6<sup>th</sup> Street

Crash Data Source: NYPD AIS/TAMS Crash Database  
Count Data: 1<sup>st</sup> Ave btwn St Marks Pl and 9<sup>th</sup> St, average of before vs after 12 hour counts taken between April and October

## Columbus Avenue (96<sup>th</sup> Street to 77<sup>th</sup> Street)

- 60' Wide
- No Pre-Existing Bike Lane
- No Lane Removal; Lane Narrowing
- Primarily Mixing Zones

Crashes w/ Injuries

**-27%**

Bicycle Volume

**+51%**

Before



13'	12'	12'	12'	11'
Parking/AM rush travel lane	Travel lane	Travel lane	Travel lane	Parking lane

After



11'	10'	10'	10'	8'	5'	6'
Parking/AM rush travel lane	Travel lane	Travel lane	Travel lane	Parking lane	Buffer	Bike lane



Mixing zone on Columbus Avenue

Crash Data Source: NYPD AIS/TAMS Crash Database  
Count Data: Columbus Ave btwn 90<sup>th</sup> and 91<sup>st</sup> St, average of before  
vs after 12 hour counts taken between April and October

## 2<sup>nd</sup> Avenue (2<sup>nd</sup> Street to 14<sup>th</sup> Street)

- 57' Wide
- Pre-Existing Bike Lane
- Lane Removal
- Primarily Mixing Zones
- Exterior Bus Lanes

Crashes w/ Injuries

**-4%**

Bicycle Volume

**+49%**

Before



10' Parking lane   10' Travel lane   10' Travel lane   10' Travel lane   3'   5' Bike lane   9' Parking lane

After



10' Bus lane   10' Travel lane   10' Travel lane   10' Travel lane   8' Parking lane   3'   6' Bike lane



2<sup>nd</sup> Avenue at 10<sup>th</sup> Street

Crash Data Source: NYPD AIS/TAMS Crash Database  
Count Data: 2nd Ave btwn St Marks Pl and 9<sup>th</sup> St, average of before vs after 12 hour counts taken between April and October

## 2<sup>nd</sup> Avenue (23<sup>rd</sup> Street to 34<sup>th</sup> Street)

- 70' Wide
- No Pre-Existing Bike Lane
- Lane Removal; Lane Narrowing
- Primarily Mixing Zones
- Upgraded Exterior Bus Lane

