FY2022 RAISE GRANT APPLICATION

SH-37 BNSF GRADE SEPARATION AND MULTIMODAL IMPROVEMENTS: MOORE, OKLAHOMA

Project Name: SH-37 Grade Separation and Multimodal Improvements
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:	$8,120,000
Total Project Costs:	$28,120,000
Department Financing Program:	No

Project Details

Capital or Planning:	Capital
Project Type:	Rail – Grade Crossing
USDOT FY22 Discretionary Application:	No
Other Federal Agency Assistance:	No
Tribal Government:	No
Tribal Benefits:	No
Private Corporation Involvement:	Yes
Private Corporation Name:	BNSF Railroad
TIFIA/RRIF:	No
Benefit Cost Ratio	1.33

Project Location

State:	Oklahoma
County:	Cleveland County
Zip Code:	73160
Project Latitude:	35.338259
Project Longitude:	-97.482298
Urban/Rural:	Urban
Urbanized Area:	Oklahoma City
Project Census Tracts:	2021.02, 2021.04
Area of Persistent Poverty:	No
Historically Disadvantaged Community:	No
Federally-Designated Community Zone:	No

All project information also available on the project webpage

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 State Highway 37 (SH-37) from a BNSF railroad crossing in Moore, Oklahoma as well as to improve multimodal mobility through constructing of a bicycle and multimodal bridge and multiuse paths (The Project) as shown in **Figure 1.** The Project represents a public-private partnership resulting from comprehensive collaboration to improve the safety, mobility, quality of life, and reliability of motorized and nonmotorized travel in and through Moore, OK.

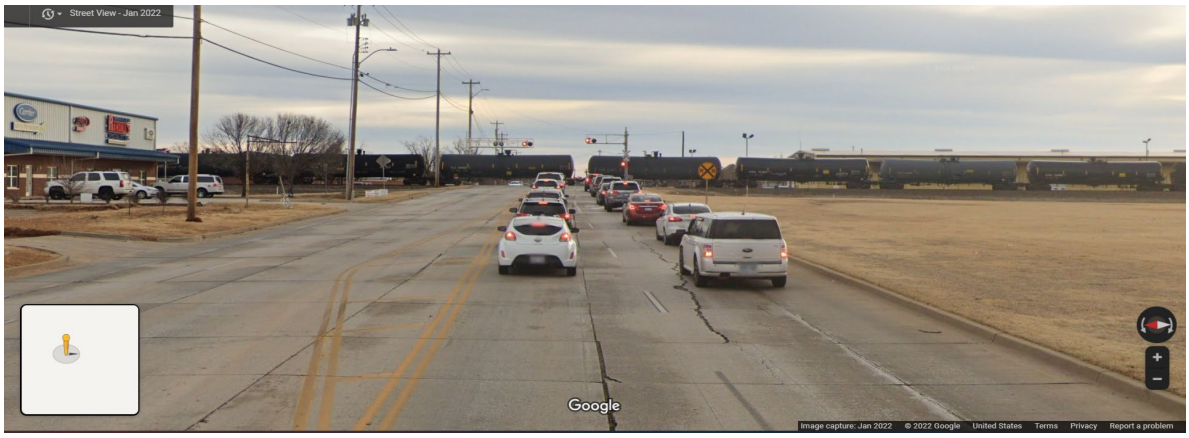
Figure 1: Rendering of Multimodal Improvements including Rail Bridge, Multimodal Bridge, and Multiuse Shared Paths

Project improvements (which are currently at 90 percent design) include the construction of a new two-track railroad bridge over SH-37 with room for a future third track. The existing SH-37 roadway will be reconstructed below the existing grade with retaining walls north and south of SH-37 throughout most of the Project limits. A raised median will be added between eastbound and westbound lanes as well as 10-foot multimodal, shared-use, raised concrete paths on both sides. A multimodal 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 Project construction, traffic will be detoured through S. Turner Avenue.

Today, the conditions of the SH-37 and BSNF railroad crossing provide a barrier to reliable community access and create a safety hazard to rail, road users, and active transportation users. 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), trains reduce speed, and the slow-moving trains block the crossing causing considerable time delays. Local Moore officials noted that unscheduled closures last between 10 minutes to three days, not including scheduled closures. For instance, recent scheduled repairs to the railroad tracks closed the SH-37 crossing from March 23rd to March 26th. The frequency and length of train blockings cause reliability concerns and congestion for both rail and road users. For example, the Google Streetview car was blocked during its annual visit in January 2022 (**Figure 2**).

Figure 2: Current Conditions



Source: Google Maps, January 2022

SH-37 and the Project'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. The City of Moore has four at-grade crossings (12th Street, Main Street, SH-37, and 34th Street) and two grade-separated crossings (19th Street and 27th St). Notably, 19th Street is the one mile to the south of SH-37 and the commercial heart of the city. Nineteenth Street experiences congestion as a result of both commercial activity and use as a throughput alternative to the at-grade crossings to the north (SH-37) and south. SH-37 along with 19th Street are the highest traveled roadways in the city.

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 blocked crossing introduces not only irregularity and congestion for road users 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."

Both freight and passenger rail are also anticipated to benefit from the Project. 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. Amtrak's Heartland Flyer also runs roundtrips daily through the intersection, moving 68,000 passengers annually (FY2019 ridership) from Oklahoma City to Dallas/Ft. Worth Texas.[1] 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 SH-37 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 than on 12th Street, and reduced impacts to adjacent property. With a location selected, the City of Moore engaged the community to review the project design and to place the project on a June 2018 ballot for a bond issue to fund a package of City of Moore construction projects. The bond measure passed with 61 percent of the vote and the final design has been underway since.

PREVIOUSLY COMPLETED COMPONENTS

To date, the city has completed critical work including 30-percent design (and subsequent public review meetings), delivery of a Moore GO bond, 60-percent design, several studies for National Environmental Policy Act (NEPA) clearance, BNSF plan review, and 90 percent design. Intensive processes related to right-of-way acquisition and utility relocation are also well underway alongside the construction of Turner Avenue to prepare the street for the detour route.

STATEMENT OF WORK

The existing SH-37 is a four-lane curb and gutter concrete at-grade rail crossing with no sidewalks. The proposed project is at 90 percent design and will create an underpass at the existing rail crossing. The profile of the roadway will be lowered to create clearance for a proposed two span rail bridge with concrete beams. The proposed roadway section is expected to be a concrete curb and gutter with two lanes in each direction with a center median to accommodate the bridge pier and a 10-foot raised multimodal path on each side. Drilled shaft retaining walls are anticipated to be utilized on both sides to retain the soil and limit the

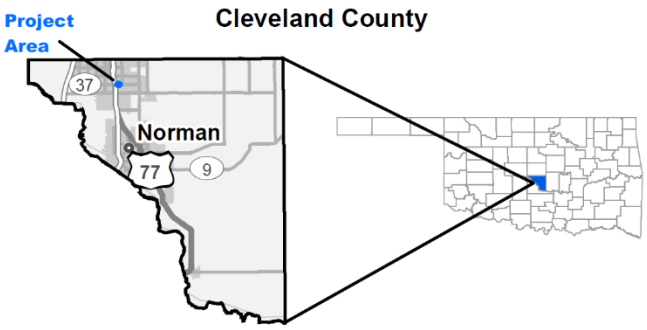
[1] FY21 Heartland Flyer ridership totaled 42,299, decreasing due to the coronavirus pandemic and travel restrictions. (Amtrak. Amtrak Route Ridership FY212 vs. FY19, December 2021. Retrieved on 03/22/2022 from https://media.amtrak.com/wp-content/uploads/2021/12/FY21-Year-End-Revenue-and-Ridership.pdf)

footprint in the cut section. A multimodal bridge west of the proposed rail bridge is slated to be utilized to convey pedestrian traffic over the roadway. The stormwater plans call for stormwater to be collected in the sump of the proposed roadway and utilize a pump station to convey stormwater drainage to the elevation of the rail line. This pump station will include an underground storage tank from which water will be released at a level equal to or less than the existing flow. The project site will be closed to all vehicular traffic during construction. The rail traffic will be shifted to the west enabling the rail bridge to be constructed and then shifted back to the new rail bridge. The remaining drilled shafts are then slated to be completed for the retaining wall and the excavation for the roadway will then be completed and the multimodal bridge will be constructed. The concrete roadway will be constructed, and the Project will open to traffic.

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.

Figure 3: Project Location



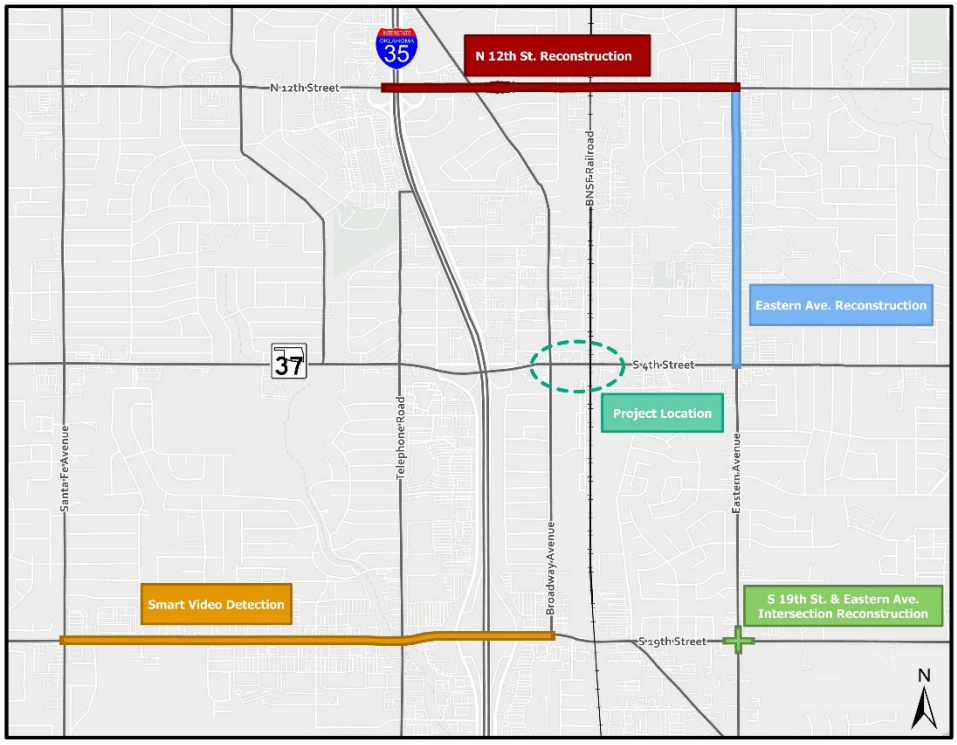
The Project sits in the Oklahoma City Urbanized Area (2010 population: 861,505) in Cleveland County (**Figure 3**). The community surrounding the Project location can be characterized as mixed-use. The northern section of the Project area contains the City of Moore's central business district, and the 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.

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. The Project location also holds potential relevance for future development in Moore building on plans by the Regional Transportation Authority (RTA) of Central Oklahoma and the Envision Moore Plan 2040.

Demographically, the project area has range of residential qualities. Environmental justice (EJ) populations are present in the Project area, adjacent Census block groups have minority percentages that range from approximately 0 to 48 percent. Additionally, the census tract just

north of the project area (2021.02) has a high percent of the population in poverty and two project-based rent-subsidized private affordable housing developments are located within a mile of the project. Full demographic information is available in the Quality of Life merit criteria section.

Figure 4: Other Local Transportation Improvements



The Project is located amidst a range of transportation investments that will improve travel through and within the City of Moore. Four major investments totaling approximately $13 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 four investments are within the 1.5-mile 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 as shown in **Figure 4.** Scheduled improvements include reconstruction of NE 12th Street, the reconstruction of Eastern Ave, smart video detection on 19th Street, 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.

The grade separation will also remove a freight bottleneck to leverage BNSF's recent 2018 premier 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.[2]

Figure 5: Project Location in relation to Moore Parks

Lastly, the Project will benefit and improve a series of community investments in Central Park and Old Town Park (**Figure 5**). Old Town Park is immediately north of the intersection and extends 0.3 miles to 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 multimodal 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.

GRANT FUNDS, SOURCES, & USES OF PROJECT FUNDS

BUDGET

With 90 percent of the design complete, the Project will use RAISE grant funds to construct the underpass and multimodal improvements, which has a total construction budget of $20 million 2021 dollars). Previously incurred costs included $1.35 million for environmental and engineering, $4.6 million for right-of-way and utilities, and $2.17 million for other (2020 dollars). For construction, a total of $5 million (25%) will come from local 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**.

[2] Progressive Railroading. Rail News: BNSF opens logistics center in Oklahoma, August 22, 2018. Retrieved 03/25/2022 from https://www.progressiverailroading.com/bnsf_railway/news/BNSF-opens-logistics-center-in-Oklahoma--55416.

