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Bicycling the Gap: A mixed method study examining bicyclists in New York City and the interactions they share with the Metro Transportation Authority Subway System, and the New York Waterway Ferry System

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Abstract

Bicycle commuting is rapidly becoming a more popular, recognized mode of sustainable transportation in major U.S. cities. Urban infrastructure and specifically public mass transportation systems must take appropriate steps in order to accommodate this new influx of bicyclists, in order to further encourage this environmentally friendly mode of transportation. The purpose of this study is to critically analyze two public mass transit systems (MTA Subway & NY Waterway Ferry) in downtown Manhattan, New York City, to gain a better understanding of what current interactions exist between bicyclists and these two public mass transit systems.

A mixed method approach that includes participant observation, ethnographic research, photographs, and a survey is used to jointly determine what the overall perception of public mass transit systems are by bicyclists in New York City. This methodology draws from both qualitative and quantitative data sources in order to determine where gaps in infrastructure and policy exist that discourage bicyclists from using these two public mass transit systems.

This thesis concludes with opportunities and obstacles that bicyclists currently face in New York City, drawing from the city's transportation history and recent "cyclist revolution". A reflective analysis ties together my mixed method approach, illuminating positive and negative findings between bicyclists and public mass transit systems in New York City. Additionally, a brief set of recommendations and suggestions from other U.S. cities follow.

Keywords

"Bicycle Commuting"
"New York City Public Transportation Systems"
"Sustainable Transportation"
"Public Mass Transit"
"Bicycle Interactions & Public Transit Systems"
"Multi-Mode Commuting"

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Introduction

"Throughout the course of the 20th century, we (The United States) seemed to lose the street to the internal combustion engine, and to rapid movement, so that the purpose was to move through an area very quickly rather than to pause and be in the neighborhood,"
~ Kenneth Jackson, Historian - Columbia University

Bridging the gap, i.e. making a connection where there is a great difference, is no easy thing to do. In today's context this idiom can often be interpreted to mean, making connections between different social, economic, political, and environmental stakeholders in an effort to push towards a congruent and unified end result. Drawing from various backgrounds, interests, and levels of investment, different stakeholders inevitably want different end results. Today, lobbyists for bicycle commuting are attempting to bridge these gaps in the United States.

Current global trends focus on environmentally based initiatives and sustainable growth patterns that meet the needs of present generations, without compromising the needs of future generations. Addressing energy-use in the transportation sector of the United States is widely agreed upon as the primary sector for change, accounting for the highest carbon dioxide emissions of all sectors (other sectors include: residential, industrial, commercial) since 1999 (US-EIA, 2011). However, social and political pushes to update existing transportation infrastructure to address carbon dioxide emissions are often met with impediments, as changes often involve massive planning and construction teams, making these processes extremely expensive and time consuming. Additional attempts to infuse new modes of transportation such as bicycling and walking with existing transportation infrastructure has also proven to be extremely

difficult, because the current transportation infrastructure is set up to accommodate the automobiles, as they currently dominate the United States. Recent data shows that 77% of American's drive alone to work, while only 0.4% ride their bicycle to work (U.S. Census, 2007).

As one of the few entirely sustainable, non-emitting forms of transportation, bicycling commuting has seen a 64% increase in the United States since 1990 (Putcher & Buehler, 2011). Although the national percentage of people bicycling to work is still very low, this recent rise has triggered subsequent changes in political policies, social trends, economic incentives, and infrastructure developments throughout the country. The most populated city in the United States, New York City, has seen a 168% increase in the number of bicyclists between 1985 and 2005, and more recently has reported a doubling of bicyclists from 2007 to 2011 (NYC-DOT, 2012). Updates in bicycle infrastructure such as bicycle lanes, bicycle paths, greenways, and proper bicycle storage have followed. In addition, the growth of bicycle advocacy groups, such as *Transportation Alternatives* and *Bike New York* has given this growing bicycle community in New York City a loud voice. Continual rises in the number of bicyclists in New York City, addresses many of the current environmental issues the transportation sector is largely responsible for including air quality, traffic congestion, and heavy petroleum reliance (US Global Research, 2012).

In a city where 54.2% of the population uses public mass transit to commute to work on a daily basis, it is clear that New York City residents rely heavily on the way the public mass transit systems are set-up to determine how they transport themselves to/from work (MTA, 2011). The primary concentration of this study focuses on how

these New York City public mass transit systems can be updated, and in some cases totally re-developed to accommodate infrastructure and policy developments to encourage non-motorized transportation users, such as bicyclists.

As an avid bicyclist myself, I have biked in New York City for a few years now, and have seen vast changes in the bicycle infrastructure throughout the city. My family lives close by in New Jersey, and my father bicycle commutes everyday as a part of his multi-mode commute to work in downtown Manhattan. As a result of both my father's experiences and my own, I have developed a good understanding of the growing bicycle culture in New York City. Seeing continued infrastructure and policy growth related to bicycle commuting in New York City is near and dear to people like my father who rely so heavily on bicycle infrastructure and policies for their daily commute.

In this study, I look closely at the connections that currently exist between bicyclists and two modes of public mass transit in New York City: The Metropolitan Transportation Authority Subway and the New York Waterway Ferry. For the purposes of the study, I define the term "bicycle commuter" to mean any bicyclist who is riding his/her bicycle for a transportation purpose, i.e. not for recreational use. Specifically, I focus on the Port Imperial Ferry Terminal located at W. 39th St and 12th Ave in New York and six different Metropolitan Transportation Authority (MTA) Subway stations located throughout downtown Manhattan. These subway stations are: West 4th St. Washington Square Park, Canal Street, Broadway-Lafayette Street, Bleecker Street, 8th Street, and Astor Place. I have attached maps showing where the Port Imperial Ferry Terminal, and MTA Subway stations are located in downtown Manhattan (Appendix A-1 & Appendix A-4).

To gather data, I use a mixed method approach that draws from participant observation & photos, a survey, and ethnographic research. Used together, these research tools allow me to find out where gaps in infrastructure and policy exist that discourage bicyclists on these public mass transit systems. This approach draws from both qualitative and quantitative sources, presenting me with both descriptive and numerical data.

The importance of the positive connections between bicyclists and public mass transit systems are very important to the way people travel throughout the city. With public mass transit moving the largest percentage of people around New York City, linking an up-and-coming mode of transportation such as bicycling with an already dominant mode of transportation such as pubic mass transit is a good way to facilitate increases in riders to both modes of transportation (CRC, 2012). Addressing potential gaps between these two modes, means reducing the number of people traveling alone in personal automobiles.

> "A transit route is only as good as its weakest link, and potential users may be lost because a lack of options at the beginning or end of their potential route, or by the cost and inconvenience of changing transit systems across municipal boundaries." (CRC, 2012).

Although New York City has recently been mentioned at the forefront of bicycle infrastructure and policy improvement (and rightfully so), political differences can play big roles in whether or not these changes continue to get made. The current Mayor of New York City, Michael Bloomberg is widely known as being a strong advocate of bicycle transportation, adding an average of 50 miles of bicycle lanes per year (NY Post, 2010). Even so, there currently are no bicycle racks on the over 4,000 MTA busses that

operate daily in New York City. Other U.S. cities such as Chicago, Las Vegas, Kansas City, Seattle, Philadelphia, and San Francisco that compete with New York City for tourists, and thus revenue can all say that 100% of their busses are equipped with bicycle racks (Eckerson, 2011). In response, bicycle advocacy groups and bicycle enthusiasts alike are lobbying throughout New York City, fighting to implement changes such as bicycle racks on busses, but they are finding that it is very difficult to bridge the gap between wanting these changes, and actually seeing them.

Cited as having the largest ferry market in the United States, and the nation's busiest ferry route by passenger volume, positive connections between bicyclists and the New York Waterway Ferry are also crucial towards reducing automobile usage (New York Economic Development Corporation, 2011). Furthermore, the MTA Subway is the 7th busiest Metro System in the world, attracting over 1.6 billion riders in 2011 alone (MTA, 2012). Both of these modes are proven, effective, and extremely popular forms of public mass transportation. Together, these transit systems are key difference makers in determining whether New York City public mass transit systems are serious about accommodating bicycle users or not. Positive connections between public mass transit and bicyclists can be hugely helpful for people who use their bicycle as a part of their multi-modal commute, while poor connections can deter people from bicycle commuting.

Literature Review

Introduction

While the United States is currently a highly developed and industrialized country, there are issues the country faces with the way infrastructure and land-use developments have been designed throughout history. The correlation between different modes of transportation and infrastructure trends is very strong, with one dictating the other. For example, the rise of the automobile in American society saw the development of the interstate highway system. A focus on what these trends are and how they dictate transportation infrastructure developments are very important when looking at how bicycles can use history to solidify themselves as a meaningful form of transportation in the United States. This literature review covers topics relevant to bicycle commuting as a form of transportation, and how connections between bicycles and public mass transit have developed along with the history of the transportation systems we know today.

History of the Industrial Revolution and Transportation in the United States

The urbanization and growth of the United States occurred primarily during the period known as the "industrial revolution" in the 19th century, and would end up becoming a crucial turning point in the social, political, economic, and cultural makeup of our country (Riefler, 1979). Before this time, employment was focused in small communities, where there were fewer opportunities for people searching for work (Riefler, 1979). The industrial revolution moved the vast majority of jobs into large cities, and with these jobs came a mass influx of people as well. American cities experienced significant population growth, and the percentage of the population living in cities grew rapidly as well (Riefler, 1979).

The sharp rise of immigrants to the United States during the turn of the century was directly proportionate to the number of new jobs available (Hirschman & Mogford, 2009). By 1920 immigrants and their immediate offspring comprised over half of all the manufacturing workers in the United States (Hirschman & Mogford, 2009). The spike in population led to numerous changes regarding the development of urban areas. Housing markets rapidly expanded during this time and the construction of urban infrastructure intensified. With more places for people to live, transporting people to these places was the next focus of development.

Transportation can be defined as a means of conveyance or travel from one place to another, using horses, carriages, trains, cars, buses, boats, planes, etc (Merriam-Webster, 2011). Transportation was developed simply as a more efficient, more practical means of travel as compared to one's feet. It wasn't until the early 19th century that

transportation began to focus on the transportation of considerable numbers of people at one time, a term we now define as "mass transit"[1]. "Mass transit" began with the horse-drawn streetcars dating back to the early 1800's. It wasn't until 1871, when Andrew Smith Hallidie patented the first non horse-drawn cable car in San Francisco, California, that streetcars stopped relying on horses. Hallidie's design was powered using a wire-rope cable that pulled the cable cars up San Francisco's steep terrain using power from a steam-driven powerhouse (Middleton, 1985). His innovative design allowed the streetcars of San Francisco to become very efficient and practical compared to the previous horse-drawn carriages (Middleton, 1985). Hallidie's cable car sparked a revolution, and people throughout the country began to think more about the importance of "mass transit."

Cities such as Chicago, Illinois; Philadelphia, Pennsylvania; New Orleans, Louisiana and New York, New York quickly began to emulate Hallidie's design in San Francisco (Middleton, 1985). The streetcar was quickly a hit with the general public. George Fisher of Philadelphia, Pennsylvania reports in his diary in 1859 how horse-drawn streetcars were perceived at the time.

> *These passenger cars, as they are called, but which are street railroads with horse power, are a great convenience…They are roomy, their motion smooth and easy, they are clean, well cushioned and handsome, low to the ground so that it is convenient to get in or out and are driven at a rapid pace.* (p. 349 Bianco, 1999)

As the streetcar continued to flourish throughout the 19th century, mass transit, as we know it today, began to take shape. Steam railroads began transporting commuters by

[1] **mass transit**, also called mass transportation, or public transportation, Transportation systems, usually publicly but sometimes privately owned and operated, designed to move large numbers of people in various types of vehicles in cities, suburbs, and large metropolitan areas (Britannica, 2011).

the 1870's (Jackson, 1987). Wealthy merchants and professionals who could afford to ride the railroads began to commute between busy downtown areas and quiet villages on the outskirts of major cities such as New York, Boston and Chicago (Cheape, 1980). By 1876 New York City had developed the country's first elevated steam railroad. It is known as the nation's first rapid transit system (Whaples, 2010). The steam railroads provided city dwellers with revolutionary intercity mobility.

The railroads continued to expand outside of the cities paving the way for suburban areas to be developed. Workers now had the ability to settle outside of the crowded cities while still being able to commute back into the city where they made a living via the steam railroad (Whaples, 2010). By the late 1890's mass transit had become vital to life in large American cities. Had the streetcar and railroad disappeared at this point, millions of Americans throughout the country would have been left miles away from their work with no way of getting to work other than walking or being drawn by the increasingly outdated horse-drawn carriage (Foster, 1981).

It wasn't until after the turn of the century that electric trains were used (Whaples, 2010). In 1904 a 21-mile subway route was put in place in New York City, followed by construction of an additional 123-mile route in 1913. The goal of installing these direct-current-electricity powered subways was to connect the five boroughs of New York City via a rapid underground mass transit system (Metropolitan Transportation Authority, 2010).

World War I (1914-1918) had a huge impact on the then privatively owned transit companies. As inflation skyrocketed, the transit companies were forced to raise their

fares to stay in business. This drastically reduced ridership numbers and the situation worsened for these transit companies (Whaples, 2010).

The arrival of the automobile in 1913 compounded the transit companies' already devastating problems. Not only did the automobile almost immediately become more popular than mass transit, but the arrival of the automobile in already crowded cities made the city streets extremely packed, drastically reducing the speed and efficiency of streetcars (St. Clair, 1986). By the mid 1920's the previously booming transit industry was dwarfed by the automobile industry, The annual revenue of the transit industry dropped almost 50% between 1926 and 1933 as the automobile industry boomed during this same time (Whaples, 2010).

