Safer Cycling

BICYCLE RIDERSHIP AND SAFETY IN NEW YORK CITY

2017

About the data in this report

Safer Cycling: Bicycle Ridership and Safety in New York City evaluates cyclist fatalities and severe injuries resulting from crashes with motor vehicles.

As you read through this report, you will see two distinct datasets:

- **Cyclist Fatalities:** the total number of *cyclists killed* in crashes with motor vehicles. Cyclist fatality data is obtained from the New York City Police Department/New York City Department of Transportation Reconciled Fatality Database and is available from 1996 through 2016.

- **Cyclist KSI:** the total number of *cyclists killed and severely injured* (known as cyclist KSI) in crashes with motor vehicles. Cyclist KSI data is obtained from the New York State Department of Transportation Crash Database and the New York City Police Department/New York City Department of Transportation Reconciled Fatality Database and is available from 1996 through 2014.

This report's primary focus is the last decade, from 2006 through the most recent year of available data for each source.

The 2006 report, *Bicyclist Fatalities and Serious Injuries in New York City,* evaluated cyclist safety from 1996 to 2005. Cyclist fatalities and cyclist KSI from this period are also included in this study. Additional datasets are noted where applicable.

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Letter from the Commissioners

To our fellow New Yorkers,

Bicycling is a healthy, affordable, and environmentally-friendly way for New Yorkers to get around our city. Increasing the number of city residents who cycle helps take cars off the road, improves air quality, and reduces greenhouse gas (GHG) emissions. Cycling is an important component of the City's *OneNYC* plan for a greener and more livable city and the City's 80 x 50 effort to address climate change.

As the city continues to grow, more New Yorkers are cycling than ever before, whether as part of their jobs, for recreation and exercise, to run errands, or as part of their daily commute. The City of New York is committed to supporting this trend and ultimately doubling the number of regular cyclists across the five boroughs.

To achieve this goal it is essential that the City continue to improve the safety of cycling. Our agencies are committed to working together to achieve Vision Zero, Mayor Bill de Blasio's initiative to eliminate traffic fatalities and severe injuries. In 2006, our agencies published *Bicyclist Fatalities and Serious Injuries in New York City,* a comprehensive study of cyclist safety from 1996 to 2005. Today, we pick up where the previous report left off.

This report describes the progress we have made in improving cyclist safety, presents a detailed analysis of the factors that contribute to serious crashes involving cyclists, and lays out a comprehensive set of strategies to further improve cycling safety. Working together, we can ensure that each bicycle ride is a safe ride.

Polly Trottenberg
DOT Commissioner

James O'Neill
NYPD Commissioner

Mary T. Bassett
DOHMH Commissioner

Executive Summary

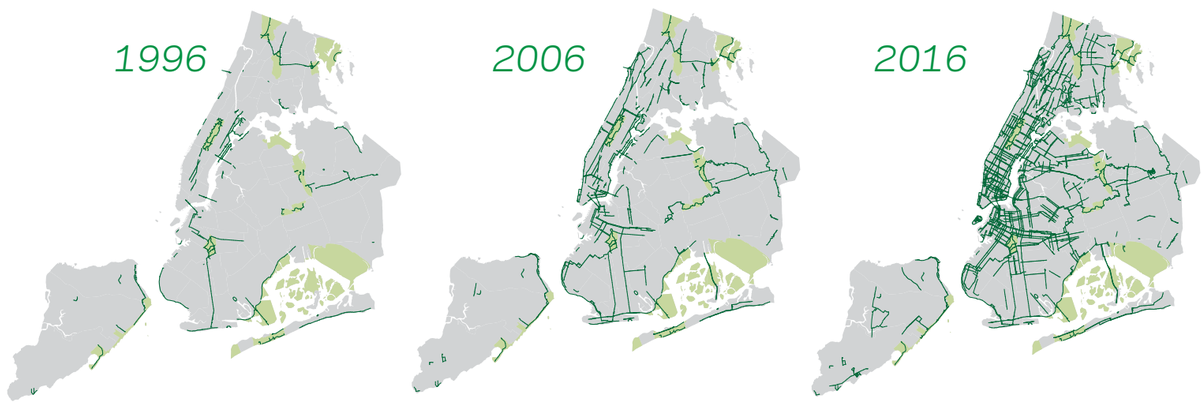
More New Yorkers than ever before are embracing cycling as a convenient and affordable way to get around—**in the last decade alone, annual bicycle trips rose 150%.** Moving forward, the City of New York is committed to supporting further growth in bicycling and doubling the number of regular cyclists by 2020 (based on 2013 levels). Increasing cycling helps to expand mobility, reduce air pollution, improve public health, and fight global climate change. Getting more New Yorkers on two wheels, however, requires a continued effort to make cycling safer than it is today.

As part of Vision Zero, Mayor de Blasio's multi-agency effort to eliminate severe traffic injuries and fatalities, the New York City Department of Transportation (NYC DOT), the New York City Department of Health and Mental Hygiene (NYC DOHMH), and the New York City Police Department (NYPD) have undertaken the first comprehensive analysis of cyclist safety since 2006. This study seeks to understand the main causes of severe injuries and fatalities involving cyclists and the factors that helped significantly improve cycling safety over the past 20 years. The agencies then used these insights to develop a package of actions to further reduce the risks cyclists face on our streets.

BICYCLE RIDERSHIP

Over the past ten years, the City dramatically increased its efforts to make cycling safer and more convenient. Under the previous and current administrations the City has implemented a coordinated set of actions to expand cycling. Since 2006, the City increased the size and quality of the bicycle network, adding 308 lane miles of conventional bicycle lanes and 74 lane miles of protected facilities. During the same period, NYC DOT distributed over 180,000 free bicycle helmets and thousands of free bicycle bells and lights, installed 24,000 bicycle racks across the five boroughs, and conducted safety trainings at hundreds of New York City public schools. In 2013, the City launched Citi Bike, now the largest bike share system in North America.

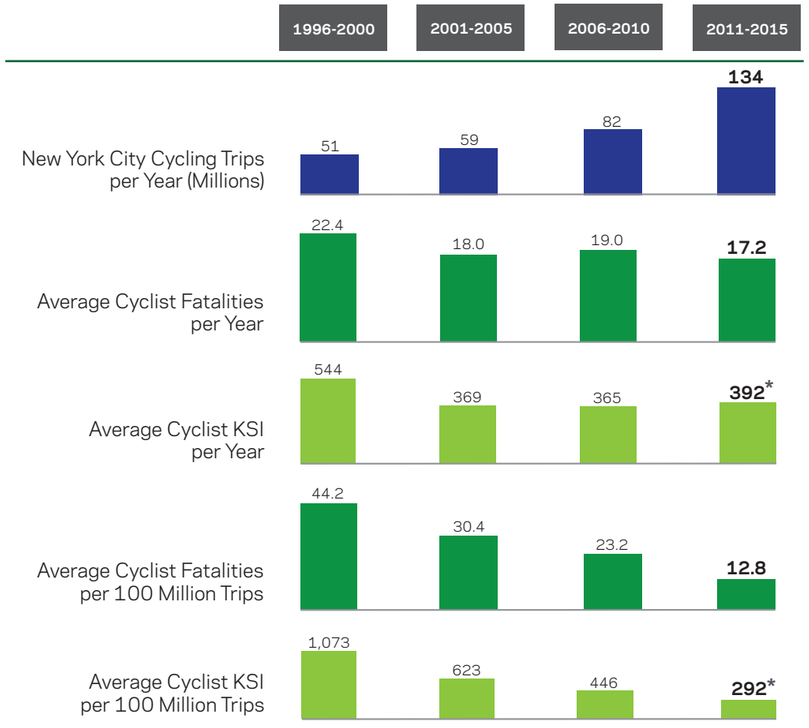
New York City Bicycle Network



More City residents are cycling than ever before. As detailed in NYC DOT's companion report *Cycling in the City*, cycling increased far faster than population or employment growth. There were an estimated 164 million bicycle trips in 2015, up from nearly 66 million trips in 2006, an increase of 150%.

CYCLIST SAFETY

Cyclist safety has improved significantly since 1996. Between 2011 and 2015, there were an average of 12.8 cyclist fatalities per 100 million bicycle trips compared to 44.2 cyclist fatalities per 100 million bicycle trips between 1996 and 2000, a decline of 71%. Combined fatalities and severe injuries (referred to as cyclist KSI) followed a similar pattern. Despite the dramatic increase in bicycle ridership, the total number of cyclist fatalities remained relatively flat over the same period.



Despite this progress, much work remains to be done. Between 2006 and 2016, there were 199 cyclist fatalities and between 2006 and 2014 there were 3,395 cyclist KSI. In 2016, 18 cyclists tragically lost their lives on the streets of New York. This report is part of the City's ongoing efforts to achieve Vision Zero and end the preventable deaths of cyclists.

*Cyclist fatalities and cyclist KSI on this page are presented in five years increments from 1996 to 2015. Cyclist KSI for 2011 to 2015 uses data from 2011 to 2014, the last year of available data.

Executive Summary (continued)

KEY FINDINGS

The growing number of cyclists on our streets is a likely contributor to the positive changes in cycling safety. Researchers in the field of traffic safety posit that the more cyclists there are on the road, the safer riding becomes for all cyclists. The correlation between the rise in cycling trips and the drop in cyclist fatalities and cyclist KSI per bicycle trip suggests that this "safety in numbers" dynamic may be occurring in New York City.

The launch of Citi Bike coincided with a drop in cyclist KSI within the bike share area. Cyclist KSI declined by 17% within the bike share zone after one year of operation, despite a recorded 8.2 million bike share trips in the first year of operation.

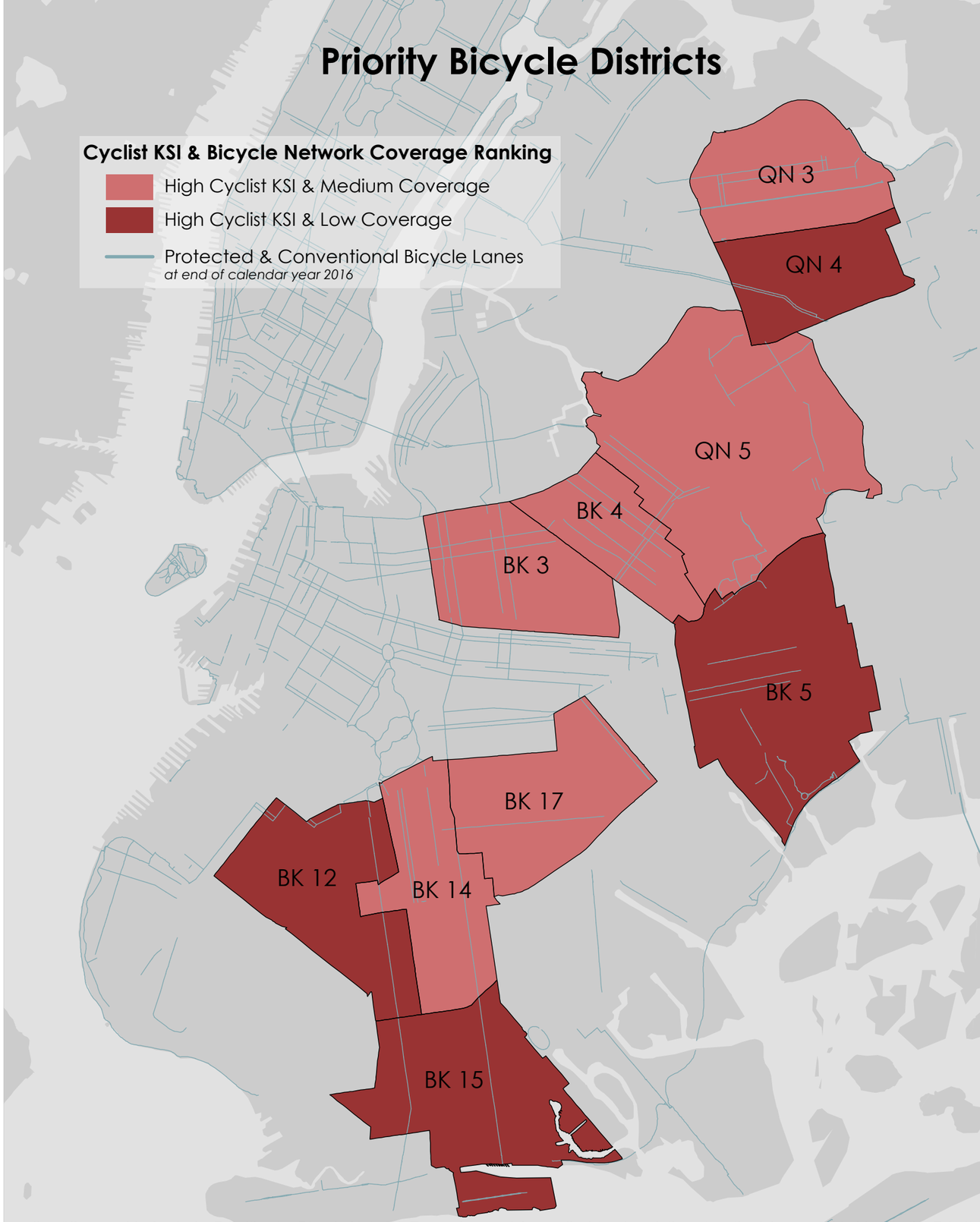
The vast majority of cyclist fatalities occur on streets without bicycle facilities. Between 2006 and 2016, only 11% of cyclist fatalities occurred on streets with a bicycle facility.

A number of New York City neighborhoods underserved by the bicycle network experience significant cyclist KSI. NYC DOT identified 10 ***Priority Bicycle Districts,*** neighborhoods with comparatively high numbers of cyclist KSI—suggesting significant bicycle ridership—and few dedicated bicycle facilities. These districts, seven in Brooklyn and three in Queens, represent 14% of the City's bicycle lane network and 23% of cyclist KSI. Moving forward, the agency will prioritize these areas for bicycle network expansion.

The overwhelming majority of cyclist fatalities and cyclist KSI occurred at intersections. The majority of cyclist fatalities (65%) and an even greater percentage of cyclist KSI (89%) occurred at intersections. NYC DOT is undertaking a study, to be released in early 2018, to examine the safety impacts of different intersection designs and make recommendations for new design treatments.

Most crashes leading to cyclist fatalities fall into three main categories. The top three crash types resulting in a cyclist fatality were: traveling adjacent to a motor vehicle (29%), traveling at a right angle to a motor vehicle (27%), and motor vehicle turn crashes (21%). A high percentage of cyclist fatalities (27%) involved trucks, when compared to cyclist KSI (5%).