Table 1: Project Budget and Anticipated Funding Sources (in Millions, 2021 $)

	BOND FUNDS		STATE FUNDS		FEDERAL FUNDS		RAISE FUNDS	TOTAL PROJECT COSTS
	Incurred	Future	Incurred	Future	Incurred	Future		
Environmental & Engineering	$1.35							$1.35
ROW & Utilities	$4.60							$4.60
Construction		$5.00		$5.00			$10.00	$20.00
Contingency & Other	$2.17							$2.17
								$28.12

FUNDING COMMITMENTS

The Project 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 25 percent of the future Project construction costs. 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.

Table 2: Summary of Future Eligible Costs

PROJECT COMPONENT	FUNDING TYPE	COST SHARE	COST (Millions, 2021 $)
Construction	RAISE	50%	$10,000,000
	ODOT	25%	$5,000,000
	Local	25%	$5,000,000
TOTAL FUTURE COSTS			**$20,000,000**

The BNSF railroad owns and operates the 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 and this project in particular. Right-of-way will be needed from BNSF for construction and 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 railroads throughout the State to both eliminate and improve railroad crossings for the safety and efficiency of the traveling public and the national freight movements on rail lines through the use of Section 130 funds which total approximately $8 million per year.

MERIT CRITERIA

SAFETY

The City of Moore, ODOT, and the BNSF all recognize the numerous benefits of completing this Project. 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 and the multimodal bridge will significantly improve safety, mobility, and connectivity in Moore.

"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."**

- Fire Chief Greg Herbster, City of Moore

THE PROJECT ELIMINATES TRAIN-VEHICLE AND TRAIN-PEDESTRIAN CRASHES, INJURIES, AND FATALITIES

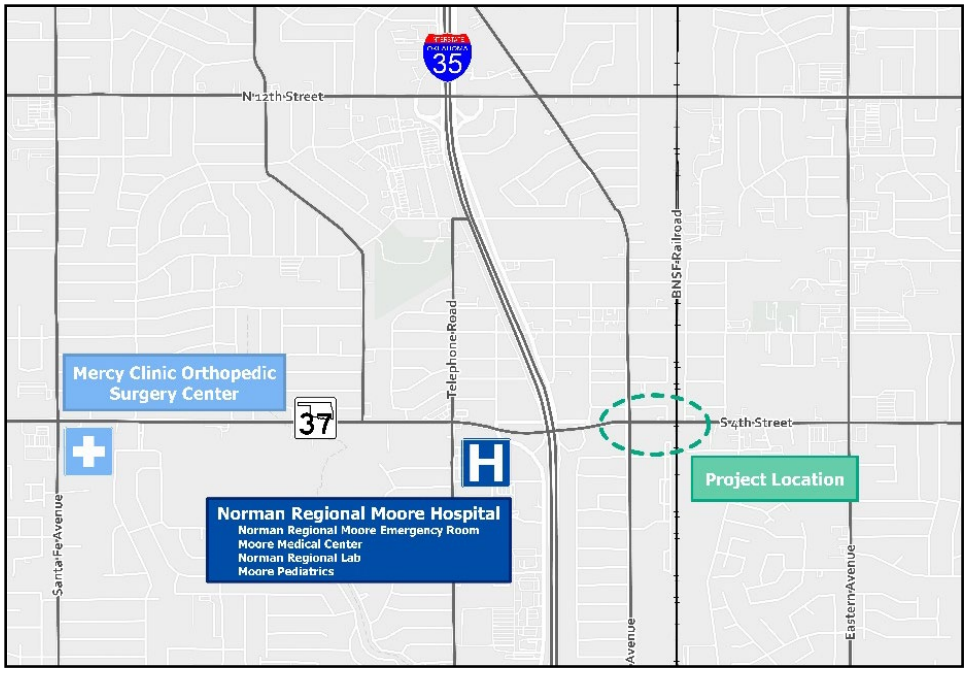
Constructing the grade separation virtually eliminates the potential for future fatalities and serious injuries by affording protection to both vehicular and active, non-motorized travelers within the community. Since 2010, there has unfortunately been one bicyclist fatality crash, 20 non-incapacitating injury auto crashes to 24 persons, 41 possible injury auto crashes impacting 47 people, and 123 crashes that resulted in property damage in the Project area. 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. With proper use, not only will the potential for train-vehicle and train-pedestrian/bicycle collisions be eliminated, many of the ancillary crashes (rear-end, sideswipe) which related to driver inattention to stopped traffic waiting for train crossings will also be eliminated.

THE PROJECT MAY 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 March 2, 2022, 115 emergency service vehicles were blocked by a train at this intersection while on an emergency call. These 115 incidents had an adverse impact on the safety and health of those within the region. This Project will eliminate potential emergency delays due to a blocked crossing at this location, as well as provide an additional unobstructed crossing when others are blocked, and in turn, the community will receive faster emergency response times.[3]

Figure 6: Project Location and Medical Facilities



THE PROJECT MAY IMPROVE THE SAFE MOVEMENT OF GOODS 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 and minimizing the potential threat of collision at an at-grade crossing removes the potential for future catastrophic incidents at this location.

[3] 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.

THE PROJECT WILL IMPROVE THE SAFE MOVEMENT OF BICYCLIST AND PEDESTRIANS

On January 30, 2017, at 5:36 AM, a crash between an automobile and a bicyclist occurred on SH-37 a few feet west of the BNSF railroad crossing. Unfortunately, the crash resulted in a fatality for the bicyclists. Based on the investigation, the City of Moore Police Department reenacted the scene and the police report noted that "At the same time of day as the collision (0536 hours), officers went back to the scene and recorded the perspective from Driver One approaching the bicyclist. The bicyclist was held up at the Area of Investigation, with both rear lights activated, and it was not visible until just a few feet away" due to the elevated rail tracks.[4] This Project will provide a separate multimodal bridge that will provide bicyclists and pedestrians a safe way to cross SH-37.

ENVIRONMENTAL SUSTAINABILITY

THE PROJECT MAY REDUCE TRAVEL DELAY AND REDUCE EMISSIONS

BNSF has played a key 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. On average 34 trains travel along this rail line daily. This busy rail corridor not only causes temporary closures to traffic on SH-37 while the 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 will improve 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. Reducing carbon emissions yields important health and economic benefits in Moore and it also may help to reverse the impact of global warming and climate change.[5] 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	12,660.47
$PM_{2.5}$	0.3170

High levels of nitrogen oxides and other oxidizing agents like volatile organic compounds (VOC) are correlated with higher tropospheric ozone production, which has been shown to irritate the respiratory system.[6] Emission reduction is critical to lowering tropospheric ozone production, and the Project's projected emission reduction represents a marked improvement in Moore's

[4] Major Ted Belling of the City of Moore Police Department noted on a phone call that the railroad tracks are slightly elevated, and this contributed to Driver One not seeing the bicyclist.

[5] U.S. Environmental Protection Agency. Evaluating Climate Policy Options, Costs and Benefits, October 6, 2016. Retrieved 03/10/2022 from https://19january2017snapshot.epa.gov/climatechange/evaluating-climate-policy-options-costs-and-benefits_.html

[6] U.S. Environmental Protection Agency. EPA Region 1: The Ozone Problem, March 28, 2022. Retrieved 04/06/2022 from https://www3.epa.gov/region1/airquality/oz_prob.html

environmental sustainability. Moore's 2020 8-hour average ozone value measured 0.066 parts per million (ppm), which is close to exceeding the standard value of 0.070 ppm.[7] Based on the EPA EJ Screen (refer to **Appendix B. EJ Screen Report**) of the project impact area, current ozone pollution within 1,000 feet of the project location is approximately 47.5 parts per billion (ppb) which is higher than the state, EPA region, and the United States average. Ozone pollution 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 in 2015, 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 (**Figure 7**). Idling for more than 10 seconds uses more fuel and produces more emissions that contribute to smog and climate change than stopping and restarting your engine does.[8] Through public meetings and conversations with the local community and law enforcement, delays of 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. The multimodal connections, outlined in the Mobility and Community Connectivity merit criteria section, provide new and safe connections for those walking and biking and may result in more zero-emissions trips.

Figure 7: Delay Builds at the Current At-Grade Crossing (June 2021)

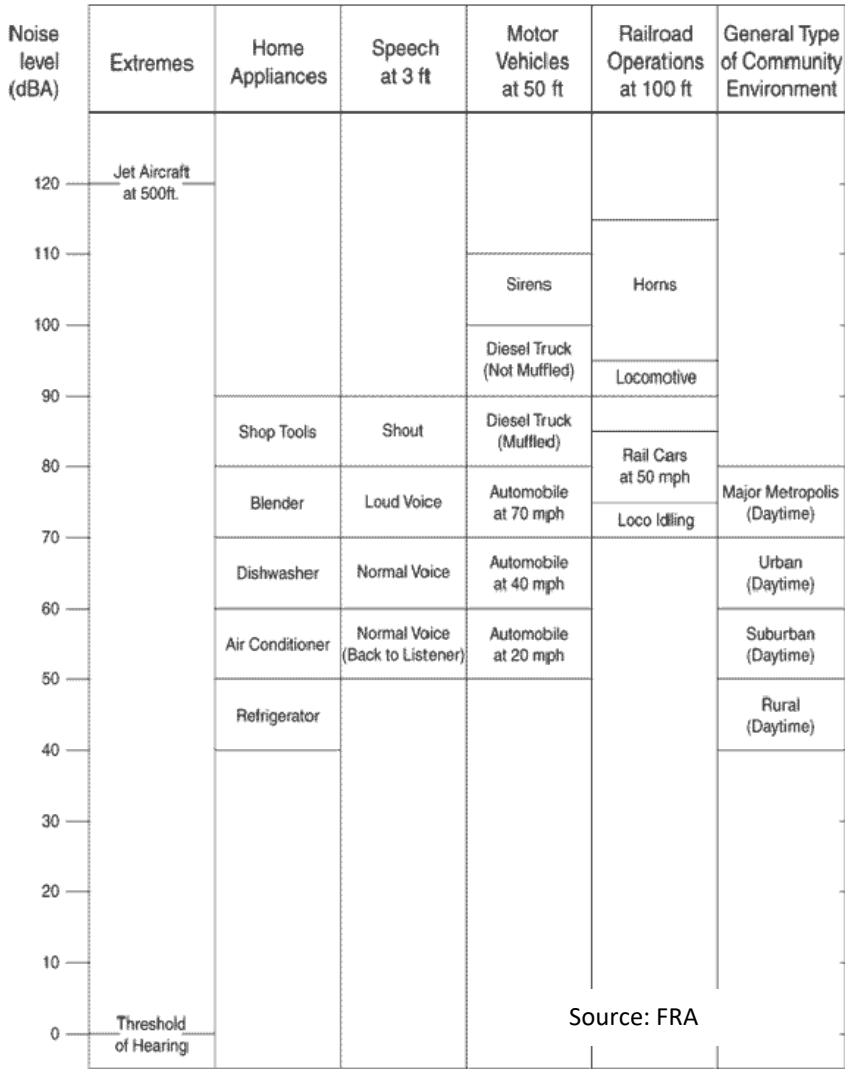
Community Benefits from Improvement in Air Quality

Oklahoma does not currently have any nonattainment or maintenance areas and is working to maintain that status. To do so, ODOT and its MPOs focus on implementing projects that will reduce emissions, particularly in metropolitan areas. Poor air quality can affect the health of residents, especially those with asthma, young children, and older adults.[9] According to the EPA, even low levels of ozone can cause adverse health effects including coughing, difficulty breathing, damaged airways, and increased asthma attacks. Based on an EPA EJ Screen Report

[7] Oklahoma Department of Environmental Quality. Air Data Report 2019, 2019. Retrieved 03/15/2022 from https://www.deq.ok.gov/wp-content/uploads/air-division/Monitoring_Air_Data_Report_2019.pdf
[8] U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy. Idling Reduction for Personal Vehicles, May 2015. DOE/CHO-AC-06CH11357-1502. Retrieved 03/20/2022 from https://afdc.energy.gov/files/u/publication/idling_personal_vehicles.pdf
[9] U.S. Environmental Protection Agency (EPA). Health Effects of Ozone Pollution. May 5, 2021. Retrieved 03/30/2022 from https://www.epa.gov/ground-level-ozone-pollution/health-effects-ozone-pollution

produced in March 2022 (refer to **Appendix B. EJ Screen Report)**, the population of areas just north and south of the project are comprised of 8 percent children under age five and 13 percent of individuals over the age of 64. Based on state-level data from the Centers for Disease Control and Prevention (CDC) the percent of adults with asthma in Cleveland County, OK in 2019 is 9.5 percent.[10] The 2019-2020 National Survey of Children's Health reports that 10.6 percent of children in Oklahoma have asthma, which is higher than the national average of 7.5 percent.[11] The health of all residents and especially those in these high-risk populations may benefit from improved air quality along the corridor.

