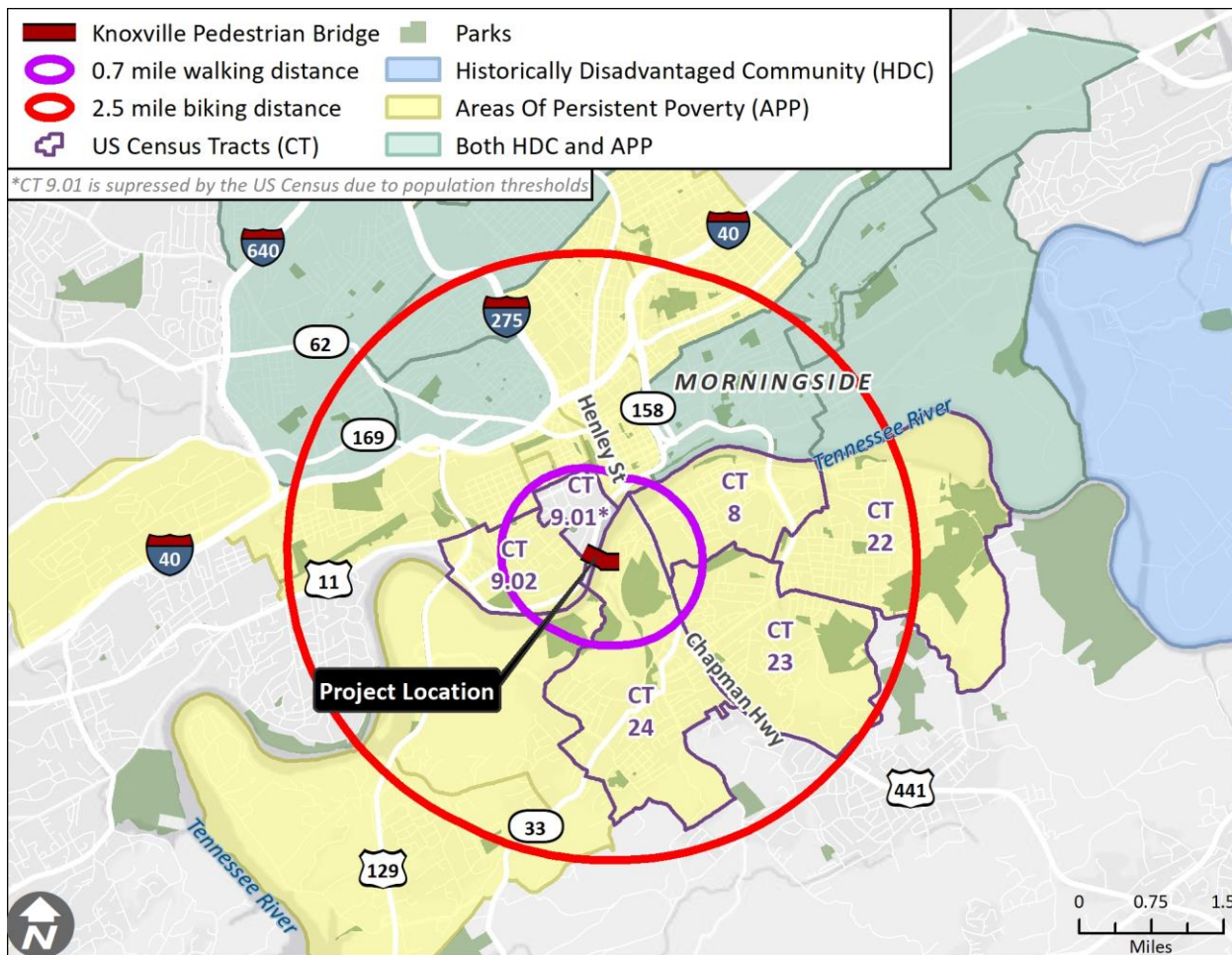




## Project Description

The City of Knoxville, Tennessee is requesting \$25 million from the RAISE Grant program to build the South Knoxville Waterfront Bike and Pedestrian Bridge (Bike and Pedestrian Bridge). This proposed infrastructure will provide a safe and accessible bridge across the Tennessee River for walking, biking, rolling, and other human-powered transportation. All four of the census tracts containing the South Knoxville Waterfront communities (CT 8, 22, 23, 24) are Areas of Persistent Poverty (APP) and three are Justice 40 disadvantaged communities (CT 8, 23, 24). The new bridge will connect these underserved communities to Knoxville’s north waterfront, the University of Tennessee (UT) main campus, the Fort Sanders neighborhood, two medical centers, and major concentrations of employment. The bridge landing ramps on each side of the river will link users to an existing network of greenways, trails, and transit and enable underserved and disadvantaged people within walking and biking distance on the north or south side of the river a chance to choose affordable transportation options to reach desired destinations on either side of the river.



The Tennessee River, the southern Appalachian Mountain’s challenging topography, along with manmade features including roads, rail lines and industrial facilities have limited connectivity between the South Knoxville Waterfront communities and the economic, social, and commercial centers of Knoxville. Providing safe connections between south Knoxville and other areas of the city will improve the quality of life and leverage new investments and redevelopment in areas of south Knoxville that have historically suffered from underinvestment.<sup>1</sup> New housing developments will carefully integrate with existing homes following transportation efficient land use and design patterns. The Bike and Pedestrian Bridge will also improve access to south Knoxville’s Urban Wilderness, a 1,000-acre natural area near downtown popular with residents and a growing number of tourists.

Although this project was initially envisioned in the South Knoxville Waterfront Vision Plan, it has become increasingly evident that the impacts and benefits from the Bike and Pedestrian Bridge can serve more than the four south Knoxville waterfront census tracts focused on in this application. Knoxville recently submitted a Reconnecting Communities’ Grant application to USDOT to “create new multi-modal transportation paths to connect underserved communities that were part of the Morningside, Mountain View, and Willow Street urban renewal areas to East Knoxville, downtown, and the Urban Wilderness.” With the Bike and Pedestrian Bridge in place, families from these neighborhoods are within walking or biking distance<sup>2</sup> of the bridge using the free Knoxville Area Transit (KAT) trolley. From the north bridge landing it is a quick walk, ride, or roll across the Tennessee River to a multitude of free, outdoor recreation and educational opportunities within Knoxville’s Urban Wilderness such as Fort Dickinson Park or to Ijams Nature Center and the Candor Arts and Heritage Center. The construction of the proposed bridge eliminates significant barriers particularly for underserved communities north and south of the river to these free recreation and educational opportunities that belong to everyone in Knoxville.

Residents in the South Knoxville Waterfront Communities will be able to safely bike and walk across the proposed bridge to the new downtown minor league baseball stadium and entertainment district, visit the Beck Cultural Center, and the Delaney Art Museum in East Knoxville. Safe active transportation across the Tennessee River and opportunities to build additional synergies between transit and active transportation<sup>3</sup> throughout these APP, HDC, and Justice 40 neighborhoods will improve quality of life, reduce VMT, improve air quality, and foster improved economic well-being for all residents.

## Transportation Challenges Driving this Project

The bike and pedestrian bridge will address significant transportation challenges:

- **Safety** –Chapman Highway (US-441), does not have protected pedestrian or bicycle facilities, crash rates and three fatalities within the South Knoxville segment of this corridor are a barrier to active transportation usage in this area. There are three other highway bridges that cross the river, the Gay Street Bridge has a protected walking path but lacks safe biking infrastructure, Alcoa Highway has protected active transportation facilities, but access is limited to a single destination, the Cherokee Farms R & D Center, a third facility, James White Parkway, does not provide any protected bike or walking facilities.
- **Environmental Sustainability** – Motorized vehicular travel time and distance using existing road corridors increases transportation related pollution and poorer air quality affecting

<sup>1</sup> “The Climate and Economic Justice Screening Tool,” White House Council on Environmental Quality, February 2022, Knox County, TN, census tract 24

<sup>2</sup> Average length of a travel trip for walkers is 0.7 miles for walking and 2.5 miles for biking. “FHWA Bicycling and Walking in the United States”

<sup>3</sup> Active Transportation refers to walking, cycling, scooters, wheelchairs, and other human powered transportation

underserved neighborhoods within biking distance of the bridge. Existing brownfield sites restrict access to the river and redevelopment of vacant and deteriorating industrial sites.

- **Quality of Life** – There is a need to continue to proactively address racial equity and barriers to opportunity, including automobile dependence as a form of barrier. Lack of access to safe, protected, and affordable active transportation choices can be a significant barrier that hinders access to education, healthcare, recreation for improved health and wellness, employment and many other opportunities.
- **Mobility and Community Connectivity** - The Tennessee River and the area’s challenging topography creates natural barriers that have constrained mobility and connections to and from South Knoxville. These barriers isolated underserved communities in South Knoxville waterfront neighborhoods, resulting in higher unemployment rates, underinvestment in housing, and lower household incomes as identified in the new Justice 40 tool.
- **Economic Competitiveness and Opportunity** – The lack of safe and protected active transportation infrastructure limits equitable access to affordable transportation choices and connections to well-paying job opportunities. Economic growth is constrained as a result of the lack of affordable transportation options that would attract employees from larger workforce catchment areas.

## The Solution

Ultimately constructing a new bridge solely for active transportation users removes barriers to equitable access for disadvantaged and disabled residents on both sides of the river providing connections to needed services, an expanded inventory of affordable housing options, and enabling residents to enjoy outdoor activities and parks in South Knoxville and employment centers and services in the urban core north of the river. The bridge will support modal diversion enabling pedestrian and bicycle users to avoid busy, unprotected highways and travel on a protected bridge across the river that will benefit all users particularly people with disabilities who “rely on active transportation to a greater degree than those without disabilities.”<sup>4</sup>

## Project History

Knoxville began creating the 20-year vision for the South Knoxville Waterfront in 2005. The goal was to revitalize South Knoxville, preserve its many assets, and build better connections to the larger community. To accomplish this vision an action plan was developed that identified strategic public and private investments to:

- Redevelop dilapidated and vacant industrial structures that lined the Tennessee River, and kept people from being able to access and enjoy the river
- Create new and improved connections to enhance mobility, safety, and accessibility to and from South Knoxville
- Foster new economic opportunities, greater personal prosperity, attract investments, and revitalize vulnerable neighborhoods
- Leverage partnerships to create high quality, transportation efficient land use developments where people can live, work, and play sustainably.

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<sup>4</sup> Evaluating Active Transportation Benefits and Costs: Guide to Valuing Walking and Cycling Improvements, Victoria Transportation Policy Institute, 2019 and 2017 National Household Travel Survey (NHTS).



The Vision and Plan was the culmination of years of public workshops, discussions, and neighborhood meetings. Citizen involvement and transparent public information has been a cornerstone of this effort since the beginning when hundreds of people participated in the development of the plan and remain engaged today in its implementation. The City's ongoing dedication to public involvement remains a



foundation of this vision and is an essential reason the plan framework continues to work.

Implementation of this plan began in the Up-River district at Island Home and progressed to the Mid River area across the river from the downtown core. Since the Plan was approved in 2006, the city has invested \$61.6 million dollars in strategic public improvements including Suttree Landing Park, Cityview Greenway Extension, and Sevier Avenue Streetscapes. These public improvements leveraged over \$400 million in private sector investments like Phillips Avenue townhomes a block from Suttree Park and the

redevelopment of a long vacant and outdated commercial building into the Alliance Brewing & Taproom and Simpl, a farm to table restaurant.

The Bike and Pedestrian Bridge will leverage new opportunities in “Down River” communities for housing, including opportunities for workforce housing, a key strategic priority of the city.<sup>5</sup>

Neighborhoods will be walkable and connect to mixed uses such as restaurants, retail space, and local small businesses. This development will follow “transportation efficient land use” principles with smaller lots, complete streets, and options to walk to your favorite coffee shop rather than drive.

## Technical and Engineering Aspects of the Project and Statement of Work

On the north bank of the Tennessee River, the Bike and Pedestrian bridge will cross Neyland Drive (SR-158) and the Gulf & Ohio Railroad (G&O) before touching down at the concourse between Thompson-Boling Arena and Pratt Pavilion at UT. The bridge must meet minimum clearance requirements over Neyland Drive, a principal arterial, the G&O Railroad, and maintain the minimum navigational clearance over the river. The south touchdown point is approximately 50-feet lower in elevation than the north end. The bridge will be designed to meet the requirements of the Americans with Disabilities Act (ADA).

Preliminary plans established a bridge deck profile grade of 2% down from the north landing to a point just south of the navigable river channel. South of the main river channel, the deck transitions to a 5% downgrade until it reaches the touchdown point near the south side of the river. In addition, the span arrangements are positioned to avoid locating any bridge foundations within the railroad right-of-way and to avoid conflicts with major utilities on the north side of the river. No bridge piers will be located in the river. (See illustration on next page.)

## Statement of Work

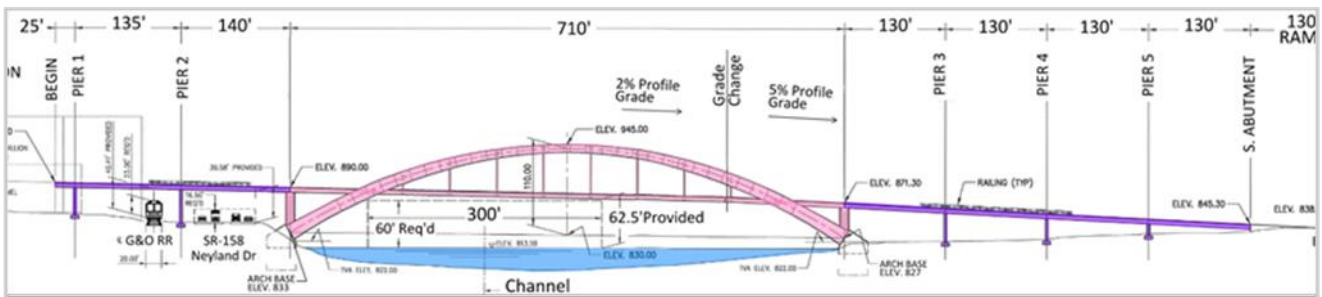
The proposed bridge will include a 710-foot-long span arch over the river and multiple shorter spans at the bridge ends. The north bridge end includes three spans at 25-feet, 135-feet, and 140-feet with the northern tie connecting to UT campus. The south bridge end includes four spans at 130-feet each with

<sup>5</sup> [https://www.knoxvilletn.gov/government/city\\_departments\\_offices/economic\\_development/public\\_private\\_partnership\\_opportunities](https://www.knoxvilletn.gov/government/city_departments_offices/economic_development/public_private_partnership_opportunities)

the southern touchdown occurring near Clancy Avenue. The bridge cross section is 25-feet wide, and this protected facility will convey pedestrians and bicycles safely across the Tennessee River.



