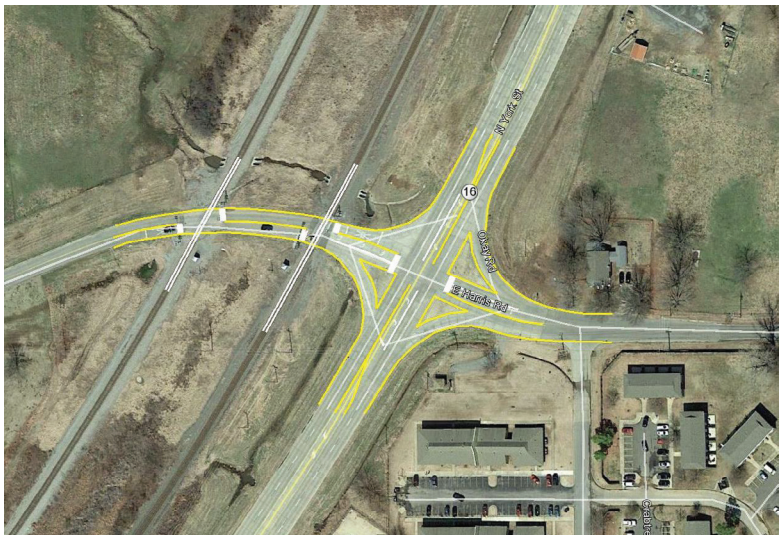
TRANSPORTATION INVESTMENT GENERATING ECONOMIC RECOVERY (TIGER)

DISCRETIONARY GRANT APPLICATION

OKLAHOMA

Oklahoma Rural Railroad Crossing Safety Improvement Project



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PROJECT TYPE:
Freight Rail

CFDA # 20.933
FY2015 National Infrastructure Investments

LOCATION:
12 railroad crossings in rural areas of Oklahoma

AREA: Rural

REQUESTED AMOUNT:
$3,000,000

TOTAL PROJECT COST:
$3,600,000

DUNS NUMBER:
824700074

PROJECT WEB ADDRESS:
http://www.okladot.state.ok.us/tiger/index.htm

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Executive Summary and Abstract

America's railroads are carrying quantities of crude oil that were unimaginable just ten years ago, bringing crude from wells in remote areas across the nation to refineries concentrated in a few locations (e.g., the Gulf Coast). Strikingly, nearly one out of every five carloads of crude oil shipped on America's railroads crosses Oklahoma. There is every reason to expect the continued growth of rail transportation. Moreover, we must anticipate that the volume of rail shipments for other products, particularly agricultural, will likewise increase in the foreseeable future.

The Sooner State is proud to be one of the Nation's essential rail crossroads. However, the welcomed increase in rail traffic comes with costs as well. Remote rural crossings that just a few years ago saw little rail traffic are today experiencing volumes that require more than yesterday's safety measures. The current schedule for upgrading safety equipment at rail crossings is inadequate to keep up with the growing potential for rail accidents.

The Oklahoma Department of Transportation is submitting this Oklahoma Rural Railroad Crossing Safety Improvement Project application for TIGER VII funding to improve safety for our citizens and to ensure the swift transit of commerce. This project will upgrade and install safety equipment at 12 rural railroad crossings across the state. The primary benefit will be accident reduction, with additional benefits including an enhanced state of good repair, improved economic competitiveness, environmental sustainability and livability.

Project Description

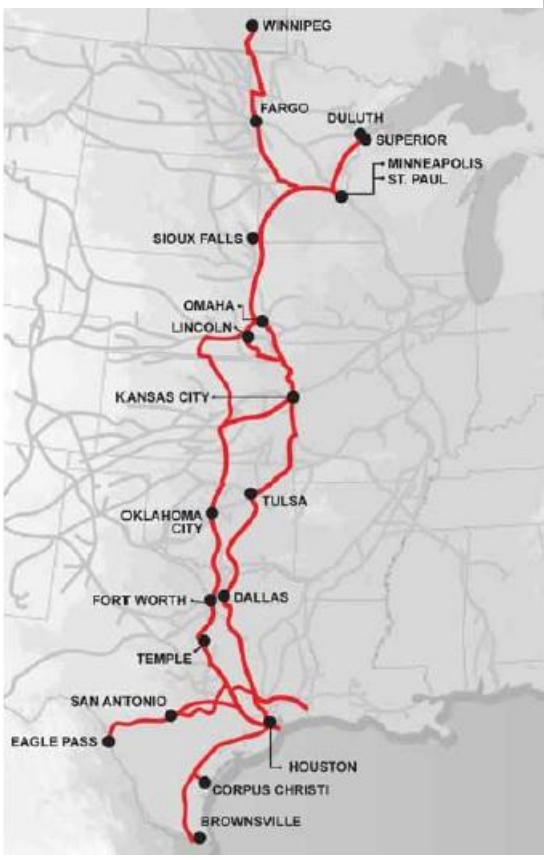
Background

This project will modernize and improve rail safety infrastructure at 12 rural railroad crossings in Oklahoma that either experience high volumes of unit trains transporting crude oil, or which intersect with highway routes that serve Indian health service centers.

U.S. crude oil production has risen sharply in recent years, with much of the increased output moving by rail. In 2008 U.S. Class I railroads originated 9,500 carloads of crude oil. In 2014 they originated 493,126 carloads of crude oil. In 2014, nearly 100,000 of these carloads passed through Oklahoma, on Burlington Northern Santa Fe Railway (BNSF), Union Pacific Railroad (UP), Kansas City Southern Railway (KCS) and various shortline railroads throughout the state. A majority of the increased oil production shipped by rail is coming from North Dakota shale oil fields to refineries in Texas, often through Oklahoma. Not only has the number of trains increased significantly, but the trains are longer, with crude currently being shipped in "unit trains" of 100 to 120 carloads. The increased volume and length has increased the number of accidents involving oil trains in the U.S. and Canada. Coupled with the high volatility of Bakken Crude, this raises serious concerns for the safety of the general public. The railroads have taken numerous steps to improve operations while the federal government is currently in the process of increasing tank car safety requirements.

Additional factors anticipated to affect rail operations in Oklahoma include the development of the BNSF "Mid-Con Corridor" from Houston to Canada (see Figure 1), which is expected to further increase traffic and service on Oklahoma railroads. The Mid-Con Corridor will have two routes traversing the state, one from the Kansas border through Oklahoma City to the Texas border and another from the Kansas border through Tulsa to the Texas border. These improvements are expected to enhance the flow of oil, coal and agricultural products southward, and increase the movement of intermodal traffic northwards from the Gulf and Mexico. The Union Pacific and Kansas City Southern routes in eastern Oklahoma will see corresponding increases in rail traffic.

Figure 1: BNSF Mid-Con Transportation Corridor



ODOT is submitting this application to improve the safety of our rural railroad/road crossings while reducing the potential for crude oil shipment related incidents.

Project Components

The State of Oklahoma, through the Oklahoma Department of Transportation, plans to address the increased potential hazard associated with increased train/motor vehicle conflict by upgrading rural railroad crossing warning devices, enhancing crossing geometry and addressing sight distance issues to provide safer operations for the traveling public, railroad operators, and any residents living near these crossings.

