

SLIC Grade Separation & Safety Improvements Project

May 2020



Application to the 2020 BUILD Program



Table of Contents

I. Project Description	1
Transportation Challenge.....	2
II. Project Location	6
Spatial Coordinates	7
III. Grant Funds, Sources and Uses of all Project Funding	7
IV. Selection Criteria	8
Primary Selection Criteria	10
Safety	10
State of Good Repair.....	12
Economic Competitiveness.....	12
Environmental Sustainability.....	12
Quality of Life	12
Secondary Selection Criteria	14
Partnership	14
V. Project Readiness	16
Technical Feasibility.....	16
Project Schedule	17
Required Approvals	17
State and Local Approvals.....	17
Federal Transportation Requirements.....	17
Assessment of Project Risks and Mitigation Strategies.....	17
VI. Benefit Cost Analysis	18
VII. Supplemental Materials.....	21

List of Tables

Table 1: Sources and Uses of Funds for the SLIC Grade Separation & Safety Improvements Project (2019 \$ Million)	8
Table 2: Evaluation Criteria Narrative Matrix	9
Table 3: Total Project Benefit Cost Analysis Results in 2017 \$M, Discounted at 7 Percent	20

List of Figures

Figure 1: Detailed Map of the Project.....	3
Figure 2: Project’s Link to Proposed Transportation Efforts in Project Area.....	5
Figure 3: Project’s Link to Proposed Bicycle and Pedestrian Network.....	6
Figure 4: Land Use Pattern in Hendersonville, 2009.....	14
Figure 5: Consolidated Project Schedule Timeline.....	17

Application Information

Supplemental Materials are available online at:	http://www.hvilletn.org/departments/public-works/projects/slic-grade-separation-and-safety-improvements
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DUNS Number:	078241734

I. Project Description

The *SLIC Grade Separation & Safety Improvements Project* (which includes the Saundersville Local Interstate Connector (SLIC) or “the Project” hereafter) will improve safety and relieve congestion in the corridor that connects US-31 (East Main Street traversing the heart of the City of Hendersonville) to State Route (SR)-386 (Vietnam Veterans Boulevard), a freeway that serves as a major transportation lifeline for the community. SR-386 is an important connection to I-65 and downtown Nashville. The Project will eliminate an at-grade rail crossing that causes traffic to queue up the off-ramp and onto the SR-386 freeway. Oncoming traffic approaches the vehicle queue at speed (65 mph) with the potential for a serious crash. A video showing the significant queuing on SR-386 and traffic congestion following a train passing is provided in the Supplemental Materials to this application. The Project will also realign the road that connects the interchange to US-31, a major east-west arterial, to improve flow and safety. Two signalized intersections will be enhanced and one removed.

Winston Hills Parkway is a local street that currently connects US-31 to the SR-386 freeway interchange with one lane in each direction and an at-grade railroad crossing. Eastbound traffic exiting the SR-386 freeway for US-31 must turn left on Saundersville Road (Local Route 6098) into a right turn lane for Winston Hills Parkway, cross the railroad tracks (which are owned and operated by CSX), then to US-31. Congestion occurs when traffic is stopped by a train crossing at Winston Hills Parkway. The existing Saundersville Road traffic signals at the ramp and at Winston Hills are both tied to the rail crossing signal and are preempted to all red when a train goes through, with the result that the whole roadway network freezes. There are 14 daily trains (12 freight and 2 switch) traversing this crossing according to Federal Railroad Administration data; during this time, it is common to have vehicles backed up onto the SR-386 freeway during peak hours.

The Project will create a new road alignment between US-31 and Saundersville Road, located approximately 0.14 miles west of the SR-386 freeway interchange with Saundersville Road. A new bridge will be constructed for the railroad over the proposed connector road, which will separate rail traffic from vehicle traffic. The existing at-grade railroad crossing on Winston Hills Parkway will be permanently closed. The Project will also widen US-31 to add turn lanes for the connector road and realign Saundersville Road for a new intersection with the connector road.

In summary, the Project will:

- Eliminate an existing at-grade rail crossing that is blocked with trains 14 times per day, causing road traffic to queue up a connecting interchange ramp and onto SR-386 so that oncoming freeway traffic approaches the vehicle queue at speed (65 mph) with the potential for a serious crash;
- Create a new grade separated crossing to replace the closed crossing and maintain access;
- Create a new road alignment, known as the Saundersville Local Interstate Connector or SLIC, between US-31 and Saundersville Road, located approximately 0.14 miles west of the SR-386 interchange with Saundersville Road;
- Add lighting from the interchange along Saundersville Road to the new connector road to improve visibility;

- Upgrade two nearby signalized intersections and provide signal interconnects for increased safety and traffic flow;
- Widen US-31 to add turn lanes for the connector road; and
- Realign Saundersville Road for a new intersection with the connector road.

Collectively, these investments will improve safety, mobility and connectivity as:

- The elimination of queued vehicles on the freeway removes a hazard to oncoming freeway traffic with a posted speed limit of 65 mph;
- Replacing an at-grade crossing with a grade separated crossing removes the potential for rail and road vehicle conflicts, provides a reliable 24-hour route for emergency response vehicles serving the surrounding neighborhoods, and increases mobility along the connector;
- Better lighting improves visibility and safety—several recent crashes have cited lighting as a factor; and
- The connector accommodates bicycle and pedestrian lanes that fill a gap in the future bicycle/greenway network.

While the *SLIC Grade Separation & Safety Improvements Project* addresses multiple evaluation criteria for the BUILD program, improved travel safety lies at the heart of this Project. This BUILD grant, when combined with the City's match and a contribution from CSX Corporation, positions the City of Hendersonville to immediately move forward to address issues that have become a local community and Tennessee Department of Transportation (TDOT) concern. Additional traffic growth is anticipated at this location as the available large tracts of residential development in the vicinity of the interchange and connector are currently or are soon anticipated to be developed as Hendersonville's part of the metropolitan Nashville economy expands. This development will increase the number of vehicles traversing the existing at-grade crossing and unlit stretches of the corridor, and increase queues on SR-386.

