

Rebuilding American Infrastructure with  
Sustainability and Equity (RAISE) Grant Program  
FFY2021



Submitted by the City of Shreveport

July 12, 2021



OFFICE OF THE MAYOR  
SHREVEPORT, LOUISIANA

July 12, 2021

US Department of Transportation  
Secretary Pete Buttigieg  
1200 New Jersey Avenue SE  
Washington, DC 20590

Dear Secretary Buttigieg:

The City of Shreveport is pleased to submit an application under the United States Department of Transportation's FY 2021 Rebuilding American Infrastructure with Sustainability and Equity (RAISE) grant program. The City is seeking funding for the Shreveport Healthcare and Development Corridor project, focusing on complete streets and modal diversion along a 1.6-mile stretch of Kings Highway that connects I-20 and I-49. This corridor is located in Persistent Poverty Census Tract, yet it is home to the two largest employers in the Shreveport-Bossier City urbanized area and is the main economic hub of the region. As such, it is presently the subject of a major, multi-party planning and redevelopment endeavor, of which the transportation improvements considered here are a necessary and core component.

We are seeking \$22,164,000 in Federal funding for this project, and the City of Shreveport is committed to providing \$5,541,000 of local match out of the City's General Fund. Our partners are excited about the City's application and have provided letters of support: these include the two largest hospital and clinical care providers in the metropolitan service area (Willis-Knighton Health System and Ochsner LSU Health), the LSU Health academic medical center (home to one of only two Tier 1 Trauma centers in the State), the largest science-focused public-private enterprise in the region (the Biomedical Research Foundation), the primary research center for cancer in the region (the Feist-Weiller Cancer Center) and others. Together, these partners have planned investments in the corridor over the next five years that exceed \$300 million, including construction of a new \$72 million LSU Health medical education building that will break ground in 2021. In support of this vision, the Shreveport Healthcare and Development Corridor project features Bus Rapid Transit using battery-electric buses, bike and pedestrian infrastructure, roadway improvements, lighting upgrades, and other safety improvements.

The City of Shreveport's application directly aligns with the Biden administration's priorities to fund projects that address climate change and equitable service delivery. The City's public transit system, SporTran, was the first transit system in our state and region to deploy extended range battery-electric buses, recording more than 440,000 electric vehicle revenue miles since 2017.

Our partners in the Shreveport Healthcare and Development Corridor provide essential medical services to underserved communities, and bus stops in the target area rank among the highest traffic stops throughout the transit system. This project will add East-West connectivity along the corridor and improve conditions for bike, pedestrian, wheelchair, and other modes of transportation. We have the expertise to quickly and successfully implement the grant, and we look forward to developing infrastructure that will support job growth and access to services for citizens throughout our region.

Sincerely,

A handwritten signature in blue ink, appearing to read 'APK', is positioned above the printed name.

Adrian Perkins  
MAYOR

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## i. Project Description

The Shreveport Healthcare and Development Corridor Improvements Project is a shared vision of public and private partners that together are the largest driver of the Northwest Louisiana economy. Situated in Shreveport at the nexus of I-49 and I-20, the 1.6-mile corridor is home to the LSU School of Allied Health Professions, Ochsner LSU Health, Willis-Knighton, Biomedical Research Foundation (BRF) Shreveport, and Shriners Hospital for Children. These partners will invest more than \$300 million in the corridor over the next five years and have requested the City of Shreveport to prioritize upgrades to the transportation network to support planned growth. Through a collaborative process, the stakeholders have identified the urgent needs that are depicted in this application.

This corridor is critical to the regional economy because of the large base of good-paying jobs and our partners' investments in high-growth initiatives. According to a 2014 study by Tripp Umbach, there are roughly 30,000 direct and indirect employees working in the Shreveport Healthcare and Development Corridor, with an estimated economic impact of \$4.9 billion per year. Several large projects have recently been announced or are underway, which is expected to generate additional investment and growth in this corridor. The \$19.5 million Center for Molecular Imaging and Therapy broke ground on Kings Highway in 2019. This facility will be located directly on the Kings Highway corridor between Ochsner LSU Health and Willis-Knighton. In 2018, the LSU System supervisors approved a proposal to expand the Shreveport medical school through the construction of a new \$72 million medical education center.

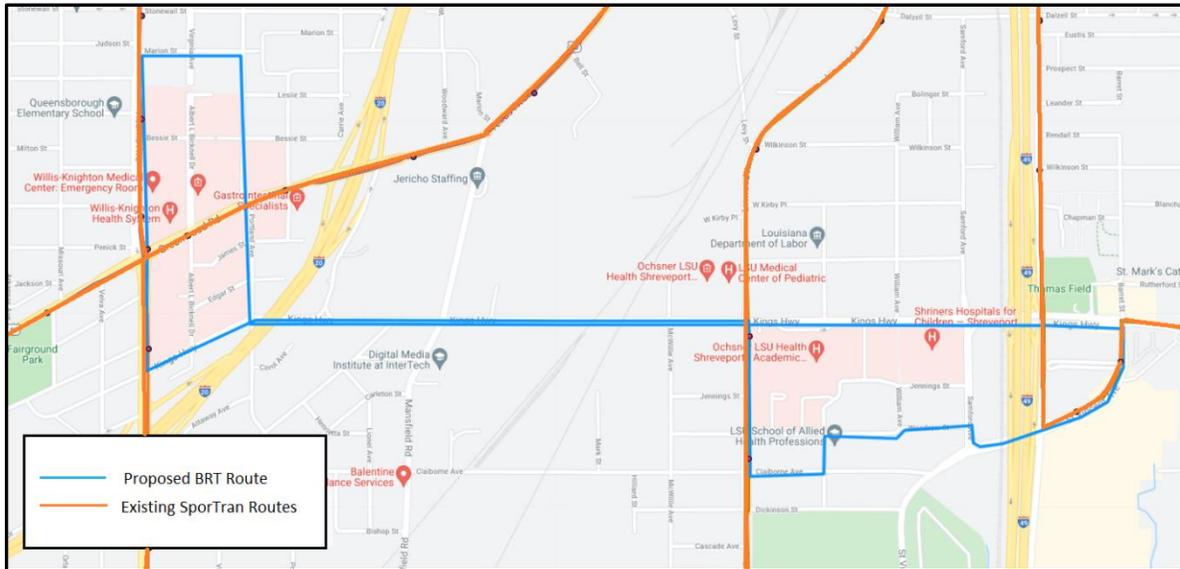


Investment in this corridor will bring new services, innovation, and employment opportunities, but the roadway and transit infrastructure are in dire need of improvements. The proposed project incorporates the following elements:

- Reconstructed roadways, transit bus pull-outs and streetscaping
- Bus Rapid Transit (BRT) using battery-electric bus technology
- Enhanced Americans with Disabilities Act (ADA) access
- Traffic signal improvements and emergency vehicle preemption (EVP) technology
- Improved pedestrian facilities including signals, a pedestrian bridge, and sidewalks
- Protected bike lanes, traditional bike lanes, and sharrows
- Improved street lighting

The BRT route will connect the two main medical facilities that anchor the ends of the corridor, capitalizing on the improvements to intersections and roadways to establish East-West connectivity that is not available on current public transit routes. This route will

provide unprecedented affordable commute option for the 43,000 daily jobs, medical appointments, and educational activities that are located within a half-mile of the project corridor. The proposed route will run a 4.8-mile loop on a 10-minute headway from 5:30am to 6:30pm and a 20-minute headway from 6:30pm to midnight. The BRT will also intersect four high traffic transit routes for transfers throughout Shreveport-Bossier City.



