FY2021 RAISE Grant Application

SH-37 BNSF Railroad Crossing: Moore, Oklahoma

Project Name: SH-37 BNSF Railroad Crossing
Project Description: Rail Grade Separation Project
Project Sponsor: Oklahoma Department of Transportation

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Project Costs

RAISE Request:	$10,000,000
Total Construction Cost:	$20,000,000
Total Federal Funding:	$10,000,000
Total Non-Federal Funding:	$10,000,000
Incurred Costs:	$6,440,000
Total Project Costs:	$26,440,000
Department Financing Program:	No

Project Location

State:	Oklahoma
County:	Cleveland County
Zip Code:	73160
Urban/Rural:	Urban
Urbanized Area for which project is located:	Oklahoma City
Project Census Tracts:	2021.02, 2021.04
Area of Persistent Poverty?	No

Project Details

Capital or Planning:	Capital
Project Type:	Rail – Grade Crossing
Prior BUILD/TIGER Funds Awarded to Project:	No
USDOT FY21 Discretionary Application:	No
Tribal Government:	No
Tribal Benefits:	No
Private Corporation Involvement:	Yes
Private Corporation Name:	BNSF Railroad
TIFIA/RRIF:	No
Benefit Cost Ratio	1.34

Supporting Material Available at:
https://oklahoma.gov/odot/progress-and-performance/federal-grant-awards/raise-grants/sh-37-bnsf-railroad-crossing.html

OKLAHOMA Transportation

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PROJECT DESCRIPTION

The Oklahoma Department of Transportation (ODOT), in partnership with the City of Moore, Oklahoma and the Burlington Northern Santa Fe (BNSF) Railroad, is requesting $10 million to facilitate the grade separation of the **State Highway 37 (SH-37) Railroad Crossing in Moore, Oklahoma** (The Project)**.** A public-private partnership, the Project is a result of comprehensive collaboration that will improve the quality of life, safety, air quality, and reliability for the residents and motorized and nonmotorized travelers of Cleveland County, OK.

As shown in **Figure 1,** the Project will include grade separation of the BNSF railroad tracks at SH-37. Project improvements (which are currently at 90 percent design) include the construction of a new two-track railroad bridge with room for a future third track over SH-37. The existing SH-37 roadway will be reconstructed as a four-lane curb and gutter section and retaining walls will be constructed north and south of SH-37 throughout most of the Project limits. A raised median between eastbound and westbound lanes will be added to the grade-separated roadway as well as 10-foot multimodal shared-use concrete paths on both sides. A pedestrian bridge will be built over the roadway, providing a new north-south pedestrian connection that will tie into the trail network of the adjacent Central Park and the soon-to-be-constructed, Old Town Park. To accommodate drainage, a pump station will be built on a permanent easement provided in-kind by BNSF. During construction, traffic will be detoured through S. Turner Avenue. Currently a curbless neighborhood street, Turner Avenue will be permanently upgraded as part of the Project with added curbs and a bike lane, adding additional mobility benefits for the largely residential neighborhood.

Figure 1: Rendering of Rail and Pedestrian Bridge over SH-37 and 10-Foot Multiuse Shared-Use Paths

SH-37 BNSF Railroad Crossing: Moore, Oklahoma

As shown in **Figure 2**, the conditions of the crossing provide a barrier to reliable community access and create a safety hazard to rail, road users, and active transportation users alike. The BNSF railroad track runs north to south through the center of the City of Moore. The rail line has on average 34 trains using the tracks daily, including two daily Amtrak trips, resulting in a frequent and unpredictable blocked crossing. As trains approach the BNSF Flynn Yard (approximately 2.3 miles north near the Moore border with Oklahoma City), they reduce their speed, and the slow-moving trains block the crossing causing significant time delays. Oklahoma had a state law that banned trains from blocking streets for more than 10 minutes, but a federal judge ruled in favor of BNSF in December 2020 thus removing financial penalties for trains blocking a street.

Figure 2: Current Conditions
Traffic builds from the blocked crossing on SH-37 in Moore, OK. Picture taken June 9, 2021.

The City of Moore has four at-grade crossings (12th Street, Main Street, SH-37, and SW 34th Street) and two grade-separated crossings including 19th Street (one mile to the south of SH-37). Notably, 19th Street is the commercial heart of the city and experiences congestion as a result of both commercial activity and use as a throughput alternative to the at-grade crossings to the north and south (including SH-37). The focus of this application, SH-37, begins in Minco, Caddo County to the southwest of the Oklahoma City Metro area and proceeds east into Moore where it ends 3.75 miles east of I-35 at the intersection with Sooner Road (SH-77H). SH-37 along with 19th Street are the highest traveled roadways in the city. SH-37 and the Project intersection's proximity to on- and off-ramps of I-35 (0.15 mile to the west) make it a highly traveled segment. The frequent slow-moving and lengthy trains and the 15,500 vehicles per day using SH-37 make this Project a priority to improve travel time reliability and accessibility of the regional transportation system.

Under current conditions, the existing crossing occurs at grade, facilitated by cross arms and warning lights. Vehicles cross two tracks, one mainline and a siding, on a four-lane concrete section with no sidewalks or multimodal access. The frequency and length of train blockings cause reliability and congestion for both rail and road users. The SH-37 rail crossing is identified

as a chokepoint and one of five statewide highway-rail grade crossing projects in the 2018 Oklahoma State Rail Plan.

For road users, the blocked crossing introduces not only irregularity and congestion but also causes significant impacts on quality of life. Emergency services often encounter disruptions when trying to access the Norman Regional Hospital which is located less than a mile west of the Project on the western side of I-35. Routes to avoid the crossing may experience congestion from those looking to detour, increasing emergency response time without ever crossing the Project intersection. With a history of deadly and destructive tornadoes, the City of Moore includes this Project as a residency priority in *Envision Moore Plan 2040*, the City of Moore's 2040 Comprehensive Plan, stating "[Transportation infrastructure] is depended upon as a primary means for preparedness and recovery before, during, and after a disruptive event in the community."

Resident Perspective from Town Hall Meeting

"I sometimes read a book while waiting, sometimes study my Bible lessons, write a grocery list, etc."

Beyond road and active transportation users, both freight and passenger rail are anticipated to benefit from the Project. Amtrak's Heartland Flyer runs roundtrips daily through the intersection, moving 68,000 passengers annually (2019 ridership) from Oklahoma City to Dallas/Ft. Worth Texas. The Heartland Flyer has stops in Norman, Purcell, Pauls Valley, and Ardmore in Oklahoma, as well as Gainesville, TX. The service connects Oklahoma to passenger rail options nationwide and passes through the Project area around 9 AM and 9 PM daily.

PROJECT HISTORY

For nearly a decade, the City of Moore has been identifying and preparing a solution for the disruptions and hazards created by the current conditions. In 2012, a study was conducted to determine the best and most feasible alternative for underpasses to carry traffic under the BNSF track alignment at SH-37 and/or 12th Street in the City of Moore. The engineering study recommended a new railroad underpass on SH-37 due to greater service to the traveling public, the higher volume of traffic on SH-37 Street than 12th Street, and reduced impacts to adjacent property.

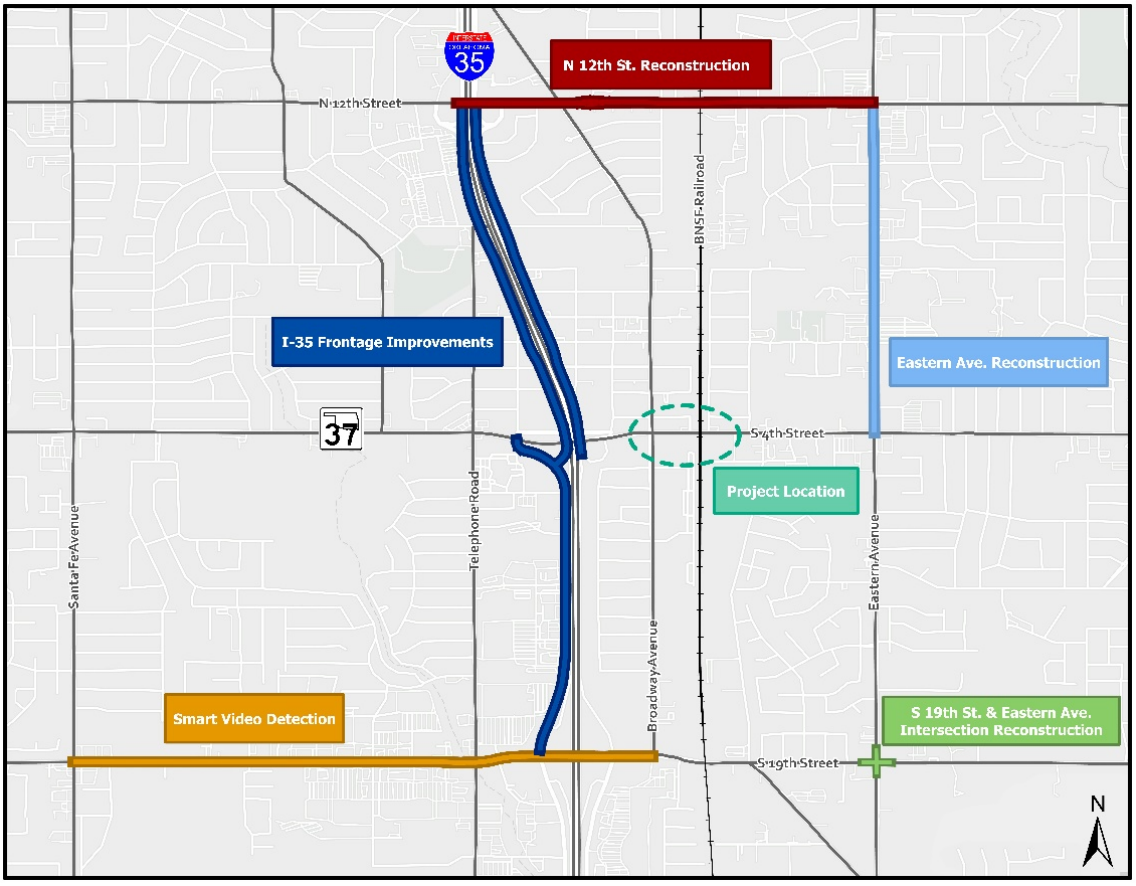
With a location selected, the City of Moore hosted a Town Hall in 2016 to roll out the Project planning. The initial project design began in January 2017 to illustrate the Project in advance of three town hall meetings held in May 2018. The three meetings were hosted throughout the city to provide project details in advance of a bond measure on the 2018 June ballot. The Project was included with other plans in a $48.6 million bond issue for the construction, improvement, and repair of city roads. Final project design began after the bond measure passed. Since then, regular updates have been provided on the City of Moore's website and at council meetings. Further public engagement will be completed as part of finalizing the design and planning construction.

OTHER TRANSPORTATION AND COMMUNITY INVESTMENTS

As shown in **Figure 3**, the Project is located amidst a range of transportation investments that will improve travel through and within the City of Moore and the State of Oklahoma. Five major investments totaling over $14 million are included in the Fiscal Year 2022-2025 Transportation Improvement Plan (TIP) for the local metropolitan planning organization (MPO), the Association of Central Oklahoma Governments (ACOG). All five investments are within the 1.5-mile square between SW 19th Street to the south, NE 12th Street to the north, I-35 to the west, and Eastern Avenue to the east; the Project is located in the middle of these locations.

Scheduled improvements include reconstruction of NE 12th Street, the reconstruction of Eastern Ave, I-35 Frontage improvements, and reconstruction of the intersection of SE 19th Street and Eastern Avenue. Lastly, to assist with traffic movement through the commercial corridor, smart video detection will be installed on SW 19th Street. As discussed in previous sections, 19th Street is the uninterrupted cross street that services as an existing alternative to SH-37. Though 19th Street runs through a commercial corridor that results in some congestion, the separated rail crossing makes it attractive to travelers. In addition to the upcoming investments on 19th Street, the Project will alleviate 19th Street congestion by providing a reliable cross-town route for through travelers.

Figure 3: Other Local Transportation Improvements (refer to Appendix A for a larger map)



The grade separation will also remove a freight bottleneck to leverage BNSF's recent 2018 premier of a logistics center. The 195-acres Logistics Center Oklahoma City is located east of the Flynn Yard and accommodates manifest and unit train customers in addition to on-site storage.

