FY 2022 Bridge
Investment Program

Improving Rural Bridges in Northwest Oklahoma

Circuit Engineering District 8, Oklahoma
September 8, 2022

CED8

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1 BASIC PROJECT INFORMATION

1.1 Project Description

Circuit Engineering District (CED) #8 is requesting $12.9 million in Bridge Investment Program (BIP) funding to replace seven (7) bridges in northwest Oklahoma (**Figure 1**). All bridges are in fair or poor condition, have deficient horizontal clearances, and are load posted (see representative photos in **Figures 2-5**). The purpose of the Improving Rural Bridges in Northwest Oklahoma Project (the Project) is to eliminate these deficient bridges and restore safe crossings that are up to today's design standards and meet regional traffic requirements for safety and weight. CED #8 intends to construct this Project as a bundle, letting all seven bridges as a single project to a single contractor.

Six of the seven bridges will be replaced with pre-stressed concrete beam bridges of similar design. The seventh bridge (Noble County NBI 09614) will be replaced with recycled steel beams from the Oklahoma Department of Transportation's (ODOT's) removal of the I-40 Crosstown Expressway in Oklahoma City in 2012. Six of the bridges will provide a 26-foot clear roadway

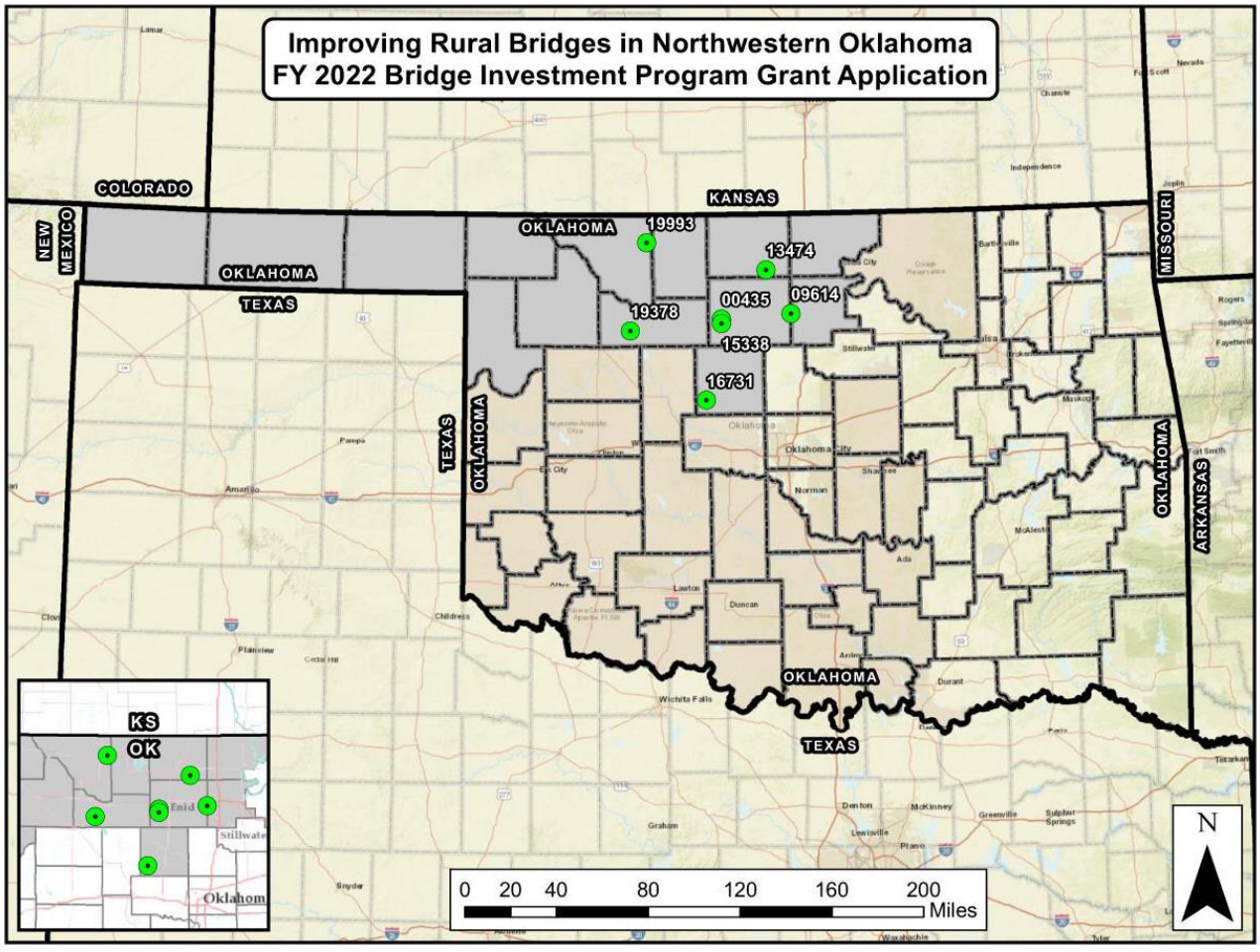

Figure 1: Location of Bridges within Circuit Engineering District #8, Oklahoma

width, and one bridge (Kingfisher County NBI 16731) will be widened to 40 feet to accommodate the higher traffic volumes. New crash-tested guardrail will be installed on all bridges and approaches to safely accommodate two lanes of traffic.

I-Beam Span Bridge on County Road E0470 over Spring Creek, Garfield County

NBI # 00435

Built 1915

Sufficiency Rating – 45 (Functionally Obsolete)

Figure 2: NBI 00435, Garfield County

Timber Span Bridge on County Road N0310 over Unnamed Creek, Grant County

NBI # 13474

Built 1955

Sufficiency Rating – 27.2 (Structurally Deficient)

Figure 3: NBI 13474, Grant County

I-Beam Span Bridge on County Road N2490 over Salt Fork Arkansas River, Woods County

NBI # 19993

Built 1981

Sufficiency Rating – 50.4 (Structurally Deficient)

Figure 4: NBI 19993, Woods County

I-Beam Span Bridge on County Road N2740 over Unnamed Creek, Kingfisher County

NBI # 16731

Built 1966

Sufficiency Rating – 47.8 (Functionally Obsolete)

Figure 5: NBI 16731, Kingfisher County

1.2 Transportation Challenges

CED #8 is responsible for fourteen (14) counties in northwestern Oklahoma (**Figure 1**). This region has some of the lowest population densities of the state, with over half of the counties in the District having fewer than 10 people per square mile. The counties in this District maintain 21,473 road miles and 2,883 bridges. Of the 2,883 bridges in the District, 432, or 15%, are in poor condition. Programming funding for bridge replacement projects would not be possible without outside support, which is provided in large part by ODOT's County Improvements for Roads and Bridges (CIRB) revolving fund. The CIRB fund was established by the Oklahoma state legislature

in 2006, allocating $120 million per year from the state's motor vehicle tax to fund county road and bridge improvements. However, the Oklahoma Legislature has periodically redirected CIRB funds to balance shortfalls elsewhere in the state budget. A 2021 report by the Oklahoma Legislative Office of Fiscal Transparency (LOFT), found that despite CIRB funding, significant infrastructure challenges remain in Oklahoma's counties (**Figure 6**). (http://www2.okloft.gov/Reports/CIRB_Report.pdf).

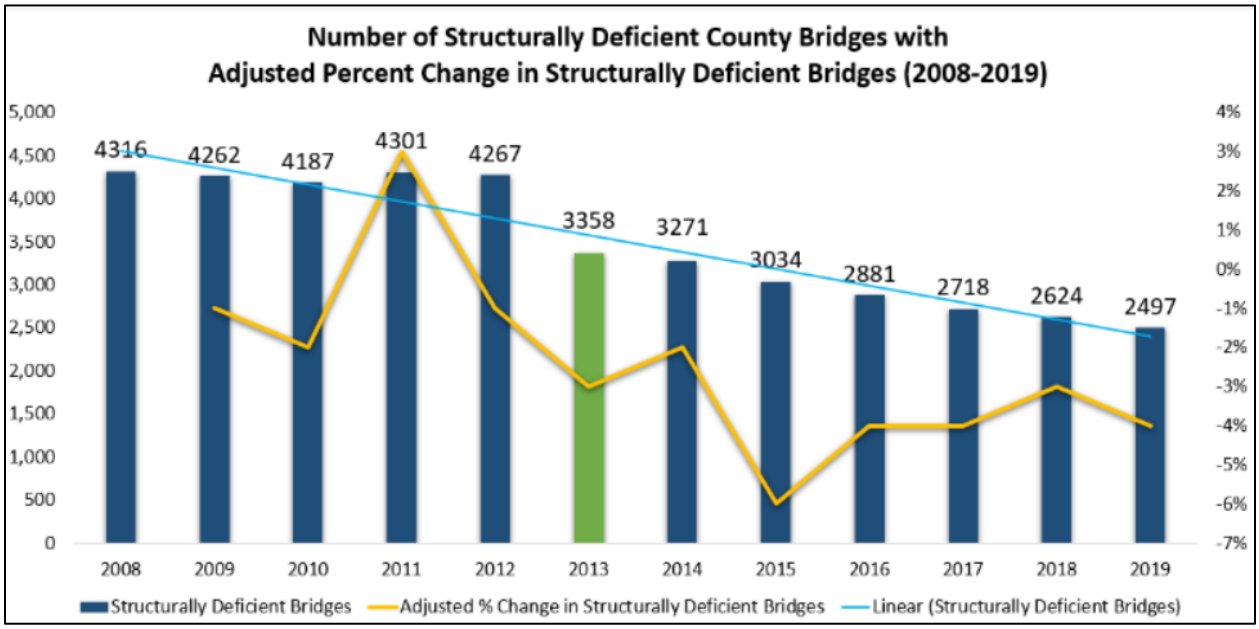

Figure 6: Structurally Deficient Bridges in Oklahoma Counties (Legislative Office of Fiscal Transparency, 2021)

With an approximate $22 million yearly budget in CIRB funds and 432 bridges in need of replacement, CED #8's funding gap is significant. In addition to bridge replacement, CIRB funds are used for roadway construction as well as design, right-of-way acquisition, and utility relocation expenses. CED #8 is able to program approximately 8 bridges per year on average in the most recent CIRB 5-Year Plan. Without the BIP grant, CED #8 would be required to allocate approximately one year of bridge projects in the 5-Year Plan to construction of the seven bridges in this application.

