Interrogating the Metropolis

Exploring the Efficiency of Rail Transit into the New York Metro Core

A Research Report prepared for

Dr. Jen Nelles

Presented on

December 23, 2013

Hunter College
Department of Urban Affairs and Planning

Urban Development Workshop
Fall 2013

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1 Executive Summary

The Graduate Consultants, a group of five graduate students, from Hunter College's Urban Affair's program, collected and analyzed data concerning regional rail transit into the New York Metropolitan Core. This report was commissioned by the International Metropolitan Research Consortium (iMRC) and contains the Consultants' research findings, which include a history of the five major rail systems into the metro core and the three hubs in which they terminate, a review of relevant literature, a discussion of findings from a survey of 177 rail passengers, interviews with stakeholders from the MTA and New Jersey Transit, and an analytical review of data provided by the rail systems to the National Transit Database (NTD) and the New York Metropolitan Transit Council (NYMTC).

The five major rail lines—and their corresponding terminus—studied in this report are:

1. Amtrak, Penn Station
2. Long Island Rail Road, Penn Station
3. Metro-North Railroad, Grand Central Terminal
4. New Jersey Transit, Penn Station
5. Port Authority Trans-Hudson (PATH), World Trade Center

This research, conducted by the Graduate Consultants, seeks to answer the following questions:

1. How efficient are the commuter rail systems originating and terminating in the metro core?
2. Where are riders coming from? Why are they coming?
3. How do riders define the New York Metro Region?

In an attempt to answer these questions, the Graduate Consultants created a survey with questions regarding respondents' length of trip, origin and destination, over-all satisfaction with the system, and their definition of the New York Metro Region. This survey was administered by the Consultants in-person at the major rail hubs, as well as online. Additionally, extensive data mining from the corresponding rail systems and rail research organizations was used to determine measures of efficiency, ridership, fares, and customer satisfaction on each of the systems.

Findings:

Our findings are a combination of the in-person and online survey results and hard data from existing transportation resources. The surveys gauge the participant's commuting experience while the hard data analyzes efficiency measures relating to rail line ridership and flows, fare revenues and operating expenses, efficiency measures, and infrastructure. Subsections include an analysis of how the metro region is perceived and the uniqueness of the PATH train in relation to the rest of system.

Recommendations:

Three recommendations were made after research findings were assessed and analyzed.

The first recommendation is to incorporate more commuter rail users whose trips terminate at the "minor" nodes located outside of the Metro Core. This recommendation to expand the nodes will also include different forms of transportation (bus and ferry

systems) as multi-modal commuters are a significant presence to the Metro Core.

The second recommendation is to revise the survey instrument to cater to individual rail lines, as oppose to all five. An additional survey revision would focus less on deficiencies of the rail system and more on expanding the strengths.

The third recommendation is to make early contact with both organizational representatives and station management to facilitate access to both key informants and transit users. This would mitigate time spent on FOIL correspondence and enable surveys to be administered at transit stations without running into issues of security.

2 Introduction

2.1 Client description

This report by the Hunter College Graduate Consultants was commissioned by the International Metropolitan Research Consortium (iMRC), a group of stakeholders from 10 counties Brazil, Italy, the UK, France, Turkey, Argentina, China, Germany, India, the United States. The mission of the iMRC is to conduct high level research and analysis about global metropolitan regions in order to support governments' regional economic development efforts. This project was conducted on behalf of the iMRC and Dr. Jennifer Nelles, whose work with the iMRC focuses on the governance of public transportation and commuter transit infrastructure, in the New York metro region.

2.2 Focus of research

The Graduate Consultants were assigned the task of collecting and analyzing data regarding the efficiency of commuter rail and bus systems into the NY metro hubs of Grand Central, Penn Station, Port Authority, and Fulton Street. Efficiency refers to both efficiency in the movement of riders and the overall economic and systematic efficiency of those systems terminating in the New York core hubs. The Graduate Consultants were tasked with answering the following questions:

1. How efficient are the commuter rail and bus systems originating and terminating in the metro core?
2. Where are riders coming from? Why are they coming?
3. How do riders define the New York Metro Region?

2.3 Evolution of project

Due to the limited time allotted to complete this assignment, the Graduate Consultants chose, with approval from Dr. Nelles, to eliminate bus systems and focus on the following rail systems and their respective terminuses.

1. Amtrak, terminating at Penn Station
2. Long Island Rail Road, terminating at Penn Station
3. Metro-North Railroad, terminating at Grand Central Terminal
4. Port-Authority Trans-Hudson (PATH), terminating at the World Trade Center and Herald Square

3 Literature Review

Public transit in New York City dates back to the late 1820s and was initially operated by using horse-powered omnibuses (oversized stagecoaches) and horse cars.[1] Streetcars that rode along embedded iron or steel tracks were eventually phased into the system as they carried more people and offered a smoother ride than the omnibuses. Horse power was later replaced by cable cars, trolleys, motor buses, and elevated and underground rail service—both of which are still in operation today.[2] However, these systems were localized and operated within the micropolitan area (five boroughs) and "as New York's metropolitan area expanded, the need for public transportation to shuttle commuters to and from the city's business centers increased."[3] To fill the void, private railroad and bus companies provided service to and from New York's northern suburbs, Long Island, and New Jersey. Private operators were "consolidated into two commuter train lines and two commuter bus lines – now all part of the MTA network – in order to provide improved service to hundreds of thousands of passengers daily."[4] Today, five major commuter railroads transport passengers to and from New York City. These railroads are Amtrak, Long Island Railroad (LIRR), Metro-North Railroad, New Jersey Transit, and Port Authority Trans-Hudson (PATH).

In spite of federal policy encouraging auto-dependence in metro regions throughout the United States, public transit use in metropolitan New York experienced a significant boom (31%) from 1995-2000 and accounted for half of the nation's overall growth in public transit ridership.[5] A growing economy with job

growth and low unemployment was helpful, but even more instrumental were transit fares.[6] From 1995-1999 transit fares in the New York Metro Region, "facilitated by a substantial increase in government assistance," rose a mere 2 percent.[7] Additionally, high gas prices and road congestion made rail transit attractive. Fare policy in New Jersey also allowed for increased ridership. In fact, during the '90s fares held constant, which actually accounted for the real price falling "25% in constant, inflation-adjusted dollars."[8] "At the same time, roadway tolls for routes between New York and New Jersey rose, parking fees in Manhattan skyrocketed, and gasoline prices increased."[9] Faster travel with new connections and less transfers on New Jersey Transit also made rail travel more desirable. During this time period, "approximately one-third of public transport's new passenger miles were commuter rail."[10]

As mentioned earlier, New York City's five boroughs are referred to as the micropolitan region of New York. It is relatively easy to define because it has district municipal borders. What is difficult to define is the entire New York Metro Region or "Megaregion." Yoav Hagler's 2009 piece, "Defining U.S. Megaregions," "explores recent and historical scholarly research on the identification of the U.S. megaregions and the different methodology used to define them."[11] Often a megaregion can be identified by systems that the different municipalities—and even states in the case of the NY metro region—share. Hagler specifically identifies "common transportation systems" as a common system that links the different population in a region together.[12] According to his

article, there are 11 megaregions defined by the Regional Plan Association (RPA) and the RPA first identified the Northeast Megaregion in the 1960s.[13] This region is also referred to at the Atlantic Urban Region or Gottman's Megalopolis and it "extends for 460 miles from Maine to Virginia."[14] Renewed interest in this topic, in the mid-2000s, led the Metropolitan Institute began attempting to define these regions by spatial connections or "place and flow" much like the Census Bureau uses "population and commuting patterns."[15] As boundaries continue to expand and blur new definitions for these ever consolidating regions will be needed.[16] Looking forward, criteria such as population growth, population density change, and employment growth can be used to define these large, interdependent regions.[17]

Though the New York Metro Region has remained dependent on public transit, regardless of the push toward automobile dependence throughout the country, much of New York's suburbs are highly car dependent. There is a movement to increase the amount of development that is built around public transit. This movement is called Transit Oriented Development of TOD and it is not simply housing that is close to transit. It is development that increases efficiency by allowing people to walk or bike or use public transit; it boosts public transit ridership and reduces traffic congestion; it calls for mixed-use of land and it is a value-add for the public and private sectors.[18] The New York Metro Region as a whole does not look like this yet, but it is an up-and-coming movement in the planning field.[19]

Public transit in New York City dates back to the late 1820s and was initially operated by using horse-powered omnibuses

(oversized stagecoaches) and horse cars[20]. The streetcars that rode along embedded iron or steel tracks were eventually phased into the system as they carried more people and offered a smoother ride than the omnibuses. Horse power was later replaced by cable cars, trolleys, motor buses, and elevated and underground rail service – both of which are still in operation today[21]. However, these systems were localized and operated within the micropolitan area (five boroughs) and "as New York's metropolitan area expanded, the need for public transportation to shuttle commuters to and from the city's business centers increased."[22] To fill the void, private railroad and bus companies provided service to New York's northern suburbs, Long Island, and New Jersey. Private operators were "consolidated into two commuter train lines and two commuter bus lines – now all part of the MTA network – in order to provide improved service to hundreds of thousands of passengers daily."[23] Today, five major commuter railroads transport passengers to and from New York City. These railroads are Amtrak, Long Island Railroad (LIRR), Metro-North Railroad, New Jersey Transit, and Port Authority Trans-Hudson (PATH).

4 Background and Context

4.1 Grand Central Terminal

First and foremost, Grand Central is a terminal *not* a station, because it is not a station stop along the way, it is a final stop.[24]

Grand Central Terminal (GCT), Manhattan's east-side depot, had its grand opening on February 1, 1913. In attendance were New York Central Railroad officials and thousands of New York residents.[25] The project, a 70-acre compound with "32 miles of track, which fed into 46 tracks and 30 passenger platforms, making it nearly twice the size of the recently-opened (and original) Pennsylvania Station," was the largest project ever constructed in New York at the time. [26] It remains the world's largest terminal and within its first day of operation 150,000 commuters were ferried through it.[27] Today, 100 years later, over 750,000 commuters and site-seers visit the terminal every day, which is four times are many visitors as New York's JFK Airport.[28]

Originally home to the New York Central Railroad, which was "headquartered in New York City…[and] served most of the Northeast, including extensive routes in New York, Pennsylvania, Ohio, Michigan, Indiana, Illinois and Massachusetts, plus additional routes in the Canadian provinces of Ontario and Québec."[29] The operation's flagship line, "Twentieth Century Limited, operated on a crack 16-hour schedule between New York's Grand Central Terminal and Chicago's LaSalle Street Station. It was one of America's premiere passenger services, and the subject of pop culture lore. The service was started in 1902, and came to an end in 1967 as a victim of corporate belt-tightening."[30] This cutback was part of the larger issue plaguing

rail at the time. Reductions in revenue resulting from travel patterns shifting in favor of trucks and federally-funded highway systems, as well as the advent of the commercial, passenger plane. A merger with the Pennsylvania Railroad and the subsequent formation of Penn Central (PC) in 1968 hoped to save the ailing rail systems, but Penn Central was forced to declare bankruptcy only two years later, in 1970. A 1976 Federal Government bailout of PC led to the formation of Conrail, who took over the operation of the majority of the former PC system, along with five other bankrupt northeastern railroads. Today, much of the former New York Central Rail Road is operated by CSX Transportation and Norfolk Southern."[31]

In the early 1980's Conrail divested its interest in the rail lines entering the Terminal and today, the three rail lines that enter this hub daily are owned and operated by Metro-North Railroad. These three lines, which carry passengers from New York City's northern suburbs—including Connecticut-are the Harlem, Hudson, and New Haven.[32]

4.2 Pennsylvania (Penn) Station

In 1910, New York City's Pennsylvania Station opened its doors to the public. Eventually becoming known as Penn Station, it's evolution over the past century has reflected the state of rail transit in this country. Prior to its opening, Pennsylvania Railroad passengers coming from the west had to enter Manhattan by ferry from Jersey City. In order to get passengers directly into one of the country's early metropolitan cores, the railroad undertook two monumental tasks, tunneling under the Hudson River and building an architecturally grand station.[33]

For the next 3 decades ridership into Penn Station grew, eventually peaking during World War II.[34] However, over the next two decades, the dramatic rise of two other forms of transportation, the automobile and passenger airplane travel, contributed to a dramatic decline in ridership on the nation's railroads. Between 1945 and 1964, non-commuter rail passenger travel declined an incredible 84 percent.[35] And between 1939 and 1960, the share of intercity passenger traffic handled by the railroads dropped from 65% to 27%.[36]

By the late 1950s, the Pennsylvania Railroad was struggling financially and it had allowed Penn Station to fall into disrepair. Eventually, the railroad struck a deal with the owners of Madison Square Garden to build an arena and office development above ground on the site, while the station below would continue to function and be remodeled. The resulting maze of corridors and stairways reflected the prevailing view that train travel, and perhaps even New York itself, were in decline.[37] The demolition of the "architectural wonder" that was Penn Station in 1963, after only 53 years, and the general recognition that what replaced it was functionally inadequate and aesthetically disappointing, is often credited with giving birth to a national historic preservation movement.

Today, Penn Station is the busiest transportation facility in the United States and the busiest train station in North America. Serving as New York City's principal intercity rail station and a major commuter rail hub, the station is now owned and operated by Amtrak. It serves as many as 600,000 passengers a day at a rate of up to a thousand every 90 seconds.[38] Penn Station is at the center of the Northeast Corridor, an electrified

passenger rail line run by Amtrak that extends from Boston to Washington, D.C. In addition to Amtrak's intercity service, the Metropolitan Transit Authority's Long Island Rail Road and New Jersey Transit run commuter rail service out of the station, which is also connected to six New York City Subway lines.

