THE CITY OF CHATTANOOGA, TN

WILCOX CORRIDOR IMPROVEMENTS:
WILCOX TUNNEL EXPANSION

APPLICATION FOR TIGER DISCRETIONARY GRANT FUNDING

JUNE 2015

Table of Contents

1. Project Description

1.1 Overview

Wilcox Boulevard is an urban minor arterial carrying 16,000 to 18,000 average daily traffic (ADT) depending on location. This corridor is a vital link in the east-west movements for the City of Chattanooga and the metropolitan area. The Wilcox Tunnel Expansion (the "Project") would create a new two lane eastbound tunnel, and convert the existing tunnel to a single westbound lane. Improvements to the Wilcox Boulevard corridor would improve the regional traffic flow through the center of the metropolitan area. The need for this improvement is greatly increased by recent economic development in the Enterprise South industrial complex that includes large employers Volkswagen, Amazon, and other international companies. Disadvantaged residents who live in the immediate neighborhood of Wilcox tunnel need to be able to access economic opportunities in the region and live in neighborhoods that are more livable. Improvements to the Wilcox corridor can provide an improved direct connection between this area and downtown Chattanooga thereby providing ladders of opportunity for low income residents in the area to access middle class job prospects. Other east-west transportation options require traversing over the south end of Missionary Ridge (I-24) or the north end (Bonnie Oaks Drive).

The Wilcox Tunnel, with a level of service (LOS) E, is widely viewed as deficient, a characterization that is borne out by a relatively high level of crashes within the Tunnel and on its approaches. The Tunnel is narrow, devoid of shoulders and does not meet standards of the National Fire Protection Association (NFPA). The current facility is sub-standard, and since August 2009 cannot accommodate bus traffic, nor can it be used by bicyclists or pedestrians because of safety concerns.

The City of Chattanooga has made improving conditions at the Wilcox Tunnel an urgent priority. The Project will improve the multi-modal use of the corridor including buses, bicyclists, and pedestrians. It will also greatly improve emergency vehicle access including access to local hospitals. The Project also entails improvements to access roads from Chamberlain Avenue to Greenwood Road (a total distance of 0.85 miles, including the 1,300 foot Wilcox Tunnel). The improvements will increase capacity and safety in the tunnel and allow CARTA (Chattanooga Area Regional Transportation Authority) to operate buses through this corridor, providing a much more direct route for passengers. Because pedestrians and bicyclists will also be allowed to use the improved Wilcox Tunnel, the Project will significantly increase accessibility and mobility for a large number of City residents living within an Economically Distressed Area. The fact that automobile traffic is the only vehicle type currently allowed forces many households that can't afford to own an auto to take much lengthier and inconvenient bus routes, or not travel at all.

The corridor is bounded to the west by the Tennessee River and the east by I-75, with Missionary Ridge in the middle. Traffic passes through Missionary Ridge via the Wilcox Tunnel, a two-lane facility built in 1931. Missionary Ridge, while a defining landmark for the City, represents a barrier to efficient and alternative routes between the east and west portions of the City. Improving this vital east west link would enhance the network of regional east west corridors, including Brainerd Road (US Route 11 and

64, State Route 2), I-24, and Ringgold Road (US Route 41, US Route76, and State Route 8), all farther south. Equally impactful as the positive impact on the regional street grid, improving the Wilcox Tunnel also will decrease travel times and cost for citizens in some of the City's most economically distressed neighborhoods. The Project will also improve access to the thousands of high paying jobs at the Enterprise South industrial complex, as well as opportunities in the mostly commercial zones along Shallowford Road / US 153 and Amnicola Highway/ US 58. Additionally, the City of Chattanooga recently purchased the former Harriet Tubman public housing project for future light industrial economic development. Access to these new industrial opportunities would be substantially enhanced by the tunnel improvements and especially as future development of the site complements industries in the Enterprise South area.

1.2 Project Description

Wilcox Boulevard extends from Amnicola Highway (at the river's edge) to Shallowford Road, where Wilcox Boulevard actually turns into Shallowford Road, which then continues on to both US 153 and then I-75. The Project Area is identified in Figure 1. The Project would create a new two lane eastbound tunnel, and will convert the existing tunnel to a single westbound lane. The Project will provide shoulders and improved vertical clearance, provide modern fire life safety systems, and allow multi-modal traffic including buses, pedestrians and bicyclists. The increased safety will provide motorists with an attractive and shorter alternate route, thus generating significant travel time savings.

Figure 1: Wilcox Tunnel Location

The Project will include the following major components:

- Building a new two-lane tunnel for east bound traffic. The new tunnel will include two 12 foot lanes, shoulders, bicycle lanes, and pedestrian sidewalks. The tunnel will have 16.5 foot vertical clearance, sufficient for buses, emergency vehicles and trucks. This work will involve the following steps:
    - Excavate the tunnel to the proper shape and install temporary support as the excavation proceeds. The temporary support will be designed by the contractor, but will probably include rock bolts and shotcrete (pneumatically applied concrete);
    - Install a waterproofing membrane over the shotcrete. The membrane will be double welded and tested as it is installed. A geotextile will be installed behind the membrane to allow drainage and protect the membrane;
    - Place a cast-in-place concrete liner over the membrane;
- The new tunnel would be compliant with NFPA 502 by adding fire life safety improvements, including:
    - Ventilation (four banks of two jet fans);
    - Signage (electronic message signs to prevent entry into the tunnel in case of emergency);
    - Closed circuit television (CCTV) cameras at key points to monitor traffic and emergency conditions;
    - Carbon monoxide detectors (linked to jet fans to decrease carbon monoxide levels);
    - Fire and police communications, and connection of the fire life safety information to the City intelligent transportation system (ITS) and 911 centers;
- Reconfiguring the existing Wilcox tunnel into a one-lane, west bound tunnel by converting the tunnel from two to one lane will increase the vertical clearance to 14.5 feet, sufficient for buses, emergency vehicles and most truck traffic. This will also provide space for sidewalks and bikeways. The work will include:
    - Constructing a new liner
    - Re-constructing the road way
    - Improving the stormwater drainage system
    - Adding both pedestrian and emergency sidewalks, and signage for bicyclists

- And adding fire life safety improvements in accordance with NFPA 502 standards as described above;

- Emergency egress would be provided by a single cross passage connecting the two tunnels at their approximate mid-point. Emergency egress would involve egress from the distressed tunnel into the adjacent tunnel. The cross passage will be constructed in manner similar to the main tunnel (excavation and support; water proofing membrane; concrete liner).

- The approach roadways on both sides of the tunnel will be improved. The eastern approach to the Tunnel would be improved to a four lane highway with a landscaped median. As shown in Figure 2, the eastern approach would split as it approaches the tunnel. The western approach would include a new two lane eastbound approach. The westbound approach would utilize the existing roadway with addition of shoulders and sidewalks as necessary. A drawing of the Alternative 3C, Option 1 is presented in Figure 3.

- Improving the approach roads on both sides of the tunnel, including elimination of dangerous intersections and improvement of sight lines. The Project will also improve the visual aspects of the road with a landscaped median and improve the water quality of the run-off from the project area.

