

University
Transportation
Research Center

Mobility Trends in New York City During COVID-19 Pandemic:

Analyses of transportation modes throughout March 2020

About the University Transportation Research Center

The University Transportation Research Center (UTRC) is one of ten original University Transportation Centers established in 1987 by the U.S. Congress. These Centers were established with the recognition that transportation plays a key role in the nation's economy and the quality of life of its citizens. University faculty members provide a critical link in resolving our national and regional transportation problems while training the professionals who address our transportation systems and their customers on a daily basis.

UTRC was established in order to support research, education and the transfer of technology in the field of transportation. The theme of the Center is "Planning and Managing Regional Transportation Systems in a Changing World." Presently, under the direction of Dr. Camille Kamga, UTRC is functioning as a consortium of eighteen major Universities throughout New York, New Jersey, and Puerto Rico. UTRC is located at the CUNY Institute for Transportation Systems at The City College of New York, the lead institution of the consortium.

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Americans became aware of the first reported case of COVID-19 in the US on January 21, 2020¹, which occurred in the State of Washington. The first case of the virus was confirmed in the State of New York in New York City on March 1 and panic buying for food and household products was reported. Governor Andrew Cuomo declared a state of emergency in New York State on March 7th, 2020. A second case in the State was announced on March 10, which was the first known case in the State to be caused through community spread. The individual was a New Rochelle resident in Westchester County located just north of the Bronx, who worked in New York City and commuted by Metro-North Railroad.

On March 10, Governor Cuomo, in collaboration with local and county officials, announced the creation of a containment zone surrounding a one-mile radius that centered on the synagogue in New Rochelle where the first known case had attended several large gatherings. This zone required any facilities where large gatherings occur (houses of worships, schools, community centers) within the zone to close immediately. On March 11th, Governor Cuomo announced the closing of the City University of New York and State University of New York starting on March 12th. On March 16, he issued an executive order to close all public and private schools throughout the State, initially ordered to last until April 1 but which was later extended. On March 22nd, the New York State stay-at-home order took effect.

The aggressive actions taken by the state and city governments and businesses in order to slow the spread of the coronavirus are reflected by the performance of the transportation system in New York City. Steep changes in the mobility indicators have been observed as non-essential workers were ordered to remain in their homes and to travel only when essential (summarized in the table below).

This report presents preliminary analyses of transportation-related data publicly available as of March 31, 2020 for New York City transportation systems. This report will be regularly updated as data will become available.

Summary of Transportation Trends across Modes in NYC

Mode	Percent Change in mid-March
Subway	(-)60% ridership
Bus	(-)50% ridership
Metro North	(-)90% ridership
LIRR	(-)67% ridership
PATH	(-)97% ridership (includes whole of March 2020)
Traffic	+40-55% average speed; (-)35-43% volume
Bike	+67% (March 11), significant (-) later
Taxi	(-)91% trips

¹ www.cdc.gov/media/releases/2020/p0121-novel-coronavirus-travel-case.html

New Yorker's Interest on the Novel Coronavirus

During unexpected events, travelers want to know more about what's going on and be informed about their transportation services. The curiosity and awareness of travelers about coronavirus and transportation services has been examined with multiple keywords like "corona virus", "covid19", "New York City + corona virus" using Google Trends, acquired from different Google portals like Web, News, Images, Froogle, and YouTube. At the beginning of this year, as outbreak of the novel COVID-19 outside of the United States was reported, New Yorkers started to increasingly show interest about the coronavirus days after the first case of COVID-19 in the United States was confirmed on January 21, 2020. As illustrated on Figure 1, New Yorkers' curiosity about the coronavirus increased over time as the number of confirmed cases in the country increased. This peaks a few days after the first case in NYC was confirmed on March 1, 2020.