In an effort to make a comeback, the privately owned transit companies underwent a process known as "motorization". In an effort to compete with the automobile industry, they converted their electric streetcars to gasoline and diesel power busses (St. Clair, 1986). The thinking behind making this change was now the busses could run on the same roads that the automobiles could, saving the struggling transit companies the fixed costs associated with running streetcars on private tracks. As the privately-owned transit companies soon found out, the capacity and efficiency of the streetcar could not be matched by the gasoline and diesel powered busses, and soon these private companies would go out of business for good (Whaples, 2010).

As the population in American cities continued to grow exponentially, so did the mass transit systems (Jackson, 1987). Currently mass transit in larger U.S. cities includes: heavy rail (high capacity metro systems), light rail (lower capacity metro systems), commuter rail (serving surrounding metropolitan area), busses, trolleybuses,

ferries, and streetcars (Rubin, 2000). Cities have become increasingly more efficient with their mass transit systems. Mass transit now provides efficient transportation of citizens throughout increasingly crowded cities (Barrett, 1992). Depending on a particular city's geographical and topographical features, certain modes (busses, trains, ferries, etc.) may work better than others in different locations throughout the country. For example, a ferry system in a city like Atlanta, Georgia, where there isn't a large enough body of water present, would not be as efficient as a ferry system in New York City, situated right along the Hudson River. Although mass transit, in one form or another is offered in virtually every city in the U.S., not all citizens choose to utilize the available public transportation systems in their cities, opting to drive personal automobiles instead because of the door-to-door convenience.

American cities with larger populations such as New York, Chicago, Boston, and Washington, D.C. have the most developed mass transit systems (Schenker & Wilson, 1967). New York City has the highest percentage of "No Automobile Households" of any city in the U.S. at 55.7% (Census, 2000). With more then half of the estimated 8.4 million people living in New York City as of 2000 without an automobile, it is no surprise that these citizens turn to public mass transportation to get around (Census, 2000). Public transit use accounts for 54.7% of all work trips in New York City (Census, 2010). Other factors like population density and the costs associated with owning a car further encourage citizens of New York to ditch the personal automobile and ride cheaper, more efficient public transit systems.

There are many reasons why public transit is widely seen as the most efficient and cost effective mode of transportation in large U.S. cities where the population density is

high. Public transit offers a cheaper alternative to cars because public transit riders do not have to individually pay for gas, parking fees, and general maintenance costs. Additionally public mass transit reduces traffic congestion, reduces foreign dependence on cheap oil, and is usually easily accessible for the general public providing it is well-marked (Estrada, 2009). As of late 2010, public mass transit in the United States throughout all sectors except busses saw increases (American Public Transportation Association, 2010). High gas prices, increased cost of car ownership, and tougher state licensing laws are some of the primary reasons sited for why public mass transit has seen these increases.

Between January 2009 and June 2009, heavy rail increased by 2.23%, the equivalent of 1.73 million people, and light rail increased by 4.15%, the equivalent of 222,000 people nation-wide. Although bus ridership decreased by 1.65% or 2.6 million people during the same time period, demand for more buses increased by 97,000+ people in the same study (American Public Transportation Association, 2010). Busses consistently remain the cheapest form of public mass transit.

Citizens who opt to drive personal automobiles over using public mass transit, choose to do so primarily because these people like the convenience of door-to-door travel. Public mass transportation cannot compete with such convenience, nor does it try to (Vugt, Meertens, & Lange, 1995). There are other negative issues associated with public mass transportation. They include: public transportation can be time inefficient as it relies heavily on following specific route schedules; it does not always go exactly where one may need it to go; it requires knowledge of route schedules and planning of

how one will navigate the routes; and there are issues of connectivity with other modes of transportation (Estrada, 2009).

Connecting different modes of transportation is crucial to public transit ridership numbers because of the way the infrastructure in American cities has been set up. Citizens cannot travel efficiently using just one mode (Berrigan, Pickle, & Dill, 2010). Many agree that connecting mass public transportation with other modes of transportation is necessary for continued growth in cities throughout the country (Dill & Carr, 2003).

History of the Growth of Bicycling in The United States and New York City

The current trend of bicycle commuting has seen a slow, but steady emergence that dates back to the early 1970's (Hendel, 2011). In 1973, the OPEC (Organization of Petroleum Exporting Countries) proclaimed an oil embargo, sending the United States oil supply plummeting as gasoline prices skyrocketed to levels previously thought to be impossible (SECO, 2010). In response, policies in the United States began searching for alternatives to dependency on foreign oil. For the first time, the United States was forced to seriously think about renewable and alternative energy sources (SECO, 2012). Aside from what the United States was doing on a national level, many American's took matters into their own hands, as over 20 million bicycles we sold in the year following the announcement of the oil embargo, a staggeringly high number (Mn, 2008).

Figure 1: Annual Bicycle Sales from 1955-1977

(Figure deleted in digital version, available in hard copy in UVM Environmental Program Office).

It was clear that American's realized that bicycles were a cheap, efficient way to transport themselves around, when the price of gasoline became unaffordable (Hendel, 2011).

Right around the same time of the booming bicycle sales in the late 1970's, the mayor of New York City, Ed Koch, introduced four on-street protected bicycle paths on Manhattan's 5th, 6th, 7th, Avenues and Broadway (NJTPA, 2011). The Mayor recognized that more people were bicycling in New York City, and wanted to make bicycling safer in New York City. However, the results were overwhelming negative as very few people used them, and there were a couple of fatalities (NJTPA, 2011). In 1980, just a month after unveiling the bicycle paths, Mayor Ed Koch ripped them out, due to severe public and media backlash (WNYC, 2011).

Passage of the 1990 Clean Air Act re-kindled the spark of bicycling in New York City (NY Times, 2010). Because New York City was struggling to meet new federal mandates with noise and congestion issues under the Clean Air Act, action to meet these

standards was forced upon New York City (NYC-DCP, 2012). In 1994, the New York City Departments of City Planning, Transportation, and Parks and Recreation partnered up to "reduce congestion by promoting cycling" in an effort known as the "Bicycle Network Development Program" (NYC-DCP, 2012). The goals of this program were simple, to implement and maintain: on-and off-street bicycle networks; improve cycling safety; improve bicycle access on bridges and mass transit; and institutionalize cycling in public and private organizations (NYC-DCP, 2012). Although over a 900-mile bicycle network was planned at this time, there were no real implementations of infrastructure that increased the number of bicycle commuters the way the city had hoped (NYC-DCP Graph, 2012).

The Transportation Equity Act for the 21st Century (TEA-21) was passed by Congress in 1998, and required consideration of bicycle and pedestrian needs in transportation planning and increases in funding opportunities for bicycle and pedestrian projects (USA Global Research Program, 2012). The passage of this act, along with the continued growth of bicycle advocacy groups such as *Transportation Alternatives* and *Bike New York*, and growing public awareness, led to the turn of the century as a time when bicycle commuters saw real growth and prosperity in New York City (NYC-DCP Graph, 2012). The variety of benefits from exercise to reduced noise pollution and traffic congestion to cleaner air to the affordability, allowed for different people to see different benefits in promoting the bicycle (BikeToWork, 2010).

Since Mayor Michael Bloomberg has been in office (January 1, 2002), New York City has been placed at the forefront of the national trend to make bicycling viable and safe even in the most urban of settings (NY Times, 2010). Rutgers University

researchers have concluded that, “bike lanes and bike paths encourage cycling,” similar to the “if you build it, they will come” mentality (University Transportation Research Center, 2011). Accordingly, New York City added 345 miles of bike lanes and bike paths from 2001 to 2011, with plans to add an additional 463 miles of lanes and paths in the next 10 years (University Transportation Research Center, 2011). Since, 2001 the City of New York has reported a 155% increase in the number of bicyclists (University Transportation Research Center, 2011). Even with these drastic increases, only 0.6% of work trips in New York City in 2009 were made by bicycle, compared to 5.8% in Portland, OR; 3.9% in Minneapolis, MN; 3.0% in San Francisco, CA; 2.2% in Washington, DC; and 1.2% in Chicago, IL (U.S. Census, 2009).

Janette Sadik-Khan, the commissioner of New York City’s Department of Transportation has stated that from 2009 to 2011, there has been an additional 66% increase in the number of bicyclists on the streets of New York City (Falk, 2011). “This is a national movement,” Sadik-Khan went onto say, “This (bicycling) has become a fundamental mainstream form of transportation,” (Falk, 2011). Often referred to as the “cycling revolution”, dozens of cities throughout the country are responding and fueling this influx of bikers through infrastructure developments and policy changes (Mapes, 2009)

Bicycle Infrastructure Growth in the United States

The rise of bicycle commuting in the United States has just begun to expand rapidly within the past few years (Boelte, 2010). Much like every other form of transportation in the past, the rise of bicycle commuting won’t happen overnight. In

order to become truly more efficient than cars and other forms of transportation, bicycle infrastructure must continue to expand, providing bicycle commuters with faster, more efficient routes than cars (Mapes, 2009).

> "Building a new bicycle culture requires extensive infrastructure, and I don't just mean painted lines. Bicycle lanes are not enough-you need physically separated bike-ways" ~ Gil Peñalosa, (Former Mayor of Bogotá, Columbia. (Boelte, 2010))

Today, Portland, Oregon is considered one of the best cities in the country for bicycle infrastructure, having received a Platinum Award by the League of American Cyclists for being an outstanding Bicycle-Friendly community since 2003 (League of American Bicyclists, 2010). Portland began thinking about bicycle infrastructure in 1973, well before many other U.S. cities, and has seen significant results from this foresight.

Figure #2: Map of Portland, Oregon Bicycle Lane Network in 1973

(Figure deleted in digital version, available in hard copy in UVM Environmental Program Office).

Figure #3: Map of Portland, Oregon Bicycle Lanes Network in 2003

(Figure deleted in digital version, available in hard copy in UVM Environmental Program Office).

There is noted to be a direct connection between changes in infrastructure and the number of bicyclists on the road (Putcher & Buehler, 2011). Since New York City implemented the country's first "cycle-track" [2] on Ninth Ave in 2007, bicycle commuters in New York City have more than doubled in numbers in a three-year span to 2010 (NYC-DOT, 2011). With presence of infrastructure hugely responsible for why bicyclists on the road have been steadily increasing over the past few years; infrastructure can also be hugely responsible for deterring and discouraging people away from bicycling, if the infrastructure is not constructed properly (Putcher, 2001). For example, a city like Mobile, Alabama, with a population of 195,000 people, has only one street

[2] A cycletrack is a particular type of segregated cycling facility: it is a path for bicyclists located next to (alongside) a roadway. A side path is similar to a sidewalk, but designated for anyone traveling by bicycle (Wikipedia, 2011b).

with a bicycle lane lasting 1.5 miles. This lack of bicycle infrastructure can deter potential bicyclists from using their bicycles if they know that there is no safe and comfortable place to ride it (McClendon, 2011).

The personal safety of bicycle commuter is cited as the utmost concern of a potential rider (Dill & Carr, 2003). When bicycle infrastructure is constructed properly, bicyclists will feel safe from any transportation related danger such as a car, bus or truck driving by (McClendon, 2011). Gil Peñalosa of Bogotá, Columbia evaluates the safety of bicycle infrastructure on the "8-80 rule". He states "If you would not send an 8-year-old along with an 80-year-old on a walk or bike ride on a particular piece of infrastructure, then it is not safe enough," (p. 48-49 Boelte, 2010). Guaranteed personal safety is detrimental to facilitating bicycle commuting, however, it is not the only issue persuading potential bicyclists to commute or not, there are a few others.

The availability of reliable bicycle facilities to properly store, maintain, and park bicycles, are known to be extremely important to bicycle commuters (Khattak & Yim, 2004). In Long Beach, California, a full service "bike station" which includes full service bicycle storage, bicycle rental facilities, bicycle repairs/tune-ups, changing areas, and a coffee bar has been installed at a major transportation hub in the city (Commuter California, 1996). The strategic location of the "bike station" at a major transportation hub, allows bicyclists to connect with local bus and train systems, shuttling commuters farther ranges throughout the city (Yao, 2007).

Most bicycle commuters incorporate bicycling somehow into their multi-mode commute[3]. As a result, bicyclists must familiarize themselves with public transportation schedules and routes accordingly (Noah, 2008). Planning a multi-mode commute is a crucial component of most bicycle commuters daily commute (Boelte, 2010). It is well known that most people need busses, trains, and cars and other forms of motorized transportation to get around at least some of the time, even if they consider themselves bicycle commuters (Krizek, El-Geneidy, & Thompson, 2007). Accordingly, most bicycle commuters rely heavily on the way these transportation infrastructure systems are set up too (Noah, 2008).

The feasibility of commuting from one's home to work only using a bicycle is not very high for most people, especially those traveling from longer distances. Only a select group of bicycle commuters have reported doing this efficiently (Boelte, 2010). Therefore, when the majority of bicycle commuters weigh the pros and cons of commuting via bicycle, the issue of how they will complete their journey to work before or after their use of the bicycle looms large (Cervero et al, 2009). Many of the current issues associated with connectivity between different modes stem from the way previous city infrastructure has been developed and for what modes of transportation these previous infrastructure systems were constructed for (Heinke, 1997).

Because bicycle commuting is a relatively new trend in urban transportation, most cities in the United States do not have proper existing infrastructure to accommodate bicycle commuters properly (Safirova et al, 2007). With a worldwide "bicycle boom" just beginning, bicycling infrastructure in the United States must be updated and in some

[3] **Mixed-mode or Multi-mode commuting** refers to the practice of using two or more modes of transportation. The goal of mixed-mode commuting is often to combine the strengths (and offset the weaknesses) of various transportation options (Wikipedia, 2011a).

places developed from scratch to accommodate the continued influx of new riders (Harden, 2008).

