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US 54 – J2P3447

Conceptual Study

Alternating Passing Lanes

Pike, Ralls, and Audrain County

Prepared For:

Missouri Department of Transportation – Northeast District

Prepared By:

Bartlett & West – June 2023

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1. Introduction

1.1: Background

Route 54 is a major transportation corridor that connects Central and Southwestern Missouri with Northeast Missouri and the State of Illinois. It is one of the highest volume corridors in the part of the state along with Routes 63, 36 and 61. The approximately 60-mile-long corridor is a vital transportation link for the business communities in Mexico, Bowling Green and Louisiana, and is important to the area's large presence of farm and agricultural related industries.

As adjacent growth and traffic on this corridor has increased over the past few decades, there have been demands from the public to add additional lanes. In the early 1990s, MoDOT explored the possibility of expanding the Route 54 corridor to four-lanes from Mexico to Bowling Green, along with improving several other routes around Mark Twain Lake. Due to a lack of funding and expansion of other nearby corridors this project never made it past the environmental document stage and was eventually shelved by MoDOT.

Local politicians, community leaders and businesses were persistent in their requests for improvements along the corridor and organized the Highway 54 Coalition to help push their agenda forward. MoDOT responded by studying a more practical solution to improve capacity and safety for Route 54. In 2009, MoDOT completed and approved a Value Engineering Study that proposed using a relatively new idea for Missouri, which is a concept of alternating passing lanes, also known as a "Shared Four-Lane," from Mexico to Bowling Green, in lieu of a divided four-lane highway.

The alternating passing lanes concept consists of providing an occasional additional lane for passing, along a conventional two-lane highway to better accommodate traffic volumes and improve safety. Alternating passing lanes are somewhat new to Missouri, with few applications, but has been used in other states, and successfully in European countries such as Sweden, Finland and Germany. These improvements are not to be confused with "climbing lanes" that have been used in Missouri previously on steep uphill grades, allowing traffic to pass slower vehicles.

An alternating passing lane design for a highway is a great means of providing the passing opportunity of a four-lane divided highway without the footprint or construction costs of a full four-lane divided highway. The overall template is considerably narrower and would not require a grade separated median. A paved intermediate median would

be necessary, but the 4’ minimum width is much less than the typical 60’ width required for a four-lane divided highway template.

For two-lane routes such as Route 54, an alternating passing lane appropriately implemented can serve as the ultimate design to serve anticipated traffic volumes at a good level of service for many decades to come.

Alternating passing lanes add a layer of safety intervention with the addition of various roadway attributes geared toward reducing vehicle conflicts. The wider median area separates head-to-head traffic by providing a four-foot median, which is an additional three feet separation from the existing one-foot median, thereby increasing the recovery area. The rumble strips on both sides of the median area provide a warning to alert drivers that could veer into oncoming traffic.

The addition of passing lanes, which alternate directions, provides an opportunity for faster vehicles to pass slower vehicles without the issue of trying to navigate passing in oncoming traffic lanes, as on a traditional two-lane roadway. The faster vehicles can move around the slower vehicles unimpeded by sight distance and visibility issues or vehicle conflicts. Lengths of these passing areas vary based on the directional roadway volumes.

The alternating passing lane template will require a wider cross section due to the additional lane and wider median, and it is generally suggested to add or require adequate shoulder width in the project expansion. Other important considerations include locations for potential turning conflicts requiring improvements, business and structure conflicts with widening, major utility conflicts and required drainage improvements.

1.2: Scope of Study

The scope of work for this study is to provide recommendations and long-range programming level cost estimates for the optimal locations and lengths of alternating passing lanes from east of Mexico to west of Louisiana. This is provided using color-coded layouts on aerial photographs and supporting the recommendations with traffic and crash history information.

A “desk-top” environmental review of the corridor is to be completed to provide potential impacts and information on any areas of concern for future improvements. This part of the study will also aid with the future environmental classification and clearances and the determination of logical project termini. This was completed by our environmental subconsultant using a 150’ corridor width after discussions with MoDOT’s environmental group.

Support for public involvement and community outreach on corridor options is to be provided by the consultant team. This will involve developing meeting displays and handouts and attending one open-house style meeting for the public. An additional meeting with key stakeholders including the Highway 54 Coalition may be required to further explain the recommendations and answer questions.

Additionally, a full corridor survey has been completed within the areas that will require improvements. This will include full topographic, utilities and legal land surveys to be completed along the corridor and provided for future detailed design and plans development.

1.3: Means and Methods of the Study

1.3.1: Length of Passing Lanes

Lengths of each segment are based on design year AADT, guidance from EPG 232.2, and experience from prior MoDOT passing lane projects. The guidance from the EPG is shown in the table below.

Table 1: Guidance for Length Passing Lane - MoDOT EPG 232.2

Length of Passing Lanes	
Directional flow rate (pc/h)	**Passing lane length (mi)**
Less than 100	≤0.50
100 - 400	>0.50-0.75
400 - 700	>0.75-1.00
≥700	>1.00-2.00
Source: Transportation Research Board, Highway Capacity Manual, 6th Edition	

The segments are separated by greater than the minimum tail-to-tail separation of 500-ft and head-to-head separation of 1,500-ft, as stated in the MoDOT EPG 232.2, which is based off a 60-mph design speed. The existing speed limit along US 54 is 60 mph. A design speed of 65 mph was chosen for this study to allow for a higher speed limit in the future, if desired, and to account for motorists traveling faster through the corridor once the passing lanes are in place.

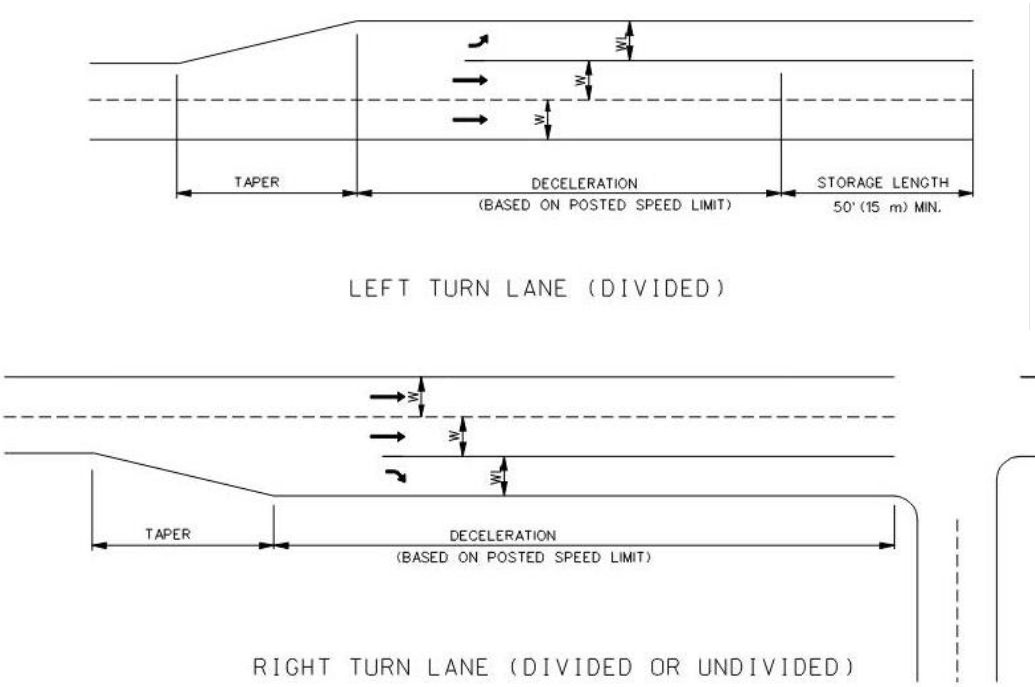
Using peak hour volumes from the MoDOT Data Zone, the “>0.75 mi - 1.00 mi” length was used as the target passing lane length for this study. Traffic volumes in the study area suggest the 0.75-mile length is applicable for current volumes (directional values ranging from 100 vph to 400 vph), while the one-mile length accommodates the future year volumes (directional values ranging from 100 vph to 500 vph), based on an annual growth rate of 1%, as provided by MoDOT.

1.3.2: Taper Length Layout

Taper lengths differ based on application and geometric conditions. Per the MoDOT EPG 232.2.3.2, a minimum lane-addition taper should be at least 360 feet, while a lane termination taper should be no less than L = WS (where L is taper length in feet, W is the terminated lane width, and S is the 85th percentile or design speed). The exit tapers for this project have a length of 780 feet.

1.3.3: Traffic Analysis Procedure

A base assumption was made that all state-route intersections should have a minimum of a left turn lane. A conceptual-level turn lane length was utilized for each location, using guidance from the MoDOT figure below.



DECELERATION LENGTH			
POSTED SPEED LIMIT mph (km/h)	MINIMUM* FT (m)	DESIRABLE** FT (m)	TAPER LENGTH FT (m)
30 (50)	90 (30)	90 (30)	100 (30)
35	90 (30)	90 (30)	100 (30)
40 (60)	90 (30)	90 (30)	100 (30)
45 (70)	120 (40)	120 (40)	100 (30)
50 (80)	160 (60)	175 (65)	100 (30)
55 (90)	200 (75)	240 (90)	180 (54)
60 (100)	240 (95)	310 (120)	180 (54)
65	290	385	180 (54)
70 (110)	350 (115)	465 (150)	180 (54)

* MINIMUM DECELERATION LENGTH IS BASED ON BRAKING DISTANCE USING 11.2 FT/S 2 DECELERATION RATE. MINIMUM DECELERATION LENGTH IS ALSO BASED ON A 10 mph (10 km/h) SPEED REDUCTION FROM POSTED SPEED.

** DESIRABLE DECELERATION LENGTH IS BASED ON 10 mph (10 km/h) SPEED REDUCTION FROM POSTED SPEED.

Left and Right Turn Lane Details

Figure 1: MoDOT Turn Lane Design Guidance (EPG Figure 233.2)

As part of the traffic analysis, crash data was reviewed for the five-year period from 2017 through 2021. Crash types were reviewed along the corridor, focusing on trends that could identify locations where a turn lane could reduce the number of crashes occurring.

1.3.4: Safety Impacts of Passing Lanes

According to the Highway Safety Manual (HSM), published by the American Association of State Highway Transportation Officials (AASHTO), providing a passing lane along a two-lane rural road has a Crash Modification Factor (CMF) of 0.75. It should be noted that there is not a Safety Performance Measure (SPM) for this scenario and the Standard Error for this condition is not reported. The CMF of 0.75 is stated in the HSM as applying to all types and all severities of crashes. While the HSM indicates a potential reduction in crashes of 25%, this data should be used with caution, as the CMF is not as fully developed as many others in the HSM.

1.3.5: Cost Estimating Procedures

Cost estimating for the project was split out for each of the five sections of the corridor, with an additional cost estimated for the completion of the four lanes around the eastern edge of Mexico. In addition, the conceptual cost was broken down for the pavement, grading, drainage items, R/W, utilities and construction incidentals for each section.

Grading cost factors were developed on a cost-per-mile basis using an average three-foot of cut and fill for the roadway cross section to develop end area quantities and costs. This assumption was applied throughout the project, as the terrain for most of the corridor is relatively level and consistent. For Section E from Bowling Green to Louisiana, the cost factors were modified to account for the more rolling terrain in this area. A full-depth saw cut along each edge of pavement and subgrade compaction for the widened areas was also included.

Drainage costs included the anticipated culvert extensions and bridge widening. Two bridge structures were included as full replacements based on age, condition and sufficiency ratings (Bridge G0870 over the West Fork Cuivre River and Bridge H0337 over Mam's Creek, both in Section A). Box culvert extensions are based on an average 40-foot extension length based on estimated concrete and steel quantities and include excavation, headwall and wingwall quantities. Pipe culverts include costs for excavation, pipe collars and flared end sections also.

Due to very flat terrain, most crossroad drainage structures have low heights of cover. Therefore, this roadway has many box culverts instead of pipes. This low fill height means that the clear zone will be hard to maintain, especially around the bigger box culverts. However, the conservative assumption was made in estimating that the crossroad structures would extend out to the clear zone. Where this is ultimately not possible to attain, it is anticipated that guardrail or some other clear zone mitigating solution will be implemented, using some of the funds remaining from this conservative estimate.

A cost was also included for replacement of entrance pipes and reconnection of entrances, as many of these will be replaced with lane and shoulder widening. The total number of entrances was tabulated, and the total pipe lengths were estimated for the corridor. This was broken down into a cost per mile amount that includes a factor for additional surfacing also.

Pavement and base costs were established on the typical sections shown in the exhibits (see Appendix A) and include a 12" asphalt pavement on 6" of aggregate base. A cost for a 1 ¾" resurfacing of any existing pavement and shoulders was also included in the cost-per-mile factor. New Type A2 shoulders were included for both sides of the travelway on Route 54 in sections that are widened.

Right-of-way amounts were estimated as described elsewhere in this report and multiplied by $10,000 per acre, based on small strip takings per parcel and the fact that the majority will be prime agricultural land. Utility relocations costs were estimated at 1% of the construction cost due to a lack of information on the extent to how many of these will be reimbursable (2% was used for the new four-lane alignment section). Construction incidentals were estimated at 15% of the construction cost based on 5% for mobilization, 2.5 % for removal of improvements, 3% for traffic control, 1% for erosion control, 2% for striping and rumble strips and 1% for new signage. These percentages were prorated and calculated contract prices for a similar MoDOT project along US 54 in Camden County, which added passing lanes to a previous two-lane alignment.

1.4: General Recommendations for Corridor

Utilizing the means and methods described above, an initial layout was developed for the proposed passing lane segments. The recommendations for passing lanes in this report are based on traffic volumes, crash data, and level of service determinations throughout the corridor. Additionally, avoidance of major known impacts such as large bridges, existing structures, high-volume intersections, large utilities, and obvious environmental concerns were important in the final passing lane recommendations.

This method creates a balance of providing passing opportunities for motorists, while also allowing for left turn lanes to be constructed at major intersections. However, providing a turn lane at every intersecting roadway is not feasible, as it would not allow for addition of new passing opportunities.

The project was divided into six segments separated by defined points, such as major intersections or communities. The recommendations are presented for each project segment in the following sections of the report.

2. Proposed Four-Lane Alignment West of Section A

2.1: Summary of Segment Lane Layouts

2.1.1: Existing Super-Two-Lane Alignment

This segment would be expanded to a four-lane alignment by adding a second set of roadway lanes, creating a divided highway.

2.1.2: New Alignment along MoDOT Right-of-Way around Vandiver and the Mexico Airport

In addition to the Right-of-Way along the existing Highway 54 alignment, MoDOT owns additional property that can accommodate a four-lane roadway extending from the current US 54/Bus 54 interchange. This property, shown circled in blue in the figure blow, proceeds away from the existing roadway, which contains several at-grade intersections. This additional property connects with the Right-of-Way adjacent to Highway 54 east of the Mexico Memorial Airport.

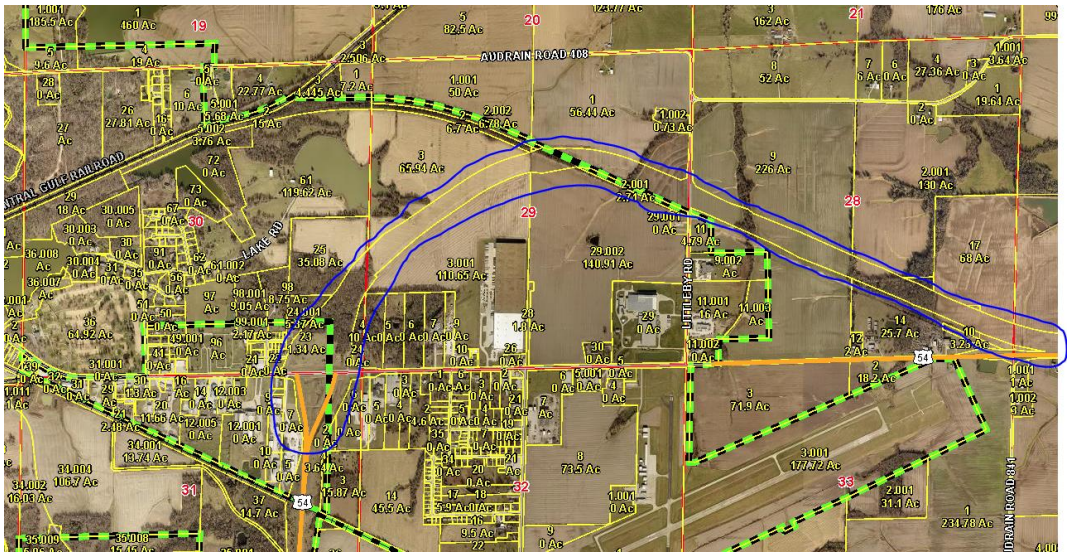


Figure 2: MoDOT ROW Near Vandiver and the Mexico Airport

2.2: Traffic Analysis

This area contains a High Severity segment, as identified by MoDOT, from Log Point 215.00 to 217.00, which is partially located on the Super-Two-Lane alignment south of the existing US 54/Bus 54 interchange in Vandiver. The approximate location is shown in the figure below, which shows crash results from the most recent three-year period of 2019 through 2021.

Figure 3: High Severity Crash Segment near Vandiver

The crash data values associated with the High Severity Segment are shown in the table below. The precise number of crashes do not match exactly, as the High Severity Range data (in the table below) was provided directly from MoDOT, while the crash data shown in the figure was obtained from MoDOT's online Data Zone.

Table 2: High Severity Crash Data

High Severity Range: 2019 to 2021

Year	Dist	County	Desg	Name	Dir	TWAY ID	Begin Log	End Log	Fatal Crashes	DI Crashes	MI Crashes	PDO Crashes	Severity Rating
2021	NE	Audrain	US	54	E	1985	215	217	2	1	7	6	24

This location is the only instance of a High Severity Range identified by MoDOT within the overall project. The crashes in this location will be reduced by construction of the four-lane highway through this area.

2.3: Turn Lanes at Intersections – n/a

2.4: Potential Impacts

No potential impacts are anticipated, as the proposed improvements are contained within existing Right-of-Way. An environmental assessment of this area was not included in the scope of this project.

3. Section A: Mexico to Scott's Corner

3.1: Summary of Segment Lane Layouts

Section A runs from the end of the proposed four-lane section, near the Mexico Memorial Airport, to just west of the roundabout at Scott's Corner (MO 19 South Jct). This section includes an eastbound acceleration lane for the transition from the existing Route 54 alignment to the proposed Route 54 passing lane section between Log Mile (LM) LM 218 and LM 219. Section A contains six alternating passing lane sections for the 8.4-mile stretch, providing a balance of passing opportunities for vehicles. The lanes alternate mostly continuously, avoiding turning areas, providing as much opportunity to pass as possible, thus alleviating congestion areas.

The initial passing lanes in each direction begin immediately after the intersection for existing Route 54 near the Mexico Airport for the eastbound lanes and west of the Scott's Corner Roundabout for the westbound lanes. This is in conformance with previous research studies that recommend passing lanes be used directly after urban areas and major intersections where traffic speeds have been reduced and vehicles have been platooned. Consideration was made within this section to avoid extending lanes through the major state intersections of Route A and Route B.

The passing lane segments are summarized in the table below and described in more detail in the next sub-section. Segment A1 is a set of acceleration and merging lanes for eastbound traffic, with one lane of traffic from the existing alignment and one lane from the proposed alignment, where traffic will merge into a single lane as the alternating passing lanes begin. Immediately adjacent to Section A, to the west, is a set of turn lanes and connection points between the existing alignment, proposed four-lane alignment, and proposed passing lanes. For eastbound traffic, the divided highway will narrow to one lane in each direction prior to this transition area. A dedicated turn lane will be present for all non-through movements, including the eastbound right turn (from the four-lane alignment to return west on the existing alignment), eastbound left turn (from the existing alignment to return west on the proposed four-lane alignment), and westbound left turn (from the passing lanes to the existing alignment). An alternate configuration would be to provide access for these movements at the US 54/Bus 54 interchange in Vandiver (approximately 2.4 miles to the west) and not allow any turning movements at this transition area. The alternate configuration would reduce conflict points, while also increasing travel time for some movements. The exact configuration could be determined during preliminary design of this section.

Table 3: Passing Lane Details - Section A

Segment	Type	Direction	Beginning Log Point	Ending Log Point	Length (mi)			Passing Lane Length (mi)	Passing Lane Ratio
					Segments (including tapers)	Sub-Total	Grand Total		
Exist./Prop. US 54	Turn Lanes	n/a	218.40	218.77	0.37	7.6	8.4	6.1	72%
A1	Acceleration	EB	218.77	219.23	0.46				
A2	Passing	WB	219.23	220.43	1.20				
CRD 449	Turn Lanes	n/a	220.53	220.72	0.19				
A3	Passing	EB	221.27	222.49	1.22				
Route B	Turn Lanes	n/a	222.59	222.77	0.18				
A4	Passing	WB	222.86	224.07	1.21				
A5	Passing	EB	224.07	225.29	1.22				
A6	Passing	WB	225.29	226.51	1.22				
Scott's Corner	Roundabout	n/a	226.51	226.82	0.31				

Note: Grand Total values includes lengths between the segments listed in the table

Each passing lane segment in Section A is approximately one mile in length with an additional 360-ft entrance taper length and 780-ft exit taper length. The segments are separated by greater than the minimum tail-to-tail separation of 500-ft and head-to-head separation of 1,500-ft, as stated in the Means and Methods section of the report. The passing lane segments do not overlap with turn lane sections, major intersections or higher volume driveways.

3.1.1: Sight Distance Review

Given the relatively flat terrain in Section A there is a great deal of sight distance for both the turning areas and the passing lane conversion locations.

3.2: Traffic Analysis

Traffic data for Segment A is shown in the table below. The analysis shows that the Level of Service (LOS) will be improved in four of the six segments, based on future-year volumes.

Table 4: Traffic Analysis - Segment A

				Initial Year - 2022				Future Year - 2042			
				Peak Hour Volumes		LOS		Peak Hour Volumes		LOS	LOS
Segment	From	To	Analysis Direction	Analysis Direction	Opposing Direction	No Build	Passing Lane	**Analysis Direction**	**Opposing Direction**	No Build	Passing Lane
A1	Route A	Scott's Corner	EB	191	204	B	B	233	249	B	A
A2			WB	204	191	B	A	249	233	C	B
A3			EB	191	204	B	B	233	249	B	B
A4			WB	204	191	B	B	249	233	C	B
A5			EB	191	204	B	B	233	249	B	B
A6			WB	204	191	B	B	249	233	C	B

LOS based on travel time, v/c ratio, and percent-time spent following Improved Level of Service Shaded in Orange

3.2.1: Crash Data Review

A review of the crash data (2017-2021) in Segment A identified the following locations where crashes were concentrated. See Appendix C for heat maps of the crash data.

- Route A – see the next sub-section for details of a proposed turn lane
- Route B – see the next sub-section for details of a proposed turn lane
- CRD 457/709
    - This intersection is located between Route A and Route B, near the center of Passing Lane Segment A3 (EB). Potential accommodations for a left turn lane at this location are to shift the proposed passing lanes, adjust the adjacent passing lane lengths, or provide a passing lane and a left turn lane at this intersection, or a combination of those options.
- Bridge G0870 over the West Fork Cuivre River
    - This bridge is located between Route B and MO 19 (Scott's Corner)/Route BB and is proposed to be replaced with this project, which should improve the crash rates here by providing shoulders consistent with the rest of the corridor (no existing shoulders on the bridge)
- CRD 485/737
    - This intersection is located between Route B and MO 19 (Scott's Corner)/Route BB, near the east end of Passing Lane Segment A5 (EB). Potential accommodations for a left turn lane at this location are to shift Segment A4 (WB) and Segment A5 (EB) to the west.

3.3: Turn Lanes at Intersections

There are three locations with proposed turn lanes in Section A. These are located at the existing Highway 54 connection (where the new 4-lane section ends), Route A, and Route B. Each of these locations are described in the list below. Intersections that had existing left or right turn lanes were accommodated with turn lanes as necessary. A base assumption was made that all state-route intersections should have a minimum of a left turn lane. Traffic volumes were reviewed to confirm the initial assumption. These volumes are shown in the list below.

- Existing Highway 54 Connection
    - This area will connect the existing Highway 54 alignment to the proposed four-lane alignment, and the beginning of the passing lane segments.
        - Mainline US 54 volume (existing): 6,458
- Route A
    - Existing AADT
        - US 54: 6,458 (to the west); 5,082 (to the east)
        - Route A: 599

- Route B
  - Existing AADT
    - US 54: 5,082 (to the west); 4,505 (to the east)
    - Route B: 735

3.4: Potential Impacts

3.4.1: Right-of-Way

Existing right-of-way in this section is generally 40 feet on both sides of the centerline, for a total of 80 feet. While there are small segments of wider right-of-way, this section has a relatively consistent width. As the segment with the most traffic and no towns, this section contains six passing lanes and two turning lane sections. As such, almost the entire length is proposed to be widened.

As shown in the typical section (see Appendix A), the assumed width for the proposed right-of-way is 135 feet, or an additional 55 feet beyond the existing right-of-way through passing lane sections. Taper areas were assumed to have an average right-of-way width of 125 feet. This proposed right-of-way allows for a full clear zone width of 30', which is not currently met. Some drainage structures or intersections may require additional width, but these areas generally already have 5 to 10 feet wider right-of-way widths, so the relative widening of 55 feet should cover these areas. As seen in the project estimate, this section requires approximately 46.7 acres of additional right-of-way. At an assumed land value of $10,000 per acre, this amounts to $467,000.

The adjacent land is mostly rural farmland, with approximately 20 entrances leading to rural housing and farming storage areas. Proposed right-of-way acquisition appears to get close to existing structures on approximately three properties. In these areas, future designers may consider shifting the roadway centerline to avoid some impacts.

3.4.2: Drainage

Section A between Vandiver and Scott's Corner (MO 19 South Jct), with two impacted bridges, has the largest cost for drainage of the sections evaluated at nearly $4.7M. More detailed impacts are summarized below:

- Bridge G0870 over the West Fork Cuivre River
  - This 119' long x 31.4' wide bridge, built in 1956, is proposed to be replaced by a new structure carrying the full passing lane typical section. The existing structure had a deck replacement in 2021/2022, but still lacks shoulders and doesn't allow for the addition of passing lanes. This bridge is shown on MoDOT's listing of "Poor Bridges" found on its website at https://www.modot.org/Bridges (dated May 2021) with a deck rating of 4, superstructure rating of 6, and substructure rating of 6. It is anticipated

that the recent deck replacement has improved at least some of these ratings. Given the previous poor rating and the crash discussion above, along with the uncertainty regarding when these improvements may be made, this bridge replacement is included in this project. This replacement is estimated to cost approximately $1.64M.
    - When Section A is constructed, if it is determined that replacement of the bridge would detract from the benefit provided with the deck replacement in 2021/2022, Segment A6 could be omitted until such time that the bridge replacement can occur. As noted above, the cost for the replacement is included with the project, as it is assumed the Segment A6 would be constructed with the bridge is replaced.
- Bridge H0337 over Mam's Creek
    - This approximately 30' wide bridge, built in 1956, is proposed to be replaced by a new structure carrying the full passing lane typical section. The existing structure does not have shoulders or concrete barriers and does not appear to have been recently rehabilitated. If replacement of this bridge were to occur before this project is incorporated, consideration should be given to widening the structure. This replacement is estimated to cost approximately $1.24M.
- Culvert J0785 over Bean Creek
    - This 10' x 10' culvert, built in 1932, is proposed to be lengthened in order to accommodate an acceleration lane from the existing Route 54 onto the relocated Eastbound 54. This extension is estimated to cost approximately $208,000.
- Culvert F10412 over Littleby Creek
    - This 20' x 9' culvert, built in the 1930's, is proposed to be lengthened in order to accommodate the taper for passing lane A3. This extension is estimated to cost approximately $345,000.
- Culvert F10422 over Drainage Ditch
    - This 16' x 8' culvert, built in the 1930's, is proposed to be lengthened in order to accommodate passing lane A5. This extension is estimated to cost approximately $258,000.
- 14 more single or double box culverts ranging in size from 2' x 1.5' to double 5' x 3' would be extended in order to accommodate passing lane additions for a total cost of approximately $820,000.

In addition to the crossroad drainage, a cost factor of $27,791.96 per mile was developed to account for entrance pipe replacements in widened areas. This added approximately $192,000 to the drainage costs for Section A.

3.4.3: Utilities

Utilities adjacent to and crossing the corridor in this section consist of overhead electric, underground telephone and a petroleum pipeline crossing. The overhead electric line impacts will mostly involve the eastbound passing lane sections which will require widening along the south right-of-way line of Route 54. There is one large "H" electrical pole located on the existing right-of-way, but this is outside any passing lane sections and should not be impacted. Underground telephone lines are present adjacent to residential properties, on both sides of the roadway and these will also be affected by lane widening where necessary. The petroleum pipeline crosses Route 54 near LM 224.5 and just west of Bridge F-10422 and is located within a proposed eastbound passing lane segment.

3.4.4: Environmental Impacts

Section A has minimal environmental conflicts and impacts based on the desk-top review performed by HG Consult for the corridor (see Appendix E). There are five locations within this section that cross a 100-year floodplain and will likely require permits for fill placement.

NHD, or "blue-line", streams are crossed by the Route 54 corridor at seven locations within this section. Several of these are larger drainage structures that will require extending or replacement, thereby requiring additional permitting.

One forested wetland was identified along the north side of Route 54 at the Littleby Creek bridge near LM 221. Widening of this structure may be avoided by shifting the passing lane slightly to the east.

Most of the adjacent land throughout this section is active farmland used for row crop farming operations. A Farmland Conversion Impact rating will have to be determined for this section during the environmental process.

4. Section B: Scott's Corner to Bassinger's Corner

4.1: Summary of Segment Lane Layouts

Section B extends from Scott's Corner (MO 19 South Jct) through the town of Laddonia to Bassinger's Corner (MO 19 North Jct). This section of US 54 runs north-south, overlapping with MO Highway 19. The US 54 eastbound lanes correspond to northbound direction, while the US 54 westbound lanes correspond to the southbound direction. Section B contains six passing sections, three eastbound and three westbound for the 8-mile section. There is a passing lane provided for egress of major intersections and the town of Laddonia, avoiding both a major bridge on this stretch of road, as well as avoiding the developed area surrounding Laddonia.

The passing lane segments are summarized in the table below and described in more detail in the next sub-section.

Table 5: Passing Lane Details - Section B

Segment	Type	Direction	Beginning Log Point	Ending Log Point	Length (mi)			Passing Lane Length (mi)	Passing Lane Ratio
					Segments (including tapers)	Sub-Total	Grand Total		
B1	Passing	EB	226.82	228.02	1.20	8.1	8.1	6.8	84%
B2	Passing	WB	228.02	229.23	1.21				
Bridge #B0171	Bridge	n/a	229.23	229.31	0.08				
B3	Passing	EB	229.31	230.51	1.20				
B4	Passing	WB	230.51	231.68	1.17				
Ladonnia	Town	n/a	231.68	232.74	1.06				
B5	Passing	EB	232.74	233.77	1.03				
B6	Passing	WB	233.77	234.80	1.03				
Basinger's Corner	Roundabout	n/a	234.80	234.95	0.15				

Note: Grand Total values includes lengths between the segments listed in the table

The two passing sections north of Ladonia are 0.85 miles in length to fit a passing section in both directions between Poet Bioprocessing and Bassinger's Corner. The segments are separated by greater than the minimum tail-to-tail separation of 500-ft and head-to-head separation of 1,500-ft, as stated in the Means and Methods section of the report. The passing lane segments do not overlap with turn lane sections, major intersections or higher volume driveways.

4.1.1: Sight Distance Review

Segment B sight distance was reviewed and poses no concern. Both the town of Laddonia and the major bridge in this section have been avoided of passing sections and transition areas. There are no turn lanes proposed for this section to cause conflict.

4.2: Traffic Analysis

Traffic data for Segment B is shown in the table below. The analysis shows that the LOS will remain the same in each of the six segments, based on existing year volumes and future year volumes, No-Build and Build conditions.

Table 6: Traffic Analysis - Segment B

				Initial Year - 2022				Future Year - 2042			
				Peak Hour Volumes		LOS		Peak Hour Volumes		LOS	LOS
Segment	From	To	Analysis Direction	Analysis Direction	Opposing Direction	No Build	Passing Lane	**Analysis Direction**	**Opposing Direction**	No Build	Passing Lane
B1	Scott's Corner	Ladonia	EB	189	173	B	B	231	211	B	B
B2			WB	173	189	B	B	211	231	B	B
B3			EB	189	173	B	B	231	211	B	B
B4			WB	173	189	B	B	211	231	B	B
B5	Laddonia	54/J/19 Junction	EB	197	169	B	B	240	206	B	B
B6			WB	169	197	B	B	206	240	B	B

LOS based on travel time, v/c ratio, and percent-time spent following | Improved Level of Service Shaded in Orange

4.2.1: Crash Data Review

A review of the crash data (2017-2021) in Segment B identified the following locations where crashes were concentrated, outside of Laddonia. See Appendix C for heat maps of the crash data.

- Bridge #B0171 over the West Fork Cuivre River
  - This bridge is located between Segment B2 (WB/SB) and Segment B3 (EB/NB) and is proposed to remain in place, as it was recently constructed (2011).
- CRD 642
  - This intersection is located between Bridge #B0171 and Laddonia, near the middle of Segment B3 (EB/NB). Potential accommodations for a left turn lane at this location is to shorten, shift, or eliminate Segment B3 or to consider installing a left turn lane concurrent with the passing lane. If a left turn lane is constructed for CRD 642, it may be desirable to also provide a turn lane at CRD 424, located approximately 1,300 feet to the south.
- Entrances to FastLane Laddonia
  - There are two driveways to the FastLane, located near the middle of Segment B4 (WB/SB), approximately ½-mile south of the Laddonia City Limits. Potential accommodations for a left turn lane at this location is to shorten, shift, or eliminate Segment B4 or to consider installing a left turn lane concurrent with the passing lane.
- CRD 456
  - This intersection is located on the south end of Segment B6 (WB/SB), between Laddonia and MO 19 (North Jct – Bassinger's Corner). Potential accommodations for a left turn lane at this location is to shorten Segment B6

4.3: Turn Lanes at Intersections

There are no proposed turn lanes in Section B.

There is an existing WB/SB left turn lane at the Poet Bioprocessing facility, just north of the Laddonia City Limits and just south of CRD 456, at the south end of Segment B5 (EB/NB). Section B5 will be shifted (and shortened, if necessary) to maintain the southbound left turn lane. One possible accommodation is for the WB/SB taper for the existing left turn lane to overlap with the EB/NB entrance taper for the passing lane in Segment B5.

4.4: Potential Impacts

4.4.1: Right-of-Way

Existing right-of-way in this section varies. South of Laddonia, the right-of-way is generally 40 feet on both sides of the centerline, for a total of 80 feet. North of Laddonia, the right-of-way is generally 35 feet on both sides of the centerline, for a total of 70 feet. While there are small segments of wider right-of-way, these sub-sections have a relatively consistent width. With the exceptions of bridge B0171 over the Cuivre River and the town of Laddonia, Section B has back-to-back passing lanes. Because of the numerous passing lanes and narrower right-of-way north of Laddonia, section B has a high cost per mile for additional right-of-way. The Section B cost per mile for right-of-way is $54,000, second only to Section A which has a cost per mile of $56,000.

As shown in the typical section (see Appendix A), the assumed width for the proposed right-of-way is 135 feet. This means that south of Laddonia, approximately 55 feet of right-of-way would need to be acquired, while 65 feet would be needed north of Laddonia. Taper areas were assumed to have an average right-of-way width of 125 feet. This proposed right-of-way allows for a full clear zone width of 30', which is not currently met. Some drainage structures or intersections may require additional width, but these areas generally already have 5 to 10 feet wider right-of-way widths, so the relative widening of 55 to 65 feet should cover these areas. As seen in the project estimate, this section requires approximately 44.3 acres of additional right-of-way. At an assumed land value of $10,000 per acre, this amounts to $443,000.

The adjacent land is mostly rural farmland, with approximately 26 entrances leading to light commercial, rural housing, and farming storage areas.

4.4.2: Drainage

Section B between Scott's Corner (MO 19 South Jct) and Bassinger's Corner (North Jct) has the second largest cost for drainage per mile of the sections evaluated at nearly $179,000 per mile. More detailed impacts are summarized in the list below:

- Culvert H0169 over Drainage Ditch – This double 12' x 6' x 45' culvert, built in the 1930's, is proposed to be lengthened in order to accommodate passing lane B5. This extension is estimated to cost approximately $411,000.
- 13 more single box culverts, ranging in size from 3' x 2' to double 6' x 4', a concrete arch culvert, and one pipe would be extended in order to accommodate passing lane additions for a total cost of approximately $883,000.

In addition to the crossroad drainage, a cost factor of $27,791.96 per mile was developed to account for entrance pipe replacements in widened areas. This added approximately $174,000 to the drainage costs for Section B.

4.4.3: Utilities

Utilities adjacent to and crossing the corridor in this section consist of overhead electric and underground telephone. South of the Cuivre River bridge, the overhead electric line impacts will mostly involve the southbound passing lane sections which will require widening along the west right-of-way line of Route 54. Underground telephone lines are present adjacent to both sides of the roadway and will be affected by lane widening for passing lanes in both directions, where necessary.

North of the Cuivre River bridge to Laddonia, the overhead electric lines run along the east side of Route 54 but should not be impacted since they are located approximately 100' east of the centerline up to approximately one mile south of Laddonia. There is one large "H" electrical pole located on the east side of existing right-of-way in this area, but it is on the opposite side of a proposed southbound passing lane section and should not be impacted. Underground telephone lines are present at various locations along both east and west right-of-way lines in this area.

A branch of the Panhandle Eastern Gas Pipeline runs from north to south along the side of the Route 54 corridor in this section. It runs along the west right-of-way from the round-about at Bassinger's Corner to north of C.R. 448 where it turns west and passes around the urban limits of Laddonia, coming back to the west right-of-way line and crossing Route 54 just south of the Fastlane station. From there the pipeline runs parallel along the east right-of-way further south to near the Cuivre River where it diverges away from Route 54 to the east. There are two sets of gas meters both on the western right-of-way, approximately ¾ miles south of Laddonia, and just south of the Bassinger round-about that will require relocation.

4.4.4: Environmental Impacts

Section B has minimal environmental conflicts and impacts based on the desk-top review performed by HG Consult for the corridor (see Appendix E). There are three locations within this section that cross a 100-year floodplain, but only two will be impacted by fill placement for widening. The West Fork Cuivre River crossing near LM 229 will be used in

place and will fall between proposed passing lane segments. However, an overflow structure just north of the main crossing, and the Middle Lick Creek crossing will be impacted by widening required for passing lanes.

NHD, or "blue-line", streams are crossed by the Route 54 corridor at five locations within this section. Several of these contain drainage structures that will require extension or replacement, thereby requiring additional permitting. Additionally, the roadside ditch on the east side of Route 54 is identified as a NHD stream in two locations south of Laddonia and will be impacted by lane widening.

One forested and one emergent wetland were identified close to the West Fork Cuivre River crossing at LM 229. Widening of this structure is not anticipated and the proposed widening of the structure just to the north can likely be avoided by shifting the passing lane slightly to the north.

Most of the adjacent land throughout this section is active farmland used for row crop farming operations. A Farmland Conversion Impact rating will have to be determined for this section during the environmental process.

The Community R-6 school facility is located at Scott's Corner near the south end of this section. None of their facilities are expected to be impacted by this project.

5. Section C: Bassinger's Corner to Jenning's Corner

5.1: Summary of Segment Lane Layouts

Section C extends from Bassinger's Corner (MO 19 South Jct) through the towns of Farber and Vandalia to Jenning's Corner (MO 19 North Jct). There are six proposed passing lane segments in this section of US 54 which runs east/west and then northeast/southwest. There is one set of passing lanes (one in each direction) between Bassinger's Corner and the town of Farber, there is then another set of passing lanes between Farber and Vandalia, and finally a third set between Vandalia and Jenning's Corner (MO 154 Jct). Section C contains six passing sections, three eastbound and three westbound for the almost 14-mile section. There is a passing lane provided for egress of the major intersections and the two towns.

A gap was placed between Segment C5 and C6 to avoid the eastern end of the passing segment being located in the curve by the railroad (between CRD 462/Swift Lane and MO 154). Shifting Segment C6 to the east placed the curve approximately in the middle of the segment.

The passing lane segments are summarized in the table below and described in more detail in the next sub-section.

Table 7: Passing Lane Details - Section C

Segment	Type	Direction	Beginning Log Point	Ending Log Point	Length (mi)			Passing Lane Length (mi)	Passing Lane Ratio
					Segments (including tapers)	Sub-Total	Grand Total		
C1	Passing	EB	234.95	236.15	1.20	12.5	13.8	7.3	53%
C2	Passing	WB	236.79	238.01	1.22				
Farber	Town	n/a	238.01	239.57	1.56				
C3	Passing	EB	239.57	240.79	1.22				
C4	Passing	WB	240.79	242.01	1.22				
CRD 557	Turn Lanes	n/a	242.01	242.11	0.10				
Van Far High School	Turn Lanes	n/a	242.18	242.27	0.09				
Vandalia	Town	n/a	242.27	245.16	2.89				
CRD 572	Turn Lanes	n/a	245.14	245.33	0.19				
Longspur Road	Turn Lanes	n/a	245.35	245.54	0.19				
C5	Passing	EB	245.54	246.76	1.22				
C6	Passing	WB	247.33	248.55	1.22				
Jenning's Corner	Turn Lanes	n/a	248.55	248.74	0.19				

Note: Grand Total values includes lengths between the segments listed in the table

The segments are separated by greater than the minimum tail-to-tail separation of 500-ft and head-to-head separation of 1,500-ft, as stated in the Means and Methods section of the report. The passing lane segments do not overlap with turn lane sections, major intersections or higher volume driveways.

5.1.1: Sight Distance Review

Section C is a mostly flat area making the area sight distance less of a challenge. The six passing sections are spaced evenly among the two towns and major intersections, thus reducing the concern for conflict point. There are also no proposed turn lane additions through this section.

5.2: Traffic Analysis

Traffic data for Segment C is shown in the table below. The analysis shows that the LOS will be improved in three of the six segments, based on future-year volumes.

Table 8: Traffic Analysis - Segment C

				Initial Year - 2022				Future Year - 2042			
				Peak Hour Volumes		LOS		Peak Hour Volumes		LOS	LOS
Segment	From	To	Analysis Direction	Analysis Direction	Opposing Direction	No Build	Passing Lane	**Analysis Direction**	**Opposing Direction**	No Build	Passing Lane
C1	54/J/19 Junction	Farber	EB	122	117	A	A	149	143	B	A
C2			WB	117	122	A	A	143	149	B	A
C3	Farber	Vandalia	EB	104	110	A	A	127	134	A	A
C4			WB	110	104	A	A	134	127	A	A
C5	Vandalia	154 Junction	EB	168	173	B	A	205	211	B	A
C6			WB	173	168	B	B	211	205	C	B

LOS based on travel time, v/c ratio, and percent-time spent following

Improved Level of Service Shaded in Orange

5.2.1: Crash Data Review

A review of the crash data (2017-2021) in Segment C identified the following locations where crashes are concentrated, outside of Farber, Vandalia, Bassinger's Corner (MO 19 North Jct/Route J), and Jenning's Corner (MO 154 Jct). See Appendix C for heat maps of the crash data.

- Box Culvert (no B#) with no shoulders.
  - This box culvert is located between CRD 509 and CRD 517. It is also located between two passing lane segments and thus is not addressed as part of the passing lane study. This location could be reviewed for potential widening as part of a separate project.
- Curve at the KCS Railroad and at CRD 541
  - This curve does not contain a passing lane and is not addressed as part of the passing lane project. This location could be reviewed for potential improvements as part of a separate project.
- Van-Far R1 High School Entrance
  - A left turn lane is proposed at the high school entrance and at the nearby CRD 557 intersection. Addition of these two turn lanes will improve safety in the area.

- CRD 572 and Longspur Road
    - Left turn lanes are proposed at both intersections to address rear end crashes.

5.3: Turn Lanes at Intersections

There are four locations with proposed turn lanes. These are located at CRD 557, the Van-Far R1 High School Entrance, CRD 572, and at Longspur Road. Each of these locations are described in the list below, along with the existing roadway volumes, if known.

- CRD 557
    - Existing AADT
        - US 54: 2,858
        - CRD 557: 164
- Van-Far R1 High School Entrance
    - Existing AADT
        - US 54: 2,858
        - High School Entrance: (counts not available)
- CRD 572
    - Existing AADT
        - US 54: 4,541
        - CRD 572: (counts not available)
- Longspur Road
    - Existing AADT
        - US 54: 4,541
        - Longspur Road: (counts not available)

5.4: Potential Impacts

5.4.1: Right-of-Way

Existing right-of-way in this section varies. West of Farber, the right-of-way is generally 35 feet on both sides of the centerline, for a total of 70 feet. East of Farber, the right-of-way is generally 40 feet on both sides of the centerline, for a total of 80 feet. While there are small segments of wider right-of-way, these sub-sections have a relatively consistent width. Section C contains two towns, Farber and Vandalia. In order to avoid the towns and other development while maintaining standard passing lane lengths, this section does not contain as many passing lanes. Because there are not as many passing lanes, Section C has the second-lowest cost per mile for additional right-of-way. The Section C cost per mile for right-of-way is $38,000.

A railroad runs along the south/east side of US 54 between Farber and just before Jenning's Corner (Jct MO 154). It was assumed that no right-of-way would be purchased

from the railroad, so all widening in these sections would be done on the north/west side of the road.

As shown in the typical section (see Appendix A), the assumed width for the proposed right-of-way is 135 feet. This means that west of Farber, approximately 65 feet of right-of-way would need to be acquired, while 55 feet would be needed east of Farber. Taper areas were assumed to have an average right-of-way width of 125 feet. This proposed right-of-way allows for a full clear zone width of 30', which is not currently met. Some drainage structures or intersections may require additional width, but these areas generally already have 5 to 10 feet wider right-of-way widths, so the relative widening of 55 to 65 feet should cover these areas. As seen in the project estimate, this section requires approximately 51.4 acres of additional right-of-way. At an assumed land value of $10,000 per acre, this amounts to $514,000.

Section C has a bit more development than Sections A and B, especially near Vandalia. The passing lanes have been laid out to avoid as much development as possible, while still providing passing options. The land adjacent to the passing lanes is mostly rural farmland, with approximately 8 entrances leading to light commercial, rural housing, and farming storage areas. Due to the assumption that no right-of-way will be purchased from the railroad, the centerline of US 54 would likely slide to the north/west and property owners on that side would see a bigger impact than other sections. There are a few buildings on this side of the roadway, including 2 houses in passing lane C4 and one house in passing lane C6, that may feel a noticeable change in the proximity of the road.

5.4.2: Drainage

Section C between Bassinger's Corner and Jenning's Corner has the lowest cost for drainage per mile of the sections evaluated at only $892,000, due to a low number of structures. More detailed impacts are summarized below:

- Five single box culverts, ranging in size from 3' x 2' to 12' x 6', and two pipes would be extended in order to accommodate passing lane additions for a total cost of approximately $706,000.

In addition to the crossroad drainage, a cost factor of $27,791.96 per mile was developed to account for entrance pipe replacements in widened areas. This added approximately $186,000 to the drainage costs for Section C.

5.4.3: Utilities

Utilities adjacent to and crossing the corridor in this section consist of overhead electric, underground telephone and gas pipeline crossings. Overhead electric line impacts will potentially exist along the south right-of-way line just east of the Bassinger's Corner

round-about involving the eastbound passing lane sections, and between C.R. 517 and Farber along the north right-of-way line involving the westbound passing lanes.

Between Farber and Vandalia, the Route 54 alignment runs parallel and adjacent to the KCS Railroad. Due to the narrow width of the right-of-way through this section, the overhead electric lines along the north side of Route 54 will most likely be impacted since some widening will occur on this side regardless of which direction the passing lanes are placed. East of Vandalia to Jenning's Corner there are no overhead electric conflicts except for a crossing of Route 54 at Longspur Rd.

A branch of the Panhandle Eastern Gas Pipeline crosses Route 54 near LM 238 and meters are present on the north side of the right-of-way. This is near the beginning lane tapers for a westbound passing lane. This utility crossing could be avoided by moving the tapers further to the west. This also applies to different gas pipeline crossings near LM 242, west of Vandalia, where the crossing is near the beginning of another westbound passing lane.

Underground telephone lines are present adjacent to residential properties, on both sides of the roadway and these will also be affected by lane widening where necessary.

5.4.4: Environmental Impacts

Section C has minimal environmental conflicts and impacts based on the desk-top review performed by HG Consult for the corridor (see Appendix E). There are six locations within this section that cross a 100-year floodplain, but only one will be impacted by fill placement for widening. This will be at the creek crossing just to the east of the new roundabout at Bassinger's Corner. However, this is near the beginning of the east bound passing lane and could be shortened at this location to avoid the impacts.

NHD, or "blue-line", streams are crossed by the Route 54 corridor at thirteen locations within this section. However, only six of these will be impacted with drainage structures that will require extension or replacement. Three of these could be avoided by either reducing the length of the adjacent passing lane or by possibly moving the lane more to the east or west.

Two emergent wetlands were identified just to the east of Farber near the curve on Route 54. Neither of these areas will be affected by the proposed passing lanes. No forested wetlands were present within this section either. Four ponds lie just adjacent the Route 54 right-of-way and will likely be impacted by any widening.

Most of the remaining adjacent land throughout this section is active farmland used for row crop farming operations. A Farmland Conversion Impact rating will have to be determined for this section during the environmental process.

The Van-Far school facility is located at the west urban limits of Vandalia and will be outside any areas of passing lanes. None of their facilities are expected to be impacted by this project. In this same area, the Evergreen Memorial Gardens Cemetery lies adjacent the north right-of-way in the northwest quadrant of the C.R. 557 intersection. A proposed westbound passing lane begins near this location and care will be taken to not disturb the cemetery.

The KCS railroad parallels and adjoins the southeastern Route 54 right-of-way from approximately LM 239, east of Farber, to approximately L.M 248, east of Vandalia. The MoDOT right-of-way width is approximately 40' for this side and any widening for additional lanes through this area will have to be closely studied to avoid impacts to the railroad.

6. Section D: Jenning's Corner to Bowling Green

6.1: Summary of Segment Lane Layouts

Section D extends from Jenning's Corner through the town of Curryville to the west side of Bowling Green. There are six proposed passing lane segments in this section of US 54 which runs east/west. There is one set of passing lanes (one in each direction) between Jenning's Corner and the town of Curryville and two sets (two in each direction) between Curryville and Bowling Green. In total, Section D contains three eastbound and three westbound passing lane segments for the almost 10-mile section. There is a passing lane provided for egress of the major intersections and the two towns.

The passing lane segments are summarized in the table below and described in more detail in the next sub-section.

Table 9: Passing Lane Details - Section D

Segment	Type	Direction	Beginning Log Point	Ending Log Point	Length (mi)			Passing Lane Length (mi)	Passing Lane Ratio
					Segments (including tapers)	Sub-Total	Grand Total		
D1	Passing	EB	248.74	249.87	1.13	8.6	9.6	6.8	70%
n/a	Turn Lanes	n/a	249.87	250.06	0.19				
D2	Passing	WB	250.50	251.72	1.22				
Curryville	Town	n/a	251.72	252.74	1.02				
D3	Passing	EB	252.74	253.72	0.98				
D4	Passing	WB	253.72	254.72	1.00				
Route U	Turn Lanes	n/a	254.72	254.91	0.19				
D5	Passing	EB	255.51	256.73	1.22				
D6	Passing	WB	256.73	257.95	1.22				
CRD 488	Turn Lanes	n/a	257.95	258.14	0.19				
Bus 54 (west jct)	Turn Lanes	n/a	258.18	258.38	0.20				

Note: Grand Total values includes lengths between the segments listed in the table

The segments are separated by greater than the minimum tail-to-tail separation of 500-ft and head-to-head separation of 1,500-ft, as stated in the Means and Methods section of the report. The passing lane segments do not overlap with turn lane sections, major intersections or higher volume driveways.

Segment D3 and D4 were shortened to provide a left turn lane at Route U. An alternate solution to allow 1.0-mile lengths of the full passing lanes for Segments D3 and D4 is to provide a left turn lane and a passing lane concurrently at Route U.

