# Protected Bicycle Lanes in NYC

NEW YORK CITY
DOT

# 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 injures decrease

### Mobility

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

- Travel times on Columbus Avenue have improved while vehicle volumes are maintained

- First Avenue travel speeds remained level through project area

- Travel times on 8th Avenue improved by an average of 14%

### 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 along corridors have been shortened anywhere between 17' and 30'
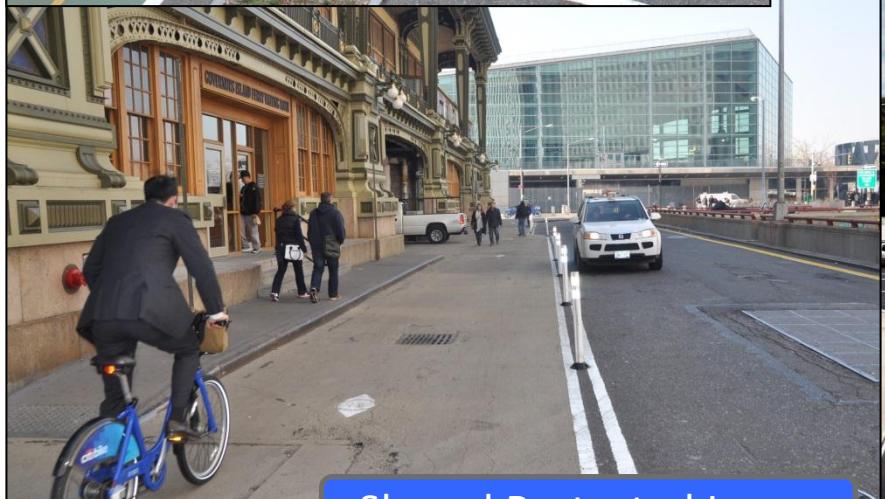
# Overview



Non-Typical

Center Lanes

Side Lanes

Lanes at Complex Intersections

Shared Protected Lanes

# Overview

Typical: One-way Manhattan Avenues

# Overview

- 7 miles of typical <u>one-way avenue protected bicycle lanes</u> 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
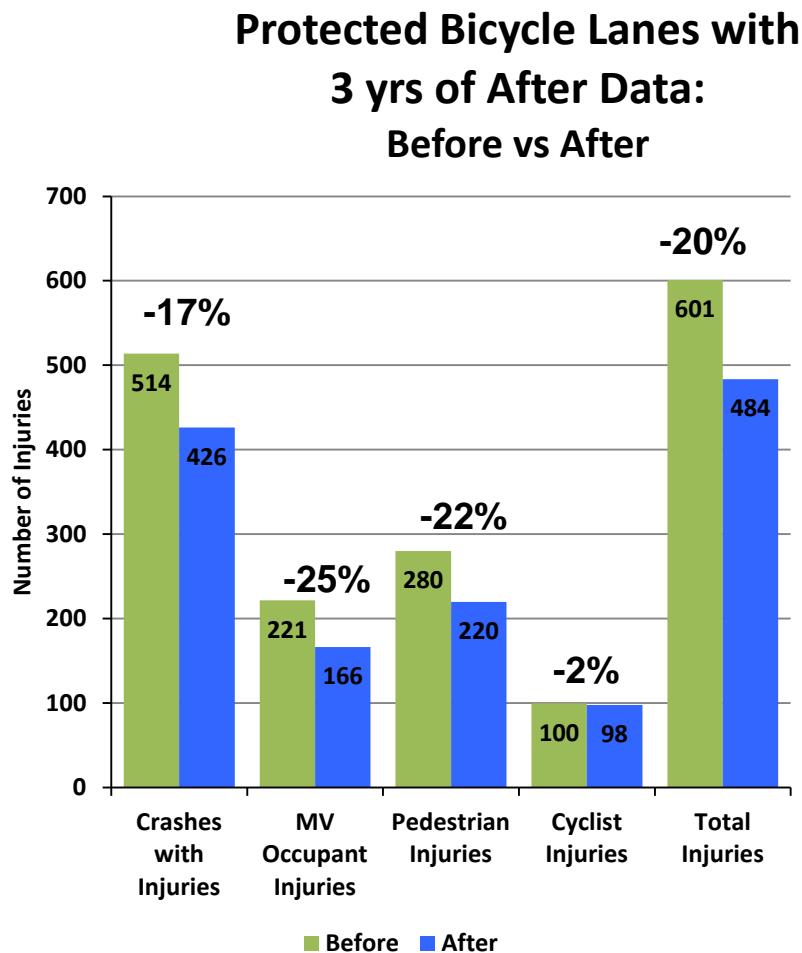
- Lane Removal (Y/N)

- 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: 9th Ave (16th-31st), 8th Ave (Bank-23rd, 23rd-34th), Broadway (59th-47th, 33rd-26th, 23rd-18th), 1st Avenue (Houston to 34th), 2nd Ave (Houston-34th), Columbus Ave (96th-77th) Note: Only sections of projects that included protected bicycle lanes were analyzed
Source: NYPD AIS/TAMS Crash Database

# 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.

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
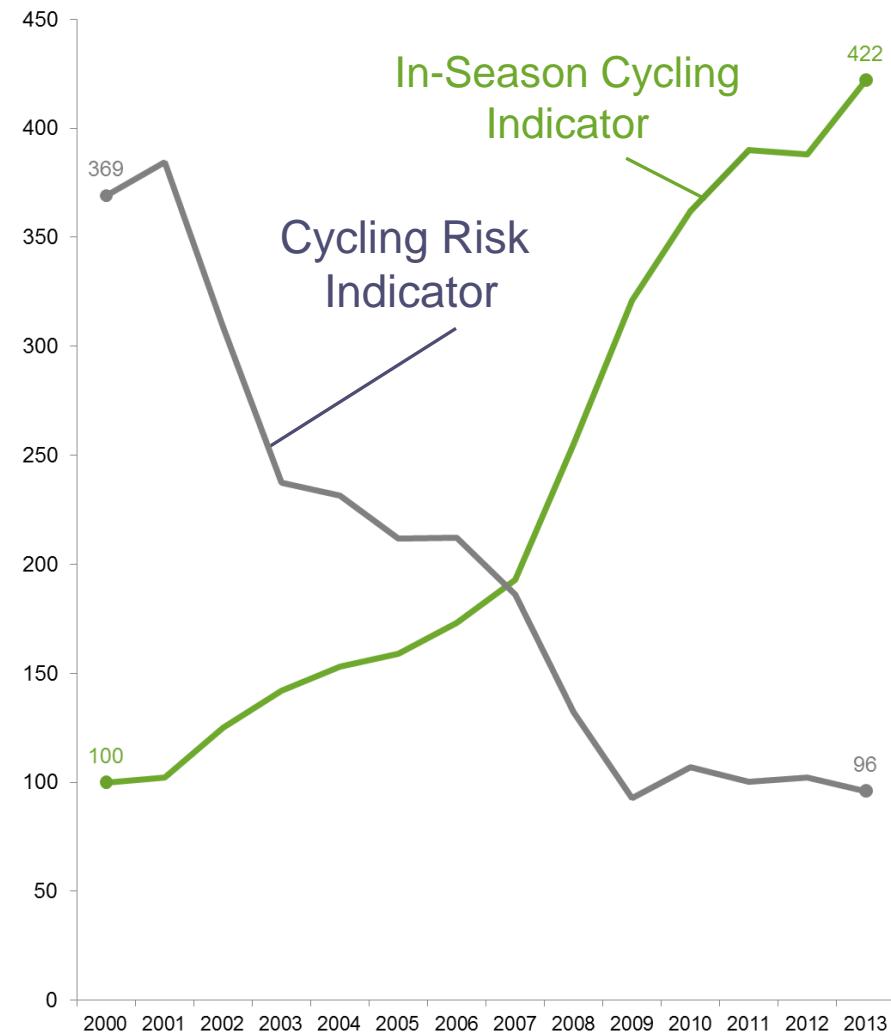
Bicyclist fatalities: NYCDOT-NYPD Reconciled Traffic Fatality Database

