

Feb. 2nd
2022



ROUTES MM & ZZ LOCATION STUDY
MISSOURI DEPARTMENT OF TRANSPORTATION

PROJECT NO. J8S0836D & J8S0836C



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1. PURPOSE AND NEED

1.1 PROJECT HISTORY:

Projects J8S0836D and J8S0836C are to address existing and future concerns due to growing traffic volumes within the Routes MM & ZZ corridor. Initially, the J8S0836 project series extended from I-44 to Rte. ZZ in Republic before it was broken into multiple segments. The J8S0836C project addresses the area between Rte. ZZ and US 60, while J8S0836D focuses on the segment between US 60 and Farm Road 160. Another project (J8S0836B) covers the area between Rte. 360 (James River Freeway) and I-44, and the remaining section of Rte. MM between FR 160 and James River Freeway remains under the root project J8S0836.

The necessary corridor improvements were identified through traffic analysis performed by a consulting agency and are discussed in detail in this report. Officials representing the City of Republic, Greene County, and the Ozarks Transportation Organization (OTO) have participated in discussions for this project and MoDOT anticipates strong public support for these improvements.



Existing intersection at US 60, Route MM, & Route M in Republic

1.2 DESCRIPTION OF EXISTING TRANSPORTATION FACILITIES

MO Route ZZ is 8.595-mile north/south major collector in Greene County that extends from Route 14 in Clever to Route M in Republic. Built in 1989, it carries approximately 7,699 veh/day (2019) and is comprised of two 12'-wide lanes of 1.25" type C asphaltic concrete over 8.75" plant mix bituminous base over 4" type 2 aggregate. Intersection improvements to install signals

at ZZ/M in 2008 included the widening of Rte. ZZ to accommodate a left turn lane between Rte. M & Repmo Dr. and a right turn lane on the northbound approach to Rte. M. There is currently no direct access from Rte. ZZ to US 60. Instead, US 60 can be reached from Rte. ZZ via Rte. M, FR 101, and FR 103, with Rte. M ending at a signalized intersection with 60.

Opposite Rte. M at its terminus at US 60, Rte. MM is a 3.95-mile north/south minor arterial with two 12' wide lanes that connects US 60 at its south end to I-44 at its north end. This route sees approximately 9,015 veh/day (2019) and was originally built in 1921. A signalized at-grade railroad crossing with BNSF rail and Rte. MM is located 530' from the intersection at US 60. The existing intersection between Rte. MM and FR 160 is 1.2 miles north of US 60.

US 60 is a 2,655-mile (in total) east/west route that runs 340.8 miles from the Missouri-Kansas border at Seneca to the Missouri-Illinois border in Mississippi County. Within the project vicinity it is a 4-lane divided highway with 12'-wide lanes & 10'-wide shoulders and carries approximately 23,739 veh/day (2020). The existing intersection of US 60, Route M, & Route MM is located at 37° 08' 44.96" N, 93° 25' 44.61" W in Republic and is currently controlled by span-wire signals directing four lanes of travel in the east/west direction and two lanes of travel in the north/south direction with single left-turn lanes in each direction. An existing bridge about 2,400' northeast of the intersection carries BNSF rail over US 60.

Farm Road 103 runs 0.952 miles north/south between US 60 and Rte. M along the quarter line of Section 11, Township 28N, Range 23W. It is a 20'-wide roadway intersected by a BNSF railroad spur a quarter mile south of US 60. FR 103 provides normal access to several adjacent properties.

1.2.1 EXISTING FACILITIES

Rte. MM

Beginning Log Mile	Ending Log Mile	Pavement		Year Built	Roadbed Width	Min. R/W Width	Access Control
		Width	Type				
0.00	2.746	24 ft.	BM	1921	24 ft.	60 ft.	Normal Access

Rte. ZZ

Beginning Log Mile	Ending Log Mile	Pavement		Year Built	Roadbed Width	Min. R/W Width	Access Control
		Width	Type				
0.000	0.052	48 ft.	BM	1989	58 ft.	150 ft.	Normal Access
0.081	0.216	36 ft.	BM	1989	44 ft.	140 ft.	Normal Access

1.2.2 RAILROAD CROSSINGS

Location	No. Tracks	No. Movements	Speed	Present Protection
FR 103	1	2	45	Yield control
Rte. MM/Brookline	1	2	45	Signalized stop control
FR 93/172	1	2	45	Signalized stop control
FR 170	1	2	45	Signalized stop control
E Haile St	2	2	20	Signalized stop control

1.3 PROPOSED DESIGN CRITERIA

A consulting agency (Olsson) was tasked by MoDOT to perform a capacity analysis and traffic study for the corridor to determine the preferred future cross-section of the realigned Rte. MM and extension of Rte. ZZ. Four alternatives were considered as part of this study: three-lane vs five-lane and partial build vs full build. It was determined that the full build alternative would most adequately address projected traffic volumes and economic growth in the area, with the construction of a five-lane cross-section between US 60 & FR 160 and a three-lane cross-section between US 60 and Rte. ZZ (Olsson, 2021). This southern segment, while constructed as a three-lane facility, would include the purchase of sufficient right-of-way to widen the segment to five lanes in the future. The decision was made to install sacrificial type A3 shoulders along this section instead of curb and gutter to minimize removal costs and lost value if the road were to be widened to five lanes. Additionally, it was also recommended that Route MM between FR 160 and Route 360 (JRF) be widened to five lanes to accommodate this anticipated growth.

The proposed facility has a functional classification of freeway with a design average daily (ADT) traffic of 30,620 for MM between FR 160 & US 60 and 12,250 for ZZ between US 60 and Rte. Z. In accordance with MoDOT's design criteria, and discussion with the district operations engineer, the following criteria will be used when designing this facility based on the stated functional classification and traffic in level/rolling terrain.

