

### WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

**Division of Highways** 

1900 Kanawha Boulevard East • Building Five • Room 110 Charleston, West Virginia 25305-0430 • (304) 558-3505

Paul A. Mattox, Jr., P. E. Secretary of Transportation/Commissioner of Highways

March 30, 2015

### **MEMORANDUM**

TO:

**Earl Ray Tomblin** 

Governor

DD, CH(CR), HD, DE/M-4, D-4(RW, Rd), PP(JJW, TB), DR(Est),

DDM(AS), DDR(FT, Util, Perm), DDI(RE, RLB, JC, DK, QA/QC), DDE,

CD, DT (Des), PR(RW)

MOZ

FROM:

DDC

SUBJECT: Stat

State Project S231-55-1.10 00

**University Avenue Intersection Improvement** 

**Design Study Final Office Review** 

Monongalia County

Attached for your review is an electronic copy, in pdf format, of the Design Study, dated March 2015, for the subject project as prepared by the Initial Design Unit of the Technical Section (DDC). A field review was held on Thursday, September 18, 2014.

A Design Study Final Office Review is scheduled for Wednesday, April 22, 2015, at 1:00 p.m., at 1334 Smith Street, Charleston, West Virginia, Room 11 to review and discuss the final study and Location and Design Approval.

Thank you in advance for taking the time to review the attached information. If you have any questions, please contact Steve Boggs at (304) 558-9662 or email <a href="mailto:Steve.D.Boggs@wv.gov">Steve.D.Boggs@wv.gov</a>.

MDL:Bkc

Attachment

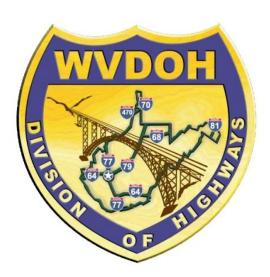
cc: HO, DR, DDC(MDL, MW, SB), FHWA(J. Robinette) - w/o attachment

## UNIVERSITY AVENUE INTERSECTION UPGRADE STUDY

University Avenue (CR 55), Collins Ferry Road (CR 57), and Baldwin Street

Morgantown, Monongalia County

March 2015



Prepared by:

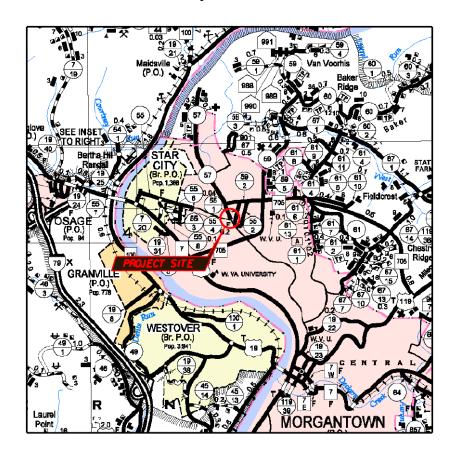
West Virginia Department of Transportation
Division of Highway
Engineering Division
Technical Section
Charleston, WV

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### **Project Purpose**

The Traffic Engineering Division has prepared a Draft Traffic Study<sup>1</sup> for the intersection of University Avenue (CR 55), Collins Ferry Road (CR 57), and Baldwin Street in Morgantown, Monongalia County, WV; and developed alternatives for improvement. The purpose of this study by the Initial Design Unit of the Technical Section of Engineering Division is to determine the approximate cost, feasibility, impacts for each of these alternates, and select a preferred alternative for construction.



Location Map – CR 55 / CR 57 intersection

### **Intersection Upgrade Alternatives**

Four alternatives were studied for this project. The first alternative proposes constructing a roundabout at the intersection. The second alternative proposes an oval roundabout with its center pushed to the northeast. The third alternative installs a traffic signal and adds additional turning lanes at the existing intersection.

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<sup>&</sup>lt;sup>1</sup> See Appendix 1.

The fourth alternative proposes installation of a traffic signal at the intersection, with a Collins Ferry Road and Baldwin Street realignment to form a "plus-type" intersection.

Commercial businesses with entry driveways are located in each quadrant around the intersection. Each of the alternates will have impacts to commercial businesses' access points in the area of the intersection; all alternatives affect Sellaro Plaza, Hibachi, and West Virginia University (WVU) office building. A summary of the proposed access management and right of way impacts are included for the alternatives.

A BP service station has been removed and a Kroger Fuel Center has been constructed and recently opened. The facility is located between Collins Ferry Road and University Avenue. The driveways for this development are farther from the intersection for the Kroger than the BP. Construction plans for this development were used in determining potential impacts to this business; these items may need field verified/survey to confirm.

The location of the site is in an urban area and the four approach roads have sidewalks. Each of the alternates has incorporated sidewalks, sidewalk ramps, and cross walks at the intersection. The relocation of the sidewalk also requires installation of curb and gutter with storm drain system.

According to the available records, the existing right-of-way width of University Avenue (CR 55 between MP 0.55 to 1.35) is 50 feet and is 30 feet on Collins Ferry Road (CR 57). Baldwin Street is a Morgantown city street.

1. <u>Alternative 1</u><sup>2</sup> – This alternative reconfigures the existing "K" type intersection to a single lane roundabout. The alternate utilizes an inscribed circle diameter of 150 feet with an 18-foot driving lane and 10-foot truck apron within the roundabout. Approximately 150 feet of approach work (roadway widening and splitter islands) would be needed along CR 57 and CR 55 approaches; approximately 225 feet of approach work would be necessary along Baldwin Street.

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<sup>&</sup>lt;sup>2</sup> See Appendix 2, Figure 2.

See below for a summary of some of Alternative 1's design characteristics:

<u>Right-Turn Bypass Lane</u> – Motorists wanting to turn right from Collins Ferry Road onto westbound University Avenue would not have adequate room to enter and immediately exit the roundabout due to the proximity of the Collins Ferry Road approach with the western University Avenue approach and the intersection angle between these routes. In order to make this movement, a vehicle would need to go completely around the roundabout in order to exit. A right-turn bypass lane has been added to the roundabout to allow vehicles to make this movement without entering the roundabout.

<u>Baldwin Street</u> – The alternate shifted the alignment of the Baldwin Street approach to the west. This provides a more perpendicular entry to the roundabout and avoids impacting the Hibachi building.

<u>Access Management</u> – Driveways would need to be moved out of and away from the circulatory roadway, as driveways within the roundabout could introduce conflicts and possibly cause wrong way movements. This would impact the driveways at the following locations:

- Sellaro Plaza currently has two entrances along University Avenue and two entrances along Baldwin Street. Proposed roundabout would close one entrance along University Ave and one along Baldwin Street. The westernmost entrance along University Ave would be converted to a right-in/right-out.
- A driveway stub would be provided to undeveloped lot north of the intersection.
- The WVU Office Building has two entrances along University Avenue; the alternate would close the northern entrance to the facility.
- Hibachi Steakhouse's access along University Avenue would be converted to a right-in/right-out.

<u>Right-of-Way</u> – Additional permanent right of way would be needed by WVDOH at the junction for the proposed roundabout. This would likely impact the following locations:

- Sellaro Plaza entry/exit of facility, parking lot (12 spaces).
- Kroger Fuel Center impact to kiosk building and pylon sign.
- Frontier Communications entry/exit of facility.
- Undeveloped lot additional r/w area.
- WVU office building entry/exit of facility and parking lot (11 spaces).
- Transit bus stop along University Avenue relocation.
- Hibachi Steakhouse entry/exit of facility, frontage sign, and parking lot (8 spaces).

<u>Utilities</u> – The site is located in a fully developed and urban setting with many utilities positioned in the area. Alternate 1 construction would likely require relocation/adjustment of:

- Eleven (11) utility poles with overhead cable, telephone, and/or electric lines (8 poles are within existing r/w limits & 3 poles are outside existing r/w).
- One fire hydrant (located within existing r/w).
- Two sanitary sewer manholes (located within existing r/w).
- Underground water lines, gas lines, sanitary sewer lines and telephone lines are located along each approach and may possibly be affected (located within existing r/w).

### Estimated cost for Alternative 1 is as follows:

		Detailed Roadway Cons	struc	truction		
Roadway Construction	\$ 1,088,100	Clearing and Grubbing	\$	10,000		
E&C (13%)	\$ 141,500	Earthwork	\$	23,800		
<b>Total Construction Cost</b>	\$ 1,229,600	HMA Wearing & Base	\$	172,500		
		Aggregate (Base & Sh)	\$	47,500		
Future Value (2017)	\$ 1,346,000	Subgrade	\$	31,000		
Engineering	\$ 260,000	Drainage	\$	114,900		
Utilities	\$ 54,000	M.O.T.	\$	350,000		
Site Cleanup (Environmental)	\$ 100,000	Erosion Control	\$	10,000		
Right-of-Way	\$ 1,750,000	Curb & Sidewalk	\$	125,800		
Total	\$ 3,510,000	All Other Items	\$	170,900		
		Mobilization	\$	31,700		
		Total Roadway Construction	\$	1,088,100		

2. <u>Alternative 2</u><sup>3</sup> – Provides a second variation of a roundabout at the intersection. It proposes an oval shaped roundabout with its center pushed to the northeast. The alternate utilizes an inscribed circle diameter of 130 feet with a 15-foot driving lane and 10-foot truck apron within the roundabout. Approximately 150 feet of approach

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<sup>&</sup>lt;sup>3</sup> See Appendix 2, Figure 3.

work (roadway widening and splitter islands) would be needed along CR 57 and CR 55 approaches; approximately 250 feet of approach work would be necessary along Baldwin Street.

<u>Access Management</u> – Similar to Alternative 1, driveways would need to be moved away from the proposed circulatory roadway. This would impact the driveways at the following locations:

- Proposed roundabout would close one entrance along University Avenue to Sellaro Plaza and convert the other one to a right-in/right-out. Both entrances along Baldwin Street would be kept.
- Accesses for the undeveloped lot, WVU Office Building, and Hibachi Steakhouse are the same as Alternative 1.

<u>Right-of-Way</u> – Additional permanent right of way would be needed at the junction for the proposed roundabout, which would likely impact the following locations:

- Sellaro Plaza entry/exit of facility, parking lot (4 spaces)
- Kroger Fuel Center pylon sign
- Frontier Communications entry/exit of facility
- Undeveloped lot additional r/w area.
- WVU office building entry/exit of facility, parking lot (21 spaces)
- Transit bus stop along University Avenue
- Hibachi Steakhouse entry/exit of facility, frontage sign, and parking lot (5 spaces)

<u>Utilities</u> – Alternate 2 constructions would likely require relocation/adjustment of the following utilities:

- Eleven (10) utility poles with overhead cable, telephone, and/or electric lines (7 poles are within existing r/w limits & 3 poles are outside existing r/w).
- One fire hydrant (located within existing r/w)
- Two sanitary sewer manholes (located within existing r/w)
- Underground water lines, gas lines, and sanitary sewer lines, and telephone lines are located along each approach and may possibly be affected (located within existing r/w)

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		Detailed Roadway Con	stru	<u>ction</u>
Roadway Construction	\$ 1,192,200	Clearing and Grubbing	\$	10,000
E&C (13%)	\$ 155,000	Earthwork	\$	26,400
Total Construction Cost	\$ 1,347,200	HMA Wearing & Base	\$	174,700
		Aggregate (Base & Sh)	\$	50,500
Future Value (2017)	\$ 1,474,000	Subgrade	\$	33,000
Engineering	\$ 260,000	Drainage	\$	128,700
Utilities	\$ 54,000	M.O.T.	\$	400,000
Site Cleanup (Environmental)	\$ 100,000	Erosion Control	\$	10,000
Right-of-Way	\$ 1,900,000	Curb & Sidewalk	\$	138,800
Total	\$ 3,788,000	All Other Items	\$	185,400
		Mobilization	\$	34,700
		Total Roadway Construction	\$	1,192,200

- 3. <u>Alternative 3</u><sup>4</sup> This alternative adds turn lanes to the University Avenue and Collins Ferry Road approaches and installs a traffic signal at the existing intersection. The proposed intersection modifications are summarized below:
  - University Avenue westbound approach has an added 300 feet left turn lane (onto Baldwin Street) and 200 feet right turn lane (onto Collins Ferry Road)
    - o It should be noted that a 300 feet right turn lane is recommended in the Traffic Study. However, to avoid the WVU office building a 200 foot lane was used in this study.
  - University Avenue eastbound approach has an added 200 feet left turn lane (onto Collins Ferry Road)
  - Collins Ferry Road approach has an added 300 feet left turn lane (onto EB University Avenue) and a channelized right turn lane (onto WB University Avenue)

See below for a summary of some of Alternative 3's design characteristics:

<u>Access Management</u> – Driveways are not permitted within signalized intersections or adjacent turning radii. This would impact the driveways at the following locations:

- Sellaro's Plaza eastern most entrance along University Avenue would be closed and convert the other one to a right-in/right-out.
- Accesses for the undeveloped lot, WVU Office Building, and Hibachi Steakhouse are the same as Alternative 1.

