Transit Concept and Alternatives Review

JTA SKYWAY CONVERSION

& BROOKLYN EXTENSION

ULTIMATE URBAN CIRCULATOR

JACKSONVILLE TRANSPORTATION AUTHORITY

FDOT

TCAR Report

JACKSONVILLE TRANSPORTATION AUTHORITY

JTA SKYWAY MODERNIZATION PROGRAM

TCAR 1 - Transit Concept and Alternatives Review
Skyway Conversion and Brooklyn Extension

U²C Program

ULTIMATE URBAN CIRCULATOR

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF TABLES

LIST OF FIGURES

REFERENCE DOCUMENTS

1. Skyway Technology Assessment Report (2015)

2. Bi-Annual Inspection Report (May 2017)

3. Infrastructure Assessment Report (November 2017)

4. Skyway Modernization Program Summary Report (2017)

5. Public Involvement Plan (2018)

6. U^2C and Autonomous Vehicle Safety White Paper

7. Brooklyn Station Environmental Report (2018)

8. Public Involvement Summary Report (2018)

9. Jacksonville, Florida: Leveraging Transit for Economic Development – A ULI Advisory Services Panel Report (2018)

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Executive Summary

This report was developed in conformance with the Florida Department of Transportation (FDOT) **Transit Concept and Alternatives Review (TCAR) Guidance** to document the evaluation of the proposed improvements to the Jacksonville Transportation Authority's Automated Skyway Express (Skyway) and request that the project be accepted into project development and become eligible for future State and/or Federal funding. The TCAR Report represents the culmination of efforts over the last several years to develop the plan for the future of the Skyway.

Project Overview

Since the late 1980's, the Skyway (originally known as the Automated Skyway Express) has glided above the streets of Downtown Jacksonville, carrying customers to work, school, daily activities, and numerous special events. Serving as a downtown circulator, the Skyway is an important community asset, carrying approximately 5,000 passenger trips on an average weekday. The Skyway is a 2.5-mile, fully automated, elevated, bi-directional monorail system with eight stations, ten two-car trains and a 25,000 square-foot operations and maintenance center. The Skyway also provides connectivity to the regional transit system, linking to local bus, bus rapid transit, and intercity bus service. As an elevated system, the Skyway also offers benefits of speed, reliability and capacity to move a significant number of passengers. Each two-car train set carries 56 passengers with a frequency of every six to eight minutes.

Existing Skyway Vehicle

The Skyway is facing multiple challenges and is in need of modernization. While the infrastructure remains sound, the most significant issues facing the Skyway involve the condition of the vehicles and operating system.

Purpose and Need for Project

The Skyway has been in operation for over 25 years and the vehicles have passed the midpoint of their service life. The elevated, driverless, automated people mover system was designed to operate with ten two-car monorail trains, however only six of the trains are in operation today. The current vehicles are the only vehicles of their type in operation and it has become increasingly difficult to maintain the system in its existing form. Due to the challenges of maintaining this system and outdated operating system, the Jacksonville Transportation Authority (JTA) conducted a series of technical analyses and developed the Skyway Modernization Program to determine the best path forward to achieve JTA Board direction to **Keep**, **Modernize** and **Expand** the system to continue its important service as a downtown circulator.

The modernization will achieve the following objectives:

- Address System Deficiencies,
- Improve System and Modal Connections, and
- Respond to Transportation and Economic Development Demands.

This report documents the planning efforts to date to confirm mode and alignment and to develop the first phase of the modernization program, which proposes the transformation of the existing elevated guideway to accommodate new emerging autonomous vehicle technology with an approximate ¼ mile extension to a new station in the Brooklyn area of Jacksonville. (See Figure ES-1) The *Skyway Modernization Program* is known as the **Ultimate Urban Circulator**, or **U²C Program.**

Alternatives Development

This TCAR Report documents the results of studies for the first phase of the program (TCAR 1). Subsequent phases, including TCAR 2, will include the evaluation of additional extensions of the existing Skyway system from its current length of 2.5 miles to a future 10-mile system. For the proposed Skyway transformation, key project components include:

- Selection of a new vehicle.
- Replacement of supervisory system with new technology.
- Conversion of the infrastructure to accommodate a new vehicle.

Figure ES-1: Project Location Map

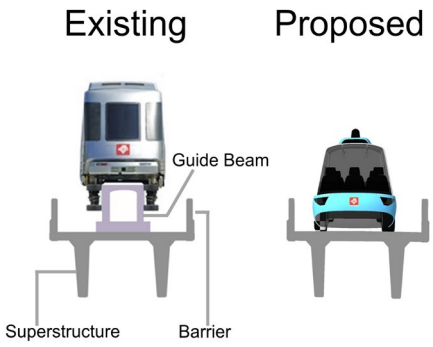
As the fundamental part of the Skyway modernization plan, JTA has chosen the deployment of autonomous vehicles to replace the outdated driverless, monorail vehicles, affording the JTA the opportunity to evaluate emerging autonomous technology in a controlled environment on the existing elevated infrastructure.

Through a series of studies which examined replacement with a similar vehicle or different technology, it was concluded that autonomous vehicles will provide the most flexibility for the expansion of the system and be more adaptable to changing development patterns to better serve the Jacksonville community. Table ES-1 summarizes all of the potential options considered through the multiple study and analysis phases leading up to U²C Program.

Table ES-1: Summary of Skyway Conversion Alternatives

Summary of Skyway Conversion Alternatives	
Skyway Technology Assessment (2014-15)	Option 1: Overhaul of the Skyway Monorail Operating System Option 2: Like-kind replacement of the Skyway Monorail Vehicles Option 3: Replacement of the Skyway vehicles with new Vehicles
Skyway Advisory Group/ Subcommittee (2016)	Option 1: Overhaul of the Skyway Monorail Operating System Option 2: Like-kind replacement of the Skyway Monorail Vehicles Option 3: Decommission and replace Streetcar, Trolley, Bus Rapid Transit or Personal Rapid Transit Option 4: Repurpose Skyway infrastructure as an elevated bicycle and pedestrian walkway
Skyway Modernization Program (2016-17)	Option 1: Rehabilitation of Existing Vehicle Option 2: Replace with similar type of vehicle on Guidebeam Option 3: Replace with Vehicle without the guidebeam Option 4: New Technology – Autonomous Vehicle
Skyway/U²C Infrastructure Assessment (2017-18)	Alternative 1: Remove existing guidebeam, build up the superstructure at stations only to facilitate level boarding, and retain the barrier wall. Alternative 2: Remove guidebeam, provide new superstructure at stations and retain barrier wall. Alternative 3: Remove guidebeam, provide new superstructure at stations, and replace barrier wall. Alternative 4: New superstructure throughout system, retain existing piers.

As stated, the current Skyway vehicles are past their mid-life and require increasing maintenance to maintain operations. In addition, the existing Skyway operating/supervisory system is based on technology that is over 20 years old. With the proposed project, the system will be updated to offer a modern, more demand-based system with automated fare collection. While the existing system relies on interconnected power and communications, it is envisioned that the new system will operate as "untethered" using state of the art wireless communications and battery powered vehicles. The JTA is currently assessing supervisory system requirements to define the parameters of the new system which will ensure interoperability with various system components.



Existing vs. Proposed

At the foundation of all successful transportation systems is a sound infrastructure. The existing elevated infrastructure and stations are all in good condition but in order to accommodate the autonomous vehicle technology, must be converted from an elevated monorail-like system (on a guidebeam) to an elevated roadway system.

The basic transformation will remove the guidebeam and replace it with a smooth-running surface. Preliminary evaluation indicates that additional analysis is needed to assess the ability of new vehicles to operate within the constraints of the existing geometry and to confirm the ability of the existing exterior walls to safely contain the vehicles. As outlined in Section 6, a series of alternatives have been defined and examined through each phase of study. As a result, four alternatives for the conversion have been identified for further analysis.

1. Alternative 1 - Remove guidebeam and raise guideway at stations
2. Alternative 2 - Remove guidebeam and replace structure at stations
3. Alternative 3 - Remove guidebeam and rehabilitate/replace barrier wall
4. Alternative 4 - Remove and replace superstructure

The following briefly describes these alternatives.

Alternative 1 involves removing the concrete guidebeam on the existing Skyway, retaining the barrier walls and existing superstructure, and building up the guideway at the station to allow for level boarding. If feasible, this is the most basic option with the least cost however would be most restrictive as it would require operation within existing geometric and physical constraints.

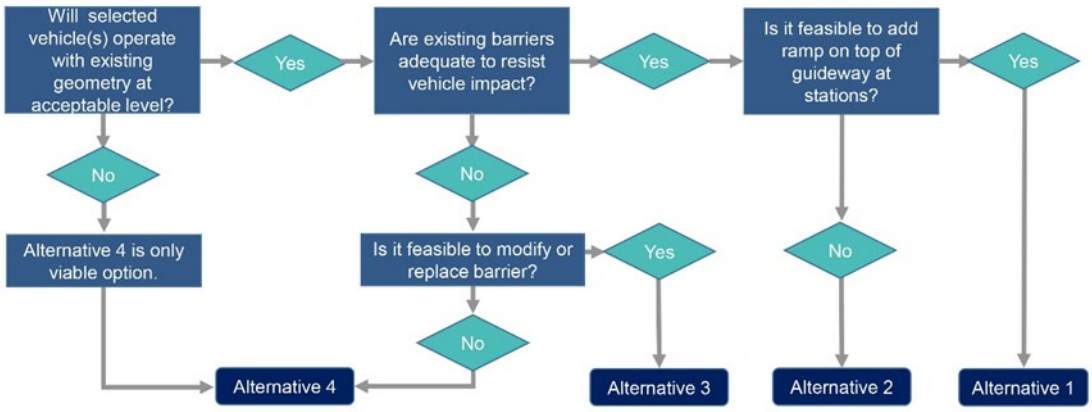
Alternative 2 requires removal of the guidebeam, retaining the barrier walls, retaining the infrastructure along the guideway, however, new superstructure would be provided at the stations. If feasible, this is the more complex than Alternative 1 with additional cost and is still restrictive as it would require operation within existing geometric and physical constraints but would allow more flexibility for design at stations.

Alternative 3 includes new superstructure at stations, removal of the guide beam, and replacement of the barrier walls. This alternative is considerably more complex than Alternative 2 as it would require demolition of 5 miles of existing barrier and risks damage to the existing superstructure. It is considerably more expensive than Alternatives 1 and 2 but could offer more flexibility by possible minor increases to travel way widths and design at stations.

Alternative 4 requires the construction of new superstructure throughout the corridor, however, the concrete piers would remain. New barrier walls and a wider running way would be provided, allowing for two-way operations throughout. This is the most expensive option but offers the most flexibility with a potential design that would provide geometric improvements to maximize operations of the system by lessening physical constraints. Also, it is possible that the cost of Alternative 4 could be mitigated by allowing innovative design and pre-fabrication of entire sections of superstructure.

Due to the unique and complex nature of the infrastructure transformation, further evaluation is needed to determine the preferred alternative that will provide the best level of service and value to the community. It is possible that the preferred alternative could be a combination of the alternatives. Figure ES-2 illustrates key decision points in determining the preferred option. This report includes a summary of each potential alternative examined to date and corresponding considerations including operations and maintenance, constructability, community impact and cost. JTA coordinated with Federal Transit Administration (FTA) regarding environmental review requirements and FTA determined that the project qualifies for Categorical Exclusion (CE).

Figure ES-2: Skyway Conversion Decision Tree



Alternatives Evaluation

Table ES-2 summarizes the criteria defined for the evaluation of the potential Skyway conversion alternatives. In addition to addressing infrastructure modifications, the evaluation also included an operations analysis and the development of ridership forecast using the FTA's Simplified Trips-On Project Software (STOPS). Several operating scenarios were defined for a future operating

system providing increased frequency of service. The STOPS process relies on data related to future development, as well as population and employment growth. With the addition of a new connection in Brooklyn, and improved headways, daily ridership increased from current conditions under the projected future year scenarios.

Table ES-2: Evaluation Criteria, Goals and Objectives

Criteria	Goals	Objectives
Operations & Safety	Level of Service / Capacity	Provide high frequency service to improve customer experience and reduce overall trip times
	Speed	Ability to maintain service reliability and avoid critical ground constraints
	Safety	Improve safety within the corridor
	Flexibility	Allows greatest flexibility for operations, vehicle type and size
	Operations	Ability to respond to changing demands in service
Constructability & Feasibility	Feasibility	Technical Feasibility of Alternative considering safety and constructability
	Ability to accommodate variety of vehicles	Maximize ability to accommodate various types and sizes of vehicles from different manufacturers
	Maximize use of existing infrastructure	Minimize cost and minimize modifications to existing infrastructure
	Constructability	Ability to minimize construction risks
	Continuity of Service	Minimize impacts to existing service during infrastructure conversion
	Damage during Demolition / Construction	Risk of damage to existing structure
Community Impact	Connectivity	Provide safe multimodal access to the transit system
	Economic Development	Provide convenient and accessible transit service to areas with economic development potential
	Aesthetics	Provide comprehensive update of system that is safe, convenient, and attractive to downtown workers, residents, and visitors
Cost	Construction Cost	Existing Infrastructure: cost of modifying infrastructure to accommodate a new vehicle
	Service Life / Operations and Maintenance	Cost to maintain structure

Funding/Finance

Order of magnitude capital, operating and maintenance costs were prepared for each alternative. Estimates were developed using approximate quantities and unit costs from FDOT historical data including long rage estimates (LRE), JTA operations and maintenance budget and other sources including engineering judgment. A detailed order of magnitude estimate is included under Appendix G. Potential funding sources were identified for the project development stage of the project, and the funds required for the local share of capital, operations and maintenance will be identified in the next stages of project development.

Table ES-3 includes a summary of order of magnitude estimates for initial capital costs and cumulative system costs that includes debt service, operations and maintenance, and renewal and replacement costs for a 47-year operating period.

Initial capital cost estimates range from $105 M for Alternative 1 to $184 M for Alternative 4. Cumulative cost estimates range from $339 M for Alternative 1 to $412 M for Alternative 3. Cumulative costs for Alternative 4 are less than for Alternative 3 because renewal and replacement costs are anticipated to be lower, considering that most of the existing superstructure will be replaced initially and therefore, will require less maintenance.

For the No Build Alternative, the initial costs represent estimate to keep the superstructure in state of good repair; and the cumulative costs are higher due to anticipated higher costs for renewal and replacement of vehicles and infrastructure. Please see Chapter 9 and Appendices F and G for additional financial information.

Table ES-3: Summary of Initial and Cumulative Cost Estimates

From Tables 9.1.1 and 9.1.2 (in Millions of dollars)					
	Alternative 1	Alternative 2	Alternative 3	Alternative 4	No-Build
Initial Order of Magnitude Capital Estimate	$105	$123	$141	$184	$13
Cumulative Cost over 47 Year Operating Period	$399	$406	$412	$377	$573

Public/Stakeholder Involvement

As part of the planning process JTA engaged the community through online surveys, community presentations and several public forums, as well as, ongoing coordination with project stakeholders including the FDOT, City of Jacksonville and the North Florida Transportation Planning Organization (North Florida TPO). Feedback received from the community indicates a strong interest in not only modernizing the existing system, but expanding it to additional destinations including the proposed Brooklyn Station.

The proposed Brooklyn Station, located on JTA owned property, is in an area of Jacksonville that has experienced recent rapid commercial, retail and residential redevelopment. The proposed station will provide a crucial link between the desirable Riverside area and Downtown Jacksonville; and is projected to substantially increase ridership with new connections to popular destinations. Subsequent extensions to the U²C system will further add to ridership as the system is expanded to help people **get where they want to go.**

Numerous maps and graphics were developed during the initial Skyway studies and as part of the TCAR Study phase to convey the proposed Skyway system expansion and present the new autonomous technology under consideration. Through 3D visualization, complex and technical information was illustrated in multiple graphic formats to allow the community to better understand the considerations of this important investment.

Discussed more in Section 8, a key outreach activity was the development of the Test and Learn Facility. JTA's **Test and Learn Facility** features a one-third mile test track and provides a living laboratory to not only test autonomous vehicle performance under varying conditions, but to seek public input and opinions on introducing autonomous vehicles as part of the overall transportation system. Through comment cards and surveys, JTA is continually evaluating public feedback. Through December 2018, one year since the opening of the testing facility, more than 1700 people have ridden an autonomous vehicle at the test track.

JTA Test and Learn Facility

Related Activities and Next Steps

In addition to this TCAR Study, JTA is advancing the U²C Program with several concurrent activities including:

- Continued testing of autonomous vehicles at the Test and Learn Facility.
- Planning for the Bay Street Innovation Corridor with agency partners.
- Development of design plans for the Autonomous Avenue project which will convert the elevated section between the proposed JRTC and Jefferson Station.
- Continued outreach and stakeholder coordination with the FTA, FDOT, North Florida TPO, City of Jacksonville and other partners.

The Skyway is an integral part of Downtown Jacksonville today as there are more than 5,000 trips daily to connect to employment, school, and other daily activities. The proposed Skyway modernization and system extensions will provide our community with dependable transportation and support the continued economic development of Jacksonville well into the future.

The Skyway - Bay St/Hogan St.

As a next step, JTA has prepared a letter to request that this project be entered into FTA project development process and that additional funding be made available to continue the planning and preliminary engineering of this transformative project that will not only serve the Jacksonville community and the region, but will position Florida as leader in developing the transit systems of the future. The JTA will partner with the FDOT and the FTA to successfully implement this system to provide safe, efficient and cost effective public transportation options.

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1 Introduction

The conversion of the Skyway presents a unique opportunity for the City of Jacksonville, the Jacksonville Transportation Authority (JTA) and the Florida Department of Transportation (FDOT) to transform the existing Skyway by deploying emerging autonomous vehicle technology and lead the transition to a transportation system of the future. Since the late 1980's, the Automated Skyway Express (Skyway) has glided above the streets of Downtown Jacksonville, carrying customers to work, school, daily activities, and numerous special events.

Opening of Southbank Stations

The Skyway is an important community asset, serving as a downtown circulator, carrying approximately 5,000 passenger trips on an average weekday. The Skyway is a 2.5-mile, fully automated, elevated, bi-directional monorail system with eight stations, ten two-car trains and a 25,000 square-foot operations and maintenance center. Spanning the scenic St. Johns River, the Skyway links the North and South banks of Downtown Jacksonville, and connects to key destinations such as City Hall, Central Business District, Baptist Medical Center Complex, LaVilla, and the Prime Osborn Convention Center. The Skyway also provides connectivity to the regional transit system, linking to local bus, bus rapid transit, and intercity bus service. As an elevated system, the Skyway also offers benefits of speed, reliability and capacity to move a significant number of passengers. Each two-car train set carries 56 passengers with a frequency of every six to eight minutes.

After more than 25 years of service, the Skyway is facing multiple challenges and is in need of modernization. While the infrastructure remains sound, the most significant issues facing the Skyway involve the condition of the vehicles and operating system.

First, the operating system is out of date. Secondly, the vehicles are due for overhaul but are no longer supported by the original manufacturer, thereby complicating efforts to find replacement parts and keep the trains operating. The worsening difficulty of finding parts results in increased costs and is impacting service reliability. And lastly, the Skyway has faced a challenge with underperforming ridership. Since the system was never fully built out, the current Skyway guideway does not reach major existing activity centers.

Similar to any transportation infrastructure, JTA will need to make a significant investment in vehicles, operating/supervisory system, and infrastructure to continue its safe and reliable service.

The Skyway is an integral part of the transportation system serving Downtown Jacksonville and surrounding neighborhoods. As the City grows and revitalizes, workers, residents and visitors will be creating more trips in an area that is constrained in terms of adding traditional transportation capacity in the form of roadways and by natural and man-made barriers that separate key sections of the City from each other. The Skyway offers a way of getting around downtown, connecting adjacent activity centers and neighborhoods without the need for additional automobile trips. The Skyway supports the first and last mile needs of commuters coming into the downtown via existing and planned regional transportation systems such as the First Coast Flyer bus rapid transit and potential future commuter rail service from the surrounding region. As more residents move into downtown, expanded Skyway service will help meet the mobility needs of the people that live, work and visit Downtown Jacksonville.

JTA Skyway Modernization Program Summary Report (2017)

To consider options for the future of the Skyway, the JTA implemented a series of technical studies to evaluate new technologies to replace or rehabilitate the Skyway vehicles. Concurrently, the JTA conducted extensive engagement with the community, key stakeholders, and industry experts. In December 2015, with the support and participation of its partners, the JTA Board of Directors approved a resolution to **"Keep, Modernize, and Expand"** the Skyway and recommended the development of the Skyway Modernization Program to define the path forward for the Skyway, specifically - to address the vehicle technology and a strategy to expand the system and reach the full potential once envisioned for the downtown circulator.

New rapidly developing technologies offer greater flexibility for public transit to improve mobility and make more cost-effective investments. Through the modernization of the Skyway, the JTA will build upon existing assets, creating a more accessible, versatile, demand-responsive, world-class system to more fully connect downtown with nearby vibrant urban neighborhoods. Through evaluation of current and emerging technologies, analyzing where people want to go now, and the future mobility needs related to existing and planned development, the Skyway Modernization Program recommended the transformation of the Skyway into a new urban circulator system. Named the **Ultimate Urban Circulator Program**, or **U^{2}C Program**, the new system will utilize the existing elevated Skyway, expand the area it serves, and employ rapidly developing technology to create a more efficient system. The U^{2}C Program's future system will provide connectivity, mobility, and support sustained economic growth to help the community achieve its vision for a vibrant downtown and improve the quality of life in Jacksonville.

An important step and first phase in developing the U²C Program is the subject of this **Skyway Conversion and Brooklyn Extension** project.

This **Transit Concept Alternatives Review (TCAR) Report** documents key observations and results of prior planning efforts, technical analyses, industry engagement, and stakeholder participation undertaken to evaluate the options for the future of the Skyway and its role as a downtown circulator. The TCAR process was developed by the FDOT to define a project evaluation process to position a project for future Federal or State funding. The TCAR process is an important step in assessing the options for the modernization of the Skyway and defining the path forward for the JTA to determine the most cost-effective approach to maximize this existing asset and better serve transportation needs in Downtown Jacksonville.

Autonomous Vehicle Examples

The Skyway conversion is unique, and the development of the U²C Program is not a traditional transportation improvement project. This project is innovative and transformative. The JTA seeks to advance the project into more detailed project development, moving from a vision to implementation. More details of the project components are described in the following section.

1.1 Project Description

The Skyway is located within the limits of the City of Jacksonville, Duval County, Florida, in the heart of the Northeast Florida region. The City of Jacksonville encompasses more than 840 square miles, with the St. Johns River bisecting downtown as it connects to the Intracoastal Waterway and the Atlantic Ocean to the east. Jacksonville is a gateway to Florida with the intersection of Interstates 10 and 95 in close proximity to Jacksonville's Central Business District.

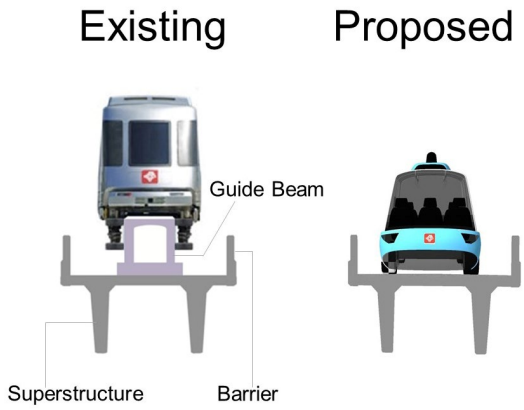
The project study area, illustrated in Figure 1.1.1, includes a 600-ft buffer around the existing Skyway alignment and along an extension of the guideway to the Brooklyn area, on JTA property. Today the Skyway extends from the current Prime Osborn Convention Center / LaVilla area, east to the Central Business District at Central Station; then north through the Financial District, connecting to City Hall, with a northern termini at the JTA's Rosa Parks Transit Station. From Central Station, the Skyway system extends south across the St. Johns River, connecting to San Marco and serving the expanding medical complex, then proceeds southeast with a southern termini at the JTA Kings Avenue Garage. A description of adjacent land uses and planned development along the Skyway alignment are provided in Sections 3 and 5 of this report.

	U²C Program - TCAR 1: Skyway Conversion and Brooklyn Extension	Figure 1.1.1: Project Location Map	Page Number: 1-4

The proposed transportation improvement involves the transformation of the Skyway from an existing, elevated, fully-automated (driverless) people mover system (rail-like system) to an elevated, automated road-like system.

Specifically, the proposed improvements include:

- Removing the existing guidebeam and replacing with a smooth running surface;
- Replacing the vehicles with next generation autonomous vehicle technology;
- Utilizing a larger fleet of smaller vehicles to improve frequency; and
- Expanding the system by extending and transitioning the elevated guideway, approximately ¼-mile to the street level, adjacent to the existing Skyway Operations and Maintenance Center in Brooklyn.



Existing vs. Proposed Skyway

Using the existing elevated structure maintains the high level of service reliability in the urban core. The elevated structure also provides the unique opportunity for JTA to deploy new autonomous vehicle technologies in a controlled environment without mixing in other traffic.

Skyway on Elevated Structure along Bay Street approaching Hogan Street

In summary, the proposed improvements involve three components:

- vehicles,
- supervisory (operating) system; and
- infrastructure (guideway and stations).

Additional information for these components is provided in the following narrative.

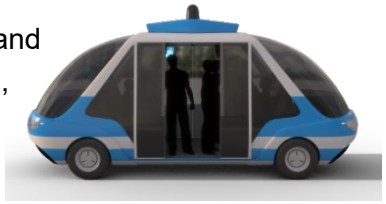
Vehicles/Supervisory System

The preferred technology for the replacement of the Skyway vehicles and future U²C Program system is autonomous vehicles. Based on research and meetings with multiple manufacturers, autonomous vehicle technology has the greatest potential to achieve the desired features for accessibility, flexibility, convenience and cost effectiveness. As discussed in Section 7 of this report, two industry forums were held as part of the Skyway assessment and modernization program development. The forums provided first-hand dialogue with industry experts to understand the technology development and potential application for public transit. The decision to modernize using autonomous vehicles considered that the existing elevated guideway would be modified to accommodate new vehicles, which could then operate in a controlled environment to safely deploy autonomous vehicles. Since the vehicles do not require a fixed rail, they could operate elevated or at-grade and provide greater flexibility when developing extensions. Autonomous technology provides great opportunities for innovation and expansion to better serve future needs.

Existing Skyway Vehicle on Guidebeam

The new autonomous vehicles offer the latest technology to allow customers to easily plan, track, and pay, turning their trips into efficient, custom-made journeys. In the future system, vehicles will run together or independently, based on customer need. The vehicles are routed to busier sections to meet demand and improve frequency, reducing wait times and serving more people. They will connect and disconnect at strategic locations for efficiency. Features including advanced controls at intersections will guide crossing traffic safely and efficiently.

The new vehicles will be visually appealing with interior features and best-in-class passenger amenities such as comfortable seating, electronic information displays, and security cameras for an enjoyable, futuristic, and safe ride experience. Access for all customers is paramount, as the new system will offer the latest accessibility features providing enhanced services for all passengers.



Autonomous Vehicle Prototype

JTA continues to examine vehicle technology options at the **Test and Learn Facility** which opened in December 2017 and is located at the eastern edge of downtown, adjacent to the sports and entertainment district. Over a period of approximately two years, various autonomous vehicle manufacturers will have the opportunity to evaluate the vehicles under varying conditions on the

one-third mile test track. More details regarding the Test and Learn Facility are provided later in Section 8.

Infrastructure

Guideway

The transformation of the guideway to a smooth running surface involves the removal of the guidebeam for the entire length of the system. The existing Skyway was originally constructed in four phases. Each segment has similar but unique design elements that must be evaluated during subsequent, more detailed project development. Refer to Figures 1.1.2, 1.1.3, and 1.1.4 for key milestones in the Skyway's history.

- Phase 1: 1989 - Starter line from Convention Center Station to Central Station via Jefferson Station using Matra vehicle.
- Phase 2: 1997 - Conversion to Bombardier vehicle and extension from Central Station to Rosa Parks Station via Hemming Plaza Station.
- Phase 3: 1998 - River Crossing and San Marco Station.
- Phase 4: 2000 – Riverplace Station and Kings Avenue Garage Station

The construction methods of the guidebeam varied from the initial starter line in Phase 1 to the subsequent phases.

In addition to the removal of the guidebeam, the conversion will also require that the guideway be raised at station platforms to bring the floor of autonomous vehicles level with the platform to facilitate passenger loading and comply with Americans with Disability Act (ADA) requirements.

Several autonomous vehicles are available, all with various specifications including capacity, weight, width, etc., and therefore the conversion of the infrastructure must accommodate the preferred vehicle(s) that will afford the JTA with the most effective operational characteristics including safety, speed, and frequency.

The existing geometry of the system, including width, horizontal curvature, and vertical grades may present constraints and will be fully assessed during ongoing and subsequent project development.

As presently proposed, the new "rubber-tired" autonomous vehicles will not be restrained by a fixed guidebeam, therefore, the barrier walls must be assessed to confirm their ability to safely accept crash loading of the new vehicles. If replacement or modification of the barrier is required, this change will provide an opportunity to develop a more flexible design but could result in additional cost. Additional information regarding existing Skyway infrastructure conversion options is included in Sections 5, 6 and 7.

Figure 1.1.2: Skyway Milestones, Starter Line

Figure 1.1.3: North Line

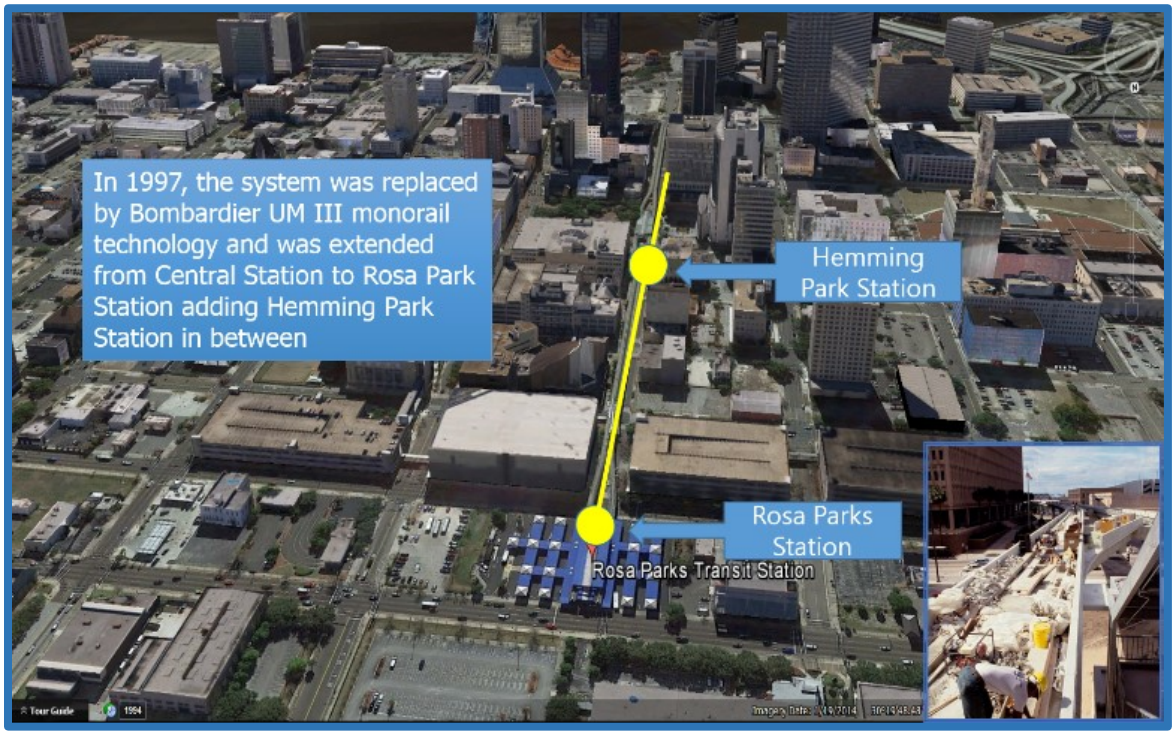
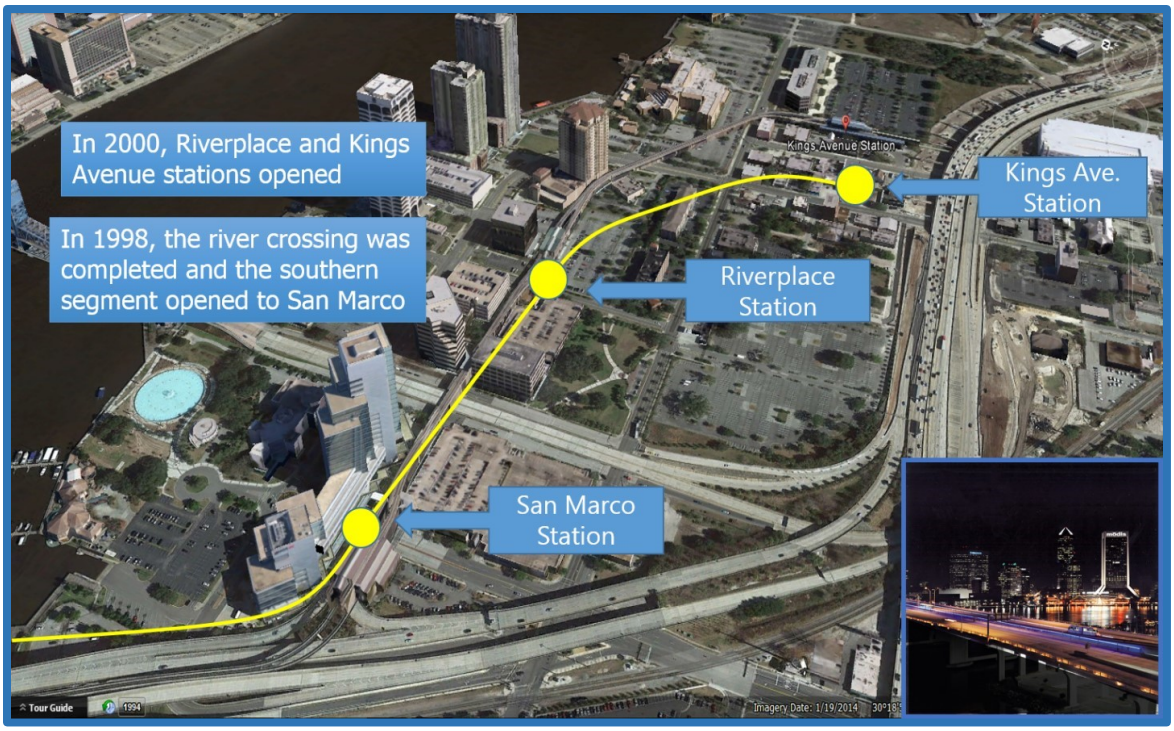


Figure 1.1.4: Southbank



Skyway Stations

The proposed improvements require modifications to the existing Skyway station platforms. The modifications are dependent on the recommended option selected and may include:

- Raising the guideway at station platforms to bring the vehicles level with the platform;
- Adjustments to power systems, including the possible addition of charging stations;
- Additional structure to accommodate vehicle crossovers and charging;
- Upgrades to passenger information systems, including information kiosks, real time arrival and departure information;
- Upgrades to ticketing equipment; and
- Upgrades to other features such as elevators, escalators, signing etc.

Additional information regarding station modifications are discussed in Section 6.

Convention Center Station

The Skyway has a long history, but its future is an opportunity to support the vision for a revitalized, innovative, and vibrant Downtown Jacksonville and a well-connected, robust transportation system.

Existing Skyway Structure Approaching Riverplace Station

Existing Skyway Station interior at Hemming Plaza Station

2 Purpose and Need

2.1 Purpose and Need for Project

Mobility. Connectivity. Accessibility.

Transforming downtown mobility and creating a more accessible, versatile, public transportation system will support the City of Jacksonville's vision for a more vibrant and livable downtown. Over the past several years, Downtown Jacksonville has seen a resurgence in employment, residential and other redevelopment and revitalization in multiple core areas. More sectors of the population, such as the increasing number of millennials and recently retired baby boomers, are interested in living in active urban environments with alternative transportation options including bike, pedestrian, and transit.

Skyway crossing Acosta Bridge

As Jacksonville continues to grow, the development of a robust, well-connected transit system is critical for economic competitiveness and quality of life. In downtown, residents and commuters need to be able to easily move around without a personal vehicle. According to Downtown Vision's recent *2017 State of Downtown Report*, "Downtown is on track to quickly beat the progress of the past 17 years, with more than $3.5 Billion in projects under construction or proposed in 2017." The report also indicates that more than 900 residential units are under construction, with another 2,800 units planned.

The Skyway, an important transportation and downtown asset, is key to strengthening both the effectiveness of the transit system, as well as the downtown. The proposed improvements for the Skyway provide the unique opportunity to modernize the iconic and once considered "ahead of its time", Skyway, to create a more effective, flexible and accessible downtown circulator, a role originally envisioned by City leaders.

Planning for the Skyway was initiated in the 1970s to address traffic congestion, air quality, and downtown parking issues. In 1985, Jacksonville was one of a handful of cities to receive federal funding for an automated people mover system. The Skyway opened in 1989, and the current configuration of the Skyway, including the Acosta Bridge crossing, was completed in 2000. The system was envisioned to serve the last mile/first mile, with ample parking on the periphery of Downtown for commuters and visitors.