Based on these findings, the *Safer Cycling* report recommends a comprehensive set of engineering and planning, enforcement, education, policy and legislation, and research and data strategies to improve cyclist safety across New York City.



See "Geographic Analysis: Priorities for Bicycle Network Expansion" and Appendix 1 for description of methodology used to identify the Priority Bicycle Districts. Data: Cyclist KSI: 2010-2014; Protected & Conventional Bicycle Lanes: As of 12/31/2016. Source: NYC DOT

Action Plan

Engineering & Planning

- Continue to implement 50 lane miles of bicycle facilities a year, including at least **ten lane miles of protected bicycle lanes**
- Create or enhance **75 lane miles** of bicycle facilities in **Priority Bicycle Districts** by 2022
- Increase the percentage of **New Yorkers living near a bicycle facility** from approximately 80% to 90% by 2022
- Complete a study of best practices in **intersection design** for bicycle facilities in early 2018 and implement and evaluate new treatments
- Evaluate and improve midblock **curb regulations** along current and future bicycle facilities to reduce conflicts with parking and loading vehicles
- Explore the expansion of New York City's **bike share** system to Priority Bicycle Districts

Enforcement

- Focus and deploy enforcement resources to **intersections with high rates of cyclist KSI**
- **Tailor enforcement** to address the most dangerous driver and cyclist behaviors

Educational Programs

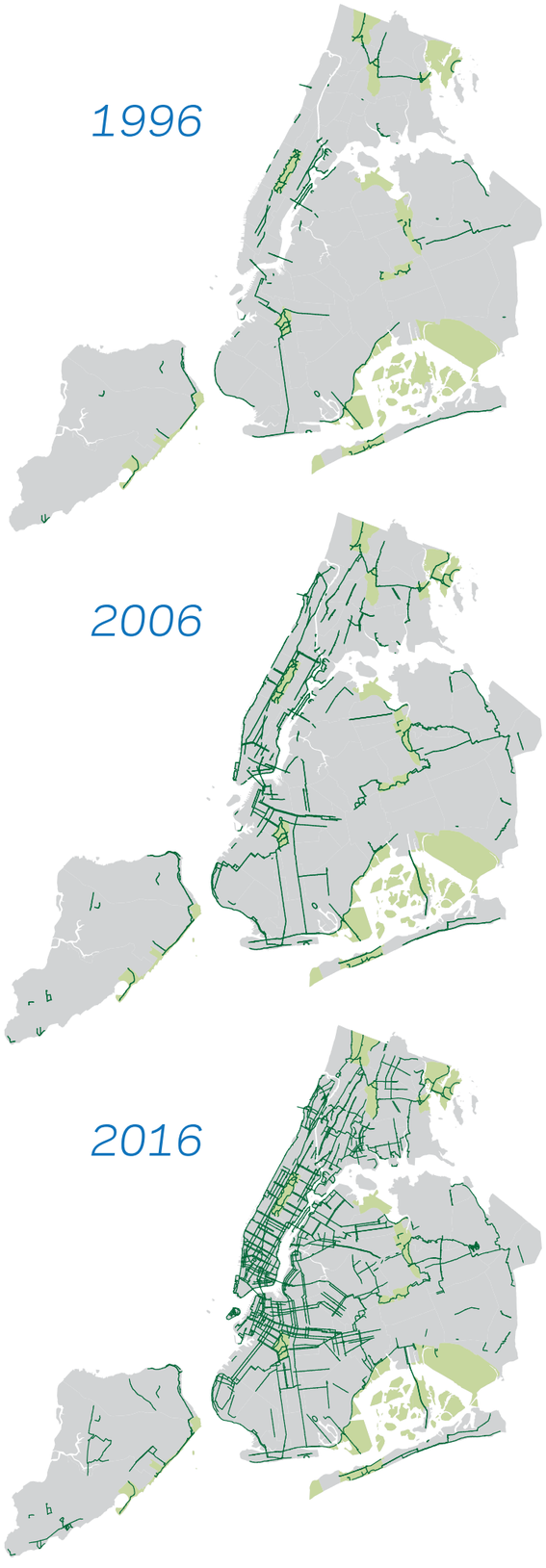
- Develop **targeted outreach strategies** to promote safe driving and cycling behaviors
- Promote safe and accessible bicycling for **young New Yorkers**
- Implement education and regulation of independent contractor **commercial cyclists**

Legislation & Policy

- Explore legislation requiring vehicles to **provide three feet** between the vehicle and bicycle when passing a bicycle
- Advocate for legislation requiring all companies that do business with the City to install **truck side guards**

Research & Data

- Conduct a comprehensive **evaluation of all bicycle facility types**
- Continue to collect **citywide bicycle ridership** data in the Department of Health and Mental Hygiene Community Health Survey, resources permitting
- Expand **bicycle count data** collection to better understand where and when New Yorkers are cycling



City Efforts to Expand Cycling

Over the past ten years, the City dramatically increased its efforts to make cycling safer and more convenient.

Since 2006, NYC DOT increased the size and quality of the bicycle network, adding 308 lane miles of conventional lanes and 74 lane miles of protected lanes; developed Citi Bike, the largest bike share system in North America; distributed over 180,000 free bicycle helmets and thousands of free bicycle bells and lights; installed 24,000 bicycle racks across the five boroughs; and conducted bicycling safety trainings for thousands of New York City public school children.

The community of bicycle groups in New York City also played an important role in organizing and educating cyclists, advocating for bicycle network expansion, and working with the City to encourage more New Yorkers to get on bicycles.

City Efforts to Expand Cycling

City Efforts to Expand Cycling

Expanding the Bicycle Network

Protected Lane

Conventional Lane

Signed/Marked Route

Over the past two decades, the City of New York more than quadrupled the size of the bicycle network, growing it from less than 250 lane miles* in 1996 to over 1,100 lane miles in 2016. As laid out in *OneNYC*, Mayor de Blasio's plan for a vibrant, sustainable, resilient, and equitable city, NYC DOT aims to install or enhance 50 bicycle lane miles, including 10 lane miles of protected lanes each year.

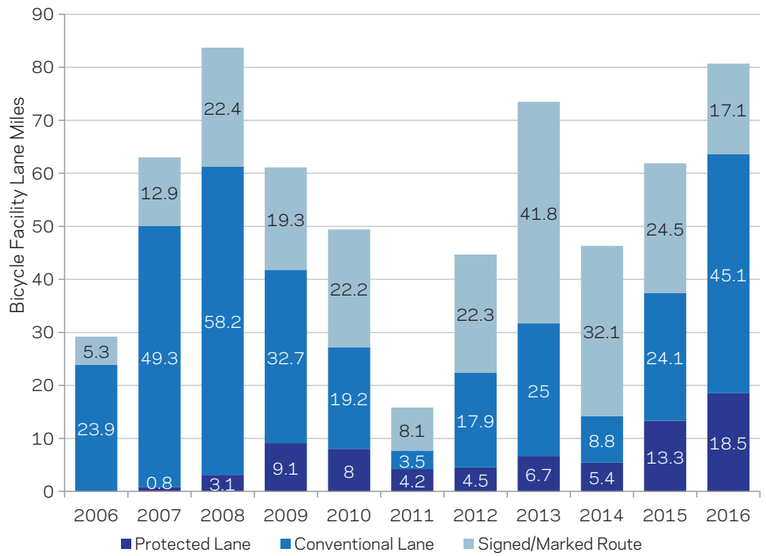
New York City's bicycle network consists of bicycle facilities, which provide dedicated space and/or directional guidance for cyclists. There are three main types of bicycle facilities:

Protected bicycle lanes physically separate cyclists from vehicle traffic with vertical elements such as a lane of parked cars, concrete medians, or other treatments.

Conventional bicycle lanes provide a dedicated travel lane for cyclists delineated with traditional street markings.

Signed/marked routes include shared lane markings, wide parking lanes, and signed bicycle routes.

Figure 2. Bicycle Facilities Installed by Year: 2006 - 2016



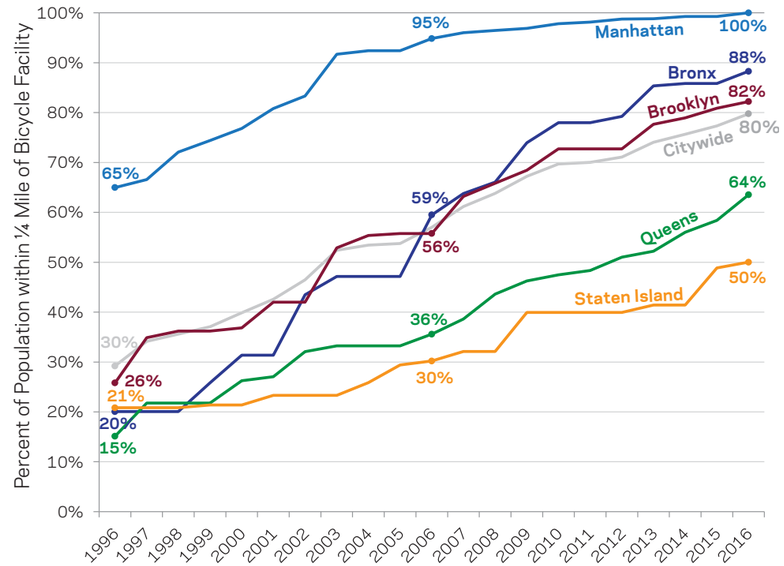
*Lane miles measure the distance of bicycle facilities in a given direction. One mile of an eastbound conventional lane and one mile of a westbound conventional lane on the same city blocks equal two lane miles.

80% of New Yorkers lived within a 2 minute bike ride of a facility in 2016

Improving Access to Bicycle Facilities

As the City expanded the bicycle network, the number of New Yorkers with convenient access to bicycle facilities grew dramatically. By the end of 2016, 80% of New Yorkers lived within a quarter mile of a bicycle facility, the equivalent of a two minute ride or a five minute walk.[1] Research shows that people who live within a quarter mile of a bicycle facility are more likely to bicycle than those who lived one mile or more away; NYC DOT continues to focus on bicycle network expansion as its core strategy to increase cycling.[2]

Figure 3. Proximity to Bicycle Facilities: 1996 - 2016



Access to bicycle facilities is highest in Manhattan, the Bronx, and Brooklyn, where more than 80% of residents live within a quarter mile of a bicycle facility. The change in access to bicycle facilities in these boroughs mirrors the City's efforts to expand the bicycle network: in 2006, only 59% of Bronx residents and 56% of Brooklyn residents lived in close proximity to a bicycle facility; by 2016 those figures had risen to 88% in the Bronx and 82% in Brooklyn. Bicycle facility access remains below the citywide average in Queens and Staten Island, although access has steadily increased in Queens and recently grown in Staten Island.

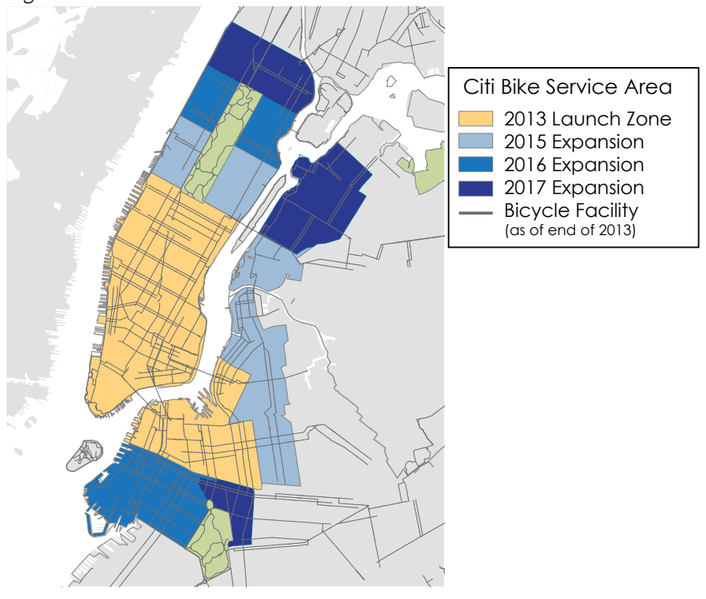
Creating a Bike Share System

To complement the buildout of the bicycle network and to make cycling more accessible and convenient, the City launched Citi Bike, New York City's public bike share system in 2013. The system launched with 6,000 bicycles at 332 stations in Manhattan below 59th Street and in neighborhoods in Brooklyn. Citi Bike expanded in 2015 and 2016 to neighborhoods in Manhattan, Brooklyn, and Queens. Additional expansion is currently underway that will bring the system up to 12,000 bicycles at over 700 stations by the end of 2017.

Citi Bike is the most used bike share system in North America. In June 2017, Citi Bike riders averaged 57,705 trips each day and the system had over 130,000 active annual members. The system is also very popular with visitors and casual users, who purchased nearly 75,000 casual (daily or three-day) passes in June 2017. In terms of safety, there has been one fatality of a Citi Bike rider out of 44.5 million Citi Bike trips taken through the end of June 2017.

As part of the Better Bike Share Partnership, led by Bedford-Stuyvesant Restoration Corporation, NYC DOHMH partnered with Interfaith Medical Center to establish the Prescribe-a-Bike Program. During the course of the pilot, over 70 providers and patients received free annual bike share memberships and helmets. To participate in the program patients need to attend an orientation, and be cleared by doctors for physical activity. The program is anticipated to expand to Woodhull Hospital in Fall 2017.

Figure 4. Bike Share Service Area



City Efforts to Expand Cycling

Promoting Cycling Safety: Education & Awareness

Working with community partners, schools, and advocacy groups, NYC DOT conducts significant outreach, educational programming, and public awareness campaigns to promote cycling as a way to get around, to provide information on the bicycle network, and to encourage cyclists, pedestrians and drivers to make safe choices. These programs include:

Figure 5. Education and Outreach Programs

Program	Description & Goals
Safety Education	Every year NYC DOT provides cycling safety training to third graders from 110 public schools at the agency's Safety City education center. The agency also provides safety education at 290 public schools each year.
Bicycle Maps	Every year NYC DOT distributes free updated bicycle network maps through bicycle shops and community events. The agency distributed 4.5 million maps through the end of 2016.
Bike Smart	Bike Smart is the City's pocket guide on the rules of the road, how to use bicycle facilities, and tips for safe riding. In 2016, NYC DOT distributed Bike Smart guides in seven languages.
Bell & Light Giveaways	Every year NYC DOT distributes free bicycle bells and lights at events throughout the city. Over 3,200 sets of lights and 5,500 bells were distributed in 2016.
Bicycle Helmet Giveaways	The agency also provides free bike helmets and helmet fittings to children and adults (including bike delivery workers) at events throughout the city. NYC DOT distributed over 180,000 helmets through the end of 2016.
Truck's Eye View	Working with partners in the freight industry, NYC DOT's Truck's Eye View program teaches cyclists and pedestrians about truck blind spots at community events across the city.
Citi Bike Street Skills	In partnership with Citi Bike, this program teaches New Yorkers how to use Citi Bike and how to ride safely and comfortably on city streets.
Heads Up Safety Campaign	This advertising campaign reminded cyclists and pedestrians to obey the rules of the road in order to keep themselves and others safe, and was targeted at high traffic locations, including bus shelters and newsstands.
"LOOK!" Safety Campaign	This advertising campaign reminded drivers and passengers in motor vehicles to be aware of cyclists when driving and when entering or exiting a vehicle.
"Don't Be a Jerk" Campaign	This advertising campaign highlighted the essential dos and don'ts of safe, responsible cycling.

