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Missouri Department of Transportation

TIGER Grant Application

Bonnots Mill Universal Crossover

10.16.2017

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Project Summary

The Bonnots Mill universal crossover project (the "Project") will reduce passenger and freight train delay on Union Pacific Railroad's Jefferson City Subdivision in Missouri, east of Jefferson City. The Project will accomplish this by providing additional operational flexibility for the 26 trains that run on this route each day. This project will strategically place a crossover in a location where there is currently a 22-mile gap between existing crossovers. Adding connections between the two main lines will allow trains of different priority to be sorted around one another. This will enable proper routing of rail traffic over the Osage River Bridge and eliminate conflicts between trains coming from different directions. It will also allow operations to be more resilient to necessary track inspection and maintenance activities. The Project will reduce freight train delay and delays incurred by the four daily Amtrak Missouri River Runner passenger trains both approaching and leaving the station stop at Jefferson City—including trains 311 and 314 which often meet in the 22-mile gap between crossovers. In total, the project will eliminate 2.2 hours of train delay per day.

In summary, project benefits will include:

- Reducing passenger train delay and freight train delay surrounding Jefferson City;
- Facilitating more efficient service to local freight customers; and
- Minimizing the adverse impact of track outages during track inspections and maintenance of way activity on the Jefferson City Subdivision.

The Project aligns with state freight planning goals, including supporting economic growth by preventing delay and improving overall system connectivity, mobility, and reliability. The Project will also help achieve state planning goals regarding Amtrak passenger service by eliminating delays along the Missouri River Runner corridor, which connects Missouri's two largest urban economies and smaller rural communities in the center of the state. Unlocking this bottleneck is a key first step in achieving the Missouri Department of Transportation's longer-term objectives of reducing end-to-end travel times on the corridor.

The Project will achieve the enumerated benefits in a cost-effective manner, with a benefit-cost ratio of between 6.06 (at a 7% discount rate) and 8.58 (at a 3% discount rate). Union Pacific and the Missouri Department of Transportation (MoDOT) are committed to achieving efficiency on this corridor. Union Pacific has committed to contributing $2.8 million out of the total $7.3 million in project costs, demonstrating the significant value of this project to economic competitiveness. In addition, Amtrak had pledged to contribute in the amount of $100,000, reflecting the project's importance to passenger rail in the corridor. The TIGER grant funding, requested in the amount of $4,400,000, would address the remaining gap in funding after maximizing non-federal funds secured through this public-private partnership. The funding would solve a bottleneck that is essential to securing permanent infrastructure improvement for the efficiency of freight and passenger service. Additionally, this project will secure additional efficiency, and leverage the full value of a prior improvement on the line (the Osage River Bridge), without adding additional public-sector operations and maintenance burdens (all future life-cycle costs will be the responsibility of Union Pacific).

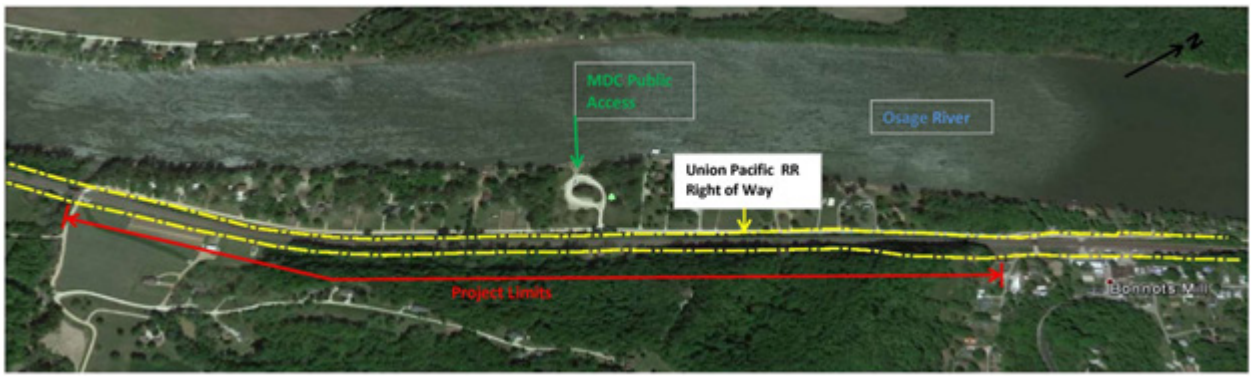
Project Description

Description of Project Improvement

The Bonnots Mill universal crossover proposed at mile post (MP) 113.5 on Union Pacific's Jefferson City Subdivision will restore an element of operational flexibility for passenger and freight trains that was lost when the Osage River Bridge was improved to accommodate a second track.

The Project is located in Osage County, Missouri, near the unincorporated community of Bonnots Mill, along the existing Union Pacific Railroad (UPRR) double mainline tracks (see Project Location section). In this area, the rail line parallels the south bank of the Osage River. At this specific location the tracks and river generally run from the southwest to the northeast (see Figure 1).