Figure 2: Map of the Proposed Expanded Wilcox Tunnel

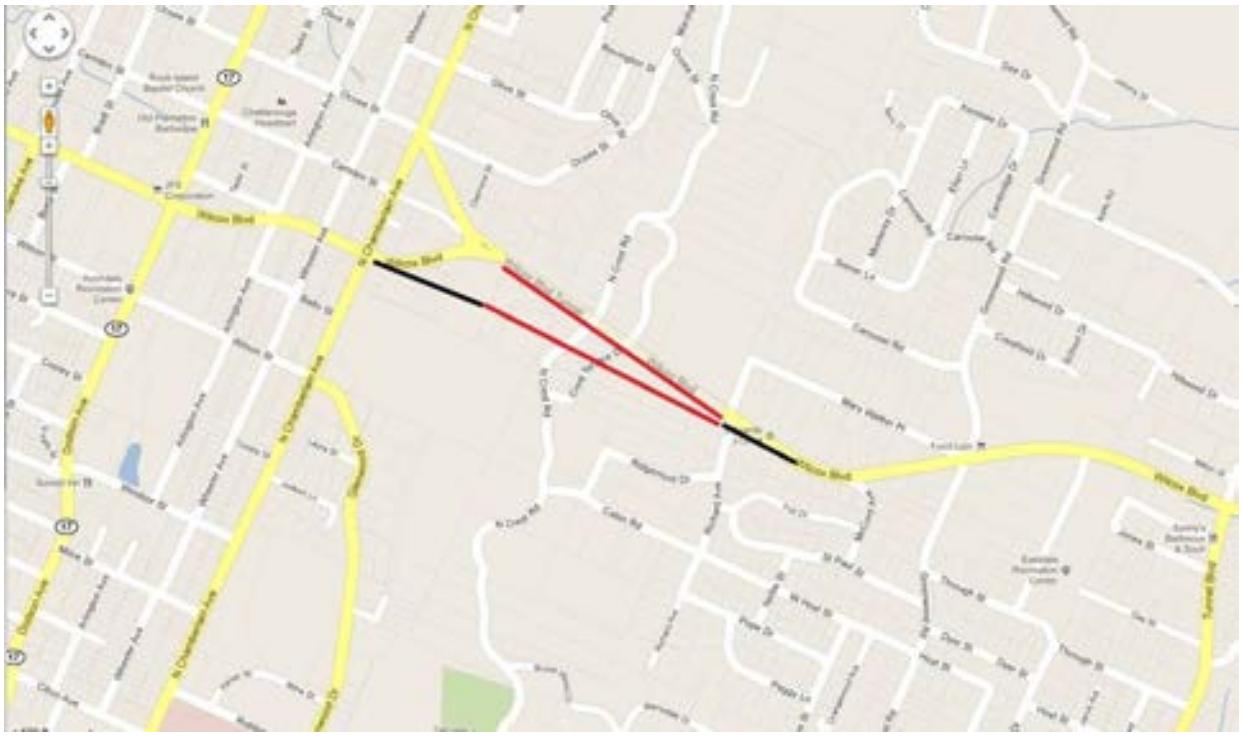
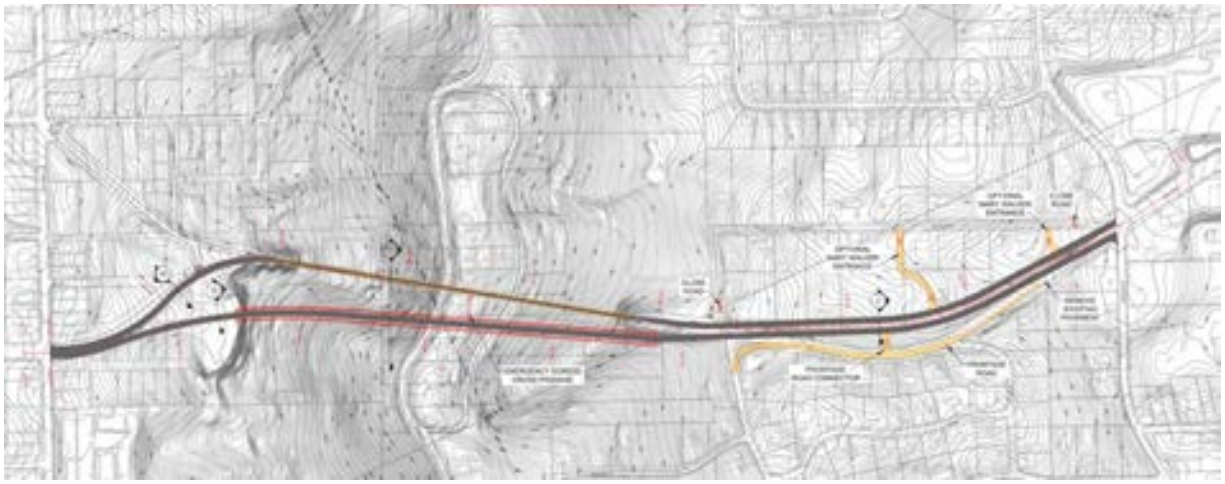
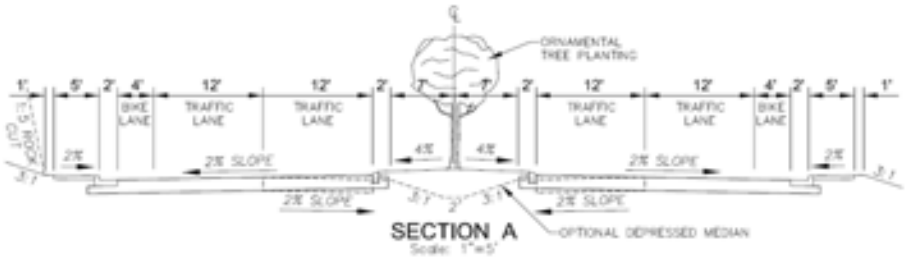
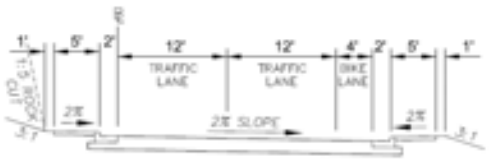


Figure 3: Schematic of the Proposed Expanded Wilcox Tunnel





SECTION A



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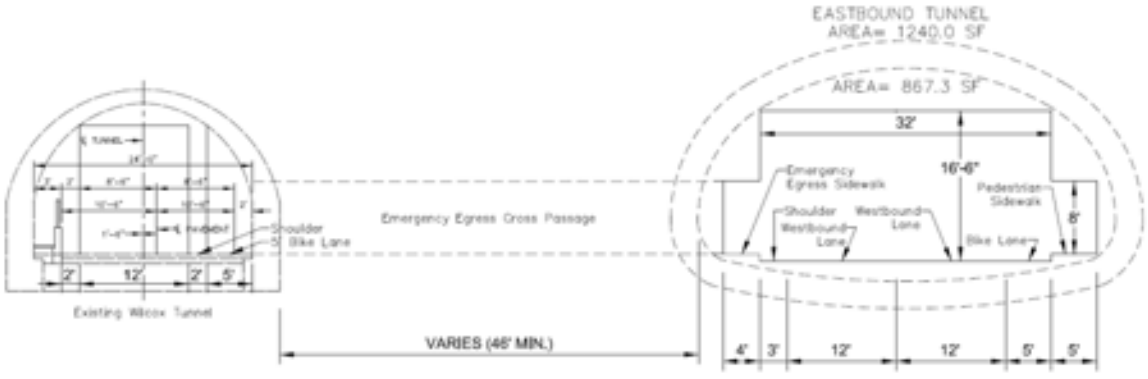


SECTION C

1.2.1 Why this Project?

- Wilcox Boulevard, including its linkage with Shallowford Road, is a vital link in Chattanooga's east-west traffic system through Missionary Ridge. Shallowford Road has recently been upgraded to four lanes. The tunnel is a major "choke point" on Wilcox Boulevard. As demonstrated in the benefit-cost analysis, this Project will facilitate significant travel time savings *and* fewer vehicle miles traveled by improving this direct route.

- The Project provides regional benefits by improving access to Chattanooga's urban core from Enterprise South Industrial Area and the Chattanooga Regional Airport, thereby encouraging investment, economic competiveness and job creation in the region. It will therefore make a significant contribution to the economic vitality of Chattanooga by providing additional ladders of opportunity for low income residents and increasing access to middle class job opportunities.

- The tunnel is a narrow facility devoid of shoulders and ventilation, and limited in vertical clearance. The tunnel also does not meet current safety or fire standards (NFPA 502). The limited clearance prohibits access by buses and fire trucks. The concern over safety and poor air quality within the tunnel has led to the prohibition of pedestrians and bicyclists.

- The Project would create a new two lane eastbound tunnel, and the conversion of the existing tunnel to a single westbound lane. The Project will provide shoulders and improved vertical clearance, provide modern fire life safety systems, and allow multi-modal traffic including buses, pedestrians and bicyclists. The improvements will provide motorists with a safe, economical and more direct route.

- The Project will also provide a great benefit to the low-income communities in this Economically Distressed Area. These communities currently face significant transportation challenges, which in turn limit private sector investment in residential and commercial opportunities in the area. The expanded tunnel will once again allow buses, emergency vehicles, pedestrians and bicyclists, greatly improving accessibility for the residents of these communities. This includes access to two hospitals located west of Missionary Ridge, as well as to middle class jobs in the downtown core and commercial zones.

- Besides improving accessibility for all residents of the Chattanooga region, the tunnel expansion will also increase the network of bicycle and pedestrian routes, helping fulfill a City objective to increase sustainability and decrease the number of motorized trips by providing the infrastructure that accommodates alternative modes of transportation.

