NYU WAGNER rudin center for transportation policy & management

Bringing Innovation to Paratransit

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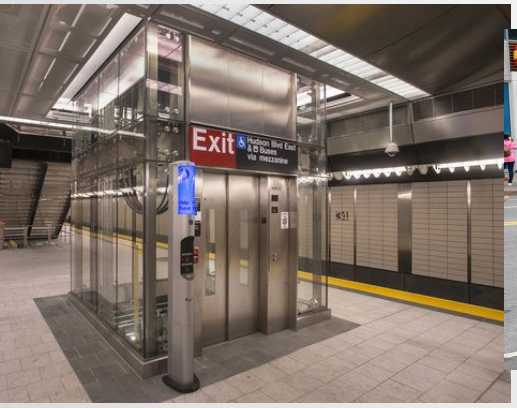
Bringing Innovation to Paratransit

Contents



Bringing Innovation to Paratransit

Executive Summary

The NYU Rudin Center for Transportation analyzed 6.3 million trips on Access-A-Ride, New York City's transportation service for people with disabilities. Approximately 150,000 people depend on Access-A-Ride (AAR), which has remained largely unchanged since 1993. The program cost New York City and State $467.7 million in 2016.

In this first-ever study of Access-A-Ride usage, the NYU Rudin Center analyzed the Metropolitan Transportation Authority's data set of all AAR trips taken in 2015. Key findings include:

Key Findings

- A total of 6,284,188 Access-A-Ride trips were recorded, each with an average duration of 45 minutes.
- In 2015, 14,092 outages occurred on subway elevators, for an average of 53 outages per elevator that year. People who use wheelchairs cannot depend on having access to the subway system. If elevators were upgraded and maintained, the city's public transportation, rather than Access-A-Ride, could be used by more passengers.
- Access-A-Ride trips starting or ending near non-ADA-accessible subway stations cost a total of $258 million in 2015. Sixteen non-accessible subway stations each has more than $2 million worth of pickups or drop-offs within a quarter-mile.
- Nearly one quarter of all Access-A-Ride trips began or ended at medical facilities in New York City. However, only 37 percent of those 1.6 million trips were rides shared among users, occupying curb space and increasing congestion near these facilities.
- Taxis were used for less than 5 percent of paratransit trips, and only one-third of those trips was shared. Access-A-Ride should better utilize yellow and green taxis and e-hail services, which are increasingly accessible, and rideshare vehicles for ambulatory disabilities to decrease waiting times and provide on-demand services.

The NYU Rudin Center for Transportation has created an interactive map for advocates, policymakers and the public to explore this previously undisclosed data. The map is available at NYURudinCenter.com.

Introduction

Bringing Innovation to Paratransit

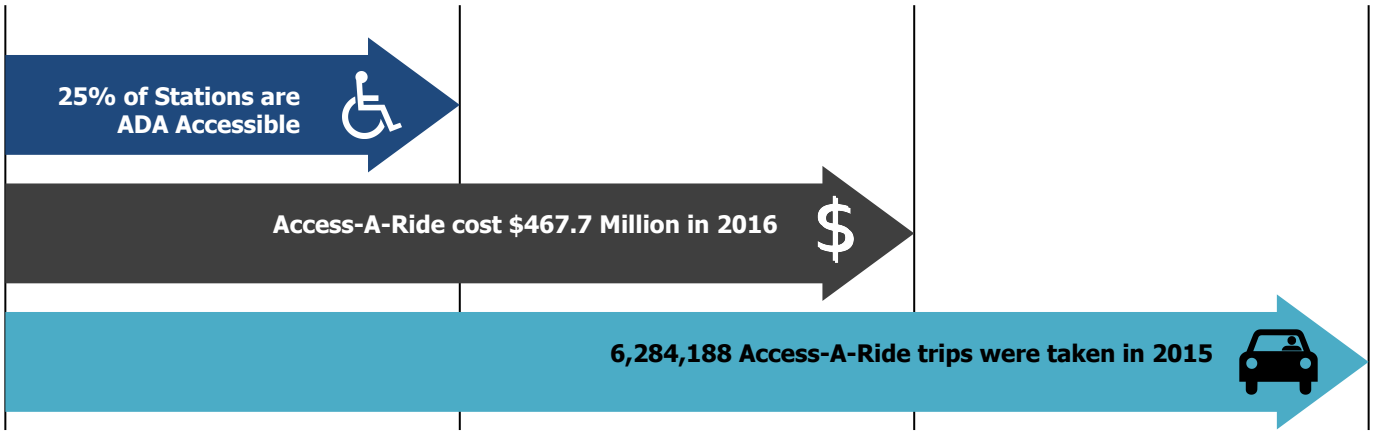
Access-A-Ride, New York City's paratransit program, provides door-to-door transportation service at the same cost as a transit ride for passengers who are unable to use the city's fixed-route buses and subways. Access-A-Ride is costly for its operator, the Metropolitan Transportation Agency (MTA): The program cost $467.7 million in 2016. AAR's high costs are due to system issues — specifically, inefficient ride matching, routing and transit feeders.

The NYU Rudin Center for Transportation conducted an in-depth analysis of the MTA's data set of all AAR trips taken in 2015. In that year, 6,284,188 trips were recorded. To date, this is the only analysis of AAR data external to the MTA.

This analysis builds upon Intelligent Paratransit, released in November 2016 by the NYU Rudin Center. In that report, 14 technology upgrades were recommended. One of those recommendations, data analysis, is at the heart of this report, and is the starting point for innovation in paratransit.

This report, Bringing Innovation to Paratransit, includes AAR usage by neighborhood, public transit accessibility needs and most commonly requested routes. The report includes recommendations to improve the paratransit program, including ride-sharing opportunities, priority subway stations for accessibility upgrades and open data for future analyses. The accompanying interactive map, located atNYURudinCenter.com, is available for the public to explore the AAR data for education and advocacy.

Bringing Innovation to Paratransit uses data to improve mobility options for the disabled in New York City, and demonstrates the power of data analysis to inform transportation planning and policy.



- Commentary by MTA NYCT Government Relations
- Although MTA NYCT has records of 6,360,165 trips for 2015, only 6,284,188 were visible in the data provided.

Key Findings From Access-A-Ride Data

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01. Access-A-Ride Activity by Location

Access-A-Ride trips show distinctive patterns of travel throughout New York City. Pickups and dropoffs, broken down by borough, indicate that passengers are using AAR to travel from the outer boroughs into Manhattan.

Access-A-Ride Activity by Borough

Borough	Pickups	Dropoffs*	Totals	Average trip duration (minutes)**
Brooklyn	2,077,700	2,042,479	4,120,179	38.40
Bronx	862,889	838,807	1,701,696	36.05
Manhattan	1,347,716	1,434,176	2,781,892	46.97
Queens	1,345,088	1,302,048	2,647,136	38.22
Staten Island	462,135	451,647	913,782	40.50
Total	**6,095,528**	**6,069,157**	**12,164,685**	

* The number of dropoffs is less than the number of pickups due to technical issues geocoding some dropoff addresses.
** Trips originating in that borough, independent of destination.

This analysis of Access-A-Ride trends documents the New York City neighborhoods that rely on the service the most. The findings within the most active neighborhoods for Access-A-Ride pickups likely indicate the characteristics of the community, including income, age and access to mass transit. In the table below, pickup locations have been organized by census tract to convey the highest-usage areas.