Skyway, 1985

While early proposals recommended a more expansive 4-mile system that would connect with adjacent neighborhoods and the Sports Complex (and formerly the Gator Bowl), the project's route and scope were reduced to meet budget constraints and federal parameters. As a result, the approved program established the 2.5-mile system in place today. A timeline of the Skyway development is depicted in Figure 2.1.1.

The modern Skyway is envisioned to not only provide first and last mile connections as originally conceived, but also providing off peak hour trips during the weekday, late night, and weekends, creating a system that meets the needs of residents, visitors and workers who live, work, and play in the downtown area and adjacent neighborhoods. As population and employment grows in the Skyway's service area, additional capacity will be needed. A modernized Skyway system will provide additional capacity, reliable service, expanded and more accessible service.

The Skyway's role in downtown will enhance connectivity to revitalizing neighborhoods and activity centers in and around the downtown core, including Brooklyn, San Marco, the emerging Sports/Entertainment District, Springfield and the downtown core. Phase 1 of the Skyway Modernization Program focuses on the existing elevated sections of the Skyway as well as initial expansions to the Brooklyn neighborhood and the Sports/Entertainment District. Leveraging the existing elevated Skyway structure will maintain efficient and reliable service, particularly in downtown, but also allow for better transportation options that are forward thinking, address the demographic changes downtown, and support the economic development goals of Jacksonville.

As outlined in the Introduction, and detailed later in this report, the JTA collaborated with numerous stakeholders and conducted multiple studies to address the future of the Skyway. This focused transportation improvement will achieve the following objectives:

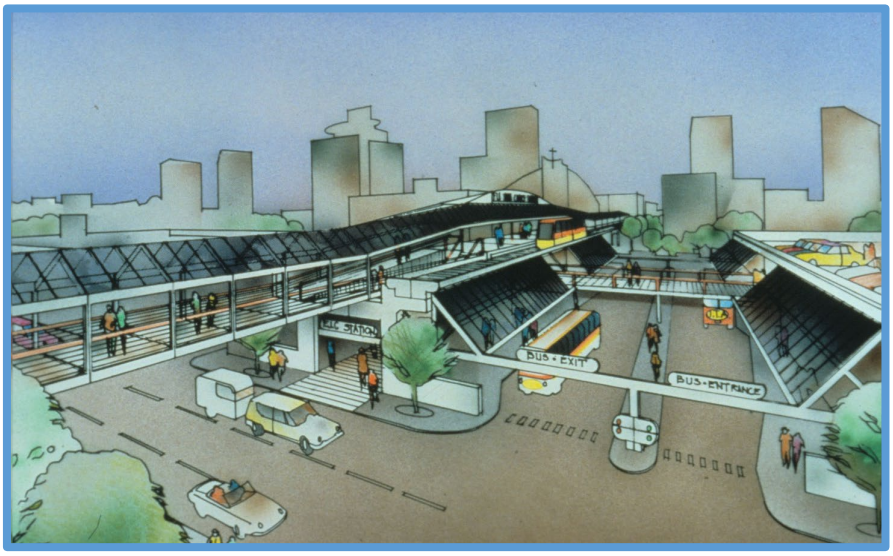
- Address System Deficiencies,
- Improve System and Modal Connections, and
- Respond to Transportation and Economic Development Demands.

The background and need for each of these objectives is contained in the following paragraphs.

Figure 2.1.1: Skyway Timeline

Address System Deficiencies

Building upon years of studies aimed at possible extensions of the Skyway to address transportation needs of emerging development in adjacent, flourishing neighborhoods, such as the Riverside / Brooklyn area, the JTA initiated more detailed technical analyses as the system reached its 25th anniversary. In August 2014, JTA launched the *Skyway Technology Assessment (Technology Assessment)* to assess the condition of the vehicles, operating system of the Skyway, and develop options to address the needs of the Skyway in preparation for the mid-life overhaul of the vehicles. The current Skyway vehicles are not used elsewhere and face obsolescence as supplies are no longer supported by the manufacturer, and maintenance is costly. Four of ten vehicles are not in service today.



Future Skyway (Circa 1985)

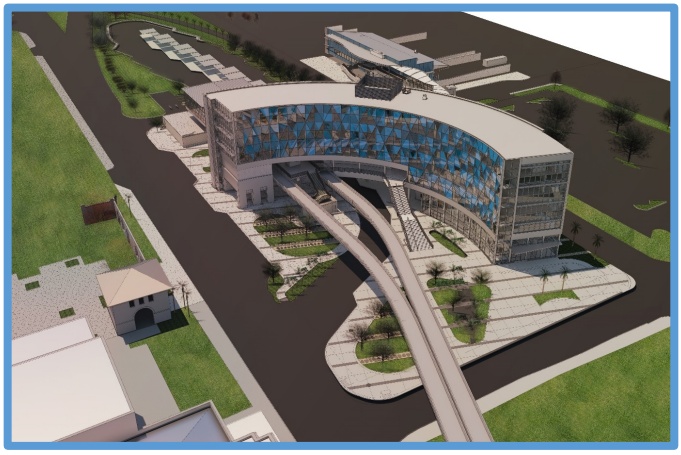
The operating, or supervisory, system is also facing obsolescence issues, with the most significant being the power distribution and communications system, also known as the Supervisory Control and Data Acquisition (SCADA) system, which is planned for upgrades.

The *Technology Assessment* found the Skyway infrastructure to be generally in satisfactory condition with some items in need of further evaluation and repair. These items include drainage, rehabilitation, and some replacements of elevators and escalators. In addition, several beams require repairs for some radial cracking. The steel box girders, piers, and column supports are in overall satisfactory condition and need routine maintenance, such as a new paint for the steel components. The *Technology Assessment* explored available options to replace the existing vehicles. More details of the technology considerations are discussed in Sections 4, 6 and 7.

Improve System and Modal Connections

From a mobility standpoint, the Skyway has significant advantages in that it is supported by an elevated structure separated from traffic, thereby ensuring faster and more reliable service. Additionally, the Skyway already connects the Northbank and Southbank, a connection that could be cost prohibitive if a new transportation option, such as streetcar, were considered.

Skyway ridership increased by 60% when the fares were removed in 2012. Ridership has continued to increase with improved connectivity to the broader transit system as a result of the JTA Route Optimization Initiative (described later in this section). Several key factors have affected the perception of underperforming ridership in the past. First, the original downtown circulator system was never fully built out. Images from initial planning documents depict a more robust automated people mover system. Second, many of the conditions that prompted the need for the Skyway no longer existed once the initial segments were completed, primarily because of the flight of employment and retail to suburban settings. In order to attract employment downtown, the City of Jacksonville largely abandoned the peripheral parking strategy that supported the Skyway. Additionally, bus operations were not coordinated effectively with the Skyway.



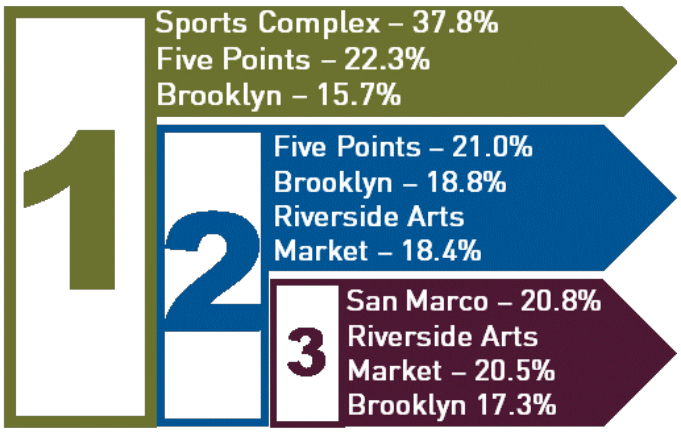
Jacksonville Regional Transportation Center (JRTC) Concept

While many view the Skyway as a stand-alone system, it serves an important role in supporting the larger transit system. The Skyway provides key local connections for commuters coming into the downtown core via regional transit service. The Skyway modernization is also incorporated into the current construction of the new Jacksonville Regional Transportation Center (JRTC) that encompasses the existing Convention Center Station. JTA's new bus transfer facilities are included as part of the JRTC construction. In early 2020, the JRTC will enable passengers to connect the JTA's local bus, paratransit, regional express services, First Coast Flyer bus rapid transit (BRT), as well as intercity bus services, such as Greyhound and Megabus. JTA's regional partners representing Baker, Clay, Nassau, Putnam, and St. Johns Counties will have the ability to make connections for regional services at this location. Access to the new Skyway or U^{2}C Program will allow commuters to immediately connect to the modernized system taking advantage of improved frequencies and a new reliable transportation option.

Intercity Bus Terminal, Opened January 2018

Respond to Transportation and Economic Development Demands

The planning for the Skyway modernization and development of the U²C Program integrated feedback from stakeholder, partner agencies and the community obtained through multiple workshops, presentations, and public outreach activities. The initial online survey, more than 1,600 responses, provided insight as to where people wanted to go and when they wanted to use the automated system.



Results from Public Opinion Survey, 2016

Survey respondents supported the expansion of the system, not only for the service linking to adjacent neighborhoods, Sports/Entertainment Complex, and into Brooklyn - but also the expansion of hours, with the desire to see more service on the weekends. Of those responding to the survey, 80% favored keeping Skyway and expanded Skyway system.

Brooklyn Station Retail areas along Riverside Avenue

From an economic development standpoint, fixed guideways systems are often catalysts for economic development and transit oriented development. The modernization of the Skyway system offers the opportunity to revisit redevelopment opportunities around the existing stations, especially at a time when Downtown is experiencing an upsurge in economic development activity. The Skyway transformation and development of the U²C Program will include transit oriented development, as well as a refresh of existing stations, increased signage, and improved passenger amenities and wayfinding to enhance the overall customer experience.

The proposed extension from the elevated system to the Brooklyn/Riverside area offers unique opportunities. Brooklyn's strategic location between revitalization efforts underway in Downtown, and in the Riverside/Five Points area to the immediate south, has resulted in substantial private investment and redevelopment. The proposed extension into the Brooklyn area will link nearly 600 market-rate and affordable multi-family units and over 70,000 square feet of commercial/ retail/office uses.

Apartments (across from Skyway O & M Center)

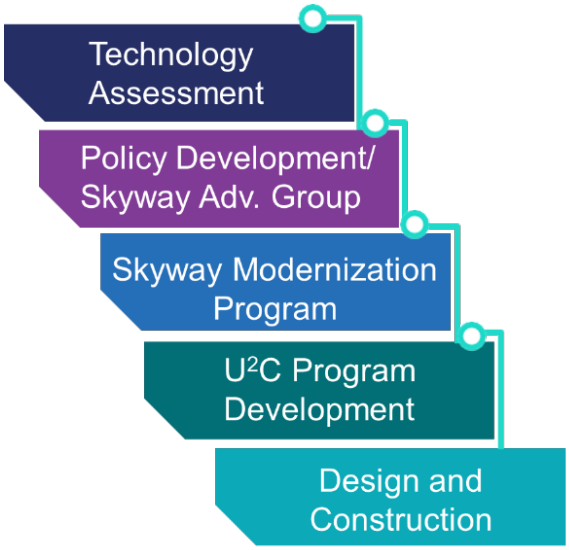
Activity in the Brooklyn area, combined with the Skyway extension project, will provide the neighborhood with a premium, fixed route transit option that has otherwise never existed. Viewed holistically, the successful integration of the U²C Program as part of the overall Brooklyn redevelopment will provide the Jacksonville market with valid, transit-oriented development and real estate necessary to attract additional private capital investment to this area and other potential station areas across the system. This transit integration supports rising property values and public tax revenues in a designated economically distressed area.

This *Skyway Conversion and Brooklyn Extension* project proposes to transform and expand the existing Skyway to improve mobility, connectivity, support economic growth, and enhance overall livability of Jacksonville. This project would achieve the purpose of a downtown circulator system, and first mile/last mile connectivity by:

- Improving Downtown Quality of Life and Mobility
  - Connects residential, employment and retail;
  - Enhances pedestrian and bicycle connectivity to downtown; and
  - Connects to the larger transit system.
- Supporting Economic Development and Accessibility;
  - Supports reliable and convenient access to employment, and educational centers;
  - Supports the City's Downtown Investment Authority and Chamber of Commerce plans for a more vibrant and urban regional economic center; and
  - Connections to eight existing stations with access to the Downtown business and financial district for thousands of employees within Downtown.

BY BUILDING ON OUR PAST, EMPLOYING CUTTING-EDGE TECHNOLOGY AND WORKING WITH OUR PARTNERS AND THE COMMUNITY, JTA WILL ADVANCE TRANSPORTATION'S VERSATILITY AND CONTINUE TO INVIGORATE THE CITY'S ECONOMY WITH TRANSPORTATION OPTIONS THAT WILL ALLOW OUR CITIZENS TO LIVE, WORK AND PLAY, WELL INTO THE FUTURE.

2.2 Related Plans and Studies



Skyway Modernization Process

Defining the purpose and need for the modernization of the Skyway and creating the ultimate urban circulator evolved from years of planning and analyses. This section of the report provides a brief overview of key studies, relevant observations and significant interpretations that have factored into demonstrating the need for the proposed project. These documents are provided as references to this TCAR Report.

Grant Applications

JTA studied extending the Skyway system multiple times, most recently in 2013 and 2014, and applied for federal funding through the U.S Department of Transportation - Transportation Investment Generating Economic Recovery (TIGER) program to extend the system to the Brooklyn area near the Skyway Operations and Maintenance (O&M) facility in Riverside. This extension was considered as a cost effective extension since much of the track/guideway already exists, but is used only for access to the O&M center.

Route Optimization Initiative/Blueprint for Transportation Excellence (2014)

In 2014, JTA embarked on an overhaul of its service that had not been significantly modified in 30 years. The resulting effort, called the *Route Optimization Initiative (ROI)*, was essential to implement the *Blueprint 2020 for Transportation Excellence*. The purpose of the ROI was to completely redesign the bus and community shuttle services to make them more appealing to current and potential riders. Key efforts included aligning bus routes with the planned First Coast Flyer BRT, optimizing transit routes to make them more frequent and direct, restructuring the entire system (with new routes, numbering and services), increasing hours of operations, and enhanced access and connectivity to the Skyway, making the overall system simpler and easier to use.

Skyway Technology Assessment (2014-2015)

In 2014, JTA conducted a condition assessment of the existing Skyway operating system (wayside technology, train control), and Skyway infrastructure including the load rating of a typical span. The *Skyway Technology Assessment (Technology Assessment)* also assessed existing technology and the evaluation of alternatives. Concurrently, JTA performed an independent assessment of the industry by putting out a Request for Industry Feedback (RFIF) on the Skyway system. Industry feedback was desired in order to gauge the feasibility of various options for updating the system from a simple overhaul of the operating system, a system overhaul plus

replacement of the vehicles, or replacement of existing vehicles with new vehicles and allowing for some modification of the existing Skyway infrastructure. Additionally, the option of replacing the existing Skyway with streetcar vehicles was considered. The *Technology Assessment* recommended additional citizen and stakeholder input. The study team provided a list of recommendations and next steps for JTA to undertake in order to evaluate all options. The Skyway Advisory Group/Skyway Subcommittee is a continuation of that effort.

Skyway Advisory Group and Skyway Subcommittee (2016)

Following the *Technology Assessment*, technology research and industry feedback, the JTA Board of Directors established a Skyway Subcommittee and Skyway Advisory Group to assist with the decisions regarding the future of the Skyway. The Subcommittee and Advisory Group, comprised of approximately 20 members, representing the business community and various agencies, were created to gain essential stakeholder input and develop policy recommendations for the future of the Skyway. The Skyway Subcommittee met six times, while the Skyway Advisory Group participated in five meetings.

Skyway Advisory Group Meeting (2016)

Five options were identified for consideration by the Subcommittee and Advisory Group. These included:

- Overhaul vehicles;
- Replace vehicles;
- Decommission and replace Skyway with Streetcar, Trolley, Bus Rapid Transit (BRT) or Personal Rapid Transit (PRT);
- Decommission Skyway, replace with Streetcar, Trolley, BRT or PRT; and
- Repurpose Skyway infrastructure as an elevated bicycle and pedestrian path.

At the fifth meeting of the Skyway Subcommittee and Skyway Advisory Group, the participants developed consensus policy statements. In conjunction with the technical analyses and public input, these consensus statements were presented as formal recommendations to the JTA Skyway Subcommittee and JTA Board of Directors to consider at the December 2015 Board meeting.

The JTA Board of Directors adopted a resolution (Resolution 2015-30) to **"Keep, Modernize and Expand"** the Skyway and supported development of a **Skyway Modernization Program**. The ensuing program and continued planning process is described in the following narrative.

Skyway Modernization Program (2016-2017)
The Skyway Modernization Program focused on the development of several plan components to fully address the transformation of the system. These components are:

- System Plan
- Operating Plan
- Capital Plan
- Financial Plan
- Communications/Outreach Plan

A series of technical memorandum were prepared for each component.

Technical Memorandum #1: **System Plan/ Future Needs Assessment** lays the foundation for future expansion and modernization and identifies key expansion areas: Five Points to Sports/Entertainment Complex, Rosa Parks to UF Health/VA Medical Complex, and San Marco.

Skyway Advisory Group Policy Recommendations for Skyway Modernization (2016)

1. *It is important to have a high quality downtown transit circulator.*
2. *The Skyway represents a significant investment by the taxpayers. JTA and the City should carefully consider that investment when making its decision about the future of the Skyway.*
3. *The transportation system should be modernized, including improvements to the operating system, stations, guideways and vehicles.*
4. *Future plans must support the vision for downtown development consistent with the Downtown Investment Authority's, and that vision should drive decision-making for downtown transportation investments.*
5. *To reach its full potential, various extensions, without being specific to mode and including expansion of operating hours, should be considered to support the Downtown Investment Authority's vision for Downtown Jacksonville and to connect to a regional transportation plan.*
6. *The ultimate Skyway solution should be a collective effort among multiple stakeholders (e.g., federal, state, local, and private sector).*

Technical Memorandum #2: **Operations Plan** identifies high level operational considerations for transitioning existing Skyway services for future mobility over a series of improvements and enhancements through 2040, including increasing frequency, hours of operations, and dedicated runningways as well as at-grade operations.

Technical Memorandum #3: **Technology Options** evaluates a list of refined vehicle technology options and presented autonomous vehicle as the preferred technology.

Technical Memorandum #4: **Capital Cost Estimates** provides a preliminary rough order of magnitude estimates for the vehicle options and at-grade or elevated extension scenarios.

Technical Memorandum #5: **Funding Options** identifies key funding options to move the project forward, including federal, state, local sources and transportation user fees.

The Skyway Modernization Program planning process was not constrained by the existing system and infrastructure and all potential innovative alternates for the modernization and extension of the system were considered including new vehicles, autonomous technology and elevated and at-grade options for extensions. The *Skyway Modernization Program Summary Report (Summary Report)* provides the path forward for the future of the Skyway. The *Summary Report* documents the research, exploration and investigation into vehicle options and the extensive dialogue with the community to define the overall transportation system plan to achieve desired downtown mobility.

The *Summary Report* identified the preferred vehicle technology to achieve the circulator system plan and initial steps for system expansion and project development. The transformation of downtown mobility and creating the ultimate urban circulator presents an exciting opportunity for Jacksonville. A fully built-out U^{2}C Program system can cost effectively reach beyond the limits of the current Skyway system to serve existing neighborhoods as well as planned and emerging development.

Summary Report (2017)

Environmental Determination

Early in 2014 as part of the TIGER Grant application for the proposed Skyway Extension, known specifically as the Brooklyn Skyway Extension and Station Development, the subject project was entered into the FDOT's Environmental Transportation Decision Making (ETDM) process. Copies of related environmental review documentation for the ETDM Summary are included in Appendix B of this report.

In March 2017 during the Skyway Modernization Program development, the JTA coordinated with the FTA regarding the NEPA (National Environmental Policy Act) checklist and other environmental review requirements for advancing the project. Subsequently in April 2017, JTA received concurrence from FTA indicating a determination that the Brooklyn Extension project qualifies for a Categorical Exclusion C9 (23 CFR 771.118, (c)(9), *"Assembly of construction of facilities that is consistent with existing land use and zoning requirements (including floodplain regulations) and uses primarily land disturbed for transportation use."*

Additionally, FTA determined that the Skyway Conversion project qualifies for Categorical Exclusion C8 (23 CFR 771.118 (c) (8*), "Maintenance, rehabilitation, and reconstruction of facilities that occupy substantially the same geographic footprint and do not result in a change of functional use."* Furthermore, FTA determined that neither project will affect any historic resources.

Additional environmental field reviews were conducted as part of this TCAR Study for the area occupied by the proposed Brooklyn Extension and Station. The results of this field assessment are described briefly in a subsequent section pertaining to the Brooklyn Extension (see Section 6.5) and a copy of the report is available as listed under Reference Documents in the Table of Contents.

The remainder of this TCAR Report is organized as follows.

Section 3 describes the existing conditions pertaining to demographics, land use and transportation modal features.

Section 4 outlines the existing conditions related to specific Skyway vehicles and infrastructure (guideway and stations).

Section 5 discusses future system needs related to planned and future development, including future travel demand projections.

Section 6 recaps the development of alternatives that have been identified through the various studies and analyses.

Section 7 summarizes the evaluation of the potential alternatives, from vehicles to supervisory system to the infrastructure options.

Section 8 reviews the public involvement and stakeholder outreach activities conducted as part of the Skyway modernization studies.

Section 9 presents cost estimates and provides an overview of potential funding options for current and future system requirements.

Section 10 is a summary of related activities and defines next steps for project development.

3 Existing Conditions

Downtown Jacksonville is the employment and cultural center of Jacksonville. With a land area of approximately 840 square miles, Jacksonville, consolidated with Duval County in 1968, is the largest city in land area in the continental U.S. Located in northeast Florida, less than 30 miles south of the Georgia state line, the city is bounded by the Atlantic Ocean to the east; Clay and St. Johns Counties to the south; and Baker and Nassau Counties to the west. The St. Johns River runs north through Jacksonville, narrowing as it passes through downtown, before releasing into the Atlantic Ocean.

Jacksonville's estimated population in 2017 was approximately 907,500. The Greater Jacksonville Metropolitan Area (GJMA), which includes Duval, Clay, St. Johns, Nassau, and Baker Counties, is estimated to have approximately 1.3 million residents. From 2010 to 2017, Jacksonville increased in population by 69,000, or 8.4% (approximately 1% annually)[1]. The outlying areas are growing at a faster rate than Jacksonville itself. As one of the largest employment centers in North Florida, workers and tourists are drawn from the region to its medical and specialty healthcare facilities, sports and entertainment facilities, banking and financial services, as well as the logistics industry. Jacksonville is also home to several military facilities, including Naval Air Station Jacksonville and Naval Station Mayport.

Section 3 provides an overview of existing demographic, land use, and transportation characteristics of the project study area. **Section 4** provides a summary of the existing conditions related to the current Skyway operations and infrastructure, including existing vehicles and stations.

Jacksonville Southbank Riverwalk and Friendship Fountain

[1] World Population Review (worldpopulationreview.com)

3.1 Demographic Profile

Demographic data describes a community's structure and is primarily collected by local, state, or federal agencies, such as the Census Bureau. Demographic data covers a range of topics about communities, including: population size, gender, age composition, ethnic backgrounds, household characteristics, and geographic distribution. This data assists in designing public participation, outreach, and education strategies that reflect the age, education, and economic backgrounds of the community.

The 2010 Census Block Group Data, which contain the most recent demographic profile, was used to complete the demographic comparison and analysis. Block groups are defined by the United States Census Bureau as "statistical divisions of census tracts and are generally defined to contain between 600 and 3,000 people." Census blocks are statistical areas bounded by visible features, such as streets, roads, streams, and railroad tracks, and by nonvisible boundaries, such as selected property lines and city, township, school district, and county limits.

The ¼-mile buffer around the existing Skyway alignment and the proposed extension to Brooklyn (Census Analysis Area) intersects seven census block groups in Duval County. After grouping the seven census blocks intersecting the corridor, the averages of specific demographic information was compared to the demographic information for all of Duval County (244 block groups) and is shown in Tables 3.1.1 to 3.1.7. Corresponding figures illustrating the area's demographic profile are included in Appendix A, entitled Skyway Station and Land Use / Demographic Figures.

Table 3.1.1: Demographic Comparison: Population

Evaluation Criteria	Duval County	Analysis Area
Total population (2010)	864,263	8,997
Percent of the population that is White	52.3%	58.4%
Percent of the population that is Black	32.7%	31.7%
Percent of the population that is Hispanic	6.7%	4.6%
Percent of the population that is Asian	3.1%	2.5%
Percent of the population that is Other[1]	5.2%	2.8%
Percent of the population that is considered 'Minority'	44.6%	40.3%
Median population age	37.8	48.5
Percent of the population that is above 65 years old	12.5%	25.4%

[1] Other nationalities include: American Indian or Alaska native, Native Hawaiian or other Pacific islander, or 2 or more races.

Table 3.1.2: Demographic Comparison: Population Density

Evaluation Criteria	Duval County	Analysis Area
Total acres	587,813	3,580
Population density (persons per acre)	1.5	2.51
Household density (housing units per acre)	2.4	6.05
Percent of housing units occupied	87.4%	87.1%
Percent of housing units vacant	12.6%	12.9%
Average family size	3.0	2.6
Average household size	2.5	1.6

Table 3.1.3: Demographic Comparison: Income

Evaluation Criteria	Duval County	Analysis Area
Median Household Income ($)	$ 49,188	$ 30,976
Median Family Income ($)	$ 58,496	$ 55,877
Percent of households below the poverty line[2]	13.0%	23.9%
Percent of the population below the poverty line[2]	13.8%	20.1%

[2] The Census Bureau uses a set of money income thresholds that vary by family size and composition to determine who is in poverty. If a family's total income is less than the family's threshold, then that family and every individual in it is considered in poverty.

Table 3.1.4: Demographic Comparison: Transportation

Evaluation Criteria	Duval County	Analysis Area
Percent of the population that commute to/from work via a car, truck or van	91.7%	84.2%
Percent of the population that does not commute to/from work	3.5%	3.8%
Percent of the population that bikes to/from work	0.6%	0.8%
Percent of the population that walks to/from work	1.7%	7.5%
Percent of the population that takes public transportation to /from work	1.6%	3.5%
Percent of the population that travels to/from work via a motorcycle	0.3%	0.0%
Percent of the population that travels to/from work via "other" means	0.6%	0.2%
Percent of occupied housing units that do not have a vehicle	7.4%	28.6%

Table 3.1.5: Demographic Comparison: Language

Evaluation Criteria	Duval County	Analysis Area
Percent of the population that speaks only English	87.4%	89.3%
Percent of the population that speaks a language other than English and also speaks English "very well"	7.7%	6.2%
Percent of the population that is considered to be Limited English Proficient [3]	4.9%	4.5%

[3] People with Limited English Proficiency (LEP) speak English "less than very well" or "not at all." These people have a limited ability to read, write, speak or understand English.

Table 3.1.6: Demographic Comparison: Education

Evaluation Criteria	Duval County	Analysis Area
Percent of the population that is over 25 years old and has less than a 9th grade education	3.8%	3.7%
Percent of the population that is over 25 years old and has completed more than 9th grade but does not have a high school diploma	9.0%	10.8%
Percent of the population that is over 25 years old and has a high school diploma	87.2%	85.4%
Percent of the population that has some college or an associate's degree	32.0%	31.8%
Percent of the population that has a bachelor's, master's, doctorate or professional degree	16.9%	17.1%

As shown in the tables, the project study area has a similar demographic profile as the whole of Duval County with a few notable exceptions. The percent of the population considered white is slightly higher in the study area (58.4%) than in all of Duval County (52.3%). The study area has a similar percentage of blacks and a slightly lower percentage of Hispanics compared to Duval County. Therefore, the overall minority percentage is slightly lower in the study area (40.3%) than in Duval County (44.6%). The median population age in the study area is significantly older than Duval County, 48.5 years old, compared to 37.8 years old respectively. Similarly, the percent of the population older than 65 years old is significantly higher in the study area (25.4%) than in Duval County (12.5%).

The project study area has a higher population density than Duval County, a characteristic which is consistent with an urban corridor. The most prevalent demographic difference between the study area and Duval County is the median household income, which is approximately $18,000 lower compared to the county as a whole. The study area median family income is similar to Duval County, $55,877 compared to $58,496 respectively. In addition, the percentage of households and population below the poverty line are significantly higher than Duval County. A total of 23.9% of the households in the study area are below the poverty line compared to 13.0% for Duval County.

The percentage of the population that commutes to/from work via a car, truck, or van in the study area (84.2%) is lower than Duval County (91.7%). Similarly, the percent of the population that walks to/from work is significantly higher in the study area (7.5%) compared to Duval County (1.7%). The percent of the population that bikes or takes public transportation is also higher in the study area than in all of Duval County. The percent of occupied housing units that do not have a vehicle is significantly higher in the study area (28.6%) compared to Duval County (7.4%).

The percent of the population that is considered Limited English Proficient (LEP) is slightly lower in the study area than in Duval County – 4.5% compared to 4.9%. This gap is consistent with the study area containing a lower percentage of Hispanics than all of Duval County.

The study area has a comparable education attainment as Duval County as a whole, with a slightly lower high school graduation rate but a slightly higher percentage with a bachelor's or higher college degree.

3.2 Existing Land Use

As the center of Northeast Florida, Downtown Jacksonville is 3.9 square miles (including the St. Johns River) and makes up just 0.4% of the total area of the City of Jacksonville. The urban core consists of five major districts: Downtown (or the Northbank), Southbank, LaVilla, Brooklyn, and the Sports Complex. Each neighborhood offers unique historic, working, and leisure opportunities.

Jacksonville has several large companies whose headquarters are located downtown, and it has become a popular destination for company expansions. Downtown serves as corporate headquarters for publicly traded companies such as CSX Corporation, Stein Mart, FIS, and Regency Centers. From the healthcare industry, Baptist Health and their affiliates occupy a series of towers, offices, and parking lots and garages in the Southbank. New to the expanding medical complex located on the Southbank of Downtown, is MD Anderson Cancer Center

In the financial sector, TIAA Bank, along with Black Knight Financial, FIS and Raymond James occupy major buildings in the Brooklyn area.

In the rail and logistics industries, CSX and Suddath, on opposite sides of the St Johns River, are also major employers for the Urban Core and Southbank.

Downtown Overlay Districts

The Downtown Investment Authority (DIA), created to revitalize Jacksonville's urban core by utilizing Community Redevelopment Area (CRA) resources, divides the downtown into 10 zoning overlay districts, described by DIA as follows.

- Brooklyn & Riverside District – Characterized by new multi-family residential developments, is ideal for a newly designed mixed-use and features walkable neighborhood with multi-family apartments, condominiums, and retail neighborhood services. Unity Plaza, a full service park, is located across from the Riverside YMCA, with access to the Northbank Riverwalk.

- Central Civil Core - The Core is bound by Church Street to the north; Main Street to the east; Jefferson Street to the west; and the St. Johns River to the south. Located in the core are cultural and services such as: Hemming Park, the Museum of Contemporary Art, the Main Library, the Jacksonville Landing, the Florida Theatre, and the Times-Union Performing Arts Center. This is the most concentrated area of focus for economic development on the Northbank.
- LaVilla District – LaVilla, remembered for its historic African-American heritage, bridges the gap between the Urban Core and Brooklyn. Restoration and reconstruction of a few historic structures such as the Ritz Theater has occurred; however, many of the historical structures were dilapidated and subsequently destroyed. Efforts to revitalize the area include a new LaVilla School of the Arts and the future Jacksonville Regional Transportation Center.
- Church District - The Church District is dominated by the presence of the First Baptist Church. The church, along with other smaller places of worship, occupy many blocks with buildings and parking. However, to the west of the district, empty or vacant properties remain underused.
- Institutional District - The Institutional District includes a correctional facility and former courthouse, the Jacksonville Sheriff's Office (JSO) headquarters, and the Maxwell House coffee processing plant. The uses in this district include longtime anchor business, and city owned riverfront property.
- Cathedral District – This district has the potential to become a revitalized residential neighborhood adjacent to the Central Civic Core, which serves as the main employment district of downtown. The traditional street pattern with a mixture of churches and residences, such as Parks at the Cathedral, provides a unique neighborhood that is walkable and bikeable to employment centers and services.
- Stadium District - The district is home to TIAA Bank Field, where the NFL Jacksonville Jaguars play, the Baseball Grounds of Jacksonville, the Jacksonville Veterans Memorial Arena, Daily's Place, and the Jacksonville Fair and Expo Center. The Stadium District is home to the Doro entertainment district and includes part of the planned Shipyards redevelopment site.
- Riverfront District – This district is a collection of shipyards, existing and former government uses, new development and redevelopment. Most significantly, there is an expanding entrepreneurial scene developing on Bay, Ocean, Forsyth, and Adams Streets. The Northbank Riverwalk provides a valuable connection experience, allowing for a magnificent public open space, linking residential and commercial development.
- River Park District - Metropolitan Park is the centerpiece of this district. At present, the Park, at the eastern extremity of Downtown Jacksonville, is isolated from the Northbank Riverwalk and the civic core by potential development sites. In conjunction

with the Shipyards redevelopment, this area will connect to the synergies of the Stadium and Entertainment districts.

- Southbank District – This district consists of a mixture of uses along the St. Johns River that range from high-rise condominiums, several hotels, the magnificent Treaty Oak Park, local and regional headquarters for multiple industries, the Baptist Medical Center, the Museum of Science and History, Duval County School Board, fine dining, a City marina and boat ramp, and Friendship Park.

The DIA overlay districts are depicted in Figure 3.2.1.

For the purposes of describing existing land uses adjacent to the existing Skyway system, the project study area is broken up into three segments, listed below and as illustrated in Figure 3.2.2:

- Area 1: Convention Center Station (JRTC) to Central Station and Skyway O&M Center
- Area 2: Central Station to Rosa Parks Station
- Area 3: Southbank

Area 1: Convention Center Station (JRTC) to Central Station and O&M Center

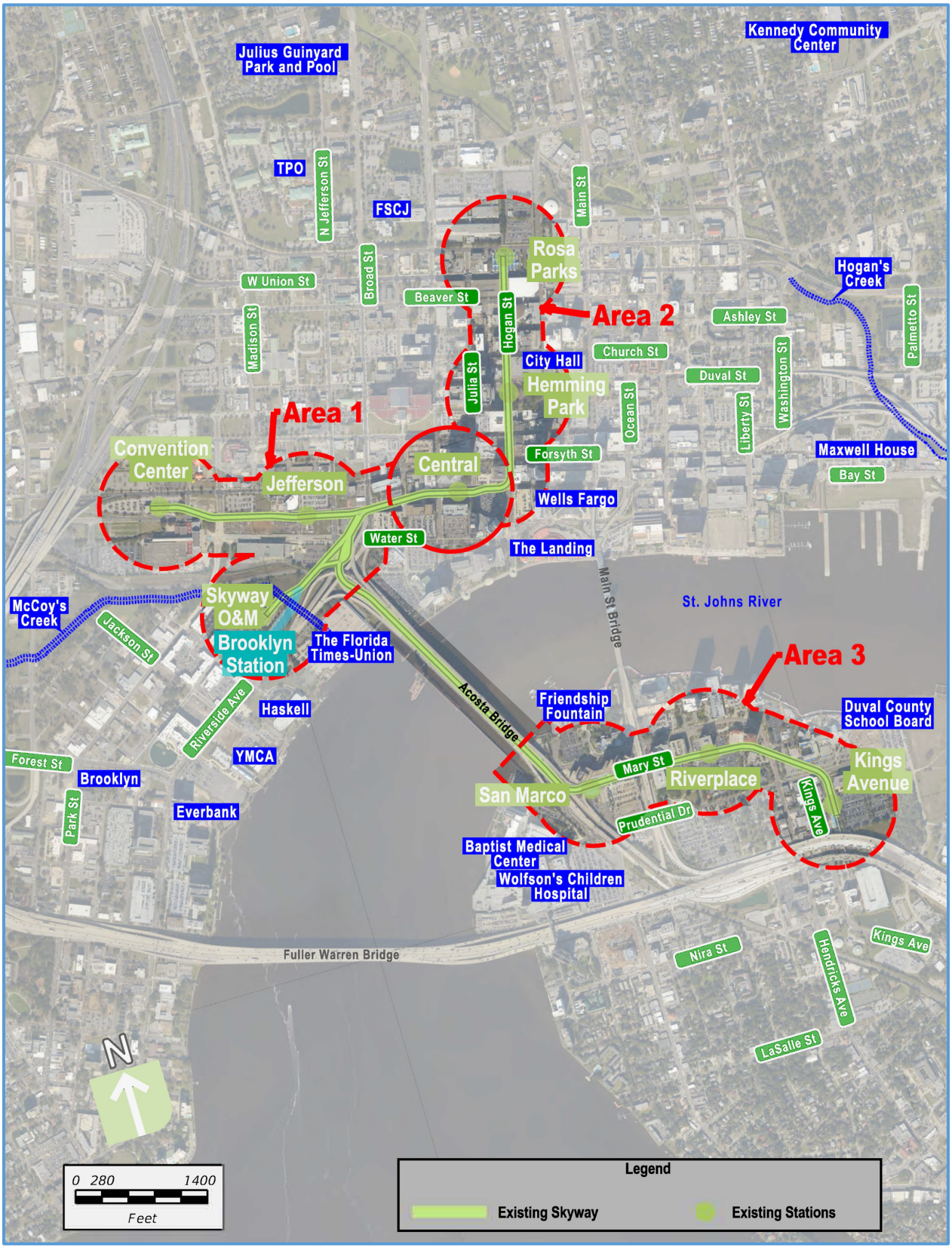
The land uses surrounding the JRTC to Central Station study area, located in the LaVilla Urban Core districts, are characteristic of a Central Business District (CBD) and its periphery. Predominant land uses include Government Facilities (45.6 acres) and Retail/Service (24.1 acres), as reported from the 2017 City of Jacksonville Property Appraiser's Office land use description and acreage. The residential footprint along this segment is the highest (8.2 acres) of the project study area, with medium-density projects completed and proposed around the Jefferson Station. Major landmarks in this area include the Prime Osborn Convention Center, the 42-story Bank of America Tower (commercial/office), the Times-Union Center for the Performing Arts, the Omni Hotel and the Landing (retail/restaurant). One public school, LaVilla School of the Arts, falls within half a mile of the existing Convention Center Station. Convention Center Station currently serves as a transportation hub, with connections to other JTA services, regional services, and intercity services such as MegaBus. Additionally, with the recent completion of the Intercity Bus Facility passengers can also connect to Greyhound, all within close proximity to the interstate system, I-10 and I-95.