Figure 4: SH-37 BNSF Railroad Crossing Project Location (Refer to Appendix A)

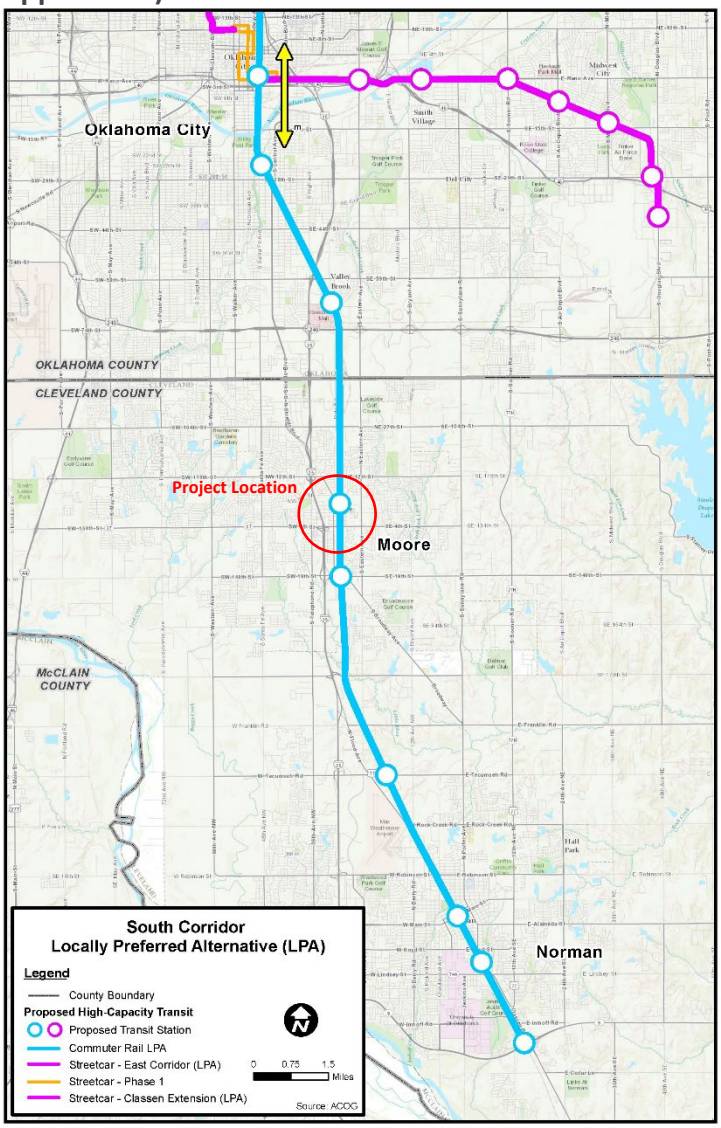
Lastly, the Project will benefit and improve a series of community investments in Central Park and Old Town Park (**Figure 4**). Old Town Park is approximately 0.7 miles to the north of the Project intersection on Main Street near another at-grade crossing. Currently under development after the passage of a 2016 voter-approved sales tax, Old Town Park will feature a new replica train depot, public art, and walking trails to the south which will connect to Central Park through the Project's pedestrian bridge. Central Park is situated on the corner of SH-37 and Broadway Avenue. With a playground, amphitheater, picnic area, and walking trails, the 51-acre Central Park, and the 53,000 square foot Station Recreation and Aquatic Center were constructed in 2016. The Station Recreation and Aquatic Center is home to a variety of group fitness, education, crafting, and hobby classes to help foster a healthy lifestyle while building a strong and social community. Both assets will be more accessible and connected for community use with the completion of this Project.

PROJECT LOCATION

Located just 0.15 miles east of I-35, the Project represents a critical crosstown connection within the City of Moore. The Project is approximately 0.3 miles long, starting at S. Broadway Avenue and continuing through the railroad crossing to S. Eastern Avenue. The total Project area is approximately 5.2 acres with 3.2 acres of existing right-of-way and approximately 2.0 acres of proposed right-of-way.

The Project sits in the Oklahoma City Urbanized Area (2010 population: 861,505) in Cleveland, County. The community surrounding the Project location can be characterized as mixed-use. The northern section of the Project area contains the City of Moore's central business district, and the City of Moore's Central Park makes up a majority of the center/southern portion of the Project area. Land uses in the Project area include residential, commercial, park space, municipal, light industrial, with very few undeveloped parcels. A variety of commercial properties and community facilities exist within the Project area, including multiple retail establishments, churches, Norman Regional Hospital, Moore Police Station, Moore Fire Station, Moore Public Library, daycare centers, non-profit organizations, Central Park, and an alternative learning school.

Figure 5: Commuter Rail South Corridor LPA (Refer to Appendix A)



The Project is located on the border of the Old Town neighborhood of Moore. The city has an ongoing emphasis to redevelop Old Town, as demonstrated by the 2019 Old Town Moore Revitalization Plan. Old Town is the historic center of the city which is also home to the City Hall and recent residential growth. The Project location also holds potential relevance for future development in Moore. The Regional Transportation Authority (RTA) of Central Oklahoma formally came into being via state law in 2019 and includes representatives from Edmond, Norman, Midwest City, Del City, Moore, and Oklahoma City. While in the early stages of planning, RTA is interested in regional transportation such as commuter rail and will likely build on a 2015 study from ACOG that identifies commuter rail corridors. The corridor as proposed in the Central Oklahoma Commuter Corridors Study is presented in **Figure 5**. The *Envision Moore Plan 2040* expresses the desire to plan for commuter rail and identifies the Project corridor as a target for mixed-use development and higher density housing types especially along SH-37 on the southern end of Old Town.

GRANT FUNDS, SOURCES, AND USES OF PROJECT FUNDS

BUDGET

With 90 percent of the design complete, the Project will use RAISE grant funds for the construction of the underpass, which has a total budget of $20 million. Previously incurred costs included $1.4 million for environmental and engineering, $5 million for right-of-way and utilities. A total of $5 million (25%) will come from Bond funds, $5 million (25%%) from state funds, and $10 million (50%) of RAISE funds are being requested through this application. A breakdown of the Project budget and funding sources is outlined in **Table 1**. Also included in the "Incurred" cost for Bond Funds are $3.46 million in costs obligated but not yet expended by the City.

Table 1: Project Budget and Anticipated Funding Source (in Millions)

	Bond Funds		State Funds		Federal Funds		RAISE Funds	Total Project Costs
	Incurred	Future	Incurred	Future	Incurred	Future		
Environmental & Engineering	$1.40							$1.40
ROW & Utilities	$5.04							$5.04
Construction		$5.00		$5.00			$10.00	$20.00
Contingency &Other								
Total:	$6.44	$5.00	$ -	$5.00	$ -	$ -	$10.00	$26.44

The federal RAISE grant funds of $10 million will provide the necessary funding to complete the construction of this critical safety, mobility, connectivity project in the heart of the City of Moore on its busiest highway. The RAISE grant funds will be used solely for construction.

FUNDING COMMITMENTS

The Project in Moore, Oklahoma is a partnership in the absolute truest sense of the word. As shown in **Table 2**, this partnership includes local, state, and federal funds**.**

Offering significant local contributions, the City of Moore is funding 36 percent of the future Project costs. The City of Moore included this railroad grade separation project in a Citywide bond package which was approved by an overwhelmingly positive vote (61%) from the citizens of the City of Moore in 2018. In addition, the City of Moore has also paid for all of the engineering, utilities, and right-of-way acquisition efforts that have been performed to date.

The BNSF railroad owns and operates the north/south rail line that is crossed by SH-37. The BNSF is a huge supporter of the elimination of at-grade crossings on their rail network. It is anticipated that right-of-way will be needed from the BNSF railroad for (a) construction and (b) the pump station that will provide stormwater control for SH-37 under the rail line. The BNSF will donate the right-of-way necessary for the construction and placement of this pump station.

The State of Oklahoma through ODOT has committed a minimum of $5 million for the construction of this Project. ODOT works closely with the BNSF railroad throughout the State of Oklahoma to both eliminate and improve railroad crossings for the safety and efficiency of the traveling public and the national freight movements on the BNSF rail line.

Table 2: Summary of Future Eligible Costs

Project Component	Funding Type	Cost Share	Cost
Construction	RAISE	50%	$10,000,000
	ODOT	25%	$5,000,000
	Local	25%	$5,000,000
TOTAL FUTURE COSTS			**$20,000,000**

PROJECT CRITERIA

SAFETY

The Project aims to achieve a grade separation through a unique partnership forged by nine repeated tornado disasters in the City of Moore over the last quarter-century. Serving as a key east-west arterial through the city carrying over 15,500 vehicles per day, SH-37 is one of the few continuous 4-lane facilities that serve the community which is bisected by both I-35 (0.15 miles away) and BNSF rail tracks. Creating the grade-separated crossing for SH-37 in Moore will significantly improve safety, mobility, and connectivity in the entire Moore community.

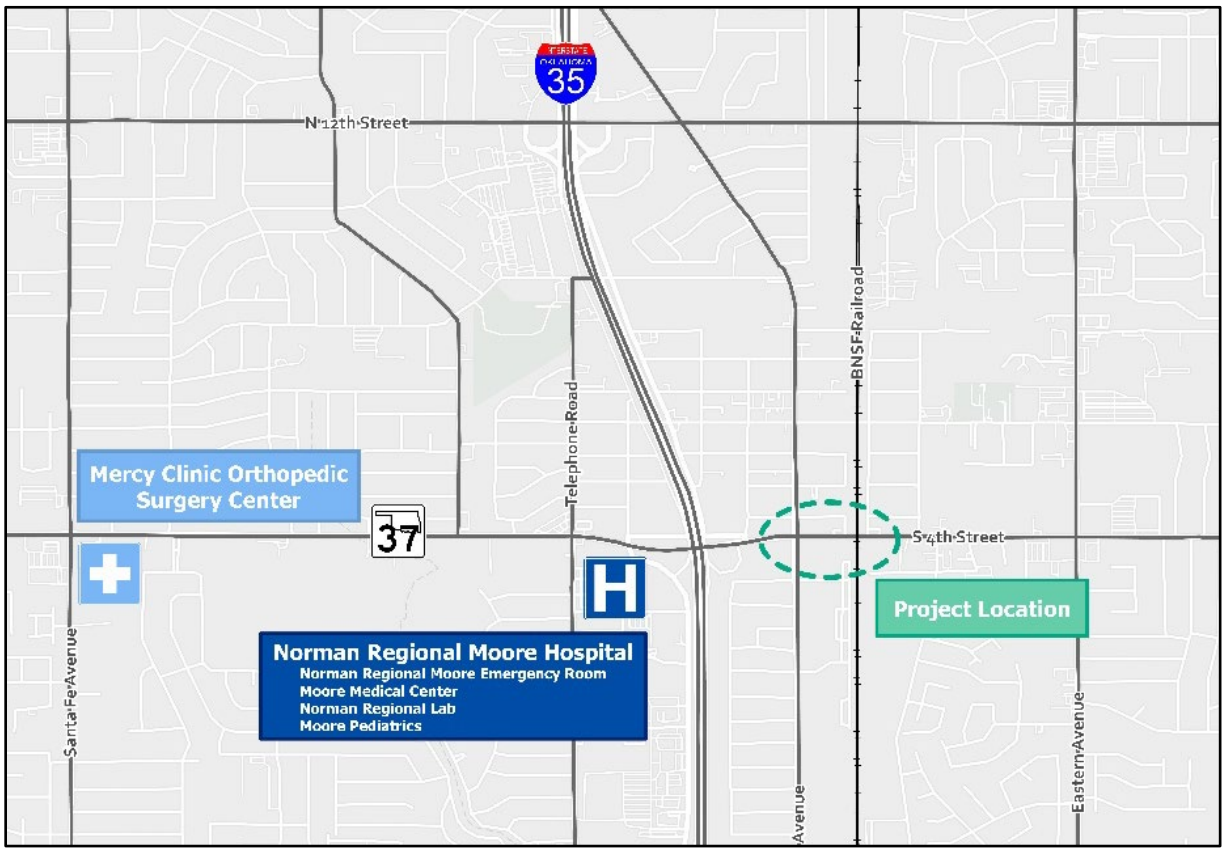
Since the Project is located 2.3 miles from the BNSF Flynn Rail Yard and located along a double track section of the BNSF mainline, there is a significant potential for conflicts to occur between the rail traffic and street, bicycle, or pedestrian traffic. The traveling public, including emergency service (ambulance, fire, and police) vehicles, frequently have a significant wait time as trains are slowly approaching or departing the Flynn Rail Yard and intermittently stop for staging of available capacity within the rail yard.

The Project will Improve Emergency Service Response Times, Especially During Natural Disasters

As shown in **Figure 6**, several significant healthcare facilities, including Norman Regional Moore Hospital, Mercy Clinic Orthopedic Surgery Center, Moore Medical Center, and Norman Regional Laboratory Services are located along the SH-37 corridor near the Project area. The Norman Regional Moore Hospital offers emergency and outpatient services to the entire community,

including those in the adjacent census blocks that have minority populations as high as 50 percent. Frequent train crossings that impede traffic daily also adversely impact access to, and availability of, healthcare and critical emergency care for individuals located on the eastern side of Moore, including environmental justice populations. Emergency vehicles attempting to reach the Norman Regional Moore Hospital emergency room have been forced to reroute, adding at least two miles to their drive, and perilously losing time in emergencies. This not only impacts ambulances and others needing emergency care but also fire and police responses to those in need. Between July 1, 2020, and June 24, 2021, 336 emergency service vehicles have been blocked by a train while on an emergency call. This Project will eliminate all emergency delays and in turn, the community will receive faster emergency response times.[1]

Figure 6: Project Location and Medical Facilities



Several tornadoes have wreaked havoc on the Moore community. Moore has been impacted by nine tornadoes since 1998 and three of these have been significant enough to cause the loss of lives and cause catastrophic property damage. May 1999 saw a tornado kill 36 people across the Oklahoma City metropolitan area. In May 2013, 24 people were killed along with 212 injuries, with many seeking treatment at area hospitals. During these tornadic events, access to the healthcare facilities was impaired due to the slow-moving trains crossing SH-37. The critical

[1] City of Moore Police Report. Major Ted B. Billing provided the number of emergency vehicles that had to reroute due to a train blocking SH-37. Moore Police, Fire, and EMS responders must report to dispatch if a train is blocking SH-37 while on an emergency call.

care needed by victims will be protected and safeguarded by constructing a grade separation to ensure that train blockage of the crucial SH-37 corridor does not occur, and that access is unobstructed by eliminating the potential for train-vehicle conflict and delay.

The Project eliminates Train-Vehicle and Train-Pedestrian Crashes, Injuries, and Fatalities

Since 2010, there has been unfortunately one auto-related fatality crash, 20 non-incapacitating injury auto crashes to 24 persons, 41 possible injury auto crashes impacting 47 people, and 123 crashes that resulted in property damage in the vicinity of the Project. Records indicate that in total there have been no train-pedestrian crashes but there have been three crashes between a freight train and a vehicle, which caused two injuries to the drivers of the vehicles. One of the train-vehicle crashes that occurred on August 16, 2018, involved a train transporting hazardous materials. While the majority of the reported accidents in the Project location did not directly involve rail traffic, the delayed and stopped conditions at the crossing greatly contribute to many crashes between vehicles on the roadway.

