TRANSPORT LONG ISLAND

A Train-to-Plane Connectivity Study

May 2018

ISP Long Island MacArthur Airport

Town of Islip Suffolk Co. N.Y.

Suffolk County New York

MTA Long Island Rail Road

NYMTC New York Metropolitan Transportation Council

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Appendix A.

Mode Book

Upgraded Taxis

New York City Hybrid Taxi, New York, NY (Image source: Karthik T J, Wikimedia)

Overview

Upgraded fleet for-hire vehicles offer rides for individual passengers or small groups. Rides are summoned by hailing a taxi parked at a stand or driving by.

Precedents

Many airports around the country advertise taxi services that connect terminals with rail stations. Examples include Trenton-Mercer, Long Beach, Harrisburg, and New Haven.

At MacArthur Airport

Orientation to pick-up areas would be facilitated by signage at Ronkonkoma Station. Service awareness and convenience of transaction would be improved with updated LIRR ticket vending machines and app.

Upgraded Taxis

Taxis are the current mode of connection between Ronkonkoma Station and MacArthur Airport. Village Taxi drives LI MacArthur-bound passengers from Ronkonkoma Station for a flat fare of $5.00 per person. At the airport, the taxi stand is located outside the baggage claim area.

Upgraded taxi service would offer an improved user experience without structural changes to operational schemes and infrastructure. After updates, LIRR ticket vending machines and app would recommend the purchase of the taxi voucher after user selection of Ronkonkoma as a destination. At Ronkonkoma Station, wayfinding and ease of orientation would be improved with more conspicuous signage guiding to the taxi stand.

An upgraded taxi fleet would have new vehicles to offer passengers a more comfortable ride. Cars would be branded as LI MacArthur connector, and would offer amenities such as A/C and USB charging ports. This managed fleet would ensure vehicles are available at Ronkonkoma Station at train arrival times, to make sure passengers complete their journeys to the airport without delay.

Delivery Time Frame

< 2 years | 2-5 years | 5 years +

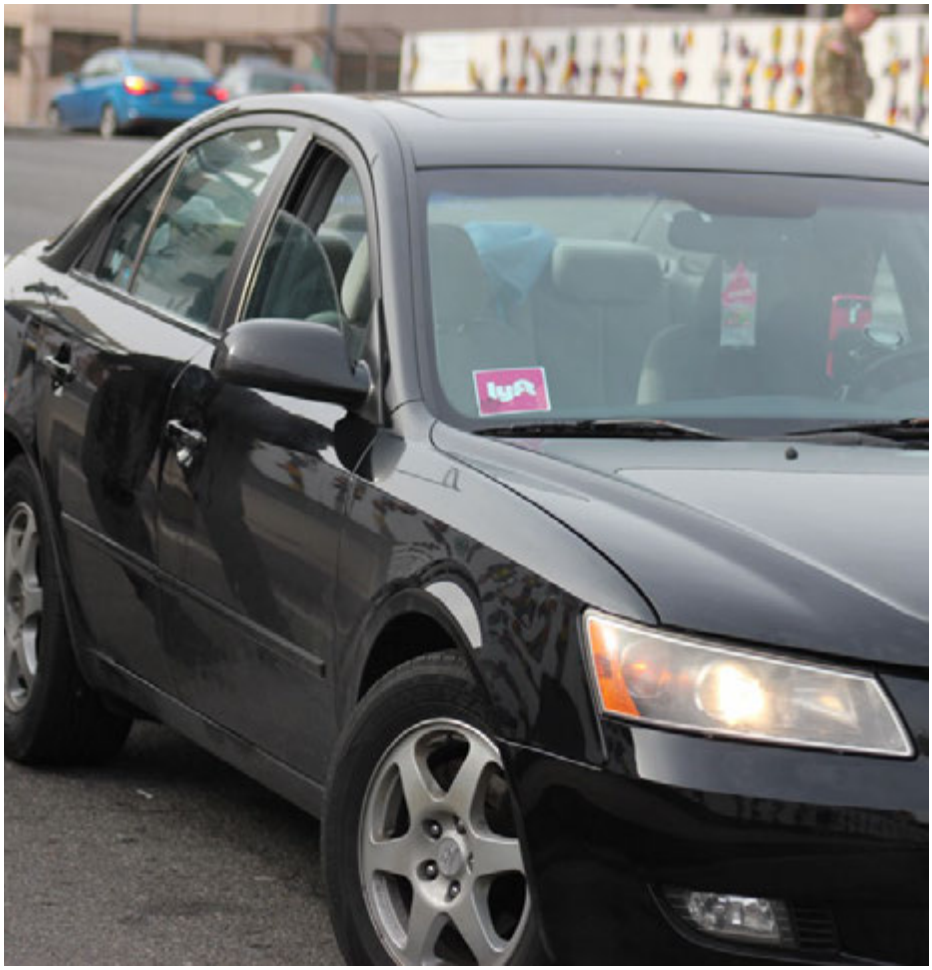
Costs

Capital Expenditures
$200K-$1M

Operating Costs
$5 per passenger

- Users must leave the train station to reach the taxi waiting area
- Service has lower capacity than mass transit alternatives

Transportation Network Companies (TNCs)



Lyft Driver in Washington, DC (Image source: Flickr User Perspective)

Overview

Also known as "ride-hailing" services, companies like Uber and Lyft provide customers the ability to arrange a ride using a GPS-enabled smartphone.

Precedents

Local agencies in Dallas, Los Angeles, Pinellas County, FL and Centennial, CO have developed pilot programs to enhance local transit through partnerships with TNCs.

At MacArthur Airport

Users would request rides between a designated location at terminal and the train station using their phones. Subsidies could be implemented via a discount code.

TNCs

TNCs, like Uber or Lyft, arrange rides between drivers and passengers using mobile devices. Drivers are independent and do not have scheduled shifts, working hours they deem convenient and profitable. TNCs operate as intermediaries between the drivers and passengers in want of a ride, and do not actively manage the service offer. These companies do, however, manage the pricing schemes and could negotiate special fares for an airport connection. Currently, a TNC ride between Ronkonkoma Station and the airport terminal costs approximately $10.00.

Throughout the U.S., various TNC partnership models have emerged for complementing transit service. With subsidies for the "first and last mile", TNCs connect users to transit stations and leverage the potential of regional transportation networks. Such arrangements require commitments for minimum service, as the default approach is market-driven supply that may not be as reliable as an airport connector would have to be.

Multiple vehicles categories are offered by TNCs, and they can be equipped to service people with disabilities, or accommodate baggage.

Delivery Time Frame

< 2 years | 2-5 years | 5 years +

Costs

Capital Expenditures
$0

Operating Costs
$10 per ride, depending on arrangement

- Provides flexible, on-demand service
- Not a high-capacity, scheduled service
- May be difficult to share rides

Upgraded Shuttle

LAX Shuttle, Los Angeles, CA (Image source: Flickr User Lucian400)

Overview

A dedicated, upgraded shuttle bus service traveling along fixed routes on fixed schedules.

Precedents

Commonly used where rail or other higher-speed transit services are located on alignments near the airport, such as Boston, San Jose, Fort Lauderdale, and Baltimore.

At MacArthur Airport

A dedicated bus would link the Ronkonkoma LIRR station with the airport terminal. The service would be timed to connect to trains and feature amenities catering to air travelers.

Upgraded Shuttle

Traveling through public roads and mixed traffic, upgraded shuttle buses connect the airport terminal and the train station with no need for capital works. Because Long Island MacArthur would plan, manage and control the service, passengers would always have a shuttle waiting for them at each end of the trip, which would have departures timed to train and airplane arrivals.

Passengers board and off-board at dedicated shuttle stops, fitted with amenities to facilitate passenger comfort, movement and luggage handling.

Travel takes place over public roads along with mixed traffic, and therefore is subject to traffic congestion. Travel reliability could be mitigated by operating a upgraded shuttle on private airport roads to avoid recurring traffic backups and speed degradation.

There is a wide variety in vehicles, passenger amenities, fare policy, and operators, with some shuttles run by the airport themselves (typically contracted out), and others run by local transit agencies who operate the connecting services.

Delivery Time Frame

< 2 years | 2-5 years | 5 years +

Costs

Capital Expenditures
$500K - $1M

Operating Costs
$500K - $800K

- Shuttles can be optimized for air passengers
- Trips subject to traffic congestion on public roads.

Bus Rapid Transit (BRT)

NYC Select Bus Service Vehicle, New York, NY (Image source: Arup)

Overview

Enhanced buses, traveling along dedicated lanes with signal priority, offer reliable, convenient, and fast transit. Systemic operational control ensures high levels of service.

Precedents

Airports with BRT stations include LaGuardia Airport New York and Logan International in Boston. These routes provide service from various neighborhoods to the terminal.

At MacArthur Airport

New BRT stations at Ronkonkoma station and at the airport terminal. Transit signal priority and dedicated ROW along route to Airport.

BRT

Airports with BRT stations include LaGuardia Airport New York and Logan International in Boston. These routes provide service from various neighborhoods to the terminal.

BRT offers a transit system with high flexibility, reliability and convenience. It employs a suite of tools, including state-of- the-art vehicles; dedicated travel lanes, priority at traffic signals; and high-quality station amenities.

A new BRT link for ISP would be approximately 3 miles in length. Stations could feasibly be constructed at the island in front of the ISP terminal building, as well as at Ronkonkoma station. Dedicated transit-way would be constructed on airport property, with transit priority at intersections with public roads. Bus fleets could be outfitted with luggage racks. A typical service pattern for BRT would include 10-15 minute headways, and could link to the proposed Nicolls Road BRT at Ronkonkoma Station. A bus depot would likely be required.

Delivery Time Frame

< 2 years | **2-5 years** | 5 years +

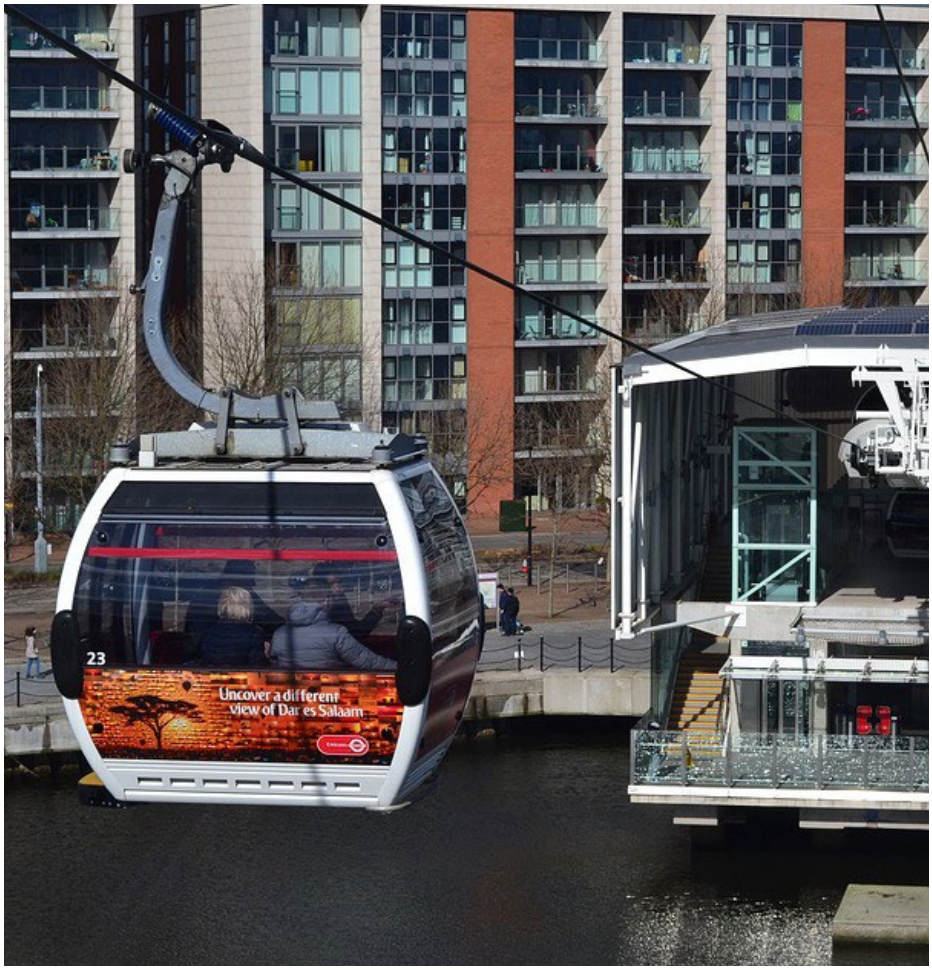
Costs

Capital Expenditures
$40 - $130M

Operating Costs
$500K - $1.5M

- High-frequency, mass transit option
- Fast and reliable travel

Gondola



Emirates Airline Cable Car, London, UK (Image source: Pixabay User NadinLisa)

Overview

Cabins supported and propelled by overhead cables connecting stations.

Used to cross landscapes where ground options are too costly or inconvenient.

Precedents

Portland, Oregon, opened an urban system in 2006.

The EU awarded funds to Genova, Italy, to connect the Erzelli train station and the airport.

At MacArthur Airport

Departing from the south side of Ronkonkoma, the cabins would head southwest and turn south on Smithtown Avenue, reaching the terminal from the west.

Gondola

Gondolas offer a fixed-guideway transit option at lower capital costs than rail modes, and travel with minimum impact to ground level activity. They also have lower operating costs – staff is only present at stations – and, because service is electrified, do not generate local emissions.

Cabling and shifting technologies produce different combinations of cost, capacity, speed and station footprints. Because cabins are not powered, there are inherent climate control challenges. Gondolas also have environmental impacts associated with elevated structures, including shadowing and obstructing view sheds.

While the project is feasible from a technical standpoint, the circuitous alignment to the airport would require four turning stations, increasing capital costs. Some right-of-way may need to be acquired for towers along Smithtown Ave.

To avoid operation with empty cabins, the gondolas can run as needed to match the LIRR schedule.

Delivery Time Frame

< 2 years | 2-5 years | **5 years +**

Costs

Capital Expenditures
$50-$100M

Operating Costs
$750K - $2M

- Fast, reliable travel
- Smooth rides
- Integrated to the track overpass level at Ronkonkoma Station
- Climate control limitations

Light Rail Transit (LRT)

Houston METRORail LRT, Houston, TX (Image source: Arup)

Overview

Rail service that can run in mixed traffic or dedicated right-of-way. Smaller vehicles and lower operating costs than traditional subways or commuter rail services.

Precedents

Light rail is an airport access option at a number of large cities and airports across the US, including Dallas-Fort Worth, Seattle, Minneapolis-Saint Paul, and Saint Louis.

At MacArthur Airport

A light rail connecting a station within the terminal to Ronkonkoma Station and potentially points beyond. The vehicle would have level boarding and luggage racks.

LRT

Light rail has been used at a number of airports in the United States, as it often represents a compromise between speed from the city center to the airport and ridership demands.

The footprint for a light rail right-of-way, its stations, and ancillary facilities often allow a light rail station to be built directly into a terminal. Passengers, both airport and non-airport, tend to view light rail as a fast, predictable, and easy to use form of transit.

LRT can serve as an impetus for development, as it represents a permanent investment in a particular corridor. LRT has long design and construction times, and high investment costs, and does not allow quick changes in its routes and services.

It is preferable that LRT has dedicated right-of-way in order to maintain fast and reliable service. The alignment must be determined through careful study, including land ownership and height restrictions related to runway proximity. This may include routing on public roads, through airfield property, or underground depending on regulatory requirements.

Delivery Time Frame

< 2 years | 2-5 years | **5 years +**

Costs

Capital Expenditures
$250 - $350M

Operating Costs
$1.5 - $5.5M

- Can be optimized for passenger use
- Fast and comfortable

Personal Rapid Transit (PRT)

Heathrow Airport ULTra PRT Pods, London, UK (Image source: thetransportpolitic.com)

Overview

Small autonomous vehicles providing on-demand pointto-oint service along a fixed guideway.

Precedents

Limited. System in operation at London-Heathrow between Terminal 5 and its parking garage. Four similar small-scale systems operating worldwide.

At MacArthur Airport

A PRT would connect the terminal to Ronkonkoma Station and potentially other points. The PRT vehicles would travel on demand and have full passenger amenities.

PRT

PRT offers a very high-quality trip in situations where demand is not great enough to justify a higher capacity form of transit. The capital costs are not as high as would be encountered with any form of rail service, but still requires right-of-way acquisition, environmental clearance, and guideway construction.

The guideways must be separate from any public accessible right-of-way, and would exist either alongside public roads or within the airport property.

PRT's small vehicles and small fleet provide a specific mobility solution, but cannot be considered mass transit. The lack of worldwide PRT examples means that each system is a bespoke design with significant capital expenditure and high costs per passenger. The relative rarity of PRT means that reliance on it as a primary transportation solution should be considered experimental.

By the time a PRT system has been approved, constructed, and commissioned, roadworthy autonomous vehicles may be deployed, rendering the PRT largely obsolete.

Delivery Time Frame

< 2 years | 2-5 years | **5 years +**

Costs

Capital Expenditures
$150M - $450M

Operating Costs
$500K - $3M

- Private vehicle comfort
- Very advanced technology

Automated People Mover (APM)

JFK AirTrain, New York, NY (Image source: Flickr User Kaspar Metz)

Overview

APM is a grade-separated mass transit system with full automated, driverless operations, featuring vehicles that travel on guideways with an exclusive right-of-way.

Precedents

APM systems are widely used by airports around the world. There are 51 systems in operation. The number of APMs has more than doubled in the 21st century.

At MacArthur Airport

An APM would connect the terminal to Ronkonkoma Station.

APM

Due to their high reliability and distinct image, people movers create the perception of arrival at the airport at the moment passengers board the trains. Passengers experience a smooth and comfortable ride in vehicles designed with air travelers in mind, offering ample accommodation for baggage to be checked and other carry-on items. A feature familiar to many of the world major airports, people movers enhance the airport's image and brand.

People movers' trains travel through exclusive guideways completely segregated from other forms of traffic. The guideway can be laid within airport property (either at ground level or below grade with a tunnel or underpass), or over public roads with an elevated structure. Trains are electrically powered, and energy is supplied by a power distribution subsystem. While the trains are automated and driverless, the system requires a staffed control center, and a maintenance and storage facility.

An alignment that circumvents the airport site would be elevated, with land take for a supporting structure. Crossing the airport site, the trains would travel at grade or through an RPZ underpass.

Delivery Time Frame

< 2 years | 2-5 years | **5 years +**

Costs

Capital Expenditures
$250M - $650M

Operating Costs
$1.5M - $3.5M

- Fast, reliable travel
- Smooth rides
- Station integration to the train station and MacArthur terminal.

Moving Walkways

Moving Walkway in Manchester, UK (Image source: G. Hogg, geograph.org.uk/photo/4263645)

Overview

A moving walkway is a slow-moving conveyor mechanism that transports people across a horizontal or inclined plane over a short to medium distance.

Precedents

Walkways are present on a large number of airports. The longest planned walkway is at Boston Logan International Airport, with 2,640 ft. Federal guidance advises distances up to 1,500 ft.

At MacArthur Airport

A covered, climate-controlled, moving walkway to connect the terminal with a nearby transportation facility as part of an overall solution for a connection with the LIRR.

Moving Walkway

Moving walkways are used widely at airports. IATA suggests a maximum unaided passenger walking distance of 985 feet; moving walkways increase the appropriate distance up to 2,133 feet. The longest moving walkway yet proposed is 2,640 feet, and would connect Terminal E at Boston Logan International Airport with the Blue Line's Airport Station.

In the long-term, and contingent on a relocated north side terminal at LI MacArthur Airport, a moving walkway could be an appropriate integrated transportation solution for the airport.

It may be desirable to locate new transportation facilities adjacent to the existing airport terminal or LIRR station, rather than directly at the entrances. In this case, a moving walkway could improve the overall passenger experience by reducing the effort and time required to walk between the LIRR, the new airport link, and the terminal.

While generally inexpensive to operate, walkways can breakdown, requiring repairs, and should be located within an interior structure with climate control. A new entrance to the existing terminal might be required to interface with the walkway alignment.

Delivery Time Frame

< 2 years | 2-5 years | 5 years +

Costs

Capital Expenditures
$15M - $40M per 1,000 ft

Operating Costs
Walkway - negligible

- Solution can be combined with other transportation modes to improve mobility at terminal and stations

Streetcar

Streetcar in Portland, OR (Image source: M.O. Stevens, Wikimedia)

Overview

Streetcars are electric, rail vehicles, operating in mixed-traffic and on tracks embedded in the pavement. Station design is similar to a high quality bus stop.

Precedents

Many cities throughout the US use heritage and modern streetcars, including Portland, OR, Seattle, WA, Washington, DC, and Boston, MA. None reviewed connect to airports.

At MacArthur Airport

Streetcars running between terminals constructed at LIRR station and adjacent to Airport terminal

Streetcar

Streetcars are rail vehicles typically operated in a single-unit configuration over tracks embedded in asphalt or concrete roadway in mixed traffic. Streetcars are propelled by electric motors, powered by overhead wires, and thus do not produce local emissions.

Streetcars have operating speeds similar to buses, but have larger cars that are able to carry more passengers (90-200+) and which provide a smoother, quieter ride than buses. Because the quality of streetcars is perceived as higher than bus systems, they have higher economic development impact on its surroundings. Streetcars have shallow track foundations that require limited relocation of utilities, and require little additional communications and signaling infrastructure.

A streetcar system could be added to existing roadways around the airport, or through the east side of the airfield, with termini at Ronkonkoma Station and a station near the terminal. Overhead wires may be a concern. Tail tracks or turnarounds would be required at both ends to change direction.

Delivery Time Frame

< 2 years | **2-5 years** | 5 years +

Costs

Capital Expenditures
$150M - $250M

Operating Costs
$1M - $4M

- Streetcars are perceived as a high-quality solution by users
- Capable of handling high ridership volumes without major capital projects

Appendix B.

Existing Conditions and Connection Modes Identification Memo

Memorandum

ARUP

To	Lou Bekofsky, Deputy Commissioner, SCEDP Ankita Rathi, Planner, SCDEDP	Date	March 19, 2018
Copies		Reference number	
From	Denis Mani, Arup Kelly Peterson, Arup Andrew Kay, Arup	File reference	
Subject	Ronkonkoma Long Island Rail Road Station / Long Island MacArthur Airport (ISP) Train-to-Plane Connectivity Study – Summary of Existing Conditions, Purpose and Needs Assessment and Connection Modes Identification		

1 Existing Conditions

1.1 Context

1.1.1 Air Travel in the New York Region

The commercial air travel market in the New York region is the nation's busiest, moving over 100 million passengers annually. Ninety-five percent of this traffic is served by the region's three large hub airports: John F. Kennedy International (JFK), Newark Liberty International (EWR), and LaGuardia Airport (LGA) (Figure 1). These three airports combined have the highest percentage of flights delayed in the U.S., a consequence of operating close to capacity, with high demand and congested airways.

Long Island MacArthur Airport (ISP), on the other hand, serves just over 1 million annual passengers, and has available capacity. Additional service at LI MacArthur Airport could boost the economy of Long Island, improve regional air capacity, and relieve air traffic congestion in the region.