City Efforts to Expand Cycling

Expanding Access to Bicycle Parking

NYC DOT has a range of efforts to expand secure and convenient bicycle parking on and off of city streets. Since 2006 the agency has installed more than 24,000 bicycle racks, providing parking for 48,000 bicycles, and created 48 bike corrals, each of which provides parking for approximately eight bicycles in a curbside parking space.

In terms of legislation, the City created the Bikes in Buildings program to expand access to secure bicycle parking in existing commercial buildings, required parking garages and lots to provide secure bicycle parking, and mandated that new residential and commercial buildings include secure bicycle parking rooms. NYC DOT is also exploring creating secure bicycle parking facilities at major transit hubs and activity centers.

Increasing Commercial Cyclist Safety

In an effort to improve the safety of commercial cyclists and to increase their compliance with the rules of the road, NYC DOT created a commercial cyclists safety program in 2013. Employers are required to provide employees who cycle with proper equipment, including helmets, reflective vests, and bicycles equipped with headlights, taillights, reflectors, bells and working brakes. The agency's Commercial Bicycle Unit has visited approximately 25,300 businesses to evaluate compliance with program rules.

City Efforts to Expand Cycling

Growth of Cycling

Cycling in New York City increased dramatically over the past 10 years and more New Yorkers are now cycling than ever before. Bicycling in New York City grew from an estimated 66 million trips in 2006 to 164 million trips in 2015, an increase of 150%.

The growth in cycling far outstripped the growth in population (4%), employment (15%), and transit ridership (8%) over this same period.[3] Part of this increase is likely attributable to the introduction of bike share.

Growth of Cycling

Cycling increased 150% between 2006 and 2015

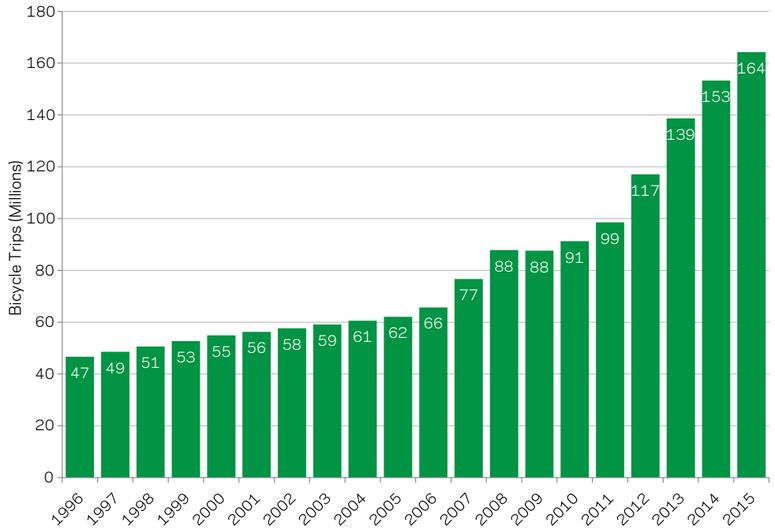
New Yorkers took 164 million cycling trips in 2015

Cycling Volumes and Frequency

Cycling volumes in New York City increased dramatically over the past decade, from an estimated 66 million bicycle trips in 2006 to an estimated 164 million trips in 2015, an increase of 150%. By comparison, citywide transit ridership increased 8% and citywide traffic volumes declined 3%.

In 2014, the City estimates that approximately 1.6 million adult New Yorkers aged 18 or older bicycled at least a few times a year. Of those, the City estimates that 778,000 adult New Yorkers bicycled at least several times a month.

Figure 6. Annual Bicycle Trips: 1996 - 2015



Growth of Cycling

There were over 38,000 bike share trips per day in 2016

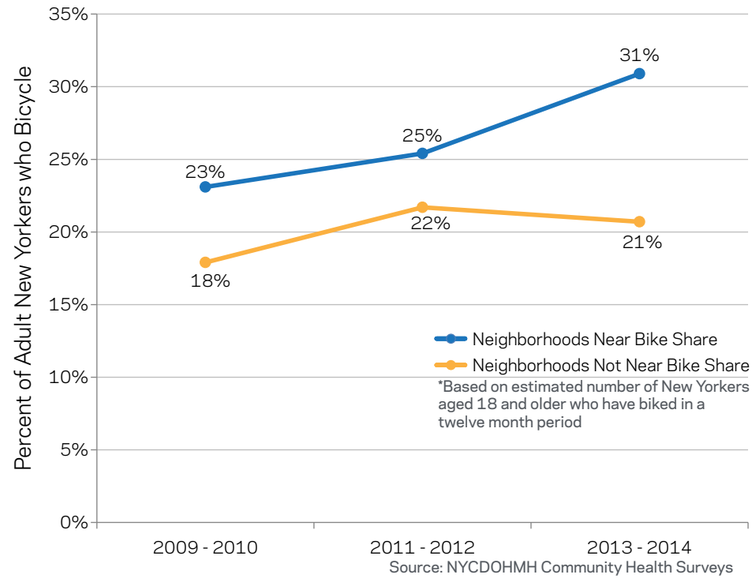
31% of adult New Yorkers living near bike share cycled in 2013 and 2014

Bike Share Ridership

Part of the increase in bicycle ridership is likely due to the implementation and expansion of Citi Bike: between May 2013 and June 2017 Citi Bike users took over 44.5 million trips. Ridership continues to grow as Citi Bike expands to more neighborhoods across the city: the number of average daily trips rose from 22,172 in 2014 to 38,244 trips per day in 2016, an increase of 72%.[4] In October 2016 the system reached a new milestone as users took almost 70,000 trips in one day.[5]

Unsurprisingly, City data shows that cycling is growing faster within the Citi Bike service area than in neighborhoods outside of it. In neighborhoods within or near the bike share service area, the estimated percentage of New Yorkers who bicycled in a 12-month period increased from an average of 23% in 2009 and 2010 to 31% in 2013 and 2014. This increase may be partially attributed to the high quality and density of the bicycle network in or near the bike share zone.

*Figure 7. New Yorkers Who Bicycled in a Twelve Month Period**



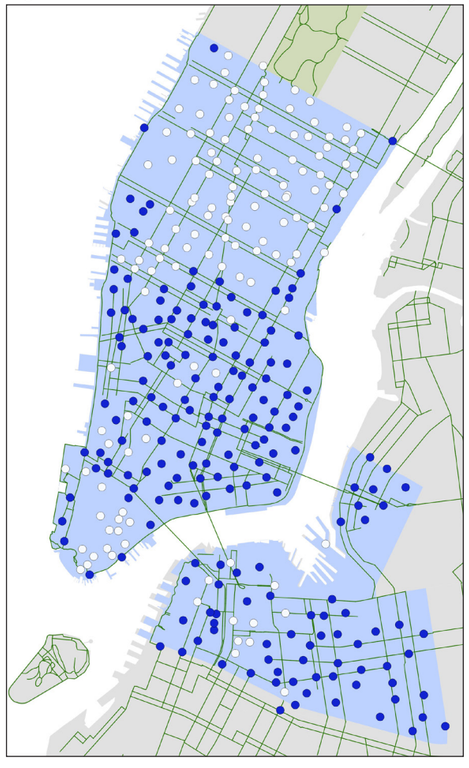
Over the same period, in neighborhoods not near bike share the estimated percentage of New Yorkers who bicycled during a 12-month period increased from 18% to 21%.

Bike Share and Gender

Female riders account for 24% of bike share trips taken by annual bike share members. Figure 8 highlights bike share stations where female annual members use bike share above the systemwide average of 24%. These stations are concentrated in Brooklyn and in Manhattan between 23rd Street and the Financial District. These neighborhoods are generally considered to be less congested than Midtown Manhattan and have well connected bicycle facilities.

An estimated half a million adult women New Yorkers aged 18 or older bicycled each year from 2010 through 2014. This represents 35% of the City's adult cyclist population. NYC DOT is considering strategies to increase the number of women who cycle and narrow the gender gap in cycling.

Figure 8. Bike Share Station by Percentage of Female Use



Growth of Cycling

Decline in Cycling Risk

Cycling safety has improved significantly since 1996. Between 2011 and 2015, there was an average of 12.8 cyclist fatalities per 100 million bicycle trips compared to 44.2 fatalities per 100 million bicycle trips between 1996 and 2000, a drop of 71%. Similarly, cyclist KSI per 100 million bicycle trips dropped by 73%.

Despite the dramatic increase in bicycle ridership, the total number of cyclist fatalities remained relatively flat over the same period. The reasons for the improvement in cycling safety are likely complex, but two factors are correlated with the decline in cyclist fatalities and KSI per trip: the expansion of the City's bicycle network and the rising number of cycling trips on our streets.

This chapter will explore the safety in numbers theory, while the next will address bicycle infrastructure and cyclist crash rates.

Decline in Cycling Risk

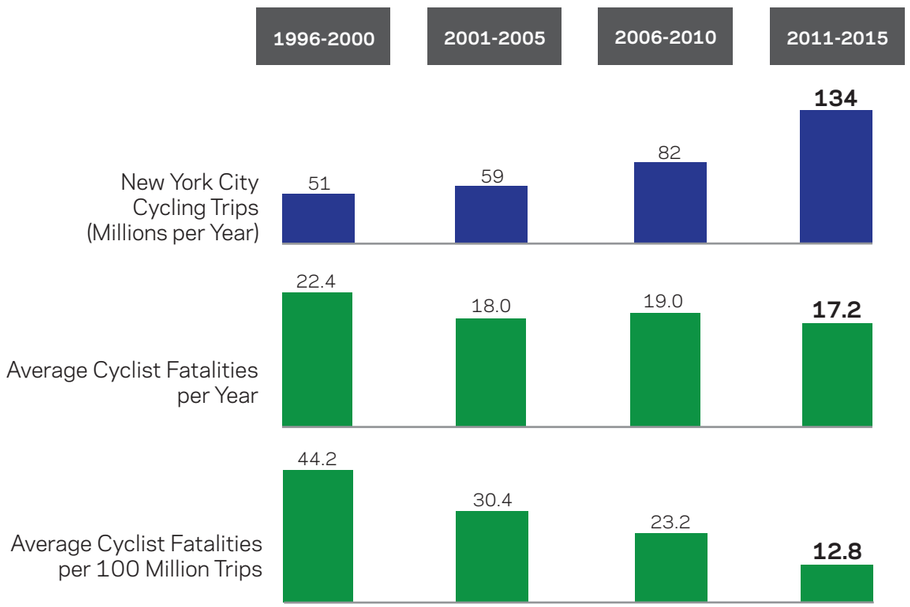
Cyclist Fatalities and Cyclist KSI per Trip

The safety in numbers theory contends that there is an inverse correlation between cycling ridership and cycling injuries and deaths. First popularized by researcher Peter Jacobsen in 2003, the theory suggests that the more cyclists there are on the road, the more attentive drivers are to their presence, and therefore the safer cycling becomes.[6] A recent study of cycling in 52 large cities showed that cities with higher cycling rates typically have lower cyclist fatality rates.[7] This phenomenon can also be observed at the neighborhood level: the city of Vancouver found that neighborhoods with the lowest cycling rates had the highest crash rates, while also noting that those neighborhoods had a lower density of bicycle facilities than other neighborhoods.[8]

Average cyclist fatalities per trips fell 71% over the past two decades

The strong correlation between the rise in cycling and the drop in cycling risk in New York City suggests that the safety in numbers dynamic may be occurring here. The estimated number of annual cycling trips increased 165% from 51 million per year in the 1996 to 2000 period to 134 the 2011 to 2015 period while cyclist fatalities per 100 million cycling trips fell 71% from 44.2 in the 1996 to 2000 period to 12.8 during the 2011 to 2015 period.

Figure 9. Average Cyclist Fatalities per Million Trips



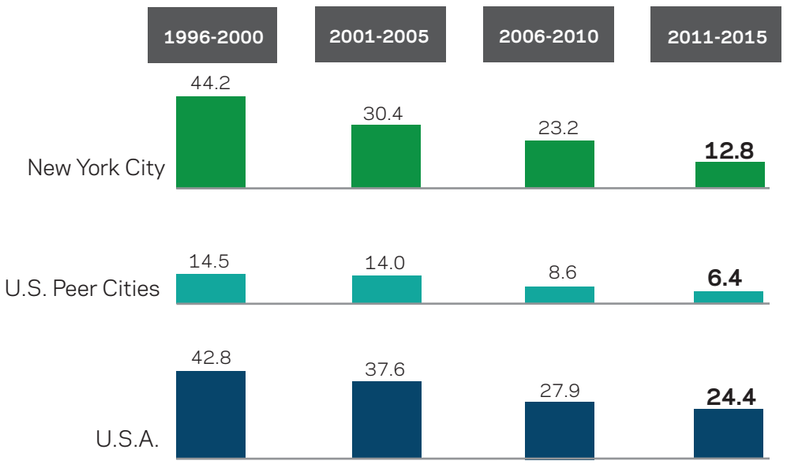
Decline in Cycling Risk

Cyclist KSI data is only available through 2014, but shows a similar trend: KSI per 100 million trips fell 73% from 1,073 during the 1996 to 2000 period to 292 during the 2011 to 2015 period.

Figure 10. Average Cyclist KSI per Million Trips

This trend is not limited to New York City: cyclist fatalities per 100 million trips fell by over 50% in U.S. peer cities and by over 40% in the United States of the past two decades.