<u>Right-of-Way</u> – The improvement will require additional permanent right of way along the route, which would likely impact the following locations:

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<sup>&</sup>lt;sup>4</sup> See Appendix 2, Figure 4.

- Sellaro Plaza entry/exit of facility, parking lot (4 spaces)
- Kroger Fuel Center kiosk building, parking lot, and pylon sign
- Frontier Communications entry/exit of facility
- undeveloped lot additional r/w area.
- WVU office building entry/exit of facility, parking lot (25 spaces)
- Transit bus stop along University Avenue
- Tudor's Biscuit World entry/exit, parking lot
- First Exchange Bank entry/exit, parking lot (14 spaces)
- Hibachi Steakhouse entry/exit, frontage sign, and parking lot (6 spaces)

<u>Utilities</u> – Construction of Alternate 3 would likely require relocation/adjustment of the following utilities:

- Fourteen (14) utility poles with overhead cable, telephone, and/or electric lines (all poles are within existing r/w limits)
- One fire hydrant (located within existing r/w)
- Four sanitary sewer manholes (located within existing r/w)
- Underground water lines, gas lines, and sanitary sewer lines, and telephone lines are located along each approach and may possibly be affected (located within existing r/w)

Estimated cost for Alternative 3 is as follows:

				Detailed Roadway Con	struct	<u>ion</u>
Roadway Construction	\$	997,100	CI	earing and Grubbing	\$	10,000
E&C (13%)	\$	129,700	Ea	rthwork	\$	19,900
Total Construction Cost	\$	1,126,800	HI	MA Wearing & Base	\$	80,400
			Ag	gregate (Base & Sh)	\$	21,100
Future Value (2017)	\$	1,233,000	Su	bgrade	\$	13,900
Engineering		260,000	Dr	Drainage		161,200
Utilities	\$	90,000	M	.O.T.	\$	125,000
Site Cleanup (Environmental)	\$	100,000	Tr	Traffic Signal		175,000
Right-of-Way	\$	1,800,000	Er	osion Control	\$	10,000
Total	\$	3,483,000	Cu	ırb & Sidewalk	\$	191,700
			Al	l Other Items	\$	159,900
			M	obilization	\$	29,000
			То	Total Roadway Construction		997,100

**4.** <u>Alternative 4</u><sup>5</sup> – This alternative proposes installation of a traffic signal at the intersection with a Collins Ferry Road/Baldwin Street realignment to form a "plustype" intersection. The proposed intersection modifications are summarized below:

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<sup>&</sup>lt;sup>5</sup> See Appendix 2, Figure 5.

- University Avenue westbound approach has an added 300 feet left turn lane (onto Baldwin Street)
- University Avenue eastbound approach has an added 200 feet left turn lane (onto Collins Ferry Road)
- Collins Ferry Road approach realigned with a 150 feet right turn lane (onto WB University Avenue) and a combination left (onto EB University Avenue)/thru lane (onto Baldwin Street)

<u>Access Management</u> – Driveways are not permitted within signalized intersections or adjacent turning radii. This would impact the driveways at the following locations:

- Sellaro Plaza's eastern most entrance along University Avenue would be closed and western entrance is converted to right-in/right-out.
- Accesses for the undeveloped lot, WVU Office Building, and Hibachi Steakhouse are the same as Alternative 1.

<u>Right-of-Way</u> – Additional permanent right of way would be needed at the intersection, which would likely impact the following locations:

- Sellaro Plaza entry/exit of facility, parking lot (4 spaces)
- Frontier Communications entry/exit of facility
- Undeveloped lot additional r/w area.
- WVU office building entry/exit of facility, parking lot (15 spaces)
- Transit bus stop along University Avenue
- Tudor's Biscuit World entry/exit, parking lot
- First Exchange Bank entry/exit, parking lot (14 spaces)
- Hibachi Steakhouse entry/exit, frontage sign, and parking lot (6 spaces)

### Utilities – Construction would likely require relocation/adjustment of:

- Eleven (11) utility poles with overhead cable, telephone, and/or electric lines (all poles are within existing r/w limits).
- One fire hydrant (located within existing r/w)
- Three sanitary sewer manholes (located within existing r/w)
- Underground water lines, gas lines, and sanitary sewer lines, and telephone lines are located along each approach and may possibly be affected (located within existing r/w)

### Estimated cost for Alternative 4 is as follows:

			Detailed Roadway Cor	ıstru	<u>ction</u>
Roadway Construction	\$	1,024,200	Clearing and Grubbing	\$	10,000
E&C (13%)	\$	133,200	Earthwork	\$	19,900
Total Construction Cost	\$	1,157,400	HMA Wearing & Base	\$	87,400
			Aggregate (Base & Sh)	\$	22,900
Future V alue (2017)	\$	1,267,000	Subgrade	\$	15,100
Engineering	\$	260,000	Drainage	\$	144,000
Utilities	\$	54,000	M.O.T.	\$	175,000
Site Cleanup (Environmental)	\$	100,000	Traffic Signal	\$	175,000
Right-of-Way	\$	1,350,000	Erosion Control	\$	10,000
Total	\$	3,031,000	Curb & Sidewalk	\$	168,700
			All Other Items	\$	166,400
			Mobilization	\$	29,800
			Total Roadway Construction		1,024,200

### **Alternatives Comparison and Summary**

See below for a conceptual cost of all alternatives:

				ALTERN	IAT	IVES					
		1		2		3		4			
		Roundabout	Oval Roundabout			Traffic Signal		Traffic Signal "plus type"			
Impact Length (ft)		1,175		1,250		1,050		1,100			
# of Parcels Impacted	8			8		13	11				
Deadurau	<u>۴</u>	4 000 400	φ.	4 402 200	r.	007.400	φ.	1 024 200			
Roadw ay E&C (13%)	\$	1,088,100 141,500	\$	1,192,200 155,000	\$	997,100 129,700	\$	1,024,200 133,200			
2015 Construction Cost	\$	1,229,600	\$	1,347,200	\$	1,126,800	\$	1,157,400			
Future Value (2017)	\$	1,346,000	\$	1,474,000	\$	1,233,000	\$	1,267,000			
Engineering	\$	260,000	\$	260,000	\$	260,000	\$	260,000			
Utility	\$	54,000	\$	54,000	\$	90,000	\$	54,000			
Site Impact (Environmental)	\$	100,000	\$	100,000	\$	100,000	\$	100,000			
Right-of-Way (**)	\$	1,750,000	\$	1,900,000	\$	1,800,000	\$	1,350,000			
Total	\$	3,510,000	\$	3,788,000	\$	3,483,000	\$	3,031,000			

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See below for Lev	iel of Service (	(1) and	delay compa	mcon.
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					Alt '	1 & 2	Alt :	3 & 4	
		Existing			Round	dabout	Traffic Signal		
		LOS	Delay (s)		LOS	Delay (s)	LOS	Delay (s)	
University Ave	- Eastbound	Α	9		Α	10	С	25	
University Ave	- Westbound	Α	8		В	11	С	20	
Baldwin St	- Northbound	С	18		Α	7	D	35	
Collins Ferry Road	- Southbound	F	349		Α	7	С	33	
Ove	-	-		Α	10	C	25		

Data from Traffic Study - See Appendix 1 for additional information/details

A decision matrix was developed for the intersection. The purpose of the table is to provide a comparative analysis that measures and weighs a various number of major design decision options. The Initial Design Unit has compiled the results of a variety of comparison factors into the matrix that includes key decision measures, assigned percentages, and weighted values:

Alternativ	e Decisio	on Matrix Univers	sity Avenue / Collins	Ferry Road / Baldwin	n Street
			ALTERN	NATIVES	
		1	2	3	4
Criteria	Weight	Roundabout	Oval Roundabout	Traffic Signal	Traffic Signal "plus type"
Cost	20%	3	2	3	4
LOS / Delay	20%	5	5	3	3
EMS & Ped Safety	25%	4	4	2	2
Vehicle Safety	25%	5	5	3	3
O & M Cost	5%	4	4	3	3
Aesthetics	5%	5	5	3	3
Total Score: Higher is Better	100%	4.3	4.1	2.75	2.95

Legend: 0=Very Poor, 1=Poor, 2=Below Avg, 3=Average, 4=Above Avg, 5=Excellent

It is understood that differing weights and factors could be used herein. The results of each numeric factor are based on results of this report, available averages, nationwide statistics, and DDC's professional judgment for this particular project.

### Conclusion

The preceding sections of this report analyzed the feasibility of a traffic signal or a roundabout at the intersection of University Avenue, Collins Ferry Road, and Baldwin Street. While the roundabout alternates have a higher cost than those of a traffic signal,

they provide the most capacity and operational safety for this project location. Our investigation and study recommends a roundabout for this intersection. It is recommended to proceed with final layout of the roundabout, including geometric design modifications and details.

### **APPENDIX "1"**

**Traffic Study** 

## TRAFFIC STUDY INTERSECTION OF UNIVERSITY AVENUE AND COLLINS FERRY MORGANTOWN, MONONGALIA COUNTY

### **MAY 2014**



## WEST VIRGINIA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS TRAFFIC ENGINEERING DIVISION

**INTRODUCTION** 

A traffic study for the intersection of University Avenue and Collins Ferry Road

was requested by District Four due to their concern of intersection operation. In response

to this request, a traffic study was conducted by the Traffic Engineering Division.

Following are the findings of that study.

PHYSICAL CONDITIONS

The intersection is a "K" type intersection located at milepost 1.10 on University

Avenue (CR 55). University Avenue is the major route in the intersection with Collins

Ferry Road (CR 57) and Baldwin Street being minor approaches.

Collins Ferry Road approaches from the north with Baldwin Street approaching

from the west. Currently, the intersection is two-way stop controlled with stop signs on

Collins Ferry Road and Baldwin Street while traffic travels unimpeded on University

Avenue.. University Avenue is a north-south roadway and approaches the intersection

from the south and also from the north but to the west of the Collins Ferry Road

approach. University Avenue, Collins Ferry Road, and Baldwin Street are all two lane

two way roads and there are no auxiliary lanes at the intersection. The right turn

movement from Collins Ferry Road is a channelized movement that does not enter the

intersection.

Commercial development is prevalent in the area near the intersection. A BP gas

station is located in the triangular lot to the north of the intersection bound by Collins

Ferry Road and University Avenue. DOH has been advised that Kroger plans to construct

a new gas station at this location and replace the existing business. To the east of the

intersection, WVU owns a large office building that parallels University Avenue. To the

west of the intersection, there is a Hibachi Steakhouse, First Exchange Bank, and a small

strip development building containing a variety of small businesses.

The speed limit is 25 mph on all approaches. Sight distance is adequate on all

approaches to the intersection. Turning maneuvers at the intersection can be difficult at

the intersection since the corner radii are not designed to accommodate large vehicles.

**TRAFFIC CONDITIONS** 

A turning movement count was conducted at the intersection on December 9,

2008 between the hours of 7:00 a.m. to 10:00 a.m., 11:00 a.m. to 1:00 p.m., and 2:00 p.m.

to 6:00 p.m. The peak hour for the intersection was found to be between the hours of

5:00 p.m. to 6:00 p.m., during which time 1024 vehicles entered the intersection. This

includes 366 vehicles on the University Avenue approach from the northwest, 464

vehicles on University Avenue from the south, 173 on Collins Ferry Road from the north,

and 21 vehicles from the west on Baldwin Street. A peak hour count was also conducted

in-house on April 23, 2014. Refer to Appendix A at the end of this report for both turning

movement distributions.

A comparison was made of the traffic volume at the intersection with the

warrants for a traffic signal contained in the Manual on Uniform Traffic Control Devices,

(MUTCD), which is published by the Federal Highway Administration and legally

adopted by the State of West Virginia as the official criteria for the installation of all

traffic control devices. The principal requirement for the installation of a traffic signal is

traffic volume. The <u>MUTCD</u> specifies one primary warrant consisting of two conditions, either of which must be met for at least eight hours before a traffic signal can be installed. Warrant 1, Condition A, "Minimum Vehicular Volume Warrant", requires that there be 500 vehicles per hour on University Avenue, at which time there must be 150 vehicles per hour on either Collins Ferry Road or Baldwin Street. Warrant 1, Condition B, "Interruption of Continuous Traffic Warrant", requires that there be 750 vehicles per hour on University Avenue at which time there must be 75 vehicles per hour on either Collins Ferry Road or Baldwin Street. The volume of vehicles entering the intersection met Condition A and Condition B for the required eight hours. Warrant data can be found at the end of Appendix A.