The travel time on Kings Highway between the two main hospital campuses on the BRT route will be approximately 5 minutes, which is a reduction of 19 minutes versus the travel time on existing SporTran public transit routes that require a transfer at the main intermodal terminal. The BRT route will include turnarounds and stops at other facilities within each medical campus, and with three buses running at peak service, the headway will remain below the 10-minute target. During off peak hours, the headway will increase to reflect reduced demand. Currently, parking is a constraint at both anchor facilities. The BRT will promote commuting by public transit as an alternative, but it will also facilitate patient and employee connections between facilities.

For employees and patients that choose to drive as their primary mode for accessing the corridor, they will be able to park in one location and easily connect to offices, restaurants, and other destinations within the area. This proposal includes funds for five battery-electric buses to launch this service, dedicated lane striping, three enhanced BRT stations with bus pull-out lanes, shelters for six minor route stops, and traffic signal prioritization/EVP equipment for the full SporTran fleet.

Stakeholders have identified more than \$40 million in infrastructure improvement needs in the target corridor and have formed the Shreveport Healthcare and Development Corridor board to lead implementation of these efforts. Some of these improvements are already underway, including a City-funded \$2.1 million Kings Highway traffic signal upgrade project and a \$5.36 million stormwater management project, but there remains a substantial need for upgraded infrastructure to support new developments that are planned for this area. This proposal focuses on street and intersection improvements on a 1.6-mile stretch of

the four-lane Kings Highway that connects Ochsner LSU Health and Willis-Knighton North, and improvements around each campus to support BRT and bike/pedestrian travel between the two facilities. Our application also includes funds for installation of prefabricated duct banks at intersections and strategic locations along the corridor to allow for underground relocation of utilities and Intelligent Transportation System (ITS) infrastructure.

Around each of the anchor medical facilities, the City plans to rehabilitate streets, construct new sidewalks and bike lanes, upgrade intersections, and construct streetscape elements that promote walkability and safety. The City contracted with an engineering firm in 2011 to develop construction plans and detailed specifications for improvements around the Ochsner LSU Health campus, however, funding has not been available to complete this project and the limited scope



does not address the majority of infrastructure deficits in the corridor. The 2011 plans will be updated under the RAISE grant to reflect new development initiatives, including the expansion of the LSU medical school campus. Design work for improvements around Willis-Knighton and along the Kings Highway Corridor will be developed using RAISE grant funds and will be scaled to match improvements around Ochsner LSU Health.

With the expansion of electric vehicle ownership, charging stations are another need identified by stakeholders that we will address as part of this project. The BRT route will link to fast charging stations at Mall St. Vincent on the eastern edge of the corridor as an immediate solution. The City currently maintains a small intermodal transit facility on Linwood Avenue, just south of the intersection of Kings Highway and Linwood. This facility includes a major bus transfer shelter, ADA parking, and parking for rural transportation providers. The facility also has limited parking spaces for public use. Although we will not purchase grant charging stations through the RAISE grant, our partners are interested in installing chargers at this location for private vehicle use.

Despite the large concentration of jobs in the corridor and widespread use of bike lanes in other parts of Shreveport, public data on Strava shows a near complete absence of bike traffic within the Healthcare and Development Corridor. New bike and pedestrian infrastructure will connect with bike lanes on Southern Avenue and St. Vincent Avenue on the east side of the corridor, fostering modal diversion for healthcare professionals and citizens accessing services in the corridor. These elements will also improve the quality of life for those living within the corridor, supporting planned mixed-use residential and commercial investments around the new LSU medical school campus.

The intersections identified for improvements under this project directly support the BRT route and will include traffic signal prioritization (TSP)/emergency vehicle preemption (EVP) for transit buses and emergency vehicles. These intersections require significant

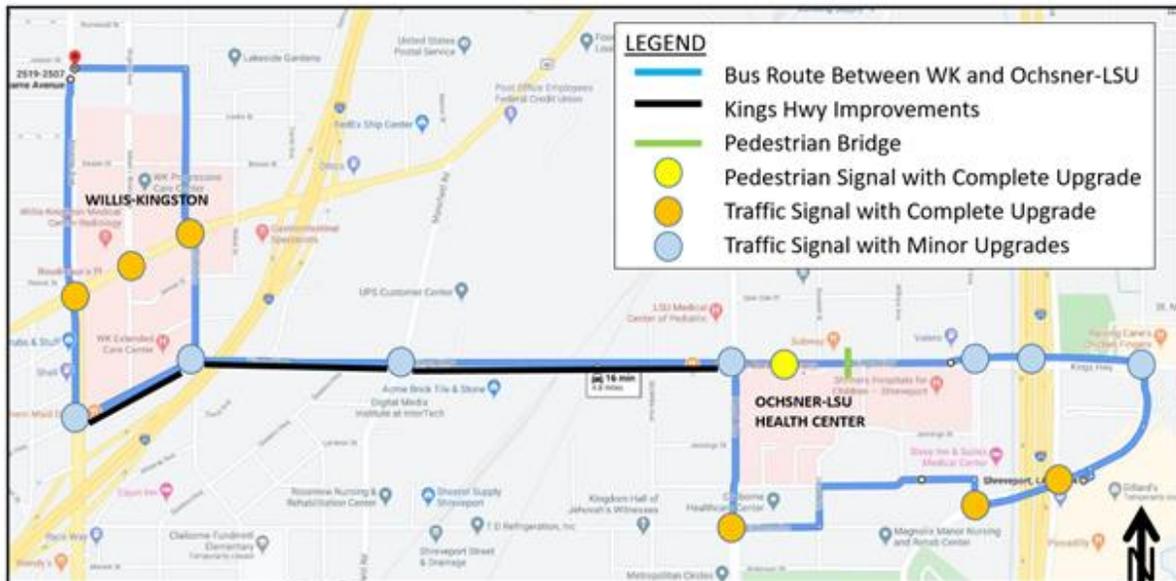
safety upgrades for pedestrian, bicycle, and vehicular traffic. As mentioned above, the City has already funded traffic signal improvements at all of the intersections on Kings Highway throughout the corridor, with that work expected to be completed in August 2021. Under that project, existing mechanical type signal lights have been replaced with a state-of-the-art traffic control systems. After that project is completed, there are six intersections along the BRT route that will still need upgrades. Those are:

- Greenwood Ave & Hearne Ave
- Greenwood Ave & Albert Bicknell Dr
- Greenwood Ave & Portland Ave
- Linwood Ave & Claiborne Ave
- St. Vincent Ave & Samford Ave
- St. Vincent Ave & Southern Ave

The proposed project also includes a mid-block pedestrian bridge at Ochsner LSU Health on Kings Highway between Linwood Avenue and Samford Avenue. Pedestrian signal upgrades will be made to other signals along the corridor.

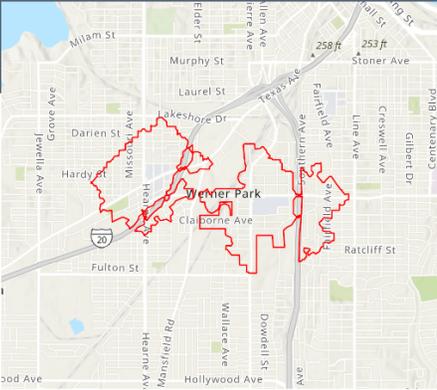
## ii. Project Location

The Shreveport Healthcare and Development Corridor Improvements Project will be implemented on and around the corridor of Kings Highway in Shreveport between I-49 and I-20. Ochsner LSU Health sits at the east end of the project and Willis-Knighton North sits at the west end. The map below shows the project location and the location of individual elements proposed for this project.



The project is situated in Caddo Parish, Louisiana - an area of persistent poverty. The project spans three census tracts, all of which are areas of persistent poverty. Details on the demographics for the project location are presented in the graphic on the next page.