4.3 World Trade Center Hub

In 1909, Hudson Terminal, the World Trade Center's predecessor began passenger service from New Jersey's Hudson waterfront areas to Manhattan.[39] The terminal was operated by the Hudson and Manhattan Railroad (H&M), which also built the depot.[40]

In 1962, H&M faced bankruptcy (similar to many other railroads at the time) and was purchased by the Port of New York Authority.[41] While continuing normal service to Hudson Terminal, the Port Authority constructed a new station, the World Trade Center, which opened in the summer of 1971 and renamed the rail system Port Authority Trans-Hudson or PATH for short. Simultaneously, Hudson Terminal was abandoned. [42]

After the 9/11 attacks on the World Trade Center, this hub faced major obstacles. Though it was not damaged, it was closed until 2003 and in 2005, construction of a new station began.[43] Once completed, in 2015, the hub will serve 200,000 riders per day. The hub will connect travelers to "11 different subway lines, the Port Authority Trans-Hudson (PATH) rail system, [and] Battery Park City Ferry Terminal."[44]

4.4 Amtrak

As mentioned previously, the growing reliance on cars and the popularity of air travel in the 1960s led to the bankruptcy of many private rail systems.[45] In an attempt to save intercity rail service, Congress passed the Rail Passenger Service Act of 1970, creating the National Railroad Passenger Corporation—commonly known as Amtrak.[46] Amtrak, which began passenger service in May of 1971, is a for-profit corporation that serves 43 states.[47]

In the summer of 1988, the New York State Department of Transportation (NYSDOT) announced the West Side or Empire Connection, which would consolidate all Amtrak service "in New York City at Pennsylvania (Penn) Station."[48] Prior to the consolidation, "approximately 100 daily Amtrak trains, carrying 5.5 million passengers a year, used Penn Station, while Grand Central accommodated 18 daily trains with 1 million annual riders."[49] Work on this projected was completed in 1991, ending Amtrak service to Grand Central Terminal.[50]

Today, Amtrak's New York bound trains (part of the system's Northeast Corridor or NEC) continue to terminate solely in New York's Penn Station hub. Amtrak's NEC is the busiest railroad in North America, with more than 2,200 trains operating over some portion of the Washington-Boston route each day. Approximately 260 million intercity and commuter rail passengers rely on the NEC each year.[51]

4.5 Long Island Rail Road

Chartered in 1834, and operating under the umbrella of the Metropolitan Transportation Authority, the Long Island Rail Road is the nation's oldest and largest commuter train service operating under its original name, with an annual ridership of nearly 82 million and an operating budget of $1.7 billion as of 2013.[52]

Comprising 11 branches, 124 stations, and 594 track miles, the LIRR services all of Long Island as well as the outer boroughs of Queens and Brooklyn, with all trains terminating at either Jamaica Station, Hunters Point Avenue in Queens, Atlantic Terminal in Brooklyn, or Pennsylvania Station in midtown Manhattan. With the anticipated completion of the East Side Access public-works project in 2019, LIRR service will extend to Grand Central Terminal, dramatically altering the scope of the Rail Road's service.[53] The largest project to affect the LIRR since the construction of the East River Tunnels in 1910, it has the potential to alleviate congestion in Pennsylvania Station while possibly exacerbating it at Grand Central.

4.6 Metro-North

In 1983, the Metro-North Commuter Railroad, later re-named Metro North Railroad, went into operation; it is part of the greater Metropolitan Transit Authority (MTA). Ancestors of the Metro-North Railroad include "the New York Central, New Haven, and Erie Railroads," which later merged to become Conrail. Conrail divested its operations at the end of 1982 paving the way for the Metro-North system used today.[54]

Currently, the Railroad operates “five routes covering 112 miles, servicing 120 stations.” It is the third largest rail system of its kind in North America with average ridership exceeding “240,000 trips on weekdays.” The railroad has three lines that provide service to New York City’s Grand Central Terminal: the Hudson, Harlem, and New Haven lines.

Metro-North is a complex organization as it leases space, right of way, and even some rolling stock and locomotives from entities such as the Connecticut Department of Transportation (ConnDOT) and the Penn Central Corporation. Additionally, Metro-North has its own tenants, including “Amtrak, CSXTransportation, Canadian Pacific, Guildford Rail System, and Providence & Worcester.”

4.7 NJ Transit

On January 1, 1980, the New Jersey Transit Corporation (NJ Transit), became the nation’s first state agency devoted exclusively to public transit. Conrail continued to operate commuter rail service under contract from NJT until January 1, 1983 when New Jersey Transit Rail Operations assumed operation of all commuter rail service in New Jersey.

Since NJ Transit was established, it has become the third-largest transit system in the U.S., growing from 622,800 passenger trips daily in FY1980 to more than 896,000 passenger trips in FY2013. With a 1.9 billion dollar operating budget and more than 62 million passenger trips occurring every year on its intercity commuter rail network, NJ Transit is a key component of rail transit in the New York Metropolitan Region.

Divided into the Hoboken and Newark Divisions, NJ Transit’s

commuter rail network includes 11 lines and 162 stations. Five of those lines terminate in New York's Penn Station. The most important line serving the New York Metropolitan Core makes use of Amtrak's Northeast Corridor (NEC), which is among the nation's most congested passenger rail corridors.

The NEC is one of the highest volume, shared-use rail corridors in the world, with 8 commuter rail authorities making use of it, in addition to Amtrak.[55] Lack of capacity has negatively affected service and on-time performance on the NEC. In the New York Metropolitan Area, the Amtrak tunnels under the Hudson River are operating at 100% capacity, so that even minor operating problems can create major service disruptions.[56]

4.8 Port Authority Trans-Hudson (PATH)

Originally named the Hudson and Manhattan Railroad (H&M), the Port Authority Trans-Hudson (PATH) Rail Line was planned in 1873 and began running trains in 1907. Its first train stations connected Hoboken, New Jersey with West 19th Street, in Lower Manhattan. After several decades of expansion, in both New Jersey and New York, H&M fell into bankruptcy and was taken over by the Port Authority of New York – New Jersey, 1962.[57] With annual ridership in 2012 over 72.5 million[58] and an operating budget of $303 million[59], the PATH train is an integral part of the transportation network that comprises the New York Metropolitan Region.

Containing 5 lines and 12 stations, the PATH connects New Jersey stations in Hoboken, Jersey City, and Newark with 6 stations in Lower Manhattan. The major transportation hubs for New York-bound trains are located at the World Trade Center and 33rd

Street – Herald Square stations. In recent years, PATH has seen a steady increase in ridership levels[60], prompting transit officials at the Port Authority to invest in modernizing the system with 21st Century transportation capabilities. These improvements include signal upgrades, new trains, a $4 billion rehabilitation of the World Trade Center station, and resiliency measures to protect the system against futures storms and saltwater corrosion[61]. Most recently, New Jersey Governor Chris Christie proposed a $1 billion extension of the PATH to Newark International Airport, streamlining the commute for riders that must transfer to the Air Train at New Jersey-Penn Station.[62]

5 Methodology

The National Transit Database:

The NTD is a publicly subsidized database that aggregates and analyzes public transportation information from across the U.S. The goal of the NTD is to provide transparency and understanding of statistics that measure publicly subsidized transportation performance. Under the law, public transportation agencies must submit annual reports to the NTD, which summarize service and safety data.[63]

The New York Metropolitan Transportation Council:

Federal transportation legislation has mandated that all urbanized areas with a population over 50,000 must have a designated Metropolitan Planning Organization (MPO), in order to qualify for Federal transportation funding; for New York, this agency is NYMTC. Their jurisdiction includes all of Long Island and the Lower Hudson Valley. Since its inception in 1982, NYMTC has been able to effectively leverage its power in deciding transportation issues and priorities of the region by working with the private sector, experts in the field, and local communities. The support and collaboration among the aforementioned groups enable NYMTC to make informed decisions in how federal funds are allocated to improve the transportation needs of the region. Among their publications is an annual Hub Bound Travel Report, which examines and analyzes all modes of public transportation that enter and leave the region. This data also takes into account the peak and off-peak travel hours that occur throughout the day.

From these resources, the group then decided to focus on only the most essential points that get at the core of exploring transportation in the New York Metropolitan Region[64].

These points include:

- Ridership Numbers
- Fare Information
- Peak Arrival and Departure Times
- Operating Expenses
- Measuring Efficiency

The information from these topics helped guide the group in understanding ridership flows and efficiency. The analysis of this information supplemented the overarching goals of the project by creating a basis of understanding. This enabled the group to move forward in a direction that would eventually shape our observations, recommendations, and conclusion of the report.

5.1 Data Mining

Data mining information across all rail lines provided a basis for the project's findings and recommendations. The group was able to move forward with the project by using data derived from the National Transportation Database (NTD), New York Metropolitan Transportation Council (NYMTC), and Freedom of Information Letter (FOIL) requests. Before discovering these resources, gathering information across all rail lines was not an easy task. Initial findings were uneven and inconsistent, as each rail line distributes information in different formats and different years – if the information was even distributed at all. Finding data cohesiveness across all rail lines from the NTD and NYMTC was a

major turning point in the progression of our project, as it became the main resource for points we would eventually make. NYMTC helped in understanding transportation infrastructure constraints while NTD reports supplemented sections on ridership efficiency and budgetary information related to fares and revenue. Both reports also contributed to understanding ridership flows into and out of the metro region. Its consistency gave us cross-sectional views of information across all rail lines. The lack of existing data was also countered by emailing several FOIL requests to transit agencies. Information from the FOIL requests helped the group find more specific data regarding rail line ridership and fares.

5.2 Key Informant Interviews

Interview Design

In order to gain qualitative information to supplement the raw data we obtained, and to better understand the context within which the various transit organizations operate, we decided to conduct interviews with a minimum of one organization representative per rail line, as well as station personnel working on the ground at the three major transit nodes. We consulted with our client to determine what questions were most pertinent to her research, and drafted interview templates with questions tailored specifically to both types of rail employee.

Questions for organization representatives tended to focus on systemic issues having to do with ridership, efficiency, and infrastructure challenges, as well as cooperation between different agencies operating within the Metro Region. Questions included, but were not limited to:

- What major challenges are riders facing?

- Where are bottlenecks occurring within the system?
- What maintenance issues does the system face?
- What are you doing to address these issues?
- How closely does your organization work with other organizations?

Interviews with station personnel were intended to dig deeper into the theme of flows and efficiency of movement within Penn Station, Grand Central Terminal, and the World Trade Center Hub by discussing their daily observations and interactions with customers. By speaking with personnel we hoped to gain a greater qualitative understanding of the everyday operations within the nodes, an issue that was not readily apparent in our mined data. These questions included:

- What are some common complaints or issues you hear often from customers?
- Are people moving efficiently within the station?
- What major changes have you seen over time, and how have these changes positively or negatively affected the efficiency of movement through the station?

The interview structure was very open-ended, and although we went into each with certain guiding themes and specific questions, they tended to take the form of relaxed conversations, allowing interviewees to naturally gravitate towards issues they deemed most noteworthy within their organizations and to make points we may not have considered ourselves beforehand.

Interview Administration

Potential interviewees were found by reviewing the websites of the transit organizations for employees involved in public outreach who would be willing to speak to us. In some instances, email correspondence with management-level representatives resulted in being passed along to other employees within the organizations; in other cases, specifically in trying to speak with Metro-North delegates, outstanding circumstances regarding the December 1st derailment in the Bronx caused initial contacts to cease communication with us. Other difficulties, including those that arose when we approached station personnel, will be discussed further in the Issues and Challenges section.

In all, we managed to obtain interviews with Joseph Calderone, Vice President of Market Development and Public Affairs for the LIRR, and John C. Leon, NJ Transit Senior Director, Community & Government Relations; Janice Pepper, Vice President of Marketing for NJ Transit; Jeremy Colangelo-Bryan, Community & Government Relations of New Jersey Transit. The interviews were conducted over the phone and via teleconference; those we were able to transcribe are included in the Appendix, and the major take-away points of both interviews will be discussed in the Findings section.

5.3 Online Discourse Analysis

Rationale and Design

Having spoken with transit representatives and received, so to speak, the party line regarding efficiency of operations within the Metro Region, we decided to implement an online discourse

analysis to better understand public perceptions of these same issues, and to supplement our survey responses with the more candid commentary available via social media.

We cast a large net for our discourse analysis, examining social media sites (specifically, Facebook and Twitter comments going back at least one year), traditional news sources and their comments sections, as well as transit blogs and editorial contributions regarding commuter rail in the region. While culling these sources we looked for comments specifically related to the following six issues:

"The reason the trains are empty from Boston is price. The Acela is $140 but you can find a bus for $20 that only takes about an extra half hour. - Comment by ActualDeadHead http://www.theatlanticcities.com/commute/2013/04/15-ideas-improving-northeast-corridor/5194/"- New York Magazine, April 2013

- Cost/Fares
- Efficiency/Ridership
- Rider Satisfaction
- Safety
- Infrastructure/Facilities
- Public Information/Communications

Our findings were uploaded to an Excel spreadsheet where we could better analyze which issues appeared more frequently across rail lines, and compare rider's and journalist's perceptions to the responses given by our transit organization contacts. Furthermore, our discourse analysis provided a qualitative background to the responses gathered in our surveys -- for instance, the preponderance of "service disruptions" as an issue cited by respondents (about 70%) was placed in context by the various comments and complaints left by riders across all five rail systems.

5.4 Surveys

The survey instrument was an integral part of the project's methodology, as it helped form observations and conclusions from riders currently using the metro region's rail lines. To increase its effectiveness and gain more survey participants, two strategies were used. The first approach was conducting the survey in-person from commuters leaving Grand Central, Penn Station, 33rd Street-Herald Square, and the World Trade Center. Dissemination was also conducted online by posting the survey link on social media websites and distributing small fliers containing a QRC code for participants to scan on their smartphones.

Group Process

It took three weeks to create the final survey instrument. After outlining the first draft of the survey, the group met weekly to edit, eliminate, and add questions to the latest version. This process proved to be one of the most difficult parts of the project, as revisions required group consensus before moving on. Editing the survey to ensure it fit within the margins of a single-page document was also an unforeseen constraint. Furthermore, these revisions had to match both the Qualtrics version of the survey, used online, and a Word document version of the survey, used in-person.

Testing

To better understand the time constraints of surveying commuters entering and leaving their rail stations, the group tested various prototypes on commuters in timing how long it would take to complete each section. This helped in

understanding the survey instruments by eliminating questions that were complicated or too redundant. Timing these surveys helped create a balanced the length of our survey with the participants needs to board their train. The final revisions took place after two in-class assessments were conducted to gain feedback from Professor Jill Gross and our classmates in the Urban Development Workshop.

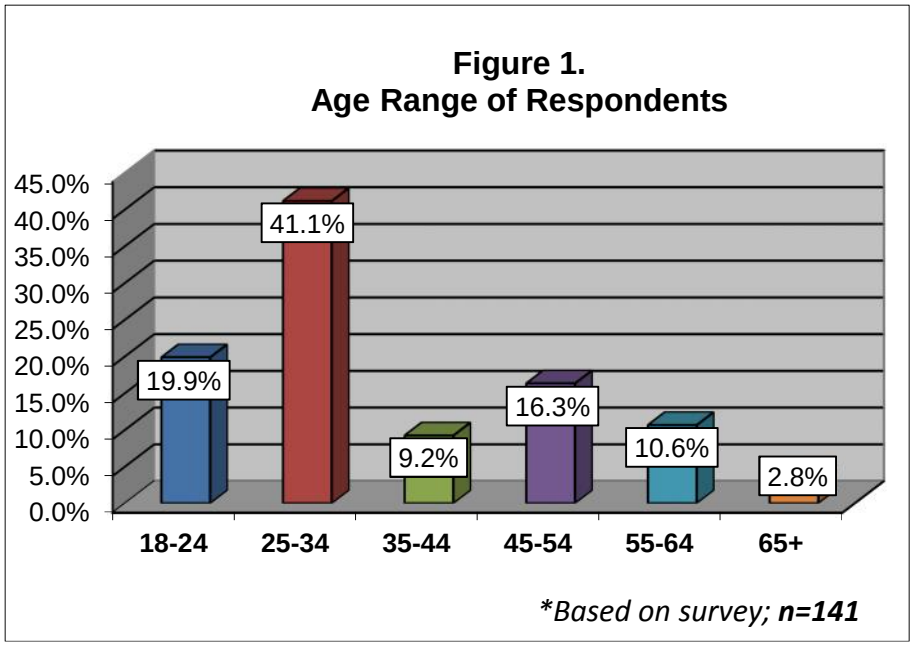
The Survey Instrument

The survey is a mix of open-ended, multiple-choice scale, and yes or no questions. Each section of the survey relates to issues regarding timing, transportation alternatives, and ridership satisfaction. Many questions allow the participants to give their answer with measured responses in the form of a sliding scale ranging from 1 to 5. Some questions are broken down into various subsections that guide responses to different categories. The survey finishes by asking participants what their perception of the metropolitan region is with three maps serving as a visual aid. This question gets at the core of how the metropolitan region is viewed by commuters beyond the Five Boroughs of New York.