### **CRASH CONDITIONS**

Collision data was researched for the intersection for a three year period of January 1, 2011, through July 31, 2013. During this time, eleven collisions were recorded at the intersection. The most common collision was of the right angle type. Provided below is a table summarizing the collision types. A total of 4C type injuries occurred from the eleven collisions. The crash rate for this intersection has been calculated at 0.77 per million entering vehicles. The full crash history summary is listed in Appendix B.

Summary		
Total	11	
Right angle	5	45%
Rear end	1	9%
Angle	3	27%
Head-on	1	9%
SVC	1	9%

### **CAPACITY ANALYSIS**

The intersection was analyzed using HCS 2010 traffic modeling software, which is based upon the 2010 Highway Capacity Manual. This method of analysis makes it possible to evaluate many different combinations of traffic volume and intersection configurations by calculating the average delay per vehicle with its respective Level of Service (LOS). LOS varies from "A", which has unimpeded traffic flow, to "F" which has severely impeded traffic flow.



**Figure 1 - Existing Configuration** 

The analysis shows that with the current intersection configuration with two-way stop control, the Collins Ferry Road approach operates at LOS "F" with an average delay of approximately 120 seconds per vehicle. The analysis further indicates that the Baldwin Street approach operates at LOS "C" with an average delay of approximately 16

seconds per vehicle. Eastbound and Westbound traffic on University Avenue operate at LOS "A" and are only impeded by occasional left turning traffic.



**Figure 2 - Roundabout Configuration** 

Additional analysis was performed using HCS to estimate the impact of constructing a roundabout. A roundabout is a type of circular intersection in which traffic is slowed and flows continuously in one direction around a central island. In a roundabout, entering traffic must always yield to traffic already within the circle. Roundabouts have been shown to be very effective at reducing intersection crashes and can operate more efficiently than traffic signals in many instances.

Based upon additional HCS analyses, construction of a one-lane roundabout would improve the intersection LOS to "A" with delays of approximately 9 second per vehicle. The approach lane has a shared left-through-right configuration. Under the roundabout scenario, all approaches operate at LOS "A" except for the WB movement of University Avenue that would operate at a LOS "B".



Figure 3 - Signal Configuration

As a means of comparison, further analysis shows that if a traffic signal was installed, the overall intersections LOS would be "C" with delays of approximately 25 seconds per vehicle. The figure above shows what a desirable layout would be for this intersection if a signal was installed. Left turn lanes would need to be constructed on both University Avenue approaches while the configuration on Baldwin Street could remain as a combination left, right, and through lane. The configuration on Collins Ferry Road could remain but the approach should be realigned to eliminate the skew and intersect closer to 90 degrees and to create a longer right turn lane. The heaviest delay would be northbound on Baldwin Street, with delays of approximately 35 seconds per vehicle. With the installation of a traffic signal, University Avenue would operate at LOS "C" with delays of approximately 22 seconds per vehicle.

The analysis for the traffic signal was based upon an intersection configuration

with realignment to modify the intersection closer to a "plus" type. As previously stated,

left turn lanes would be needed on both University Avenue approaches to the

intersection. The recommended storage capacity based upon the analysis is 200 feet for

eastbound approach and 300 feet for the westbound approach. The recommended storage

length of the right turn lane on Collins Ferry Road is 150 feet. The HCM comparison and

analysis is located in Appendix C.

A signal could also be installed at this intersection without moving the road in any

direction, but would be considered undesirable. Three more options for a signal have

been analyzed using Synchro 8. Synchro 8 allows the intersection to be analyzed to

incorporate the strange layout into the calculations for LOS, but requires the results not

be based upon the HCM, but is a reasonable approximation. The full comparison chart is

located in Appendix D. Below are three figures that show different configurations for the

approach lanes. The LOS for the existing with signal is an E with 57 seconds of delay.

The LOS with the first set of improvements is a C with 21 seconds of delay. The second

set of improvements yields a LOS of B with 17 seconds of delay. If a signal had to be

installed with "K" type layout it is recommended that one of the improved approach

layouts is used. The third signal is the best but also takes the most surrounding land

because of the extra right turn lane.



Figure 4 - Existing with Signal

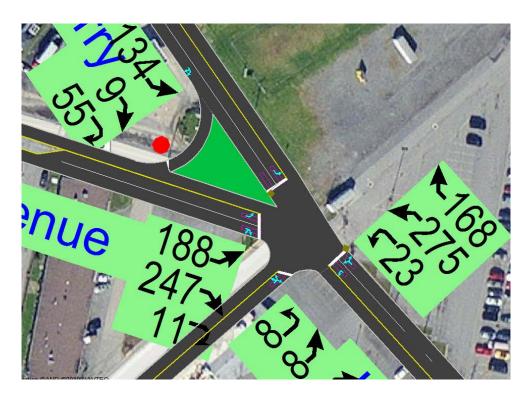


Figure 5 - Signal with Added University Lefts and Right on Collins Ferry

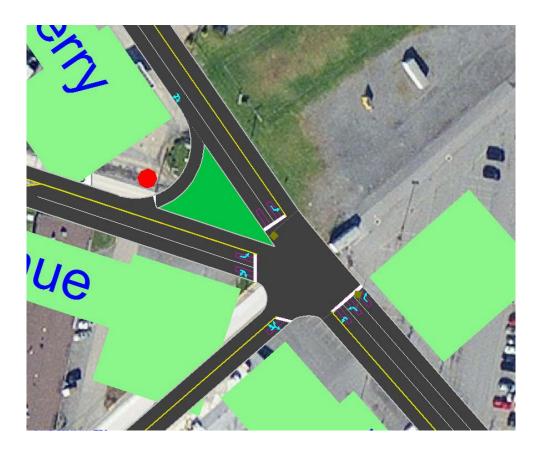


Figure 6 - Best Signal Option with As-Is Layout

### **RECOMMENDATIONS**

recommended that a roundabout be constructed at the intersection. The study shows

1.) After reviewing three different configurations, and multiple layouts for a signal, it is

that a roundabout would operate well with significant improvement compared with

the existing intersection LOS. From a preliminary review, it appears that

construction of a roundabout is feasible at this location.

2.) If it is determined that a roundabout is not feasible, further consideration is

necessary to determine if a signal should be installed in conjunction with

construction of auxiliary lanes on University Avenue. Based upon the intersection

capacity analyses and the odd intersection geometry, a roundabout is preferable to a

traffic signal.

### APPENDIX A

## VEHICLE AND PEDESTRIAN VOLUME SUMMARY

							172	1095	1063	1943	1099					
		ALL		324	311	285	252	247	279	265	308					1172
		E-W		83	63	85	49	26	92	6	72					260 1172
	Total	N-S		241	248	220	203	191	203	204	236					912
		_		-	۳	0	-	0	0	N	m					m
		E		54	45	55	44	52	75	54	64					198
A		TOT		11 8	14 ,	15	15	12 5	17 7	13	21 6		-			55 18
Collins Ferry	(WB)	IK.		4	8	-	_	2	7	9	2			_	 	6
Collin	EAST (WB)			39	28	39	28	35	51	35	38			<del> </del>	 	134
				0	7	0	0	က	2	F	7					2
		TOT		29	18	10	5	4	1	7	8					62
instruction (CD)				19	17	9	4	3	-	9	5	_				46
Sire	(A)	T		က	~-	4	0	-	0	1	2					8
Baldwin Street	WEST (EB)			7	0	0	1	0	0	0	-					œ
Be	≱			•	6	0	0	0	0	-	0					-
9		TOT		113	119	130	104	8	120	119	126					466
ity Avenue	ĺ∝	œ		1 43	8 45	4 41	2 39	34	4 36	32	1 42					5 168
rsity	H (NB)	<u> </u>		9 61	89 9	5 84	3 62	4 58	0 84	1 86	3 81					23 275
Universi	SOUTH		:													
				4	0	0	0	0	0	0	0					4
		TOT		128	129	06	66	95	83	85	110					46
G,				5	3 1	က	0	1	0	Ψ.	7					11 446
Avent	(£	T		69	69	53	29	64	53	20	79					
rsity	H (SE	•		54	22	34	43	30	30	34	30					188 247
University Avenue	NORTH (SB)															
Ī				3:15	3:30	3:45	4.00	4:15	4:30	4:45	5:00					
STREET		TIME														Peak Hour

CITY	Morgantown	INTERSECTION	University and Collins Ferry
COUNTY	Monongalia	DATE	4/23/2014
DISTRICT	Hour	WEATHER	

85% SPEED > 4 POPULATION <

University Avenue |

,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	EAST Collins Ferry	
		SOUTH University Avenue
	WEST Baldwin Stree	os S

# VEHICLE AND PEDESTRIAN VOLUME SUMMARY

																		EAST y Ave.
		ALL		791	721	631		904	1025		917	915	1014	1024			1024	EAST University Ave.
		E-W	Т	636	563	529		720	813		742	718	825	830			830	
	Total	N-S-F	_	155	158	102	<del> </del>	184	212		175	197	189	194			194	Collins Ferry Rd.
																		Mins Fer NORTH
		TOT		337	366	281		379	416		396	339	336	366			366	So.
Ave		R		_	6	5	<del> </del>	6	4		9	2	2	12	-		12	WEST University Ave.
	West			246	256	191		282	281		248	240	220	216			216	WEST
\$ 100 mm	From West			8	101	85		87	131		142	94	114	138			138	
																		***
		TOT		299	197	248		341	397		346	379	489	464			464	Ave, and Collins Ferry
A Ç.		22		103	88	98		137	162		129	125	192	194			194	\$1 11 15 0
Nisevin	From East	F		192	104	147		198	224		206	231	284	255			255	
2	Fron			4	5	5		ပ	7	C. C	7	23	13	15	Distance		15	
				L								_						ON University 7/23/2012
		TOT		19	7 11	5 5		19	23		3 19	34	8	21			21	7723
ž	£	œ		3 14	2	0		17	0 21		2 16	5 28	0	1 20			1 20	
Baldwin St	From South	上		2	2	0		2 (	2 (		,		0	,			0	INTERSECTI DATE WEATHER
je G	Fro	7																INTER DATE WEAT
				9	7	97		5	- 16		9	<u> </u>	-	3			8	WW. H. OO
Ö		TOT		12 136	6 147	13 9		18 165	19 189		22 156	31 163	30 181	24 173			24 173	Morgantown Monongalia 4  A D > 40 MPH ON < 10,000
	£	œ		4	12	9		7	8		10 2	15 3	10 3	18 2			18 2	NO LED A
Collins Fary	From North	<b> </b>		120	129 1	78		140	32		124 1						Ш	CITY Morgantow COUNTY Monongalia DISTRICT 4 85% SPEED > 40 MPH POPULATION < 10,000
ိ	Fro			1,	12		V V	14	162		12	117	141	131			131	
_			7 AM	3 AM	9 AM	10 AM	10 AM - 11 AM	Noon	1 PM	PM 5	3 PM	t PM	5 PM	) PM	, PM		  ặ	
STREET		TIME	6 AM - 7 AM	7 AM - 8 AM	AM - 5	9 AM - 10 AM	OAM -	11 AM - Noon	Noon - 1 PM	1 PM - 2 PM	PM -	3 PM - 4 PM	4 PM - 5 PM	5 PM - 6 PM	6 PM - 7 PM		Peak Hour	
လ	L	H	ဖ	7	∞	റ	7	Ť	Z	<u>~</u>	N	က	4	ιC	ဖ	<u> </u>		

South Baldwin St.