# Population Profile for Shreveport Healthcare and Development Corridor Walkshed





## AT RISK POPULATION PROFILE

### Walking Distance Areas Summary



Walking Distance Areas Summary

**3,097**  
Population

**1,166**  
Households

**2.54**  
Avg Size Household

**35.7**  
Median Age

**\$23,689**  
Median Household Income

**\$90,710**  
Median Home Value

**27**  
Wealth Index

**158**  
Housing Affordability

**33**  
Diversity Index

#### AT RISK POPULATION



**384**  
Households With Disability



**527**  
Population 65+



**218**  
Households Without Vehicle

#### POVERTY AND LANGUAGE



**32%**  
Households Below the Poverty Level



**306**  
Households Below the Poverty Level



**0**  
Pop 65+ Speak Spanish & No English

#### POPULATION AND BUSINESSES



**17,806**  
Daytime Population

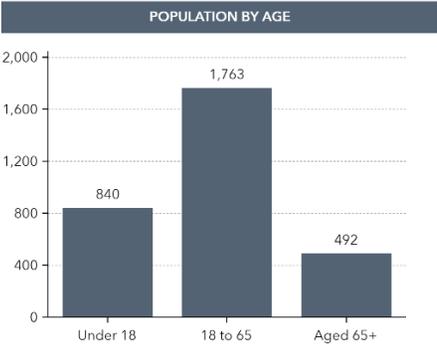


**334**  
Total Businesses



**21,742**  
Total Employees

Language Spoken (ACS)	Age 5-17	18-64	Age 65+	Total
English Only	430	1,640	471	2,541
Spanish	15	47	1	63
Spanish & English Well	15	47	1	63
Spanish & English Not Well	0	0	0	0
Spanish & No English	0	0	0	0
Indo-European	0	32	6	38
Indo-European & English Well	0	32	6	38
Indo-European & English Not Well	0	0	0	0
Indo-European & No English	0	0	0	0
Asian-Pacific Island	0	0	0	0
Asian-Pacific Isl & English Well	0	0	0	0
Asian-Pacific Isl & English Not Well	0	0	0	0
Asian-Pacific Isl & No English	0	0	0	0
Other Language	0	0	0	0
Other Language & English Well	0	0	0	0
Other Language & English Not Well	0	0	0	0
Other Language & No English	0	0	0	0



Source: Esri forecasts for 2021, U.S. Census Bureau, 2015-2019 American Community Survey (ACS) Data.

Source: This infographic contains data provided by Esri, American Community Survey (ACS), Esri and Data Axle. The vintage of the data is 2021, 2026, 2015-2019.

### **iii. Grant Funds, Sources and Uses of Project Funds**

The City of Shreveport is requesting \$22,164,000 in RAISE grant funding and will provide a 20% local match out of the City of Shreveport General Fund for all project activities. The budgeted local match is \$5,541,000, bringing the total project cost to \$27,705,000. The City will not budget to use other Federal funds for this project. There are not any contingencies related to City funding. Funds will be appropriated as needed to complete the project on schedule. Operating costs for the BRT will be covered out of the annual SporTran enterprise fund budget. The cover letter for our narrative from Mayor Perkins commits the required local match, and the Letters of Support attachment includes a City Council resolution that was adopted unanimously supporting the project.

Although this project will leverage on-going City, state, and private investments along the Kings Highway corridor, those activities are not included in this project budget. These other projects however signify the importance of the Shreveport Healthcare and Development Corridor and represent additional investment by the City and stakeholders in this area above and beyond the local match included in this grant budget. The budget includes funds for installation of prefabricated duct banks primarily for ITS-related infrastructure. These duct banks will also facilitate burying utilities within the corridor; however, the cost of utility relocation will be borne by utilities or will be paid for with private funds outside of the project budget.

As depicted below, our project is broken into two main components – 1) Complete streets, roadway, signalization, and the pedestrian bridge and 2) BRT vehicles, equipment, and shelters. The construction cost estimates are based off of detailed estimates prepared for complete street improvements around Ochsner/LSU Health, the recent Kings Highway traffic signal upgrade project, and ADA accessibility projects undertaken by the City.

The BRT prices are based on the City's recent electric bus procurements. The City has available electric bus charging infrastructure, so no additional charging equipment is included for heavy-duty vehicles in this grant. The City also has appropriated funds through a public-private partnership for overhead fast charging equipment and will be procuring and installing that infrastructure in 2022. That equipment will be installed near the SporTran intermodal terminal, which is a four-minute deadhead from the proposed BRT route.

## Estimated Design and Construction for RAISE Grant

Description	Federal (RAISE)	Local Match	Other Federal	Total Project
Complete Streets Improvements near Ochsner LSU Health Center (Including BRT Stations)	\$3,200,000	\$800,000	\$ -	\$4,000,000
Complete Streets Improvements near Willis-Knighton (Including BRT Stations)	\$3,200,000	\$800,000	\$ -	\$4,000,000
Kings Hwy Roadway, Sidewalk, Bike Lane and Lighting Improvements between Samford Ave and Hearne Ave	\$5,440,000	\$1,360,000	\$ -	\$6,800,000
Duct Bank for ITS and utility relocation	\$880,000	\$220,000	\$ -	\$1,100,000
Pedestrian Bridge: Kings Highway	\$960,000	\$240,000	\$ -	\$1,200,000
Traffic Signal Improvements	\$1,920,000	\$480,000	\$ -	\$2,400,000
<b>Estimated Construction Cost:</b>	<b>\$15,600,000</b>	<b>\$3,900,000</b>	<b>\$ -</b>	<b>\$19,500,000</b>
<b>Design &amp; Construction Services:</b>	<b>\$2,808,000</b>	<b>\$702,000</b>	<b>\$ -</b>	<b>\$3,510,000</b>
<b>Total Estimated Cost:</b>	<b>\$18,408,000</b>	<b>\$4,602,000</b>	<b>\$ -</b>	<b>\$23,010,000</b>

## Estimated BRT Capital and Signal Prioritization

Description	Federal (RAISE)	Local Match	Other Federal	Estimate
Branded BRT Buses 5 @ \$815,000 each	\$3,260,000	\$815,000	\$ -	\$4,075,000
Bus Shelters for primary BRT Stops 3 @ \$50,000	\$120,000	\$30,000	\$ -	\$150,000
Bus Shelters for secondary BRT Stops 6 @ \$20,000	\$96,000	\$24,000	\$ -	\$120,000
Signage and Striping	\$60,000	\$15,000	\$ -	\$75,000
Traffic Signal Prioritization On-Vehicle Hardware for Transit Fleet - 55 @ \$5,000	\$220,000	\$55,000	\$ -	\$275,000
<b>Total Estimated Cost:</b>	<b>\$3,756,000</b>	<b>\$939,000</b>		<b>\$4,695,000</b>

