Completed April 2023

Berry Road Back-of-Curb Improvements

Grant Readiness Report

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Revive 2 Thrive Community Revitalization Initiative
Harris County Engineering Department
Northside
The Goodman Corporation

Project Scope

The proposed Berry Road Back-of-Curb Improvements Project will improve safety and provide enhanced multimodal access, particularly for students and nearby businesses. The project is 2.5 miles along Berry Road between Airline Drive and Jensen Drive. Proposed improvements include the installation of new sidewalks, improved lighting and signage, address drainage concerns as needed, and roadway rehabilitation where needed.

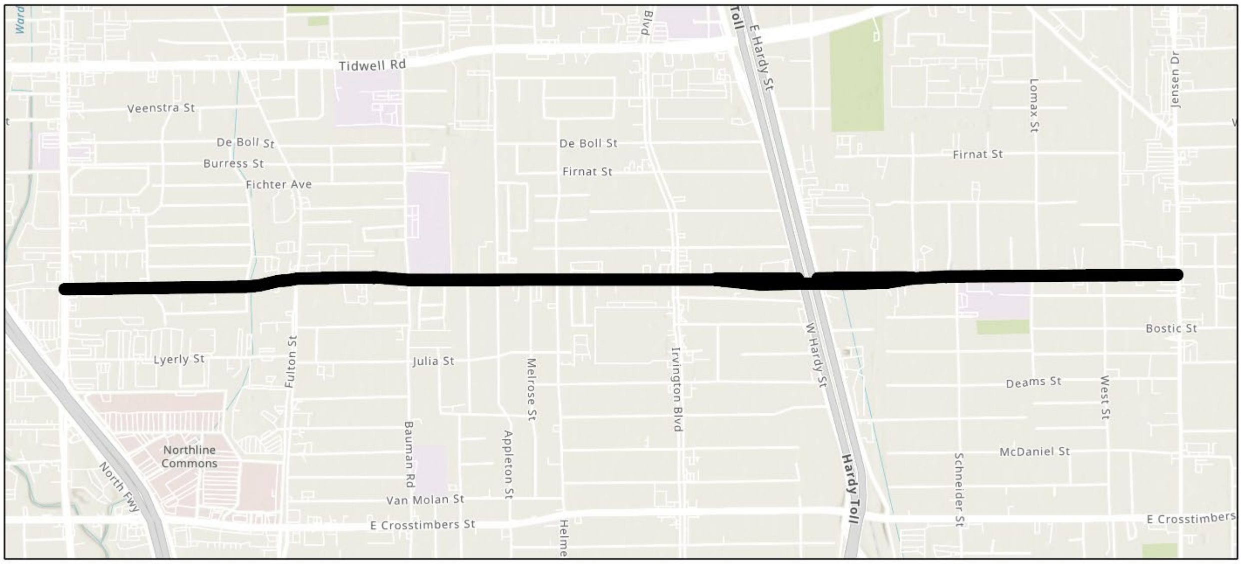

Figure 1. Project Limits

The improvements consist of back-of-curb, pavement rehabilitation, and storm water drainage improvements, including:

- Construction of approximately 17,500 linear feet of 6-ft sidewalks and 8,500 linear feet of 10-ft shared use paths, with associated driveway, curb, and wheelchair ramp appurtenances.
- Rehabilitation of approximately 600 linear feet of asphalt pavement east of Airline Drive and 600 linear feet of concrete pavement east of Helmers Street.
- Improving approximately 3,700 linear feet of 24- to 48-in reinforced concrete pipe with related appurtenances and 10,000 linear feet of ditch reshaping to improve storm water drainage.

Shared use paths, where proposed, consist of one 10-ft wide concrete path on one side of the roadway. The proposed locations include:

- 2,700 linear feet from Airline Drive to Fulton Street
- 500 linear feet east of Bauman Road (in front of Burbank Middle School)
- 5,300 linear feet from east of Irvington Blvd to Jensen Drive

The shared use path on the bridge over Hardy Toll Road will be constructed by permanently closing the right eastbound traffic lane, removing existing curb, doweling a new raised concrete pathway into the existing bridge deck and sidewalk, and installing new railing and curb. Where shared use paths are not proposed, 6-ft sidewalks will be constructed. Proposed storm water improvements will provide sufficient clear right-of-way for shared use paths and sidewalks.

Additional back-of-curb improvements include traffic signal, signing, pavement marking, and streetlight improvements. The traffic signals at Irvington Blvd will be upgraded to include pedestrian signal heads. Existing roadside signs and pavement markings will be replaced, and new signs and markings installed as required per the TMUTCD and Infrastructure Design Manual (IDM) for the proposed shared use paths and sidewalks. Streetlights will be installed where needed to provide visibility for pedestrians and bicyclists.

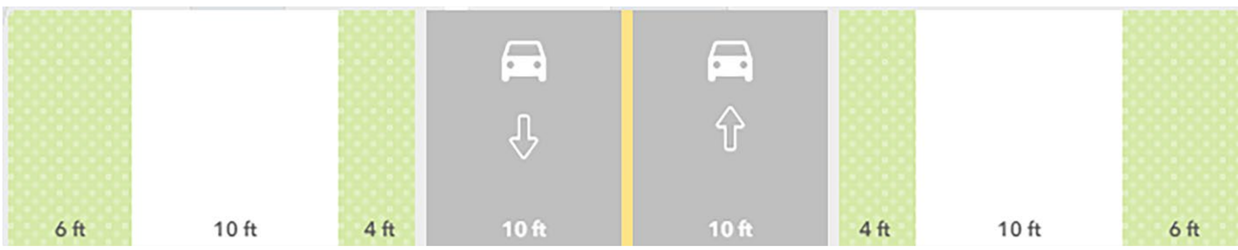

Figure 2. Typical Cross Section where 10-foot shared used paths are proposed (between Airline Drive and Fulton Street, in front of Burbank Middle School, and Irvington Blvd to Jensen Drive)

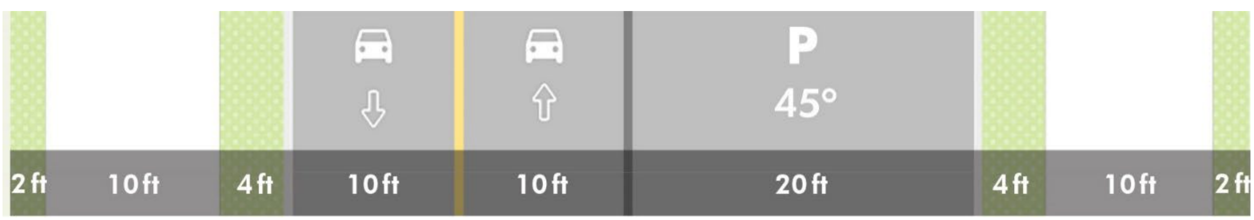

Figure 3. Angled Parking Cross Section proposed in front of Berry Elementary School

Best management practices will be employed for the Storm Water Pollution Prevention Plan (SWPPP). Traffic control will be managed in accordance with the Texas Manual of Uniform Traffic Control Devices (TMUTCD). Uniformed Peace Officers shall be used for work along or adjacent to major thoroughfares, schools, churches, and hospitals.

Cost Summary

The total cost for the Project is estimated to be $17.68 million, of which $3.7 million is allocated for engineering and design. Cost estimates are in 2022 dollars and are provided at a line item level in the table below.

Table 1. Cost Estimate

Item	Est. Cost
Mobilization	$350,000
Traffic Control	$290,000
Environmental	$290,000
Clearing & Landscaping	$1,050,000
Paving	$5,860,000
Storm Sewer	$2,930,000
Water Line	$0
Waste Water	$0
Signals, Signs, Markings & Lighting	$940,000
Construction Subtotal	$11,710,000
Contingency (20%)	$2,340,000
Total Construction Cost	$14,050,000
Topographic Survey (3%)	$420,000
Environmental Documentation (0.5%)	$70,000
Engineering Plans, Specs & Estimates (15%)	$2,108,000
Construction Engineering & Inspections (8%)	$1,120,000
Total Engineering Costs	$3,718,000
Project Total Cost	**$17,768,000**

Project Purpose Statement

Most, if not all, funding and oversight agencies such as the City of Houston, H-GAC, FTA, or the USDOT require grantees to develop a public purpose and needs statement for any capital project. The purpose is considered the "what" and the need(s) is the "why" of the Program.

This Project will improve safety and provide enhanced multimodal access, particularly for students and nearby businesses.

Project Needs

The project will address several key needs within the District and for the community, discussed in the following sections.

Connect Underserved Communities

Transportation options have a significant impact on community residents' quality of life. This Project is needed to connect underserved communities within the District. People with lower incomes are often less likely to own cars and may not live in areas well-served by high-quality transportation assets, thereby experience more difficulty accessing schooling, employment, and other critical needs.

The Biden administration is committed to mitigating these outcomes by furthering equitable and inclusive policies and programs. To this effect, some of the initiatives the administration supports are safer and smart streets, bringing greater connection to underserved communities and transparency to USDOT grant programs, investing in inner-city transit, and an emphasis on policies that leverage land-use components to deliver more innovative mobility options to residents. While these initiatives have an integral equity and sustainability component built into them, the discretionary dollars disbursed under these programs have performance indicators that evaluate equity.

Safe Access to Schools

The Safe Routes Partnership, a national non-profit working to advance safe routes to school, has compiled research from across the country that shows that building safer pedestrian and biking infrastructure to and from schools provides an array of benefits, including a reduction in student absences and tardiness, healthier students and improved academic performance. Currently, the Project area is not conducive for school aged children to walk, bike, or roll, given the narrow sidewalks with missing and/or broken ADA ramps and crosswalks.

The Project will provide a well-lit, seamless, safe, and accessible multimodal connection for all residents, particularly children who are walking or rolling to schools in the District. All schools in the area are participating Title 1 schools that receive additional funding to assist students in poverty to meet education goals. Currently, residents along the Project corridor attend several schools in the District; two schools are directly on Berry Road – Berry Elementary and Burbank Middle School. Information about each school is listed in the following table. A higher percentage of students attending these two schools higher are considered Minority, At-Risk, Economically Disadvantaged, and/or Limited English Proficiency when compared to Houston ISD and Statewide.

Table 2. Nearby Schools

School	Grades Offered	Total Students	Minority %	At-Risk %	Economically disadvantaged %	Limited English Proficiency %
Berry Elementary	'EE-05	758	98.5	68.2	99.5	52.3
Burbank Middle	'06-08	1,423	99	74	93.4	45.2
For comparison purposes, districtwide data is provided for public and charter schools, as well as statewide data for all students.						
Houston ISD		193,727	90.3	61.5	79.2	35.1
KIPP Texas Public Schools		*32,318*	*98.4*	*45.7*	*91.1*	*37.7*
YES Prep Public Schools		*14,557*	*99*	*65*	*90*	*42.5*
Statewide		*5,402,928*	*73.7*	*53.5*	*60.7*	*21.7*
Source: 2021-2022 School Year; Texas Education Agency, 2021-22 Texas Academic Performance Report - Student Information						
A student is identified as being "at risk" of dropping out of school based on state-defined criteria.						
A student is defined as "economically disadvantaged" if he or she is eligible for free or reduced-price lunch or other public assistance.						

Environmental Justice and Equity Demographics

Selected demographics for the project corridor are presented below. Within 500 feet of the Project corridor, there are about 2,000 residents; nearly 40% live below the poverty threshold, which is higher than the rate of poverty in the City of Houston, Harris County, and surrounding MSA. Households in the Project area are less likely to have a vehicle or higher than high school education.

Table 3. Selected Demographics

Demographic	Project Area	City of Houston	Harris County	Houston-The Woodlands-Sugar Land MSA
Total Population	**1,979**	2,293,288	4,697,957	7,048,954
Population in Poverty (%)	**38.62%**	17.44%	14.34%	12.57%
Minority Population (%)	**93.43%**	75.94%	71.74%	65.26%
Less than High School Education (%)	**49.45%**	20.50%	18.13%	15.57%
Households with no vehicles (%)	**34.98%**	9.18%	6.43%	5.44%
Population with a disability (%)	**45.12%**	19.93%	20.84%	21.18%
Source: U.S. Census Bureau. 2017-2021 American Community Survey 5-year data				

Social Vulnerability Index

The Center for Disease Control (CDC)'s Social Vulnerability Index (SVI) ranks each Census tract in the United States using 15 factors based on socioeconomic status, including household composition, race/ethnicity, language, housing, and transportation. The SVI is a tool used to determine the level of assistance communities will need in the case of a disaster. The Census tracts adjacent to the project corridor are in areas of high vulnerability, particularly the area north of the project corridor and the western segment of the roadway.

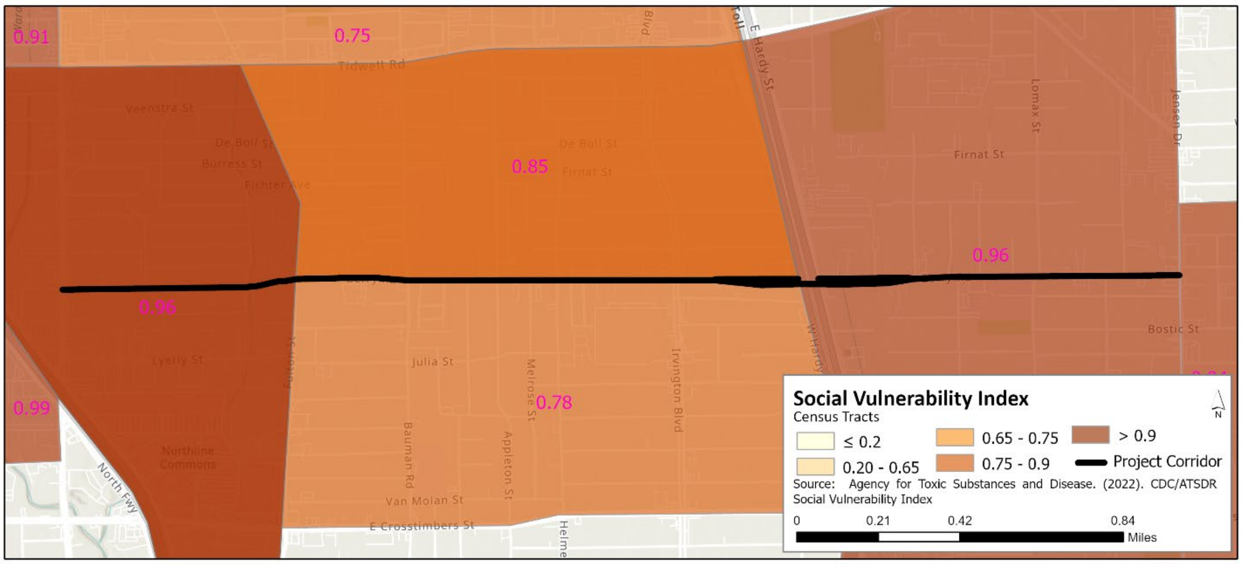

Figure 4. Social Vulnerability

Respond to Community Desire

The community supports improvements on Berry Road, particularly near the schools. In September 2022, a student was struck by a vehicle outside Burbank Middle School. Several concerned parents elevated their concerns to the District and to the Council Member. At the community meeting, several attendees expressed interest and support for this project.

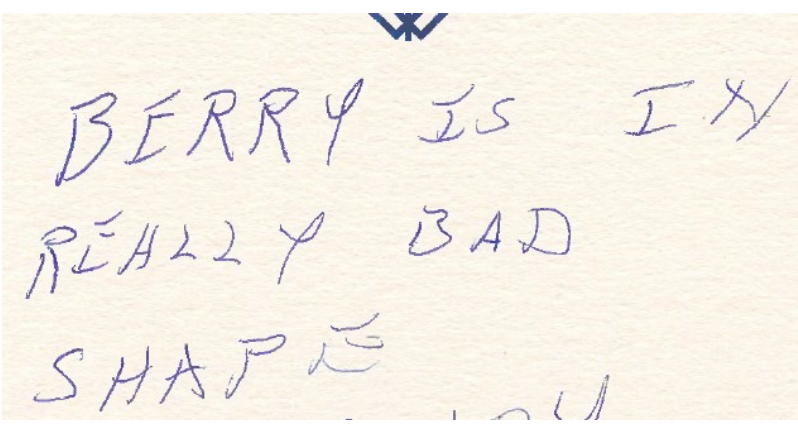

Figure 5. Comment received at the community meeting

This Project is consistent with the District's 10-year Service Plan (2021-2030) to enhance economic diversification, business expansion, and economic growth by providing better access to businesses and neighborhoods, creating safer environment for pedestrians and bicyclists, attracting new businesses, and supporting adjustment and the reallocation of resources towards new activities.

In support of COH Executive Order EO-1-15 Houston Complete Streets and Transportation Plan, improving Berry Road will promote Complete Street principles to develop and maintain a regional bicycle and pedestrian network that is sustainable, interoperable, efficient, and holistic in nature, thus encouraging regular bicycling and walking for the purpose of utility and recreation while improving safety for all users of the network.

Figure 6. Existing conditions on Berry Road

Provide Safe Streets for All

Traffic fatalities are rising in Houston, especially among the most vulnerable street users—pedestrians, bicyclists, motorcyclists, low-income neighborhoods, and socially vulnerable neighborhoods.[1] From 2017-2021, there 347 crashes on the corridor; were two fatalities and several severe injuries. The location of the fatal and severe crashes is shown below.

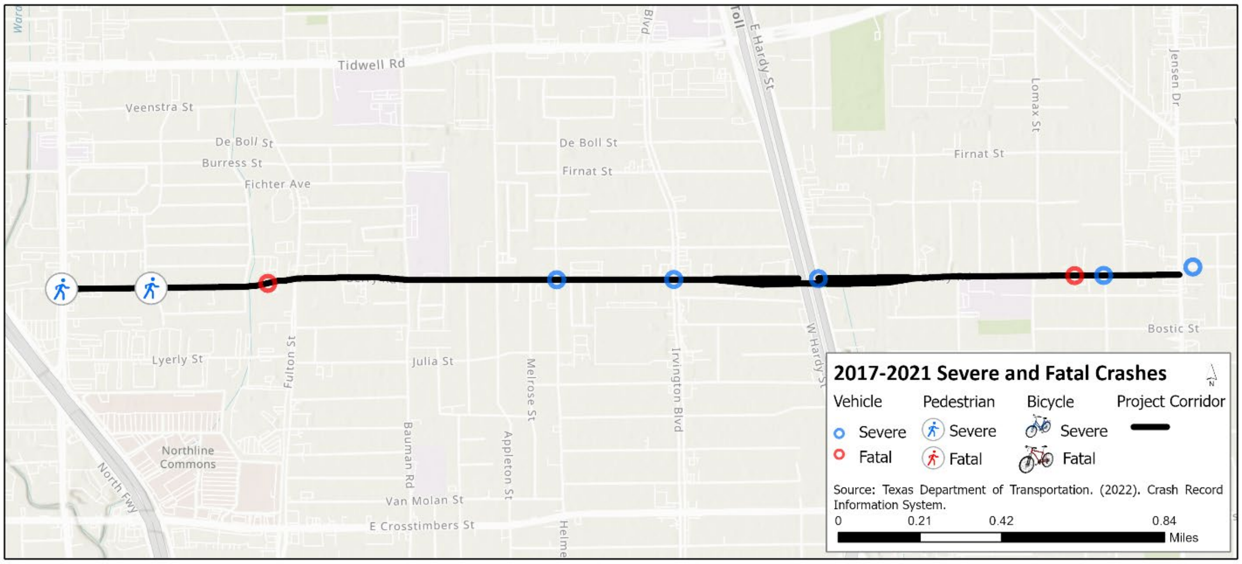

Figure 7. Crash Locations

The Highway Safety Improvement Program (HSIP) Work Codes correspond to different enhancements (e.g., new sidewalks, added through lanes, raised medians, additional stop signs). TxDOT has provided the public with a safety counter measure code table that provides associated definitions, counter measure reduction factors, and preventable crash codes. Preventable crashes are those with defined characteristics that may be affected by the proposed improvement as described by the work code. These codes are used to monetize and predict the reduction, given the proposed improvement, in future crashes along a corridor. The reconstruction of the roadway will result in reduction in crashes from improved lighting, improved pavement markings, installing a raised median, install bike lanes, and installing a rectangular rapid flashing beacon. Together, these countermeasures will reduce crashes by 24 to 49%. Additional information is provided in the benefit-cost analysis appendix.