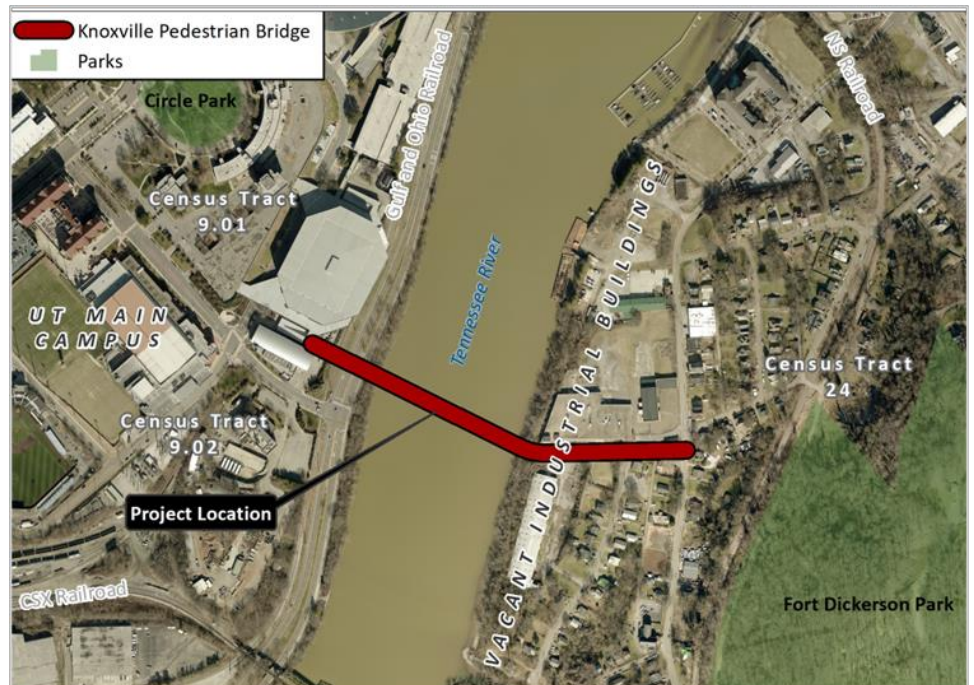
PLAN



ELEVATION

**Project Location**

- The project is in Knoxville, Tennessee, urbanized area UA45640
- The South Knoxville Waterfront Bike and Pedestrian Bridge is located within 2 census tracts (24 and 9.01)
- The project spans the Tennessee River from Clancy Avenue on the south (census tract 24) to the pedestrian concourse between Thompson-Boling Arena and Pratt Pavilion on the north (census tract 9.01)



**The following attachment is not included in this view since it is not a read-only PDF file.**

**The agency will receive all application forms and attachments without any data loss.**

**AttachmentForm\_1\_2-ATT3-1236-Project Location File.kmz**





## Project Budget

The estimated cost of the Bike and Pedestrian Bridge is \$70,000,000. This cost is based on a type, size, and location bridge design prepared by Lawrie and Associates in 2011. A current cost estimate for the bridge construction was prepared by Modjeski & Masters Bridge Engineers in November 2022. This firm's recent design and estimating experience on the new I-74 Mississippi River Arch Bridges, a complex structure similar to the requirements of the Bike and Pedestrian Bridge, provided the experience and insights needed to develop this updated cost estimate. A milestone deliverable of the preliminary design was an approved D-List Categorical Exclusion (CE) obtained in 2014.

The City of Knoxville is requesting \$25,000,000 in RAISE Grant funds for the Bike and Pedestrian Bridge project. The total eligible project budget is \$70,000,000. The City of Knoxville and our partners, The University of Tennessee, will provide a local match of up to \$8,000,000 in non-federal funding for the project. Tennessee Congressman Tim Burchett has committed \$500,000 from Consolidated Appropriations Act, 2023 federal funds. In addition, the City and UT have requested \$36.5 million from the State of Tennessee FY2023-2024 budget specifically to support this project and are committed to funding all needed property acquisition for the project. In addition, the City is committed to improving via its annual capital programs and the Tax Increment Financial (TIF) District the peripheral infrastructure needs within the Down River portions of the South Waterfront similar to improve Up River and Mid River within the South Waterfront Form District.

There are no conditions or restrictions affecting the use of these funds for this project.



**Project Budget Breakdown**

Major Construction Activity	Total Project Cost	Estimated City Funds Expended Prior to Obligation of RAISE Grant	Eligible RAISE Project Budget
NEPA & PE	\$1,000,000	\$12,000	\$988,000
ROW (Acquisition & Services)	\$9,060,000	\$0	\$9,060,000
Final Design	\$4,400,000	\$0	\$4,400,000
Construction	\$43,990,000	\$0	\$43,990,000
Utility Relocation	\$550,000	\$0	\$550,000
CEI/Design Review	\$4,400,000	\$0	\$4,400,000
Contingency (15%)	\$6,600,000	\$0	\$6,600,000
<b>Total</b>	<b>\$70,000,000</b>	<b>\$12,000</b>	<b>\$69,988,000</b>

**Federal vs non-Federal Breakdown**

Major Construction Activity	Total	Non-Federal		RAISE		Other Federal	
	Eligible Budget	Dollars	Percent	Dollars	Percent	Dollars	Percent
NEPA & PE	\$988,000	\$488,000	49.39%	\$0	0.00%	\$500,000	50.61%
ROW (Acquisition & Services)	\$9,060,000	\$6,522,000	71.99%	\$2,538,000	28.01%	\$0	0.00%
Final Design	\$4,400,000	\$880,000	20.00%	\$3,520,000	80.00%	\$0	0.00%
Construction	\$43,990,000	\$0	0.00%	\$18,942,000	43.06%	\$25,048,000	56.94%
Utility Relocation	\$550,000	\$550,000	100.00%	\$0	0.00%	\$0	0.00%
CEI/Design Review	\$4,400,000	\$0	0.00%	\$0	0.00%	\$4,400,000	100.00%
Contingency	\$6,600,000	\$5,560,000	84.24%	\$0	0.00%	\$1,040,000	15.76%
<b>Total</b>	<b>\$69,988,000</b>	<b>\$14,000,000</b>	<b>20.00%</b>	<b>\$25,000,000</b>	<b>35.72%</b>	<b>\$30,988,000</b>	<b>44.28%</b>

**Funding Sources**

Funding Source	Component 1	Total Funding
	Funding Amount	
RAISE Funds:		\$25,000,000
Other Federal Funds:	Federal Earmark - 2023	\$500,000
	State of Tennessee	\$30,488,000
Non-Federal Funds:	City of Knoxville	\$3,988,000
	University of Tennessee	\$4,000,000
	State of Tennessee	\$5,982,000
<b>Total:</b>		<b>\$69,988,000</b>



### Construction Activity by Funding Source Category

Funding Category	Percent of Total	Funding Source	Eligible Project Budget
<b>NEPA &amp; PE</b>			<b>\$988,000</b>
Non-Federal	49.39%	City of Knoxville Capital Funds	\$488,000
		University of Tennessee Facilities	\$0
Raise Grant	0.00%	Raise Grant	\$0
Federal	50.61%	Federal Earmark - 2023	\$500,000
<b>ROW (Acquisition &amp; Services)</b>			<b>\$9,060,000</b>
Non-Federal	71.99%	City of Knoxville Capital Funds	\$2,620,000
		University of Tennessee Facilities	\$3,902,000
Raise Grant	28.01%	Raise Grant	\$2,538,000
Federal	0.00%		\$0
<b>Final Design</b>			<b>\$4,400,000</b>
Non-Federal	20.00%	City of Knoxville Capital Funds	\$880,000
		University of Tennessee Facilities	\$0
Raise Grant	80.00%	Raise Grant	\$3,520,000
Federal	0.00%		\$0
<b>Construction</b>			<b>\$43,990,000</b>
Non-Federal	0%	City of Knoxville Capital Funds	\$0
		University of Tennessee Facilities	\$0
Raise Grant	43.06%	Raise Grant	\$18,942,000
Federal	56.94%	State of Tennessee <sup>1</sup>	\$25,048,000
<b>Utility Relocation</b>			<b>\$550,000</b>
Non-Federal	100.00%	City of Knoxville Capital Funds	\$0
		University of Tennessee Facilities	\$98,000
		State of Tennessee	\$422,000
Raise Grant	0.00%	Raise Grant	\$0
Federal	0.00%	State of Tennessee <sup>1</sup>	\$0
<b>CEI/Design Review</b>			<b>\$4,400,000</b>
Non-Federal	0.00%	City of Knoxville Capital Funds	\$0
		University of Tennessee Facilities	\$0
		State of Tennessee	\$0
Raise Grant	0.00%	Raise Grant	\$0
Federal	100.00%	State of Tennessee <sup>1</sup>	\$4,400,000
<b>Contingency</b>			<b>\$6,600,000</b>
Non-Federal	84.24%	City of Knoxville Capital Funds	\$0
		University of Tennessee Facilities	\$0
		State of Tennessee	\$5,560,000
Raise Grant	0.00%	Raise Grant	\$0
Federal	15.76%	State of Tennessee <sup>1</sup>	\$1,040,000
<b>TOTAL</b>			<b>\$69,988,000</b>

<sup>1</sup> The City of Knoxville has requested \$36.5 M from the State of Tennessee to support this project. The State's FY-2023-2024 budget is expected to be approved by the Tennessee General Assembly by May 2023.

## Project Costs per Census Tract Assumptions

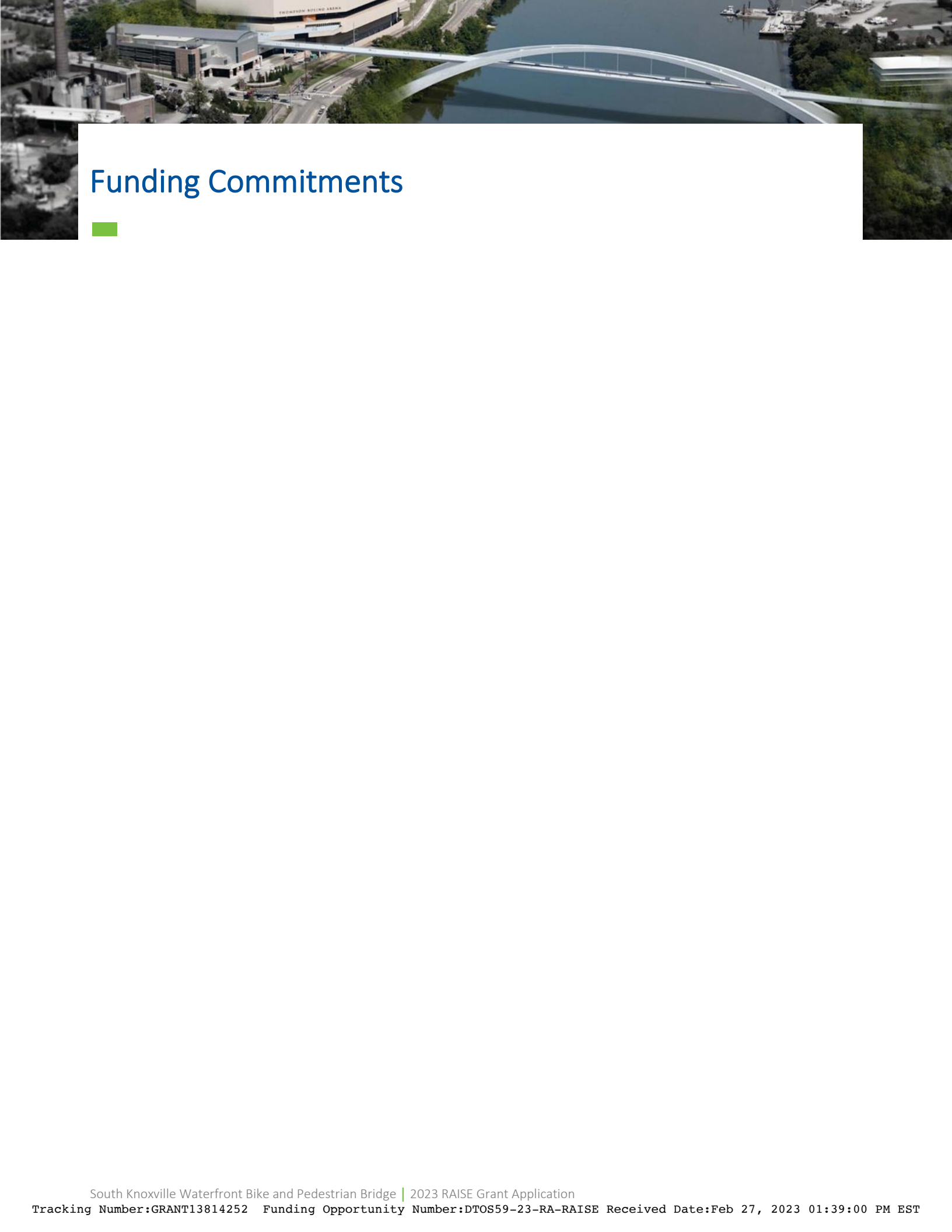
Use the length of project in each census tract to establish the percent of design, CEI, and construction costs for that tract (see the graphic below).