Figure 8: Comparison of Various Noise Levels



Source: FRA

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.[12] BNSF helps Oklahoma farmers expand their markets by providing a vital link for Oklahoma's emerging ethanol industry.[13]

The Project May Mitigate Noise Impacts

The Project may reduce the overall noise impact to the local area because passing trains will no longer use their horns at the crossing. As noted by the Federal Railroad

[10] Centers for Disease Control and Prevention (CDC). National Environmental Public Health Tracking Network. Retrieved 03/30/2022 from https://www.epa.gov/ground-level-ozone-pollution/health-effects-ozone-pollution

[11] Child and Adolescent Health Measurement Initiative. 2019-2020 National Survey of Children's Health (NSCH) data query. Data Resource Center for Child and Adolescent Health supported by the U.S. Department of Health and Human Services, Health Resources and Services Administration (HRSA), Maternal and Child Health Bureau (MCHB). Retrieved 03/15/2022 from https://www.childhealthdata.org/browse/survey/results?q=8465&r=38

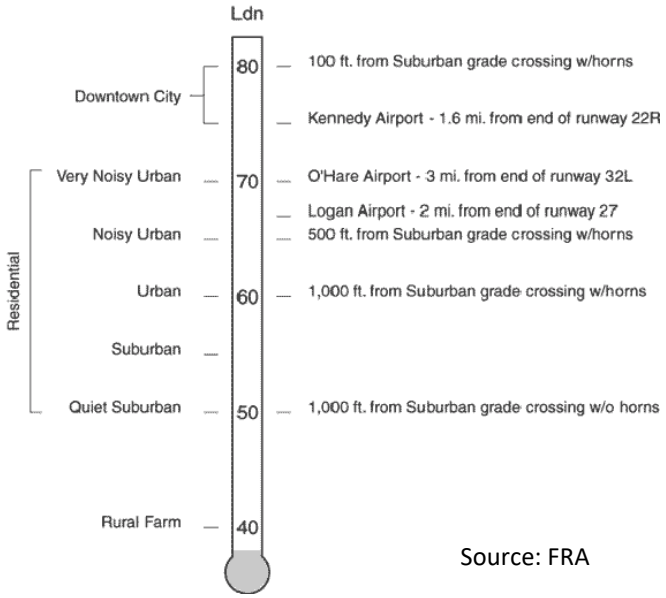
[12] U.S. Energy Information Administration, Biofuels Explained. December 2020. Retrieved 03/30/2022 from https://www.eia.gov/energyexplained/biofuels/ethanol-and-the-environment.php#:~:text=Producing%20and%20burning%20ethanol%20results,CO2)%2C%20a%20greenhouse%20gas.&text=Some%20ethanol%20producers%20burn%20coal,stocks%20or%20sugar%20cane%20stocks.

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

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. Experienced noise sources in our environment as well as typical ambient noise levels is shown in **Figure 8** on the previous page**.** 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. The locomotive horn can significantly disturb those living or working near highway-rail grade crossings. [14]

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 9: Day-Night Sound Leels in Typical Environments



Source: FRA

THE PROJECT AVOIDS THREATENED AND ENDANGERED SPECIES IMPACTS

Based on the 2021 Biological Assessment, three species are observed in the Project area and include the whooping crane, piping plover, and red knot. There are no anticipated negative effects to these species as a result of the Project.

THE PROJECT MAY IMPROVE STORMWATER MANAGEMENT AND INCREASE RESILIENCY

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 controlled drainage system of inlets and pipes carrying the runoff to the pump system will improve stormwater drainage in the Project location. With effective stormwater management streams, rivers, and lakes are cleaner; flood risks are reduced; costs due to flood damage decrease; and community quality of life increases.[15] The pump system will make this portion of SH-37 more resilient to flooding during rain events.

[14] U.S. Department of Transportation, Federal Railroad Administration. Horn Noise FAQ, February 14, 2022. Retrieved 03/15/2022 from https://railroads.dot.gov/environment/noise-vibration/horn-noise-faq

[15] Holm, B; et al. University of Nebraska, Lincoln Extension, Institute of Agriculture and Natural Resources. NebGuide, Stormwater Management: What Stormwater Management Is and Why It Is Important, July 2014. Retrieved 03.10/2022 from https://extensionpublications.unl.edu/assets/pdf/g2238.pdf

QUALITY OF LIFE

The Project will positively enhance community cohesion by creating safer and more efficient means for residents to travel by car, walking, and biking. Based on 2020 U.S. Census data, the census tract just north of the project area (2021.02) has a high percent of the population in poverty (**Figure 10**).

Figure 10: Percentage of Population in Poverty, by Census Tract

Residents in the Project area will benefit from the multimodal bridge crossing which will provide them access to the businesses to the south along 19th Street and the Central Park community center. This will improve the quality of life for these residents through improved mobility as well as the benefits of improved air quality and noise reduction in the immediate project area as explained in the Environmental Sustainability merit criteria section.

THE PROJECT MAY INCREASE TRANSPORTATION CHOICES AND EQUITY FOR INDIVIDUALS

A Social, Economic and Environmental Justice Analysis Report was completed for this Project in May 2021 and 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 likely experience shorter travel times along the SH-37 corridor. Additionally, the multimodal bridge over SH-37 and continuous raised 10-foot-wide shared-use paths in each direction along SH-37 expands transportation choices by improving safety, connectivity, and mobility for pedestrians and bicyclists.

Environmental justice (EJ) populations are present in the Project area. Adjacent Census block groups have minority percentages that range from approximately 0 to 48 percent (**Figure 11**). However, the proportion of minority population in this block is similar to city and county averages (approximately 25.4% and 24.3% minority persons, respectively). No displacements will occur in the block containing a minority population nor within the block group containing a predominantly low-income population. Minority and low-income populations will benefit from

this project by having improved access to healthcare and experiencing greater connectedness to the community.

Figure 11: Project Area Minority Populations, By Percentage of Total Census Tract Population

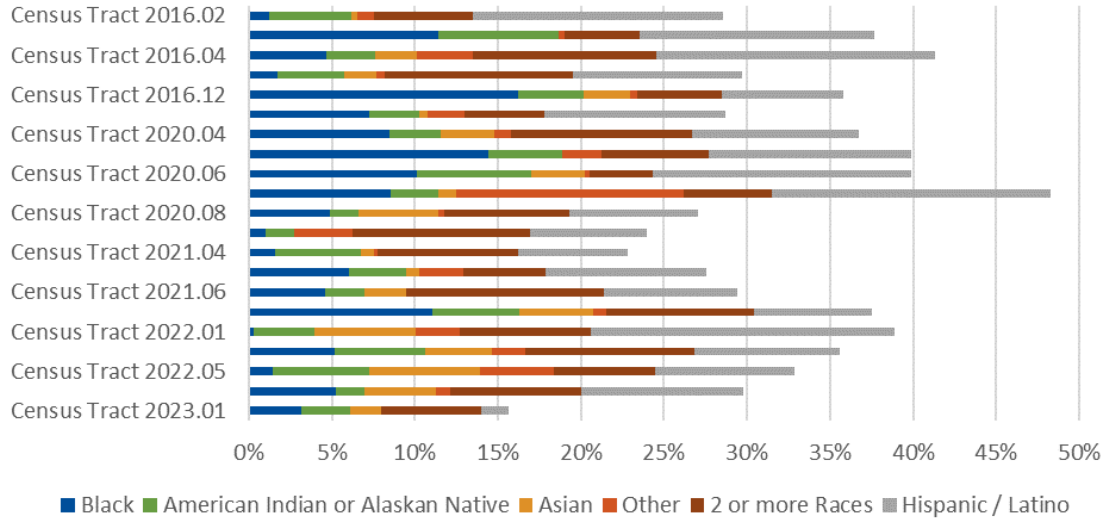
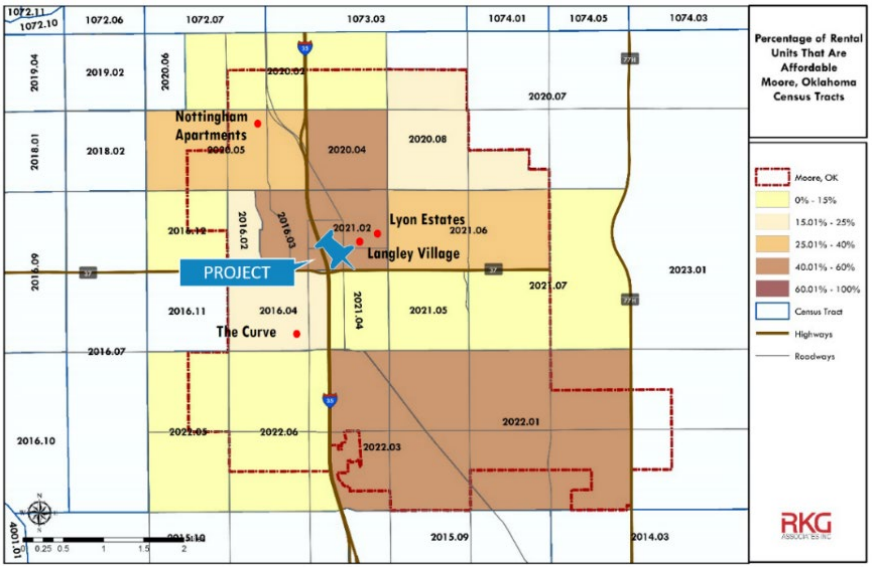


Figure 12 illustrates how the Project will increase access to location-efficient affordable housing. The neighborhoods in and around the Old Town area north of the Project have between 40 and 60 percent of rental units that are affordable, the highest concentration in Moore as a whole. Additionally, two project-based rent-subsidized private affordable housing developments (Lyons Estates and Langley Village) are less than one mile from the Project. Lyons Estates offers a mix of market rate and affordable housing while Langley Village is a senior affordable housing community.[16]

Figure 12: Percentage of Affordable Rental Units, by Census Tract



[16] City of Moore, OK. Analysis of Impediments to Fair Housing Choice, June 2020. Retrieved 03/21/2022 from rkg-final-aimoore-ok-rev-june-232020.pdf (cityofmoore.com)

The Project will likely 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, 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.

The Project Improves Connectivity of Essential Services – Jobs, Healthcare & Parks

The Project connectivity improvements include:

- Improved access to jobs in the medical facilities, entertainment venues, and restaurants located just west of I-35, as well as the downtown Moore area.
- Residents living northeast of the Project will be able to utilize the multimodal bridge and shared-use paths along SH-37 to safely access job locations to the south and west of the project. The distance from the project location to the 19th Street business district east of I-35 is one mile; on average, this is equivalent to 19 minutes walking or five minutes biking.
- The shared-use paths and multimodal bridge provide safe, separated infrastructure along the paths that residential and visiting populations may take to medical facilities east of the Project. Rather than crossing at-grade rail facilities and navigating among on-street vehicular traffic, pedestrians and bicyclists will be able to use the newly created shared-use path and multimodal 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 multimodal bridge will provide connectivity between parks and provide community members with welcoming, safe, and enjoyable facilities that previously did not exist.

Additional connection details are outlined in the Mobility and Community Connectivity merit criteria section while access to jobs is outlined in the Economic Competitiveness and Opportunity merit criteria section.

The Project Addresses Racial Equity and Barriers to Opportunities

The multimodal bridge will provide improved walking, biking, and rolling access between the existing Central Park and new Old Town Park. This would assist in mitigating two community barriers – the rail corridor that runs north-south and SH-37 that runs east-west. The Project minimizes these physical barriers to both vehicular and active transportation, allowing improved, full access to community resources, such as the parks, schools, and a library. Economic barriers addressed by the Project are detailed in the following Economic Competitiveness and Opportunity section.

MOBILITY AND COMMUNITY CONNECTIVITY

Under current conditions, the Project area provides an unconnected, discontinuous network of multimodal infrastructure that restricts mobility and access to community assets. There is one

bicycle lane along South Howard Street, from SW 1st Street to SH-37 and sidewalks throughout the project area. Sidewalks west of the grade crossing are most consistently available along S. Broadway both southbound (facilitated by new, accessible infrastructure constructed along with Central Park) and northbound, though sidewalks that connect north are sometimes disrupted by commercial driveways and parking. East of the crossing, sidewalks are consistently available along Tower Drive going southbound, but sidewalks to the north are only available along S. Eastern Ave, nearly a half mile from the intersection. Painted piano crosswalks are available across SH-37, only some of which are signalized and few of which are directly accessible from ADA compliant curb ramps. The lack of bicycle or pedestrian infrastructure on SH-37 was identified as the largest active transportation barrier for the Old Town neighborhood during the creation of the Envision Moore Plan 2040.

The Project improves community connectivity and mobility for all users by separating conflicting modes and providing new, safe, and accessible connections that will help Moore residents and visitors move freely with or without car. New bicycle and pedestrian connections include a north-south multimodal bridge over SH-37, new east-west paved 10-foot shared-use paths along SH-37, and a new north-south bicycle lane along S. Turner Avenue. The new pedestrian infrastructure will be ADA compliant, including the multimodal pathways, curbs and crosswalks. Three new crosswalks with ADA curb ramps and highly visible paint will be installed at the east side of Broadway and SH-37, across Turner Avenue, and across SH-37 at Tower Drive.

