City of Shreveport –

Common Link Project

Submitted March 21, 2019 in response to:
U.S. Department of Transportation
Notice of Funding Opportunity (NOFO) Number 693JJ319NF00001
“Automated Driving System Demonstration Grants”

OFFICE OF THE MAYOR
SHREVEPORT, LOUISIANA

March 21, 2019

Secretary Elaine L. Chao
US Department of Transportation
1200 New Jersey Ave, SE
Washington, DC 20590
United States

Dear Secretary Chao:

The City of Shreveport is pleased to submit an application under the United States Department of Transportation's (USDOT) Automated Driving System (ADS) Demonstration Grants program. The City of Shreveport is on a path to a smarter city. This is an effort to create a more responsive government and to provide services in a streamlined and efficient way. To do this, it will require everything from analyzing big data sources like transit information to creating smart grids that help our buses run on time and our first responders move safely via smart traffic lights. There are endless opportunities in front of the City of Shreveport, but the top two smart city infrastructural needs for investment are in traffic and public transportation – and autonomous vehicles are a top priority.

Our three-year Common Link Project budget includes funds for two 12-passenger EasyMile EZ10 automated shuttles and two automated heavy-duty buses. Through a phased approach, our goal is to begin using automated buses interchangeably with traditional transit buses on one of our existing bus routes by the end of the demonstration period. The total cost of our proposed project is $7,167,952. We are requesting $6,917,506 from USDOT and will provide $250,446 in local match from the City's general fund and private sector partners American Electric Power (AEP) and Verizon Wireless.

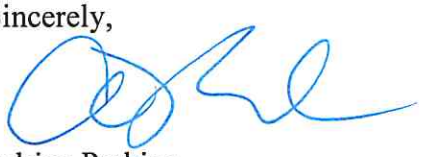
We selected our technology partner EasyMile through an extensive review of other ADS deployments and following discussions with other transit agencies and automated vehicle manufacturers. EasyMile brings industry-leading capabilities in the area of automation, specifically focusing on shuttles and larger vehicles that are well suited to public transit. We are excited about the potential of our proposed technology stack and are committed to implementing a robust data management system that will foster further understanding of the potential applications of ADS with local, state, and national stakeholders. Our proposal includes partner letters of commitment that show true excitement for what ADS technology can bring to our city, and our project will leverage other ongoing investments in Shreveport including our HUD Choice Neighborhood grant and our soon-to-be-completed Shreveport Common urban park.

Recipient capability and risk are important considerations for USDOT, and we have proposed a management approach that will guide the successful implementation of our project. We have a highly-skilled and pragmatic team that understands transportation systems and knows how to

insert innovative technology successfully into the City's transit operations. While we will produce and disseminate a massive amount of data during this project, our team is approaching this as much more than a research project. We see this as an opportunity to improve our public transportation system and to support our mission of making a difference in our customers' lives by providing safe, dependable, convenient, and courteous service.

We appreciate your consideration of this application and are eager to bring ADS technology to our public transit riders and community. As the proposed chair of our Common Link Project implementation committee, I look forward to personally sharing our successes nationally to support the goals of this grant program.

Sincerely,



Adrian Perkins
MAYOR

Summary Table	
Project Name/Title	Common Link Project
Eligible Entity Applying to Receive Federal Funding	City of Shreveport 505 Travis Street Shreveport, LA 71101
Point of Contact	Dinero' Washington CEO, SporTran Dinero.Washington@shreveportla.gov (318) 673-7400
Proposed Location for the Demonstration	Shreveport, Louisiana
Proposed Technologies for the Demonstration	EasyMile EZ10 12-passenger Shuttles; ADS-equipped Heavy-Duty Transit Buses
Proposed duration of the Demonstration	3 Years – July 1, 2019 to June 30, 2022
Federal Funding Amount Requested	$6,917,506
Non-Federal Cost Share Amount Proposed	$250,446
Total Project Cost (Federal Share + Non-Federal Cost Share)	$7,167,952

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Part 1 – Project Narrative and Technical Approach

1. EXECUTIVE SUMMARY

For the City of Shreveport, the United States Department of Transportation's Automated Driving System (ADS) Demonstration Grants program presents an opportunity to introduce cutting edge technology that will eventually make public transit more cost effective and financially sustainable. Our Common Link Project will be implemented in phases over a three-year period, with the ultimate goal of putting autonomous buses on one of our existing, high ridership bus routes by the end of the demonstration period. Our project will launch on two new low-speed routes within the Shreveport central business district using the Level 4 – High Automation EasyMile EZ10 shuttle. As the project progresses, we will make incremental changes to routes and vehicle speed, and we will introduce two larger capacity Level 4 automated battery-electric buses to demonstrate that ADS can be layered onto existing transit technology.

We have designed the demonstration routes in coordination with our technology partner, EasyMile, focusing on turns, traffic signals, speed limits, and traffic patterns to create routes that are safe, but will at the same time advance ADS technology. The first route will provide connectivity between our downtown business district, the Shreveport Common cultural district and urban park, and United States Department of Housing and Urban Development Choice Neighborhood construction in the Ledbetter Heights neighborhood. The second route will link the central business district, convention center, and downtown hotels with Shreveport's riverfront entertainment district. The City's $24.2 million Choice Neighborhood grant will have a massive economic impact for Shreveport and will transform the area in and around our demonstration site. The total investment is estimated at $140 Million, including both grant dollars and leveraged capital. This will generate an estimated $2.6 billion in economic impact and will create an estimated 2,500 direct, indirect, and induced jobs in construction, supportive services, community improvements, and administration.

Our proposed routes will complement and feed into the City's public transportation network, with transfer points on each route to connect with the Shreveport-Bossier Downtown Circulator route. This route is the highest ridership route in the City's public transit system and is the route that we will incorporate into the demonstration during year three. Storage in close proximity to routes is a key consideration for AVs, and is a project component that we have already addressed. Our autonomous vehicles will charge and be stored at our new light-duty transit maintenance garage

that the City purchased in early 2019. This facility is adjacent to our intermodal terminal that houses our transit system (SporTran), Greyhound, and Amtrak Thruway. As we roll out AV technology to other locations, this new garage will allow us to serve multiple routes from a central location and minimize overhead cost for vehicle storage.

To measure progress toward our goal of using autonomous vehicles in regular transit service, we have identified a number of intermediate objectives for this project including increasing passenger acceptance of ADS, achieving operations and maintenance (O&M) cost recovery, strengthening interagency coordination, and developing a track record for safe AV operations. Data collection and data management will be critical to all of these objectives, and we propose data-sharing tools that will support communication efforts with all project stakeholders. Passengers will be key stakeholders in our demonstration, so we will take efforts to keep citizens engaged in our project. When we first roll out this technology, there will be excitement because of the novelty of driverless vehicles. To capitalize on this excitement, we will create an interactive brand with a local flare to share progress toward our objectives and to help sustain customer feedback. Our marketing team will engage the public to develop a branding strategy that reflects the rich history of our downtown area, pulling in themes such as the iconic Louisiana Hayride and Huddie “Lead Belly” Ledbetter.

