



Reimagining Mobility Project

Local Alternative Mobility Network
Orange County, Florida



The United States Department of Transportation
“Better Utilizing Investments to Leverage Development (BUILD)”
FY 2019 National Infrastructure Investments

Funding Opportunity Number: DTOS59-19-RA-BUILD
CFDA Number: 20.933 -- National Infrastructure Investments

JULY 15, 2019

Letter of Transmittal



ORANGE COUNTY MAYOR

Jerry L. Demings

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July 10, 2019

The Honorable Elaine Chao
 Secretary of Transportation
 The United States Department of Transportation
 1200 New Jersey Avenue, SE
 Washington, DC 20590

Dear Secretary Chao:

As Chief Executive of Orange County, Florida, I am pleased to submit an application for a U.S. Department of Transportation (DOT) “Better Utilizing Investment to Leverage Development” FY 2019 National Infrastructure Grant.

An important item on Orange County’s priority agenda is to pursue and execute innovative and efficient ways to accommodate the transportation needs for our 1.4 million residents and nearly 75 million annual visitors.

Like most public entities, we seek creative ways to leverage and implement public-private partnerships. In this application, we are proud to showcase such a partnership with Tavistock, the developer of Lake Nona in South Orange County. Tavistock will help deliver our collective vision of a local alternative mobility network project entitled “Reimagining Mobility”.

This multi-faceted project features many new technologies and directives that DOT is embracing to include the safe use of autonomous shuttle vehicles and green infrastructure, which connects mobility support facilities. These facilities will serve first and last mile access to essential services. By reducing automobile dependency, we strive to create better mobility options. This can be a model for future deployments in Orange County as it serves our residents and visitors now and in the future.

We are also grateful for the 43% local match, in excess of \$18 million that the Tavistock / Lake Nona private partnership has committed toward the total project cost of \$43 million (BUILD grant ask of \$25 million).

Thank you for your leadership in exploring new and vital ways to enhance mobility for citizens across the country. The “infrastructure agenda” is key to our economic vitality as a city, county and nation and we salute your role in leading the way to a safer and mobile future for all Americans.

Sincerely,

A handwritten signature in blue ink that reads "Jerry L. Demings".

Jerry L. Demings
 Orange County Mayor

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1.0 Project Description

With a population of over 1.4 million residents and a visitor base exceeding 75 million annually and growing, Central Florida, and Orange County in particular, remains one of the most mobility-challenged areas in the United States. Current road infrastructure, even at an ever-quicken pace of construction, cannot keep up with resident and transient population demand.

New and innovative mobility solutions are needed.

The Reimagining Mobility Project provides Orange County with a first of its kind, robust Local Alternative Mobility Network (LAMN). This LAMN will be located in south Orange County at Lake Nona, a 17-square-mile innovative “Wellbeing Community” adjacent to Orlando International Airport (see Figure 1). The Lake Nona area LAMN will tie into existing and future infrastructure and integrate multi-modal systems into a rapidly developing urban fabric. Accommodating pedestrians, cyclists (both casual and commuter), electric assist personal vehicles, and a fleet of autonomous vehicles (AV’s), the project will modify existing and create new infrastructure consisting of multi-use corridors, dedicated commuter ways, mobility hubs, and AV support infrastructure that will reduce automobile dependency and better connect residents, visitors, and students to employment, medical facilities, essential services, retail, education and entertainment offerings.

BUILD Grant funding will support the planning, design, and construction of critical infrastructure, including shared mobility lanes, dedicated rights of way (ROW), recovery zones for user equipment repairs, rest and hydration, a head-end mobility hub, sheltered waiting areas, upgrading of existing pedestrian and bicycle paths, naturally shaded and streetscaped environments, and LAMN wayfinding.

The full-scale implementation of the LAMN will improve public safety and quality of life for residents of and visitors to Lake Nona by further enabling modal choice while reducing the burdens of commuting and congestion-related emissions and the quantity of traffic incidents/ accidents. The resultant impact on the built environment is a sustainable and intelligently developed, higher density, mixed-use community as Lake Nona approaches more than 35,000 residents, 15,000 students, and more than 30,000 employees at buildout. By the end of 2022, it is projected that Lake Nona will receive over 12 million annual visitors including hotel guests, competitive tennis players at the USTA National Campus, Medical City Visitors (the Orlando VA Medical Center, Nemours Children’s Hospital and the University of Central Florida Medical Center), KPMG’s Global Training and Innovation Center, and a 1.4M square-foot major expansion of the office, entertainment, dining and retail based urban core of Lake Nona.

The LAMN will allow for intelligent changes in regional and local planning in other critical areas of Orange County including fast-growing west Orange County and the mobility-challenged and highly visited Orange County Convention Center zone. Testifying to the need and feasibility of this project, the applicant attaches Letters of Support, as shown in **Appendix B**.

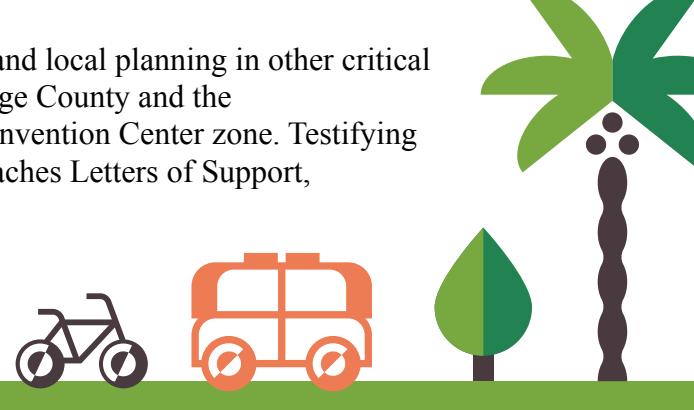




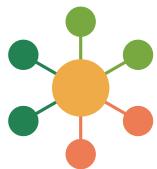
Figure 1: Proposed Local Alternative Mobility Network Map

The LAMN at Lake Nona will allow for intelligent changes in regional and local planning in other critical areas of Orange County in central Florida including fast-growing west Orange County and the mobility-challenged and highly visited Orange County Convention Center zone. Testifying to the need and feasibility of this project, the applicant attaches Letters of Support, as show in **Appendix B**.

In addition to the infrastructure and supporting facilities to be funded in part by the BUILD Grant, an Innovation Center will be privately funded, focused on studying next-gen transportation networks. This will be a shared asset for Orange County, University of Central Florida, Lake Nona, BEEP, private enterprises, and public entities to help advance small business enterprises that can contribute solutions in the AV space. Additionally, this facility will be utilized to provide training and educational opportunities to advance job opportunities for the disadvantaged.

To deliver on this vision, a detailed Project Scope Narrative (See **Appendix C**) and Project Budget (See **Appendix D**) have been developed to build the infrastructure required to enable innovative alternative mobility solutions for the community, workforce, and visitors.

The LAMN is comprised of five primary components:



Mobility Network Hub

Full-service hub facility for recreational and commuter users located in Lake Nona Town Center, connecting all modes of transportation and inclusive of restrooms with shower facilities, digital kiosks, seating, bike racks, storage and access to dedicated parking.



Autonomous Vehicle Infrastructure

Infrastructure required for the safe and efficient operation of an AV fleet consisting of approximately 20 multi-passenger shuttles on the route network, including dedicated AV stops, shared ROW lanes, dedicated AV lanes, and an AV car barn for storage, maintenance and vehicle charging. In addition, the AV system and its users will have access to the same services for the shared bicycle and electric assist programs to be offered in Lake Nona.



Bicycle Transportation Network (BTN)

A bicycle network consisting of three facility types to accommodate various users. First, a multi-use trail network (MUT) provides commuter and recreational corridors for bicycle and pedestrian users alike. Second, a dedicated commuter way provides destination-oriented commuter paths for higher-speed travel. Finally, enhanced and expanded on-street dedicated lanes support the travel of bicycle users throughout the community. The BTN is complemented by strategically located support facilities, called “Recovery Zones,” that allow users to rehydrate, repair, and recover during their journey.



