GRANT COUNTY BRIDGE REPLACEMENTS

Grant County, Oklahoma

Supporting information can be found at:

Grant County Bridges CHBP

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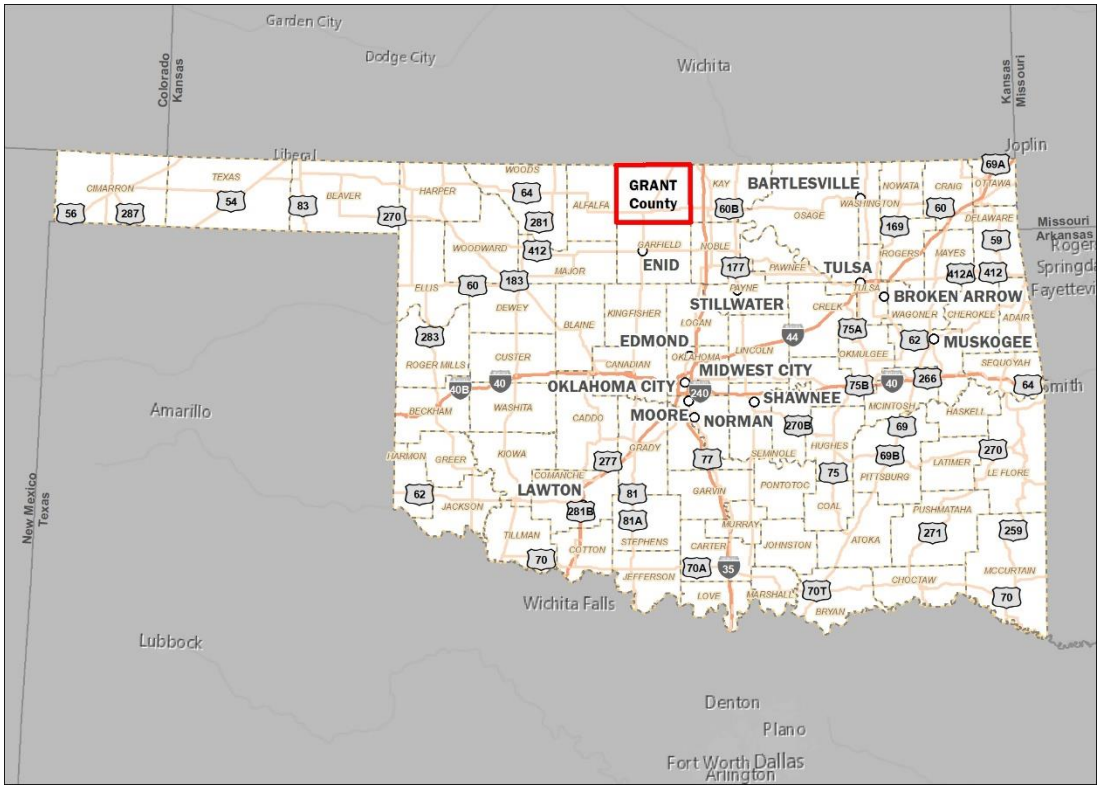

Grant County Bridge Replacement	
Statewide Ranking:	**#1 of 3**
Previously Incurred Project Cost:	$0
Future Eligible Project Cost:	$10,270,788
Total Project Cost:	$10,270,788
CHBP Grant Request:	$4,762,003
Total Federal (DOT) Funds (including CHBP)	$5,238,003

This application was submitted by the Oklahoma Department of Transportation to Grants.gov at http://www.grants.gov on December 4, 2018

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1.0 PROJECT DESCRIPTION

Local municipal governments historically have had difficulty planning and completing their infrastructure projects due to the changes in federal funding formulas, and the low dollar amounts allotted to cities and counties. This has made it challenging for local governments to obtain adequate funds to rehabilitate or replace their aging infrastructure. The Oklahoma Department of Transportation (ODOT) and Grant County, Oklahoma are eager to present the merits of this project for consideration. Due to the rising cost of transportation infrastructure design, materials, labor and construction, and the insufficient state and county match funding available, ODOT on behalf of **Grant County is requesting $4,762,003 in CHBP funds** to assist with construction costs associated with this 34-bridge bundle project. The project involves the replacement of 34 selected structurally deficient or temporary county bridges in Grant County, Oklahoma (see **Figure 1** and Maps and Graphics at **Grant County Bridges CHBP**).

