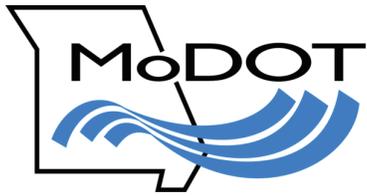


Missouri Department of Transportation

Safety and Operational Improvements to the I-70 Corridor in Missouri



Submitted to:
United States Department of Transportation
Office of the Secretary

Application for Funding Opportunity under the
Department of Transportation's BUILD Transportation
Discretionary Grants for Fiscal Year 2018

June 19, 2018

1.0 Introduction

The Missouri Department of Transportation (MoDOT) is seeking \$25 million in BUILD Grant funding from the USDOT to supplement more than \$35.6 million of state funds for improvements to I-70, a route on the USDOT Primary Highway Freight Network of national and regional significance. The transportation crossroads for the entire nation, Missouri's strategic location puts it within 500 miles of 43 percent of the U.S. population, 44 percent of all U.S. manufacturing plants and seven of the top 25 international cargo hubs in the U.S. Missouri is also home to the country's 2nd and 3rd largest rail hubs in Kansas City and St. Louis, respectively. The planned highway upgrades and safety enhancements will benefit not only Missouri and the Midwest region, but the entire nation by enhancing the safety and reliability of this critical national freight highway corridor.

Significance of Missouri's Freight Corridors

- ☑ Carries 100 Million tons of freight worth \$154 billion
- ☑ About 30% of tonnage and 60% of value is through-traffic: freight moving through Missouri to and from other states
- ☑ Over 1.1 million jobs nationwide depend on I-70 in Missouri
- ☑ \$113 billion of the nation's GDP depends on I-70 in Missouri
- ☑ Over 20% of through-freight on I-70 originates as far away as Florida, Nevada, and Washington
- ☑ Agricultural products from rural counties comprise about one-fifth of freight leaving Missouri via I-70

2.0 BUILD Grant Request

MoDOT is requesting a BUILD Grant of \$25,000,000 to leverage more than \$35.6 million in state funds for improvements in the I-70 corridor. Table 1 below provides a breakout of the costs and anticipated funding sources for these three I-70 projects.

TABLE 1: MISSOURI BUILD GRANT REQUEST: OVERVIEW OF ANTICIPATED FUNDING FLOW

Project	Amount (\$, in thousands)		
	Total Cost	BUILD	State Funds
I-70 Corridor-wide Incident Management	\$36,608	\$15,000	\$21,608
I-70 High Hill Curve	19,000	7,750	11,250
I-70 Climbing Lanes at Mineola	5,000	2,250	2,750
Totals	\$60,608	\$25,000	\$35,608

All costs shown in Table 1 are future costs and include no previously-incurred expenses.

Grant Recipient

The Missouri Department of Transportation (MoDOT) will be the recipient of the requested BUILD Grant.

3.0 Project Description and Location

The projects on I-70 comprising this request for a USDOT BUILD Grant will leverage both current and past investments and serve the long-term needs of the vital national and regional freight transportation system. These projects are among the most critical needs identified throughout the state to support the safe and reliable movement of freight across Missouri and throughout the United States. In addition to trans-continental traffic, the I-70 corridor also supports critical freight movements serving rural parts of Missouri, particularly in the non-metropolitan regions, and will help the agriculture industry address the challenges of moving agricultural products from farm to market. Annually, I-70 in Missouri carries about 100 million tons of freight worth over \$154 billion. About *30 percent of this tonnage and 60 percent of this value is through-traffic* – freight moving through Missouri to and from other states. In addition, over 1.1 million jobs nationwide and \$113 billion of the nation’s GDP depend on I-70 in Missouri.

Over 1.1 million jobs nationwide depend on the reliability and performance of I-70 in Missouri

Given its national significance, I-70’s performance is a vital and urgent national economic concern. Traffic from throughout the United States is subject to increasing safety risk and incident delay each year due both to the current state of repair as well as events ranging from crashes and routine road work to winter storms that jeopardize I-70’s performance. As freight demand and traffic volumes grow, I-70 is increasingly in need of modernization to both support ongoing safe and efficient traffic flow and reduce the impacts of incidents. Between 2011 and 2016, the number of crashes, mainly in the rural segments of I-70, *grew by 2.7 percent*, including 76 fatalities. These statistics underscore the importance of MoDOT’s plans for corridor-wide incident management in the rural segments of I-70 and the projects to address safety and capacity deficiencies disrupting the flow of national traffic. As shown in the supporting analysis and documentation, the projects described below and proposed in this application are expected to *save highway users, including freight carriers, over 2.7 million hours of travel time, and more than 2 million vehicle miles of diversion as well as prevent 800 crashes*. Implementation of these improvements is the first step in making significant gains in safety and reliability on these corridors. By focusing on the most critical bottlenecks and causes of disruption, the most essential improvements can be made while minimizing the overall necessary capital outlays. Collectively, these improvements will provide system-wide benefits of national and regional significance.