GreenLink

A linear park connecting a dense mixed-use environment with Lake Nona Town Center, displacing a conventional automobile street with a dedicated bicycle commuter way, dedicated AV right of way, and pedestrian paths organized around an exposed stormwater conveyance waterway (see Figure 2).

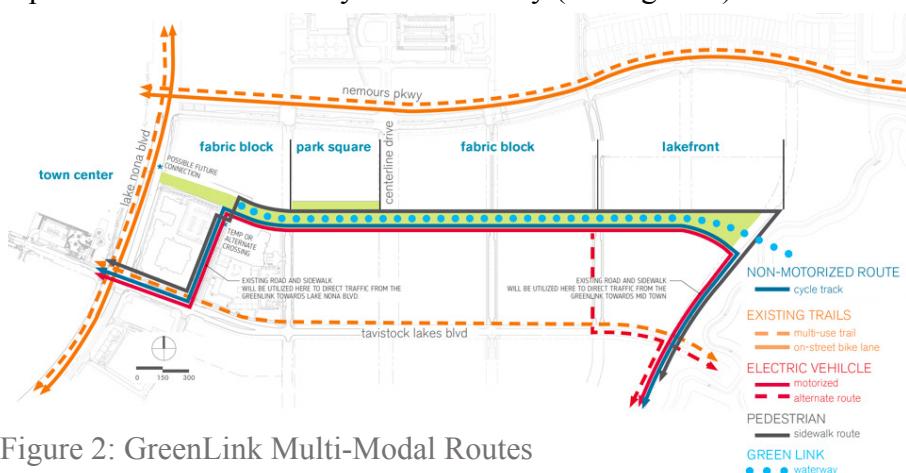


Figure 2: GreenLink Multi-Modal Routes

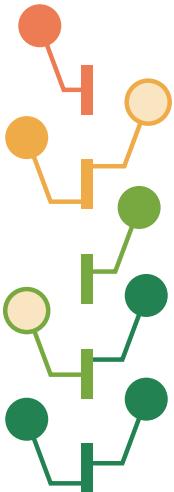


GreenLink Bridge

A dedicated bridge over the highly traveled six-lane Lake Nona Boulevard, providing bicycle and pedestrian access to the Lake Nona Town Center and Hub. Serving the AV's will be an intelligent, at-grade mid-block crossing on Lake Nona Boulevard at the bridge location.

In addition to the development and livability output of the Reimagining Mobility Project Orange County will have access to all data and lessons learned during the development and operation of the project, including:

- Validation of infrastructure and AV use cases for public transit. 3D route mappings, engineering and testing plans for future leverage.
- Proven designs and plans for the incorporation of new technologies into other communities that will drive public transportation improvement and enhance safety and mobility.
- Grant artifacts and project learnings will be valuable for future funding opportunities that are becoming available.
- Streamlined process for taking transportation innovation from planning to constituent benefit in months versus decades.
- Data and output from ridership input and learnings to be utilized for planning future deployments of services, including needed transportation services in support of constituent health services needs through examples such as the Orlando Veterans Administration Medical Center and Nemours Children's Hospital.
- Data and output from key research and analysis on various monetization results, such as ROI models, advertising revenue models and rider chargeability models that can fund future public services.



In addition to the data, process and key learnings, the County and local economy will benefit from widespread job creation, both permanent and temporary. Lake Nona's Alternative Mobility Network will require AV operators, maintenance engineers, bicycle transportation network attendants, operations center analysts, and other jobs affiliated with the ongoing operations of the project. Temporary construction jobs will also be created through the installation and implementation of new facilities and infrastructure.

Lake Nona's LAMN will offer additional mobility options to residents and visitors. This is especially beneficial for people with limited car availability and for short trips within the area. It can also be used for first- and last-mile access to and from the Mobility Hub. The autonomous shuttles and shared bikes provide not only convenience, but also monetizable benefits to their users.

The Benefit-Cost Analysis (BCA) (See **Appendix E**) measures all identified user benefits and compares them to the cost. The Benefit-Cost ratio for the project exceeds 3.5, meaning that for every dollar spent to build, run and maintain the LAMN, more than three dollars and fifty cents of benefits to the users will result. While the largest benefits are generated by travel time savings and increased reliability, safety gains and reduced emissions can also be achieved.

2.0 Project Location

A high growth area needs solutions.

Located in one of the fastest growing regions in the nation, Orange County was ranked as the fastest growing metropolitan area in the United States in 2017, welcoming about 1,000 new

residents each week. From its early roots in aviation, aerospace and military defense industries, Orange County has expanded into new tech clusters, such as modeling, simulation and training, electrooptic and lasers, digital media, interactive entertainment, microelectronics, life sciences, and healthcare and medical technologies. Home to the City of Orlando and renowned world-class attractions, Orange County also welcomes 75 million visitors annually.

This dynamic growth is not without its challenges. The Central Florida region has suffered from past unilateral investment on auto-centered infrastructure, mostly neglecting alternative transit options and the development of safe pedestrian and bicycle infrastructure. Unfortunately, this has resulted in the highest pedestrian fatality index in the country, according to [Smart Growth America's Pedestrian Danger Index](#). The Reimagining Mobility project will be a meaningful first step towards Orange County leading the way in the mitigation of this statistic.