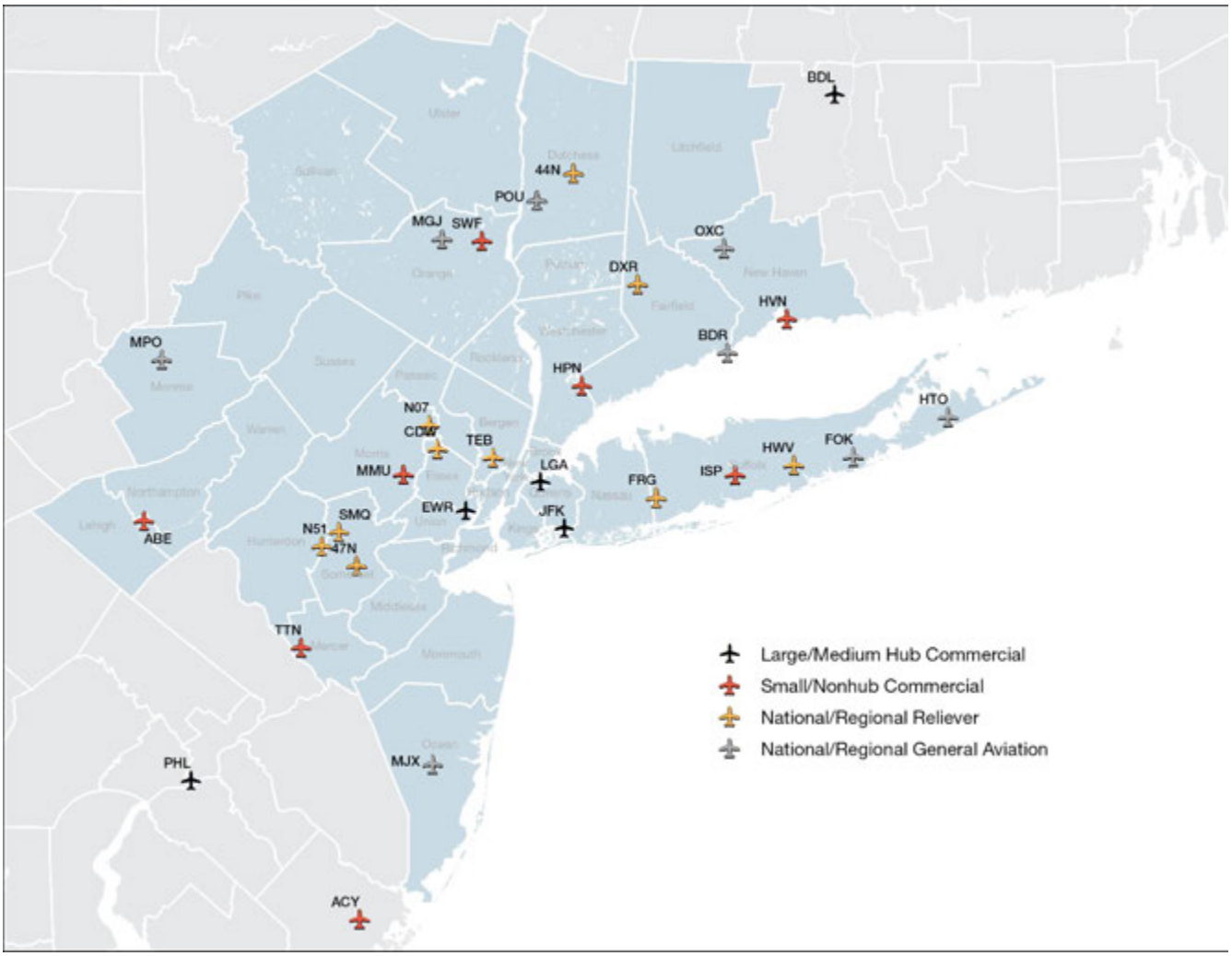


Figure 1: Commercial primary and non-primary airports in the New York region.[1]

1.1.2 Long Island MacArthur Airport

Long Island MacArthur Airport is located in Suffolk County, and is owned and operated by the Town of Islip. Though it is designated by the Federal Aviation Administration (FAA) as an Official Metro Airport, it is not grouped by the International Air Transport Association (IATA) with JFK, Newark-Liberty, LaGuardia, Stewart International, and Skyport SPB[2] in travel and information searches for New York airports. LI MacArthur Airport has 11 gates and four runways. With 1,311acres, the airport's footprint is twice as large as LaGuardia's (
Table 1).

[1] Data Source: (Federal Aviation Administration, 2017a, pp. Appendix A, 64 - 67), image credits: Arup
[2] Skyport SPB is a seaplane base in the East River, Manhattan. It is a General Aviation airport identified by FAA as 6N7.

Table 1: Key airport metrics for LaGuardia and LI MacArthur

	LI MacArthur Airport[3]	**LaGuardia Airport**[4]
Footprint	1,311 acres	680 acres
Number of Runways	4	2
Maximum Runway Length	7,006 feet	7,000 feet

The primary catchment area for the airport is Suffolk County, which has a population of 1.4 million people. The secondary catchment is Nassau County on Long Island, which has a population of 1.5 million. The airport's aspirational catchment area includes the New York City boroughs of Manhattan, Queens, and Brooklyn, with a combined population of 6.5 million (Figure 2). Over 1.2 million people live within a 30-minute drive of LI MacArthur Airport, and over 3.8 million people live within a 60-minute drive[5].

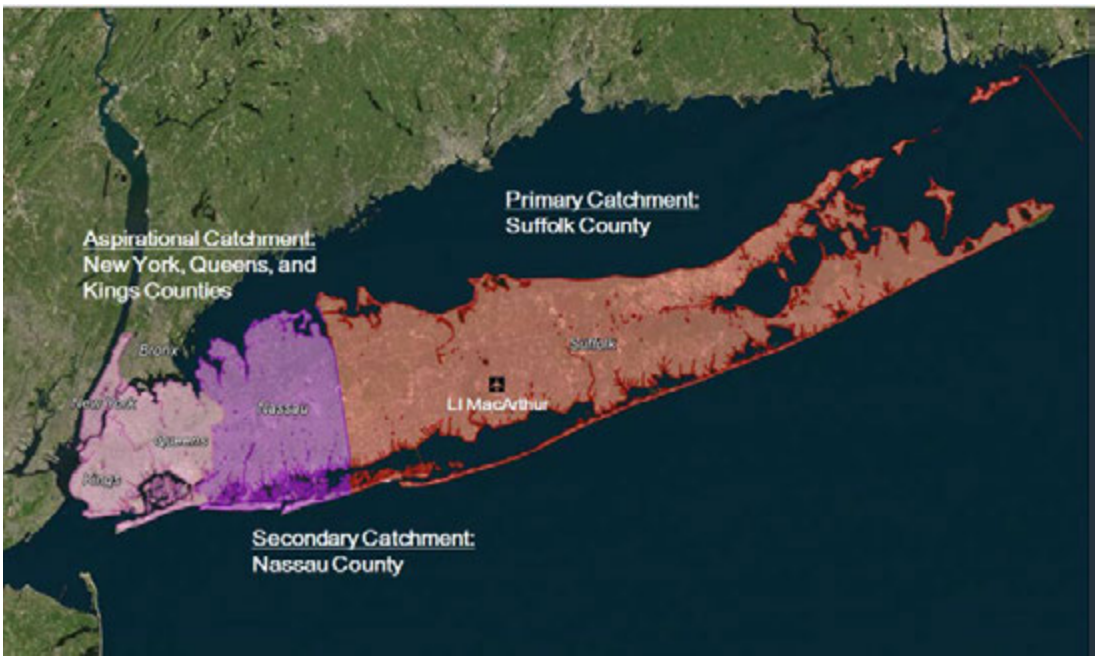


Figure 2: Catchment Areas for LI MacArthur Airport

[3] (Town of Islip, 2017a)
[4] (LaGuardia Airport, 2017)
[5] (U.S. Census Bureau)

1.1.3 Land Use Context

Long Island MacArthur Airport is surrounded by medium- to low-density land uses (Figure 3). The areas immediately to the north and east of the airport are zoned for medium residential density, characterized primarily by single-family homes. North of the LIRR tracks, the transit-oriented development Ronkonkoma Hub is on its first phase of development and should soon break ground.

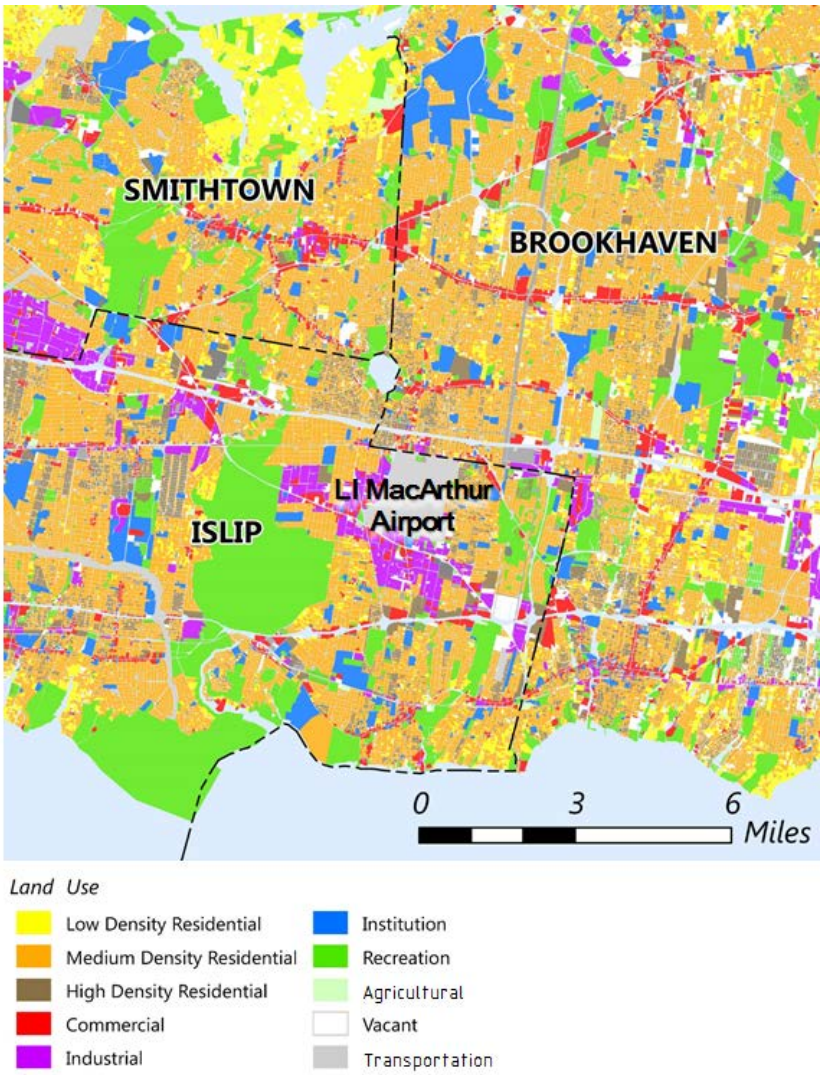


Figure 3: Land Use near MacArthur Airport

To the south and west of the airport there are areas of industrial land use, as well as commercial corridors along key roads, such as New York State Route 112, Middle Country Road, and Portion Road/Horseblock Road. Further away, there are commercial uses at Smith Haven Mall to the north and along Nicolls Road to the east.

1.1.4 Airport Accessibility Context

Long Island MacArthur Airport is situated south of Long Island Expressway (LIE/I-495), close to exits 59, 60 and 61. It is also north of Veterans Memorial Highway (State Route 454). There are 3,449 parking spaces available at the airport, in short- and long-term parking lots.

The airport is also adjacent to the Ronkonkoma Long Island Rail Road (LIRR) station (Figure 4). Ronkonkoma Station is a 78-minute train ride from Penn Station in Manhattan, on average at peak hours.[6] The station sees over 17,000 daily riders[7]. There are 5,897 parking spaces at the train station and over 700 feet of curb space for bus and taxi pickup and drop-off.

Figure 4: Ronkonkoma Station

The airport's passenger terminal is located on the opposite side of the property from Ronkonkoma Station, a 15-minute drive on local streets (Figure 5). Through an agreement between LI MacArthur Airport and Village Taxi, a shuttle service from the station to the terminal is available for a $5 fee per rider. Rides with Transportation Network Companies (TNCs) cost on average $10 per trip. The station is also served by Suffolk County Transit's S57 bus route, connecting it to Sayville to the south and

[6] (MTA Long Island Rail Road, 2017)
[7] (Suffolk County Department of Economic Development and Planning, 2014a, p. 23) and (Town of Brookhaven Department of Planning, Environment and Land Management, 2011, p. 2) (Suffolk County Department of Economic Development and Planning, 2014b)

Smith Haven Mall to the north. Public transit bus service, however, only runs once an hour in each direction and schedules are currently not coordinated with LIRR train arrivals or departures.

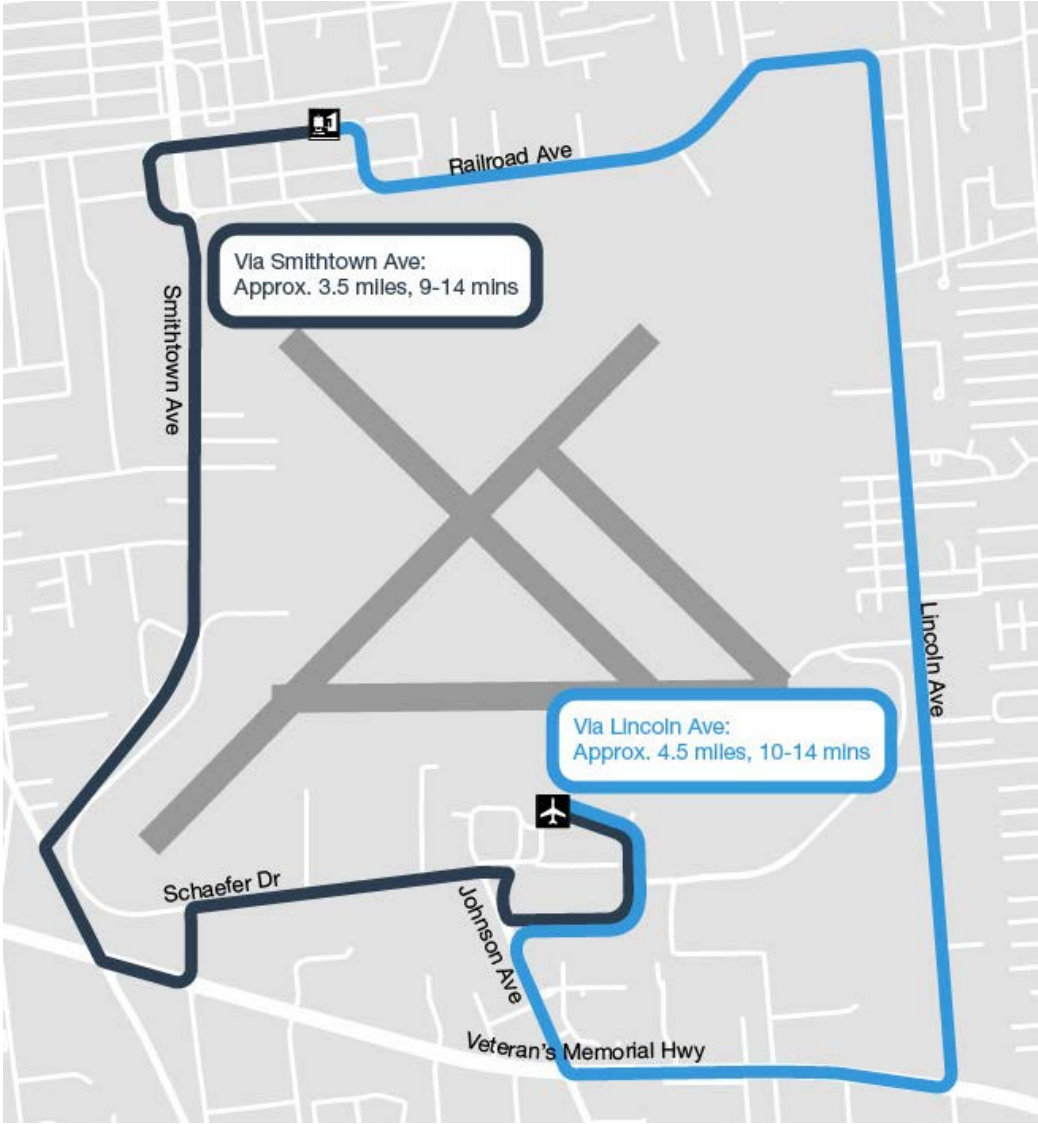


Figure 5: Driving times from Ronkonkoma Station to LI MacArthur Airport

1.2 Air Traffic

1.2.1 Commercial Service

Currently, LI MacArthur Airport is served by three commercial carriers: Southwest Airlines, Frontier Airlines, and American Airlines.

Southwest offers daily nonstop flights to the following destinations:

- Baltimore–Washington International, MD (BWI)
- Fort Lauderdale, FL (FLL)
- Orlando, FL (MCO)
- Tampa, FL (TPA)
- West Palm Beach, FL (PBI)

American Airlines currently offers daily nonstop flights to Philadelphia, PA (PHL) (Figure 6).

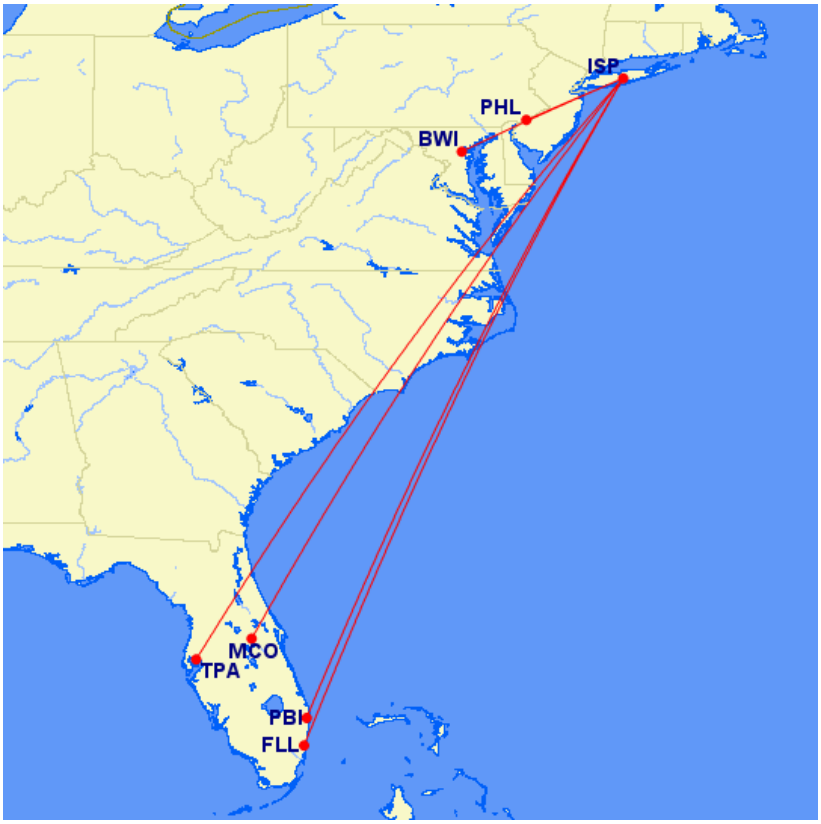


Figure 6: Southwest Airlines and American Airlines destinations

Frontier Airlines operates two daily nonstop flights to Orlando, FL (MCO), and will begin service to the following locations over the next year (Figure 7):

- Miami, FL (MIA)
- Tampa, FL (TPA)
- West Palm Beach, FL (PBI)
- New Orleans, LA (MSY)
- Fort Myers, FL (RSW)
- Atlanta, GA (ATL)
- Chicago O'Hare, IL (ORD)
- Detroit, MI (DTW)
- Minneapolis-St. Paul, MN (MSP)

Figure 7: Frontier Airlines destinations

1.2.2 Airport Customers

Currently, the airport caters mostly to passengers with an origin or destination in Suffolk County. According to a 2005 passenger survey, over 93% of passengers departing from the airport started their journey on Long Island. Of these passengers, 79.9% came from Suffolk County and 13.9% came from Nassau County. The remaining 6% of surveyed passengers began their journey in Manhattan. The survey also found that 81% of these passengers were travelling for non-business reasons, and about 55% were finishing a visit to Long Island.[8]

Customers seek nonstop flights for added convenience and time savings. According to a 2016 survey, 1.2 million passengers used LI MacArthur Airport for nonstop flights during that year. This represents an 87% share of all nonstop traffic in LI MacArthur Airport's trade territory. In other words, 87% of airline passengers seeking nonstop flights in the airport's trade territory chose to fly through MacArthur Airport. In the territory competitive with LaGuardia, 37% of passengers seeking nonstop flights chose MacArthur.[9]

[8] (Federal Aviation Administration, 2007a)
[9] (Lex Volo / Ailevon Pacific Study)

1.2.3 Potential Market

Among other factors, the number of destinations served by nonstop flights limits passenger growth at LI MacArthur Airport, since potential passengers can drive to JFK or LaGuardia for more nonstop alternatives. An expansion of nonstop flights to and from LI MacArthur Airport has the potential to attract more passengers from the region seeking the convenience of nonstop flights.

Long Island MacArthur Airport has an international customs processing center that handles its international arrivals, which amount to 200 per year. This space, however, dos not meet the last update of U.S. Customs and Border Protection (CBP) facility requirements, and therefore is slated for rehabilitation and expansion in 2019, to bring it up to the latest CBP standards. The renovated space will be fit for processing both general aviation and scheduled airline passengers. This will allow LI MacArthur Airport to market potential carriers to provide international flights to Canada, Mexico, and the Caribbean, greatly expanding the airport's potential markets.

1.2.4 Demand Growth and Potential Benefits

With Frontier Airlines as a new carrier, which opened service in 2017 and plans to add four additional nonstop destinations in 2018, LI MacArthur Airport should increase its number of annual passengers. Even with this increase, the airport will remain operating at a good level of service; the airport master plan 2017 update allows the airport to handle an additional 92% of passenger volume, reaching a total of 1,165,700 enplanements in 2037. The success of LI MacArthur Airport in growing service and attracting demand over the years would not only benefit Suffolk County, but also the New York region as a whole.

It has long been identified by the industry that the core New York Region airports operate at congested levels and will struggle to handle the region's increase for air traffic demand. As early as 2007, the FAA indicated that "It is widely accepted that at some point in the future, John F. Kennedy International (JFK), Newark Liberty International (EWR), and LaGuardia Airport (LGA), will ultimately exceed their capacity to accommodate the demand for commercial air service in the NY/NJ metropolitan area"[10]. In 2011, the Regional Plan Association (RPA) issued a report on the state of the region's air traffic, and stated that "Today, the region's three airports rank 1st, 2nd and 3rd for worst delays in the nation, a product of more flights that the region's constrained airports and airspace can handle. While delays at most airports in the nation averaged about 10 minutes, takeoff and landing delays at each of our airports exceeded an average of 20 minutes per flight.[11]" Both reports pointed out that Long Island MacArthur would have a positive impact in the region by absorbing demand that would otherwise strain JFK and LaGuardia, and the RPA study went as far as stating that, under certain conditions of expanded passenger service, LI MacArthur could attract between 645,000 to 1,407,000 annual passengers from the region's major airports[12].

[10] (Federal Aviation Administration, 2007a, pp. I-1)
[11] (Zupan, Barone, & Lee, 2011, p. 11)
[12] (Zupan, Barone, & Lee, 2011, p. 75)

Nowadays, the region's problems not only persist but are aggravated. In its latest report on airport capacity needs, FACT3, issued in 2015, the FAA indicated that by 2020 "Delays at LGA and JFK are expected to increase to severe levels, exceeding the FACT3 criteria significantly"[13], even if near-term improvements are implemented. Currently, the FAA places limitations on JFK's and LGA's schedule, as it finds that they are capacity constrained and improvements to manage capacity are not feasible in the near future[14]. FACT3 also recognizes the challenges in building new runways at JFK and LGA, and encourages initiatives that consider a regional solution for the New York region air travel market. At this year's State of the State address, Governor Cuomo recognized the demand and capacity issues at JFK, and stated that "As early as the mid-2020s, JFK demand will exceed capacity by up to three million passengers annually". At the same speech, the Governor reiterated his commitment to improving Long Island, and proposed investments to connect the LIRR to MacArthur Airport[15].