Connecting Bicycle Commuters with Public Mass Transportation Systems in the United States & in New York City

As cities throughout the nation attempt to accommodate and facilitate bicycling, city planners have begun to look closely at improving connections between public mass transportation systems and bicyclists (TheNewModel, 2010). In order to successfully increase bicycle commuters in a cities such as New York, where the majority of the population relies heavily on public mass transit systems; infrastructure developments and political policy must make it easy for bicyclists to interact with public mass transit (CRC, 2011). Filling in these gaps and disconnections to reach convenient, intuitive links between multiple modes of transportation is the goal of many of today's sustainable transportation planners (CRC, 2011).

An example of a positive link between a bicyclist and a public mass transit system can be seen in Chicago, Illinois. Allison Krueger, a 26-year-old botanist chooses to ride her bike from her home three miles to Union Station. There she catches a train to the suburbs, and then proceeds to cycle three more miles to her office. Krueger demonstrates how efficient connections between bicycling and public mass transit systems can be extremely beneficial both to the bicycle commuter and to the ridership numbers of public transit systems (Helliker, 2006). Another example cites the city of Louisville, Kentucky that first installed bike racks on its busses in 2002, and since then bicyclist boarding's have almost doubled from 48,000 riders in 2002 to 91,000 riders in 2005 (Helliker,

2006). Although Chicago and Louisville demonstrate examples of positive links these between bicyclists and public mass transit, there are many cities throughout the nation including New York City, that have a ways to go before connections between their bicyclists and public transit systems are up to speed (TheNewModel, 2010).

As of early 2011 New York City had not one bike rack on the over 4,000 busses that drive around the city (Eckerson, 2011). This is a point of concern for bicyclists throughout New York City, who rely on both modes to transport themselves around. Other U.S. cities that compete with New York City for tourist revenue, such as Chicago, Las Vegas, Kansas City, Seattle, Philadelphia, and San Francisco can say that 100% of their bus fleets are equipped with bike racks (Eckerson, 2011).

Although there are no bicycle racks on busses throughout the five boroughs of New York City, there are other connections that link bicyclists with public mass transit that do exist. In 1993, Transportation Alternatives, a well-known bicycle advocacy group in New York City, won bicyclists the right to bring their bikes onto the MTA Subways 24 hours a day, 7 days a week (TransAlt, 2010). Today, bicycles are allowed on MTA Subways, Metro-North/LIRR railroads, NJ Transit, PATH, New York Water Taxi ferries, New York Waterway Ferries, Staten Island Railway, and the Staten Island Ferry (TransAlt, 2010). Each transit system has its own set of rules concerning when and how bicycles are allowed, based on the safety procedures of that particular transit system.

The MTA Subways which include the 1, 2, 3, 4, 5, 6, 7, A, B, C, D, E, F, G, J, L, M, N, Q, R, S, and Z trains, allows bicycles anytime as long as bicyclists are familiar with their eight rules (MTA, 2011) (Appendix A-6). Their rules include how to properly enter and exit the station, how to enter the train properly, where to position oneself in the

train, and how to be considerate to fellow riders. The Metropolitan Transportation Authority website states:

> *"Riding a bike, hopping on a bus or taking the subway all help reduce pollution in the air we breathe, since it means leaving a car at home. But bicycles can create safety problems in the subway system for both passengers and transit operations. These problems can be easily avoided by following these eight safety tips, observing the rules, and remembering to be considerate of other passengers whenever you take a bicycle into the subway."*
> ~ (MTA, 2011).

The PATH (Port Authority Trans Hudson), a train line which runs underneath the Hudson River connecting New Jersey to New York, allows full size bicycles, but only during off-peak hours (NJDOT, 2011). This means only folding bicycles are allowed on the PATH trains any time of day. Full-size bicycles are not permitted between 6am and 9:30am going Inbound to New York City, and between 3pm and 6:30pm going Outbound to New Jersey (NJDOT, 2011). This is simply because bicycles would be a safety hazard to fellow transit riders during these peak times.

For bicyclists planning to ride the MTA Metro-North and Long Island Railroad lines, a permit is required for all non-folding bicycles (MTA Metro-North, 2011). The permit can be purchased for five dollars at Grand Central Station. The Metro-North railroad has a number of other set rules that all bicyclists must be familiar with before riding. There are certain restrictions riding trains inbound and outbound to and from New York City on different holiday weekends throughout the year. For example:

> "No bicycles will be carried on New Year's Eve, New Year's Day, St. Patrick's Day, Mother's Day, Eve of Rosh Hashanah, Eve of Yom Kippur, Eve of Thanksgiving, Thanksgiving Day, Christmas Eve, and Christmas Day." ~(MTA Metro-North, 2011)

Furthermore, only two bicycles, per car will be permitted on weekdays with a maximum of four bicycles per train. New York Waterway ferries, Staten Island ferries, and New York Water taxi ferries are all required to provide transportation of bicycles, as called for by the New York Waterway Ferry Company (NJDOT, 2011). Because these ferry boats are generally spacious enough to accommodate many bicyclists if necessary, there are not many rules properly handling a bicycle on a ferry.

Conclusion

The history of transportation in the United States has followed a dynamic and changing pattern, with different modes of transportation dominating different time periods in history. Currently, the U.S. is seeing a commitment shown by many cities towards increasing bicycle awareness through infrastructure and policy developments. Policy makers and citizens alike have rejoiced in the positive benefits that bicycling can offer to air quality, traffic congestions, efficiency, and others. Additionally, federal legislation has set forth a clear dedication towards funding and supporting bicycling and walking related projects into the future.

While New York City has made vast improvements in its bicycle infrastructure over the past decade, and has subsequently attracted large increases in bicycle commuters as well; other cities around the country are facilitating the national "cycling revolution" more effectively than New York City. Linking bicyclists with public mass transit can be a hugely beneficial step towards facilitating bicyclists in New York City (CRC, 2011). There exists a massive opportunity for New York City to thrive off positive connections

between these two modes, as New York City is home to over 2/3 of the United States public transportation trips annually (MTA, 2011). While some steps have been taken in certain cities (including New York City) to better link public transportation with bicycle commuters, there is still vast room for improvement (Lafsky, 2010).

Methods

Goal and Overall Strategy

My research critically analyzes the Metropolitan Transportation Authority (MTA) Subway system and the New York Waterway Ferry system in order to develop a comprehensive understanding of how bicyclists integrate and connect with these two public mass transportation systems. I would like to point out and inform the bicyclist community in New York City, what connections currently exist between these modes. This information can be important for bicyclist's commuting to/from work, school, grocery stores, movie theaters, etc. Additionally, even if information regarding these connections is publically available, it is often hard to find and not intuitive for bicyclists who are not familiar with bicycling in New York City.

I use a mixed method approach that includes: participant observation & photos, a survey, ethnographic research, and an internship at Bike New York. In order to accurately and successfully complete this mixed method approach, I took to the streets, and brought my bicycle on bike paths, bike lanes, streets, ferries, subways, and bridges, during a one-year period in New York City between spring 2011 and spring 2012.

My primary focus during this period was intently observing, critiquing, experiencing, and inquiring about the few minute window when a bicyclist and bicycle

become public mass transit rider(s) and vice versa. In order to go about this strategically, I followed a set of objectives. Specifically, I looked for how easy and smooth the shift from bicyclist to public transit rider was based on the rules, regulations, infrastructure, and policies set forth by both MTA and New York Waterway respectively. I believe that studying these connections in order to show data explaining what current connections exist, is very important to the way people who live, work, and travel throughout New York City by bicycle. Furthermore, finding and experiencing these connections first hand, can help me convey this information to city planners and bicycle advocacy groups to facilitate continued growth of the bicycle commuter community in New York City.

Objectives

Objective 1→ Determine 1 New York Waterway Ferry Terminal and at least 5 MTA Subway Stations in downtown Manhattan to study.

Objective 2→ At each station begin with general participant observation. Example questions I ask myself while generally observing are: How many bicyclists are coming and going over a set time period? What times have least/most bicyclists? What age groups do bicyclists at each site represent? Do bicyclists look rushed or frantic?

Objective 3→ Continue with more in-depth participant observation. Example questions I ask myself during this step are: How long do bicyclists take getting on and off public transit systems? Do bicyclists seem at ease or stressed getting on or off public transit? How do other non-bicyclist public transit riders view bicyclists? Do bicyclists seem to be

minority? Are the New York Waterway and MTA officials accommodating and friendly towards bicyclists? Are connections between bicyclist and public transit working smoothly?

Objective 4→ Gain further insight through ethnographic research, conversational data and distribution of my survey (See Appendix A-2).

Objective 5→ Continue to have regular interactions with bicycle commuters to further find out what their perceptions are of MTA Subways and NY Waterway Ferries as bicyclists. As an intern with Bike New York, I am able to have regular interactions with this community of bicyclists. I ask people: How do they view interactions between public transit and bicyclists? Have these interactions changed for better or worse during the time that they have been bicycling in New York City? From their experience, are bicycle commuters generally knowledgeable as to what bicyclists can /cannot do on MTA Subway and NY Waterway Ferry systems?

Objective 6→ Draw conclusions relating to where connections are working and where improvements between the two modes (bicycles and public mass transit) are needed.

Objective 7→ Draft a set of recommendations and suggestions towards infrastructure and policy developments that I believe will help improve interactions between the two modes.

Introduction to the Approach of Accomplishing Each Objective

In order to accurately and efficiently accomplish each objective, I use a number of methods. Specifically, three distinctly different approaches were used with each one presenting me with a different framework in order to succeed in accomplishing each objective. The first method incorporates my own general observations and more specific participant observations noted via notebooks, cell phones, photographs, experiences, and interactions mostly throughout the summer of 2011, but occasional interactions occurred throughout the 2011-2012 academic school year. This method allows me to complete Objectives One, Two, and Three. Secondly, I draw from ethnographic research, based primarily on conversational and cultural data I collected while an intern with *Bike New York* during the summer of 2011. Through this research I am able to further address Objectives One, Two, and Three, and more directly address objectives Four and Five. Finally, I use both participant observation and ethnographic research to formulate a reasonable and informative survey to address objectives Four & Five as well.

Objectives Six and Seven involve a collaboration of all the aforementioned methods, as they heavily draw from my personal experiences in New York as well as a road-trip across the United States in the late summer of 2011. On this trip I became a participant observer in cities such as Boulder, CO; San Francisco, CA; Portland, OR; and Seattle, WA. After bicycling in these cities, I have seen first hand what bicycle infrastructure and policies exist outside of New York City, and thus feel confident coming up with a number of recommendations and suggestions based on these experiences, for New York City.

Participant Observation

I followed the National Park Service's National Park Ethnography Program's method as I deemed it to be a helpful example of different methodologies used to properly conduct my ethnographic research. Under this methodology, participant observation falls under the umbrella term of "ethnographic research", and it is considered one of many ways that researchers carry out this type of anthropogenic research. Participant observation involves, "getting close to people and making them feel comfortable enough with your presence so that you can observe and record information about their lives," (NPS, 2012).

My participant observation research includes various field notes and photographs captured by me in a notebook or camera respectively. Throughout the summer of 2011, I carried around a notepad and camera, both of which I would frequently use while waiting around or riding the MTA Subway and NY Waterway Ferry stations, bicycling on the streets (I would stop to take notes), riding on busses throughout NYC, and whenever else I deemed it appropriate to jot something down.

I would look at specific methods that bicyclists used for getting on/off of public transit systems, facial expressions/demeanors they showed, types of bicycles they were riding, clothing they were wearing, age they were, physical fitness level they appeared to be, and others. Most of the times I would take notes occurred during the hours between 8:00 AM and 10:00 AM on weekdays, as that was when I would be bicycle commuting to my *Bike New York* internship. However, there were numerous occasions, when I would take at random times, while visiting New York City on the weekend, for example. Between both my normal time slot for observation and other random times, I was able to

observe bicyclists during a fairly large range of time of day, days of the week, and weather conditions.

The primary purpose my participant observation served was to educate myself, as the researcher, as to what bicycling in New York City was really like. As a current student at the University of Vermont, I live in Burlington, VT for more than ¾ of the calendar year. This participant observation was the quickest, most efficient method for me to gain valuable knowledge bicycling in New York City.

Internship at Bike New York

From late May 2011 until mid-July 2011, I was one of two interns at *Bike New York*, located at 475 Riverside Drive, New York, New York 10115 (BNY, 2012). My duties as an intern mostly primarily revolved around coordinating "Weekend Walk", and "Learn-to-Ride for Kids" events. These events were hosted throughout Manhattan, Brooklyn, Queens, and the Bronx and involved children, parents, community members, city officials, among others.

Through my duties at *Bike New York*, I became actively engaged within the bicycling community in New York City. As a direct result of my coordination responsibilities and participation in "Weekend Walk" and "Learn-to-Ride" events, I was able to talk to bicycle commuters, members of NYC-DOT (Department of Transportation), members of Recycle-A-Bicycle (in Brooklyn), and general bicycle enthusiasts in various communities. Through casual conversations with these groups of people, I was able to share my enthusiasm for bicycling and how I got to be an intern at *Bike New York*.

As I progressed to deeper, more informational and inquisitively based conversations with these same groups of people, I began to notice differences in interest levels between people who were really engaged in my conversations and people who were just being polite. In the end I was able to gather about three people, who left me with their name, phone number, and email address, as they expressed interest in helping me to collect my ethnographic data.