"The SH-37 rail crossing is a vital corridor for all emergency traffic. Delays and obstructions impact human lives. It is not uncommon for the train to block SH-37 and or Main Street in Moore. When this occurs the only other crossings are miles away. This causes police services to be significantly delayed as they must travel miles to an alternate crossing. When police are responding to emergency calls this wastes critical minutes and causes delays. The operations and efficiency of the Moore Police Department would be enhanced greatly. Therefore, the community will benefit and be safer for the completion of this project."

Chief Todd Gibson, City of Moore Police Chief

Interactions between train traffic and vehicles, pedestrians, or bicyclists can be particularly catastrophic. The creation of grade-separated crossings eliminates the potential for such interactions to occur. Not only will the potential for train-vehicle and train-pedestrian/bicycle collisions be eliminated, many of the ancillary crashes (rear-end, sideswipe) related to stopped traffic waiting for train crossings will also be eliminated.

The Project Improves the Safe Movement of Good and People and Prevents Environmental Contamination

Since collisions between trains and vehicles, particularly large trucks, cause extensive damage to the vehicle and passengers on the roadway, significant loss of life and risk of any cargo being inadvertently released into the environment is a concern. Oklahoma's energy and agricultural industries transport many truckloads and trainloads of potentially hazardous materials through this corridor. Additionally, Oklahoma's only Amtrak route utilizes the track at this location twice every day as it passes from Oklahoma City to Ft. Worth, Texas. Improving the flow of both

passenger and freight rail, as well as future commuter rail, while minimizing the potential threat of collision at an at-grade crossing removes the potential for future catastrophic incidents at this location.

ENVIRONMENTAL SUSTAINABILITY

THE PROJECT WILL IMPROVE TRAVEL DELAY AND REDUCE EMISSIONS

BNSF has played an important role in Oklahoma's economy for over a century and owns almost 30 percent of the total Oklahoma rail network. As previously mentioned, the BNSF rail line that intersects SH-37 is 2.3 miles from the BNSF Flynn railyard and the BNSF Logistics Center, a 195-acre logistics hub that can handle both manifest and unit trains.[2] On average 32 freight trains and two passenger trains travel along this rail line daily. This busy rail corridor not only causes temporary closures to traffic on SH-37 while the 34 trains pass per day but also occasionally experiences blockings due to the proximity to the BNSF Flynn railyard and logistics center. A grade-separated crossing would allow for improved traffic flow on SH-37 resulting in less delay and reduced emissions. The 25-year forecasted reduction of CO_2 is 12,660 metric tons with the construction of the new separated crossing. Other estimated emission reductions are provided in **Table 3.**

Table 3: Projected Emission Reductions Resulting from the Project (2024-2048)

Pollutant	Total Metric Tons Saved
NOx	5.2182
SOx	0.0693
CO_2	12,660.4657
PM2.5	0.3170

Oklahoma does not currently have any nonattainment or maintenance areas and is working to maintain that status. To do so, Oklahoma DOT and its MPOs focus on implementing projects that will reduce emissions, particularly in metropolitan areas.

This is a critical improvement because the 8-hour average ozone value at the Moore monitoring site measured 0.068 parts per million (ppm) in 2019 which is close to exceeding the standard value of 0.0705 ppm.[3] Ozone causes many negative health effects, so it is important to ODOT, the City of Moore, and ACOG to maintain or reduce the ozone levels in Moore to avoid exceeding the standard. As noted by the U.S. Department of Energy, idling reduces a vehicle's fuel economy, costs more money, and creates pollution. Based on current traffic data and travel time and speed data at the Project location, peak hour delay is estimated to be about 30 seconds per vehicle with a maximum delay of about four minutes to clear the queue. Idling for more than 10 seconds uses more fuel and produces more emissions that contribute to smog

[2] "BNSF opens logistics center in Oklahoma" Progressive Railroading. August 22, 2018. https://www.progressiverailroading.com/bnsf_railway/news/BNSF-opens-logistics-center-in-Oklahoma--55416 accessed 6/2021.

[3] Oklahoma Department of Environmental Quality Air Data Report 2019. https://www.deq.ok.gov/wp-content/uploads/air-division/Monitoring_Air_Data_Report_2019.pdf

and climate change than stopping and restarting your engine does.[4] Through public meetings and conversations with the local community and law enforcement, delays over ten minutes have been reported at the crossing location. This not only impacts the travel time reliability of SH-37 in Moore but also increases the emissions caused by idling vehicles.

In addition to the benefit of reducing delay, this Project also includes the addition of bicycle and pedestrian amenities along the corridor to support active transportation use in the City of Moore and connections to its parks and trail system. A curbed shared-use path is included in the Project along SH-37 to provide safe pedestrian and bicycle access through the underpass and a pedestrian bridge will be installed to provide a safe crossing over the SH-37 underpass to Central Park.

The Project Considered Environmental Justice in Planning and Design Stage

A social, economic, and environmental justice (EJ) analysis report was conducted in May 2021 for the Project. The purpose of the analysis was to assess potential social and economic impacts associated with the proposed Project and included a community profile. The summary findings of this analysis are that the proposed Project will:

- improve safety and reduce travel delay caused by the existing at-grade crossing;
- promote connectivity and mobility for pedestrians and cyclists along the corridor; and
- provide equal benefits to EJ and non-EJ communities.

The public has been engaged through the Project development process and will continue to be engaged throughout the Project to deliver the Project with accountability and transparency.

Project Provides Improved Mobility Options that Reduces Emissions

Currently, limited sidewalks exist in the Project area but are not connected. Due to the discontinuous nature of the sidewalks, most of the Project area lacks pedestrian infrastructure and thus discourages pedestrian use. One bicycle lane is located in the Project area along South Howard Street, from SW 1st Street to SH-37 but is discontinuous.

The lack of bicycle or pedestrian infrastructure on this road was identified as the largest active transportation barrier for the Old Town neighborhood during the creation of the *Envision Moore Plan 2040*. The Project will resolve this barrier through the addition of paved 10-foot shared-use paths which will allow east to west active transportation access. Additionally, as shown in **Figure 7**, the Project's new pedestrian bridge will provide a dedicated north-south connection between a range of community assets.

[4] U.S. Department of Energy. Energy Efficiency & Renewable Energy. DOE/CHO-AC-06CH11357-1502, May 2015

Figure 7: Rendering of Shared-Use Paths and Pedestrian Bridge

The pedestrian bridge will provide a new north-south pedestrian connection that will tie into the trail network of the adjacent Central Park and the future Old Town Park. The distance between these two parks is currently 0.7 miles and it takes approximately four minutes to bike and 14 minutes to walk between the park locations. However, with the new pedestrian bridge, the distance is reduced to 0.37 miles, and it would take approximately 1 minute and 45 seconds to bike and six minutes to walk between the park locations.[5] In 2020, the annual attendance at the Station at Central Park was 68,907 and the new pedestrian bridge will greatly improve mobility and safety for the thousands of residents and visitors who will access both parks.[6]

The Project will positively enhance community cohesion by creating safer and more efficient means for community members to travel along SH-37 by car, walking, and biking. Based on a study by the Commonwealth of Massachusetts, shared-use paths located in areas with higher concentrations of those of a racial or ethnic minority, experiencing poverty, with limited English proficiency, with a disability, with no vehicle access, or of youth or elderly age groups can benefit these historically transportation disadvantaged or vulnerable populations.[7]

[5] Distance and time were generated by using Google maps and directions.
[6] Annual attendance at The Station at Central Park was provided the City of Moore Park and Recreation Department.
[7] https://www.mass.gov/guides/benefits-of-shared-use-paths#-shared-use-paths-benefits-primer-

The Project will provide improved mobility options that will reduce emissions for residents in the Project area. The shared-use path will accommodate pedestrians and thus will serve the purpose of a sidewalk. This is a critical improvement as FHWA notes the following:[8]

- Sidewalks separated from the roadway are the preferred accommodation for pedestrians.
- Sidewalks provide many benefits including safety, mobility, and healthier communities.
- In addition to reducing walking-along-roadway crashes, sidewalks reduce other pedestrian crashes. Roadways without sidewalks are more than twice as likely to have pedestrian crashes as sites with sidewalks on both sides of the street.
- By providing more comfortable facilities, the number of trips made by walking, particularly in areas with mixed land uses is increased.
- Providing sidewalks increases the transportation options for individuals who may not be able to drive a car. Additionally, by moving pedestrians off the travel lanes, motorist operations are improved and capacity increased.

Project Serves the Renewable Energy Supply Chain

Ethanol, a cleaner and more sustainable fuel, is among the freight commodities moved on this line. According to the U.S. Energy Information Administration, the combustion of ethanol made from biomass (such as corn and sugarcane) is considered atmospheric carbon-neutral because as the biomass grows, it absorbs CO_2, which may offset the CO_2 produced when the ethanol is burned.[9] BNSF helps Oklahoma farmers expand their markets by providing a vital link for Oklahoma's emerging ethanol industry.[10] Improving the intersection with SH-37 and eliminating this at-grade crossing will allow BNSF to continue to expand and continue to provide this service to Oklahoma's farmers and supporting Oklahoma's ethanol industry.

The Project will mitigate Noise Impacts

The Project will also reduce the overall noise impacts to the local area because passing trains will no longer use their horns at the crossing. As noted by the Federal Railroad Administration (FRA), train horns are installed on locomotives to warn motorists or pedestrians of an approaching train at a highway-rail grade crossing. In many geographic locations, and during much of the year, motor vehicles operate with windows rolled up, air conditioning systems, and radios in use. Therefore, audible warning signals must be sufficiently loud to be perceived. Unfortunately, the locomotive horn can significantly disturb those living or working near

[8] U.S. Department of Transportation, Federal Highway Administration. Safety Benefits of Walkways, Sidewalks, and Paved Shoulders. https://safety.fhwa.dot.gov/ped_bike/tools_solve/walkways_trifold/walkways_trifold.pdf

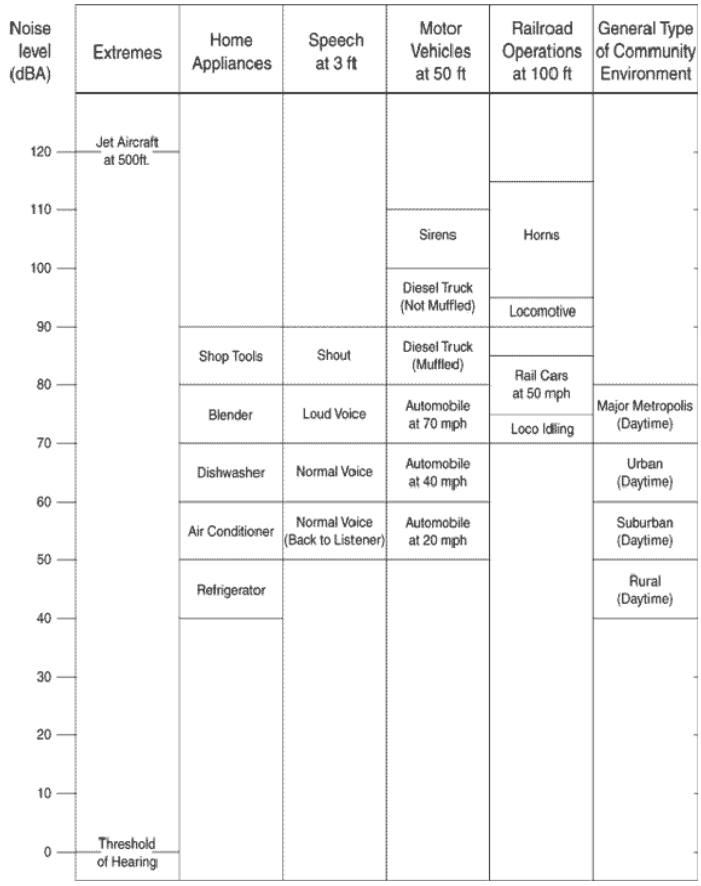
[9] U.S. Energy Information Administration, Biofuels Explained. December 2020. https://www.eia.gov/energyexplained/biofuels/ethanol-and-the-environment.php#:~:text=Producing%20and%20burning%20ethanol%20results,CO2)%2C%20a%20greenhouse%20gas.&text=Some%20ethanol%20producers%20burn%20coal,stocks%20or%20sugar%20cane%20stocks.

[10] Oklahoma Statewide Freight and Passenger Rail Plan. 2012 and 2018.

highway-rail grade crossings. [11] A comparison of general noise levels from various commonly experienced noise sources in our environment as well as typical ambient noise levels is shown in **Figure 8**. For instance, the noise resulting from the sounding of train horns has a similar impact to that of low-flying aircraft and emergency vehicle sirens.

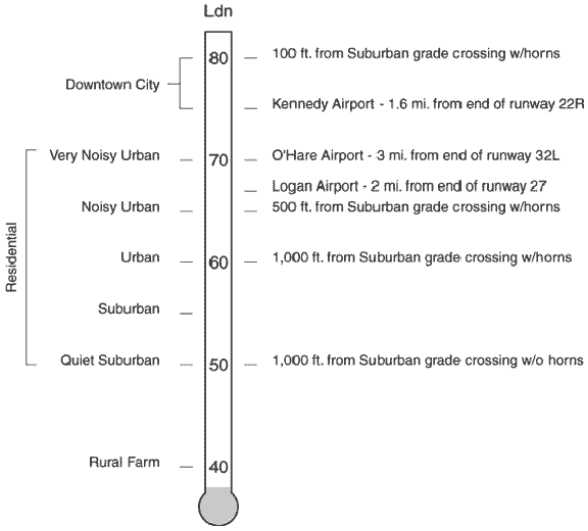
As noted by FRA in the Horn Noise FAQ, the preferred descriptor for environmental noise assessments is the day-night sound level (Ldn). Ldn provides an accurate measure of the overall "noise climate" of an area. Rather than representing the moment-to-moment variation in sound levels, Ldn describes the cumulative effect of all noise sources over a longer period. Typical Ldn's in various areas are shown in **Figure 9** and being 100 feet from the grade crossing a train horn is louder than “very noisy urban” residential settings.