6.1.1: Sight Distance Review

Segment D sight distance review showed slightly higher instances of vertical obstruction and has one turn lane section at State Route U. While these are areas for consideration,

there is not enough of a vertical issue to warrant concern. There are also no conflict areas with substantial limited sight distance to cause concern.

6.2: Traffic Analysis

Traffic data for Segment D is shown in the table below. The analysis shows that the LOS will be improved in five of the six segments, based on future year volumes.

Table 10: Traffic Analysis - Segment D

				Initial Year - 2022				Future Year - 2042			
				Peak Hour Volumes		LOS		Peak Hour Volumes		LOS	LOS
Segment	From	To	Analysis Direction	Analysis Direction	Opposing Direction	No Build	Passing Lane	**Analysis Direction**	**Opposing Direction**	No Build	Passing Lane
D1	154 Junction	Curryville	EB	126	134	A	A	154	163	C	B
D2			WB	134	126	A	A	163	154	B	A
D3	Curryville	Bowling Green	EB	254	227	C	B	310	277	C	C
D4			WB	227	254	B	B	277	310	C	B
D5			EB	254	227	C	B	310	277	C	B
D6			WB	227	254	B	B	277	310	C	B

LOS based on travel time, v/c ratio, and percent-time spent following | Improved Level of Service Shaded in Orange

As noted above Segment D3 does not show an improvement in LOS for the future year scenario. The HCS analysis indicates a slight improvement in the average speed and the percent-time-following for Segment D3, while the other segments show greater improvement, which was significant enough to improve the LOS for those segments.

6.2.1: Crash Data Review

A review of the crash data (2017-2021) in Segment D identified the following locations where crashes are concentrated, outside of Jenning's Corner (MO 154 Jct) and Curryville. See Appendix C for heat maps of the crash data.

- Vandiver County Club (two entrances)
  - These two entrances are located near the west end of Passing Lane Segment D1 (EB). Potential accommodations for a left turn lane at this location is to shorten, shift, or eliminate Segment D1 or to consider installing a left turn lane concurrent with the passing lane.
- CRD 85/CRD 459
  - A left turn lane is proposed at this intersection to address rear end crashes.
- CRD 39/CRD 465 (offset by approximately 0.25 miles)
  - These two intersections are separated by approximately 0.25 miles and are located approximately in the middle of Passing Lane Segment D3 (EB). Potential accommodations for a left turn lane at this location is to shorten, shift, or eliminate Segment D3 or to consider installing a left turn lane concurrent with the passing lane.

- Non-Intersection area west of Route U
  - The predominant crash types are Head-On, Passing, and Out-of-Control. Alternating passing lanes in the general area should reduce these crash types.
- Route U/CRD 483
  - A left turn lane is proposed at this intersection to address rear end crashes.
- CRD 30/CRD 485
  - This intersection is located near the west end of Passing Lane Segment D4 (WB). Potential accommodations for a left turn lane at this location is to shorten, shift, or eliminate Segment D4 or to consider installing a left turn lane concurrent with the passing lane.
- CRD 41
  - This intersection is located near the west end of Passing Lane Segment D5 (EB). Potential accommodations for a left turn lane at this location is to shorten, shift, or eliminate Segment D5 or to consider installing a left turn lane concurrent with the passing lane.
- CRD 43/CRD 488 & Bus 54
  - Left turn lanes are proposed at both intersections to address crashes in this segment.

6.3: Turn Lanes at Intersections

There are five locations with proposed turn lanes. These are located at MO 154 (Jenning's Corner), CRD 85/CRD 459, Route U, CRD 43/CRD 488, and at Bus 54 (West Jct to Bowling Green). Each of these locations are described in the list below. Intersections that had existing left or right turn lanes were accommodated with turn lanes as necessary. A base assumption was made that all state-route intersections should have a minimum of a left turn lane. Traffic volumes were reviewed to confirm the initial assumption. These volumes are shown in the list below.

- MO 154 (Jenning's Corner)
  - Existing AADT
    - US 54: 4,550 (to the west); 3,458 (to the east)
    - MO 154: 598
  - Construction of a roundabout at this intersection could be considered. The roundabout alternative has been included in the cost estimate.
- CRD 85/CRD 459
  - Existing AADT
    - US 54: 3,458
    - CRD 85/459: 80 (turn lane recommendation based on crash experience)

- Route U
  - Existing AADT
    - US 54: 5,580 (to the west); 4,790 (to the east)
    - Route U: 165
- CRD 43/CRD 488
  - Existing AADT:
    - US 54: 4,790
    - CRD 43/488: 60 (turn lane recommendation based on crash experience)
- Bus 54 (West Jct to Bowling Green)
  - Existing AADT
    - US 54: 4,771
    - Bus 54 (West Jct to Bowling Green): 2,442

6.4: Potential Impacts

6.4.1: Right-of-Way

Existing right-of-way in this section is generally 50 feet on both sides of the centerline, for a total of 100 feet. Section D contains two towns, Curryville and Bowling Green. In order to avoid the towns and other development while maintaining standard passing lane lengths, this section does not contain as many passing lanes, similar to Section C. Because there are not as many passing lanes and the more generous existing right-of-way, Section D has the lowest cost per mile for additional right-of-way at just $29,000.

As shown in the typical section (see Appendix A), the assumed width for the proposed right-of-way is 135 feet. This means that approximately 35 feet of right-of-way would need to be acquired. Taper areas were assumed to have an average right-of-way width of 125 feet. This proposed right-of-way allows for a full clear zone width of 30', which is not currently met. Some drainage structures or intersections may require additional width, but these areas generally already have 5 to 10 feet wider right-of-way widths, so the relative widening of 55 to 65 feet should cover these areas. As seen in the project estimate, this section requires approximately 29.8 acres of additional right-of-way. At an assumed land value of $10,000 per acre, this amounts to $298,000.

Section D has seen development, especially near Bowling Green. The passing lanes have been laid out to avoid as much development as possible, while still providing passing options. The land adjacent to the passing lanes is mostly rural farmland, with approximately 18 entrances leading to light commercial, rural housing, and farming storage areas. There are a few buildings relatively close to the roadway on Section D, including one house in passing lane D6, that may feel a noticeable change in the proximity of the road.

6.4.2: Drainage

Section D between Jenning's Corner and Bowling Green is in the middle of the sections for drainage cost per mile of the sections evaluated at only $142,000 per mile. This amounts to a total drainage cost for this section of approximately $1.4M. More detailed impacts are summarized below:

- 19 single box culverts, ranging in size from 2' x 1.5' to 10' x 6', and three 24" reinforced concrete pipes would be extended in order to accommodate passing lane additions for a total cost of approximately $1,260,000.

In addition to the crossroad drainage, a cost factor of $27,791.96 per mile was developed to account for entrance pipe replacements in widened areas. This added approximately $191,000 to the drainage costs for Section D.

6.4.3: Utilities

Overhead electrical lines and underground telephone lines are present along the north right-of-way through most of Section D. Impacts will mostly involve the westbound passing lane sections which will require widening along the north right-of-way line of Route 54. Underground telephone lines and risers are present adjacent to residential properties, on both sides of the roadway and these will also be affected by lane widening where necessary. A gas pipeline crosses Route 54 east of C.R. 458 near LM 251.3, and another pipeline crosses east of Curryville near LM 253.

6.4.4: Environmental Impacts

Section D has minimal environmental conflicts and impacts based on the desk-top review performed by HG Consult for the corridor (see Appendix E). There is only one location within this section that crosses a 100-year floodplain, but it is located outside the limits of fill placement for widening.

NHD, or "blue-line", streams are crossed by the Route 54 corridor at nine locations within this section. Only three of these contain drainage structures that will require extension or replacement, impacting the stream crossing. The remaining crossings identified as NHD streams are located outside any areas of widening for passing lanes.

No forested or emergent wetlands were identified within this section of the study.

Most of the adjacent land throughout this section is active farmland used for row crop farming or livestock grazing operations. A Farmland Conversion Impact rating will have to be determined for this section during the environmental process.

The Vandalia Country Club/golf course is located east of Jenning's Corner near the west end of this section. None of their facilities are expected to be affected by this project as any widening could be constructed on the opposite side of the roadway.

7. Section E: Bowling Green to Louisiana

7.1: Summary of Segment Lane Layouts

Section E of the US 54 Shared 4-lane Conceptual Study Project is a 12.1-mile section of US 54 roadway between Bowling Green, MO and Louisiana, MO. The rolling topography along US 54 in this section differs from the more level topography of the remaining portions of US 54 between Mexico, MO and Bowling Green, MO. Additionally, the alignment of the US 54 roadway between Bowling Green and Louisiana contains more horizontal curves and changes in vertical profile than the remaining portions of US 54 between Mexico and Bowling Green. Jurisdictional streams, Noix Creek and Little Noix Creek, cross the US 54 roadway via significant drainage structures three times within this portion of US 54. As a result of these factors, the number of passing lanes within this section of US 54 was limited to four, comprised of two eastbound lanes and two westbound lanes. These lanes begin near County Road 291 and end near Bridge B0210. See Appendix A for passing lane configurations.

The passing lane segments are summarized in the table below and described in more detail in the next sub-section.

Table 11: Passing Lane Details - Section E

Segment	Type	Direction	Beginning Log Point	Ending Log Point	Length (mi)			Passing Lane Length (mi)	Passing Lane Ratio
					Segments (including tapers)	Sub-Total	Grand Total		
Bus 54 (west jct)	none	n/a	258.38	259.94	1.56	10.0	13.0	4.2	32%
US 61 Interchange	Intersections	n/a	259.94	260.30	0.36				
Bus 54 (east jct)	Turn Lanes	n/a	261.10	261.24	0.14				
Pike Co. Fairgrounds	Turn Lanes	n/a	261.44	261.51	0.07				
Route AA/CRD 292	Turn Lanes	n/a	261.51	261.65	0.14				
E1	Passing	EB	261.96	263.18	1.22				
Bridge/Intersections	none	n/a	263.18	263.91	0.73				
E2	Passing	WB	263.91	264.88	0.97				
E3	Passing	EB	264.88	265.94	1.06				
E4	Passing	WB	266.10	267.06	0.96				
Route UU	Turn Lanes	n/a	267.50	267.64	0.14				
Route NN	Turn Lanes	n/a	268.05	268.19	0.14				
Kelly Lane	Turn Lanes	n/a	270.67	270.81	0.14				
Louisiana City Limits	Town	n/a	269.04	271.40	2.36				

Note: Grand Total values includes lengths between the segments listed in the table

Segment E1 is an eastbound passing lane, of 1 mile in length (excluding tapers). This segment begins near County Road 291 and ends on the west side of Box Culvert J0126.

Segment E2 is a westbound passing lane, of 0.75 mile in length (excluding tapers). This segment begins on the east side of County Road 279 and ends at County Road 277.

Segment E3 is an eastbound passing lane, of 0.84 mile in length (excluding tapers). This segment begins at County Road 277 and ends on the west side of Bridge A6519. The roadway widening for this segment will need to occur on the westbound side of the pavement, due to the proximity of the Kansas City Southern Railway running adjacent to the eastbound lane of US 54.

Segment E4 is a westbound passing lane, of 0.75 mile in length (excluding tapers). This segment begins on the east side of Bridge A6519 and ends on the west side of Bridge B0210.

The segments are separated by greater than the minimum tail-to-tail separation of 500-ft and head-to-head separation of 1,500-ft, as stated in the Means and Methods section of the report. The passing lane segments do not overlap with turn lane sections, major intersections or higher volume driveways.

7.1.1: Sight Distance Review

Segment E is a slightly different area with respect to sight distance and geometric challenges. There is a much higher frequency of both horizontal and vertical curvature. Due to the placement of the passing sections and the locations of transition areas, there is little concern even given the geometric variance from the rest of the corridor. There are multiple locations on this section with existing and proposed turn lanes due to both geometric and volumetric conditions. Passing sections were located to avoid the area with turn lanes and any associated conflicting conditions and thus limiting the need for concern of limited sight distance locations.

7.2: Traffic Analysis

Traffic data for Segment E is shown in the table below. The analysis shows that the LOS will be improved in three of the four segments, based on future year volumes.

Table 12: Traffic Analysis - Segment E

				Initial Year - 2022				Future Year - 2042			
				Peak Hour Volumes		LOS		Peak Hour Volumes		LOS	LOS
Segment	From	To	Analysis Direction	Analysis Direction	Opposing Direction	No Build	Passing Lane	**Analysis Direction**	**Opposing Direction**	No Build	Passing Lane
E1	Bowling Green	Louisiana	EB	269	242	C	B	328	295	C	B
E2			WB	242	269	B	A	295	328	C	B
E3			EB	269	242	C	B	328	295	C	C
E4			WB	242	269	B	B	295	328	C	B

LOS based on travel time, v/c ratio, and percent-time spent following Improved Level of Service Shaded in Orange

7.2.1: Crash Data Review

A review of the crash data (2017-2021) in Segment E identified the following locations where crashes are concentrated, outside of the US 61 Interchange and Louisiana. See Appendix C for heat maps of the crash data.

- Bus 54 (East Jct to Bowling Green)
  - Left turn lanes are proposed at both intersections to address crashes in this segment.
- Pike County Fairgrounds Entrance
  - An eastbound left turn lane and a westbound right turn lane are proposed at this intersection to address crashes in this segment.
- Route AA/CRD 292
  - An eastbound right turn lane is proposed at this intersection to address crashes in this segment. An existing westbound left turn lane is proposed to remain in place.
- Cow Pasture Road
  - An eastbound left turn lane is not able to be accommodated here because of the existing westbound left turn lane for Route AA. Consideration of a center two-way left turn lane (TWLTL) was given. However, per MoDOT's EGP 232.3, a TWLTL is not suggested in areas where the speed is in excess of 45 mph, which is the case along Highway 54 in this segment, where the posted speed is 60 mph,
- CRD 272
  - This intersection is located near the east end of Passing Lane Segment E3 (EB). Potential accommodations for a left turn lane at this location is to shorten, shift, or eliminate Segment E3 or to consider installing a left turn lane concurrent with the passing lane.
- Route UU
  - An eastbound left turn lane is proposed at this intersection to address crashes in this segment.
- Route NN
  - An westbound left turn lane and an eastbound right turn lane are proposed at this intersection to address crashes in this segment.
- CRD 137/Kelly Lane
  - This intersection does not contain a passing lane and is not addressed as part of the passing lane project. Existing left turn lanes are in place for both directions. This location could be reviewed for potential improvements as part of a separate project.
- CRD 136
  - This intersection does not contain a passing lane and is not addressed as part of the passing lane project. This location could be reviewed for potential improvements as part of a separate project.

7.3: Turn Lanes at Intersections

Several left and right turn lanes are already in place within the limits of this section of the US 54 corridor. The existing turn lanes are recommended to remain in place, while six additional turning lane locations are recommended to be added to this section of the US 54 corridor.

The addition of an eastbound left turn lane and westbound right turn lane are recommended at the entrance to the Pike County Fairgrounds toward the western limits of Section E. Eastbound right turn lanes are recommended at the intersections of Business 54 and Route AA near Bowling Green. These right turn lanes will further enhance the intersection safety considerations, as existing westbound left turn lanes on US 54 are already in place at these intersections. An eastbound left turn lane is recommended at the Route UU intersection, which will enhance the safety of the intersection that is already in place with the existing westbound right turn lane. A westbound left turn lane is recommended at the Route NN intersection, which will enhance the safety of the intersection that is already in place with the existing eastbound right turn lane. A westbound left turn lane is recommended at the Route NN intersection. Additionally, the existing eastbound right turn lane at Route NN is recommended for modification to an offset right turn lane to address intersection sight distance concerns due to the US 54 roadway curvature at this location.

- Bus 54 (East Jct to Bowling Green)
  - Existing AADT
    - US 54: 5,147
    - Bus 54 (East Jct to Bowling Green): 1,373
- Pike County Fairground Entrance
  - Existing AADT
    - US 54: 5,147
    - Fairgrounds Entrance (traffic counts not available)
- Route AA/CRD 292
  - Existing AADT
    - US 54: 5,147
    - Route AA: 1,278
- Route UU
  - Existing AADT
    - US 54: 5,147
    - Route UU: 622
- Route NN
  - Existing AADT
    - US 54: 4,968
    - Route NN: 2,279

- Kelly Lane
  - Existing AADT
    - US 54: 4,578
    - Kelly Lane: no data available

7.4: Potential Impacts

Sideroads and entrances falling within the recommended passing/turning lane locations will require adjustment to meet the widened edge of pavement/shoulder. In addition, entrance pipes will require relocation or adjustments.

7.4.1: Right-of-Way

The existing Controlled Access Right-of-Way width is 65-75' on the eastbound and westbound sides of US 54 for most of Section E. No additional Right-of-Way acquisition is anticipated for the purpose of adding the recommended passing or turning lanes to this section.

7.4.2: Drainage

The recommended passing lane configurations will not require widening of any bridge structures in Section E. However, the existing crossroad box culverts and pipes will require modification to extend the inlets/outlets to meet the toe of the sideslope of the propose/widened roadbed.

Section E between Bowling Green and Louisiana, has a drainage cost of nearly $2,590,300. There are five bridges located within this portion of US 54; however, none of these bridges will be impacted by the recommended passing/turning lane improvements. Most of the drainage structures in this section are box culverts. More detailed impacts are described below:

- Culvert over Drainage Ditch – This double 12' x 9' box culvert, constructed in 1929, is proposed to be lengthened on the south end to accommodate an eastbound left turning lane to the Pike County Fairgrounds and an eastbound right turn lane to Route AA. This extension is estimated to cost approximately $464,200.
- Culvert over Drainage Ditch – This single 12' x 7' box culvert, constructed in 1929, is proposed to be lengthened to accommodate eastbound passing lane, E1. This extension is estimated to cost approximately $81,960.
- Culvert over Drainage Ditch – This single 8' x 4' box culvert, constructed in 1929, is proposed to be lengthened to accommodate eastbound passing lane, E1. This extension is estimated to cost approximately $47,725.
- Culvert over Drainage Ditch – This single 6' x 4' box culvert, constructed in 1929, is proposed to be lengthened to accommodate eastbound passing lane, E1. This extension is estimated to cost approximately $37,235.

- Culvert over Drainage Ditch – This single 10’ x 6’ box culvert, constructed in 1929, is proposed to be lengthened to accommodate westbound passing lane, E2. This extension is estimated to cost approximately $66,066.
- Culvert over Drainage Ditch – This single 10’ x 5’ box culvert, constructed in 1929, is proposed to be lengthened to accommodate westbound passing lane, E2. This extension is estimated to cost approximately $66,066.
- Culvert over Drainage Ditch – This single 10’ x 5’ box culvert, constructed in 1929, is proposed to be lengthened to accommodate westbound passing lane, E2. This extension is estimated to cost approximately $66,066.
- Culvert over Drainage Ditch – This single 12’ x 5’ box culvert, constructed in 1929, is proposed to be lengthened to accommodate eastbound passing lane, E3. This extension is estimated to cost approximately $81,960.
- Culvert over Drainage Ditch – This single 6’x4’ box culvert, constructed in 1929, is proposed to be lengthened to accommodate westbound passing lane, E2. This extension is estimated to cost approximately $37,235.
- Culvert over Drainage Ditch – This single 6’x4’ box culvert, constructed in 1929, is proposed to be lengthened to accommodate westbound passing lane, E2. This extension is estimated to cost approximately $37,235.
- Culvert over Drainage Ditch – This single 6’x6’ box culvert, constructed in 1929, is proposed to be lengthened to accommodate westbound passing lane, E2. This extension is estimated to cost approximately $44,787.
- Seven more single box culverts, ranging in size from 2’ x 1.5’ to 5’ x 3’, will be extended to accommodate passing lane additions for a total cost of approximately $140,505.

In addition to the crossroad drainage, a cost factor of $27,791.96 per mile was developed to account for entrance pipe replacements in widened areas. This added approximately $105,000 to the drainage costs for Section E.

7.4.3: Utilities

The Kansas City Southern Railroad runs along the eastbound lanes of US 54 for portions of this section of roadway. While there is an eastbound passing lane recommended in this area, the pavement widening can occur on the opposite side of the roadway to avoid impacts to this utility.

Overhead electric lines are present along the US 54 corridor in this section. The additional roadway width needed to construct the recommended passing and turning lanes will likely require relocation of a small percentage of the power poles. These relocations are anticipated in the areas where existing sideslopes are steep or the roadway is in a high-fill location.

The Panhandle Eastern Gas Pipeline crosses US 54 twice within Section E; however, no impacts to this utility are anticipated as the primary improvements require placement of fill material to construct the added pavement width.

7.4.4: Environmental Impacts

Section E has minimal environmental conflicts and impacts based on the desk-top review performed by HG Consult for the corridor (see Appendix E).

There are 8 locations within this section that cross a 100-year floodplain, but only 3 locations will be impacted by the addition of passing lanes. These 100-year floodplain areas will be impacted due to placement of fill material for the roadway widening.

There are twenty-three National Hydrography Dataset (NHD), or "blue-line" streams that are crossed by the US 54 corridor in Section E. However, only nine of these will be impacted with drainage structures that will require extension to accommodate the widened roadway pavement.

Numerous emergent and forested wetlands have been identified for much of this section of US 54. Most of these wetlands are associated with Noix Creek and its associated tributaries. While the presence of wetlands has been identified, no impacts are anticipated.

The Pike County Country Club is located near LM 266.50. This area is designated as parkland, however, there are no anticipated impacts to this parkland.

Some of the remaining adjacent land throughout this section is active farmland used for row crop farming operations; however, no impacts are anticipated.

Appendices

Appendix A: Study Area Drawings and Exhibits

(16 pages)

- Title Sheet
- Typical Sections
- Detail Sheet
- Overview Sheet
- Plan Sheets

DESIGN DESIGNATION

FUNCTIONAL CLASSIFICATION – PRINCIPAL ARTERIAL
VANDIVER TO SCOTT'S CORNER – SECTION A
A.A.D.T. – 2022 = 5,596
A.A.D.T. – 2042 = 6,827
SCOTT'S CORNER TO BASINGER'S CORNER – SECTION B
A.A.D.T. – 2022 = 4,525
A.A.D.T. – 2042 = 5,520
BASINGER'S CORNER TO JENNING'S CORNER – SECTION C
A.A.D.T. – 2022 = 3,439
A.A.D.T. – 2042 = 4,196
JENNING'S CORNER TO BOWLING GREEN – SECTION D
A.A.D.T. – 2022 = 4,489
A.A.D.T. – 2042 = 5,477
BOWLING GREEN TO LOUISIANA – SECTION E
A.A.D.T. – 2022 = 4,713
A.A.D.T. – 2042 = 5,746

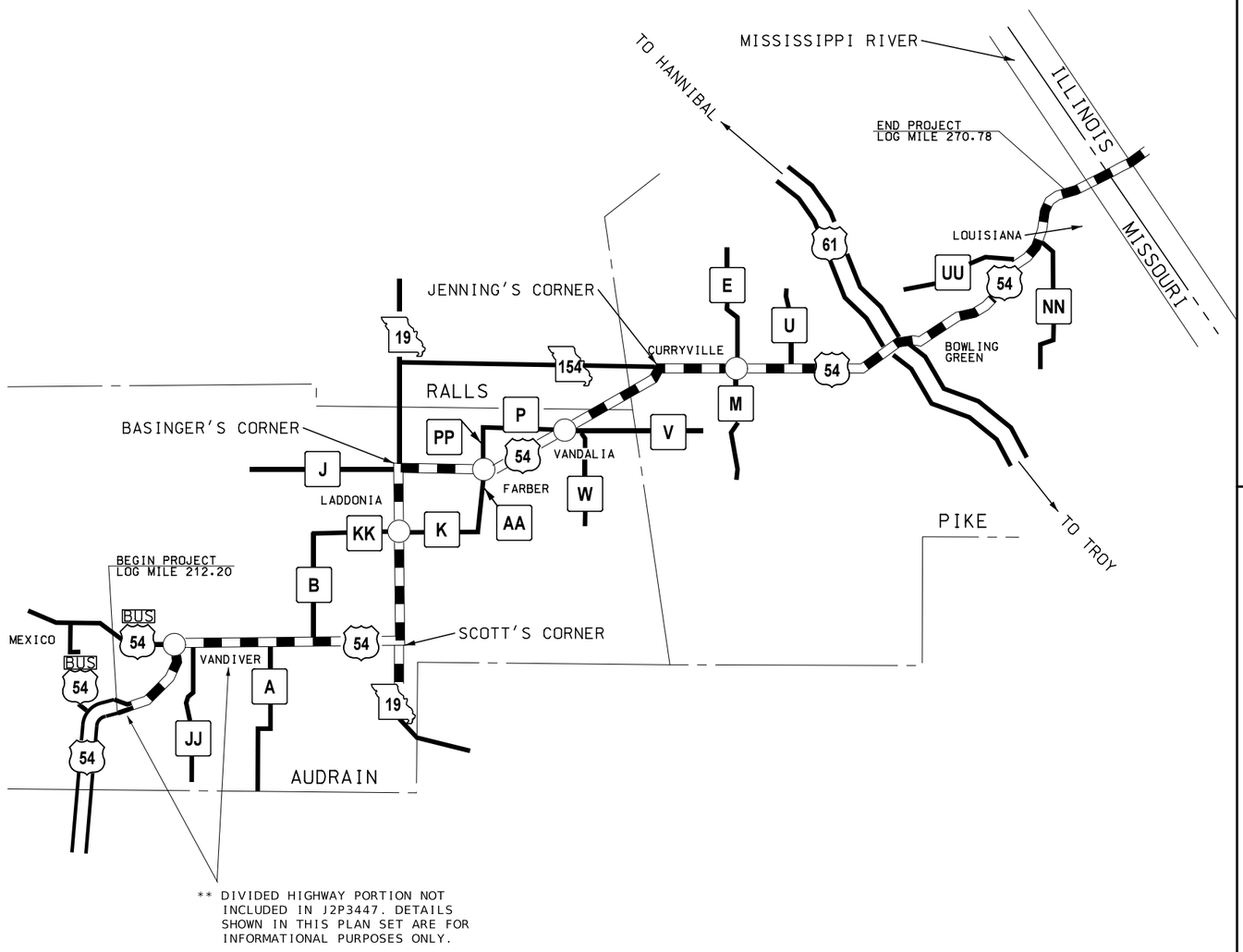
MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION

PLANS FOR PROPOSED STATE HIGHWAY

PIKE, RALLS, AND AUDRAIN COUNTY

CONCEPTUAL STUDY PLAN

NOT TO SCALE



** DIVIDED HIGHWAY PORTION NOT INCLUDED IN J2P3447. DETAILS SHOWN IN THIS PLAN SET ARE FOR INFORMATIONAL PURPOSES ONLY.

INDEX OF SHEETS

LENGTH OF PROJECT

ROUTE 54

BEGINNING OF PROJECT	LOG MILE 212.20	
END OF PROJECT	LOG MILE 270.78	
APPARENT LENGTH	58.58	MILES
EQUATIONS AND EXCEPTIONS:	NONE	
TOTAL CORRECTIONS	0.00	MILES
NET LENGTH OF PROJECT	58.58	MILES
STATE LENGTH	58.58	MILES

Preliminary Plans – NOT FOR CONSTRUCTION

DATE PREPARED 6/30/23

ROUTE	STATE
54	MO
DISTRICT	SHEET NO.
NE	1

COUNTY AUDRAIN/PIKE

JOB NO. J2P3447

CONTRACT ID.

PROJECT NO.

BRIDGE NO.

DESCRIPTION	DATE

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Bartlett & West
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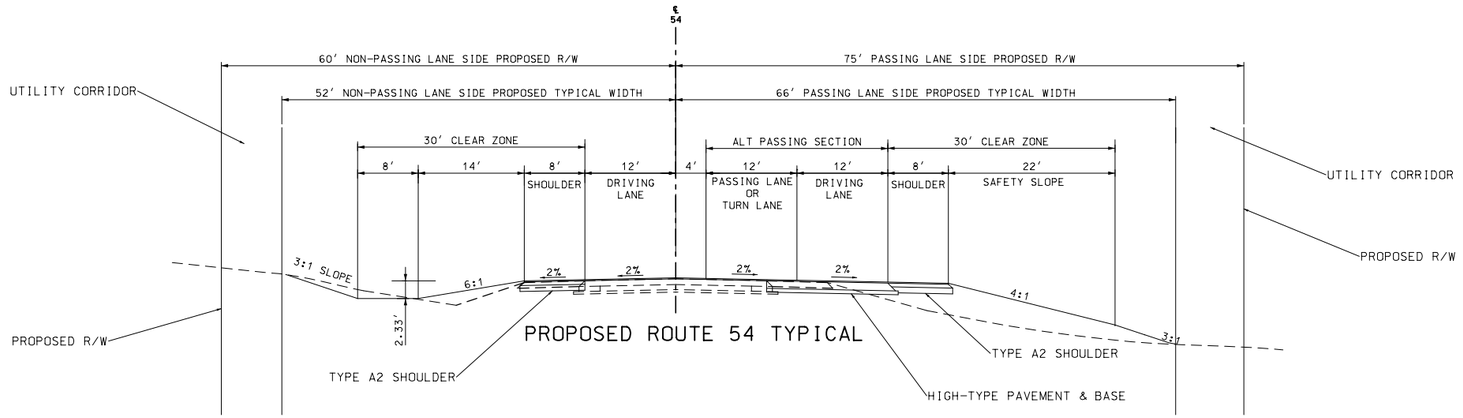

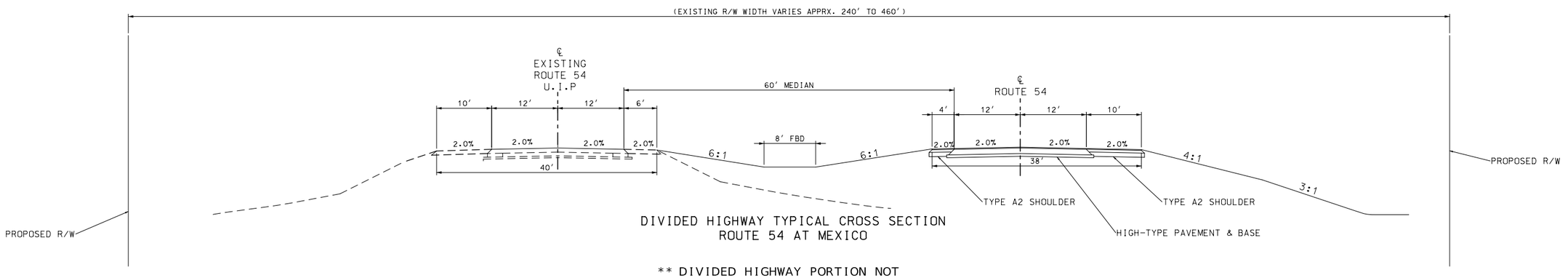

DIVIDED HIGHWAY TYPICAL CROSS SECTION
ROUTE 54 AT MEXICO

** DIVIDED HIGHWAY PORTION NOT INCLUDED IN J23447. DETAILS SHOWN HERE FOR INFORMATIONAL PURPOSES ONLY.

* ALTERNATE PASSING LANE OR TURN LANE WILL VARY BETWEEN EASTBOUND AND WESTBOUND DIRECTIONS

TYPICAL SECTION
SHEET 1 OF 1

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DATE PREPARED 6/30/23
ROUTE 54 | STATE MO
DISTRICT NE | SHEET NO. 2
COUNTY AUDRAIN/PIKE
JOB NO. J2P3447
CONTRACT ID.
PROJECT NO.
BRIDGE NO.

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Bartlett & West
601 MONROE STREET SUITE 201 - JEFFERSON CITY, MO 65101
PHONE 573-634-3181
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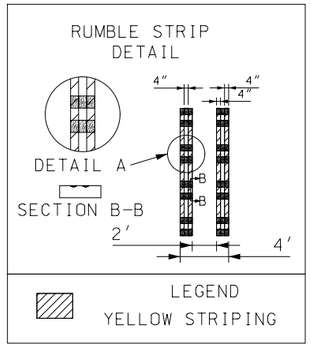

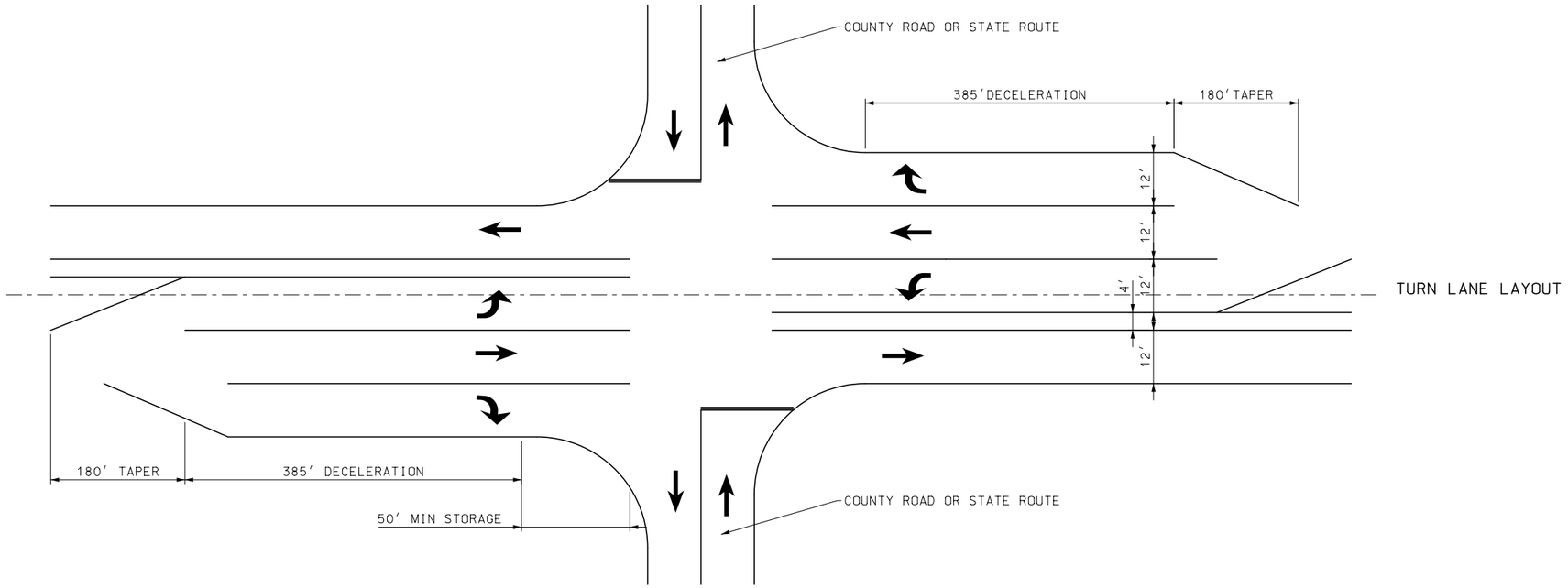

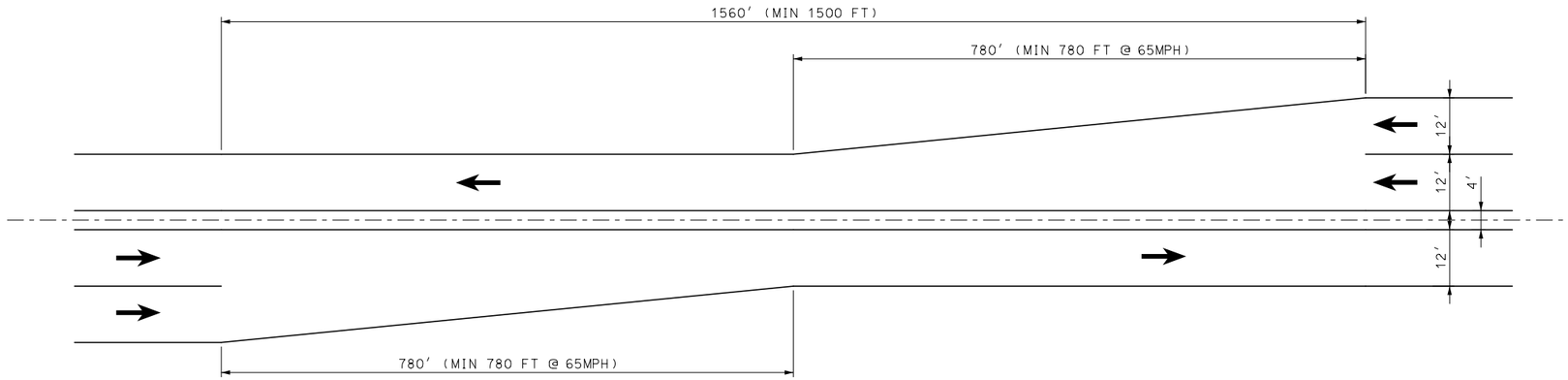

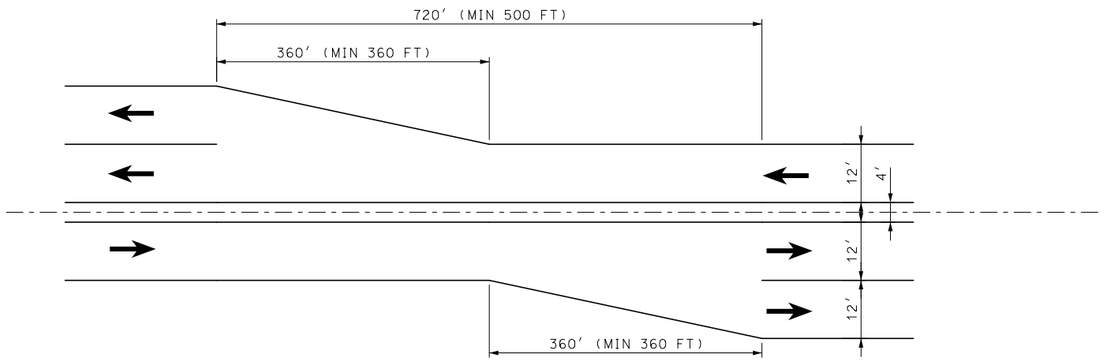

✳ NOT TO SCALE

✳ ALL LANES ASSUMED 12' WIDE

DETAIL SHEET
SHEET 1 OF 1

Preliminary Plans - NOT FOR CONSTRUCTION

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ROUTE 54 | STATE MO

DISTRICT NE | SHEET NO. 3

COUNTY AUDRAIN/PIKE

JOB NO. J2P3447

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1-888-ASK-MODOT (1-888-275-6636)

Bartlett & West

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PHONE 573-634-3181
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Preliminary Plans - NOT FOR CONSTRUCTION

DATE PREPARED 6/30/23

ROUTE 54 | STATE MO

DISTRICT NE | SHEET NO. 4

COUNTY AUDRAIN/PIKE

JOB NO. J2P3447

CONTRACT ID.

PROJECT NO.

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601 MONROE STREET SUITE 201- JEFFERSON CITY, MO 65101
PHONE 573-634-3181
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OVERVIEW SHEET
SHEET 1 OF 1

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LEGEND
- PROPOSED DIVIDED HIGHWAY
- EASTBOUND PASSING LANE
- WESTBOUND PASSING LANE
- TURNING LANES

** DIVIDED HIGHWAY PORTION NOT INCLUDED IN J2P3447. DETAILS SHOWN HERE FOR INFORMATIONAL PURPOSES ONLY.

SCALE
0 500 1000 1500 2000 2500

PLAN SHEET
SHEET 1 OF 12

Preliminary Plans – NOT FOR CONSTRUCTION

DATE PREPARED 6/30/23

ROUTE	STATE
54	MO
DISTRICT	SHEET NO.
NE	5

COUNTY: AUDRAIN/PIKE

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601 MONROE STREET SUITE 201 - JEFFERSON CITY, MO 65101
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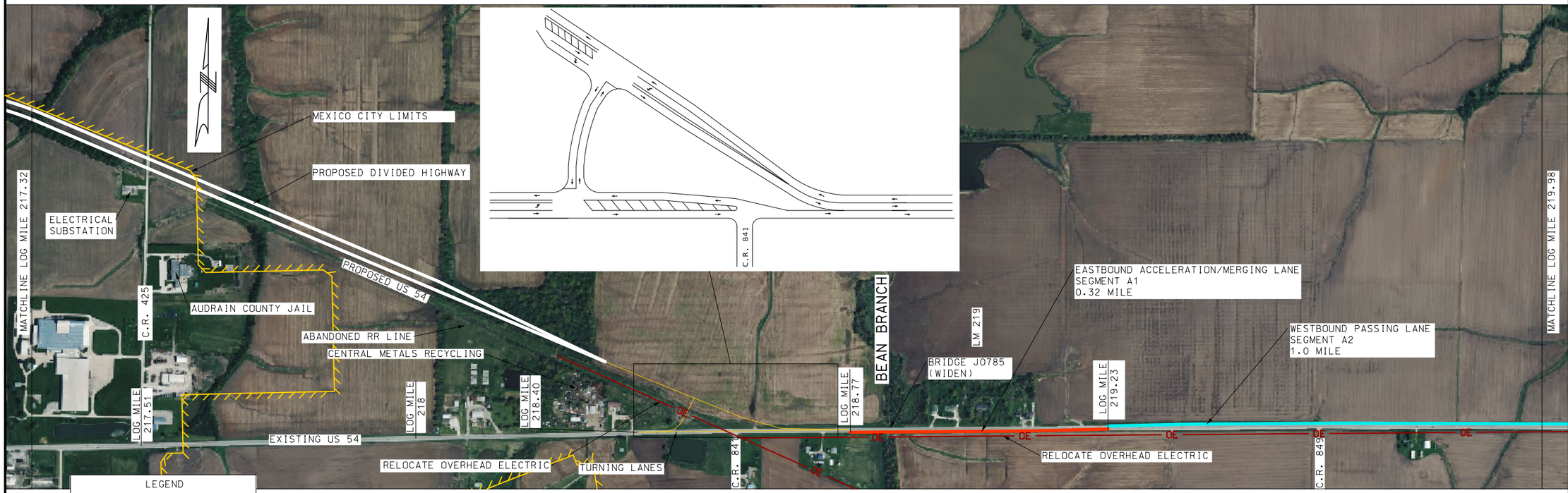

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ROUTE 54 | STATE MO

DISTRICT NE | SHEET NO. 6

COUNTY AUDRAIN/PIKE

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601 MONROE STREET SUITE 201 - JEFFERSON CITY, MO 65101
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PLAN SHEET
SHEET 2 OF 12

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Preliminary Plans – NOT FOR CONSTRUCTION

DATE PREPARED 6/30/23

ROUTE 54 | STATE MO

DISTRICT NE | SHEET NO. 7

COUNTY AUDRAIN/PIKE

JOB NO. J2P3447

CONTRACT ID.

PROJECT NO.

BRIDGE NO.

DESCRIPTION | DATE

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MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION

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Bartlett & West

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WESTBOUND PASSING LANE SEGMENT A6 1.0 MILE
COMMUNICATION TOWER (DND)
EASTBOUND PASSING LANE SEGMENT B1 1.0 MILE
LOG MILE 226.50
BRIDGE F1043 (UIP)
KOBUSH WELDING MACHINING, LLC
LOG MILE 226.82
OVERHEAD ELECTRIC
COMMUNITY R6 HIGH SCHOOL
SCOTT'S CORNER
PIPELINE
ROUTE BB
US 54
LM 227
C.R. 408
LM 228
LOG MILE 228.02
WESTBOUND PASSING LANE SEGMENT B2 1.0 MILE
C.R. 416
RELOCATE OVERHEAD ELECTRIC LINE
OVERHEAD ELECTRIC LINE
LM 229
LOG MILE 229.23
CUIVRE RIVER
BRIDGE B0171 (UIP)
MATCHLINE LOG MILE 229.29
LEGEND
PROPOSED DIVIDED HIGHWAY
EASTBOUND PASSING LANE
WESTBOUND PASSING LANE
TURNING LANES
* SEGMENT LENGTHS NOTED ARE THE LENGTH OF PASSING LANES. DISPLAYED SEGMENTS (RED AND BLUE) INCLUDE TAPERS.
LOG MILE 229.31
OVERHEAD ELECTRIC
C.R. 424
LM 230
EASTBOUND PASSING LANE SEGMENT B3 1.0 MILE
C.R. 642
RELOCATE OVERHEAD ELECTRIC
LOG MILE 230.51
WESTBOUND PASSING LANE SEGMENT B4 0.95 MILE
LM 231
PIPELINE
RELOCATE OVERHEAD ELECTRIC
FASTLANE LADDONIA
LOG MILE 231.68
ROUTE KK
ROUTE K
LADDONIA CITY LIMITS
LADDONIA
MATCHLINE LOG MILE 231.97
SCALE
0 500 1000 1500 2000 2500
PLAN SHEET
SHEET 4 OF 12
Preliminary Plans - NOT FOR CONSTRUCTION
DATE PREPARED 6/30/23
ROUTE 54
STATE MO
DISTRICT NE
SHEET NO. 8
COUNTY AUDRAIN/PIKE
JOB NO. J2P3447
CONTRACT ID.
PROJECT NO.
BRIDGE NO.
DESCRIPTION
DATE
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EXISTING EB/NB RIGHT TURN LANES (UIP)
EXISTING WB/SB LEFT TURN LANE (UIP)
LADDONIA CITY LIMITS
RAILROAD
LM 232
MATCHLINE LOG MILE 231.97
OVERHEAD ELECTRIC
US 54
LADDONIA
C.R. 448
LOG MILE 232.74
PIPELINE
LM 233
PIPELINE
EASTBOUND PASSING LANE
SEGMENT B5
0.81 MILE
OVERHEAD ELECTRIC
OVERHEAD ELECTRIC
MIDDLE LICK CREEK
BRIDGE H0169
(WIDEN)
POET BIOPROCESSING
LOG MILE 233.77
C.R. 456
LM 234
RELOCATE OVERHEAD ELETRIC
WESTBOUND PASSING LANE
SEGMENT B6
0.81 MILE
OVERHEAD ELECTRIC
MATCHLINE LOG MILE 234.64

LEGEND
PROPOSED DIVIDED HIGHWAY
EASTBOUND PASSING LANE
WESTBOUND PASSING LANE
TURNING LANES

✳ SEGMENT LENGTHS NOTED ARE THE LENGTH OF PASSING LANES. DISPLAYED SEGMENTS (RED AND BLUE) INCLUDE TAPERS.

ROUTE 19
GAS METER
BASINGER'S CORNER
(CONNECT TO
EXISTING ROUNDABOUT)
PIPELINE
PIPELINE
LOG MILE 234.95
LM 235
EASTBOUND PASSING LANE
SEGMENT C1
1.0 MILE
ROUTE J
LOG MILE 234.80
PANHANDLE EASTERN
PIPELINE COMPANY
GAS METER
RELOCATE OVERHEAD ELECTRIC
MATCHLINE LOG MILE 234.64
PIPELINE
WESTBOUND PASSING LANE
SEGMENT B6
0.81 MILE
C.R. 509
LM 236
LOG MILE 236.15
BOX CULVERT
(NO B#) WITH
NO SHOULDER
US 54
RELOCATE OVERHEAD ELECTRIC
C.R. 509
C.R. 517
LOG MILE 236.79
LM 237
WESTBOUND PASSING LANE
SEGMENT C2
1.0 MILE
MATCHLINE LOG MILE 237.45
C.R. 517
OVERHEAD ELECTRIC

SCALE
0 500 1000 1500 2000 2500

PLAN SHEET
SHEET 5 OF 12

Preliminary Plans – NOT FOR CONSTRUCTION

DATE PREPARED 6/30/23
ROUTE 54 | STATE MO
DISTRICT NE | SHEET NO. 9
COUNTY AUDRAIN/PIKE
JOB NO. J2P3447
CONTRACT ID.
PROJECT NO.
BRIDGE NO.

DESCRIPTION | DATE

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MATCHLINE LOG MILE 237.45

PIPELINE

RELOCATE OVERHEAD ELECTRIC

C.R. 525

LM 238

LOG MILE 238.01

C.R. 529

FARBER CITY LIMITS

ROUTE PP

LM 239

OVERHEAD ELECTRIC

LOG MILE 239.57

LM 240

EASTBOUND PASSING LANE
SEGMENT C3
1.0 MILE

MATCHLINE LOG MILE 240.24

WESTBOUND PASSING LANE
SEGMENT C2
1.0 MILE

GAS METER

PANHANDLE EASTERN PIPELINE

OVERHEAD ELECTRIC

ROUTE AA

FARBER

US 54

RAILROAD

CE GRAIN

OE

G

LEGEND

- PROPOSED DIVIDED HIGHWAY
- EASTBOUND PASSING LANE
- WESTBOUND PASSING LANE
- TURNING LANES

✳ SEGMENT LENGTHS NOTED ARE THE LENGTH OF PASSING LANES. DISPLAYED SEGMENTS (RED AND BLUE) INCLUDE TAPERS.

MATCHLINE LOG MILE 240.24

EASTBOUND PASSING LANE
SEGMENT C3
1.0 MILE

LOG MILE 240.79

LM 241

C.R. 549

C.R. 556

RELOCATE OVERHEAD ELECTRIC

WESTBOUND PASSING LANE
SEGMENT C4
1.0 MILE

VAN FAR R1 ELEMENTARY SCHOOL

VAN FAR R1 HIGH SCHOOL

PIPELINE

EVERGREEN MEMORIAL GARDEN CEMETERY (DND)

LM 242

LOG MILE 242.01

LOG MILE 242.11

LOG MILE 242.18

LOG MILE 242.27

C.R. 557

VANDALIA CITY LIMITS

PIPELINE

ROUTE P

MATCHLINE LOG MILE 242.91

RAILROAD

DND HOUSE

OVERHEAD ELECTRIC

SERVICE & SUPPLY CO-OP

OVERHEAD ELECTRIC

OVERHEAD ELECTRIC

OVERHEAD ELECTRIC

SCALE

0 500 1000 1500 2000 2500

PLAN SHEET
SHEET 6 OF 12

Preliminary Plans – NOT FOR CONSTRUCTION

DATE PREPARED 6/30/23

ROUTE 54 | STATE MO

DISTRICT NE | SHEET NO. 10

COUNTY AUDRAIN/PIKE

JOB NO. J2P3447

CONTRACT ID.

PROJECT NO.

BRIDGE NO.

DATE | DESCRIPTION

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VANDALIA

VANDALIA CITY LIMIT LINE

RALLS/AUDRAIN COUNTY LINE

EASTBOUND PASSING LANE
SEGMENT C5
1.0 MILE

MISSOURI DEPARTMENT
OF CORRECTIONS

LM 244

LM 243

LM 245

ROUTE P

PIPELINE

US 54

C.R. 571

C.R. 572

LOG MILE 245.14

LOG MILE 245.33

LOG MILE 245.35

LOG MILE 245.54

LONGSPUR RD

MATCHLINE LOG MILE 242.31

MATCHLINE LOG MILE 245.62

BRIDGE #H0269
(UIP)

OVERHEAD ELECTRIC

RAILROAD

OVERHEAD ELECTRIC

RALLS COUNTY

AUDRAIN COUNTY

LEGEND
- PROPOSED DIVIDED HIGHWAY
- EASTBOUND PASSING LANE
- WESTBOUND PASSING LANE
- TURNING LANES

✳ SEGMENT LENGTHS NOTED ARE THE LENGTH OF PASSING LANES. DISPLAYED SEGMENTS (RED AND BLUE) INCLUDE TAPERS.

RALLS COUNTY

PIKE COUNTY

SWIFT LN.

LM 246

LM 247

LM 248

EASTBOUND PASSING LANE
SEGMENT C5
1.0 MILE

WESTBOUND PASSING LANE
SEGMENT C6
1.0 MILE

LOG MILE 246.76

LOG MILE 247.33

RAILROAD

US 54

C.R. 462

MATCHLINE LOG MILE 245.62

MATCHLINE LOG MILE 248.41

SCALE

0 500 1000 1500 2000 2500

PLAN SHEET
SHEET 7 OF 12

Preliminary Plans – NOT FOR CONSTRUCTION

DATE PREPARED 6/30/23

ROUTE 54 | STATE MO

DISTRICT NE | SHEET NO. 11

COUNTY AUDRAIN/PIKE

JOB NO. J2P3447

CONTRACT ID.

PROJECT NO.

BRIDGE NO.