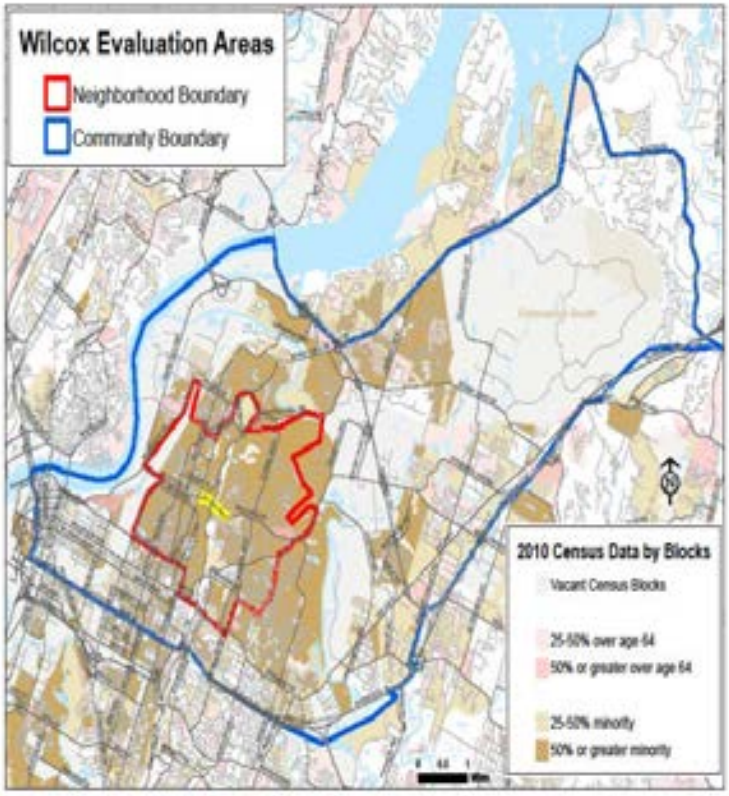
1.2.2 Benefits to an Economically Distressed Area

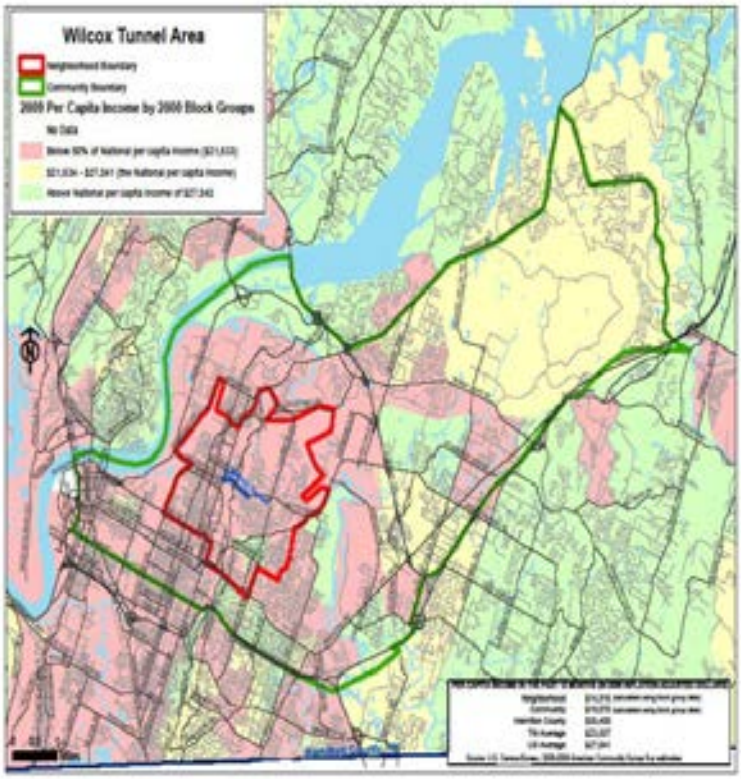
The Project lies in an area that is designated as disadvantaged. Chattanooga is located in Hamilton County, whose per capita income is essentially identical to the United States average. However, as illustrated in the map in Figure 4, the Project Area is located in some of the poorest sections of the County. In particular, Census Tracts (2000) 2, 3, 4, 12, and 32, which define a neighborhood boundary surrounding the Project Area, had average per capita incomes of $14,916 in 2009, roughly 55% of the national average of $27,041.

The immediate area around Wilcox tunnel has income around 55% of National per Capita income and a minority population greater than 50%

Due to the design of the current Wilcox Tunnel, residents directly in need of access to this corridor via walking, biking, or transit are not being served. The corridor is a critical connection for residents between downtown and other major employment areas (Chattanooga's urban downtown core, the Chattanooga Metropolitan Airport, and the Enterprise South Industrial Park, home to Volkswagen and Amazon). The limited access provided by the Wilcox Tunnel effectively separates the larger community into two distinctly isolated disadvantaged areas: The neighborhoods of Avondale, Bushtown, Glenwood, Churchville and Orchard Knob, as well as the neighborhoods of Eastdale, Foxwood Heights and North Brainerd, which cannot access public facilities provided for the larger community on either sides of the tunnel. The proposed Wilcox Tunnel expansion will provide improved access to higher paying jobs for residents of these low income areas, with the associated opportunity to ascend the ladder to the more equitable middle class.

Figure 4: Income and Population Diversity Map of Wilcox Tunnel



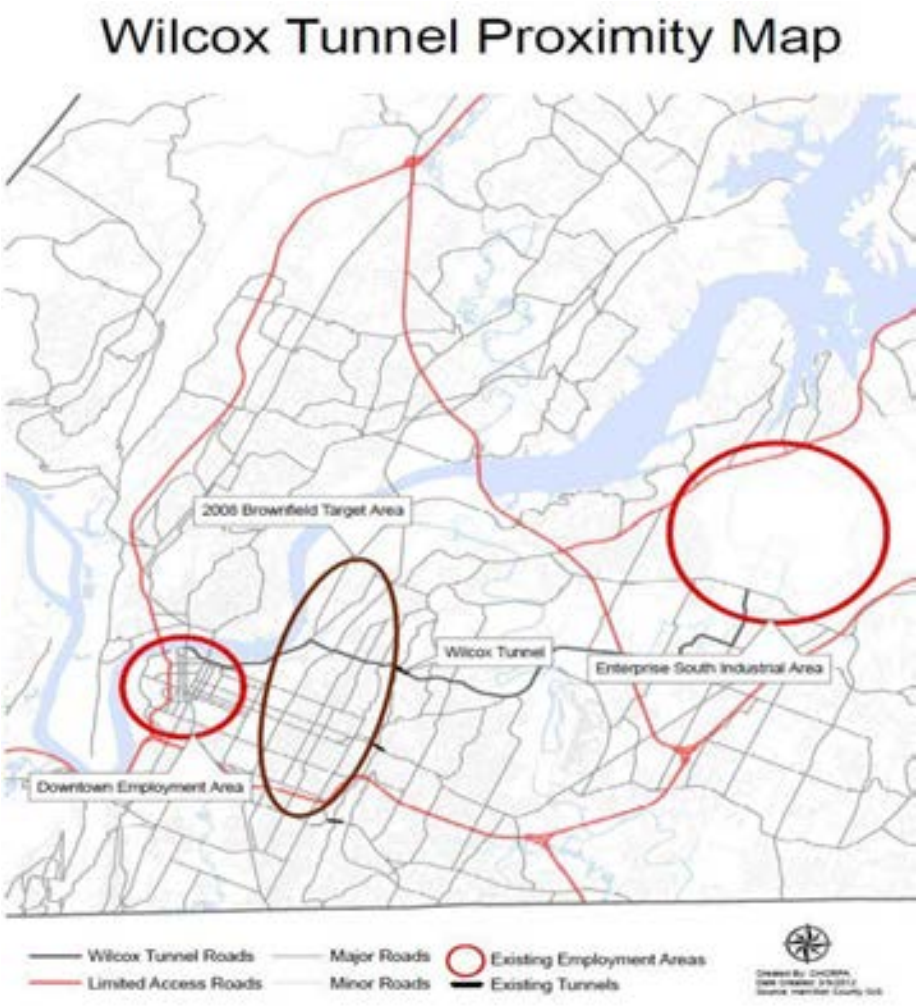


1.3 Challenges and Opportunities

It is hard to overstate the degree to which the Wilcox Tunnel, in its current condition, is seen as inadequate to serve the needs of Chattanooga. As described in more detail below, upgrading the Tunnel will address the TIGER Infrastructure Grant primary and secondary criteria with significant benefits in all specified long-term outcomes. Further, it can be argued that the Wilcox Tunnel could inhibit future growth in Chattanooga. Wilcox Boulevard is classified as a minor arterial and is considered a regionally significant facility connecting two major employment generators (See Figure 5). The City has been successful in attracting major employers, notably Volkswagen, Plastic Omnium, Gestamp, and Amazon, who have located to the Enterprise South Industrial Park in east Chattanooga. In fact, VW is building an expansion to increase their production line which will provide the opportunity for two-thousand additional jobs. These firms, and other firms located in the area, would benefit from increased accessibility through the Wilcox Tunnel, which will make their location increasingly attractive and