*Based on Routes MM & ZZ Corridor Study by Olsson

Route	Const. ADT (2025)	Design ADT (2045)	Operational (Posted) Speed	No. & Width Of Lanes	Median Width	Roadbed Width	Right of Way	
							Width	Control
MM	7,830 (2020)	22,720-30,620	45	5	14' TWLTL	82'	130'	PCA
ZZ	N/A	12,250	45	3	14' TWLTL	50'	130'	PCA

1.4 SYSTEM LINKAGE

Facility at the north end of the projects: J8S0836C: US 60, J8S0836D: FR 160

Facility at the south end of the projects: J8S0836C: Rtes. ZZ/M, J8S0836D: US 60

Rte. ZZ acts as one of the main connections between Republic, Nixa, and Clever. The route is mostly rural but provides access to many residential properties and several traffic generators such as Wilson’s Creek National Battlefield and Republic High School.

Rte. MM extends about four miles from US 60 in Republic to I-44. This corridor is expected to continue experiencing heavy development as it provides access to generators like the Amazon STL3 facility, Magellan Midstream Partners L.P., and the McLane distribution center.

1.4.1 LOGICAL TERMINI

The Federal Highway Administration defines logical termini as “rational end points for a transportation improvement and a review of environmental impacts” (FHWA, 1993). Three principles are used to define these points:

1. Termini must be of sufficient length to address environmental matters on a broad scope.
2. Termini must be set such that a project is determined to have independent utility and be a reasonable expenditure.
3. Termini are placed to not restrict any alternatives or foreseeable improvements.

For this study, the logical termini are specified as:

- For J8S0836C (Rte. ZZ extension) – 1.) At the existing intersection of Route ZZ and Route M and 2.) at the proposed intersection of the Route ZZ extension with US 60 and Route MM.
- For J8S0836D (Rte. MM realignment) – 1.) At the existing intersection of Route MM and Farm Road 160 and 2.) at the proposed intersection of the Route MM realignment with US 60 and Route ZZ.
- For J8S0836 (the entire corridor) – 1.) At a point about 300’ north of the northernmost ramps at the existing interchange of James River Freeway and Route MM and 2.) at the existing intersection of Route ZZ and Route M.

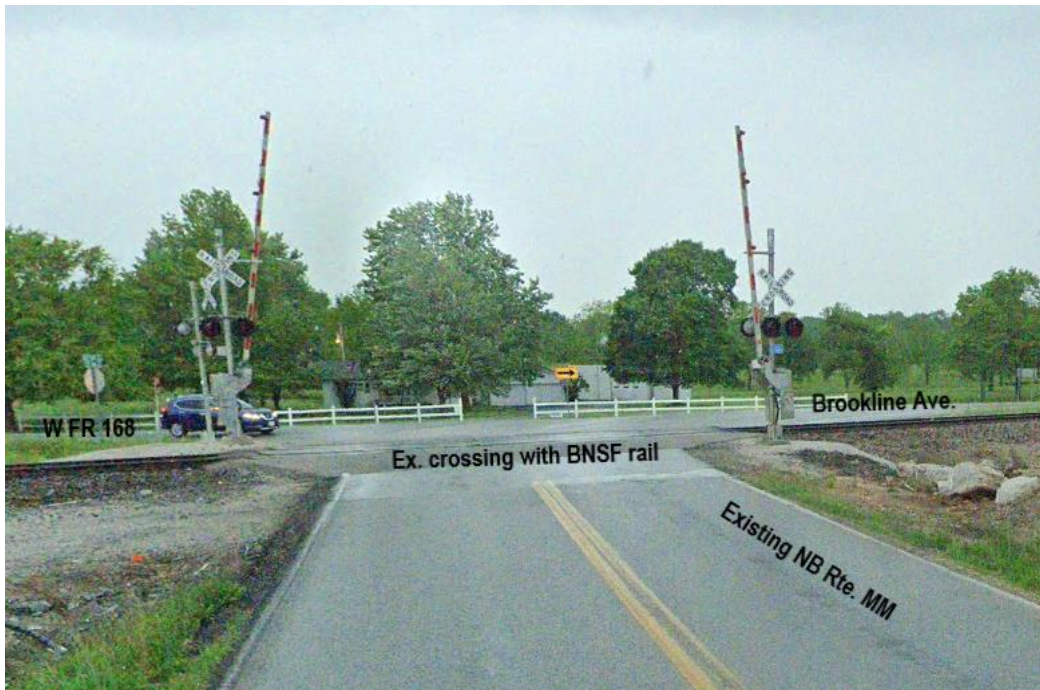
1.5 OVERVIEW OF PURPOSE AND NEED

To address recent and projected growth in the area, Route MM was identified as likely to be over-burdened in the near future, with sections of the corridor already performing at a level of service (LOS) D or F (Olsson, 2021). Its location between I-44 and US 60 as well as the access it provides to existing and future traffic generators make it subject to high levels of congestion,

particularly near its intersections with the interstate and US 60. This congestion is likely to increase as the City of Republic expects population growth of up to 100% by 2040 (Republic, n.d.). Development throughout the corridor has recently accelerated with the construction of new residential properties and commercial facilities such as the Cox Health Center and the Amazon STL3 Fulfillment Center. South of US 60, access to Republic High School via Route M and Farm Road 103 will also see increased usage as development extends east from Republic towards Wilson's Creek National Battlefield and Route ZZ. MoDOT, in cooperation with the City of Republic and Greene County, is proposing significant corridor improvements along Rte. MM between Route 360 (James River Freeway) & US 60 and an extension of Route ZZ from its current terminus at Route M north to US 60 in order to accommodate these future concerns. Recommended improvements include the construction of a five-lane corridor between US 60 & Farm Road 160 and a 3-lane corridor between US 60 & Routes M/ZZ. A new signalized intersection will be constructed at US 60 & Route MM, and the existing intersections of ZZ/M and MM/FR 160 will be converted into dual lane roundabouts. In addition to increasing corridor capacity, another primary objective of this project is to eliminate (or greatly reduce) the negative impacts to traffic caused by trains at the existing rail crossings. In total, four crossings are expected to be eliminated as a result of the realignment of Rte. MM and one as a result of the extension of Rte. ZZ:

1. Rte. M and Farm Road 168, about 600 ft. north of US 60
2. Farm Road 170, just north of US 60 and west of Rte. MM
3. Farm Road 172 & Farm Road 93, just north of US 60 and west of Farm Road 170
4. E Haile Street and E Orr Street, near Brookline Fire Station No. 1
5. Farm Road 103, about 1,400 ft. south of US 60 and east of Rte. MM

These rail crossings see significant usage and are occasionally obstructed by trains causing backups and presenting serious safety concerns. The proposal calls for the permanent closure and removal of these crossings. The realignment of Route MM will include a railroad overpass to eliminate all referenced crossings north of US 60, and the extension of Route ZZ will replace the crossing on Farm Road 103 with another railroad overpass.



Railroad crossing on Rte. MM just north of US 60 and Kum & Go

Congestion at the existing intersection of Farm Road 103 & Route M due to thru traffic was also investigated as part of the study. It was determined that providing an alternate connection between US 60 and Route ZZ could help to alleviate congestion at this intersection and improve the existing roundabout level of service to LOS A by 2045 (Olsson, 2021). One early consideration for the Route ZZ connection was to carry Route ZZ traffic along existing Route M to Farm Road 103 and then along FR 103 to US 60. This was of particular concern to the City of Republic and the Republic School District due to the expected impact of increasing thru traffic volume, and the alternative was abandoned.

1.6 ACCIDENT DATA, SAFETY ENHANCEMENTS AND ACCESS MANAGEMENT

Between 2016 and 2020, there were 77 total crashes (See Appendix E, Accident Summaries) along the existing **Rte. MM** alignment between Farm Rd. 160 (L.M. 2.746) and US 60 (L.M. 3.95). Of these incidents, five resulted in serious injuries, 22 in minor injuries, and 50 accidents resulted in only property damage. There were no fatal crashes in this area over the 5-year study period. Many these were rear end crashes (41), right-angle crashes (8), or out-of-control crashes (11)

OFFSET	TRAVEL WAY ID	DESIGN ACTION	TRAVEL WAY NAME	DIRECTION	BEGIN LOG	END LOG	BEGIN DISTRICT	END DISTRICT	BEGIN COUNTY	END COUNTY	COUNTY BEGIN LOG	COUNTY END LOG	BEGIN DESCRIPTION	END DESCRIPTION
	2603	RT	MM	S	2.746	3.95	6	6	GREENE	GREENE	2.746	3.95	CRD 160 E	US 60 E

TYPE	2016	2017	2018	2019	2020	TOTAL
FATAL	0	0	0	0	0	0
SERIOUS INJURY	2	2	0	0	1	5
MINOR INJURY	7	3	4	4	4	22
PROPERTY DAMAGE ONLY	13	9	10	10	8	50
TOTAL	22	14	14	14	13	77
AADT	9201	9283	9377	7400	7785	

1 Year Statewide Rate

TYPE	2016	2017	2018	2019	2020	Rate Level
CRASH RATE	544.09	343.18	339.74	430.5	379.98	
STATE RATE-RT	283.32	274.29	277.06	271.45		ROUTE DESG
STATE RATE-TWO-LANE	211.67	208.06	210.88	194.42	0	ROADWAY TYPE

There were 59 total crashes (See Appendix E, Accident Summaries) on **westbound US 60** in the vicinity of the existing intersection with Rtes. MM & M (L.M. 21.693 to 21.767), comprised of two serious injuries, 11 minor injuries, 46 property damage only accidents, and zero fatalities over the study period. This segment saw a lot of rear end crashes (49) and right-angle collisions (5) from following too close or running the light.

OFFSET	TRAVEL WAY ID	DESIGNATION	TRAVEL WAY NAME	DIRECTION	BEGIN LOG	END LOG	BEGIN DISTRICT	END DISTRICT	BEGIN COUNTY	END COUNTY	COUNTY BEGIN LOG	COUNTY END LOG	BEGIN DESCRIPTION	END DESCRIPTION
	7783	US	60	W	265.042	265.116	6	6	GREENE	GREENE	21.693	21.767	CO US60W TO RTMMN	CO RTMM TO US60W W

TYPE	2016	2017	2018	2019	2020	TOTAL
FATAL	0	0	0	0	0	0
SERIOUS INJURY	1	1	0	0	0	2
MINOR INJURY	1	3	2	1	4	11
PROPERTY DAMAGE ONLY	8	8	9	9	12	46
TOTAL	10	12	11	10	16	59
AADT	13171	13290	13091	13504	11505	

1 Year Statewide Rate

TYPE	2016	2017	2018	2019	2020	Rate Level
CRASH RATE	2810.97	3342.96	3110.97	2741.66	5148.83	
STATE RATE-US	116.14	108.89	113.73	114.39		ROUTE DESG
STATE RATE-EXPRESSWAY	133.59	127.2	130.67	118.21	0	ROADWAY TYPE

Along **eastbound US 60** there were 66 total crashes (See Appendix E, Accident Summaries) including three serious injury crashes, nine minor injury crashes, 54 property damage only crashes, and zero fatalities. Like westbound US 60, most accidents were rear end crashes (40).