The proposed multi-location, multi-jurisdictional project will upgrade 12 rural railroad crossings in Oklahoma, adding new gated signal installations and other improvements to enhance the safety of motor vehicle and railroad operations. These locations are listed in Figure 2 and mapped in Figure 3.

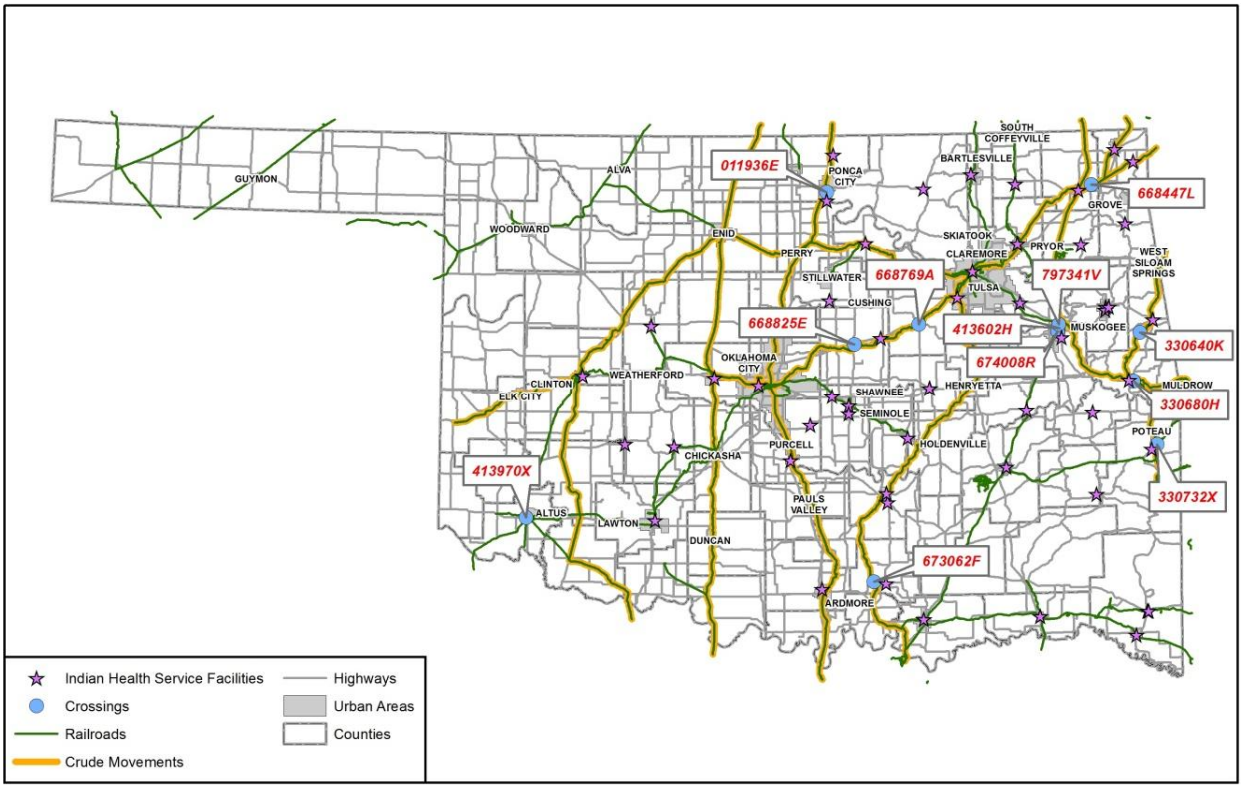
Figure 2: Crossing Improvement Locations and Details

County	# of Xings	DOT#	Railroad	DTI Date	Location	Description	Project Total	R-O-W Requirements
KAY	1	011936E	BNSF	04/20/06	E0250	Signal & Surface Improvements on the BNSF at Kay Co Rd N0250. Crossing sketch on file.	$375,000	No
ADAIR	2	330640K	KCS	05/26/10	N4660	Signal Improvements on the KCS at Adair Co Rd N4660 southeast of Lyons. Crossing sketch on file.	$225,000	No
CRAIG	3	668447L	BNSF	04/19/06	N4460	Signal & Surface Improvements on the BNSF at Craig Co Rd N4460. Heavy Truck Traffic. Crossing sketch on file.	$325,000	No
CREEK	4	668769A	SLWC	04/08/14	SH-16 MAIN STREET	Signal & Surface Improvements on the SLWC at SH-16/Main Street in Bristow, Creek County. Crossing sketch on file.	$300,000	No
LINCOLN	5	668825E	SLWC	04/08/14	1ST STREET	Signal Improvements on the SLWC at 1st Street in Chandler. Crossing sketch on file.	$225,000	No
JOHNSTON	6	673062F	BNSF	10/28/13	LOCUST STREET	Signal Improvements on the BNSF at Locust Street in Ravia. Crossing sketch on file.	$235,000	No
WAGONER	7	797341V	UP	05/07/14	N 4310 WYBARK ROAD	Signal & Surface Improvements on the UP at Wagoner Co Rd N4310 north of Muskogee. Crossing sketch on file.	$325,000	No
SEQUOYAH	8	330680H	KCS	05/26/10	DOGMOND STREET	Signal & Surface Improvements on the KCS at Dogmond Street in Sallisaw. Crossing sketch on file.	$290,000	No
LE FLORE	9	330732X	KCS	08/09/11	DEWEY STREET	Signal Improvements on the KCS at Dewey Street in Poteau. Crossing sketch on file.	$375,000	No
MUSKOGEE	10	413602H	UP	06/23/09	HARRIS STREET	Signal Improvements on the UP in Muskogee on Harris Street. Crossing sketch on file.	$325,000	No
JACKSON	11	413970X	WT&J	11/17/08	US-62 BROADWAY	Signal Improvements on the WTJ at US-62 (Broadway) in Altus, Jackson County. Crossing sketch on file.	$275,000	No
MUSKOGEE	12	674008R	BNSF	06/26/07	YORK STREET	Signal & Surface Improvements on the BNSF at York Street in Muskogee. Crossing sketch on file.	$325,000	No
TOTAL							**$3,600,000**	

In developing the criteria to establish a methodology to objectively and equitably determine which crossings were most in need of improvement, ODOT utilized the U.S. DOT Accident Prediction Model, and considered characteristics of the existing crossing geometry and additional site distance criteria recently collected for the national initiative to place Stop and/or Yield signs at passive grade crossing locations. None of the 12 crossings is currently equipped with gates, and six of the crossings rely only on passive warning devices (crossbuck signs). The traffic counts for the locations vary from 200 to 6,500 daily traffic (AADT). The resulting list of rural crossings most in need of safety upgrades was then further prioritized based on which crossings were along important access roads to Indian Health Service Facilities (Figure 3).

Each of these crossings will be provided with safety improvements that include the installation of gates to physically separate rail and road traffic. Two of the project crossings, located along the SLWC Sooner Subdivision linking Tulsa and Oklahoma City, will also be equipped with lengthened circuit approaches, which have the additional benefit of facilitating train speeds of 10 mph higher than present over approximately 20 miles of track.

Figure 3: Map of Crossing Locations and Indian Health Service Facilities



Project Timeline

Figure 2 above shows that each crossing location has had a diagnostic team inspection (DTI) and as such is essentially immediately ready to progress. Each location lies within existing railroad right of way and will require no additional environmental documentation to proceed with construction. ODOT, along with our partners at the local public agencies, and the railroad operators, are ready to proceed with construction upon notice of award.