The multimodal bridge creates a new, safe and accessible connection that will directly tie into the trail network of the adjacent Central Park and the future Old Town Park. When Old Town Park is constructed, the multimodal bridge will facilitate the connection between parks that can serve as a direct off-road connection for those walking or rolling between E Main Street and SW 16th Street (a one-mile distance). SW 16th Street is adjacent to stores (Sam's Club, restaurants) approaching the SW 19th Street business district. Directly at the intersection of S. Broadway Avenue and SW 19th Street sits the Shops at Moore, which includes over a dozen retail shops and restaurants.

Connections between the parks will be significantly easier; the distance between the northern entrance of Old Town Park and the Central Park Recreation Center 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 multimodal bridge, the distance is reduced to 0.5 miles, and it would take approximately three minutes to bike and ten minutes to walk between the park locations.[17] With 1.65 miles of safe, well-lit trails, Central Park serves as a valuable community asset and transportation resources in Moore. In 2021, the annual attendance at the Station at Central Park was 162,704 and the new multimodal bridge will greatly improve connections to and safety for the thousands of residents and visitors who will access both parks.[18]

[17] Distance and time figures generated using Google maps and directions.
[18] Annual attendance at The Station at Central Park was provided the City of Moore Park and Recreation Department.

The combination of shared-use paths on SH-37 and the new bicycle lane on Turner Avenue will provide 0.5 miles of dedicated infrastructure for north-east bicycle connections. This could benefit the residents off S. Broadway Avenue (SW 5th Street through SW 16th Street) in making connections to E Main Street (home to Kiwanis Park, Moore High School, and other commercial offerings).

A truly multimodal endeavor, the Project also improves mobility for motorized travelers by reducing the current at-grade conflict that results in congestion and unreliability as described in Mobility and Community Connectivity merit criteria section. Additionally, reducing the potential conflict for freight and passenger rail provides additional reliability for the movement of goods and people through the rail corridor. Additional benefits of the new community connections are identified in the Economic Competitiveness and Opportunity merit criteria section.

ECONOMIC COMPETITIVENESS AND OPPORTUNITY

THE PROJECT ELIMINATES A MAJOR BOTTLENECK REDUCING DELAY AND IMPROVING RELIABILITY

The at-grade SH-37 rail crossing is a bottleneck in Moore. With 34 BNSF and Heartland Flyer trains per day, the blocked crossing frequently and unpredictably bisects the city. When the crossing is closed, it cuts off access between east and west Moore, forcing traffic to reroute to longer alternative routes. These in turn become congested, causing ripple effects across the community. The Project will save substantial hours of vehicular delay and reduce significant travel unreliability for both people and goods movement. At current average daily traffic volumes, there are approximately 170 daily passenger hours and eight commercial vehicle hours of delay attributable to the at-grade rail crossing. Because train stoppages are unpredictable, they have a huge effect on businesses, causing unreliability both for deliveries and workers who are unable to get to work on time.

The Project may alleviate the negative externalities and maximize the net benefits of other nearby efforts to expand freight and passenger rail mobility. This includes BNSFs 195-acre logistics center which is located east of Flynn Yard and just north of the Project. The yard and logistics centers are designed to handle increasing volumes of goods movement to serve the Oklahoma City regional market. With the Project, such growth will allow BNSF to conduct increasing train operations into the logistics center without further blocking traffic at SH-37. Similarly, the Regional Transportation Authority of Central Oklahoma is currently studying the North-South corridor along BNSF right-of-way through Moore for potential commuter rail service.[19] If implemented, the proposed station location in Moore is Central Park immediately south of the Project. The Project positions the city to take advantage of the benefits of commuter rail, while mediating the potential downsides of even more trains per day if commuter rail is implemented.

[19] Regional Transportation Authority of Central Oklahoma. North/South Corridor. Retrieved 03/21/2022 from https://engagekh.com/rtamoves/ns-corridor/

The Project can Strengthen the Moore Economy

The Project may strengthen the economy of Moore by improving labor and customer market access, supporting the retail businesses that anchor the city's economic development, providing reliable route redundancy to the growing 19th Street commercial corridor, and potentially increasing land productivity. **Figure 13** shows that all of Moore is within a 10-minute drive of the railroad crossing and the majority of the city's area is within a 5-minute drive of the SH-37 crossing.[20] In fact, 50 percent of Moore's population and 76 percent of its employment is within a 5-minute drive of the SH-37 crossing (**Table 4**). The administrative office for the city's largest employer—Moore Public Schools—is located 1.2 miles east of the crossing. Norman Regional Moore Hospital, another significant employer, is less than a mile west of the Project. When the crossing is closed, this effectively limits access between businesses and their customers and employees. Research shows that access improvements can improve overall business productivity and facilitate regional growth.[21]

Figure 13: Driving Distance from Project

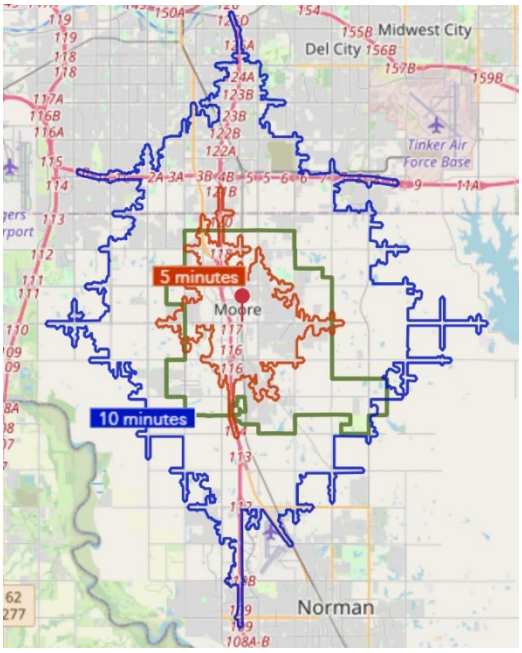


Table 4: Employment and Population Accessible within 5- and 10-Minutes Driving of the Crossing, Compared to Moore, OK[22]

		WITHIN DRIVE-TIME RADIUS OF CROSSING	
METRIC	**MOORE, OK TOTAL**	5-MINUTE	10-MINUTE
Population	61,245	30,766	121,710
Employment	16,261	12,403	52,350

Access is particularly important to the retail sector, which comprises 37 percent of the employment in Moore and 34 percent of the employment within a five-minute drive of the project. Most retail business is located west of the railroad crossing, while about half of the city's population is located to the east. When the crossing is closed, which can at times occur for hours or days, the retail anchors suffer from degraded access. Additionally, sales tax revenue fund the city's budget, the health and success of retail is linked to the city's ability to provide services to residents. Retail sales tax revenue makes up 71.3 percent of the city's general fund, which is used to pay for key services and amenities including the police and fire departments, public works, parks, recreation, and library facilities.[23]

[20] EBP Analysis with ESRI Business Analyst Online.
[21] National Academies of Sciences, Engineering, and Medicine 2014. Assessing Productivity Impacts of Transportation Investments. Washington, DC: The National Academies Press. https://doi.org/10.17226/22294.
[22] EBP Analysis with ESRI Business Analyst Online.
[23] City of Moore Finance Department. Budget and Audits: City of Moore Annual Budget, 2021-2022 City of Moore Budget, 10/12/2021. Retrieved 03/21/2022 from https://www.cityofmoore.com/departments/finance/budgets-and-audits

"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

When the railroad crossing is closed, 19th Street is a common detour route to the south and suffers spillover effects from traffic diversions. It is also used as an alternative to other at-grade crossings in Moore. These effects compound existing congestion on 19th Street which serves as the commercial heart of the city. The Project will provide more reliable route redundancy to this growing center of economic activity.

The Project has the potential to increase the value of land and support development around the I-35 interchange and along the SH-37 corridor. The construction of the underpass at 19th Street under the BNSF rail line provides a precedent for the economic value of this type of initiative to a key economic corridor in Moore.

The Project Improves Multimodal Access to Better Connect and Revitalize the Community

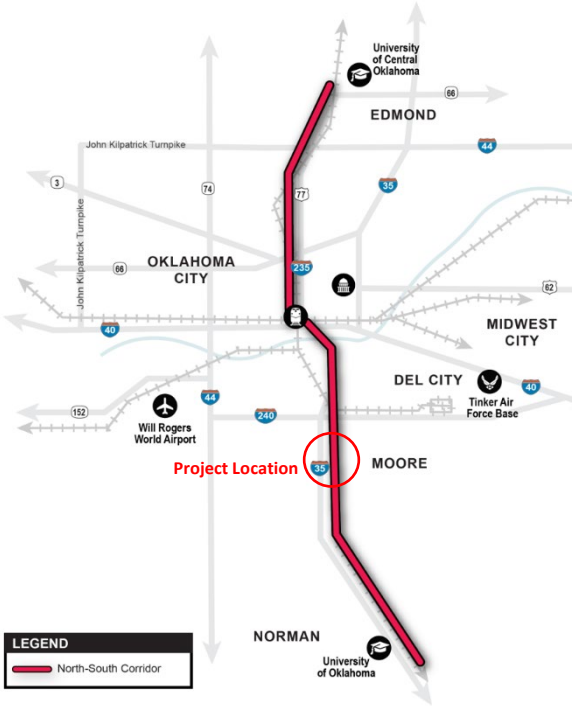
The multimodal bridge which parallels the rail line, as well as the uninterrupted pedestrian walkway through the new underpass will significantly improve the quality and availability of pedestrian and bicycle modal options, increasing access for people to jobs, retail, and recreational opportunities. Approximately 2,800 people live within a 15-minute walk of the project and 3,300 jobs are in the same proximity, comprising 20 percent of all jobs in Moore.[24] As discussed in the Quality of Life merit criteria section, the Project will provide access to low-to-moderate income neighborhoods located to the north of the project. Residents living in these areas will be able to utilize the multimodal bridge and shared-use paths along SH-37 to safely access jobs south and west of the Project, as well as cultural resources and amenities located at Central Park to the immediate South.

The Project additionally supports strategic development plans centered on revitalization of the Old Town neighborhood. Old Town, located east of I-35 and centered around the intersection of Main and Broadway Streets just north of the Project, was the site of the original settlement now known as Moore. Over time, however, the development center of the city shifted toward I-35, leaving an underutilized downtown. In 2019, the city completed the Old Town Moore Revitalization Plan, responding to "recent cultural and generational changes within Moore…" that have "begun to generate a demand for downtown living and a renewed interest in Old Town." Among the Plan's priorities are promoting development and redevelopment of the area, supporting small businesses, enhancing walkability, redressing the barrier effect of the railroad, and developing Old Town Park with trail connectivity to Central Park across the railroad.

[24] EBP Analysis with ESRI Business Analyst Online.

The Project is a component of the Plan. Public comments on the Plan specifically point to a desire for more commercial businesses on the east side of the railroad crossing, something that is more likely to occur with the Project's improved connectivity. Old Town is host to dedicated events like the Homecoming Parade, Haunt Old Town, Old Town Christmas, and Open Streets Moore, which are the biggest tourism attractions to the area and bring in thousands of visitors to Old Town annually. The Project will further support and facilitate this tourism as a local economic generator by ensuring visitors can easily get around the city, including on foot or bicycle.

Figure 14: Map of Proposed Commuter Rail North- South Corridor



Another potential development opportunity presents in long term passenger rail plans. The Regional Transportation Authority of Central Oklahoma (RTA) includes representatives from Edmond, Norman, Midwest City, Del City, Moore, and Oklahoma City. While in the initial stages of planning, RTA is interested in regional transportation such as commuter rail. The alignment has not been finalized but RTA and BNSF are exploring an alignment on this corridor (**Figure 14)**. Currently, the RTA project team is studying the type of commuter rail operation that best meets the needs of the community and working with BNSF to determine compatibility with freight obligations.[25] 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.

STATE OF GOOD REPAIR

The Project modernizes this segment of SH-37 through the total reconstruction of the dated facilities, incrementally improving core infrastructure assets. Full implementation of the Project provides ODOT, Moore and the surrounding populations with a safer, new and functional asset which is more readily maintained at a consistent level than the existing deteriorated pavement with an at-grade rail crossing. ODOT collects pavement condition data annually and uses this data to make decisions about pavement treatment. ODOT currently tracks the Good, Fair, and Poor pavement condition metrics as per FHWA and also evaluates individual pavement distresses when recommending pavement treatment types. Since EJ populations are present in the Project area, but are not displaced, the Project, with the updated facility, shared-use paths

[25] Regional Transportation Authority of Central Oklahoma. North/South Corridor. Retrieved 03/21/2022 from https://engagekh.com/rtamoves/ns-corridor/

and associated park connectivity will improve conditions for traditionally underserved and disadvantaged communities.

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 2022 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 over a 28-year period.

The Project Eliminates Threats and Consequences if SH-37 is Left Unimproved

ODOT has agreed to turn over ownership and operation of this segment of SH-37 to the City of Moore. Completing this Project before the ownership transition ensures the city will have a roadway with good pavement condition that will 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.

PARTNERSHIP AND COLLABORATION

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 Project and included a community profile. The summary findings of this analysis are that the Project will:

- improve safety and reduce travel delay caused by the existing at-grade crossing;
- promote connectivity and mobility for pedestrians and bicyclists 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.