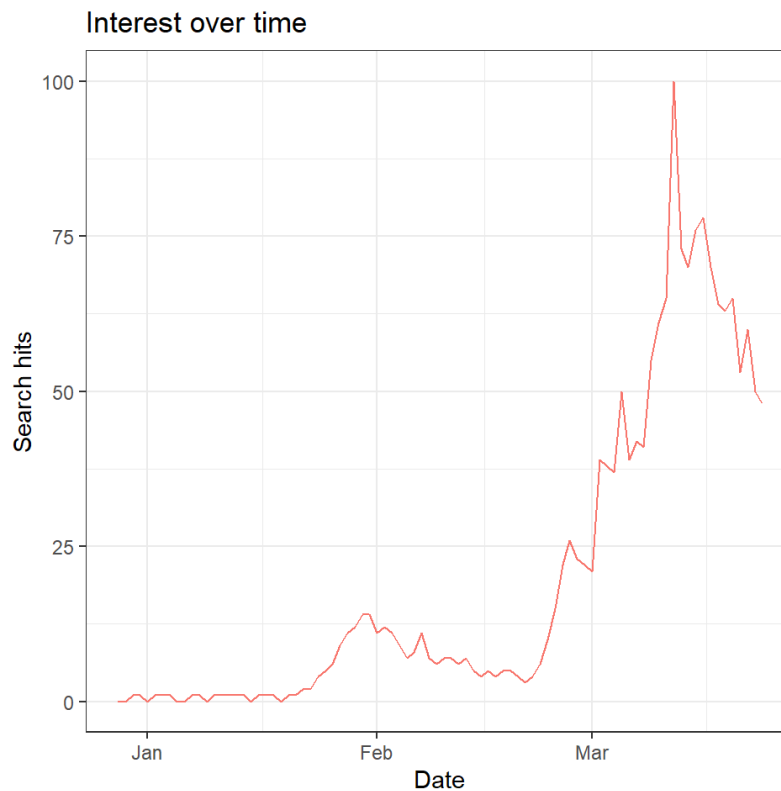
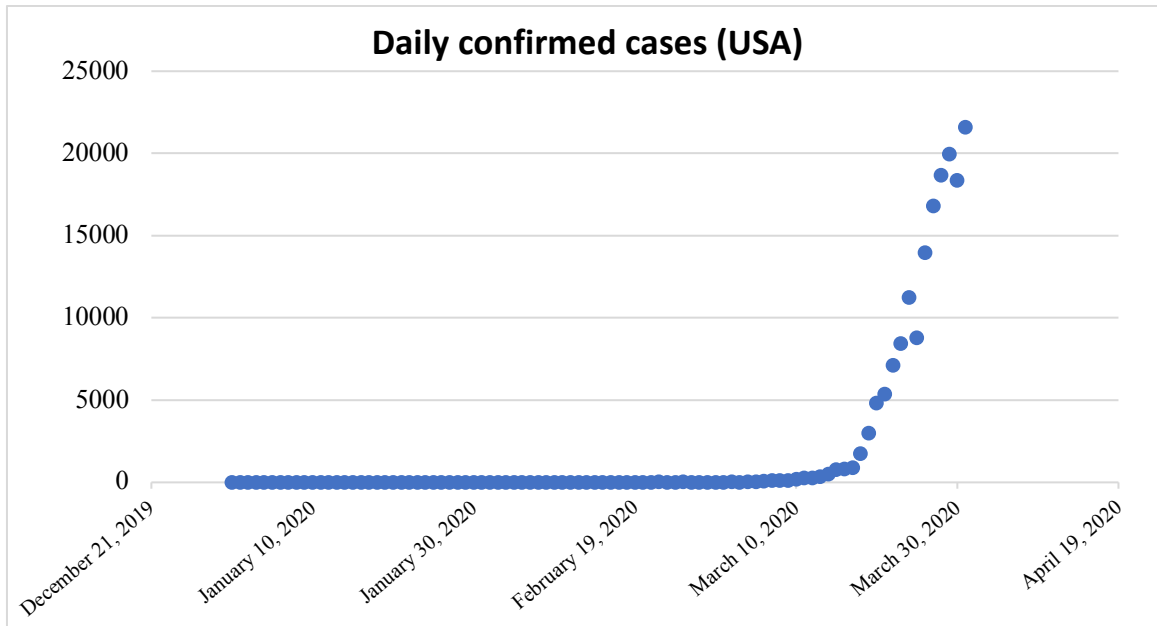
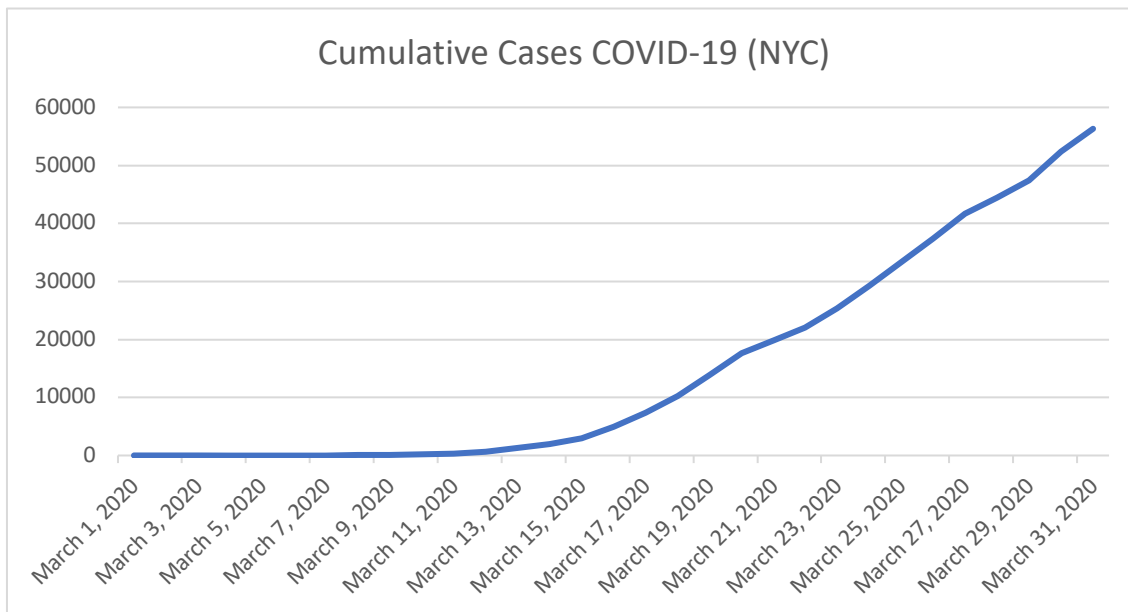