The Common Link Project includes technology partners, local and state government, the private sector, law enforcement, and other stakeholders who are committed to our project’s success. Our SporTran transit executive team – Dinero’ Washington, Chief Executive Officer, and Alan Bright, Chief Financial Officer – will lead implementation on behalf of the City and will coordinate closely with Chief Technical Officer Keith Hanson and City Attorney Mekisha Creal. As referenced above, EasyMile is the main technology partner for our application, and our local utility provider AEP/SWEPCO has committed to a $150,000 match toward vehicle charging infrastructure. Additionally, Verizon Wireless has committed to providing wireless data plans for the duration of the demonstration. Throughout the project, our Common Link Committee will meet at least quarterly to review demonstration data, document challenges, identify safety risks, develop mitigation strategies, and make recommendations on next steps. Chaired by Mayor Adrian Perkins, this committee will be made up of staff from the City/SporTran, Louisiana Department of Transportation and Development (LADOTD), Shreveport Police Department, Greater

Shreveport Chamber of Commerce, Shreveport-Bossier Tourism and Convention Bureau, and other stakeholders identified during project start-up.

The SporTran executive team has played a leadership role in the state and regional transit sector with deploying innovative technology over the past five years, serving as a resource for other transit agencies looking to make investments in new technology. Dinero' Washington serves as President of the Louisiana Public Transit Association (LPTA) and is an active board member for the Southwest Transit Association (SWTA). The City of Shreveport has received the Louisiana Clean Fuels Municipality of the year every year since 2014 and has transitioned more than two-thirds of its fixed-route bus fleet to alternative fuel vehicles. The City most recently added five battery-electric buses to its fleet in November 2017. In the first full year of our electric bus deployment in 2018, SporTran recorded an average revenue mileage usage of just over 30,000 miles per electric bus. This is more than two times the 2017 National Transit Database-reported average annual heavy-duty electric bus mileage and demonstrates our ability to successfully implement innovative projects in revenue service.

Our partner EasyMile brings additional leadership in the field of ADS for transit-oriented vehicles. EasyMile focuses on enabling autonomous transportation adoption through developing driverless software for vehicles operating on open roads, integrating driverless technology into different vehicles to address a variety of use cases, and developing methodologies to efficiently and safely deploy fleets of automated vehicles. Since 2015, EasyMile has successfully deployed vehicles more than 250 times in 23 countries on 4 different continents, transporting more than 300,000 people on more than 200,000 vehicle miles. These projects have served to develop their technology in a range of environments (city centers, university campuses, corporate campuses, amusement parks, etc.), traffic conditions (segregated road, mixed traffic with bicycles and pedestrian, mixed traffic with low speed cars, etc.), and various weather conditions.

Layering ADS technology onto a heavy-duty transit bus platform during year three is an important element of our approach. Currently, there is not a product available that meets our needs, but EasyMile is in discussions

Common Link – The Driving Force

EasyMile's vehicles, including the EZ10 are Level 4 according to the Society of Automotive Engineers (SAE) definition of Driving Automation Systems for On-Road Motor Vehicles - J3016_201806. A Level 4 system is an ADS that can itself perform all driving tasks and monitor the driving environment – essentially, do all the driving – in certain circumstances. AVs are preprogrammed to run on predefined routes or a network of routes. EasyMile's ADS software is able to determine the vehicle's exact position with centimeter-level precision by merging data from the following sensor stacks:

- Laser scanning (LiDAR)
- Cameras
- Differential GPS
- Visual location
- Estimation using an Inertial Measurement Unit (IMU)
- Odometry estimation

with several leading bus manufacturers to address this market failure. We will conduct a competitive procurement for heavy-duty automated buses during the first year of our demonstration to select a heavy-duty bus manufacturing partner. This approach will ensure that USDOT is getting the best possible value, will lead to a partnership that best meets the needs of our demonstration, and will provide the framework for a Buy American compliant procurement. We have included letters of interest from two leading bus manufacturers – New Flyer and Proterra – that show the priority that the industry is placing on ADS, and we expect that our solicitation will generate proposals from a number of potential partners.

Currently, autonomous shuttles and buses are used almost exclusively on low-speed routes, and manufacturers are not yet comfortable with "putting the pedal to the metal." This makes it difficult to substitute AVs for traditional transit buses, largely due to route lengths and higher speed limits found on main transit corridors, especially in less dense urban areas such as Shreveport. Using safety and performance data to drive decision-making and timing, we propose to gradually increase vehicle speed to the point where using these vehicles in regular transit service becomes a viable option. The EZ10 shuttle is capable of traveling at 30 mph, but is typically governed to 15 mph. At its top end speed however, the EZ10 could be used on our existing Shreveport-Bossier Downtown Circulator route without negatively impacting the flow of traffic. The heavy-duty buses will be capable of going even faster, opening up the possibility of using automated buses on a wide range of routes throughout the SporTran service area in the future once the technology is proven and accepted.

Getting Up To Speed

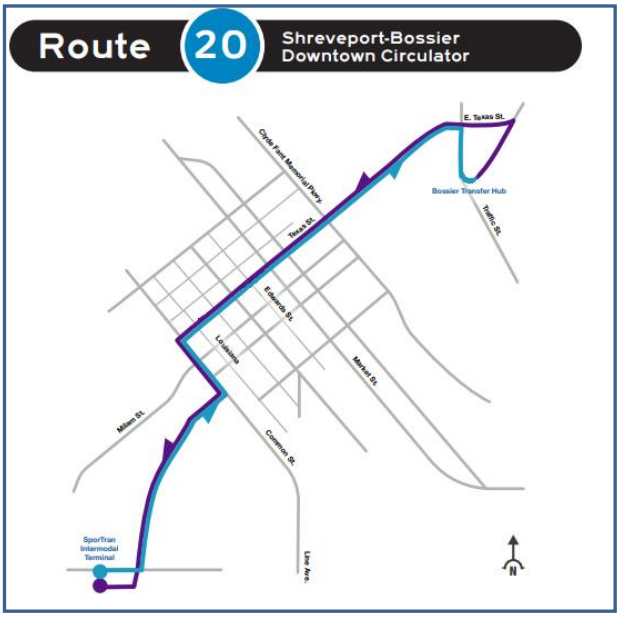
For our initial deployment, vehicle speeds will be limited to 15 mph. Our team will meet quarterly to analyze data and make decisions to increase vehicle speed by 1-2 mph on specific route segments. We will repeat this process every quarter and by the end of year two, we expect vehicles will travel close to 25 mph on certain segments of our routes.

The Common Link Project will first be implemented in downtown Shreveport, and will extend into Bossier City during the third year of the demonstration. Our proposed routes will operate on both local and state roads, and we have the LADOTD's commitment to upgrade communications infrastructure along these routes to facilitate safe AV operations. The period of performance for our project is three years. We anticipate deploying two EZ10 shuttles within six months of award, and we propose to add two 30- or 35-foot automated heavy-duty transit buses at the beginning of year three. We recognize however that in order to be successful, our implementation schedule must be data driven. As such, we will set targets and milestones to demonstrate progress toward our objectives and to ensure that safety remains a cornerstone of all deployment decisions.