The positive role that LI MacArthur Airport plays in the New York Region has also been identified by the Long Island's business community, and the LI MacArthur Airport's administration. In 2015, the Long Island Economic Development Council met with councils from New York City and Mid-Hudson, and "…the greater utilization of our transportation infrastructure, such as the Stewart Airport in Mid-Hudson and the MacArthur Airport on Long Island, to alleviate some of the volume from New York City."[16] Long Island MacArthur Airport expressed a similar point of view, first in 2014: "ISP is seeking to continue its efforts to develop air service that is complimentary to air service at LGA and JFK and that provides benefits to the airlines, the passengers, the region's airport operators and the region's economy" [17], and again in 2017: "L.I. MacArthur Airport's proximity to New York City and nearby access to a mass transit connection makes the airport a logical alternative as a reliever for domestic and international demand as John F. Kennedy International and LaGuardia Airport reach capacity."[18]

The increase in service at Long Island MacArthur would also directly benefit Suffolk County and its communities. The Town of Islip Industrial Development Agency Executive Director, in 2014, stated "The growth of air service at ISP is critical to the economic development of the Town if Islip, Suffolk County and the Long Island region" and "Recent economic impact studies for ISP and other similar US airports have shown that increases in passenger traffic at airports such as ISP provide direct increases in jobs, payroll and economic activity in the region". [19] At its Master Plan issued in 2014, Suffolk County pointed out that "The full potential of MacArthur Airport to serve as an important economic engine for the region remains untapped", and identified proximity to airport as one of criteria for prioritizing growth center locations for "advanced manufacturing", and "office areas, including R&D and start-up space". [20]

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[13] (Federal Aviation Administration, 2015, p. 15)
[14] (Federal Aviation Administration, 2017b)
[15] (Cuomo, 2017, pp. 37, 43)
[16] (Long Island Regional Economic Development Council, 2015, p. 48)
[17] (Long Island MacArthur Airport, 2014, p. 11)
[18] (AECOM, 2017, p. 5)
[19] (Mannix, 2014)
[20] (Suffolk County Department of Economic Development and Planning, 2014b, pp. A-159, B-40 - B-48)

Long Island MacArthur Airport has lower cancelation rates and higher on-time performance than either JFK or LaGuardia. Fares at those airports are also considerably higher than at LI MacArthur Airport: 16% higher at LaGuardia and 45% higher at JFK.[21] A passenger at LI MacArthur Airport will likely spend less time getting to the airport, less time at the airport, and less money on their flight than if they had gone to an airport in New York City.

1.3 Long Island MacArthur Airport Site Plans

Long Island MacArthur Airport currently has one terminal that has 10 active gates and 7 remote loading positions. The terminal was built in 1966 and expanded in 1999 and 2006. The airport has four runways and two helipads, and covers a footprint of 1,311 acres within the Town of Islip. In addition to commercial service, the airport has general aviation and U.S. Army Guard facilities.

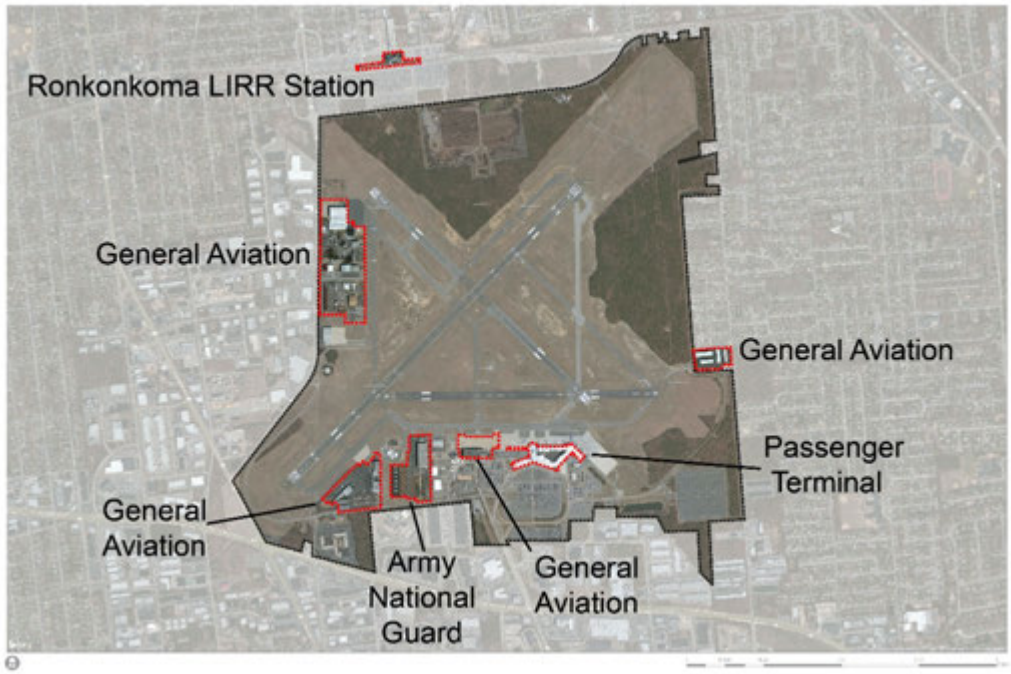


Figure 8: Long Island MacArthur Airport's key facilities and Ronkonkoma LIRR station

Long Island MacArthur Airport plans to build a new ground Transportation Facility on the east side of the property to consolidate and support car rental operations, taxis, and other ground transport services. This facility is scheduled to be constructed in 2018. Currently, car rental services are available outside of the baggage claim area from Alamo, Budget, Avis, Hertz and Enterprise. The taxi pickup/drop-off location and the local bus stop are both located on the curb outside of the baggage claim area.

[21] (Town of Islip, 2017b)

1.3.1 Planned and Proposed Improvements

2017 Master Plan

The length of the current runways limit the planes that can use the airport. At these lengths, international flights to Mexico, Caribbean, and Canada could be operated without restrictions but only the new generation of narrow-body aircraft, such as 737MAX or A321neoLR, could fly to Europe. These types of aircraft, however, would face a reduction in payloads, possibly restricting passenger loads. The only aircraft that can currently fly transatlantic from LI MacArthur without a payload restriction is the Boeing 757-200.

Runway extensions could eliminate any payload restrictions and potentially attract international ultra-low-cost carriers. Since minimum takeoff lengths vary by carrier and aircraft performance, only the airlines can indicate the minimum runway lengths required to operate to specific markets.

The 2017 Long Island MacArthur Airport Master Plan proposes extending the two main runways. Runway 6/24 would be lengthened from 7,006 feet to 7,500 feet, and runway 15R/33L would be lengthened from 5,186 feet to 7,000 feet. Runway 15L/33R would remain at its current length of 3,175 feet, and runway 10/28 would be converted into a taxiway (Figure 9).[22]

[22] (Town of Islip, 2017a)

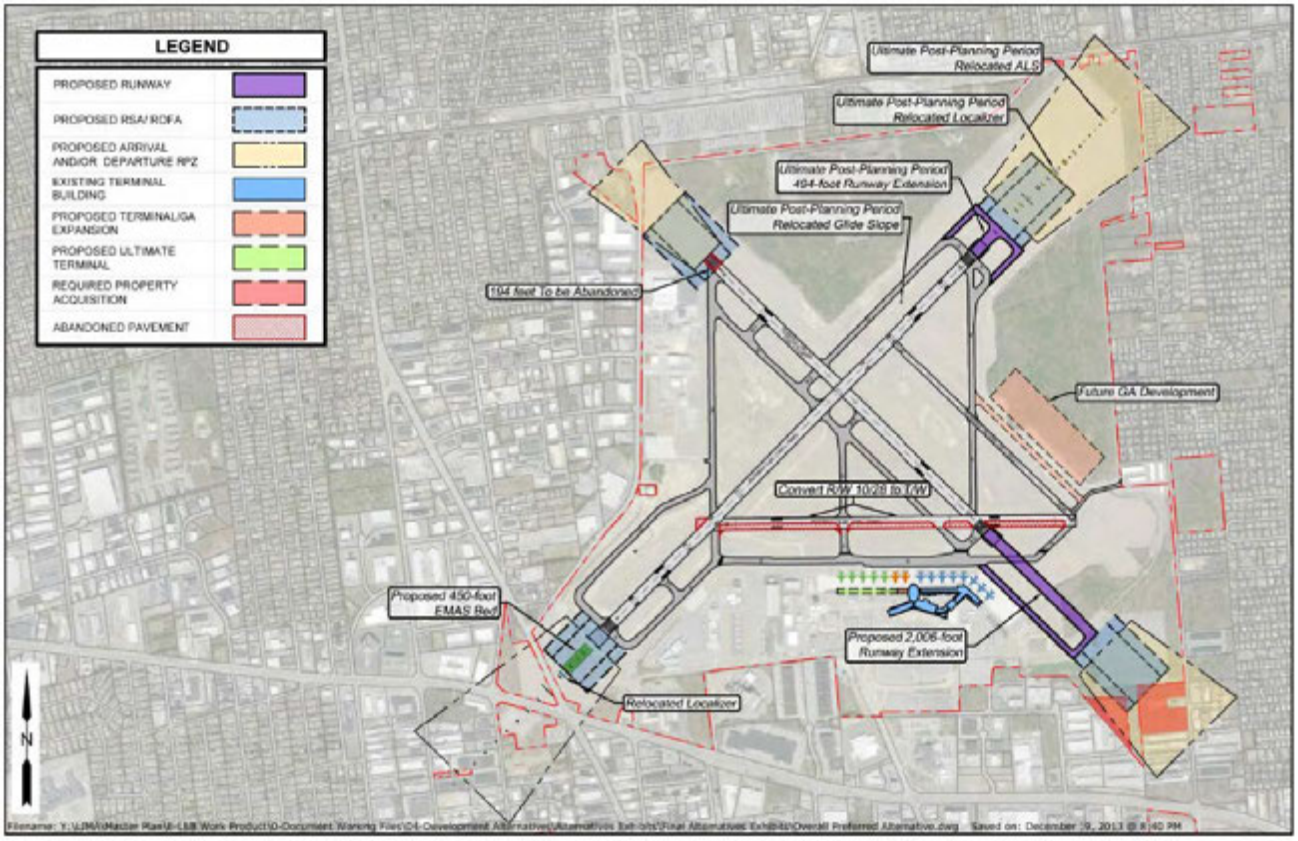


Figure 9: 2017 LI MacArthur Airport Site Master Plan

Capital Improvement Program

Long Island MacArthur Airport has $50.1 million in capital improvements programmed for the fiscal years 2018 through 2023, of which most are airfield improvements[23]. The program funds come from federal, state, and local sources. In relation to plans for runway extension, the LI MacArthur Airport Administration stated:

> "The Federal Aviation Administration can only support and provide federal funding for runway extensions based on need. At this time, Long Island MacArthur Airport has adequate runway length and capacity to accommodate the type of aircraft using the airport in 2017. Prospective carriers over the past years have commented on the runway length available. It is in the best interest of the airport and Town, to prepare for future air carriers that require additional runway length to serve new markets. The airport will seek capital funding to conduct a feasibility study to determine which runway should be extended and how much length is necessary to support future prospective operations."

[23] (Long Island MacArthur Airport, 2017a)

Replacement Customs Facility

A replacement U.S. Customs and Border Protection facility is set to open in 2019 in the central terminal area. This facility will allow the airport to continue to accommodate international general aviation, and to serve the needs of scheduled international airline flights, should they arise.

1.4 Long Island MacArthur Airport Accessibility

1.4.1 Personal Vehicle Access

Ninety-three percent of households in Suffolk and Nassau Counties have access to at least one vehicle, and 63% have access to more than one vehicle. Vehicle ownership rates in New York City, though, are very different. City households are far more reliant on transit and taxis. In Queens, only 62% of households have access to at least one vehicle, in Brooklyn just 44%, and in Manhattan only 22%.[24]

Over 1.2 million people live within 30 minutes of LI MacArthur Airport by car, under weekday peak hour traffic conditions. An additional 2.5 million residents are between 30 minutes and 1 hour of auto travel under the same travel conditions (Figure 11).[25]

Long Island MacArthur Airport is served by a robust local and state road network. Four major roadways in the immediate vicinity provide connections to communities across Long Island. The Long Island Expressway is a limited-access highway extending from Queens to Riverhead. Sunrise Highway, a component of New York State Route 27, is a limited-access highway from Queens to the Shinnecock Canal. Veterans Memorial Highway is a four-lane divided arterial from Commack to Patchogue. Nicolls Road, a four-lane limited access arterial, is the main north-south connection in central Suffolk County and is a key employment corridor in the county (Figure 10).

[24] (U.S. Census Bureau)
[25] Population information from (U.S. Census Bureau), travel time analysis by Arup with Google Maps API.

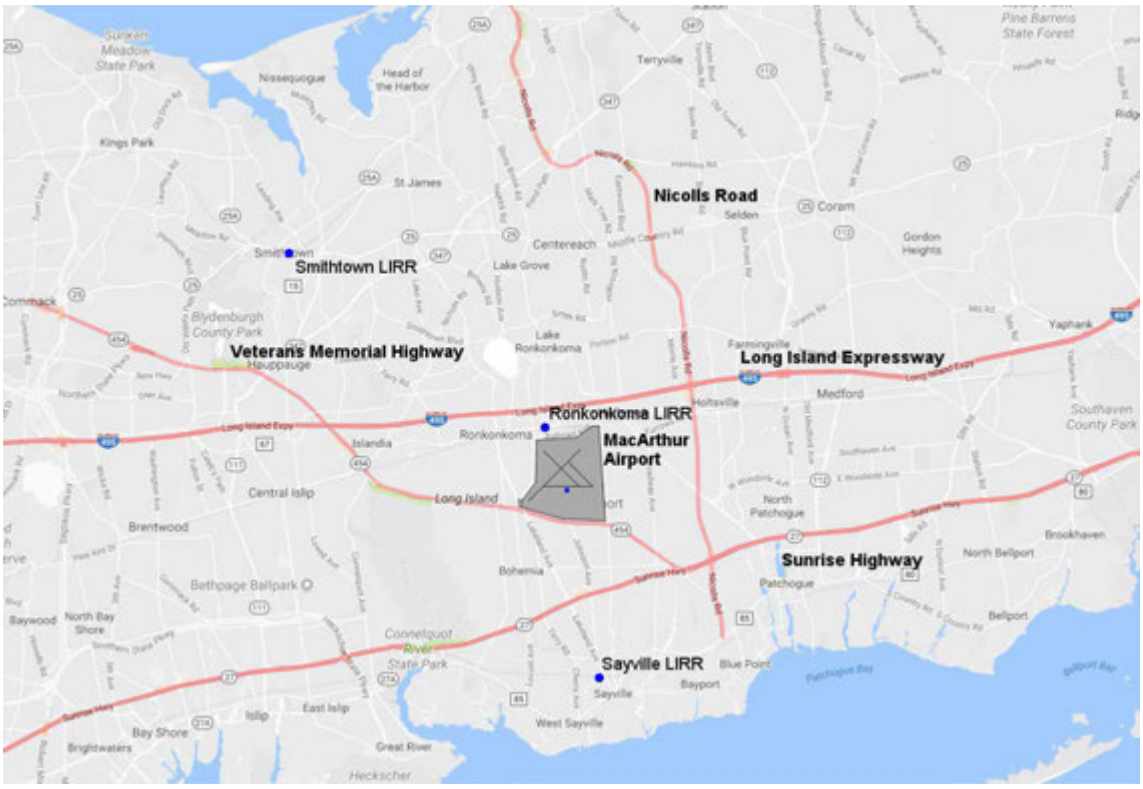
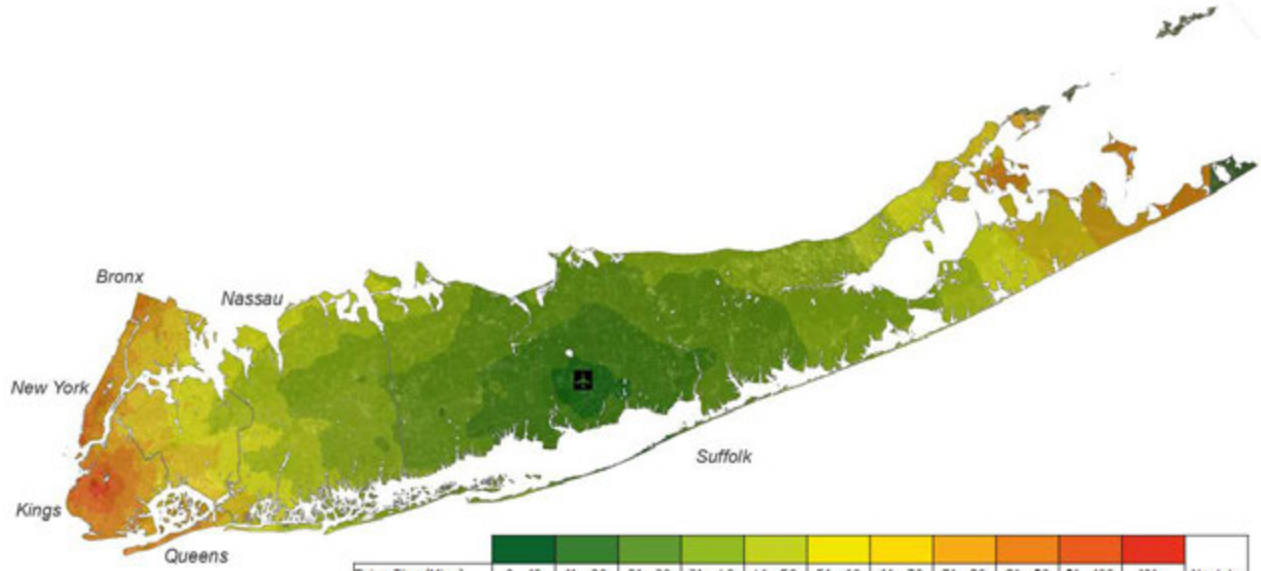


Figure 10: Major Roadways near LI MacArthur Airport



Drive Time (Mins)	0 - 10	11 - 20	21 - 30	31 - 40	41 - 50	51 - 60	61 - 70	71 - 80	81 - 90	91 - 100	101 +	No data
Population (000s)	88.9	509.9	663.4	708.4	732.7	1,116.0	2,274.7	2,023.8	1,844.0	749.8	98.4	0.2
Population (%)	1%	5%	6%	7%	7%	10%	21%	19%	17%	7%	1%	0%
Households (000s)	30.3	158.4	215.7	231.8	249.6	370.6	780.0	771.3	775.3	268.8	30.2	0.1
Households (%)	1%	4%	6%	6%	6%	10%	20%	20%	20%	7%	1%	0%

Figure 11: Drive times to LI MacArthur Airport

New and proposed transit-oriented developments (TODs) in Suffolk County, and denser communities under development within this 60-minute drive shed (Figure 12) will further increase the relative airport accessibility to Long Island residents.

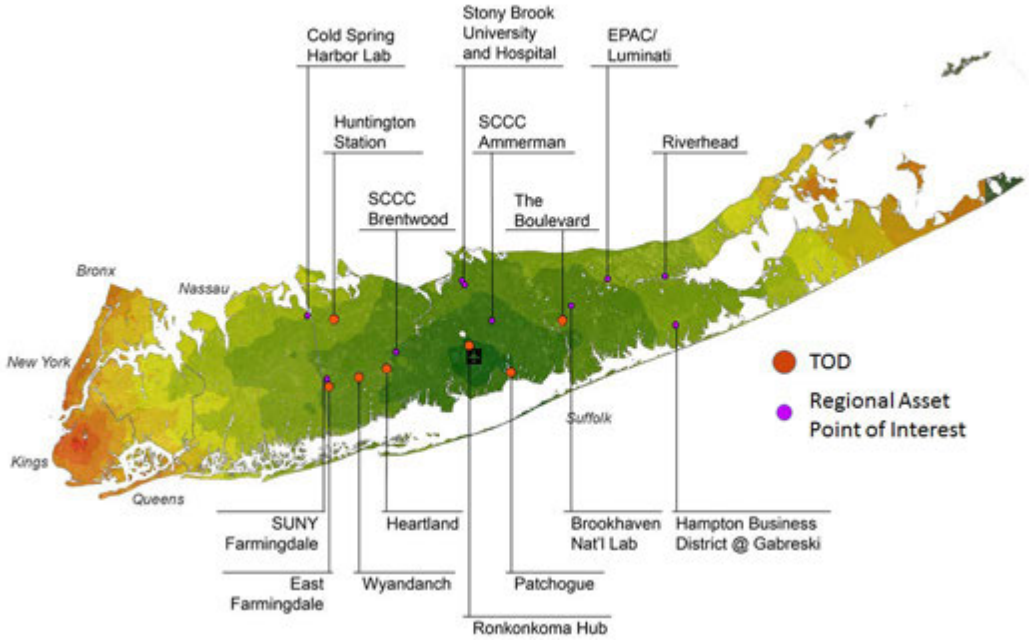


Figure 12: Major Developments in Suffolk and Nassau Counties

There are 3,449 parking spaces available on-site at LI MacArthur Airport (Figure 13), offered at lower daily rates than those at JFK and LaGuardia.