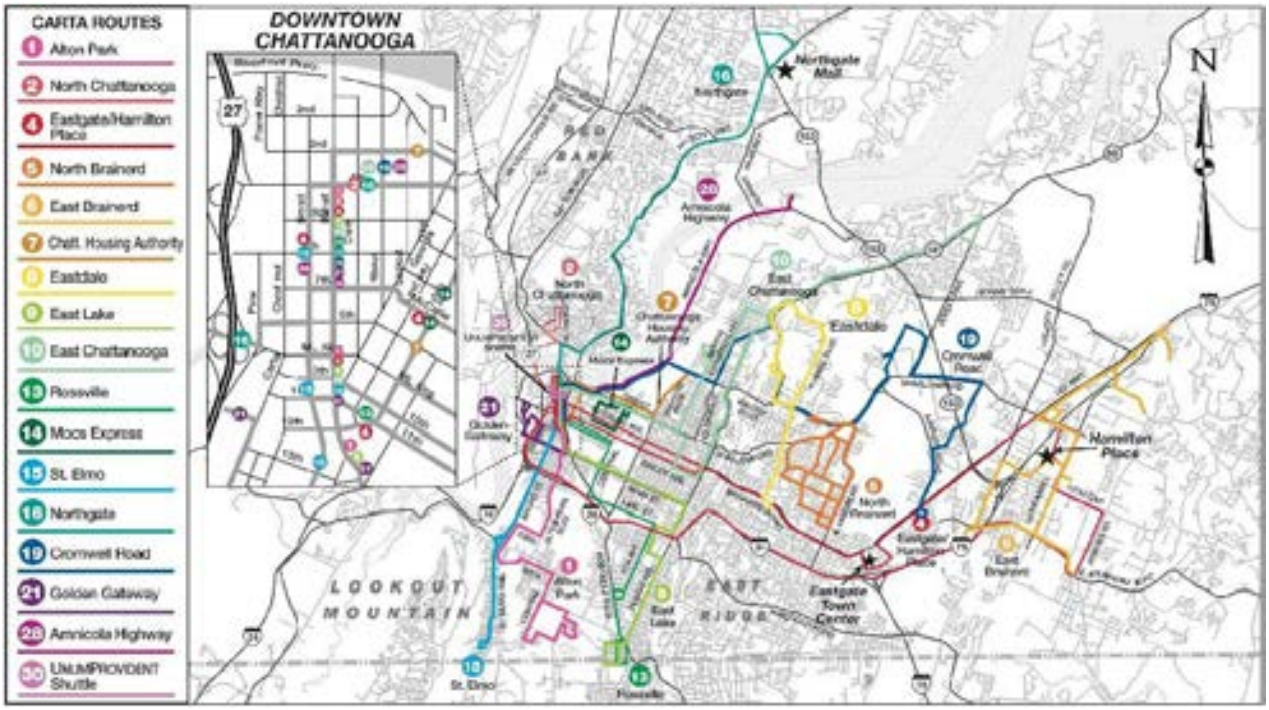
valuable. In addition, this corridor serves as a vital link between the downtown commercial district and the Chattanooga Metropolitan Airport.

Figure 5: Employment Centers



One of the major drawbacks of the current Wilcox Tunnel is its inability to serve CARTA buses. As shown in Figure 6, bus service over Missionary Ridge is restricted to CARTA Route 19 (Cromwell Road), which previously passed through the Wilcox Tunnel. The route's current, less direct, route includes going around the north end of Missionary Ridge – a change that adds ten minutes to the typical daily commute of those using that route.

Figure 6: CARTA System Route



The Project presents the opportunity to address what is seen as possibly Chattanooga's most urgent transportation need. Immediate benefits of the Project include both quantifiable benefits (detailed in the benefit-cost analysis) and more qualitative benefits such as addressing the sense of community isolation felt by many residents due to the restricted access provided by the Tunnel. In Appendix B we report testimony of City residents discussing the impact of the current Wilcox Tunnel on their communities. Further, the Project will also allow a considerable improvement to Chattanooga's expanding and popular bicycle route network. As shown in Figure 7, the system is currently deficient with respect to east-west connectivity. The upgraded Wilcox Boulevard Corridor, with its separate bike lanes, will greatly improve this facet of the system and be an important part of the implementation of the pedestrian and bicycle facilities within the City of Chattanooga and identified in the Chattanooga Urban Area Bicycle Facilities Master Plan from October 1, 2001 thru April 2002 (Resolution No. 23445) and updated in the Chattanooga Area Regional Bicycle and Pedestrian Plan in April 2010.

2. Project Parties

The City of Chattanooga and its Department of Transportation is set up to receive funding from the United States Department of Transportation (USDOT) under the TIGER Discretionary Grants appropriation. As such, the City has the legal, engineering, planning, accounting, and other technical and administrative staff to oversee federally-funded transportation projects. The City oversees a complex transportation network, and is in charge of traffic engineering and operations functions. The City also

has a long history of working closely with the Tennessee Department of Transportation on many regionally significant transportation projects such as the Wilcox Tunnel Project.

3. Sources and Uses of Project Funds

Table 1 below outlines Sources and Uses of Funds for the Project. The total costs for the Project are $52.3 million. Of this, the City of Chattanooga, through its Capital Improvement Plan, will be providing $25.0 million or a local match equal to 48%**.** The requested funds under TIGER Discretionary Grants are $27.3 million or 52% of the costs of the Project.

Table 1: Sources and Uses of Funds for Wilcox Tunnel Expansion (in Millions)[1]

Uses of Funds		
Roadway	$3.4	
New Tunnel	$32.0	
Cross Passage	$1.1	
Rehabilitation of Existing Wilcox Tunnel	$1.5	
Fire Life Safety	$3.3	
Contingency	$10.0	
Real Estate	$1.0	
Total Cost	$52.3	
Funding		**% of Total**
Local Match	$25.0	48%
TIGER Discretionary GRANT	$27.3	52%
Total Funding	$52.3	100%

4. Primary Selection Criteria

The Project is described and analyzed below to illustrate that it successfully meets the Primary Selection Criteria outlined by USDOT for TIGER Discretionary Grants. We discuss these measures below, focusing first on the quantifiable economic benefits and costs attributable to the Project.

4.1 Long Term Outcomes

4.1.1 State of Good Repair

The Project will greatly improve a facility that is in need of immediate attention:

- The air quality in the tunnel is poor due to the high levels of Carbon Monoxide and other noxious fumes resulting from vehicle emissions. This is detrimental to drivers and especially

[1] Cost estimates for construction are in 2014 dollars

detrimental to pedestrians and bicyclists. This issue, combined with the inadequate pedestrian walkway has resulted in closure to pedestrians and bicyclists.

- The tunnel does not meet any of the safety requirements of NFPA 502 (Standard for Road Tunnels). This standard encompasses all safety issue related to highway tunnels, including emergency egress, ventilation, fire detection and suppression. Thus, the existing tunnel represents a potentially highly hazardous condition in the event of a tunnel fire or similar emergency.
- The storm water drainage in the vicinity of the tunnel is poor. Storm water flows off Missionary Ridge and into the tunnel (east portal). This represents a highly dangerous condition, particularly in the winter. Ground water also seeps through the tunnel liner onto vehicles and the roadway.
- Voids behind the tunnel liner (documented in previous studies) present a long term structural concern.
- Constructing the expanded Wilcox tunnel will prevent expensive (in terms of travel time and congestion) closures to the existing tunnel to upgrade the existing tunnel to safety requirements set by the NFPA 502 standard.

The Project will improve all the affected intersections along Wilcox Boulevard, including providing adequate sight distance. The Project will also provide shoulders and separate the traffic into east and west bound tunnels. Air quality will be improved by ventilation fans and the "piston effect" created by one-way traffic. Air quality will also be monitored and the ventilation system initiated if standards are exceeded. The tunnel will also be brought into conformance with NFPA 502 and be designed for safe pedestrian and bicycle facilities. The Project will also address issues related to drainage.

Given an expected useful life of 100 years, the Wilcox Tunnel will retain a significant residual value at the end of thirty (30) years of operation. Using standard procedures for estimating depreciation of this type of asset, the residual value after thirty years would equal **$26.6 million**. If discounted at 7%, this yields a present value benefit of **$2.3 million**.