Key Findings From Access-A-Ride Data

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Neighborhoods with Most Access-A-Ride Activity in 2015

Rank	Neighborhood	Borough	Total Trips	Average trip Duration (min)
1	Crown Heights North	Brooklyn	230,554	34.13
2	Murray Hill-Kips Bay	Manhattan	230,063	54.34
3	East New York	Brooklyn	211,263	40.34
4	Midtown-Midtown South	Manhattan	209,643	59.20
5	DUMBO-Vinegar Hill - Downtown Brooklyn - Boerum Hill	Brooklyn	192,027	46.76
6	Lenox Hill-Roosevelt Island	Manhattan	177,091	51.05
7	Battery Park City-Lower Manhattan	Manhattan	170,308	63.42
8	Flatbush	Brooklyn	169,394	39.11
9	Prospect Lefferts Gardens-Wingate	Brooklyn	161,252	34.29
10	Hudson Yards - Chelsea - Flatiron - Union Square	Manhattan	155,099	53.30
11	Central Harlem North-Polo Grounds	Manhattan	154,955	38.09
12	East Harlem South	Manhattan	146,767	45.69
13	Canarsie	Brooklyn	141,567	40.88
14	Forest Hills	Queens	138,832	35.30
15	SoHo-TriBeCa-Civic Center-Little Italy	Manhattan	138,426	62.68
16	Stuyvesant Heights	Brooklyn	134,279	36.67
17	Brownsville	Brooklyn	129,717	37.15
18	Sheepshead Bay - Gerritsen Beach - Manhattan Beach	Brooklyn	127,022	38.21
19	Bay Ridge	Brooklyn	122,794	43.85
20	Upper West Side	Manhattan	122,604	40.67
	Average		**163,183**	**44.76**

This table indicates trips starting or ending in the neighborhood and average duration of trips originating in the neighborhood.

Key Findings From Access-A-Ride Data

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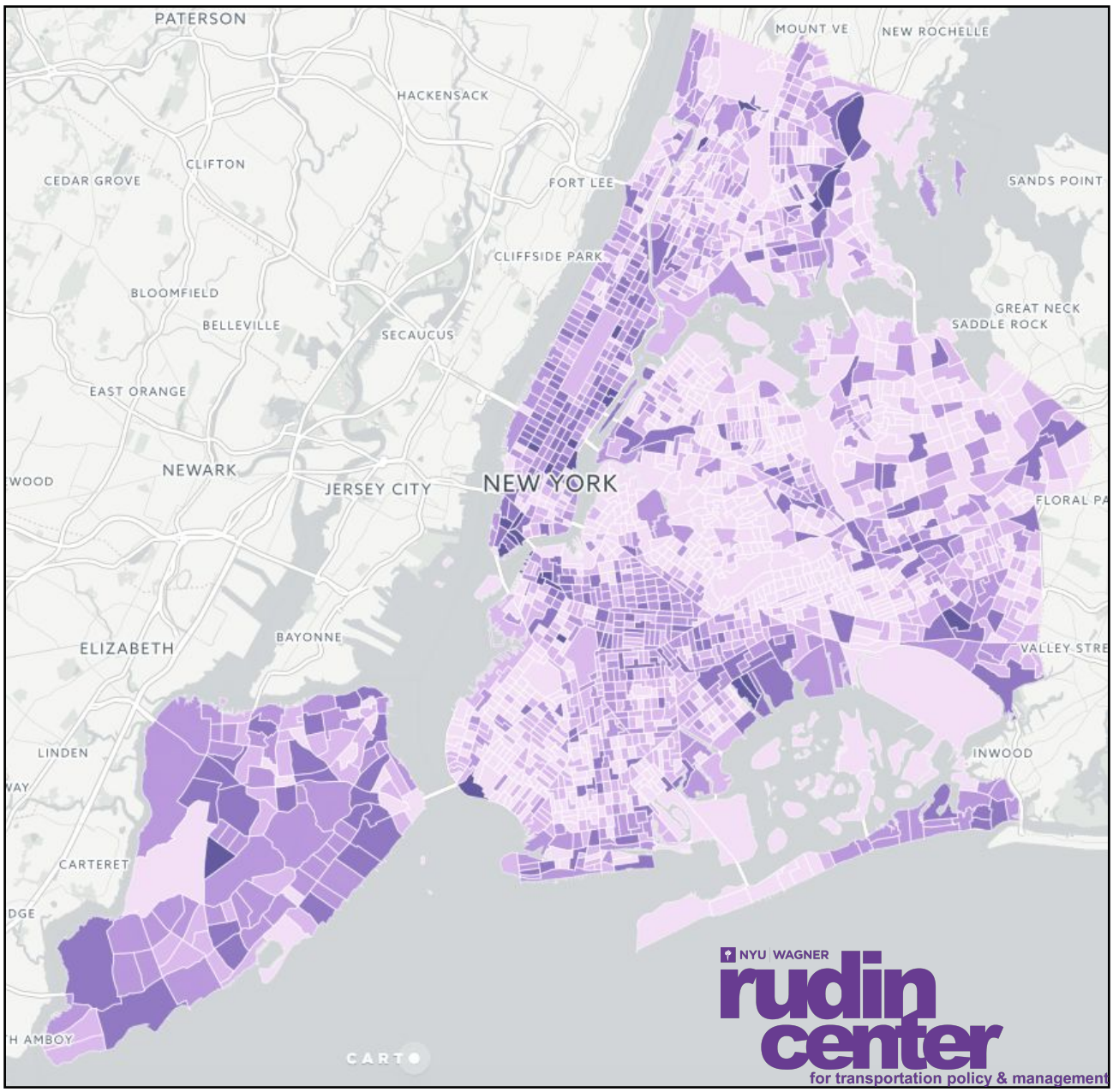
Access-A-Ride Trip Concentration by Neighborhood, 2015



Interactive map available at NYURudinCenter.com

Key Findings From Access-A-Ride Data

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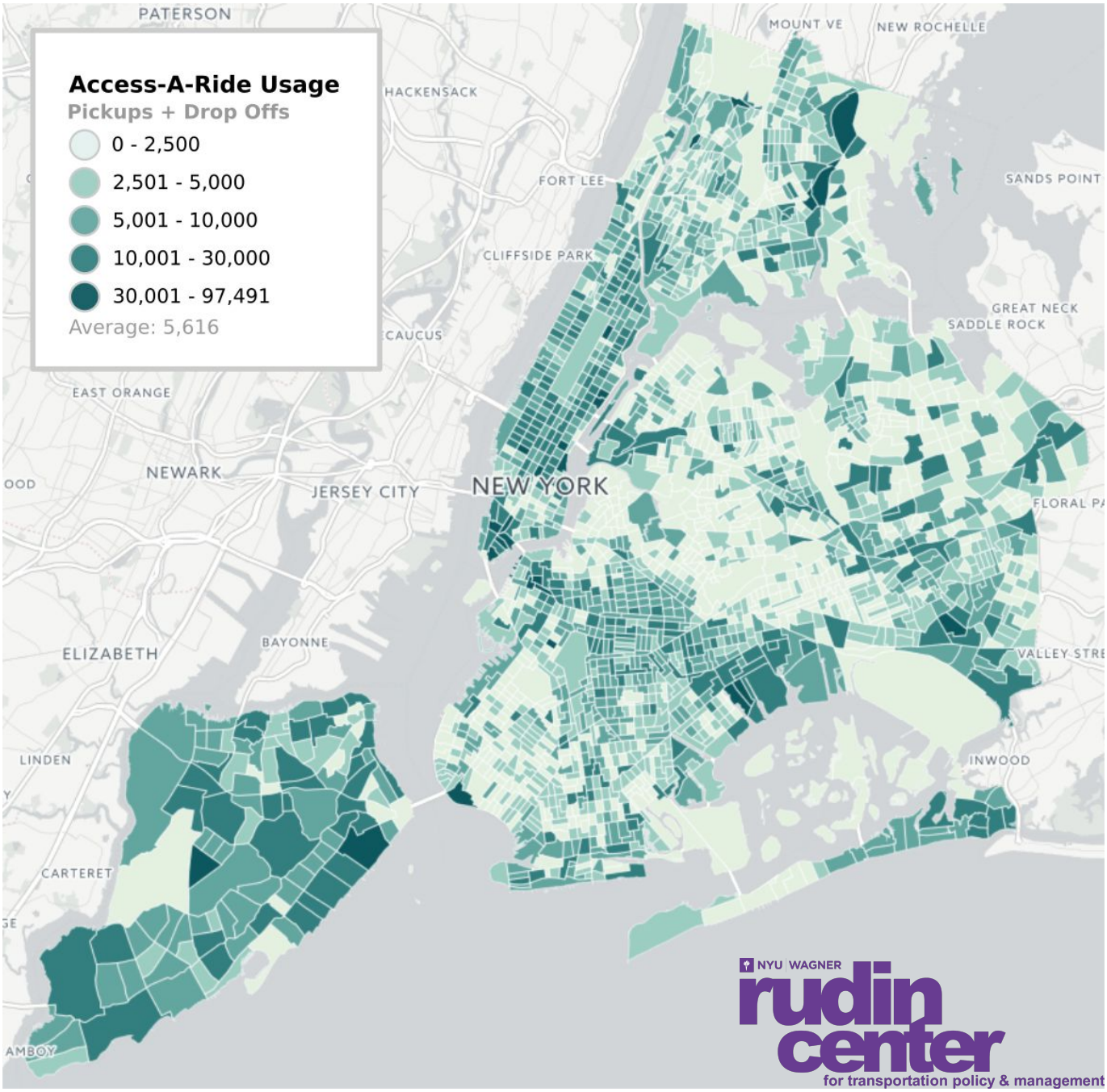
Access-A-Ride Trip Concentration by Neighborhood, 2015