<b>Total Project Cost</b>	<b>\$22,164,000</b>	<b>\$5,541,000</b>	<b>\$27,705,000</b>
<b>Federal to Local Ratio</b>	<b>80%</b>	<b>20%</b>	

iv. Selection Criteria

(1) Primary Selection Criteria

(a) Safety

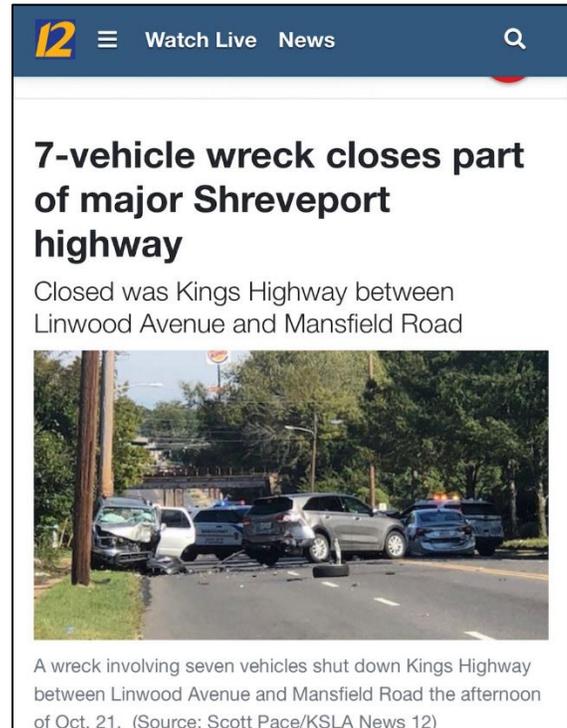
Safety improvements are a critical aspect of this project and is the area where we see the largest calculated benefit. Based on crash reduction projections, this project will provide a benefit of more than **\$2.3 million annually** and **more than \$18 million in total**. The main medical campuses within the corridor have extremely limited onsite parking, requiring employees and visitors to cross principal arterial roadways around the clock to access their cars. Traffic signal upgrades, crosswalk upgrades and beacons, improved lighting, new sidewalks, and a pedestrian bridge are included to address the cost of accidents in the area.

Not all safety improvements lead to direct monetization in the BCA, but they still contribute to the effectiveness of this project. For example, the traffic signal upgrades will facilitate movement of emergency vehicles in the corridor, reducing travel time and ultimately saving lives.

Safety data only captures accidents in the corridor, but improved travel times for ambulances will arguably have an even greater benefit through reduced loss of life. Additionally, this area has traditionally had a very limited residential component, but with the expanded medical school, this is expected to change. Well-lit, walkable routes will be important to development of this corridor.

The table below presents the “No Build” cost of vehicle accidents in the corridor, using crash data from 2014-2018 to illustrate the benefit that will be derived from the project.

Crash Type	5 year total	5 year average	Monetized Value (\$2019)	Annualized Cost	“No Build” 20yr Cost (\$2019)
Serious Injury	6.0	1.2	\$2,899,400	\$3,618,451.20	\$29,711,867.34
Moderate	18.0	3.6	\$512,300	\$1,918,051.20	\$15,749,523.66
Complaint	116.0	23.2	\$32,700	\$788,985.60	\$6,478,527.46
Property	323.0	64.6	\$4,500	\$302,328.00	\$2,482,479.09
<b>Total</b>					<b>\$54,422,397.55</b>



## (b) Environmental Sustainability

The City is proposing battery-electric buses for the BRT as part of its emissions reduction strategy and the BRT route will connect the Healthcare and Development Corridor with electric vehicle fast charging stations located at St. Vincent Mall. **The total benefit calculated for emissions reduction is \$4,483,601.** The City of Shreveport has been the Louisiana Clean Fuels Municipality of the Year every year since 2013, demonstrating a strong commitment to environmental sustainability. The City was the first in Louisiana and one of the first in the country to introduce long-range battery-electric buses to its fleet in 2017. Since that time, SporTran has recorded more than 440,000 electric vehicle revenue miles, putting Shreveport in the top 15 transit systems nationally for electric bus usage in 2019 according to National Transit Database records.

Stormwater management was originally included in our project budget; however, that element is now addressed through a \$5.36 million Louisiana Watershed Initiative grant. The two projects will be coordinated by the City of Shreveport's engineering department. The watershed grant will include pedestrian paths that will link with the RAISE grant infrastructure, creating an urban trail network within the project zone.

## (c) Quality of Life

This project will have a major, positive quality of life impact for those working and seeking services in the medical corridor. As home to two of the largest medical facilities serving Northwest Louisiana, Southern Arkansas, and East Texas, the improvements this will offer for connecting citizens to jobs and healthcare services are significant. While the BCA looks at the health benefit of bike and pedestrian uptake, the monetized benefit over the 20-year life of the project is less than \$50,000. The complete streets elements of this project have a minimal return in the BCA analysis, but they go hand-in-hand with the economic competitiveness goals for the corridor. Complete streets upgrades represent approximately two-thirds of the total project and provide quality of life improvements that make this corridor more attractive for investment in a wide variety of sectors including residential, retail, commercial and institutional.



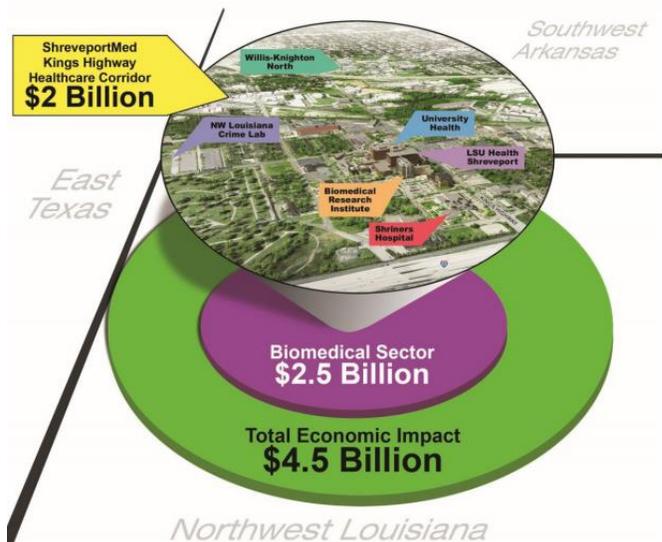
Currently, this corridor is dominated by vehicular traffic, and although bus routes serve all of the partners' major facilities, there is not any East-West public transit connectivity. As a result, public transit in this area serves transit dependent riders primarily. With the introduction of BRT and new bike/pedestrian infrastructure, there will be a large change to mobility patterns in the corridor. As mentioned in the Project Description section above, bike and pedestrian traffic almost completely disappears at the middle of the heatmap image on the right. This dividing line is I-49 and the edge of the Shreveport Healthcare and Development Corridor, and the data reflects the lack of infrastructure to support alternative modes of transportation. Many patients and their families coming from outside Shreveport are "stuck" at medical facilities due to limited transportation options in the corridor. This project will greatly enhance access to restaurants, retail, and other services in the area to address this critical quality of life constraint both for visitors and residents.



**(d) Economic Competitiveness**

At its core, this project is about economic competitiveness and bringing high paying jobs into the Shreveport-Bossier economy. As noted in a 2014 economic impact study, the project corridor has an annual economic impact of more than \$4.5 million, and "an ambitious strategy for improvements and new construction could transform this area into a thriving healthcare and bioscience district...The result will yield a future potential economic impact of \$6.6 to \$7.6 billion and 42,000 to 49,000 jobs for the Kings Highway Healthcare Corridor in 2035."

To reach this potential impact, the City and our partners are continuously recruiting new companies and talent to the region, and these efforts are largely concentrated on the Healthcare and Development Corridor. For these efforts to succeed, infrastructure and multimodal transportation networks are a key component. Our partner BRF plans to spend more than \$10 million over the next five years on pre-development of properties along Kings Highway to foster investment and business development, and they are leading this charge through their Shreveport Next program. Shreveport Next's mission is to recruit small to mid-sized businesses from across the country to relocate or build new facilities in the Shreveport-Bossier area, bringing new jobs and revenue to the region. A



walkable, bikeable, transit accessible Kings Highway is an integral part of the vision that BRF and our other partners are promoting in their efforts to attract investment.

Travel time savings are primary economic benefit presented in our BCA. At just under \$200,000 of benefit annually, these projections are quite conservative. With both the complete streets improvements and planned investments by our partners, the Healthcare and Development Corridor will become the vibrant hub presented in our partners' collective vision plans.