Figure 8: Comparison of Various Noise Levels



Source: FRA

Figure 9: Day-Night Sound Levels in Typical Environments



Source: FRA

[11] U.S. Department of Transportation, Federal Railroad Administration. Horn Noise FAQ. https://railroads.dot.gov/environment/noise-vibration/horn-noise-faq

The Project will Mitigate Threatened and Endangered Species Impacts

Three species are observed at the Project location and include the whooping crane, piping clover, and red knot. There are no anticipated negative effects to these species as a result of the Project. The Project does not include widening or a new roadway. Because of this, there are no anticipated negative environmental impacts. The completion of the Project will result in more positive impacts or improvements to the community and the natural environment.

The Project will Improve Stormwater Management and Increase Resiliency and Disaster Preparedness

The stormwater drainage for the underpass will require a pump system that will discharge water at the same or lesser rate to the existing railroad ditch southwest of the crossing. The existing surface runoff for SH-37 currently drains along the curb to the railroad drainage ditch. The Project's drainage system of inlets and pipes carrying the runoff to the pump system will improve stormwater drainage in the Project location. Effective stormwater management provides environmental, social, and economic benefits to local communities. When stormwater management is done well, streams, rivers, and lakes are cleaner; flood risks are reduced; costs due to flood damage decrease; and community quality of life increases.[12]

The pump system will also make this portion of SH-37 more resilient to flooding after torrential rain events. The Project will improve disaster preparedness by ensuring free flow access along SH-37 to Norman Regional Hospital (0.6 miles from Project location), Moore Fire Station #2 (1.20 miles from Project location), Moore Police Station (0.33 mile from Project location), and I-35 (0.15 mile from Project location).

QUALITY OF LIFE

The Project Increases Transportation Choices and Equity for Individuals

A Social, Economic and Environmental Justice Analysis Report was completed for this Project in May 2021 based upon the build configuration established in the 90 percent plans. The report concluded that changes in travel patterns are anticipated during the construction of a grade-separated underpass beneath the BNSF railroad overpass between S. Broadway Avenue and S. Eastern Avenue along SH-37. There are several businesses and one community facility located along the corridor that would have access restrictions; however, the City of Moore is working with property owners to provide alternative access to the businesses and community facilities to avoid potential adverse changes in access.

Post-construction, motorists will experience shorter travel times along the SH-37 corridor due to grade-separated underpass. Additionally, the pedestrian bridge over SH-37 and continuous 10-foot-wide shared-use paths in each direction along SH-37 will increase transportation choices by improving safety, connectivity, and mobility for pedestrians and cyclists along the corridor. Overall, these improvements offer safety and mobility benefits for the majority of

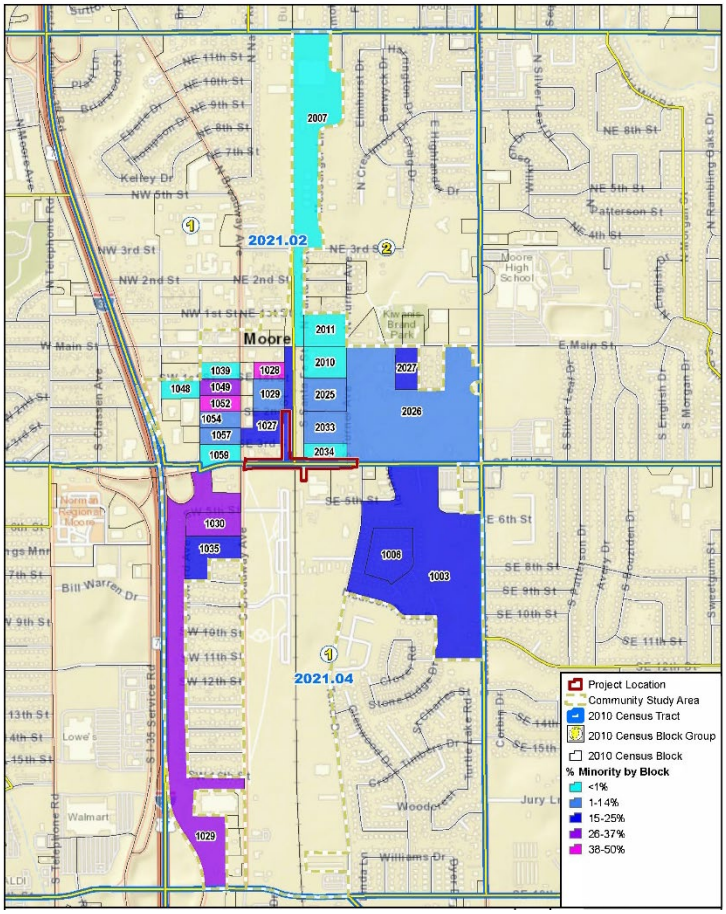
[12] Stormwater Management: What Stormwater Management Is and Why It Is Important. University of Nebraska, NebGuide. G2238. July 2014.

residents and would not significantly adversely affect the frequency with which people access other parts of the community.

Environmental justice (EJ) populations are present in the Project area. Adjacent Census block groups have minority percentages that range from approximately 0 to 50 percent (**Figure 10**). However, the proportion of minority population in this block is similar to the city and county averages (approximately 25.4 percent and 24.3 percent minority persons, respectively). No displacements would occur in a block containing a minority population and no displacements are located within a block group containing a predominantly low-income population. With the improved access to healthcare and connectedness to the remainder of the community, the minority and low-income populations will experience an improved condition.

The Project would enhance safety and efficiency for those traveling in the City of Moore, thus increasing the ease of traveling throughout the corridor and positively impacting community cohesion and connectivity. The Social, Economic and Environmental Justice Analysis Report concluded that the Build Alternative will not cause disproportionately high and adverse effects on any minority or low-income populations per the provisions of E.O. 12898 and FHWA Order 6640.23 and that no further Environmental Justice analysis is required.

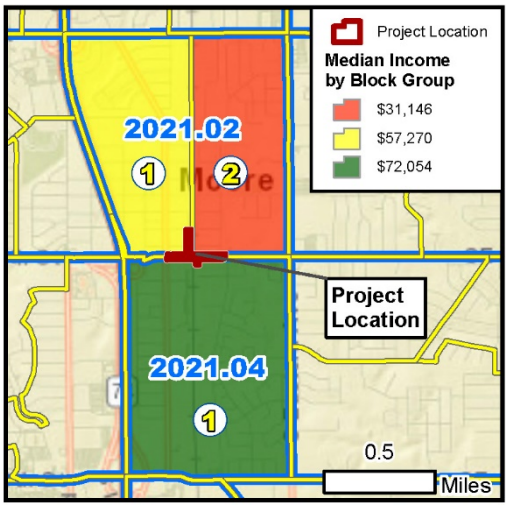
Figure 10: Minority Populations (Refer to Appendix A)



THE PROJECT IMPROVES CONNECTIVITY OF ESSENTIAL SERVICES – JOBS, HEALTHCARE & PARKS

As noted earlier, the Project includes a physical-barrier-mitigating pedestrian bridge over SH-37 which safely connects residents to local parks, health care facilities, and jobs in downtown Moore.

Figure 11: Median Income



Residents living northeast of the Project will be able to utilize the pedestrian bridge and shared-use paths along SH-37 to safely access job locations to the south and west of the project. Many low-income individuals lack vehicles and must either walk or bicycle to work. Access to jobs in the medical facilities, entertainment venues, and restaurants located just west of I-35, as well as the downtown Moore area will improve the conditions, access, and safety of many of the marginalized populations in the area. These investments create new connections and opportunities for the minority (**Figure 10**) and low-income (**Figure 11**) populations in proximity to the Project as many of the employers are located west of the Project location.

The predominant medical facilities in the corridor, the shared-use paths, and the pedestrian bridge will greatly improve access of all individuals located east of the Project to medical and healthcare facilities. Rather than crossing at-grade rail facilities and navigating among on-street vehicular traffic, all pedestrians and bicyclists will be able to use the newly created shared-use path and pedestrian bridge to safely travel to and from medical appointments.

Access to parks and recreational activities has long been a challenge in this vicinity as the at-grade rail facility presented a clear barrier to the community. The new shared-use paths provide for an unobstructed and safe passage for residents to the new and existing parks on the west side of the BNSF tracks. The pedestrian bridge will provide connectivity between parks and provide community members with welcoming, safe and enjoyable facilities that previously did not exist.

The Project Addresses Racial Equity and Barriers to Opportunities

The new pedestrian bridge provides a link for improved walking, biking, and rolling access between the existing Central Park and proposed Old Town Park just to the north of the Project. This would assist in mitigating the bifurcation of the community by the rail corridor by minimizing the rail as a physical barrier to both vehicular and active traffic and allowing improved, full access to community resources, such as the parks, schools, and library.

Creating a grade-separated crossing for traffic allows for the free flow of freight rail to the BNSF Flynn Yard as well as delivery truck traffic to local commercial enterprises and employers. Providing this improved free-flow and reducing delays due to queues associated with passing trains on the SH-37 at-grade crossing. As such, deliveries of commercial goods, as well as access for customers and employees ensures that businesses within the area are more dependable, timely, and effective for the community as a whole.

ECONOMIC COMPETITIVENESS

THE PROJECT WILL IMPROVE THE EFFICIENCY IN THE MOVEMENT OF PEOPLE AND GOODS

The Project will save substantial hours of vehicular delay and reduce travel unreliability, currently resulting from the approximately 34 BNSF and Heartland Flyer trains that pass through the SH-37 at-grade rail crossing. That traffic includes approximately seven percent commercial vehicles. At current average daily traffic volumes, there are approximately 170 daily passenger hours and seven commercial vehicle hours of delay attributable to the at-grade rail crossing. The traffic flow through the crossing also includes emergency fire, police, and medical emergency vehicles and because of the potential for tornadoes, the route also may be used for evacuation purposes. In addition to vehicular delay, the at-grade crossing may impact train operations and posted speeds, impacting the movement of goods and intercity rail passengers.

The new east-west pedestrian bridge which parallels the rail line, as well as the uninterrupted pedestrian walkway through the new underpass will also significantly improve the movement of pedestrians and bikes (as well as other non-motorized transportation), and provide important access to adjacent commercial, recreational, and cultural sites.

"MANY TIMES, I HAVE **BEEN LATE FOR APPOINTMENTS** WHEN I TRY TO TAKE A DETOUR. IT SEEMS MANY OTHERS HAVE THE SAME IDEA AND **THAT COULD TAKE 30 MINUTES IN ITSELF."** – RESIDENT OF A NEARBY TOWN, TRAVELS THROUGH MOORE

THE PROJECT WILL INCREASE THE ECONOMIC PRODUCTIVITY OF LAND

By eliminating an important barrier to movement as well as a physical and aesthetic impediment within downtown Moore, the Project has the potential to increase the value of land and upgrade land use development around the I-35 interchange and along the SH-37 corridor. As an example, an underpass was constructed at 19th Street under the BNSF rail line, and this is now one of the main economic corridors in Moore.

THE PROJECT WILL STRENGTH THE ECONOMY OF THE CITY AND REGION AND CREATE OPPORTUNITIES FOR LONG-TERM JOB CREATION

Removing the at-grade crossing will provide an opportunity for new commercial and other productive land uses in and around the I-35 interchange and along the SH-37 corridor and long-term job creation would be enhanced. While Moore's employment base presently comprises a little over three percent of businesses and two percent of employment in the Oklahoma City MSA, it is located strategically within the MSA. For example, Moore is about equidistant between the Oklahoma City downtown area and the City of Norman, the home of the state's largest university and a major national presence as an academic and sports institution. Since Moore is centrally located within the OKC MSA, the improvements may spur business developments such as warehousing and distribution union jobs, a prospect further made possible by its location with respect to the major north-south freight corridor to the Mexican border, along I-35 and the BNSF mainline.

THE PROJECT WILL HELP THE US COMPETE IN A GLOBAL ECONOMY BY FACILITATING EFFICIENT AND RELIABLE FREIGHT MOVEMENT

The OKC MSA is a major north-south and east-west crossroad for the movement of freight. The I-35 and the BNSF, as noted, comprise a major complex of freight channels to and from the Mexican border and through the Midwest. As shown in **Table 4** and **Table 5**, the Freight Analysis Framework data confirms significant volumes of freight in and through the OKC MSA, with a significant modal balance between truck and rail freight. The Project will enhance the efficiency of goods movement through Moore and will enhance competitiveness as a result.

Table 4: Oklahoma City Regional Exports in 2017

Origin	Mode	Thousand Tons in 2017
401-Oklahoma City OK	1-Truck	34,441.2
401-Oklahoma City OK	2-Rail	5,407.3

Source: Freight Analysis Framework, Federal Highway Administration (https://faf.ornl.gov/faf5/)

Table 5: Oklahoma City Regional Imports in 2017

Destination	DMS Mode	Thousand Tons in 2017
401-Oklahoma City OK	1-Truck	44,051.9
401-Oklahoma City OK	2-Rail	8,583.1

Source: Freight Analysis Framework, Federal Highway Administration (https://faf.ornl.gov/faf5/)

STATE OF GOOD REPAIR

ODOT collects pavement condition data annually and uses this data to make decisions about pavement treatment. ODOT currently tracks the pavement condition metrics as per FHWA and also evaluates individual pavement distresses when recommending pavement treatment types.

THE PROJECT OPTIMIZES LONG-TERM COSTS THROUGH GOOD ASSET MANAGEMENT

The pavement condition along SH-37 in the Project area is currently rated as “fair” when utilizing the FHWA Good, Fair, Poor rating system. The slab index and joint index in the Project area are both low and would require extensive patching to maintain at the fair condition. Due to this, the preferred treatment is reconstruction. The long-term asset management cost of maintaining and rehabilitating SH-37 pavement in the Project area from 2021 through the year 2050 is estimated to be $519,606. The estimated maintenance cost to the BNSF railroad for the active control devices at the rail crossing is another $779,409 (both in 2021 dollars). The overall cost to maintain the roadway pavement and active control devices is approximately $1.3 million.