In addition to involvement at "Weekend Walk" and "Learn-to-Ride" events, through my internship I was able to build relationships with *Bike New York* employees, all of which are actively involved one way or another in the bicycle culture of New York City. Emilia Crotty, Rich Conroy and Francesca Hays who are the Education Operations Director, Education Programs Director, and Education Volunteer Manager, respectively were the primary people I was in contact with during my time at *Bike New York.* Together, they were able to engage me with the bicycle commuting culture in New York City, and explain to me observations and experiences they had with using public mass transit systems as bicyclists.

Formulation and Distribution of the Survey

Through my participant observation and internship at *Bike New York* I was able to gather personal observations and connections with people that I talked to. Building upon this data, I distributed a survey that drew its questions almost entirely from my participant observation and experiences at *Bike New York.* The survey allowed me to gain a much better understanding as to what a larger sample of New Yorker's thought about connections between bicyclists and public mass transit systems.

Many of the questions on the survey came from observations and feelings I gathered about how I felt when bringing my bicycle onto different modes of public mass transit. Through a series of seven questions, I asked survey participants to; rank their "comfort" level on a scale of 1-10 (when using public transit systems with their bicycle), select the mode of public transit that needs the least and most improvement, describe how often they ride public transit with their bicycle, and select the main causes for riding public transit with their bicycle. Beside most questions I left space for any written responses participants wanted to include. (See Appendix A-2 for full survey)

I distributed my survey at two "Bike Commuting 101" classes, hosted by *Bike New York* at two separate facilities in Manhattan. The first located at *Eastern Mountain Sports* at 530 Broadway (Spring & Broadway), and the second located at *Ogilvy & Mather* at 636 11th Ave (EMS, 2012; Ogilvy & Mather, 2012). Both of these classes were aimed at teaching first-time bicycle commuters how to properly plan their route, what clothes to wear, what bicycle to ride, what protective/supplemental gear to use, etc. Another big part of these classes was answering questions people had about bicycle commuting in general. I thought that distributing my survey to the population at these two classes would leave me with a good, diverse sample of bicyclists in New York City.

In addition to these two classes, I distributed my survey throughout the *Bike New York* office, and to my father's office at NYU Law School. I thought these two would also be good places for me to collect quality data, because most of the employees at *Bike New York* bicycle commute to work, and my father and a few of his co-workers also bicycle commute to their work in Manhattan.

Results

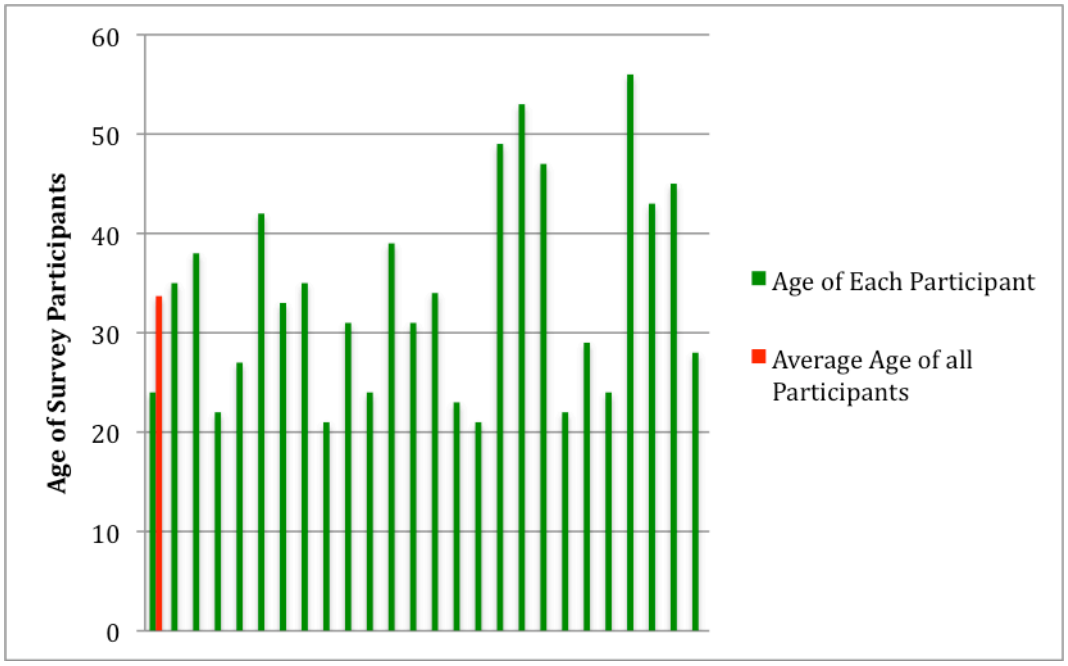
The goal of my mixed method research approach was to critically analyze the Metropolitan Transportation Authority (MTA) Subway system and the New York Waterway Ferry system in order to develop a comprehensive understanding of how bicyclists integrate and connect with these two public mass transportation systems. My participant observation and ethnographic research allowed me to gain needed exposure to the qualitative and descriptive data that existed within the bicycle community who uses public mass transit systems. Additionally, my survey collected quantitative and numerical data from a much larger sample size of bicycle commuters throughout New York City. Together, these mixed methods allowed me to gain a comprehensive understand of how bicyclists integrated with the MTA Subway and NY Waterway Ferry transit systems.

General Survey Data

In total I was able to gather 27 survey responses from people living and/or working in New York City. With these 27 responses I was gained a variety of different responses, from survey participants of diverse backgrounds. Of the 27 total participants, there were 14 female and 13 male participants. This almost identically equals the current gender distribution in New York City, which is reported as 52.6% females and 47.4% males (City Data-NYC, 2012). The average age of my survey participants was between 33 and 34 years old. According to the city demographics of New York City, the current

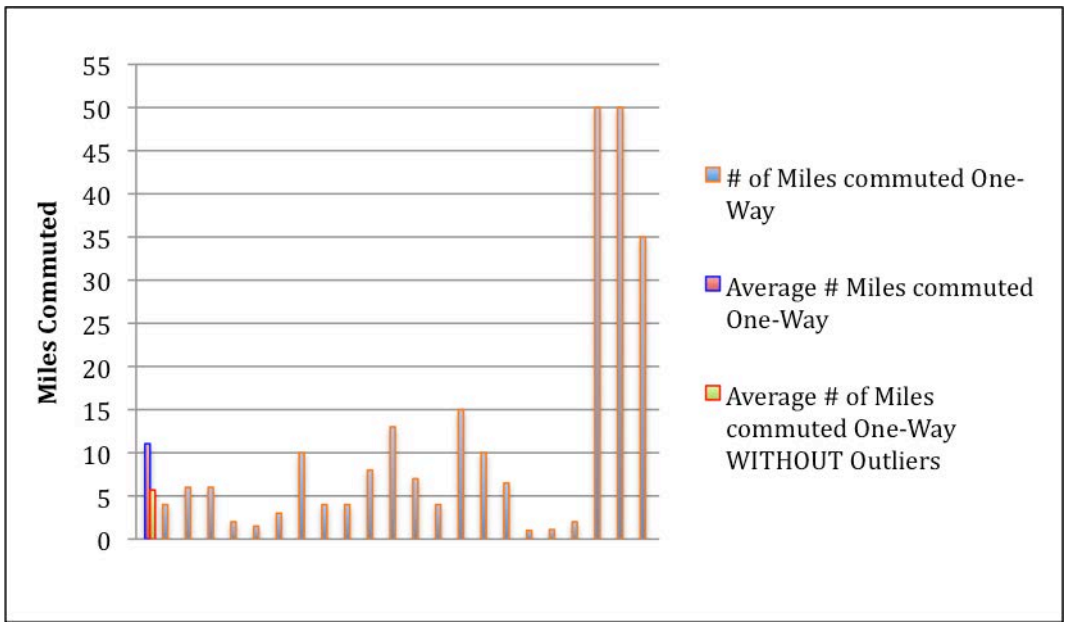
median age of NYC residents were 34.2 years old (City Data-NYC, 2012). Attached below is a graph that shows the age distribution of participants in the survey.

Graph #1: Age Distribution of Survey Participants



I also asked participants in my survey to include how many miles they traveled to/from work one-way. The average number of miles participants in my survey traveled one-way was 11.05 miles. But, there were three participants who commuted from Huntington, NJ; Rockland County, NY; and Woodbridge, NJ who reported one-way commuting lengths of 50+, 50, and 35 miles respectively. For the sake of obtaining more accurate data, I removed these three outliers to recalculated the average miles traveled one-way and came up with an average of 5.7 miles traveled each day. Below is a graph illustrating this data and the average with the outliers, and the average without the outliers.

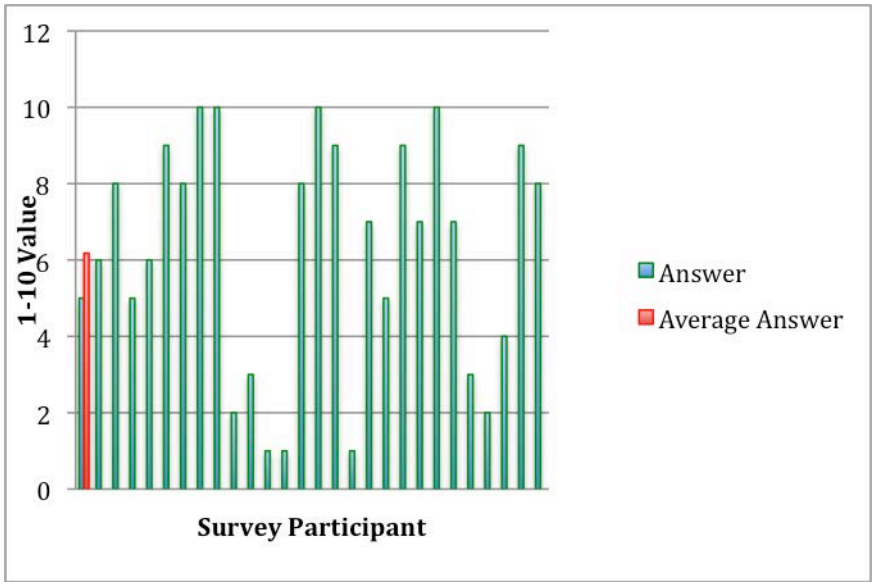
Graph #2: Miles Commuted One-Way



Another question I asked participants was to rank on a scale of 1-10 (with 1 being the least comfortable, and 10 being the most) how "comfortable" they felt using public

mass transportation systems in New York City with their bicycle. The average answer was 6.2 out of 10, and is shown in red on the graph below.

Graph #3: Comfort Level With a Bicycle on Public Mass Transit



The Metropolitan Transportation Authority (MTA) Subway

While riding the MTA Subway around Brooklyn, Queens, The Bronx, and Manhattan, I realized just how many New Yorker's relied on the Subway. MTA reports that in 2011 there were 1,640,434,672 trips made throughout the year, breaking down to be 5.3 million trips per week (MTA, 2012). The frequency of the subway trains is a strong indication of just how needed they are. The trains almost always came every few minutes, with the only exception being the express trains, which arrived at about 10-15 minutes intervals. I never checked any sort of train schedule, to find out when the next subway was; I would just head to the platform and wait for the next train. While waiting, I noticed a technology, which displays the time passengers must wait before the next train arrives. For example, the ticker would say "1 line to Van Cortlandt Park/242nd Street, scheduled to arrive in less than one minute."

I primarily rode the "1" line, although I also found myself primarily riding the A, B, C, D, E, 2, 3, 4, 5, and 6 lines, throughout my time in New York City. I have attached a map of the New York City Subway map for reference as to where each of the aforementioned lines run to/from (See Appendix A-3). My observations on the subway occurred at many different times throughout the week and weekend days. Certain times and days had more people on the cars than others. Relatively speaking, I found that after 9 am the subway was less crowded than it would be if I rode at 8am. Additionally, I found that after 6pm, the ridership numbers on the subway were quite large. On most nights I observed, I found that the ridership numbers after 6pm remained pretty steady, at least on most of the Manhattan lines, presumably because people were headed out to restaurants, bars, plays, shows, etc.

Throughout my time riding the subway, I saw only two bicycles on the MTA Subway. Because of the extremely low sample size, I was not able to engage in any conversations with these two bicyclists. One bicyclist carried a fold-up bicycle onto the train car, and the other had a touring/road bike. The man with the fold-up bicycle entered the West 4th Street subway station around 4:30pm, and appeared as though he was leaving his work, as he was dressed in khakis and an overcoat. This man proceeded to collapse his bicycle into the size of a rolling suitcase, and rolled his bicycle through the turnstile and onto the subway platform. As the train arrived, he walked right into the crowded subway car, and in doing so forced other passengers to move farther inwards so that he could fit his bicycle in.

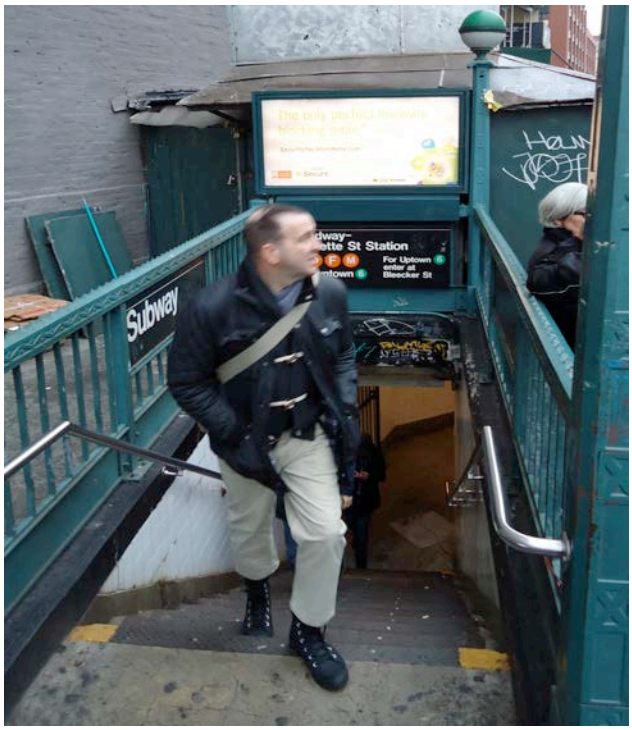
The other man possessed a seemingly expensive road bicycle and was wearing a standard bicycle race outfit equipped with: spandex, sunglasses, a racing helmet, water bottles, and clip-on bicycle shoes. He seemed as if he was going on an extensive bicycle ride. I was not able to see how this man got his non-folding bicycle into the subway station, as he was already on train when I entered.