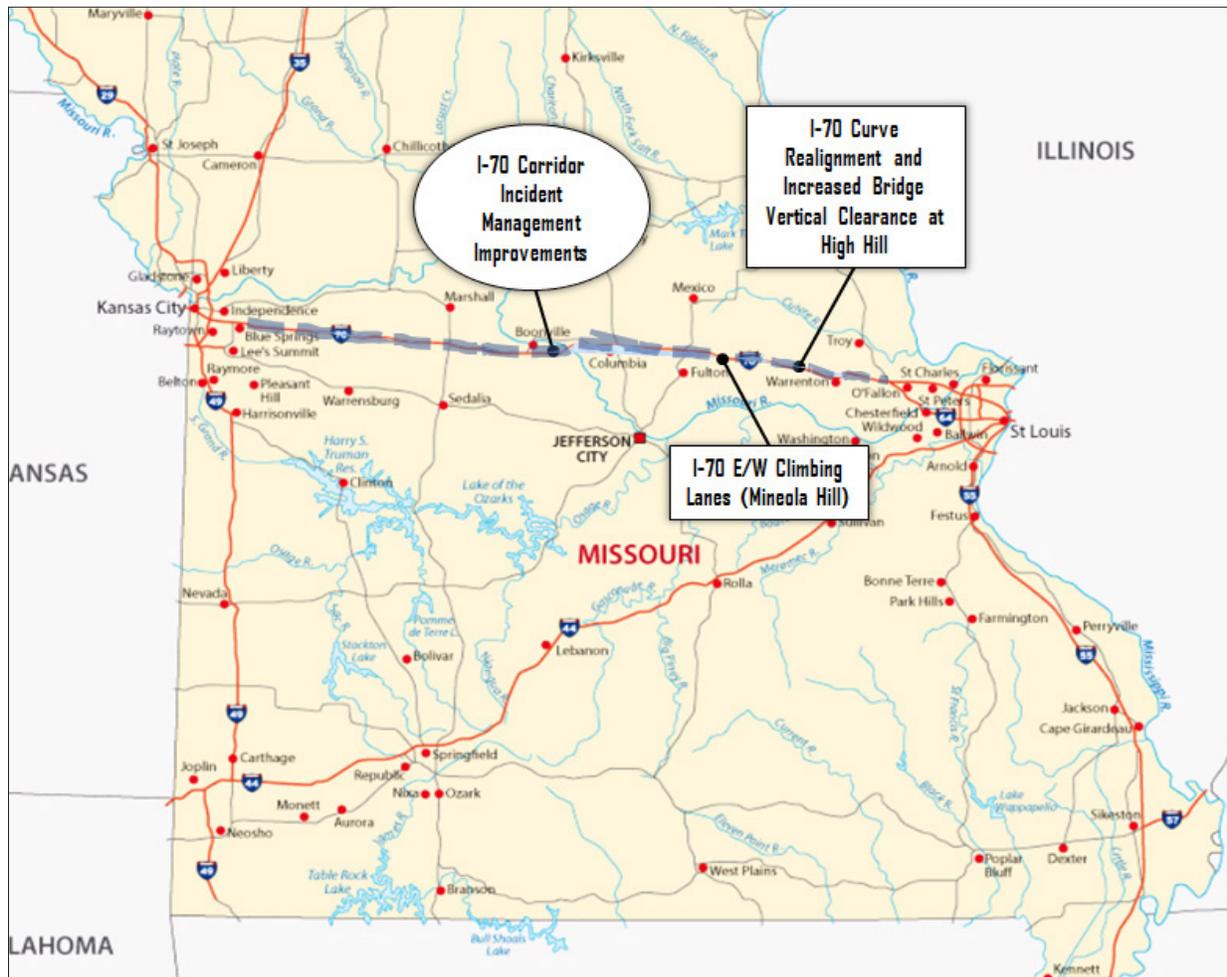
MoDOT will use the design-build delivery method to speed implementation of these projects, maximize the scope of work, and spur innovation. MoDOT has an excellent track record using the design-build approach, delivering over \$1.5 billion in projects, and saving taxpayers \$275

million. Collectively, MoDOT's design-build projects have been completed *86 months (7 years) ahead of schedule*. Nationally, design-build projects are completed 33 percent faster and 6 percent cheaper than conventional design-bid-build projects. This is largely the result of innovative solutions fostered by the design-build approach, and MoDOT expects similar results from the proposed BUILD projects. MoDOT is also considering a design-build-finance approach that could accelerate project delivery further by seeking contractor financing through construction until MoDOT has additional bonding capacity or available cash flow.

MoDOT has delivered \$1.5 billion in design-build projects 86 months (7 years) ahead of schedule

Figure 1 below provides an overview of the I-70 projects.

FIGURE 1: OVERVIEW OF I-70 PROJECTS FOR BUILD GRANT FUNDING



Development and Identification of Project Priorities

The projects included in this application are high-priority statewide freight improvements identified in the [Missouri State Freight Plan](#). These projects align with the objectives of the BUILD Grant program and represent a practical approach to eliminating critical freight bottlenecks on the USDOT Primary Highway Freight Network.

From November 2013 to November 2014, MoDOT engaged freight stakeholders for input into the Missouri State Freight Plan. These stakeholders included Metropolitan Planning Organizations (MPO), Regional Planning Commissions (RPC), economic developers, modal operators, business organizations and freight operators and owners.

Over 100 stakeholders at three regional forums developed project evaluation criteria and weightings that focused on the safe, efficient movement of goods supporting economic benefits for Missouri.

MoDOT narrowed the list of 3,800 suggested projects to 122 multimodal projects that were consistent with the freight plan goals, on the state network, and could be ready for construction within seven years. Using the scoring criteria defined and weighted through the stakeholder engagement process, MoDOT evaluated and approved the highway projects included in the Missouri State Freight Plan. These criteria focused on *freight* and *economic development*.