The City of Moore hosted a Town Hall in 2016 to roll out the Project planning. The 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.

INNOVATION

Innovative Technologies

In addition to traditional public outreach, 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 inform the public and provide communication to allow users to plan alternative routes. These efforts reduce congestion during construction while improving the safety and efficiency of movement through and around the work zone.

> **"I sometimes read a book while waiting, sometimes study my Bible lessons, write a grocery list, etc."**
>
> -Resident Perspective from Town Hall Meeting

Innovative Project Delivery

In order to facilitate project delivery and minimize community disruption through accelerated construction, ODOT commits to 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. ODOT plans to 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. 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.

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.

Innovative Financing

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. To date, $5.95 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 64 percent of the Project funding, $13.12 million and $5 million, respectively.

In 2018, the Oklahoma State Legislature enacted House Bill 1010, which raised the State's motor fuel taxes on gasoline and diesel by three and six cents per gallon, respectively.[26] 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. Increased state revenue improves ODOT's ability to participate in the Project.

PROJECT READINESS & ENVIRONMENTAL RISK

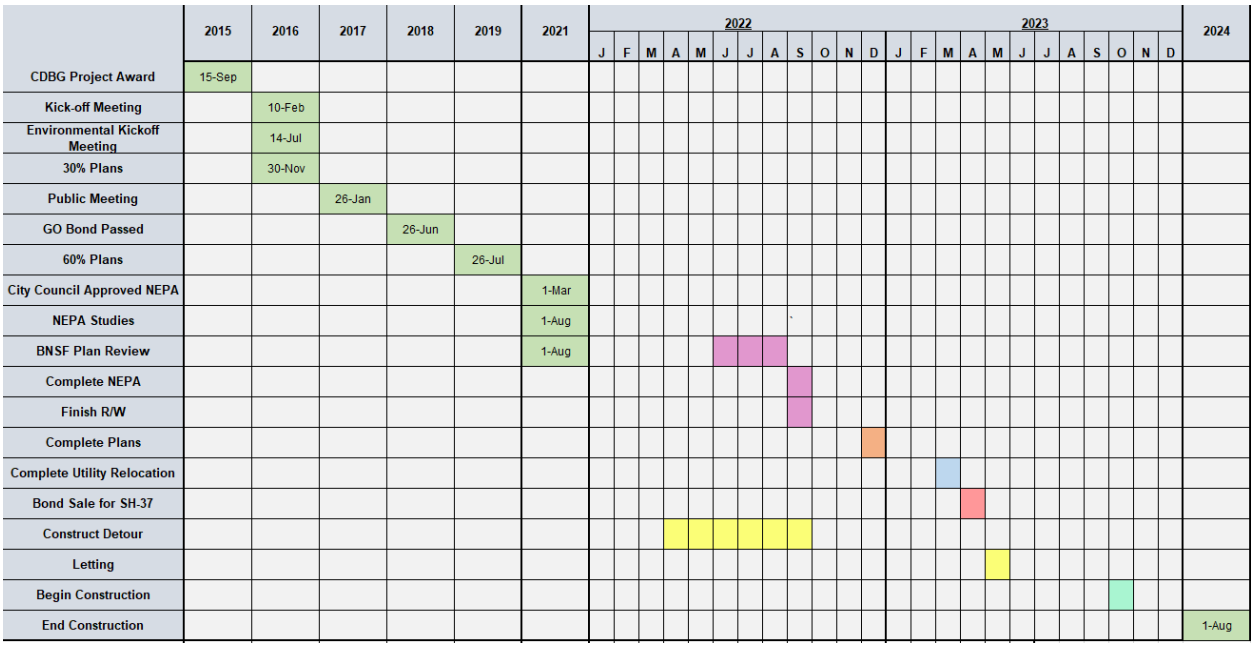
The following environmental clearance documents have been completed for the Project and they are located on the Project website: Community Impact Assessment, Noise Assessment, Biological Assessment, Waters and Wetlands Report, Cultural Resources Survey Report, and the Social, Economic and Environmental 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.

PROJECT SCHEDULE

As shown in **Figure 15**, the city and ODOT have been proceeding with improvements within this critical corridor for years and remain committed to completing this Project. Moore initially placed a contract in effect to complete efforts on the engineering and analysis on the Project in September 2015. The Project design began in 2016, right-of-way acquisition began in 2019, and utility relocation began in 2020. The obligation of funds for assumed letting and construction of the Project will occur on February 15, 2023, with assumed letting scheduled for May 18, 2023. Construction is anticipated to start on October 1, 2023 and be completed on August 1, 2024.

[26] http://www.oklegislature.gov/BillInfo.aspx?Bill=hb1010&Session=172X

Figure 15: Assumed Project Schedule



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 September 2022 with only minor Phase II testing remaining to be completed. 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.

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.

Federal Transportation Requirements Affecting State and Local Planning

- **ACOG Long Range Transportation Plan (LRTP):** The ACOG LRTP, Encompass 2045 approved in 2021 did not include the Project but the Project aligns with the Plan goals related to connectivity, equity, healthy communities, safety, performance, and system preservation
- **Statewide Transportation Improvement Program (STIP):** The ODOT STIP incorporates the first four years of the ODOT 8 Year CWP. The Project is included in the STIP for FFY 2023 at $5,000,000.
- **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 rather than a project-based document. 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 Flynn 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, all 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).

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).

This Project is in ODOT's 2022-2029 8 Year CWP and is scheduled to be let by FFY 2023.[27] The amount and timing will be confirmed during the annual rebalancing that traditionally occurs and will ensure the funding commitment of $10.0 million set aside for ODOT's participation. ODOT and Moore remain committed to adjusting the current schedule if necessary to meet RAISE grant requirements.

- **Delay of adjacent/involved projects**: No tied projects are part of this effort.
- **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 development of 90 percent design plans indicates that minority and traditionally underserved neighborhoods are not adversely impacted by any right-of-way needed for the Project.

Moore and ODOT follow all the FHWA policies and federal laws regarding securing right-of-way for federal aid projects.

- **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 September 2022.

- **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 (March 2022). 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 D. All costs and benefits in the BCA are expressed in 2020 constant dollars discounted to the year 2020 (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.

[27] https://oklahoma.gov/odot/programs-and-projects/8-year-construction-work-plan.html

Costs Included in the BCA

Total capital costs for the Project totals $28.12 million in 2020 dollars. This includes $20 million for construction, as well as additional costs for engineering and design, utility relocation, and ROW acquisition. As shown in **Table 1** on page 7, $8.12 million have been previously incurred (primarily in 2019), including planning and engineering, ROW acquisition, legal fees and costs associated with issuance of bonds. For purposes of conducting the BCA, the $2.17 million in legal fees and bond issuance costs have been excluded, as these are services and financial exchanges and not resource costs.

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 BCA Report in Appendix D.
- **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 USDOT 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 multimodal 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 $32.40 per hour, as per 2022 BCA guidance.
- **Crash reductions**: Crash reductions include vehicle-train incidents (three injury-related incidents over the past 47 years), and 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. In addition, it reflects the sole bicyclist fatality that occurred at the crossing in 2017 and discussed in the Safety merit criteria section. While only one such event has occurred, the possibility of a future fatality should not be dismissed, as the geometry of the at-grade crossing presents a potential hazard as described by the City of Moore police officer. Accordingly, the safety analysis includes an annual probability of such fatalities occurring in the future without the grade crossing elimination project. A conservative estimated probability was set at .04 assuming one such fatal event could occur over the next 25 years under the No-Build condition.
- **Emergency Response Benefits**: Based on the City of Moore Police Department records, 115 emergency service vehicles were forced to detour while trains were passing through or stopped at 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 six percent 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.[28] 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 was entered in the BCA model in the year 2025, the first full year of operation.
- **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.

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

RESULTS

Table 5 provides the BCA results. The Benefit Cost Ratio (BCR) is 1.33, with a Net Present Value (NPV) of $6.9 million. This represents a 62 percent return on investment (ROI) on the requested federal grant funding. All cost and benefits shown in the table are discounted to the year 2020. As a result, for example, the capital cost figure shown in the table below ($22.16 million) is the result of discounting the previously undiscounted $25.95 million 2021 capital cost.

Table 5: Summary BCA Results (in Millions of 2020 $s)

DISCOUNTED COSTS	
Build Capital Costs (previously incurred and future)	$22.16[29]
Annual O&M and Periodic Rehab Cost (Build - No Build)	$ -
Salvage Value	$(1.37)
Total	**$20.79**
DISCOUNTED BENEFITS	
Travel Delay Savings - Vehicles	$11.60
Travel Time Savings - Bike and Pedestrian	$1.80
Emissions Benefits (CO2)	$0.47
Emissions Benefits (All Other)	$0.13
Noise Reduction (one time capitalization effect)	$1.43
Travel Reliability Benefits - Vehicles	$3.92
Emergency Vehicle Response	$0.79
Crash Reductions Benefits	$7.12
Fuel Cost Savings	$0.21
At-Grade Crossing Protection Elimination (Life Cycle Cost Savings)	$0.22
Total	**$27.69**
SUMMARY	
Benefit Cost Ratio	**1.33**
Net Present Value	**$6.90**
SHARE OF BENEFITS	
Travel Delay Savings - Vehicles	41.9%
Travel Time Savings - Bike and Pedestrian	6.5%
Emissions Benefits	2.2%
Noise Reduction Benefits	5.2%
Reliability Benefits	14.2%
Emergency Response Benefits	2.8%
Crash Reductions Benefits	25.7%
Fuel Cost Savings	0.8%
At-Grade Crossing Protection Life Cycle Cost Savings	0.8%

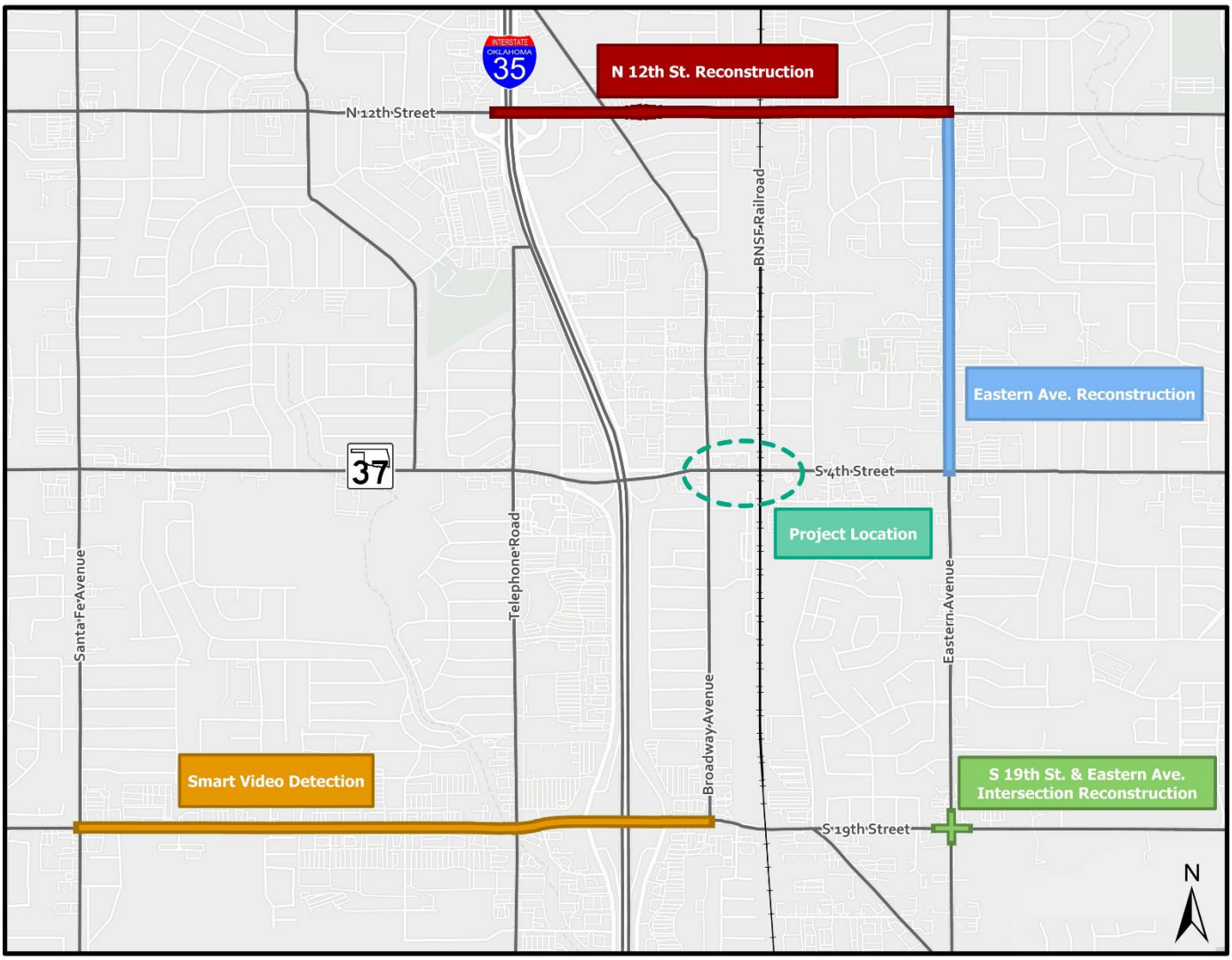
[29] Refer to page 44 of Appendix D for details on the capital cost calculations.