Interactive map available at NYURudinCenter.com

Key Findings From Access-A-Ride Data

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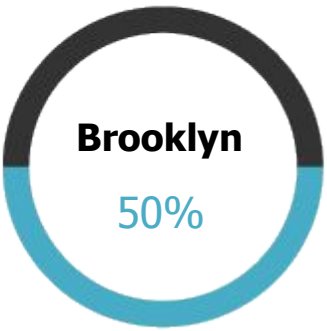
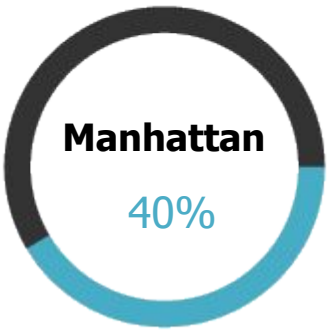
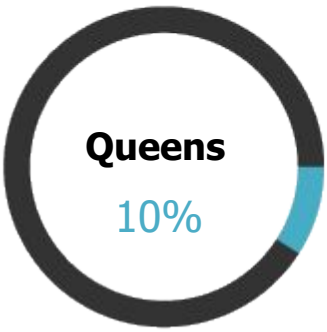
In the 20 neighborhoods with the most Access-A-Ride usage, 10 are in Brooklyn, nine are in Manhattan and one is in Queens. The discrepancy is likely related to higher population density in these boroughs, which implies a higher number of trips per census tract. In addition, the geographic proximity of origins and destinations is higher in Manhattan; the motivation to use AAR for short trips is high, because they are likely to be brief.







Variation among income levels

AAR dependence is often high in low- and middle-income neighborhoods. For example, 37,667 trips started or ended in Starrett City, Brooklyn, where the median household income is $27,649. The high usage is likely because the users cannot regularly afford taxis or private car services, and local subway service requires transfers to reach much of the city. In other cases, high AAR usage is independent of the local economy and is primarily due to the location of a hospital or health center in the neighborhood. For example, East Harlem South has a median household income of $26,136, but the local Mt. Sinai hospital is likely responsible for a large portion of the 65,700 pickups and drop-offs.

To explore Access-A-Ride use in relation to United States Census demographic makeup of all New York City neighborhoods, visit the interactive map at NYURudinCenter.com.

Key Findings From Access-A-Ride Data

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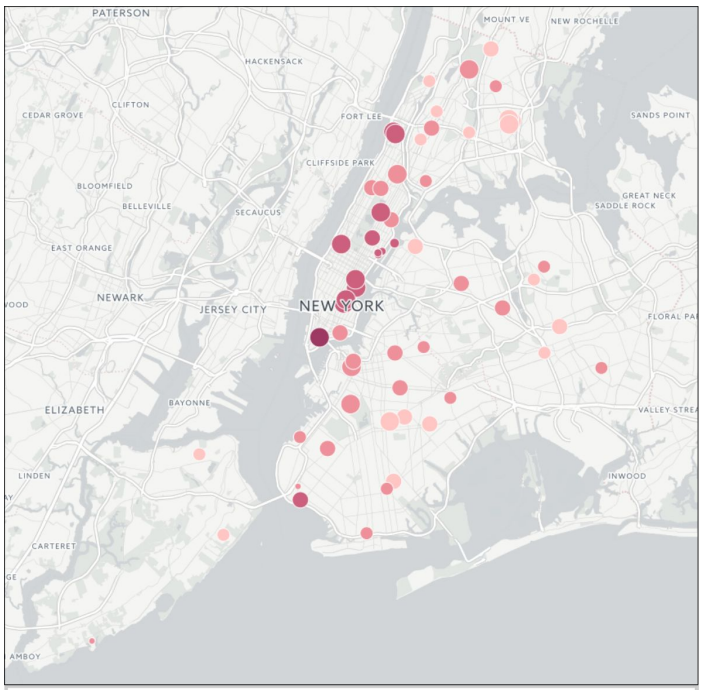
Concentrated Activity

In the census tracts where Access-A-Ride was used most, an average of 447 pickups and drop-offs took place per day, an exceedingly high number in these small geographic areas. AAR dependence relates highly to two factors in these locations: proximity to health-service centers and car ownership and driving rates. These root causes of high AAR use should be addressed to reduce dependence on the system.

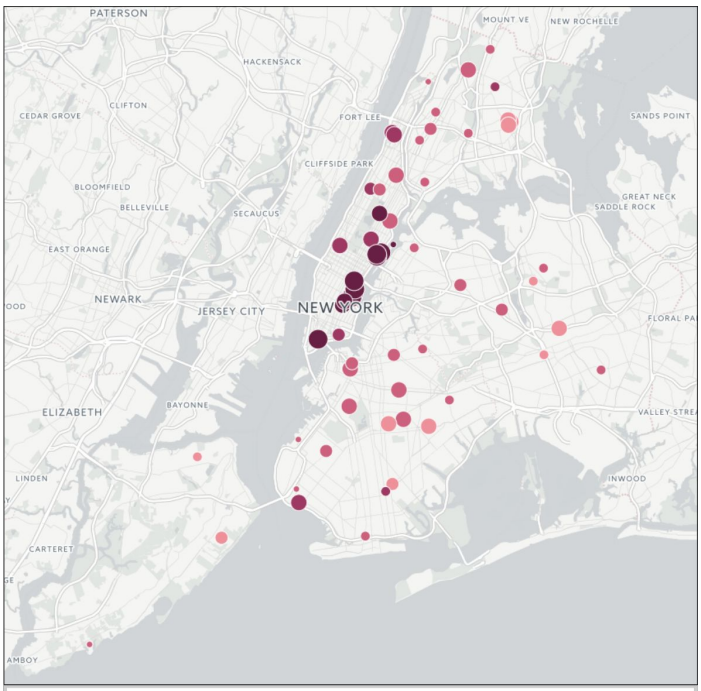


Non-Shared AAR Activity Near Health Centers

Pickups + drop offs & average trip duration within 1/4 mile of health center

0 - 30 minutes	25k - 54,265
30.1 - 40 minutes	10k - 25k
40.1 - 50 minutes	5k - 10k
50.1 - 60 minutes	2.5k - 5k
60+ minutes	0 - 2.5k

Averages: 36.2 minutes; 21,495 uses



Shared AAR Activity Near Health Centers

Pickups + drop offs & average trip duration within 1/4 mile of health center

0 - 30 minutes	25k - 43,016
30.1 - 40 minutes	10k - 25k
40.1 - 50 minutes	5k - 10k
50.1 - 60 minutes	2.5k - 5k
60.1 - 65.1 minutes	0 - 2.5k

Averages: 48.6 minutes; 12,936 uses

Nearly one-quarter of all Access-A-Ride trips began or ended at medical facilities within New York City. However, only 37 percent of those 1.6 million trips were shared, as shown in the table below. It is likely that sharing rides to and from these facilities would reduce passengers' wait times for vehicles. It would also reduce curbside congestion, enabling passengers to locate and access their vehicles more easily.