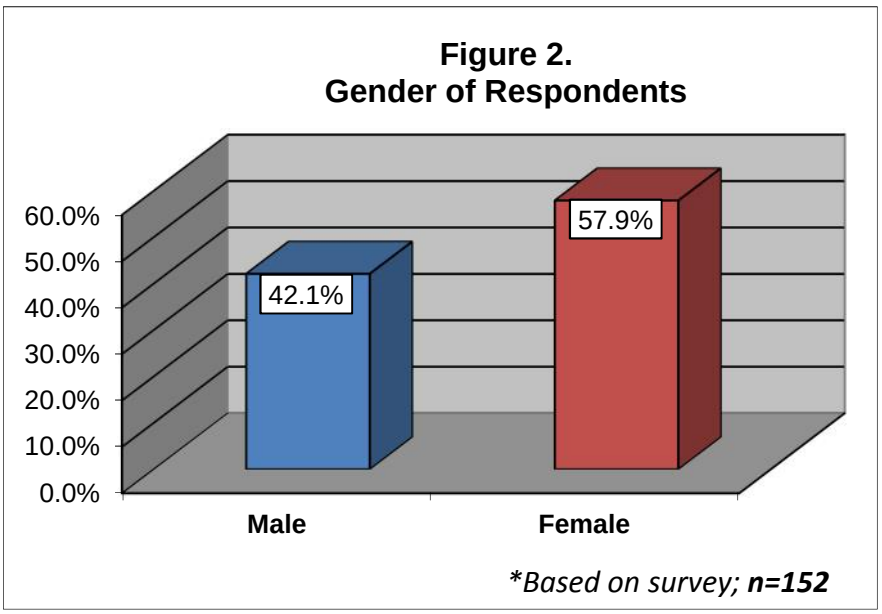
6 Findings

6.1 Survey results

The age range of the respondents was between 25-34 years old with 41.1%.



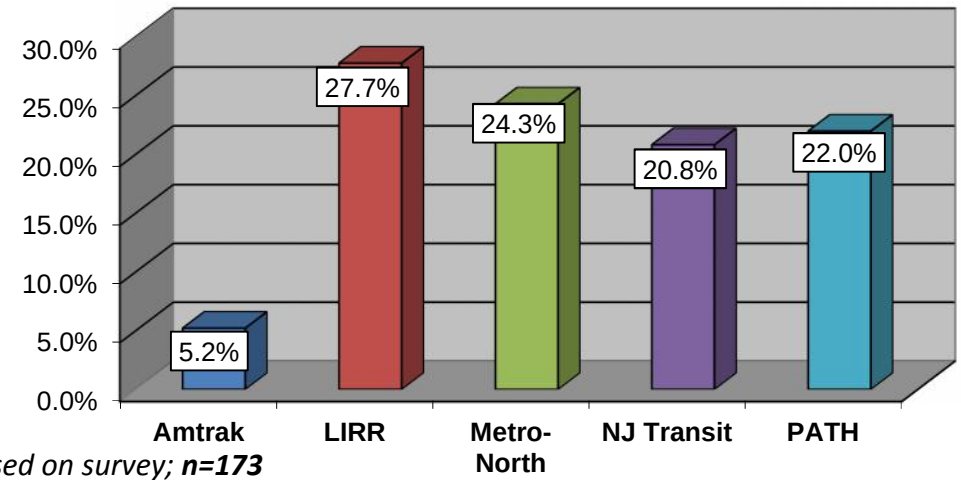
Gender responses were 57.9% female vs. 42.1% male responses. (Figure 2)



Trip Information Findings

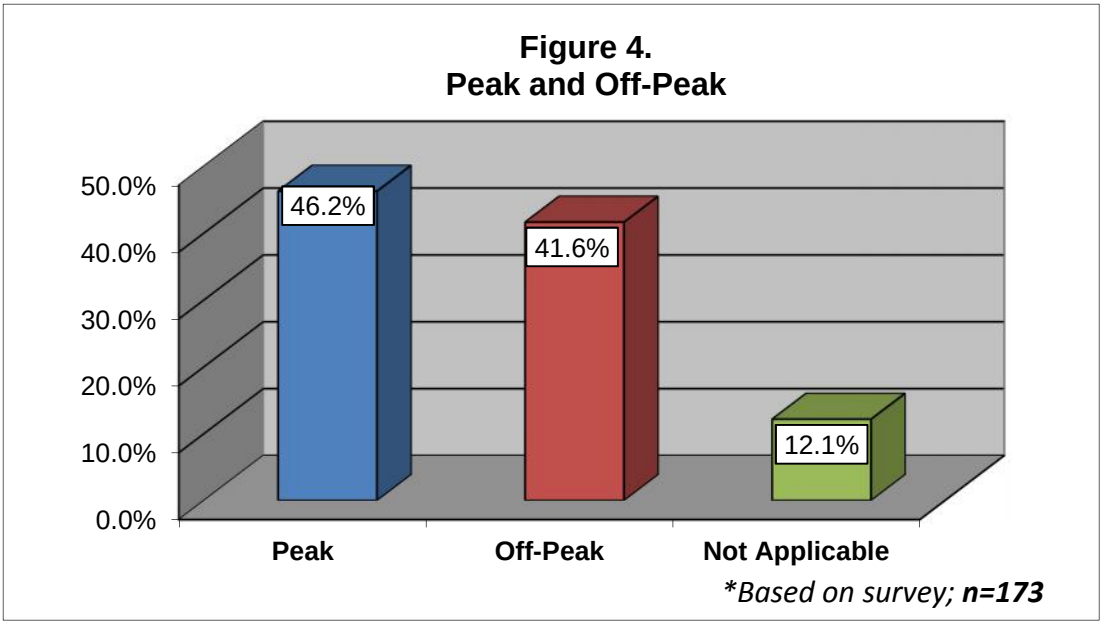
Participants responded to the question: "*What rail line did you use (today)?"*, the results on Figure 3 indicates the highest rate of 27.7% for the Long Island Rail Road (LIRR) followed by Metro-North (24.3%) and the lowest rate of 5.2% for Amtrak.

Figure 3.
What rail line did you use?

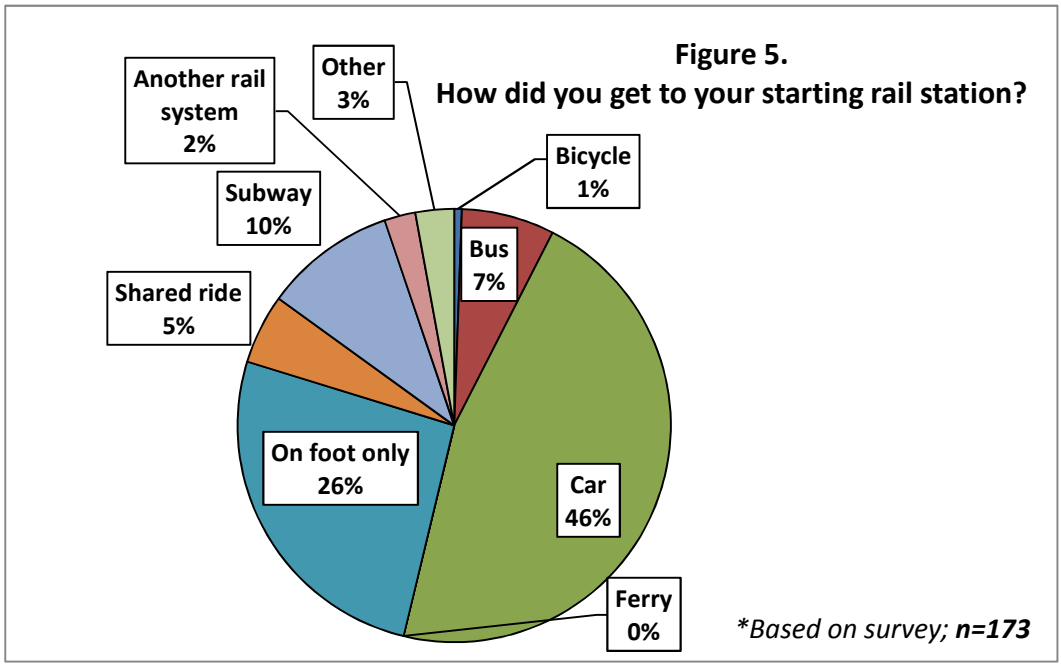


Based on survey; **n=173*

The following question *"Please indicate if your trip was Peak, Off-Peak or Not Applicable* "The findings on Figure 4 compares 46.2% responses for "Peak" with 41.6% for "Off-Peak" and only 12.1% were "Not Applicable" due that their rail line does not work in a "Peak" or "Off-Peak" timetable.(Figure 4-next page)



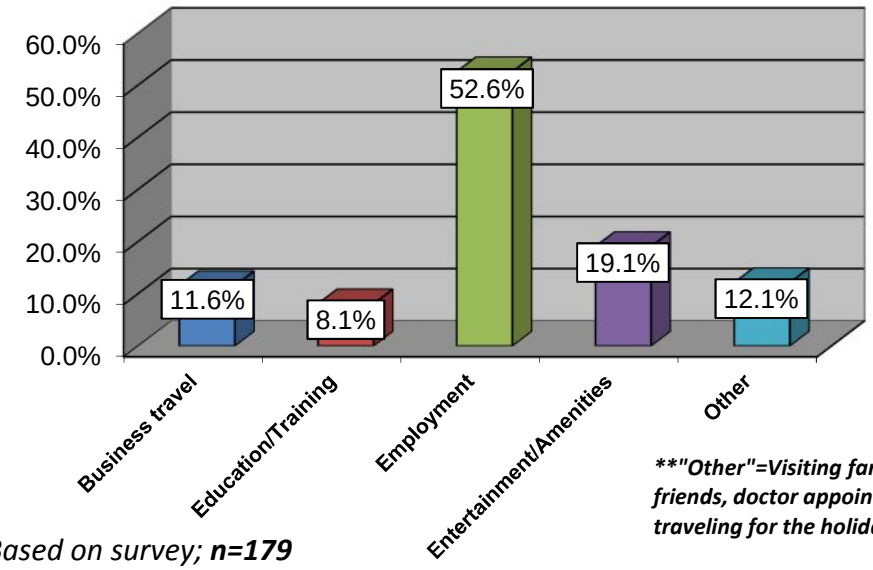
Based on our findings, "*How did you get to your [starting] rail station?*" The results below show that majority of passengers use a "Car" as a way of getting to their rail station. In the following figure 5, we see that "Car" is the highest result with 46% vs. 0% for the ferry system. (Figure 5)



In the same question, if respondent selected the option *"Another rail system"* we asked to specify which rail line they used for the trip. Only 1 person answered that they used the "Metro-North" system. For the "Other" category, the results were only few that were compiled into "Got dropped off [at rail station]" and "taxi". (Figure 6)

Moreover, another question asked was *"What is the purpose of this trip?"* respondents selected from a multiple selection from "Business travel" to "Other" purposes. 52.6% responded "Employment" as their main purpose followed by "Entertainment/Amenities" with 19.1%. Under "Other" category, 12.1% responded "Visiting family and friends", "doctor appointments" and "traveling for the holidays".

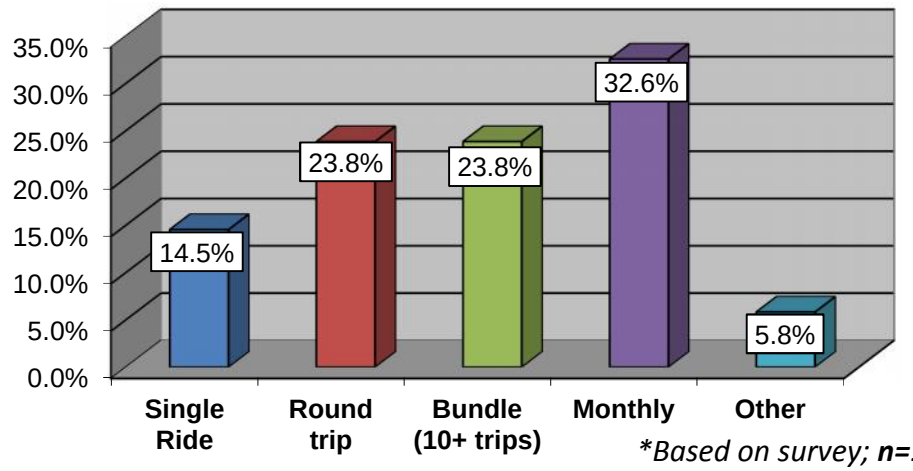
Figure 6.
What is the purpose of this trip?



*Based on survey; **n=179***

On the section of "*What type of rail ticket did you use for this trip?"* The results on Figure 7 shows the majority of respondents (32.6%) bought the "Monthly" ticket vs. "Single Ride" with 14.5%. Under, "Other" category, the responses were from "$20 metro cards" to "Special Pass" like "Senior/Disabled or Government-issued pass"

Figure 7.
What type of rail ticket did you use for this trip?