The sections that follow further describe our goal, our approach to implementing our project, how our demonstration aligns with USDOT's focus areas, and the resources that the City of Shreveport will bring to this project to help accelerate the adoption of ADS technology nationally in the public transit sector.

2. CITY OF SHREVEPORT GOALS

Planning for long-term investments in the City's transportation network is the primary impetus for our project, and we have designed our demonstration as a means to prepare the City of Shreveport and other cities our size for the integration of ADS into public transit. As a City, we strive to adopt the best and most innovative technologies available, but this must but be done within the context of budget, regulatory, and systemic constraints. Our goal is to replace traditional transit vehicles with self-driving vehicles in circumstances where doing so will allow for more frequent and reliable service at a lower cost.



One near-term opportunity to achieve this goal is on our Shreveport-Bossier Downtown Circulator route. This route has minimal turns and a maximum speed limit of 30mph. Ridership on this route exceeded 400,000 passengers in 2018, or roughly 16% of total system riders. For a city and system our size, this is an extremely effective and highly utilized route. The Downtown Circulator was originally served by three buses at peak time when it was launched in November 2017, with 13 minute headways. Due to budget and schedule constraints, we streamlined this route and now serve it with two buses at peak on a 15 minute headway and with one bus every 30 minutes at night and on weekends.

Downtown Circulator Route Points of Interest: Cohab Entrepreneur Hub, Convention Center and Hotels, Government Plaza, Louisiana Boardwalk and Casinos, Marlene Yu Museum, Red River Entertainment District, Sci-Port Science Museum, Shreveport Aquarium, Shreveport Common Park, Spring Street Museum, Southern University Metro Center, Texas Street Library

Using automated vehicles on the Downtown Circulator would allow us to increase frequency within our current budget, or maintain our current frequency and reallocate resources to other routes or services. During year three of our demonstration, we plan to phase in automated vehicles on the Downtown Circulator. We envision first implementing this technology on nights and weekends when ridership and downtown traffic are lower. This service will be provided using heavy-duty transit buses, and the EZ10 shuttles could be used as well if need to maintain frequent headways.

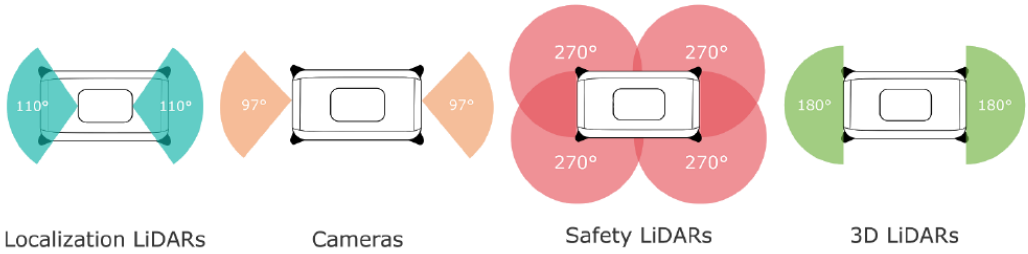
Typical of our system, an estimated 10% of riders on the Shreveport-Bossier Downtown Circulator route are seniors or individuals with disabilities. With the completion of HUD Choice Neighborhood housing developments along the route, we expect ridership to grow on this route, serving primarily transportation challenged populations. Service to the $2.5 million Shreveport Common Park and food truck court, which is under construction and expected to be completed in summer 2019, will attract additional riders to the route.

As stated above, a few of our intermediate objectives for this project include increasing passenger acceptance of ADS, achieving operations and maintenance (O&M) cost recovery, strengthening interagency coordination, and developing a track record for safe AV operations. We have proposed initial performance indicators as part of our data management plan to assess how we are meeting our objectives. These indicators will be further developed after award to ensure that they align with USDOT and other stakeholder needs.

The USDOT has emphasized the need for demonstration projects to advance its stated goals. We provide additional detail below on how the Common Link Project aligns with those goals.

a. Safety: Initially our project will resemble most other AV demonstrations, but this is a necessary step to develop baseline data and grow passenger acceptance of driverless vehicle technology. However, through increased vehicle speeds and deployment on more challenging routes as the demonstration progresses, we will develop a robust set of safety and performance data that will allow for detailed analysis of the challenges that more demanding routes pose and for understanding how ADS and other interventions are able to respond to these challenges.

EasyMile's technology relies on an extensive range of technology, with sensors providing feedback on the oper ating environment and determining what actions the vehicle takes in response to on-road conditions. Through our Common Link Committee, we will analyze events and work with EasyMile to identify areas where technology improvements or other actions are needed to address problems.



b. Data for Safety Analysis and Rulemaking: Public transit is a data-rich sector, and we will leverage existing and new data to provide insights into the advantages of ADS technology to inform local, state, and federal rulemaking and to evaluate the benefits of local investments in automated transit vehicles. We understand that any accident in a driverless vehicle is going to generate headlines, and our goal is an accident-free demonstration. In an on-road application however, this is an unfair standard.

Using comparison data from the City of Shreveport's regular transit fleet, we will objectively depict the safety track record of our autonomous vehicles and communicate our story in an effort to positively influence public perception. We assess our bus accidents using the National Safety Council definitions for Non-Preventable, Preventable I, and Preventable II and will apply this same standard to AVs. For example, a Non-Preventable "mirror clip" caused by an opposing driver crossing into an AV's lane will be an event worth analyzing, but it should not necessarily be viewed as an ADS failure. During the third year of our demonstration, we propose to use the heavy-duty AVs on our Shreveport-Bossier Downtown Circulator Route, but we will also continue to run traditional transit buses on this route. During that year, the comparison data will become particularly compelling – man vs. machine!

An important part of our approach will be to use our existing data collection tools – in addition to some new ones – to facilitate comparisons between autonomous and traditional vehicles. Our transportation supervisors and maintenance supervisors currently use a tablet-based Software as a Service (SaaS) application to document and classify accidents and incidents. We

expect to follow the same process for our AVs, allowing us to easily generate reports and analyze AV performance as a subgroup of our fixed-route fleet. We will also develop tools specifically for AV data collection and data sharing, such as a website that will 1) keep the public and stakeholders on progress toward our targets and 2) provide a mechanism for customer feedback and engagement. These tools and approaches are described in our Data Management Plan, and will be more fully developed during the first three months of project implementation.

c. Collaboration: We have included letters of commitment from key project stakeholders in our proposal, and we will expand the project team as we identify new needs and challenges throughout the project. The makeup of our Common Link Committee reflects the complexity of implementing an AV demonstration and aligns with our project objectives. We have identified partners who are committed to the safety and technology aspects of the project, and our committee includes partners that are invested in downtown Shreveport's economic vitality including the City's Department of Community Development, Downtown Development Authority, Shreveport Common, Inc., and the Shreveport-Bossier Tourism and Convention Bureau. New Horizons Independent Living Center, a disability advocacy organization serving 29 parishes (counties) in Louisiana, has also agreed to participate in our committee.

