THE PORT AUTHORITY OF NEW YORK & NEW JERSEY

AIRTRAIN LGA

LGA GROUND ACCESS MODE CHOICE MODEL AND AIRTRAIN RIDERSHIP FORECAST 2025-2045

APPENDICES

OCTOBER 2018

THE PORT AUTHORITY
OF NEW YORK & NEW JERSEY

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A.1 DESCRIPTION OF AIRPORT SURVEYS

The primary sources that were used to understand travel demand for this study were the 2017 LaGuardia Airport (LGA) Ground Access, Passenger Preference, and Employee Surveys; and the Port Authority of New York and New Jersey (PANYNJ) Customer Satisfaction Surveys (CSS) for the years 2014 through 2016. Secondary aggregate data sources such as the total number of passengers, number of employees, bus ridership information, ground transportation reservations, and taxis dispatched were used to expand the survey data. The 2017 LGA Ground Access Survey, Passenger Preference, and Employee Surveys were designed to address the demand forecasting needs for the new AirTrain service and the survey design and details of the questionnaire correspond to the best practices in the profession.

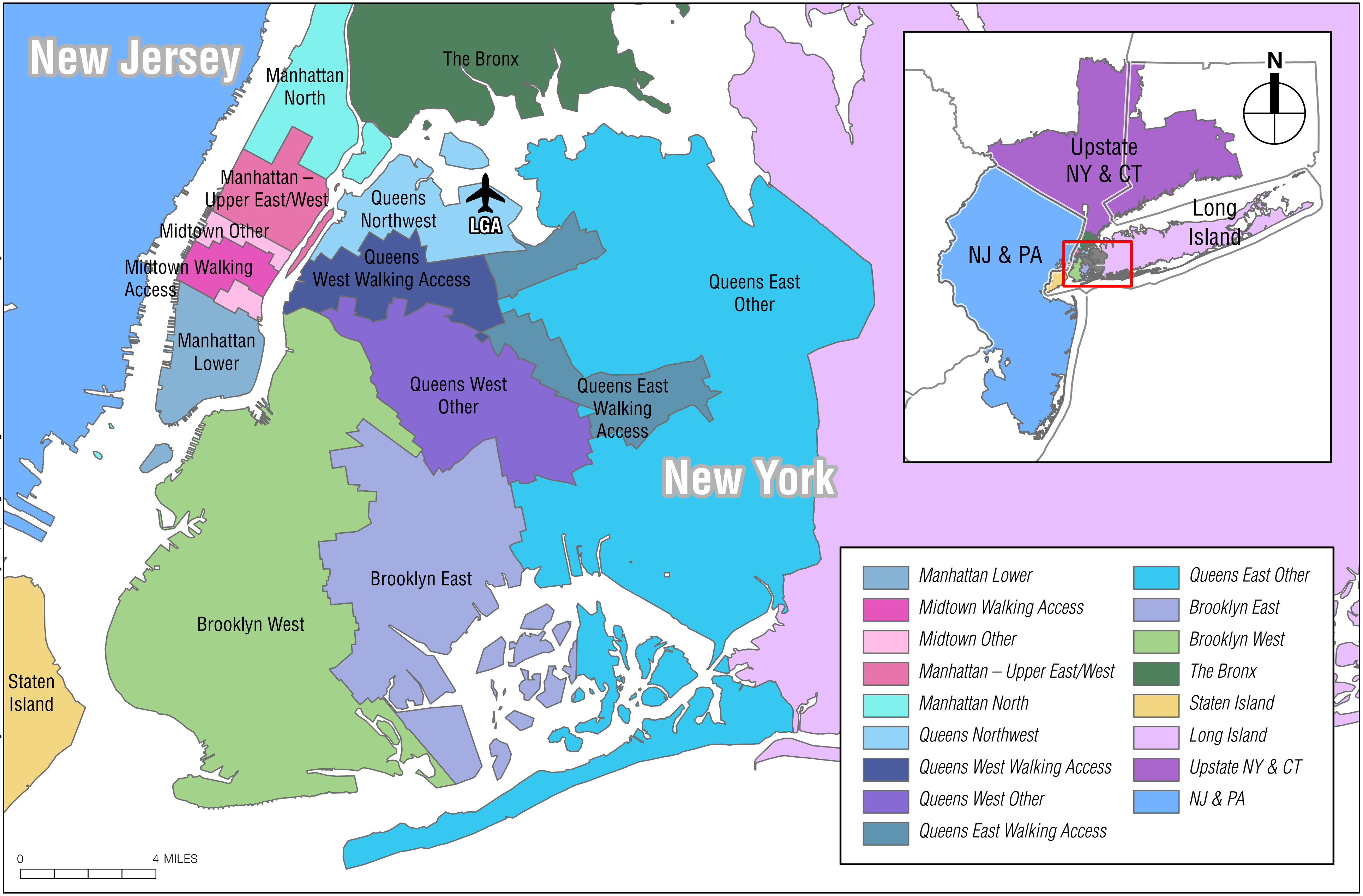
A.1.1 2017 LGA SURVEYS

The 2017 LGA Ground Access, Passenger Preference, and Employee Surveys were conducted at LGA in August 2017. Questionnaires developed for departing and arriving air passengers asked air passengers about their existing trips to and from LGA (Ground Access Survey) and about the likelihood of using a new AirTrain LGA service (Passenger Preference Survey). A questionnaire developed for employees asked employees about their usual commute and the likelihood of using a new AirTrain LGA service. Responses were recorded on tablet devices by trained surveyors, and data results were prepared by Kantar TNS. The tablet-based survey instrument was in English. However, the trained team of surveyors provided a language translation for those who did not speak English.

The 2017 LGA Ground Access Survey collected trip information from: 1,891 departing passengers (interviewed at the gate with the survey programmed on a tablet); 482 arrival passengers (interviewed at baggage claim areas, taxi lines, and bus stops with the paper survey); and 824 employees (interviewed at the ID badging office, Hangar 7, and Delta terminal with the survey programmed on tablets). The Passenger Preference Survey was designed as a complementary set of questions to the survey of air passengers conducted at LGA in 2017. This survey was only offered to the air passengers who could logically use AirTrain in combination with LIRR or subway. The eligibility rules required that this new option would be competitive compared to the existing access modes for the actual trip origin location (for departing passengers) or trip destination location (for arriving passengers). Overall, 1,515 out of 2,373 passengers were eligible and agreed to participate in the Passenger Preference Survey (see **Table A-1**). The passengers that were eligible include those with origins/destinations from Manhattan, Queens, Brooklyn, the Bronx, and Long Island, which represents approximately 83 percent of the passenger geographic market for LGA (**Figure A-1**). The Passenger Preference Survey questionnaire was adjusted to the particular origin/destination and mode reported by participating passengers earlier in the survey.

Some passengers who participated in the main survey were eligible to participate in an evaluation of preferences for both AirTrain travel options (LIRR+AirTrain and Subway+AirTrain), some in only one of the AirTrain travel options, and some were not eligible to participate in the Passenger Preference Survey at all, and were screened out in a two-stage process.

9.21.18



Data source: Port Authority LGA Ground Access Survey 2017, weighted using Customer Satisfaction Survey data from 2014-2016.

AirTrain LGA, LGA Ground Access Mode Choice Model and AirTrain Ridership Forecast 2025-2045

LaGuardia Airport Geographic Markets
Figure A-1

Table A-1 Participation in LGA Air Passenger Surveys

Number of survey respondent by category	Departing passengers	Arriving passengers	Total
Total number of Ground Access Survey respondents	1,891	482	2,373
Participants in the Passenger Preference Survey	1,038	477	1,515
Total participants in LIRR+AirTrain evaluation	636	477	1,113
Total participants in Subway+AirTrain evaluation	885	474	1,359

At the first stage, the passengers with a remote trip origin or destination in the areas such as Staten Island, New Jersey, Pennsylvania, Connecticut, and New York State beyond the five boroughs and Long Island, were excluded automatically since a transit service to Willet Points for them would require multiple transfers and would be an unlikely travel option. At the second stage, the respondents who qualified based on their origin/destination but did not use transit for the actual trip to or from LGA were asked a self-selection question if they "would consider AirTrain with either connection to LIRR or to Subway." Those who did not express interest in either of these options were also excluded from the Passenger Preference Survey questions. Existing transit users who qualified by their origin/destination were all offered the Passenger Preference Survey. The applied rules are summarized in **Table A-2** below.

Table A-2 Passenger Preference Survey Participation Rules

Reported trip origin for departing passengers or destination for arriving passengers	Reported access mode	Answer to the "would consider connecting via" question	AirTrain travel options offered
Manhattan	Existing mode is Auto, Drop-off/Pick-up, Taxi/FHV, Airporter, Shuttle, Van	Respondents who answered LIRR + AirTrain or respondents who answered they would consider both LIRR + AirTrain & Subway + AirTrain	LIRR + AirTrain
Manhattan	Existing mode is Auto, Drop-off/Pick-up, Taxi/FHV, Airporter, Shuttle, Van	Respondents who answered Subway + AirTrain or respondents who answered they would consider both LIRR + AirTrain & Subway + AirTrain	Subway + AirTrain
Manhattan	Existing mode is Metro-North Rail, NYC subway, or Public/City Bus	Not asked	LIRR + AirTrain Subway + AirTrain
Queens, Brooklyn, the Bronx	Existing mode is Auto, Drop-off/Pick-up, Taxi/FHV, Airporter, Shuttle, Van	Respondents who answered LIRR + AirTrain or respondents who answered they would consider both LIRR + AirTrain & Subway + AirTrain	LIRR + AirTrain
Queens, Brooklyn, the Bronx	Existing mode is Auto, Drop-off/Pick-up, Taxi/FHV, Airporter, Shuttle, Van	Respondents who answered Subway + AirTrain or respondents who answered they would consider both LIRR + AirTrain & Subway + AirTrain	Subway + AirTrain
Queens, Brooklyn, the Bronx	Existing mode is Metro-North Rail, NYC subway, or Public/City Bus	Not asked	LIRR + AirTrain Subway + AirTrain
Long Island	Existing mode is Auto, Drop-off/Pick-up, Taxi/FHV, Airporter, Shuttle, Van	LIRR + AirTrain	LIRR + AirTrain
Long Island	Existing mode is rail, NYC subway, or Public/City Bus	Not asked	LIRR + AirTrain

The data was processed and compiled. Trips with origins or destinations outside LGA were initially geocoded to the zip code level. Some of the traveler and/or trip attributes were imputed for missing cases using auxiliary statistical methods in order to retain as many survey records as possible. To further enrich the sample, each air passenger record was duplicated and their trip was reversed. For example, each departing passenger provided an observed trip to LGA for which a corresponding trip from LGA was created. This approach balances the total daily trips to and from the airport. Likewise, every employee record generated two commute trips.

Although the data was originally geocoded at zip code level, a finer analysis was conducted of changes in ground access mode choice to LGA, requiring origin and destination (O&D) data to be assigned to a Traffic Analysis Zone (TAZ)-level of detail (with each TAZ approximately equal to the size of a census block group). TAZs were assigned to each record within the larger geocoded geography. The TAZ-level of detail is essential for the subsequent data transfer between the LGA ground access mode choice model and the regional New York Metropolitan Transportation Council's (NYMTCs) Best Practices Model (BPM) as described in previous sections.

The 2017 survey questionnaires administered to departing and arriving air passengers and LGA employees are reproduced below in **Section A.2**. The questionnaires include corresponding instructions for the programming implementation. In the actual survey field work, the interviewed person would only see a subset of relevant questions appearing on the tablet dependent on the answers to the previous questions. The survey questionnaires reflect the differences between departing and arriving passengers.

A.1.2 USE OF PANYNJ CUSTOMER SATISFACTION SURVEYS

PANYNJ conducts a CSS every year for each of the airports in the NY region, and this survey includes trip information details for air passengers with a questionnaire similar to the 2017 LGA Ground Access Survey. Since the 2017 Ground Access Survey had a limited number of records, the data for air passengers was enriched with information from CSS. Data cleaning and processing steps were applied to the CSS data. It is important to note that CSS does not include an employee survey; however, this survey provided many additional valuable records for air passengers. Specifically, the additional origins and destinations of trips ensured that there were enough records for each geographic market.

The 2017 Ground Access and CSS 2014-2016 survey data was combined and expanded to represent the most statistically plausible distribution of LGA employees and air passengers by access mode and person type in order to create the Baseline Alternative. The expansion process was implemented in an open-source statistical package called R, using iterative multi-dimensional balancing to match a set of established aggregate controls taken from other reliable sources of information. The balancing algorithm starts with a predefined set of initial individual-record weights, in this case set all to 1. The balancing algorithm iterates over all controls and calculates adjustment factors to the expansion factors until a reasonable match is achieved for each control. Calculation of the adjustment factors at each step is based on the Newton-Raphson method. This method finds successively better approximations to the roots (or zeroes) of a real-valued function that, in this case, is a function that represents the discrepancy between the control and corresponding current value from the survey based on the current expansion factors. The controls have differing importance levels or priority (**Table A-3**), which signify how much relaxation can be applied to these controls in case of a conflict between multiple controls.

Table A-3 Target Controls for Survey Expansion

Description	Priority
Total Inbound Passenger by Terminal	High
Total Outbound Passenger by Terminal	High
Total Connecting Passengers	High
Connecting Passengers (Inter-Terminal)	High
Total Employee Trips	High
Air Passengers by Purpose (Business/Non-Business)	Medium
Short Term Parking for Air Passengers (Total ins and outs)	Medium
Long Term Parking for Air Passengers (Total ins and outs)	Medium
NYC Airporter	Medium
Taxi/Limo/ For Hire Vehicles Dispatched	Medium
Rental Car- On Airport (Drop-offs and Pick-ups)	Medium
Rental-Off Airport (Drop-offs and Pick-ups)	Medium
Hotel Courtesy Vehicles	Medium
Shared Vans	Medium
Off-Airport Parking	Medium
Bus Ons and Offs at LGA - Air Passengers	Medium
Bus Ons and Offs at LGA - Employee	Medium
Employee Parking Lot (Total Ins and Outs)	Medium
Employee Totals by Geography (16)	Medium

This procedure is implemented with relaxation factors that allow for a deviation from the control targets and for the procedure to find the unique and most statistically significant solution with possibly imperfect controls that may not be consistent. The procedure loops over all the controls at each iteration and applies an adjustment factor to the record weight based on the specific control. The majority of the control target data was provided by PANYNJ. Estimated controls were also provided to define a target for modes that did not have control data available.

The composition of the final database for air passengers, which combines all surveys, is presented unweighted in **Table A-4** and as weighted summaries in **Table A-5**. **Table A-4** shows that the combination of four surveys creates a database with close to 9,000 individual records. This size of the sample is specifically important for analysis of the spatial structure of air passenger trips and representation of various possible origins and destinations of LGA air passengers. These records are almost uniformly distributed between years 2014-2017. The combined database also provides a sufficient sub-sample for each of the four major groups of air passengers as a combination of travel purposes, i.e. business vs. non-business, and possible places of residence, i.e. residents of the New York region vs. visitors.

Table A-4 Composition of the Database for LGA Air Passengers from 2017 Ground Access Survey and 2014-2016 CSS (unweighted individual records)

Distribution by Survey Records by Year (Unweighted) - one record for each travel party

Survey Year	Resident		Visitor			Resident		Visitor		
	Business	Non-Business	Business	Non-Business	Total	Business	Non-Business	Business	Non-Business	Total
2014	28.3%	19.9%	31.9%	24.0%	25.4%	281	392	639	947	**2,259**
2015	20.7%	20.8%	30.6%	30.8%	27.4%	206	408	611	1,213	**2,438**
2016	35.6%	27.9%	19.3%	18.0%	22.4%	353	547	387	709	**1,996**
2017	15.3%	31.4%	18.2%	27.3%	24.8%	152	616	363	1,076	**2,207**
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**992**	**1,963**	**1,999**	**3,945**	**8,899**

Source: WSP

The weighted summary of the air passenger trips to and from LGA is presented in **Table A-5**. In the weighting process, the recent survey of 2017 was given a higher global weight of 50% while the three CCS surveys were given the same combined total weight of 50 percent. Overall, the main proportions in the unweighted and weighted summaries are similar, which indicates a representative sample and reasonable expansion factors. Overall, LGA is characterized by a higher proportion of visitors (versus residents) and higher proportion of non-business passengers (versus business passengers). These biases, however, are pertinent to all three major airports in the New York region.

Table A-5 Composition of the Database for LGA Air Passengers from 2017 Ground Access Survey and2014–2016 CSS (weighted daily O&D trip summary)

Survey Year	Resident		Visitor			Resident		Visitor		
	Business	Non-Business	Business	Non-Business	Total	Business	Non-Business	Business	Non-Business	Total
2014	22.9%	14.5%	16.3%	17.8%	17.2%	1,456	2,382	2,221	5,771	**11,830**
2015	13.4%	15.0%	17.1%	20.7%	17.9%	851	2,461	2,329	6,717	**12,359**
2016	19.2%	18.5%	14.1%	12.6%	14.9%	1,219	3,038	1,915	4,087	**10,259**
2017	44.5%	52.1%	52.5%	49.0%	50.0%	2,830	8,570	7,160	15,895	**34,455**
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**6,356**	**16,452**	**13,625**	**32,470**	**68,902**

Source: WSP

A representative database of LGA air passengers was used to generate all meaningful summaries discussed in Appendix B. The summaries for each specific air passenger characteristic are always presented in both unweighted and weighted fashions. In all tabulations, the four key air passenger types are preserved and shown separately since they are characterized by different socio-economic profiles and mode preferences.

A.2 2017 SURVEY QUESTIONNAIRES

A.2.1 LGA DEPARTING PASSENGERS

TNS

THE PORT AUTHORITY OF NY & NJ
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2017 ON-AIRPORT SURVEY
DEPARTING/CONNECTING PASSENGERS

(INTERVIEWER: FILL OUT ITEMS BELOW) **AIRPORT:** ☐ **JFK** ☐ **EWR** ☐ **LGA**

Lang. Version:.1

Date: ☐☐ / ☐☐ / ☐☐ **Time:** ☐☐ : ☐☐ ☐ AM ☐ PM ☐ **Reg'l Jet**

Terminal: ☐☐ **Gate Number:** ☐☐☐☐ **Airline Name:** ____________________ **Interviewer ID#:** ☐☐☐

Flight #: _________________ **Sch'd Dep. Time (MT):** ☐☐ : ☐☐

NOTE: PROGRAM CUSTOMIZED DROP DOWN LIST FOR EACH AIRPORT FOR TERMINAL/GATE #. AIRLINE, FLIGHT #, DEP. TIME ARE CAPTURED AT END OF INTERVIEW.

Weather (Check All That Apply): ☐ **Sunny** ☐ **Dry** ☐ **Wet**

1. **Which one of the following situations best describes your travel plans at [PN: ENTER FULL AIRPORT NAME, THEN (3-LETTER AIRPORT CODE] today? Please Check Only One Answer**

   ☐ Transferring from one plane to another (that is, changing planes) *within* [PN: ENTER 3-LETTER AIRPORT CODE] airport, TODAY.

   ☐ Departing only from [PN: ENTER 3-LETTER AIRPORT CODE] airport and got here by ground transportation (private car, taxi, bus, train, shuttle, etc.).

2. **Is your flight from LaGuardia today to a location within the domestic U.S., including Alaska, Hawaii, a U.S. Territory (Puerto Rico, Virgin Islands, Guam, etc.)?**

   ☐ Yes (Domestic U.S. Flight)

   ☐ No (International Flight)

3a. **[IF "DEPARTING—NOT "TRANSFERRING" IN Q.1, ANSWER Q.3a and 3b. OTHERWISE, SKIP TO Q.5] What was the one main mode of transportation you used to travel to LaGuardia today? Please Check Only One Answer Below Under 3a. [PROGRAMMER: GROUP THE MODES UNDER CATEGORY HEADINGS]**

Personal Car

Drove Your Own Car .... ☐

Passenger in Car Parked at Airport .... ☐

Passenger in Car and Dropped Off at Airport .... ☐

Rental Car

Drove Rental Car (Specify Co.: ___________________) ... ☐

Rental Car Shuttle/Van .... ☐

Rail/Train/Subway

NJ Transit or Amtrak .... ☐

Metro-North Railroad .... ☐

NYC Subway (Specify Line: ______________) .... ☐

LIRR .... ☐

Hired Car/Van Service

Taxi .... ☐

Limo/Executive Car/Town Car Service .... ☐

Uber .... ☐

Lyft .... ☐

Shared-Ride Van/Service (Specify Name:___) .... ☐

Bus

Public/City Bus (that is, a local bus) .... ☐

NYC Airporter Bus from Manhattan .... ☐

NYC Airporter Bus from JFK/LaGuardia Airports .... ☐

Chartered/Tour Bus .... ☐

Local Airport Transport

Hotel/Motel Shuttle/Van .... ☐

On-Airport Terminal Access Shuttle Bus .... ☐

Off-Airport Parking Co. Shuttle/Van (Specify Co__) .... ☐

Other (Specify: ________________________) .... ☐

3b. What other modes of transportation did you use to get to LaGuardia and the terminal you're in now? Please Check All That Apply Under Q.3b. [PROGRAMMER: EXCLUDE ON SCREEN ANY MODE MENTIONED IN Q.3a. GROUP THE MODES UNDER CATEGORY HEADINGS]

Personal Car
- Drove Your Own Car ☐
- Passenger in Car Parked at Airport ☐
- Passenger in Car and Dropped Off at Airport ☐

Rental Car
- Drove Rental Car (Specify Co.: ___________________) ☐
- Rental Car Shuttle/Van

Rail/Train/Subway
- NJ Transit or Amtrak ☐
- PATH ☐
- Metro-North Railroad ☐
- NYC Subway (Specify Line: ______________) ☐
- LIRR ☐

Hired Car/Van Service
- Taxi ☐
- Limo/Executive Car/Town Car Service ☐
- Uber ☐
- Lyft ☐
- Shared-Ride Van/Service (Specify Name:___) ☐

Bus
- Public/City Bus (that is, a local bus) ☐
- NYC Airporter Bus from Manhattan ☐
- NYC Airporter Bus from JFK/LaGuardia Airports ☐
- Chartered/Tour Bus ☐

Local Airport Transport
- Hotel/Motel Shuttle/Van ☐
- On-Airport Terminal Access Shuttle Bus ☐
- Off-Airport Parking Co. Shuttle/Van (Specify Co__) ☐

Other (Specify: ________________________) ☐

[PROGRAMMER: Q.3c IS MANDATORY IF QUALIFIED TO ANSWER]

3c. [IF DROVE OWN CAR OR PERSONAL CAR PARKED W. PASSNGR IN Q.3a] Where did (IF DROVE OWN CAR: you/IF PASSENGER: the driver) park the car?

- ☐ **P6, Parking Lot (near Terminal A)**
- ☐ **P10, Parking Lot (near Terminal A)--Long Term Parking**
- ☐ **P2 Parking Garage (in front of Terminal B)**
- ☐ **P4 Parking Lot (in front of Terminals C & D)**
- ☐ **P4 Parking Garage (in front of Terminal C)**
- ☐ **P5 Parking Lot (on the side of Terminal D)**

3d. [IF Q3a/Q3b is "Public/City Bus", ASK] Which NYCT/MTA bus route did you take to LaGuardia airport?

- ☐ **Q70 SBS LaGuardia Link**
- ☐ **M60 SBS**
- ☐ **Q47**
- ☐ **Q33 (then walk to airport)**
- ☐ **Q48**
- ☐ **Q72**
- ☐ **Q23 (then walk to airport)**

3e. [**IF Q3a/Q3b = LIRR, NYC Subway or NYC Bus**] **How did you pay for your transit ride today? (Check ONE box)**

1☐ Pay per ride (MetroCard or LIRR ticket) 2☐ Monthly pass 3☐ Weekly pass 4☐ 10 Ride pass 5☐ Did not have to pay to ride

ABOUT THIS TRIP (PROGRAMMER: THIS SECTION IS MANDATORY).

[IF "DEPARTING" PAX. IN Q.1, ASK Q's 4a–L, IF ELIGIBLE. IF "TRANSFERRING" IN Q.1, SKIP TO Q.5)

4a. Were you just visiting the New York, New Jersey, Connecticut or Pennsylvania local area(s) on this trip and are now flying back out from LaGuardia?

☐ Yes, just visiting for a short period **-- Q.4b. How many nights did you stay locally on this trip? #______**

☐ No, live, or staying for an extended period or a student in the local area **— Q.4c. How many nights will you be away on this trip? #______**

4d. [IF Q.4a is "Yes", ASK] What airport did you come into when you flew into the New York area?

☐ JFK International ☐ LaGuardia ☐ Newark-Liberty International ☐ Stewart International ☐ Atlantic City International
☐ Other (Specify: __________________)

4e. [IF Q.4a is "Yes", ASK] What was the arrival time of your initial flight into the New York area? __ : __

4f. [IF Q.4a is "No", ASK] What airport will you fly into when you return to the New York area?

☐ JFK International ☐ LaGuardia ☐ Newark-Liberty International ☐ Stewart International ☐ Atlantic City International
☐ Other (Specify: __________________)

4g. [IF Q.4a is "No", ASK] What time will your return flight back to New York arrive? __ : __

4h. Where were you in the local area when you began leaving for (ENTER DEPARTING AIRPORT NAME) today? Please check only one answer below.

☐ New York ☐ New Jersey ☐ Connecticut ☐ Pennsylvania ☐ Other U.S. -- **[GO TO Q.4l]**

4i. Where was that? Please check only one answer.

☐ Home ☐ Staying with Friends/Relatives ☐ Cruise Ship ☐ Work ☐ School ☐ Hotel
☐ Another LOCAL Airport (such as JFK Int'l, LaGuardia, Newark Liberty Int'l, Stewart Int'l, or Atlantic City Int'l) ☐ Other (please specify:) ___________

4j. (IF "ANOTHER LOCAL AIRPORT" CHECKED IN Q.4i, ASK) Which local airport was it? [PROGRAMMER: DO NOT INCLUDE CURRENT AIRPORT)

☐ JFK International ☐ LaGuardia ☐ Newark-Liberty International ☐ Stewart International ☐ Atlantic City International
☐ Other (Specify: __________________)

[PROGRAMMER NOTE:
IF "JFK" IN Q.4j, ENTER "QUEENS" IN Q.4m AND Q.4p AND 11430 IN Q.4o.
IF "LGA" IN Q.4j, ENTER "QUEENS" IN Q.4m AND Q.4p AND 11371 IN Q.4o.
IF "SWF" IN Q.4j, ENTER "OUTSIDE NYC" IN Q.4m AND "ORANGE" IN Q.4p AND 12553 IN Q.4o.
IF "EWR" IN Q.4j, ENTER "ESSEX" IN Q.4p AND 07114 IN Q.4o.
IF "ATLANTIC CITY" IN Q.4j, ENTER "ATLANTIC" IN Q.4p AND 08234 IN Q.4o.

[THEN, SKIP TO Q.5. OTHERWISE, CONTINUE TO Q.4k]

4k. [IF "HOME" ANSWERED IN Q.4i:] Is this your primary residence? ☐ Yes ☐ No

4l. [IF "OTHER U.S." IN Q.4h:] Where was that? PROGRAMMER NOTE:
USE STATE DROP DOWN BOX; PLEASE EXCLUDE NY, NJ, CT, AND PA., BUT SHOW "OTHER" LAST ON THE LIST WITH A "PLEASE SPECIFY.")

4m. [IF "NEW YORK" IN Q.4h, ASK Q.4m, OTHERWISE SKIP TO Q.4n] Please check only one answer below:

☐ Manhattan-Below 14th St. ☐ Manhattan-14th-96th St. ☐ Manhattan- Above 96th St. ☐ Bronx ☐ Brooklyn ☐ Queens ☐ Staten Island
☐ Outside New York City – **ASK Q.4n; ALL OTHERS IN Q.4m, SKIP TO Q.4o.**

4n. [IF Q.4m is "Outside New York City" OR Q.4h is "New Jersey," "Connecticut" or "Pennsylvania," ASK:]
What city or town did you leave from today to get to LaGuardia Airport: ______________________________

4o. [PROGRAMMER: IF NY, NJ, CT OR PA STATE ORIGIN IN Q.4h:] Please enter the Zip Code Area for that location. ☐☐☐☐☐
If you don't know the zip code area, please check this box: ☐

If you don't know the zip code for the area you are going to next, what is the address, nearest intersection, or a prominent landmark?

____

4p. [PROGRAMMER: IF NY, NJ, CT OR PA STATE ORIGIN IN Q.4h:] Please select the name of the County for that location.
[CUSTOMIZED COUNTY LIST BY STATE DROP DOWN BOX WITH "DON'T KNOW" LAST.]

ASK EVERYONE

5. **What was the primary purpose of your trip today?**

☐ Leisure/Vacation/Visiting ☐ Business ☐ Both Business/Non-Business ☐ School-Related ☐ Illness/Bereavement ☐ Moving/Relocation
☐ Other (please specify): ________________

6a. **[IF "ARRIVING—NOT "TRANSFERRING" IN Q.1, ANSWER Q.6a] Did a friend, relative or colleague go inside this terminal to see you off today?**
☐ No ☐ Yes—**Q.6b. How many people were there to see you off?** #: ____

7. **IF *NOT* TRANSFERRING BETWEEN FLIGHTS AT LAGUARDIA AIRPORT:**

a. How many minutes did it take to reach LaGuardia Airport today? ☐☐☐ **Minutes to reach airport**

b. How much did it cost you to reach LaGuardia Airport today (including transit fare, tolls, taxi/Uber fare, parking, etc.)? $_______ . ____

8. **How many people, including yourself, are in your party on this flight today? #:___________**

9a. **[IF MORE THAN ONE IN Q.8:] How many are children under age 18? #_______**

10a. **[IF ONLY ONE IN Q.8:] How many bags did you check on the flight leaving LaGuardia Airport today? (Write in number -- "0" if none) #:** ______

10b. **[IF MORE THAN ONE IN Q.8:] How many bags in total were checked today for your travel party? (Write in number --"0" if none) #:______**

11. **[ASK EVERYONE:] How many carry-on bags do you, yourself, have today? (Write in number -- "0" if none) #: _______**

12. **What terminal did your flight come into at LaGuardia Airport TODAY?**

☐ Same terminal you are in now ☐ A different terminal

13. **(IF "A DIFFERENT TERMINAL IN Q.12, ASK) Which terminal did you fly into today?**

[PN: DROPDOWN MENU: DISPLAY TERMINAL LIST, EXCLUDING CURRENT TERMINAL]

☐ LGA: TA (Delta Shuttle) ☐ LGA: TB (Central Terminal Bldg.) ☐ LGA: TC (American and Delta) ☐ LGA: TD (Delta and Westjet)

14. **(IF "A DIFFERENT TERMINAL IN Q.12, ASK) Are you transferring at LaGuardia Airport today from a domestic or international flight?**
☐ Domestic U.S. Flight ☐ International Flight

THESE LAST FEW QUESTIONS ARE FOR CLASSIFICATION PURPOSES ONLY.

15. **(IF "HOME" TO Q.4i, AND "YES, PRIMARY RESIDENCE" TO Q.4k, SKIP TO Q.18. ALL OTHERS*, ASK)**
Is your primary residence in the U.S. or outside of the U.S.?

☐ U.S.
☐ Outside U.S.

*** PROGRAMMER NOTE: THIS INCLUDES ALL CONNECTORS, Q1 ANSWER "1"**

16. **(IF NON-U.S. RESIDENT IN Q.15, ASK)**
What is your primary country of Residence? (USE COUNTRY DROP-DOWN BOX, THEN SKIP TO Q.21)

17. **(IF USA RESIDENT IN Q.15): Please enter Zip Code:** ☐☐☐☐☐

AND State/Territory (USE STATE/TERRITORY DROP DOWN BOX)

18. **(IF "NEW YORK" IN Q.17): Please check only one answer below.**
[IF NJ, CT, OR PA RESIDENT IN Q.17, SKIP TO Q.20. OTHERWISE, SKIP TO Q.21]

☐ Manhattan-Below 14th St. ☐ Manhattan-14th-96th St. ☐ Manhattan- Above 96th St. ☐ Bronx ☐ Brooklyn ☐ Queens ☐ Staten Island

☐ Not New York City Resident - **ASK Q.19; ALL OTHERS IN Q.17 SKIP TO Q.21.**

19. **And, please enter residential city or town:** ____

20. **[PROGRAMMER: IF NY, NJ, CT OR PA PRIMARY STATE RESIDENCE IN Q.17, ASK:] Please select the name of the County where you reside. [CUSTOMIZED COUNTY LIST BY STATE DROP DOWN BOX.]**

21. **Gender:** ☐ Male ☐ Female

22. **Year Born:** ☐☐☐☐

23. **Which one of the following groups best describes your household's total annual income before taxes in 2016?**

☐ Under $25,000	☐ $50,000 - $59,999	☐ $90,000 - $99,999	☐ $175,000 - $199,999
☐ $25,000 - $29,999	☐ $60,000 - $69,999	☐ $100,000 - $124,999	☐ $200,000 - $249,999
☐ $30,000 - $39,999	☐ $70,000 - $79,999	☐ $125,000 - $149,999	☐ $250,000 - $299,999
☐ $40,000 - $49,999	☐ $80,000 - $89,999	☐ $150,000 - $174,999	☐ $300,000 or more

24. **We'd like to follow-up with you in the future about our airports, may we contact you at your e-mail address?**

If yes, please complete:

____________________ @ _________________ . ______________

25. Please rank the relative importance of the following airport access trip attributes (Ranked Preference)

_____ Total travel time

_____ Number of transfers

_____ Ease of transfer

_____ Predictability of travel time

_____ Cost per person

_____ Convenience

_____ Comfort

_____ Safety and Security

26. Please rank the relative importance of the following airport access convenience factors (Ranked Preference)

_____ Waiting time (e.g. waiting for the subway or taxi)

_____ Walking time

_____ Avoiding stairs

_____ Crowding

_____ Ease of wayfinding

_____ Ease of payment options (i.e. mobile payment)

[PROGRAMMER: Departing from Manhattan]
Suppose that a new, easy to use rail service linked Manhattan to LaGuardia Airport in 30 minutes or less. This new service would provide you with a quicker and more reliable option to reach LaGuardia, avoiding the uncertainty of traffic congestion.