The average project timeframe for each crossing improvement is anticipated to be between 18 and 24 months. Overall, the project will be constructed over a three year period (2016-2018). While the projects are ready and able to be constructed in a shorter time-frame, the additional time will be required as a result of coordination between the partners to ensure that construction does not occur in a manner that unduly disrupts roadway or rail traffic.

Project Parties

Oklahoma Department of Transportation (ODOT) is the official state executive agency for administration and implementation of federal and state transportation spending. It is authorized by state statute.

ODOT is an eligible grant applicant under TIGER, and will be providing 16% of the matching funds and administering the federal funding.

The Burlington Northern Santa Fe Railway (BNSF), Union Pacific Railroad (UP), Kansas City Southern Railway Company (KCS), South Kansas and Oklahoma Railroad (SKO), Wichita Tillman and Jackson Railway (WT&J), and Stillwater Central Railroad (SLWC) are the owners of the various crossings considered in this application. These railroads support the improvements discussed in this application and are planning to provide a 1% match of the project costs, as well as administering the construction contracts.

Grant Funds

The project match will be provided predominantly by Oklahoma DOT, using state funding as shown in Figure 4 below.

Figure 4: Funding sources

Source	Amount	Share of Project Total
ODOT	$570,000	16%
Private Railroads	$30,000	1%
TIGER Request	$3,000,000	83%

Figure 5: Main Street on the SLWC in Bristow (DOT# 668769A)

Long-Term Outcomes

The anticipated long-term outcomes are safer rail operations in Oklahoma's rural areas, specifically a reduction in the potential for collisions at railroad crossings. These reductions will help lower the potential for more catastrophic exposure associated with the derailment of hazardous cargo.

Additional benefits result from the rail travel speed improvements along the Sooner Subdivision, which will improve rail operations and reduce vehicle delay at crossings. The project provides benefits in each of the five primary benefit areas identified in the TIGER guidelines, as described below.

Safety

Figure 6: Accident reductions

Total Benefit Value (Present Value at 7% over the 20-year analysis period)		
Accident Reduction	$9,682,826	

None of the 12 identified crossings currently have gates. Half of these crossings only have crossbucks. The improvements included in this application will install gates at each of these crossings, thereby greatly increasing the safety of both the rail and roadway traffic. The benefit to the public and the railroad operators, over the 20 years examined in the Benefit Cost Analysis (BCA), is valued at over $9.6 million, about three times the project cost. The benefit/cost ratio for the project improvements is 8.07, and the Accident Reduction benefit represents 40% of the total evaluated benefits.

Two illustrative examples of the need for these safety improvements are the crossings at Main Street (SH-16) on the SLWC in Bristow (Figure 7) and Harris Street on the UPRR in Muskogee (Figure 8). As the aerial views show, both crossings are close to major intersections, and have sight distance problems. The AADT for these crossings is between 6,000 and 7,000 vehicles daily. Coal and oil are frequently carried by UP over the Muskogee crossing, which is surrounded by rail lines, major roads, and the Port of Muskogee (Figure 9).

The SH-16 crossing in Bristow is at a skewed angle, making it difficult for drivers to see train traffic coming from the left behind them. The crossing on Harris Street in Muskogee is unusual, and is difficult for unfamiliar drivers to figure out. Two crossings are located parallel to one another, and both are located near the intersection with the five-lane Okay Road, meaning that cars stopping for a train passing on the eastern rail crossing may potentially find themselves stopped on the western track, or in the intersection with Okay Road, increasing the chances for both vehicle-vehicle and vehicle-rail collisions.

The significant increase in the potential for incidents at these crossings due to growth in rail traffic vividly illustrates the time-critical need for the safety upgrades being proposed. If this application is unsuccessful, improvements at these and the other ten locations will be delayed under the current grade crossing safety program because of the limited amount of Section 130 Funding available on an annual basis.

Figure 7: Main Street (SH-16) on the SLWC in Bristow (DOT# 668769A)

Figure 8: Harris Street on the UPRR in Muskogee (DOT 413602H)

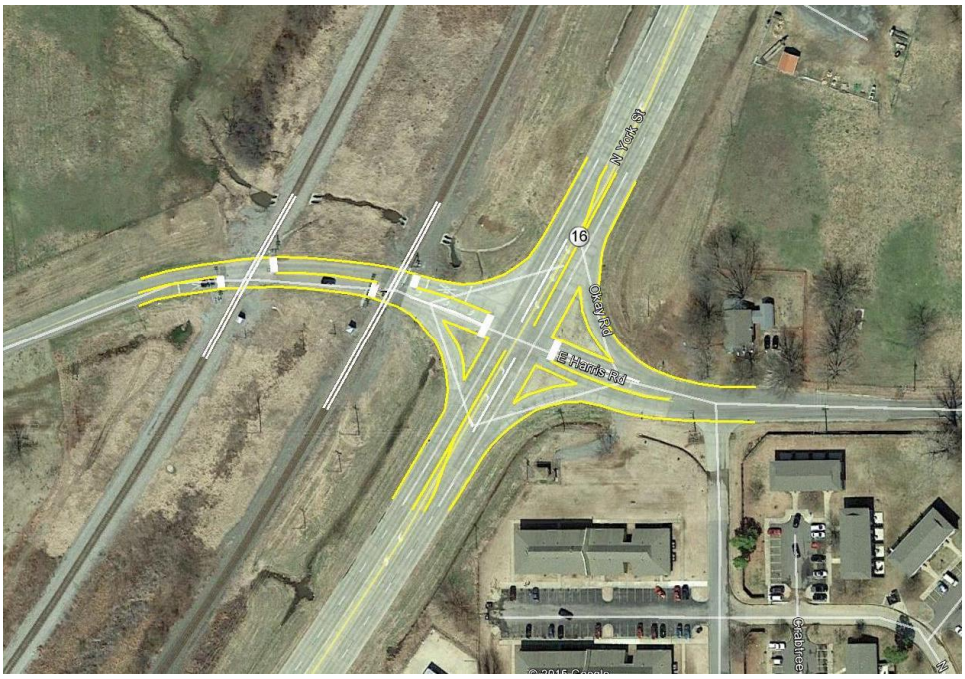
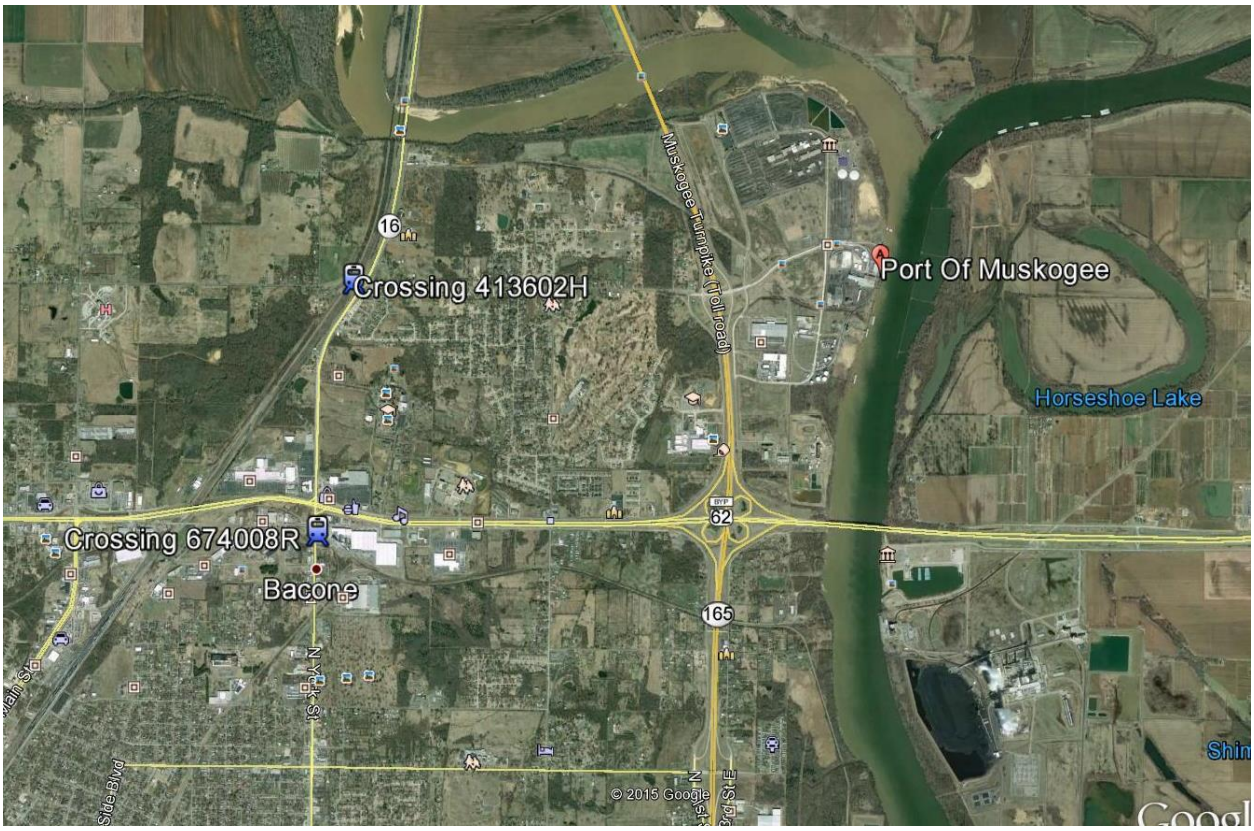