Key Findings From Access-A-Ride Data

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Access-A-Ride Activity at Medical Centers, 2015

Description	Count	Average Duration (Minutes)
Ride-Share Pickups	276,481	55.11
Ride-Share Drop offs	299,956	51.63
Total Ride-Shared Activity	**576,437**	**53.30**
Non-shared Pickups	462,816	39.77
Non-shared Drop offs	518,911	38.85
Total Non-shared Activity	**981,727**	**39.28**

In addition to orchestrating more shared rides, additional opportunities exist for MTA and medical centers to streamline paratransit activity for medical travel:

01 Designated Space

Designate two distinct curbside spaces for Access-A-Ride drop-offs and pickups. This method will ensure a flow of vehicles and simpler boarding and alighting.

02 Break Locations

Establish driver break locations in hospital and nearby parking lots. Access-A-Ride drivers take scheduled breaks after each trip or half hour of driving. By keeping drivers and vehicles close to medical facilities, pickups will be more immediate and drivers will spend less time in traffic.

03 Waiting Areas

Use nearby parking lots as driver waiting areas to limit congestion near hospitals. For example, having drivers wait for pickup in the New York City Housing Authority lots near Mt. Sinai could mitigate street congestion at the hospital.

04 Technology

Develop technology that alerts a liaison in the hospital lobby when an Access-A-Ride vehicle is approaching for a specific passenger. Although AAR systems alert passengers with phone calls when drivers are 15 minutes away, a designated hospital AAR manager would be instrumental in orchestrating pickups and drop-offs. A five-minute warning can offer adequate time for the passenger to get to the designated waiting area.

Key Findings From Access-A-Ride Data

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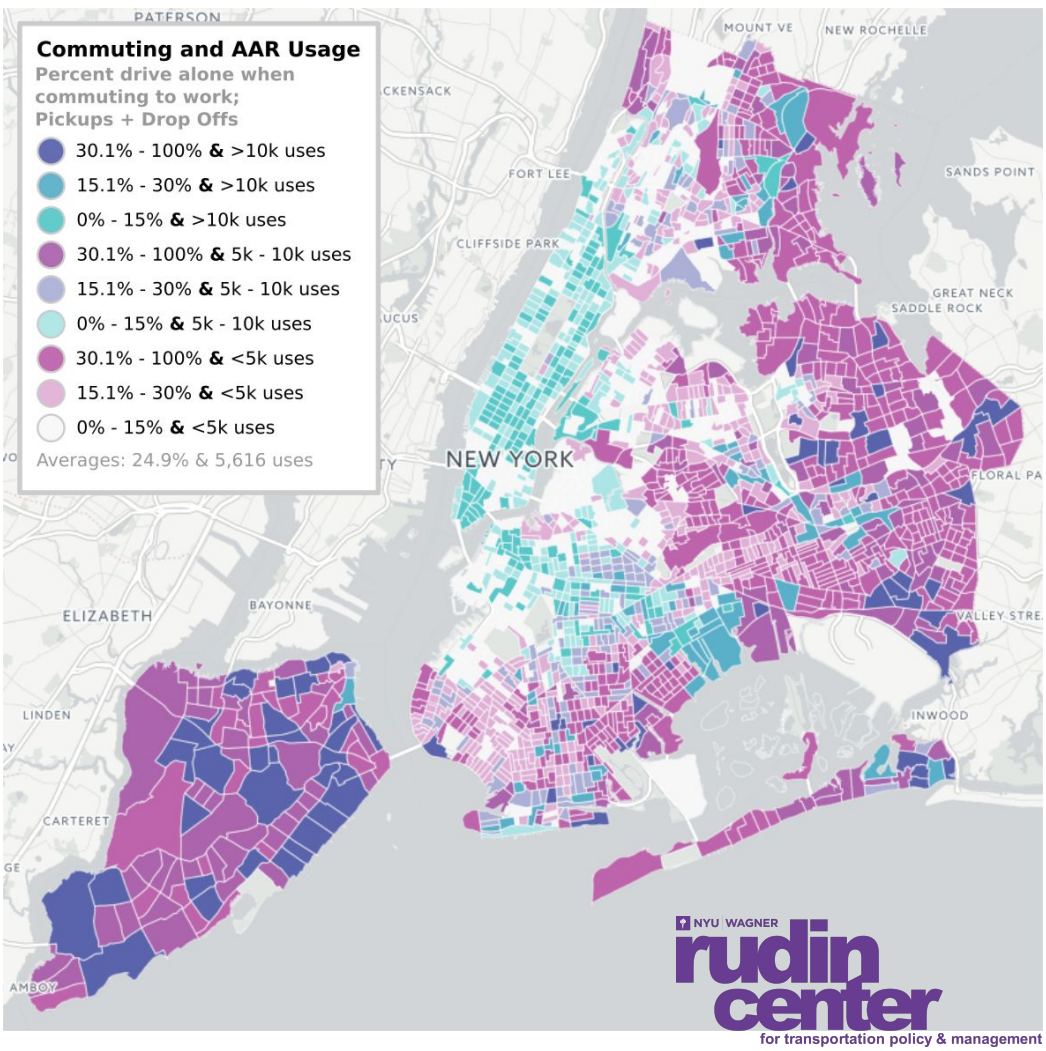
05 Shuttle Service

Provide shuttles to the nearest accessible subway stations. Most New York hospitals are not a walkable distance from the subway, and typically not near accessible subway stations. By offering transportation to accessible stations, patients who would otherwise use transit will have easier access, and the number of Access-A-Ride vehicles will be reduced.

By creatively approaching the issue of Access-A-Ride saturation near medical facilities, the service can be improved for passengers and made more efficient for the MTA.

Area Driving Rates and Access-A-Ride Usage, 2015



Key Findings From Access-A-Ride Data

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In 26 neighborhoods, a high use of AAR coincides with a high rate of commuting alone by car. The top 10 of these neighborhoods (in rates of commuting alone by car) are located in Queens and Staten Island, where transit access is limited, or perceived as limited. Were accessible rapid transit more readily available in these areas, the population would likely rely less on paratransit.

Top Ten Neighborhoods for Car Commuting Rates and AAR Use

Neighborhood	Borough	% Drive Alone When Commuting to Work	Total AAR Pickups & Dropoffs
Annadale - Huguenot - Prince's Bay-Eltingville	Staten Island	69.6	16,234
Grasmere - Arrochar - Ft. Wadsworth	Staten Island	63.8	12,701
Glen Oaks - Floral Park - New Hyde Park	Queens	63.4	22,098
Charleston - Richmond Valley - Tottenville	Staten Island	62.6	12,931
New Springville - Bloomfield - Travis South	Staten Island	62.5	22,660
New Springville - Bloomfield - Travis	Staten Island	62.0	16,896
Ft. Totten - Bay Terrace - Clearview	Queens	61.1	16,471
Todt Hill - Emerson Hill - Heartland Village - Lighthouse Hill	Staten Island	60.6	35,872
New Springville - Bloomfield - Travis West	Staten Island	59.7	19,700
Oakwood - Oakwood Beach	Staten Island	58.8	14,103
Average		**62.4**	**18,967**

These neighborhoods dominated by car travel also host an average of 52 Access-A-Ride trips every day. Making subway and/or express-bus service more available would help these neighborhoods reduce their dependence on both cars and Access-A-Ride.