The I-70 improvements highlighted in this BUILD Grant application were rated as high statewide priorities. The scoring criteria used to develop this BUILD project list is consistent with the criteria used to score highway related projects in the Missouri State Freight Plan.



4.0 How the I-70 Projects Satisfy BUILD Grant Criteria

CRITERION A: Safety

To improve response times and incident clearance times on rural I-70, MoDOT will use the design-build approach to spur innovation and explicitly consider performance outcomes. MoDOT anticipates this method will lead to improved safety in the rural sections of the I-70 corridor by maximizing available resources and combining traditional and technological strategies. *Traditional Strategies* may include installing additional emergency crossovers, emergency exit ramps, and improvements to outer road connections to better facilitate diversion opportunities. *Technology Strategies* may include additional closed-circuit television (CCTV) cameras, additional dynamic message signs (DMS), truck parking availability hardware and software, and expanding MoDOT’s real-time, automated congestion warning system along I-70. The congestion warning system is a software-based tool that monitors live traffic speeds 24 hours a day and immediately pushes warning messages to rural DMS whenever backups occur on the interstate.



CRITERION B: State of Good Repair

Overall, the improvements to the system will reduce annual operation and maintenance (O&M) costs on many facilities and decrease the need for other preservation improvements later. The differences between cost streams shown in the workbook of Appendix B and described in Appendix A demonstrate in dollar terms how these savings contribute to the overall project benefits (and net costs).



In addition to the safety and reliability benefits, it is expected these projects would also *reduce ongoing operations and maintenance (O&M) costs* via reconstructed pavement and bridges as well as less diversion of traffic, particularly large trucks, onto less substantial roads. The proposed BUILD projects would result in an estimated O&M savings of \$33 million (7 percent discount rate) to \$49 million (3 percent discount rate). Furthermore, the proposed projects will not create a situation in which MoDOT is dependent upon additional federal grant funding to operate and maintain the improvements.

CRITERION C: Economic Competitiveness

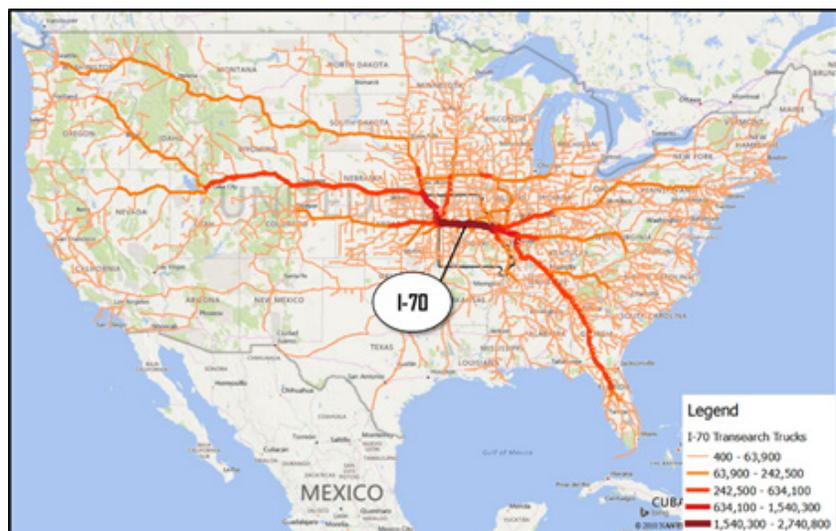
Missouri's central location and diverse infrastructure has made the state a logistics hub for the nation. Each year, over \$700 billion of freight travels through, to, from, or within the state, facilitated by a diverse, interconnected transportation system that includes:

- Interstate highways traversing the state
- The nation's second and third largest rail hubs -- Kansas City and St. Louis
- The cargo-carrying Missouri and Mississippi Rivers have the most northern year-round shipping in the U.S., with a direct connection to the Gulf of Mexico and freight opportunities from the newly expanded Panama Canal
- Three of the nation's top cargo airports -- Kansas City (37), St. Louis (56), and Springfield (106)

I-70 is the heart of national and regional distribution and commodity flows

The national east-of-the-Mississippi interstate network serving regional and national supply chains converges at the iconic gateway to the west at St. Louis. This is *the nation's second largest east-west interstate connection hub*. The linkage of businesses in the East North Central, Northeast, Mid-Atlantic and Southeast regions of the U.S. via I-55 North, I-64 East, I-270 North/I-70 East and I-55 South at St. Louis is critical to regional and national supply chains that extend to the west on I-70. For example, *over 30 percent of the freight moving on I-70 in Missouri is through-traffic*. I-70 is an artery of

commerce serving the heart of national and regional distribution and commodity flows, from rural areas in the west on to New York and New England, and to Philadelphia, Baltimore, and Washington in the Mid-Atlantic. The multimodal crossroads of American commerce in St. Louis and the connections to the West North Central via I-29 and I-35 in Kansas City are critical to business and population in rural areas and Western state urban areas as well. American exports reach to the Gulf Coast ports through the highway connectivity to the Missouri and Mississippi River ports served by I-70. In addition, the rail freight that flows to St. Louis from the East Coast and to Kansas City from the West Coast relies greatly on I-70 for inland distribution by truck in Missouri and throughout the Midwest. Overall, these I-70 projects will help provide long-term reliability and resiliency for these national and regional freight networks.