Minor Street Jurisdiction 85% Speed > 4 Population < 10				Collins Ferry Rd. Monongalia County Yes
85% Speed > 4				<u> </u>
				Voe
Population < 10	אור			163
	JN			No
# of Lanes on N	√lajor Street			1
# of Lanes on N	Vinor Street	1, 1		1
Minor St. Right	Turns Discou	inted		YES
Have five (5) co	orrectable cra	shes occurred in	1 year?	NO
		MAJOR ST	MINOR ST	
	HOUR	VOLUME	VOLUME	

HOUR	MAJOR ST VOLUME	MINOR ST VOLUME	
6-7 AM	0	0	
7-8 AM	636	120	
8-9 AM	563	129	
9-10 AM	529	78	
10-11 AM	0	0	
11-12 PM	720	140	
12-1 PM	813	162	
1-2 PM	0	0	
2-3 PM	742	124	
3-4 PM	718	117	
4-5 PM	825	141	
5-6 PM	830	131	
6-7 PM	0	0	

### FINDINGS:

Condition 'A' Satisfied	YES	
Condition 'B' Satisfied	YES	· · · · · · · · · · · · · · · · · · ·
Combination 'A' & 'B' Satisfied	YES	
WARRANT 1 Satisfied?	YES	

<u>COMMENTS:</u> Turns and through not counted on Collins Ferry

WARRAN	T 1 EIGH	T-HOUR VI	EHICULAR	VOLUME	
CONDITION	<u> 'A' MINIM</u>	<u>UM VEHICU</u>	LAR VOLUM	pour Less Less	
Major Street			University Ave	enue	
Minor Street			Collins Ferry	Rd.	
Jurisdiction			Monongalia C	ounty	
85% Speed >			Yes		
Population < 1			No		
# of Lanes on			1		
# of Lanes on			1		
	t Turns Discoun	ted	YES		
	anting Volume		500		
	anting Volume		150		
30% Warrant \	Volume Reducti	on	YES		
	5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5				
HOUR	MAJOR	MINOR	MAJOR ST	MINOR ST	HOUR
	STREET	STREET	WARRANT	WARRANT	MET
	VOLUME	VOLUME	VOLUME	VOLUME	
6-7 AM	0	0	350	105	NO
7-8 AM	636	120	350	105	YES
8-9 AM	563	129	350	105	YES
9-10 AM	529	78	350	105	NO
10-11 AM	0	0	350	105	NO
11-12 PM	720	140	350	105	YES
12-1 PM	813	162	350	105	YES
1-2 PM	0	0	350	105	NO
2-3 PM	742	124	350	105	YES
3-4 PM	718	117	350	105	YES
4-5 PM	825	141	350	105	YES
5-6 PM	830	131	350	105	YES
6-7 PM	0	0	350	105	NO
Makanan laku santan per					
FINDINGS:	å.				
INI. wahar of Lia.	rs Condition 'A'	Mot	8		
	\'Satisfied?	INICE	YES		

CO	M	M	E٨	IT	S:

Major Street	A L) IIAILII	NOFION	F CONTINUC University Av		
Minor Street			Collins Ferry		
Jurisdiction		***************************************	Monongalia C		
85% Speed >	40 mph		Yes	Odiley	
Population < 1			No		
# of Lanes on			1		
# of Lanes on			1		
	t Turns Discour	ited	YES		
	ranting Volume	***************************************	750		
Minor St. War	ranting Volume		75	, , , , , , , , , , , , , , , , , , ,	
	Volume Reducti	ion	YES		
HOUR	MAJOR	MINOR	MAJOR ST	MINOR ST	HOUR
	STREET	STREET	WARRANT	WARRANT	MET
	VOLUME	VOLUME	VOLUME	VOLUME	
6-7 AM	0	0	525	53	NO
7-8 AM	636	120	525	53	YES
8-9 AM	563	129	525	53	YES
9-10 AM	529	78	525	53	YES
	0	0	525	53	NO
10-11 AM			more with your	p= 0%	YES
11-12 PM	720	140	525	53	
11-12 PM 12-1 PM	813	162	525 525	53	YES
11-12 PM 12-1 PM 1-2 PM	813 0	162 0	525 525	53 53	
11-12 PM	813	162	525	53	YES

F	ľ	ı	٩	ĺ	Ì	ľ	)	)	I	Ì	۷	1	C	ì	S	٠	

3-4 PM

4-5 PM

5-6 PM

6-7 PM

Number of Hours Condition 'B' Met	9
Condition 'B' Satisfied?	YES

YES

YES

YES

NO

### COMMENTS:

Major Street			University Avenu		
/linor Street			Collins Ferry Rd		
lurisdiction			Monongalia Cou	nty	
CONDITION 'A'					
HOUR	MAJOR	MINOR	MAJOR ST	MINOR ST	HOUR
	STREET	STREET	WARRANT	WARRANT	MET
	VOLUME	VOLUME	VOLUME	VOLUME	
-7 AM	0	0	280	84	NO
-8 AM	636	120	280	84	YES
-9 AM	563	129	280	84	YES
-10 AM	529	78	280	84	NO
0-11 AM	0	0	280	84	NO
1-12 PM	720	140	280	84	YES
2-1 PM	813	162	280	84	YES
-2 PM	0	0	280	84	NO
-3 PM	742	124	280	84	YES
-4 PM	718	117	280	84	YES
-5 PM	825	141	280	84	YES
-6 PM	830	131	280	84	YES
-7 PM	0	0	280	84	NO
ONDITION 'B'					
HOUR	MAJOR	MINOR	MAJOR ST	MINOR ST	HOUR
	STREET	STREET	WARRANT	WARRANT	MET
	VOLUME	VOLUME	VOLUME	VOLUME	
		0	420	42	NO
	0		~~v	6# Z.	NU
-8 AM	636	120	420	42	YES
8 AM 9 AM	636 563	120 129		<u>L</u>	
-8 AM -9 AM -10 AM	636 563 529	120	420	42	YES
8 AM 9 AM 10 AM 0-11 AM	636 563 529 0	120 129	420 420	42 42	YES YES
-8 AM -9 AM -10 AM 0-11 AM 1-12 PM	636 563 529 0 720	120 129 78 0 140	420 420 420 420 420 420	42 42 42	YES YES YES
8 AM 9 AM 10 AM 0-11 AM 1-12 PM 2-1 PM	636 563 529 0	120 129 78 0	420 420 420 420	42 42 42 42 42	YES YES YES NO
-8 AM -9 AM -10 AM 0-11 AM 1-12 PM 2-1 PM -2 PM	636 563 529 0 720 813	120 129 78 0 140 162	420 420 420 420 420 420 420 420	42 42 42 42 42 42	YES YES YES NO YES
-8 AM -9 AM -10 AM 0-11 AM 1-12 PM 2-1 PM -2 PM -3 PM	636 563 529 0 720 813 0 742	120 129 78 0 140 162 0	420 420 420 420 420 420 420 420	42 42 42 42 42 42 42	YES YES YES NO YES YES
-7 AM -8 AM -9 AM -10 AM 0-11 AM 1-12 PM 2-1 PM -2 PM -3 PM -4 PM	636 563 529 0 720 813 0 742 718	120 129 78 0 140 162 0 124 117	420 420 420 420 420 420 420 420 420	42 42 42 42 42 42 42 42	YES YES NO YES YES NO YES YES
-8 AM -9 AM -10 AM 0-11 AM 1-12 PM 2-1 PM -2 PM -3 PM -4 PM -5 PM	636 563 529 0 720 813 0 742 718	120 129 78 0 140 162 0 124 117	420 420 420 420 420 420 420 420 420 420	42 42 42 42 42 42 42 42 42	YES YES YES NO YES YES NO YES NO YES
-8 AM -9 AM -10 AM 0-11 AM 1-12 PM 2-1 PM -2 PM -3 PM -4 PM -5 PM -6 PM	636 563 529 0 720 813 0 742 718 825 830	120 129 78 0 140 162 0 124 117 141	420 420 420 420 420 420 420 420 420 420	42 42 42 42 42 42 42 42 42 42 42 42 42	YES YES YES NO YES YES NO YES NO YES NO YES YES
-8 AM -9 AM -10 AM -11 AM 1-12 PM 2-1 PM -2 PM -3 PM -4 PM -5 PM -6 PM -7 PM	636 563 529 0 720 813 0 742 718	120 129 78 0 140 162 0 124 117	420 420 420 420 420 420 420 420 420 420	42 42 42 42 42 42 42 42 42 42 42 42	YES YES NO YES NO YES NO YES NO YES YES YES YES YES
8 AM 9 AM 10 AM 0-11 AM 1-12 PM 2-1 PM 2 PM 3 PM 4 PM 5 PM 6 PM 7 PM	636 563 529 0 720 813 0 742 718 825 830	120 129 78 0 140 162 0 124 117 141	420 420 420 420 420 420 420 420 420 420	42 42 42 42 42 42 42 42 42 42 42 42 42	YES YES NO YES YES NO YES YES NO YES YES YES YES YES YES
8 AM 9 AM 10 AM 0-11 AM 1-12 PM 2-1 PM 2 PM 3 PM 4 PM 5 PM 6 PM 7 PM	636 563 529 0 720 813 0 742 718 825 830	120 129 78 0 140 162 0 124 117 141 131	420 420 420 420 420 420 420 420 420 420	42 42 42 42 42 42 42 42 42 42 42 42 42	YES YES NO YES YES NO YES YES NO YES YES YES YES YES YES
-8 AM -9 AM -10 AM 0-11 AM 1-12 PM 2-1 PM -2 PM -3 PM -4 PM -5 PM -6 PM -7 PM INDINGS:	636 563 529 0 720 813 0 742 718 825 830 0	120 129 78 0 140 162 0 124 117 141 131 0	420 420 420 420 420 420 420 420 420 420	42 42 42 42 42 42 42 42 42 42 42 42 42	YES YES NO YES YES NO YES YES NO YES YES YES YES YES YES

/lajor Street			University Avenu									
linor Street			Collins Ferry Rd	Collins Ferry Rd.								
urisdiction			Monongalia County									
lave five (5) co	rectable crashes oc	curred in 1 year?	NO									
ONDITION 'A'												
HOUR	MAJOR	MINOR	MAJOR ST	MINOR ST	HOUR							
	STREET	STREET	WARRANT	WARRANT	MET							
	VOLUME	VOLUME	VOLUME	VOLUME								
-7 AM	0	0	350	105	NO							
-8 AM	636	120	350	105	YES							
-9 AM	563	129	350	105	YES							
-10 AM	529	78	350	105	NO							
0-11 AM 1-12 PM	0	0	350	105	NO							
1-12 PM 2-1 PM	720 813	140	350	105	YES							
2-1 PM -2 PM	813	162	350	105	YES							
- <u>2 PIVI</u> -3 PM	742	0 124	350	105	NO							
-3 PM -4 PM	742	124	350 350	105	YES							
-4 FM -5 PM	825	141		105	YES							
-6 PM	830	131	350 350	105	YES							
-7 PM	030	0	350	105 105	YES							
7 1 141		V	330	601	NO							
ONDITION 'B'												
HOUR	MAJOR	MINOR	MAJOR ST	MINOR ST	HOUR							
	STREET	STREET	WARRANT	WARRANT	MET							
	VOLUME	VOLUME	VOLUME	VOLUME	JWINex 1							
-7 A <b>M</b>	0	0	525	53	NO							
·8 AM	636	120	525	53	YES							
-9 AM	563	129	525	53	YES							
10 AM	529	78	525	53	YES							
D-11 AM	0	0	525	53	NO							
1-12 PM	720	140	525	53	YES							
2-1 PM	813	162	525	53	YES							
2 PM	0	0	525	53	NO							
-3 PM	742	124	525	53	YES							
-4 PM	718	117	525	53	YES							
-5 PM	825	141	525	53	YES							
6 PM	830	131	525	53	YES							
7 PM	0	0	525	53	NO							
NDINGS:			1									
<i>NDINGS:</i> ondition A Satis			8									
INDINGS: ondition A Satis ondition B Satis	fied?		8									
<u>NDINGS:</u> ondition A Satis ondition B Satis			<u> </u>									

### APPENDIX B

	Left turn into Collins Ferry Road	Left turn into Collins Ferry Road	Left turn into Collins Ferry Road	SB on University	Crash with Bike		Lost control - Driver error											j			
Time of Ge Number of Number of Collision Type	Right Angle	0 Angle	0 Right Angle	0 Rear End	SVC	0 Angle	0 Right Angle	0 Angle	0 Right Angle	Right Angle	Head-On										
mber of Numb	0 10	0	0	0	0 1C	0	0	0	0	0 1C	0 1C										
Time of Ge Nu	1500	1040	1221	1809	945	1835	1843	1430	1725	1715	1954										
Date	9/6/2011	10/5/2012	9/3/2013	12/31/2011	9/9/2013	1/12/2013	7/20/2012	8/24/2013	11/8/2012	4/10/2013	9/17/2012										
Subroute MP Intersectin	0 1 UNIVERSIT	0 1 UNIVERSIT	0 1 UNIVERSIT 9/3/2013	0 110 COLLINS FF 12/31/2011	0 110 COLLINS FF 9/9/2013	0 110 COLLINS FF 1/12/2013	0 110 COLLINS FF	0 110 COLLINS FE	0 110 COLLINS FE	0 110 COLLINS FE	0 111 BALDWIN : 9/17/2012										
	57	57	27	55	55	55	55	55	25	55	22										
County Highway C Route	Monongali County/H⊅	Monongali County/H⊅	Monongali County/HA	Monongali County/HA	Monongali County/H⊅	Monongali County/HA	Monongali County/HA	Monongali County/HA	Monongali County/HA	Monongali County/HA	Monongali County/HA		4 <b>-</b>	5 45%	1 9%	3 27%	1 9%	1 9%			
Crash Record Number County	R201126376	R201228561	R201324525	R201139117	R201325170	R201300739	R201220432	R201323038	R201232181	R201309364	R201226865	Summary	Total	Right angle	Rear end	Angle	Head-on	SVC			