- Total project length = 1,660 feet
- Project length north of the river = 655 feet (39% of total)
- Project length south of the river = 1,005 feet (61% of total)
- All the utility relocations are north of the river – adjacent to Neyland Drive.
- All the ROW costs are south of the river.

The project is located in two census tracts, 9.01 and 24. Census tract 24 where the majority of the project improvements will be located, is an APP and Justice 40 tract. Census tract 9.01 is “Not Identified” as the tract has a population of less than 2,000 and the income and employment data for this tract is suppressed.

### *Project Costs per Census Tract*

Census Tract(s)	Project Costs per Census Tract
9.01	\$24, 102.100
24	\$45,897,900
<b>Total Project Cost</b>	<b>\$70,000,000</b>



# Funding Commitments







February 24, 2023

The Honorable Pete Buttigieg, Secretary  
 U.S. Department of Transportation  
 1200 New Jersey Avenue SE  
 Washington, DC 20509

Dear Secretary Buttigieg:

I was recently in Washington, D.C. as part of the U.S. Conference of Mayors and appreciate the time your staff, including Chris Small and Will Raskey, made to meet with me and discuss the alignment of the Administration and Knoxville's priorities.

I want to extend an open invitation to you and anyone at DOT to visit Knoxville to learn more about how this mid-size city in the South is making strides to put theory into practice around mobility issues. I serve on the Steering Committee of Climate Mayors and am grateful for the opportunity to have met in a small group with Andrew Wishnia and Katie Thompson to talk about specific, mutual goals in sustainability and equity.

As part of Knoxville's path forward toward these goals, we are requesting \$25 million in the FY 2023 RAISE grant program to build a pedestrian bridge across the Tennessee River. The **South Knoxville Waterfront Bicycle and Pedestrian Bridge** will forge a new, multimodal connection to strengthen our residents' access to the significant economic, educational, and recreational opportunities that exist on each side of the river. The benefits are particularly important for the South Knoxville neighborhoods immediately surrounding the south terminus of the bridge, which are within Areas of Persistent Poverty (APP).

The South Waterfront Bicycle and Pedestrian Bridge is a long-standing idea that emerged nearly 25 years ago during extensive community conversations that led to Knoxville's South Waterfront Vision Plan. From the earliest days, we knew that this project required a collaborative effort, and we are thrilled that key partners – including University of Tennessee, Knox County, and the State of Tennessee Department of Transportation – support bringing this vision to life.

CITY COUNTY BUILDING • ROOM 691 • 400 MAIN STREET • P.O. BOX 1631 • KNOXVILLE, TENNESSEE 37901  
 PHONE: 865-215-2040 • FAX: 865-215-2085 • EMAIL: MAYOR@KNOXVILLETN.GOV  
 WWW.KNOXVILLETN.GOV

The City of Knoxville and our partners, including the University of Tennessee, are committed to an \$8,000,000 local match, and we are in discussions with the State of Tennessee during their budget process to secure the additional \$36.5 million in funding required for this project. Assuming adequate federal and state funding is secured and in accordance with the RAISE Notice of Funding Opportunity, the City of will cover cost overruns that exceed the project contingency budgeted.

In bipartisan fashion, Tennessee Congressman Tim Burchett included \$500,000 in the Consolidated Appropriations Act, 2023 for the bridge.

To date, the City of Knoxville has invested over \$61.6 million in strategic projects within South Knoxville Waterfront Communities for affordable housing, greenways and waterfront parks, construction of complete streets, business loans, and support for private, mixed-use and mixed-income development. These public investments have leveraged over \$400 million in private investment.

This bridge will take the next step toward bringing to life the Knoxville community's vision for the South Waterfront, while also advancing our goals related to sustainability and equitable mobility. Our application addresses how this project meets the requirements of the RAISE grant and the benefits it will provide to vulnerable communities as it helps to improve multimodal transportation access for our city. As you will see, this project has been on the table for almost 20 years, and we are ready to get started!

In closing, I just want to share my appreciation to this Administration. Mitch Landrieu has been kind enough to serve as a mentor, and I have benefited from his advice and counsel on a variety of issues. The fact that former mayors, such as yourself and Mitch, are in these important leadership roles communicates the understanding and support this Administration has shown to cities.

We appreciate all of the efforts that you and the Biden Administration have taken to update and improve infrastructure throughout our communities through the RAISE grants and more.

Sincerely,



Indya Kincannon  
Mayor

## Federal Wage Rate Certification


City of Knoxville, Tennessee certifies that it will comply with the requirements of subchapter IV of chapter 31 of title 40, United States Code (Federal wage rate requirements), as required by the Recovery Act.

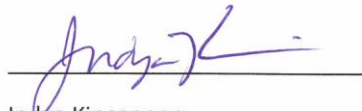
FY 2023 RAISE Discretionary Grant Application  
**South Knoxville Waterfront Bike and Pedestrian Bridge**

FEDERAL WAGE RATE CERTIFICATION

The undersigned agrees to comply with the requirements of Subchapter IV of Chapter 31 of title 40, United States Code regarding Federal wage rate requirements, as required by the Consolidated and Further Continuing Appropriations Act, 2019.

APPROVED AS TO FORM:

  
CHARLES W. SWANSON  
LAW DIRECTOR



Indya Kincannon  
Mayor  
City of Knoxville, Tennessee

February 28, 2023



**The following attachment is not included in this view since it is not a read-only PDF file.**

**The agency will receive all application forms and attachments without any data loss.**

**AttachmentForm\_1\_2-ATT6-1239-Merit Criteria Narrative.pdf**

**The following attachment is not included in this view since it is not a read-only PDF file.**

**The agency will receive all application forms and attachments without any data loss.**

**AttachmentForm\_1\_2-ATT7-1240-Project Readiness.pdf**



# BCA Narrative

The Tennessee River and Appalachian Mountains’ topography create a natural barrier constraining mobility and connectivity to/from South Knoxville. These natural barriers constrain housing and commuting patterns, resulting in longer commuting, increased travel time, accidents, and urban sprawl.

The proposed infrastructure provides a pedestrian bridge across the Tennessee River for walking, biking, etc., connecting south Knoxville, the University of Tennessee (UTK) main campus, medical centers, and major employment concentrations. Bridge landing ramps link users to existing greenways, trails, and transit. This benefit-cost analysis (BCA) evaluates the project costs and associated benefits of building a new Tennessee River Pedestrian Bridge.

## Overview, Alternatives, and Benefit Types

Baseline and Problem	Alternative Change to Baseline	Benefit Types
Current natural barriers constrain housing and commercial development, and increase travel time, accidents, and urban sprawl.	A Tennessee River Pedestrian Bridge connects existing and planned student housing directly across from central UTK campus, sport/entertainment venues, medical facilities, and employment centers.	The bridge reduces travel disbenefits (e.g., distance, safety, accident, and emission savings) and fosters mortality reduction benefits associated with mode shifting modes from vehicles to pedestrian.

The BCA starts in 2023 with planning and engineering services, followed by 2024-to-2026 construction, and a 30-year operating horizon thereafter. Monetary costs and benefits are estimated in 2021\$ and summarized in standard metrics such as a benefit-cost ratio (BCR), net present value (NPV), internal rate of return (IRR), payback period, etc.

*Conclusions* – Discounting estimated capital costs and 30-year travel efficiency benefits at 7% (3% for CO2) yields \$49.5 million net costs and \$65.6 million net benefits, resulting in a positive \$16.2 million NPV, equating to a 1.33 BCR, and payback period by 2045.

*Major Factors/Sensitivities* – Capital costs are a major assumption. On the benefits-side, the major determinates are the vehicle-to-pedestrian/bike diversions, VMT-related benefits (VOC, safety, and emissions) cost savings, and congestion reduction externalities.

## Overview, Alternatives, and Benefit Types (\$2021)

Net Present Components (mil.)	
Benefits	\$65.6
Costs	<u>-\$49.5</u>
Value (NPV)	\$16.2
<b>Other Summary Metrics</b>	
Benefit-Cost Ratio (BCR)	1.33
Internal Rate of Return (IRR)	10.2%
Payback Period	2045



## Approach

**Introduction** – This benefit-cost analysis (BCA) evaluates a 25x1,660 ft. pedestrian bridge to accommodate commuting demand via congested roadways (and Chapman Bridge). Accommodating a vehicle to pedestrian mode shift reduces passenger car disbenefits (e.g., distance, safety, accident, and emission savings) and fosters pedestrian/bicycling mortality reduction benefits. The bridge includes a 710’ span over the Tennessee River, three north-end spans (25’, 135’, and 140’) connecting to the UTK campus, and four south-end spans (130’’ each) connecting near Clancy Avenue (South Knoxville).

The analysis follows RAISE BCA guidance and recommended values.<sup>1</sup> These and other sources/materials are provided in the accompanying workbook.

**No-Build** – Reflects current and future passenger car congestion associated with UTK commuting (student, faculty, and staff) between residences south of the Tennessee River to the UTK campus, sport/ entertainment venues, medical facilities, and employment centers. Existing roadway/bridges constraints and limited pedestrian/bike lanes, inhibit non-vehicle transport. This paradigm will worsen as new housing develops south of the river to accommodate growing UTK enrollment.

**Build** – Construct a pedestrian/bike bridge to alleviate roadway congestion by shifting people from vehicles resulting primarily in mortality reduction benefits.

**Table 1: Overview, Alternatives, and Benefit Types**

Baseline and Problem	Alternative Change to Baseline	Benefit Types
Current natural barriers constrain housing and commercial development, and increase travel time, accidents, and urban sprawl.	A Tennessee River Pedestrian Bridge connects existing and planned student housing directly across from central UTK campus, sport/ entertainment venues, medical facilities, and employment centers.	The bridge reduces travel disbenefits (e.g., distance, safety, accident, and emission savings) and fosters mortality reduction benefits associated with mode shifting modes from vehicles to pedestrian.

**Basic Parameters** – The BCA starts in 2023 with planning and engineering (P/E), followed-by 2024-to-2026 construction, and a subsequent 30-year operating horizon. Costs and benefits are evaluated in 2021\$ and discounted at 7% (except CO2 at 3%), per USDOT guidelines, and summarized in standard BCA metrics such as a benefit-cost ratio (BCR), net present value (NPV), internal rate of return (IRR), payback period, etc. The following table summarizes the significance of the various cost and benefit categories as enumerated in the following subsections.

**Table 2: Cost and Benefit Types**

Type	Description	Significance
Costs	P/E, Construction	High
User Benefits	Vehicle Operating. Cost	Medium
	Safety	Medium
	Emissions (NOX, PM2.5, SOX, CO2)	Low
	Congestion Externalities	Low
	Ped/ Bike Mortality Reduction	High
Agency Benefits	Agency - Operations and Maintenance Costs	Medium
	Agency - Residual Value	Low

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

### Cost Assumptions

*Capital Costs* – Costs shown below are in 2021\$ and span 2023-2026. The \$55.80 million includes planning/engineering (\$5.36 million, 10%) in 2023. Construction (bridge and approaches), ROW, utilities, CEI, and contingencies span three years (2024-2026) totaling \$50.44 million (90%).

*Table 3: Annual Capital Cost Summary by Type (2021\$, millions)*

Year	Plan/Design	Construction	Total	Discounted
2023	\$5.36	\$0.00	\$5.36	\$5.36
2024	\$0.00	\$16.81	\$16.81	\$15.71
2025	\$0.00	\$16.81	\$16.81	\$14.69
2026	\$0.00	\$16.81	\$16.81	\$13.72
Total	\$5.36	\$50.44	\$55.80	\$49.48

### Benefit Assumptions

Assumptions regarding traffic volumes, vehicle occupancy, unit costs, diverted trips, etc. are discussed below. All tables are provided in the accompanying BCA Excel workbook.

*Traffic Volumes* – A Knoxville VISSIM model (microsimulation travel demand model) simulated base and future year peak hour vehicle volumes (in 2023 and 2045, respectively) and pedestrian/bike diversions. Three peak-hour periods were modeled: AM (7-8 AM), midday (12-1 PM), and evening (5-6 PM) for three times of the year: 200 in-session school weekdays, 60 not-in-session weekdays, and 100 weekend days. Peak-hour/time-period volumes were converted to daily and annual build vs. no-build vehicle volumes.

The VISSIM model focused on the UTK area directly affected by the proposed bridge. Several new student housing developments are planned over the next 10+ years comprising roughly 1,000 units with 2,000 beds. New students commuting over the Tennessee River exacerbates Chapman Bridge traffic.

VISSIM model estimates 2045 daily network vehicle-miles travelled (VMT) savings of 10,842 (9.1% decrease) via a vehicles-to-pedestrian/bike shift. Daily vehicle trip diversions (one-way) to ped/bike trips total 1,595 in 2023 rising to 7,361 by 2045. Interim/unmodeled years were estimated based on relative phasing on new housing developments south of the Tennessee River between 2025 and 2035. These diverted trips comprise 1.2% in 2023, rising to 3.9% in 2045. Annual diverted trips total 318,983 (1.9% of total) in 2023 and 1.5 million (6.0% in 2045). Vehicle trips are converted to pedestrian/bicyclists via an assumed 1.67 vehicle occupancy rate, per USDOT RAISE guidance.