CRITERION D: Environmental Protection

The mission statement for MoDOT's environmental steering committee states that "MoDOT is committed to a sustainable environment for all Missourians and using innovative tools and methods to provide an affordable, diverse, convenient, livable and eco-friendly transportation system, while creating jobs, providing better options for travel and improving the quality of life in Missouri."



Environmental sustainability benefits are derived from reductions in a variety of emission types released into the air as a result of vehicle operations. Avoidance of long diversion routes as necessitated by congestion, incident management or construction/maintenance activities would result in fewer tons of damaging emissions being released as well as a reduction in the amount of fuel used, and thus less cost imposed on society. Reducing congestion on I-70 will have the

potential to improve air quality by shortening travel times and reduce the number of vehicles who idle for extended time during periods of congestion.

In addition, between 2000 and 2009, MoDOT conducted environmental studies on the 200-mile I-70 corridor between Independence and Lake St. Louis, in accordance with the National Environmental Policy Act (NEPA). Those studies fully evaluated the impacts of I-70 improvements on the natural and human environments and made commitments to avoid, minimize or mitigate those impacts. In the case of Mineola Hill, MoDOT has documented the presence of significant cultural resources and a threatened and endangered species in the project area as well as measures to protect them.

CRITERION E: Quality of Life

The I-70 improvements proposed in this BUILD grant application hold the promise for appreciable positive impacts on the lives of both Missourians and those visiting our state for business or pleasure. For example, crashes and incidents on I-70 will often require significant numbers of cars and trucks to divert onto other state and local roads. In some cases, such a road functions as the main street of a small town that is then overwhelmed with diverted traffic and the congestion, safety, noise, and emissions impacts accompanying it. With faster and more effective incident clearing tools and methods in place, the incidence of these local road diversion events should decrease substantially. In addition, these projects will help improve the reliability and safety of the I-70 corridor, resulting in safer driving conditions, reduced time spent by cars and trucks in congested conditions, and better overall mobility for Missouri's residents, businesses, and visitors.



CRITERION F: Innovation

As highlighted earlier, MoDOT has *great success with design-build* projects since 2005, with 10 projects completed and 2 others under construction. As recent experience has shown, design-build opens the door for innovation and promotes accelerated construction and added value on projects. Collectively, MoDOT's design-build projects have been completed *\$275 million under budget and 86 months ahead of schedule*. Nationally, DB projects are completed 33 percent faster and 6 percent cheaper than conventional design-bid-build projects. MoDOT intends to use design-build to deliver several of the proposed projects, including the *incident management projects* on the I-70 corridor. MoDOT has a long history with operating effective traffic incident management in Missouri's most urbanized areas. However, crashes on the Interstates in the state's rural areas present many more challenges related to response time, incident clearance times, traffic delays, and secondary crashes. In Missouri, rural I-70 accounts for approximately 3,500 crashes per year. FHWA estimates approximately 25 percent of congestion is caused by traffic crashes. In addition, for every minute a freeway travel lane is blocked during peak travel times, four minutes of delay result. Further, these primary crashes periodically result in more severe secondary crashes.



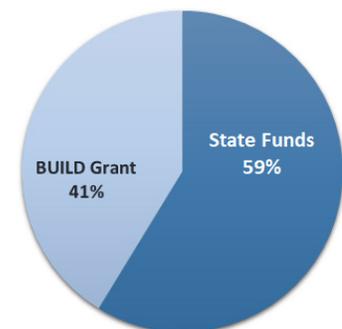
CRITERION G: Partnership

Local communities may also build upon these projects through the Missouri Highways and Transportation Commission's cost-share program to expedite important local projects. Since 1998, \$462 million in MoDOT funds have supported the construction of locally-important projects totaling \$1.1 billion by leveraging funds from local entities. Utilization of the cost-share program near the projects included in this BUILD Grant application could swell the transportation improvements made to these facilities and bring additional locally-sourced funds to the table. Likewise, the state legislature has created the 21st Century Transportation Task Force to identify solutions for increasing the state's transportation funding. Such an increase would allow MoDOT to expand on the proposed BUILD improvements and further improve these corridors of national and regional significance.



CRITERION H: Non-Federal Revenue for Transportation Infrastructure Investment

MoDOT's plan for funding implementation of these three I-70 projects seek *only 41 percent* of total project costs from the BUILD Grant. All remaining funds will be comprised of state funds.



5.0 I-70 Improvement Projects

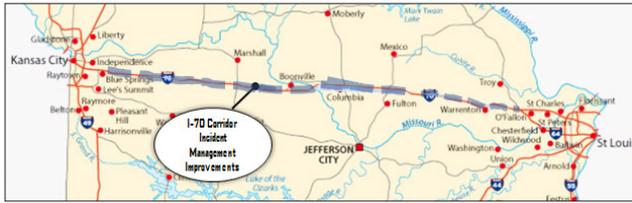
MoDOT has been studying the needs of Missouri’s “Main Street” – Interstate 70 – for nearly two decades, seeking remedies for condition, capacity and safety problems that plague one of the nation’s oldest and most important interstate highways – constructed from 1956-65.



An Environmental Impact Statement (EIS) completed in 2006 concluded I-70 should be rebuilt from the ground up with a minimum of one additional lane in each direction, and with reconstructed interchanges. In 2009, MoDOT completed a Supplemental EIS that compared the previous identified alternative with an eight-lane I-70 featuring two lanes in each direction dedicated to long-haul trucks, and two lanes in each direction for general purpose traffic.