Transportation Challenge

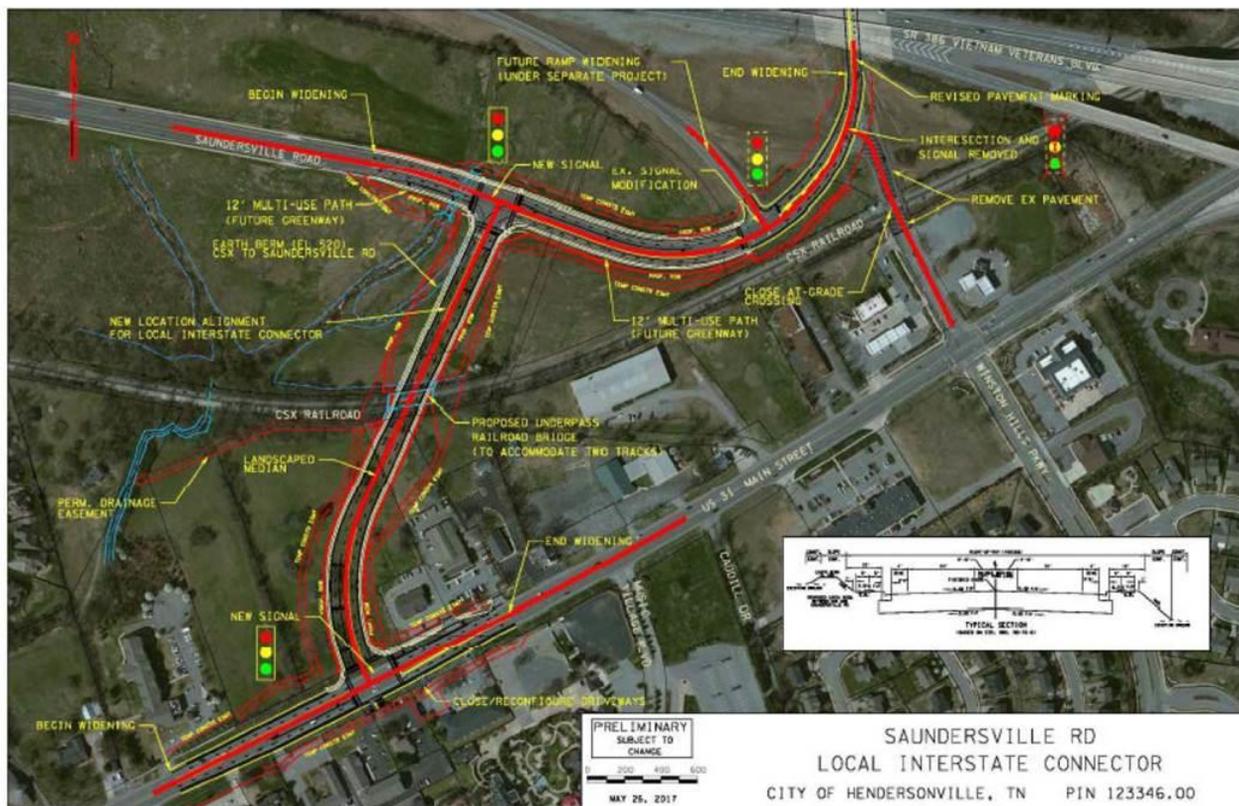
As noted above, the purpose of the Project is to improve safety, mobility, and system linkage by replacing the existing connection between a freeway (SR-386) and principal arterial (US-31) with a new connector road that replaces an at-grade railroad crossing with an underpass structure. The Project will address multiple transportation challenges as outlined below.

The Project will improve safety by providing a new connection between US-31 and the SR-386 interchange that eliminates the at-grade railroad crossing and the need for the existing preemptive signal at the interchange. According to FRA records, there are 14 trains per day that cross at Winston Hills Parkway—12 freight and 2 switches. The Project would replace the at-grade crossing with a grade separated crossing, eliminating the potential for a collision with a train at this location.

In addition, low light or dark conditions were cited in recent crashes as a factor on Saundersville Road. Currently, only the interchange has adequate lighting. The Project would add lighting from the interchange along Saundersville Road to the new connector road to improve visibility.

Intensifying concern about the potential for crashes in this corridor, Hendersonville’s economy continues to grow as a suburb of the burgeoning Metropolitan Nashville economy. Traffic volumes are estimated to increase at an annual rate of 1.5 percent based on projections from TDOT and the Nashville Area Metropolitan Planning Organization (MPO). The proposed project would be designed for 2040 traffic volumes with additional turn lanes on Saundersville Road and US-31 and revised signal timing. Additional growth is anticipated due to the influx of residential development on large tracts of land in the vicinity of the interchange and corridor. Trips generated by these developments increase the number of vehicles traversing the grade crossing and unlighted stretches of the corridor. The Project will increase the roadway capacity with two lanes in each direction for the connection between US-31 and the SR-386 interchange, along with dual turn lanes on Saundersville Road and the connector road. A plan view map of the Project is provided in Figure 1.

Figure 1: Detailed Map of the Project



Increases in population will translate into increases in the demand for emergency services. Hendersonville's Fire Chief reports that in three years (2014-2016), there were 1,792 fire and emergency calls from Firehouse No. 6 which is located approximately one-half mile from the project site. Of this total, 595 calls have been on or off Saundersville Road. Approximately 27 (1-2 percent) of these calls have occurred when the preferred route was blocked because of a passing train. Three detour routes are available when the preferred route is blocked. One is to the west via Indian Lake Boulevard for 6.2 miles, one to the east via Lower Station Camp Boulevard and back on SR-386 to exit at Saundersville Road for a total of 6.9 miles, or one for 1.1 miles to the east that is not considered due to trucks having to make a U-turn across multiple lanes of US-31 to access the westbound entrance ramp of SR-386 and then exit off at Saundersville Road.