Figure 1. Aerial View Showing Project Right of Way and Extent



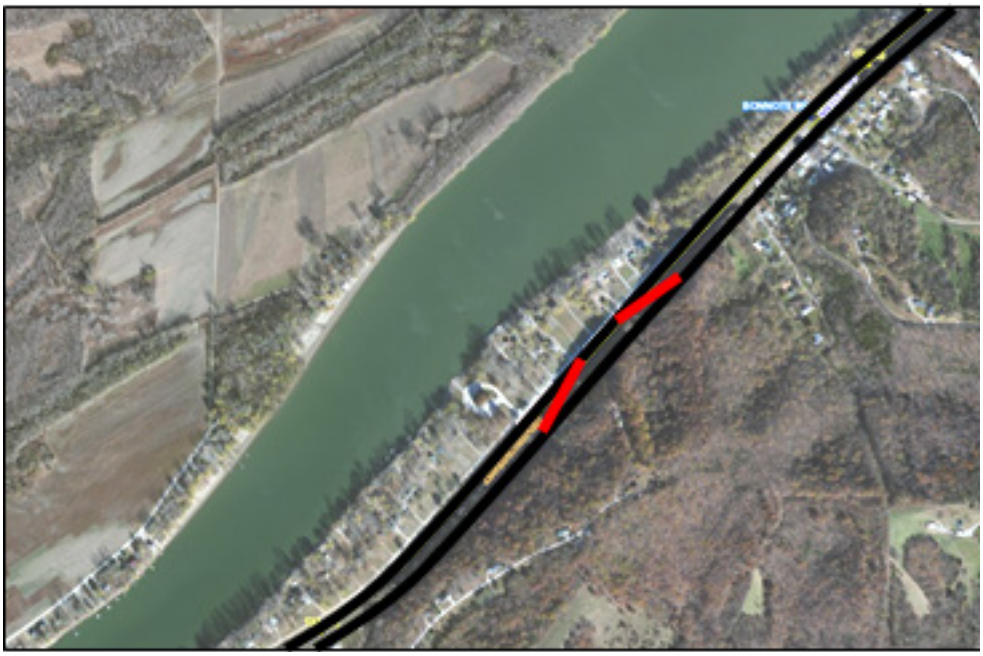
Source: Union Pacific - Federal Railroad Administration Categorical Exclusion Worksheet

The Project consists of the construction of two crossovers (one in each direction) to provide a universal crossover (see Figure 2). The Project will involve shifting the southernmost track up to seven feet to the south over a total length of approximately 4,000 feet (0.76 miles). This will provide a 20-foot separation between track centers to facilitate future maintenance of the turnouts while allowing operations to continue on one of the mainline tracks. The current separation between the tracks averages 13.5 feet in this area.

The Project will also involve widening the existing rail embankment to provide a trackside vehicular access road approximately 14 feet wide along the south side of the tracks extending from the west end of the Project at the existing County Road 416 grade crossing eastward to a point between the two proposed turnouts—a total length of approximately 1,900 feet (0.36 miles). Some additional widening of the embankment is also proposed in this area to provide a lay-down area for construction of the turnouts. This additional embankment area will be approximately 28 feet wide over a length of approximately 1,200 feet (0.23 miles).

All embankment widening and related construction work will be on the south side of the existing embankment, and will be contained within the existing railroad right-of-way. The railroad right-of-way through the Project area is generally 150 feet in width, although it narrows slightly at the east end of the Project (see Figure 1).

Figure 2. Project Diagram Showing Crossovers



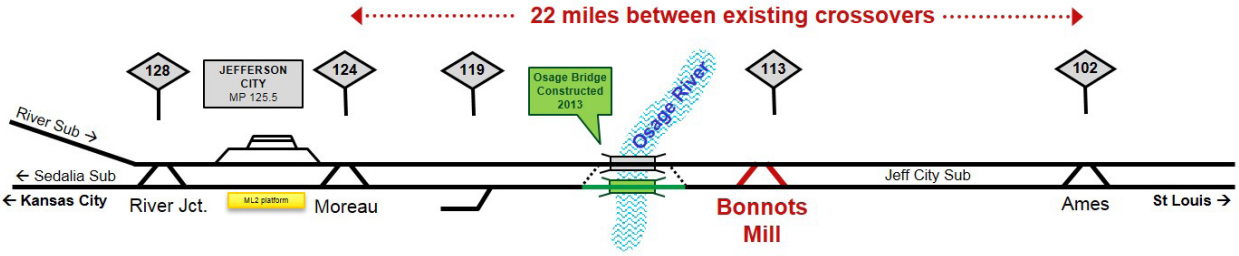
Source: Union Pacific

No changes to any existing drainage facilities or drainage patterns are proposed, except for one 36-inch culvert which may need to be extended approximately 6-10 feet on the south side of the existing embankment. There will be no changes to existing roadways or grade crossings, except for simple grading required where the new gravel access road within existing railroad right-of-way will intersect with the east side of existing County Road 416 just south of the existing grade crossing. Associated signal work will include new signals for the universal crossover and integrating the crossover interlockings with Union Pacific's Centralized Traffic Control Center in Omaha, Nebraska.

Transportation Challenges Addressed

The purpose of the Project is to provide an additional location for faster passenger trains to overtake and pass slower freight trains on this heavily used double-track line, dividing in half what is currently a 22-mile distance between existing universal crossovers at mile posts 102.0 and 124.3 (see Figure 3).

Figure 3. Schematic Showing Existing Crossovers and Landmarks



Source: Union Pacific

This area was identified as a bottleneck by a University of Missouri study in 2006. The new crossover, combined with the recently-completed second bridge over the Osage River just to the west of the Project location, will greatly help sort trains heading to the Jefferson City station and yard, and allow Amtrak trains to get to the correct track to stop at the Jefferson City station.

The Project will also provide greater operational flexibility under circumstances where one track must be taken out of service or is otherwise unavailable because of maintenance activities or operational disruptions. The increased operational flexibility will reduce delays and improve schedule reliability for all rail service using the line, but particularly for the faster Amtrak passenger trains. The new crossover should also decrease blocked crossings in the area as trains that stop and block crossings while waiting to move to other tracks will now be able to move freely to the second track, thereby decreasing the number of stopped trains.