Adjacent to the Skyway O&M Center are multiple new medium-density residential communities and a neighborhood shopping and retail center, called Brooklyn Station, anchored by Fresh Market. This area is also located near multiple business complexes, along Riverside Avenue, including Haskell, Florida Blue and the Riverside YMCA.

Figure 3.2.1: Downtown DIA Districts

Source: Downtown Investment Authority (2014)

Figure 3.2.2: Study Area Key Map



At the time of the Property Appraiser's database review, both parking lot parcels (including a mix of surface and parking garages) and vacant parcels occupied close to 29% of the area, providing abundant opportunities for residential, commercial and retail growth as well as Transit-Oriented Development near the Jefferson Station, the Convention Center Station, and the O&M Center. Some partially vacant sites, such as Lofts at LaVilla (residential) have since been occupied. Lofts at Jefferson Station is under construction. Appendix A illustrates the existing land use around the JRTC to Central Station and Skyway O&M Center.

Area 2: Central Station to Rosa Parks Station

The Central Station to Rosa Parks portion of the project study area, located in the Urban Core district, has mixed land use and densities that are typical of a CBD including, predominantly service/office land use during the day. Existing land uses include Government Facilities (37.8 acres), Commercial/Retail/Office (22.2 acres) and Educational (21.88 acres). The Residential footprint along this segment is the lowest (1.3 acres) of the three study areas and is dominated by high-rise buildings, all of which are east of Hogan Street. As a major financial and commercial center, this segment includes the 42-story Bank of America Tower, the Wells Fargo Center, and the TIAA Bank Center, which are all commercial/office buildings.

Hemming Park, a one-block public park bounded by the named station, City Hall, City of Jacksonville offices, the Federal Building, Main Public Library, and the Jacksonville Museum of Contemporary Art (MOCA), is a popular destination for both tourists and daytime workers. The Rosa Parks Station serves the Florida State College of Jacksonville (FSCJ) Downtown Campus as well as the existing bus transfer station. The Landing (retail/restaurants) and the Northbank Riverwalk (park), are popular tourist destinations near Central Station. Appendix A shows the existing land use surrounding Central Station to Rosa Parks Stations.

Area 3: Southbank

The Southbank portion of the project study area, located in the Southbank and San Marco neighborhoods, is predominantly Office/Service-oriented with Baptist Health Hospitals, MD Anderson Cancer Center, and additional medical facilities occupying more than 16 acres and concentrated on the westernmost segment, near San Marco Station. The area is also recreation/tourist-oriented, with the Jacksonville Museum of Science and History, Treaty Oak Park, Friendship Park, and multiple hotels facing the Southbank Riverwalk and the St. Johns River.

Most of the residential parcels are concentrated near Riverplace Station, with two high-rise residential buildings, including the 36-story Peninsula at St. Johns Center. At the time of the assessment, vacant parcels occupied approximately 17% of the area, providing abundant opportunities for additional residential and retail growth. Appendix A shows the existing land use in the vicinity of Southbank

3.3 Existing Transportation System Features

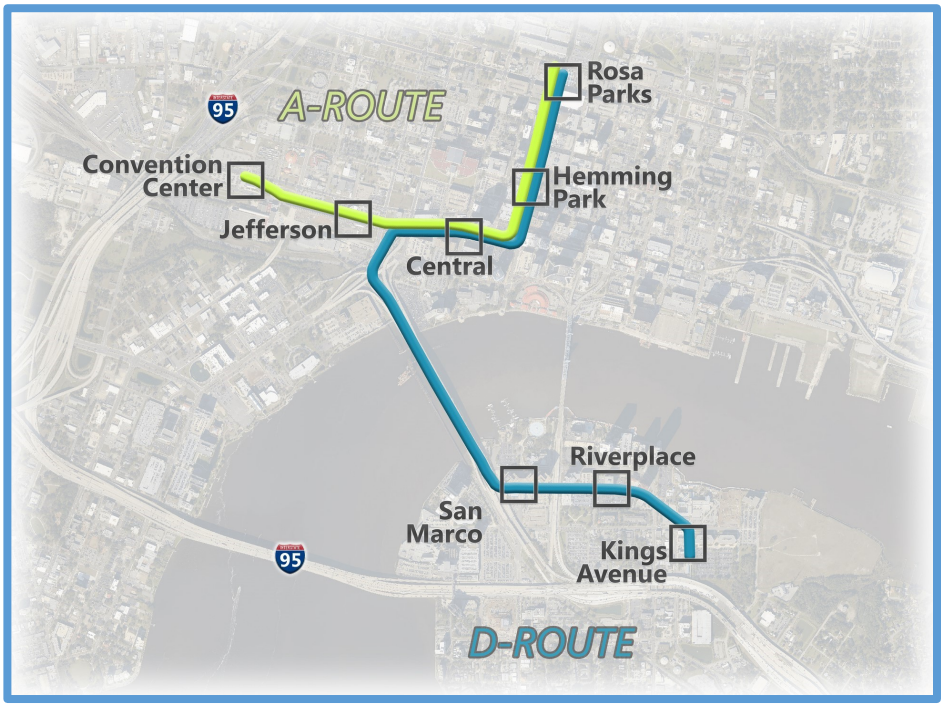
Skyway

Existing Skyway System

The existing Skyway system is an automated people mover, operating on an elevated guideway platform and operating between eight dual-platform stations, connecting the Jacksonville Urban Core with San Marco/Southbank neighborhoods and the LaVilla neighborhoods.

The 2.5-mile system operates weekdays, 6 a.m. to 9 p.m., with vehicles arriving every six to eight minutes, along two routes. Figure 3.3.1 displays the existing Skyway service operating routes. The Northbank route or, A-Route, runs between the Convention Center Station and the Rosa Parks Station and serves the following stations: Jefferson, Central, and Hemming Park. There is no passenger service offered at the Skyway O&M Center. The Southbank route, or D-Route, runs between the Kings Avenue Station and the Rosa Parks Station, and stops at the following stations: Riverplace, San Marco, Central and Hemming Park. The JTA has the flexibility to operate other routes or patterns besides Routes A and D, including a shuttle between Convention Center Station (JRTC) and Central Station. Existing service is complimentary for all passengers.

Figure 3.3.1: Existing Skyway Service



The JTA has the flexibility to operate other routes or patterns besides Routes A and D, including a shuttle between Convention Center Station (JRTC) and Central Station. Existing service is complimentary for all passengers. Station amenities include wayfinding maps, benches, escalators, and elevators. Overhead screens at both ends of the platforms provide route information and estimated vehicle arrival time. Vehicle capacity for the current two-car train carries 56 passengers at full capacity. Stations also strategically connect to other JTA and regional transit services, including the JTA First Coast Flyer BRT system, and Park-n-Ride facilities (e.g., Kings Avenue Parking Garage). All stations and vehicles are monitored through closed-circuit video. During special events and when operating demand warrants, the JTA modifies operations.

Skyway Control Room, Operations and Maintenance Center

Transit System

The JTA operates express and local bus service, Bus Rapid Transit (BRT), the Skyway, a Ferry, Stadium Shuttles for various sporting events at Jacksonville's Stadium/Sports/Entertainment Complex, paratransit for the disabled and elderly (Connexion), and on-demand services (Community Shuttle soon to be ReadiRide).

Fare structure varies by type of service (bus, BRT, express bus, Ferry, etc.) and duration (single ride, day passes). Regular bus fare is $1.50 and express route fare is $2. Reduced bus fare is available for younger than 18 years old, persons with disabilities and Medicare card holders, and free for senior citizens. Ferry fares range from $1 for pedestrian/bicyclists and $6 for cars. Customers have multiple ticketing options, including cash, a reusable STAR card, and the MyJTA app, an e-ticketing option.

Local Bus

As of summer 2018, the JTA operates 30 fixed routes and six express routes including more than 2,600 individual stops. Service frequency varies by time of day and weekday / weekends.

Many fixed-route buses are air-conditioned, provide complimentary Wi-Fi, and can accommodate bikes on bus racks. The JTA has been steadily moving forward with diversifying its fleet, incorporating Hybrid and Compressed Natural Gas (CNG) buses.

JTA Bus

First Coast Flyer BRT

The First Coast Flyer is JTA's premium BRT service. The Flyer offers customers a frequent, limited stop, easy and reliable way to get around town. When completed, the Flyer will be 57 miles (see Figure 3.3.2) and will be the largest bus rapid transit system in the Southeast. The BRT system, spread out in five phases and four lines, operates with a service frequency of 10 minutes during peak hours, 15 minutes during off-peak periods, and 30 minutes during evenings and weekends. The Green Line, Blue Line and Red Line are currently operational, with the Purple Line in design phase. Unique BRT features include CNG buses, transit signal priority, ticket vending machines, and dedicated bus lanes in Downtown Jacksonville. Figure 3.3.2 displays the First Coast Flyer bus routes.

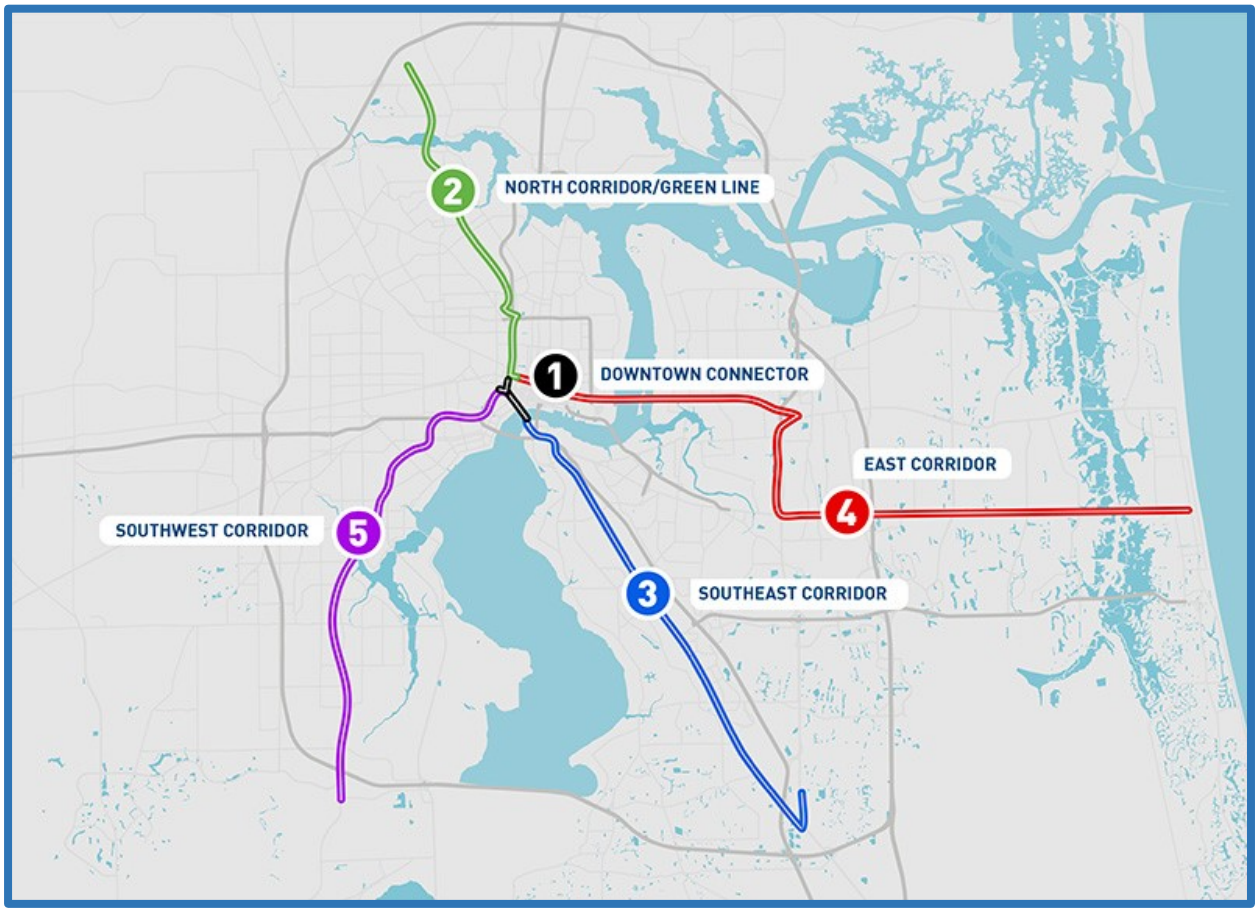
Connexion

Paratransit service, branded Connexion, is offered for persons with disabilities through a contract with a transportation provider. This service includes scheduled door-to-door service as well as out of county medical trips. JTA paratransit services average more than 50,000 trips in Duval County monthly.

Connexion (Paratransit Service)

First Coast Flyer (JTA's premium BRT service)

Figure 3.3.2: First Coast Flyer Bus Routes



Park-N-Ride Lots

The JTA operates Park-n-Ride lots, served by local bus routes, the Skyway or First Coast Flyer BRT routes. Amenities at Park-n-Ride facilities vary and can include bike racks, indoor customer waiting areas, restrooms, ticket vending machines, and safety and security offices. Across all sites, the JTA Park-n-Ride Lots provide more than 3,000 parking spaces for customers. In addition to the existing Park-n-Ride lots, a new lot near Avenues Mall (Avenues Walk), is expected to be operational by the end of 2018. The Park-n-Ride lots are as follows:

1. Jefferson Lot
2. Kings Avenue Garage
3. Armsdale Lot
4. Baldwin Lot
5. A1A and Wonderwood Lot
6. Monument Road Lot
7. Phillips Highway / JTB Lot
8. Marbon Lot
9. Black Creek Station (Clay County Lot)
10. Avenues Walk (under construction), adjacent to US-1/SR 115 (Southside)

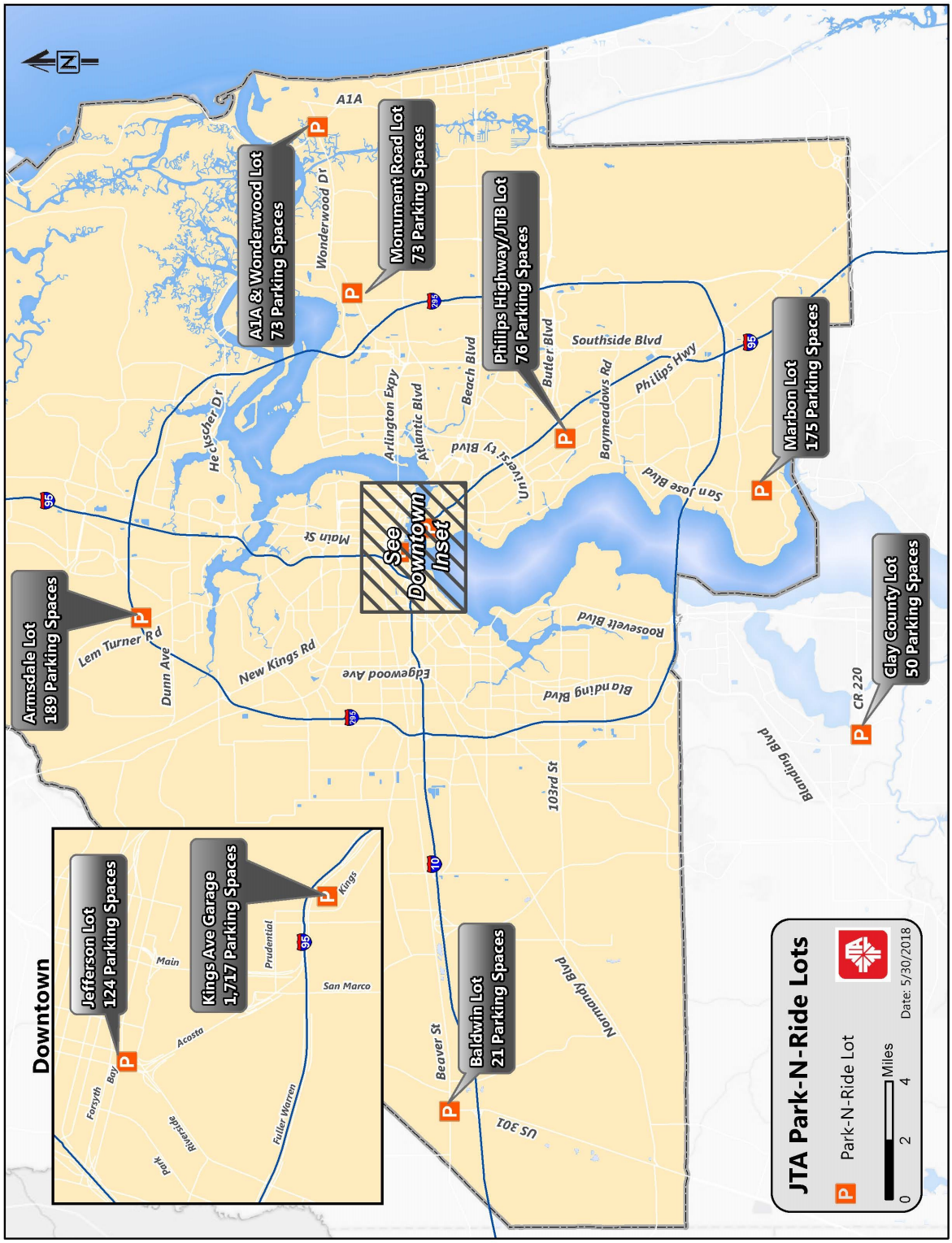
The existing Park-n-Ride lots are shown in Figure 3.3.3.

St. Johns River Ferry

The St. Johns River Ferry runs from Mayport Village to Ft. George Island seven days a week, from 6 a.m. to 7:15 p.m. on weekdays and 7:00 a.m. to 8:45 p.m. on weekends, with departures every half hour. The service, which connects the north and south ends of Florida State Road A1A, takes about 15 minutes and carries both passenger vehicles and pedestrians, to either side of the St. Johns River.

St. Johns River Ferry

Figure 3.3.3: Existing Park-n-Ride Lots



Road Network

A number of state and local roads are located adjacent or within the Skyway project study area and provide critical access to the existing Skyway, Park-n-Rides, sports complexes, commercial businesses and residential development in Downtown Jacksonville. At the highest road classification level, I-95 and I-10, located immediately adjacent to the Skyway system, provide connectivity for commuters, visitors and freight alike. Additionally, other major facilities including US 1 and US 17 traverse through the urban core.

On the north side of the St. Johns River, the existing Skyway follows the Acosta Bridge (over the St. Johns River), then runs south of and parallel to Forsyth Street before turning north onto Hogan Street.

On the south side of the river, the Skyway again follows the Acosta Bridge before turning east onto Mary Street, then crosses Riverplace Boulevard / Hendricks Avenue and ends near Kings Avenue. Figures 3.3.4 and 3.3.5 show the major road network south of the St. Johns River and north of the St. Johns River, respectively.

Skyway ramps over the Acosta Bridge

	U²C - TCAR 1 Program: Skyway Conversion and Brooklyn Extension	Figure 3.3.5: Road Network South Side	Page Number: 3-18


State St
Union St
Pearl St
Hogan St
Rosa Parks
Laura St
Ocean St
95
17
Church St
Monroe St
Convention Center
Julia St
Main St
Newman St
Hemming Park
Adams St
Forsyth St
Duval St
Jefferson
Central
1
Market St
Liberty St
Water St
Leila St
Bay St
Riverside Ave
Acosta Bridge
13
Main Street Bridge
ONE WAY
N
0
0.075
0.15
Miles
Legend
Brooklyn Station
Existing Skyway Stations
Brooklyn Extension
Existing Skyway Route

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Bicycle and Pedestrian Accommodations

A network of sidewalk and bicycle lanes exists within vicinity of the Skyway, providing additional linkages to the Skyway and adjacent transportation facilities. Within the quarter mile buffer around the existing Skyway, there are bicycle facilities (see Figures 3.3.6 and 3.3.7):

- Jefferson Street from Forsyth Street to Duval Street (shared bus-bike lane, left side of the road);
- Broad Street from Forsyth Street to Duval Street (shared bus-bike lane, right side of the road);
- San Marco Boulevard from Prudential Drive to Gary Street (both sides of the road); and
- Hendricks Avenues from Prudential Drive to Nira Street and beyond (both sides of the road).

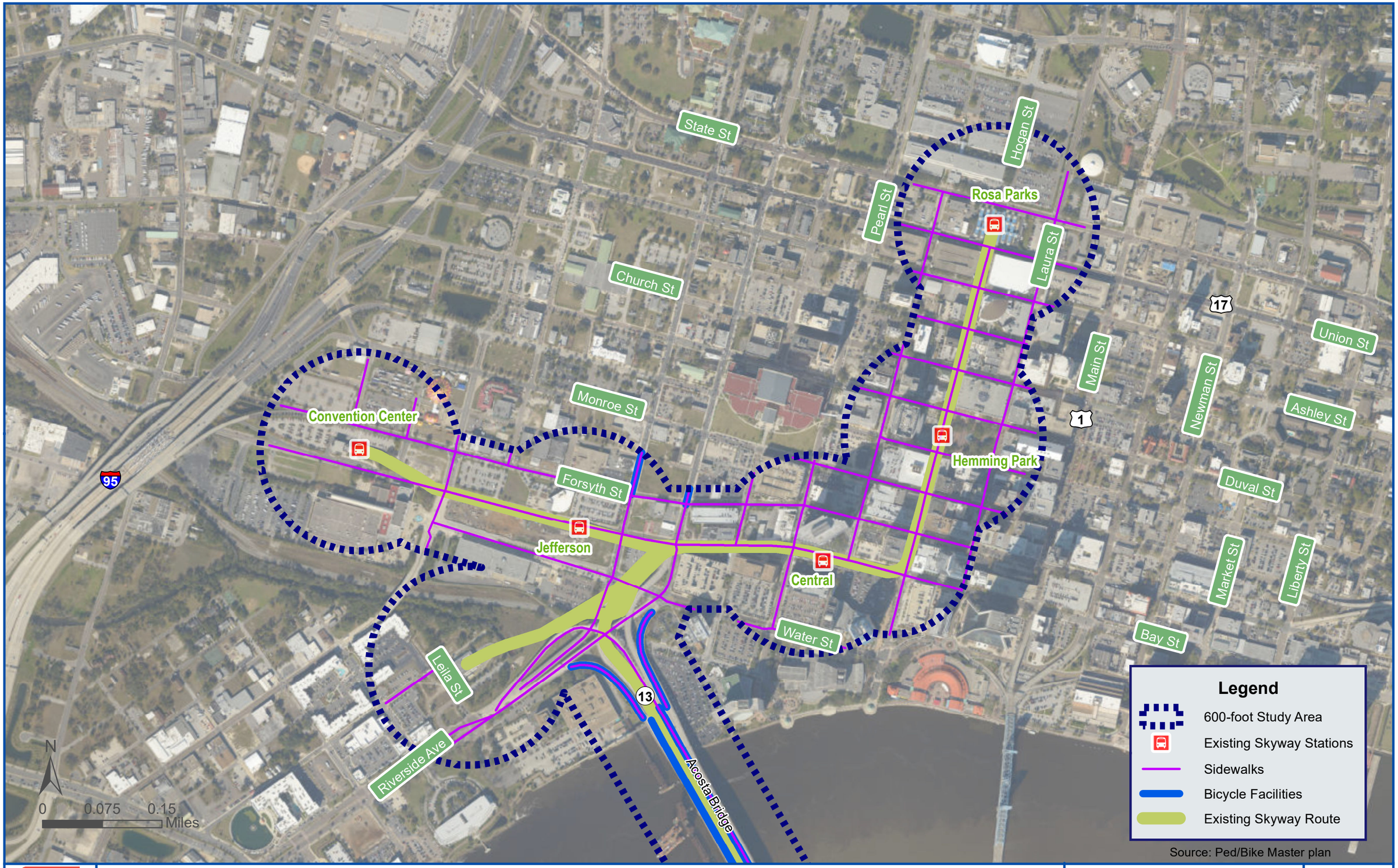
There is also one shared use path facility in the study area: the Acosta Bridge from Mary Street to Riverside Avenue includes a shared use path on both sides of the bridge. Just outside of the study area, a new shared use path is under construction adjacent to the Fuller Warren Bridge connecting San Marco with Riverside. Also, within the quarter mile buffer around the existing Skyway are 40 sidewalks, which are listed in Table 3.3.1 and shown on Figures 3.3.6 and 3.3.7.

In addition, the City of Jacksonville also has the Northbank and the Southbank Riverwalks. The Northbank Riverwalk extends from Berkman Plaza to I-95 in Riverside. The Northbank Riverwalk, offers a fantastic view of the St. Johns River and is approximately 2 miles long. The Southbank Riverwalk borders the St. Johns River on the south side of the river, with 1.25 miles between Friendship Fountain Park and Duval County Public Schools building.

Southbank Riverwalk

Table 3.3.1: Existing Sidewalk within the Study Area

Road Name	Limits	Side of Road
Independent Drive	E Independent Drive to Prime Osborn Convention Center	Both
Ocean Street	Independent Drive to Orange Street	Both
Main Street	Prudential Drive to Phelps Street	Both
N Laura Street	The Landing to W 1st Street	Both
Hogan Street	Times Union Center to Rosa Parks Station	Both
Julia Street	W Bay Street to FSCJ	Both
Pearl Street	Independent Drive to Bethel Baptist Institutional Church	Both
Clay Street	W Bay St to Courthouse then Courthouse to W State Street	Both
Broad Street	Water Street to W Duval Street	Both
Jefferson Street	Water Street to Duval Street	Both
Davis Street	Forsyth Street to W Duval Street	Both
Lee Street	Water Street to W Duval Street	Both
Johnson Street	W Forsyth Street to Houston Street	Both
Stuart Street	W Forsyth Street to Houston Street	Right
Water Street	Park Street to Hogan Street	Both
Bay Street	Myrtle Avenue to Ocean Street	Both
Forsyth Street	Myrtle Avenue to Ocean Street	Both
Adams Street	Apex Color to Ocean Street	Both
Monroe Street	Apex Color to Courthouse then Courthouse to Ocean Street	Both
Duval Street	Broad Street to Ocean Street	Both
Church Street	Broad Street to Ocean Street	Both
Ashley Street	Broad Street to Ocean Street	Both
Beaver Street	Broad Street to Ocean Street	Both
Union Street	Broad Street to Ocean Street	Both
State Street	Broad Street to Ocean Street	Both
Caroline Street	Pearl Street to Laura Street	Both
Riverside Avenue	Water Street to 220 Riverside	Both
Park Street	Water Street to Jackson Street	Both
Magnolia Street	Leila Street to Jackson Street	Both
Jackson Street	YMCA to Park Street	Both
Stonewall Street	Riverside Avenue to Brooklyn Apartments	Both
Palm Avenue	Prudential Drive to Gary Street	Both
San Marco Boulevard	Friendship Fountain to Gary Street	Both
Flagler Avenue	Prudential Drive to Riverplace Boulevard	Both
Kipp Avenue	Louisa Street to Prudential Drive	Left
Hendricks Avenue	Nira Street to Prudential Drive	Both
Kings Avenue	Nira Street to Prudential Drive	Both
Prudential Drive	Baptist Medical Center to Broadcast Place	Both
Riverplace Boulevard	Prudential Drive to Museum Circle	Both



Source: Ped/Bike Master plan

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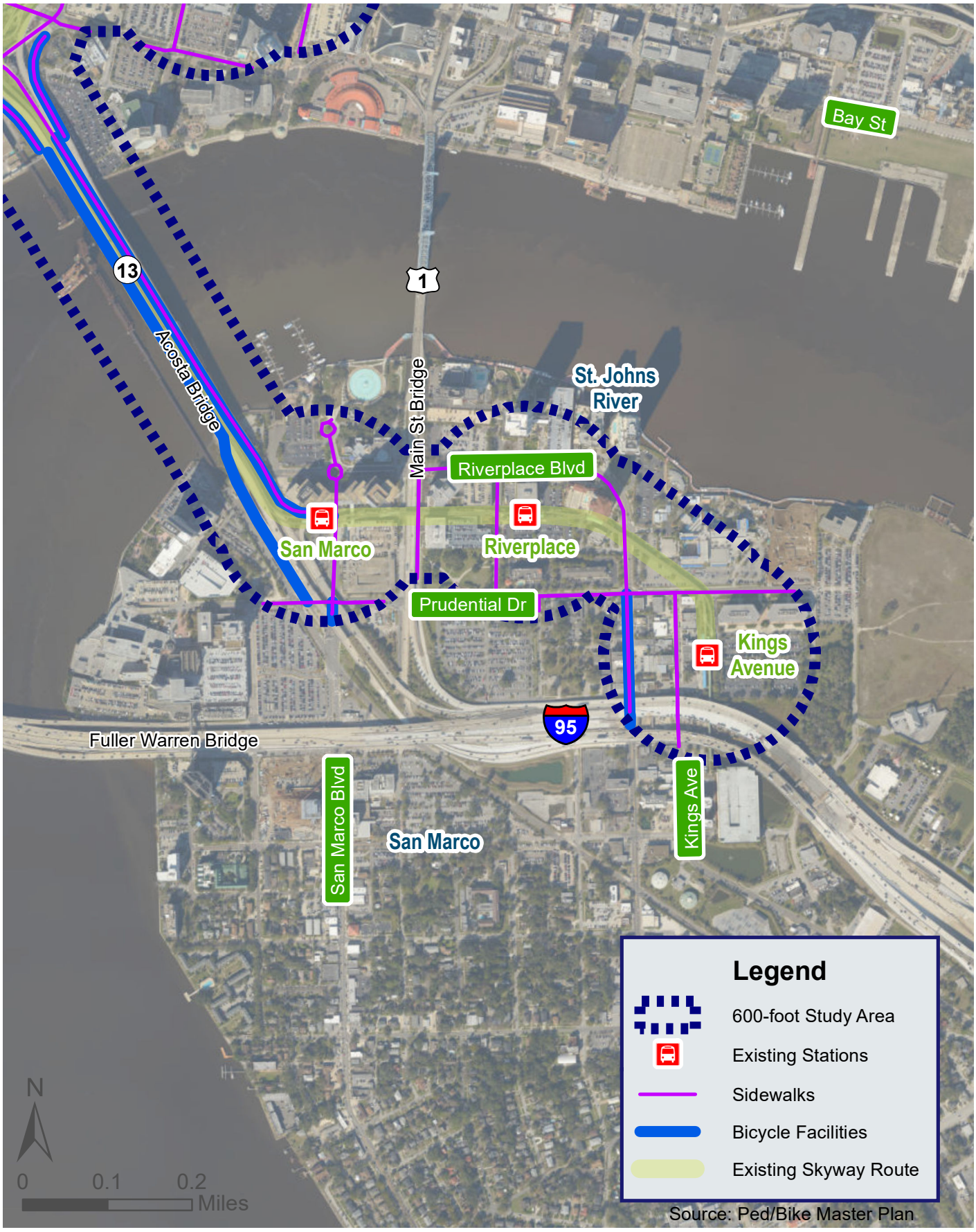


Source: Ped/Bike Master Plan

	U²C - TCAR 1 Program: Skyway Conversion and Brooklyn Extension	Figure 3.3.7 Pedestrian and Bicycle Facilities - South Side	Page Number: 3-25

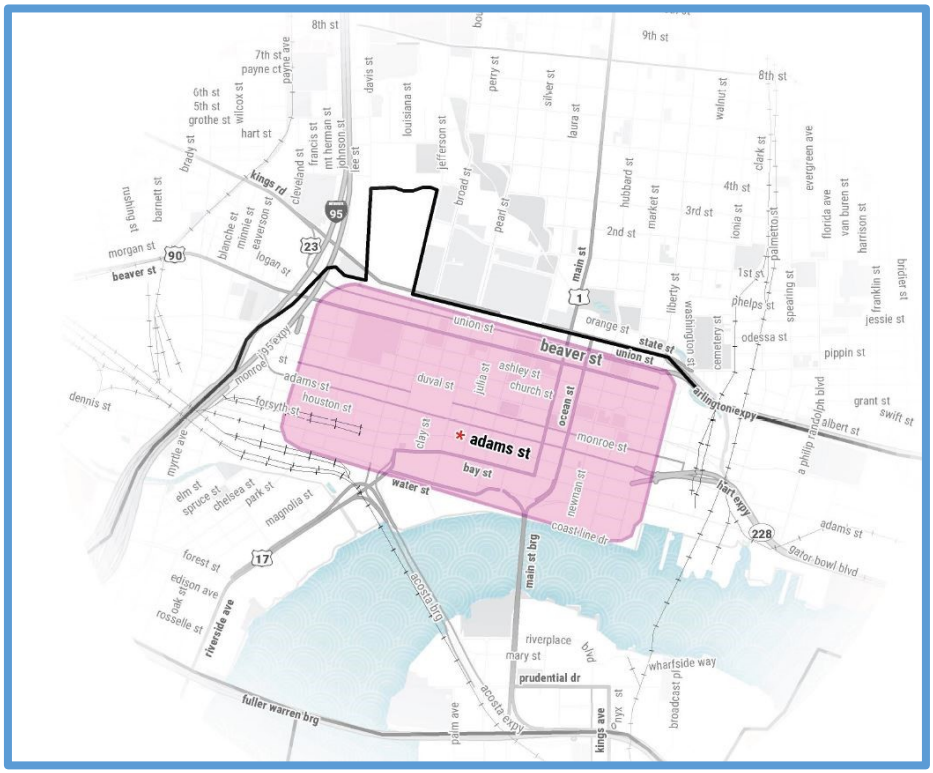
The City of Jacksonville developed a *Pedestrian and Bicycle Master Plan (September 2017) (COJ Master Plan)* which identifies short, medium and long-term safety actions related to additional bicycle and pedestrian facilities. The master plan is designed to be a roadmap to quickly and efficiently implement additional bicycle and pedestrian facilities. Projects are prioritized in order of importance by the following categories: Safety, Demand, Connectivity, and Equity.

The *COJ Master Plan* identified eight recommendations to increase accessibility to and through Downtown Jacksonville while enhancing the environment to attract additional services including:

1. Convert one-way streets to two-way;
2. Consider lane reductions / road diets;
3. Widen sidewalks;
4. Create a bicycle network throughout downtown;
5. Add outdoor seating through the creation of parklets or on widened sidewalks;
6. Install sidewalks across driveways and limit driveway width;
7. Keep curb radii narrow; and
8. Add mid-block crossings.

The *COJ Master Plan* recommends that the streets shown in the shaded area in Figure 3.3.8 should be retrofitted using the eight identified safety enhancements.

Figure 3.3.8: Downtown Safety Enhancements



The *COJ Master Plan* identified and prioritized a network of 250 miles of on- and off-street infrastructure that includes existing bikeways on city and state right-of-way as well as potential corridors for bicycle improvement and are shown in Figure 3.3.9. Table 3.3.2 shows the pedestrian and bicycle master plan projects located in the study area in order of priority.

The Skyway stations are served well by existing pedestrian facilities within a quarter mile of the study area. Combined with the list of prioritized projects in Table 3.3.2, a well-connected network of bicycle and pedestrian facilities, many of them consisting of enhancements such as shared paths, trails, and buffered bike lanes, will support the Skyway Conversion and Brooklyn expansion as well as allow for enhanced access to the riverfront areas and other natural resources in the study area.