- **Guaranteed 30-minute (or less) trip from Midtown to your LaGuardia terminal via the Long Island Railroad, with a connection to the AirTrain at Willets Point, the second stop from Manhattan**
- **Long Island Railroad (LIRR) service departing every 15 minutes from either Penn Station or Grand Central Terminal, with a 15-minute ride from Manhattan to Willets Point, and a 5-6 minute AirTrain ride from there to the terminal**
- **Quick and effortless transfer from either LIRR or the #7 subway to a brand new AirTrain system, via a modern, attractive transfer station at Willets Point, which is air conditioned in the summer and heated in the winter, providing a welcoming gateway to the airport**
- **Connection to the entire New York City subway system, including access from Manhattan and the outer boroughs, via the #7 line**
- **AirTrain stations serving the primary passenger terminals on-airport will be easy to get to (steps away) and have a very short transfer from AirTrain to check in, security and pre-security amenities, with connecting shuttle bus service to the Marine Air Terminal (Terminal A)**
- **Designed to provide an easy transfer between both LIRR and the subway for all types of passengers, including passengers with disabilities, seniors, passengers traveling with children, and passengers with large luggage**
- **Single integrated fare with a mobile payment option**

[PROGRAMMER: Departing from Queens, Brooklyn, or The Bronx]
Suppose that a new, easy to use rail service linked LaGuardia with the #7 subway line, Long Island Railroad (LIRR), and an airport parking lot at Willets Point. This new service would provide you with a quicker and more reliable option to reach LaGuardia, avoiding the uncertainty of traffic congestion.

- **New AirTrain between Willets Point and the LaGuardia terminals in 5-6 minutes, running every 4 minutes**
- **Quick and effortless transfer from either the #7 subway or LIRR to a brand new AirTrain system, via a modern, attractive transfer station at Willets Point, which is air conditioned in the summer and heated in the winter, providing a welcoming gateway to the airport**
- **Connection to the entire New York City subway system, including access from all New York City boroughs, via the #7 line**
- **Convenient auto access to an airport parking lot at Willets Point from the Grand Central, Van Wyck, and Long Island Expressways**
- **AirTrain stations serving the primary passenger terminals on-airport will be easy to get to (steps away) and have a very short transfer from AirTrain to check in, security and pre-security amenities, with connecting shuttle bus service to the Marine Air Terminal (Terminal A)**
- **Designed to provide an easy transfer between both LIRR and the subway for all types of passengers, including passengers with disabilities, seniors, passengers traveling with children, and passengers with large luggage**
- **Single integrated fare with a mobile payment option**

[PROGRAMMER: Departing from Long Island]

Suppose that a new, easy to use rail service linked LaGuardia with the Long Island Railroad (LIRR) Port Washington branch and an airport parking lot at Willets Point. This new service would provide you with a quicker and more reliable option to reach LaGuardia, avoiding the uncertainty of traffic congestion.

- **New AirTrain between Willets Point and the LaGuardia terminals in 5-6 minutes, running every 4 minutes**
- **Directly connected to the Port Washington branch of LIRR, with access to the entire LIRR network via a quick connection at Woodside station**
- **Quick and effortless transfer from LIRR to a brand new AirTrain system, via a modern, attractive transfer station at Willets Point, which is air conditioned in the summer and heated in the winter, providing a welcoming gateway to the airport**
- **Convenient auto access to an airport parking lot at Willets Point from the Grand Central, Van Wyck, and Long Island Expressways**
- **AirTrain stations serving the primary passenger terminals on-airport will be easy to get to (steps away) and have a very short transfer from AirTrain to check in, security and pre-security amenities, with connecting shuttle bus service to the Marine Air Terminal (Terminal A)**
- **Designed to provide an easy transfer between both LIRR and the subway for all types of passengers, including passengers with disabilities, seniors, passengers traveling with children, and passengers with large luggage**
- **Single integrated fare with a mobile payment option**

27. [PROGRAMMER: Departing] If the cost to use this new rail service designed for air passengers is comparable to existing transit and commuter rail services, how likely would you be to use it for the trip you made today?

☐ Definitely would use

☐ Likely to use

☐ Would consider

☐ Not likely to use

☐ Definitely would not use

28. [PROGRAMMER: ASK IF (Q.4i =“WORK”) AND (Q.4b =“NO, LIVE IN THE LOCAL AREA)] How likely would you be to use this new rail service designed for air passengers for a trip from home, rather than from work, if cost was comparable to existing transit and commuter rail services?

☐ Definitely would use

☐ Likely to use

☐ Would consider

☐ Not likely to use

☐ Definitely would not use

29. [PROGRAMMER: ASK IF Q.4i =“HOME” AND Q.4b =“NO, LIVE IN THE LOCAL AREA”] How likely would you be to use this new rail service designed for air passengers for a trip from work, rather than from home, if cost was comparable to existing transit and commuter rail services?

☐ Definitely would use

☐ Likely to use

☐ Would consider

☐ Not likely to use

☐ Definitely would not use

☐ Not Applicable

30. [PROGRAMMER: Departing] Please rank the following attributes of this new rail service designed for air passengers in order of their importance. (Ranked Preference)

_____ Regularly scheduled LIRR service (i.e. every 15 minutes)

_____ Reliability and predictability of travel time

_____ Convenient access to the rail station from Midtown Manhattan

_____ Total travel time

_____ Frequency of service

_____ Ease of transfer from/to LIRR/subway at AirTrain station

_____ Ease of payment options (i.e. mobile payment)

_____ Other (please specify) ____________________

31. [PROGRAMMER: ASK IF Q3a is "Drove Your Own Car", "Passenger in Car Parked at Airport", "Passenger in Car and Dropped Off at Airport", "Taxi", "Limo/Executive Car/Town Car Service", "Uber", "Lyft", "NYC Airporter Bus from Manhattan" or "NYC Airporter Bus from JFK/LaGuardia Airports"] You may have experienced traffic congestion on your way to the airport today. Trends point towards increased future traffic congestion throughout the region. As a result, it is expected that roadway travel times to LaGuardia will increase and become less predictable. If there was a new rail transit service (as previously described) that would offer a more predictable travel time to the airport, how likely would you be to switch from today's travel mode to the new rail service designed for air passengers, if cost was comparable to existing transit and commuter rail services?

☐ Definitely would switch

☐ Likely to switch

☐ Would consider switching

☐ Not likely to switch

☐ Definitely would not switch

☐ Not applicable

[PROGRAMMER: REQUEST that respondents read the following before answering fare questions.] The following questions discuss various hypothetical fare rates for the future AirTrain and its subway/LIRR connections. Any potential future fare policy decisions will be determined by the Port Authority and the MTA, respectively.

32. [PROGRAMMER: ASK IF Q3a is "Drove Your Own Car", "Passenger in Car Parked at Airport", "Taxi", "Limo/Executive Car/Town Car Service", "Uber" or "Lyft"] If you were to consider using the new rail service designed for air passengers to LGA, would you connect via the LIRR or the #7 Subway line?

☐ LIRR

☐ Subway (#7 Line)

☐ Would consider LIRR or Subway

32a. [PROGRAMMER: ASK IF Q32 is "LIRR" or "Would consider LIRR or Subway"] If the new rail service designed for air passengers were available for an integrated fare of <u>$15</u> for a combined Long Island Rail Road plus AirTrain LGA journey from Manhattan. Given this anticipated fare, how likely would you be to switch from today's travel mode to the new rail service?

1☐ Definitely would switch

2☐ Likely to switch

3☐ Would consider switching

4☐ Not likely to switch

5☐ Definitely would not switch

32b. [PROGRAMMER: ASK IF Q32a is 1 or 2 or 3] If the new rail service designed for air passengers were available for an integrated fare of <u>$20</u> for a combined Long Island Rail Road plus AirTrain LGA journey from Manhattan, how likely would you be to switch from today's travel mode to the new rail service?

1☐ Definitely would switch

2☐ Likely to switch

3☐ Would consider switching

4☐ Not likely to switch

5☐ Definitely would not switch

32c. [PROGRAMMER: ASK IF Q32a is 4 or 5] If the new rail service designed for air passengers were available for an integrated fare of <u>$12</u> for a combined Long Island Rail Road plus AirTrain LGA journey from Manhattan, how likely would you be to switch from today's travel mode to the new rail service?

1☐ Definitely would switch

2☐ Likely to switch

3☐ Would consider switching

4☐ Not likely to switch

5☐ Definitely would not switch

32d. [PROGRAMMER: ASK IF Q32 is "Subway" or "Would consider LIRR or Subway"] If the new rail service designed for air passengers were available for an integrated fare of <u>$11</u> for a combined No. 7-line subway plus AirTrain LGA journey, how likely would you be to switch from today's travel mode to the new rail service?

1☐ Definitely would switch

2☐ Likely to switch

3☐ Would consider switching

4☐ Not likely to switch

5☐ Definitely would not switch

32e. [PROGRAMMER: ASK IF Q32d is 1 or 2 or 3] If the new rail service designed for air passengers were available for an integrated fare of <u>$14</u> for a combined No. 7-line subway plus AirTrain LGA journey, how likely would you be to switch from today's travel mode to the new rail service?

1☐ Definitely would switch

2☐ Likely to switch

3☐ Would consider switching

4☐ Not likely to switch

5☐ Definitely would not switch

32f. [PROGRAMMER: ASK IF Q32d is 4 or 5] If the new rail service designed for air passengers were available for an integrated fare of <u>$8</u> for a combined No. 7-line subway plus AirTrain LGA journey, how likely would you be to switch from today's travel mode to the new rail service?

1☐ Definitely would switch

2☐ Likely to switch

3☐ Would consider switching

4☐ Not likely to switch

5☐ Definitely would not switch

33. [PROGRAMMER: ASK IF Q3a is "Drove Your Own Car", "Passenger in Car Parked at Airport", "Passenger in Car and Dropped Off at Airport", AND ((Q.4i ="HOME" AND Q.4k ="YES, PRIMARY RESIDENCE") OR (Q.30="U.S. RESIDENT"))] Suppose a new long-term parking lot is located at Willets Point with a direct connection to the new, modern airport people mover system, bringing you to LaGuardia's two primary terminals in 5-6 minutes. If parking rates were approximately 50% lower than today's standard long-term parking rates (currently $39 per day), how likely would you be to utilize this new parking lot in the future?

☐ Definitely would use

☐ Likely to use

☐ Would consider

☐ Not likely to use

34. [PROGRAMMER: ASK IF Q3a is "Metro-North Railroad", "NYC Subway" or "Public/City Bus"] Currently, all public transportation access options to LaGuardia utilizes a local bus connection. Trends point towards increased future traffic congestion throughout the region. As a result, it is expected that roadway travel times to LaGuardia will increase and become less predictable. If there was a new airport rail transit service designed for air passengers (as previously described) with an incremental cost of <u>$8</u> that would offer a more reliable travel time to the airport and greater comfort, how likely would you be to use the new rail service?

1☐ Definitely would switch

2☐ Likely to switch

3☐ Would consider switching

4☐ Not likely to switch

5☐ Definitely would not switch

34a. [PROGRAMMER: ASK IF Q34 is 1 or 2 or 3] If the new rail service designed for air passengers were available for an incremental cost of <u>$11</u>, how likely would you be to use the new rail service?

1☐ Definitely would switch

2☐ Likely to switch

3☐ Would consider switching

4☐ Not likely to switch

5☐ Definitely would not switch

34b. [PROGRAMMER: ASK IF Q34 is 4 or 5] If the new rail service designed for air passengers were available for an incremental cost of <u>$5</u>, how likely would you be to use the new rail service?

1☐ Definitely would switch

2☐ Likely to switch

3☐ Would consider switching

4☐ Not likely to switch

5☐ Definitely would not switch

THANK YOU FOR TAKING PART IN THIS IMPORTANT SURVEY!

A.2.2 LGA ARRIVING PASSENGERS

(INTERVIEWER: FILL OUT ITEMS BELOW) **AIRPORT LGA** ☐

Lang. Version:..1

Date: ☐☐ / ☐☐ / ☐☐ **Time:** ☐☐ : ☐☐ ☐ AM ☐ PM ☐ **Reg'l Jet**

Terminal: ☐☐ **Gate Number:** ☐☐☐☐ **Airline Name:** ____________________ **Interviewer ID#:** ☐☐☐

Flight #: _________________ **Sch'dArr. Time (MT):** ☐☐**:** ☐☐

Weather (Check All That Apply): ☐ **Sunny** ☐ **Dry** ☐ **Wet**

1. Are you visiting the local area or do you live here?

- ☐ Visiting new York Area
- ☐ Live in New York Area
- ☐ Transferring flights

2a. What is the main mode of transportation you will use to leave from LaGuardia Airport today? If you will use more than one mode to get to your final destination, please indicate the first mode. (Check ONE box)

Personal Car

- Drove Your Own Car .... ☐
- Passenger in Car Parked at Airport .... ☐
- Passenger in Car and Dropped Off at Airport .... ☐

Rental Car

- Drove Rental Car (Specify Co.: ___________________) . ☐
- Rental Car Shuttle/Van........ ☐

Rail/Train/Subway

- NJ Transit or Amtrak........ ☐
- Metro-North Railroad........ ☐
- NYC Subway (Specify Line: ______________) .... ☐
- LIRR........ ☐

Hired Car/Van Service

- Taxi .... ☐
- Limo/Executive Car/Town Car Service........ ☐
- Uber .... ☐
- Lyft .... ☐
- Shared-Ride Van/Service (Specify Name:___) .... ☐

Bus

- Public/City Bus (that is, a local bus)........ ☐
- NYC Airporter Bus from Manhattan .... ☐
- NYC Airporter Bus from JFK/LaGuardia Airports .... ☐
- Chartered/Tour Bus........ ☐

Local Airport Transport

- Hotel/Motel Shuttle/Van........ ☐
- On-Airport Terminal Access Shuttle Bus........ ☐
- Off-Airport Parking Co. Shuttle/Van (Specify Co__) .... ☐

Other (Specify: ______________________) .... ☐

2b. What other modes of transportation will you use to get to your destination from the terminal you're in now? (Check All That Apply)

Personal Car
- Drove Your Own Car ☐
- Passenger in Car Parked at Airport ☐
- Passenger in Car and Dropped Off at Airport ☐

Rental Car
- Drove Rental Car (Specify Co.: ____________________) ☐
- Rental Car Shuttle/Van

Rail/Train/Subway
- NJ Transit or Amtrak ☐
- PATH ☐
- Metro-North Railroad ☐
- NYC Subway (Specify Line: ________________) ☐
- LIRR ☐

Hired Car/Van Service
- Taxi ☐
- Limo/Executive Car/Town Car Service ☐
- Uber ☐
- Lyft ☐
- Shared-Ride Van/Service (Specify Name:___) ☐

Bus
- Public/City Bus (that is, a local bus) ☐
- NYC Airporter Bus from Manhattan ☐
- NYC Airporter Bus from JFK/LaGuardia Airports ☐
- Chartered/Tour Bus ☐

Local Airport Transport
- Hotel/Motel Shuttle/Van ☐
- On-Airport Terminal Access Shuttle Bus ☐
- Off-Airport Parking Co. Shuttle/Van (Specify Co__) ☐

Other (Specify: _________________________) ☐

Trends point towards increased future traffic congestion throughout the region. As a result, it is expected that roadway travel times from LaGuardia will increase and become less predictable. Currently, all public transportation access options from LaGuardia utilize a local bus connection. Suppose that a new, easy to use rail service linked LaGuardia Airport to Manhattan in <u>30 minutes or less</u>. This new service would provide you with a quicker and more reliable option to reach Midtown Manhattan or connect to transit options for other destinations, avoiding the uncertainty of traffic congestion.

- **Guaranteed 30-minute (or less) trip to Midtown from your LaGuardia terminal**
- **Quick and effortless transfer from a brand new AirTrain system to either LIRR or the #7 subway, via a modern, attractive transfer station at Willets Point, which is air conditioned in the summer and heated in the winter, providing a welcoming gateway to the city**
- **Long Island Railroad (LIRR) service arriving every 15 minutes at either Penn Station or Grand Central Terminal**
- **Connection to the entire New York City subway system, with access to all New York City boroughs via the #7 line, and connection to the entire LIRR system at Woodside station**

3a. How likely would you be to switch from your planned travel mode to the new rail service designed for air passengers, guaranteeing a 30-minute ride to Midtown Manhattan at a comparable cost to existing transit and commuter rail services? (Check ONE box)

1 ☐ Definitely would switch 2 ☐ Likely to switch 3 ☐ Would consider switching 4 ☐ Not likely to switch 5 ☐ Definitely would not switch
☐ Not applicable

3b. How likely would you be to switch from your planned travel mode to the new rail service, with a connection to the New York City subway system via the #7 line, at a comparable cost to existing transit services? (Check ONE box)

1 ☐ Definitely would switch 2 ☐ Likely to switch 3 ☐ Would consider switching 4 ☐ Not likely to switch 5 ☐ Definitely would not switch
☐ Not applicable

NOTE: The following questions discuss various hypothetical fare rates for the future AirTrain and its subway/LIRR connections. Any potential future fare policy decisions will be determined by the Port Authority and the MTA, respectively.

4a.[ALL RESPONDENTS] If the new rail service designed for air passengers were available for an integrated fare of $15 for a combined AirTrain LGA plus **LIRR journey** to **Manhattan, how likely would you be to switch from today's travel mode to the new rail service?**

1☐ Definitely would switch

2☐ Likely to switch

3☐ Would consider switching

4☐ Not likely to switch

5☐ Definitely would not switch

4b. [IF Q4a is 1 or 2 or 3] If the new rail service designed for air passengers were available for an integrated fare of $20 for a combined AirTrain LGA plus **LIRR journey** to **Manhattan, how likely would you be to switch from today's travel mode to the new rail service ?**

1☐ Definitely would switch

2☐ Likely to switch

3☐ Would consider switching

4☐ Not likely to switch

5☐ Definitely would not switch

4c. [IF Q4a is 4 or 5] If the new rail service designed for air passengers were available for an integrated fare of $12 for a combined AirTrain LGA plus LIRR journey to Manhattan, how likely would you be to switch from today's travel mode to the new rail service ?

1☐ Definitely would switch

2☐ Likely to switch

3☐ Would consider switching

4☐ Not likely to switch

5☐ Definitely would not switch

5a. [ALL RESPONDENTS] If the new rail service designed for air passengers were available for an integrated fare of $11 for a combined AirTrain LGA plus No. 7-line subway journey, how likely would you be to switch from today's travel mode to the new rail service ?

1☐ Definitely would switch

2☐ Likely to switch

3☐ Would consider switching

4☐ Not likely to switch

5☐ Definitely would not switch

5b. [IF Q5a is 1 or 2 or 3] If the new rail service designed for air passengers were available for an integrated fare of $14 for a combined AirTrain LGA plus No. 7-line subway journey, how likely would you be to switch from today's travel mode to the new rail service ?

1☐ Definitely would switch

2☐ Likely to switch

3☐ Would consider switching

4☐ Not likely to switch

5☐ Definitely would not switch

5c. [IF Q5a is 4 or 5] If the new rail service designed for air passengers were available for an integrated fare of $8 for a combined AirTrain LGA plus No. 7-line subway journey, how likely would you be to switch from today's travel mode to the new rail service ?

1☐ Definitely would switch

2☐ Likely to switch

3☐ Would consider switching

4☐ Not likely to switch

5☐ Definitely would not switch

6. [IF Q2a is "Drove Your Own Car", "Passenger in Car Parked at Airport", "Passenger in Car and Dropped Off at Airport", AND Q.1 ="No, live in the area"] As part of the potential project, suppose a new long-term parking lot is located at Willets Point with a direct connection to the new airport people mover system, bringing you to LaGuardia's two primary terminals in 5-6 minutes. If parking rates were approximately 50% lower than today's standard long-term parking rates (currently $39 per day), how likely would you be to utilize this new airport parking lot in the future?

☐ Definitely would use

☐ Likely to use

☐ Would consider

☐ Not likely to use

7. **Which one of the following situations best describes your travel plans at LaGuardia Airport today? Please Check Only One Answer**

☐ Arriving at LaGuardia airport and plan to take ground transportation (private car, taxi, bus, train, shuttle, etc.) to your final destination.

☐ Transferring from one plane to another (that is, changing planes) *within* LaGuardia Airport, TODAY.

8. **Was your flight to LaGuardia Airport today from a location within the domestic U.S., including Alaska, Hawaii, a U.S. Territory (Puerto Rico, Virgin Islands, Guam, etc.)?**

☐ Yes (Domestic U.S. Flight)
☐ No (International Flight)

8a. **What was the departure airport for your flight to LaGuardia Airport today?** (INTERVIEWER: ENTER AIRPORT NAME AND 3-LETTER CODE, IF KNOWN) _________________

8b. **At what time did your flight arrive at LaGuardia Airport?** TIME:- ____:____ AM PM

[INTERVIEWER: ASK Q.8c IF DROVE OWN CAR OR PASSENGER IN PARKED CAR IN Q.1a]

8c. **Where did you/the driver park the car**? SHOW LGA PARKING MAP IF NEEDED.

☐ P6, Parking Lot (near Terminal A)
☐ P2 Parking Garage (in front of Terminal B)
☐ P4 Parking Garage (in front of Terminal C)
☐ P10, Parking Lot (near Terminal A)--Long Term Parking
☐ P4 Parking Lot (in front of Terminals C & D)
☐ P5 Parking Lot (on the side of Terminal D)

IF PUBLIC/CITY BUS IN Q.1a OR Q.1b, ASK:

8d. **Which NYC Transit/MTA bus route will you take on your trip from LaGuardia Airport today?**

☐ Q70 SBS LaGuardia Link
☐ M60 SBS
☐ Q47
☐ Q33 (then walk to airport)
☐ Q48
☐ Q72
☐ Q23 (then walk to airport)

9a. [**IF Q1a/Q1b = LIRR, NYC Subway or NYC Bus] How will you pay for your transit ride today? (Check ONE box)**

1☐ Pay per ride (MetroCard or LIRR ticket) 2☐ Monthly pass 3☐ Weekly pass 4☐ 10 Ride pass 5☐ Will not have to pay to ride

9b. **Where is your next destination in the local area after you leave LGA today? INTERVIEWER: Please check only one answer below.**

☐ New York ☐ New Jersey ☐ Connecticut ☐ Pennsylvania ☐ Other U.S. -- **[GO TO Q.4h]**

9c. **Where is that? INTERVIEWER: Please check only one answer.**

☐ Home ☐ Staying with Friends/Relatives ☐ Cruise Ship ☐ Work ☐ School ☐ Hotel
☐ Another LOCAL Airport (such as JFK Int'l, Newark Liberty Int'l, Stewart Int'l, or Atlantic City Int'l) ☐ Other (please specify) ___________

9d. **(IF "ANOTHER LOCAL AIRPORT" CHECKED IN Q.9b, ASK:) Which local airport is it?**

☐ JFK International ☐ Newark-Liberty International ☐ Stewart International ☐ Atlantic City International
☐ Other (Specify: ___________________)

9e. **[IF "HOME" ANSWERED IN Q.9c:] Is this your primary residence?** ☐ Yes ☐ No

9f. **[IF "OTHER U.S." IN Q.9b:] Where is that?** _________________

9g. **[IF "NEW YORK" IN Q.9b, ASK Q.9g, OTHERWISE SKIP TO Q. 9h] Please check only one answer below:**

☐ Manhattan-Below 14th St. ☐ Manhattan-14th-96th St. ☐ Manhattan- Above 96th St. ☐ Bronx ☐ Brooklyn ☐ Queens ☐ Staten Island
☐ Outside New York City – **ASK Q.9h; ALL OTHERS IN Q.9g, SKIP TO Q.9i.**

9h. **[IF Q.9g is "Outside New York City" OR Q.9b is "New Jersey," "Connecticut" or "Pennsylvania," ASK:]**

What city or town are you going to today from LaGuardia Airport: _____________________________

9i. [INTERVIEWER: IF NY, NJ, CT OR PA STATE ORIGIN IN Q.9b:] Please enter the Zip Code Area for that location. If you don't know the zip code for the area you are going to next, what is the address, nearest intersection, or a prominent landmark?
____

9j. [INTERVIEWER: IF NY, NJ, CT OR PA STATE ORIGIN IN Q.9b, ASK:] What is the name of the County for that location?
____

9k. [IF JUST VISITING NY/NJ/CT/PA AREA (Q.1 is "Yes"), ASK] What airport will you fly from when you leave the New York area?

☐ JFK International ☐ LaGuardia ☐ Newark-Liberty International ☐ Stewart International ☐ Atlantic City International
☐ Other (Specify: ___________________)

ASK EVERYONE

10. What was the primary purpose of your trip today?

☐ Leisure/Vacation/Visiting ☐ Business ☐ Both Business/Non-Business ☐ School-Related ☐ Illness/Bereavement ☐ Moving/Relocation
☐ Other (please specify):_________________

11. [IF "ARRIVING—NOT "TRANSFERRING" IN Q.7, ANSWER Q.11.] Did a friend, relative or colleague come inside this terminal to greet you today?

☐ No ☐ Yes – **6a. How many people were there to greet you?** #: _________

12. How many people, including yourself, were in your party on the flight today? #:____________

13. [IF MORE THAN ONE IN Q.12:] How many were children under age 18? #________

14. [IF ONLY ONE IN Q.12:] How many bags did you check on the flight coming to LaGuardia Airport today? (Write in number -- "0" if none) #: _______

15. [IF MORE THAN ONE IN Q.12:] How many bags in total were checked today for your travel party? (Write in number --"0" if none) #:______

16. [ASK EVERYONE:] How many carry-on bags do you, yourself, have today? (Write in number -- "0" if none) #: _______

17. What terminal did your flight come into at LaGuardia Airport TODAY?

☐ Same terminal you are in now ☐ A different terminal

18. (IF "A DIFFERENT TERMINAL IN Q.17, ASK:) Which terminal did you fly into today?

INTERVIEWER, ANSWER TO Q.18 CANNOT BE THE TERMINAL YOU ARE IN NOW]

☐ LGA: TA (Delta Shuttle) ☐ LGA: TB (Central Terminal Bldg.) ☐ LGA: TC (American and Delta) ☐ LGA: TD (Delta and Westjet)

READ: THESE FINAL FEW QUESTIONS ARE FOR CLASSIFICATION PURPOSES ONLY.

(IF "HOME" TO Q.9c, AND "YES, PRIMARY RESIDENCE" TO Q.9e, SKIP TO Q.26. ALL OTHERS ASK Q.19.

19. Is your primary residence in the U.S. or outside of the U.S.?

☐ U.S.
☐ Outside U.S.

20. (IF NON-U.S. RESIDENT IN Q.19, ASK:)

What is your primary country of Residence?) ________________________________

21. (IF USA RESIDENT IN Q.19): Please enter Zip Code: ☐☐☐☐☐

22 (IF USA RESIDENT IN Q.19, ASK State/Territory _____________

23. (IF "NEW YORK" IN Q.22): Please check only one answer below.
[IF NJ, CT, OR PA RESIDENT IN Q.22, SKIP TO Q.25. OTHERWISE, SKIP TO Q.26]

☐ Manhattan-Below 14th St. ☐ Manhattan-14th-96th St. ☐ Manhattan- Above 96th St. ☐ Bronx ☐ Brooklyn ☐ Queens ☐ Staten Island

☐ Not New York City Resident - **ASK Q.24; ALL OTHERS IN Q.23 SKIP TO Q.26.**

24. And, please enter residential city or town: ____

25. [INTERVIEWER: IF NY, NJ, CT OR PA PRIMARY STATE RESIDENCE IN Q.22, ASK:] What is the name of the County where you reside?

____

26. Gender: ☐ Male ☐ Female

27. Year Born: ☐☐☐☐

28. Which one of the following groups best describes your household's total annual income before taxes in 2016?

☐ Under $25,000	☐ $50,000 - $59,999	☐ $90,000 - $99,999	☐ $175,000 - $199,999
☐ $25,000 - $29,999	☐ $60,000 - $69,999	☐ $100,000 - $124,999	☐ $200,000 - $249,999
☐ $30,000 - $39,999	☐ $70,000 - $79,999	☐ $125,000 - $149,999	☐ $250,000 - $299,999
☐ $40,000 - $49,999	☐ $80,000 - $89,999	☐ $150,000 - $174,999	☐ $300,000 or more

29. And finally, we'd like to follow-up with you in the future about our airports, may we contact you at your e-mail address?

If yes, please complete:

______________________ @ __________________ . _______________

THANK YOU FOR TAKING PART IN THIS IMPORTANT SURVEY!

A.2.3 LGA EMPLOYEES

TO BE FILLED OUT BY INTERVIEWER BEFORE INITIATING SURVEY:

Interview Date: ____ / ____ / ____ Interview Time: ____ : ____ AM / PM Interviewer ID / Name: _______________

Interview Platform/Location **(Completed by interviewer)** ___________________________________

1. Do you work at LGA Airport? This includes any employer at or near LGA Airport, or if you are employed by an airline. **(Check ONE box)**

1☐ Yes 2☐ No (Term) 3☐ Refused (Term)

2. **Note ONLY – No Response Required** Thank you for taking the LGA Airport Employee Travel Survey! We have a few questions about how you travel to, from, and within LGA. Your answers will help us to improve your travel options in the future.

2a. Do you live in the New York, New Jersey, Connecticut or Pennsylvania local areas? **(Check ONE box)**

1☐ Yes 2☐ No

2b. [IF Q2a is "No", ASK] From which location did you come to LGA today? READ LIST

1☐ Hotel near LGA 2☐ Other hotel 3☐ Other accommodation

3. For which type of company or entity do you work at LGA? **(Check ALL that apply)**

1☐ Airline flight crew
2☐ Airline other
3☐ Airport security
4☐ Airport vendor (store, restaurant, etc.)
5☐ Airport ground transportation
6☐ Airport contractor
7☐ Other (please specify) _________

4. Do you work at that company full time or part time? **(Check ONE box)**

1☐ Full time 2☐ Part Time

5. What is the primary location of your work? **(Check ONE box)**

1☐ Terminal A
2☐ Terminal B
3☐ Terminal C
4☐ Terminal D
5☐ Cargo area
(please specify building number) _________
6☐ Hangar area
7☐ Car rental area at Federal Circle
8☐ Parking area
(please specify parking lot) _________
9☐ Employee Parking area
(please specify parking lot) _________
996☐ Other (Specify) ______________

6. In a typical week, how many days do you work at LGA Airport? **(Check ONE box)**

1☐ 1 day
2☐ 2 days
3☐ 3 days
4☐ 4 days
5☐ 5 days
6☐ 6 days
7☐ 7 days

7. What time does/did your most recent shift at LGA Airport start? **(Please indicate the time, including AM or PM)**

1 ☐ 12
2 ☐ 1
3 ☐ 2
4 ☐ 3
5 ☐ 4
6 ☐ 5
7 ☐ 6
8 ☐ 7
9 ☐ 8
10 ☐ 9
11 ☐ 10
12 ☐ 11

1 ☐ 00
2 ☐ 30

1 ☐ AM
2 ☐ PM

8. About how long is/was your shift? **(Please indicate the number of hours)**

____

9. Typically, how long is your door to door commute to work? **(Please indicate the number of minutes)**

____

10. For your commute to work today, what is the address or nearest intersection (or zip code) of your starting location? **(Please be as specific as possible)**

____

11. How did you get to the airport for work today? **(Check ALL that apply)**

Personal Car
1 ☐ Drive your own car
2 ☐ Shared a ride in another person's private vehicle

Rental Car
3 ☐ Drive or was passenger in Rental Car
(Please specify company name) _______________

Rail/train/Subway
4 ☐ NJ Transit or Amtrak
5 ☐ PATH
6 ☐ Metro-North Railroad
7 ☐ NYC Subway
(Please specify all lines) _______________
8 ☐ LIRR

Hired Car/Van Service
9 ☐ Taxi
10 ☐ Limo/Executive Car/Town Car Service
11 ☐ Uber
12 ☐ Lyft

Bus
13 ☐ Public/City Bus (that is, a local bus)
14 ☐ NYC Airporter Bus from Manhattan
15 ☐ Newark Liberty Airport Express Bus from Manhattan
16 ☐ NYC Airporter Bus between JFK/LaGuardia Airports
17 ☐ Chartered/Tour Bus
18 ☐ Transbridge Bus

Local Airport Transport
19 ☐ Hotel/Motel Shuttle/Van
20 ☐ On-Airport Parking Lot Bus
21 ☐ On-Airport Terminal Access Shuttle Bus
22 ☐ Off-Airport Parking Co. Shuttle/Van
(Please specify Company) _______________
23 ☐ Other (Specify) ______________

11a. **Ask only if Q.11 equals Public/City Bus** Which NYC Transit/MTA bus route did you take to LaGuardia Airport today? **(Check ALL that apply)**

1☐ Q70 SBC LaGuardia Link
2☐ M60 SBS
3☐ Q47
4☐ Q33 (then walk to airport)
5☐ Q48
6☐ Q72
7☐ Q23 (then walk to airport)

12. **Ask only if Q.11 = LIRR, NYC Subway or NYC Bus** How did you pay for your transit ride today? **(Check ONE box)**

1☐ Pay per ride (MetroCard or LIRR ticket) 2☐ Monthly pass 3☐ Weekly pass 4☐ 10 Ride pass 5☐ Did not have to pay to ride

13. **Ask only if Q11 = LIRR, NYC Subway or NYC Transit bus** Is your public transit cost reimbursed by your employer? **(Check ONE box)**

1☐ Yes – Fully reimbursed 2☐ Yes – Partially reimbursed 3☐ No

13a. **Ask only if Q11 = LIRR, NYC Subway or NYC Transit bus** Was a private car available to you for this trip? **(Check ONE box)**

1☐ Yes 2☐ No – I do not own a car 3☐ No - I own a car but it was used by somebody else

14. **Ask only if Q11 = Drive own car** What is the main reason that you drove yourself to the airport for work today? **(Check ONE box)**

1☐ Cost 2☐ Convenience 3☐ Only available mode of transportation 4☐ Other (Specify) ______________

15. **Ask only if Q11 = Drive own car or Shared a ride** Are you part of a shared ride or carpool group? **(Check ONE box)**

1☐ Yes 2☐ No

16. **Ask only if Q15 = Yes** Was the car you rode to work in today driven… **(Check ONE box)**

1☐ To your work location, then off-airport
2☐ To your work location, then to an on-airport parking facility
3☐ Directly to an off-airport parking facility
4☐ Directly to an on-airport parking facility

17. **Ask only if Q15 = Yes** Did you/the driver of the car pay for parking today? **(Check ONE box)**

1☐ Yes, fully paid by me/driver
2☐ Yes, fully or partially re-imbursed by employer
3☐ No, employer provides parking
4☐ No

18. **Ask only if Q11 = Drive own car or Shared a ride** Where did you/the driver park the car? **(Check ONE box)**

1☐ P6, Parking Lot (near Terminal A)
2☐ P2 Parking Garage (in front of Terminal B)
3☐ P4 Parking Garage (in front of Terminal C)
4☐ Employee Parking Lot
5☐ P10 Parking Lot (near Terminal A)-Long Term Parking
6☐ P4 Parking Lot (in front of Terminals C & D)
7☐ P5 Parking Lot (on the side of Terminal D)

19a. Do you travel from terminal to terminal during your workday? **(Check ONE box)**

1☐ Yes 2☐ No

19b. **Ask only if Q19a = Yes** How many times per day?
Please specify the number of times per day______________

19c. **Ask only if Q19a = Yes** What mode of travel did you use to get from terminal to terminal?
Please specify the mode of travel______________

20. In what year were you born? **(Please indicate full year, for example, 1988)**

21. In US dollars, what was the total combined income (before taxes) for your household in 2016? **(Check ONE box)**

1 ☐ Under $25,000
2 ☐ $25,000 - $49,999
3 ☐ $50,000 - $74,999
4 ☐ $75,000 - $99,999
5 ☐ $100,000 - $124, 999
6 ☐ $125,000 - $149, 999
7 ☐ $150,000 - $174,999
8 ☐ $175,000 - $199,999
9 ☐ $200,000 - $299,999
10 ☐ $300,000 or greater
999 ☐ Decline to answer

22. **(Do not read)** **(Check ONE box)**

1 ☐ Male 2 ☐ Female

23. Please rank the relative importance of the following airport access trip attributes. **(Please use 1 for the most important item and 7 for the least important item; please assign a number to each item)**

____ Total travel time
____ Number of transfers
____ Predictability of travel time
____ Cost per person
____ Convenience
____ Comfort
____ Safety and Security

24. Please rank the relative importance of the following airport access convenience factors. **(Please use 1 for the most important item and 7 for the least important item; please assign a number to each item)**

____ Waiting time (e.g. waiting for the subway or taxi)
____ Walking time
____ Avoiding stairs
____ Crowding (possibility of finding a seat)
____ Ease of payment options (i.e. mobile payment)
____ Ease of transfer (if transfer required)

Read: We have just a few more questions. These last questions are about a potential new rail service to LaGuardia Airport and how employees might use the service to get to work.

