TRANSPORT LONG ISLAND

A Train-to-Plane Connectivity Study

Cover Illustration by Alex J. Wallach, Suffolk County EDP

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ISP Long Island MacArthur Airport

Long Island Rail Road

NYMTC NEW YORK METROPOLITAN TRANSPORTATION COUNCIL

Appendices

Appendix C.

Project Screening Criteria Memo

Memorandum

To	Lou Bekofsky, Deputy Commissioner, SCEDP Ankita Rathi, Planner, SCDEDP	Date	January 24, 2018
Copies		Reference number	
From	Denis Mani, Arup Amy Leitch, Arup Andrew Kay, Arup	File reference	
Subject	Ronkonkoma Railroad Station / Long Island MacArthur Airport (ISP) Train-to-Plane Connectivity Study - Project Screening Criteria		

Task 5: Develop Screening Criteria Matrix

After the project team identified 10 transportation modes that could connect the LIRR Ronkonkoma Station and the LI MacArthur Airport passenger terminal, a Screening Criteria Matrix was developed to support in determining the four connection modes that should advance to Task 6, in which the project team will detail implementation plans for each selected mode. A preferred alternative for the airport connector will be defined in Task 9, when a combination of modes will be selected from the list of 4 modes detailed in task 6.

One of the results of this evaluation is a graphic tool, the screening matrix, displaying how each mode would perform as a train-to-plane connection to LI MacArthur Airport. From these results, four modes amongst those that demonstrate the strongest opportunities with regards to their performance against air traveler, community and delivery focused criteria will be carried forward for further investigation by the project team to inform the final recommendations of the Study.

The memo is structured in the following sections:

- Introduction
- Screening Criteria
- Mode Assessment
- Summary Matrix

1 Introduction

The 10 connection modes evaluated in this study are presented in detail in the Task 4 memo, which sets out the existing conditions and the connection modes for exploration. These 10 modes were grouped into three supply-demand classes:

- Point-to-point: Modes that may pickup and drop-off passengers at almost any location.

- Structured centered on airport: Modes focused on airport-bound demand, running along a fixed route with pre-determined pickup and drop-off points.
- Structured branched to airport: Modes with structured routes serving multiple travel markets in the wider community, extended to the airport with a spur to serve airport demand.

The connection modes were evaluated based on two scenarios, one considering the existing terminal at LI MacArthur Airport, and one with a potential north-side terminal, which would be located less than a quarter-mile to the LIRR Ronkonkoma Station. The combination of scenarios and modes evaluated is illustrated in Table 1.

Table 1: Modes and scoring scenarios

Mode Group	Mode	Scenario	
		Existing Terminal	North Side Terminal
Point to Point	Updated Taxi System	●	
	Transportation Network Companies (TNCs)	●	
Structured, Centered On Airport	Shuttle Bus	●	
	Automated People Mover (APM)	●	
	Personal Rapid Transit (PRT)	●	
	Gondola		●
	Moving Walkway		●
Structured, Branched To Airport	Bus Rapid Transit (BRT)	●	●
	Streetcars	●	●
	Light Rail Transit (LRT)	●	●

● *indicates mode is evaluated for this scenario*

The project team used a bespoke evaluation framework to identify the connection modes' strengths and weaknesses and to score them against project goals. The framework comprises 10 screening criteria that represent specific goals for the project. The framework is intended as a high-level decision-making tool to determine four connection modes from the long list of potential options.

The screening criteria were identified through a process that included a high-level desktop literature review and interview of project team members to assess:

- Project goals
- Project risks
- Best practices
- Opportunities for innovation
- Stakeholders

The best practices component included input from Arup's professional expertise, as well as a review of peer projects, such as the evaluation of options for the LaGuardia Airport redevelopment. It also included industry guidance, such as the US Department of Transportation's MAP-21 Performance Management goals, and operational goals, such as set out by the Long Island Rail Road, and the Metropolitan Transportation Authority.

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Within best practices, the team also sought to include criteria that promote quality in design and resilience in communities, such as robustness, redundancy, flexibility, resourcefulness, reflection, inclusivity and integration.[1] The team also considered criteria to reflect the feasibility and deliverability of the connection modes, including assumptions on the potential time period for service delivery, increase in demand for use and potential for further development / deployment to service additional markets.

The project team synthesized this review to identify 10 screening criteria. The criteria focused on the impact of the identified mode in operation; thus, the community focused criteria do not consider any additional impacts on the area surrounding the airport that might be associated with construction activity. This distinction reflects the objective of the task to determine the top four options that best deliver project goals. The specific impacts of these top four options, including mitigation options for any negative impacts, will be investigated in further detail in later project stages.

The 10 screening criteria reflect three focus areas:

Table 2: Focus Areas for the Screening Criteria

Focus area	Description
Air Traveler Focused	Criteria focus on the experience of air travelers using the transit mode in terms of ease of connection between the train station and the airport, the reliability of service, and overall passenger experience.
Community Focused	Criteria focus on the impact of the mode on the community in terms of the built environment, the ability of the mode to serve other markets in the future, and the impact to the environment.
Delivery Focused	Criteria focus on the deliverability of the mode in terms of rollout phasing, ease of implementation, capital cost and operational cost.

The diagram below illustrates the three key steps of the mode assessment: 1) develop the screening criteria, 2) assess each of the 10 project modes against the criteria, and 3) identify the relative performance of each mode in delivering project goals (Figure 1).

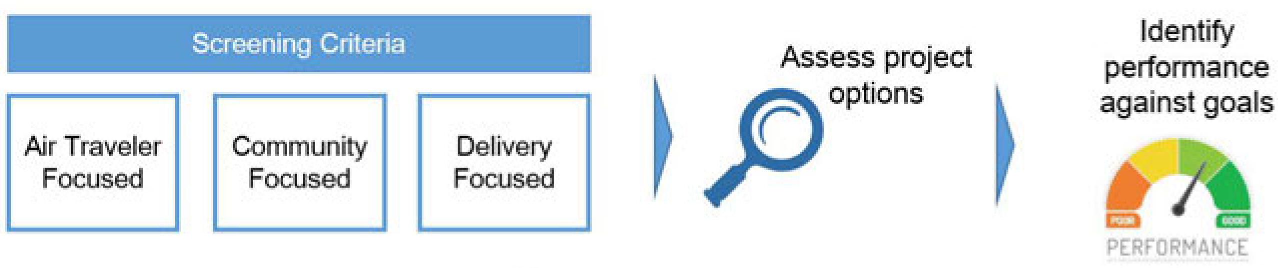

Figure 1: Screening Criteria Process

[1] Arup (2014). The City Resilience Index.

Each identified mode was evaluated against the screening criteria using an impact scale with three levels, and for summary scoring purposes, each level was scored according to the scale presented on Table 3.

Table 3: Key for score levels

Rating levels		Score
●	Good	10
◒	Fair	4
○	Poor	1

2 Screening Criteria

The screening criteria provide an unbiased grading system for the identified connection modes by overall potential to deliver the project goals. The screening criteria and evaluation methodology may also be further refined and used to inform a more detailed assessment as the project progresses towards final recommendations.

The 10 screening criteria used on Task 5 are defined in Table 4, along with the definitions for their three levels of impact.

At a workshop held on November 2017, the project stakeholders defined the subset of priority criteria. These prioritized criteria were weighted 50% higher, to tune the scoring process to the stakeholders' specific values and concerns. The six prioritized criteria are: ease of connection, reliability, passenger experience, rollout phasing, capital costs, and operating costs.

Table 4: Screening criteria definition and impact levels

Criteria		Definition
1	**Ease of connection** *Convenience of transferring into the connection vehicle, assessed by walking distance, level changes, wayfinding and baggage movement effort.*	• Good: Provision of clear and simple level transfer from train station to overpass into the connector's station. • Fair: Connector's station is at ground level and within 100ft of the elevator to the station overpass. Path from elevator to station has no steps or circuitous ramps to overcome grade changes, and offers protection from the weather. • Poor: Absence of covered path from train station to connector boarding area, walking distance from train station to boarding above 100ft or presence of steps along the way.

Criteria		Definition
2	**Reliability** *Frequency of delays on the connection travel, and of vehicle availability for pickup.*	• Good: Connector departures or vehicle availability are timed with train and airplane arrivals. Connection takes place over rail, or dedicated roadways without mixed traffic. • Fair: Connector departures or vehicle availability are timed with train and airplane arrivals. Connection takes place over public roadways, and thus are subject to interference of traffic. • Poor: Connector departures or vehicle availability are not timed to train and airplane arrivals.
3	**Passenger experience** *Quality and convenience of the train-to-plane journey, considering fare transaction, connector station quality, and in-vehicle comfort.*	• Good: Service is free of charge; a climate-controlled station displays information on connector estimated arrival time, and the status of flight departure; rides are smooth, predictable and have climate control. • Fair: Fare transaction is possible by mobile device, or physical means. Connector station has protection from weather; rides are smooth, predictable and have climate control. • Poor: Fare transaction does not enable payment by more than one method (i.e., either by cash/card only or by mobile phone only); boarding area has no protection from weather; rides take place over public roads, subject to variation in quality of pavement.
4	**Neighborhood integration** *Degree to which the travel mode complements or degrades the neighborhood and adjacent land uses, considering shading, obstructed views, and scale context.*	• Good: Connector station's (or boarding area's) scale is smaller than Ronkonkoma LIRR Station's and in line with surrounding land uses. Absence of elevated structures along public roads. • Fair: Connector station is at the scale of Ronkonkoma LIRR Station. Absence of elevated structures along public roads. • Poor: Need for elevated structures on public roads.

Criteria		Definition
5	**Ability to serve other markets** *Convenience of integrating the mode to the regional transit network, and ease of route extension to contribute to a 21st century transit network on other county travel markets.*	• Good: Route could easily be extended into other destinations to contribute to a 21st century transit network on other markets, or connector station has a seamless connection to planned BRT station at Ronkonkoma Station. • Fair: Route extension into other destinations would require intense planning and community engagement, and connector station does not seamlessly connect to the planned BRT stop at Ronkonkoma Station. • Poor: Route cannot be extended without substantial investment and long approval processes, and connector station does not seamlessly connect to the planned BRT station at Ronkonkoma, or mode is not part of a transit network.
6	**Environmental performance** *Efficiency of natural resources usage and magnitude of adverse effects on natural systems.*	• Good: Strong opportunity to decrease local emissions per passenger and little increase to noise and vibration levels. • Fair: Moderate to strong opportunity to decrease local emissions per passenger and little to moderate increase to noise and vibration levels. • Poor: Little opportunity to decrease local emissions per passenger or moderate to significant increase to noise and vibration levels.
7	**Rollout phasing** *Ability of project to be de-livered in incremental stages, in which capacity is built gradually over time and adjusted to observed demand.*	• High: Train-to-plane capacity can be expanded in small incremental steps, and a small portion of builtout capital expenses are incurred upfront. • Fair: Train-to-plane capacity can be expanded in small incremental steps, or only a small portion of builtout capital expenses are incurred upfront. • Poor: Train-to-plane capacity can be expanded only large in incremental steps and most of builtout capital expenses are incurred upfront.

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Criteria		Definition
8	**Ease of implementation** *Complexity of project, construction delivery timeframes.*	• Good: Mode has precedents in the U.S. for airport ground access, and can be delivered under three years for design, approval and construction. • Fair: Mode has either precedents in the U.S. for airport ground access or can be delivered under three years for design, approval and construction. • Poor: Mode has no precedents in the U.S. for airport ground access, and cannot be delivered under three years for design, approval and construction.
9	**Capital Costs** *Amount of funds required for construction, vehicle purchase and systems procurement for start of operations.*	• Good: Existing terminal connections have average capex under $1 million. North terminal connections have average capex under $50 million. • Fair: Existing terminal connections have average capex under $100 million. North terminal connections have average capex higher than $50 million and lower than $100 million. • Poor: Existing terminal connections have average capex above $100 million. North terminal connections have average capex higher than $100 million.
10	**Operating Costs** *Amount of funds required for annual operations of the connection.*	• Good: Average opex under $500 thousand. • Fair: Average opex higher than $500 thousand and under $1 million. • Poor: Average opex above $1 million.

3 Mode Assessment

3.1 Point-to-Point Transportation

3.1.1 Updated Taxi System

A fleet of for-hire vehicles offers rides for individual passengers or small groups. Rides are summoned by hailing a taxi parked at a stand or driving by. The updated taxi system mode differs from the existing conditions baseline service by the provision of enhanced facilities and amenities for passengers such as dedicated mobile device application.

Performance Summary

	Air Traveler Focused			Community Focused			Delivery Focused			
Scenario	Ease of connection	Reliability	Passenger experience	Neighborhood integration	Ability to serve other markets	Environmental performance	Rollout phasing	Ease of implementation	Capital costs	Operating costs
Existing Terminal	◒	◒	◒	●	◒	◒	●	●	●	●

Performance Narrative

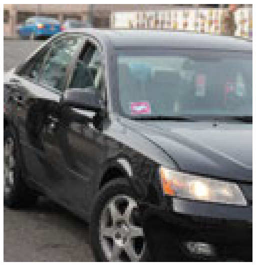
This option would retain many features from the current connection mode between the station and LI MacArthur Airport, with benefits through low implementation and operations cost, easy rollout and implementation, and minimal impact to the local neighborhood.

The updated system would deploy modern vehicles equipped with onboard digital amenities, and design favorable for stepping in and out, baggage movement and accommodation of persons with disabilities. The new fleet would allow passengers to pay by cash/card in addition to a new mobile device function, and to reserve a trip in advance through their smartphone.

This solution could be rolled out fast, and gradually expanded by addition of vehicles, because there are multiple companies offering software and cloud services for updating taxi fleets into a level of service similar to TNCs, and a next-generation taxi vehicle was recently developed by Nissan to serve New York City.

However, this option still provides low performance across ease of connection due to the sidewalk to asphalt transfer, need to move baggage and the distance from the train station to the taxi stand. Albeit reliability could be improved in relation to the no-action mode, with ride reservation apps, there is still possibility of capacity issues as a result of growing demand, and the need to travel through public roads, subject to traffic congestion.

3.1.2 Transportation Network Companies (TNCs)



Two variations of TNCs would suit the connection: 'ride-hailing' services, from companies like Uber and Lyft provide customers the ability to arrange a ride using a GPS-enabled mobile device; 'microtransit' services such as Chariot, Birdj and Via connect passengers to high-occupancy vehicles and shared rides.

Performance Summary

	Air Traveler Focused			Community Focused			Delivery Focused			
Scenario	Ease of connection	Reliability	Passenger experience	Neighborhood integration	Ability to serve other markets	Environmental performance	Rollout phasing	Ease of implementation	Capital costs	Operating costs
Existing Terminal	◒	◒	○	●	●	○	◒	●	●	●

Performance Narrative

Like the Updated Taxi System mode, the Transportation Network Companies (TNC) option enhances the current transit service between LIRR and LI MacArthur airport by offering a wider range of mobility choices to travelers.

This option performs strongly in delivering cost, easy rollout and implementation, and minimal impact to the local neighborhood. Many airports across the U.S. have struck deals with TNCs to regulate their services within airport property, and public transit companies have made agreements with TNCs to offer minimum service in last-mile/first-mile links.

In terms of ease of connection, a pickup and drop-off station could be designed and constructed to offer a good quality of experience to riders, and the airport could negotiate with a microtransit service to guarantee service meeting every Ronkonkoma train.

Regarding passenger experience, TNCs present a challenge: they only allow for payment by smartphone and cannot accept cash/credit. TNCs rely on user accounts tied to their smartphone to offer rewards and penalties to users and drivers, and would therefore be opposed to a system in which users are not identified and negotiate via app. This restriction excludes from the system passengers who prefer to not use or do not own a smartphone, or even who do not have a TNC account

3.2 Structured, Centered on Airport

3.2.1 Shuttle

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

Performance Summary

	Air Traveler Focused			Community Focused			Delivery Focused			
Scenario	Ease of connection	Reliability	Passenger experience	Neighborhood integration	Ability to serve other markets	Environmental performance	Rollout phasing	Ease of implementation	Capital costs	Operating costs
Existing Terminal	◒	●	●	●	○	◒	●	●	●	●

Performance Narrative

A dedicated shuttle bus service performs strongly in delivering cost, easy rollout and implementation, and minimal impact to the local neighborhood.

