Investigating the Comparative Advantage of the Willet's Point LaGuardia AirTrain

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Abstract

A railway link to the LaGuardia airport has been a point of contention among city residents and travelers for two decades. The current AirTrain proposal will link to the 7 train and Long Island Rail Road (LIRR) at Mets-Willets point, claiming travel time of 30 minutes or less to Penn Station on the LIRR. Critics claim the LIRR is infrequent and will not provide reduced travel time to most parts of the city. To investigate this further, we test the hypothesis of whether the AirTrain will decrease Metropolitan Transit Authority (MTA) travel time for four origin points: Times Square, Harlem & 125th, Barclay's Center and Flushing Library. For each origin location, real-time and scheduled travel data was obtained on the fastest routes to the airport, as determined by schedules. A Gaussian KDE distribution of wait times and travel times were produced for each leg of the journey and 1,000 random samples of total travel time were pulled for analysis. The travel times with and without the AirTrain were compared for each origin point using a Welsh 2 sample T-test. Our analysis concludes that out of the 4 locations we selected, the addition of the AirTrain solution would decrease travel time to the airport for those traveling from Times Square, Flushing Main Street, and the Barclay's center.

Background

LaGuardia airport (LGA) has been regarded New York City's most shamed airport for reasons including its size and capacity, proximity to neighborhoods, lack of transportation routes to the city, and the shabby atmosphere. LGA is currently in the midst of a $8 Billion massive renovation project to expand and modernize the airport.

Travel to LaGuardia airport has always been very difficult: the lack of a rail or subway link to New York City's LaGuardia Airport requires all passengers and employees to take roadway transportation. The Metropolitan Transit Authority (MTA) and the Port Authority of New York and New Jersey has been trying to build alternative transportation to LGA for almost 2 decades. The initial plan in the late 90's proposed a 2.9 mile extension of the elevated N Subway line from Astoria to the airport, which would provide additional subway stops along the way. Alternatives to this plan proposed a similar extension from Jackson Heights, which would link to the Woodside Long Island Rail Road (LIRR) station as well as the 7, E, F, M and R subways. Both plans were fiercely opposed by local NIMBY residents and have since been abandoned (The Port Authority of New York & New Jersey, 2018).

The current and least-opposed proposal is to build an AirTrain extending along the flushing bay and linking to the Mets-Willets Point LIRR. Governor Cuomo recently

signed legislation to begin progress on the plan reasoning that the AirTrain is essential for the airport's transformation and will provide improved customer experience and allow for better access to airlines and public transportation. The Governor claims that this proposed AirTrain would provide reliable, 30-minute travel time from Midtown. However, this travel time assumes passengers use the Long Island Railroad to get to Willets Point. The AirTrain solution will provide a higher quality travel experience with increased ease and comfort. Additionally, this option will increase the reliability of public transportation travel to the airport, since the LIRR and AirTrain are not as prone to traffic issues and delays.

However, the Long Island Rail Road has not publicly commented on its participation in this plan. Currently the LIRR to Mets-Willets Point only runs on event days and there is not much local demand for the train. Therefore, the LIRR would need to provide additional trains just to meet airport travel demand, and it is uncertain how frequently those additional trains would leave. Additionally, the cost of the LIRR from Penn Station to Mets-Willets point is as high as $15.00 one-way (peak travel, onboard ticket purchase), but can be as cheap as $4.25 one-way on weekends.

Analysis performed by Yonah Freemark using Google Maps scheduled travel data has revealed that the addition of the AirTrain will not reduce travel time for the majority of passengers traveling to LGA. The cost of this AirTrain is $450 Million, and while representing only 5% of the $8 Billion renovation of the entire airport, critics of this proposal do not believe the cost is justified by its benefits.

Using actual and scheduled data provided on MTA transportation times, we will test the hypothesis if the air train will in fact decrease travel time to LaGuardia during rush hour, when considering delays, traffic, and wait periods between each leg of the journey.

> **H_0:** The Airtrain will have no effect on or will increase travel time to LaGuardia during rush hour.
>
> **H_A:** The Airtrain will decrease travel time to LaGuardia during rush hour.

Based on statistical data provided on LaGuardia commute travel, we have selected four optimal travel nodes located in New York City to test our hypothesis:

-Times Square (Midtown Manhattan)
-Harlem & 125th Street (Uptown Manhattan)
-Barclay's center (Downtown Brooklyn)

-Flushing Library (Central Queens)

Data Methods and Assumptions

Actual and scheduled subway and bus travel time was obtained from the Metropolitan Transit Authority. The actual subway data is accessible via a API real-time feed in General Transit Feed Specification (GTFS) format. The MTA does not make its historical subway and bus actual travel records publicly available, therefore all data was accessed and downloaded real-time.

For each origin, we selected the optimal travel routes from Google Maps for the current travel and the AirTrain travel to LGA to selectively download only the relevant bus lines and subways. The selected routes are shown in Table 1.