# **APPENDIX C**

# Comparison of Collins Ferry and University Avenue

	NORTH	a
WEST University Avenue		EAST University Avenue
	SOUTH	
	Raldwin Street	·

	Delay (s)	LOS	95% Queue (cars)(ft)
Roundabout	10	Α	-
EB	10	Α	2.8 (70)
WB	11	В	3.3 (83)
NB	7	Α	0.3 (8)
SB	7	Α	1 (25)
Signal	24.9	С	-
EB	25	С	7.4 (185)
WB	20	С	11.4 (285)
NB	35	D	2.3 (58)
SB	33	С	5.3 (133)
Existing	-	-	-
(Two-way Stop)			
EB	9	Α	0.69 (18)
WB	8	Α	0.06 (1.5)
NB	18	С	0.68 (17)
SB	349	F	22 (550)

HCS 2010 Signalized Intersection Results Summary															
											•				
General Inform	nation	14 (14.5. 14.5. 14.5. 14.5. 14.5. 14.5. 14.5. 14.5. 14.5. 14.5. 14.5. 14.5. 14.5. 14.5. 14.5. 14.5. 14.5. 14.5	CONTROL DIFFERENCE		A CONTROL OF THE STATE OF THE S	12.000 (10.000 (10.000 (10.000 (10.000 (10.000 (10.000 (10.000 (10.000 (10.000 (10.000 (10.000 (10.000 (10.000		ĺ	Interse	ction Ir	formati	on		1156	i is is
Agency	enneyddining martin-Onto	WW DOH		ACC INCIDENTAL PROPERTY.	TERRAPORTO PORTO DE LA CONTRACTOR DE LA	тепрев такаро сточату ч	PROSERVE ENTERNACION CONTROL		Duration	7, h	1.00	See Commission of the Commissi	10000	¥ 14	
Analyst	elektriste och meller och states (4 teter	DLD		Analy	sis Dat	e Apr 2	3, 2014		Area Ty	pe	Othe	:r	*		施
Jurisdiction	(CONTRACTOR AND	Mononglia County	POCOSTORION XXXVIII SANCES	ng manusung kanding colleges (	<sup>o</sup> eriod	3:15 -	CANADA SERVICIO SE CONTRACTO DE	esanember etter efter	PHF		1.00	STANSBURENTERS OF COSTUL	omer S	***	<b>.</b>
Intersection	MONTH STREET,	Collins Ferry		Analy	sis Yea	r 2014	construction of the second of	IST I STATE OF THE PARTY OF THE	Analysis	Period	1> 5:	:00			
File Name	STREET, STREET	Streets1 (Collins).xu	JS	Šamusania sala	***************************************	okennedi sensenikan distantisti	ida necesara e e e e e e e e e e e e e e e e e e	and the second s	novimento constitutivi proprieta	TOTAL STATE OF THE	พลเพราะก็โด <i>ก</i> ระหวายของรอย	DEFFERENCES CHEMOLOGICS		***	<u>,</u>
Project Descrip	tion	Signal Analysis	iyayaayingii Manbir Kalib	Meedinalalasiniintiintiintiintiintii	mona minima vide e de de	en mer minimum en sen en en minimum en		mentanian periodo en car	ешев в въентистију да дууда је с	Milion emanteramenten.		MANAGE CLESSON NEWS OF	interfaces	7 4 1 9 3	
		Microsoft Control of the Control of			200										
Demand Inforr	nation		د در	EB WB							NB			SB	Kinesan Managaria
Approach Move	ement			L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), ve	h/h			188	247	11	23	27	5   168	8	8	46	134	9	55
Signal Informa				o Quintena	3 6			CA26/65V010s	dia				-		
Cycle, s	94.9	Reference Phase	2				7	TWING THE PROPERTY OF THE PROP	=======================================	(Applement Cross			⊕ .		K.43
Offset, s	0	Reference Point	End		43.9	19.9	16.1	0.0	0.0	0.0			K		
Uncoordinated	Yes	Simult. Gap E/W	On	Yellow	4.0	4.0	4.0	0.0	0.0	0.0	erespondence -		7		N/A
Force Mode	Fixed	Simult. Gap N/S	On	Red	1.0	1.0	1.0	0.0	0.0	0.0	)	- 6	6	7 3 2 <b>7</b>	
											anii anii anii anii anii anii anii anii	and the second			
Timer Results		See to the second se		EB	L management	EBT	WB	L L	WBT	NE	3L	NBT	SB	L	SBT
Assigned Phase	•	\$\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\		animitaturetania.	ermiesra esperant	<b>2</b> ************************************	Samoonia marania militaria B	navierna and legente	6	ne jayahamatattan ma		8	The state of the s	mana mana mana mana mana mana mana mana	4
Case Number						6.0		ni mi	6.0			12.0			11.0
Phase Duration, s				wity/emwillencowskilenco	1000-1000-000 genterance	48.9			48.9	THE SECOND MONEY OF THE PROPERTY OF		21.1			24.9
ASSESSOR AND ASSESSOR AND ASSESSOR ASSES	Change Period, (Y+R₀), s				Material Market September	5.0		TO THE PERSON NAMED IN COLUMN	5.0			5.0			5.0
Max Allow Head	esiman rasaan kansan rasaa	harantanamatinensiamatuunoon oo loonsa soomaan oo loonsa saasia kalisakiin oo l	endo en el transcripció de la construidad del construidad de la co	gy)s)symmetimaterisimg)	าแพวกสมเสริสเทยกลาก	6.4		oveloobleen Scotte	6.4	o di marina di mana di Mana di mana di		6.3			6.2
Queue Clearan	อัตร์เลืองร่างโรกิเทศภัศณาที่สามาร์เกเต	manalarine de walder forme de la faction	Sinidiomoinesis monem	38.0			5.3		, in the same of t	9.0					
Green Extensio	economia del circino de la companya (para por la companya (para por la companya (para por la companya (para po	(ge), s		uniomoniomonomo	unsumun di	5.9	_	eriseinen Saasa	9.5	Complete Company	0.4			, contraction	1.5
Phase Call Prol		nint (nd pomityk ennt gatyknik (ninint 31 (n3 pomity 13 )), nomeny (Nameny 13 km) dezh Nel a anek kkissis	eo locumento de la constanta d	orlandon de production de l'économic	melecconstruction of the construction of	1.00			1.00			0.80		jiww.	0.99
Max Out Probal	bility					0.63			0.16			0.00	Summer management		0.00
**															
Movement Gro		iuits 			EB		<u></u>	wB		ļ	NB	egiotio::::::::::::::::::::::::::::::::::		SB	angaraninasamanasara
Approach Move	abbian malibar kansar kanya	THE MOTING METERS IN THE PROPERTY OF THE PROPE	nio missini mpine	evirometra herimitatististist	T	R	L	T	R		T	R	L L	. T	R
Assigned Move	o de de la maria de la companya del companya de la companya del companya de la co	marinamaninamananamanananananananananananan	::::::::::::::::::::::::::::::::::::	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow F	ARREN MARKET PRINCIPAL PROPERTY OF THE PROPERT	<del>nian permana piatra reponantian de la colo </del>		188	258		23	443	iningarintan katalan mengentan		62	Žirini zamina na piema na mana na piema ()	EDDOOJNOO-VOULVIIV	143	55
······································		ow Rate (s), veh/h/ln		959	1736	parenten er renner er	1136	1634			1532	ļ		1672	1469
Queue Service	anyymyninynnyntallibahililibil	BGGPRING-ANTHEGGGDASHNANGEGGGAND-BRIDAKHRIBA KARINA ATIIDAKIIIIAK		17.0	8.9	potinion et insultent veixennaturio	1.2	19.0	SHEAD ATHOMOST EMBERS (MET MASSIVA	Secretarion de la companya della companya de la companya della com	\$ 3.3 \$\displays \text{3.3}	ndaleumine s temmenti ettimo	entropolisticos (monestica)	7.0	2.9
Cycle Queue Cl	ikeletrakkinerkikreekekernen	e time ( $g_c$ ), $s$		36.0	8.9	and the second second	10.1	19.0	tata (tableatii maasa kai in nagayana		3.3	a matetantitature, mes	L	7.0	2.9
Green Ratio (g/	MARKATON MARKATANA	TESPYXXVIIA XXXII V SY AARTA AA TAANA A		0.46	0.46		0.46	0.46		genneseoneseo	0.17	Marine Contraction of the Contra	en e	0.21	0.21
Capacity (c), ve	gaines de procure de la companya de	**************************************		328	803		495	756			260			350	308
Volume-to-Capa	CONTRACTOR INCOMENSATION	404090mm09m0s600000000000000000000000000000		0.573	0.321	in proprietable and a second an	0.046	0.586	••••••••••••••••••••••••••••••••••••••		0.238		ina and and and an	0.408	ดเทียงระหายคระหายขากนยู่
Available Capac	netofanenhaenane	EPROTESSA PROGESIONAL PROGESIONAL PRODUCTION AND CONTRACTOR AND CO	econtraction and a section of	390	915	o lovernamierowane	568	861	iani (mananananananananananananananananananan		565	e de la company	Note Alsonismons	616	542
- 1 1 ya yanginelya emenjiba ya Gilbahah kalabah kalabah ka kamela k	ennemonymentalistaticitist	n/ln (95th percentile)	ionith Circultivo med PVI	7.4	6.2		0.6	11.4			2.3			5.3	1.9
	wirwyydawninajyddorylliddyddolei	RQ) (95th percentile)	***************************************	0.00	0.00		0.00	0.00	-		0.00			0.00	0.00
Uniform Delay (		NBM21955/XXM153/линивания каканания профессорующего при		32.0	16.1	(lapidajiwiiimwwaanine)	19.3	18.8			34.1		Zalialis estaturas e	32.4	30.8
Incremental Del	สาขางเกราะเกราะการการการการการการการการการการการการการก	PART PATER-AN EXTRACORMACCA CANALISM CONTINUES AND ANALISM CONTINUES ANALISM CONTINUES AND ANALISM CONTINUES AND ANALISM CONTINUES ANALISM CONTINUES AND A	attivasa kattioinas konsimisinini kohs	3.4	0.5	is primitalainitata arialean	0.1	1.6	and construction of the second		1.0	Antenia (minerali) (1000)		1.6	0.6
/	Queue Delay ( <i>d₃</i> ), s/veh			0.0	0.0	ļ.	0.0	0.0		ļ	0.0	Constantential de la constan	Salarani Paramaja provinci provinci pa	0.0	0.0
117-1-2-shequequequequequittimoqqqiaqimqmqqqqqqqq	ntrol Delay (d), s/veh			35.4 D	16.6	ni (ililimi i vensimeni) veii isely	19.3	20.4	ing prison comments	_	35.1	and the second second	Contraterno contraterno con p	34.1	31.4
	evel of Service (LOS)				В		В	C			<u>D</u>	<u> </u>	platical e aleger es se capaça que	LC	C
1.11-12-12 Sammermermerwerprinchtwisklichbörbeitlichsbischeinbeite	pproach Delay, s/veh / LOS					C	20.4	<b>!</b>	C	35.	1	<b>D</b>	33.3	3	C
Intersection Del	tersection Delay, s/veh / LOS					24	1.9						nd Mariania in thinis all mariani annone annone an Service portune e consistent e consistent.  Consistent in National I describe a proposition annone anno anno		
	Aultimodal Results				EB.	×	annini naasaan	WB	ekit til til entre timilan panneng		NB	trisiii riminin priisemė seseguoje		SB	racrementations processing
Pedestrian LOS	waliporto rożuści i do kystalnie jedosta	TENNYYSOTTEN VIETETT KANTON K		2.1		В	2.3	:::::::::::::::::::::::::::::::::::::	В	2.3	naararanimakinkahinisiininsi	В	2.3	oneistuminum seljuminenssus	B
BICYCIE LUS SCI	ycle LOS Score / LOS			1.2		Α	1.3		Α	0.6	j [	Α	0.8	i	Α