Figure 9: Port of Muskogee, Harris Avenue (DOT 413602H) & York Street (DOT# 674008R) Crossings on the UPRR and Port of Muskogee lead in Muskogee



The installation of new signals with gates and enhanced crossing improvements will decrease the probability of collisions occurring, leading to fewer fatalities, injuries and unnecessary suffering. In addition, nine of these crossings were selected for improvement because they are needed to provide safer access to the Indian Health Services Facilities.

An additional public safety benefit could result from the project's improvement to rail operations on the Sooner Subdivision. Smoother operations and reduced costs for railroad operators should allow for a shift of freight away from truck modes. Operations that facilitate and further enhance the safe and efficient transport of hazardous cargo via rail will reduce highway congestion and limit the exposure of the general population to oil shipments by placing these volatile shipments in more manageable and confined transportation corridors, compared to truck shipments, which travel along multiple highways and other roads.

The grade crossing signal and surfacing improvements may also have further impacts – specifically, there may be a reduced likelihood of train derailments. Train derailments can potentially be devastating, creating fireballs that can destroy the surrounding area causing massive property damage and loss of life. In July 2013, a 74-car freight train carrying Bakken crude oil became derailed in the town of Lac-

Mégantic, Québec causing the loss of dozens of lives and destroying a good portion of the downtown area. More recently in May 2015, a crude oil train derailed in Wells County, North Dakota igniting the surrounding area. Luckily no deaths occurred as the accident occurred in a field. As track obstructions are a potential cause for train derailment, it can be reasoned that with accident reduction following the safety improvements at each crossing, the probability of derailment also decreases.

The benefits of this improvement were not quantified as it is unlikely that this benefit will materialize. Train derailments are rarely caused by track obstructions and the probability of a crossing accident causing derailment is a small fraction of a percent. Derailments are unlikely to occur in either the No Build or the Build case, particularly as new reforms are passed to improve the safety of crude oil shipments.

An additional possible impact brought by the crossing improvements is cost savings for railroads in the form of reduced litigation. With certain incidents occurring at the crossings, it is possible that a third party may take legal action against the railroad on grounds of poor maintenance of their corridor, whether or not the railroad is indeed negligent. With the addition of gates and more generally the improvement of safety at each crossing, third parties will have fewer grounds on which to bring claims against the railroad. If the crossing improvements do in fact reduce litigation, the railroads' cost savings can be invested in expanding operations and potentially reducing shipping prices, bringing economic competitiveness benefits through lower shipping costs.

State of Good Repair

Figure 10: Maintenance Costs

Total Benefit Value (Present Value at 7% over the 20-year analysis period)		
Reduced O&M Costs	($55,767)	

Improving the crossings identified in this project will improve the state of repair for existing infrastructure that is handling increasing volumes of crude oil shipments via rail. New signal, gate and surface infrastructure will be somewhat more expensive to maintain than the existing grade crossing warning devices.

A present value of $55,767 in added costs will be required to maintain the upgraded crossing infrastructure in a state of good repair. This is a relatively insignificant sum as it is distributed over the 20-year analysis period. The cost increase is driven by the six rural crossings which currently only have passive warning devices, as active devices including gates will be installed and it is more costly to maintain active devices than passive ones. For the crossings that have existing active warning devices, the improvements will result in cost savings of approximately $1,000 per crossing per year in undiscounted 2014 dollars.

The improved crossings will also enhance rail operations, allowing for higher speeds as well as safer travel.

Economic Competitiveness

Figure 11: Economic competitiveness

Total Benefit Value (Present Value at 7% over the 20-year analysis period)		
Vehicle Travel Time Savings	$124,235	
Vehicle Operating Cost Savings	$5,803	
Rail Operating Cost Savings	$4,304,550	

The travel time savings for both vehicles and rail that will result from this project will have broad-based economic competitiveness benefits.

Travel time savings due to expedited rail throughput

Improved at grade crossing warning devices will allow for higher average train speeds and reduced transportation time of goods. This brings the benefit of reduced costs for shippers currently using rail to transport goods.

Modal switch from truck to rail

With higher average train speeds, shipper rates may decrease, thereby enhancing the attractiveness of rail as a shipping mode. Benefits of a modal switch from highway to rail generally include reduced costs for shippers, but also result in public benefits such as reduced highway congestion, fewer vehicle accidents, reductions in public exposure to hazardous material releases from trucks, decreased highway maintenance costs and the enhanced ability to define transportation corridors with a greater need for emergency service planning and coordination during catastrophic events.

Travel time savings due to reduced automobile delays

Higher average train speeds will lead to decreased automobile wait times at the crossings for passing trains, and increased accessibility of amenities in rural areas. Reduced time wasted in traffic, whether for commuting, personal travel or business travel, increases the economic competitiveness of an area.

Environmental Sustainability

Figure 12: Environmental sustainability

Total Benefit Value (Present Value at 7% over the 20-year analysis period)		
Reduced Rail Emissions	$10,388,740	
Reduced Vehicle Emissions	$1,496	

These improvements will result in reduced emissions though improved rail speeds, allowing for improved diesel fuel efficiencies during the operation of locomotives, and through the reduction of automobile delay at the crossings. Reductions in delay at the crossings will reduce the amount of time motor vehicles sit idling at grade crossings, resulting in a corresponding reduction of automobile emissions.