Analyzing Accessible Transit

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Wheelchair Accessibility at Subway Stations

Only 117 of 472 subway stations are wheelchair-accessible, with elevator access to the mezzanine and platforms. This proportion is particularly low when compared to Chicago, where 69 percent of stations are accessible, and Boston, where 71 percent of stations are accessible. If the MTA increased elevator installations in subway stations, dependence on Access-A-Ride would be reduced, and user options would vastly improve.

Boston	Chicago	New York
71%	69%	25%

In addition to being sparse, elevators in subway stations do not adequately meet rider needs.

In addition to being sparse, elevators in subway stations do not adequately meet rider needs: Elevators and escalators are often out of service. There were nearly 40,000 subway elevator and escalator outage events in 2015, based on the MTA's elevator outage reporting feed. These outages often occur unexpectedly (as opposed to planned maintenance), resulting in a lack of reliable travel options for passengers. Although escalator outages occur for cleaning, planned reversals and preventive maintenance approximately 70 percent of the time, elevator outages are far less predictable. Passengers attempting to exit a subway station often learn of a non-working elevator upon arriving at the station, requiring them to ride the train several stations away from their destination to reach a working elevator.

In a 2017 Transit Center report on this subject, *Access Denied*, the authors found that the MTA reported in the fourth quarter of 2016 that subway elevators operated correctly 95.7 percent of the time. This uptime is on a downward trend: It is a decrease of 1 percent from the previous year and 2 percent since 2010.

In contrast, Boston's MBTA system has been reporting 99.5 percent uptime since 2008. Chicago's Transit Authority has committed to 100 percent station accessibility in the next 20 years.

- For this analysis, an outage is a separate report from the MTA Elevator and Escalator feed indicating an outage; this includes new outages. Every day of the same outage is considered a distinct outage.

Analyzing Accessible Transit

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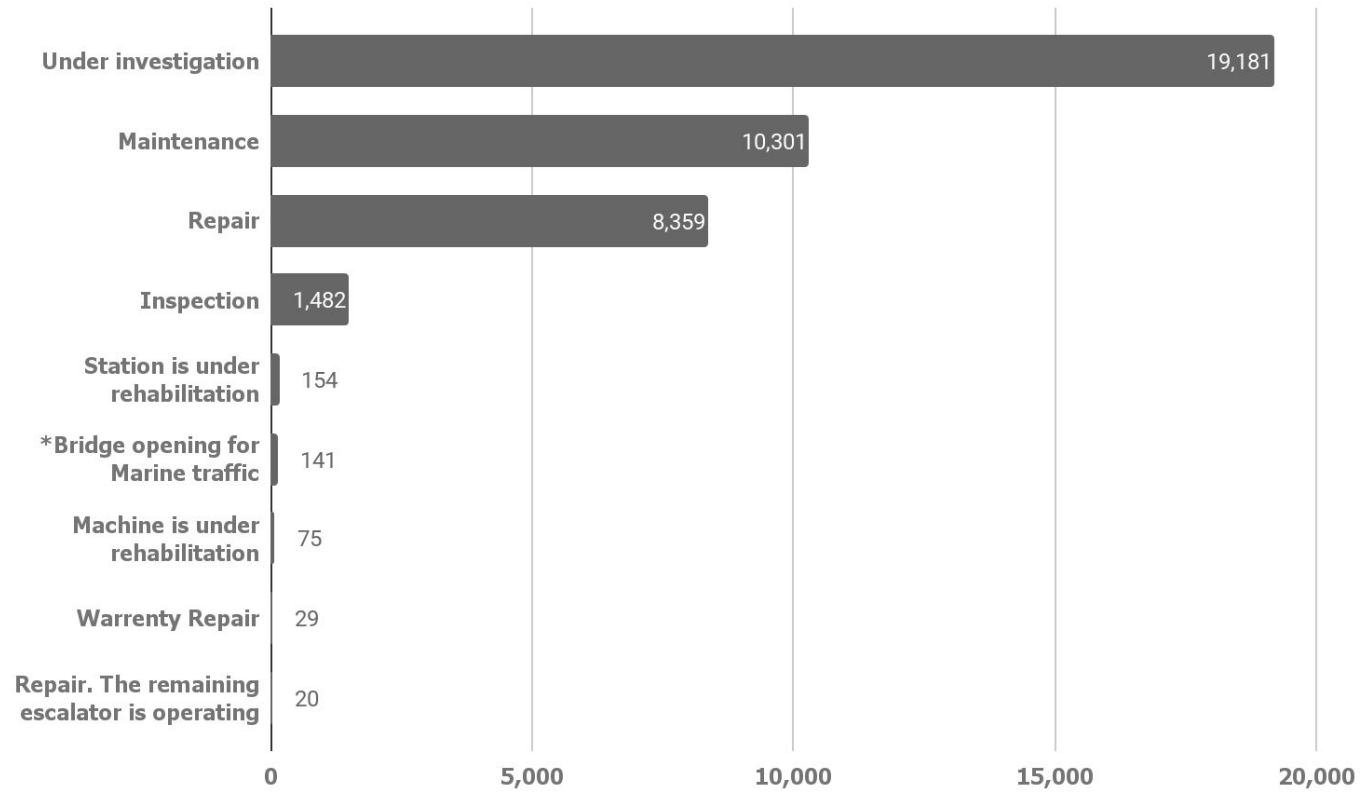
Boston and Chicago have similarly aging infrastructure as New York, and large systems that present significant challenges for station accessibility. However, those systems' progress is enviable and should serve as models for New York. At this stage, people who use wheelchairs cannot depend on the New York City subway system.

The NYU Rudin Center for Transportation evaluated subway elevator and escalator outages for the year 2015, the same year as this report's Access-A-Ride data. The MTA reported 39,742 subway equipment outages, according to its data feeds. Of the reported outages, only 1,183, or 2.9 percent, were planned. The most common reasons for outages were equipment investigation, maintenance and repair. However, uptime of existing systems is essential to having an accessible subway.

2015 | **Reasons Cited by MTA for Equipment Outages**



Data source: MTA elevator/escalator alert feed
*at Rockaway Park Beach 116 St

Outages of both elevators and escalators are concentrated in particular stations, as shown in the table below:

Subway Stations with Most Reported Equipment Outages, 2015

STATION	BOROUGH	NEIGHBORHOOD	ANNUAL RIDERSHIP	# of OUTAGES
Lexington Ave - 59th St / Lexington Ave 63rd St Station	Manhattan	Lenox Hill	21,407,792	2,375
34th St - Herald Sq Station	Manhattan	Chelsea	39,541,865	2,335
42nd St - Grand Central Station	Manhattan	Midtown	46,737,564	2,219
Jay St - Metrotech	Brooklyn	Downtown Brooklyn	12,765,132	1,744
Lexington Ave - 53 St / 51 St	Manhattan	Midtown East	66,359,208	1,487
Fulton St Station	Manhattan	Lower Manhattan	21,671,684	1,194
Bowling Green	Manhattan	Lower Manhattan	9,153,462	1,144
Jamaica Center Parsons/Archer	Queens	Jamaica	12,622,977	1,100
Jackson Hts - Roosevelt Ave Station	Queens	Jackson Heights	17,224,537	924
181 Street	Manhattan	Washington Heights	3,628,174	848

It is possible that these stations experienced high numbers of equipment outages due to high ridership numbers causing wear on the infrastructure.