Conceived in the 2000s, Vision Zero is an international movement to address this reality, viewing crashes as a preventable public-health crisis. More than 20 U.S. cities, including Houston, have committed to Vision Zero and to ultimately eliminating traffic deaths through this data-driven,

[1] City of Houston. Vision Zero Action Plan. Retrieved March 2023 from https://houstontx.gov/visionzero/pdf/VZAP_Final%20Report.pdf

transparent, and multi-agency approach that recognizes human imperfections. Harris County is adopting has adopted the Vision Zero Action Plan, with the goal of eliminating traffic fatalities and serious injuries by 2030. Approved by Commissioners Court in 2022, the Action Plan is in line with the international Vision Zero movement's philosophy that traffic deaths are preventable, and that human error needs to be factored into our decision-making process.

In November 2020, the City of Houston published the Vision Zero Action Plan. The Vision Zero Action Plan provides the community with 13 priority actions aimed at creating safer streets for the most vulnerable users. The City of Houston desires to "redesign 10 locations on the High Injury Network (HIN) every two years and implement reconstruction within the following fiscal year and construct at least 50 miles of sidewalks each year."[1] Although Berry Road is not located on the HIN, the roadway intersects with Airline Drive – that is located on the HIN - on the western end of the Project corridor. This Project is needed to further achieve the City of Houston safe streets priority actions and create a safer environment for all users.

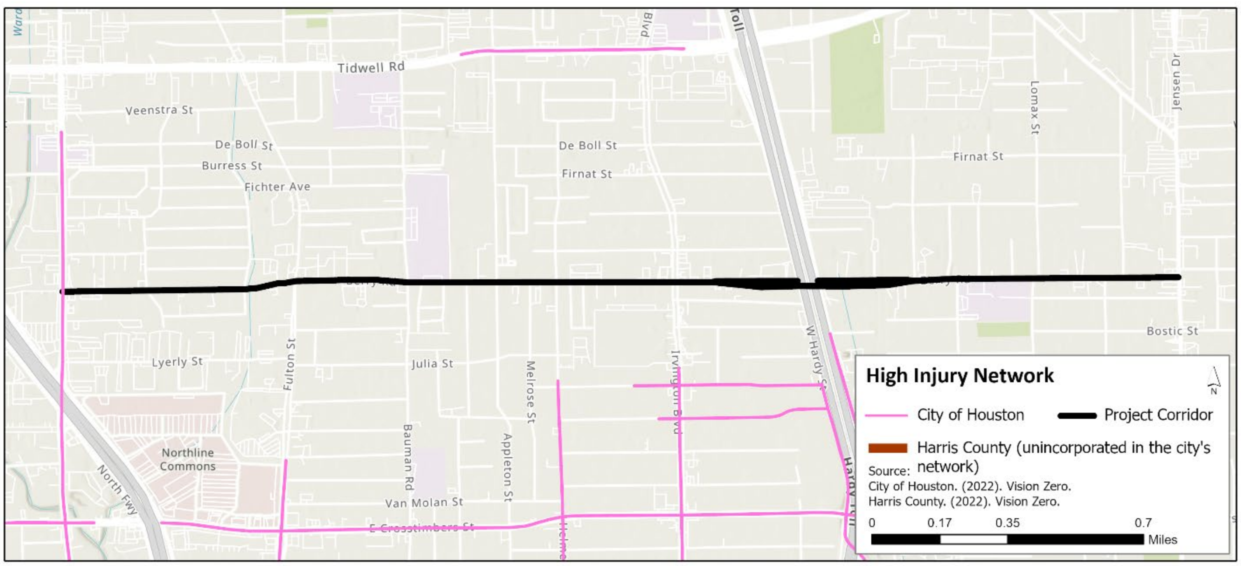

Figure 8. High Injury Network

Enhance Multimodal Mobility

Berry Road is a mixed-use corridor, with commercial, industrial, institutional, and residential land uses. The roadway has schools, restaurants, and other services that are accessed by the nearby community and residential land uses.

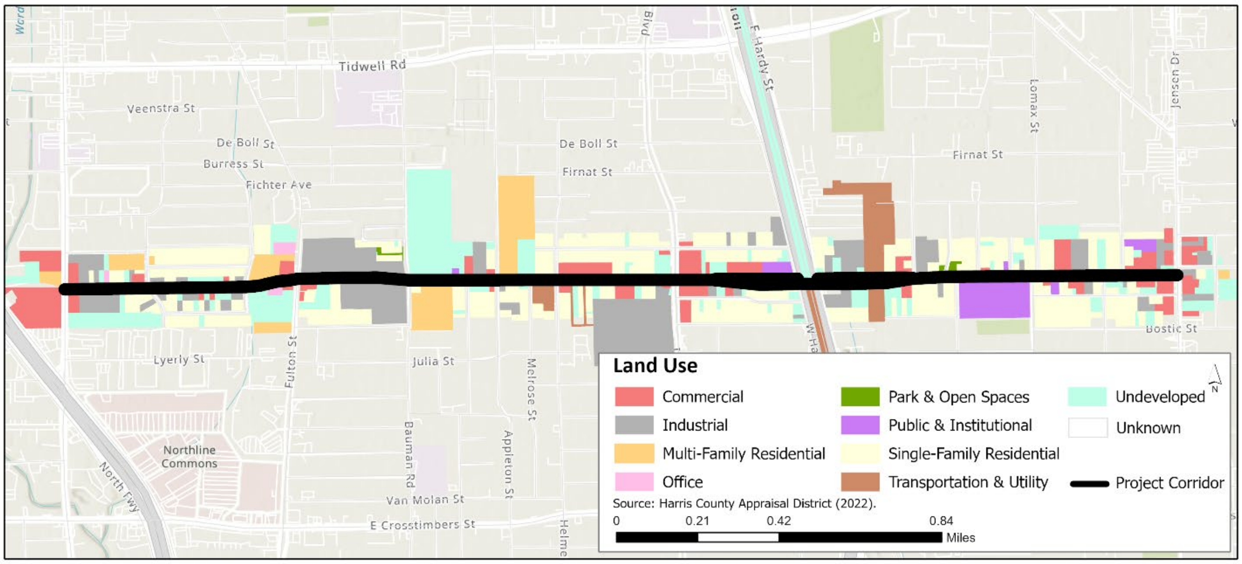

Figure 9. Land use

The average daily traffic on Berry Road along the project corridor is about 7,600 vehicles per day on average, with an average of 3.2% trucks. The proposed improvements will provide for a safer experience for all users, including vehicles, and allow for improved access to the land uses along the corridor. The improvements will also enhance multimodal connectivity by improving sidewalks and shared use paths for pedestrian and transit users.

Most people will not walk on high volume streets with sidewalks in poor condition. According to the 2017 FHWA National Household Travel Survey, over 65% of respondents indicated that they do not walk more because there are no sidewalks or sidewalks are in poor condition. Over 35% indicated they don't feel safe walking due to heavy traffic volumes.[2] The benefits of the improved sidewalks and resulting increase in walking activity are quantified in the benefit-cost analysis.

This Project is needed to create a safer opportunity for multimodal users, including transit users. The pathway for a transit rider is from door to door and therefore sidewalks, ADA-compliant ramps, and stops at both the origin and destination of the trip are part of the overall "service" provided to the rider.

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[2] Federal Highway Administration (2017). National Household Survey. Retrieved August 2021 fromhttps://nhts.ornl.gov/

Figure 8 shows the locations of bus routes and bus stops along the project corridor. The project corridor is serviced by METRO Route 56 (Airline / Montrose) and Route 79 (Irvington). Route 56 provides service every 10 minutes on weekdays and 20 minutes on the weekends between 5 a.m. and 10 p.m. On Route 56, passengers can connect to libraries, parks and trails, medical centers, transit centers, schools, grocery stores, shopping, and the Museum District. Route 56 is a BOOST corridor. BOOST routes will have enhancements such as improved pedestrian access, bus shelters, and other amenities, as well as improvements to travel time, including signal priority and streamlined stops. Construction is now complete along a 1.5 mile stretch of Studewood Street between White Oak Drive and Cavalcade Street; construction is set to begin on the next segment on Airline Drive between Cavalcade Street and Tidwell Road in the near future.

Route 79 runs every 60 minutes 7 days per week between 5 a.m. and 10 p.m. From this route, passengers can connect to libraries parks, healthcare facilities, schools, shopping, and transit centers.

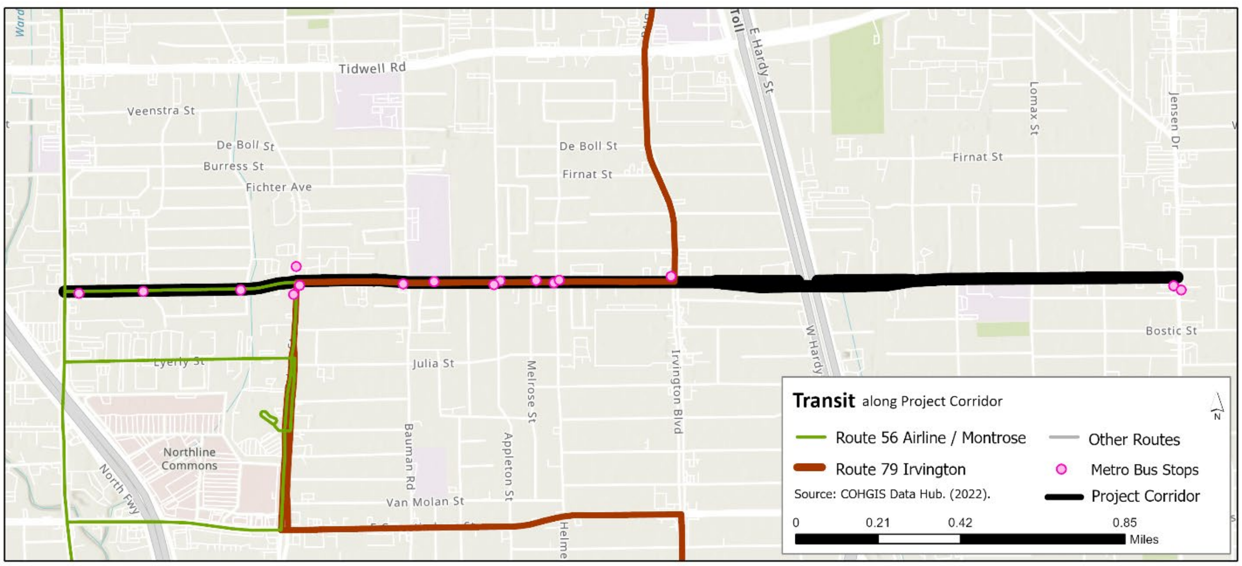

Figure 10. Transit

Sidewalk width is a key facility attribute that directly affects the comfort, convenience, and safety of the facility for pedestrian use. The proposed improvements will increase sidewalk width throughout the project corridor to make this a comfortable, convenient, and safe facility for pedestrian use and align with METRO's planned improvements to transit amenities along the corridor.

Sidewalks are not typically considered "transit" service, however the disabled, low income, non-car owners, and elderly often do not live, work, or play directly adjacent to a METRO bus stop and desperately need easy-to-use pathways to the bus stop. The pathway for a rider is from door to door and therefore sidewalks, ADA-compliant ramps, and stops at both the origin and destination of the trip are part of the overall "service" provided to the rider. This Project is needed to create a safer opportunity for multimodal use for all users along the corridor.

Figure 11. Existing Conditions on Berry Road

Improve Air Quality

The EPA has classified the Houston-Galveston-Brazoria area in moderate nonattainment of the eight-hour ozone standard; air quality does not meet federal standards.[3] The investment in mobility infrastructure could produce environmental benefits due to decreased automobile use and decreased vehicle delay resulting in a reduction of air pollutants, which is important to the region's future growth. H-GAC models and tracks various harmful air pollutants.

Two of the gravest concerns are Nitrogen Oxides (NOx) and Volatile Organic Compounds (VOCs), which when combined create ground-level ozone. Ground-level ozone can cause acute respiratory health effects, including, but not limited to, aggravated asthma, difficulty breathing, damaged airways, and other related symptoms.[4] The Houston metropolitan area experiences about 25-30 "unhealthy," or worse, air quality days per year, the most of any metro in Texas. According to the American Lung Association, Houston is ranked as the 8th worst city for ozone in the United States (worse than last year's 11th ranking).[5]

The project will improve sidewalks and pedestrian connections along the corridor. Based on these improvements, it is projected that an average of 191 daily new pedestrian trips will occur along the

[3] United States Environmental Protection Agency (2022). Health Effects of Ozone Pollutions. Retrieved March 2023 from https://www.epa.gov/ground-level-ozone-pollution/health-effects-ozone-pollution
[4] United States Environmental Protection Agency (2022). Health Effects of Ozone Pollutions. Retrieved March 2023 from https://www.epa.gov/ground-level-ozone-pollution/health-effects-ozone-pollution
[5] American Lung Association (2022). State of the Air Report. Retrieved March 2023 from https://www.lung.org/research/sota

corridor. An average of 49 new daily bicycle trips will occur along the corridor as a result of the shared use path improvement. The conversion of the trips from automobile to walking will reduce harmful emissions due to the reduction in automobile usage and associated vehicle miles traveled. Additional information is provided in the benefit-cost analysis appendix.

Advance Policy Goals

The data presented in the previous sections justify the Project through technical and stakeholder analysis. The Project is also needed to help advance the various safety, connectivity, equity, economic, environmental, and other related policies rooted within the national, state, regional, and local transportation objectives, goals, missions, and/or visions. This project is needed because it is aligned with goals in the following plans:

- USDOT Strategic Plan safety and equity goals to make our transportation system safer for all people and promote safe, accessible, and multimodal access to opportunities and services.
- TxDOT's strategic goal to promote safety.
- 2045 Regional Transportation Plan's vision for a multimodal transportation system that supports enhanced economic vitality, promotes safety, access, and mobility.
- 2022-2024 Regional Comprehensive Economic Development Strategy's goal to support increased connectivity to activity centers.
- Vision Zero Action Plan's goals to create a safe, accessible, equitable street network and to Houston Active Living Plan's goal to promote a multimodal transportation network with active transportation options and access to high quality transit
- make walking, rolling, and biking safe.

Summary of Benefit/Cost Analysis

A benefit-cost analysis was conducted for this project, which quantifies the net difference between the No-Build and Build Scenarios. The No-Build Scenario assumes that the roadway will be minimally maintained throughout the planning horizon, and the Build Scenario assumes a replacement of the infrastructure in the public right-of-way, as described in the Project scope.

Each benefit's baseline (No-Build) and Build methodology and calculations are contained within this technical memorandum, supported by the BCA Excel Workbook. The benefits are quantified and monetized for the BCA. The benefit-cost ratio is 5.87 in 2021 real dollars and when discounted at a 7% discount rate, the benefit-cost ratio is 3.22. The 2021 real dollar net present value (NPV) is $80.7 million and when discounted at 7%, $28.7 million. The following tables summarize the benefits and costs for the Project. A technical memorandum explaining the benefit/cost analysis methodology is attached in Appendix 1.

Table 4. BCA Summary

Build Scenario	$2021 Real Dollars	$2021 Real Dollars 7% Discount
Benefits	$97,313,000	$41,604,000
Costs	$16,580,000	$12,913,000
BCA	5.87	3.22
NPV	$80,733,000	$28,691,000

Table 5. Summary of benefits

Benefit	Current Status/Baseline and Problem to be Addressed	Change to Baseline or Alternatives	Types of Impacts	$2021 Monetized Value	$2021 Real Dollars 7% Discount Rate
Benefit 1: Remaining Useful Life of Asset	The current asset has 0% remaining useful life	Replace infrastructure within public right-of-way	Extend useful life	$7,654,000	$1,410,000
Benefit 2: State of Good Repair	Ongoing expensive maintenance of roadway pavement	Low maintenance required of new facility through the planning horizon	Maintenance cost savings	$222,000	$66,000
Benefits 3, 4, and 5: Safety Benefits	Outdated design, disproportionally higher crash rates	Safety improvement resulting in reduction in traffic crashes	Reduced crashes resulting in reduced fatalities and injuries	$73,792,000	$34,315,000
Benefits 6 and 7: Facility Improvements	The current facilities are not conductive for active transportation or using transit	Improvements to the current facilities will improve the quality or comfort of journeys	Improved comfort for active transportation users	$701,000	$266,000
Benefits 8 and 9: Operating Cost Savings	The current facilities result in limited demand of walking, biking, and transit usage	New and improved walking, biking, and transit facilities will induce demand	Reduced operating costs derived from modal shift from driving personal vehicles to walking and biking	$8,667,000	$3,294,000
Benefits 10 and 11: Mortality Reduction Benefits	Roadway is not conducive for active transportation	New and improved active transportation facilities will encourage more walking and cycling	Reduced mortality risks associated with increased walking and cycling	$5,683,000	$2,093,000
Benefit 12: Congestion Externalities Reduction	Roadway is not conducive for active transportation	New and improved facilities will encourage more walking and cycling	Reduced congestion externalities	$190,000	$72,000
Benefits 13 and 14: Emissions Reduction	The current facilities are not conductive for active transportation	Improvements to the existing facilities will induce demand for walking and cycling	Reduced emission derived from modal shift from driving personal vehicles to walking and biking	$28,000	$18,000
			Total	**$96,934,000**	**$41,534,000**

Useful Life

The City of Houston IDM states that the useful life of the project asset is 50 years. The design plans will call for 50-year useful life, therefore, at the end of the 20-year planning horizon, there is 60% of the useful life remaining. This monetized benefit is approximately $7.65 million.

State of Good Repair

The Project will reconstruct the corridor with concrete panels. If the roadway is not reconstructed, it will need to be maintained throughout the planning horizon including the City of Houston's programed maintenance schedule. In addition to maintenance and rehabilitation costs incurred, users would incur increased operating costs on their vehicles as a result of the poor pavement condition. During reconstruction and rehabilitation, users would also incur travel time costs as a result of construction. Combining these three categories yields a monetized benefit of approximately $222,000 for reconstruction of the roadway over the 20-year planning horizon.

Quality of Life

Active transportation modes such as walking and cycling can help improve cardiovascular health and lead to other positive outcomes for users. Adding or upgrading cycling or pedestrian facilities can convert users from inactive transportation modes to active transportation modes. The improvements along this Project corridor will reduce mortality rates by encouraging walking and rolling. The monetized benefit is approximately $5.68 million. The facility improvements also have a benefit due to revealed preferences; the total monetized benefits due to wider sidewalks and improved bicycle facilities is about $701,000 over the planning horizon.