However, with the onset of disruptive technologies, it’s now possible the safety and reliability of I-70 could be greatly enhanced at a fraction of the previously estimated reconstruction costs of \$2-4 billion. Innovations in vehicle-to-vehicle and vehicle-to-infrastructure communication, autonomous vehicles, and the like, are creating new opportunities to maximize system efficiency and highway safety. Aware of this shift, MoDOT proactively launched its [Road to Tomorrow](#) program in 2015 seeking new ideas and technologies for creating a 21st century I-70, an information and innovation corridor across the heart of the country. MoDOT is willing and actively pursuing new solutions to accommodate today’s transportation and economic needs. With such innovation and technology looming, MoDOT is now focusing on implementing the most critical, yet practical improvements along I-70 to address deficiencies with the most significant national and regional implications.

I-70 Incident Management Improvements



MoDOT will implement a package of incident management improvements on the rural segment of I-70 between Exits 21 and 210, with a goal of reducing average incident clearance time as well as the frequency of secondary crashes resulting from traffic stopped due to the primary incident.

Goal: Improve overall safety and reliability for vehicles (passenger and freight) in the I-70 corridor by reducing response times, clearance times, and secondary crashes

Key Elements: Add new emergency crossovers, new emergency off-ramps, improved outer road connectivity, additional dynamic message signs (DMS) and closed-circuit television (CCTV), and potentially, truck parking availability systems; also expand MoDOT's automated congestion warning system.

Schedule: 2020-2021

Estimated Cost: \$36 million

I-70 East/West Climbing Lanes at Mineola Hill



MoDOT will add both eastbound and westbound climbing lanes to I-70 to make traffic (both truck and passenger) flow safer and more efficient. The grades of 4 percent to 6 percent in this approximately 1.5-mile segment of I-70 slow trucks and increase their travel time by 30-35 percent. Adding climbing lanes will allow vehicles to safely pass slow-moving trucks and mitigate the relatively high crash rates at this location.

Goal: Improve truck capacity and make overall traffic (truck and passenger) flows safer and more efficient.

Key Elements: New climbing lanes on I-70 between mile markers 168.4 and 170.2 (eastbound) and between mile markers 167.6 and 166.4 (westbound)

Schedule: 2020

Estimated Cost: \$5 million

I-70 Curve Realignment and Removal of Vertical Clearance Issue at High Hill



MoDOT will remove existing vertical and horizontal clearance issues of an existing railroad bridge over I-70 to better accommodate trucks with oversize loads. The current clearance constraint requires oversize load trucks to use a 50-mile detour through towns and lower classification roadways where such traffic is not desirable, creating a freight bottleneck of national and regional significance. MoDOT will also realign the roadway to flatten out two curves on either side of the railroad bridge. The current roadway configuration has a 50 percent higher crash rate than the full rural I-70 corridor. This project will thus improve freight efficiency and roadway safety.

Goal: Eliminate the need for oversize loads to re-route; improve safety for all motorists and provide more efficient truck movement

Key Elements: Realign I-70 roadway between mile markers 180.6 and 182.0 to improve safety and allow large trucks with oversize loads to more safely and efficiently traverse this segment; replace railroad bridge crossing I-70 to eliminate vertical clearance restrictions for trucks on I-70.

Schedule: 2020-2021

Estimated Cost: \$19 million

6.0 Project Readiness

MoDOT has significant experience in the development and implementation of large and complex transportation capital projects. In addition, MoDOT plans, designs, constructs, and maintains 33,856 miles of highways and 10,403 bridges – the nation’s seventh largest state highway system, with more miles than Iowa, Nebraska and Kansas’ systems combined. Between 2007 and 2016, MoDOT delivered over 4,600 projects 7 percent under budget and 94 percent on-time.

The readiness of each of the projects in this application is reflected in the estimated implementation schedule shown in Figure 2 below. As the State of Missouri owns and operates all the affected facilities that comprise these project components, MoDOT can amend the STIP and move ahead with implementation upon securing required funding.

MoDOT has an excellent track record of quickly delivering projects once authorized. In fact, MoDOT has regularly accelerated the delivery of projects when additional funding opportunities have been presented. For example, when Congress passed the FAST Act, MoDOT proactively responded by increasing the state’s construction program because of the stability in federal funding provided by the legislation. Likewise, when a TIGER grant was awarded for the US 54 Champ Clark Bridge over the Mississippi River in Louisiana, MO, MoDOT moved quickly to procure delivery of the project through the design-build process. Similarly, MoDOT stands ready to deliver the proposed BUILD projects upon award.

FIGURE 2: OVERVIEW OF PLANNED I-70 PROJECT IMPLEMENTATION TIMEFRAMES

Project	2020	2021
I-70 Incident Management Improvements (corridor-wide)	[Blue bar spanning 2020 and 2021]	
Add Climbing Lanes at Mineola	[Blue bar in 2020]	
Curve Realignment & Elimination of Vertical Clearance Restriction at High Hill	[Blue bar spanning 2020 and 2021]	

Environmental Review Status

In 2006, MoDOT completed a Tiered Environmental Impact Statement (EIS) to reconstruct I-70 in its present location from Independence to Lake St. Louis with a minimum of three lanes in each direction. Subsequently, as part of FHWA’s “Corridors of the Future” program, MoDOT conducted a Supplemental EIS (SEIS) on the 200-mile corridor to evaluate the impacts and benefits of an eight-lane I-70 that included dedicated truck lanes against the previously selected alternative. FHWA issued a [Record of Decision](#) for the truck-only lane concept in 2009. To move forward with I-70 improvements, MoDOT would need to conduct a re-evaluation of the SEIS which is expected to take six months or less.