The data I collected via my own experiences and photographs while riding the subway with my bicycle suggested that riding the subway with a bicycle was not an easy thing to do. The MTA Subways were almost always crowded (as the ridership numbers show) and the infrastructure leading to and from the subway car was not constructed so that it was intuitive for bicyclists to figure out how to bring their bicycle onto the subway without questioning the proper way to do so. Additionally, I found no evidence of helpful signage in the six subway stations I studied explaining the process or outlining the rules MTA has published on their website that bicyclists should follow. Attached below

are a couple of photographs that illustrate obstacles associated with the infrastructure impediments and the presence of people in and around the subway stations that make it difficult for bicyclists to safely access the train platform.

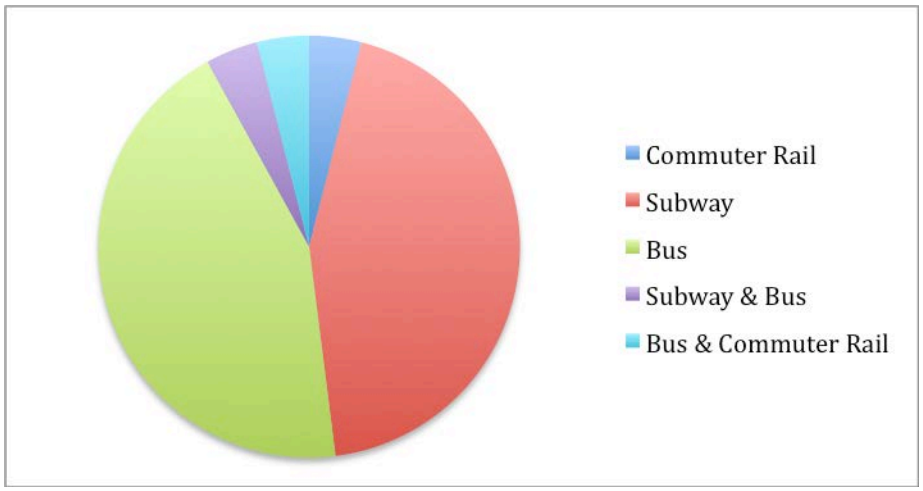
Photograph #1: Bicycle Blocked by a Turnstile Gate

Photograph #2: Busy stairwell into Subway Station



Adding on to my own observations, participants in my survey were asked which mode of public mass transportation they thought needed the most improvement to accommodate bicyclists, and the MTA Subway was at the forefront. The below pie chart illustrates this data.

Graph #4: In MOST need of improvement



The New York Waterway Ferry

The New York Waterway ferry attracted a different sort of public transit rider than the MTA Subway did. Ferries travel from predominantly from Manhattan island to New Jersey across the Hudson River and to/from Brooklyn via the East River. I focused on the New York Waterway Ferry that ran from West 39th St. in Midtown Manhattan to Port Imperial Terminal in Weehawken, New Jersey. (Appendix A-4).

I was a passenger on this ferry 2-3 times per week during the summer of 2011. I would commute from my home in Ho-Ho-Kus, NJ to Weehawken, NJ with my father in his car. Then we would both take the ferry across from Weehawken, NJ to Manhattan, and then I would pick up my bicycle at the ferry terminal on the Manhattan side and bike

up the Hudson River Greenway (See Appendix A-5). I decided that leaving my bicycle on the Manhattan side was the most convenient for me, for the frequency in which I was using the bicycle. This way I wouldn't have to bring the bicycle in the car with my father and I each evening we left the New York City.

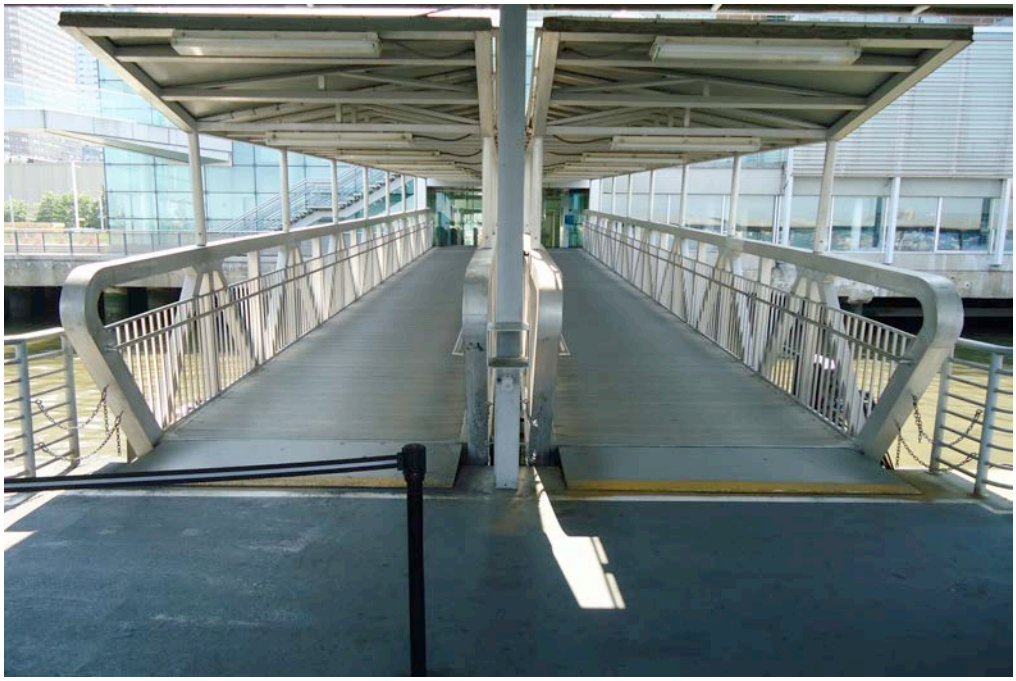
There were a few men who I found myself seeing every morning at around the same time, taking their bikes on/off the bike rack at the West 42nd St. ferry terminal. After engaging in brief conversations, I found out that these guys lived in Manhattan, and worked in New Jersey. Much like my father and I, but just the opposite, these guys would take their bicycles on the ferry and head into New Jersey for work. These couple of men were middle-aged, lean, healthy looking, business-type men, who often dressed in a semi-casual style. One man proclaimed, "The ferry is the way to go with a bike…can't beat the convenience of it!"

The ferry terminal's close proximity to the Hudson River Greenway encouraged bicyclists as virtually every time I was at the ferry terminal on the Manhattan side, I saw a bicyclist in the terminal. The ferry terminal was very spacious, and had multiple entrances into and out of the terminal, which made it really easy to roll a bicycle through the doors. Attached below are some pictures that illustrate the infrastructure that can be found in and around the ferry terminal.

Photograph #3: Open Gate and Turnstiles in Ferry Terminal

Photograph #4: Boarding the Ferry

Photograph #5: Runway Connecting Ferry Terminal and Dock



In addition to my personal observations and photographs, I easily found that New York Waterway had multiple online links encouraging bicyclists to use their stations. For example, there is an easily accessible webpage on the New York Waterway website that wants ferry riders to support getting a bike-share station at the East River Ferry terminal (New York Waterway-East River Ferry, 2012). Also, the homepage of the New York Waterway's East River Ferry reads, "Go Ahead, Bring it On: The Bike-Friendly Ferry."

Figure #4: New York City Bike-Share and The Ferry

(Figure deleted in digital version, available in hard copy in UVM Environmental Program Office).

Figure #5: Map of "Suggest a Station Location" for NYC Bike-Share

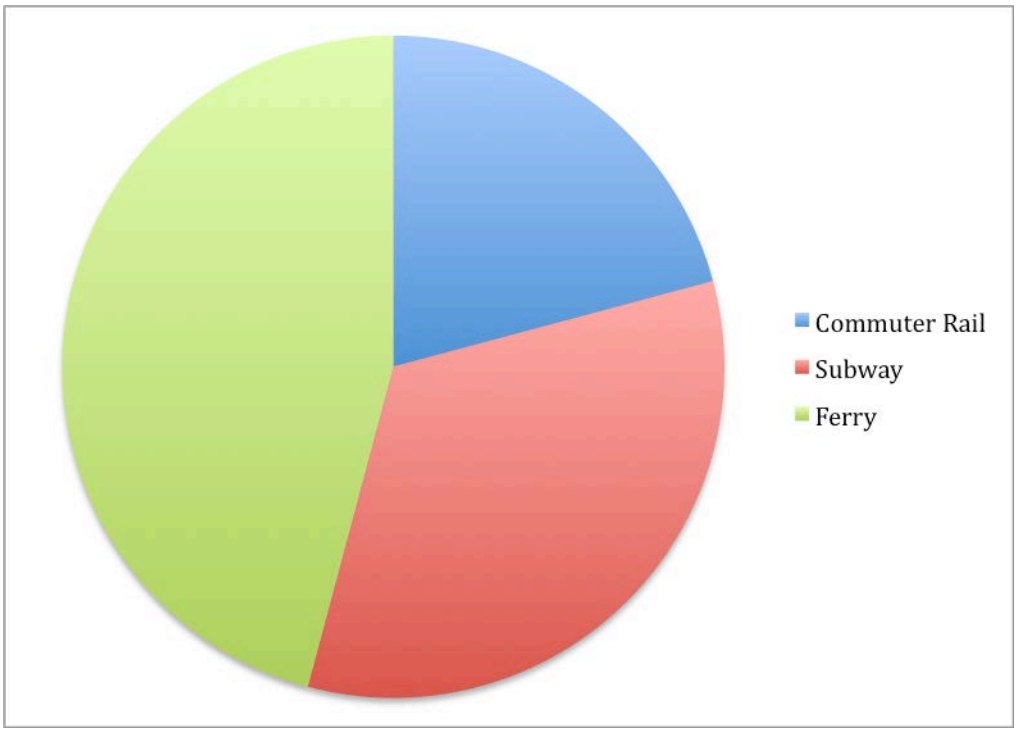
(Figure deleted in digital version, available in hard copy in UVM Environmental Program Office).

Figure #6: The Bike-Friendly Ferry

(Figure deleted in digital version, available in hard copy in UVM Environmental Program Office).

Additionally, my survey data showed that the majority of participants believed that the ferry needed the least amount of improvement to encourage bicyclists too.

Graph #5: In LEAST need of improvement



Discussion

The results of my data collection were telling and showed me what current trends between bicyclists and public transit systems in New York City. I have grouped my data into three distinct categories based on my observations, photographs and survey data in order to highlight the differences in infrastructure, signage, and availability of space between the MTA subway and the New York Waterway ferry. I found these three categories to be at the forefront of my data collection and observations. The differences I have found between infrastructure and spatial patterns between the MTA Subway and the New York Waterway Ferry help explain the current positive and negative connections that exist linking bicyclists with these two modes.

The Metropolitan Transportation Authority (MTA) Subway

Infrastructure

As I have outlined previously, the way infrastructure is designed plays a monumental role in determining who and what modes of transit can use space safely (Replogle, M., & Kodransky, M. (2010). The MTA Subway system consists of approximately 840 miles, enough to stretch from New York City to Chicago (MTA, 2012). The extreme length and diversity of this subway system, means that many people have access to the system, and thus want to ride it. These high levels of demand force subway stations to be placed in high-traffic areas, in order to accommodate the highest

numbers of customers. The infrastructure in New York City is already very tightly fit together, as the population density of the city as of 2010 was 69, 464 people per square mile, by far the most densely populated area in the United States (U.S. Census, 2012). Combining the extremely high demand for subway usage and the lack of space to develop proper infrastructure developments to accommodate these riders, the MTA Subway is faced with its share of infrastructure related obstacles that discourage bicyclists from bringing a bicycle onto the subway.

Beginning with entering a subway station, many station entrances require traveling down steep, narrow flights of stairs just to enter the station from street level. Of the six subway stations I studied, only the West 4th Washington Square Park station offered an elevator as an alternative way down into the station. Although the elevator is primarily designed for handicap customers, it can also serve as an easy access route for MTA customers with bicycles, baby-strollers, and suitcases, as well as elderly customers who may have a hard time walking down stairs. Additional sets of stairs often exist beyond the first set of stairs too. These infrastructure impediments make bringing a bicycle down into the subway station difficult and potentially obtrusive to other customers, and are inflated when other customers are rushing into and out of the stations.

Once down the stairs, the next obstacle a potential MTA customer with a bicycle will face is getting around the turnstiles. For regular customers, they simply wait their turn on line, swipe their MetroCard, and walk through the turnstiles and onto the subway platform in no time. Customers with bicycles are left puzzled as far as how they should properly go about getting their bicycle through the turnstiles. Simply lifting one's bicycle over the turnstiles is strictly prohibited, according to the MTA website, and also various

MTA officials I talked to. Because traditional MTA customers "read" the infrastructure around them and proceed through the turnstiles, it is implied that customers with bicycles should do the same. However, after talking with MTA representatives at information kiosks at the Broadway-Lafayette Street, Bleecker Street, and Astor Place stations I was told about how I should properly go about getting my bicycle through the turnstile area.