4.1.2 Economic Competitiveness

Chattanooga's economic prospects have been improving recently. One catalyst for regional growth has been Chattanooga's success in attracting major employers, such as Volkswagen and Amazon to the area. These new employers supplement traditional economic anchors in the Chattanooga area such as the Tennessee Valley Authority, Blue Cross Blue Shield of Tennessee, Alstom Power and McKee Food Corporation.

The Volkswagen plant and its suppliers have created an estimated 11,477 jobs in the region and approximately $56 million in annual tax revenues for state and local governments. The majority of these new jobs offer a ladder of opportunity for low income residents to improve their financial situation. Further, just as with other automotive plants, the successful development of the initial production facility has resulted in additional investments and capacity expansion that will drive job growth to much greater levels.

Bus Route 19's current indirect route makes it one of the most expensive routes to operate and CARTA can only provide very limited service – six round trips per day. The Project will make this a much more efficient route to operate with more frequent service.

Deficient infrastructure such as the Wilcox Tunnel is of concern given this backdrop of optimism about the economic future of the region. Currently, there are very few trucks that use the facility and height restrictions mean that most trucks cannot use the more direct east – west connection offered by Wilcox Tunnel. Most residents are also very reluctant to use the facility due to the unsafe nature of the facility and the absence of any median. As a result commuters and residents cannot capitalize on significant travel savings that can result through more direct route offered by the Wilcox Tunnel. The Project will address a transportation need that has consistently been cited by major employers as a considerable problem, both in restricting truck accessibility and in terms of constraining mobility of the workforce.

As noted above, this project does lie within an Economically Distressed Area that also happens to be strategically located between Chattanooga's downtown central business district and other key regional economic assets like the Enterprise South Industrial Area and the municipal airport. To illustrate the importance of this Project to local development, the Chattanooga real estate office of NAI Charter Commercial Real Estate Services estimates that if the Wilcox Tunnel were to close, it would have an immediate 30% negative impact on property values in the nearby area.[2] Conversely, local development leaders frequently cite the current Wilcox Tunnel as an impediment to attracting more residential and commercial development interest in the local communities.

The Project will provide **$13.6 million** in travel time savings to car users (future benefits discounted at 7 percent), **$1.5 million** in savings to bus users, and **$2.8 million** in vehicle operating cost savings over a period of 30 years adding greatly to the economic competitiveness of the region.

4.1.2.1 Short Term Economic Impacts

The method used to estimate short-term economic impacts (in job-years) from additional spending uses the Council of Economic Advisors' (CEA) methodology as presented in a 2011 analysis[3]. This method assumes that for every $76,923 of government spending, one job-year is created. The analysis indicates that the Project would create 667 person years of employment during the life of the project.

[2] This is based on email correspondence with David DeVaney, President of NAI Charter Real Estate Corp.
[3] Executive Office of the President, Council of Economic Advisers, "Estimates of Job Creation from the American Recovery and Reinvestment Act of 2009," Washington, D.C., May 11, 2009; and September 2011 Update.

Table 2: Short-Term Economic Impacts

Period	Spending (Millions of 2013 Dollars)	Total Job Hours
2016 Q4	$0.50	6.5
2017 Q1	$0.50	6.5
2017 Q2	$0.00	0.0
2017 Q3	$4.20	54.5
2017 Q4	$4.20	54.5
2018 Q1	$4.20	54.5
2018 Q2	$4.20	54.5
2018 Q3	$4.20	54.5
2018 Q4	$4.20	54.5
2019 Q1	$4.20	54.5
2019 Q2	$4.20	54.5
2019 Q3	$4.20	54.5
2019 Q4	$4.20	54.5
2020 Q1	$4.20	54.5
2020 Q2	$4.20	54.5
2020 Q3	$0	0.0
2020 Q4	$0	0.0
Total	**51.34**	**667**

4.1.3 Safety

As described previously safety benefits are the second largest positive impact attributable to the Project. The urgency of the safety needs in the Project Area is illustrated by the average crash data for the last several years. As shown in Table 3, the Project Area could be expected to see 69 crashes in a single year.

- Stopping sight distance is poor at the tunnel portals, especially the eastern portal. An excessive number of accidents happen at the portals, and accident data shows a high rate at the intersections just east of the tunnel portal

- The tunnel has no shoulders or median; thus, the potential for head-on, or side-swiping accidents are high

Table 3: Historical Crashes by Crash Severity

Crash Severity	2007	2008	2009	2010	Average (2007 - 10)
PDO	47	77	54	68	61.5
C	4	4	12	2	5.5
B	2	0	3	2	1.75
A	1	0	0	0	0.25
K	0	0	0	0	0
Total	**54**	**81**	**69**	**72**	**69**

*Note: ** According to the Police-Reported Injury Severity System (KABCO), Class A injury is an incapacitating injury, Class B injury is a non-incapacitating injury, and Class C injury is a possible injury. Define PDO (Property Damage Only) and Class A, B, C, K*

The Project will also improve safety within the tunnel. This will include:

- Provisions for emergency egress
- Fire detection and fire fighting facilities
- Ventilation for evacuation of fire related smoke and dangerous automobile fumes

Accidents are estimated to be reduced 86% or 62 crashes per year. The Project will result in $10.0 million in accident costs saved over 30 years.

These improvements will be designed in accordance with NFPA 502 (Standard for Road Tunnels, Bridges and Other Limited Access Highways)

Our analysis of the Project's safety benefits using FHWA's Desktop Reference for Crash Reduction Factors, estimates that accidents overall would be reduced by 86%.

4.1.4 Livability

The primary livability benefit will be the increased mobility offered to local residents, many of whom rely on transit, pedestrian or bicycle accessibility as their only mode of transportation. This Project will also increase the quality and type of transportation facilities and services available to help achieve broader community goals such as access to a variety of jobs, community services, affordable housing,

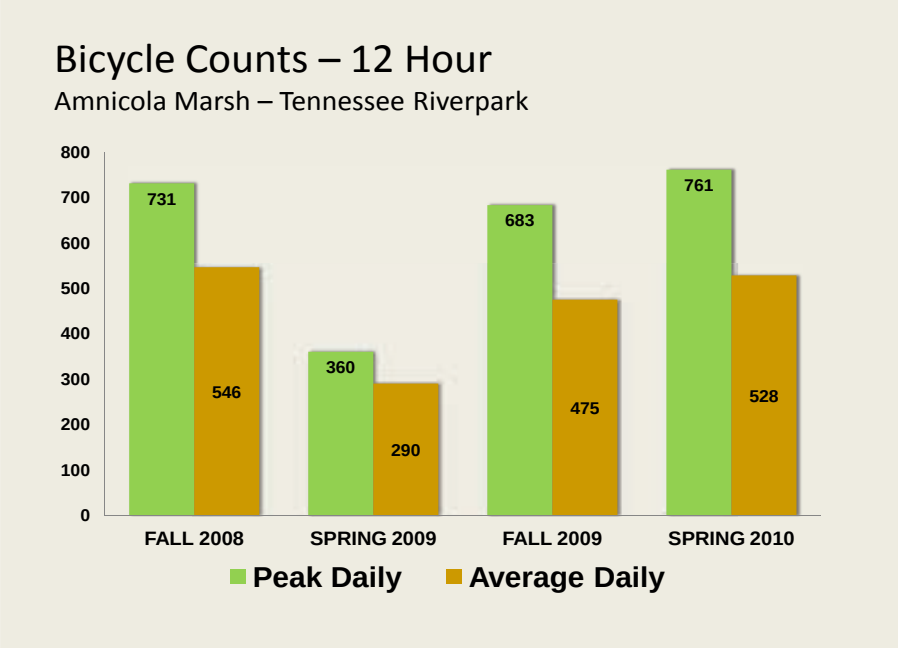
and safe streets. A key aspect of Livability in the transportation realm is developing fast, frequent, dependable public transportation to foster economic development and accessibility to a wide range of housing choices. The economic vulnerability of some of the residents makes an expeditious completion of the Project a classic economic justice concern.

The Chattanooga Bicycle Implementation plan was developed in 2014. The plan builds upon 74 miles of existing bicycle facilities in the city. The recommended bicycle facilities provided a comprehensive network that will accommodate cyclists of various skill levels. The plan identified 314 miles of additional facilities that comprised of the following:

1. 43 miles of Class I: Multi-use Paths (off-road trail separated from motorized traffic by open space or a structural barrier and protected lanes)
2. 136 miles of Class II: Bike Lanes (separated lane 4-6' wide immediately adjacent to the vehicular travel lane)
3. 135 miles of Class III: Bike Routes (a wide outside lane to accommodate both vehicles and bicycles)

Wilcox Tunnel is currently closed to pedestrians and bicyclists. The Project will provide a crucial east – west connection for residents

As shown in the figure below, nearby Tennessee Riverpark has more than 500 daily riders some of whom will be able to benefit from the improved connections provided by the Project.