The reduction in automobile costs due to mode conversion will save users money. The total monetized benefit of reduced operating costs over the 20-year planning horizon is approximately $8.67 million. The project will also have societal benefits through reducing externalities from noise and congestion; the total benefit is about $190,000 over the planning horizon.

Safety

The Project will improve safety along the Project corridor by reducing the number of pedestrian, bike, and vehicle crashes. There were 347 crashes along the project corridor from 2017–2021, of which 16 involved pedestrians or cyclists. Of these 16 crashes over the 5-year period, three were fatal and four were considered severe. The total monetized benefit over the 20-year planning horizon is approximately $73.7 million.

Environmental Sustainability

The improved sidewalks and increased transit access will encourage a modal shift for trips that would otherwise use an automobile. The proposed improvements will thereby reduce over 50,000 vehicle miles traveled due to conversion to pedestrian and bicycle trips once the Project opens over the life of the project. This reduction results in fewer harmful pollutants entering the atmosphere, such as NOx, VOCs, and carbon dioxide. The total monetized environmental benefit over the 20-year planning horizon is approximately $28,000.

Economic Competitiveness

Berry Road has recently become an area of interest for new development. The improved walkability of the corridor will also improve the property values for residential and commercial parcels adjacent to the improvements. While this property value increase is not considered a federally recognized societal benefit, it is important for the City of Houston and District to consider. Improving shared use paths along the corridor can increase residential property values by 5% per property and by 9% for commercial property values. Appraised property values by acre in the District for properties adjacent to the project corridor are illustrated in the figure below. Over the 20-year planning horizon, the expected property value increase will be approximately $69 million.

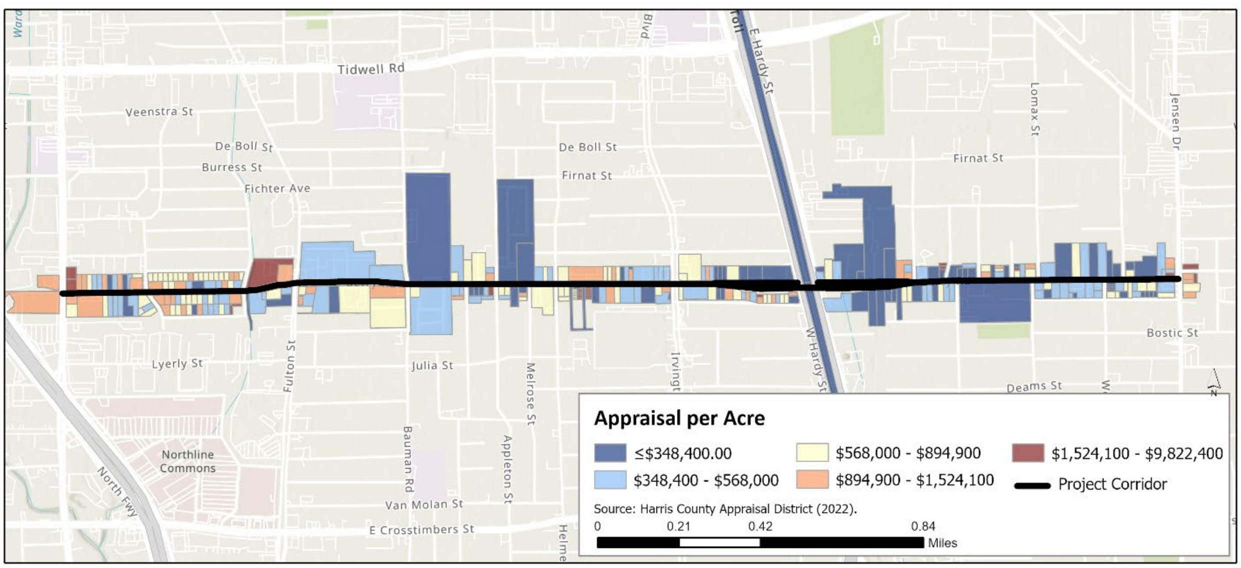

Figure 12. Appraisal Value per Acre

Summary of Existing NEPA Status

An environmental risk assessment was conducted for the areas around the program sites. The table below summarizes the potential for environmental risk or any "red flags" which would impact schedule or budget. A full environmental risk assessment follows this report. Overall, the Project is not anticipated to have any adverse impacts, however additional coordination and assessment will be necessary to address various hazmat sites near the project corridor.

Table 6. Existing NEPA Status

NEPA Category	Potential Impacts
Land Use	Positive impacts.
Air Quality	No adverse impacts.
Cultural Resources	Based on existing sidewalks, the amount of available space for new sidewalks, and the general condition of properties in the area, adverse impacts are not anticipated to potentially eligible properties. A submittal package to SHPO is expected to receive concurrence within the standard 30-day review period.
Hazardous Materials	The proposed project has multiple hazardous materials sites adjacent to the alignment. Further review is likely required.
Public Parks and Recreation Areas	No adverse impacts.
Population Characteristics and Socioeconomics	Positive impacts.
Community Resources	Positive impacts.
Transportatin Resources	Positive impacts.
Soil	No adverse impacts.
Wetlands	The project alignment crosses a designated riverine wetland. There are existing sidewalks in this location and adverse impacts to wetlands are not anticipated as work is proposed within the existing right-of-way.
Floodplains	The alignment crosses the 100-year floodplain. The area is developed with the roadway and residential and commercial structures. The proposed project is not anticipated to cause permanent adverse impacts to the floodplain.
Waters of the U.S.	See wetlands discussion.
Water Quality, Navigable Waterways, and the Coastal Zone	No adverse impacts.
Ecologically Sensitive Areas and Endangered and Threatened Species	No adverse impacts.
Migratory Birds	No adverse impacts.
Right-of-Way and Acquisition	No adverse impacts.
Traffic and Parking	No adverse impacts.
Noise	No adverse impacts.
Safety and Secutity	No adverse impacts.
Aesthetics	No adverse impacts.
Public Outreach	No adverse impacts.
Construction Impacts	No adverse impacts.

Funding Pursuit Recommendations

To be competitive for funding opportunities, it is recommended that the District continue to develop the Project by completing, in conjunction with the City of Houston and Harris County, the design of the Project. Design is not required to apply for local, state, or federal funding; however, a completed design will increase competitiveness. Additional coordination will be necessary, and funding will likely need to be awarded from several sources to realize full implementation. A phased approach to completing improvements will likely be necessary.

The following is a recommended timeline for funding pursuit for the Project:

- Spring 2023: Develop grant readiness report.
- Spring / Summer 2023: Begin coordination with stakeholders for discretionary funding opportunities. Stakeholders include, but are not limited to, the City of Houston, Harris County, METRO, Houston-Galveston Area Council, and elected officials.

Pursuit of Funding

In March 2023, the District applied for funding to complete the design concept and Phase 1 construction on Berry Road to Representative Sylvia Garcia for FY24 Community Project Funding, but was not successful in this pursuit. Additional funding sources will be needed to enable the District to determine a definitive design for the corridor, identify and define phases of development (including additional community and stakeholder engagement, drainage analysis, environmental assessment, traffic analysis, survey, and assessment of transit connections), and ultimately implement the proposed improvements.

Funding Opportunities

The following section provides discretionary funding opportunities relevant to this Project.

Houston-Galveston Area Council (H-GAC), Call for Projects

The Houston-Galveston Area Council administers funding and grant awards for the Gulf Coast Region for CMAQ and STBG.

Congestion Mitigation and Air Quality (CMAQ)

The Houston-Galveston area is designated as a non-attainment area for air quality standards. CMAQ funding is provided by the federal government for transportation projects that reduce traffic congestion and improve air quality, particularly in areas that do not meet attainment targets. These funds are allocated through the H-GAC Call for Projects process.

Surface Transportation Block Grant (STBG)

Surface Transportation Block Grants are distributed via the regional Metropolitan Planning Organization (MPO), which is the Houston-Galveston Area Council (H-GAC). Every 2-3 years, the H-GAC releases a Call for Projects across the 8-county region. The last Call for Projects was issued in Fall 2018, with announcements of funding awards finalized in Spring 2019. Funding availability was $920 million from FY2019-FY2028. Eligible applicants included state and local governments, public transit providers, and public ports. A variety of project types were eligible, including roadway, active transportation and transit projects. The funding requested was a minimum of $500,000 for roadway projects and $150,000 for active transportation and transit projects. Another call is anticipated to be issued in 2023. The amount of funding available will be dependent upon the state of the federal surface transportation bill and other federal funding programs related to transportation infrastructure.

Rebuilding American Infrastructure with Sustainability and Equity (RAISE)

RAISE is a national opportunity through the USDOT. Transportation projects for RAISE funding will be evaluated based on merit criteria that include safety, environmental sustainability, quality of life, economic competitiveness, state of good repair, innovation, and partnership. Within these criteria, USDOT will prioritize projects that can demonstrate improvements to racial equity, reduce impacts of climate change, and create good-paying jobs. The maximum grant award is $25 million. The RAISE grant yields significant funds and is very competitive nationally.

Federal Earmarks / Community Project Funding

Members of Congress are currently enabled to select and submit projects for funding consideration via a variety of annual federal appropriations bills. The process is currently structured in a manner where eligible applicants can coordinate with their elected congressional representative to identify unfunded community needs and requisite projects to meet those needs. The projects can then be matched with the applicable appropriations category (e.g., Transportation Housing and Urban Development, Interior and Environment) and existing programs within those categories. Based on congressional priorities and available funding, projects can be funded via selection by congressional representative and eventual approval by the relevant appropriations committee, bicameral approval, and authorization into law by the President. The best approach to target this funding opportunity is to discuss project priorities with the applicable political representative.

Safe Streets and Roads for All Discretionary Grant Program

The Infrastructure Investment and Jobs Act of 2021 includes a provision for $5 billion dollars for this program for five years of funding. The program will support local initiatives to prevent death and serious injury on roads and streets, including comprehensive road safety plans and measures to increase safety for vulnerable road users like cyclists and pedestrians. Implementation grants can reach up to $50 million.

Next Steps

The information presented in this report is current as of April 2023. The proposed improvements and cross sections are preliminary and are subject to change during the design and engineering phases. As this project comes to fruition, additional coordination will be required with all other agencies, including the City of Houston and METRO as it relates to the Route 56 BOOST corridor.

NORTHSIDE ON THE MOVE

Berry Road Back-of-Curb Improvements
Benefit-Cost Analysis

ADRIAN GARCIA COMMISSIONER
REVIVE 2 THRIVE Community Revitalization Initiative
HARRIS COUNTY ENGINEERING DEPARTMENT
NORTHSIDE
THE GOODMAN CORPORATION

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Executive Summary

The 2023 USDOT Benefit-Cost Analysis (BCA) Guidance for Discretionary Grant Programs provides the foundation for the methodologies used to estimate the quantified and subsequent monetized benefits in this BCA.[1] The evaluation process examines the fundamental question of whether the expected societal benefits of the project justify the cost with the understanding that some benefits and costs are difficult to quantify. This analysis examines how the No-Build and Build Scenarios improve the societal benefits throughout the planning horizon.

The BCA quantifies the net difference between the No-Build and Build Scenarios for the project corridor. The Berry Road Pedestrian Improvements Project ("Project") limits are described in Table 1.

Table 1. Project Limits

Street	Terminus A	Terminus B
Berry Road	Airline Drive	Jensen Drive

The **No-Build Scenario** assumes that the roadway will continue to deteriorate and be minimally maintained throughout the planning horizon. The planning horizon includes 20 years, from 2026 to 2046.

The **Build Scenario** assumes a replacement of infrastructure within public right-of-way (ROW) along the project limits, which will include the following major components:

- Rehabilitate pavement which consists of approximately 600 linear-foot of asphalt pavement east of Airline Drive and 600 linear-foot of concrete pavement east of Helmers Street.
- Improve storm water drainage which includes approximately 3,700 linear-foot of 24- to 48-in reinforced concrete pipe with related appurtenances and 10,000 linear-foot of ditch reshaping.
- Construct approximately 17,500 linear-foot of 6-ft sidewalks and 8,500 linear-foot of 10-ft shared use paths, with associated driveway, curb, and wheelchair ramp appurtenances.
- Improve traffic signal, signing, pavement marking, and streetlight along the project corridor. The traffic signals at Irvington Boulevard will be upgraded to include pedestrian signal heads. Existing roadside signs and pavement markings

[1] United States Department of Transportation (2023). Benefit-Cost Analysis Guidance for Discretionary Grant Programs. Retrieved January 2023 from https://www.transportation.gov/office-policy/transportation-policy/benefit-cost-analysis-guidance-discretionary-grant-programs-0

will be replaced, and new signs and markings installed as required per the TMUTCD and IDM for the proposed shared use paths and sidewalks. Streetlights will be installed where needed to provide visibility for pedestrians and bicyclists.

Summarized Planning, Design, Environmental, and Capital Costs

The costs (excluding ongoing maintenance) for the Project in the year of expenditure, or nominal dollars, is $18,136,000. The annual inflation factor of 2.44% applied to the projected costs (nominal $), was discounted from the year of expenditure to reflect the real $ in year 2021. The 2.44% inflation factor is derived from the inflation adjustment values found in Table A-7 in the 2023 USDOT BCA Guide.[1] The total project cost in 2021 real dollars is $16,580,000. These costs are discounted 7% from the expenditure year to year 2021. The total year 2021 real discounted costs are $12,913,000. Project costs are described in Table 2.

Table 2. Project Costs

Cost	Nominal $ Year of Expenditure No Discount	Real $ $2021 No Discount	7% Discount $2021
Planning	$50,000	$48,000	$44,000
Design/Environmental	$3,340,000	$3,144,000	$2,657,000
Construction	$14,745,000	$13,388,000	$10,213,000
Project Costs	**$18,136,000**	**$16,580,000**	**$12,913,000**

Summarized Benefits

The proposed Project will provide a variety of societal benefits to the local and regional transportation system.

The No-Build Scenario will result in the following:

- The existing sidewalk will continue to be in **disrepair**. The existing narrow sidewalks on both sides of Berry Road do not meet the standards in the City of Houston Infrastructure Design Manual (COH IDM).
- The existing storm sewer system along the corridor will remain **undersized**. The pipes in service have unknown dates of installation and will likely be reaching the end of their useful service life.
- The Corridor will likely remain **unsafe** with aging sidewalks, outdated signs and markings, no bicycle facilities, and inadequate streetlights.

Moving forward with the **Build Scenario** will result in the following monetized societal benefits; however, there are some disbenefits also associated with the Project, as explained below:

Benefits Monetized – Transportation

- **Benefit 1: Remaining Useful Life of Asset**
    - The asset will be built with a useful life of 50 years, therefore there will be 60% remaining useful life at the end of the planning horizon.
- **Benefit 2: State of Good Repair**
    - The Project will replace the pavement, which will significantly reduce vehicle wear and tear and ongoing maintenance costs.
- **Benefit 3: Motorist Safety Improvements**
    - The Project will provide significant safety improvements and as a result, a likely reduction of motor vehicle crashes (separate from pedestrian and bicycle related crashes).
- **Benefit 4: Pedestrian Safety Improvements**
    - The Project will experience significant pedestrian safety improvements and as a result, a likely reduction of pedestrian related injuries.
- **Benefit 5: Bicycle Safety Improvements**
    - The Project will experience significant bicycle safety improvements and as a result, a likely reduction of bicycle related injuries.
- **Benefit 6: Facility Improvements – Walking**
    - The Project will improve sidewalks and therefore improve the quality or comfort of journeys made by pedestrians.
- **Benefit 7: Facility Improvements – Cycling**
    - The Project will install shared use paths and therefore improve the quality or comfort of journeys made by cyclists.
- **Benefit 8: Operating Cost Savings – Walking**
    - The Project will include upgraded sidewalks and therefore encourage active transportation ultimately reducing automobile usage.
- **Benefit 9: Operating Cost Savings – Cycling**
    - The Project will include shared use paths and therefore encourage active transportation ultimately reducing automobile usage.
- **Benefit 10: Mortality Reduction Benefits — Walking**
    - The Project will encourage more walking which can lead to a reduction in mortality risks for pedestrians.
- **Benefit 11: Mortality Reduction Benefits — Cycling**

    - The Project will encourage more cycling which can lead to a reduction in mortality risks for bicyclists.
- **Benefit 12: Congestion Externalities Reduction**
    - The Project will include new active transportation facilities and therefore encourage active transportation, which reduces automobile usage and results in reduced congestion externalities.
- **Benefit 13: Emissions Reduction – Walking**
    - The Project will include upgraded sidewalks and therefore encourage active transportation, which reduces automobile usage and therefore a reduction of emissions from automobile usage.
- **Benefit 14: Emissions Reduction – Cycling**
    - The Project will include shared use paths and therefore encourage active transportation, which reduces automobile usage and therefore a reduction of emissions from automobile usage.

Benefits Monetized but Not Widely Accepted in Transportation Grant Applications – Local Economic

- Shared Use Paths Economic Benefit
    - The Project will include new shared use paths, which can increase the surrounding residential property value.

The baseline (No-Build) and Build methodology and calculations for each benefit are contained within this technical memorandum, supported by the BCA Excel Workbook. The benefits are quantified and monetized for the BCA.

Benefits and costs in real dollars and discounted real dollars are showing in the following table. Real dollars, also known as inflation-free dollars or constant dollars, stands for dollars that are netted out the effect of inflation by using a common base year. Discounting is made to account for the time value of money. It means benefits and costs that occur sooner rather than later are valued more, and there is thus a cost associated with diverting the resources needed for an investment from other productive uses in the future. Future streams of benefits and costs will be expressed in the same present value terms after discounting.

The benefit-cost ratio is 5.87 in 2021 real dollars and when discounted at a 7% discount rate, the benefit-cost ratio is 3.22. The 2021 real dollar NPV is $80,733,000 and when discounted at 7%, $28,691,000.

Table 3. BCA Summary

Scenario	$2021 Real Dollars	$2021 Real Dollars 7% Discount
Benefits	$97,313,000	$41,604,000
Costs	$16,580,000	$12,913,000
BCA	5.87	3.22
NPV	$80,733,000	$28,691,000

Table 4 summarizes the Project benefits.

Table 4. Project Benefits Summary

Benefit	Current Status/Baseline and Problem to be Addressed	Change to Baseline or Alternatives	Types of Impacts	$2021 Monetized Value	$2021 Real Dollars 7% Discount Rate
Benefit 1: Remaining Useful Life of Asset	The current asset has 0% remaining useful life	Replace infrastructure within public right-of-way	Extend useful life	$7,654,000	$1,410,000
Benefit 2: State of Good Repair	Ongoing expensive maintenance of roadway pavement	Low maintenance required of new facility through the planning horizon	Maintenance cost savings	$222,000	$66,000
Benefits 3, 4 and 5: Safety Benefits	Outdated design, disproportionally higher crash rates	Safety improvement resulting in reduction in traffic crashes	Reduced crashes resulting in reduced fatalities and injuries	$73,792,000	$34,315,000
Benefits 6 and 7: Facility Improvements	The current facilities are not conductive for active transportation or using transit	Improvements to the current facilities will improve the quality or comfort of journeys	Improved comfort for active transportation users	$701,000	$266,000
Benefits 8 and 9: Operating Cost Savings	The current facilities result in limited demand of walking, biking, and transit usage	New and improved walking, biking, and transit facilities will induce demand	Reduced operating costs derived from modal shift from driving personal vehicles to walking and biking	$8,667,000	$3,294,000

Benefit	Current Status/Baseline and Problem to be Addressed	Change to Baseline or Alternatives	Types of Impacts	$2021 Monetized Value	$2021 Real Dollars 7% Discount Rate
Benefits 10 and 11: Mortality Reduction Benefits	Roadway is not conducive for active transportation	New and improved active transportation facilities will encourage more walking and cycling	Reduced mortality risks associated with increased walking and cycling	$5,683,000	$2,093,000
Benefits 12: Congestion Externalities Reduction	Roadway is not conducive for active transportation	New and improved facilities will encourage more walking and cycling	Reduced congestion externalities	$190,000	$72,000
Benefits 13 and 14: Emissions Reduction	The current facilities are not conductive for active transportation	Improvements to the existing facilities will induce demand for walking and cycling	Reduced emission derived from modal shift from driving personal vehicles to walking and biking	$28,000	$18,000
			Totals	**$96,934,000**	**$41,534,000**

Foundations to Benefit / Cost Analysis

The following methodologies and/or general assumptions are used to quantify the benefits for the Project.