Figure 1: Interest of New Yorkers about coronavirus over first three months of 2020 in Google Trends



Source: Our World in Data, <https://ourworldindata.org/grapher/daily-cases-covid-19?country=USA>



Source: NYC Health, www1.nyc.gov/site/doh/covid/covid-19-data.page

Public Transit:

Public transit ridership was severely affected due to actions such as school closings, the shelter-at-home order, closing non-essential businesses, etc. to slow the spread of COVID-19 cases. Figure 2 shows the decline of ridership in New York City on March 12th, March 16th, and March 23rd in comparison to comparable dates in 2019. This decrease of transit ridership is observed in all transit modes and facilities operated by the Metropolitan Transportation Authority (MTA) which include: Subway, NYC Transit Bus, MTA Bus, Metro North Railroad (a.m. peak), and Long Island Railroad (a.m. peak). The data is obtained from MTA annual disclosure statement supplement in April 3rd, 2020.²

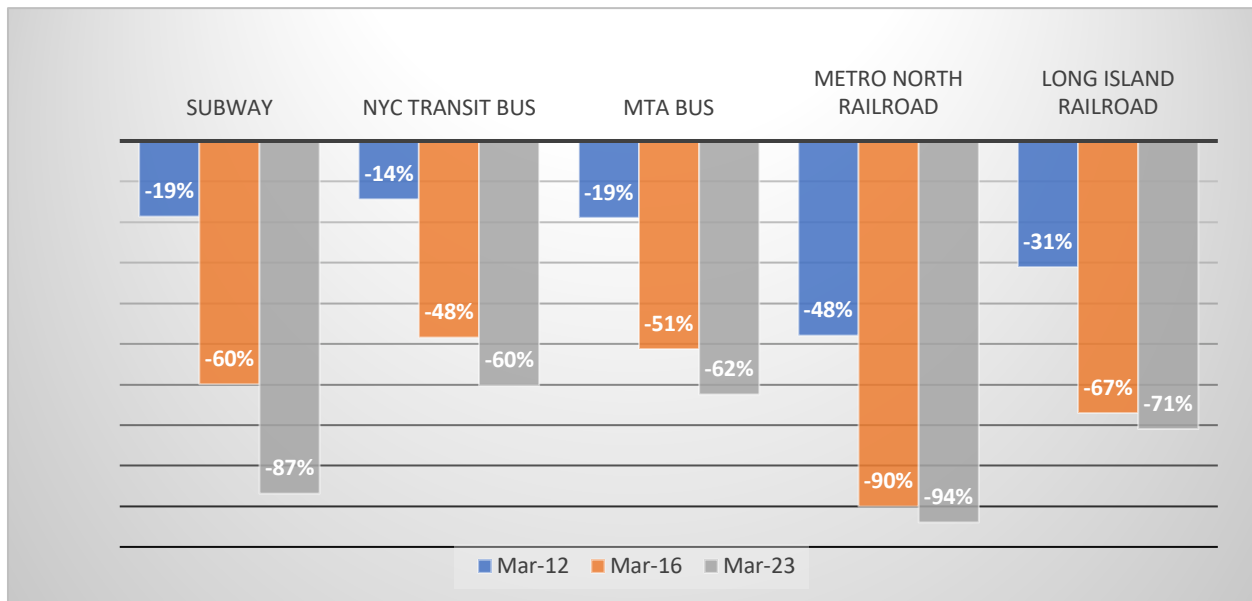


Figure 2: Transit ridership percentage reduction in March 12th, 16th, March 23rd from 2019 to 2020

An analysis of ridership over time at select subway stations was performed to understand how the population responded to measures ordered during the pandemic. Figure 3 shows the 7-day moving average with rolling window for South Ferry Subway station ridership (entries), starting from January 1st in 2019 to April 3rd in 2020. Applying moving average to the ridership time series will remove seasonality and reduce variability in the dataset. This will make the time series data to be more interpretable and observe trends. Subway ridership started to decline gradually; then, it plunged in March 2020 upon the orders of travel restriction were mandated by state officials.