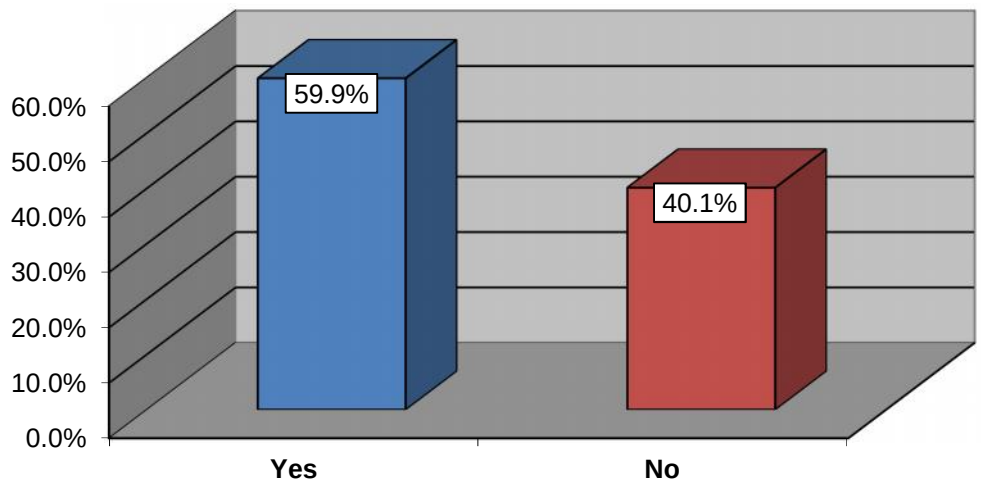


Based on survey;* ***n=173*

Evaluation

In this section, we asked the participants about their assessment of their transportation. For the questions "*Do you have another way of getting to your destination?"* Figure 8 shows us that 59.9% responded Yes vs. 40.1% who said No.

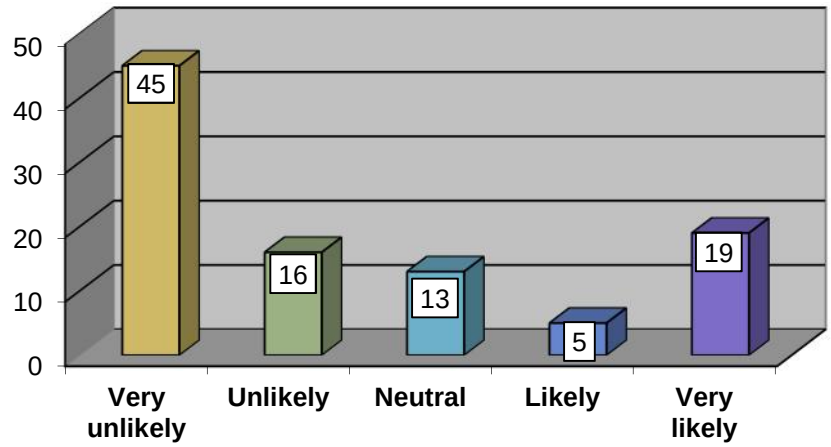
Figure 8.
Do you have another way of getting to your destination?



Based on survey;* ***n=172*

If respondents answered "Yes", there was a subsequent set of questions. The questions to follow were, *"Why is this your alternative and not your primary choice?"* and *"What is the likelihood that your would use that form of transportation on a regular basis?"* For the first question, Figure 9 shows that 52.0% has an alternative choice to arrive to their destination. Moreover, 49.0% who selected "Other" responded that "Traffic Congestion" was their explanation selected besides "Time" and "Cost". Figure 10 shows the results of the second question were, 45 respondents said it is "Very Unlikely" that they would use their alternate form of transportation.

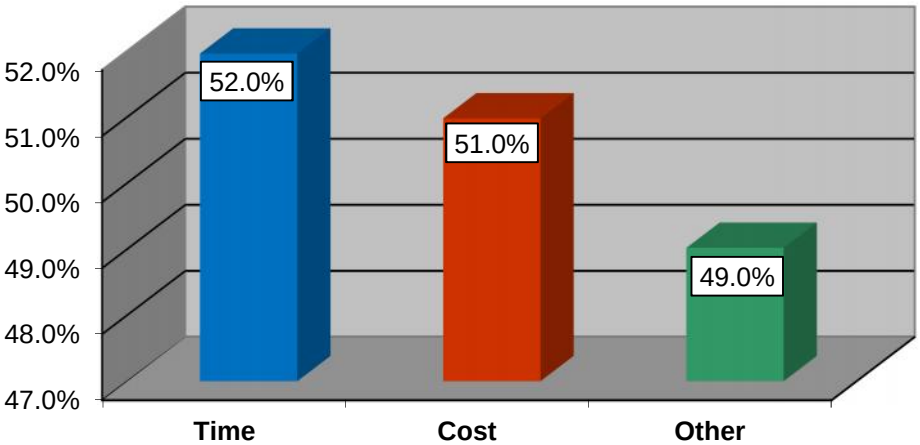
Figure 9.
What is the likelihood that you would use it on a regular basis?



*Most commuters have alternative modes of transportation; many, however, said they would be "very

*Based on survey; **n=102***

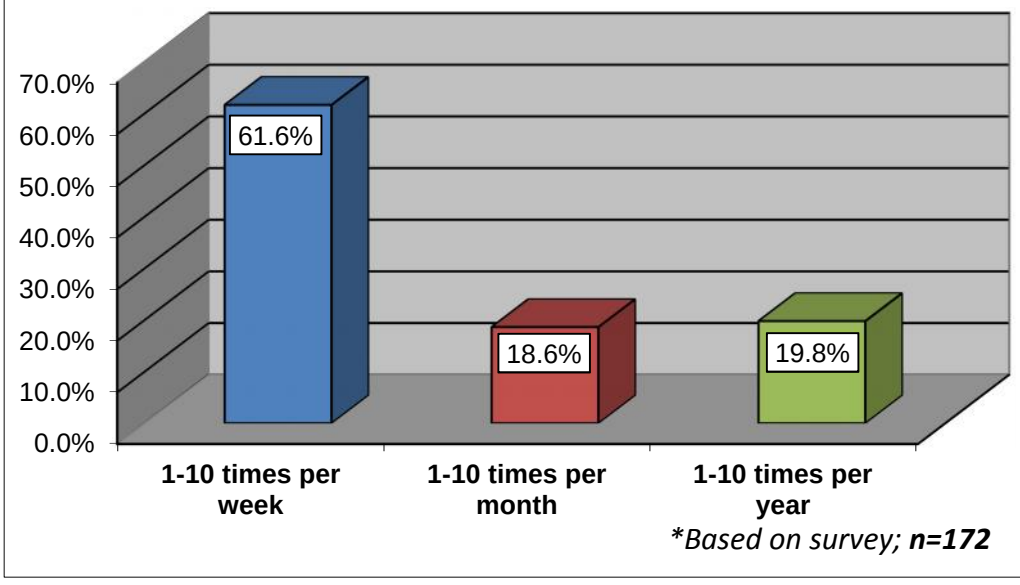
Figure 10.
Why is this your alternative and not your primary choice?



*Based on survey; **n=155***

The survey continued with *"How often do you use this rail system?"*. The responses shown on Figure 11 indicate that most of the riders selected "1-10 times a week", with 61.6% rather than "1-10 times per month with 18.6%.

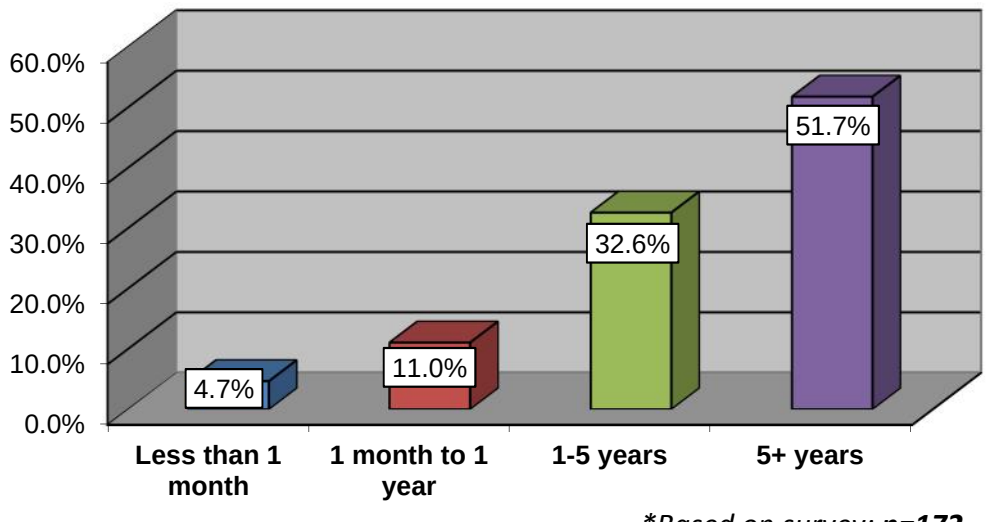
Figure 11.
How often do you use this rail system?



Based on survey;* ***n=172*

The following question, *"How long have you been a rider on this rail system?"* the majority of respondents responded "5+ years" with 51.7% vs. 4.7% of riders being "Less than 1 month". (Figure 12-next page)

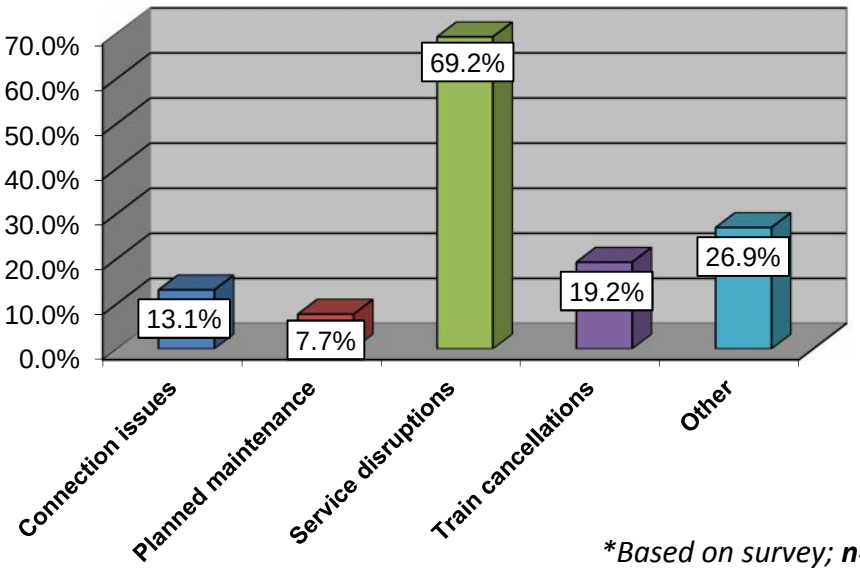
Figure 12.
How long have you been a rider on this rail system?



Based on survey; **n=172*

In continuation, the following question, *"What are the most significant service-related issues?"* respondents had an option of selecting several options like shown on Figure 13. The majority selected "Service Disruptions" as their main option with 69.2%, followed by "Other "with 26.9% and by "Train Cancellations" with 19.2%. Under the "Other" category, people wrote "weather related issues".

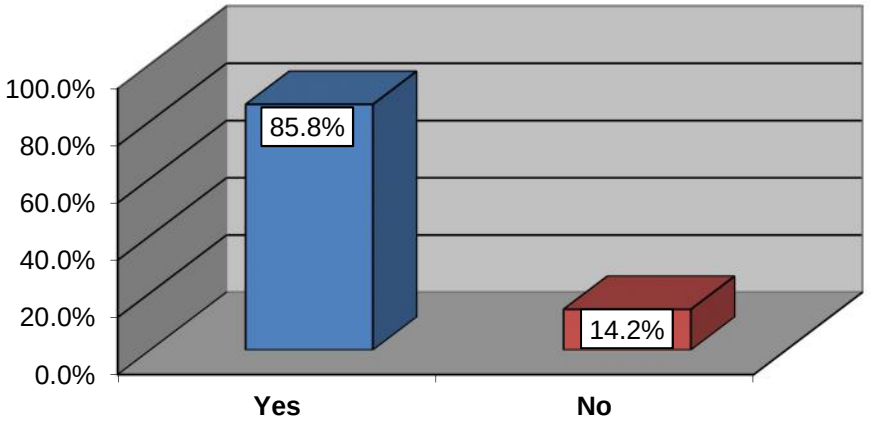
Figure 13.
What are the most significant service-related issues?



Based on survey;* ***n=177*

Another question that was presented to riders was *"Do you consider the frequency of trains at your original station adequate for your needs?"* Figure 14 show that 85.8% does agree vs. 14.2% who do not agree with the question.

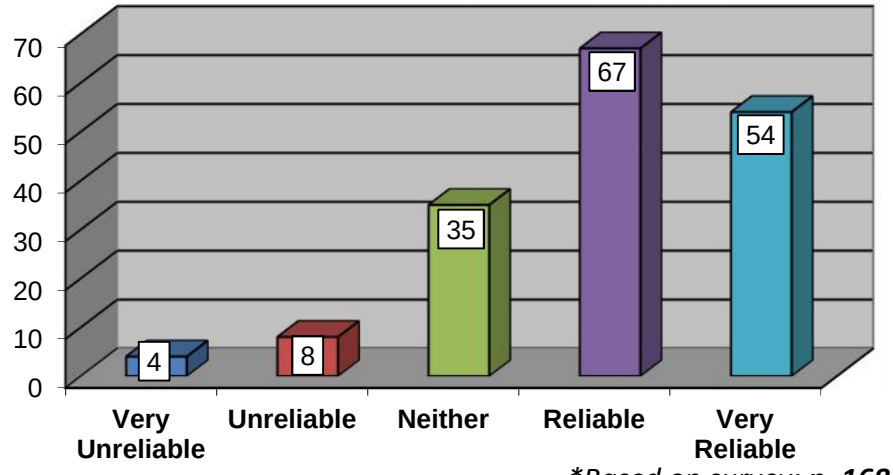
Figure 14.
Do you consider the frequency of trains at your original station adequeate for your needs?



Based on survey;* ***n=162*

After these questions, respondents were asked to complete in a set of Likert Card scale questions shown by Figures 15, 16, 17 and 18. The first question is *"How would you rate the reliability of your train service?"* The results were that 67 people (38.7%) agreed that the services were "Reliable" vs. 4 responses (2.3%) who believed that were "Very Unreliable". (Figure 15)

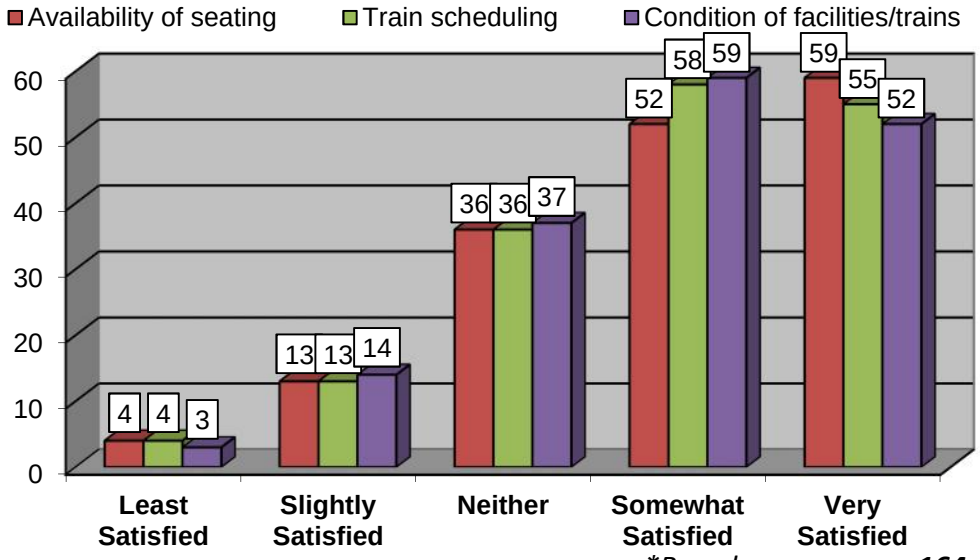
Figure 15.
How would you rate the reliability of your train service?