This mode represents a moderate improvement in traveler experience, with easy connection as transfer would be possible within 50ft of the elevator to the station overpass with no-step transfer and a covered walkway for protection from weather. The option makes provision for improved access to amenities, branding, and other ‘soft’ services. Buses would be clearly identified and provide a strong legibility / sense of place for ridership connection between the station and airport.

Shuttle buses also provide a moderate improvement in reliability of service, as shuttle availability can be scheduled to meet air and rail passengers. However, buses would still be subject to road congestion on public roads outside the airport.

The option performs strongly in terms of environment impact, with fully electric vehicles eliminating local carbon emissions and minimal impact to noise and vibration beyond existing conditions.

The option performs poorly in terms of ability to service other market, because it does not offer additional benefits to the existing service provided by Suffolk County Transit.

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3.2.2 Automated People Mover (APM)

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.

Performance Summary

	Air Traveler Focused			Community Focused			Delivery Focused			
Scenario	Ease of connection	Reliability	Passenger experience	Neighborhood integration	Ability to serve other markets	Environmental performance	Rollout phasing	Ease of implementation	Capital costs	Operating costs
Existing Terminal	●	●	●	◒	○	◒	○	◒	○	○

Performance Narrative

Automated People Mover (APM) service provides strong ease of connection and reliability, as the service can be designed to provide same-level connection from the station to the vehicles, and as the vehicles travel on a dedicated guideway segregated from traffic, they can provide timed service free of exposure to road congestion. APM also provide strong performance in passenger experience, as they provide fast, smooth service. APM is one of the only two modes assessed in this memo that received the highest score in all three air traveler focused criteria, a reflection of how it is the gold standard for mass movement of people for airport ground access.

While the operating costs of APM are mitigated as service can be automated, the technical and infrastructure requirements perform poorly across all other delivery-focused criteria. The guideway would be constructed at grade level through the airport, mitigating impact on the neighborhood.

The APM would perform fairly against environmental criteria as although APM can connect with a green power grid, and thus mitigate local carbon emissions from operation, the operation would generate adverse noise and vibration impacts (albeit, less than traditional rail-based modes).

In addition, the option also performs poorly in terms of ability to service other markets with limited opportunity to connect with local and regional service and the infrastructure requirements limit opportunity for rollout phasing.

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3.2.3 Gondola

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

Performance Summary

	Air Traveler Focused			Community Focused			Delivery Focused			
Scenario	Ease of connection	Reliability	Passenger experience	Neighborhood integration	Ability to serve other markets	Environmental performance	Rollout phasing	Ease of implementation	Capital costs	Operating costs
North Side Terminal	●	●	◒	◒	○	●	○	◒	◒	○

Performance Narrative

This option is only evaluated for a scenario in which the airport terminal is relocated to the north side of the airfield.

A gondola service provides strong ease of connection and reliability, as the service can be designed to provide same-level connection from the station to the gondola cabins, and as the cabins do not travel on the ground they can provide timed service free of exposure to road congestion. Passenger experience, however, suffers from lack of climate control in the cabin.

Gondolas require elevated structures that are not allowed within RPZs, and therefore would have to be set up on public roads, with an alignment that goes around the airport to connect Ronkonkoma Station to the Airport Terminal. While gondolas would require limited land development footprint, the tall support towers would be out of scale with the local neighborhood, causing issues such as overshadowing and obstruction of viewsheds. On the upside, Gondolas can also connect with a green power grid, mitigating carbon emissions from operation, and have very low noise and vibration impacts.

While the operating costs of a gondola system may be moderate, and capital costs best-in-class, in comparison to other long-term options, gondolas perform poorly across the other delivery focused criteria.

3.2.4 Personal Rapid Transit (PRT)

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

Performance Summary

	Air Traveler Focused			Community Focused			Delivery Focused			
Scenario	Ease of connection	Reliability	Passenger experience	Neighborhood integration	Ability to serve other markets	Environmental performance	Rollout phasing	Ease of implementation	Capital costs	Operating costs
Existing Terminal	●	●	●	◒	○	●	○	○	○	○

Performance Narrative

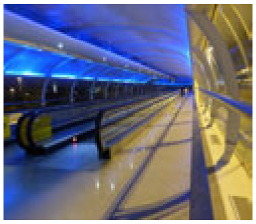
Like APM, Personal Rapid Transit (PRT) service provides strong ease of connection and reliability, as the service can be designed to provide same-level connection from the station to the vehicles with transit provided on a dedicated guideway segregated from traffic and free of exposure to road congestion. PRT also provide strong performance in passenger experience, as they provide fast, smooth service, and have strong recognition and positive perception by passengers. The gold standard for mass movement of passengers for airport ground access, PRT is one of the only two modes assessed in this memo that received the highest score in all three air traveler focused criteria.

While the operating costs of PRT are mitigated as service can be automated, the technical and infrastructure requirements perform poorly across all other delivery-focused criteria. Like APM, the guideway would be constructed at grade level through the airport, mitigating impact on the neighborhood.

The PRT would perform fairly against environmental criteria as although PRT can connect with a green power grid, and thus mitigate local carbon emissions from operation, the operation would generate moderate adverse noise and vibration impacts.

In addition, the option also performs poorly in terms of ability to service other markets with limited opportunity to connect with local and regional service and the infrastructure requirements limit opportunity for rollout phasing.

3.2.5 Moving Walkway



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

Performance Summary

	Air Traveler Focused			Community Focused			Delivery Focused			
Scenario	Ease of connection	Reliability	Passenger experience	Neighborhood integration	Ability to serve other markets	Environmental performance	Rollout phasing	Ease of implementation	Capital costs	Operating costs
North Side Terminal	●	●	●	●	○	●	○	●	◒	●

Performance Narrative

A moving walkway option is evaluated only for a scenario in which the main terminal building is located to the north side of the airfield. Under that assumption, the walkway performs well in nearly all categories.

The connection would be possible within 50 ft. of the elevator and could be designed with no level change. A climate controlled corridor would take passengers directly from the train station to the terminal in comfort and without the need to wait for a connecting service vehicle, and presenting LIRR passengers with a strong sense of arriving at an airport facility. These features result in high scores for reliability, passenger experience, and neighborhood integration. Moving walkways are propelled using electric motors and have no local air emissions or noticeable noise impacts.

Once a decision has been reached to relocate the airport terminal, the moving walkway could easily be integrated into the plans, without large additional capital investments or operating costs.

The walkway however performs poorly on two criteria: ability to serve other markets and rollout phasing. The nature of the walkway is limited to connecting two, nearby facilities. In addition, once situated within a structure, implementing additional walkway capacity may not be possible.

3.3 Structured, Branched to Airport

3.3.1 Bus Rapid Transit (BRT)

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

Performance Summary

	Air Traveler Focused			Community Focused			Delivery Focused			
Scenario	Ease of connection	Reliability	Passenger experience	Neighborhood integration	Ability to serve other markets	Environmental performance	Rollout phasing	Ease of implementation	Capital costs	Operating costs
Existing Terminal	◒	●	●	●	●	◒	●	◒	◒	◒
North Side Terminal	◒	●	●	●	●	◒	●	●	●	●

Performance Narrative

Bus Rapid Transit (BRT) performs well across all criteria, with no ‘Low’ score in any category.

BRT service provides an improvement in ease of connection as transfer would be possible within 50ft of the elevator to the station overpass with no-step transfer and a covered walkway for protection from weather. The option provides for improved access to amenities, branding, and other ‘soft’ services. Buses would be clearly identified and provide a strong legibility / sense of place for ridership connection between the station and airport.

BRT also provides more reliable service compared with other bus modes because they operate in dedicated right-of-way, and are not subject to local traffic impact. Bus availability can be optimized for air passengers, and through installation or protected service lanes, buses would not be subject to road congestion on public roads or within the airport.

The option performs strongly in terms of environmental impact, with fully electric vehicles eliminating local carbon emissions and minimal impact to noise and vibration beyond existing conditions.

The option also performs strongly in terms of blending into the local neighborhood, ability to service other markets with opportunity to connect with existing plans for local and regional BRT service to expand delivery beyond the station-airport connection. The fast delivery also supports strong rollout phasing opportunity, with the ability to provide enhanced service when needed to meet growing demand.

Ease of implementation is rated higher in the scenario of a relocated the terminal to the north side of the airfield. This new location would minimize the amount of route-miles required to serve the airport and provide more ready integration with other proposed BRT service in Suffolk County.

3.3.2 Streetcar

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.

Performance Summary

	Air Traveler Focused			Community Focused			Delivery Focused			
Scenario	Ease of connection	Reliability	Passenger experience	Neighborhood integration	Ability to serve other markets	Environmental performance	Rollout phasing	Ease of implementation	Capital costs	Operating costs
Existing Terminal	◒	●	●	●	●	○	◒	◒	○	○
North Side Terminal	◒	●	●	●	●	○	◒	●	◒	○

Performance Narrative

Streetcar service provides an improvement in ease of connection as the transfer would be possible within 100ft of the elevator to the station overpass with no-step transfer and a covered walkway for protection from weather. The option provides for improved access to amenities, branding, and other ‘soft’ services. Vehicles would be clearly identified and provide a strong legibility / sense of place for ridership connection between the station and airport.

Streetcars are capable of handling high ridership volume without major capital projects. The route alignment would go through the airport site, to provide for the dedicated right-of-way that would deliver high reliability in travel times. Because there can be no structures on the RPZ, the streetcar would require batteries that would be charged at the route termini or over the portions of the alignment outside the RPZ.

While this mode is electrified, and therefore has no local emissions and has the opportunity of being connected to the green power grid, there are other environmental issues. Rail modes in general have higher patterns of noise and vibration than rubber-tire based modes. Because noise and vibration are of primary environmental concern for airports, this mode scored low in the environmental performance criteria.

The option has moderate opportunity to serve other markets, should streetcar service be expand beyond the station-airport connection. The infrastructure need for rail, overhead wires and stations would also limit opportunity for rollout phasing.

Ease of implementation is rated higher in the scenario of a relocated the terminal to the north side of the airfield. This new location would minimize the amount of route-miles required to serve the airport.

3.3.3 Light Rail Transit (LRT)

Rail service running on dedicated right-of-way. Smaller vehicles and lower operating costs than traditional subways or commuter rail services.

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Performance Summary

	Air Traveler Focused			Community Focused			Delivery Focused			
Scenario	Ease of connection	Reliability	Passenger experience	Neighborhood integration	Ability to serve other markets	Environmental performance	Rollout phasing	Ease of implementation	Capital costs	Operating costs
Existing Terminal	◒	●	●	◒	◒	○	○	○	○	○
North Side Terminal	◒	●	●	◒	◒	○	○	○	○	○

Performance Narrative

LRT service provides an improvement in ease of connection, as it would offer level boarding and a station would be set up by the elevator access to the Ronkonkoma station overpass. The service would be very reliable with departures timed to match air and rail schedule, and travel along exclusive right-of-way through the airport site. The option makes provision for improved access to amenities, branding, and other 'soft' services. Vehicles would be clearly identified and provide a strong legibility / sense of place for ridership connection between the station and airport.

The larger vehicles used in LRT compositions require heavier track and power distribution infrastructure, and these systems and construction needs are the biggest difference between LRT and Streetcar modes. With a larger set up, the LRT composition cannot share the right-of-way with other vehicles at no times, and consequently expansion of the system to other markets in Suffolk County would entail a long and demanding process of planning and approval seeking.

The extensive construction costs for track and power supply hurt the ability of the system to be rolled out in phases, and implementation would take more than five years due to stringent design standards and long lead times in delivery of rolling stock and system parts. The operating costs are the worst-performing across the long-term modes, but the capital expenses needed for system launch are on par with the group average.

Ease of implementation is rated higher in the scenario of a relocated the terminal to the north side of the airfield. This new location would minimize the amount of route-miles required to serve the airport.

4 Summary Matrix

Existing Terminal

For the existing terminal configuration, the four highest ranking options were: extending a BRT branch to the airport, updating the taxi system, shuttle buses, and TNCs. These options align with the majority of ground access solutions employed across the U.S. They all feature lower capital costs than the others and could be implemented as part of a combined strategy.

Figure 2: Existing Terminal Modes Screening Matrix

North Side Terminal

The BRT extension, and the moving walkway options scored higher than the others. The costs for relocating the airport terminal, which should be similar across all connection modes, are not considered in this portion of the analysis.

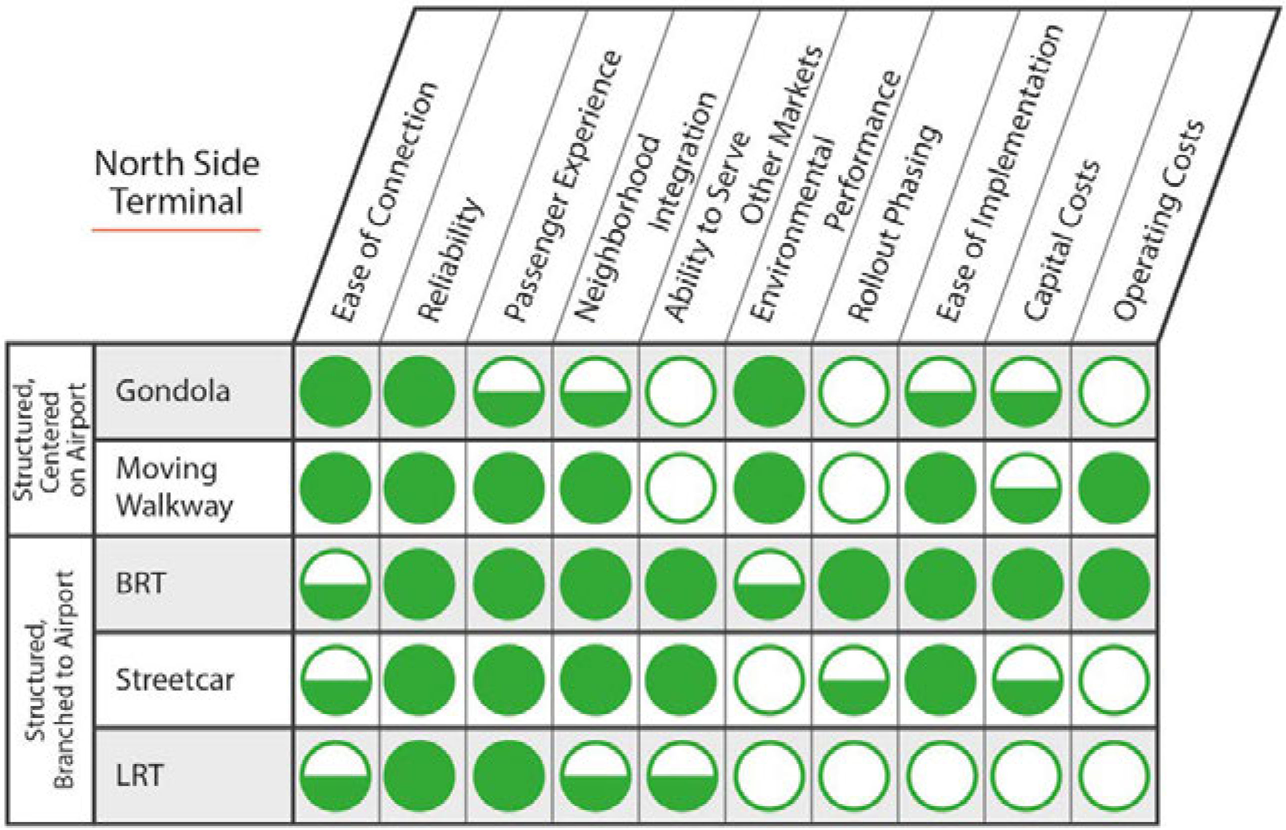

Figure 3: North Side Terminal Modes Screening Matrix

The aggregated score for each of the modes is indicated on Table 5 and Table 6.

Table 5: Existing Terminal Modes Score

Existing Terminal		Score
Point to Point	Updated Taxi System	7.0
	TNCs	6.2
Structured, Centered on Airport	Shuttle Bus	8.2
	APM	4.8
	PRT	5.0
Structured, Branched to Airport	BRT	7.0
	Streetcar	5.4
	LRT	3.9

Table 6: North Side Terminal Modes Score

North Side Terminal		Score
Structured, Centered on Airport	Gondola	4.9
	Moving Walkway	7.6
Structured, Branched to Airport	BRT	8.8
	Streetcar	6.2
	LRT	3.9

Appendix A– Screening Criteria Breakdown

A1.1 Ease of Connection

Updated Taxi System

Existing Terminal: Fair

- Current taxi stand is 200ft away from the overpass elevator, but a new boarding zone could be set up south of the tracks, less than 100ft from the overpass elevator.
- There is a step down from the sidewalk to the pavement and baggage needs to be lifted into the trunk
- An awning would extend over the taxi boarding area protecting passengers from rainfall.