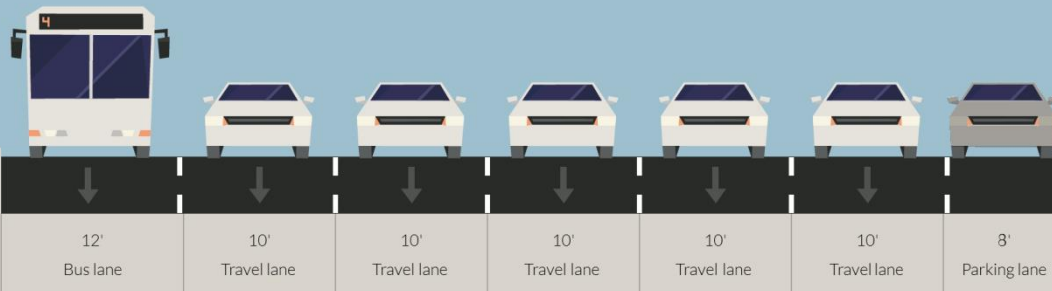
Crashes w/ Injuries

**-7%**

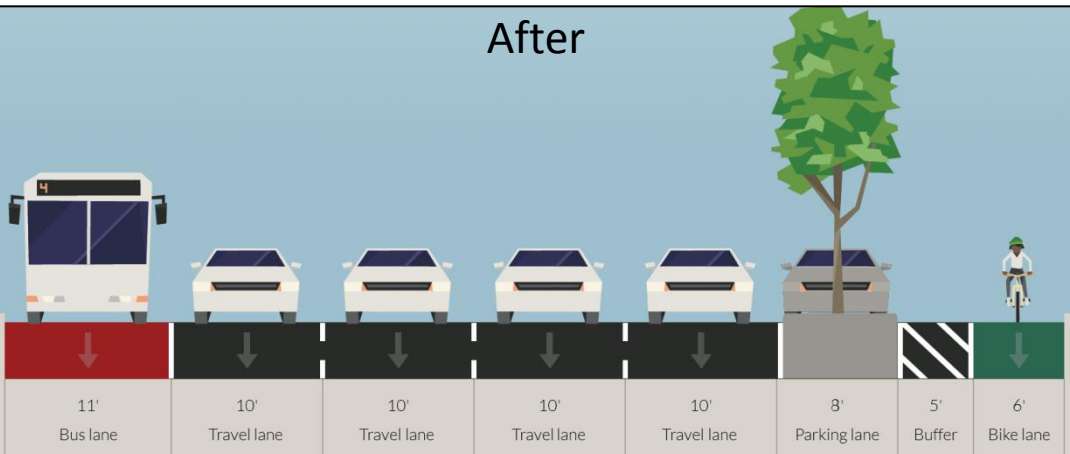
Bicycle Volumes

**+60%**

Before



After



2<sup>nd</sup> Avenue at 28<sup>th</sup> Street

Crash Data Source: NYPD AIS/TAMS Crash Database  
Count Data: 2<sup>nd</sup> Ave btwn 22<sup>nd</sup> and 21<sup>st</sup> St, average of before vs after  
12 hour counts taken between April and October

## Broadway (47<sup>th</sup> Street to 59<sup>th</sup> Street)

- 59' Wide
- Pre-Existing Bike Lane
- Lane Removal
- Split Phase Signals at All Turning Conflicts
- Major Traffic Network Change

Crashes w/ Injuries

**-18%**

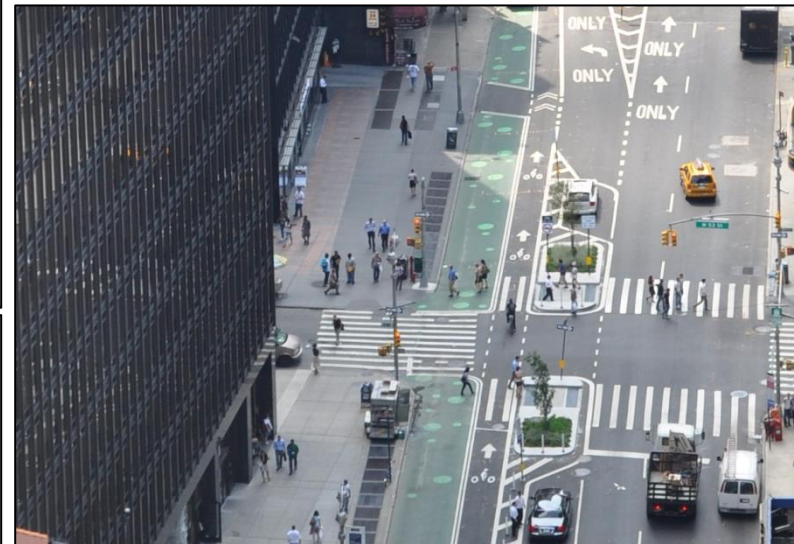
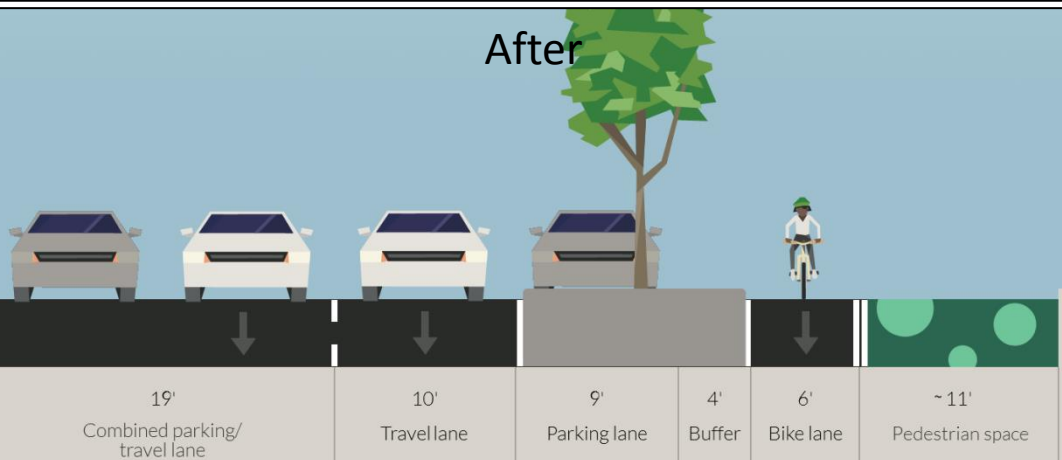
Bicycle Volume