**(e) State of Good Repair**

Basic infrastructure is in place in the target corridor, but the condition of streets, sidewalks, signals and other infrastructure will not support growth and attract investment. As stated above, the City will complete a \$2.1 million Kings Highway traffic signal project by August 2021, but that project will only cover about half of the signal infrastructure needs in the corridor. Pedestrian signals and sidewalks in the corridor are either nonexistent or are in a state of disrepair, especially in the blighted, formerly heavy industrial section of Kings Highway where BRF is redeveloping and recruiting in technology companies.

The city has been able to regularly overlay streets, however streets are only a small part of the vision of a vibrant medical corridor. The sections of street referenced below are the most urgently needed repairs, however on the main Kings Highway corridor, reconstruction efforts will focus on improving and adding bike/pedestrian facilities and adding BRT bus pull-outs at stations.

<b>Pavement Conditions - Shreveport Healthcare and Development Corridor</b>				
<b>Street</b>	<b>From</b>	<b>To</b>	<b>Surface Type</b>	<b>PCI</b>
Samford Ave	St Vincent Ave	Woodrow St	Asphalt	61
Woodrow St	Samford Ave	William Ave	Asphalt	36
Dowdell St	Woodrow St	Claiborne Ave	Asphalt	55
Claiborne Ave	Dowdell St	Linwood Ave	Asphalt	52

## (2) Secondary Selection Criteria

### (a) Partnership

The dynamic growth in the target corridor has happened because of decades of public-private partnerships and planning, and we have attached letters from a wide range of stakeholders and public officials to demonstrate the widespread support for this project. The revitalization of this corridor was identified as a priority in the Shreveport-Caddo 2030 Master Plan following an extensive public participation process that emphasized “fairness and opportunity for everyone” as a guiding principle. This project will help sustain growth and support new investments envisioned by key stakeholders and Shreveport Healthcare and Development Corridor board members, including Ochsner LSU Health, Willis-Knighton Health Systems, and BRF. These partners have developed vision plans for expansion and new investment, but public investments in basic infrastructure upgrades are fundamental to our partners’ ability to implement their plans. These partners and the Shreveport Healthcare and Development Corridor board will help finalize design parameters for corridor improvements to ensure that Federal and City investments support the needs of the medical and business community along the corridor.

The formal establishment of the Shreveport Healthcare and Development Corridor board of directors in 2019 demonstrates the renewed importance of this corridor to the City’s strategic long-term plan for attracting new investment and high paying jobs, and stakeholders are actively working to address shared challenges in the project area. With COVID-19, the importance of this corridor has only magnified, and collaboration among stakeholders has increased.

In June 2021, the City of Shreveport was awarded a \$5.36 million Louisiana Watershed Initiative grant for flood mitigation in the Ockley Basin. The flood sensitive Ockley Basin contains 636 structures – including homes, businesses and critical facilities such as Ochsner LSU Health Hospital, LSU School of Medicine, Shriner’s Hospital for Children, and other major institutions such as the Shreveport main U.S. Post Office, the UPS distribution facility, the Catholic Diocese, and BRF’s InterTech Science Park with 26 tenants. The grant will fund construction of flood storage areas in low lying areas in the basin and will include landscape buffers and a pedestrian walkway that will link to the proposed pedestrian and bike infrastructure along Kings Highway.

“This multimillion-dollar project will bring long-awaited relief to an area that has experienced recurring flooding in recent years,” Shreveport Mayor Adrian Perkins said. “The project has been a top priority for our Shreveport community for years and is ready to be constructed. Through the Louisiana Watershed Initiative, this funding allows us to immediately move this project forward to help make our community more resilient in the face of future flooding. This area is important to Shreveport’s economy, critical services and future development.”

In addition to the healthcare partners highlighted throughout our proposal, the City is also partnering with communications service providers and our regional electric utility. Through meetings with AT&T, Comcast, and AEP/SWEPCO, we identified an opportunity to facilitate increased broadband activity and relocation of utilities underground by installing

duct banks at strategic locations along the corridor. The primary purpose of the duct bank is to support ITS infrastructure, but by making spare conduit in the banks available to the major utilities, they have committed to bringing new technology to the corridor and removing above-ground utilities that contribute regularly to accidents.

### Key Project Stakeholders



*Ochsner LSU Health.* LSU Health Shreveport is an academic health system with three hospitals and three schools. On the main campus are Schools of Allied Health Professions, Graduate Studies, and Medicine. The flagship LSU Medical Center is located here – with 450 beds and which serves as a trauma center, regional burn center and resource for a host of tertiary and quaternary services. The campus is also home to the renowned Feist-Weiller Cancer Center

*Willis-Knighton Health Systems.* Willis-Knighton is a not-for-profit, locally-operated healthcare organization and is the region’s largest healthcare organization. The flagship location on the project corridor (Willis-Knighton North) is home to tertiary services such as the Willis-Knighton Cancer Center and Willis-Knighton Heart & Vascular Institute. It is also home to WK’s corporate offices. For decades Willis-Knighton has maintained a strong relationship of support for LSU School of Medicine in Shreveport and its training 11 programs for healthcare professionals, offering access to WK facilities, technology and a large patient population to broaden LSU’s healthcare education.

*Shriners Hospital for Children.* The Shriners Hospitals for Children – Shreveport combines a child-friendly environment with world-class medical care for children with a host of orthopedic and neuromusculoskeletal disorders and diseases along with cleft lip and palate conditions. Care is provided free to children under the age of 18 in the 45-bed hospital. This facility was the first Shriners Hospital in the United States. Shriners Hospital is a unique asset for Shreveport and the Ark-La-Tex, boasting the regions’ only pediatric orthopaedic group, clinical motion analysis center, EOS low-radiation imaging system, in-hospital orthotics and prosthetics department, and pediatrics focused scoliosis treatment program based on Schroth-Barcelona Institute methodology.

*BRF*. Founded in 1986 as the Biomedical Research Foundation of Northwest Louisiana, a 501(c)(3) nonprofit, BRF is an innovative economic development organization establishing North Louisiana as a preferred destination for high-growth initiatives through its programs and six strategic business units. BRF has been instrumental in bringing new investment to the Kings Highway corridor through the development of the InterTech Science Park which spans 800 acres and is a Brownfields and Smart Growth redevelopment plan site.

#### (b) Innovation

Our project and proposed BRT will be built around electric vehicle and connected vehicle technology (traffic signal prioritization) and will provide the infrastructure for introducing automated vehicles (AVs) into the Shreveport Healthcare and Development Corridor. Although AVs are outside the scope of our proposed project, we have been working closely with manufacturers to identify where AVs can be deployed within the corridor. For example, within the Ochsner/LSU Health campus, we have worked with Navya to model routes, and there is a clear opportunity to use AVs to connect the campus with satellite parking and the BRT route. However, signal infrastructure and lane striping will need to be upgraded to mitigate concerns where the delta between speed limits and the maximum speed of current generation AVs is too high.

These considerations will be incorporated into design work for our project so that infrastructure in the corridor will accommodate automation innovations and next generation transit vehicles. Currently Ochsner and LSU Health are spending more than \$1.3 million per year on parking shuttles. With the correct signals and infrastructure in place, they could invest in battery-electric AVs and cut this operating in half over the near term, with even further reductions with advancements in the technology and regulatory framework.