Each attendant was helpful in explaining to me the process and also suggested I take a look at the MTA website, which also explains the proper process. The process required a few steps, each of them essential to meet the safety guidelines outlined by MTA's rules and regulations. The process was to be handled slightly differently depending on if there was an attendant present at the information kiosk or not (depending on the time of day presumably). If there was an attendant present the process is:

1. Get the attendant's attention behind the information kiosk, informing him/her that you were going to be taking your bicycle onto the subway platform.
2. Leaving your bicycle aside, swipe your MTA card, and precede to turn the turnstile gate without actually walking through the gate. This takes care of the issue of you paying for your subway ride.
3. You are then to return back to your bicycle and wait for the attendant to unlock the service door.
4. Once unlocked, you swing open the heavy black door as it attempts to close on it's own. A loud siren generally goes off every time this door

gets open, which can cause alarm to people whom are not familiar with the sound.

5. Once through the door, you may need to carry your bicycle down more sets of stairs depending on the station, in order to reach the subway platform.

If there is no MTA attendant present, the process is similar, but requires a few *different* steps because there is no attendant there to unlock the service door for you.

1. Leave your bicycle aside, swipe MTA card and walk through turnstile gates as normal.
2. Once through the gates, locate the service door and push open from the inside, keeping in mind that the loud siren will go off.
3. While keeping the door open, grab your bicycle and walk both you and your bicycle through the heavy service door.
4. Once through the door, you may need to carry your bicycle down more sets of stairs depending on the station, in order to reach the subway platform.

Based on the survey question I asked about “comfort level” most survey participants felt fairly comfortable (6.2 out of 10) when bringing their bicycle onto public transit (not just limited to the subway). This answer surprised me, considering how much of a pain I found it to be getting my bicycle onto the subway.

Personally, I would have answered this question somewhere around a 3 or lower, because besides the ferry, I can't say that I felt truly comfortable on any New York City public transportation systems with my bicycle. As illustrated previously, I believe that MTA makes it difficult for bicyclists of all ages/fitness levels to get their respective bicycles onto the subway platform and then into the subway cars. Looking at other modes of public transit, zero New York City buses have bicycle racks, and commuter rail lines have unclear, and hard to find rules.

Because participants of my survey answered this question with an average answer (give or take), I can interpret that to mean that there are some people extremely comfortable riding public transit with their bicycles, while others find it extremely uncomfortable. Four participants answered 10 out of 10, and five participants answered at 2 out of 10 or lower. In analyzing this data further, I can come up with a few reasons why people answered the way they did.

The first reason I thought of for people who answered 10 out of 10, is that these select people know what connections exist between bicycling and public transit systems, and either properly know how to use these connections to their advantage without letting it impede their "comfort", or choose to not use them at all. Alternatively, participants could also be rare, if ever use public transit riders with their bicycle, and when they do choose to make the connections, they use a mode such as the ferry that they find to be very easy to use, stress free and comfortable.

On the other end of the spectrum, I would guess anticipate that people who answered 2 out of 10 or lower, have had a few bad experiences riding public transit systems with their bicycle (at least enough so to understand that these connections aren't

always there). Additionally, I would speculate that these people may not be properly educated and knowledgeable about the different rules of using public transit systems with bicycles as outlined by popular public transit systems such as ferries, commuter rails and subways. For example, these participants most likely would not have known the proper way to get through the subway turnstiles (as outlined above) or if they do, they deem it too difficult and "uncomfortable" for them to do. Almost all other participants who didn't answer either 10 of out 10 or 2 out of 10, answered somewhere around the middle of the spectrum, suggesting that they are mixed, and have had some good experiences and some poor experiences.

Personally, one of the biggest problems I encountered, concerning my own level of comfort specific to the MTA Subway, was that often the service doors were not properly marked in the stations. This made the process even harder than it already was, as there was now added uncertainty and thus discomfort about where to go with my bicycle. Also, in my experiences there was rarely a time when the MTA official at the information kiosk was not busy with other customers, so just to find out the cumbersome process could require additional waiting time. Below are two pictures of service doors, illustrating the current state of confusion around the purpose of the doors

Photographs #6 & #7: Poorly Marked Service Entry Doors in Subway Stations

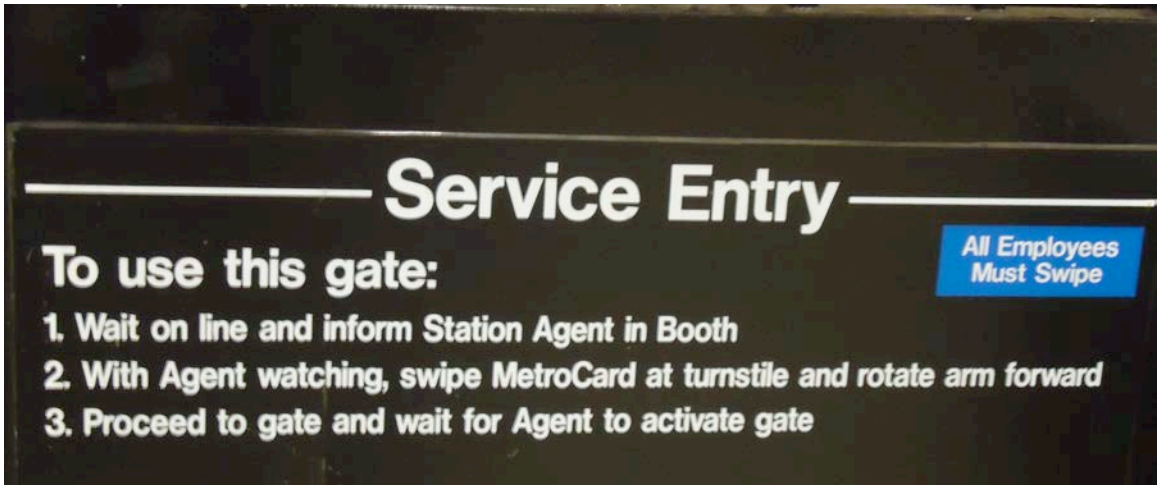
Signage

In-line with the poor infrastructure systems that the MTA subway stations offer to accommodate bicyclists; the quality of signage and availability of necessary information is also very poor and lacking towards bicyclists riding the subway. On the MTA's website, they have a detailed list of rules and regulations about bringing a bicycle onto the subway (See Appendix A-6). However, once inside the subway station, these rules are nowhere to be found. In the six stations that I studied, not one had any sign of rules or regulations that bicyclists should use to follow. The information I gathered on how to go about getting through the turnstiles and onto the subway platform was solely from talking with MTA officials. Although this is still an option, MTA customers with their bicycles may be deterred (as I was sometimes) from using the subway if they have to

depend entirely on talking to an MTA official. Talking to an MTA official can be a time consuming process that most people don't want to wait for. Additionally, waiting on line with a bicycle at the often centrally located information kiosk, blocks other passengers ability to move safely around the station and can cause verbal backlash from other customers.

Each subway station did have a designated area for signage and maps, but there was nothing in that area directed towards bicycles. Furthermore, as I outlined before, part of the process for getting one's bicycle onto the subway involves going through the service entry door. These doors are often not marked (as the pictures above illustrate) and this can add to the confusion of having a bicycle in a crowded subway station. The sign on the service entry door should read: "To use this gate: 1. Wait on line and inform Station Agent in Booth, 2. With Agent watching, swipe MetroCard at turnstile and rotate arm forward, 3. Proceed to gate and wait for Agent to activate gate."

Figure #7: Properly Marked Service Entry Door



The combined lack of proper infrastructure and poor signage makes riding the subway with a bicycle a tough task.

Survey data showed that 11 people said that the subway was in need of the most improvement to accommodate bicyclists. Survey participants in support of improving the MTA Subway to accommodate bicycles were quoted as saying "Bicycles should compliment the public transit system, and shouldn't be viewed as something extra." At an event at one of the "Weekend Walk" events through *Bike New York*, one woman told me, "How am I supposed to know how to get my bike onto the subway?".

Based on observations and data I collected, I am surprised that there were not more survey participants who found the MTA Subway to be particularly difficult to use. I ran into obstacles surrounding not knowing where to go or what rules to follow with my bicycle in the subway station. It was clear to me that I was different than other MTA customers and could not use the infrastructure the same way as people around me, and there was no signage instructing me towards what I should and should not be doing. Although MTA does have rules, they are essentially irrelevant to any bicyclist who is in the subway station, and has no previous knowledge of these rules. I felt helpless and uncomfortable while I paraded myself around the subway station, desperately trying to find a sign telling me what to do.

Availability of Space

Once down the multiple sets of stairs, and through the often poorly marked service entry door, an MTA customer with a bicycle now finds him or herself faced with

finding a spot on the next subway train car. The difficulty of this is pretty obvious, especially when trying to get onto a crowded subway car. On MTA's website, there are a few recommendations for bicyclists in order to avoid safety hazards and social conflicts. MTA states:

> Strongly recommend that cyclists avoid boarding crowded rush hour trains…Cyclists should choose "express" trains and use "end cars" or the first and last car of the train (because generally less crowded). ~ MTA

While I found these to be helpful recommendations, there is no evidence that these recommendations are published anywhere else but the MTA website (i.e. they are hard to find). Personally, I would have found it very helpful if a sign was located somewhere on the subway platform telling bicyclists about these recommendations. Otherwise, bicyclists are effectively left on their own to get onto often extremely crowded train cars.

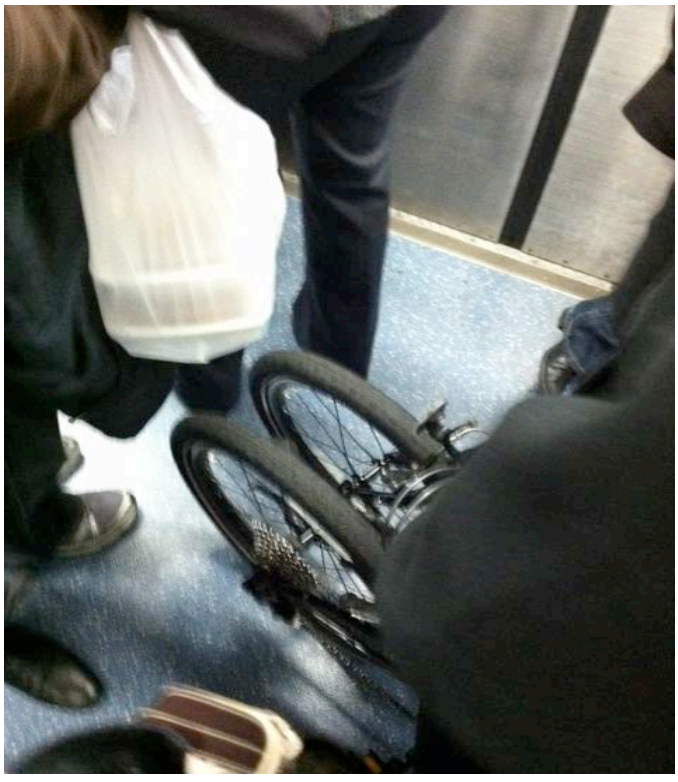
Photograph #8: Crowded Subway Train Car

(Photograph deleted in digital version, available in hard copy in UVM Environmental Program Office).

Another part worth noting about MTA's recommendations is that often times taking an "express" train is not a feasible option for customers only planning on traveling 2 or 3 stops. These trains typically travel to and from only major transfer points and destinations (MTA, 2012).

Also, even if bicyclists follow MTA's recommendations, there is still no guarantee that they will find a spot on the next subway train, and may find themselves waiting longer than other customers in order for there to be enough space on a train car for a bicycle. I had that happen to me once, as I had to pass getting on a crowded train car because there was simply no room on the train car for my bicycle and me. I noticed that bicyclists who ride folding bikes have a much easier time getting onto crowded train cars. Below is a picture I took of a man with a folding bicycle on a crowded subway train car.

Photograph #9: Folding Bike on Subway



The New York Waterway Ferry

Infrastructure

The newly constructed Hudson River Greenway is a 32-mile long foreshoreway[4] that runs parallel to the West Side Highway. According to the New York City Parks Department, the Hudson River Greenway is currently the most heavily used bikeway in the United States (NYC-DOT, 2012). From my experiences, the greenway offers a fantastic, safe place for bicyclists, joggers, skateboarders, and roller-bladers' alike to travel all year round. I would bicycle the greenway 3-4 times per week during my time as an intern at *Bike New York.* Immediately upon exiting the ferry terminal on the Manhattan side, I found myself within 30 feet of the Hudson River Greenway. Each morning, I would ride about 5 miles north on the greenway to get to the *Bike New York* Office located at 475 Riverside Drive (BNY, 2012). Frequently, I saw bicyclists of all different ages, sizes, styles, gender, etc riding the greenway, as it was a very safe place to ride.

Photograph #10: Hudson River Greenway

[4] A **foreshoreway** is a type of greenway that provides a public right of way along the edge of a water body. (Wikipedia, 2012).

I found there to be a hugely positive connection between the location of the Hudson River Greenway and the New York Waterway Ferry terminal, as it seemed that riders of both infrastructure systems were constantly interchanging with each other. From my observation, bicyclists had a very easy time getting to and from the ferry terminal with the Hudson River Greenway right outside. Additionally, the New York Waterway's website (Figures #3, #4 & #5) has recently taken appropriate steps to further push the encouragement of bringing bicycles onto the ferry.

The way bicyclists "read" the infrastructure around the ferry terminal was very smooth and intuitive. Bicyclists had very few, if any hesitations locating the greenway, and realizing that it was a safe place for them to ride. From other bicyclists horror stories around New York City to my own experiences, bicyclists elsewhere rejoiced at how nice it was to safely ride their bicycle on the greenway. There was noticeably less hesitation and nervousness for bicyclists riding on the greenway in comparison to riding with traffic.