DESCRIPTION | DATE

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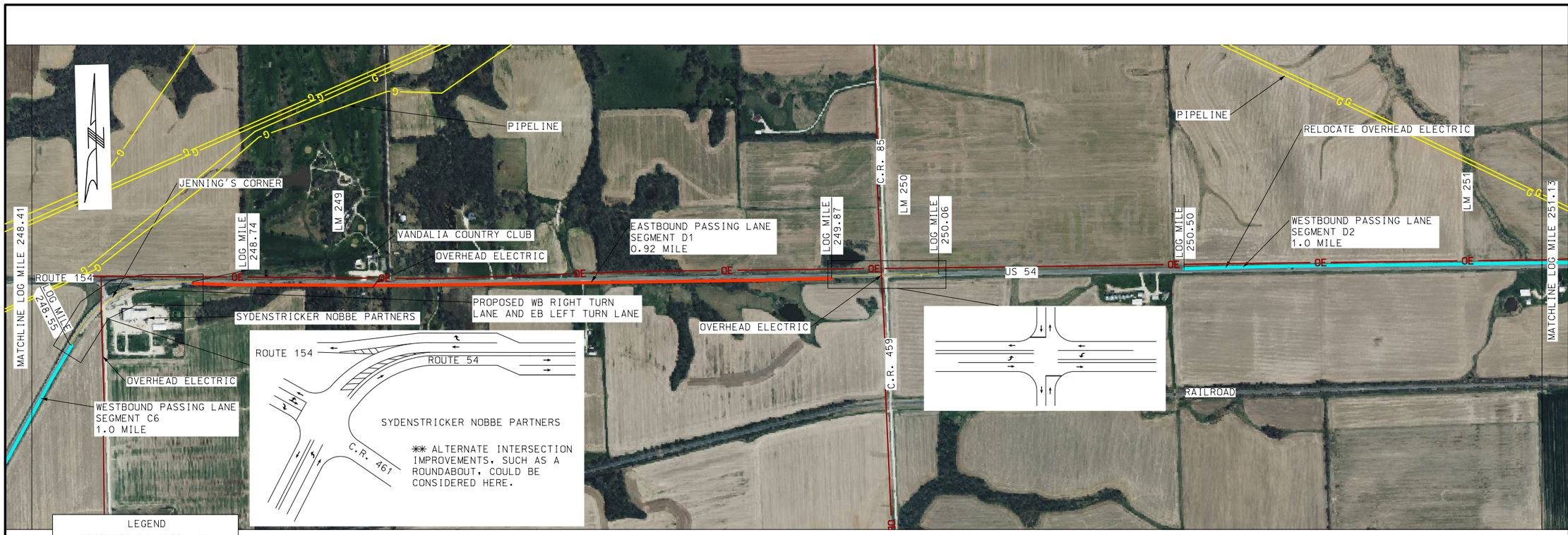

Preliminary Plans – NOT FOR CONSTRUCTION

DATE PREPARED 6/30/23

ROUTE 54 | STATE MO

DISTRICT NE | SHEET NO. 12

COUNTY AUDRAIN/PIKE

JOB NO. J2P3447

CONTRACT ID.

PROJECT NO.

BRIDGE NO.

DESCRIPTION | DATE

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601 MONROE STREET SUITE 201 - JEFFERSON CITY, MO 65101
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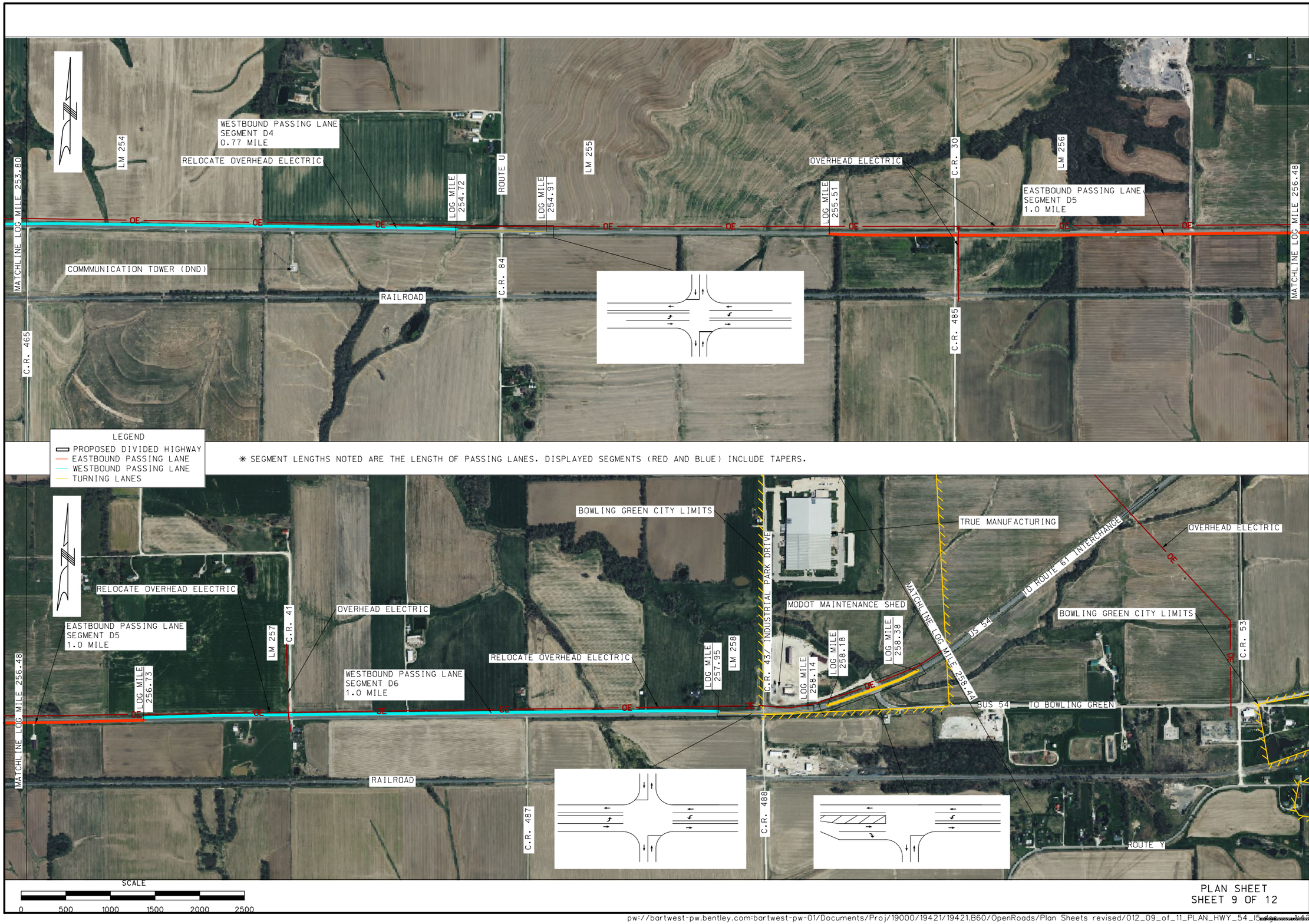

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DATE PREPARED 6/30/23

ROUTE 54 | STATE MO

DISTRICT NE | SHEET NO. 13

COUNTY AUDRAIN/PIKE

JOB NO. J2P3447

CONTRACT ID.

PROJECT NO.

BRIDGE NO.

DATE | DESCRIPTION

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PLAN SHEET
SHEET 9 OF 12

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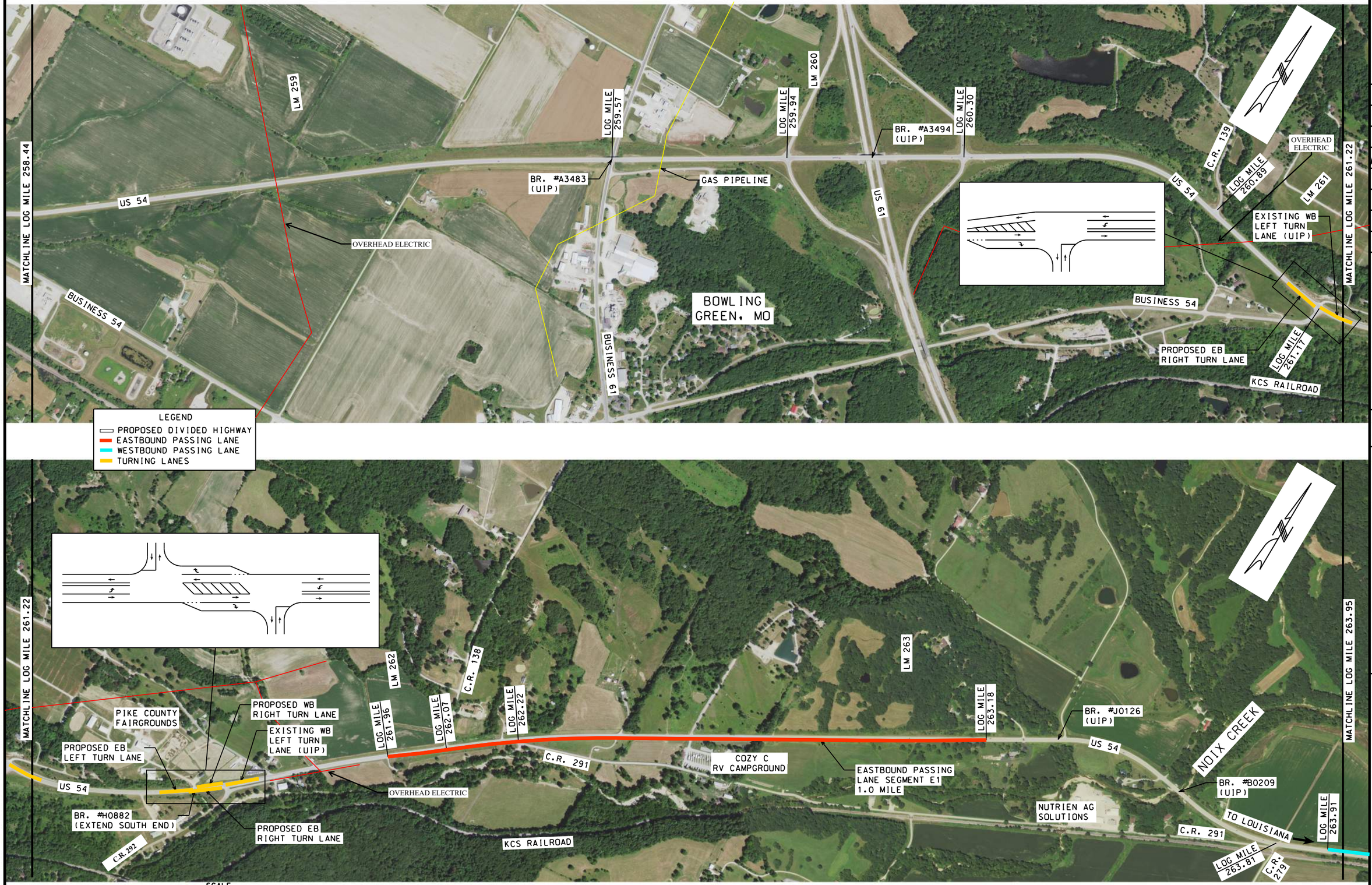

Appendices

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DATE PREPARED	2/10/2023
ROUTE	54
STATE	MO
DISTRICT	NE
SHEET NO.	14
COUNTY	AUDRAIN/PIKE
JOB NO.	J2P3447
CONTRACT ID.	.
PROJECT NO.	.
BRIDGE NO.	.

DESCRIPTION	DATE
.	.

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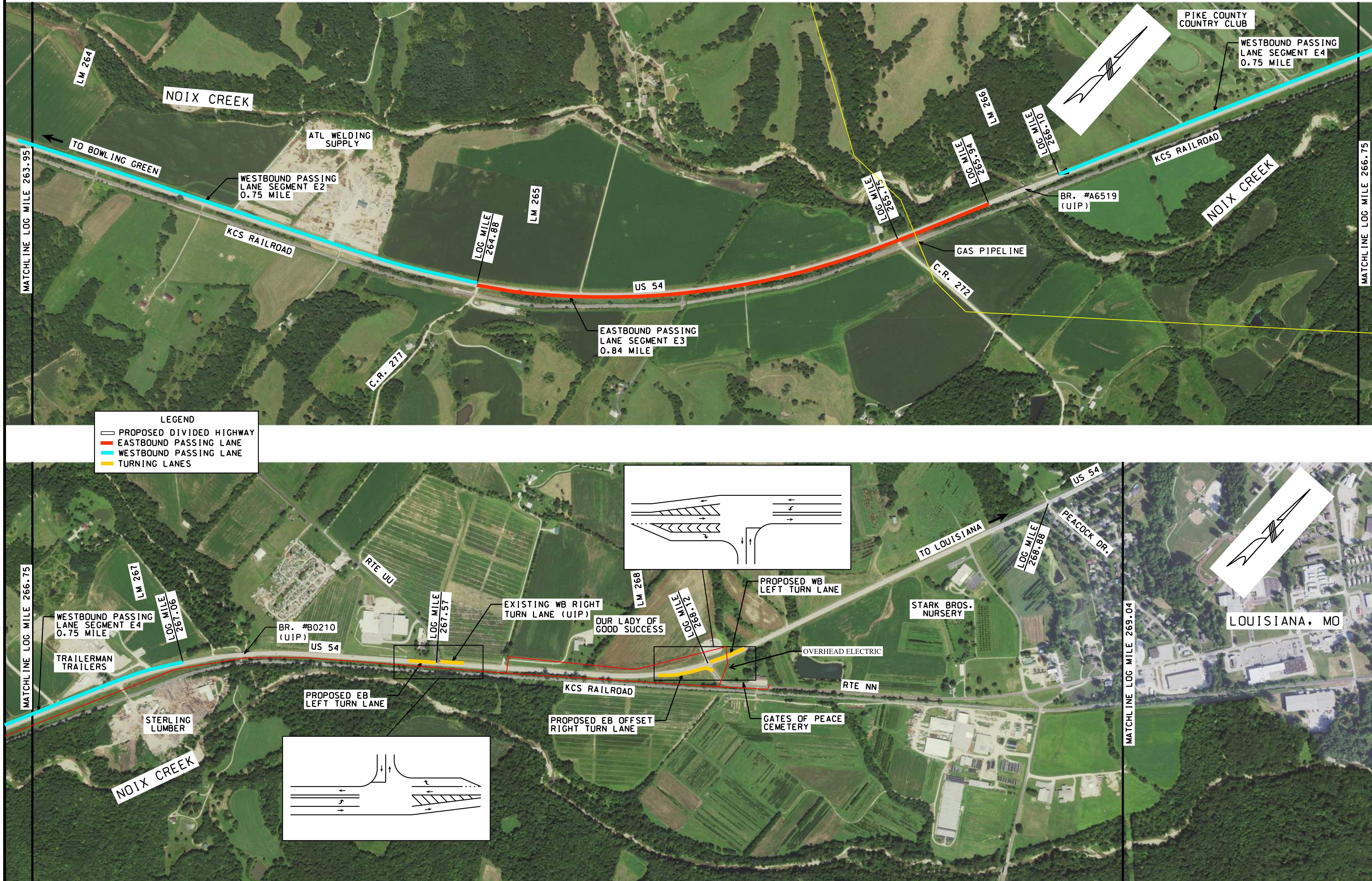
KLINGNER & ASSOCIATES, P.C.
Engineers · Architects · Surveyors
Columbia, Missouri
www.klingner.com
Quincy, IL · Davenport, IA · Burlington, IA · Peoria, IL

LAYOUT SHEET
SHEET 10 OF 12

Bartlett & West

June 2023



MATCHLINE LOG MILE 263.95
LM 264
NOIX CREEK
TO BOWLING GREEN
ATL WELDING SUPPLY
WESTBOUND PASSING LANE SEGMENT E2 0.75 MILE
KCS RAILROAD
LOG MILE 264.88
LM 265
US 54
EASTBOUND PASSING LANE SEGMENT E3 0.84 MILE
C.R. 277
LOG MILE 265.75
LOG MILE 265.94
LM 266
LOG MILE 266.10
GAS PIPELINE
C.R. 272
BR. #A6519 (UIP)
KCS RAILROAD
NOIX CREEK
PIKE COUNTY COUNTRY CLUB
WESTBOUND PASSING LANE SEGMENT E4 0.75 MILE
MATCHLINE LOG MILE 266.75
LEGEND
PROPOSED DIVIDED HIGHWAY
EASTBOUND PASSING LANE
WESTBOUND PASSING LANE
TURNING LANES
MATCHLINE LOG MILE 266.75
WESTBOUND PASSING LANE SEGMENT E4 0.75 MILE
LM 267
LOG MILE 267.06
TRAILERMAN TRAILERS
STERLING LUMBER
NOIX CREEK
BR. #B0210 (UIP)
US 54
RTE UU
LOG MILE 267.57
EXISTING WB RIGHT TURN LANE (UIP)
PROPOSED EB LEFT TURN LANE
LM 268
OUR LADY OF GOOD SUCCESS
LOG MILE 268.12
PROPOSED WB LEFT TURN LANE
OVERHEAD ELECTRIC
KCS RAILROAD
PROPOSED EB OFFSET RIGHT TURN LANE
GATES OF PEACE CEMETERY
RTE NN
TO LOUISIANA
STARK BROS. NURSERY
LOG MILE 268.88
US 54
PEACOCK DR.
MATCHLINE LOG MILE 269.04
LOUISIANA, MO

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DATE PREPARED	2/10/2023
ROUTE	54
STATE	MO
DISTRICT	NE
SHEET NO.	15
COUNTY	AUDRAIN/PIKE
JOB NO.	J2P3447
CONTRACT ID.	.
PROJECT NO.	.
BRIDGE NO.	.

DESCRIPTION

DATE

MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION

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JEFFERSON CITY, MO 65102
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0 500 1000 1500 2000 2500

LAYOUT SHEET
SHEET 11 OF 12

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DATE PREPARED	2/10/2023
ROUTE	54
STATE	MO
DISTRICT	NE
SHEET NO.	16
COUNTY	AUDRAIN/PIKE
JOB NO.	J2P3447
CONTRACT ID.	.
PROJECT NO.	.
BRIDGE NO.	.

DESCRIPTION

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LAYOUT SHEET
SHEET 12 OF 12

Appendix B: Cost Estimate Assumptions and Calculations

(13 pages)

Bartlett & West

Preliminary Estimate
Route 54 Capacity Improvements Audrain, Ralls, Pike County
Project Number J2P3447

ROUTE 54 SHARED 4-LANE STUDY ESTIMATED COSTS

NO.	STUDY SECTION	LENGTH (mi.)	GRADING COST	DRAINAGE COST	BRIDGE COST	PAVEMENT/BASE COST	CONST. INCIDENTALS	ROW COSTS	UTILITY COSTS	SECTION TOTAL	REMARKS
0	Mexico Bypass Completion	6.0	$ 5,984,009.60	$ 1,445,500.00	$ 10,102,000.00	$ 11,587,919.96	$ 4,367,914.43	$ -	$ 467,700.00	$ 33,955,049.97	
A	Mexico to Scott's Corner	8.4	$ 2,336,961.44	$ 1,589,449.43	$ 2,881,408.00	$ 9,268,242.30	$ 2,411,409.17	$ 440,500.00	$ 141,800.00	$ 19,069,778.74	
B	Scott's Corner to Basinger's Corner	8.2	$ 2,307,238.56	$ 1,466,827.09	$ -	$ 9,130,832.95	$ 1,935,734.79	$ 439,900.00	$ 134,600.00	$ 15,415,141.60	
C	Basinger's Corner to Jenning's Corner	13.7	$ 2,682,489.92	$ 733,140.56	$ -	$ 11,489,286.30	$ 2,235,737.52	$ 537,700.00	$ 145,400.00	$ 17,823,768.00	
-	Jenning's Corner Roundabout	N/A	$ 343,868.30	$ 465,411.50	$ -	$ 2,210,002.20	$ 1,098,706.35	$ 29,000.00	$ 41,200.00	$ 4,188,188.35	Const. Cost & R/W Acres from Basinger Rdbt
D	Jenning's Corner to Bowling Green	10.2	$ 2,556,167.68	$ 1,255,325.90	$ -	$ 10,382,470.03	$ 2,129,094.54	$ 304,000.00	$ 144,900.00	$ 16,771,968.35	
E	Bowling Green to Louisiana	12.1	$ 2,593,321.28	$ 1,274,297.62	$ -	$ 11,445,461.69	$ 2,296,962.09	$ -	$ 153,000.00	$ 17,763,054.78	
	TOTALS (Thousands of Dollars)	**58.58**	**$ 18,804**	**$ 8,230**	**$ 12,983**	**$ 65,514**	**$ 16,476**	**$ 1,751**	**$ 1,229**	**$ 124,987**	**Totals in Thousands of Dollar**

Revised: 3/2/23

Bartlett & West

Preliminary Estimate

Route 54 Capacity Improvements Audrain, Ralls, Pike County
Project Number J2P3447

Mexico Bypass Completion

Log Mile Start	End	LENGTH (mi.)	GRADING COST	DRAINAGE COST	BRIDGE COST	PAVEMENT/BASE COST	CONST. INCIDENTALS	ROW ACRES	ROW COSTS	UTILITY COSTS	SECTION TOTAL	REMARKS
1.00	4.80	3.80	$ 2,649,968.00	$ 665,000.00	$ 5,634,000.00	$ 5,069,545.80	$ 2,102,777.07	$ -	$ -	$ 209,700.00	$ 16,330,990.87	Add EBL
4.80	6.98	2.18	$ 3,040,489.60	$ 763,000.00	$ 4,468,000.00	$ 5,816,636.76	$ 2,113,218.95	$ -	$ -	$ 234,700.00	$ 16,436,045.31	Add EBL and WBL from Vandiver to Section A
10.00	10.20	0.20	$ 83,872.00	$ 5,000.00	$ -	$ 200,496.40	$ 43,405.26	$ -	$ -	$ 6,700.00	$ 339,473.66	EBL Off-Ramp to Existing 54
20.00	20.25	0.25	$ 104,840.00	$ 6,250.00	$ -	$ 250,620.50	$ 54,256.58	$ -	$ -	$ 8,300.00	$ 424,267.08	EBL On-Ramp from Existing 54
30.00	30.25	0.25	$ 104,840.00	$ 6,250.00	$ -	$ 250,620.50	$ 54,256.58	$ -	$ -	$ 8,300.00	$ 424,267.08	WBL Off-Ramp to Business 54
Subtotals		**5.98**	**$ 5,984,009.60**	**$ 1,445,500.00**	**$ 10,102,000.00**	**$ 11,587,919.96**	**$ 4,367,914.43**	**0.00**	**$ -**	**$ 467,700.00**		
TOTALS (in $ Thousands)			**$ 5,984**	**$ 1,446**	**$ 10,102**	**$ 11,588**	**$ 4,368**		**$ -**	**$ 468**	**$ 33,956**	
Cost/Mile			$ 1,001	$ 242	$ 1,689	$ 1,938	$ 730		$ -	$ 78	$ 5,678	

ROW Cost Per Acre $ 10,000.00
Utiities Estimated at 2% of Construction Costs

Bartlett & West

Preliminary Estimate

Route 54 Capacity Improvements Audrain, Ralls, Pike County
Project Number J2P3447

Vandiver to Scott's Corner

Passing Lanes	EB/WB	LENGTH (mi.)	GRADING COST	DRAINAGE COST	BRIDGE COST	PAVEMENT/BASE COST	CONST. INCIDENTALS	ROW ACRES	ROW COSTS	UTILITY COSTS	SECTION TOTAL	REMARKS
A1	EB	0.39	$ 144,899.04	$ 219,246.87		$ 498,180.50	$ 129,348.96	2.88	$ 28,800.00	$ 9,900.00	$ 1,030,375.37	
A2	WB	1.09	$ 404,974.24	$ 139,058.24		$ 1,392,350.63	$ 290,457.47	7.73	$ 77,300.00	$ 22,300.00	$ 2,326,440.58	
Left Turn Lanes	EB/WB Left	0.19	$ 70,591.84	$ -		$ 242,703.32	$ 46,994.27	1.27	$ 12,700.00	$ 3,600.00	$ 376,589.44	
A3	EB	1.11	$ 412,404.96	$ 486,104.08		$ 1,417,898.35	$ 347,461.11	7.87	$ 78,700.00	$ 26,600.00	$ 2,769,168.50	
Left Turn Lanes	EB/WB Left	0.18	$ 66,876.48	$ 76,156.00		$ 229,929.46	$ 55,944.29	0.76	$ 7,600.00	$ 4,300.00	$ 440,806.23	
A4	WB	1.11	$ 412,404.96	$ 193,612.08	$ 1,639,440.00	$ 1,417,898.35	$ 549,503.31	7.80	$ 78,000.00	$ 25,700.00	$ 4,316,558.70	
A5	EB	1.11	$ 412,404.96	$ 396,604.08		$ 1,417,898.35	$ 334,036.11	7.87	$ 78,700.00	$ 25,600.00	$ 2,665,243.50	
A6	WB	1.11	$ 412,404.96	$ 78,668.08	$ 1,241,968.00	$ 1,417,898.35	$ 472,640.91	7.87	$ 78,700.00	$ 23,800.00	$ 3,726,080.30	
Resurface 40'	EB/WB	2.11	$ -	$ -	$ -	$ 442,327.21	$ 66,349.08	0.00	$ -	$ -	$ 508,676.29	
Resurface 24'	EB/WB	6.29	$ -	$ -	$ -	$ 791,157.77	$ 118,673.67	0.00	$ -	$ -	$ 909,831.44	
Subtotals		**8.4**	**$ 2,336,961.44**	**$ 1,589,449.43**	**$ 2,881,408.00**	**$ 9,268,242.30**	**$ 2,411,409.17**	**44.05**	**$ 440,500.00**	**$ 141,800.00**		
TOTALS (in $ Thousands)			**$ 2,337**	**$ 1,589**	**$ 2,881**	**$ 9,268**	**$ 2,411**		**$ 441**	**$ 142**	**$ 19,069**	
Cost/Mile			$ 278	$ 189	$ 343	$ 1,103	$ 287		$ 53	$ 17	$ 2,270	

Entrance Pipe Replacements (per mile) $ 27,791.96
Drainage costs consist of the Entrance Pipe Replacements and the cross-road structures as detailed in the conceptual report.
ROW Cost Per Acre $ 10,000.00
Utiities Estimated at 1% of Construction Costs
Passing lane lengths include length of Passing Lane and half of taper lengths
Resurface 40' includes areas between passing/turn lanes
Resurface 24' includes the original travelway area where passing/turn lanes are added

Bartlett & West

Preliminary Estimate

Route 54 Capacity Improvements Audrain, Ralls, Pike County
Project Number J2P3447

Scott's Corner to Basinger's Corner

Passing Lanes	EB/WB	LENGTH (mi.)	GRADING COST	DRAINAGE COST	BRIDGE COST	PAVEMENT/BASE COST	CONST. INCIDENTALS	ROW ACRES	ROW COSTS	UTILITY COSTS	SECTION TOTAL	REMARKS
B1	EB	1.1	$ 408,689.60	$ 310,793.16		$ 1,405,124.49	$ 318,691.09	7.73	$ 77,300.00	$ 24,400.00	$ 2,544,998.34	
B2	WB	1.11	$ 412,404.96	$ 153,045.08		$ 1,417,898.35	$ 297,502.26	7.80	$ 78,000.00	$ 22,800.00	$ 2,381,650.65	
B3	EB	1.1	$ 408,689.60	$ 117,950.16		$ 1,405,124.49	$ 289,764.64	5.36	$ 53,600.00	$ 22,200.00	$ 2,297,328.89	
B4	WB	1.06	$ 393,828.16	$ 188,824.48		$ 1,354,029.05	$ 290,502.25	7.53	$ 75,300.00	$ 22,300.00	$ 2,324,783.95	
B5	EB	0.92	$ 341,813.12	$ 607,775.61		$ 1,175,195.03	$ 318,717.56	7.72	$ 77,200.00	$ 24,400.00	$ 2,545,101.32	
B6	WB	0.92	$ 341,813.12	$ 88,438.61		$ 1,175,195.03	$ 240,817.01	7.85	$ 78,500.00	$ 18,500.00	$ 1,943,263.77	
Resurface 40'	EB/WB	1.99				$ 417,171.16	$ 62,575.67				$ 479,746.84	
Resurface 24'	EB/WB	6.21				$ 781,095.35	$ 117,164.30				$ 898,259.66	
Subtotals		**8.2**	**$ 2,307,238.56**	**$ 1,466,827.09**	**$ -**	**$ 9,130,832.95**	**$ 1,935,734.79**	**43.99**	**$ 439,900.00**	**$ 134,600.00**		
TOTALS (in $ Thousands)			**$ 2,307**	**$ 1,467**	**$ -**	**$ 9,131**	**$ 1,936**		**$ 440**	**$ 135**	**$ 15,416**	
Cost/Mile			$ 281	$ 179	$ -	$ 1,114	$ 236		$ 54	$ 16	$ 1,880	

Entrance Pipe Replacements (per mile) $ 27,791.96
Drainage costs consist of the Entrance Pipe Replacements and the cross-road structures as detailed in the conceptual report.
ROW Cost Per Acre $ 10,000.00
Utiities Estimated at 1% of Construction Costs
Passing lane lengths include length of Passing Lane and half of taper lengths
Resurface 40' includes areas between passing/turn lanes
Resurface 24' includes the original travelway area where passing/turn lanes are added

Bartlett & West

Preliminary Estimate

Route 54 Capacity Improvements Audrain, Ralls, Pike County
Project Number J2P3447

Basinger's Corner to Jenning's Corner

Passing Lanes	EB/WB	LENGTH (mi.)	GRADING COST	DRAINAGE COST	BRIDGE COST	PAVEMENT/BASE COST	CONST. INCIDENTALS	ROW ACRES	ROW COSTS	UTILITY COSTS	SECTION TOTAL	REMARKS
C1	EB	1.1	$ 408,689.60	$ 236,224.16		$ 1,405,124.49	$ 307,505.74	9.19	$ 91,900.00	$ 23,600.00	$ 2,473,043.99	
C2	WB	1.11	$ 412,404.96	$ 30,849.08		$ 1,417,898.35	$ 279,172.86	9.35	$ 93,500.00	$ 21,400.00	$ 2,255,225.25	
C3	EB	1.11	$ 412,404.96	$ 30,849.08		$ 1,417,898.35	$ 279,172.86	7.82	$ 78,200.00	$ 21,400.00	$ 2,239,925.25	
C4	WB	1.11	$ 412,404.96	$ 30,849.08		$ 1,417,898.35	$ 279,172.86	7.87	$ 78,700.00	$ 21,400.00	$ 2,240,425.25	
Turn Lanes	EB Left	0.19	$ 70,591.84	$ -		$ 242,703.32	$ 46,994.27	1.27	$ 12,700.00	$ 3,600.00	$ 376,589.44	
Turn Lanes	EB Lt/WB Rt	0.38	$ 141,183.68	$ -		$ 485,406.64	$ 93,988.55	2.53	$ 25,300.00	$ 7,200.00	$ 753,078.87	
C5	EB	1.11	$ 412,404.96	$ 255,800.08		$ 1,417,898.35	$ 312,915.51	7.87	$ 78,700.00	$ 24,000.00	$ 2,501,718.90	
C6	WB	1.11	$ 412,404.96	$ 148,569.08		$ 1,417,898.35	$ 296,830.86	7.87	$ 78,700.00	$ 22,800.00	$ 2,377,203.25	
Resurface 40'	EB/WB	6.48				$ 1,358,426.70	$ 203,764.01				$ 1,562,190.71	
Resurface 24'	EB/WB	7.22				$ 908,133.41	$ 136,220.01				$ 1,044,353.42	
Subtotals		**13.7**	**$ 2,682,489.92**	**$ 733,140.56**	**$ -**	**$ 11,489,286.30**	**$ 2,235,737.52**	**53.77**	**$ 537,700.00**	**$ 145,400.00**		
TOTALS (in $ Thousands)			**$ 2,682**	**$ 733**	**$ -**	**$ 11,489**	**$ 2,236**		**$ 538**	**$ 145**	**$ 17,823**	
Cost/Mile			$ 196	$ 54	$ -	$ 839	$ 163		$ 39	$ 11	$ 1,301	

Entrance Pipe Replacements (per mile) $ 27,791.96
Drainage costs consist of the Entrance Pipe Replacements and the cross-road structures as detailed in the conceptual report
ROW Cost Per Acre $ 10,000.00
Utiities Estimated at 1% of Construction Costs
Passing lane lengths include length of Passing Lane and half of taper lengths
Resurface 40' includes areas between passing/turn lanes
Resurface 24' includes the original travelway area where passing/turn lanes are addec

Bartlett & West

Preliminary Estimate

Route 54 Capacity Improvements Audrain, Ralls, Pike County
Project Number J2P3447

Jenning's Corner Roundabout

Passing Lanes	EB/WB	LENGTH (mi.)	GRADING COST	DRAINAGE COST	BRIDGE COST	PAVEMENT/BASE COST	CONST. INCIDENTALS	ROW ACRES	ROW COSTS	UTILITY COSTS	SECTION TOTAL	REMARKS
Roundabout	EB/WB	0.19	$ 343,868.30	$ 465,411.50	$ -	$ 2,210,002.20	$ 1,098,706.35	2.90	$ 29,000.00	$ 41,200.00	$ 4,188,188.35	Const. Cost & R/W Acres from Basinger Rdbt
Subtotals		**13.7**	**$ 343,868.30**	**$ 465,411.50**	**$ -**	**$ 2,210,002.20**	**$ 1,098,706.35**	**2.90**	**$ 29,000.00**	**$ 41,200.00**		
TOTALS (in $ Thousands)			**$ 344**	**$ 465**	**$ -**	**$ 2,210**	**$ 1,099**		**$ 29**	**$ 41**	**$ 4,188**	
Cost/Mile			$ 25	$ 34	$ -	$ 161	$ 80		$ 2	$ 3	$ 306	

ROW Cost Per Acre $ 10,000.00
Utiities Estimated at 1% of Construction Costs

Bartlett & West

Preliminary Estimate

Route 54 Capacity Improvements Audrain, Ralls, Pike County
Project Number J2P3447

Jenning's Corner to Bowling Green

Passing Lanes	EB/WB	LENGTH (mi.)	GRADING COST	DRAINAGE COST	BRIDGE COST	PAVEMENT/BASE COST	CONST. INCIDENTALS	ROW ACRES	ROW COSTS	UTILITY COSTS	SECTION TOTAL	REMARKS
D1	EB	1.02	$ 378,966.72	$ 409,866.80		$ 1,302,933.62	$ 313,765.07	4.53	$ 45,300.00	$ 24,100.00	$ 2,474,932.21	
Turn Lane	EB/WB Left	0.19	$ 70,591.84	$ -		$ 242,703.32	$ 46,994.27	0.81	$ 8,100.00	$ 3,600.00	$ 371,989.44	
D2	WB	1.11	$ 412,404.96	$ 104,203.08		$ 1,417,898.35	$ 290,175.96	4.91	$ 49,100.00	$ 22,200.00	$ 2,295,982.35	
D3	EB	0.87	$ 323,236.32	$ 193,260.01		$ 1,111,325.73	$ 244,173.31	3.89	$ 38,900.00	$ 18,700.00	$ 1,929,595.37	
D4	WB	0.89	$ 330,667.04	$ 34,721.85		$ 1,136,873.45	$ 225,339.35	3.98	$ 39,800.00	$ 17,300.00	$ 1,784,701.69	
Turn Lane	EB/WB Left	0.19	$ 70,591.84	$ -		$ 242,703.32	$ 46,994.27	0.81	$ 8,100.00	$ 3,600.00	$ 371,989.44	
D5	EB	1.11	$ 412,404.96	$ 297,273.08		$ 1,417,898.35	$ 319,136.46	4.91	$ 49,100.00	$ 24,500.00	$ 2,520,312.85	
D6	WB	1.11	$ 412,404.96	$ 216,001.08		$ 1,417,898.35	$ 306,945.66	4.91	$ 49,100.00	$ 23,500.00	$ 2,425,850.05	
Turn Lanes	EB/WB Left	0.39	$ 144,899.04	$ -		$ 498,180.50	$ 96,461.93	1.65	$ 16,500.00	$ 7,400.00	$ 763,441.47	
Resurface 40'	EB/WB	3.71				$ 777,741.21	$ 116,661.18				$ 894,402.39	
Resurface 24'	EB/WB	6.49				$ 816,313.82	$ 122,447.07				$ 938,760.90	
Subtotals		**10.2**	**$ 2,556,167.68**	**$ 1,255,325.90**	**$ -**	**$ 10,382,470.03**	**$ 2,129,094.54**	**30.40**	**$ 304,000.00**	**$ 144,900.00**		
TOTALS (in $ Thousands)			**$ 2,556**	**$ 1,255**	**$ -**	**$ 10,382**	**$ 2,129**		**$ 304**	**$ 145**	**$ 16,771**	
Cost/Mile			$ 251	$ 123	$ -	$ 1,018	$ 209		$ 30	$ 14	$ 1,644	

Entrance Pipe Replacements (per mile) $ 27,791.96
Drainage costs consist of the Entrance Pipe Replacements and the cross-road structures as detailed in the conceptual report.
ROW Cost Per Acre $ 10,000.00
Utiities Estimated at 1% of Construction Costs
Passing lane lengths include length of Passing Lane and half of taper lengths
Resurface 40' includes areas between passing/turn lanes
Resurface 24' includes the original travelway area where passing/turn lanes are added

Bartlett & West

In association with Klingner & Associates, P.C.

Preliminary Estimate

Route 54 Capacity Improvements Audrain, Ralls, Pike County

Project Number J2P3447

Bowling Green to Louisiana

Passing Lanes	EB/WB	LENGTH (mi.)	GRADING COST	DRAINAGE COST	BRIDGE COST	PAVEMENT/BASE COST	CONST. INCIDENTALS	ROW ACRES	ROW COSTS	UTILITY COSTS	SECTION TOTAL	REMARKS
Left Turn Lane	ke Co. Fairgroun	0.40	$ 148,614.40	$ 464,200.00	$ -	$ 510,954.36	$ 168,565.31	0.00	$0.00	$ 12,900.00	$ 1,305,234.07	
Right Turn Lane	ke Co. Fairgroun	0.40	$ 148,614.40	$ -	$ -	$ 510,954.36	$ 98,935.31	0.00	$0.00	$ 7,600.00	$ 766,104.07	
Right Turn Lane	Business 54	0.40	$ 148,614.40	$ -	$ -	$ 510,954.36	$ 98,935.31	0.00	$0.00	$ 7,600.00	$ 766,104.07	
Right Turn Lane	Route AA	0.40	$ 148,614.40	$ -	$ -	$ 510,954.36	$ 98,935.31	0.00	$0.00	$ 7,600.00	$ 766,104.07	
E1	EB	1.11	$ 412,404.96	$ 297,399.88	$ -	$ 1,417,898.35	$ 319,155.48	0.00	$0.00	$ 24,500.00	$ 2,471,358.67	
E2	WB	0.86	$ 319,520.96	$ 252,099.89	$ -	$ 1,098,551.87	$ 250,525.91	0.00	$0.00	$ 19,200.00	$ 1,939,898.63	
E3	EB	0.95	$ 352,959.20	$ 117,438.37	$ -	$ 1,213,516.61	$ 252,587.13	0.00	$0.00	$ 19,400.00	$ 1,955,901.30	
E4	WB	0.86	$ 319,520.96	$ 143,159.49	$ -	$ 1,098,551.87	$ 234,184.85	0.00	$0.00	$ 18,000.00	$ 1,813,417.17	
Left Turn Lane	Route UU	0.40	$ 148,614.40	$ -	$ -	$ 510,954.36	$ 98,935.31	0.00	$0.00	$ 7,600.00	$ 766,104.07	
Left Turn Lane	Route NN	0.40	$ 148,614.40	$ -	$ -	$ 510,954.36	$ 98,935.31	0.00	$0.00	$ 7,600.00	$ 766,104.07	
Offset Rt Turn Lane	Route NN	0.40	$ 297,228.80	$ -	$ -	$ 1,532,863.08	$ 274,513.78	0.00	$0.00	$ 21,000.00	$ 2,125,605.66	Estimate factors for grading were doubled and Pavement/Base were tripled to account for the additional width required on the offset right turn.
Resurface 40'	EB/WB	5.92	$ -	$ -	$ -	$ 1,241,031.80	$ 186,154.77	0.00	$0.00	$ -	$ 1,427,186.57	
Resurface 24'	EB/WB	6.18	$ -	$ -	$ -	$ 777,321.95	$ 116,598.29	0.00	$0.00	$ -	$ 893,920.24	
Subtotals		**12.10**	**$ 2,593,321.28**	**$ 1,274,297.62**	**$ -**	**$ 11,445,461.69**	**$ 2,296,962.09**	**0.00**	**$ -**	**$ 153,000.00**		
TOTALS (in $ Thousands)			**$ 2,593**	**$ 1,274**	**$ -**	**$ 11,445**	**$ 2,297**		**$ -**	**$ 153**	**$ 17,762**	
Cost/Mile			$ 214	$ 105	$ -	$ 946	$ 190		$ -	$ 13	$ 1,468	

Entrance Pipe Replacements (per mile) $ 27,791.96

Drainage costs consist of the Entrance Pipe Replacements and the cross-road structures as detailed in the conceptual report

ROW Cost Per Acre $ 10,000.00

Utiities Estimated at 1% of Construction Costs

Passing lane lengths include length of Passing Lane and half of taper lengths

Resurface 40' includes areas between passing/turn lanes

Resurface 24' includes the original travelway area where passing/turn lanes are addec

Cost per Mile calculations for 16' widening (passing lane plus 4' median)

Overall Cost per Mile						
Item #	Description	Quantity	Unit	Price	Total	Remarks
	Grading (See table below)				$ 371,536.00	
	Pavement and Base (See table below)				$ 1,277,385.90	
	Misc. Items	15%			$ 247,338.29	
				Subtotal	$ 1,896,260.19	

Grading						
Item #	Description	Quantity	Unit	Price	Total	Remarks
2022014	Full Depth Sawcut	10560	Lin. Ft.	$ 4.50	$ 47,520.00	
2031000	Class A Excavation	25612	Cu. Yards	$ 10.00	$ 256,120.00	
2036000	Compacting Embankment	1134	Cu. Yards	$ 4.00	$ 4,536.00	
2101003A	Subgrade Compaction	52.8	Station	$ 1,200.00	$ 63,360.00	
				Total	**$ 371,536.00**	

Pavement & Base						
Item #	Description	Quantity	Unit	Price	Total	Remarks
4030103	Asphaltic Concrete Mixture SP125C PG 70-22	902.2	Tons	$ 85.00	$ 76,687.00	
4030208	Asphaltic Concrete Mixture SP190C PG 70-22	1731.6	Tons	$ 89.00	$ 154,112.40	
4030306	Asphaltic Concrete Mixture SP250C PG 64-22	4005.1	Tons	$ 80.00	$ 320,408.00	
4071007	Tack Coat - Low or Non-Tracking	2606	Gallons	$ 2.75	$ 7,166.50	
4010150	A2 Shoulders	9386.7	Sq. Yards	$ 40.00	$ 375,468.00	
3040506	Type 5 Aggregate for Base (6 in Thick)	10584	Sq. Yards	$ 11.00	$ 116,424.00	
3049905	Type 5 Aggregate for Base (12 in Thick)	11356	Sq. Yards	$ 20.00	$ 227,120.00	Under A2 Shoulders
				Total	**$ 1,277,385.90**	

Drainage costs were estimated by a cost per mile of $27,791.96 for entrances pipe replacements, based on a count of the total number of entrances throughout the project. Cross-road drainage structure extensions and bridges were estimated on an individual basis and those costs are summarized in the conceptual report for each section.

RESURFACING COSTS

40' Wide (Areas of no added passing lane), 2 - 12' lanes and 2 - 8' shoulders						
Item #	Description	Quantity	Unit	Price	Total	Remarks
4030103	Asphaltic Concrete Mixture SP125C PG 70-22	2,255.5	Tons	$85.00	$191,717.50	
4071007	Tack Coat - Low or Non-Tracking	6,515.0	Gallons	$2.75	$17,916.25	
				Total per mile	**$209,633.75**	

24' Wide (Areas with added passing lane), 2 - 12' lanes						
Item #	Description	Quantity	Unit	Price	Total	Remarks
4030103	Asphaltic Concrete Mixture SP125C PG 70-22	1,353.3	Tons	$85.00	$115,030.50	
4071007	Tack Coat - Low or Non-Tracking	3,909.0	Gallons	$2.75	$10,749.75	
				Total per mile	**$125,780.25**	

Section 0 - Mexico Bypass

Each half of divided 4-lane						
Item #	Description	Quantity	Unit	Price	Total	Remarks
Pavement & Base						
4030103	Asphaltic Concrete Mixture SP125C PG 70-22	1,369	Tons	$85.00	$116,365.00	
4030208	Asphaltic Concrete Mixture SP190C PG 70-22	1,597	Tons	$89.00	$142,133.00	
4030306	Asphaltic Concrete Mixture SP250C PG 64-22	4,938	Tons	$80.00	$395,040.00	
4071007	Tack Coat - Low or Non-Tracking	3,000	Gallons	$2.75	$8,250.00	
4010150	A2 Shoulders	8,213	Sq. Yards	$40.00	$328,520.00	
3040506	Type 5 Aggregate for Base (6 in Thick)	15,253	Sq. Yards	$11.00	$167,783.00	
3049905	Type 5 Aggregate for Base (12 in Thick)	8,800	Sq. Yards	$20.00	$176,000.00	
					$1,334,091.00	SUBTOTAL Pavement & Base
2031000	Class A Excavation	53,000.00	Cu. Yards	$10.00	$530,000.00	
2036000	Compacting Embankment	26,000.00	Cu. Yards	$4.00	$104,000.00	
2101003A	Subgrade Compaction	52.8	Station	$1,200.00	$63,360.00	
					$697,360.00	SUBTOTAL Grading
Drainage based on rough Averages for Sections A - E.					**$175,000.00**	SUBTOTAL Drainage
				Total Per Mile	**$2,206,451.00**	

Entrance/Exit Ramps						
Item #	Description	Quantity	Unit	Price	Total	Remarks
4030103	Asphaltic Concrete Mixture SP125C PG 70-22	799.00	Tons	$85.00	$67,915.00	
4030208	Asphaltic Concrete Mixture SP190C PG 70-22	945.00	Tons	$89.00	$84,105.00	
4030306	Asphaltic Concrete Mixture SP250C PG 64-22	2,982.00	Tons	$80.00	$238,560.00	
4071007	Tack Coat - Low or Non-Tracking	1,500.00	Gallons	$2.75	$4,125.00	
4010150	A2 Shoulders	8,213.00	Sq. Yards	$40.00	$328,520.00	
3040506	Type 5 Aggregate for Base (6 in Thick)	9,387.00	Sq. Yards	$11.00	$103,257.00	
3049905	Type 5 Aggregate for Base (12 in Thick)	8,800.00	Sq. Yards	$20.00	$176,000.00	
					$1,002,482.00	SUBTOTAL Pavement & Base
2031000	Class A Excavation	24,000.00	Cu. Yards	$10.00	$240,000.00	
2036000	Compacting Embankment	29,000.00	Cu. Yards	$4.00	$116,000.00	
2101003A	Subgrade Compaction	52.8	Station	$1,200.00	$63,360.00	
					$419,360.00	SUBTOTAL Grading
Ramps typically have limited drainage needs					**$25,000.00**	SUBTOTAL Drainage
				Total Per Mile	**$1,446,842.00**	

J2P3447, US 54 - COST ESTIMATION FACTORS

	Grading Cost	Pavement/ Base Cost	Construction Incidentals	ROW Costs	Utility Costs
Assumptions	See Below	See Below	Mobiliz.- 5%, Removals - 2.5%, TC - 3%, EC - 1% , Stripe/rumb.-2.5%, Signing - 1%	Cost from NE District	Cost from NE District
Calcs			5.00% 2.50% 3.00% 1.00% 2.50% 1.00%		
Cost Factor	**$371,536.00**	**$1,277,385.90**	**15.00%**		
Units	per mile	per mile	% of Grading/Drain/Pavt /Base	per Acre	per mile

Pavement and Base Factor

Item #	Description	Quantity	Unit	Price	Total	Remarks	Resurfacing Cost (40')	Resurfacing Cost (24')
		(16' widen width)						
4030103	Asphaltic Concrete Mixture SP125C PG 70-22	902.2	Tons	$85.00	$76,687.00		$191,717.50	$115,030.50
4030208	Asphaltic Concrete Mixture SP190C PG 70-22	1,731.6	Tons	$89.00	$154,112.40			
4030306	Asphaltic Concrete Mixture SP250C PG 64-22	4,005.1	Tons	$80.00	$320,408.00			
4071007	Tack Coat - Low or Non-Tracking	2,606.0	Gallons	$2.75	$7,166.50		$17,916.25	$10,749.75
4010150	A2 Shoulders	9,386.7	Sq. Yards	$40.00	$375,468.00			
3040506	Type 5 Aggregate for Base (6 in Thick)	10,584.0	Sq. Yards	$11.00	$116,424.00			
3049905	Type 5 Aggregate for Base (12 in Thick)	11,356.0	Sq. Yards	$20.00	$227,120.00	Under A2 Shoulders (extra base to drain)		
				Total	**$1,277,385.90**	per mile	**$209,633.75**	**$125,780.25**
Resurf Cost								

Pvmt/Base - Each Half of divided 4 lane per mile Quantity	Total	Ramp per mile Quantity	Total
1,369.00	$ 116,365.00	799.00	$ 67,915.00
1,597.00	$ 142,133.00	945.00	$ 84,105.00
4,938.00	$ 395,040.00	2,982.00	$ 238,560.00
3,000.00	$ 8,250.00	1,500.00	$ 4,125.00
8,213.00	$ 328,520.00	8,213.00	$ 328,520.00
15,253.00	$ 167,783.00	9,387.00	$ 103,257.00
8,800.00	$ 176,000.00	8,800.00	$ 176,000.00
	########## **Per Mile**		**$ 1,002,482.00 Per Mile**
Drainage	$ 175,000.00 Per Mile		$25,000 Per Mile

Based on rough averages for Sections A - E. Ramps typically don't have much crossroad drainage.