Table 1. Selected Optimal Travel Routes

Origin	Fastest Current Route	Fastest Route with AirTrain
Times Square	F Train, Q70 Bus	7 Train, AirTrain
Flushing - Main Street	7 Train, Q70 Bus	7 Train, AirTrain
Harlem - 12th Street	M60 Bus	5 Train, 7 Train, AirTrain
Barclay's Center	5 Train, W Train, M60 Bus	G Train, 7 Train, AirTrain

An MTA API key was required to download all subway data, and data for each of the relevant buses and subways. The data was downloaded during rush hour (between 2 PM and 7 PM) on December 10, 12, and 14. The frequency of bus arrivals and subway arrivals was calculated to obtain the waiting periods in between each mode of transportation. The times between bus arrivals and subway and bus arrivals was calculated to get a collection of possible wait times. The actual travel times for the buses between the origin points and the airport were calculated to collect data on actual bus travel times. For the subways, the travel times were garnered from schedule, therefore we did not take into account real-time delays occurring for subway travel times. For AirTrain calculations, it was assumed the train would arrive every 6 minutes as indicated in the proposal. We did not consider every public transportation option,

since we did not explore methods or algorithms to find the shortest travel time with the data we collected.

Model Methodology

We created a model in order to get 1000 samples of each journey. The basic equation, repeated 1000 times for each route was:

Total journey time = wait time a + travel time a + wait time b + travel time b + wait time c + travel time c

Wait times for bus lines and subways and travel times for buses were randomly sampled from a kde distribution created from the actual data we collected for that leg of the journey. Wait times for the AirTrain were drawn as a random integer between 0 and 6. Travel times for the AirTrain and subways were taken to be their "official" time.

Results

The results for each origin point are presented in Table 2. We found that for 3 of the 4 origin locations, we can reject the null hypothesis that the travel times to LGA will stay the same or increase with the addition of the AirTrain. For the origin points where the AirTrain reduces travel time, the standard deviation of travel time is also greatly reduced. This can partly be attributed to the lack of data we have on the actual AirTrain travel times and frequency, so we just assumed that the AirTrain would arrive every 6 minutes.

Table 2.

Origin	Statistic	Status Quo	With Airtrain	T-Score	P-Value
Times Square	Mean Travel Time (min)	46.31	42.31		
	Standard Deviation (min)	10.39	3.55	-11.48	4.58 e-29
Flushing - Main Street	Mean Travel Time (min)	35.21	14.08		
	Standard Deviation (min)	10.6	3.59	-59.69	0
Harlem - 125th Street	Mean Travel Time (min)	46.6	59.1		
	Standard Deviation (min)	7.98	14.72	23.62	1.61 e105
Barclay's Center	Mean Travel Time (min)	103.76	48.12		
	Standard Deviation (min)	18.31	4.77	-92.95	0

Conclusion

The data illustrates a reduced travel time with the addition of for three out of the four origin locations when traveling during afternoon rush hour traffic. Travel from Midtown Manhattan Our results are limited for the days that we collected, and the validity of the results can be further explored by collecting additional data across many days at different times of day. The analysis can be expanded to run with added origin points to further explain the impact of the AirTrain for more New Yorkers. Incorporating an automated fastest-route selection algorithm would further improve the model, which could be done with a network analysis. Finally, it will be important to factor in the capacity of the AirTrain and current transportation options and compare with the forecasted LGA passenger demand once the LGA renovation and expansion project is completed.

In addition to reduced travel time, an evaluation of the other benefits of the AirTrain should be considered to provide a comprehensive review. Of these include increased ease and comfort of the train, reduced traffic congestion at the airport for ground travel, as well as the anticipated capacity of mode of transportation.

References

Bernhardsson, Erik (2016) NYC subway math. Available at (accessed November 14, 2018): https://erikbern.com/2016/04/04/nyc-subway-math.html

Freemark, Yonah (2015) For LaGuardia, an AirTrain that will save almost no one any time. The Transport Politic. Available at (accessed November 25, 2018): https://www.thetransportpolitic.com/2015/01/21/for-laguardia-an-airtrain-that-will-save-almost-no-one-any-time/

The Port Authority of New York & New Jersey (2018) LGA Airport Access Improvement Project. Purpose and Objectives and Analysis of Alternatives Report. Available at (accessed November 28, 2018): https://anewlga.com

MTA Develop Resources Google Groups: https://groups.google.com/forum/#!forum/mtadeveloperresources