OFFSET	TRAVEL WAY ID	DESIGNATION	TRAVEL WAY NAME	DIRECTION	BEGIN LOG	END LOG	BEGIN DISTRICT	END DISTRICT	BEGIN COUNTY	END COUNTY	COUNTY BEGIN LOG	COUNTY END LOG	BEGIN DESCRIPTION	END DESCRIPTION
	7782	US	60	E	74.821	75.879	6	6	GREENE	GREENE	4.946	6.004	CRD 170 E	CRD 101 S

TYPE	2016	2017	2018	2019	2020	TOTAL
FATAL	0	0	0	0	0	0
SERIOUS INJURY	1	1	0	0	1	3
MINOR INJURY	2	0	3	3	1	9
PROPERTY DAMAGE ONLY	15	12	14	8	5	54
TOTAL	18	13	17	11	7	66
AADT	14571	14702	14482	14870	11719	

1 Year Statewide Rate

TYPE	2016	2017	2018	2019	2020	Rate Level
CRASH RATE	319.89	228.98	303.98	191.56	154.68	
STATE RATE-US	116.14	108.89	113.73	114.39		ROUTE DESG
STATE RATE-EXPRESSWAY	133.59	127.2	130.67	118.21	0	ROADWAY TYPE

At the **existing intersection of Rtes. ZZ and M**, past accident history includes three minor injury crashes and 11 property damage only crashes for a total of 14 crashes (See Appendix E, Accident Summaries) over the past five years. Of these crashes, eight were rear-end crashes, three were right-angle crashes, two were head-on crashes, and one was an out-of-control crash.

OFFSET	TRAVEL WAY ID	DESIGNATION	TRAVEL WAY NAME	DIRECTION	BEGIN LOG	END LOG	BEGIN DISTRICT	END DISTRICT	BEGIN COUNTY	END COUNTY	COUNTY BEGIN LOG	COUNTY END LOG	BEGIN DESCRIPTION	END DESCRIPTION
	2727	RT	ZZ	S	0	0	6	6	GREENE	GREENE	0	0	RT ME	RT ME

TYPE	2016	2017	2018	2019	2020	TOTAL
FATAL	0	0	0	0	0	0
SERIOUS INJURY	0	0	0	0	0	0
MINOR INJURY	0	1	0	2	0	3
PROPERTY DAMAGE ONLY	4	3	1	1	2	11
TOTAL	4	4	1	3	2	14
AADT	6816	6874	6831	6871	6609	

1 Year Statewide Rate

TYPE	2016	2017	2018	2019	2020	Rate Level
CRASH RATE	1.61	1.59	0.4	1.2	0.83	
STATE RATE	0.37	0.38	0.34	0.33	0	

Ten total accidents (See Appendix E, Accident Summaries) occurred at the **intersection of FR 103/Commercial Ave. and US 60** between 2016 and 2020, of which one was a fatal crash, two resulted in minor injuries, and seven resulted in property damage only. The lone fatality came from November of 2016 when a westbound car turned southbound to 103 in front of an eastbound car causing a right-angle crash. The front-seat passenger of the westbound vehicle sustained fatal injuries. Five of the ten accidents were rear-end crashes.

OFFSET	TRAVEL WAY ID	DESIGNATION	TRAVEL WAY NAME	DIRECTION	BEGIN LOG	END LOG	BEGIN DISTRICT	END DISTRICT	BEGIN COUNTY	END COUNTY	COUNTY BEGIN LOG	COUNTY END LOG	BEGIN DESCRIPTION	END DESCRIPTION
	7782	US	60	E	76.484	76.484	6	6	GREENE	GREENE	6.609	6.609	CST COMMERCIAL AVES	CST COMMERCIAL AVES

TYPE	2016	2017	2018	2019	2020	TOTAL
FATAL	1	0	0	0	0	1
SERIOUS INJURY	0	0	0	0	0	0
MINOR INJURY	1	0	0	0	1	2
PROPERTY DAMAGE ONLY	2	1	3	1	0	7
TOTAL	4	1	3	1	1	10
AADT	24987	25232	24872	27006	23875	

1 Year Statewide Rate

TYPE	2016	2017	2018	2019	2020	Rate Level
CRASH RATE	0.44	0.11	0.33	0.1	0.11	
STATE RATE	0.37	0.38	0.4	0.41	0	

There was a total of nine accidents (See Appendix E, Accident Summaries) at the **existing intersection of Rte. MM and FR 160**, two of which resulted in minor injuries and seven resulted in property damage only. Three of the accidents were rear-end crashes.

OFFSET	TRAVEL WAY ID	DESIGN ACTION	TRAVEL WAY NAME	DIRECTION	BEGIN LOG	END LOG	BEGIN DISTRICT	END DISTRICT	BEGIN COUNTY	END COUNTY	COUNTY BEGIN LOG	COUNTY END LOG	BEGIN DESCRIPTION	END DESCRIPTION
	2603	RT	MM	S	2.746	2.746	6	6	GREENE	GREENE	2.746	2.746	CRD 160 E	CRD 160 E

TYPE	2016	2017	2018	2019	2020	TOTAL
FATAL	0	0	0	0	0	0
SERIOUS INJURY	0	0	0	0	0	0
MINOR INJURY	0	1	0	1	0	2
PROPERTY DAMAGE ONLY	3	2	2	0	0	7
TOTAL	3	3	2	1	0	9
AADT	24039	24256	23892	25617	22517	

1 Year Statewide Rate

TYPE	2016	2017	2018	2019	2020	Rate Level
CRASH RATE	0.34	0.34	0.23	0.11	0	
STATE RATE	0.37	0.38	0.4	0.41	0	

1.7 ROADWAY CAPACITY

Segment	Construction Year (2025)		Design Year (2045)	
	ADT	LOS	ADT	LOS
MM (FR 160 to US 60)	7,830 (2020)	A	22,720- 30,620	A
ZZ (US 60 to Rte. M)	N/A	N/A	12,250	A