Based on survey; **n=168*

The following scale of questions was in reference to their level of satisfaction with "Availability of seating"; "Train scheduling" and "Condition of facilities/trains". Figure 16 shows that 59 responses were "Very Satisfied" with the "Availability of seating" in their rail system. However, respondents are only "Somewhat Satisfied" with the "Train scheduling" and "Condition of facilities/train" with the highest responses of 58 and 59 respectively.

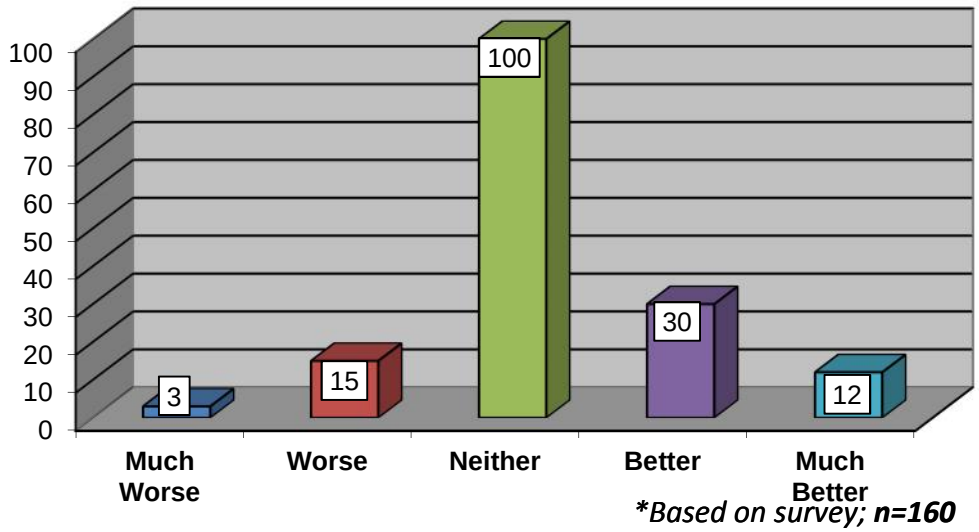
Figure 16.
How often do you use this rail system?



Based on survey; **n=164*

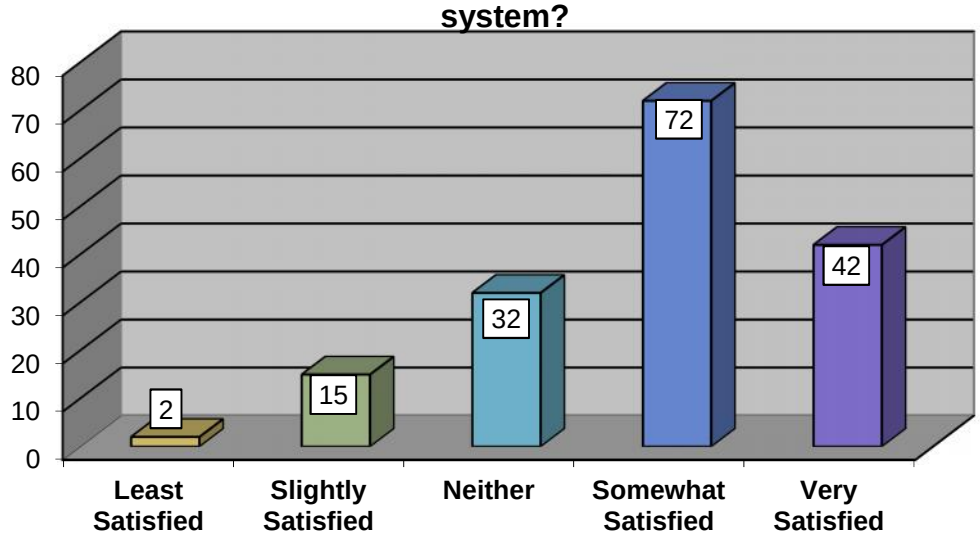
For the questions *"Please rate how your ride has changed over time?"* and *"Please rate your overall satisfaction with this rail system"*, Figure 17 shows "Neither" is the highest response with 100 answers and Figure 18 "Somewhat Satisfied" was selected the most with 72 for overall satisfaction.

Figure 17.
Pleas rate how your ride has changed over time?



Based on survey; **n=160*

Figure 18.
Pleas rate your overall satisfaction with this rail system?



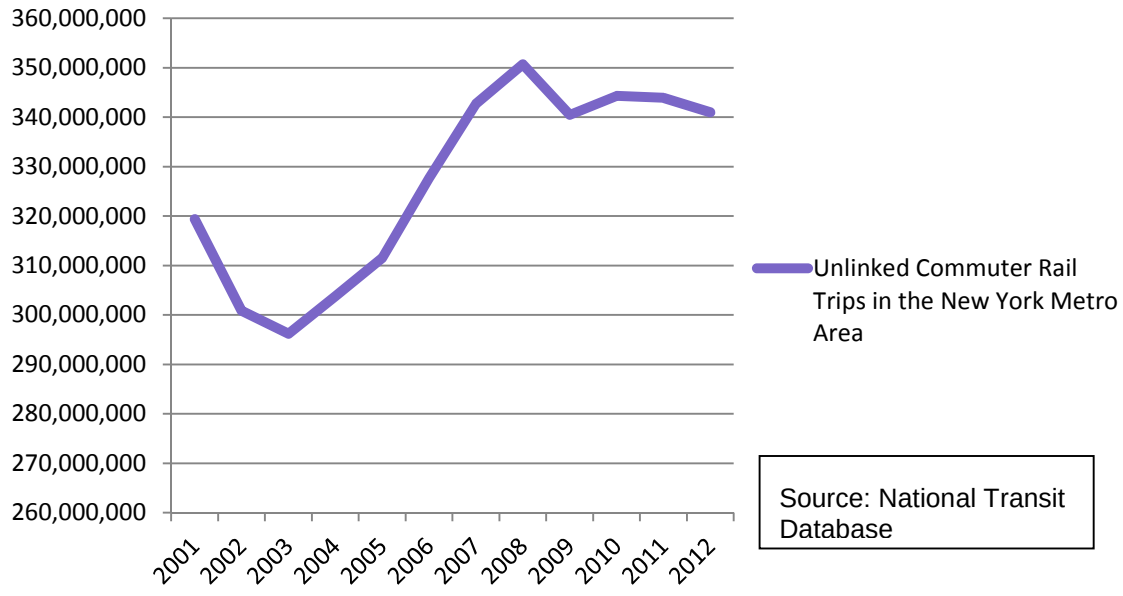
Based on survey;* ***n=163*

6.2 Comparative analysis of cross cutting issues

Ridership & Passenger Flows

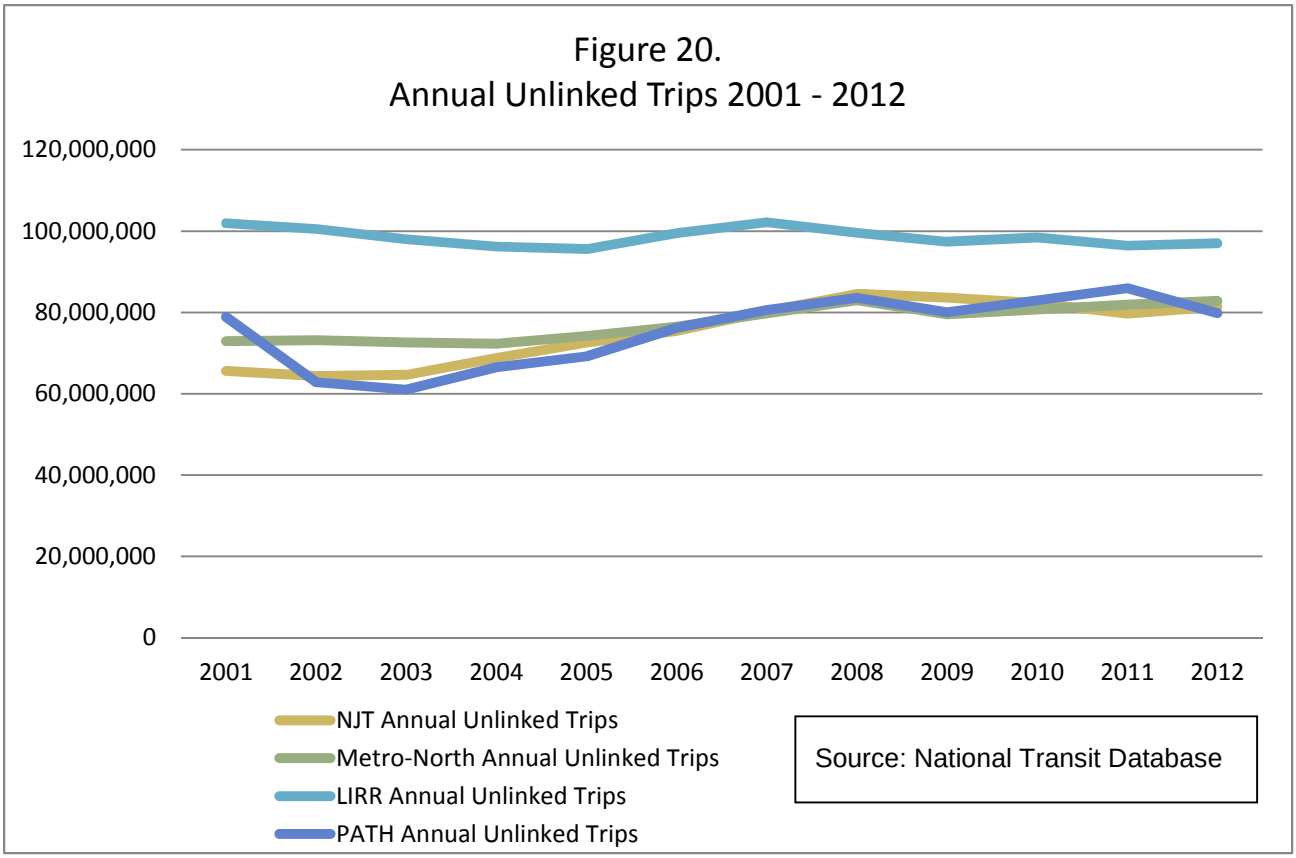
The use of intercity and commuter rail along the Northeast Corridor and in New York has grown tremendously since the 1960's. In 2012 alone, there were more than 340 million unlinked trips on the 4 commuter rail lines serving New York City, and since 2001, these rail systems have logged more than 3.9 billion trips (Figure 19). Over the past decade, NJ Transit and Metro North have experienced a 23.9% and a 13.5% growth in the number of unlinked trips respectively. On the other hand, from 2000-2012, average Long Island Rail Road weekday ridership has declined by approximately 20,000 unlinked customer trips, and the system's overall ridership declined by 4.8% over the course of the decade (Figure 20).

Figure 19.
Unlinked Commuter Rail Trips in the New York Metro Area



While its ridership is in decline (peaking in 2000 with approximately 282,400 average weekday unlinked trips), LIRR remains the largest commuter rail system in the region with more that 96 million unlinked trips in 2012. The other three lines handled between 79 million and 82 million trips that year. For the period 2005-2012, LIRR carried approximately 112,871 riders to Penn Station on an average weekday, reaching a high in 2008 of 118,210 passengers.

Figure 20.
Annual Unlinked Trips 2001 - 2012



On average, about 430,000 riders are entering and leaving Penn Station via intercity or commuter rail on any day of the week. MTA LIRR accounts for approximately 54% of daily riders on a typical weekday, while NJ Transit accounts for 39%. Amtrak only accounts for 7% of daily riders on an average weekday, divided between its Northeast Corridor, which accounts for approximately 26,000 daily riders, and its Empire Corridor, which accounts for approximately 4,750 daily riders.[65] With respect to passenger flows, one study found that 75.8% of all LIRR riders travel through Penn Station, while only 58.7% of NJ Transit riders do so.[66]

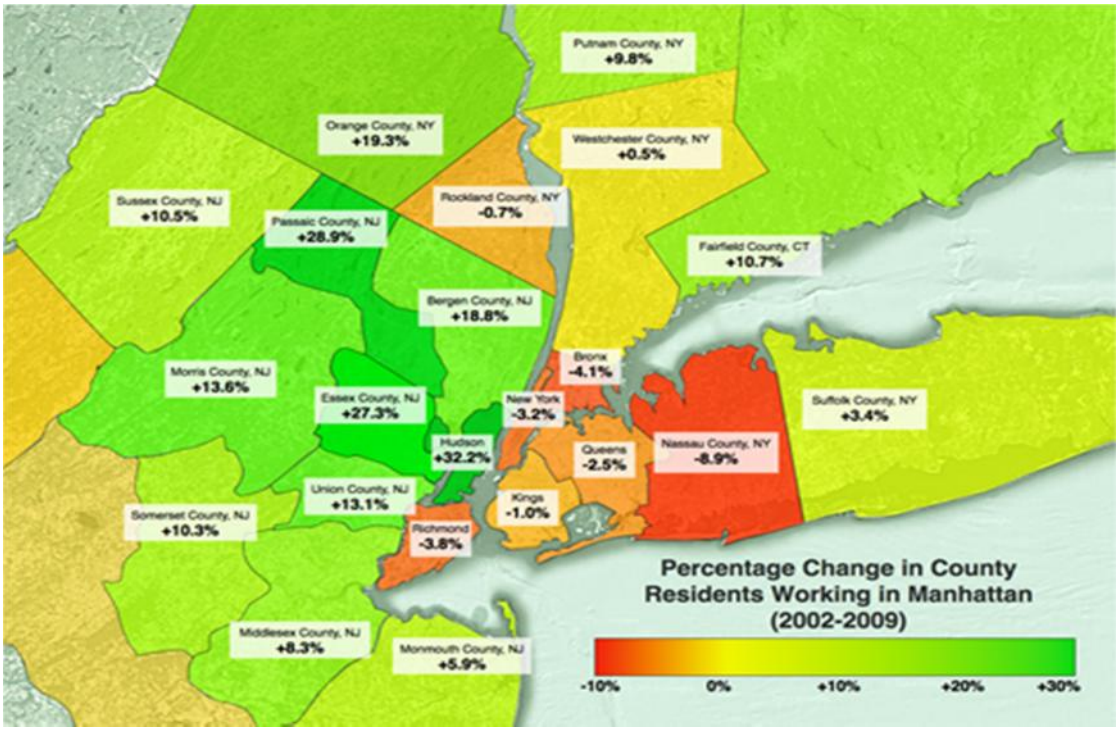
These marked differences in the share of each system's ridership that travel to the New York Metro Core reflect their respective historical, geographic, and economic roles as regional rail roads. Like the LIRR, Metro-North is strongly oriented toward channeling passengers into the New York Metro Core. With 89% of inbound trains terminating in Grand Central Station, Metro-North has the highest percentage of daily trains terminating in Manhattan when compared to LIRR and NJ Transit. And the remaining 11% of its daily trains connect to trains that do terminate in Manhattan.[67]

"NJT needs to provide more bi level service on the Northeast Corridor and North Jersey Coast Lines instead of these arrow/comet cars which only have one level and less seats than the Multi level cars." George Daniel Worotikan, 12/10/13-NJ Transit Facebook Profile

Over the past seven years, NJ Transit has had the greatest increase in the number of passengers flowing through Penn Stations, with approximately 4,500 more NJ Transit passengers boarding and alighting in the terminal every day. The other two major regional systems make use of Penn Station, NJ Transit and LIRR, saw their annual ridership increase by 2.2 million passengers

and decrease by 4.3 million passengers respectively between From 2007 to 2012.