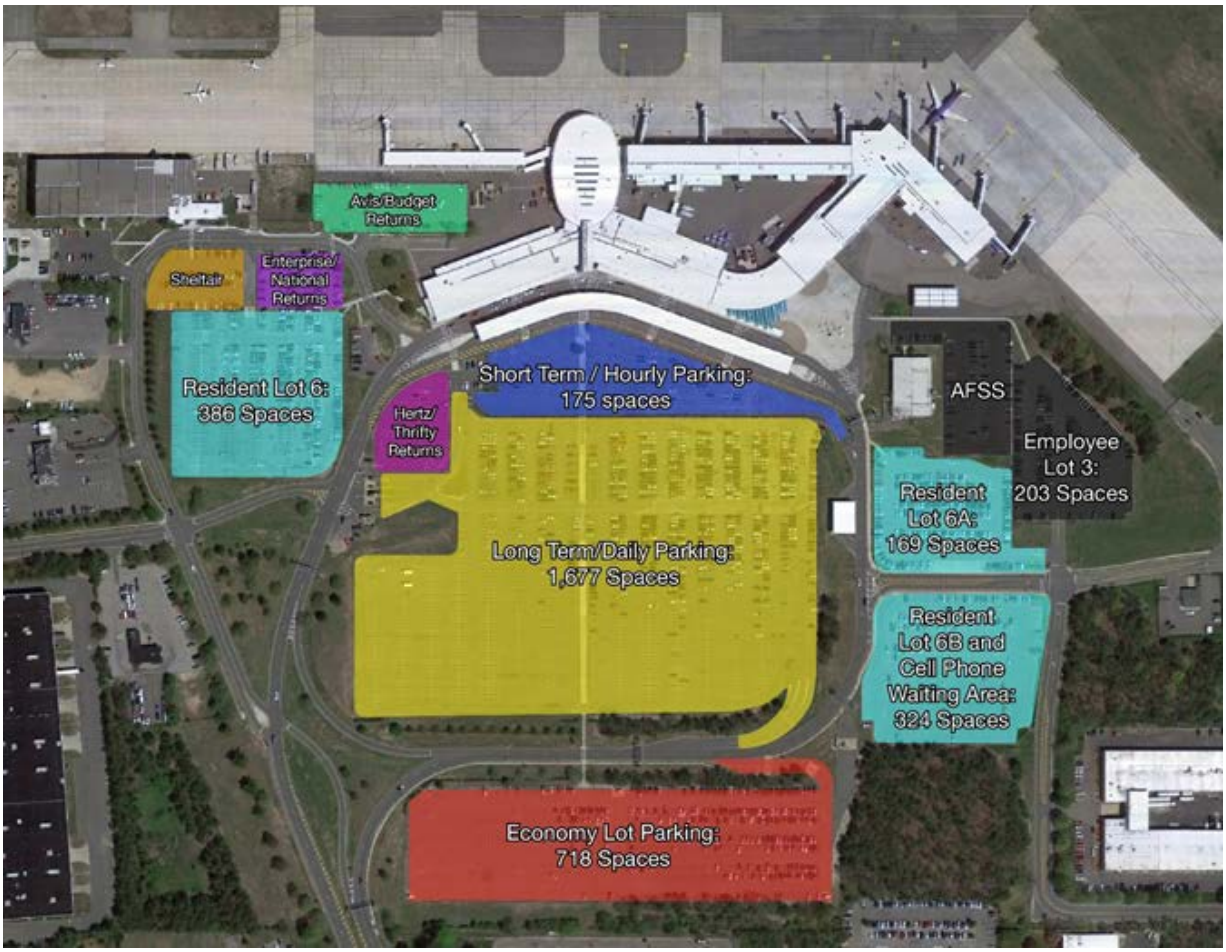


Figure 13: Parking capacity at MacArthur Airport

- Short-term parking
  - 175 spaces
  - $3.50 per hour / Daily maximum of $25
- Long-term/Daily parking
  - 1,677 spaces
  - $4 per hour / Daily maximum of $15.50
- Economy parking
  - 718 spaces
  - $4 per hour / Daily maximum of $14
- Resident parking
  - 879 spaces
  - $40 annual permit

1.4.2 Rail Transit Access

Long Island MacArthur Airport is accessible by rail transit on the Ronkonkoma branch of the LIRR at Ronkonkoma Station. Other nearby stations include Smithtown on the Port Jefferson Branch and Sayville on the Montauk Branch (Figure 14). Express service to Ronkonkoma LIRR Station is available from Penn Station in Manhattan, Jamaica and Woodside LIRR stations in Queens, and from Mineola LIRR Station in Nassau County.

In 2007, the FAA published the results of a survey with LI MacArthur Airport passengers that indicated that 8% of the Airport's passengers had used the LIRR as their mode of access to the airport (6% as primary mode, and 2% as secondary mode).[26] Given the fluctuations in demand the Airport experienced in the past ten years, and the fact that there is new Frontier service to be rolled-out in 2018, it is hard to make projections on the current and future levels of LIRR participation in the Airport's accessibility matrix without additional surveys. Nonetheless, this study is still the sole reference available, and an estimate of annual LIRR riders bound to LI MacArthur based on this 8% share and on a grand total of 606,491 enplanements in 2016 would result in the total of 48,519 LIRR-based passengers in 2016.[27]

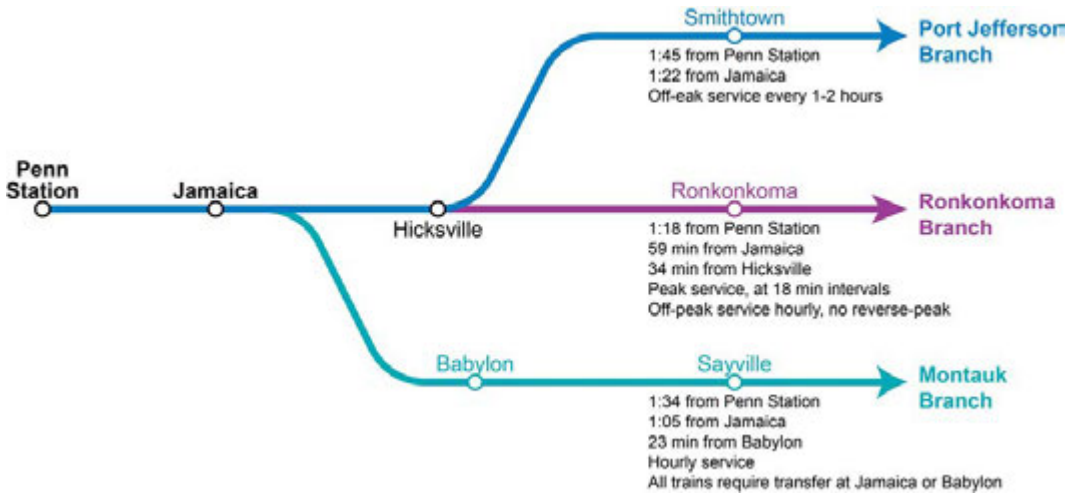


Figure 14: LIRR service near LI MacArthur Airport[28]

If traveling by transit to LI MacArthur Airport, New York City residents can take subways or buses to the nearest LIRR stations, from where they board to Ronkonkoma station. When factoring in this first-leg, travel times to Manhattan and Queens are in the range of 1½ to 2 hours, while trips to Brooklyn can take over 2 hours.

A Long Island resident who wishes to arrive at LI MacArthur Airport via LIRR, can reach his or her nearest LIRR station either by bus, by automobile (one's own auto, taxi or a shared ride), or on foot. Figure 15 illustrates typical travel times to Ronkonkoma LIRR Station at morning peak hours.

[26] (Federal Aviation Administration, 2007a, pp. III-2)
[27] (Long Island MacArthur Airport, 2017b, p. 3)
[28] Source: MTA.info

Once rail passengers reach Ronkonkoma Station they must take a taxi or bus to reach the airport terminal building, about a 15-minute drive away.

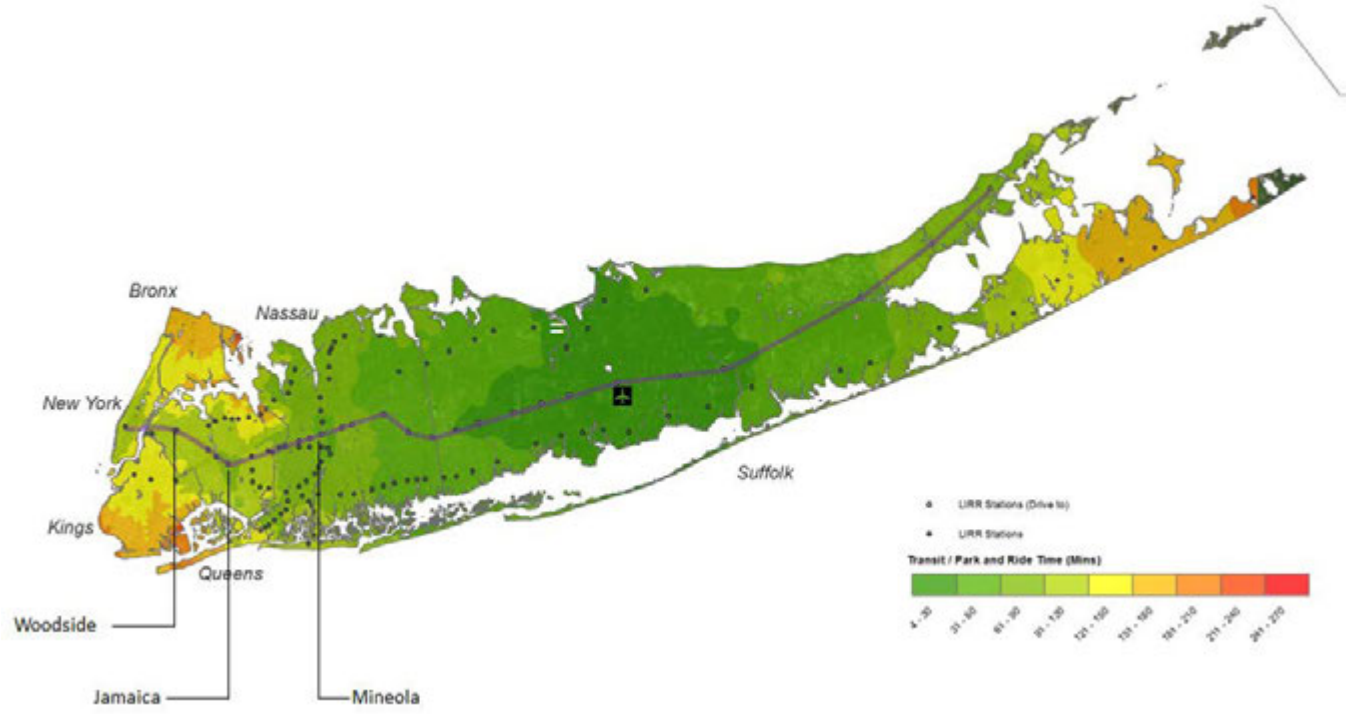


Figure 15: Transit times to Ronkonkoma LIRR Station[29]

LIRR Double Track Project

Ronkonkoma LIRR Station has a 2½-hour gap in non-peak-direction service, between 6:38 a.m. and 8:59 a.m. for eastbound trains, and between 4:48 p.m. and 7:13 p.m. for westbound trains. To eliminate this gap in service, LIRR is building a second track between Farmingdale and Ronkonkoma stations that will allow off-peak and shoulder service expansion on the Ronkonkoma branch. This project will be a key access improvement to LIRR MacArthur Airport as its peak hours may not align with typical LIRR peak hours.

The first phase of the project, between Ronkonkoma and Central Islip was completed in 2016, and the second phase, between Central Islip and Farmingdale is scheduled for completion in December 2018.[30] The project will support population growth in Long Island, and the associated ridership increase, including intra-island mobility, with no significant impact to existing land uses. The project's environmental assessment indicates it would not result in significant increase of traffic around rail stations, and that intersection approaches in the study area would keep operating at acceptable level-of-

[29] Image: Arup, Data Source: Google Maps Directions API – Trips beginning in NYC were simulated as a bus/subway trip to the nearest LIRR station; trips beginning in Nassau and Suffolk Counties were simulated as an auto trip to the nearest LIRR station.
[30] (Metropolitan Transportation Authority, 2016)

service. The assessment also indicated that there is a likely reduction in vehicle trips in the study area.[31] In 2016, LIRR's Ronkonkoma Branch had weekday ridership above 48,000[32], and LIRR forecasts a ridership growth factor 1.69% year-on-year until 2018[33].

The station's train yard is currently undergoing expansion, to increase its storage tracks from 12 to 23 by 2018. According to the MTA, this new facility will "enable the Railroad to improve interior car cleaning and servicing and carry out mandatory Federal Railway Administration inspections." The expanded facility is not only needed to increasing peak-hour trains, but also to provide "direct service to Grand Central Terminal as part of the East Side Access project."[34]

Discount Ticket Package LIRR + Village Taxi\Shuttle – "Deals & Getaways"

The LIRR currently offers a discount package including a rail ticket and a Village Taxi voucher for connection to LI MacArthur Airport terminal, with savings of $4.50 per package[35]. While the package is promoted online at MTA's website, as part of its '*Deals & Getaways*' program and '*Take the LIRR to New York Area Airports*' page. The discount package is not offered to ticket machine users that select Ronkonkoma as a destination, and instead is only an option to those who select '*Deals & Getaways*' at the home screen. The package can be purchased at LIRR ticket windows or ticket machines, but it is not available at the Airport or through LIRR's mobile ticketing app, MTA eTix.[36] The package has not been widely used, with just 162 one-way combined tickets sold in all of 2015, and only 119 sold in 2016.[37]

1.4.3 For-Hire Vehicle Access

Taxis & Shuttle Vans

Village Taxi, the on-site taxi service at LI MacArthur Airport, offers a $5 ride per passenger between Ronkonkoma LIRR Station and the airport terminal. Service is made available at all times during which the airport is operating. A sizable portion of the fleet is used to meet each LIRR train in a dedicated parking area to ensure LIRR customers are able to obtain immediate service (Figure 16).

At the airport, taxi pickup and drop-off is located outside of the baggage claim area. A dispatcher is present at the airport to manage queues and provide information to passengers. Vehicles are dispatched to the airport to meet arriving flights in numbers that are Passengers wishing to connect with the LIRR are directed to a separate queuing area from the general taxi line.

Village Taxi's fleet – comprised of town cars, SUVs and vans with capacity for 10 passengers. Passenger service using the van is offered at the same price as a standard taxi trip ($5 per person).

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[31] (MTA Long Island Rail Road, 2013, pp. 33, ES-8 - ES-11)
[32] (Metropolitan Transportation Authority, 2016)
[33] (MTA Long Island Rail Road, 2013, p. 32)
[34] (Metropolitan Transportation Authority, 2015)
[35] (Metropolitan Transportation Authority, a)
[36] (Metropolitan Transportation Authority, c)
[37] Source: Metropolitan Transportation Authority via email

While Village Taxi experimented with fixed-interval shuttle van service in the past, this scheme was found to be inefficient because train and flight schedules are uncoordinated. Service is now provided on an as-needed basis (determined by the dispatcher). During especially busy periods, Village Taxi sometimes runs two, closely-timed trips using the shuttle van. This allows for immediate pickup of air passengers with only carry-on luggage followed by a second trip for those awaiting checked luggage.

Village Taxi stated in a telephone interview that the number of taxi and shuttle customers has been growing since the inception of Frontier Airlines service at LI MacArthur, with as many as 40 people seeking service after the arrival of one of Frontier's flights. The company is considering purchasing a new shuttle vehicle with capacity for 40 persons should demand continue to rise.[38]

Figure 16: Village Taxi office at Ronkonkoma LIRR Station

Transportation Network Companies

App-based transportation services like Lyft and Uber, also known as Transportation Network Companies (TNCs), launched service in Suffolk County in June 2017. Though these services are new to the area they are already drawing customers at Ronkonkoma Station, taking up space at the pickup and drop-off areas. In the first two months on Long Island, Ronkonkoma LIRR Station has been recorded as one of the top LIRR station destinations for Lyft.[39]

1.4.4 Suffolk County Transit Access

Suffolk County Transit's bus route S57 provides daily service to LI MacArthur Airport. The service runs Monday through Saturday between 7:00 a.m. and 7:00 p.m., with hourly service between Smith Haven Mall and Sayville. The route also connects to Ronkonkoma LIRR station, and has a scheduled

[38] (Village Taxi, 2017)
[39] (Blasey, 2017)

10-minute travel time between the station and the airport. However, the current bus schedule is not aligned with the LIRR train schedule, which means passengers who rely on this service may face long wait times at either end of their trip.`

1.4.5 Proposed Nicolls Road Bus Rapid Transit

In June 2016, Suffolk County released a final report for the Nicolls Road Alternatives Analysis. The recommended alternative was a Bus Rapid Transit (BRT) system, operating mostly along Nicolls Road, with a spur providing service to Ronkonkoma LIRR Station and Ronkonkoma Hub TOD (Figure 17). The route would be 23.5 miles long and have 19 stations. BRT service would operate seven days a week, with weekday peak service operating on 10-minute intervals.[40]

[40] (Suffolk County, 2016) (Suffolk County, 2016)

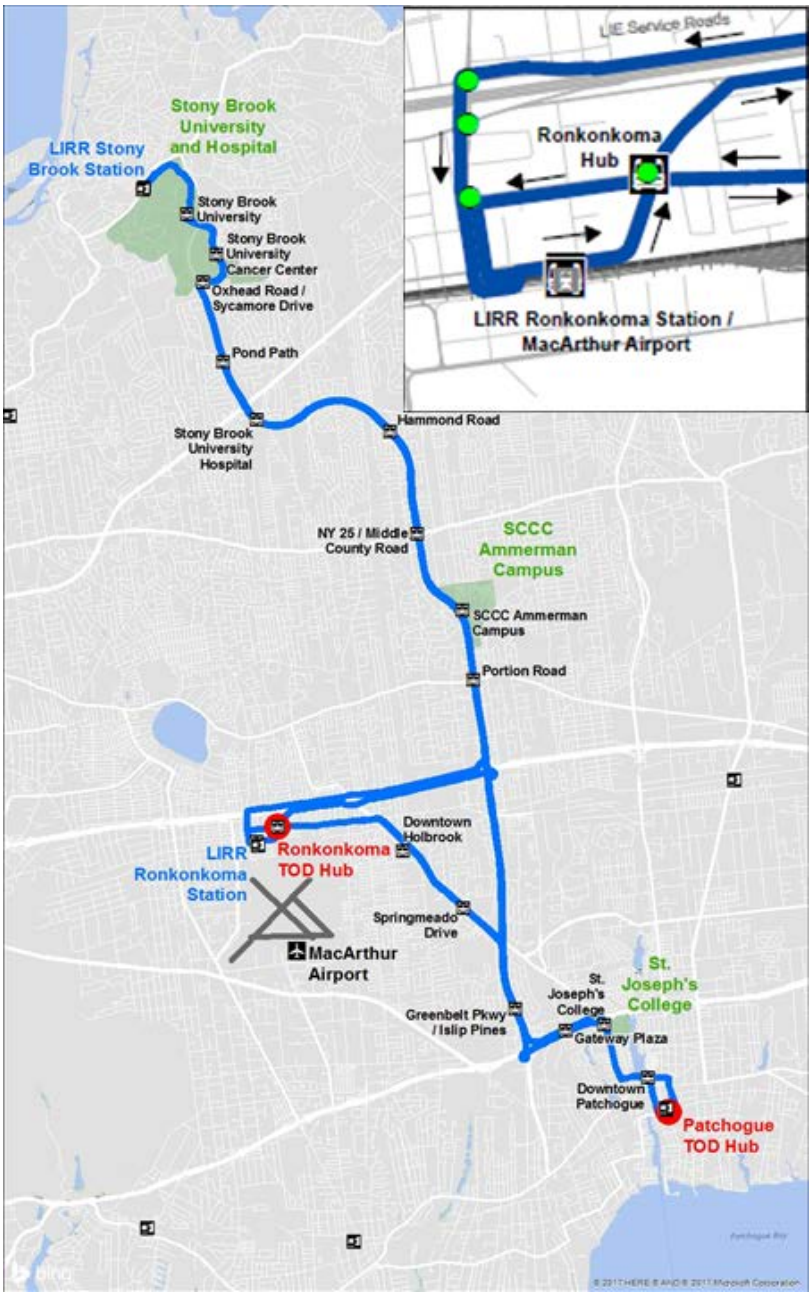

Figure 17: Nicolls Road proposed BRT route

1.4.6 Potential Impacts of Improved Accessibility

In regions served by multiple airports, travelers have to choose which airport best meets their air travel needs. A variety of factors play into consumers' airport choice, and the Transportation Research Board (TRB), through its Airport Cooperative Research Program (ACRP) identified that the two key factors are "air service quality (availability, frequency, capacity, and routing); and price (airfare, taxation, and

ancillary fees).[41]" Still, in addition to these primary factors, ACRP also finds that airport ground accessibility has influence in passenger's choice, especially for business travelers.

Airport accessibility is an attribute with many dimensions. In broad terms, it can be thought of as the extent to which it is easy or difficult for the passengers to get to the airport. In strict sense, accessibility is defined as the combination of travel times, reliability, and cost.

Travel Times

Travel times are the most important component of accessibility. Even when passengers enjoy roughly similar levels of accessibility to multiple airports – as is the case in the New York Region – small differences in travel times may be important. The ACRP has found that "passengers are highly sensitive to [travel times] … and even small changes in access time, such as a 5-minute reduction, can induce notable shifts in air travel demand at an airport[42]". Passenger surveys conducted at the New York region's airports in 2007 indicated that "travel time to the airport, especially from home, is an import factor for airport choice. Given equal air service quality and similar pricing, passengers will usually choose the closer airport[43]". This same study indicated that most air passengers in the region choose airports "within about 60 minutes of their local trip origins."

Travel times are mostly affected by external factors, such as regional traffic congestion and transit schedules, and the train-to-plane connector is one of the few tools within the Airport's reach. In 2007, the FAA reported survey results that indicated that 6% of LI MacArthur air travelers used the LIRR as their primary mode for accessing the Airport, with an additional 2% using it as a secondary mode[44]. In 2011, the RPA supported the notion that an enhanced rail connection to LI MacArthur would have a positive impact in the Airport usage, reporting that "faster and more frequent rail service" brought about by the LIRR's Double Track Project would be essential for increased shift of passengers from other airports[45].

Reliability

Reliability is the property of a transportation system to perform in a consistent manner. A reliable system will have few disruptions over its life time, or will have a diminished impact of these disruptions. In 2010, the Organization for Economic Co-Operation and Development defined Reliability as "the ability of the transport system to provide the expected level of service quality, upon which users have organized their activities"[46]. The U.S. DOT Federal Highway Administration (FHWA) is more specific, and defines reliability in terms of travel times, by calling reliable a

[41] (Airport Cooperative Research Program, 2013, p. 12)
[42] (Airport Cooperative Research Program, 2013, p. 13)
[43] (Federal Aviation Administration, 2007b, pp. II-3)
[44] (Federal Aviation Administration, 2007a, pp. III-2)
[45] (Zupan, Barone, & Lee, 2011, pp. 71 - 77, 144)
[46] (Organization for Economic Co-Operation and Development, 2010, p. 17)

system that "provides users with a consistent range of predictable travel times.[47]" Typical sources of unreliability are non-recurring traffic congestion and delays in the transit system.

In addition to in-vehicle travel times, transit modes are subject to other sources of potential unreliability: consistency of wait times, availability of seating, and ability to consistently and easily make required connections.[48] Therefore, transit modes are not only subject to interferences while in-travel, but also at stops, where vehicles can dwell longer than planned. These sources of unreliability can be mitigated by an operational plan that provides a buffer for possible vehicular delays arising from eventful boardings, alightings and maintenance routines.

Partly because passengers account for unreliability in their travel to the airport by building in additional time to their travel plans,[49] travelers consider reliability one of the key dimensions of accessibility. Among LI MacArthur travelers surveyed in 2007, reliability was the most frequently cited factors for mode choice to the airport, at 42%[50]. Among transit modes, dedicated transitways, such as rail tracks, are usually perceived as more reliable than mixed-traffic roadways. Business travelers are also more sensitive to reliability than are leisure travelers. With less flexible schedules, they are more willing to pay a premium to ensure on-time arrival.[51]

Costs

Travel time and reliability tend to be much more important factors in mode choice to airports than monetary costs. However, costs can trump other factors when "the cost of one mode is much higher than that of an alternative.[52]" The literature suggests that leisure passengers, who are likely to pay these costs directly, are more sensitive to costs than business travelers, who are more concerned with convenience and time. The costs associated with airport access include parking, tolls, fuel costs for passengers who choose private vehicle modes, and fares for those choosing transit or taxi modes.

At LI MacArthur Airport, the costs ground transportation seem to play a small role into how travelers choose their access mode. Only 14% of passengers surveyed in 2007 said that cost was an important factor in their choice of mode for airport access.

1.5 Ronkonkoma LIRR Station

1.5.1 Connection Wayfinding

The Ronkonkoma LIRR station has three platforms and two tracks, with an overpass connecting all platforms to exits on the north and south sides of the tracks. The passenger waiting room is located on

[47] (Federal Highway Administration (FHWA), 2017)
[48] (Transit Cooperative Research Program, 2013, pp. 3-13 - 3-14)
[49] (Airport Cooperative Research Program, 2013, pp. 13 - 14)
[50] (Federal Aviation Administration, 2007a, pp. III-3)
[51] (Airport Cooperative Research Program, 2013)
[52] (Airport Cooperative Research Program, 2013, p. 14)

the north side of the station. Neither the platforms nor the overpass have any signage indicating where to go for LI MacArthur Airport, the taxi stand, or the bus stop (Figure 18).