TNCs

Existing Terminal: Fair

- TNC pickup area would be south of the tracks, within 100ft walking distance from the overpass access.
- There is a step down from the sidewalk to the pavement and baggage needs to be lifted into the trunk
- An awning would extend over part of the boarding zone, but some vehicles would still be exposed to the elements.

Shuttle Bus

Existing Terminal: Fair

- Connector station would be at south side, less than 100ft from the overpass access.
- Connector station would be at level with the shuttle bus.
- An awning would extend over the bus boarding area protecting passengers from rainfall.

APM

Existing Terminal: Good

- New station would be level transfer from overpass.

PRT

Existing Terminal: Good

- New station would be level transfer from overpass.

Gondola

North Side Terminal: Good

- New station would be level transfer from overpass.

Moving Walkway

North Side Terminal: Good

- Moving walkway entrance would be south of the tracks within 100ft walking distance from overpass access.
- Walkway would be in an enclosed or covered structured, protecting passengers from elements.

BRT

Existing & North Side Terminals: Fair

- Connector station would be at south side, less than 100ft from the overpass access.
- Connector station would be at level with the shuttle bus.
- An awning would extend over the BRT boarding area protecting passengers from rainfall.

Streetcar

Existing & North Side Terminals: Fair

- Connector station would be at south side, less than 100ft from the overpass access.
- Connector station would be at level with the shuttle bus.
- An awning would extend over the Streetcar boarding area protecting passengers from rainfall.

LRT

South & North Side Terminals: Fair

- Connector station would be at south side, less than 100ft from the overpass access.
- Connector station would be at level with the shuttle bus.

An awning would extend over the LRT boarding area protecting passengers from rainfall.

A1.2 Reliability

Updated Taxi System

Existing Terminal: Fair

- Taxis are available to meet every train connection.
- Trips are subject to traffic congestion on public roads.

TNCs

Existing Terminal: Fair

- TNCs should guarantee availability for each train connection.
- Trips subject to traffic congestion on public roads.

Shuttle Bus

Existing Terminal: Good

- Because Long Island MacArthur would plan, manage and control the service, shuttle departures would be timed to train and airplane arrivals.
- Trips would take place at a dedicated roadway through the airport site.

APM

Existing Terminal: Good

- Because Long Island MacArthur would plan, manage and control the service, APM departures would be timed to train and airplane arrivals.
- Service runs on a fully separated rail right-of-way.

PRT

Existing Terminal: Good

- PRT vehicles would be requested by passengers at terminal or train station. Enough vehicles would be supplied to ensure availability.
- Service would be provided on guideways separated from any public accessible right of way and would be constructed within the airport property.

Gondola

North Side Terminal: Good

- Because Long Island MacArthur would plan, manage and control the service, Gondola service would be optimized for air passengers.
- Service is provided on an aerial ropeway, and is not subject to local traffic congestion.

Moving Walkway

North Side Terminal: Good

- Moving walkway service would be available at all times air service is offered and does not require waiting for a vehicle.

BRT

Existing & North Side Terminals: Good

- Because Long Island MacArthur would plan, manage and control the service, BRT departures would be timed to train and airplane arrivals.
- Dedicated transit-way would be constructed on airport property, with transit priority at intersections with public roads.

Streetcar

Existing & North Side Terminals: Good

- Because Long Island MacArthur would plan, manage and control the service, Streetcar departures would be timed to train and airplane arrivals.
- Dedicated transit-way would be constructed on airport property, with transit priority at intersections with public roads.

LRT

Existing & North Side Terminals: Good

- Because Long Island MacArthur would plan, manage and control the service, Streetcar departures would be timed to train and airplane arrivals.
- Dedicated transit-way would be constructed on airport property, with transit priority at intersections with public roads.

A1.3 Passenger Experience

Updated Taxi System

Existing Terminal: Fair

- Fare transaction could be electronic or by cash/card.
- Passengers can wait for in climate-control environment, with no information over flight status.
- Ride comfort subject to pavement quality on public roads and on quality of vehicle, which are both out of airport's control.
- Vehicles may not ride with the AC on.

TNCs

Existing Terminal: Poor

- Fare transactions are accomplished through mobile devices only, requires an account and is difficult to split between passengers.
- Passengers would be picked up outdoors, with no information over flight status.
- Ride comfort subject to pavement quality on public roads and on quality of vehicle, which are both out of airport's control.

Shuttle Bus

Existing Terminal: Good

- No fare transaction necessary. Airport would cover costs.
- Waiting area would be minimally furnished with no information over flight status.
- Ride comfort subject to pavement quality on the airport, which would receive maintenance to ensure a smooth ride.

APM

Existing & North Side Terminals: Good

- No fare transaction necessary. Airport would cover costs.
- Fast, reliable and comfortable travel.
- APM creates the perception of arrival at the airport immediately upon boarding
- Smooth and comfortable ride quality in vehicles designed with air travelers in mind.

PRT

Existing & North Side Terminals: Good

- No fare transaction necessary. Airport would cover costs.
- Dedicated guideway provides a smooth and comfortable ride in vehicles designed with air travelers in mind.

Gondola

North Side Terminals: Fair

- No fare transaction necessary. Airport would cover costs.
- Cabins are not powered, only one international precedent where cabins have climate control.

Moving Walkway

North Side Terminal: Good

- No fare transaction necessary.
- Ideally located in a climate controlled corridor, in which information could be provided.

BRT

Existing & North Side Terminals: Good

- No fare transaction necessary. Airport would cover costs.
- Ride comfort subject to pavement quality on the airport, which would receive maintenance to ensure a smooth ride.
- Upgraded, high-quality amenities in vehicles and passenger information at stations.

Streetcar

Existing & North Side Terminals: Good

- No fare transaction necessary. Airport would cover costs.
- Upgraded, high-quality amenities in vehicles and passenger information at stations.
- Smooth, comfortable ride quality.

LRT

Existing & North Side Terminals: Good

- No fare transaction necessary. Airport would cover costs.
- Upgraded, high-quality amenities in vehicles and passenger information at upgraded stations.
- Smooth, comfortable ride quality.

A1.4 Neighborhood integration

Updated Taxi System

Existing Terminal: Good

- Existing facilities are small scale and in line with surrounding land uses.
- No elevated structures.

TNCs

Existing Terminal: Good

- Additional station facilities would be small scale, likely limited to a designated pick-up area.
- No elevated structures.

Shuttle Bus

Existing Terminal: Good

- Additional station facilities would be small scale, likely limited to a designated pick-up area.
- No elevated structures.

APM

Existing Terminal: Fair

- Additional facilities would be medium scale.
- Guideway at ground level.

PRT

Existing Terminal: Fair

- Additional facilities would be medium in scale.
- Guideway at ground level.

Gondola

North Side Terminal: Fair

- Additional station facilities scale would be on par with Ronkonkoma Station.
- Requires elevated ropeway structures, but visual impacts would be limited to parking areas and airport facilities.

Moving Walkway

North Side Terminal: Good

- Walkway structure would be small scale and not require elevated structures on public roads.

BRT

Existing and North Side Terminal: Good

- Additional station facilities would be small scale.
- No elevated structures.

Streetcar

Existing and North Side Terminal: Good

- Additional station facilities would be small scale.
- Vehicles could be powered by batteries over some segments, to reduce their impact to the neighborhood and interference with airport restrictions.

LRT

Existing Terminal: Fair

- Additional station facilities scale would be on par with Ronkonkoma Station.
-

North Side Terminal: Fair

- Additional station facilities scale would be on par with Ronkonkoma Station.

A1.5 Ability to Serve Other Markets

Updated Taxi System

Existing Side Terminal: Fair

- Taxis can easily be shifted to address demand imbalances and serve other markets.
- The adoption of mobile device payment and other web-based services could lead to increased adoption of taxis as a solution to first- and last-mile access to the regional transit network.
- While taxis are a public service, they are not a mass transportation alternative, and do not by themselves represent an expansion of transit in Suffolk County.

TNCs

Existing Terminal: Good

- TNCs can easily be shifted to address demand imbalances and serve other markets.
- Microtransit services can build on the success of an airport connector to expand service into the county.
- Suffolk County Transit, the Long Island Rail Road or the Nicolls Road BRT operator could partner with microtransit operators to provide access to first- and last-mile trips, and to extend transit to neighborhoods in a cost efficient manner.

Shuttle Bus

Existing Terminal: Poor

- Service would not be provided to non-airport markets.
- Would not contribute to wider transit network.

APM

Existing Terminal: Poor

- Service would not be provided to non-airport markets.

PRT

Existing Terminal: Poor

- Service would not be provided to non-airport markets.

Gondola

North Side Terminal: Poor

- Service would not be provided to non-airport markets.

Moving Walkway

North Side Terminal: Poor

- Service would not be provided to non-airport markets.

BRT

Existing & North Side Terminals: Good

- Route could easily be extended to serve non-airport markets, given current BRT planning already underway by County.
- Strong opportunity to contribute to wider transit network.
- Could share station facilities with planned BRT station at Ronkonkoma.

Streetcar

Existing& North Side Terminals: Good

- Route could easily be extended to serve non-airport markets, but would require intense alignment planning.
- Strong opportunity to contribute to wider transit network.
- Could potentially share facilities with proposed BRT station at Ronkonkoma.

LRT

Existing & North Side Terminals: Fair

- Route could easily be extended to serve non-airport markets, but would require intense alignment planning.
- Strong opportunity to contribute to wider transit network.

A1.6 Environmental Performance

Updated Taxi System

Existing Terminal: Fair

- Typical motor vehicle emissions with moderate impacts on air pollution, but with opportunities for lower impact vehicle technologies.
- Low noise and vibration impacts.

TNCs

Existing Terminal: Poor

- Typical motor vehicle emissions with moderate impacts on air pollution.
- Low noise and vibration impacts.

Shuttle Bus

Existing Terminal: Fair

- Electric buses would offer opportunity to connect to the green power grid.
- Electric buses would have low emission
- Vibration and noise would be higher than light vehicles.

APM

Existing Terminal: Fair

- Vehicles are powered by electricity, producing no local emissions.
- Strong opportunity to purchase power through clean energy sources.
- APMs are designed to have lower noise and vibration impacts than traditional rail modes, but are still higher than light vehicles.

PRT

Existing Terminal: Good

- Vehicles are powered by electricity, producing no local emissions.
- Strong opportunity to purchase power through clean energy sources.
- Low noise and vibration impacts.

Gondola

North Side Terminals: Good

- Ropeway is powered by electricity, producing no local emissions.
- Strong opportunity to purchase power through clean energy sources.
- Low noise and vibration impacts.

Moving Walkway

North Side Terminal: Good

- Walkway is powered by electricity, producing no local emissions.
- Strong opportunity to purchase power through clean energy sources.
- Low noise and vibration impacts.

BRT

Existing & North Side Terminals: Fair

- Electric buses would offer opportunity to connect to the green power grid.
- Electric buses would have low emission vibration and noise.
- Vibration and noise would be higher than light vehicles.

Streetcar

Existing & North Side Terminals: Poor

- Vehicles are powered by electricity, producing no local emissions.
- Strong opportunity to purchase power through clean energy sources.
- Higher vehicle noise and vibration impacts than buses.

LRT

Existing & North Side Terminals: Poor

- Vehicles are powered by electricity, producing no local emissions.
- Strong opportunity to purchase power through clean energy sources.
- Higher noise and vibration impacts than buses.

A1.7 Rollout Phasing

Updated Taxi System

Existing Terminal: Good

- Expanded service is incremental by vehicle.

TNCs

Existing Terminal: Fair

- Unproven / unknown delivery, reliant on external provider.

Shuttle Bus

Existing Terminal: Good

- Small upfront investment.
- Expanded service is incremental by vehicle.

APM

Existing Terminal: Poor

- Installation of track and power equipment requires moderate upfront investment.
- Because vehicles have high capacity, each new composition adds a major step to overall system capacity.
- Expanded service may require additional track and power work.

PRT

Existing Terminal: Poor

- Installation of guideway and system components require very high upfront investment.
- Some potential for expanded capacity by adding new vehicles.

Gondola

North Side Terminal: Poor

- Installation of ropeway and power equipment requires high upfront investment.
- Expanded service require additional ropeway and power work.

Moving Walkway

North Side Terminal: Poor

- Walkway would be housed in a structure. Once implementing, additional walkway capacity would be difficult to provide.

BRT

Existing & North Side Terminals: Good

- Small upfront investment.
- Capacity can be expanded with new vehicles.

Streetcar

Existing & North Side Terminals: Fair

- Installation of track and power equipment requires moderate upfront investment.
- Because vehicles have high capacity, each new composition adds a major step to overall system capacity.
- Expanded service may require additional track and power work.

LRT

Existing & North Side Terminals: Poor

- Installation of track and power equipment requires moderate upfront investment.
- Because vehicles have high capacity, each new composition adds a major step to overall system capacity.
- Expanded service may require additional track and power work.

A1.8 Ease of implementation

Updated Taxi System

Existing Terminal: Good

- Many precedents in the U.S. for airport ground access.
- Service can be delivered in under two years.

TNCs

Existing Terminal: Good

- Many precedents in the U.S. for airport ground access.
- Service can be delivered in under two years.

Shuttle Bus

Existing Terminal: Good

- Many precedents in the U.S. for airport ground access.
- Service can be delivered in under two years.

APM

Existing Terminal: Fair

- Many precedents in the US for airport ground access.
- Service cannot be delivered in under three years.

PRT

Existing Terminal: Poor

- No precedents in the U.S. for airport ground access.
- Service cannot be delivered in under three years.

Gondola

North Side Terminal: Fair

- No precedents in the U.S. for airport ground access.
- Alignment must be determined through careful study, including land ownership and height restrictions related to runway proximity.
- Reduced system length could reduce design and construction complexity, making it possible to deliver in three years.

Moving Walkway

North Side Terminal: Good

- Many precedents in the U.S. for airport ground access.

BRT

Existing Terminal: Fair

- Many precedents in the U.S. for airport ground access.
- Service can be delivered between two and five years, depending on complexity of design and construction and vehicle specification.

North Side Terminal: Good

- Reduced system length could potentially reduce design and construction complexity, and could likely be delivered in under three years.

Streetcar

Existing Terminal: Fair

- No precedents in U.S. for airport ground access, where the vehicle rolls powered by batteries for some extension.
- Service can be delivered between three and five years, depending on complexity of design and construction and vehicle specification.

North Side Terminal: Good

- Reduced system length could reduce design and construction complexity, and could likely be delivered in under three years.

LRT

Existing Terminal: Poor

- No precedents in U.S. for airport ground access, where the vehicle rolls powered by batteries for some extension.
- Service cannot be delivered in under three years.

North Side Terminal: Poor

- Reduced system length could reduce design and construction complexity, making it possible to deliver in three years, but still novel technology in the state.