Figure 13: Reduction of Emissions in 2019 (short tons)

	Rail	Road	Total
CO_2	1,779	1	1,780
NOx	47	-	47
PM	2	-	2
VOC	-	-	-
Total	1,827	1	1,829

Livability

Figure 14: Environmental sustainability

Total Benefit Value (Present Value at 7% over the 20-year analysis period)		
Road Vehicle Travel Time Savings	$124,235	
Vehicle Operating Cost Savings	$5,803	

The project will provide livability for the traveling public as well as individuals living near the crossings. The project will reduce the risk of accidents and reduce vehicle emissions, providing important safety and environmental benefits, particularly in the lower-income residential areas often sited near railroads. The project will also decrease the response times for emergency vehicles at the two crossings where higher rail speeds are expected.

Figure 15: Livability Measures for the First Year of Benefits

	2019 (No Build)	2019 (Build)	Change
Persons delayed by passing trains (#)	743,524	735,454	▼ 8,070
Time spent idle at crossing (person-hrs)	31,311	30,635	▼ 676
Discounted value of idle time (2014 $)	333,710	326,505	▼ 7,204
Discounted value of vehicle O&M due to idling (2014 $)	17,307	16,934	▼ 374

Lower automobile operating costs

Further, reduced idling at crossings will result in less money spent by drivers on fuel and O&M expenditures (less wear and tear on motor vehicle engines and brakes), as well as reduced travel times, providing benefits throughout the community. The estimated benefits for the first full year of the project (2019) are shown in Figure 15. Project benefits will increase in the years to follow, as population, road traffic and rail traffic continue to grow.

Project Readiness

This project is truly "ready to go," as no new right-of-way is required for any of the 12 grade crossing improvements. No additional environmental analysis, design, or permitting/approval is needed and there are no issues that will slow the advancement of this project.

While the project schedule shows a start date in 2016, this date was chosen simply based on the assumption that U.S. DOT commits TIGER funds late in 2015. Should TIGER awards move forward at an

expedited pace, so too can this project be expedited, with the procurement process for some locations able to start immediately upon notice of award. While the project has been conservatively estimated to take three years to implement, with all of the crossing improvements being operational as of January 1, 2019, it is likely that many if not all of the crossing improvements will be operational by 2018 or sooner.

Innovation

Our specific project is not expected to result in any technological innovation, but it will result in the means to move crude oil and other volatile commodities more efficiently and safely. With fewer crashes, fewer resources need to be dedicated to accident management activities, and more resources can to be allocated to innovative transportation projects in the State of Oklahoma.

Partnerships and Disciplinary Integration

The State of Oklahoma is working together with city and county governments, the federal government, and private railroads to make this project a model for cooperative public-private infrastructure efforts in America. Oklahoma has a long and rich history when it comes to energy transportation and safety, and this project will enhance the productivity and efficiency of both these sectors.

Our TIGER application website (www.okladot.state.ok.us/tiger/index.htm) includes letters of support for this project from:

- Burlington Northern Santa Fe Railway
- Union Pacific Railroad
- Stillwater Central Railroad
- Kansas City Southern Railway

Results of the Benefit Cost Analysis

A formal benefit-cost analysis (BCA) was conducted for this project using best practices for BCA in transportation planning, and reflecting all TIGER VII grant application guidelines. It is important to note that a formal BCA is not a comprehensive measure of a project's total economic impact, as many benefits cannot be readily quantified or occur under conditions of uncertainty.

The BCA for this project covers all five of the primary long-term impact areas identified in the TIGER VII grant application guidelines:

- Safety: With the addition of warning devices, including new gates at all crossings, driver awareness of oncoming trains will improve and accidents will become less frequent. Fatalities, injuries, and property damage will all be reduced if this project proceeds.
- Economic Competitiveness: As the crossing infrastructure is improved to facilitate higher train speeds along the Sooner Subdivision, there will be a benefit to local, regional, and national economic competitiveness as rail shipping costs are reduced. This allows oil shippers, farmers, and industry to improve their logistics and grow their capabilities.

- Environmental Sustainability: The project will result in reduced emissions because the Sooner Subdivision improvements have a double benefit. Not only do these improvements allow for the optimization of train speeds, thereby reducing train emissions, but vehicle idling at the crossings is also reduced, resulting in decreased auto emissions.
- Quality of Life: With reduced accidents and reduced vehicle wait times for passing trains, travel times are reduced. This is particularly important for individuals that require access to health facilities and other important amenities located on the opposite side of the crossing.
- State of Good Repair: With the surface improvements at the crossings, the overall quality of the existing infrastructure will improve. It is expected that fewer critical repairs will be needed in the future, allowing maintenance spending to be directed towards maintaining the state of good repair on other components of the railroads.

The computed benefit-cost ratio for the grade crossing project is estimated at 8.07 using a seven percent discount rate. The BCA compares the capital construction costs, along with the increase in operating and maintenance costs, with the quantifiable benefits of the project for 20 years following construction.

The quantified project benefits are:

1. Accident reduction
2. Rail operating cost savings
3. Road vehicle travel time savings
4. Road vehicle operating cost savings
5. Rail emissions reduction
6. Road vehicle emissions reduction

Discount Rates

Federal TIGER VII guidance recommends applicants discount future benefits and costs to present values using a real discount rate of seven percent to represent the opportunity cost of money in the private sector, and a three percent discount rate when the funds dedicated to the project would be other public expenditures. This is largely the case for this project, which is five percent privately funded. The benefit-cost ratio at three percent is 12.02.

The project benefits are presented in Figure 16 using the more conservative seven percent discount rate to demonstrate that the project's long term benefits clearly outweigh the project's costs.

Figure 16: Benefit Cost Analysis Summary (in 2014 $)

Category	Present Value at 7%
Evaluated Costs	
Capital costs	$2,982,505
Maintenance costs	$55,767
Total Evaluated Costs	$3,038,272
Evaluated Benefits	
Accident reduction	$9,682,826
Rail operating cost savings	$4,304,550
Road vehicle travel time savings	$124,235
Road vehicle operating cost savings	$5,803
Rail emissions reduction	$10,388,740
Road vehicle emissions reduction	$1,496
Total Evaluated Benefits	$24,507,649
Net Present Value	$21,469,377
BENEFIT/COST RATIO	8.07

Cost Benefit Results

Figure 16 summarizes the project's cost and the quantifiable benefits in terms of present value. Detailed analysis of costs and benefits, including data sources and methodology descriptions, are available on the project website in the BCA Technical Memo. As shown in the table, the present value of the project's capital and maintenance costs are $3.0 million. The benefits have an estimated present value of $24.5 million over the 20-year period, yielding the 8.07 benefit-cost ratio.

While the BCA assesses the project for a 20-year period, the project's assessed benefits are projected to cover the total project costs within 2 years of operation (before the end of 2020). This is illustrated in Figure 17.