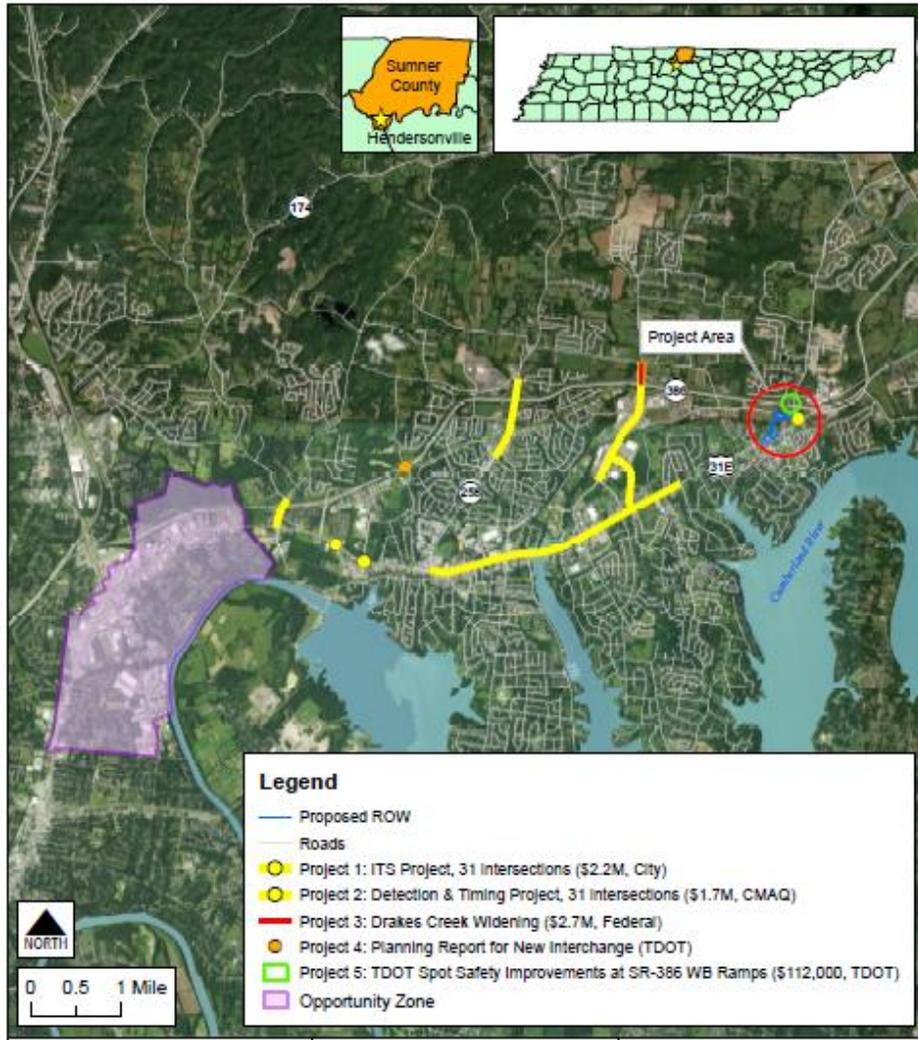
Any of these detour routes add critical minutes to response times which is a concern to the fire department. The proposed project would have a grade separation with the CSX railroad and eliminate the at-grade crossing at Winston Hills Parkway. The new route would increase the distance from Fire Station No. 6 to the Saundersville Road interchange by 0.7 miles, adding less than two minutes to the current response time when there is no train passing and reducing the emergency response time when the crossing is blocked.

Finally, the Project expands the connectivity of the region's bicycle and greenway network as it adds a new multimodal connection between US-31 and Saundersville Road. The City of Hendersonville's current Bicycle-Greenway Plan proposes bike lanes along wide shoulders on US-31 through the city limits. US-31 currently has dedicated bike lanes between Sanders Ferry Road and Winston Hills Parkway. The City's Greenway Plan proposes to extend the existing Indian Lake East Greenway (multi-use path) eastward from its current terminus near the Hendersonville Public Library to the city limits along Saundersville Road either on a multi-use path or wide outside lanes.

The Project will retain the wide shoulders (10-foot total, 8-foot paved) on US-31 with existing bike lanes. The connector road will include 4-foot wide dedicated bike lanes and 5-foot sidewalks in both directions. The sidewalk along the westbound lanes of Saundersville Road will be replaced where the road is being widened. Along the eastbound lanes of Saundersville Road, the existing 5-foot sidewalk will be replaced with a 12-foot multi-use path that would connect to the future extension of the existing greenway along Saundersville Road.

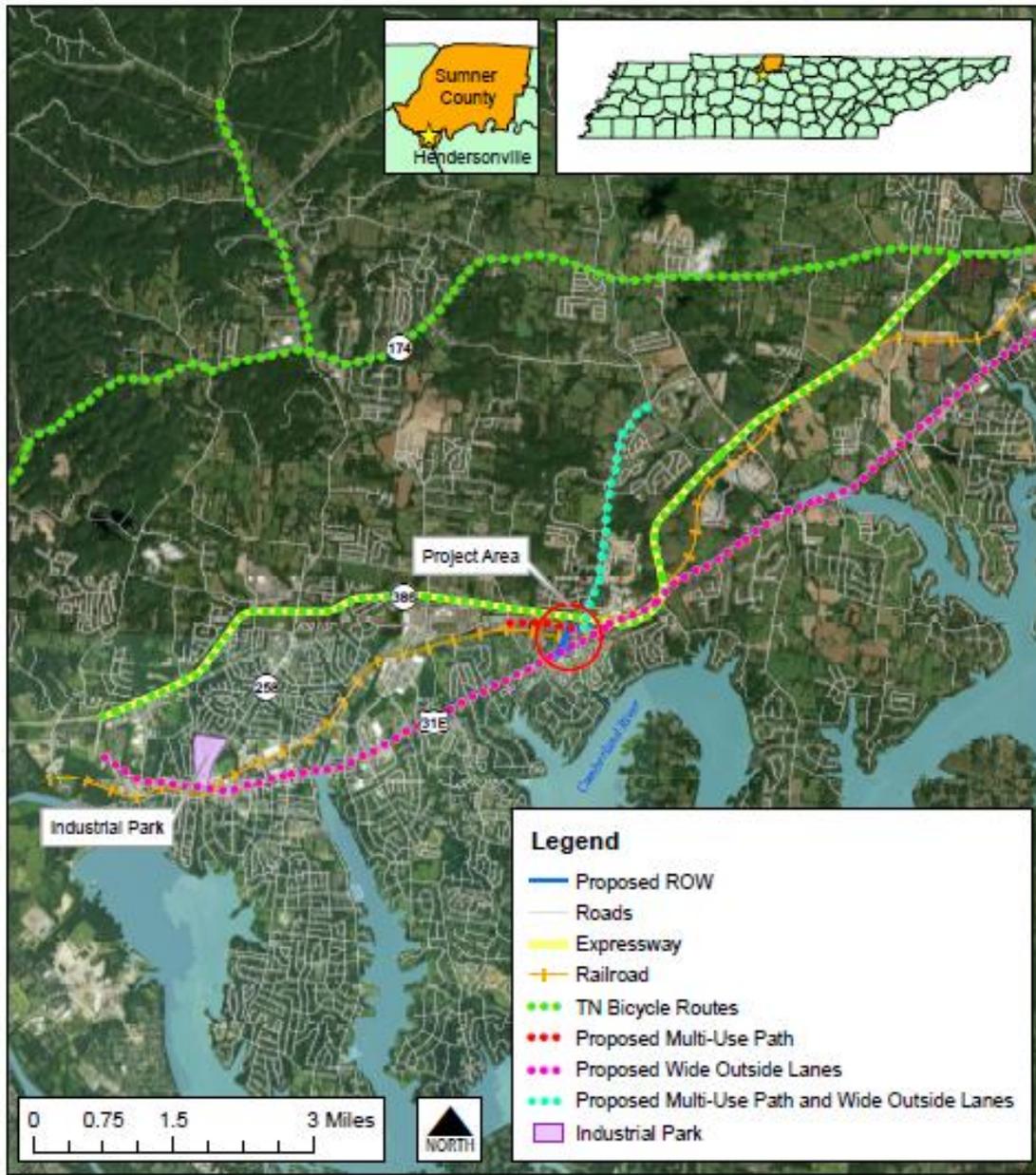
The Project is part of a larger effort to improve traffic flow in the city and region. Figure 2 presents some of the other efforts being undertaken, which includes signal timing and detection technology to synchronize the traffic signals and optimize the flow of traffic moving on the major corridors. In addition, TDOT is currently conducting preliminary engineering for a project that will widen and provide managed lanes along a 16.6 mile portion of SR-386 (Vietnam Veterans Boulevard), which includes the portion through the project area.