**Table 4: Vissim Summary**

	7-8AM	12-1MD	5-6PM	Daily Total	Annualized
<b>Vehicle Distance Travelled (VMT)</b>					
<b>2023</b>					
No Build	6,421	6,925	8,853	82,510	10,738,302
Build	<u>6,267</u>	<u>6,920</u>	<u>8,601</u>	<u>81,221</u>	<u>10,480,403</u>
Abs. Δ	-154	-5	-252	-1,289	-257,898
% Δ	-2.4%	-0.1%	-2.8%	-1.6%	-2.4%
<b>2045</b>					
No Build	9,615	10,582	11,790	119,720	16,237,653
Build	<u>8,683</u>	<u>9,560</u>	<u>10,868</u>	<u>108,879</u>	<u>14,069,316</u>
Abs. Δ	-932	-1,022	-922	-10,842	-2,168,337
% Δ	-9.7%	-9.7%	-7.8%	-9.1%	-13.4%
<b>Vehicle Trips (1x) Diverted to Ped.</b>					
<b>2023</b>					
No Build	9,707	11,478	14,899	134,964	17,135,878
Build	<u>9,585</u>	<u>11,362</u>	<u>14,699</u>	<u>133,369</u>	<u>16,816,895</u>
Abs. Δ	-122	-116	-200	-1,595	-318,983
% Δ	-1.3%	-1.0%	-1.3%	-1.2%	-1.9%
<b>2045</b>					
No Build	14,234	16,706	19,327	188,824	24,374,870
Build	<u>13,584</u>	<u>15,885</u>	<u>18,909</u>	<u>181,462</u>	<u>22,902,599</u>
Abs. Δ	-650	-821	-418	-7,361	-1,472,271
% Δ	-4.6%	-4.9%	-2.2%	-3.9%	-6.0%

*User Benefit Assumptions* – VMT-related and trip-diversion benefits were developed based on USDOT BCA guidance<sup>2</sup>. VMT-related benefits include vehicle-operating, safety, emission, and congestion externalities. Morbidity reduction relates to trip-diversion from vehicle to pedestrian/bicycle.

- *Vehicle Operating* – VOC/mile for light duty vehicles (\$0.46), per USDOT Guidelines, which are applied to the VMT reductions.
- *Safety* – 2021 Tennessee accident rates and VMT were applied to USDOT costs by severity to estimate an average accident cost of \$0.384 per VMT, as summarized below.

**Table 5: Safety Factors (2021\$)**

Tennessee 2021	Crashes	per 100m VMT	USDOT values	2021\$/VMT
Fatalities	1,266	1.53	\$13,046,800	\$0.200
Injuries	47,059	56.97	\$307,800	\$0.175
PDO	144,689	175.18	\$4,800	\$0.008
VMT (millions)	82,596			
Summary Cost/VMT				\$0.384

- *Emissions* – Were quantified and monetized by type (NOX, PM2.5, SOX, and CO2). Historically declining grams per-VMT emission factors (EPA) were extrapolated for future years, expecting a continued decline. These factors and costs were applied to annual VMT changes, per BCA Guidelines. First and last year emission factors and costs are summarized by emission types in table below. CO2 values were discounted at the lower 3% rate.

<sup>2</sup> [Benefit-Cost Analysis Guidance for Discretionary Grant Programs | US Department of Transportation](#)



**Table 6: Emission Factors and Costs (2021\$)**

Emissions	Grams/VMT		2021\$/Metric Ton		2021\$/VMT	
	2027	2056	2027	2056	2027	2056
NOX	0.081	0.003	\$17,900	\$18,900	\$0.0014	\$0.0001
PM2.5	0.008	0.005	\$865,600	\$907,600	\$0.0069	\$0.0045
SOX	0.002	0.000	\$48,700	\$51,300	<u>\$0.0001</u>	<u>\$0.0000</u>
<i>Non-CO2 Subtotal</i>					<i>\$0.0084</i>	<i>\$0.0046</i>
CO2	208.6	24.8	\$61	\$88	\$0.0127	\$0.0034

- **Mortality Reduction** – Per round-trip savings are applied to pedestrian/bicycle diverted trips for mortality reduction benefits, accounting for user age. Diverted one-way trips were converted to round-trips (divided by two) and are assumed 85% walking, with benefits to people between 20-74 years (assumed 68%, per USDOT assumption); 15% are assumed bicycling, with benefits between ages 20-64 (59%, per USDOT). Hence, year 2045 diverted roundtrips are about 1.0 million walking trips and 184,000 cycling trips. Monetization follows USDOT guidance and assumes a walking (e.g., pedestrian) benefit of \$7.20 and a cycling (e.g., bike) benefit of \$6.42 per roundtrip (85/15% average = \$7.02).

**Table 7: Diverted Roundtrips**

	Share	Round Trips	Age %	Appl. Trips
<b>2023</b>				
Walking (Pedestrian)	85%	226,398	68%	153,951
Cycling (Bike)	15%	39,953	59%	23,572
Total	100%	266,351		177,523
<b>2045</b>				
Walking (Pedestrian)	85%	1,044,945	68%	710,562
Cycling (Bike)	15%	184,402	59%	108,797
Total	100%	1,229,347		819,359

- **Congestion Externalities** – The recommended \$0.13 per VMT was applied to VMT reductions, per USDOT Guidelines.
- **Agency Benefit Assumptions** – Include the additional O&M costs and the residual value:
  - **O&M Costs** – The disbenefits associated with annual bridge operation and maintenance costs assume annual drainage cleaning, bi-annual bridge inspection, lighting replacements (every five-years) and painting (every 15 years) as summarized in table below.

**Table 8: O&M Frequency and Costs (2021\$)**

O&M	Freq. (Yrs.)	Cost
Drainage	1	\$10,000
Inspection	2	\$60,000
Lighting	5	\$15,000
Bridge Painting	15	\$2,000,000

- *Residual Value* – A 50-year life cycle was assumed for the bridge. Given the 30-year analysis horizon, a 20-year remaining life is assumed totaling 40% of the construction value, per USDOT guidelines. This results in an undiscounted agency benefit of \$20.2 million in year 2056 (before discounting).

**Benefits Summary**

VMT-related and trip-diverted mortality reduction benefits are summarized below. Unit costs savings are applied to annual VMT benefits to monetize user cost-savings by type (vehicle operations, safety, emissions, and congestion externalities). Undiscounted user benefits are summarized below by type for opening through 2035, whereafter the benefits are assumed full housing development build-out..

*Table 9: Annual User Benefits (Undiscounted 2021\$, millions)*

Year	VOC	Safety	Emissions		Congest. Extern.	Mortality Reduction	Total
			non-CO2	CO2			
2027	\$0.30	\$0.25	\$0.01	\$0.01	\$0.09	\$1.76	\$2.42
2028	\$0.30	\$0.25	\$0.01	\$0.01	\$0.09	\$1.76	\$2.42
2029	\$0.30	\$0.25	\$0.01	\$0.01	\$0.09	\$1.76	\$2.42
2030	\$0.82	\$0.68	\$0.01	\$0.02	\$0.23	\$4.76	\$6.52
2031	\$0.82	\$0.68	\$0.01	\$0.02	\$0.23	\$4.76	\$6.52
2032	\$0.82	\$0.68	\$0.01	\$0.02	\$0.23	\$4.76	\$6.52
2033	\$0.82	\$0.68	\$0.01	\$0.02	\$0.23	\$4.76	\$6.52
2034	\$0.82	\$0.68	\$0.01	\$0.02	\$0.23	\$4.76	\$6.51
2035+	\$1.00	\$0.83	\$0.01	\$0.02	\$0.28	\$5.80	\$7.95
<b>Total</b>	<b>\$26.94</b>	<b>\$22.47</b>	<b>\$0.33</b>	<b>\$0.34</b>	<b>\$7.61</b>	<b>\$156.75</b>	<b>\$214.45</b>

**BCA Summary**

*Conclusions* – Discounting the estimated costs and 30-year benefits at 7% discounting (3% for CO2) yields \$65.6 million in net benefits versus \$49.5 million in net costs, resulting in a positive \$16.2 million NPV, equating to a 1.33 BCR, and a payback period by 2045, as summarized below. Annual undiscounted benefits and costs are graphed by type in the following figure. Summary annual discounted benefits and costs are graphed in the second figure, showing the break-even in 2045.

*Major Factors/Sensitivities* – Capital costs are a major assumption, especially with the early timing and lower net discounting. Discounted benefits are led by mortality reduction (\$47.3 million, 72%) associated with trip diversion and VMT-related benefits (\$17.4 million, 27%),<sup>3</sup> and agency benefits.

<sup>3</sup> VOC, safety, emissions and congestion externality cost-savings

*Table 10: BCA Summary (2021\$, millions)*

Net Present Benefits (millions)		
<b>User Benefits</b>		
Mortality Reduction (Trip Diversion)	\$47.3	72.0%
VMT-Related		
VOC	\$8.1	12.4%
Safety	\$6.8	10.3%
non-CO2	\$0.1	0.2%
CO2	\$0.1	0.2%
Congestion Externalities	\$2.3	3.5%
<b>Agency Benefits</b>		
O&M	-\$1.2	-1.9%
Residual	<u>\$2.2</u>	<u>3.3%</u>
Total Benefits	\$65.6	28.0%
Net Present Costs (millions)	<b>-\$49.5</b>	
<b>Summary Metrics</b>		
Net Present Value (NPV, millions)	\$16.2	
Benefit-Cost Ratio (BCR)	1.33	
Internal Rate of Return (IRR)	10.2%	
Payback Period	2045	
Breakeven Annual Benefits (millions)	\$4.9	

*BCR Range and Confidence Rating* – A 1.33 BCR falls within the BCR 1.0 to 1.5 range prescribed in the USDOT grant preparation material.

*Merit Criteria* – Of the eight merit criteria identified in the USDOT grant materials, a number are directly quantified and incorporated into the BCA, a few are indirectly quantified, and a couple are not directly pertinent to this BCA. Directly quantified and monetized benefits pertain to merit criteria: Safety (VMT reduction-related), Environmental Sustainability (VMT-emissions), Mobility and Community Connectivity (South Knoxville access to downtown Knoxville), Economic Competitiveness and Opportunity (increased travel reliability and faster travel time). Quality of Life is also improved for the commuters (mortality reduction). Partnership and Collaboration and Innovation merit criteria are not quantifiable or monetizable within a BCA paradigm.

Table 11: Annual Benefits and Costs by Type, and Discounting (2021\$, millions)

Years				Capital Costs			(dis) Benefits										Total	Discounting		
Cap.	Ops.	Proj.	Cal.	P/E	Constr.	Subtotal	VOC	Safety	non-CO2	CO2	Externalities	Mort Red.	O&M	Residual	Subtotal	Total	7.0%	3.0%	Total	
1	0	0	2023	-\$5.358	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	1.000	1.000	-\$5.358
2	0	1	2024	\$0.000	-\$16.813	-\$16.813	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	-\$16.813	0.935	0.935	-\$15.713
3	0	2	2025	\$0.000	-\$16.813	-\$16.813	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	-\$16.813	0.873	0.873	-\$14.685
4	0	3	2026	\$0.000	-\$16.813	-\$16.813	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	-\$16.813	0.816	0.816	-\$13.725
0	1	4	2027	\$0.000	\$0.000	\$0.000	\$0.303	\$0.253	\$0.006	\$0.008	\$0.086	\$1.762	-\$0.010	\$0.000	\$2.407	\$2.407	0.763	0.763	\$1.836	
0	2	5	2028	\$0.000	\$0.000	\$0.000	\$0.303	\$0.253	\$0.006	\$0.008	\$0.086	\$1.762	-\$0.070	\$0.000	\$2.346	\$2.346	0.713	0.713	\$1.673	
0	3	6	2029	\$0.000	\$0.000	\$0.000	\$0.303	\$0.253	\$0.006	\$0.007	\$0.086	\$1.762	-\$0.010	\$0.000	\$2.406	\$2.406	0.666	0.666	\$1.603	
0	4	7	2030	\$0.000	\$0.000	\$0.000	\$0.817	\$0.682	\$0.015	\$0.019	\$0.231	\$4.756	-\$0.070	\$0.000	\$6.451	\$6.451	0.623	0.623	\$4.017	
0	5	8	2031	\$0.000	\$0.000	\$0.000	\$0.817	\$0.682	\$0.014	\$0.018	\$0.231	\$4.756	-\$0.025	\$0.000	\$6.494	\$6.494	0.582	0.582	\$3.780	
0	6	9	2032	\$0.000	\$0.000	\$0.000	\$0.817	\$0.682	\$0.013	\$0.017	\$0.231	\$4.756	-\$0.070	\$0.000	\$6.448	\$6.448	0.544	0.544	\$3.507	
0	7	10	2033	\$0.000	\$0.000	\$0.000	\$0.817	\$0.682	\$0.013	\$0.016	\$0.231	\$4.756	-\$0.010	\$0.000	\$6.506	\$6.506	0.508	0.508	\$3.307	
0	8	11	2034	\$0.000	\$0.000	\$0.000	\$0.817	\$0.682	\$0.012	\$0.015	\$0.231	\$4.756	-\$0.070	\$0.000	\$6.445	\$6.445	0.475	0.475	\$3.062	
0	9	12	2035	\$0.000	\$0.000	\$0.000	\$0.997	\$0.832	\$0.015	\$0.018	\$0.282	\$5.804	-\$0.010	\$0.000	\$7.937	\$7.937	0.444	0.444	\$3.524	
0	10	13	2036	\$0.000	\$0.000	\$0.000	\$0.997	\$0.832	\$0.014	\$0.017	\$0.282	\$5.804	-\$0.085	\$0.000	\$7.861	\$7.861	0.415	0.415	\$3.262	
0	11	14	2037	\$0.000	\$0.000	\$0.000	\$0.997	\$0.832	\$0.014	\$0.016	\$0.282	\$5.804	-\$0.010	\$0.000	\$7.934	\$7.934	0.388	0.388	\$3.077	
0	12	15	2038	\$0.000	\$0.000	\$0.000	\$0.997	\$0.832	\$0.013	\$0.015	\$0.282	\$5.804	-\$0.070	\$0.000	\$7.873	\$7.873	0.362	0.362	\$2.854	
0	13	16	2039	\$0.000	\$0.000	\$0.000	\$0.997	\$0.832	\$0.013	\$0.014	\$0.282	\$5.804	-\$0.010	\$0.000	\$7.932	\$7.932	0.339	0.339	\$2.687	
0	14	17	2040	\$0.000	\$0.000	\$0.000	\$0.997	\$0.832	\$0.012	\$0.013	\$0.282	\$5.804	-\$0.070	\$0.000	\$7.871	\$7.871	0.317	0.317	\$2.492	
0	15	18	2041	\$0.000	\$0.000	\$0.000	\$0.997	\$0.832	\$0.012	\$0.013	\$0.282	\$5.804	-\$2.025	\$0.000	\$5.915	\$5.915	0.296	0.296	\$1.750	
0	16	19	2042	\$0.000	\$0.000	\$0.000	\$0.997	\$0.832	\$0.012	\$0.012	\$0.282	\$5.804	-\$0.070	\$0.000	\$7.869	\$7.869	0.277	0.277	\$2.176	
0	17	20	2043	\$0.000	\$0.000	\$0.000	\$0.997	\$0.832	\$0.011	\$0.011	\$0.282	\$5.804	-\$0.010	\$0.000	\$7.928	\$7.928	0.258	0.258	\$2.049	
0	18	21	2044	\$0.000	\$0.000	\$0.000	\$0.997	\$0.832	\$0.011	\$0.011	\$0.282	\$5.804	-\$0.070	\$0.000	\$7.867	\$7.867	0.242	0.242	\$1.900	
0	19	22	2045	\$0.000	\$0.000	\$0.000	\$0.997	\$0.832	\$0.011	\$0.010	\$0.282	\$5.804	-\$0.010	\$0.000	\$7.926	\$7.926	0.226	0.226	\$1.789	
0	20	23	2046	\$0.000	\$0.000	\$0.000	\$0.997	\$0.832	\$0.011	\$0.009	\$0.282	\$5.804	-\$0.085	\$0.000	\$7.850	\$7.850	0.211	0.211	\$1.656	
0	21	24	2047	\$0.000	\$0.000	\$0.000	\$0.997	\$0.832	\$0.010	\$0.009	\$0.282	\$5.804	-\$0.010	\$0.000	\$7.924	\$7.924	0.197	0.197	\$1.562	
0	22	25	2048	\$0.000	\$0.000	\$0.000	\$0.997	\$0.832	\$0.010	\$0.008	\$0.282	\$5.804	-\$0.070	\$0.000	\$7.864	\$7.864	0.184	0.184	\$1.449	
0	23	26	2049	\$0.000	\$0.000	\$0.000	\$0.997	\$0.832	\$0.010	\$0.008	\$0.282	\$5.804	-\$0.010	\$0.000	\$7.923	\$7.923	0.172	0.172	\$1.364	
0	24	27	2050	\$0.000	\$0.000	\$0.000	\$0.997	\$0.832	\$0.010	\$0.007	\$0.282	\$5.804	-\$0.070	\$0.000	\$7.862	\$7.862	0.161	0.161	\$1.265	
0	25	28	2051	\$0.000	\$0.000	\$0.000	\$0.997	\$0.832	\$0.010	\$0.007	\$0.282	\$5.804	-\$0.025	\$0.000	\$7.907	\$7.907	0.150	0.150	\$1.189	
0	26	29	2052	\$0.000	\$0.000	\$0.000	\$0.997	\$0.832	\$0.010	\$0.007	\$0.282	\$5.804	-\$0.070	\$0.000	\$7.862	\$7.862	0.141	0.141	\$1.105	
0	27	30	2053	\$0.000	\$0.000	\$0.000	\$0.997	\$0.832	\$0.010	\$0.007	\$0.282	\$5.804	-\$0.010	\$0.000	\$7.922	\$7.922	0.131	0.131	\$1.041	
0	28	31	2054	\$0.000	\$0.000	\$0.000	\$0.997	\$0.832	\$0.010	\$0.007	\$0.282	\$5.804	-\$0.070	\$0.000	\$7.862	\$7.862	0.123	0.123	\$0.965	
0	29	32	2055	\$0.000	\$0.000	\$0.000	\$0.997	\$0.832	\$0.010	\$0.007	\$0.282	\$5.804	-\$0.010	\$0.000	\$7.922	\$7.922	0.115	0.115	\$0.909	
0	30	33	2056	\$0.000	\$0.000	\$0.000	\$0.997	\$0.832	\$0.010	\$0.007	\$0.282	\$5.804	-\$2.085	\$20.176	\$26.023	\$26.023	0.107	0.107	\$2.791	
Total				-\$5.358	-\$50.440	-\$50.440	\$26.939	\$22.474	\$0.333	\$0.344	\$7.613	\$156.746	-\$5.290	\$20.176	\$229.337	\$178.897				\$16.159
Share				10.6%	100.0%	100.0%	11.7%	9.8%	0.1%	0.2%	3.3%	68.3%	-2.3%	8.8%	100.0%					