For those who live in Manhattan:

Now, suppose that a new, easy to use rail service linked Manhattan to LaGuardia Airport in 30 minutes of less. This new service would provide you with a quicker and more reliable option to reach LaGuardia, avoiding the uncertainty of traffic congestion.

- Guaranteed 30-minute (or less) trip from Midtown to your LaGuardia terminal via the Long Island Railroad, with a connection to the AirTrain at Willets Point, the second stop from Manhattan
- Long Island Railroad (LIRR) service departing every 15 minutes from either Penn Station or Grand Central Terminal, with a 15-minute ride from Manhattan to Willets Point, and a 5-6 minute AirTrain ride from there to the terminal
- Quick and effortless transfer from either LIRR or the #7 subway to a brand new AirTrain system, via a modern, attractive transfer station at Willets Point, which is air conditioned in the summer and heated in the winter
- Connection to the entire New York City subway system, including access from Manhattan and the outer boroughs, via the #7 line
- AirTrain stations serving the primary passenger terminals on-airport will be easy to get to (steps away), with connecting shuttle bus service to the Marine Air Terminal (Terminal A) and other employment locations on the west side of the airport
- Single integrated fare with a mobile payment option
- Discounted AirTrain monthly and multi-ride passes will be available

For those who live in Queens, Brooklyn, or The Bronx:

Now, suppose that a new, easy to use rail service linked LaGuardia with the #7 subway line, Long Island Railroad (LIRR), and a parking lot reserved for employees at Willets Point, avoiding the uncertainty of traffic congestion.

- New AirTrain between Willets Point and the LaGuardia terminals in 5-6 minutes, running every 4 minutes
- Quick and effortless transfer from either the #7 subway or LIRR to a brand new AirTrain system, via a modern, attractive transfer station at Willets Point, which is air conditioned in the summer and heated in the winter
- Connection to the entire New York City subway system, including access from all New York City boroughs, via the #7 line
- AirTrain stations serving the primary passenger terminals on-airport will be easy to get to (steps away), with connecting shuttle bus service to the Marine Air Terminal (Terminal A) and other employment locations on the west side of the airport
- Convenient auto access to parking lot at Willets Point from the Grand Central, Van Wyck, and Long Island Expressway
- Single integrated fare with a mobile payment option
- Discounted AirTrain monthly and multi-ride passes will be available

For those who live in Long Island:

Now, suppose that a new, easy to use rail service linked LaGuardia with the Long Island Railroad (LIRR), and a parking lot reserved for employees at Willets Point, avoiding the uncertainty of traffic congestion.

- New AirTrain between Willets Point and the LaGuardia terminals in 5-6 minutes, running every 4 minutes
- Directly connected to the Port Washington branch of LIRR, with access to the entire LIRR network via a quick connection at Woodside station
- Quick and effortless transfer from LIRR to a brand new AirTrain system, via a modern, attractive transfer station at Willets Point, which is air conditioned in the summer and heated in the winter
- AirTrain stations serving the primary passenger terminals on-airport will be easy to get to (steps away), with connecting shuttle bus service to the Marine Air Terminal (Terminal A) and other employment locations on the west side of the airport
- Convenient auto access to parking lot at Willets Point from the Grand Central, Van Wyck, and Long Island Expressway
- Single integrated fare with a mobile payment option
- Discounted AirTrain monthly and multi-ride passes will be available

25. Which option to use AirTrain would be most interesting to you? (Check ONE box)

1☐ With transfer from transit 2☐ With driving and parking at Willets Poing 3☐ With drop off or pick up at Willets Point
4☐ None

26. If the cost to use this new rail service is comparable to existing transit and commuter rail services, how likely would you be to use this new service for the trip you made today? (Check ONE box)

1☐ Definitely would use 2☐ Likely to use 3☐ Would consider 4☐ Not likely to use 5☐ Definitely would not use

27. Please rank the following attributes of this new rail service designed for air passengers in order of their importance? (Ranked Preference)

1☐ Regularly scheduled LIRR service (i.e. every 15 minutes)
2☐ Reliability and predictability of travel time
3☐ Convenient access to rail station from Midtown Manhattan
4☐ Total travel time
5☐ Frequency of service
6☐ Ease of transfer from/to LIRR/subway at AirTrain station
7☐ Ease of payment options (i.e. mobile payment)
8☐ Other (Specify) ______________

NOTE: The following questions discuss various hypothetical fare rates for the future AirTrain and its subway/LIRR connections. Any potential future fare policy decisions will be determined by the Port Authority and the MTA, respectively.

28a. <u>Ask only if Q11 = Drive own car, shared a ride in a private vehicle, or drive/passenger in rental car</u>

You may have experienced traffic congestion on your way to the airport today. Trends point towards increased future traffic congestion throughout the region. As a result, it is expected that roadway travel times to LaGuardia will increase and become less predictable.

As part of the potential project, suppose all employee parking is moved to a new lot at Willets Point, at comparable parking rates to what you pay today, inclusive of any employer subsidies. The lot would have a built-in connection to the new airport people mover system to take you from the parking garage to the main terminals via a free 5-6 minute train ride.

The new airport people mover system with a direct connection to the LIRR and No. 7 Subway line (as previously described) would offer a more reliable travel time to the airport than current transit options. If there was a monthly pass cost of $65 (for the airport people mover only), elgible for any employer transit subsidies, how likely would you be to switch from driving to a transit mode utilizing this new rail service? **(Check ONE box)**

1☐ Definitely would switch 2☐ Likely to switch 3☐ Would consider switching 4☐ Not likely to switch 5☐ Definitely would not switch

28b. <u>Ask only if Q28a = 1 or 2 or 3</u>

If the new airport rail service was available with a monthly pass cost of $90, how likely would you be to switch from driving to this new rail service? **(Check ONE box)**

1☐ Definitely would switch 2☐ Likely to switch 3☐ Would consider switching 4☐ Not likely to switch 5☐ Definitely would not switch

28c. <u>Ask only if Q28a = 4 or 5</u>

If the new airport rail service was available with a monthly pass cost of $40, how likely would you be to switch from driving to this new rail service? **(Check ONE box)**

1☐ Definitely would switch 2☐ Likely to switch 3☐ Would consider switching 4☐ Not likely to switch 5☐ Definitely would not switch

29a. <u>Ask only if Q11 != Drive own car, shared a ride in a private vehicle, or drive/passenger in rental car</u>

Currently, all public transportation access options to LaGuardia utilize a local bus connection. Trends point towards increased future traffic congestion throughout the region. As a result, it is expected that roadway travel times to LaGuardia will increase and become less predictable. If there was a new airport people mover system (as previously described), that would offer a more reliable travel time to the airport and greater comfort, with an incremental monthly pass cost of $65 (for the airport people mover system only), how likely would you be to switch from today's travel mode to the new rail service? **(Check ONE box)**

1☐ Definitely would switch 2☐ Likely to switch 3☐ Would consider switching 4☐ Not likely to switch 5☐ Definitely would not switch

29b. <u>Ask only if Q29a = 1 or 2 or 3</u>

If the new airport rail service was available with an incremental monthly pass cost of $90, how likely would you be to switch from today's travel mode to the new rail service? **(Check ONE box)**

1☐ Definitely would switch 2☐ Likely to switch 3☐ Would consider switching 4☐ Not likely to switch 5☐ Definitely would not switch

29c. <u>Ask only if Q29a = 4 or 5</u>

If the new airport rail service was available with an incremental monthly pass cost of $40, how likely would you be to switch from today's travel mode to the new rail service? **(Check ONE box)**

1☐ Definitely would switch 2☐ Likely to switch 3☐ Would consider switching 4☐ Not likely to switch 5☐ Definitely would not switch

<u>THANK YOU FOR TAKING PART IN THIS IMPORTANT SURVEY!</u>

Appendix B. LGA Passenger and Employee Survey Results

B.1 GROUND ACCESS SURVEY RESULTS

The 2017 LGA Ground Access Survey was designed to obtain the most detailed and unbiased description of the existing ground access modes for various groups of air passengers (such as business vs. non-business, residents vs. non-residents, and national vs. international) and employees. Decisions about the questionnaire, survey field work, and subsequent survey weighting were based on the thorough analysis of the multiple surveys implemented in the past and corresponding forecasting models developed based on these surveys. The survey questionnaire was built upon the Customer Satisfaction Survey (CSS) questionnaire that has been used by the PANYNJ for a long period of time and has been the main source for ground access analysis for all airports in the region. The CSS field work experience largely settled the boundaries for levels of detail regarding the air passenger and travel party characteristics. The project team specifically revised the CSS questionnaire with respect to the questions important for mode choice modeling. The survey requested a very detailed description of the access mode combinations pertinent to LGA (more than 20).

The survey requested a detailed geo-coding for trip origins and destinations. The survey team analyzed multiple available publications on other airport surveys and included all questions that were found useful for the study. In particular, important ground access details of mode combinations for departing and arriving passengers were refined. State-of-the art advanced methods were applied for the survey weighting that was another substantial improvement. The survey was weighted to match multiple independent controls from different available focused surveys (such as a ridership survey for bus lines serving LGA).

Section B.1.1 below provides a detailed analysis of LGA air passenger characteristics and their actual ground access mode choices based on a combined dataset from the 2017 LGA Ground Access Survey and the 2014-2016 CSS. This database was used for model development purposes since it provides the richest possible data on trip origins and destinations. However, it limited the analysis to the data items available in all surveys. Section B.1.2 below presents the raw unweighted and weighted data using only the 2017 LGA Ground Access Survey dataset to provide insights into the specifics of the actual ground access mode choices for LGA.

B.1.1 LGA AIR PASSENGER CHARACTERISTICS

Table B-1 shows a summary of the distributions of LGA air passengers by income in terms of unweighted individual records. Overall, LGA air passengers are characterized by a wide distribution of incomes, from very low to very high incomes. Also, it should be noted that since reporting income is a sensitive personal issue, a large proportion of survey respondents skipped this question. In general, air passengers are characterized by a high average income (the income distribution is skewed towards higher incomes) compared to the general urban population of travelers in the New York region. It can also be seen that business air passengers logically have an income distribution somewhat skewed towards higher income categories compared to non-business passengers. Residents have a distribution slightly skewed towards higher incomes compared to visitors, but this difference is not very prominent.

Table B-1 Distribution of Air Passengers by Income (Unweighted Individual Records)

Income Groups	Resident		Visitor			Resident		Visitor		
	Business	Non-Business	Business	Non-Business	Total	Business	Non-Business	Business	Non-Business	Total
Under $25,000	3.6%	5.5%	1.8%	5.1%	4.3%	36	107	36	202	**381**
$25,000 - $29,999	1.1%	2.7%	0.4%	1.8%	1.6%	11	53	7	73	**144**
$30,000 - $39,999	1.9%	3.5%	1.3%	2.4%	2.3%	18	68	25	96	**208**
$40,000 - $49,999	1.7%	4.0%	2.0%	3.2%	2.9%	17	78	40	125	**260**
$50,000 - $59,999	2.7%	3.7%	2.4%	4.6%	3.7%	27	73	47	182	**329**
$60,000 - $69,999	2.6%	3.8%	2.0%	4.3%	3.5%	26	75	41	169	**311**
$70,000 - $79,999	2.8%	4.4%	3.0%	5.7%	4.5%	28	86	59	226	**399**
$80,000 - $89,999	3.2%	3.3%	3.8%	5.8%	4.5%	32	64	76	229	**401**
$90,000 - $99,999	4.6%	2.1%	4.5%	5.8%	4.6%	46	42	90	227	**405**
$100,000 - $124,999	6.0%	5.6%	6.7%	7.1%	6.6%	59	109	134	281	**583**
$125,000 - $149,999	4.0%	3.0%	5.1%	4.4%	4.2%	40	60	103	173	**375**
$150,000 - $174,999	2.6%	2.1%	3.6%	2.6%	2.7%	25	40	73	101	**240**
$175,000 - $199,999	2.4%	2.5%	3.2%	1.8%	2.3%	23	50	64	71	**208**
$200,000 - $249,999	3.2%	2.4%	2.0%	2.1%	2.3%	32	46	40	83	**200**
$250,000 - $299,999	2.5%	1.0%	2.1%	1.1%	1.5%	24	19	43	44	**130**
$300,000 or more	6.0%	4.3%	4.8%	3.2%	4.1%	60	84	96	126	**366**
Uknown	55.3%	50.6%	56.2%	42.1%	48.6%	548	993	1,123	1,663	**4,326**
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**992**	**1,963**	**1,999**	**3,945**	**8,899**

Source: WSP

Similar observations can be made from the weighted summary of daily O&D trips presented in **Table B-2**. The weighted summary shows even a higher proportion of high-income air passengers and somewhat more prominent income differences between business and non-business air passengers and between residents and visitors. These major differences are reflected in the ground access mode choice model by the corresponding differentiation of Values of Time (VOTs) and other model parameters by the air passenger type.

Table B-2 Distribution of Air Passengers by Income (Weighted Daily O&D Trip Summary)

Income Groups	Resident		Visitor			Resident		Visitor		
	Business	Non-Business	Business	Non-Business	Total	Business	Non-Business	Business	Non-Business	Total
Under $25,000	5.3%	6.5%	4.5%	7.2%	6.3%	336	1,066	620	2,344	**4,366**
$25,000 - $29,999	0.5%	2.5%	0.5%	1.7%	1.5%	30	416	65	555	**1,066**
$30,000 - $39,999	1.6%	3.2%	4.3%	2.5%	2.9%	104	531	585	800	**2,020**
$40,000 - $49,999	5.3%	4.6%	4.3%	3.2%	3.9%	338	758	589	1,032	**2,717**
$50,000 - $59,999	2.7%	3.7%	3.4%	5.0%	4.2%	170	614	469	1,613	**2,866**
$60,000 - $69,999	3.4%	4.1%	2.1%	4.8%	4.0%	217	667	283	1,570	**2,737**
$70,000 - $79,999	1.8%	5.5%	4.1%	5.5%	4.9%	117	913	562	1,770	**3,362**
$80,000 - $89,999	3.6%	3.5%	3.2%	5.4%	4.3%	226	583	431	1,741	**2,982**
$90,000 - $99,999	5.0%	2.9%	4.8%	5.5%	4.7%	316	476	659	1,786	**3,238**
$100,000 - $124,999	9.5%	7.9%	5.7%	7.8%	7.6%	604	1,300	778	2,532	**5,215**
$125,000 - $149,999	5.8%	3.2%	6.0%	5.9%	5.3%	370	521	811	1,931	**3,633**
$150,000 - $174,999	2.4%	2.8%	5.3%	3.7%	3.7%	152	461	718	1,215	**2,547**
$175,000 - $199,999	2.8%	3.1%	4.5%	2.8%	3.2%	177	508	610	920	**2,215**
$200,000 - $249,999	4.1%	4.9%	2.3%	3.7%	3.7%	258	801	309	1,194	**2,562**
$250,000 - $299,999	2.3%	1.3%	2.3%	1.3%	1.6%	145	218	320	416	**1,099**
$300,000 or more	11.6%	8.8%	9.0%	4.7%	7.2%	738	1,443	1,226	1,523	**4,931**
Unknown/Missing	32.4%	31.4%	33.7%	29.3%	31.0%	2,056	5,173	4,590	9,528	**21,347**
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**6,356**	**16,452**	**13,625**	**32,470**	**68,902**

Source: WSP

Travel party size is another characteristic that is an important determinant of ground access mode choice, and also is unique for trips to and from airports compared to other urban trips. The unweighted distribution of air passengers by travel party size is presented in **Table B-3**. Air passengers, in general, are characterized by a significant share of large parties, which is especially prominent for non-business visitors. Large travel parties have an important implication for ground access modeling because the cost savings found when sharing taxis and For Hire Vehicles are high when compared to transit options and AirTrain in particular. However, this factor is less essential for business travelers, who predominantly travel alone.

Table B-3 Distribution of Air Passengers by Travel Party Size (Unweighted Individual Records)

Party size	Resident		Visitor		Total	Resident		Visitor		Total
	Business	Non-Business	Business	Non-Business		Business	Non-Business	Business	Non-Business	
1	81.4%	56.6%	80.2%	39.3%	57.0%	807	1,110	1,604	1,549	**5,070**
2	13.2%	28.5%	15.1%	40.7%	29.2%	131	560	301	1,605	**2,597**
3	2.3%	7.5%	2.5%	10.2%	7.0%	23	147	50	401	**622**
4	1.8%	4.2%	0.9%	5.8%	3.9%	18	83	17	230	**349**
5+	1.2%	3.2%	1.3%	4.1%	2.9%	12	62	27	160	**261**
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**992**	**1,963**	**1,999**	**3,945**	**8,899**

Table B-4 shows the weighted trips summary by travel party size. Overall, it confirms the observations based on the raw unweighted survey with even a more prominent shift toward large travel parties for all groups of air passengers.

Table B-4 Distribution of Air Passengers by Travel Party Size (Weighted Daily O&D Trip Summary)

Party size	Resident		Visitor		Total	Resident		Visitor		Total
	Business	Non-Business	Business	Non-Business		Business	Non-Business	Business	Non-Business	
1	54.8%	31.8%	48.1%	20.5%	31.8%	3,481	5,230	6,556	6,669	**21,935**
2	24.2%	29.1%	25.3%	37.3%	31.8%	1,537	4,792	3,452	12,124	**21,904**
3	2.5%	13.7%	7.7%	15.4%	12.3%	157	2,247	1,047	5,004	**8,455**
4	8.2%	10.3%	6.1%	13.0%	10.6%	519	1,699	834	4,224	**7,276**
5+	10.4%	15.1%	12.7%	13.7%	13.5%	661	2,484	1,737	4,449	**9,332**
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**6,356**	**16,452**	**13,625**	**32,470**	**68,902**

The next step of the analysis is to determine the spatial distribution of trip origins and destinations for air passengers. LGA is characterized by its unique location close to Manhattan and by its location between the high-density urbanized areas of Queens, Brooklyn, and the Bronx. Another important aspect of LGA geographic markets is that Willets Point is a hub for several major highways including Grand Central Parkway and the Long Island Expressway, which makes LGA accessible for air passengers and employees from Long Island. Given these factors and based on the analysis of the existing spatial structure of LGA users, a compact meaningful geographic system was developed and used throughout the entire project. **Figure A-1** shows the zonal system that was developed. Each geographic market represents a group of air passengers or employees with a well-defined set of access modes to and from LGA and a certain potential propensity to use AirTrain LGA that makes the subsequent analysis of the results easier and more meaningful.

This geographic system is detailed for major markets in Manhattan and Queens. Manhattan, a key market for LGA air passengers, is subdivided into the following five areas that are directly related to the probability of using AirTrain LGA with a combination of either LIRR or the MTA 7 Line:

- 1.1 = Lower Manhattan (below the 23rd Street)
- 1.21 = Midtown Manhattan (between the 23rd and 60th Streets) with walking access to either Grand Central or Penn Station or to one of the 7 Line stations
- 1.22 = Other Midtown Manhattan
- 1.3 = Manhattan Upper East Side and Upper West Side (between 60th and 96th Streets)
- 1.4 = Manhattan North (above the 96th Street)

Queens, a key market for LGA employees, is subdivided into the following five areas by potential propensity to use transit access to AirTrain:

- 2 = Queens North-West
- 2.1 = Queens West with a walking access to the NYCT 7 Line or LIRR, which generates the primary market for employees who could use AirTrain
- 2.2 = Queens West other
- 2.3 = Queens East with a walking access to the subway (New York City Transit)
- 2.4 = Queens East other

The geographic system becomes less granular for secondary markets and areas farther away from LGA.

The observed distributions of LGA air passengers by geography are presented in **Table B-5** and **Table B-6**. The geography of LGA air passengers is very specific and the major potential markets are well defined. LGA attracts air passengers from across the New York metropolitan region. However, the major markets in Manhattan, Queens, Brooklyn, the Bronx, and Upstate New York rely greatly on LGA as the closest and most accessible major airport. In terms of potential ridership for AirTrain LGA, portions of Midtown Manhattan within a walking distance of 0.5 miles to the LIRR or the NYCT 7 Line stations represent the key market—with a substantial 18 percent share of LGA air passengers.

It is important to note systematic geographic effects by trip purpose and air passenger place of residence. Logically, the key geographic market in Midtown Manhattan is primarily associated with business and non-business visitors. Almost a quarter of visitors for business purposes and almost a quarter of visitors for non-business purposes stay in Midtown Manhattan within walking distance of the LIRR or NYCT 7 stations. For the entire Manhattan area, the share of LGA air passengers who are visitors reaches 60 percent. This demonstrates, in part, the need to provide a convenient and reliable rail access from Manhattan to LGA. It also should be noted that this statistical analysis is entirely based on the existing geography of LGA air passengers who do not have a convenient transit access to Manhattan today. One can reasonably expect that AirTrain LGA would also generate additional demand by a redistribution of air passengers between the major airports. In this regard, the adopted modeling approach where the air passenger geography is essentially fixed at the level observed today should be considered conservative.

Table B-5 Distribution of Air Passengers by Trip Origin/Destination (Unweighted Individual Records)

Origin Location	Resident		Visitor			Resident		Visitor		
	Business	Non-Business	Business	Non-Business	Total	Business	Non-Business	Business	Non-Business	Total
Manh Lower	7.6%	5.9%	10.7%	8.6%	8.4%	75	116	214	340	**744**
Manh Mid WA	7.9%	6.4%	24.6%	19.1%	16.3%	79	126	492	752	**1,448**
Manh Mid Other	4.1%	3.5%	9.7%	9.2%	7.5%	41	68	194	365	**667**
Manh UES UWS	10.3%	10.3%	10.1%	11.1%	10.6%	102	202	202	438	**945**
Manh North	10.1%	9.1%	14.3%	13.9%	12.5%	100	178	286	549	**1,113**
Queens NW	2.8%	2.7%	0.5%	0.8%	1.4%	28	53	9	31	**121**
Queens W WA	3.0%	2.7%	0.8%	1.1%	1.6%	29	52	16	45	**143**
Queens W Other	0.5%	0.8%	0.3%	0.3%	0.4%	5	16	5	12	**39**
Queens E WA	1.4%	1.8%	1.3%	1.7%	1.6%	14	35	27	68	**144**
Queens E Other	7.5%	7.1%	5.6%	7.3%	6.9%	75	139	112	287	**612**
Brooklyn E	1.9%	2.5%	1.7%	2.5%	2.3%	19	50	34	98	**201**
Brooklyn W	11.2%	11.4%	5.0%	6.5%	7.8%	111	223	100	257	**691**
Bronx	6.8%	10.5%	3.3%	3.6%	5.4%	68	206	67	143	**484**
Staten Island	1.3%	1.2%	1.1%	1.0%	1.1%	13	23	22	40	**98**
Long Island	7.4%	8.0%	3.1%	4.0%	5.1%	73	157	61	159	**451**
Upstate NY & CT	13.7%	12.6%	5.4%	6.8%	8.5%	136	247	108	268	**758**
NJ, PA	2.5%	3.6%	2.5%	2.4%	2.7%	25	71	50	93	**239**
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**992**	**1,963**	**1,999**	**3,945**	**8,899**

Source: WSP

Table B-6 Distribution of Air Passengers by Trip Origin/Destination (Weighted Daily O&D Trip Summary)

Origin Location	Resident		Visitor			Resident		Visitor		
	Business	Non-Business	Business	Non-Business	Total	Business	Non-Business	Business	Non-Business	Total
Manh Lower	7.9%	4.9%	11.7%	10.0%	8.9%	504	809	1,588	3,257	**6,158**
Manh Mid WA	7.8%	5.2%	24.9%	23.7%	18.0%	493	852	3,392	7,699	**12,436**
Manh Mid Other	6.5%	2.8%	9.3%	11.1%	8.3%	413	465	1,261	3,601	**5,739**
Manh UES UWS	6.7%	7.4%	9.1%	9.3%	8.6%	423	1,223	1,242	3,017	**5,905**
Manh North	4.0%	3.9%	6.2%	4.7%	4.8%	253	645	847	1,541	**3,287**
Queens NW	1.6%	2.3%	0.9%	1.0%	1.3%	103	383	118	321	**925**
Queens W WA	3.5%	2.2%	2.1%	1.5%	2.0%	220	354	291	490	**1,355**
Queens W Other	0.9%	1.3%	0.6%	0.5%	0.7%	54	206	80	160	**500**
Queens E WA	1.0%	2.2%	1.2%	1.3%	1.5%	63	360	157	437	**1,018**
Queens E Other	5.6%	8.0%	3.9%	6.2%	6.1%	353	1,313	531	2,005	**4,202**
Brooklyn E	1.3%	1.8%	1.2%	2.2%	1.9%	83	297	170	726	**1,275**
Brooklyn W	9.8%	12.2%	7.2%	6.9%	8.5%	622	2,000	977	2,238	**5,837**
Bronx	6.0%	9.7%	4.1%	4.2%	5.6%	383	1,597	563	1,349	**3,892**
Staten Island	1.7%	0.9%	1.0%	0.8%	1.0%	109	156	141	276	**682**
Long Island	11.6%	10.8%	6.6%	4.8%	7.2%	735	1,783	895	1,573	**4,986**
Upstate NY & CT	15.1%	20.1%	7.7%	8.7%	11.8%	960	3,302	1,045	2,815	**8,122**
NJ, PA	9.2%	4.3%	2.4%	3.0%	3.7%	585	705	326	966	**2,582**
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**6,356**	**16,452**	**13,625**	**32,470**	**68,902**

Source: WSP

Another important insight from the LGA surveys relate to the existing ground access mode shares. The mode choice summaries are presented in **Table B-7** and **Table B-8**. Currently, a majority of LGA air passengers (more than 50 percent) use taxis and other For Hire Vehicles for ground access. The second most frequent mode (more than 20 percent in the modal split) is auto drop-offs of departing passengers and pick-ups of arriving passengers. The share of transit use is low, which is a direct consequence of the absence of a good reliable transit option.

Table B-7 Distribution of Air Passengers by Ground Access Mode (Unweighted Individual Records)

Origin Location	Resident		Visitor			Resident		Visitor		
	Business	Non-Business	Business	Non-Business	Total	Business	Non-Business	Business	Non-Business	Total
Auto Drop-off	19.1%	27.3%	13.0%	20.4%	20.1%	189	536	260	805	**1,791**
Auto Short Term Park	5.0%	4.5%	0.6%	0.9%	2.1%	50	89	12	35	**185**
Auto Long Term Park	1.3%	1.0%	0.0%	0.0%	0.4%	13	20	0	0	**33**
Off-Airport Park	2.7%	3.8%	0.0%	0.0%	1.1%	27	75	0	0	**101**
Rental Car - At Airport	0.0%	0.0%	2.2%	1.2%	1.0%	0	0	43	49	**92**
Rental Car Off Airport	0.0%	0.0%	3.8%	3.3%	2.3%	0	0	75	130	**205**
Taxis/FHVs	51.7%	40.2%	64.2%	53.4%	52.7%	512	789	1,284	2,108	**4,694**
Hotel Courtesy Vehicle	1.5%	1.4%	4.4%	2.9%	2.7%	15	27	87	114	**242**
Shared Ride Van/Shuttl	1.0%	1.7%	2.2%	2.9%	2.2%	10	32	44	113	**199**
NYC Airporter	5.3%	5.6%	4.0%	6.3%	5.5%	52	110	80	250	**492**
Bus	8.2%	9.2%	3.5%	5.2%	6.0%	82	180	69	205	**536**
Subway+Bus	4.1%	5.0%	1.9%	3.1%	3.4%	41	99	38	123	**301**
Rail+Bus/Taxi	0.0%	0.3%	0.4%	0.3%	0.3%	0	7	7	13	**26**
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**992**	**1,963**	**1,999**	**3,945**	**8,899**

Source: WSP

Table B-8 Distribution of Air Passengers by Ground Access Mode (Weighted Daily O&D Trip Summary)

Origin Location	Resident		Visitor			Resident		Visitor		
	Business	Non-Business	Business	Non-Business	Total	Business	Non-Business	Business	Non-Business	Total
Auto Drop-off	21.8%	29.3%	12.5%	18.1%	20.0%	1,384	4,827	1,705	5,883	**13,800**
Auto Short Term Park	13.5%	12.7%	1.0%	2.5%	5.6%	858	2,095	136	802	**3,890**
Auto Long Term Park	2.8%	3.2%	0.0%	0.0%	1.0%	178	519	0	0	**697**
Off-Airport Park	3.4%	4.8%	0.0%	0.0%	1.5%	216	784	0	0	**1,000**
Rental Car - At Airport	0.0%	0.0%	3.3%	2.2%	1.7%	0	0	451	703	**1,154**
Rental Car Off Airport	0.0%	0.0%	8.6%	9.4%	6.1%	0	0	1,178	3,038	**4,216**
Taxis/FHVs	48.6%	38.7%	62.4%	53.3%	51.2%	3,092	6,362	8,499	17,316	**35,269**
Hotel Courtesy Vehicle	1.1%	1.1%	4.7%	2.6%	2.5%	68	185	642	850	**1,745**
Shared Ride Van/Shuttle	1.3%	1.6%	2.5%	4.3%	3.0%	85	267	347	1,395	**2,094**
NYC Airporter	1.1%	1.1%	0.9%	1.3%	1.1%	69	180	120	417	**787**
Bus	4.2%	4.7%	2.1%	3.1%	3.4%	265	767	286	1,011	**2,329**
Subway+Bus	2.2%	2.6%	1.5%	2.8%	2.4%	141	433	199	906	**1,679**
Rail+Bus/Taxi	0.0%	0.2%	0.5%	0.5%	0.4%	0	33	62	147	**243**
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**6,356**	**16,452**	**13,625**	**32,470**	**68,902**

Source: WSP

There are some important systematic differences in mode preferences across different trip purposes and air passengers by place of residence. The share of taxis/For Hire Vehicles is high for visitors and for business purposes. It is logical given the fact that most of the business travelers are reimbursed for the travel cost and tend to use the most convenient mode regardless of cost; also, visitors naturally rely less on drop-offs and pick-ups. Additionally, visitors who do not live in the New York region, very rarely use regular transit options compared to the residents of the region since they are not familiar with the transit system. These factors are fully accounted in the developed ground access choice model through the differentiation of VOTs by trip purpose and the differentiation of mode choice constants by trip purpose and place of residence.

Another insight into the air passenger travel market relates to age distribution. The corresponding tabulation of the raw survey records is presented in **Table B-9** and the weighted daily O&D trip summary is presented in **Table B-10**. Age distribution requires a different expansion approach compared to the previously discussed distributions since the travel party size in this case cannot be used for expansion. It is not a reasonable assumption that all members of a travel party are of approximately the same age. Thus, the weighted distribution relates to the actual survey respondents. This distribution is naturally skewed since the respondents for most of the non-business family parties would be adults while the children would be largely underrepresented. However, with respect to the adult air passengers these distributions are still representative.

Table B-9 Distribution of Air Passengers by Age (Unweighted Individual Records)

Source: WSP

Age Group	Resident		Visitor			Resident		Visitor		
	Business	Non-Business	Business	Non-Business	Total	Business	Non-Business	Business	Non-Business	Total
16 - 24 years	7.7%	17.2%	6.1%	13.1%	11.8%	76	337	123	516	**1,052**
25 - 35 years	17.4%	22.8%	15.9%	16.5%	17.9%	172	448	318	653	**1,590**
35- 45 years	19.5%	14.4%	18.8%	12.4%	15.0%	193	283	375	488	**1,339**
45 - 64 years	18.9%	17.8%	25.8%	18.0%	19.8%	188	349	516	711	**1,764**
65 - 79 years	1.4%	3.0%	1.9%	3.7%	2.9%	13	59	37	144	**254**
80 years or older	0.1%	0.2%	0.1%	0.1%	0.1%	1	4	2	5	**12**
Missing	35.1%	24.6%	31.4%	36.2%	32.4%	348	483	628	1,427	**2,887**
Total	**64.8%**	**75.2%**	**68.5%**	**63.7%**	**67.4%**	**992**	**1,963**	**1,999**	**3,945**	**8,899**

Source: WSP

Table B-10 Distribution of Air Passengers by Age (Weighted Daily O&D Trip Summary for a Single Respondent per Travel Party)

Age Group	Resident		Visitor			Resident		Visitor		
	Business	Non-Business	Business	Non-Business	Total	Business	Non-Business	Business	Non-Business	Total
16 - 24 years	6.1%	11.3%	6.1%	8.0%	8.2%	391	1,857	832	2,596	**5,676**
25 - 34 years	13.3%	11.6%	10.3%	8.1%	9.8%	846	1,910	1,401	2,624	**6,783**
35- 44 years	13.3%	7.6%	11.9%	6.6%	8.5%	845	1,243	1,616	2,139	**5,844**
45 - 64 years	14.2%	10.3%	18.5%	10.0%	12.2%	904	1,686	2,526	3,257	**8,373**
65 - 79 years	0.9%	2.0%	1.7%	2.4%	2.0%	58	333	229	786	**1,406**
80 years or older	0.1%	0.2%	0.2%	0.1%	0.2%	8	32	32	45	**117**
Missing	23.8%	13.6%	18.7%	15.1%	16.2%	1,511	2,236	2,550	4,896	**11,192**
Total	**47.9%**	**42.7%**	**48.5%**	**35.1%**	**40.8%**	**3,044**	**7,029**	**9,186**	**11,403**	**39,391**

Source: WSP

Several observations can be made. First, a predominant share of LGA air passengers are between 25 and 64 years old, with business passengers somewhat older than non-business passengers. There is no strong statistical difference between residents and visitors of the region with respect to age.