   Establishing the Common Link Committee is an important step in our project, but maintaining commitment is always a challenge. Our approach and the makeup of our committee are designed to mitigate this challenge. Newly elected Mayor Adrian Perkins will serve as the chair of our committee, signaling the importance of this project to stakeholders. Additionally, our phased approach and increasingly challenging demonstration means that committee members will be actively involved in decision-making throughout the project. We will also emphasize the committee's role in performance monitoring and develop a shared responsibility for project outcomes and results.

3. COMMON LINK FOCUS AREAS

The City of Shreveport recognizes that the Automated Driving System (ADS) Demonstration Grants are in high demand, and we have designed a project that supports both the USDOT and the City's priorities. Automated vehicles are a novelty, but we need them to be much more than that. First and foremost, the demonstration must be successful and must safely push the limits of the technology. Below, we highlight how our project addresses the focus areas in the grant program notice.

a. Significant Public Benefit(s): On a local level, ridership statistics will depict passenger acceptance and the usefulness of the demonstration routes. By year three, however, we expect the demonstration to evolve to the point where autonomous vehicles are saving the City money on operator labor, which is one of the long-term benefits that many municipalities hope to achieve from ADS technology. If the City of Shreveport achieves its goals, the national significance will be an even more compelling result of USDOT's investment in our project.

b. Addressing Market Failure and Other Compelling Public Needs: For the City of Shreveport, we are excited about AV technology, but we are disappointed that automated buses/shuttles on the road today are limited in speed. Alphabet's Waymo is a notable exception, but studies have shown that driverless cars will actually increase roadway traffic, meaning that larger transit-oriented autonomous vehicles must remain part of the transportation equation. The current shuttle technology is capable of higher speeds, but it has not been fully implemented due to legitimate safety concerns. These vehicles also do not have the seating capacity necessary to serve most transit routes, which is something we will address through a competitively selected partnership with a transit bus manufacturer. Once these faster, larger vehicles are unleashed, the market opportunity will be enormous. Our project is designed to help push the technology to this stage and develop a track record for safety that provides the regulatory and public support for this next step.

c. Economic Vitality: Our partners understand that federal funds must support advancing domestic industry, and EasyMile is committed to working with domestic bus manufacturers to deploy ADS technology. EasyMile's expertise is in the sensors and software required for vehicle automation. The limited manufacturing base for ADS technology is a challenge, but we will work with USDOT during implementation to request waivers as needed, and we will prioritize procurements that fully meet Buy American requirements. The largest part of our budget however is for heavy-duty transit buses, and

through our competitive procurement process, we will identify a manufacturing partner that will meet the Buy American requirements.

d. Complexity of Technology: Our proposed EZ10 vehicles and the EasyMile ADS-equipped heavy duty buses will include Level 4 SAE Driving Automation Systems for On-Road Motor Vehicles - J3016_201806. The following is a summary of the sensors and technology used in the EasyMile ADS platform:
    - *LiDARs* – Light Detection and Ranging (LiDAR), is a remote sensing method that uses light in the form of a pulsed laser to measure ranges. The proposed EasyMile ADS system includes 4 LMS Safety LiDARS, 2 LDRMS Localization LiDARs, 2 VLP16 3D LiDARs for navigation and obstacle detection and redundant coverage
    - *Indoor and Outdoor Cameras* – used for navigation and environmental detection
    - *Inertial Measurement Unit* - inertial unit capable of integrating the vehicle's movements (acceleration and angular velocity) to estimate its orientation (roll, pitch and heading angles), linear velocity and position.
    - *Odometric Estimation* - sensors on the wheels to measure the vehicle's movement. Odometry is based on the measurement of wheel movements to reconstruct the overall vehicle movement. Starting from a known initial position and integrating the measured displacements, the current position of the vehicle can be calculated at any time.
    - *GNSS Antenna* – this antenna feeds into a GNSS real-time kinematic correction provider to refine the vehicle's positon with centimeter accuracy.

Data collected through these sensors is processed through EasyMile's fleet management software EZ Fleet, which is the electronic brain of the ADS. The software collects, fuses, and interprets data using a technique called S.L.A.M. (Simultaneous Localization and Mapping). The fusion of data from the sensors ensures redundancy and robustness in the vehicle's localization, with weak points of one system being compensated by strong points of the others.

e. Diversity of Projects: The urbanized area (UZA) for the City of Shreveport includes Bossier City and has a combined population of 298,317 per the 2010 Census. Our population and low density are typical of metropolitan areas in the southern United States, and our public routes are similar to those of cities our size. Through the Common Link Project, we aim to show that AV bus technology is applicable to cities of all sizes, even if it is not yet viable on all public transit routes due to speed limits, limited communications infrastructure, and route lengths.

f. Transportation-challenged Populations: The Common Link Project includes vehicles and bus stops, and accessibility and safety will be key design parameters for all aspects of our routes and technology. Additionally, the Common Link Committee includes individuals from the disability community who will serve as a resource to influence and assess the project from an accessibility standpoint. For our demonstration, we will have safety specialists on board the autonomous vehicles at all time while the vehicles are in operation. This is one of EasyMile's requirements, but the safety specialist will also play a vital role in data collection and operational support. One of their initial functions will be securing mobility devices. The ramp on the EZ10 can be deployed from either inside or outside the vehicle.

In addition to accessibility considerations, we have selected routes that will provide last-mile service and mobility options for transportation-challenged populations. One of our demonstration routes provides service to/from the Shreveport Common/Ledbetter Heights neighborhoods. These areas are home to several social service organizations and are a major focus of Shreveport's HUD Choice Neighborhood grant. Our other demonstration route will serve the downtown riverfront district and will provide transportation for tourist activities around the convention center and casinos, but it will also get casino and other service-industry employees closer to work.

g. Prototypes: We propose to deploy two EasyMile EZ10 shuttles and two automated heavy-duty battery-electric buses. The EZ10 has been deployed around the world and has moved beyond prototype status. Our heavy-duty buses will be among the first automated heavy-duty transit buses deployed in an on-road public transit setting; however, the base vehicle platform will be proven, field-tested technology.