Figure 11. Peer Comparisons: Average Cyclist Fatalities per 100 Million Trips



*Cyclist fatalities and cyclist KSI on these pages are presented in five years increments from 1996 to 2015. Cyclist KSI for 2011 to 2015 uses data from 2011 to 2014, the last year of available data.
Peer cities include all U.S. cities with populations over 500,000, at least 5,000 residents per square mile and a cycling mode share greater than 1%. Peer cities are Boston, Chicago, Los Angeles, Philadelphia, Portland, San Francisco, Seattle, and Washington, DC.

Decline in Cycling Risk

Cyclist KSI declined 17% in the Bike Share Launch Zone

Cyclist KSI and Bike Share

The introduction of bike share to New York City likely contributed to improved safety for all cyclists. NYC DOT compared average annual cyclist KSI for the three year period prior to Citi Bike's launch and one year after the launch. Cyclist KSI declined 17% in neighborhoods within or near the bike share launch zone after one year of operation, despite a recorded 8.2 million bike share trips within that zone.

Figure 12. Cyclist KSI Before & After Bike Share Launch

Zone	Average Cyclist KSI Before (2010 - 2012)	Cyclist KSI After (2014)	Percent Change
Inside Bike Share Zone	**165**	**137**	**-17%**
Outside Bike Share Zone	233	224	-4%
Total	398	361	-9%

In neighborhoods outside this zone, cyclist KSI declined just 4%. It should be noted, however, that other factors, such as the growth of the bicycle network, likely also played a role in reducing cyclist risk both within the Citi Bike service area and citywide.

Total Cyclist Fatalities and Cyclist KSI

Cyclists represented 6.7% of traffic fatalities between 2006 and 2015

Despite this progress, there were still 18 cyclist fatalities in 2016 and a total of 199 cyclist fatalities from 2006 through 2016. Between 2006 and 2014, there were 3,395 cyclist KSI. Although New York City has made progress, the rate of cyclist fatalities per 100 million cycling trips is still above those found in U.S. peer cities, such as Boston, San Francisco, and Seattle. Overall, cyclists represented 6.7% of all traffic fatalities between 2006 and 2016. New York City will continue to take aggressive steps to make cycling safer for all riders.

Figure 13. Cyclist Fatalities & KSI by Year: 1996-2016

Year	Cyclist Fatalities	Cyclist KSI
1996	17	587
1997	22	609
1998	20	529
1999	35	536
2000	18	458
2001	13	403
2002	21	391
2003	18	345
2004	16	360
2005	22	344

Year	Cyclist Fatalities	Cyclist KSI
2006	18	369
2007	24	365
2008	22	348
2009	12	338
2010	19	406
2011	22	395
2012	18	393
2013	12	420
2014	20	361
2015	14	N/A
2016	18	N/A

Decline in Cycling Risk

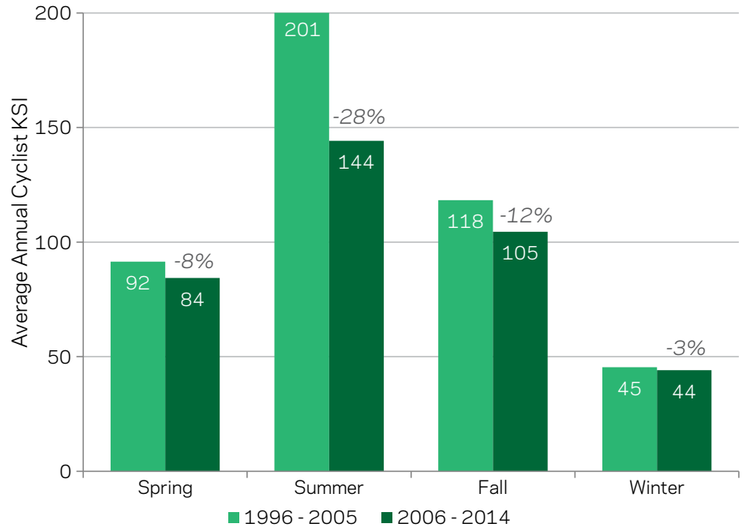
Average cyclist KSI declined 28% in Summer from the previous to the current study period

Seasonal Variation in Cyclist Fatalities and Cyclist KSI

Given the seasonal variation in bicycle ridership, it is not surprising that the majority of cyclist KSI occur during the spring, summer, and fall. In 2016, average daily bike share volumes peaked in September at almost 55,000 trips. By contrast, average daily bike share volumes in the colder month of December were just over 26,000. Between 2006 and 2016, 42% of cyclist fatalities occurred in the summer, while only 14% occurred in winter. On average during this period, the city experienced 8 cyclist fatalities each summer and 3 cyclist fatalities each winter.

Cyclist KSI declined at a significantly higher rate during the summer months (June - August) than during rest of the year, especially during the winter months (December - February). Between the 1996 and 2005 period and the 2006 and 2014 period, summer cyclist KSI declined by over 28%, compared to a 8% decline in spring, an 12% decline in the fall, and a 3% decline in winter.

Figure 14. Annual Cyclist KSI by Season



This seasonal variation in the reduction of cyclist KSI may provide further support that the safety in numbers dynamic is occurring in New York City. If the growth in cycling has been occurring disproportionately during the warmest months of the year—a reasonable assumption—this may help explain why the greatest drop in cyclist KSI between the two periods occurred in the summer. Further data collection is required to support this theory.

Crash Analysis

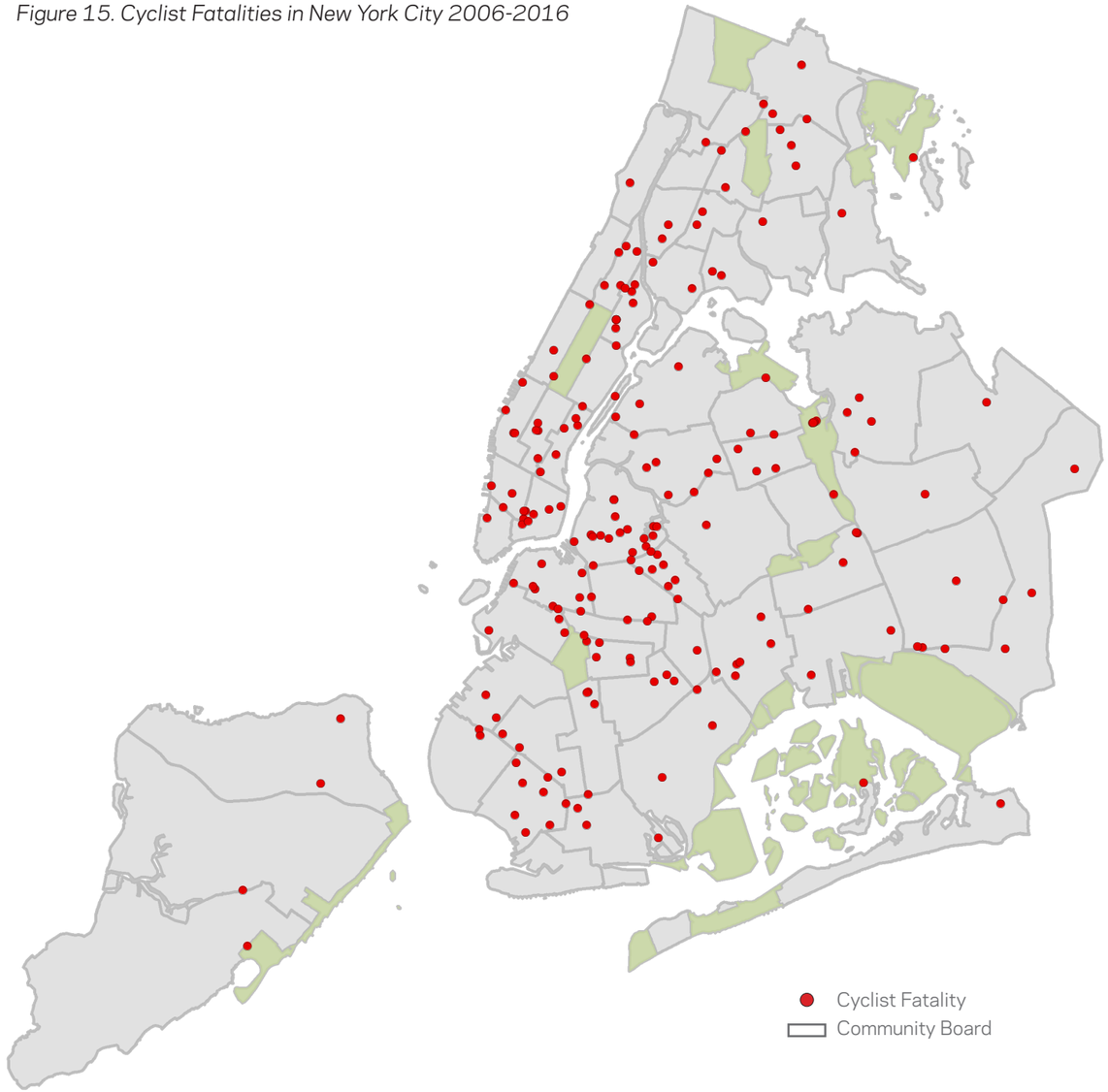
While New York City continues to make progress in reducing cyclist risk, there are still a tragic number of cyclist fatalities and cyclist KSI each year. Between 2006 and 2016, 199 cyclists were killed and between 2006 and 2014 3,395 cyclists were either killed or severely injured.

This chapter examines the geographic distribution of cyclist KSI and the most common types of crashes that lead to death or severe injury.

Crash Analysis

Crash Analysis

Figure 15. Cyclist Fatalities in New York City 2006-2016



89% of cyclist fatalities occurred on streets without bicycle facilities

Median distance from fatal crash to the cyclist's home was 1.1 miles

Cyclist Fatalities on Bicycle Facilities

The vast majority of cyclist fatalities occurred on streets without a bicycle facility. Of cyclist fatalities between 2006 and 2016 where the precise location of the crash is known, 89% occurred on streets without a bicycle facility. In addition, a 2014 NYC DOT study of one-way protected bicycle lanes in Manhattan found that the risk of injury per cyclist fell by over 35% on six of the eight corridors studied. Overall cyclist injuries decreased 2% on the eight corridors, falling from 100 to 98, while cyclist volumes increased dramatically.[9]

Of the 22 cyclist fatalities that occurred on streets with bicycle facilities between 2006 and 2016: five were on streets with protected bicycle lanes, eleven were on streets with conventional bicycle lanes, and six were on streets with signed or marked routes. See Appendix 4 for specific details of each crash.

Cyclist Fatalities and Place of Residence

The majority of cyclist fatalities occurred close to a rider's place of residence. Between 2006 and 2014, the median distance between a fatal crash and a cyclist's residence was 1.1 miles. Forty-three percent of cyclist fatalities occurred in the community district where the cyclist lived and 30% occurred in an adjacent district. Bicycle facilities in a given neighborhood likely provide a benefit to members of that community, not just cyclists passing through that community.

Crash Analysis

Geographic Analysis: Priorities for Bicycle Network Expansion

Moving forward, NYC DOT will focus bicycle network expansion on areas of the city where cyclist KSI is relatively high, but bicycle facilities remain comparatively sparse.

NYC DOT rank ordered the 59 New York City Community Districts (also known as Community Boards) based on cyclist KSI between 2010 and 2014 and then divided the Districts into three equally-sized groups (Low KSI, Medium KSI, and High KSI). See Figure 16.

The agency then followed the same process to create three groups for bicycle network coverage (Low Coverage, Medium Coverage, and High Coverage). Network coverage was measured as the proportion of a District's streets with a protected or conventional bicycle lane. See Figure 17.

NYC DOT then designated 10 Community Districts categorized as High KSI and Low or Medium Coverage as Priority Bicycle Districts for bicycle network expansion. The Districts contain 23% of the citywide cyclist KSI but have only 14% of City's protected and conventional lane miles.

The Priority Bicycle Districts present the opportunity to better meet demand for new bicycle lanes while addressing cyclist severe injuries and fatalities. For additional information on the Bicycle Priority District methodology see Appendix 1.