Figure 3.3.9: Recommended Bicycle Network

Table 3.3.2: Master Plan Prioritized Bikeway Network Projects in the Study Area

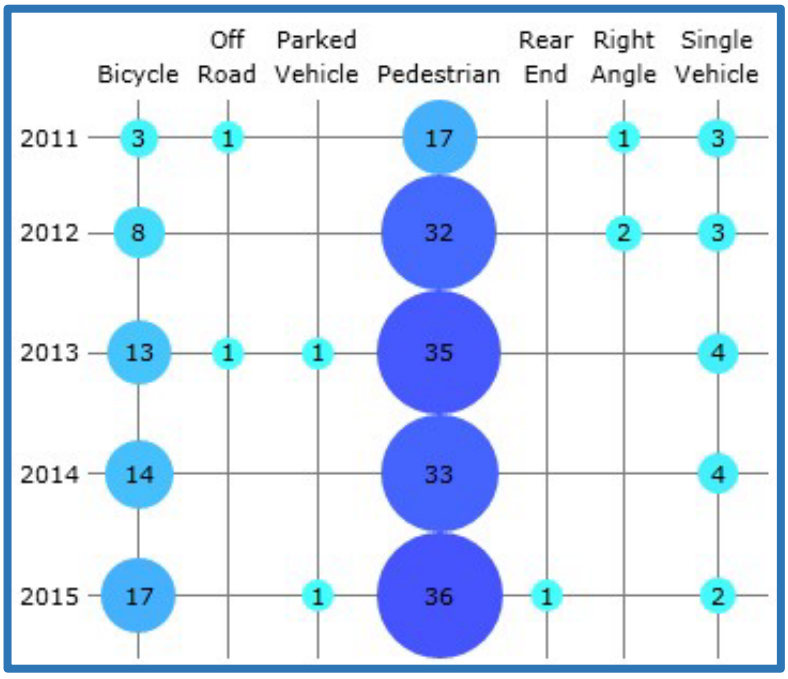
Proj. #	Location	From	To	Project	Priority Ranking
74	Laura St	Independent Dr	1st St	Buffered Bike Lanes, Bike Lanes, Priority Sharrows	2
77	Liberty St	1st St	Courthouse Dr	Buffered Bike lanes, Bike lanes, Bicycle Blvd	7
91	Fuller Warren	Southbank	Northbank	Shared use path	11 (FDOT)
106	Riverplace Blvd	San Marco Blvd	Prudential Dr	Bike Lanes	11
104	Children's Way; Nira St; Palm Avenue; Prudential Dr	San Marco Blvd	Hendricks Avenue	Sharrows	13
66	Myrtle Avenue (I-95 Overpass)	Dennis St	Bay St	Shared use path	14
69	Jefferson St	Leila St	Forsyth St	Separated Bike Lane	16
191	Main St	Main St Bridge	S Line Existing trail	Buffered Bike Lanes	20
75	Bay St	Bay St	Liberty St	Separated Bike lanes	21
76	Bay St	Liberty St	A Philip Randolph Blvd	Bike Lanes	22
49	Riverside Avenue	Margaret St	Leila St	Buffered Bike lanes, Bike Lanes	23
105	San Marco Blvd	Mary St	Prudential Dr	Separated Bike Lane	24
197	Water St	Park St	Jefferson St	Buffered Bike lanes	26
71	Church St	Jefferson St	Washington St	Separated Bike lanes, Bike lanes, Sharrows	44
103	San Marco Blvd	Nira St	Hendricks Avenue	Sharrows; Priority Sharrows	50
72	Ashley St	Jefferson St	Washington St	Separated Bike Lane	51
70	Jefferson St	Forsyth St	Ashley St	Sharrows	54
82	A Philip Randolph Blvd	Bay St	1st St	Bike lanes, Sharrows	64
107	Main St Bridge	Southbank	Northbank	Shared use path	69
88	Bryan St; Duval St	Talleyrand Avenue	Northbank Riverwalk Extension	Sharrows	85
108	Southbank Riverwalk East Extension	Friendship Park	Duval County Public Schools	Trail	97
90	Northbank Riverwalk Extension	I-95	Berkman Plaza	Trail	135
92	FEC Rail Corridor	Acosta Bridge	Avenues Walk Blvd	Trail	154

Safety

Pedestrian and bicyclist crash data was obtained from Signal Four Analytics for the ¼ mile project study area. From 2011 to 2015, a total of 131 pedestrian or bicycle crashes were reported in the study area. The number of pedestrian / bicycle crashes per year has increased from 14 crashes in 2011 to 27 crashes in 2015, although 2014 recorded the highest number of pedestrian / bicycle crashes in the study period with 37 total crashes. Figure 3.3.10 displays the crash types per year. Of the 131 crashes, 90 involved hitting a pedestrian (92 pedestrians involved) and 41 involved hitting a bicycle (43 bicyclists involved). Only 20 of the pedestrian / bicycle crashes did not result in an injury or fatality:

- 55 crashes resulted in a possible injury;
- 40 crashes resulted in a non-incapacitating injury;
- 13 crashes resulted in an incapacitating injury; and
- 3 crashes resulted in a fatality.

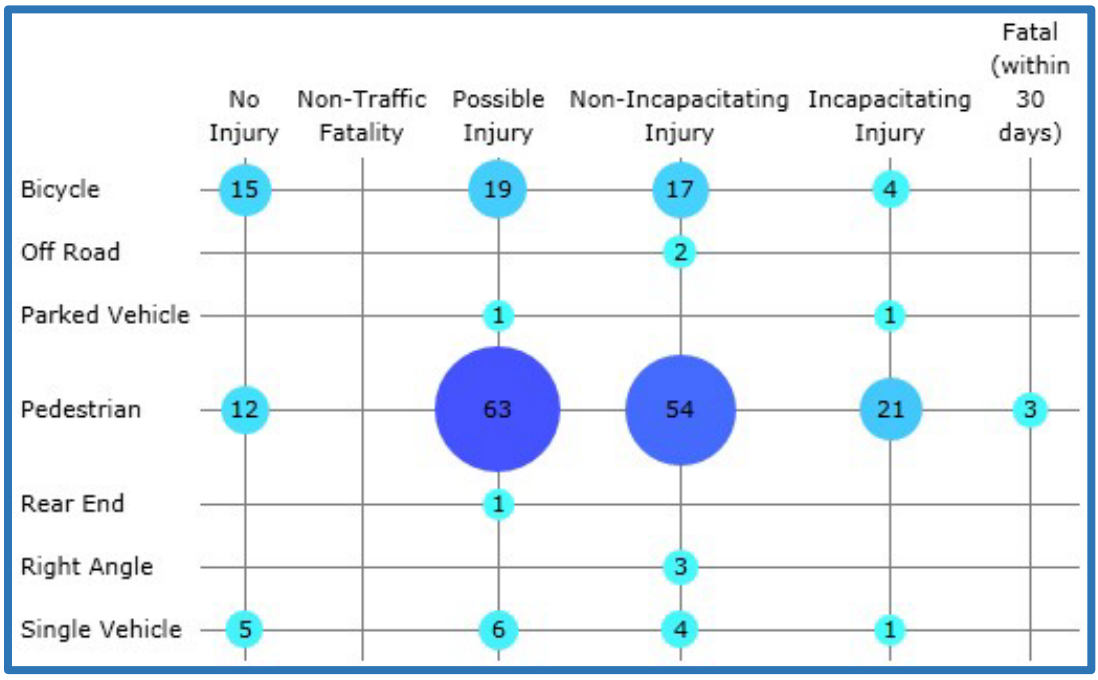
Figure 3.3.10: Crash Year and Type



A total of three fatalities and 115 injuries were reported; a break down on the crash type and crash severity is shown in Figure 3.3.11. Of the 131 crashes, 115 occurred on the road, nine occurred in a parking lot, three occurred off the road, three occurred on the shoulder, and one location of crash is unknown. A total of 44 crashes occurred at an intersection and 14 additional crashes were intersection-related. According to the police reports, the roads with the most pedestrian / bicycle crashes are as follows:

- Main St – 16 crashes;
- Union St – 15 crashes;
- Laura St – 11 crashes;
- State St – 10 crashes;
- Bay St – 9 crashes;
- Prudential Drive – 9 crashes; and
- Beaver St – 8 crashes.

Figure 3.3.11: Crash Type and Severity

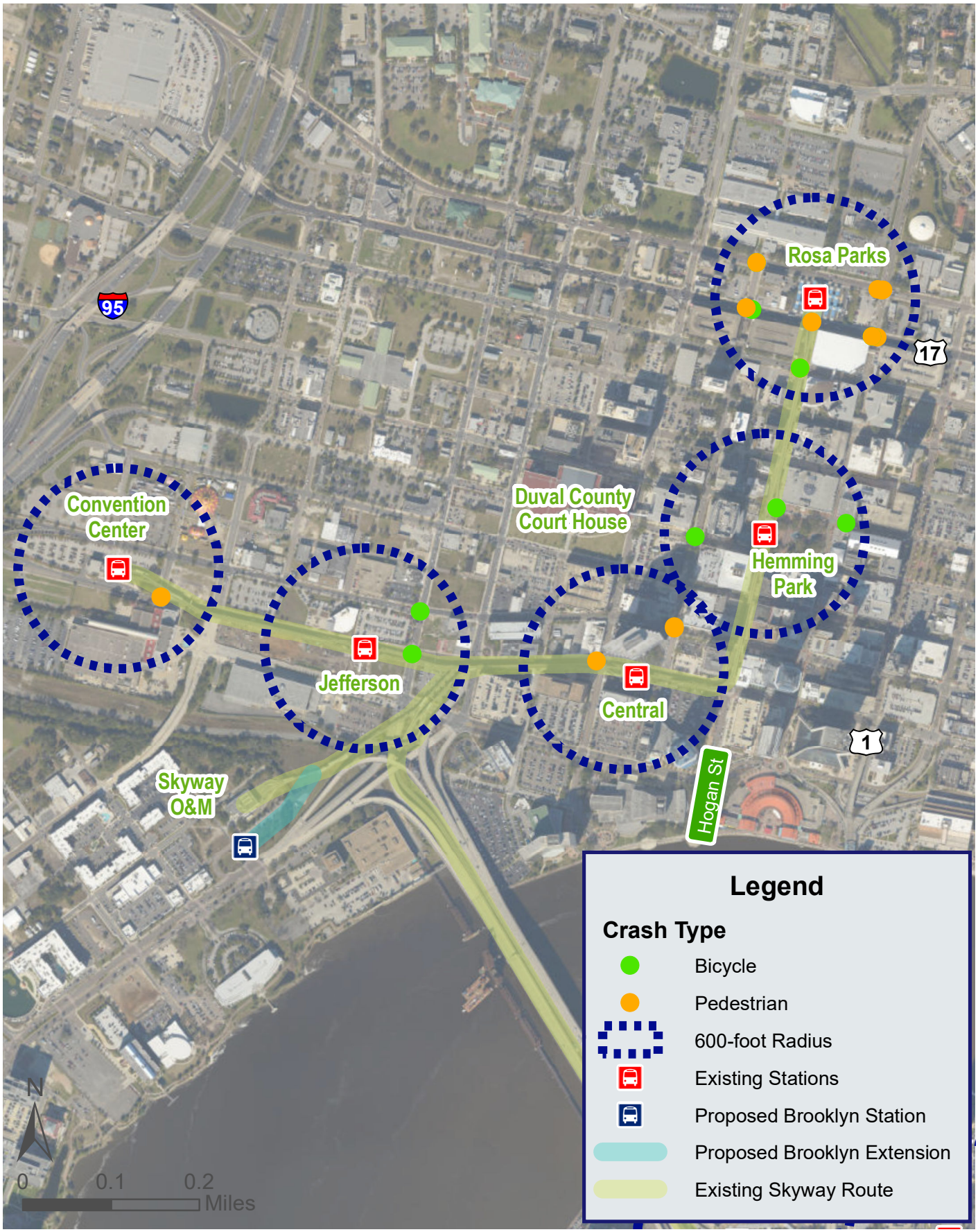


A total of 31 pedestrian / bicyclist crashes occurred within 500 feet of the existing Skyway Stations from 2011 to 2015. The Rosa Parks Station had the highest number of pedestrian / bicycle crashes, the crashes per station are as follows:

- Convention Center Station – 2 pedestrian crashes resulting in 2 injuries;
- Jefferson Station – 2 bicycle crashes resulting in 1 injury;
- Central Station – 4 pedestrian crashes resulting in 4 injuries;
- Hemming Plaza Station – 3 bicycle crashes resulting in 2 injuries;
- Rosa Parks Station – 10 pedestrian crashes and 5 bicycle crashes resulting in 12 injuries and 1 fatality;
- San Marco Station – 1 pedestrian and 1 bicycle crash resulting in 2 injuries;
- Riverplace Station – 1 pedestrian crash resulting in 1 injury; and
- Kings Station – 2 pedestrian crashes resulting in 2 injuries.

Figures 3.3.12 and 3.3.13 show the pedestrian and bicycle crashes within 500 feet of the existing Stations. The one fatal pedestrian crash occurred at 10:43 am on June 4, 2013. The crash occurred on State St, just west of the intersection with Laura Street near Rosa Parks Transit Station.

As Skyway improvements are implemented, safety concerns will be continually evaluated and addressed during design.



	U²C Program - TCAR 1: Skyway Conversion and Brooklyn Extension	Figure 3.3.12: Pedestrian and Bicycle Crashes from 2011 to 2015 near Skyway Stations	Page Number: 3-31

	U²C Program - TCAR 1: Skyway Conversion and Brooklyn Extension	Figure 3.3.13: Pedestrian and Bicycle Crashes from 2011 to 2015 near Skyway Stations	Page Number: 3-32

4 Existing Vehicle/Infrastructure Conditions

This section of the report provides an overview of the existing conditions and challenges specific to the Skyway vehicles/operating system and infrastructure.

One of six remaining UM III Monorail Vehicles in operation

4.1 Skyway Vehicles

The existing Skyway vehicle fleet consists of ten UM III Monorail vehicles delivered in 1997 by Bombardier. Of the ten trains, only six are currently in passenger service. The remaining four trains have experienced Permissive Movement Authority (PMA) signal loss failures that impede their use. Several attempts have been made to resolve the PMA problem. The motor/gear box was manufactured by Kaman Electromagnetics and is a special unit custom made for the JTA Skyway. Even though the manufacturer is not supporting the product line, JTA staff indicated that units are repaired/rebuilt by a local vendor as necessary. JTA also purchased the remaining 25 Control Unit Boards after the manufacturer informed them that the control boards will no longer be available. Similar issues arise with the SCADA system, with multiple obsolete components that will need to be replaced.

Bombardier has stated that vehicle replacement in-kind would be difficult as well as costly to locate suppliers and vendors willing to “recreate” the very specialized components contained within the existing Skyway vehicles.

4.2 Skyway Infrastructure

A detailed inspection and subsequent infrastructure assessment was performed from February through December 2017 and is summarized in these documents:

- *JTA Skyway 2017 Routine Inspection of Bridge Structures*
- *JTA U²C/Skyway Infrastructure Assessment*

The *2017 Routine Inspection (Routine Inspection)* summarizes findings from a field inspection performed from February through March 2017 and includes an assessment of the existing infrastructure condition along with recommendations for routine maintenance items.

The *U²C Infrastructure Assessment (Infrastructure Assessment)* documents an evaluation of modifications required to convert the existing monorail system to accommodate rubber tired autonomous vehicles. This assessment, in effect, requires conversion of the existing elevated

monorail to an elevated roadway. The report includes a summary of key considerations for the conversion, estimated costs and recommendations for next steps.

Both of the above documents are included as appendices to this report and key considerations from each are summarized below.

JTA Skyway 2017 Routine Inspection of Bridge Structures

The routine inspection was performed from February through March of 2017 and included a detailed inspection of the approximately 2.5 mile system using under bridge access equipment and an internal walk through of all steel box beams.

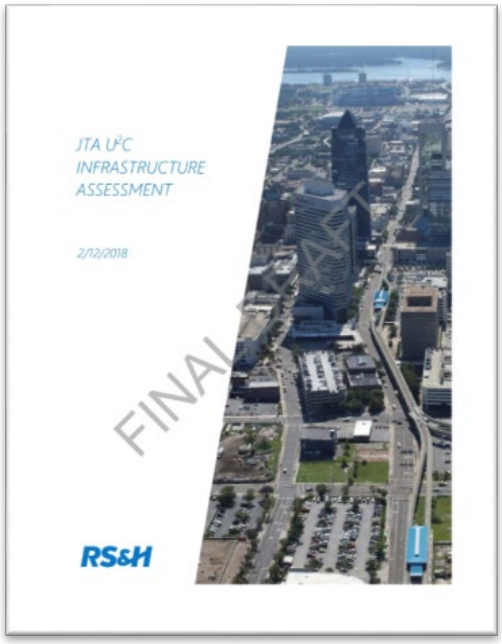
Inspection findings indicate that overall the structure is in good condition with a few deficiencies as noted in summary below:

- Substructure - Overall good condition with very few deficiencies
- Superstructure – The superstructure primarily consists of 60% double tee -pre-stressed concrete on tangent sections and 40% steel box beam at longer and curved spans.
- The concrete sections are in overall good condition however cracks at the dapped beam sections at supports were noted throughout and should be monitored during subsequent inspections as well as repairs performed at locations noted in the report.
- Steel superstructure is in overall good condition however rust occurs at several locations and entire steel superstructure should be re-painted.
- Deck / Guidebeam – Overall deck is in good condition, however most joints are deteriorated and in need of replacement.
- Stations – Overall stations in good condition.

The *Skyway 2017 Routine Inspection of Bridge Structures Report* includes a detailed summary of maintenance recommendations and order of magnitude cost estimates for near and long term items.

Infrastructure Assessment

The *Skyway/U²C Infrastructure Assessment* was performed subsequent to the routine inspection and was completed in February of 2018 as a component of the TCAR Study. The purpose of the assessment was to evaluate the feasibility of the conversion of the existing elevated infrastructure to accommodate autonomous transit vehicles. The assessment includes a summary of key considerations, order of magnitude cost estimates and recommendations for coordination to further define applicable standards and the scope of the conversion.



Fundamentally, the conversion will require the removal of the guidebeam and the creation of a smooth running surface on the elevated structure. Technical specifications of a range of various available autonomous vehicles were obtained and were used in the evaluation of the conversion requirements. A summary of key considerations include:

- Design Life – The expected service life at the time the system was designed was 50 years. Segments of the system are approaching 30 years in service or over half of the expected service life. As these areas degrade, future increases in maintenance costs and further reductions in the structure service life can be expected.

- Vehicle Considerations – The size of available autonomous vehicles is manageable, however, horizontal clearance in the small radius curves is an area of concern. These areas will require careful attention during design of the conversion.

- Guidebeam Removal – Removal of the concrete guidebeam and installation of a smooth running surface appears to be feasible. However, removal will require careful demolition to avoid adversely affecting the structural integrity.

- Profile Modifications at Stations – Guideway modifications at stations will be required for the floor of the new vehicles to be level with the station platform. These modifications will add additional weight that will reduce the structural capacity of the existing superstructure.

- Barrier Walls – The ability of the existing sidewalls to resist an impact and contain the vehicles on the elevated guideway is questionable and will depend on the approved design standards, size, weight and speed of the chosen vehicle.

- Running Surface and Drainage – Installation of the new running surface is feasible but will require detailed design to accommodate superelevation and ensure drainage that meets standards for an elevated roadway.

- Maintenance Costs – Annual maintenance costs to keep existing infrastructure in a state of good repair and in operation are likely to increase significantly as the service life is approached.

The findings from the *Skyway 2017 Routine Inspection of Bridge Structures Report* and the *Infrastructure Assessment* were used to define the conversion options and develop an order of magnitude cost estimates. These options are presented in Section 6 for alternative analyses.

4.3 Skyway Stations

The existing Skyway system includes eight stations. The condition of Skyway stations were reviewed as part of an assessment in the fall of 2016 and were found to be in overall good condition. Recent maintenance includes new roof at several stations, elevator rehabilitation, escalator rehabilitation at two stations and upgrades to fire alarm and security systems. These stations will be modernized as part of the U^{2}C Program to provide upgrades to communications, passenger information systems, fare collection, and other features to compliment the deployment of autonomous vehicles.

The following paragraphs provide additional information for each station. Appendix A contains figures showing each station and the surrounding land use and planned development.

Convention Center Station

The Convention Center Station is the western station of the original three stations of the Skyway system. Completed in 1989, the station was formerly known as Terminal station. Typical of JTA's Skyway design, the building consists of two levels: the ground level and the platform level. The Skyway Automated People Mover (APM) is accessible from the island platform, which can be accessed via two staircases, an elevator, and an escalator system. The public areas are exposed to the natural elements, with the platform level waiting and seating area being covered by a multilevel corrugated metal roof system.

The Convention Center Station serves as the westernmost terminal of the starter line and A-Route. Trains typically operate Monday through Friday from 6 a.m. to 9 p.m., with vehicles arriving every six to eight minutes. The station connects on the ground level to the JTA First Coast Flyer

BRT system's Blue line that serves Jacksonville's southeast corridor and is expected to serve as terminal for the Purple line, serving the southwest corridor and town of Orange Park. Existing bus service includes Route 201 (Clay Regional Express) as of May 2018.

Convention Center Skyway Station

The Convention Center Station also serves as hub for JTA, regional and intercity service, currently serving Greyhound and Megabus. The JTA Administrative Offices, including other amenities such as parking, pedestrian bridge over W. Forsyth St., public restrooms, customer service area, passenger waiting lobby, park-n-ride, taxi, car share, and bike share are under construction as part of the JRTC and are on track for substantial completion in early 2020.

Convention Center Station is also anchored by the adjacent Prime F. Osborn III Convention Center, a historic renovated train station (Jacksonville Terminal) providing a unique venue for meetings, social events, and conventions. The Convention Center features 78,000 square feet of exhibit space and a large main parking lot. Future Amtrak and commuter rail service may be served from this location.

Residential complexes, Lofts at LaVilla, Lofts at Monroe, and The Brooklyn as well as the LaVilla neighborhood and the Jacksonville Branch of the Federal Reserve Bank of Atlanta are within walking distance of Convention Center Station. The magnet public school LaVilla School of the Arts is located a half mile from the station. Nearby Johnson Street and Convention Center Park-n-Ride lots provide parking across from the Intercity Bus Facility. Park-n-Ride and vacant lots are often coordinated with JTA shuttle service for special events, including football games and downtown festivals.

Jefferson Station

Jefferson Station is the middle station of the original three stations of the Skyway system. Completed in 1989, the building consists of two levels: the ground level and the platform level. The Skyway is accessible from the island platform, which can be accessed via two staircases and an elevator. The public areas are exposed to the natural elements, with the platform level waiting and seating area being covered by a multilevel corrugated metal roof system.

Jefferson Station

The Jefferson Station serves as a stop for the starter line along Bay St. Passengers boarding Jefferson Station can transfer at Central Station to reach the Southbank stations. Trains operate Monday through Friday from 6 a.m. to 9 p.m., with vehicles arriving every six to eight minutes. The Station connects through the ground level to the JTA First Coast Flyer BRT Blue line that serves Jacksonville's southeast corridor. Existing bus service connection includes Routes 5 (Park/Blanding), 14 (Edison), and 15 (Post/Normandy) as of May 2018.

This station serves multiple residential complex, including Lofts at LaVilla, Lofts at Monroe, Houston Street Manor (under construction), and Lofts at Jefferson Station (under construction). Nearby employers include the Jacksonville Branch of the Federal Reserve Bank of Atlanta, Sally Corp., and Interline Brands. Some on-street parking and nearby Park-n-Ride facilities, including the Jefferson Lot, provide vehicle access to the station.

Central Station

Central Station is located on the starter line, with the Convention Center terminus point located to the west and Jefferson Station located immediately to the west. The station was completed in 1989. Typical of JTA's design, the station consists of two levels: the ground level and the platform level. The Skyway is accessible from the island-platform level via two staircases, an elevator, and an escalator system. The public areas are exposed to the natural elements, with the platform level waiting and seating area being covered by a multilevel corrugated metal roof system.

Central Station serves as a stop and transfer point for passengers heading from the Northbank to the Southbank routes (A-Route and D-Route). Trains operate Monday through Friday from 6 a.m. to 9 p.m., with vehicles arriving every six to eight minutes. Existing bus service connections around the station include Routes 5, 14, 15, 31, 32, 200 (Mandarin Express), 201 (Clay Express), and 205 (Beaches Express) as of May 2018.

This station serves multiple office buildings including Bank of America Tower, Wells Fargo Center, and TIAA Bank Center as well as the Omni Jacksonville Hotel/Enterprise Center. Adjacent large employers include the Internal Revenue Service and CSX Corporation. Major entertainment venues include the Times-Union Center for the Performing Arts and The Landing, both providing access to the Northbank Riverwalk along the St Johns River. Some on-street parking and downtown parking garages provide vehicle parking next to the station.

Central Station

Hemming Park Station

Hemming Park Station is located on the Northbank line and was completed in 1989. The station is sited adjacent to Hemming Park and consists of two levels: the ground level and the platform level. The Skyway is accessible from the island-platform level via two staircases, an elevator, and an escalator system. The public areas are exposed to the natural elements, with the platform level waiting and seating area being covered by a multilevel corrugated metal roof system. The platform level also serves as a shelter/open space for pedestrians coursing through Hemming Park.

The Hemming Park Station serves as a stop for passengers on the North route or A-Route. Trains operate Monday through Friday from 6 a.m. to 9 p.m., with vehicles arriving every six to eight minutes. The station is located along a high-traffic pedestrian area.

Hemming Park Station

Hemming Park Station serves multiple government facilities, including Jacksonville City Hall, Ed Ball Building, the Federal Courthouse, Office of the State Attorney, Duval County Courthouse, and JTA. Hemming Park, a pedestrian-oriented urban park serves as venue for multiple downtown events, including Art Walk and Jacksonville Jazz Festival. The Jacksonville Public Library Main building and Conference Center, the Museum of Contemporary Art Jacksonville and the Florida Theater are popular destinations for visitors and locals. Residential buildings in proximity include The Carling, The Metropolitan Lofts, and 11 East Forsyth. Various higher-education institutions are present in the area: Florida State College at Jacksonville (culinary school, dorms under construction), Jacksonville University (classrooms), and the University of North Florida (classrooms, under construction). On-street parking and downtown parking garages provide parking next to the station.

Rosa Parks Station

Rosa Parks Station (formerly known as FSCJ station) is located on the northern terminal of the North line and was completed in 1997. The station is sited adjacent to Rosa Parks and consists of two levels: the ground level and the platform level. The Skyway is accessible from the island-platform level via two staircases, an elevator, and an escalator system. The public areas are exposed to the natural elements, with the platform level waiting and seating area being covered by a multilevel corrugated metal roof system. The street level of this station also includes as the ticket customer service.

Rosa Parks Station

The Rosa Parks Transit Station serves as a stop for passengers on the Northbank route or A-Route. Trains operate Monday through Friday from 6 a.m. to 9 p.m., with vehicles arriving every six to eight minutes. The station also serves as the current major bus transfer facility with 20 bays available for local service, First Coast Flyer, Baker County Transit and Nassau Express Select. In addition to ticket vending machines, JTA operates the transit center customer service window weekdays from 6 a.m. to 6 p.m.

The Rosa Parks Transit Station serves the Florida State College at Jacksonville (FSCJ) Downtown Campus, located in the Springfield neighborhood. The station also offers convenient access to First Baptist Church of Jacksonville, affiliate schools and services as well as to JEA headquarters. Nearby parks include the FSCJ Cancer Survivors Park and Hogan's Creek's Klutho and Confederate Parks. FSCJ parking lots and downtown parking garages, along with some limited on-street parking, provide vehicle parking close to the station.

San Marco Station

San Marco Station is the first facility of the southern part of the Skyway system and is located on the south bank of the St. Johns River, adjacent to the Acosta Bridge access ramps, and started service in 1998. Unlike the typical design of some of the other Skyway Stations, the San Marco Station consists of three levels: the ground level, the Mezzanine level, and the platform level. The Skyway train is accessible from the platform level which can be accessed via two staircases, an elevator, and an escalator system. The public areas are exposed to the natural elements, with the platform level being covered by a translucent canopy.

San Marco Station

The San Marco Station serves as the first stop for passengers on the Southbank route or D-Route. Trains operate Monday through Friday from 6 a.m. to 9 p.m., with vehicles arriving every six to eight minutes. Transit connections include JTA routes 8, 25, 200 (Mandarin Express) as of May 2018. The First Coast Flyer Blue line provides service in the nearby Museum Circle stop.

The San Marco Station serves three major employment centers: Two Prudential Plaza (Interline Brands, Prudential), Eight Forty One building (One Call), and the Baptist Health Medical Complex (Baptist Medical Jacksonville, Baptist Heart Hospital, Wolfson Children's Hospital, and Baptist MD Anderson Cancer Center). The station also offers convenient access to the Jacksonville Museum of Science and History, Treaty Oak Park, Friendship Fountain Park, and Southbank Riverwalk. Paid parking garages, along with some limited surface parking, provide parking close to the station.

Riverplace Station

Riverplace Station is the middle of three stations located in the Southbank alignment. The station was completed in 2000 and was renovated in 2009, after a severe roof fire. The Skyway is accessible from the island-platform level via two staircases, an elevator, and an escalator system. The public areas are exposed to the natural elements, with the platform level waiting and seating area being covered by a multilevel corrugated metal roof system.

Riverplace Station

The Riverplace Station serves as the second stop for passengers on the Southbank route or D-Route. Trains operate Monday through Friday from 6 a.m. to 9 p.m., with vehicles arriving every four minutes during peak hours and every eight minutes during off-peak hours. First Coast Flyer Blue line provides service in the nearby Southbank stop. The proximity of this station also serves as the transfer point to the St Johns River Water Taxi at the Southbank Riverwalk/Doubletree dock.

The Riverplace Station provides access to commercial/corporate buildings Riverplace South, Riverplace Tower, Stein Mart and Suddath. Residential high-rise towers The Peninsula of Jacksonville and The Strand are walking distance to Riverplace Station. The station also offers convenient access to Southbank Riverwalk and hotels, including DoubleTree by Hilton and Lexington Hotel. Paid parking garages, along with on-street parking, provide vehicle parking close to the station.

Kings Avenue Station

Kings Avenue Station is the terminal station located in the Southbank alignment. The Skyway is accessible from the island-platform level via two staircases, an elevator, and an escalator system. The public areas are exposed to the natural elements, with the platform level waiting and seating area being covered by a multilevel corrugated metal roof system. The station connects to the JTA Kings Avenue Parking Garage via an elevated walkway to the third level of the garage, passing under the I-95/Overland Bridge.

Kings Avenue Station

The Kings Avenue Station serves as the last stop for passengers on the Southbank route or D-Route. Trains operate Monday through Friday from 6 a.m. to 9 p.m., with vehicles arriving every four minutes during peak hours and every eight minutes during off-peak hours. First Coast Flyer Blue line provides connection service outside of the ground level entrance.

The Kings Avenue Station provides access to DuPont Center, the Duval County Public Schools administrative offices, and a mix of retail and professional service businesses along Kings Avenue. The station also offers convenient access to Hilton Garden Inn and Homewood Suites hotels. Broadstone River House, a six-story apartment community near the Riverwalk, is under construction and would be within walking distance. The Kings Avenue Parking Garage serves as Park-n-Ride location for this station.

5 Future Needs Assessment

This section of the report discusses future needs within the study area as a result of anticipated growth and changes in nearby development patterns along the Skyway corridor as the transformation and expansion of the Skyway is evaluated. Projected population and employment data are assembled and used as input into the travel demand forecasting model to determine future transportation demand for the system.

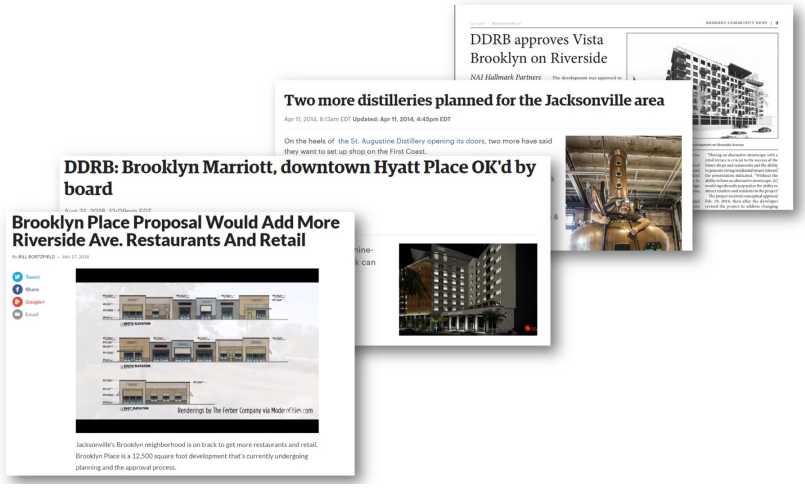
5.1 Planned / Proposed Developments

Similar to the discussion of land use, the study area corridor is divided three major areas for the overview of planned and proposed development to be considered as part of the Skyway system transformation.

- Area 1: Convention Center Station (JRTC) to Central Station
- Area 2: Central Station to Rosa Parks Station
- Area 3: Southbank

Area 1: JRTC to Central Station to O&M Center

Multiple proposed and recently-constructed developments surround the JRTC to Central Station area and the Skyway O&M Center. The area near the Skyway O&M Center, located in the Brooklyn neighborhood, has seen the construction of two multi-family residential apartment complexes, the Brooklyn Riverside and 220 Riverside, as well as the accompanying urban park, Unity Plaza. A proposed residential complex, Vista Brooklyn was approved for 308 apartments and 14,000 SF of retail. Additional retail is also approved for Brooklyn Place, a multi-tenant retail center adjacent to Brooklyn Station at Riverside shopping center. Across from Unity Plaza, a craft distillery, Burlock & Barrel Distillery is constructing a 3,400 SF distillery and 3,500 SF retail/tasting room.



Upcoming developments in Brooklyn

Anchoring the Convention Center Station, the JRTC, currently under construction, will consolidate JTA offices, as well as multimodal transit operations under one hub. The nearby Intercity Bus Terminal, recently opened, houses Greyhound, Megabus, as well as customer amenities.

JRTC Renderings

Along the JRTC to Central Station corridor, multiple residential projects in the LaVilla neighborhood stand out: Lofts at LaVilla, a five story, 130 unit community opened in 2017. Lofts at Monroe, under construction, will add 108 units of affordable housing, parking and retail space. Lofts at Jefferson Station, under construction, plans for a similar five-story, 133 unit complex next to the Jefferson Skyway Station. Finally, located between Jefferson and Central Station, Houston Street Manor, started construction of 72 units of affordable senior housing.

Figure 5.1.1 displays the planned improvements in the JRTC-Central-O&M Center segment of the project study corridor.

Construction near Jefferson Station

	U²C Program - TCAR 1: Skyway Conversion and Brooklyn Extension	Figure 5.1.1: Planned Developments: JRTC to Central Station & O&M Center	Page Number: 5-3

Area 2: Central Station to Rosa Parks

Along the dense Central Station to Rosa Parks Station corridor, multiple historical buildings are planned for repurpose and reuse. The Barnett, under construction, plans the repurpose of the 18-story building as a mixed-use retail, residential and academic complex that will also house the University of North Florida downtown classrooms. Across the street, the Laura Street Trio development, a combination of three historic buildings, plans for the adaptive reuse of space for a Courtyard by Marriot hotel, with 131 rooms, restaurants, and meeting space.

Hotel Indigo is proposing the redevelopment of the seven-story 100 W Bay Street building into hotel, restaurant, meeting and retail space near Central Station. Another mixed-use development, close to both Rosa Parks and Hemming Park Stations, is also being proposed by ACE JAX LLC for the seven-story Jones Furniture Building, their concept includes 28 apartments.

Finally, another secondary institution, the Florida State College at Jacksonville, recently opened culinary program facilities, 20 West Café, at the historic Lerner building, near Hemming Park Station. FSCJ is constructing 20 West FSCJ Residential Community, adding 58 units of student housing. Figure 5.1.2 displays the planned improvements in the Central Station-to-Rosa Parks Station segment.

Area 3: Southbank

The Southbank portion of the study corridor, enclosed by the Southbank and San Marco neighborhoods, interconnects two signature developments: the expanding Baptist Medical Complex and the proposed District. The Baptist Medical Complex has grown into multiple specialized-care hospitals and continues to expand with the addition of a nine-story building for the new Baptist MD Anderson Cancer Center. The facility is designed to serve a full continuum of cancer care needs, from screening and diagnosis to treatment and survivorship. In addition to 330,000 SF of new medical space, Baptist is constructing an elevated walkway to connect their facilities. At the other end of the Southbank, The District, is a proposed mixed-development complex on the site of the former JEA Generating station. The initial phase plans for 500 residential units, with about 45-65 townhomes, 94,400 SF of retail/commercial and 200,000 SF of office space. The site plans to include 4.5 acres of public park, as well as five restaurants, hotel, and a pedestrian walkway.

Additional planned residential developments along the corridor include the Venture Residential Development, a new 13-story 300 unit multi-family apartment development near the St Johns River and Broadstone River House, a new 300-unit luxury apartment complex near the Kings Avenue Station and the Southbank Riverwalk.

Figure 5.1.3 displays the planned improvements in the Southbank Skyway corridor.

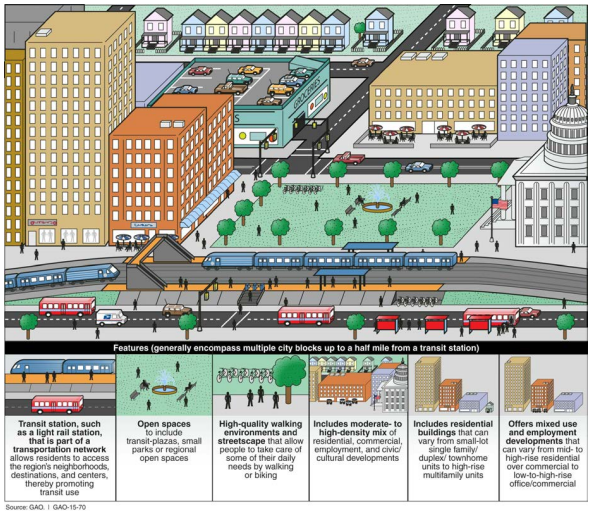
	U²C Program - TCAR 1: Skyway Conversion and Brooklyn Extension	**Figure 5.1.2: Planned Developments: Central Station to Rosa Parks Station**	**Page Number: 5-5**

	U²C Program - TCAR 1: Skyway Conversion and Brooklyn Extension	**Figure 5.1.3: Planned Developments: Southbank**	**Page Number: 5-6**

5.2 Economic Development Opportunities

Downtown Jacksonville is experiencing an economic upsurge along Bay St, from I-95, adjacent to the new JRTC, east through the business district, to the historic neighborhoods of Brooklyn, LaVilla, Riverside, Five Points, Springfield and San Marco, and the revitalized multi-use, sports and entertainment district located on the banks of the St. Johns River. The Riverfront, Sports Complex, Health Facilities, Educational and Religious Institutions located throughout Downtown Jacksonville are tremendous assets that can benefit from improved mobility options.