A1.9 Capital costs[2]

Updated Taxi System

Existing Terminal: Good

- $200K – $1M

TNCs

Existing Terminal: Good

- $0

Shuttle

Existing Terminal: Good

- $500K - $1M

BRT

Existing Terminal: Fair

- $40 - $130M

North Side Terminal: Good

- $0 - $5M

Streetcar

Existing Terminal: Poor

- $150 - 250M

North Side Terminal: Fair

- $50 - $150M

LRT

Existing Terminal: Poor

- $250 - $350M

North Side Terminal: Poor

- $100 - $200M

Gondola

North Side Terminal: Fair

- $50 - $100M

APM

Existing Terminal: Poor

- $250 - 650M

PRT

Existing Terminal: Poor

- $150 - $450M

Walkway

North Side Terminal: Fair

- $25M - $100M

[2] Sources:

Taxis: Individual vehicles source: NYC TLC, NY Times

Shuttle: Analysis – Arup; Data Sources: Bureau of Transportation Statistics

BRT, APM and Walkway: Data Source: ISP CBP Study

Streetcar, LRT: Analysis – Arup, Data Source: FTA Current Capital Investment Grant Projects

PRT: Data Source: University of Washington, Princeton University

Gondola: Analysis – Arup NY, Data Sources –Cable Car Confidential

Walkway: Analysis – Arup, Data Sources: ISP CBP Study

A1.10 Operating costs[3]

Updated Taxi System

Existing Terminal: Good

- $5 per passenger

TNCs

Existing Terminal: Good

- $10 per ride, depending on arrangement

Shuttle

Existing Terminal: Good

- $500 - $800K

BRT

Existing Terminal: Fair

- $500K - $1.5M

North Side Terminal: Good

- $250K - $750K

Streetcar

Existing Terminal: Poor

- $1 - 4M

North Side Terminal: Poor

- $500K - $2M

LRT

Existing Terminal: Poor

- $1.5 - $5.5M

North Side Terminal: Poor

- $750K - $3M

Gondola

North Side Terminal: Poor

- $750K - $2M

APM

Existing Terminal: Poor

- $1.5 - 3.5M

PRT

Existing Terminal: Poor

- $500K - $3M

Walkway

North Side Terminal: Good

- Negligible

[3] Sources:

Taxis and TNCs: current prices for passengers.

Shuttle: Analysis – Arup; Data Sources: Hoboken Shuttle

BRT, Streetcar, LRT: Analysis – Arup, Data Source: 2015 National Transit Database

Gondola: Analysis – Arup NY, Data Sources – MTA (for NY-region wages), Cable Car Confidential, Arup Bogota, Dopplemayr, NYSERDA (electricity costs).

PRT: Data Source: University of Washington, Princeton University

Walkway: Analysis – Arup with ACRP 117 tool, Data Sources: NYSERDA, Otis, ACRP.

Appendix D.

High-Level Implementation Plans Memo

Memorandum

ARUP

To	Lou Bekofsky, Deputy Commissioner, SCEDP Ankita Rathi, Planner, SCDEDP	Date	April 27, 2018
Copies		Reference number	
From	Arup	File reference	
Subject	Ronkonkoma Long Island Rail Road Station / Long Island MacArthur Airport (ISP) Train-to-Plane Connectivity Study – High-level implementation plans		

1 Upgraded Taxi Service

1.1 Mode Outline

The Upgraded Taxi Service connection option builds upon the existing connection between Ronkonkoma LIRR Station (the LIRR Station) and LI MacArthur Airport (the Airport), improving the customer experience with modern vehicles designed for airport-bound taxi passengers' needs and expectations, supported by mobile transactions for reservation and payment.

Both at Ronkonkoma LIRR Station and at the Airport terminal, passenger pick up and drop off will take place at pre-determined locations. At the LIRR Station, this area is in the parking lot north of the railway tracks. At the Airport, taxi riders are currently directed to the western edge of the terminal's front curbside; however, once the new Transportation Facility is completed, all taxi operations will be relocated to this new facility east of the terminal, where the Airport plans to direct all its commercial ground access vehicles. Taxis can choose their travel route between the airport and the train station, as there will be no pre-determined alignment. Free from a rule to follow specific roads for travel, drivers can choose the best travel route based on traffic conditions, as reported by a mobile application.

The upgraded fleet will offer more safety and comfort than the town cars currently in operation. A wide variety of vehicles are available to be integrated into the upgraded fleet, including sedans, SUVs, and minivans. Taxis based on modified small cargo vans – such as the Ford Transit and Nissan NV200 – have grown in popularity among operators. These vehicles offer good mix of passenger amenities and have been designed to maximize interior space on a small chassis. Desirable amenities for the new taxi fleet include:

- Capacity to seat a minimum of four passengers plus one driver comfortably;
- Sliding doors, interior grab-handles, and swing out-steps to maximize ease of entry and exit;
- Flat vehicle floors which provide additional comfort and space for small luggage;
- Independent rear climate control;
- Spacious rear luggage compartment;
- Wipe-clean interior surfaces;
- Reading lights and floor lighting; and
- Universal Accessibility features.

In addition to upgraded vehicles, introduction of an electronic reservation, dispatching, and payment system is proposed. This system will allow users to request rides in advance of arriving at the taxi area using a mobile device. After the user requests a ride through the mobile app, an available driver receives the order and prepares to welcome the upcoming passenger. Drivers and passengers identify one another using profile information (e.g., driver name, vehicle model, license plate number) shared by the application. If they choose to do so, passengers can pay for the ride with the app, in a cashless transaction.

There are many vendors capable of offering this electronic hailing and dispatch service, with either custom or off-the-shelf systems. Cloud-based services are preferred to avoid procurement, setup and maintenance of network servers. Still, to ensure service reliability and provide service options for passengers, the ability to request a taxi in person and pay in cash or a physical credit card should be preserved alongside introduction of new digital technology.

To promote the connector upgrade and to disseminate a consistent message of the its values, a new branding strategy will accompany the system launch. A distinctive, recognizable and strong brand will ensure that the public gets a positive and accurate impression of the system from the onset, raising the social profile of existing customers, and increasing the potential of attracting new users. To achieve visual cohesiveness, the strategy will define the system's standard typeface and color palette, and update its logo. The combination of these elements defines a visual identity which will be systematically deployed every time the system sends visual cues to riders: on signage at the Airport and LIRR Station, at drivers' uniforms, on vehicles liveries, at the mobile application and at the connection's webpage. This visual identity will be distinguished from the taxi operator's, to guarantee consistency in the event of a future change of operator, but it may reference the LIRR's and the Airport's brands, to increase its association with them.

Ancillary improvements associated with the upgraded taxi system include:

- Improved wayfinding signage at Ronkonkoma LIRR Station to guide passengers to the taxi curb; and
- Installation of video screens near the taxi station, providing up-to-date flight information.

1.2 Rollout Plan

The next steps for rolling out the upgraded taxi fleet are depicted in Figure 1. Some steps may require more complex decisions or additional design work that must be completed as part of the implementation process. These are discussed in Section 1.3 as key considerations.

The initial steps involve investigating vehicles, contractual requirements, and systems. Suffolk County should choose a specific vehicle, or mix of vehicles, that will be used in provision of the taxi service. Ultimately, these vehicles may be owned by the taxi operator, or owned by a public agency and leased to the operator under a service agreement. Both cases will require changes to existing contractual agreements. Simultaneously, Suffolk County should begin the process of refined scoping and vendor identification for the mobile hailing and dispatching service.

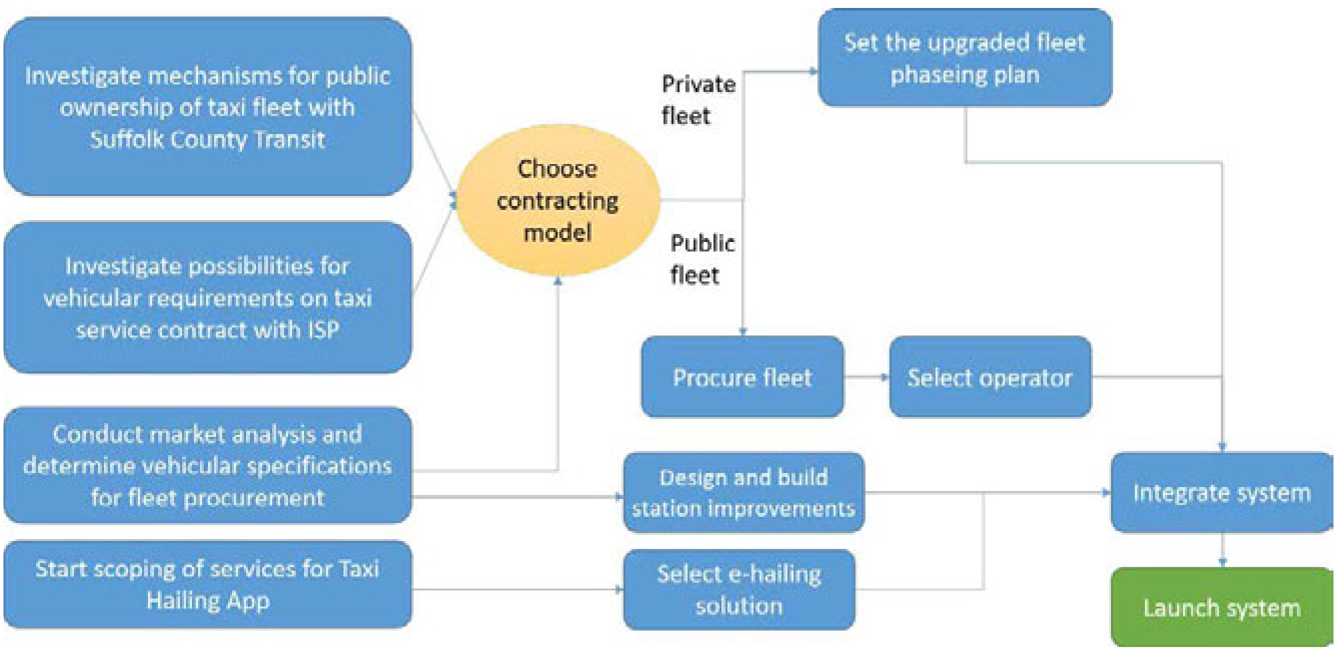

Figure 1: Rollout Plan, Upgraded Taxis

Once the contractual model is chosen, and a preferred vendor for the electronic hailing solution identified, the procurement process can proceed. If the preferred model involves private ownership of the upgraded fleet, the operator must agree to a plan specifying the vehicle performance requirements and timeline for phasing in the new vehicles. Under a public ownership model, a specified government entity will directly procure the vehicles. The taxi service provider only needs to operate and maintain the vehicles. The final design and construction of ancillary improvements may take place on a similar timeframe.

Once the vehicles and electronic hailing solution are in place, the digital infrastructure and systems can be integrated. The process entails the testing of the services to determine operational readiness and subsequently, launching the service to the public.

1.3 Key Considerations

The key considerations for the upgraded taxi service are:

Fleet ownership and operation model – There are two options available for ownership of the upgraded taxi fleet. The fleet may be procured and owned by a public entity such as Suffolk County or Suffolk County Transit, and then leased to a private taxi operator. This private operator would provide service and maintain the vehicles under the terms of lease and a service agreement. This model decreases financial risk to the operator associated with capital investment in new vehicles. Direct procurement also eliminates potential negotiation with the operator regarding vehicle specifications and costs, enabling straightforward delivery of the fleet.

Alternatively, the upgraded fleet could be procured directly by the private operator, after an update of the taxi service provision contract that include higher standards of quality. The company would own, maintain and operate the fleet under contract to a public entity. This arrangement may require more gradual introduction of the new fleet, as the taxi operator manages risk and capital investments in their vehicles.

Vehicle specifications – A final vehicle specification – or mix of vehicles specifications – must also be selected to provide the service. This process may involve choosing amongst available vehicles based on performance. If a hybrid vehicle is selected, chargers will have to be procured and installed in at least one of the waiting areas for the taxis, and in that case the Ronkonkoma LIRR Station should be prioritized, as it is the location where the taxis dwell, even when they are not returning from a trip to airport. A summary of taxi fleet vehicles is provided in Appendix A1 for informational purposes.

Electronic hailing platform – Either the private operator or a public entity could serve as the contracting entity. If the private operator is chosen, a list of minimal requirements should be specified. As discussed above, a variety of vendors can provide applications using solutions ranging from off-the-shelf, semi-customized, to fully customized. These systems are likely to include an upfront cost for set up and development as well as ongoing subscription or transaction-based fees A desktop review of several systems is provided in Appendix A2 for informational purposes.

1.4 Cost

The total expected capital expenditures associated with an upgraded taxi fleet including 10 vehicles is $1.1 million. It is that the expected cost for new taxis will be $40,000 per vehicle.

No estimate of operating costs is provided for this mode, as operating costs will depend largely on the contractual arrangement with the taxi operator. In addition, the operating costs will include ongoing costs associated with the electronic hailing application; however, not enough public information is available to inform a reliable estimate.

2 Upgraded Shuttle to Airport Terminal on Public Roads

2.1 Mode Outline

Currently, Village Taxi operates a shuttle service to transport passengers between the LIRR Ronkonkoma Station and LI MacArthur Airport terminal. The upgraded shuttle plan involves changes and improvements to the current system infrastructure and operations to enhance the customers' sense of connectivity when using transit to access the airport. Most changes to the system center on adoption of high-standard vehicles, introduction of frequent service, and improvements to the passenger experience at the train station and at the boarding and drop-off zones.

There are two options for siting the shuttle at the Ronkonkoma LIRR station: the loop north of the tracks, or south of the tracks. The shuttle would proceed along a route on public roadways, following Smithtown Avenue, Lakeland Avenue, and Veterans Memorial Highway before accessing the airport via Schaeffer Road.

Generally, shuttles would be scheduled to depart from the train station and airport terminal approximately every twenty minutes during peak activity hours, with adjustments to meet every train arrival. Service should be provided during all hours during which the airport is active – approximately 4:00am to 1:00am.

The service should operate with new buses. Two vehicles plus one spare should be sufficient to operate the service. These vehicles are usually 40-feet in length, with a capacity to seat 40 persons and hold a similar number of standing passengers. However, to improve the experience for air-travelers, the final fit-out should include a seating arrangement that accommodates luggage racks and better in-vehicle circulation. To reduce emissions, the fleet could be comprised of new, battery electric buses. While such buses are more expensive to purchase and require installation of new charging infrastructure, they have lower lifetime costs due to lower fuel and maintenance expenses. Buses should be equipped with an automatic vehicle location system that can be used to track the location of the vehicles in transit and provide real time passenger information (RTPI) on shuttle arrival times for passengers waiting at the train station or airport. Vehicle livery should be designed with a unique brand to reinforce the new connectivity provided by the service.

Several ancillary improvements are associated with the new shuttle system:

- An enclosed bus shelter at Ronkonkoma LIRR Station would provide a comfortable waiting area for passengers at the train station. The station should feature amenities such as seating, heating and cooling, information displays, and check-in kiosks. To ensure that the shelter can comfortably accommodate travelers with luggage, a minimum of 10 square feet per passenger, net of furnishings, is recommended for shelter sizing.[1] MTA should be consulted on providing wayfinding around the station area to help guide passengers to the pick-up area. Stations should feature branding elements consistent with the vehicles.
- To provide space for a new shelter, capital improvements (extending curblines and building new concrete sidewalks) are needed adjacent to the train station area.
- A small depot is required to provide the buses with light maintenance, cleaning, storage and charging (should the vehicles be electric).
- A layover area for driver breaks is also required on airport property. Stakeholders have indicated that the new Transportation Facility located at 150 Arrival Avenue should be suitable upon completion.
- Video screens for passenger information should be set up at the train station bus shelter, and at the airport terminal. At the train station, these screens should display information on departing flights as well as the time of the next departing shuttle. At the airport, arriving passengers should be provided with real time arrival and departure information for the LIRR as well as the time of the next departing shuttle.

2.2 Rollout Plan

The initial steps for implementing the upgraded shuttle service involve siting the new infrastructure required. First, the location of shuttle stops must be finalized. The existing options at the LIRR station are either north or south of the tracks. At the airport, the route may be configured for shuttles to stop curbside at the terminal or at a new location near the transportation facility. Preliminary engineering of the stations and shelters may be required to inform this process. Suitable locations and size must also be determined for parking at the driver layover area and for the bus depot capable of supporting light-maintenance, cleaning, and vehicle charging.

At a future conceptual design phase, Suffolk County should further explore options for contractual means and business models for operations. This involves identifying the appropriate public and/or private entities to purchase the vehicles and to provide drivers and administrative staff for operations. The service could be operated by Suffolk County Transit, or a private contractor. In the latter case, the vehicles and technology may be owned by a public entity and operated and

[1] Based on the minimum threshold for a Level of Service "B" rating for queuing areas.

maintained under a service agreement. Alternatively, a private entity willing to purchase and own the vehicles could be sought.