Figure 2: Project’s Link to Proposed Transportation Efforts in Project Area



The City of Hendersonville is also undertaking a number of other efforts to improve the bicycle and pedestrian safety in the project area that would be greatly enhanced by the Project. Figure 3 illustrates the link of the Project to the proposed bicycle and pedestrian network.

Figure 3: Project’s Link to Proposed Bicycle and Pedestrian Network



II. Project Location

The Project is located in the City of Hendersonville, Tennessee, which is part of the Nashville-Davidson metropolitan area. Population growth is outpacing the national average; the American Community Survey estimates that Hendersonville’s population grew by 1.5 percent per year so far this decade, rising to 57,576 (2018 estimate) and slightly ahead of the balance of the Nashville-Davidson metropolitan area which posted a 1.4 percent gain. While year-to-year housing permit totals vary with major weather events and economic conditions, the three-year average total number of permits issued in the City has risen from an average of 2,200 in 2015

when TDOT sent a letter expressing concern about safety on SR-386¹ to an average of 2,600 in 2018. The pace of residential/commercial expansion in the City has increased, with the result that demand for travel on SR-386 is intensifying as well.

Spatial Coordinates

The following coordinates describe the southwest corner and the northeast corner of the Project area.

Latitude	Longitude	Location
36° 19' 24.689" N	86° 34' 10.111" W	SW point
36° 19' 43.170" N	86° 33' 46.895" W	NE point

The Project is located just east of Qualified Opportunity Zone Tract 47037010401; both the CSX rail line and SR-386 (Vietnam Veterans Boulevard) pass through the project area to serve the zone. While the Project is not directly adjacent to the zone, it addresses a nearby bottleneck that affects service to the zone. Improving the peak hour traffic flows along the road, adding capacity for a future second track, and allowing trains more room to switch without blocking traffic, collectively make the opportunity zone more attractive for businesses that might use truck or rail.

III. Grant Funds, Sources and Uses of all Project Funding

The following outlines the funding strategy for the *SLIC Grade Separation & Safety Improvements Project*. The estimated cost to build the new connector, add lanes, build the bridge that will separate rail traffic from road traffic, and add lighting is approximately \$16.6 million, as detailed in Table 1. The detailed costs and engineering drawings that support the cost estimates are provided in the Supplemental Materials provided with this application.

Previously incurred expenses: Previously incurred expenses are \$581,000 for project development work and environmental work completed to date, which are not eligible for BUILD grant funding

Eligible project costs: The total estimated cost to complete the *SLIC Grade Separation & Safety Improvements Project* is \$16.6 million, of which \$16.0 million are eligible for BUILD grant funding.

The non-federal funds for the Project will be provided by three sources: the City’s own funds, a grant from TDOT using state funds, and a private contribution from CSX Corporation.

Funding commitment: Documentation of the funding commitment from each party is provided in the Supplemental Materials for this application.

Federal matching funds: No federal funds are planned for use for the Project other than the BUILD funds requested in this application. Thus, no other federal matching funds are required beyond the BUILD funding request.

¹ The letter from TDOT is discussed in the Safety section of this application and provided as supplemental material.

Budget for SLIC Grade Separation & Safety Improvements Project: The budget is summarized in Table 1, identifying those sources that are non-federal, BUILD, and other federal as requested in the guidance.

The City of Hendersonville, on behalf of its partners, is requesting **\$11,782,820 of BUILD capital funding. A non-federal match of \$4,250,800 is committed to the project.** Every dollar of BUILD funding leverages an additional \$0.36 dollars of non-federal spending. Table 1 provides a summary of the funding source, amount of committed or requested funds, and funding sources.

Table 1: Sources and Uses of Funds for the SLIC Grade Separation & Safety Improvements Project (2019 \$ Million)

Summary	Soft Costs	ROW	Railroad Construction	Roadway Construction	Total	% of Grant	% of Total Project Inclusive of Previously Incurred Costs
Total Project Costs Included in Grant Request							
Non-federal sources	\$901,082	\$846,214	\$1,502,171	\$1,001,334	\$4,250,800	26.5%	29.1%
BUILD	\$2,710,819	\$2,545,755	3,513,829	\$3,012,417	\$11,782,820	73.5%	70.1%
Other federal	\$-	\$-	\$-	\$-	\$-	0.0%	\$0
Grant Total	\$3,611,900	\$3,391,969	\$5,016,000	\$4,013,751	\$16,033,620	100%	
Previously Incurred Costs	\$581,000	\$0	\$0	\$0	\$581,000		
Grand Total	\$4,111,900	\$3,391,969	\$5,016,000	\$4,013,751	\$16,641,620		

*2019 Dollars

IV. Selection Criteria

The road and grade crossing investments proposed in this BUILD application will generate a variety of benefits for local residents and businesses, travelers through the region, and the railroad. Some of these benefits were quantified and captured in the Benefit Cost Analysis; but some were not. Before moving to a discussion of each of the long-term outcomes, Table 2 provides a summary overview of how the Project aligns with the evaluation criteria.