B.1.2 UNWEIGHTED AND WEIGHTED SURVEY DATA

As indicated above, the data presented in this section reflects the raw unweighted and weighted data using only the 2017 LGA Ground Access Survey dataset to provide insights into the specifics of the actual ground access mode choices for LGA.

Distribution of air passengers by household income is presented **Table B-11** (unweighted) and **Table B-12** (weighted) below. The most significant observation is that the majority of air passengers and especially business travelers are characterized by a relatively high income compared to the general population that is reflected in the Value of Time (VOT) parameters adopted in the model.

Table B-11 Distribution of Air Passengers by Income (Unweighted Individual Records)

Income Groups	Resident		Visitor		Total	Resident		Visitor		Total
	Business	Non-Business	Business	Non-Business		Business	Non-Business	Business	Non-Business	
Under $25,000	4.3%	7.3%	5.7%	11.0%	9.0%	8	78	28	229	**343**
$25,000 - $29,999	0.0%	3.6%	0.8%	2.8%	2.6%	0	38	4	59	**101**
$30,000 - $39,999	1.5%	4.0%	5.5%	3.5%	3.8%	3	43	27	73	**146**
$40,000 - $49,999	5.1%	6.0%	3.7%	3.8%	4.5%	10	64	18	80	**172**
$50,000 - $59,999	2.6%	6.9%	4.7%	5.7%	5.7%	5	74	23	118	**220**
$60,000 - $69,999	1.5%	4.5%	3.3%	4.6%	4.3%	3	48	16	96	**163**
$70,000 - $79,999	2.0%	6.0%	3.9%	4.9%	4.9%	4	64	19	102	**189**
$80,000 - $89,999	6.1%	4.8%	3.7%	4.9%	4.8%	12	51	18	102	**183**
$90,000 - $99,999	7.7%	3.8%	5.1%	5.0%	4.8%	15	40	25	105	**185**
$100,000 - $124,999	14.8%	9.9%	7.4%	8.8%	9.2%	29	105	36	184	**354**
$125,000 - $149,999	9.7%	5.0%	7.5%	6.4%	6.3%	19	53	37	133	**242**
$150,000 - $174,999	3.6%	3.8%	6.5%	4.8%	4.7%	7	40	32	100	**179**
$175,000 - $199,999	5.6%	4.6%	7.6%	2.9%	4.1%	11	49	37	60	**157**
$200,000 - $249,999	5.1%	6.2%	3.7%	4.9%	5.1%	10	66	18	101	**195**
$250,000 - $299,999	3.1%	1.5%	4.3%	2.4%	2.4%	6	16	21	49	**92**
$300,000 or more	16.4%	11.0%	14.1%	7.2%	9.6%	32	117	69	149	**367**
Decline to answer	10.9%	11.2%	12.6%	16.4%	14.2%	21	120	62	341	**544**
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**196**	**1,065**	**490**	**2,081**	**3,832**

Table B-12 Distribution of Air Passengers by Income (Weighted Daily O&D Trip Summary)

Income Groups	Resident		Visitor		Total	Resident		Visitor		Total
	Business	Non-Business	Business	Non-Business		Business	Non-Business	Business	Non-Business	
Under $25,000	3.7%	7.6%	6.2%	11.4%	8.7%	208	1,306	888	3,610	**6,013**
$25,000 - $29,999	0.0%	3.1%	0.6%	2.3%	2.0%	0	530	93	743	**1,365**
$30,000 - $39,999	1.3%	2.9%	7.3%	3.0%	3.7%	72	503	1,047	941	**2,562**
$40,000 - $49,999	8.9%	5.6%	3.6%	4.2%	4.8%	504	967	513	1,326	**3,311**
$50,000 - $59,999	1.6%	5.8%	4.7%	5.8%	5.2%	92	992	669	1,830	**3,583**
$60,000 - $69,999	1.0%	4.4%	2.2%	5.4%	4.1%	59	759	315	1,720	**2,853**
$70,000 - $79,999	1.2%	6.7%	4.1%	5.0%	4.9%	70	1,154	587	1,574	**3,385**
$80,000 - $89,999	5.2%	4.7%	2.9%	5.0%	4.5%	294	797	411	1,576	**3,079**
$90,000 - $99,999	5.7%	4.3%	5.6%	5.2%	5.1%	321	729	804	1,660	**3,514**
$100,000 - $124,999	15.9%	9.4%	6.1%	8.7%	8.9%	899	1,613	868	2,754	**6,134**
$125,000 - $149,999	9.2%	4.7%	7.9%	6.7%	6.6%	521	798	1,131	2,119	**4,569**
$150,000 - $174,999	2.7%	4.4%	7.1%	5.4%	5.3%	154	752	1,016	1,705	**3,627**
$175,000 - $199,999	4.6%	4.6%	6.7%	2.7%	4.2%	258	789	966	847	**2,861**
$200,000 - $249,999	5.6%	7.6%	2.9%	4.9%	5.2%	318	1,296	414	1,559	**3,587**
$250,000 - $299,999	2.2%	1.9%	3.3%	1.7%	2.1%	126	324	477	542	**1,468**
$300,000 or more	20.2%	12.1%	14.7%	7.0%	10.9%	1,144	2,077	2,104	2,218	**7,544**
Unknown/Missing	10.9%	10.2%	14.1%	15.9%	13.7%	618	1,752	2,015	5,061	**9,446**
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**5,659**	**17,138**	**14,318**	**31,787**	**68,902**

Distribution of air passengers by travel party size is presented in **Table B-13** (unweighted) and **Table B-14** (weighted) below. The most important observation is that a substantial share of air passengers travel in a party of two or more. This is reflected in the ground access forecasting model in the cost sharing mechanism for travel parties for such modes as taxi/FHV.

Table B-13 Distribution of Air Passengers by Party Size (Unweighted Individual Records)

Party Size	Resident		Visitor		Total	Resident		Visitor		Total
	Business	Non-Business	Business	Non-Business		Business	Non-Business	Business	Non-Business	
1	61.7%	34.9%	56.8%	23.4%	32.8%	121	371	278	487	**1,257**
2	25.6%	23.7%	25.7%	33.9%	29.6%	50	252	126	706	**1,134**
3	1.5%	15.8%	5.5%	15.4%	13.5%	3	168	27	321	**519**
4	6.1%	15.4%	4.9%	15.0%	13.4%	12	164	24	312	**512**
5+	5.1%	10.3%	7.1%	12.3%	10.7%	10	110	35	255	**410**
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**196**	**1,065**	**490**	**2,081**	**3,832**

Table B-14 Distribution of Air Passengers by Party Size (Weighted Daily O&D Trip Summary)

Party Size	Resident		Visitor		Total	Resident		Visitor		Total
	Business	Non-Business	Business	Non-Business		Business	Non-Business	Business	Non-Business	
1	47.5%	35.7%	41.9%	23.5%	32.3%	2,690	6,110	5,993	7,478	**22,271**
2	29.1%	24.3%	26.8%	34.9%	30.1%	1,646	4,172	3,832	11,084	**20,734**
3	0.9%	15.0%	7.5%	15.8%	12.6%	50	2,567	1,079	5,018	**8,715**
4	9.3%	12.5%	9.1%	13.0%	11.8%	524	2,147	1,302	4,142	**8,115**
5+	13.2%	12.5%	14.8%	12.8%	13.2%	749	2,142	2,113	4,064	**9,067**
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**5,659**	**17,138**	**14,318**	**31,787**	**68,902**

Distribution of air passengers by geography of their trip origins or destinations is presented in **Table B-15** (unweighted) and **Table B-16** (weighted) below. The most important observation is that Manhattan (and specifically Midtown Manhattan for visitors for business purposes) represents the main market. This is fully reflected in the ground access choice model where the AirTrain combinations with either LIRR or Subway Line 7 are specifically designed to provide the best service to this market.

Table B-15 Distribution of Air Passengers by Geography (Unweighted Individual Records)

Origin Location	Resident		Visitor		Total	Resident		Visitor		Total
	Business	Non-Business	Business	Non-Business		Business	Non-Business	Business	Non-Business	
Manh Lower	11.2%	5.5%	12.0%	11.4%	9.8%	22	59	59	237	**377**
Manh Mid WA	11.4%	5.5%	28.6%	24.4%	19.0%	22	59	140	508	**729**
Manh Mid Other	11.2%	3.1%	10.3%	8.2%	7.2%	22	33	50	170	**275**
Manh UES UWS	5.6%	9.5%	8.8%	9.8%	9.4%	11	101	43	204	**359**
Manh North	3.2%	5.0%	4.5%	4.0%	4.3%	6	54	22	83	**165**
Queens NW	1.0%	2.7%	1.4%	2.0%	2.1%	2	29	7	42	**80**
Queens W WA	2.6%	1.8%	2.9%	2.8%	2.5%	5	19	14	59	**97**
Queens W Other	1.5%	1.6%	1.3%	0.5%	0.9%	3	17	6	10	**36**
Queens E WA	0.5%	1.5%	1.0%	0.9%	1.1%	1	16	5	19	**41**
Queens E Other	3.6%	6.5%	1.5%	4.4%	4.5%	7	69	7	91	**174**
Brooklyn E	0.5%	1.4%	0.5%	1.9%	1.5%	1	15	2	40	**58**
Brooklyn W	10.7%	12.6%	10.7%	8.8%	10.2%	21	134	52	183	**390**
Bronx	1.0%	9.1%	2.4%	3.1%	4.6%	2	97	12	64	**175**
Staten Island	0.0%	0.1%	0.0%	0.4%	0.2%	0	1	0	8	**9**
Long Island	9.9%	12.5%	7.8%	6.2%	8.3%	19	133	38	128	**318**
Upstate NY & CT	19.2%	17.1%	5.1%	9.2%	11.4%	38	182	25	191	**436**
NJ, PA	6.6%	4.5%	1.2%	2.2%	2.9%	13	48	6	46	**113**
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**196**	**1,065**	**490**	**2,081**	**3,832**

Table B-16 Distribution of Air Passengers by Geography (Weighted Daily O&D Trip Summary)

Origin Location	Resident		Visitor		Total	Resident		Visitor		Total
	Business	Non-Business	Business	Non-Business		Business	Non-Business	Business	Non-Business	
Manh Lower	10.9%	4.6%	11.3%	10.6%	9.3%	618	782	1,611	3,371	**6,382**
Manh Mid WA	8.0%	4.7%	26.1%	24.3%	18.5%	452	811	3,731	7,737	**12,731**
Manh Mid Other	9.0%	2.8%	8.6%	8.9%	7.3%	508	480	1,236	2,815	**5,039**
Manh UES UWS	4.0%	8.4%	10.6%	9.6%	9.1%	225	1,446	1,521	3,062	**6,255**
Manh North	2.1%	4.6%	5.4%	3.7%	4.1%	117	785	773	1,181	**2,856**
Queens NW	0.9%	2.4%	1.4%	1.9%	1.8%	53	403	197	589	**1,242**
Queens W WA	2.2%	1.4%	3.6%	2.4%	2.4%	126	240	512	752	**1,630**
Queens W Other	1.3%	1.6%	0.8%	0.5%	0.9%	75	279	108	156	**619**
Queens E WA	0.4%	1.6%	0.9%	0.8%	1.0%	21	275	126	260	**683**
Queens E Other	2.7%	7.7%	1.2%	4.6%	4.5%	151	1,316	179	1,451	**3,098**
Brooklyn E	0.4%	1.2%	0.4%	2.0%	1.4%	21	211	55	648	**935**
Brooklyn W	9.4%	12.3%	10.0%	8.2%	9.7%	529	2,101	1,427	2,617	**6,674**
Bronx	1.4%	8.2%	3.1%	3.8%	4.5%	81	1,401	451	1,202	**3,134**
Staten Island	0.0%	0.1%	0.0%	0.4%	0.2%	0	16	0	139	**154**
Long Island	13.3%	13.3%	10.4%	6.4%	9.5%	752	2,271	1,495	2,044	**6,562**
Upstate NY & CT	17.4%	21.1%	5.0%	9.3%	12.0%	986	3,614	717	2,947	**8,264**
NJ, PA	16.6%	4.1%	1.2%	2.6%	3.8%	942	707	179	816	**2,643**
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**5,659**	**17,138**	**14,318**	**31,787**	**68,902**

Distribution of air passengers by current access mode is presented in **Table B-17** (unweighted) and **Table B-18** (weighted) below. The most important observation is that today LGA air passengers and especially business travelers visiting New York predominantly use Taxi/FHV and auto modes. This is a clear manifestation of the fact that LGA today does not have a convenient transit access option. This is fully reflected in the ground access choice model where the new AirTrain combinations with either LIRR or Subway Line 7 compete with all existing ground access modes (and with Taxi/FHV, in particular) in terms of travel time, cost, convenience and reliability.

Table B-17 Distribution of Air Passengers by Mode (Unweighted Individual Records)

Mode	Resident		Visitor		Total	Resident		Visitor		Total
	Business	Non-Business	Business	Non-Business		Business	Non-Business	Business	Non-Business	
Auto Drop-off	19.1%	32.3%	11.3%	18.1%	21.2%	37	344	56	377	**814**
Auto Short Term Park	7.7%	7.3%	0.8%	1.3%	3.2%	15	78	4	27	**124**
Auto Long Term Park	0.0%	1.1%	0.0%	0.0%	0.3%	0	12	0	0	**12**
Off-Airport Park	4.1%	2.7%	0.0%	0.0%	1.0%	8	29	0	0	**37**
Rental Car - At Airport	0.0%	0.0%	3.9%	2.8%	2.0%	0	0	19	58	**78**
Rental Car - Off Airport	0.0%	0.0%	4.2%	5.9%	3.7%	0	0	20	123	**143**
Taxis/FHVs	60.5%	43.8%	67.6%	54.2%	53.4%	118	467	331	1,129	**2,045**
Hotel Courtesy Vehicle	0.0%	0.8%	3.3%	1.8%	1.6%	0	8	16	37	**61**
Shared Ride Van/Shuttle	0.5%	1.2%	2.2%	4.2%	2.9%	1	13	11	88	**113**
NYC Airporter	3.6%	3.8%	2.4%	3.7%	3.5%	7	41	12	76	**136**
Bus	2.3%	4.0%	1.6%	3.0%	3.1%	5	43	8	63	**119**
Subway+Bus	1.8%	2.6%	1.6%	3.8%	3.1%	4	28	8	80	**119**
Rail+Bus/Taxi	0.5%	0.3%	1.0%	1.1%	0.8%	1	4	5	23	**32**
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**196**	**1,065**	**490**	**2,081**	**3,832**

Table B-18 Distribution of Air Passengers by Mode (Weighted Daily O&D Trip Summary)

Mode	Resident		Visitor		Total	Resident		Visitor		Total
	Business	Non-Business	Business	Non-Business		Business	Non-Business	Business	Non-Business	
Auto Drop-off	21.2%	30.9%	11.8%	17.9%	20.1%	1,198	5,292	1,695	5,678	**13,862**
Auto Short Term Park	16.2%	11.4%	1.1%	2.2%	5.4%	918	1,962	161	712	**3,754**
Auto Long Term Park	0.0%	4.0%	0.0%	0.0%	1.0%	0	681	0	0	**681**
Off-Airport Park	4.8%	4.4%	0.0%	0.0%	1.5%	270	747	0	0	**1,017**
Rental Car - At Airport	0.0%	0.0%	4.1%	2.3%	1.9%	0	0	584	745	**1,329**
Rental Car - Off Airport	0.0%	0.0%	5.9%	9.9%	5.8%	0	0	846	3,158	**4,004**
Taxis/FHVs	53.0%	39.4%	65.9%	51.0%	51.3%	2,999	6,745	9,435	16,196	**35,374**
Hotel Courtesy Vehicle	0.0%	0.8%	5.1%	2.8%	2.5%	0	136	732	878	**1,746**
Shared Ride Van/Shuttle	0.4%	1.5%	1.9%	4.8%	3.0%	24	260	275	1,537	**2,096**
NYC Airporter	1.0%	1.3%	0.8%	1.2%	1.1%	57	221	115	393	**787**
Bus	1.9%	3.7%	1.3%	2.9%	2.7%	105	627	188	930	**1,851**
Subway+Bus	1.2%	2.4%	1.2%	3.9%	2.8%	67	415	176	1,246	**1,903**
Rail+Bus/Taxi	0.4%	0.3%	0.8%	1.0%	0.7%	22	51	111	314	**497**
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**5,659**	**17,138**	**14,318**	**31,787**	**68,902**

Distribution of air passengers by age group (of the head of the travel party) is presented in **Table B-19** (unweighted) and **Table B-20** (weighted) below. The most important observation is that today LGA air passengers and especially business travelers visiting New York are characterized by a median age. This age (and especially in combination with relatively high income and business travel purposes) is characterized by a relatively high willingness to pay but also by a high sensitivity to service convenience and reliability. This is reflected in the ground access choice model through VOT parameters differentiated between business and non-business passengers and also through the mode convenience factors, although age is not used in the model directly.

Table B-19 Distribution of Air Passengers by Age Group (Unweighted Individual Party Records)

Age Group	Resident	Visitor		Total	Resident	Visitor		Total
	Business	Non-Business	Business	Non-Business	Business	Non-Business	Business	Non-Business
16 - 24 years	11.6%	23.7%	12.8%	21.0%	19.8%	18	146	46	226	**436**
25 - 35 years	22.4%	20.9%	13.8%	16.3%	17.6%	34	129	50	175	**388**
35- 45 years	16.5%	12.3%	15.2%	13.1%	13.5%	25	76	55	141	**297**
45 - 64 years	22.4%	18.5%	32.5%	23.9%	23.7%	34	114	118	257	**523**
65 - 79 years	2.6%	4.7%	3.9%	6.0%	5.1%	4	29	14	65	**112**
80 years or older	0.7%	0.6%	0.6%	0.5%	0.5%	1	4	2	5	**12**
Missing	23.7%	19.2%	21.4%	19.3%	19.9%	36	118	78	207	**439**
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**152**	**616**	**363**	**1,076**	**2,207**

Table B-20 Distribution of Air Passengers by Age Group (Weighted Daily O&D Party Trip Summary)

Age Group	Resident		Visitor		Total	Resident		Visitor		Total
	Business	Non-Business	Business	Non-Business		Business	Non-Business	Business	Non-Business	
16 - 24 years	10.4%	23.2%	12.9%	20.8%	18.6%	397	2,329	1,162	3,447	**7,335**
25 - 34 years	22.0%	20.2%	13.5%	16.6%	17.4%	839	2,028	1,217	2,750	**6,835**
35- 44 years	18.1%	11.7%	15.7%	13.1%	13.8%	691	1,176	1,412	2,169	**5,448**
45 - 64 years	22.2%	18.8%	31.7%	23.2%	23.9%	848	1,879	2,859	3,844	**9,431**
65 - 79 years	1.7%	4.7%	3.7%	6.6%	5.0%	64	474	335	1,100	**1,973**
80 years or older	0.4%	0.6%	0.7%	0.5%	0.6%	17	64	63	91	**235**
Missing	25.1%	20.7%	21.8%	19.0%	20.7%	955	2,069	1,969	3,142	**8,135**
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**3,811**	**10,018**	**9,018**	**16,544**	**39,391**

Distribution of air passengers by number of accompanying children under 18 years is presented in **Table B-21** (unweighted) and **Table B-22** (weighted) below. It should be noted that overall LGA is characterized by a very low share of children amongst air passengers. This observation is important since a family traveling with young children would generally represent a transit-averse market with a high preference for taxi/FHV or auto because of the convenience. Since this factor proved to be very minor for LGA, it was not necessary to include presence of children as an additional variable in the in the forecasting model.

Table B-21 Distribution of Air Passengers by Number of Children (under 18 years) in the Travel Party (Unweighted Individual Party Records)

Number of children (under 18 years)	Resident		Visitor		Total	Resident		Visitor		Total
	Business	Non-Business	Business	Non-Business		Business	Non-Business	Business	Non-Business	
0	96.0%	83.6%	96.7%	81.7%	85.7%	146	515	351	879	**1,891**
1	3.3%	8.1%	2.8%	11.7%	8.7%	5	50	10	126	**191**
2	0.0%	5.7%	0.6%	4.9%	4.1%	0	35	2	53	**90**
3	0.7%	2.3%	0.0%	1.1%	1.2%	1	14	0	12	**27**
4+	0.0%	0.3%	0.0%	0.6%	0.4%	0	2	0	6	**8**
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**152**	**616**	**363**	**1,076**	**2,207**

Table B-22 Distribution of Air Passengers by Number of Children (under 18 years) in the Travel Party (Weighted Daily O&D Trip Summary)

Number of children (under 18 years)	Resident		Visitor		Total	Resident		Visitor		Total
	Business	Non-Business	Business	Non-Business		Business	Non-Business	Business	Non-Business	
0	93.3%	81.8%	94.8%	82.7%	86.3%	3,557	8,199	8,551	13,688	**33,994**
1	5.9%	9.0%	4.3%	10.8%	8.4%	226	904	386	1,790	**3,306**
2	0.0%	5.7%	0.9%	4.7%	3.6%	0	573	81	782	**1,435**
3	0.8%	3.2%	0.0%	1.2%	1.4%	29	319	0	201	**549**
4+	0.0%	0.2%	0.0%	0.5%	0.3%	0	23	0	83	**106**
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**3,811**	**10,018**	**9,018**	**16,544**	**39,391**

Distribution of air passengers by total luggage for the travel party is presented in **Table B-23** (unweighted) and **Table B-24** (weighted) below. The most important observation is that today LGA air passengers and especially business travelers are characterized by traveling with small luggage. This factor works in favor of transit modes since large luggage makes taxi/FHV and auto much more convenient compared to transit. This is reflected in the ground access choice model through the mode convenience factors, although the luggage size is not used in the model directly.

Table B-23 Distribution of Air Passengers by Total Luggage for the Travel Party (Unweighted Individual Party Records)

Total Number of Luggage	Resident		Visitor		Total	Resident		Visitor		Total
	Business	Non-Business	Business	Non-Business		Business	Non-Business	Business	Non-Business	
0	91.4%	75.8%	84.6%	61.7%	71.5%	139	467	307	664	**1,577**
1	2.6%	6.0%	3.6%	10.4%	7.5%	4	37	13	112	**166**
2	3.3%	9.1%	6.9%	16.0%	11.7%	5	56	25	172	**258**
3	0.7%	4.9%	1.9%	6.5%	4.9%	1	30	7	70	**108**
4	1.3%	2.9%	1.7%	2.9%	2.6%	2	18	6	31	**57**
5+	0.7%	1.3%	1.4%	2.5%	1.9%	1	8	5	27	**41**
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**152**	**616**	**363**	**1,076**	**2,207**

Table B-24 Distribution of Air Passengers by Total Luggage for the Travel Party (Weighted Daily O&D Party Trip Summary)

Total Number of Luggage	Resident		Visitor		Total	Resident		Visitor		Total
	Business	Non-Business	Business	Non-Business		Business	Non-Business	Business	Non-Business	
0	88.0%	75.3%	77.2%	61.8%	71.3%	3,355	7,547	6,958	10,225	**28,085**
1	2.7%	6.3%	4.8%	10.8%	7.5%	102	631	436	1,781	**2,950**
2	3.9%	8.2%	9.0%	15.8%	11.1%	148	818	809	2,615	**4,389**
3	0.4%	5.0%	2.6%	6.5%	4.6%	17	498	235	1,073	**1,823**
4	3.0%	3.3%	3.1%	2.6%	3.0%	115	335	283	437	**1,170**
5+	1.9%	1.9%	3.3%	2.5%	2.5%	74	190	297	413	**974**
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**3,811**	**10,018**	**9,018**	**16,544**	**39,391**

Distribution of air passengers by total number of carry-on bags for the travel party is presented in **Table B-25** (unweighted) and **Table B-26** (weighted) below. The most important observation is that today LGA air passengers are characterized by multiple carry-on bags (to compensate for the smaller or not checked in luggage). However, in terms of potential transit use, carry-on bags are much less onerous compared to the large luggage. Thus, this factor does not override the transit convenience for passengers without luggage mentioned above.

Table B-25 Distribution of Air Passengers by Total Carry-ons for the Travel Party (Unweighted Individual Party Records)

Total Number of Carry-ons	Resident		Visitor		Total	Resident		Visitor		Total
	Business	Non-Business	Business	Non-Business		Business	Non-Business	Business	Non-Business	
0	8.1%	9.2%	9.1%	10.2%	9.6%	12	57	33	110	**212**
1	52.8%	53.2%	57.5%	51.6%	53.1%	80	328	209	555	**1,172**
2	35.8%	28.8%	31.7%	29.0%	29.9%	54	178	115	312	**659**
3	2.0%	4.5%	1.4%	4.2%	3.7%	3	28	5	45	**81**
4	0.7%	2.3%	0.3%	2.6%	2.0%	1	14	1	28	**44**
5+	0.7%	1.9%	0.0%	2.4%	1.8%	1	12	0	26	**39**
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**152**	**616**	**363**	**1,076**	**2,207**

Table B-26 Distribution of Air Passengers by Total Carry-ons for the Travel Party (Weighted Daily O&D Party Trip Summary)

Total Number of Carry-ons	Resident		Visitor		Total	Resident		Visitor		Total
	Business	Non-Business	Business	Non-Business		Business	Non-Business	Business	Non-Business	
0	7.4%	8.4%	8.8%	10.7%	9.4%	283	844	791	1,774	**3,691**
1	50.8%	52.0%	57.5%	50.6%	52.5%	1,935	5,210	5,184	8,367	**20,696**
2	34.8%	28.8%	30.7%	29.1%	29.9%	1,326	2,883	2,768	4,819	**11,796**
3	2.5%	5.5%	2.7%	4.3%	4.0%	94	547	246	705	**1,592**
4	2.0%	2.6%	0.3%	2.4%	1.9%	76	256	29	393	**754**
5+	2.5%	2.8%	0.0%	2.9%	2.2%	97	279	0	486	**861**
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**3,811**	**10,018**	**9,018**	**16,544**	**39,391**

Distribution of air passengers by terminal and type of flight is presented in **Table B-27** (unweighted) and **Table B-28** (weighted) below. The most important observation is that LGA today is characterized by a dominant share of three major terminals (B, C, and D) and domestic air passengers. This is reflected in the ground access choice model through a differentiation of the travel times for each terminal. A possible differentiation of international travelers (in addition to the model segmentation by trip purpose and residency) was also considered by the statistical analysis of VOT and did not confirm that this additional differentiation is necessary.

Table B-27 Distribution of Air Passengers by Terminal and Type of Flight (Unweighted Individual Records)

Terminal	Domestic		International		Total	Domestic		International		Total
	Inbound	Outbound	Inbound	Outbound		Inbound	Outbound	Inbound	Outbound	
Terminal A	0.0%	0.0%	0.0%	0.0%	0.0%	0	0	0	0	**0**
Terminal B	46.7%	46.7%	70.8%	70.8%	50.1%	769	769	191	191	**1,918**
Terminal C	26.8%	26.8%	2.0%	2.0%	23.3%	442	442	6	6	**894**
Terminal D	26.5%	26.5%	27.1%	27.1%	26.6%	437	437	73	73	**1,020**
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**1,647**	**1,647**	**269**	**269**	**3,832**

Table B-28 Distribution of Air Passengers by Terminal and Type of Flight (Weighted Daily O&D Trip Summary)

Terminal	Domestic		International		Total	Domestic		International		Total
	Inbound	Outbound	Inbound	Outbound		Inbound	Outbound	Inbound	Outbound	
Terminal A	0.0%	0.0%	0.0%	0.0%	0.0%	0	0	0	0	**0**
Terminal B	49.4%	48.6%	83.1%	83.1%	53.0%	14,881	14,967	3,312	3,333	**36,494**
Terminal C	35.6%	36.8%	3.2%	3.4%	32.4%	10,700	11,351	127	135	**22,312**
Terminal D	15.0%	14.6%	13.7%	13.5%	14.7%	4,515	4,495	545	541	**10,096**
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**30,095**	**30,813**	**3,984**	**4,009**	**68,902**

Distribution of air passengers by the time period of travel is presented in **Table B-29** (unweighted) and **Table B-30** (weighted) below. The most important observation is that today the midday period corresponds to the peak of LGA air passengers departing and arriving. This means that on the one hand, traffic congestion effects in the AM and PM periods are less critical, but on the other hand its requires for all general transit services such as LIRR or Subway Line 7 that to keep high frequencies through the entire day to make their combination with AirTrain successful. This is reflected in the ground access choice model through the travel time variables differentiated by time of day.

Table B-29 Distribution of Air Passengers by Time Period of Travel (Unweighted Individual Records)

Travel Time Period	Percentage			Count		
	Inbound	Outbound	Total	Inbound	Outbound	Total
AM Peak (6:00 - 9:59)	21.3%	10.2%	15.8%	408	196	**604**
Midday (10:00 - 15:59)	61.9%	45.2%	53.5%	1,186	866	**2,052**
PM Peak (16:00 - 19:59)	16.8%	25.8%	21.3%	322	495	**817**
Night/ Early (20:00 - 5:59)	0.0%	18.8%	9.4%	0	360	**360**
Total	**100.0%**	**100.0%**	**100.0%**	**1,916**	**1,916**	**3,832**

Table B-30 Distribution of Air Passengers by Time Period of Travel (Weighted Daily O&D Trip Summary)

Travel Time Period	Percentage			Count		
	Inbound	Outbound	Total	Inbound	Outbound	Total
AM Peak (6:00 - 9:59)	21.8%	9.9%	15.8%	7,421	3,454	**10,876**
Midday (10:00 - 15:59)	60.1%	45.8%	52.9%	20,492	15,959	**36,452**
PM Peak (16:00 - 19:59)	18.1%	26.9%	22.5%	6,166	9,362	**15,527**
Night/ Early (20:00 - 5:59)	0.0%	17.4%	8.8%	0	6,047	**6,047**
Total	**100.0%**	**100.0%**	**100.0%**	**34,079**	**34,823**	**68,902**

Distribution of air passengers by aggregate mode groups segmented by other key characteristics is presented in **Table B-31** (unweighted) and **Table B-32** (weighted) below. The most important observations reflected in the ground access mode choice model is that there are substantial differences in mode preferences by passenger type, party size and other passenger characteristics. The same analysis but for travel parties as a unit rather than person is presented in **Table B-33** and **Table B-34** respectively.