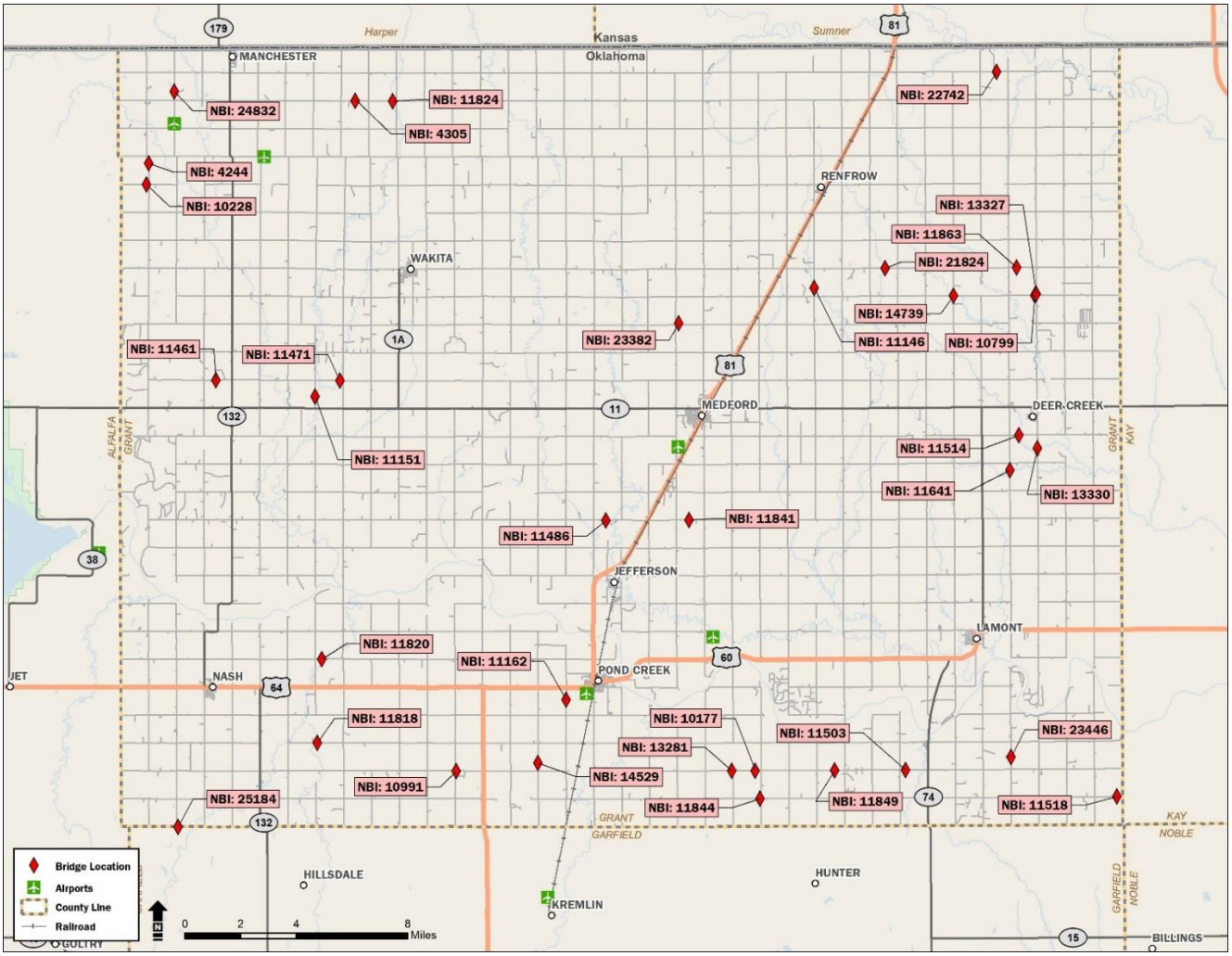
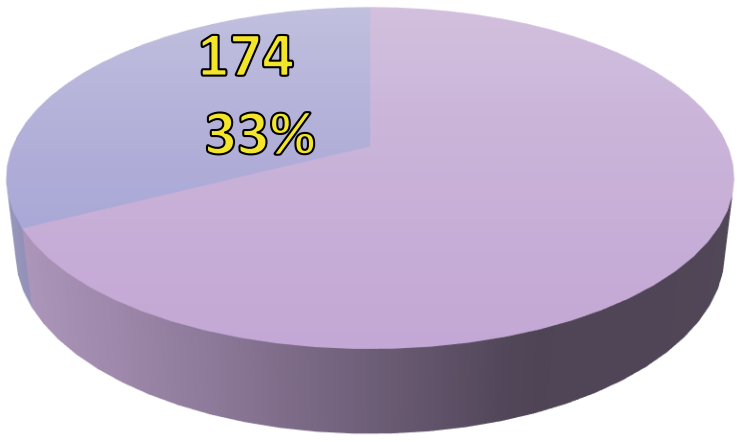


Figure 1: Bridge Locations in Grant County

1.1 Existing Condition

Grant County is a rural county in north central Oklahoma with a population of approximately 4,500. There are 1,920 public road miles that run through Grant County, 92% of which are owned and maintained by the county, with the balance maintained by the state. Grant County alone has 535 bridges on the National Bridge Inventory, the highest among Oklahoma counties. **One hundred seventy-four Grant County road bridges, or 33% of the total, are structurally deficient** (SD), meaning that one or more of the bridge components (deck, superstructure or substructure) are in poor or worse condition, or the overall structural evaluation is less than "tolerable" (**Figure 2**). In fact, Grant County has more structurally deficient off system bridges than the total number of structurally deficient bridges (153, as per ODOT Bridge Division, November 2018) on system in the entire state. While the average age of the nation's 607,380 bridges is 42 years, the average age of the bridges in this application is 65 years. As of November 2018, all of the selected 34 county bridges are classified as either structurally deficient or not applicable to the rating system since being replaced with a temporary structure. Thirteen (13) bridges are posted with weight restrictions (load posted), fifteen (15) have been temporarily replaced with a pipe or box structures, and two of the bridges are closed to traffic due to structural condition (see Reports and Technical Information at [Grant County Bridges CHBP]). **Figures 3-5** show some representative photos.

*There are **more structurally deficient (SD) bridges** on the **Grant County** road network than on the **entire Oklahoma** state and federal **highway network***



535 Total Grant County Bridges; 174 Structurally Deficient Bridges

Figure 2: Structurally Deficient Bridges in Grant County, Oklahoma
Source: Grant County Commissioner Office, November 2018

I-Beam Span Bridge on County Road EW-15 (Haskell Rd.)

NBI # 11514

Built 1950

Sufficiency Rating – 38.2 (SD)

Figure 3: Existing I-Beam Span Bridge

Timber Span Bridge on County Road EW-18 (Greer Rd.)

NBI # 11486

Built 1950

Rating – 19.4 (SD) **CLOSED** to Traffic

Figure 4: Existing Timber Span Bridge

Temporary Arch Pipe Bridge on County Road EW-13 (Jackson Rd.)

NBI # 11471

Built 1950 as a Timber Span

Rating – 34.0 (SD)

Figure 5: Temporary Arch Pipe Bridge

The county roadway approach surfaces at the bridge locations are either gravel or graded earth and vary between 14 feet and 22 feet wide with no safety shoulders (see **Figure 6**). The current average annual daily traffic (AADT) on these county roads ranges between 24 to 100 vehicles per day. Approximately 10% of the daily vehicles are large trucks.

Figure 6: Gravel and Graded Earth County Roads

1.2 Challenges

1.2.1 Poor Condition

The local economy in Grant County has historically been based on agriculture. The principal crops include wheat, corn, soybeans, feed grains and alfalfa. The County also produces livestock, such as cattle, hogs and horses. While Grant County may not have the day-to-day congestion experienced by many urban counties, their 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 their infrastructure network. During this time, heavy haul trucks and large farm equipment travel down the mostly dirt or gravel county roads. While these roads and bridges were ideal for transporting livestock and crops to market 65 years ago, they are less than adequate to support the heavier trucks, larger modern farm equipment, increased traffic demands and higher operating speeds of today. This point was made numerous times in the over 130 letters written in support of this project (see Letters of Support at **Grant County Bridges CHBP**):

"*Farmers have even bigger combines and now, and most trucks carry 1,000 bushels of grain; and the bridges are still called on to hold all this weight even though they are 70 or more years old! In fact, we have one farm that requires us to drive across an unsafe bridge as it is the only way to the field. So, what are we to do? I generally get in the combine, approach the bridge, stop, say a short prayer, and cross the bridge as quickly as possible. The alternative is to leave the wheat uncut in the field, which is not acceptable to me.*" - Mr. Don E. Muegge, Lamont, Oklahoma (see **Figure 7**)

Figure 7: Large Farm Equipment on a Grant County SD bridge

Providing safe and reliable transportation infrastructure is a critical service that all municipal and county governments seek to fulfill. Data collected over the past ten years regarding traffic accidents on Grant County roadways reveal that a high number of the collisions were from large trucks (21% heavy trucks such as semi-trailers, 43% medium trucks such as delivery vehicles). A large percentage of the accidents (34%) were from a vehicle hitting a fixed object on the side of the road, which may indicate that the width of the roads and bridges play a factor in the overall safety of the facility. Accident data and collision reports can be found in Reports and Technical Information at **Grant County Bridges CHBP**. As was mentioned previously, none of the county roads have safety shoulders, and the bridge widths between 14 feet and 22 feet are considered dangerously narrow by current design standards.