THE PROJECT ELIMINATES THREATS AND CONSEQUENCES IF SH-37 IS LEFT UNIMPROVED

ODOT and the City of Moore have agreed to turn over ownership and operation of this SH-37 to the City of Moore. Completing this Project before the ownership transition will ensure the City of Moore will have a roadway with good pavement condition that will last and not require

excessive maintenance and preservation expenses in the near future. If left unimproved, this segment of SH-37 will require reconstruction and will continue to impede traffic flow through the City of Moore and more importantly reduce safety, connectivity, and mobility of travel to and from healthcare facilities, jobs, parks, schools, and library.

SECONDARY MERIT CRITERIA

PARTNERSHIP

The Project has Strong Collaboration Among a Broad Range of Stakeholders

A truly collaborative effort, the Project involves both public and private entities to ensure minimal impact and maximum benefits for all Project stakeholders. The City of Moore, ODOT, and BNSF have and will all be dedicating financial and in-kind resources toward the Project. The City of Moore provided professional engineering services for the development of the Plans, Specifications, and Estimates (PS&E) with participation, review, and acceptance by BNSF, ODOT, and FHWA. The City of Moore is also leading environmental studies, preparation of the National Environmental Policy Act (NEPA) documentation, and land acquisition and utility relocation.

> "**I cannot explain how important it is to our citizens that we have access to cross the tracks during an emergency incident.** Time is such an important factor in us mitigating an emergency scene, whether it be an EMS, fire or natural disaster call. We will benefit tremendously by having an underpass for our daily operations and not being delayed on emergency calls by the tracks being blocked. SH-37 is a main artery for traffic flow in our community and we utilize it several times a day for emergency calls. **With the number of trains that commute through our city, this will be an invaluable underpass to allow us to provide emergency services for the citizens of Moore."**
>
> Chief Greg Herbster, City of Moore Fire Chief

BNSF will provide approximately 0.34 acres of permanent easement and 0.11 acres of easement at no expense. The 0.5 acres of land will be used for the Project's required pump station and land for rail detours. ODOT will advertise and let the Project for construction.

The Project's Planning and Design is Based on Equity-Focused Community Outreach

Other critical partners to the endeavor are the Moore residents and community members. Extensive public outreach occurred before project engineering as the City of Moore took the Project to residents for consideration as part of the 2018 bond package. Following public meetings located throughout the city, Moore voters approved the bond package with 61 percent of the vote. The community and stakeholders will continue to be engaged throughout the Project to deliver the Project with accountability and transparency.

Lastly, as a project with significant local and regional impact, support from business, industry, and government entities is widespread. Letters of support are available at the project website.

INNOVATION

The Project Will Use Innovative Technologies

ODOT will employ the use of Dynamic Message Signs (DMS), to inform the public of the upcoming project events, closures, and detours. These assets will help reduce congestion during construction while improving the safety and efficiency of movement through and around the work zone.

The Project Will Use Innovative Project Delivery

ODOT will make use of No Excuses Bonuses on the Project, including a substantial completion incentive of five percent to 10 percent of the contract with internal milestones included for key Project elements. The internal milestones may also have incentives associated to encourage contractor innovation in the early completion of major Project components including stages that open portions of the corridor to traffic.

ODOT will also make use of the e-Construction and 3D Engineered Models as innovations outlined in the Every Day Counts (EDC) Initiative. Additionally, the Project partners will refer to the EDC documentation for Improving DOT and Railroad Coordination in their efforts to deliver the Project since the BNSF is a key component of the Project. RAISE funding will allow the Project to let in the timeline established. E-Construction methods will include mobile inspection and reporting of construction progress.

ODOT commits to providing 3D computer models of the Project as part of the contracting process. This technology will allow contractors to utilize the most recent GPS-controlled equipment with Automated Machine Guidance in the construction process. Using and following the 3D model will minimize the potential for human error in establishing grades and elevations while improving efficiency in earthmoving during the construction process. These efficiencies improve quality while reducing the overall cost of construction.

ODOT is willing to incorporate stipulations that the contractor can make use of embedded strain gauges to serve as maturity meters in newly placed concrete. Current wireless technology allows for a smartphone connection or remote logger with cloud connections to track the strength of concrete. The readings from these meters would be utilized by the contractor and ODOT to make critical real-time decisions during concrete curing. This allows for the removal of concrete forms and opening to traffic earlier than conventional time-constrained specifications. Together these innovative delivery practices will result in more efficient Project implementation to advance safe, efficient, and reliable corridor improvements.

THE PROJECT WILL USE INNOVATIVE FINANCING AND IS A PUBLIC-PRIVATE PARTNERSHIP

In June of 2018, Moore residents approved a package of $48.6 million in General Obligation bonds for multiple infrastructure projects. The SH-37 project is one of many included in the package. The City has only issued bonds as they are necessary for the Project as they are needed. As such, to date, only $2.98 million has been issued for engineering costs, property acquisition, and utility relocation for this Project.

As noted earlier, this is a public-private partnership between the City of Moore, ODOT, and BNSF. BNSF will donate the right-of-way necessary for the construction and placement of the pump system that will improve stormwater drainage in the Project location. The City of Moore and ODOT will provide over 57 percent of the Project funding, $8.45 million and $5 million, respectively.

In 2018, the Oklahoma State Legislature enacted House Bill 1010XX, which raised the State's motor fuel taxes on gasoline and diesel by three and six cents per gallon, respectively. According to the Oklahoma Tax Commission, the increased gasoline tax was estimated to generate $52.0 million annually and the increased diesel tax was estimated to generate $53.0 annually. A combined 95.5 percent of these revenues are credited to the Rebuilding Oklahoma Access and Driver Safety (ROADS) Fund created by Title 69, Section 1521, Oklahoma Statutes.[13]

House Bill 1014XX of 2018 reduced general-purpose tax revenue to ODOT by the amounts attributable to the House Bill 1010XX tax increases and redirected certain Oklahoma Vehicle License and Registration Act from the General Revenue Fund to the ROADS Fund. The net impact of House Bills 1010XX and 1014XX was to increase state revenue to ODOT generated from the ownership or operation of a motor vehicle by $194.0 million per year and to reduce transfers of general-purpose state revenue to ODOT by the same amount.[14] Increased state revenue improves ODOT's ability to participate in the Project ensuring the goals of improving safety, equity, accessibility, and reliability.

ENVIRONMENTAL RISK

The Project has developed construction plans to the 90 percent stage. The following environmental clearance documents have been completed for the Project: Community Impact Assessment, Noise Assessment, Biological Assessment, Waters and Wetlands Report, Cultural Resources Survey Report, and the Social, Economic and Environmental Justice Analysis Report. None of these reports or assessments indicated the presence of items or concerns that may limit the Project's ability to move forward quickly. The built and previously disturbed nature of

[13] From the HB 1010XX fiscal impact statement. http://www.oklegislature.gov/BillInfo.aspx?Bill=HB1010&Session=172X

[14] From the HB 1014XX fiscal impact statement: http://webserver1.lsb.state.ok.us/cf_pdf/2017-18%20SUPPORT%20DOCUMENTS/impact%20statements/fiscal/senate/HB1014XX%20ENR%20FI.PDF

the existing transportation corridors in the Project area have enabled the process to proceed quickly.

As shown in **Figure 12**, Moore and ODOT have been proceeding with improvements within this critical corridor for years and remain committed to completing this Project to ensure fair and equitable transportation alternatives for the entire community.

Moore initially placed a contract in effect to complete efforts on the engineering and analysis on the Project in September 2015. In the subsequent years, design began in 2016 with right-of-way acquisition following in 2019 and utility relocations in 2020. The obligation of funds for assumed letting and construction of the Project will occur on June 10, 2022, with assumed letting scheduled for November 2022. Construction is anticipated to start on March 1, 2023, and be completed on February 28, 2024.

Figure 12: Assumed Project Schedule (Refer to Appendix B)

	2015	2016	2017	2018	2019	2021									2022											2023	2024
						M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D		
CDBG Project Award	15-Sep																												
Kick-off Meeting		10-Feb																											
Environmental Kickoff Meeting		14-Jul																											
30% Plans		30-Nov																											
Public Meeting			26-Jan																										
GO Bond Passed				26-Jun																									
60% Plans					26-Jul																								
City Council Approved NEPA																													
NEPA Studies																													
BNSF Plan Review																													
Complete NEPA																													
Finish R/W																													
Complete Plans																													
Complete Utility Relocation																													
Bond Sale for 4th Street																													
Construct Detour																													
Letting																													
Begin Construction																											January		
End Construction																												January	

REQUIRED APPROVALS

Environmental Permits and Reviews

The NEPA clearance process for the Project is well underway and ongoing. An environmental document in the form of a Categorical Exclusion (CE) is anticipated to be completed by October 2021. Moore is sponsoring the environmental clearance effort with oversight from ODOT which is utilizing their programmatic agreement with FHWA to update and clear the environmental processes.

As noted, a significant portion of the update, including data collection and compilation, including the Community Impact Assessment, Noise Assessment, Biological Assessment, Waters and Wetlands Report, Cultural Resources Survey Report and the Social, Economic and Environmental Justice Analysis Report, have already been completed and available on the Project website.

A public meeting was held on January 26, 2017, with 99 attendees and 19 written comments received. Through feedback at the public meeting, the community members shared that they were pleased that the planning efforts include safety, pedestrian, and environmental improvements. The community and stakeholders will continue to be engaged throughout the

Project to deliver the Project with accountability and transparency. Improving safety, travel time reliability, and mobility options for residents is an integral part of the Project design.

Since the Waters and Wetland Report indicates no streams/linear aquatic features, wetlands or ponds are present in the Project vicinity, coordination with the U.S. Army Corps of Engineers (USACE) for securing Section 404 permits should not be required. However, if permitting for this Project is deemed necessary, it would likely be limited to Section 404 Nationwide permits. ODOT has agency liaisons in place at the USACE as well as the U.S. Fish and Wildlife Service, which greatly accelerate and improve the consistency of permitting reviews if necessary.

State and Local Approvals

The City of Moore and Moore Chamber of Commerce have provided support letters for this Project. All letters of support are provided at the project website.

These agencies, and the public they represent, recognize that the critical nature of the Project improves access throughout the area as a result of extensive public information and engagement efforts by Moore since 2015. ACOG has stated support for inclusion in the Transportation Improvement Program (TIP). Due to the community support established for the Project, all state and local approvals will be readily obtained.

State and Local Planning

ACOG Long Range Transportation Plan (LRTP): The ACOG LRTP, Encompass 2040, approved in 2016 did not include the Project but will consider the request with the next plan update since the Project aligns with the obvious goals related to safety, infrastructure condition, congestion, freight movement, and economic vitality, and environmental viability and resilience.

Statewide Transportation Improvement Program (STIP): The ODOT STIP incorporates the first four years of the ODOT 8 Year CWP. As such, the Project will be incorporated into the STIP.

Long Range Transportation Plan (LRTP): The ODOT LRTP 2020-2045 is a policy document that provides a strategic direction for the development of the Oklahoma multimodal transportation system. The Project aligns with ODOT's long range strategic direction.

ASSESSMENT OF PROJECT RISKS AND MITIGATION STRATEGIES

Potential risks and mitigation strategies to minimize the potential impact of those risks are as follows:

- **Contamination risk due to prior site use:** There are 11 regulated sites near the project but based upon review only the BNSF right-of-way was considered a recognized environmental concern for the area of interest. This is due to the presence of parked railcars, long-term use for railroad operations, and the proximity of the railyard which increases the likelihood of contamination. Advance work is recommended to ensure that contamination does not exist but is not anticipated to represent significant impediments to construction.

- **Leaking Underground Storage Tank (LUST) sites:** There are three storage tank sites within or adjacent to the Project area, three of which are LUST sites. However, the LUST cases in the Project area have been closed, implying levels of contaminants are at or below levels considered appropriate for the site by the Oklahoma Corporation Commission (OCC).

For the risks noted above, ODOT has a well-defined, successful approach for addressing potential contamination and LUST sites. Locations, where these issues may arise, are identified and included within the construction plans as "Areas of Environmental Concern" to put the contractor and their employees on alert that the potential exists for encountering contamination.

- **Cost and schedule:** ODOT has established the anticipated costs of the Project within this application. The estimated capital cost is $20.0 million in 2021 dollars (including contingency).

ODOT will place this Project into the 8 Year CWP with a funding commitment of $5.0 million set aside in 2022. Letting the construction contract is currently set for 2022 within the 8 Year CWP. However, ODOT and Moore remain committed to adjusting the current schedule to meet RAISE grant requirements that project funds are obligated by September 30, 2022. ODOT commits to ensuring this occurs as part of the annual process of rebalancing the 8 Year CWP. ODOT undertakes this rebalancing every year to keep estimates accurate, account for project progress, address changes in needs, and maintain fiscal responsibility. Currently, Moore has final designs under contract for the Project and they have reached 90 percent completion.

- **Delay of adjacent/involved projects:**

No tied projects are part of this effort.

- **Earthquakes:** Earthquakes have been a concern to ODOT for the impact on its facilities over the past 5-10 years. This is especially true for bridges after any magnitude 3.0 or greater event.

The State of Oklahoma has instituted significant changes to the drilling activities which has greatly diminished the number of earthquakes in Oklahoma. All structures have seismic designs incorporated for this region of the country.

- **Tornadoes:** Tornadoes have impacted the Moore community and Oklahoma for many years.

Creating a rail overpass over SH-37 allows for free flow of emergency vehicle traffic to and from the medical facilities located in the SH-37 corridor independent of the status of rail traffic.

- **Economic downturn/employment changes:** Economic issues are a constant consideration in state funding and with the recent impacts of the COVID-19 pandemic, employment changes and their impacts on travel became clear risks for transportation funding.