In addition to funding challenges, CED #8 maintains critical infrastructure for Oklahoma's economy. Northwestern Oklahoma 's economy is primarily based on agriculture, both crops and livestock. The area is also an important and growing area for energy (oil/gas) production. While these rural counties do not experience the day-to-day congestion common in many urban areas, the prolonged harvest season—which begins with planting as early as February and lasts through December with the final harvests—creates the added seasonal stress on the infrastructure network. During this time, heavy haul trucks and large farm equipment travel down the mostly dirt or gravel county roads (**Figure 7**). Oilfield vehicles, including heavy sand and water trucks, also use these roads to access well sites and tank batteries. Wind energy is also a growth industry in the region and requires transport of large turbine parts over county roads. The roads and

bridges in the CED #8 counties are not adequate to support the heavier trucks, larger modern farm equipment, increased traffic demands, and higher operating speeds needed to be competitive in today's economy.

The CED #8 Improving Rural Bridges in Northwest Oklahoma Project will address the following goals of the BIP:

Figure 7: Oversized Agricultural Equipment on a Structurally Deficient Bridge in Grant County, OK

- Improve the safety, efficiency, and reliability of movement of people and freight in northwest Oklahoma,
- Reduce the number of bridges in fair/poor condition by replacing seven existing bridges that are either structurally deficient (poor condition), or are considered at risk of becoming structurally deficient (fair condition) within the next three years,
- Reduce the number of bridges that do not meet current geometric design standards by replacing seven bridges with wider decks,
- Improve the structural capacity of seven bridges that currently do not meet the traffic requirements anticipated for the network, thus improving the local economy,
- Reduce the total person miles traveled over bridges that are in poor condition or at risk of falling into poor condition; and
- Leverage non-Federal contributions from ODOT in the planning, design, and construction of the project.

1.3 Project History

CED #8 has begun design and environmental work on five of the seven bridges in this Project. Plans and environmental documents completed to date are available at CED #8 BIP. To date, CED #8 has encumbered $795,830 for preliminary engineering and environmental activities. All the bridges have design funds encumbered and five of the seven bridges have funds encumbered for National Environmental Policy Act (NEPA) documentation. Funding for design has come from CED #8's CIRB allocation. NEPA is funded through the Oklahoma Department of Transportation (ODOT)'s On-Demand Environmental Services contracts and does not affect CED #8's CIRB budget. As a general policy, ODOT provides NEPA services for local governments using federal funds for construction of local projects. All design and NEPA activities will be completed prior to BIP grant funding obligation.

1.4 Project Location

The seven (7) bridges that are the subject of this application are located in Garfield, Grant, Kingfisher, Major, Noble, and Woods Counties in northwestern Oklahoma (**Figure 8**). More detailed locations of the seven bridges are listed below:

- NBI 00435: E0470 Road over Spring Creek, Garfield County, Lat 36.33278, Long -97.99528
- NBI 15338: E0490 Road over Turkey Creek, Garfield County, Lat 36.30387, Long -97.99449
- NBI 13474: N3010 Road over Unnamed Creek, Grant County, Lat 36.63986, Long -97.64194
- NBI 16731: N2740 Road over Unnamed Creek, Kingfisher County, Lat 35.81961, Long -98.11841
- NBI 19378: E0520 Road over Cheyenne Creek, Major County, Lat 36.26083, Long -98.70758
- NBI 09614: E0450 Road over Unnamed Creek, Noble County, Lat 36.36154, Long -97.45216
- NBI 19993: N2490 Road over Salt Fork Arkansas River, Woods County, Lat 36.81785, Long -98.57646

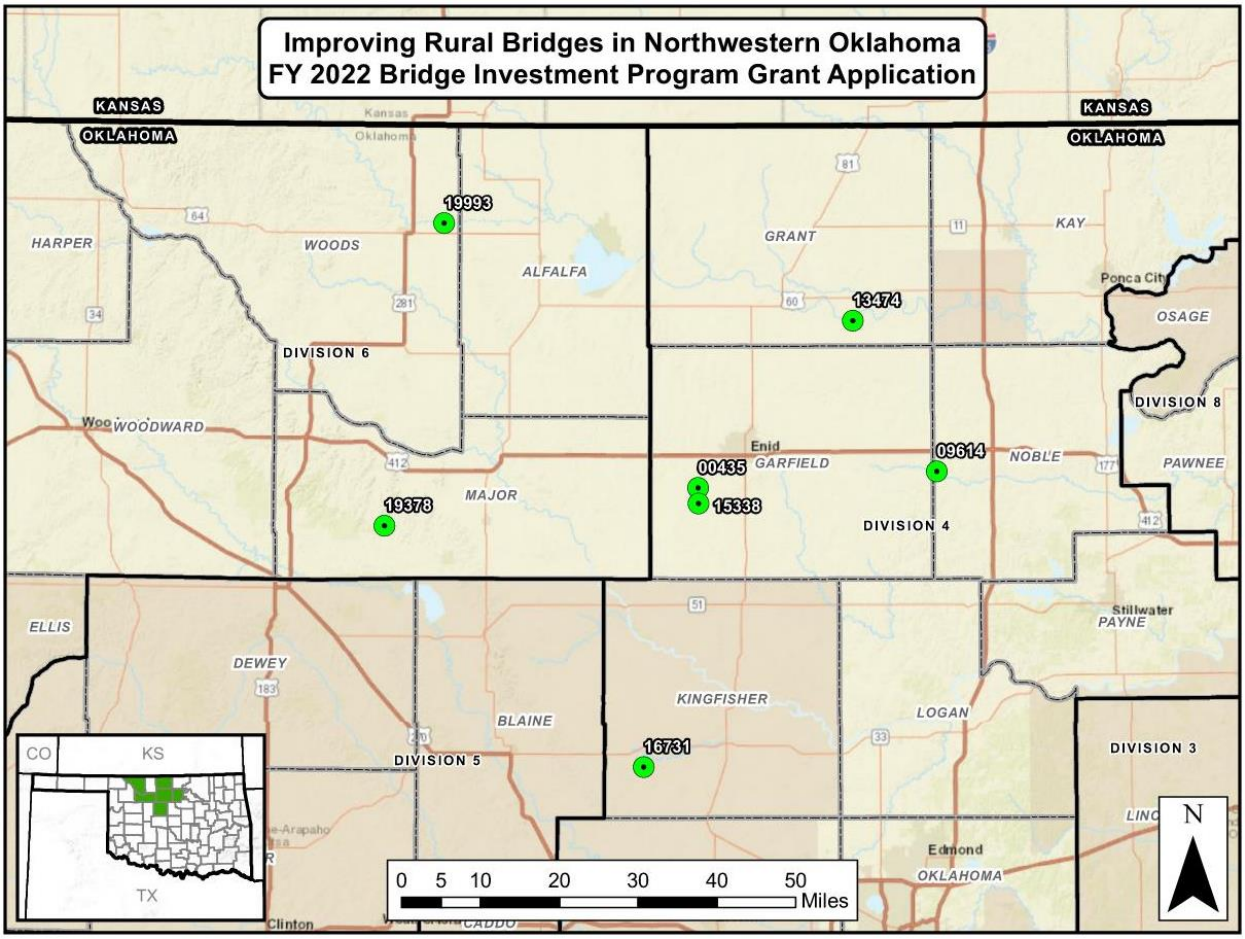

Figure 8: Location of CED #8 BIP Grant Bridges

All bridges are on rural roadways connecting agricultural areas with local towns and larger roadway facilities. None of the bridges are in Urbanized Areas and none are in any Federally designated community development zones.

The Project will contribute to the functioning and growth of the regional economy by providing a safe and efficient transportation network for the region's agricultural and energy economies. These industries often require heavy, oversized vehicles to utilize narrow county roads and bridges. Many of these bridges do not have structural capacity to carry these heavy vehicles and in many cases are posted for load restriction. While intended to enhance safety and protect drivers, these postings are frequently ignored, particularly if a vehicle would have to make a lengthy detour. Oversized vehicles using load posted bridges only accelerates their deterioration and eventual closure.