Figure 21.
Percentage Change in Ridership



*Source: Trends & Opportunities: How Changes in Ridership, Population, and Employment Should Guide Future Metropolitan Transit Planning, July 2013

The flow of riders into the New York Metro Core from New Jersey has been steadily increasing since the mid-90s, when economic growth in the Greater New York Area contributed to a dramatic increase in ridership on NJ Transit lines serving Manhattan. For example, between 1995 to 2000, NJ Transit's rail systems attracted 35% additional passengers, more than twice the rate of growth for the other suburban rail systems in the region over the same time period.[68] And between 2001 and 2012, the number of annual unlinked passenger trips increased by 24% from more than

65 million to more than 81 million. This was paralleled by a similar increase in ridership on the PATH (Figure 20).

Both population growth and relative economic dynamism in the regions served by commuter rail is having implications for the flow of riders into and out of the New York Metro Core. Over the past three decades, the counties served by NJ Transit have seen significantly greater population growth as compared to the counties served by Metro-North and LIRR with a net growth of more than 1 million residents as opposed to about 550,000 in the service area of the other two rail systems.[69] From 2000-2010, NJ Transit's service areas experienced three times the growth of LIRR's and twice as much as Metro-North's.[70]

In addition, New Jersey has seen an increase in the number of individuals commuting to Manhattan that often far outstrips its population growth (Figure 21). For example, according to the last census, Bergen County's population grew by 2.7% between 2000 - 2010, yet the number of Bergen County residents commuting to Manhattan grew by 18.8% during the same time period. Given that 64.2% of survey respondents who could use a car to enter Manhattan indicate that they were unlikely to do so on a regular basis, continued population and commuting trends in Northern New Jersey and the Hudson Valley have significant implications for the regional rail systems.

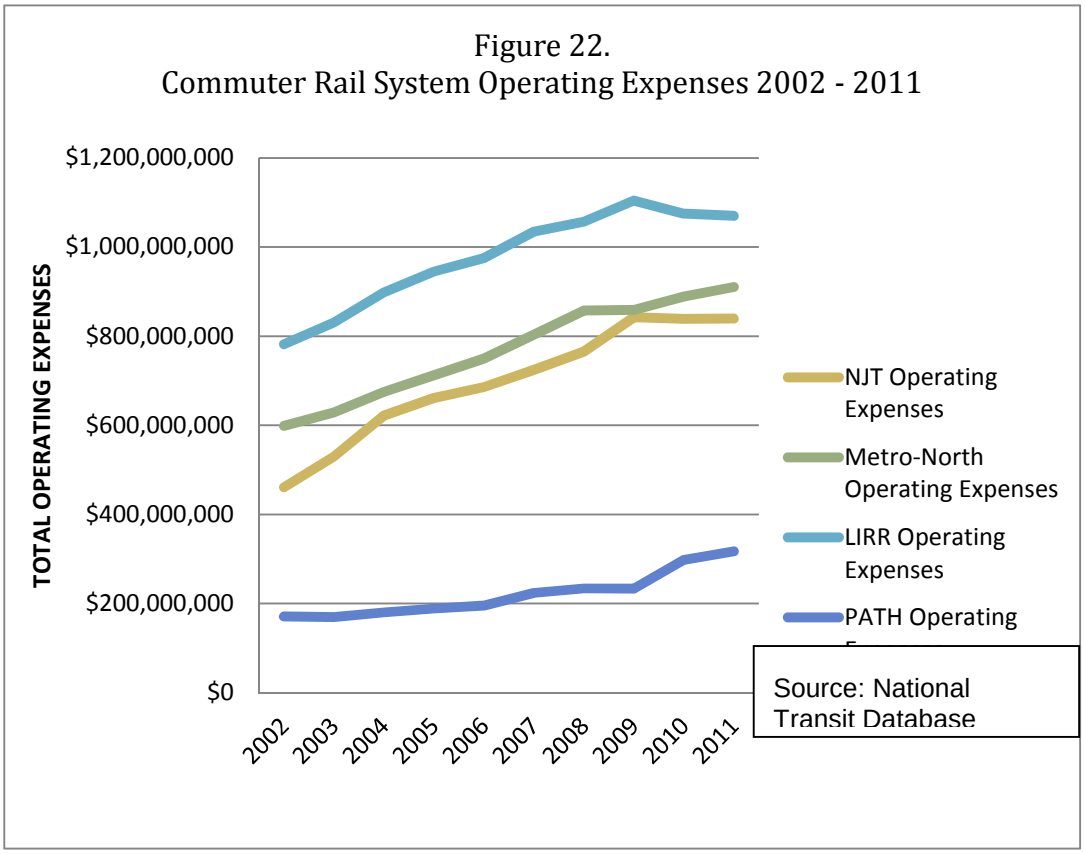
Fare revenue & Operating expenses

Figure 22 depicts the operating expenses for the four rail systems—LIRR, Metro-North, NJT, and PATH—from 2001-2011. The data, taken from the National Transit Database (NTD), shows that these major rail systems have all experienced significant rises in operating costs since 2001, with the total percent change from the year 2001 to 2011, for all four systems, averaging an increase of 64.1%. PATH and NJTransit had the highest percentage changes, with 85.7% and 82.1% respectively.[71] Metro-North and LIRR, both subsidiaries of the Metropolitan Transit Authority (MTA), had a 52% and a 36.8% change respectively from 2001 to 2011.[72] However, percentage increase is only part of the picture. In 2011, PATH still had total operating expenses far lower than the other three systems.[73] The PATH's operating expenses in 2011 totaled $316,911,272, which is $622,827,848 lower than the 2011 expenses of the other three lines average operating expenses of $939,739,120.[74]

It was hypothesized that these rising costs were the result of rising salaries or greater increases for the MTA subsidiary systems, Metro-North and LIRR, compared to NJT and PATH. According to an MTA fact sheet, this hypothesis holds true for LIRR which attributed the rise in operating costs from 2003 to 2004 to higher salaries and the increase costs of fridge benefits for employees.[75] This rise in salary costs does not equal a greatly increased workforce—the number of employees only increased by nine positions or .1% during that time period.[76] At the same time, LIRR is losing ridership which means they must increase fares in order to avoid a loss in fare revenue.[77] In fact, since 2005, monthly fares have increased by 35.9%, peak one-way fares have seen a

37.2% jump, and off-peak one-way fares have increased by 34.3%.[78]

Figure 22.
Commuter Rail System Operating Expenses 2002 - 2011



The four rail systems all have income streams that involve combination revenue and subsidies. This income is used to pay the system's yearly operating expenses. In figure 23, we attempt to discern how much of these systems' commuter rail expenses are being furnished by fare revenue.

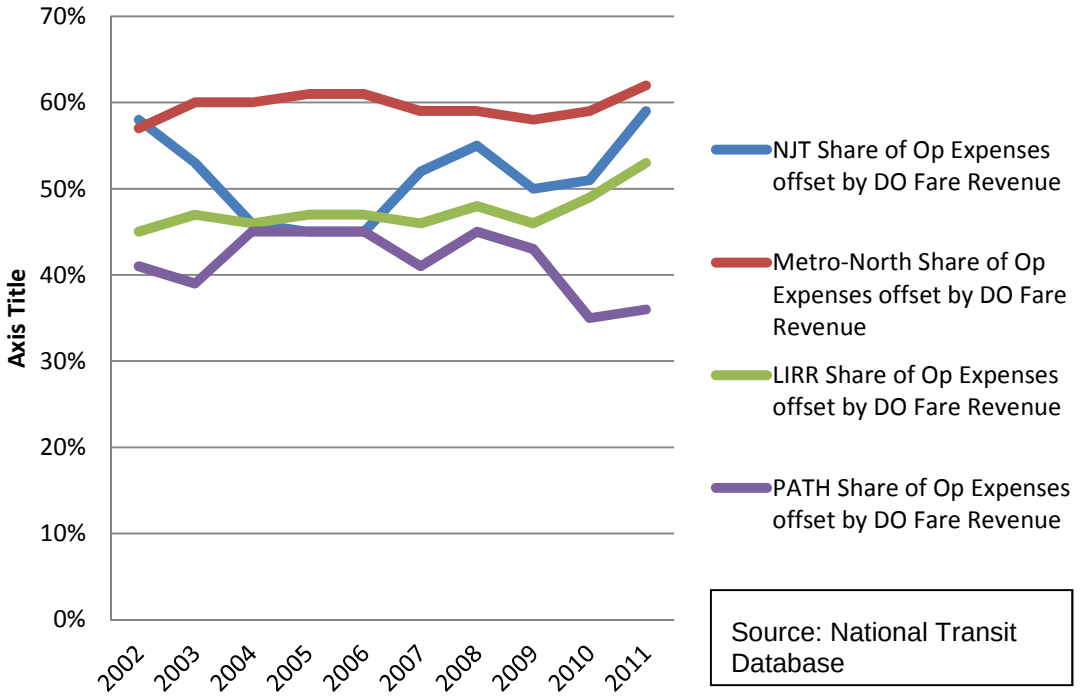
Figure 23 uses data from the NTD and depicts what percentage of total expenses for the commuter rail portion of these systems is being off-set fare revenue. The graph shows that while Metro-North has the highest share of fare revenue compared to operating expenses, the PATH train has the least.[79] On average, over the nine year period from 2002-2011, Metro-North's percentage of operating expenses off-set by fair revenue was 59.6

%, compared to the PATH which averaged 41.5%.[80] At its height, in 2011, Metro-North's fare revenue covered 62% percent of operating expenses.[81] The PATH train reached a high of 45% for the years 2004, 2005, 2006, and 2008. New Jersey Transit and Long Island Rail Road ran the closest percentage wise for this graph, with averages from 2002-2011 of 51.4% and 47.4% respectively.[82] Both systems had peaked in the year 2011 with NJT's share reaching 59% and LIRR hitting 53%.[83] However, though LIRR held relatively steady throughout the time period shown, NJT's percentage of operating expenses off-set by fare revenue declined from 2002-2005, falling, on average, 4.3 percentage points per year (and holding steady in 2006).[84] NJT saw increases in 2007 and 2008, but fell again in 2009, followed by a 1% increase in 2010 and an 8% increase in 2011 to the high of 59%.[85] Essentially, NJT ended 2011 (59%), where they started in 2002 (58%), with ups and downs in between those years.[86]

Further analysis of the PATH train's funding structure and fare increases over the same time period allows for further discussion of the trends predicted in Figure 23. In 2011, according to the NTD, the PATH train's funding structure was as follows: 43% from fare revenue, 1% from local funds, 26% from state funds, 26% from federal assistance (meaning more than half of their expenses are covered by subsidies), and 4% or $77,140,014 from other funds.[87] In the same year, Metro-North and LIRR both received $0 in federal assistance forcing them to rely more heavily on fare revenue than the PATH system to off-set their operating expenses.[88] New Jersey Transit also received federal assistance in 2011, $389,897,833 or 20% of their total sources of revenue for operating expenses, for the entire system (including buses and

light rail).[89] Presumably, this reliance on federal assistance may make the PATH train rider's vulnerable to a steep and sudden increase should the funds not be available in the coming years. While the MTA systems, Metro-North and LIRR, are more self-reliant and not vulnerable to cuts in federal subsidies.

Figure 23.
Share of Operating Expenses offset
by Directly Operated Fare Revenue 2002 - 2011



Measuring Performance and Efficiency

Efficiency is contextual concept typically shaped by the values, priorities, and needs of whoever is measuring it. Thus, efficiency can very much be in the eye of the beholder. To a passenger on a rail system, efficiency is measured by how quickly and effortlessly they are able to reach their destination. Anything that interferes with that goal is likely to alter their perception of the efficiency of any rail line they might be riding. At the regional scale, understanding the efficiency of a particular transit system would be tied to maintaining and increasing economic vibrancy and environmental sustainability. A rail system on the other hand, must look at efficiency both broadly, applying the concept across the various parts of the organization, and deeply, drilling down to examine how efficiently particular units and divisions operate. They must examine a broad range of issues from how well their workforce is doing their jobs to how much it costs to move their riders from one station to another.

"Service disruptions caused by problems in the tunnels or Amtrak efforts to fix them have been on the rise. At least six major disruptions occurred over the summer, including the June derailment of an LIRR passenger train that was caused by a loose track component in one of the Amtrak tunnels."-Newsday August, 2013

Generally, the survey results support the notion that the riders of the four rail systems believe that they are being operating at an acceptable level of efficiency. By nearly a 65.9% margin, respondents indicated that they were satisfied with the rail system they were using. Conversely, nearly 70% of respondents cited service disruptions as the issue that concerned them most with their rail system's performance. Of those, 62.5% remained very satisfied or somewhat satisfied, perhaps indicating that they had not experienced enough service disruptions to undermine their level of satisfaction or that the service disruptions they experienced were handled appropriately in their view.

At the regional level, the rise of the Smart Growth movement has created a new policy and regulatory landscape for urban planners, transportation professionals, and transit officials. Transit-Oriented Development is a particular category of Smart Growth focused on promoting more compact, mixed use development within easy walking or biking distance of transit stations (typically a half mile).[90] Generally, automobile-oriented development is space intensive because of the amount of land required for roads and parking facilities. Thus, the large Park & Ride facilities used by 3 of the 4 rails systems are inconsistent with Transit-Oriented Development and Smart Growth principles, since a rail station surrounded by large parking lots and access roads is generally not conducive for residential development or pedestrian access.