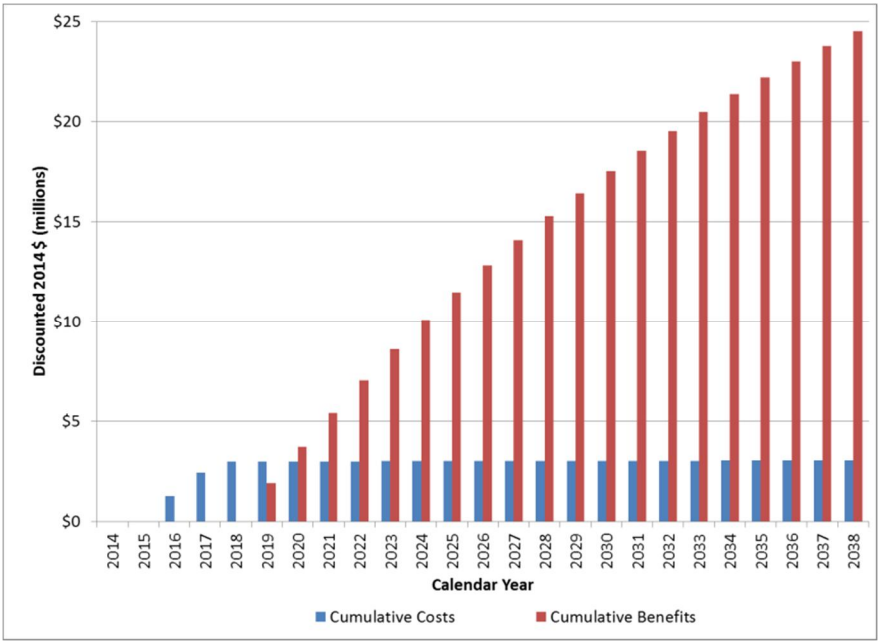
Benefit Calculation Assumptions

The Benefit Cost Analysis is based on the difference between an assumed Build scenario and an assumed No Build scenario, both of which were developed conservatively.

Under the No Build scenario, routine maintenance expenditures are assumed to continue at $2,500 to $3,000 per year for each grade crossing with existing active warning devices, and at $50 per year for each grade crossing with passive warning devices. No major refurbishment or replacement of the existing infrastructure is anticipated, and it is expected that none of the crossings will be subject to grade separation before 2038.

The analysis assumes that rail will continue to be an important mode of freight transportation within and through Oklahoma. For example, in the event new pipeline capacity is created to connect the Bakken region to its markets, it is assumed freed rail capacity in Oklahoma will be used to transport other commodities. Road and rail traffic are forecast to grow at a rate of 2 percent per year.

Figure 17: Cumulative Benefits and Costs in 2014 Dollars (Discounted at 7 percent)



In the Build scenario, the same assumptions with respect to road and rail traffic growth are used. In addition, the proposed signaling and surfacing improvements will proceed at the 12 rural grade crossings as detailed in Figure 2. Two crossings along the Sooner Subdivision will also be equipped with lengthened circuit approaches to facilitate train speeds of 10 mph higher than present, although there will be no impact to train volumes beyond what is assumed in the No Build scenario. Figure 18 illustrates the impact of the Build scenario on some key factors driving the benefit evaluation.

Capital expenditures and construction will take place during a three year period beginning in 2016, with the improvements yielding their first full year of benefits in 2019. As a result of these improvements, maintenance expenditures are expected to increase.

Figure 18: Project Impacts for Grade Crossing Improvements, Cumulative from 2019-2038 (inclusive)

Category	Quantity
Road vehicle travel time (person-hours)	▼ 20,227
Road vehicle travel time (vehicle-hours)	▼ 13,919
Rail travel time (train-hours)	▼ 44,209
Tons of rail vehicle emissions (tons of CO_2, NOx, and PM emitted)	▼ 37,244
Tons of road vehicle emissions (tons of CO_2, NOx, PM, and VOC emitted)	▼ 42
Total accidents (number)	▼ 20
Total fatalities (number)	▼ 2

Accident Reduction

With improved warning devices at each crossing, the frequency of accidents will decrease. The 12 crossings are presently equipped with passive devices and some have flashing lights, but all lack gates. These crossing characteristics served as inputs to the U.S. DOT Accident Prediction Model (APM), which was used to forecast accident frequency in the No Build scenario. Other inputs to the model

include road and rail traffic volumes, and historical accident frequency as per the FRA Accident Reports for each crossing. As an output of the APM, the number of accidents in the base year (2014) was modeled as 1.42 accidents, gradually growing in line with road and rail traffic to 1.88 accidents in the final forecast year, 2038.

The APM was run a second time for the Build scenario. The key variable impacting the APM's outputs was the addition of gates at all crossings, which are proven to reduce the anticipated frequency of accidents. The Build scenario models 0.62 accidents in the first year of operation, 2019, which also grows slowly year over year to 0.77 accidents in 2038. These accident rates are less than half of the rates in the No Build scenario.

The TIGER BCA Resource Guide (2015) was used to monetize these forecasted accident rates. The present value of accident reduction is $9.7 million, which represents 40% of the total monetized benefits in this analysis. This dollar value is driven primarily by a reduction in fatalities, which makes up approximately 12% of the total accidents, a figure consistent with the accident counts reported by the Bureau of Transportation Statistics (BTS). As the safety engineering of vehicles continues to improve, it is possible that the share of fatalities will reduce in the future, although this condition applies to both the Build and No Build scenarios and therefore has minimal impact on the analysis.

Rail Operating Cost Savings

The hours of rail operation saved due to the 10 mph speed increases along the Sooner Subdivision translates into a reduction of rail operating costs. The benefits are fourfold – with fewer hours of service, employee wages, fuel expenditures, and railcar rental costs decrease and locomotives are utilized more efficiently. With reduced rail operating costs, railroads can either use the savings to reinvest in their business, or pass on the benefit to their customers by offering lower prices.

The total hours saved was forecasted to be 44,209 hours over the 20 year period. This results in a conservative estimate of rail operating cost savings at $4.3 million, which is a little under half the value of accident reduction. This estimate used an assumed value of $251.75 per train-hour of operation, which was derived from a 2008 study by RailTEC at the University of Illinois at Urbana-Champaign. Other sources suggest hourly costs are on the order of $1,000 per train-hour, although given that the corridor services primarily bulk-goods trains, the smaller value seems more appropriate.

Road Vehicle Travel Time Savings

With improved train speeds, there is decreased blockage time at the crossing and road users realize travel time savings. The impact of this benefit varies between individuals. Many users make their trips outside of the scheduled times of passing trains and are unaffected, while others are delayed multiple times per day. It is the aggregated benefit for all users that is considered in the BCA.

Based on train speed and frequency, along with the lead/lag time associated with each passing train, the total change in blockage time per train is estimated at a little over 50 seconds per passing train. Multiplying this by the number of trains and road users that are blocked over a 20-year period, and considering that there are two rural crossings with lengthened circuit approaches, the result is 13,919 vehicle-hours of travel time saved. Following U.S. DOT and BTS data regarding passengers per vehicle

and vehicles per mode (automobile, truck, and bus), this travel time savings translates into 20,227 person-hours.

Based on the total person-hours saved along with an assumed dollar value of time per the TIGER BCA Resource Guide, the present value of travel time savings benefits was calculated to be $124 thousand. This benefit is relatively small at only 0.5% of the total monetized benefits, primarily due to low average daily traffic in rural areas as compared to urban ones.