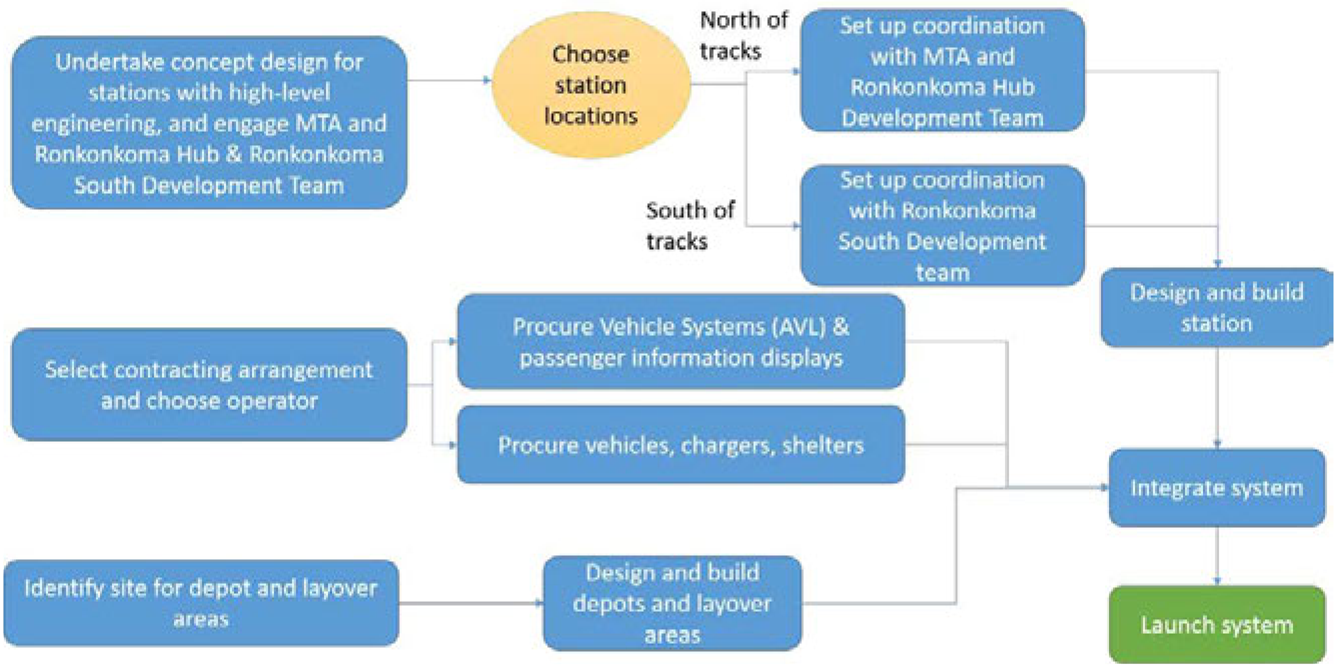

Figure 2: Rollout Plan, Upgraded Shuttles on Public Roadways

The next steps are begin acquiring and constructing the elements needed to run the service. At this stage, vehicles, shelters, AVL and real-time passenger information systems will be procured from a vendor. Final design and construction for the bus depot and transportation center improvements will begin. Final designs for the shuttle station at the LIRR should be coordinated with the MTA and/or property developers of Ronkonkoma Hub and Ronkonkoma South, and then constructed.

In the final step, the operator defines the service plan (scheduling trips and assigning shifts to drivers). It also requires integrating the technology components so that real time information on flights, trains, and shuttles are communicated and displayed appropriately to customers. Subsequently, the service can be launched to the public.

2.3 Key Considerations

The key considerations for the upgraded shuttle service are related to contractual model and siting of various elements.

Contractual models – Key considerations on the contractual model focuses on two key questions: who will operate the bus service and who will purchase the vehicles? Duties of the operator will include providing staff for driving, cleaning and conducting light maintenance for vehicles, and periodically updating the service plan as train and flight schedules change. A selected public entity, such as Suffolk County Transit, would procure and own the buses, in-vehicle technology, and charging infrastructure. If the operator is a private company, the private contractor would operate and maintain the publicly-owned fleet under a service agreement. A private ownership model would involve accepting proposals to identify a company that would be willing to purchase vehicles and technology meeting Suffolk County's standards in addition to operating the bus service. The public procurement model is likely to be more successful, as the capital investment in new high-standard vehicles poses a large financial risk to the operators.

Infrastructure siting – There are two potential locations for siting the shuttle station at the LIRR Ronkonkoma station: on the north side of Railroad Avenue, just south of the square planned in the Ronkonkoma Hub development; or south of the station; as shown in Figure 3. While the northern station alignment (Location A) avoids potential delay resulting from heavy park-and-ride activity during the morning and evening peak hours, the routing is more circuitous and must stop at the signalized intersections located just east and west of Smithtown Avenue on Railroad Avenue. The southern alignment (Location B) may suffer delays from conflicts with parking vehicles, but avoids potentially recurring stops at the traffic lights.

Because the sidewalks adjacent to the train station are narrow, installation of the proposed shelters requires additional capital work at either location. At Location A, the new shelter and bus dwelling areas would have to be integrated into the local design for the Ronkonkoma Hub Development. At Location B, the curb would be extended southward into the existing drop off area to allow for installation of the shelter and a clear path on the north side of Easton Street. In addition, the plan for Location A would require coordination with the long-term development of Ronkonkoma Hub, while the Location B plan for south side operations would require coordination with the eventual development of the Ronkonkoma South Site.

Memorandum

Figure 3: Shuttle Stop and Routing Options at Ronkonkoma

In addition to stations, a convenient layover area where driver may park vehicles during breaks is required. It is desirable to place parking near the new transportation facility at the airport terminal, as this location has been identified as a suitable location for administrative functions and to house bathrooms, breakrooms, and other amenities for drivers.

Bus depot – This facility should be designed to support bus storage, light maintenance, and regular cleaning of the shuttle buses. Electric vehicle charging infrastructure should also be located at the depot (only if the vehicular fleet is electric or hybrid). Ideally, this location would be close to the new transportation facility, to consolidate the operational infrastructure (parking, break rooms, and administrative functions) within the airport. To provide a sense of scale, Figure 4 presents a diagram showing two possible locations for a 100-by-100-foot bus depot.

Figure 4: Potential Size and Location of Bus Depots

2.4 Costs

The total expected capital expenditures associated with an upgraded shuttle service amount to $8.5 million. This includes a fleet of three new, battery electric buses along with charging infrastructure and ancillary structures.

The annual operating costs could amount to approximately $2.2 million, but this would vary with specific operating plans and contractual arrangements.

3 AV Shuttle to Airport Terminal on Private Roads

3.1 Mode Outline

The upgraded shuttle on private roads will operate with similar elements and service to the upgraded shuttle on public roads. The service will accept passengers at the Ronkonkoma LIRR Station shortly after arriving LIRR trains from a sheltered station, bringing them to a station located at the airport terminal and vice versa.

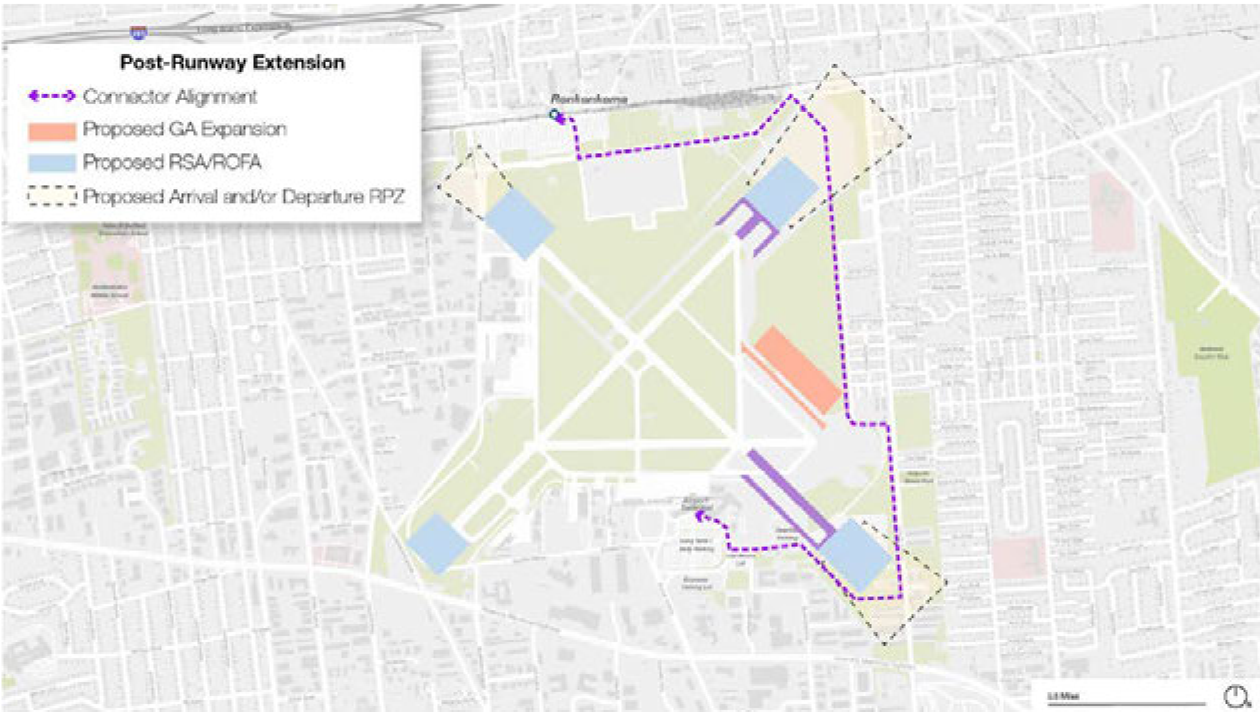

Figure 5: AV shuttle on private roads route alignment

The major difference between the two shuttle options is the routing. Shuttles will travel mostly on exclusive right-of-way, entirely within airport property. The shuttle will travel along a portion of Railroad Avenue south of the LIRR tracks, entering the airport property at a secure gate located north-north-east of the airfield. Shuttles would then travel toward the terminal along a new roadway within the airport, approximately 3.5 miles in length. An Airport Operation Area (AOA) fence will be required on both sides of the roadway until the roadway exits the airport secured area and enters public area.

To avoid conflict with the Runway Protection Zones (RPZ) and other FAA protected surfaces for runways 6/24 and 15R/33L, the airport shuttle roadway would traverse underneath the two RPZs and other surfaces in tunnels to be constructed as part of the system implementation. Based on soil data from the USDA, the ground underneath the runway and taxi lane area consists of cut and fill land (CuB) and the area surrounding the runway (including the runway safety zone and RPZ) consists mostly of sandy loam (RdA).

Figure 6: LI MacArthur Airport Soils Map (USDA)

Preliminary geotechnical observations suggest that a culvert box tunnel would be most cost efficient and viable. A cut and cover method shall be considered as the preferred construction technique for the tunnel. The proposed bus route will be passing through approximately 2,000 feet in northeast of runway 6/24 RPZ area and 2,000 feet southeast of runway 15L/33R RPZ area. Since the tunnel with 2-way lane is too large for pre-cast box culvert, the construction of the tunnel will require a support wall system, excavation, built-in covert box, and cover. Assuming normal construction period and weather-permitting condition, it would require a range of 6 to 12 months to complete 2,000 feet of tunnel. Use of precast box culverts could reduce construction time, but a second box would be required to support two-way traffic.

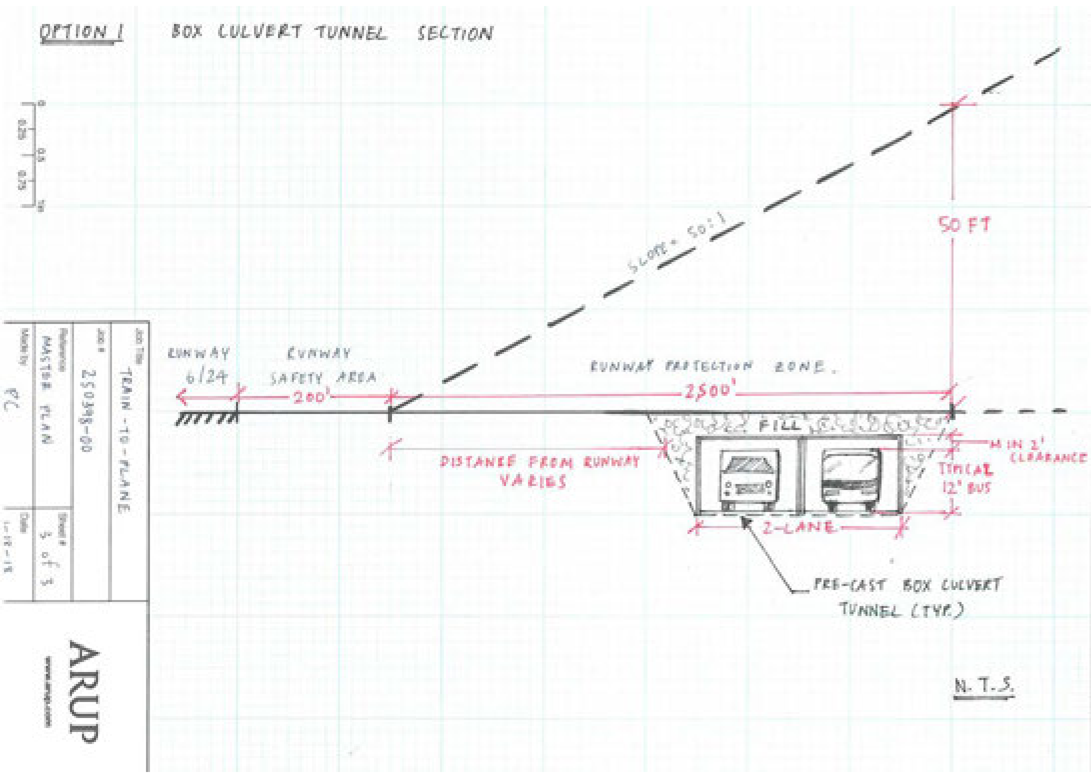

Figure 7: Aircraft Landing Clearance Sketch with Box Culvert

As the shuttle roadway approaches each RPZ, it would slope down and enter the box-culvert tunnel, exiting the tunnel once clear of the RPZ.

Due to the tunnel and roadway construction, this option is viable only in the medium- to long-term option. Because of this time-frame, and the exclusive right-of-way, it may be possible to offer the shuttle service using autonomous vehicles (AVs). In the context of the train-to-plane connection, an AV would arrive at the designated shuttle station south of the train station, transporting passengers to the airport. At the airport, the passenger pick-up and drop-off area would be located at the end of the shuttle route, near the new transportation facility, and not curbside in front of the terminal.

To avoid railway crossings, the shuttle station should be located south of the LIRR tracks. The AV's operational plan should be similar to the conventional shuttle's, with vehicle headways of approximately 20 minutes, with some flexibility to meet arriving trains and aircraft on peak activity periods.

Ancillary improvements associated with an autonomous shuttle operating using new roadways on airport property include:

- Security gates at the entrance to the airport property, as well as fencing alongside the shuttle route. The fence will be a typical chain link fence, with at least 8 feet om height with 3 strands of barbed wire, totaling approximately 1.3 miles in length (2.6 miles if required on both sides of the roadway. The security fence will require AOA access gate to provide access to service vehicles, and a Perimeter Intrusion Detection System (PID) may be required.

- New utilities will be required along the proposed roadway. New fixtures are needed to provide lights, and electric conduit, wires, and pull boxes are required to supply these light poles. A water line may also be required if the proposed roadway and tunnel needs fire protection. Assuming all on-airport utility lines are active, the proposed utility shall be connected to the existing airport system.
- A stormwater system is required for the proposed roadway. Impervious area generated from proposed roadway is approximately 731,200 sf (17 acre). Using the NYS standard stormwater management guideline and NOAA rainfall intensity of Long Island for a duration of 15 minutes using 10-year design storm runoff, the roadway could accumulate more than 70,000 cubic foot of water (524,000 gallons of water) per rainfall event. Stormwater runoff is required to be treated to a certain quality before release into the municipal system. By using stormwater management system such as underground detention tanks, bioswales, and a traditional storm sewer system, stormwater runoff could be treated, the flow reduced, and then connected to the existing airport storm sewer. The existing storm sewer may need to be increased in size to manage additional runoff from new roadways. Additional information would be required to evaluate this.
- Enclosed, climate controlled shelters for shuttle passengers at the train station and airport.
- Small depot for light maintenance, cleaning, and parking of AV shuttles. If a traditional shuttle bus depot has already been constructed – this may only require a few simple upgrades.