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

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

# 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
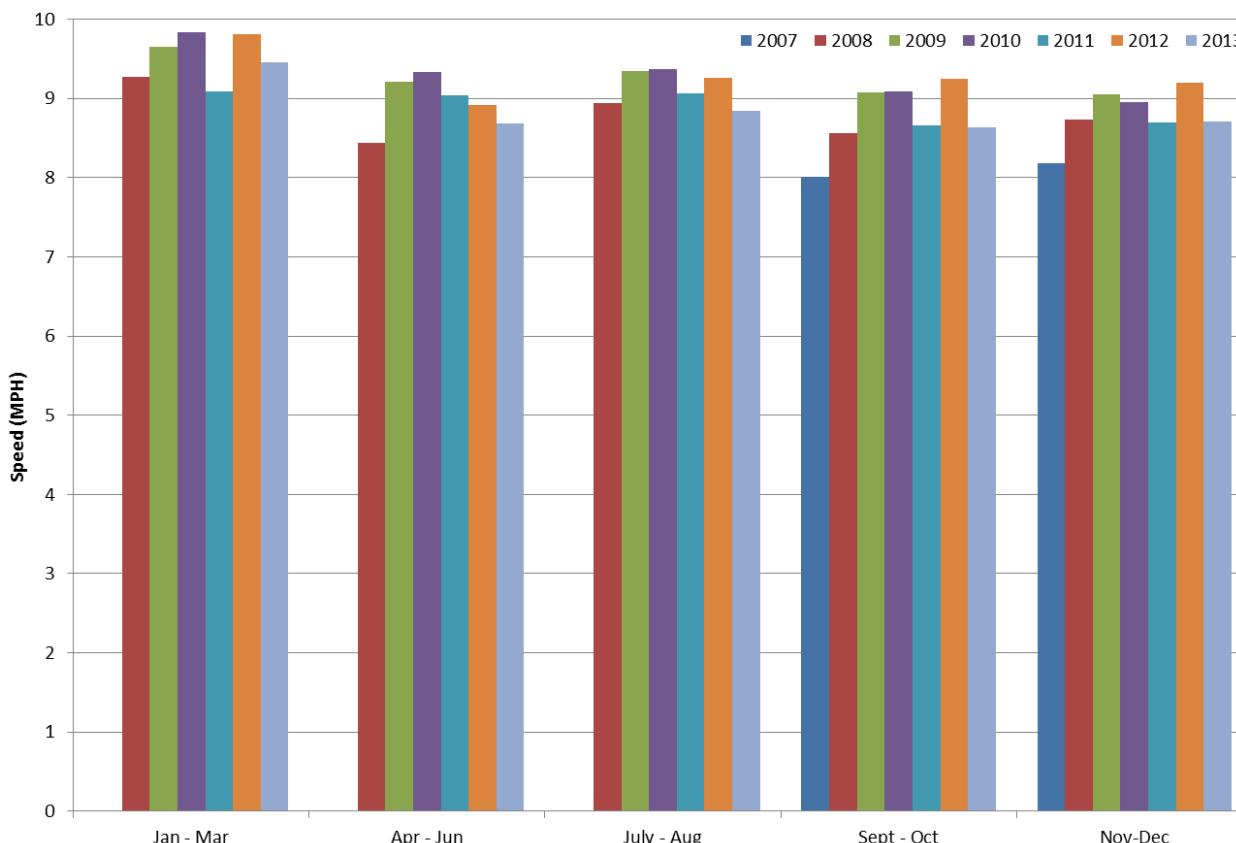
The cyclist risk measure was calculated as a relative rate of injury per cyclist during the 3-year before period and the 3-year after period. To generate the cyclist risk measure, the number of injuries recorded in the project area over the entire investigation period was normalized by the number of 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
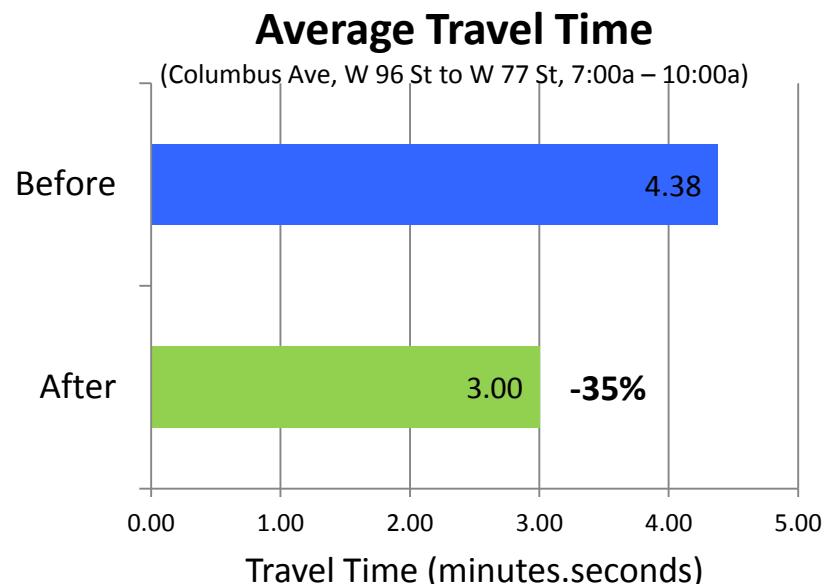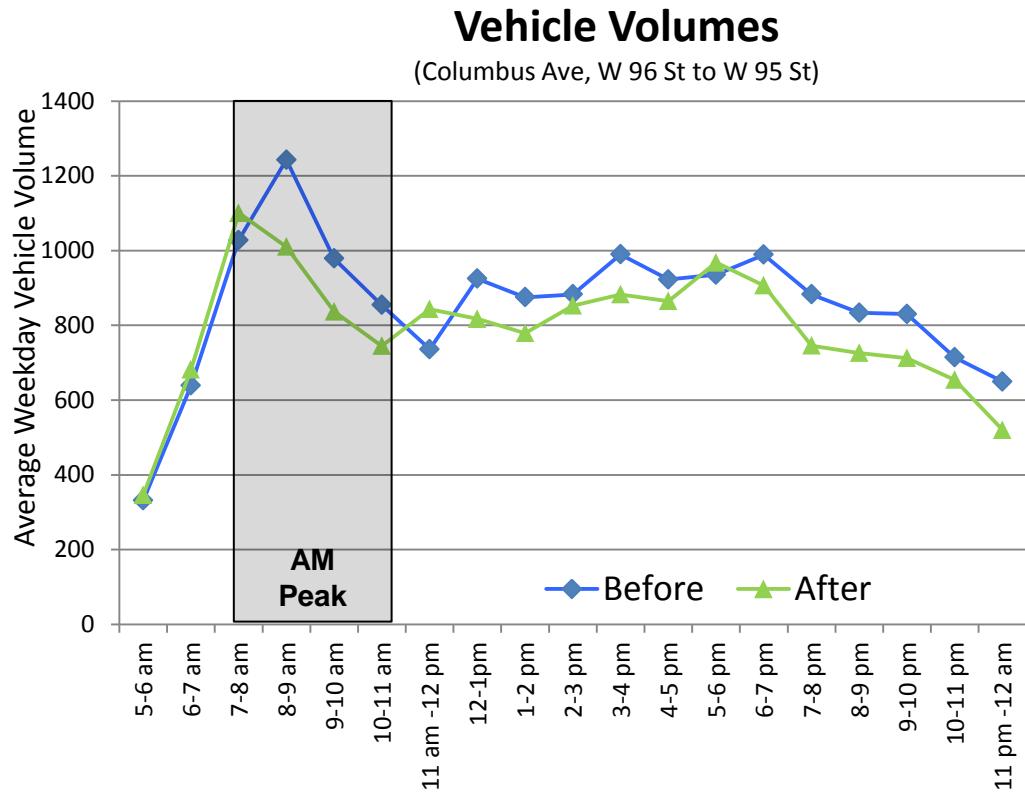
Note: CBD includes all projects in study except Columbus Avenue
Source: NYC TLC – Data includes all weekday yellow taxi trips from 8am-6pm taken in the Manhattan CBD (from Bowling Green to 59th St, river to river), excludes New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving and Christmas.
Job Data Source: NYC Economic Development Corporation