4. REQUIREMENTS

We have designed the Common Link Project to meet USDOT's requirements and have identified the budget and other resources necessary to implement our approach successfully. In this section, we provide additional details on how our project addresses the requirements set forth in the notice of funding opportunity.

a. L3 or Greater Automation: As stated above, our proposed EZ10 vehicles and the ADS-equipped heavy-duty bus will include Level 4 SAE Driving Automation Systems for On-Road Motor Vehicles - J3016_201806. We will have onboard safety specialists throughout the demonstration, but eventually, we expect to limit human involvement in our AV operations.

b. Physical Demonstration: We have included two initial demonstration routes and propose to deploy our automated buses on an existing fixed-route bus route during year three. To fit with the technology, we have designed short demonstration routes that can be completed in less than 20 minutes. By deploying on two routes, we can test a greater number of scenarios and route challenges as each route will have unique characteristics associated with the roadways, turns, traffic patterns, etc. These characteristics and the challenges of our routes are presented in detail in Section 5, Approach.

c. Data Collection and Storage: We will use multiple approaches for data collection, storage and communication, using our existing tools and resources in most cases to minimize cost and to simplify the customer experience. For example we will use our existing City of Shreveport and SporTran websites as the entry point for the public looking to access information on the project, allowing them to then navigate to a Common Link webpage. We will use this webpage to communicate project data and to host passenger surveys. Other data sources include EasyMile application programming interfaces (APIs), on-vehicle cameras, our incident/accident supervisor software application, and semi-annual LiDAR dumps. We will are open to using USDOT's secure data common for sensitive data and for long-term data storage, subject to budget considerations. As alternatives, we propose using either the Socrata Data-as-a-Service Platform, Google Cloud, or Amazon Web Services, with all setup and enablement work handled internally by City IT staff. Our part-time data analyst will be responsible for uploading and organizing this data. The City of Shreveport will make available all data collected directly through the demonstration, including data provided by its partners, both during the demonstration and for a period of up to five years after the project and will document this commitment via a data sharing agreement with USDOT.

d. User Interfaces: Public engagement will integral to all aspects of our project, and technology plays an important role in getting citizen input and buy-in. Passengers will be able to track vehicles both through our Common Link Project website and through the SporTran Automatic Vehicle Locator system at www.sportranbus.com. Additionally, passengers will be encouraged to respond to regular surveys, either online, or the vehicle with the assistance of the onboard safety specialists. Each safety specialist will have a tablet for data incident reporting, and they will use these tablets to conduct passenger surveys for passengers who need assistance with the electronic survey. Lastly, we will report out on information generated by the ADS in a number of ways, including on the project website, on-board using public information monitors, and through social media. Curiosity Rover's four million followers on twitter show that people want to interact with technology. We will use social media as a fun way to keep the public engaged throughout the project.

e. Outreach and Scalability: Mayor Perkins was sworn into office at the end of December 2018 and has made technology a primary focus of his administration. He appointed the City's first ever Chief Technical Officer and recently participated in the South by Southwest Civic I/O Mayor's Summit. Under his leadership, the City of Shreveport will implement a robust outreach campaign to share our lessons learned, demonstrate the impact of USDOT's investment, and make the case for municipal investments in ADS. Although we are proposing a three-year demonstration, we expect that future AV deployment schedules can be significantly condensed. As one of our final deliverables, we will provide a report on how we will expand our AV program beyond the demonstration routes. This report will serve as a roadmap for other cities our size to use for route selection and AV project design. Our data management plan includes details on the types of information that we will gather and disseminate to promote and inform ADS adoption in the public transit sector.

5. APPROACH

a. Technical Approach to Implementation and Evaluation: Our implementation calls for deployment of Level 4 autonomous vehicles, initially on two new downtown routes, and then on the City's existing Shreveport-Bossier Downtown Circulator Route during the third year of our demonstration. Major elements of our project include the proposed vehicles, our vehicle storage facility, our multi-stakeholder Common Link Committee, project staff, training, and data collection to support operational decision-making.

The EasyMile EZ10 shuttle is the backbone of our project as it will be used to develop performance and safety data that will support adoption of more advanced technology as our demonstration progresses. This is a 12-15 passenger battery-electric vehicle with a 9.2 foot wheelbase and a 30 mph maximum speed, which is currently electronically limited to 15 mph in all deployments. The EZ10 has a 30.72 kWh battery capacity that supplies up to 15 hours of runtime in a single charge. We expect to operate the EZ10s for no more than 10 hours per charge and have budgeted safety specialist labor accordingly. During the first year, we will deploy the EZ10s exclusively on new routes that we will establish specifically for introducing AVs into our downtown community. Starting in year two, we will begin testing the EZ10s on our Downtown Circulator route without passengers and during off-peak times to prepare for deployment of heavy-duty AV buses on that route in year three.

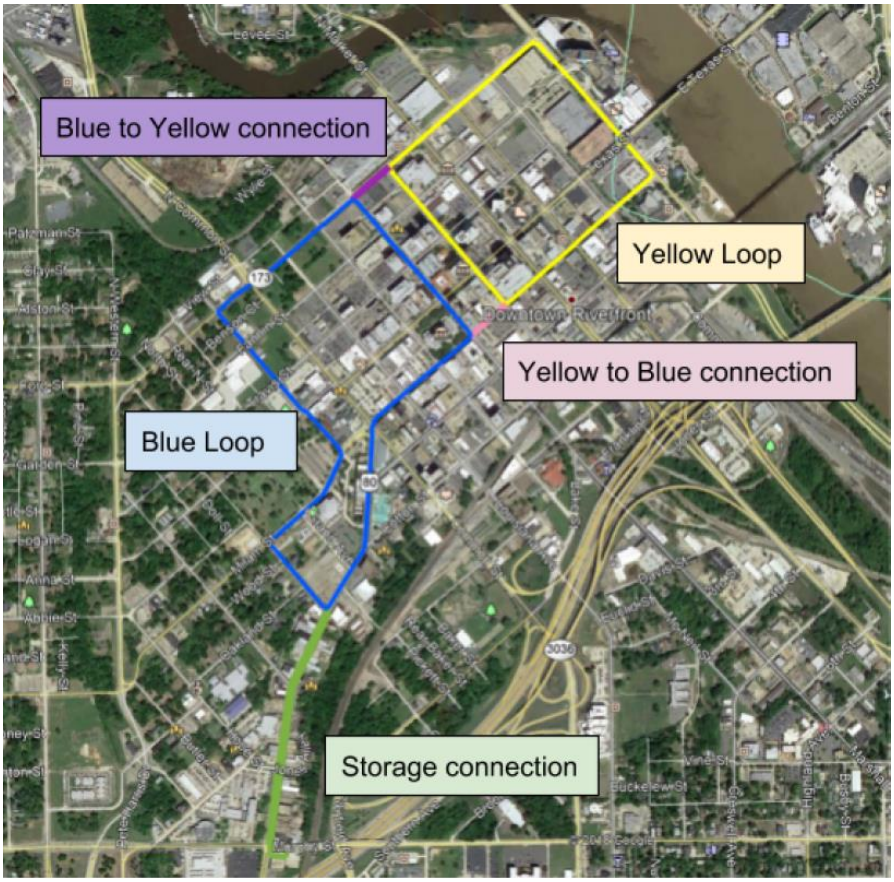
With an eye to future infrastructure needs, the City of Shreveport acquired a new maintenance garage in January 2019 that will serve as our AV storage facility. This building is directly across the street from the City's intermodal transportation terminal and faces Texas Avenue, the main corridor connecting Interstates 20 and 49 with downtown Shreveport. This facility will house our AV charging structure, including an overhead fast charger for the heavy-duty buses to allow us to maximize the time that these vehicles are on the road each day.