3.2 Rollout Plan

The initial step is to coordinate with key stakeholders to determine the feasibility of the autonomous shuttle operations. NYSDOT will likely need to issue regulatory approval for the AV program as the regulator. Consulting with AV vendors is necessary to determine the available vehicle specifications and the operating requirements of these vehicles. Depending on regulatory and technological changes in the future, an AV shuttle may require that some right-of-way *outside* the airport also be converted to exclusive AV routes. It important to coordinate with the developers of Ronkonkoma Hub and Ronkonkoma South to understand any impacts to nearby land uses of changes to the road network and siting of the shuttle station.

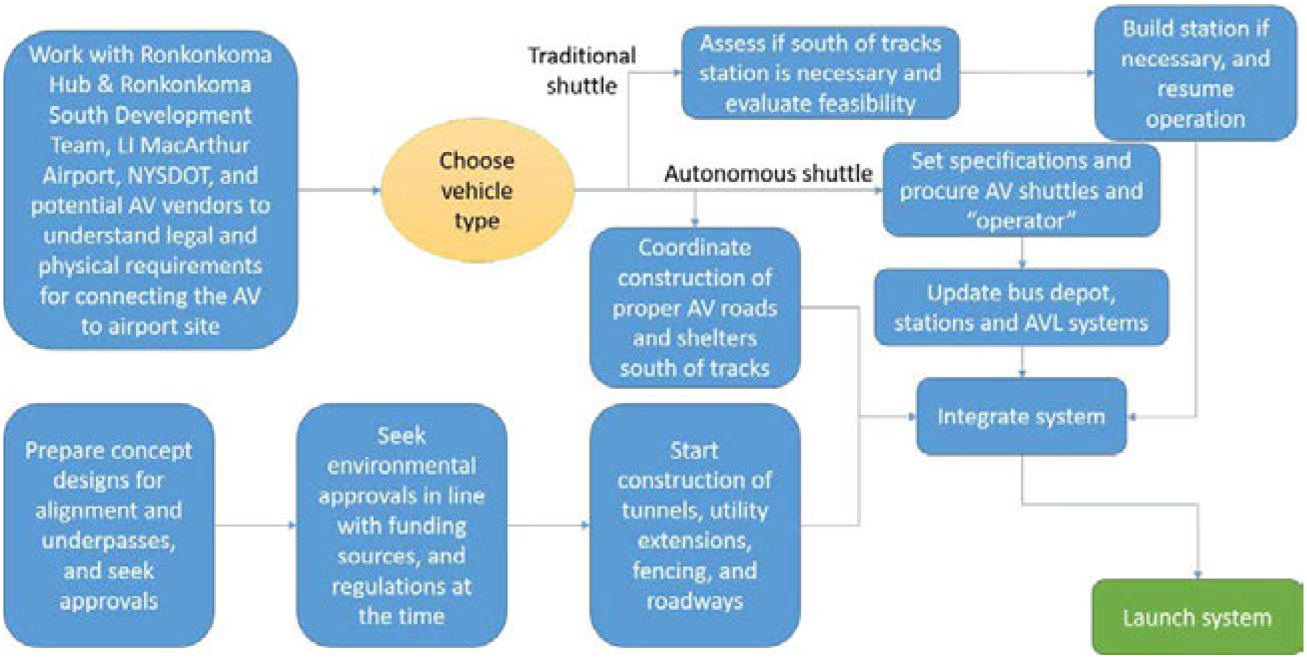

Figure 8: Rollout Plan, AV Shuttles on Private Roadways

If autonomous vehicles are deemed feasible, the next steps are to set forth vehicle specifications (capacity, features, number of vehicles required) and to begin the procurement process. At this stage, a new or updated bus depot and all roadway improvements needed to run the AV shuttle should be constructed. Updates to the AVL and real-time passenger information systems will proceed around this time.

If conventional vehicles are selected to operate on the airport, the airport may already be operating service with suitable vehicles. (If no service is in operation at that time, vehicles should be procured and an operator selected, per the previous section). However, if a sheltered shuttle station been placed north of the LIRR, it may need to be relocated to the south side of the tracks to efficiently access the airport via Railroad Avenue. A final determination should be made whether this is necessary and feasible.

Regardless of the vehicle technology used, conceptual designs for the roadway alignment and tunnel underpasses should also be completed in an independent, parallel timeline. This initial design phase is necessary to apply for and obtain approvals by the FAA for Obstruction Evaluation/Airport Airspace Analysis (OE/AAA), by the New York State Department of Environmental Conservation (NYS DEC) for the State Environmental Quality Review (SEQR), and the United States Environmental Protection Agency (EPA) for the National Environmental Policy Act (NEPA) process (the last only if the project is funded at least in part from federal sources). Once approvals are received, final design and construction for the new roadway, tunnels, bus shelters, and associated infrastructure improvements can move forward.

Once infrastructure improvements are made and the passenger information systems have been upgraded, the service may be launched to the public.

3.3 Key Considerations

The key considerations for an upgraded shuttle traveling on private roadways to the airport terminal are the vehicle technology, the regulatory environment, and complexity of construction.

Vehicle technology – The concept of a shuttle service on airport roads does not depend on use of any vehicle technology. The service could be provided using conventional buses, in which case similar considerations to the shuttle operating on public roads concept would apply. Alternatively, a shuttle service could potentially be provided using autonomous shuttle vehicles. The implementation requirements will depend on the best-available technology at the time of deployment.

Currently, pilot projects in the U.S., Europe, and Japan are underway using low-capacity (9-12 person) autonomous shuttles.[2] These vehicles generally meet the criteria for "high automation," meaning the vehicle is "capable…of all driving functions under *certain* conditions" (emphasis added).[6,3,4,5] These vehicles are not yet capable of navigating busy public roads with mixed-traffic, but circulate in private areas or very limited sections of public roads. While the individual vehicles do not require drivers, the system is managed remotely by operators capable of handling exceptions and issues.

The technology to enable "full automation" – which allows vehicles to perform "all driving functions under *all* conditions" – is advancing rapidly (emphasis added).[6] Full automation would allow the autonomous shuttle to operate in mixed traffic safely and reliably.

If the "high automation" level represents the best available technology at the time of deploying the train-to-plane connection system, portions of the road network south of the train station may need to be closed to private traffic to operate the autonomous shuttle safely. Physically separated automated vehicle lanes could also be required on portions of Railroad Avenue used by shuttles to access the on-airport roadways. However, if "full automation" technology is commercially available, the shuttle vehicles could likely operate independently in mixed traffic under any scenario, generally without supervision from a remote operator.

Regulatory environment – As AV technology evolves over the next decade, so too will regulations. To provide this service, the final operator of the autonomous shuttle system (whether a

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[2] https://www.prnewswire.com/news-releases/aaa-and-keolis-launch-nations-first-public-self-driving-shuttle-in-downtown-las-vegas-300551187.html;
[3] http://www.easymile.com/portfolio-page/sohjoa-project-finland/;
[4] https://futurism.com/japan-is-testing-driverless-buses-to-help-the-elderly-get-around/
[5] https://navya.tech/en/inauguration-of-the-autonomous-shuttles-service-at-la-defense-in-paris-2/;
[6] https://www.nhtsa.gov/technology-innovation/automated-vehicles-safety

public entity or a private contractor) will need to seek approval from NYSDOT to provide commercial service using unmanned vehicles. Currently, NYSDOT does not have a specific policy that would cover the train-to-plane connection. The agency may develop such a policy in the future or require an approval as the primary regulatory for commercial transportation in the State of New York.

The extensive construction in the airport will trigger the need to seek additional approvals. The roadways and tunnels under the RPZ would likely require an update to some or all of LI MacArthur Airport's Airport Layout Plan (ALP). The airport will need to coordinate with the FAA's New York Airports District Office to determine the scope of changes to the ALP. In addition, the capital works will trigger environmental reviews by State and Federal agencies (depending on the project's funding sources), and airspace reviews by the FAA.

3.4 Cost

Capital expenditures for this option are expected to be in the rough-order-of-magnitude of $41 million. This figure includes construction of the new roadways and tunnels.

Not enough public information is available to inform an estimate of the capital and annual operating costs of procuring and operating AV shuttles. However, the initial investment in vehicles is likely to be small in comparison to the costs of providing the roadway and tunnel infrastructure.

4 Moving Walkway to Relocated Terminal

4.1 Mode Outline

Under a scenario of relocating the LI MacArthur Airport terminal to the north side of the airfield, the new terminal would be located much closer to Ronkonkoma LIRR Station and a vehicular transportation system would likely be unnecessary. Instead, a moving walkway could bridge transit-riders' final leg from the train station building to the north-side terminal facility. It would consist of two parallel conveyor systems to aid passengers' travel in both the direction of the train station and the airport. The walkways would provide universal access – without vertical steps – and allow passengers to walk or ride at faster-than-walking speed. Because the system would run continuously, customers will simply walk between the two facilities, with no need to wait. The walkway system enhances this journey by making it faster and more comfortable. Such a system would easily be able to meet current and likely future demand for LI MacArthur Airport access.

The alignment of the walkway would be determined to provide the shortest, most direct connection between the train station and terminal and would be housed within a climate-controlled structure, with entry/exit points located directly at the train station and terminal buildings. Depending the ultimate on future development of the airport and adjacent properties, the walkway could be constructed at ground level, elevated, or potentially underground.

Various moving walkway systems and technologies exist, with slightly varying speeds and lengths. It is likely that the moving walkway systems for LI MacArthur Airport would be long, with travel times in the range of 3.5 to 6 minutes. Trip times would be minimized by using a variable speed walkways. Such walkways have two-speeds: typical walkway speeds towards the access and egress points, and faster "cruise" speeds towards the middle.

For maximum user comfort, the supporting structure for the system should include sufficient access to views and daylight, and be safely lit during times of darkness. This structure should also include enclosure walls, external railing, guards, closures, shutters, ventilation and smoke barriers as required. Adequate areas should be provided for passengers to queue before entry and to re-adjust any baggage, attend to children, etc. upon exit, with further detail defined in ASME A17.1 (Section 6.2.3.8.4).

4.2 Rollout Plan

Because of the transit oriented development goals for Ronkonkoma Station, the physical environment around the train station is likely to change in the medium-to-long term. The moving walkway and additional development should complement and not preclude each other. Thus, the first stage in developing the moving walkway system plan is to coordinate conceptual designs between the terminal development team and the developers of Ronkonkoma Hub and Ronkonkoma South sites. The location and mass of structures and future roadway alignments will influence the final alignment of the walkway system and help determine whether an at-grade or elevated walkway structure is preferable.

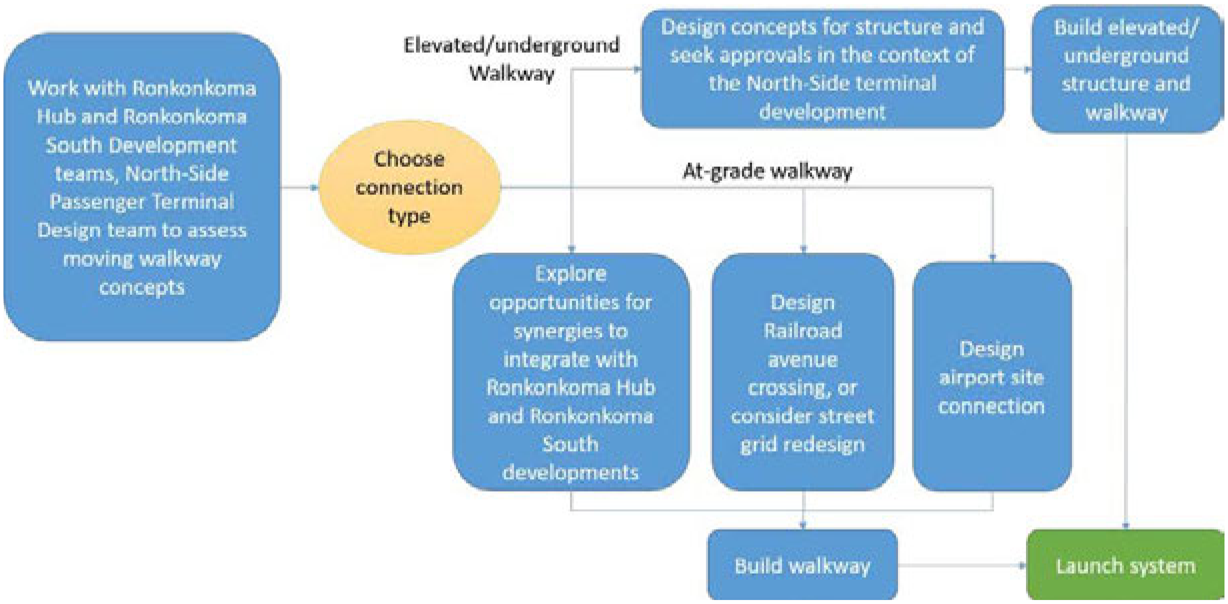

Figure 9: Rollout Plan, Moving Walkway

If the walkway is at-grade (at street level) several opportunities should be explored. First, there may be potential for providing additional access points to new development sites. In addition, reconfiguration of the street grid south of the train station may be required to provide the at-grade walkway system to avoid conflicts with circulating traffic on the street level.

Once the final elevation is determined, the access points and structures – including mechanical integration of the walkway – will be designed. During this period, the airport may begin the process of procuring the walkway components from a manufacturer. The next phase is to construct the moving walkway, meeting the construction timeline of the new terminal – with the new facilities opening to the public at the same time.

4.3 Key Considerations

The key considerations for the moving walkway center on the timeframe, future development, and the supporting structure.

Timeframe – The moving walkway system is not feasible without relocation of the LI MacArthur Airport passenger terminal to the north side of the airfield, near the Ronkonkoma LIRR station. Redevelopment of the airport is a major undertaking, placing the potential for a walkway connection firmly on a long term (20+ years) planning horizon. Any required environmental review related to the walkway would be folded into the larger assessment of the airport redevelopment.

Future development –The system would be constructed concurrent to the development of the proposed North-Side Terminal, and should be integrated into the design of any proposed new build that occurs between Ronkonkoma Station and LI MacArthur Airport – the Ronkonkoma Hub South project. For example, the Moving Walkway could be integrated into new development proposed for the existing surface parking lot, providing an opportunity for users to exit the walkway for retail opportunity or comfort stations and re-enter to continue their journey.

Supporting structure – The supporting structure for the Moving Walkway could be constructed at ground level or as an elevated skyway. Ground-level construction would require less structural support, greater flexibility for adjacent walkways, and reduced complexity for integration with the Station and the North-Side Terminal. However, a ground-level structure would obstruct roadways, requiring re-routing of surface transit, or under/overpass construction. An elevated structure would require greater technical and infrastructure considerations, and is thus costlier. However, it would preserve the flexibility of surface-level mobility with a minimal footprint. As discussed above, the plans for the moving walkway – as well as the terminal relocation – will need to be closely coordinated with land use developments adjacent to the train station, the Ronkonkoma South, which should redevelop the existing park-and-ride lots south of the tracks.

4.4 Costs

The total capital expenditures the moving walkway equipment are expected to reach approximately $15 million. This figure includes the purchase and installation of walkway equipment. This figure does not include the costs of relocating the terminal itself. Due to the high level of uncertainty regarding the range of construction options, it also excludes any elevated structures, tunnels, or other features required for integration with the new terminal.

The annual operating costs for the walkway may reach approximately $150,000. This cost includes the energy requirements of the walkway as well as maintenance and cleaning.

5 Cost-Effectiveness Review

The cost estimate is classified as a Class 5 rough order of magnitude estimate according to Arup's estimate classification matrix (Level 5), which was developed from the Association for the Advancement of Cost Engineering (AACE) best practices.

The accuracy range of this estimate has been determined to be -25% and +50%. The accuracy range is a gauge of likely bid prices if the project was issued to tender at this current stage.

These estimates are based on the measurement and pricing of quantities wherever information is provided and/or reasonable assumptions for other works not covered in the drawings and programs as stated in this document. The unit rates reflected herein have been obtained from experience of projects of this nature.