APPENDICES

Appendices documents are also available on the project webpage.

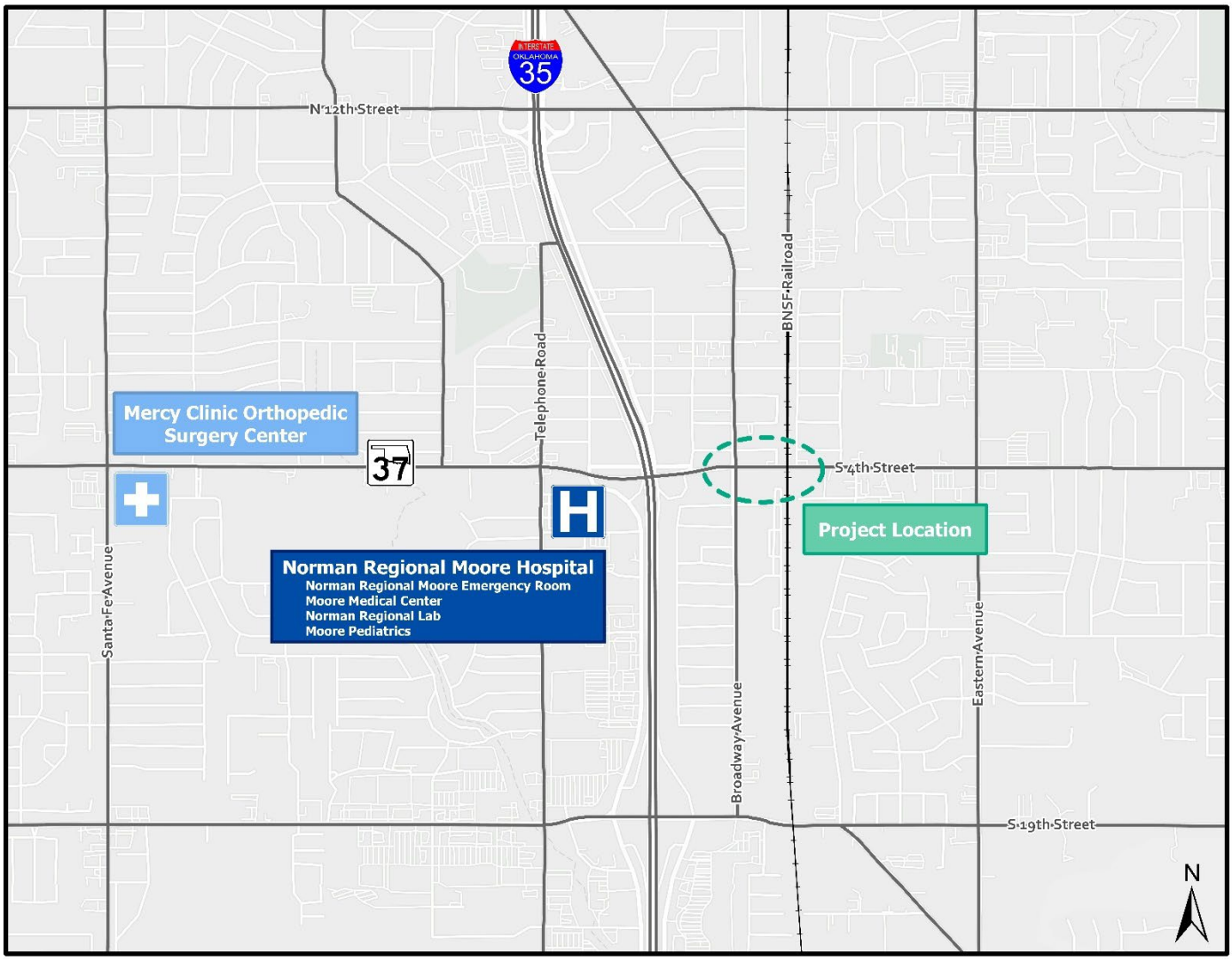
APPENDIX A. MAPS AND IMAGES

OTHER LOCAL TRANSPORTATION IMPROVEMENTS

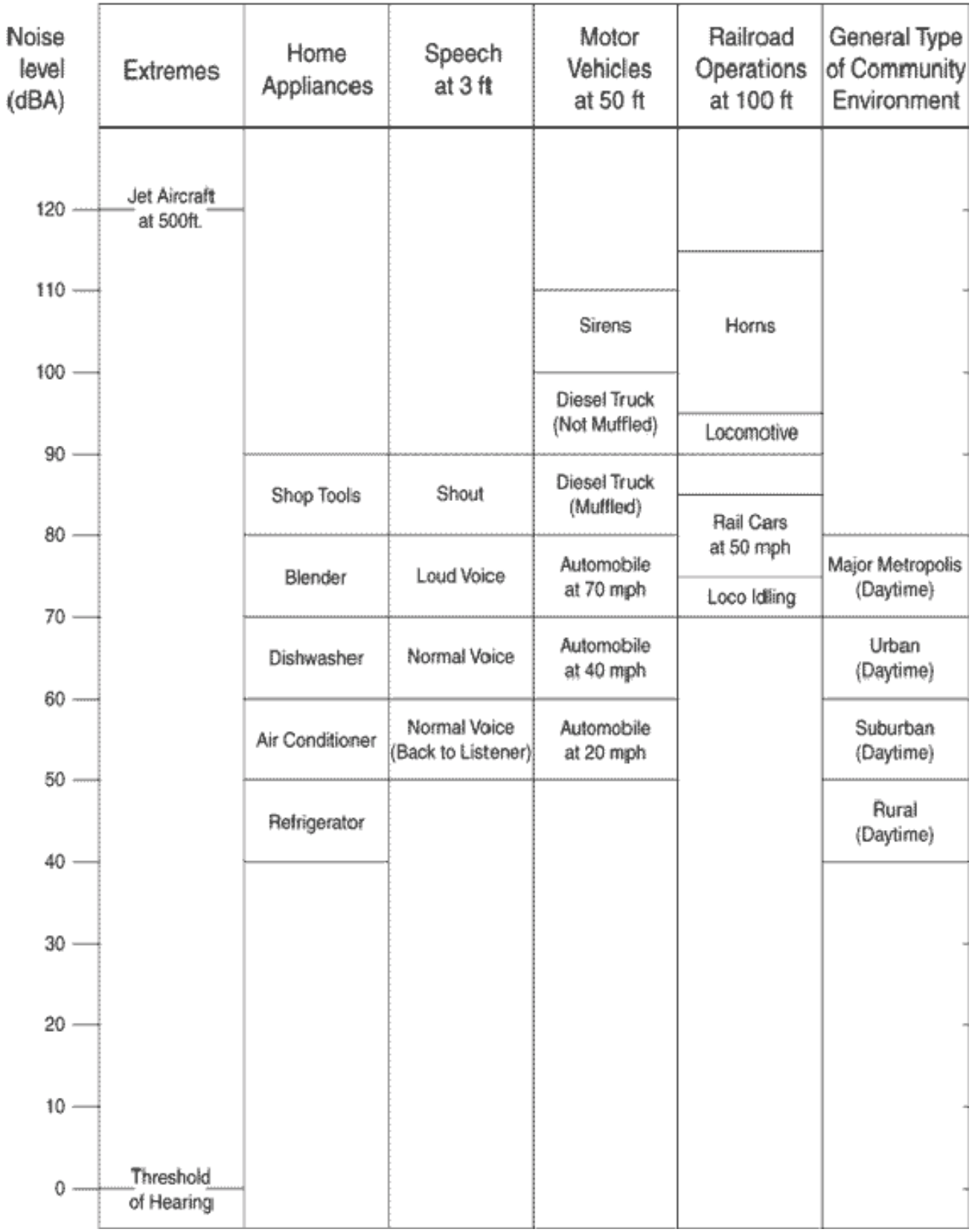


PROJECT LOCATION IN RELATION TO MOORE PARKS

PROJECT LOCATION AND MEDICAL FACILITIES

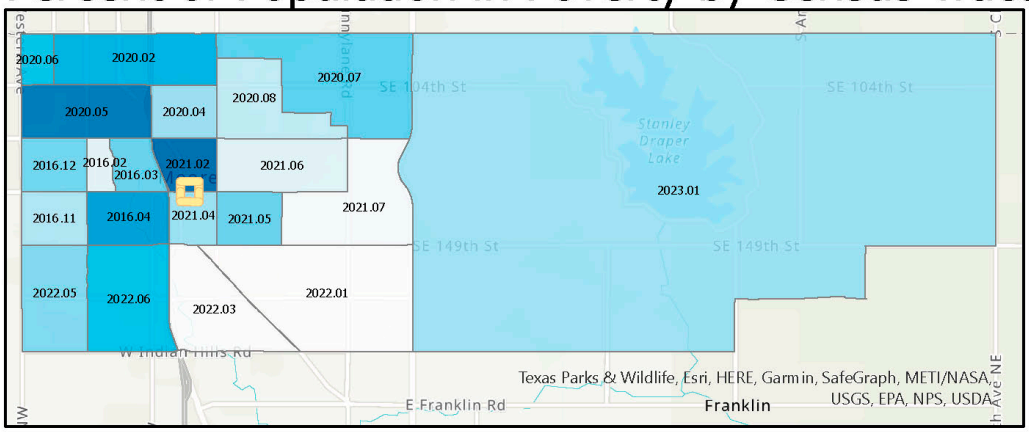


COMPARISON OF VARIOUS NOISE LEVELS



PERCENT OF POPULATION IN POVERTY AND MEDIAN INCOME BY CENSUS TRACT

Percent of Population in Poverty by Census Tract



Legend

OK RAISE Census Data

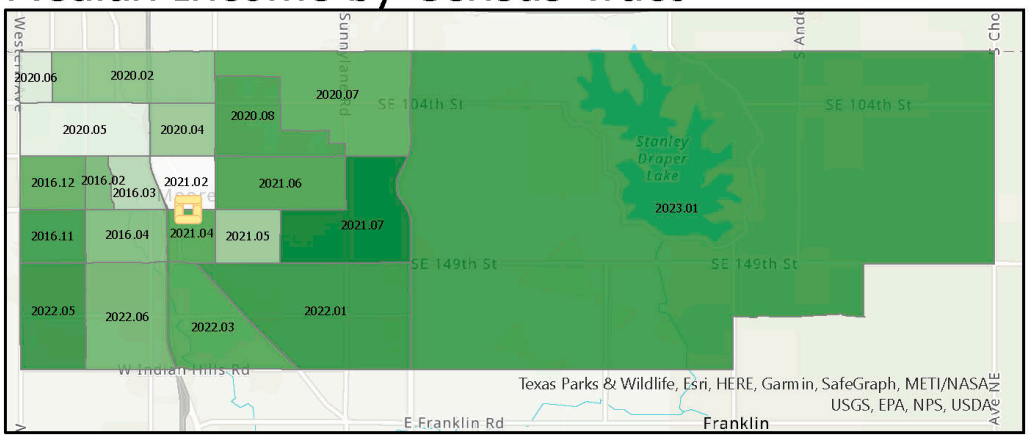
Percent of Population in Poverty

3%

20%

Project Impact Area

Median Income by Census Tract



Legend

OK RAISE Census Data

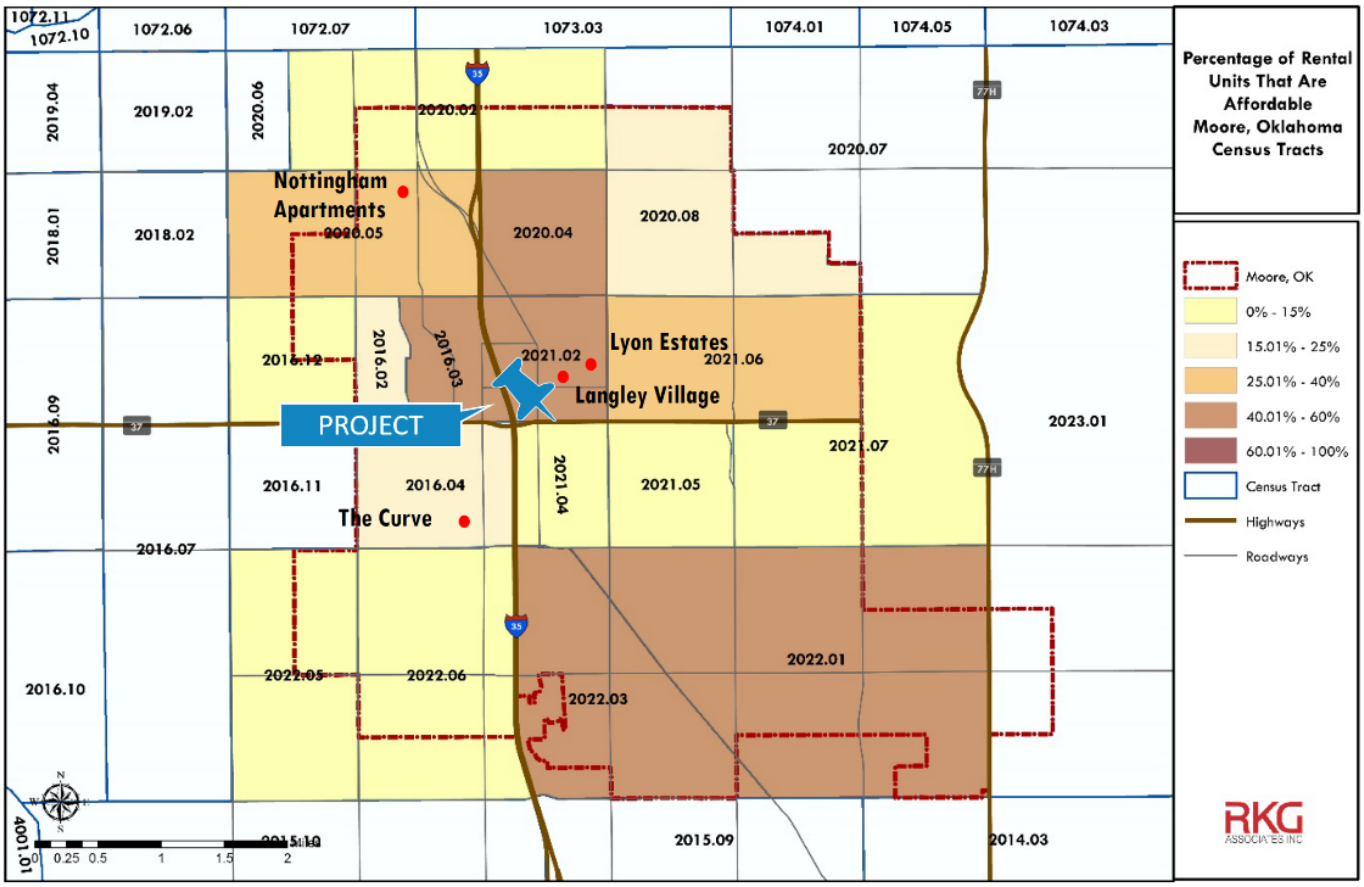
Median Income

$36,000

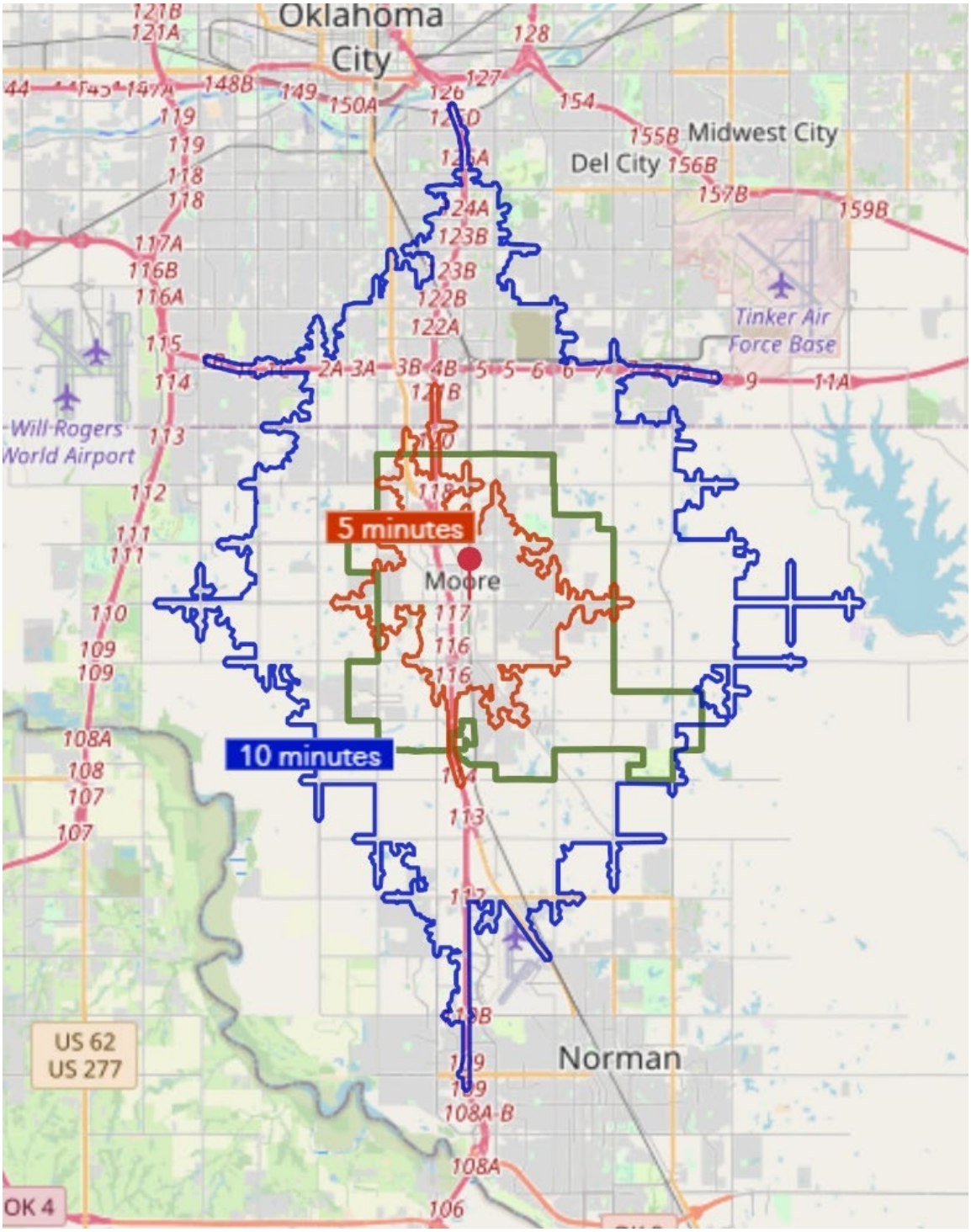
$110,000

Project Impact Area

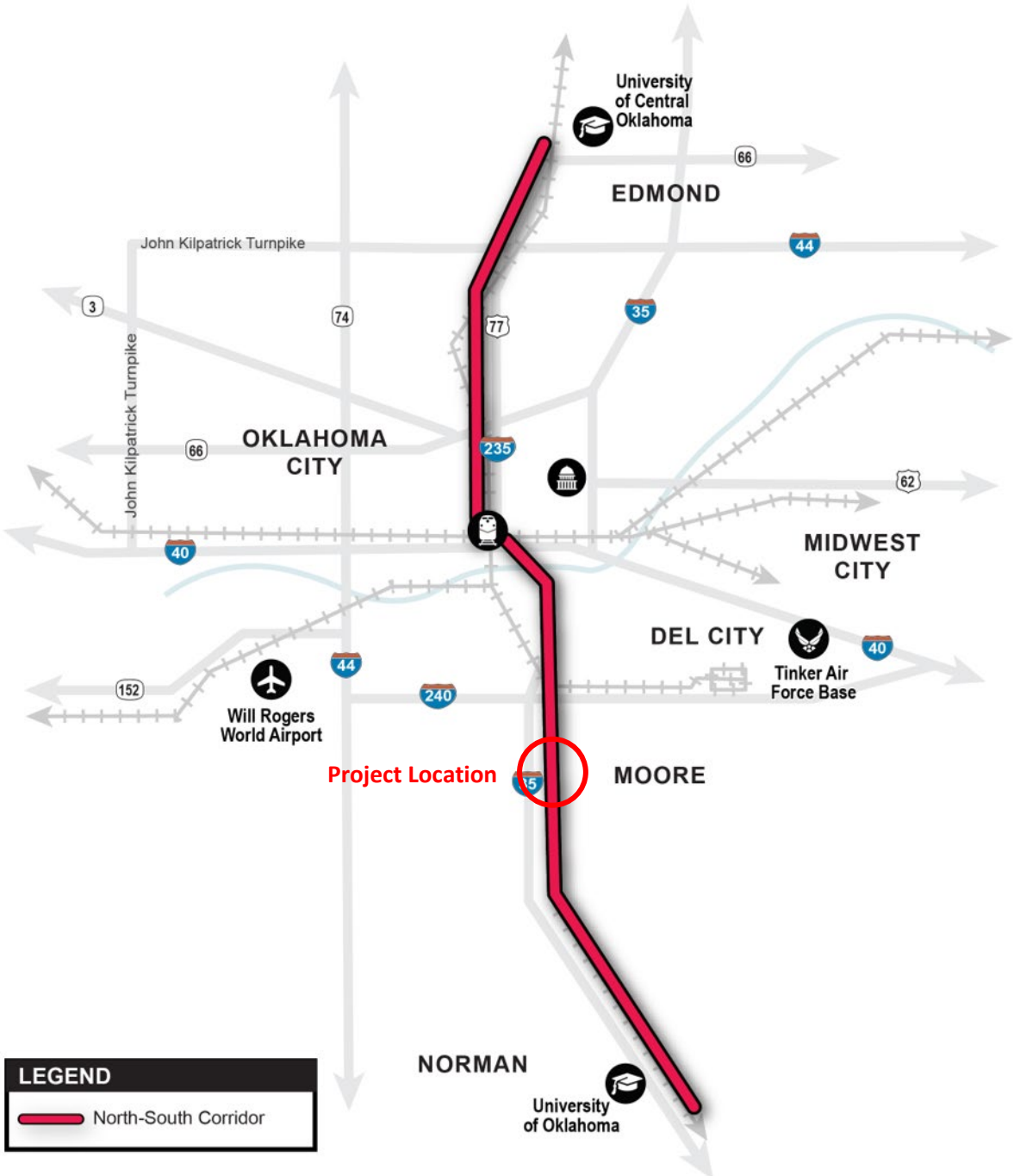
PERCENTAGE OF AFFORDABLE RENTAL UNITS, BY CENSUS TRACT



DRIVING DISTANCE FROM PROJECT



LPA OF COMMUTER RAIL SOUTH CORRIDOR



APPENDIX B. EJ SCREEN REPORT

EPA United States Environmental Protection Agency

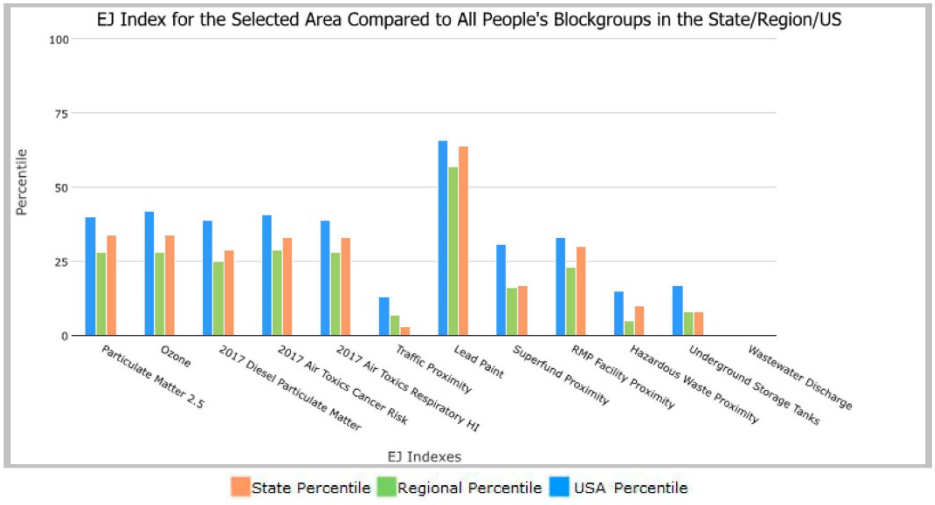
EJScreen Report (Version 2.0)

the User Specified Area, OKLAHOMA, EPA Region 6

Approximate Population: 513

Input Area (sq. miles): 0.34

Selected Variables	State Percentile	EPA Region Percentile	USA Percentile
Environmental Justice Indexes			
EJ Index for Particulate Matter 2.5	34	28	40
EJ Index for Ozone	34	28	42
EJ Index for 2017 Diesel Particulate Matter*	29	25	39
EJ Index for 2017 Air Toxics Cancer Risk*	33	29	41
EJ Index for 2017 Air Toxics Respiratory HI*	33	28	39
EJ Index for Traffic Proximity	3	7	13
EJ Index for Lead Paint	64	57	66
EJ Index for Superfund Proximity	17	16	31
EJ Index for RMP Facility Proximity	30	23	33
EJ Index for Hazardous Waste Proximity	10	5	15
EJ Index for Underground Storage Tanks	8	8	17
EJ Index for Wastewater Discharge	N/A	N/A	N/A



This report shows the values for environmental and demographic indicators and EJSCREEN indexes. It shows environmental and demographic raw data (e.g., the estimated concentration of ozone in the air), and also shows what percentile each raw data value represents. These percentiles provide perspective on how the selected block group or buffer area compares to the entire state, EPA region, or nation. For example, if a given location is at the 95th percentile nationwide, this means that only 5 percent of the US population has a higher block group value than the average person in the location being analyzed. The years for which the data are available, and the methods used, vary across these indicators. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJSCREEN documentation for discussion of these issues before using reports.