NJ Transit is a leader in Transit-Oriented Development in the New York Metropolitan Area, which is likely to have facilitated and contributed to the increasing ridership levels into Manhattan over the past decade. It provides technical assistance to municipalities interested in initiating a planning effort for a transit station area, and it has published a handbook entitled "Planning for Transit-Friendly Land Use", designed to assist citizens, local officials and planning professionals interested in improving the coordination between land use planning and transit.[91] Implementing Transit-Oriented Development effectively necessitates coordination of existing plans for growth, transit, housing and jobs, as well as programs and policies at all levels of government.

For this project, the manner in which the rail systems themselves understood, measured, and reported their own efficiency was deemed critical. Thus, two sets of performance measures were examined – the On-Time Performance statistics the rail systems

routinely report to the riding public in their annual reports and statistics regarding performance that the Federal Government requests on an annual basis. All the rail lines in the New York Metropolitan Area have adopted a uniform definition for On-Time Performance. If a train arrives at its scheduled station no more than 5 minutes, 59 seconds late, then it is considered "on time." By that measure, all the rail lines studied have average on-time performance in the mid- to high- 90th percentiles (Table 1).

Table 1.
Commuter Rail On-time Performance Statistics 2009 - 2012

Rail System	2009	2010	2011	2012	4 year Average
New Jersey Transit	94.1%	94.8%	94.3%	95.7%	94.7%
Metro-North*	97.8%	97.7%	96.9%	97.6%	97.5%
LIRR	95.2%	92.8%	93.7%	94.3%	94.0%

To facilitate analytical comparison between different transit systems and modes of travel, the Federal Transit Administration (FTA) developed a set of universal "Performance Measures" designed to track "service efficiency," "cost effectiveness," and "service effectiveness" All transit systems in the United States must submit annual reports to FTA that include statistics on these performance measures and a spectrum of other data in order to be eligible for federal grants administered by the agency. The data is made available through the National Transit Database, which has become the primary source of standardized and comprehensive data on transit in the nation.[92]

For this project, two performance measures were chosen for comparative analysis. Operating Expenses per Unlinked Passenger Trip is a performance measure designed to track cost

effectiveness and it helps to convey how cheaply a particular system is able to move a given rider from their boarding station to their alighting (Figure 24). Unlinked Passenger Trips per Vehicle Revenue Mile (VRM) is used to measure the effectiveness of a transit system's service and it reveals how many riders are being moved while a vehicle is in active service (Figure 25). By both these measures, the PATH trains stands out.

Between 2002 and 2005, even while still recovering from the events of September 11th, the PATH system handled more than twice as many trips as the other three systems. And by 2006, it was handling more than 3 times the number. Similarly, while the cost per unlinked trip rose from $8 to between $10 and $11 for the other three lines between 2003 - 2001, the PATH's costs only rose $1 over the same time period. These stark differences illustrate that the PATH system is a much more economically efficient and cost-effective mover of people via commuter rail in the New York Metropolitan Area.

Figure 24.
Unlinked Trips per Vehicle Revenue Mile

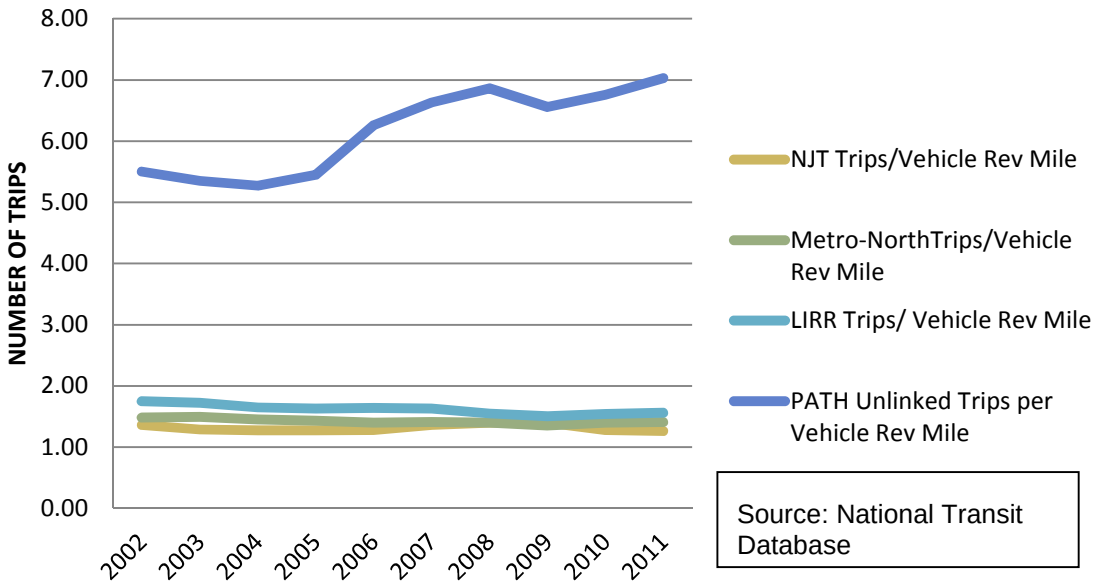
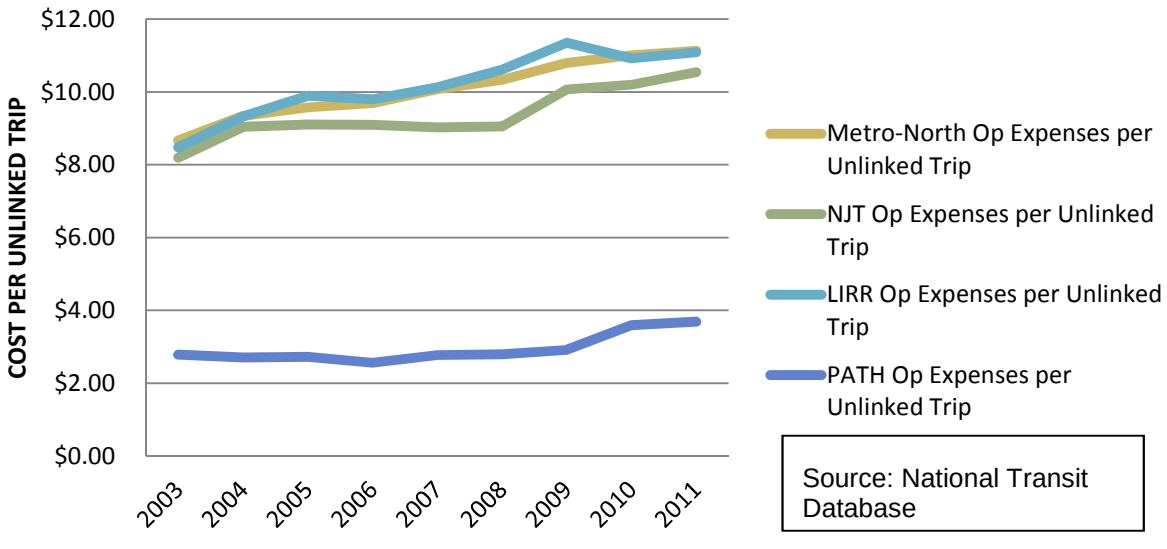


Figure 25.
Commuter Rail Expenses per Unlinked Trip 2003 - 2011



"The LIRR funnels hundreds of trains and most of its 300,000-plus riders through this bottleneck every day from Penn Station -- under the river to Long Island City, Queens, and points east. Amtrak makes far fewer daily trips through the tubes. It needs a persistent reminder of the LIRR's crucial, tightly choreographed squeeze."- Newsday June, 2013

Infrastructure challenges

Efficiently handling nearly four billion unlinked trips requires an extensive rail-related infrastructure across the New York Metropolitan Area. The increased ridership numbers that have been seen by most of the commuter rail systems over the past decade exacerbates a spectrum of infrastructure challenges faced by these organizations, from aging facilities, tracks, and trains to the continuing congestion caused by having to share access to key tunnels that provide rail access to Manhattan.

Three of the four rail lines examined as part of this project are part of Amtrak's Northeast Corridor, which is one of the highest volume, shared-use rail corridors in the world. A grand total of 8 separate commuter rail authorities make use of it, in addition to Amtrak.[93] In recent years, a lack of capacity has negatively affected service and on-time performance on the NEC. For example, the Amtrak tunnels under the Hudson River, which are also used by NJ Transit for the five lines it operates into Penn Station, have basically been operating at 100% capacity for decades. As a result, even minor operating problems can create major service disruptions.

Even the everyday congestion that results from use of this shared critical infrastructure can be problematic. In figure 26, the impacts on NJ Transit of not having priority access to Amtrak's Hudson River Tunnels are evident. During peak times, the number of NJ Transit trains entering and leaving Penn Station on an Average Fall Business Day varied considerably from year to year, likely reflecting limited access to the Amtrak tunnels. Unlike the other three lines whose number of trains varied by no more

"Pennsylvania Station, a gateway to the nation's biggest city, was designed to accommodate about 200,000 riders a day. Now, it is packed with more than 600,000. At rush hours, it resembles a human demolition derby. All it takes to strand hundreds of thousands of people is a glitch on one of only two tracks linking Manhattan to New Jersey under the Hudson River." Verena Dobnik, 5/16/13-Huffington Post

than 5 from year to year between 2007 and 2011, NJ Transit's had more than twice the annual variance, ranging from 108 – 122 over the same period. By contrast, the PATH system, which has complete control over the two tunnels it uses for its Downtown and Uptown service into Manhattan, has typically been able to run twice as many trains under the Hudson River as NJ Transit since 2006.

Recognizing the various infrastructure issues and other coordination challenges associated with the continued operation and development of the Northeast Corridor, Congress authorized the establishment of the NEC Commission by passing the Passenger Rail Investment and Improvement Act of 2008 (PRIIA). Established in 2010, the Commission draws its membership from all NEC states, Amtrak, and the commuter railroads and freight railroads that operate on the NEC. In addition to promoting improved coordination, planning and communication between the members generally, one of the NEC Commission's key mandates is to The NEC Commission's mission is to develop a common methodology for allocating costs for commuter use of NEC infrastructure and services.

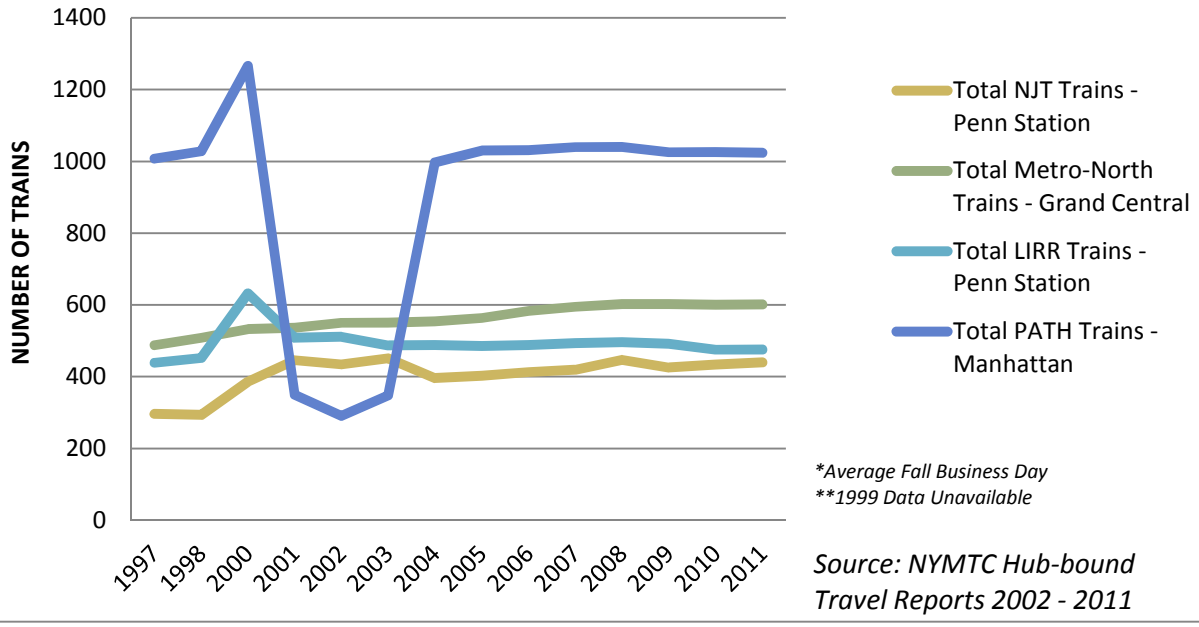
Beyond tunnel congestion, calls to completely revamp and redesign Penn Station have been increasing in volume and frequency over the past few years. The station currently operates above capacity on any given day and it will likely not be able to adequately handle the increased ridership that will result from major planned real estate developments such as the Hudson Yards complex to be built two blocks away.

In addition to chronic infrastructure challenges such as tunnel congestion, the research provided an interesting window into the

recovery of rail system that had suffered an acute, catastrophic shock. On September 11, 2001, the PATH's World Trade Center (WTC) terminal, which had been located below the Twin Towers, was completely destroyed. As a result, the PATH's Downtown Service was suspended for more than two years. Because Exchange Place, the next station on the WTC line, could not be used as a terminal station, it also had to be closed and required major modifications, before it could be reopened in June 2003. Five months later, on November 23, 2003, PATH service to Lower Manhattan was restored when a $323 million temporary station opened. The permanent WTC Hub station opened in March 2008.

Figure 27 dramatically illustrates the impact the 9/11 tragedy had on PATH service. In terms of the frequency of trains destined for Manhattan, the PATH system had successfully recovered from the massive blow to its infrastructure and had returned to its pre-September 11th service levels by 2004.