Road Vehicle Operating Cost Savings

An additional benefit of reduced vehicle-hours is reduced wear and tear on the engine, reduced fuel expenses, and generally reduced vehicle operating costs. Reduced vehicle expenses bring economic benefits by way of freeing up more personal and corporate income for spending elsewhere. Vehicle users also have the ability to choose between more frequent vehicle use or less frequent fueling and servicing trips. In the case of the latter, there is an additional benefit of freed up personal time.

The 13,919 vehicle-hours of travel time saved were multiplied by all-inclusive hourly idling cost values found on the FHWA website to arrive at a present value of $6 thousand in benefits. Similar to the road vehicle travel time savings benefit, many road users will individually realize minimal or no benefits, while others will realize noticeable benefits. Overall, due to low traffic levels in rural areas, the collective benefits over the 20-year analysis period are limited.

Rail Emissions Reduction

With the train-hours saved from quicker speeds through the Sooner Subdivision in the Build scenario, there is an additional benefit of reduced rail emissions. Although the miles traveled are equal in the Build and No Build scenarios, train engineers in the Build scenario are able to operate at more optimal and consistent speeds throughout the corridor, and therefore utilize diesel fuel more efficiently. This benefit aligns closely with the long-term TIGER criteria of environmental sustainability, as fewer harmful pollutants are generated causing less strain on the ecosystem and on resident health and well-being.

A 2015 study by RailTEC at the University of Illinois at Urbana-Champaign describes train delays as costing $25.35, $103.02, and $175.42 per locomotive-hour for CO_2, NOx, and particulate matter emissions, respectively. These assumptions were used to arrive at a present value of $10.4 million in benefits for reduced emissions, which is on the same order as the accident reduction benefit and constitutes 42 percent of the total monetized benefits.

Road Vehicle Emissions Reduction

Similar to road vehicle operating costs, road vehicle emissions are also reduced as a result of the vehicle-hour savings from lesser idling. In this case it is gasoline combustion that is the primary source of emissions. Diesel combustion is secondary. The societal benefits are similar to those of rail emissions – with fewer pollutants entering the atmosphere, there is a positive impact on the ecosystem and on resident health and well-being.

Road vehicle emissions were modeled slightly differently than rail emissions, which was necessary as the source of the benefit is reduced idling rather than optimized speed and fluidity. In this case, idling

emissions rates in grams per hour were determined for CO_2, NOx, particulate matter, and volatile organic compounds from the EPA for automobiles and diesel-powered trucks and buses. These emissions rates were multiplied by the change in vehicle-hours and converted to short tons. It was determined that 42 tons of emissions will be reduced over the 20-year horizon, the majority of which are CO_2 emissions. This translates into a present value of $1.5 thousand for the benefit of reduced road vehicle emissions.

Other Non-Quantifiable Costs and Benefits

There are a number of other project benefits as well as costs that could not be reasonably quantified for the benefit-cost analysis. Among these were:

- Travel time savings resulting from fewer accidents: While accident reduction was monetized as was travel time savings resulting from reduced idling, there are also travel time savings due to fewer accidents as there will be less frequent lane closures and lane blockages. This benefit was not monetized as it is difficult to quantify the number of hours that would be saved. The standard deviation among quantity and duration of lane blockages per accident is very high, even among accidents of the same AIS level. There is also a large variance in road users' preferences as to whether or not to alter their route to escape any closures or congestion.
- Improved community connectivity: With fewer road blockages and shorter travel times, residents have improved access to amenities that are located on the opposite side of the crossing from which they live. This is especially relevant in rural areas where access to Indian health facilities is of particular importance.
- Improved emergency response times: With fewer blockages and quicker train speeds comes the benefit of improved emergency response times. A 50 second reduction in idling time at a crossing could be the difference between life and death for an individual located on the opposite side of the crossing as the nearest emergency vehicle.
- Modal shift from trucking to rail: With the reduction in rail operating costs along the Sooner Subdivision, there are two possible outcomes – either the railroads will invest the cost savings in the business and grow their operations more quickly, or they will pass on the cost savings to the customers. The ultimate outcome is increased rail capacity, reduced shipper fees, or both. These outcomes could entice shipping companies to re-evaluate their choice mode of transport and it is possible that some shift from road to rail would result.
- Noise reduction: As a result of faster train speeds along the Sooner Subdivision, there will be less road vehicle idling. There are public benefits in the form of noise reduction particularly as it relates to trucks, which can be noisy when idling. In addition, with a smaller probability of being blocked by a passing train, it is expected that trucks will less frequently apply their engine brakes to come to a full stop at the crossings.
- Increased pedestrians and bicycles: Another possible outcome resulting from less congestion, fewer emissions, fewer accidents, and reduced noise is a greater incentive for walking and bicycling at and around the crossings. This brings health benefits in the form of increased pedestrian and bike miles while likely further reducing automobile emissions.

Job Impacts

Introduction

The surfacing and signaling improvements of the Build scenario are expected to create near-term economic impacts for the state of Oklahoma. These impacts would be distributed well across the state as the 12 grade crossings are located in 11 counties, spanning most corners of the state aside from the Oklahoma Panhandle. Economic impacts are driven by an increase in construction spending, with construction funds originating from outside the local economy being of particular significance (e.g., federal grant funding). These project expenditures would generate a short term increase in demand for engineering and technical services, as well as construction-related labor and materials.

To quantify the near-term economic impacts of this project, this analysis utilized an input-output modeling framework based on multipliers from MIG Inc., the developers of IMPLAN.[1] U.S. National-level data were selected for the economic profile and multiplier set to enable simple comparison between projects for the purposes of TIGER grant funding. However, it is understood that local regions will generate employment and economic output at rates that may vary from the national average.

Two types of economic impacts are identified for the purpose of this analysis:

- Direct/Indirect Impacts: Direct impacts represent new spending, hiring, and production by civil engineering construction companies to accommodate the demand for resources in order to complete the project. Indirect impacts result from the quantity of inter-industry purchases necessary to support the increase in production from the construction industry experiencing new demand for its goods and services. All industries that produce goods and services consumed by the construction industry will also increase production and, if necessary, hire new workers to meet the additional demand.
- Induced Impacts: Induced impacts stem from the re-spending of wages and salaries earned by workers benefitting from the increase in direct and indirect expenditure activity within an area. For example, if an increase in construction demand leads to new employment and earnings in a set of industries, these workers will spend some portion of their increased earnings at local retail shops, restaurants, and other places of commerce, and thereby further stimulate economic activity.

Costs

The Build scenario forecasts total capital costs of $3.60 million (2014 $). The spending schedule for the project is provided below in Figure 19.

Figure 19: Capital Costs for Project (2014 $ millions)

2016	2017	2018	Total
1.44	1.44	0.72	3.60

[1] http://implan.com/

Results

A summary of the short term economic impacts are shown in Figure 20.

Figure 20: Summary of Near-Term Economic Impacts

Direct + Indirect Impacts	
Employment (Person-Year Jobs)	35 jobs
Earnings (2014 $)	$2,163,900
Economic Output (2014 $)	$6,892,100
Induced Impacts	
Employment (Person-Year Jobs)	20 jobs
Earnings (2014 $)	$1,005,300
Economic Output (2014 $)	$3,077,000
Total Impacts	
Employment (Person-Year Jobs)	55 jobs
Earnings (2014 $)	$3,169,300
Economic Output (2014 $)	$9,969,000

Assuming the grant is awarded to complete construction funding, the crossing improvements project is expected to generate economic impacts for the region beginning in 2019 at the latest. In total, the project is projected to create employment of 55 person-year jobs, including 35 direct/indirect person-year jobs. A person-year is one person working full time for one year. As an example, 20 person years can represent 20 people each working one year, or ten people working for two years each. Figure 21 shows the number of persons directly and indirectly employed by the project per year.