34% of major accidents on Grant County roads were collisions with fixed objects.

64% of all reported accidents involved trucks.

In addition to the increase in large and heavy vehicles using the selected bridges, several of the structures are not sized adequately to handle large flash flood events.

During storms, water overtops the roadway damaging the road and creating a safety hazard for drivers. According to the inspection reports, all of the bridges in this application bundle show at least minor damage to the channel embankment, indicating increased susceptibility to wash out. Eleven (11) of the bridges, or 35%, show embankment condition at a rating of 5 or less, indicating erosion, undermining, and in one case, failure. The bridges that have failed or were determined to be inadequate have been replaced with temporary pipes, which are also hydraulically inadequate to handle flood event water flows.

Figure 8: Temporary pipe structures – NBI # 11818 and NBI # 11863

The condition of these bridges has affected the safety and reliability of school bus routes, postal routes and emergency services. With a high percentage of structurally deficient bridges in the county, many bridges have had to be either closed to through traffic completely or "load posted", meaning that heavier vehicles such as school buses and fire trucks cannot cross. This has caused local schools and emergency services to use detour routes around closed or load posted bridges. A loaded school bus weighs approximately 20 Tons, and several of these bridges have a load rating well below this. This increases travel times which, in the case of emergency response, could have life threatening consequences; and, for school children, increases in the accident risk exposure. This temporary solution is not sustainable in the long term as the infrastructure continues to age without significant repair.

Figure 9: Transportation Challenges

1.2.2 Funding Challenges

Figure 10: Oil and gas industry boom in Grant County

The oil and gas boom in Grant County in 2007 caused heavy truck traffic to increase, and in some cases nearly double. The roads and bridges used to access oil drilling areas were not built for the types of vehicles required to extract and transport petroleum products, which damaged existing infrastructure and reduced safety. Several bridges were damaged from the weight of the heavy trucks and oilfield equipment. Other bridges were made completely unserviceable and had to be replaced with temporary pipes in lieu of full replacement due to lack of funding. And while the oil boom generated added economic value for Oklahoma by way of a significantly larger collection in ad valorem (or property) taxes, **in Oklahoma these taxes legally cannot go to fund roads or bridges**. Instead, they go to support schools, jails, courthouses and health departments, and other community services. Limitations like these impact Grant County's ability to effectively raise additional revenue to pay for transportation infrastructure. Due to these state and local funding constraints, Grant County depends on a strong local, state and federal partnership to deliver transportation investments that are critical to the local and national economy.

1.2.3 Economic Growth

Figure 11: Wind Turbines in Grant County

Economic development is a high priority for local Grant County leadership, and the needed bridge infrastructure improvements are required to sustain current economic generators and to attract new commercial development. New developments have been made with the arrival of three new wind turbine farms, which provide land owners with additional income through their land lease agreements.

In 2016, a new train car loading facility opened northeast of Medford, in Grant County. This new facility supports local farmers by maintaining a central location where their grain can be collected and transported via railway across the country. By providing this convenient access to nationwide railways, the facility also helps reduce the number of grain transportation miles on the county roads and helps reduce some of the farmers' transportation costs.

Figure 12: Farmers Grain Co. Train Car Loading Facility, Medford, Grant County

Another long-standing economic generator is the Atmospheric Radiation Measurement (ARM) Site managed by the U.S. Department of Energy and built in 1992 in the town of Lamont, Oklahoma. The site employs 30 local residents, and hosts scientists from all over the world who temporarily live in Grant County and contribute to the local economy. Existing county road and bridge infrastructure are vital to providing access to and from these facilities, and the continued use of the roads by these industries adds to the road and bridge maintenance requirements.

1.3 Planned Project Strategy to Address Challenges

ODOT worked with Grant County Commissioners to select bridges throughout each of the three commission districts that had some of the worst existing conditions in order to obtain the most benefit in addressing the challenges mentioned in the previous section. All of the 34 bridges will be bundled into one project to save time and cost. These particular bridges were chosen based on the condition and length of the bridge, the condition of the approach roadway, the average annual daily traffic (AADT), the individual distance between bridges, and the relative importance of the route. These bridges represent those in the poorest condition in the county. Approximately 70% of the selected bridges are on an active U.S. mail delivery route, and 50% are on an active school bus route (see Reports and Technical Information at **Grant County Bridges CHBP**).

These bridges are all between 20-35 feet in length, lending themselves well to a bundling approach where similarities in design and construction methods can produce economies of scale and result in significant savings. The proposed replacement bridges will be designed to current standards, providing the appropriate widths and load capacities to accommodate trucks and modern agricultural vehicles, and allow for future roadway widening if and when warranted. Hydraulic analyses will be performed at each bridge location to ensure each bridge meets state and federal requirements including ODOT, Federal Emergency Management Agency (FEMA), and U.S. Army Corps of Engineers (USACE) design criteria, including overtopping frequency.

This project will correct 20% of the County's structurally deficient bridges, provide a boost to the local economy, improve traffic safety, and assist the local community with a more advanced and sustainable travel corridor. This project and the associated benefits will not be possible without the funding partnership through the CHBP grant.

This project will correct

20%

of Grant County's structurally deficient bridges

Historically, Grant County has been able to fund on average one bridge replacement project per year with current funding levels. Without grant assistance, replacing these 34 bridges would take 40 years, assuming these 34 bridges remained the highest priorities in the county during that time. In that time period, some of these bridges may be forced to close, and other bridges will likely become deficient. In contrast, as discussed in Section 5.4.2, with grant assistance these 34 bridges can be replaced in 5 years. Funding this application will allow Grant County to make significant headway in the improvement of their deteriorating infrastructure.