² <http://web.mta.info/mta/investor/pdf/2020/040320COVIDUpdateSupp.pdf>

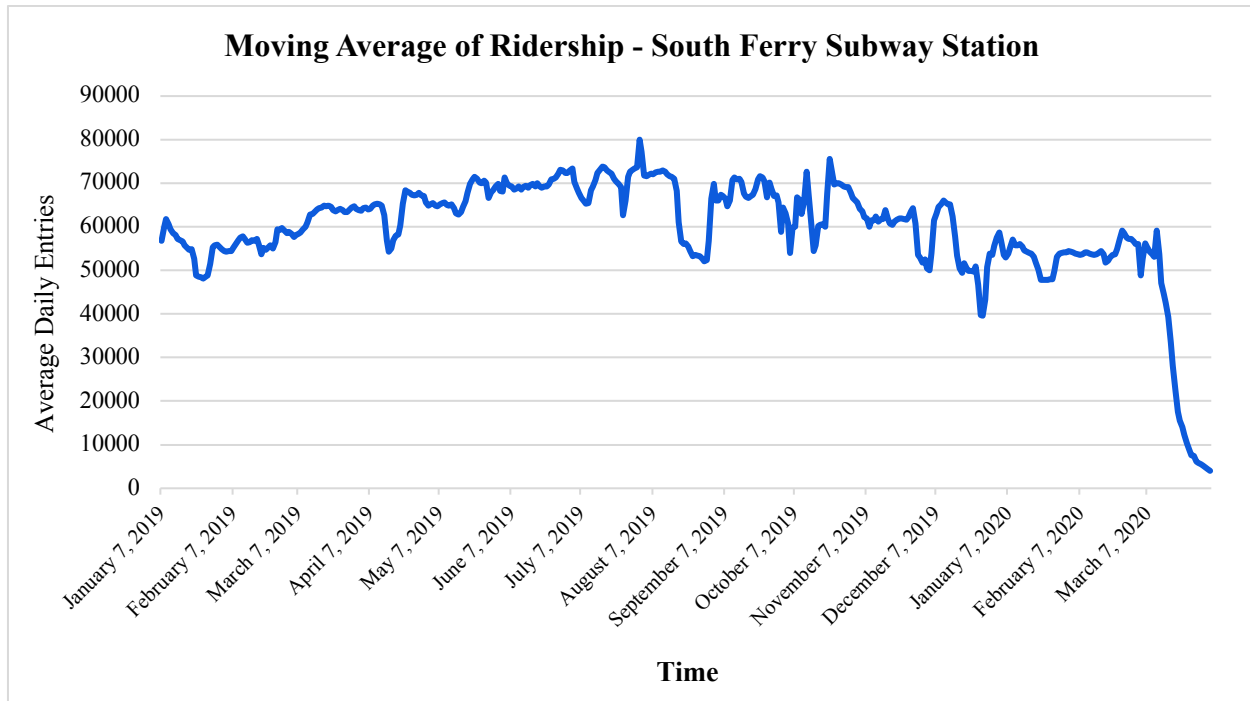


Figure 3: Moving average of ridership of South Ferry Subway Station

Daily subway ridership change in four subway stations are compared from February to March 2020, and also to the corresponding values in 2019. These four stations are: South Ferry station in Lower Manhattan, 137 St - City College station in Upper Manhattan, Bronx Park East station in the Bronx, and Crescent Street station in Brooklyn. Table 1 displays the change of ridership in these four subway stations. It shows the ridership percentage ranging between -7% to 7% from February 2019 to February 2020. On the other hand, ridership reduction in March was abrupt, ranging from 37% to 55%. It shows that the impact of social distancing measures has been significant in the decline of transit ridership.

Table 1: Subway ridership change in February and March, between 2019 and 2020

Subway Stations	South Ferry	137 St – City College	Bronx Park East	Crescent St – Brooklyn
February, 2020	54418	62320	10644	19492
March, 2020	27785	32756	6960	13041
Ridership Reduction (%)	48.9%	47.4%	34.6%	33.1%
February, 2019	56535	58046	10380	20932
March, 2019	62085	58389	11044	21292
Change- Feb 2019 to 2020	4%	-7%	-3%	7%
Change- Mar 2019 to 2020	55%	44%	37%	39%

PATH Train:

PATH train ridership has also been impacted by the COVID-19 outbreak. Figure 4 displays the average daily ridership of PATH service in February and March 2020. Here, only ridership changes for stations in New York are reported. PATH train average daily ridership has plunged more than 50% at all NYC's stations from February to March 2020. Also, the subtotal of PATH train ridership in New York was reduced from 2,806,746 in February to 96,784 in March, representing a 97% decline.