7.0 Cost Effectiveness Summary

A National Economic Priority

As described earlier in the application, the transportation performance challenges addressed by the entire package of improvements on I-70 represent over \$92 million (7 percent discount rate) in avoidable transportation costs, including loss of life, loss of travel time and reliability, emissions, fuel consumption and vehicle operating costs. Looking at value-chain effects of economic activity making, using, and selling goods moved on the I-70 system and their role in America’s economy highlights the national significance of this system. Using input-output data from the TREDIS fueled by TRANSEARCH system (including both Global Insight data and IMPLAN input-output accounts) – it is observable that goods moved on the I-70 system in Missouri are involved in commerce accounting for over \$113.8 billion of America’s overall annual GDP and over 1.1 million jobs (82 percent of which are American jobs outside of Missouri). By providing additional capacity at key junctures for traffic throughout Missouri, supporting more efficient traffic movement through incidents ranging from flooding to blizzards to crashes and other events – the proposed improvement program is essential to securing America’s economic performance in the 21st century.

Table 2 provides the required Project Matrix summarizing the analysis of impacts from the changes from the proposed I-70 improvement projects. In this table the first column provides a description of the current I-70 infrastructure baseline (including the anticipated changes over the analysis period) and identifies the problems on this segment of a national interstate that these projects will address. The second column describes how the improvements from the projects would change the current I-70 infrastructure baseline. The third and fourth columns describe the impact of the improvements and the corresponding population it will affect. The fifth column identifies the economic nature of the benefits. The last column provides reference to the location in the report for this information.

TABLE 2: PROJECT SUMMARY MATRIX

Current Status/ Baseline and Problem to be Addressed	Change to Baseline/ Alternatives	Type of Impacts	Population Affected by Impacts	Economic Benefit	Grant Application Reference
Delays and unreliability of highway freight movement from congestion, and crashes on the I-70 interstate highways	Truck lanes, curve realignment, increased bridge clearance, and incident management system	Reduce travel time for trucks and increase reliability of shipment delivery times; lower vehicle congestion; reduce crashes	Number of vehicles with reduced delay time & number of crashes, fatalities, & injuries per year	Monetized value of reduced travel time, reduced operating costs, improved reliability, reduced crash costs, reduced emissions	Pages 3-6 & Appendix A

Table 3 summarizes the types of expected outcomes based on the benefit-cost assessment. These outcomes are organized according to BUILD grant merit criteria. As detailed above, the quantification of benefits involves both spreadsheet evaluations and calculations performed by the TREDIS Economic Modeling tool (See Appendices B and C).

The time horizon of the benefit-cost analysis covers the construction period from 2020-2021, and an operational period from 2021-2050. All benefits are expressed in constant 2017 dollars and discounted to 2018.

TABLE 5: PROJECT OUTCOMES

State of Good Repair	Maintenance and repair savings	Quantitative assessment: Appendix B “BCA Results” Also Refer to Table 6 & “Overview of Costs & Benefits”
	Shifted VMT from lower capacity roads	Quantitative assessment: Appendix B “BCA Results” Also Refer to Table 6 & “Overview of Costs & Benefits”
Economic Competitiveness	Travel time savings from reduced congestion and less diversion	Quantitative assessment: Appendix B “BCA Results” Also Refer to Table 6 & “Overview of Costs & Benefits”
	Operating cost savings from avoided congestion & resulting diversion	Quantitative assessment: Appendix B “BCA Results” Also Refer to Table 6 & “Overview of Costs & Benefits”
Economic Impacts	Short-term job creation from construction & long-term job creation from transportation efficiency gains	Quantitative assessment: Appendix B “BCA Results” Also Refer to Summary of Economic Impacts
Safety	Prevented crashes from avoiding increased exposure from diversion, from improved road design, and reduced exposure to back-ups	Quantitative assessment: Appendix B “BCA Results” Also Refer to Table 6 & “Overview of Costs & Benefits”
Environmental Sustainability	Emission benefits from reduced congestion and avoided extra mileage on associated alternative routes	Quantitative assessment: Appendix B “BCA Results” Also Refer to Table 6 & “Overview of Costs & Benefits”
Quality of Life	Improved mobility for residents and businesses connected by this road segment	Qualitative Assessment Also Refer to “Overview of Costs & Benefits”

Summary of Benefits and Costs

Table 4 shows a summary of project benefits by performance area, undiscounted and discounted at 3 percent and 7 percent as further documented in Appendixes A and B. An estimated 64% of the value of goods transported on I-70 in Missouri is pass-through traffic and of the 1.2 million jobs supported by the production, use, and sale of goods moving on this system in Missouri, 82% of them are located elsewhere in the United States. Consequently, the benefits shown below represent an important gain to the U.S. economy overall.