# 2. Mobility – Columbus Avenue
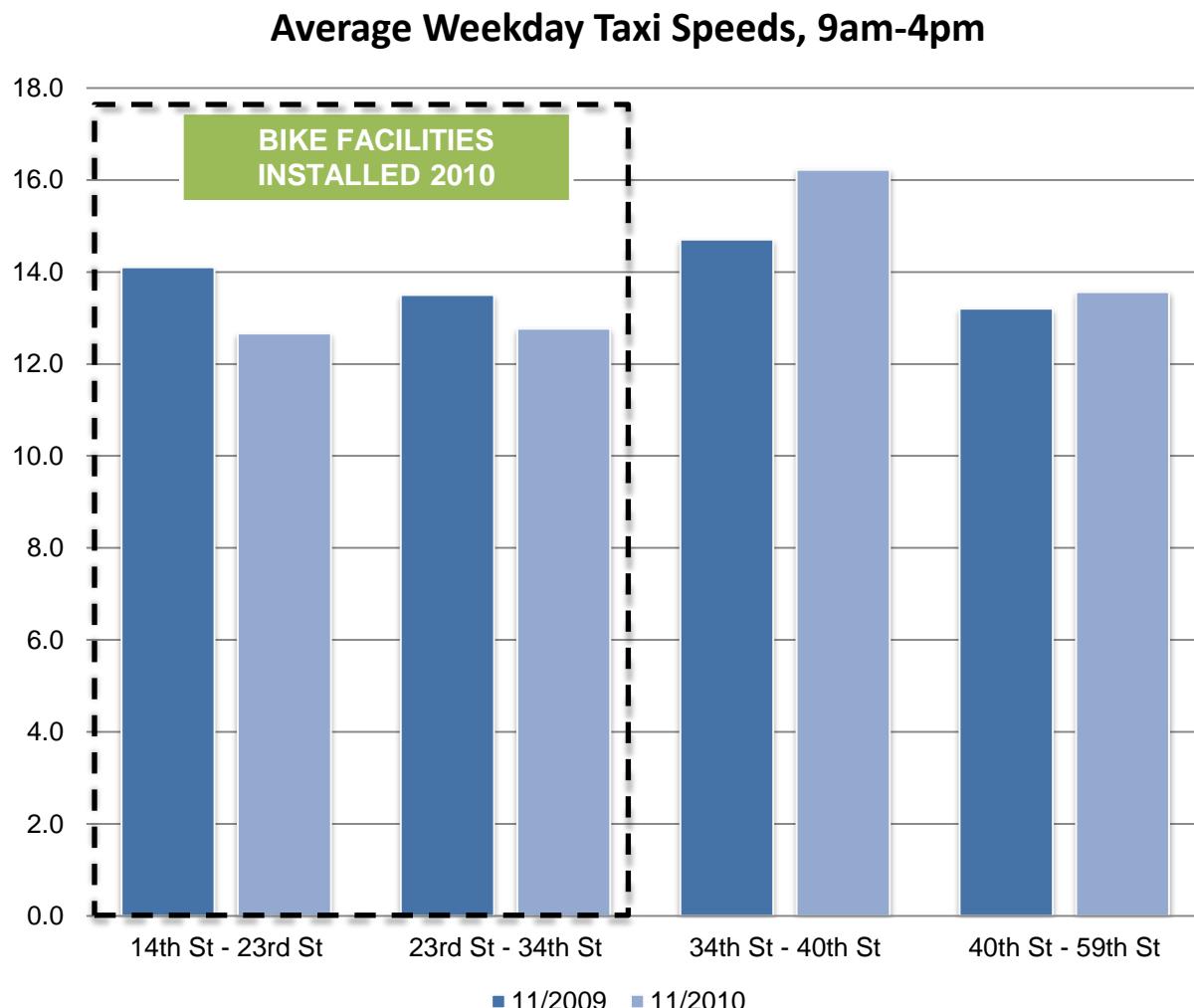
- Travel times on Columbus Avenue have improved while vehicle volumes are maintained

**Vehicle Volumes**

(Columbus Ave, W 96 St to W 95 St)



**Average Travel Time**

(Columbus Ave, W 96 St to W 77 St, 7:00a – 10:00a)

Before — 4.38
After — 3.00 **-35%**

Travel Time (minutes.seconds)

Note: Before volume data collected June 4-10, 2010. After data collected February 23-March 1, 2011. Before travel times collected July 25, 2010. After data collected July 19, 2011. Results are average travel times between 7:00a and 10:00a, 2 runs per hour.
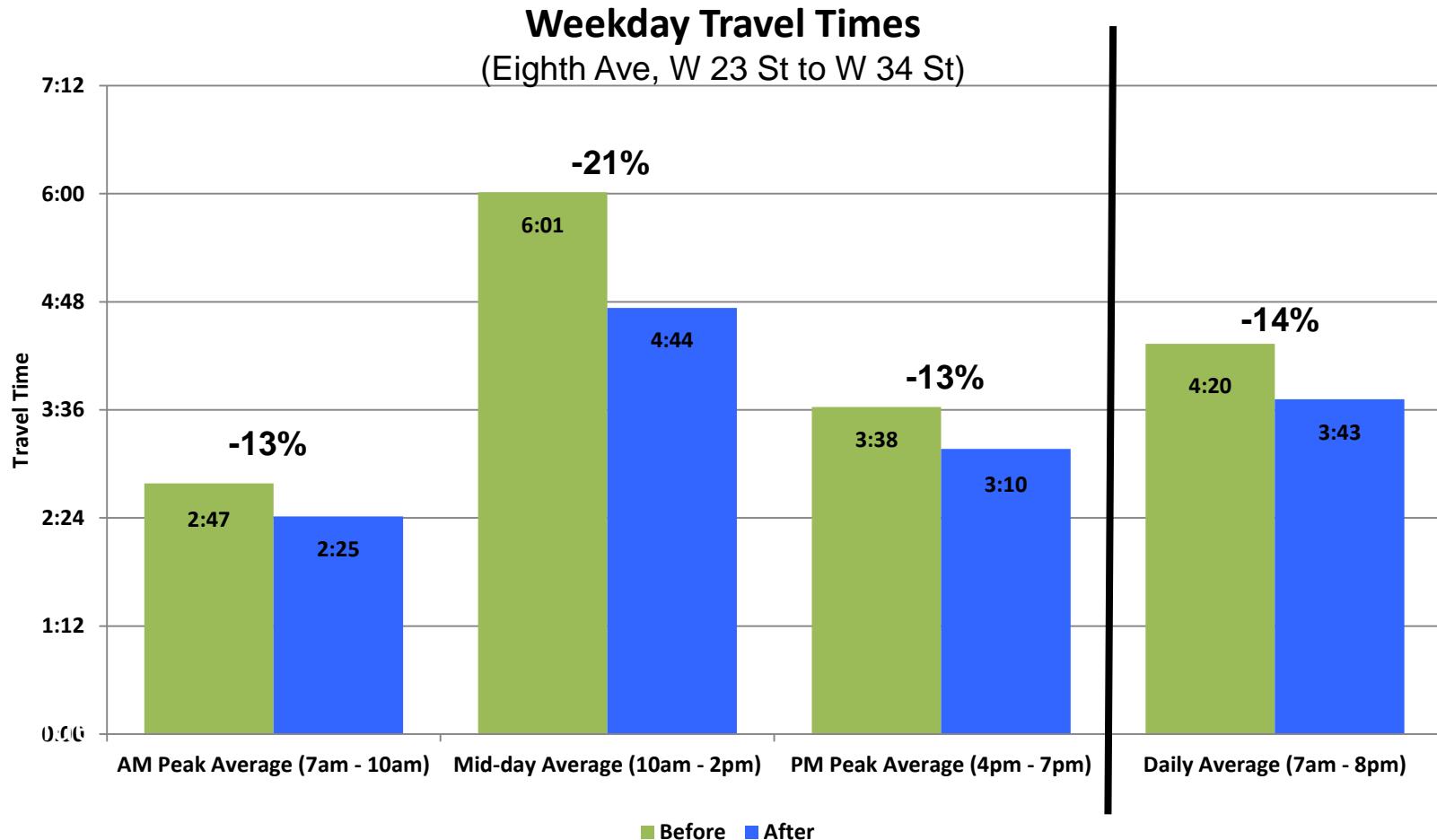
# 2. Mobility – First Avenue