"Lots of heavy oil field trucks crossing 15 ton bridge"

(NBI 16731 Inspection Report, 6/8/2022)

1.5 Project Parties

CED #8 is the Lead Applicant for this Project. Circuit Engineering Districts (CEDs) were established by law in Oklahoma in 1992 (Title 69 § 687.1). This law allowed counties to come together as a cooperative and provide efficiencies not available to an individual county. The CEDs act as political subdivisions of the state managed by the counties they represent. The eight CEDs in the state are governed by the Oklahoma Cooperative Circuit Engineering Districts Board (OCCEDB) and receive state, federal, and county funds. Through ODOT, the CEDs receive and expend Federal-aid highway program funds under title 23, U.S.C. ODOT provides assistance to the CEDs in administering these funds.

ODOT will be assisting CED #8 with funding and management of the Project. The matching funds for the Project will come from CED #8's allocation of ODOT's CIRB fund. Each CED across the state produces a 5-year plan showing how CIRB and other funds will be programmed based on local priorities. ODOT compiles the CED plans into a Statewide 5-Year CIRB Plan which is updated annually. Individual counties are then responsible for developing their CIRB-funded projects. ODOT also provides assistance to the counties through the provision of NEPA services, project letting, and construction oversight of CIRB projects.

2 NBI DATA

NBI data for each bridge is provided in the application template.

3 PROJECT COSTS

The total costs of the Project are shown in **Table 1**. CED #8 is requesting $12,943,175 in BIP grant funding to construct the Project. Funds for design will come from the ODOT CIRB fund, all of

which have already been encumbered. NEPA is also funded through ODOT and will be complete prior to obligation of any BIP funds. No other federal funds will be used for the Project. No other Federal grants have been requested or awarded to the Project. All of the match (10% as required for off-system bridges) for the Project will come from CED #8's allocation of the ODOT CIRB fund. These funds are currently programmed in CED #8's 5-Year Plan and are available upon grant award. A letter of funding commitment from CED #8 is attached to this application and included at CED #8 BIP. Estimates for right-of-way acquisition, utility relocation, and construction include 20% contingency to account for potential cost increases. Construction costs in **Table 1** reflect a 10% savings due to bundling. Unbundled, the cost of construction for these seven bridges would be $15,652,650 in 2022 dollars, increasing the total project cost to $16,742,480.

Table 1: Sources and Uses of Funds

PROJECT COMPONENT	SOURCES of FUNDS					
	OTHER FEDERAL	BIP	NON-FEDERAL FUNDS	FUTURE PROJECT COSTS	PREVIOUSLY INCURRED COSTS	TOTAL PROJECT COSTS
			ODOT			
Design	$0	$0	$0	$0	$549,000	$549,000
Environmental	$0	$0	$0	$0	$162,830	$162,830
Right-of-Way and Utilities	$0	$264,600	$29,400	$294,000	$84,000	$378,000
Construction & Inspection	$0	$12,678,575	$1,408,730	$14,087,305	$0	$14,087,305
TOTAL	**$0**	**$12,943,175**	**$1,438,130**	**$14,381,305**	**$795,830**	**$15,177,135**
% OF FUTURE ELIGIBLE COSTS	**0.0%**	**90.0%**	**10.0%**	**100%**		

4 PROJECT OUTCOME CRITERIA

4.1 State of Good Repair

The seven bridges proposed for BIP funding in this application are all in fair or poor condition. Five are considered structurally deficient (SD) and the other two are considered functionally obsolete (FO) and at risk of becoming structurally deficient. The Project will improve this condition by providing new structures designed with a 75-year design life[1]. Hydrologic and hydraulic analysis will be performed at all locations to ensure the bridges are designed with adequate capacity to provide long-term resiliency for extreme weather events.

The bridges proposed for replacement as part of this grant application were constructed between 1915 and 1981. Five of the seven bridges consist of steel I-beam spans. One bridge is a timber span and one is a concrete beam span bridge (see **Figures 2-5**). Sufficiency ratings range from

[1] All new prestressed concrete beam bridges will have a design life of 75 years. The new bridge in Noble County (NBI 0916) using recycled Crosstown steel beams will have a design life of 50 years.

27.2 to 50.4 (out of 100). All seven bridges are currently load posted, requiring commercial trucks and school buses in some cases to detour to other routes. Horizontal clearances (i.e. deck width) on the bridges ranges from 15.6 (one lane only) to 28 feet. All the bridges have less than the desired roadway width to meet the traffic requirements on the network. Six of the bridges carry 120 vehicles per day or less, and one bridge carries approximately 2,400 vehicles per day. Truck traffic is estimated to make up approximately 15% of this volume; however, some of the bridges currently carry much higher truck volumes, in some cases close to 50%.

Ratings of the seven bridges are provided in **Table 2** below. NBI 00435 is considered in Fair condition even though it is over 100 years old, is only 18 feet wide, and lacks guardrail. The Structural Evaluation Appraisal (NBI Item 67) rates this structure as a 2 – Intolerable and a High Priority Replacement. NBI 16731 is also considered in Fair condition but has the same overall Structural Evaluation Appraisal of 2 – Intolerable. FHWA's InfoBridge tool was used to review the historical inspection data and forecast future bridge condition for these two Fair-rated bridges. The tool was not able to forecast the future condition of NBI 00435 due to its bridge type (timber span). The tool indicated that the deck on NBI 16731 would fall into poor condition within 3 years (based on the median ratings of bridges of this type, see **Figure 9**).

Table 2: Bridge Rating Data (Deficiencies noted in red)

NBI	Year Built	Suff. Rating	FO/SD	Horiz. Clr.	ADT (2020)	Number of Lanes	Deck Rating	Super Rating	Sub Rating
00435	1915	45	FO	18'	100	2	8	6	5
09614	1941	27.2	SD	15.6'	24	1	6	4	4
13474	1955	39.5	SD	23'	50	2	6	6	4
15338	1961	39	SD	19.7'	100	2	7	6	3
16731	1966	47.8	FO	28'	2400	2	5	6	6
19378	1978	39.9	SD	21.3'	100	2	4	6	3
19993	1981	50.4	SD	23.6'	120	2	5	5	4

Replacing the seven bridges in CED #8 will reduce lifecycle costs. Should no major rehabilitation or replacement occur, it is estimated the existing bridges will all require closure in the next fifteen years (**Table 3**). Maintenance costs decline significantly after closure, involving only signage and barriers. Therefore, maintenance cost savings of the Project are small, but positive ($3,200 per year), over the 30-year analysis period. Maintenance costs for the new bridges would be funded by the individual counties in which the bridges are located and will ensure the new bridges will remain in a state of good repair. Maintenance commitments are codified in every CIRB funding agreement with ODOT (see Section 5.9 in the CIRB Project Agreement at CED #8 BIP). This Project is consistent with ODOT's Asset Preservation Plan which seeks to rehabilitate bridges that are at risk of becoming structurally deficient. The bridges in this application are either already

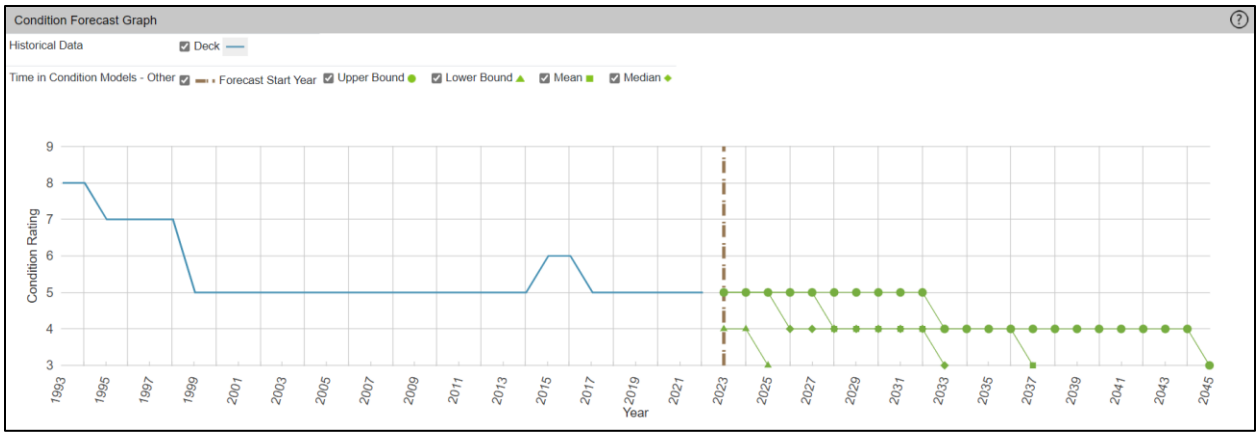

Figure 9: NBI 16731 Condition Forecast (FHWA InfoBridge)

Table 3: Current Load Postings and Anticipated Closure Dates

Bridge NBI#	Current Load Posting	Anticipated Closure Date*
00435	9 tons	2029
09614	3 tons	2023
13474	6 tons	2027
15338**	27 tons	2032
16731	15 tons	2037
19738	10 tons	2032
19993**	10 tons	2030

* assuming only minimal maintenance is performed
** school bus route

structurally deficient, are load posted, and/or do not provide sufficient width to accommodate the traffic on the regional network.