				RO	JNDABO	OUT REF	ORT									
General Information	····					Site In	forma	tior	n		•••					
Analyst DLD Agency or Co. WVDC Date Performed 4/23/2 Time Period 3:15-4	014					Intersection University and Collins Ferry E/W Street Name University Avenue N/S Street Name Analysis Year 2014										
Peak Hour Factor 1.00 Project Description:	<del>,</del>	·		.,		Project	טו		Roui	ndabout .	Simulati	on				
Volume Adjustment an	d Sita	Chara	torictie	····	·····											
voiame Adjustment an	u one	EE		. <b>3</b>		VB				NB	T			SB	-	
	L	TT	····	U L	Ιτ	R	U	L	Т	R	U	L	Т	R	U	
Number of Lanes (N)	0	1	0	0	1	0		0	1	10	t		1	10		
Lane Assignment		<u> </u>	LTR		<u>l</u>	LTF	7			Lī	TR		!		LTR	
Right-Turn Bypass		Non	е		No	None			1	lone			None			
Conflicting Lanes		1				1			· · · · · · · · · · · · · · · · · · ·	1			1			
Volume (V), veh/h	188	247	11	0 23	275	168	0	8	8	46	0	134	9	55	0	
Heavy Veh. Adj. (f <sub>HV</sub> ), %	3	3	3	3 3	3	3	3	3	3	3	3	3	3	3	3	
Pedestrians Crossing		0	•	7	•	0				0			l	0		
Critical and Follow-Up	Headv	vay Adj	ustmer	ìt	······································			***************************************			······					
	**		EB		7	WB				NB				SB		
		Left	Right	Bypass	Left	Right	Вура	ss	Left	Right	Bypass	Le	ft	Right	Bypass	
Critical Headway (sec)			5.1929	5.1929	5.1929	5.1929	5.192	9 5	5.1929	5.1929	5.1929	5.19	29 5	5.1929	5.1929	
Follow-Up Headway (sec)		3.1858	3.1858 3.18		3.1858	3.1858	3.185	8 3	3.1858	3.1858	3.1858	3.18	58 3	3.1858	3.1858	
Flow Computations							,									
			EB			WB				NB				SB		
		Left	Right	Bypass	Left	Right	Вура	38	Left	Right	Bypass	Let	ft	Right	Bypass	
Circulating Flow (V <sub>c</sub> ), pc/h			171		·	210				586				315		
Exiting Flow (V <sub>ex</sub> ), pc/h			440			348	· · · · · · · · · · · · · · · · · · ·		375			44		44		
Entry Flow (V <sub>e</sub> ), pc/h			459		ļ	480				64		<u> </u>		204		
Entry Volume veh/h		<u> </u>	446			466	<u> </u>			62		***************************************		198		
Capacity and v/c Ratios	•	·					<del></del>									
			EB	1		WB				NB		ļ	- 1	SB	T	
Consoit / /a \ \ nolls		Left	Right	Bypass	Left	Right	Bypas	SS	Left	Right	Bypass	Lei	t	Right	Bypass	
Capacity (c <sub>PCE</sub> ), pc/h			952			916		+		629		<u> </u>		825		
Capacity (c), veh/h			925			889	<u> </u>			611	···	-	+	801		
v/c Ratio (X)	.i.a		0.48	<u></u>	<u> </u>	0.52				0.10	<u></u>			0.25		
Delay and Level of Serv	rice	I			1	100	~~~		••	N.D.		1				
		Left	EB Right	Bypass	Left	WB Right	Вураз	+	Left	NB Biobt	D	Lef	<u>. T</u>	SB	D	
Lane Control Delay (d), s/ve	h	reir	9.9	Dypass	Leit	11.0	nypas	0	LCIL	Right	Bypass	Let	١	Right	Bypass	
Lane LOS			9.9 A	<del> </del>		11.0 B	<del>                                     </del>			7.1 A			+	7.2 A		
Lane 95% Queue			2.7			3.1	<del> </del>	+		0.3		-		1.0		
Approach Delay, s/veh			9.86		11.04	L	+		7.07				7.20	<u> </u>		
Approach LOS, s/veh		9.86 A				B A						7.20 A				
Intersection Delay, s/veh					<u> </u>			 9.73	3			<u></u>				
		<b></b>						A								

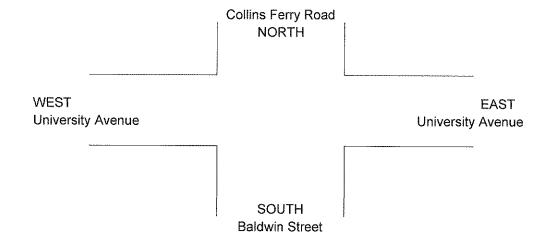
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HCS 2010<sup>TM</sup> 6.50 Roundabouts Generated: 5/22/2014 2:11 PM

****		O-WAY STOP	CONTIN	V		/// I					
General Informatio	n		Site I	nform	atic	n					
Analyst	DLD		Interse	ection			Universit	y and Coll	ins Ferry		
Agency/Co.	WVDOH		Jurisdi	ction	************		Mononga	lia			
Date Performed	4/23/201		Analys	is Year	r		2012				
Analysis Time Period	3:15-4:15	5		w.							
	kisting								***************************************		
East/West Street: <i>Univ</i>							Ferry and Baldwin St.				
ntersection Orientation:	East-West		Study F	Period (	(hrs):	1.00					
Vehicle Volumes a	nd Adjustme	nts									
Major Street		Eastbound					Westbou	ınd			
Vlovement	1	2	3			4	5		6		
	L	T	R			L	Т		R		
/olume (veh/h)	188	247	11			23	275		168		
Peak-Hour Factor, PHF	1.00	1.00	1.00			1.00	1.00		1.00		
Hourly Flow Rate, HFR veh/h)	188	247	11			23	275		168		
Percent Heavy Vehicles	0	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,				0					
Median Type				Undiv	rided						
RT Channelized			0						0		
.anes	0	1	0			0	1		0		
Configuration	LTR				***************************************	LTR	<u> </u>				
Jpstream Signal		0					0				
/linor Street		Northbound	7.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1				Southbou	ınd			
/lovement	7	8	9			10	11		12		
	L	Т	R			L	Т				
/olume (veh/h)	8	8	46		**********	134	9		55		
Peak-Hour Factor, PHF	1.00	1.00	1.00		1.00		1.00		1.00		
dourly Flow Rate, HFR veh/h)	8	8	46			134	9		55		
Percent Heavy Vehicles	0	0	0			0	0		0		
Percent Grade (%)		0				t	0				
lared Approach		N					N				
Storage	******	0					0				
RT Channelized			0		***************************************				0		
anes	0	1	o			0	1		1		
Configuration		LTR	<u> </u>			L.T	<b></b>		Ŕ		
Delay, Queue Length, a	and level of Se						<u> </u>		, ı		
opproach	Eastbound	Westbound	P	Vorthbo	und			outhbound			
Novement	asibound	4	7	8	unu	9	10	11			
ane Configuration	LTR	LTR	′	LTR	$\dashv$	J		11	12		
							LT		R		
(veh/h)	188	23		62			143		55		
(m) (veh/h)	1128	1318		386			156		690		
/c	0.17	0.02		0.16			0.92		0.08		
5% queue length	0.60	0.05		0.57			11.75		0.26		
Control Delay (s/veh)	8.8	7.8		16.1			162.1		10.7		
OS	Α	Α		С			F		В		
pproach Delay (s/veh)	######################################			16.1				120.1	- E		
pproach LOS			70. T				F				
opyright © 2010 University of Fl				CS+TM			Generated: 5/22/2014 2:13				

## APPENDIX D

# Comparison of Collins Ferry and University Avenue



	Delay (s)	LOS	95% Queue (ft)
No Added Lanes	57	E	-
EB	74	E	#465
WB	54	D	#508
NB	2	A	#201
SB	44	D	12
Signal (LT Added to University EB+WB, Right turn lane also added on Collins Ferry)	21	С	-
EB	18	В	177
WB	24	С	#318
NB	5	Α	20
SB	23	С	131
Signal (Previous + RT Lane added to WB University)	17	В	-
ЕВ	16	В	62
WB	19	В	209
NB	4	Α	0
SB	19	В	45

Synchro 8 Analysis

# Lanes, Volumes, Timings 1: Baldwin & University Avenue & Collins Ferry

	22	110	n	ΛÍ
~\/		'' '	ш	4

	<b>*</b>		7	×	Ĵ	4	<b>X</b>	*	K	1	"	<b>~</b>
Lane Group	EBL	EBR	EBR2	SET	SER	SER2	NWL2	NWL	NWT	NEL2	NEL	NER
Lane Configurations	γ			13	**************************************				4		M	
Volume (vph)	188	247	11	134	9	55	23	275	168	8	8	46
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0			100	alikana.		0			0	0
Storage Lanes	1	0			0			0			1	0
Taper Length (ft)	25					<u>Arriada</u>		25			25	AAA HA
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.922			0.956			ARIVEREN				0.900	September 1
Flt Protected	0,979			3 700					0.969		0.987	
Satd. Flow (prot)	1681	0	Ō	1781	0	0	0	0	1805	Ó		Õ
Flt Permitted	0.979		7,1,14			***		475	0.969	***	0.987	8
Satd. Flow (perm)	1681	0	0	1781	0	0	0	0	1805	0		0
Right Turn on Red			Yes			Yes	**		: /#00/AL	54.	3420 441 14	Yes
Satd, Flow (RTOR)	121			18							121	
Link Speed (mph)	25			25					25		25	
Link Distance (ft)	405			469					625		739	
Travel Time (s)	11.0			12.8					17.0		20.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	188	247	11	134	9	55	23	275	168	8	8	46
Shared Lane Traffic (%)								<b>OHANN</b>		Ų skielių i		wiki Kat
Lane Group Flow (vph)	446	0	0	198	0	0	0	0	466	0	62	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Right	Rìght	Left	Right	Right	Left	Left	Left	Left	Left	Right
Median Width(ft)	12			0	HEALING N	y (Milye)	A, Bakini		0	jiakita.	12	
Link Offset(ft)	0			0					0		Ô	
Crosswalk Width(ft)	16			16					16		16	
Two way Left Turn Lane	SERVING NO.											
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1,00	1.00
Turning Speed (mph)	15	9	9		9	9	15	15		15	15	9
Number of Detectors	1			2					2	1	1	
Detector Template	Left			Thru			Left	Left	Thru	Left	Left	
Leading Detector (ft)	20			100			20	20	100	20	20	
Trailing Detector (ft)	0			0			0	0	0	0	0	
Detector 1 Position(ft)	0		Manistra	0			0	0	0	0	0	ANNER -
Detector 1 Size(ft)	20			6			20	20	6	20	20	
Detector 1 Type	CI+Ex			CI+Ex			CI+Ex	CI+Ex	CI+Ex	CI+Ex	CI+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0			0.0	Militaria.		0,0	0,0	0.0	0.0		miki Kar
Detector 1 Queue (s)	0.0	Anna ann ann an Taoire		0.0			0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0			0.0			0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(ft)	. N. S.	ates to a consequence		94					94			
Detector 2 Size(ft)				6		andrik Ar			6			ENTER E
Detector 2 Type			orang ng Nasaran	CI+Ex	, eg eg galasa a sa e A	andywasty gwasienia	ta se e e e e e e e e e e e e e e e e e e	al Vallation and the second	CI+Ex	Supplied to Supplied		
Detector 2 Channel												
Detector 2 Extend (s)	nga nga <b>jaw</b> an atawa	Section Australia		0.0			. <u> </u>	1	0.0			
Turn Type	Prot		asetternit	NA		TANGE TO SERVICE TO SE	Split	Split	NA	Prot	Prot	<b>建建建</b> 基
Protected Phases		nggan sang Aggangan s	organia tanàna ao	ter egypettagster	National Agents (Steel St.	sandagerrezezzen	2	2	2	4	4	
Permitted Phases			Westward	3								
Detector Phase	1			3			2	2	2	4	4	