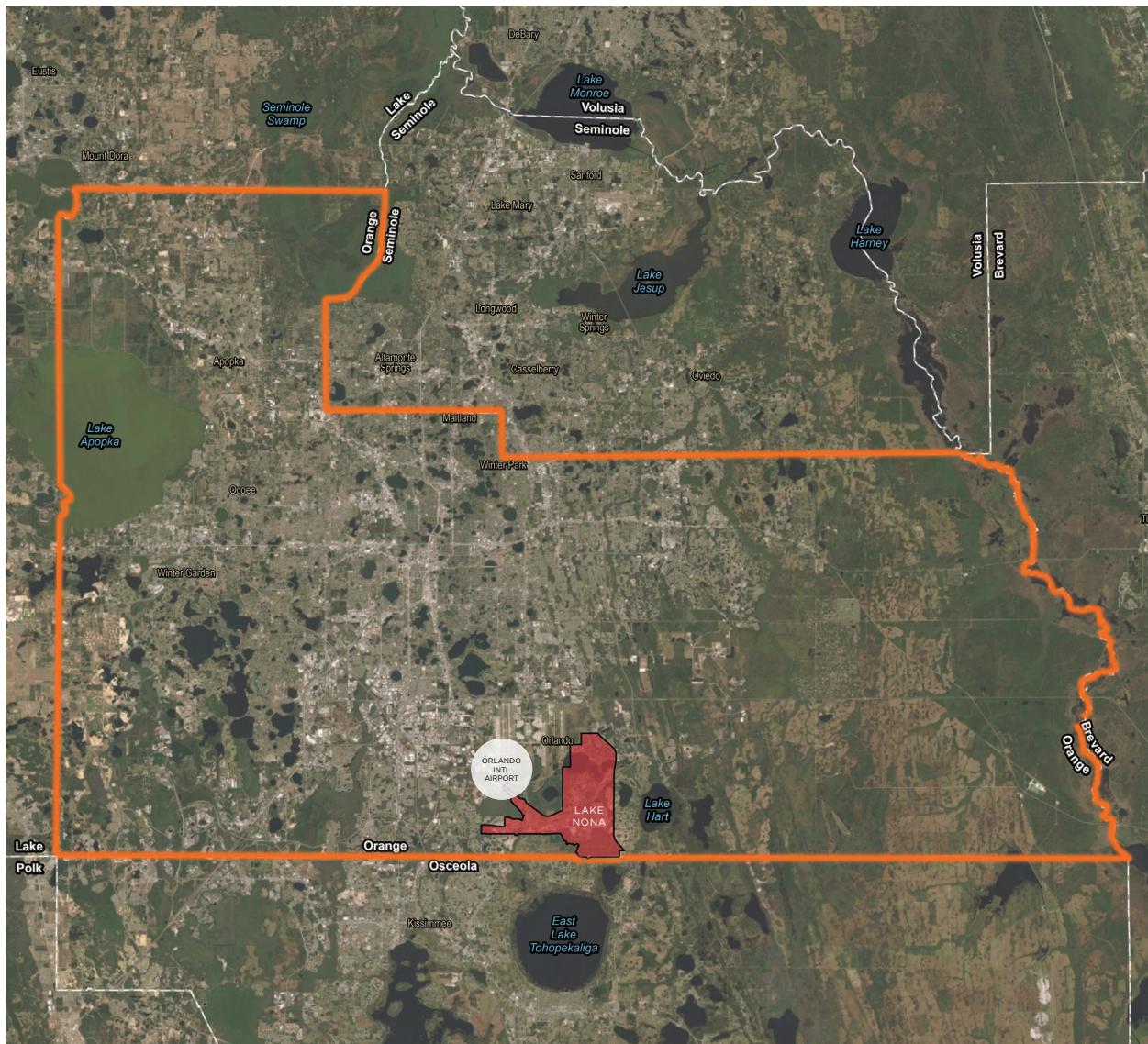


Figure 3: Orange County Project Location Map

Lake Nona has been preparing to Reimagine Mobility.

Mostly a greenfield site 15 years ago, Lake Nona was strategically planned for the future, with foundational strategies that have and will guide development principles well into the future to encourage the continued evolution of a community that is healthy, sustainable, vibrant, and able to adapt to new technologies, innovations, and global trends (see Figure 3). This approach has proven to be a platform for growth in Orange County and has resulted in Lake Nona being designated as one of only nine global “Iconic Smart + Connected Communities” by Cisco.



Figure 4: Lake Nona Community Map

Three universities and colleges have a major physical presence in Lake Nona, as well as public schools and early childhood education centers. It is also home to Lake Nona Medical City, a life sciences and healthcare cluster of excellence featuring some of the Nation’s top universities, hospitals and research institutions, employing more than 5,000 medical professionals (see Figure 4 and 5).



Figure 5: Lake Nona Community Aerials and Town Center Phase II Rendering

Lake Nona is an ideal location in Orange County to establish this sustainable LAMN as the community has established itself as a leader in the implementation of wellbeing and sustainable initiatives such as:

- Working in partnership with the State of Florida, Orange County, and the City of Orlando to create a world class Medical City anchored by the Orlando VA Medical Center
- Establishing the Lake Nona Life Project, a landmark multi-generational community health and wellness research project
- Creating an existing master framework plan for bicyclists, pedestrians, and automobiles
- Entering into an agreement with BEEP, an Autonomous Mobility solutions provider, to establish a demonstration AV program with two multi-rider shuttles scheduled to begin implementation at the end of July 2019.



Lake Nona's resources and the foundation it has laid enables it to embrace the challenge of providing robust alternative mobility options for residents, workers, and visitors. With certain initiatives already underway such as primary infrastructure, a bike share program, and a demonstration AV program, Orange County has a ready and willing partner in Tavistock and Lake Nona willing to engage other partners such as BEEP, Inc., the Community Development Districts, and others to execute the entirety of the Reimagining Mobility Project.

3.0 Grant Funds, Sources, and Use of Project Funds

3.1 Project Costs

The Project Scope Narrative (See **Appendix C**) and Budget Detail (See **Appendix D**) provide a detailed breakdown of all hard costs (construction), soft costs (design and engineering), contingency, land/right of way costs, and project administration required to deliver a complete scope of work associated with each major project element scope.

Also included is a Project Cash Flow (See **Appendix F**) which distributes total cost for each major work category and scope of work. Each cost category is distributed over a period of time. The time periods represented correlate directly to the development schedule, which is described in Section 5.2. No project phasing is anticipated.

SOURCES AND USES OF FUNDS

		Total Funding	% of Total
I. Sources			
Federal Build		\$25,000,000	54%
Non-Federal			
Private Funding	\$10,935,468		
Local Funding	\$7,073,638		
Total Local		\$18,009,106	46%
Other Federal		\$0	
Total Sources		\$43,009,106	
II. Uses			
Environmental		\$0	0%
Right of Way (R.O.W.)¹		\$8,809,671	20%
Engineering/Design²		\$2,802,523	7%
Construction		\$25,944,389	60%
Project Administration		\$1,252,692	3%
Contingency		\$4,199,831	10%
Total Uses		\$43,009,106	

Table 1: Sources and Uses of Funds

¹ All right of way required for the LAMN is either previously acquired by the CDD's, Orange County, and City of Orlando or under control by a Tavistock affiliate.

² DOT requires that all NEPA environmental actions be completed prior to the execution of a grant agreement with the designated modal administration. Since the cost is not eligible to be counted toward the grant expenditure or local match, the local private partnership will cover the projected cost of \$250,000 from private funds. Therefore, the environmental line item is listed as \$0. Mobility Hub: Approximately .25 acres required are under control by a Tavistock affiliate will be acquired by the Reimagining Mobility entity at appraised value.

- a. Bicycle Transportation Network: 12.24 acres required is under control by a Tavistock affiliate and will be acquired by the CDD's. Additional existing 140,000 lane-feet are within City of Orlando right of way and do not require acquisition.
- b. Autonomous Vehicle Infrastructure: Approximately 208,000 lane-feet are existing and within City of Orlando and Orange County ROW. 1.04 acres of ROW is under control by a Tavistock affiliate and will be acquired by the Boggy Creek Improvement District. Approximately 3.0 acres required for the car barn facility are controlled by a Tavistock affiliate and will be acquired by the Reimagining Mobility entity.
- c. GreenLink: Approximately 8.7 acres required for the GreenLink under control by Tavistock affiliate and will be acquired by the Greenway Improvement District.
- d. GreenLink Bridge: Approximately 1.28 acres required for the GreenLink Bridge are under control by a Tavistock affiliate and will be acquired by the Boggy Creek and Greenway Improvement Districts.
- e. Right of way acquisition for CDD work will be made at set discounted rates based on the particular CDD, ranging from \$75,000 per acre to \$217,930 per acre. For purposes of estimating the BUILD Grant, blended rates are used. (note: appraised commercial land in and around Lake Nona typically ranges from \$400,000 per acre to over \$900,000 per acre).

3.2 Non-Federal Funding Commitments and Matches

Of the \$43,009,106 required to fund the Reimagining Mobility Project, \$18,009,106 will be funded from private sources and previously committed Community Development District³ (CDD) sources. No additional federal, state, or local jurisdictional sources of funding are required to complete this project.

FUNDING PARTNER	DESCRIPTION	FUNDING AMOUNT	FUNDING PERCENTAGE	TYPE OF FUND
BOGGY CREEK IMPROVEMENT DISTRICT				
GREENEWAY IMPROVEMENT DISTRICT				
MYRTLE CREEK IMPROVEMENT DISTRICT				
POITRAS EAST CDD	Community Development District	\$6,816,138	16%	Non-Federal
TAVISTOCK DEVELOPMENT COMPANY	Private	\$11,192,968	26%	Non-Federal
UNITED STATES DEPARTMENT OF TRANSPORTATION (USDOT)	BUILD Grant Funds Administrator	\$25,000,000	58%	BUILD

Table 2: Funding Commitments and Matches

The non-Federal funding to be provided by the four CDD's is in place or authorized to be in place to fund scope associated with the LAMN and the commitment is evidenced by the adopted Engineer's Reports for Capital Improvements for each district (See **Appendix G**).

To date, the four CDD's have funded and constructed a significant amount of critical public infrastructure in and around the 17-square-mile Lake Nona area through the issuance of bonds and other instruments, backed by real property within each of the Districts. The four CDD's within Lake Nona are Boggy Creek Improvement District (BCID), Myrtle Creek Improvement District (MCID), Greeneway Improvement District (GID), and Poitras Improvement District (PID).