Our approach calls for minimal direct labor, with on-board safety specialists and a part-time data analyst as the only paid project staff. Our SporTran executive team will oversee the day-to-day operations and the Common Link Committee will provide overall guidance and decision-making support to ensure that we complete milestones and achieve project objectives. This oversight is not reflected in our project budget, but will represent a significant investment from the City. Likewise, many of our data collection tools and

approaches will leverage existing City of Shreveport investments at no cost to the Common Link Project.

We have worked with EasyMile to develop our proposed demonstration routes and our plan to ultimately use AVs on our Shreveport-Bossier Downtown Circulator Route. Because we want to minimize the need for manual/human operation of the vehicle, EasyMile will also pre-program paths in the fleet management system to/from our storage facility and between routes so that vehicles can change assignments throughout the day without intervention by the on-board safety specialist. Working with EasyMile, we have broken the demonstration site down into five different areas, which are described in detail on the following pages.

Overview of Routes and Connections



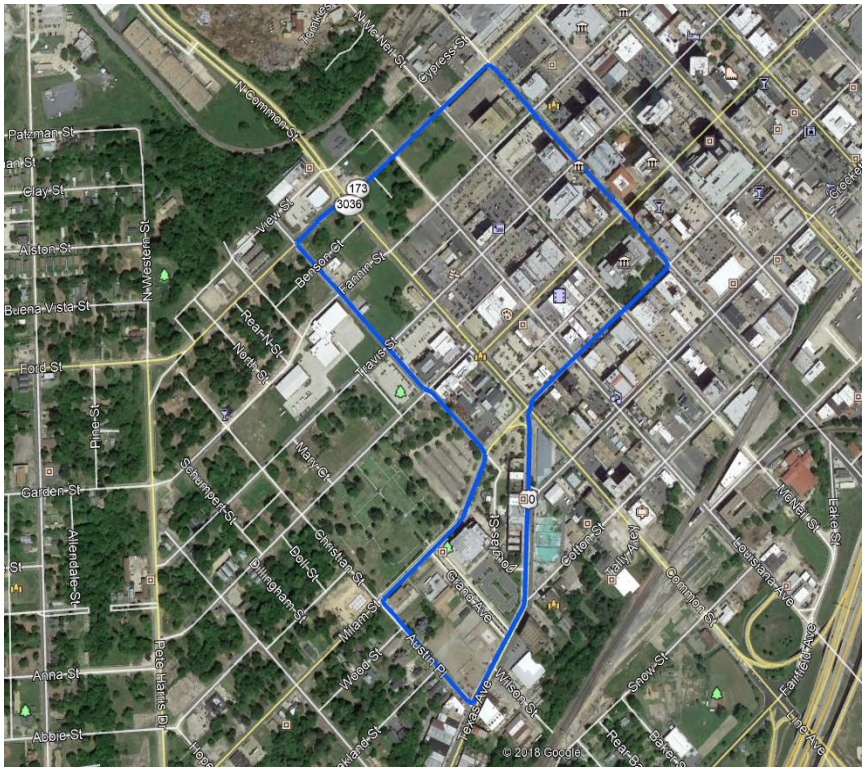
Access to the map online here

Area 1 - Storage Connection

Route	Storage Connection
Purpose	• Connection between the garage and the blue route
Length	• 0.45 mile
Road Characteristics	• Concrete • Intersections: Intersections with stop signs and stop lights equipped with RSU (or to be equipped) • No grade
Route Schedule	• Estimated time to complete full service route (Including intersections and traffic interactions) – Approximately 5 minutes
Operation details	• On-demand • No passengers
Days of Operation	• 7 days a week
Hours of Operation	• Before and after service with passengers on Blue and Yellow loops

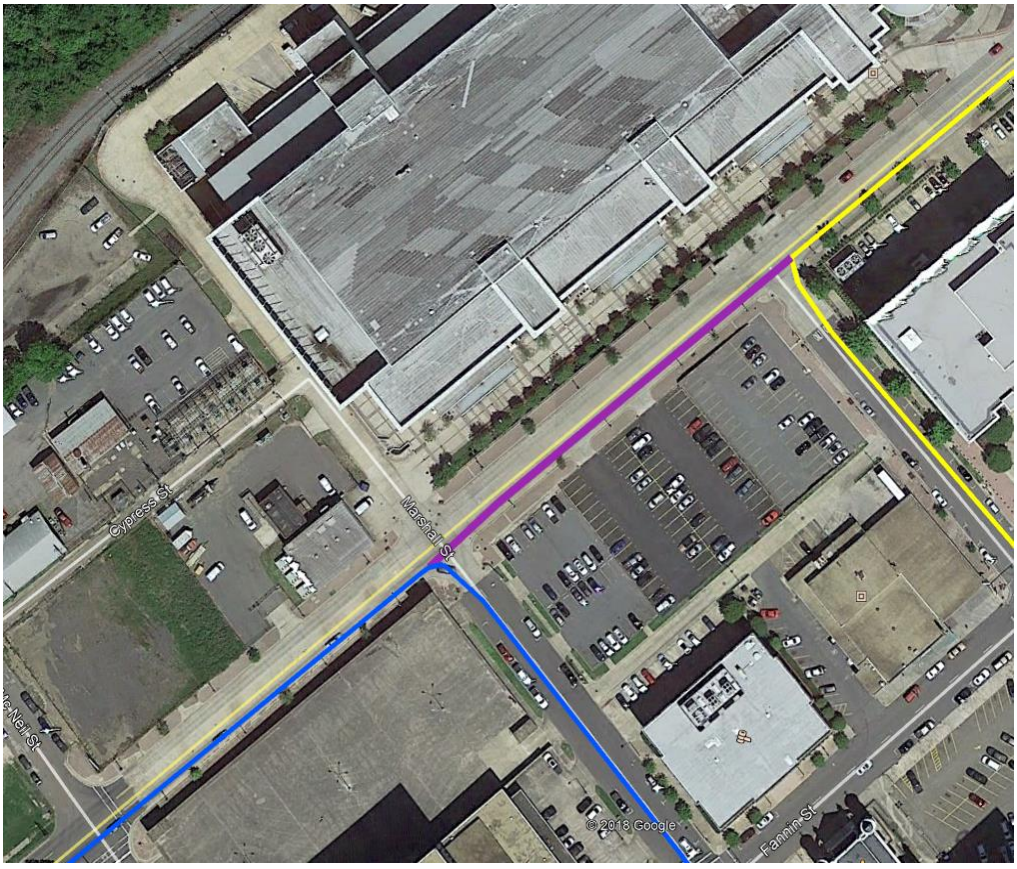
Area 2 - Blue Loop (Park Route)