Figure 16. Cyclist KSI Ranked by Community District

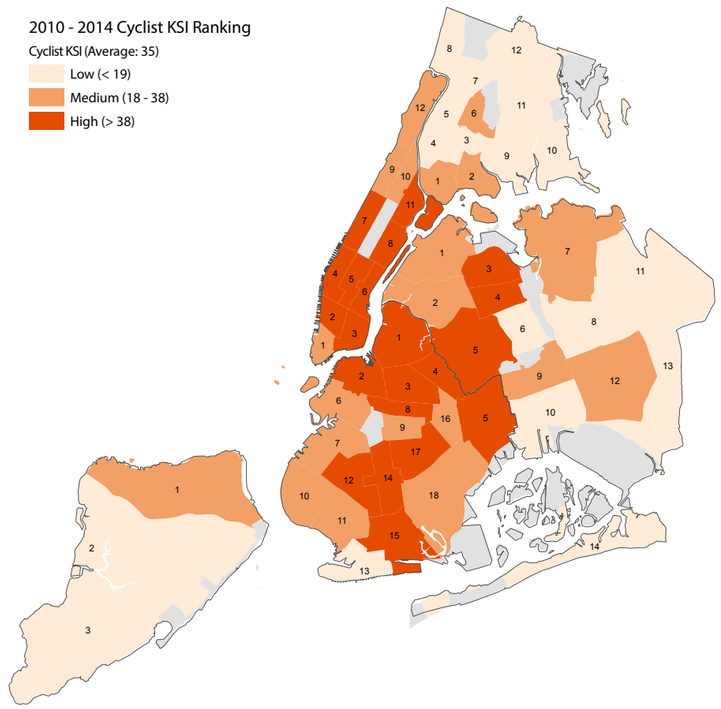


Figure 17. Bicycle Network Coverage Ranked by Community District

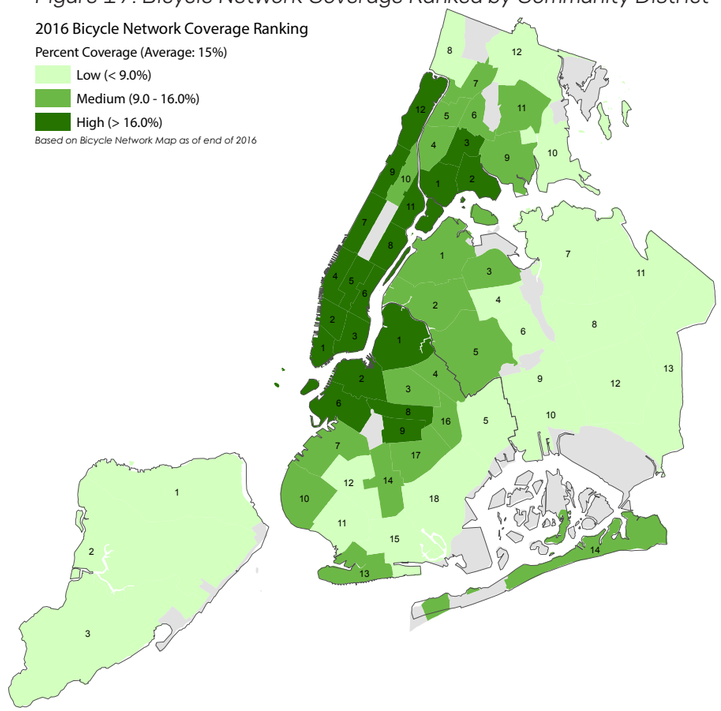
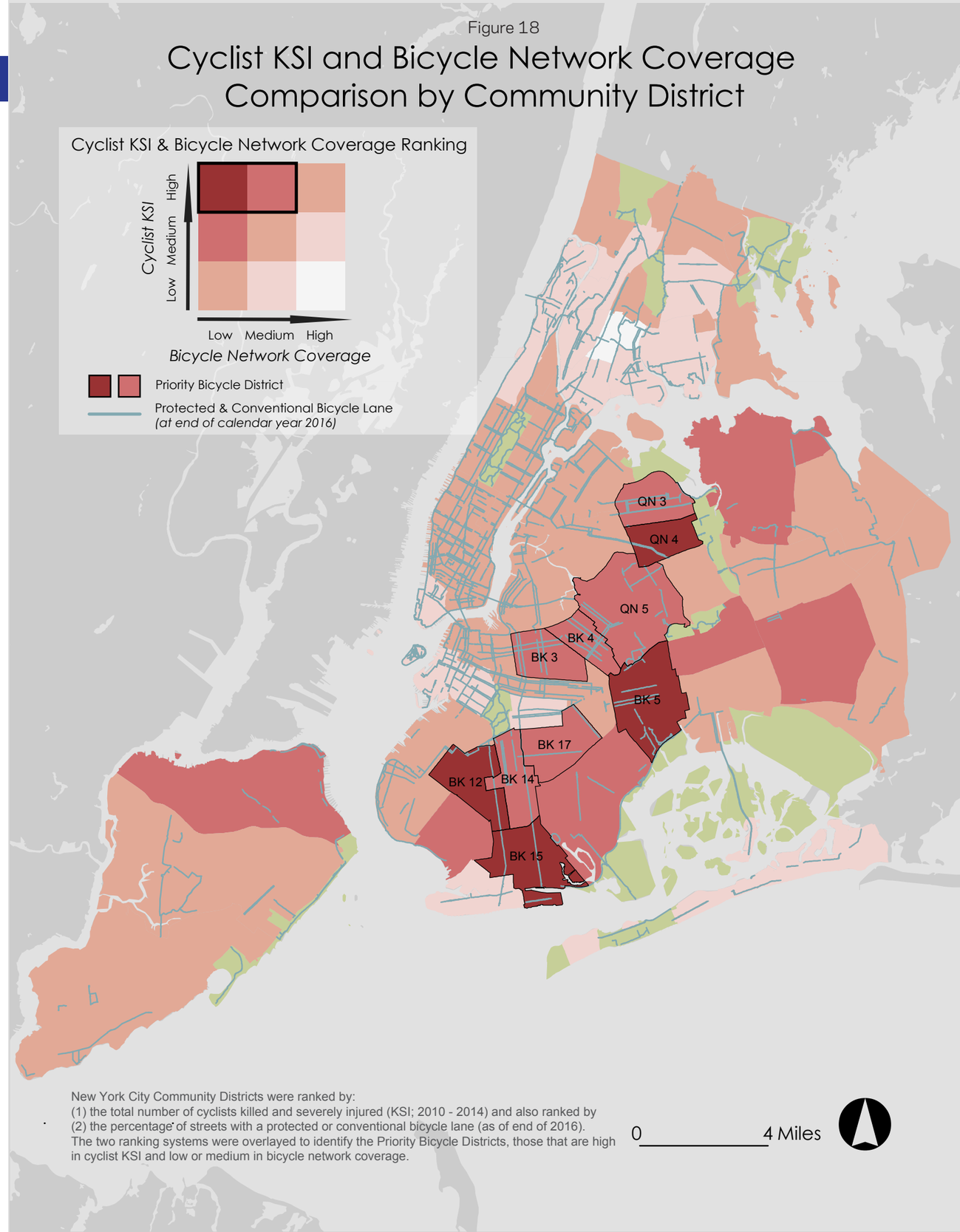
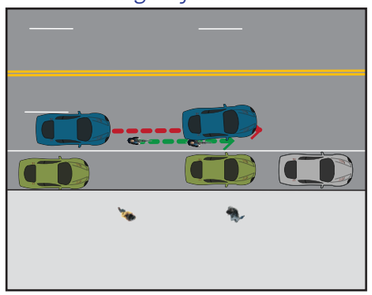


Figure 18

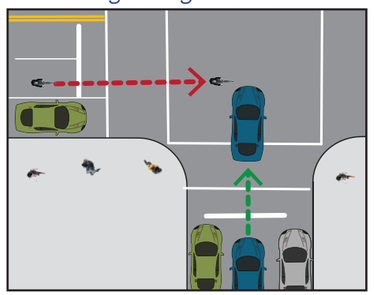
Cyclist KSI and Bicycle Network Coverage Comparison by Community District



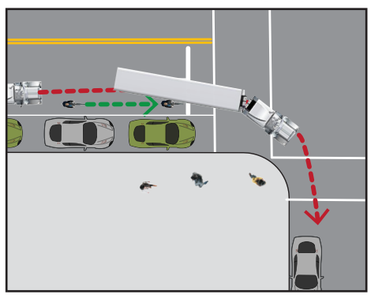
Traveling Adjacent Crash



Right Angle Crash



Motor Vehicle Turn Crash



Cyclist Fatality Crash Types

As part of the analysis for this report, NYC DOT conducted a detailed analysis of all bicycle fatalities between 2006 and 2016 as described in NYPD collision reports. The analysis revealed that the three most prevalent crash types resulting in a cyclist fatality between 2006 and 2016 were: traveling adjacent, right angle, and motor vehicle turn crashes.

Traveling adjacent crashes are crashes in which the bicycle and motor vehicle are traveling in the same direction at the point of collision, and primarily include sideswipe and rear-end crashes. These crashes accounted for 29% of cyclist fatalities. The majority of these cases (32 of 52 fatalities) occurred at midblock locations.

Right angle crashes occur when the motor vehicle and bicycle are traveling on perpendicular streets and then collide at a right angle. These crashes accounted for 27% of cyclist fatalities. Out of 48 total cases, in 29 the cyclist was reported to have disobeyed a traffic signal, in 6 the cyclist was reported to have disobeyed a stop sign, in 3 the cyclist was reported to have obeyed a traffic signal, and in 10 the cyclist's signal compliance was unknown. However, research from London suggests that these figures may overstate the number of cyclists disobeying the signal prior to a fatal crash, as in these cases only the driver's account is available.[10]

Motor vehicle turn crashes are crashes in which the bicycle and motor vehicle are traveling parallel to each other either in the same or opposite direction and a collision occurs when the motor vehicle makes a left or right turn. Between 2006 and 2016, these crashes accounted for 21% of cyclist fatalities. Hooks, cases in which the bicycle and motor vehicle where traveling parallel to each other and in the same direction prior to the motor vehicle turning, constituted 54% (20 of 37) of fatalities in turn crashes.

Crash Analysis

Figure 19. Cyclist Fatalities by Crash Type

Crash Type *(Totals)*	Cyclist Fatalities 2006-2016		Cyclist KSI 2006-2014
	#	% of Total Known	
Traveling Adjacent	52	29%	N/A
Right Angle	48	27%	
Motor Vehicle Turn	37	21%	
Bicycle Turn	13	7%	
Bicycle Crossing Midblock	13	7%	
Head On	9	5%	
Dooring	8	4%	
Other/Unknown	19		
Total	**199**		

The remaining 23% of crashes resulting in a fatality occurred when the cyclist was making a turn, crossing midblock, collided head on with a vehicle, or collided with an open car door ("dooring").

Cyclist KSI Crash Types

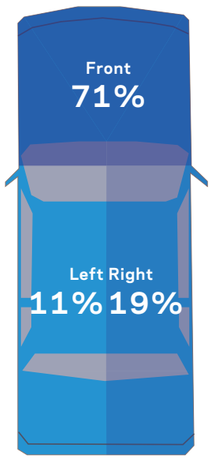
Motor vehicle right turns represent 13% of cyclist fatalities but only 8% of cyclist KSI

Less detailed information is available from the records of crashes that result in a severe cyclist injury, but generally similar patterns emerge (see Figure 20). Motor vehicle right turns were somewhat over represented among cyclist fatalities as compared to cyclist KSI, accounting for 13% of cyclist fatalities between 2006 and 2016 but only 8% of known cyclist KSI between 2006 and 2014.

Figure 20. Cyclist Fatalities & KSI by Motor Vehicle Action

Motor Vehicle Action *(Totals)*	Cyclist Fatalities 2006-2016		Cyclist KSI 2006-2014	
	#	% of Total Known	#	% of Total Known
Traveling Straight	130	70%	2,041	65%
Right Turn	25	13%	238	8%
Left Turn	12	6%	347	11%
Other	20	11%	495	16%
Unknown	12		274	
Total	**199**		**3,395**	

Figure 21. Motor Vehicle Impact Zone



Vehicle Type

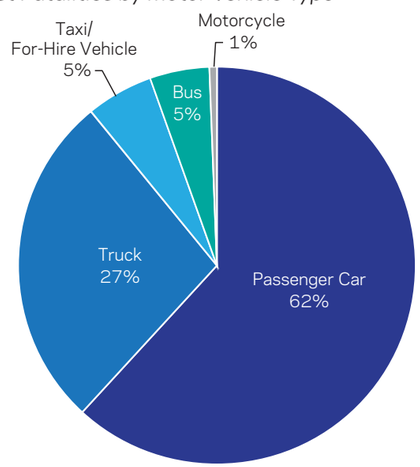
As Figure 21 shows, 71% of all cyclist fatalities—regardless of crash type—involved a collision with the front portion of the motor vehicle. Passenger cars were the most common type of motor vehicle involved in cyclist fatalities and cyclist KSI: 62% of cyclist fatalities between 2006 and 2016 and 73% of cyclist KSI between 2006 and 2014 involved passenger cars.

Twenty-seven percent of cyclist fatalities between 2006 and 2016 involved trucks, compared to only 5% of cyclist KSI between 2006 and 2014. The over-representation of trucks in cyclist fatalities reflects the larger size, weight, and axle distance of these vehicles as compared to passenger cars. The significant blind spots of many trucks may also play a role, as 72% of motor vehicle right turn fatalities between 2006 and 2016 involved a truck.

An average of 55 cyclist KSI per year involved taxi or other for-hire vehicles (FHVs) between 2006 and 2014, an increase of 18% over the previous study period (1996 to 2005). This increase may be explained by the growth in the taxi and FHV sector in recent years, especially the introduction of green cabs and the growth in ride-hailing services. The number of FHV vehicle licenses rose 51% from 38,540 in 2006 to 58,295 in 2016.[11,12]

Trucks are involved in 27% of cyclist fatalities but only 5% of cyclist KSI

Figure 22. Cyclist Fatalities by Motor Vehicle Type



65% of cyclist fatalities occurred at intersections

Intersection versus Midblock Locations

Between 2006 and 2016, 65% of cyclist fatalities occurred at intersections, while 89% of cyclist KSI between 2006 and 2014 occurred at intersections. The number of cyclist KSI at intersections rose modestly between 2006 and 2014, increasing from 277 in 2006 to 309 in 2014, an increase of 12%. These findings are consistent with fatality and KSI patterns for other modes in New York City.

Figure 23. Cyclist Fatalities & KSI by Location Type

Location *(Totals)*	**Cyclist Fatalities 2006-2016**		**Cyclist KSI 2006-2014**	
	#	% of Total Known	#	% of Total Known
Intersection	129	*65%*	2,845	*89%*
Midblock	65	*33%*	338	*11%*
Highway	5	*3%*	11	*0%*
Unknown	0		201	
Total	**199**		**3,395**	

Bicycle Crashes with Pedestrians

Fatalities resulting from a crash between a cyclist and a pedestrian are rare compared to those resulting from a crash between a motor vehicle and a pedestrian. From 2006 to 2016 of the 1,677 pedestrian traffic fatalities, seven occurred as a result of pedestrian-bicycle collisions, accounting for 0.4% of all pedestrian traffic fatalities in New York City. Of these seven, five pedestrians in Manhattan and two pedestrians in Brooklyn died as a result of a crash with a bicycle. There were no such pedestrian fatalities in the Bronx, Queens, or Staten Island. During this time period, three cyclists were killed as a result of a crash with a pedestrian.

Action Plan

Based on the findings in this report, NYC DOT, NYPD, and NYC DOHMH have developed a comprehensive set of engineering, enforcement, education, legislative, and data collection and analysis initiatives to continue to improve bicycle safety and achieve Vision Zero.

This Action Plan recommends enhancing existing programs and developing new ones, continuing to develop innovative street designs, and focusing bicycle lane expansion in neighborhoods underserved by the bicycle network.

Engineering & Planning

Continue to implement 50 lane miles of bicycle facilities, including at least ten miles of protected bicycle lanes

As laid out in *OneNYC* and NYC DOT's 2016 Strategic Plan, NYC DOT will continue to expand the bicycle network by at least 50 lane miles per year, including at least 10 miles of protected bicycle lanes. Bicycle network expansion is the core of NYC DOT's bicycle safety efforts.