**+108%**

Before



After



Broadway

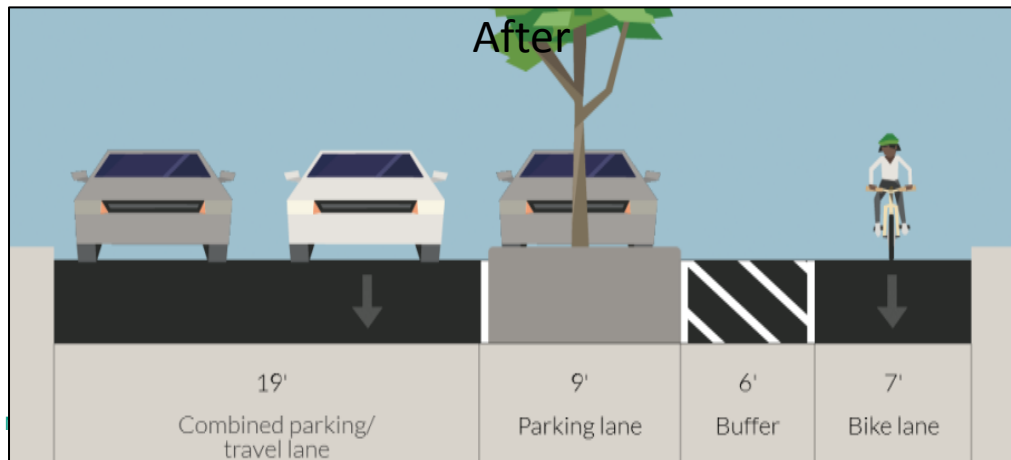
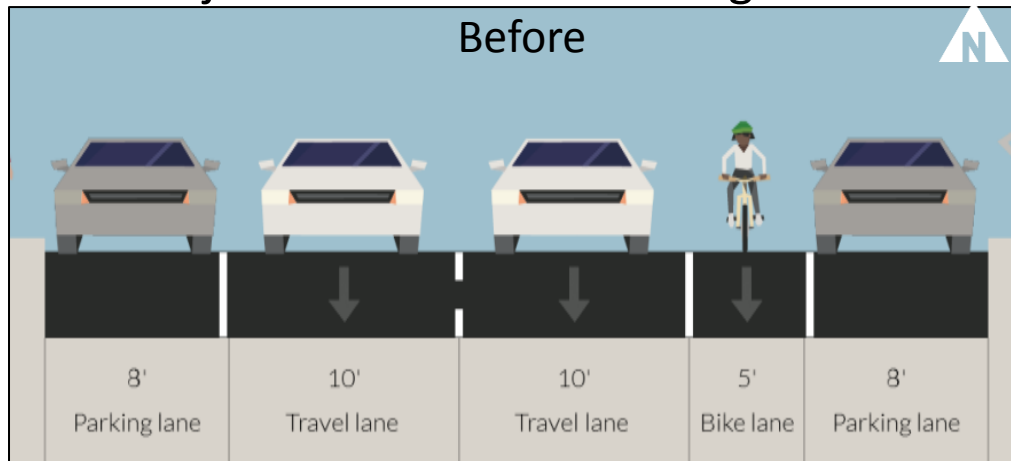
Crash Data Source: NYPD AIS/TAMS Crash Database  
Count Data: Broadway btwn 50<sup>th</sup> St and 51<sup>st</sup> St, average of before vs after 12 hour counts taken between April and October