General cost assumptions:

- The values are from the fourth quarter of the year 2017
- Material costs are calculated from data bases such as RS Means, similar project costs and vendors
- Labor rates, fringes and taxes are calculated based on the Bureau of Labor Statistics from the United States Department of Labor
- A New York location factor is applied to the labor and material costs, this factor is obtained from the portal RS Means
- The Operational Cost estimate is not a Life Cycle Cost, meaning that there might be other costs involved to operate the facilities
- ARUP has no control over the cost of labor and materials, general contractor's or any subcontractor's method of determining prices, or competitive bidding and market conditions. This opinion of probable cost of construction is made based on the experience, qualifications, and best judgment of the professional consultant familiar with the construction industry. ARUP cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from this or subsequent cost estimates.
- ARUP recommends that the Owner carefully review this document, including line item descriptions, unit prices, clarifications, exclusions, inclusions and assumptions, contingencies, escalation and markups. If the project is over budget, or if there are unresolved budgeting issues, alternate systems schemes should be evaluated before proceeding into the construction phase.

Some items that may affect the cost estimate:

- Modifications to the scope of work included in this estimate.
- Special phasing requirements.
- Restrictive technical specifications or excessive contract conditions.
- Any other non-competitive bid situations.
- Bids delayed beyond the projected schedule.
- Loss of labor productivity.
- Future market conditions.

The cost estimates reflect standard project conditions, and the best information available, and therefore exclude items that have substantial variation or that require design details available only at a future date. These items are listed at Table 1.

Table 1: Items excluded from the cost estimate

Items excluded from the cost estimate
The costs or impacts of latent environmental issues that result in litigations or development delays
Owners contingency
Planning and enquiry costs, including legal expenses and fees
Local planning obligations and agreements
Site investigation
Local taxes and duties
Right-of-way and or land acquisition costs
Risk-based contingency analysis
Tests and inspections performed by others, apart from that listed in the estimate
Program management and construction management costs
Compensatory costs to other interested parties
Cost benefits and impacts associated with improvements in construction technology, more severe regulatory requirements, and future construction that may impact the work contemplated under this project
Removal and disposal of hazardous materials, unless otherwise stated in the cost estimate
Integration to the building management or communication systems otherwise stated
Structural, civil and architectural costs otherwise stated
Consultant fees
Owners Costs
Preliminary Engineering costs
Detailed Engineering costs
Escalation allowance

5.1 Capital Expenditures

Pricing shown reflects probable construction costs obtainable for replacement works on the date of this statement of probable costs. This estimate is a determination of fair market value for the construction of this project. It is not a prediction of low bid. Pricing assumes competitive bidding for every portion of the construction work for all subcontractors, that is to mean 4 to 5 bids. If fewer bids are received, bid results can be expected to be higher.

Assumptions regarding other costs:

- An allowance of 20% from direct cost is considered as general requirements, which covers costs related to general staff wages and fringes, site conditions and temporary power.
- Allowed a project reserve of 15% from total direct cost due to the project's uncertainty.

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- Allowed contractor's overhead and profit of 15% from the total cost.
- Allowed contractor's bonds and insurances of 2.5% from the total cost.
- Escalation allowance is excluded in this estimate.
- The Total Unit Cost is compound by material, crew and sub-contractor overhead and profit.
- Crews are integrated of labor and equipment and are defined based on similar project costs and RS Means portal.

Table 2: Upgraded Taxis Capital Cost Estimate

CAPITAL COST ESTIMATE			
Alternative 1 - Upgraded Taxis	**QUANTITY**	**Total Cost [$]**	
Direct costs			
Charging Station		**$**	**590,000**
Taxi charging station	10	$	520,000
Installation civil works and connections	10	$	70,000
Total Direct Costs		**$**	**405,000**
Indirect Costs			
General Requirements (staff, site conditions, temporary power)	20.00%	$	81,000
Construction Contingency	15.00%	$	60,800
Total Cost (Direct + Indirect)		**$**	**546,800**
Contractor's Costs			
Overhead and Profit	15.00%	$	82,000
Bond & Insurances	2.50%	$	13,700
Total Contractor's Cost		**$**	**100,000**
Vehicles		**$**	**405,000**
Nissan NV200	10	$	305,000
Taxi special accomodations	10	$	100,000
Total Price (Total Cost + Contractor's Cost)		**$**	**1,051,800**
Total Price (Low)	**-25%**	**$**	**789,000**
Total Price (Likely)		**$**	**1,051,800**
Total Price (High)	**35%**	**$**	**1,420,000**

Assumptions:

- Assumed 10 Nissan NV200 plus taxi special accommodations
- Assumed 10 charging stations
- An allowance of $8.5k per charging station for installation and minor civil works

- No civil works considered otherwise stated
- Depot or maintenance facility excluded

Table 3: Shuttle on Public Roads Capital Cost Estimate

CAPITAL COST ESTIMATE			
Alternative 2 - Shuttle system on public roads	**QUANTITY**	**UNIT**	**Total Cost [$]**
Direct costs			
Bus Platform / Station	**2**	**EA**	**$ 906,000**
Shelter to accommodate 30 passengers	1,500	SF	$ 375,000
HVAC system (heating/AC)	1,500	SF	$ 34,500
Vending machines	1	EA	$ 8,100
Displays and installation	1	EA	$ 12,400
Real time passenger information system (RTPI)	1	EA	$ 23,000
Bus depot	**1**	**EA**	**$ 3,104,000**
Storage and maintenance depot, 10000 SF	10,000	SF	$ 1,980,000
Additional Depot items	10,000	SF	$ 860,000
Bus charging station	4	EA	$ 264,000
Total Direct Costs			**$ 4,010,000**
Indirect Costs			
General Requirements (staff, site conditions, temporary power)	20.00%		$ 802,000
Construction Contingency	15.00%		$ 602,000
Total Cost (Direct + Indirect)			**$ 5,414,000**
Contractor's Costs			
Overhead and Profit	15.00%		$ 812,000
Bond & Insurances	2.50%		$ 135,000
Total Contractor's Cost			**$ 950,000**
Shuttle Bus			
BYD K9 electric bus	3	EA	$ 2,166,000
Total Price (Total Cost + Contractor's Cost)			**$ 8,530,000**
Total Price (Low)	**-25%**		**$ 6,398,000**
Total Price (Likely)			**$ 8,530,000**
Total Price (High)	**35%**		**$ 11,516,000**

Assumptions:

- Two 1500 SF stations considered

- A 10000 SF bus depot / maintenance facility considered

Roadway and tunnels under the RPZ					
	DESCRIPTION	**QTY**	**UNIT**	**UNIT PR**	**AMOUNT**
1	2-Lane Road with shoulder (6" base, 6" stone, 3" top)	680,000	SF	12	8,160,000
2	Street Strippinng	20,000	LF	15	300,000
3	Demolition of existing roadway	20,000	SF	10	200,000
4	Cut and fill roadway profile	31,481	CY	15	472,222
5	AOA fence	20,000	LF	170	3,400,000
6	Water	20,000	LF	60	1,200,000
7	Lighting fixtures	20	EACH	6,000	120,000
8	Electrical	20,000	LF	50	1,000,000
9	Storm	20,000	LF	70	1,400,000
10	12' x 6' Pre-cast box culvert tunnel	4,000	FT	3,665	14,660,000
11	Cut and Cover	118,519	CY	15	1,777,778
	TOTAL				32,690,000
	CONTINGENCIES	25%			**40,862,500**

Assumptions:

- Roadway length = 20,000 ft
  - Width = 34 ft
  - Depth = 1.25 ft
- Tunnel length = 4,000 ft
  - Width = 40 ft
  - Depth = 20 ft

Table 4: Moving Walkway Capital Cost Estimate

CAPITAL COST ESTIMATE			
Alternative 4 - Moving Walkway	QUANTITY	UNIT	Total Cost [$]
Direct costs			
Moving Walkway	2	EA	**$ 9,520,000**
Moving Walk, 48" tread width	1,400	LF	$ 4,760,000
Infraestructure			**$ -**
			$ -
Total Direct Costs			**$ 9,520,000**
Indirect Costs			
General Requirements (staff, site conditions, temporary power)	20.00%		$ 1,904,000
Construction Contingency	15.00%		$ 1,428,000
Total Cost (Direct + Indirect)			$ 12,852,000
Contractor's Costs			
Overhead and Profit	15.00%		$ 1,928,000
Bond & Insurances	2.50%		$ 321,000
Total Contractor's Cost			$ 2,250,000
Total Price (Total Cost + Contractor's Cost)			**$ 15,102,000**
Total Price (Low)	**-25%**		**$ 11,327,000**
Total Price (Likely)			**$ 15,102,000**
Total Price (High)	**35%**		**$ 20,388,000**

Assumptions:

- A 1400 Linear Feet 48" tread width moving walkway considered
- Moving walkway installation allowance considered
- No civil works considered otherwise stated

5.2 Operating Expenditures

Assumptions regarding other costs:

- Allowed a project reserve of 15% from the total operational cost due to the project's uncertainty.
- The operational costs are calculated for a year of operations, which is equivalent to 365 days.

- The frequency of each activity is considered based on similar projects and conversations with operators.
- A crew formed by labor and equipment is considered for each activity.
- A cost of $ 0.2 kwh for energy is considered.

Table 5: Shuttle on Public Roads Operating Cost Estimate

	Quantity	Units		total cost per year
Operations costs				
Bus Platform / Station	**2**	**EA**	**$**	**108,000**
Energy Consumption (HVAC, lights, AC, etc)	12.5	KWH	$	18,250
Cleaning allowance	1	MO	$	35,561
Bus depot	**1**	**EA**	**$**	**825,000**
Facility Technical Staff	4	MO	$	491,021
Facility Manager Staff	1	MO	$	197,561
Office consumables	1	MO	$	12,000
Energy Consumption (HVAC, lights, AC, etc)	50	KWH	$	30,000
Cleaning allowance	1	MO	$	94,830
Shuttle Bus	**2**	**EA**	**$**	**1,021,214**
Electric power / fuel	1	EA	$	11,340
Bus Drivers	3	MO	$	499,267
Total Operational Cost			**$**	**1,954,000**
Reserve	15%		$	293,100
Total Price (Total Operational Cost + Operator's Cost)			**$**	**2,247,000**
Total Price (Low)			**$**	**1,685,000**
Total Price (Likely)			**$**	**2,247,000**
Total Price (High)			**$**	**3,033,000**

Table 6: Moving Walkway Operating Cost Estimate

	Quantity	Units		total cost per year
Operations costs				
Moving Walkay				
Maintenance for Moving Walk, 48" tread width	1400	FT	$	52,015
Electric power / fuel	1400	FT	$	26,205
Cleaning allowance	1	MO	$	47,415
Total Operational Cost			**$**	**126,000**
Reserve	15%		$	18,900
Total Price (Total Operational Cost + Operator's Cost)			**$**	**144,900**
Total Price (Low)			**$**	**109,000**
Total Price (Likely)			**$**	**144,900**
Total Price (High)			**$**	**196,000**

5.2.1 Cost Summary

The summary of the capital and operating costs for the connector options, to the extent that is possible to estimate them (as outlined by the assumption in the previous sections), is presented at Table 7.

Table 7: Cost Summary

	Short-Term: Upgraded Taxis
Capex	$ 1,100,000
Opex	TBD
	Estimate based on the cost of 10 vehicles and 10 chargers. Capex and opex of E-hailing app are not indicated, since there are not enough public records to inform an estimate. Opex also influenced by contracting arrangements with taxi operator.

	Medium-Term: Bus Shuttles
Capex	$ 8,530,000
Opex	$ 2,247,000
	Estimate based on the cost of 3 vehicles and ancillary structures. Opex wil vary according operational plans and contracting arrangements.

	Long-Term Current Terminal: AVs Through Airport
Capex	$ 41,000,000.00
Opex	TBD
	Capex cover new roadway and tunnels. Capex and opex of AVs are not indicated, since there are not enough public records to inform an estimate.

	Long-Term North Terminal: Walkway
Capex	$ 15,000,000
Opex	$ 144,900
	Capex considers purchase and setup of walway; does not include construction costs of elevated structure, tunnels and other festures required for integration with the terminal.

5.3 Revenue Sources

There may be some small opportunities for generating revenue from the upgrading of train-to-plane services at the airport. The table below splits out ticket and advertising revenue potential for each alternative. Any generation of ticket revenue needs to be balanced against the cost of collecting the revenue and the impact on passenger experience and appetite for using the new service. Upgrading train-to-plane access might also create new advertising opportunities, which are worth considering but will not bring in significant revenue.

Who owns and operates the proposed alternatives and the contractual relationship between involved parties will also dictate the amount of revenue the airport will collect, compared to revenue for the taxi or shuttle operators (if they are not the airport).

Table 8: Potential revenue sources for the operator

Alternatives	User charges (ticket revenue)	Advertising revenue
Upgraded Taxi Service	**Potential small revenue opportunity** Train-to-plane taxi services currently charge $5 per person and that revenue goes to the taxi operator. The taxi operator then pays an annual fixed fee to the airport for monopoly rights to provide this service. Upgrading the taxi service might justify increasing the $5 charge, but this needs to be considered in the wider context of potential competition from the shuttle bus, and impacts to the attractiveness of the offer. Depending on the future contractual relationship and ownership of the upgraded taxi service there may be opportunities for the airport to capture more of the revenue from taxis rides, instead of a flat fee regardless of usage.	**Potential very small revenue opportunity** Taxis can have exterior and interior advertising which could be a source of revenue for the operator.
Upgraded Shuttle to Airport Terminal on Public Roads	**Potential small revenue opportunity** An Airport shuttle could be free or be available at a small fee for usage. Typically, shuttles owned by an airport are free for passengers and almost always free for airport staff. However, a user charge could be applied. Any user charge would need to be small to be competitive with Taxis, which currently charge $5 per person.	**Potential very small revenue opportunity** Depending on the contractual arrangement with the shuttle owner/operator there may be some opportunities for modest advertising inside or outside of the shuttle.
AV Shuttle to Airport Terminal on Private Roads		
Moving Walkway to North-Side Terminal	**No potential revenue opportunity.** In theory, users could be charged for usage of the walkway, but there are no examples of this in practice and consumer expectation is that moving walkways are free at the point of use.	**Very small revenue opportunity** Depending on the design of the walkway there may be some opportunities for modest advertising.

5.4 Effectiveness

Each proposed alternative brings different benefits for passengers and the airport. In addition to the benefits tabled below, enhancements to train-to-plane access may also encourage more people to choose Long Island MacArthur Airport over alternative airports. The degree to which ground transportation improvements may stimulate additional air passengers has not been calculated in this report but studies indicate that improvements to the quality, reliability, and travel time to and from the airport can induce noticeable shifts in air travel demand at an airport[7].

[7] Transport Research Board - Understanding Airline and Passenger Choice in Multi-Airport Regions. https://doi.org/10.17226/22443.

Table 9: Potential benefits of each alternative

Alternatives	Benefits
Upgraded Taxi Service	**Improved passenger experience:** The updated system would deploy modern vehicles equipped with onboard digital amenities, and design favorable for stepping in and out, baggage movement and accommodation of persons with disabilities. The new fleet would allow passengers to pay by cash/card in addition to a new mobile device function, and to reserve a trip in advance through their smartphone. **Ease of operation:** Like today, by outsourcing train-to-place operations to a third-party taxi operator the airport has lower operational costs and fewer management responsibilities.
Upgraded Shuttle to South Terminal on Public Roads	**More environmentally friendly:** Having a full shuttle bus of passengers is more environmental friendly than multiple taxis or cars transporting passengers to and from the airport. Reducing the number of vehicle trips around the airport will improve local air quality and reduce carbon emissions. This could be further enhanced with a low or zero-emission shuttle buses. **More affordable options for passengers:** Assuming the shuttle would be free, or at least cheaper than a taxi, this alternative would provide users with more choice and less expensive options.
Upgraded Shuttle to South Terminal on Private Roads	**More reliable and resilient service** By using a dedicated private airport road, the shuttle service will be more reliable. Although traffic congestion is not a major issue on the public roads near the airport, by taking the shuttle off public roads it protects the service from un-expected delays that might occur, for example from congestion related to crashes or police activity. **Faster journey times** A dedicated private road would have a marginally more direct route and fewer junctions, meaning that journey times to the airport from the station may be marginally faster than a shuttle bus or taxi on public roads. **More environmentally friendly:** Having a full shuttle bus of passengers is more environmental friendly than multiple taxis or cars transporting passengers to and from the airport. Reducing the number of vehicle trips around the airport will improve local air quality and reduce carbon emissions. This could be further enhanced with a low or zero-emission shuttle buses. **More affordable options for passengers:** Assuming the shuttle would be free, or at least cheaper than a taxi, this alternative would provide users with more choice and less expensive options.