Table B-31 Distribution of Air Passengers by Mode Groups (Unweighted Individual Records)

	Mode Group				Total	Mode Group				Total
	Auto	Taxi/FHV	Shared Ride, Airporter	Transit		Auto	Taxi/FHV	Shared Ride, Airporter	Transit	
Residency										
Resident	41.5%	46.4%	5.6%	6.6%	100.0%	523	585	70	83	**1,261**
Visitor	26.6%	56.8%	9.3%	7.2%	100.0%	685	1,460	240	186	**2,571**
Purpose										
Business	23.3%	65.6%	6.8%	4.4%	100.0%	160	450	47	30	**686**
Non-Business	33.3%	50.7%	8.4%	7.6%	100.0%	1,048	1,595	263	239	**3,146**

	Mode Group				Total	Mode Group				Total
	Auto	Taxi/FHV	Shared Ride, Airporter	Transit		Auto	Taxi/FHV	Shared Ride, Airporter	Transit	
Party Size										
1	32.9%	50.4%	8.7%	8.1%	100.0%	413	633	109	102	**1,257**
2	29.3%	52.9%	9.5%	8.3%	100.0%	332	600	108	94	**1,134**
3	32.4%	55.5%	6.9%	5.2%	100.0%	168	288	36	27	**519**
4+	32.0%	56.8%	6.2%	5.0%	100.0%	295	524	57	46	**922**
Number of Kids in the travel party										
No Kids	29.0%	54.6%	9.0%	7.4%	100.0%	811	1,527	251	206	**2,795**
1	34.4%	51.7%	7.7%	6.2%	100.0%	188	283	42	34	**547**
2	40.1%	51.2%	3.5%	5.2%	100.0%	138	176	12	18	**344**
3	53.9%	41.7%	0.0%	4.3%	100.0%	62	48	0	5	**115**
4+	29.0%	35.5%	16.1%	19.4%	100.0%	9	11	5	6	**31**
Number of Luggage Pieces (for the Party)										
0	30.9%	53.6%	7.3%	8.3%	100.0%	642	1,116	151	172	**2,081**
1	35.9%	50.4%	8.6%	5.1%	100.0%	147	206	35	21	**409**
2+	48.4%	40.9%	7.3%	3.4%	100.0%	419	354	63	29	**865**
Number of Carry-on Pieces (for the Party)										
0	35.0%	47.4%	10.0%	7.6%	100.0%	129	175	37	28	**369**
1	29.6%	54.6%	7.7%	8.2%	100.0%	546	1,008	142	151	**1,847**
2	28.7%	55.7%	9.9%	5.7%	100.0%	308	597	106	61	**1,072**
3	42.1%	46.0%	6.4%	5.5%	100.0%	99	108	15	13	**235**
4	44.1%	49.0%	6.9%	0.0%	100.0%	64	71	10	0	**145**
5+	37.8%	52.4%	0.0%	9.8%	100.0%	62	86	0	16	**164**

	Mode Group				Total	Mode Group				Total
	Auto	Taxi/FHV	Shared Ride, Airporter	Transit		Auto	Taxi/FHV	Shared Ride, Airporter	Transit	
Type of Flight										
Domestic	32.3%	53.0%	7.9%	6.8%	100.0%	1,065	1,746	260	223	**3,294**
International	26.6%	55.6%	9.3%	8.6%	100.0%	143	299	50	46	**538**
Time of Day										
AM Peak (6:00 - 9:59)	31.0%	50.5%	9.9%	8.7%	100.0%	187	305	60	53	**604**
Midday (10:00 - 15:59)	32.4%	53.3%	8.4%	5.9%	100.0%	664	1,094	173	121	**2,052**
PM Peak (16:00 - 19:59)	30.4%	54.6%	7.2%	7.8%	100.0%	249	446	59	64	**817**
Night/ Early (20:00 - 5:59)	30.1%	55.7%	5.4%	8.8%	100.0%	109	201	20	32	**360**
Income Groups										
Under $25,000	33.8%	42.6%	8.7%	14.9%	100.0%	116	146	30	51	**343**
$25,000 - $49,999	33.2%	45.3%	11.9%	9.5%	100.0%	139	190	50	40	**419**
$50,000 - $99,999	29.9%	51.4%	10.0%	8.7%	100.0%	281	483	94	82	**940**
$100,000 - $149,999	30.5%	56.0%	6.5%	6.9%	100.0%	182	334	39	41	**596**
$150,000 or more	28.5%	64.9%	4.1%	2.4%	100.0%	282	643	41	24	**990**
Unknown/Missing	38.2%	45.8%	10.3%	5.7%	100.0%	208	249	56	31	**544**
Total Air Passengers						**1,208**	**2,045**	**310**	**269**	**3,832**

Table B-32 Distribution of Air Passengers by Mode Groups (Weighted Daily O&D Trip Summary)

	Mode Group				Total	Mode Group				Total
	Auto	Taxi/FHV	Shared Ride, Airporter	Transit		Auto	Taxi/FHV	Shared Ride, Airporter	Transit	
Residency										
Resident	48.5%	42.7%	3.1%	5.6%	100.0%	11,068	9,744	699	1,287	**22,798**
Visitor	29.5%	55.6%	8.5%	6.4%	100.0%	13,579	25,631	3,930	2,965	**46,104**
Purpose										
Business	28.4%	62.2%	6.0%	3.3%	100.0%	5,673	12,433	1,203	668	**19,977**
Non-Business	38.8%	46.9%	7.0%	7.3%	100.0%	18,975	22,941	3,425	3,584	**48,925**
Party Size										
1	36.1%	49.8%	6.3%	7.8%	100.0%	8,038	11,100	1,398	1,736	**22,271**
2	34.3%	51.3%	7.7%	6.7%	100.0%	7,119	10,630	1,591	1,394	**20,734**
3	37.6%	51.7%	6.3%	4.4%	100.0%	3,278	4,503	547	387	**8,715**
4+	36.2%	53.2%	6.4%	4.3%	100.0%	6,212	9,141	1,093	735	**17,182**
Number of Kids in the travel party										
No Kids	33.9%	52.2%	6.8%	7.1%	100.0%	11,515	17,737	2,320	2,422	**33,994**
1	43.1%	43.8%	7.2%	5.9%	100.0%	1,424	1,448	238	196	**3,306**
2	49.0%	44.2%	3.7%	3.0%	100.0%	704	635	53	43	**1,435**
3	73.1%	24.5%	0.0%	2.4%	100.0%	401	135	0	13	**549**
4+	22.1%	31.7%	5.3%	41.0%	100.0%	23	34	6	43	**106**
Number of Luggage Pieces (for the Party)										
0	35.3%	50.9%	5.9%	7.9%	100.0%	9,918	14,295	1,655	2,216	**28,085**
1	44.0%	45.0%	7.3%	3.6%	100.0%	1,299	1,329	216	107	**2,950**
2+	34.1%	52.2%	8.9%	4.7%	100.0%	2,851	4,364	745	395	**8,356**

	Mode Group				Total	Mode Group				Total
	Auto	Taxi/FHV	Shared Ride, Airporter	Transit		Auto	Taxi/FHV	Shared Ride, Airporter	Transit	
Number of Carry-on Pieces (for the Party)										
0	38.8%	45.1%	8.1%	8.0%	100.0%	1,432	1,666	299	294	**3,691**
1	34.9%	51.2%	6.3%	7.6%	100.0%	7,229	10,600	1,298	1,569	**20,696**
2	32.5%	53.9%	7.7%	5.9%	100.0%	3,833	6,362	905	696	**11,796**
3	47.3%	44.5%	4.0%	4.3%	100.0%	753	708	64	68	**1,592**
4	48.0%	45.3%	6.7%	0.0%	100.0%	362	342	51	0	**754**
5+	53.2%	36.0%	0.0%	10.7%	100.0%	458	310	0	92	**861**
Type of Flight										
Domestic	36.8%	50.9%	6.4%	5.9%	100.0%	22,397	31,004	3,908	3,600	**60,909**
International	28.1%	54.7%	9.0%	8.2%	100.0%	2,250	4,371	721	652	**7,993**
Time of Day										
AM Peak (6:00 - 9:59)	38.1%	47.9%	6.5%	7.4%	100.0%	4,148	5,209	709	809	**10,876**
Midday (10:00 - 15:59)	36.3%	50.8%	7.5%	5.4%	100.0%	13,242	18,499	2,743	1,967	**36,452**
PM Peak (16:00 - 19:59)	33.2%	54.3%	6.2%	6.3%	100.0%	5,162	8,424	962	979	**15,527**
Night/ Early (20:00 - 5:59)	34.6%	53.6%	3.5%	8.2%	100.0%	2,094	3,242	214	496	**6,047**
Income Groups										
Under $25,000	39.3%	43.9%	4.9%	12.0%	100.0%	2,362	2,638	292	721	**6,013**
$25,000 - $49,999	32.5%	44.2%	14.3%	9.0%	100.0%	2,356	3,196	1,034	652	**7,238**
$50,000 - $99,999	34.8%	48.5%	8.0%	8.6%	100.0%	5,714	7,963	1,321	1,417	**16,415**
$100,000 - $149,999	34.1%	53.5%	6.5%	5.9%	100.0%	3,646	5,727	696	634	**10,703**
$150,000 or more	33.4%	61.4%	3.2%	2.0%	100.0%	6,371	11,717	613	386	**19,087**
Unknown/Missing	44.4%	43.8%	7.1%	4.7%	100.0%	4,199	4,134	673	441	**9,446**
Total Air Passengers						**24,647**	**35,374**	**4,629**	**4,252**	**68,902**

Table B-33 Distribution of Air Passengers by Mode Groups (Unweighted Individual Party Records)

	Mode Group					Mode Group				
	Auto	Taxi/FHV	Shared Ride, Airporter	Transit	Total	Auto	Taxi/FHV	Shared Ride, Airporter	Transit	Total
Residency										
Resident	39.3%	45.7%	6.4%	8.6%	100.0%	302	351	49	66	**768**
Visitor	27.8%	55.5%	9.7%	7.1%	100.0%	400	798	139	102	**1,439**
Purpose										
Business	23.0%	64.8%	6.5%	5.6%	100.0%	119	334	34	29	**515**
Non-Business	34.5%	48.2%	9.1%	8.2%	100.0%	583	815	154	139	**1,692**
Party Size										
1	32.9%	50.4%	8.7%	8.1%	100.0%	413	633	109	102	**1,257**
2	29.3%	52.9%	9.5%	8.3%	100.0%	166	300	54	47	**567**
3	32.4%	55.5%	6.9%	5.2%	100.0%	56	96	12	9	**173**
4+	31.9%	57.1%	6.2%	4.8%	100.0%	67	120	13	10	**210**
Number of Kids in the travel party										
No Kids	30.7%	52.8%	8.8%	7.8%	100.0%	580	998	166	147	**1,891**
1	34.6%	49.2%	9.4%	6.8%	100.0%	66	94	18	13	**191**
2+	44.8%	45.6%	3.2%	6.4%	100.0%	56	57	4	8	**125**
Number of Luggage Pieces (for the Party)										
0	31.8%	51.8%	8.0%	8.4%	100.0%	501	817	126	133	**1,577**
1	36.7%	48.8%	9.0%	5.4%	100.0%	61	81	15	9	**166**
2+	42.8%	44.0%	9.2%	4.0%	100.0%	140	144	30	13	**327**

	Mode Group					Mode Group				
	Auto	Taxi/FHV	Shared Ride, Airporter	Transit	Total	Auto	Taxi/FHV	Shared Ride, Airporter	Transit	Total
Number of Carry-on Pieces (for the Party)										
0	35.4%	46.2%	9.9%	8.5%	100.0%	75	98	21	18	**212**
1	32.0%	51.6%	7.9%	8.4%	100.0%	375	605	93	99	**1,172**
2	28.2%	55.2%	10.0%	6.5%	100.0%	186	364	66	43	**659**
3	40.7%	48.1%	6.2%	4.9%	100.0%	33	39	5	4	**81**
4	40.9%	52.3%	6.8%	0.0%	100.0%	18	23	3	0	**44**
5+	38.5%	51.3%	0.0%	10.3%	100.0%	15	20	0	4	**39**
Type of Flight										
Domestic	32.5%	51.8%	8.3%	7.4%	100.0%	625	995	160	142	**1,922**
International	27.0%	54.0%	9.8%	9.1%	100.0%	77	154	28	26	**285**
Time of Day										
AM Peak (6:00 - 9:59)	32.4%	48.7%	10.3%	8.6%	100.0%	115	172	37	31	**354**
Midday (10:00 - 15:59)	32.4%	52.0%	9.0%	6.7%	100.0%	378	607	105	78	**1,167**
PM Peak (16:00 - 19:59)	30.6%	53.7%	7.2%	8.6%	100.0%	147	257	35	41	**479**
Night/ Early (20:00 - 5:59)	30.5%	54.6%	6.0%	8.9%	100.0%	64	114	13	19	**208**
Income Groups										
Under $25,000	37.1%	40.5%	9.8%	12.7%	100.0%	76	83	20	26	**205**
$25,000 - $49,999	35.7%	43.3%	9.9%	11.1%	100.0%	90	109	25	28	**252**
$50,000 - $99,999	30.6%	49.4%	10.3%	9.8%	100.0%	169	273	57	54	**553**
$100,000 - $149,999	27.5%	57.7%	7.8%	7.0%	100.0%	95	199	27	24	**345**
$150,000 or more	27.1%	64.9%	4.6%	3.3%	100.0%	146	349	25	18	**538**
Unknown/Missing	40.1%	43.3%	10.8%	5.7%	100.0%	126	136	34	18	**314**
Total Air Passengers						**702**	**1,149**	**188**	**168**	**2,207**

Table B-34 Distribution of Air Passengers by Mode Groups (Weighted Daily O&D Trip Party Summary)

	Mode Group					Mode Group				
	Auto	Taxi/FHV	Shared Ride, Airporter	Transit	Total	Auto	Taxi/FHV	Shared Ride, Airporter	Transit	Total
Residency										
Resident	45.7%	42.9%	3.9%	7.6%	100.0%	6,318	5,931	534	1,047	**13,830**
Visitor	30.3%	55.0%	8.1%	6.5%	100.0%	7,750	14,057	2,083	1,672	**25,561**
Purpose										
Business	27.3%	62.6%	5.1%	5.0%	100.0%	3,496	8,034	660	639	**12,829**
Non-Business	39.8%	45.0%	7.4%	7.8%	100.0%	10,572	11,955	1,957	2,079	**26,562**
Party Size										
1	36.1%	49.8%	6.3%	7.8%	100.0%	8,039	11,102	1,398	1,736	**22,274**
2	34.3%	51.3%	7.7%	6.7%	100.0%	3,560	5,316	796	697	**10,368**
3	37.6%	51.7%	6.3%	4.4%	100.0%	1,093	1,501	182	129	**2,906**
4+	35.8%	53.9%	6.3%	4.1%	100.0%	1,376	2,070	240	157	**3,843**
Number of Kids in the travel party										
No Kids	33.9%	52.2%	6.8%	7.1%	100.0%	11,515	17,737	2,320	2,422	**33,994**
1	43.1%	43.8%	7.2%	5.9%	100.0%	1,424	1,448	238	196	**3,306**
2+	54.0%	38.4%	2.8%	4.8%	100.0%	1,129	803	59	100	**2,091**
Number of Luggage Pieces (for the Party)										
0	35.3%	50.9%	5.9%	7.9%	100.0%	9,918	14,295	1,655	2,216	**28,085**
1	44.0%	45.0%	7.3%	3.6%	100.0%	1,299	1,329	216	107	**2,950**
2+	34.1%	52.2%	8.9%	4.7%	100.0%	2,851	4,364	745	395	**8,356**

	Mode Group					Mode Group				
	Auto	Taxi/FHV	Shared Ride, Airporter	Transit	Total	Auto	Taxi/FHV	Shared Ride, Airporter	Transit	Total
Number of Carry-on Pieces (for the Party)										
0	38.8%	45.1%	8.1%	8.0%	100.0%	1,432	1,666	299	294	**3,691**
1	34.9%	51.2%	6.3%	7.6%	100.0%	7,229	10,600	1,298	1,569	**20,696**
2	32.5%	53.9%	7.7%	5.9%	100.0%	3,833	6,362	905	696	**11,796**
3	47.3%	44.5%	4.0%	4.3%	100.0%	753	708	64	68	**1,592**
4	48.0%	45.3%	6.7%	0.0%	100.0%	362	342	51	0	**754**
5+	53.2%	36.0%	0.0%	10.7%	100.0%	458	310	0	92	**861**
Type of Flight										
Domestic	36.4%	50.5%	6.4%	6.7%	100.0%	12,699	17,636	2,241	2,328	**34,904**
International	30.5%	52.4%	8.4%	8.7%	100.0%	1,369	2,353	375	391	**4,487**
Time of Day										
AM Peak (6:00 - 9:59)	38.6%	46.8%	7.0%	7.6%	100.0%	2,431	2,950	442	477	**6,299**
Midday (10:00 - 15:59)	35.9%	50.6%	7.3%	6.2%	100.0%	7,404	10,438	1,503	1,283	**20,628**
PM Peak (16:00 - 19:59)	33.4%	53.2%	5.9%	7.5%	100.0%	2,939	4,672	518	659	**8,788**
Night/ Early (20:00 - 5:59)	35.2%	52.5%	4.2%	8.2%	100.0%	1,294	1,928	153	301	**3,676**
Income Groups										
Under $25,000	42.0%	40.6%	6.2%	11.3%	100.0%	1,463	1,416	216	392	**3,487**
$25,000 - $49,999	37.7%	42.1%	9.1%	11.1%	100.0%	1,586	1,770	382	467	**4,205**
$50,000 - $99,999	35.2%	47.2%	8.1%	9.4%	100.0%	3,381	4,534	777	906	**9,598**
$100,000 - $149,999	30.2%	56.5%	7.3%	6.1%	100.0%	1,874	3,512	451	377	**6,215**
$150,000 or more	31.5%	61.9%	3.7%	2.9%	100.0%	3,300	6,481	386	300	**10,466**
Unknown/Missing	45.5%	42.0%	7.4%	5.1%	100.0%	2,465	2,275	404	276	**5,419**
Total Air Passengers						**14,068**	**19,988**	**2,616**	**2,719**	**39,391**

B.2 PASSENGER PREFERENCE SURVEY RESULTS

B.2.1 POTENTIAL USE OF AIRTRAIN AS A FUNCTION OF FARE

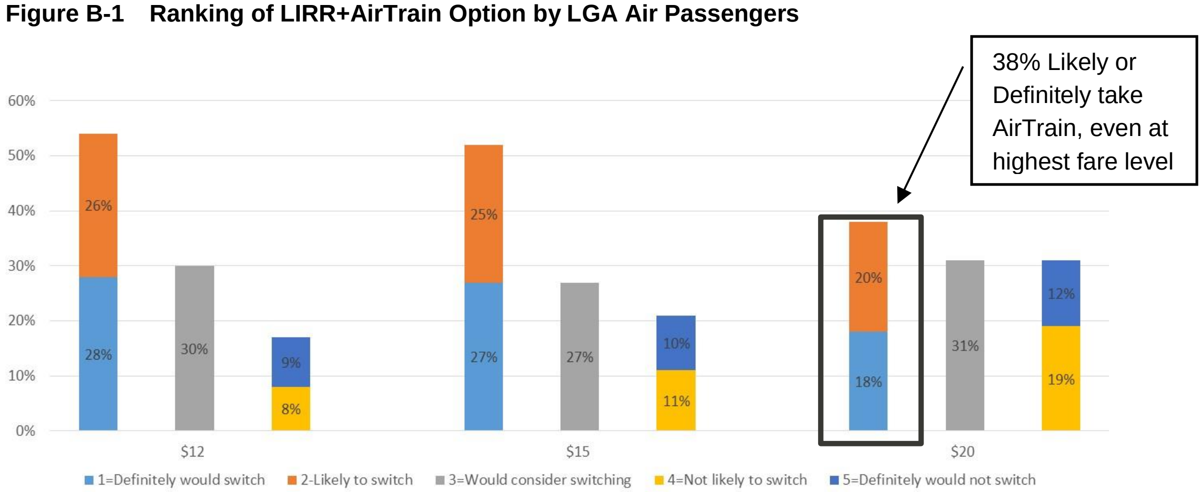
The Passenger Preference Survey presented hypothetical ground access options to the respondents, and they were asked to rank their likelihood of using an AirTrain access option. Only air passengers respondents of the LGA Ground Access Survey who had origins and destinations that could use either the LIRR or 7 Line to connect to the AirTrain LGA were eligible for the Passenger Preference Survey.

The respondents were presented a new option with AirTrain at three different levels of integrated fares in one direction. The corresponding questions and AirTrain options were algorithmically tailored for each respondent and only the option that was realistic given a person's trip origin or destination was presented. LIRR connection with AirTrain LGA was presented with a $15 fare as the base, $12 as the low-fare scenario, and $20 as the high-fare scenario. Subway connection with AirTrain LGA was presented as an $11 fare as the base, $8 as the low-fare scenario, and $14 as the high-fare scenario. The respondents were asked to rate their likelihood to switch to the new relevant option:

1 = Definitely would use,
2 = Likely to use,
3 = Would consider,
4 = Not likely to use, and
5 = Definitely would not use.

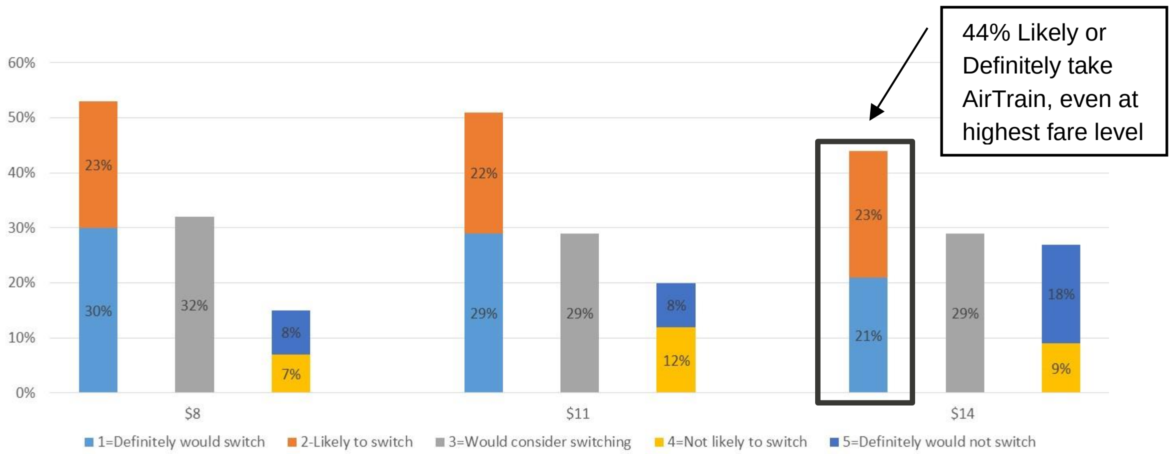
The results of the Passenger Preference Survey for each fare scenario are summarized in **Figure B-1** and **Figure B-2**. Overall, close to 80 percent of air passengers expressed a strong interest in an AirTrain LGA.

Figure B-1 Ranking of LIRR+AirTrain Option by LGA Air Passengers



Among the potential users of the LIRR connection to AirTrain LGA presented in **Figure B-1**, 80 percent of respondents expressed interest in using this option instead of their current access mode, and 27 percent of respondents indicated that they would definitely use it. This expression of interest was first solicited with the average combined fare of $15. In the attitudinal survey, the next steps included a variation of the fare where the respondents were asked to reevaluate their attitudes with a different fare level. The first fare variation was a reduction from $15 to $12. Logically, this shifted the responses towards the positive answers, which reached 83 percent. The second fare variation was a raise from $15 to $20. Logically this generated a more negative response, with the share interest in AirTrain LGA dropping slightly below 70 percent. In general, it is a known psychological phenomenon in attitudinal surveys that variations in inputs produce asymmetric response, i.e. in this case a higher fare is perceived more strongly than a lower fare. Nevertheless, it should be noted that the respondents exhibited a remarkably high level of interest in the LIRR-AirTrain LGA combination with a relatively low sensitivity to fare price.

Figure B-2 Ranking of Subway+AirTrain Option by LGA Air Passengers



Among the potential users of a subway connection to AirTrain presented in **Figure B-2**, more than 80 percent of respondents expressed interest in using this option instead of their current access mode, and almost 30 percent of respondents indicated that they would definitely use it. This expression of interest was first solicited with the average combined fare of $11. In the attitudinal survey, the next steps included a variation of the fare where the respondents were asked to reevaluate their attitudes with a different fare level. The first fare variation was a reduction from $11 to $8. Logically, this shifted the responses towards the positive answers, which reached 84 percent. The second fare variation was a raise from $11 to $14. Logically this generated a more negative response with the share of interest in AirTrain dropping slightly below 74 percent. In general, it should be noted that similarly to the LIRR-AirTrain LGA combination, the respondents exhibited a remarkably high level of interest in the Subway-AirTrain LGA combination with a relatively low sensitivity to fare prices.

The high level of interest in using the AirTrain, despite the fare differences, indicates that the AirTrain ridership would have a low fare price sensitivity because they are willing to pay for travel time reliability. This aspect is analyzed in more detail in the next section.

The Passenger Preference Survey allows for an aggregate analysis of the AirTrain ridership elasticity. For this purpose, the following method was used. Five original rankings were aggregated into two main categories:

- Positive response that includes three first answers (1=definitely, 2=likely, 3=would consider)

- Negative response that includes two last answers (4=not likely, 5=definitely would not)

The percentage of positive response is evaluated compared to the fare change using the following arc elasticity formulas:

Arc elasticity for fare increase:

$$EL_{INC} = \frac{(HFPR - BFPR)/BFPR}{(HF - BF)/BF} \qquad \text{Equation B-1}$$

Arc elasticity for fare decrease:

$$EL_{DEC} = \frac{(LFPR - BFPR)/BFPR}{(LF - BF)/BF} \qquad \text{Equation B-2}$$

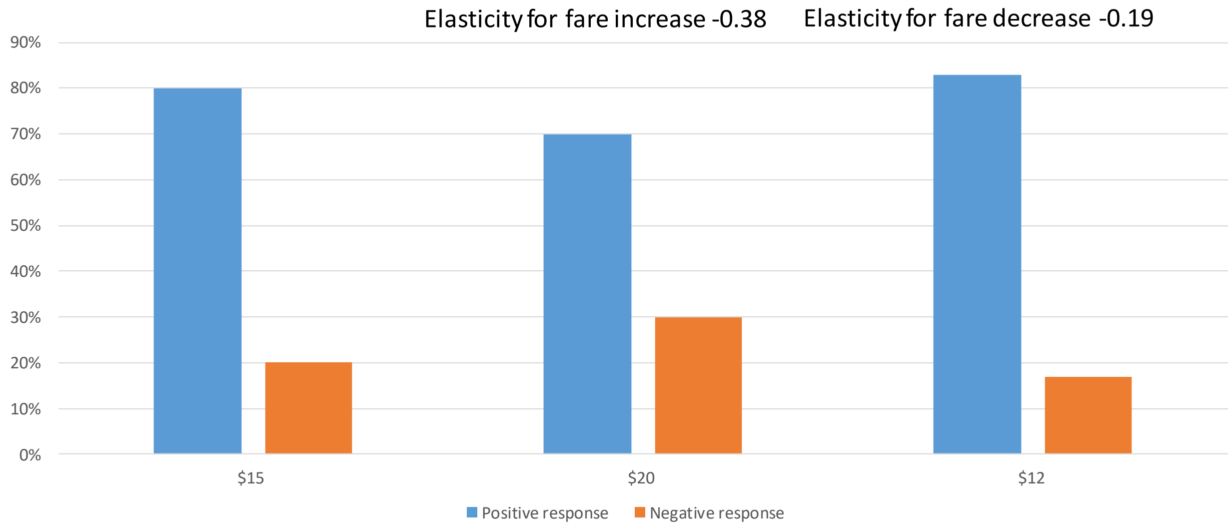
Where:

EL_{INC}	=	Ridership elasticity when the fare increases
EL_{DEC}	=	Ridership elasticity when the fare decreases
BF	=	Base fare
HF	=	High fare
LF	=	Low fare
$BFPR$	=	Percent of positive response with the base fare
$HFPR$	=	Percent of positive response with the high fare
$LFPR$	=	Percent of positive response with the low fare

Essentially, arc elasticity is a ratio of percent change in ridership (positive response) to percent change in fare. If the arc elasticity is equal to one, 1 percent change in the fare would result in 1 percent change in the ridership. It is normally expected for transit services to have a ridership elasticity with respect to fares at a relatively low level between 0.2 and 0.4. An extensive synthesis of the observed transit fare elasticities can be found in TCRP (Transit Cooperative Research Program) Report 95, Chapter 12 “Transit Pricing and Fares. Traveler Response to Transportation System Changes.”

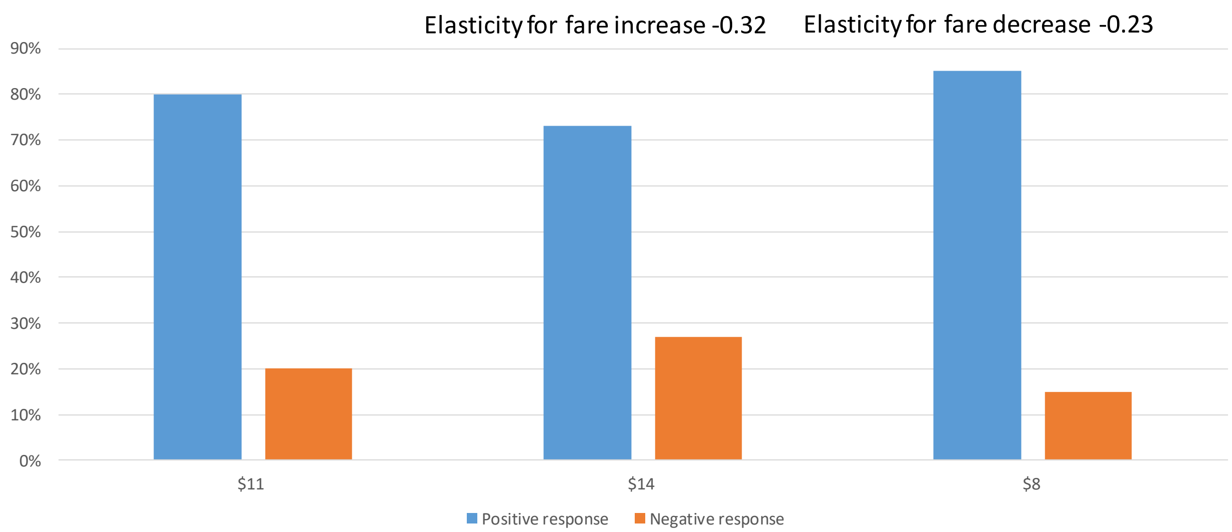
The results of the fare elasticity calculation for potential AirTrain users who transfer to or from LIRR are presented in **Figure B-3** along with the proportion of positive responses at three fare levels. It can be seen that the fare elasticity is in the reasonable range reported in literature and it is higher for the cases where the fare was increased compared to the cases where the fare was decreased.

Figure B-3 Fare Elasticity for AirTrain Users Connecting to LIRR



The results of the fare elasticity calculation for potential AirTrain users who transfer to or from Subway 7 Line are presented in **Figure B-4** along with the proportion of positive responses at three fare levels. It can be seen that the fare elasticity again is in the reasonable range reported in literature and it is higher for the cases where the fare was increased compared to the cases where the fare was decreased.

Figure B-4 Fare Elasticity for AirTrain Users Connecting to Subway Line 7



It should be noted that the LGA ground access mode choice model showed a similar level of AirTrain ridership sensitivity to fare that was observed in the survey (see **Table B-35**). The model was run for scenarios where AirTrain fare was reduced by $3, increased by $3, and finally increased by $5 to make these test directly comparable to the attitudinal survey. The survey results were processed in two ways. The first way included a summation of the first three answers as the positive response. The second way included only the first answer as the positive response.

Table B-35 Fare Elasticities Obtained from the Model Compared to Passenger Preference Survey of LGA Air Passengers, 2017

Fare change versus the base scenario	Ridership change predicted by the model	Ridership change predicted by attitudinal SP (LIRR+AirTrain)		Ridership change predicted by attitudinal SP (Subway+AirTrain)	
		Positive response including answers 1,2,3	Answer 1 only ("definitely would switch")	Positive response including answers 1,2,3	Answer 1 only ("definitely would switch")
-$3	+11%	+5%	+1%	+6%	+2%
+$3	-10%			-9%	-28%
+$5	-17%	-12%	-34%		

It can be seen that the model elasticity is very much in line with the Passenger Preference Survey although the model elasticity is more symmetric with respect to the fare increase and decrease. It can be said that the model does not have a psychological bias pertinent to the Passenger Preference Survey when people perceive the very fact of a fare increase negatively compared to fare decrease.

B.1.3 DETAILED ANALYSIS OF PASSENGER PREFERENCES

This section presents a detailed analysis of the stated passenger preferences by the type of air passenger and his/her current ground access mode. While the general strong positive attitude towards the new AirTrain that was mentioned in the previous section remains the most important finding that proved to be common across all passenger types, there were several differences that are important for the understanding and evaluation of the potential AirTrain ridership. This analysis is implemented separately for air passengers who would most probably use AirTrain in combination with LIRR rail service and those who would most probably use AirTrain in combination with the NYCT Subway Line 7. As explained above, these two groups of air passengers were not necessarily exclusive but for each AirTrain option (with LIRR or with Subway) a separate survey design was applied.

The first important distinction among air passengers relates to residents of the New York region versus visitors. The willingness to switch for both groups to AirTrain with LIRR and AirTrain with Subway is presented in **Figure B-5** and **Figure B-6** respectively. It can be seen that there is a general trend for visitors to be more interested in AirTrain compared to residents, although for both groups the willingness to use AirTrain is very high. This can be explained by the fact that visitors are less familiar with alternative transit options and have fewer auto options. Thus, for visitors a clear and simple AirTrain connection to either rail or subway is a preferred option.

Figure B-5 Air Passenger Willingness to Switch to AirTrain+LIRR for Residents and Non-residents (Visitors)

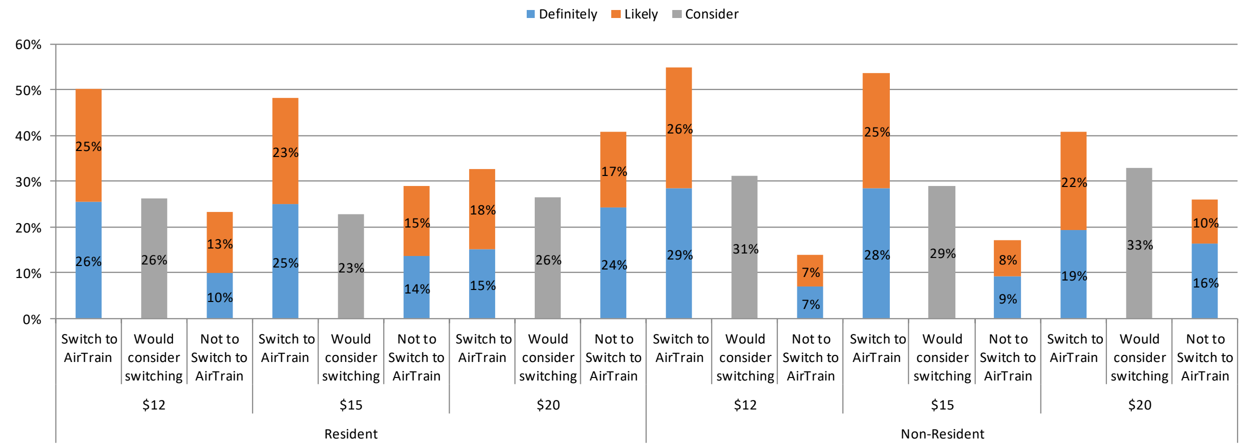
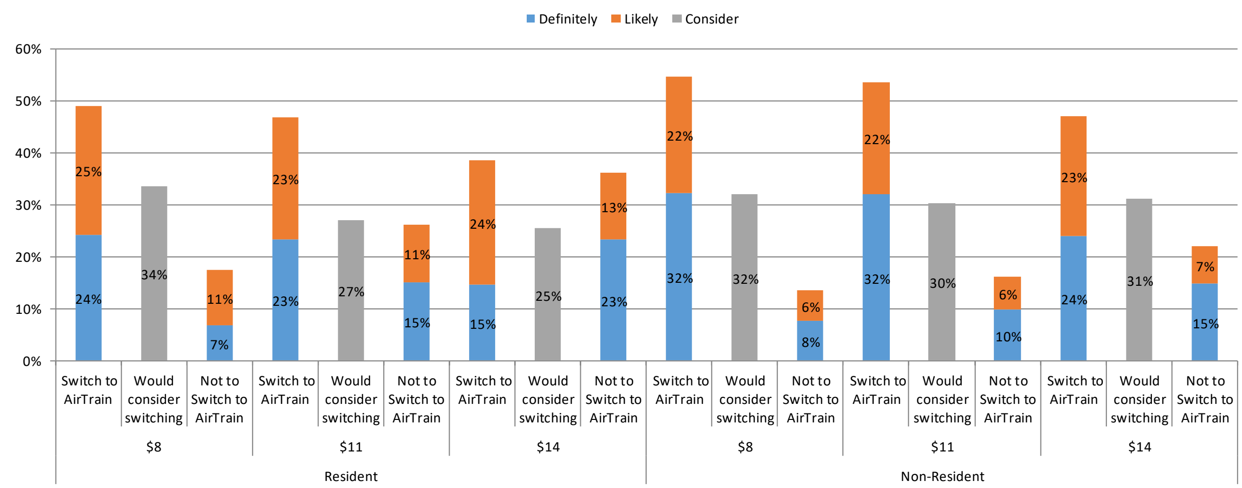


Figure B-6 Air Passenger Willingness to Switch to AirTrain+Subway for Residents and Non-residents (Visitors)



The second important distinction among air passengers relates to the trip purpose, where business travelers are distinguished from non-business travelers. The willingness to switch for both groups to AirTrain with LIRR and AirTrain with Subway is presented in **Figure B-7** and **Figure B-8**, respectively. It can be seen that there is a general trend for business travelers to be less sensitive to higher AirTrain fare compared to residents, although for both groups the willingness to use AirTrain is very high. This can be explained by the fact that business passengers are commonly reimbursed by the employer for their business travel and they are more willing to pay for travel time saving and better reliability (that is expressed in the higher value of time in the ground access model). Thus, increased AirTrain fare in the presented range is a minor issue for business travelers while it is a more substantial issue for non-business travelers.