The most significant benefit of the Project is travel time and vehicle operating cost savings due to avoided detours. As expressed in user costs, closing these seven bridges would have significant negative impact to transportation network efficiency, accessibility and mobility of people and goods, and economic growth. The costs of closing the bridge far outweigh the costs of the new structures. The seven bridges collectively carry approximately 2,900 vehicles per day. Assuming 1.48 passengers per vehicle [Table A-4, *USDOT Benefit Cost Analysis Guidance 2022 (Revised)*], 4,292 person miles per day would be impacted by the improvement. With the detours that would be required by closure, **over 20,000 person miles per day will be avoided by the Project**. More information on the travel time and vehicle operation cost savings is provided in **Section 5**.

The new bridges proposed in this Project would also provide long-term resiliency to extreme weather events. The new bridges will be designed to accommodate the 100-year storm and minimize overtopping. See **Section 4.4** for more discussion of resiliency.

4.2 Safety

The current widths of six of the seven bridges do not meet today's design standards (see **Table 2**). These narrow bridges do not provide sufficient space for two-way traffic on the bridge and provide no refuge if a breakdown or collision were to occur on the bridge. According to InfoBridge, none of the bridges have railings that meet currently acceptable standards, and three of the bridges lack railing altogether. The Project will reconstruct the majority of the bridges with a 26-foot-wide deck providing one 13-foot driving lane in each direction (**Figure 10**). The Kingfisher County bridge (NBI 16731) will be reconstructed with two 12-foot lanes and 8-foot outside shoulders to accommodate the larger traffic volumes. Pavement markings will utilize reflective paint to be visible in dark and rainy conditions. All bridges will have concrete traffic rail (TR3), which is crash tested and will minimize the potential for vehicles to leave the bridge.

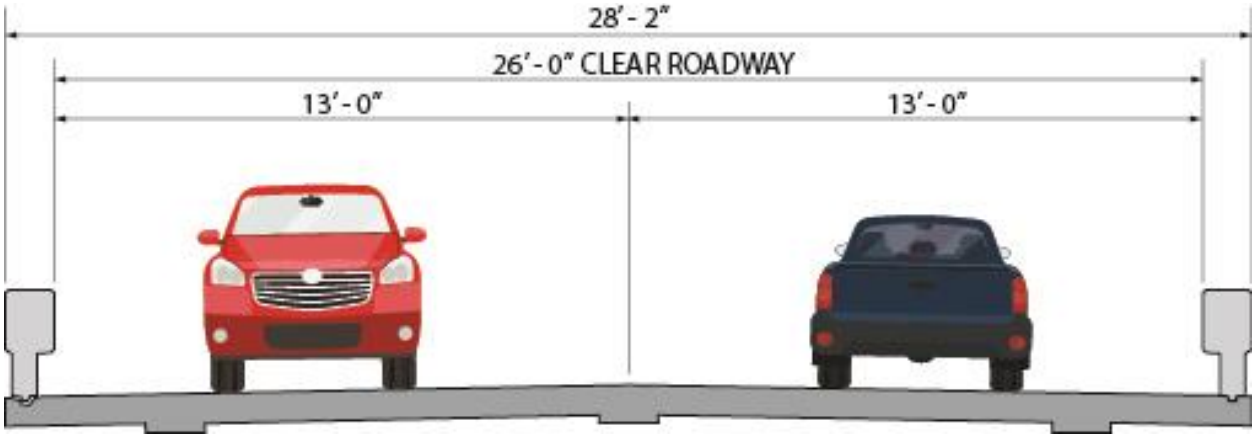

Figure 10: Proposed Bridge Typical Section

The condition of these bridges has affected the safety and reliability of school bus routes, postal routes, and emergency services. All the bridges are currently load posted, meaning that heavier vehicles such as school buses and fire trucks cannot safely cross. This has caused local schools and emergency services to use detour routes around closed or load posted bridges. For example, NBI 19993 on N2490 Road in Woods County serves bus routes for Alva Schools. This bridge is currently posted at 10 tons and is the only crossing of the Salt Fork of the Arkansas River within 10 miles of Alva. A loaded school bus weighs approximately 20 tons. Therefore, school busses must detour 12 miles to avoid this bridge (**Figure 11**), which adds approximately 16 minutes to the trip (at 45 miles per hour). This means increased travel times and accident risk exposure for school children. The same detour applies to emergency response vehicles such as fire trucks, where consequences of detours could be a matter of life or death. This temporary solution is not sustainable in the long term as the infrastructure continues to age without significant repair. See CED #8 BIP for maps of all the detour routes.

Eight (8) collisions have occurred at the seven bridges over the last ten years. While not a large number, the severity of these collisions is higher than anticipated. Six of the eight collisions (75%) involved injury (**Figure 12**). Half of the collisions involved overturn/rollovers which tend to result in more severe outcomes. This relatively high proportion can be attributed in part to the narrow width of the bridge and lack of separation between the two directions of traffic. Inattention was the most frequently cited cause. "Left of center" was also cited as the cause of the single head-on collision, where a vehicle crossed the centerline and hit an oncoming vehicle. Fixed object collisions with guardrail and culverts were also noted. The narrow widths on these bridges likely contributed to these collisions. As noted, all the bridges have either insufficient or no railing which could also be contributing to the high severity rate. Collision data is available at CED #8 BIP.

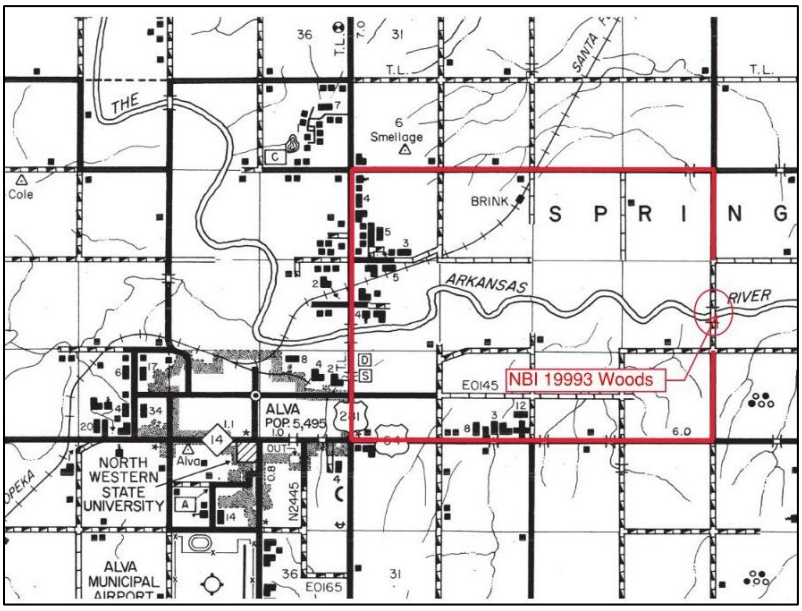

Figure 11: Detour Route for NBI 19993, Woods County

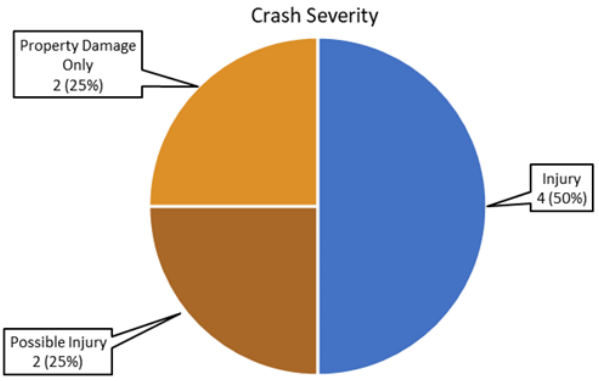

Figure 12: CED #8 Bridge Collisions, 2011-2020

The Project will increase the width of all seven bridges and will install crashworthy guardrail (see **Figure 10**). According to FHWA's Crash Modification Factor clearinghouse[2], widening the bridges to 26 feet could potentially **reduce collisions by 24 to 75 percent**, depending on existing bridge width (CMF 2839). Safety would be improved even more on the Kingfisher County bridge, where 8-foot shoulders would be included. The installation of guardrail on bridges that currently lack guardrail is also anticipated to reduce collisions by up to 58 percent (CMF 2948), while improvement of the existing guardrail could reduce injury-related collisions by 22 percent (CMF 5550).

[2] www.cmfclearinghouse.org

4.3 Mobility and Economic Competitiveness

Figure 13: Transporting a Wind Turbine Tower Component

Improving the structural and geometric conditions of the seven bridges in this application will improve the mobility, efficiency, and reliability of the movement of people and freight in the area. Today, all the bridges are load posted, meaning trucks and in some cases school buses must find alternate routes. These postings also affect oversize agricultural and oilfield vehicles which are important to the region's economy. Energy sector and agricultural equipment, such as oil rig materials, combines, and occasionally large wind turbine towers, must move on these narrow roadways **(Figure 13)**. Improving bridges to allow these oversized and overweight vehicles to pass will allow for reduced travel time of this equipment and therefore reduce shipping costs. These improvements will cumulatively enhance the mobility of equipment that serves these sectors.

Rural Oklahoma is an economically productive, vital part of the State and the nation. In 2020, Oklahoma generated approximately $6.2 billion in agricultural cash receipts, roughly 3.3% of State GDP.[3] The energy sector drives roughly one third of Oklahoma's economic activity, with wind energy, oil, and gas located primarily in the State's rural areas. This Project will directly support the mobility necessary to keep these sectors thriving.