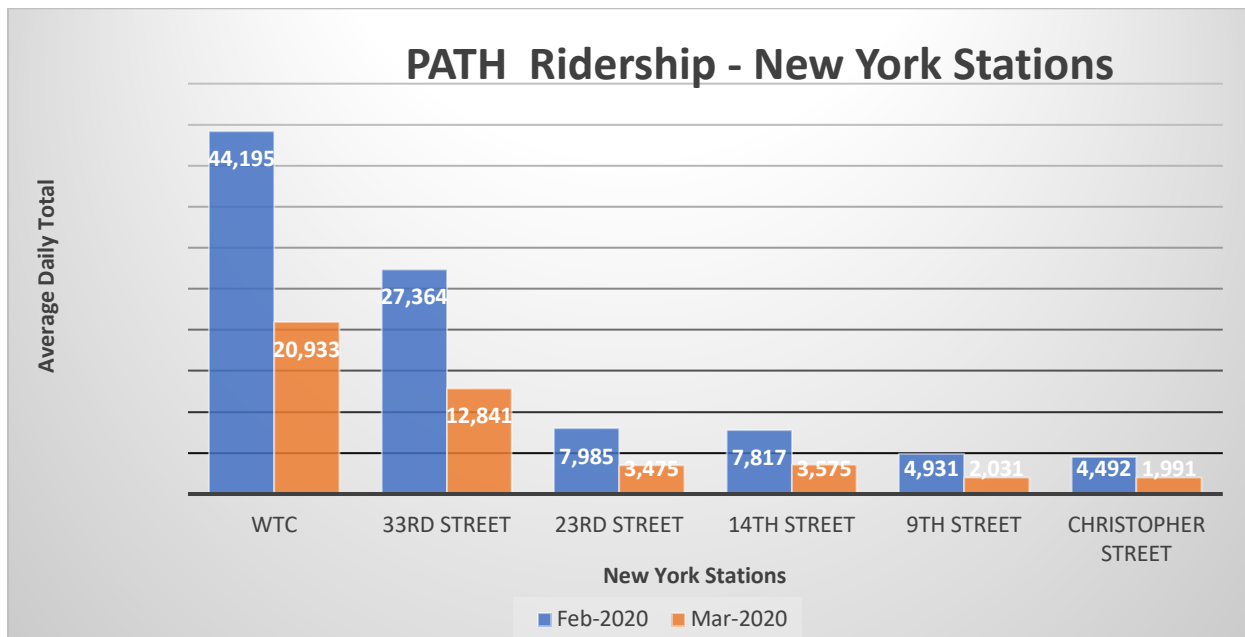


Figure 4: Average Daily of PATH ridership of New York stations in February and March 2020

Vehicular Traffic Speed:

With the limitation imposed on non-essential travel, the speed of vehicular traffic has improved during this pandemic. It is observed that this speed improved from seven mph to 32 mph across various Interstates, Highways, and Expressways in New York City on March 18th. Table 2 shows average traffic speed improvement at some corridors on March 18th (Wednesday) during morning and afternoon hours. Extending this trend, the 'lack of congestion' resulted in an increase in speed in NYC roadways by 39% in AM peak to 54% in PM peak on March 20th.³

³ <https://inrix.com/>

Table 2: Speed improvement in New York City during morning and afternoon (Source: INRIX)

Speed Improvement	Interstates and Highways	Bronx-Queens Expressway-Northbound	Bronx-Queens Expressway-Southbound	Cross Bronx Express way – Eastbound	Cross Bronx Express way – Westbound
Morning	+13 MPH	+7 MPH	+16 MPH	+22 MPH	+26 MPH
Afternoon	+14 MPH	+19 MPH	+32 MPH	+13 MPH	+27 MPH

Average traffic speed on the west tube of the Lincoln Tunnel (traveling from New Jersey towards New York City) has also been analyzed. Figure 6 shows the average speed for all Wednesdays in February and March 2020 during a 24-hour period. One can visibly observe that the average travel speed is higher in March compared to February. Such improvement in speed in March is more pronounced during AM and PM peaks.