Intersection Location	Intersection Type	Construction Year LOS	Design Year LOS
Rte. MM/FR 160 (Existing)	Unsignalized to Roundabout	N/A	A
Rte. MM/Rte. 60/Rte. M (Existing)	Signalized	AM: D, PM: F	AM: B, PM: C
Rte. 60/FR 103 (Existing)	Unsignalized to Signalized	F	E
Rte. ZZ/Rte. M (Existing)	Signalized to Roundabout	AM: C, PM: D	B
Rte. M/FR 103 (Existing)	Ex. Roundabout	B	A

1.8 ROADWAY DEFICIENCIES

Several notable deficiencies exist throughout this corridor that are directly or indirectly correlated with recent crash history. Adequate sight distance is a concern at several intersections as a result of vegetation or geometric constraints. For example, FR 101 intersects Rte. M at a 35° angle creating a challenge for drivers to see approaching vehicles and forcing larger vehicles to enter opposing lanes when making NB-to-EB or SB-to-WB movements. The existing intersections at US 60/FR 101 & US 60/FR 103 present similar concerns, although the 2017 addition of offset left & right turn lanes at these locations has helped address them.

As described above, 62% of the accidents within the study area between 2016 and 2020 were rear-end crashes resulting from vehicles following others too closely or driver inattentiveness, and almost 10% were out-of-control crashes. The sharp curves and lack of shoulders throughout much of the corridor contribute to deficient space for errant vehicle recovery. As the existing route experiences >4,500 AADT, a benefit/cost analysis is likely to show that adding or widening shoulders to the existing roadway would provide a good return on investment (EPG 231.4.2).

Based on current and projected traffic volumes along Route MM and existing roadway features, a minimum clear zone of 22 feet should be maintained (Roadside, 2011). Upon site inspection, several existing culverts can be seen within this clear zone that have been left unprotected by guardrail. This presents a safety concern as these objects can prevent vehicle recovery and introduce more collision potential were a driver to lose control of their vehicle.

This project will remove five existing railroad crossings within the area. The railroad crossings at FR 172 & FR 93, FR 170, Rte. MM & FR 168/Brookline Ave, and at E Haile St. (all north of 60) will be closed as part of J8S0836D while the railroad crossing at FR 103 south of US 60 will be replaced with a bridge over the railroad as part of J8S0836C. Current conditions result in the occasional blockage of these routes by trains causing traffic backups.

1.9 ADDITIONAL JUSTIFICATION

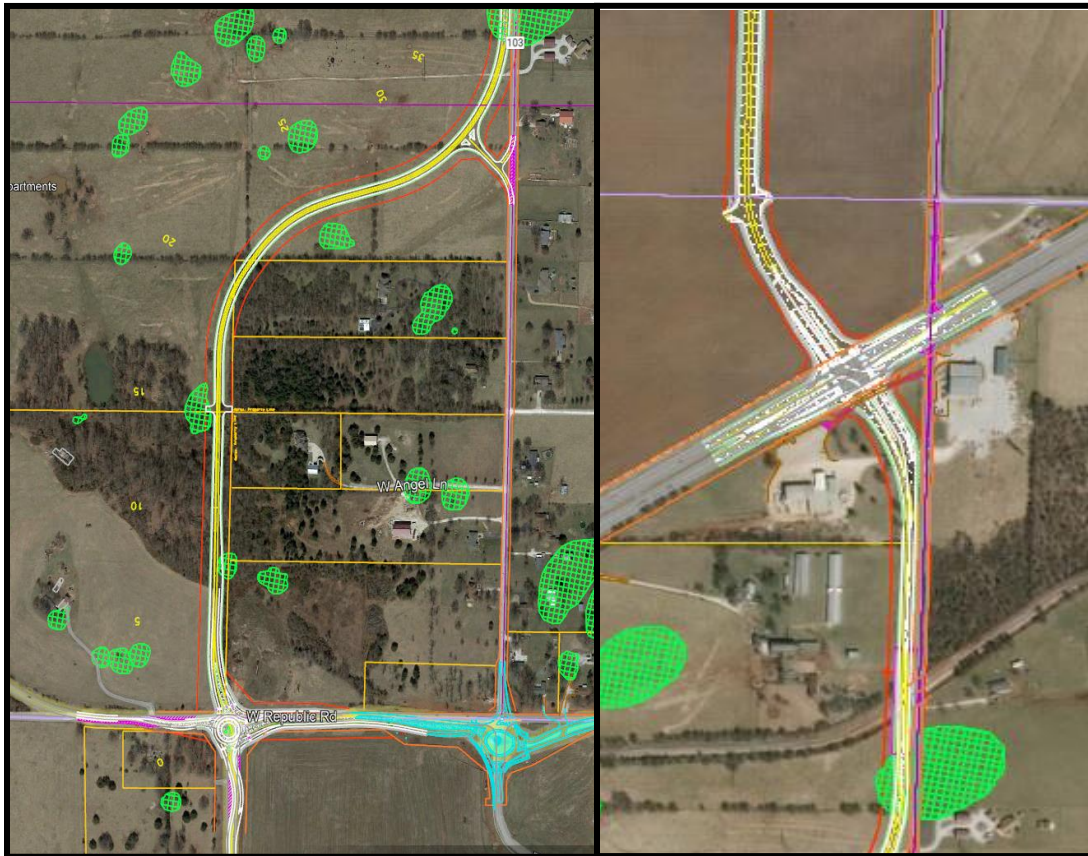
Future development will also add strain the existing system. The US 60 corridor in Republic is experiencing accelerated development. New housing developments and apartment complexes along with commercial properties such as the Cox Health Center and the Amazon STL3 Fulfillment Center are causing increased traffic congestion and a need for improved transportation facilities. The existing intersection at US 60 & Rte. MM was found to currently perform at a LOS D during the AM peak hour and a LOS F during the PM peak hour (Olsson, 2021). The intersection at Rtes. M & ZZ operate at a LOS C in the AM peak hour and a LOS D in the PM peak hour (Olsson, 2021). The existing US 60 & FR 103 intersection performs at a LOS F for both AM and PM peak hours (Olsson, 2021). These intersections will be improved and the new route constructed such that the capacity of the new facilities will be capable of sustaining projected design volumes.