2.0 PROJECT LOCATION

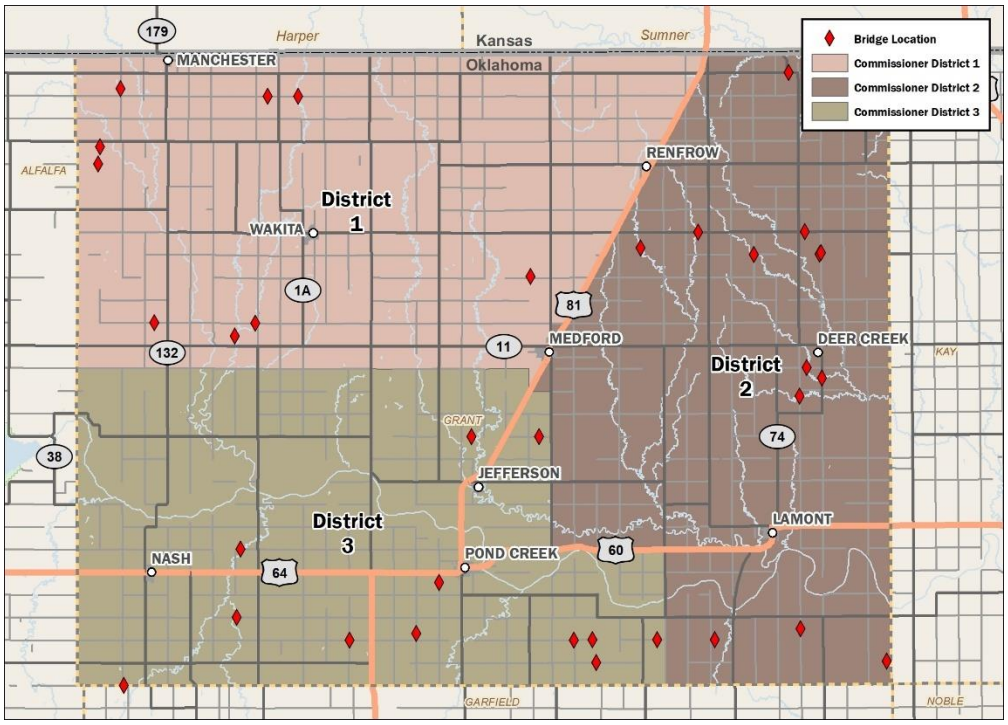


Figure 13: Grant County Bridges with District Map

The project involves the replacement of 34 selected county bridges in Grant County, Oklahoma. Grant County is a rural county located approximately 100 miles north of Oklahoma City along the Kansas border. It has a population of approximately 4,500 people and an area of over 1,000 square miles. The County is divided into 3 districts with a County Commissioner in each district responsible for county road and bridges in their district (see **Figure 13** and Maps and Graphics at **Grant County Bridges CHBP**). A representative group of bridges to be replaced was selected from each district: Nine (9) bridges in District 1, thirteen (13) bridges in District 2, and twelve (12) bridges in District 3.

All bridges to be replaced are on county roads over streams or creeks (see Reports and Technical Information at **Grant County Bridges CHBP**). These roads are all 2-lane facilities of gravel or dirt with speed limits of 45-55 miles per hour. The county roads that join the affected bridges also connect to other transportation infrastructure such as the Union Pacific Rail Road, the Medford and Pond Creek Municipal Airports, U.S. Highways 60, 64 and 81, and State Highways 11, 11A, 74 and 132. There are no interstate highways in Grant County. Because the federal and state highway system is limited in Grant County, the county road system is of heightened importance to local residents and businesses.

Since the existing county road network is on 1-mile grid sections, relatively short construction detours can be set up per bridge, redirecting traffic to adjacent county roads for a total additional travel length of 2 miles per detour, per bridge (see **Figure 14** for a typical detour).

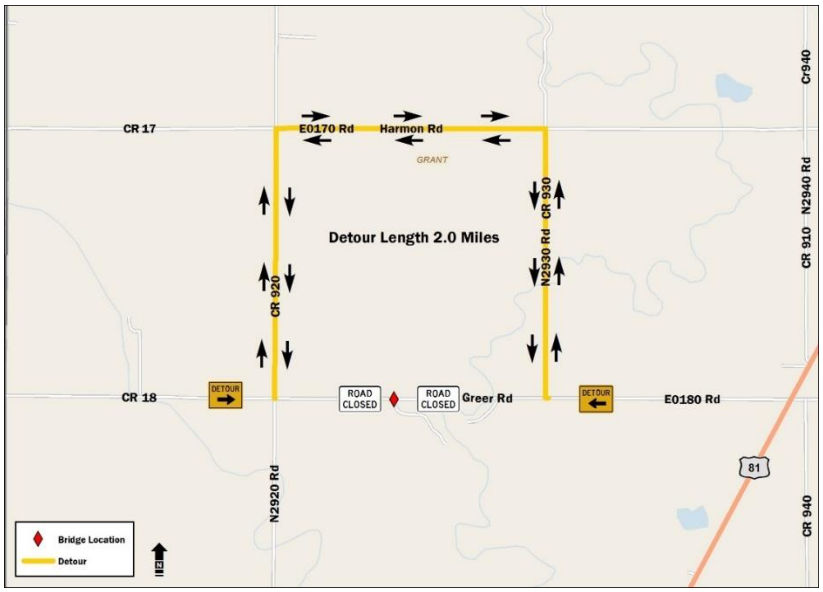


Figure 14: Typical 2-mile Construction Detour

3.0 PROJECT PARTIES

This project includes financial support from three (3) entities. ODOT is the project sponsor and is obtaining additional federal financial support from FHWA's Surface Transportation Program (STP), and local support from Grant County funds (see **Table 1**).

City and County local governments in the area are supportive of the project. Grant County Commissioners have obtained over 130 letters of support from government officials, local government service offices, economic development organizations, educational institutions, trade organizations, businesses and individuals (see Letters of Support at **Grant County Bridges CHBP**).

4.0 GRANT FUNDS, SOURCES AND USES

The Grant County bridge bundle replacement project will be accomplished as a result of established partnerships, using County, State and Federal funds as shown in **Table 1**. There are no previously incurred funds for this project. The **total cost and future eligible costs are $10,270,788**. A project of this size is beyond the established funding levels for County projects, and ODOT would not be able to fund the project with current federal and state appropriations. Without the CHBP funds, ODOT and the County would have no choice but to program the bridge improvements as several projects over 40 years or more. Due to these limitations, ODOT is requesting **$4,762,003 of CHBP funds** for the construction of this project, or **46% of the total project cost** (see **Table 2**).