The non-Federal funding to be privately sourced by Tavistock is evidenced by the funding commitment correspondence from the President of Tavistock Development Company (See **Appendix H**).

In addition to the scope of the Reimagining Mobility Project for which BUILD Grant funds are sought, award of the BUILD Grant will enable additional private investment by Tavistock and BEEP Inc. (BEEP) of approximately \$14,000,000 in related scope necessary to ensure a robust and optimally functioning LAMN. This related scope includes items such as user parking and the AV shuttle building structure for the Mobility Hub, the entire AV fleet, systems operating supplies, complementary community park nodes, and the Lake Nona Autonomous Mobility Innovation Lab.

A principal stakeholder project partner is BEEP, a major national provider of autonomous technology. BEEP has selected the the Lake Nona LAMN project site as its national headquarters and will invest in a fleet of autonomous vehicles (20 vehicles at project build out by Year 3), and design and build a Mobility Innovation Lab.

³A Community Development District (CDD) is a local, special-purpose government framework authorized by Chapter 190 of the Florida Statutes as amended and is an alternative to municipal incorporation for managing and financing infrastructure required to support development of a community.

A major component of the Reimagining Mobility Project is to attract new businesses and create jobs that focus on developing and building many of the autonomous technologies domestically. As further evidence of its commitment, BEEP is currently developing an operating center for monitoring and managing fleets of AVs across the U.S. from its Orange County headquarters. Additionally, BEEP has established a research and development team for developing and integrating software components. The proposed Mobility Innovation Lab, in partnership with the University of Central Florida (UCF), will attract new companies to its “mobility incubator” providing a test bed for new mobility technologies.

3.3 Budget

The Project Budget (See **Appendix D**) for the Reimagining Mobility Project is \$43,009,106. The all-in summary costs for each component are as follows:

PROJECT ELEMENT	COMPONENT COST
Mobility Network Hub	\$2,999,937
Autonomous Vehicle Infrastructure	\$12,643,451
Bicycle Transportation Network	\$7,573,619
GreenLink	\$13,542,059
GreenLink Bridge	\$6,250,040
Reimagining Mobility Project Total:	\$43,009,106

Table 3: All-in Summary Cost for each Project Component

4.0 Selection Criteria

4.1 Primary Selection Criteria

4.1.1 Safety

The growth in population and therefore the demand on the transportation infrastructure in Orange County has led to a significant number of incidents on the roadway network. Crash data supplied by Kittelson and Associates for a 5-year period (2014-18) shows that the crash rates differ largely between different parts of the road network in the area.

The Reimagining Mobility Project will reduce vehicle miles on community roads by 2.5 million per year (2035) (See **Appendix E**). This will result in reduction of annual injuries by 4.5 percent and fatalities by 8 percent. Safer infrastructure and use of alternative transportation modes will reduce the number, rate and consequences of crashes. While it is not assumed that the crash rates for cars change due to the project, car traffic volumes do change as users choose to ride an AV shuttle or bike instead of driving their vehicles within the area (See Figure 6).



Figure 6: Measures taken at conflict points via intermodal crossings enhance pedestrian and bicycle safety.

For example, the AV technology has an average response time of 300 milliseconds upon identifying ("seeing") an obstacle. This is the time something moves in its path to the time it begins the braking process. This is 5 times faster than the average time estimated for a human response in a similar situation. Crash testing authorities estimate that time to average 1.5 seconds.

Additionally, our proposed project provides for a new bridge dedicated to these uses which will eliminate pedestrian, biker and autonomous riders from crossing a main intersection, further improving safety. Implementation of the Bicycle Transportation Network (BTN) makes cycling safer. The Benefit Cost Analysis (BCA) of this project shows the following results in safety improvement: the reduction of car mileage in the area as well as the safer infrastructure for bicycles lead to safety benefits. In total, \$26 million (undiscounted) can be saved over the course of the included operation period.

4.1.2 State of Good Repair

Maintaining a state of good repair for both present and future states of all transportation facilities and systems is a top priority of the LAMN. The current public infrastructure within Lake Nona is owned and maintained in a state of good repair in a variety of arrangements including:

- Roadways, pathways, and landscaping owned and maintained by Orange County
- Roadways owned and operated by the City of Orlando; pathways and landscaping maintained (funded) by CDD's
- Standalone pathways, trails, and landscaping owned and operated by CDD's
- The GreenLink and GreenLink Bridge maintained by the City of Orlando and a Property Owners Association (POA) or similar instrument. Lifecycle costs for the improvements will be funded by the respective entities noted above.

These maintenance arrangements are in place in perpetuity and will ensure an ongoing state of good repair for both the existing and proposed LAMN improvements. Additionally, the scope of the Reimagining Mobility Project includes a substantial amount of re-striping and modification

of existing roadways and pathways. This will ensure that all infrastructure required to enable the programs within the Reimagining Mobility Project will function properly for the foreseeable future.

The maintenance of improvements put in place through the Reimagining Mobility Project will be funded respectively by:

- Orange County (annual operating budget)
- City of Orlando (annual operating budget)
- Each of the CDD's (annual assessment revenue)
- The LAMN operating entity - to be formed (annual operating budget)

Lifecycle costs for the improvements will be funded by the respective entities noted above. The scope also includes maintaining and operating 20 AV shuttles on the route network. The annual cost per shuttle is \$144,000 including the cost of the vehicles themselves, which is annualized over the five-year lifecycle.

4.1.3 Economic Competitiveness

The LAMN will enhance economic competitiveness by reducing road congestion in the project area, allowing for more efficient movement of residents, workers, and visitors and improving reliable access to critical services. The new modal options provide travel time-related user benefits of almost \$18 million per year in 2035 (See **Appendix E**).

The efficiency of its existing transportation network has been a critical factor in the selection of Orange County and Lake Nona as a center for business relocation and expansion. The implementation of the Reimagining Mobility Project is expected to accelerate business expansion and job creation. Furthermore, the benefits of the LAMN and future deployment of this model throughout Orange County will continue to be a key site selection factor for business prospects in other areas of Orange County.

In addition to the data, process, and key learnings, the County and local economy will benefit from the hundreds of construction jobs and dozens of permanent jobs the proposed infrastructure projects will bring. The LAMN will require AV operators, maintenance engineers, bicycle transportation network attendants, operations center analysts, and other professionals to successfully manage the ongoing operations of the network.

4.1.4 Environmental Sustainability

The Remaining Mobility Project places an emphasis on alternative transportation that fosters energy efficiency practices, such as walking, bicycling and transit. A system of interconnected networks that are exclusive to pedestrian, bicycle, and AV transit reduces the negative environmental effects of personal vehicles that are petroleum-dependent and emit harmful pollutants (See **Appendix E**).

The proposed AV transit helps reduce emissions in two key ways. First, a reduction in vehicular trips, as an average of 140 users will be partaking in the service at any given time. Typically, a share of those 140 riders would use their personal vehicle for travel. Second, the AV's are electric-powered vessels. This is an immediate reduction in oil-dependency and pollution emissions. The AVs will be charged at designated charging stations that are solar-powered, where possible. The removal of pollutants emitted will also improve air quality.

GreenLink, a 3,377-foot-long linear park, is the centerpiece of the Reimagining Mobility Project. GreenLink celebrates each of the modes of the LAMN and anchors what will be the most densely populated district of Lake Nona. By design, GreenLink displaces a conventional, two-lane vehicle-centric roadway, on-street parking, narrow sidewalks, and underground primary stormwater conveyance. GreenLink replaces the conventional roadway with dedicated modal paths running alongside a waterway, celebrating each of the alternative modes of transportation accommodated in the Reimagining Mobility Project – autonomous vehicle shuttles, bicycles, electric-assist personal vehicles (scooters, etc.) and pedestrians.