Real Dollars & Discount Rate

All monetized values in both benefit and cost equations within the analysis have been converted to a base year (real dollars) of 2021. Cost elements that were expended or derived from cost estimates in prior years were inflated using the inflation adjustment values found in Table A-7 in the 2023 USDOT BCA Guidance for Discretionary Grant Programs.[1] The inflation factors were removed for non-capital and operational cost elements (e.g., safety monetization factor) that occurred in 2021.

The OMB Circular A-94 provides guidance on discount rates. As a default position, OMB Circular A-94 states that a discount rate of 7% should be used as a base-case for regulatory analysis. The 7% rate is an estimate of the average before-tax rate of return to private capital in the U.S. economy. It is a broad measure that reflects the returns to real estate and small business capital as well as corporate capital. A 7% discount rate was applied to all 2021 real dollar monetized costs and benefits.

Planning, design, environmental and capital costs

The costs for the Project in year of expenditure, or nominal dollars, is $18,136,000. The annual inflation factor of 2.44% applied to the projected costs (nominal $), was discounted from the year of expenditure to reflect the real $ in year 2021. The 2.44% inflation factor is derived from the 2003 to 2021 inflation adjustment values found in Table A-7 in the 2023 USDOT BCA Guide. The total project cost in 2021 real dollars is $16,580,000. These costs are discounted 7% from the expenditure year to year 2021. The total year 2021 real discounted costs are $12,913,000.

Planning Horizon

The 20-year planning horizon is from 2026 to 2046 and discounted at 7% to 2021 dollars. The Project is assumed to open in 2026; thus, most benefits are generally quantified for a 20-year period, from 2026-2046 once the facility is open for users.

No-Build Scenario

The No-Build Scenario assumes that roadway improvements will only consist of minimal planned improvements to the project corridor within the No-Build Scenario.

Benefit 1: Remaining Useful Life of Asset

No-Build Scenario

The roadway in the Project corridor will need to be repaired throughout the planning horizon.

Build Scenario

The Project will be designed and constructed for a useful life of 50 years.[2]

Methodology/Summary

The residual life benefit assumes there will be 60% of the Project life remaining at the end of the planning horizon. The residual life benefit only captures 60% of the construction cost of the Project. Using Equation 1, the remaining useful life for the Project is calculated.

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[2] City of Houston (2022). Public Works Infrastructure Design Manual. Retrieved August 2022 from https://www.houstonpermittingcenter.org/news-events/2021-infrastructure-design-manual-announcement

Equation 1. Useful Life Methodology

Useful Life = Construction Costs * 60%

Accumulated benefits for the 20-year horizon are quantified and discounted at a 7% rate, shown in Table 5.

Table 5. Useful Life Benefit

Scenario	Monetized Values
No-Build Benefit	$0
Build Benefit	$7,654,000
Net Benefit	**$7,654,000**
Net Benefit Discounted @ 7% to $2021	**$1,410,000**

Benefit 2: State of Good Repair

Maintenance and user costs associated with the condition of a roadway's surface are significant factors in the decision to continue with the current pavement or to replace it. The capital expenditure required for a reconstruction project may make economic sense if it saves money over the planning horizon. Demonstrating a roadway's current surface condition, or state of good repair (SOGR), and projecting the costs and benefits for alternative maintenance strategies will provide the information needed to make this decision.

No-Build Scenario

Continue maintenance strategy through remaining life of facility. The roadway is currently composed of approximately 600 linear-foot of asphalt pavement east of Airline Dr and 600 linear-foot of concrete pavement east of Helmers St.

Build Scenario

The existing pavement along the project corridor will be replaced with new pavement.

Methodology

This section summarizes the methodology and results of this analysis.

Life Cycle Cost Analysis Methodology

The evaluation for SOGR uses a Life Cycle Cost Analysis (LCCA) model adapted to the scope of this project to determine the more cost-effective of the No-Build and Build Scenarios.[3] The primary purpose of this method is to compare the costs of

[3] Federal Highway Administration. Life-Cycle Cost Analysis. Retrieved August 2022 at https://www.fhwa.dot.gov/infrastructure/asstmgmt/lcca.cfm.

reconstruction to those of continued maintenance of the existing roadway surface. The focus of the analysis is pavement condition and does not include costs associated with drainage, traffic management, or other non-vehicular support facilities. The analyzed costs include agency costs due to reconstruction or repair, user costs due to construction zone time delays, and operation and upkeep of vehicles used on the roadway throughout its life cycle. The life cycles for asphalt and concrete pavement are assumed to be 20 years and 50 years, respectively. The phasing of the 25-year asphalt life cycle is shown in Figure 1.[4,5]

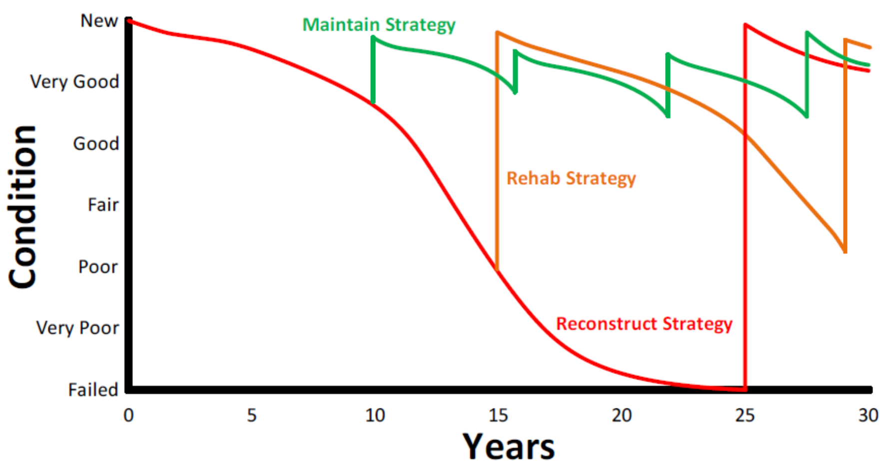

Figure 1. Pavement Life Cycle Curve

The key assumption is that if the proposed Project is not implemented (No-Build Scenario), the City of Houston will follow a maintenance strategy that includes annual routine maintenance and periodic rehabilitation for the project corridor. Conversely, the Build Scenario, in which the roadway is rebuilt and thus brand new, would result in no maintenance or rehabilitation requirements within the planning horizon. The key roadway characteristics related to the analysis are summarized in Table 6.

4 Texas Department of Transportation. Transportation Asset Management Plan, p. 53. Retrieved August 2022 from https://www.nctcog.org/nctcg/media/Transportation/DocsMaps/Data/Performance/TxDOT-Initial-Transportation-Asset-Management-Plan.pdf
5 City of Houston (2018). Public Works Infrastructure Design Manual, p. 10-6. Retrieved June 2019 from https://edocs.publicworks.houstontx.gov/documents/design_manuals/idm.pdf

Table 6. Berry Road Characteristics

Segment	Class	Pavement	Length (ft)	Lanes	Lane-miles	Average Daily Traffic (2021)	Truck %
600 linear-foot east of Airline Drive	Major Collector	Asphalt Overlay	600	2	0.23	8,866	3.20%
600 linear-foot east of Helmers Street	Major Collector	Concrete	600	2	0.23	7,363	3.20%

Maintenance - Concrete Pavement

An assessment of the pavement's current SOGR determines where the roadway is on its life cycle curve. The life cycle curve is composed of phases established by the Texas Department of Transportation (TxDOT) Transportation Asset Management Plan (TAMP) and assumes a 50-year life for concrete pavement. By modeling the deterioration of pavement over time due to environmental and traffic factors, the phases establish timings for maintenance requirements and effects on user vehicle operating costs for the No-Build Scenario.

The pavement's condition declines gradually in its first 10 years, but then quickly deteriorates to an unacceptable state. Any rehabilitation or maintenance strategy can reset the pavement's life cycle to a certain extent. Based on information from the City of Houston Public Works, and verified by site visits, the corridor is mostly in the early phase of its service life. Most of Berry Road in the east of Helmers Street is in good condition.

Table 7. Condition Assessment - Berry Road in the East of Helmers Street

Street Name	Overall Condition (Weighted Average)
Berry Road 600 Linear-foot East of Helmers Street	Good

A critical planning factor for maintenance operations is that the cost of repairs increases as the reliability of pavement decreases over the service life.[6] Essentially, newer pavement requires less maintenance than older, more deteriorated pavement to maintain acceptable levels of service. To approximate the increasing probabilities of portions of each roadway requiring repairs and the effects on maintenance costs, this analysis used approximate failure rate factors as a multiplier of the annual maintenance

[6] Federal Highway Administration (2013). Reformulated Pavement Remaining Service Life Framework, p. 43-49. Retrieved August 2022 from https://www.fhwa.dot.gov/publications/research/infrastructure/pavements/13038/13038.pdf

costs incurred by the City of Houston. The City of Houston FY2021 expenditures on street and bridge maintenance is over $100 million, which covers about 16,600 lane-miles of roadways, according to the Department of Public Works.[7] This analysis used the average expenditure from these totals ($6,135 per lane-mile), the lane-miles of each roadway, and the failure rate factor to develop estimates of annual maintenance costs by life cycle phase based on condition, shown in Table 8.

Table 8. Annual Pavement Maintenance Costs by Life Cycle Phase - Berry Road in the East of Helmers Street

Phase	Percent of Life	Failure Rate Factor	Cost
New	24%	0.00	$0
Very Good	40%	0.00	$0
Good	52%	0.25	$349
Fair	64%	1.00	$1,394
Poor	80%	1.50	$2,091
Very Poor	100%	3.00	$4,183

Rehabilitation, which for this analysis consists of full-depth panel replacement for concrete conducted at select intervals in addition to routine annual repairs to maintain the structural integrity of the roadways. The expected result of this strategy is the extension of the service lives of the roadways by approximately 20 years for concrete.[8] Based on the concrete's life cycle, iterations of systematic repairs will be required over the next 20 years. Table 9 shows the schedule for rehabilitation under the No-Build Scenario.

Table 9. Rehabilitation Cycle - Berry Road in the East of Helmers Street

Street Name	Pavement	1st Panel Replacement	2nd Panel Replacement
Berry Road	Concrete	2031	2052

For simplicity, this analysis assumes the rehabilitation of the entire length of the Project within the stated limits would be accomplished within time periods noted above. Similarly, it is assumed all failures of pavement within a certain life cycle phase occur all at once and the replacement costs may be captured as discrete projects. This analysis also assumes that unforeseen pavement failures that affect daily traffic are addressed as needed through annual maintenance and there would be residual life of the last major rehabilitation within the planning horizon.

[7] City of Houston Fiscal Year Operating Budgets, Retrieved in August 2022 from https://www.houstontx.gov/budget/
[8] City of Houston Report to TTI Committee. Retrieved August 2022 from https://www.houstontx.gov/council/committees/tti/20140513/Maintaining_Houston_Streets.pdf

This analysis assumes the rehabilitation of the Project takes the form of concrete panel replacement. According to City of Houston 2022 Capital Improvement Projects Panel Replacement Package, the cost for full-depth repair of joint concrete pavement is $171 per square yard (SY) in 2021. If the TxDOT standard panel dimensions of 12-foot (lane size) by 50 linear-foot are used, the per panel replacement cost can be calculated using Equation 2.

Equation 2. Cost of Concrete Panel Replacement

Panel Replacement Cost = $171 · A · P
A = 67 SY (panel surface area) P = number of panels required

The number of panels required to be replaced is based on the condition assessment presented above. The proportion of panels in the various phases of the life cycle for the length of the project under analysis and the associated life expectancies and replacement costs are summarized in Table 10.

Table 10. Concrete Pavement Costs - Berry Road in the East of Helmers Street

Phase	Percent of Total	Number of Panels	Year(s) of Replacement	Replacement Cost	Remaining Life
Very Poor	0%	0	N/A	$0	$0
Poor	0%	0	N/A	$0	$0
Fair	0%	0	N/A	$0	$0
Good	100%	19.9	N/A	$290,000	$72,000
Very Good	0%	0	N/A	$0	$0

The preferred alternative minimizes total maintenance costs over the planning horizon. As presented above, annual maintenance and scheduled rehabilitation for the existing pavements create a cost, or disbenefit, to the City of Houston for the No-Build Scenario. The Build Scenario presents an opportunity to avoid most of that financial burden. The proposed construction calls for concrete roadway and the new pavement would not require maintenance or rehabilitation for the remainder of the planning horizon; thus, the only rehabilitation costs are those incurred prior to project implementation. Table 11 summarizes the maintenance and rehabilitation costs for each scenario.

Table 11. Summary of Maintenance & Rehabilitation Costs - Berry Road in the East of Helmers Street

Roadway	No-Build Scenario			Build Scenario		
	Annual Maintenance	Scheduled Rehab	Roadway Subtotal	Annual Maintenance	Scheduled Rehab	Roadway Subtotal
Berry Road	$18,000	$290,000	$308,000	$9,000	$0	$9,000

Maintenance – Asphalt Pavement

An assessment of the pavement's current SOGR determines where the roadway is on its life cycle curve. The life cycle curve is composed of phases established by the TxDOT TAMP and assumes a 25-year life for asphalt pavement. By modeling the deterioration of pavement over time due to environmental and traffic factors, the phases establish timings for maintenance requirements and effects on user vehicle operating costs for the No-Build Scenario.

The pavement's condition declines gradually in its first four years, but then quickly deteriorates to an unacceptable state. Any rehabilitation or maintenance strategy can reset the pavement's life cycle to a certain extent. Based on information from the City of Houston Public Works, and verified by site visits, the corridor is mostly in the early phase of its service life. The Berry Road in the East of Airline Drive is in Good condition.

Table 12. Condition Assessment - Berry Road in the East of Airline Drive

Street Name	Overall Condition (Weighted Average)
Berry Road	Good

A critical planning factor for maintenance operations is that the cost of repairs increases as the reliability of pavement decreases over the service life.[9] Essentially, newer pavement requires less maintenance than older, more deteriorated pavement to maintain acceptable levels of service. To approximate the increasing probabilities of portions of each roadway requiring repairs and the effects on maintenance costs, this analysis used approximate failure rate factors as a multiplier of the annual maintenance costs incurred by the City of Houston. The City of Houston FY2021 expenditures on street and bridge maintenance is over $100 million, which covers about 16,600 lane-miles of roadways, according to the Department of Public Works.[10] This analysis used the average expenditure from these totals ($6,135 per lane-mile), the lane-miles of each roadway, and the failure rate factor to develop estimates of annual maintenance costs by life cycle phase based on condition, shown in Table 13.

[9] Federal Highway Administration (2013). Reformulated Pavement Remaining Service Life Framework, p. 43-49. Retrieved August 2022 from https://www.fhwa.dot.gov/publications/research/infrastructure/pavements/13038/13038.pdf

[10] City of Houston Fiscal Year Operating Budgets, Retrieved in August 2022 from https://www.houstontx.gov/budget/

Table 13. Annual Pavement Maintenance Costs by Life Cycle Phase - Berry Road in the East of Airline Drive

Phase	Percent of Life	Failure Rate Factor	Cost
New	24%	0.00	$0
Very Good	40%	0.00	$0
Good	52%	0.25	$349
Fair	64%	1.00	$1,394
Poor	80%	1.50	$2,091
Very Poor	100%	3.00	$4,183

Rehabilitation, for this analysis, consists of asphalt mill and overlay conducted at select intervals in addition to routine annual repairs to maintain the structural integrity of the roadway. The expected result of this strategy is the extension of the service life of the roadway by approximately 10 years for asphalt.[11] Based on each pavement's life cycle, iterations of systematic repairs will be required over the next 20 years. Table 14 shows the schedule for rehabilitation under the No-Build Scenario.

Table 14. Rehabilitation Cycle - Berry Road in the East of Airline Drive

Roadway	Pavement	Mill & Overlay	Mill & Overlay	Mill & Overlay	Mill & Overlay
Berry Road	Mill & Overlay	2027	2035	2043	2051

For simplicity, this analysis assumes the rehabilitation of the entire length of the Project within the stated limits would be accomplished within time periods noted above. Similarly, it is assumed all failures of pavement within a certain life cycle phase occur all at once and the replacement costs may be captured as discrete projects. This analysis also assumes that unforeseen pavement failures that affect daily traffic are addressed as needed through annual maintenance and there would be residual life of the last major rehabilitation within the planning horizon.

The rehabilitation of the asphalt surfaces of the Project is projected in this analysis to occur in 10-year increments. According to TxDOT's Average Low Bid Unit Prices, the cost for mill and overlay is $11,400 per lane-mile in 2021. The total cost of mill and overlay can be calculated using Equation 3.

Equation 3. Cost of Asphalt Pavement with Mill & Overlay

Mill & Overlay Cost = $11,400 * L * M
L = number of lanes M = roadway (project limits) length in miles

[11] City of Houston Report to TTI Committee. Retrieved August 2022 from https://www.houstontx.gov/council/committees/tti/20140513/Maintaining_Houston_Streets.pdf

Given the roadway characteristics and rehabilitation schedule, the total rehabilitation costs of the asphalt pavement under the No-Build Scenario are listed in in Table 15.

Table 15. Asphalt Pavement Mill and Overlay Costs - Berry Road in the East of Airline Drive

Roadway	Lane-miles	1st Mill & Overlay	2nd Mill & Overlay	3rd Mill & Overlay	4th Mill & Overlay	Residual Life Remaining	Total Cost
Berry Road	0.23	$30,000	$37,000	$44,000	$0	$24,000	$87,000

The preferred alternative minimizes total maintenance costs over the planning horizon. As presented above, annual maintenance and scheduled rehabilitation for the existing pavements create a cost, or disbenefit, to the City of Houston for the No-Build Scenario. The Build Scenario calls for new pavement which would not require maintenance or rehabilitation for the remainder of the planning horizon; thus, the only rehabilitation costs are those incurred prior to project implementation.

Table 16 summarizes the maintenance and rehabilitation costs for each scenario.

Table 16. Summary of Maintenance & Rehabilitation Costs - Berry Road in the East of Airline Drive

Roadway	No-Build Scenario			Build Scenario		
	Annual Maintenance	Scheduled Rehab	Roadway Subtotal	Annual Maintenance	Scheduled Rehab	Roadway Subtotal
Berry Road	$20,000	$87,000	$107,000	$23,000	0	$23,000

User Costs

As pavement conditions worsen over the life of the roadway, the cost to the community to maintain vehicles operated on the roads also increases.[12] For planning purposes, this analysis assumes that qualitative assessments of pavement condition are correlated with established roughness indices and thus may be used to estimate its impact on vehicle operating costs. The study referenced by this analysis established baseline costs in terms of cents per mile for passenger and commercial vehicles on new pavement, as well as cost factors for each of five roughness index values, listed in Table 17.