#### **v. Environmental Risk**

We developed the scope of this project to focus on low-risk improvements within the target area that can be designed and constructed well in advance of the statutory deadlines for obligation and completion. The Shreveport Healthcare and Development Corridor connects two interstate highways and is rehabilitating and upgrading disturbed ground and existing roadway systems. From experience with prior projects and NEPA categorical exclusion requests, we do not anticipate significant delays with this project. The project area does not include wetlands or present other significant risk. There will not be an increase in noise or vibrations from the project based on current uses in the corridor. The project will also not disturb any historically significant sites and does not require demolition of any buildings.

There is a potential need for minor ROW acquisition. Any ROW acquisition would be for pedestrian/bike/transit improvements and would not be related to expansion of single occupancy vehicles (SOVs) along the corridor. If required, ROW acquisition presents the largest known risk to the project schedule, but through design changes, this risk can be eliminated without materially impacting the scope of the project if acquisition obstacles

arise and pose risk to the overall project schedule. Additionally, much of the land along the corridor is owned by project partners who are heavily vested in this project and have committed to donating ROW, e.g. for the footprint of the pedestrian bridge and for BRT pull-offs and stations.

The City of Shreveport has coordinated closely with the Northwest Louisiana Council of Governments (NLCOG) and the Louisiana Department of Transportation and Development (LADOTD) on this project and the corridor. Letters of support are included from the State and NLCOG, indicating the importance of this project and how the project responds to needs outlined in the region’s long-term Metropolitan Transportation Plan.

**Project Schedule**

The proposed project schedule assumes a grant award date in November 2021. Construction will be broken into multiple contracts so that improvements can be completed as quickly as possible, and risk can be mitigated by focusing on project elements that can be completed first. Elements required for the BRT route will be scheduled for completion to align with delivery and acceptance of the BRT buses.

<b>Detailed Task/Milestone</b>	<b>Estimated Completion Date</b>
TIP/STIP Modification	December 31, 2021
RFS Design Services (multiple awards)	March 31, 2022
Design Contracts Awarded	July 31, 2022
BRT Bus Bid	August 31, 2022
Preliminary Design Completed	October 31, 2022
NEPA Submissions	November 15, 2022
BRT Bus Award	November 15, 2022
NEPA Approvals	December 31, 2022
Final Design Completed	December 31, 2022
Construction Bid (multiple awards)	January 31, 2023
Construction Contracts	March 31, 2023
BRT Bus Delivery and Acceptance	August 31, 2023
BRT Route Launch	October 1, 2023
Construction Completion (all phases)	March 31, 2024

**Required Approvals**

As depicted in the project schedule above, this project will be added to the MPO’s Transportation Improvement Program TIP and State’s TIP (STIP) immediately upon award. NLCOG, the Metropolitan Planning Organization (MPO) for the region, has been involved in the development of this grant application and is committed to implementing the improvement projects along the Kings Highway Corridor. Upon award, NLCOG (staff) will work with members of the MPO’s Transportation Policy Committee (TPC) as well as, engage the state (Louisiana Department of Transportation and Development – LADOTD) to include this project within the current STIP. Additionally, as noted in the MPO letter of

support, this project directly contributes to the goals found within the MPO's adopted Metropolitan Transportation Plan (MTP), "*Northwest Louisiana Mobility 2040*". (<http://www.nlcog.org/MPO/MTP/Default.html>)

All improvements proposed through this grant application fall under Transportation Systems Management and Operations (TSMO) and Safety general enhancement categories. Any ROW acquisition related to complete streets is to meet the minor (feet of ROW) infrastructure needs of the transit/bike/pedestrian/traffic signal improvements that may fall slightly outside the current ROW footprint of Kings Hwy. Under NEPA, these types of improvements are acceptable because they do not contribute to the expansion of single occupancy vehicles (SOVs) along the corridor. Further, slight modifications/realignment to driveway access along Kings Highway Corridor may require a few feet of additional ROW, as needed, in order to satisfactorily complete the improvement. It is anticipated that the proposed improvements environmental impacts upon the public meet the NEPA defined Programmatic Categorical Exclusion (P-CE) level of impacts. Consultation with the appropriate resource agencies will commence once the project is awarded in order to establish the level of environmental impact and begin the process of documenting these impacts through LADOTD's Environmental Section and Louisiana's Department of Environmental Quality (LDEQ).

### **Assessment of Project Risks and Mitigation Strategies**

As mentioned above, the City of Shreveport is working closely with the LADOTD on this project to ensure that infrastructure improvements are coordinated and that the project schedule is reasonable. Previously, ROW acquisition was the greatest risk for the project. Over the past 12 months, project partners have acquired key parcels within the corridor that have addressed this risk. Currently the largest risk is pricing risk for construction materials. This risk however is not unique to the Shreveport market and prices are expected to level out before we anticipate releasing construction solicitations. The City will also put out a solicitation for the electric vehicles described in this proposal. There are at least four heavy-duty electric bus manufactures with vehicles who can meet our draft specifications with vehicles that comply with all FMVSS and Buy America requirements. We have proposed a timeline for vehicle that is realistic and aligns with current lead time from these manufacturers.

**vi. Benefit Cost Analysis**

With significant travel time, emissions reductions, quality of life, and safety savings, the overall Benefit Cost Ratio for the proposed Shreveport Healthcare and Development Corridor project is 1.19, indicating a favorable return on investment. We initially included other elements in the project, but ultimately reduced the project scope to maximize the return on investment while addressing our partners’ priority needs. Additionally, we modeled a scenario to remove the pedestrian bridge and the utility duct bank from the project. Although this would improve the ratio further, stakeholders agreed that both elements contribute heavily to future developments in the corridor and should remain in the project.

The elements of this project are interconnected and would not be completed as independent projects. Therefore, the benefit cost analysis looked at the composite of costs and benefits for the improvement on the surrounding area.

Costs developed for this project include identification of improvements to individual signals, pedestrian crossing locations, and roadway sections. Capital equipment costs included purchase of BRT buses along with shelters and stop upgrades to create a cohesive system following FTA’s design and branding recommendations. The City of Shreveport and SporTran provided the cost information expressed in 2020 dollars. Costs associated with operation and maintenance for BRT elements came from SporTran’s 2019 National Transit Database report. Estimate of roadway operational maintenance came from values developed for the adopted as part of the NLCOG 2045 MTP. A summary of variables and sources is presented in the table below:

<u>Key Analysis Assumptions</u>	<u>Value</u>	<u>Source</u>
Analysis period (year)	20	USDOT <i>Benefit-Cost Analysis Guidance</i>
Base year	2019	USDOT <i>Benefit-Cost Analysis Guidance</i>
Operational start year	2023	City of Shreveport estimate
Discount rate	7%	USDOT <i>Benefit-Cost Analysis Guidance</i>
Discount rate for greenhouse gas emissions	3%	USDOT <i>Benefit-Cost Analysis Guidance</i>
Travel time value (person-hour)	\$17.90	Table A.3 USDOT <i>Benefit-Cost Analysis Guidance</i> (In-Vehicle Travel, All Purposes)
Days of BRT operation per year	303	Supplied by SporTran
Goal for average daily trips induced in corridor	3,000	TCRP Guide 90, Bus Rapid Transit, Volume 2: Implementation Guidelines adjusted to correspond to proposed bus capacity.
ADT Estimate (2020)	10,000	NLCOG Travel Demand Model
ADT Future (2040)	15,800	NLCOG Travel Demand Model
Project Corridor length (mile)	1.60	Proposed BRT corridor improvement on Kings Highway
BRT Buses in Service (Peak/Non-Peak)	3/2	Supplied by SporTran

The expected benefits are detailed in the attached BCA spreadsheet and methodology memo, and they are summarized on the following table:

**Step 4: Benefits**

**Travel Time Savings**

Annual time saving in Peak for vehicles	\$	199,990
Net present value of travel time saving benefits [8]	\$	1,880,114
Net present value of passenger travel time saved [8]	\$	680,291