Figure 18: Ronkonkoma LIRR station overpass

1.5.2 MTA Capital Program: Enhanced Stations Initiative

The MTA has budgeted $150 million for its LIRR Enhanced Stations Initiative (ESI), which will improve aesthetics and user experience for 17 stations in Long Island[53]. The Initiative will deliver "new facilities, Wi-Fi, charging stations, public art, new platform waiting areas, general station renovations and improved signage"[54].

The MTA is currently procuring design and construction services for ESI improvements. Ronkonkoma is in the Phase 2 package along with 4 other stations ($45 to $55 million for all stations)[55].

1.5.3 Station Parking

The station has a total of 6,233[56] parking spaces, the majority of which are public, free, and unrestricted. There are two privately operated parking lots on the north side of the station. The capacity for each parking lot is indicated on Figure 19.

[53] (Metropolitan Transportation Authority, 2017b)
[54] (Metropolitan Transportation Authority, 2017a)
[55] (Metropolitan Transportation Authority, b)
[56] Lot ownership/operation: (Metropolitan Transportation Authority, 2017c); Suffolk County lots: Arup; Allpro Parking garage counts: Allpro Parking; Town of Brookhaven, free unrestricterd/undeveloped, and other private operators' lots: (VHB Engineering, Surveying and Landscape Architecture, P.C., 2010).

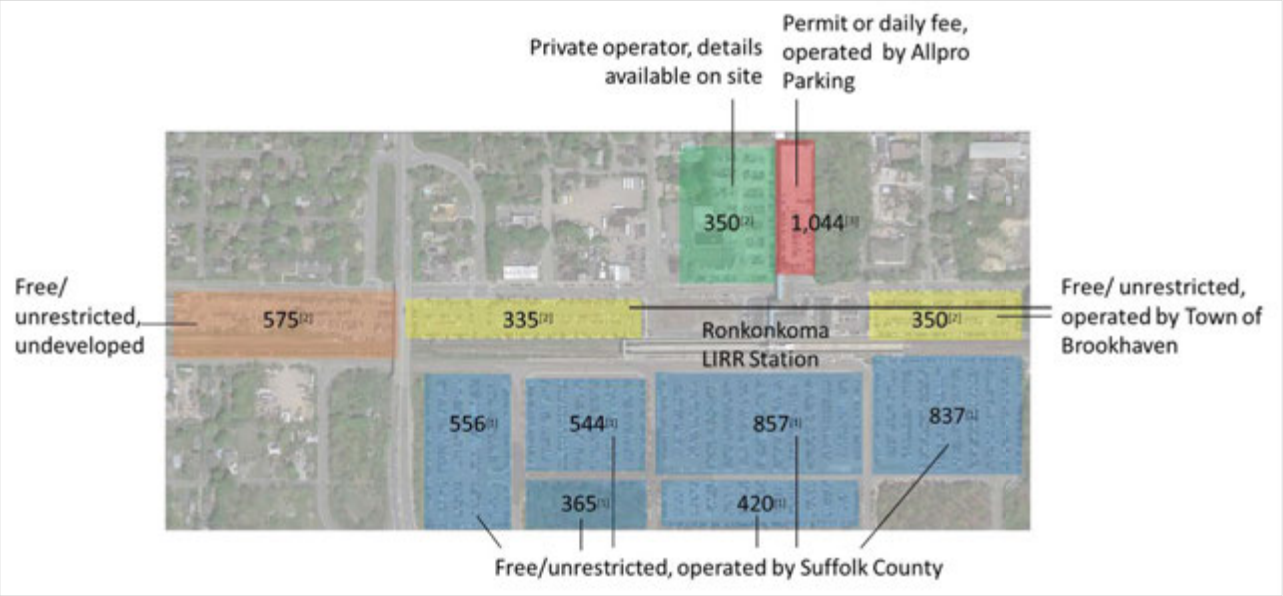

Figure 19: Ronkonkoma Station Parking

1.6 Current and Studied Train-to-Plane Connections

1.6.1 Train-to-Plane Drive Times

There are currently two routes between Ronkonkoma LIRR Station and the passenger terminal at LI MacArthur Airport. The first route, via Smithtown Avenue, is 3.5 miles and takes between 9-14 minutes. The second route, via Lincoln Avenue, is 4.5 miles and takes between 10-14 minutes.

Review of traffic forecast tools indicates that, on the route between Ronkonkoma LIRR Station and MacArthur Airport, only Veterans Highway faces congestion during peak hours of traffic (Figure 20). Suffolk County's Master Plan indicates that level-of-service for this segment of roadway in 2015 was LOS B, and is forecast to be LOS C in 2035[57].

[57] (Suffolk County Department of Economic Development and Planning, 2014b, pp. A-13)

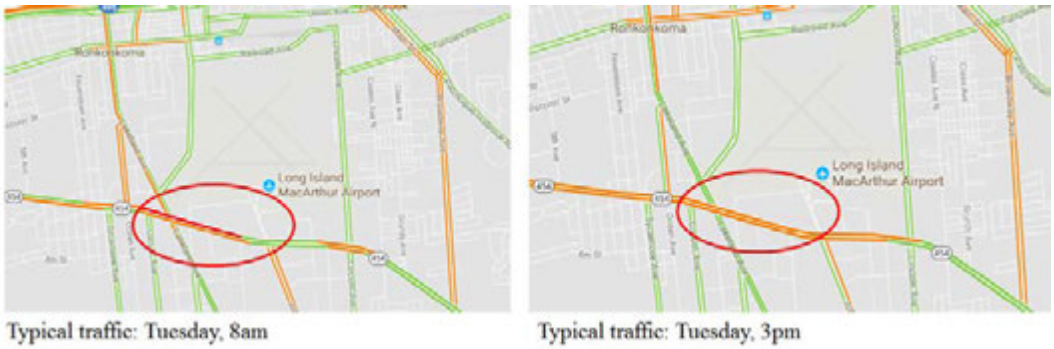

Figure 20: Typical Traffic on Veterans Memorial Highway

For the shortest route from Ronkonkoma LIRR station to LI MacArthur Airport terminal, analysis of typical weekday traffic patterns produce the following results[58]:

- Minimum travel time is 9mins and 52 seconds;
- Average travel time is 11 mins and 6 seconds;
- Recurring congestion adds up to 2 minutes and 11 seconds of delay;
- Recurring travel times above 11 minutes are more frequent in the periods 5 a.m. to 9 a.m., 10:30 a.m. to 12:00 p.m., and 2:00 p.m. to 9:00 p.m.
- Non-recurring congestion may add up to 3 minutes and 27 seconds
- Non-recurring congestion that drives travel times above 13 minutes is most frequent in the period 7:00 a.m. to 7:30 p.m.

The travel time profile is presented on Figure 21. Recurring congestion is the product of the mismatch of road capacity and the typical traffic volume; non-recurring congestion are caused by temporary disruptions such as crashes, disabled vehicles, work zones, adverse weather events, and planned special events.

[58] Analysis: Arup, Data Source: Google Maps Directions API. (Origin: 40.807882, -73.106133, Destination: 40.789259, -73.097534, Start Date: 20/12/2017, Waypoints: 40.789722, -73.115067, 40.785683, -73.111007, recurring congestion: traffic model = best_guess, non-recurring congestion: traffic model = pessimistic, Analysis from 00:00 to 24:00 each 30 mins).

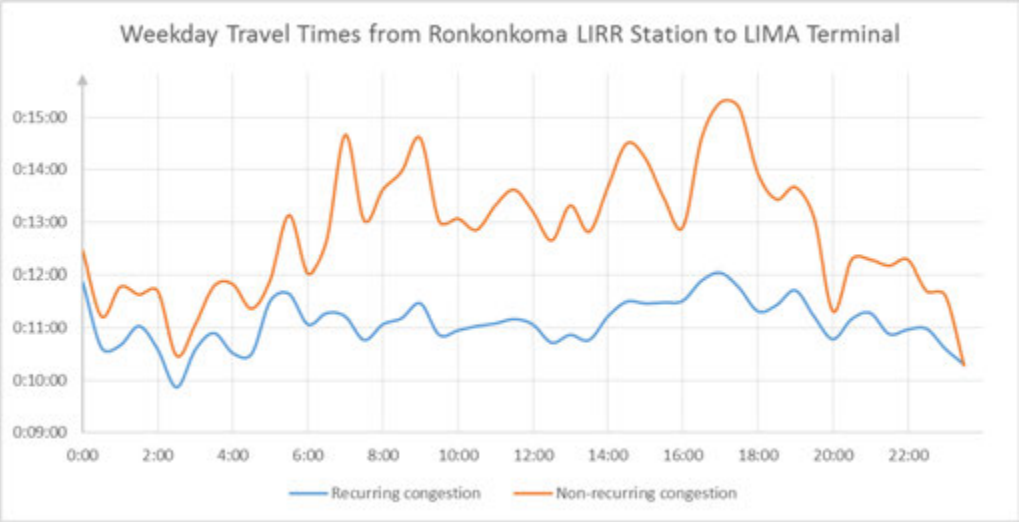

Figure 21: Typical Traffic Pattern Analysis

1.6.2 Previous Planning Studies

A study to evaluate locations for the replacement U.S. Customs and Border Protection facility at LI MacArthur Airport was released in June 2017.[59] The study looked at locations within the existing terminal as well as a new north side customs facility. The study found the most favorable options include alterations to the existing Central Terminal Area.

The study also offered a concept-level assessment identifying options and rough order-of-magnitude cost estimates for improved intermodal access between the airport and Ronkonkoma Station. The study reviewed options for a new connection to the existing terminal as well as a new north side terminal (Table 2).

Table 2: MacArthur Airport Customs Facility Location Study

Current Facility Location	Transit Connection Mode	Frequency of Service (min)	One-Way Travel Time (min)	Capital Cost Estimate (millions)
Existing Terminal	BRT (at-grade)	12	10-11	$43
	BRT (at-grade & elevated)	12	9-11	$128.3
	Automated Guideway Transit (AGT)	10	7.5	$641.9
New North Side Facility	Bus Shuttle	10	4.2	$1.2
	Automated Guideway Transit (AGT)	10	3.6	$134.6
	Moving Sidewalk	Continuous	6	$59.6

[59] (AECOM, 2017)

The study indicated that at-grade BRT service to the existing terminal was the most feasible option. The capital cost for a five-vehicle bus system would be approximately $43 million.

1.6.3 Environmental Considerations

In recent years, Suffolk County has demonstrated a strong commitment to environmental quality and sustainable development. In 2012, The Suffolk County Legislature registered with the Climate Smart Communities Pledge and passed a resolution "in the interest of reducing greenhouse gas emissions and adapting to a changing climate…"[60] The Pledge is part of a program that "provides support and assistance for reduction of greenhouse gas emissions and climate adaptation at the local level."[61] The Town of Islip also adopted the Pledge, and in doing so "partnered with their state government to build a resilient, low-emission future."[62]

Along with other municipalities, non-governmental organizations, and consultants, the Town of Islip participated in the Cleaner Greener Consortium of Long Island. In 2013, the Consortium published the Cleaner Greener Long Island Regional Sustainability Plan. The plan establishes a transportation goal to "Improve transportation options for all Long Islanders: reduce Long Island's vehicle miles traveled, fuel consumption and GHG emissions"[63], and articulates a community-based vision for a more sustainable future.

In 2015, Suffolk County saw the adoption of two plans that reiterated and shaped the County's commitment to the environment and sustainable development. In March, the Suffolk County Climate Smart Community Standing Committee drafted, and in June the Legislature adopted, the County's Climate Action Plan, which states "[the County] has similarly set a 20 percent GHG emissions reduction target by 2020 from a 2005 baseline for community-wide emissions." While the plan recognizes that the County has less control over community emissions, it nevertheless states that it "has utilized its ability to provide regional leadership and adopt policies that encourage improved efficiency and adoption of renewables."[64]

The second plan, adopted in June 2015, is the Suffolk County Comprehensive Master Plan 2035. The plan lists "Protect the Environment and Enhance Our Human Capital" as one of its six key policy areas, and provides guidance that can be followed to achieve the broad regional goal of providing "the foundation for sustainable growth and resiliency of Suffolk County." The plan offers initiatives to address transit improvements and meet the essential needs for clean air, among other goals.[65]

An improved train-to-plane connection would support these goals, especially if it succeeds in increasing the share of travelers accessing the Airport via the LIRR. GHG emissions from on-road

[60] (Suffolk County - The Administrative Code, 2012, p. 1)
[61] (New York State Department of Environmental Conservation, a)
[62] (New York State Department of Environmental Conservation, b)
[63] (Cleaner Greener Consortium of Long Island, 2013, p. 75)
[64] (Suffolk County Climate Smart Community Standing Committee, 2015, pp. 1, 6)
[65] (Suffolk County Department of Economic Development and Planning, 2014a, pp. 43, 58-59)

vehicles are the second largest contributor to Long Island's climate-change related carbon footprint,[66] with "84% stemming from gasoline used in passenger vehicles."[67] The American Planning Association found that more energy-efficient transportation – infrastructure, vehicles, modes – can create a significant positive impact in reducing climate change-related greenhouse gas emissions (GHGs).[68] The County Master Plan identifies as recommended actions to 'encourage participation in rideshare programs and multimodal bus / train / bicycle and auto use', and to "develop mass transit infrastructure necessary for local and non-local tourists…"[69]

The possible adoption of low- or zero-emission vehicles in the train-to-plane connection would also improve the air quality in the County. The Environmental Protection Agency (EPA) documents that automobiles are a significant contributor to ozone generation and suspended particulate matter ($PM_{2.5}$), and notes that driving a private car is "probably a typical citizen's most "polluting" daily activity", and states that actions geared towards reducing ozone and $PM_{2.5}$ include reducing automobile use or by switching to low or zero-emission vehicles.[70] The County Master Plan recommends "the expansion of the use of vehicles powered by alternative/low carbon fuels"[71], and the 'Cleaner Greener' Plan promotes alternative transport options and transition to a cleaner vehicle fleet as an effective strategy to improve ambient air quality in the short-to-medium term, and create a higher quality of life and increased health and well-being for Long Islanders to ensure a more sustainable future.[72]

1.7 Planning for Suffolk County Growth

1.7.1 Connect Long Island Plan

The 2014 Connect Long Island Regional Transportation and Development Plan, commissioned by Suffolk County aims to create sustainable economic growth through coordinated land use and transportation planning, and investments in transportation infrastructure that strategically connect Suffolk's educational and research institutions, TODs, and Long Island Rail Road stations. A major component of the Connect Long Island plan is the vision to develop north-south mass transit connections between key County assets and existing east-west transportation modes, transforming mass transit commuting into a viable and attractive alternative for young job-seekers, to drive economic growth. The plan supports development of mixed-use communities around LIRR stations.

[66] (Cleaner Greener Consortium of Long Island, 2013, p. 9)
[67] (Suffolk County Climate Smart Community Standing Committee, 2015, p. 37)
[68] (American Planning Association, 2011, p. 39)
[69] (Suffolk County Comprehensive Master Plan 2035, 2014, pp. 2-12, 2-14)
[70] (U.S. Environmental Protection Agency, Cars and Air Pollution, https://www.adeq.state.ar.us/air/planning/ozone/cars.aspx)
[71] (Suffolk County Department of Economic Development and Planning, 2014b, pp. 2-12)
[72] (Cleaner Greener Consortium of Long Island, 2013, pp. 75 - 83)

1.7.2 Transit-Oriented Development

At present, there are a number of transit-oriented developments planned in Suffolk County, centered at or near eight different LIRR stations.[73] These projects will feature dense, mixed-use development and other capital improvement to help improve connectivity. Outside of these developments, Suffolk County is planning various improvements to increase corridor-connectivity countywide. Long Island MacArthur Airport will be adjacent to the Ronkonkoma Hub development, and lies at a key junction between north-south and east-west corridors.

Ronkonkoma Hub

Ronkonkoma Hub is a planned transit-oriented development adjacent to Ronkonkoma LIRR Station and just north of LI MacArthur Airport (Figure 22). It will be a 50-acre development with high multi-modal accessibility. The Hub will be served by local bus, the future Nicolls Road BRT and the LIRR. It is just south of Long Island Expressway. The Hub will include 1,450 residential units, of which 20% will be set aside as affordable housing, and over a half-million square feet of retail and commercial space. There are also nearby clusters of professional and technical employment in the towns of Smithtown and Islip, and along the Long Island Expressway. The project's phase 1 should soon break ground, and funds for sewer hookup have been appropriated by the County[74].

Figure 22: Ronkonkoma Hub rendering and site plan

1.7.3 Economic Development

The Suffolk County 2035 Master Plan sets out to grow the business base and create jobs around Long Island's top research facilities at Stony Brook University, the Brookhaven National Laboratory, and along the Route 110 corridor.

Innovation Zone

[73] (Suffolk County Department of Economic Development and Planning, 2014a)
[74] (Suffolk County, 2017)

The Innovation Zone, or I-Zone, is Suffolk County's initiative to connect TODs with the region's research institutions[75]. The plan brought together multiple levels of government and leaders of the region's top research institutions. The goal is to create a "quality of life ecosystem" to support smart economic growth within the county.[76] The key projects that will contribute to the success of the I-Zone are the Nicolls Road BRT, Ronkonkoma Hub, plane-to-train connection at MacArthur Airport, and a future connection to the Brookhaven National Laboratory.

1.7.4 New York State "Transforming Long Island" Proposal

Improving transit access to LI MacArthur Airport figures prominently into Governor Andrew M. Cuomo's $160 million plan to "Transform Long Island," one of 37 key budgetary proposals announced in the January, 2017 State of the State address. The Governor identified $20 million dollars to support the development of a direct connection between LI MacArthur Airport and the Ronkonkoma LIRR station. The proposal also includes $5 million for enhancements at the station that will improve passenger experience.[77]

1.8 Existing Conditions Key Takeaways

Airport demand

Different factors point towards potential demand growth for LI MacArthur Airport in the coming years:

- Frontier Airlines is expected to double the number of passengers that travel through LI MacArthur by 2018.
- Runway extensions and a renovated CBP facility will allow carriers to serve other markets, should they chose to do so.
- The three major airports in the New York City region are constrained[78].

Suffolk and Nassau Counties have a strong demand base for the airport, albeit most residents have a set-up favorable for driving:

- Suffolk and Nassau Counties have over 2.8 million residents[79]:
- 1.2 million live less than a 30-minute drive to the airport
- Currently, airport-bound travel in Suffolk and Nassau counties is mostly carried out by automobile, with most households planning their mobility strategy around private vehicles:
    - 93% of Suffolk and Nassau counties' households have access to at least one vehicle

[75] (Suffolk County Government, 2016)
[76] (Suffolk County Government, 2015)
[77] (New York State Office of the Governor, 2017)
[78] (Long Island MacArthur Airport, 2014, p. 11), (Zupan, Barone, & Lee, 2011, p. 11), (Federal Aviation Administration, 2017b)
[79] Source: U.S. Census Bureau, 2016 American Community Survey 1-Year Estimates

- 63% have access to more than one vehicle

Suffolk County plans to expand and enhance its transit network and to foster compact, walkable communities:

- Planned TODs around LIRR stations[80]:
  - Huntington
  - Heartland
  - Ronkonkoma Hub
  - Riverside
  - East Farmingdale
  - Wyandanch
  - Patchogue
  - The Meadows at Yaphank
- Planned north-south BRT corridors:
  - Nicolls Road
  - Sagtikos Parkway
  - Route 110.

These initiatives are key to reduce auto-reliance in Suffolk County, and to create a mobility environment favorable for public transportation. A transit-friendly landscape is essential for building demand for a train-to-plane connection.

Accessibility

Penn Station in Manhattan is 78 minutes from the Ronkonkoma LIRR Station. The LIRR has room to improve its connection to LI MacArthur Airport:

- Station wayfinding does not support an airport-bound rider
- Ticket vending kiosks do not have intuitive menus to buy the taxi and train bundle

Ronkonkoma Station is within a 15-minute drive from the passenger terminal at LI MacArthur Airport. Village Taxi offers $5 per person flat fare to the airport. A taxi voucher may be purchased as part of a "Long Island Getaway" package ticket at LIRR ticket vending machines, but the existing process for doing so is likely confusing to customers.

A ride offered by a TNC costs about $10, however:

- There is no guarantee that cars will be available for service[81]
- Far surcharges, a key component of many TNCs' business model, increase uncertainty for travelers

Long Island MacArthur Airport

Previous studies analyzed BRT and AGT and concluded that investments between $40 million and $650 million would be required to build the connection[82]. While the airport does not envision moving

[80] (Suffolk County, 2016, p. 3)
[81] (Metropolitan Transportation Authority, a)
[82] (AECOM, 2017)

the terminal to the north side of the property in the short- to mid-term, it is open during this timeline to consider connection alignments through its site, so long as they adhere to airport and FAA regulations[83], Town planning and zoning codes.

2 Purpose and Need Statement

2.1 Project Purpose

The project purpose is to connect the Ronkonkoma LIRR Station with LI MacArthur Airport, providing an integrated and reliable linkage for air travelers served by Long Island Rail Road and county transit services.

The new connection will pursue the County's key policy of building a 21st century transit network, and will complement the development projects that foster compact, walkable communities.

The project will support the growth of MacArthur Airport's catchment area and reaffirm the airport's values of offering an efficient and comfortable experience to its customer base. The train to plane connection should be affordable, reliable and convenient as it meets the needs of air travelers.

2.2 Project Needs

The train-to-plane connection will address current and future gaps in the transportation network, which were identified and detailed previously in the Existing Conditions section.

There are significant opportunities, both current and future, that the project can leverage and benefit from. The strong existing and growing customer base for MacArthur Airport create opportunities for projects that benefit from economies of scale. The new Frontier Airlines service will offer alternatives to travelers looking for flight options that are more convenient than those at other congested New York City-area airports.

Suffolk County's focus on increasing transit use through TODs near LIRR stations and new BRT routes will invite travelers that choose to travel by alternative modes. Improvements to Ronkonkoma Station will further enhance the utility of a new train-to-plane connection.

Project challenges include cost, timing, complexity, and congestion. Funding needs may reach the hundreds of millions, and multiple sources may have to be procured. The airport's previous connection study considered BRT or AGT connections ranging from $40 - $650 million. The connection will consider the boundaries and safety zones for the expanded runways. Growth of airport demand coupled with increase in background traffic, especially on Veterans Highway, would lead to increase in recurring congestion in the surrounding road network, and more frequent events of non-recurring congestion due to vehicle disruptions. An airport connector with a dedicated alignment, could alleviate

[83] Code of Federal Regulations Title 14, §77 – Safe, Efficient Use, and Preservation of the Navigable Airspace, and §139 – Certification of Airports

some of the pressure in roadway bottlenecks, and offer airport-bound travelers a transportation option wits reduced exposure to traffic conditions and higher travel time reliability.

Considering these opportunities and challenges, the needs for this project fall under three categories: System Linkage, Transportation Demand, and Economic Growth, which are each detailed below.

System Linkage:

- To link LI MacArthur Airport with the Ronkonkoma LIRR Station.
- To link LI MacArthur Airport with Suffolk County's transit services.

Transportation Demand:

- To integrate LI MacArthur into the LIRR network, serving markets in Suffolk County, Nassau County and New York City.
- To offer a scalable and flexible connection that accommodates future airport growth plans.