- First Avenue travel speeds remained level through project area

**Average Weekday Taxi Speeds, 9am-4pm**



BIKE FACILITIES INSTALLED 2010

Legend: ■ 11/2009 ■ 11/2010

Categories: 14th St - 23rd St, 23rd St - 34th St, 34th St - 40th St, 40th St - 59th St

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

# 2. Mobility – Eighth Avenue

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



**Weekday Travel Times**
(Eighth Ave, W 23 St to W 34 St)
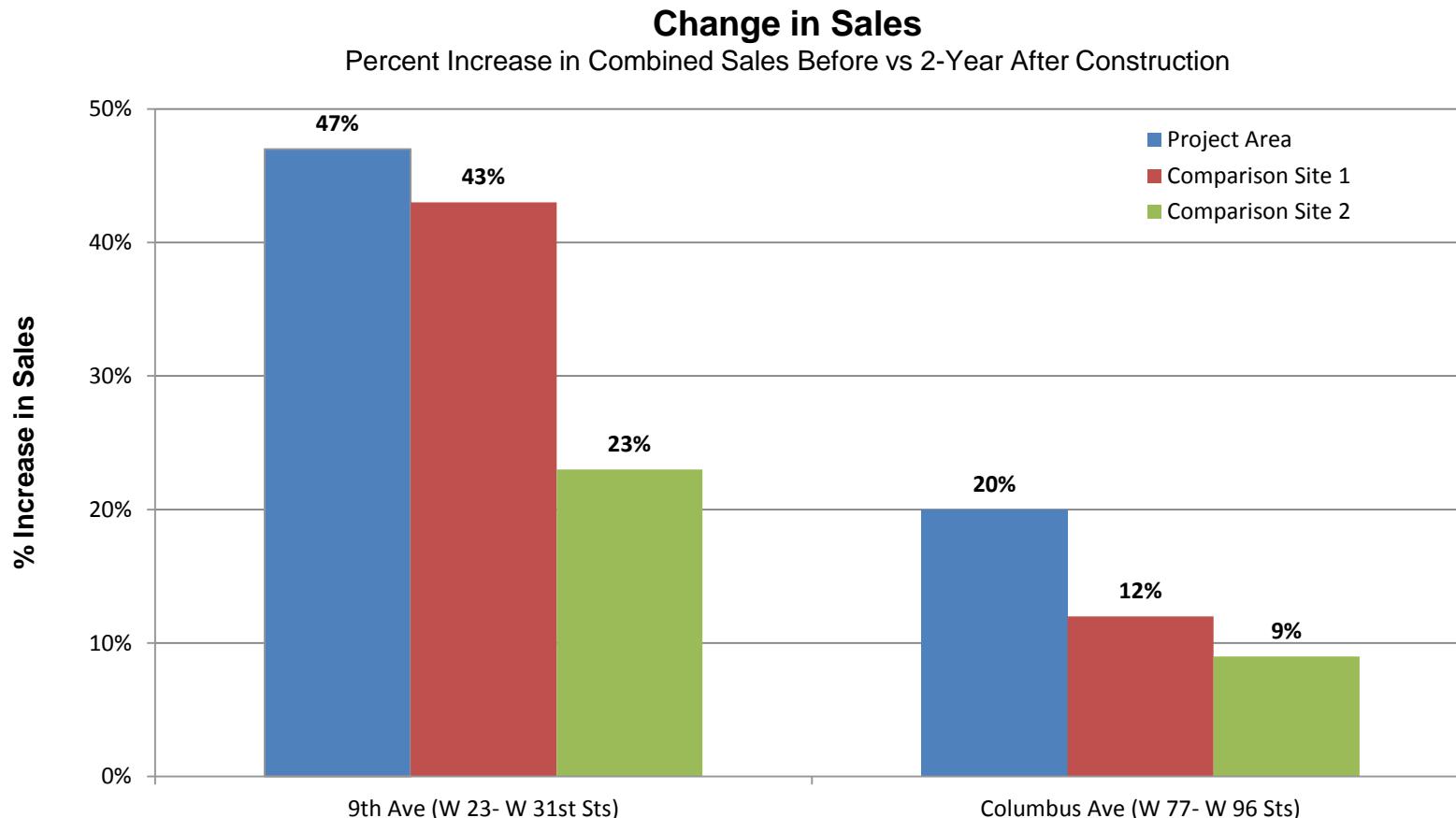
Before data collected September 30 to October 1, 2009 and October 6 to October 8, 2009.
After data collected November 16 to November 18, 2010.

# 3. Economic Impact – Retail Sales

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

**Change in Sales**

Percent Increase in Combined Sales Before vs 2-Year After Construction



Source: NYC DOT (December 2013), "The Economic Benefits of Sustainable Streets". 9th Ave Comparison Site 1 = 10th Ave (16-26 Sts), Comparison Site 2 = 7th 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 – 2nd Avenue (14th Street to 23rd 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$^{nd}$ Avenue (14$^{th}$ Street to 23$^{rd}$ 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



NEW YORK CITY DEPARTMENT OF TRANSPORTATION

Appendix
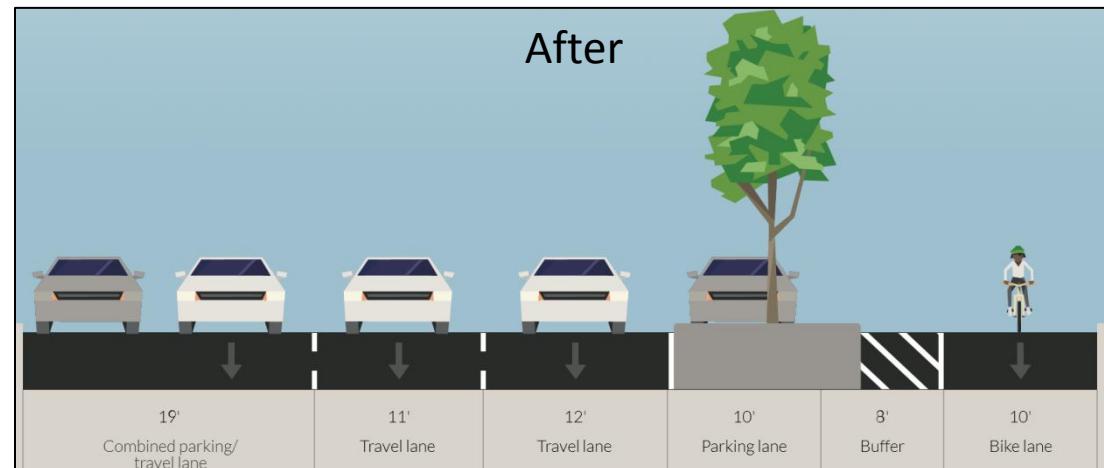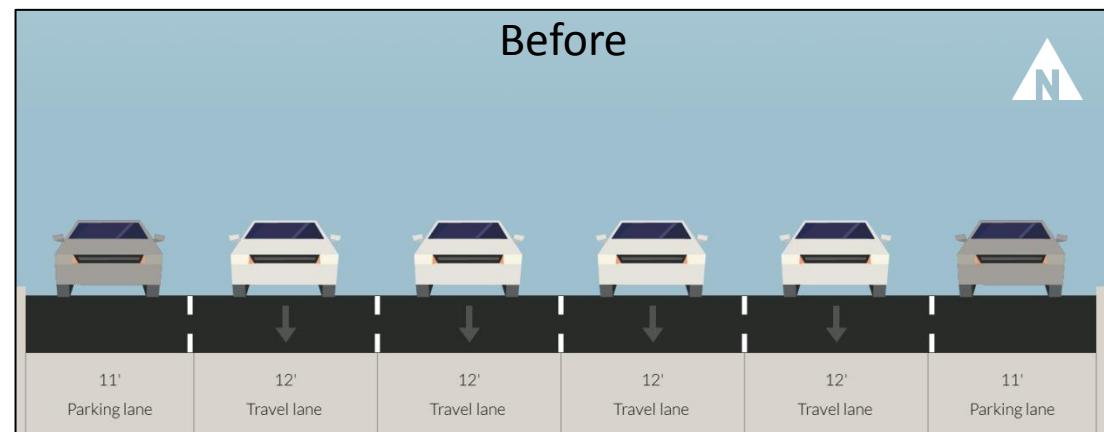
# 9th Avenue (16th Street to 23rd Street)