Figure 1: Annual Benefits and Costs by Type (Undiscounted 2021\$, millions)

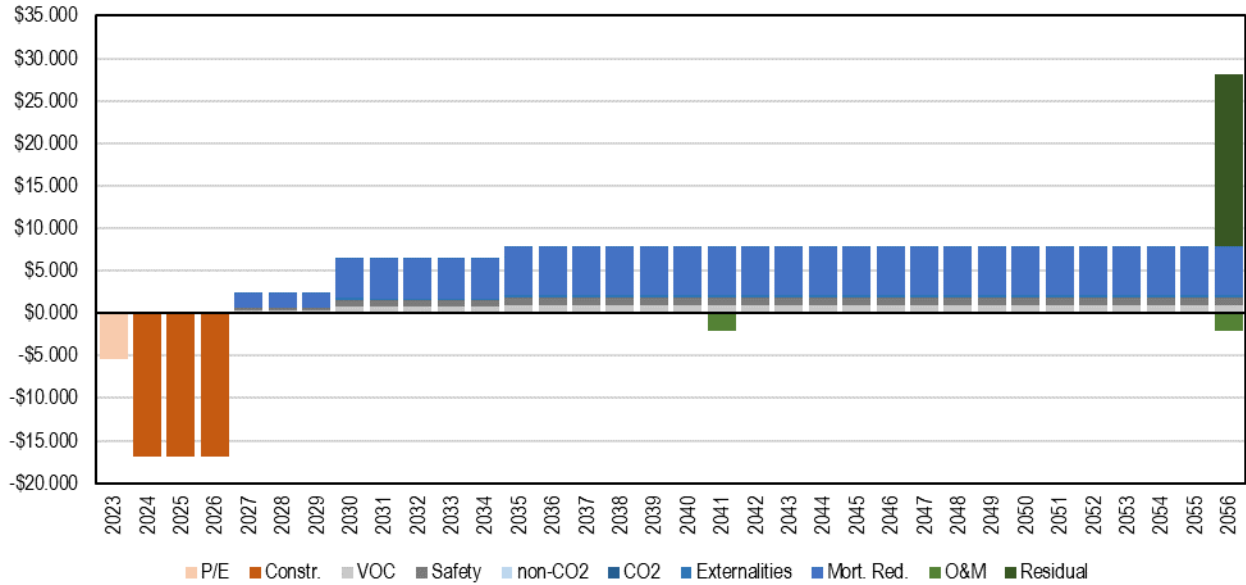
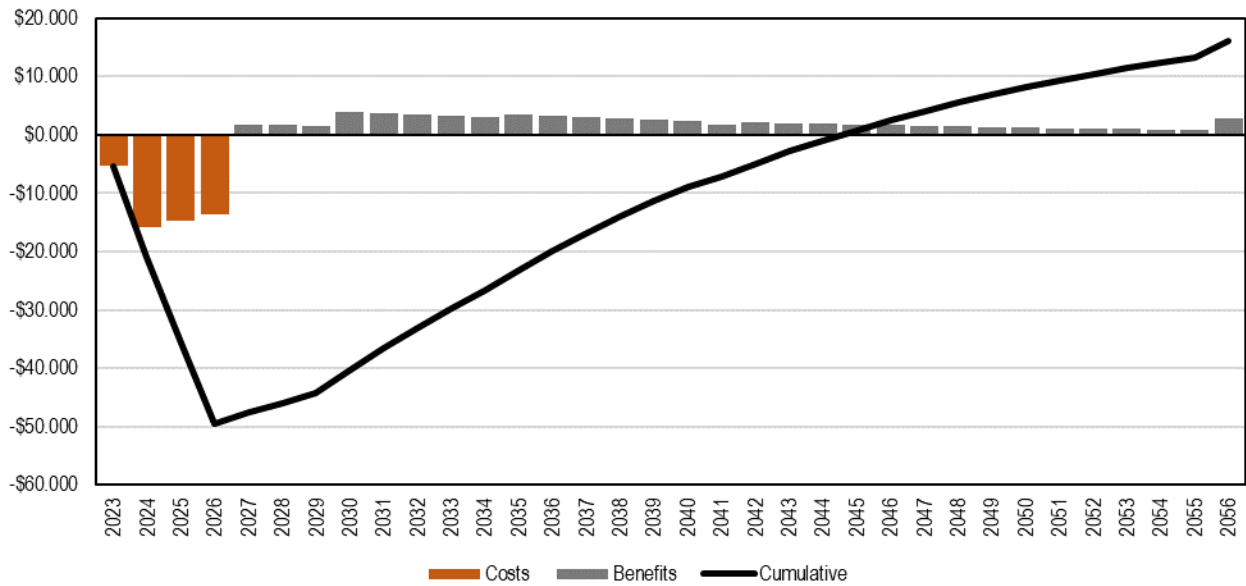


Figure 2: Total Annual Benefits and Costs (Discounted 2021\$, millions)



**The following attachment is not included in this view since it is not a read-only PDF file.**

**The agency will receive all application forms and attachments without any data loss.**

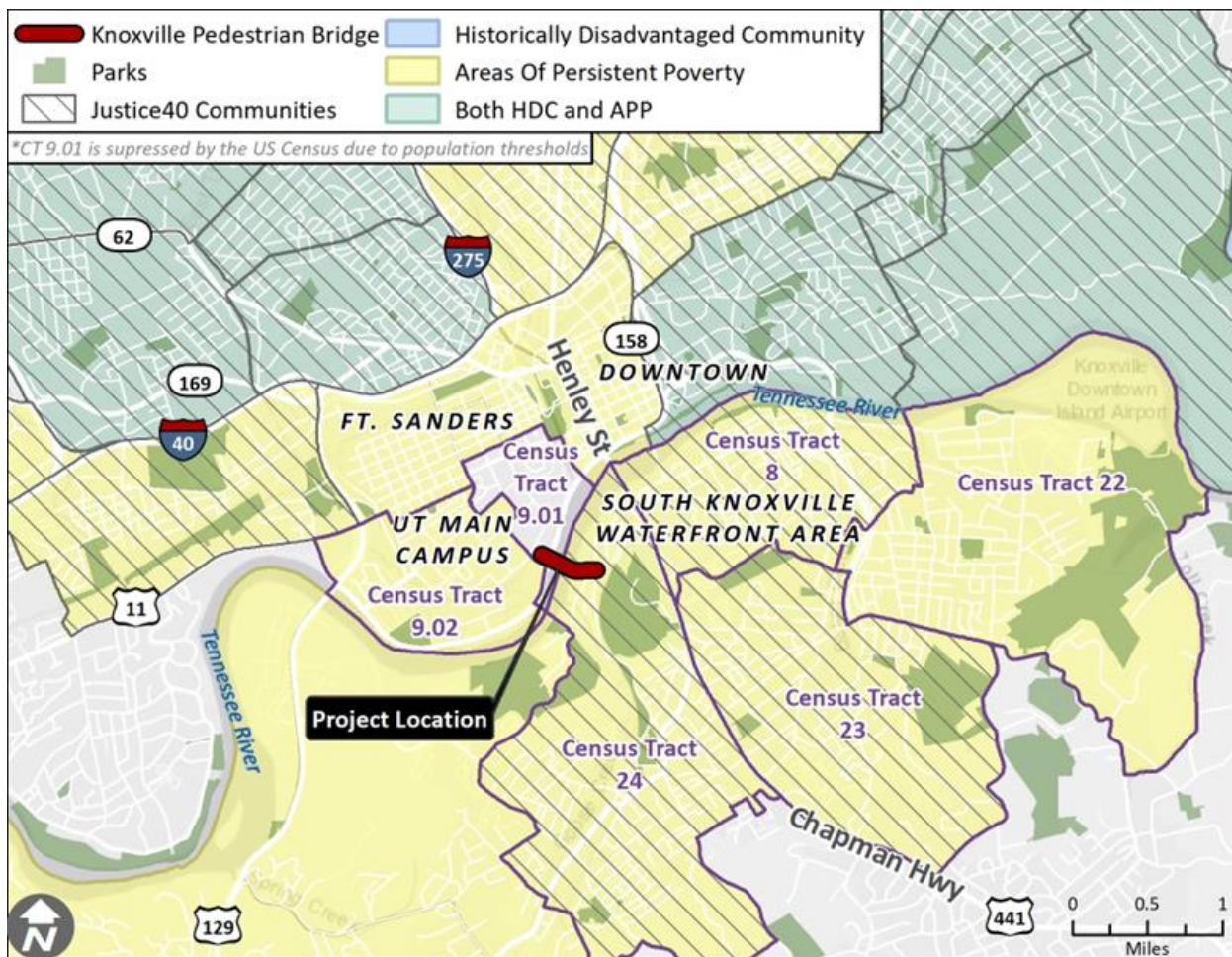
**AttachmentForm\_1\_2-ATT9-1242-BCA Calculations.xlsx**



## Merit Criteria

### Safety

Safety is a primary purpose of the project. This project will provide new infrastructure specifically to protect non-motorized travelers. The proposed Bike and Pedestrian Bridge will address a significant gap within the regional active transportation network to facilitate the safe movement of people south and north of the river, including Areas of Persistent Poverty (APP), Historically Underserved Communities (HDC), and Justice 40 disadvantaged areas shown on the map below. This will be the only Tennessee River crossing in the region providing fully protected and safe infrastructure for walking, biking, rolling, and other human-powered transportation options, and will enable people to connect to the University of Tennessee, major concentrations of employment downtown and in the Fort Sanders area, and to the parks, trails and tourism sites south of the river which offer significant recreational and health opportunities to the region.



