Draft Feasible Alternatives Selection Report

US-20 @ US-35
Interchange (Ramp) Modification
Des No.: 0014050
Located 0.9 miles West of I-94
LaPorte County
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Introduction:

The interchange being analyzed is located southeast of Michigan City, Indiana in LaPorte County where US-20, US-35 and SR-212 converge. More specifically the interchange is located at RP 43.990 on US-20. The subject interchange is also located 3.9 miles east of the US-20/US-421 intersection and 0.95 miles west of the I-94 interchange with US-20/US-35.

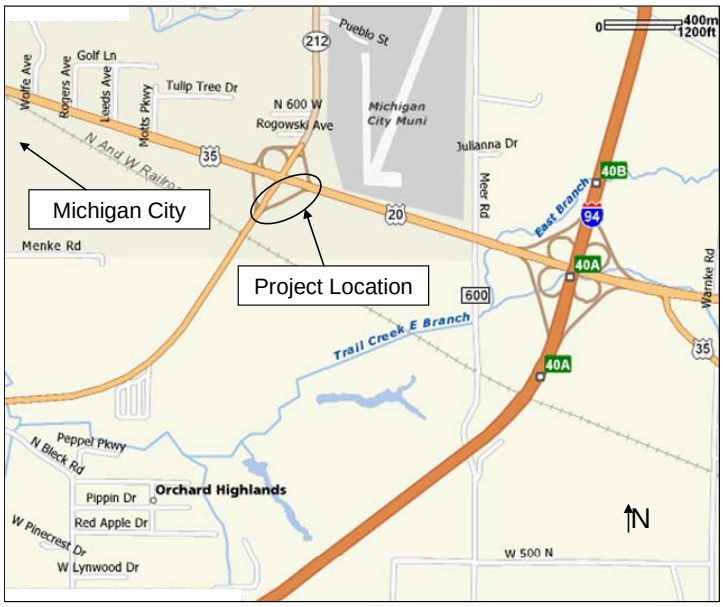

Figure 1: Project Location Map, US-20 @ US-35 Interchange

Existing Conditions:

The existing configuration at the US-20 and US-35 interchange is an old/archaic style cloverleaf interchange. As can be seen in Figure 1 to the right, the interchange only has one somewhat traditional loop ramp in the northwest quadrant. The ramps in the northeast, southeast, and southwest quadrants combine with the diagonal connector ramps to form two lane ramps that carry two-way traffic. The lanes on these ramps are separated by a double yellow line. As a result of the odd looking configuration, left turn movements act as they would in a traditional full cloverleaf interchange but since there are not true loop ramps the cars have to decelerate rapidly to make the sharp right turn of 115 degrees to 150 degrees depending on the ramp. Furthermore there are not any auxiliary lanes; therefore, traffic is required to stop at the end of each of these pseudo look ramps.

US-20 is a four lane undivided Urban Minor Arterial with 12 foot lanes and a 10 foot shoulder on each side. US-35 is a four lane undivided Urban Major Collector with 12 foot lanes and a 10 foot shoulder on each side. SR-212 begins at the interchange and continues north when US-20 splits to the east. Eastbound US-20 traffic follows the diagonal ramp in the southeast quadrant while westbound US-20 traffic traverses the true loop ramp in the northwest quadrant. Only the southbound to eastbound and the eastbound to northbound movements have an auxiliary lane for deceleration purposes. The speed limit on each route is 55 miles per hour. A billboard near the

US-20 eastbound ramp will also need to be removed. The radius of the US-20 eastbound ramp exit curve is less than half of the radius of the ramp entrance curve. This causes a need for a reduced speed sign on the ramp as the radius of the ramp exit curve is not large enough for the location. Those who do not notice the sign are caught unaware going too fast for the curve.

Crash History:

Crash data was gathered for the dates of January 1st 2003 through December 31st 2005. During this period of time there were 10 crashes involving 17 vehicles at the US-20 and US-35 interchange. Of the 10 crashes at the interchange, 8 involved property damage only, 2 involved personal injuries, and none resulted in fatality. There were 3 crashes on the US-20 eastbound ramp. The tighter radius curve at the exit of the ramp than at the entrance of the ramp has potentially been a contributing factor in the crashes at this location. Some of the crashes involved vehicles leaving their lane (these crashes are listed in Table 1). Despite warning signs being present on the ramp, it is apparent the tighter radius curve has caught some drivers off guard. There were 5 rear end collisions at the interchange. These collisions could possibly have been the result of the yield signs at the ends of the ramps on this older, non-traditional cloverleaf interchange. It seems that for many drivers the yield signs are somewhat unexpected. The crash rate at the interchange was 3.33 per year. The intersection crash rate is 0.6514 crashes per million entering vehicles. Any value under 1.5 crashes per million entering vehicles shows that there are not any really significant operational problems. Table 1 and Table 2 below show other information regarding the crashes during the aforementioned three year period.