LINCOLN TUNNEL W CENTER TUBE NY - NJ February and March, WEDNESDAY

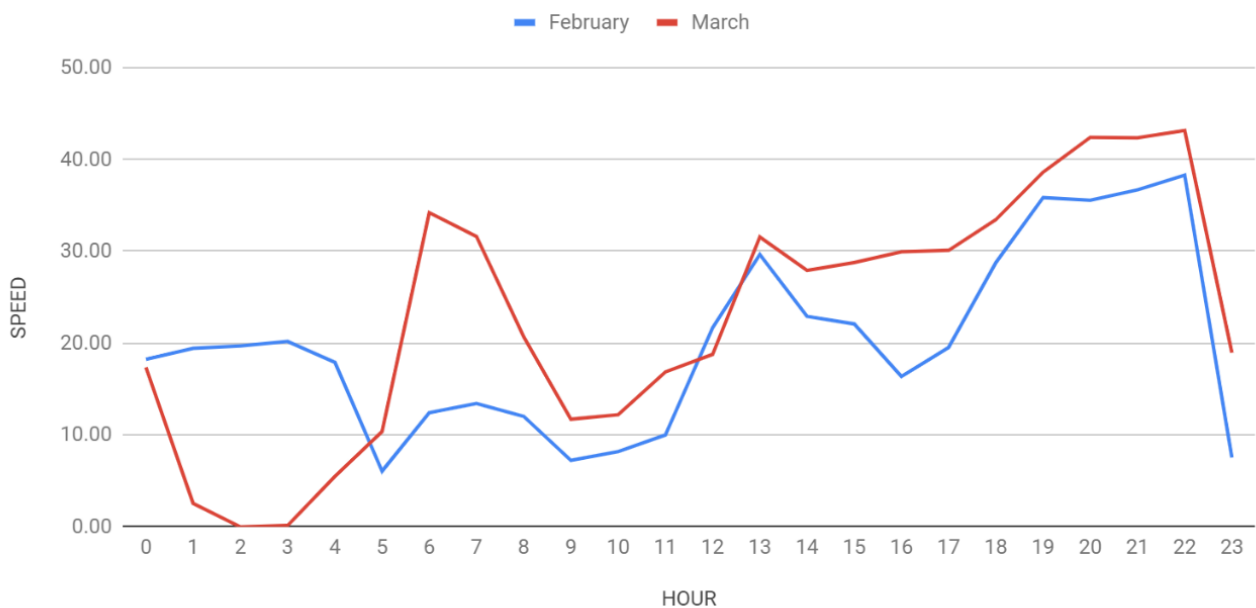


Figure 5: average link speed of 24 hours in February and March

Vehicular Traffic Volume:

New York City daily traffic volume has also decreased in response to COVID-19 measures. Figure 8 shows this reduction for the third week of March, from March 14th (Saturday) to March 20th (Sunday), compared to the same days three weeks before, February 22nd to 29th. The reductions in traveling vehicles are pronounced as we go further into the month of March as additional measures are taken to slow the spread of the virus. One can observe that the daily reductions in traffic volume range from 20% on March 14 to 43% on March 19th and 20th.⁴

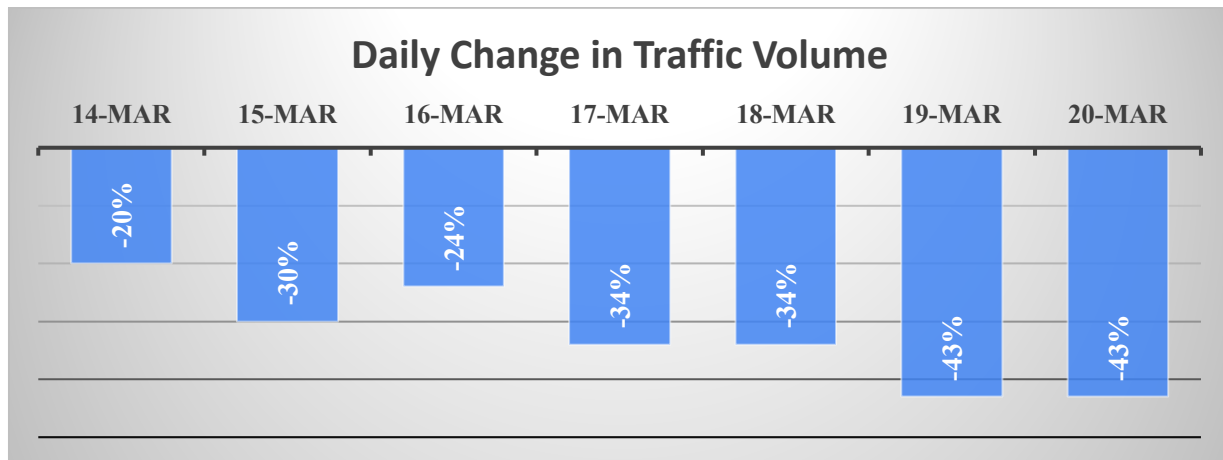


Figure 6: Daily percentage change in traffic volume, March 14-20

The traffic volumes on bridge and tunnel crossings in and around NYC have also seen a significant reduction. MTA’s bridges and tunnels data on March 12th, 16th and 23rd showed a 7%, 21% and 60% reduction respectively from corresponding days in 2019.