With more than 56,000 employees and 1,800 businesses representing predominantly financial, technology, healthcare and legal services, including three Fortune 500 Companies, Downtown Jacksonville is expanding at record pace. According to Downtown Vision's recent *2017 State of Downtown Report*, Downtown is on track to quickly beat the progress of the past 17 years with more than $3.5 B in projects under construction or proposed in 2017. There is momentum in new investments spurred by public private partnerships but is slower than other peer cities and is focused in some neighborhoods more than others. The historic Brooklyn neighborhood's redevelopment is a key contributor to Jacksonville's growth. Brooklyn, a vibrant mixed-use community demonstrates over a decade of cooperative planning between state and local agencies, the community, and developers.



Elements of Transit-Oriented Development. Source: U.S. Government Accountability Office

Currently, more than 8,500 people call Downtown home, and the number of Downtown residents is rapidly increasing with more than 4,450 units added in 2017 alone, more than twice the 2,100 units in 2007. Approximately 900 units are under construction with an additional 2,800 units planned, offering a diversity of urban living opportunities, from historical to modern eclectic, to waterfront options. Residents and visitors alike concentrate along multiple venues: The Riverwalk, the Convention Center, the Florida Times Union Center for the Performing Arts, the Florida Theater, MOSH, Hemming Park, MOCA, Daily's Place Amphitheater and the TIAA Bank Field are great examples of year-round festivals, expos, entertainment, and recreation events. On par to this dynamic environment, developers can capitalize from Transit Oriented Developments, with high-level density near transit and magnet facilities and mid-level density transition into neighborhoods. Backed by a viable street grid, open spaces, high-quality walking environments

and streetscapes, Transit Oriented Development can be activated by leveraging the Skyway stations and the JRTC.

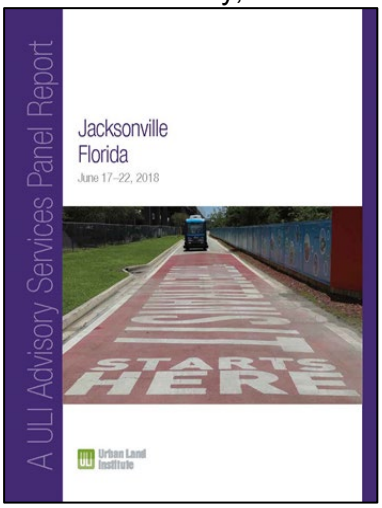
Currently, the ongoing *LaVilla Neighborhood Development Strategy* study, commissioned by the DIA and JTA, will evaluate assets and identify development opportunities in the LaVilla neighborhood. The strategy is expected to capitalize recent investments in the JRTC transportation hub, LaVilla's history, and design strategies. Ongoing construction adjacent to Jefferson Station will locate residential in close proximity to the system.

Looking west – Loft construction at Jefferson Station

Along with large scale developments such as The District on the Southbank and The Shipyards on the Northbank, smaller infill projects in key locations can help catalyze surrounding venues. An example of this is the ongoing *Rosa Parks Transit Center Repurpose Action Plan (Action Plan).* The *Action Plan* considers new, mixed land uses around the reduced footprint of the Rosa Parks Skyway Station as JTA relocates the station's existing bus transfer services to LaVilla at the new JRTC.

Downtown Jacksonville is already a destination; with a number of large and aspirational projects, and by fostering transportation choices of all kinds and allowing residents to get around without a car, Transit Oriented Development (also referred to as TOD) can enhance mobility, stimulate economic revitalization and position Jacksonville for economic competitiveness.

As part of the Skyway transformation evaluation, JTA solicited the input of the Urban Land Institute (ULI) and a technical advisory panel was convened in Jacksonville in June 2018. ULI panelists are independent subject matter experts that provide objective candid advice on important land use and real estate issues. Panelists included architects, planners, public policy and administration researchers, a business improvement district administrator, and a member of the federal government National Planning Commission.



ULI Final Report

Key ULI presentation takeaways:

- Implement best practices for Transit Oriented Development
- Economic development includes high quality streets and public places
- Move forward with the proposed U²C Program
- Support established and emerging neighborhoods
- Take intentional, strategic and coordinated action
- Think beyond the stations

Building upon the ULI process, JTA has engaged agency partners to create a Transit Oriented Development Working Group to collectively evaluate economic development opportunities along the transportation corridors.

Panel provided insight and tools to help drive economic development around transportation in Downtown Jacksonville.

5.3 Future System Needs

Travel Projection Methodology

The assessment of future transportation system needs takes into consideration planned and proposed development, in addition to estimated growth in overall population and employment for the proposed study area. Travel or transportation demand is determined based on the development of travel forecasts using a trip estimation model. For this study, the FTA's mandated Simplified Trips-On-Project Software (STOPS) was used to develop future travel demand. Under the base assumptions, the STOPS model inputs include the 2015 JTA transit schedules, passenger counts, and National Transit Database (NTD) ridership volumes, the Northeast Florida Regional Planning Model (NERPMAB1) highway travel times and cost, and population and employment by Traffic Analysis Zone for 2010 and 2040; 2006-2010 American Community Survey data; 2006-2010 Census Journey to Work data; and, known development activity data not included as part of the NERPMAB1 model. The future ridership model was subdivided into 13 districts as part of the study area and 30 districts to support the calibration and reporting of transit service (see Figure 5.3.1 for model districts and Section 7.1 for a list of included planned developments). The *Travel Demand Model Technical Memorandum* for this project is included in Appendix D.

Figure 5.3.1: STOPS Model Districts

The residential population growth between 2010 and 2040 within the study area is projected to be 18,471. This represents a 60% increase. The employment within the study area is expected to increase by 15,839 which is a 17.5% increase during that same time period. Table 5.3.1 lists the population and employment estimates by district.

Tables 5.3.2 and 5.3.3 summarize the population and employment data used in the STOPS model. As reflected in these two tables, the Brooklyn and Sports Complex areas have added a significant amount of residential units within the last several years, contributing to the overall growth of the downtown study area.

The STOPS model travel demand results for the future operating conditions and Skyway modifications are summarized in Section 7. The STOPS model also utilizes input from operating plans developed based on existing Skyway operational data as outlined in the following section.

Operations Analysis

Existing System, Vehicles, and Service Hours

This section of the report outlines the current Skyway operating conditions and reviews the future needs of the system to meet the demands of anticipated growth and development, and the feasibility of interim expansion of service hours to meet demand. The operating plans and evaluation of specific options are presented in Section 7.

The existing Skyway generally operates two routes utilizing five of the 10 vehicles in the fleet, plus a spare. Operations are affected by existing vehicle capacity, vehicle operating condition, and the characteristics of the Skyway guideway, stations, and switching configurations. These impact operating speeds, ability for vehicles to pass, the number of vehicles that can be operated, service hours, and operating costs.

As discussed in Sections 3 and 4, the current A-Route runs between the Convention Center Station and the Rosa Parks Station and serves Jefferson, Central, and Hemming Park Stations. The A-Route requires two vehicles and operates on a cycle time (round trip time) of 15:50. The D-Route runs between the Kings Avenue Station on the Southbank, to Rosa Parks Station and serves Riverplace, San Marco, Central, and Hemming Park Stations. The D-Route requires three (3) vehicles and operates on a cycle time of approximately 22 minutes. The JTA can operate other route or patterns besides the A and D routes. During special events and when operating demand warrants, JTA will modify operations.

Table 5.3.1: Population Growth Patterns between the Years 2010 and 2040

District		Population					Employment				
#	Name	2010*	2015	2020	2030	2040	2010*	2015	2020	2030	2040
Study Area											
1	CBD West	172	172	1,349	1,566	1,781	3,869	3,870	3,985	4,127	4,261
2	CBD Central South	261	284	620	622	624	15,227	16,760	17,524	17,875	18,227
3	CBD Central North	1,069	1,069	1,201	1,336	1,470	6,512	6,559	6,698	6,930	7,161
4	CBD East	829	842	1,791	3,686	5,583	10,188	10,573	10,759	11,111	11,465
5	Sport Complex	32	1,575	1,575	1,575	1,576	3,457	8,376	8,605	8,721	8,839
6	San Marco	822	822	1,523	1,527	1,531	4,902	4,924	4,957	5,023	5,088
7	Southbank District	2,145	2,163	5,209	5,241	5,275	7,699	7,962	9,185	9,332	9,478
8	Brooklyn	64	2,156	2,676	2,678	2,678	9,282	9,440	9,942	10,249	10,557
9	Riverside	5,186	5,193	5,360	5,700	6,037	10,488	10,647	10,685	10,762	10,837
10	Five Points	7,069	7,106	7,166	7,288	7,410	1,738	1,740	1,755	1,794	1,828
11	Shands	6,799	6,845	7,164	7,806	8,449	12,612	13,050	13,089	13,164	13,238
12	Southbank Central	2,405	2,423	2,432	2,448	2,464	2,259	2,273	2,894	2,937	2,977
13	Jackson Square	3,843	3,868	3,951	4,120	4,289	2,067	2,067	2,091	2,137	2,183
Subarea Subtotal		**30,696**	**34,518**	**42,017**	**45,593**	**49,167**	**90,300**	**98,241**	**102,169**	**104,162**	**106,139**

Table 5.3.1 (con't): Population Growth Patterns between the Years 2010 and 2040

District		Population					Employment				
#	Name	2010*	2015	2020	2030	2040	2010*	2015	2020	2030	2040
Region											
14	US 1	91,537	93,955	107,825	135,561	163,291	78,750	80,591	89,563	107,507	125,451
15	Belfort	80,099	88,736	94,370	105,647	116,921	89,650	91,769	99,942	116,283	132,625
16	Beaches	111,354	113,161	123,242	143,415	163,579	43,138	43,370	49,855	62,847	75,819
17	Mandarin	144,416	148,282	167,809	206,858	245,908	33,690	34,985	43,855	61,591	79,321
18	Far South	54,393	54,393	59,075	68,448	77,819	23,635	23,635	24,409	25,954	27,500
19	Southwest	59,055	59,843	61,504	64,837	68,158	25,801	26,430	26,794	27,531	28,263
20	NAS	17,437	17,486	18,017	19,085	20,147	27,031	27,070	27,565	28,554	29,542
21	Orange Park	160,560	160,560	182,030	224,985	267,927	39,883	39,883	46,258	59,006	71,748
22	Edgewood	58,630	59,766	67,035	81,578	96,113	37,720	38,248	41,633	48,406	55,183
23	Lem Turner Moncrief	56,460	56,696	60,005	66,623	73,240	12,689	12,863	12,945	13,116	13,284
24	Northside	139,385	144,602	156,764	181,079	205,393	53,356	54,811	60,911	73,129	85,337
25	Springfield	9,282	9,326	10,034	11,442	12,849	7,743	7,768	7,862	8,060	8,254
26	Westconnett	145,280	149,472	159,330	179,066	198,799	41,549	42,787	47,548	57,094	66,627
27	Arlington	67,344	68,625	70,096	73,038	75,982	20,312	20,765	20,964	21,367	21,763
28	Empire Point	41,619	42,340	43,709	46,438	49,171	20,224	20,651	20,864	21,292	21,721
29	Wonderwood	94,142	97,065	99,584	104,608	109,633	30,844	31,335	31,808	32,755	33,702
30	San Jose	23,805	24,085	24,411	25,063	25,714	9,274	9,395	9,454	9,570	9,685
Regional Subtotal		**1,354,798**	**1,388,393**	**1,504,840**	**1,737,771**	**1,970,644**	**595,289**	**606,356**	**662,230**	**774,062**	**885,825**
Grand Total		**1,385,494**	**1,422,911**	**1,546,857**	**1,783,364**	**2,019,811**	**685,589**	**704,597**	**764,399**	**878,224**	**991,964**

Table 5.3.2: Population Growth Patterns between the Years 2010 and 2040

District		Population Growth							
#	Name	2010-2015		2015 - 2020		2020 - 2030		2030 - 2040	
		Number	%	Number	%	Number	%	Number	%
Study Area									
1	CBD West	0	0.00%	1,177	684.30%	217	16.10%	215	13.70%
2	CBD Central South	23	8.80%	336	118.30%	2	0.30%	2	0.30%
3	CBD Central North	0	0.00%	132	12.30%	135	11.20%	134	10.00%
4	CBD East	13	1.60%	949	112.70%	1,895	105.80%	1,897	51.50%
5	Sport Complex	1,543	4821.90%	0	0.00%	0	0.00%	1	0.10%
6	San Marco	0	0.00%	701	85.30%	4	0.30%	4	0.30%
7	Southbank District	18	0.80%	3,046	140.80%	32	0.60%	34	0.60%
8	Brooklyn	2,092	3268.80%	520	24.10%	2	0.10%	0	0.00%
9	Riverside	7	0.10%	167	3.20%	340	6.30%	337	5.90%
10	Five Points	37	0.50%	60	0.80%	122	1.70%	122	1.70%
11	Shands	46	0.70%	319	4.70%	642	9.00%	643	8.20%
12	Southbank Central	18	0.70%	9	0.40%	16	0.70%	16	0.70%
13	Jackson Square	25	0.70%	83	2.10%	169	4.30%	169	4.10%
Subarea Subtotal		**3,822**	12.50%	**7,499**	21.70%	**3,576**	8.50%	**3,574**	7.80%

Table 5.3.2 (con't): Population Growth Patterns between the Years 2010 and 2040

District		Population Growth							
#	Name	2010-2015		2015 - 2020		2020 - 2030		2030 - 2040	
		Number	%	Number	%	Number	%	Number	%
Study Area									
Region									
14	US 1	2,418	2.60%	13,870	14.80%	27,736	25.70%	27,730	20.50%
15	Belfort	8,637	10.80%	5,634	6.30%	11,277	11.90%	11,274	10.70%
16	Beaches	1,807	1.60%	10,081	8.90%	20,173	16.40%	20,164	14.10%
17	Mandarin	3,866	2.70%	19,527	13.20%	39,049	23.30%	39,050	18.90%
18	Far South	0	0.00%	4,682	8.60%	9,373	15.90%	9,371	13.70%
19	Southwest	788	1.30%	1,661	2.80%	3,333	5.40%	3,321	5.10%
20	NAS	49	0.30%	531	3.00%	1,068	5.90%	1,062	5.60%
21	Orange Park	0	0.00%	21,470	13.40%	42,955	23.60%	42,942	19.10%
22	Edgewood	1,136	1.90%	7,269	12.20%	14,543	21.70%	14,535	17.80%
23	Lem Turner Moncrief	236	0.40%	3,309	5.80%	6,618	11.00%	6,617	9.90%
24	Northside	5,217	3.70%	12,162	8.40%	24,315	15.50%	24,314	13.40%
25	Springfield	44	0.50%	708	7.60%	1,408	14.00%	1,407	12.30%
26	Westconnett	4,192	2.90%	9,858	6.60%	19,736	12.40%	19,733	11.00%
27	Arlington	1,281	1.90%	1,471	2.10%	2,942	4.20%	2,944	4.00%
28	Empire Point	721	1.70%	1,369	3.20%	2,729	6.20%	2,733	5.90%
29	Wonderwood	2,923	3.10%	2,519	2.60%	5,024	5.00%	5,025	4.80%
30	San Jose	280	1.20%	326	1.40%	652	2.70%	651	2.60%
Regional Subtotal		**33,595**	**2.50%**	**116,447**	**8.40%**	**232,931**	**15.50%**	**232,873**	**13.40%**
Grand Total		**37,417**	**2.70%**	**123,946**	**8.70%**	**236,507**	**15.30%**	**236,447**	**13.30%**

Table 5.3.3: Employment Growth Patterns between the Years 2010 and 2040

District		Employment Growth							
#	Name	2010-2015		2015 - 2020		2020 - 2030		2030 - 2040	
		Number	%	Number	%	Number	%	Number	%
Study Area									
1	CBD West	1	0.00%	115	3.00%	142	3.60%	134	3.20%
2	CBD Central South	1,533	10.10%	764	4.60%	351	2.00%	352	2.00%
3	CBD Central North	47	0.70%	139	2.10%	232	3.50%	231	3.30%
4	CBD East	385	3.80%	186	1.80%	352	3.30%	354	3.20%
5	Sport Complex	4,919	142.30%	229	2.70%	116	1.30%	118	1.40%
6	San Marco	22	0.40%	33	0.70%	66	1.30%	65	1.30%
7	Southbank District	263	3.40%	1,223	15.40%	147	1.60%	146	1.60%
8	Brooklyn	158	1.70%	502	5.30%	307	3.10%	308	3.00%
9	Riverside	159	1.50%	38	0.40%	77	0.70%	75	0.70%
10	Five Points	2	0.10%	15	0.90%	39	2.20%	34	1.90%
11	Shands	438	3.50%	39	0.30%	75	0.60%	74	0.60%
12	Southbank Central	14	0.60%	621	27.30%	43	1.50%	40	1.40%
13	Jackson Square	0	0.00%	24	1.20%	46	2.20%	46	2.20%
Subarea Subtotal		**7,941**	**8.80%**	**3,928**	**4.00%**	**1,993**	**2.00%**	**1,977**	**1.90%**

Table 5.3.3 (con't): Population Growth Patterns between the Years 2010 and 2040

District		Employment Growth							
#	Name	2010-2015		2015 - 2020		2020 - 2030		2030 - 2040	
		Number	%	Number	%	Number	%	Number	%
Study Area									
Region									
14	US 1	1,841	2.30%	8,972	11.10%	17,944	20.00%	17,944	16.70%
15	Belfort	2,119	2.40%	8,173	8.90%	16,341	16.40%	16,342	14.10%
16	Beaches	232	0.50%	6,485	15.00%	12,992	26.10%	12,972	20.60%
17	Mandarin	1,295	3.80%	8,870	25.40%	17,736	40.40%	17,730	28.80%
18	Far South	0	0.00%	774	3.30%	1,545	6.30%	1,546	6.00%
19	Southwest	629	2.40%	364	1.40%	737	2.80%	732	2.70%
20	NAS	39	0.10%	495	1.80%	989	3.60%	988	3.50%
21	Orange Park	0	0.00%	6,375	16.00%	12,748	27.60%	12,742	21.60%
22	Edgewood	528	1.40%	3,385	8.90%	6,773	16.30%	6,777	14.00%
23	Lem Turner Moncrief	174	1.40%	82	0.60%	171	1.30%	168	1.30%
24	Northside	1,455	2.70%	6,100	11.10%	12,218	20.10%	12,208	16.70%
25	Springfield	25	0.30%	94	1.20%	198	2.50%	194	2.40%
26	Westconnet t	1,238	3.00%	4,761	11.10%	9,546	20.10%	9,533	16.70%
27	Arlington	453	2.20%	199	1.00%	403	1.90%	396	1.90%
28	Empire Point	427	2.10%	213	1.00%	428	2.10%	429	2.00%
29	Wonderwoo d	491	1.60%	473	1.50%	947	3.00%	947	2.90%
30	San Jose	121	1.30%	59	0.60%	116	1.20%	115	1.20%
Regional Subtotal		**11,067**	**1.90%**	**55,874**	**9.20%**	**111,832**	**16.90%**	**111,763**	**14.40%**
Grand Total		**19,008**	**2.80%**	**59,802**	**8.50%**	**113,825**	**14.90%**	**113,740**	**13.00%**

The question of augmenting the existing fleet is important because a potential initial expansion of existing operations will require more than the six serviceable vehicles currently available to JTA.

If JTA were to expand the days and hours of operation, a fleet of six vehicles would suffice, if breakdowns are minimized through careful vehicle rotation and maintenance. However, if JTA were to increase operating headways (service frequency), additional vehicles are required.

Similarly, increasing headways on the A-Route and the D-Route from every 7-8 minutes, to every 6 minutes would require an increase in the available serviceable vehicles. For the A-Route with a cycle time of 15:50, two (2) vehicles provide service roughly every 8 minutes. If the headway is increased to 6 minutes, the A-Route will require 2.6 vehicles, effectively 3 vehicles. This creates an average headway of a vehicle every 5.5 minutes.

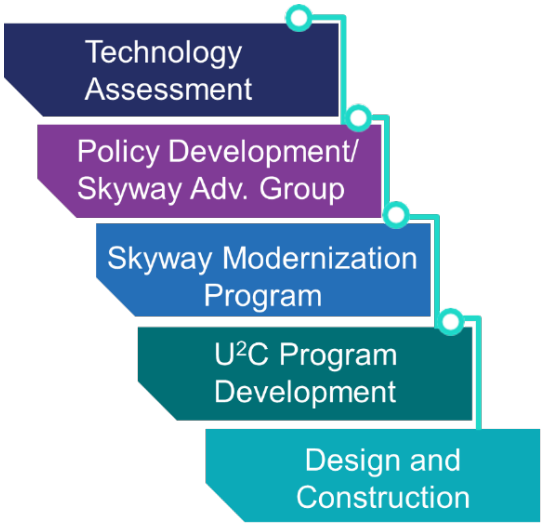
The D-Route with a cycle time of 21:43, two vehicles provide service roughly every 7 minutes. If the headway in increased to 6 minutes, the D-Route will require 3.6 vehicles, effectively four vehicles. This also creates an average headway of a vehicle every 5.5 minutes.

Combining the A-Route and D-Route, the sections between Central, Hemming, and the Rosa Parks Stations, where these routes overlap, the effective service frequency becomes a vehicle every 2.7 minutes. The vehicle requirements in jumps from a fleet of 6 vehicles (5 operated in maximum service) to a fleet of 9 vehicles (7 operated in maximum service).

The impact of expanded service span, operating days and increased headways on service hours is significant. While the existing Skyway operations add up to 75 vehicle service hours per weekday, and no weekend service, an expanded operating scenario will require 119 hours for service Mondays – Thursdays, 140 hours Fridays, 140 hours on Saturdays, and 105 hours on Sundays and holidays. This expansion of Skyway service, as described above, with an expanded fleet and increased headways, service span, and days of operation, will result in an annual service hour increase from approximately 15,700 to 44,800.

6 Alternatives Development

As referenced in Sections 2 and 4, JTA performed the *Skyway Technology Assessment* from August 2014 to August 2015 due to increasing challenges in keeping the 25-year-old existing system in operation and to assess options for upgrading. The *Technology Assessment* initiated the evaluation of the existing infrastructure and the vehicles and operating systems.



The *Technology Assessment*, and the subsequent *Skyway Advisory Group/Skyway Subcommittee*, and later, the *Skyway Modernization Program*, produced and considered a series of alternatives for the transformation of the Skyway vehicles, operating system and infrastructure. Each of these study efforts, described briefly in Section 2, documents the extensive investigation the alternatives considered for the proposed improvements to the Skyway and expansion into Brooklyn. The specific alternatives identified for each study phase or initiative are summarized as follows.

6.1 Skyway Technology Assessment

As noted in Section 4, the *Technology Assessment* found the Skyway infrastructure (bridges, guidebeam, drainage, etc.) to be in overall satisfactory condition with some items in need of addressing and proper maintenance. A review of the operating system, however, found obsolesce issues on the Supervisory Control and Data Acquisition (SCADA) and Programmable Logic Controllers (PLCs). The most significant concern at the time of the assessment were the life of the vehicles.

At the time of the assessment, four out of ten Bombardier Transportation UM III Monorail vehicles were out of service due to Permissive Movement Authority (PMA) issues. Even more concerning, the current Skyway motor and parts are no longer supported or produced by the manufacturer, making it difficult to service and secure parts.

The assessment also involved a *Request for Industry Feedback (RFIF)* to 18 selected suppliers with the intent to gauge industry interest in the following three options:

- Option 1: Overhaul of the Skyway Monorail Operating System;
- Option 2: Like-kind replacement of the Skyway Monorail Vehicles; and
- Option 3: Replacement of the Skyway vehicles with new vehicles “allowing infrastructure modifications”.

RFIF responses were received by the JTA in May 2015. The respondents were Schwager Davis (SDI), Bombardier, Skyweb Express and Thales. Industry responses did not see the feasibility of overhaul favorably. Similarly, there was no interest for like-kind vehicle replacement (one manufacturer expressed interest after initial request response).

As part of the *Technology Assessment*, replacement of the Skyway monorail with a streetcar along the current Skyway alignment was also examined on a conceptual basis. The assessment provided an overview of the following systems: Alstom Citadis 402, Bombardier Flexity 2, Brookville Liberty Modern Streetcar, and United Modern Streetcar. The study noted that the existing guideway structure was unlikely to support a heavier Streetcar system.

The *Technology Assessment* also identified the need to determine FTA payback if vehicles and infrastructure will not be used for the design life originally agreed upon with the FTA.

6.2 Skyway Advisory Group/Skyway Subcommittee

During the *Skyway Advisory Group/Skyway Subcommittee* collaboration process, four basic options were identified for consideration:

1. Overhaul vehicles;
2. Replace vehicles;
3. Decommission and replace Skyway with Streetcar, Trolley, Bus Rapid Transit or Personal Rapid Transit; and
4. Decommission Skyway, replace with Streetcar, Trolley, Bus Rapid Transit, Personal Rapid Transit and repurpose Skyway infrastructure as an elevated bicycle and pedestrian path.

Life cycle cost analysis and high-level planning level cost estimates were presented for each of these options. Based on the results of these reviews, several suppliers were contacted to provide details on potential vehicle solutions and determine the industry's likelihood of responding to a solicitation for various rehabilitation and/or replacement options.

6.3 Skyway Modernization Program

Subsequent to the *Skyway Advisory Group/Skyway Subcommittee* review, the focus of the *Skyway Modernization Program* was to propose a System Plan and an Operating Plan, including the preferred technology for the future expanded circulator system, and adhere to the policy direction to: "**Keep, Modernize and Expand the Skyway**."

The *Skyway Modernization Program* considered four options for the Skyway transformation:

Option 1: Rehabilitation of Existing Vehicle / System

Option 1 continues to remain the same option from the initial stages of project development and as previously defined. This option involved rehabilitating the existing vehicles and operating systems.

Option 1 provides an approximate additional service life of 10-15 years. This could allow for JTA to provide a short-term solution, while a more permanent, long-term solution (including possible system extensions) is developed. Option 1 would not require infrastructure modifications and would only come with minor operational impacts.

Option 2: Replace with Same Type of Vehicle on Guidebeam

Option 2 considers the possibility of replacing the current vehicles with similar monorail type vehicles that will fit onto the existing guideway with minimal infrastructure. One of the major concerns with this option is that it will extend the commitment (+30 years) to the current technology and limit flexibility with the possibility of system expansions (significant infrastructure costs for any extensions).

Option 3: Replace with Vehicle without Guidebeam (Self-Propelled APM)

Option 3 considers the possibility of replacing the current vehicles with new vehicles that do not operate on a guidebeam. Because of this, there will be extensive modifications required to the existing guideway structure and the stations, but the new vehicles will provide a service life up to 30 years, and a new operating system will be installed.

Option 4: New Technology – Autonomous Vehicle

The rapidly emerging technology of autonomous vehicles has numerous unknowns and is relatively unproven in the current marketplace. If selected, it will most likely require significant modifications at the stations and the guideway. The service life for the vehicles is unknown, though it may be similar to that of a bus. The operating systems will be completely different from the existing one. Autonomous vehicle technologies however, have the potential to be affordable, cost-effective, and provide a great deal of flexibility for future growth and extensions. Consideration of Autonomous Vehicle technologies prompted the team to consider how this technology is looking ahead and possibly avoid technology obsolescence.

Summary of Initial Options

Following the options evaluation, the JTA issued a letter to the industry as an outreach to gauge interest in participation on the Skyway modernization. Please refer to RFI #: 17-005, *Ultimate Urban Circulator (*U^{2}C*)*, with due date June 16, 2017 and *RFI Response Summary Report* on July 2017.

Based on a technical analysis, the technology options were ranked and evaluated on a weighted set of 14 important factors that would then be weighted as to the level of importance to the JTA

when determining what the best option would be for the Skyway (scoring in parenthesis, 5 being most desirable).

Refined options:

1. Replace technology with a same type of APM vehicle on the guidebeam
2. Replace technology with a same type of APM vehicle on rail
3. New Technology – Autonomous Vehicles (AV)
4. Personal Rapid Transit (PRT)

Based on this evaluation, the autonomous vehicle option was selected as the preferred technology to pursue for the development of the Skyway Modernization Program. Table 6.6.2 displays the options examined through the final phase of alternatives development.

Table 6.3.1: Initial Options Evaluation Matrix

Criteria	Weight	APM-Beam	APM-Rail	AV	PRT
At-Grade	10	1	1	5	1
Elevated	5	5	5	5	5
Operational Flexibility	10	2	2	5	4
Cost -Vehicle	5	1	2	5	3
Cost- Infrastructure (exist)	5	5	1	2	3
Cost- Infrastructure (new)	5	1	1	3	3
Cost O&M	5	1	1	4	1
Vehicle Capacity	5	4	5	3	1
Proven Technology	10	4	5	2	1
Frequency	15	3	3	4	5
Vehicle Speed	5	4	4	2	5
Maintainability	5	1	4	3	1
Reliability	5	5	5	4	4
Transition Impacts	10	5	1	1	2
Total	***100***	***3***	***2.75***	***3.45***	***2.85***

Source: Table 4-1: Options Evaluation Matrix, Technical Memorandum 3: Technology Options

The *Skyway Modernization Program* consisted of developing a system plan which recommended extensions to Five Points, Brooklyn, Riverside, Sports/Entertainment Complex, Shipyards, San Marco, Southbank Medical Complex, re-developed Southside Generating Station, Springfield, and UF Health/Shands, depicted in Figure 6.3.1. Additionally, the *Skyway Modernization Program* identified the potential of autonomous vehicle technology to operate on elevated guideway today and at the street level in the future, along with service improvements, to achieve a downtown circulator system and offer flexible, efficient demand based service for the next several decades.

Figure 6.3.1: Skyway Map with Potential Extensions

For the overall U²C Program, the following phases are proposed.

Near Term – In approximately 5 to 7 years, replace the existing Skyway with autonomous vehicle technology utilizing the existing guideway structure modified to accommodate autonomous vehicles. Also includes the planned extension to Brooklyn.

Mid Term – In approximately 7 to 10 years, complete remaining planned extensions including potential river crossing with transitions to grade with dedicated lanes for autonomous shuttle vehicles. Refer to Figure 6.3.1 depicting the existing alignment and planned extensions.

Long Term – In 10+ years, as autonomous technologies mature, open up the dedicated right of ways to allow mixed traffic at-grade with other autonomous shuttles that are able to operate on the same communications infrastructure as well as incorporate more on demand based service to the system as artificial intelligence progresses.

6.4 Summary of Infrastructure Conversion Alternatives

Table 6.4.1 summaries all of the potential Skyway conversion options considered in the study phases described in the previous section. Building on the findings from the previous phases, as well as the U²C Program infrastructure assessment, information from autonomous vehicle vendors, and additional research, four alternatives have been selected for further evaluation. All of the alternatives include autonomous vehicles, modernized supervisory system, infrastructure conversion and an at grade extension to a new Brooklyn Station in the vicinity of the existing Skyway Operations and Maintenance Center. These four alternatives are presented in Section 7.

Al of the conversion alternatives would also include an extension to the Brooklyn area. The Brooklyn Extension evaluation is described in Section 6.5.

Table 6.4.1: Summary of Skyway Alternatives

Summary of Skyway Conversion Alternatives	
Skyway Technology Assessment (2014-2015)	Option 1: Overhaul of the Skyway Monorail Operating System Option 2: Like-kind replacement of the Skyway Monorail Vehicles Option 3: Replacement of the Skyway vehicles with new Vehicles
Skyway Advisory Group/ Subcommittee (2016)	Option 1: Overhaul of the Skyway Monorail Operating System Option 2: Like-kind replacement of the Skyway Monorail Vehicles Option 3: Decommission and replace Streetcar, Trolley, Bus Rapid Transit or Personal Rapid Transit Option 4: Repurpose Skyway infrastructure as an elevated bicycle and pedestrian walkway
Skyway Modernization Program (2016-17)	Option 1: Rehabilitation of Existing Vehicle Option 2: Replace with similar type of vehicle on Guidebeam Option 3: Replace with Vehicle without the guidebeam Option 4: New Technology – Autonomous Vehicle
Skyway/U²C Infrastructure Assessment (2017-18)	Alternative 1: Remove existing guidebeam, build up the superstructure at stations only to facilitate level boarding, and retain the barrier wall. Alternative 2: Remove guidebeam, provide new superstructure at stations and retain barrier wall. Alternative 3: Remove guidebeam, provide new superstructure at stations, and replace barrier wall. Alternative 4: New superstructure throughout, retain existing piers.

6.5 Proposed Brooklyn Extension

This project also includes an approximate ¼ mile extension of the Skyway system to the proposed Brooklyn Station adjacent to the Skyway O&M Center at the intersection of Riverside Avenue and Leila Street. The existing elevated structure will transition to an at-grade, street level station that will allow for future expansion into the Riverside and Five Points areas.

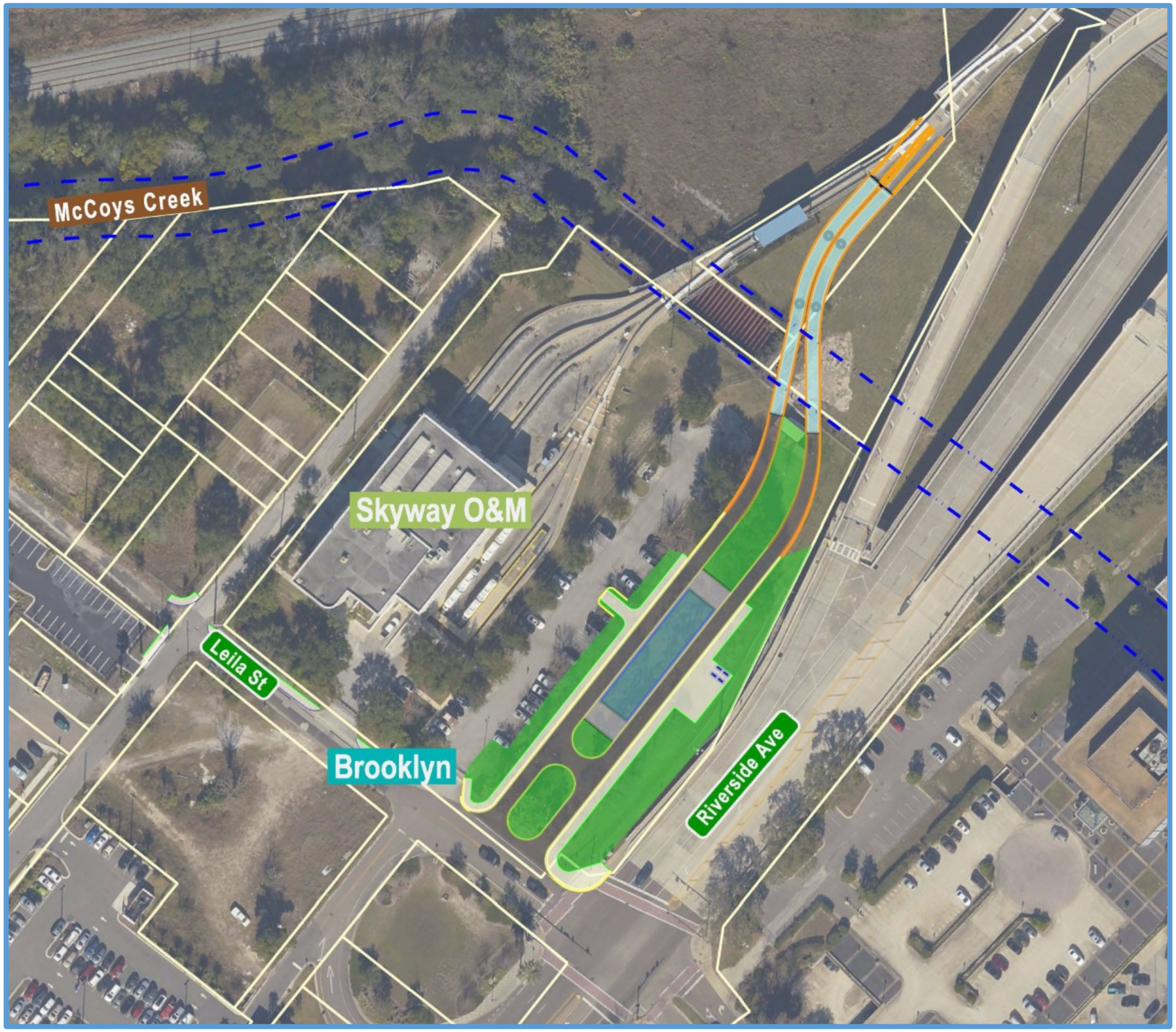
A conceptual plan, typical section and profile have been created using as-built Skyway plans, available mapping and elevation data from FDOT plus supplemented by elevations from Duval County two-foot contour lines and are included in Appendix I. More detailed plans will be developed as part of further project development. The proposed plan is illustrated in Figure 6.5.1.