The large-scale deployment of wind energy is crucial to the future energy mix of the United States, and Oklahoma is leading the way. In 2021, wind supplied 41% of Oklahoma's total electricity net generation, surpassing natural gas' share for the first time. Oklahoma ranks third in the nation in total electricity net generation from wind.[4] There is tremendous potential to expand this wind energy, particularly in the western part of Oklahoma where many windfarms have been established (**Figure 14**). **Of the 5,359 wind turbines in Oklahoma, 2,601 (48.5%) of them are located within CED #8.** Constructing and repairing these large pieces of equipment requires travel by oversize vehicles on two-lane roadways, and the safety and state of good repair improvements will enhance their mobility.

[3] https://economic-impact-of-ag.uada.edu/oklahoma/
[4] https://www.eia.gov/state/?sid=OK#tabs-4

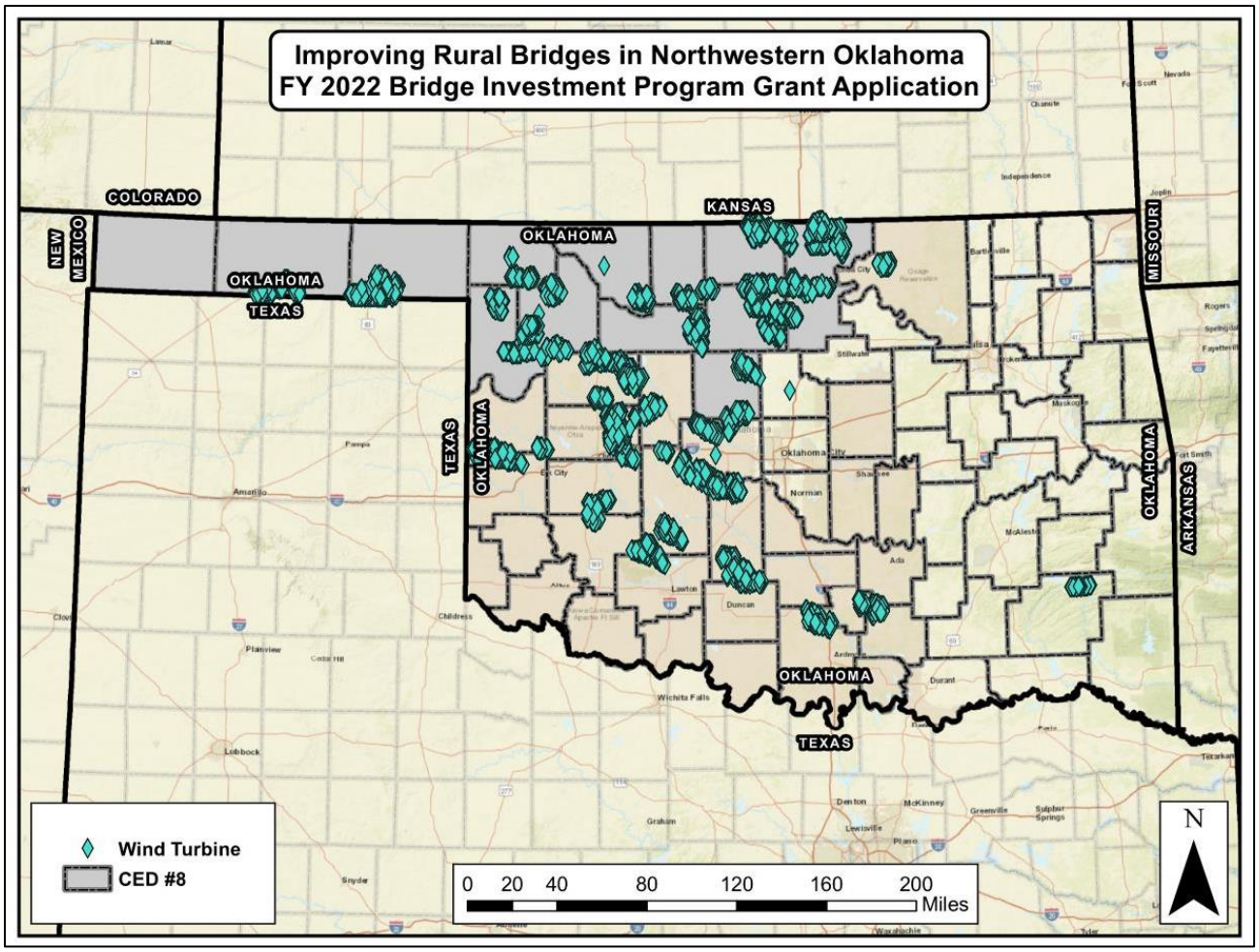

Figure 14: Wind Turbine Locations in Oklahoma (USGS Wind Turbine Dataset)

The CED #8 bridges becomes even more critical transportation links in the light of regional transportation patterns and lack of alternative routes. Given their rural locations, closures of these bridges would result in detours ranging from 3 to 14 miles. The savings in vehicle operating costs and travel times as a result of avoiding these detours are substantial (see **Section 5**). Network reliability is extremely important in the agricultural and energy industries that rely on getting products to market in a cost-effective manner. Unexpected delays due to bridge postings or closures add time and cost to transporting materials and equipment, affecting carriers' ability to provide on time delivery and impacting the downstream supply chain. If an oversized vehicle approaches a load posted bridge and must backtrack, this increases travel time and costs even more. For freight such as wind turbine parts shown in **Figure 13**, the detour can impact local traffic as the oversized vehicle must reverse and attempt to turn around.

The Project will directly lead to good-paying jobs in the construction sector. According to the Bureau of Labor Statistics, Oklahoma's highway, street, and bridge construction laborers make a

higher mean hourly wage than any other construction related jobs or industries[5] These wages then create indirect economic benefits to the communities housing the workers. A $15.6 million construction contract for seven bridges would require large numbers of laborers to complete, attracting employees and further enhancing economic benefits in northwestern Oklahoma.

4.4 Climate Change, Resiliency, and the Environment

Replacing the seven bridges in CED #8 will reduce air pollution and greenhouse gas emissions from motor vehicles. Currently, all seven bridges are load posted, requiring heavier vehicles such as trucks, school buses, and oilfield and agricultural vehicles to detour. Trucks are estimated to make up at least 15% of the traffic volume, which currently ranges from 24 to 2,400 vehicles per day. Therefore, the load postings are currently adding over 2,000 vehicle miles by trucks to the network every day. In the future, as deteriorating condition forces bridges to close, this additional mileage will increase over five times (13,762 miles per day) as all vehicles are required to detour. These additional miles increase vehicle emissions and negatively impact air quality.

As bridges deteriorate and are forced to close, detours will add more than

13,760

vehicle miles and associated emissions to the system

CED #8 looks for every opportunity to reuse and/or recycle materials during construction. Existing bridge beams will be used if suitable. Concrete will be ground and used as roadway base material. Asphalt can also be recycled and reused. For the Noble County bridge (NBI 09614), CED #8 plans to use recycled beams from ODOT's Crosstown Expressway project (**Figure 15**). Called one of the country's largest transportation recycling efforts at the time by the American Association of State Highway and Transportation Officials (AASHTO), ODOT removed the aging I-40 bridges in Oklahoma City in 2012, and salvaged over 2,000 steel beams to be used on county bridges (see article from The Oklahoman, January 12, 2022). Counties have been able

Figure 15: Example County Bridge using Crosstown Beams

[5] Construction Laborers (bls.gov)

to realize significant cost and time savings by reusing the beams versus building new. CED #8 has used over 500 Crosstown beams on 57 bridges to date.

According to the inspection reports, all bridges in this application bundle show at least minor damage to the channel embankment, indicating increased susceptibility to wash out. Two of the seven bridges show embankment condition at a rating of 5 or less, indicating erosion and undermining. The Project will improve the resiliency of at-risk infrastructure by building larger, higher bridges to reduce flood risk (**Figure 16**). These new bridge elevations will keep the structures above water during the 100-year storm event, or an event that has 1% chance of occurring in a given year. All bridges would be designed to protect against scour and will include measures to protect stream banks against erosion. The new bridges will be designed to keep bridge piers and other fill out of stream channels. This will allow restoration of natural flow patterns and provide environmental benefits to aquatic ecosystems. Approach roadways will include appropriate cross slopes and drainage ditches to convey runoff. All bridges will also be designed to current seismic standards, ensuring resiliency during earthquake events.