2. ALTERNATIVES ANALYSIS

Multiple alternatives were considered to address crash history and eliminate at-grade railroad crossings in the area. Several, such as incorporating FR 101 as part of the Rte. ZZ extension, splitting properties south of US 60 with the new Rte. ZZ alignment, or realigning Rte. MM along Commercial Ave, were initially discussed and dismissed. A Rte. ZZ realignment along FR 101 was eliminated due to major sinkhole concerns. Upcoming development planned for properties south of US 60 was the main deterrent for avoiding the second option. Realigning Rte. MM along Commercial Ave. created geometric constraints that would increase the cost of the project significantly and cause greater impact to adjacent residences. Ultimately, three alternatives were identified for further analysis (see Appendix C for alternatives exhibits).

FINAL STUDY ALTERNATIVES:

2.1 Green Line Alternative (Concept 1): Roundabouts at M/ZZ & FR 160/MM



Extension of Rte. ZZ, roundabout at the intersection of M/ZZ, and existing roundabout at intersection of M/FR 103 (in blue).

Signaled intersection at US 60/MM/ZZ.

As part of project J8S0836C, the first alternative includes constructing a 3-lane, 1.039-mile-long extension of Rte. ZZ between the current northern terminus at Rte. M and US 60. A new two-lane roundabout will be installed at the intersection of Rte. M and the new Rte. ZZ extension. Curves in alignment are placed such that requirements for geometry based on superelevation (minimum radii, curve length, etc.) are balanced with limiting impacts to existing properties. A new bridge will be built over the existing BNSF railroad spur, as well as a new signalized intersection with US 60. The proposed roadway will include a sacrificial type A3 shoulder in place of curb & gutter to avoid the lost costs of removing the curb & gutter and storm sewer system if the road was to be widened to five lanes. A new connection between Rte. MM and Commercial Ave. will also be constructed.



Realignment of Rte. MM and roundabout at MM/FR 160.

J8S0836D will include a 5-lane, 0.897-mile-long realignment of Rte. MM between FR 160 and the new intersection at Rte. ZZ & US 60. A new bridge will be constructed over the existing BNSF railroad and a two-lane roundabout will be installed at the new intersection of Rte. MM & FR 160. This design will include curb & gutter and storm sewer facilities. No displacements are expected from Concept 1.

2.2 Blue Line Alternative (Concept 2): Roundabouts Plus Reverse Curves Moved Further South



Reverse curves of Rte. ZZ moved further south.

The second alternative features similar alignment and intersection geometry as Concept 1. However, the curves of the Rte. ZZ extension are further to the south, allowing maximum usage of the existing FR 103 roadbed as well as providing ample space between the curves and the railroad bridge to ensure there is no need for horizontal curvature of the bridge. This alignment requires more inconsistent impacts to existing properties than Concept 1 and will cause at least one displacement, but it is more accommodating to currently proposed development projects in the area.

2.3 Red Line Alternative (Concept 3): Signalized Intersections at M/ZZ & FR 160/MM



Signalized intersection at M/ZZ.

Signalized intersection at MM/FR 160.

The third alternative substitutes the proposed roundabout intersections at Rte. MM/FR 160 & Rtes. M/ZZ with signalized intersections. The alignments for both routes are simplified due to removal of the skewed approaches at the roundabouts, causing Rte. ZZ to run directly north from the new M/ZZ intersection. This results in increasing property impacts to the east of the Rte. ZZ alignment (by including three additional properties) but reducing the impacts to the west of the alignment. No displacements are expected from Concept 3.

Full plan views of each alternative are available in Appendix C.

2.4 COST ESTIMATES

J8S0836C – Route ZZ Extension between Route M & US 60			
(Costs in 1,000's)	Concept 1	Concept 2	Concept 3
Categories	Roundabouts at MM/FR 160 & ZZ/M	Roundabouts plus reverse curves moved further south	Signalized intersections at MM/FR 160 & ZZ/M
Bridge/MSE Wall	5,630	5,630	5,630
Grading/Drainage	6,789	7,024	6,896
Misc.	3,456	3,222	3,486
Pavement/Base	2,906	2,963	2,662
Contract Estimate	18,781	18,839	18,674
Const. Contingency (2%)	376	377	373
Construction Estimate	19,157	19,216	19,047
Utilities	1,675	1,675	1,675
Other Costs	200	200	200
Construction Cost (Total)	21,032	21,091	20,922
Right-of-way Acreage	16.4	17.5	17.3
Right-of-way Costs	3,315	3,537	3,497

J8S0836C (Continued)			
Right-of-way Incidentals	70	70	70
Preliminary Engineering (12%)	2,254	2,261	2,241
Construction Engineering (8%)	1,502	1,507	1,494
Total Project Cost	28,173	28,466	28,224

J8S0836D – Route MM Realignment between Farm Road 160 & US 60			
(Costs in 1,000's)	Concept 1	Concept 2	Concept 3
Categories	Roundabouts at MM/FR 160 & ZZ/M	Roundabouts plus reverse curves moved further south	Signalized intersections at MM/FR 160 & ZZ/M
Bridge/MSE Wall	5,454	5,454	5,454
Grading/Drainage	10,776	10,776	10,955
Misc.	3,865	3,865	4,058
Pavement/Base	2,938	2,938	2,842
Contract Estimate	23,033	23,033	23,309
Const. Contingency (2%)	461	461	466
Construction Estimate	23,494	23,494	23,775
Utilities	1,151	1,151	1,151
Other Costs	200	200	200
Construction Cost (Total)	24,845	24,845	25,126
Right-of-way Acreage	14.1	14.1	14.9
Right-of-way Costs	2,859	2,859	3,021
Right-of-way Incidentals	80	80	80
Preliminary Engineering (12%)	2,764	2,764	2,797
Construction Engineering (8%)	1,843	1,843	1,865
Total Project Cost	32,391	32,391	32,889

CONCEPTUAL COST DATA:

Cost (\$1,000's)

Right of Way Costs: J8S0836D: \$2,939
J8S0836C: \$3,385

Contract Estimate: J8S0836D: \$23,067
J8S0836C: \$18,781

Detailed cost estimates for each concept are included in Appendix D.