- 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 9th Avenue

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

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# 9th Avenue (23rd Street to 31st Street)
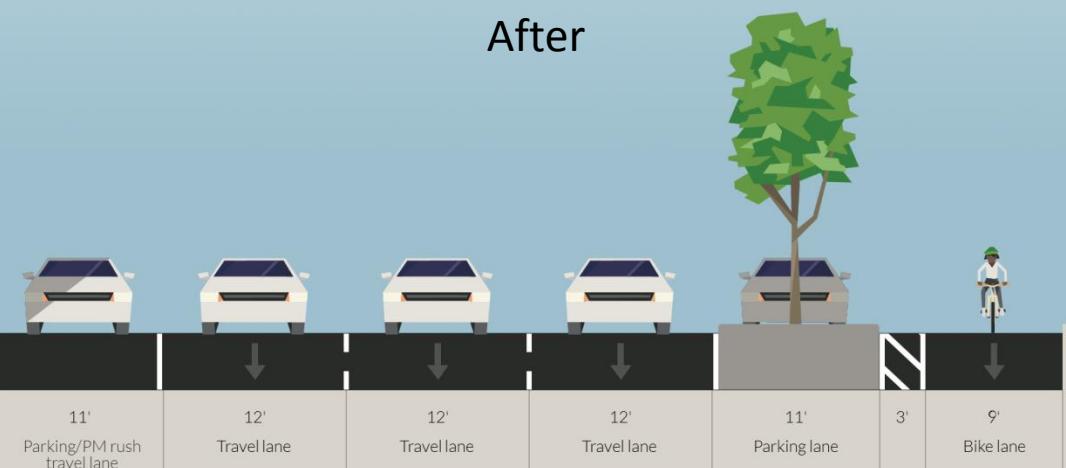
- 70' wide
- No Pre-Existing Bike Lane
- Lane Removal
- Split Phase Signals at All Turning Conflicts

Crashes w/ Injuries

## -43%



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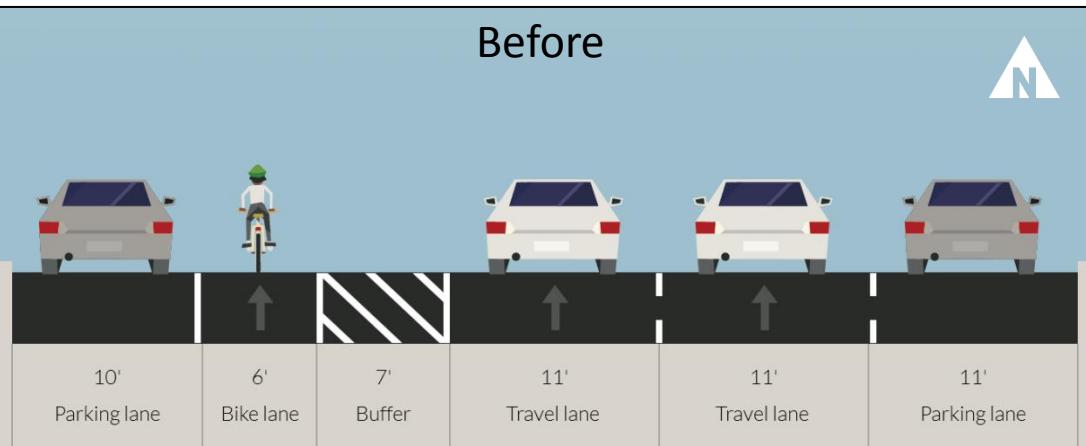
| 11' Parking lane | 12' Travel lane | 12' Travel lane | 12' Travel lane | 12' Travel lane | 11' Parking/AM rush travel lane |

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 9th Avenue

Crash Data Source: NYPD AIS/TAMS Crash Database
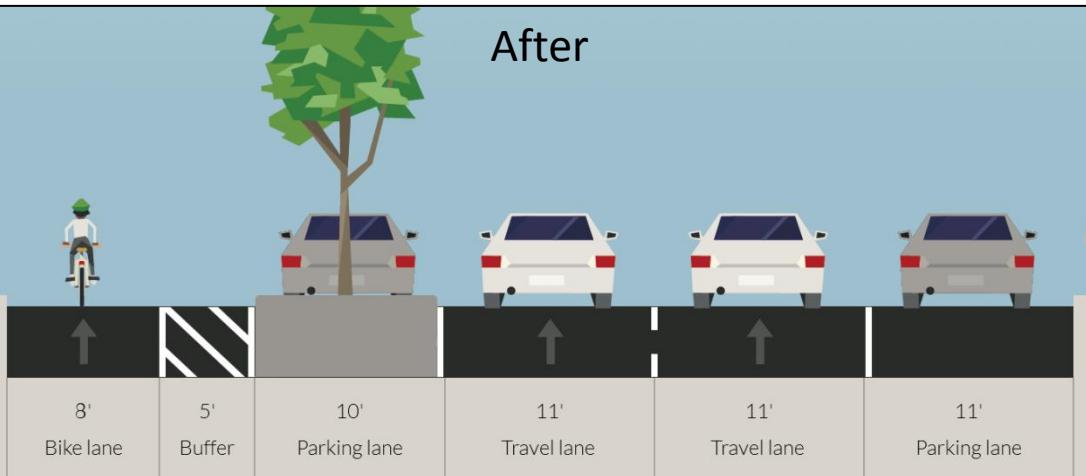
# 8th Avenue (Bank Street to 14th Street)

- 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**

| 10' Parking lane | 6' Bike lane | 7' Buffer | 11' Travel lane | 11' Travel lane | 11' Parking lane |

**After**

| 8' Bike lane | 5' Buffer | 10' Parking lane | 11' Travel lane | 11' Travel lane | 11' Parking lane |



8th Avenue at Bleecker Street

Crash Data Source: NYPD AIS/TAMS Crash Database

# 8th Avenue (14th Street to 23rd Street)
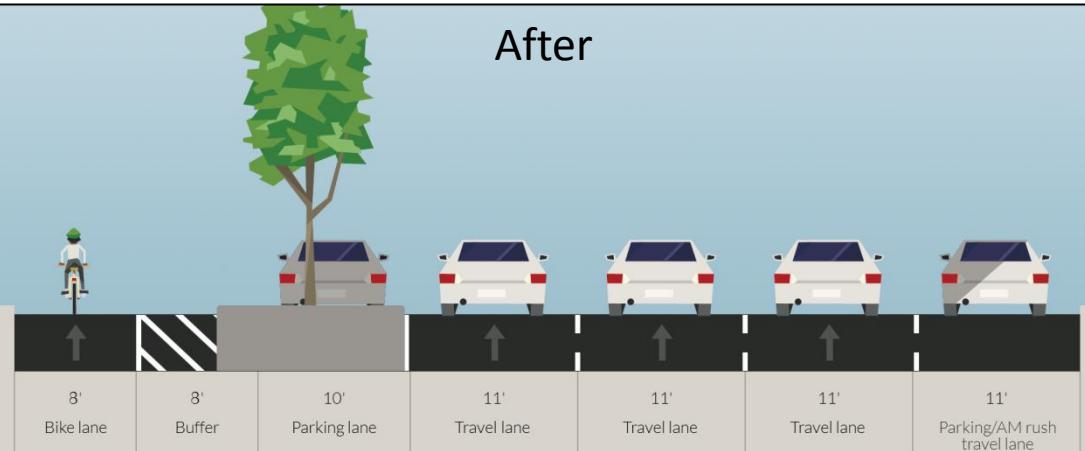
- 70' wide
- Pre-Existing Buffered Bike Lane
- Part-Time Lane Removal; Lane Narrowing
- Split Phase Signals at All Turning Conflicts