The 265 subway elevators were reported out of service 14,092 times, for an average of 53.2 outages per elevator in 2015. The stations with the most elevator outages experienced up to 755 outages. In some stations, such as 168th Street, the elevator is the primary method of reaching the platform for all passengers, not only those who are disabled. The stations with the most outages are shown in the table below and the map that follows.

Subway Stations with Most Reported Elevator Outages, 2015

STATION	# of ELEVATOR OUTAGES	BOROUGH	NEIGHBORHOOD	ANNUAL RIDERSHIP	# of ELEVATORS
168th Street - Bway- Washington Hgts	755	Manhattan	Washington Heights	8,009,233	7
Fulton St Station	511	Manhattan	Lower Manhattan	21,671,684	13
181 Street - St. Nicholas	417	Manhattan	Washington Heights	3,779,275	7
190th St Station	404	Manhattan	Washington Heights	1,530,460	3
59th St - Columbus Circle	402	Manhattan	Midtown West	23,299,666	5
181 Street	394	Manhattan	Washington Heights	3,628,174	3
Atlantic Av-Barclays Ctr	394	Brooklyn	Downtown Brooklyn	13,690,678	10
14th St - Union Sq Station	388	Manhattan	East Village	35,320,623	7
42nd St - Grand Central Station	384	Manhattan	Midtown	46,737,564	4
161 St - Yankee Stadium Station	344	Bronx	Grand Concourse/Yankee Stadium	8,922,188	5

- Note: MTA New York City Transit has commented that there were 13,066 elevator outages during 2015. The NYU Rudin Center based its finding of 14,092 outages on public alerts issued by the MTA. The discrepancy may be due to certain outages straddling midnight, which the Rudin Center considers two outages based on the multiday effects.

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Subway Stations with Most Reported Elevator Outages, 2015

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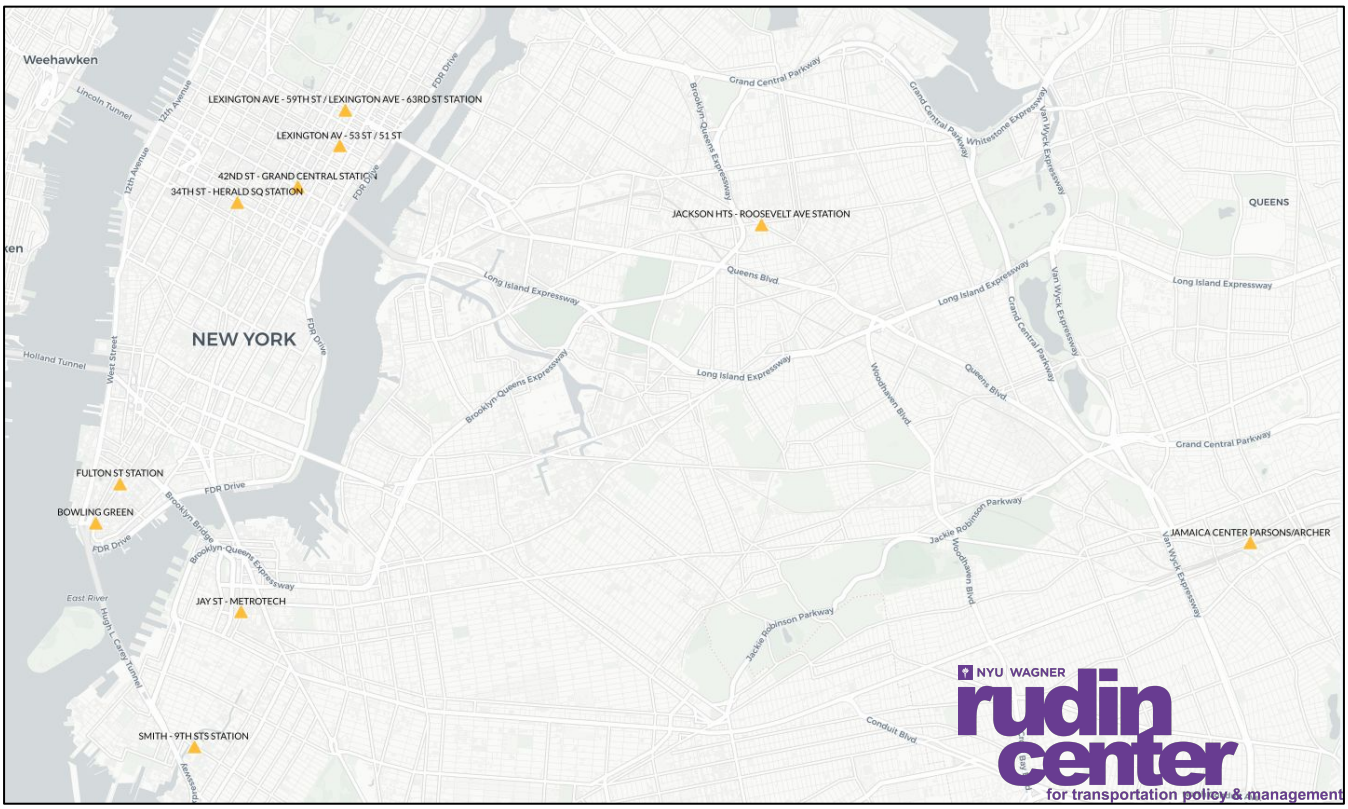
Escalators serve all riders, including those with ambulatory disabilities. Like elevators, escalators have frequent outages: In 2015, there were 25,133 outages from 231 distinct escalators, for an average of 108.8 outages per escalator. The stations with the most escalator outages in 2015 are shown in the table below and map that follows.

Subway Stations with Most Reported Escalator Outages, 2015

STATION	# of ESCALATOR OUTAGES	BOROUGH	NEIGHBORHOOD	ANNUAL RIDERSHIP	# of ESCALATORS
Lexington Ave - 59th St / Lexington Ave - 63rd St Station	2,149	Manhattan	Lenox Hill	21,407,792	17
34th St - Herald Sq Station	2,074	Manhattan	Chelsea	39,541,865	12
42nd St - Grand Central Station	1,835	Manhattan	Midtown	46,737,564	13
Jay St - Metrotech	1,508	Brooklyn	Downtown Brooklyn	12,765,132	7
Lexington Av - 53 St / 51 St	1,208	Manhattan	Midtown East	66,359,208	10
Bowling Green	955	Manhattan	Lower Manhattan	9,153,462	9
Jamaica Center Parsons/Archer	932	Queens	Jamaica	12,622,977	10
Smith - 9th Sts Station	694	Brooklyn	Red Hook	1,636,221	6
Fulton St Station	683	Manhattan	Lower Manhattan	21,671,684	12
Jackson Hts - Roosevelt Ave Station	649	Queens	Jackson Heights	17,224,537	5

Subway Stations with Most Reported Escalator Outages, 2015



If subway elevators and escalators were more reliable, fewer New Yorkers would depend on Access-A-Ride. The resulting fewer paratransit trips would reduce program costs and provide faster service to riders.

The cost of Access-A-Ride trips near non-accessible subway stations is enormous, averaging $680,562 per year per station. More than 29 percent of trips (3,684,757) in 2015 originated or ended within a quarter mile of a non-accessible subway station, costing the MTA a total of $257,932,990. As shown in the map on the following page, 16 noncompliant subway stations each had more than $2 million worth of pickups or drop-offs within a quarter-mile for 2015. Despite the expected $40 million capital cost per subway station, installing elevators would present long-term savings to far outweigh the capital costs. However, those elevators must be maintained at a reliable level.