## Broadway (26<sup>th</sup> Street to 33<sup>rd</sup> Street)

- 41' Wide
- Pre-Existing Bike Lane
- Lane Removal
- Split Phase Signals at All Turning Conflicts
- Major Traffic Network Change

Crashes w/ Injuries

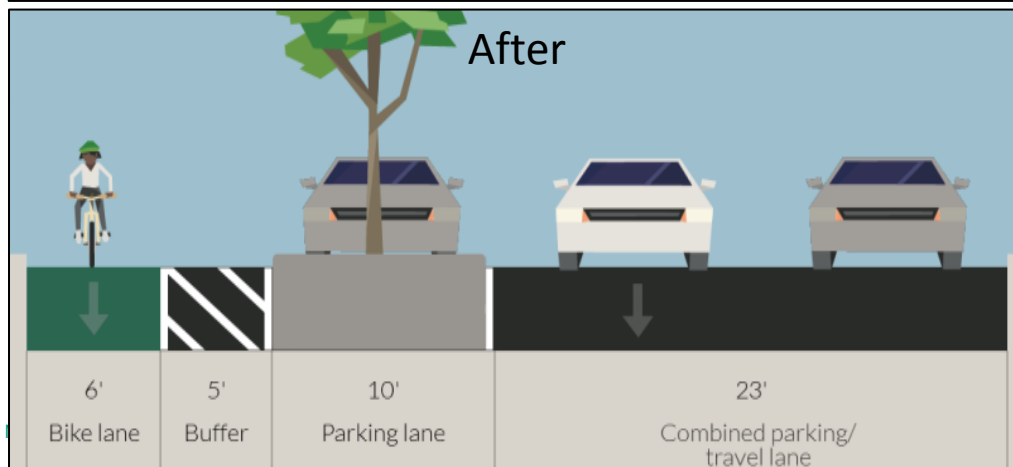
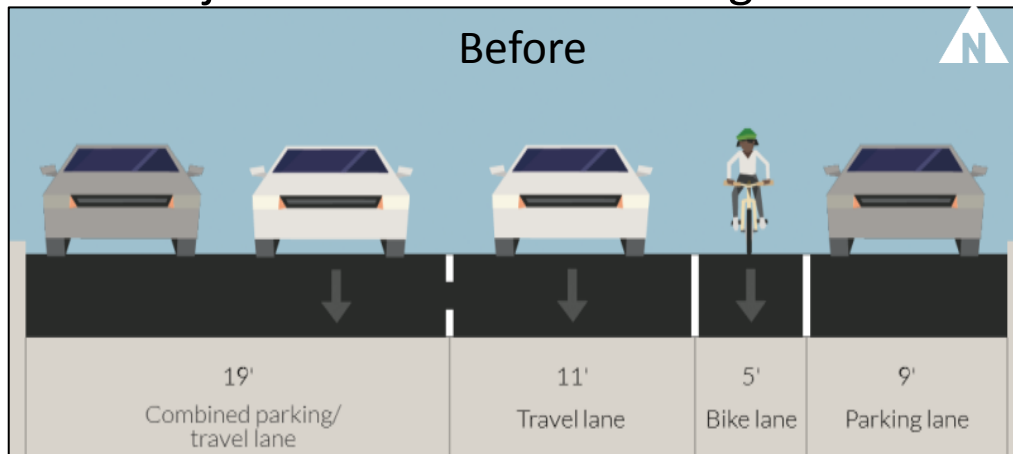
**-45%**



Broadway at 29<sup>th</sup> Street

## Broadway (18<sup>th</sup> Street to 23<sup>rd</sup> Street)

- 44' Wide
- Pre-Existing Bike Lane
- Lane Removal
- Primarily Mixing Zones
- Major Traffic Network Change



Crashes w/ Injuries

**-33%**

Bicycle Volume

**+28%**



Broadway at 20<sup>th</sup> Street

Crash Data Source: NYPD AIS/TAMS Crash Database  
Count Data: Broadway btwn 18<sup>th</sup> and 19<sup>th</sup> St, average of before vs after 12 hour counts taken between April and October