TABLE 1: Sources and Uses of Funds

USES OF FUNDS	SOURCES of FUNDS (in $1,000s)								
	LOCAL FUNDS		STATE FUNDS (ODOT)		FEDERAL FUNDS (STP)		CHBP FUNDS	FUTURE ELIGIBLE COSTS	TOTAL PROJECT COST
	Previously Incurred	Future	Previously Incurred	Future	Previously Incurred	Future			
Pre-Construction		$2,117.6		$1,440.8				$ 3,558.4	$ 3,558.4
Construction		$ 877.4		$ 597.0		$476.0	$4,762.0	$ 6,712.4	$ 6,712.4
TOTAL		$2,995.0		$2,037.8		$476.0	$4,762.0	$ 10,270.8	$ 10,270.8

Cost estimates were developed by ODOT based on estimated quantities and recent similar projects constructed in the State of Oklahoma. A pre-construction and construction schedule and detailed cost estimate for both the bundled and unbundled bridges are included as a part of the application attachments (see Reports and Technical Information at **Grant County Bridges CHBP**). The budget includes the cost of each project component, and how non-federal (state), CHBP, and other federal funds will be allocated to each component. A summary of the future costs of the different project components and the anticipated cost share is presented in **Table 2**. Approximately 20% of the costs ($2,037,785) will be covered by ODOT's state transportation funds. Grant County will contribute $2,995,000 in county funds, or 29% of the total project cost. The remaining 5% will come from federal STP funds.

TABLE 2: Summary of Future Project Costs

PROJECT ACTIVITY	COST SHARE	COST ($1,000S)
Pre-Construction	60% Local (County)	$ 2,117.6
	40% State (ODOT)	$ 1,440.8
	SUBTOTAL	**$ 3,558.4**
Construction	13% Local (County)	$ 877.4
	9% State(ODOT)	$ 597.0
	7% Federal STP	$ 476.0
	71% CHBP	$ 4,762.0
	SUBTOTAL	**$ 6,712.4**
TOTAL	29% Local	$ 2,995.0
	20% State ODOT	$ 2,037.8
	5% Federal STP	$ 476.0
	46% CHBP	$ 4,762.0
	SUBTOTAL	**$ 10,270.8**

Counties have traditionally used local and State funding sources for all their maintenance activities, and funding for the future maintenance of the Grant County Bridge improvements would be no different. ODOT and Grant County are committed to building and maintaining the county bridge improvements on behalf of their constituents and in support of future development.

Grant County currently has $4.3 million of Local CIRB funds programmed in the CIRB 5-year Construction Work Plan (FY2018-2022). The CHBP funding award would allow for a reallocation of a portion of programmed funds to focus on the structurally deficient bridges in this project, while still maintaining the bulk of the existing CIRB 5-year schedule.

5.0 SELECTION CRITERIA

This section describes why the Grant County bridge bundle project meets the criteria defined in the CHBP program, and why it is a good candidate for the support of grant funding.

5.1 Innovation

Previous sections of this application have described the typical funding and programming scenario for County bridges in Oklahoma. With the bundling of several bridges into one project, it affords ODOT the opportunity to apply innovative approaches that have been successfully used by other Departments of Transportation.

5.1.1 Innovative Technology

ODOT plans to employ an innovative and cost-effective design solution which involves a series of 4 to 5 bridge design templates that can be selected depending on the needs at each location. Each of these bridge templates will consist of several pre-cast concrete components that are constructed in large quantities off-site and can be easily delivered and assembled in sections according to a predetermined order and schedule. See **Figure 15** for a representative photo of a bridge built in Mississippi with similar components. These designs have shallow substructure depths, making it possible to maintain hydraulic adequacy while minimizing the need for any changes to profile grade. Ultimately the design templates will become standards that Oklahoma counties can utilize to streamline construction on other projects.

Use of pre-cast elements will allow the construction contractor the flexibility to plan and schedule the construction of individual components in harmony with available company labor forces. ODOT has reviewed the successful examples of this approach from the

Figure 15 – Bridge with pre-cast components, Mississippi

Indiana and Nebraska DOTs and is prepared to implement a similar program for this project. An added benefit to this approach is that the construction contractor will not need special equipment or large cranes, so ODOT will not be limited to a selection of just a few large companies, which could contribute to cost savings with a larger pool of competitive bidders.

The proposed bridges are anticipated to have precast concrete slab beam superstructures that can be easily fabricated, transported, and erected on site. Similarly, substructures will be composed of precast elements. Piers/bents will use driven piles topped with a precast or cast-in-place cap, which supports the slab beams.

Abutment elements will be composed of either pile and concrete cap construction, similar to the piers, or with a Geosynthetic Reinforced Soil (GRS) system depending on site conditions. The GRS system is an innovation to help reduce bridge construction costs and time. The technology consists of three main components: the reinforced soil foundation, the abutment, and the integrated approach. Alternating layers of compacted granular fill and geosynthetic reinforcement provide support for the bridge. The closely spaced reinforcement and granular soil create an efficient composite material that is internally stable and capable of carrying bridge loads significantly higher than designed with predictable and reliable performance.

The designer places the bridge directly on the GRS substructure, creating a seamless and smooth transition between the bridge and approach roadway without joints, deep foundations, approach slabs, or cast-in-place concrete. The smooth transition from the roadway to the bridge helps alleviate the "bump at the end of the bridge" problem caused by differential settlement between the bridge abutment and the approaching roadway.

GRS construction offers the following advantages:

- **Reduced Time and Cost**: GRS construction employs commonly available equipment and materials and does not require specialized labor. Constructing a GRS bridge can result in 25 to 60 percent savings over one built with conventional methods.
- **Reduced Maintenance**: Once built, GRS bridges are also durable and easy to maintain. This, combined with fewer components compared to traditional construction, also provides the potential for lower life-cycle costs.
- **Reduced Environmental Impact**: Construction of the abutment is contained within its footprint and a deep foundation is not needed.
- **Convenience and Flexibility**: The technique can be used in less-than ideal weather conditions and can accommodate on-site modifications. GRS bridges also perform well and can be designed for a wide range of loading conditions, such as in seismic areas and rapidly changing water elevations.

The GRS system is promoted by the FHWA Every Day Counts (EDC) Program. The EDC program is a State-based model that identifies and rapidly deploys proven, yet underutilized innovations to shorten the project delivery process, enhance roadway safety, reduce traffic congestion, and improve environmental sustainability. Proven innovations promoted through EDC facilitate greater efficiency at the State and local levels, saving time, money and resources that can be used to deliver more projects.

5.1.2 Innovative Project Delivery

Many innovative approaches to project delivery can be utilized with the bundling of multiple bridges. Bundling will allow ODOT to design all of the replacement bridges in one set of design plans, reducing the workload on the design team, and allowing them to focus on the needs of each location in one continuous problem-solving process, as opposed to using multiple design teams, problem solving a handful of locations at a time over several years. This approach will allow ODOT to maintain a project delivery schedule that can quickly address the challenges in Grant County.

Bundling will also streamline other project delivery requirements such as environmental study, documentation, and permitting. ODOT will pursue environmental approval of the bundled project as a single Categorical Exclusion (CE) under the National Environmental Policy Act (NEPA). Small bridge replacement projects such as these are rarely elevated to a higher level NEPA document. This approach would also lend itself to a single Section 404 Nationwide Permit 14 application to the U.S. Army Corps of Engineers (USACE) to streamline the permitting of work in jurisdictional waters at the bridge locations.