The Project is expected to reduce delays incurred by the four daily Amtrak Missouri River Runner passenger trains when they approach and leave the station stop at Jefferson City, including trains 311 and 314 which often meet in the 22-mile gap between existing crossovers. Since January 1, 2015, there have been a total of 67 trains that would have been on time with respect to Union Pacific's commitments to Amtrak/MODOT if they did not encounter delays between Jefferson City and Hermann, Missouri approximately 50 miles away (17 trains in 2015, 32 in 2016, and 18 in 2017 through September). By adding connections between the two main lines, allowing trains of different priority to be sorted around one another, the Project will eliminate 2.2 hours per day of train delay and allow Union Pacific to further optimize the number and timing of work events scheduled to occur in its yard in Jefferson City.

Project History

Before the Osage River Bridge expansion project provided a second track crossing over the Osage River, dispatchers took advantage of the short single-track segment over the bridge as an opportunity to move up to two thirds of trains from one track to the other. This included moving the four daily Amtrak trains to and from Main Line #2 in Jefferson City where the sole passenger platform is located. The stretch of single track provided the capability of a universal crossover, complementing existing crossovers at Moreau (MP 124) and Ames (MP 102). Having multiple locations around a terminal to move trains from track to track improves the ability to line trains up in the most efficient manner and promotes the fluidity of those orchestrated movements.

When the double track project was completed without any sort of crossover to replicate the previous capability, dispatchers were faced with a 22-mile gap between the existing crossovers east of Jefferson City where they could make similar moves (see Figure 3). This restricted their ability to (1) sort higher priority trains around other slower through trains or around local trains serving customers; (2) route trains around track inspections/maintenance of way activity; and (3) stage trains in the proper order to perform work events and change crews in Jefferson City.

The bottleneck addressed by the Project was identified in a 2006 University of Missouri study. Recognizing the restrictions plaguing this section of track, the 2012 Missouri State Rail plan included the Project in its list of 20-year recommended passenger rail improvements (see Passenger Planning Goals section).

Alignment with Planning Goals

Freight Planning Goals

The 2014 Missouri State Freight Plan establishes the following planning goals[1]:

1. **Maintenance:** Maintain the freight system in good condition by keeping highways and bridges in good condition and supporting the maintenance of railways, waterways, airports, and multimodal connections.
2. **Safety:** Improve safety on the freight system by decreasing the number and severity of crashes involving commercial vehicles and improving safety at railroad crossings.
3. **Economy:** Support economic growth and competitiveness in Missouri through strategic improvements to the freight system.
4. **Connectivity and Mobility:** Improve the connectivity and mobility of the freight system by reducing congestion and increasing reliability on the roadways; by supporting improved efficiency of rails, waterways, and airports; and by improving connections between freight modes.

The Project primarily addresses two of these goals: (1) supporting economic growth and competitiveness and (2) improving the connectivity and mobility of the freight system. By preventing delay, the Project will generate business cost savings and wider economic benefits. By facilitating more efficient service to local freight customers and minimizing the adverse impact of track outages during track inspections and maintenance, the Project will improve connectivity, mobility, and reliability. In addition, the Project addresses the Maintenance and Safety goals by reducing the cascading operational inefficiencies that occur at present when a section of track is closed to facilitate inspection and maintenance activities that are critical to safe ongoing operations of services on the line.

Passenger Planning Goals

In its list of recommendations, the 2012 Missouri State Rail Plan emphasizes reliability and travel time improvements like that which the Project will provide. The plan also recommends maintaining and expanding Amtrak's Missouri River Runner service, which currently provides daily trips from Kansas City to St. Louis with a stop in Jefferson City[2]. Current travel time is 5 hours 40 minutes, according to Amtrak, and the plan recommends reducing this to less than four hours by increasing speed incrementally to 90 miles per hour. In its proposed 20-year plan, the plan lists the Project among its recommended passenger rail improvements (see Table 24, Page 102). By addressing a key bottleneck along this corridor, the Project is a necessary first step towards future efforts to reduce end-to-end Amtrak travel times on the corridor.

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1 *Missouri State Freight Plan Executive Summary,* http://www.MoDOT.org/othertransportation/freight/documents/Missouri-Freight-Plan-Executive-Summary-FINAL-small-version.pdf