Grading Cost Factor

Item #	Description	Quantity	Unit	Price	Total	Remarks
2022014	Full Depth Sawcu	10,560.0	Lin. Ft.	$4.50	$47,520.00	
2031000	Class A Excavatio	25,612.0	Cu. Yards	$10.00	$256,120.00	
2036000	Compacting Emba	1,134.0	Cu. Yards	$4.00	$4,536.00	
2101003A	Subgrade Compac	52.8	Station	$1,200.00	$63,360.00	
				Total	**$371,536.00**	per mile

Quantity	Total
0	$0.00
53,000.00	$530,000.00
26,000.00	$104,000.00
52.8	$63,360.00
	$697,360.00 Per Mile

Quantity	Total
0	$0.00
24,000.00	$240,000.00
29,000.00	$116,000.00
52.8	$63,360.00
	$419,360.00 Per Mile

Culvert Cost per Extension Location

Description	Length	Unit	Unit Price	Total	Class 3 Exc.	Price	total	Pipe Collar	Price	Total	FES	Price	Total	**Overall Total**	**cost/foot**
18" Gr A pipe	40.0	Lin. Ft.	$80.00	$3,200.00	21.6	$20.00	$432.00	2	$1,650.00	$3,300.00	2	$950.00	$1,900.00	**$8,832.00**	**$220.80**
24" Gr A pipe	40.0	Lin. Ft.	$100.00	$4,000.00	23.8	$20.00	$476.00	2	$1,650.00	$3,300.00	2	$1,300.00	$2,600.00	**$9,076.00**	**$226.90**
36" Gr A pipe	40.0	Lin. Ft.	$250.00	$10,000.00	41.5	$20.00	$830.00	2	$1,650.00	$3,300.00	2	$2,200.00	$4,400.00	**$16,330.00**	**$408.25**
48" Gr. A pipe	40.0	Lin. Ft.	$300.00	$12,000.00	66.9	$20.00	$1,338.00	2	$1,650.00	$3,300.00	2	$4,000.00	$8,000.00	**$20,638.00**	**$515.95**
Pipe length based on extending existing pipe.															
Class 3 Excavation volume based on minimum coverage over pipe															

Box Culvert Cost per Extension Location

Description	Length	Unit	Unit Price	Total	Class 3 Exc.	Price	Total	Total Price	Price/ Foot	Remarks				
2' x 1.5'										Use 24" Pipe Extension Price				
3' x 2'										Use 36" Pipe Extension Price				
4' x 2.5'										Use 48" Pipe Extension Price				
5' x 3'	40.0	Lin. Ft.	$716.57	$28,662.80	66.9	$20.00	$1,338.00	$30,000.80	**$750.02**					
6' x 4'	40.0	Lin. Ft.	$893.39	$35,735.60	75	$20.00	$1,500.00	$37,235.60	**$930.89**					
6' x 6'	40.0	Lin. Ft.	$1,069.68	$42,787.20	100	$20.00	$2,000.00	$44,787.20	**$1,119.68**					
8' x 4'	40.0	Lin. Ft.	$1,148.16	$45,926.40	90	$20.00	$1,800.00	$47,726.40	**$1,193.16**					
10' x 6'	40.0	Lin. Ft.	$1,579.15	$63,166.00	145	$20.00	$2,900.00	$66,066.00	**$1,651.65**					
12' x 6'	40.0	Lin. Ft.	$1,964.00	$78,560.00	170	$20.00	$3,400.00	$81,960.00	**$2,049.00**					
16' x 8 '	40.0	Lin. Ft.	$3,500.00	$140,000.00	270	$20.00	$5,400.00	$145,400.00	**$3,635.00**					
12'x9' (double)	40.0	Lin Ft.	$5,600.00	$224,000.00	405	$20.00	$8,100.00	$232,100.00	**$5,802.50**					

Cost of Entrances and Entrance Pipes

Distance	units	Private Ent.	culvert	Commerical	culvert	Sideroads	culvert	State Routes	Culvert	Total pipes	Total Length	Average
1.12	Miles	9	7	18	13	2	1	1	0	21	1230	59
3.64	Miles	14	15	17	14	2	2	1	1	32	1218	38
2.05	Miles	7	6	0	0	3	1	1	1	8	479	60
4.05	Miles	16	10	0	0	6	2	0	0	12	670	56
5.1	Miles	19	21	4	2	5	2	2	0	25	875	35
2.25	Miles	10	6	1	1	3	3	0	0	10	390	39
3.83	Miles	14	13	5	3	10	5	2	0	21	1229	59
3.38	Miles	13	10	1	1	6	3	0	0	14	640	46
3.48	Miles	5	0	1	0	5	1	2	2	3	96	32
3.36	Miles	14	12	1	0	3	3	0	0	15	731	49
32.26		121	100	48	34	45	23	9	4	161	7558	47

# of pipes/mile	5	Assume 15" Pipes + 2 FES
cost /pipe	$ 4,455.00	
cost/mile	$ 22,233.57	
grading/surfacing	1.25	
Total Cost/Mile	**$ 27,791.96**	

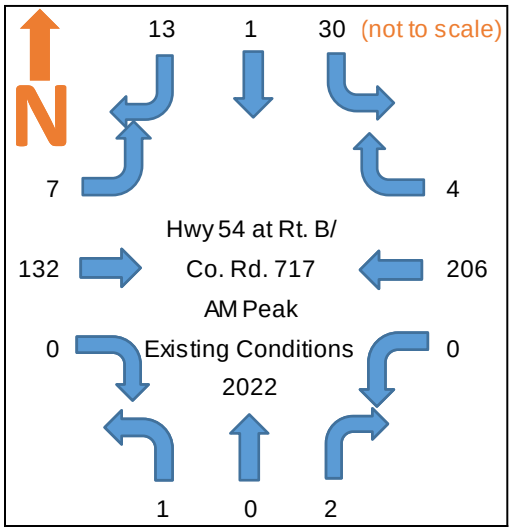
Appendix C: Traffic Data

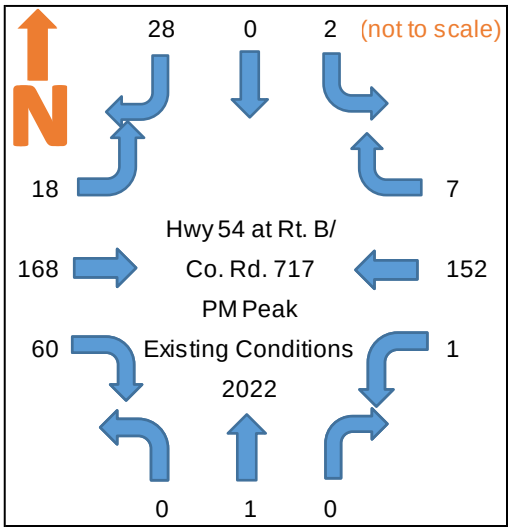
C.1: Turning Movement Counts

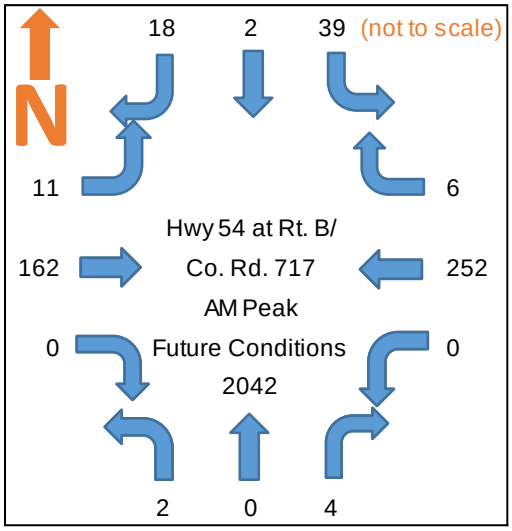
C.1.1: Segment A (Mexico to MO-19)

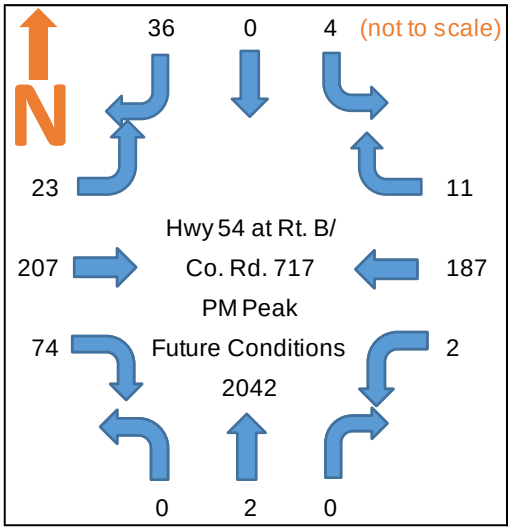
Hwy 54 at Route A

Hwy 54 at Route B



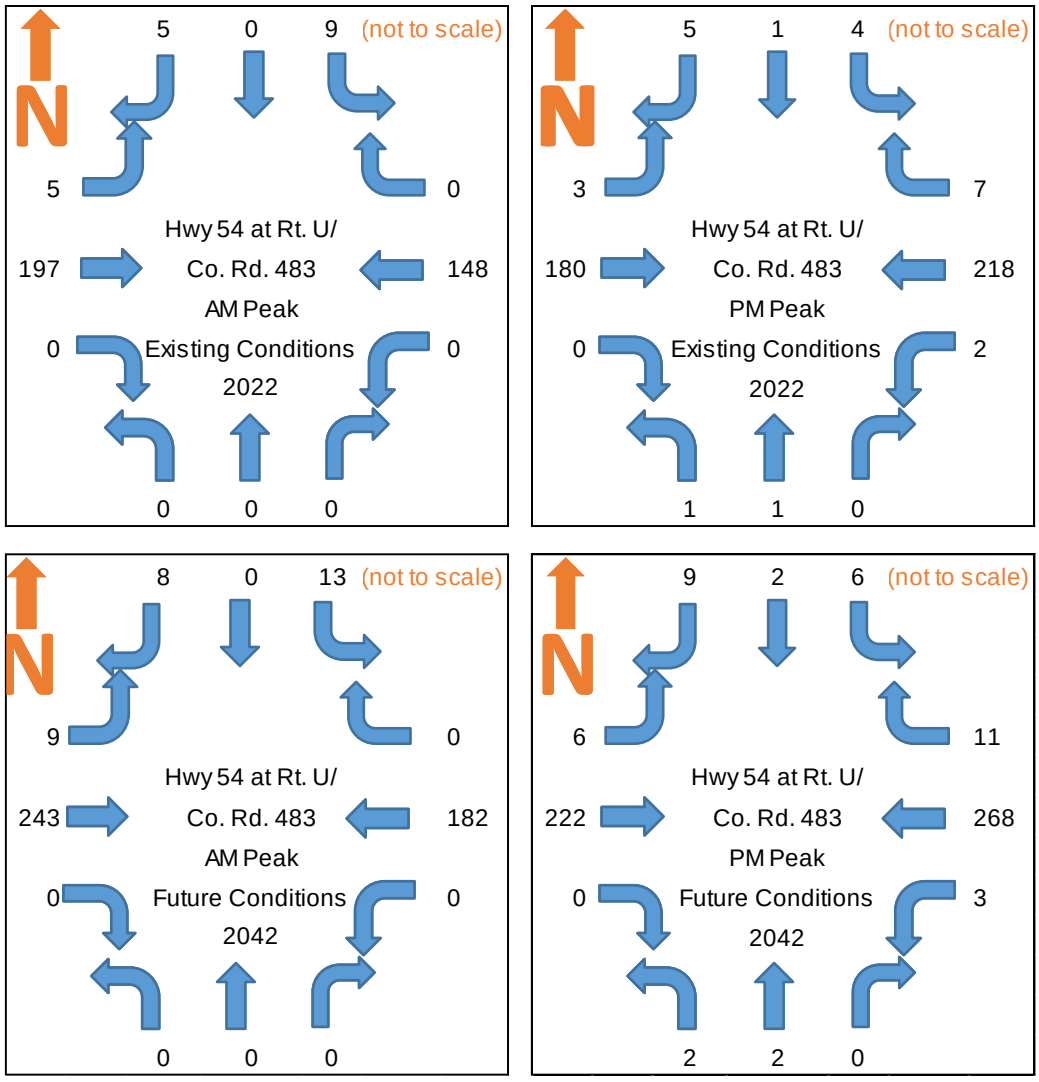






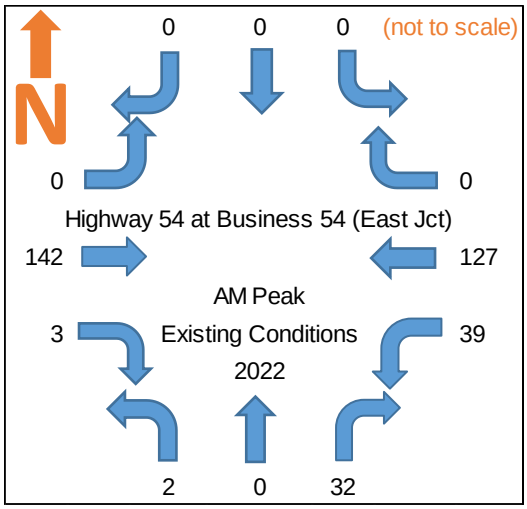
C.1.2: Segment D (MO-154 to Bowling Green)

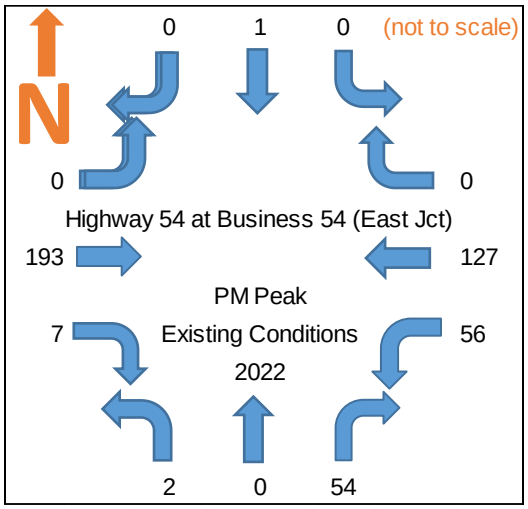
Hwy 54 at Route U

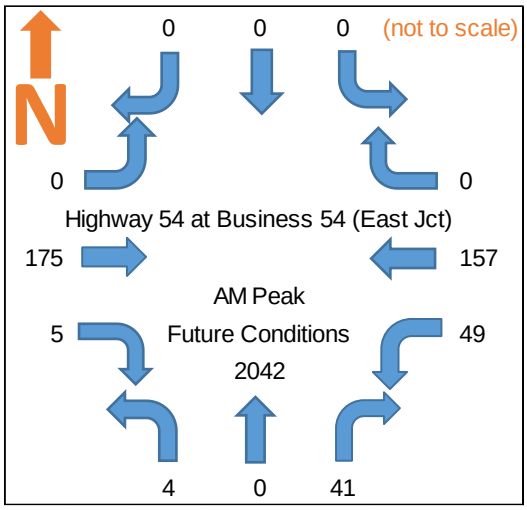


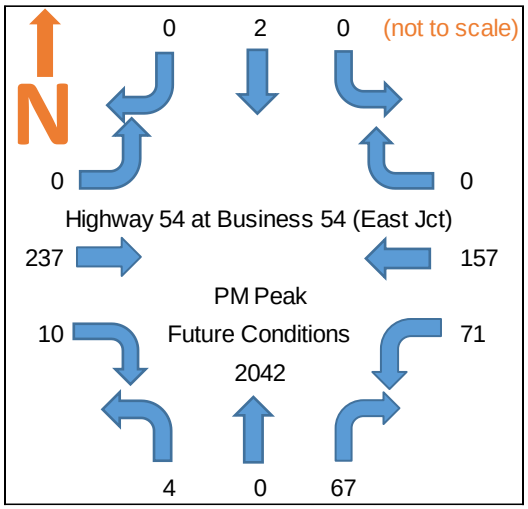
C.1.3: Segment E (Bowling Green to Louisiana)

Hwy 54 at Bus 54 (East Jct into Bowling Green)

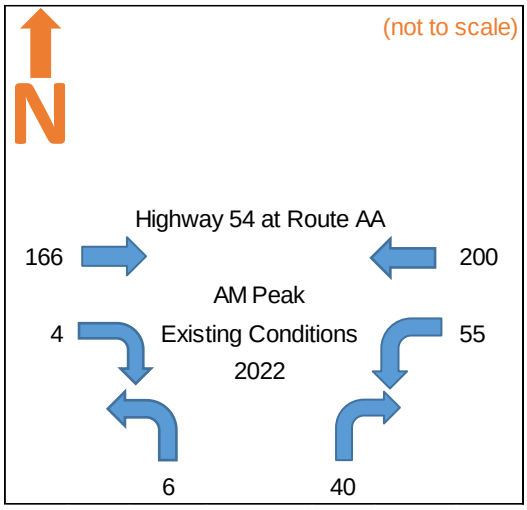


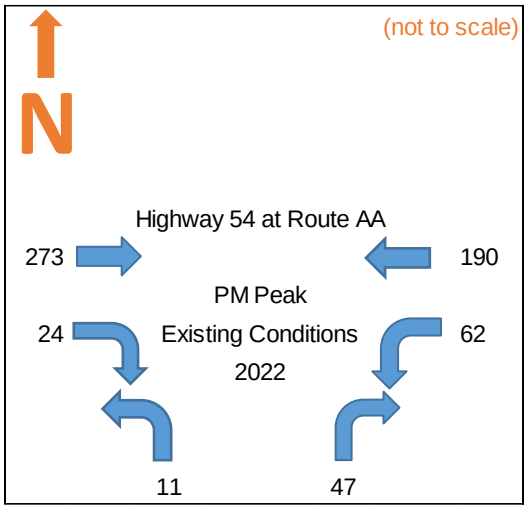


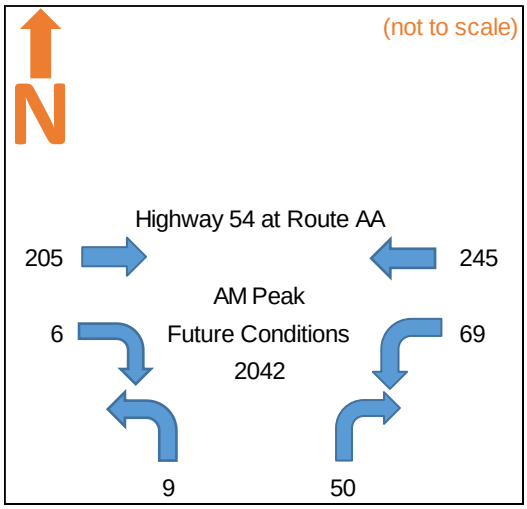


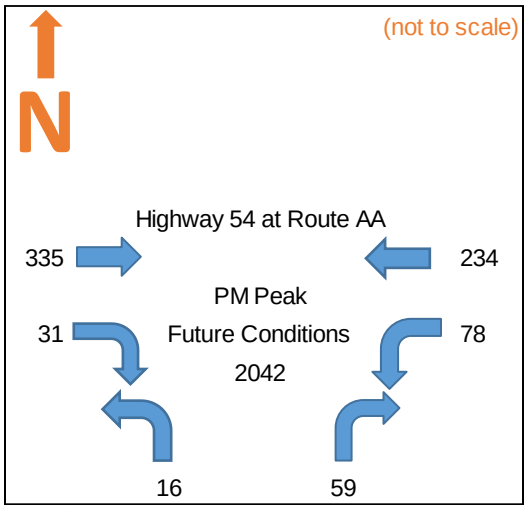


Hwy 54 at Route AA

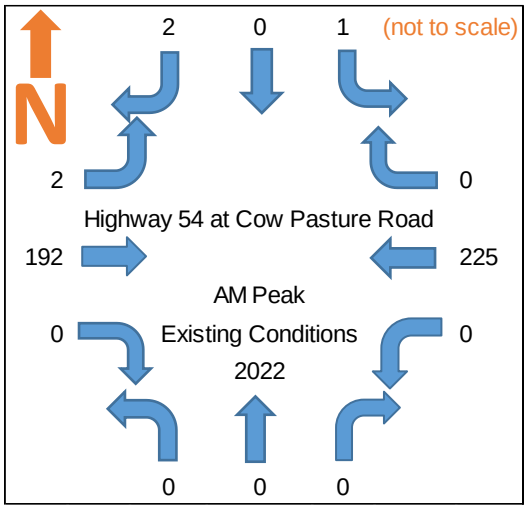


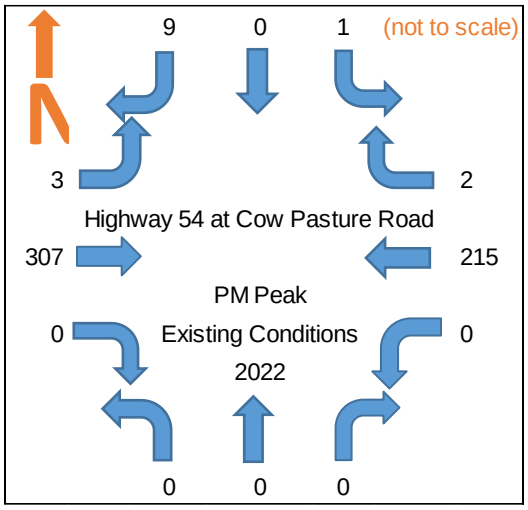


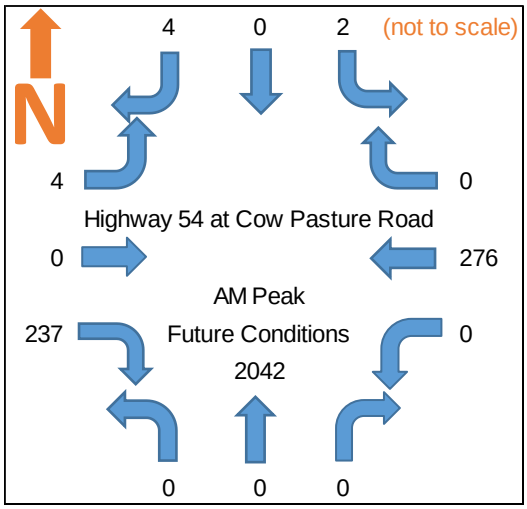


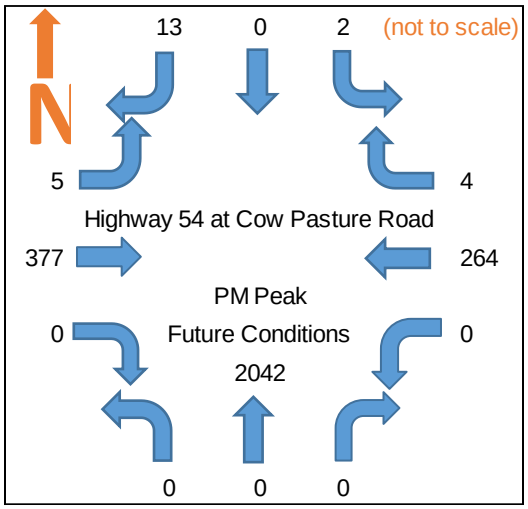


Hwy 54 at Cow Pasture Road

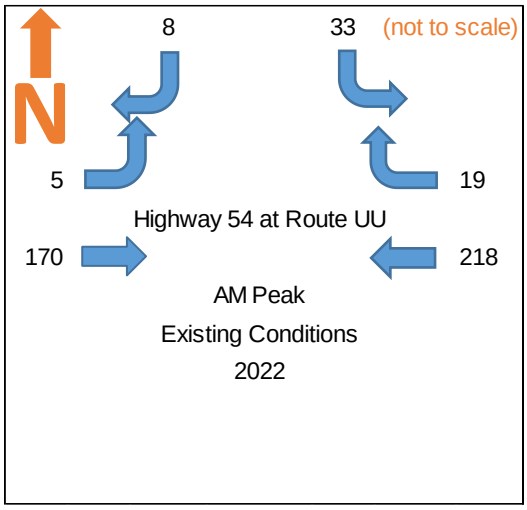


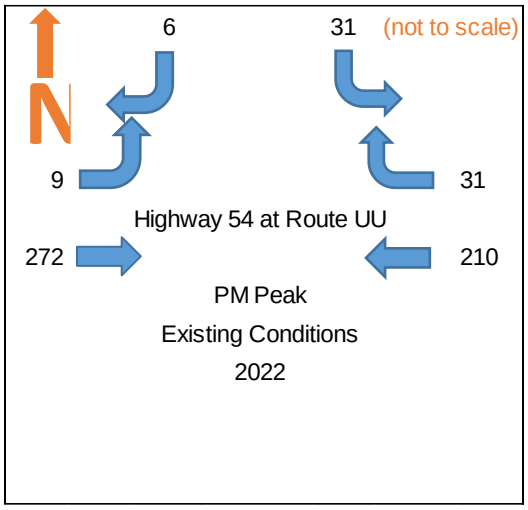


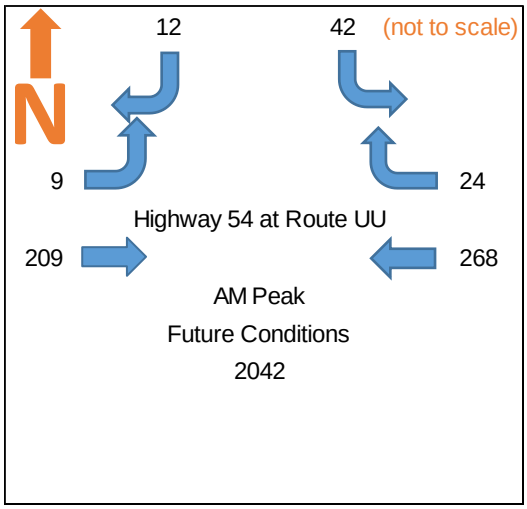


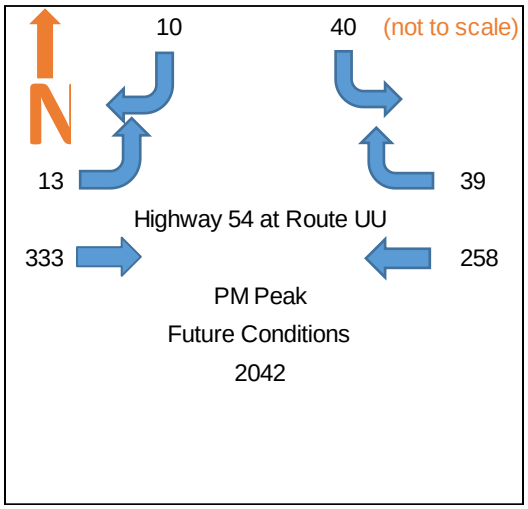


Hwy 54 at Route UU

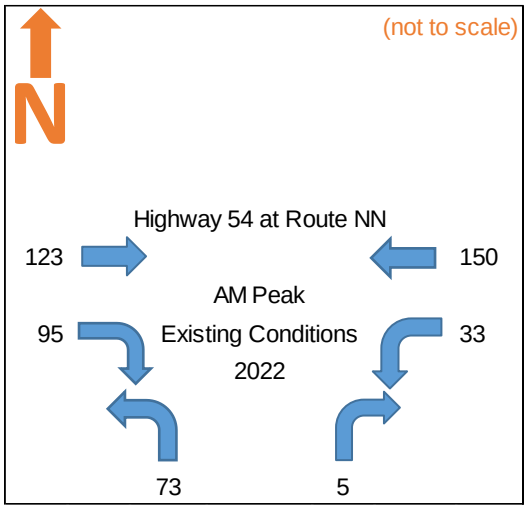


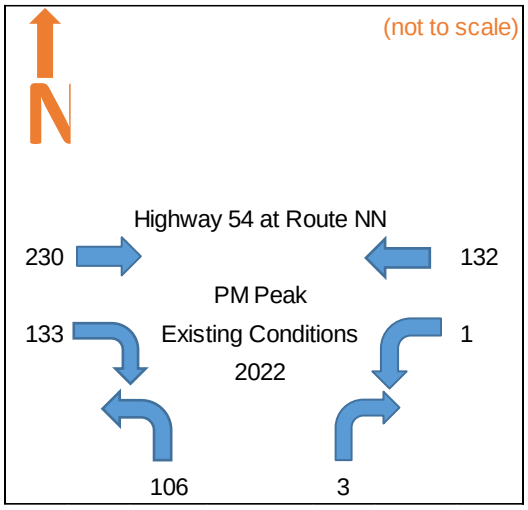


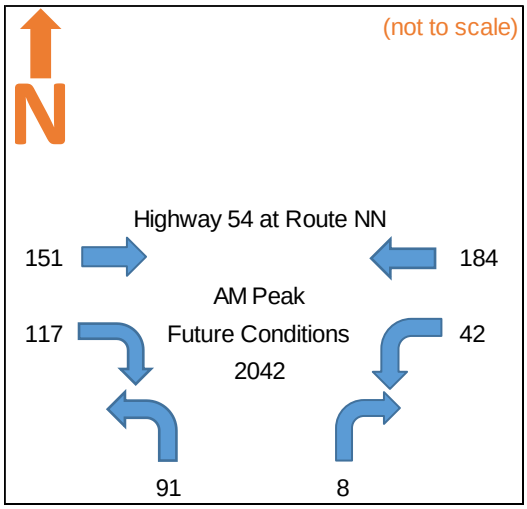


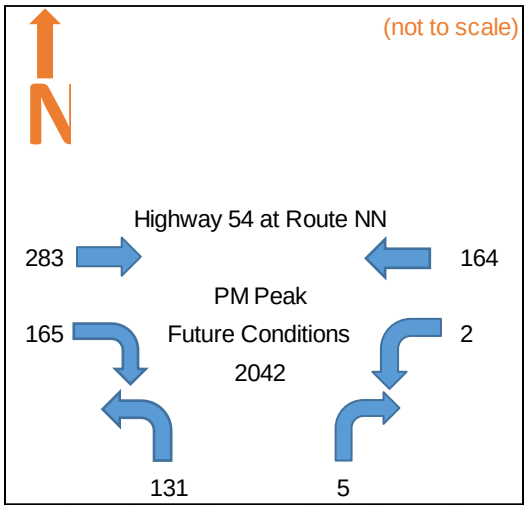


Hwy 54 at Route NN





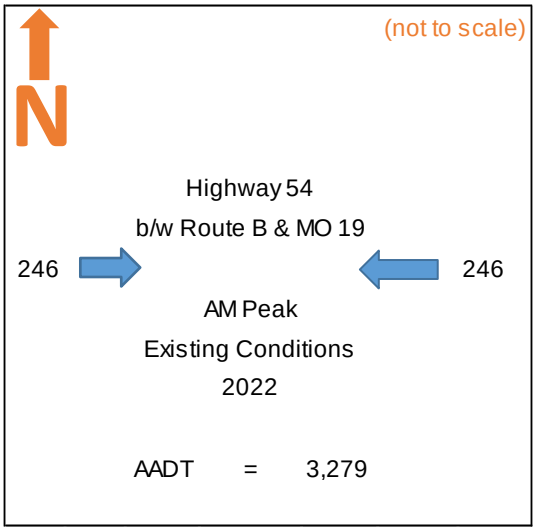


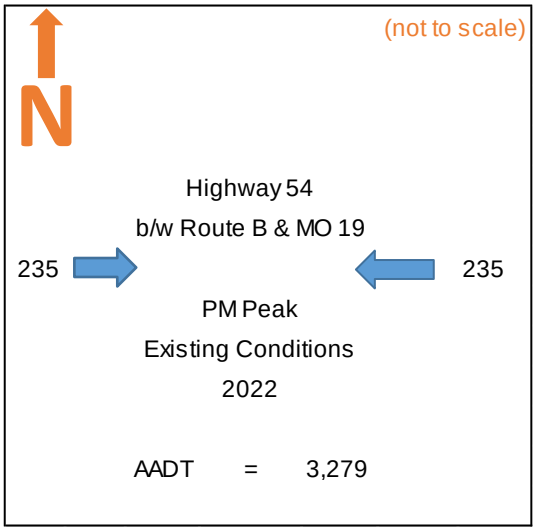


C.2: AADT Counts

C.2.1: Segment A (Mexico to MO-19)

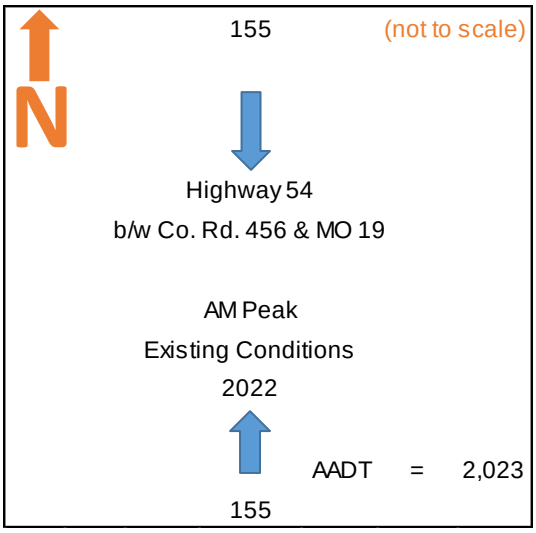
Hwy 54 b/w Route B and MO-19

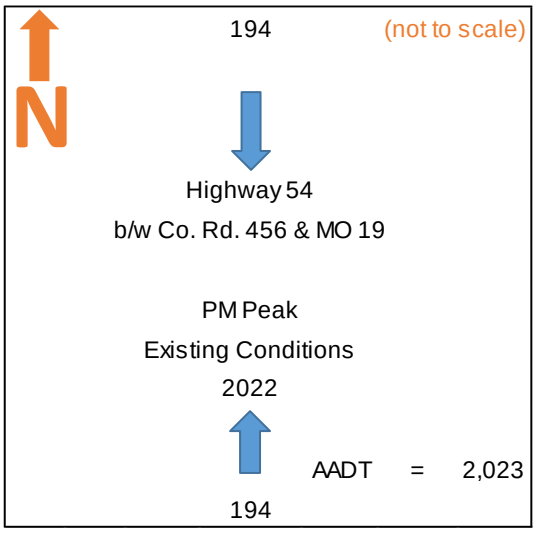




C.2.2: Segment B (MO-19 to Highway J Jct)

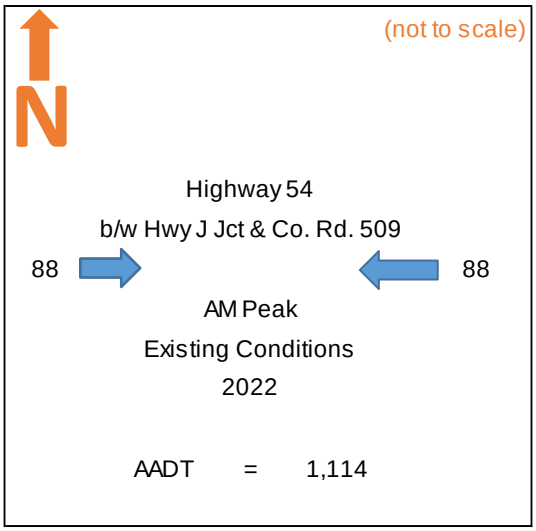
Hwy 54 b/w Co. Rd. 456 and MO-19

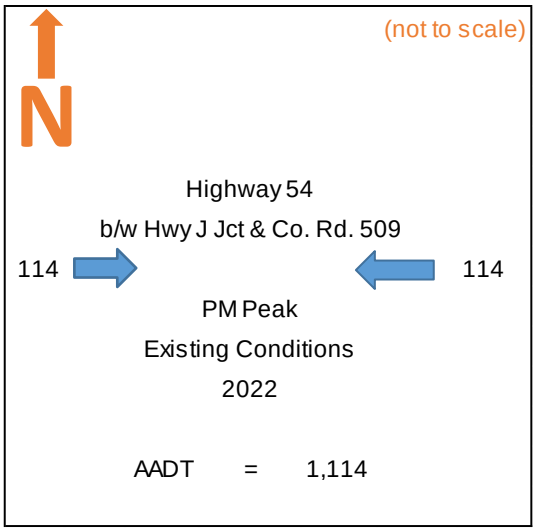




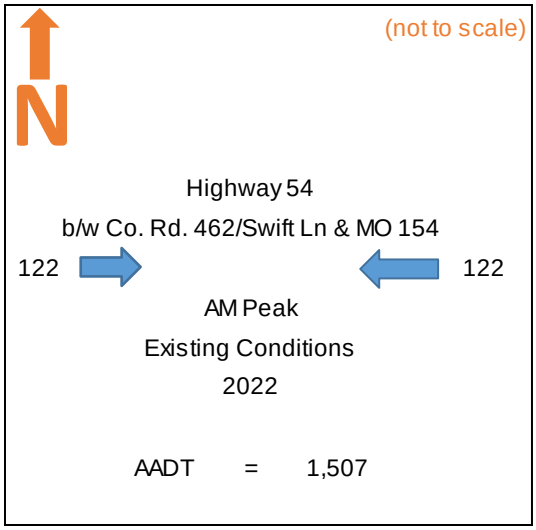
C.2.3: Segment C (Highway J Jct to MO-154)

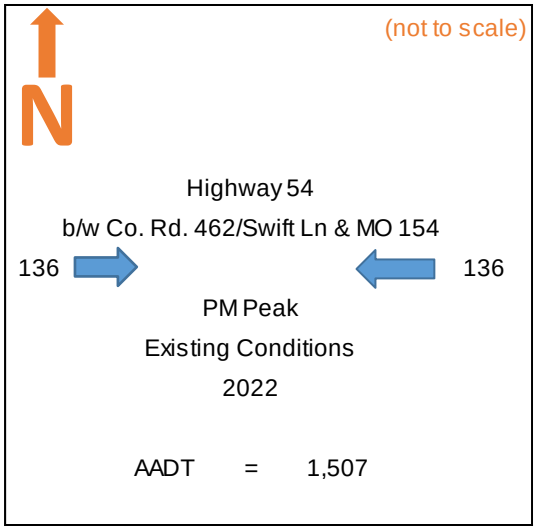
Hwy 54 b/w Hwy J Jct and Co. Rd. 509





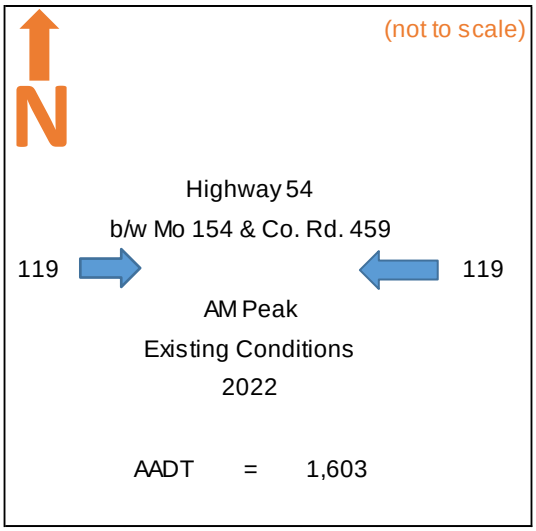
Hwy 54 b/w Co. Rd. 462 and MO-154

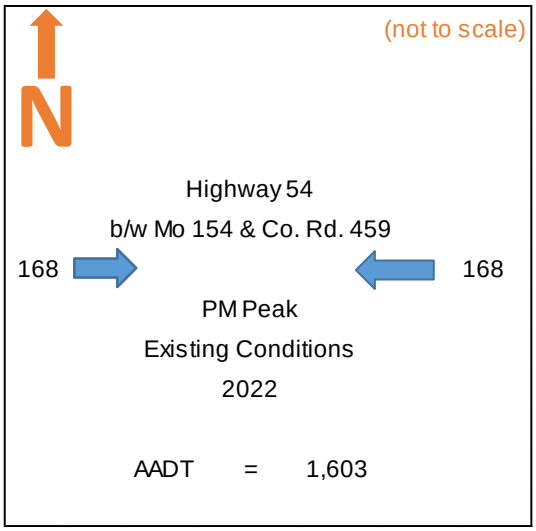




C.2.4: Segment D (MO-154 to Bowling Green)

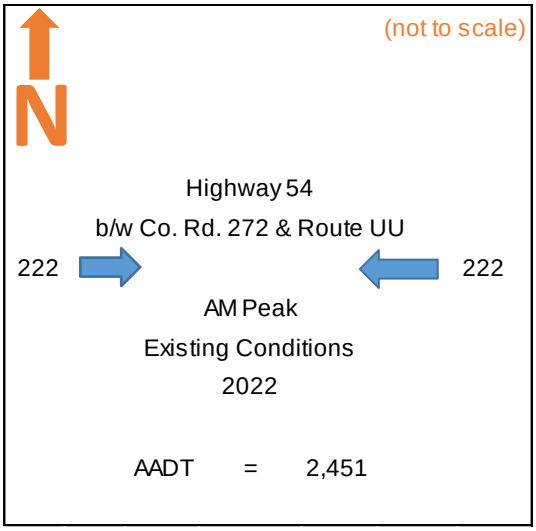
Hwy 54 b/w MO-154 and Co. Rd. 459

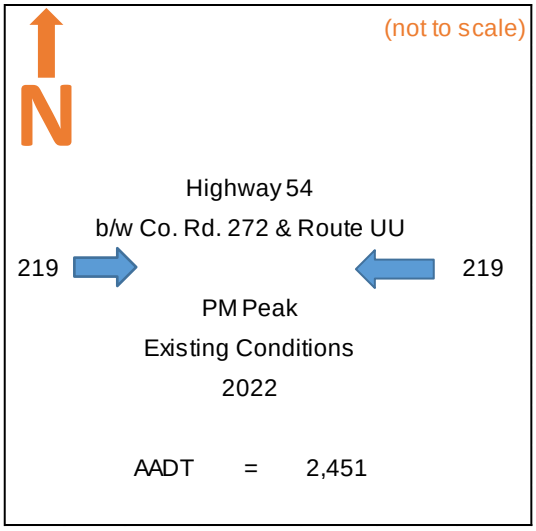




C.2.5: Segment E (Bowling Green to Louisiana)

Hwy 54 b/w Co. Rd. 272 and Route UU





C.3: Turn Lane Warrants

C.3.1: Segment A (Mexico to MO-19)

Hwy 54 at Route A

2022				
Highwy 54 at Route A				
WB Left Turn Lane				
Peak	AM (7:12 am)		Peak	PM (4:12 pm)
Major Approach	Hwy 54		Major Approach	Hwy 54
Minor Approach	Route A		Minor Approach	Route A
V_o	145		V_o	346
V_a	265		V_a	222
V_LT	2		V_LT	4
Speed Limit	60		Speed Limit	60
%_LT	1%		%_LT	2%
Left Turn Lane?	No		Left Turn Lane?	No
EB Right Turn Lane				
Peak	AM (7:12 am)		Peak	PM (4:12 pm)
Major Approach	Hwy 54		Major Approach	Hwy 54
Minor Approach	Route A		Minor Approach	Route A
V_a	145		V_a	346
V_RT	7		V_RT	46
Speed Limit	60		Speed Limit	60
Right Turn Lane?	No		Right Turn Lane?	Yes

2042				
Highwy 54 at Route A				
WB Left Turn Lane				
EB Left Turn Lane	AM (7:12 am)		Peak	PM (4:12 pm)
Major Approach	Hwy 54		Major Approach	Hwy 54
Minor Approach	Route A		Minor Approach	Route A
V_o	177		V_o	422
V_a	323		V_a	271
V_LT	2		V_LT	5
Speed Limit	60		Speed Limit	60
%_LT	1%		%_LT	2%
Left Turn Lane?	No		Left Turn Lane?	Yes
EB Right Turn Lane				
Peak	AM (7:12 am)		Peak	PM (4:12 pm)
Major Approach	Hwy 54		Major Approach	Hwy 54
Minor Approach	Route A		Minor Approach	Route A
V_a	177		V_a	422
V_RT	9		V_RT	56
Speed Limit	60		Speed Limit	60
Right Turn Lane?	No		Right Turn Lane?	Yes

Hwy 54 at Route B

2022				
Highwy 54 at Route B				
WB Left Turn Lane				
Peak	AM (7:15 am)		Peak	PM (3:00 pm)
Major Approach	Hwy 54		Major Approach	Hwy 54
Minor Approach	Route B		Minor Approach	Route B
V_o	132		V_o	228
V_a	210		V_a	160
V_LT	0		V_LT	1
Speed Limit	60		Speed Limit	60
%_LT	0%		%_LT	1%
Left Turn Lane?	No		Left Turn Lane?	No
EB Right Turn Lane				
Peak	AM (7:15 am)		Peak	PM (3:00 pm)
Major Approach	Hwy 54		Major Approach	Hwy 54
Minor Approach	Route B		Minor Approach	Route B
V_a	139		V_a	246
V_RT	0		V_RT	60
Speed Limit	60		Speed Limit	60
Right Turn Lane?	No		Right Turn Lane?	Yes

2042				
Highwy 54 at Route B				
WB Left Turn Lane				
EB Left Turn Lane	AM (7:15 am)		Peak	PM (3:00 pm)
Major Approach	Hwy 54		Major Approach	Hwy 54
Minor Approach	Route B		Minor Approach	Route B
V_o	161		V_o	278
V_a	256		V_a	195
V_LT	0		V_LT	2
Speed Limit	60		Speed Limit	60
%_LT	0%		%_LT	1%
Left Turn Lane?	No		Left Turn Lane?	No
EB Right Turn Lane				
Peak	AM (7:15 am)		Peak	PM (3:00 pm)
Major Approach	Hwy 54		Major Approach	Hwy 54
Minor Approach	Route B		Minor Approach	Route B
V_a	170		V_a	300
V_RT	0		V_RT	73
Speed Limit	60		Speed Limit	60
Right Turn Lane?	No		Right Turn Lane?	Yes

C.3.2: Segment D (MO-154 to Bowling Green)

Hwy 54 at Route U

2022				
Highwy 54 at Route U				
WB Left Turn Lane				
Peak	AM (7:15 am)		Peak	PM (3:00 pm)
Major Approach	Hwy 54		Major Approach	Hwy 54
Minor Approach	Route B		Minor Approach	Route B
V_o	197		V_o	180
V_a	148		V_a	227
V_LT	0		V_LT	2
Speed Limit	60		Speed Limit	60
%_LT	0%		%_LT	1%
Left Turn Lane?	No		Left Turn Lane?	No
EB Right Turn Lane				
Peak	AM (7:15 am)		Peak	PM (3:00 pm)
Major Approach	Hwy 54		Major Approach	Hwy 54
Minor Approach	Route B		Minor Approach	Route B
V_a	202		V_a	183
V_RT	0		V_RT	0
Speed Limit	60		Speed Limit	60
Right Turn Lane?	No		Right Turn Lane?	No

2042				
Highwy 54 at Route U				
WB Left Turn Lane				
EB Left Turn Lane	AM (7:15 am)		Peak	PM (3:00 pm)
Major Approach	Hwy 54		Major Approach	Hwy 54
Minor Approach	Route B		Minor Approach	Route B
V_o	240		V_o	220
V_a	181		V_a	277
V_LT	0		V_LT	3
Speed Limit	60		Speed Limit	60
%_LT	0%		%_LT	1%
Left Turn Lane?	No		Left Turn Lane?	No
EB Right Turn Lane				
Peak	AM (7:15 am)		Peak	PM (3:00 pm)
Major Approach	Hwy 54		Major Approach	Hwy 54
Minor Approach	Route B		Minor Approach	Route B
V_a	246		V_a	223
V_RT	0		V_RT	0
Speed Limit	60		Speed Limit	60
Right Turn Lane?	No		Right Turn Lane?	No

C.3.3: Segment E (Bowling Green to Louisiana)

Hwy 54 at Bus 54 (East Jct into Bowling Green)

2022				
Highwy 54 at Business 54 East Jct				
WB Left Turn Lane				
Peak	AM (10:28 am)		Peak	PM (3:43 pm)
Major Approach	Hwy 54		Major Approach	Hwy 54
Minor Approach	Bus 54		Minor Approach	Bus 54
V_o	145		V_o	200
V_a	166		V_a	183
V_LT	39		V_LT	56
Speed Limit	60		Speed Limit	60
%_LT	23%		%_LT	31%
Left Turn Lane?	no		Left Turn Lane?	no
EB Right Turn Lane				
Peak	AM (10:28 am)		Peak	PM (3:43 pm)
Major Approach	Hwy 54		Major Approach	Hwy 54
Minor Approach	Bus 54		Minor Approach	Bus 54
V_a	145		V_a	200
V_RT	3		V_RT	7
Speed Limit	60		Speed Limit	60
Right Turn Lane?	no		Right Turn Lane?	no

2042				
Highwy 54 at Business 54 East Jct				
WB Left Turn Lane				
EB Left Turn Lane	AM (10:28 am)		Peak	PM (3:43 pm)
Major Approach	Hwy 54		Major Approach	Hwy 54
Minor Approach	Bus 54		Minor Approach	Bus 54
V_o	177		V_o	244
V_a	203		V_a	223
V_LT	48		V_LT	69
Speed Limit	60		Speed Limit	60
%_LT	23%		%_LT	31%
Left Turn Lane?	no		Left Turn Lane?	no
EB Right Turn Lane				
Peak	AM (10:28 am)		Peak	PM (3:43 pm)
Major Approach	Hwy 54		Major Approach	Hwy 54
Minor Approach	Bus 54		Minor Approach	Bus 54
V_a	177		V_a	244
V_RT	4		V_RT	9
Speed Limit	60		Speed Limit	60
Right Turn Lane?	no		Right Turn Lane?	no

Hwy 54 at Route AA

2022				
Highwy 54 at Route AA				
WB Left Turn Lane				
Peak	AM (7:08 am)		Peak	PM (4:23 pm)
Major Approach	Hwy 54		Major Approach	Hwy 54
Minor Approach	Route AA		Minor Approach	Route AA
V_o	170		V_o	297
V_a	255		V_a	252
V_LT	55		V_LT	62
Speed Limit	60		Speed Limit	60
%_LT	22%		%_LT	25%
Left Turn Lane?	Right on the line		Left Turn Lane?	Yes
EB Right Turn Lane				
Peak	AM (7:08 am)		Peak	PM (4:23 pm)
Major Approach	Hwy 54		Major Approach	Hwy 54
Minor Approach	Route AA		Minor Approach	Route AA
V_a	170		V_a	297
V_RT	4		V_RT	24
Speed Limit	60		Speed Limit	60
Right Turn Lane?	no		Right Turn Lane?	yes

2042				
Highwy 54 at Route AA				
WB Left Turn Lane				
EB Left Turn Lane	AM (7:08 am)		Peak	PM (4:23 pm)
Major Approach	Hwy 54		Major Approach	Hwy 54
Minor Approach	Route AA		Minor Approach	Route AA
V_o	207		V_o	362
V_a	311		V_a	307
V_LT	67		V_LT	76
Speed Limit	60		Speed Limit	60
%_LT	22%		%_LT	25%
Left Turn Lane?	yes		Left Turn Lane?	yes
EB Right Turn Lane				
Peak	AM (7:08 am)		Peak	PM (4:23 pm)
Major Approach	Hwy 54		Major Approach	Hwy 54
Minor Approach	Route AA		Minor Approach	Route AA
V_a	207		V_a	362
V_RT	5		V_RT	29
Speed Limit	60		Speed Limit	60
Right Turn Lane?	no		Right Turn Lane?	yes

Hwy 54 at Cow Pasture Road

2022				
Highwy 54 at Cow Pasture Road				
EB Left Turn Lane				
Peak	AM (7:15)		Peak	PM (4:15)
Major Approach	Cow Pasture Road		Major Approach	Cow Pasture Road
Minor Approach	Hwy 54		Minor Approach	Hwy 54
V_o	225		V_o	217
V_a	194		V_a	310
V_LT	2		V_LT	3
Speed Limit	60		Speed Limit	60
%_LT	1%		%_LT	1%
Left Turn Lane?	no		Left Turn Lane?	no
WB Right Turn Lane				
Peak	AM (7:15)		Peak	PM (4:15)
Major Approach	Cow Pasture Road		Major Approach	Cow Pasture Road
Minor Approach	Hwy 54		Minor Approach	Hwy 54
V_a	225		V_a	215
V_RT	0		V_RT	2
Speed Limit	60		Speed Limit	60
Right Turn Lane?	no		Right Turn Lane?	no

2042				
Highwy 54 at Cow Pasture Road				
EB Left Turn Lane				
Peak	AM (7:15)		Peak	PM (4:15)
Major Approach	Cow Pasture Road		Major Approach	Cow Pasture Road
Minor Approach	Hwy 54		Minor Approach	Hwy 54
V_o	275		V_o	265
V_a	237		V_a	378
V_LT	2		V_LT	4
Speed Limit	60		Speed Limit	60
%_LT	1%		%_LT	1%
Left Turn Lane?	no		Left Turn Lane?	no
WB Right Turn Lane				
Peak	AM (7:15)		Peak	PM (4:15)
Major Approach	Cow Pasture Road		Major Approach	Cow Pasture Road
Minor Approach	Hwy 54		Minor Approach	Hwy 54
V_a	275		V_a	262
V_RT	0		V_RT	2
Speed Limit	60		Speed Limit	60
Right Turn Lane?	no		Right Turn Lane?	no

Hwy 54 at Route UU

2022				
Highwy 54 at Route UU				
EB Left Turn Lane				
Peak	AM (6:00 am)		Peak	PM (3:00 pm)
Major Approach	Route UU		Major Approach	Route UU
Minor Approach	Hwy 54		Minor Approach	Hwy 54
V_o	237		V_o	241
V_a	175		V_a	281
V_LT	5		V_LT	9
Speed Limit	60		Speed Limit	60
%_LT	3%		%_LT	3%
Left Turn Lane?	NO		Left Turn Lane?	NO
WB Right Turn Lane				
Peak	AM (6:00 am)		Peak	PM (3:00 pm)
Major Approach	Route UU		Major Approach	Route UU
Minor Approach	Hwy 54		Minor Approach	Hwy 54
V_a	237		V_a	241
V_RT	19		V_RT	31
Speed Limit	60		Speed Limit	60
Right Turn Lane?	right on the line		Right Turn Lane?	YES

2042				
Highwy 54 at Route UU				
EB Left Turn Lane				
EB Left Turn Lane	AM (6:00 am)		Peak	PM (3:00 pm)
Major Approach	Route UU		Major Approach	Route UU
Minor Approach	Hwy 54		Minor Approach	Hwy 54
V_o	289		V_o	294
V_a	214		V_a	343
V_LT	6		V_LT	11
Speed Limit	60		Speed Limit	60
%_LT	3%		%_LT	3%
Left Turn Lane?	no		Left Turn Lane?	no
WB Right Turn Lane				
Peak	AM (6:00 am)		Peak	PM (3:00 pm)
Major Approach	Route UU		Major Approach	Route UU
Minor Approach	Hwy 54		Minor Approach	Hwy 54
V_a	289		V_a	294
V_RT	23		V_RT	38
Speed Limit	60		Speed Limit	60
Right Turn Lane?	yes		Right Turn Lane?	yes