Location	Year	Number of accidents	No. of Vehicles	Collision involved			Severity			Collision Diagram								Light Condition	
				fixed object, animal	embankment	other motor vehicle	Property Damage only	Personal Injury	Fatal	Animal	Head on	Rear end	Rt Turn	off rd	Lt turn	Side swipe	Rt angle	Day	Dark
US-20 Eastbound Ramp	2003	3	4	2	0	1	2	1	0	0	0	0	1	1	0	0	1	3	0
	2004	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2005	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals		3	4	2	0	1	2	1	0	0	0	0	1	1	0	0	1	3	0

Table 1: Crash Data Summary for US-20 Eastbound Ramp

Location	Year	Number of accidents	No. of Vehicles	Collision involved			Severity			Collision Diagram								Light Condition	
				fixed object, animal	embankment	other motor vehicle	Property Damage only	Personal Injury	Fatal	Animal	Head on	Rear end	Rt Turn	off rd	Lt turn	Side swipe	Rt angle	Day	Dark
US-20 & US-35 Interchange	2003	5	7	3	0	2	4	1	0	0	1	1	1	1	0	0	1	5	0
	2004	1	2	0	0	1	1	0	0	0	0	1	0	0	0	0	0	1	0
	2005	4	8	0	0	4	3	1	0	0	0	3	0	0	0	0	1	4	0
Totals		10	17	3	0	7	8	2	0	0	1	5	1	1	0	0	2	10	0

Table 2: Crash Data Summary for US-20 @ US-35 Interchange

Traffic Analysis:

Traffic data was obtained from the Modeling & Forecasting Section of INDOT. Peak hour traffic counts were provided for all movements and intersections within the US-20, US-35 and SR-212 interchange. Highway Capacity Software was used for the analysis of the traffic data.

The analysis shows that for the base year of 2003 the interchange is operating well with a good level of service. The operations were not as good in the design year but did not exceed a LOS of 'D' and the delay was not higher than 29.2 seconds per vehicle in any movement. It is important to note that the analysis was done by breaking the interchange down into the intersections that the older, non-traditional cloverleaf ramps create with US-20, US-35 and SR-212. This breakdown yielded a north, east, south, and west intersection for the interchange. Table 3 through Table 6 below show the levels of service (LOS) and the number of seconds of delay per vehicle for the AM and PM peaks in both the base year and the design year for the existing interchange configuration.

Year	AM Northbound LOS(Delay, sec)	AM Southbound LOS(Delay, sec)	PM Northbound LOS(Delay, sec)	PM Southbound LOS(Delay, sec)
2003	B(12.8)	C(16.5)	B(13.6)	B(14.3)
2031	C(20.7)	C(19.5)	D(28.4)	C(16.2)

Table 3: LOS and seconds of delay per vehicle for the EAST ramp terminal

Year	AM Northbound LOS(Delay, sec)	AM Southbound LOS(Delay, sec)	PM Northbound LOS(Delay, sec)	PM Southbound LOS(Delay, sec)
2003	B(12.1)	C(16.1)	B(12.8)	C(15.0)
2031	C(16.0)	C(21.7)	C(19.8)	C(19.5)

Table 4: LOS and seconds of delay per vehicle for the WEST ramp terminal

Year	AM Eastbound LOS(Delay, sec)	AM Westbound LOS(Delay, sec)	PM Eastbound LOS(Delay, sec)	PM Westbound LOS(Delay, sec)
2003	B(13.6)	B(12.1)	B(13.1)	B(10.8)
2031	D(29.2)	B(13.1)	C(25.0)	B(11.2)

Table 5: LOS and seconds of delay per vehicle for the NORTH ramp terminal

Year	AM Eastbound LOS(Delay, sec)	AM Westbound LOS(Delay, sec)	PM Eastbound LOS(Delay, sec)	PM Westbound LOS(Delay, sec)
2003	B(10.9)	B(10.8)	B(10.8)	B(11.4)
2031	C(15.2)	B(12.1)	B(14.6)	B(13.2)

Table 6: LOS and seconds of delay per vehicle for the SOUTH ramp terminal

According to the traffic forecast report the projected growth rates used to find the future traffic at the US-20 and US-35 interchange were between 0.5% and 2.78% depending on the particular movement in question. As is shown in the tables above, the LOS for the design year of 2031 is

acceptable. There are not any traffic movements for any ramp terminal that has a LOS worse than D in either the AM or the PM peak hour. These acceptable levels of service show that the interchange will continue to serve motorists well in the design year.