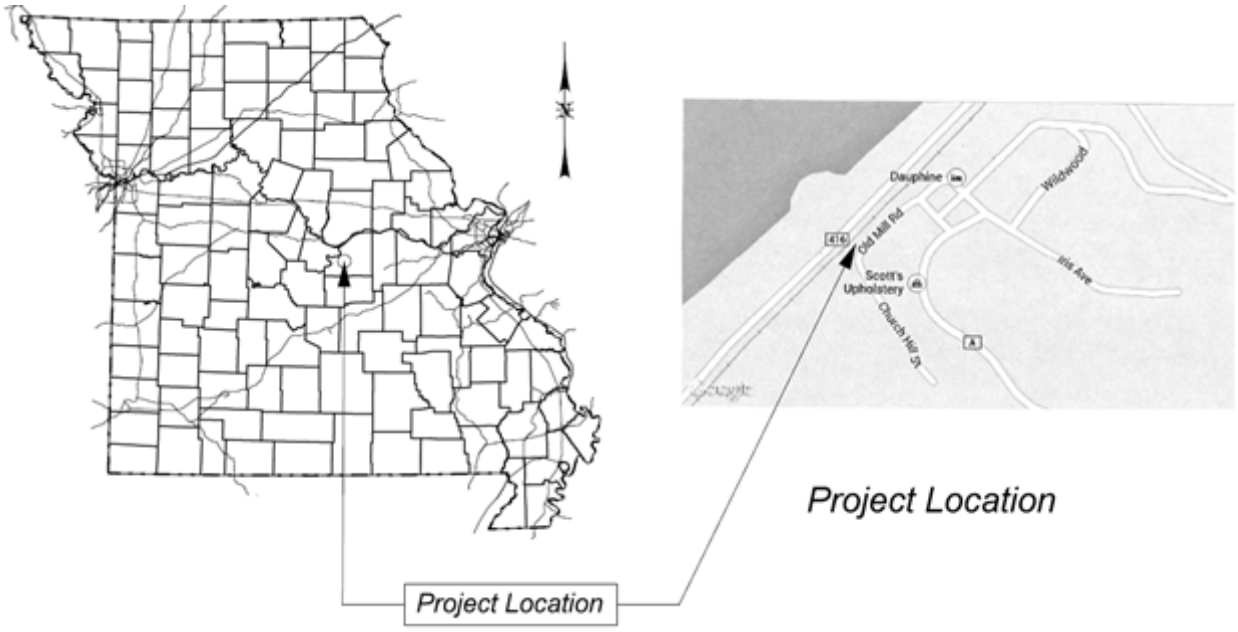
2 *Missouri State Rail Plan, May 2012,* http://www.MoDOT.org/othertransportation/rail/documents/Missouri_State_Rail_Plan_FINAL.pdf.

The Project also aligns with MoDOT's goal of providing reliable intercity transportation for residents across the state of Missouri, including rural communities located along the rail corridor between the major urban economies of Kansas City and St. Louis . MoDOT demonstrates its commitment to providing rail access along this corridor by financially sponsoring the Missouri River Runner service.

Project Location

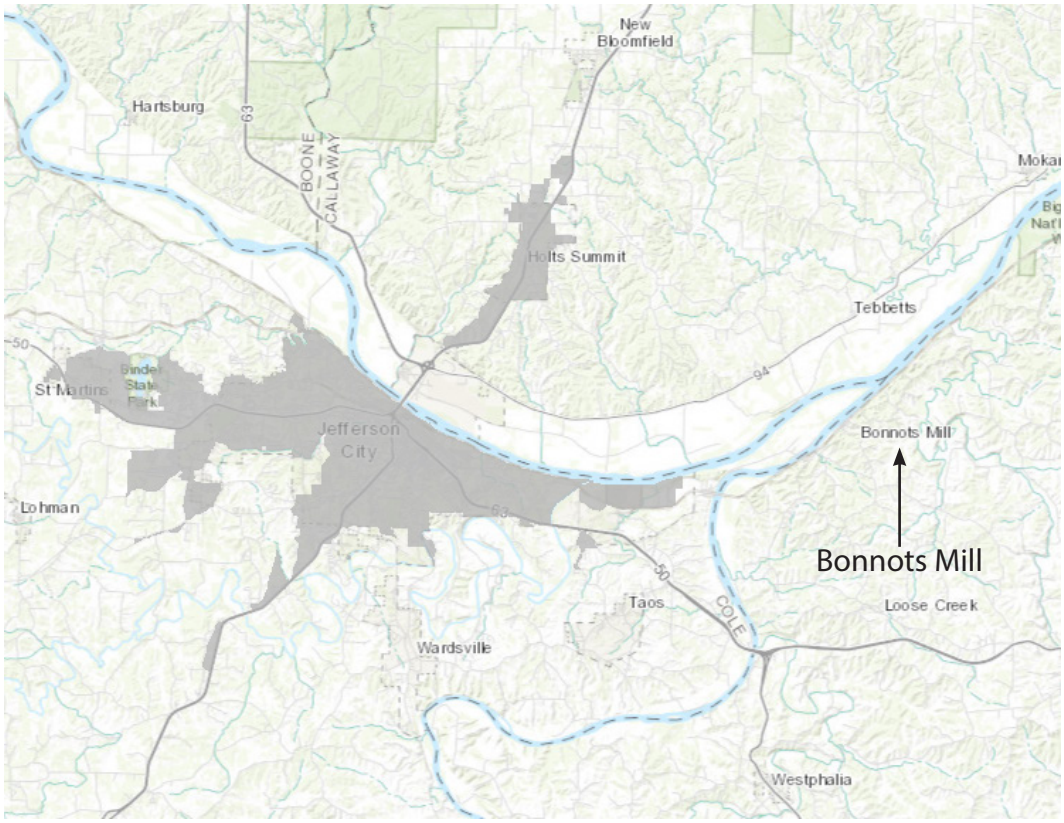
The Project is located in Bonnots Mill, Missouri, at mile post 113.5 on Union Pacific's Jefferson City Subdivision, adjacent to County Road 416 and the Osage River (see Figure 4). Bonnots Mill is a rural community located in Osage County and the Jefferson City Metropolitan Statistical Area (MSA), approximately 170 miles east of Kansas City and 120 miles west of St. Louis (in driving distance). The closest 2010 Census Designated Urban Area is Jefferson City (Figure 5). Administratively, the Project is situated in MoDOT's Central District and the Meramec Regional Planning Commission area. The exact coordinates of the Project are 38.5747° N, 91.9701° W. On Amtrak's Missouri River Runner, the Project is located just east of the station in Jefferson City, and west of the next stop in Hermann, Missouri.