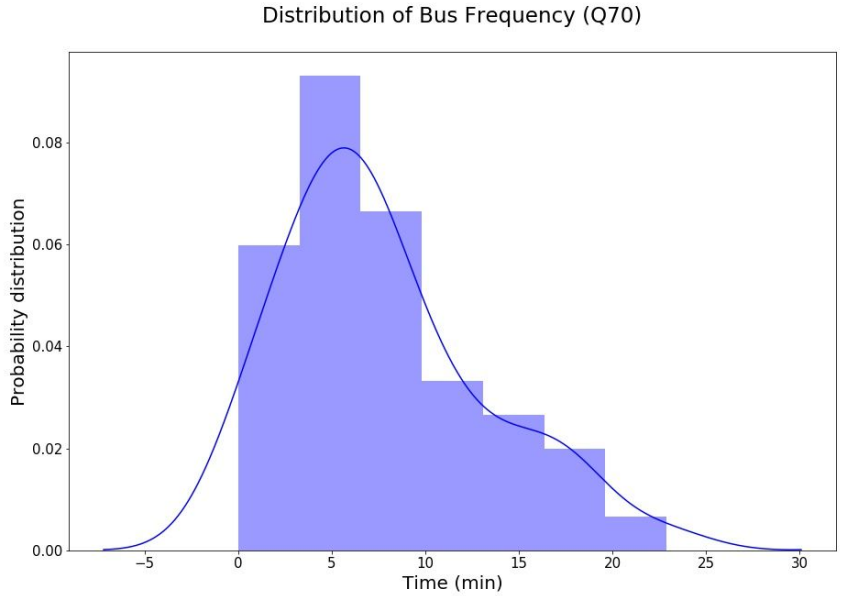
Contributions

The background and literature review was performed by all three authors (Zoe Martiniak, Marium Sultan, Katharine Voorhees). Code writing to access, download, clean and wrangle the data was done by Marium and Zoe. The model was designed

and performed by Katharine, and results interpretation was performed by Katharine and Marium. The presentation was completed by all authors, and report was written by Zoe.

Data cleaning and analysis is documented on Github:
https://github.com/zem232/LaGuardia-travel-times

Appendices


Distribution of Bus Frequency (Q70)
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0.06
0.08
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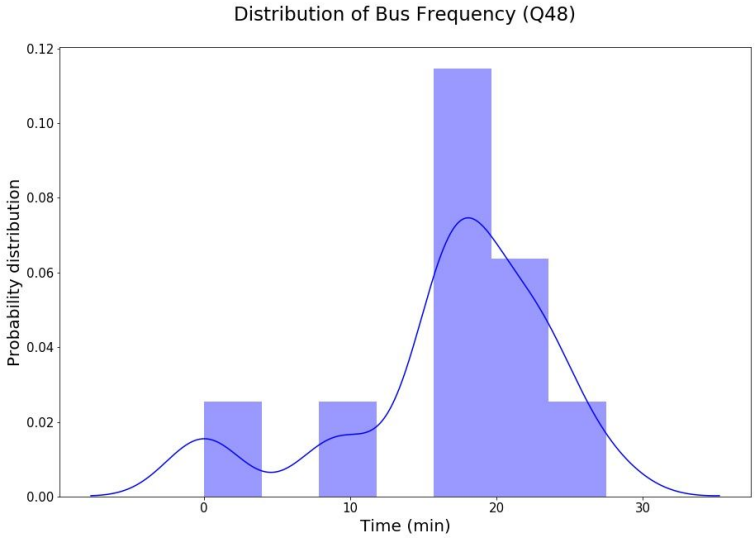
15
20
25
30
Time (min)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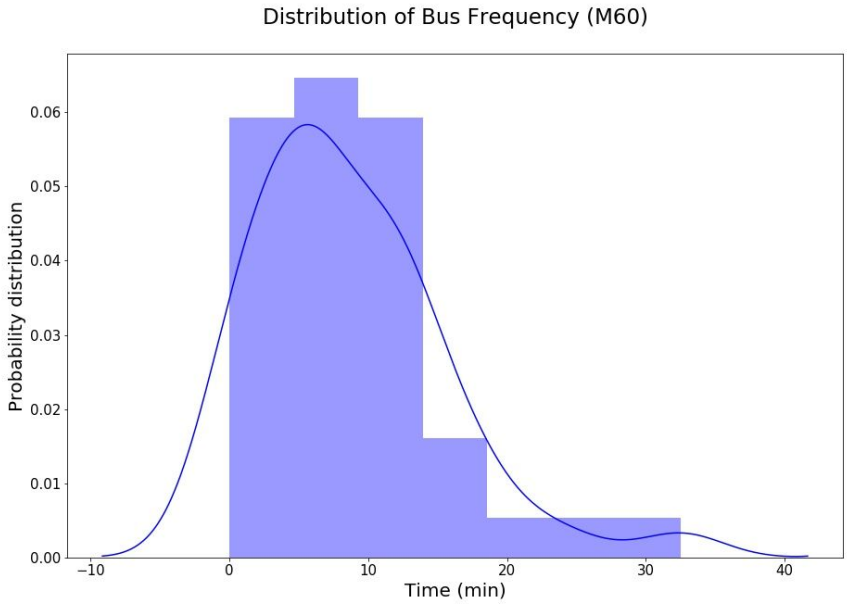
Time (min)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Time (min)