**Residual Value**

Net present value of residual infrastructure value	\$	3,391,714
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**Safety Improvement Benefits**

Overall Savings from Safety Related Improvements [8]	\$	18,940,570
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**Emission Reduction Benefits**

Reduced CO <sub>2</sub> emissions (net present value)	\$	252,817
Reduced NO <sub>x</sub> emissions (net present value)	\$	2,047,213
Reduced SO <sub>2</sub> emissions (net present value)	\$	519
Reduced PM <sub>2.5</sub> emissions (net present value)	\$	2,183,052
Overall emission reduction benefits [8]	\$	4,483,601

**Fuel Saving Benefits**

Annual fuel savings	\$	220,642
Overall fuel savings [8]	\$	2,074,262
O&M savings from electric over diesel	\$	341,211

**Quality of Life Benefits - Equity**

Transit equity benefits - net present value [8]	\$	425,657
Pedestrian/bicycle health benefits - net present value	\$	47,109

<b>Total Benefit</b>	<b>\$32,264,530</b>
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**Step 5: Benefit-Cost Estimation**

Net Benefit	\$5,115,280
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<b>Benefit Cost Ratio</b>	<b>1.19</b>
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## Detailed Explanation of Benefits

This analysis considered both direct and indirect benefits as defined by USDOT. The variables identified include the following:

- Travel Time Savings
- Safety Improvement Benefits
- Residual
- Emission Reduction Benefits
- Fuel Saving Benefits
- Operations and Maintenance Benefits
- Quality of Life Benefits

The following sections provide an overview of the methodology and data used for calculating each benefit area. Full calculation methods can be reviewed in the BCA Data attachment.

### Travel Time Savings (Transit)

#### *Method of Calculation – Transit Travel Time*

To determine transit time between the starting and ending points of the proposed BRT system (Ochsner LSU Health Shreveport and Willis-Knighton North), we used available SporTran service schedules and route planners to determine the base trip length and transfers required. This was compared against the time for the same trip via the BRT on Kings Highway (with a 10-minute peak and 20-minute off-peak profile) to determine the time savings realized by transit passengers.

The same analysis was repeated to estimate benefits to walking and cycling trips in the corridor by switching to transit. This analysis used the same starting and ending points to determine the time these groups would save by opting to use transit. A composite of time saved by all groups (transit riders, walkers, cyclists) was developed using the CTPP Journey to Work data for the census tracts 216, 217, 218 and 223 in Caddo Parish along Kings Highway (A202105 - *Means of Transportation (18) (Workers 16 years and over, U.S. Census Bureau, American Community Survey 2012-2016 Five-year estimates. Special Tabulation: Census Transportation Planning)*). The value of time saved applied to the actual time savings came from the value for All Purposes outlined in Table A-3, Value of Travel Time Savings, Appendix A of *Benefit-Cost Analysis Guidance for Discretionary Grant Program*.

Positives Associated with This Variable	Negatives Associated with Variable
<ul style="list-style-type: none"> <li>• Travel time via BRT less than walking or existing transit</li> <li>• Bicycles can be added to BRT bus (via racks) to encourage shift</li> <li>• High frequency service helps encourage ridership</li> <li>• Maintains SporTran’s high quality of service</li> </ul>	<ul style="list-style-type: none"> <li>• BRT bus may not be attractive to some in community who would rather drive between points</li> <li>• Existing estimate of BRT ridership based upon TCRP rule of thumb and does not account for current routes and future development in area</li> </ul>

### **Travel Time Savings (Vehicle)**

#### *Method of Calculation – Vehicle Travel Time*

This represents the savings received by motorists traveling through the corridor based upon updated and coordinated signalization which would reduce travel time between the various ends, as well as savings for transit riders created by the new service which reduces total transit travel time between the endpoints of the corridor (Ochsner LSU Health Shreveport and Willis-Knighton North).

To determine current corridor travel time, we ran a modified *Floating Car Technique* study on Kings Highway to identify current travel time given traffic conditions between Hearne and Barret. Given the current COVID-19 closures across the county which have impacted traffic flow, this study used Google data for the dates of March 11-13, 2020 prior to issuance of widespread stay at-home orders by the Governor of Louisiana. The study focused on travel times during AM, PM, and Midday peak, documenting the worst-case scenario travel times for planning purposes. An average of travel time identified from the peak came from three samples drawn during each period. This established the travel time encountered by motorists traveling Kings Highway.

To determine how travel time information translates into level-of-service and quality of operations, we used a standard arterial design rule of thumb from the Florida Department of Transportation for arterials in urban areas, as approved for use by NLCOG on May 13, 2020. Applying this table to Kings Highway (a minor arterial in an urban area), we determined this corridor would best identify as a Class II, Interrupted Flow Facility. This class of road has a threshold value of LOS D with speed of greater than 13 MPH and less than 17 MPH. The results of the travel time survey put speed and travel time in the LOS E category. For the purposes of planning, based upon information supplied by the City of Shreveport, the analysis assumes the combination of signal upgrades have the potential improve travel time in the corridor to meet the LOS C threshold (or the midpoint of >17 and <22 MPH) on average between Hearne and Barret. In addition, to account for the efficiency of the traffic signal coordination, speed estimates in the corridor under the project scenario were enhanced further. The value of time saved applied to the actual time savings came from the value for All Purposes outlined in Table A-3, Value of Travel Time Savings, Appendix A of *Benefit-Cost Analysis Guidance for Discretionary Grant Program*.

<b>Positives Associated with This Variable</b>	<b>Negatives Associated with Variable</b>
<ul style="list-style-type: none"><li>• Vehicle and BRT travel times will improve in corridor with new signals.</li><li>• Improve transit vehicle time makes BRT more attractive and able to achieve targets for service frequency.</li></ul>	<ul style="list-style-type: none"><li>• Improving auto travel in the corridor may discourage BRT ridership.</li></ul>

### **Safety Improvements**

#### *Method of Calculation – Safety Improvements*

This represents the savings received through a reduction of potential for accidents created because of the corridor traffic signal upgrades and associated improvements in pavement markings and signage contained in the cost estimate from the City of Shreveport. The

analysis incorporated the crash reduction factors (CRF) as documented below for the analysis which considered the total number of accidents provided for Kings Highway (Hearne to Barret) as well as the key intersections described in the application summary, being Greenwood Ave & Hearne Ave (LADOTD), Greenwood Ave & Albert Bicknell Dr (LADOTD), Greenwood Ave & Portland Ave (LADOTD), Linwood Ave & Claiborne Ave, St. Vincent Ave & Samford Ave, and St. Vincent Ave & Southern Ave.

Crash data was obtained from NLCOG 2045 MTP document crashes and covered a span of five years (2014-2018). The crash data contained attributes for severity, time of day, contributing factors, and location. Data was clipped in ArcGIS to the locations identified in the proposed scope of work. The data was then summarized by severity and year. The seven-year average for each applicable severity type was used to develop annualized costs. The Analysis team then used the Crash Modification Factors Clearing House to find appropriate CMFs that both corresponded to the scope of work and were applicable to the crash types shown in the data. The following Crash Reduction Factors (CRF) were selected:

- Improving Signal Visibility (CMF ID: 3941)
- Install a pedestrian hybrid beacons (CMF ID 10591).

Unit value (\$2019) costs based on MAIS level were used for severe through minor injury crashes. Property Damage Only (PDO) costs were used for no injury crashes.<sup>1</sup>

Positives Associated with This Variable	Negatives Associated with Variable
<ul style="list-style-type: none"> <li>• Improving safety in corridor will reduce loss to property, potential for serious crashes or incidents.</li> </ul>	None

### **Fuel Savings**

#### *Method of Calculation – Fuel Savings*

This represents the savings realized using Electricity/Battery Power over diesel fuel for the BRT service.