Chapman Highway (U.S. 441) is part of the National Highway System (NHS) and the primary north south highway linking South Knoxville to the rest of the city and counties to the south. This highway is a 5-lane major arterial with a center-turn lane, the corridor becomes Henley Street at the south bank of the Tennessee River. There is no protected bike or walking facilities on this highway or on the Henley Street bridge. The recent crash data from 2019 – 2022, for the 1.33-mile segment of Chapman Highway from Moody Avenue to the south bank of the Tennessee River, documents three fatalities during this time period, two involving pedestrians.<sup>1</sup> Based on reported traffic crash history between 2019 and 2022, this highway has a crash rate of 8.784 crashes per million vehicle miles (MVM) compared to a statewide average crash rate of 3.223 crashes per MVM for similar roadway facilities.

This crash analysis extended the limits to include the road segment from Henley Street at the south bank of the river north to Cumberland Avenue, which resulted in a total segment length of 1.8 miles. With the additional historical crashes on the Henley Street Bridge and in the downtown area on Henley Street, the Chapman Highway crash rate increased from 8.784 to 10.053 crashes per million vehicle miles (MVM) including the additional length. Cumberland Avenue is an east-west corridor providing local access to the UTK campus with private student housing and parking garages located on the northside of Cumberland Avenue and UTK Campus located on the southside of this arterial roadway. A crash rate of 5.239 crashes per MVM was calculated using the 2019 through 2022 historical crash data. The Cumberland Avenue facility does in fact experience over 1.5 times more crashes than other arterials in Tennessee based on the statewide average crash rate of 3.223 crashes per MVM.

Road Name	Report Crash Totals*				
	2019	2020**	2021	2022	Grand Total
Chapman Hwy	167	128	176	167	638
Cumberland Ave	17	15	22	17	71
Grand Total	184	143	198	184	709

\* Source: Tennessee Department of Transportation E-TRIMS Database.

\*\* Note: Covid event in 2020 and 2021.

Road Name	Grand Total	2021 AADT	Length (miles)	Crash Rate	Statewide	TDOT Study
Chapman Hwy	638	21,149	1.80	10.053	3.223	8.784
Cumberland Ave	71	12,377	0.75	5.239	3.223	

Based on a Vissim model developed to evaluate traffic operations with and without the proposed Bike and Pedestrian Bridge crossing the Tennessee River, the proposed active transportation bridge would result in a mode shift which will reduce the number of daily vehicles on Chapman Highway by 4,033 cars thereby, reducing wear and tear on these roads. Utilizing a 1.5-percent annual growth rate and new housing developments, the 16 percent reduction in average daily traffic volume is equal to 11 years in added capacity to the road without having to add lanes. The volume of traffic reduced on Henley Street and Cumberland Avenue, if the active transportation



<sup>1</sup> Tennessee Department of Transportation Chapman Highway Safety Study, 2023, included three years of crash data 8/1/2019 – 7/31/2022)



bridge is constructed, reduces the potential for crashes creating a safer environment on these roads also.

### *Incorporating DOT's National Roadway Safety Strategy*

The City of Knoxville has adopted a “Vision Zero” goal to eliminate traffic deaths and serious injuries on Knoxville’s streets. As part of that commitment, the city has completed a citywide roadway safety analysis in 2022 and is currently working in partnership with the Knoxville Transportation Planning Organization to enhance the safety analysis to be compliant with the Safe Streets and Roads for All (SS4A) Safety Action Plan. The roadway safety analysis prioritizes specific projects to address transportation infrastructure where there are higher crash rates, pedestrian incidents, and design concerns. Once the current changes in the Manual on Uniform Traffic Control Devices are completed those changes will be reviewed and appropriate revisions will be made in the Knoxville Safety Action Plan in accordance with the National Roadway Safety Strategy.

### Environmental Sustainability

A primary purpose of this project is environmental sustainability. The proposed Bike and Pedestrian Bridge will comply with the Federal Flood Risk Management Standard established with EO 11988, 13690, and 14030.

For over 15 years, the City of Knoxville has worked to make Knoxville a greener, more sustainable city – one where the economy, environment, and community can thrive today and in the future. In 2020, Mayor Indya Kincannon convened over 65 community leaders and technical experts as the Mayor’s Climate Council to identify the top strategies for achieving the City’s goal of reducing community greenhouse gas emissions 50% by 2050. The top strategy identified by the Climate Council for addressing transportation emissions is to “Improve facilities for safe, convenient, and active travel, including walking, bicycling, and transit,” a key result of this proposed bridge investment.

The City of Knoxville is committed to advancing environmental justice and is diligent in their efforts to ensure fair and equitable treatment of all people. This project supports that goal. In 2020, the Knoxville City Council approved a Council Resolution to invest \$100 million in Knoxville’s Black neighborhoods damaged by urban renewal projects.<sup>2</sup> Council created the African American Equity Restoration Task Force to oversee these investments. This task force is also reviewing City policies and practices to identify and remove barriers that unintentionally have a disparate and negative impact on racial minorities. Reductions in Emissions

The Bike and Pedestrian Bridge will advance the Climate Council recommendation to increase zero-emission transportation options and reduce barriers to greater use of non-motorized transportation by creating a safe and protected connection across the Tennessee River. This new bridge will connect to a



<sup>2</sup> “African American Equity Restoration Task Force”, City of Knoxville Website



network of greenways, parks, essential services, and destinations that in many cases result in a shorter travel distance utilizing the ped bridge. The mode shift from motorized vehicles to non-motorized will reduce the number of motorized vehicles on Chapman Highway by 4,033. Reduced vehicle miles traveled (VMT) from active transportation use will help to lower transportation emissions, improve air quality in underserved neighborhoods surrounding the new bridge, improve health outcomes for diverse populations in disadvantaged communities, and reduce traffic congestion on roadway that benefit from mode shift. Based on the travel demand analysis, active transportation trips using the Bike and Pedestrian Bridge were quantified and monetized by type (NOX, PM2.5, SOX, and CO2). Historically declining grams per-VMT emission factors (EPA) were extrapolated for future years, expecting a continued decline. These factors and costs were applied to annual VMT changes. First and last year emission factors and costs are summarized by emission types in table below. CO2 values were discounted at the lower 3% rate.

### *Emission Factors and Costs (2021\$)*

Emissions	Grams/VMT		2021\$/Metric Ton		2021\$/VMT	
	2027	2056	2027	2056	2027	2056
NOX	0.081	0.003	\$17,900	\$18,900	\$0.0014	\$0.0001
PM2.5	0.008	0.005	\$865,600	\$907,600	\$0.0069	\$0.0045
SOX	0.002	0.000	\$48,700	\$51,300	<u>\$0.0001</u>	<u>\$0.0000</u>
<i>Non-CO2 Subtotal</i>					<i>\$0.0084</i>	<i>\$0.0046</i>
CO2	208.6	24.8	\$61	\$88	\$0.0127	\$0.0034

Numerous studies have been conducted to analyze walking or biking distances in urban environments. A median walking distance of 0.7 miles and 2.5 miles for cycling is generally accepted as a reasonable distance for average users. The map on page 1 shows the median walking and biking distances from the center point of the proposed Bike and Pedestrian Bridge and the underserved census tracts north and south of the river that fall within this radius.<sup>3</sup> These neighborhoods will benefit from improved equitable access and affordable transportation choices once the bridge is completed.

Transit services connected to walking and biking infrastructure encourage residents to use active transportation at a higher rate than in locations where active transportation networks are not present. Transit and active transportation connectivity is particularly beneficial to people with disabilities. Multi-modal transportation options enable those with disabilities greater equitable connections to employment opportunities, educational and training services, and expanded access to more affordable housing.<sup>4</sup>

### *Redevelop Brownfields and Implement Transportation-Efficient Land Use*

The South Knoxville Waterfront Communities are within 4 census tracts: 24, 8, 23, and 22. Historically, south Knoxville was the industrial heart of the city with many heavy industrial facilities constructed along the Tennessee River waterfront in these neighborhoods including Scottish Pike and Vestal. The potential impacts either perceived or actual, associated with past use of these properties meets the definition of a brownfield. Several brownfield sites have already been redeveloped in the Up-River and Mid-River areas of the South Knoxville revitalizing vacant and dilapidated industrial buildings in neighborhoods utilizing transportation-efficient land use and design development patterns established in the vision plan. This redevelopment has incorporated a mixture of housing densities, connections to accessible open space, and mixed uses allowing residents to achieve a “live, work,

<sup>3</sup> Average length of a travel trip for walkers is 0.7 miles for walking and 2.5 miles for biking. “FHWA Bicycling and Walking in the United States”

<sup>4</sup> “Active Transportation Transforms America”, Rails to Trails Conservancy, October 2019

play” environment. A network of complete streets provides equitable connections to walkers, bikers, rollers, and transit for vulnerable users.

The proposed Bike and Pedestrian Bridge will leverage additional redevelopment of industrial brownfield sites on the river in the Down River area of South Knoxville. A private developer recently acquired one of these former industrial sites to construct 321 units of new housing near the site of the proposed bridge. The developer has committed to set aside 32 housing units for workforce housing, which will be affordable to households with incomes at or below 80 percent of the area median income.



*Before*



*After*

The Climate and Economic Justice Screening Tool identified Census Tract 24 (Down River area) as disadvantaged for: health, legacy pollution, housing, and low income. The Bike and Pedestrian Bridge is an important catalyst to redevelop this area and leverage new investment opportunities to improve and revitalize former brownfield sites significantly improving the environmental sustainability of these neighborhoods.

### *Reduce Vehicle Miles Traveled*

The proposed Bike and Pedestrian Bridge crossing the Tennessee River would result in a mode shift which will reduce the number of daily vehicles on Chapman Highway by 4,033 cars thereby, reducing wear and tear on these roads. Utilizing a 1.5-percent annual growth rate and new housing developments, the 16 percent reduction in average daily traffic volume is equal to 11 years in added capacity to the road without having to add lanes. (Additional data in Safety Merit Criteria and in the Benefit Cost Narrative for the project)

### *Avoid Adverse Impacts to Water Quality*

The Bike and Pedestrian bridge construction includes a clear span arch over the river with foundations on each bank and no bridge piers constructed in the river. This design approach eliminates many environmental impacts protecting water quality and aquatic species in the Tennessee River. With the reduction of vehicle trips non-point source pollution will be reduced and less impervious parking will be required with the mode shift of 4,000+ cars to active transportation.

## Quality of Life

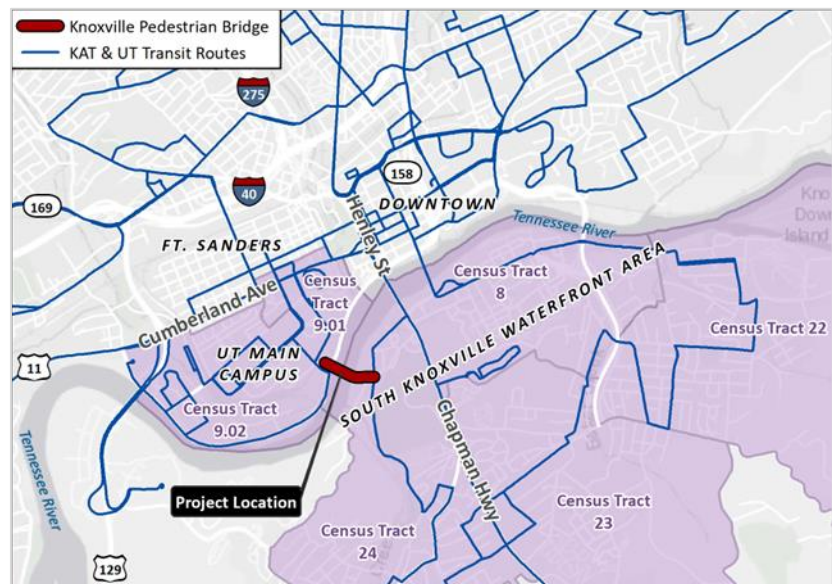
Improving the quality of life for Knoxville residents is a central objective of this project. You can stand on the north bank of the Tennessee River looking toward the Down River area of South Knoxville, shown in the picture below, and still sense the isolation. Empty industrial buildings along the river, historic under investment, long-standing railroad infrastructure barriers and limited transportation connections have affected the quality of life in this community. However, the neighborhoods in this area have a fierce commitment to their community and a passionate belief in the 2006 South Waterfront Vision Plan.



Traci McDonell, City of Knoxville, Webmaster/Photographer, February 14, 2023

## Increase Affordable Transportation Choices

The Bike and Pedestrian Bridge will provide affordable transportation options for residents in APP and Justice 40 communities south of the Tennessee River. This bridge eliminates a barrier that has limited the use of affordable active transportation for residents in this area, lack of safe and protected biking and walking facilities crossing the Tennessee River. The bridge will connect residents in these underserved communities to existing greenways and trails and future services to be evaluated by the City, UT, and KAT might include a shuttle with frequent connections through south waterfront neighborhoods to the bridge. With access to affordable non-motorized transportation choices, these residents will have connections to a wider array of opportunities including access to a larger inventory of affordable housing options, more competitively priced retail services, workforce and educational services, and economical connections to employment opportunities with well-paying jobs in areas within walking and biking distances.





### *Reduced Transportation and Housing Cost Burdens*

The south Knoxville Waterfront census tracts have a significant percentage of residents living below the poverty level. Fifty-five percent of the residents living in census tract 8 have incomes below the poverty level. The census tract with the lowest poverty level in this area is tract 22 where 23 percent of residents live at or below the 5-year poverty level. Thirty percent of residents in census tract 24 identify as minority.<sup>5</sup>

The new bridge supports affordable transportation choices and redevelopment plans for this area will incorporate a range of housing types with a broader diversity of housing densities and mixed uses. The result provides low- and moderate-income residents access to more affordable housing opportunities and lower transportation costs benefiting their economic prosperity. According to the Housing and Transportation Affordability Index, annual transportation costs in Knoxville, TN are \$12,388 and the median monthly housing cost for homeowners is \$1,077, median gross monthly rent is \$844.<sup>6</sup> The median household income in census tract 24 (Down River area) is \$34,429.<sup>7</sup> Assuming average transportation costs and median homeowner expenses, residents in this community spend 74% of their annual income on transportation and housing costs. Having the option to use low cost or free active transportation significantly improves their disposable income and their quality of life.