Oklahoma has made tremendous strides since 2006 to ensure increased transportation funding. The construction industry has responded robustly with joint ventures and A+B contracts to guarantee project completion commitments. ODOT has a tremendous record of timely delivery of major projects over the past decade. Additionally, the funding commitments from Moore and ODOT ensure the availability of funds and provides a stable source against future economic changes.

- **Inability to secure right-of-way:** Failure to secure right-of-way can cause significant project delay.

Moore has been proceeding with right-of-way acquisition. The recent development of 90 percent design plans indicates that minority and traditionally underserved neighborhoods are not adversely impacted by any right-of-way takings necessary for the Project.

Moore and ODOT follow all the FHWA policies and federal laws regarding securing right-of-way for federal aid projects. As such, if landowners are unwilling to successfully negotiate, Moore and ODOT can, and will, as a last resort, utilize the eminent domain process to secure necessary rights-of-way for the Project.

- **Inability to secure permits:** The Project has no stream or wetland impacts.

Permitting for this Project is expected to be minimal. ODOT and Moore expect to complete the environmental review and permitting process for the Project by the end of December 2021.

- **Weather-related construction delays:** The past few years have offered challenges to the construction industry with major rain events and subsequent flooding.

ODOT is now seasoned in working closely with contractors to renegotiate project time while still delivering the Project within projected time constraints. History has shown weather can work both ways as contractors may allow winter downtime in their bids and then get a mild winter which can accelerate their completion date.

BENEFIT COST ANALYSIS

Benefit Cost Analysis

The benefit cost analysis (BCA) has been conducted following the guidance from the USDOT contained in Benefit-Cost Analysis Guidance for Discretionary Grant Programs (February 2021). The BCA results are presented below, accompanied by a summary report on the costs and benefits included, with clarifying information about methodology. A more detailed and comprehensive BCA report on results and details of data and methodology are provided in Appendix C.

All costs and benefits in the BCA are expressed in 2019 constant dollars discounted to the year 2019 (year zero for discounting). The period of operation is assumed to be 25 years, a compromise between recommended 20 years for replacement infrastructure versus 30 years for new infrastructure.

Costs Included in the BCA

Total capital costs have been estimated by project engineers at $26.4 million. This includes $20 million for construction, as well as additional costs for engineering and design, utility relocation, and ROW acquisition.

Periodic major rehabilitation and repair costs have not been included, nor have routine maintenance costs. Initial engineering estimates indicate that these costs will be about the same under Build and No-Build conditions. Cost reductions associated with the maintenance and operation of the grade crossing protection and pavement installations are included as project life cycle cost benefits rather than as cost offsets, since they are not road related but rather are current expenses incurred by the railroad.

A salvage value has also been included, reflecting a useful life of 40 years for the new infrastructure, considered a reasonable engineering estimate for new highway facilities constructed with current materials and technology.

Benefits Included in the BCA

The following benefits have been estimated and included in the BCA:

- **Travel time savings for vehicular traffic**: Benefits have been calculated based on a queuing analysis of delay caused by the frequent blockage when 34 trains pass through the at-grade crossing. These calculations are described in detail in the Appendix C BCA Report.
- **Travel reliability improvement for vehicular traffic**: While about seven percent of vehicles each day are held up when 34 trains pass, the train movements are not fixed by a rigid schedule, and thus uncertainty in travel is introduced. This analysis calculates reliability benefits based on buffer time that travelers are likely to build into their schedules to offset the risk of late arrival. The analysis assumes that trucks and passenger vehicles use that buffer based on a probabilistic calculation of a potential stoppage. Specifically, the analysis estimates a buffer time applicable to drivers who are *not* delayed by a blockage, weighted by a seven percent probability of being delayed. The buffer is assumed to be equal to the average delay, which is between three and four minutes per train. Drivers who are blocked have already incurred that delay penalty, calculated in travel time delay, and thus are not "double penalized" by buffer and delay.
- **Air emissions reductions**: Emissions reductions were estimated based on the reductions in delay hours for traffic. Rates of emissions (kg per vehicle hour) for cars, small trucks, and large trucks were obtained from the MOVES3 model, and are consistent with emissions

rates currently employed in EBP's TREDIS model. Emissions reductions for NOx, SOx, CO_2, and $PM_{2.5}$ were obtained from MOVES3 and monetized based on the DOT BCA guidance.

- **Fuel cost savings**: Fuel consumed while vehicles idle at the grade-crossing have been estimated based on average rates of fuel consumed per vehicle hour of idling as reported by the U.S. Office of Energy Efficiency and Renewable Energy. Fuel prices net of fuel taxes are applied to gallons saved.
- **Bike and pedestrian time savings:** The pedestrian bridge will shorten walk and bike times for the average local walk and bike trip in and around the study area. Travel time savings have been valued at $33 per hour, as per 2021 BCA guidance.
- **Crash reductions**: Crash reductions included both vehicle-train incidents (three injury-related incidents over the past 47 years) as well as an estimate of rear-end collisions in and around the study area, which are reasonably assumed to be associated with stopped vehicles during times when the crossing gates are down. Half of historic rear-end collisions are assumed to be associated with the at-grade crossing. Other accidents caused by drivers attempting to avoid delay are not identified in the historic accident figures.
- **Emergency Response Benefits**: Moore police report that in the most recent year, 336 emergency service vehicles were forced to detour while trains were passing through the SH-37 at-grade crossing. Assuming only one percent of those vehicles involve life threatening, time sensitive emergencies, and further assuming the detour results in delay equal to about half the "red time" at the crossing, the economic cost of lives lost from such delay has been calculated. Based on research published by FEMA, the probability of survival falls by about 6.0% as a result of the response time increase. Over the entire analysis period, the possibility of a life lost due to emergency response delay is about 25 percent.
- **Noise reductions**: Academic research indicates that there is a house price decrease associated with locations exposed to high levels of train horn noise. The econometric research, in a hedonic price case study of Pennsylvania locations, found that for noise levels significantly above an acceptable base level of 50 dB, house prices were reduced by about $5,000.[15] Based on this and the elevated dB levels associated with train horn noise in Moore, and further based on an assumption of about 100 households exposed to intense train horn noise, a one-time economic cost of about $2 million was estimated. This one-time benefit has been entered in the BCA model in the year 2026, the year of opening the new underpass
- **Life cycle cost savings**: The project will save approximately $18K per year in costs incurred by the railroad to maintain and operate crossing protection and pavement installations for the grade crossing.

[15] William K. Bellinger, "The economic valuation of train horn noise: A US case study", Transportation Research, Part D 11 (2006) 310–314.
https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.1090.8905&rep=rep1&type=pdf

RESULTS

Table 6 provides the results of the BCA. The Benefit Cost Ratio (BCR) is 1.34, with an NPV of $6.22 million. This represents a 62 percent return on investment (ROI) on the requested federal grant funding.

Table 6: Summary BCA Results (in Millions)

Discounted Costs	
Build Capital Costs	$19.68
Annual O&M and Periodic Rehab Cost (Build - No Build)	$ -
Salvage Value	$(1.36)
Total	**$18.32**
Discounted Benefits	
Travel Delay Savings - Vehicles	$11.63
Travel Time Savings - Bike and Pedestrian	$1.83
Emissions Benefits (CO_2)	$0.52
Emissions Benefits (All Other)	$0.14
Noise Reduction (one time capitalization effect)	$1.43
Travel Reliability Benefits - Vehicles	$3.93
Emergency Vehicle Response	$2.14
Crash Reductions Benefits	$2.49
Fuel Cost Savings	$0.21
At-Grade Crossing Protection Elimination (Life Cycle Cost Savings)	$0.22
Total	**$24.54**
Summary	
Benefit Cost Ratio	**1.34**
Net Present Value	**$6.22**
Share of Benefits	
Travel Delay Savings - Vehicles	47.4%
Travel Time Savings - Bike and Pedestrian	7.5%
Emissions Benefits	2.7%
Noise Reduction Benefits	5.8%
Reliability Benefits	16.0%
Emergency Response Benefits	8.7%
Crash Reductions Benefits	10.1%
Fuel Cost Savings	0.9%
At-Grade Crossing Protection LC Cost Savings	0.9%