- $40 million is the average expected investment per station for elevator construction, including $13 million per subway elevator and $7.5 million per elevated or at-grade station elevator. MTA Capital Plan 2015–2019 Amendment, http://web.mta.info/mta/news/books/docs/2015-19%20Capital%20Program%20Amendment%20-%20May%202017.pdf

Analyzing Accessible Transit

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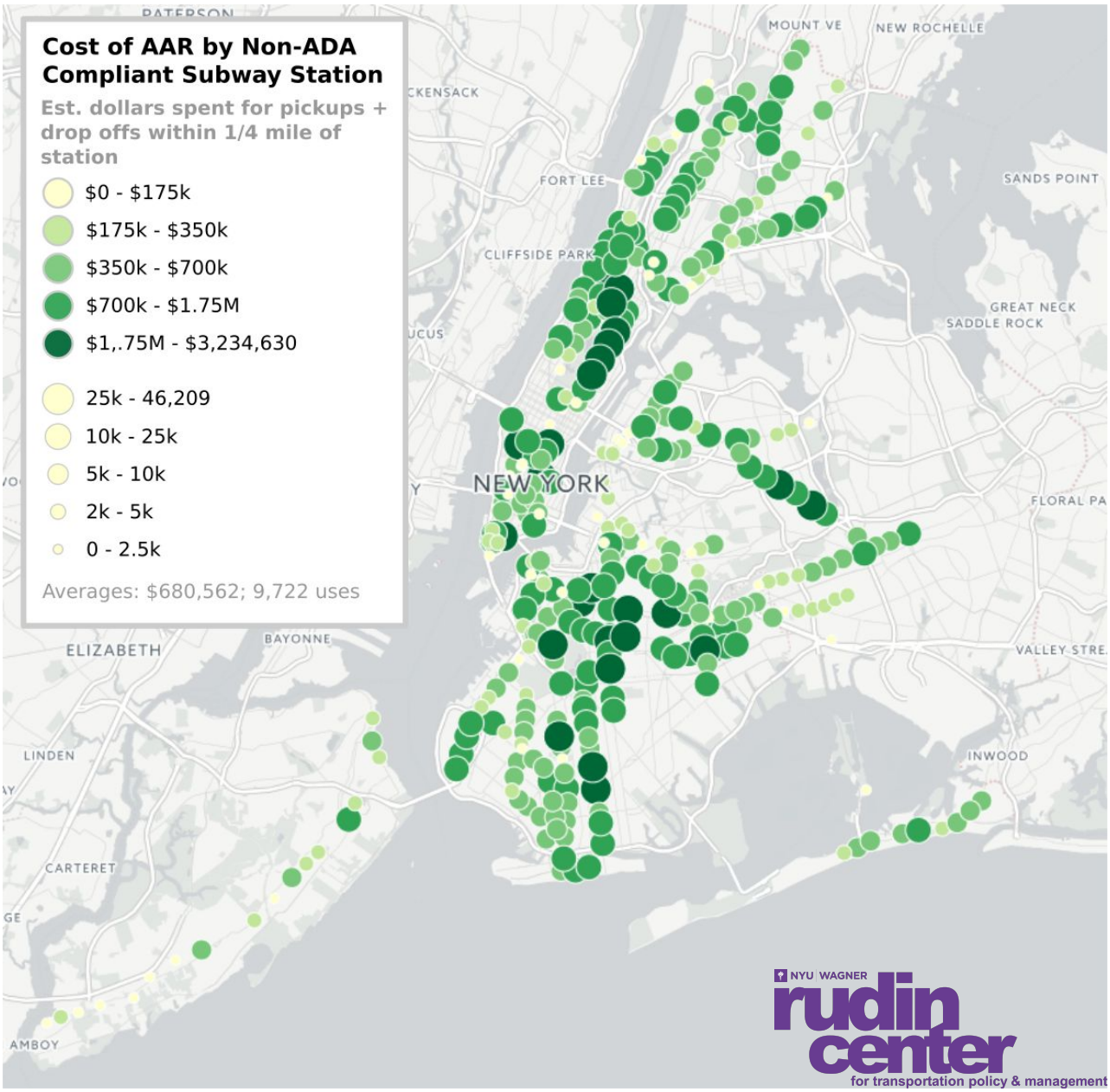
Cost of Access-A-Ride Activity Within 1/4 Mile of Non-ADA Compliant Subway Stations, 2015



The stations in the table below, indicating the most trips within one quarter mile and the high costs associated with this service, should be prioritized for accessibility buildouts.

Non-ADA-Compliant Stations with Highest Total Cost of Nearby AAR Trips, 2015

Subway Station Name	Routes	Total Cost of AAR Trips within ¼ mile, 2015*
7th Avenue - Park Slope	F, G	$3,234,630
86th Street	4, 5, 6, 6X	$3,161,200
3rd Avenue - 14 Street	L	$3,036,180
125 Street	2, 3	$2,689,260
77th Street	4, 6, 6X	$2,638,440
18 Avenue - Culver	F	$2,451,400
103rd Street	4, 6, 6X	$2,441,810
33rd Street	4, 6, 6X	$2,332,960
116 Street	2, 3	$2,307,690
Avenue M	B, Q	$2,242,660
Kingston - Throop Ave	A, C	$2,190,720
71 Av - Continental Ave	E, F, M, R	$2,182,670
96th Street	4, 6, 6X	$2,164,820
23rd Street	A, C, E	$2,078,370
63rd Drive - Rego Park	E, M, R	$2,015,790
TOTAL		**$37,168,600**

* Based on estimate of $70 per Access-A-Ride trip

Analyzing Accessible Transit

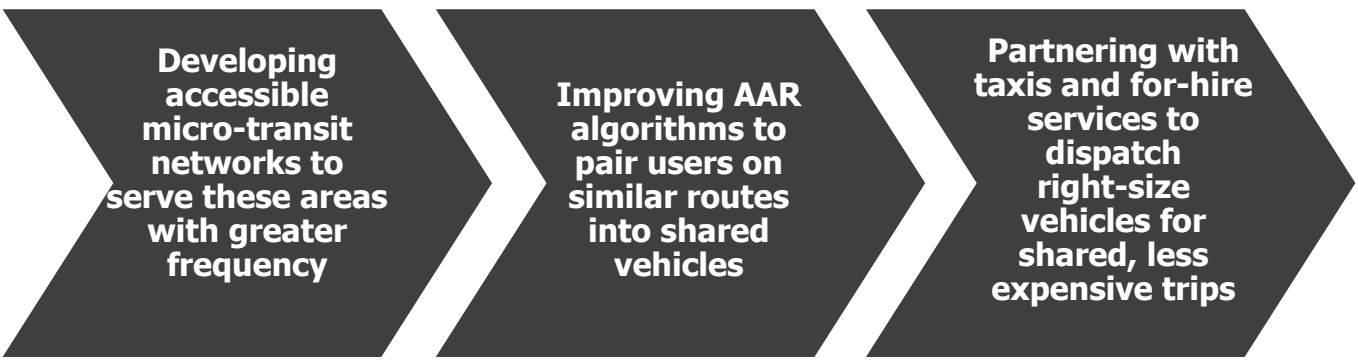
Bringing Innovation to Paratransit

The 20 most requested Access-A-Ride routes generated 21,418 trips that originated in 11 neighborhoods. Eight of the most requested routes started in Co-op City, with a relatively brief average trip length of 17.8 minutes, as shown in the table below. This pattern indicates inadequate accessible transit in these areas, and a potential for shared rides.