TABLE 4: SUMMARY OF BENEFITS OF PROJECTS, COMBINED (3% AND 7% DISCOUNT RATES)

BENEFIT CATEGORY	3% Discount Rate (In \$M's)	7% Discount Rate (In \$M's)	Undiscounted (In \$M's)
Travel Time Savings	\$41.4	\$23.9	\$68.3
Vehicle Operating Cost Savings	\$19.1	\$11.1	\$31.5
Value of Travel Time Reliability	\$1.8	\$1.1	\$3.0
Safety Benefits	\$83.7	\$48.1	\$138.2
Environmental & Social Benefits	\$0.4	\$0.2	\$0.7
Wider Economic (Productivity) Benefits	\$13.4	\$7.7	\$22.2
Total Benefits	\$159.9	\$92.2	\$264.0
Capital Investment Costs	\$56.2	\$50.9	\$60.6
Operations & Maintenance Costs	-\$0.9	-\$0.8	-\$0.8
Total Costs	\$55.3	\$50.1	\$59.9
Benefit Cost Ratio	2.89	1.84	4.41

The benefits and costs presented in Figure 3 and Table 5 show the economic feasibility of this investment package of projects using the 7% discount rate and an alternative 3% discount rate.

FIGURE 3: COMPARISON OF BENEFITS AND COSTS, BY COMPONENT, 3% & 7% DISCOUNT RATE

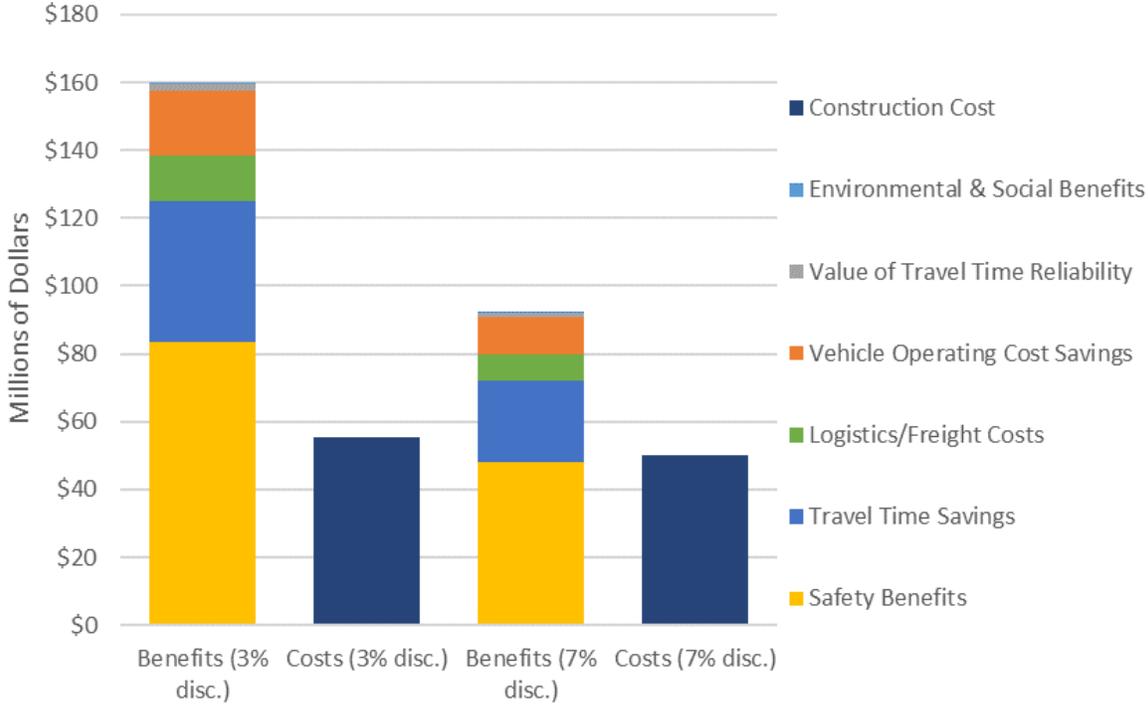


TABLE 5: SUMMARY OF BENEFITS AND COSTS OF PROJECTS, COMBINED

	Discounted at 3%	Discounted at 7%
Project Costs, Adjusted*	\$55.3	\$50.1
Total Benefits	159.89	\$92.183
Benefit-Cost Ratio	2.89	1.84

* Project costs are shown in millions and include capital outlays, along with adjustments for O&M costs.

The cohesive program of improvements to I-70 not only represents a favorable benefit-cost ratio for the nation, but each individual component has more than sufficient benefits to justify its cost. Table 6 summarizes each of three projects that are part of this application as described in Section 5, demonstrating that using either the 3 percent or 7 percent discount rates, these improvements generate benefits exceeding their costs.

TABLE 6: SUMMARY OF BENEFITS AND COSTS INDIVIDUAL PROJECTS (Millions)

Project	3% Discount Rate			7% Discount Rate		
	Total Benefits	Total Costs	BC Ratio*	Total Benefits	Total Costs	BC Ratio
High Hill	\$29.6	\$12.6	2.36	\$17.2	\$12.7	1.35
I-70 Mineola	\$46.8	\$5.2	9.01	\$27.3	\$4.5	6.01
I-70 IMS	\$83.5	\$37.6	2.22	\$47.7	\$32.8	1.45
Grant Package Total	\$159.9	\$55.3	2.89	\$92.2	\$50.1	1.84

*Details regarding costs, benefits, and the discounted value of time are included in Appendix A: Technical Documentation of BCA Sources and Methods.