A comparison of the total costs for fuel and electricity, based upon the number of vehicle operating hours and miles (Revenue Miles plus transit time to facilities) per year. To obtain electric rates, this analysis used municipal electric rates from the Southwestern Electric Power Company’s [latest fee schedule](#) for Louisiana consumers, last revised November 2019. For diesel, this analysis used the 2021 costs per gallons of Clean Diesel fuel as supplied by the US Department of Energy [April 2021 report on commodity fuel prices](#) as posted at the US Department of Energy website with no adjustments.

We pulled mileage ratings of electric vehicles from Proterra, SporTran’s electric bus vendor, compared against the fuel economy of diesel fueled buses from a manufacturer with an Altoona tested and approved vehicle (New Flyer). These values, multiplied by the number of miles travelled annually, produced the number of kilowatt-hours of electricity or gallons of diesel required. This was calculated against the cost per kilowatt-hour or gallon, which produced a

<sup>1</sup> <https://www.transportation.gov/office-policy/transportation-policy/benefit-cost-analysis-guidance-discretionary-grant-programs-0>

difference between total costs for electric and diesel fuel, thus calculating savings in 2019 dollars from switching to electric.

Positives Associated with This Variable	Negatives Associated with Variable
<ul style="list-style-type: none"> <li>Electricity costs less annually than the equivalent cost of diesel given current pricing trends.</li> <li>Electric buses support City efforts to reduce emissions from municipal vehicle fleets.</li> </ul>	None

**Residual Infrastructure Values**

*Method of Calculation – Residual Value After 2040*

Most project elements will have longer lifespans than the 20-year analysis period, and will therefore continue to benefit Shreveport and SporTran after 2040. The value of performing infrastructure work and bringing up to a state of good repair is reflected as a residual value: the remaining value of the infrastructure after the analysis period.

Project elements were sorted according to their category in the [BEA Rate of Depreciation, Service Lives, Declining-Balance Rates, and Hulten-Wyckoff Categories](#), and the 20-year project analysis period was subtracted from the total expected lifespan of each category in order to determine how much useful life each element of infrastructure would still have after 2040. The percentage of the useful life remaining was multiplied by the cost of the project element, and counted toward the project as a benefit to the city.

Positives Associated with This Variable	Negatives Associated with Variable
<ul style="list-style-type: none"> <li>Project elements will contribute value to SporTran and Shreveport after the project analysis period ends in 2040</li> </ul>	<ul style="list-style-type: none"> <li>Certain elements may require replacement before their expected service life ends</li> </ul>

**Emission Reduction**

*Method of Calculation – Emission Reduction*

This represents the reduction in CO<sub>2</sub>, NO<sub>x</sub>, SO<sub>2</sub>, and particulate matter (PM<sub>2.5</sub>) emissions by opting to use electric buses instead of clean diesel technology. A comparison between electric and Clean Diesel emissions was completed using factors for emissions in metric tons per mile, given the number of vehicle operating hours and miles (Revenue Miles plus transit time to facilities) per year. Savings were identified as the difference between emissions produced by burning diesel fuel, and emissions from electric buses. Electric buses have zero tailpipe emissions, so emissions of NO<sub>x</sub>, SO<sub>2</sub>, and PM<sub>2.5</sub> were assumed to be zero, and thus converting to electric results in a 100% emission decrease relative to diesel.

CO<sub>2</sub> emissions, on the other hand, cannot be assumed to be zero. Generating electricity from fossil fuels produces upstream emissions, which the EPA has calculated as 7.09 x 10<sup>-4</sup> metric

tons of CO<sub>2</sub> per kilowatt-hour ([source](#)). Hence, every mile travelled by electric bus indirectly produces CO<sub>2</sub> emissions that can be compared to diesel emissions.

Next, FTA has provided cost estimates per metric ton of each pollutant in Table A-6, Damage Costs for Emissions per metric ton, in Appendix A of the *Benefit-Cost Analysis Guidance for Discretionary Grant Program*. These costs are specified differently for each year from 2020-2050. For each pollutant, a discounted net present value of emissions reductions across the 20-year time period was calculated. Per FTA instructions, CO<sub>2</sub> as a greenhouse gas was discounted using only a 3% discount rate, rather than 7% as with all other factors in this analysis.

Positives Associated with This Variable	Negatives Associated with Variable
<ul style="list-style-type: none"> <li>• Zero tailpipe emissions from transit vehicles in Shreveport using emissions fuel as compared to diesel</li> <li>• Electric fueled vehicles more efficient than previous-generation diesel buses</li> </ul>	<ul style="list-style-type: none"> <li>• Upstream greenhouse gas emissions associated with electricity generation</li> </ul>

**Operations and Maintenance Benefits**

The benefits derived because of the use of electric buses instead of diesel buses in the corridor. These values, from the California Air Resources Board (<https://ww2.arb.ca.gov/sites/default/files/classic/regact/2018/ict2018/appg.pdf>), provide a comparison for the costs associated with clean bus (electric, zero emission) to diesel buses in operation with State of California during 2016. These costs have been evaluated using the FTA methodology which derives a discounted net present value based upon reductions across a 20-year period, with a discount rate of 7%.

Positives Associated with This Variable	Negatives Associated with Variable
<ul style="list-style-type: none"> <li>• Zero tailpipe emissions from transit vehicles in Shreveport using emissions fuel as compared to diesel</li> <li>• Electric fueled vehicles more efficient than previous-generation diesel buses</li> <li>• Electric vehicles cost less to maintain than the comparable diesel buses in regular operation.</li> <li>• The City of Shreveport already uses electric buses in regular revenue operation.</li> </ul>	<ul style="list-style-type: none"> <li>• Upstream greenhouse gas emissions associated with electricity generation</li> </ul>

**Quality of Life –Equity**

*Method of Calculation – Quality of Life-Equity*

This represents the potential savings realized within the community for improved transit access. As mentioned in the project location section, all of Caddo Parish is noted as an Area of Persistent Poverty according to the US Census Bureau. The quality-of-life impacts help address a number of mobility concerns beyond the calculable benefits discussed further in this section.

This value was developed using the Equity objectives assessment from "*Transportation Cost and Benefit Analysis Techniques, Estimates and Implications*" by Victoria Transport Policy Institute. Based on ridership estimates for the span of BRT service and bus capacity, quality of life improvements from improved service were estimated.

Health benefits were calculated by estimating increased numbers of pedestrians and bicyclists along the corridor, multiplying by the length of the corridor to estimate additional route-miles, and using research data from the Victoria Transport Policy Institute to estimate the total health savings to users from physical exercise.

Positives Associated with This Variable	Negatives Associated with Variable
<ul style="list-style-type: none"> <li>• This variable accounts for the indirect costs associated with improving mobility in the population.</li> <li>• Many residents of Shreveport use SporTran to access jobs, shopping, school, and services. Having dependable transit is very important to all community residents.</li> <li>• Proposed BRT service is part of strategic plan to reduce travel times for the transit dependent, specifically for east-west travel in the Shreveport area.</li> </ul>	None

### Sensitivity Analysis

The benefit cost analysis includes a sensitivity analysis to examine how the outcome of benefit-cost analysis changes with variations in inputs, assumptions, or the way the analysis is set up. The file *BCA Data* contains a worksheet to document this analysis based upon changes in BRT ridership against relative project costs, benefits made because of Safety Improvements and Travel Time Savings. The analysis considered four scenarios, including no growth (steady passenger demand) or increase in the number of passengers by 1%, 2%, or 3% annually. The outcome was a constant relationship which little deviation between the iterations.