The wider GreenLink ROW exhibits a significantly reduced percentage of impervious area within the corridor, ranging from as low as roughly 15 percent in the Park Square block to roughly 40 percent along the stormwater pond. This compares favorably to 78 percent impervious area within the 64-foot-wide conventional street right of way GreenLink replaces (See Figure 8). This reduction in impervious area results not only in a reduction in stormwater runoff, but also a reduction in the pollutants associated with stormwater runoff that are common to conventional roadways.

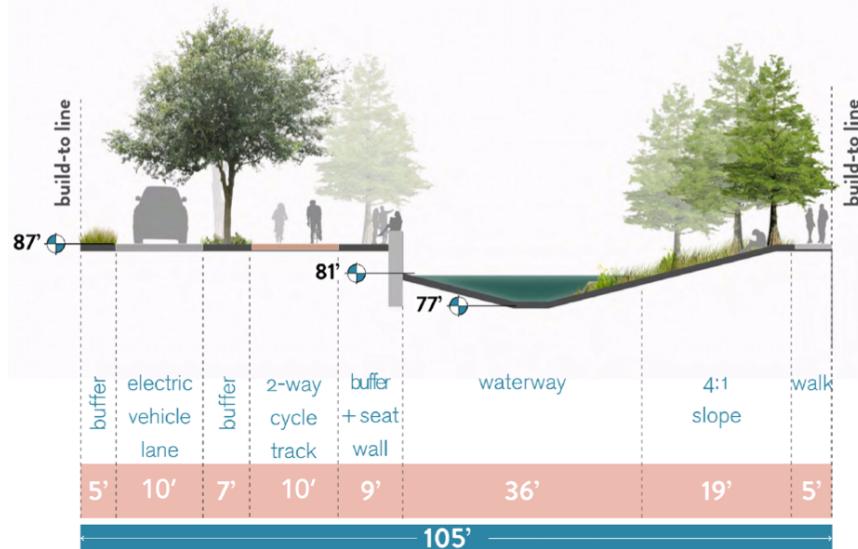


Figure 8: Typical 105' cross section in the GreenLink. Replaces conventional vehicular roadways with alternative mobility paths for pedestrians, bicycles, and AV.

GreenLink will act as an alternative to the traditional treatment of stormwater by turning it into a feature, rather than putting it through a series of stormwater pipes, buried underground (See Figure 9). GreenLink will celebrate stormwater in the form of an open waterway. It will flow over a series of weirs from the west to the east, into an existing stormwater treatment pond. In addition, the water is circulated from the stormwater pond to a series of source points upstream in the waterway, so that when it re-enters the pond, it is cleaner than regulatory standards. Stormwater from adjacent parcels will be treated before entering the waterway.

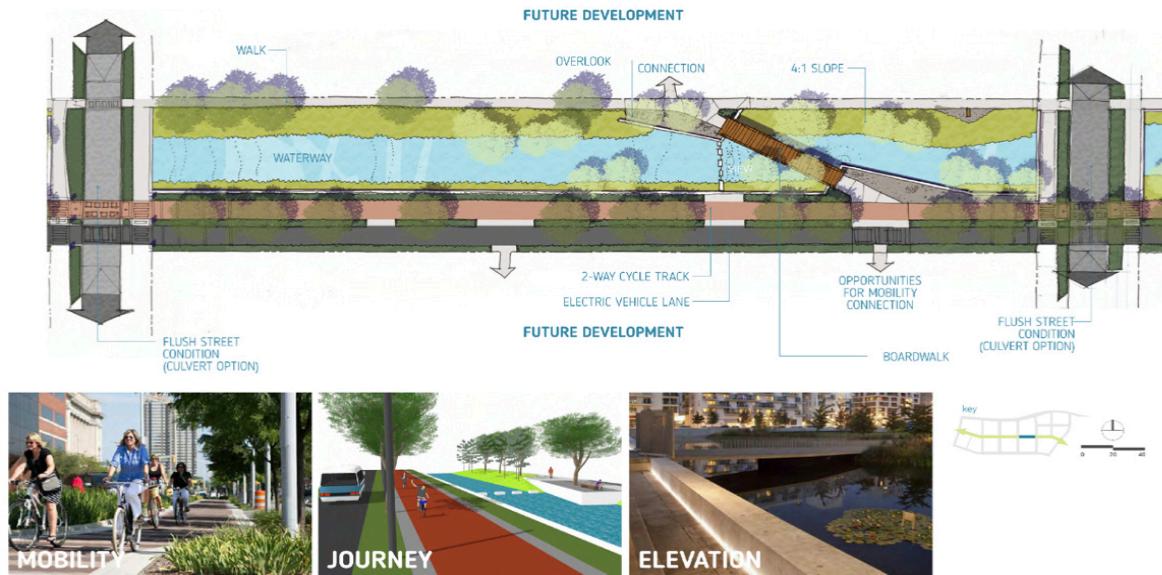


Figure 9: Aerial view of the GreenLink. Depicts the reimaged right of way and stormwater treatment.

The proposed section of GreenLink discharging into the stormwater pond will establish an area of wetland habitat further filtering the water entering the pond through native littoral plantings and species habitation. Overall, the GreenLink creates a greenway corridor focused on multi-modality and connectivity between the built and natural environment.

4.1.5 Quality of Life

The Reimagining Mobility Project includes significant new options for transportation to the community, visitors and surrounding areas in south-central Orange County, while also providing a number of social and ecological benefits. The LAMN will improve quality of life through reduced traffic congestion, increased efficiency, lower carbon emissions and increased road safety. It will also provide residents, especially the aging, disabled and those who choose not to own a vehicle, with critical access to important services such as healthcare, recreational areas, retail and dining options and more, thus positively impacting the quality of life for these constituents as well.

Although Orange County is fortunate to have essential medical services included in Lake Nona Medical City, such as the Orlando VA Medical Center, transportation between these facilities and employment centers, residences, and external transit options are limited. For example, those arriving by LYNX (local bus transit) have limited connectivity to medical services and other amenities and services within Lake Nona.

4.2 Secondary Selection Criteria

4.2.1 Innovation

4.2.1.A Innovative Technologies

Autonomous Vehicles: Autonomous Vehicles (See Figure 10) are a major component of the proposed LAMN. Significant research has been conducted, in partnership with the private sector, and continues with testing low speed AV's later this summer in a trial deployment through the NHTSA/US DOT DS7 process. This allows testing of a proven technology from Europe, where AV's are being deployed more broadly for constituent use, but with partners that have the

capacity to build these mobility solutions in the United States. Orange County is very familiar with the government efforts to evaluate rule changes to allow for expanded, safe testing and use of these autonomous mobility solutions.



Figure 10: BEEP, Inc. Autonomous Vehicle Shuttles

The AV system launch will include a mobile application which updates travelers on current routes, vehicle availability and location, arrival times, and service changes or disruptions. The mobile application is an existing, deployed, cloud-based application available on a subscription basis through the AV fleet manager. The AV will be offered at no cost and no traveler information will not be collected.

Currently the low speed AV's do not meet FMVSS standards, but upon deployment of this proposed project, the solutions will either achieve FMVSS standards or apply for existing government waivers. All AV's in use will be categorized in the Low Speed Vehicle category for safety standards or utilize the autonomous software and hardware platforms on existing FMVSS and FMCSA compliant vehicles. All these options are being pursued and tested. The proposed project to develop dedicated infrastructure in support of these deployments further advances project readiness for executing on this proposed project. Orange County has also worked very closely with the Florida DOT to align these efforts with Florida laws and regulations. The proper compliance with Federal, state and local regulations to ensure safe and effective deployment of these new mobility solutions is a top priority.

The fully functioning AV is a proven technology with an established deployment record. The shuttles are equipped with onboard operating systems that operate with a Global Navigation Satellite System (GNSS) and fixed-base installed onsite for tracking and route navigation within a 1cm tolerance. Additionally, the shuttles are equipped with LIDAR sensors, to compare the route map to what the shuttle senses in real-time. This enables the shuttle to safely respond to real-time activity on the route. For the AV's considered for this project, 115-like shuttles have been deployed worldwide, providing transportation for more than 350,000 passengers, with a perfect safety record.