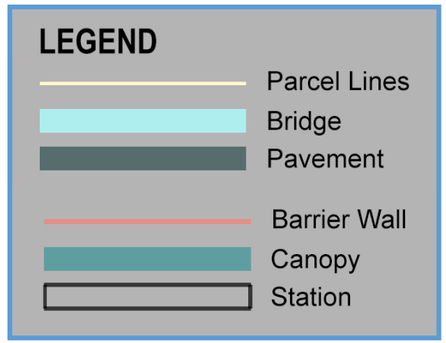
Proposed Typical Section

The existing elevated Skyway track with clear track width of 9'-7" will transition to 12-foot lanes with 2' wide curb and gutter on the outside and a median curb on the inside at the ground level station.

For analysis purposes, the proposed Brooklyn Station is approximately 32' wide and a 160' long with a 120' foot long canopy. Additional space is included on each side for ADA access, bicycle racks, and other customer amenities such as information kiosks, benches, trash receptacles, etc. as illustrated in Figure 6.5.2 and the renderings in figures 6.5.3 and 6.5.4.

Figure 6.5.1: Brooklyn Station Plan View





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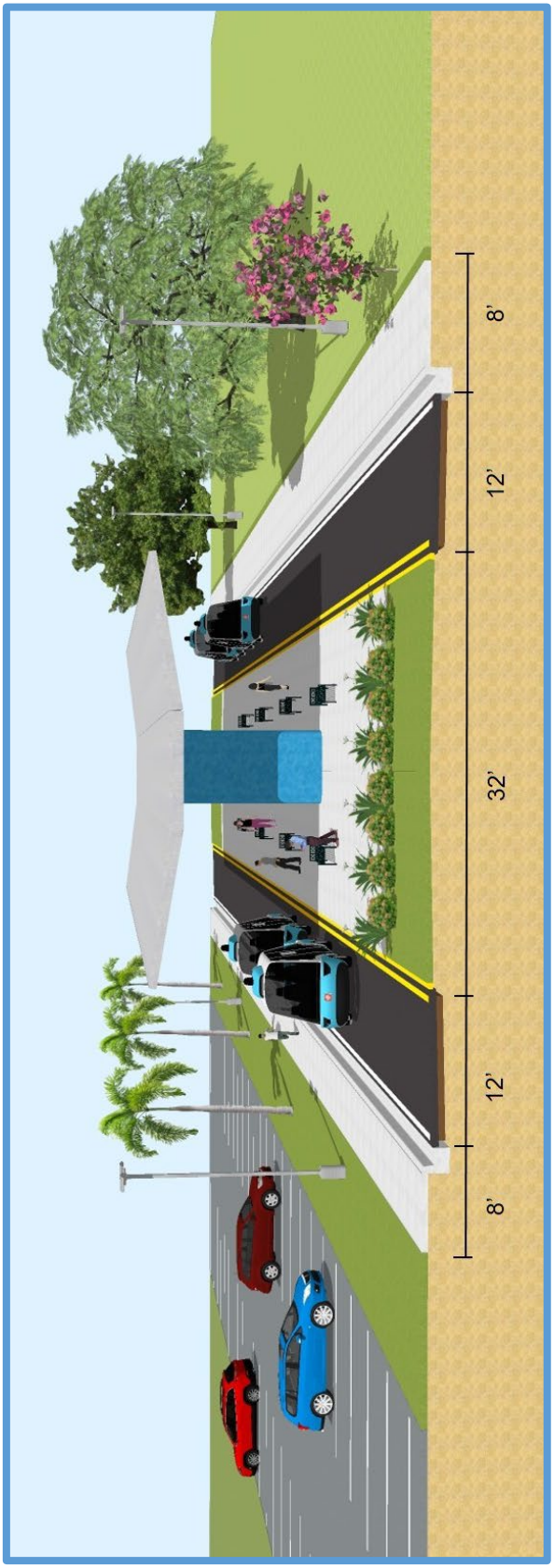

Figure 6.5.2: Brooklyn Station Typical Section

Figure 6.5.3: Brooklyn Station Rendering

Figure 6.5.4: Brooklyn Station Rendering (looking north)

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Brooklyn Station Area Environmental Review

A preliminary environmental assessment was performed at the potential site for the Brooklyn Station near the intersection of Leila Street and Riverside Avenue, where the existing Skyway O&M Center operates. A summary of key findings is below.

The project study area includes a portion of McCoy's Creek. This portion of the creek is heavily altered and disturbed. The northern portion of the creek on-site is exposed but is contained within concrete retaining walls. The southern portion extends through a subterranean concrete channel and is overlaid by roads and other infrastructure. No in-water work will be conducted as part of the Brooklyn Skyway Extension.

There are no wetlands within the project area. Therefore, this project is not expected to require wetland mitigation. If impacts to or work within McCoy's Creek are proposed, JTA will coordinate with St. Johns River Water Management District (SJRWMD), United States Army Corps of Engineers (USACE), and/or National Marine Fisheries Service (NMFS) to determine if wetland mitigation is necessary and will provide appropriate mitigation if necessary.

The portion of McCoy's Creek that lies within the project area is subject to tidal action and is considered Essential Fish Habitat (EFH). However, since the project will not affect the creek, no loss of EFH will be incurred and no EFH mitigation will be required. Refer to the supporting documents included in the list of reference documents for the complete environmental report.

A total of 71 plant and wildlife species that are federally-listed, candidates for federal listing, and/or state-listed were determined to have no probability of occurrence in the project area. These species, which are listed in technical memorandum Environmental Resource Evaluation: JTA Brooklyn Skyway Extension, will not be affected. Three state-listed wading birds, the tricolored heron, the little blue heron, and roseate spoonbill, were determined to have a low probability of occurrence in the project area. No adverse effect is anticipated for these species. The federally-listed short nose sturgeon, Atlantic sturgeon, loggerhead sea turtle, green sea turtle, hawksbill sea turtle, Kemp's ridley, wood stork, and West Indian manatee were determined to have low probabilities of occurrence and the project will have no effect on these species. Continued agency coordination will occur during permitting to address final determination of impacts, implementation of protection measures, and mitigation if necessary.

Also, as part of project development a detailed drainage design, storm water management and erosion protection plan will be developed in accordance with City of Jacksonville, FDOT and St Johns River Water Management District requirements.

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7 Evaluation of Alternatives

The evaluation of alternatives for the proposed Skyway system conversion considers several project components:

1. Operational Requirements
2. Vehicles
3. Supervisory System
4. Infrastructure Considerations

The proposed system must demonstrate an improvement over the current **operational characteristics** including passenger throughput, headways, speed and safety.

The **vehicles** under consideration are rubber tired autonomous vehicles which will operate without a guidebeam and will have the ability to operate on the elevated structure and at street level. These will replace the existing vehicle Bombardier UMIII monorail which operate on a fixed guideway.

The **supervisory system** must provide JTA with upgrades to supervision and monitoring of the system using state of the art technology. The supervisory system will consist of the hardware, software and other components necessary for control, communications and supervision and management of the system.

The **infrastructure** includes the physical structure, guideway, stations and the Brooklyn Extension. The team evaluated the condition of the existing infrastructure as well as modifications necessary to accommodate rubber tired autonomous vehicles.

7.1 Operational Requirements

The proposed alternatives evaluated included the addition of the proposed Brooklyn Station and assumed autonomous vehicle operations:

- **Operating Alternative 1A** – Autonomous vehicles operation along the existing Skyway guideway footprint without the I-beam plus the bus network as coded for SW BRT submittal, expanded weekday service span from 4 a.m. to 1 a.m. This alternative does not include the Brooklyn Station. Service line frequency is a 3-minute headway.
- **Operating Alternative 1B** – Same as Alternative 1A with service line at a 2-minute headway.
- **Operating Alternative 2A** – Autonomous vehicles operation along the existing Skyway guideway footprint without the guidebeam plus the bus network (as required for SW BRT project), expanded weekday service span from 4 a.m. to 1 a.m. This alternative does include the new Brooklyn Station. Service line frequency is a 4-minute headway.

- **Operating Alternative 2B** – Same as Alternative 2A with service line at a 3-minute headway.

With the addition of the Brooklyn Station, the Operating Alternatives were expanded from existing Skyway A-Route (JRTC to Rosa Parks) and the D-Route (Kings Avenue to Rosa Parks) to include three service lines (without Brooklyn) and six service lines with Brooklyn. For Build Alternative 1, autonomous vehicle (AV) operations without Brooklyn station, the service lines include:

- JRTC to Rosa Parks
- Kings Avenue to Rosa Parks
- JRTC to Kings Avenue

For Operating Option 2, AV operations with Brooklyn Station, the service lines include:

- JRTC to Rosa Parks
- Kings Avenue to Rosa Parks
- JRTC to Kings Avenue
- JRTC to Brooklyn
- Brooklyn to Rosa Parks
- Brooklyn to Kings Avenue

Operating Assumptions

The Operating Alternatives were tested under a range of service line frequencies from a vehicle every 2-minutes to one every 4-minutes. Other key operating assumptions include:

- The vehicle capacity is 12 passengers.
- The vehicle speed range is 25-35 mph.
- Vehicle speed range is 25-35 mph along separated station bypass.
- Vehicle 30-second dwell time at each station.
- Vehicles run in push-pull operation (bi-directional operation) – vehicles must switch from inbound to outbound track leaving end of line stations to avoid head-on collisions.
- Passing tracks available at each station for bypass operations inbound and outbound.
- Operating days – 7 days per week.
- Service span:
    - Monday –Thursday 6 a.m. -11 p.m.
    - Friday 6 a.m. - 2 a.m.
    - Saturday 6 a.m. - 2 a.m.
    - Sunday 8 a.m. - 11 p.m.

Operating Requirements for Alternatives

Using the operating assumptions identified above, the Operating Options were developed and tested to yield the system-wide operating requirements depicted in Table 7.1.1.

Table 7.1.1: Alternative Operating Requirements

System Alternative	Service Line Headway	Peak Vehicles	Weekday Service Hours
Operating Alt. 1A - no Brooklyn	3-minutes	14	294
Operating Alt. 1B - no Brooklyn	2-minutes	21	441
Operating Alt. 2A - Brooklyn	4-minutes	19	399
Operating Alt. 2B - Brooklyn	3-minutes	25	525

These alternatives included defining service line operating requirements and service frequencies to be used to generate ridership demand. As part of the evaluation process, the four alternatives above were developed to address the various operating scenarios that would best meet the operating plans described previously. All four alternatives assume the service would operate on the existing elevated guideway with the guidebeam removed with an autonomous vehicle.

Both Alternative 1A and 1B do not include an extension to Brooklyn. Alternative 1A would operate with 3 minute headways while Alternative 1B would operate more frequently with a 2 minute headway. As a result, 1B would require additional vehicles and more service hours supplied, but the advantage would be in providing more frequent service and additional capacity. However, not including the Brooklyn extension would limit the reach of the service and not realize the desired advantages of autonomous vehicle operations.

Alternatives 2A and 2B include the Brooklyn Extension, which leverages the desired flexibility of Autonomous Vehicle operations. Like the 1A and 1B alternatives, these alternatives differ in operation frequency where Alternative 2A operates on 4 minute headways while Alternative 2B would operate with 3 minute headways. Alternative 2A would require fewer vehicles than Alternative 1B, but utilizes the greatest headway spacing of all the alternatives at 4 minutes. Alternative 2B would require the most vehicles and greatest number of service hours supplied of all 4 alternatives, but frequencies of 3 minutes are consistent with Alternative 1A. The advantage of Alternative 2B is that it provides the desired frequency as well as the desired expansion to Brooklyn.

Table 7.1.2 presents the system-wide ridership and demand to service capacity assessment for each Operating Alternative for opening year 2022. This table calculates peak demand as a percentage of peak service capacity. Each alternative would consume between 9% and 21% of available capacity.

Table 7.1.2: Operating Alternative Demand to Capacity (2020)

System Alternative	Service Line Headway	Peak Vehicles	2020 Daily Demand	Peak Capacity	Peak Demand[3]	Peak Demand to Capacity
Operating Alt. 1A - no Brooklyn	3-minutes	14	6,765	3360	677	20%
Operating Alt. 1B - no Brooklyn	2-minutes	21	6,980	7560	698	9%
Operating Alt. 2A - Brooklyn	4-minutes	19	7,038	3420	704	21%
Operating Alt. 2B - Brooklyn	3-minutes	25	7,371	6000	737	12%

1. Capacity per Hour = [(Vehicles*Seats)*(Trips/Hour)] where Trips/Hour = 60/Headway
2. Demand per Hour = Demand/Service Span where service span is 21 hours Monday-Friday
3. Peak Hour Demand = 10 percent of Daily Demand based on Texas Transportation Institute (2011).

Table 7.1.3 presents the system-wide ridership and demand to service capacity assessment for each Operating Alternative for design year 2040. This table calculates peak demand as a percentage of peak service capacity.

Table 7.1.3: Operating Alternative Demand to Capacity (2040)

System Alternative	Service Line Headway	Peak Vehicles	2040 Daily Demand	Peak Capacity	Peak Demand[3]	Peak Demand to Capacity
Operating Alt. 1A - no Brooklyn	3-minutes	14	7,289	3360	729	22%
Operating Alt. 1B - no Brooklyn	2-minutes	21	7,518	7560	752	10%
Operating Alt. 2A - Brooklyn	4-minutes	19	7,536	3420	754	22%
Operating Alt. 2B - Brooklyn	3-minutes	25	7,931	6000	793	13%

The intent of the analysis is to ensure that sufficient operating capacity exists to serve estimated travel demand. Ideally, a transit system is designed such that demand is not greater than 80% of the system capacity to serve expected demand. The modeled operating plans tested service line frequencies of between 2-minutes and 4-minutes resulting in effective vehicle headways at most stations of between 60-seconds and 90-seconds due to overlapping service lines. This analysis represents a robust service plan designed to attract high ridership.

Operating Alternative 1, without the Brooklyn Station, at a service line frequency of 4-minutes, results in three service lines and an average headway of a vehicle every 80-seconds where the service lines overlap stations (1:20 minutes). At a service line frequency of 8-minutes, the average headway is a vehicle every 160-seconds (2:40 minutes).

Operating Alternative 2, with the Brooklyn station, at a service line frequency of 4-minutes, results in six service lines and an average headway of a vehicle every 40-seconds where the service lines overlap stations. At a service line frequency of 8-minutes, the average headway is a vehicle every 80-seconds where the stations overlap.

Service Hours and Operating Costs

The annual service hour requirement for each Operating Alternative is presented in Table 7.1.4. The annual service hours range from 105,602 hours for Alternative A1 to a high of 188,575 hours for Alternative 2B. These hours are reflective of the service policy operating plan for each alternative and therefore are influenced by speed, number of stations, dwell time, cycle time, service span, operating days, the number of service lines operated, and service frequency. The vehicles requirement is likewise influenced by these operating considerations. The fleet size is calculated at 20% of the peak vehicle requirement.

Table 7.1.4: Operating Alternative Service Hours and Fleet Size

Operating Alternative	Service Line Headway	Annual Service Hours	Peak Vehicles	Est. Fleet Size
Operating Alt. 1 A - no Brooklyn	3-minutes	105,602	14	17
Operating Alt. 1 B - no Brooklyn	2-minutes	158,403	21	26
Operating Alt. 2 A - Brooklyn	4-minutes	143,317	19	23
Operating Alt. 2 B - Brooklyn	3-minutes	188,575	25	30

Ridership Projections

Model Implementation and Assumptions

Ridership forecast for the TCAR 1 project was prepared using an advanced copy of v2.01 of Federal Transit Administration's (FTA) Simplified Trips-On-Project Software (STOPS). As part of the review, the Jacksonville Area STOPS model was used to compare various scenarios for TCAR 1. The Jacksonville Area STOPS model is a combination of JTA's existing bus, Express bus, BRT, community shuttle and Skyway services along with socioeconomic data to estimate (a) person travel volumes, (b) travel times, (c) mode share, and (d) ridership. Scenario ridership were estimated for 2015, 2020, 2030 and 2030 for No Operating, improved Skyway headways, and Brooklyn Station addition with improved Skyway headways.

Ridership scenarios were estimated for 2017, 2022, 2030 and 2040 for No Operating (existing stations), improved Skyway headways, and Brooklyn Station addition with improved Skyway headways. These scenarios account for population and employment growth as well as the completion of the First Coast Flyer BRT system. Data on future development was collected as well (see Table 7.1.5 for a detailed list). These were added to the data in the year in which it was assumed the development would take place. Planned development assumptions may need to be refined more specific information becomes available.

Table 7.1.5: Planned and Proposed Developments Considered in Ridership Forecast

Development	Year
Seminole Club: Sweet Pete's	2015
Palmetto Place	
Former Federal Courthouse: State Attorney's Office	
Tucker Brothers Building: The Federal	
Police and Fire Pension Fund Building: Hertz Rent-a-Car	
The Carling: Wine Decadence	
Elks Building: Cathedral Arts and Jimmy John's	
Jacksonville Bank Building: Anytime Fitness	
121 Atlantic Place: Jacksonville Transportation Authority	
Zodiac Bar and Grill	
Everbank Center: Citizen's Bank	
11E: Superior Food and Brew	
Haydon Burns Library: Jessie Ball duPont Center	
Drew Building: Urban Grind Coffee	
Levels Night Club	
Parador Parking Garage	
Suntrust Building: Jersey Mike's	
100 West Bay Street Building: Peterbrook Chocolatier	
Old Republic Title Building/New York Steam Laundry Building	
The Brooklyn Riverside	
220 Riverside	
Brooklyn Station on Riverside	
Hyatt Regency Jacksonville Riverfront	
Berkman II	
Intuition Ale Works	
The Shipyards	
Everbank Plaza: Carlson Dental	
DoubleTree Jacksonville Riverfront	
Museum of Science and History	
The Jacksonville Landing	
Winston YMCA	2016
Beaver St. Villas	2017
Lofts at LaVilla	
225 N. Laura St. Apartments	
Bostwick Building: Cowford Chophouse	
Unity Plaza + Hotel	
Daily's Place Amphitheatre	

**Note: If the target year was beyond year 2015, the data was placed in the year 2020 model.*

Table 7.1.5 (Continued)

Development	Year
Houston Street Manor	
20 West Café/ FSCJ Dorms (20 West FSCJ Residential Community)	
Broadstone River House	
Baptist MD Anderson Cancer Center	
Lofts at Monroe	2018
Lofts at Jefferson Station	
Barnett Building: The Barnett	
Burlock & Barrel Distillery	
Brooklyn Place	2019
JRTC	
Marble Bank/Laura Street Trio	
Hotel Indigo	
200 Riverside	
Venture Residential Development	2020
Jones Furniture Building	2021
JEA Site: Healthy Town (now known as The District)	2022

**Note: If the target year was beyond year 2015, the data was placed in the year 2020 model.*

The travel demand model considered the following scenarios developed in the previous section:

- Operating Alternative 1A – Existing Skyway (40 second service at Central), expanded BRT and local Bus service.
- Operating Alternative 1B – Improved Skyway headways (30 second service at Central), expanded BRT and local Bus service.
- Operating Alternative 2A – Same transit services as 1A but includes Brooklyn Station.
- Operating Alternative 2B – Same transit services as 1B but includes Brooklyn Station.

Based on scenarios described above, Tables 7.1.6 and 7.1.7 summarize the ridership projections from their respective STOP models. Average daily ridership values are presented for an improved system with the existing Skyway stations (Table 7.1.6) and with the addition of Brooklyn Station (Table 7.1.7).

Scenarios 1A and 1B show that if no station additions are made to the system, combined Skyway, BRT and Local Bus average daily ridership is estimated to increase from approximately 46,000 to 53,000 in the year 2040. A scenario without the Brooklyn station but improved headways of 45 seconds increases daily ridership from approximately 6,370 to 7,290, while service with 30-second headways increases from approximately 6,710 to 7,800 between 2015 and 2040. The inclusion of the proposed Brooklyn Station and 40-second headways sees daily ridership increase from approximately 6,550 to 7,560, and from approximately 6,840 to 7,970 with a 30-second headway.

Table 7.1.6: Projections without Brooklyn Station

1A (45 seconds frequency at Central Station) and Alternative 1B (30 seconds frequency at Central Station) Average Daily Ridership Comparison								
Route Name	**STOPS Estimate Year 2015**		**STOPS Estimate Year 2020**		**STOPS Estimate Year 2030**		**STOPS Estimate Year 2040**	
	45 s	**30 s**	**45 s**	**30 s**	**45 s**	**30 s**	**45 s**	**30 s**
65-JRTC to Rosa Parks	810	1,060	820	1,110	830	1,130	850	1,140
66-Kings Ave to Rosa Parks	4,390	4,390	4,830	4,830	5,030	5,030	5,210	5,210
67-JRTC to Kings Ave	1,170	1,260	1,200	1,390	1,210	1,420	1,230	1,450
Total Skyway	**6,370**	**6,710**	**6,850**	**7,330**	**7,070**	**7,580**	**7,290**	**7,800**

Table 7.1.7: Projections with Brooklyn Station

2A (40 seconds frequency at Central Station) and Alternative 2B (30 seconds frequency at Central Station) Average Daily Ridership Comparison								
Route Name	**STOPS Estimate Year 2015**		**STOPS Estimate Year 2020**		**STOPS Estimate Year 2030**		**STOPS Estimate Year 2040**	
	40 s	**30 s**	**40 s**	**30 s**	**40 s**	**30 s**	**40 s**	**30 s**
65-JRTC to Rosa Parks	730	740	750	760	770	770	780	790
66-Kings Ave to Rosa Parks	3,720	3,950	4,080	4,360	4,240	4,550	4,380	4,720
67-JRTC to Kings Ave	610	610	640	640	660	660	680	680
68-Brooklyn to Kings Ave	810	810	940	940	960	960	970	970
69-Brooklyn to Rosa Parks	380	380	420	420	420	420	420	420
70-Brooklyn to JRTC	300	350	310	360	320	380	330	390
Total Skyway	**6,550**	**6,840**	**7,140**	**7,480**	**7,370**	**7,740**	**7,560**	**7,970**

Along with a BRT system in place, the STOPS models show the Skyway system serving more passengers in the scenarios that contemplated shorter headways and the addition of Brooklyn Station. Furthermore, the three service lines to the new Brooklyn Station would make up approximately 23% of the total ridership. Additional refinements could be made to the background bus network as future operational information becomes available. Similarly, it will be important to stay abreast of the development patterns in the downtown area and reflect these in the socioeconomic data sets, especially since Downtown Jacksonville is experiencing a resurgence in development.

7.2 Vehicles

Autonomous vehicle (AV) technology is an emerging technology that is rapidly evolving. A variety of autonomous vehicle options are in development and have been examined through this study, with capacities ranging from 4 to 24 passengers. In order to develop the new vehicle design criteria, several design parameters must be defined. Those include:

- Speed – Maximum speed at which vehicles will travel.
- Dimensions – Size of the vehicle considering existing infrastructure constraints and the various classes autonomous vehicles available in the industry.
- Maximum Grades – How does a significant grade impact the overall vehicle performance, battery performance and battery life?
- Safety Compliance – Safety requirements/standards that will be specified.
- Certification Requirement – Safety Certification process.
- Service Life – Expected service life of autonomous vehicles and their components.
- Operating Range/Battery Charge – How long can the vehicle operate on a single charge? Battery charging infrastructure: charging stations, online charging, replacement batteries.
- Local Environmental Impact – Impact of Jacksonville's hot and humid environment on passenger comfort, HVAC requirements, and battery performance, Impact of significant rain and wind events on vehicle operating performance (traction, grade), vehicle positioning, communications, and sensing (GPS, LIDAR, etc.) and passenger safety
- Cybersecurity

Speed

Table 7.2.1 was generated based on data collected from the Industry Forum and RFI responses received in early 2017. Based on this data, speeds of available autonomous vehicles ranges from 12 to 30 MPH as compared to the existing Skyway monorail maximum speed of 35 MPH. The existing guideway structure includes some speed constraints through curves and at areas where vehicles would crossover from one lane to another. Average speed considers acceleration, deceleration, civil speed constraints and distance between stations. Speed will be more reliable on the elevated section. At-grade operation speed will be affected by speed limits, congestion due to other vehicles and traffic signals at intersections.

Dimensions

The size of autonomous vehicles is considerably smaller than that of the existing Skyway monorail 2-car train. However, what is important as it relates to operating on the existing infrastructure, is the single car length, width and height as these dictate how it will fit on the guideway and navigate through curves and crossover locations. Another important consideration is the vehicle floor height as the existing monorail guide beam is planned to be removed. The autonomous vehicles will need to have an elevated running surface at stations to match the vehicle floor height with the existing station platform elevation. This is particularly important when considering ADA compliance requirements. The floor heights of the various cars range from 0.76 feet to 1.35 feet. Since the JTA is considering the possibility of having multiple AV suppliers operating on the U^{2}C Program system, the design criteria for the vehicles will have to set the standard for vehicle floor height as measured from the running surface elevation to mitigate any potential issues with the station platforms, passenger access, etc. and insure compatibility and intra-operability between autonomous technologies.

Maximum Grade

The maximum grade on the Skyway is 8% over the Acosta Bridge. Available data suggests this grade to be within the operating range of known vehicles (Figure 7.3.1). All AV technology vehicles operate on battery power. Maintaining constant speed up a grade with a fully loaded vehicle will require increased power consumption which in turn impacts the time between battery charging. In addition, vehicle controls must support safe operation and braking on ascending and descending grades.

Safety Compliance

The new vehicle must comply with safety requirements established by the authorities having jurisdiction, i.e. NHTSA, FDOT and the City of Jacksonville. A discussion on safety Certification is included as an appendix. The National Highway Traffic Safety Administration (NHTSA) is responsible for establishing, maintaining and enforcing vehicle safety standards. The Federal Motor Vehicle Safety Standards (FMVSS) cover three aspects: crash avoidance, crashworthiness, and post-crash survivability. There are presently no complete set of safety standards specific to autonomous vehicles. The NHTSA has issued a voluntary guidance on automated driving systems in 2016 and an update in 2017. Transit agencies must apply for and obtain a waiver from NHTSA to operate transit vehicles in public right of way. It is important that JTA comply with current NHTSA requirements as these will be updated periodically and specific requirements may apply for vehicles manufactured in the US or in other countries. JTA staff are in communication with USDOT officials regarding NHTSA waiver status. Refer to Appendix E for additional information on vehicle operating requirements.

Table 7.2.1: Autonomous Vehicle Comparison

Characteristics	Existing Skyway	Autonomous Vehicle							
	Bombardier	Navya	2getthere	EasyMile		LocalMotors	Ohmio	RDM Group	Waymo**
	UMIII VAL 2-Car OP	NAVYA ARMA DL4	GRT	EZ1, 1st Gen.	EZ10, 2nd Gen.	Olli	LIFT	Pod-Zero (4-Seater)	Chrysler Pacifica Hybrid
Length (ft)	48	15.6	19.7	12.9	13.2	12.86	N/A	8.9	17
Width (ft)	7	6.9	6.9	6.6	6.6	6.73	N/A	4.6	6.7
Height (ft)	9	8.7	9.2	9.1	9.4*	8.2	N/A	6.6	5.8
Wheel base length (ft)	2.83	9.3	12.1	9.2	9.2	8.29	N/A	N/A	10.1
Ground Clearance (ft)	-	0.66	0.54	0.55	0.56	N/A	N/A	N/A	0.425
Floor height (ft)	4.2 (includes beam)	0.76	1.35	1.2	1.2	N/A	N/A	N/A	N/A
Unloaded Weight AW0 (lb/car)	26,100	5,291	7,720	4,400	4,695	3,300	N/A	1,323	6,300
Crush load Weight AW3 (lb/car)	39,540	7,716	14,660	6,614	6,900	5,500	N/A	N/A	N/A
Charging Time	-	8 hr. (90%, induction) / 4 hr. (90%, plug	10 min (30% 80% charge, induction)	5 hr.	5 hr.	4.5 hr.	N/A	< 3 hr.	N/A
Battery Charge Life	N/A	9 hr.	30 min	14 hr.	12-Jun	N/A	N/A	4-6 hr.	N/A
Door Openings	One	One	Both	One	One	One	Both	Both	One
Passenger Capacity	56 (2-car)	15	24	12	12	12	20	4	7
Maximum Speed (mph)	35	30	25	25	28	25	30	15	115
Maximum Percent Grade (%)	8	12	10	15	8	N/A	N/A	N/A	N/A
									

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Safety Standards

There are a few safety standards applicable to autonomous vehicles. Based on a review by manufacturers, some of the existing FMVSS standards will be required to be amended to be applicable to autonomous vehicles. Below is a discussion of some of the existing or forthcoming safety standards.

ISO 26262- Road Vehicles Functional Safety standard, focuses on the functional safety of electrical and electronic (E/E) systems in vehicles. The scope is for series production passenger cars with maximum gross weight up to 3500 kg. Functional safety in accordance with ISO 26262 affects all systems containing electrical, electronic, or electromechanical components, i.e. systems from the fields of actuator and sensor technology as well as control electronics. Industrial systems are covered by IEC 61508, with additional specific standards applying to railroads, aircraft etc. ISO 26262 is the sector specific extension of IEC 61508 for the automotive industry. ISO 26262 is not a certification standard and therefore contains no clauses regulating certifications or the scope thereof.

The NHTSA recently issued a notice of proposed rulemaking (NPRM) to establish a new Federal Motor Vehicle Safety Standard (FMVSS), No. 150, mandating vehicle-to-vehicle (V2V) communications for new light vehicles and to standardize the message and format of V2V transmissions. The proposed standard was issued for public comments in early 2017 and the comment period was closed in April 2017.

Certification Requirement

H.R. 3388, also cited as the “Safely Ensuring Lives Future Deployment and Research In Vehicle Evolution (SELF DRIVE) Act”, was adopted on September 6, 2017. Based on review by legal scholars, the SELF DRIVE Act was passed out-of-concern for the patchwork of state laws that could hinder innovation but appears to leave a safety gap until NHTSA adopts a rule on safety assessments. The bill directs NHTSA to issue a final rule within two years that “requires the submission of safety assessment certifications regarding how safety is being addressed by each entity developing a highly automated vehicle or an automated driving system.” In the interim two years, the bill requires auto manufacturers to submit a safety assessment letter as contemplated by any NHTSA guidance in effect. However, the current 2017 NHTSA guidance does not appear to require such a certification letter.

Service Life

Although the autonomous vehicles are significantly less costly than replacement of the Skyway monorail cars, consideration must be given to the technology’s design service life. Current APM specifications require a vehicle design service life of 25 years. Many APM vehicles have met and even exceeded these requirements through the years. Autonomous technology vehicle suppliers appear to state that they can achieve a service life of up to 10 years before replacement.

Vehicle Cost

It is unknown at this time what an autonomous vehicle that meets all the vehicle design criteria would cost. The JTA is currently testing several vehicles at the AV test track. The expected cost of autonomous vehicles range from $250,000 to $1,000,000. However, it is likely that currently produced vehicles will not meet all of the U²C Program design requirements, and this may result in higher cost for each vehicle.

Operating Range / Battery Charge

A key consideration for vehicle design criteria must include the battery range and charge time. This not only impacts system operation but also the size of the fleet required to support the 15-hours per day operation (6:00AM – 9:00PM). Current suppliers state that they can operate in a range from 6 to 14 hours per day before requiring a full recharge. This range varies widely depending on several factors including vehicle size, weight, speed, guideway grades, HVAC, onboard lighting, communications, etc. Battery recharge time is another key consideration for design criteria development. The average battery recharge time from fully discharged to fully charged is in the range of 3 to 8 hours. It should be noted that the battery technology and associated discharge and recharge time and processes are constantly evolving and improving. Consideration must also be given to the battery design service life for AV technology. Replacement of the batteries over the design service life of a vehicle can become a significant cost to the Owner and must be considered as part of the life cycle cost of a vehicle.

Local Environmental Conditions

Jacksonville's maritime climate requires unique environmental considerations for the AV vehicles. The temperatures can range from sub-freezing to over 100° F with humidity levels reaching 100% during the summer months. As passenger comfort is a key consideration, the AV vehicle must be able to maintain a comfortable environment. The HVAC system will be a drain on the vehicle battery and could impact the battery life and re-charge times. This must be taken into consideration.

In addition to the temperature and humidity, Jacksonville can experience periods of heavy wind and rains especially with tropical storms and hurricanes. The autonomous vehicles will be required to safely maintain communication (GPS, LIDAR, etc.) and operation (traction, traction on grade, etc.) during these periods.

Cybersecurity

A group of international industry experts have come together to form the SAE International's cyber standards development committee. The aim of the committee has been to prioritize cybersecurity concerns and aggressively address these. After examining international research data, including government and industry collaboration, and privately funded industry consortia, the world's first Automotive Recommended Practice, SAE J3061 has been produced. J3061™ recommends that

a cybersecurity process be applied for all automotive systems that are responsible for functions that are ASIL (Automotive Safety Integrity Level) rated per ISO 26262, or that are responsible for functions associated with:

- Propulsion
- Braking
- Steering
- Security
- Safety

J3061™ also recommends that a cybersecurity process be applied for automotive systems that handle Personally Identifiable Information (PII).

7.3 Supervisory System Requirements

In order to replace the existing Skyway with a fully functional and integrated autonomous vehicle technology system, multiple subsystems would be required as part of the overall system architecture. These subsystems include:

- Autonomous Vehicles.
- Supervisory Control System.
- Communications.
- Power Distribution/Charging Stations.

Autonomous Vehicles

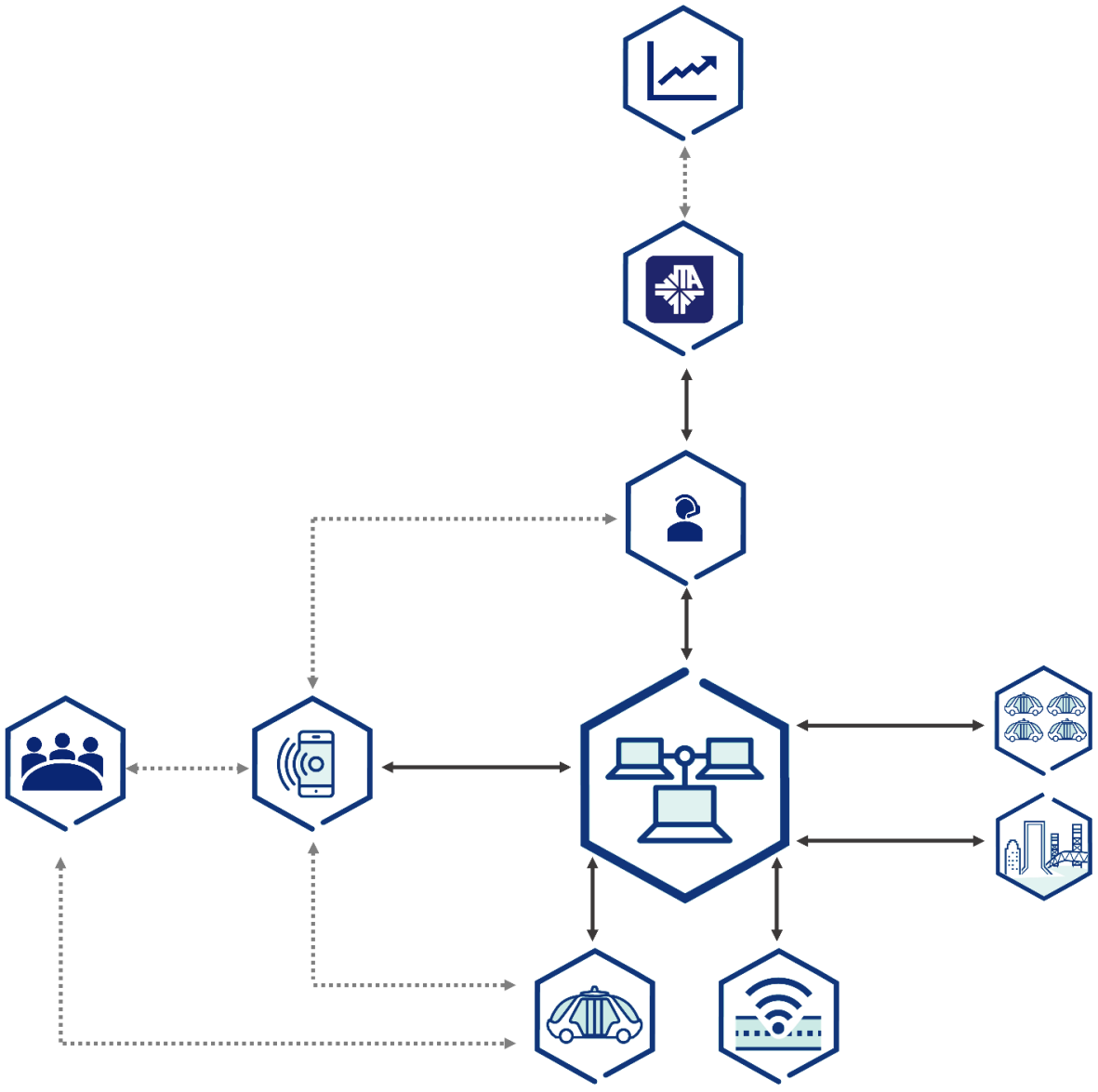
Based on the information gathered from the JTA Industry Forum and the RFI, the autonomous vehicles are typically outfitted with a series of cameras, lenses, and sensors located around the vehicle to characterize the surrounding environment and sense the location of the vehicle in proximity to obstacles. The cameras/sensors, are combined with a mapping system (Lidar) and/or GPS, and in some cases wayside magnets embedded along the alignment, to travel along their route. Information is managed through proprietary onboard operating systems that control the vehicle speed, acceleration/deceleration profiles, steering, direction, station stops, braking and safety functions such as collision avoidance between vehicles and with end of track buffers.