Hwy 54 at Route NN

2022				
Highwy 54 at Route NN				
WB Left Turn Lane				
Peak	AM (11:14 am)		Peak	PM (4:29 pm)
Major Approach	Hwy 54		Major Approach	Hwy 54
Minor Approach	Route NN		Minor Approach	Route NN
V_o	227		V_o	363
V_a	183		V_a	133
V_LT	33		V_LT	1
Speed Limit	60		Speed Limit	60
%_LT	18%		%_LT	1%
Left Turn Lane?	no		Left Turn Lane?	no
EB Right Turn Lane				
Peak	AM (11:14 am)		Peak	PM (4:29 pm)
Major Approach	Hwy 54		Major Approach	Hwy 54
Minor Approach	Route NN		Minor Approach	Route NN
V_a	218		V_a	363
V_RT	95		V_RT	133
Speed Limit	60		Speed Limit	60
Right Turn Lane?	yes		Right Turn Lane?	yes

2042				
Highwy 54 at Route NN				
WB Left Turn Lane				
EB Left Turn Lane	AM (11:14 am)		Peak	PM (4:29 pm)
Major Approach	Hwy 54		Major Approach	Hwy 54
Minor Approach	Route NN		Minor Approach	Route NN
V_o	277		V_o	443
V_a	223		V_a	162
V_LT	40		V_LT	2
Speed Limit	60		Speed Limit	60
%_LT	18%		%_LT	1%
Left Turn Lane?	yes		Left Turn Lane?	no
EB Right Turn Lane				
Peak	AM (11:14 am)		Peak	PM (4:29 pm)
Major Approach	Hwy 54		Major Approach	Hwy 54
Minor Approach	Route NN		Minor Approach	Route NN
V_a	266		V_a	443
V_RT	116		V_RT	162
Speed Limit	60		Speed Limit	60
Right Turn Lane?	yes		Right Turn Lane?	yes

C.3: Crash Data

C.3.1: Crash Details and Summary

Crash Rate Calculations

Crash data from 2017-2021

Hwy 54 Segments		Log Points		End Ref.	Length			
From	To	Beginning	End					
MO 15/22	54 Juction			Bus 54 (EJ)				
54 Juction	Mexico City Limits	216.379	216.991	Rt JJ	0.612	0.61	0.61	55.57
Mexico City Limits	RT A	216.991	220.608	Rt A	3.617	9.68	54.96	
Rt A	Scotts Corner	220.608	226.671	MO 19	6.063			
Scotts Corner	Ladonia	226.671	231.804	Rt K	5.133	8.11		
Ladonia	54/J/19 Junction	231.804	234.781	MO 19	2.977			
54/J/19 Junction	Farber	234.781	238.607	Rt PP	3.826	13.76		
Farber	Vandalia	238.607	243.126	Rt P	4.519			
Vandalia	154 Junction	243.126	248.539	MO 154	5.413			
154 Junction	(Curryville)	248.539	252.238	Rt M	3.699	9.71		
(Curryville)	Route U	252.238	254.775	Rt U	2.537			
Route U	Bowling Green	254.775	258.25	Bus 54	3.475			
Bowling Green	US 61	258.25	260.103	US 61	1.853	13.70		
US 61	Route UU	260.103	267.533	Rt UU	7.43			
Route UU	Route NN	267.533	268.081	Rt NN	0.548			
Route NN	Louisiana	267.533	271.403	MO 79	3.87			

Hwy 54 Segments		Seg.	2022 AADT			Weighted			'17-'21 Crashes	
From	To		East	West	Combined				Count	Rate
MO 15/22	54 Juction		2,906	2,906	5,812					
54 Juction	Mexico City Limits		4,571	5,109	9,680	9,680		4,539	432	93.8
Mexico City Limits	RT A	A	3,160	3,298	6,458	5,596	4,482			
Rt A	Scotts Corner		2,364	2,718	5,082					
Scotts Corner	Ladonia	B	2,336	2,312	4,648	4,525				
Ladonia	54/J/19 Junction		2,157	2,155	4,312					
54/J/19 Junction	Farber	C	1,290	1,264	2,554	3,439				
Farber	Vandalia		1,452	1,406	2,858					
Vandalia	154 Junction		2,348	2,202	4,550					
154 Junction	(Curryville)	D	1,752	1,706	3,458	4,489				
(Curryville)	Route U		2,855	2,725	5,580					
Route U	Bowling Green		2,450	2,340	4,790					
Bowling Green	US 61	E	1,588	1,588	3,176	4,713				
US 61	Route UU		2,606	2,541	5,147					
Route UU	Route NN		2,522	2,446	4,968					
Route NN	Louisiana		2,217	2,361	4,578					
					Rate = Crashes per 100 Million Vehicle Miles					

Crash Summaries

- Entire Project Limits (432 crashes: 2017-2021)

Crash Class	Crashes
Out of Control	103
Sideswipe	20
Rear End	108
Head On	14
Deer	65
Right Turn Right Angle Collision	6
Left Turn Right Angle Collision	19
Other	17
Fixed Object	3
Pedestrian	1
Passing	16
Left Turn	19
Farm Animal	3
Dog	1
Right Angle	15
Right Turn	3
Avoiding	7
Backing	2
U - Turn	1
Debris	6
Parking or Parked Car	1
Animal not Deer/Dog/Farm Animal	2
Total	432

Severity Rating	Crashes
Property Damage Only	306
Minor Injury	94
Suspected Serious Injury	16
Disabling Injury	9
Fatal	7
Total	432

Year of Crash	Crashes
2017	89
2018	75
2019	88
2020	95
2021	85
Total	432

Light Conditions	Crashes
Daylight	278
Dark w/ Street Lights On	18
Dark w/ Street Lights Off	132
Dark - Unknown	4
Total	432

Weather Condition	Crashes
Clear	282
Cloudy	95
Rain	20
Fog/Mist	4
Crosswind	1
Snow	16
Freezing	13
Unknown	1
Total	432

Road surface Condition	Crashes
Dry	347
Wet	46
Snow	22
Ice	16
Swtr	1
Total	432

- Excluding towns and major intersections (267 crashes: 2017-2021)

Crash Class	Crashes
Out of Control	69
Sideswipe	14
Rear End	58
Head On	6
Deer	58
Right Turn Right Angle Collision	1
Left Turn Right Angle Collision	7
Fixed Object	1
Pedestrian	0
Passing	8
Left Turn	10
Farm Animal	2
Dog	1
Right Angle	5
Right Turn	1
Avoiding	6
Backing	0
U - Turn	0
Debris	4
Parking or Parked Car	1
Animal not Deer/Dog/Farm Animal	1
Other	14
Total	267

Severity Rating	Crashes
Property Damage Only	191
Minor Injury	51
Suspected Serious Injury	13
Disabling Injury	9
Fatal	3
Total	267

Year of Crash	Crashes
2017	54
2018	50
2019	48
2020	61
2021	54
Total	267

Light Conditions	Crashes
Daylight	156
Dark w/ Street Lights On	5
Dark w/ Street Lights Off	104
Dark - Unknown	2
Total	267

Weather Conditions	Crashes
Clear	163
Cloudy	64
Rain	14
Fog/Mist	3
Crosswind	1
Snow	12
Freezing	9
Unknown	1
Total	267

Road Surface Condition	Crashes
Dry	208
Wet	30
Snow	14
Ice	14
Swtr	1
Total	267

C.3.2: Crash Data – Heat Maps

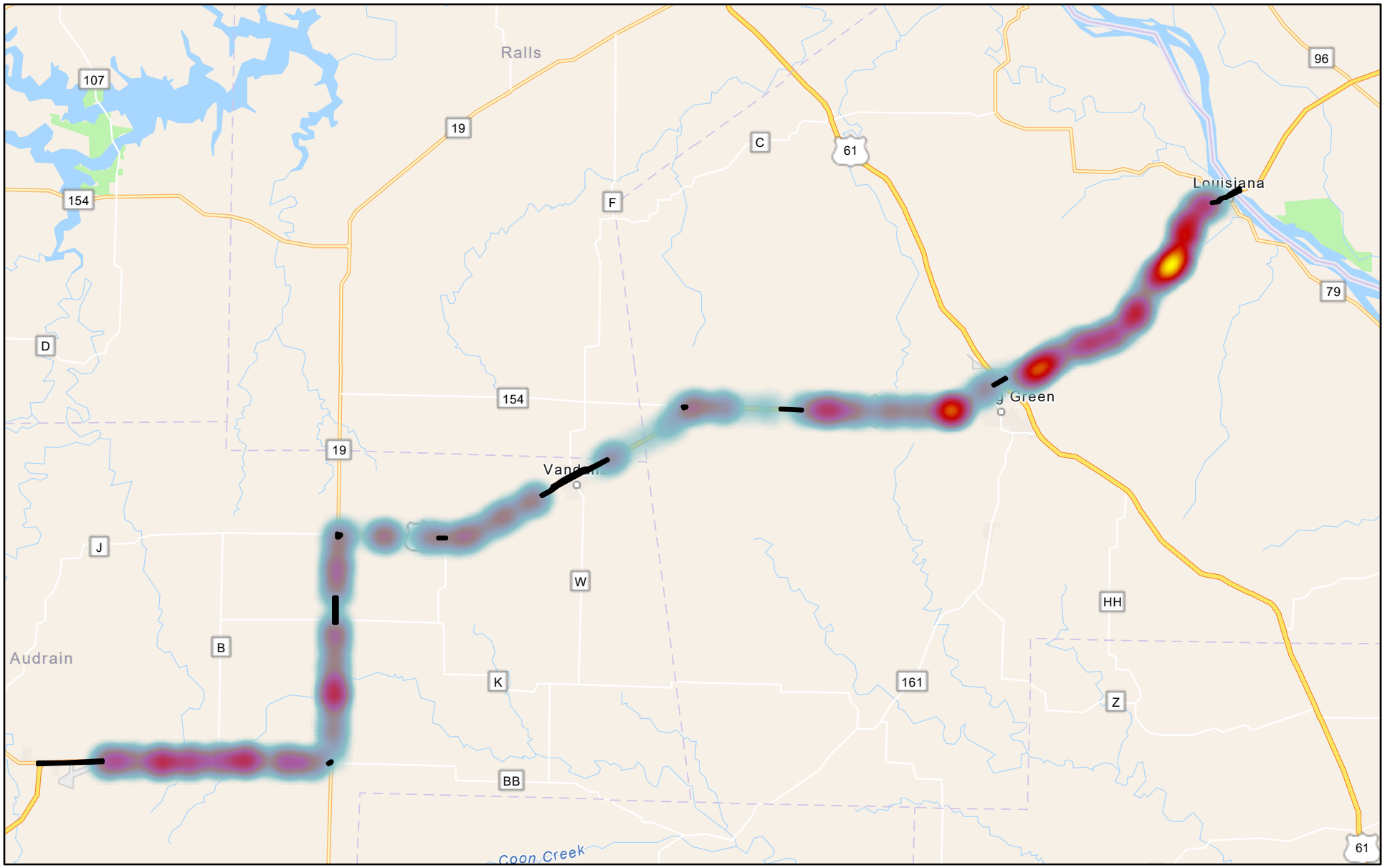
(24 pages)

(all heat map data excludes towns and major intersections not included in the project analysis)

(each category includes an overview map and five zones
(Sections A, B, C, D, and E)

- All Crashes…… (6 pages)
- Head-On, Passing, and Out of Control Collisions.. (6 pages)
- Rear End Collisions……. (6 pages)
- Turning Collisions…… (6 pages)

MO-54 All Accidents (Overview)



11/28/2022

Excluded Area

Low

High

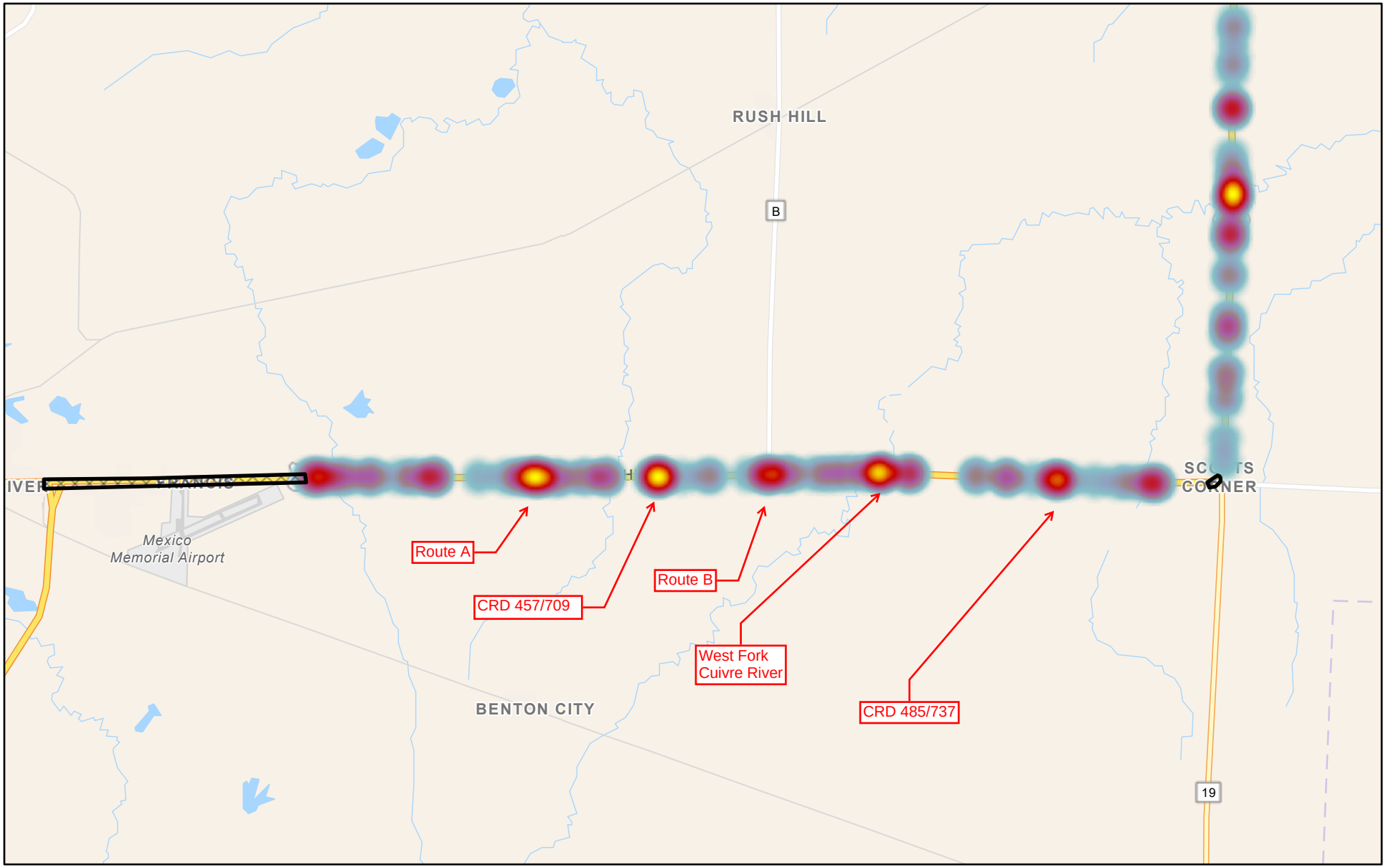
1:401,565

0 2.5 5 10 mi

0 4.25 8.5 17 km

Missouri Dept. of Conservation, Missouri DNR, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS

MO-54 All Accidents (Zone 1)



11/28/2022

Excluded Area

Low

High

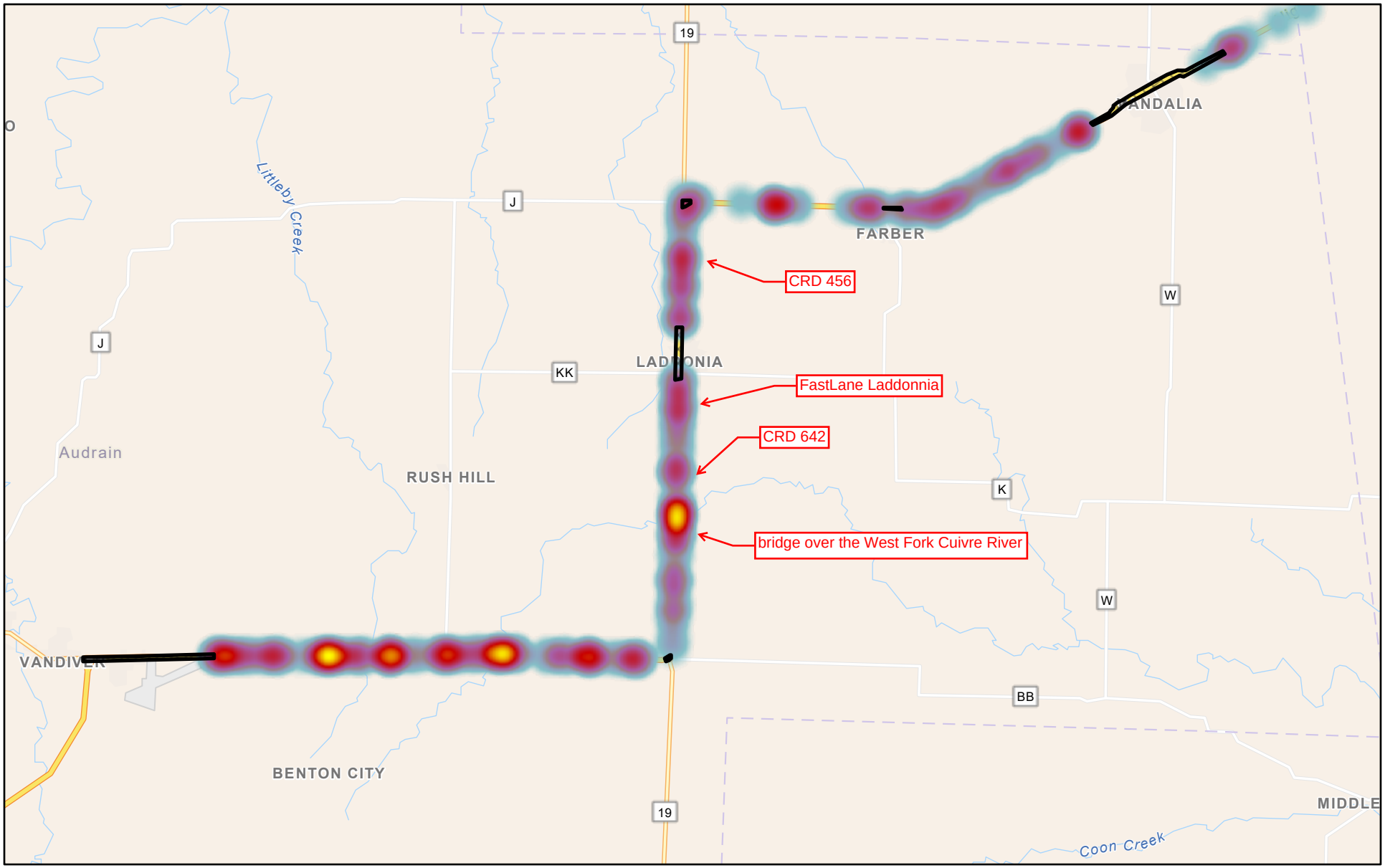
1:100,391

0 0.5 1 2 mi

0 1 2 4 km

Missouri Dept. of Conservation, Missouri DNR, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA

MO-54 All Accidents (Zone 2)



11/28/2022

Excluded Area

Low

High

1:200,783

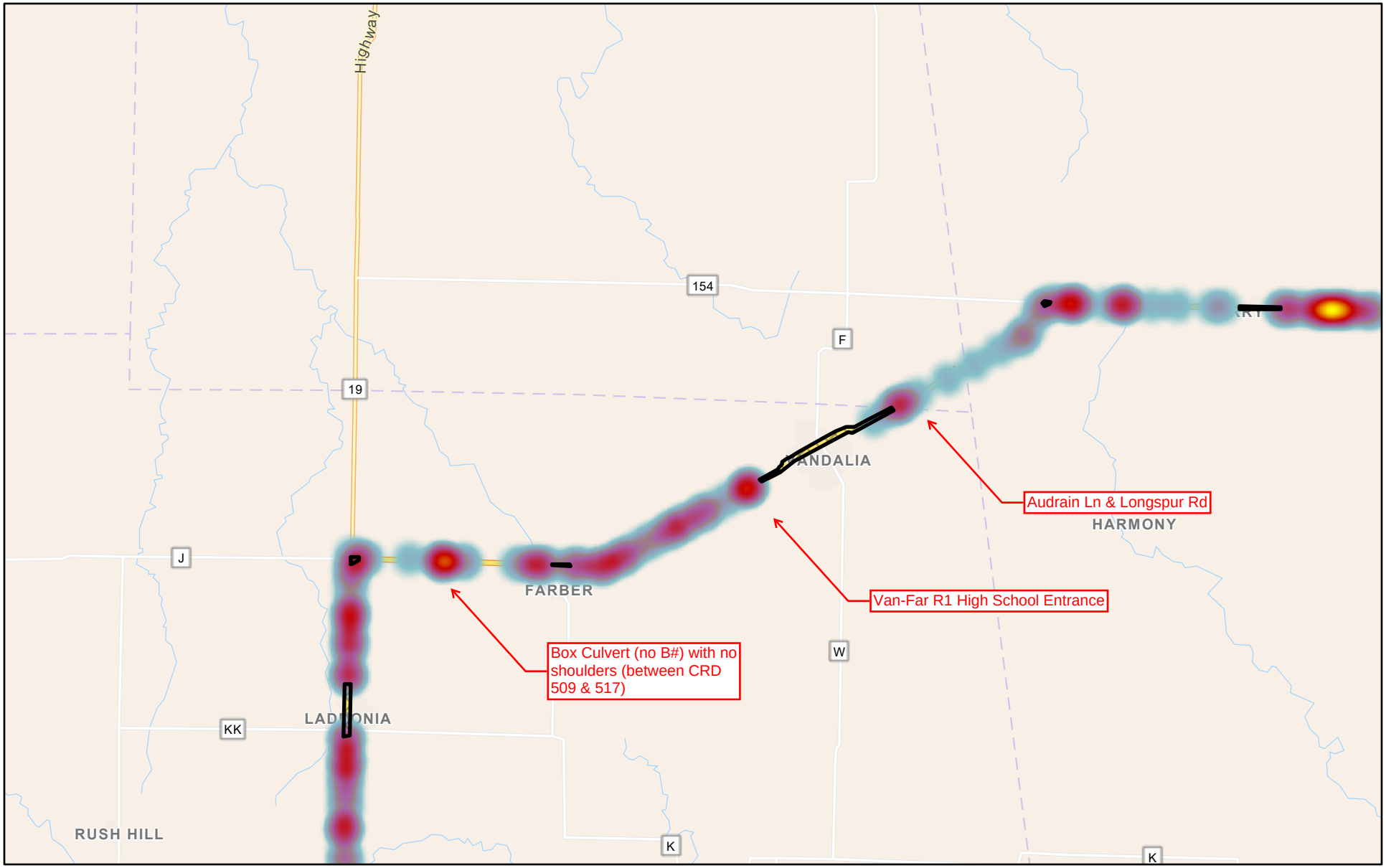
0 1.25 2.5 5 mi

0 2 4 8 km

Missouri Dept. of Conservation, Missouri DNR, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA

Bartlett & West

MO-54 All Accidents (Zone 3)



11/28/2022

Excluded Area

Low

High

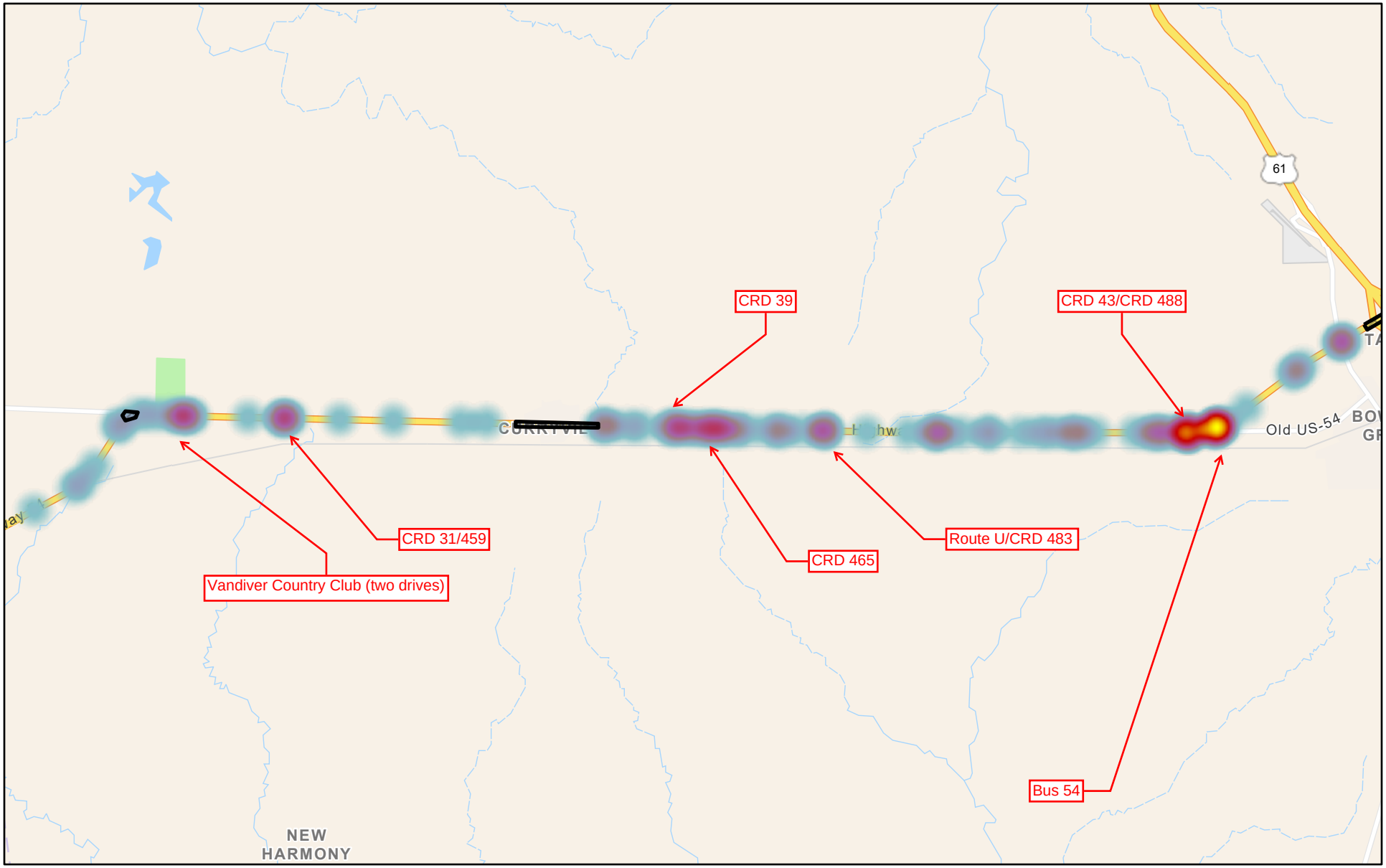
1:200,783

0 1.25 2.5 5 mi

0 2 4 8 km

Missouri Dept. of Conservation, Missouri DNR, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA

MO-54 All Accidents (Zone 4)



11/28/2022

Excluded Area

Low

High

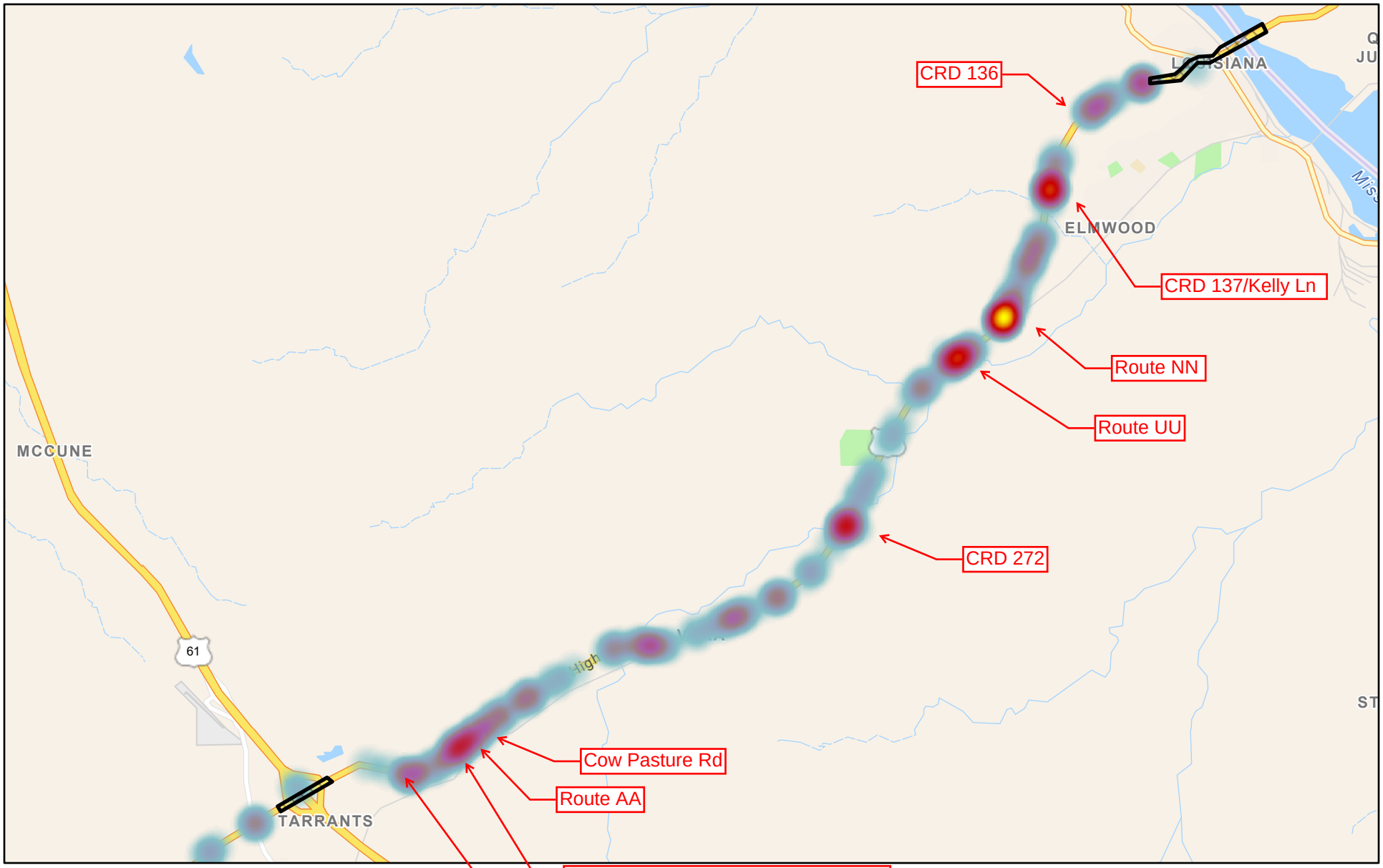
1:100,391

0 0.5 1 2 mi

0 1 2 4 km

Missouri Dept. of Conservation, Missouri DNR, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA

MO-54 All Accidents (Zone 5)



11/28/2022

Excluded Area

Low

High

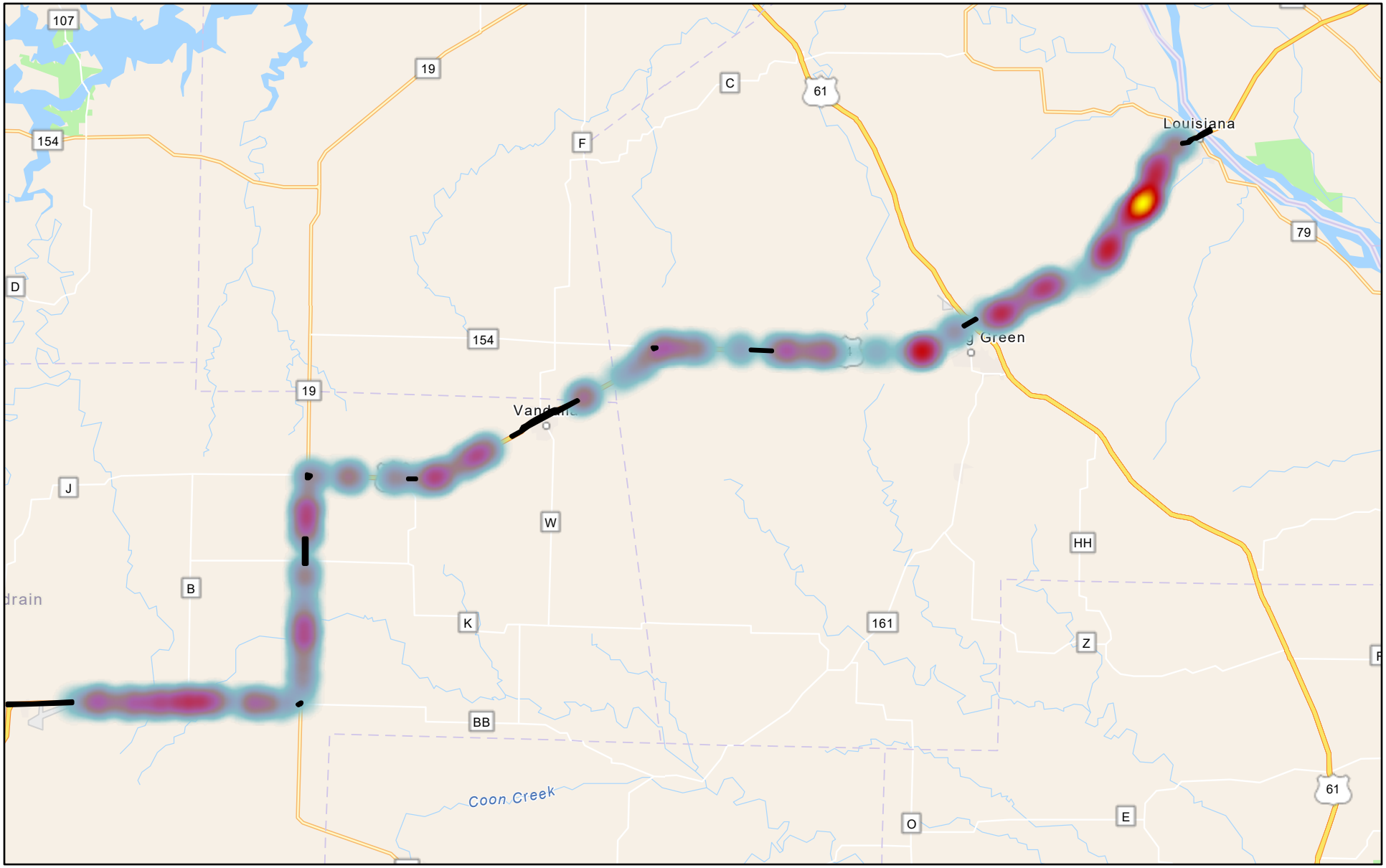
1:100,391

0 0.5 1 2 mi

0 1 2 4 km

Missouri Dept. of Conservation, Missouri DNR, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA

MO-54 Head-On, Passing, and Out of Control Collisions (Overview)



11/28/2022

Excluded Area

Low

High

1:401,565

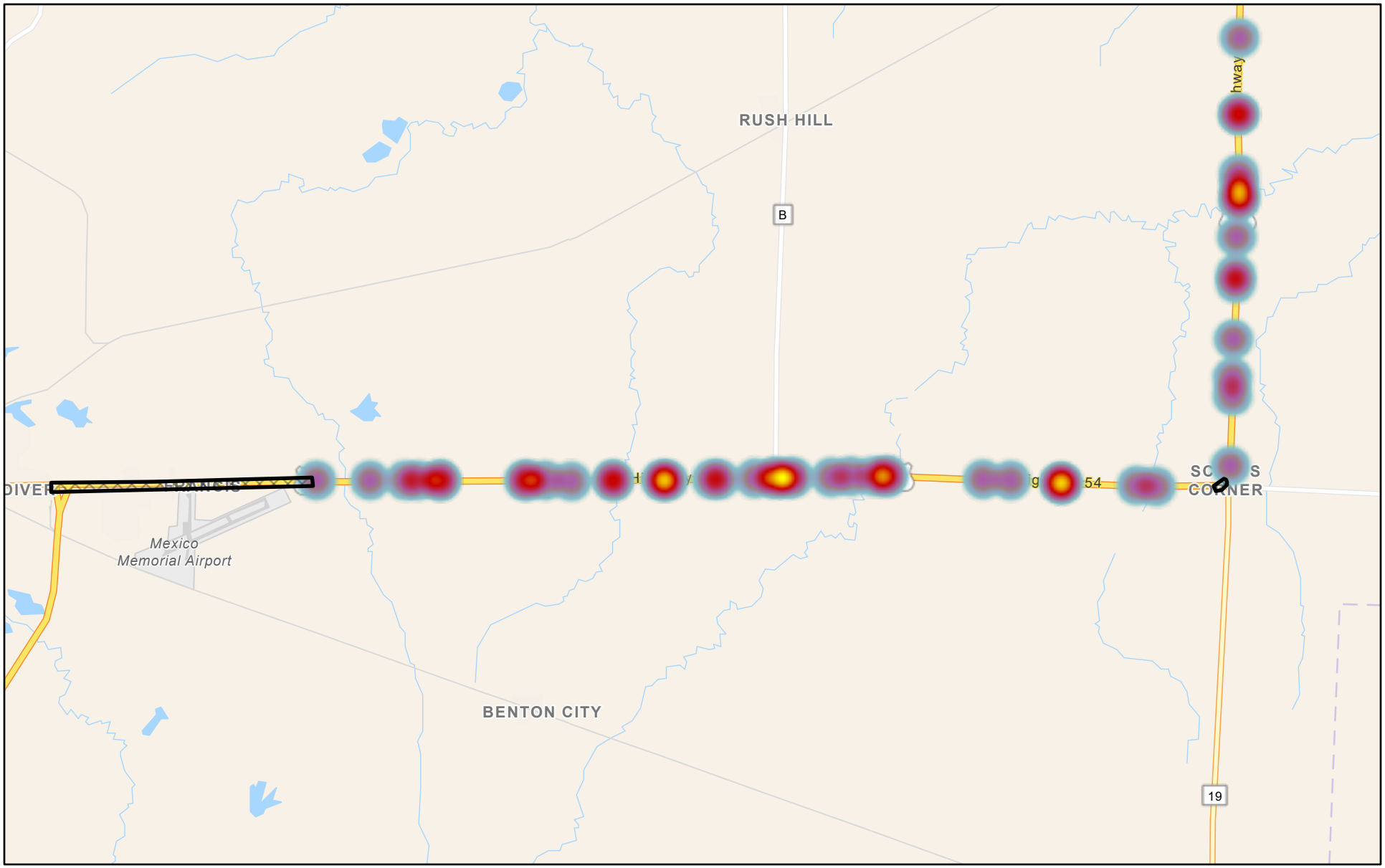
0 2.5 5 10 mi

0 4.25 8.5 17 km

Missouri Dept. of Conservation, Missouri DNR, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS

Bartlett & West

MO-54 Head-On, Passing, and Out of Control Collisions (Zone 1)



11/28/2022

Excluded Area

Low

High

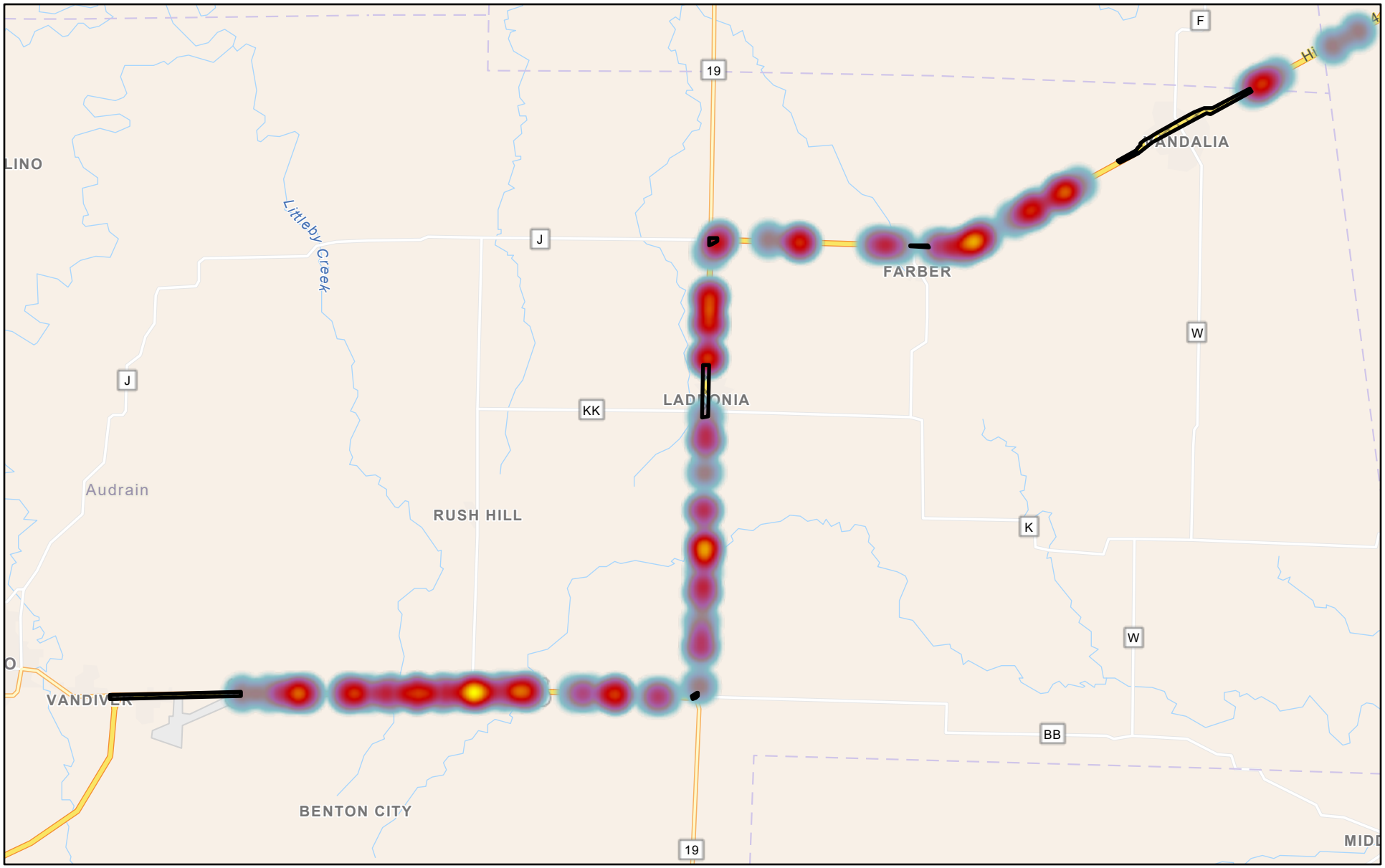
1:100,391

0 0.5 1 2 mi

0 1 2 4 km

Missouri Dept. of Conservation, Missouri DNR, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA

MO-54 Head-On, Passing, and Out of Control Collisions (Zone 2)



11/28/2022

Excluded Area

Low

High

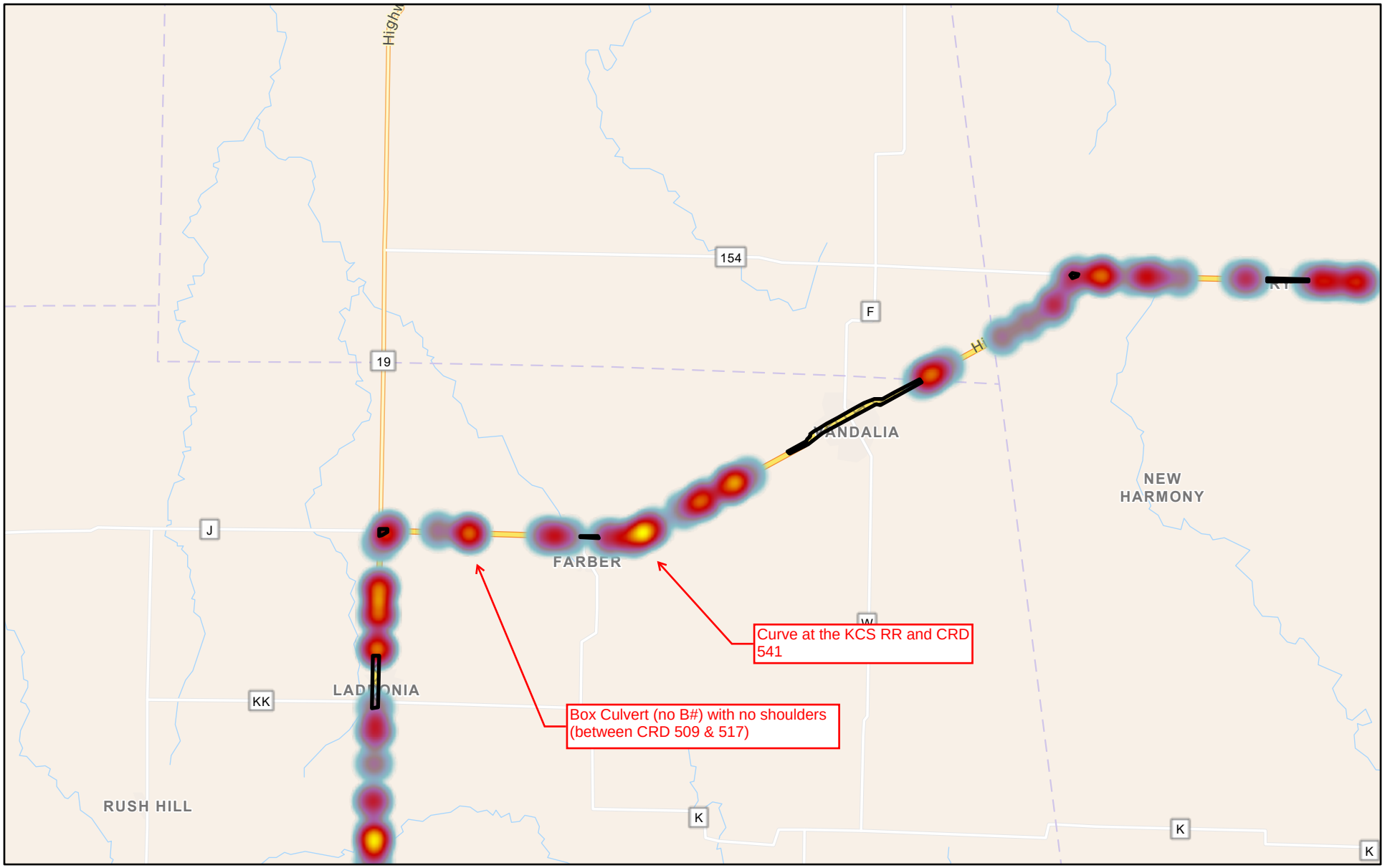
1:200,783

0 1.25 2.5 5 mi

0 2 4 8 km

Missouri Dept. of Conservation, Missouri DNR, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA

MO-54 Head-On, Passing, and Out of Control Collisions (Zone 3)



11/28/2022

Excluded Area

Low

High

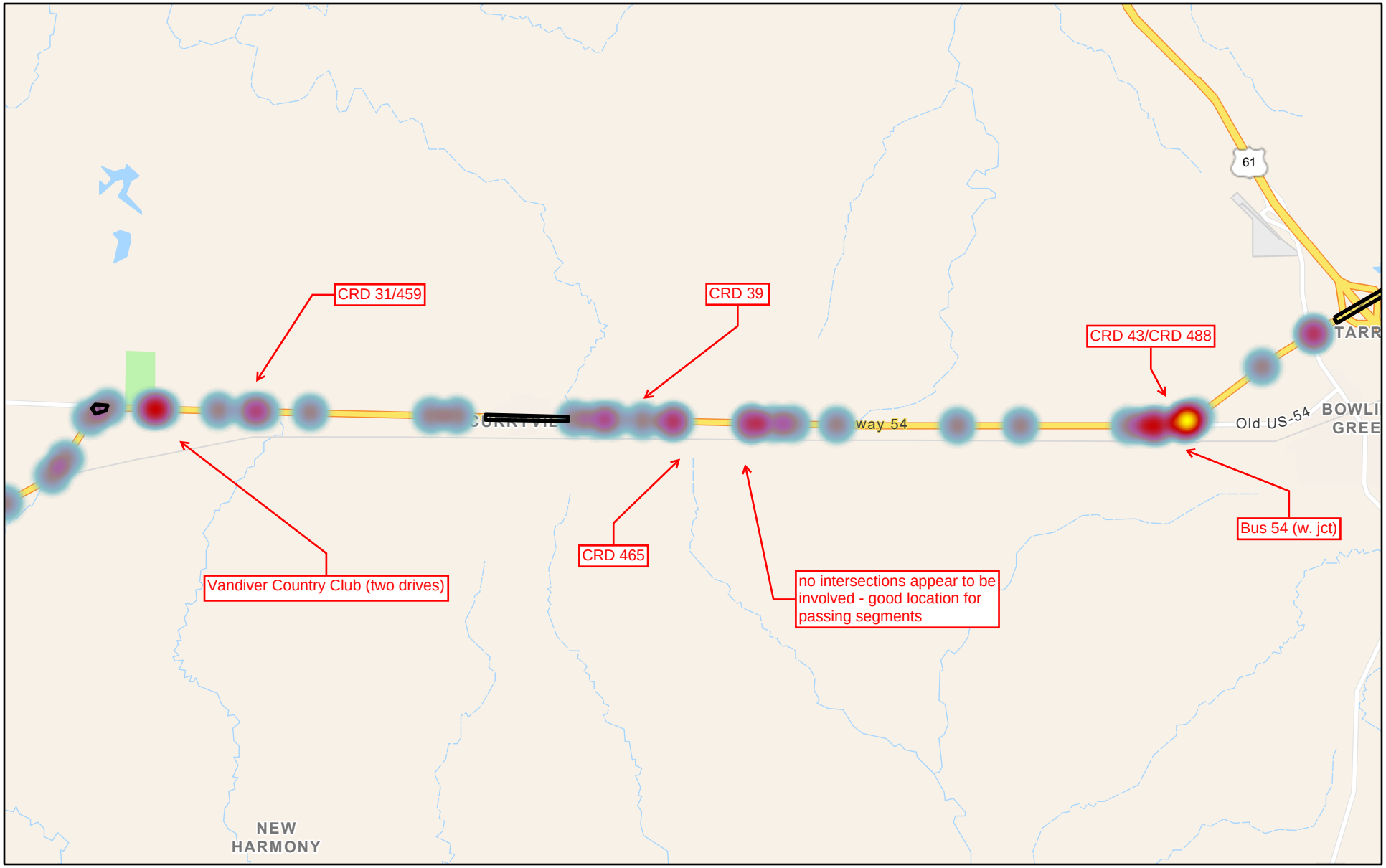
1:200,783

0 1.25 2.5 5 mi

0 2 4 8 km

Missouri Dept. of Conservation, Missouri DNR, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA

MO-54 Head-On, Passing, and Out of Control Collisions (Zone 4)