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Figure B-7 Air Passenger Willingness to Switch to AirTrain+LIRR by Trip Purpose

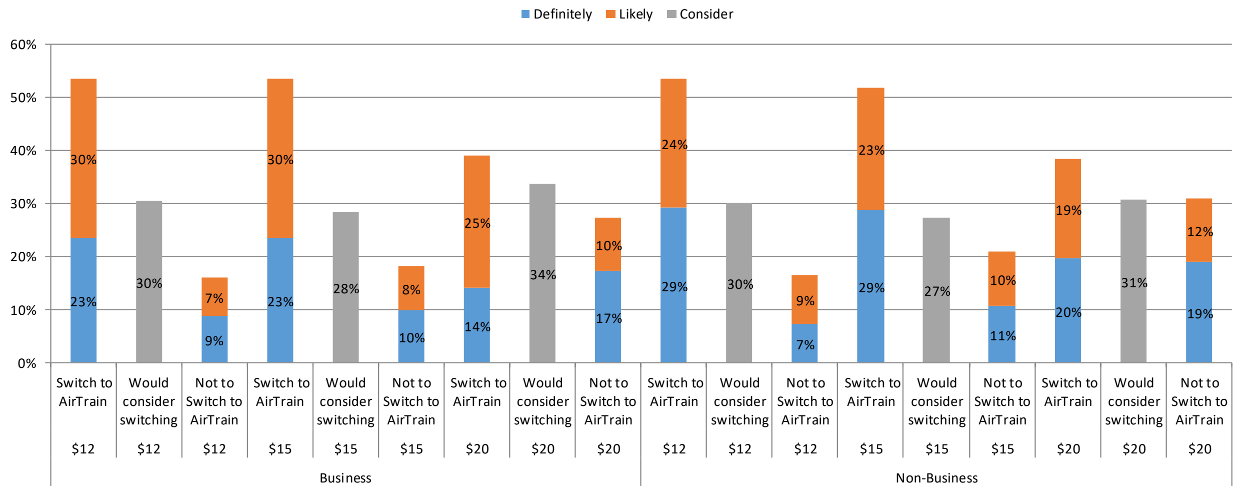
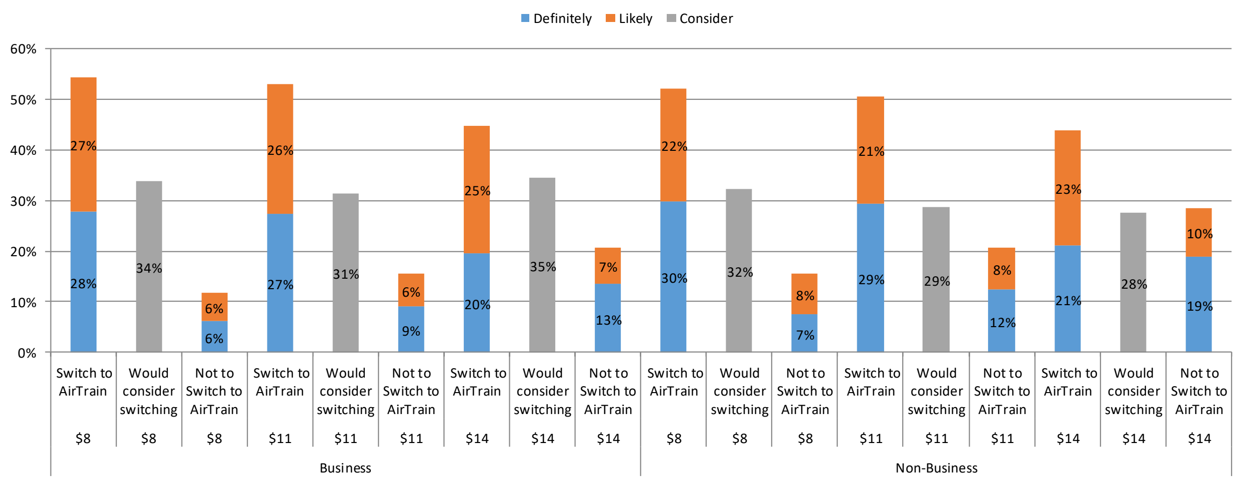


Figure B-8 Air Passenger Willingness to Switch to AirTrain+Subway by Trip Purpose



The third important distinction among air passengers relates to the trip origin (for departing passengers) or destination (for arriving passengers) where travelers with origin/destination in Manhattan are distinguished from travelers with origin/destination outside Manhattan. The willingness to switch for both groups to AirTrain with LIRR and AirTrain with Subway is presented in **Figure B-9** and **Figure B-10**, respectively. It can be seen that there is a general trend for travelers to/from Manhattan to exhibit a much higher willingness to switch to AirTrain compared to other areas. This is logical because the outlined options to use AirTrain in combination with either LIRR or the Subway are more appealing and competitive for travel between Manhattan and LGA rather than to/from other origins/destination. Thus, Manhattan represents the primary geographic market for AirTrain as is confirmed by the ground access mode choice model. However, air passengers with other origins/destinations - although characterized by a lower propensity to switch to AirTrain compared to travelers to/from Manhattan - still collectively represent a large potential market with a substantial willingness to consider AirTrain.

Figure B-9 Air Passenger Willingness to Switch to AirTrain+LIRR by Trip Origin/Destination

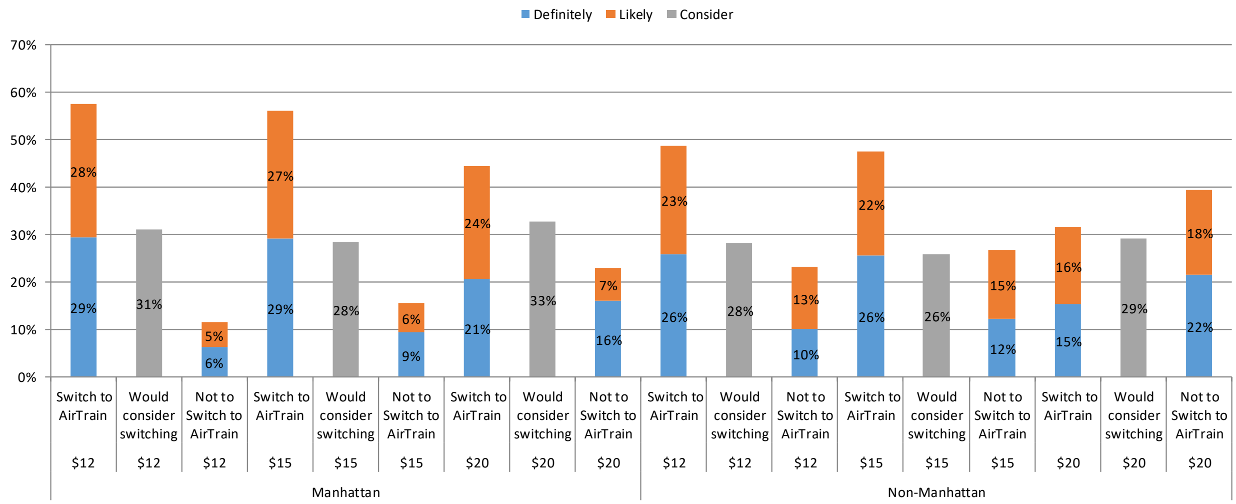
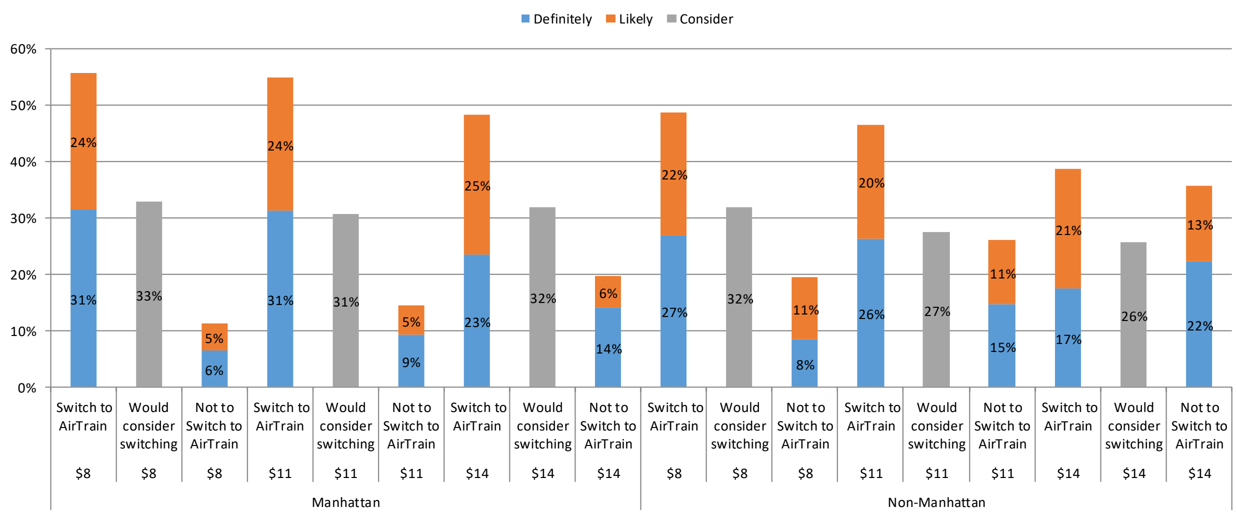


Figure B-10 Air Passenger Willingness to Switch to AirTrain+Subway by Trip Origin/Destination



The fourth important distinction among air passengers relates to their current access mode for the reported trip to/from LGA. In this regard, they are grouped into four major modal classes: auto, taxi/For Hire Vehicle, shared ride and other special services, and general transit. The willingness to switch for all four groups to AirTrain with LIRR and AirTrain with Subway is presented in **Figure B-11** and **Figure B-12**, respectively. It can be seen that there is a general trend for existing transit users to have an exceptionally high willingness to switch to AirTrain, especially with lower fares, compared to all other groups. This is logical because the outlined options to use AirTrain in combination with either LIRR or Subway are especially appealing and competitive compared to the existing transit options (bus only, or LIRR /Subway with bus) for trips to and from LGA. Thus, existing transit users represent an important market although with somewhat constrained willingness to pay for AirTrain. Air passengers who currently use other access modes are also characterized by a high propensity to switch to AirTrain that is approximately uniform across the current modes. A notable observation is that taxi/FHV users did not exhibit any particularly negative attitude towards switching to transit if it is a premium service such as LIRR+AirTrain or Subway+AirTrain. Given that taxi/FHV modes represent more than 50% in the existing ground access model split, this is an important finding.

Figure B-11 Air Passenger Willingness to Switch to AirTrain+LIRR by Current Ground Access Mode

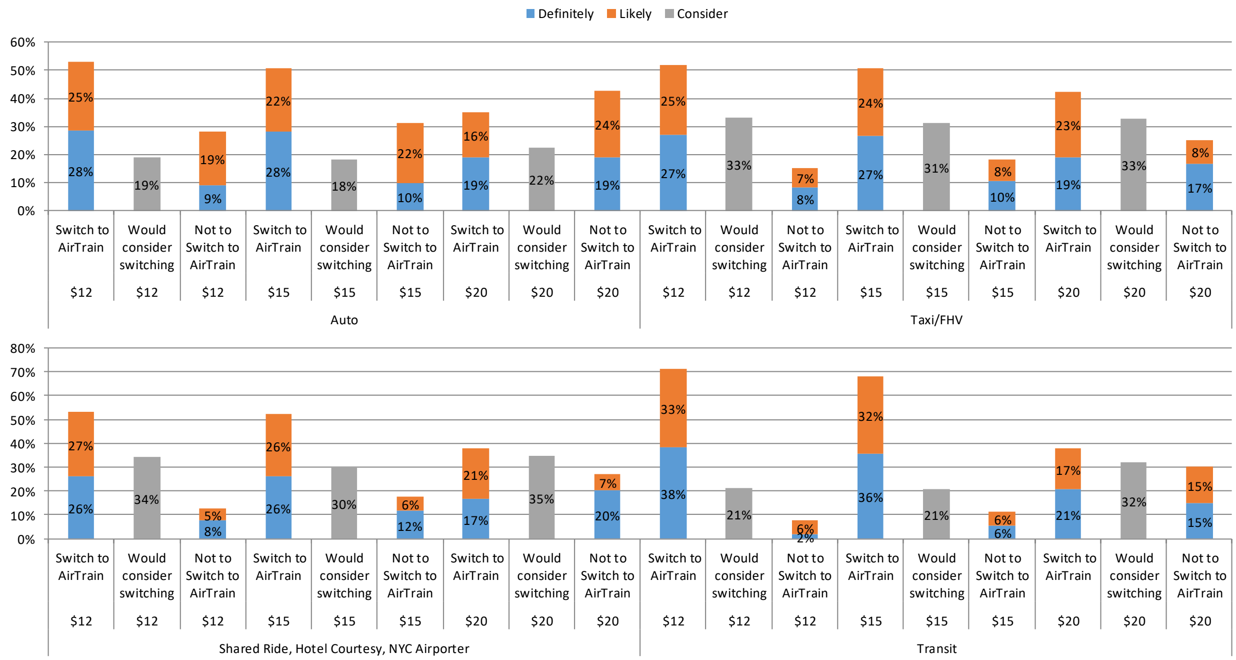
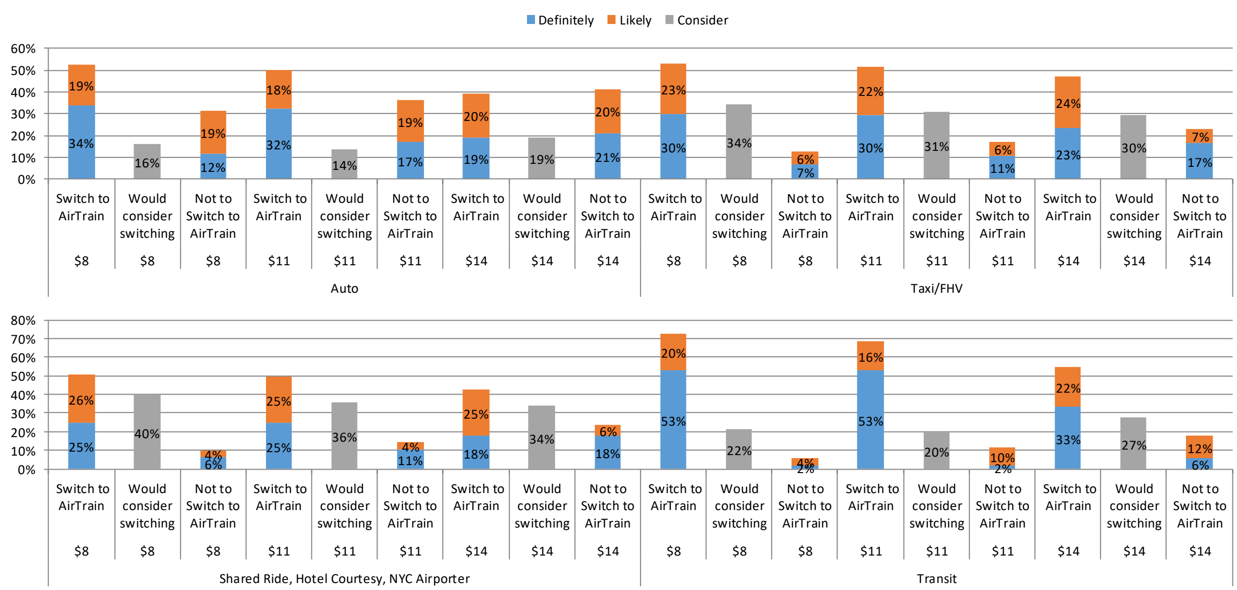


Figure B-12 Air Passenger Willingness to Switch to AirTrain+Subway by Current Ground Access Mode



The fifth important distinction among air passengers relates to their yearly household income. In this regard, they are grouped into three major income classes: low (under $50,000), medium ($50,000-$100,000), and high ($100,000+). The willingness to switch for all three groups to AirTrain with LIRR and AirTrain with Subway is presented in **Figure B-13** and **Figure B-14**, respectively. It can be seen that there is a clear general trend for medium income travelers to have an exceptionally high willingness to switch to AirTrain, especially with lower fares, compared to the other two groups. This observation can be a manifestation of the sensitivity of low-income travelers to the AirTrain fare while high-income travelers may prefer even more expensive modes such as taxi/FHV for a perceived convenience of a one-seat ride. Thus, with the suggested fare structure, medium-income travelers represent the primary AirTrain market. However, air passengers from other income groups are also characterized by a high propensity to switch to AirTrain.

Figure B-13 Air Passenger Willingness to Switch to AirTrain+LIRR by Income Group

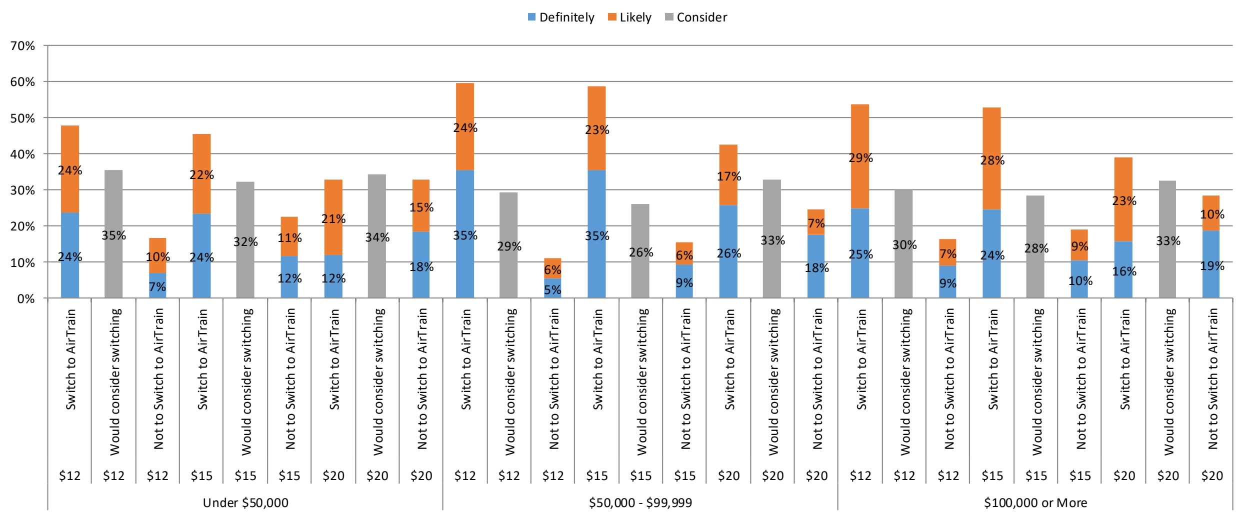
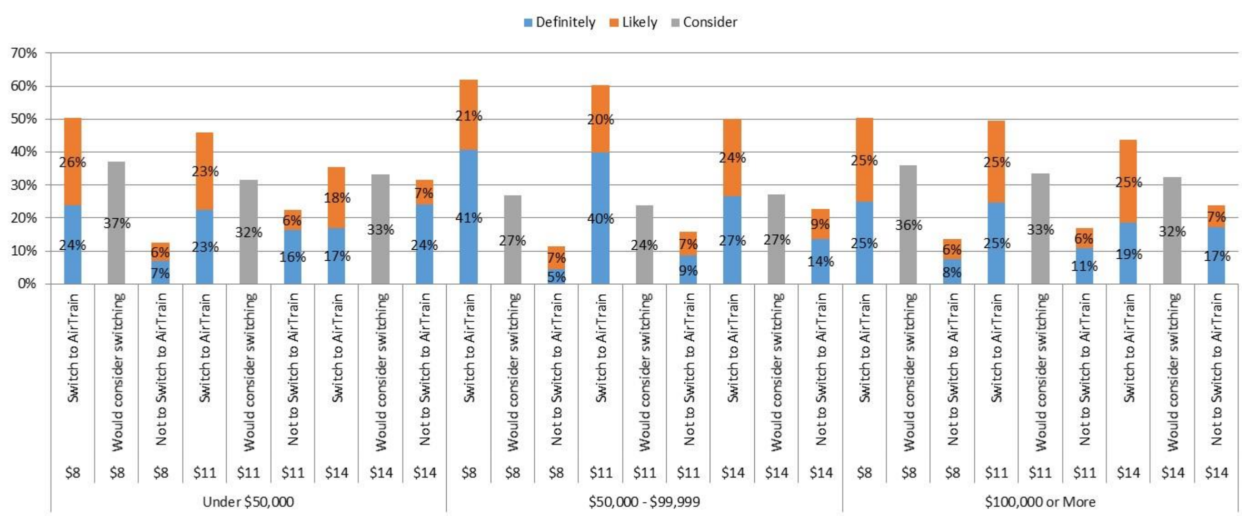


Figure B-14 Air Passenger Willingness to Switch to AirTrain+Subway by Income Group



B.3 EMPLOYEE SURVEY RESULTS

LGA employee profiles are tabulated from the 2017 LGA Employee Survey, which included 861 complete person records. The expansion of this data used three factors – the total employment of LGA, the attendance factor over a week, and two commuting trips per each attending employee per day. Using these factors, the weighted summary represents the daily commuting trips of an average day over the course of the year.

The raw distribution of LGA employees and weighted daily commuting trips is presented in **Table B-36**. Overall, more than 60 percent of LGA employees are characterized by a household income less than $75,000. This income correlates with the fact that a majority of LGA employees represent airport security, ground, and terminal services. Fewer employees comprise flight crew staff with higher incomes. This justifies a relatively low VOT applied for employees in the developed ground access choice model. Another important consideration reflected in the model and AirTrain ridership forecast is that it is essential to provide a discounted monthly pass for employees using AirTrain.

Table B-36 Distribution of LGA Employees and Commuting Trips by Household Income Group

	Daily Commuting Trips (weighted)		Employees (unweighted)	
Income Groups	Percentage	Count	Percentage	Count
Under $25,000	16.1%	2,162	15.0%	129
$25,000 - $49,999	27.3%	3,654	27.8%	239
$50,000 - $74,999	17.2%	2,304	17.3%	149
$75,000 - $99,999	9.2%	1,230	9.3%	80
$100,000 - $124, 999	7.4%	994	7.4%	64
$125,000 - $149, 999	3.1%	417	3.5%	30
$150,000 - $174,999	2.4%	317	2.3%	20
$175,000 - $199,999	1.7%	228	1.9%	16
$200,000 - $299,999	1.7%	221	1.7%	15
$300,000 or greater	0.9%	120	0.9%	8
Decline to answer	13.1%	1,751	12.9%	111
Total	**100.0%**	**13,398**	**100.0%**	**861**

Another important travel characteristic where the LGA employees differ substantially from air passengers is the travel party size. The corresponding raw distribution of LGA employees and weighted daily commuting trips is presented in **Table B-37**.

Table B-37 Distribution of LGA Employees and Commuting Trips by Travel Party Size

	Daily Commuting Trips (weighted)		Employees (unweighted)	
Party Size	**Percentage**	**Count**	**Percentage**	**Count**
1	96.9%	12,981	94.5%	814
2	3.1%	416	5.5%	47
3	0.0%	0	0.0%	0
4	0.0%	0	0.0%	0
5+	0.0%	0	0.0%	0
Total	**100.0%**	**13,398**	**100.0%**	**861**

As shown above, a small number of LGA employees commute together. Most LGA employees commute alone. This important fact is reflected in the ground access choice model when travel cost is scaled and when parking constraints are considered. For employees, every commuting trip to LGA by auto should be translated into a parking space.

The raw distribution of LGA employees and weighted daily commuting trips by place of residence is presented in **Table B-38**. LGA employees are less geographically dispersed compared to air passengers. The main concentration of employees is in Queens, Brooklyn, and the Bronx, and a substantial share is from Long Island. Employees from Queens and Brooklyn are most likely to use the AirTrain LGA, since they can choose between a subway connection or driving to Willets Point (WP). Additionally, employees from Long Island could use the AirTrain LGA by connecting with the LIRR or driving and parking at Willets Point. For employees from the Bronx, there is no convenient transit access to WP, and driving to LGA is an easier option. Nevertheless, these employees would more likely choose the AirTrain LGA in scenarios where employee parking is available only at Willets Point and not provided at LGA. It should be noted that, as the JFK AirTrain experience has shown, employees become a substantial part of the ridership if they can take advantage of a discounted AirTrain pass.

Table B-38 Distribution of LGA Employees and Commuting Trips by Place of Residence

	Daily Commuting Trips (weighted)		Employees (unweighted)	
Origin Location	**Percentage**	**Count**	**Percentage**	**Count**
Manh Lower	0.9%	120	1.2%	10
Manh Mid WA	0.3%	43	0.6%	5
Manh Mid Other	0.1%	16	0.2%	2
Manh UES UWS	0.4%	53	0.5%	4
Manh North	4.4%	588	4.2%	36
Queens NW	8.2%	1,093	8.7%	75
Queens W WA	8.3%	1,112	8.1%	70
Queens W Other	2.2%	293	3.0%	26
Queens E WA	9.7%	1,299	5.8%	50
Queens E Other	18.8%	2,524	20.1%	173

	Daily Commuting Trips (weighted)		Employees (unweighted)	
Origin Location	**Percentage**	**Count**	**Percentage**	**Count**
Brooklyn E	6.5%	866	7.8%	67
Brooklyn W	6.6%	881	6.9%	59
Bronx	11.4%	1,521	12.1%	104
Staten Island	0.9%	120	1.2%	10
Long Island	14.5%	1,942	10.3%	89
Upstate NY & CT	3.3%	443	3.8%	33
NJ, PA	3.6%	484	5.6%	48
Total	**100.0%**	**13,398**	**100.0%**	**861**

Existing mode choice for LGA employees is presented in **Table B-39**. LGA employees commute today mainly by auto or by regular transit. A substantial parking capacity for employees is provided at LGA and additional parking options are near the airport. There are several bus lines (M60, Q33, Q48, Q70, Q72) that connect LGA from Manhattan and Queens and also connect LGA to the subway lines and LIRR. It should be noted, that the overall share of rail use is negligible despite a substantial number of employees commuting from Long island. It also should be kept in mind that the potential for employees to use AirTrain would largely be driven by the available parking capacity at Willets Point compared to LGA.

Table B-39 Distribution of LGA Employees by Commuting Mode

	Daily Commuting Trips (weighted)		Employees (unweighted)	
Origin Location	**Percentage**	**Count**	**Percentage**	**Count**
Auto - Park at Employee/P10 Lot	45.4%	6,082	50.6%	436
Auto - Park Elsewhere	11.9%	1,600	12.1%	104
Taxis/FHVs	1.3%	170	1.0%	9
NYC Airporter	0.4%	48	0.3%	3
Bus	19.5%	2,619	16.6%	143
Subway+Bus	18.9%	2,537	17.0%	147
Rail+Bus/Taxi	1.5%	200	1.2%	11
Non-Motorized	1.0%	141	1.0%	9
Total	**100%**	**13,398**	**100%**	**861**

The distribution of LGA employees and commuting trips by number of work days per week is presented in **Table B-40**. The vast majority of employees work more than four days per week.

Table B-40 Distribution of LGA Employees and Commuting Trips by Number of Working Days per week

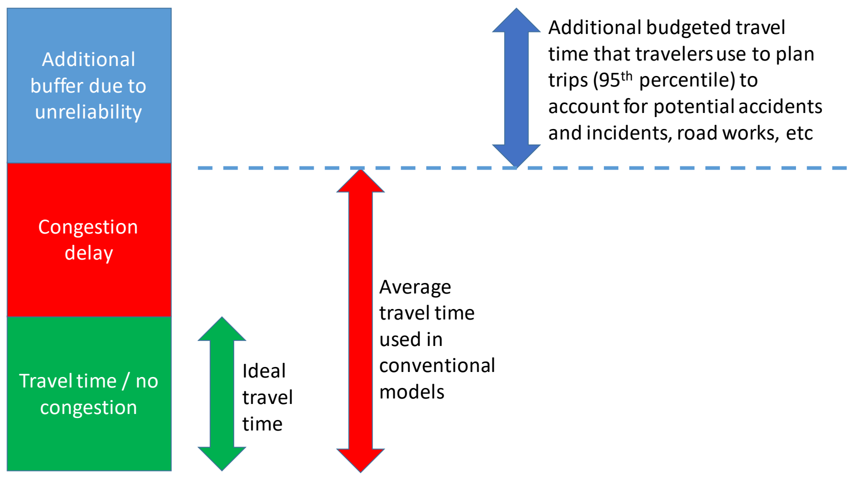
	Daily Commuting Trips (weighted)		Employees (unweighted)	
Number of Days	Percentage	Count	Percentage	Count
1	2.4%	316	2.8%	24
2	2.7%	359	3.0%	26
3	2.9%	384	2.9%	25
4	14.5%	1,940	14.4%	124
5	66.8%	8,948	65.6%	565
6	6.9%	919	7.1%	61
7	4.0%	531	4.2%	36
Total	**100%**	**13,398**	**100%**	**861**

Appendix C. Analysis of Congestion Growth and Highway Time Reliability for Trips To and From LGA

C.1 METHODOLOGY FOR INCORPORATION OF TRAVEL TIME RELIABILITY AND ACCOUNTING FOR CONGESTION GROWTH IN 2025 AND 2045

Travel time reliability has been recognized as a very important measure of transportation Level of Service (LOS). Specific methods for the quantification of travel time reliability were analyzed and compared in recent large-scale research projects such as the Strategic Highway Research Program 2 (SHRP 2) Project L04 "Incorporating Reliability Performance Measures in Operations and Planning Modeling Tools" and Project L05 "Incorporating Reliability Performance Measures into the Transportation Planning and Programming Processes." The general concept that was adopted by the FHWA for highway operation analysis is illustrated in **Figure C-1**. This concept is especially appealing for trips to airports because air passengers must be on time and the penalty associated with being late is one of the highest across all passenger trip types.

Figure C-1 Travel Time Reliability Measures (as defined by FHWA)



In terms of highway user perceptions of LOS there are three major components of travel time. The first component is an ideal free-flow time that the user would experience without congestion. In reality, free-flow time can only be expected in certain off-peak periods. More realistically, highway users would experience a congested travel time that includes certain delays in addition to free-flow time. The usual modeling practice is to calculate the mean travel time for each time-of-day period over multiple days. While the mean travel time represents road congestion to a certain extent, it may mask the real magnitude of travel time reliability impacts. Travelers rarely plan their trips solely based on the average travel time. In fact, planning for an average travel time would correspond to an approximate 50 percent probability of being late. To avoid being late, travelers plan their trips by building in some buffer time that can be added to the mean travel time.

For trips to airports, the buffer has to be substantial in order to cover practically all uncertainty associated with travel times. This can be achieved by using the 95th percentile of travel times as the measure of the "longest" possible travel time in practical terms.

C.2 ANALYSIS AND CORRECTION OF THE MEAN TRAVEL TIMES OBTAINED FROM BPM

Even before the travel time reliability measure is introduced, it is important to ensure that the base congestion factor is properly calculated and the mean travel time is reasonable for all relevant Origin & Destination (O&D) trips since the additional buffer time is added on top of it. Congested travel times constitute the main LOS characteristic of taxis and For Hire Vehicles, auto parking, auto drop-offs, and other ground access modes competing with the AirTrain. The main source of LOS variables for the LGA ground access model is the official regional travel model developed and maintained by the New York Metropolitan Transportation Council (NYMTC), the Best Practice Model (BPM). This model provides a comprehensive coverage of all LOS variables for years 2017, 2025, and 2045.

The mean highway times provided by BPM for 2017 were validated by comparison to available taxi GPS data from the NYC Taxi and Limousine Commission. In most cases, it was found that BPM underestimates auto travel times for trips to and from LGA by 10-20 percent, or even more (see **Table C-1**). It was also found that BPM overestimated free-flow time. The GPS-based free-flow time was calculated as a 15th percentile of travel times for the corresponding O&D trips and time-of-day period.

Table C-1 Comparison of Taxi GPS Times to BPM Times for Trips To and From LGA, 2017

Time-of-day period	Travel time type	Trip origin/destination	Average ratio of taxi GPS time to NYBPM time
AM Peak (6am-10am) & PM Peak (4pm-8pm)	Congested Time	NY City & Long Island (LI)	109%
		NY Hudson Valley & CT	97%
		NJ	108%
	Free flow time	NY City & LI	138%
		NY & CT	116%
		NJ	139%
Midday (10am-4pm)	Congested Time	NY City & LI	118%
		NY & CT	104%
		NJ	120%
	Free flow time	NY City & LI	127%
		NY & CT	111%
		NJ	146%
Night (8pm-6am)	Congested Time	NY City & LI	125%
		NY & CT	117%
		NJ	131%
	Free flow time	NY City & LI	112%
		NY & CT	104%
		NJ	115%

To produce an LOS adjustment that was consistent across all forecasting years, the calculated correction factors were applied to the mean highway times obtained from BPM for 2025 and 2045.

C.3 CONGESTION GROWTH IN THE STUDY AREA AS PREDICTED BY BPM

BPM predicts a very moderate growth of traffic in the study area around LGA as shown in **Figure C-2** and **Table C-2**, as well as in the entire county of Queens as illustrated in **Table C-3**.