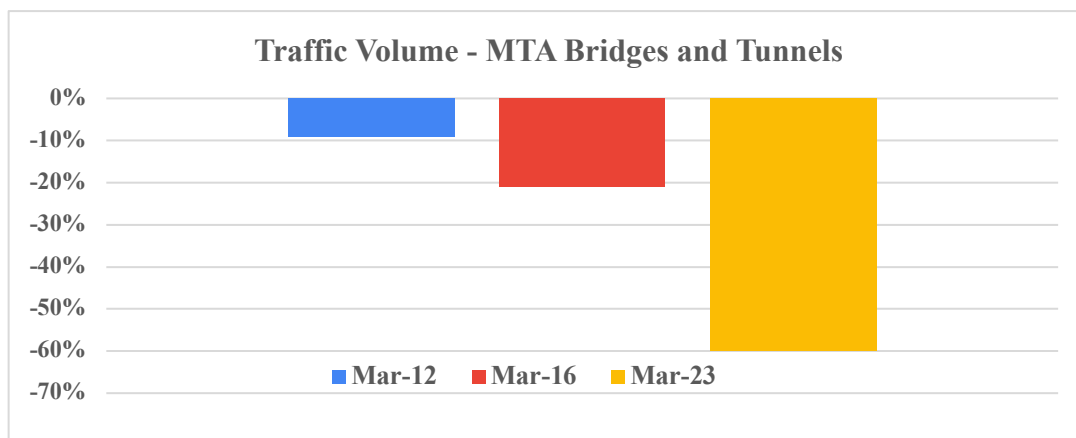


Figure 7: MTA Bridges and Tunnels percentage changes in March 12th, 16th, and March 23rd from 2019 to 2020

⁴ <https://inrix.com/>

Citi Bike:

To see the impact of Covid19 on bike ridership, we have compared Citi Bike trips that were made in New York City in February 2020 to those values in February 2019 (Citi Bike website has released NYC ridership data up to February 2020). To remove outliers in the datasets, all bike trips with a trip duration of more than one hour were removed. Figure 8 shows that bike trips have increased by about 19% in February 2020 when they are compared to February 2019. Also, it was reported that between March 1 and March 11, the bike ridership skyrocketed by about 67% when it is compared to the previous year.⁵

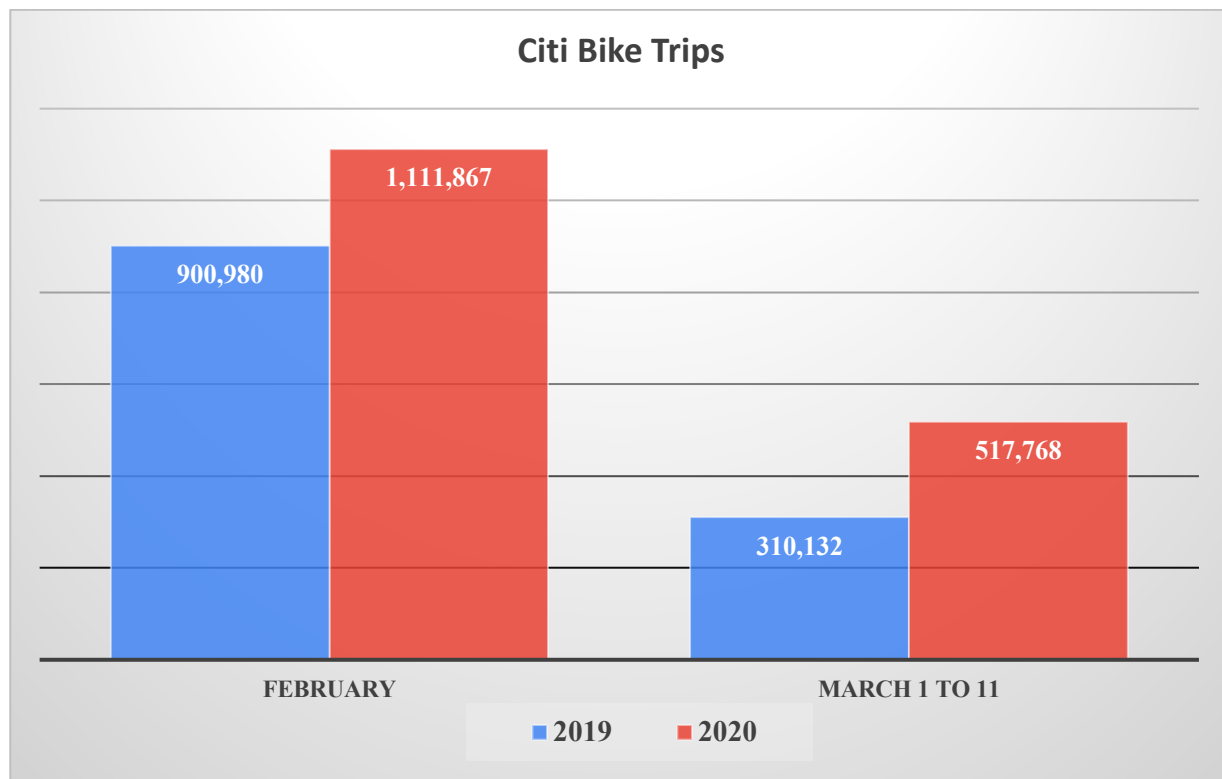


Figure 8: Citi Bike trip change in 2019 and 2020, for February and March 1st to 11th