Figure 4. Map of Missouri and Exact Project Location



Source: Union Pacific

Figure 5 Bonnots Mill Relative to Jefferson City, the Nearest Census Designated Urbanized Area

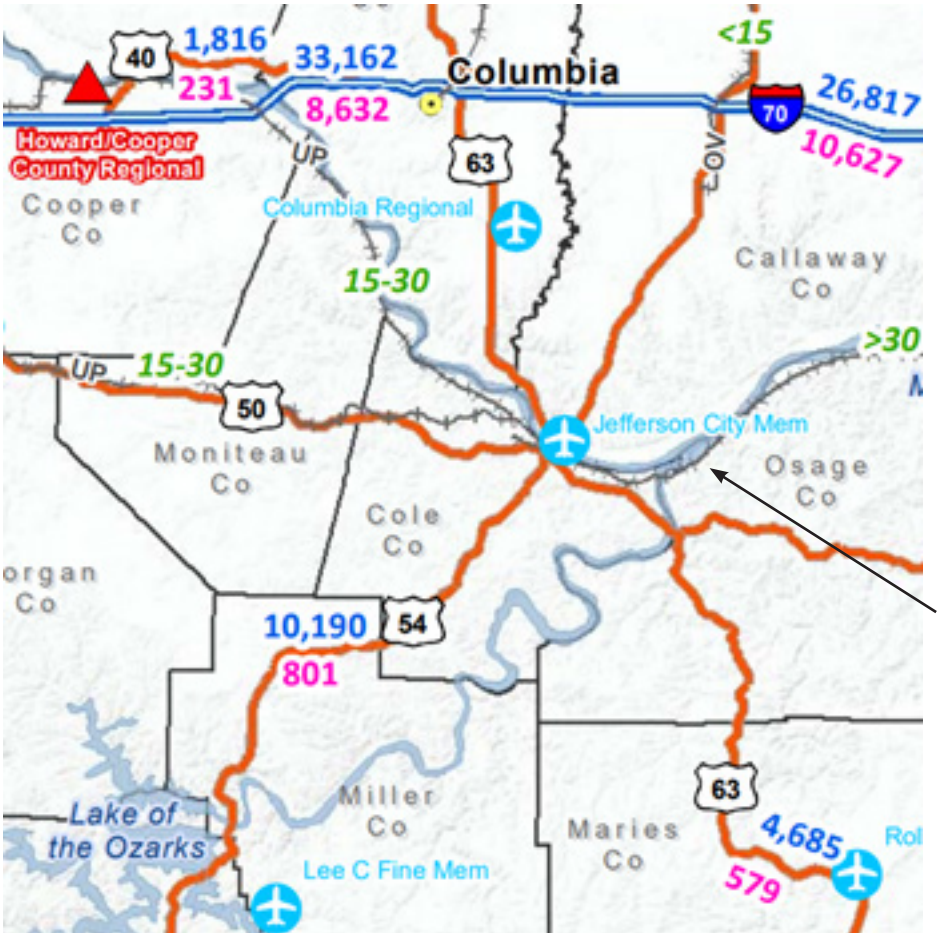


Source: Esri and U.S. Census Bureau, Geography Division – 2010 Urbanized Areas

With respect to other components of the transportation system, the Project is situated along the Osage River just southwest of where the Osage and Missouri rivers converge (see Figure 6) and approximately 20 miles east (driving distance) of the Jefferson City Memorial Airport, which does not provide commercial air service but does serve general aviation, business, and military aircraft.[1] Several highways converge in Jefferson City, including US-50, US-54, US-63, MO-94, and MO-179. Approximately 80 miles upriver from the Project is the Howard/Cooper County Regional Port Authority, the only public shipping access point along the Missouri River between Kansas City and St. Louis. The port marks the start of an unobstructed channel (no dams or locks) extending all the way to its junction with the Mississippi River in St. Louis. The nearest intermodal facilities are in St. Louis.

1 *Jefferson County Memorial Airport,* http://www.jeffersoncitymo.gov/government/airport.php.

Figure 6. Transportation Facilities Surrounding Project Location



Source:
http://www.MoDOT.org/othertransportation/freight/documents/Central-Missouri-District-Maps-for-website-4.pdf

Project Parties

The Missouri Department of Transportation and Union Pacific Railroad are the two parties involved in this project development and grant application process. Contact information for this grant is shown in Table 1.

Table 1 Contact Information and Project Parties

Contact Information	Project Parties
Michael DeMers Innovative Partnerships and Alternative Funding Director Missouri Department of Transportation 105 W. Capitol Avenue Central Office – Director's Office P.O. Box 270, Jefferson City, MO 65102 Office: 573-751-7452 Mobile: 573-291-5812 www.modot.mo.org	Missouri Department of Transportation Union Pacific Railroad

Grant Funds, Sources and Uses of Project Funds

The total project cost estimate as of July 12, 2016, is approximately $7,258,213. Track and signal work will account for over half of the total project cost (see Table 2). Union Pacific will perform all phases of the Project except for construction, which it will contract out for approximately $1.3 million or 17.6 percent of the total project cost.