[12] National Academy of Sciences, Engineering, and Medicine (2012). Estimating the Effects of Pavement Condition on Vehicle Operating Costs, p. 40-50.. Washington, D.C.: The National Academies Press. https://doi.org/10.17226/22808

Table 17. Vehicle Operating Costs in ¢/mile (inflated to $2021)

Vehicle Class	Road Class	Pavement Roughness Index / TxDOT Phase					
		Baseline	Adjustment Factors (multiplied by baseline for cost per mile)				
		Cents Per Mile ($2021)	2 Very Good	3 Good	4 Fair	5 Poor	6 Very Poor
Very Poor Poor Fair	Collector	19.8	1.02	1.03	1.07	1.15	1.25
	Arterial	24.7	1.02	1.03	1.07	1.15	1.24
	Highway	32.4	1.01	1.02	1.06	1.14	1.22
Good Very Good	Collector	52.1	1.02	1.03	1.07	1.13	1.21
	Arterial	80.3	1.01	1.02	1.05	1.11	1.18
	Highway	114.0	1.01	1.02	1.04	1.09	1.15

When correlated with the five TxDOT pavement condition phases, these factors can be applied to forecast vehicle operating costs that the public bears to the planning horizon. Several variables are required to complete this analysis, including current condition assessments of the roadways, H-GAC traffic model data for volume on each road type over time, and TxDOT traffic count data for commercial vehicle (truck) percentage; all of which were provided earlier in this section.

The difference between the costs due to the condition of the pavement during any year within the planning horizon and the baseline costs for new pavement is the disbenefit to the community from the state of good (or bad) repair. This analysis accumulated the year-over-year car and truck cost differentials to compare the total disbenefit due to vehicle operating costs for No-Build and Build Scenarios. Table 18 shows the total operating costs for each scenario.

Table 18. Summary of Vehicle Operating Costs (inflated to $2021)

Roadway	No-Build Scenario			Build Scenario		
	Car	Truck	Total Vehicle	Car	Truck	Total Vehicle
Berry Road in the East of Airline Drive	$69,000	$5,000	$75,000	$70,000	$6,000	$75,000
Berry Road in the East of Helmers Street	$50,000	$4,000	$55,000	$30,000	$2,000	$33,000

During reconstruction (Build Scenario) or maintenance treatment cycles (No-Build Scenario), users incur costs due to delays. They may need to reduce speed or wait in a queue. For the purposes of this analysis, overall speed through work zones is assumed to drop by 25%. Repairs are assumed to take approximately 240 days per mile for reconstruction and 120 days per mile for the maintenance treatment cycles. Per USDOT guidance, the value of travel time is $19.24 per hour per person and vehicle occupancy is 1.65 persons per vehicle. Since repair projects occur in multiple years, this analysis adjusted traffic volume used to calculate cost based on growth rate to the year of repair. Equation 4 shows the total user cost due to delays during the construction period is equivalent to time lost to slower overall speeds through the work zones.

Equation 4. User (Delay) Cost

User (Delay) Cost = AADT · 1.65 * $19.24 * D * 0.75(T)
AADT = Average Annual Daily Traffic (number vehicles per day)
D = construction work zone duration (workdays)
T = Normal travel time (hours) through zone = Lane-miles / Speed Limit (mph)

The analysis tabulated AADT for each year in the planning horizon by factoring the growth rate inferred from results of forecast year traffic volumes from the TxDOT. Assuming linear growth, annual traffic volume can be calculated using Equation 5.

Equation 5. Traffic Volume

Traffic Volume = AADTc * (1+ X) * N
$AADT_c$ = Current year's volume
X = Annual growth rate
N = Number of years to which volume is being forecasted

The results of the user delay costs are shown in Table 19.

Table 19. Summary Value of Travel Time Costs

Scenario	Costs
No-Build Cost	$60,000
Build Cost	$250,000

SOGR Benefit Summary

The preferred scenario from the perspective of SOGR minimizes costs due to maintenance and user costs. Overall, the Build Scenario is preferable to No-Build on the merits of savings in each of the three categories covered in this section: life cycle costs, maintenance costs, and user costs. Accumulated benefits for the analysis period are quantified and discounted at a 7% rate, shown in Table 20.

Table 20. State of Good Repair Benefit

Scenario	Monetized Value
No-Build Cost	$604,000
Build Cost	$383,000
Net Benefit	$222,000
Net Benefit Discounted @ 7% to $2021	**$66,000**

Benefits 3, 4 and 5: Safety Benefits

The Project will improve safety along the Project corridor by reducing the number of crashes. Benefits can be derived from the projected reduction in the number of crashes and property damage incurred.

No-Build Scenario

The corridor would incur no safety improvements and would continue to be an unsafe urban corridor in Houston, Texas.

Build Scenario

The Project would experience significant safety improvements, resulting in fewer traffic accidents.

Methodology/Summary

The analysis uses the average number of crashes by type over the last 5 years (2018-2022) from TxDOT Crash Record Information System (CRIS) database. The appropriate reduction factor was given by TxDOT based on the 2022 TxDOT Highway Safety Improvement Program (HSIP) work codes, and the damages avoided are quantified.[13] Accumulated benefits are totaled and discounted at a 7% rate.

To evaluate the existing conditions on the Project corridor, crash records were obtained from TxDOT CRIS database for years 2018-2022. TxDOT uses the KABCO Scale in the CRIS database, which uses law enforcement data and rates traffic crash injuries. The monetary value of potential safety improvements used in the BCA that are provided by the 2023 USDOT BCA Guide are listed in Table 21. The methodology uses the reduction in crashes associated with each roadway improvement, as identified in HSIP.

For all project types, when the number of crashes decreases with safety improvements, benefits also accrue from reduced property damage. This methodology is documented

[13] Texas Department of Transportation (2022). Highway Safety Improvement Manual. Retrieved August 2022 from https://www.txdot.gov/inside-txdot/forms-publications/publications/highway-safety.html

in the 2023 USDOT BCA Guide. The guide values each crash with only property damage at $8,600 in damages ($2021).

Table 21. Monetary Value of Fatalities and Injuries from Traffic Accidents

KABCO Level	Monetized Value ($2021)
O – No Injury	$4,000
C – Possible Injury	$78,500
B – Non-incapacitating	$153,700
A – Incapacitating	$564,300
K – Killed	$11,800,000
U – Injured (Severity Unknown)	$213,900
# Accidents Reported (Unknown if Injured)	$162,600

HSIP Work Codes correspond to different enhancements (e.g., improve traffic signals, install raised medians, install pavement markings). TxDOT has a work code table that provides associated definitions, reduction factors, and preventable crash codes. Preventable crashes are those with defined characteristics that may be affected by the proposed improvement as described by the work code. The codes correspond to numeric codes assigned in CRIS to the indicated variable. Information is collected from law enforcement crash reports and converted into a coded format that corresponds to the work code table.

A crash can only be assigned to one work code. If multiple work codes are applicable to one crash, the work code with the highest crash reduction rate will be assigned to that crash. For the Project, crashes from 2018-2022 were assigned to codes listed in Figure 2.

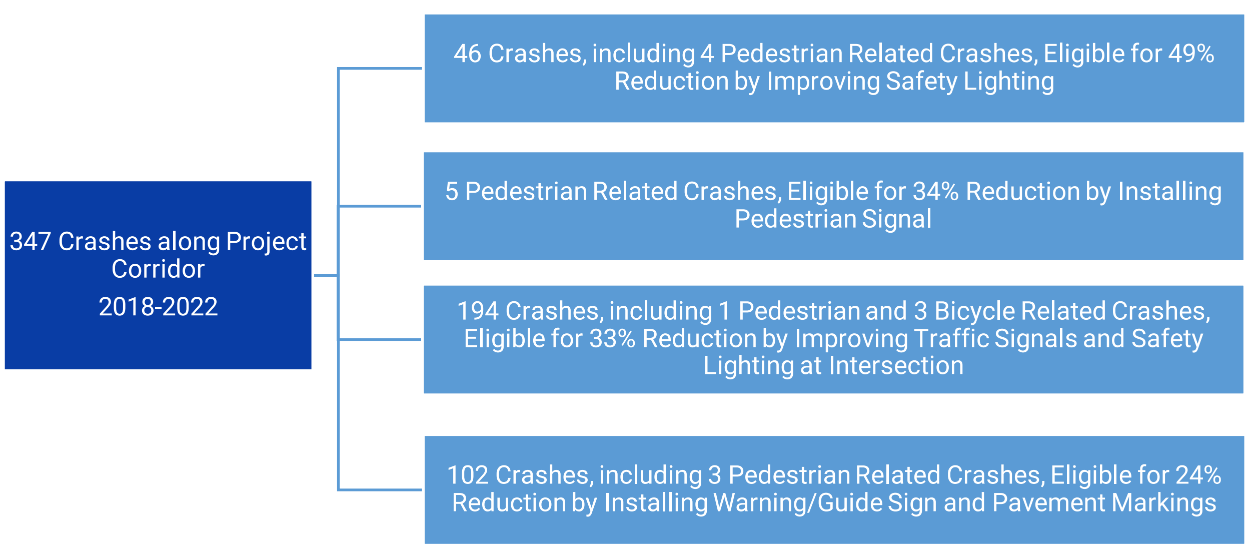

Figure 2. Traffic Crashes and HSIP Work Codes

Work codes based on crashes that can be avoided are described in the following tables.

Table 22. Crash Reduction Factor – Safety Lighting

Work Code 304: Safety Lighting	
Definition	Provide roadway lighting, either partial or continuous, where either none existed previously, or major improvements are being made.
Reduction Factor	49%
Service Life (Years)	15
Maintenance Cost	$100 per Luminaire
Preventable Crashes	Light Condition = 3, 4 or 6

Table 23. Crash Reduction Factor – Install Pedestrian Signal

Work Code 110: Install Pedestrian Signal	
Definition	Provide a pedestrian signal at an existing signalized location where no pedestrian phase exists, but pedestrian crosswalks are existing, or in conjunction with Refer to W.C. 403 for installation of pedestrian crosswalks.
Reduction Factor	34%
Service Life (Years)	10
Maintenance Cost	N/A
Preventable Crashes	First Harmful Event = 1

Table 24. Crash Reduction Factor – Improve Traffic Signals and Safety Lighting at Intersection

Work Code 108 and 305: Improve Traffic Signals and Safety Lighting at Intersection	
Definition	Improve existing intersection signals to current design standards; Improve existing intersection signals to current design standards; Install lighting at an intersection where either none existed previously or major improvements are proposed.
Reduction Factor	33%
Service Life (Years)	15
Maintenance Cost	N/A
Preventable Crashes	((Intersection Related = 1 or 2) AND [(Vehicle Movements/Manner of Collision =10-39) OR (First Harmful Event = 1 or 5)]) OR (Light Condition = 3, 4 or 6 AND Intersection Related = 1 or 2)

Table 25. Crash Reduction Factor – Install Warning/Guide Signs and Install Pavement Markings

Work Code 101 and 401: Install Warning/Guide Signs and Install Pavement Markings	
Definition	Provide advance signing for unusual or unexpected roadway features where no signing existed previously.; Place complete pavement markings, excluding crosswalks, in accordance with the TMUTCD where either no markings or nonstandard markings exist. This work code includes items such as turn arrows, stop bars, lane markings, etc.

Reduction Factor	24%
Service Life (Years)	6
Maintenance Cost	N/A
Preventable Crashes	[(Vehicle Movements/Manner of Collision = 20-22 or 30) OR (Roadway Related = 2, 3 or 4)] OR [(Roadway Related = 1) OR (Vehicle Movements/Manner of Collision = 21 or 30)]

Using the average crash data from 2018-2022 available in the CRIS dataset, eligible crashes are reduced by the reduction factor above and monetized based on the USDOT recommended values in Table 21. Accumulated benefits for the specified service life are quantified up and discounted at a 7% rate, shown in the following tables.

Table 26. Motorist Safety Benefits

Scenario	Monetized Value
No-Build Cost	$10,989,000
Build Cost	$6,255,000
Net Benefit	**$4,735,000**
Net Benefit Discounted @ 7% to $2021	**$2,222,000**

Table 27. Pedestrian Safety Benefits

Scenario	Monetized Value
No-Build Cost	$10,989,000
Build Cost	$6,255,000
Net Benefit	**$4,735,000**
Net Benefit Discounted @ 7% to $2021	**$2,222,000**

Table 28. Bicycle Safety Benefits

Scenario	Monetized Value
No-Build Cost	$1,312,000
Build Cost	$961,000
Net Benefit	**$351,000**
Net Benefit Discounted @ 7% to $2021	**$137,000**

Benefits 6 and 7: Facility Improvement Benefits

Improvements to pedestrian, cycling, transit facilities, and transit vehicles often provide amenities that can improve the quality and comfort of journeys made by active transportation (e.g., cyclists and pedestrians) and public transportation users. The improvements will not only benefit the existing users, but also encourage more people walking, biking, and using public transit. The methodology used to estimate new active or public transportation demand is explained in the Modal Diversion and Reduced VMT section at the end of this document. The 2023 USDOT BCA Guidance provides recommended monetized values for facility improvement benefits based on the research of revealed preferences of system users. For additional users attracted to the improved facilities, the value of the benefits they receive is at one-half the product of the value and the difference in volumes between the Build and No-Build Scenarios.

No-Build Scenario

The current condition of the existing facilities is not conductive for walking or cycling.

Build Scenario

The Project will improve facilities for active transportation.

Methodology/Summary

This section summarizes the methodology and results of the analysis for facility improvement benefits.

Pedestrian Facility Improvements

The 2023 USDOT BCA Guidance points out that traffic speeds and volumes along key pedestrian corridors, as well as elevation gains and width of sidewalks, can directly affects the comfort, convenience, and safety of the facility for pedestrian use.

Using revealed preference studies, the recommended value per person-mile walked on an expanded sidewalk is $0.11 for each foot of added width. For the mile-based benefits, the estimated value per pedestrian is capped at 0.86 miles, which is the average length of a walking trip in the 2017 National Household Travel Survey. The monetized benefits for expansions are appliable for sidewalks up to approximately 31 feet. For additional users attracted to the improved facilities, the value of the benefits they receive is at one-half the product of the value and the difference in volumes between the Build and No-Build Scenarios The benefits of improved pedestrian facilities are calculated using Equation 6.

Equation 6. Pedestrian Facility Improvement Benefits – Sidewalk Expansion

Sidewalk Expansion Benefit = $0.11 * Added Width (foot) * (Number of Existing Walking Trips + ½ New Walking Trips) * Trip Length
Trip Length = Proposed Length of Expanded Sidewalk or 0.86 Miles (whichever is smaller)

Accumulated benefits for the 20-year horizon are quantified and discounted at a 7% rate, presented in Table 29.

Table 29. Pedestrian Facility Improvement Benefit

Scenario	Monetized Value
No-Build Cost	$0
Build Cost	$266,000
Net Benefit	**$266,000**
Net Benefit Discounted @ 7% to $2021	**$101,000**

Bicycle Facility Improvements

The 2023 USDOT BCA Guidance suggests that cycling facilities can improve journey quality and comfort for cyclists, in addition to any travel time savings they provide. The recommended monetized value per cycling mile for various cycling facility improvements are listed in Table 30. The Project includes a 10-ft shared use path that could be used by cyclists as well. The value of Cycling Path with At-Grade Crossings is used for calculating the improvement benefit.

Table 30. Cycling Facility Improvement Revealed Preference Values

Facility Type	Recommended Value per Cycling Mile (2021 $)
Cycling Path with At-Grade Crossings	**$1.42**
Cycling path with no At-Grade Crossings	$1.78
Dedicated Cycling Lane	$1.69
Cycling Boulevard/"Sharrow"	$0.26
Separated Cycle Track	$1.69

The benefit of cycling facility improvements is calculated using Equation 7. The average length of a cycling trip in the 2017 National Household Travel Survey is 2.38 miles. According to 2023 USDOT BCA Guidance, if the cycling facility length is less than 2.38 miles, then the trip length per cyclist is equal to the facility length; however, if the cycling facility is longer than 2.38 miles, the assumption that all cyclists travel the full distance of a proposed facility cannot be made. For additional users attracted to the improved facilities, the value of the benefits they receive is at one-half the product of the value and the difference in volumes between the Build and No-Build Scenarios.

Equation 7. Cycling Facility Improvement Benefit

Cycling Facility Improvement Benefit = Value per Cycling Mile * (Number of Existing Cycling Trips + ½ New Cycling Trips) * Trip Length
Trip Length = Proposed Cycling Facility Length or 2.38 Miles (whichever is smaller)

Accumulated benefits for the 20-year horizon are quantified and discounted at a 7% rate, presented in the following table.

Table 31. Cycling Facility Improvement Benefit

Scenario	Monetized Value
No-Build Benefit	$0
Build Benefit	$435,000
Net Benefit	**$435,000**
Net Benefit Discounted @ 7% to $2021	**$165,000**

Benefits 8 and 9: Operating Cost Savings

Operating a vehicle is one of the most expensive budget items in American households. The reduction in VMT from automobile trips converted to walking, cycling, and transit trips results in a benefit for automobile owners. The methodology for modal diversion and reduction in VMT is explained in the last section of this document (Modal Diversion and Reduced VMT).

No-Build Scenario

The current condition of the active transportation facilities are not conducive for pedestrians or cyclists.

Build Scenario

The Project will improve pedestrian and bicycle facilities along the project corridor. These amenities will induce new pedestrian and cyclists.

Methodology

The 2023 USDOT BCA Guide estimates the cost of light duty vehicle operation as $0.46 ($2021) per mile. The value per mile includes operating costs such as gasoline, maintenance, tires, and depreciation. The benefit omits fixed costs of owning a vehicle such as insurance and registration. Equation 8 is used to estimate the total automobile operating costs saved by reducing VMT.

Equation 8. Automobile Operating Cost Saving

Automobile Operating Savings = VMT * MC * 260
VMT = Annual Reduced Vehicle Miles Traveled Due to Modal Diversion MC = Automobile Operating Costs per mile 260 = Average Number of Working Days in a Year

The accumulated benefits of increased walking, biking, and transit trips on automobile maintenance savings for the analysis period are quantified and discounted at a 7% rate, presented in the tables below.

Table 32. Operating Cost Savings - Walking

Scenario	Monetized Value
No-Build Cost	$0
Build Cost	$198,000
Net Benefit	**$198,000**
Net Benefit Discounted @ 7% to $2021	**$75,000**

Table 33. Operating Cost Savings - Cycling

Scenario	Monetized Value
No-Build Cost	$0
Build Cost	$8,469,000
Net Benefit	**$8,469,000**
Net Benefit Discounted @ 7% to $2021	**$3,219,000**

Benefits 10 and 11: Mortality Reduction Benefits

Active transportation modes such as walking and cycling can help improve cardiovascular health and lead to other positive outcomes for users. Adding or upgrading cycling or pedestrian facilities can convert users from inactive transportation modes to active transportation modes. A key health outcome from increased physical activity is a reduction in mortality risks for those users that are converted to active transportation modes from inactive modes. The methodology for modal diversion is explained in the last section of this document (Modal Diversion and Reduced VMT).

No-Build Scenario

The existing sidewalks are in disrepair and there is a lack of bicycle facilities.

Build Scenario

The Project will install new 6-feet sidewalks and 10-feet shared use paths.