**Crashes w/ Injuries -20%**



Before

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

After

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



8th Avenue at 19th Street

Crash Data Source: NYPD AIS/TAMS Crash Database

# 8th Avenue (23rd Street to 34th Street)
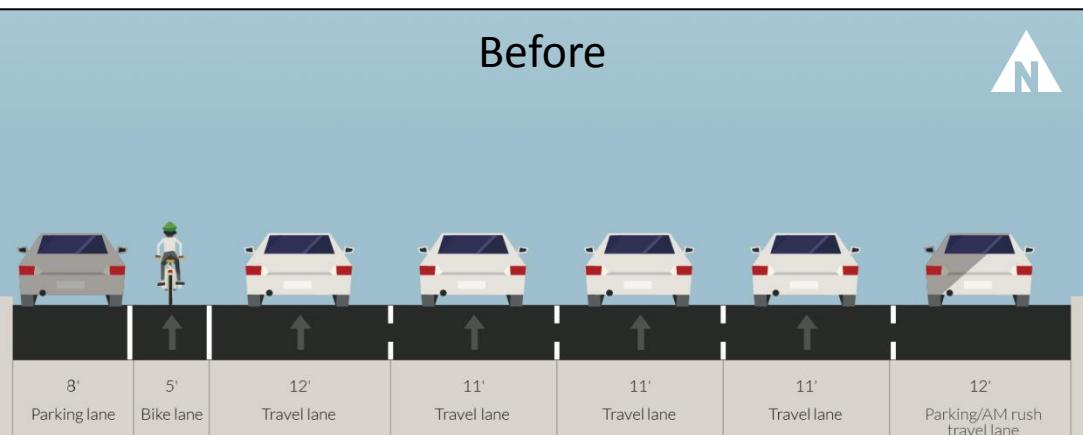
- 70' wide
- Pre-Existing Bike Lane
- No Lane Removal; Lane Narrowing
- Primarily Mixing Zones

**Crashes w/ Injuries**

## -2%

**Bicycle Volumes**

## +9%



Before

| 8' Parking lane | 5' Bike lane | 12' Travel lane | 11' Travel lane | 11' Travel lane | 11' Travel lane | 12' Parking/AM rush travel lane |



After

| 6' Bike lane | 5' Buffer | 9' Parking lane | 10' Travel lane | 10' Travel lane | 10' Travel lane | 10' Travel lane | 10' Parking lane |
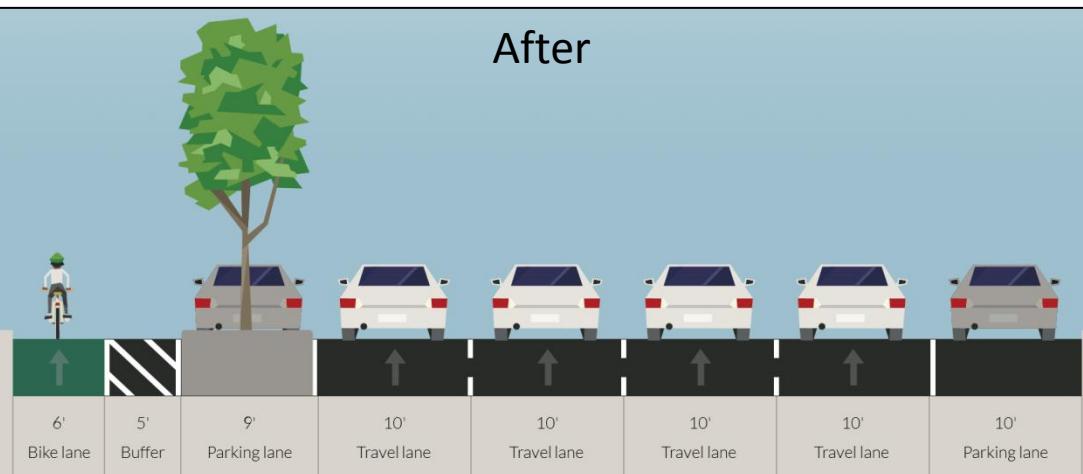


8th Avenue at 26th Street
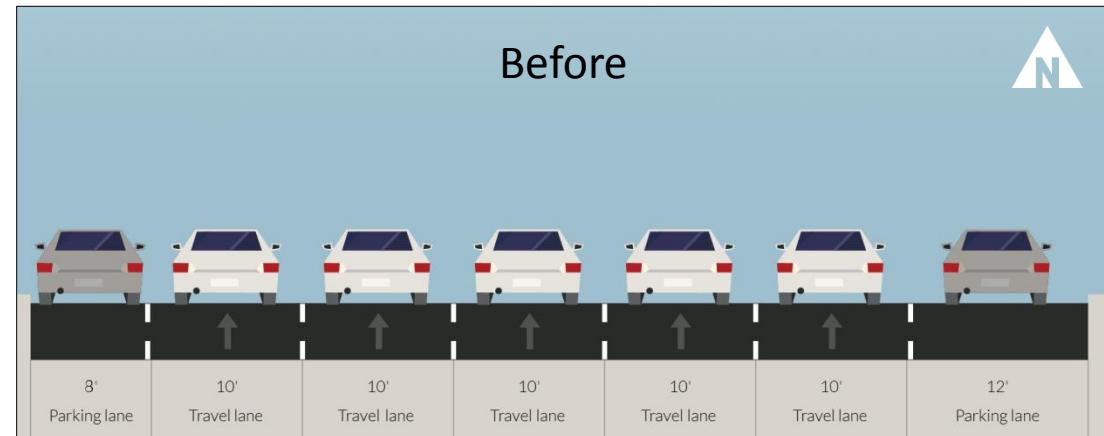
Crash Data Source: NYPD AIS/TAMS Crash Database
Count Data: 8th Ave btwn 28th and 29th St, average of before vs after
12 hour counts taken between April and October

# 1st Avenue (1st Street to 34th Street)
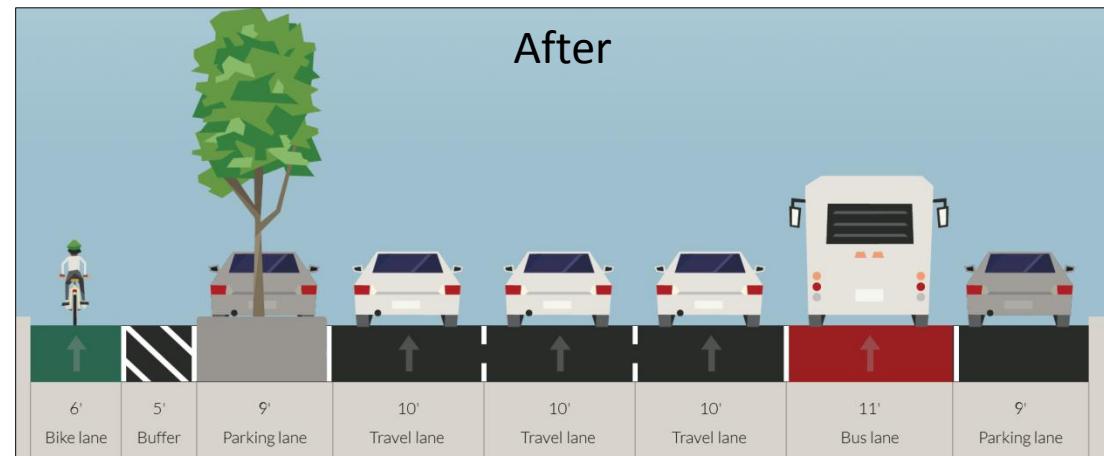
- 70' wide
- No Pre-Existing Bike Lane
- Lane Removal
- Primarily Mixing Zones
- Exterior Bus Lane

**Crashes w/ Injuries**
**-7%**

**Bicycle Volumes**
**+160%**

**Before**

| 8' Parking lane | 10' Travel lane | 10' Travel lane | 10' Travel lane | 10' Travel lane | 10' Travel lane | 12' Parking lane |

**After**

| 6' Bike lane | 5' Buffer | 9' Parking lane | 10' Travel lane | 10' Travel lane | 10' Travel lane | 11' Bus lane | 9' Parking lane |