Table 2. Project Cost Breakdown

Project Phase	Estimated Project Costs	Share of Total Project Cost	Services Performed By
Design Engineering	200,000	2.8%	Union Pacific
Environmental Assessment	200,000	2.8%	Union Pacific
Utilities	75,000	1.0%	Union Pacific
Construction Contract	1,279,500	17.6%	Contractor
Construction Engineering	200,000	2.8%	Union Pacific
Force Account Track Work	2,174,569	30.0%	Union Pacific
Force Account Signal Work	1,919,442	26.4%	Union Pacific
Contingencies	1,209,702	16.7%	
TOTAL	***$7,258,213***	***100.0%***	

Source: Union Pacific

Table 3 summarizes Project funding by source. The overall funding packages includes a significant contribution of private sector capital from Union Pacific (38%) and a contribution from Amtrak, with a TIGER grant request for the $4.4 million not available from other sources that is necessary to complete the Project.

Table 3 Project Funding by Source[1]

Category	Amount	Percent
Non-Federal Contribution: Union Pacific	$2,758,213	38%
Other Federal Contribution: Amtrak	$100,000	1%
TIGER Grant Request	$4,400,000	61%
Total Project Cost	***$7,258,213***	***100%***

There are no restrictions on the use of dedicated Union Pacific funds for the project or other anticipated constraints on funding availability for the proposed non-federal share. Documentation of funding commitments is attached as an Appendix.

1 *Should a Tiger Grant be secured in the amount requested, Union Pacific Railroad takes full responsibility for ensuting the project is implemented.*

Merit Criteria

The Bonnots Mill Universal Crossover will lead to long-term benefits in a variety of categories including economic competitiveness, state of good repair, environmental sustainability, and improvements to quality of life, among others. A discussion of these project outcomes, and the mechanisms by which they are achieved, is provided in the following subsections.

Economic Competitiveness

The core objective and outcome of the Bonnots Mill crossover is to improve the long-term reliability and efficiency of passenger and freight rail service in the corridor between Kansas City and St. Louis, Missouri. The crossover will secure cost savings for rail operators, including both Union Pacific and Amtrak, and for companies that rely on Union Pacific to move their goods to market or access key inputs from suppliers. It will also reduce the burden of intercity travel for Amtrak passengers on the Missouri River Runner line. These benefits can be traced directly from the 2.2 hours of delay reductions that will be achieved each day by the crossover because of increased operational flexibility on the rail line and elimination of conflicts associated with rail congestion.

The economic competitiveness benefits of the project fall into several distinct categories:

(1) Savings in crew costs associated with operating freight and passenger rail service: By avoiding delay in rail operations, Union Pacific and Amtrak will be able to make more efficient use of their train crew staff. This includes conductors, engineers, and foods service staff.

(2) Savings in the freight logistics time costs: When goods are tied up in transit, the companies that rely on rail are subject to business opportunity costs of freight delay, including shipper inventory, dock handling, and consignee schedule disruption costs. In 2016, the volume of freight affected by rail delays on this segment of track reached 70.5 million tons, with similar levels expected to continue into the future. Private industry relies on Union Pacific rail services to move a variety of commodities including automobiles, high-value containerized intermodal cargo, coal, grain, and other mixed freight. In the future, the mix of freight is expected to shift towards higher value and more time-sensitive commodities through reductions in the proportion of coal carried relative to intermodal rail traffic. This means that the freight logistics time savings will become even more important in the future.

(3) Savings in travel time for Amtrak passengers: The Missouri River Runner line provides four daily train operations between St. Louis and Kansas City, Missouri (two trains in each direction). Ridership on the line is upward of 170,000 per year, the vast majority of which (approximately 150,000) is subject to delays that would be addressed by the crossover project. Travelers on Amtrak stand to gain in overall levels of intercity accessibility, with improved on-time performance and reductions in delays. Moreover, the Missouri River Runner line helps integrate the economy of Missouri by connecting the two largest urban areas in the state, and

by providing access for smaller communities and rural areas. in the center of the state to the economic activity in Kansas City and St. Louis (see Figure 7).

Together, these cost savings will help the United States compete in a global economy by facilitating efficient and reliable freight and passenger movement. The importance of the Project to economic competitiveness is further demonstrated by the partnership and cost sharing of Union Pacific in this application for funding.

Figure 7 Missouri River Runner Line

Source: https://www.amtrak.com/missouri-river-runner-train (labels added)