Methodology

Mortality Reduction - Walking

To monetize the reduction in mortality risks associated with increased walking, the 2023 USDOT BCA Guide recommends $7.20 ($2021) per induced walking trip. This is based on the following factors: an assumed average walking speed of 3.2 miles per hour, an assumed average age of the relevant age range (20-74 years) of 45, a corresponding baseline mortality risk of 267.1 per 100,000, an annual risk reduction of 8.6 percent per daily mile walked, and an average walking trip distance of 0.86 miles. This monetized value can only be applied to trips induced from non-active transportation modes within the relevant age range. A general assumption of 68% of overall induced trips falling into the walking age range (20-74 years), assuming a distribution matching the national average, is applied in the absence of more localized data on the proportion of the expected users falling into the age range. Equation 9 is used to estimate the mortality reduction benefits of induced walking trips.

Equation 9. Mortality Reduction Benefits - Walking

Mortality Reduction Benefits = Number of New Walking Trips Induced from Non-Active Transportation Modes * 68% * $7.20

The accumulated benefits of mortality reduction benefits for the analysis period are quantified and discounted at a 7% rate, presented in Table 34.

Table 34. Mortality Reduction Benefit - Walking

Scenario	Monetized Value
No-Build Cost	$0
Build Cost	$4,705,000
Net Benefit	**$4,705,000**
Net Benefit Discounted @ 7% to $2021	**$1,721,000**

Mortality Reduction - Cycling

The 2023 USDOT BCA Guide recommends $6.42 ($2021) per induced cycling trip to monetize reduced mortality risks associated with increased cycling. It is based on an assumed average cycling speed of 9.8 miles per hour, an assumed average age of the relevant age range (20-64 years) of 42, a corresponding baseline mortality risk of 217.9 per 100,000, an annual risk reduction of 4.3 percent per daily mile cycled, and an average cycling trip distance of 2.38 miles. This monetization value can only be applied to trips induced from non-active transportation modes within the relevant age ranges. A general assumption of 59% of overall induced trips falling into the cycling age range (20-64 years), assuming a distribution matching the national average, is applied in the absence of more localized data on the proportion of the expected users falling into the age range. Equation 10 is used to estimate the mortality reduction benefits of induced cycling trips.

Equation 10. Mortality Reduction Benefits – Cycling

Mortality Reduction Benefits = Number of New Cycling Trips Induced from Non-Active Transportation Modes * 59% * $6.42

The accumulated benefits of mortality reduction benefits for the analysis period are quantified and discounted at a 7% rate, presented in Table 35.

Table 35. Mortality Reduction Benefit - Cycling

Scenario	Monetized Value
No-Build Cost	$0
Build Cost	$978,000
Net Benefit	**$978,000**
Net Benefit Discounted @ 7% to $2021	**$372,000**

Benefits 12: Congestion Externalities Reduction

Reductions in external costs from modal diversion may represent a source of potential benefits beyond those experienced directly by users of an improved facility or service. The operation of automobiles can cause negative impacts such as delays to other vehicles during congested travel conditions, increased external crash costs, emissions of air pollutants, noise pollution, and damage to pavement or other road infrastructure. These impacts impose costs on occupants of other vehicles and on the society at large. The methodology for modal diversion and reduction in VMT is explained in the last section of this document (Modal Diversion and Reduced VMT).

No-Build Scenario

The current condition of the existing facilities is not conducive for pedestrians and cyclists.

Build Scenario

The Project will replace existing sidewalks to meet the COH's current design standards, as well as install new bicycle facilities along the project corridor. These amenities will result in modal shift with a reduction in overall VMT.

Methodology/Summary

The 2023 USDOT BCA Guide provides recommended monetized values for external highway use costs. The recommended costs per vehicle mile traveled including all kinds of vehicles in urban locations are $0.144 for congestion and $0.0048 for noise. Equation 11 is used to determine the benefit of reducing congestion externalities.

Equation 11. Congestion Externalities Reduction

Congestion Externalities Reduction = VMT * ($0.144+$0.0048)
VMT = Vehicle Miles Traveled Reduced because of Modal Diversion

The accumulated benefits of increased walking and transit trips on reducing external highway use costs for the analysis period are quantified and discounted at a 7% rate, presented in Table 36.

Table 36. Congestion Externalities Reduction

Scenario	Monetized Value
No-Build Benefit	$0
Build Benefit	$190,000
Net Benefit	**$190,000**
Net Benefit Discounted @ 7% to $2021	**$72,000**

Benefits 13 and 14: Emission Reduction Benefits

The EPA has classified the Houston-Galveston-Brazoria area in marginal nonattainment of the eight-hour ozone standard; air quality does not meet federal standards.[14] The investment in mobility infrastructure could produce environmental benefits due to decreased automobile use or vehicle delay which reduces air pollutants and is important to the region's future growth. The methodology for modal diversion and reduction in VMT is explained in the last section of this document (Modal Diversion and Reduced VMT).

No-Build Scenario

The current condition of the existing facilities is not conducive for pedestrians, cyclists, or transit riders.

Build Scenario

The Project will install new sidewalks that can accommodate both pedestrians and bicyclists, as well as improve the existing transit facilities along the project corridor. These amenities will result in modal shift with a reduction in overall VMT.

Methodology/Summary

H-GAC models NOx using the following emissions factor:

- Nitrogen Oxides (NO_X): 0.19 grams (g) per VMT

United Environmental Protection Agency (EPA) using the following emissions factor for CO_2:[15]

- Carbon Dioxide (CO_2): 0.0089 metric tons per gallon of gasoline used

[14] United States Environmental Protection Agency (2022). 8-Hour Ozone (2015) Nonattainment Area State/Area/County Report. Green Book. Retrieved September 2022 from https://www3.epa.gov/airquality/greenbook/jncs.html#TX
[15] Environmental Protection Agency. (n.d.). EPA. Retrieved August 23, 2022, from https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references

NOx and CO_2 have measurable societal economic impacts on the economy. The 2023 USDOT BCA Guide provides recommended monetized values of damage costs for NOx and CO_2 emissions per metric ton by year between 2022 and 2050. These values are used to calculate the Project's benefit derived from the reduction of harmful air pollutants.

For active transportation and transit improvements that improve the walkability and bikeability of an area and increase transit utilization, there is a presumed environmental benefit from automobile trips being converted into walking, biking, and transit trips. The VMT benefit is derived and converted into the amount of NOx and CO_2 grams reduced, which is then monetized based on the H-GAC emissions factor. VMT is assumed to grow annually at the same rate as internal trips. Accumulated benefits for pedestrian and transit users are quantified over the 25-year analysis period and discounted at a 7% rate, shown in tables below.

Table 37. Emission Reduction Benefits - Walking

Scenario	Monetized Value
No-Build Benefit	$0
Build Benefit	$19,000
Net Benefit	**$19,000**
Net Benefit Discounted @ 7% to $2021	**$12,000**

Table 38. Emission Reduction Benefits - Cycling

Scenario	Monetized Value
No-Build Benefit	$0
Build Benefit	$9,000
Net Benefit	**$9,000**
Net Benefit Discounted @ 7% to $2021	**$6,000**

Benefits Monetized but Not Widely Accepted in Transportation Grant Applications – Local Economic

Shared Use Path Improvements

The Project will include new shared use paths. Research has shown that improving walkability can increase the property values of residential and commercial properties.[16] Adding shared use paths can increase the value of adjacent residential properties within 600-foot of the project by 5% and by 9% for commercial properties. The following equations estimate the property tax value increase when adding shared use paths, and the table below shows the monetized benefit of adding shared use paths for each scenario. Benefits are only attributed to the increment for each property.

Equation 12. Shared Use Path Projects – Residential Property Tax Value

Residential Tax Increase = No-Build Residential Value * (1 + 5%) * Tax Rate

Equation 13. Shared Use Path Projects – Commercial Property Tax Value

Commercial Tax Increase = No-Build Commercial Value * (1 + 9%) * Tax Rate

The net economic benefit of shared use paths on property values in the study area over the 20-year planning horizon is shown in Table 39.

Table 39. Economic Benefits of Shared Use Paths on Property Values

Scenario	Monetized Value
No-Build Tax Collection	$39,061,000
Build Tax Collection	$108,790,000
Net Benefit	**$69,728,000**
Net Benefit Discounted @ 7% to $2020	**$27,448,000**

Modal Diversion and Reduced VMT

The benefits of active transportation improvements of the Project are mostly derived from the new projected walking and cycling trips diverted from automobile usage. The additional transit users are derived from the addition of better amenities for access. The additional users of these alternative modes result in less passenger vehicle usage. This in turn leads to reduced VMT, which has a variety of benefits.

[16] O'Hanlon, J., Scott, Marcia S., West, L. (2016). Healthy and complete communities in Delaware: The walkability assessment tool. Institute for Public Administration, University of Delaware.

Sidewalk Improvements

Sidewalk Expansion

According to the USDOT's BCA Guidance, sidewalk width has a direct and significant impact on the comfort, convenience, and safety of the facility for pedestrian use, principally by increasing the allowance for distances between pedestrians and moving vehicles and among pedestrians themselves, leading to improved safety, decreased noise exposure, and increased comfort. Meanwhile, research conducted by Aziz, et al. (2018) indicates that increasing sidewalk width increases the likelihood of more people taking active transportation modes. The empirical results show that when the average width of sidewalks increased by 30 percent, 50 percent, or 65 percent, the probability to walk increases by approximately 12 percent, 17 percent, and 21 percent correspondingly within the origin and destination tracts. The trips that shift from driving to walking are mostly likely for commuting purposes.

For this Project, there is a lack of existing pedestrian counts. The sidewalk improvement would add 158 new daily pedestrian trips in the project open year (Equation 24). In other words, 158 daily pedestrian trips will be converted from internal automobile trips within the traffic analysis zones (TAZs) abutting the Project based on the H-GCA travel demand model.

Equation 14. New Daily Pedestrian Trips - Sidewalk Expansion

New Daily Pedestrian Trips = W * IAT
W = Increased Probability of Walking IAT = Internal Automobile Trips within Half-mile from the Project

Decreased Automobile Usage from New Walking Trips

The 2017 NHTS reports an average walking trip length of 0.86 mile.[17] Equation 15 is used to estimate the reduction in VMT from newly converted auto to pedestrian trips. The annual reduction of VMT is used to calculate the benefit from reduced emissions and reduced automobile maintenance required.

[17] Federal Highway Administration (2017). National Household Travel Survey. Retrieved in August 2022 from https://nhts.ornl.gov/

Equation 15. VMT Reduction from New Walking Trips

Annual VMT reduced = New Daily Walking Trips * 260 * Trip Length
260 = Weekdays in the year (Annual trips) Trip Length = 0.86 Mile or Proposed Pedestrian Facility Length in Mile (whichever is smaller)

Reduced Auto VMT from Pedestrian Diversion (Opening Year)
Build Scenario Annual Reduction in VMT: 35,400

Bicycle Facility Improvements

New Cycling Trips

Measuring and forecasting the demand for bicycling in a project area is vital to calculate the benefits of a given facility. Based on research by the Texas A&M Transportation Institute, new bike trips within a 1-mile buffer of the Project corridors equal 1.36% of the internal trips within the same area.[18] The annual internal auto vehicle trips within the TAZs abutting the Project is obtained from the H-GAC travel demand model.

Equation 16. New Bike Trips

New Cycling Trips = 1.36%* Internal Trips

Total Bike Users Demand (Opening Year)
Build Scenario Daily Bike Trips: 41

Decreased Automobile Usage from New Cycling Trips

There is a presumed benefit from automobile trips being converted into both commuter and recreation bicycle trips for improvements that enhance bicycle access and mobility in an area. This benefit is based on the additional commuter and recreational travelers now using a bicycle as their mode of transportation.

To estimate this, the Build Scenario total bike demand trips were used. It is assumed that the reduction in automobile trips will increase in proportion to the increase in internal trips within the area. Additionally, the 2017 NHTS reports an average biking trip length of 2.38 miles; however, the proposed cycling facility, which is 2.5 miles, is more than the average bike trip length, thus the trip length of 2.38 miles is used to estimate the annual

[18] Lasley, P, M. Metzger-Galarza, S. Guo. (2017). Estimating Congestion Benefits of Transportation Projects with FIXiT 2.0: Updating and Improving the Sketch Planning Tool. Texas A&M Transportation Institute. Retrieved February 2022, from https://tti.tamu.edu/tti-publication/estimating-congestion-benefits-of-transportation- projects-with-fixit-2-0-updating-and-improving-the-sketch-planning-tool/

reduction in VMT as a result of new bicycle trips. The VMT saved is used tocalculate the benefit from reduced emissions and reduced automobile maintenance required.

Equation 17. VMT Reduction from New Cycling Trips

Annual VMT Reduction = New Cycling Trips * Trip Length *260
Trip Length = 2.38 Mile or Proposed Cycling Facility Length in Mile (whichever is smaller) 260 = Weekdays in the year (Annual trips)

Bike Diversion from Auto VMT Reduced (Opening Year)

Build Scenario Annual VMT Reduced: 17,000

Berry Road Back-of-Curb Improvements
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Environmental Risk Assessment

Summary

Table 1 provides an "at-a-glance" summary of potential National Environmental Policy Act (NPEA) impacts for the proposed project. The document that follows goes into detail on impacts, agency coordination, possible mitigation and other factors that could affect the budget and schedule of the projects.

Table 1. Summary of potential environmental impacts

NEPA Category	Potential Impacts
Land Use	Positive impacts.
Air Quality	No adverse impacts.
Cultural Resources	Based on existing sidewalks, the amount of available space for new sidewalks, and the general condition of properties in the area, adverse impacts are not anticipated to potentially eligible properties. A submittal package to SHPO is expected to receive concurrence within the standard 30-day review period.
Hazardous Materials	The proposed project has multiple hazardous materials sites adjacent to the alignment. Further review is likely required.
Public Parks and Recreation Areas	No adverse impacts.
Population Characteristics and Socioeconomics	Positive impacts.
Community Resources	Positive impacts.
Transportatin Resources	Positive impacts.
Soil	No adverse impacts.
Wetlands	The project alignment crosses a designated riverine wetland. There are existing sidewalks in this location and adverse impacts to wetlands are not anticipated as work is proposed within the existing right-of-way.
Floodplains	The alignment crosses the 100-year floodplain. The area is developed with the roadway and residential and commercial structures. The proposed project is not anticipated to cause permanent adverse impacts to the floodplain.
Waters of the U.S.	See wetlands discussion.
Water Quality, Navigable Waterways, and the Coastal Zone	No adverse impacts.
Ecologically Sensitive Areas and Endangered and Threatened Species	No adverse impacts.
Migratory Birds	No adverse impacts.
Right-of-Way and Acquisition	No adverse impacts.
Traffic and Parking	No adverse impacts.
Noise	No adverse impacts.
Safety and Secutity	No adverse impacts.
Aesthetics	No adverse impacts.
Public Outreach	No adverse impacts.
Construction Impacts	No adverse impacts.

Introduction

The Greater Northside Capital Projects Development Strategy resulted in four preferred mobility-focused projects. The Berry Road Sidewalk and Drainage Improvements Project, from Airline Drive to Jensen Street, was identified as a strong candidate for funding and is evaluated here for environmental risk, i.e., any "red flags" that could potentially impact schedule or budget.

The project proposes to:

- Upgrade/install new sidewalks
- Improve intersections
- Upgrade pavement markings, crosswalks, and ADA ramps
- Install traffic calming improvements (e.g., bulb outs, speed cushions)
- Install/improve lighting and signage
- Address drainage concerns

See Figure 1 for the location of the proposed project.

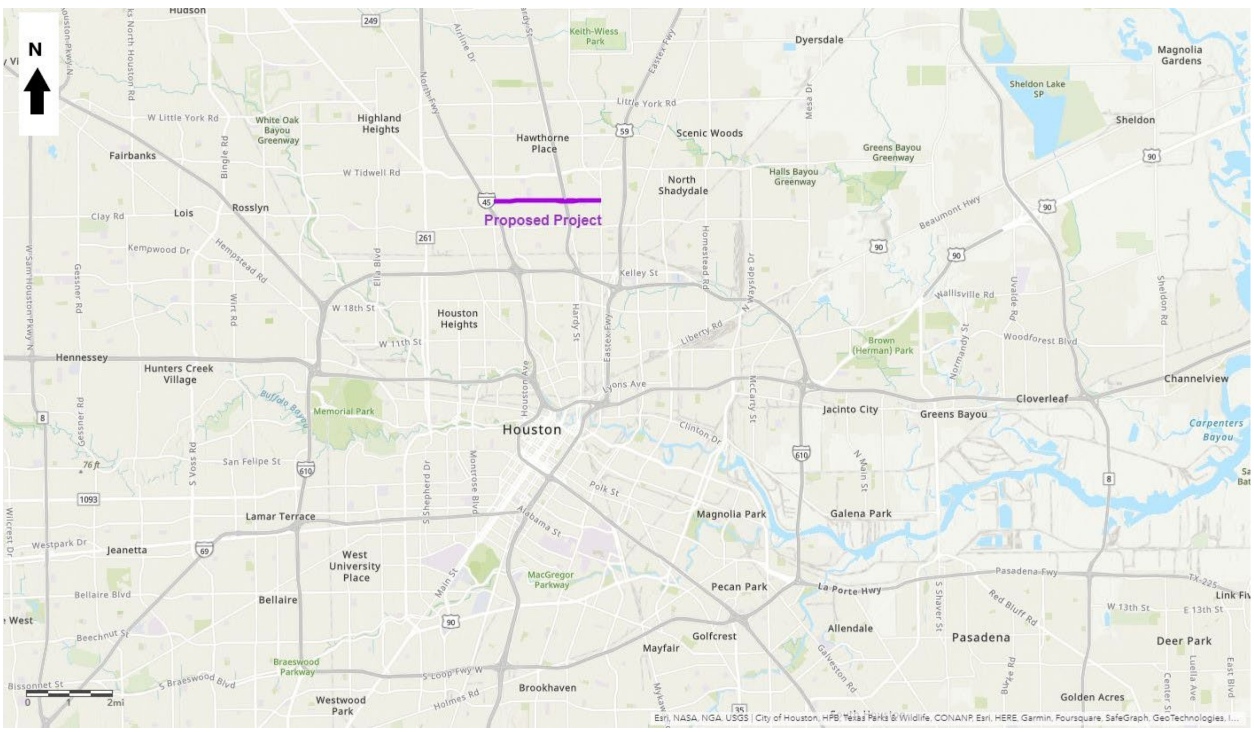

Figure 1. Project location
Source: Base Map: ArcGIS Online, www.maps.arcgis.com. Retrieved December 2, 2022.

NEPA Impact Categories and Existing Conditions

The National Environmental Policy Act mandates that potential impacts are considered before any federal action likely to significantly affect the environment is undertaken. Projects that receive any amount or type of federal funding must comply with NEPA.[1] Depending on the intensity of project impacts, a Categorical Exclusion (CE), Environmental Assessment (EA), or Environmental Impact Statement (EIS) must be completed. A CE tends to be a simpler document that may only include a checklist, while an EIS requires extensive analysis.

This document provides information on existing conditions for the project and a review of planned improvements through the lens of gaining NEPA project approval. For relevant impact categories, background on NEPA and state and federal regulations is provided, as well as potential impacts or the anticipated need for additional analysis or agency coordination.

Land Use

There are a mix of land uses in the project area: Residential, Commercial, Industrial, Multiple, and Other (see Figure 2).

The proposed projects are not anticipated to have adverse impacts on land use; in fact, the impact to land use is expected to be positive as the improvements to safety, mobility, drainage, and lighting will spark economic investment along the corridor and vacant and/or blighted parcels will be developed for higher uses.