Figure 21: Direct and Indirect Jobs by Year

	2016	2017	2018
Direct and Indirect Jobs	14	14	7
Induced Jobs	8	8	4

The project will generate an estimated average of 18 direct, indirect, and induced jobs per year over 3 years. This includes 12 direct and indirect jobs, and 7 induced jobs. Figure 22 shows the profile of annual employment generated by the project's expenditures.

Figure 22: Annual Employment During Construction

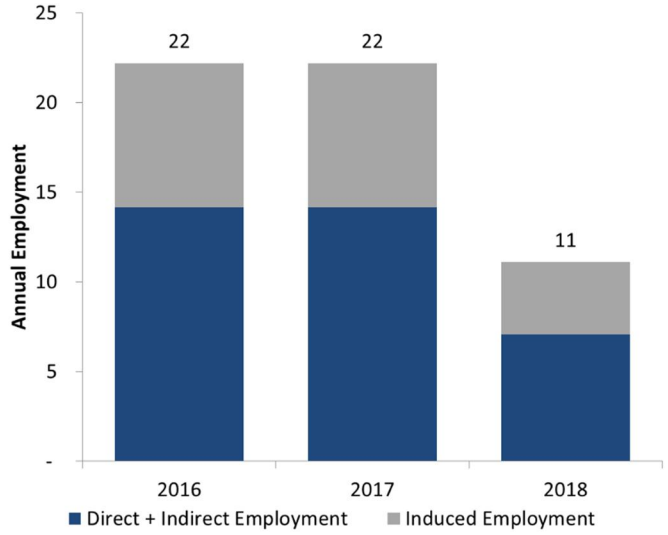
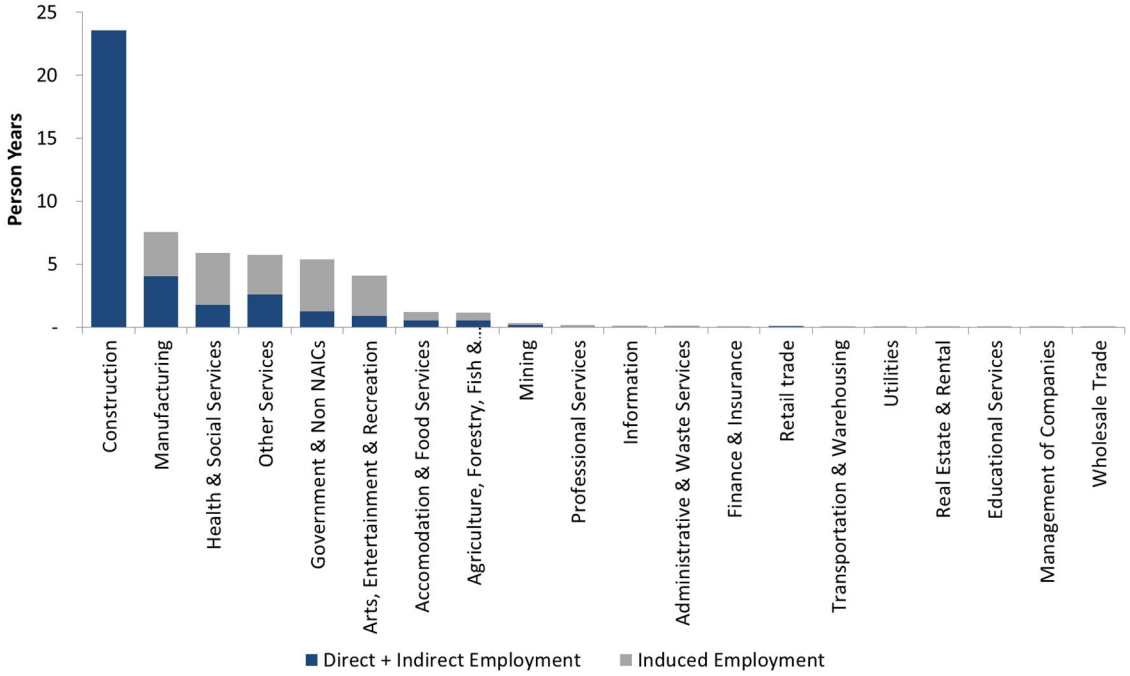


Figure 23 shows the breakdown of jobs created by industry and type of impact. As expected, the civil works construction sector is estimated to receive the largest increase in employment from the project (24 person-year jobs), almost all of which are direct jobs created. The other industries that will see the largest levels of new employment created include manufacturing (8 person-years of employment), healthcare and social services (6 person-years), other services (6 person-years), government (5 person-years), and arts, entertainment, and recreation (4 person-years).

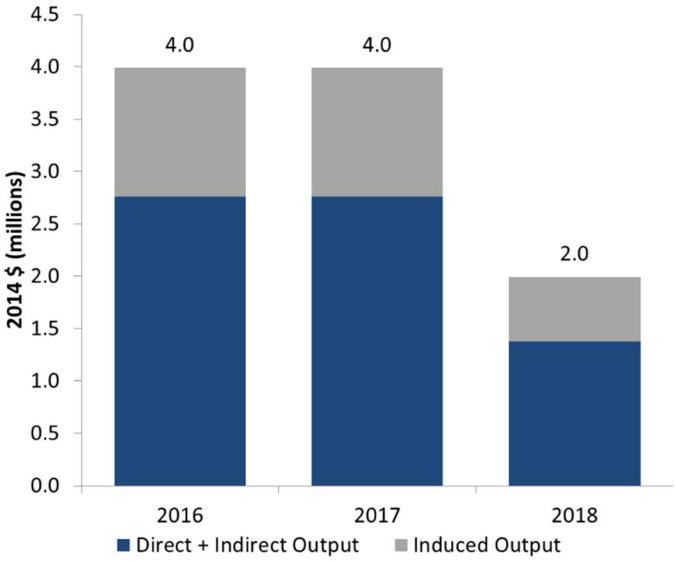
Figure 23: Breakdown of Job Creation by Industry Sector and Type of Impact



The amount of short term economic activity generated by the project is shown in Figure 24. In total, the project will generate $10.0 million in gross real economic output or activity (measured in 2014

dollars), with $4.0 million dollars of economic output generated in each of 2016 and 2017, and $2.0 million generated in 2018.

Figure 24: Breakdown of the Value of Economic Output/Activity Generated by the Project



Changes since Pre-Application Submission

There are no changes since the Pre-Application.

Wage Rate Certification

OKLAHOMA DEPARTMENT OF TRANSPORTATION

As required in the Notice of Funding Availability for the Department of Transportation's National Infrastructure Investments (Tiger FY 2015) Under the Full Year Continuing Appropriations, 2015: The Oklahoma Department of Transportation states and assures that I will comply with the requirements of Subchapter IV of Chapter 31 of Title 40 United State Code, the federal Wage requirements.

Mike Patterson, Executive Director
Oklahoma Department of Transportation

6/4/15

Date