2.5 SATISFACTION OF THE PURPOSE AND NEED

Through internal alternative analyses and in concurrence with the traffic study provided by Olsson, each alternative was considered to address the concerns presented by projected growth in the project vicinity. Many economical and practical factors involved in the analyses were considered including necessary right-of-way acquisition, environmental impact, level of service, accessibility to adjacent properties, existing & future traffic volumes, existing crash history &

crash predictions, upcoming development, traffic interaction at intersections, travel time, drainage concerns, geometric constraints, and overall construction costs.

The variation in alignments of each alternative meant that each concept affected a unique area and required different amounts of acquisition. Due to the number of potentially impacted properties, Concept 3 was considered undesirable relative to Concepts 1 & 2 which would potentially affect fewer properties. Concepts 2 & 3 would require more tree clearing than Concept 1, meaning greater potential for negative impacts to threatened or endangered species. Concept 2 was also considered undesirable due to a displacement caused by the alignment.

All three concepts involve limiting access to the relocated routes in order to ensure optimal traffic flow and reduce conflict points. Direct access from Rte. ZZ to adjacent properties will rely on the existing FR 103 remaining in place. A new connection between it and the extension of Rte. ZZ will be constructed to minimize access along the corridor. Due to the location of the curves in Concept 2, additional access point(s) to the west of Rte. ZZ would be required to allow connectivity to residences on the west side. However, Concepts 1 & 3 would keep access to these properties to the east of the new alignment allowing local traffic to continue using FR 103 and reducing access to a single intersection with Rte. ZZ.

Based on expected ADT, the provided traffic study identified the proposed intersection of Routes MM/ZZ and Route M as operating at a LOS D during peak periods if signalized (Concept 3). Alternatively, as a roundabout the intersection is expected operate at a LOS B for AM and LOS C for PM peak hours. With the addition of a westbound slip right-turn lane, the roundabout could operate at LOS B for both AM and PM peak hours, making this (Concepts 1 & 2) the preferred configuration (Olsson, 2021). Furthermore, the roundabouts are expected to require less widening than the signalized intersections would while reducing travel time by introducing continuous flow to the intersections.

The most significant difference between Concept 2 and the others is the location of the reverse curves between Route M and US 60. The location of these curves was central to the discussion surrounding the projects effects on planned development in the area. The underlying and governing geometric constraints in this case were requirements associated with achieving proper superelevation runoff/runout lengths to provide a comfortable and efficient transition into and out of the curves. 208 feet was calculated as the minimum length required between curves to provide adequate transitions from one curve to the next and 711 feet was found to be the required minimum radius length (MoDOT, 2021 Standard Plans 203.20 & EPG 230.1). The curves were placed such that these constraints were met. Concept 2 places the curves further south than Concepts 1 & 3 while maintaining superelevation requirements. To reduce impacts to existing residences, the curves of Concept 2 were pushed as far south as possible forcing the southernmost curve to begin directly adjacent to the roundabout. This was considered unideal as the curve would reduce southbound sight distance giving approaching drivers less of a warning of the upcoming intersection than if the approach were straight, such as in Concept 3.

As described previously, future development in this area and the impact it will have on traffic congestion is a major concern shared by MoDOT and the City of Republic. Each alternative was chosen with this projected growth in mind, with a focus on minimizing crash potential. To reduce rear-end type crashes (the most common in the area), skewed approaches were added to the roundabouts in Concepts 1 & 2 to slow vehicles approaching the intersections down. It is recommended these approaches are kept at 20°-40° skews to enhance entry deflection (NCHRP, 2010). Extra-long turn lanes were included at the proposed intersection of US 60 and Route MM (and the other two intersections for Concept 3) to allow greater space for deceleration and storage. The addition of railroad overpasses also serves to eliminate stoppage points and reduce the potential for crashes at the existing at-grade railroad crossings.

It should be noted that regardless of the chosen alternative, the traffic study identified a potential level of service concern at the proposed signalized intersection of US 60 & Routes MM and ZZ. Traffic volumes are projected to grow such that this intersection could be operating at a level of service E and approaching capacity by the design year of 2045 (Olsson, 2021). In this case, it's recommended that the intersection be reevaluated at that time and innovative designs be considered to address the increased volumes.

As part of the analysis a no-build option was also considered, but segments of Route MM were found to be approaching or above a volume-to-capacity (v/c) ratio of 1.0 by 2045 – meaning these segments would be operating over-capacity or approaching capacity by the design year (Olsson, 2021). Therefore, the no-build option was found to be undesirable since it will likely contribute to increased congestion throughout the corridor as development continues in the coming years.