Table 2: Evaluation Criteria Narrative Matrix

Criteria		How the Project Satisfies the Criteria
Primary	Safety	The existing at-grade crossing will be closed and replaced with a new grade-separated crossing, reducing conflicts between 14 (12 freight and 2 switch) daily trains and vehicle traffic.
		With the existing crossing, cars exiting SR-386 queue up the exit ramp and onto the freeway. Traffic on the mainline freeway approaches at speed (65mph). This condition was the incentive for TDOT to write the City about addressing this problem.
		Lighting will be added along Saundersville Road to improve visibility. Visibility has been cited in several recent crashes along this section of road.
		EMS responders will have a reliable and direct route to serve households on the other side of the crossing, avoiding detours and the additional response time that may lessen health outcomes or increase fire damage.
	State of Good Repair	The Project will have value after the end of the analysis period because the useful lives of project elements are longer than 30 years.
	Economic Competitiveness	The improvements will improve travel times on the SR-386 freeway as well as north-south circulation as cars will not be stopped at the crossing.
		The Project eliminates a bottleneck near the Opportunity Zone; these improvements will increase the reliability and resiliency of the connecting rail and road network.
		Auto and truck operating costs will be reduced as vehicles will not be caught in long queues when one of the 14 daily (12 freight and 2 switch) trains comes through.
		Improves reliability for rail traffic traversing the corridor at 50 mph (see CSX letter of support)
	Environmental Sustainability	The travel time savings in the network and elimination of vehicle idling at the closed grade crossing eliminates the associated emissions and improves local air quality.
Quality of Life	The Project will improve the performance of SR-386, one of the major freeways serving Hendersonville and is a major commuter route for communities between Gallatin and Nashville, and facilitate access to the City’s commercial and activity centers. This supports local efforts to develop a local economy rather than serving as a bedroom community to Nashville.	
	Trains will have less cause to blow their horns in the City once the crossing is grade separated, eliminating a nuisance.	
Secondary	Innovation (innovative finance)	Public and private partners are collaborating to advance the project. CSX has committed to contribute 5 percent of the bridge costs. If selected for award, every dollar of BUILD grant funding leverages \$0.36 in non-federal funding, including local, state, and private contributions.
	Innovation (technical)	The Project will add two traffic signals that will be incorporated into the City’s network. The overall system of traffic signals will be coordinated (under a separate project) to optimize mobility in the City.
	Partnership	The City has partnered with TDOT and CSX Transportation to advance this Project.

Primary Selection Criteria

This section provides additional detail on the Project features that align with the 2019 BUILD program’s Primary Selection Criteria.

Safety

The Project improves safety in several ways. First, the Project will eliminate an at-grade crossing and provide a grade separated alternative. The Project is called out in Tennessee’s Statewide Rail Plan (page 89) as one that local communities identified as a location of concern in the Tennessee Statewide Multimodal Freight Plan or through the stakeholder outreach for the rail plan itself. This underscores the public’s concern about the Project crossing. TDOT maintains a list of priority crossings for improvement. The state’s Railroad Grade Crossing Priority Listing Report for 2001, which ranked the state’s (then) 3,429 crossings based on 13 factors to prioritize the most hazardous ones, reported that this crossing ranked 158 or in the top five percent of all crossings in Tennessee at that time. Though the data is provided from an older report (more recent versions of TDOT’s report could not be obtained) it is unlikely that the crossing has fallen in the rankings since that time.

Beyond the hazard of the crossing itself, there is the secondary risk of crashes as traffic queues back up onto the freeway with traffic coming up on the queue at speed. Video taken from a drone following a train crossing illustrates the impact on traffic and the significant safety issues in the project area. The drone footage recorded traffic congestion (and delays) following a train that passed through Hendersonville before 5:00 PM on a weekday. The footage shows **heavy**

The Value of Reducing Emergency Services Response Times

“The evidence from the literature concludes that for every minute delay in primary response for certain life-threatening medical emergencies, there is a measurable effect on mortality. The research is conclusive especially for the first 5 minutes in the response interval, where rapid intervention makes the greatest difference. Critical medical intervention can be performed by professional responders or bystanders who receive instructions from 9-1-1 call takers over the phone. For critical medical incidents such as cardiac and neurological emergencies, together composing around 5 percent of 9-1-1 calls, a mere one-minute delay in response time increases the mortality rate by 1 to 2 percent. A solution that could reduce response times by only one minute on average would save thousands of lives per year across the nation.

In addition to affecting mortality, healthcare costs for survivors are also greatly impacted by response times. For the set of medical conditions that limit perfusion of the brain and heart, each minute of delay in response time increases hospital treatment costs by 7 percent. These costs are associated with longer stays in the intensive care unit, additional complicated and costly procedures, and a slower recovery leading to longer hospital stays. For a typical cardiac emergency, one minute of faster response translates into \$1,542 of savings in hospital costs per patient, leading to a \$7B reduction in US healthcare expenditures per year and a better quality of life for patients. Apart from medical conditions, delays in response times can also lead to greater property damages in situations like building fires. Building fires typically grow by 20 percent per minute that response is delayed.”

Quoted from RapidSOS, “Quantifying the Impact of Emergency Response Times,” 2015

congestion and queuing on SR-386 over an hour after the train passed. (The video is included with the application as supplemental material.) This queuing is a significant concern since studies have shown that of all fatal crashes, 13 percent are caused by end-of-queue crashes.² Aside from the risk of vehicles approaching stopped vehicles at speed causing a multicar crash, there is also the risk of vehicles trying to leave the queue in frustration and pulling into the adjacent lane in front of other vehicles traveling at speed.

In 2015 TDOT took the unusual step of writing a letter notifying the City that the current configuration at SR-386 (Vietnam Veterans Boulevard) and Saundersville Road is a safety hazard with vehicles often backing up on the off-ramp and onto SR-386 when a train passes. (The letter is provided in the supplemental materials.) TDOT’s concerns stem from the recurring condition of traffic queuing up the ramp and onto the freeway creating the potential for severe crashes on a high speed (65 mph) facility. The causes of the traffic backup are trains passing the at-grade crossing and the associated preemptive signal conditions (all red) at the interchange ramp. In the letter, Paul Degges, Deputy Commissioner and Chief Engineer for TDOT, said the Saundersville Road residential area had grown to the point that leaving the current at-grade railroad crossing was no longer feasible. “This residential growth and the associated increase in traffic volumes has now approached the safety and operational limitations of the traffic signal interconnect at the CSX at-grade railroad crossing” the letter states. “it has now been observed that under the preempted signal conditions (all red phase during train passage) Saundersville off-ramp vehicle queues are extending into the eastbound travel lanes on mainline SR-386. This stopped condition on a high-speed facility (65 mph) creates the potential for severe crashes including fatalities.” In June of 2015, the *Hendersonville Standard* reported that TDOT had indicated that their engineers believe the queue could yield a fatality. The article cites a TDOT spokesperson saying that, “...**there are safety issues that are of great concern to the department, concerns that could ultimately force the department to close the ramp.**”

Safety concerns also exist for other roads in the project areas. A crash analysis was completed for 2012-2014 crash data on the four roadway segments within the project area, including Saundersville Road, US-31, Winston Hills Parkway and SR-386. Three of the four roads had a higher crash rate than the statewide average for a similar roadway type, with SR-386 as the only road that was below the average statewide crash rate. To address these concerns, the Project will re-align Saundersville Road, increase turning lanes and increase lighting to improve visibility. Visibility has been cited in several recent crashes along this section of road.