11/28/2022

Excluded Area

Low

High

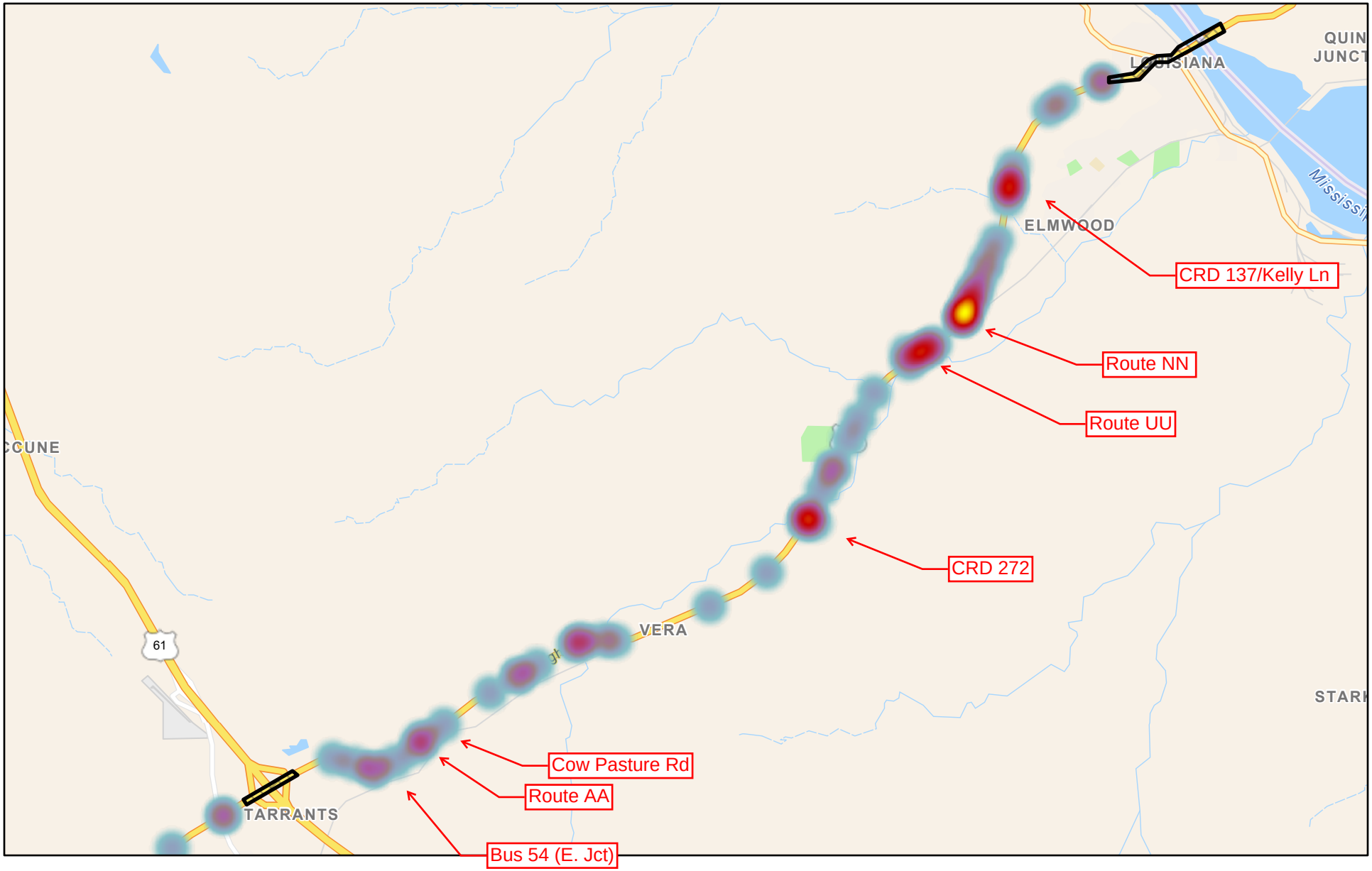
1:100,391

0 0.5 1 2 mi

0 1 2 4 km

Missouri Dept. of Conservation, Missouri DNR, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA

MO-54 Head-On, Passing, and Out of Control Collisions (Zone 5)



11/28/2022

Excluded Area

Low

High

1:100,391

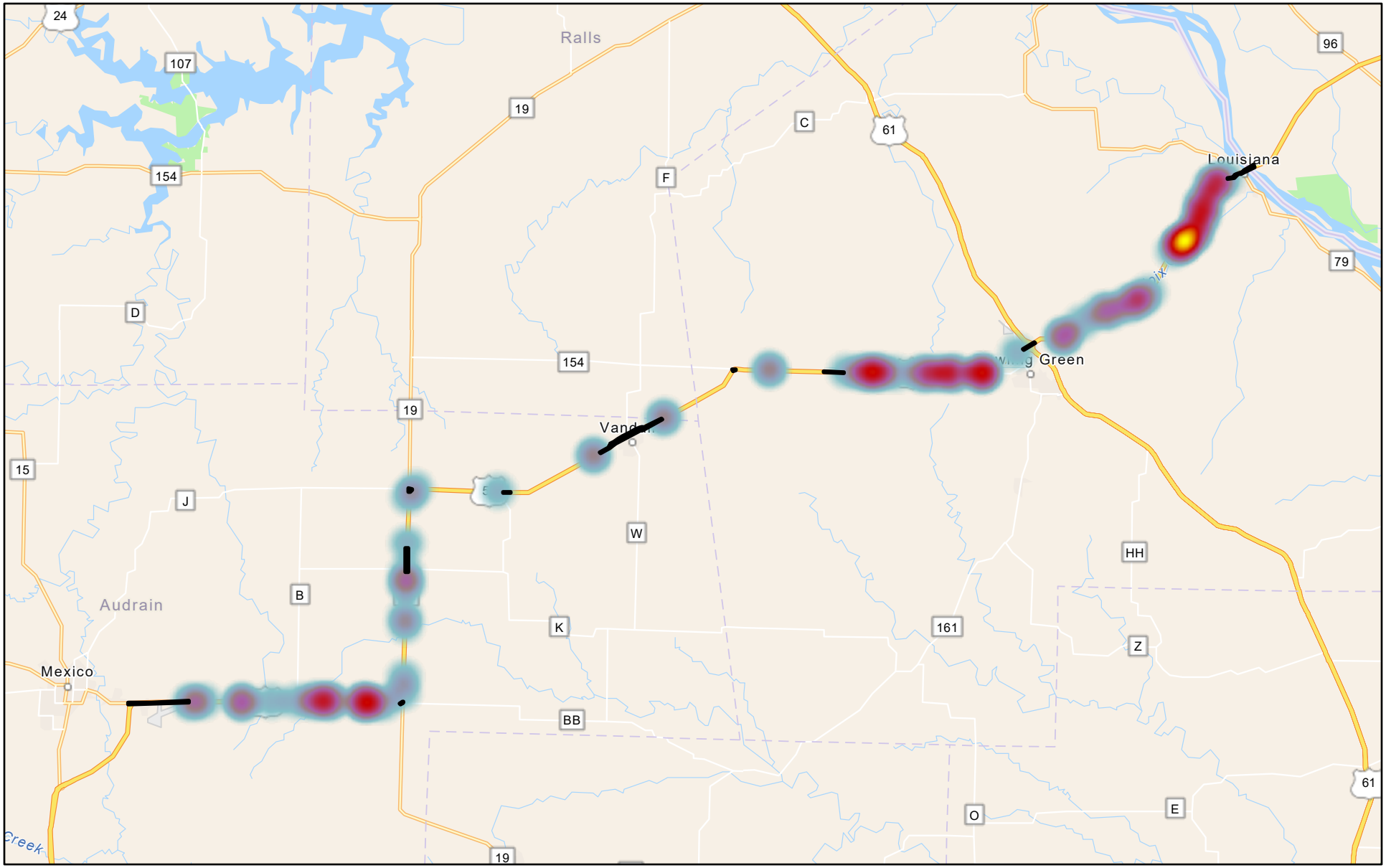
0 0.5 1 2 mi

0 1 2 4 km

Missouri Dept. of Conservation, Missouri DNR, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA

Bartlett & West

MO-54 Rear-End Collisions Overview



11/28/2022

Excluded Area

Low

High

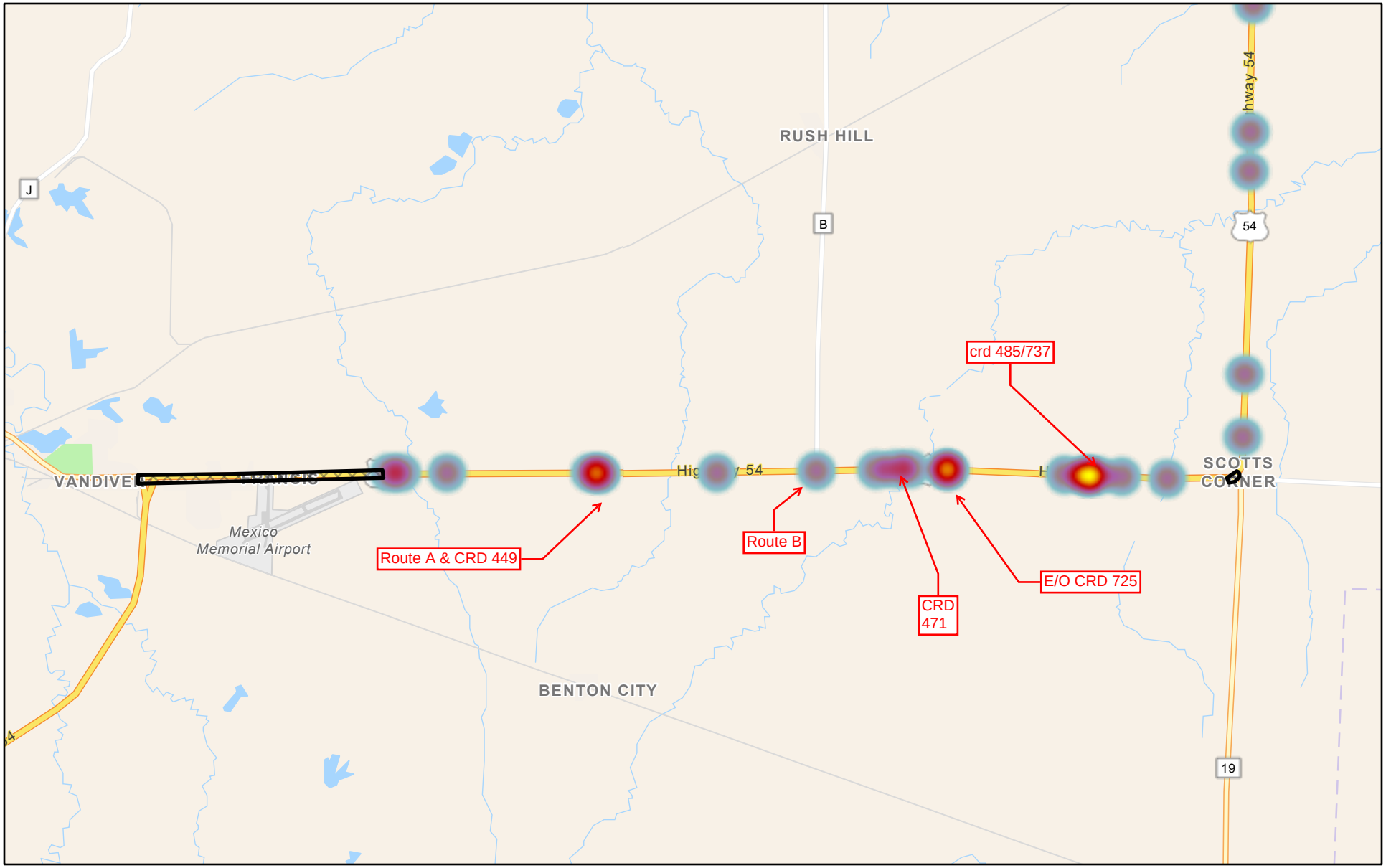
1:429,010

0 2.75 5.5 11 mi

0 4.5 9 18 km

Missouri Dept. of Conservation, Missouri DNR, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS

MO-54 Rear-End Collisions (Zone 1)



11/28/2022

Excluded Area

Low

High

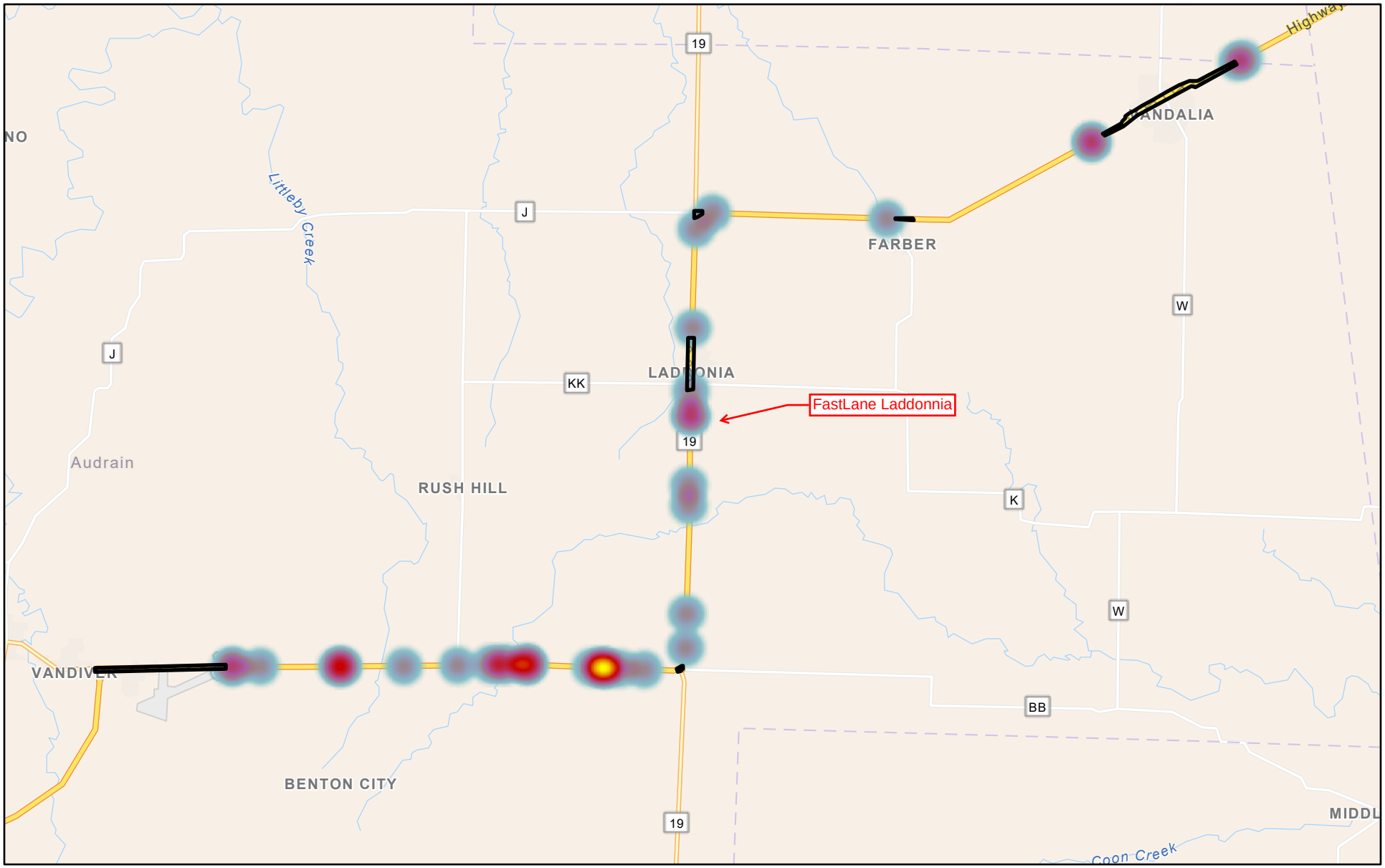
1:107,253

0 0.5 1 2 mi

0 1 2 4 km

Missouri Dept. of Conservation, Missouri DNR, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA

MO-54 Rear-End Collisions (Zone 2)



11/28/2022

Excluded Area

Low

High

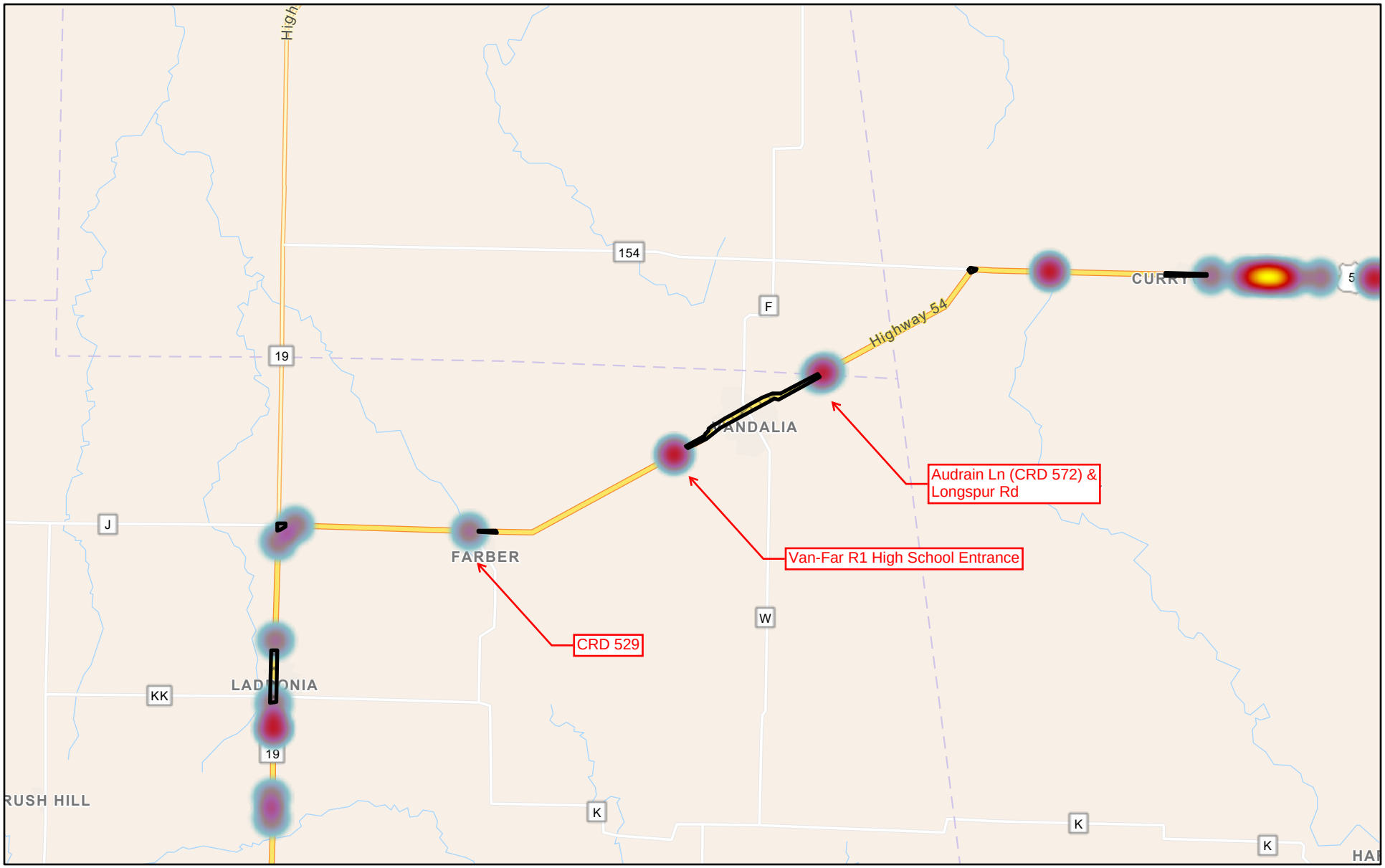
1:200,783

0 1.25 2.5 5 mi

0 2 4 8 km

Missouri Dept. of Conservation, Missouri DNR, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA

MO-54 Rear-End Collisions (Zone 3)



11/28/2022

Excluded Area

Low

High

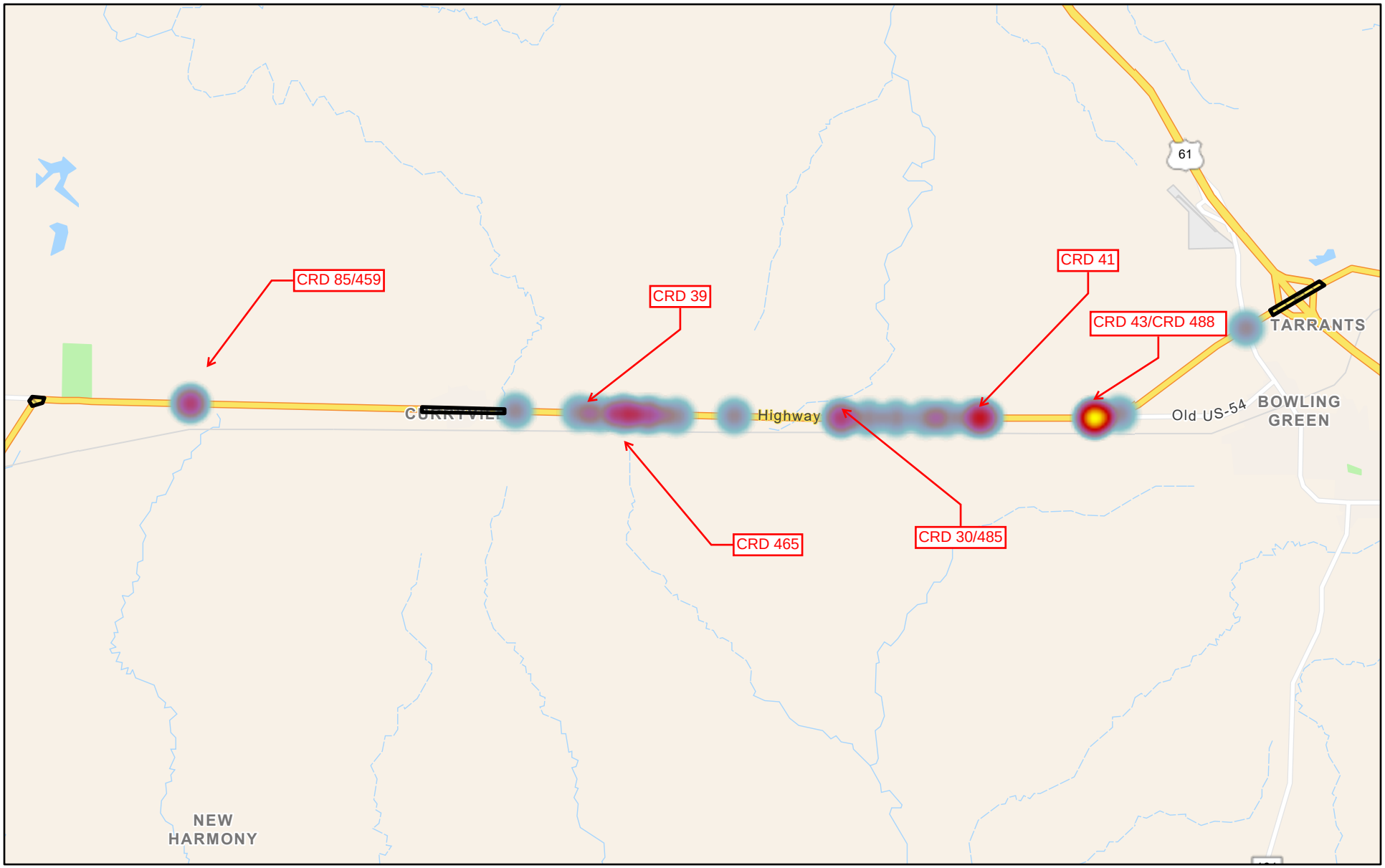
1:200,783

0 1.25 2.5 5 mi

0 2 4 8 km

Missouri Dept. of Conservation, Missouri DNR, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA

MO-54 Rear-End Collisions (Zone 4)



11/28/2022

Excluded Area

Low

High

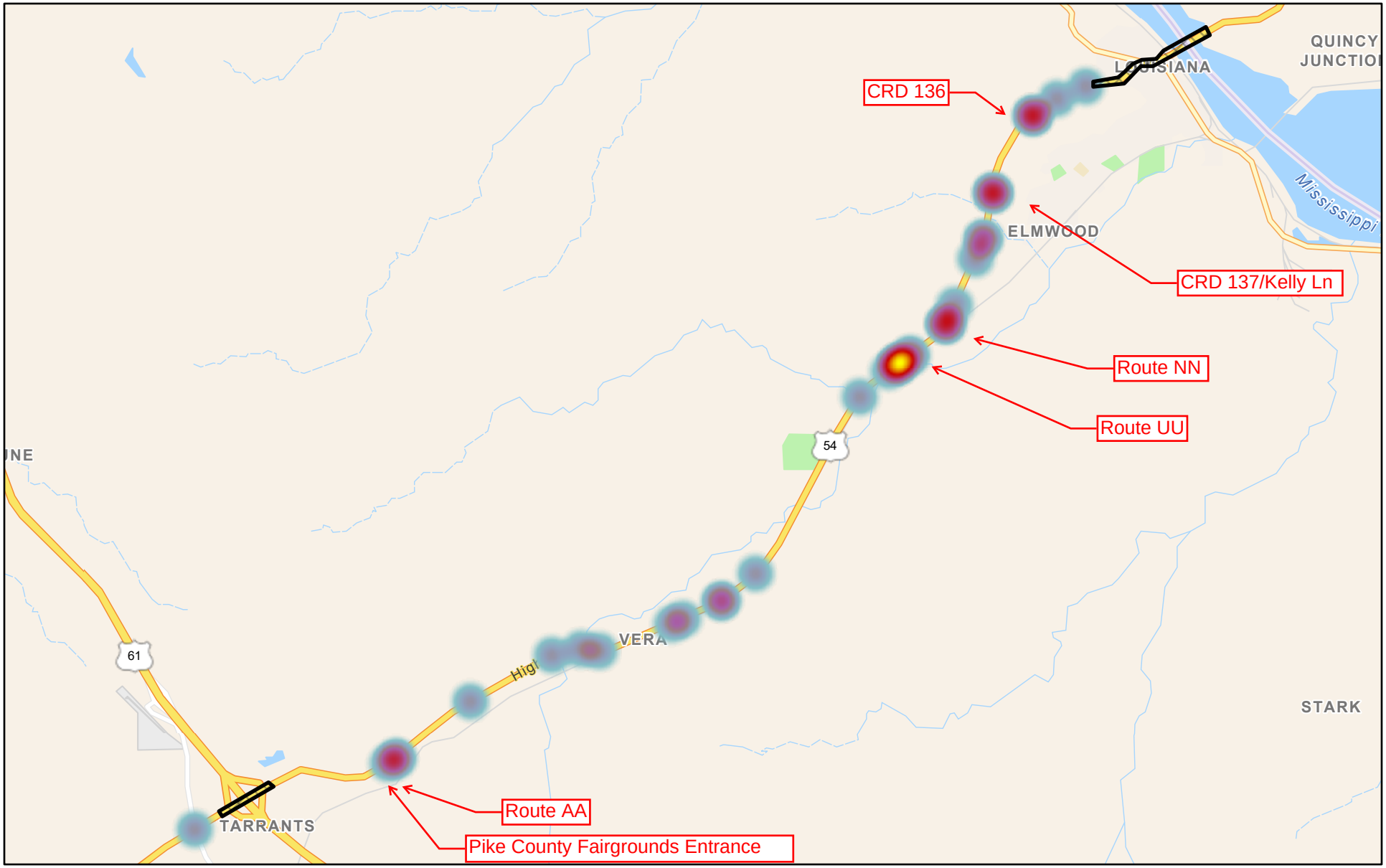
1:100,391

0 0.5 1 2 mi

0 1 2 4 km

Missouri Dept. of Conservation, Missouri DNR, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA

MO-54 Rear-End Collisions (Zone 5)



11/28/2022

Excluded Area

Low

High

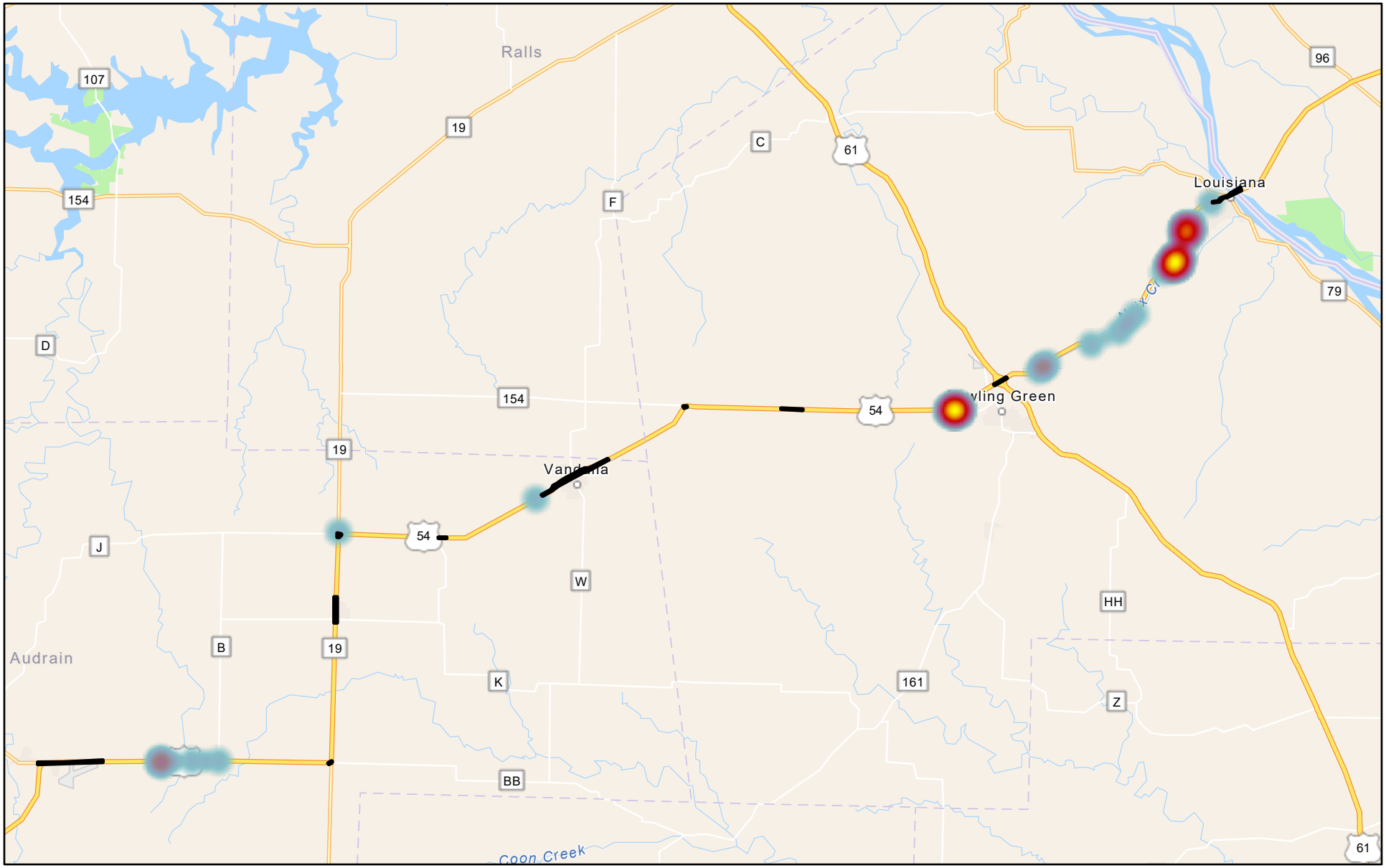
1:100,391

0 0.5 1 2 mi

0 1 2 4 km

Missouri Dept. of Conservation, Missouri DNR, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA

MO-54 Turning Collisions (Overview)



11/28/2022

Excluded Area

Low

High

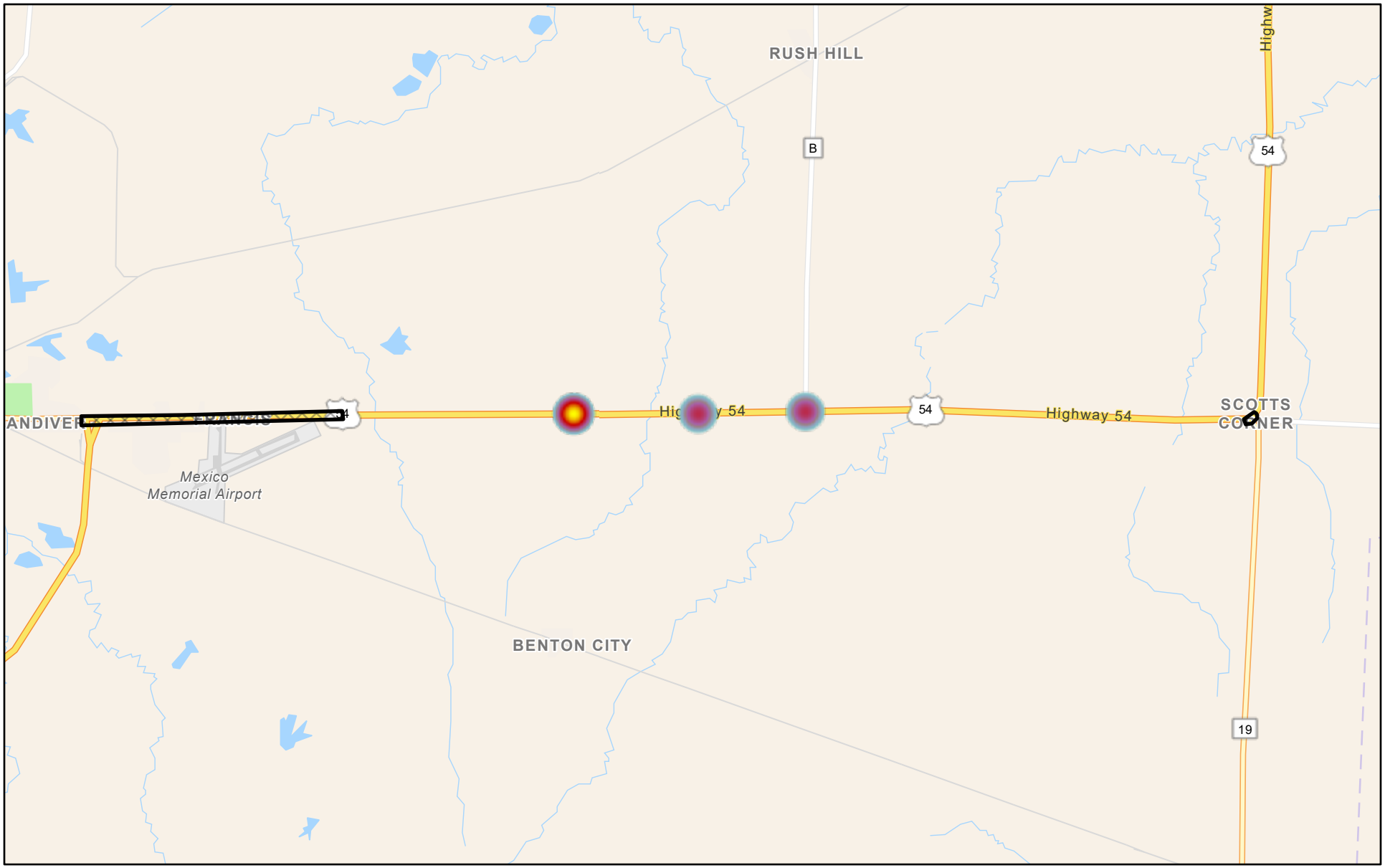
1:401,565

0 2.5 5 10 mi

0 4.25 8.5 17 km

Missouri Dept. of Conservation, Missouri DNR, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS

MO-54 Turning Collisions (Zone 1)



11/28/2022

Excluded Area

Low

High

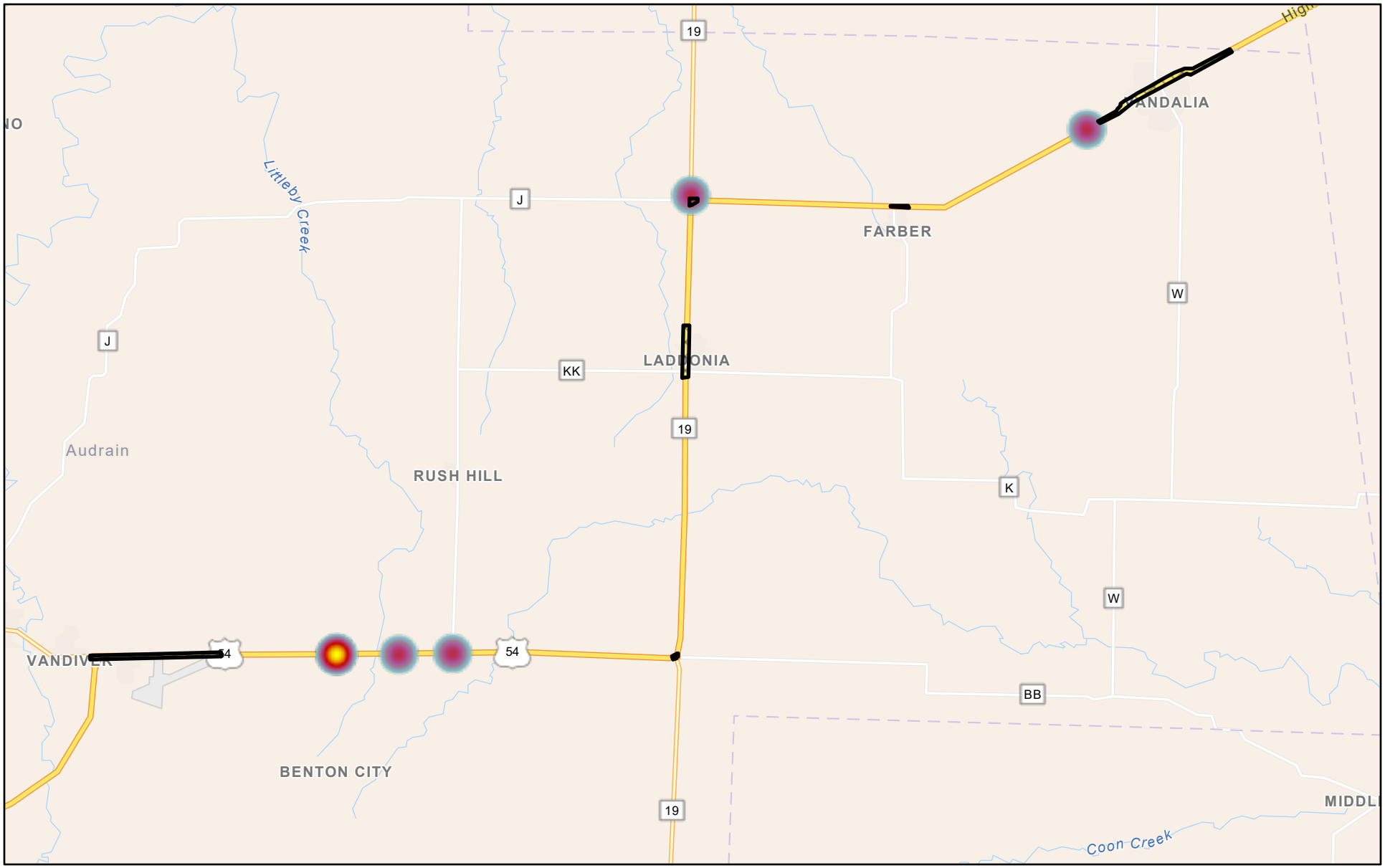
1:100,391

0 0.5 1 2 mi

0 1 2 4 km

Missouri Dept. of Conservation, Missouri DNR, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA

MO-54 Turning Collisions (Zone 2)



11/28/2022

Excluded Area

Low

High

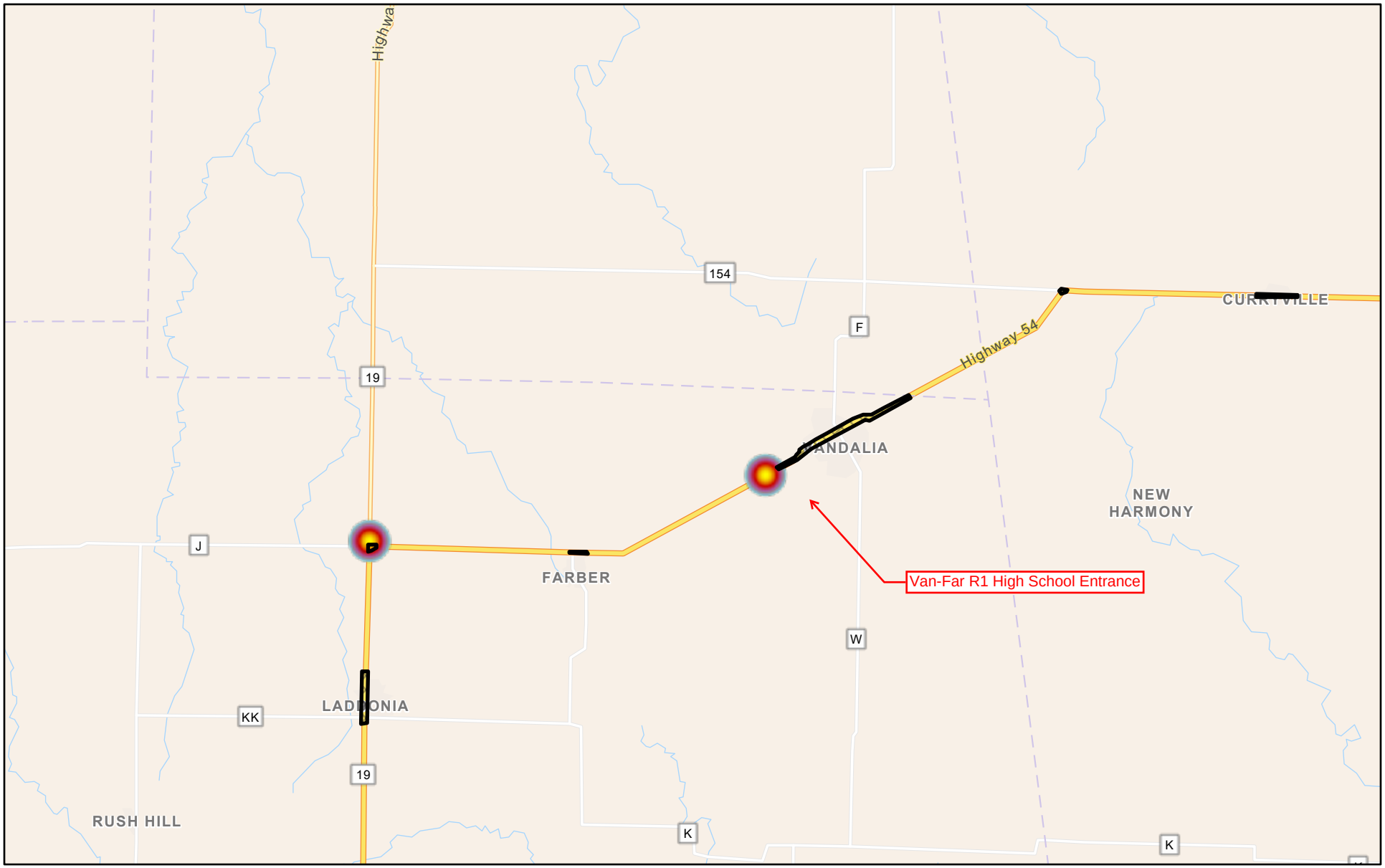
1:200,783

0 1.25 2.5 5 mi

0 2 4 8 km

Missouri Dept. of Conservation, Missouri DNR, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA

MO-54 Turning Collisions (Zone 3)



11/28/2022

Excluded Area

Low

High

1:200,783

0 1.25 2.5 5 mi

0 2 4 8 km

Missouri Dept. of Conservation, Missouri DNR, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA

MO-54 Turning Collisions (Zone 4)

11/28/2022

Excluded Area

Low

High

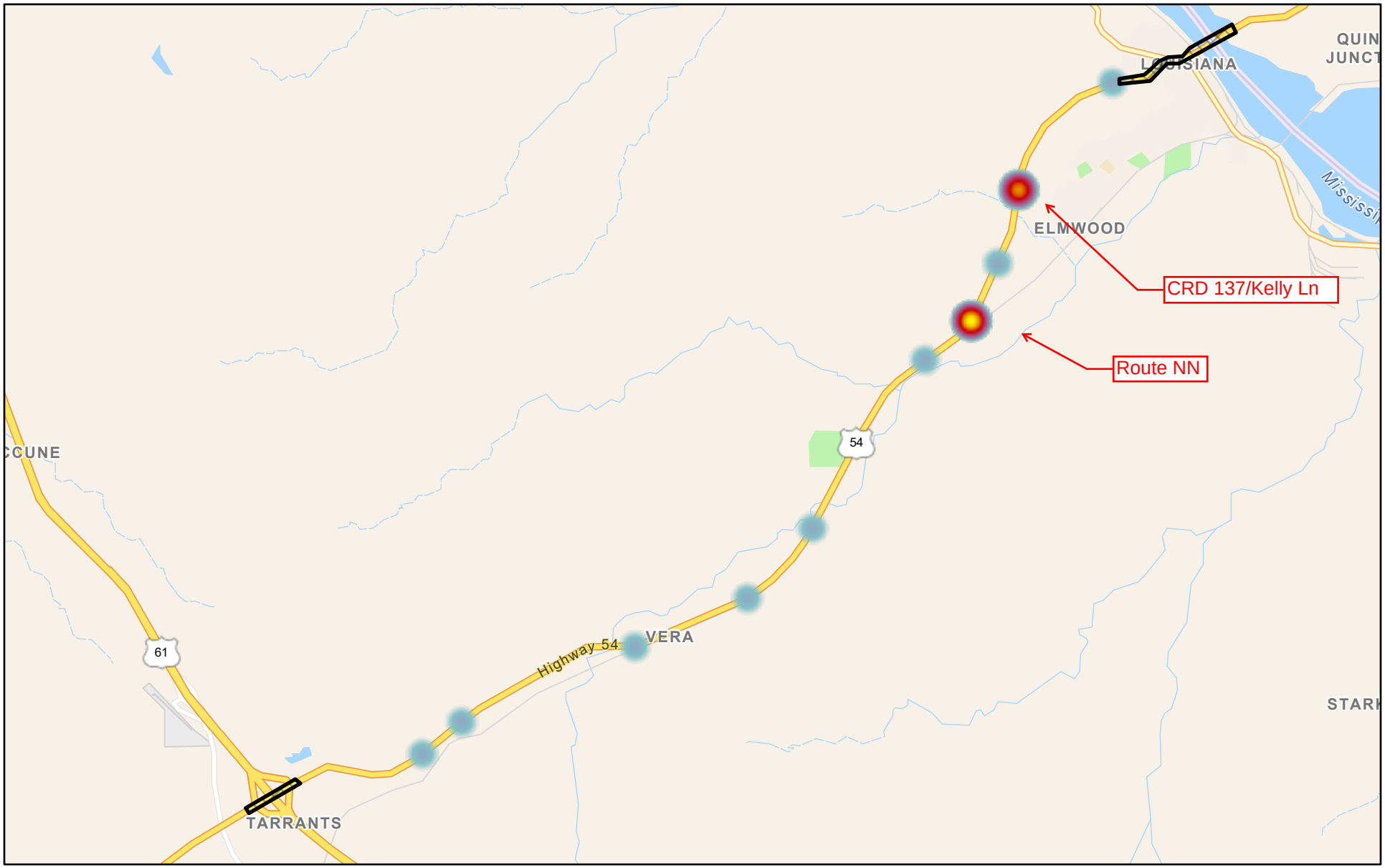
1:100,391

0 0.5 1 2 mi

0 1 2 4 km

Missouri Dept. of Conservation, Missouri DNR, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA

MO-54 Turning Collisions (Zone 5)



11/28/2022

Excluded Area

Low

High

1:100,391

0 0.5 1 2 mi

0 1 2 4 km

Missouri Dept. of Conservation, Missouri DNR, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA

Appendix D: Traffic Model Results and Reports

D.1: Traffic Model Results

D.1.1: HCM Results (2022 and 2042)

				Initial Year - 2022				Future Year - 2042			
				Peak Hour Volumes		LOS		Peak Hour Volumes		LOS	LOS
Segment	From	To	Analysis Direction	Analysis Direction	Opposing Direction	No Build	Passing Lane	**Analysis Direction**	**Opposing Direction**	No Build	Passing Lane
A1	Route A	Scott's Corner	EB	191	204	B	B	233	249	B	A
A2			WB	204	191	B	A	249	233	C	B
A3			EB	191	204	B	B	233	249	B	B
A4			WB	204	191	B	B	249	233	C	B
A5			EB	191	204	B	B	233	249	B	B
A6			WB	204	191	B	B	249	233	C	B
B1	Scott's Corner	Ladonia	EB	189	173	B	B	231	211	B	B
B2			WB	173	189	B	B	211	231	B	B
B3			EB	189	173	B	B	231	211	B	B
B4			WB	173	189	B	B	211	231	B	B
B5	Laddonia	54/J/19 Junction	EB	197	169	B	B	240	206	B	B
B6			WB	169	197	B	B	206	240	B	B
C1	54/J/19 Junction	Farber	EB	122	117	A	A	149	143	B	A
C2			WB	117	122	A	A	143	149	B	A
C3	Farber	Vandalia	EB	104	110	A	A	127	134	A	A
C4			WB	110	104	A	A	134	127	A	A
C5	Vandalia	154 Junction	EB	168	173	B	A	205	211	B	A
C6			WB	173	168	B	B	211	205	C	B
D1	154 Junction	Curryville	EB	126	134	A	A	154	163	C	B
D2			WB	134	126	A	A	163	154	B	A
D3	Curryville	Bowling Green	EB	254	227	C	B	310	277	C	C
D4			WB	227	254	B	B	277	310	C	B
D5			EB	254	227	C	B	310	277	C	B
D6			WB	227	254	B	B	277	310	C	B
E1	Bowling Green	Louisiana	EB	269	242	C	B	328	295	C	B
E2			WB	242	269	B	A	295	328	C	B
E3			EB	269	242	C	B	328	295	C	C
E4			WB	242	269	B	B	295	328	C	B

LOS based on travel time, v/c ratio, and percent-time spent following

Improved Level of Service Shaded in Orange

D.1.2: Vissim Results

Vissim Results – No Build 2022

No Build 2022				
Passing Section	Travel Direction	Delay Percentage	Average Travel Time (s)	Average Vehicle Delay (s)
A1	EB	0.96%	19.9	0.2
	WB	3.40%	20.4	0.7
A2	EB	2.02%	61.6	1.2
	WB	2.75%	62.8	1.7
A3	EB	2.53%	62.7	1.6
	WB	2.03%	62.1	1.3
A4	EB	3.27%	62.9	2.1
	WB	1.18%	62.1	0.7
A5	EB	17.14%	74.4	12.7
	WB	0.73%	61.6	0.4
A6	EB	6.30%	63.3	4.0
	WB	0.40%	61.3	0.2
B1	NB	0.62%	61.2	0.4
	SB	5.07%	63.5	3.2
B2	NB	1.27%	61.3	0.8
	SB	3.31%	63.0	2.1
B3	NB	7.01%	65.7	4.6
	SB	1.58%	61.8	1.0
B4	NB	4.87%	59.6	2.9
	SB	0.71%	58.3	0.4
B5	NB	0.78%	49.8	0.4
	SB	2.07%	50.3	1.0
B6	NB	1.87%	50.2	0.9
	SB	0.80%	49.9	0.4
C1	EB	0.15%	61.0	0.1
	WB	0.09%	61.0	0.1
C2	EB	0.57%	61.4	0.3
	WB	0.24%	60.5	0.1
C3	EB	0.31%	61.1	0.2
	WB	0.72%	61.5	0.4
C4	EB	0.52%	61.2	0.3
	WB	0.44%	61.3	0.3
C5	EB	0.36%	61.1	0.2
	WB	0.84%	61.6	0.5
C6	EB	0.97%	61.6	0.6
	WB	0.37%	61.2	0.2
D1	EB	0.23%	61.0	0.1
	WB	0.88%	61.5	0.5
D2	EB	0.86%	61.4	0.5
	WB	0.23%	60.8	0.1
D3	EB	0.72%	47.3	0.3
	WB	1.80%	47.9	0.9
D4	EB	1.48%	47.5	0.7
	WB	1.46%	47.8	0.7
D5	EB	2.40%	62.6	1.5
	WB	1.18%	61.4	0.7
D6	EB	2.76%	62.6	1.7
	WB	0.42%	60.9	0.3
E1	EB	0.43%	61.3	0.3
	WB	2.61%	62.6	1.6
E2	EB	1.29%	46.3	0.6
	WB	1.83%	46.8	0.9
E3	EB	2.00%	52.3	1.0
	WB	0.90%	51.5	0.5
E4	EB	2.59%	46.6	1.2
	WB	0.23%	45.8	0.1