As I began to pick up on the way bicyclists "read" infrastructure more, I also noticed that the location of the ferry terminals (on the water) versus the locations of the subway stations (in the heart of the city grid), allowed for the ferry terminal to be closer to and more open to new bicycle infrastructure. In addition to the Hudson River Greenway on the western side of Manhattan, there also exists a similar greenway on the eastern side of Manhattan, called the East River Greenway. Similar to the impact the Hudson River Greenway has on the Hudson River ferries, the East River Greenway links bicyclists with ferries that run across the East River to/from Brooklyn and Queens.

Between observing both of these ferry terminals, I noticed many more bicyclists congregating at ferry terminals than I did bicyclists at any MTA Subway station I studied. I believe that the high-levels of bicyclists riding these greenways, combined with the close proximity these safe bike-routes have to ferry terminals, allows for these ferry terminals to attract many more bicyclists.

Figure #8: Location of the Port Imperial Ferry Terminal

(Figure deleted in digital version, available in hard copy in UVM Environmental Program Office).

As I continued to study the location of the Port Imperial/West 39th St. Ferry terminal along the Hudson River, I noticed that even with the terminal's prime location, there were also significantly important infrastructure features within the terminal that served to encourage bicyclists. Just before entering the terminal, it is quite easy to notice that the ferry terminal has entrances above ground, thus not requiring a descent to enter the station (in comparison most subway stations). The doors entering the ferry terminal are very wide, and swing open easily, which make rolling a bicycle through the doors very easy. Additionally, there are no stairs throughout the entire station, just ramps, which makes rolling a bicycle through the ferry terminal effortless.

Photograph #11: Entrance Doors to Ferry Terminal

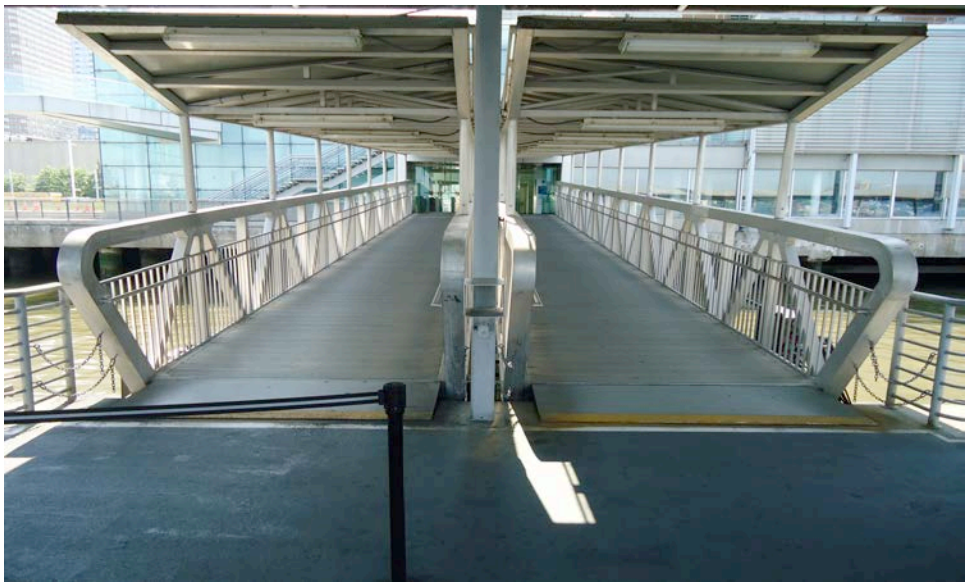
Although there are turnstiles located within the ferry terminal, these turnstiles are never locked and don't prohibit people from getting through them and onto the dock. The purpose of these turnstiles is simply to count how many people go through the terminal each day. The importance of these turnstiles not being locked is that bicyclists can now avoid going through the turnstiles only unless their fee has been paid.

Perhaps the biggest infrastructure encouragement for bicyclists in the ferry terminal is the large gate next to the turnstiles that is *always* unlocked and swung open. I found that bicyclists "read" this open gate quite easily, and walk through it without hesitation.

Photograph #12: Turnstiles and Gate in Ferry Terminal

Once through the gate, there are two long ramps connecting the ferry terminal to the dock where the ferry picks up customers. These ramps are covered, and are sloped gently downwards as every customer (handicap, elderly, etc.) must walk down them with ease in order to reach the ferry. The ramps are wide and thus great for walking a bicycle to the dock with ease.

Photograph #13: Covered Ramps Connecting Ferry Terminal and Dock



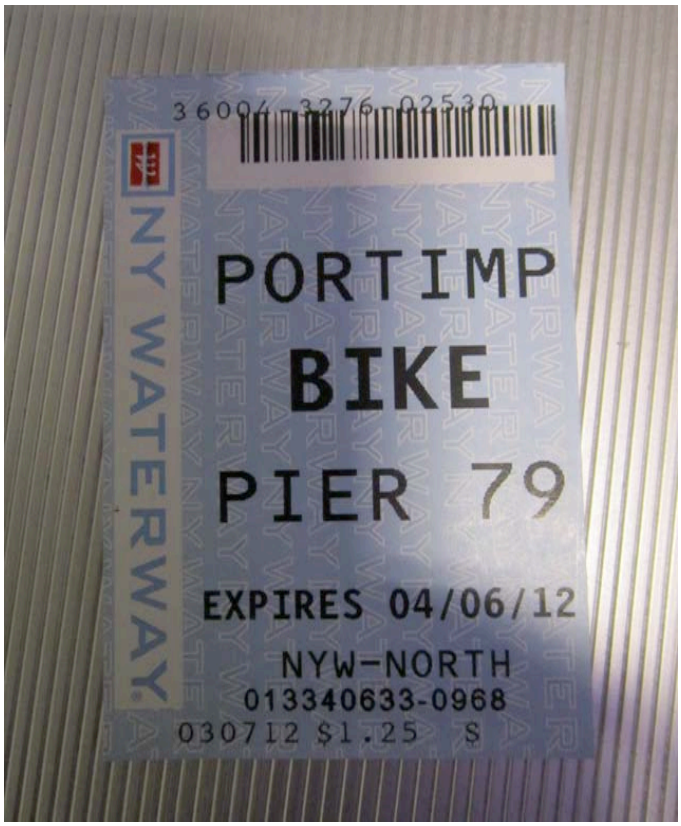
The final step of getting onto the ferry with a bicycle is also made extremely easy by the way the infrastructure is set-up. A large, mechanical ramp comes down from the dock and touches down on the top of the main ferry deck when the ferry arrives. This creates yet another ramp, pitched down ever so slightly, that bridges the gap between the dock and the ferry.

Photographs #14 & #15: Getting onto the Ferry

Signage / Paying Extra for Bicycle Infrastructure

Within the ferry terminal, there are no overtly visible signs aimed at bicyclists. However, while waiting on line to buy a ticket for the ferry, there is a purchase option called “Bike Surcharge”, which is the additional fee ferry customers must pay to bring their non-folding bicycle onto the ferry. As of January 2012, the additional fee for riding the ferry with a non-folding bicycle is $1.25 (New York Waterway, 2012). Although there is no specific signage explaining the process of bringing a bicycle onto the ferry, I found that the combination of the infrastructure and the clear, available option to purchase a ticket for transportation of a bicycle, was enough for most people, including myself, to understand that bicycles are allowed and encouraged on the ferry.

Photograph #16: Bike Surcharge Ferry Ticket



Through my own observations and experiences, I stand by supporting the additional fee that the New York Waterway charges, for what in my opinion is *extremely* bicycle-friendly infrastructure. I asked participants in the survey if they agreed with me, and would likely pay an additional fee for *extremely* bicycle-friendly infrastructure in and around public-transit systems (such as the "Bike Surcharge" example with the Ferry). Of the 27 participants, 12 answered "yes" and 11 answered "no", with the other four answering either "unsure" or "not relevant". Common comments for the participants who answered "no" were: "prices were already too high", "public transit companies *should already* be taking into consideration bicyclists as viable customers", and that "rules and regulations are too strict for bicyclists, so that it would not be worth it to pay more."

One of the biggest reasons I stand by paying more for *extremely* bicycle-friendly infrastructure is that this way I can avoid the misery and confusion of using a public-transit station that has not properly thought about bicyclists as additional paying customers. Although it is unfortunate in some cases that bicyclists have not been properly thought about in past planning of certain public transit modes; the reality is that many of these systems were developed before bicyclists were taken seriously, and thus they were not thought about the way they are today. In my opinion, paying a slight fee to jumpstart improvements made to modes of public mass transit that need them, can only help bicycle commuters in the long run.

Availability of Space

Contrary to the subway, I found the New York Waterway ferry to be significantly less crowded, even during peak rush hours times. In general, New York Waterway ferry ridership is far less than MTA subway ridership annually (30 million customers vs. 1.1 billion customers) (New York Economic Development Corporation, 2011). Considerably less annual riders combined with the frequent service (generally every 10 minutes) that New York Waterway offers, allows for there to be substantially more space both in the ferry terminal and on the ferry boat in comparison to in a subway station and on a subway car. This abundance of space allows customers with bicycles, baby-strollers, wheelchairs, suitcases, etc. to take less crowded routes within the station in order to reach the same ultimate destination as other customers. Additionally, there is also more space for infrastructure to be developed that better accommodates these customers (such as ramps).

Through my observations, I noticed that the availability of this space seems to be a hugely important feature that bicyclists using public transit systems are aware of. While riding the ferry with my bicycle well over a dozen times, never once was I unable to board the ferry because it was too crowded. I also found that the New York Waterway Ferry officials, treated bicyclists with respect, courtesy and even priority. On multiple occasions, I was told by different ferry officials where to position my bicycle so that I could be the first one off the boat to “avoid the rush”, as one of the MTA officials said.

Photograph #17: Bicycle on the Ferry

Additional Bicycle Infrastructure Observations throughout New York City

Away from the Hudson River Greenway, I found that different areas/boroughs of New York City were extremely diverse and different regarding their abundance of bicycle infrastructure. I spent the vast majority of my time collecting data in Manhattan, and found that overall, Manhattan had great bicycle-related infrastructure. A recent study shows that as of February 2009, there were over 170 miles of painted bike lanes in the streets of New York City, and that number is continually growing (NYC-DOT, 2012). I came across many miles of these painted bike lanes, separated bike lanes, shared bike lanes, bike route signs, and bike parking facilities throughout New York City. Although I

did not spend nearly as much time in other borough's I found areas of Brooklyn such as Park Slope and Prospect Park to be very bicycle friendly as well.

On the other hand, I also encountered certain areas that had quite the opposite feeling of encouragement that Manhattan had to offer. My experiences biking in the Bronx were very scary and dangerous, and made me appreciate how nice the Hudson River Greenway was. I found myself bicycling with fast moving tractor-trailers, over busy automotive bridges, and up/down huge flights of stairs, among other obstacles. Below I have attached a picture that illustrates the exit ramp on I-278 The Bruckner Expressway that I was forced to cross, due to the poor and dangerous way the infrastructure was designed. Here, cars would frequently exit Interstate 278, driving 40-50 mph around a curve, not expecting to see a pedestrian or a bicyclist crossing the ramp.

Photograph #18: Crossing the Bruckner Expressway

(Figure deleted in digital version, available in hard copy in UVM Environmental Program Office).

The point of me illustrating this poor infrastructure is to enforce the importance of good bicycle-friendly infrastructure, such as the Hudson River Greenway. The safeness and ease of riding on a greenway should not be taken for granted. I learned this very quickly after leaving the Hudson River Greenway for infrastructure like the photograph above, where I felt seriously in danger and threatened by automobiles and trucks.

Conclusion

Bridging the gap between bicyclists and public mass transit systems is not only important to the people who rely on these systems for their daily commutes, but also detrimental to continued facilitation of sustainable growth in our nation's transportation sector. While there are social and political pushes being made around the country to expedite and fund better connections between these two modes; there are also significant gaps and obstacles that these movements face which slow down this push. Although in many cases, changes in infrastructure are seen as the problem solving solution by many bicycle advocacy groups, more often than not these changes are extremely difficult to accommodate because of the mass financial costs and political support needed.

Throughout the United State's transportation history, different time periods have been dominated by different modes of transportation. Currently, the automobile dominates the majority of the country's infrastructure, funding, manufacturing, and political support in the United States; 77% of American's rely on their automobile to drive to work each day (U.S. Census, 2007). Recent efforts to reduce American's dependence on their automobiles has encouraged the use of public mass transportation as a cheaper, easier, "greener" way to transport American's throughout the country. American's have responded; in 2011 more than 10.4 Billion trips on U.S. public mass transportation systems were made, the second highest ridership numbers since 1957 (APTA, 2011). Along with this new influx in public transit ridership in the United States, a "cycling revolution" has also sparked huge spikes in the numbers of bicycle commuters riding all around the country.

New York City is currently leading the country in public transit ridership with 54.3% (~4 million people) of their population relying on public mass transit systems daily (MTA, 2011). Additionally, New York City has reported a 168% increase in the number of bicyclists between 1985 and 2005, and an additional 100% increase between 2007 and 2011 (NYC-DOT, 2012). Separately, these modes are increasing rapidly, but combined they could be increasing even faster. With over 1.6 billion riders each year, the Metropolitan Transit Authority Subway system is the busiest subway system in the United States, and the 7th busiest in the world (MTA, 2012). Connecting bicyclists with proven, dominant modes of rapid public transit systems such as the MTA Subway and New York Waterway Ferry, can be hugely successful to increases in both bicyclists and public transit riders (Replogle & Kodransky, 2010).