And finally, as noted in the Project description, the ability to maintain movement is critical for the provision of emergency services. Interviews with county emergency services staff highlighted how the congestion delays emergency response vehicles either because they are caught in the queue or because of the need to detour. Although the effects of delayed service response vary with the type of emergency, the literature has confirmed that there are several where time—even a minute—makes a meaningful difference in outcomes. For medical events such as cardiac and neurological emergencies, which collectively account for about 5 percent of 9-1-1 calls nationally, a one-minute delay in response time increases the mortality rate by 1 to 2

² *Characterizing Interstate Crash Rates Based on Traffic Congestion Using Probe Vehicle Data*, Mekker, Remias, McNamara, Bullock, November 11, 2015

percent. Not all emergencies are medical. The literature on emergency response reports that building fires typically grow by 20 percent per minute that response is delayed.³

State of Good Repair

The project will have value after the end of the analysis period because the useful lives of project elements are longer than 30 years.

Economic Competitiveness

The Project generates a variety of economic competitiveness benefits—quantifiable and qualitative. First, the Project removes a source of congestion and improves reliability of travel in this part of the City. Businesses invest where they have confidence in access to labor and markets. If a region’s road system is perceived as less reliable due to regular repeated grade crossing closures, it will attract less investment than a place where the road system is rarely closed. With the elimination of detours and/or delays, travelers save time and avoid the cost of the extra vehicle miles traveled (VMT) needed to make the detour or the lost value of time and fuel while idling at the crossing. Trucks will save operating costs by avoiding the crossing delay.

Beyond the economic benefits generated at the crossing location, both the road and rail service to Hendersonville’s nearby Opportunity Zone will be improved. As noted in the support letter from CSX, train reliability will improve, benefiting all shippers on the corridor. Road service will become less congested and more predictable as well as noted throughout the application. Collectively, this increases the attractiveness of the Opportunity Zone, which is becoming a prime site for redevelopment within the City’s remaining centrally located tracts of land.

Environmental Sustainability

The reduction of travel times through the corridor and the elimination of idling at the grade crossing reduce emissions. In addition, by opening up developable land in the existing commercial center and promoting north-south circulation in this area, the Project supports infill development rather than sprawl into the undeveloped agricultural land north of the City.

Quality of Life

The Project benefits Quality of Life in several ways. First, by removing the at-grade crossing and replacing it with a grade separated crossing, a source of daily driving conflict is eliminated from residents’ lives. Though this benefit is captured in the benefit cost analysis (BCA) as enhanced safety, time, cost, and emissions savings at the grade separation, there is also

At the time of the last Comprehensive Plan for Hendersonville, residents were asked what their vision was for the community in 2020. The specific question was “*Should Hendersonville continue to be a "bedroom community" with many of its citizens commuting to work in Nashville? Or should Hendersonville try to establish itself as a city with its own identity, its own businesses and jobs, and an independence from the economy of Nashville:*

What type of community?	Percent
Separate Identity	61.6%
Bedroom Community	14.4%
Uncertain	18.4%
Both	5.6%
Total	100%

Hendersonville Tomorrow: Assessment, Vision, Goals and Action Steps for 2020 (2006)

³ RapidSOS, “Quantifying the Impact of Emergency Response Times,” 2015. RapidSOS is a member of the National Emergency Number Association (NENA ID: RSOS) seeking to provide an alternate technology for the current 9-1-1 system. It developed this White Paper to review the literature on the causes and consequences of EMS delay.

an unquantifiable benefit of not having to plan around the train schedule or alternatively periodically getting caught at a crossing. For those that grow up or have lived for some time in areas with active crossings with multiple daily trains, it is “just how it is.” This project will lessen that daily distraction by one crossing.

In addition, the improved circulation helps to open up development in the remaining available areas for growth. Hendersonville’s vision for itself in 2007 was to transition from a bedroom community to one that has its own economic base. This theme was echoed in the current Mayor’s 2019 priorities for the City where he explained, “We have thousands of professional employees living here, but many are spending too much time getting to their jobs in other cities. When we attract employers to Hendersonville, our residents spend more time with their families and less time commuting.”⁴ In the State of the City address, he reported that the City has gained \$57 million in commercial investment and \$84 million in residential investment since 2018.⁵

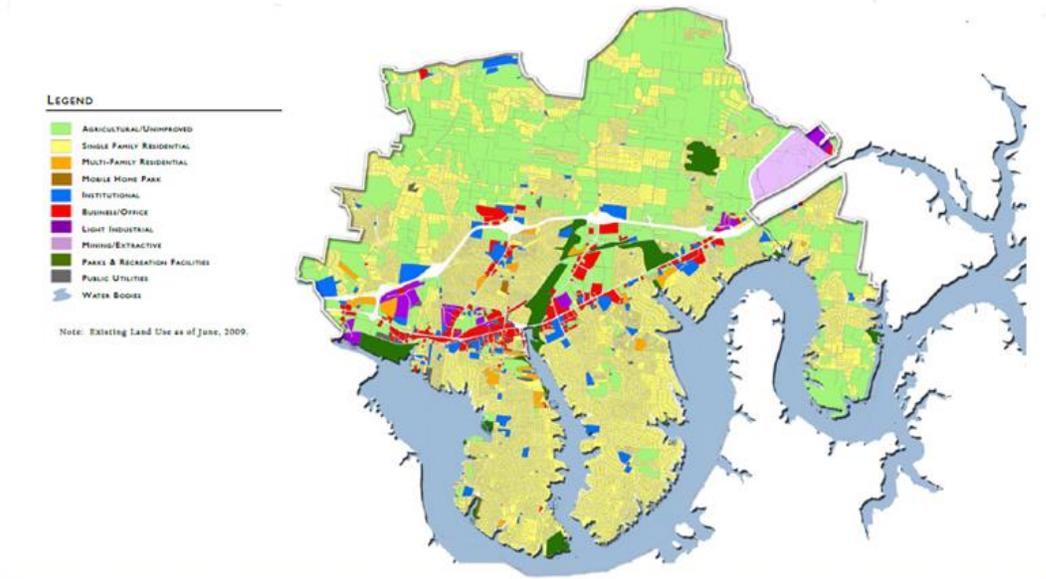
In recent years, the local economy has expanded, driven by its own population growth which became attractive to a new set of businesses as it approached 50,000 residents, its proximity to Nashville, and local efforts to attract business. The Project helps to open up remaining land for development in Hendersonville’s core, as well as support north-south circulation. The new road will connect at the portion of Saundersville Road in a still undeveloped area of Indian Lake Village, pass beneath the railroad tracks on undeveloped land and connect with East Main Street across from several small office buildings. The project also improves road and rail service to a nearby Opportunity Zone.