Figure C-2 Definition of Study Area around LGA for Traffic Impacts

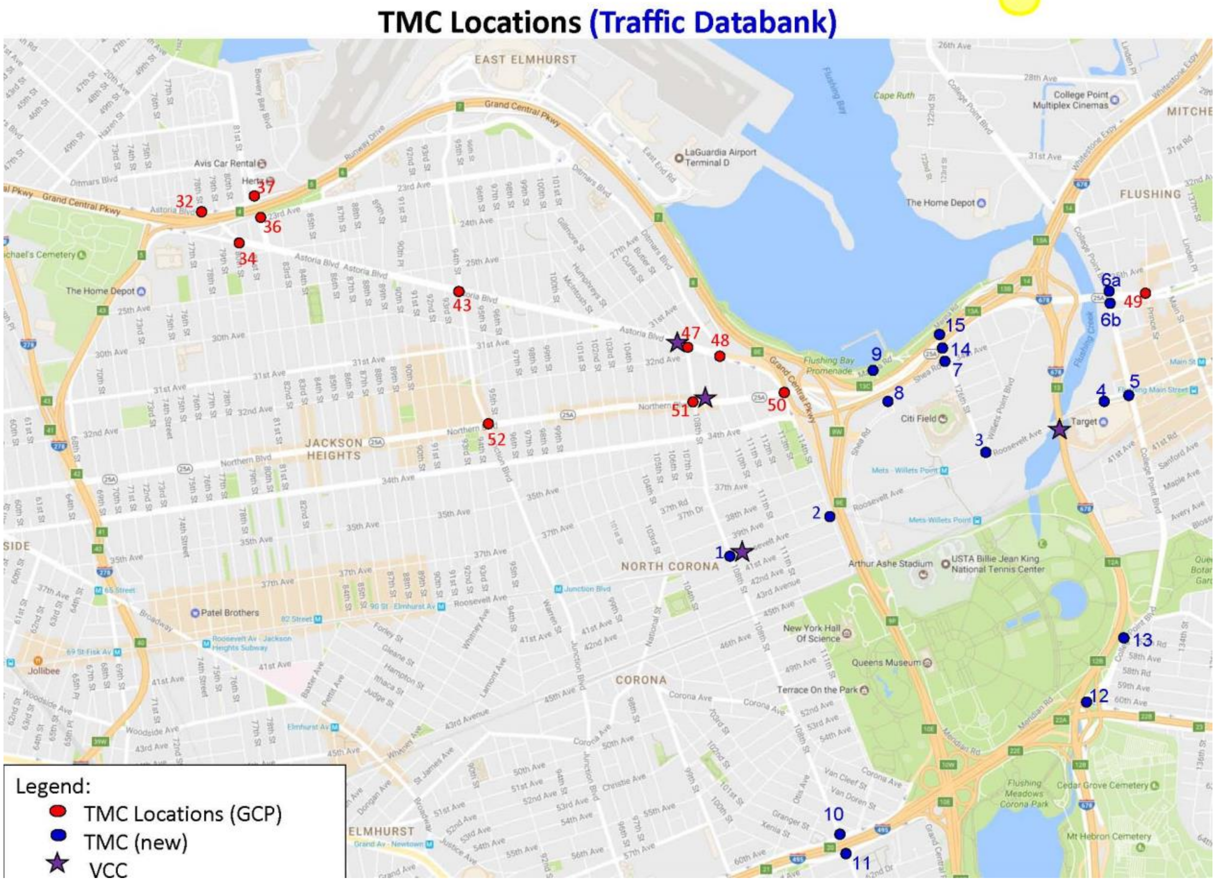


Table C-2 Expected Growth of Traffic Volumes (based on the regional travel model) in the Study Area around LGA

Functional Class	Time-of-day period	2017-2025	2025-2045	2017-2045
Highway Facilities	Off-Peak	1.06	1.05	1.11
Highway Facilities	Peak	1.05	1.03	1.09
Highway Facilities	Daily	1.06	1.04	1.10
Local Roadways	Off-Peak	1.05	1.08	1.13
Local Roadways	Peak	1.02	1.06	1.08
Local Roadways	Daily	1.04	1.07	1.11

Table C-3 Expected Growth of Traffic Volumes (based on the regional travel model) in Entire Queens

Functional Class	Time-of-day period	2017-2025	2025-2045	2017-2045
Highway Facilities	Off-Peak	1.05	1.05	1.10

Highway Facilities	Peak	1.04	1.03	1.08
Highway Facilities	Daily	1.05	1.04	1.09
Local Roadways	Off-Peak	1.04	1.08	1.12
Local Roadways	Peak	1.03	1.06	1.09
Local Roadways	Daily	1.04	1.07	1.11

C.4 EVIDENCE FOR HIGHWAY TRAVEL TIME UNRELIABILITY FOR TRIPS TO AND FROM LGA

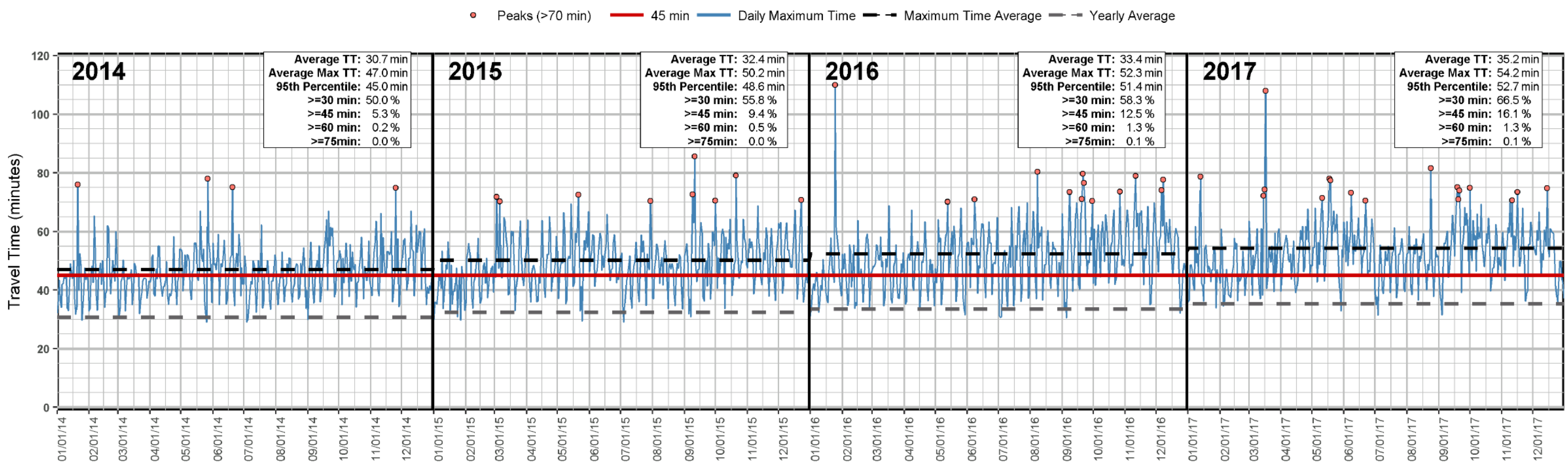
The taxi GPS trip record data is collected and provided to the NYC Taxi and Limousine Commission (TLC) by technology providers authorized under the Taxicab & Livery Passenger Enhancement Programs (TPEP/LPEP).[1]

For this analysis, only yellow taxi data was used including: pick-up and drop-off dates/times; pick-up and drop-off locations; trip distances; itemized fares; rate types; payment types; and driver-reported passenger counts. The data was obtained for four years (2014-2017) and was filtered for trip records between Times Square and the Theater District zone and LGA. Travel time was computed based on the pick-up and drop-off time stamps, and average speed was computed using reported trip distance. The data was compiled and processed in statistical package R to exclude unreasonable records such as zero travel time, speeds less than three mph, speeds greater than 80 mph, trip distance less than seven miles, travel time greater than five hours, etc. **Figure C-3** and **Figure C-4** show the maximum daily travel time (95th percentile time) between Times Square and LGA Airport for four consecutive years. The data points reflecting travel times greater than 70 minutes are highlighted in red as "Peaks (>70 minutes)." The plots show time trends in travel to the airport from Midtown Manhattan. The number of long travel time episodes seems to be increasing every year showing the un-reliability of travel times. The average travel time has also increased every year between 2014 and 2017 showing an increase in overall congestion. The gap between the yearly average travel time (grey dashed line) and yearly average of maximum travel time (black dashed line) also seems to be increasing (from 12 minutes to 20 minutes).

C.5 METHOD FOR CALCULATION OF AUTO TRAVEL TIMES FOR LGA GROUND ACCESS MODEL

The entire method for calculation of auto travel times for the LGA ground access mode choice model is summarized in **Table C-4**. This method ensures a consistent adjustment of three different travel times – free-flow travel time, mean congested time, and full planning time (as shown in **Figure C-1**) – for each trip to or from LGA using the taxi GPS data and BPM travel time as an input.

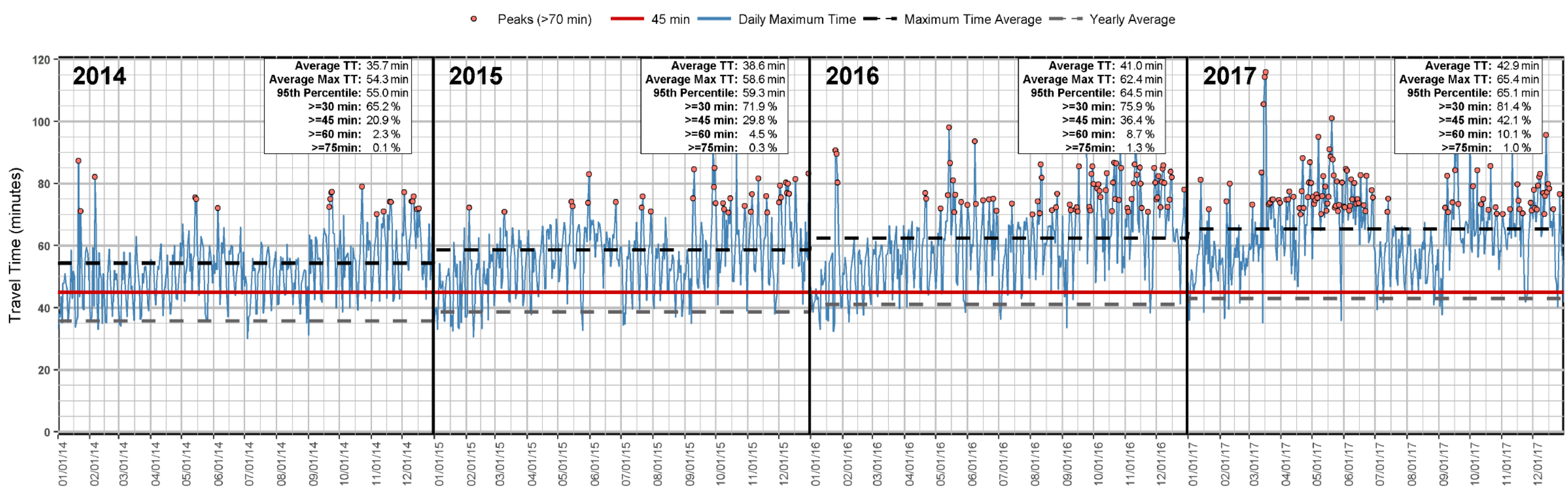
[1] Available at *http://www.nyc.gov/html/tlc/html/about/trip_record_data.shtml*. Accessed April 24, 2018.



Note: Data cleaned to remove any days during which on-airport traffic conditions led to delays on the off-airport roadway network. Data for following dates was excluded: 08/22/16, 11/10/16, 11/18/16, 12/12/16, 12/15/16, 12/16/16, 12/21/16, 01/19/17, 02/10/17, 02/08/17, 04/28/17, 12/20/17

Source: The NYC Taxi and Limousine Commission. Taxi GPS Datasets. 2017

Maximum Travel Time to
LaGuardia Airport from Times Square
Figure C-3



Source: The NYC Taxi and Limousine Commission. Taxi GPS Datasets. 2017

Maximum Travel Time from LaGuardia Airport to Times Square

Figure C-4

Table C-4 Method for Calculation of Auto Travel Times for LGA Ground Access Model, 2017

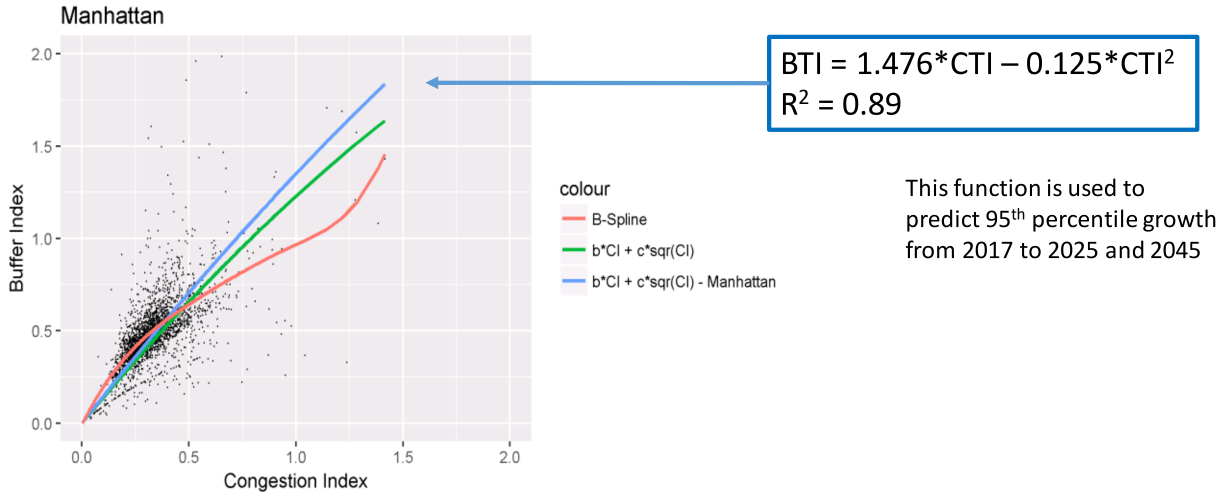
Travel time	2017	2025	2045
From taxi GPS:			
- Free-flow time (X)	X17		
- Mean congested time (Y)	Y17		
- Full planning time (Z)	Z17		
From NYBPM:			
- Free-flow time (U)	U17	U25	U45
- Mean congested time (V)	V17	V25	V45
Used in LGA Model:			
- Free-flow time	X17	X17	X17
- Mean congested time	Y17	Y25 = Y17*(V25/V17)	Y45 = Y17*(V45/V17)
- Full planning time	Z17	Z25 = Z17*f(Y25)/f(Y17)	Z45 = Z17*f(Y45)/f(Y17)

For 2017, all three travel times were collected from taxi GPS data. BPM travel times were used only to calculate congestion growth factors between 2017 and 2025 and between 2017 and 2045. The most complex calculation was of the 95th percentile (full planning time) for future years 2025 and 2045. This calculation is based on a statistically estimated function that predicts how full planning time grows with the growing mean time. This function is described in the subsequent section.

C.6 STATISTICAL FUNCTIONS FOR TRAVEL TIME RELIABILITY

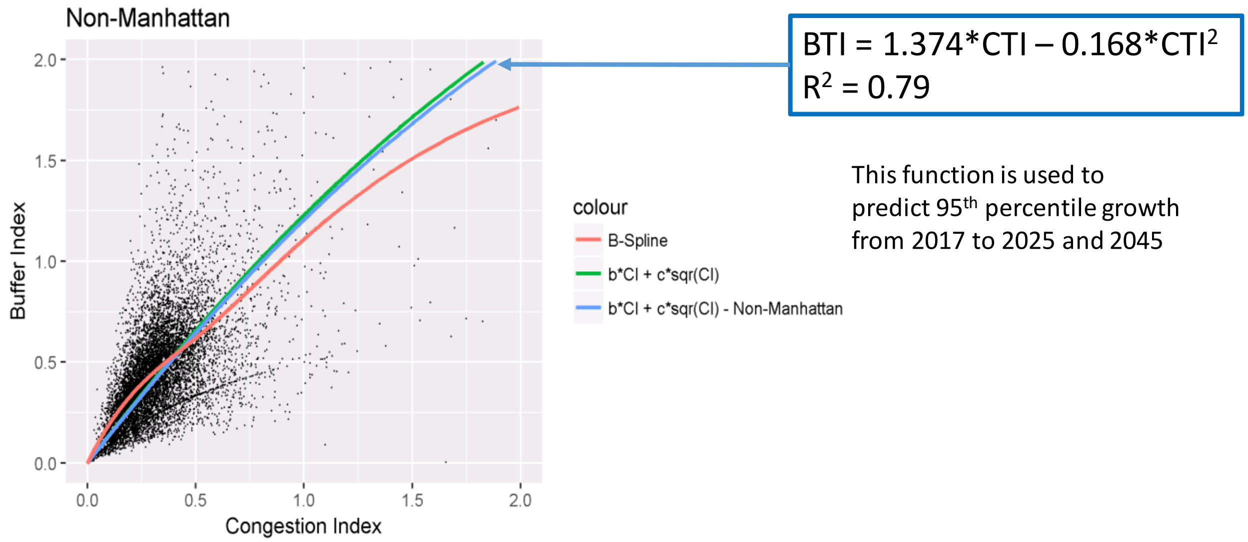
The purpose of this function is to predict the complete planning time that includes the reliability buffer in a form like the 95th percentile, as a function of the mean congested travel time. Several possible statistical forms for these functions were explored in the course of the project. The best statistical fit and corresponding meaningful interpretation were achieved with the functional form that relates the Buffer Time Index to the Congestion Index in a non-linear concave way as shown in **Figure C-5** and **Figure C-6**. The Buffer Time Index (BTI) represents the ratio of the 95th percentile minus mean travel time compared to the mean travel time. By definition, BTI is always greater or equal to zero. If the BTI equals one (1) then the 95th percentile of travel time is twice as long as the mean travel time. The Congestion Time Index (CTI) is the ratio of the mean travel time minus free flow time compared to the free-flow time. By definition, CTI is always greater or equal to zero. If the CTI equals one (1) that means the mean travel time is as twice as long as the free-flow travel time.

Figure C-5 Buffer Time Index as Function of Congestion Time Index (trips from/to Manhattan to/from LGA)



…

Figure C-6 Buffer Time Index as Function of Congestion Time Index (trips from/to Non-Manhattan to/from LGA)



The functions chosen for the model application are concave functions that relate BTI to CTI in a monotonically increasing way, but not in a linear fashion. This means that if the CTI is doubled the corresponding BTI will grow, but less than two times the amount. Nevertheless, this concavity is applied to two different measures. The BTI is calculated over the mean travel time while the CTI is calculated over free-flow time. As a result, the composition of the effects leads to a stronger growth of 95th percentile compared to the growth in average travel times.

C.7 EXAMPLES OF TRAVEL TIME PREDICTIONS FOR KEY O&D PAIRS FOR TRIPS TO AND FROM LGA

The application of the developed functions showed important differences in travel time predictions for future years as summarized in **Table C-5**. It can be seen that for all key origins and destinations, the 95th percentile of travel times as well as the planning time index grow at a much higher rate than the mean travel time. This confirms the major point of the travel time reliability analysis, namely, that the mean travel time, if used as the sole measure of congestion, can mask the actual deterioration of LOS. While, the average travel time might show a moderate growth over time, the corresponding travel times become less predictable and the 95th percentile normally grows at a much higher rate than the average travel time. Given that air passengers need to avoid lateness, it pushes them to plan for a progressively worse case and use longer and longer buffer times.

Table C-5 Examples of Travel Time Prediction w/New Functions for 2045 (with LGA terminal times)

Reference location	Direction	Time of day	Avg travel time, 2017 (min)	Avg travel time, 2045 (min)	Avg travel time growth (%)	95th percentile travel time, 2017 (min)	95th percentile travel time, 2045 (min)	95th percentile travel time growth (%)	Planning time index, 2017	Planning time index, 2045	Planning time index growth (%)
Grand Central	From LGA	AM peak	44	56	26%	62	104	68%	1.41	1.88	33%
	To LGA	PM peak	40	44	9%	61	75	23%	1.54	1.73	12%
Penn Station	From LGA	AM peak	50	56	11%	70	87	26%	1.38	1.57	14%
	To LGA	PM peak	48	54	11%	74	92	25%	1.52	1.71	13%
Financial District	From LGA	AM peak	49	53	8%	68	81	19%	1.38	1.52	10%
	To LGA	PM peak	51	55	8%	76	91	20%	1.50	1.66	11%
Union Square	From LGA	AM peak	47	50	6%	69	79	15%	1.46	1.58	8%
	To LGA	PM peak	46	50	8%	76	90	19%	1.63	1.80	10%
Court St/Boro Hall, Brooklyn	From LGA	AM peak	47	52	12%	66	84	27%	1.40	1.59	14%
	To LGA	PM peak	43	49	13%	64	84	32%	1.47	1.70	16%
Long Island City, Queens	From LGA	AM peak	30	34	14%	42	56	33%	1.40	1.64	17%
	To LGA	PM peak	31	37	21%	47	71	52%	1.52	1.91	25%

C.8 IMPLICATIONS OF TRAVEL TIME RELIABILITY ON LGA AIRTRAIN RIDERSHIP FORECAST

The developed methods for accounting for travel time reliability were incorporated in the LGA ground access mode choice model as additional sensitivity tests. This version of the model includes the difference between the 95th percentile and the mean travel time (buffer time) as an additional LOS measure along with the average travel time and cost. When this measure is included in the highway mode utilities with a coefficient equal to the mean travel time coefficient, (i.e. travel time reliability is equalized in importance with the mean travel time), it means that the model operates with the 95th percentile as the main LOS measure instead of the mean travel time. When the coefficient for this measure is set to zero, it means that the model performs exactly as the core version of it described in the main body of the report. Any fractional number between 0 and 1 can be used to weigh the travel time reliability measure between these two extreme cases and valuate the corresponding impact on AirTrain LGA ridership.

For the base year 2017, a model version with reliability is recalibrated with some minor adjustments to the mode-specific constants and it replicates the observed mode shares of the existing mode exactly in the same way as the model without reliability. The differences, however, become prominent for future years 2025 and 2045 due to the higher growth rate for the 95th percentile of travel times. A summary of two sensitivity tests with different weights for travel time reliability is shown in **Table C-6** for 2025 as an example. The effects are even more prominent for 2045.

Table C-6 AirTrain Ridership (annual numbers) Sensitivity Tests with Travel Time Reliability

Run	Expansion	Highway Level of Service	Value of Time	Total Trips to/from LGA	Paid AirTrain Ridership	Paid AirTrain Share
1	2025	2025 Build/ 95th Percentile	75,50,16	33.54	7.09	21.1%
2	2025	2025 Build/ Average TT	75,50,16	33.54	5.32	15.9%

In **Table C-6**, the two model runs summarized are different in terms of reliability measures. Run 1 uses 95th percentile of travel times with a full account for travel time reliability. Run 2 is based on the average travel time. It can be seen that when accounting for travel time reliability the model generates a substantially higher forecast for the paid AirTrain ridership. The paid ridership for Run 1 is more than 4 percent higher than for Run 2 and reaches 20 percent in Run 1.

Appendix D. Survey of VOT and Mode Convenience Factors in Applied Models for Airport Ground Access Mode Choice

D.1 VOT IN APPLIED MODELS FOR AIRPORT GROUND ACCESS MODE CHOICE

Value of Time (VOT) is an important parameter of a mode choice model that expresses how the travelers trade off travel time and cost for each mode. All else being equal, higher VOT means that the travelers value travel time savings more and would be willing to pay for more expensive but faster, more convenient, and more reliable modes. Conversely, lower VOT means that travelers would prefer cheaper modes even if they are inferior in terms of travel time or other service characteristics. There are multiple published reports on VOT for air passengers and employees including Special Airport Cooperative Research Program (ACRP) Synthesis 4 (*Ground Access to Major Airports by Public Transportation*), Synthesis 5 (*Airport Ground Access Mode Choice Models. A Synthesis of Airport Practices*), Synthesis 22 (*Passenger Value of Time, Benefit-Cost Analysis and Airport Capital Investment Decisions. Volume 1: Guidebook for Valuing User Time Savings in Airport Capital Investment Decision Analysis*), and Synthesis 118 (*Integrating Aviation and Passenger Rail Planning*). A wide range of applied VOTs in different models can be found (**Table D-1**) from the ACRP 5 Synthesis.

Only a few of the applied models were rigorously estimated based on an extensive survey of air passengers. In many applied models, VOTs were assumed based on the prevailing practices at the time; subsequently, the entire model was validated and adjusted to match the available aggregate data without a specific statistical proof of the adopted VOT. However, several general patterns were quite common across different models. Specifically, it was agreed that all else being equal, air passengers should have a higher VOT compared to employees, and business air passengers should have a higher VOT than non-business passengers.

Table D-1 Examples of Estimated or Assumed VOT in Applied Airport Ground Access Mode Choice Models

	Airport or Study								
	ATL	BOS	ORD	MDW	MIA	OAK	PDX	SJC	YYZ
Year of Cost Data	a	1993	2003	2003	b	c	1996	c	2002
Travel Times ($/hour)						d		e	f
Highway time		g	h	h			i		
Resident business trips	15	11	33	63	78	15	19	15	53
Resident non-business trips	13	17	25	22	78	16	29	10	29
Non-resident business trips	16	40	33	63	78	15	19	15	71
Non-resident non-business trips	12	13	25	22	78	16	30	10	34
Transit in-vehicle time		j				k		k	
Resident business trips	11	26	33	63	78	11	19	11	53
Resident non-business trips	9	7	25	22	78	12	29	7	29
Non-resident business trips	12	15	33	63	78	11	19	11	71
Non-resident non-business trips	9	9	25	22	78	12	30	7	34
Travel time (other cases)		l	m	m		n	o	n	
Resident business trips		22	92	82		20	24	20	
Resident non-business trips		38	55	57		19	37	12	
Non-resident business trips		40	92	82		20	24	19	
Non-resident non-business trips		13	55	57		19	39	11	

Source: Special ACRP 5 Synthesis Report, 2008 [7].

Historically, very high VOT estimates for air passengers were reported in academic research where some advanced statistical methods were applied with disaggregate data from special surveys:

- $93-$155/h depending on air passenger purpose and income – see Hess, S. and J. W. Polak (2005) Accounting for random taste heterogeneity in airport-choice modelling. Transportation Research Record, 1915, pp. 36-43 and Hess, S. and J. W. Polak (2006) Airport, airline and access mode choice in the San Francisco Bay area. Papers in Regional Science, 85.4, pp. 543-567.
- $120-$170/h depending on air passenger purpose – see Pels E., P. Nijkamp and P. Rietveld (2000) Airport and Airline Competition for Passengers Departing from a Large Metropolitan Area. Journal of Urban Economics, Volume 48, Issue 1, July 2000, pp. 29-45.
- $72.6/h – see Furuichi, M. and F. S. Koppelman (1994) An Analysis of Air Travelers' Departure Airport and destination Choice Behavior. Transportation Research Part A: Policy and Practice. Volume 28, Issue 3, pp. 187-195.

For the current study, VOTs for air passengers were based on more recent research and estimation with the PANYNJ survey for 2008 for all airports (see Gupta, S., P. Vovsha, and R. Donnelly (2008) Air Passenger Preferences for Choice of Airport and Ground Access Mode in the New York City Metropolitan Region. Transportation Research Record 2042, pp. 3-11) and survey implemented in 2016 for JFK (see AirTrain JFK Ridership and Fare Elasticity Study. (2016) Final Report. Prepared by WSP|Parsons

Brinckerhoff). The primary data source for the 2008 study was the 2005 originating air passenger survey conducted by the Federal Aviation Administration (FAA), Port Authority of NY and NJ (PANYNJ), New York Department of Transportation (NYSDOT), and the Delaware Valley Regional Planning Commission (DVPRC) in the greater New York region. This survey was carried out at 9 airports in the 54-county region. The survey questionnaire included trip information such as purpose of travel, origin location, destination, mode of transport to airport, size of traveling party and person socio-demographic attributes. A rich database with 19,127 observations was built based on the survey with 5,812 business travel records, and 13,315 non-business records. It was augmented by the data on the airport characteristics, as well as level-of-service variables for all 9 airports and 8 ground access modes. The original rigorous estimates of VOT for JFK air passengers were:

- $63/h for business air passengers
- $42/h for non-business air passengers

Subsequent corrections were introduced for LGA VOT for air passengers based on the comparison of the average income of the LGA air passengers to JFK that was available in the LGA and JFK ground access surveys. LGA air passengers have a higher average household income ($108,200) than JFK air passengers ($86,300). SHRP 2 C04 Report *Improving Our Understanding of How Highway Congestion and Pricing Affect Travel Demand,* substantiated a VOT elasticity with respect to income. VOT grows with income but not linearly. VOT growth is proportional to income growth raised to the 0.8 power (so-called "constant elasticity" model). Application of this method for LGA air passengers resulted in the following VOT that was adopted for this study:

- $75/h for business air passengers
- $50/h for non-business air passengers

It should be noted that the observed mode choice for LGA air passengers with a very high share (more than 50 percent) of the most expensive modes such as taxi/For Hire Vehicles serves as indirect evidence of a high VOT. Additionally, an extensive set of sensitivity tests for AirTrain ridership with different VOTs showed a relatively low ridership elasticity with respect to VOT, which means that the ridership forecast did not change drastically with either higher or lower VOT in a reasonable range. This can be explained by the fact that for LGA, the main "competition" for AirTrain comes from the expensive taxi/For Hire Vehicles modes. In this regard, a higher VOT value actually makes taxi/For Hire Vehicles *more* competitive against AirTrain. Conversely, a lower VOT assumption makes transit (and AirTrain, in particular) more competitive against taxi/For Hire Vehicles. Thus, the adopted VOT for the current study does not automatically favor AirTrain in the ground access mode competition. However, higher VOTs in general reduce the AirTrain ridership elasticity with respect to the fares.

For the LGA employees, and in order to be consistent with the way level-of-service (LOS) variables were generated by the BPM), VOT was directly adopted from BPM. BPM uses the following VOT that was rigorously estimated based on the New York Metropolitan Transportation Council household survey in 1997:

- $16/h for work trips – this VOT was adopted for LGA employees.
- $10-$12/h for non-work trips depending on the detailed trip purpose.

For LGA employees, AirTrain ridership sensitivity to the VOT assumptions proved to be relatively low but for a different reason. It was assumed, following the JFK experience, that employees will have an affordable monthly pass for the AirTrain at the level of $60.

D.2 MODE CONVENIENCE FACTORS IN APPLIED MODELS FOR AIRPORT GROUND ACCESS MODE CHOICE

In addition to LOS variables such as mean travel time, cost, and reliability, mode choice decisions of travelers are largely driven by considerations of convenience and comfort that are more difficult to quantify. These additional travelers' preference for certain modes beyond physically measured travel time, reliability, and cost are commonly used in all travel models in a form of so-called "mode-specific constants". These mod-specific constants are added to the utility function of each mode on top of the generalized cost that includes all travel time and cost components with the corresponding behavioral weights and penalties. These mode convenience factors are estimated and/or calibrated using statistical methods based on travel surveys (revealed or stated preference). It has been recognized in travel modeling that without convenience factors the observed mode shares cannot be matched and practically all travel models used in practice have substantial mode-specific constants – see the Airport Cooperative Research Program (ACRP) Synthesis 5 "Airport Ground Access Mode Choice Models. A Synthesis of Airport Practices" as a source from which the subsequent specific examples in this section are provided.

For purposes of analysis and cross-comparisons between different travel models, the convenience factors can be expressed in equivalent minutes of travel time. For example, a relative convenience factor of 25 equivalent minutes for mode A versus mode B means that all else (physical time and cost) being equal, mode A is perceived by the travelers as a faster one by 25 minutes due to the more convenient and comfortable ride. Quite large convenience factors of 100+ minutes are common in travel models. They express strong preferences of travelers beyond time and cost. It can be said that in many respects the mode choice is largely formed by these convenience-driven preferences that may override time and cost differentials between modes. In particular, for trips to and from airport by air passengers with luggage, the convenience explains such a high share observed of taxi/For Hire Vehicles. For new modes like AirTrain, convenience factors can be borrowed from other regions and airports where AirTrain is already in operation. As explained in the following sub-sections, the mode-specific constants that express mode convenience factors adopted for the LGA ground access mode choice model were essentially transferred from the JFK ground access mode choice model where these factors were calibrated to match the observed ridership on the existing AirTrain. It should be stressed that since mode convenience factors are applied as components of mode utilities, only the relative differences between them matters while the overall scale is arbitrary. Any specific mode can be considered as a reference case with a zero convenience factor and all other modes would have non-zero convenience factors relative to this one.

Ground access mode convenience for air passengers has multiple aspects of which the main ones are summarized in **Table D-2**. It can be seen that these preferences vary across different groups of air passengers, which explains why in travel models these factors are frequently segmented by trip purpose, party size, place of residence and other characteristics. Majority of convenience factors work in favor of taxi that explains while in many airport ground access choice models taxi has the highest mode-specific constant. However, there are also several strong factors that work in favor of rail transit modes such as possibility to use travel time productively and more convenient and seamless transfer conditions (between two rail modes within the same station complex) compared to buses or multi-mode combinations.

Additionally, rail transit such as LIRR-with-AirTrain connection planned for LGA are very easy to identify and navigate for visitors of the New York region that may not be familiar with the entire transit system and all transit options that are available.

Table D-2 Main Constituents of Convenience for Air Passengers

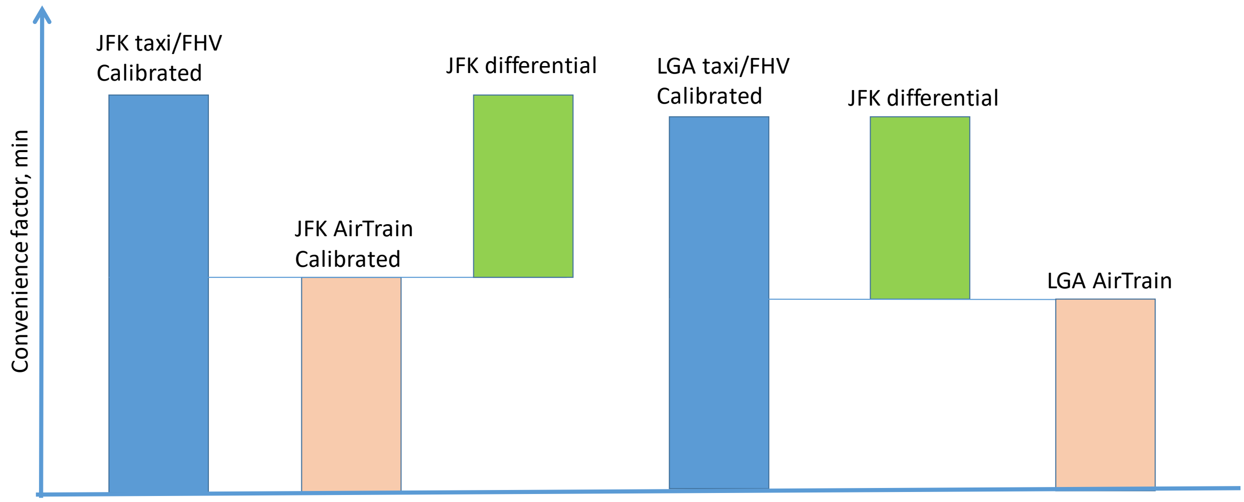
Convenience factor	What modes are favored
Door-to-door service w/o transfers and walks	Auto, Taxi, For Hire Vehicles
Handling luggage	Auto, taxi, For Hire Vehicles, AirTrain
Traveling with young children	Auto, Taxi, For Hire Vehicles
Elderly or disabled person	Auto, Taxi, For Hire Vehicles
Privacy and comfort	Auto, Taxi, For Hire Vehicles
Productive use of travel time	Rail
Probability of having a seat	Transit if not crowded
Convenient transfer	Rail, AirTrain
Information and ease of use for visitors	Rail, AirTrain
Not being dependent on car availability and others	Taxi, For Hire Vehicles, Transit
Travel party of several persons	Taxi, For Hire Vehicles

Mode convenience factors for the LGA ground access model were adopted from the JFK ground access model with the subsequent adjustment and calibration based on the observed LGA mode choice. Convenience factors for all modes including AirTrain were estimated and validated for JFK based on an extensive survey of more than 7,000 the airport air passengers and employees, 2016 (see *AirTrain JFK Ridership and Fare Elasticity Study. Final Report. Prepared by WSP|Parsons Brinckerhoff*). After that, Convenience factors for all existing access modes were additionally calibrated for LGA based on the CSS 2014-2016 and new LGA survey, 2017 described in Appendix A. An exact match of the model to the survey was achieved in terms of the share of each mode. This calibration was implemented is a way that preserves the relative AirTrain convenience factors versus the other major competing modes as were statistically estimated for JFK ground access. In particular, the relative LGA AirTrain convenience factors were calculated based on the difference between taxi/For Hire Vehicle and AirTrain convenience factors for JFK. This way, the LGA ground access mode choice model preserves the relative advantage of taxi/For Hire Vehicle and AirTrain as was observed for JFK (that is the closets proxy to LGA due to a large number of air passengers who use these two airports interchangeably).