1st Avenue at 6th Street
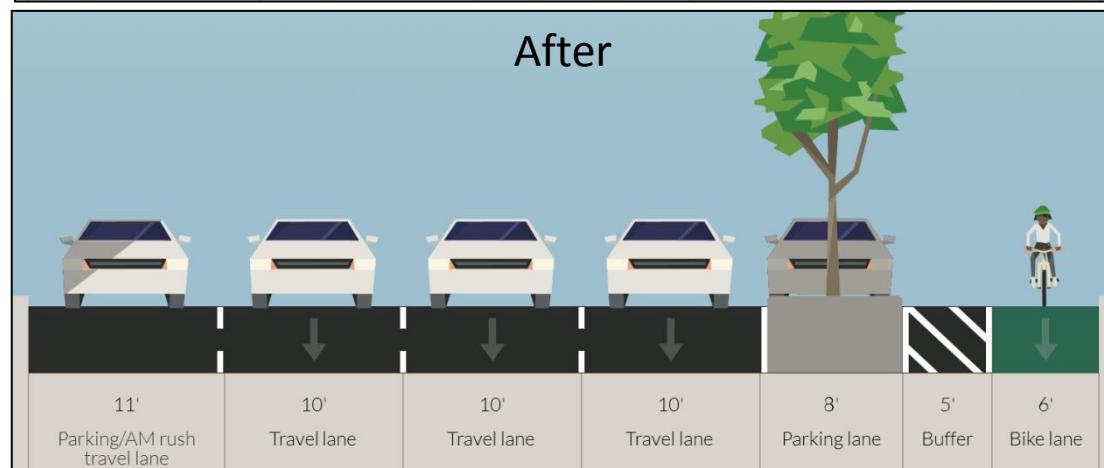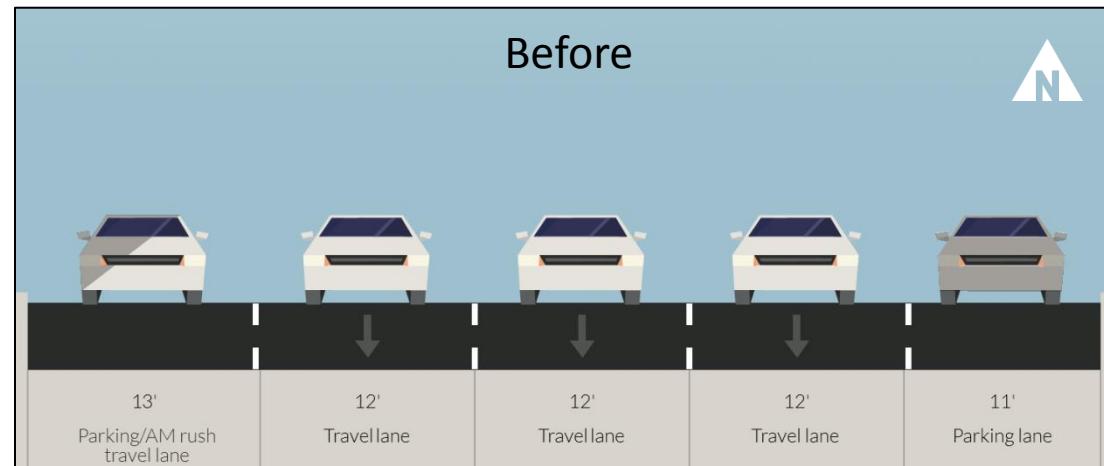
Crash Data Source: NYPD AIS/TAMS Crash Database
Count Data: 1st Ave btwn St Marks Pl and 9th St, average of before vs after 12 hour counts taken between April and October

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# Columbus Avenue (96th Street to 77th 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 90th and 91st St, average of before vs after 12 hour counts taken between April and October

26
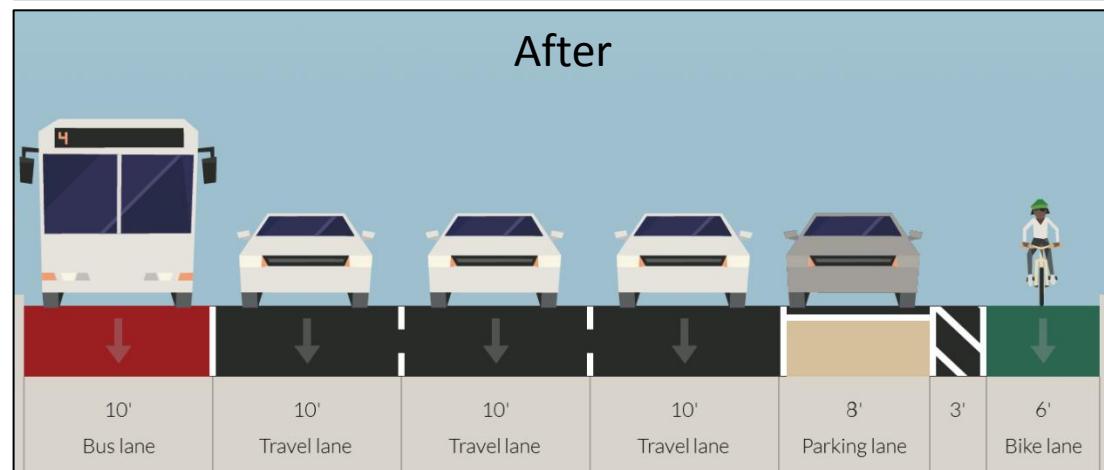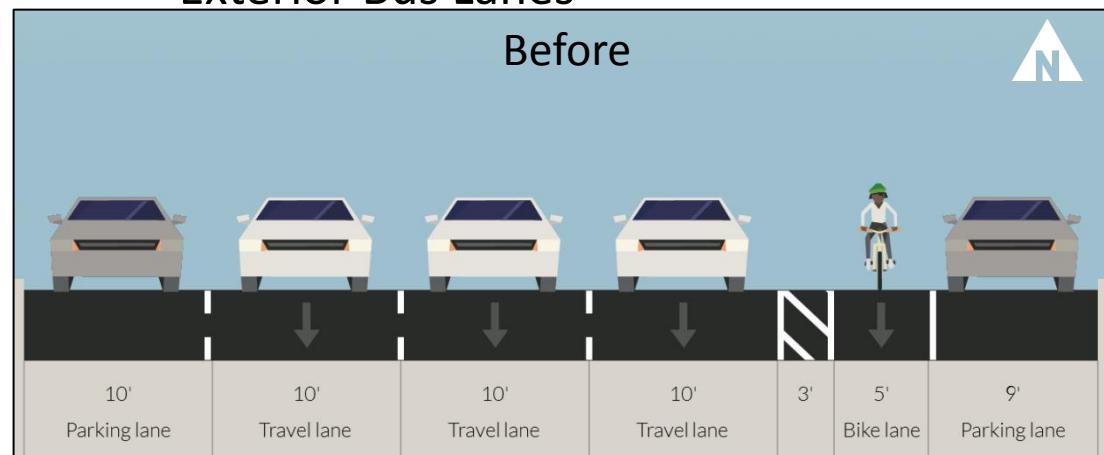
# 2$^{nd}$ Avenue (2$^{nd}$ Street to 14$^{th}$ Street)

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

**Crashes w/ Injuries**
**-4%**

**Bicycle Volume**
**+49%**



Before

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

After

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



2$^{nd}$ Avenue at 10$^{th}$ Street

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

# 2nd Avenue (23rd Street to 34th Street)

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

**Crashes w/ Injuries**
## -7%
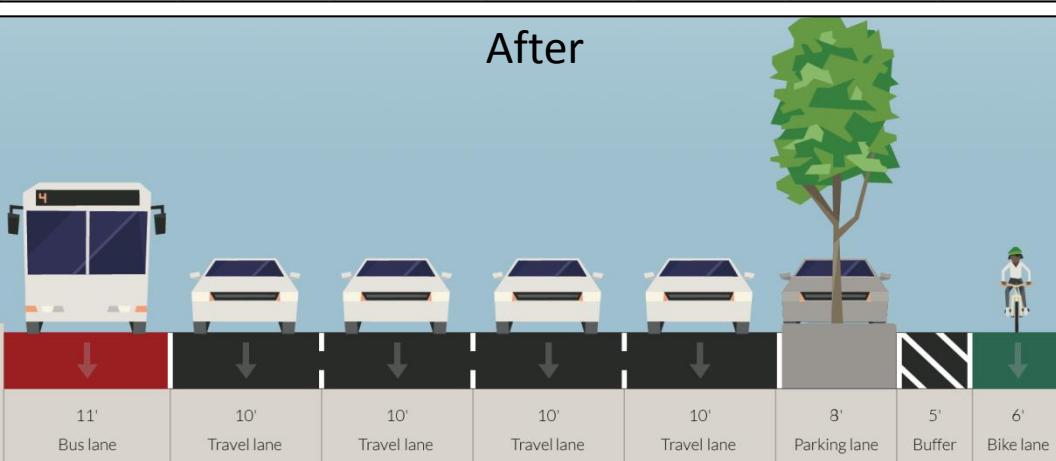
**Bicycle Volumes**
## +60%



### Before

| 12' Bus lane | 10' Travel lane | 10' Travel lane | 10' Travel lane | 10' Travel lane | 10' Travel lane | 8' Parking lane |