### *Improve Access to Increase Transportation Choices and Destinations*

Connectivity from the bike and pedestrian bridge creates safe walking and biking access to some of the largest employers in East Tennessee including two major hospitals East Tennessee Children’s Hospital and Fort Sanders Regional Medical Center. At the north bridge landing, the University of Tennessee has over 15,000 employees at the main campus with job opportunities across staff, service, and faculty



positions. A pedestrian and bike friendly street network, as well as a free KAT trolley from UT campus, provide easy access to downtown businesses including Brunswick Boat Group HQ, Ortho Tennessee, Truist Bank, and other major banking institutions.

The pedestrian bridge will equitably connect underserved communities north and south of the river to ethnic markets, larger grocery stores, churches, parks, greenways, and additional transit and active transportation choices that also connect to other areas of the city. A

growing number of South Knoxville residents including people with disabilities, seniors, and those who just don’t like to drive frequently see safe active transportation as a real option for achieving independence enabling them to get to destinations they chose, regardless of their income, age, or abilities.

<sup>5</sup> U.S. Census, American Community Survey data 5-year data series (2014 – 2018) for Knox County census tracts 8, 22, 23, and 24.

<sup>6</sup> “Housing and Transportation Affordability Index,” Center for Neighborhood Technology, 2022

<sup>7</sup> American Community Survey, Median Income Census Tract 24, 2021.

### *Improved Health from new Active Transportation Facilities*

The Bike and Pedestrian Bridge proposed in this application will create a safe and protected active transportation connection across the Tennessee River enabling App, HDC, and Justice 40 communities that literally surround this bridge to walk, bike or roll to a growing network of greenways that help them to incorporate physical activity into their lives regularly improving their health and wellbeing. Knoxville currently has 112.5 miles of paved greenways and natural trails located throughout the city and additional trails and greenways will be developed next year.

### Mobility and Community Connectivity

#### *Improve System-Wide Connectivity*

Mobility and connectivity are an essential purpose of this proposed Bike and Pedestrian Bridge. The Bike and Pedestrian Bridge improves connectivity north and south of the Tennessee River to greenways and trails, shared e-bikes and e-scooter stations, KAT transit, the “T” transit system UT’s campus-wide service, and accessible public transportation options provided by KAT and the “T”. The City will install micro mobility corrals at the bridge landings north and south of the river and expand bridge micro-mobility services at the bridge as demand warrants.



### *Community Participation*

The City of Knoxville and KAT make meaningful changes to their plans and systems after engaging with the community. Both organizations use a variety of tools including surveys, community open house meetings, and focus group discussions to learn about transportation needs and concerns in neighborhoods. KAT maintains an on-line FAQ list with responses to continue the dialogue with riders. Most recently the city hosted a neighborhood South Knoxville Open House that KAT, UT, local developers, and others participated in on February 13. Of the four project topics addressed at the open house two focused on transportation: Sevier Avenue streetscapes and the Pedestrian/Bicycle Bridge across the Tennessee River. Knowledgeable representatives were available to discuss projects with residents and story boards and post-it-note comment areas were also provided throughout the room. Over 250 people from the south Knoxville Waterfront communities attended the meeting.





### ***Removing Physical Barriers to Communities***

The Tennessee River is a major barrier to connectivity for active transportation users. Although there are three highway bridges that cross the river in Knoxville at Gay Street, Chapman/Henley Street, and Alcoa Highway, these bridges lack safe, protected walking and biking facilities or serve a single destination. The most centrally located South Knoxville connection, Chapman Highway/Henley Street experienced 2 pedestrian fatalities from 2019 – 2022 and a crash MVM over 3 times the statewide average for similar roadway facilities. For most active transportation users, the traffic volume, travel speeds, and lack of protected facilities eliminate this option from consideration resulting in more people in motorized vehicles on the highway.

Based on the model analysis developed to evaluate traffic operations for this project, the Bike and Pedestrian Bridge would result in a mode shift reducing the number of daily vehicles on Chapman Highway by 4,033 cars. Having access to a fully protected active transportation river crossing will encourage more users, enhancing their health, and improving air quality in the surrounding underserved communities.

### ***Transportation features Increasing Access for non-motorized travelers***

Since 2014, the City of Knoxville has had a Complete Streets Policy in effect that applies to all public and private street design, construction, and retrofit projects. Complete streets are planned as part of the redevelopment of the Down River area in the South Knoxville Waterfront similar to projects completed in the other areas. The surrounding roadway network will be improved to accommodate all users, making access to the pedestrian and bicycle bridge even more convenient for residents. The potential for developing a transit traffic circle near the bridge landing to facilitate synergies between transit and active transportation will be evaluated in the future to determine a strategy that meets the needs of users and transit equipment.

During the project design and construction phase, the City of Knoxville and the University of Tennessee will evaluate opportunities to develop some type of cost-effective shuttle service to South Knoxville Waterfront communities, UT, and underserved neighborhoods north of the river to the new bridge. During peak periods, the shuttle might run a fixed route and operate as a mobility on demand service during the off-peak hours. The shuttle would make it convenient for residents to connect to the Bike and Pedestrian Bridge enhancing access to jobs, cultural and social opportunities, and education and training services.

### **Economic Competitiveness and Opportunity**

Expanding economic opportunities and community prosperity is an essential purpose of this project. The genesis of the South Knoxville Waterfront Plan, a driving force for the Bike and Pedestrian Bridge project, is the economic revitalization of South Knoxville's Waterfront communities. The bridge project will generate economic benefits on both sides of the river and will provide vulnerable residents

equitable access to low cost, reliable and safe transportation, significant for lower-income residents trying to achieve economic mobility and connections to jobs, education, and more affordable housing options. This bridge will help students who participate in the *UT Promise* scholarship program which guarantees free tuition and fees for qualified Tennessee residents attending the University. Students with a family household income of less than \$60,000 will have an affordable and safe transportation choice so they can avoid parking fees, fuel costs, and other motorized travel expenses while completing their college education at UT.

### *Promoting long-term economic growth, tourism, and economic benefits*

Once the bridge is completed there will be a safe convenient option to walk or bike across the Tennessee River to reach destinations and connect with transit services allowing underserved community residents to reach a larger area more efficiently for affordable retail, medical care, and take advantage of recreational and sports facilities and cultural and social amenities in Knoxville. Public and private investments along the Up and Mid River areas of the waterfront where the vision implementation initially started has generated economic benefits from new housing construction, entrepreneurial investments in unique shopping and retail, and renovated industrial buildings that now house restaurants, office space, and recreational businesses in the area. A similar development template is expected in the Down River area leveraged by the bridge.



Active transportation is transforming Knoxville. The Bike and Pedestrian Bridge will significantly improve equitable connectivity to outdoor assets in South Knoxville for underserved and disadvantaged residents. The Urban Wilderness has 50 miles of trails in the middle of the city connecting 10 city parks, 3 historic sites, a major nature center, and a world-class mountain bike park. The Urban Wilderness attracted 303,782 visitors and \$52 million in tourism revenues in 2021.<sup>8</sup>

Mountain biking festivals and classes at the Ijams Nature Center along with walking and cycling adventures continue to attract a growing number of tourists, creating additional economic opportunities and new business ventures to the area. In 2022 the USA Cycling Professional Road National Championships were held in Knoxville and the event will return again in 2023 attracting thousands of tourists and generating millions of dollars for the local economy.

The bridge will make it easier for residents and tourists to use active transportation to connect with the riverfront and outdoor facilities in South Knoxville expanding the economic impacts of the revitalization efforts in this area and creating new employment and businesses opportunities for residents. A map of Knoxville greenways can be found at [www.cityofknoxville.org/greenways](http://www.cityofknoxville.org/greenways).

As more people are attracted to this area, neighborhoods once identified as areas of “historic underinvestment” are experiencing new development and growth in property values.<sup>9</sup> The table below shows the appraised value of both vacant property (parcels) and buildings and improvements in 2000, 2010, and 2021 over the four South Knoxville Waterfront census tracts. The total increase in value for improved properties in these 4 census tracts from 2000 – 2021 is over \$326 million.

<sup>8</sup> “The Knoxville Urban Wilderness Trail System and Baker Creek Preserve Bike Park: Profile of Users and Physical Activity,” Howard H. Baker Jr. Center for Public Policy, University of Tennessee, January 2023.

<sup>9</sup> “The Climate and Economic Justice Screening Tool,” White House Council on Environmental Quality, February 2022, Knox County, TN, census tract 24, compiled January 2023.

Census Tract	Appraisal Year	Total Appraised Value - Parcels			Total Appraised Value Buildings and Improvements		
		2000	2010	2021	2000	2010	2021
8		\$14,132,300	\$25,924,100	\$37,083,900	\$67,375,800	\$122,611,500	\$161,019,300
22		\$16,158,800	\$32,956,800	\$30,553,400	\$58,960,300	\$94,587,000	\$125,774,900
23		\$17,843,400	\$31,612,900	\$32,441,700	\$65,624,200	\$99,036,300	\$119,122,900
24		\$21,587,700	\$45,864,400	\$45,503,500	\$53,986,200	\$108,457,100	\$165,517,100
<b>TOTAL</b>		<b>\$69,722,200</b>	<b>\$136,358,200</b>	<b>\$145,582,500</b>	<b>\$245,946,500</b>	<b>\$424,691,900</b>	<b>\$571,434,200</b>

Source: Knox County Tax Roll Snapshots; Compiled by: Knoxville-Knox County Planning; 1/30/2023

**Promote Public and Private Investments Land Use to achieve equitable development**

The University of Tennessee (UT) is a major economic driver in the State of Tennessee and in Knox County the University employees over 15,000 and generates \$1.7 billion in annual income.<sup>10</sup> Current student enrollment is 33,700 and is forecast to reach 46,000 by 2030.<sup>11</sup> Expanded access to higher education “creates more economic opportunity for residents and strengthens the state’s economy more than anything else the state can do”.<sup>12</sup> As the University continues to grow, careful considerations are being made to invest in UT’s future built environment to achieve their missions. To that end, additional classroom space, research facilities, housing, and the mobility connections to sustainably move students and employees throughout the campus is essential.

The University recognizes the importance of building safe and accessible pedestrian connections between campus hubs, the river, and a “north-south corridor connecting the South Waterfront neighborhoods with the Melrose interdisciplinary hub.”<sup>13</sup> To facilitate the campus growth, there will be adaptive reuse of some facilities to support interdisciplinary hubs for learning and research and some conversions to more pedestrian and bike friendly streets. The Bike and Pedestrian bridge will support a mode shift from motorized vehicles reducing traffic congestion on connecting roadways and within campus, improved safety for students and employees, reduced demand for parking facilities, and lower emissions and fuel consumption.



The development patterns for the Down River neighborhoods around the Bike and Pedestrian Bridge will utilize transportation efficient land use and design similar in character to many older historic towns. These compact and walkable neighborhoods will include a range of housing densities that consider the housing trends that are more prevalent today, open spaces and complete streets that foster more biking and walking opportunities. Some of the existing housing in the Down River neighborhoods within two blocks of the new bridge already have some of these design characteristics including smaller lots and mixed uses.

Knoxville is committed to increasing the supply of affordable housing throughout the city and has built 328 new affordable housing units in south Knoxville waterfront neighborhoods in the past four years.

<sup>10</sup> University of Tennessee Estimated Economic Impact FY 2018”, Center for Business and Economic Research, February 2019.  
<sup>11</sup> “The University of Tennessee Knoxville Master Plan 2023: Executive Summary,” February 2023.  
<sup>12</sup> “Well Educated Workforce Key to State Prosperity,” Noah Berger and Peter Fisher, Economic Policy Institute, August 22, 2013.  
<sup>13</sup> “The University of Tennessee Knoxville Master Plan 2023.”



Southside Flats and Young High Flats serve families with incomes at or below 60 percent of the area median income and ensure equitable access to quality affordable housing near high opportunity areas on the waterfront. The city has negotiated a workforce housing set-aside with the new LIV development to provide a percentage of the apartments for families with incomes at or below 80% of the area median income. This development will construction 321 multifamily units, 32 of which will be affordable workforce apartments located a block from the Bike and Pedestrian Bridge.

### State of Good Repair

The new Bike and Pedestrian Bridge will be owned and maintained by the City of Knoxville. The city practices a proactive approach to regular maintenance work related to structures to ensure they are kept in a state of good repair for the benefit of the traveling public. The city will perform a bi-annual inspection of the bridge and landing structures on both sides of the river to ensure the structure remains in a state of good repair.

Maintenance requirements of the bridge will need to address the structure itself, as well as the systems that are on the bridge. The number of systems requiring maintenance is small, consisting primarily of the drainage and lighting systems. Drains and drainage piping will require periodic cleaning to keep them open and free-flowing, and occasional repairs to prevent drainage from impacting the structure. Lighting systems will require periodic upkeep including fixture replacement as necessary. The walking/riding surface is expected to require replacement, but only after approximately 50 years of service.



### Partnership and Collaboration

The South Knoxville Waterfront Bike and Pedestrian Bridge was conceived during a community visioning process with a goal of taking the South Knoxville Waterfront from an isolated and underserved area of the city to a regional and even national asset for all users and residents. Equity has been central to this process from the beginning and is a core value of the City and University. The core communities in Knoxville are diverse and people have recognized equitable access must provide new

affordable transportation choices that engage underserved communities which is a central purpose of this bridge. Many public and private partners are working together to build the Bike and Pedestrian Bridge. Community meetings and discussions continue to occur regularly to ensure the plan reflects the desire to adapt to changing conditions and needs. However, the strength of the community process and vision for the South Waterfront has remained constant since its adoption.