Further, the AV technology is underpinned by a robust cybersecurity program designed to address concerns of intrusion into the onboard operating systems. The cybersecurity program includes a comprehensive cyber risk analysis and mitigation process, required training for the identification and assessment of cyber threats, real-time intrusion monitoring of the entire fleet, and a documented incident response process.

Broadband Deployment: Lake Nona has an existing robust fiber system with direct connection of fiber to all properties. Currently, a 5G system within the Lake Nona region is being planned, with telecom and technology partners participating in an accelerator program to bring 5G use cases at scale into the community.

The deployment of the 5G network will open a new world of possibility for autonomous mobility. 5G will replace the need for communication by dedicated short range communications (DSRC). For example, traffic signals can communicate with lower latency and higher reliability, allowing operation of the vehicles in a fully autonomous mode while maintaining a high safety rating. 5G connectivity will provide fast, reliable access to the efficiency benefits of cloud computing, enabling the expansion processing power without the expense of updating the processor and storage components that currently reside in the vehicle. This also allows for faster innovation and the addition of new systems and functions. As AV technologies continue to evolve, the data generated inside the vehicles continues to grow exponentially. Level 5 AV's will use terabytes for their memory and processing power and will need 5G to reach that level of autonomy. As an added benefit, 5G capability will also enable faster network communications with emergency vehicles (EV), increasing response time and safer operation of EV.

Mobility Innovation Lab: An important component of the Reimagining Mobility Project is the creation of a 4,000-square-foot Lake Nona Autonomous Mobility Innovation Lab (AV Lab). While not part of the subject Grant, this is another tremendous example of public/private partnership which will further position Orange County and the State of Florida as leaders for safely advancing the use of autonomous technology and transportation innovation.

In partnership with UCF, this AV Lab will be funded entirely by the private sector made available for other uses to support FDOT and the National Highway Traffic Safety Administration, as well as transportation technology partners to perform equipment tests and participate in educational opportunities. With its close-proximity to the FDOT SunTrax facility, this will result in Central Florida having complete end-to-end testing capabilities for AV's.

The AV Lab will include dedicated kiosks for new technologies to be displayed, tested and integrated into simulated and live environments. In addition to supporting a wide range of transportation technologies, it will also support the full life-cycle of the citizen transportation experience, to include: innovations in disability technologies and equipment, autonomous software and platforms, rider communication/information tools, AV stops, traffic signal interface equipment, etc. To our knowledge, this will be the first center in the U.S. where transportation officials can leverage a single location and tools for both evaluating and testing new innovations to consider for their communities.

This program will include a partnership among UCF, Orange County, Tavistock and BEEP, that will bring new educational opportunities to the community via vocational training for careers in the autonomous transportation sector and college level curricula for autonomous software development. Most impactful will be the regularly scheduled training opportunities the Lab will sponsor for disadvantaged youth and young adults seeking new skills to participate in this significant market movement and gain new employment opportunities.

4.2.1.B Innovative Project Delivery

Most of the improvements will be constructed by the CDD's, which are already established and have the structure and resources in place to design and construct the improvements. Tavistock affiliates will implement the remaining improvements, including technology and support

facilities, to be designed and constructed in an expeditious manner consistent with the speed and efficiency exhibited in the development of other public and private work in Lake Nona.

4.2.1.C Innovative Financing

Innovative funding beyond the bond financing allowed for the CDD's under Florida state statutes is not necessary for the non-Build Grant funds. Funding is or will be in place by the CDD's through bond financing and traditional bank lending instruments, and Tavistock is committed to fund through private sources the remaining non-BUILD Grant funds required.

4.2.2 Partnership

Project Parties

- Orange County is the lead Grant applicant and administrator of Grant funding
- The CDD's will design and construct certain Reimagining Mobility Project improvements as defined in their respective adopted capital improvement plans (See **Appendix G**)
- City of Orlando is the jurisdictional building and permitting authority for the infrastructure and building construction
- Tavistock Development Company (TDC) is the master developer for Lake Nona. TDC will design and construct through its affiliates certain Grant improvements
- BEEP will advise on AV infrastructure needs and specifications as well as provide ongoing programming support. BEEP will also procure, install and operate the non-Grant funded operating equipment, including the AV fleet.
- The Florida Department of Transportation (FDOT) is a strong advocate of mobility solutions for Orange County and the deployment of AV technology. FDOT will supply direct technical support and assistance for the design and installation of Dedicated Short-Range Communications (DSRC) technology for the LAMN AV road infrastructure and intersections in the initial phases of the project, and will be a resource to the project as it moves to full build-out
- The Mobility Innovation Lab will provide students in UCF's Engineering, Urban Planning and Community Innovation programs with practical learning environments in Lake Nona.

Letters of Support from project partners and supporters can be found in **Appendix B**.

TDC and its affiliates have a long history of working as agents of Orange County, as well as the City of Orlando, in the management of design and construction of a variety of public works, including utilities and transportation networks. It is intended that Orange County will enter into a Development Agreement with a TDC affiliate to execute the BUILD Grant scope.

As a requirement of the Development Agreement to be entered into with Orange County, TDC will ensure an inter-district agreement between the CDD's, as required to effectuate the BUILD Grant scope to be performed collaboratively and efficiently by the CDD's.

5.0 Project Readiness

Project Element		Pre-Engineering			Final Design		Plan, Specification and Estimate				Construction		
		10%	30%	60%	90%	100%	10%	25%	50%	100%	10%	25%	50%
1	Mobility Network Hub												
2	Bicycle Transportation Network												
3	Autonomous Vehicle Infrastructure												
4	GreenLink												
5	GreenLink Bridge												

Table 4: Project Readiness Design-Build Status

5.1 Technical Feasibility

This project is divided into five key components as described below and as shown in the Local Alternative Mobility Network Map (See **Appendix J**).

Autonomous Vehicles Infrastructure Design and Operations: Existing roadways will support the proposed AV program. Enhancements will be made to striping, signage, and lane markings to create a distinct visualization of AV lane locations and use. Utilities are stubbed out based upon the current planned development for existing framework roads. Existing ROW will be utilized as much as possible (See Figure 12).



Figure 12: Typical right of way cross section of dedicated AV, bicycle, and pedestrian infrastructure

A new dedicated AV lane will be built into the existing ROW along Laureate Boulevard between Veterans Way and Medical City Drive. This new AV lane will be built in the same manner as shown in the cross section of the future road expansion of Laureate Boulevard. This would enable the AV lane to be easily converted to one of the two new travel lanes in the final configuration. This is a BCID project and in the current 3-year Capital Improvement Program.

The AV Route Network Map (See **Appendix K**) outlines the planned AV route network, both for the short-term (36-month proposed project period of performance) and the long-term operations at full build out. The status of the network design at the time of application is that the master plan is complete with an expectation of final design and testing of the system operations by Q1 of 2023.

The construction costs associated with the AV Route Network are sourced through a combination of Donald W. McIntosh Associates and Jr. Davis Construction Company, Inc.

Car Barn: The Car Barn is planned as a 25,000-square-foot warehouse-style building which serves as a key support facility for the entire mobility system. In addition to serving as a storage facility for the AV fleet, it will include changing stations for all vehicles. Repair and maintenance equipment (tools, lifts, compressors, benches) will be housed in this building, and all AV systems and controls, including the IT/Telecom/Data network required to support the AV system, will be located here. This facility will also include administrative offices for the AV staff as well as adequate space for storage supplies, AV parts, system signage, kiosks, shelter parts, and equipment.

The construction costs associated with the Car Barn are sourced through the Tavistock Development Company historical cost database.

Mobility Hub: A key project element and point of interaction with all mobility needs will be the central Mobility Hub. Located in the Lake Nona Town Center, this Hub will be the central station providing interaction with all other modes of transportation, both local and regional.