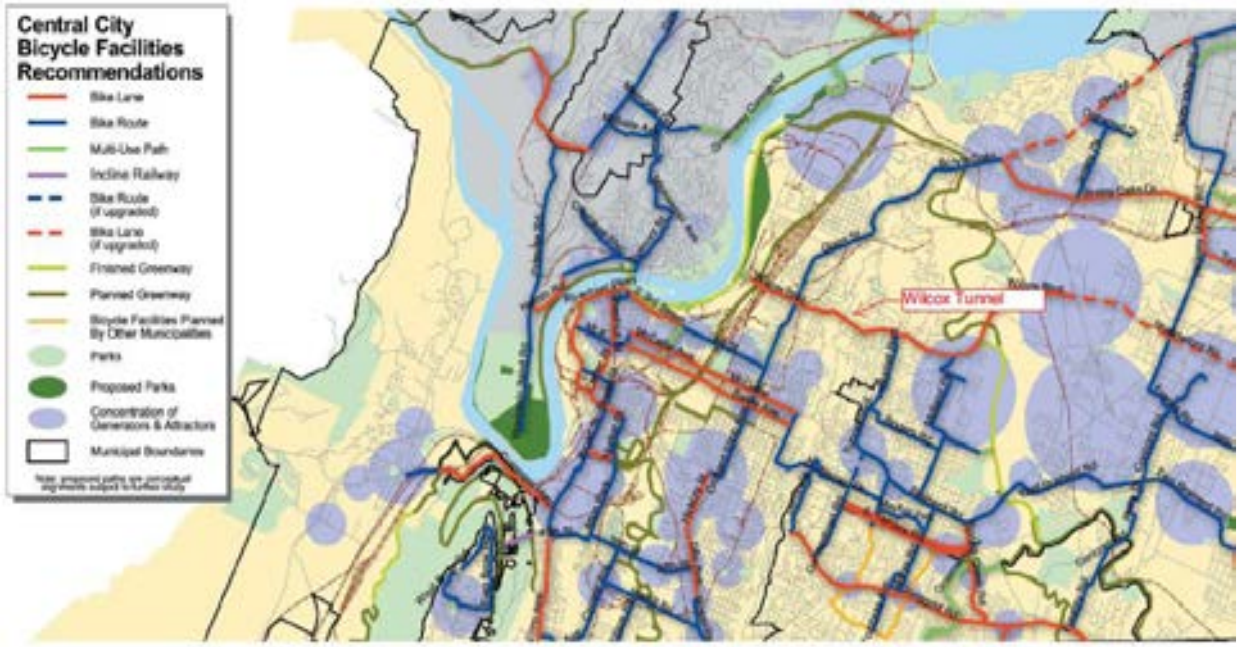


Bike lanes as part of the project corridor were identified as an important part of the plan. As can be seen

in the bike recommendations map below, bike lanes in Wilcox Tunnel would link to existing or planned greenways (both in east and the west). Bike lanes would also provide disadvantaged communities easy access to recreation and the cities many outdoor activities, in addition to providing much needed transportation modal alternatives to access centers of employment.

The Avondale neighborhood, located near the Project identified the need to develop and maintain a pedestrian friendly atmosphere in its neighborhood plan which was adopted by the City Council in 2004 (developed by the RPA). It identified the need to provide and maintain a network of sidewalks and greenways that provide access to residential neighborhoods, commercial nodes, schools and community assets. Areas near the Project particularly at the intersection of Dodson Avenue and Wilcox Blvd are considered the "heart of Avondale" and improving pedestrian access through enabling east – west bike connectivity would improve the pedestrian character of the area.

Figure 7: Chattanooga Bike Facility Recommendations



The Project will provide **$3.1 million** in livability benefits (over a period of 30 years) to residents greatly improving their quality of life.

4.1.5 Environmental Sustainability

The transportation modeling developed for the BCA revealed that the impact of the Project in terms of emissions is not significant. However, we can anticipate, if not currently quantify, that the Project will encourage non-motorized and transit trips by increasing accessibility through the Wilcox Tunnel. An estimate of potential mode share shifts was not possible for the current application, but experience in other locations suggests that safer, more attractive bicycle and pedestrian facilities will encourage greater non-motorized trips.

Bicycle use in Chattanooga has been encouraged by a concerted effort by the City to establish a network of safe and attractive bicycle paths. It has also been facilitated by the mode's intrinsic benefits: The Chattanooga-Hamilton County/North Georgia Transportation Planning Organization's *Multimodal Travel Time Pilot Study* results show that bicycling is generally the fastest transportation mode in the downtown urban corridor. For many potential users, the inclusion of bicycle lanes through the Wilcox Tunnel will significantly increase the attractiveness of this modal choice.

The City of Chattanooga and Hamilton County Governments as part of the Sustainable Communities Regional Planning Grants have been designated as a "Preferred Sustainability Status" community. The contact for this designation is Beth Jones with the Southeast Tennessee Development District.

In addition the Project will make use of bio-swales and pervious pavements that will significantly reduce storm water runoff in the area.

4.1.6 Land Use and Building Form

<u>City- wide</u>

The Wilcox Tunnel Corridor Improvement is a critical piece of infrastructure which aids in reinforcing growth patterns in Chattanooga of livable well connected neighborhoods with access and mobility to key employment areas, destinations, and services. The Project dovetails into several city-wide goals to foster mixed- use developments along commercial corridors and in neighborhood centers accessible for walking, cycling, public transit, and automobile. The Passenger Rail Feasibility Study will investigate the potential to implement transit oriented developments within ¼ mile walking distance of rail stops. Efforts to establish the zoning for Transit Oriented Development are currently being implemented by the City's Regional Planning Agency through the creation of form based codes in the downtown and adjacent neighborhoods. The code developed for these areas will provide a transferable model for other potential Neighborhood and Town Centers Identified within the Chattanooga Department of Transportation's Complete Streets Design Guidelines.

Local

The Wilcox Tunnel contributes to community resiliency by establishing a safe multi-modal connection between several vibrant and engaged yet underserved communities. These communities will have access to future rail services and important neighborhood center destinations thus enabling high quality development which supports multi-modal transit. The Wilcox tunnel will remove a large connectivity barrier between neighborhoods further increasing the mobility and positive growth of this corridor and the communities it connects.

Neighborhood Center Diagram

As part of the Project and paired with the city's Passenger Rail Feasibility study which is expected to have parallel positive impacts on the community and neighborhoods in the east part of downtown, and

as part of these improvements, the City would undergo a major overhaul of zoning and development codes to assure that the communities are developed in a way that encourages and supports multi-modal transportation.

4.2 Secondary Selection Criteria

4.2.1 Partnership

The Project is a City priority, and has the full backing of the Chattanooga-Hamilton County Regional Planning Agency, the regional planning organization. The Project is addressing conditions at a facility that has been identified as inadequate with respect to its alignment, cross section, intersections and pedestrian facilities. Support is widespread and evidenced by the City Council's adoption of Resolution No. 26928 (December 20, 2011) which is funding the construction feasibility and proposed improvements for the Wilcox Tunnel. The Resolution is included in Appendix D.

The Project would also be an important part of the implementation of the pedestrian and bicycle facilities within the City of Chattanooga and identified in the Chattanooga Urban Area Bicycle Facilities Master Plan from October 1, 2001 thru April 2002 (Resolution No. 23445) and updated in the Chattanooga Bicycle Implementation Plan in 2014. The 2014 Chattanooga Bicycle Implementation Plan was prepared by the City of Chattanooga's Department of Transportation and the Chattanooga-Hamilton County Regional Planning Agency and Transportation Planning Division and the Chattanooga-Hamilton County/North Georgia Transportation Planning Organization (TPO).

During the conceptual design, numerous meetings were held with various stakeholders from the community. These included local officials, planners, police and fire, National Park Service representatives, the bicycling community, and community representatives. The Project is located near a Civil War Battlefield and would require a close working relationship with the National Parks Service. Comments from all involved were compiled into several criteria memos. In these criteria memos the needs of the interest groups were taken into account. A full environmental study is being performed as well and public meetings that will present the conceptual ideas to the public will be integrated into all future design phases.

4.2.2 Innovation

The Project intends to use innovative approaches for treatment and reduction of storm-water runoff including the use of bio-swales and pervious pavements. Since the Project cuts through a ridge, storm water run-off can be significant. In addition, there are plans to explore in the tunnel high efficient wireless communications lighting which would be coupled to the City's wireless network to provide real-time monitoring of outages to improve response times to potential unsafe conditions as well solar powered back-up energy for emergency lighting.