# Lanes, Volumes, Timings 1: Baldwin & University Avenue & Collins Ferry

	_ ﴿	* × *	7 7	~	4	×	•	7	74
Lane Group	EBL EB	R EBR2 SET	SER SER2	NWL2	NWL	NWT	NEL2	NEL	NER
Switch Phase									
Minimum Initial (s)	10.0	10.0	1	10.0	10.0	10.0	10.0	10.0	
Minimum Split (s)	20.5	20.5		20.5	20.5	20.5	20.5	20.5	
Total Split (s)	23.7	20.5		30.3	30.3	30.3	20.5	20.5	
Total Split (%)	24.9%	21.6%		31.9%	31.9%	31.9%	21.6%	21.6%	espagni.
Maximum Green (s)	19.2	16.0		25.8	25.8	25.8	16.0	16.0	
Yellow Time (s)	3,5	3.5		3.5	3.5	3.5	3.5	3.5	
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	0.0	0.0				0.0		0,0	
Total Lost Time (s)	4.5	4.5				4.5		4.5	
Lead/Lag	Lead	Lead		Lag	Lag	Lag	Lag	Lag	de la Maria
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	(SASSE)
Recall Mode	Min	None	1	Min	Min	Min	Min	Min	
Walk Time (s)	5,0	5.0		5.0	5.0	5.0	5.0	5.0	Period
Flash Dont Walk (s)	11.0	11.0	ı	11.0	11.0	11.0	11.0	11.0	
Pedestrian Calls (#/hr)	0	O The second second		0	0	0	0	0	
Act Effct Green (s)	19.2	13.5		140		25.1		10.0	
Actuated g/C Ratio	0.22	0.16				0.29		0.12	
v/c Ratio	0.95	0.67				88.0		0.21	
Control Delay	73.6	43.8				54.2		2.1	
Queue Delay	0.0	0.0				0.0		0.0	
Total Delay	73.6	43,8				54.2	ya hydd	2.1	SW St.
LOS	E	D				D		A	
Approach Delay	73,6	43.8				54.2	laastelt fan Sanstal Súdstwakstússef	2.1	
Approach LOS	E	D				D		Α	
90th %ile Green (s)	19.2	16.0		25,8	25.8	25.8	10.0	10.0	
90th %ile Term Code	Max	Max		Max	Max	Max	Min	Min	
70th %ile Green (s)	19.2	16.0		25.8	25.8	25.8	10.0	10.0	
70th %ile Term Code	Max	Max		Max	Max	Max	Min	Min	
50th %ile Green (s)	19.2	14.0		25.8	25.8	25.8	10.0	10.0	
50th %ile Term Code	Max	Gap		Max	Max	Max	Min	Min	
30th %ile Green (s)	19.2	11.7		25.8	25.8	25.8	10.0	10.0	West File
30th %ile Term Code	Max	Gap		Max	Max	Max	Min	Min	
10th %ile Green (s)	19.2	10.0		22.4	22.4	22.4	10.0	10.0	
10th %ile Term Code	Max	Min		Gap	Gap	Gap	Min	Min	
Stops (vph)	284	165				401	PREFERE		
Fuel Used(gal)	9	3 			energen er en	9	on the character to the Asia	0	ent discount and a second
CO Emissions (g/hr)	651	223				640	and an experience of the second	29	mas in terms in a property of the control of the co
NOx Emissions (g/hr)	127	43		Parketta da ribeli	State Section	125	. to the growth	6	es autores un tra
VOC Emissions (g/hr)	151	52			Median de de	148	kelo lintiko	7	
Dilemma Vehicles (#)	0 <b>≱</b> na	0 ••••••••••••••••••••••••••••••••••••		neg depart news	. Na special section is	0	A section of	0	e talbier eine
Queue Length 50th (ft)	183	94				241		0	
Queue Length 95th (ft)	#465	#201			māna crais ir ir	#508	i grguns site snaka	12	ANDERS S
Internal Link Dist (ft)	325	389				545		659	stituteje in.
Turn Bay Length (ft)	na ing pangangan na kalabahan na	e ja ja salata salata kan ja ja kan ja	eg Georgia (p. 1942) e di periode e e e e e e e e e e e e e e e e e e	galippingapingapina	energies de como	dan	damak delakaren	ing graph of the same of	nanterjati
Base Capacity (vph)	470	347			a yakaki hilik	543		407	Maria C
Starvation Cap Reductn	0	0 0			sala aregani at a t	0		0	
Spillback Cap Reductn	va de la propieta de la companya de							0	

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### 1: Baldwin & University Avenue & Collins Ferry

	<b>y</b>	~	7	×	Ĺ	4	*	4	×	*)	7	~
Lane Group	EBL	EBR	EBR2	SET	SER	SER2	NWL2	NWL	NWT	NEL2	NEL	NER
Storage Cap Reductn Reduced v/c Ratio	0 <b>0.9</b> 5			0 <b>0.57</b>					0 <b>0</b> .86		0 0.15	
Intersection Summary												
Area Type: O Cycle Length: 95	ther											
Actuated Cycle Length: 85.9 Natural Cycle: 95		nybinjevin						PAPA BAR	MERCH			PARAMA.
Control Type: Actuated-Uncoc Maximum v/c Ratio: 0.95	ordinated	Hini/ita									lovani Mari	
Intersection Signal Delay: 57.: Intersection Capacity Utilization				200	tersection	LOS: E					intrinipie i	ALAN K
Analysis Period (min) 60 90th %ile Actuated Cycle: 89							- Partie					PARAFE
70th %ile Actuated Cycle: 89 50th %ile Actuated Cycle: 87					legan et de la				de fluis et et Net de est et et e	Anggarana dagad Manggarana dagad		
30th %ile Actuated Cycle: 84.		(sometia	vár lejés (G			ir eşdikil beşd				HÁNG RÁNG		pájádkei
10th %ile Actuated Cycle: 79.6 # 95th percentile volume exc Queue shown is maximum	eeds cap		eue may l	be longer	neime karen e Yan da marine							
Splits and Phases: 1: Baldw	in & Univ	ersity Av	enue & C	ollins Fer	ry							

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# Lanes, Volumes, Timings 1: Baldwin & University Avenue & Collins Ferry

5/22/2014

	٨	74	7	لير	لږ	4	<b>*</b>	*	*	•	<b>*</b>	~
Lane Group	EBL	EBR	EBR2	SBL	SBR	SBR2	NWL2	NWL	NWR	NEL2	NEL	NER
Lane Configurations	A	Ĭ.		ሻ	Ž.		Ŋ	A			ď	
Volume (vph)	188	247	11	134	9	55	23	275	168	8	8	46
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200	0		0	300			0	0	uday.	0	0
Storage Lanes	1	1		1	1			2	0		1	0
Taper Length (ft)	25	A difference		25	ari i Agiri	90 to 30 to	5 1 Japan	25	yar e Egis	a Hysy	25	Nagara.
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850	Kiika Was	vile/Ab	0.850	18.08.08.08.08.08.08.08.08.08.08.08.08.08	into the	0.943		a Albain	0.900	
Fit Protected	0.950	1200000 1000		0.950			0.950	0.970			0.987	
Satd, Flow (prot)	1770	1583	0	1770	1583	0	1770	1704	Ő.	0	1655	Ô
Fit Permitted	0.950	r ngagarjata	2.004	0.950	·	**	0.950	3 7 650.00	7/4	_	0.943	2.
Satd. Flow (perm)	1770	1583	0	1770	1583	0	1770	1757	0	0	101	0
Right Turn on Red	2 4 4 7554		Yes	9.7 2.999	V 1 1 200	Yes	38 3 Stee	465.773	Yes	52	3 <i>4</i> (4),3	Yes
Satd. Flow (RTOR)		108	differential	e di Sap	108	ા નહીં હ	SAMA AR	108		144.45	108	glata et
Link Speed (mph)	25	7875941		25	199900			25			25	
Link Distance (ft)	730		gradeli.	729	en di dalah	es digraps.	h whitelete	625	s tylina tyran	e ta e verse d	739	BARBAR E
Travel Time (s)	19.9		-	19.9				17.0			20.2	
Peak Hour Factor	1.00	1,00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	188	247	11	134	9	55	23	275	168	8	8	46
Shared Lane Traffic (%)					Nama							ia in dia ia
Lane Group Flow (vph)	188	258	0	134	64	0	23	443	0	0	62	0
Enter Blocked Intersection	.oo No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Right	Right	Left	Right	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)	12	Tagin	rugiit	12	ragin	rugiit	2011 1111 1111	24	ragnt	£CIL	12	Night
Link Offset(ft)	0			0				0			<u>ιχ</u>	
Crosswalk Width(ft)	16		1,11	16	gardan e		a singila	16			16	
Two way Left Turn Lane	190			1,0				10			10	
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	9	15	9	9	1.00	15	9	15	15	1.00
Number of Detectors	1	ing ing single sages.			ت 1		13	13 1	ang Bagasan yang Majaran dan pang	13	13 1	<b>لا</b> المعادلة
Detector Template	Left	Right		Left	Right	*****	Left	Left		Left		
Leading Detector (ft)	20	20	1.00 8.000	20	20	s i filit galad	20	20	s North Artic	20	Left 20	and the second
Trailing Detector (ft)	0	0	*		0			* * *				
Detector 1 Position(ft)	0	. 0		0	0	ti kanalesia	0	0		0	0 <b>0</b>	tive total
	20	20			· .		4			0	- 1	1.4
Detector 1 Size(ft)			n nama	20	20	general services	20	20	State of A	20	20	i de i el e
Detector 1 Type	CI+Ex	CI+Ex	* ***	CI+Ex	CI+Ex		CI+Ex	UITEX		CI+Ex	CI+Ex	
Detector 1 Channel	0.0	0.0			n n	ing a sign of a	0.0	***			and the second	5
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0,0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	. N. Garage	0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	71	0.0	0.0		0.0	_ 0.0	Jana A
Turn Type	Prot	Perm		Perm	Perm		Prot	Perm		Perm	Perm	
Protected Phases			the early property		enderverter i		5	Heritaria.		* * * * £ * * \$1.		
Permitted Phases	and the second section of the second	6		3	3			2		4	4	
Detector Phase	1 1 1 1 1 1	6		3	3		5	2		4	4	HARLEY !
Switch Phase	e je ned takkar		i de la compansión de la c	- 11-12-14-14-14-14-14-14-14-14-14-14-14-14-14-			n nakazar e					
Minimum Initial (s)	10.0	4.0		72	1.2	on its affects		562 .	Aleks being	4	4.0	
Minimum Split (s)	20.5	20.5		20.5	20.5		20.5	20.5		20.5	20.5	
Total Split (s)	20,6	32.4		20,5	20.5		20.5	32,4		32.4	32.4	
Total Split (%)	19.5%	30.6%		19.4%	19.4%		19.4%	30.6%		30.6%	30.6%	