The Mobility Hub includes two primary features: a 21,000-square-foot AV parking facility (retrofitted to accommodate the shuttles) which includes parking spaces, AV boarding/deboarding and staging zones, passenger seating, system signage and electronic kiosks. The second feature includes a 5,000-square-foot Mobility Rider Services Center which will house restrooms, showers, bike lockers, bike racks, system kiosks and wayfinding information.

Also included within this facility are bike tools/repair equipment stations, charging stations and power sources. The entire facility will be designed to include lighting and security systems to ensure a safe environment for all. Design will commence upon award of Grant.

The construction costs associated with the Mobility Hub are sourced through the Tavistock Development Company historical cost database.

Bicycle Transportation Network (BTN): Bike lanes exist along most framework roads in development and will be upgraded to any new standards and colors. Existing ROW, easements and owned property will be utilized to install dedicated bike paths and multiuse trails. Dedicated use lanes will be installed where appropriate and possible to support major routes. Design is projected to commence upon award of Grant and all elements will support the operation start on April 2023.

New bicycle-only commuter ways will be created connecting GreenLink to properties north and south of the project (See **Appendix L**). These new bicycle commuter ways will use existing ROW, easements and current planned roadways being constructed by the CDD, as shown in the current three-year Capital Improvement Program. There will be some minor modifications to the planned roadways cross sections to accommodate the new bicycle commuter ways in those road sections being constructed by the CDD. New routes will be needed along existing properties utilizing the existing easements for both bicycle commuter ways and multi-use trails.

Multi-use trails exist in most of the current framework roads cross sections. These trails will be connected to GreenLink in several places and will be incorporated into the GreenLink Bridge to Lake Nona Town Center. Much of this multi-use trail program is included in current CDD's Capital Improvement Programs. Grant funds will be used to enhance and repair existing and future multi-use trails as they interact with sidewalks, bicycle commuter ways, and AV routes.

The construction costs associated with the BTN are sourced through the combination of Donald W. McIntosh Associates, Inc and Jr. Davis Construction Company, Inc.

Recovery Zones: Planned Recovery Zones will be placed throughout routes at key points and intersections of other transportation routes. Recovery Zones will provide a place to interact with other users and provide necessary items for minor repairs, charging of devices, route types and locations, time and travel information along planned routes, and hydrating stations.

The construction costs associated with the Recovery Zones are sourced through the Tavistock Development Company historical cost database.

GreenLink: At the time of this writing, GreenLink is under contract for permit drawing to be completed in Q3 2019, with permit issuance in Q1 2020, with construction able to commence as early as Q2 2020 subject to the Grant agreement being executed.

GreenLink is the consolidation of district stormwater conveyance, dedicated AV lanes, bicycle commuter ways, and multi-use/pedestrian ways in an urban park setting. As part of a greater master stormwater management system, stormwater runoff from a 104-acre area is collected in a single exposed conveyance channel 3,377 feet in length with four control elevation steps. This stormwater discharges into a stormwater retention pond.

A singular 10-foot wide pavement section along the entire length of GreenLink connects to the broader AV shuttle network. Bulb-outs are incorporated at strategic points along the route to provide room for passing shuttles.

As part of the overall BTN network, a 10-foot-wide asphalt paved section will run the length of GreenLink. The pavement will be specially striped and marked with signage along the way to denote the limited access. Additionally, active lighting and signage will be installed at each point of automobile crossing.

Pedestrians will be accommodated by virtue of a meandering walkways ranging in width from six to 10 feet wide, in a variety of surfaces. Special accommodations such as seating and signage at certain points of interest will also be provided. GreenLink will also incorporate Recovery Zones as part of the BTN and as shown in **Appendix J**.

The construction costs associated with GreenLink are sourced through the combination of Donald W. McIntosh Associates, Inc, Dix.Hite + Partners, Inc. and Jr. Davis Construction Company, Inc.

GreenLink Bridge: The GreenLink Bridge will connect GreenLink to the Lake Nona Town Center for bicycle and pedestrian traffic, while AV's will cross in the same location but at a dedicated mid-block-controlled crossing. The design parameters for the budget include an 18-foot-wide elevated structure with a 20-foot-wide approach ramp from GreenLink suitable for bicycles. Structurally, the bridge will likely be a box beam type construction with a mid-span support in the median of Lake Nona Boulevard. On the Lake Nona Town Center side of the street, it is anticipated that the bridge will land at grade initially but be designed to integrate into an upper level of a future building. The bridge will be engineered and constructed using a design-build methodology.

The construction costs associated with the GreenLink Bridge are sourced through the Bridge Division of Jr. Davis Construction Company, Inc.

5.2 Project Schedule

A summary of key milestones for the project period of performance is as follows:

PROJECT PERIOD OF PERFORMANCE	36 MONTHS
Project Start	10/1/20
Project End	9/30/23
Grant award notification	11/30/19
Development Agreement with Orange County	3/15/19
Completion of NEPA	7/15/20
Signing of Grant Agreement with DOT	9/15/20
Grant Pre-Performance Reporting	11/15/20
Grant Final Performance Reporting	11/30/23
Grant Close Out	12/31/23

Table 5: Period of Performance Key Milestones

The attached project schedule (See **Appendix I**) directly correlates to the Project Scope Narrative and Project Budget. GreenLink, which is expected to be submitted for construction permit by 10/3/2019, and the Mobility Hub are key drivers within the overall schedule as other scopes of work cascade off their design and approval milestones. Associated stops, routes and ROW modifications are scheduled in a manner that allows for the completion of major infrastructure to concur with the delivery of the associated routes.

BUILD MILESTONE SCHEDULE

	2019				2020				2021				2022			
	Q1	Q2	Q3	Q4												
Mobility Hub									D	D	D	D	P	C	C	C
Bike Infrastructure									D	D	D	P	C	C		
GreenLink Bridge									D	D	D	P	P	P	P	C
GreenLink Site/Civil	D	D	D	P	P	P		C	C	C	C					
Greenlink Landscape/Hardscape/Irrigation	D	D	D	P	P	P		C	C	C	C					
Car Barn Storage								D	D	D	P	C	C	C	C	
AV Stops & ROW Lanes								D	D	D	P	C	C	C		
Bike Recovery Zones & Lanes								D	D	D	P	C	C	C	C	C



Design
Permitting
Construction

Table 6: Project Milestone Schedule

5.3 Required Approvals

5.3.1 Environmental Permits and Reviews

Elements of the National Environmental Policy Act (NEPA) compliance requirements remain to be completed for this project. Reimagining Mobility Project's major environmental consultants, PSI and AECOM, have provided documentation detailing the project scope (See Appendix M).

The proposed project scope will be evaluated against existing permits and research already completed. All ACOE and SFWMD for wetlands and uplands impacts are either in place or in progress. LOMR and CLMOR studies are done or in progress for all areas. Archaeological studies have been completed in most areas, as part of the ACOE permits received or in progress. PSI/Intertek and AECOM have completed this work previously for Lake Nona projects. All final NEPA processes required for project compliance will be initiated upon award.

The applicant and its private sector partners estimate that all final NEPA findings/FONSI will be completed/issued over a period of 120-180 days from award and/or signing of the Grant agreement with the DOT-designated modal administration.

Land use approvals are in place around all framework roads currently planned. Permits and approvals are in place for current work. There are no impacts to any wetlands in the proposed work area that are not currently or currently being addressed.

5.3.2 State and Local Approvals

State Level: The project elements as articulated under this Grant administration are not required to be submitted to the local MPO for approval and inclusion in the local STIP/TIP program.

Regional Level: Established in 1996, the Southeast Orlando Sector Plan (SEOSP) oversees the administration of land development in the Lake Nona region. At its inception, the SEOSP covered 19,000 acres in south Orange County. Since that time, the boundary has grown, and all

land has been incorporated into the City of Orlando's jurisdiction. The SEOSP, most recently updated in 2012, serves as a visioning tool for sustainable growth by establishing a regulatory framework for Lake Nona and the surrounding area via comprehensive plan policies, design guidelines, and a unique approval process. Today, these tools continue to administer the overall vision for south Orange County and Lake Nona.