For a typical project, right-of-way acquisition and utility relocation have the potential to delay project delivery. Grant County has a 66-foot wide statutory right-of-way (government owned road corridor land) on the local county roadways (see **Figure 16**). This relatively wide existing right-of-way will likely preclude the need for acquiring additional property from land owners in many, if not all of the proposed bridge locations. With all 34 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. Grant County has established relationships with the local utility providers and will coordinate any needed utility relocations.

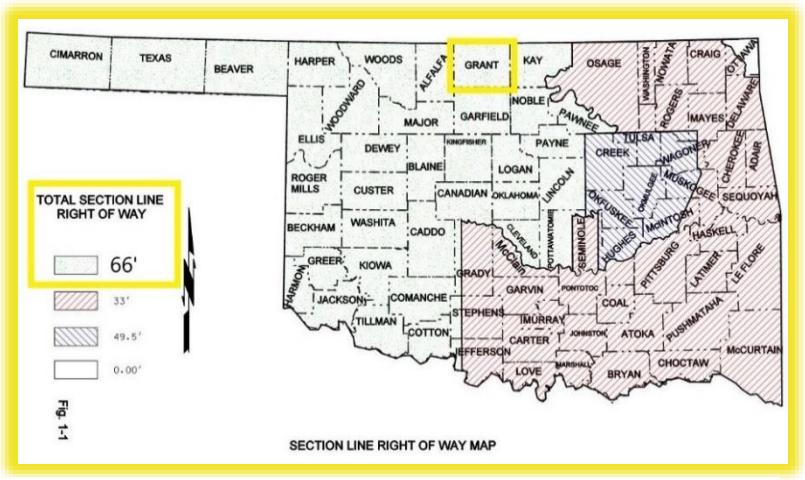


Figure 16: Oklahoma Section Line Right-of-Way Map

Another benefit of bundling is economy of scale. The Indiana DOT, through its Purdue University study, described how the grouping of multiple bridges within a 15 to 20-mile radius results in cost savings and construction schedule reduction, and ODOT used this as one of the factors in selecting the 34 bridges. ODOT also plans to use a single contract award for this project to save cost, as well as construction and procurement time.

5.1.3 Innovative Financing

In 2006 the Oklahoma State Legislature created a revolving fund known as the County Improvements for Roads and Bridges (CIRB), which receives 20% of the revenue from the State Motor Vehicle Tax. The State is divided into eight Transportation Commission Districts, and the annual funds are distributed equally to each district, and then to the counties. A Circuit Engineering District (CED) then programs its funds in a 5-year Construction Work Plan. Grant County roads and bridges are managed under CED 8, and county priorities are determined by the three Grant County Commissioners. This innovative program allows the counties to receive their annual funding allotments without requiring the county to reapply each year.

Being that Grant County is very rural, there are no large corporations in the area that have the ability to contribute financing to the project. Contributing funds were not pursued from larger corporations outside of the county since they do not have a shared interest in the project. Tradewind Energy, the owner and operator of one of the windfarms in the County, partnered with Grant County in the past by upgrading several county roads within the windfarm footprint, which they mention in their letter of support for the project. The likelihood of such financial partnerships in the future is high as the area continues to grow and develop.

5.2 Support for Economic Vitality

The CHBP initiative would generate a substantial gain in economic vitality, according to the benefit-cost analysis (BCA) conducted on all 34 bridges. The analysis accounts for benefits and costs over a 30-year period of operations that begin after construction is complete in 2023. The results in **Table 3** indicate that the total present value of bundled costs (at a 7 percent discount rate) are over $8.8 million. The estimated economic benefits exceed these costs by nearly $7.5 million, as indicated by the net present value. **The benefit-cost ratio indicates that over 2.83 dollars of value are generated for every 1 dollar invested.** From a lifecycle cost assessment alone, the projects would collectively generate about $805 thousand in annual maintenance cost savings at a 7% discount rate. After 30 years of operations, the remaining value of the initial capital cost is about $720 thousand, since bridges should last 70 years.

TABLE 3: Summary of BCA Results

Items	Total Discounted Value (7%) (thousands of $)	Total Discounted Value (3%) (thousands of $)
Costs		
Capital Cost	$8,098.6	$9,249.0
O&M Cost	$731.0	$1,658.9
Total	**$8,829.7**	**$9,249.0**
Benefits		
Existing Bridge O&M Cost Savings	$804.9	$1,218.5
Remaining Value of Capital Investment	$717.7	$2,774.2
Time Savings	$6,513.3	$13,378.0
Crash Risk Reduction	$8,293.6	$17,344.7
Pavement Damage Reduction	$268.2	$517.4
Fuel Cost Savings	$6,886.7	$13,550.1
Emissions Cost Reduction	$166.8	$292.5
Total	**$23,651.2**	**$49,075.4**
Net Present Value (NPV)	**$14,821.5**	**$39,826.4**
Benefit – Cost Ratio (BCR)	**2.83**	**5.13**

BENEFIT COST ANALYSIS RESULTS

2.83 *Benefit / Cost Ratio* *at the* **7%** *Discount Rate*

5.13 *Benefit / Cost Ratio* *at the* **3%** *Discount Rate*

Table 3 also indicates that the net present value of these projects would more than double to nearly $40 million, if the analysis was based on a 3 percent discount rate, which places a higher relative value on future benefits compared to a 7 percent rate.

The largest sources of benefits for passenger vehicles and trucks include their travel time savings, user cost savings and reduced accident risk, each of which are associated with vehicle

access to the improved bridge instead of taking a 2-mile detour. These benefit categories generate about $6.5 million, and $6.9 million, and $8.3 million, respectively. These measures of benefits are large because of the high rates of traffic detours due to the anticipated closures of 18 bridges by 2025 and 28 bridges (total) by 2030. Other relatively smaller sources of benefits include reduced pavement damage (primarily from truck-miles traveled), fuel cost savings and emission cost reductions. See **Table 4** for a summary of the largest benefits. BCA data and results for each bridge and the project overall are discussed in the BCA Technical Memo at **Grant County Bridges CHBP**.