Vissim Results – Build 2022

Build 2022				
Passing Section	Travel Direction	Delay Percentage	Average Travel Time (s)	Average Vehicle Delay (s)
A1	EB	0.96%	19.9	0.2
	WB	3.55%	20.4	0.7
A2	EB	2.06%	61.6	1.3
	WB	2.77%	62.8	1.7
A3	EB	2.53%	62.7	1.6
	WB	2.04%	62.1	1.3
A4	EB	3.33%	62.9	2.1
	WB	1.17%	62.1	0.7
A5	EB	17.43%	74.6	13.0
	WB	0.73%	61.6	0.4
A6	EB	5.36%	62.9	3.4
	WB	0.40%	61.3	0.2
B1	NB	0.62%	61.2	0.4
	SB	4.90%	63.2	3.1
B2	NB	1.27%	61.3	0.8
	SB	3.07%	62.9	1.9
B3	NB	3.94%	63.8	2.5
	SB	1.58%	61.8	1.0
B4	NB	5.37%	59.8	3.2
	SB	0.71%	58.3	0.4
B5	NB	0.77%	49.8	0.4
	SB	2.07%	50.3	1.0
B6	NB	1.87%	50.2	0.9
	SB	0.80%	49.9	0.4
C1	EB	0.15%	61.0	0.1
	WB	0.09%	61.0	0.1
C2	EB	0.56%	61.4	0.3
	WB	0.24%	60.5	0.1
C3	EB	0.31%	61.1	0.2
	WB	0.72%	61.5	0.4
C4	EB	0.52%	61.2	0.3
	WB	0.44%	61.3	0.3
C5	EB	0.36%	61.1	0.2
	WB	0.84%	61.6	0.5
C6	EB	0.97%	61.6	0.6
	WB	0.37%	61.2	0.2
D1	EB	0.23%	61.0	0.1
	WB	0.88%	61.5	0.5
D2	EB	0.86%	61.4	0.5
	WB	0.23%	60.8	0.1
D3	EB	0.72%	47.3	0.3
	WB	1.75%	47.9	0.8
D4	EB	1.47%	47.5	0.7
	WB	1.46%	47.8	0.7
D5	EB	2.41%	62.7	1.5
	WB	1.20%	61.4	0.7
D6	EB	2.75%	62.6	1.7
	WB	0.42%	60.9	0.3
E1	EB	0.42%	61.3	0.3
	WB	2.68%	62.6	1.7
E2	EB	1.29%	46.3	0.6
	WB	1.81%	46.8	0.8
E3	EB	2.10%	52.4	1.1
	WB	0.90%	51.5	0.5
E4	EB	2.55%	46.6	1.2
	WB	0.24%	45.8	0.1

Vissim Results – No Build 2042

No Build 2042				
Passing Section	Travel Direction	Delay Percentage	Average Travel Time (s)	Average Vehicle Delay (s)
A1	EB	1.43%	20.0	0.3
	WB	7.36%	20.7	1.5
A2	EB	70.99%	61.8	43.8
	WB	3.67%	63.7	2.3
A3	EB	66.56%	186.4	124.1
	WB	2.31%	62.2	1.4
A4	EB	62.99%	163.7	103.1
	WB	1.50%	62.2	0.9
A5	EB	43.14%	111.5	48.1
	WB	0.89%	61.7	0.5
A6	EB	5.06%	62.6	3.2
	WB	0.34%	61.4	0.2
B1	NB	0.77%	61.3	0.5
	SB	6.36%	63.0	4.0
B2	NB	51.10%	108.6	55.5
	SB	40.59%	98.0	39.8
B3	NB	58.38%	144.8	84.5
	SB	3.92%	61.8	2.4
B4	NB	6.81%	59.7	4.1
	SB	0.72%	58.3	0.4
B5	NB	63.67%	141.2	89.9
	SB	3.49%	50.6	1.8
B6	NB	10.95%	51.0	5.6
	SB	1.09%	49.9	0.5
C1	EB	0.15%	61.0	0.1
	WB	0.26%	61.0	0.2
C2	EB	0.62%	61.4	0.4
	WB	0.37%	60.6	0.2
C3	EB	0.28%	61.3	0.2
	WB	0.82%	61.5	0.5
C4	EB	0.69%	61.3	0.4
	WB	0.47%	61.4	0.3
C5	EB	0.48%	61.2	0.3
	WB	1.11%	61.7	0.7
C6	EB	1.27%	61.8	0.8
	WB	0.42%	61.3	0.3
D1	EB	0.26%	61.1	0.2
	WB	0.96%	61.6	0.6
D2	EB	0.83%	61.4	0.5
	WB	0.24%	60.8	0.1
D3	EB	0.88%	47.3	0.4
	WB	2.94%	48.3	1.4
D4	EB	1.75%	47.6	0.8
	WB	2.04%	48.1	1.0
D5	EB	2.78%	62.9	1.7
	WB	1.67%	61.6	1.0
D6	EB	3.79%	63.1	2.4
	WB	0.51%	61.1	0.3
E1	EB	0.85%	61.5	0.5
	WB	2.70%	62.5	1.7
E2	EB	1.93%	46.6	0.9
	WB	1.76%	46.8	0.8
E3	EB	11.60%	58.2	6.8
	WB	0.85%	51.5	0.4
E4	EB	5.24%	46.8	2.5
	WB	0.28%	45.8	0.1

Vissim Results – Build 2042

Build 2042				
Passing Section	Travel Direction	Delay Percentage	Average Travel Time (s)	Average Vehicle Delay (s)
A1	EB	1.43%	20.0	0.3
	WB	7.09%	20.7	1.5
A2	EB	57.97%	61.8	35.8
	WB	3.73%	63.7	2.4
A3	EB	60.38%	152.4	92.0
	WB	2.35%	62.2	1.5
A4	EB	57.28%	144.9	83.0
	WB	1.50%	62.2	0.9
A5	EB	34.58%	94.4	32.6
	WB	0.89%	61.7	0.5
A6	EB	4.76%	62.8	3.0
	WB	0.34%	61.4	0.2
B1	NB	1.44%	61.4	0.9
	SB	5.70%	63.2	3.6
B2	NB	65.80%	155.0	102.0
	SB	17.14%	74.1	12.7
B3	NB	59.50%	154.3	91.8
	SB	5.48%	62.0	3.4
B4	NB	6.92%	59.9	4.1
	SB	0.72%	58.3	0.4
B5	NB	51.25%	105.1	53.9
	SB	3.49%	50.6	1.8
B6	NB	9.96%	50.9	5.1
	SB	1.09%	49.9	0.5
C1	EB	0.15%	61.0	0.1
	WB	0.26%	61.0	0.2
C2	EB	0.62%	61.4	0.4
	WB	0.37%	60.6	0.2
C3	EB	0.28%	61.3	0.2
	WB	0.82%	61.5	0.5
C4	EB	0.69%	61.3	0.4
	WB	0.47%	61.4	0.3
C5	EB	0.48%	61.2	0.3
	WB	1.11%	61.7	0.7
C6	EB	1.27%	61.8	0.8
	WB	0.42%	61.3	0.3
D1	EB	0.26%	61.1	0.2
	WB	0.96%	61.6	0.6
D2	EB	0.82%	61.4	0.5
	WB	0.24%	60.8	0.1
D3	EB	0.88%	47.3	0.4
	WB	2.91%	48.2	1.4
D4	EB	1.74%	47.6	0.8
	WB	2.03%	48.1	1.0
D5	EB	2.81%	62.9	1.8
	WB	1.63%	61.6	1.0
D6	EB	3.82%	63.1	2.4
	WB	0.51%	61.1	0.3
E1	EB	0.85%	61.5	0.5
	WB	2.73%	62.6	1.7
E2	EB	1.97%	46.6	0.9
	WB	1.78%	46.8	0.8
E3	EB	11.88%	58.3	6.9
	WB	0.85%	51.5	0.4
E4	EB	4.88%	46.7	2.3
	WB	0.28%	45.8	0.1

D.2: Traffic Model Reports

D.2.1: HCS Reports – 2022

(84 pages)

- Section A
  - 6 segments at 3 pages each: 18 pages
- Section B
  - 6 segments at 3 pages each: 18 pages
- Section C
  - 6 segments at 3 pages each: 18 pages
- Section D
  - 6 segments at 3 pages each: 18 pages
- Section E
  - 4 segments at 3 pages each: 12 pages

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84 pages

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - EB
Highway	54
From/To	Rt A / Scotts Corner
Jurisdiction	
Analysis Year	2022
Description	Pass A1 - Existing

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	0.3	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	2	/mi

Analysis direction volume, Vd 191 veh/h
Opposing direction volume, Vo 204 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.5		1.5	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.971		0.971	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	224	pc/h	239	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	0.5	mi/h
Free-flow speed, FFSd	59.5	mi/h
Adjustment for no-passing zones, fnp	1.8	mi/h
Average travel speed, ATSd	54.1	mi/h
Percent Free Flow Speed, PFFS	91.0	%

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.1		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	0.994		0.994	
Grade adjustment factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	218	pc/h	233	pc/h
Base percent time-spent-following,(note-4) BPTSFd	23.7	%		
Adjustment for no-passing zones, fnp	39.6			
Percent time-spent-following, PTSFd	42.8	%		

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.13	
Peak 15-min vehicle-miles of travel, VMT15	16	veh-mi
Peak-hour vehicle-miles of travel, VMT60	57	veh-mi
Peak 15-min total travel time, TT15	0.3	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	0.3	mi
Length of two-lane highway upstream of the passing lane, Lu	0.0	mi
Length of passing lane including tapers, Lpl	0.0	mi
Average travel speed, ATSd (from above)	54.1	mi/h
Percent time-spent-following, PTSFd (from above)	42.8	
Level of service, LOSd (from above)	B	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.40	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.09	
Average travel speed including passing lane, ATSpl	58.6	
Percent free flow speed including passing lane, PFFSpl	98.5	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	12.75	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-12.45	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.59	
Percent time-spent-following including passing lane, PTSFpl	25.5	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	A	
Peak 15-min total travel time, TT15	0.3	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	217.0
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.49
Bicycle LOS	C

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - WB
Highway	54
From/To	Rt A / Scotts Corner
Jurisdiction	
Analysis Year	2022
Description	Pass A2 - Existing

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	2.2	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	2	/mi

Analysis direction volume, Vd 204 veh/h
Opposing direction volume, Vo 191 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.5		1.5	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.971		0.971	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	239	pc/h	224	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	0.5	mi/h
Free-flow speed, FFSd	59.5	mi/h
Adjustment for no-passing zones, fnp	1.8	mi/h
Average travel speed, ATSd	54.1	mi/h
Percent Free Flow Speed, PFFS	90.9	%

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.1		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	0.994		0.994	
Grade adjustment factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	233	pc/h	218	pc/h
Base percent time-spent-following,(note-4) BPTSFd	25.6	%		
Adjustment for no-passing zones, fnp	39.6			
Percent time-spent-following, PTSFd	46.1	%		

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.14	
Peak 15-min vehicle-miles of travel, VMT15	128	veh-mi
Peak-hour vehicle-miles of travel, VMT60	449	veh-mi
Peak 15-min total travel time, TT15	2.4	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	2.2	mi
Length of two-lane highway upstream of the passing lane, Lu	0.9	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	54.1	mi/h
Percent time-spent-following, PTSFd (from above)	46.1	
Level of service, LOSd (from above)	B	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.60	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.09	
Average travel speed including passing lane, ATSpl	56.9	
Percent free flow speed including passing lane, PFFSpl	95.6	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	12.54	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-12.44	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.59	
Percent time-spent-following including passing lane, PTSFpl	34.9	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	A	
Peak 15-min total travel time, TT15	2.3	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	231.8
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.53
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - EB
Highway	54
From/To	Rt A / Scotts Corner
Jurisdiction	
Analysis Year	2022
Description	Pass A3 - Existing

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	3.3	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	4	/mi

Analysis direction volume, Vd 191 veh/h
Opposing direction volume, Vo 204 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.5		1.5	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.971		0.971	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	224	pc/h	239	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	1.0	mi/h
Free-flow speed, FFSd	59.0	mi/h
Adjustment for no-passing zones, fnp	1.7	mi/h
Average travel speed, ATSd	53.7	mi/h
Percent Free Flow Speed, PFFS	91.0	%

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.1		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	0.994		0.994	
Grade adjustment factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	218	pc/h	233	pc/h
Base percent time-spent-following,(note-4) BPTSFd	23.7	%		
Adjustment for no-passing zones, fnp	39.6			
Percent time-spent-following, PTSFd	42.8	%		

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.13	
Peak 15-min vehicle-miles of travel, VMT15	179	veh-mi
Peak-hour vehicle-miles of travel, VMT60	630	veh-mi
Peak 15-min total travel time, TT15	3.3	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	3.3	mi
Length of two-lane highway upstream of the passing lane, Lu	2.0	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	53.7	mi/h
Percent time-spent-following, PTSFd (from above)	42.8	
Level of service, LOSd (from above)	B	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.60	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.09	
Average travel speed including passing lane, ATSpl	55.5	
Percent free flow speed including passing lane, PFFSpl	94.0	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	12.75	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-12.65	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.59	
Percent time-spent-following including passing lane, PTSFpl	35.9	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	B	
Peak 15-min total travel time, TT15	3.2	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	217.0
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.49
Bicycle LOS	C

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - WB
Highway	54
From/To	Rt A / Scotts Corner
Jurisdiction	
Analysis Year	2022
Description	Pass A4 - Existing

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	3.7	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	5	/mi

Analysis direction volume, Vd 204 veh/h
Opposing direction volume, Vo 191 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.5		1.5	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.971		0.971	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	239	pc/h	224	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	1.3	mi/h
Free-flow speed, FFSd	58.8	mi/h
Adjustment for no-passing zones, fnp	1.7	mi/h
Average travel speed, ATSd	53.4	mi/h
Percent Free Flow Speed, PFFS	90.9	%

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	0.994	0.994
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	233 pc/h	218 pc/h
Base percent time-spent-following,(note-4) BPTSFd	25.6 %	
Adjustment for no-passing zones, fnp	39.6	
Percent time-spent-following, PTSFd	46.1 %	

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.14	
Peak 15-min vehicle-miles of travel, VMT15	214	veh-mi
Peak-hour vehicle-miles of travel, VMT60	755	veh-mi
Peak 15-min total travel time, TT15	4.0	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	3.7	mi
Length of two-lane highway upstream of the passing lane, Lu	2.4	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	53.4	mi/h
Percent time-spent-following, PTSFd (from above)	46.1	
Level of service, LOSd (from above)	B	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.60	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.09	
Average travel speed including passing lane, ATSpl	55.0	
Percent free flow speed including passing lane, PFFSpl	93.6	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	12.54	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-12.44	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.59	
Percent time-spent-following including passing lane, PTSFpl	39.5	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	B	
Peak 15-min total travel time, TT15	3.9	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	231.8
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.53
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - EB
Highway	54
From/To	Rt A / Scotts Corner
Jurisdiction	
Analysis Year	2022
Description	Pass A5 - Existing

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	2.8	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	5	/mi

Analysis direction volume, Vd 191 veh/h
Opposing direction volume, Vo 204 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.5		1.5	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.971		0.971	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	224	pc/h	239	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	1.3	mi/h
Free-flow speed, FFSd	58.8	mi/h
Adjustment for no-passing zones, fnp	1.7	mi/h
Average travel speed, ATSd	53.4	mi/h
Percent Free Flow Speed, PFFS	91.0	%

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.1		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	0.994		0.994	
Grade adjustment factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	218	pc/h	233	pc/h
Base percent time-spent-following,(note-4) BPTSFd	23.7	%		
Adjustment for no-passing zones, fnp	39.6			
Percent time-spent-following, PTSFd	42.8	%		

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.13	
Peak 15-min vehicle-miles of travel, VMT15	152	veh-mi
Peak-hour vehicle-miles of travel, VMT60	535	veh-mi
Peak 15-min total travel time, TT15	2.8	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	2.8	mi
Length of two-lane highway upstream of the passing lane, Lu	1.6	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	53.4	mi/h
Percent time-spent-following, PTSFd (from above)	42.8	
Level of service, LOSd (from above)	B	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.09	
Average travel speed including passing lane, ATSpl	55.4	
Percent free flow speed including passing lane, PFFSpl	94.3	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	12.75	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-12.75	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.59	
Percent time-spent-following including passing lane, PTSFpl	35.3	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	B	
Peak 15-min total travel time, TT15	2.7	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	217.0
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.49
Bicycle LOS	C

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - WB
Highway	54
From/To	Rt A / Scotts Corner
Jurisdiction	
Analysis Year	2022
Description	Pass A6 - Existing

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	2.4	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	3	/mi

Analysis direction volume, Vd 204 veh/h
Opposing direction volume, Vo 191 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.5		1.5	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.971		0.971	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	239	pc/h	224	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	0.8	mi/h
Free-flow speed, FFSd	59.3	mi/h
Adjustment for no-passing zones, fnp	1.8	mi/h
Average travel speed, ATSd	53.9	mi/h
Percent Free Flow Speed, PFFS	90.9	%

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.1		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	0.994		0.994	
Grade adjustment factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	233	pc/h	218	pc/h
Base percent time-spent-following,(note-4) BPTSFd	25.6	%		
Adjustment for no-passing zones, fnp	39.6			
Percent time-spent-following, PTSFd	46.1	%		

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.14	
Peak 15-min vehicle-miles of travel, VMT15	139	veh-mi
Peak-hour vehicle-miles of travel, VMT60	490	veh-mi
Peak 15-min total travel time, TT15	2.6	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	2.4	mi
Length of two-lane highway upstream of the passing lane, Lu	1.2	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	53.9	mi/h
Percent time-spent-following, PTSFd (from above)	46.1	
Level of service, LOSd (from above)	B	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.09	
Average travel speed including passing lane, ATSpl	56.2	
Percent free flow speed including passing lane, PFFSpl	94.8	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	12.54	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-12.54	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.59	
Percent time-spent-following including passing lane, PTSFpl	36.6	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	B	
Peak 15-min total travel time, TT15	2.5	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	231.8
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.53
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - EB
Highway	54
From/To	Scotts Corner / Ledonia
Jurisdiction	
Analysis Year	2022
Description	Pass B1 - Existing

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	2.9	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	6	/mi

Analysis direction volume, Vd 189 veh/h
Opposing direction volume, Vo 173 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.5		1.5	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.971		0.971	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	221	pc/h	202	pc/h

Free-Flow Speed from Field Measurement:

Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h

Estimated Free-Flow Speed:

Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	1.5	mi/h
Free-flow speed, FFSd	58.5	mi/h
Adjustment for no-passing zones, fnp	1.8	mi/h
Average travel speed, ATSd	53.4	mi/h
Percent Free Flow Speed, PFFS	91.4	%

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	0.994	0.994
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	216 pc/h	198 pc/h
Base percent time-spent-following,(note-4) BPTSFd	23.0 %	
Adjustment for no-passing zones, fnp	39.8	
Percent time-spent-following, PTSFd	43.8 %	

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.13	
Peak 15-min vehicle-miles of travel, VMT15	156	veh-mi
Peak-hour vehicle-miles of travel, VMT60	548	veh-mi
Peak 15-min total travel time, TT15	2.9	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	2.9	mi
Length of two-lane highway upstream of the passing lane, Lu	1.7	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	53.4	mi/h
Percent time-spent-following, PTSFd (from above)	43.8	
Level of service, LOSd (from above)	B	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.09	
Average travel speed including passing lane, ATSpl	55.3	
Percent free flow speed including passing lane, PFFSpl	94.6	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	12.78	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-12.78	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.59	
Percent time-spent-following including passing lane, PTSFpl	36.4	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	B	
Peak 15-min total travel time, TT15	2.8	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	214.8
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.49
Bicycle LOS	C

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis–the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15–14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - WB
Highway	54
From/To	Scotts Corner / Ledonia
Jurisdiction	
Analysis Year	2022
Description	Pass B2 - Existing

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	2.6	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	4	/mi

Analysis direction volume, Vd 173 veh/h
Opposing direction volume, Vo 189 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.5		1.5	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.971		0.971	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	202	pc/h	221	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	1.0	mi/h
Free-flow speed, FFSd	59.0	mi/h
Adjustment for no-passing zones, fnp	1.8	mi/h
Average travel speed, ATSd	53.9	mi/h
Percent Free Flow Speed, PFFS	91.4	%

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.1		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	0.994		0.994	
Grade adjustment factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	198	pc/h	216	pc/h
Base percent time-spent-following,(note-4) BPTSFd	22.3	%		
Adjustment for no-passing zones, fnp	39.8			
Percent time-spent-following, PTSFd	41.3	%		

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.12	
Peak 15-min vehicle-miles of travel, VMT15	128	veh-mi
Peak-hour vehicle-miles of travel, VMT60	450	veh-mi
Peak 15-min total travel time, TT15	2.4	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	2.6	mi
Length of two-lane highway upstream of the passing lane, Lu	1.4	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	53.9	mi/h
Percent time-spent-following, PTSFd (from above)	41.3	
Level of service, LOSd (from above)	B	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.09	
Average travel speed including passing lane, ATSpl	56.1	
Percent free flow speed including passing lane, PFFSpl	95.1	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	13.00	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-13.00	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.58	
Percent time-spent-following including passing lane, PTSFpl	33.3	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	A	
Peak 15-min total travel time, TT15	2.3	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	196.6
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.45
Bicycle LOS	C

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - EB
Highway	54
From/To	Scotts Corner / Ledonia
Jurisdiction	
Analysis Year	2022
Description	Pass B3 - Existing

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	2.5	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	6	/mi

Analysis direction volume, Vd 189 veh/h
Opposing direction volume, Vo 173 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.5		1.5	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.971		0.971	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	221	pc/h	202	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	1.5	mi/h
Free-flow speed, FFSd	58.5	mi/h
Adjustment for no-passing zones, fnp	1.8	mi/h
Average travel speed, ATSd	53.4	mi/h
Percent Free Flow Speed, PFFS	91.4	%

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	0.994	0.994
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	216 pc/h	198 pc/h
Base percent time-spent-following,(note-4) BPTSFd	23.0 %	
Adjustment for no-passing zones, fnp	39.8	
Percent time-spent-following, PTSFd	43.8 %	

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.13	
Peak 15-min vehicle-miles of travel, VMT15	134	veh-mi
Peak-hour vehicle-miles of travel, VMT60	473	veh-mi
Peak 15-min total travel time, TT15	2.5	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	2.5	mi
Length of two-lane highway upstream of the passing lane, Lu	1.3	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	53.4	mi/h
Percent time-spent-following, PTSFd (from above)	43.8	
Level of service, LOSd (from above)	B	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.09	
Average travel speed including passing lane, ATSpl	55.6	
Percent free flow speed including passing lane, PFFSpl	95.1	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	12.78	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-12.78	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.59	
Percent time-spent-following including passing lane, PTSFpl	35.2	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	B	
Peak 15-min total travel time, TT15	2.4	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	214.8
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.49
Bicycle LOS	C

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - WB
Highway	54
From/To	Scotts Corner / Ledonia
Jurisdiction	
Analysis Year	2022
Description	Pass B4 - Existing

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	2.4	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	4	/mi

Analysis direction volume, Vd 173 veh/h
Opposing direction volume, Vo 189 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.5		1.5	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.971		0.971	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	202	pc/h	221	pc/h

Free-Flow Speed from Field Measurement:

Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h

Estimated Free-Flow Speed:

Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	1.0	mi/h
Free-flow speed, FFSd	59.0	mi/h
Adjustment for no-passing zones, fnp	1.8	mi/h
Average travel speed, ATSd	53.9	mi/h
Percent Free Flow Speed, PFFS	91.4	%

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	0.994	0.994
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	198 pc/h	216 pc/h
Base percent time-spent-following,(note-4) BPTSFd	22.3 %	
Adjustment for no-passing zones, fnp	39.8	
Percent time-spent-following, PTSFd	41.3 %	

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.12	
Peak 15-min vehicle-miles of travel, VMT15	118	veh-mi
Peak-hour vehicle-miles of travel, VMT60	415	veh-mi
Peak 15-min total travel time, TT15	2.2	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	2.4	mi
Length of two-lane highway upstream of the passing lane, Lu	1.3	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	53.9	mi/h
Percent time-spent-following, PTSFd (from above)	41.3	
Level of service, LOSd (from above)	B	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.80	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.09	
Average travel speed including passing lane, ATSpl	53.9	
Percent free flow speed including passing lane, PFFSpl	91.4	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	13.00	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-13.10	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.58	
Percent time-spent-following including passing lane, PTSFpl	33.4	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	B	
Peak 15-min total travel time, TT15	2.2	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	196.6
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.45
Bicycle LOS	C

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - EB
Highway	54
From/To	Ledonia / 54-J-19 Junciton
Jurisdiction	
Analysis Year	2022
Description	Pass B5 - Existing

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	3.3	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	7	/mi

Analysis direction volume, Vd 197 veh/h
Opposing direction volume, Vo 169 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.5		1.5	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.971		0.971	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	231	pc/h	198	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	1.8	mi/h
Free-flow speed, FFSd	58.3	mi/h
Adjustment for no-passing zones, fnp	1.7	mi/h
Average travel speed, ATSd	53.2	mi/h
Percent Free Flow Speed, PFFS	91.3	%

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	0.994	0.994
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	225 pc/h	193 pc/h
Base percent time-spent-following,(note-4) BPTSFd	23.8 %	
Adjustment for no-passing zones, fnp	39.0	
Percent time-spent-following, PTSFd	44.8 %	

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.13	
Peak 15-min vehicle-miles of travel, VMT15	185	veh-mi
Peak-hour vehicle-miles of travel, VMT60	650	veh-mi
Peak 15-min total travel time, TT15	3.5	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	3.3	mi
Length of two-lane highway upstream of the passing lane, Lu	2.2	mi
Length of passing lane including tapers, Lpl	1.0	mi
Average travel speed, ATSd (from above)	53.2	mi/h
Percent time-spent-following, PTSFd (from above)	44.8	
Level of service, LOSd (from above)	B	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.60	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.09	
Average travel speed including passing lane, ATSpl	54.7	
Percent free flow speed including passing lane, PFFSpl	93.9	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	12.65	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-12.55	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.59	
Percent time-spent-following including passing lane, PTSFpl	38.7	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	B	
Peak 15-min total travel time, TT15	3.4	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	223.9
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.51
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - WB
Highway	54
From/To	Ledonia / 54-J-19 Junciton
Jurisdiction	
Analysis Year	2022
Description	Pass B6 - Existing

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	2.6	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	4	/mi

Analysis direction volume, Vd 169 veh/h
Opposing direction volume, Vo 197 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.5		1.5	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.971		0.971	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	198	pc/h	231	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	1.0	mi/h
Free-flow speed, FFSd	59.0	mi/h
Adjustment for no-passing zones, fnp	1.8	mi/h
Average travel speed, ATSd	53.9	mi/h
Percent Free Flow Speed, PFFS	91.4	%

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	0.994	0.994
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	193 pc/h	225 pc/h
Base percent time-spent-following,(note-4) BPTSFd	21.6 %	
Adjustment for no-passing zones, fnp	39.0	
Percent time-spent-following, PTSFd	39.6 %	

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.11	
Peak 15-min vehicle-miles of travel, VMT15	125	veh-mi
Peak-hour vehicle-miles of travel, VMT60	439	veh-mi
Peak 15-min total travel time, TT15	2.3	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	2.6	mi
Length of two-lane highway upstream of the passing lane, Lu	1.6	mi
Length of passing lane including tapers, Lpl	1.0	mi
Average travel speed, ATSd (from above)	53.9	mi/h
Percent time-spent-following, PTSFd (from above)	39.6	
Level of service, LOSd (from above)	B	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.08	
Average travel speed including passing lane, ATSpl	55.5	
Percent free flow speed including passing lane, PFFSpl	94.1	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	13.00	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-13.00	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.58	
Percent time-spent-following including passing lane, PTSFpl	33.2	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	A	
Peak 15-min total travel time, TT15	2.3	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	192.0
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.43
Bicycle LOS	C

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - EB
Highway	54
From/To	54-J-19 Junciton / Farber
Jurisdiction	
Analysis Year	2022
Description	Pass C1 - Existing

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	2.4	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	3	/mi

Analysis direction volume, Vd 122 veh/h
Opposing direction volume, Vo 117 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.7		1.8	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.960		0.954	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	144	pc/h	139	pc/h

Free-Flow Speed from Field Measurement:

Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h

Estimated Free-Flow Speed:

Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	0.8	mi/h
Free-flow speed, FFSd	59.3	mi/h
Adjustment for no-passing zones, fnp	1.1	mi/h
Average travel speed, ATSd	55.9	mi/h
Percent Free Flow Speed, PFFS	94.4	%

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.1		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	0.994		0.994	
Grade adjustment factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	139	pc/h	134	pc/h
Base percent time-spent-following,(note-4) BPTSFd	15.7	%		
Adjustment for no-passing zones, fnp	33.4			
Percent time-spent-following, PTSFd	32.7	%		

Level of Service and Other Performance Measures

Level of service, LOS	A	
Volume to capacity ratio, v/c	0.08	
Peak 15-min vehicle-miles of travel, VMT15	83	veh-mi
Peak-hour vehicle-miles of travel, VMT60	293	veh-mi
Peak 15-min total travel time, TT15	1.5	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	2.4	mi
Length of two-lane highway upstream of the passing lane, Lu	1.2	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	55.9	mi/h
Percent time-spent-following, PTSFd (from above)	32.7	
Level of service, LOSd (from above)	A	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.08	
Average travel speed including passing lane, ATSpl	58.1	
Percent free flow speed including passing lane, PFFSpl	98.0	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	13.00	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-13.00	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.58	
Percent time-spent-following including passing lane, PTSFpl	25.8	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	A	
Peak 15-min total travel time, TT15	1.4	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	138.6
Effective width of outside lane, We	33.41
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	1.07
Bicycle LOS	A

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - WB
Highway	54
From/To	54-J-19 Junciton / Farber
Jurisdiction	
Analysis Year	2022
Description	Pass C2 - Existing

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	3.1	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	3	/mi

Analysis direction volume, Vd 117 veh/h
Opposing direction volume, Vo 122 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.8		1.7	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.954		0.960	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	139	pc/h	144	pc/h

Free-Flow Speed from Field Measurement:

Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h

Estimated Free-Flow Speed:

Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	0.8	mi/h
Free-flow speed, FFSd	59.3	mi/h
Adjustment for no-passing zones, fnp	1.2	mi/h
Average travel speed, ATSd	55.9	mi/h
Percent Free Flow Speed, PFFS	94.3	%

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	0.994	0.994
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	134 pc/h	139 pc/h
Base percent time-spent-following,(note-4) BPTSFd	15.2 %	
Adjustment for no-passing zones, fnp	33.4	
Percent time-spent-following, PTSFd	31.6 %	

Level of Service and Other Performance Measures

Level of service, LOS	A	
Volume to capacity ratio, v/c	0.08	
Peak 15-min vehicle-miles of travel, VMT15	103	veh-mi
Peak-hour vehicle-miles of travel, VMT60	363	veh-mi
Peak 15-min total travel time, TT15	1.8	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	3.1	mi
Length of two-lane highway upstream of the passing lane, Lu	1.9	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	55.9	mi/h
Percent time-spent-following, PTSFd (from above)	31.6	
Level of service, LOSd (from above)	A	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.08	
Average travel speed including passing lane, ATSpl	57.5	
Percent free flow speed including passing lane, PFFSpl	97.1	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	13.00	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-13.00	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.58	
Percent time-spent-following including passing lane, PTSFpl	26.5	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	A	
Peak 15-min total travel time, TT15	1.8	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	133.0
Effective width of outside lane, We	33.89
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	0.88
Bicycle LOS	A

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - EB
Highway	54
From/To	Farber / Vandalia
Jurisdiction	
Analysis Year	2022
Description	Pass C3 - Existing

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	4.7	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	2	/mi

Analysis direction volume, Vd	104	veh/h
Opposing direction volume, Vo	110	veh/h

Average Travel Speed

Direction	Analysis (d)		Opposing (o)	
PCE for trucks, ET	1.8		1.8	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor, (note-5) fHV	0.954		0.954	
Grade adj. factor, (note-1) fg	1.00		1.00	
Directional flow rate, (note-2) vi	124	pc/h	131	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed, (note-3) S FM	-	mi/h
Observed total demand, (note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, (note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width, (note-3) fLS	0.0	mi/h
Adj. for access point density, (note-3) fA	0.5	mi/h
Free-flow speed, FFSd	59.5	mi/h
Adjustment for no-passing zones, fnp	1.0	mi/h
Average travel speed, ATSd	56.5	mi/h
Percent Free Flow Speed, PFFS	94.9	%

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.1		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	0.994		0.994	
Grade adjustment factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	119	pc/h	126	pc/h
Base percent time-spent-following,(note-4) BPTSFd	13.6	%		
Adjustment for no-passing zones, fnp	31.9			
Percent time-spent-following, PTSFd	29.1	%		

Level of Service and Other Performance Measures

Level of service, LOS	A	
Volume to capacity ratio, v/c	0.07	
Peak 15-min vehicle-miles of travel, VMT15	139	veh-mi
Peak-hour vehicle-miles of travel, VMT60	489	veh-mi
Peak 15-min total travel time, TT15	2.5	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	4.7	mi
Length of two-lane highway upstream of the passing lane, Lu	3.5	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	56.5	mi/h
Percent time-spent-following, PTSFd (from above)	29.1	
Level of service, LOSd (from above)	A	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.08	
Average travel speed including passing lane, ATSpl	57.6	
Percent free flow speed including passing lane, PFFSpl	96.7	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	13.00	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-13.00	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.58	
Percent time-spent-following including passing lane, PTSFpl	26.0	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	A	
Peak 15-min total travel time, TT15	2.4	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	118.2
Effective width of outside lane, We	35.12
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	0.40
Bicycle LOS	A

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis–the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15–14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - WB
Highway	54
From/To	Farber / Vandalia
Jurisdiction	
Analysis Year	2022
Description	Pass C4 - Existing

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	3.9	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	5	/mi

Analysis direction volume, Vd 110 veh/h
Opposing direction volume, Vo 104 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.8		1.8	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.954		0.954	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	131	pc/h	124	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	1.3	mi/h
Free-flow speed, FFSd	58.8	mi/h
Adjustment for no-passing zones, fnp	0.9	mi/h
Average travel speed, ATSd	55.8	mi/h
Percent Free Flow Speed, PFFS	95.1	%

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	0.994	0.994
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	126 pc/h	119 pc/h
Base percent time-spent-following,(note-4) BPTSFd	14.3 %	
Adjustment for no-passing zones, fnp	31.9	
Percent time-spent-following, PTSFd	30.7 %	

Level of Service and Other Performance Measures

Level of service, LOS	A	
Volume to capacity ratio, v/c	0.07	
Peak 15-min vehicle-miles of travel, VMT15	122	veh-mi
Peak-hour vehicle-miles of travel, VMT60	429	veh-mi
Peak 15-min total travel time, TT15	2.2	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	3.9	mi
Length of two-lane highway upstream of the passing lane, Lu	2.7	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	55.8	mi/h
Percent time-spent-following, PTSFd (from above)	30.7	
Level of service, LOSd (from above)	A	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.08	
Average travel speed including passing lane, ATSpl	57.1	
Percent free flow speed including passing lane, PFFSpl	97.3	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	13.00	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-13.00	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.58	
Percent time-spent-following including passing lane, PTSFpl	26.7	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	A	
Peak 15-min total travel time, TT15	2.1	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	125.0
Effective width of outside lane, We	34.55
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	0.63
Bicycle LOS	A

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - EB
Highway	54
From/To	Vandalia / 154 Junciton
Jurisdiction	
Analysis Year	2022
Description	Pass C5 - Existing

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	2.0	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	2	/mi

Analysis direction volume, Vd 168 veh/h
Opposing direction volume, Vo 173 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.5		1.5	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.971		0.971	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	197	pc/h	202	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	0.5	mi/h
Free-flow speed, FFSd	59.5	mi/h
Adjustment for no-passing zones, fnp	1.9	mi/h
Average travel speed, ATSd	54.5	mi/h
Percent Free Flow Speed, PFFS	91.7	%

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	0.994	0.994
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	192 pc/h	198 pc/h
Base percent time-spent-following,(note-4) BPTSFd	20.8 %	
Adjustment for no-passing zones, fnp	40.1	
Percent time-spent-following, PTSFd	40.5 %	

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.11	
Peak 15-min vehicle-miles of travel, VMT15	95	veh-mi
Peak-hour vehicle-miles of travel, VMT60	336	veh-mi
Peak 15-min total travel time, TT15	1.7	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	2.0	mi
Length of two-lane highway upstream of the passing lane, Lu	0.8	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	54.5	mi/h
Percent time-spent-following, PTSFd (from above)	40.5	
Level of service, LOSd (from above)	B	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.08	
Average travel speed including passing lane, ATSpl	57.1	
Percent free flow speed including passing lane, PFFSpl	95.9	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	13.00	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-13.00	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.58	
Percent time-spent-following including passing lane, PTSFpl	30.3	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	A	
Peak 15-min total travel time, TT15	1.7	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	190.9
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.43
Bicycle LOS	C

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - WB
Highway	54
From/To	Vandalia / 154 Junciton
Jurisdiction	
Analysis Year	2022
Description	Pass C6 - Existing

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	3.2	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	5	/mi

Analysis direction volume, Vd 173 veh/h
Opposing direction volume, Vo 168 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.5		1.5	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.971		0.971	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	202	pc/h	197	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	1.3	mi/h
Free-flow speed, FFSd	58.8	mi/h
Adjustment for no-passing zones, fnp	1.8	mi/h
Average travel speed, ATSd	53.9	mi/h
Percent Free Flow Speed, PFFS	91.7	%

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	0.994	0.994
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	198 pc/h	192 pc/h
Base percent time-spent-following,(note-4) BPTSFd	21.4 %	
Adjustment for no-passing zones, fnp	40.1	
Percent time-spent-following, PTSFd	41.8 %	

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.12	
Peak 15-min vehicle-miles of travel, VMT15	157	veh-mi
Peak-hour vehicle-miles of travel, VMT60	554	veh-mi
Peak 15-min total travel time, TT15	2.9	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	3.2	mi
Length of two-lane highway upstream of the passing lane, Lu	2.0	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	53.9	mi/h
Percent time-spent-following, PTSFd (from above)	41.8	
Level of service, LOSd (from above)	B	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.09	
Average travel speed including passing lane, ATSpl	55.6	
Percent free flow speed including passing lane, PFFSpl	94.7	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	13.00	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-13.00	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.58	
Percent time-spent-following including passing lane, PTSFpl	35.2	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	B	
Peak 15-min total travel time, TT15	2.8	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	196.6
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.45
Bicycle LOS	C

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - EB
Highway	54
From/To	154 Junciton / Curryville
Jurisdiction	
Analysis Year	2022
Description	Pass D1 - Existing

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	3.2	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	5	/mi

Analysis direction volume, Vd 126 veh/h
Opposing direction volume, Vo 134 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.7		1.7	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.960		0.960	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	149	pc/h	159	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	1.3	mi/h
Free-flow speed, FFSd	58.8	mi/h
Adjustment for no-passing zones, fnp	1.3	mi/h
Average travel speed, ATSd	55.0	mi/h
Percent Free Flow Speed, PFFS	93.7	%

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	0.994	0.994
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	144 pc/h	153 pc/h
Base percent time-spent-following,(note-4) BPTSFd	16.2 %	
Adjustment for no-passing zones, fnp	34.7	
Percent time-spent-following, PTSFd	33.0 %	

Level of Service and Other Performance Measures

Level of service, LOS	A	
Volume to capacity ratio, v/c	0.08	
Peak 15-min vehicle-miles of travel, VMT15	115	veh-mi
Peak-hour vehicle-miles of travel, VMT60	403	veh-mi
Peak 15-min total travel time, TT15	2.1	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	3.2	mi
Length of two-lane highway upstream of the passing lane, Lu	2.0	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	55.0	mi/h
Percent time-spent-following, PTSFd (from above)	33.0	
Level of service, LOSd (from above)	A	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.08	
Average travel speed including passing lane, ATSpl	56.6	
Percent free flow speed including passing lane, PFFSpl	96.3	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	13.00	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-13.00	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.58	
Percent time-spent-following including passing lane, PTSFpl	27.8	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	A	
Peak 15-min total travel time, TT15	2.0	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	143.2
Effective width of outside lane, We	33.03
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	1.21
Bicycle LOS	A

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis–the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15–14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - WB
Highway	54
From/To	Vandalia / 154 Junciton
Jurisdiction	
Analysis Year	2022
Description	Pass D2 - Existing

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	4.0	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	3	/mi

Analysis direction volume, Vd	134	veh/h
Opposing direction volume, Vo	126	veh/h

Average Travel Speed

Direction	Analysis (d)		Opposing (o)	
PCE for trucks, ET	1.7		1.7	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor, (note-5) fHV	0.960		0.960	
Grade adj. factor, (note-1) fg	1.00		1.00	
Directional flow rate, (note-2) vi	159	pc/h	149	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed, (note-3) S FM	-	mi/h
Observed total demand, (note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, (note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width, (note-3) fLS	0.0	mi/h
Adj. for access point density, (note-3) fA	0.8	mi/h
Free-flow speed, FFSd	59.3	mi/h
Adjustment for no-passing zones, fnp	1.2	mi/h
Average travel speed, ATSd	55.6	mi/h
Percent Free Flow Speed, PFFS	93.9	%

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	0.994	0.994
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	153 pc/h	144 pc/h
Base percent time-spent-following,(note-4) BPTSFd	17.1 %	
Adjustment for no-passing zones, fnp	34.7	
Percent time-spent-following, PTSFd	35.0 %	

Level of Service and Other Performance Measures

Level of service, LOS	A	
Volume to capacity ratio, v/c	0.09	
Peak 15-min vehicle-miles of travel, VMT15	152	veh-mi
Peak-hour vehicle-miles of travel, VMT60	536	veh-mi
Peak 15-min total travel time, TT15	2.7	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	4.0	mi
Length of two-lane highway upstream of the passing lane, Lu	2.8	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	55.6	mi/h
Percent time-spent-following, PTSFd (from above)	35.0	
Level of service, LOSd (from above)	A	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.08	
Average travel speed including passing lane, ATSpl	56.9	
Percent free flow speed including passing lane, PFFSpl	96.0	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	13.00	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-13.00	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.58	
Percent time-spent-following including passing lane, PTSFpl	30.6	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	A	
Peak 15-min total travel time, TT15	2.7	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	152.3
Effective width of outside lane, We	32.27
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	1.49
Bicycle LOS	A

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - EB
Highway	54
From/To	Curryville / Bowling Green
Jurisdiction	
Analysis Year	2022
Description	Pass D3 - Existing

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	4.4	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	4	/mi

Analysis direction volume, Vd	254	veh/h
Opposing direction volume, Vo	227	veh/h

Average Travel Speed

Direction	Analysis (d)		Opposing (o)	
PCE for trucks, ET	1.4		1.4	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor, (note-5) fHV	0.977		0.977	
Grade adj. factor, (note-1) fg	1.00		1.00	
Directional flow rate, (note-2) vi	295	pc/h	264	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed, (note-3) S FM	-	mi/h
Observed total demand, (note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, (note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width, (note-3) fLS	0.0	mi/h
Adj. for access point density, (note-3) fA	1.0	mi/h
Free-flow speed, FFSd	59.0	mi/h
Adjustment for no-passing zones, fnp	1.7	mi/h
Average travel speed, ATSd	53.0	mi/h
Percent Free Flow Speed, PFFS	89.8	%

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.1		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	0.994		0.994	
Grade adjustment factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	290	pc/h	260	pc/h
Base percent time-spent-following,(note-4) BPTSFd	30.6	%		
Adjustment for no-passing zones, fnp	38.3			
Percent time-spent-following, PTSFd	50.8	%		

Level of Service and Other Performance Measures

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.17	
Peak 15-min vehicle-miles of travel, VMT15	318	veh-mi
Peak-hour vehicle-miles of travel, VMT60	1118	veh-mi
Peak 15-min total travel time, TT15	6.0	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	4.4	mi
Length of two-lane highway upstream of the passing lane, Lu	3.2	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	53.0	mi/h
Percent time-spent-following, PTSFd (from above)	50.8	
Level of service, LOSd (from above)	C	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.09	
Average travel speed including passing lane, ATSpl	54.2	
Percent free flow speed including passing lane, PFFSpl	91.9	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	11.74	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-11.74	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.59	
Percent time-spent-following including passing lane, PTSFpl	45.1	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	B	
Peak 15-min total travel time, TT15	5.9	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	288.6
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.64
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - WB
Highway	54
From/To	Curryville / Bowling Green
Jurisdiction	
Analysis Year	2022
Description	Pass D4 - Existing

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	3.8	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	2	/mi

Analysis direction volume, Vd 227 veh/h
Opposing direction volume, Vo 254 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.4		1.4	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.977		0.977	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	264	pc/h	295	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	0.5	mi/h
Free-flow speed, FFSd	59.5	mi/h
Adjustment for no-passing zones, fnp	1.6	mi/h
Average travel speed, ATSd	53.5	mi/h
Percent Free Flow Speed, PFFS	90.0	%

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	0.994	0.994
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	260 pc/h	290 pc/h
Base percent time-spent-following,(note-4) BPTSFd	30.0 %	
Adjustment for no-passing zones, fnp	38.3	
Percent time-spent-following, PTSFd	48.1 %	

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.15	
Peak 15-min vehicle-miles of travel, VMT15	245	veh-mi
Peak-hour vehicle-miles of travel, VMT60	863	veh-mi
Peak 15-min total travel time, TT15	4.6	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	3.8	mi
Length of two-lane highway upstream of the passing lane, Lu	2.6	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	53.5	mi/h
Percent time-spent-following, PTSFd (from above)	48.1	
Level of service, LOSd (from above)	B	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.09	
Average travel speed including passing lane, ATSpl	55.0	
Percent free flow speed including passing lane, PFFSpl	92.4	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	12.16	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-12.16	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.59	
Percent time-spent-following including passing lane, PTSFpl	41.9	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	B	
Peak 15-min total travel time, TT15	4.5	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	258.0
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.58
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - EB
Highway	54
From/To	Curryville / Bowling Green
Jurisdiction	
Analysis Year	2022
Description	Pass D5 - Existing

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	2.5	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	4	/mi

Analysis direction volume, Vd 254 veh/h
Opposing direction volume, Vo 227 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.4		1.4	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.977		0.977	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	295	pc/h	264	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	1.0	mi/h
Free-flow speed, FFSd	59.0	mi/h
Adjustment for no-passing zones, fnp	1.7	mi/h
Average travel speed, ATSd	53.0	mi/h
Percent Free Flow Speed, PFFS	89.8	%

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.1		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	0.994		0.994	
Grade adjustment factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	290	pc/h	260	pc/h
Base percent time-spent-following,(note-4) BPTSFd	30.6	%		
Adjustment for no-passing zones, fnp	38.3			
Percent time-spent-following, PTSFd	50.8	%		

Level of Service and Other Performance Measures

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.17	
Peak 15-min vehicle-miles of travel, VMT15	180	veh-mi
Peak-hour vehicle-miles of travel, VMT60	635	veh-mi
Peak 15-min total travel time, TT15	3.4	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	2.5	mi
Length of two-lane highway upstream of the passing lane, Lu	1.3	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	53.0	mi/h
Percent time-spent-following, PTSFd (from above)	50.8	
Level of service, LOSd (from above)	C	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.09	
Average travel speed including passing lane, ATSpl	55.2	
Percent free flow speed including passing lane, PFFSpl	93.5	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	11.74	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-11.74	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.59	
Percent time-spent-following including passing lane, PTSFpl	40.8	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	B	
Peak 15-min total travel time, TT15	3.3	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	288.6
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.64
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - WB
Highway	54
From/To	Curryville / Bowling Green
Jurisdiction	
Analysis Year	2022
Description	Pass D6 - Existing

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	2.4	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	7	/mi

Analysis direction volume, Vd 227 veh/h
Opposing direction volume, Vo 254 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.4		1.4	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.977		0.977	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	264	pc/h	295	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	1.8	mi/h
Free-flow speed, FFSd	58.3	mi/h
Adjustment for no-passing zones, fnp	1.6	mi/h
Average travel speed, ATSd	52.3	mi/h
Percent Free Flow Speed, PFFS	89.9	%

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.1		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	0.994		0.994	
Grade adjustment factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	260	pc/h	290	pc/h
Base percent time-spent-following,(note-4) BPTSFd	30.0	%		
Adjustment for no-passing zones, fnp	38.3			
Percent time-spent-following, PTSFd	48.1	%		

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.15	
Peak 15-min vehicle-miles of travel, VMT15	155	veh-mi
Peak-hour vehicle-miles of travel, VMT60	545	veh-mi
Peak 15-min total travel time, TT15	3.0	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	2.4	mi
Length of two-lane highway upstream of the passing lane, Lu	1.2	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	52.3	mi/h
Percent time-spent-following, PTSFd (from above)	48.1	
Level of service, LOSd (from above)	B	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.09	
Average travel speed including passing lane, ATSpl	54.6	
Percent free flow speed including passing lane, PFFSpl	93.7	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	12.16	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-12.16	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.59	
Percent time-spent-following including passing lane, PTSFpl	38.2	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	B	
Peak 15-min total travel time, TT15	2.8	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	258.0
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.58
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - EB
Highway	54
From/To	Bowling Green / Virginia
Jurisdiction	
Analysis Year	2022
Description	Pass E1 - Existing

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	2.3	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	7	/mi

Analysis direction volume, Vd 269 veh/h
Opposing direction volume, Vo 242 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.4		1.4	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.977		0.977	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	313	pc/h	281	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	1.8	mi/h
Free-flow speed, FFSd	58.3	mi/h
Adjustment for no-passing zones, fnp	1.6	mi/h
Average travel speed, ATSd	52.0	mi/h
Percent Free Flow Speed, PFFS	89.3	%

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.1		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	0.994		0.994	
Grade adjustment factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	308	pc/h	277	pc/h
Base percent time-spent-following,(note-4) BPTSFd	33.1	%		
Adjustment for no-passing zones, fnp	38.0			
Percent time-spent-following, PTSFd	53.1	%		

Level of Service and Other Performance Measures

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.18	
Peak 15-min vehicle-miles of travel, VMT15	176	veh-mi
Peak-hour vehicle-miles of travel, VMT60	619	veh-mi
Peak 15-min total travel time, TT15	3.4	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	2.3	mi
Length of two-lane highway upstream of the passing lane, Lu	1.0	mi
Length of passing lane including tapers, Lpl	1.3	mi
Average travel speed, ATSd (from above)	52.0	mi/h
Percent time-spent-following, PTSFd (from above)	53.1	
Level of service, LOSd (from above)	C	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.10	
Average travel speed including passing lane, ATSpl	54.9	
Percent free flow speed including passing lane, PFFSpl	94.2	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	11.32	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-11.32	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.60	
Percent time-spent-following including passing lane, PTSFpl	41.1	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	B	
Peak 15-min total travel time, TT15	3.2	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	305.7
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.67
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - WB
Highway	54
From/To	Bowling Green / Virginia
Jurisdiction	
Analysis Year	2022
Description	Pass E2 - Existing

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	2.8	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	7	/mi

Analysis direction volume, Vd 242 veh/h
Opposing direction volume, Vo 269 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.4		1.4	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.977		0.977	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	281	pc/h	313	pc/h

Free-Flow Speed from Field Measurement:

Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h

Estimated Free-Flow Speed:

Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	1.8	mi/h
Free-flow speed, FFSd	58.3	mi/h
Adjustment for no-passing zones, fnp	1.5	mi/h
Average travel speed, ATSd	52.1	mi/h
Percent Free Flow Speed, PFFS	89.4	%

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	0.994	0.994
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	277 pc/h	308 pc/h
Base percent time-spent-following,(note-4) BPTSFd	30.8 %	
Adjustment for no-passing zones, fnp	38.0	
Percent time-spent-following, PTSFd	48.8 %	

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.16	
Peak 15-min vehicle-miles of travel, VMT15	192	veh-mi
Peak-hour vehicle-miles of travel, VMT60	678	veh-mi
Peak 15-min total travel time, TT15	3.7	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	2.8	mi
Length of two-lane highway upstream of the passing lane, Lu	0.8	mi
Length of passing lane including tapers, Lpl	2.1	mi
Average travel speed, ATSd (from above)	52.1	mi/h
Percent time-spent-following, PTSFd (from above)	48.8	
Level of service, LOSd (from above)	B	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.80	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.09	
Average travel speed including passing lane, ATSpl	53.5	
Percent free flow speed including passing lane, PFFSpl	91.9	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	11.92	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-12.02	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.59	
Percent time-spent-following including passing lane, PTSFpl	34.5	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	B	
Peak 15-min total travel time, TT15	3.6	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	275.0
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.61
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - EB
Highway	54
From/To	Bowling Green / Virginia
Jurisdiction	
Analysis Year	2022
Description	Pass E3 - Existing

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	3.4	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	7	/mi

Analysis direction volume, Vd 269 veh/h
Opposing direction volume, Vo 242 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.4		1.4	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.977		0.977	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	313	pc/h	281	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	1.8	mi/h
Free-flow speed, FFSd	58.3	mi/h
Adjustment for no-passing zones, fnp	1.6	mi/h
Average travel speed, ATSd	52.0	mi/h
Percent Free Flow Speed, PFFS	89.3	%