4.3 Benefit-Cost Analysis

A benefit-cost analysis (BCA) of the Project was carried out, with the focus here on *traditional user benefits.* The comparison of costs and benefits has been estimated over a 30 year lifecycle, in present value terms, using the required 7% discount rate. All benefits are estimated using unit values prescribed by USDOT or where specific guidance was not provided, standard industry practice. A summary of methods, data and assumptions are included in Appendix A to this application.

PROJECT BENEFITS

Project benefits assessed in a quantitative manner for the BCA are described in Table 2. The primary benefits of the Project are reduced travel time, reduced vehicle miles traveled, and safety improvements (reduced accidents). We are able to rigorously model the positive impacts expected of safety given detailed data on crashes and severity in the Project Area. The Chattanooga-Hamilton County Regional Planning Agency (RPA) has developed a four-step, network travel demand model, which was used to estimate diversion from alternative routes to the Wilcox Tunnel. The RPA model has been developed for regional planning, and contains certain characteristics that make it less effective for modeling specific changes to the road network. Of these, the most significant is the fact that the model is a 24 hour daily model, and simulations cannot replicate peak hour or peak period conditions. Since it is precisely in the peaks that one would expect a greater proportion of traffic diverting to an expanded Wilcox Tunnel, there is a likely under-estimate of traffic using the new Wilcox Tunnel. There is also a strong likelihood that the RPA model is also underestimating the travel time savings accruing to users switching to the Tunnel, as peak period congestion is not captured in a daily model.

Another benefit from the Project is decreased rehabilitation costs. The City is categorically committed to improving the Wilcox Tunnel, and has been required to pursue minor rehabilitation projects in order to maintain the tunnel in its current condition to ensure safety. Current maintenance and rehabilitation projects in the amount of $1.2 million are as follows:

- Rehabilitation of the existing tunnel liner to improve long term stability
- Replacement of the existing lighting system for improved safety

Additional upgrades would bring the tunnel into conformance with the NFPA 502 requirements. The upgrades may be summarized as follows:

- Improving drainage inside the tunnels and at the portals
- Adding ventilation to the tunnel to improve regular air quality and also removal of smoke during a fire
- Adding other Fire/Safety items to the tunnel such as: CCTV, Carbon Monoxide detection, fire water stand pipes, emergency communication, and traffic control devices

- Providing emergency egress

These necessary improvements would cost an estimated $7.9 million (in undiscounted costs). Since the Project would obviate the need for these necessary improvements (improvements to the existing Wilcox Tunnel are included in alternate case costs), these base case construction costs (of improvements to the existing tunnel alone) are considered a benefit, as standard in BCA practice. Similarly, as these improvements would require a lengthy Tunnel closure of nearly six months, the estimated disruption to traffic under the base case is also considered a Project benefit. In the alternate case, no significant disruptions to traffic or extended closures would be required since the Project would create additional capacity and traffic would be diverted to the new tunnel while the existing tunnel is rehabilitated.

PROJECT COSTS

The initial construction costs of the Project expressed in 2014 dollars are $52.3 million. If construction costs are discounted to present value terms at 7% (as required by USDOT guidance) yields costs of $38.1 million.

Table 4: Project Costs

Costs	Cost Categories	3% Discount Rate	7% Discount Rate
Construction Cost of Project Wilcox Tunnel		$45.0	$38.1
Operation and Maintenance Cost of Project		$13.7	$6.9
Base Case Costs Avoided	Construction	($7.3)	($6.5)
	Maintenance	($7.8)	($4.4)
Total Cost Estimates Net of Base Case Costs		**$43.7**	**$34.1**

Also accounted for in Project costs are net additional operating and maintenance costs. Over the life cycle of the Project these are estimated at $2.9 million dollars (discounted at 7 percent) in additional costs. In addition, if the Project does not go ahead as planned it is expected that the existing tunnel will require a higher level of rehabilitation then is currently scoped.

Table 5: Quantitative Benefits and Descriptions by Evaluation Criterion

Criteria	Benefits	Description
State of Good Repair Benefits	Residual Value of Asset	The Project will result in restoring an asset to good repair and increasing the life of an asset beyond the analysis horizon
	Prevented closure of existing facility to make upgrades	Monetized travel time savings and vehicle operating costs as result of minimum upgrades required as part of base case
Economic Competitiveness	Vehicle Operating Cost and User Cost Savings	Reductions in monetary costs due to reduction in travel delays

	Travel Time Savings	Travel time benefits for car and bus users from the reduction in travel delays
Livability	Modal Alternatives	Bicycle and pedestrian benefits from making the project corridor more accessible and pedestrian friendly
Environmental Sustainability	Emissions Reductions	Reductions in pollutants and green house gasses due to reduction in travel delay relative to the no-build condition
Safety	Accident Reduction	Reductions in property losses and injuries and deaths due to implementation of several safety features

BENEFIT-COST ANALYSIS RESULTS

Benefits have been estimated for each primary evaluation criteria. Where appropriate, these are aggregated and compared to project costs. Table 6 describes the primary outcomes of the evaluation and presents the benefit-cost analysis outcomes. As indicated, the BCA yields an internal rate of return (IRR) for the Project of 9.0% and benefit cost ratio of 1.2 when future benefits and costs are discounted at 7% and benefit cost ratio of 1.8 when future benefits and costs are discounted at 3 percent.

Table 6: Summary of Cost-Benefit Analysis Results (7% Discount Rate, $ Millions)

Summary of Primary Selection Criteria - Long Term Outcomes	3% Discount Rate	7% Discount Rate
Total Discounted Benefits	$80.9	$40.5
Total Discounted Costs	$43.7	$34.1
Net Present Value	$37.2	$6.4
Benefit / Cost Ratio	1.9	1.2
Internal Rate of Return	9.0%	

Provided in the table below are a summary of benefits by long term economic outcome. State of good repair benefits are estimated at $11.0 million dollars (discounted at 7 percent) while total travel time savings and vehicle operating cost savings for bus and car users are estimated at $17.9 million dollars. Safety benefits are significant and estimated at $9.3 million.

Table 7: Summary of Discounted Benefits (Millions of dollars)

Long-Term Outcomes	Benefit Categories	3% Discount Rate	7% Discount Rate
State of Good Repair	Residual Value	$9.2	$2.3
	Avoided Closures During Upgrade	$8.8	$7.8
Economic Competitiveness	Time Savings	$28.9	$13.6
	Vehicle Operating Cost	$5.7	$2.8
	Travel Time Savings for Bus Users	$3.1	$1.5
Livability	Bicyclist Benefits	$6.2	$3.1
Environmental Sustainability	Emissions Benefits	$0.1	$0.1
Safety	Accident Reduction	$19.0	$9.3
Total Benefit Estimates		**$80.9**	**$40.5**