⁴ Nixon, Amy. “Infrastructure, growth, public safety, recycling among Hendersonville mayor's top priorities for 2019,” The Tennessean. January 10, 2019. Accessed <https://www.tennessean.com/story/news/local/sumner/hendersonville/2019/01/10/what-expect-hendersonville-2019/2535675002/>

⁵ Nixon, Amy. “4 Takeaways from Hendersonville Mayor Jamie Clary’s State of the City Address” The Tennessean. May 8, 2019. <https://www.tennessean.com/story/news/local/sumner/hendersonville/2019/05/08/jamie-clary-praises-emergency-personnel-roads-economic-development-state-of-the-city-address/1139985001/>

Figure 4 is drawn from Hendersonville’s most recent Land Use and Transportation Plan in 2009. While the plan is somewhat dated, the overall pattern that is illustrated still holds today. The southern part of the City is largely residential while the northern part of the City remains largely agricultural with some residential development. Commercial development is focused in the “eye” formed by the major roadways in the center of the City.

Figure 4: Land Use Pattern in Hendersonville, 2009



Source: Hendersonville Land Use and Transportation Plan, 2009

Secondary Selection Criteria

This section provides additional detail on the Project features that align with the 2019 BUILD program’s Secondary Selection Criteria.

Innovation (Technical)

The City has invested in signal timing and detection technology to synchronize the traffic signals and optimize the flow of traffic moving on the major corridors in the City; Figure 2 highlights this network of investments. The signals included as part of this Project will be added to that network, expanding the optimized network and leveraging the value of the signal investment included in this application.

Innovation (Project Finance)

The Project will be implemented through a public and private partnership between the City, TDOT and CSX Transportation—all funding partners.

Partnership

The City of Hendersonville will deliver the Project in partnership with TDOT and CSX Transportation.

City of Hendersonville, TN

The City of Hendersonville is the fourth-largest city in the Nashville metropolitan area after Nashville, Murfreesboro, and Franklin, and the 11th largest in Tennessee. Hendersonville is located 18 miles northeast of downtown Nashville. The City provides a full range of municipal services including police and fire protection; the construction and maintenance of



highways, streets, and other infrastructure; sanitation services; recreational and cultural activities; planning and zoning; and general administrative services.

The City understands USDOT reporting requirements and maintains the records and accounting systems that will allow it to comply with USDOT's reporting and administration requirements. Moreover, the City has partnered with TDOT to help advise on the management of this federal grant as TDOT has deep experience with USDOT's policies and procedures.

The City's roles for the Project includes:

- BUILD 2019 Discretionary Grant Applicant and Recipient responsible for administering the grant if selected for award
- Funding partner
- Owner of the connecting right of way
- Aids in ensuring efficient integration of the BUILD 2019 Project into the existing regional transportation network, including the coordinated signal system
- Maintenance of the road elements after construction
- Oversight of the capital project delivery
- Economic development division helps to market the nearby Opportunity Zone

Tennessee Department of Transportation

The Department of Transportation provides citizens of Tennessee and travelers with one of the best transportation systems in the country. TDOT consistently wins awards for its projects, highway design and innovative approach to transportation. Since 1998, Tennessee was voted as having one of the top five highway systems in the country by a national trade magazine. TDOT is a multimodal agency with responsibilities in aviation, public transit, waterways, railroads, and cycling and walking. TDOT's involvement ranges from airport improvements to funding transit buses to planning for river ports. Road and bridge assets (those similar to this Project) include: 19,823 bridges (including 8,386 state owned bridges and 11,437 locally owned bridges), 1,201 Interstate miles, and 13,890 state-maintained highway miles.



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The State's roles for the Project includes:

- Funding partner
- Owner of the freeway/off-ramp right of way
- Developer of design standards for road elements

CSX Corporation

The CSX Corporation network encompasses about 21,000 route miles of track in 23 states, the District of Columbia and the Canadian provinces of Ontario and Quebec.

Nearly two-thirds of Americans live within CSX's service territory. Within Tennessee, CSX operates and maintains



nearly 1,600 miles of track; maintains nearly 1,000 public and private grade crossings; and handled nearly 1.6 million carloads of freight on the state's rail network. CSX maintains a major rail yard in Nashville (Radnor), intermodal terminals in Memphis and Nashville, TRANSFLO terminals in Chattanooga, Knoxville and Nashville; automotive distribution centers in Memphis, Nashville, Smyrna and Spring Hill; and a division headquarters in Nashville.

CSX's roles for the Project includes:

- Funding partner
- Owner of the rail right of way
- Developer of design standards for rail elements
- Maintain rail assets post construction

V. Project Readiness

Should the Project be approved for BUILD grant funding, the City of Hendersonville and its partners are ready for obligation as soon as the necessary documentation can be executed. All proposed investments are located within an active roadway and rail corridor, with no change in the existing land use. **The Project's environmental requirements are nearing completion; the Tennessee Environmental Evaluation Report (TEER) is provided with this application and was completed consistent with federal requirements.** This Project has been a City, State, and rail priority for many years. The Project partners have done as much engineering work in advance as possible and only lack the remaining funding to advance the project into construction.

Technical Feasibility

The *SLIC Grade Separation & Safety Improvements Project* is technically feasible. The City has overseen numerous road projects and TDOT has constructed hundreds of bridges with similar designs. The detailed engineering drawings and construction budget are included in the Supplemental Materials included in this application narrative. A 10 percent construction contingency is included in the cost estimate.

CSX will be responsible for maintaining the track and rail elements of the project. The net change in rail operating costs is negligible as CSX will avoid the costs of an open at-grade crossing but gain a small cost associated with the bridge maintenance. On the road side, the City will add 0.15 miles of road to its network with an estimated increase in annual operating costs of \$4,600.

Project Schedule

Figure 5 depicts the project schedule.

Figure 5: Consolidated Project Schedule Timeline

	2006	...	2016	2017	2018	2019	2020	2021	2022	2023
Project Initiation	█									
State and Local Approvals			█							
Environmental Review				█	█					
Environmental Approval					█					
Final Design						█	█			
Right of Way Acquisition						█	█			
Utility Relocation							█	█		
Construction								█	█	█

Required Approvals

Environmental Permit and Reviews

All required environmental permits and reviews to advance this Project have been completed. The TEER is provided with this application and was completed in accordance with federal standards. If the Project were selected for a BUILD award, that would be the first federal source applied to the Project. With this new federal element, the existing TEER would be sent to FHWA for review and approval. It was not submitted to FHWA in the past, as there is no federal funding support for the Project. As the Project was evaluated in the TEER two years ago, the TEER would be updated for small changes in the Project details and submitted to FHWA.

State and Local Approvals

No legislative approvals are required to replace the crossing. The Project is included in the State Rail Plan, the State Transportation Improvement Plan (STIP), and it was the subject of a letter from TDOT to the City urging them to prioritize and advance this Project due to safety concerns. The Project was also identified as a needed investment through the public outreach conducted for Tennessee’s State Rail Plan and Multimodal Freight Plans.