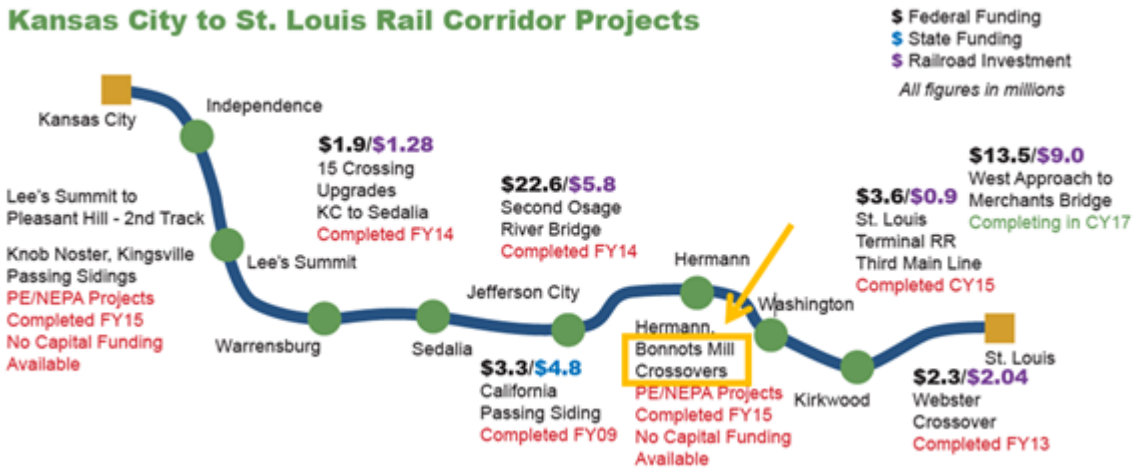
State of Good Repair

The Bonnots Mill crossover project will contribute to a state of good repair by improving the resilience of railroad operations. The new crossover will reduce the cascading operational inefficiencies that occur at present when a section of track is closed to facilitate inspection and maintenance activities. The Project is consistent with MoDOT and Union Pacific's joint plans to maintain this rail line in a state of good repair and address current operational vulnerabilities. The project will reduce the negative effects of inspection and maintenance activities that are key to ensuring the continued operation of passenger and freight rail services. The project was included in MoDOT's 2012 State Rail Plan as a priority, and is a key component of MoDOT's overall passenger rail improvement strategy on the Kansas City to St. Louis rail corridor (Figure 8).

If left unimproved, the corridor will continue to experience delays. Moreover, the Project will address a key bottleneck on the corridor that would otherwise threaten the ability of rail services to improve in the future to meet the needs of the Missouri economy.

After construction, the Bonnots Mill crossover will be maintained as part of the overall rail corridor owned by Union Pacific. It is not forecast to meaningful alter operational and maintenance costs and therefore will not introduce any new burdens in terms of overall life-cycle costs. Rather, constructing the crossover will improve the efficiency of passenger and freight rail operations, given necessary ongoing activities on the rail line to maintain a state of good repair.

Figure 8 Kansas City to St. Louis Rail Corridor Projects



Source: MoDOT Fact Sheet: Improving Missouri's Passenger Rail System, FY17.

Environmental Sustainability

The crossover will address the goal of improving environmental sustainability by reducing dependence on diesel fuel and corresponding harmful emissions released into the atmosphere. By achieving reductions in train delay, the project will reduce the extra time that locomotives are in operation, thus reducing the fuel that must be burned.

In total, it is estimated that the Bonnotts Mill crossover will facilitate a reduction in diesel fuel consumed by nearly 12,000 gallons annually. This results in a corresponding reduction in emissions of Volatile Organic Compounds (VOCs), Nitrogen Oxides (NOx), and Particulate Matter (PM).

Additionally, the project contributes to the overall efficiency of rail operations which generally serve as a more environmentally-friendly alternative to the movement of goods and people over the highway network.

With respect to impacts of project construction on the surrounding environment, all improvements will be constructed exclusively within existing railroad right-of-way and the project has received a Categorical Exclusion under the National Environmental Policy Act.

Figure 9 Location of Proposed Universal Crossover, looking to the east

Source: FRA Categorical Exclusion Worksheet: Bonnots Mill Universal Crossover

Quality of Life

The rail connections that would be improved with this project support quality of life by providing non-vehicular transportation mobility choices for individuals and companies located in Missouri and elsewhere in the United States. This includes increased accessibility and transportation options for rural communities located in the central part of the state. As discussed previously, the Amtrak Missouri River Runner line provides access to the economically important destinations of St. Louis and Kansas City. Union Pacific freight rail services similarly provide shippers with a viable and efficient alternative to moving goods by truck. For example, Union Pacific serves Alpla Inc., a local plastic packaging manufacturer in Jefferson City. The crossover would further improve the quality of these transportation options.

The importance of the project for community quality of life is demonstrated by the collaborations between Union Pacific and MoDOT in pursuit of the project's successful completion, and by the letter of support provided by the Meramec Regional Planning Commission, the regional planning commission for the area in which the project is located. The value of the Amtrak service to Missouri, including rural communities along the River Runner corridor, is further evidenced by MoDOT's decision to financially sponsor the service. The department's overall rail vision is to *"provide safe, environmentally-friendly transportation options supporting efficient movement of freight and passengers, while strengthening communities and advancing global competitiveness through intermodal connectivity."* [1]

1 http://www.modot.org/othertransportation/rail/staterailplan.htm

Beyond delay savings described previously, quality of life benefits of the project can be described in terms of expected improvements in Amtrak on time performance. From January 2015 to September 2017 there were 67 late Missouri Amtrak trains that would have been have been on-time with respect to Union Pacific's commitments to Amtrak/MoDOT had they not encountered freight or passenger train delay between Jefferson City and Hermann, where the Project is proposed. On time performance is an important characteristic of service quality considered by riders when they weigh their transportation options, and improvements in reliability have in the past been correlated with ridership increases in Missouri.[2]

Safety

This project addresses the goal of improving safety on the transportation system by **reducing the cascading operational inefficiencies that occur at present when a section of track is closed to facilitate inspection and maintenance activities that are critical to the safe ongoing operations of services on the line**. In addition, by reducing passenger train and freight train delay, reductions in system delays can be realized. **Improving fluidity of all movement in this corridor will resolve a pinch point for train traffic traveling across Missouri, potentially reducing blocked crossings and similar impacts from train delay.**

Innovation

The Bonnots Mill crossover project represents an innovative partnership between the private sector and government, with both Union Pacific and Missouri DOT committing to improving the performance of passenger and freight rail transportation in the Kansas City to St. Louis rail corridor. Additionally, the **Bonnots Mill universal crossover project will leverage previous federal investment** that was made on the Osage River Bridge project (through the High-Speed Intercity Passenger Rail Program)[3] capitalizing on and investing in the success of the previous project. By investing in this rail corridor, permanent improvements for freight movement and passenger service will be completed **without any future public obligation for maintenance**.