### After

| 11' Bus lane | 10' Travel lane | 10' Travel lane | 10' Travel lane | 10' Travel lane | 8' Parking lane | 5' Buffer | 6' Bike lane |

**2nd Avenue at 28th Street**

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

# Broadway (47th Street to 59th 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

| 15' Parking/AM rush travel lane | 10' Travel lane | 10' Travel lane | 10' Travel lane | 5' Bike lane | 9' Parking lane |

After
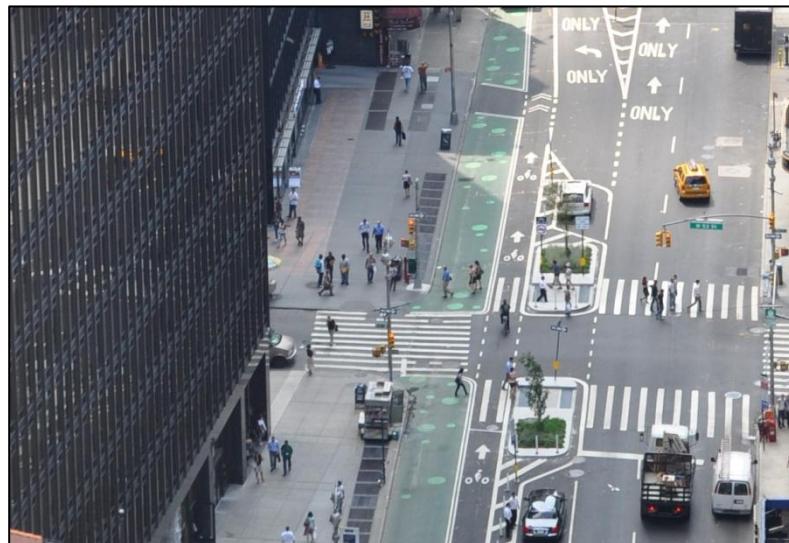
| 19' Combined parking/ travel lane | 10' Travel lane | 9' Parking lane | 4' Buffer | 6' Bike lane | ~11' Pedestrian space |
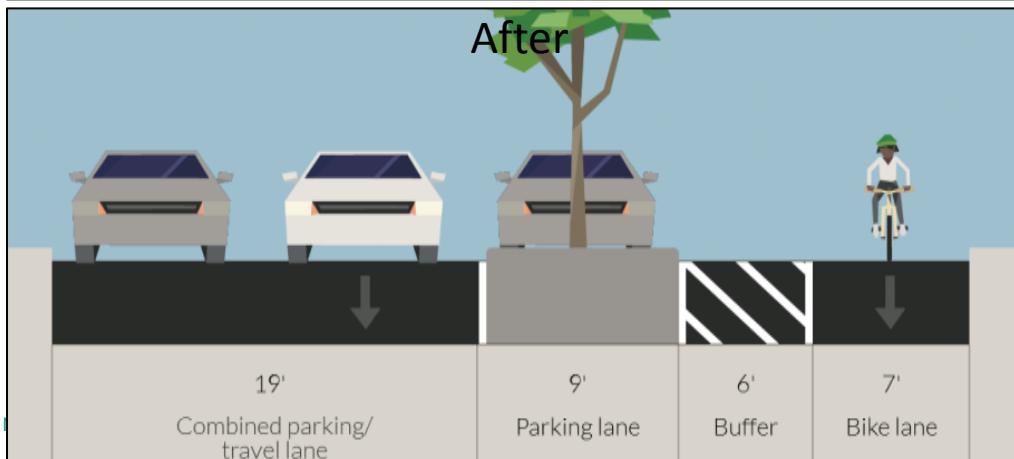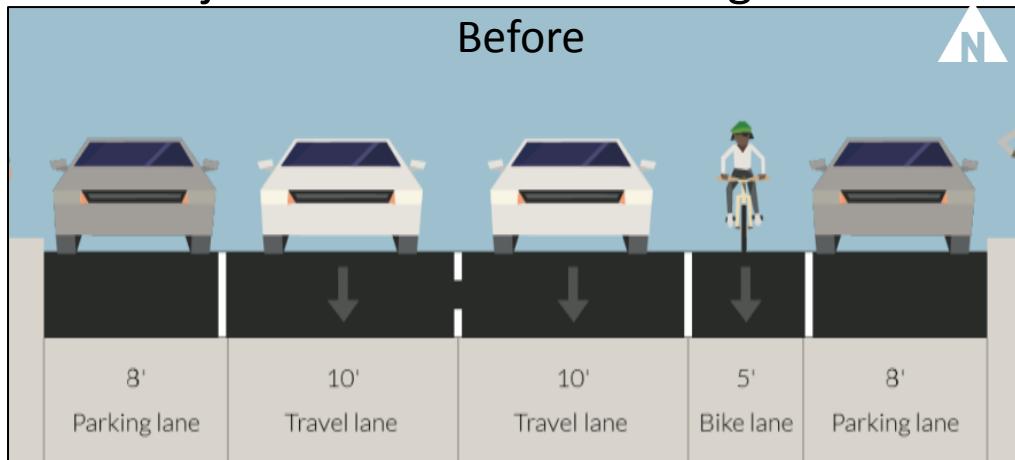


Broadway

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

# Broadway (26th Street to 33rd Street)

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

Crashes w/ Injuries

**-45%**



Before

| 8' | 10' | 10' | 5' | 8' |
|----|-----|-----|-----|-----|
| Parking lane | Travel lane | Travel lane | Bike lane | Parking lane |

After

| 19' | 9' | 6' | 7' |
|-----|-----|-----|-----|
| Combined parking/ travel lane | Parking lane | Buffer | Bike lane |



Broadway at 29th Street

Crash Data Source: NYPD AIS/TAMS Crash Database
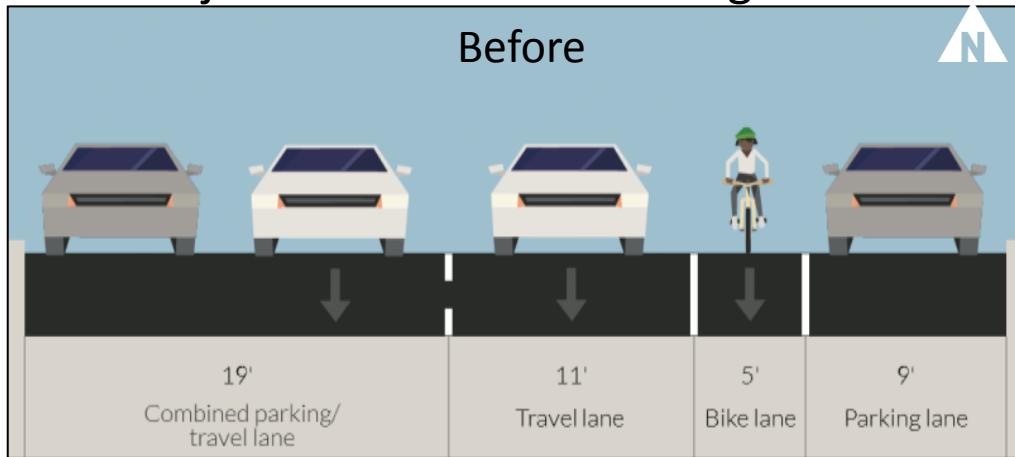
# Broadway (18th Street to 23rd Street)

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

**Crashes w/ Injuries**
# -33%

**Bicycle Volume**
# +28%



**Before**

| 19' | 11' | 5' | 9' |
|---|---|---|---|
| Combined parking/ travel lane | Travel lane | Bike lane | Parking lane |

**After**

| 6' | 5' | 10' | 23' |
|---|---|---|---|
| Bike lane | Buffer | Parking lane | Combined parking/ travel lane |

Broadway at 20th Street

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