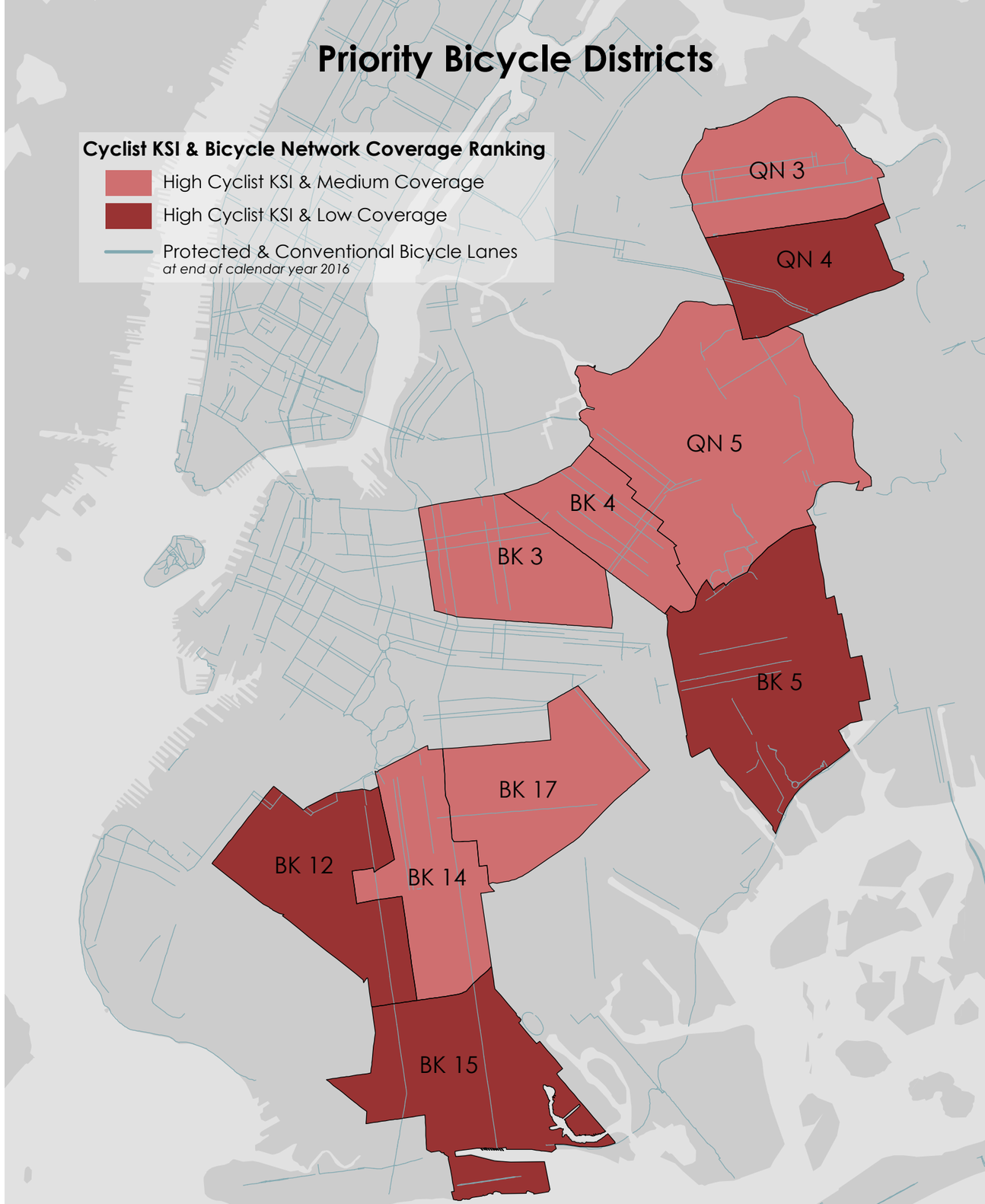
Create or enhance 75 bicycle lane miles in Priority Bicycle Districts by 2022

As detailed in the Crash Analysis section, NYC DOT identified 10 Priority Bicycle Districts, which have comparatively high cyclist KSI and comparatively low access to the existing bicycle network. NYC DOT will expand or enhance 75 lane miles of bicycle facilities in the Priority Bicycle Districts over the next five years.

NYC DOT will expand planning efforts in the Priority Bicycle Districts and engage with local communities, as part of that planning process. Planning will focus on specific corridors and intersections with the highest numbers of cyclist KSI.

Increase the percentage of New Yorkers living near a bicycle facility from approximately 80% to 90% by 2022

Currently, approximately 80% of New Yorkers live within one-quarter mile of a bicycle facility. Through steady expansion of the bicycle network across the five boroughs, NYC DOT will increase the proportion of New Yorkers with easy access to a bicycle lane to 90% by 2022. This target reflects the agency's goal of encouraging additional ridership and providing opportunities for safe cycling beyond the bicycle network's core.



See "Geographic Analysis: Priorities for Bicycle Network Expansion" and Appendix 1 for description of methodology used to identify the Priority Bicycle Districts. Data: Cyclist KSI: 2010-2014; Protected & Conventional Bicycle Lanes: As of 12/31/2016. Source: NYC DOT

Engineering & Planning, continued

Complete a study of best practices in intersection design for bicycle facilities in early 2018 and implement and evaluate new treatments

Eighty-nine percent of cyclist KSI between 2006 and 2014 occurred at intersections. NYC DOT will target intersections on bicycle facilities with the highest number of cyclist KSI for enhanced treatment installation. The agency will use treatments already in its tool box, including left turn traffic calming and split leading pedestrian intervals, that slow turning vehicles and increase yield compliance among drivers.

In addition, NYC DOT will investigate new treatments (including protected intersections), implement and evaluate these new treatments, and assess whether they should become a permanent part of the NYC DOT design toolkit.

Randolph Street , Chicago
(Photo: Chicago Department of Transportation)

Improve curb management on streets with bicycle facilities

NYC DOT will evaluate and improve midblock curb regulations, such as parking and loading restrictions, along current and future bicycle facilities to reduce conflicts with parking and loading vehicles. Regulation changes will address the usage of curbside space, including permitted and illegal parking, truck loading, and double parking.

Expand the bike share system in Priority Bicycle Districts

Since launching in 2013, bike share likely contributed to improved safety for all cyclists. By the end of 2017, NYC DOT and Citi Bike will expand bike share to 12,000 bicycles at about 700 stations in Manhattan, Queens, and Brooklyn. NYCDOT will explore the feasibility of further expanding bike share to the Priority Bicycle Districts.

Enforcement

Focus and deploy enforcement resources to the most dangerous intersections for cyclists

In the 2014 Vision Zero Pedestrian Safety Action Plans, NYPD and NYC DOT set out to improve safety for pedestrians by concentrating on high-crash areas in each borough. To address cyclist safety, NYPD will use a similar approach and focus traffic enforcement at intersections with the highest rates of cyclist KSI.

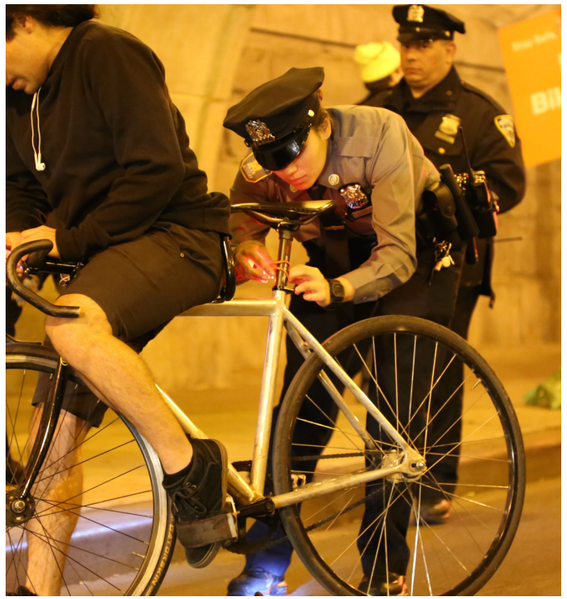
Tailor enforcement to address specific crash types

To further improve safety for cyclists, the NYPD will tailor enforcement to address specific driver and cyclist behaviors that contribute most to cyclist injuries.

Tailored enforcement for drivers will focus on the following driver actions and related crash types:

- Failure to yield to cyclists while turning and signaling to address turning and right hook crashes;
- Failure to use turn-signal to address turning and right hook crashes;
- Double parking and vehicles parked in bicycle lanes to address midblock crashes and travelling adjacent crashes; and,
- Truck failure to yield to bicycles on truck and bicycle facilities to address the high proportion of trucks involved in turning crashes.

In 2016, the NYPD initiated Operation Safe Passage, a weeklong citywide traffic enforcement effort designed to discourage hazardous parking and driving infractions that interfere with the safe passage of cyclists. NYPD will continue Operation Safe Passage on a monthly basis to discourage dangerous driver behavior.



Tailored cyclist enforcement will focus on cyclists disobeying traffic signals or riding in the wrong direction on roadways, where traffic volumes and speeds are higher and cyclist risk of injury is higher.

Additionally, NYPD will emphasize the importance of visibility of cyclists by enforcing the use of bicycle white front lights and red tail lights from dusk to dawn. NYC DOT will provide NYPD with bicycle lights to be distributed as part of bicycle safety outreach campaigns.

Educational Programs

Develop targeted outreach strategies to promote safe driving and cycling behaviors

Educating drivers and cyclists has been a key component of Vision Zero. Based on the Crash Analysis, NYC DOT will continue existing educational programs and develop outreach strategies to target vulnerable populations and address common crash patterns. NYC DOT will develop materials and deliver outreach in multiple languages to serve the diversity of New York City cyclists.

NYC DOT will continue to promote safe driving behaviors through the Vision Zero public awareness campaign, and will explore targeted communications efforts to motorists in areas with high rates of cyclist KSI.

NYC DOT will continue to produce and distribute materials that promote safe cycling, detailed in the City Efforts to Expand Cycling section. Additionally, NYC DOT will explore new strategies for targeting speakers of languages other than English.

Promote safe and accessible bicycling for young New Yorkers

NYC DOT and NYC DOHMH will partner with schools and youth centers across New York City to develop wellness policies, provide access to bike education, install bicycle racks, and identify safe bicycle routes to school for students. NYC DOT will continue the "Bike to School" program in over a dozen middle and high schools citywide. NYC DOHMH will continue to develop a program targeting high school students that encourages students to bicycle to school using bike share.

Implement education and regulation of independent contractor commercial cyclists

New York City's commercial cyclist law requires that businesses ensure their employees who cycle for work complete the NYC DOT Commercial Bicyclist Safety Course, have required safety equipment, prominently post required safety posters in appropriate languages, and maintain a roster of their employees who cycle for work. The increased popularity of delivery services such as UberRUSH, Relay, Caviar, and Post Mates, which rely on independent contractor commercial cyclists resulted in difficulties enforcing these requirements.

The City supported City Council legislation (Local Law 91 of 2017) introduced by Council Member Van Bramer that clarified commercial cyclist requirements in order to ensure safety and accountability, which the Council passed in May 2017 and the Mayor signed into law. NYC DOT will conduct information sessions to educate companies and independent contractor commercial cyclists about the requirements and seek to ensure compliance.

Legislation & Policy

Explore legislation requiring vehicles to provide three feet between the vehicle and bicycle when passing a bicycle

New York State enacted a safe passing law in 2010 (Vehicle Traffic Law 1122-a) requiring that drivers pass to the left of bicycles at a safe distance when overtaking a cyclist. As the current law is vague and difficult to enforce, the City will explore the benefits and enforcement mechanisms of legislation requiring drivers to provide at least three feet between their vehicle and a cyclist while passing the cyclist. This would provide specific, easily understandable guidance to motorists, and is important both in the event of a crash and as an educational tool.

Currently 28 states (including California, Florida, and Illinois) and the District of Columbia require at least three feet of passing distance, with states like Pennsylvania requiring a minimum of four feet. To improve compliance, police departments in the U.S. and Canada are piloting the use of ultrasound and sonar devices to measure compliance and enforce against violators.

Advocate for legislation requiring all companies that do business with city install truck side guards

New York City began installing side guards—protective panels on the sides of trucks that prevent cyclists and pedestrians from falling or rolling underneath the vehicle—on City vehicles in 2015. In June 2015 Mayor de Blasio signed into law a bill requiring side guards on all City vehicles and licensed private waste haulers by 2024. The City will advocate for City Council legislation requiring all companies with truck fleets that conduct business with the City to install truck side guards.

Research & Data

Conduct a comprehensive evaluation of all bicycle facility types

NYC DOT will conduct a comprehensive evaluation of different bicycle facilities types. This study will analyze the safety and ridership outcomes of each type of bicycle facility, as well as their impact on non-cyclist safety outcomes. These results will expand NYC DOT's understanding of cyclist injury risk and will inform future design and planning decisions.

Continue to collect citywide bicycle ridership data in the Department of Health & Mental Hygiene Community Health Survey, resources permitting

As the bicycling population continues to grow, continuous collection of data is essential to evaluate the needs of the cycling population. Analysis in this report utilized NYC DOHMH's annual Community Health Survey. Resources permitting, NYC DOHMH will continue to collect citywide bicycle ridership data annually.

Expand bicycle count data collection to better understand where and when New Yorkers are cycling

NYC DOT will continue to improve the breadth, accuracy, and efficiency of the bicycle count program. NYC DOT will take the following actions to achieve this goal:

- Install additional automated bicycle counters to collect continuous, accurate bicycle volume information with a focus on the expanding protected bike lane network
- Conduct additional bicycle counts (automated and manual) in Brooklyn, the Bronx, Queens, and Staten Island locations to improve our understanding of bicycle volume patterns away from the Manhattan core
- Test and utilize new technologies to quantify bicycle volumes and utilization patterns
- Conduct studies of select neighborhoods to understand bicycle activity on a neighborhood level
- Increase the amount of bicycle count data available to the public and improve the relevance of this data
- Deploy on-street displays of bicycle volumes, visible to cyclists and drivers

Methodology

This report analyzes trends in cyclist fatalities and KSI in New York City from 1996 through 2016. The report resumes the analysis begun in the 2006 report *Bicyclist Fatalities and Serious Injuries in New York City*. The majority of this report uses two distinct datasets, spanning the most recent years of available data.

1. **Cyclist fatalities** rely on the NYC DOT/NYPD Reconciled Fatality database. Fatality crash data is populated by NYPD data and maintained by NYC DOT (Source i). This dataset includes:
    - 199 cyclist fatalities from 2006 – 2016
    - 202 cyclist fatalities from 1996 – 2005

2. **Cyclist KSI** (fatality and severe injury) data combines fatalities from the NYC DOT/NYPD Reconciled Fatality database and severe injuries from the NYS DOT/NYS DMV Crash Database; the latter is only available through 2014 (Sources i and ii). This dataset includes:
    - 3,395 cyclist KSI from 2006 – 2014 (167 cyclist fatalities, 3,228 severe cyclist injuries)
    - 4,562 cyclist KSI from 1996 – 2005 (202 cyclist fatalities, 4,360 severe cyclist injuries)

While the periods for the two datasets differ, they are used to identify general trends in New York City cycling over the last decade. Fatalities are updated on a rolling basis to account for victims who succumb to their injuries and perish at any date following the date of the crash. The figures represented in this report are current as of July 31, 2017. Detailed methodology for each section's analysis is outlined below. Citations can be found on page 54 in "Sources".