Alternatives:

A: The initial proposal is to revise only the geometry of the US-20 eastbound ramp's curve where it gets aligned to allow traffic to exit the interchange area and enter US-35 southbound travel lanes. The drawing and aerial photograph of this alternative can be seen in Appendix A-3. Currently this section of the ramp has a geometric deficiency in the form of this horizontal curve having an approximate radius of 300 feet. A horizontal curve of 300 foot radius near the end of a long, flat and straight alignment on a free flow diagonal ramp is considered poor design. This particular curve is "out of character" in relation to the entire ramp and therefore, it is also unexpected by the operators of vehicles traveling this ramp. The construction would involve increasing the radius from 300 feet to 700 feet. The entering curve of the ramp has a 700' radius. With both curves having a 700 foot radius the reduced speed sign would be unnecessary and drivers would be less likely to lose control of their vehicles. This improvement will address the crash situation at the exit of the US-20 eastbound ramp. Approximately 0.305 acres of right of way will be needed to keep the proposed right of way line 65 feet to the right of the ramp baseline. A billboard on the property adjacent to the ramp will also need to be removed.

B: An alternate proposal for the interchange would be to revise the geometry of the two ramps that connect to US-20 south of US-35. The two ramps will be reconstructed as a typical diamond interchange would look and would be two-way stop controlled. The eastbound exit ramp from US-35 to US-20 will be a two lane ramp with left and right turn lanes. The northbound and southbound approaches will each have two through lanes. The right through lane of the two northbound lanes will be shared and have a turnoff to the right for continuing on US-20. The left through lane of the two southbound lanes will be shared with the left turning movement to US-20 eastbound. The three ramps that connect to SR-212 on the north side of US-35 will mostly remain the same. The only change will be the addition of a left turn lane on northbound SR-212 to allow vehicles to make the movement to westbound US-35. Traffic analysis is shown below in Table 7 and Table 8. The analysis was completed using Highway Capacity software. The resulting levels of service and delays in seconds per vehicle show that the proposal would have acceptable traffic operation both now and in the design year.

Year	AM Eastbound LOS(Delay, sec)	AM Westbound LOS(Delay, sec)	PM Eastbound LOS(Delay, sec)	PM Westbound LOS(Delay, sec)
2003	A(9.1)	B(11.6)	A(9.1)	B(10.4)
2031	B(10.7)	B(12.3)	B(10.7)	B(10.8)

Table 7: LOS and seconds of delay per vehicle for the NORTH ramp terminal (Alternate "B")

Year	AM Eastbound LOS(Delay, sec)	AM Southbound LOS(Delay, sec)	PM Eastbound LOS(Delay, sec)	PM Southbound LOS(Delay, sec)
2003	C(21.9)	A(9.6)	D(33.5)	B(10.6)
2031	E(46.8)	B(11.4)	F(268.1)	C(15.1)

Table 8: LOS and seconds of delay per vehicle for the SOUTH ramp terminal (Alternate "B")

Cost Estimate:

The alternatives to modifying the US-20/US-35/SR-212 interchange as evaluated and analyzed in this report could involve a relatively minor amount of construction only or it could involve a total reconstruction of the interchange. In Alternative "A", the US-20 eastbound ramp will be the focus of the construction. As was previously mentioned, the radius of the US-20 eastbound ramp as it joins US-35/US-20 eastbound is much too sharp for its functional location.

Item	Construction Alternative A	Construction Alternative B
Construction	$311,500	$13,470,759
Traffic Maintenance	$36,000	$509,964
Contingencies (20%)	$69,500	$2,796,144
Sub Total for Construction	**$417,000**	**$16,776,868**
Right of Way	$11,550	$77,053
Engineering (5%)	$20,850	$838,843
Total	**$449,400**	**$17,692,764**

Table 9: Construction Cost Estimates

Additional changes, Alternative B, could be made to further improve the interchange. These changes, however, would incur costs that are significantly higher than desired for the project. The construction of merge lanes for each ramp would likely reduce the frequency of accidents at the interchange as well as improve any small delay at the ramp junctions. A full interchange modification may be a necessary step to bring the interchange up to date.

Conclusion/Recommendations:

As a result of the evaluation and analysis conducted in this report, Alternative "A", the construction of the subject curve on the US-20 eastbound ramp is selected. It should also be noted that there may be the need for further improvements in the future. The existing interchange design and geometrics are out of date and could be confusing to motorists due to its rare configuration. A modification of the interchange would open the possibilities for long-term improved functionality and service for motorists.

Appendix:

Appendix A: Maps & Drawings

A-1	Location map
A-2	USGS topographic map
A-3	Recommended Alternative Plan w/ aerial photograph
A-4	Alternative Plan w/ aerial photograph

Appendix B: Data

B-1 to B-8	Traffic Data (Hanson)
B-9 to B-24	Highway Capacity Analysis for US-20 @ US-35 & SR-212 (Alternative A)
B-25 to B-32	Highway Capacity Analysis for US-20 @ US-35 & SR-212 (Alternative B)