Alternatives	Benefits
Moving Walkway to North-Side Terminal	**Shorter journey:** A moving walkway between the train station and a new northern terminal would significantly reduce the time it takes to transfer from train to airport. The shorter the transfer time the more attractive ISP will be for passengers. With a shuttle or taxi, a passenger might have to wait a few minutes for service but with a moving walkway there is zero waiting time, it is always available when the passenger needs it. **Simpler journey:** Travelling on a moving walkway is easier than using a taxi or shuttle bus. Firstly, you do not need to lift your baggage into a taxi or shuttle. Secondly, most passengers do not perceive a moving walkway as a mode of transport and therefore in the eyes of the consumer moving between the train station and the airport would not require a ‘transfer’. **Weather protection:** Depending on the design of the walkway, passengers could move from the train station to the airport under cover. If the walkway is fully enclosed, passengers could benefit from a more comfortable transfer. **Easy to operate:** Once constructed, a moving walkway have very low operating costs and does not require staff to operate.

6 Environmental Review Effort Assessment

This review estimates the effort required to undertake an environmental assessment for each connection option. This assessment is aimed at assisting decision-making that could impact the development of the train-to-plane connection, and it includes a summary of key regulatory and policy considerations with illustrative assessment durations and potential costs. The schedule and cost estimates reflect rough order-of-magnitude approximations based on information currently available.

This is not an exhaustive evaluation of the options, and a detailed environmental assessment in compliance with all relevant local, state and federal regulations should be undertaken to inform subsequent project stages.

Illustrative time and cost considerations are not provided for the moving walkway, as the environmental assessment for this option would need to be undertaken in conjunction with the development of the proposed North Side Terminal.

A list of references that informed the review are provided at the end of this section.

6.1 Upgraded Taxi Service

Estimated timeline for assessment: 2 – 3 months

Estimated cost of assessment: $25,000 - $50,000

It is assumed that no Federal funding will be used for the development of this option and therefore no National Environmental Policy Act (NEPA) review will be required by the U.S. Environmental Protection Agency.

The project is an unlisted action under the New York State Environmental Quality Review (SEQR). The environmental review will require the preparation of an Environmental Assessment Form (EAF) followed by a Negative Declaration as per SEQR requirements. No public hearings would be required as part of this SEQR review.

A SEQR Lead Agency will need to be identified, and it is anticipated that the EAF will include multiple Involved Agencies, so a coordinated review will be necessary.

The only element of the development of this option anticipated to require environmental analysis would be the construction of electric vehicle (EV) charging stations. Per current development plans, the proposed locations for EV charging stations are on paved and/or previously disturbed surfaces which have been maintained as developed sites. From preliminary review, no trees or other natural vegetation will need to be cleared. It is anticipated that there are no federal or state listed endangered, threatened special concern species, significant natural communities or rare plants that will need to be addressed.

The project is not in the designated Coastal Zone. There are no surface waters or wetlands in the vicinity. The project is in a Sole Source Aquifer area; however, no detailed analysis is anticipated. It is anticipated that there are no cultural resources in the vicinity that could be impacted.

6.2 Upgraded Shuttle Bus on Public Roads

Estimated assessment duration: 3 – 5 months

Estimated assessment cost: $40,000 - $80,000

Even if the project is not funded through the AIP program, grant assurances require the airport to conduct a NEPA review. Because the only new building in the airport would be the bus depot, the FAA would require the airport to complete a Categorical Exclusion (CATEX) or short form EA. Federal funds may also be applied towards this project through FTA’s Urbanized Area Formula Grants (5307).

The project is an unlisted action under the New York State Environmental Quality Review (SEQR). The environmental review will require the preparation of an Environmental Assessment Form (EAF) followed by a Negative Declaration as per SEQR requirements. No public hearings would be required as part of this SEQR review.

A SEQR Lead Agency will need to be identified, and it is anticipated that the EAF will include multiple Involved Agencies, so a coordinated review will be necessary.

Per current development plans, the proposed locations for the shuttle stations and bus depot are on either paved and/or previously disturbed surfaces that have been maintained as developed sites. Based on existing information, it is anticipated that a Phase 1 Environmental Site Assessment (ESA) will be required. It is assumed that no potential hazardous waste issues will be identified.

From preliminary review, no trees or other natural vegetation will need to be cleared. It is anticipated that there are no federal or state listed endangered, threatened special concern species, significant natural communities or rare plants that will need to be addressed.

The project is not in the designated Coastal Zone. There are no surface waters or wetlands in the vicinity. The project is in a Sole Source Aquifer area; however, no detailed analysis is anticipated. It is anticipated that there are no cultural resources in the vicinity that could be impacted.

6.3 AV Shuttle on Private Roads

Estimated assessment duration: 18 – 24 months

Estimated assessment cost: $500,000 - $1,000,000

It is assumed that the development of a new roadway and tunnel will involve Federal funding, from sources other than the AIP, which currently cannot be committed for the project. A NEPA review would be required, and a Federal Lead Agency would need to be identified to determine NEPA documentation format. A detailed Design Report and Environmental Assessment (DR/EA) would be required, and, depending on its findings, an Environmental Impact Statement (EIS) will have to be prepared.

The DR/EA may also serve as the SEQR document. It is anticipated that there would be multiple SEQR Involved Agencies, so a coordinated review will be necessary. The DR/EA will be subject to a Public Hearing, and depending on the requirements of the eventual Federal NEPA Lead Agency, public information meetings may also be required.

Per current development plans, it is anticipated that that trees or other natural vegetation would need to be cleared. Depending on the season of clearing, surveys for the Northern Long-eared Bat (NLEB) may be required. Other than the NLEB, it is anticipated that there are no federal or state listed endangered, threatened special concern species, significant natural communities or rare plants that will need to be addressed.

The project is not in the designated Coastal Zone. Preliminary review indicates a Federally regulated wetland may be present on the airport property that will need to be avoided. Under federal wetland regulations, there is no regulatory boundary beyond the limits of the wetland. There are no surface waters or State regulated wetlands in the vicinity.

The project is within in a Sole Source Aquifer Area. If any new pavement is proposed, a groundwater analysis will be required. A State Pollutant Discharge Elimination System (SPDES) permit and Stormwater Pollution Prevention Plan (SWPPP) will be required if the clearing equals or exceeds one (1) acre.

It is anticipated that there are no cultural resources in the vicinity that could be impacted.

6.4 Moving Walkway

Estimated assessment duration: not estimated

Estimated assessment cost: not estimated

Regulations will not permit an environmental review of this option to be segmented apart from the proposed development of the future North Side passenger terminal. Environmental review procedures are anticipated to evolve during the 20-year time frame anticipated to plan, design, fund and construct this facility. The summary below sets out environmental review considerations in line with current regulations.

It is assumed that this project will only take place with Federal funding, from different agencies, as well as other sources at different levels of government. A NEPA review would be required, and a Federal Lead Agency would need to be identified to determine NEPA documentation format. A detailed Design Report and Environmental Assessment (DR/EA) would be required.

The DR/EA may also serve as the SEQR document. It is anticipated that there would be multiple SEQR Involved Agencies, so a coordinated review will be necessary. The DR/EA will be subject to a Public Hearing, and depending on the requirements of the eventual Federal NEPA Lead Agency, public information meetings may also be required.

Per current development plans, it is anticipated that that trees or other natural vegetation would need to be cleared. Depending on the season of clearing, surveys for the Northern Long-eared Bat (NLEB) may be required. Other than the NLEB, it is anticipated that there are no federal or state listed endangered, threatened special concern species, significant natural communities or rare plants that will need to be addressed.

The project is not in the designated Coastal Zone. Preliminary review indicates a federally regulated wetland may be present on the airport property that will need to be avoided. Under federal wetland regulations, there is no regulatory boundary beyond the limits of the wetland. There are no surface waters or State regulated wetlands in the vicinity.

The project is within in a Sole Source Aquifer Area. If any new pavement is proposed, a groundwater analysis will be required. A State Pollutant Discharge Elimination System (SPDES) permit and Stormwater Pollution Prevention Plan (SWPPP) will be required if the clearing equals or exceeds one (1) acre.

It is anticipated that there are no cultural resources in the vicinity that could be impacted.

6.5 Summary Table

Table 10: Considerations for environmental assessment for each option

Environmental Screening Criteria	**Upgraded Taxi Service**	**Upgraded Shuttle Bus, public roads**	**AV Shuttle, private roads**	**Moving Walkway**
NEPA: National Environmental Policy Act				
Detailed Design Report and Environmental Assessment (DR/EA) anticipated?	No	Yes	Yes	Yes
Environmental Impact Statement (EIS) anticipated?	No	No	Yes	No
SEQR: New York State Environmental Quality Review				
Requires Environmental Assessment Form followed by a Negative Declaration?	No	No	No	No
Requires public hearing?	No	No	Yes	Yes
Requires public information meeting?	No	No	Yes	Yes
Requires identification of SEQR Lead Agency?	Yes	Yes	Yes	Yes
Requires coordinated review (with Multiple Agencies)?	Yes	Yes	Yes	Yes
Scope of environmental analysis				
Requires clearing of trees or other natural vegetation?	No	No	Yes	Yes
Requires development of previously undeveloped or undisturbed land?	No	No	No	No
Phase 1 Environmental Site Assessment (ESA) anticipated?	No	Yes	No	No
Presence anticipated of Federal or State listed endangered, threatened special concern species, significant natural communities, or rare plants within site boundary?	No	No	Yes	Yes
Located within a Coastal Zone?	No	No	No	No
Presence anticipated of regulated surface waters or wetland within site boundary?	No	No	Yes	Yes
Detailed Sole Source Aquifer Area analysis anticipated?	No	No	Yes	Yes
State Pollution Discharge Elimination System (SPDES) permit and Stormwater Pollution Prevention Plan (SWPPP) anticipated?	No	No	Yes	Yes
Presence anticipated of cultural resources within site boundary?	No	No	No	No

N.B. Moving Walkway: Environmental regulations will not permit the moving walkway option to be segmented apart from the future passenger terminal. It is assumed that this option will only take place with federal funding. Environmental review procedures are anticipated to evolve during the 20-year time frame anticipated to plan, design, fund and construct this facility. The assessment presented here is based on current environmental regulations.

Appendix

A1 Upgraded Taxi Vehicle Features

Vehicles should feature passenger amenities that maximize comfort and convenience. Desirable amenities for new taxi purchases include:

- Sliding doors, interior grab-handles, and swing out-steps to maximize ease of entry and exit;
- Facilitated boarding;
- Flat vehicle floors which provide additional comfort and space for small luggage;
- Independent rear climate control;
- A spacious, rear luggage compartment;
- Wipe-clean interior surfaces; and
- Reading lights and floor lighting.

Not all the desired features listed above will be readily available in a single vehicle model, and therefore procurement should be based on a model of “should-have” rather than “must-have” for the performance features.

Taxi-versions of a variety of vehicles are available. Cargo van based taxis offer a good mix of passenger amenities, and have been designed to maximize interior space on a small chassis. This results in an easy to board vehicle with a good amount of space for luggage and comfortable middle sit on the rear bench. Mini vans offer some of the same features, but on a larger vehicle frame. Their overall comfort and capacity depends on the configuration of benches. Some minivans may be equipped with either rear-loading or side-loading wheelchair ramps, making them the most accessible.

SUVs may offer slightly more luggage capacity than sedans, but overall provide a similar experience. However, these vehicle types are the most commonly available in hybrid, plug-in hybrid, or fully electric models. Taxi operators around the world – including New York City, Montreal, and several European cities – continue to experiment with integrating electric vehicles – including Nissan Leaf, Kia Soul, and even the more expensive Tesla Model S – into their fleets.

Memorandum

Table 11: List of Potential Taxi Vehicles[8]

Vehicle Type	Example Vehicles	Passenger Capacity	Luggage Capacity	Fuels	Other Comfort Factors	Wheelchair Accessibility
Small Cargo Van	Nissan NV-200 Ford Transit Connect	Rear: 3 (comfortably) Front: 1	Best	Prototype Electric/Hybrids only. Transit can be configured as CNG	Easy boarding with spacious interior	Medium (rear-loading)
Mini Van	Toyota Sienna Dodge Grand Caravan	Rear: 2 per bench (comfortably), up to 3 per bench Front: 1	Best	Limited Hybrid options may be available.	Multiple benches make entry/exit difficult.	Best (side-loading options may be available)
SUV	Toyota Highlander Toyota Rav4 Ford Escape	Rear: 2 (comfortably), up to 3 Front: 1	Medium	Hybrid options widely available.	May have higher boarding than a sedan, making entry/exit difficult.	Worst (none)
Sedan	Toyota Prius/Prius V Toyota Camry Nissan Leaf (EV)	Rear: 2 (comfortably), up to 3 Front: 1	Worst	Hybrid options widely available. Potential for electric vehicles.[9]	Typical taxi vehicle experience.	Worst (none)

[8] http://www.nyc.gov/html/tlc/html/industry/taxicab_vehicles_in_use.shtml
[9] https://electrek.co/2017/05/30/nissan-leaf-all-electric-taxi/

A2 Taxi E-Hailing App Vendors

The electronic hailing and dispatching system is the primary new technological system associated with upgrading the taxi fleet. A variety of software systems have been developed to shift dispatching operation. The below case studies provide an overview of features available10.

- **Flywheel** is a San Francisco software company that has developed a solution called TaxiOS, which provides both driver, fleet management, and passenger applications for both iOS and Android. This solution includes cloud-based dispatching, meaning it runs on a remote server, obviating the need for new, back-end IT infrastructure. It also replaces all in-vehicle hardware: the taximeter, radio, navigation, and credit card processing systems are integrated into a mobile phone application. The dispatching system runs on a remote server, and can display fleet information in a web browser. The company offers some support for continued voice dispatching. Advanced features include carpooling, advance trip booking, and limited vehicle selection (i.e. ability to select a car, SUV, or accessible ride). Customers can pay using a stored credit card and tip drivers. The application also supports payout transactions between the driver and fleet manager.[11]
- **TaxiStartup** advertises full service solutions for fleet management. It offers a dispatch panel with telephone integration as well as automated dispatch via the driver app, which provides route directions to the customer's location. The dispatching software is cloud-based, running on a remote server, and does not require new back-end IT infrastructure. The application also supports zone based fares and multiple vehicle types. A queue algorithm allows drivers at a near a single pick up point to be assigned to trips one by one. The passenger app – available for both iOS and Android phones – can be configured to support both credit card and cash payments. In addition, a "Webdesk" product allows for a kiosk-like set up by allowing a taxi agent to instantly summon a vehicle to a permanent point-of-interest. The application also supports payout transactions between the driver and fleet manager using a managed account, and allows for integrated brand identity.[12]
- **ARRO** is a free-download web-based application that connects passengers with professional licensed drivers, like Uber or Lyft. ARRO works with locally regulated vehicle and drivers (such as taxis or private drivers), and where available, offers Wheelchair Accessible Vehicles or other types of vehicles such as minivans. The ARRO app works on both iOS and Android devices and passengers can register with their Facebook account or email address. Users can see the estimated cost of a ride before requesting, request a ride to book service immediately or in the future, and pay for rides. Customers are also able to directly dial drivers such as for confirmation

[10] This research is intended to provide information on system functionality, and should not be considered an endorsement of any product.
[11] http://www.flywheel.com/
[12] https://taxistartup.com/product/#features

or to find each other upon arrival. In New York City, ARRO has developed a service that enables passengers to ‘pair’ their smartphone with the Taxi TV to access a payment code and complete payment. Drivers can use either an ARRO app on their smartphone or use a mobile data terminal (MDT) for dispatching and payment. E-hails are only sent to drivers if near to the requesting customer, however the ARRO website does not provide information on what dispatching technologies they are able to offer or link to. [13]

- **Curb** is a product from Verifone Taxi Systems to help taxi operators compete with Transportation Network Companies, such as Uber. Curb provides both driver and passenger applications for iOS and Android smartphones, but will only allow licensed and insured taxi drivers to use their service. It supports multiple credit-card payment processing methods, including PayPal, and has support for ride-sharing. In addition to using the smartphone application, Curb supports customer booking by sending their pickup address via SMS. The Curb website, however, does not provide information on what dispatching technologies they are able to provide.[14]

[13] https://www.ridearro.com/about/
[14] https://gocurb.com/fleets/

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