Route	Blue Loop (Park Route)
Purpose	• Downtown connectivity
Length	• 1.8 mile round trip
Road Characteristics	• Concrete • Intersections: Intersections with stop signs and stop lights equipped with RSU (or to be equipped) • No grade
Route Schedule	• Estimated time to complete full service route (Including Service Stops, intersections and traffic interactions) – Approximately 18 minutes
Operation details	• Subway mode (meaning service will stop at each station as predefined along the route) during peak hour • 1 EZ10s in service • Up to 200 passengers per hour
Days of Operation	• 7 days a week
Hours of Operation	• 10 hours per day



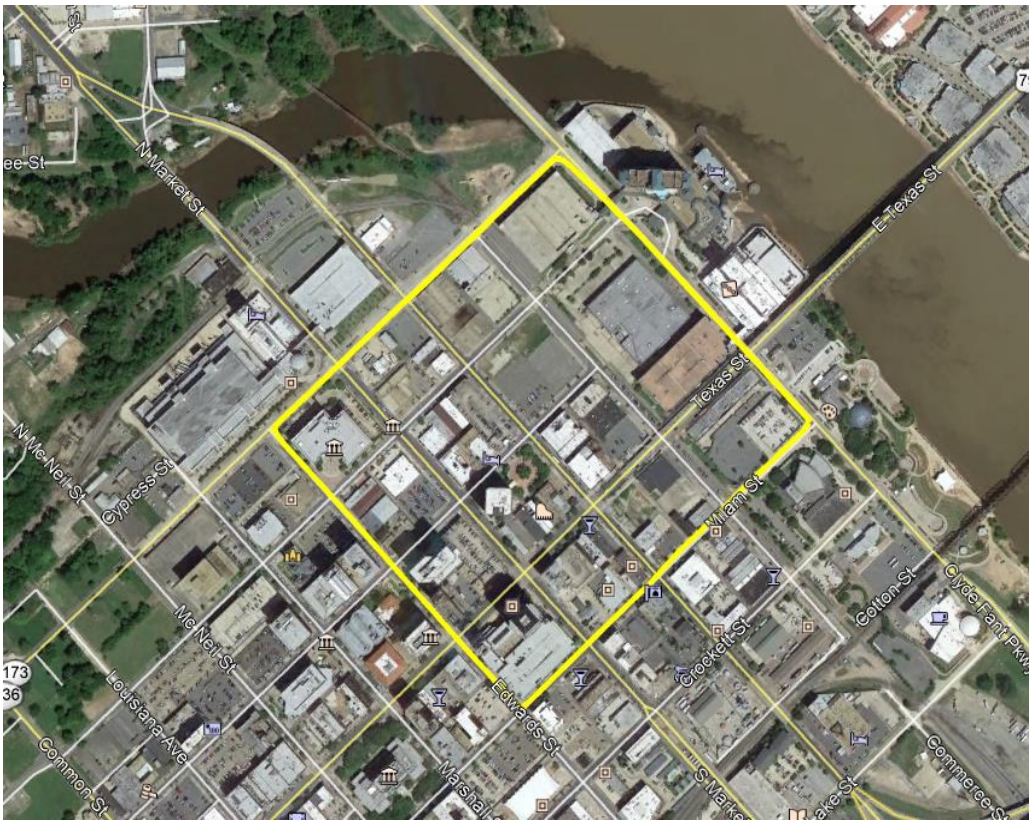
Area 3 - Blue Loop to Yellow Loop Connection

Route	Blue Loop to Yellow Loop Connection
Purpose	• Blue Loop to Yellow Loop Connection
Length	• 450 ft one way
Road Characteristics	• Concrete • Intersections: Intersections with stop signs • Low grade
Route Schedule	• Estimated time to complete connection (Including intersections and traffic interactions) – Approximately 1 minute
Operation details	• On-demand • No passengers
Days of Operation	• 7 days a week
Hours of Operation	• Before and after service with passengers on Blue and Yellow loops



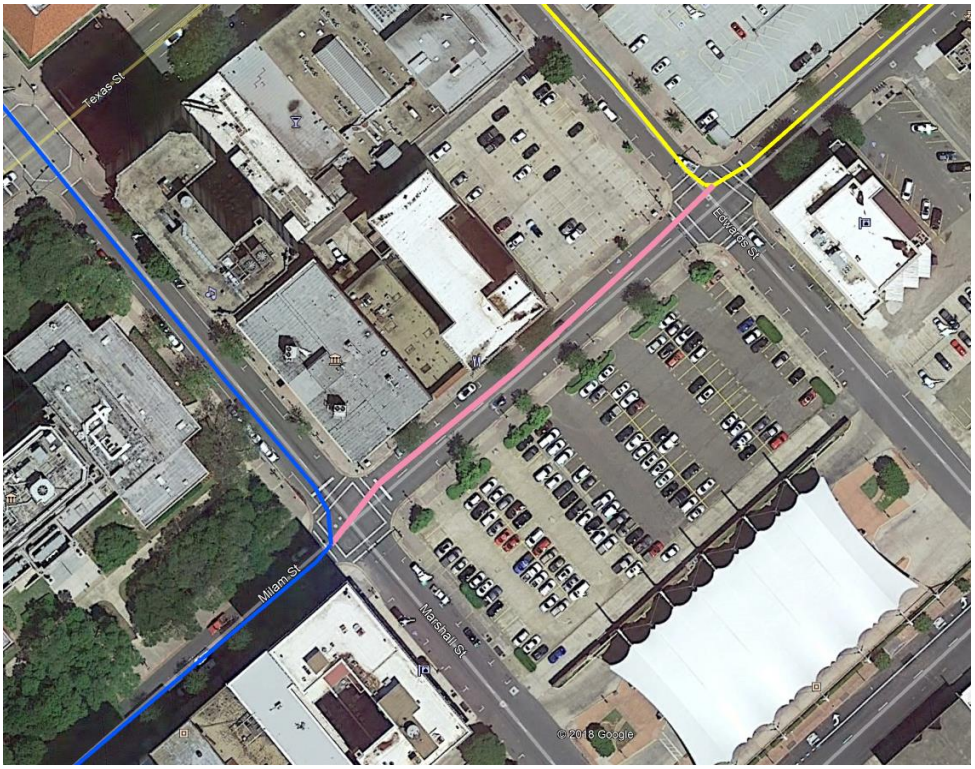
Area 4 - Yellow Loop (Riverfront Route)

Route	**Yellow Loop (Riverfront Route)**
Purpose	• Entertainment district service
Length	• 1.2 miles round trip
Road Characteristics	• Concrete • Intersections: Intersections with stop signs and stop lights equipped with RSU(or to be equipped) • No grade
Route Schedule	• Estimated time to complete full service route (Including Service Stops, intersections and traffic interactions) – Approximately 15 minutes
Operation details	• Subway mode (meaning service will stop at each station as predefined along the route) • 1 EZ10s in service • Up to 200 passengers per hour
Days of Operation	• 7 days a week
Hours of Operation	• 10 hours per day



Area 5 - Yellow Loop to Blue Loop Connection

Route	**Yellow Loop to Blue Loop Connection**
Purpose	• Yellow Loop to Blue Loop Connection
Length	• 430 ft one way
Road Characteristics	• Concrete • Intersections: Intersections with stop signs • Low grade
Route Schedule	• Estimated time to complete connection (Including intersections and traffic interactions) – Approximately 1 minute
Operation details	• On-demand • No passengers
Days of Operation	• 7 days a week
Hours of Operation	• Before and after service with passengers on Blue and Yellow loops



b. Approach to addressing legal, regulatory, environmental, and/or other obstacles: From a local and state level, we have high-level commitment to our project, and City and State officials will participate in our Common Link Committee to ensure that appropriate resources are available to address identified obstacles.