Originating Neighborhoods for Top-Requested Access-A-Ride Routes, 2015

Neighborhood	Borough	AAR Trips Originating	Average Trip Duration
Co-op City	Bronx	10,075	17.8
Van Nest-Morris Park-Westchester Square	Bronx	2,680	22.5
Flatbush	Brooklyn	1,642	46.7
Pelham Parkway	Bronx	1,476	17.2
Port Richmond	Staten Island	1,196	28.2
West New Brighton-New Brighton-St. George	Staten Island	1,089	25.0
Rugby-Remsen Village	Brooklyn	876	47.1
Starrett City	Brooklyn	836	44.5
Flatlands	Brooklyn	816	32.6
DUMBO-Vinegar Hill-Downtown Brooklyn-Boerum Hill	Brooklyn	732	48.0

Although AAR trips are concentrated in these neighborhoods, the proportion of shared routes (32 percent) is small. Excessive trips to these neighborhoods could be reduced by:



Recommendations

Bringing Innovation to Paratransit

With more than 17,000 trips every day at $70 per trip, paratransit is overly expensive to New York City and the Metropolitan Transportation Authority. Significant innovation will make paratransit more efficient and less costly. The NYU Rudin Center for Transportation recommends improvements to mobility services for the disabled in New York City, based on the findings in this analysis.

Several of the recommendations focus on improving accessibility of public transit. By making transit more accessible, the MTA will reduce reliance on Access-A-Ride, making the city more available to more people.

01 Elevators must be installed at key subway stations

The cost of installation is far less than that of providing trips near non-accessible stations indefinitely. Priority stations include Smith-9th Street, the highest subway station in the city, and key subway stations near hospitals, including:

- 7th Avenue in Brooklyn (near Methodist Hospital)
- 77th Street in Manhattan (near Lenox Hill Hospital)
- Westchester Square in the Bronx (near Montefiore Medical Center, Cavalry Hospital and Albert Einstein College of Medicine).

As recommended by the New York City Mayor's Office for People with Disabilities, subway elevator installations can be used as developer incentives for increased square footage. This method is already underway in Midtown East and should be expanded

02 Innovate subway elevator maintenance and notification processes

Because subway elevator outages are not known or publicized until discovered by an unwitting passenger, the process must be improved. Subway elevators should be fitted with advanced sensors and networked so that upon malfunction, they will:

- Notify elevator repair personnel immediately of specific malfunction
- Automatically populate elevator outage data feeds and in-train announcements and digital signage to notify passengers; they will better be able to re-route as needed

03 Create dynamic bus services in areas with high Access-A-Ride usage

Locations like Co-op City, with disproportionately high numbers of paratransit trips, should be considered for new, dynamic bus services. These services would require smaller, accessible public transport vehicles and would travel the most-requested paratransit routes, on demand. A dynamic bus system would reduce vehicle usage in the city, increase efficiency of accessible trips, and limit short-but-costly paratransit rides.

Recommendations

Bringing Innovation
to Paratransit

04 Develop robust ridesharing mechanisms for accessible trips

Only 32 percent of paratransit trips were shared in 2015, but many origins and destinations were similar.

- Paratransit ride-sharing should tap into algorithms from private companies, like Via, to streamline trips.
- Trips to and from health centers, composing millions of paratransit trips, should be shared where available. In addition, paratransit pickup and dropoff zones should be designated at all health facilities and coordinated with in-lobby announcements.

05 Paratransit customers should be matched to right-size vehicles from a variety of modes

Paratransit trips can be served by taxis and for-hire vehicles, which are already distributed throughout New York City, and could reach customers quickly. Only five percent of Access-A-Ride trips were served by taxis in 2015. With half of all yellow taxis becoming accessible in the coming years, and heightened accessibility requirements for private car services forthcoming, these services should be used more frequently for on-demand accessible trips.

On-demand vehicles, including paratransit, taxis and for-hire vehicles, should provide last-mile solutions to complement accessible transit. They can serve as shared trips from health centers to accessible stations, or from specific neighborhoods to transit hubs, like Atlantic Avenue-Barclays Center.

06 Release Access-A-Ride data for public analysis

By sharing anonymized trip data with the public, users can help to understand how paratransit works both within their communities and in the city as a whole. Frequent Access-A-Ride destinations like hospitals and government offices can better understand how to streamline their visitors' timing, curb space usage and shared trips.

07 Expand ongoing pilot programs

Ongoing pilot programs, including Accessible Dispatch from the Taxi and Limousine Commission and MTA partnerships with Uber and Lyft, should be continued and expanded. These services have already improved the experiences of participants and have the potential to overcome barriers of trip tracking and timely ride hails.

By organizing transit to be more accessible and Access-A-Ride to be more efficient, New York City will become vastly more available to New Yorkers with disabilities.

Report Methodology

Bringing Innovation
to Paratransit

The NYU Rudin Center for Transportation acquired all Access-A-Ride trip data directly from the Metropolitan Transportation Authority via CD-ROM in April 2016. The data was provided for academic research, with the agreement that all addresses would be masked.

The MTA provided the NYU Rudin Center with data regarding all Access-A-Ride trips taken in 2015. Data was geocoded and quantified by JD Godchaux and Lela Prashad of NiJeL.

This dataset contained data on 6,248,188 trips, including addresses for the pickup and drop-off locations. These locations were geocoded using the NYC Geoclient API. 204,008 records successfully geocoded the pickup location but not the drop-off location, and 178,345 records successfully geocoded the drop-off location but not the pickup location. 5,894,415 records successfully geocoded both pickup and drop-off locations.

This geocoded dataset was loaded into a PostgreSQL/PostGIS database. Other datasets loaded into PostgreSQL include:

- Subway stations from the Center for Urban Research at the Graduate Center/CUNY
- Demographic information from U.S. Census Bureau's 2015 five-year American Community Survey (ACS)
- Health centers in New York City provided by the Center for Independence of the Disabled, NY.

Calculating the cost of Paratransit service to and from nearby non-ADA-compliant subway stations

Using the ST_DWithin PostGIS function, the number of pickups and drop-offs within a quarter mile of at least one non-ADA-accessible subway station was calculated. A distance selection ensured that each pickup and drop-off location was not counted more than once. Accounting for nearby ADA-accessible subway stations also within a quarter mile ensured that pickup and drop-off locations were not mistakenly counted. The total cost of paratransit service near non-ADA-compliant subway stations was calculated assuming each trip cost $70.

Demographic analysis

Using the ST_Within PostGIS function, the locations of pickups and drop-offs were aggregated to U.S. Census tracts, zip-code tabulation areas (ZCTA) and New York City borough boundaries. Average trip duration was also calculated for pickups that originate in a tract, ZCTA or borough. Two variable choropleth maps were created with median household income (DP03), the percentage of people who speak English less than "very well" (DP02) and the percentage of people who drove alone to work (DP03), from the 2015 ACS tables, *Selected Social Characteristics in the United States*.

Health center analysis

Using the ST_DWithin PostGIS function, the number of shared and non-shared pickups and drop-offs within a quarter mile of at least one major health center was calculated. A distance selection ensured that each pickup and drop-off location was not counted more than once.

Additional research for this study was conducted by Ashley Smith and David Morse. Editing by Marla Garfield. Preliminary data cleansing by Danny Sheehan of Carto.

About the Rudin Center for Transportation

The Rudin Center for Transportation Policy and Management at NYU's Wagner school explores challenges in transportation and infrastructure. The Center draws upon faculty and graduate students to conduct research on cities and mobility, information technology in transportation and access to mass transit.

We have built a Mobility Factbook exploring the 27 modes of transportation in New York City, and issue reports on social media in transit, the future of taxis and the Citi Bike system.

The Rudin Center was named in recognition of a gift from Lewis Rudin and receives support from leading firms in transportation, finance, and communications. The director of the Center is Mitchell L. Moss, Henry Hart Rice Professor of Urban Policy and Planning.

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