Figure 2. Project area land use
Source: HGAC Land Use. ArcGIS Online, www.maps.arcgis.com. Retrieved December 2, 2022.

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[1] Overview of NEPA as Applied to Transportation Projects. U.S. Department of Transportation, Federal Highway Administration. https://www.fhwa.dot.gov/federal-aidessentials/catmod.cfm?id=35, retrieved December 2, 2022.

Air Quality

Air quality impacts are generally only of concern with projects that are adding capacity; this project will not add capacity and therefore is not anticipated to have adverse impacts on air quality.

Cultural Resources

If designated properties and potentially eligible properties could be impacted by a project, as determined by the appropriate federal or state agency, Section 4(f) and Section 106 evaluations are required. These evaluations include an alternatives analysis, measures to minimize and/or mitigate impacts, and agency coordination. Full historic consultation takes several months and involves the State Historic Preservation Office (SHPO), local historic commissions and groups, and interested stakeholders.

Historic Resources

Because no new right-of-way is needed for the proposed project, the area of potential effect (APE) for impacts to historic and potentially historic sites was determined to be any property adjacent to the project alignment. There are no designated sites adjacent to the project alignment; the closest site is the Adath Israel Cemetery approximately 300 feet south of the project (see Figure 3).

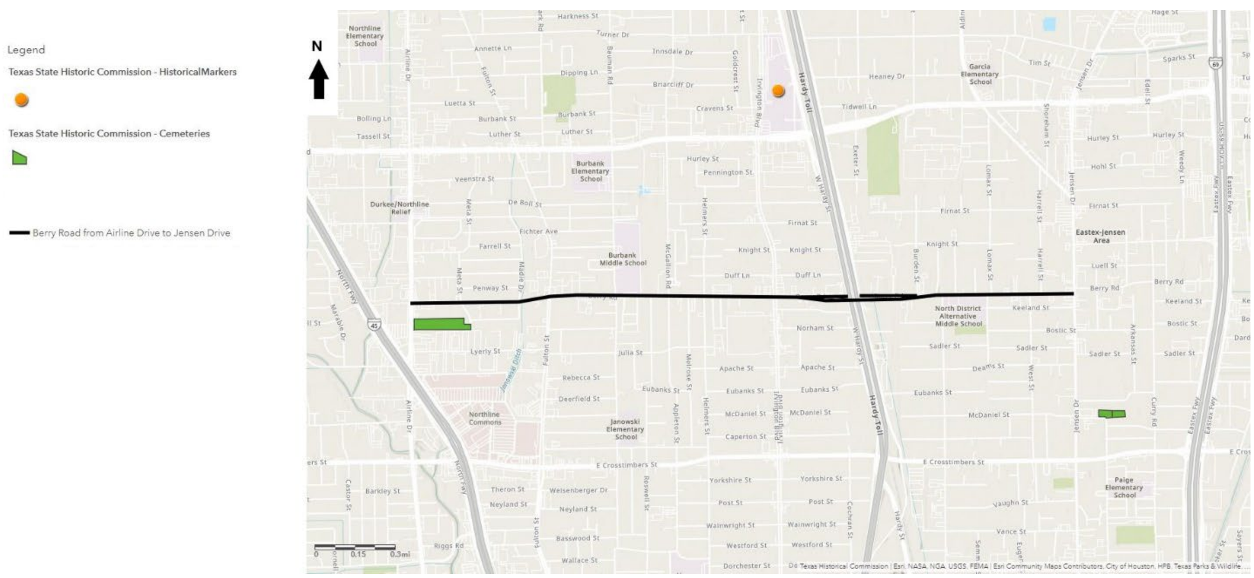

Figure 3. Historic resources
Source: Texas State Historical Commission and City of Houston. ArcGIS Online, www.maps.arcgis.com. Retrieved December 2, 2022.

There are no historic bridges in the project area.[2]

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[2] NHRP Listed and Eligible Bridges of Texas. TxDOT, www.txdot.maps.arcgis.com. Retrieved December 2, 2022.

Any structures age 50 years and older are potentially eligible for the National Register of Historic Places; because few projects are completed in less than one year, the general standard for assessment of potentially eligible historic properties is 45 years and older. Due to the length of the corridor (almost three miles) and the density of development, it is not feasible to conduct a survey of properties potentially eligible as historic at the level of review of this document. Based on existing sidewalks, the amount of available space for new sidewalks, and the general condition of properties in the area, adverse impacts are not anticipated to potentially eligible properties and Section 4(f) and 106 evaluations are not expected to be required; rather, an initial submittal package to the State Historic Preservation Office (SHPO) is anticipated to receive concurrence within the standard 30-day review period.

Archeological Resources

TxDOT's Potential Archeological Liability Map (PALM) indicates that the entire project alignment is in an area designated as "No Survey Recommended" (see Figure 4).

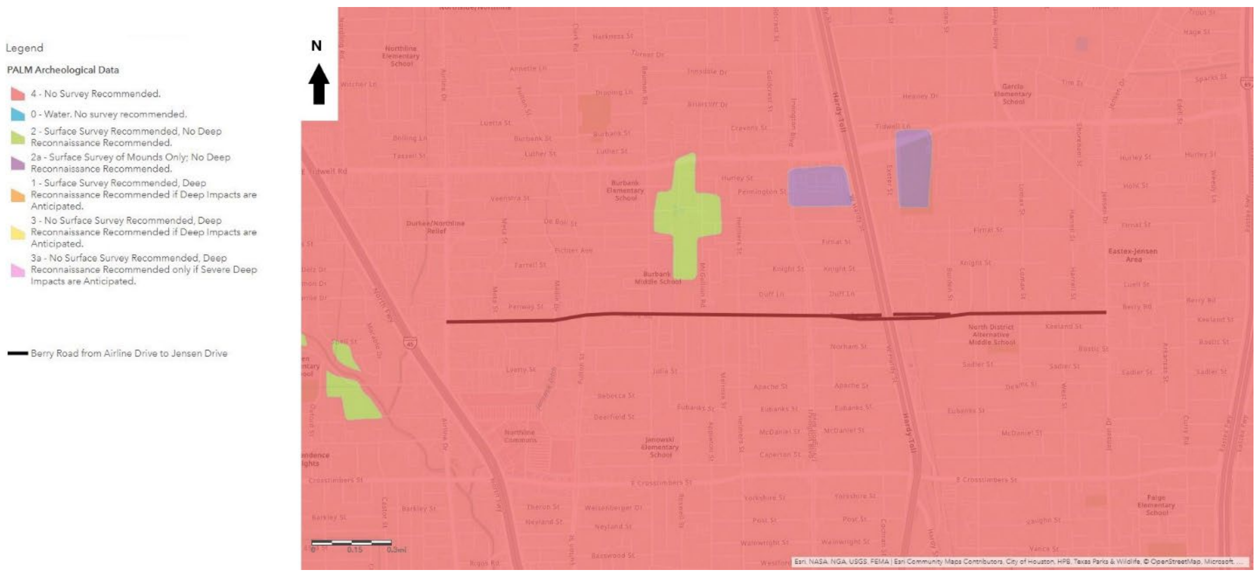

Figure 4. Potential Archeological Liability Map
Source: PALM Archeological Data. ArcGIS Online, www.maps.arcgis.com. Retrieved December 2, 2022.

Hazardous Materials

Projects where excavation is anticipated to be over five feet in depth would benefit from a Phase I Environmental Site Assessment compliant with American Society of Testing and Materials (ASTM) standards to determine potential risks more accurately from past releases of hazardous materials. A key part of a Phase I ESA is the full review of local, state, and federal environmental records of sites within a defined radius from the project site (ranging from on-site to one mile), obtained from a recognized professional database provider (EDR, GeoSearch, etc.). A Phase I may result in findings of Recognized Environmental Conditions, which may in turn necessitate performing a limited subsurface investigation (Phase II) to obtain more definitive data on contamination that could impact construction.

Every project receiving federal funding will require at least an initial assessment to determine if there are any known or potentially hazardous waste sites within the proposed project limits, especially projects that include the acquisition of new right-of-way, excavation, and/or structure demolition or modification.[3] The proper due diligence procedures should be followed to limit liability. Due diligence involves conducting a Phase I Environmental Site Assessment in accordance with the EPA's All Appropriate Inquiries Rule.[4]

Projects receiving state funding from TxDOT are required to complete a Hazardous Materials Initial Site Assessment Report,[5] which contains the same information as a Phase I ESA but in TxDOT's preferred format.

Because of the developed nature of land uses around the projects, the volume of sites that store, treat, or have released hazardous substances is too great to perform detailed analysis in the vein of a Phase I ESA in this preliminary report. For the purposes of this document, a high-level review of hazardous waste sites was conducted using Texas Commission on Environmental Quality (TCEQ) GIS data.

The proposed project has multiple hazardous materials sites adjacent to the alignment, most commonly Leaking Petroleum Storage Tanks (LPST). Please note that the listing of sites does not necessarily indicate a site active in remediation; sites remain listed even after they have been closed by TCEQ. A map depicting the location of hazardous materials sites is shown in Figure 5.

[3] Hazardous Materials and Brownfields. U.S. Department of Transportation, Federal Transit Administration, https://www.transit.dot.gov/regulations-and-guidance/environmental-programs/hazardous-materials-brownfields. Retrieved November 16, 2022.

[4] All Appropriate Inquiries, or AAI, is the process of evaluating a property's environmental conditions and assessing potential liability for any contamination. The AAI Final Rule at 40 CFR Part 312 provides that ASTM International Standard E1527-13 ("Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process") and E2247-16 ("Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process for Forestland or Rural Property") are consistent with the requirements of the final rule and can be used to satisfy the statutory requirements for conducting AAI. AAI may be conducted in compliance with either of these standards to obtain protection from potential liability under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as an innocent landowner, a contiguous property owner, or a bona fide prospective purchaser.

[5] Hazardous Materials Toolkit. TxDOT, http://www.txdot.gov/inside-txdot/division/environmental/compliance-toolkits/haz-mat.html. Retrieved November 16, 2022.

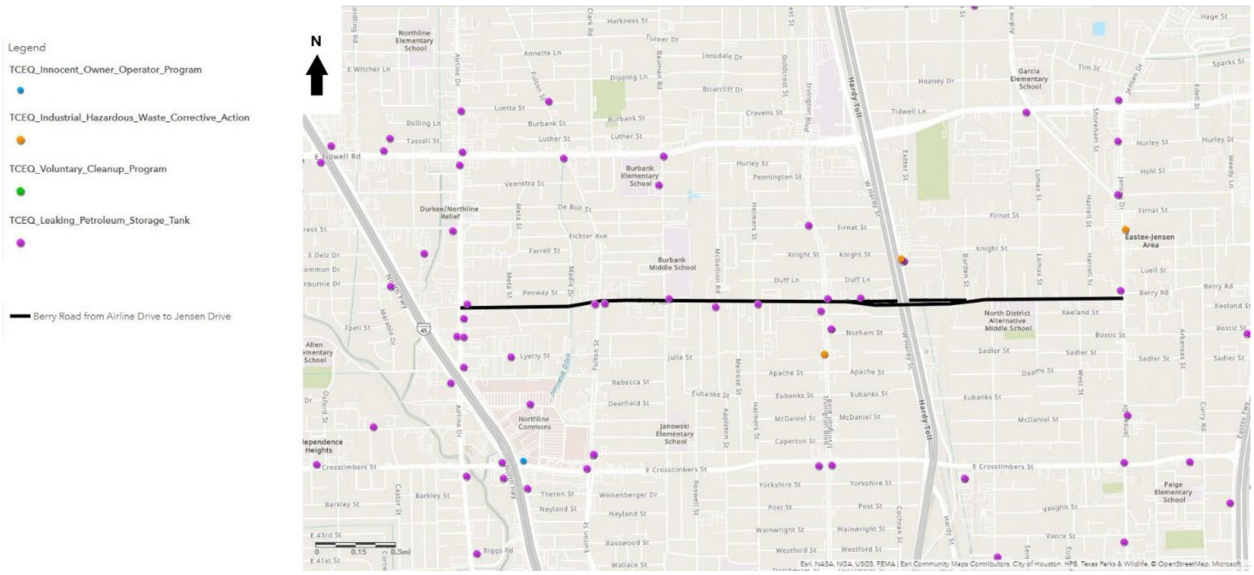

Figure 5. Hazardous materials sites
Source: HARC TCEQ. ArcGIS Online, www.maps.arcgis.com. Retrieved December 5, 2022.

Public Parks and Recreation Areas

Publicly owned, significant and accessible parks, recreation areas, and wildlife and waterfowl refuges are, like historic and archeological resources, protected under Section 4(f). These properties would require the same 4(f) evaluation discussed earlier in the Cultural Resources section of this document.

The proposed project is adjacent to Croyden Gardens Park, which is associated with Berry Elementary and North District Alternative Middle School (see figures below). There is an existing sidewalk and extensive right-of-way in this area. Because the proposed project is not anticipated to take any park land - i.e., repurpose land currently designated as park/recreation land for sidewalks or roadways – adverse impacts to parks are not anticipated.

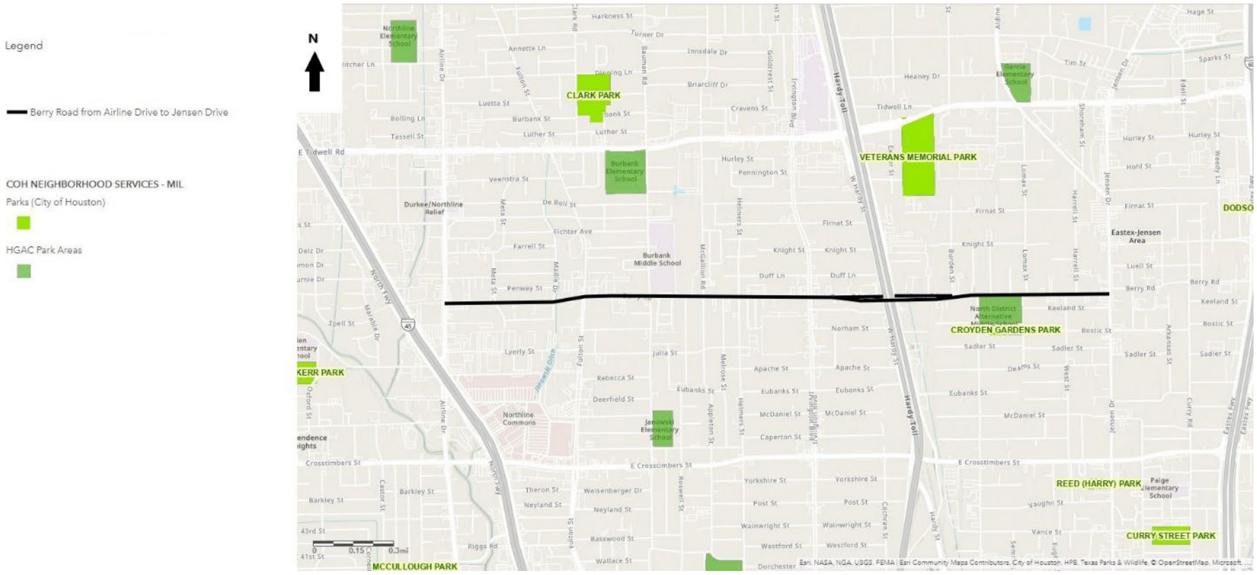

Figure 6. Parkland
Source: COH Neighborhood Services - MIL. ArcGIS Online, www.maps.arcgis.com. Retrieved December 5, 2022.

Figure 7. Looking southwest toward Croyden Gardens Park from intersection of Berry Road and Millicent Street
Source: Google Earth. Retrieved December 5, 2022.

Population Characteristics, Socioeconomics, and Environmental Justice

The project is located within or adjacent to 13 U.S. Census Block Groups (see Figure 8):

- 482012204.001
- 482012204.002
- 482012205.002
- 482012205.003
- 482012205.004
- 482012206.001
- 482012206.002
- 482012206.003
- 482012207.011
- 482012207.012
- 482012207.013
- 482012207.021
- 482012208.001

Figure 8. Project area Census Block Groups
Source: ArcGIS Online Business Analyst, www.bao.arcgis.com. Retrieved December 5, 2022.

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, requires the U.S. Department of Transportation (DOT) and the Federal Transit Administration (FTA) to make environmental justice (EJ) a part of their mission by identifying and addressing disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and/or low-income populations.

This document does not undertake a full NEPA EJ evaluation, but data on population characteristics and socioeconomic conditions in the project area are provided for the minority population and poverty level.

The project is anticipated to improve mobility, connectivity, safety, and access; it is not anticipated to have disproportionately high and adverse impacts on any population, EJ or otherwise. There may be temporary construction impacts related to traffic, noise, and air quality. These impacts are expected to be minimal and addressed with BMP, as discussed in the Construction Impacts section of this document. It is not anticipated that any businesses or households will experience substantial negative short- or long-term impacts.

Minority Population

The non-white population in the project area varies from nine to 47 percent. There are no Block Groups with a minority population of 50 percent or greater. Detailed information on race is provided in Table 2 and Figure 9.

Table 2. Minority Population
Source: 2020 Race: White Alone (ACS 5 Year)(%). ArcGIS Online Business Analyst, www.bao.arcgis.com. Retrieved December 5, 2022.

Block Group	White Alone Population	Non-White Population
482012204.001	58.29%	41.71%
482012204.002	65.15%	34.85%
482012205.002	60.20%	39.80%
482012205.003	66.23%	33.77%
482012205.004	56.65%	43.35%
482012206.001	71.96%	28.04%
482012206.002	57.08%	42.92%
482012206.003	71.47%	28.53%
482012207.011	52.81%	47.19%
482012207.012	90.98%	9.02%
482012207.013	33.16%	66.84%
482012207.021	77.65%	22.35%
482012208.001	64.07%	35.93%

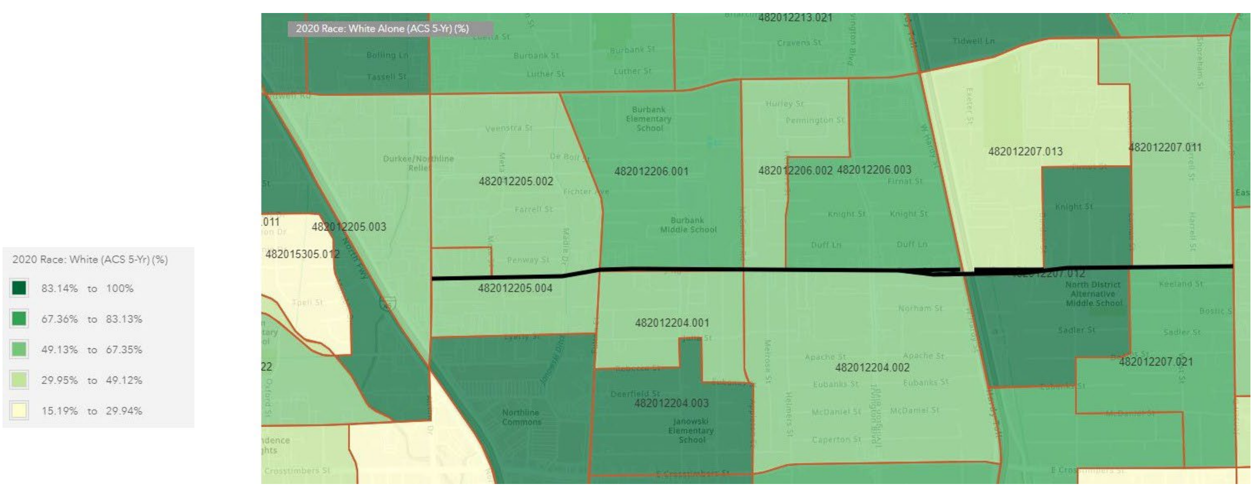

Figure 9. White Alone population
Source: 2020 Race: White Alone (ACS 5 Year)(%). ArcGIS Online Business Analyst, www.bao.arcgis.com. Retrieved December 5, 2022.