   Federally, our vehicle manufacturing partners will be required to get exemptions from the National Highway Traffic Safety Administration (NHTSA) to operate on public roads (as no autonomous shuttle complies with the current FMVSS standards). In October 2018, NHTSA updated their process for granting these approvals, and EasyMile was the first to apply and be approved for projects via this new process.

   Easy Mile's manufacturing base is outside of the United States. As a result, our demonstration will likely require an exception under the Buy American Act. The EZ10 vehicles are an important part of our demonstration, as they are available now and will enable us to test and further develop the ADS technology to prepare for our deployment of our U.S.-manufactured heavy-duty buses in year three.

c. Commitment to provide data and participate in the evaluation of the safety outcomes: We will provide demonstration data both through real-time APIs and through periodic data dumps. Our data analyst will organize data to make it as useful and accessible as possible. For example, we will maintain video recordings of all accidents/incidents/events that are physically observed by our on-board safety specialists. This will be achieved by the safety specialist hitting an event button on the bus (a process we already use on our buses), triggering a download to our data server. These videos on their own may tell part of the story, but we will append other data to these records to give a more complete picture of what was going on when the accident occurred. We have proposed an initial set of safety indicators in our data management plan, but we will work closely with USDOT to incorporate additional data collection needs during start-up and as new requirements emerge over time.

d. Approach to risk identification, mitigation, and management: Risk identification will require input from all stakeholders and risk mitigation. During each Common Link Committee meeting, our agenda will include a section on risk management. Our onboard safety specialists will attend these meetings to provide a human perspective on risk, and our team will present statistics and data that will guide discussion on risk management, technology

deficiencies, and recommended infrastructure upgrades. Risk mitigation and management go beyond routes and infrastructure however, and training will be one of our primary mitigation strategies. Training will focus on staff and stakeholders, but we will also tailor our outreach to ensure that the public understands the impact of introducing AVs into our transportation network.

"Training is something that EasyMile takes very seriously. Our focus on safety leads us to be not only the most deployed autonomous shuttle in the world, but crucially, the only shuttle with zero accidents and a 100% safety record."

For our proposed physical demonstrations, significant risk identification work has already been undertaken as part of our preliminary route design efforts. Below, we outline some of the potential risks and suggested mitigation strategies for our demonstration routes.

Challenge 1 - Other Road Users
AVs will be running with mixed traffic, around a variety of vehicles - motorized and not, and will have to manage intersections and road crossings, to follow vehicles, and stop for pedestrians and bicycles, etc.

Challenge 1 Mitigation Strategy
Signage will be necessary on site to communicate to other road users that AVs are running in this area. All streets on the route are posted at 30mph or less, which will help ensure safe and smooth operations.

Challenge 2 - Intersections
Our shuttles will need to navigate through several intersections including traffic lights, stop signs, yield signs and pedestrian crossings. EasyMile's ADS technology programs vehicles to slow down when approaching each of the different types of intersection, and then make the decision to cross or stop depending on the environment and the traffic around. At a Stop or Yield intersection, vehicles are able to scan the environment and make the decision to cross the intersection when the area is free.

For pedestrian crossings, EasyMile ADS-equipped vehicles will be required to scan the environment and make sure there is no one present in the crosswalk or potentially crossing the street outside of the crosswalk before going through. At Intersections with traffic lights – DSRC, EasyMile can read SPaT messages broadcasted by traffic light controllers to determine the phase and time of the light, and take the decision to cross or stop at the intersection.

Challenge 2 Mitigation Strategy

To support the safe crossing EasyMiles recommends that traffic light controllers are equipped with RoadSide Units to enable DSRC. During implementation, EasyMile will work with City of Shreveport traffic engineers and LADOTD staff to assess the systems that are already in place and develop a plan for updating systems were needed.

Challenge 3 – Localization

The EasyMile ADS fuses data from Odometry, IMU, GNSS and LiDAR to accurately identify its location within reference maps. LiDAR and GNSS data accuracy highly depend on the environment (trees, open sky, high buildings, etc.).

Challenge 3 Mitigation Strategy
The EasyMile team will update the reference maps on our vehicles on a regular basis. Also, the data will be fused from all sensor points, including ground markings, buildings, etc. to provide redundancy and ensure that the vehicles can run safely on a weak signal.

Challenge 4 - Stations
Stations are the only location where, when running in autonomous mode, the EasyMile ADS vehicles can stop and open doors for passengers to board and alight. There is always the possibility that other vehicles may park in the stations and block access by the AVs.

Challenge 4 Mitigation Strategy
We will dedicate a no parking area at each station to be sure our automated buses can always safely reach their stop without being blocked by other vehicles. EasyMile will provide technical support to the City for designing the stations in a way that does not disturb the flow of traffic, and where other road users will not be surprised when shuttles are stopping. The stations will also be designed so as to be safe for passengers, and adapted for wheelchairs so that the automatic ramp can be fully deployed without any issues.

Challenge 5 - Lane Change and Lane Merging
Dynamic lane changing and lane merging remain one of the biggest challenges for the AV industry today. The ability to maneuver into a new lane requires a negotiation that currently requires a degree of emotional intelligence (e.g., interpreting eye contact, hand waves, and head light flashing). This is something that has not been fully accomplished by any AV company today - largely due to the conservative approach to safety today.

Southbound Texas Av. Milam St & Common St Intersection Texas Av. & Austin Pl. Intersection

Challenge 5 Mitigation Strategy
The City will work to continuously identify and improve on solutions to facilitate lane changing and merging. Initial solutions are as follows:

1. Add signage or ground markings to ensure that any vehicles in the right lane have the right-of-way (e.g., on the southbound portion of Texas Avenue);
2. Develop traffic signalization strategy that minimizes lane merging (e.g., at the Milam St and Common St intersection);
3. Add a shuttle stop at the intersection of Texas Avenue and Austin Place so that the safety specialist can be included in the decision of when the shuttle should re-enter traffic.

e. Approach to contribute and manage Non-Federal resources (cost share): All federal and non-federal resources will be included in the City of Shreveport capital budget. Our proposed local match will be made up of private sector contributions from our electric utility provider, AEP, and from our cellular data provider, Verizon Wireless. In year three, we propose to pay for labor for two of the safety specialists out of the transit operating budget. These funds will be transferred to the capital budget as part of the annual City budget process, and transit will request a reimbursement based on actual direct labor expenses.