Economic Growth:

- To pursue Suffolk County's policies for expansion of public transit as a means to enable growth without degrading current quality of life standards.
- To strengthen compact, walkable communities that will foster economic development.
- To catalyze economic growth in Suffolk County, strengthening LI MacArthur Airport's position as a regional asset.

2.3 Project Impacts

The impacts of this project fall under three categories: transportation networks, land uses, and the economy. The impacts listed in Table 3 indicate the possible outcomes and contributions of the train-to-plane connection.

Table 3: Project Impacts

Transportation Networks	
1	Increased accessibility to LI MacArthur Airport, especially for LIRR riders
2	Additional reliable and timed connection between trains and LI MacArthur Airport
3	Enhanced link between regional transportation assets (MacArthur Airport and LIRR)
4	Flexible connection to accommodate potential future extensions of transit service
5	Increased use of transit to/from MacArthur Airport would reduce the impact of the airport passenger access traffic in the surrounding roadway
Land Uses and Environment	
1	Delivery of a transport link in line with the vision of walkable, compact communities
2	Protected flexibility for future development options and runway extensions
3	Protected and enhanced local environment (e.g., noise, vibration, and air quality)

4	Reduced auto reliance for travel to LI MacArthur Airport, and associated mitigation of CO_2 emissions
Economic Development	
1	Direct employment creation for construction and operation of the connection
2	Increased competitiveness of MacArthur Airport, being more attractive to passengers
3	Catalyzed economic growth throughout Long Island

3 Connectivity Modes Identification and Technology Assessment

As stated by its purpose, LI MacArthur Airport's improved connection to the Ronkonkoma LIRR Station will be integrated and reliable, enhancing the airport's values of high quality service. This connection will also support key policy areas of Suffolk County's Comprehensive Masterplan 2035 such as building a 21st century transit network; and priority actions such as the development of compact, walkable communities.

This train-to-plane connection will contribute towards solutions for needs related to regional transportation system linkage, economic growth and travel demand. Nonetheless, it will come to reality only after addressing existing future challenges, related to limited funding options; strict airport standards, rules and procedures; and the spatial constraints that result from an airport site woven into the urban fabric. After overcoming these challenges, the connection should offer a better option for the airport's strong customer base.

Airports around the world employ a wide range of modes to connect into regional transportation networks. This variety of solutions arises from the specific economic, social and physical challenges involved with each airport context. This section introduces ten transportation modes that either have been used, are in planning stage, or could be used to connect airports to regional transportation networks.

This section is comprehensive in listing public transportation modes to airports, and introduces technologies covering different implementation schedules (from under one year to above five years of rollout), capacity thresholds, performance standards, and funding levels. While some solutions presented are time-tested, others are very recent and still do not offer with extensive business cases that can be used for reference. Some solutions are applicable in virtually any context, some are restricted.

These transportation modes and technologies are introduced with high-level considerations for:

- efficiency of use;
- potential environmental impacts;
- technology, land use and development opportunities;
- passenger experience;
- integration with existing transportation network;
- costs and cost effectiveness.

This characterization will support an effort of ranking these modes across a screening criteria matrix, and a constructability assessment, to be carried out on Task 5 of this project, and recorded at an upcoming document. The four highest-ranking modes will be advanced into an implementation plan development phase.

The modes included in this assessment were selected based on the Arup's team experience, LI MacArthur's CBP study, and research into ground transportation access at other airports, and other origin-destination pairs with some operational similarities.

3.1 General Considerations

3.1.1 Connector Station / Boarding Area

The design of the connector's stations or boarding areas will make the system's first impression. From the approach to the station – signage, length and level of pathways – to the experience while waiting – climate control, real-time information – station features can affect a passenger's perception of the airport. While most station details are designed after the planning stage, the potential location of the stations is discussed in this section, for it factors into route alignments, and may even render a specific transportation mode unfeasible, in case of lack of space to reasonably accommodate a station in the Ronkonkoma LIRR Station.

The current boarding area is located at the north side of the LIRR tracks, adjacent to the Ronkonkoma LIRR Station's waiting room and support buildings (Figure 23). From the station overpass, passengers may take an elevator or stairs to the ground level, where they walk 170 ft or 90 ft respectively, under a covered path to reach the Village Taxi waiting room. While the Airport is located south of the LIRR tracks, crossing the nearby Ronkonkoma Ave/Smithtown Ave overpass adds less than a minute to the total travel time. Furthermore, the north-side location is not subject to peak-hour traffic at Easton St., resulting from access and egress of the Suffolk County parking lots to the south of the tracks.

Figure 23: Current LI MacArthur Airport Shuttle boarding zone at Ronkonkoma LIRR Station

Passenger shelter is provided in the retail space currently used as Village Taxi's dispatching and business office. If this space were to become unavailable, and there were still a need to operate a shuttle, it would be necessary to build a new sheltered passenger waiting area. On the north side of the tracks, there is an opportunity to do so at the undeveloped parcel at the center of the bus/taxi loop. Should this parcel become unavailable, a station would have to be developed on the south side, east of the elevator entrance (Figure 24), possibly requiring some additional construction to re-accommodate, shuttle loading areas, traffic lanes, lighting poles and ADA requirements.

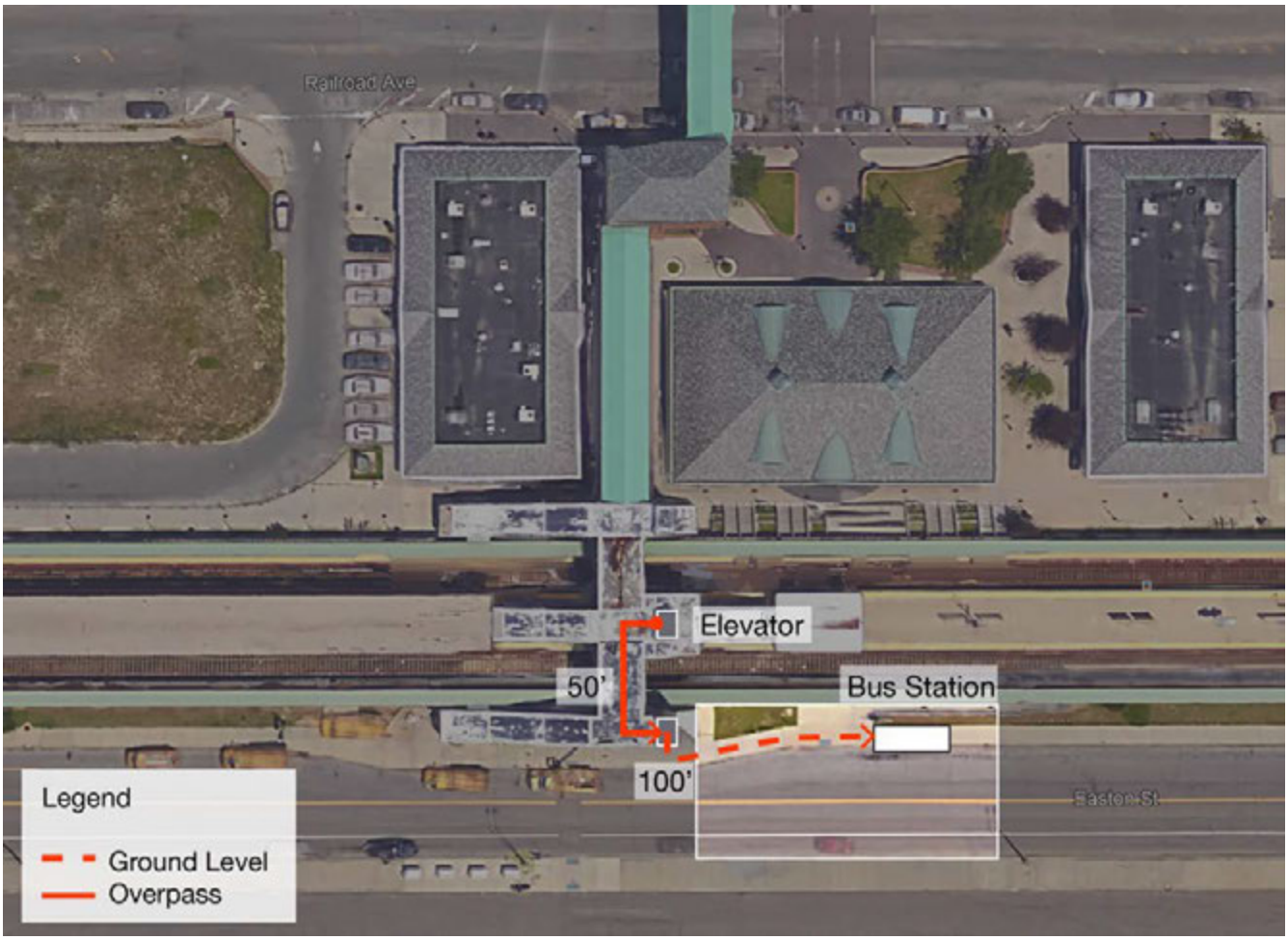

Figure 24: Possible south-of-tracks location for a shuttle passenger waiting area, plan view

There are two situations in which a south side station and boarding area would become the better option: if the connector travels along an on-airport road to the east of the runways, and if the connector needs to travel solely on exclusive guideways, as is the case for automated people movers. The north-south on-airport road would likely start at the gate close to the intersection of Knickerbocker and Railroad Avenues. Knickerbocker Avenue crosses the LIRR tracks at grade, an arrangement that would lead to delays in the shuttle route. In this location, a track overpass could be an impossibility due to conflicts of the potential overpass landing within the RSA or RPZ of an extended runway 6/24, depending on final siting. Figure 25 illustrates a potential location of a south-of-track station for a bus shuttle.

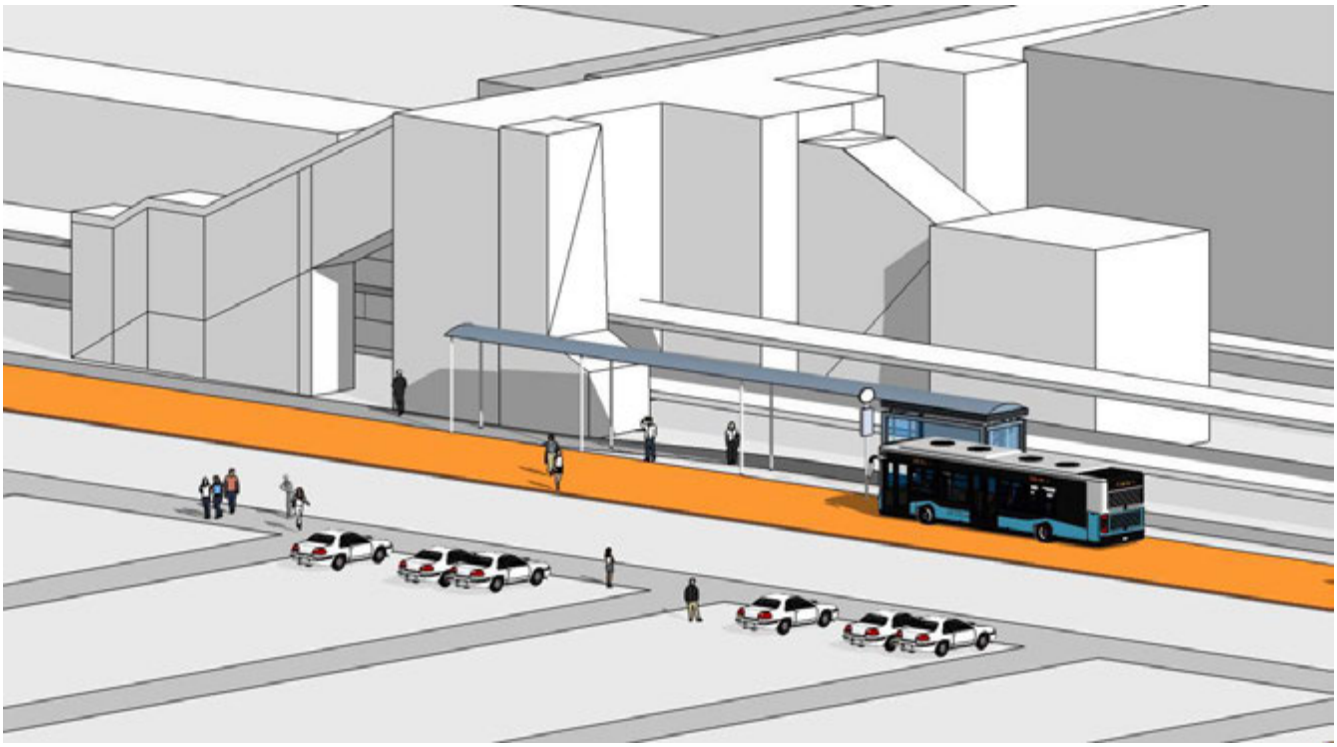

Figure 25: Possible south-of-tracks location for a shuttle passenger waiting area, axonometric view

In the case of travel modes with dedicated guideways, such as people movers and personal rapid transit, a station south of the LIRR tracks is much preferred. The access roads leading to the airport terminal do not have enough width to accommodate dedicated guideways, and therefore elevated structures would be required to carry the tracks over certain segments. A station south of the tracks would require less construction, as it would unlock the possibility of shorter route alignments, and avoid the need of crossing the LIRR tracks.

Still, the presence of elevated structures on an on-airport alignment would raise other issues. Federal restrictions ban the presence of structures on the runways protection zones, so any elevated structure carrying the guideway would have to be sloped down to an underground overpass before entering these zones, possibly leading to substantial engineering challenges in achieving this grade change in constrained spaces.

An elevated station that would allow passengers to go from the track overpass straight into the connector would improve the ease of connection but also entail in more extensive construction (Figure 26).

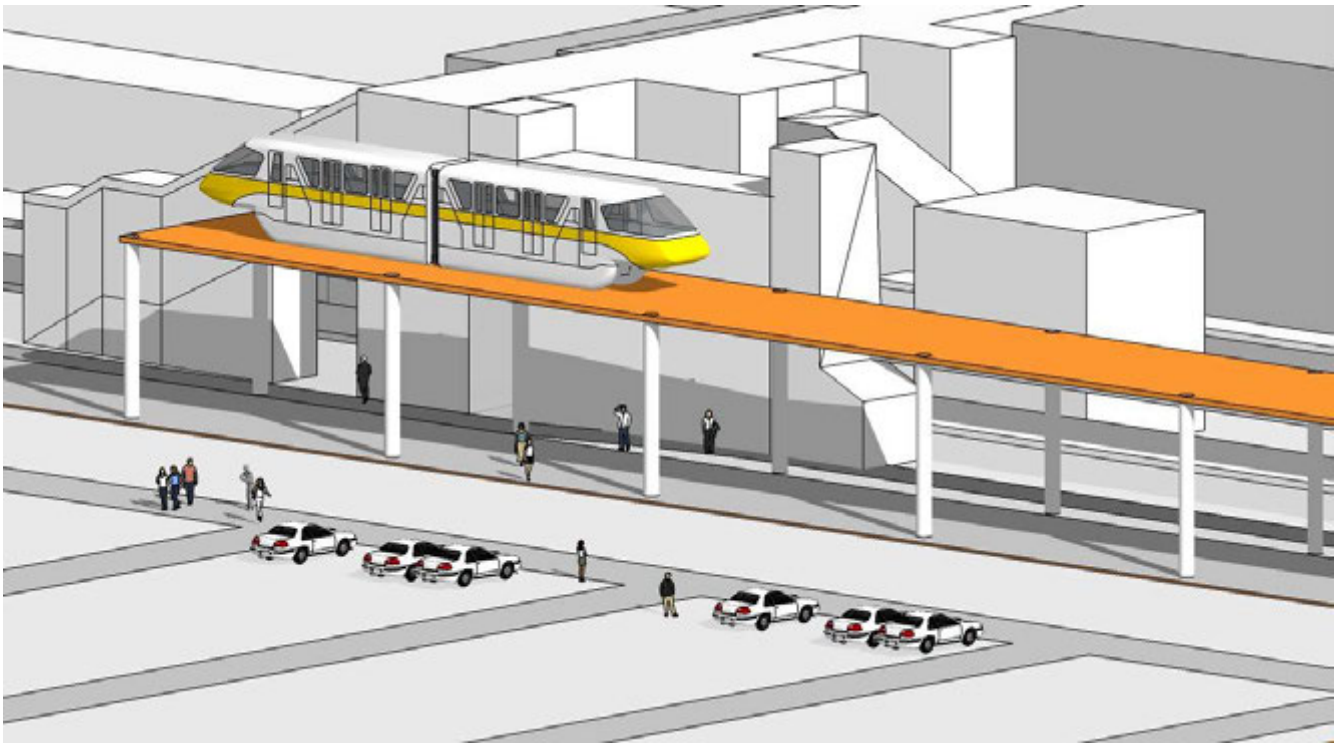

Figure 26: Possible south-of-tracks location for an elevated shuttle passenger waiting area, axonometric view

3.1.2 Route Alignments

Route alignment is one of the key factors for consideration of a transportation mode for the connector. It affects both operating and capital costs, trip length, travel times, reliability and the extent of environmental impact. Alignments options vary with each transportation mode, according to their different requirements of footprint, height, and turning radius. But for slight variations, the current terminal, at the south of the airport site, would have two alignment options, one on-airport and one off-airport. A north-side terminal would have the possibility of having an almost straight-line connection to the Ronkonkoma LIRR Station.

Currently, taxis and vans shuttling between the Ronkonkoma LIRR Station and LI MacArthur's Airport terminal share the roadway with mixed traffic, traveling along off-airport public roads. Coming from the taxi waiting area, located north of the LIRR tracks, the shuttle heads south on Smithtown Avenue before taking short segments of Lakeland Avenue and Veterans Memorial highway to reach the Airport's access roads. The straight-line distance between the Ronkonkoma Station and the Airport Terminal is 1.3 miles, but the driving distance along this typical route, at 3.6 miles, is significantly longer (Figure 26). The opposite direction travel is similar in both length and routing.

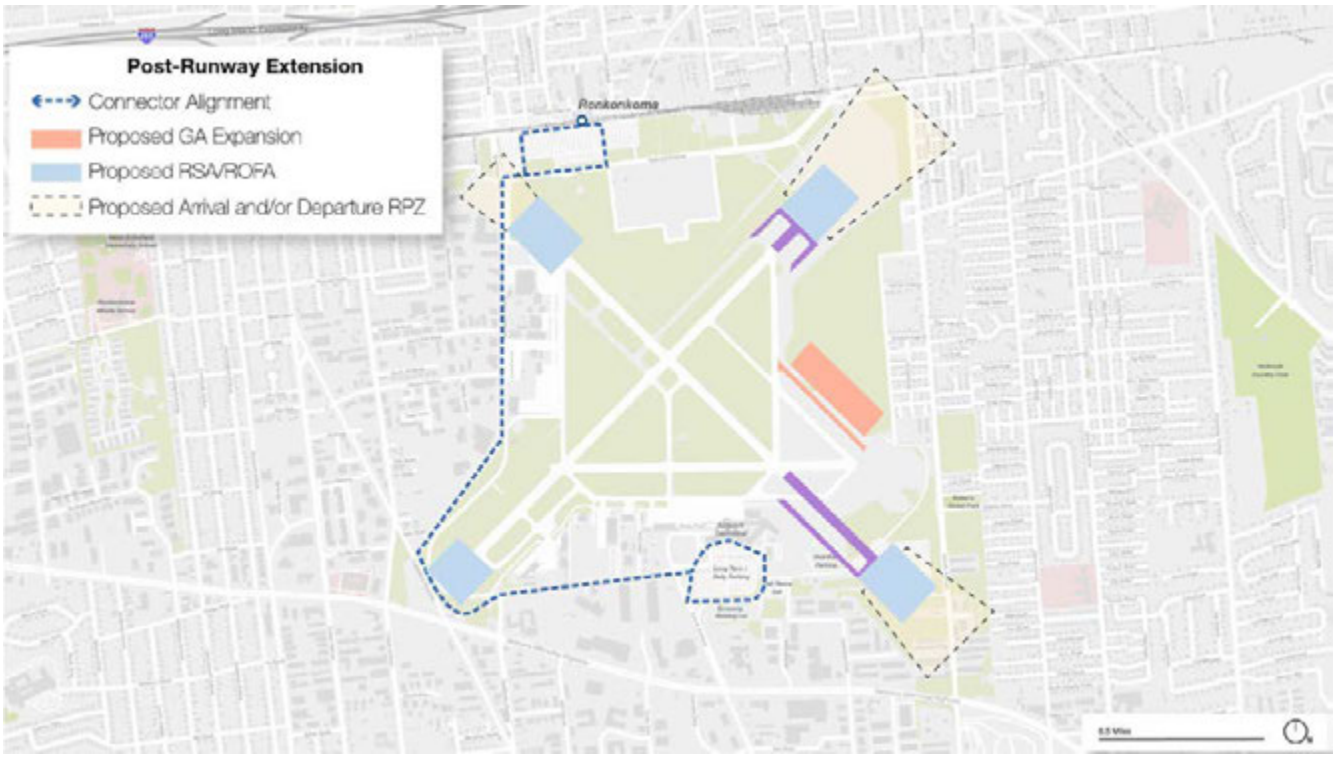

Figure 27: Connector alignment from a station north of LIRR tracks to the Airport Terminal

The off-airport alignment would present challenges to some potential new modes for the connector. For the most part of the alignment, Smithtown Avenue and Veterans Memorial Highway are bound by buildings on both sides, and therefore cannot be widened to accommodate a travel mode that requires exclusive right-of-way. In addition, travel along mixed-traffic is subject to disruptions from non-recurring congestion, such as traffic crashes, work zones and broken vehicles. While infrequent, these events hurt the reliability of the connection system.

An on-airport alignment would, on the other hand, travel mostly along a new, dedicated roadway. The length of this roadway would be approximately 3.5 miles in length. While similar in terms of distance to the off-airport option, it would isolate the connector from non-recurring congestion caused by vehicle breakdowns and crashes in mixed-traffic, and would offer right-of-way for construction of an at-grade, rail-based mode. Starting at the south side of the LIRR Ronkonkoma Station, vehicles would travel along either a new road in the north perimeter of the airport site, or Railroad Avenue before entering the airport side. After they cross the safety areas of runway 6/24 (through a tunnel or another underground structure) where they would turn right to travel south. This alignment is not suitable for modes that require support structures or overhanging wires, for it would cross the RPZs (or potentially the RSAs) of runways 6/24 and 15R/33L with underground structures (such as tunnels or underpasses), in a future scenario in which the runways are extended. In terms of distance, this option is similar to the off-airport, with 3.5 miles in length (Figure 28).