Partnership

The Bonnots Mill crossover project has been developed in strong collaboration between MoDOT and Union Pacific, with additional support from Amtrak and the Meramec Regional Planning Commission, to achieve shared objectives of increased efficiency of rail services in Missouri. This grant application represents a culmination of joint planning activities between Union Pacific and MoDOT. Union Pacific is responsible for design of the project and has already completed 25% Design Plans for the universal crossover. Union Pacific will also be taking responsibility for the letting of the project's construction and ensuring the project is built to specification on-time and on-budget via the selected contractor. In partnership with

2 Martin, Brent. "Better on-time performance increases Amtrak ridership." Missourinet. 13 January 2010. http://www.missourinet.com/2010/01/13/better-on-time-performance-increases-amtrak-ridership/

3 Federal Railroad Administration. "Osage River Bridge and Rail Project." https://www.fra.dot.gov/Page/P0412

Union Pacific, MoDOT has incorporated this project within its broader passenger and freight rail planning processes, as discussed in earlier sections of this document. The partnership leverages strong financial participation from the private sector, with Union Pacific contributing 38 percent of total project costs.

To initiate this project, Union Pacific underwent an application and review process through the *Missouri Moves Cost Share Program*. Union Pacific and MoDOT also have a successful ongoing relationship in relation to Amtrak service and coordinate on issues related to railroad crossings, safety, and overall rail operations. For example, Union Pacific and MoDOT collaborate on educational programming through the safety program "Operation Lifesaver" which focuses on rail crossing safety and incident reduction. Longstanding collaborative efforts to ensure the quality of the passanger rail service resulted in the Missouri River Runner Service ranking in the top 20% of Amtrak services for lowest host railroad delay minutes per 10,000 train miles in 2016, based on national Amtrak statistics.

Summary of Cost Effectiveness (BCA)

As detailed above, construction of the Bonnots Mill Universal Crossover will result in a variety of benefits. **When quantified in monetary terms, the cumulative discounted benefits of the project more than outweigh the costs of the project.** Table 4 and Table 5 present the summary results of the full benefit cost analysis detailed in the BCA Appendix document and its supporting excel spreadsheet. The time horizon of the analysis covers the construction period from 2018 to 2019, and a 20-year operational period from 2020 to 2039. All benefits and costs are expressed in constant 2016 dollars and are discounted to 2017. As shown in Table 4, the largest portion of benefits derive from savings in freight logistics time costs because of the delay that would be avoided with the new crossover. Additional benefits include savings in crew time costs, passenger time costs, and avoided emissions costs. **Using a discount rate of 7 percent, the ratio between monetized benefits and costs is 6.06. A sensitivity analysis using a 3 percent discount rate results in a benefit-cost ratio of 8.58** (Table 5). The crossover project, therefore, represents a cost-effective use of funds.

Table 4 Summary of Undiscounted Benefits ($000s)

Benefit Type	Cumulative Benefits
Freight crew time	$1,131
Amtrak crew time	$336
Freight logistics time	$78,981
Passenger time	$3,579
Avoided emissions	$239
TOTAL	***$84,266***

Source: EDR Group Analysis, detailed in accompanying BCA Appendix and spreadsheet.

Table 5 Summary of Benefits and Costs ($000s)

	Undiscounted	Discounted at 7%	Discounted at 3%
Project Costs	7,258	6,376	6,858
Total Benefits	84,266	38,656	58,860
Benefit-Cost Ratio		***6.06***	***8.58***

Source: EDR Group Analysis, detailed in accompanying BCA Appendix and spreadsheet.

Project Readiness

Technical Feasibility

Union Pacific has completed 25% Design from the Project, as shown in the attached design document. This level of design ensures that the project is feasible within the existing railroad right-of-way and also provides a firm and technically valid estimate of project costs. Union Pacific has vetted this project through its own internal planning and engineering processes, with oversight from MoDOT, to ensure that this project is technically feasible and can be delivered successfully as proposed in this application.

Project Schedule

The total timeline for completion of the Project is 14 months (see Table 6). This includes time for design/permitting, bidding/contracting, contract site work, and track/signal work.

Table 6. Project Schedule

Notice to Proceed/ AWO	Length of Time
Design/Permitting	2 mo.
Bidding/Contracting	2 mo.
Contract Site Work	4 mo.
Track/Signal Work	6 mo.
TOTAL	***14 mo.***

Source: Union Pacific

In support of this relatively short project schedule, Union Pacific has already completed 25% Design and secured a National Environmental Policy Act (NEPA) Categorical Exclusion, and has determined that right-of-way acquisition is not required for the project. If TIGER funds are secured, there will be no barrier to ensuring those funds are obligated ahead of the September 30, 2020 statutory deadline and construction will be able to proceed quickly after work and funding is authorized.

Required Approvals

This project complies with the NEPA and has received a Categorical Exclusion. At the state and local level, there are no impediments foreseen related to environmental permitting or approvals. This project is a priority for the MoDOT Multimodal Division and as such is incorporated into related planning documents and coordination efforts.

Assessment of Project Risks and Mitigation Strategies

Delaying Union Pacific freight and Amtrak passenger movement while constructing a new universal crossover at Bonnots Mill is a project risk. Train movement on the Jefferson City Subdivision is dependent on this area of track being available.

To decrease the amount of closure time and minimize disruption of current rail service, railroad crews will build the new track components alongside the track and utilize low volume days/ nights and holidays to make necessary pre-manufactured turnout connections. Down time of the route will be kept to a minimum.