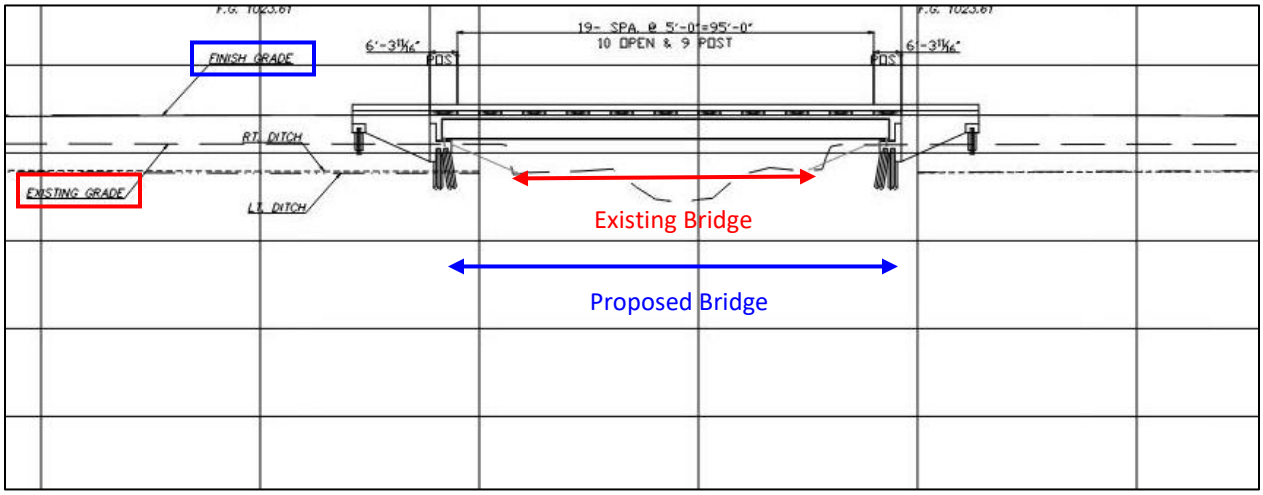

Figure 16: Existing and Proposed Bridge Profiles, Grant County NBI 13474

4.5 Equity, Partnership, and Quality of Life

The Project will improve the quality of life for local and regional users. As critical links for agricultural and oilfield activity, the seven bridges will provide improved mobility and reliability for personal and business travel. In this rural, sparsely populated part of the state, a reliable network able to carry large, overweight vehicles is critical to the livelihoods of most residents. The Project will improve reliability and capacity and support quality of life for the region's farmers, ranchers, and energy workers. The bridges will be safer and provide emergency vehicles better access.

CED #8 considered the need to accommodate pedestrians and bicycles on the seven bridges in this Project. As has been described in this application, the subject bridges are in rural, sparsely populated areas with little to no pedestrian or bicycle use. Most of the roadways carried by these

bridges are narrow with little to no shoulder. Four of the bridges are on gravel roads. While pedestrian and bicycle use are technically allowed on these county roads, there is no designated accommodation for these modes. Adding shoulder or sidewalk for bicycles and pedestrians on the bridges in this Project would not serve an existing need and would be unlikely to generate additional benefit. Shoulders will be included on the Kingfisher County bridge (NBI 16731) due to higher traffic volumes. Pedestrians and cyclists would be able to use the new shoulder on this bridge. Increasing the widths of the remaining bridges to 40 feet to accommodate 7-foot shoulders would increase the cost of each bridge by over 36% and is not warranted by traffic volumes (see estimate at CED #8 BIP). This exceeds the 20% threshold defined by FHWA as defining "reasonable cost" (Accommodating Bicycle and Pedestrian Travel: A Recommended Approach - Guidance - Bicycle and Pedestrian Program - Environment - FHWA (dot.gov)).

Although the CED #8 Project will not include dedicated bicycle or pedestrian accommodations, the new bridges will provide a safer crossing surface for nonvehicular users. The new bridges will have new 26-foot-wide (or 40-foot-wide) concrete decks, allowing bicycles and pedestrians room to cross if desired. Guardrail will also be provided to protect bicycles and pedestrians. This will provide an improved condition over the existing in most cases (**Figure 17**).

Figure 17: Existing Bridge Decks (Grant NBI 13474 (left) and Garfield NBI 15338 (right)

While the CED #8 bridges are not located within Historically Disadvantaged Communities or Areas of Persistent Poverty as defined by USDOT, a review of the Environmental Protection Agency (EPA) EJSCREEN tool indicates that the population is disadvantaged in several key areas (**Figures 18 and 19**). Unemployment is relatively high in the region, and much of region is considered medically underserved.

The CED #8 has partnered with ODOT to plan and design the projects in this application. All bridges are designed to ODOT standards and NEPA activities are funded and led by ODOT. ODOT will manage the letting of the projects and will provide construction inspection. Public involvement for the CED #8 Project has been completed for the majority of the bridges and involved notification of adjacent property owners. Owners and local school districts, utilities, and emergency service providers will be notified of any road closures in advance of construction.

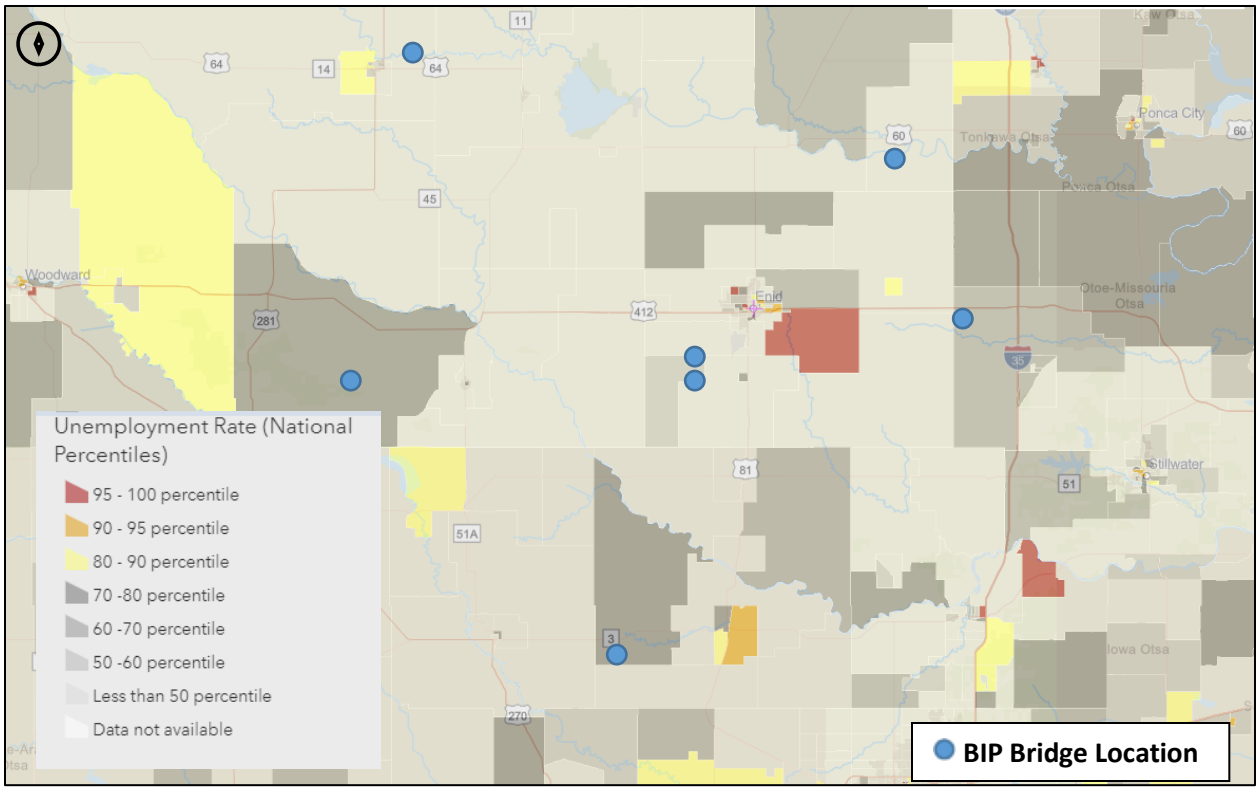

Figure 18: Unemployment Percentiles in the CED #8 Bridge Bundle Project Area (EJSCREEN)