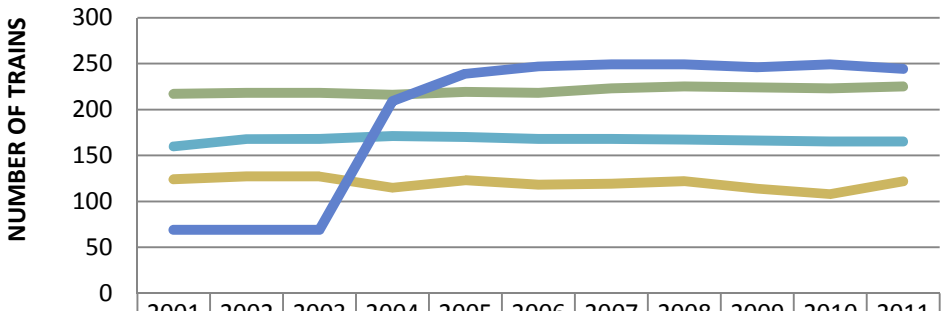
Figure 26.
Trains Entering and Leaving the Metro Core* 1997 - 2011**



*Average Fall Business Day
**1999 Data Unavailable

Source: NYMTC Hub-bound Travel Reports 2002 - 2011

Figure 27.
Trains Entering and Leaving the Metro Core during Peak Hours
2001-2011



Source: NYMTC Hub-bound Travel Reports 2002 - 2011

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
NJT Trains - Penn Station	124	127	127	115	123	118	119	122	114	108	122
Metro-North Trains - Grand Central	217	218	218	216	219	218	223	225	224	223	225
LIRR Trains - Penn Station	160	168	168	171	170	168	168	167	166	165	165
PATH Trains - Manhattan	69	69	69	209	239	247	249	249	246	249	244

6.3 Perceptions of the New York Metro Region

Background and Context

Perceptions of what constitutes the New York Metro Region range from the area as small as that bounded by the borders of the five boroughs, to the larger, vaguer "Tri-State Area", encompassing the counties of the Lower Hudson Valley, western Connecticut, and northern New Jersey. To some, the Metro Region constitutes only a small component of the greater "Mega Region" stretching along the eastern seaboard from Washington, D.C. to Maine, with New York at its economic and cultural heart.[94]

Officially, the Metro Region is divided for statistical purposes into the Metropolitan Statistical Area (MSA) and the larger Combined Statistical Area (CSA), home to approximately 19 million and 22 million inhabitants, respectively. The counties included in these definitions (25 in the MSA and 35 in the CSA) share close economic ties as well as an interconnectivity that allows for the greater movement of people, goods, and services within the area.[95]

Question Design

In order to understand how riders traveling within the region perceive and visualize it, we included in our survey three maps (included in the Appendix) and asked survey respondents to choose that which most closely conformed with their idea of the New York Metro Region (respondents were also given the option to choose "None of the above" and provide their own definition). In addition to gaining a sense of rider's perceptions, were sought to find out:

- Do survey responses differ from or align with official designations as outlined by the U.S. Office of Management and Budget?

- Do rider's geographic origins create a bias in perception?

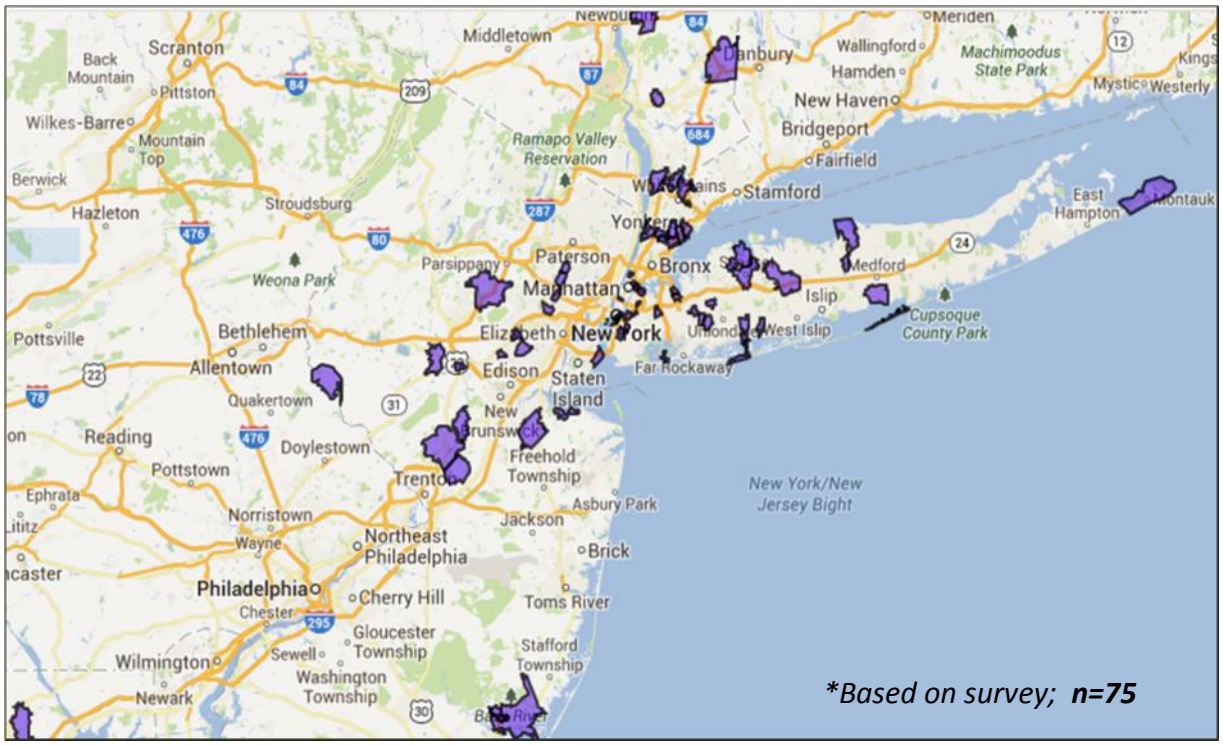
The primary issue we encountered with the implementation of this question was that its place towards the end of the survey resulted in its not being answered by those riders in a rush; in future studies, questions regarding the Metro Region could be given higher priority, or even form the basis for a separate survey entirely.

Findings

Of the 173 riders surveyed, a total of 130 responded to our Metro Region question, with approximately 16.4% selecting Map A (the five boroughs, Nassau, Westchester, and Hudson Counties), 15.8% selecting Map B (the aforementioned area, plus Suffolk and Fairfield Counties), and 43.9% selecting Map C (the entire aforementioned geographic area, extended to include Rockland, Orange, Putnam, Dutchess, New Haven, Bergen, Passaic, Sussex, Essex, Morris, Warren, Hunterdon, Mercer, Monmouth, Middlesex, Somerset, Union, Morris, and Essex Counties). About 24% indicated none of the above.

With responses broken down by both rail line and home zip code, a few interesting observations become apparent; most notably, that riders traveling within the New York Metro Region come from all corners of the Metropolitan Statistical Area, and that for at least half of them, their perceptions mirror the officially designated boundaries. These riders do not necessarily see the Metro Region as a destination they travel to each day, but rather a larger geographic area to which they belong, despite state or city boundaries.

Figure 28.
Home Zip Codes of Respondents who most closely identified the Metro Region with Map C



In terms of geographic bias, there does seem to be, at first glance, a general tendency for riders of certain rail systems to identify the Metro Region with the map that most closely mirrors the area serviced by their system. For instance, although more riders from each system (excluding the PATH train) chose Map C over the other three choices, a large proportion of LIRR riders (about 45%) selected Map B; Metro-North users, more than any other group, chose Map A (about 26%); and both Amtrak and New Jersey Transit customers, who generally are traveling from the more far-flung counties of New Jersey and those areas serviced by the Northeast Corridor route, opted overwhelmingly (79% and 71%, respectively) for the largest and most inclusive of the three maps.

Despite these potential biases, Map C still constituted the majority (if slim) of responses from riders across four of the five systems, with PATH being the only exception (partly due to logistical issues with the survey, and partly due to the PATH's status, as we've noted, as a subway-like rather than commuter rail system, servicing a smaller, more urban geographic area). Approximately 45% of LIRR riders and 45% of Metro-North riders selected Map C.

Of our three geographic outlier respondents, two selected Map C and one selected Map A; it is interesting to note that the respondent from Texas identified the New York Metro Region with the smallest geographic area, indicating, perhaps, that to those from outside the region, "New York" means the city of New York. Respondents from Maryland and Pennsylvania, on the other hand, both selected Map C -- an indication, possibly, of a more subtle understanding of the region and its interconnectedness by those who live at its outermost bounds.

Of those respondents who selected "none of the above" (11 total) and elaborated on their own perceptions, five indicated that the Metro Region is, in fact, even larger than Map C, often including all of New Jersey and Connecticut in their definitions. This may indicate an association of the term "Tri-State Area" with the geographic entirety of all three states, rather than just those counties included in the MSA (a separate study of New Jersey and Connecticut residents to determine which Metro Region they most identify with -- New York, Boston, or Philadelphia -- would be interesting for comparative purposes). And finally, one forward-thinking respondent noted that she believes the Metro Region is "always changing."

7 Issues and Challenges

As the project progressed and evolved, the group experienced problems with finding existing hard data and conducting in-person surveys. As mentioned in methodology, initial findings were uneven and inconsistent, as each rail line distributes information in different formats and different years. Some rail lines provide ample, easily accessible ridership data on their website while other rail lines only provide select data. This created one of the largest challenges, which was finding cohesiveness across all rail lines. As a result, the group relied on news articles or occasional rail line press releases for the initial Literature Review before discovering resources such as the NTD and NYMTC.

7.1 Access to passengers for administering surveys

Access to Passengers

An anticipated problem that the group understood would happen was the unwillingness of passengers – many of whom on their way to work or on their way home – at each station to participate in the survey. Although this challenge was inevitably encountered, another large problem that was unforeseen and unique to the PATH train was the high frequency with which trains arrive and depart each station. After a train leaves the station, only a 5-7 minute window is available to conduct an interview before the next one arrives. As the survey takes 4-5 minutes to complete, this created a time constraint problem for participants riding the PATH train. The only way to ensure surveys were completed in their entirety was by approaching participants that arrived at the station right after a train departs. The rarity of such an occurrence meant that many PATH train surveys were only 75% complete. It became very common for passengers to board their train before the survey was finished being conducted.

Security

A 33rd Street-Herald Square PATH station police officer politely informed one group member that a permit was needed in order to conduct the survey at the station. Without the permit, surveys were only allowed to be administered on the street level, outside the railway entrance. Another instance occurred at Penn Station for the Amtrak train line, where a group member was told by Customer Service that they must contact the station superintendent in order to get permission to conduct survey interviews.

7.2 Access to transit representatives (stakeholders)

Access to Station Workers

Station workers were reluctant to reveal any information to the group. Despite emphasizing that their name and work location would remain anonymous, station managers would not cooperate with us for an in-person interview.

7.3 Differences in data across the rail systems

FOIL Requests

The lack of information forced group members to send FOIL requests to the rail agencies. This process, however, had unforeseen communication issues between what the group asked and what representatives gave. For instance, when ridership information was asked of the LIRR spanning 10 years, the agency responded by only sending information for certain years while skipping others. The LIRR reports also lacked consistency as well, with some being very detailed and thorough and others remaining broad in their scope of information provided. With Metro North, FOIL requests asking for ridership numbers were responded to by giving

demographic information or directing our questions to the website, which lacked the information we were looking for in the first place.

8 Recommendations

For continued research of this topic, we recommend an extension of the survey to include those riders utilizing other modes of transportation as outlined in the client's original project proposal (specifically, the extensive bus and ferry systems), as well as those commuter rail users whose rail trips terminate at the "minor" nodes located outside of the Metro Core (i.e. Atlantic Terminal, Hunters Point Avenue, 125th Street, etc.) who may nevertheless continue their trips to the Metro Core via subway, bus, or ferry. Continued research in this vein would address those aspects of the transit system we were unable to study, as well as expound upon the varied methods of commuter rail travel in the greater Metro Area.

A revision of the existing survey to include these other transportation options would be necessary, and possibly even the creation of unique surveys for a) each mode of transportation, or b) geographic starting point. For future study of the commuter rail systems we looked at in this project, we recommend building off of the responses we attained to address those areas not necessarily included in our initial survey structure. For instance, approximately 70% of riders surveyed expressed overall satisfaction with their rail system; a revised survey would allow for greater explanation in this area and focus less, perhaps, on structural and organizational deficiencies.

Finally, for logistical and practical purposes, we recommend making early contact with both organizational representatives and station management to facilitate access to both key informants and transit users. Difficulties in reaching potential respondents due to time and security constraints could be avoided in the future by broadening the research tools to include focus groups, especially for PATH and Amtrak riders, who

might otherwise be difficult to engage with in the transit node environment. Organizational contacts made during this project could potentially assist in future research efforts.

Areas of Potential Interest

Three topics stood out to us as worthy of potential future studies in and of themselves, should the client choose to focus in depth on any one area. These are, specifically, the governance of shared infrastructure among the rail lines studied; the effects of fare increases on ridership across demographics; and perceptions of the Metro Region among riders of not only commuter rail, but other transportation modes, as well.

In looking at the insights gleaned from our interviews as well as the results of our survey and discourse analysis, it is clear that the cooperation, or lack thereof, between transit organizations (specifically Amtrak, the MTA, and New Jersey Transit) is a topic that is both widely complained about and yet little-understood by the average commuter. What is also apparent is that the tightly choreographed interplay between rail systems in such areas as the East River Tunnels, the shared track space at Penn Station, and the leasing of track infrastructure between Amtrak and Metro-North, has the potential to quickly and drastically reduce otherwise dependable service to a nightmare. Further research into the effectiveness of cross-organization cooperation (and a follow-up study after the completion of such projects as East Side Access and the Fulton Street Transit Center) would complement and expand upon the results obtained in this study.

An area that was touched upon in our survey which may benefit from further study is the relationship between economic demographics and access to rail service. Does the accessibility of specific rail lines vary across demographics? If fares increase, will riders pay more for the same

service, or seek out alternatives? How do more affluent riders respond to fare increases or disruptions in service compared to less affluent riders? It would do well to include more targeted demographic questions in future surveys to tackle this project, if so desired, from an economic perspective.

Lastly, the findings taken away from our question regarding the New York Metro Region reveal that, while at least half of all respondents' perceptions reflect the U.S. Office of Management and Budget's definition of what constitutes the Metropolitan Statistical Area, all respondents who chose "Other" defined it to be larger -- not smaller -- than the three map choices presented. We therefore recommend conducting future surveys in which Map C is presented as the intermediate choice, with an even larger area (stretching, perhaps, from Washington, D.C. to Boston) as the third option. Presenting respondents with this greater option may reveal a perception of the region rivalling even the larger Combined Statistical Area, with policy implications for both transit organizations and regional government agencies.

9 Conclusion

As the population of the New York metro region continues to grow, this report can serve as a reference tool and basis of understanding for academics, experts in the field, and lawmakers when making potential transportation-based decisions. The “Key Findings” section has the ability to streamline hours of work that would otherwise be spent analyzing and aggregating existing data. The “Issues and Challenges” section has the ability to eliminate obstacles that the group experienced if research is continued by another academic group or organization. Knowing the challenges that the original survey faced, the survey instrument can be shortened to take time constraints into consideration or modified to analyze strengths rather than weaknesses of existing rail lines.

Altogether, the report has met the obligations of the Client Contract by examining and analyzing the efficiency and performance of rail transportation systems at the major transit nodes. The relatively short amount of time that the group had in planning, collaborating, and revising different sections of the project did not deter the amount of work that was accomplished. In three months, the group has been able to create a report that gauges ridership efficiency, evaluates trends in ridership levels, and recommends topics to be explored for future study. Although further discussions on regional transportation issues will eventually be discussed by NYMTC and related transportation advocacy groups, the report will help the iMRC and Dr. Jen Nelles gain a better understanding of New York’s transportation networks in relation to the New York metro region.

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12 Appendices

Appendix A: Presentation of the project

Appendix B: Contract with Client

Appendix C: Key Informant Transcription

Appendix D: Online Discourse Analysis

Appendix E: Survey Instrument