TABLE 4: Summary of Largest Benefits

CURRENT STATUS OR BASELINE and problems to be addressed	CHANGES TO BASELINE / ALTERNATIVES	TYPE OF IMPACTS	POPULATION AFFECTED by impacts	ECONOMIC BENEFIT	SUMMARY OF RESULTS ($M discounted at 7%)
Grant County bridges remain in poor condition and become increasingly expensive to maintain, creating traffic growth constraints, and hindering connectivity in the region. Travel times increase for delays for passenger vehicles and trucks as longer routes are required to detour around posted or closed bridges.	Improve bridge condition by replacing bridges. Maintenance costs are reduced and detours due to condition are eliminated.	Improved Safety	Passenger vehicles, trucks	Accident Cost Reduction	$8,293.6
		Fuel Cost Savings	Passenger Vehicles, Trucks	Vehicle Operating Cost Savings	$6,886.7
		Improved Travel Times	Passenger vehicles, trucks	Travel Time and Vehicle Operating Cost Savings	$6,513.3

The benefits of the project described in the BCA, while substantial, may be somewhat underestimated. As illustrated in many of the Letters of Support (**Grant County Bridges CHBP**), local residents often choose to detour around bridges that they feel are not safe or sufficient to carry their large farming vehicles, even if these bridges are currently open to traffic. While difficult to quantify, there are likely a number of trips today that are detoured due to perceived

bridge condition rather than actual load postings or closures. Replacing the 34 bridges would likely increase the benefit of travel times, improved safety, and reduced fuel costs beyond even what is quantified in the BCA.

Replacing the 34 bridges would also address the common problem of hydraulic inadequacy, which can lead to flooding and wash outs. As stated previously, the majority of these bridges have embankment stability issues which would be corrected with new bridges. New bridges would not only reduce the likelihood of wash outs and closures but would better protect adjacent private property from flooding.

5.3 Life-Cycle Costs and State of Good Repair

The bridges included in this CHBP application have an average age of 65 years, and bridges designed during this time period typically had an anticipated life of 50 years. As expected, the condition of these bridges is poor overall. Of the 34 bridges included in the application, 33 are structurally deficient and one bridge is not applicable to the rating system after being replaced with a non-standard temporary structure. A bridge is classified as structurally deficient if the deck, superstructure, substructure, or culvert is rated in "poor" condition (0 to 4 on the NBI rating scale). A bridge can also be classified as structurally deficient if its load carrying capacity is significantly below current design standards or if a waterway below frequently overtops the bridge during floods.

Currently the average sufficiency rating of the bridges is 36 out of a possible 100. Over the past 10 years, the sufficiency ratings for these bridges has decreased by 16% on average. Sufficiency ratings are used by the Federal Highway Administration to select candidate bridges for the Highway Bridge Program. Sufficiency ratings are determined during the biennial bridge inspection and are intended to indicate a measure of the ability of a bridge to remain in service. Calculations for sufficiency ratings utilize a formula that includes various factors determined during the bridge field inspection and evaluation. Due to the poor ratings of these bridges, 38% of them have been load posted, and 6% of them have been closed to traffic completely (see Reports and Technical Information at **Grant County Bridges CHBP**).

It is anticipated that bundling will result in a savings of

11.8%

over individual projects.

ODOT and Grant County anticipate substantial savings from bundling these 34 bridges into a single project. The detailed cost estimates for the individual bridges and the bundled project are presented in appendices found Reports and Technical Information at **Grant County Bridges CHBP**. **Table 5** below summarizes the differences and the savings.

TABLE 5: Summary of Bundled Cost Savings

PROJECT COMPONENT	UNBUNDLED COST ($1000s)	BUNDLED COST ($1000s)	SAVINGS ESTIMATE %
Survey	$510	$510	0%
Environmental	$850	$765	10%
Hydraulics & Hydrology	$680	$158.6	77%
Geotechnical Studies	$510	$382.5	25%
Roadway Design	$331.7	$258.8	22%
Bridge Design	$331.7	$483.5	-46%*
Utility Relocations	$1000	$1000	0
TOTAL PRECONSTRUCTION	**$4,213.4**	**$3,558.4**	**16%**
Bridge Construction	$5,486.9	$5,157.7	6%
Roadway Construction	$204	$191.7	6%
Staking	$204	$191.7	6%
Traffic Control	$34	$32	6%
Erosion Control	$102	$95.9	6%
Mobilization	$603.1	$283.5	53%
TOTAL CONSTRUCTION	**$6,634.0**	**$5,952.5**	**10%**
Inspection	**$796.1**	**$759.9**	5%
TOTAL	**$11,643.5**	**$10,270.8**	**11.8%**

* design costs increase with the bundled project due to the need to develop new ODOT standards

A schedule of pre-construction and construction activities with detailed cost estimates for bundled and unbundled bridges in Grant County is included as part of the application attachments. The related cost savings compare favorably with data ODOT has compiled regarding alternative bids received for standalone bridge construction, versus tying multiple bridge projects into one construction bid (see ODOT Bid Data in Reports and Technical Information at **Grant County Bridges CHBP**).

While there is no specific contingency amount built into the cost estimate, the numbers used to build the estimate are conservative and based on ODOT's experience with small county bridge projects.

5.4 Project Readiness

As previously mentioned, Grant Count, Oklahoma has the highest number of structurally deficient county (off highway system) bridges in the state. ODOT has years of experience and has become a nationwide innovator in the approach to rehabilitating or replacing structurally deficient bridges. In the year 2004, Oklahoma was near the top of the list as one of the worst states, with nearly 17% (1,168 out of 6,771) of all highway system bridges classified as structurally deficient. In 2005, a new program with a visionary plan was developed and implemented with the special focus of reducing the number of structurally deficient bridges to 1% by the end of 2020. At the time of this report, through that program, ODOT has reduced the number of structurally deficient highway bridges to 153 or 2.3%. This success is due to ODOT's commitment to achieving the program goal, setting a workable program schedule and applying innovative approaches to bridge rehabilitation and replacement. ODOT intends to build on this success from its highway system bridges and apply the same commitment to achieving success at the county level.

5.4.1 Project Feasibility

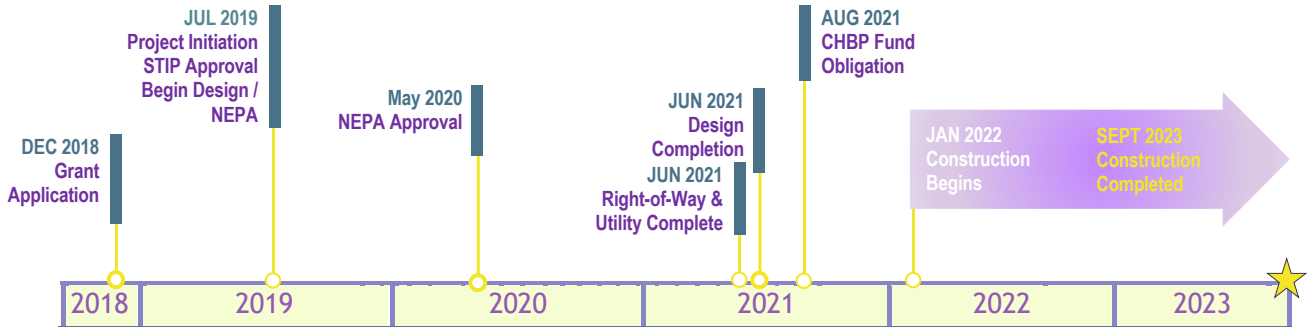
The 34 bridges for this project have been selected and approved for replacement as recommended by Grant County and as approved by ODOT. As stated in prior sections of this application, this project would not be possible without funding assistance through the CHB Program. Therefore, the project is not yet programmed, nor has preliminary engineering, design or environmental investigations been performed. In ODOT's letter of support for this project, Director Patterson confirms the Department's commitment to the project, as well as to providing resources to complete project activities. (see Letter of Support from Oklahoma Secretary of Transportation Mike Patterson at **Grant County Bridges CHBP**). Likewise, Grant County has signed a resolution committing matching funds (see Letters of Support at **Grant County Bridge CHBP**).