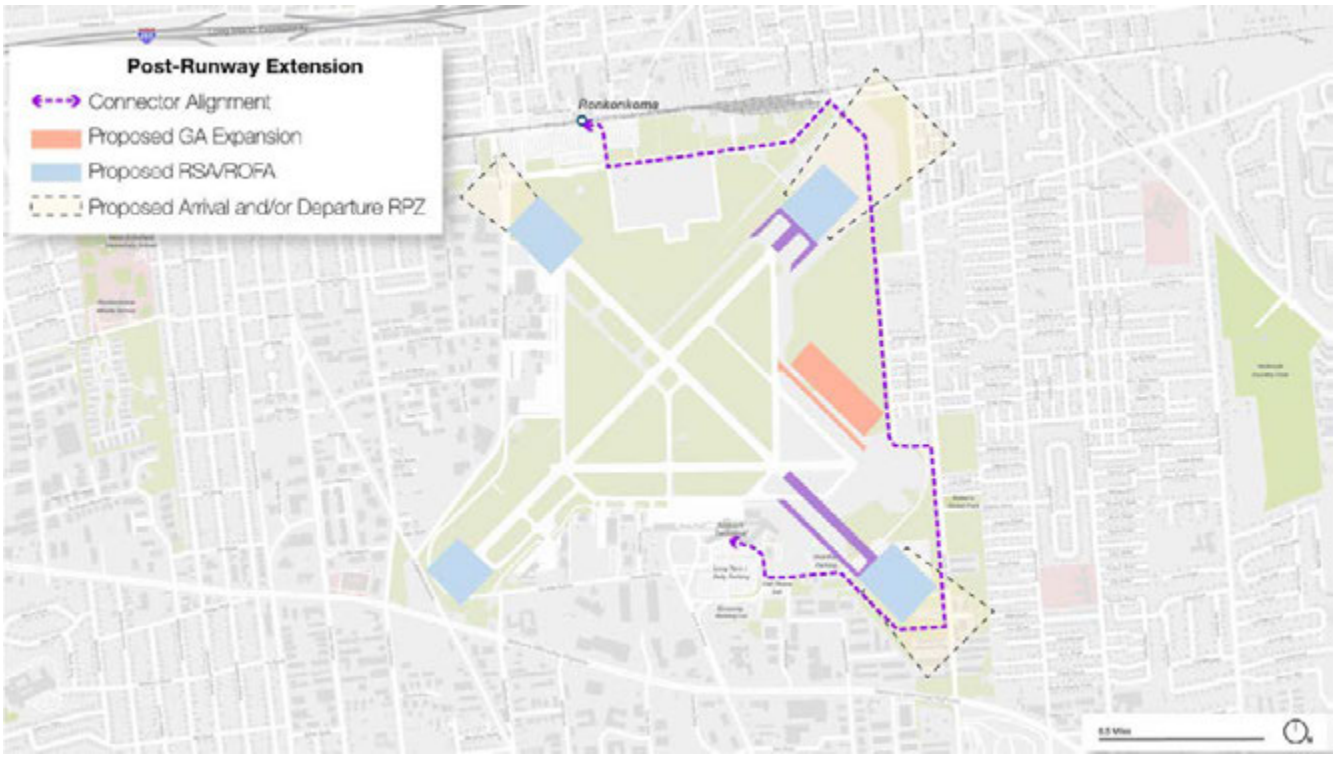

Figure 28: Connector alignment from a station south of LIRR tracks to the Airport Terminal, though on-airport roads

In a long term scenario in which the airport terminal is relocated to the north side of the airport, the connector would have to just cross the commuter parking lot and Railroad Avenue before reaching the new facility. This alignment would likely be less than half a mile long, and would have no height limitations, being an alternative for modes with elevated support structures or overhead wires. Given the short distance, the train station and the airport terminal could even be connected with an underground moving walkway.

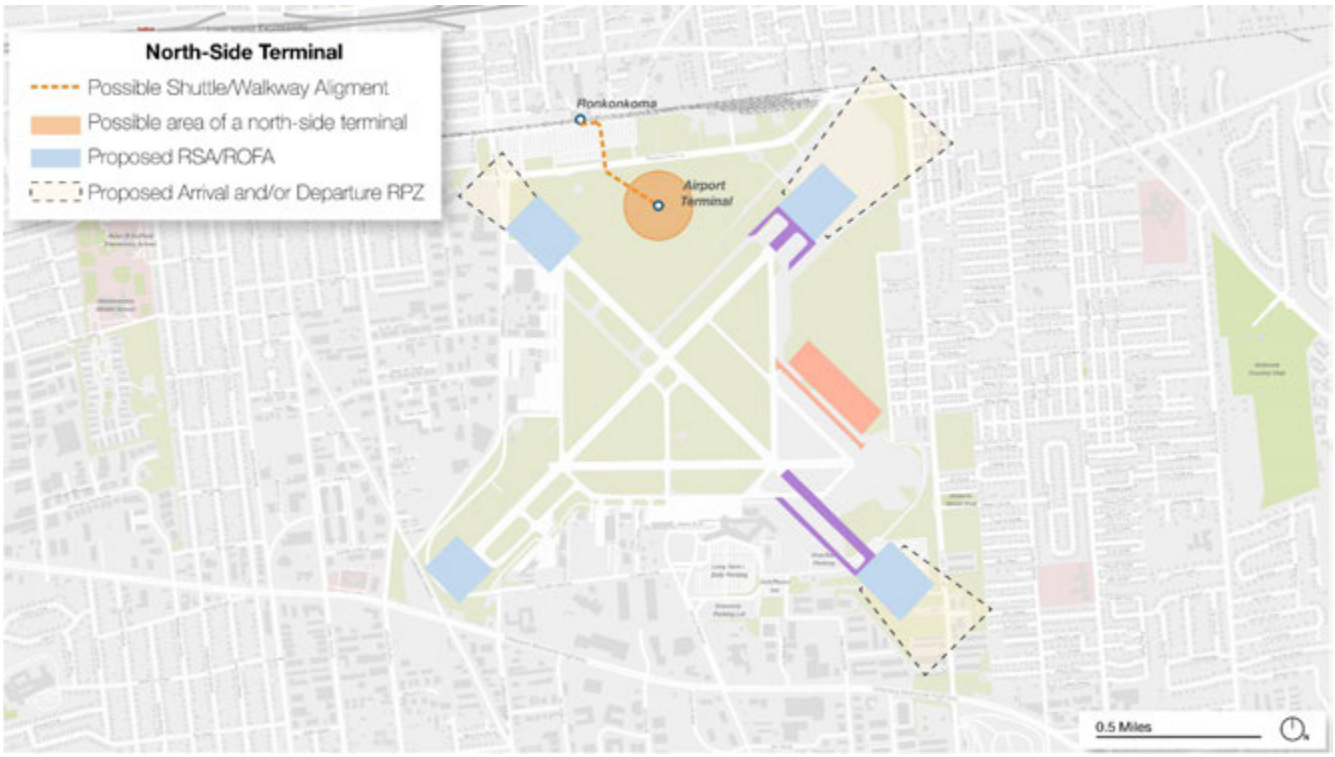

Figure 29: Connector alignment from a north-side Airport Terminal

3.1.3 Automated Vehicles

The impacts of automated vehicles (AVs) on our mobility systems will be so deep, that they may reshape our spatial relationship with urban areas, and which implications "will cut across every facet of government, society, and the economy." [84] Commercial fully automated vehicles are not yet the reality, but we already experience some degree of vehicular automation, and technology and regulations are in progress.

Vehicle automation exists in a spectrum of increasing scope and efficacy for driving support functions. In 2016, the U.S. Department of Transportation (USDOT) adopted SAE International's levels of automation for defining driving automation.[85] This scale ranges from 0 – for 'No Automation' – to 5 – for 'Full Automation'. Technologies on level 4 – 'High Automation' – are undergoing pilot projects and could see commercial deployment in the next few years.

'Highly automated' vehicles have a system capable of monitoring the environment and can control the vehicle under some conditions. Several companies have functioning prototypes of shuttles (with capacity between 9 to 12 people) with this technology; pilot projects are taking place in the U.S.[86],

[84] (Bloomberg Philantropies, The Aspen Institute, 2017, p. 7)
[85] (SAE International, 2016)
[86] (Navya, 2017c), **Invalid source specified.**

Europe[87] and Japan.[88] These vehicles are not yet capable of navigating busy public roads with mixed-traffic, and are available for circulation in private areas or very limited sections of public roads. While the individual vehicles do not require drivers, the system as a whole is managed remotely by operators capable of handling exceptions and issues. The RPA predicts that microtransit[89] operators will start to incorporate these vehicles in their fleets before the year 2022.

The combination of technologies that will enable vehicles to be fully automated, i.e. to be "…capable of performing all driving functions under all conditions" [90], is in fast development and automated vehicles will have a "significant number of trips" in the New York Region "over the next two decades."[91] The RPA predicts that some AVs will enter the market by 2022, but that only after 2027 they will start to be increasingly adopted. Legislation is still a major obstacle in the way of automated vehicles, since they will upend the current practices of licensing, liability and insurance, in addition to creating new issues with privacy. Once fully automated vehicles enter the roads *en masse*, the benefits of the technology will be amplified and significant changes in the built environment will take place.

The connector between Ronkonkoma LIRR Station and LI MacArthur Airport would be a good fit for adoption of AVs, once the technology and regulatory systems become more mature. Benefits would include not only reduction of operating costs, but also reduction in costs associated with crashes and liability payments. The bus transit industry has shown in recent years a trend of increase in liability expenses, even with a trend of reduction of crashes.[92] Because 94% of road accidents[93] result from human errors, driving automation would reduce the connector's exposure to this risk.

3.2 Transportation Modes

As a first step in the analysis of alternatives, the project team has conducted a summary assessment of 10 transportation modes and technologies which could satisfy the needs of a new train-to-plane connection. This assessment details high-level considerations for efficiency of use, potential environmental impacts, technology, land use and development opportunities, passenger experience, integration with existing transportation network, and costs/cost effectiveness for each of the ten modes.

An approximate delivery timeframe is also included for each mode: less than two years; between two and five years; and more than five years. This represents a planning-level estimate of when service could be initiated once Suffolk County and LI MacArthur agree upon preferred mode and should primarily be understood to provide a reasonable comparison of deployment time between the modes assessed for this project.

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[87] (Easy Mile, 2016), (Navya, 2017b)
[88] (Navya, 2017)
[89] "App and technology-enabled shuttle services, typically in a can-size vehicle; some with dynamic routing, others with semi-fixed routes", ex: Via, and Chariot. (Regina R. Clewlow, 2017, p. 4)
[90] (National Highway Traffic Safety Administration (NHTSA), 2017, p. 4)
[91] (Regional Plan Association, 2017, p. 2)
[92] (Jerome M. Lutin, 2013)
[93] (Barclays, 2016, p. 11)

The information compiled will be used identify which transportation systems have the greatest potential to meet the project's needs and should developed for further analysis in the task 5 memo.

The transportation modes and technologies assessed fall roughly into three categories:

- **Point-to-point** – Modes that do not require significant investment on stations, tracks and rolling stock; and that may pickup and drop-off passengers at almost any location. The service would require limited additional investment and capacity can be easily shifted to and from other transportation markets in Suffolk County:
  - **Existing taxi service**
  - Upgraded taxi service
  - Transportation Network Company (TNC) / ride-hailing service
- **Structured centered on airport –** Modes that require investment on stations, transitways or rolling stock that would mostly be mobilized in the train-to-plane connection. These modes are mostly considered when designing a transportation system entirely focused on airport passengers and employees:
  - Shuttle
  - Gondola
  - Automated People Mover (APM)
  - Personal Rapid Transit (PRT)
  - Moving walkway
- **Structured branched to airport** – Modes that require investment on stations, transitways or rolling stock that would be mobilized in a county transit network, with an extension to the train-to-plane connection. These modes are mostly considered as solutions to regional mobility goals, and can either be extended to or start from the train-to-plane link:
  - Bus Rapid Transit (BRT)
  - Streetcar
  - Light Rail Transit (LRT)

3.2.1 Upgraded Taxi Service

Figure 30: Nissan NV 200 in use as a taxi in NYC, New York, NY (Image source: Lawrence, J)

Overview

A fleet for-hire vehicles offers rides for individual passengers or small groups. Rides are summoned either by hailing a taxi or by communicating through a mobile device app.

Precedents

Many airports around the country advertise taxi services that connect terminals with rail stations. Examples include Trenton-Mercer, Long Beach, Harrisburg, and New Haven, and LI MacArthur itself.[94,95,96,97]

At MacArthur Airport

Orientation to pick-up areas would be facilitated by improved signage at Ronkonkoma Station. Service awareness and convenience of transaction would be improved with updated LIRR ticket vending machine system and app. Application would allow users to book rides in advance, pay for fare, and secure a vehicle with enough storage for luggage. Vehicles could be updated to incorporate modern design comfort standards.

Assessment

Taxis are the current mode of connection between Ronkonkoma Station and MacArthur Airport. Village Taxi drives MacArthur Airport-bound passengers from Ronkonkoma Station for a flat fare of

[94] (Mercer County, New Jersey, n.d.)
[95] (Long Beach Airport, n.d.)
[96] (Harrisburg International Airport, n.d.)
[97] (Tweed New Haven Airport, n.d.)

$5.00 per person.[98] At the airport, the taxi stand sits outside baggage claim. Airports of all sizes utilize taxi services as a key ground transportation option.

The taxi service could be improved to offer a better user experience without structural changes to operational schemes and infrastructure. After updates, the LIRR ticket kiosks and mobile device app would recommend the purchase of the taxi voucher after user selection of Ronkonkoma as a destination. At Ronkonkoma Station, wayfinding and ease of orientation would be improved with more conspicuous signage guiding to the taxi stand.

The taxi fleet would have new vehicles to offer passengers a more comfortable ride. Cars would offer amenities such as USB charging ports, wheelchair accessibility, flat passenger floor area, independent climate control on all vehicles. Keeping today's operating practice, this managed fleet would always make vehicles available at Ronkonkoma Station at train arrival times, to ensure passengers complete their journeys to the airport without interruptions.

Delivery Time Frame

Less than two years.

Planning Level Cost Estimate

Capital Expenditures: $200,000 - $1,000,000[99] (for modernization of fleet, signage improvements and improvements on boarding zones to offer level boarding)

Operating costs: $5 per passenger[100,101]

[98] (Long Island MacArthur Airport, n.d.)
[99] Arup estimate, assuming an updated vehicle fleet
[100] (Long Island MacArthur Airport, n.d.)
[101] Operating costs on annual basis are unknown; costs represent those borne by passengers.

3.2.2 Transportation Network Companies (TNCs)

Figure 31: Lyft Driver (Image source: Flickr User Perspective)

Overview

Also known as "ride-hailing" services, companies like Uber and Lyft provide customers the ability to arrange a ride using a GPS-enabled smartphone. Micro-transit firms, such as Chariot and Via, offer demand-driven mass transit routes on high occupancy vehicles (such as vans and mini-buses).

Precedents

Local agencies in Dallas, Los Angeles, Pinellas County, FL and Centennial, CO have developed pilot programs to enhance local transit through partnerships with TNCs.[102,103,104,105]

At MacArthur Airport

TNCs like Uber and Lyft are already operating in Suffolk County and are being used to connect to LI MacArthur Airport. Users request rides between a designated location at terminal and the train station using their phones. An operational agreement with TNCs could be adjust fares to regulate competition with the traditional taxi system.

[102] (DART, 2015)
[103] (The Source, 2016)
[104] (PSTA, 2016)
[105] (Centennial Innovation Team, Fehr & Peers, 2017)

Microtransit services like Chariot ad Via currently do not offer train-to-plane routes. These services could offer a complement the existing system, and possibly be extended to address mobility needs on other points of the County.

Assessment

TNCs, like Uber or Lyft, arrange rides between drivers and passengers using mobile devices. Drivers are independent and do not have scheduled shifts, working hours they deem convenient and profitable. TNCs operate as intermediaries between the drivers and passengers in want of a ride, and do not actively manage the service offer. These companies do, however, manage the pricing schemes and could negotiate special fares for an airport connection. TNCs are widely used for ground transportation access to airports of all sizes, and do not present significant demand considerations.

Currently, a TNC ride between Ronkonkoma Station and the airport terminal is priced at approximately $10.00. Throughout the U.S., various TNC partnership models have emerged for complementing transit service. With subsidies for the "first and last mile", TNCs connect users to transit stations and leverage the potential of regional transportation networks. Such arrangements require commitments for minimum service, as the default approach is market-driven supply that may not be as reliable as an airport connector would have to be. TNCs are also a low-capacity mode: service is usually provided in sedans or SUVs capable of comfortably carrying a maximum of three to four passengers with luggage.

Multiple vehicles categories are offered by TNCs, and they can be equipped to service people with disabilities, or accommodate baggage.[106]

Delivery Time Frame

Less than two years.

Planning Level Cost Estimate

Capital Expenditures: $0

Annual Operating Costs: $10 per ride, depending on arrangement[107]

[106] (Transit Center, 2016)
[107] Based on a trip booked with Uber app at 5:00 pm on August 22, 2017.

3.2.3 Shuttle Bus

Figure 32: LAX Shuttle, Los Angeles, CA (Image source: Flickr User Lucian400)

Overview

A dedicated bus service traveling along fixed routes on fixed schedules.

Precedents

Shuttle service is already provided by Village Taxi at LI MacArthur, but without fixed schedules.[108] Commonly used where rail or other higher-speed transit services are located on alignments near the airport, such as Boston, San Jose, Fort Lauderdale, and Baltimore, and Milwaukee.[109,110,111,112]

At MacArthur Airport

A dedicated bus links the Ronkonkoma LIRR station with the airport terminal. The service is timed to connect to trains and feature amenities catering to air travelers. An improved service could have dedicated stations offering level boarding, real-time information on flights and connection status,

[108] (Village Taxi, 2017)
[109] (Massport, 2017a)
[110] (Santa Clara Valley Transportation Authority, 2017)
[111] (South Florida Regional Transportation Authority, 2015)
[112] (Baltimore/Washington International thurgood Marshall Airport, n.d.)

climate control and fare payment kiosks. In a scenario with and alignment through the airport, a south of tracks station would be more conveniently located for passengers.

Assessment

Traveling through public roads and mixed traffic, shuttle buses connect the airport terminal and the train station with no need for capital works. Passengers meet a bus waiting for them at each end of the trip, with departures timed to train and airplane arrivals. Airports of all sizes use shuttles for circulation between terminals and parking lots. The smallest airport identified with a short-haul shuttle to a nearby rail link was Milwaukee's General Mitchell Airport.

Passengers board and alight at dedicated areas fitted with amenities to facilitate movement and luggage handling. Travel takes place over public roads along with mixed traffic, and therefore is subject to traffic congestion. Travel reliability can be improved by construction of a dedicated alignment through the airport site. The shuttle buses would jump ahead road segments with recurring traffic backups and speed degrading.

There is wide variety in vehicles, passenger amenities, fare policy, and operators, with some shuttles run by the airport themselves (typically on a contracted-out basis), and others run by the local transit agencies who operate the connecting services. Currently and LI MacArthur, the airport shuttle is operated by Village Taxi. A high-quality service would likely require two vehicles (plus a spare). Operating 2 to 4 trips per hour, the person capacity of such a system would be approximately 80 to 170 persons per hour at the peak direction.

Delivery Time Frame

Less than two years.

Planning Level Cost Estimate

Capital Expenditures: $500,000 - $1,000,000[113]

Annual Operating Costs: $500,000 - $800,000[114]

[113] (John A. Volpe National Transportation Systems Center, 2016), Arup
[114] (Federal Transit Administration, 2016), (Strunsky, 2016)

3.2.4 Gondola

Figure 33: Emirates Airline Cable Car, London, UK (Image source: Pixabay User NadinLisa)

Overview

Cabins supported and propelled by overhead cables connecting stations. Used to cross landscapes where ground options are too costly or inconvenient.

Precedents

Portland, Oregon, opened an urban system in 2006. The EU awarded funds to Genova, Italy, to connect the Erzelli train station and the airport.[115],[116]

At MacArthur Airport

Gondolas are not a feasible connection solution for the current LI MacArthur terminal. To reach the terminal where it stands today, south of the runways, a gondola would have to depart from the south side of Ronkonkoma, head southwest along Smithtown Avenue, and turn left to reach the passenger terminal from the west, conflicting with the RPZs for the runways.

Only a new passenger terminal facility, north of the runways, would allow a feasible gondola alignment, which could connect the track overpass straight into the new passenger terminal.

[115] (Portland Aerial Tram, n.d.)
[116] (Center for Urban Projects, 2013)

Assessment

Gondolas offer a fixed-guideway transit option at lower capital costs than rail modes, and travel with minimum impact to ground level activity. They also have lower operating costs – staff is only present at stations – and, because service is electrified, do not generate local emissions. Capacity of ropeway transit systems varies by technology, but typical planning capacities are about 4,000 to 6,000 persons per hour in the peak direction for gondola systems.[117]

Cabling and shifting technologies produce different combinations of cost, capacity, speed and station footprints. Because cabins are not powered, there are inherent climate control challenges. Gondolas also have environmental impacts associated with elevated structures, including shadowing and obstructing view sheds.[118] To avoid operation with empty cabins, the gondolas can run as needed to match the LIRR schedule.

Delivery Time Frame

Five years or more.

Planning Level Cost Estimate

Capital Expenditures: $150,000,000 - $250,000,000[119]

Annual Operating Costs: $1,500,000 - $4,000,000 [120]

[117] (Center for Urban Projects, 2013)
[118] (Dale, 2013)
[119] (Dale, 2013)
[120] Arup, based on prior project research

3.2.5 Airport People Mover (APM)

Figure 34: JFK Air Train (Image source: Ad Meskens, Wikimedia)

Overview

APM is a grade-separated mass transit system with full automated, driverless operations, featuring vehicles that travel on guideways with an exclusive right-of-way.

Precedents

APM systems are widely used by airports around the world. There are 51 systems in operation. The number of APMs has more than doubled in the 21st century.

At MacArthur Airport

Stations would be located at the passenger terminal, and at the track overpass at Ronkonkoma LIRR Station, where passengers would access the vehicle without having to moving down to ground level. From that station, the APM would gradually slope down to ground level, where it would enter the airport site, to cross it with an entirely at-grade alignment, arriving at the passenger terminal from the east.

Assessment

Due to their high reliability and distinct image, people movers create the perception of arrival at the airport at the moment passengers board the trains. Passengers experience a smooth and comfortable ride in vehicles designed with air travelers in mind, offering ample accommodation for baggage to be checked and other carry-on items. A feature familiar to many of the world major airports, people movers enhance the airport's image and brand.

People movers' trains travel through exclusive guideways completely segregated from other forms of traffic. The guideway can be laid within airport property (either at ground level or below grade with a tunnel or underpass), or over public roads with an elevated structure. Trains are electrically powered, and energy is supplied by a power distribution subsystem. While the trains are automated and driverless, the system requires a staffed control center, and a maintenance and storage facility.

Airports with APM systems are typically medium or large hub airports serving between 12 million annual passengers (MAP) and 30 MAP of O/D passengers. Current APM systems serve various landside and airside facilities, including multiple terminals, parking facilities, car rental locations, and regional rail. Typical demand and capacity for these systems vary depending the number and type of locations served by the APM. Passenger demand ranges from 1,000 to 3,500 persons per hour in the peak direction (pphpd). A high-frequency, landside system can carry a maximum of between 3,000 and 6,000 pphpd.[121] For a simple airport connection at LI MacArthur operating using two trainsets, the person-capacity of an LRT line would range from approximately 300 ppdph (at twice hourly frequency with a 2-car train) to 900 ppdph (at frequencies of four trains per hour with a 3-car train).

An alignment that circumvents the airport site would be elevated, with land take for a supporting structure. Crossing the airport site, the trains would travel at grade or through an RPZ underpass.

Delivery Time Frame

Five years or more.

Planning Level Cost Estimate

Capital Expenditures: $250,000,000 - $650,000,000[122]

Annual Operating Costs: $1,500,000 - $3,500,000[123]

[121] (Airport Cooperative Research Program, 2010)
[122] (AECOM, 2017)
[123] (Federal Transit Administration, 2016)

3.2.6 Personal Rapid Transit (PRT)

Figure 35: Heathrow Airport ULTra PRT Pods, London, UK (Image source: thetransportpolitic.com)

Overview

Small autonomous vehicles providing on-demand point-to-point service along a fixed guideway.

Precedents

Limited. System in operation at London-Heathrow between Terminal 5 and its parking garage. Four similar small-scale systems operating worldwide.[124]

At MacArthur Airport

Stations would be located at the passenger terminal, and at the track overpass at Ronkonkoma LIRR Station, where passengers would access the vehicle without having to move down to ground level. From that station, the PRT would gradually slope down to ground level, where it would enter the airport site, to cross it with an entirely at-grade alignment, arriving at the passenger terminal from the east.