For trips with combined modes (such as LIRR with a transfer to AirTrain), the convenience factors are calculated as a weighted average of mode-specific factors where weighting is done by travel time. For example, for a trip from Manhattan to LGA where the LIRR part of the trip takes 30 minutes of total travel time (including rail in-vehicle time, walk and wait) and AirTrain part takes 10 minutes of total travel time (again including AirTrain in-vehicle time, walk, and wait), the blended convenience factors would include three fourths of the LIRR convenience factor and one fourth of the AirTrain convenience factor.

Details of calculation of the LGA AirTrain convenience factor are further illustrated in **Figure D-1** where the logical process can be followed from left to right. First, the observed share of the JFK AirTrain was used to establish the taxi/For Hire Vehicles constant, AirTrain constant, and the differential between them. Secondly, this differential was applied to the recalibrated constant for LGA taxi/For Hire Vehicles to calculate the most plausible constant for AirTrain LGA.

Figure D-1 Illustration for Calculation of LGA AirTrain Convenience Factor



Further comparative analysis of the convenience factors adopted for the LGA ground access mode choice model for taxi/For Hire Vehicles, rail, and AirTrain is presented to portray the main mode competition represented in the LGA model versus several other ground access mode choice models for comparable airports. Convenience factors for taxi/For Hire Vehicles, rail, and AirTrain applied in different ground access mode choice models are presented as relative travel time savings (hence, in negative minutes) versus the other modes. To scale the convenience factor in equivalent minutes of travel time savings, its original value in the utility function is divided by the in-vehicle time coefficient of the corresponding mode. Other modes such as subway, bus, and auto are considered less convenient by air passengers and are less represented in the observed ground access mode choice for LGA. Some of the convenience factors are dependent on trip length; they are presented for a typical average trip length. Convenience factors are segmented by air passenger trip purpose and place of residence since these characteristics affect mode preferences.

Summary of the Taxi/For Hire Vehicles mode convenience factors versus the best mode other than Taxi/For Hire Vehicles and rail is presented in **Table D-3**. It should be noted that taxi/For Hire Vehicles indeed is highly preferred mode for trips to and from airports where the share of this mode can reach 50% or more (like in the case of LGA as discussed in Appendix A in detail). In ground access mode choice models this is naturally expressed in large taxi/For Hire Vehicles convenience factors at the level of 40-120 minutes depending on the air passenger trip purpose, place of residence, and the regional airport specifics. Most frequently, the taxi/For Hire Vehicles convenience factor is somewhat greater for business travelers versus non-business travelers and somewhat greater for visitors versus residents of the region. These differences proved to be less prominent for LGA air passengers although the overall order of magnitude of the taxi/For Hire Vehicles perceptional convenience advantage (around 60 minutes) is exactly in the center of the range.

Table D-3 Taxi/For Hire Vehicles Mode Convenience Factor Versus the Best Mode Other than Taxi/For Hire Vehicles and Rail (minutes of perceived travel time savings

Airport Ground Access Model	Resident, business	Resident, non-business	Visitor, business	Visitor, non-business
LGA, 2017	-60.4	-64.0	-58.0	-60.6
JFK, 2016[1]	-77.2	-57.8	-77.2	-57.8
PANYNJ airport choice, 2008[2]	-105.6	-99.6	-121.5	-109.5
Atlanta, 2005[3]	-41.4	-37.3	-114.0	-87.4
Chicago O'Hare, 2004[3]	-45.5	-65.6	-83.1	-66.9

Notes:

[1] AirTrain JFK Ridership and Fare Elasticity Study. (2016) Final Report. Prepared by WSP|Parsons Brinckerhoff,

[2] Gupta, S., P. Vovsha, and R. Donnelly (2008) Air Passenger Preferences for Choice of Airport and Ground Access Mode in the New York City Metropolitan Region. Transportation Research Record 2042, pp. 3-11.

[3] Airport Cooperative Research Program (ACRP) Synthesis 5 (2008). Airport Ground Access Mode Choice Models. A Synthesis of Airport Practices. Washington, DC: The National Academies Press.

Summary of the rail and AirTrain mode convenience factors versus the best mode other than Taxi/For Hire Vehicles and rail is presented in **Table D-4**. Overall, across most of the models and corresponding regions, rail modes are characterized by a substantial mode convenience advantage over other modes although the magnitude is relatively less prominent compared to the taxi/For Hire Vehicles convenience factor. One interesting exception that deserves attention is that for the PANYNJ joint model of airport choice and ground access mode, rail by itself did not exhibit a strong convenience factor unless it was combined with AirTrain (for EWR and JFK). It reflects that for all New York regional airports, rail share without AirTrain is relatively low (as can be seen prominently for LGA today).

Table D-4 Rail and AirTrain Mode Convenience Factor Versus the Best Mode Other than Taxi/For Hire Vehicles and Rail (minutes of perceived travel time savings)

Airport Ground Access Model	Resident, business	Resident, non-business	Visitor, business	Visitor, non-business
LGA, 2017, Rail	-31.8	-5.3	-22.8	-12.0
LGA, 2017, AirTrain	-51.0	-24.6	-27.2	-16.4
JFK, 2016, Rail[1]	-41.5	-23.4	-41.5	-23.4
JFK, 2016, AirTrain[1]	-45.1	-26.9	-45.1	-26.9
PANYNJ airport choice, 2008, rail[2]	22.1	14.9	2.3	-27.4
PANYNJ airport choice, 2008, rail+AirTrain[2]	-21.2	-15.4	-41.0	-64.2
Chicago O'Hare, 2004, CTA express[3]	-5.1	-13.2	-0.6	22.6
Heathrow Express, 2005 / Central London[3]	-6.7	-17.9	-9.1	-15.5
Heathrow Express, 2005 / Outer London[3]	-3.2	-5.1	-4.1	-7.8

Notes:

For Rail+AirTrain a weighted convenience factor is used for LGA and JFK.

[1] AirTrain JFK Ridership and Fare Elasticity Study. (2016) Final Report. Prepared by WSP|Parsons Brinckerhoff,

[2] Gupta, S., P. Vovsha, and R. Donnelly (2008) Air Passenger Preferences for Choice of Airport and Ground Access Mode in the New York City Metropolitan Region. Transportation Research Record 2042, pp. 3-11.

[3] Airport Cooperative Research Program (ACRP) Synthesis 5 (2008). Airport Ground Access Mode Choice Models. A Synthesis of Airport Practices. Washington, DC: The National Academies Press.

Finally, a summary of the taxi/For Hire Vehicles mode convenience factors versus rail and AirTrain is presented in **Table D-5**. It can be seen that taxi/For Hire Vehicles all else being equal is perceived as a more convenient mode than rail or even rail+AirTrain combination although the taxi/For Hire Vehicles advantage in this regard is significantly less prominent against rail compared to the previously presented advantage over other modes in **Table D-3**. This means that the success of LGA AirTrain and its combination with LIRR, Subway 7 Line, and other modes is conditional upon other objective advantages such as average travel time, cost, and travel time reliability. With the growing congestion in the New York region, these factors have a strong negative impact on taxi/For Hire Vehicles as an expensive but unreliable mode. It can be said that while taxi/For Hire Vehicles still represent the most convenient and widely used access mode, rail and especially with an AirTrain connection represent the most viable alternative compared to any other ground access mode.

Table D-5 Taxi/For Hire Vehicles Mode Convenience Factor Versus Rail and AirTrain (minutes of perceived travel time savings)

Airport Ground Access Model	Resident, business	Resident, non-business	Visitor, business	Visitor, non-business
LGA, 2017, Rail	-28.6	-58.7	-35.2	-48.6
LGA, 2017, AirTrain	-9.4	-39.4	-30.8	-44.2
JFK, 2016, Rail[1]	-35.7	-34.4	-35.7	-34.4
JFK, 2016, AirTrain[1]	-32.1	-30.9	-32.1	-30.9
PANYNJ airport choice, 2008, rail[2]	-127.7	114.5	-123.8	-82.1
PANYNJ airport choice, 2008, rail+AirTrain[2]	-84.4	-84.2	-80.5	-45.3
Chicago O'Hare, 2004, CTA express[3]	-40.4	-52.4	-82.5	-89.5

Notes:

Note 1: For Rail+AirTrain a weighted convenient factor is used for LGA and JFK

Note 2: Detailed LGA AirTrain differentials versus taxi were equal to JFK; they were adjusted in the calibration process and also reflect differences in average trip length

[1] AirTrain JFK Ridership and Fare Elasticity Study. (2016) Final Report. Prepared by WSP|Parsons Brinckerhoff,

[2] Gupta, S., P. Vovsha, and R. Donnelly (2008) Air Passenger Preferences for Choice of Airport and Ground Access Mode in the New York City Metropolitan Region. Transportation Research Record 2042, pp. 3-11.

[3] Airport Cooperative Research Program (ACRP) Synthesis 5 (2008). Airport Ground Access Mode Choice Models. A Synthesis of Airport Practices. Washington, DC: The National Academies Press.

Appendix E. Comparative Analysis of Rail Mode Share for Different Airports

E.1 RAIL SHARE IN AIRPORT GROUND ACCESS MODE CHOICE

The purpose of this section is to provide evidence on the actual share of rail access modes comparable to AirTrain LGA for different airports that are similar to LGA in terms of size, location, and surrounding urbanized area. The observed share of rail access modes to comparable airports provides a valuable comparison and objective independent validation for the AirTrain LGA ridership forecast. The “peers” for LGA were selected primarily for having a connector to the local transit system (no one-seat ride). Anecdotal evidence shows even a short transfer can be onerous. One example from the International Air-Rail Organization (IARO) is Dusseldorf, where for two cities with the same fare and train frequency, and a difference of two minutes in travel time “…rail had a 54% share to Solingen but only 5 percent from Mulheim/Ruhr because a 2-minute cross platform interchange was needed” (see IARO Report 14.10 page 13).

North American airports are most similar in service and composition of access modes to LGA. Many European airports have multiple rail lines not just to downtown but regionally. The comparable airport transit link analyses are based on publicly available information as references in this section. Several important notes on this analysis have to be made. Perfect “apples-to-apples” comparisons between different airports are difficult. First of all, data reported by airports or local organizations is not consistent in methodology, timing, definitions, etc. Number of air passengers can mean one or both directions (inbound and/or outbound), it is often not clear if data include employees, meeter-greeters, or non-airport users of the transit. Mode share may consider all passengers or focus on a catchment area only. Transit usage is often collected from passenger surveys, sometimes of a limited sample size.

IARO is a key source for this synthesis. It includes about 27 members, mostly airports but also universities and consultancies. It provides the best compendium of data available, but of limited accuracy and consistency across multiple sources. Airport Cooperative Research Program (ACRP) Report 4 “Ground Access to Major Airports by Public Transportation” is the best-researched source, but it is a 2008 publication. The data does not consider such details as trip start/endpoints for travelers. The report recognizes a wide range of factors affecting mode choice for airport ground access that are summarized in **Table E-1**. It includes two other major airports in the New York region (JFK and EWR), Ronald Reagan Washington National Airport (DCA), two major airports in the Chicago region (ORD and MDW), Boston Logan International Airport (BOS), and San Francisco International Airport (SFO).

The main statistics for comparable U.S. airports are summarized in **Table E-2**.

Table E-1 Major Factor Affecting Airport Ground Mode Choice

Factor	Importance Rating
City Population	Low
Urban Density	High
Public Transport Usage	High
Car Ownership Level	Moderate
Airport Isolation (distance to destinations)	High
Travel Time (compared to other modes)	High
CBD Origins/Destinations	High
Trip Purpose	Low
Resident versus Visitor Profile	Moderate
Modal Competition	High
Fares	Low
Source: Compiled from: Bradley, M, Australasian Transport Research Forum, 28th, 2005, SYDNEY, New South Wales, Australia	

Table E-2 Comparison Between U.S. Airports with Respect to Rail Share in Ground Access Mode Choice

Airport	Name	Year Service Initiated	Airport Origin-Destination Passengers (millions)	2016 Rail Total Utilization (millions) [1]	Source of Utilization Data	% Air Passengers Utilizing Rail to Access Airport	Source of Mode Share Data	Air Passengers Riding Airtrain (Calculated millions)
JFK (JFK)	AirTrain JFK	2003	45.4	7.4	PANYNJ	12%	Port Authority	5.5
Newark Liberty (EWR)	AirTrain Newark	1996	27.1	2.6	PANYNJ	8%	PANYNJ 2016 Survey	2.2
Washington (DCA)	Metro	1977	22.9	3.6	WMATA	12%	MWCOG	2.7
Chicago O'Hare (ORD)	CTA Blue Line	1984	41.9	4.0	CTA	5%	IARO 17.13	2.1
Chicago Midway (MDW)	CTA Orange Line	1993	14.3	2.8	CTA	6%	IARO 17.13	0.9
Boston (BOS)	MBTA Blue Line rail, MBTA Silver Line BRT	1952/ 2004	33.6	4.7 Blue Line 1.4 Silver Line	MBTA Ridership and Service Statistics, 2014	6.4%[2]	2016 BOS Passenger Ground Access Survey	2.2
San Francisco (SFO)	BART	2003	41.1	4.0	BART	8.6%	SFO Ground Access Survey	3.5

Source: WSP

Notes:

[1] Includes all rail passengers whether or not they are air travelers (i.e., includes employees, meeter/greeters, etc.)

[2] Boston mode share is 3.1% for Blue Line Rail, 3.3% Silver Line BRT

Further comparison to several major international airports is presented in **Table E-3**. The two major New York regional airports with an existing rail access with AirTrain JFK and AirTrain Newark are repeated in this table to specifically contrast the U.S. and international experience. It can be seen that the European, Canadian, and Australian airports chosen for this comparison are characterized by a substantially higher share of rail in the ground access for air passengers that equal or exceed the projected share for AirTrain LGA. While there are many objective factors that contribute to the observed differences between the U.S. airports and airports in other countries including urban structure and density, cultural preferences, income levels, car ownership, presence of special modes (such as airport shuttles or vans), etc. New York represents the most cosmopolitan and dense urban conglomeration in the U.S. and is arguably more similar to the major European cities than to the other major cities in the U.S. Specifically examples of London Heathrow, Vancouver, and Sydney airports represents observed cases of rail ridership share closer to, or higher than, the one projected for AirTrain LGA.

Table E-3 Comparison Between International Airports with Respect to Rail Share in Ground Access Mode Choice

Airport	Name	Year Service Initiated	Airport Origin-Destination Passengers (millions)	2016 Rail Total Utilization (millions) [1]	Source of Utilization Data	% Air Passengers Utilizing Rail to Access Airport	Source of Mode Share Data	Air Passengers Riding Airtrain (Calculated millions)
JFK (JFK)	AirTrain JFK	2003	45.4	7.4	PANYNJ	12%	Port Authority	5.5
Newark Liberty (EWR)	AirTrain Newark	1996	27.1	2.4	PANYNJ	8%	PANYNJ 2016 Survey	2.2
London Heathrow (LHR)	Heathrow Express	1998	53	6.2	Heathrow Express	11.7%	Calculated from riders	6.2
London Heathrow (LHR)	London Underground	1977	53	14.5	Transport for London	18%	Heathrow Airport	9.5
London City (LCY)	Docklands Light Rail	2005	4.4	4.5	Transport for London	51%	IARO 14.10	2.2
Oslo (OSL)	Airport Express	1998	21.8[2]	7	WSP Calculation	33.2%	Flytoget	7.2
Vancouver (YVR)	Canada Line	2009	16.7	4.4	TransLink	17%	IARO 17.13	2.8
Sydney (SYD)	Airport Link	2000	33.5	5.9[3]	NSW Government Report	15%	NSW Government	5.0

Source: WSP

Notes:

[1] Includes all rail passengers whether or not they are air travelers (i.e., includes employees, meeter/greeters, etc.)

[2] Oslo O&D percentage is based on all Norway connecting traffic

[3] SYD total rail ridership from is from 2013 data; 2006 report estimated 10% of 12,000 employees ride daily = 876,000 annual riders.

E.2 RAIL SYSTEM CHARACTERSITICS

The key characteristics of the rail systems for U.S. airports used for comparisons with AirTrain LGA in the previous section are summarized in **Table E-4**. Neither of the existing rail systems provide a perfect direct analogy to LGA AirTrain. JFK AirTrain is the closest in terms of most of the characteristics but JFK is still much more distant from the regional city core (Manhattan) compared to LGA. In this regard, it should be noted that proximity to the regional core (CBD – Central Business District) has a positive impact on the rail share in mode choice in major cities such as Washington, DC.

The key characteristics of the rail systems for international airports used for comparisons with AirTrain LGA in the previous section are summarized in **Table E-5**. The two major New York regional airports with an existing rail access with AirTrain JFK and AirTrain Newark are repeated in this table to specifically contrast the U.S. and international experience. From this perspective, the Sydney AirportLink although a one-seat ride, provides an example of a relatively expensive short connector to CBD with the observed share of 15 percent in the air passenger access model choice that is close to the projected share of LGA AirTrain in the ground access mode choice for LGA.

As an overall conclusion, it can be said that the projected AirTrain LGA ridership and mode share are quite in line with the national and international experience and with the order of magnitude of travel demand associated with rail systems of this type in comparable urban conditions.

Table E-4 Rail System Characteristics for U.S. Airports

Airport	Name	Airtrain Fare[1]	Headway (minimum, maximum)	Operating Hours	Length of Rail Connector (miles)	Approximate Distance to CBD (miles)
JFK (JFK)	AirTrain JFK	$5.00[1]	7, 20	24 hours	3.0	13 mi
Newark Liberty (EWR)	AirTrain Newark	$5.50[1]	3, 15	24 hours	3.4	16 mi
Washington (DCA)	Metro	$2.30 - $2.65	4, 6	Monday – Thursday: 5:00 am – 11:30 pm Friday: 5:00 am – 1:00 am Saturday: 7:00 am – 1:00 am Sunday: 8:00 am - 11:00 pm	One-seat ride	4.5 mi
Chicago O'Hare (ORD)	CTA Blue Line	$2.25 to airport $5.00 from airport	3,12	24 hours	One-seat ride	19 mi
Chicago Midway (MDW)	CTA Orange Line	$2.25	3,12	3:30 am – 1:00 am	One-seat ride	9.5 mi
Boston (BOS)	MBTA Blue Line rail, MBTA Silver Line BRT	$2.75/ Free for Silver Line	5,15	5:30 am – 12:30 am	One-seat ride	4 mi
San Francisco (SFO)	BART	$8.95	15	Weekday: 4:00 am – 12:00 am Saturday: 6:00 am – 12:00 am Sunday: 8:00 am – 12:00 am	One-seat ride	15 mi

Source: WSP

Notes:

[1] For first ride from airport (i.e., AirTrain for EWR and JFK), downtown for others

Table E-5 Rail System Characteristics for International Airports

Airport	Name	Airtrain Fare[1]	Headway (minimum, maximum)	Operating Hours	Length of Rail Connector (miles)	Approximate Distance to CBD (miles)
JFK (JFK)	AirTrain JFK	$5.00[1]	7, 20	24 hours	3.0	13 mi
Newark Liberty (EWR)	AirTrain Newark	$5.50[1]	3, 15	24 hours	3.4	16 mi
London Heathrow (LHR)	Heathrow Express	$24.60-$42.60	15	Monday – Saturday: 5:00 am-12:00 am Sunday: 6:00 am to 12:00 am	One-seat ride	19.3 mi
London Heathrow (LHR)	London Underground	$4.14-$8.01	Up to 10	5:45 am-12:30 am (to LHR) 5:00 am- 11:45 pm (from LHR) 24 hours Friday night - Sunday morning	One-seat ride	19.3 mi
London City (LCY)	Docklands Light Rail	$1.98 – $6.47	8, 15	Monday – Saturday: 5:30 am – 12:30 am Sunday: 7:00 am –11:30 pm	One-seat ride (change required to downtown London)	6.8 (4.0 to Canary Wharf Financial District)
Oslo (OSL)	Airport Express	$21.60	10, 20	4:30 am – 12:00 am	One-seat ride	29.2 mi
Vancouver (YVR)	Canada Line	$2.17 – 3.18 to airport $6.06 - $7.07 from airport	3, 20	4:48 am – 1:15 am	One-seat ride	9 mi
Sydney (SYD)	Airport Link	$12.75 - $13.73	7, 15	4:20 am - 1:00 am	One-seat ride	4.5 mi

Source: WSP

Notes:

[1] Fare for first ride from airport (i.e., AirTrain for EWR and JFK, downtown for others)

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Appendix F. Details of Switching Logit Model Formulation

F.1 MAIN FEATURES OF THE SWITCHING MODEL

A general formulation of the *switching model* can be written in the following form:

$$P(i) = \sum_{j \in I} \tilde{P}(j) \times P(i|j) \qquad \text{Equation F-1}$$

Where:

$i \in I$	=	set of available alternatives
$\tilde{P}(i)$	=	choice probability in the base scenario
$P(i)$	=	choice probability in the build scenario
$P(i\|j)$	=	reflects probability to switch from alternative i to alternative j.

The main difference between the known incremental logit and switching formulations is that the switching model explicitly reveals a matrix of alternative-to-alternative switches because of utility changes; and the incremental logit formulation gives only the final choice probabilities and the underlying detailed switches are hidden.

Explicit estimation of the switching model requires a duration-panel survey where both the current (after the improvement) and previous (before the improvement) choices are observed for respondents. If durational data on switches is not available, then switching probabilities cannot be strictly estimated. It should also be noted that knowledge on the final model outcome in terms of the choice probabilities before $\tilde{P}(i)$ and after $P(i)$ is generally not enough to restore the underlying structure of switches unambiguously. However, using additional assumptions regarding the switching rules, opens a way to restore a switching matrix from the known margins.

The way to make minimal assumptions on the switching probabilities is to assume that all switching probabilities are equal across the previously chosen (observed) alternatives and thus depends only on the utilities of new alternatives, i.e. $P(i|j) = P(i)$. Under this assumption $P(i)$ can be verified in the following way:

$$P(i) = \sum_{j \in I} \tilde{P}(j) \times P(i) = P(i) \times \sum_{j \in I} \tilde{P}(j) = P(i) \qquad \text{Equation F-2}$$

However, this structure has an obvious drawback in creating unrealistic two-directional switches between each pair of alternatives. Since we are interested in the final balance of switches for each pair, we may calculate it as a difference between switches "to" and switches "from" for each pair of alternatives. This switch between alternatives can be calculated in the following way:

$$\Delta P(ij) = P(i)\times \tilde{P}(j) - P(j)\times \tilde{P}(i)$$ **Equation F-3**

This expression reflects a share of new users of alternative i who previously used alternative j (potential switch from j to i) from which is subtracted a share of new users of alternative j who previously used alternative i (potential switch from i to j). Several logical analytical properties of (Equation F-3) can be mentioned:

1. Symmetry of switches for each pair of alternatives:
$$\Delta P(ij) = -\Delta P(ji)$$ **Equation F-4**

2. No switch for alternatives preserving the same proportion of probabilities before and after the change (i.e. growing or reduced by the same percent):
$$\Delta P(ij) = 0, \text{ if } \frac{P(i)}{\tilde{P}(i)} = \frac{P(j)}{\tilde{P}(j)}.$$ **Equation F-5**

3. No switch from alternative to the same alternative (staying on the same alternative is not considered as a switch):
$$\Delta P(ii) = 0$$ **Equation F-6**

4. Sum of the switches to an alternative from all other alternatives is equal to the increment of the alternative probability:
$$\sum_j \Delta P(ij) = P(i) - \tilde{P}(i)$$ **Equation F-7**

5. Sum of the switches from an alternative to all other alternatives is equal to the negative of increment of the alternative probability:
$$\sum_i \Delta P(ij) = \tilde{P}(j) - P(j)$$ **Equation F-8**

F.2 SWITCHING MODEL DERIVED FROM THE INCREMENTAL MULTINOMIAL LOGIT MODEL (MNL)

Now, consider an incremental MNL as an example (the same technique can be applied to the nested logit model but the formulas become more complex). According to the multinomial logit model (MNL) choice probability in the base and build scenarios is calculated in the following way:

$$\tilde{P}(i) = \frac{\exp(\tilde{V}_i)}{\sum_{j \in I} \exp(\tilde{V}_j)}$$

Equation F-9

$$P(i) = \frac{\exp(V_i)}{\sum_{j \in I} \exp(V_j)}$$

Equation F-10

Where:

$\tilde{V}_i$	=	utility for the base scenario,
V_i	=	utility for the build scenario,

Using the incremental MNL expression, the increment for choice probability (difference between the choice probability for the proposed scenario and base scenario) can be written in the following way:

$$\Delta P(i) = P(i) - \tilde{P}(i) = \frac{\tilde{P}(i) \times \exp(\Delta V_i)}{\sum_{j \in I} \tilde{P}(j) \times \exp(\Delta V_j)} - \tilde{P}(i) = \tilde{P}(i) \times \left[\frac{\exp(\Delta V_i)}{\sum_{j \in I} \tilde{P}(j) \times \exp(\Delta V_j)} - 1 \right] =$$

$$= \tilde{P}(i) \times \frac{\exp(\Delta V_i) - \sum_{j \in I} \tilde{P}(j) \times \exp(\Delta V_j)}{\sum_{k \in I} \tilde{P}(k) \times \exp(\Delta V_k)} = \tilde{P}(i) \times \frac{\sum_{j \in I} \tilde{P}(j) \times [\exp(\Delta V_i) - \exp(\Delta V_j)]}{\sum_{k \in I} \tilde{P}(k) \times \exp(\Delta V_k)} =$$

$$= \sum_{j \in J} \tilde{P}(i) \times \tilde{P}(j) \times \frac{\exp(\Delta V_i) - \exp(\Delta V_j)}{\sum_{k \in I} \tilde{P}(k) \times \exp(\Delta V_k)}$$

Equation F-11

Where:

$\Delta V_i = V_i - \tilde{V}_i$	=	utility increment,

From (Equation F-11) it can be seen that the increment of choice probability can be broken into parts that represent switches to and from the alternative:

$$\Delta P(i) = \sum_{j \in J} \Delta P(ij)$$

Equation F-12

Where a *pair-wise switch* is defined by the following expression:

$$\Delta P(ij) \quad = \quad \tilde{P}(i) \times \tilde{P}(j) \times \frac{\exp(\Delta V_i) - \exp(\Delta V_j)}{\sum_{k \in I} \tilde{P}(k) \times \exp(\Delta V_k)}$$

Equation F-13

This provide a very simple, analytically convenient, and tractable expression for the predicted switch from mode j to i. It is essentially proportional to the difference between the utility improvements of these modes.

F.3 APPLICATION RULES FOR SWITCHING MODEL

As was mentioned above, a standard incremental model cannot be generalized for an individual-record case where the observed shares formally look like all zeros (for non-chosen alternatives) and one (for the chosen alternative). It inherently requires that both observed shares and modeled probabilities to be positive fractional numbers. However, the switching model allows for such a generalization. The base mechanism is shown in **Figure F-1** (numbers are picked up for the illustration purpose only).

Figure F-1 Application of Switching Model

Individual Record with Observed Choice (Auto without Toll)

Individual Matrix of Switching Probabilities

		Modes After				Total Before
		Auto	Auto/Toll	Transit	P&R	
Modes Before	Auto	0.4	0.2	0.0	0.1	0.7
	Auto/Toll	0.0	0.0	0.0	0.0	0.0
	Transit	0.1	0.0	0.1	0.1	0.3
	P&R	0.0	0.0	0.0	0.0	0.0
Total After		0.5	0.2	0.1	0.2	1.0

Weight-Split Proportions

Auto	0.4/0.7	0.2/0.7	0.0/0.7	0.1/0.7

At first stage a calculation of fractional probabilities before and after is implemented for each individual record and a matrix of switching probabilities is constructed based on the technique described in Section F.2. Then, at the second stage, a relevant row (corresponding to the observed mode) is singled out and the corresponding probabilities are re-scaled to represent a relative switch from the chosen mode to the other alternatives available.

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Appendix G. Travel Times Used For Ridership Model Inputs

G.1 MODELED TRANSIT TRAVEL TIMES TO AND FROM LGA FROM SELECTED LOCATIONS IN 2025 AND 2045

Table G-1 Modeled Transit Travel Times to LGA from Selected Locations in 2025 in the PM Peak

	A	B	C	D	E	F	G		
Reference location	Walk from Origin & Wait Time for Subway or LIRR	LIRR Ride Time	Subway Ride Time	Walk & Wait Time for Intermediate Transfers	Walk to AirTrain at Willets Point	Wait Time at Willets Point	AirTrain to LGA	Total Modeled Transit Travel Time	In Transit Travel Time (Columns B through G)
Grand Central	8	18	0	0	1	2	6	35	27
Penn Station	8	18	0	0	1	2	6	35	27
Financial District	4	18	12	8	1	2	6	51	47
Union Square	3	18	5	8	1	2	6	43	40
Downtown Brooklyn	4	18	16	11	1	2	6	58	54
Long Island City	10	0	22	0	3	2	6	43	33

Note: For modeling purposes, 18 minutes was used for the LIRR in-vehicle travel time between both New York Penn Station and Grand Central Terminal and Mets-Willets Point. 18 minutes was chosen to be conservative even though most trains for LIRR special event service are currently scheduled at 16 minutes from Penn Station to Mets-Willets Point.

Table G-2 Modeled Transit Travel Times to LGA from Selected Locations in 2045 in the PM Peak

	A	B	C	D	E	F	G		
Reference location	Walk from Origin & Wait Time for Subway or LIRR	LIRR Ride Time	Subway Ride Time	Walk & Wait Time for Intermediate Transfers	Walk to AirTrain at Willets Point	Wait Time at Willets Point	AirTrain to LGA	Total Modeled Transit Travel Time	In Transit Travel Time (Columns B through G)
Grand Central	8	18	0	0	1	2	6	35	27
Penn Station	8	18	0	0	1	2	6	35	27
Financial District	4	18	12	8	1	2	6	51	47
Union Square	2	18	5	11	1	2	6	45	43
Downtown Brooklyn	4	18	16	11	1	2	6	58	54
Long Island City	10	0	23	0	3	2	6	44	34

Note: For modeling purposes, 18 minutes was used for the LIRR in-vehicle travel time between both New York Penn Station and Grand Central Terminal and Mets-Willets Point. 18 minutes was chosen to be conservative even though most trains for LIRR special event service are currently scheduled at 16 minutes from Penn Station to Mets-Willets Point.

Table G-3 Modeled Transit Travel Times from LGA to Selected Locations in 2025 in the AM Peak

	A	B	C	D	E	F	G	H		
Reference location	**Wait Time for AirTrain at LGA**	**AirTrain to Willets Point**	**Walk to LIRR or Subway at Willets Point**	**Wait Time at Willets Point**	**LIRR Ride Time**	**Subway Ride Time**	**Walk &Wait Time for Intermediate Transfers**	**Walk Time to Destination**	**Total Modeled Transit Travel Time**	**In Transit Travel Time (Columns B through G)**
Grand Central	2	6	1	8	18	0	0	0	35	33
Penn Station	2	6	1	8	18	0	0	0	35	33
Financial District	2	6	1	8	18	12	1	5	53	46
Union Square	2	6	1	8	18	5	1	4	45	39
Downtown Brooklyn	2	6	1	8	18	16	4	2	57	53
Long Island City	2	6	3	7	0	22	0	5	45	38

Note: For modeling purposes, 18 minutes was used for the LIRR in-vehicle travel time between both New York Penn Station and Grand Central Terminal and Mets-Willets Point. 18 minutes was chosen to be conservative even though most trains for LIRR special event service are currently scheduled at 16 minutes from Penn Station to Mets-Willets Point.

Table G-4 Modeled Transit Travel Times from LGA to Selected Locations in 2045 in the AM Peak

	A	B	C	D	E	F	G	H		
Reference location	**Wait Time for AirTrain at LGA**	**AirTrain to Willets Point**	**Walk to LIRR or Subway at Willets Point**	**Wait Time at Willets Point**	**LIRR Ride Time**	**Subway Ride Time**	**Walk & Wait Time for Intermediate Transfers**	**Walk Time to Destination**	**Total Modeled Transit Travel Time**	**In Transit Travel Time (Columns B through G)**
Grand Central	2	6	1	8	18	0	0	0	35	33
Penn Station	2	6	1	8	18	0	0	0	35	33
Financial District	2	6	1	1	18	12	8	5	53	46
Union Square	2	6	1	1	18	5	11	2	46	42
Downtown Brooklyn	2	6	1	1	18	16	11	2	57	53
Long Island City	2	6	3	7	0	22	0	5	45	38

Note: For modeling purposes, 18 minutes was used for the LIRR in-vehicle travel time between both New York Penn Station and Grand Central Terminal and Mets-Willets Point. 18 minutes was chosen to be conservative even though most trains for LIRR special event service are currently scheduled at 16 minutes from Penn Station to Mets-Willets Point.