Supervisory Control System

Although the autonomous vehicles can operate automatically and safely along a defined route, the overall system architecture must include a supervisory control system that monitors and controls certain aspects of autonomous vehicles. This includes route setting for each vehicle, vehicle health monitoring, which includes alarms such as low battery, flat tire, vehicle stopped or misaligned at a station, motor failure or overload, smoke or fire onboard and all other alarms required to ensure reliable, flexible, functional and safe operations of the vehicles. The supervisory control system is typically located in a central control facility. For the new U^{2}C

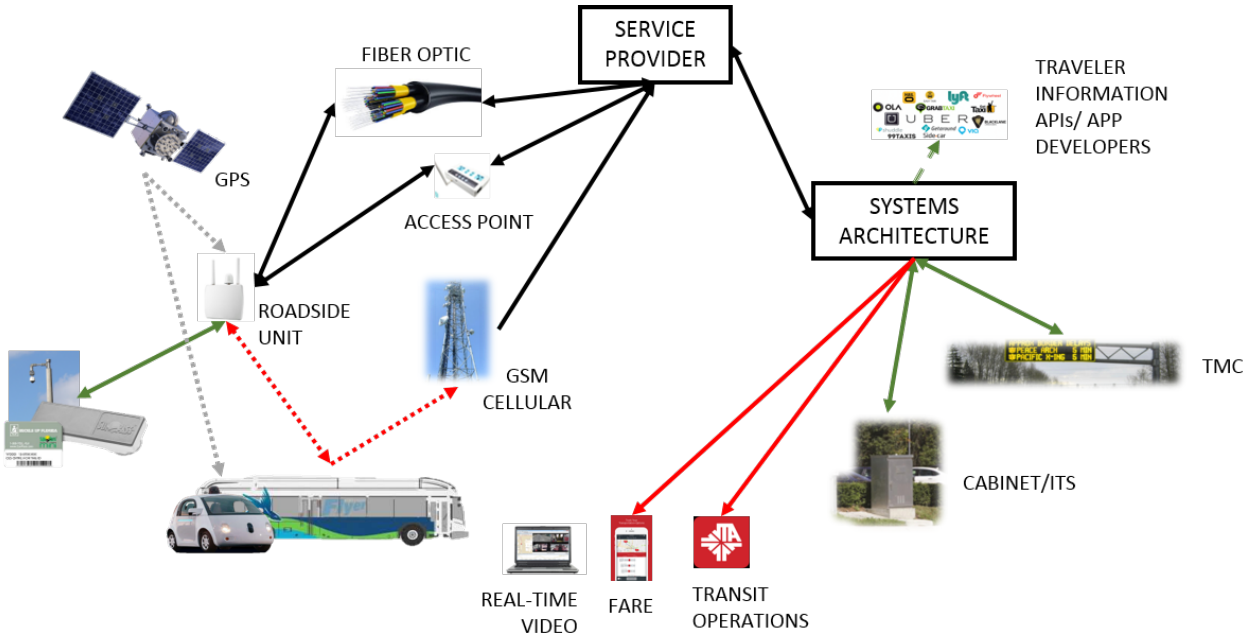
Program the plan would be to replace/upgrade the existing central control room equipment and workstation monitors with new equipment. Current Automated Transit Systems deployed in several locations around the world typically include supervisory control systems that are well developed and could be readily adapted to the U²C Program. Supervisory Control Systems would also provide monitoring and controls for other system equipment such as opening and closing power circuit breakers, status of circuit breakers, monitoring access to critical wayside equipment rooms, etc.

Figure 7.3.1: AV Technology Supervisory System Architecture



A second AV technology system requirement will be the physical infrastructure necessary for all communications to occur. Cybersecurity measures must be implemented to avoid malicious interference. Autonomous vehicle communication may rely on DSRC or use a public 4G or 5G wireless network, or a combination thereof, or a proprietary system that is dedicated and secured similar to the existing Skyway system. To address some of the cybersecurity concerns, the JTA is considering utilizing their own communications network and protocols for the AVs operating in the U^{2}C system environment. Figure 7.3.2 shows a potential communications network concept.

Figure 7.3.2: JTA Communications Network Concept



Communications

The autonomous vehicles technology will need to include the ability to communicate vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) including both voice and data. V2V communications would be used so that each AV knows other nearby AV's location, direction, routes and speed, and use such information for its own operational parameters. V2I communication is used to allow the vehicle to communicate with the supervisory system including the supervisory functions described above, as well as vehicle to station communications for triggers related to platform Public Announcements (PA) and dynamic signage. V2I can also be used for voice communications from onboard passengers to the Supervisory Control Operator or other designated person to manage potential emergencies or other passenger related necessary communication.

Power Distribution / Charging Stations

As previously mentioned, autonomous vehicles are powered with onboard batteries that provide necessary power for propulsion motors, onboard HVAC, lighting, communications equipment,

door motors/controls and onboard vehicle operational control and monitoring equipment. These onboard batteries have a finite charge life ranging from 4 to 14 hours and are required to be recharged when their charge has been depleted. Recharge times can vary from 3 to 8 hours. As such, charging stations must be considered and provided, to allow for the most efficient use of their charging time. Depending on how the charging stations are located and configured throughout the system, and how long they can hold a single charge, additional AVs can be deployed into service while the AVs are removed from service for charging, to maintain the desired/required capacity at the given time of day. A key consideration for vehicle charging stations is the existing Skyway power infrastructure that utilizes 480V, 3-phase power, distributed along the alignment from several substations. One option would be to provide a possible pocket track at strategic locations to allow for efficient dispatching of newly charged AVs and removal and charging of AVs with low battery charge. Another option is to have the charging station centrally located at or near the AV maintenance facility. Other considerations would include online dynamic charging perhaps at stations while the vehicles dwell or some method of inductive charging while the vehicles operate along their routes. As the battery technologies continue to evolve, better solutions are likely to become available in time.

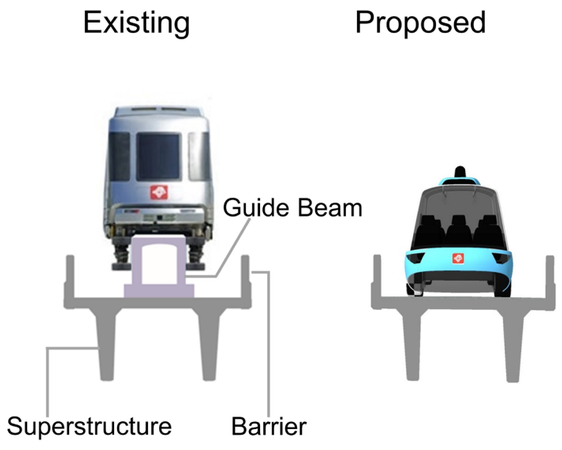
7.4 Infrastructure Considerations

Creating a set of alternatives for the Skyway conversion is mostly driven by the feasibility of using the existing elevated infrastructure and extent of modifications to the Skyway that may be required to accommodate the rubber tired autonomous vehicles.

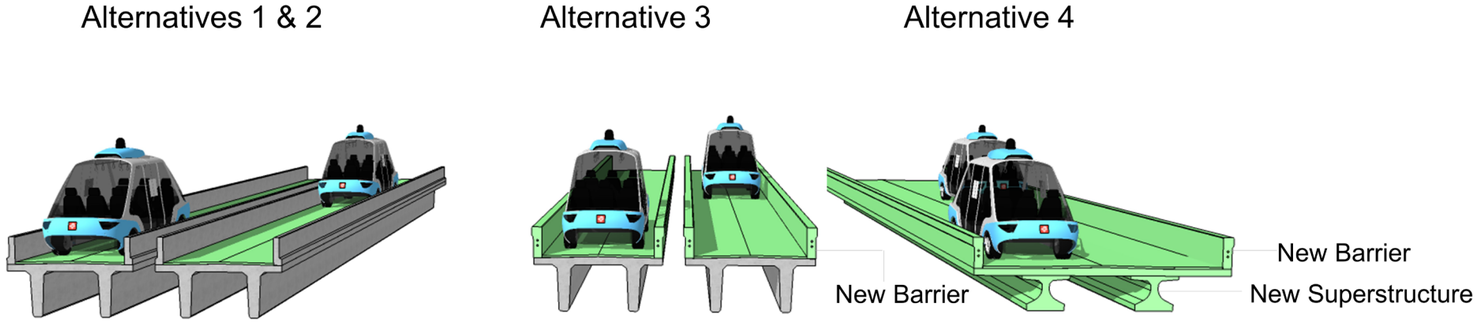
As a result, four alternatives were developed that focus on various scenarios where the existing superstructure is modified or replaced. Using the existing infrastructure, while desirable, may not always be feasible. Evaluating the alternatives focuses on the pros and cons of each scenario – for example, maintaining the existing superstructure and barrier walls limits vehicle size and operating characteristics, while, removing and replacing the superstructure provides the most flexibility in terms of vehicle type and operating characteristics, however, this would significantly increase costs. The four alternatives are summarized below.

The four alternatives considered are as follows:

- **Alternative 1:** Remove existing guidebeam, build up the superstructure at stations only to facilitate level boarding, and retain the barrier wall.
- **Alternative 2:** Remove guidebeam, provide new superstructure at stations and retain barrier wall.
- **Alternative 3:** Remove guidebeam, provide new superstructure at stations, and replace barrier wall.
- **Alternative 4:** New superstructure throughout system, retain existing piers.



Proposed Alternatives for Skyway Conversion



	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Description of Alternative	Removes the guide beam, retains the barrier, and builds the superstructure up at the stations.	Removes the guide beam, retains the barrier, and requires new superstructure at the stations.	Removes the guide beam, replaces the barrier, and requires new superstructure at the stations.	New superstructure throughout.	No Build
Guidebeam	Remove	Remove	Remove	Remove	No Build
Superstructure	Add Ramp at Stations	New at Stations	New at Stations	Replace	No Build
Barrier	Retain	Retain	Modify / Replace	Replace	No Build

Figure 7.4.1: Renderings of Alternatives

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The *U²C Infrastructure Assessment* provides details on the potential alternatives, and *2017 Inspection Report* that summarizes the existing condition and recommended maintenance. Both documents are included as reference documents for additional details and information.

All options will require raising the grade of the elevated guideway at the stations to bring the floors of the new vehicles level with the station platforms to conform to ADA requirements.

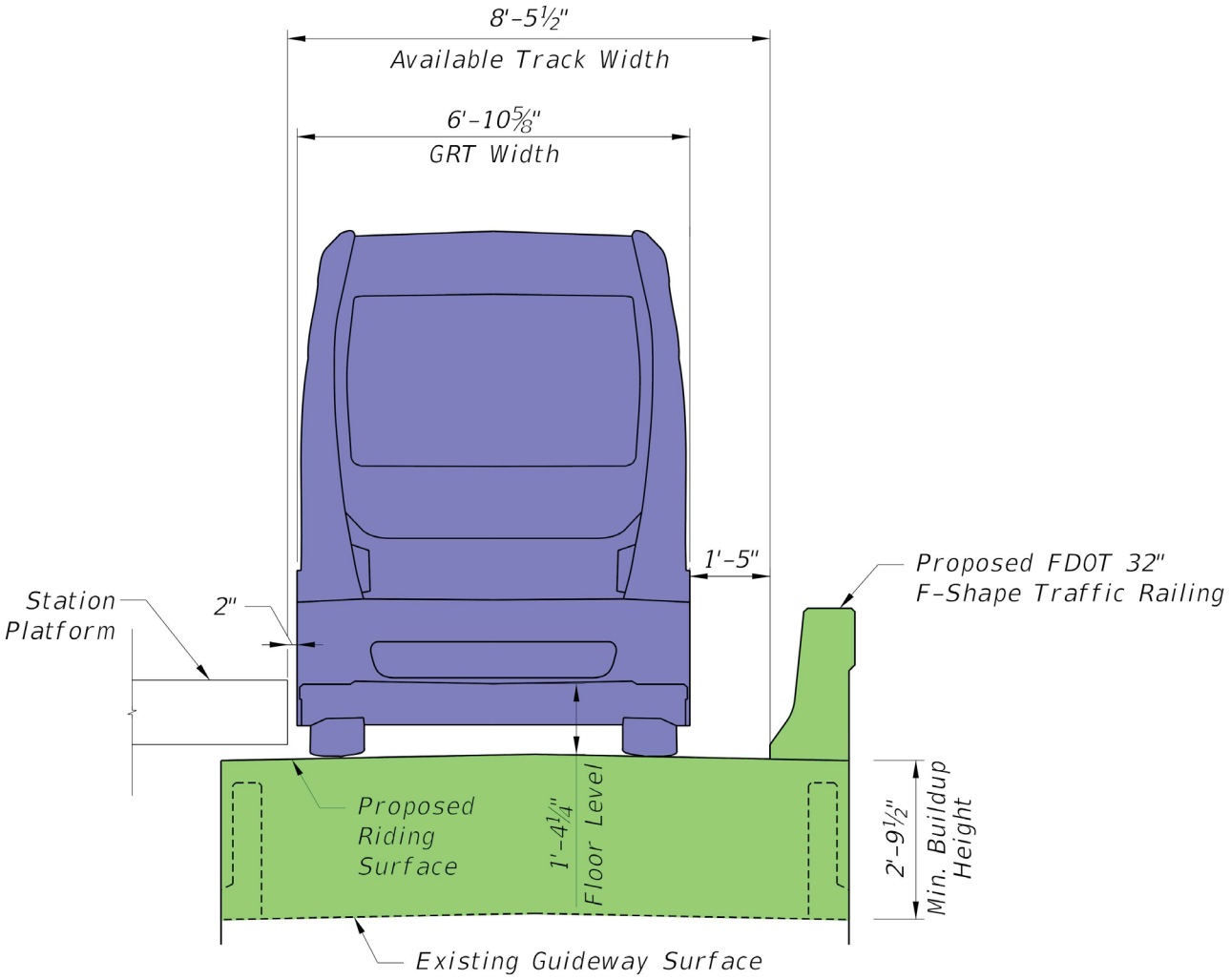

Figure 7.4.2: Typical Section View at Stations

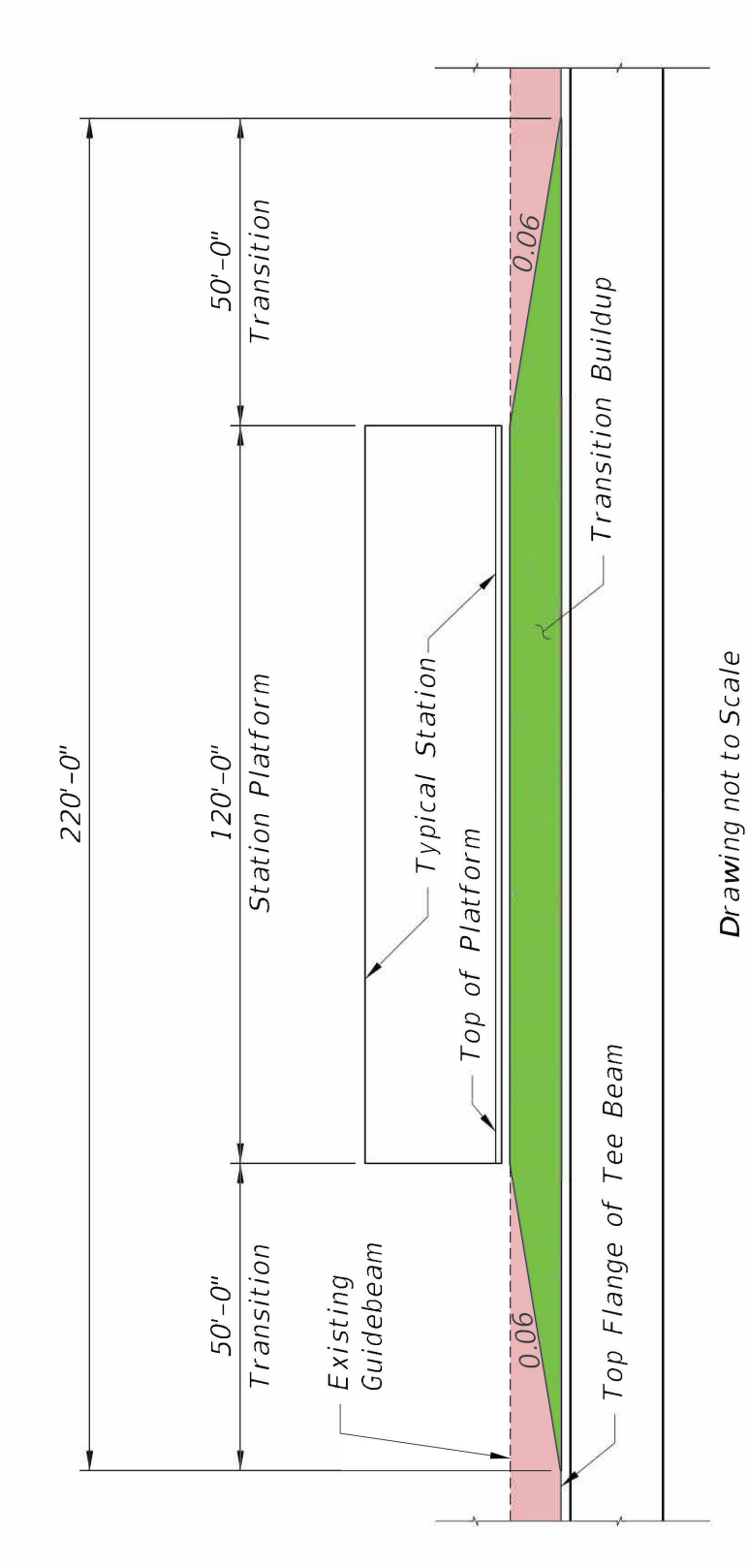

Figure 7.4.3: Profile View at Stations

7.5 Alternatives Evaluation Matrix

Evaluation Plan Development

The Evaluation Plan and methodology is designed to assist JTA select a Skyway conversion option that will offer the best value, both short and long term that achieves the stated Purpose and Need for the U²C conversion and expansion.

Since the alignment of the Skyway is already established and previous work on the Skyway assessments identified potential future extensions, the evaluation framework to be used in the U²C TCAR 1 Study consists of a single screening process focused on four broad areas:

- Operations & Safety – measures assess the extent to which the alternatives address the stated needs in the corridor such as service frequency and mobility.
- Constructability & Feasibility – measures evaluate the alternatives that provide the most flexibility in terms of accommodating an autonomous vehicle and future technologies.
- Community Impact – measures evaluate the extent to which the alternatives support other local policy goals and community desires.
- Cost Effectiveness – measures assess the extent to which the costs of alternatives, both capital and operating, are commensurate with their anticipated benefits.

Organizing the evaluation around these different perspectives helps to bring out the important trade-offs to be made in selecting the best alternative for JTA to move forward into project development.

Goals, Objectives, and Evaluation Measures

Project goals, objectives and evaluation measures describe the desired outcomes of the transit investment, both existing in the case of the Skyway, and future in the case of the U²C. These were developed based upon the recommendations and findings of recent documents, The *Skyway Modernization Report* and the *JTA Infrastructure Assessment*, both completed in 2017.

The goals, objectives and evaluation measures in the evaluation table (Table 7.5.1) consider the vision and recommendations documented in the two reports. The goals, objectives and measures were reviewed multiple times as part of collaborative process with the project team and refined prior to completing the final evaluation matrix.

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Table 7.5.1: Goals, Objectives and Evaluation Measures

Goals		Objectives	Screening Measure
Operations & Safety	Level of Service / Capacity	Provide high frequency service to improve customer experience and reduce overall trip times	Infrastructure constraints that may limit service.
	Speed	Ability to maintain service reliability and avoid critical ground constraints	Infrastructure constraints including tight curves that limit operating speed.
	Safety	Improve safety within the corridor	Cost/Benefits of mitigation measures used in operating and design plans
	Flexibility	Allows greatest flexibility for operations, vehicle type and size	Opportunity for infrastructure to accommodate different vehicles systems and operating patterns
	Operations	Ability to respond to changing demands in service	Ability of infrastructure to accommodate flexible service such as individual and coupled vehicles, demand response, point to point service, etc.
Constructability & Feasibility	Feasibility	Technical Feasibility of Alternative considering safety and constructability	Probability of alternative to provide desired level of service and safety
	Ability to accommodate variety of vehicles	Maximize ability to accommodate various types and sizes of vehicles from different manufacturers	Infrastructure ability to accommodate maximum number of vehicles currently available of different sizes
	Maximize use of existing infrastructure	Minimize cost and minimize modifications to existing infrastructure	Degree of infrastructure modification required including geometrical limitations
	Constructability	Ability to minimize construction risks	Use of proven means and methods, potential effect on local transportation network
	Continuity of Service	Minimize impacts to existing service during infrastructure conversion	Degree of system kept open during infrastructure conversion
	Damage during Demolition / Construction	Risk of damage to existing structure	Selective demolition may result in damage to structure. Pose safety hazard to workers and the public and result in increased cost and schedule
Community Impact	Connectivity	Provide safe multimodal access to the transit system	Opportunity for first and last mile service, bike share, other mobility as a service available within 1/4 mile of stations
	Economic Development	Provide convenient and accessible transit service to areas with economic development potential	Linear miles and number of stations within designated economic development areas
	Aesthetics	Provide comprehensive update of system that is safe, convenient, and attractive to downtown workers, residents, and visitors	Degree of transformation of skyway infrastructure, station areas, and new technology
Cost	Construction Cost	Existing Infrastructure: cost of modifying infrastructure to accommodate a new vehicle	Estimated initial infrastructure costs
	Service Life / Operations and Maintenance	Cost to maintain structure	Cost to maintain new vs existing structure

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Evaluation of Alternatives

The fundamental requirements to convert the existing elevated structure from a fixed rail to an elevated roadway are the primary focus for the alternative evaluation.

The following assumptions were made when evaluating each alternative:

- Autonomous vehicles will be used for each alternative.
- Supervisory System will be similar for each alternative.
- Operations will be similar.
- Brooklyn Extension is included in each alternative.

The screening of the alternatives is shown in the evaluation matrix in Figure 7.5.1. A numerical rating system was developed from 1 through 5 to evaluate each component for each of the alternatives. Each category was rated for each alternative by the project team and summarized in the following matrix. Weighting factors were assigned to each category based on the relative importance of each to project success.

Following from Section 6, Alternatives Development, four alternatives are under consideration for the purposes of the infrastructure component of the alternatives evaluation, differentiated by the extent of reconstruction needed to operate autonomous vehicles at the desired operational characteristics. The alternatives are briefly described below:

- **Alternative 1** involves removing the concrete guidebeam on the existing Skyway, retaining the barrier walls and existing superstructure, and building up the guideway at the station to allow for level boarding.
- **Alternative 2** requires removal of the guidebeam, retaining the barrier walls, retaining the infrastructure along the guideway, however, new superstructure would be provided at the stations.
- **Alternative 3** includes new superstructure at stations, removal of the guide beam, and replacement of the barrier walls.
- **Alternative 4** requires the construction of new superstructure throughout the corridor, however, the concrete piers would remain. New barrier walls and a wider running way would be provided, allowing for two-way operations throughout.

Selection of Preferred Alternative

Additional engineering analyses must be performed to determine the feasibility of each alternative with the goal to minimize costs and retain as much of the existing superstructure as possible and potentially reduce the time to implement autonomous vehicle technologies for the Skyway conversion and expansion.

Key project constraints include:

- Existing clear width of the guideway (9 foot-7 inches);
- Crash worthiness of the existing barrier walls, which may not have been designed for a vehicle without a guidebeam; and
- The vehicles themselves and the technology needed to meet the operating goals of the U²C project.

Alternative 1, while the least costly, would likely have the most limitations and must be proven to be feasible through further engineering analysis, specifically the ability to retain the existing barrier wall and for the vehicles to safely and efficiently operate within the existing width (9 foot-7 inches) of the alignment. The narrow operating width limits the size of the vehicle that can operate on the guideway.

Alternative 2 would remove the superstructure at the stations only. While costlier than Alternative 1, it has many of the same limitations related to operations and the ability for vehicles to operate on the guideway. Reconstruction at the stations may be necessary for potential structural limitations of the existing station areas, however additional engineering analysis would be needed to determine if the existing station areas would need to be rebuilt.

Alternative 3 would replace the barrier walls and the superstructure at stations. Costlier than Alternatives 1 and 2, this option may be necessary if it is determined that the crash worthiness of the existing barriers is deemed insufficient. This alternative may also provide slightly more flexibility in terms of vehicle size and operating characteristics.

Alternative 4 would provide new superstructure throughout the Skyway System, while retaining the existing piers. It is the costliest option but allows for the most flexibility in terms of vehicle size and operating characteristics. It would also allow for side by side operations and a wider guideway.

Table 7.5.2: Evaluation Matrix

Goals		Objectives	Screening Measure	Alternative 1 Remove Guidebeam Superstructure Build up at Stations & Retain Barrier	Alternative 2 Remove Guidebeam New Superstructure at Stations & Retain Barrier	Alternative 3 Remove Guidebeam New Superstructure at Stations & Replace Barrier	Alternative 4 New Superstructure throughout	Weight factor	Weight
Operations & Safety	Level of Service / Capacity	Provide high frequency service to improve customer experience and reduce overall trip times	Infrastructure constraints that may limit service.	3	3	3	4	25%	5%
	Speed	Ability to maintain service reliability and avoid critical ground constraints	Infrastructure constraints including tight curves that limit operating speed.	2	2	3	4		3%
	Safety	Improve safety within the corridor	Cost/Benefits of mitigation measures used in operating and design plans	2	2	3	4		8%
	Flexibility	Allows greatest flexibility for operations, vehicle type and size	Opportunity for infrastructure to accommodate different vehicles systems and operating patterns	2	2	3	5		5%
	Operations	Ability to respond to changing demands in service	Ability of infrastructure to accommodate flexible service such as individual and coupled vehicles, demand response, point to point service, etc.	3	3	3	4		5%
Constructability & Feasibility	Feasibility	Technical Feasibility of Alternative considering safety, constructability,	Probability of alternative to provide desirec level of service and safety	1	2	3	4	25%	10%
	Ability to accommodate variety of vehicles	Maximize ability to accommodate various types and sizes of vehicles from different manufacturers	Infrastructure ability to acoomodate maximum number of vehicles currently available of different sizes	2	2	2	4		3%
	Maximize use of existing infrastructure	Minimize cost and minimize modifications to existing infrastructure	Degree of infrastructure modification required including geometrical limitations	4	3	3	2		3%
	Constructability	Ability to minimize construction risks	Use of proven means and methods, potential effect on local transportation network	3	2	2	3		3%
	Continuity of Service	Minimize impacts to existing service during infrastructure conversion	Degree of system kept open during infrastructure conversion	3	3	2	4		3%
	Damage during Demolition / Construction	Risk of damage to existing structure	Selective demolition may result in damage to structure. Pose safety hazard to workers and the public and result in increased cost and schedule	3	3	2	3		3%
Community Impact	Connectivity	Provide safe multimodal access to the transit system	Opportunity for first and last mile service, bike share, other mobility as a service available within 1/4 mile of stations	3	3	3	3	10%	5%
	Economic Development	Provide convenient and accessible transit service to areas with economic development potential	Linear miles and number of stations within designated economic development areas	3	3	3	3		3%
	Aesthetics	Provide comprehensive update of system that is safe, convenient, and attractive to downtown workers, residents, and visitors	Degree of transformation of skyway infrastructure, station areas, and new technology	2	2	3	4		2%
Cost	Construction Cost	Existing Infrastructure: cost of modifying infrastructure to accommodate a new vehicle	Estimated initial infrastructure costs	4	3	2	1	40%	20%
	Service Life / Operations and Maintenance	Cost to maintain structure	Cost to maintain new vs existing structure	2	2	3	4		20%
Total				**42**	**40**	**43**	**56**	**100%**	**100%**
Weighted Average				2.63	2.47	2.68	3.24		
Weighted Average (Out of 100)				53	49	54	65		

Ratings	1- Very Poor	2 - Poor	3- Fair	4 - Good	5 - Very Good
	1	2	3	4	5
Weighting	1- Very Low	2 - Low	3- Medium	4 - High	5 - Very High

No Build - Continue to operate with committed maintenance funding only. Does not include rehabilitation or replacement of vehicles or systems.

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Given the current unknowns with respect to the crash worthiness of the existing barrier wall and capacity of the superstructure to accommodate the ramps at stations, Alternatives 1 and 2 may not be feasible and Alternative 3 may not provide the return on investment and flexibility of autonomous vehicle operations desired leading to consideration of Alternative 4 which includes replacement of the superstructure.

To better illustrate key questions and decisions that need to be answered to fully evaluate the alternatives, a decision tree was developed (see Figure 7.5.1) that will be used throughout the project development phase to help guide decision makers as these project unknowns are eliminated and help to determine the preferred alternative for the conversion.

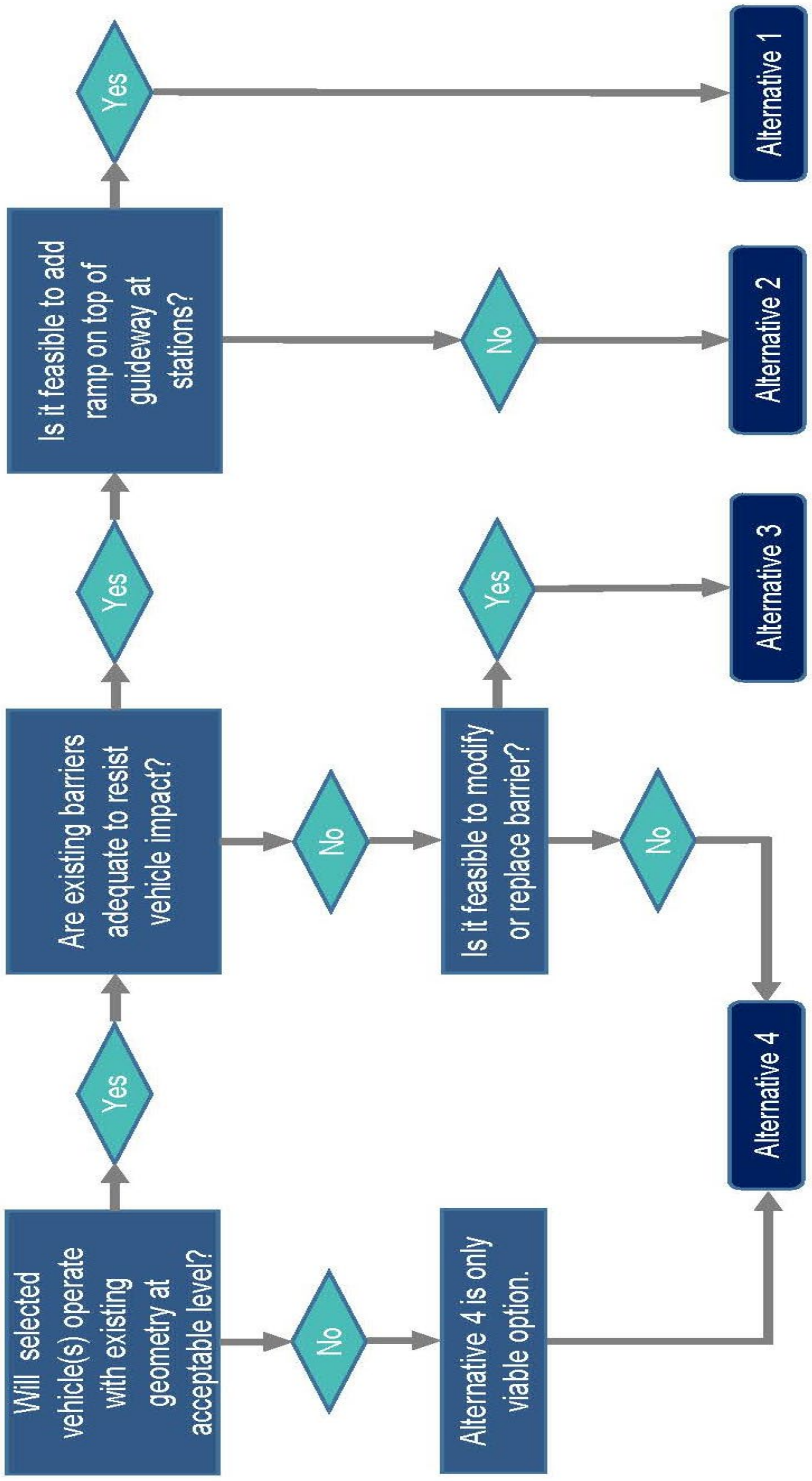
Summary

Based on the current known constraints of existing vehicle technologies and the limitations of the existing Skyway superstructure it appears that Alternative 4 would provide the best fit in terms of the stated goals of the U^2C purpose and need. However, Alternatives 1-3 should be further evaluated to develop a plan that will achieve the following goals:

- Provide an acceptable level of service;
- Maximize retention of the existing structure;
- Meet acceptable safety requirements;
- Accommodate ADA accessibility and emergency evacuation of system; and
- Provide best value to the community.

The preferred alternative could be a combination of the above alternatives as a result of further analysis and confirmation of available vehicle and systems technologies.

Figure 7.5.1: Skyway Conversion Alternatives Decision Tree



8 Public Involvement

The Skyway has been part of the Downtown landscape for more 25 years. As an iconic feature of Downtown Jacksonville, the Skyway has been engrained in many community conversations related to Downtown growth, development and mobility strategies. Additionally, as City leaders face decisions about future transportation investments, the Skyway has a wide array of support. Community dialogue has always centered on the fact that the Skyway was never fully built out according to original plans. Community leaders and the public have never shied away from saying it just doesn't go where it needs to go, and it does not connect to key community destinations.

This section of the TCAR Report summarizes the public involvement and community engagement activities that have occurred throughout the Skyway study process to afford decision makers, stakeholders, and all members of the community, the opportunity to:

- Understand the importance of transportation improvements;
- Offer feedback into the project development; and
- Participate in decision making processes.

8.1 Summary of Public Outreach in Prior Skyway Studies

As discussed in Section 2 of this report, a series of preliminary technical studies were conducted leading up to this TCAR Study. Through each phase of the Skyway assessment and evaluation process, the JTA reached out to the community to hear questions and comments, gather and document input, and solicit ideas to help reach decisions on how best to maximize the use of this importation transportation asset.

The scope of this TCAR 1 Study was built on the premise that a significant amount of transportation planning had been undertaken to examine the wide spectrum of options for the Skyway transformation and expansion. This is also true for the public engagement. Throughout the three years spanning the time from the initiation of the *Skyway Assessment* in 2014, through the *Skyway Modernization Program*, multiple activities and strategies were implemented to make the community aware of the efforts taking place to address new mobility options for Downtown. The following is a brief summary of the prior Skyway study activities.

- Online public surveys receiving more than 1600 responses.
- Two public forums with more than 100 people in attendance in January 2016 and January 2017.
- More than 25 presentations to community leaders, associations and stakeholder groups.

- Assembling a Skyway Advisory Group of more than 20 community leaders and stakeholders engaged in an intense four month review of technical analyses, technology and services.
- An Industry Forum with more than 100 people in attendance representing more than 50 companies representing engineering, technology, finance and construction sectors.
- A visualization was developed to depict more specific details of the infrastructure modifications and the features of autonomous technology.
- Test and Learn Facility constructed to provide a living outdoor lab to test autonomous vehicles and provide an opportunity for the public to ride and experience the emerging transportation technologies.

The results of these activities, which have shaped the foundation for the alternatives under consideration in this TCAR Study, have been documented in multiple reference documents which are listed as part of the table of contents for this report. Additional information on the continued involvement and subsequent outreach activities is presented throughout the remainder of this section.

8.2 Public Involvement Plan

At the outset of the project, a *TCAR Public Involvement Plan*, specific to the Skyway Conversion and Brooklyn Extension, was created to outline the plans and strategies for engaging the community to ensure that there would be widespread public involvement to increase exposure of the project within the community. Given the unique nature of this project, it was important to provide multiple formats and opportunities to share information. An enormous amount of graphic materials were prepared for this project. Many of these images were shared in presentations and at the public forums held throughout the multiple study phases.

The project team utilized multiple charts and tables to track and document outreach activities. Examples of these documents can be found in Appendix I of this report. A *Public Involvement Summary Report* serves as a separate reference document.

8.3 Summary of Outreach Activities

Presentations/Events

The project team recognized the value in utilizing visuals or presentations to share the project information. A template was developed to provide a consistent identity for the project outreach materials. Often, presentations were also tailored to specific groups to shorten, or lengthen, depending on background of the audience. During the six months from the commencement of the TCAR 1 Study in

December 2017 through July 2018, 25 presentations were conducted for various stakeholders as outlined in Table 8.1.1.