Local Level: Policies authorized within the SEOSP, the City of Orlando Growth Management Plan, and the Land Development Code uphold a long-term vision that enforces enhanced mobility standards, universal accessibility, and alternative transportation uses, as well as environmental sustainability. The Growth Management Plan: (Policy 4.1.8(e)) establishes development directives for land use activities within Lake Nona and the surrounding region through the creation of "a balanced transport system providing equal emphasis to transit, pedestrian, and bicycle mobility to reduce the reliance on automobiles." The proposed Reimagining Mobility Project shall implement a balanced mobility network through the provision and enhancement of AV infrastructure (via shared ROWs, on-street dedicated lanes, and dedicated ROWs) and bicycle and pedestrian infrastructure (via shared ROWs, on-street dedicated lanes), and enhanced multi-use trails (MUT) (bicycle and pedestrian).

Transit mobility objectives defined within the SEOSP indicate the need to provide transit convenient access to community centers, provide direct routes, and locate stops in areas of high pedestrian traffic. The Reimagining Mobility Project is designed around providing reliable access to key locations within Lake Nona, where stops are located at significant points of interest and destinations. For example, AV routes provide access to Lake Nona Medical City, residential neighborhoods, Lake Nona Town Center, and key anchors, such as the USTA National Campus, KPMG Global Training and Innovation Center, and Valencia College, among others.

Additional Project Support: Local officials offer public support for the implementation of the Reimagining Mobility Project. Refer to the attached Letters of Support.

5.3.3 Federal Transportation Requirements Affecting State and Local Planning

The project elements as articulated under this Grant administration do not require action by the FHWA.

5.4 Assessment of Risks and Mitigation Strategies

Overall, the Reimagining Mobility Project has a very low risk profile. Most of the federal funding is in place or committed, major environmental permitting is complete, necessary entitlements and zoning are in place, and the supporting utility infrastructure is in place or committed.

A risk-mitigation analysis, which outlines the potential risks that may threaten the ability of the project to meet its objectives and schedule, accompanied by proposed mitigation plans, is provided below.

RISK NAME	RISK DESCRIPTION	EXPOSURE	PROBABILITY	IMPACT	MITIGATION STRATEGY
FUNDING	IF public funding is not received, THEN significant components of project will be cancelled.	20	4	5	Aggressively work with collaborators to secure BUILD Grant funding
DEVELOPMENT AGREEMENT	IF a Development Agreement is unable to be negotiated between the County and developer, THEN schedule will be impacted.	5	1	5	Utilize previous Development Agreement terms and conditions between Orange County and Tavistock affiliate.
DESIGN APPROVALS	IF designs are not approved by AHDs and require modifications, THEN schedule will be impacted.	2	1	2	Seeking preliminary approvals prior to official submissions. Maintain open line of communication with AHD.
ENVIRONMENTAL PERMITS	IF environmental permits are delayed, THEN schedule is affected.	2	1	2	Actively working with AHDs to ensure timely delivery of permits
RIGHT OF WAY ACQUISITION	IF Right of Way cannot be acquired THEN plan/routes will need to be reconfigured	0	0	4	All R.O.W is currently under control.
GRANT ADMINISTRATION	IF Orange County has difficulty administering and managing Grant Funding and the Grant Agreement THEN the schedule will be affected.	0	0	2	Orange County has a long history of managing Federal grants from a number of agencies. The County will have staff and management information systems dedicated to the proper administration of the Grant and will comply with all Federal requirements as will be contained in a Federal Discretionary Grant Agreement with the U.S. DOT-designated modal administration.

Table 7: Project Risk Register

Orange County is not seeking a waiver for relevant U.S. preference laws. A major component of the Reimagining Mobility Project is to create new jobs by attracting new businesses to the area that focuses on developing and building many of the autonomous technologies domestically. Independent of this Grant request, BEEP is currently developing an operating center for monitoring and managing fleets of AVs across the U.S. in Orange County. Additionally, BEEP has established a research and development team for developing and integrating software components. The proposed Innovation Lab will attract new companies and provide a test bed for new mobility technologies to be built domestically.

6.0 Benefit Cost Analysis

6.1 Analysis Approach

The Benefit Cost Analysis (BCA) of the project was prepared per the U.S. DOT Benefit-Cost Analysis Guidance for Applicants for BUILD Grants published in December 2018 and in reference to OMB Circulars A-4 and A-94 concerning BCA.

Table 8 summarizes the analysis of impacts from changes due to the LAMN between the Base Scenario (maintaining conditions) and the Project Scenario (implementing a mobility plan encouraging the use of bicycles and AVs).

CURRENT STATUS/ BASE & PROBLEM TO BE ADDRESS	CHANGE TO BASE / ALTERNATIVES	TYPE OF IMPACTS
Without the LAMN, future conditions at Lake Nona are expected to be subject to congestion and the region risks being uninviting to new residents, businesses and visitors.	<ul style="list-style-type: none"> Operation of autonomous shuttles to provide mobility within the district Without the LAMN, future conditions at Lake Nona are expected to be subject to congestion and the regions risks being uninviting to new residents, businesses and visitors. 	<ul style="list-style-type: none"> Reduced crashes Reduced VMT Reduced VHT Reduced congestion

Table 8: Project Summary Matrix

Table 9 summarizes the types of outcomes that have been identified for the project and the assessment approach used to prepare the BCA. These outcomes are organized per BUILD Grant selection criteria.

The time horizon of the BCA covers a design and construction period from 2019 to 2023 (five years) and an operational period from 2021 to 2047 (27 years).

LONG-TERM OUTCOME	TYPE OF SOCIETAL BENEFITS	ASSESSMENT APPROACH AND DOCUMENT SECTION REFERENCE
Safety	Prevented accidents both from safer infrastructure and from autonomous shuttles	Quantitative assessment
State of Good Repair Project Costs	Maintenance & repair savings, Project costs	Quantitative assessment
Economic Competitiveness	Travel time savings from new modal options and improved reliability	Quantitative assessment
	Operating cost savings from new modal	Quantitative assessment
Environmental Protection	Emission benefits from mode shift to more environmentally friendly modal	Quantitative assessment
Quality of Life	Improved mobility for residents and businesses within the development district with mobility plan	Quantitative assessment

Table 9: Project Outcomes

6.2 Summary of Benefits and Costs

BENEFIT	UNDISCOUNTED (IN \$MILLIONS)	7% DISCOUNT RATE (IN \$MILLIONS)
SAFETY	26.44	\$10.71
OPERATION AND MAINTENANCE COSTS	-\$76.0	-\$30.8
RESIDUAL VALUE OF INFRASTRUCTURE	\$24.7	\$3.7
VEHICLE OPERATING COSTS	\$110.1	\$38.9
BUSINESS TIME AND RELIABILITY COSTS	\$346.2	\$122.2
VALUE OF PERSONAL TIME AND RELIABILITY	\$19.4	\$6.9
ENVIRONMENTAL: NON-CO2	\$1.6	\$0.6
LOGISTICS/FREIGHT COSTS	\$26.44	\$10.71
TOTAL BENEFITS	\$452.4	\$152.1

Table 10: Summary of Benefits

COSTS	UNDISCOUNTED (IN \$MILLIONS)	7% DISCOUNT RATE (IN \$MILLIONS)
CAPITAL INVESTMENTS COSTS	\$48.8	\$42.4
TOTAL COSTS	\$48.8	\$42.4
TOTAL BENEFITS	\$452.4	\$152.1
BENEFITS/COST RATIO	9.27	3.59

Table 11: Summary of Benefits and Costs

6.3 Methodology of Obtaining Key Inputs

Benefits are determined based on travel changes in Vehicle Miles Traveled (VMT) and Vehicle Hours Traveled (VHT), and improvements in accident rates. At the end of this report, **Appendix E** provides the overview of how key inputs to the analysis were determined and includes instructions for making use of an accompanying Excel workbook (See **Appendix N**). This workbook provides detailed output that was used in creating the summary tables in this document.