BY SECTION

City Efforts to Expand Cycling

"Expanding the Bicycle Network" and Figure 2 use an aggregation of all bicycle lane miles installed by NYC DOT by calendar year.

"Improving Access to Bicycle Facilities" and Figure 3 approximate the percentage of citywide and borough population living in a U.S. Census block group that is within a quarter-mile of a bicycle facility. This analysis utilizes the 2010 US Decennial Census block group population data (Source x). It compares this data to the New York City Bicycle Network Map for each year from 1996-2016. For each year, the population of a block group is counted as "near facility" if that block group is within a ¼ mile from at least one facility that has been implemented on or before that year.

"Creating a Bike Share System" and Figure 4 rely on data aggregated by the NYC DOT Bike Share Program.

Growth of Cycling

"Cycling Volumes and Frequency" and Figure 6 estimate bicycle trips using the same calculations as the NYC DOT *Cycling in the City* report; starting with the number of bicycle commuters (Sources iii and iv). This number was then rounded to the nearest hundred and multiplied by two (assuming that each commuter takes two trips). The New York State 2009 NHTS Comparison Report indicated that 18.2% of trips New Yorkers take using personal vehicles are commuting trips to work (Source v). This analysis used a more conservative assumption that 20% of total bicycle trips are commuting trips; therefore each commuting trip number was divided by 20%. This daily trip number was multiplied by 365 for an annual estimate (note: 366 in leap years: 1996, 2000, 2004, 2008, and 2012). Finally, the number was divided by one million to arrive at annual bicycle trips in millions. Annual bicycle trips for 1996 to 1999 and 2001 to 2004 were interpolated based on compound annual growth rate.

This section also detailed the results of the 2014 NYC DOHMH Community Health Survey for the question on the prevalence of cyclist activity among New York City adults 18 years and older (source ix).

"Bike Share Ridership" uses data aggregated by the NYC DOT Bike Share Program. Trip data represents the period from launch of bike share, in 2013, through the end of June 2017 (Source xi).

Figure 7 shows the percentages of New York City residents aged 18 years or older who have bicycled in New York City in a 12-month period, from 2009-2014 (Source ix). The percentages are shown by neighborhoods approximated to match the Bike Share "Launch Zone". "Neighborhoods Near Bike Share" are based on the United Hospital Fund (UHF) Neighborhoods most closely aligned to the 2016 Bike Share station map in New York City.

Methodology (continued)

These include UHFs 201, 202, 203, 211, 304, 305, 306, 307, 308, 309, 310, and 401. All other New York City UHFs are considered "Neighborhoods Not Near Bike Share". "New Yorkers who have biked in a 12 month period" data are pooled into two-year groupings in order to obtain more stable estimates.

"Bike Share and Gender" section and Figure 8 rely on annual member station usage data from the launch of bike share, in May 2013, through the end of 2016 (Source xi). This data represents total Citi Bikes docked in and out by annual members who have opted to provide their gender in their member account. New York City cyclists by gender are taken from 2010 – 2014 combined year NYC DOHMH Community Health Survey estimates, which can be found in Appendix 3.

Decline in Cycling Risk

"Cyclist Fatalities and KSI per Trip" and Figures 9 and 10 is an analysis that uses the average of five years of cyclist fatality and cyclist KSI datasets (Sources i and ii). The analysis splits the data into five year intervals beginning with the first year of the previous report, 1996, in order to see sustained trends and to avoid annual shifts due to the relatively low number of cyclist fatalities per year. Since 2015 data is not available in the cyclist KSI dataset, a cyclist KSI average of 2011 - 2014 is used.

"New York City Cyclist Trips" in millions per year is used to provide context for New York City cyclist fatalities. Originally presented in the NYC DOT *Cycling in the City* report (Source iii), it is presented here as an average for each five year period. See "Cycling Volumes" methodology for further explanation. Average cyclist fatalities are then divided by the average annual cycling trips (in 100 millions) for each period.

"Peer Comparisons" in Figure 11 compares New York City's average annual cyclist fatalities per 100 million cycling trips to that of an aggregate of U.S. peer cities and the U.S. as a whole (Source iv and vi).

U.S. Peer Cities include U.S. cities with populations over 500,000, at least 5,000 residents per square mile and a cycling mode share greater than one percent. Peer cities are Boston, Chicago, Los Angeles, Philadelphia, Portland, San Francisco, Seattle, and Washington, D.C.

New York City cyclist fatalities include persons who have died more than 30 days after the crash while peer city and national fatality figures exclude these. This is due to a difference in reporting standards between NYC DOT and NHTSA, the source of peer and national cyclist fatalities (Source vi).

"Cyclist KSI Before & After Bike Share Launch" and Figure 12 use the cyclist KSI dataset for years 2010, 2011, 2012, and 2014 (Sources i and ii). Cyclist KSI are considered "Inside Bike Share Zone" if the crash location is within 100 feet of the 2013 "Launch Zone" and "Outside Bike Share Zone" if the crash location is farther than 100 feet from the "Launch Zone." The before period is an average of 2010-2012 cyclist KSI and the after period is 2014 KSI, 2013 KSI are excluded because they contain both before and after launch periods.

"Total Cyclist Fatalities and Cyclist KSI" and Figure 13 presents total motor vehicle related cyclist fatality and cyclist KSI from the crash datasets (Sources i and ii).

"Seasonal Variation in Cyclist Fatalities & KSI" and Figure 14 separate the cyclist KSI dataset for the two study periods by season of crash (Sources i and ii). "Spring" includes March, April, and May for each crash year, "Summer" includes June, July, and August, "Fall" includes September, October, and November, and "Winter" includes December, January, and February. For each cyclist KSI period average cyclist KSI per year is used to account for the difference in total number of years in each period (10 in previous study period and 9 in 2006-2014).

Methodology (continued)

Crash Analysis

"Cyclist Fatalities on Bicycle Facilities" describes an analysis reviewing every cyclist traffic fatality from 2006 through 2016; 199 in total (Source i). Of the 199 fatalities, 22 occurred on a street with a bicycle facility, while in 1 case, it was uncertain whether the cyclist was on such a street when the fatal crash occurred. This crash was excluded from the calculation of percent of cyclist fatalities on streets with bicycle facilities.

"Cyclist Fatalities and Place of Residence" calculates the median distance between cyclist fatality crash location and that cyclist's home (Sources vii). The analysis also categorizes community districts by a combination of districts where cyclist fatalities occurred and that cyclist's home community district.

"Geographic Analysis: Priorities for Bicycle Network Expansion" evaluates the relationship between the bicycle network and cyclist KSI to determine target neighborhoo ds for future bicycle network development. The analysis identifies the New York City Community Districts with high cyclist KSI and low or medium bicycle network coverage. A detailed list of findings from this analysis for each Community District is available in Appendix 1.

- "Cyclist KSI Ranked by Community District," Figure 16, shows cyclist KSI in 2010-2014, the most recent five years of available data, displayed by community district of crash (Sources i and ii). The figure shows the map as displayed by terciles of New York City Community Districts, or three equally sized groups of districts that are ranked by number of 2010-2014 cyclist KSI. The districts were ranked from highest to lowest cyclist KSI and then separated into three groups. "High" contains the 21 community districts with the highest cyclist KSI (an additional district is included because of a tie in KSI in the highest 20th and 21st districts). "Medium" contains the 20 community districts with the next highest 20 cyclist KSI figures, and "Low" contains the remaining 18 community districts with the lowest cyclist KSI of the group.
- "Bicycle Network Coverage Ranked by Community District," Figure 17, shows a map of New York City Community Districts split into terciles, or three equally sized groups, of districts that are ranked by bicycle network coverage. Bicycle network coverage is a percentage determined by taking the total lane mileage of protected and conventional bicycle lanes (at the end of 2016) in a community district (with a buffer of 30 feet) and dividing by the total number of vehicular roadway mileage in that district (with a buffer of 30 feet, Source xii). The community districts were ranked from lowest to highest bicycle network coverage and then separated into three groups. "Low" contains the 20 community districts with the lowest percentage of bicycle network coverage, "Medium" contains the 20 community districts with the following middle 20 bicycle network coverage percentages, and "High" contains the remaining 19 community districts with the highest bicycle network coverage percentages.
- "Cyclist KSI and Bicycle Network Coverage Comparison by Community District," Figure 18, combines the "Cyclist KSI Ranked by Community District" analysis and the "Bicycle Network Coverage Ranked by Community District" analysis. It aims to identify community districts in which cyclist KSI is relatively high, but bicycle facilities remain comparatively sparse. The "High," "Medium," and "Low" rankings for each analysis are overlaid on a grid, which can be found at the top left corner of the figure. Community districts with "High" cyclist KSI and "Low" or "Medium" bicycle network coverage have been identified as "Priority Bicycle Districts" by NYC DOT.

"Cyclist Fatalities and KSI Crash Types" and Figure 19 review cyclist traffic fatalities from 2006 through 2016; 199 in total (Source i). Using descriptive data provided in NYPD crash reports, these crashes were categorized into different crash types. The categories here indicate a combination of motor vehicle driver and cyclist behavior.

"Cyclist KSI Crash Types" and Figure 20 review the motor vehicle action for cyclist fatalities and cyclist KSI (Sources i and ii). The comparison provides an indication of crash severity for motor vehicle action. This metric provides some detail of the crash type, but not as much as the previous analysis due to the limited detail in the KSI data.

"Vehicle Type" and Figure 22 compare cyclist fatality by the category of motor vehicle type and Figure 21 summarizes the motor vehicle's location of impact. Both utilize the fatality dataset (Source i).

"Intersection versus Midblock Locations" and Figure 23 utilize the cyclist fatality and cyclist KSI datasets to distinguish between crashes occurring at intersections, those at midblock locations, and highway crashes (Sources i and ii).

"Bicycle Crashes with Pedestrians" uses the NYPD/NYC DOT Reconciled Fatality Database for pedestrian fatality crash types.

Methodology (continued)

Appendices

Appendix 1 is a reference table of statistics used in "Geographic Analysis: Priorities for Bicycle Network Expansion" for each New York City Community District. The analysis is described in more detail on page 53.

Appendix 2 further lists cyclist fatality and cyclist KSI dataset details (Sources i and ii). Due to the limited detail provided by the KSI dataset, this data is not available for all analyses listed.

Appendix 3 compares the demographics of New York City residents to that of the City's cyclists and cyclist fatalities. New York City cyclist data is based on residents, aged 18 and older, who have bicycled in NYC in a 12-month period. This may not be an accurate depiction of exposure for each demographic group as there is no indication of how frequently people in each group have cycled in the 12-month period. Further sources, limitations to data, and exceptions are listed in the appendix.

Appendix 4 details cyclist fatalities on bicycle facilities between 2006 and 2016 and is a reference table for "Cyclist Fatalities on Bicycle Facilities," described in more detail on page 53.

SOURCES

i. New York City Police Department/New York City Department of Transportation. Reconciled Fatality Database, 1996-2016. NY, NY: NYCDOT/NYPD.
ii. New York State Department of Transportation/New York State Department of Motor Vehicles. Crash Database, 1996-2014. Albany, NY: NYSDOT.
iii. New York City Department of Transportation. (2017, January). "Cycling in the City: Cycling Trends in NYC."
iv. U.S. cities and national figures: Census of Population: Social and Economic Characteristics (1990); Journey to Work, Census (2000); Workers by Means of Transportation, American Community Survey (2005 - 2015), U.S. Census Bureau; numbers are rounded to the nearest 100; because the sample size is smaller for the ACS, a rolling three year average is used for each year after 2005 (e.g. two years are used for 2006).
v. Oak Ridge National Laboratory. (2012, June). "New York State 2009 NHTS Comparison Report."
vi. U.S. cities and national figures: "Pedalcyclists," Fatality Analysis Reporting System (FARS) data, National Highway Traffic Safety Administration.
vii. New York City Department of Health and Mental Hygiene. Cyclist Fatalities by Community District of Crash and Cyclist Home, 2006-2014. NY, NY.
viii. U.S. Census Bureau. American Community Survey 5-Year Estimates, 2010-2014.
ix. New York City Department of Health and Mental Hygiene. New York City Community Health Survey (CHS), 2010-2014. 2010-2014 combined year analyses are weighted to the New York City adult residental population as per US Census 2010 and the 2011-2013 American Community Survey.
x. U.S. Census Bureau; Decennial Census Data. 2010.
xi. New York City Department of Transportation, Bike Share Program. Bike Share Usage Data and Launch Zone, 2013-2017.
xii. New York City Department of Transportation. CLION proprietary street network based on New York City Department of City Planning's LION 16D street network. (2016, November).