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	0.994	0.994
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	308 pc/h	277 pc/h
Base percent time-spent-following,(note-4) BPTSFd	33.1 %	
Adjustment for no-passing zones, fnp	38.0	
Percent time-spent-following, PTSFd	53.1 %	

Level of Service and Other Performance Measures

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.18	
Peak 15-min vehicle-miles of travel, VMT15	260	veh-mi
Peak-hour vehicle-miles of travel, VMT60	915	veh-mi
Peak 15-min total travel time, TT15	5.0	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	3.4	mi
Length of two-lane highway upstream of the passing lane, Lu	2.5	mi
Length of passing lane including tapers, Lpl	0.8	mi
Average travel speed, ATSd (from above)	52.0	mi/h
Percent time-spent-following, PTSFd (from above)	53.1	
Level of service, LOSd (from above)	C	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.60	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.10	
Average travel speed including passing lane, ATSpl	53.3	
Percent free flow speed including passing lane, PFFSpl	91.5	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	11.32	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-11.22	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.60	
Percent time-spent-following including passing lane, PTSFpl	47.5	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	B	
Peak 15-min total travel time, TT15	4.9	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	305.7
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.67
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - WB
Highway	54
From/To	Bowling Green / Virginia
Jurisdiction	
Analysis Year	2022
Description	Pass E4 - Existing

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	2.0	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	7	/mi

Analysis direction volume, Vd 242 veh/h
Opposing direction volume, Vo 269 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.4		1.4	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.977		0.977	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	281	pc/h	313	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	1.8	mi/h
Free-flow speed, FFSd	58.3	mi/h
Adjustment for no-passing zones, fnp	1.5	mi/h
Average travel speed, ATSd	52.1	mi/h
Percent Free Flow Speed, PFFS	89.4	%

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	0.994	0.994
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	277 pc/h	308 pc/h
Base percent time-spent-following,(note-4) BPTSFd	30.8 %	
Adjustment for no-passing zones, fnp	38.0	
Percent time-spent-following, PTSFd	48.8 %	

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.16	
Peak 15-min vehicle-miles of travel, VMT15	138	veh-mi
Peak-hour vehicle-miles of travel, VMT60	484	veh-mi
Peak 15-min total travel time, TT15	2.6	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	2.0	mi
Length of two-lane highway upstream of the passing lane, Lu	1.2	mi
Length of passing lane including tapers, Lpl	0.8	mi
Average travel speed, ATSd (from above)	52.1	mi/h
Percent time-spent-following, PTSFd (from above)	48.8	
Level of service, LOSd (from above)	B	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.09	
Average travel speed including passing lane, ATSpl	53.9	
Percent free flow speed including passing lane, PFFSpl	92.5	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	11.92	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-11.92	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.59	
Percent time-spent-following including passing lane, PTSFpl	40.8	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	B	
Peak 15-min total travel time, TT15	2.6	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	275.0
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.61
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

D.2.2: HCS Reports – 2044

(84 pages)

- Section A
  - 6 segments at 3 pages each: 18 pages
- Section B
  - 6 segments at 3 pages each: 18 pages
- Section C
  - 6 segments at 3 pages each: 18 pages
- Section D
  - 6 segments at 3 pages each: 18 pages
- Section E
  - 4 segments at 3 pages each: 12 pages

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84 pages

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - EB
Highway	54
From/To	Rt A / Scotts Corner
Jurisdiction	
Analysis Year	2042
Description	Pass A1 Future

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	0.3	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	2	/mi

Analysis direction volume, Vd 233 veh/h
Opposing direction volume, Vo 249 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.4		1.4	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.977		0.977	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	271	pc/h	290	pc/h

Free-Flow Speed from Field Measurement:

Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h

Estimated Free-Flow Speed:

Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	0.5	mi/h
Free-flow speed, FFSd	59.5	mi/h
Adjustment for no-passing zones, fnp	1.6	mi/h
Average travel speed, ATSd	53.5	mi/h
Percent Free Flow Speed, PFFS	89.9	%

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.1		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	0.994		0.994	
Grade adjustment factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	266	pc/h	285	pc/h
Base percent time-spent-following,(note-4) BPTSFd	29.2	%		
Adjustment for no-passing zones, fnp	38.5			
Percent time-spent-following, PTSFd	47.8	%		

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.16	
Peak 15-min vehicle-miles of travel, VMT15	20	veh-mi
Peak-hour vehicle-miles of travel, VMT60	70	veh-mi
Peak 15-min total travel time, TT15	0.4	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	0.3	mi
Length of two-lane highway upstream of the passing lane, Lu	0.0	mi
Length of passing lane including tapers, Lpl	0.0	mi
Average travel speed, ATSd (from above)	53.5	mi/h
Percent time-spent-following, PTSFd (from above)	47.8	
Level of service, LOSd (from above)	B	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.40	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.09	
Average travel speed including passing lane, ATSpl	57.9	
Percent free flow speed including passing lane, PFFSpl	97.3	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	12.08	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-11.78	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.59	
Percent time-spent-following including passing lane, PTSFpl	28.4	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	A	
Peak 15-min total travel time, TT15	0.3	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	264.8
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.60
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - WB
Highway	54
From/To	Rt A / Scotts Corner
Jurisdiction	
Analysis Year	2042
Description	Pass A2 Future

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	2.2	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	2	/mi

Analysis direction volume, Vd 249 veh/h
Opposing direction volume, Vo 233 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.4		1.4	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.977		0.977	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	290	pc/h	271	pc/h

Free-Flow Speed from Field Measurement:

Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h

Estimated Free-Flow Speed:

Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	0.5	mi/h
Free-flow speed, FFSd	59.5	mi/h
Adjustment for no-passing zones, fnp	1.7	mi/h
Average travel speed, ATSd	53.5	mi/h
Percent Free Flow Speed, PFFS	89.8	%

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.1		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	0.994		0.994	
Grade adjustment factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	285	pc/h	266	pc/h
Base percent time-spent-following,(note-4) BPTSFd	31.5	%		
Adjustment for no-passing zones, fnp	38.5			
Percent time-spent-following, PTSFd	51.4	%		

Level of Service and Other Performance Measures

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.17	
Peak 15-min vehicle-miles of travel, VMT15	156	veh-mi
Peak-hour vehicle-miles of travel, VMT60	548	veh-mi
Peak 15-min total travel time, TT15	2.9	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	2.2	mi
Length of two-lane highway upstream of the passing lane, Lu	0.9	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	53.5	mi/h
Percent time-spent-following, PTSFd (from above)	51.4	
Level of service, LOSd (from above)	C	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.60	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.09	
Average travel speed including passing lane, ATSpl	56.2	
Percent free flow speed including passing lane, PFFSpl	94.4	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	11.81	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-11.71	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.59	
Percent time-spent-following including passing lane, PTSFpl	39.0	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	B	
Peak 15-min total travel time, TT15	2.8	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	283.0
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.63
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - EB
Highway	54
From/To	Rt A / Scotts Corner
Jurisdiction	
Analysis Year	2042
Description	Pass A3 Future

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	3.3	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	4	/mi

Analysis direction volume, Vd 233 veh/h
Opposing direction volume, Vo 249 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.4		1.4	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.977		0.977	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	271	pc/h	290	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	1.0	mi/h
Free-flow speed, FFSd	59.0	mi/h
Adjustment for no-passing zones, fnp	1.6	mi/h
Average travel speed, ATSd	53.0	mi/h
Percent Free Flow Speed, PFFS	89.9	%

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.1		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	0.994		0.994	
Grade adjustment factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	266	pc/h	285	pc/h
Base percent time-spent-following,(note-4) BPTSFd	29.2	%		
Adjustment for no-passing zones, fnp	38.5			
Percent time-spent-following, PTSFd	47.8	%		

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.16	
Peak 15-min vehicle-miles of travel, VMT15	218	veh-mi
Peak-hour vehicle-miles of travel, VMT60	769	veh-mi
Peak 15-min total travel time, TT15	4.1	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	3.3	mi
Length of two-lane highway upstream of the passing lane, Lu	2.0	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	53.0	mi/h
Percent time-spent-following, PTSFd (from above)	47.8	
Level of service, LOSd (from above)	B	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.60	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.09	
Average travel speed including passing lane, ATSpl	54.8	
Percent free flow speed including passing lane, PFFSpl	92.9	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	12.08	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-11.98	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.59	
Percent time-spent-following including passing lane, PTSFpl	40.1	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	B	
Peak 15-min total travel time, TT15	4.0	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	264.8
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.60
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - WB
Highway	54
From/To	Rt A / Scotts Corner
Jurisdiction	
Analysis Year	2042
Description	Pass A4 Future

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	3.7	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	5	/mi

Analysis direction volume, Vd 249 veh/h
Opposing direction volume, Vo 233 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.4		1.4	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.977		0.977	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	290	pc/h	271	pc/h

Free-Flow Speed from Field Measurement:

Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h

Estimated Free-Flow Speed:

Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	1.3	mi/h
Free-flow speed, FFSd	58.8	mi/h
Adjustment for no-passing zones, fnp	1.6	mi/h
Average travel speed, ATSd	52.7	mi/h
Percent Free Flow Speed, PFFS	89.8	%

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.1		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	0.994		0.994	
Grade adjustment factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	285	pc/h	266	pc/h
Base percent time-spent-following,(note-4) BPTSFd	31.5	%		
Adjustment for no-passing zones, fnp	38.5			
Percent time-spent-following, PTSFd	51.4	%		

Level of Service and Other Performance Measures

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.17	
Peak 15-min vehicle-miles of travel, VMT15	262	veh-mi
Peak-hour vehicle-miles of travel, VMT60	921	veh-mi
Peak 15-min total travel time, TT15	5.0	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	3.7	mi
Length of two-lane highway upstream of the passing lane, Lu	2.4	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	52.7	mi/h
Percent time-spent-following, PTSFd (from above)	51.4	
Level of service, LOSd (from above)	C	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.60	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.09	
Average travel speed including passing lane, ATSpl	54.3	
Percent free flow speed including passing lane, PFFSpl	92.5	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	11.81	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-11.71	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.59	
Percent time-spent-following including passing lane, PTSFpl	44.0	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	B	
Peak 15-min total travel time, TT15	4.8	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	283.0
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.63
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - EB
Highway	54
From/To	Rt A / Scotts Corner
Jurisdiction	
Analysis Year	2042
Description	Pass A5 Future

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	2.8	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	5	/mi

Analysis direction volume, Vd 233 veh/h
Opposing direction volume, Vo 249 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.4		1.4	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.977		0.977	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	271	pc/h	290	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	1.3	mi/h
Free-flow speed, FFSd	58.8	mi/h
Adjustment for no-passing zones, fnp	1.6	mi/h
Average travel speed, ATSd	52.8	mi/h
Percent Free Flow Speed, PFFS	89.9	%

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.1		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	0.994		0.994	
Grade adjustment factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	266	pc/h	285	pc/h
Base percent time-spent-following,(note-4) BPTSFd	29.2	%		
Adjustment for no-passing zones, fnp	38.5			
Percent time-spent-following, PTSFd	47.8	%		

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.16	
Peak 15-min vehicle-miles of travel, VMT15	185	veh-mi
Peak-hour vehicle-miles of travel, VMT60	652	veh-mi
Peak 15-min total travel time, TT15	3.5	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	2.8	mi
Length of two-lane highway upstream of the passing lane, Lu	1.6	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	52.8	mi/h
Percent time-spent-following, PTSFd (from above)	47.8	
Level of service, LOSd (from above)	B	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.09	
Average travel speed including passing lane, ATSpl	54.7	
Percent free flow speed including passing lane, PFFSpl	93.1	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	12.08	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-12.08	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.59	
Percent time-spent-following including passing lane, PTSFpl	39.4	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	B	
Peak 15-min total travel time, TT15	3.4	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	264.8
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.60
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - WB
Highway	54
From/To	Rt A / Scotts Corner
Jurisdiction	
Analysis Year	2042
Description	Pass A6 Future

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	2.4	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Rolling		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	3	/mi

Analysis direction volume, Vd 249 veh/h
Opposing direction volume, Vo 233 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	2.1		2.2	
PCE for RVs, ER	1.1		1.1	
Heavy-vehicle adj. factor,(note-5) fHV	0.935		0.929	
Grade adj. factor,(note-1) fg	0.82		0.80	
Directional flow rate,(note-2) vi	369	pc/h	356	pc/h

Free-Flow Speed from Field Measurement:

Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h

Estimated Free-Flow Speed:

Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	0.8	mi/h
Free-flow speed, FFSd	59.3	mi/h
Adjustment for no-passing zones, fnp	1.5	mi/h
Average travel speed, ATSd	52.1	mi/h
Percent Free Flow Speed, PFFS	88.0	%

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.7	1.7
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	0.960	0.960
Grade adjustment factor,(note-1) fg	0.84	0.83
Directional flow rate,(note-2) vi	351 pc/h	332 pc/h
Base percent time-spent-following,(note-4) BPTSFd	37.4 %	
Adjustment for no-passing zones, fnp	35.9	
Percent time-spent-following, PTSFd	55.8 %	

Level of Service and Other Performance Measures

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.17	
Peak 15-min vehicle-miles of travel, VMT15	170	veh-mi
Peak-hour vehicle-miles of travel, VMT60	598	veh-mi
Peak 15-min total travel time, TT15	3.3	veh-h
Capacity from ATS, CdATS	1663	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1663	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	2.4	mi
Length of two-lane highway upstream of the passing lane, Lu	1.2	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	52.1	mi/h
Percent time-spent-following, PTSFd (from above)	55.8	
Level of service, LOSd (from above)	C	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.10	
Average travel speed including passing lane, ATSpl	54.6	
Percent free flow speed including passing lane, PFFSpl	92.2	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	9.82	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-9.82	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.60	
Percent time-spent-following including passing lane, PTSFpl	44.6	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	B	
Peak 15-min total travel time, TT15	3.1	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	283.0
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.63
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - EB
Highway	54
From/To	Scotts Corner / Ledonia
Jurisdiction	
Analysis Year	2042
Description	Pass B1 Future

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	2.9	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	6	/mi

Analysis direction volume, Vd 231 veh/h
Opposing direction volume, Vo 211 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.4		1.5	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.977		0.971	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	269	pc/h	247	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	1.5	mi/h
Free-flow speed, FFSd	58.5	mi/h
Adjustment for no-passing zones, fnp	1.7	mi/h
Average travel speed, ATSd	52.8	mi/h
Percent Free Flow Speed, PFFS	90.3	%

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.1		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	0.994		0.994	
Grade adjustment factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	264	pc/h	241	pc/h
Base percent time-spent-following,(note-4) BPTSFd	29.1	%		
Adjustment for no-passing zones, fnp	38.8			
Percent time-spent-following, PTSFd	49.4	%		

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.15	
Peak 15-min vehicle-miles of travel, VMT15	190	veh-mi
Peak-hour vehicle-miles of travel, VMT60	670	veh-mi
Peak 15-min total travel time, TT15	3.6	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	2.9	mi
Length of two-lane highway upstream of the passing lane, Lu	1.7	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	52.8	mi/h
Percent time-spent-following, PTSFd (from above)	49.4	
Level of service, LOSd (from above)	B	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.09	
Average travel speed including passing lane, ATSpl	54.7	
Percent free flow speed including passing lane, PFFSpl	93.5	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	12.10	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-12.10	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.59	
Percent time-spent-following including passing lane, PTSFpl	41.0	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	B	
Peak 15-min total travel time, TT15	3.5	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	262.5
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.59
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis–the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15–14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - WB
Highway	54
From/To	Scotts Corner / Ledonia
Jurisdiction	
Analysis Year	2042
Description	Pass B2 Future

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	2.6	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	4	/mi

Analysis direction volume, Vd 211 veh/h
Opposing direction volume, Vo 231 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.5		1.4	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.971		0.977	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	247	pc/h	269	pc/h

Free-Flow Speed from Field Measurement:

Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h

Estimated Free-Flow Speed:

Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	1.0	mi/h
Free-flow speed, FFSd	59.0	mi/h
Adjustment for no-passing zones, fnp	1.7	mi/h
Average travel speed, ATSd	53.3	mi/h
Percent Free Flow Speed, PFFS	90.4	%

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.1		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	0.994		0.994	
Grade adjustment factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	241	pc/h	264	pc/h
Base percent time-spent-following,(note-4) BPTSFd	27.6	%		
Adjustment for no-passing zones, fnp	38.8			
Percent time-spent-following, PTSFd	46.1	%		

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.14	
Peak 15-min vehicle-miles of travel, VMT15	156	veh-mi
Peak-hour vehicle-miles of travel, VMT60	549	veh-mi
Peak 15-min total travel time, TT15	2.9	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	2.6	mi
Length of two-lane highway upstream of the passing lane, Lu	1.4	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	53.3	mi/h
Percent time-spent-following, PTSFd (from above)	46.1	
Level of service, LOSd (from above)	B	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.09	
Average travel speed including passing lane, ATSpl	55.4	
Percent free flow speed including passing lane, PFFSpl	94.0	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	12.43	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-12.43	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.59	
Percent time-spent-following including passing lane, PTSFpl	37.4	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	B	
Peak 15-min total travel time, TT15	2.8	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	239.8
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.55
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - EB
Highway	54
From/To	Scotts Corner / Ledonia
Jurisdiction	
Analysis Year	2042
Description	Pass B3 Future

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	2.5	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	6	/mi

Analysis direction volume, Vd 231 veh/h
Opposing direction volume, Vo 211 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.4		1.5	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.977		0.971	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	269	pc/h	247	pc/h

Free-Flow Speed from Field Measurement:

Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h

Estimated Free-Flow Speed:

Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	1.5	mi/h
Free-flow speed, FFSd	58.5	mi/h
Adjustment for no-passing zones, fnp	1.7	mi/h
Average travel speed, ATSd	52.8	mi/h
Percent Free Flow Speed, PFFS	90.3	%

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.1		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	0.994		0.994	
Grade adjustment factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	264	pc/h	241	pc/h
Base percent time-spent-following,(note-4) BPTSFd	29.1	%		
Adjustment for no-passing zones, fnp	38.8			
Percent time-spent-following, PTSFd	49.4	%		

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.15	
Peak 15-min vehicle-miles of travel, VMT15	164	veh-mi
Peak-hour vehicle-miles of travel, VMT60	578	veh-mi
Peak 15-min total travel time, TT15	3.1	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	2.5	mi
Length of two-lane highway upstream of the passing lane, Lu	1.3	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	52.8	mi/h
Percent time-spent-following, PTSFd (from above)	49.4	
Level of service, LOSd (from above)	B	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.09	
Average travel speed including passing lane, ATSpl	55.0	
Percent free flow speed including passing lane, PFFSpl	94.0	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	12.10	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-12.10	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.59	
Percent time-spent-following including passing lane, PTSFpl	39.7	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	B	
Peak 15-min total travel time, TT15	3.0	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	262.5
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.59
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - WB
Highway	54
From/To	Scotts Corner / Ledonia
Jurisdiction	
Analysis Year	2042
Description	Pass B4 Future

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	2.4	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	4	/mi

Analysis direction volume, Vd 211 veh/h
Opposing direction volume, Vo 231 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.5		1.4	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.971		0.977	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	247	pc/h	269	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	1.0	mi/h
Free-flow speed, FFSd	59.0	mi/h
Adjustment for no-passing zones, fnp	1.7	mi/h
Average travel speed, ATSd	53.3	mi/h
Percent Free Flow Speed, PFFS	90.4	%

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.1		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	0.994		0.994	
Grade adjustment factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	241	pc/h	264	pc/h
Base percent time-spent-following,(note-4) BPTSFd	27.6	%		
Adjustment for no-passing zones, fnp	38.8			
Percent time-spent-following, PTSFd	46.1	%		

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.14	
Peak 15-min vehicle-miles of travel, VMT15	144	veh-mi
Peak-hour vehicle-miles of travel, VMT60	506	veh-mi
Peak 15-min total travel time, TT15	2.7	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	2.4	mi
Length of two-lane highway upstream of the passing lane, Lu	1.3	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	53.3	mi/h
Percent time-spent-following, PTSFd (from above)	46.1	
Level of service, LOSd (from above)	B	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.80	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.09	
Average travel speed including passing lane, ATSpl	53.3	
Percent free flow speed including passing lane, PFFSpl	90.4	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	12.43	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-12.53	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.59	
Percent time-spent-following including passing lane, PTSFpl	37.4	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	B	
Peak 15-min total travel time, TT15	2.7	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	239.8
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.55
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - EB
Highway	54
From/To	Ledonia / 54-J-19 Junciton
Jurisdiction	
Analysis Year	2042
Description	Pass B5 Future

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	3.3	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	7	/mi

Analysis direction volume, Vd 240 veh/h
Opposing direction volume, Vo 206 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.4		1.5	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.977		0.971	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	279	pc/h	241	pc/h

Free-Flow Speed from Field Measurement:

Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h

Estimated Free-Flow Speed:

Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	1.8	mi/h
Free-flow speed, FFSd	58.3	mi/h
Adjustment for no-passing zones, fnp	1.7	mi/h
Average travel speed, ATSd	52.5	mi/h
Percent Free Flow Speed, PFFS	90.2	%

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	0.994	0.994
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	274 pc/h	235 pc/h
Base percent time-spent-following,(note-4) BPTSFd	28.5 %	
Adjustment for no-passing zones, fnp	38.4	
Percent time-spent-following, PTSFd	49.2 %	

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.16	
Peak 15-min vehicle-miles of travel, VMT15	225	veh-mi
Peak-hour vehicle-miles of travel, VMT60	792	veh-mi
Peak 15-min total travel time, TT15	4.3	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	3.3	mi
Length of two-lane highway upstream of the passing lane, Lu	2.2	mi
Length of passing lane including tapers, Lpl	1.0	mi
Average travel speed, ATSd (from above)	52.5	mi/h
Percent time-spent-following, PTSFd (from above)	49.2	
Level of service, LOSd (from above)	B	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.60	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.09	
Average travel speed including passing lane, ATSpl	54.0	
Percent free flow speed including passing lane, PFFSpl	92.7	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	11.96	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-11.86	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.59	
Percent time-spent-following including passing lane, PTSFpl	42.5	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	B	
Peak 15-min total travel time, TT15	4.2	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	272.7
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.61
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - WB
Highway	54
From/To	Ledonia / 54-J-19 Junciton
Jurisdiction	
Analysis Year	2042
Description	Pass B6 Future

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	2.6	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	4	/mi

Analysis direction volume, Vd 206 veh/h
Opposing direction volume, Vo 240 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.5		1.4	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.971		0.977	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	241	pc/h	279	pc/h

Free-Flow Speed from Field Measurement:

Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h

Estimated Free-Flow Speed:

Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	1.0	mi/h
Free-flow speed, FFSd	59.0	mi/h
Adjustment for no-passing zones, fnp	1.6	mi/h
Average travel speed, ATSd	53.3	mi/h
Percent Free Flow Speed, PFFS	90.4	%

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.1		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	0.994		0.994	
Grade adjustment factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	235	pc/h	274	pc/h
Base percent time-spent-following,(note-4) BPTSFd	26.7	%		
Adjustment for no-passing zones, fnp	38.4			
Percent time-spent-following, PTSFd	44.4	%		

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.14	
Peak 15-min vehicle-miles of travel, VMT15	152	veh-mi
Peak-hour vehicle-miles of travel, VMT60	536	veh-mi
Peak 15-min total travel time, TT15	2.9	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	2.6	mi
Length of two-lane highway upstream of the passing lane, Lu	1.6	mi
Length of passing lane including tapers, Lpl	1.0	mi
Average travel speed, ATSd (from above)	53.3	mi/h
Percent time-spent-following, PTSFd (from above)	44.4	
Level of service, LOSd (from above)	B	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.09	
Average travel speed including passing lane, ATSpl	55.1	
Percent free flow speed including passing lane, PFFSpl	93.3	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	12.51	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-12.51	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.59	
Percent time-spent-following including passing lane, PTSFpl	37.4	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	B	
Peak 15-min total travel time, TT15	2.8	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	234.1
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.53
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis–the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15–14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - EB
Highway	54
From/To	54-J-19 Junciton / Farber
Jurisdiction	
Analysis Year	2042
Description	Pass C1 - Future

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	2.4	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	3	/mi

Analysis direction volume, Vd 149 veh/h
Opposing direction volume, Vo 143 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.6		1.6	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.965		0.965	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	175	pc/h	168	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	0.8	mi/h
Free-flow speed, FFSd	59.3	mi/h
Adjustment for no-passing zones, fnp	1.5	mi/h
Average travel speed, ATSd	55.1	mi/h
Percent Free Flow Speed, PFFS	93.0	%

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	0.994	0.994
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	170 pc/h	163 pc/h
Base percent time-spent-following,(note-4) BPTSFd	18.7 %	
Adjustment for no-passing zones, fnp	36.8	
Percent time-spent-following, PTSFd	37.5 %	

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.10	
Peak 15-min vehicle-miles of travel, VMT15	102	veh-mi
Peak-hour vehicle-miles of travel, VMT60	358	veh-mi
Peak 15-min total travel time, TT15	1.9	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	2.4	mi
Length of two-lane highway upstream of the passing lane, Lu	1.2	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	55.1	mi/h
Percent time-spent-following, PTSFd (from above)	37.5	
Level of service, LOSd (from above)	B	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.08	
Average travel speed including passing lane, ATSpl	57.2	
Percent free flow speed including passing lane, PFFSpl	96.6	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	13.00	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-13.00	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.58	
Percent time-spent-following including passing lane, PTSFpl	29.6	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	A	
Peak 15-min total travel time, TT15	1.8	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	169.3
Effective width of outside lane, We	30.85
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	1.99
Bicycle LOS	B

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
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Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - WB
Highway	54
From/To	54-J-19 Junciton / Farber
Jurisdiction	
Analysis Year	2042
Description	Pass C2 Future

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	3.1	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	3	/mi

Analysis direction volume, Vd 143 veh/h
Opposing direction volume, Vo 149 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.6		1.6	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.965		0.965	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	168	pc/h	175	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	0.8	mi/h
Free-flow speed, FFSd	59.3	mi/h
Adjustment for no-passing zones, fnp	1.5	mi/h
Average travel speed, ATSd	55.0	mi/h
Percent Free Flow Speed, PFFS	92.9	%

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.1		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	0.994		0.994	
Grade adjustment factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	163	pc/h	170	pc/h
Base percent time-spent-following,(note-4) BPTSFd	18.0	%		
Adjustment for no-passing zones, fnp	36.8			
Percent time-spent-following, PTSFd	36.0	%		

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.09	
Peak 15-min vehicle-miles of travel, VMT15	126	veh-mi
Peak-hour vehicle-miles of travel, VMT60	443	veh-mi
Peak 15-min total travel time, TT15	2.3	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	3.1	mi
Length of two-lane highway upstream of the passing lane, Lu	1.9	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	55.0	mi/h
Percent time-spent-following, PTSFd (from above)	36.0	
Level of service, LOSd (from above)	B	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.08	
Average travel speed including passing lane, ATSpl	56.7	
Percent free flow speed including passing lane, PFFSpl	95.6	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	13.00	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-13.00	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.58	
Percent time-spent-following including passing lane, PTSFpl	30.1	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	A	
Peak 15-min total travel time, TT15	2.2	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	162.5
Effective width of outside lane, We	31.42
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	1.79
Bicycle LOS	B

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
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Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - EB
Highway	54
From/To	Farber / Vandalia
Jurisdiction	
Analysis Year	2042
Description	Pass C3 Future

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	4.7	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	2	/mi

Analysis direction volume, Vd 127 veh/h
Opposing direction volume, Vo 134 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.7		1.7	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.960		0.960	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	150	pc/h	159	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	0.5	mi/h
Free-flow speed, FFSd	59.5	mi/h
Adjustment for no-passing zones, fnp	1.4	mi/h
Average travel speed, ATSd	55.7	mi/h
Percent Free Flow Speed, PFFS	93.7	%

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	0.994	0.994
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	145 pc/h	153 pc/h
Base percent time-spent-following,(note-4) BPTSFd	16.3 %	
Adjustment for no-passing zones, fnp	34.8	
Percent time-spent-following, PTSFd	33.2 %	

Level of Service and Other Performance Measures

Level of service, LOS	A	
Volume to capacity ratio, v/c	0.08	
Peak 15-min vehicle-miles of travel, VMT15	170	veh-mi
Peak-hour vehicle-miles of travel, VMT60	597	veh-mi
Peak 15-min total travel time, TT15	3.1	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	4.7	mi
Length of two-lane highway upstream of the passing lane, Lu	3.5	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	55.7	mi/h
Percent time-spent-following, PTSFd (from above)	33.2	
Level of service, LOSd (from above)	A	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.08	
Average travel speed including passing lane, ATSpl	56.8	
Percent free flow speed including passing lane, PFFSpl	95.5	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	13.00	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-13.00	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.58	
Percent time-spent-following including passing lane, PTSFpl	29.6	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	A	
Peak 15-min total travel time, TT15	3.0	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	144.3
Effective width of outside lane, We	32.94
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	1.24
Bicycle LOS	A

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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Phone: Fax:
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Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - WB
Highway	54
From/To	Farber / Vandalia
Jurisdiction	
Analysis Year	2042
Description	Pass C4 Future

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	3.9	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	5	/mi

Analysis direction volume, Vd 134 veh/h
Opposing direction volume, Vo 127 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.7		1.7	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.960		0.960	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	159	pc/h	150	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	1.3	mi/h
Free-flow speed, FFSd	58.8	mi/h
Adjustment for no-passing zones, fnp	1.2	mi/h
Average travel speed, ATSd	55.1	mi/h
Percent Free Flow Speed, PFFS	93.8	%

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	0.994	0.994
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	153 pc/h	145 pc/h
Base percent time-spent-following,(note-4) BPTSFd	17.1 %	
Adjustment for no-passing zones, fnp	34.8	
Percent time-spent-following, PTSFd	35.0 %	

Level of Service and Other Performance Measures

Level of service, LOS	A	
Volume to capacity ratio, v/c	0.09	
Peak 15-min vehicle-miles of travel, VMT15	148	veh-mi
Peak-hour vehicle-miles of travel, VMT60	523	veh-mi
Peak 15-min total travel time, TT15	2.7	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	3.9	mi
Length of two-lane highway upstream of the passing lane, Lu	2.7	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	55.1	mi/h
Percent time-spent-following, PTSFd (from above)	35.0	
Level of service, LOSd (from above)	A	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.08	
Average travel speed including passing lane, ATSpl	56.4	
Percent free flow speed including passing lane, PFFSpl	96.0	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	13.00	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-13.00	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.58	
Percent time-spent-following including passing lane, PTSFpl	30.5	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	A	
Peak 15-min total travel time, TT15	2.6	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	152.3
Effective width of outside lane, We	32.27
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	1.49
Bicycle LOS	A

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - EB
Highway	54
From/To	Vandalia / 154 Junciton
Jurisdiction	
Analysis Year	2042
Description	Pass C5 Future

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	2.0	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	2	/mi

Analysis direction volume, Vd 205 veh/h
Opposing direction volume, Vo 211 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.5		1.5	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.971		0.971	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	240	pc/h	247	pc/h

Free-Flow Speed from Field Measurement:

Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h

Estimated Free-Flow Speed:

Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	0.5	mi/h
Free-flow speed, FFSd	59.5	mi/h
Adjustment for no-passing zones, fnp	1.7	mi/h
Average travel speed, ATSd	54.0	mi/h
Percent Free Flow Speed, PFFS	90.7	%

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	0.994	0.994
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	234 pc/h	241 pc/h
Base percent time-spent-following,(note-4) BPTSFd	26.4 %	
Adjustment for no-passing zones, fnp	39.7	
Percent time-spent-following, PTSFd	46.0 %	

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.14	
Peak 15-min vehicle-miles of travel, VMT15	116	veh-mi
Peak-hour vehicle-miles of travel, VMT60	410	veh-mi
Peak 15-min total travel time, TT15	2.1	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	2.0	mi
Length of two-lane highway upstream of the passing lane, Lu	0.8	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	54.0	mi/h
Percent time-spent-following, PTSFd (from above)	46.0	
Level of service, LOSd (from above)	B	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.09	
Average travel speed including passing lane, ATSpl	56.8	
Percent free flow speed including passing lane, PFFSpl	95.4	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	12.52	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-12.52	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.59	
Percent time-spent-following including passing lane, PTSFpl	34.7	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	A	
Peak 15-min total travel time, TT15	2.0	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	233.0
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.53
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - WB
Highway	54
From/To	Vandalia / 154 Junciton
Jurisdiction	
Analysis Year	2042
Description	Pass C6 - Future

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	3.2	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	5	/mi

Analysis direction volume, Vd 310 veh/h
Opposing direction volume, Vo 277 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.3		1.4	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.982		0.977	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	359	pc/h	322	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	1.3	mi/h
Free-flow speed, FFSd	58.8	mi/h
Adjustment for no-passing zones, fnp	1.5	mi/h
Average travel speed, ATSd	51.9	mi/h
Percent Free Flow Speed, PFFS	88.4	%

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	0.994	0.994
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	354 pc/h	317 pc/h
Base percent time-spent-following,(note-4) BPTSFd	38.4 %	
Adjustment for no-passing zones, fnp	35.8	
Percent time-spent-following, PTSFd	57.3 %	

Level of Service and Other Performance Measures

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.21	
Peak 15-min vehicle-miles of travel, VMT15	282	veh-mi
Peak-hour vehicle-miles of travel, VMT60	992	veh-mi
Peak 15-min total travel time, TT15	5.4	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	3.2	mi
Length of two-lane highway upstream of the passing lane, Lu	2.0	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	51.9	mi/h
Percent time-spent-following, PTSFd (from above)	57.3	
Level of service, LOSd (from above)	C	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.10	
Average travel speed including passing lane, ATSpl	53.8	
Percent free flow speed including passing lane, PFFSpl	91.5	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	9.71	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-9.71	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.60	
Percent time-spent-following including passing lane, PTSFpl	48.7	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	B	
Peak 15-min total travel time, TT15	5.2	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	352.3
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.74
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - EB
Highway	54
From/To	154 Junciton / Curryville
Jurisdiction	
Analysis Year	2042
Description	Pass D1 Future

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	3.2	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	5	/mi

Analysis direction volume, Vd 310 veh/h
Opposing direction volume, Vo 277 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.3		1.4	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.982		0.977	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	359	pc/h	322	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	1.3	mi/h
Free-flow speed, FFSd	58.8	mi/h
Adjustment for no-passing zones, fnp	1.5	mi/h
Average travel speed, ATSd	51.9	mi/h
Percent Free Flow Speed, PFFS	88.4	%

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	0.994	0.994
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	354 pc/h	317 pc/h
Base percent time-spent-following,(note-4) BPTSFd	38.4 %	
Adjustment for no-passing zones, fnp	35.8	
Percent time-spent-following, PTSFd	57.3 %	

Level of Service and Other Performance Measures

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.21	
Peak 15-min vehicle-miles of travel, VMT15	282	veh-mi
Peak-hour vehicle-miles of travel, VMT60	992	veh-mi
Peak 15-min total travel time, TT15	5.4	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	3.2	mi
Length of two-lane highway upstream of the passing lane, Lu	2.0	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	51.9	mi/h
Percent time-spent-following, PTSFd (from above)	57.3	
Level of service, LOSd (from above)	C	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.10	
Average travel speed including passing lane, ATSpl	53.8	
Percent free flow speed including passing lane, PFFSpl	91.5	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	9.71	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-9.71	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.60	
Percent time-spent-following including passing lane, PTSFpl	48.7	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	B	
Peak 15-min total travel time, TT15	5.2	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	352.3
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.74
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis–the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15–14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - WB
Highway	54
From/To	Vandalia / 154 Junciton
Jurisdiction	
Analysis Year	2042
Description	Pass D2 Future

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	4.0	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	3	/mi

Analysis direction volume, Vd 163 veh/h
Opposing direction volume, Vo 154 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.6		1.6	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.965		0.965	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	192	pc/h	181	pc/h

Free-Flow Speed from Field Measurement:

Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h

Estimated Free-Flow Speed:

Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	0.8	mi/h
Free-flow speed, FFSd	59.3	mi/h
Adjustment for no-passing zones, fnp	1.6	mi/h
Average travel speed, ATSd	54.7	mi/h
Percent Free Flow Speed, PFFS	92.4	%

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	0.994	0.994
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	186 pc/h	176 pc/h
Base percent time-spent-following,(note-4) BPTSFd	20.2 %	
Adjustment for no-passing zones, fnp	38.2	
Percent time-spent-following, PTSFd	39.8 %	

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.11	
Peak 15-min vehicle-miles of travel, VMT15	185	veh-mi
Peak-hour vehicle-miles of travel, VMT60	652	veh-mi
Peak 15-min total travel time, TT15	3.4	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	4.0	mi
Length of two-lane highway upstream of the passing lane, Lu	2.8	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	54.7	mi/h
Percent time-spent-following, PTSFd (from above)	39.8	
Level of service, LOSd (from above)	B	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.08	
Average travel speed including passing lane, ATSpl	56.0	
Percent free flow speed including passing lane, PFFSpl	94.5	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	13.00	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-13.00	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.58	
Percent time-spent-following including passing lane, PTSFpl	34.8	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	A	
Peak 15-min total travel time, TT15	3.3	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	185.2
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.41
Bicycle LOS	C

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - EB
Highway	54
From/To	Curryville / Bowling Green
Jurisdiction	
Analysis Year	2042
Description	Pass D3 Future

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	4.4	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	4	/mi

Analysis direction volume, Vd 310 veh/h
Opposing direction volume, Vo 277 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.3		1.4	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.982		0.977	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	359	pc/h	322	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	1.0	mi/h
Free-flow speed, FFSd	59.0	mi/h
Adjustment for no-passing zones, fnp	1.6	mi/h
Average travel speed, ATSd	52.2	mi/h
Percent Free Flow Speed, PFFS	88.4	%

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.1		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	0.994		0.994	
Grade adjustment factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	354	pc/h	317	pc/h
Base percent time-spent-following,(note-4) BPTSFd	38.4	%		
Adjustment for no-passing zones, fnp	35.8			
Percent time-spent-following, PTSFd	57.3	%		

Level of Service and Other Performance Measures

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.21	
Peak 15-min vehicle-miles of travel, VMT15	388	veh-mi
Peak-hour vehicle-miles of travel, VMT60	1364	veh-mi
Peak 15-min total travel time, TT15	7.4	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	4.4	mi
Length of two-lane highway upstream of the passing lane, Lu	3.2	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	52.2	mi/h
Percent time-spent-following, PTSFd (from above)	57.3	
Level of service, LOSd (from above)	C	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.10	
Average travel speed including passing lane, ATSpl	53.5	
Percent free flow speed including passing lane, PFFSpl	90.7	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	9.71	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-9.71	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.60	
Percent time-spent-following including passing lane, PTSFpl	51.0	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	C	
Peak 15-min total travel time, TT15	7.3	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	352.3
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.74
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - WB
Highway	54
From/To	Curryville / Bowling Green
Jurisdiction	
Analysis Year	2042
Description	Pass D4 Future

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	3.8	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	2	/mi

Analysis direction volume, Vd 277 veh/h
Opposing direction volume, Vo 310 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.4		1.3	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.977		0.982	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	322	pc/h	359	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	0.5	mi/h
Free-flow speed, FFSd	59.5	mi/h
Adjustment for no-passing zones, fnp	1.5	mi/h
Average travel speed, ATSd	52.7	mi/h
Percent Free Flow Speed, PFFS	88.6	%

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	0.994	0.994
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	317 pc/h	354 pc/h
Base percent time-spent-following,(note-4) BPTSFd	35.2 %	
Adjustment for no-passing zones, fnp	35.8	
Percent time-spent-following, PTSFd	52.1 %	

Level of Service and Other Performance Measures

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.19	
Peak 15-min vehicle-miles of travel, VMT15	299	veh-mi
Peak-hour vehicle-miles of travel, VMT60	1053	veh-mi
Peak 15-min total travel time, TT15	5.7	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	3.8	mi
Length of two-lane highway upstream of the passing lane, Lu	2.6	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	52.7	mi/h
Percent time-spent-following, PTSFd (from above)	52.1	
Level of service, LOSd (from above)	C	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.10	
Average travel speed including passing lane, ATSpl	54.3	
Percent free flow speed including passing lane, PFFSpl	91.2	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	11.01	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-11.01	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.60	
Percent time-spent-following including passing lane, PTSFpl	45.5	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	B	
Peak 15-min total travel time, TT15	5.5	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	314.8
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.68
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis–the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15–14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - EB
Highway	54
From/To	Curryville / Bowling Green
Jurisdiction	
Analysis Year	2042
Description	Pass D5 Future

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	2.5	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	4	/mi

Analysis direction volume, Vd 310 veh/h
Opposing direction volume, Vo 277 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.3		1.4	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.982		0.977	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	359	pc/h	322	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	1.0	mi/h
Free-flow speed, FFSd	59.0	mi/h
Adjustment for no-passing zones, fnp	1.6	mi/h
Average travel speed, ATSd	52.2	mi/h
Percent Free Flow Speed, PFFS	88.4	%

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	0.994	0.994
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	354 pc/h	317 pc/h
Base percent time-spent-following,(note-4) BPTSFd	38.4 %	
Adjustment for no-passing zones, fnp	35.8	
Percent time-spent-following, PTSFd	57.3 %	

Level of Service and Other Performance Measures

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.21	
Peak 15-min vehicle-miles of travel, VMT15	220	veh-mi
Peak-hour vehicle-miles of travel, VMT60	775	veh-mi
Peak 15-min total travel time, TT15	4.2	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	2.5	mi
Length of two-lane highway upstream of the passing lane, Lu	1.3	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	52.2	mi/h
Percent time-spent-following, PTSFd (from above)	57.3	
Level of service, LOSd (from above)	C	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.10	
Average travel speed including passing lane, ATSpl	54.5	
Percent free flow speed including passing lane, PFFSpl	92.4	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	9.71	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-9.71	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.60	
Percent time-spent-following including passing lane, PTSFpl	46.3	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	B	
Peak 15-min total travel time, TT15	4.0	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	352.3
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.74
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis–the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15–14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - WB
Highway	54
From/To	Curryville / Bowling Green
Jurisdiction	
Analysis Year	2042
Description	Pass D6 Future

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	2.4	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	7	/mi

Analysis direction volume, Vd 277 veh/h
Opposing direction volume, Vo 310 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.4		1.3	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.977		0.982	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	322	pc/h	359	pc/h

Free-Flow Speed from Field Measurement:

Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h

Estimated Free-Flow Speed:

Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	1.8	mi/h
Free-flow speed, FFSd	58.3	mi/h
Adjustment for no-passing zones, fnp	1.4	mi/h
Average travel speed, ATSd	51.5	mi/h
Percent Free Flow Speed, PFFS	88.4	%

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	0.994	0.994
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	317 pc/h	354 pc/h
Base percent time-spent-following,(note-4) BPTSFd	35.2 %	
Adjustment for no-passing zones, fnp	35.8	
Percent time-spent-following, PTSFd	52.1 %	

Level of Service and Other Performance Measures

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.19	
Peak 15-min vehicle-miles of travel, VMT15	189	veh-mi
Peak-hour vehicle-miles of travel, VMT60	665	veh-mi
Peak 15-min total travel time, TT15	3.7	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	2.4	mi
Length of two-lane highway upstream of the passing lane, Lu	1.2	mi
Length of passing lane including tapers, Lpl	1.2	mi
Average travel speed, ATSd (from above)	51.5	mi/h
Percent time-spent-following, PTSFd (from above)	52.1	
Level of service, LOSd (from above)	C	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.10	
Average travel speed including passing lane, ATSpl	54.0	
Percent free flow speed including passing lane, PFFSpl	92.7	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	11.01	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-11.01	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.60	
Percent time-spent-following including passing lane, PTSFpl	41.7	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	B	
Peak 15-min total travel time, TT15	3.5	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	314.8
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.68
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - EB
Highway	54
From/To	Bowling Green / Louisiana
Jurisdiction	
Analysis Year	2042
Description	Pass E1 Future

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	2.3	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	7	/mi

Analysis direction volume, Vd 328 veh/h
Opposing direction volume, Vo 295 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.3		1.4	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.982		0.977	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	380	pc/h	343	pc/h

Free-Flow Speed from Field Measurement:

Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h

Estimated Free-Flow Speed:

Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	1.8	mi/h
Free-flow speed, FFSd	58.3	mi/h
Adjustment for no-passing zones, fnp	1.5	mi/h
Average travel speed, ATSd	51.2	mi/h
Percent Free Flow Speed, PFFS	87.8	%

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.1		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	0.994		0.994	
Grade adjustment factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	375	pc/h	337	pc/h
Base percent time-spent-following,(note-4) BPTSFd	39.1	%		
Adjustment for no-passing zones, fnp	34.8			
Percent time-spent-following, PTSFd	57.4	%		

Level of Service and Other Performance Measures

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.22	
Peak 15-min vehicle-miles of travel, VMT15	214	veh-mi
Peak-hour vehicle-miles of travel, VMT60	754	veh-mi
Peak 15-min total travel time, TT15	4.2	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	2.3	mi
Length of two-lane highway upstream of the passing lane, Lu	1.0	mi
Length of passing lane including tapers, Lpl	1.3	mi
Average travel speed, ATSd (from above)	51.2	mi/h
Percent time-spent-following, PTSFd (from above)	57.4	
Level of service, LOSd (from above)	C	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.10	
Average travel speed including passing lane, ATSpl	53.9	
Percent free flow speed including passing lane, PFFSpl	92.6	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	8.98	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-8.98	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.60	
Percent time-spent-following including passing lane, PTSFpl	44.4	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	B	
Peak 15-min total travel time, TT15	4.0	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	372.7
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.77
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - WB
Highway	54
From/To	Bowling Green / Louisiana
Jurisdiction	
Analysis Year	2042
Description	Pass E2 Future

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	2.8	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	7	/mi

Analysis direction volume, Vd 295 veh/h
Opposing direction volume, Vo 328 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.4		1.3	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.977		0.982	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	343	pc/h	380	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	1.8	mi/h
Free-flow speed, FFSd	58.3	mi/h
Adjustment for no-passing zones, fnp	1.4	mi/h
Average travel speed, ATSd	51.2	mi/h
Percent Free Flow Speed, PFFS	88.0	%

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	0.994	0.994
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	337 pc/h	375 pc/h
Base percent time-spent-following,(note-4) BPTSFd	37.4 %	
Adjustment for no-passing zones, fnp	34.8	
Percent time-spent-following, PTSFd	53.9 %	

Level of Service and Other Performance Measures

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.20	
Peak 15-min vehicle-miles of travel, VMT15	235	veh-mi
Peak-hour vehicle-miles of travel, VMT60	826	veh-mi
Peak 15-min total travel time, TT15	4.6	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	2.8	mi
Length of two-lane highway upstream of the passing lane, Lu	1.0	mi
Length of passing lane including tapers, Lpl	1.3	mi
Average travel speed, ATSd (from above)	51.2	mi/h
Percent time-spent-following, PTSFd (from above)	53.9	
Level of service, LOSd (from above)	C	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.20	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.10	
Average travel speed including passing lane, ATSpl	54.3	
Percent free flow speed including passing lane, PFFSpl	93.2	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	10.31	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-9.81	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.60	
Percent time-spent-following including passing lane, PTSFpl	40.1	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	B	
Peak 15-min total travel time, TT15	4.3	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	335.2
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.71
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - EB
Highway	54
From/To	Bowling Green / Louisiana
Jurisdiction	
Analysis Year	2042
Description	Pass E3 Future

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	3.4	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	7	/mi

Analysis direction volume, Vd 328 veh/h
Opposing direction volume, Vo 295 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.3		1.4	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.982		0.977	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	380	pc/h	343	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	1.8	mi/h
Free-flow speed, FFSd	58.3	mi/h
Adjustment for no-passing zones, fnp	1.5	mi/h
Average travel speed, ATSd	51.2	mi/h
Percent Free Flow Speed, PFFS	87.8	%

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	0.994	0.994
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	375 pc/h	337 pc/h
Base percent time-spent-following,(note-4) BPTSFd	39.1 %	
Adjustment for no-passing zones, fnp	34.8	
Percent time-spent-following, PTSFd	57.4 %	

Level of Service and Other Performance Measures

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.22	
Peak 15-min vehicle-miles of travel, VMT15	317	veh-mi
Peak-hour vehicle-miles of travel, VMT60	1115	veh-mi
Peak 15-min total travel time, TT15	6.2	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	3.4	mi
Length of two-lane highway upstream of the passing lane, Lu	2.5	mi
Length of passing lane including tapers, Lpl	0.8	mi
Average travel speed, ATSd (from above)	51.2	mi/h
Percent time-spent-following, PTSFd (from above)	57.4	
Level of service, LOSd (from above)	C	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.60	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.10	
Average travel speed including passing lane, ATSpl	52.4	
Percent free flow speed including passing lane, PFFSpl	90.0	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	8.98	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-8.88	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.60	
Percent time-spent-following including passing lane, PTSFpl	51.3	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	C	
Peak 15-min total travel time, TT15	6.0	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	372.7
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.77
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.5

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	Nina Killion
Agency/Co.	Bartlett & West - 19421.B60
Date Performed	10/26/2022
Analysis Time Period	Peak Hour - WB
Highway	54
From/To	Bowling Green / Louisiana
Jurisdiction	
Analysis Year	2042
Description	Pass E4 Future

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.88	
Shoulder width	7.0	ft	% Trucks and buses	6	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	2.0	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	4	%
Grade: Length	-	mi	% No-passing zones	20	%
Up/down	-	%	Access point density	7	/mi

Analysis direction volume, Vd 295 veh/h
Opposing direction volume, Vo 328 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.4		1.3	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.977		0.982	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	343	pc/h	380	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access point density,(note-3) fA	1.8	mi/h
Free-flow speed, FFSd	58.3	mi/h
Adjustment for no-passing zones, fnp	1.4	mi/h
Average travel speed, ATSd	51.2	mi/h
Percent Free Flow Speed, PFFS	88.0	%

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	0.994	0.994
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	337 pc/h	375 pc/h
Base percent time-spent-following,(note-4) BPTSFd	37.4 %	
Adjustment for no-passing zones, fnp	34.8	
Percent time-spent-following, PTSFd	53.9 %	

Level of Service and Other Performance Measures

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.20	
Peak 15-min vehicle-miles of travel, VMT15	168	veh-mi
Peak-hour vehicle-miles of travel, VMT60	590	veh-mi
Peak 15-min total travel time, TT15	3.3	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	2.0	mi
Length of two-lane highway upstream of the passing lane, Lu	1.2	mi
Length of passing lane including tapers, Lpl	0.8	mi
Average travel speed, ATSd (from above)	51.2	mi/h
Percent time-spent-following, PTSFd (from above)	53.9	
Level of service, LOSd (from above)	C	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.70	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.10	
Average travel speed including passing lane, ATSpl	53.2	
Percent free flow speed including passing lane, PFFSpl	91.3	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	10.31	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-10.31	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.60	
Percent time-spent-following including passing lane, PTSFpl	45.3	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	B	
Peak 15-min total travel time, TT15	3.2	veh-h

Bicycle Level of Service

Posted speed limit, Sp	60
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	335.2
Effective width of outside lane, We	26.00
Effective speed factor, St	4.94
Bicycle LOS Score, BLOS	3.71
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

Appendix E: Works Cited

American Association of State and Highway Transportation Officials (AASHTO)

A Policy on Geometric Design of Highways and Streets (the Green Book), 2018, 7th Edition

Highway Safety Manual, 2010, with 2014 Supplement

Section 16.6.2 – Passing and Climbing Lane Treatments with CMFs

Google Earth (2022)

Images retrieved in September through December 2022.

Pike County, MO

Ralls County, MO

Audrain County, MO

Missouri Department of Transportation (MoDOT)

Data Zone

http://modatazone.modot.org/

Traffic Volumes:

https://datazoneapps.modot.mo.gov/bi/apps/maps/Home/Index/AADT

Traffic Crashes:

(web address encrypted; accessed via secure login)

Engineering Policy Guide (EPG)

http://epg.modot.org/index.php/Main_Page

233.2: At-Grade Intersections with Stop and Yield Control

233.2 At-Grade Intersections with Stop and Yield Control - Engineering_Policy_Guide (modot.org)

Figure 233.2: Left and Right Turn Details

233_2_Left_RightTurn.dgn (modot.org)

940.9: Auxiliary Acceleration and Turning Lanes

https://epg.modot.org/index.php?title=940.9_Auxiliary_Acceleration_and_Turning_Lanes