Poverty Level

The 2020 federal poverty level for a family of four is $26,200.[6] The percent of households below poverty level in the project area ranges from 12 to 65 (see Table 3 and Figure 10). There are three Block Groups with a household poverty level over 50 percent.

Table 3. Households Below Poverty Level
Source: 2020 Households Below Poverty Level (ACS 5 Year)(%). ArcGIS Online Business Analyst, www.bao.arcgis.com. Retrieved December 5, 2022.

Block Group	Households Below Poverty Level
482012204.001	44.56%
482012204.002	25.12%
482012205.002	44.96%
482012205.003	44.74%
482012205.004	34.04%
482012206.001	12.19%
482012206.002	37.04%
482012206.003	39.08%
482012207.011	46.56%
482012207.012	**51.95%**
482012207.013	**65.41%**
482012207.021	31.10%
482012208.001	**51.91%**

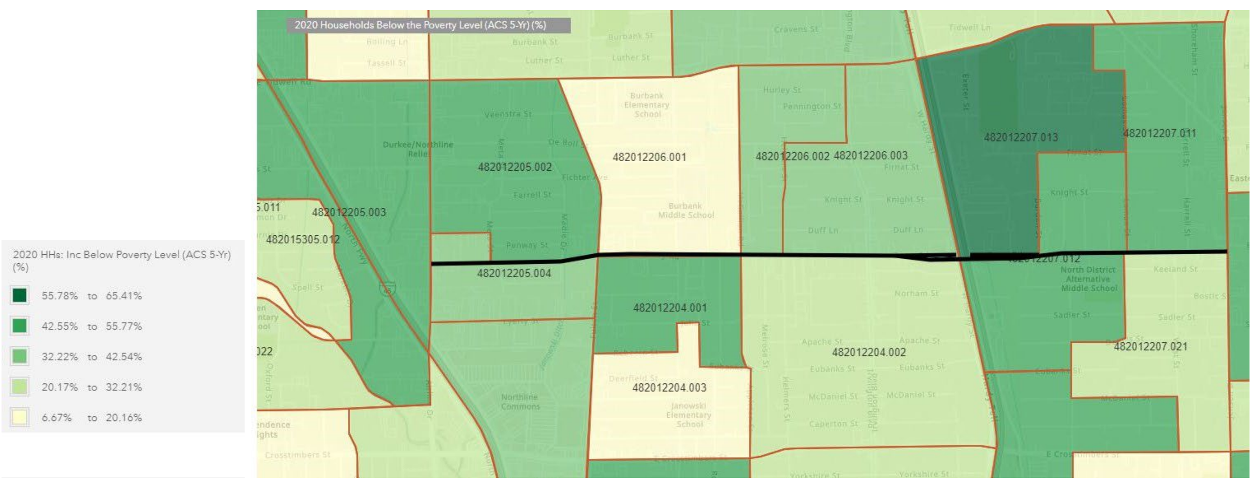

Figure 10. Households below poverty level
Source: 2020 Households Below Poverty Level (ACS 5 Year)(%). ArcGIS Online Business Analyst, www.bao.arcgis.com. Retrieved December 5, 2022.

[6] HHS Poverty Guidelines. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Planning and Evaluation, https://aspe.hhs.gov/topics/poverty-economic-mobility/poverty-guidelines/prior-hhs-poverty-guidelines-federal-register-references. Retrieved November 17, 2022. The 2020 data was the most recent available for this analysis. For reference, the 2022 poverty level for a family of four is $27,750.

Community Resources

Multiple churches are located adjacent to the project alignment, as well as Berry Elementary and its after-school program, North District Alternative Middle School, and Burbank Middle School (see Figure 11). The Northside WIC/Health Center is approximately 0.1 mile east of the project alignment.

The proposed improvements are not anticipated to permanently adversely impact community resources; in fact, they are expected to improve safe access to these resources.

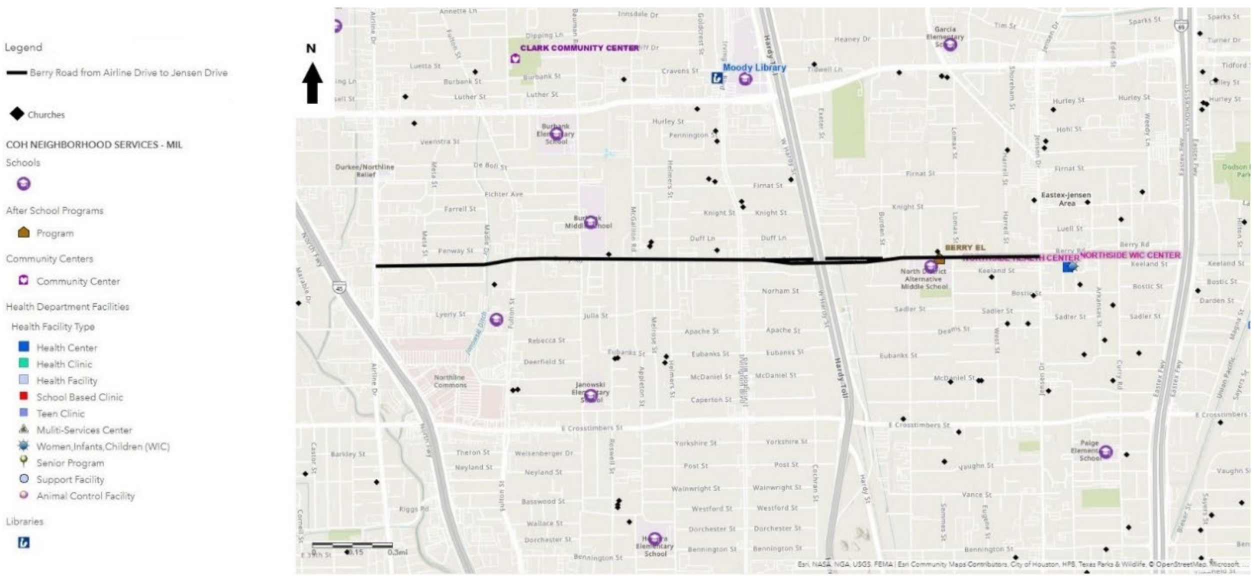

Figure 11. Community resources

Source: COH Neighborhood Services - MIL. ArcGIS Online, www.maps.arcgis.com. Retrieved December 5, 2022.

Transportation Resources

The project corridor is directly served by bikeways and METRO bus routes (see Figure 12). The METRO Rail Red Line and two transit centers are also in the project area. The proposed improvements are not anticipated to permanently adversely impact transportation resources; in fact, they are expected to complement existing and proposed resources.

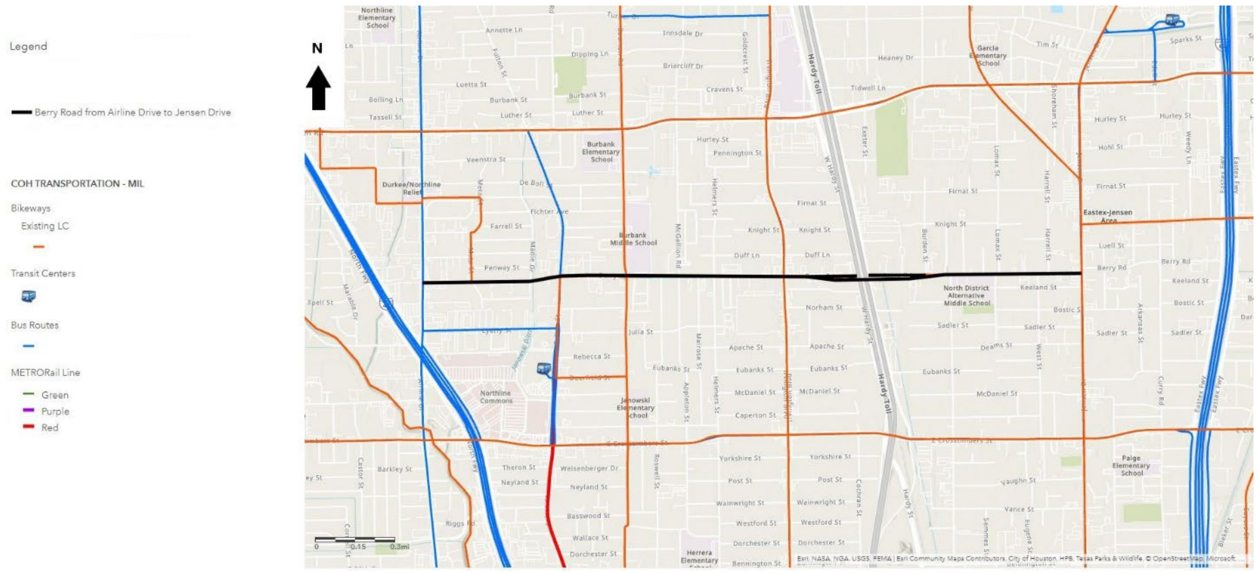

Figure 12. Transportation resources
Source: COH Transportation Services - MIL. ArcGIS Online, www.maps.arcgis.com. Retrieved December 6, 2022.

Soil

The project is not located in prime farmland.[7]

Wetlands

For state or federally funded projects that may affect wetland areas, an analysis of impacts must be performed. If it is determined that a project will have significant impacts, an EIS may be required. Section 404 permits are required by the U.S. Army Corps of Engineers (USACE) for work that will dredge or fill Waters of the U.S. and associated wetlands.

The project alignment crosses Janowski Ditch, a designated riverine wetland, at the intersection of Berry Road and Madie Drive (see figures below). The ditch appears to be a relatively flat grassy area. There are existing sidewalks in this location and adverse impacts to wetlands are not anticipated as work is proposed within the existing right-of-way.

[7] USA SSURGO – Farmland Class. ArcGIS Online, www.maps.arcgis.com. Retrieved December 6, 2022.

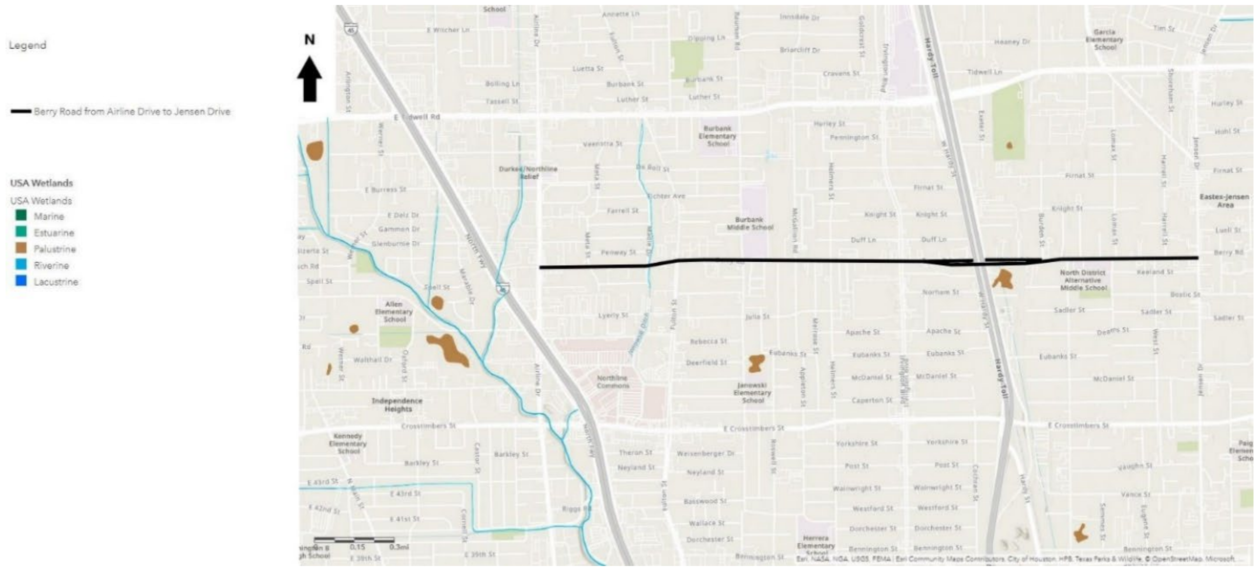

Figure 13. Wetlands
Source: USA Wetlands. ArcGIS Online, www.maps.arcgis.com. Retrieved December 6, 2022.

Figure 14. Looking north from intersection of Berry Road and Madie Drive toward wetland area on east side of Madie Drive
Source: Google Earth. Retrieved December 6, 2022.

Floodplains

The project alignment is just outside the 500-year floodplain (see Figure 15). The proposed project is not anticipated to cause permanent adverse impacts to the floodplain.

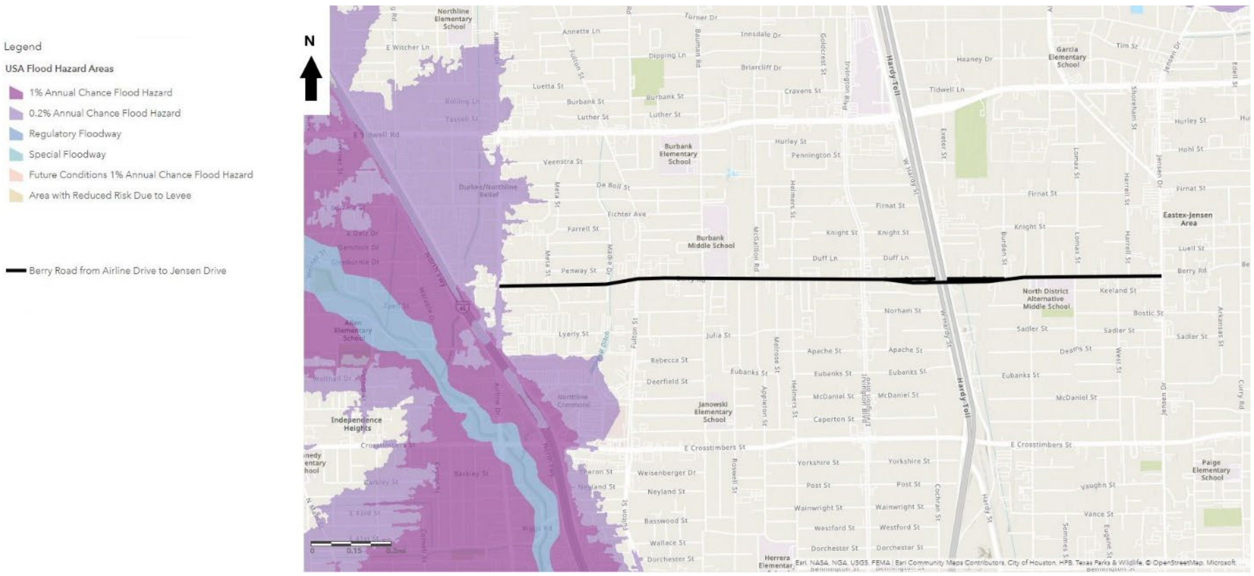

Figure 15. Floodplains
Source: USA Flood Hazard Area. ArcGIS Online, www.maps.arcgis.com. Retrieved December 6, 2022.

Waters of the U.S.

Section 404 of the Federal Water Pollution Control Act (Clean Water Act) authorizes the USACE to regulate material removed from or placed into "waters of the United States." The jurisdiction of this law includes not only navigable waters but most other waters and wetlands adjacent to such waters. Waters of the United States can be any of the following: natural streams that carry water; dry river beds that can carry water; mud flats or sand flats; meadows; playa lakes; and numerous other areas that may or may not have water in them at the time of observation.[8] For waters or wetlands not part of a tributary system, determination of jurisdiction by the appropriate USACE district engineer may be needed.

See the Wetlands section of this document for a map and photos of the locations where the proposed project crosses potential Waters of the U.S. (wetlands).

There are existing sidewalks in this location and adverse impacts to Waters of the U.S. are not anticipated as work is proposed within the existing right-of-way.

[8] 33 CFR 328.3.

Water Quality, Navigable Waterways, and the Coastal Zone

Sections 9 and 10 of the Rivers and Harbors Act of 1899, The Coastal Zone Management Act (CZMA) of 1972, and Section 1424(e) of the Safe Drinking Water Act of 1974 all govern potential impacts to water resources.

Water Quality

The project is not anticipated to increase impervious cover to a degree that will adversely impact runoff or water quality in the project area.

Sole Source Aquifers

The proposed project is not in the vicinity of an Environmental Protection Agency sole source aquifer.[9]

Navigable Waterways

The project alignment does not cross any navigable waterways.

Coastal Zone

The proposed project is not located within the coastal zone.[10]

Ecologically Sensitive Areas and Endangered or Threatened Species

No critical habitat is identified by the U.S. Fish and Wildlife Service (USFWS) in the project area.[11] While threatened and endangered species are located in Harris County, none would be impacted by the proposed project due to the lack of habitat.[12]

Migratory Birds

Birds have been known to nest in rights-of-way, bridges, light poles, culverts, and equipment. The major concern of the Migratory Bird Treaty Act of 1918 (MBTA) is to protect migratory birds, nests,

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[9] Sole Source Aquifers. Environmental Protection Agency. https://epa.maps.arcgis.com, retrieved December 6, 2022.

[10] The Texas Coastal Zone. Texas General Land Office. https://www.glo.texas.gov/coast/coastal-management/forms/files/CoastalBoundaryMap.pdf, retrieved December 6, 2022.

[11] FWS HQ ES Critical Habitat for Threatened and Endangered Species. ArcGIS Online, www.maps.arcgis.com. Retrieved December 7, 2022.

[12] Please note that TxDOT requires species and habitat review for ALL projects, regardless of anticipated impacts or lack thereof.

and eggs from the impacts of power lines, wind turbines, cell towers, and similar infrastructure; however, the clearing of vegetation may also require prior consultation or a bird habitat survey.

Because the project does not involve any major land clearing activities, it is not anticipated to impact migratory bird habitat. In general, the "safest" time for project work to be undertaken regarding migratory birds is late September through spring, as birds are not usually nesting during these months.

Right-of-Way and Land Acquisition

No right-of-way or land acquisition will be needed for the proposed project.

Traffic and Parking

No changes in parking availability, road traffic volumes, level of service, or local/regional circulation patterns will result from the proposed project.

Noise

The proposed project will not add vehicular capacity or involve heavy vehicles; therefore, no permanent adverse impacts are anticipated.

Safety and Security

The proposed projects are not anticipated to have adverse impacts to safety; in fact, they are expected to increase safety for both pedestrians and drivers.

Aesthetics

The proposed project will improve existing facilities and will not alter the aesthetics of the adjacent area.

Public Outreach

Even projects eligible for Categorical Exclusions may require documented public outreach, whether in the form of a notice mailed to all adjacent property owners, a virtual meeting, or a public meeting/hearing. Please note that TxDOT requires all projects that add bike lanes in the existing roadway, even if there are no other project impacts, to hold a public hearing as a bike lane is considered a "substantial change in function."

So far, a stakeholder survey and public meeting have been conducted and taken into consideration for project development.

Construction Impacts

As has been discussed throughout this document, there is the potential for temporary adverse impacts during construction, such as changes to access, increased noise and dust from equipment, and increased traffic due to lane closures. Impacts during construction can be mitigated through BMP such as fencing, signage, and a traffic control plan.