Part of the reason for this increase in the bike trip indicator in February 2020 can be associated to people avoiding transit due the fear of the perceived high risk of infection with the coronavirus and for self-enforcement to maintain social distancing while traveling. It is worth mentioning that bike crossings over the East River Bridge have increased about 52% on a single day of March 9th, from 14,032 trips in 2019 to 21,332 trips in 2020.

⁵ <https://www.nytimes.com/2020/03/14/nyregion/coronavirus-nyc-bike-commute.html>

Taxi:

At the time of publication of this report, the NYC Taxi and Limousine Commission had not released the yellow and green taxi trip records for the months of 2020. However, the largest taxi group of NYC which represents 5,500 yellow cabs, the Metropolitan Taxicab Board of Trade, provided an estimate. Comparing taxi trips that occurred February 27-29, 2020 to three weeks later in the midst of the COVID-19 crisis, the March 17-19 Friday-Saturday-Sunday total dropped from 217,540 to 20,596. This indicates that there had been a decrease of 91 percent in taxi trips.

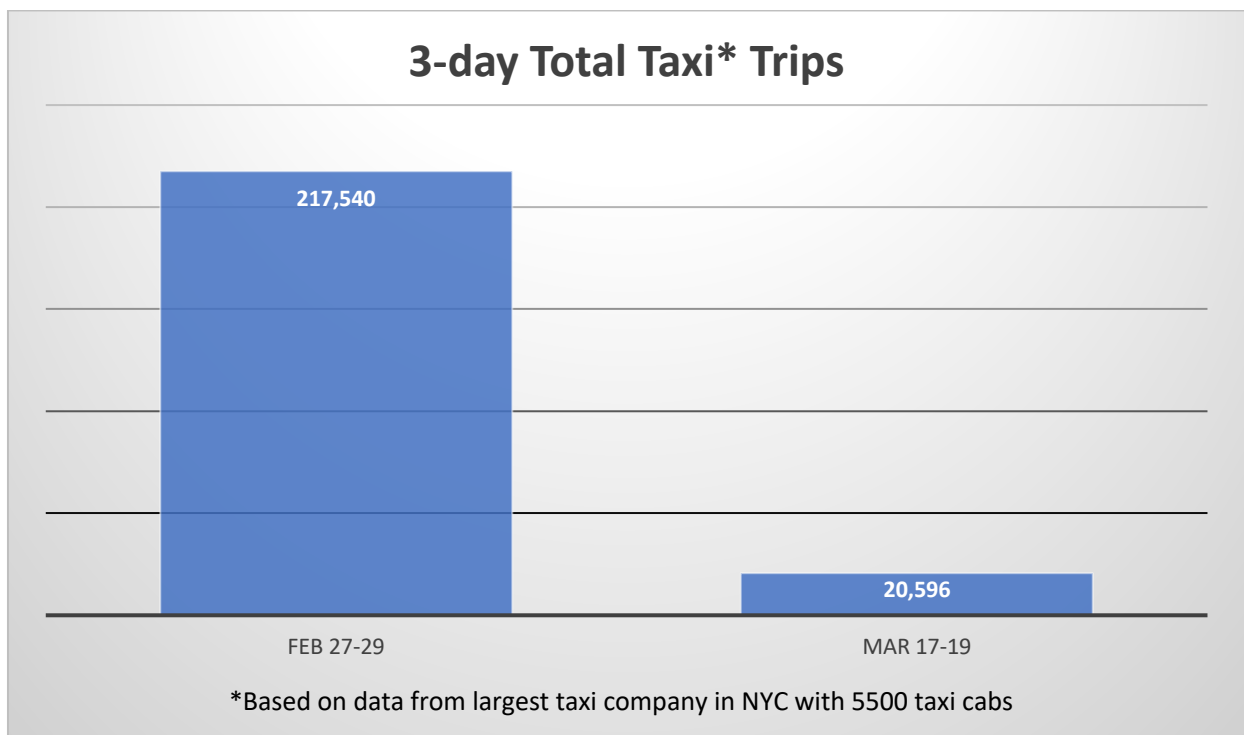


Figure 9: 3-day Total Taxi Trips February 27-29 and March 17-19, 2020