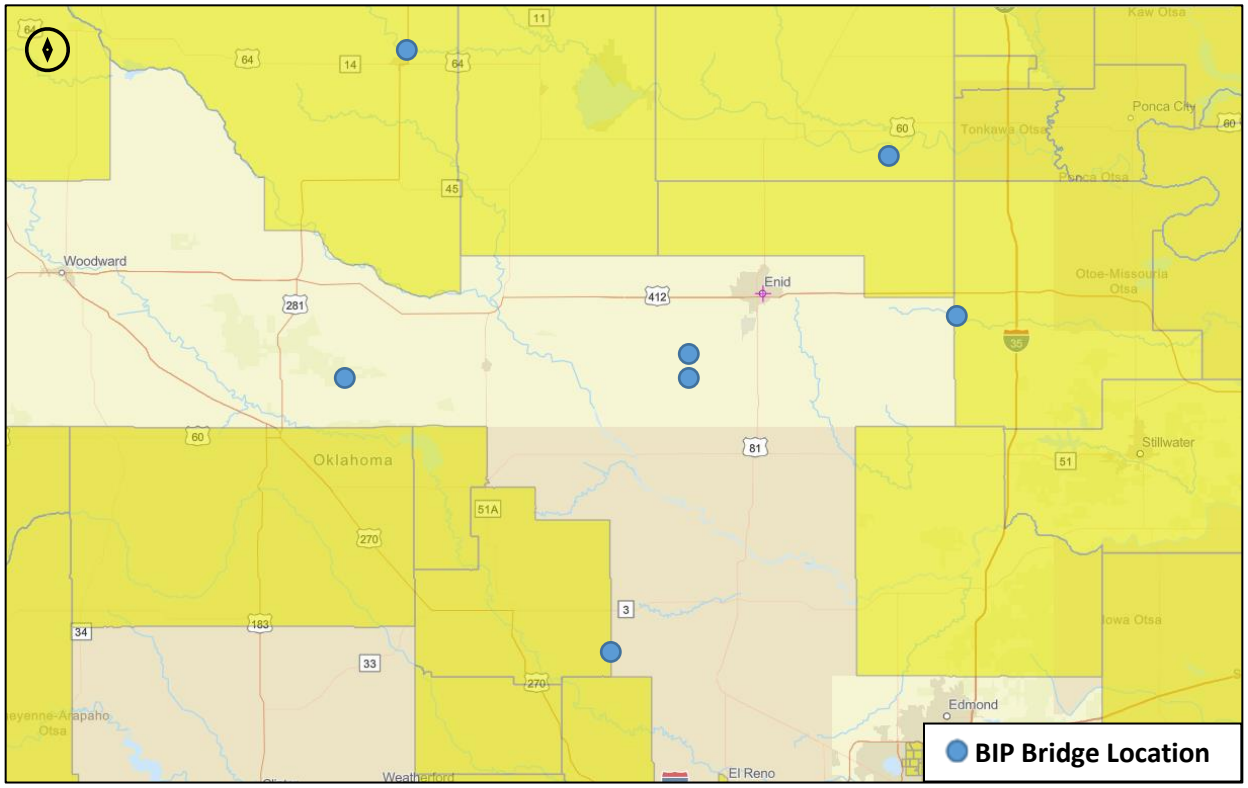

Figure 19: Medically Underserved Areas in the CED #8 Bridge Bundle Project Area (EJSCREEN)

4.6 Innovation

Many innovative approaches to project delivery can be utilized with the bundling of multiple bridges. For a typical project, right-of-way acquisition and utility relocation have the potential to delay project delivery. All of the counties in CED #8 have a 66-foot wide statutory right-of-way on county roadways. This relatively wide existing right-of-way will minimize the need for acquiring additional property from landowners. With seven locations bundled into one project, single agreements can more easily be made with public and private utility owners to relocate their lines in advance of project construction. CED #8 has established relationships with the local utility providers and will coordinate any needed utility relocations. Another benefit of bundling is economy of scale. CED #8 intends to use a single contract award for this project to save cost, as well as construction and procurement time. **Bundling is anticipated to save 10% over the costs of the individual bridges**.

CED #8 will use recycled steel beams on the Noble County bridge (NBI 09614). As described in **Section 4.4**., the innovative Crosstown Beam program has supplied over 2,000 salvaged steel beams to counties across Oklahoma for use on off-system bridges [see map at Bridges using Crosstown Beams (arcgis.com)]. With beams provided at no cost, the program has saved counties significant time and cost over the last ten years. One County Commissioner estimated the reused beams saved six to eight weeks of construction time (I-40 Crosstown Expressway beams are building bridges across Oklahoma (oklahoman.com).

5 BENEFIT COST ANALYSIS

The period of analysis used in the estimation of benefits and costs is 37 years, including roughly 7 years of project development and construction and 30 years of operations. Total project construction costs are estimated at $14.1 million in 2022 dollars. In addition, $795,830 has been encumbered to date on various tasks related to project development. For this BCA, all costs were de-escalated to 2020 dollars using the GDP deflator. The total (undiscounted) project costs are estimated at $13.8 million (including previously incurred costs).

All relevant data and calculations used to derive the benefits and costs of the project are shown in the BCA model that accompanies this grant application. Based on the analysis presented in that document, the project is expected to generate $44.3 million in discounted benefits with $9.2 million in discounted development and construction costs, using a 7 percent real discount rate. Therefore, the project is expected to generate a **Net Present Value of $35.1 million and a Benefit/Cost Ratio of 4.8**. Overall results are shown in **Table 4**.

Table 5 below compiles all project benefits evaluated. The vast majority of project benefits (at 88 percent) is accounted for by travel time savings and vehicle operating cost savings. Reduction in accident costs accounts for about nine percent of the overall benefits. Maintenance cost savings account for less than one percent, while environmental cost savings account for about two percent. Residual value of assets accounts for approximately 1.6 percent of total benefits.

Table 4: Overall Results of the Benefit Cost Analysis, Millions of 2020 Dollars

	Undiscounted	Discounted at 7%	Discounted at 3%
Total Benefits	$239.5	$44.3	$110.5
Total Costs	$13.8	$9.2	$11.5
Net Present Value (NPV)	$225.7	$35.1	$99.0
Benefit Cost Ratio (BCR)	17.4	**4.8**	9.6
Internal Rate of Return (IRR)	18.6%		
Discounted Payback Period (DPP)	12.9 years		

Table 5: Overall Benefits, Millions of 2020 Dollars

Benefit Categories	Over Project Lifecycle		
	Undiscounted	Present Value at 7% Discount Rate	Present Value at 3% Discount Rate
Travel Time Savings	$104.6	$19.1	$48.6
Vehicle Operating Cost Savings	$104.0	$18.7	$48.1
Reduction in Accident Costs	$18.6	$3.8	$9.0
Environmental Cost Savings	$4.5	$2.0	$2.1
Maintenance Cost Savings	-$0.04	$0.003	-$0.01
Residual Value of Assets	$7.8	$0.7	$2.7
Total Benefits	**$231.7**	**$44.3**	**$107.8**

6 PROJECT READINESS AND ENVIRONMENTAL RISK

6.1 Technical Feasibility

Since its inception in the early 1990s, CED #8 has managed the replacement of hundreds of bridges across northwest Oklahoma. Due to ODOT's contribution of CIRB funding, the Project is subject to ODOT design and construction specifications. Preliminary plans have been completed for four of the seven bridges. NEPA has been completed on one bridge and is underway on three additional bridges. Completed plans and NEPA documents are available at CED #8 BIP. Design criteria established for the project follow ODOT's Roadway Design Standards, Standard Specifications for Highway Construction and Drainage Manual. Cost estimates were based on ODOT's Roadway Pay Quantities and Notes and include a 20% contigency. Risks to scope, schedule, and budget are described in **Section 6.4**. As a recipient of ODOT and federal funds, CED #8 is subject to Title VI of the Civil Rights Act, the Uniform Relocation Act, and federal procurement requirments.

The Project will replace seven bridges in Garfield, Grant, Kingfisher, Major, Noble, and Woods County, Oklahoma. CED #8 and ODOT have partnered to construct hundreds of bridges across the District. Many of these have included federal funds. Therefore, CED #8 is familiar with federal requirements and receives assistance from ODOT in ensuring compliance with applicable rules and regulations. Six of the seven bridges will be replaced with pre-stressed concrete beam span

bridges with a 26-foot clear roadway, a common bridge type used on the county system across the state. The seventh bridge (in Noble County) will be replaced with recycled steel beams from the ODOT Crosstown Beam program. These beams have been successfully installed on 57 bridges in CED #8. The new bridges will carry two 13-foot driving lanes and guardrail. The approach roadways will generally be reconstructed with two 11-foot lanes with 3-foot outside shoulders (either asphalt or gravel, depending on the existing condition).

6.2 Project Schedule

The illustration of the major Project milestones is outlined in the summary of schedule milestones below (**Table 6**). The schedule shows the start and completion dates for design, environmental approvals, right-of-way acquisition, utility relocations, and construction for the entire bundled Project. Depending on construction sequence, certain bridges would be completed and opened prior to the September 2027 date shown in **Table 6**.

Table 6: Summary of Schedule Milestones

Project Activity	Schedule	
	Start Date	Completion Date
Preliminary Design	02/2015	09/2023
NEPA Documentation	02/2017	03/2024
BIP Grant Agreement	03/2024	09/2024
Funding Obligation: September 2024		
Right-of-Way Acquisition	09/2024	12/2024
Utility Relocation	12/2024	04/2025
Bidding/Letting	04/2025	09/2025
Construction	09/2025	09/2027

Design and environmental approval for the bridges has begun and made significant progress. Completed activities include environmental assessments, topographic surveys, metes and bounds surveys, hydraulic analysis, hazardous materials assessments, and general estimates of the types and quantities of materials. These activities are reflected in the preliminary plans for four of the seven bridges (see CED #8 BIP). Design plans and NEPA documents are anticipated to be complete by March 2024, allowing BIP funds to be obligated well in advance of the September 30, 2025 funding obligation deadline. Right-of-way acquisition is anticipated to begin immediately after funding obligation, allowing for approximately six months to develop a BIP grant agreement. Construction is scheduled to start in September 2025, approximately 12 months after funding obligation. Construction is anticipated to take approximately two years, allowing the contractor flexibility in their approach to the bundled project. All funds will be expended prior to the statutory deadline of September 30, 2030.

6.3 Required Approvals

6.3.1 Environmental Permits and Reviews

The environmental process has begun on four of the seven bridges and is complete for one bridge. Given the location of these bridges, environmental documentation is anticipated to be

completed quickly. Northwestern Oklahoma has relatively few sensitive environmental resources. Once preliminary engineering is complete for each bridge, each County will submit a NEPA document to ODOT and FHWA for approval. It is anticipated that all bridges **will be processed with a Categorical Exclusion (CE) and will be complete by March 2024**. It is likely that the CEs can be approved under ODOT's programmatic agreement with FHWA for projects that do not involve other federal lands or approvals. Programmatic CE's do not require FHWA signature and can be approved more quickly.