As previously mentioned, ODOT is prepared to perform all preliminary engineering and design, so the initial portion of the project schedule is constrained only by factors internal to the organization, and not hindered by the need to contract to outside entities. This greatly reduces the risk to the schedule. The budget for the State and County portion of costs are committed and will be programmed upon receipt of grant award; therefore, the risks associated with budget and funding availability are low.

5.4.2 Project Schedule

The major project milestones are shown in the summary of schedule below (**See Figure 17**) and the detailed project schedule is included in Reports and Technical Information at **Grant County Bridges CHBP.** It is estimated that grant funding and authorization will be completed, and the project activities can begin in July 2019. Subject to grant approval, ODOT and Grant County will add the project to the STIP and CIRB plans. Once the project scope is finalized, the NEPA approval process will begin concurrently with preliminary engineering and design. During design ODOT will apply for all Federal and State regulatory permits and will obtain all needed approvals prior to the production of construction bid packages (estimated August 2021 per schedule). All necessary activities will be completed to allow CHBP funds to be obligated in advance of the September 30, 2021 deadline.

Figure 17: Summary of Schedule Highlights



Project construction will begin by January 2022, and CHBP funds will be expended according to the construction invoicing and payment schedule. With construction estimated to be complete in September 2023, ODOT can ensure that all construction claims can be paid and all CHBP funds will be expended well in advance of the September 30, 2026 deadline.

Although identified in the schedule, at this time it is not anticipated that right-of-way acquisition will be necessary since the current County owned rights-of-way are anticipated to be wide enough to accommodate the proposed bridge structures. Should real property be required, ODOT and Grant County will ensure that acquisition is handled in accordance with 49 CFR part 24 and 23 CFR part 710.

The schedule to construct all project bridges separately would span

40 years

with ODOT's current funding.

There would be a significant difference in project scheduling if each bridge was planned as a separate construction project without the CHBP grant funds. ODOT's 5-year CIRB construction work plan is only able to fund on average one bridge replacement project per year in Grant County. Therefore, it would take up to 40 years for design and construction completion of all 34 bridges as separate projects under the current program.

5.4.3 Required Approvals

5.4.3.1 - Environmental Study and NEPA Approval

The environmental studies (research including but not limited to topics such as biology, cultural resources, hazardous materials, and wetlands) will be initiated once the project scope is finalized. Once studies and preliminary engineering are complete, ODOT will submit a single NEPA document to FHWA for approval in accordance with the NEPA 42 U.S.C. 4321 and applicable ODOT NEPA policy. It is anticipated that, given the relatively small footprints of these projects and the known environmental conditions in Grant County, that this **project will be processed with a Categorical Exclusion (CE)**, the least complex NEPA document.

Consultation with the U.S. Fish and Wildlife under the Endangered Species Act is expected to be straightforward as Grant County does not contain habitat for a large number of threatened and endangered species. Consultation with the State Historic Preservation Officer under the National Historic Preservation Act (NHPA) is also expected to be streamlined. Most of the bridges are either temporary structures and are not of historic age or are concrete/steel structures constructed after 1945 and are subject to the Advisory Council on Historic Preservation's Program Comment for Post-1945 Concrete and Steel Bridges. These bridges are not subject to individual review. Only nine (9) of the 34

bridges would require individual assessment for NHPA eligibility. Given that most, if not all of the construction will take place within existing County rights-of-way that are often disturbed by utility installations or road and bridge maintenance activities, intact archeological sites are not anticipated.

5.4.3.2 - Permitting

The only permitting anticipated for the project is a Section 404 Nationwide Permit 14, to be coordinated with the USACE. The permit application will be submitted for approval with the final set of design plans. ODOT has a dedicated staff liaison at the USACE who reviews and permits only ODOT projects, and who responds to ODOT's priorities. ODOT will direct this individual to provide review and approval in a timely manner.

5.4.3.3 - State and Local Approvals

Support for the project by state and local entities is indicated by **over 130 letters of support** available at **Grant County Bridges CHBP.** The project has the support of both the County Circuit Engineering District and the three Grant County Commissioners, who have resolved to commit CIRB funds and expedite the project schedule. The project is in harmony 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.

The Project is also consistent with the 2015-2040 Oklahoma Long Range Transportation Plan (LRTP), specifically the policy calling to:

"*Protect Oklahoma's investment in transportation by seeking to preserve and enhance current and/or new funding mechanisms for all modal systems. Cooperate and coordinate with local governments to research possible new funding partnerships for transportation projects of mutual interest.*"

Additionally, the application supports the mobility/connectivity/accessibility and economic vitality goals of the Oklahoma Freight Transportation Plan, 2018-2022.

Because of lack of funding, these bridge improvements are currently not a part of the part of the State Transportation Improvement Program. Subject to grant approval, the State Transportation Improvement Program as well as the County Improvements for Roads and Bridges Work Plan will be amended to include this project.

5.4.4 Project Risk

It has been shown in previous sections that, should the CHBP grant be awarded for this project, ODOT would not consider budget, funding or schedule to be a significant risk to project delivery, having the experience of a successful structurally deficient bridge rehabilitation and replacement program for which accelerated schedules and dedicated budgets were achieved. Environmental risk is also considered low, given the setting of the project and the small footprints required for construction.

One project risk worth noting is ODOT's planned use of innovative technologies that have not been attempted at the scale of this project. While construction of small bridges using precast components has been successful on many ODOT projects, the particular combination of techniques and the number of bridges bundled has not yet been attempted by ODOT. To mitigate this risk, ODOT will continue to consult with Indiana DOT and other transportation agencies and consult with FHWA for guidance to benefit from lessons learned and implement strategies that have been most successful.

6.0 OTHER INFORMATION

6.1 Use of System for Award Management (SAM)

ODOT is familiar with the SAM and has used it successfully in previous grant applications. Standard forms SF424 and SF424C have been submitted.