APPENDICES

APPENDIX A: MAPS AND IMAGES

Figure 3: Other Local Transportation Projects

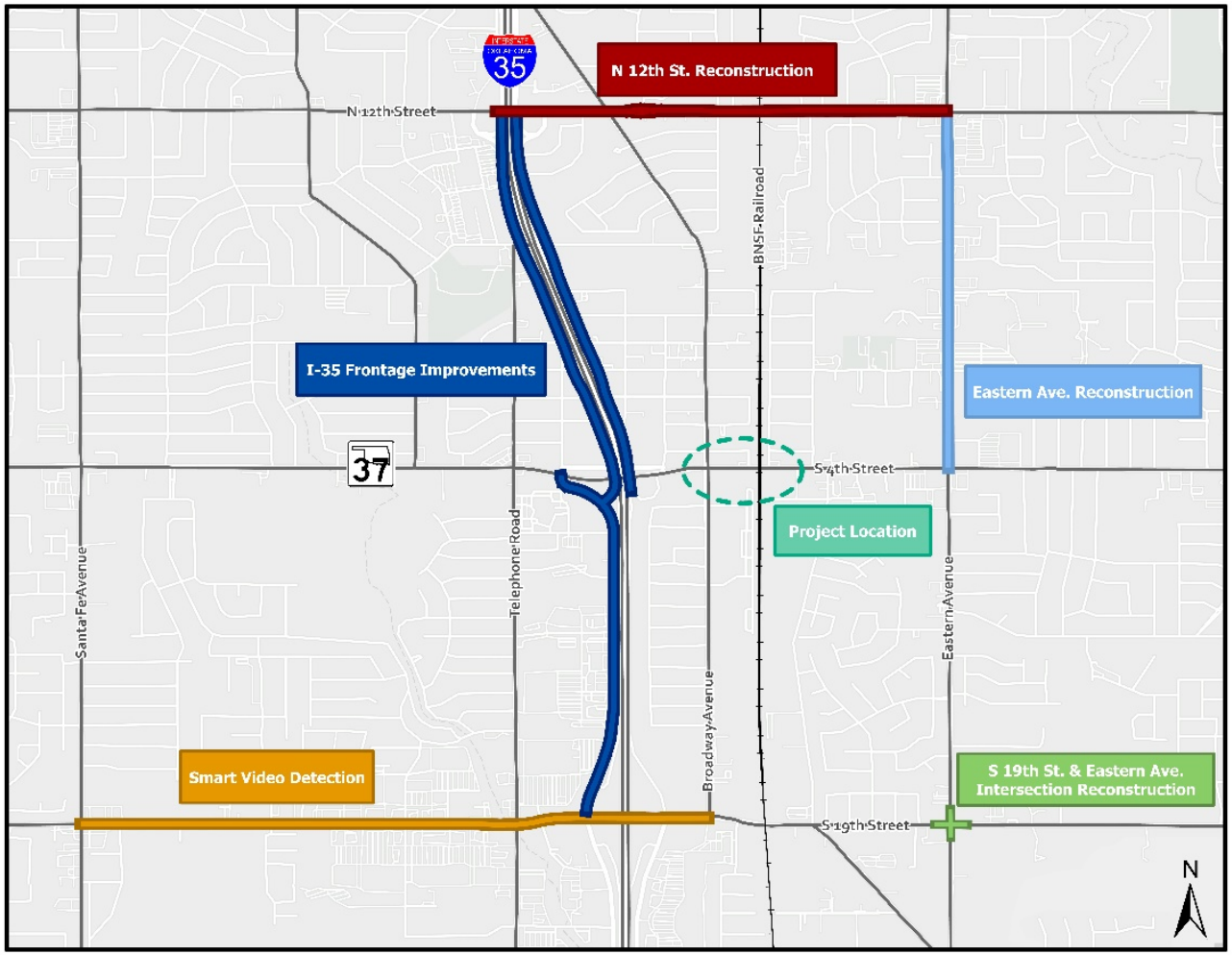


Figure 4: BNSF Railroad Crossing Project Location

Figure 5: Commuter Rail South Corridor LPA

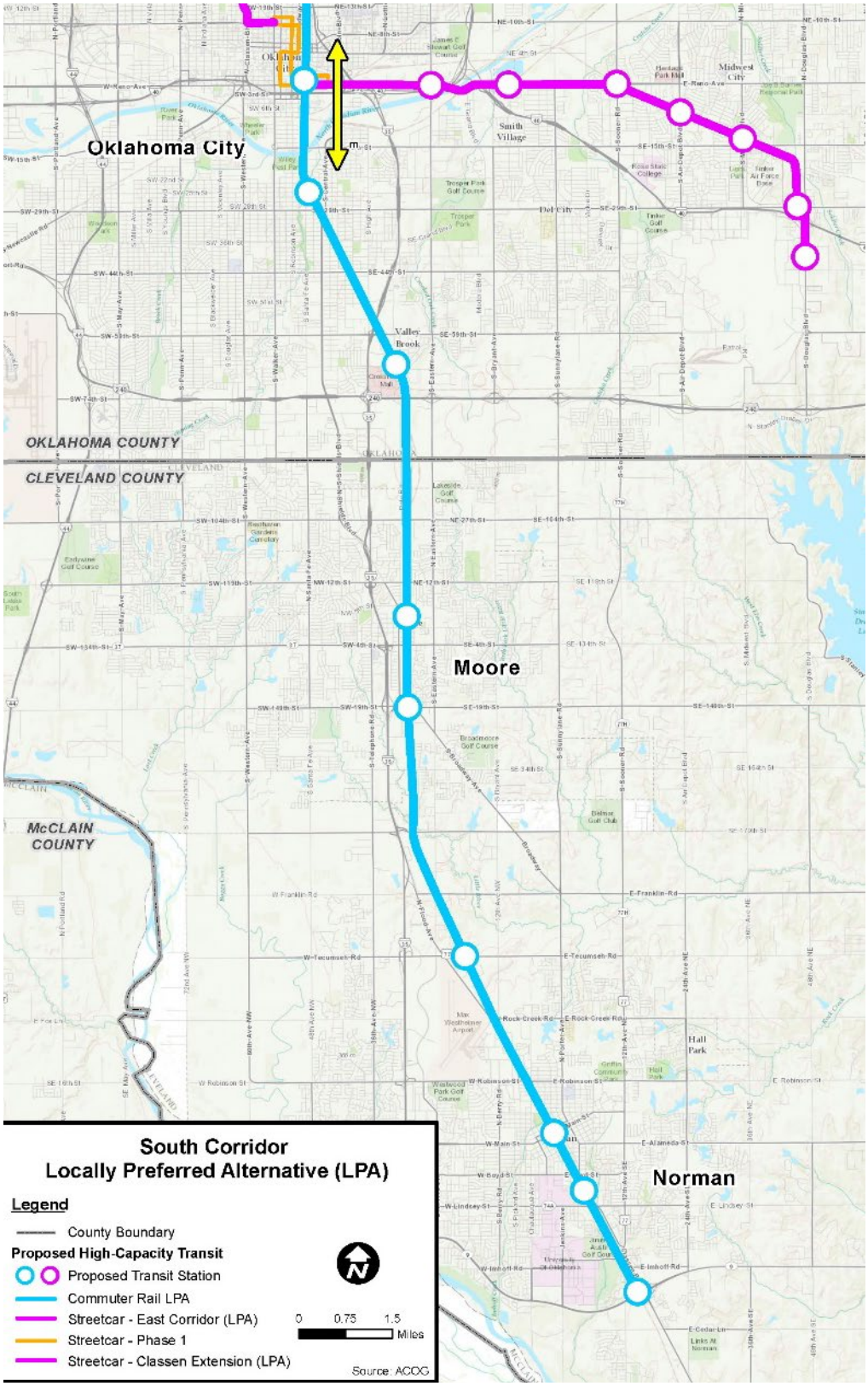
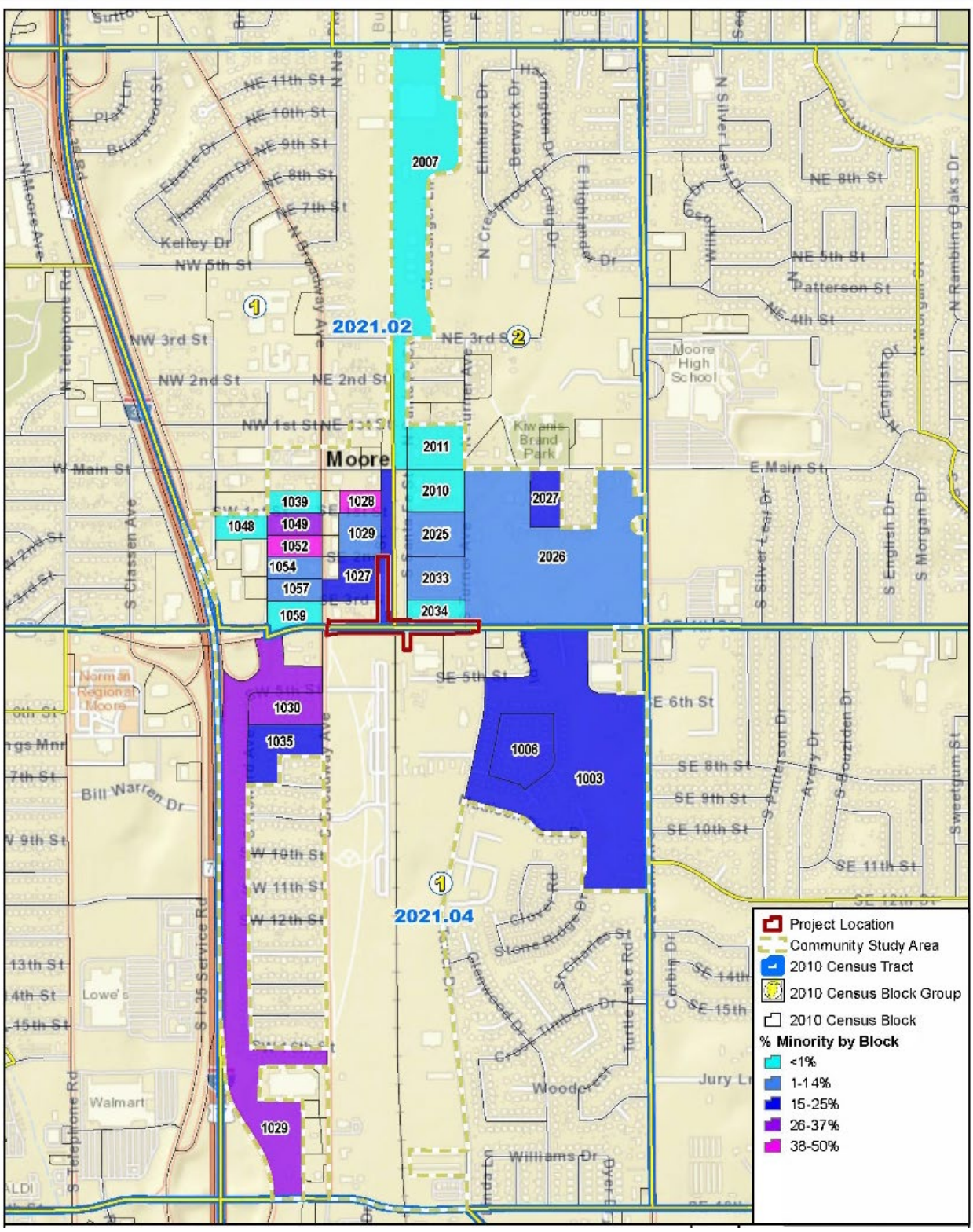


Figure 10: Minority Population



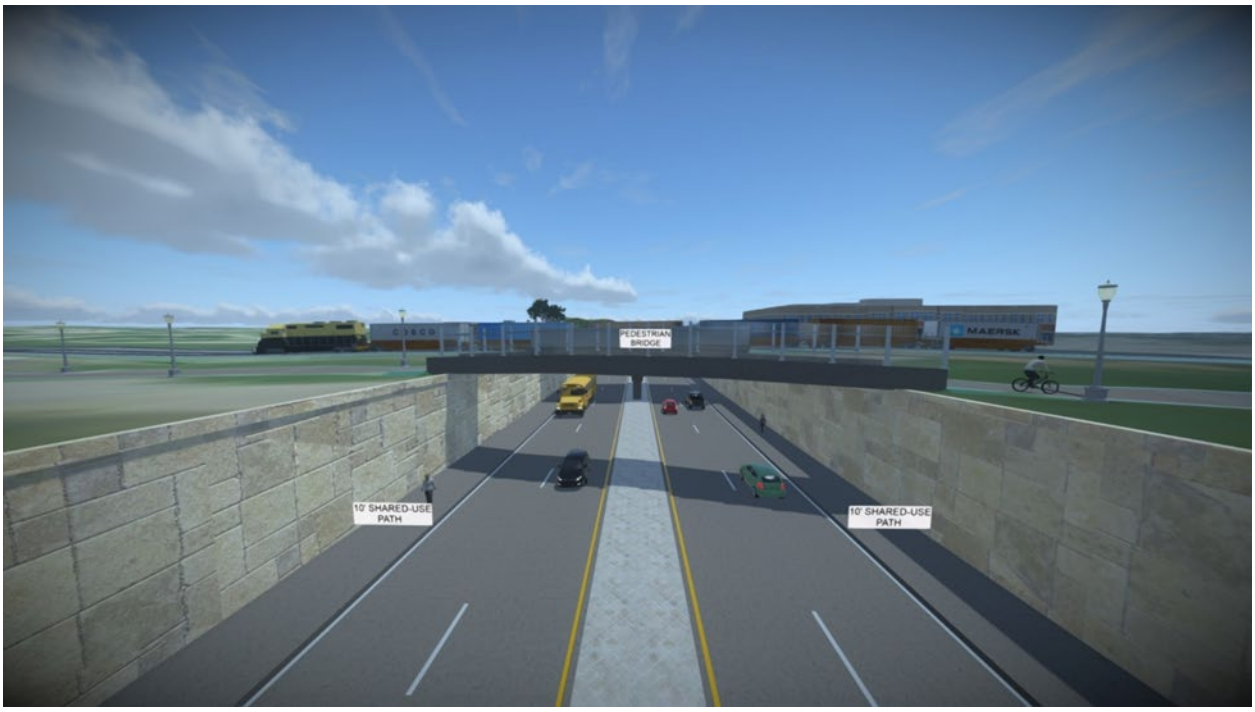
OKLAHOMA Transportation

APPENDIX B: PROJECT SCHEDULE

	2015	2016	2017	2018	2019	2021										2022											2023	2024
						M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D		
CDBG Project Award	15-Sep																												
Kick-off Meeting		10-Feb																											
Environmental Kickoff Meeting		14-Jul																											
30% Plans		30-Nov																											
Public Meeting			26-Jan																										
GO Bond Passed				26-Jun																									
60% Plans					26-Jul																								
City Council Approved NEPA																													
NEPA Studies																													
BNSF Plan Review																													
Complete NEPA																													
Finish R/W																													
Complete Plans																													
Complete Utility Relocation																													
Bond Sale for 4th Street																													
Construct Detour																													
Letting																													
Begin Construction																											January		
End Construction																												January	

SH-37 BNSF Railroad Crossing: Moore, Oklahoma

2021 RAISE Grant Application Benefit Cost Analysis Report



July 9, 2021

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1. OVERVIEW OF APPROACH

The benefit cost analysis (BCA) has been conducted following the guidance from the USDOT contained in Benefit-Cost Analysis Guidance for Discretionary Grant Programs (February 2021).

1.1 GENERAL ASSUMPTIONS

- All costs and benefits in the BCA are expressed in 2019 constant dollars discounted to the year 2019 (year zero for discounting). GDP price deflator indices were used to adjust prices to 2019.

- The period of operation is assumed to be 25 years, a compromise between recommended 20 years for replacement infrastructure versus 30 years for new infrastructure.

- All monetary values are discounted using a 7 percent discount rate, with the exception of carbon emissions, which are discounted at 3 percent.

- Because the number of train crossings and volume of vehicular traffic are relatively consistent over the course of an entire week, including weekends, all daily values (e.g., modeled daily travel delay savings) are annualized using 365 days per year.

2. PROJECT COSTS

2.2 CAPITAL COST

Total capital costs have been estimated by project engineers at $26.4 million. This includes $20 million for construction, as well as additional costs for engineering and design, utility relocation, and ROW acquisition. Engineer's 90% cost estimates are shown below in **Table C.1**.

Table C.1 – 90% Engineering Cost Estimate, 2021 $s

	No Build			Build
Year	Maint. & Rehab Cost	Rail Maint. Cost	Total	Capital Cost
2019		$ 25,000.00	$ 25,000.00	
2020		$ 25,000.00	$ 25,000.00	
2021		$ 25,000.00	$ 25,000.00	
2022	$ 125,250.00	$ 25,000.00	$ 150,250.00	
2023		$ 25,000.00	$ 25,000.00	$ 26,434,283.00
2024		$ 25,000.00	$ 25,000.00	
2025		$ 25,000.00	$ 25,000.00	
2030	$ 125,250.00	$ 125,000.00	$ 250,250.00	
2035		$ 125,000.00	$ 125,000.00	
2040	$ 125,250.00	$ 125,000.00	$ 250,250.00	
2045		$ 125,000.00	$ 125,000.00	
2050	$ 125,250.00	$ 125,000.00	$ 250,250.00	
Total	$ 501,000.00	$ 800,000.00	$ 1,301,000.00	$ 26,434,283.00

Source: Project Engineer, Poe Engineering

2.2 MAINTENANCE AND REHAB COSTS

As seen in the Table above, engineering estimates indicate that these costs will be about the same under Build and No-Build conditions. Cost reductions associated with the maintenance and operation of the grade crossing protection (gates, lights) and pavement installations are not included in **Table C.1** but are included as project life cycle cost benefits rather than as cost offsets, since they are not road related but rather are current expenses incurred by the railroad.

2.3 SALVAGE VALUE

A salvage value has also been included at the end of the 25th and final year of analysis, reflecting a useful life of 40 years for the new infrastructure. The forty year assumption is considered by project engineers to be a reasonable estimate for new highway facilities constructed with current materials and technology. The salvage value was computed utilizing straight line depreciation.

3. PROJECT BENEFITS INCLUDED IN THE BCA

3.1 TRAVEL TIME SAVINGS FOR VEHICULAR TRAFFIC

Benefits have been calculated based on a queuing analysis of delay caused by the frequent blockages when the 30-plus daily trains move through the at-grade crossing. The following **Table C.2** highlight the key input assumptions. The analysis is conducted for the year 2040, and all resulting delay values are adjusted downward prior to 2040 based on the compound annual rate of growth in daily traffic.

Table C.2 – Key Traffic Inputs to Queuing Analysis

Daily Traffic	15500
Avg Passenger Vehicle Occupancy	1.7
Percent Trucks	7%
Duration of Train (Minutes)	3.92
Discount Rate	0.07
Cycle Length between Train Arrivals (	2706.77
"red" time (seconds)	234.00
Green Ratio g/C	0.91
Capacity Per Lane (PCE / HR)	1000
Saturation Flow Rate	4000
SH-37 Hourly Capacity PCE (w.r.t. cro	3654.2

Source: City of Moore, High Street Consulting, Poe Engineering

Estimated delay reflects the number of trains, the hourly volumes of traffic over a twenty four hour period, the probability of traffic during each hourly interval of being blocked, the roadway capacity, and the speed at which queues dissipate after a blockage is ended by the gate control equipment.[16]

3.2 TRAVEL RELIABILITY IMPROVEMENT FOR VEHICULAR TRAFFIC

While about seven percent of vehicles each day are held up when trains pass, the train movements are not fixed by a rigid schedule, and thus uncertainty in travel is introduced. This analysis calculates reliability benefits based on buffer time that travelers are likely to build into their schedules to offset the risk of late arrival. The analysis assumes that trucks and passenger vehicles use that buffer based on a probabilistic calculation of a potential stoppage. Specifically, the analysis estimates a buffer time applicable to drivers who are *not* delayed by a blockage, weighted by a seven percent probability of being delayed. The buffer is assumed to be equal to the average delay, which is between three and four minutes per train. Drivers who are blocked have already incurred that delay penalty, calculated in travel time delay, and thus are not "double penalized" by buffer and delay. The value estimated in this category does not include

[16] The analysis utilizes the methodology for traffic queuing analysis contained in "Traffic Signal Systems Operations and Design" by Michael Kyte and Tom Urbanik, 2012, Pacific Crest (Plainfield, IL).

the economic costs of delay to emergency vehicles, which are calculated separately using a different methodology based on survival probabilities.