My research has shown that the way the infrastructure, signage and availability of space in and around the MTA Subway stations are set up; make it very difficult for most bicyclists to get their bicycle onto the subway without much hassle. There are many stairs, turnstiles, and people that prove to be significant obstacles to bicyclists. Although the MTA has outlined a set of recommendations that bicyclists should follow in order to get their bicycles onto the subway train cars safely, these suggestions are not well publicized, and thus hard to access when bicyclists need them the most.

While the MTA Subway demonstrated a relatively poor example of connections between bicyclists and public transit systems, I found that the New York Waterway Ferry offered a very encouraging, and positive example. Unlike the MTA Subway, the infrastructure at the Port Imperial Ferry terminal was very easy and intuitive to use, which allowed for bicyclists to enter, maneuver through, and board their respective ferry

while facing little to no setbacks. Additionally, The Port Imperial Ferry terminal had no stairs, required no getting around turnstiles, and made it very clear the bicyclists were welcome by offering a ticket option for “Bicycle Surcharge”.

Addressing the gaps that I found between bicyclists and the MTA Subway, bring into consideration all of the social, political, economic, and environmental stakeholders that are involved. The roles of bicycle advocacy groups such as *Transportation Alternatives* and *Bike New York* can assist in bridging thsee gaps between these different stakeholders. Often, these bicycle advocacy groups are more determined and driven than other stakeholders to make sure that social and political gaps towards bicyclists, get bridged. Groups like *Transportation Alternatives* and *Bike New York* have mission statements that are focused almost solely around getting more bicyclists on the streets of New York City. Thus, these groups offer the best opportunity for collaboration solutions addressing gaps between social and political stakeholders that may be holding up or slowing down positive change.

Drawing from a study done about four different bicycle commuters in Portland, Oregon; the goal of bicycle advocacy groups around the country is to figure out how to bridge the different gaps so that “Interested but Concerned” potential bicycle commuters (which make of 60% of the study) can feel like “Enthused and Confident” and even “Strong and Fearless” bicycle commuters (Portland BOT, 2012).

Figure #9: Four Types of Transportation Cyclists in Portland, OR

(Figure deleted in digital version, available in hard copy in UVM Environmental Program Office).

The studying of the bicycle culture in New York City is very important to me. As my father continues to ride his bicycle everyday as a part of his multi-modal commute into Manhattan, I periodically hear about his experiences and what he notices is happening with bicycling in New York City. Through his experiences and my own passionate interest in bicycling, I am seriously interested in seeing bicycle commuting in New York City continue to grow. I believe that in order to do this, strong, positive connections between public mass transit systems and bicyclists are the next step and can be hugely helpful for people, like my father, who use their bicycle as a part of their multi-modal commutes. New York City offers an amazing opportunity for these connections to flourish and for bicycling in New York City to become solidified as a dominant mode of transportation.

Other cities around the country such as Portland, Oregon; Long Beach, California; Boulder, Colorado; Seattle, Washington; and San Francisco, California have already taken these next steps and have enacted infrastructure and policy changes that give bicyclists privileges and thus confidence to ride public mass transit systems with ease; New York City should learn from these cities. Together, bicycle advocacy groups, bicyclists, policy makers and environmentalists should be looking at bicycling in New

York City as an incredible opportunity to reduce traffic congestion, poor air quality, and heavy foreign petroleum dependence. Accordingly, these stakeholders must bridge the appropriate gaps that are currently holding back bicycles from becoming a dominant form of transportation in New York City.

Recommendations & Suggestions

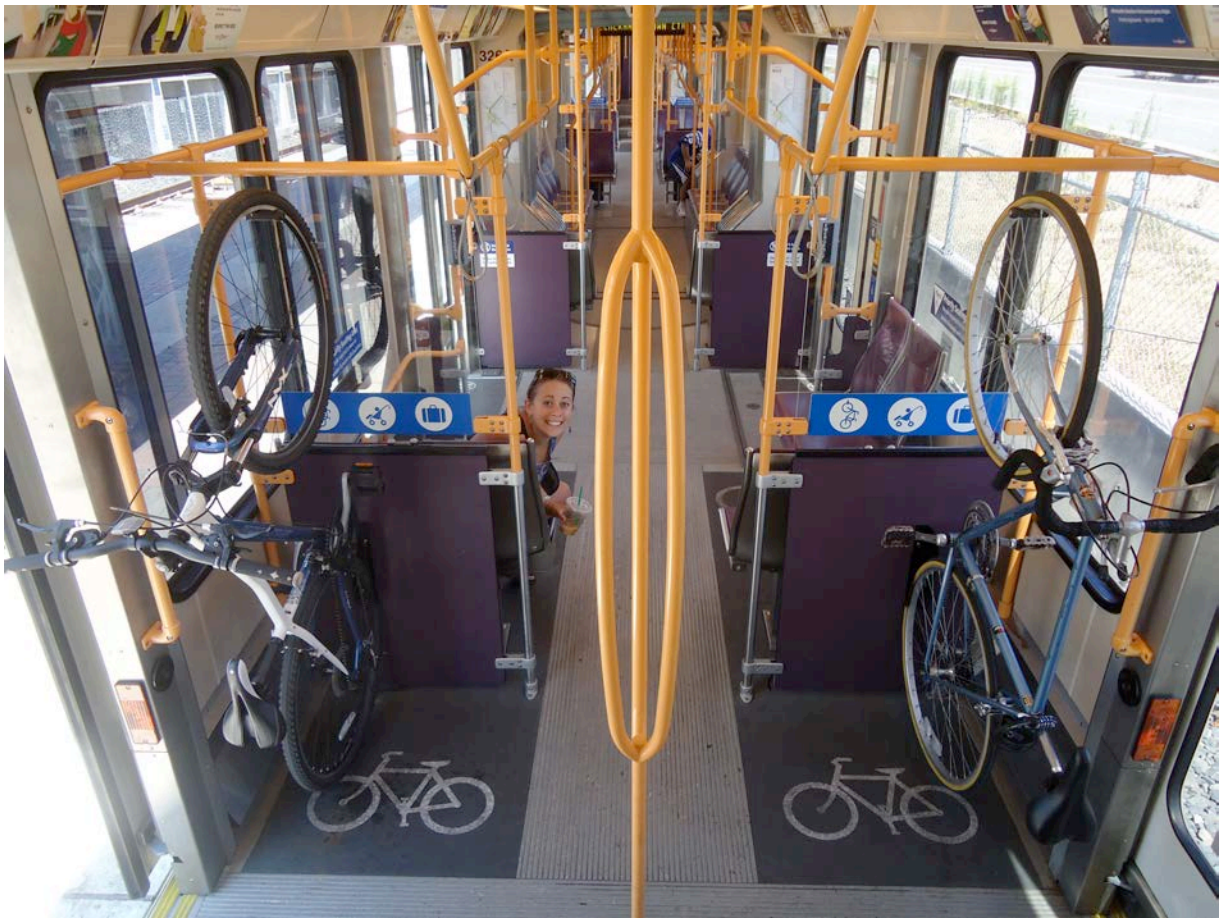
Based on the data I have collected, I have drawn conclusions related to the fact that the MTA Subway system is not up to par in accommodating bicyclists. In order to fix this, I believe that looking at examples from cities across the country, can help MTA take the appropriate next steps to get caught up with their bicycle-friendly infrastructure. I draw these recommendations from cities I personally have visited. These cities include: Boulder, Colorado; Boston, Massachusetts; Montreal, Quebec (Canada); Portland, Oregon; San Francisco, California; and Seattle, Washington. While in these cities, I closely observed each city's' public transit systems, looking at how each dealt with connecting bicyclists, and realized that each of these cities had something to offer that New York City did not.

The differences in the public transit systems in these cities are grouped into two categories: infrastructure and signage. Viewing examples of cities with better infrastructure and signage than systems in New York City such as the MTA Subway and MTA Bus systems, allowed me to gain a better idea as far as what existed outside of New York City that could help MTA make needed improvements to these public transit systems.

Good Infrastructure

In Portland, Oregon I rode the TriMet metro system with my bicycle. Upon arriving at the station via bicycle, I found a series of ramps leading up the to train platform, which made it very easy for me to get my bicycle to the train. Once I entered the train car, I found that there were two bicycle racks inside of the train car. These racks suspended bicycles vertically, keeping them safely away from passengers walking by. Having bicycle racks in a train-car allow bicyclists to know immediately that they are welcome on board. Additionally, I was not required to pay any extra fee to bring my bicycle onto the train-car, I just paid the cost a normal passenger would pay.

Photograph #19: Bicycle Racks on TriMet in Portland, Oregon



Beyond just subway and train infrastructure, other infrastructure improvements should be made to other modes of public transit systems in New York City, such as bicycle racks on the city busses. It is still shocking to me that New York City has zero bicycle racks on their city busses, while cities such as Chicago, IL; Las Vegas, NV; Kansas City, MO; Seattle, WA; Philadelphia, PA; and San Francisco, CA can all say that 100% of their city busses are equipped with bicycle racks (Eckerson, 2011). Of the 50 most populous cities in the United States in 2010, New York City is the only city that has 0% of their city busses equipped with bicycle racks (Eckerson, 2011). While in San Francisco, CA and Seattle, WA; I rode the city busses in both cities with my bicycle. Both times, I found the process of getting a bicycle onto the front of a bus to be very easy to use and convenient. Like the train-car in Portland, OR, I was not required to pay an additional fee in either of these cities.

Photographs #20 & #21: Bicycle Racks on San Francisco, CA City Bus and Seattle, WA City Bus

(Photographs deleted in digital version, available in hard copy in UVM Environmental Program Office).

Good Signage

Proper signage to either encourage bicyclists to enter a public transit station, or to instruct bicyclists how to get their bicycle into a safe place on the mode of transit they are trying to use is extremely helpful. While in Boston, MA, I noticed that right at the entrance to an MBTA ("T") station, there was a sign with a bicycle on it, telling bicyclists the rules that bicycles must follow when riding the MBTA. Because this sign was positioned at the entrance to the station, bicyclists could read the sign and decide right away if they were allowed to ride the MBTA mode they were planning on.

Photograph #22: Bikes on the "T" Sign

Similar to the sign in Boston, MA, I also encountered a very similar sign while in Montreal, QC upon entering a METRO station there. Although the sign was in French, it stated “Welcome Bicyclists”. It is clear that bicyclists were welcome in the METRO with a sign like this. The sign was positioned on the door leading into the METRO station at street level, and was one of the first things people entering the station saw. The sign detailed certain hours listed that bicyclists were and were not allowed to ride the METRO as well as other general rules and guidelines that bicyclists were to follow in order to safely bring their bicycles onto the subway cars.

Photograph #23: “Bienvenue Aux Velos” Sign in Montreal, Quebec

Summary of Recommendations

By making a few simple, fairly non-expensive changes, MTA can improve it's linkage with bicyclists immensely. The extensive network of the MTA Subway is already hugely appealing to bicyclists, as the system can get people to/from places virtually everywhere in New York City. Drawing from other cities I observed, I have come up with a few recommendations that I believe will improve connections between public transit systems and bicyclists in New York City. They are as follows:

- **Add** proper signage near entrances to subway stations from the street or in areas where riders refer to maps and general rules about the subway.
- **Invest** in bicycle racks on busses.
- **Construct** ramps in the place of some stairs leading to/from subway stations to make entering and exiting a station easily possible.
- **Redesign** entry onto subway platform through service entry door, making it easier and more intuitive for bicyclists to figure out where they should go in a crowded subway station.
- **Look into** long-term investment into either subway cars that are solely meant for storing bicycles, or bicycle racks on subway cars.

Infusing any sort of change takes time to properly implement, especially into a system as complex as New York City's public transit system. However, I believe that New York City is falling further and further behind other cities in its attempt to keep up

with the “cycling revolution’s” affect on public transit systems. The longer companies like MTA wait to improve their systems to accommodate bicyclists, the harder it will be to implement changes when that time does come. Even small steps in their systems can make huge differences, and I encourage them to seriously look into making some of these changes.

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Appendices

(Appendices A-1 & A-3 through A-6 deleted in digital version, available in hard copy in UVM Environmental Program Office).

Note: Appendix A-6 can be found at:
http://www.mta.info/nyct/safety/bike/

Appendix A-2:

Bike Commuter Survey

Age: 24 Gender: Male Where do you live(If in NYC, what borough? Rego Park About how many miles is your commute one way?_____

1. On a scale of 1-10 (10=great and 1=poor), how comfortable do you feel using NYC public mass transit (busses, ferries, subways, commuter rail, etc) w/your bike?

1 2 (3) 4 5 6 7 8 9 10

2. Which modes of public transit do you think needs the most improvement?

Ferry (Subway) Busses Commuter Rail Other_____

3. What changes would you like to see? More gates that are bigger enough for a bikes are needed.

4. Would you likely pay more to ride public transit if it were *EXTREMELY* bicycle friendly? (I.E. trains cars for bikes, bike lanes to/from stations, safe bicycle storage @ stations, etc.)

Yes (No) Not Relevant...If so, why?_____

5. Which modes of transportation need the least amount of improvement?

(Ferry) Subway Busses Commuter Rail Other_____

6. How often do you use public transportation when you have your bike?

_____/week 5 /month _____/year Never Other_____

7. What causes you to choose to use public transportation with your bike?

Proximity to public transit Weather (Reducing Travel Time) Emergency

Other (please specify)_____

Thank you for completing this survey! This information will be a huge help to me as I continue working on my senior thesis. I really appreciate your input. Thanks again! Feel free to contact me (Daniel Clark) if you feel as though I missed anything or would just like to talk about the issue. As real bike commuters in NYC you know more about the issue than me, so I would love to hear what you have to say. My email is drclark18@gmail.com and my cell # is (551) 206 3502.