Assessment

PRT offers a very high-quality trip in situations where demand is not great enough to justify a higher capacity form of transit. The capital costs are not as high as would be encountered with any form of rail service, but still requires right-of-way acquisition, environmental clearance, and guideway construction.

[124] (LHR Aiports Limited, n.d.)

The guideways must be separate from any public accessible right of way, and would exist either alongside public roads or within the airport property. PRT's small vehicles and small fleet provide a specific mobility solution, but cannot be considered mass transit. The lack of worldwide PRT examples means that each system is a bespoke design with significant capital expenditure and high costs per passenger. The relative rarity of PRT means that reliance on it as a primary transportation solution should be considered experimental.

The capacity of these systems is highly scalable to meet the needs of individual applications. The Heathrow Pod system is designed to carries approximately 800 passengers daily between Terminal 5 and the T5 parking lot, but is theoretically capable of carrying 1,125 pphpd.[125] A higher demand system could reach capacities upwards of 10,000 pphpd.[126]

By the time a PRT system has been approved, constructed, and commissioned, roadworthy autonomous vehicles may be deployed, rendering the PRT largely obsolete.

Delivery Time Frame

Five years or more.

Planning Level Cost Estimate

Capital Expenditures: $150,000,000 - $450,000,000[127]

Annual Operating Costs: $500,000 - $3,000,000[128]

[125] (Ultra Global PRT, n.d.)
[126] (Furman, Fabian, Ellis, Muller, & Swenson, 2014)
[127] (Yoder, Weserman, & DeLaurentis, 2000)
[128] Arup

3.2.7 Moving Walkway

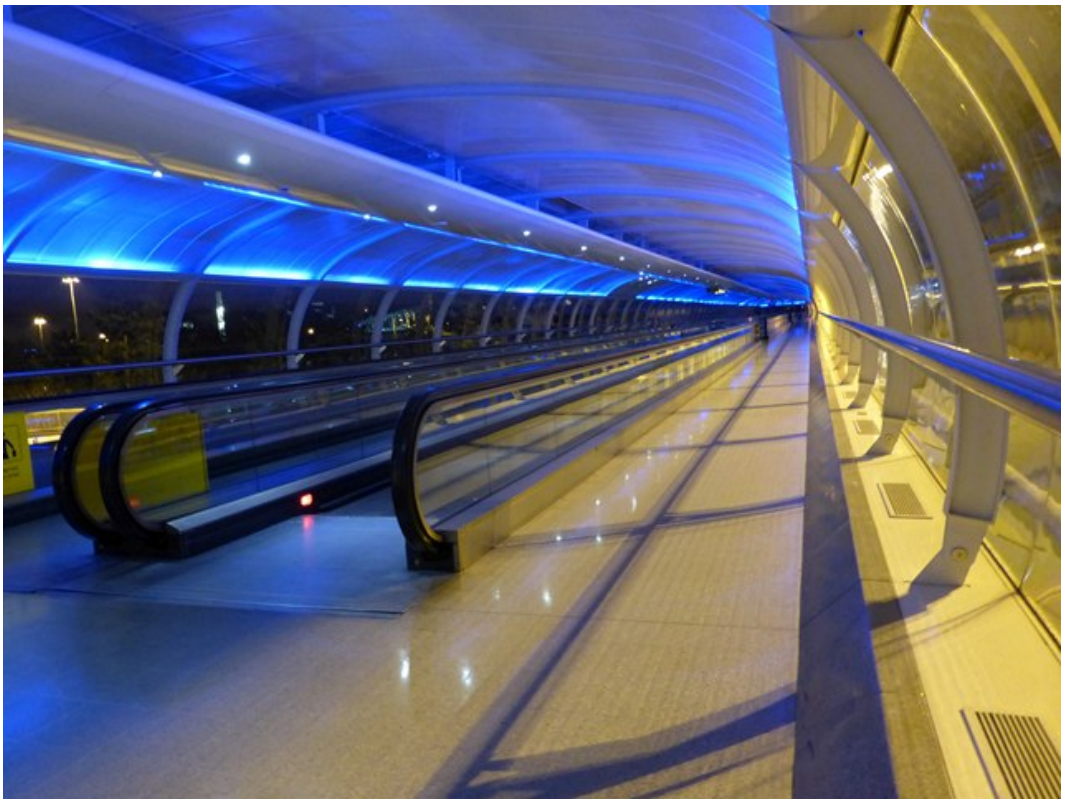

Figure 36: Moving Walkway in Manchester, UK (Image source: G. Hogg, geograph.org.uk/photo/4263645)

Overview

A moving walkway is a slow-moving conveyor mechanism that transports people across a horizontal or inclined plane over a short to medium distance.

Precedents

Walkways are present on a large number of airports. The longest planned walkway is at Boston Logan International Airport, with 2,640 ft. Federal guidance advises distances up to 1,500 ft.[129]

At MacArthur Airport

A covered, climate-controlled, moving walkway to connect the terminal with a new passenger terminal, located north of the runway, or as part of an overall solution for a connection with the LIRR.

[129] (Airport Cooperative Research Program, 2012)

Assessment

Moving walkways are used widely at airports. IATA suggests a maximum unaided passenger walking distance of 985 feet; moving walkways increase the appropriate distance up to 2,133 feet.[130] The longest moving walkway yet proposed is 2,640 feet, and would connect Terminal E at Boston Logan International Airport with the Blue Line's Airport Station. [131]

In the short- to medium-term, a moving walkway could be an appropriate addition to an overall transportation solution for the airport. It may be desirable to locate new transportation facilities adjacent to the existing airport terminal or LIRR station, rather than directly at the entrances. In this case, a moving walkway could improve the overall passenger experience by reducing the effort and time required to walk between the LIRR, the new airport link, and the terminal.

While generally inexpensive to operate, walkways can breakdown, requiring repairs, and should be located within an interior structure with climate control. A new entrance to the existing terminal might be required to interface with the walkway alignment.

Delivery Time Frame

Less than two years.

Planning Level Cost Estimate

Capital Expenditures: $15,000,000 - $40,000,000 per 1,000 feet.[132]

Annual Operating Costs: Walkway – negligible

[130] (IATA, 2004)
[131] (Rocheleau, 2015)
[132] (AECOM, 2017)

3.2.8 Bus Rapid Transit (BRT)

Figure 37: Swift BRT Vehicle, Snohomish County, WA (Image source: Flickr User Oran Viriyincy)

Overview

Enhanced buses, traveling along dedicated lanes with signal priority, offer reliable, convenient, and fast transit. Systemic operational control ensures high levels of service.

Precedents

Airports with BRT stations include LaGuardia Airport New York and Logan International in Boston. These routes provide service from various neighborhoods to the terminal, and do not serve as dedicated connections to other transit facilities.[133, 134]

At MacArthur Airport

The planned Nicolls Road BRT will have a stop at Ronkonkoma LIRR Station. The train-to-plane connection could be served by a dedicated BRT route connecting the airport passenger terminal to this planned BRT station. This new branch would have the same vehicle standard and operator as Nicolls

[133] (The Port Authority of New York & New Jersey, 2017)
[134] (Massport, 2017b)

Road BRT, to better integrate both routes, and reduce transaction costs of setting up the train-to-plane branch. Transit signal priority and dedicated ROW along route to Airport.

Assessment

BRT offers a transit system with high flexibility, reliability and convenience. It employs a suite of tools, including state-of- the-art vehicles; dedicated travel lanes, priority at traffic signals; and high quality station amenities. Theoretical capacities for high-frequency BRT systems range from 10,000 pphpd on arterial streets to 30,000 pphpd on fully dedicated rights-of-way.[135]

Airports with BRT stations include LaGuardia Airport New York and Logan International in Boston. These routes provide service from busy transit stations in dense neighborhoods to the terminal, rather than a dedicated rail-to-air connection. A new BRT link for LI MacArthur Airport operate on a circuitous alignment that avoids the airfield and would be approximately 3 miles in length, and would likely require two vehicles (plus a spare). Operating 2 to 4 trips per hour, the capacity of such a system would be approximately 125 to 250 ppdph. Dedicated transit-way would be constructed on airport property, with transit priority at intersections with public roads.

Stations could feasibly be constructed at the island in front of the LI MacArthur Airport terminal building, as well as at Ronkonkoma LIRR station. For a pure airport connector, only these two stations would be proposed, although the connector could potentially share a station facility with the proposed Nicolls Road BRT system at the train station. Bus fleets could be outfitted with luggage racks. A typical service pattern for BRT would include 10-15 minute headways, but a dedicated airport connector could be also timed to simply meet trains approximately every 30 minutes.

Delivery Time Frame

Between two and five years.

Planning Level Cost Estimate

Capital Expenditures: $40,000,000 - $130,000,000[136]

Annual Operating Costs: $500,000 - $1,500,000[137]

[135] (U.S. Department of Transportation Federal Transit Administration)
[136] (AECOM, 2017), (Federal Transit Administration, 2017)
[137] (Federal Transit Administration, 2016),

3.2.9 Streetcar

Figure 38: Streetcar in Portland, OR (Image source: M.O. Stevens, Wikimedia)

Overview

Streetcars are electric, rail vehicles, operating in mixed-traffic and on tracks embedded in the pavement. Station design is similar to a high quality bus stop.

Precedents

Many cities throughout the US use heritage and modern streetcars, including Portland, OR, Seattle, WA, Washington, DC, and Boston, MA. None reviewed connect to airports.[138,139,140,141]

At MacArthur Airport

Streetcars running between terminals constructed at LIRR station and adjacent to Airport terminal. The streetcars would operate without the overhanging wires in the alignment through the airport, relying on batteries for power.

A train-to-plane streetcar link could be the first branch of a wider streetcar network connecting other travel markets in Suffolk County. The train-to-plane streetcar would solve the airport ground

[138] (Portland Streetcar, Inc., 2017)
[139] (Seattle Streetcar, n.d.)
[140] (DDOT, 2017)
[141] (About the T, n.d.)

connection to LIRR, and would bring technological know-how to the County, that could be leveraged to expand the system. Rail-based systems, such as streetcars, have shown potential to increase property values, and to unlock new opportunities for transit-oriented developments.

Assessment

Streetcars are rail vehicles typically operated in a single-unit configuration over tracks embedded in asphalt or concrete roadway in mixed traffic. Streetcars are propelled by electric motors powered by overhead wires, and thus do not produce local emissions.[142] Some modern streetcars are capable of operating off-wire for portions of their route using battery power. Batteries may be charged via induction at stops or while traversing route segments with overhead catenary. Vehicles capable of switching between wired and battery operation were recently procured in Dallas.[143] Streetcars have shallow track foundations that require limited relocation of utilities, and require little additional communications and signaling infrastructure. [144]

Streetcars have operating speeds similar to buses, but have larger cars that are able to carry more passengers (90-200+) and which provide a smoother, quieter ride than buses.[145]

Because the quality of streetcars is perceived as higher than bus systems, they have higher economic development impact on its surroundings in those contexts.[146]

A streetcar line could be added to existing roadways around the airport, or through the east side of the airfield, with stations at Ronkonkoma Station and a station near the terminal. No stops would be proposed between these two stations. However, such a system could be theoretically be extended to other major residential and employment centers nearby the airport, leading to potential economic impacts. A simple streetcar connector at LI MacArthur, operating using two vehicles at frequencies of two to four trips per hour, would have a person-capacity of approximately 210 to 420 ppdph.

Overhead wires may be a concern, necessitating use of off-wire technology Tail tracks or turnarounds would be required at both ends to change direction.

Delivery Time Frame

Between two and five years.

Planning Level Cost Estimate

Capital Expenditures: $150,000,000 - $250,000,000[147]
Annual Operating Costs: $1,000,000 - $4,000,000[148]

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[142] (APTA, 2014)
[143] (Brookville Equipment Corporation, 2013)
[144] (Tumlin, 2011)
[145] (APTA, 2013)
[146] (Weiner, 2014)
[147] (Federal Transit Administration, 2017)
[148] (Federal Transit Administration, 2016)

3.2.10 Light Rail Transit (LRT)

Figure 39: Link LRT SeaTac/Airport Station, Seattle, WA (Image source: Flickr User andynash)

Overview

Rail service that can run in mixed traffic or dedicated right-of-way. Smaller vehicles and lower operating costs than traditional subways or commuter rail services.

Precedents

Light rail is an airport access option at a number of large cities and airports across the US, including Dallas-Fort Worth, Seattle, Minneapolis-Saint Paul, and Saint Louis.[149,150,151,152] Service typically links the airport with important residential and employment centers as part of an overall transit network.

At MacArthur Airport

A light rail connecting a station within the terminal to Ronkonkoma Station and potentially points beyond. The vehicle would have level boarding and luggage racks. Through an on-airport alignment, the vehicle would dispense with overhanging wires, being powered by batteries.

[149] (DART, 2017)
[150] (DDOT, 2017)
[151] (Metropolitan Airports Commission, 2017)
[152] (St. Louis Lambert International Airport, 2017)

A train-to-plane LRT link could be the first branch of a wider light-rail network connecting other travel markets in Suffolk County. The train-to-plane streetcar would solve the airport ground connection to LIRR, and would bring technological know-how to the County, that could be leveraged to expand the system. Rail-based systems, such as LRTs, have shown potential to increase property values, and to unlock new opportunities for transit-oriented developments.

Assessment

Light rail has been used at a number of airports in the United States, as it often represents a compromise between speed from the city center to the airport and ridership demands.

The footprint for a light rail right-of-way, its stations, and ancillary facilities often allow a light rail station to be built directly into a terminal. Passengers, both airport and non-airport, tend to view light rail as a fast, predictable, and easy to use form of transit. Airports reviewed that featured LRT connections had a wide range of air passenger demand, from about 7 million to 30 million annual enplanements.[153] These LRT connections are part of a broader local and regional transit network, and serve as a primary mode of transport the airport rather than a connection.

The person capacity of LRT varies based on train configuration and operational requirements. It can theoretically reach up to 20,000 pphpd, but this is rarely achieved. Typical service falls in the range of about 2,500 to 12,000 ppdph.[154,155] For a simple airport connection at LI MacArthur operating using two trainsets, the person-capacity of an LRT line would range from approximately 630 ppdph (at twice hourly frequency with a 2-car train) to 1,900 ppdph (at frequencies of four trains per hour with a 3-car train).

When designed to connect important residential and commercial centers as part of overall transit network, LRT can serve as an impetus for development, as it represents a permanent investment in a particular corridor. LRT has long design and construction times, and high investment costs, and does not allow quick changes in its routes and services.

It is preferable that LRT has dedicated right-of-way in order to maintain fast and reliable service. The alignment must be determined through careful study, including land ownership and height restrictions related to runway proximity. This may include routing on public roads, through airfield property, or underground depending on regulatory requirements.

Delivery Time Frame

Five years or more.

[153] (Federal Aviation Administration, 2017)
[154] (Hook, Lotshaw, & Weinstock, 2013)
[155] (Transit Cooperative Research Program, 2013)

Planning Level Cost Estimate

Capital Expenditures: $2,500,000 - $3,500,000[156]

Annual Operating Costs: $1,500,000 - $5,500,000[157]

3.3 Feasibility Context

The feasibility of a transport link is associated with the balance of its costs against its benefits, estimated as a combination of ridership level and quality of experience. In the specific case or airport connectors, it is common to provide capacity that is in excess of demand, as noted by ACRP Report 4: "in virtually all cases under consideration, the capacity of bus, light rail, rapid transit, or commuter rail service is vastly higher than that required for airport related activity."[158] That is partially because those systems are often designed with focus on service quality features such as comfort, reliability and possible connection to other destinations.

Cost and quality of experience for the identified modes are discussed on section 3.2, and this section discusses the feasibility context of those modes in terms of potential ridership levels. Some modes are typically applied to serve primarily airport customers, while others usually provide ground access from and to major regional population and employment centers.

This assessment can be benchmarked by the number of enplanements or millions of annual passengers (MAP) at other airports offering similar ground transportation services, or by the airport demand and local land use context in the case of ground connectors designed to serve other regional travel markets as well.

Moving walkways and for-hire vehicle services (including taxis and Transportation Network Companies) are highly scalable, flexible technologies with wide application for ground transportation at airports. While they should be implemented at a scale that meets the needs of air passengers, operators, and the airport, their feasibility does not depend in particular on the size of the airport. Therefore, the demand considerations for these mode are discussed in general terms, rather than in comparison with other airports.

Point-to-point

<u>Taxis and TNCs</u>

Taxi service is available to and from nearly all airports regardless of size. Taxi service are already available to transport customers between the Ronkonkoma LIRR station and MacArthur Airport. TNCs have similar operating characteristics as taxis and they are grouped here together.

There is no demand ceiling for successful taxi operations, since the service can be easily shared across other taxi markets. The key consideration is to supply an appropriate number of to roughly match the

[156] (Federal Transit Administration, 2017)
[157] (Federal Transit Administration, 2016)
[158] (Airport Cooperative Research Program, 2008)

demand for taxi trips generated by airport activity. If too much service is provided, drivers must wait long periods between fares, leading to uneconomical service. Conversely, undersupply of taxis results in long waits and unreliable service for customers. While taxis are nearly always provided by private commercial enterprises, airports manage undersupply by requesting more service from companies, encouraging ride-sharing, or when possible, mandating minimum service levels when contractual power is available.[159]

Structured Centered on Airport

'Structured Centered on Airport' are transportation links typically deployed at airports with the focus of moving passengers from and to terminals to other facilities. These links are often operated with Shuttle Buses, Automated People Movers (APM), and Personal Rapid Transit (PRT), and the Genoa airport in Italy is planning to have a gondola-based system. Moving walkways are an architectural solution to a mobility problem that can also be grouped in this category. They connect terminals of the same airport, or airport terminals to key transportation facilities. They are designed solely to serve airport-related traffic.

<u>Shuttle Bus</u>

Buses are used at airports of all sizes to link terminals with parking areas. Shuttle connections to rail also exist at airports with a wide range of demand levels. At the higher end, Massport runs shuttle service at Boston Logan International (nearly 18 million annual enplanements) to connect a commuter rail station with the terminal.[160] At the lower end, a free shuttle is available to transport passengers between Milwaukee's General Mitchell International Airport (about 3 million annual enplanements) and the nearby Amtrak station.[161] Fixed-schedule shuttle service was previously available at LI MacArthur, but uncoordinated train and flight schedules made this scheme inefficient.[162]

<u>APM</u>

APMs are typically deployed at medium to large hub airports. ACRP Report 37 indicates that U.S. airports with APM systems generally fall in the range of 12 MAP to 30 MAP of total passengers. The demand for these systems depends in part on how many and which types of facilities the system serves (i.e. multiple terminals, parking lots, regional rail, and car rental locations).[163]

<u>PRT</u>

With just one major application, it is difficult to evaluate a general range of air-travel demand that might support a PRT system. One of the few operating examples is London Heathrow's Terminal 5 Ultra Pod system, which links the terminal with a car park. According to the manufacturer, the pods

[159] (Airport Cooperative Research Program, 2015)
[160] (Massport, 2017a)
[161] (GMIA, 2017)
[162] (Village Taxi, 2017)
[163] (Airport Cooperative Research Program, 2010)

carry about 800 passengers a day using a 21 vehicle system.[164] Recent studies of automated transit networks at airports reveal that the demand for these systems may be more sensitive to the system purpose and individual airports individual context than the sheer size of passenger volumes at the airport and that these systems can be scaled in order to meet lower levels of demand.[165] Recently, a feasibility study was conducted for the Norman Y. Mineta San Jose International airport in San Jose, which serves much lower air travel demand (5 million annual enplanements) than Heathrow. This study considered a conceptual six mile, 10 station system connecting multiple terminals, parking lots, and rail stations that would serve an estimated demand of 5,780 daily total trips.[166]

Gondola

With no direct precedent for an airport Gondola system outside of one proposed system in Italy, it is impossible to identify current supportive air-traffic demand levels. However, with a capacity and cost structure slightly lower than APM's, it can be inferred that they would be feasible for the similar range of airports.

Moving Walkways

Moving walkways are implemented because on the comfort and convenience they provide to pedestrians traveling through a facility, not a projected demand. However, when designing moving walkway enough walkway width (among all installed units) should be provided to ensure high levels of service for pedestrians using the system.

Structured Branched to Airport

Another possibility of connecting LI MacArthur to the Ronkonkoma LIRR Station is by creating a branch to a regional public transportation system, such as those delivered with Bus Rapid Transit (BRT), Light Rail Transit (LRT), and Streetcars. The new connector could become a new branch integrated to the planned Nicolls Road BRT, or it could be the seed of a new rail-based system. In this context, air travel is one of many activities that generate the demand justifying the investment in new or extended infrastructure.

While the vehicles themselves could theoretically be used to provide simple, shuttle-like service between LI MacArthur's terminal and the Ronkonkoma LIRR station, this application would be unusual, since most of the benefits of these robust systems come from their ability to handle higher demand, with a more complex road network serving multiple stops. The airport link could be the first step in an integrated transit plan that would connect to destinations beyond the airport and LIRR.

BRT

Little research is available regarding successful BRT applications for ground access at airports. Two relevant airport examples are LaGuardia International and Boston Logan, both mega-hub airports with

[164] (Ultra Global PRT, n.d.)
[165] (Furman, Fabian, Ellis, Muller, & Swenson, 2014)
[166] (Arup, 2012)

well over 14 million enplanements annually. Both these BRT lines carry several thousand daily passengers between the airport and major rapid stations in dense neighborhoods.[167]

Examples of BRT are limited to higher traffic airports in part because BRT service is mostly found in urban areas requiring higher-frequency, higher-capacity transit service with limited stops. However, even some smaller airports, such as Sarasota-Bradenton International (590,000 annual enplanements) offer relatively frequent bus service, as high as two to three buses per hour on some routes connecting to their downtown area[168].

Benchmarks in the literature indicate that BRT services are typical of communities with densities of 7 to 8 dwelling units per acre (4,400 to 5,100 units per square mile) in the with a quarter mile catchment area, or about 17 residents plus jobs per acre[169]. However, the land use supportive of bus service generally scales with the proposed frequency of service.

LRT

Since the early 1990s, many cities have rolled out LRT lines that connect to their airports. LRT lines in Dallas and Seattle serving the airport also serve major downtown destinations, connecting with other rail and bus transit lines.

Airports reviewed that have LRT connections featured air-travel levels ranging from about 6 million annual enplanements (St. Louis) to about 30 million (Dallas) annual enplanements. Demand for LRTs at airports is not necessarily proportional to the air traffic market, but depends in part of the transportation geography in which the transit lines are situated. Dallas's Orange Line DFW station served about 900 average weekday passengers in 2016, while Seattle's SeaTac/Airport Station had average weekday boardings of over 6,700 [170].

Benchmarks in the literature indicate a wide range of local densities supportive of LRT: 16 to 67 residents per gross acre (10,000 to 42,000 per square mile) in a half-mile catchment area, or access provided to clusters of 100,000-150,000 jobs.[171]

Streetcars

Streetcars provide service patterns similar to buses', and are typically deployed for circulation in roads without enough width to accommodate fully segregated transitways, such as commercial districts with recurring congestion patterns. Currently there are no examples of Streetcar service extended to airports. However, the supportive demand for an airport application may be reasonably assumed to be similar to LRT, provided trip times are similar.

[167] (Massachusetts Bay Transportation Authority, 2014)
[168] (Sarasota County, 2017)
[169] (Puget Sound Regional Council, 2015)
[170] (Dallas Area Rapid Transit, 2017)

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