Buffer time for passenger vehicles and trucks are calculated utilizing the formula:

> ***Buffer time$_m$ = (total trips$_m$ - trips actually delayed$_m$) x average delay when gates down x probability of delay***
>
> *where m equals mode (passenger vehicle, commercial vehicle).*

The value of buffer time is then estimated based on the average value of time for passengers and for commercial vehicles. The reliability benefits are shown in **Table C.3**.

Table C.3. Reliability Benefits - 2040

	2040
Auto	
Total daily auto trips	16247
Daily auto trips delayed	1038
Daily auto trips not delayed	15209
Average length of delay at a crossing (minutes)	3.9
Daily auto buffer time not delayed (hours)	63.1
Daily value of auto buffer time (not delayed)	$ 1,130
Annual value of auto buffer time (undiscounted)	$ 412,564
Truck	
Total daily truck trips	1223
Daily truck trips delayed	78
Daily truck trips not delayed	1145
Average length of delay at a crossing (minutes)	3.9
Daily truck buffer time not delayed (hours)	4.8
Daily value of truck buffer time (not delayed)	$ 146
Annual value of truck buffer time (undiscounted)	$ 53,432
Total annual reliability benefit (undiscounted)	$ 465,996

Source: City of Moore, High Street Consulting, Poe Engineering

3.3 AIR EMISSIONS REDUCTIONS:

Emissions reductions were estimated based on the reductions in delay hours for traffic. Rates of emissions (kg per vehicle hour) for cars, small trucks, and large trucks were obtained from the MOVES3 model, and are consistent with emissions rates currently employed in EBP's TREDIS model. Emissions reductions for NOx, SOx, CO_2, and $PM_{2.5}$ were obtained from MOVES3 and monetized based on the DOT BCA guidance.

3.4 FUEL COST SAVINGS

Fuel consumed while vehicles idle at the grade-crossing have been estimated based on average rates of fuel consumed per vehicle hour of idling as reported by the U.S. Office of Energy Efficiency and Renewable Energy. Fuel prices net of fuel taxes are applied to gallons saved.

3.5 BIKE AND PEDESTRIAN TIME SAVINGS

The pedestrian bridge will shorten walk and bike times for the average local walk and bike trip in and around the study area. Travel time savings have been valued at $33 per hour, as per 2021 BCA guidance. The bike and walking time savings are shown in **Table C.4**.

Table C.4. Bike and Ped Time Savings

Annual park visitors/passes		68907
Daily park visitors/passes		189
	minutes/trip	estimated daily two-way trips
walk time differential (build vs. no build)	8	50
bike time differential (build vs. no build	2.25	50

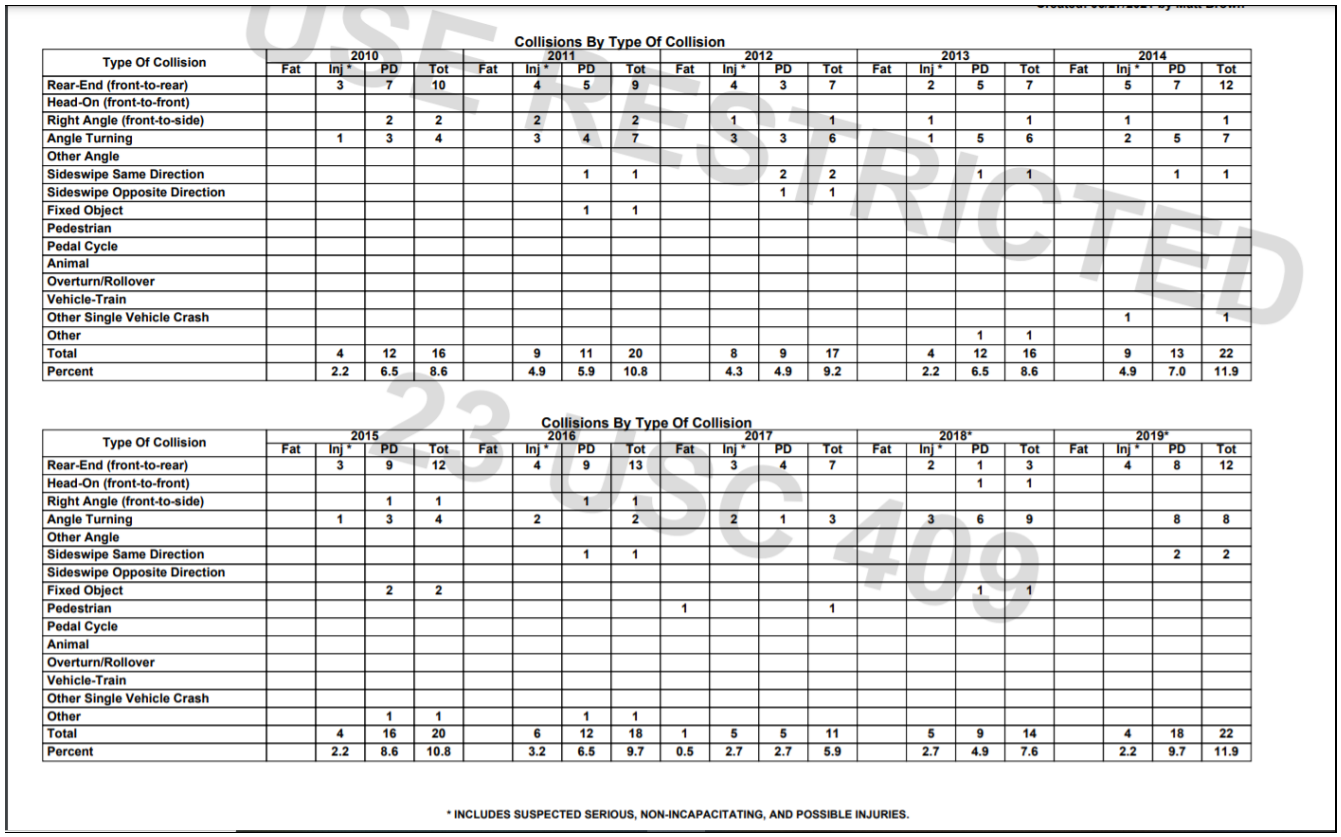
Source: City of More; HighStreet Consulting and Poe Engineering

3.6 CRASH REDUCTIONS

Crash reductions include both vehicle-train incidents (three injury-related incidents over the past 47 years) as well as an estimate of rear-end collisions in and around the study area, which are reasonably assumed to be associated with stopped vehicles during times when the crossing gates are down. Half of historic rear-end collisions are assumed to be associated with the at-grade crossing. Other accidents caused by drivers attempting to avoid delay are not identified in the historic accident figures.

Accident data utilized to establish accident rates under future 2040 traffic levels were estimateed based on the following data provided by ODOT. The 10-year accident rates are shown in **Table C.5**.

Table C.5. 10-Year Vehicular Accident Rates Proximate to the At-Grade Crossing



Collisions By Type Of Collision

Type Of Collision	2010				2011				2012				2013				2014			
	Fat	Inj *	PD	Tot	Fat	Inj *	PD	Tot	Fat	Inj *	PD	Tot	Fat	Inj *	PD	Tot	Fat	Inj *	PD	Tot
Rear-End (front-to-rear)		3	7	10		4	5	9		4	3	7		2	5	7		5	7	12
Head-On (front-to-front)																				
Right Angle (front-to-side)			2	2		2		2		1		1		1		1		1		1
Angle Turning		1	3	4		3	4	7		3	3	6		1	5	6		2	5	7
Other Angle																				
Sideswipe Same Direction							1	1			2	2			1	1			1	1
Sideswipe Opposite Direction											1	1								
Fixed Object							1	1												
Pedestrian																				
Pedal Cycle																				
Animal																				
Overturn/Rollover																				
Vehicle-Train																				
Other Single Vehicle Crash																		1		1
Other															1	1				
Total		4	12	16		9	11	20		8	9	17		4	12	16		9	13	22
Percent		2.2	6.5	8.6		4.9	5.9	10.8		4.3	4.9	9.2		2.2	6.5	8.6		4.9	7.0	11.9

Collisions By Type Of Collision

Type Of Collision	2015				2016				2017				2018*				2019*			
	Fat	Inj *	PD	Tot	Fat	Inj *	PD	Tot	Fat	Inj *	PD	Tot	Fat	Inj *	PD	Tot	Fat	Inj *	PD	Tot
Rear-End (front-to-rear)		3	9	12		4	9	13		3	4	7		2	1	3		4	8	12
Head-On (front-to-front)															1	1				
Right Angle (front-to-side)			1	1			1	1												
Angle Turning		1	3	4		2		2		2	1	3		3	6	9			8	8
Other Angle																				
Sideswipe Same Direction							1	1											2	2
Sideswipe Opposite Direction																				
Fixed Object			2	2											1	1				
Pedestrian									1			1								
Pedal Cycle																				
Animal																				
Overturn/Rollover																				
Vehicle-Train																				
Other Single Vehicle Crash																				
Other			1	1			1	1												
Total		4	16	20		6	12	18	1	5	5	11		5	9	14		4	18	22
Percent		2.2	8.6	10.8		3.2	6.5	9.7	0.5	2.7	2.7	5.9		2.7	4.9	7.6		2.2	9.7	11.9

* INCLUDES SUSPECTED SERIOUS, NON-INCAPACITATING, AND POSSIBLE INJURIES.

Source: ODOT, Poe Engineering

3.7 EMERGENCY RESPONSE BENEFIT

Moore police report that in the most recent year, 336 emergency service vehicles were forced to detour while trains were passing through the SH-37 at-grade crossing. Assuming only one percent of those vehicles involve life threatening, time sensitive emergencies, and further assuming the detour results in delay equal to about half the "red time" at the crossing, the economic cost of lives lost from such delay has been calculated. Based on research published by FEMA,[17] the probability of survival falls by about 6.0% as a result of the response time increase. Over the entire analysis period, the possibility of a life lost due to emergency response delay is about 25 percent. The emergency response analysis is shown in **Table C.6**.

[17] https://files.hudexchange.info/course-content/ndrc-nofa-benefit-cost-analysis-data-resources-and-expert-tips-webinar/FEMA-BCAR-Resource.pdf

Table C.6. Emergency Response Analysis

	2026
Emergency Vehicles Delayed per Year	336
Percent of Emergency Vehicles in Life Critical Situation	0.01
Average Delay Time per Vehicle (minutes)	2
Survival Probability without detour	0.1107
% reduction in survival probability from detour	6.0%
Survival Probability with detour	0.10406
Change in Survival Probability per Delayed Trip	0.00664
Economic Cost Based on Survival Rate	$241,025

Source: EBP

3.8 NOISE REDUCTIONS

Academic research indicates that there is a house price decrease associated with locations exposed to high levels of train horn noise. The econometric research, in a hedonic price case study of Pennsylvania locations, found that for noise levels significantly above an acceptable base level of 50 dB, house prices were reduced by about $5,000[18]. Based on this and the elevated dB levels associated with train horn noise in Moore, and further based on an assumption of about 100 households exposed to intense train horn noise, a one-time economic cost of about $2 million was estimated. This one-time benefit has been entered in the BCA model in the year 2026, the year of opening the new underpass

3.9 LIFE CYCLE COST SAVINGS

The project will save approximately $18,000 per year in costs incurred by the railroad to maintain and operate crossing protection and pavement installations for the grade crossing. This is based on information provided by the BNSF.

BCA RESULTS

Table C.7 provides the results of the BCA. The Benefit Cost Ratio (BCR) is 1.34, with an NPV of $6.22 million. This represents a 62 percent return on investment (ROI) on the requested federal grant funding.

[18] William K. Bellinger, "The economic valuation of train horn noise: A US case study", Transportation Research, Part D 11 (2006) 310–314. https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.1090.8905&rep=rep1&type=pdf

Table C.7: Summary BCA Results

Discounted Costs	
Build Capital Costs	$19,683,478
Annual O&M and Periodic Rehab Cost (Build - No Build)	$ -
Salvage Value	$(1,359,999)
Total Costs	$18,323,479
Discounted Benefits	
Travel Delay Savings - vehicles	$11,626,600
Travel Reliability Benefits - vehicles	$3,926,097
Travel Time Savings - bike and ped	$1,829,379
Emissions Benefits (CO2)	$523,748
Emissions Benefits (All Other)	$144,357
Fuel Cost Savings	$210,973
Crash Reductions Benefits	$2,490,614
At-grade Crossing Protection Elimination (Life Cycle Cost Savings)	$222,262
Emergency Vehicle Response	$2,142,823
Noise Reduction Benefit (one time capitalization)	$1,425,972
Total Benefits	$24,542,825
Summary	
Benefit Cost Ratio	1.34
Net Present Value	$6,219,346
Share of Benefits	
Travel Delay Savings - vehicles	47.4%
Travel Time Savings - bike and ped	7.5%
Emissions Benefits	2.7%
Reliability Benefits	16.0%
Crash Reductions Benefits	10.1%
Noise Reduction Benefit	5.8%
Fuel Cost Savings	0.9%
At-grade Crossing Protection LC Cost Savings	0.9%

Source: EBP