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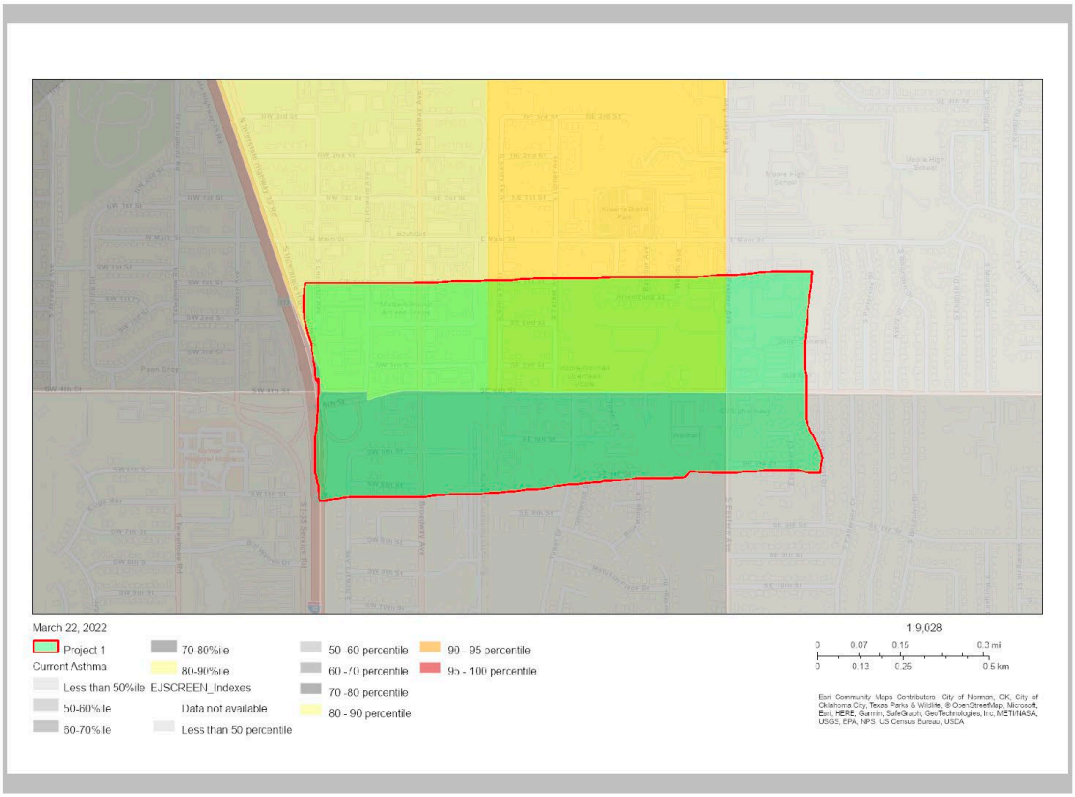
EPA United States Environmental Protection Agency

EJScreen Report (Version 2.0)

the User Specified Area, OKLAHOMA, EPA Region 6

Approximate Population: 513

Input Area (sq. miles): 0.34



Sites reporting to EPA	
Superfund NPL	0
Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)	1

EPA United States Environmental Protection Agency

EJScreen Report (Version 2.0)

the User Specified Area, OKLAHOMA, EPA Region 6

Approximate Population: 513

Input Area (sq. miles): 0.34

Selected Variables	Value	State Avg.	%ile in State	EPA Region Avg.	%ile in EPA Region	USA Avg.	%ile in USA
Pollution and Sources							
Particulate Matter 2.5 (µg/m³)	10.1	9.66	77	9.32	80	8.74	85
Ozone (ppb)	47.5	45.9	64	41.1	84	42.6	85
2017 Diesel Particulate Matter* (µg/m³)	0.254	0.195	72	0.219	60-70th	0.295	50-60th
2017 Air Toxics Cancer Risk* (lifetime risk per million)	30	29	88	32	70-80th	29	80-90th
2017 Air Toxics Respiratory HI*	0.4	0.39	79	0.37	80-90th	0.36	80-90th
Traffic Proximity (daily traffic count/distance to road)	600	220	92	470	80	710	72
Lead Paint (% Pre-1960 Housing)	0.078	0.23	40	0.16	54	0.28	35
Superfund Proximity (site count/km distance)	0.091	0.05	90	0.08	76	0.13	63
RMP Facility Proximity (facility count/km distance)	0.95	0.57	81	0.83	72	0.75	75
Hazardous Waste Proximity (facility count/km distance)	2.3	0.84	90	0.8	90	2.2	73
Underground Storage Tanks (count/km²)	4.6	1.5	92	2	86	3.9	76
Wastewater Discharge (toxicity-weighted concentration/m distance)	N/A	0.09	N/A	0.5	N/A	12	N/A
Socioeconomic Indicators							
Demographic Index	28%	36%	39	44%	30	36%	47
People of Color	21%	34%	26	52%	19	40%	38
Low Income	35%	37%	49	36%	52	31%	62
Unemployment Rate	5%	5%	56	5%	56	5%	56
Linguistically Isolated	0%	2%	54	6%	37	5%	45
Less Than High School Education	11%	12%	55	15%	47	12%	59
Under Age 5	8%	7%	71	7%	66	6%	74
Over Age 64	13%	15%	36	13%	53	16%	42

*Diesel particular matter, air toxics cancer risk, and air toxics respiratory hazard index are from the EPA's 2017 Air Toxics Data Update, which is the Agency's ongoing, comprehensive evaluation of air toxics in the United States. This effort aims to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that the air toxics data presented here provide broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. Cancer risks and hazard indices from the Air Toxics Data Update are reported to one significant figure and any additional significant figures here are due to rounding. More information on the Air Toxics Data Update can be found at: https://www.epa.gov/haps/air-toxics-data-update.

For additional information, see: www.epa.gov/environmentaljustice

EJScreen is a screening tool for pre-decisional use only. It can help identify areas that may warrant additional consideration, analysis, or outreach. It does not provide a basis for decision-making, but it may help identify potential areas of EJ concern. Users should keep in mind that screening tools are subject to substantial uncertainty in their demographic and environmental data, particularly when looking at small geographic areas. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJScreen documentation for discussion of these issues before using reports. This screening tool does not provide data on every environmental impact and demographic factor that may be relevant to a particular location. EJScreen outputs should be supplemented with additional information and local knowledge before taking any action to address potential EJ concerns.

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APPENDIX C: PROJECT SCHEDULE

	2015	2016	2017	2018	2019	2021	2022												2023												2024
							J	F	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						1-Mar																									
NEPA Studies						1-Aug																									
BNSF Plan Review						1-Aug																									
Complete NEPA																															
Finish R/W																															
Complete Plans																															
Complete Utility Relocation																															
Bond Sale for SH-37																															
Construct Detour																															
Letting																															
Begin Construction																															
End Construction																															1-Aug

APPENDIX D. BENEFIT COST ANALYSIS REPORT

BCA TABLE OF CONTENTS

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 (March 2022)[30].

1.1 GENERAL ASSUMPTIONS

- All costs and benefits in the BCA are expressed in 2020 constant dollars discounted to the year 2020 (year zero for discounting). Costs and benefits have been adjusted where needed to 2020 dollars based on the inflation guidance provided by the USDOT Table A-7.

- 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 $26.0 million in 2021 dollars (slightly less in 2020 dollars), including a total construction cost of $20 million. Previously incurred costs (primarily in 2019) included $1.35 million for environmental and engineering and $4.60 million for right-of-way and utilities. Previously incurred bond issuance costs ($2.17 million) have been excluded from the BCA, as these are financial exchanges and not resource costs. The previously incurred capital costs are about $ 6.37 million in 2020 dollars. The construction costs are assumed to be incurred and split evenly between 2023 and 2024. The discounted future year build capital cost in 2020 dollars is $15.79 million.

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.

[30] https://www.transportation.gov/sites/dot.gov/files/2022-03/Benefit%20Cost%20Analysis%20Guidance%202022%20%28Revised%29.pdf

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. The salvage value is approximately $1.37 million in 2020 dollars. The discounted cost of $20.79 million (in 2020 dollars) is calculated by subtracting the salvage value ($1.37 million) from the total build capital cost of $22.16 million (in 2020 dollars). The total capital build cost of 22.16 million is the sum of the previously incurred cost of $6.37 million and the future capital cost of $15.79 million.

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

	BOND FUNDS		STATE FUNDS		FEDERAL FUNDS		RAISE FUNDS	TOTAL PROJECT COSTS
	Incurred	Future	Incurred	Future	Incurred	Future		
Environmental & Engineering	$1.35							$1.35
ROW & Utilities	$4.60							$4.60
Construction		$5.00		$5.00			$10.00	$20.00
Total included in BCA	$5.95	$5.00		$5.00			$10.00	$25.95

Source: Project Engineer, Poe Engineering

2.2 MAINTENANCE AND REHAB COSTS

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 the construction cost 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 D.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 – that is, the annual numbers prior to 2040 work "backward" from that year based on the growth curve.

Table D.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.[31]

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

[31] 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).

"double penalized" by buffer and delay. The value estimated in this category does not include 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 D.3**.

Table D.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 $32.40 per hour, as per 2022 BCA guidance. The bike and walking time savings are shown in **Table D.4**.

Table D.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

Vehicle Crashes: Crash reductions include vehicle-train incidents (three injury-related incidents over the past 47 years), and 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.

Accident data utilized to establish vehicular 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 D.5**.

Table D.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.

Bike/Ped Crashes: In addition to auto/vehicle related crashes, the crash reduction benefits for this application reflect the sole cyclist fatality that occurred at the crossing in 2017 and discussed in the Safety merit criteria section. While only one such event has occurred, the possibility of a future fatality should not be dismissed, as the geometry of the at-grade crossing presents a potential hazard as described by the City of Moore police officer. Accordingly, the safety analysis includes an annual probability of such fatalities occurring in the future without the grade crossing elimination project. A conservative estimated probability was set at .04 assuming one such fatal event could occur over the next 25 years under the No-Build condition.

3.7 EMERGENCY RESPONSE BENEFIT

Based on the City of Moore Police Department records, 115 emergency service vehicles were forced to detour while trains were passing through or stopped at 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 six percent 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 D.6**.

Table D.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[32]. 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 first full 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.

[32] 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

BCA RESULTS

Table D.7 provides the results of the BCA. The Benefit Cost Ratio (BCR) is 1.33, with a Net Present Value (NPV) of $6.9 million. This represents a 62 percent return on investment (ROI) on the requested federal grant funding. All cost and benefits shown in the table are discounted to the year 2020, based on when they are incurred. The discounted capital costs, including the previously incurred $5.95 million, the $20 million for future construction, and the discounted salvage value (a cost offset), result in a net discounted capital cost of $20.8 million[33]. Total discounted benefits equal $27.7 million. The undiscounted cost is most relevant for funding assessment, but must be discounted for consistent benefit cost analysis purposes.

[33] *Future costs are discounted in the usual way, which reduces the "face value" of the $20 million construction cost as well as the salvage value, which occurs at the end of the 25th year; the $5.95 M which was previously incurred in 2019 is also discounted to 2020, but in this case the discounted value is higher than the "face value".*

Table D.7: Summary BCA Results

DISCOUNTED 2020 COSTS	
Build Capital Costs (previously incurred and future)	$22.16
Annual O&M and Periodic Rehab Cost (Build - No Build)	$ -
Salvage Value	$(1.37)
Total	**$20.79**
DISCOUNTED 2020 BENEFITS	
Travel Delay Savings - Vehicles	$11.60
Travel Time Savings - Bike and Pedestrian	$1.80
Emissions Benefits (CO2)	$0.47
Emissions Benefits (All Other)	$0.13
Noise Reduction (one time capitalization effect)	$1.43
Travel Reliability Benefits - Vehicles	$3.92
Emergency Vehicle Response	$0.79
Crash Reductions Benefits	$7.12
Fuel Cost Savings	$0.21
At-Grade Crossing Protection Elimination (Life Cycle Cost Savings)	$0.22
Total	**$27.69**
SUMMARY	
Benefit Cost Ratio	**1.33**
Net Present Value	**$6.90**
SHARE OF BENEFITS	
Travel Delay Savings - Vehicles	41.9%
Travel Time Savings - Bike and Pedestrian	6.5%
Emissions Benefits	2.2%
Noise Reduction Benefits	5.2%
Reliability Benefits	14.2%
Emergency Response Benefits	2.8%
Crash Reductions Benefits	25.7%
Fuel Cost Savings	0.8%
At-Grade Crossing Protection Life Cycle Cost Savings	0.8%