### *Collaboration with Public and Private Entities*

This project has been developed by a diverse group of partners including residents of the South Knoxville Waterfront Communities; Private developers; City of Knoxville departments including Engineering, Economic Development, Parks and Recreation, Office of Sustainability, and the Webmaster and Photographer; the University of Tennessee; Tennessee Department of Transportation, Knox County Government; Knoxville Area Urban League; Knoxville Community Development Corporation, regional agencies including the Knoxville Transportation Planning Organization; Knoxville GIS; Knoxville Knox County Planning; Greater Knoxville Chamber of Commerce; and volunteer organizations including Appalachian Mountain Bike Club, BikeWalk Knoxville who have joined forces to try and make the Bike and Pedestrian Bridge a reality for Knoxville and the region. The City's ongoing public engagement process that began in 2005 continues to involve all of these partners and neighborhood residents in planning and decision-making.

As the Bike and Pedestrian Bridge project moves forward the City of Knoxville will ensure continued opportunities for all residents, particularly residents from APP, HDC, and Justice 40 communities to ensure their input is carefully considered. Community input will help to determine bridge lighting, any gateway features, and signage. Community support for this project can be found in the Letters of Support appendices included in this grant application.

### Innovation

The South Waterfront Bicycle and Pedestrian bridge includes a 710' long clear span arch over the Tennessee River. The innovative use of a long arch will be a first for the Knoxville region, and this design essentially eliminates impacts on the river environment – one of the most important natural resources in our region. In order to construct the arch with minimal impact to the river, the design will utilize an innovative erection technique that stages the construction operations from the two riverbanks. In general, the construction would utilize a series of towers and tiebacks that cantilever out from each riverbank. Sections of the arch would be erected simultaneously from both ends until a final arch piece is placed over the center of the span. This innovative construction technique has not been used in the Knoxville region.

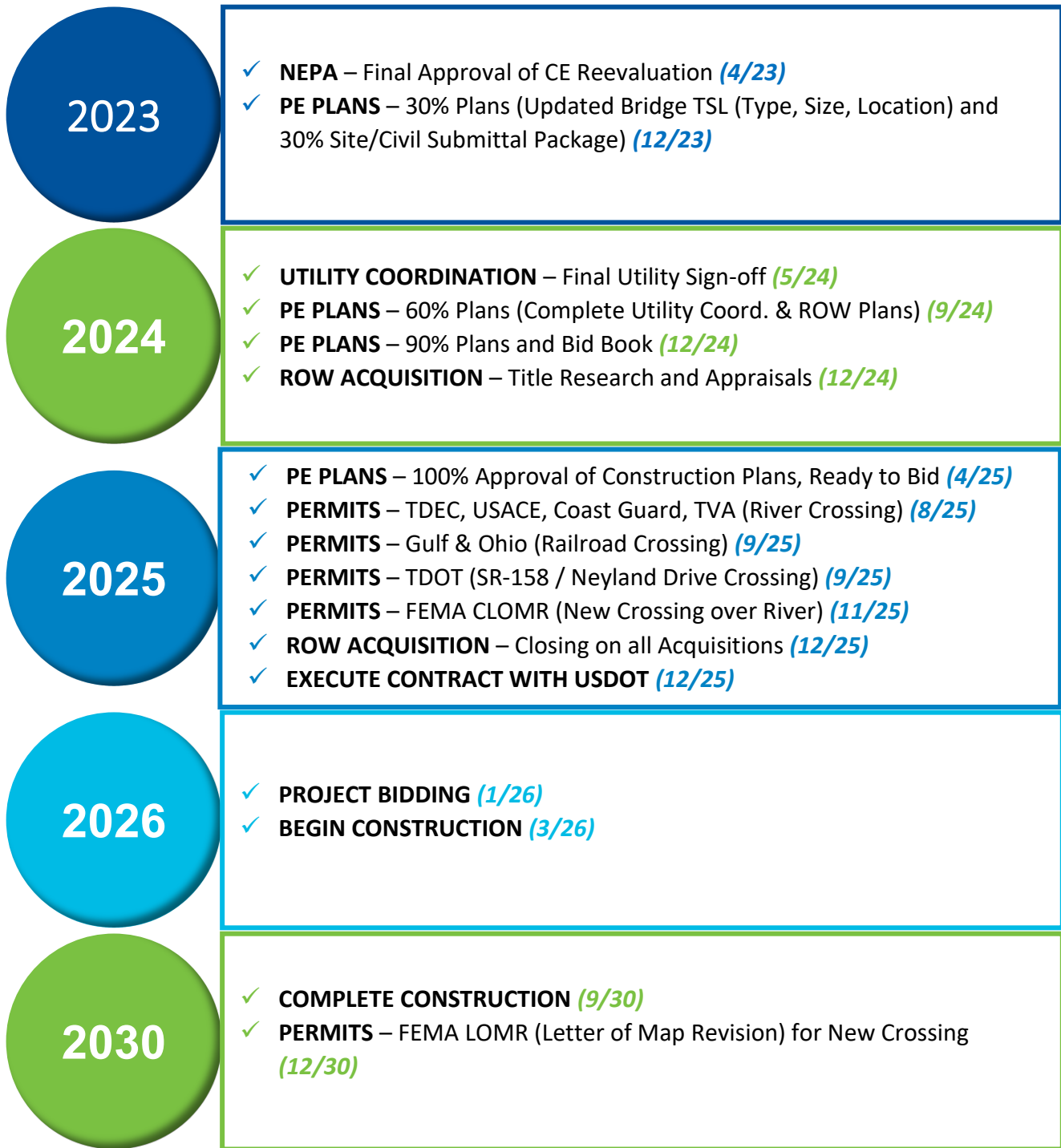
The city will also focus on innovative materials in order to significantly enhance the operational performance and service life of the bridge structure. For the bridge, our design team will explore the use of corrosion resistant reinforcing in the form of GFRP bars and/or stainless-steel rebar, designed in appropriate locations where the risk of corrosion and deterioration are greatest. For members of the bridge constructed with steel, the strategic use of more highly corrosion resistant materials, such as ASTM A709 grade 50CR steel will be considered to reduce long term maintenance costs and extend the useable service life of the structure. Key bridge elements, such as the tension hangers supporting the deck under the arch ribs would be ideal locations were innovative, high-performance materials would provide significant enhancements to the operational performance of the bridge.





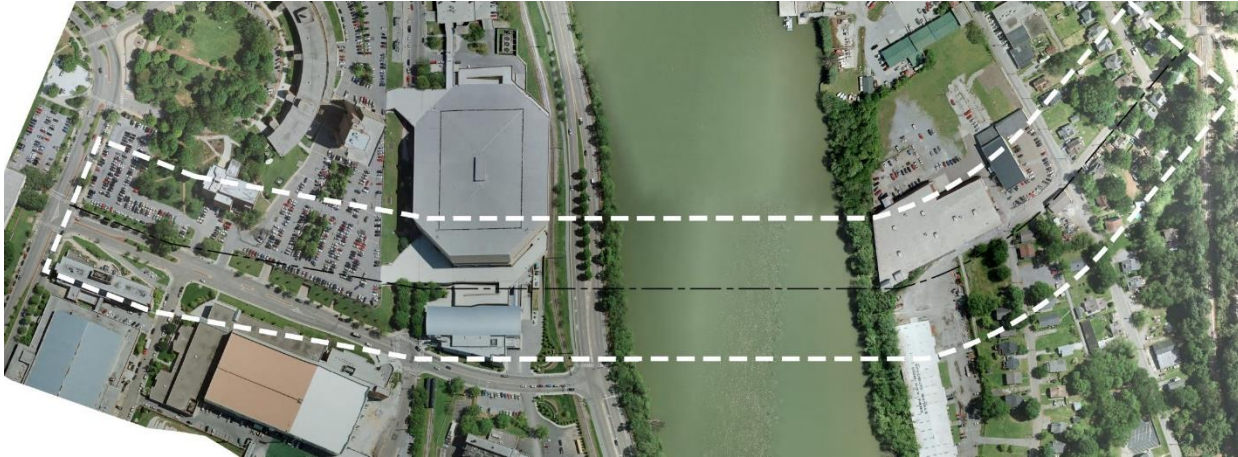
# Project Readiness

## Project Schedule



## Environmental Risk

The City of Knoxville successfully secured a Tennessee Department of Transportation D-List Categorical Exclusion (CE) in 2014 for the Bike and Pedestrian Bridge project boundary shown in the graphic below. The limits of the CE boundary continue to be maintained for this project. The approved CE was coordinated with input from the Tennessee Department of Environment and Conservation (TDEC), U.S. Army Corps of Engineers (USACE), U.S. Fish and Wildlife Service (USFWS), Tennessee Wildlife Resource Agency (TWRA), and the State Historic Preservation Office (SHPO). The fundamental design concept for the long span arch bridge includes a clear span over the river with foundations on each bank. This design eliminates many environmental impacts and cost implications that would have otherwise occurred if foundations were built in the water.



In 2017, the city recognized that the CE timeframe would expire and procured technical services to complete a re-evaluation of the environmental document. The document was subsequently approved again. In 2023, the City initiated a second re-evaluation of the CE, final approval is expected in April 2023.

The CE approval is premised on the understanding that no bridge piers are to be constructed in the river. In addition, design issues such as pier placement, laydown areas, and haul road access to the bridge site must be carefully evaluated with respect to Section 106 compliance included with the approved CE.

There are no right-of-way acquisitions required for the bridge development on the north side of the Tennessee River. There are eleven parcels located at the south bridge landing to be acquired for project right-of-way. Two parcels are easements owned by the Tennessee Valley Authority (TVA), a public power generator. Of the remaining parcels there are 2 commercial parcels, 3 vacant residential parcels, 3 residential relocation parcels and 1 small business relocation parcel. All right-of-way acquisitions will be completed in accordance with 49 CFR part 24, 23 CFR part 710 and other applicable legal requirements. The City of Knoxville will follow all applicable requirements of the Uniform Relocation Act in carrying out this project.

## State and Local Approvals

This project is currently programmed in the TIP and will be updated in the new TIP cycle.

## ***Federal Transportation Requirements Affecting State and Local Planning***

This project has been programmed in the TIP and will be updated in the new TPO TIP cycle.

## Required Permits and Approvals

The city previously secured a Tennessee Department of Transportation D-List Categorical Exclusion (CE) for this project. The previously prepared analysis included cultural and natural resources, community impacts, environmental justice, hazardous materials evaluation, and consideration of impacts to park land. Once the final bridge design is completed, the City of Knoxville will approve building permits, stormwater impacts, and site plan compliance with local planning ordinances. A list of other permits and approvals are identified below. The time required to submit and secure the approvals and permits have been incorporated into the project schedule. The City does not anticipate the approvals or permits requiring additional time beyond what is included in the project schedule.

1. National Pollutant Discharge Elimination System Permit
2. Construction General Permit (CGP) with Storm Water Pollution Prevention Plan (SWPPP) from TDEC
3. ARAP Permit may be required from Tennessee Department of Environment and Conservation (TDEC)
4. Local Government Permit for construction on TDOT right-of-way
5. Air rights permit for crossing TDOT right-of way
6. United States Army Corp of Engineers (USACE) Permit
7. Review and approval by the Tennessee Valley Authority (TVA) for 26A permit for shoreline construction
8. Review and permit from the Coast Guard to confirm required clearances over the navigable channel of the Tennessee River
9. Review and permit from Gulf and Ohio Railroad to confirm required clearance over their railroad tracks.
10. Review Floodplain with City of Knoxville to verify no rise impact
11. Submittal of Conditional Letter of Map Revision (CLOMR) to FEMA for new bridge crossing over the Tennessee River
12. The Project is currently programmed in the TIP and will be updated in the new TIP cycle
13. Design review and approval from the TDOT, the University of Tennessee, and the City of Knoxville

## Assessment of Project Risks and Mitigation Strategies

Four bridge concepts were developed and presented to the public and project stakeholders and a final concept was selected. The Concept Plan for the bridge was completed in 2011 by Lawrie and Associates. The bridge will avoid piers in the Tennessee River and meet various clearance requirements for river navigation, existing utilities, and rail and road infrastructure. The concept plan was used to successfully obtain a D-List Categorical Exclusion for the bridge and established the CE boundary for the project that continues to be maintained. The length of the long span arch over the river and the northern and southern tie connections were established in this plan and remain consistent. The bridge did not progress seven years ago because of funding constraints.

Cost estimates for the project were revised in November 2022 to account for current conditions and adjustments by Modjeski and Masters Bridge Engineers. This firm has significant design and cost estimation experience on arch bridges which are similar to the bridge concept for this project. Modjeski and Masters designed the Second Blue Water Bridge in Michigan and the I-74 River Arch Bridge in Iowa that opened in December 2021. The estimated cost for the Bike and Pedestrian Bridge is \$70 million.

Due to some uncertainties with material, labor costs and supply issues, there are some risks associated with the project schedule and budget. A 15 percent construction contingency has been included in the budget to address unforeseen material, labor, and supply cost impacts. This approach should ensure the project budget captures prices at the start of construction and the schedule for design and construction will accommodate limited delays if intermittent shortages occur. In accordance with the RAISE NOFO, the City of Knoxville will cover cost overruns that exceed the project contingency budgeted.

Meetings to discuss this project continue to be held with project area residents, business owners, and other stakeholders. Many of the participants consulted as part of the ongoing public engagement activities for this project are from underserved communities. Their input was used to identify project priorities, community needs and to prioritize plan investments. As the project proceeds after the award of the RAISE grant, the City of Knoxville, the University and the bridge design team will hold extensive public meetings and ensure residents from disadvantaged neighborhoods are deeply engaged in the bridge design and development. The city and the University are committed to a vigorous public engagement process.

### Technical Capacity Assessment

The staff at the City of Knoxville's Engineering Department have managed numerous federally funded projects following the Local Government Guidelines from Tennessee Department of Transportation (TDOT). These projects include Cumberland Avenue Streetscapes, Holbrook Drive Bridge Replacement, Jackson Avenue Streetscapes, and First Creek Greenway. All of these projects required the use of our experience in all phases of project development as set forth in these guidelines. In addition to these transportation projects, the City has successfully managed a Department of Housing and Urban Development (HUD) Community Development Entitlement Grant for nearly forty years and has experience managing other federal funds from the Department of Commerce, Environmental Protection Agency, Federal Aviation Administration, and the U.S. Department of Energy.