Federal Transportation Requirements

Beyond the NEPA process described above, there are no federal requirements affecting state or local planning for this Project.

Assessment of Project Risks and Mitigation Strategies

The City has completed work similar to the proposed project and experienced no procurement delays of any significance. The project site is currently utilized for highway purposes and is situated within an active transportation corridor, reducing many potential risks.

VI. Benefit Cost Analysis

A number of analytical tools were applied to develop the supporting information for the BCA, including a Synchro simulation of the traffic flow, a GradeDec.NET analysis of the crossing hazard, and a predictive safety analysis of the road alignment/shoulder improvements, as well as the intersection improvements. Each modeling tool captured an important element of the proposed Project and a summary of the modeling exercises and findings is included with the Supplemental Materials for with this application.

Tools and models failed the Project team, however, when it came to the assessment of the queuing on SR-386, Saundersville Road, and US-31. Neither the Synchro work nor the predictive safety analysis captured that critical element of the Project. Work zone literature devotes considerable discussion to ways to mitigate queuing, but that literature is generally silent on the likelihood of a crash associated with the formation of the queue itself. There are no commonly reported crash reduction factors for the elimination of freeway queues, as there are for rumble strips, warning signs, and other safety treatments. The Project team infers that the absence of a common set of crash reduction factors for the elimination of queues on freeways is because queues are an aberration in general highway travel and generally do not occur in a predictable way outside of work zones.

A review of the literature completed for this application identified the following information as it relates to the crash risk associated with freeway queues (or the crash reduction benefit from removing queues, by contrast):

- The crash involvement rate in Bottleneck Front, Back of Queue, and Congestion states are approximately 5 times higher than free flow traffic⁶;
- There is a large amount literature on how to manage the risk of queueing in work zones, places where the driver is warned in advance that there may be a queue ahead with orange cones and blinking arrows as opposed to the unmarked conditions on SR-386, for example⁷;
- Highway queues may lead to secondary crashes through distraction and rubbernecking⁸; and
- In a test of a freeway “queue warning system operation, the crash frequency recorded at the I-94 test site was 9.34 crashes per vehicle miles traveled (VMT) and 51.8 near-crashes. This was a 22 percent decrease from the 11.9 crashes per VMT recorded at the site in 2013 monitoring data, and a 54 percent decrease from the 111.8 near-crashes recorded there in 2013.” The article highlights the value of measuring near-misses, as well as actual crashes.

⁶ Yeo, Hwasoo , Kitae Jang , Alexander Skabardonis , Seungmo Kang. Accident Analysis & Prevention, Volume 50, January 2013, Pages 713-723.

⁷ FHWA web resources for example

⁸ One literature review found that “overheating of engines and truncated spacing between vehicles due to incident related congestions accounts for 60 percent of total freeway congestion [25], these factors significantly increases the likelihood of secondary incidents deteriorating congestion, clearance time, and safety [3] [10][26]. The likelihood of a secondary crash increases by 2.8 percent for each minute of delay in clearing the primary incident. Causes include the dramatic change in traffic conditions, including the rapid spreading of queue length, and the substantial drop in traffic speed, as well as rubbernecking [7]. Secondary crashes due to congestion resulting from a previous crash are estimated to represent 20 percent of all crashes.” as written in Rohit Reddy Saddi, 2009, Thesis on “Studying the Impacts of Primary Incidents on Freeways to Identify Secondary Incidents,” University of Nevada.

Multiple transportation experts have assessed the queuing at the crossing and concluded that it is a serious hazard that is likely to result in a fatality if not addressed. Given this, the Project team applied a 90 percent reduction in rear-end crashes in the project area. This approach yields a conservative estimate that misses much of the quantitative benefit because:

- The whole queue on SR-386 is removed, but the estimation only takes credit for 90 percent of the reduction;
- It does not consider potential fatalities that could occur from a high-speed back of queue collision on SR-386;
- Near-misses and other crash types that could result from queuing such as sideswipes are omitted from the estimate;
- It relies only on the crash history over the past six years;
- Secondary crashes that are caused by the first crash are omitted as they may be in other locations due to rubbernecking or other types of crashes than rear-end types.

Of particular note for the BCA, the baseline does not assume a ramp closure as TDOT has not moved forward with that action. If the ramp were closed, it would increase VMT and congestion in the area, likely yielding a higher benefit cost ratio than that presented in this application.

For the BCA, the analysis estimates a four-year project implementation period with completion in 2023. The costs and benefits of the Project operations were captured over a 30-year analysis period from 2024-2053. Table 3 summarizes the discounted value (7 percent discount rate in 2017 dollars) of the benefits and costs of the total Project. Taken in total across the full Project cost and using a 7 percent discount rate, the benefits and residual savings provide over \$25.6 million dollars of net benefits over the analysis period. Compared to a similarly discounted cost estimate, the Benefit Cost (BC) Ratio for the total Project is 2.9. This estimate includes the disbenefit of construction disruption.

For details on the BCA and the methods used, please see the technical memorandum and BCA workbook included as Attachments and in the Supplemental Materials (BCA Tech Memo and HendersonvilleBUILD_BCA.xlsx).

Table 3: Total Project Benefit Cost Analysis Results in 2017 \$M, Discounted at 7 Percent

Costs	Value
Capital Costs	\$13.6
Total Costs	\$13.6
Benefits	
Value	
Safety	
Safety at Grade Crossings	\$0.4
Road Impacts	\$2.4
Emergency Services	\$0.4
Subtotal Safety Benefits	\$3.2
Economic Competitiveness	
Travel Time Savings	\$37.7
Truck Operating Cost Savings	\$0.8
Vehicle Operating Cost Savings at Grade Crossings	\$0.04
Construction Delays	-\$1.7
Subtotal Economic Competitiveness Benefits	\$36.8
State of Good Repair	
Residual Value	\$0.7
Subtotal State of Good Repair Benefits	\$0.7
Environmental Sustainability	
Auto Emissions Savings	\$0.04
Truck Emissions Savings	\$0.02
Subtotal Environmental Sustainability Benefits	\$0.05
Operating and Maintenance Costs	-\$1.5
Total Benefits	\$39.3
Results	
Value	
Net Benefits	\$25.6
BCR	2.9

VII. Supplemental Materials

The following items are included as supplemental material to support the grant application:

- Henderson BUILD Project Information Form (BUILDInfoForm.xlsx)
- BCA Workbook (HendersonvilleBUILD_BCA.xlsx)
- BCA Technical Memorandum (BCA Tech Memo.docx)
- Funding Commitment Letters
- Letters of Supports
- Tennessee Environmental Evaluation Report
- Drone video footage of queues following a train passing