Summary of Economic Impacts

While safety improvements account for 52% of all benefits, other benefits that affect the flow of money will have long-term impacts on the economy. The proposed improvements to I-70 are expected to support 300 jobs per year in 2020 and 2021 and an average of 11 jobs per year over the 30-year operations period from 2021-2050. During construction, project expenditures are expected to support \$37.2 million in wage income, \$48.9 million in Gross Regional Product, and \$93.9 million in business output cumulatively from 2020-2021. In addition, transportation efficiency gains will generate an additional \$20.7 million in wage income, \$32.5 million in Gross Regional Product, and \$73.5 million in business output cumulatively from 2021-2050. Details on the estimated economic impacts are included in Appendix D of this document.

TABLE 7: SUMMARY OF ECONOMIC IMPACTS

Source of Impact	Cumulative Impacts			Average Annual Jobs over the Period
	Business Output (\$ mil.)	GRP (\$ mil.)	Wage Income (\$ mil.)	
Construction (2020-2021)	\$93.9	\$48.9	\$37.2	300
Improved Transportation Efficiency (2021-2050)	\$73.5	\$32.5	\$20.7	11

Overview of Costs and Benefits

Project Costs

Design and construction of the I-70 improvements are scheduled to occur in the two-year period from 2020-2021. During construction, the current highways will remain open. The I-70 improvements are expected to cost \$60.2 million (net, undiscounted) in capital outlays. These highway system improvements will yield savings in operating and maintenance cost relative to

the base-case scenario in which the highways are not improved through 2050. In the build case, the improved Interstates will require fewer resources for annual maintenance, reducing total operations and maintenance costs by a total of \$800k (net, undiscounted) over the evaluation period. The total undiscounted net costs of the package of projects is \$59.9 Million. Discounted at 7 percent, the present value of costs is \$50.1 million, and at 3 percent, the present value of costs is \$55.3 million. The tabs for each project in Appendix B spreadsheet present all cost assumptions in detail by year.

State of Good Repair

Overall, the improvements to the system will reduce annual operation and maintenance (O&M) costs on many facilities and decrease the need for other preservation improvements later. The differences between cost streams shown in the workbook of Appendix B and described in Appendix A demonstrate in dollar terms how these savings contribute to the overall project benefits (and net costs).

Travel Time Savings – Trucks and Passenger Cars

The proposed improvement program will save time for cars and trucks by (1) eliminating bottlenecks at key locations on I-70, (2) facilitating the ongoing movement of people and goods across the I-70 corridor during sporadic incidents affecting traffic flow (through incident management) and (3) reducing the likelihood of secondary crashes during slow-downs caused by incidents. Because of the hours saved as described in the introduction to this application in the period from 2021-2050, across all the projects, improvements are expected to result in a total cumulative travel time savings of \$23.9 million (discounted 7 percent).

Vehicle Operating Cost Savings

By reducing crashes and providing critical infrastructure to manage all incidents affecting traffic flow on these critical trans-continental facilities – the proposed improvements will reduce idling, reduce the number of miles cars and trucks must drive to divert when incidents occur – greatly improving fuel efficiency and reducing long-term vehicle operating costs. Because of the mileage and speed savings described in the introduction, in the period from 2021-2050, the projects are expected to generate total cumulative vehicle operating cost savings of \$11.1 million (discounted 7 percent.)

Safety Benefits – Trucks, Passengers, Residents

By enhancing capacity and design at key pinch-points and improving interchange design at key locations the proposed improvements will reduce crashes at some of the most significant safety hot-spots on Missouri's trans-continental highways. There have been 76 fatal crashes across the I-70 over the past six years. In that same time there have been 261 disabling injury crashes, 1,492 minor injury crashes, and 8,337 property damage only crashes across the system. With the safety benefits from the implementation of the proposed improvements, through 2050 there will be 799 fewer crashes and 10 lives saved. The number of crash reductions can be traced to two effects: (1) reduced accident rates on the improvements to I-70 relative to the current highway conditions, and (2) reduced accident exposure from avoiding increases in vehicle-miles on detour routes. In the period from 2020-2050, the projects are expected to

generate total cumulative safety savings of \$48.1 million (discounted at 7 percent). Most of these savings derive from the effect of avoiding crashes through use of the improved interstate facilities.

Emission Reduction Impacts

Avoidance of incident delays and diversion routes results in faster speeds, less idling and therefore fewer tons of emissions being released from travel on Missouri's trans-continental highways. The emissions saved by 2050 are estimated based on savings in vehicle-miles traveled and then monetized. In the period 2020-2050, the project is expected to generate total cumulative savings to society of \$218,000 (discounted at 7 percent), deriving from reductions in volatile organic compounds (VOC), nitrogen oxides (NOx), sulfur dioxide (SOx), and particulate matter (PM).

Quality of Life and Intangible Benefits

The benefits of the proposed improvements extend far beyond the readily quantifiable areas described above. The occurrence of incidents impeding traffic on I-70 affect not only business and commercial traffic, but also passenger car traffic carrying Americans on journeys ranging from family vacations to holiday gatherings and cultural, athletic, and social events of all kinds. While the value of personal travel time savings is quantified in Appendixes A and B (and can be included as part of the travel time benefit); the importance of this system and its performance carries an intangible quality that cannot be captured entirely in dollars. In addition, the frequency and magnitude of slow-down incidents described in the introduction affects not only the mainline traffic on I-70 but besets cities and towns throughout Missouri with a backup of passenger car and truck traffic overwhelming local street networks when I-70 is disabled by incidents. For example, if I-70 traffic diverts through the main street of a small town, it can easily gridlock the entire system, rendering much of the town's population immobile for even the most basic activities until the incident is resolved. The proposed projects will greatly reduce and, in some areas, eliminate this problem.