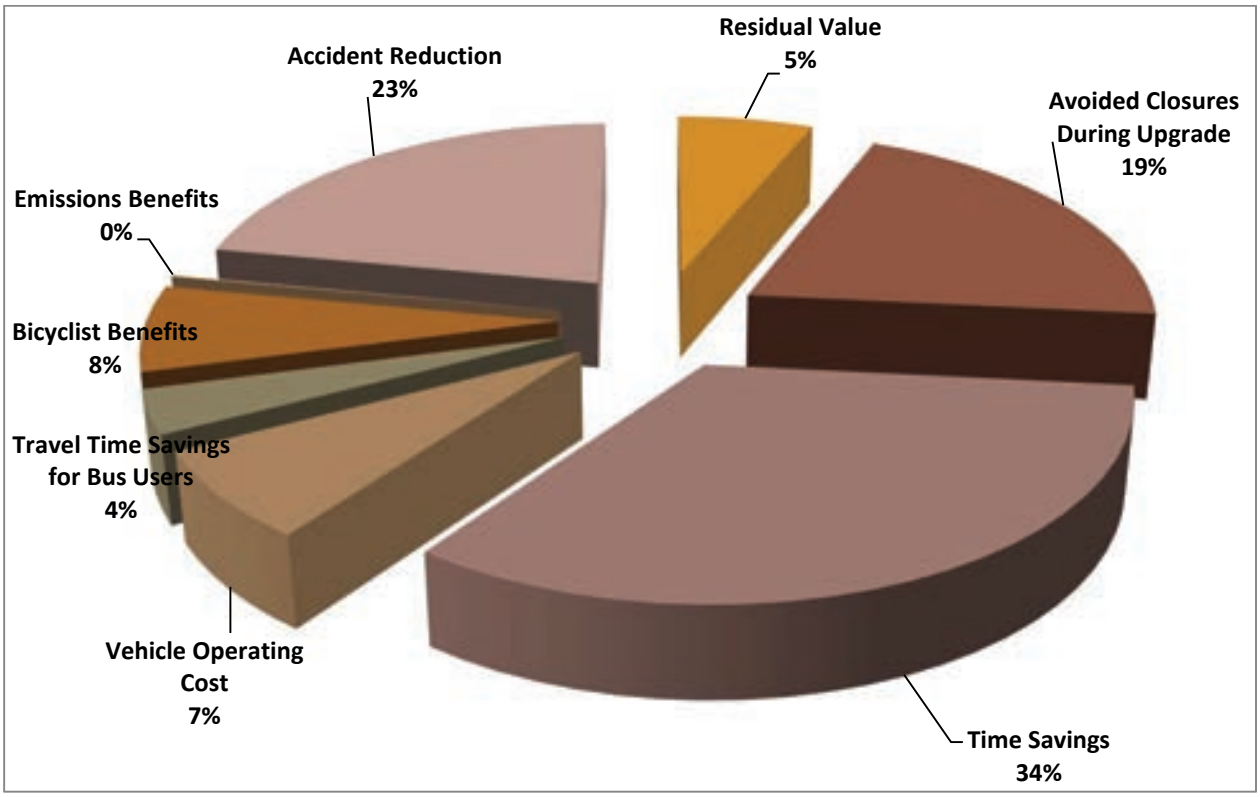
Safety benefits generated from the adoption of several safety features, notably the separation of traffic into separate east and westbound tunnels, account for more than 22% of the total project benefits. Table 8 presents summary of safety benefits and the crash reduction factors used in this analysis.

Table 8: Summary of Safety Benefits

Crash Type	Existing Condition (Annual Crashes 07-10)	Average Annual Crashes after Reconstruction Project	Annual Accident Cost Savings (Opening Year)	Total Lifecycle Accident Cost Savings, Discounted at 7%
Minor (AIS 1)	9.74	1.36	$0.3	$2.3
Moderate (AIS 2)	0.72	0.10	$0.3	$2.6
Serious (AIS 3)	0.16	0.02	$0.1	$1.3
Severe (AIS 4)	0.03	0.00	$0.1	$0.6
Critical (AIS 5)	0.01	0.00	$0.0	$1.5
Fatal (AIS 6)	0.00	0.00	$0.0	$0.0
PDO	61.50	8.61	$0.2	$2.1
Total	72.1	10.1	$1.0	$9.3

Figure 8 shows the project benefits over the life cycle of the Project discounted at 7 percent. Travel time savings are the primary benefit of the Project, followed by safety and avoided closures during upgrades. Vehicle operating costs savings account for about 7 percent of project benefits.

Figure 8: Distribution of Project Benefits (7 % discount rate)



Travel time savings account for 34% of estimated Project benefits. Also estimated are vehicle operating cost and emission benefits using output from the RPA model, as mentioned. According to the modeling, the proposed reconfiguration would reduce vehicle and pedestrian conflict which will result in large decrease in total delay. The table below shows overall measures of effectiveness for the Project. Vehicle miles travelled are expected to reduce 2,868 vehicle miles per day while travel time is expected to change by 208 hours per day in 2035 as a result of the Project.

Table 9: Measure of Effectiveness Comparison for Wilcox Tunnel Expansion Project

Network-Wide Measures of Effectiveness	2035 Existing Conditions	2035 Build Conditions	Percent Change Build vs. Existing
Total Vehicle Miles Traveled	2,864,610	2,861,742	-0.1%
Total Travel Time (hr)	72,691	72,483	-0.3%
Average Speed (mph)	39.41	39.48	0.2%
PM Emissions (Metric tons)	10.8	10.8	-0.1%
Nox Emissions (Metric tons)	162.6	162.5	-0.1%

The Project Area is surrounded by neighborhoods that are economically distressed, and many of the beneficiaries of the Project will be members of low-income households. 2009 data revealed that the poverty rate in areas adjacent to the Project reach levels significantly higher than the County average, with per capita income 55% of the national average.

4.4 Project Readiness

NEPA

The City of Chattanooga has initiated the NEPA process for the Wilcox Tunnel Project. **On October 27, 2011, FHWA determined that this Project will be handled as a Categorical Exclusion.**

The NEPA decision-making schedule has a significant impact on the design and construction schedule. However, the City of Chattanooga has developed a schedule for a Categorical Exclusion. The NEPA process is already well under way but has been on-hold pending resolution of some temporary site access issues and also confirmation that TIGER Grant funding is available. A detailed description of the current status of the NEPA process, including how the temporary site access issues are being resolved such that they will not delay the overall schedule, is provided in Appendix F. We have reviewed all remaining activities required to complete the NEPA process and are confident that the following dates are achievable:

	Duration	*Anticipated Completion*
Complete NEPA Document	6 to 7 months	June 2016
Tennessee DOT / FHWA Review & Approval	5 months	November 2016

The City has a plan to complete the design and award the construction based on the Categorical Exclusion NEPA requirement. The above schedule still provides 8 months for completion of final design, so that the USDOT's June 30, 2017 readiness date can be met and funding can be obligated by September 30, 2017. In reality it is anticipated that certain elements of the final design could be progressed during the TDOT/FHWA review processes, providing additional comfort within the schedule.

TRANSPORTATION IMPROVEMENT PLAN

The Project, though described as an important project in the region's *2040 Long Range Transportation Plan: Creating a Multimodal Network,* could not be modeled or fiscally constrained due to a lack of funding sources. In light of the City's commitment to make progress on the Project, efforts are underway to add the Project to the urban area travel demand model, amend the 2035 fiscally

constrained plan, and prepare the necessary regional air quality conformity analysis and Conformity Determination Report to demonstrate attainment for EPA's 2.5 micron particulate matter standard. The timeline for this process is outlined below.

- August - September 2015 – travel demand model complete
- November - December 2015 – plan document revisions and air quality emissions analysis/review
- February – March 2016 – Chattanooga-Hamilton County Regional Planning Agency technical committee and policy board approvals
- April 2016 – State/Federal approvals

The Project schedule is outlined below.

Table 10: Wilcox Tunnel Expansion Project Schedule

Task	*Start Date*	*End Date*
Planning	March 1, 2011	July 1, 2011
Conceptual Design	July 1, 2011	September 1, 2011
Preliminary Design	January 1, 2012	June, 2016
Final Design	June 2016	June 30, 2017
Construction Procurement	July 1, 2017	September 30, 2017
Construction Phase	October 1, 2017	September, 2020

4.4.1 Technical Feasibility

The City has separately already committed over $2,000,000 for engineering design, which included or will include scope development, alternatives analysis, preliminary engineering and NEPA, highlighting the substantial level of commitment from the City to seeing this Project through to completion. The following preliminary engineering tasks have already been completed: Geotechnical Review, Topographic Survey Data Review, Archaeological and Historical Review, Schematic Geometric Design, Preliminary Cost Estimating, and Structural Investigations.

4.4.2 Financial Feasibility

The City of Chattanooga has committed $27,000,000 for the Project through 2020. Of this amount, $2,000,000 can be treated as sunk costs for preliminary design and NEPA studies. This local City commitment of capital funding demonstrates the City's strong commitment to this Project. The City Council resolution authorizing this commitment is in Appendix D. Chattanooga's financial condition is strong and their bonds are highly rated.

Table 11: Proposed Capital Plan Funding for Wilcox Tunnel

Proposed Capital Plan Funding for Wilcox Tunnel	15/16	16/17	17/18	18/19	19/20	Total 5 Year Plan
Local Funds	$5,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000	**$25,000,000**

5. Evaluation of Project Performance

A post implementation transportation, safety and air quality analysis which includes pedestrian and auto trips will be prepared once project is complete.

6. Federal Wage Rate Certification

The Federal Wage Rate certification is included in Appendix E

7. General Letters of Support

Appendix C includes letters of support for the Project submitted by:

- United States Senator Bob Corker
- United States Congressman Chuck Fleishman
- Chattanooga Area Regional Transportation Authority
- Chattanooga/Hamilton County Regional Planning Agency
- Memorial Health Care System
- University of Tennessee, Chattanooga
- Erlanger Health System
- Hamilton County Mayor Jim Coppinger
- City of Chattanooga, Police Department
- City of Chattanooga, Fire Department
- Benwood Foundation
- Lyndhurst Foundation
- Chattanooga Housing Authority
- Glass House Collective
- Outdoor Chattanooga
- Tennessee American Water