Other Permits and Approvals

The Project may require Section 404 permits to replace the existing bridges. In some cases (e.g. Grant County) the new bridge will span over the existing channel and will not place any fill within the stream (**Figure 20**). In these cases, a Section 404 permit is not required. Significant impacts to streams and wetlands are not anticipated, and in cases where permits are required, it is likely Nationwide Permit 14 will apply. Nationwide permits include automatic Section 401 water quality certification. The Oklahoma Pollution Discharge Elimination System (OPDES) Construction General Permit (OKR10) is issued by the Oklahoma Department of Environmental Quality and satisfies National Pollution Discharge Elimination System (NPDES) requirements for discharges to surface waters. The contractor will obtain the OKR10 permit for Construction Stormwater and prepare any needed Stormwater Pollution Prevention Plan (SWPPP) prior to construction. These construction commitments are included in the ODOT/County CIRB funding agreement (see CED #8 BIP).

Figure 20: Example Pre-Stressed Concrete Beam Bridge (photo courtesy of Guy Engineering)

Right-of-Way Acquisition Plan

Right-of-way acquisition will be limited to the minimum amount of required property to construct the Project. Given that the new bridges will be wider, longer, and higher than what exists today, some right-of-way acquisition is anticipated at all bridges. All acquisition will be completed in a timely manner in accordance with 49 CFR part 24, 23 CFR part 710, ODOT Acquisition Branch Index of Procedures, and other applicable requirements. Acquisition will not involve any structures and will not require any relocations. In most cases the acquisition will consist of a small

amount of property from large agricultural parcels which will cause little to no community disruption and will not affect community cohesion. Given the small number of affected landowners, right-of-way acquisition is anticipated to be complete within three months.

6.3.2 State and Local Approvals

The ODOT funds committed to this Project are programmed in the ODOT CIRB 5-Year Work Plan for CED #8. CED #8 and ODOT will coordinate the creation of a single project for the bridge bundle upon award and will include this project in the CIRB 5-Year Plan. The necessary CIRB funds will be programmed for the bundled project. The CIRB 5-Year Plan is incorporated by reference into the Statewide Transportation Improvement Program (STIP). No other federal funding is anticipated, and no other state or local approvals are required. The Project has received broad public support from over 35 elected officials and various economic development, emergency management, freight, and educational organizations across the District. All letters of support for the Project can be found at CED #8 BIP.

CED #8 has broad public support for the Project as evidenced by the more than

35

Letters of support received

6.3.3 Federal Transportation Requirements Affecting State and Local Planning

The Project is listed in the ODOT Statewide Transportation Improvement Program (STIP) as part of the ODOT CIRB 5-Year Plan for FY-2023-2027. The Project is consistent with the goals set out in ODOT's 2018-2027 Transportation Asset Management Plan (TAMP) with the goal of maintaining and preserving Oklahoma's transportation network. Additionally, the application supports the safety, mobility, connectivity, accessibility, environmental, and economic vitality goals of ODOT's Long Range Transportation Plan. The project complies with the goals of the Oklahoma Freight Transportation Plan, 2018-2022, which are consistent with national freight goals, including improving reliability, congestion and bottleneck reduction, safety, state of good repair, ensuring the competitive performance of the state's freight system, and promoting competitive access to domestic and international markets for its industries.

6.4 Assessment of Project Risks and Mitigation Strategies

There is some risk to the preconstruction schedule for this Project given that design and environmental work are not yet complete for all bridges. However, the bridges are of similar designs and are not in environmentally sensitive areas. The 18-month schedule for design and NEPA authorization is conservative and well within the funding obligation deadline.

There are risks associated with right-of-way acquisition and utility relocations. Landowner negotiations could take longer than anticipated and utility companies could take longer than desired to complete the relocation process. The Project schedule mitigates this risk by providing

7 months for right-of-way acquisition and utility relocation. This is a conservative schedule compared to typical time frames for these activities for CED #8.

Construction risk is minimal. Both CED#8 and ODOT have extensive experience with completing projects of this type. Cost estimates contain a 20% contingency, appropriate for the current economic environment, the type of project, and the status of design.

Cost escalation is likely the greatest risk to the Project, given the recent upward trends affecting materials and labor. CED #8 has accounted for potential escalation in its construction estimates, including a 20% contingency based on recent project bids. However, if the full amount of BIP funding is not awarded to the Project, CED #8 would not be able to construct the Project as described in this application. It would be preferable to scale the project to match the BIP funding provided. Should a lesser amount of BIP funding be awarded, CED #8 would propose to reduce the number of bridges included in the bundle. Alternatively, CED #8 could reallocate other federal (i.e. STP) funding from other projects in the CIRB 5-Year Plan to this Project.

7 DOT PRIORITY CONSIDERATIONS

CED #8 would be unable to complete the construction of the bundled Project without BIP funding. To let seven bridges simultaneously would be beyond the financial capacity of the District and would halt progress on other ongoing and planned projects. The Project described in this application will be ready to proceed to final design immediately upon receipt of the final approved NEPA Categorical Exclusion. The schedule shown in **Section 6.2** includes six months for negotiation of the BIP grant agreement prior to beginning right-of-way acquisition. Without a BIP grant, this Project is unlikely to be constructed as described. Individual bridges would remain in the ODOT CIRB 5-Year Plan and would be replaced as funds allow. It is likely that one or more of the bridges would need to close before this could be accomplished.

A two-phased BIP funding approach is feasible for this Project. Initial obligation of BIP funds could occur after the completion of NEPA, anticipated in March 2024. CED #8 intends to have final design and right-of-way acquisition complete by January 2025. A second obligation of funding could occur at this time and be available for construction, anticipated to start in September 2025. Because CED #8 has already encumbered funds for design, NEPA, and a portion of the right-of-way and utility relocations, progress can continue while funding agreements are negotiated.

8 STATUTORY EVALUATION REQUIREMENTS

Table 7 below summarizes the statutory evaluation requirements as outlined in the NOFO for the BIP program.

Table 7: Statutory Evaluation Requirements

Requirement	Response
Costs avoided by the prevention of the closure or reduced use of the bridge to be improved by the project [23 U.S.C. § 124(f)(3)(B)(i)(I)]	The primary costs avoided stem from travel time savings and vehicle operating cost savings from avoided detours. See **Section 5**.

Requirement	Response
Benefits from protection as described in 23 U.S.C. § 133(b)(10), including improving seismic and scour protection [23 U.S.C. §	The Project will design bridges to meet current scour and seismic standards. See **Section 4.4.**
Reductions in maintenance costs, including, in the case of a Federally-owned bridge, cost savings to the Federal budget [23 U.S.C. § 24(f)(3)(B)(i)(XI)]	These state of good repair improvements are expected to result in a small savings in maintenance costs to the counties of CED #8. **Section 4.1**.
Safety benefits, including the reduction of accidents and related costs [23 U.S.C. §	Wider bridges with guardrail are anticipated to reduce crashes by up to 75%. See **Section 4.2.**
Person and freight mobility benefits, including congestion reduction and reliability improvements [23 U.S.C. § 124(f)(3)(B)(i)(IV)]	The seven bridges are expected to carry 4,630 person-miles by 2052. Avoiding closure of these bridges will result in significant person-mile savings and reliability benefits. See **Sections 4.3**
National or regional economic benefits [23 U.S.C. § 124(f)(3)(B)(i)(V)]	All bridges play an important role in the access to agricultural and energy production sites including moving large equipment critical to these industries. See **Section 4.3.**
Benefits from long-term resiliency to extreme weather events, flooding, or other natural disasters [23 U.S.C. § 124(f)(3)(B)(i)(VI)]	The new bridges will be constructed longer and higher to withstand the 100-year storm event. See **Section 4.4.**
Environmental benefits, including wildlife connectivity [23 U.S.C. § 124(f)(3)(B)(i)(VIII)]	Many of the new bridges will span the existing streams without piers in the channel, removing permitting restrictions and improving stream flow and aquatic habitat. See **Section 4.4.**
Benefits to nonvehicular and public transportation users [23 U.S.C. § 124(f)(3)(B)(i)(IX)]	The bridges will be constructed with wider decks and crash-tested guardrail to protect non-motorized users. See **Section 4.5**.
In the case of a bundle of projects, benefits from executing the projects as a bundle compared to as individual projects [23 U.S.C. § 124(f)(3)(B)(i)(II)]	The bundling of projects is expected to result in a cost savings of 10 percent from improved efficiency in the use of labor and bulk purchase of materials. See **Section 4.6.**
Benefits of using innovative design and construction techniques or innovative technologies [23 U.S.C. § 124(f)(3)(B)(i)(X)(aa) and (bb)]	Project bundling will be utilized for project delivery. The project will employ recycled steel beams on one bridge. See **Section 4.6**.
Whether and the extent to which the benefits, including the benefits described in 23 U.S.C. § 124(f)(3)(B)(i), are more likely than not to outweigh the total project costs (23 U.S.C. §	The Benefit-Cost Analysis shows a Benefit-Cost Ratio of 4.8. **See Section 5.**