Appendix 1. Community District Prioritization

Borough	Community District	Street Mileage	Bicycle Network Mileage	Percent Bicycle Network Coverage	Bicycle Network Coverage	Cyclist Fatalities	Cyclist Severe Injuries	Cyclist KSI	Cyclist KSI Rank	Community District	Borough
Bronx	01	67.9	12.1	18%	High	1	29	30	Medium	01	Bronx
	02	60.4	16.2	27%	High	0	20	20	Medium	02	
	03	44.2	12.6	28%	High	1	14	15	Low	03	
	04	72.0	10.0	14%	Medium	0	16	16	Low	04	
	05	49.6	6.6	13%	Medium	2	15	17	Low	05	
	06	51.2	7.1	14%	Medium	2	22	24	Medium	06	
	07	56.1	6.5	12%	Medium	2	16	18	Low	07	
	08	87.5	1.6	2%	Low	0	3	3	Low	08	
	09	115.1	17.5	15%	Medium	1	13	14	Low	09	
	10	183.2	11.4	6%	Low	0	13	13	Low	10	
	11	102.1	10.5	10%	Medium	1	13	14	Low	11	
	12	142.3	7.9	6%	Low	1	15	16	Low	12	
Brooklyn	01	139.5	24.1	17%	High	9	96	105	High	01	Brooklyn
	02	103.0	27.2	26%	High	5	85	90	High	02	
	03	**78.0**	**8.9**	**11%**	**Medium**	**3**	**86**	**89**	**High**	**03**	
	04	**58.2**	**8.0**	**14%**	**Medium**	**3**	**48**	**51**	**High**	**04**	
	05	**167.6**	**13.9**	**8%**	**Low**	**2**	**37**	**39**	**High**	**05**	
	06	93.7	27.1	29%	High	0	36	36	Medium	06	
	07	98.1	8.7	9%	Medium	0	38	38	Medium	07	
	08	46.3	20.9	45%	High	3	58	61	High	08	
	09	48.2	12.4	26%	High	2	36	38	Medium	09	
	10	128.0	20.1	16%	Medium	1	24	25	Medium	10	
	11	112.4	2.6	2%	Low	5	30	35	Medium	11	
	12	**105.1**	**8.5**	**8%**	**Low**	**2**	**49**	**51**	**High**	**12**	
	13	77.0	10.0	13%	Medium	0	12	12	Low	13	
	14	**83.8**	**13.0**	**16%**	**Medium**	**1**	**44**	**45**	**High**	**14**	
	15	**162.0**	**11.3**	**7%**	**Low**	**1**	**41**	**42**	**High**	**15**	
	16	59.4	5.6	9%	Medium	2	33	35	Medium	16	
	17	**101.4**	**10.2**	**10%**	**Medium**	**1**	**39**	**40**	**High**	**17**	
	18	217.5	10.8	5%	Low	1	34	35	Medium	18	
Manhattan	01	70.4	25.4	36%	High	1	22	23	Medium	01	Manhattan
	02	51.3	15.8	31%	High	1	66	67	High	02	
	03	68.7	25.6	37%	High	4	73	77	High	03	
	04	63.0	17.2	27%	High	1	60	61	High	04	
	05	50.6	13.8	27%	High	1	103	104	High	05	
	06	55.2	11.5	21%	High	2	60	62	High	06	
	07	57.2	16.9	30%	High	1	39	40	High	07	
	08	67.4	20.0	30%	High	4	72	76	High	08	
	09	45.0	9.1	20%	High	0	34	34	Medium	09	
	10	47.5	6.5	14%	Medium	3	23	26	Medium	10	
	11	79.6	24.1	30%	High	7	36	43	High	11	
	12	84.3	29.1	35%	High	1	25	26	Medium	12	
Queens	01	173.6	24.0	14%	Medium	0	29	29	Medium	01	Queens
	02	153.0	16.9	11%	Medium	3	34	37	Medium	02	
	03	**109.5**	**11.6**	**11%**	**Medium**	**2**	**45**	**47**	**High**	**03**	
	04	**82.0**	**2.9**	**3%**	**Low**	**0**	**39**	**39**	**High**	**04**	
	05	**196.9**	**19.2**	**10%**	**Medium**	**2**	**44**	**46**	**High**	**05**	
	06	112.3	0.2	0%	Low	0	12	12	Low	06	
	07	314.0	9.7	3%	Low	2	21	23	Medium	07	
	08	215.6	16.7	8%	Low	1	15	16	Low	08	
	09	125.2	0.3	0%	Low	3	25	28	Medium	09	
	10	177.6	6.7	4%	Low	1	10	11	Low	10	
	11	262.9	12.7	5%	Low	0	9	9	Low	11	
	12	286.8	1.3	0%	Low	2	30	32	Medium	12	
	13	372.4	12.2	3%	Low	2	10	12	Low	13	
	14	186.0	23.3	13%	Medium	1	5	6	Low	14	
Staten Island	01	332.0	9.4	3%	Low	2	19	21	Medium	01	Staten Island
	02	377.0	23.1	6%	Low	0	9	9	Low	02	
	03	457.5	15.1	3%	Low	0	1	1	Low	03	
Sources	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[1]	

[1] Community Districts are sorted numerically.
[2] Street mileage is an approximate sum of mileage from roadbeds within each district. NYC DCP LION street network was used in this calculation.
[3] Bicycle Network Mileage was caculated using NYC DOT's 2017 bicycle network map. Bicycle facilities considered include bicycle lanes and protected bicycle lanes, with the exception of dirt trails, boardwalks, and velodrome tracks. Bicycle facilities within a 30-foot radius of each district is used to account for geographical measurement error.
[4] = [3] / [2]
[5] Bicycle Network Coverage is a tercile ranking of column [4], Percent Bicycle Network Coverage. "Low" coverage ranges from 0 - 8.5% coverage; "Medium" coverage ranges from 9.0 - 16.2%; "High" coverage ranges from 17.2 - 45.1%.
[6], [7], [8] Cyclist fatalities, severe injuries, and KSI based on last 5 years of available data; 2010 - 2014.
[9] Cyclist KSI Rank is a tercile ranking of column [8], Cyclist KSI. "Low" KSI range from 1 - 17; "Medium" range from 20 - 37; "High" range from 38 - 105.

Appendix 2. Cyclist Fatality & KSI Crash Details

Bicycle Facilities *(Totals)*	Cyclist Fatalities 2006-2016		Cyclist KSI 2006-2014
	#	% of Total Known	
Protected Lane	5	3%	N/A
Conventional Lane	11	6%	
Signed/Marked Route	6	3%	
Not on Facility	176	89%	
Unknown	1		
Total	**199**		

Modes of Crash *(Totals)*	Cyclist Fatalities 2006-2016		Cyclist KSI 2006-2014
	#	% of Total	
Cyclist/Motor Vehicle Crash	199	93.0%	N/A
Cyclist/No Vehicle Crash	11	5.1%	
Cyclist/Pedestrian Crash	3	1.4%	
Cyclist/Cyclist Crash	1	0.5%	
Total	214		

Borough of Crash *(Totals)*	Cyclist Fatalities 2006-2016		Cyclist KSI 2006-2014	
	#	% of Total	#	% of Total
Bronx	22	11%	383	11%
Brooklyn	83	42%	1,330	39%
Manhattan	46	23%	1,046	31%
Queens	44	22%	582	17%
Staten Island	4	2%	54	2%
Total	**199**		**3,395**	

Season *(Totals)*	Cyclist Fatalities 2006-2016		Cyclist KSI 2006-2014	
	#	% of Total	#	% of Total
Winter	28	14%	397	12%
Spring	49	25%	759	22%
Summer	84	42%	1,298	38%
Fall	34	19%	941	28%
Total	**199**		**3,395**	

Crash Type *(Totals)*	Cyclist Fatalities 2006-2016		Cyclist KSI 2006-2014
	#	% of Total Known	
Traveling Adjacent	52	29%	N/A
Right Angle	48	27%	
Motor Vehicle Turn	37	21%	
Bicycle Turn	13	7%	
Bicycle Crossing Midblock	13	7%	
Head On	9	5%	
Dooring	8	4%	
Other/Unknown	19		
Total	**199**		

Motor Vehicle Action *(Totals)*	Cyclist Fatalities 2006-2016		Cyclist KSI 2006-2014	
	#	% of Total Known	#	% of Total Known
Traveling Straight	130	70%	2,041	65%
Right Turn	25	13%	238	8%
Left Turn	12	6%	347	11%
Other	20	11%	495	16%
Unknown	12		274	
Total	**199**		**3,395**	

Appendix 2. Cyclist Fatality & KSI Crash Details (continued)

Location *(Totals)*	Cyclist Fatalities 2006-2016		Cyclist KSI 2006-2014	
	#	% of Total Known	#	% of Total Known
Intersection	129	65%	2,845	89%
Midblock	65	33%	338	11%
Highway	5	3%	11	0%
Unknown	0		201	
Total	**199**		**3,395**	

Vehicle Type *(Totals)*	Cyclist Fatalities 2006-2016		Cyclist KSI 2006-2014	
	#	% of Total Known	#	% of Total Know
Passenger Car	102	62%	1,948	73%
Truck	45	27%	123	5%
Taxi/For-Hire Vehicle	9	5%	495	19%
Bus	8	5%	59	2%
Motorcycle	1	1%	31	1%
Unknown	35		739	
Total	**199**		**3,395**	

Dark/Light *(Totals)*	Cyclist Fatalities 2006-2016		Cyclist KSI 2006-2014	
	#	% of Total Known	#	% of Total Known
Daylight	129	65%	2,331	69%
Darkness	70	35%	1,049	31%
Unknown	0		15	
Total	**199**		**3,395**	

Peak Hour *(Totals)*	Cyclist Fatalities 2006-2016		Cyclist KSI 2006-2014	
	#	% of Total Known	#	% of Total Known
Peak Hour	53	27%	827	24%
Off-Peak Hour	146	73%	2,553	76%
Unknown	0		15	
Total	**199**		**3,395**	

Age *(Totals)*	Cyclist Fatalities 2006-2016		Cyclist KSI 2006-2014	
	#	% of Total Known	#	% of Total Known
School Aged Children (5-17)	15	8%	397	13%
Young Adults (18-29)	61	31%	1,161	39%
Adults (30-64)	98	50%	1,350	45%
Seniors (65+)	22	11%	96	3%
Other/Unknown	3		391	
Total	**199**		**3,395**	

Gender *(Totals)*	Cyclist Fatalities 2006-2016		Cyclist KSI 2006-2014	
	#	% of Total Known	#	% of Total Known
Female	25	13%	399	12%
Male	174	87%	2,956	88%
Other/Unknown	0		40	
Total	**199**		**3,395**	

Notes: Severe injuries in crashes with more than one cyclist injury are counted as "Other/Unknown" in the age and gender tables due to the inability of attributing demographics to a severity in cases with multiple injured persons.

Seasonality: Winter: December, January, February; Spring: March, April, May; Summer: June, July, August; Fall: September, October, November

Daylight/Darkness: Hours are based on average monthly sunrise and sunset and include an hour buffer.

Peak Hour: Monday – Friday from 7:00-10:00am and 4:00-7:00pm are counted as "Peak Hour."

Appendix 3. Demographics of Cyclists

Borough of Residence	Population of NYC[1]		Cyclists[2]		Cyclist Fatalities[3*]	
	# (Millions)	% of Total	# (Thousands)	% of Total	#	% of Total
Bronx	1.41	17%	183	13%	17	12%
Brooklyn	2.57	31%	457	32%	66	45%
Manhattan	1.62	19%	357	25%	29	20%
Queens	2.28	27%	378	26%	34	23%
Staten Island	0.47	6%	69	5%	0	0%
Total	**8.35**		**1,443**		**146**	

*Note: Unavailable for 6 Fatalities.

Level of Education	Population of NYC[1]		Cyclists[2]		Cyclist Fatalities[3*]	
	# (Millions)	% of Total	# (Thousands)	% of Total	#	% of Total
College Degree**	2.36	41%	530	47%	28	26%
Some College	0.82	14%	219	19%	7	7%
High School Degree or Less	2.54	44%	378	34%	72	67%
Total	**5.72**		**1,127**		**107**	

*Note: Unavailable for 2 Fatalities. Population limited to those aged 25 or older.
**College degree for Source 1 includes Associates Degree while Source 2 only includes 4-year degrees or more.

Place of Birth	Population of NYC[1]		Cyclists[2]		Cyclist Fatalities[3*]	
	# (Millions)	% of Total	# (Thousands)	% of Total	#	% of Total
U.S. Born	5.25	63%	852	59%	75	50%
Foreign Born	3.10	37%	585	41%	74	50%
Total	**8.35**		**1,436**		**149**	

*Note: Unavailable for 3 Fatalities.

Race	Population of NYC[1]		Cyclists[2]		Cyclist Fatalities[3*]	
	# (Millions)	% of Total**	# (Thousands)	% of Total	#	% of Total
Asian	1.10	13%	156	11%	20	13%
Black, non-Hispanic	1.89	23%	277	20%	34	23%
Hispanic	2.41	29%	407	29%	50	33%
White, non-Hispanic	2.74	33%	566	40%	46	31%
Total	**8.35**		**1,405**		**150**	

*Note: Unavailable for 2 Fatalities.
**Population percents taken from Source 1 and include other races not shown here including "two or more races."

Gender	Population of NYC[1]		Cyclists[2]		Cyclist Fatalities[4]	
	# (Millions)	% of Total	# (Thousands)	% of Total	#	% of Total
Female	4.38	52%	505	35%	25	13%
Male	3.98	48%	938	65%	174	87%
Total	**8.35**		**1,443**		**199**	

1. 2010-2014 American Community Survey 5-Year Estimates, U.S. Census Estimates.
2. New York City Department of Health and Mental Hygiene. New York City Community Health Survey (CHS), 2010-2014. 2010-2014 combined year analyses are weighted to the New York City adult residental population as per US Census 2010 and the 2011-2013 American Community Survey.
3. NYC DOHMH Bureau of Vital Statistics and NYC Office of Chief Medical Examiner
4. NYCDOT/NYPD Fatality Database; 2006 - 2016

Appendix 4. Cyclist Fatalities on Bicycle Facilities: 2006-2016

Date	Borough	Facility Type	On Street	Cross Street	Crash Type
6/22/06	MN	Protected	12 Ave	W 39 St	Motor vehicle right turn
12/1/06	MN	Protected	West St	Clarkson St	Head on
12/5/07	MN	Conventional	6 Ave	W 36 St	Dooring
4/16/08	MN	Conventional	Allen St	Hester St	Bicycle left turn
8/31/08	BK	Conventional	Bedford Ave	Union St	Right angle
9/6/08	BK	Conventional	Boerum Pl	Livingston St	Motor vehicle right turn
12/13/08	BX	Signed/Marked	3 Ave	E 168 St	Unknown
10/22/10	MN	Conventional	E 120 St	3 Ave	Dooring
8/2/11	QN	Conventional	Cross Bay Blvd	E 1 Rd	Bicycle crossing midblock
6/12/12	BK	Conventional	Bedford Ave	Empire Blvd	Motor vehicle turn
8/26/12	BK	Signed/Marked	Franklin Ave	Flushing Ave	Right angle
10/20/13	BK	Signed/Marked	Smith St	Schermerhorn St	Bicycle left turn
8/29/14	QN	Conventional	Jewel Ave	Grand Central Pkwy	Bicycle crossing midblock
1/17/15	QN	Signed/Marked	Vernon Blvd	41 Ave	Motor vehicle right turn
7/28/15	QN	Protected	Queens Plz N	29 St	Right Angle
9/11/15	BX	Protected	City Island Rd	City Island Bridge	Bicycle crossing midblock
4/15/16	BK	Signed/Marked	Classon Ave	Lexington Ave	Motor vehicle left turn
6/7/16	BK	Conventional	Evergreen Ave	Hart St	Motor vehicle left turn
6/11/16	MN	Protected	West St	Chambers St	Motor vehicle right turn
7/2/16	BK	Conventional	Grand St	Manhattan Ave	Traveling adjacent
7/17/16	BK	Signed/Marked	Gerritsen Ave	Everett Ave	Head on
12/15/16	MN	Conventional	12 Ave	W 55 St	Motor vehicle right turn

List of Figures

Credits / Works Cited

This report was developed by the New York City Department of Transportation's Office of Research, Implementation, & Safety. The project team consisted of Arthur Getman, Lily Gordon-Koven, Seth Hostetter, and Rob Viola in conjunction with Lawrence Fung and Anna Caffarelli of the New York City Department of Health and Mental Hygiene.

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