Table 8.3.1: Outreach Summary

Presentations/One-on-One Meetings			
#	**Event**	**Date**	**Comments**
1	U²C Project Delivery Workshop	1//3/18	JTA, consultants and other stakeholders in attendance
2	Agency Kickoff Meeting	1/10/18	Held at JTA Skyway Operations Training Room
3	Northeast Florida Regional Transportation Commission (RTC)	12/2017	Follow up presentation after TCAR
4	City of Jacksonville Mayor's Office	Monthly	Provide monthly updates of all U²C Program activities.
5	JaxChamber	2/19/18	Presentation and Skyway Tour
6	Agency Partners Update	3/27/18	ZOOM presentation
7	One Spark Event	4/6-7/18	Community Event; Assisted with Test & Learn outreach
8	APTA Fare Collection/Technology International Conference	4/9-10/18	Presentation at National Conference
9	APWA Statewide Conference Presentation	4/17/18	Presentation at this Statewide Conference in Jacksonville
10	LaVilla Jazz and Heritage Festival	4/22/18	Supported Test & Learn event.
11	JTAC (Jacksonville Transportation Advisory Committee)	5/14/18	Presentation
12	JTA State of the Authority	5/16/18	U²C Program video provided
13	JRTC Public Meeting	5/24/18	Table displays
14	COJ Urban CPAC	6/4/18	Presentation
15	North Florida TPO TAC	6/6/18	Presentation
16	North Florida TPO CAC	6/6/18	Presentation
17	North Florida TPO Board	6/14/18	Presentation
18	FSITE Summer Meeting	6/14/18	Presentations
19	ULI Advisory Panel	6/17-22/18	Participated in interviews
20	Downtown Investment Authority (DIA)	6/20/18	Presentation

Presentations/One-on-One Meetings			
#	**Event**	**Date**	**Comments**
21	"Open Door" Tabletop at Riverside YMCA	6/25/18	Tabletop displays/surveys near Brooklyn Extension.
22	Public Forum	6/26/18	Main Library 4 – 6 pm
23	Downtown Development Authority (DDRB)	6/28/18 2 pm	Presentation
24	Downtown Vision Stakeholders Quarterly Meeting	7/3/18, 8:30 am	Presentation

Multiple project team members shared in conducting presentations or participated in events throughout the community. Some of the key presentations include the May 14, 2018 presentation for the Jacksonville Transportation Advisory Committee (JTAC) which represents the disabled community who utilize JTA transit services; and the June 6th and 14th presentations to the committees and board of the North Florida TPO. In general, all presentations generated support for the Skyway transformation, but most importantly, created an awareness of our community's important mobility challenges and transportation assets.

Project team members supported activities related to community events or other JTA project meetings, such as the public meeting for the construction of the JRTC, to distribute information pertaining to the TCAR Study and obtain feedback from the community.

LaVilla Jazz Festival, April 2018

Public Meetings

As part of the TCAR outreach plan, in addition to the presentations and events outlined in Table 8.1, two public meetings were conducted in June 2018 to share the project information, technology research and potential options for the proposed transportation improvements.

The first public meeting was held on June 25, 2018 in the format of an “Open Door” Tabletop held at the Riverside YMCA near the Brooklyn extension segment of the project study area. At this Tabletop Session, the project team was set up in a general purpose room, from 9 am until 5 pm, at the popular YMCA location on Riverside Avenue. Members of the community could peruse project maps and ask questions of the project personnel. Approximately 22 people signed in at the event. Comment cards and surveys were made available to document feedback. Additionally, the displays included an electronic kiosk to allow the public to view the Skyway/U2C Program visualization that was developed and updated throughout the Skyway assessment process.

The second opportunity was a public meeting, in the format of an Open House, was held at the Main Library in Downtown Jacksonville on June 26, 2018 from 4 pm until 6 pm. Approximately 41 people signed in at the meeting, including project support staff and agency representatives. A series of project displays and a continuous looping PowerPoint presentation were the featured materials at the public meeting to present the project information. An informational handout, included in Appendix I was developed. Comment forms and surveys were made available to document public comment and questions. Five comment cards were received and 11 surveys were completed at the event. A brief overview of the survey comments is provided below and copies of the survey will be included in the *Public Involvement Summary Report*.

Public Meeting Signage, June 2018

Public Meeting, June 2018

Video Kiosk, Public Meetings, June 2018

Included with the display materials was a video kiosk to show the five minute visualization developed by the project team to provide a narrated visual understanding of the proposed Skyway transformation and U²C Program development plan.

A complete set of the displays are included in the *Public Involvement Summary Report* prepared as a separate reference document for the project.

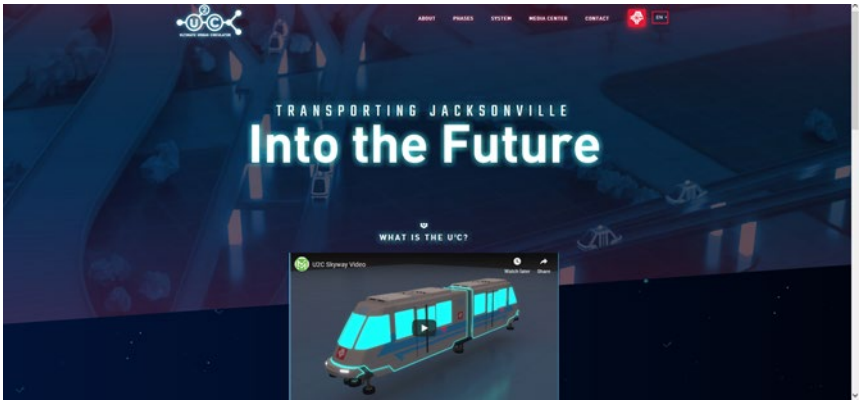
Notification

The preparation for the public meetings included the development of a project mailing list for all properties within 400 feet of the Skyway alignment and stations. This list includes over 400 property owners based on the City of Jacksonville Property Appraisers database. A map depicting the limits is provided in Appendix H and will be included in the Public Involvement Summary Report.

Additional Outreach Tools

Website

During the *Skyway Modernization Program*, JTA created a webpage specific to the U²C Program development, www.u2cjax.com. This website was valuable to provide additional opportunity to share the graphics materials including the computer generated visualization. The website will be continually updated through the development of the U²C Program.



U2Cjax website screenshot

Surveys

Building upon the surveys used during the earlier phase of the *Skyway Modernization Program*, a new survey was developed and distributed as part of the project public meetings and presentations. Fifty surveys have become a part of the project files as part of the TCAR process, adding to the more than 1600 survey respondents in the previous planning study. Of the TCAR survey respondents, 95% support the expansion of the system to Brooklyn and approximately 70% "Strongly Support" JTA's proposal to use autonomous transit shuttles to replace the monorail trains. Additionally, approximately 67% of those completing surveys indicated they would support paying a nominal fee for the expanded system. Community feedback focused on the lack of destinations served by the current Skyway system. A copy of the updated survey is included in the *Public Involvement Summary Report*.

Comment Cards

Acknowledging that various forms of the materials are necessary to document public feedback, comment cards were also created to use at the various events, meetings and presentations. To date, eleven comment forms have been added to project files.


Comment Card

PUBLIC MEETING _____

Ultimate Urban Circulator (U²C) Program

PLEASE PRINT:

Name: Last First Middle Initial

Address: Street

City State Zip Code

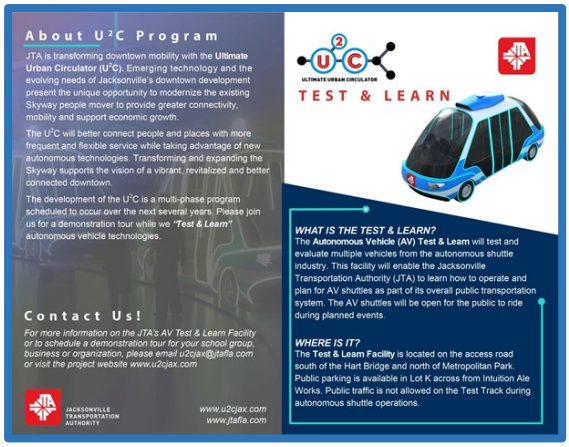
Comment:

Example Comment Card

Test & Learn Facility

Undertaking a unique and transformative project such as the Skyway modernization and expansion is both exciting and challenging for the project team, as well as for stakeholders and the community. The arena for autonomous vehicle technologies is new and complex. In order to advance the examination of autonomous vehicles and further the understand the operation and maintenance, JTA embarked on creating an "Autonomous Vehicle Experience" for the public, and JTA staff, to see, ride and provide feedback on autonomous transit shuttles under consideration in this project.

Test & Learn Facility



Test & Learn Flyer

The Test and Learn Facility was created and launched in December 2017, at the commencement of the TCAR Study. The Test and Learn Facility is a one-third mile test track located downtown adjacent to the sports and entertainment complex. Vehicle vendors have been contracted to run various autonomous shuttles over the next two years. The Test and Learn will not only provide important data on the operations of the autonomous vehicle but it also provides the opportunity to gather input on public perception of autonomous technologies. Industry professionals, elected officials and school groups can schedule a time to ride the autonomous shuttle. A flyer was developed, as well as short survey, both distributed as people ride the vehicle. The TCAR project team participated in staffing several events at the Test and Learn to further expand the awareness of the proposed Skyway modernization and expansion.

Test and Learn, April 2018

Agency Coordination

Through the *Skyway Modernization Program*, several workshops were convened to bring together agency representatives from FDOT, City of Jacksonville, the Downtown Investment Authority (DIA), Downtown Vision (DVI) and the North Florida TPO. The TCAR Study is a collaborative effort between the JTA and the FDOT. The JTA also meets regularly with the City of Jacksonville to review various components of the U^2C Program development.

The TCAR Study process included a Kick-Off meeting held on January 10, 2018 and an Agency Partner Update on March 27, 2018 in advance of the public presentations and participation in community events. Copies of the presentations and other materials will be included in the *TCAR Public Involvement Summary Report*.

Prior to the TCAR Public Forum and Open House, presentations were made in June 2018 to provide an update on U2C Program activities for the North Florida TPO Technical Advisory Committee, Citizens Advisory Committee and Board of Directors.

9 Financial Analysis and Potential Funding

9.1 Cost Estimates

Order of magnitude cost estimates were prepared to assist with the comparison of each alternative. Estimates were developed using approximate quantities using unit costs from FDOT historical data including long range estimates (LRE), JTA Operations and Maintenance budget and other sources including engineering judgment. A detailed order of magnitude estimate is included in Appendix G. Estimates are organized into the following categories:

- Initial Capital Cost
  - Infrastructure.
  - Vehicles.
  - Systems.
- Operations and Maintenance
  - Initial & Routine Maintenance.
  - Recurring Maintenance.
  - Operations.
  - JTA Enterprise.
  - Consultant Planning and Design.

The initial capital costs for infrastructure were developed as part of the *U²C Infrastructure Assessment* which is included as a reference document. Costs for vehicles and systems are based on information from vehicle vendors and JTA planning estimates for systems.

Initial and routine maintenance costs are based on information from the *2017 Biannual Inspection Report* which is also included as a reference document.

Recurring and operating costs are based on historical information and engineering assumptions for intervals and extent of rehabilitation or replacement that may be required for major components including vehicles, infrastructure repair, etc.

JTA Enterprise costs includes estimates for staffing, IT, communications, executive services, and other miscellaneous administrative costs. Consultant planning and design costs are based on a percentage of estimated capital costs for each alternative.

Estimates are presented for planning purposes only and that more detailed estimates should be prepared during further stages of project development. Actual costs could vary significantly from the estimates in this report and will be dependent on a variety of factors including the extent of infrastructure modifications required and market conditions at time of procurement.

The estimates were incorporated into the financial model the results of which are presented in the following section.

9.2 Summary of Funding Options

As part of the TCAR 1 Alternatives Analysis financial analysis services for the alternatives is provided. This included the development of a project-level financial model that would be used to compile the estimated capital and operations and maintenance costs as well as identified potential funding sources to evaluate the feasibility of each option.

Model Scenarios

In total, three separate funding and financing scenarios were conducted for each of the four individual alternatives, with one additional model run for the "No Build" option, for a total of 13 model runs:

- **Local Funding Only** - Model runs 1-5 evaluated each of the four alternatives, plus the "No Build" option, with the assumption that JTA would shoulder the entire financial responsibility for the project, including capital and operations and maintenance. Each of these model runs requires a significant contribution from JTA for which no funding has yet been identified beyond project development.

- **Local – State Funding** - Model runs 6-9 evaluated each of the four alternatives with the assumption that JTA and FDOT would share the financial burden for the upfront capital portion of the project. The "No Build" option was excluded from this additional analysis. As with model runs 1-5, it was assumed that JTA would bear the responsibility of funding operations and maintenance of the system. While an upfront contribution from FDOT helps reduce the capital costs for JTA, each model run still requires a sizeable contribution from JTA, again, for which no funding has yet been identified beyond project development.

- **Local – State – Federal Funding** - Model runs 10-13 evaluated each of the four alternatives with the assumption that FTA would shoulder 50% of the upfront capital costs (likely though a grant process such as the Small Starts Program) and JTA and FDOT would split the remaining 50% for the upfront capital portion of the project. Again, the "No Build" option was excluded. As with model runs 1-9, it was assumed that JTA would bear the responsibility of funding operations and maintenance of the system. With the addition of FTA as a capital funding partner, each of the alternatives comes closer to achieving financial feasibility. Model runs 10-13 were further refined to include some basic financing scenarios for the JTA capital cost contributions to demonstrate the annual cost to JTA should a loan such as and FDOT State Infrastructure Bank Loan be utilized to cover the local match.

The cost estimates for capital, operations and maintenance are included in Appendix G for reference purposes.

The model assumes a total lifecycle of 50 years. This time period includes assumed design-build for 3 years and operations and maintenance for 47 years. The project is expected to be not in use at the end of the 50-years. This was simply used to capture the impact of each alternative across time while also providing a long enough time horizon to evaluate the impact of potential financing options.

For financing the scenarios assume a FDOT State Infrastructure Bank (SIB) Loan to advance local funds for the local match (JTA) portion of the capital costs. This was assumed with the understanding that the FDOT SIB Loan would only qualify as local match as long as the loan was repaid using local funds.

Funding sources were identified for the Project Development stage of the project, with the funds required for the local share of capital and operations and maintenance remaining to be identified in the next stage of project development.

Financial Summary Results

Table 9.1.1 shows the funding breakdown for the most economically viable option for each of the four alternatives: 50% FTA capital funding contribution, 25% FDOT capital funding contribution and 25% JTA (Local) funding contribution.

Table 9.1.2 summarizes the cumulative impact of the project over the full 47-year forecast and Includes debt service, operations and maintenance and renewal and replacement costs.

Based on the estimated funding share and assuming a low cost FDOT SIB loan to cover the JTA funding portion, JTA would be responsible for $1.3-$2.5 million (depending on the chosen alternative) per year for 30 years to cover the local matching portion of the upfront capital contribution.

For operations and maintenance, the model assumes a 47-year forecast with costs for the new system beginning in 2021 after a three-year design/construction phase. Costs to operate and maintain the system begin initially around $4 million and increase each year based on assumed inflation rates and increased ridership. In terms of an average annual operations and maintenance cost over the full 47-year term, it ranges from $8.25-$9.50 million for the lowest and highest cost alternatives for the project.

Table 9.2.1: Initial Capital Cost Funding Share

Initial Capital Cost Funding Share	Alternative 1	Alternative 2	Alternative 3	Alternative 4	No Build
	JTA 25% FDOT 25% FTA 50%	JTA 25% FDOT 25% FTA 50%	JTA 25% FDOT 25% FTA 50%	JTA 25% FDOT 25% FTA 50%	JTA 100%
Capital Costs	104,911,705.08	123,373,930.26	140,690,135.97	183,710,792.65	13,487,422.88
Funding Share					
JTA Capital Cost Contribution	26,227,926.27	30,843,482.56	35,172,533.99	45,927,698.16	13,487,422.88
FDOT Capital Cost Contribution	26,227,926.27	30,843,482.56	35,172,533.99	45,927,698.16	-
FTA Capital Cost Contribution	52,455,852.54	61,686,965.13	70,345,067.99	91,855,396.32	-
Total Capital Funding	104,911,705.08	123,373,930.26	140,690,135.97	183,710,792.65	13,487,422.88

Table 9.2.2: Cumulative System Cost over 47-Year Operating Period

Operating Period (47-Years) Cumulative Cost by Funding Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	No Build
	JTA 25% FDOT 25% FTA 50%	JTA 25% FDOT 25% FTA 50%	JTA 25% FDOT 25% FTA 50%	JTA 25% FDOT 25% FTA 50%	JTA 100%
Cumulative Operating Costs					
Total Debt Service Payments (30-Year term)	40,070,233.44	47,121,740.92	53,735,534.92	70,166,949.84	N/A
Total Operations & Maintenance (O&M) Costs (47-Years)	240,926,435.57	240,926,435.57	240,926,435.57	240,926,435.57	446,476,081.97
Total Renewal & Replacement (R&R) Costs (47-Years)	117,828,311.44	117,828,311.44	117,828,311.44	65,641,548.03	57,092,627.99
Total Debt Service, O&M and R&R	398,824,980.46	405,876,487.94	412,490,281.93	376,734,933.44	573,735,659.80

10 Related Activities, Summary and Next Steps

10.1 Related U²C Program Activities

The project presented in this report, the conversion of the existing skyway and Brooklyn extension represents one component of the overall U²C Program currently in progress. Other significant ongoing U²C Program projects include:

- **Test and Learn Facility** – JTA has contracted with several vehicle operators to test various autonomous shuttles in Downtown Jacksonville. This includes providing community access for select events and conducting public surveys.
- **Bay Street Innovation Corridor** – In cooperation with the City of Jacksonville, North Florida TPO and the Jacksonville Chamber of Commerce, JTA is investigating deployment of autonomous vehicles on Bay Street at street level in dedicated lanes or in mixed traffic. It is anticipated that the evaluation of this project will be included as part of the next study TCAR 2.
- **Autonomous Avenue** – This project consists of advancing the conversion of the existing elevated track between Convention Center Station (at new JRTC) east to Jefferson Station due to construction of the new JRTC complex. This will serve as a pilot project to further evaluate the feasibility of the conversion and will be applied to the concept for the overall conversion.
- **ULI Study** – In conjunction with the ULI, JTA initiated a study in June 2018 to assess the potential economic impact of the U²C Program. The ULI panel presented key findings to JTA and community leaders on June 22, 2018. The full report, *A ULI Advisory Services Panel Report, Leveraging Transit for Economic Development*, Jacksonville, Florida June 17-22, 2018 is included as a reference document.
- **Public Outreach and Stakeholder Coordination** – JTA continues to coordinate with local partners including FDOT North Florida TPO, City of Jacksonville and the Jacksonville Chamber of Commerce, as well as, the business community to develop overall strategy for the U²C Program.

10.2 Summary

This TCAR Report has been prepared to present information required to demonstrate the evaluation of the proposed transportation improvements and request that the FDOT consider this project, the modernization and transformation of the existing Skyway to accommodate autonomous vehicles, for acceptance into the State and/or Federal Project Development process and that additional funding be provided to continue project development.

The alternatives under consideration all include new autonomous vehicles, modernized supervisory system and station upgrades and various scenarios for infrastructure transformation.

Due to the complexity and unique nature of this project additional evaluation is needed to identify the preferred alternative for the transformation of the infrastructure.

The development of an autonomous transit network is an emerging industry with rapid changes occurring each year. Further assessment of the performance of these vehicles must be performed to confirm their suitability as a replacement that will provide a level of service that meets or exceeds the performance of current system. Further investigation is required to assess available vehicle options through continued testing and monitoring to ensure that selected vehicle or vehicles will meet performance and safety requirements.

10.3 Recommended Next Steps

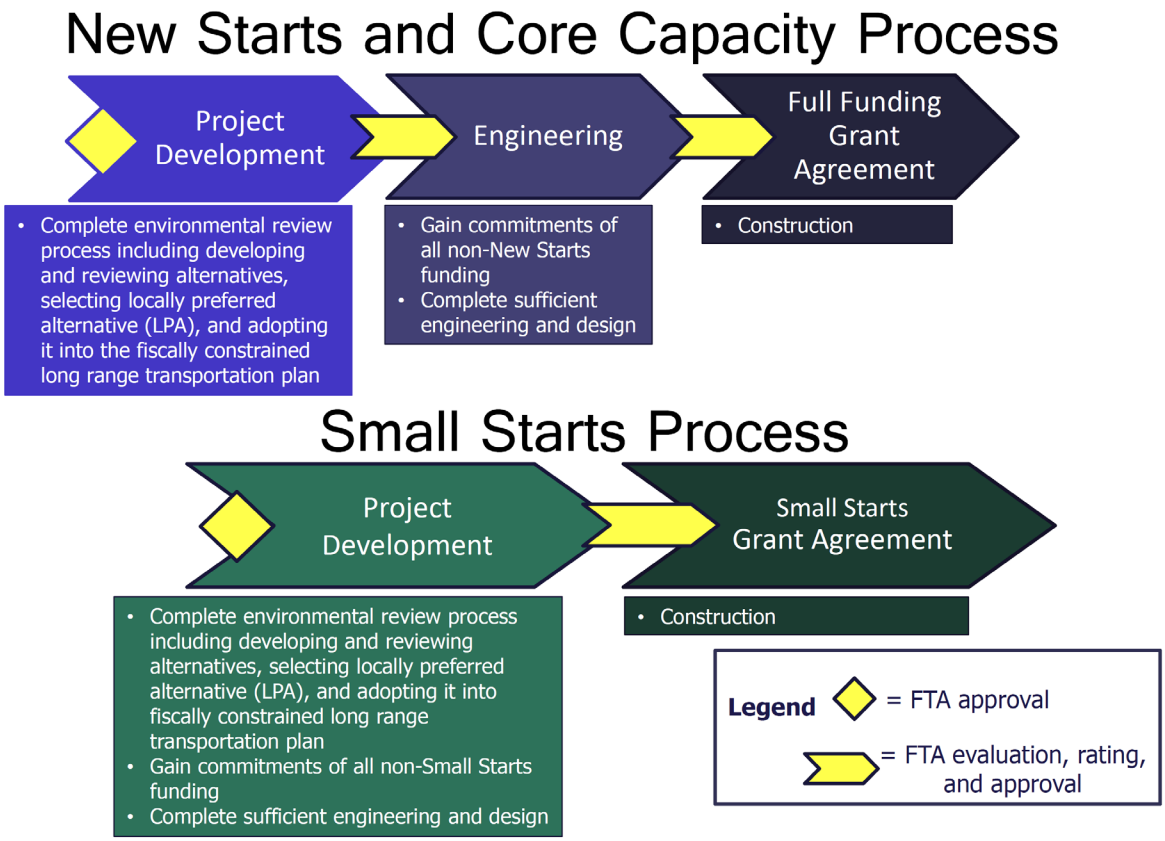
JTA recommends that this project be accepted into Project Development (PD) and that additional funding be made available to continue development of a preferred alternative for the conversion of the existing skyway infrastructure and systems to accommodate autonomous vehicles with an extension to Brooklyn Station.

Entry into the FTA's PD process requires a formal written request to FTA outlining the project elements and the purpose and need for the project. The documentation included in this TCAR Report will provide the necessary documentation needed to enter into the next phase of the Capital Investment Grant Program (CIG). In accordance with the TCAR guidance a separate letter/package describing the project and requesting entry into the PD phase has been prepared. Figure 10.3.1 illustrates the Federal process for the New Starts and Small Starts Process.

The purpose of the TCAR Report is to document data and analysis that provides the justification needed to enter the PD phase. In general, it takes two years from the time project sponsors are granted entry into PD by the FTA and when the Small Starts/News Starts project application is submitted. During that time span, project sponsors will complete the NEPA process, complete 30% engineering, and adopt a Locally Preferred Alternative (LPA).

Depending on the cost of the project and federal funding requested, the project can either be considered for New Starts or Small Starts. New Starts projects are those with a total cost of greater than $300 million, or request more than $100 million in Federal funds. New Starts projects have a more involved process and additional decision points by FTA, however, federal funding for engineering and final design can be included as part of the project cost. Small Starts is a more streamlined process for projects less than $300 million in total cost and less than $100 million in federal funds. The advantage of the Small Starts program is that once the PD phase is completed, the grant recipient can move directly into construction once a medium or higher rating has been received and a Small Starts Grant Agreement has been executed.

Figure 10.3.1: FTA Capital Investment Grant Program



However, all non-Federal financial commitments need to be identified, engineering and design needs to be sufficient to enter into construction, and the environmental review process needs to be completed.

While a specific LPA has not been identified to date, the TCAR Report documents the steps needed to complete the PD phase. The infrastructure report, ridership projections, preliminary cost estimates, and public involvement process completed to date provide sufficient documentation for entry into the process.

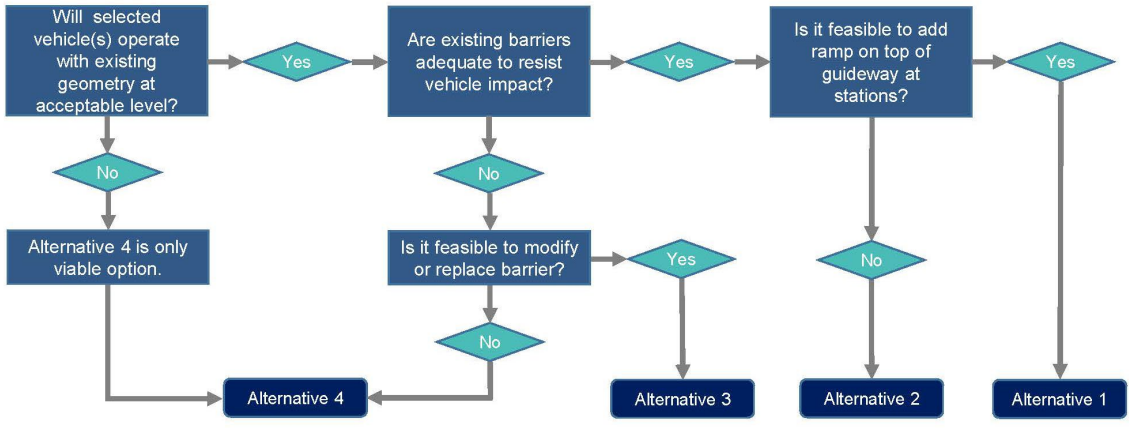
The following is a list of required information that needs to be included in a letter addressed to the FTA for requesting approval to enter into PD:

- Name of project sponsor, project partners, if any, and roles and responsibilities of each.
- A brief description and map of the corridor being studied, including length and key activity centers.
- A brief description of the transportation problem or a statement of purpose and need.
- Electronic copies of or weblinks to prior studies completed, if any.
- Identification of a proposed project if one is known and alternatives to that project if any are being considered.

- A brief description of current levels of transit service in the corridor today.
- Identification of a cost estimate for the project, if applicable.
- Anticipated cost to complete PD, not including cost of any work done prior to officially entering the PD phase.
- Identification of non-CIG funding available and committed to conduct the PD work.
- Documentation demonstrating commitment of funds for the PD work.
- An anticipated draft timeline for completing the following activities.
    - NEPA documentation.
    - Selected LPA.
    - Adoption of the LPA into the fiscally constrained Long Range Transportation Plan.
    - Completion of the activities required to obtain a project rating under the evaluation criteria outlined in the law.
    - Completion of the readiness requirements for entry into Engineering.
    - Anticipated receipt of a construction grant agreement from FTA.
    - Anticipated start of revenue service.

The alternatives identified in this report will be further refined during the PD phase (30% engineering). The decision tree shown in Figure 10.3.2 will assist JTA and community decision makers in choosing the best alternative for the existing Skyway infrastructure that best addresses the purpose and need for the project based on construction feasibility, cost effectiveness, and desired operating characteristics. Other project elements being considered include identifying vehicle requirements and supervisory systems necessary to achieve the desired U^{2}C program. Many of these activities are currently underway and being developed by JTA.

Figure 10.3.2: Alternatives Decision Tree



Recommended next steps for project development include:

- Continued testing of autonomous vehicles
- Development of performance requirements for supervisory system
- Assessment of station modifications that will accompany the transformation
- Further evaluation of infrastructure conversion to confirm extent of modifications needed
- Development of a preferred alternative with refined cost estimates
- Complete NEPA documentation
- Develop a financial plan
- Adopting a Locally Preferred Alternative into the fiscally constrained Long Range Transportation Plan
- Development of a Risk Register to assist JTA in selecting/evaluating the alternatives

After the PD phase is completed, JTA will need to complete a New Starts (or Small Starts) Application which will request that FTA rate the project. A medium or higher rating will be required to receive funding (subject to funding availability) for the project. A New Starts Application package should include the following:

- New Starts templates used for developing the evaluation criteria and ratings which can be found here - https://www.transit.dot.gov/funding/grant-programs/capital-investments/how-apply
- 20-year financial plan, including supporting documentation
- Cost estimate provided using the Standard Cost Category (SCC) worksheets
- Project Management Plan and Subplans
- Integrated project schedule
- Documentation of plans and documents
- Contracting plans and documents
- Project delivery method identified
- Identification of third party agreements with schedule for completion
- A preliminary geotechnical report
- A draft value engineering report
- Preliminary safety hazard analysis, preliminary threat and vulnerability analysis as well as initial safety and security design criteria
- A draft constructability review report
- Draft before and after study data collection plan

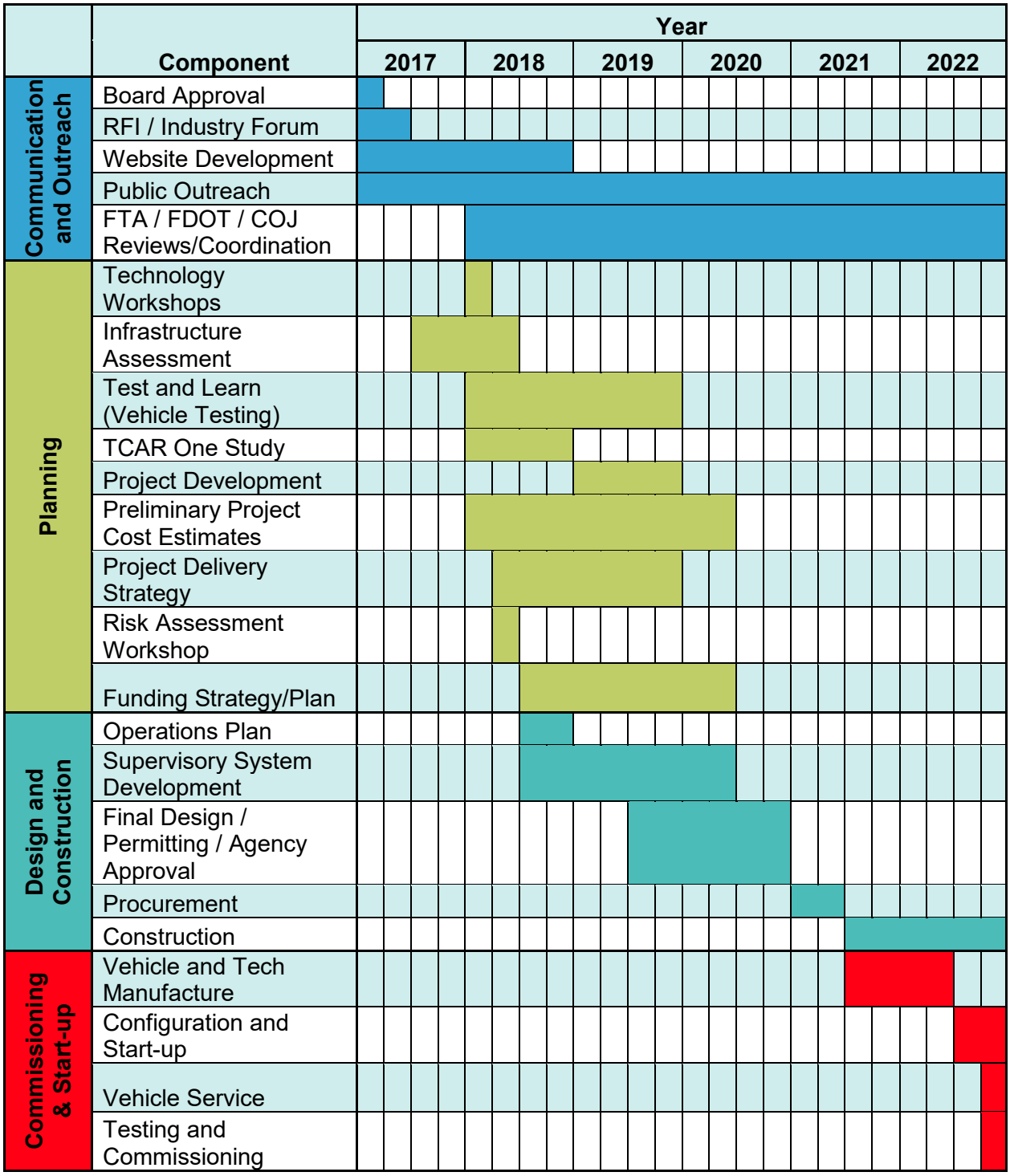
The New Starts and Small Starts application packages are not significantly different; however, the Small Starts application does not require approval to enter into a separate Engineering Phase and the two year limit for completing PD is not specified, though following the two-year time frame would make sense in terms of keeping the U^2C program moving into implementation. Sufficient engineering and Design should be included in the package for FTA to make an informed decision. More competitive projects will have fewer project unknowns and potential risks associated with

environmental constraints, constructability, financing, and public support. Also, the greater the non-Federal funding included in the project financial plan, the greater likelihood of the project receiving a better rating.

10.4 Project Milestones

Preliminary project milestones (Figure 10.4.1) have been developed to illustrate future planning, preliminary design, and related activities to enable the success of the Skyway modernization and transformation program. The overriding goal is that the program be successfully implemented prior to the onset of additional maintenance and operational issues that could result in either a significant reduction in operations or shut down of the existing Skyway.

Figure 10.4.1: TCAR 1 - Skyway Conversion and Brooklyn Extension Milestones



Milestones are presented for planning purposes only. Actual schedule will be dependent on a variety of factors including funding availability, technology readiness, agency approvals etc.

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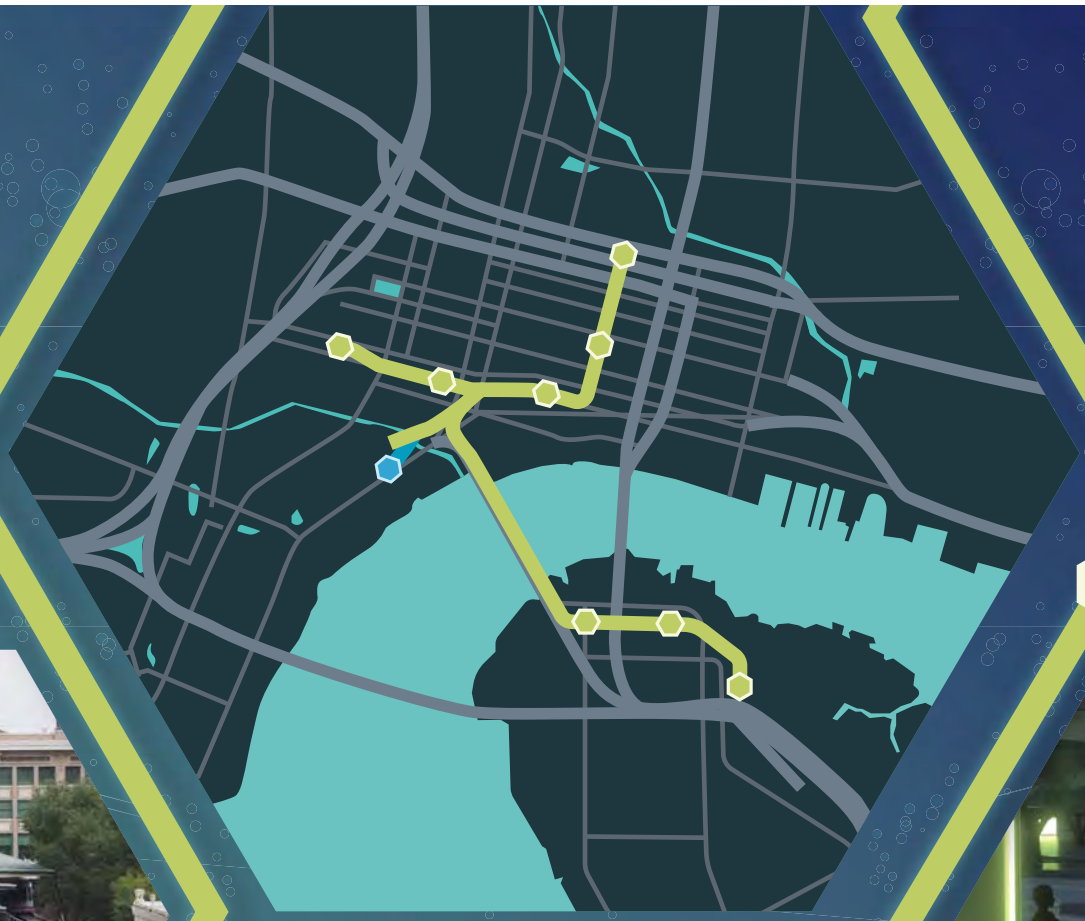
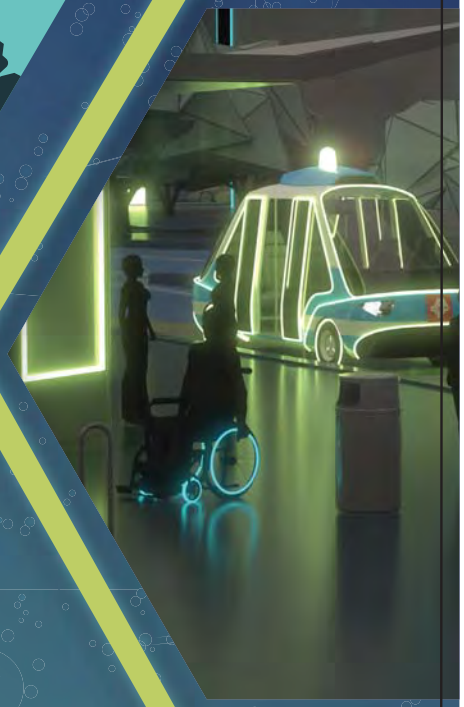
Appendices





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