3. CONSTRUCTION IMPACTS

3.1 UTILITIES

J8S0836D (FR 160 to US 60): improvements will require relocation of 345' of 12" City of Republic water line in the northwest quadrant of the proposed intersection at Rte. MM & FR 160 and an additional 570' relocation of 12" City of Republic water line along the north side of US 60 and west of FR 103. 330' of encased 12" gravity sewer and three new manholes will be constructed under the proposed alignment of Rte. MM. Southwest Power Administration has a 154 kV transmission line passing over the new alignment with two H-towers on each side that will be raised to obtain proper clearance. AT&T has a direct buried 96-count fiber optic line in easement that will be encased in a split wall duct under the new roadway fill (about 550'). City Utilities has 3-phase electric facilities at the northwest and southwest quadrant of the proposed intersection of Rte. MM and FR 160. A Liberty 69 kV line runs along the east side of the new alignment that will require a new inline tower and turning structure. Ozark Electric Cooperative owns a 3-phase crossing at US 60 and FR 103, with a parallel along the north side of US 60 east of FR 103 for which four poles are estimated for relocation. Spire has a 2" steel crossing at Rte.

MM, a 2" parallel north along the east side and a 2" parallel along the west side south of FR 160. City Utilities also has a 4" gas line along the north side of US 60 which will likely require relocation from FR 103 to west of the new intersection at 60/MM.

J8S0836C (Rte. MM/ZZ to US 60): this project will require relocation of 1026' of City of Republic 12" PVC along the south side of US 60 and 803' of City of Republic 12" PVC along the north side of Rte. M. The City of Republic has sanitary sewer along FR 103 that will require about 955' of relocation and seven new manholes. Ozark Electric Cooperative owns a 3-phase line along the west side of FR 103 and the south side of Rte. M that will require 16 pole adjustments. City Utilities has a 3-phase line buried along the north side of Rte. M, approximately 803' of which will be relocated. City Utilities also has a 345 kV line that will be impacted by the new alignment with two H-towers on each side of Rte. ZZ, a 161 kV line currently under construction that will require a mono-pole on each side of Rte. ZZ, and a 4" plastic gas main along the north side of Rte. M that will require 803' of relocation. AT&T has toll fiber in the north right-of-way of Rte. M and KAMO Electric Cooperative also has existing fiber that may be impacted.

3.2 HANDLING TRAFFIC

A large portion of construction will not affect traffic on existing facilities since much of the construction is of new roadway where there are no existing facilities. Most impacts will be at the proposed intersections where the new alignments will connect to existing ones. Intermittent lane closures will be needed to complete construction of the new intersection at 60/MM/ZZ, as well as the roundabouts at ZZ/M & MM/FR 160. A complete closure of FR 103 will be needed to build the bridge over the southern rail, with a 2-mile detour available along Route M and US 60. There will also be significant multimodal impacts due to the removal/closure of multiple railroad crossings. MoDOT will work with BNSF to coordinate an effective mitigation strategy.

3.3 DISPOSITION OF EXISTING ROUTE

In discussions with local officials from the City of Republic and Greene County, it was agreed that the existing Rte. MM should be left in place to allow access to the relocated Rte. MM from Brookline Ave. as well as to private residences and properties. Ownership and maintenance of the existing Rte. MM from FR 160 to FR 168 will likely become the responsibility of the City of Republic, but discussions on the subject are ongoing. There will be no disposition of Rte. ZZ since there is no relocation associated with it, only an extension of the existing route.

3.4 LAND USE WITHIN THE STUDY AREA

Most of the properties within the study area affected by the projects are classified as agricultural or residential, while three parcels are classified as commercial, one as exempt, and one as railroad utilities. The nearest airport (Springfield-Branson National Airport) is located about five miles north of the northern terminus of J8S0836D at FR 160. No properties that could qualify as 4(f) or 6(f) land or hazardous waste sites within the study area will be impacted by these projects.

No wetlands exist within the area, but more information is required to determine if there is any impact to an existing stream in the southern portion of the area. Future land use within the area based on projected development will primarily include properties for residential, commercial, and industrial activity. See Appendix F for more details.

3.5 ENVIRONMENTAL SUMMARY

The initial estimate for right of way to be acquired is 30.5 acres in total, with approximately 3.5 acres of tree clearing required for Concept 1. Concept 2 is estimated to require 31.6 acres and Concept 3 will require 32.2 acres. These acquisitions will require a farmland impact rating from NCRS. A floodplain development permit from SEMA will be required and possible impacts to threatened & endangered species (Indiana bat, northern long-eared bat) exist due to tree clearing. The projects qualify as Type 1 and will require a noise analysis. An archaeological survey will be performed on all properties that may be affected to determine the extent of potential impacts to cultural resources. No public land impacts are anticipated at this time. No displacements result from Concept 1 or Concept 3, but Concept 2 will have one displacement at 4047 S FR 103. A conceptual Request for Environmental Services (RES) for J8S0836C was reviewed and returned on 10/28/2021 and a conceptual RES for J8S0836D was reviewed and returned on 11/8/2021. A CE2 will be prepared by environmental staff to achieve Section 106 clearance. See Appendix F for more details.

4. COMMENTS AND RECOMMENDATIONS

No pre-location meeting has been conducted, and an initial virtual public meeting is tentatively scheduled for late February of 2022. All potentially affected property owners have been contacted with regards to rights of access to gather data for preliminary geotechnical and environmental studies. MoDOT will ensure sufficient opportunities will be available for addressing property owners' concerns and receiving public input.

As a result of the alternative analysis as presented above and with input from City of Republic officials & Greene County officials, *Concept 1 was chosen as the preferred alternative*. As described previously, the environmental concerns, geometric constraints, necessary right-of-way acquisition, and level of service associated with Concepts 2 & 3 were deemed unfavorable relative to Concept 1. A preference for roundabouts at the proposed intersections of Rte. MM & FR 160 and Rte. ZZ & Rte. M based on construction costs, anticipated maintenance issues, and intersection level of service were the primary reasons for this study's recommendation against Concept 3, while reducing accessibility and right-of-way displacement made a strong case against Concept 2.