	À	-34	يا چ	لر	4	~	4	*	1	<i>*</i>	~
Lane Group	EBL	EBR	EBR2 SE	JL SBR	SBR2	NWL2	NWL	NWR	NEL2	NEL	NER
Maximum Green (s)	16.1	27.9	16	.0 16.0	y Menangany	16.0	27.9		27.9	27.9	
Yellow Time (s)	3.5	3.5	**	.5 3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	1.0	1.0		.0 1.0		1.0	1.0		1.0	1.0	Markara
Lost Time Adjust (s)	0.0	0.0	,	.0 0.0		0.0	0.0		সংক্র -	0.0	
Total Lost Time (s)	4.5	4.5	instructed starting.	.5 4.5		4.5	4.5	Aged America	134.50	4.5	et in st
Lead/Lag	Lead	Lag	Lea			Lead	Lag		Lag	Lag	
Lead-Lag Optimize?	Yes	Yes	i da karana ƙ	s Yes		Yes	Yes	Sel Day	Yes	Yes	Alter
Vehicle Extension (s)	3.0	3.0	3	.0 3.0		3.0	3.0		3.0	3.0	
Recall Mode	Min	None	Nor	ie None	had kindiningiran	None	None	gagai ente	None	None	yan baran
Walk Time (s)	5.0	5.0	5	.0 5.0		5.0	5.0		5.0	5.0	
Flash Dont Walk (s)	11.0	11.0	elastratismi <mark>n</mark>	.0 11.0		11.0	11.0	spinite (re	11.0	11.0	979 F T
Pedestrian Calls (#/hr)	0	0	W -0	0 0		0	0		0	0	
Act Effct Green (s)	14.3	38.0	va 6 - savi 43	.0 13.0	No si na sala	7.2	20.4	g Ningapat	ar Miss	6.4	\$44 A.F
Actuated g/C Ratio	0.22	0.59	0.2	0.20	ı	0.11	0.32			0.10	
v/c Ratio	0.48	0.26	0.3	8 0.16	41 - 1 - 1 - 1 - 1 - 1 - 1	0.12	0.70	jegana nega	otott s	0.24	
Control Delay	31.7	8.4	31			34.2	23.4			4.6	·-
Queue Delay	0.0	0.0	0		T. GRE	0.0	0.0			0,0	ergen in die August
Total Delay	31.7	8.4	31			34.2	23.4			4.6	
LOS	C	Α		C A		C	C			Α	
Approach Delay	18.2	***	22				23.9			4.6	
Approach LOS	В	Visi Allia (NA)		C	an bahar		C	taduur kaji	halisining Majalah	Α	ga ver
90th %ile Green (s)	16.1	35.9	15	5 15.5		8.1	27.9		6.1	6.1	
90th %ile Term Code	Max	Hold	Ga		partition.	Gap	Max	e en anta	Gap	Gap	13.114
70th %ile Green (s)	16.1	33.9	12			7.2	25.0		5,5	5.5	
70th %ile Term Code	Max	Hold	Ga	p Gap	la para da	Gap	Gap	Altantani,	Gap	Gap	
50th %ile Green (s)	13,7	38.9	11.			0.0	20.7		5,5	5.5	
50th %ile Term Code	Gap	Hold	Ga		Andrew Mark	Skip	Gap		Gap	Gap	
30th %ile Green (s)	11.1	32.2	10.			0.0	16.6		5.5	5.5	
30th %ile Term Code	Gap	Hold	M	d 2. 400 m		Skip	Gap	Mark Salinia	Gap	Gap	Years .
10th %ile Green (s)	10.0	25.4	0.	Zer to to the contract of		0.0	10.9		0.0	0.0	
10th %ile Term Code	Min	Hold	Ski		r-Distillari	Skip	Gap	eri kanala	Skip	Skip	Grand Control
Stops (vph)	154	87	10			23	283		0,5//	4	
Fuel Used(gal)	3	2		2 0		0	6	a saadasa	Japan S		: -
CO Emissions (g/hr)	208	166	14			26	388			32	
NOx Emissions (g/hr)	40	32		9 6		5	76		A.H.	6	- 1 V
VOC Emissions (g/hr)	48	39		4 7		6	90			8	
Dilemma Vehicles (#)	0	0		0 0		Ō	0		energia.	ŏ	garan an
Queue Length 50th (ft)	72	28	5	2 0		9	126			n	
Queue Length 95th (ft)	177	122	13		agra v Sužiskije Parigovi Distribu die saladi u V	38	#318			20	e de la companya de
Internal Link Dist (ft)	650	7	64	1		-22-	545			659	
Turn Bay Length (ft)	200			300			grafija in	s Alexandr	Maga	11.5	1.3
Base Capacity (vph)	508	961	50	35		504	928			840	
Starvation Cap Reductn	Ò	0	and the second second second	0 0		Ö	020			0-0	
Spillback Cap Reductn	Ò	0		0 0		Ő	0			0	
Storage Cap Reductn	0	0.		0 0		Ŏ	ŏ	in interior		ŏ	A stank
Reduced v/c Ratio	0.37	0.27	0.2			0.05	0.48			0.07	
Intersection Summary			-7-	3 <b>-</b>		31.00				3.31	
Area Type:	Other										
Cycle Length: 105.9	Ould										Variaties.

University and Collins Ferry 11:55 am 12/17/2012 Baseline DLD

Synchro 8 Report Page 2

### 1: Baldwin & University Avenue & Collins Ferry

Actuated Cycle Length: 64.2

Natural Cycle: 85

Control Type: Actuated-Uncoordinated 

Maximum v/c Ratio: 0.70

Intersection Signal Delay: 20.5

Intersection Capacity Utilization 63.0% ICU Level of Service B

Analysis Period (min) 60

90th %ile Actuated Cycle: 83.6

70th %ile Actuated Cycle: 77.4

50th %ile Actuated Cycle: 69

30th %ile Actuated Cycle: 61.2

10th %ile Actuated Cycle: 29.9

# 95th percentile volume exceeds capacity, gueue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 1: Baldwin & University Avenue & Collins Ferry

<b>-</b> ≉ <sub>61</sub>	\$2	ø3	<b>1</b>
28.6.5	32.4 s	29.5 \$	32.4 s <sub>n</sub> .
F 195	~% ø6		
26.5 s	J32.4 5	<u> </u>	

Intersection LOS: C

### Lanes, Volumes, Timings

### 1: Baldwin & University Avenue & Collins Ferry

5/22/2014

Bane Group   EBI		<b>^</b> ▲		7	Ļ	لر	4	<b>_</b>	*	*	*)	*	<b>∕</b> ≰
Volume (vph)	Lane Group	EBL	EBR	EBR2	SBL	SBR	SBR2	NWL2	NWL	NWR	NEL2	NEL	NER
Ideal Flow (rphpl)	Lane Configurations	-	Ã		-			74	F.	ř		ď	
Storage Length (ft)	Volume (vph)	188	247	11	134	9	55	23	275	168	8	8	46
Storage Lanes			1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Taper Length (ft)	Storage Length (ft)	200	0		0	300		Albeighig.	300	300		0	0
Lane Util. Factor	Storage Lanes	. •	1		1	1			2	0		1	0
Fit									25			25	
Fit Protected		1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Said. Flow (prot)			0.850			0.850				0.850		0.900	
Fit Permitted					0.950			0.950	0.950			0.987	
Said. Flow (perm)   1770   1583   0   1863   1583   0   1770   1863   1583   0   1581   0			1583	0	1770	1583	0	1770	1770	1583	0	1655	0
Right Turn on Red   Yes   Yes   Yes   Yes   Yes   Yes   Yes   Sald. Flow (RTOR)   108   109   109   100								0.950				0.943	**
Said. Flow (RTOR)		1770	1583	0	1863	1583	0	1770	1863	1583	0	1581	0
Link Speed (mph)   25			1170-14	Yes			Yes			Yes			Yes
Link Distance (ff)   730			108			108				168		108	
Travel Time (s)	Link Speed (mph)								25			25	
Peak Hour Factor   1.00   1.	Link Distance (ft)	730			729				625			739	
Adj. Flow (vph)	Travel Time (s)				19.9				17.0			20.2	
Shared Lane Traffic (%)   Lane Group Flow (yph)   188   258   0   134   64   0   23   275   168   0   62   0	b 100 - 1 - 0 - 12 - 0 - 0 - 100 - 1			1.00		1.00	1,00	1.00	1.00	1.00	1,00	1.00	1.00
Lane Group Flow (vph)   188   258   0   134   64   0   23   275   168   0   62   0	Adj. Flow (vph)	188	247	11	134	9	55	23	275	168	8	8	46
Enter Blocked Intersection   No   No   No   No   No   No   No													
Lane Alignment		188	258	0	134	64	0	23	275	168	0	62	0
Median Width(ft)         12         12         24         12           Link Offset(ft)         0         0         0         0           Crosswalk Width(ft)         16         16         16         16           Two way Left Turn Lane         1.00         1.		No	No	No	No	No	No	No	No	No	No	No	No
Median Width(ft)         12         12         24         12           Link Offset(ft)         0         0         0         0           Crosswalk Width(ft)         16         16         16         16           Two way Left Turn Lane         1.00         1.	Lane Alignment		Right	Right		Right	Right	Left	Left	Right	Left	Left	Right
Crosswalk Width(ff) 16 16 16 16 16  Two way Left Turn Lane  Headway Factor 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.0		12			12				24			12	
Two way Left Turn Lane Headway Factor 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00									•				
Headway Factor   1.00		16			16		Addition.		16		ti in i di	16	
Turning Speed (mph)         15         9         9         15         9         9         15         15         9         15         15         9           Number of Detectors         1 <td>and the second second for the transfer to the second secon</td> <td></td> <td>. messer a</td> <td></td>	and the second second for the transfer to the second secon		. messer a										
Number of Detectors         1			1.00	1.00	A 5 20	1.00	1.00	1,00	1.00	1,00	1.00	1.00	1.00
Detector Template		15	9	9	15	9	9	15	15	9	15	15	9
Leading Detector (ff)         20         0	WARRING STATE OF THE RESERVE					1					4.0	100	
Trailing Detector (ft)         0													
Detector 1 Position(ff)   0   0   0   0   0   0   0   0   0		20	20		20	20		20	20	20	20	20	
Detector 1 Size(ft)   20   20   20   20   20   20   20   2										_	0		
Detector 1 Type   CI+Ex CI+E		* 4	3.3		1.41	F -				0	0	0	
Detector 1 Channel         Detector 1 Extend (s)         0.0											20	20	
Detector 1 Channel         Detector 1 Extend (s)         0.0		CI+Ex	CI+Ex		CI+Ex	CI+Ex		CI+Ex	CI+Ex	CI+Ex	CI+Ex	CI+Ex	Walan Pala
Detector 1 Queue (s)         0.0		. 42 54			es is take								
Detector 1 Delay (s) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0		19.55	474 4 12		2000 44 0040	,		70 90				0.0	
一点,这是一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个					2141 2 411	1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2		1.44.4	0.0	0,0	0.0	0.0	
T T	and the second of the second o	~	0.0		THE PERSON			0.0	0.0	0,0	0.0	0.0	
NA 1997 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Turn Type	Prot	Perm		Perm	Perm		Prot	Perm	Perm	Perm	Perm	
Protected Phases 1							giri virin	5					
Permitted Phases 6 3 3 2 2 4 4	the state of the s				3				2				
Detector Phase 1 6 3 3 5 2 4 4		1	6		3	3		5	2	2	4	4	
Switch Phase	reduct the control of											·	
Minimum Initial (s) 10.0 4.0 10.0 10.0 4.0 4.0 4.0 4.0					7 45%					4.0	4.0		
Minimum Split (s) 20.5 20.5 20.5 20.5 20.5 20.5 20.5													
Total Split (s) 20.6 32.4 20.5 20.5 20.5 32.4 32.4 32.4						2474		1.99			32.4	32.4	
Total Split (%) 19.5% 30.6% 19.4% 19.4% 19.4% 30.6% 30.6% 30.6% 30.6%	Total Split (%)	19.5%	30.6%		19.4%	19.4%		19.4%	30.6%	30.6%	30,6%	30.6%	

### 1: Baldwin & University Avenue & Collins Ferry

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Lane Group	EBL	EBR	EBR2 SBL	SBR	SBR2	NWL2	NWL	NWR	NEL2	NEL	NER
Maximum Green (s)	16.1	27.9	16.0	16.0		16,0	27.9	27.9	27.9	27,9	
Yellow Time (s)	3.5	3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5	
All-Red Time (s)	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0		0.0	0.0	0.0	7 20	0.0	
Total Lost Time (s)	4.5	4.5	4.5	4.5		4.5	4.5	4.5	Herrich	4.5	Nepper
Lead/Lag	Lead	Lag	Lead	Lead		Lead	Lag	Lag	Lag	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3,0	3.0		3.0	3.0	3.0	3.0	3,0	
Recall Mode	Min	None	None	None		None	None	None	None	None	
Walk Time (s)	5.0	5.0	5.0	5.0		5,0	5.0	5.0	5.0	5.0	
Flash Dont Walk (s)	11.0	11.0	11.0	11.0	San Antigis	11.0	11.0	11.0	11.0	11.0	
Pedestrian Calls (#/hr)	0	0	0	~ .		0	0	0	0	0	
Act Effct Green (s)	13.8	32.2	12.5	12.5		7.1	15.2	15.2		6.4	BERT S
Actuated g/C Ratio	0.25	0,58	0.22	0,22		0.13	0.27	0.27		0.11	
v/c Ratio	0.43	0.27	0.32	0.15	er het vivetet.	0.10	0.54	0.30		0.23	gya a kiriki ili
Control Delay	26.5	8.8	26.8			30.2	25.2	5.8		4.3	
Queue Delay	0.0	0,0	0.0			0.0	0.0	0.0		0.0	
Total Delay	26.5	8.8	26.8			30.2	25.2	5.8		4.3	
Los	Ċ	Α	C			С	С	Α		A	viller i
Approach Delay	16.3	1000	19.0				18.5	Think	*****	4.3	
Approach LOS	В		В		kasidati (ili)		В			Α	New York
90th %ile Green (s)	16.1	29.4	14.9	14,9		8.1	21.4	21.4	6.1	6.1	
90th %ile Term Code	Max	Hold	Gap			Gap	Gap	Gap	Gap	Gap	PARTY.
70th %ile Green (s)	15.2	25.7	11.9	11.9		7.0	17.5	17.5	5.5	5.5	
70th %ile Term Code	Gap	Hold	Gap			Gap	Gap	Gap	Gap	Gap	114 4 3 4 4
50th %ile Green (s)	12.7	32.1	10.2	10.2		0.0	14.9	14.9	5.5	5.5	
50th %ile Term Code	Gap	Hold	Gap			Skip	Gap	Gap	Gap	Gap	1000
30th %ile Green (s)	10.6	27.5	10.0	10.0		0.0	12.4	12.4	0.0	0.0	
30th %ile Term Code	Gap	Hold	Min	Min		Skip	Gap	Gap	Skip	Skip	Martin
10th %ile Green (s)	10.0	23,2	0.0	0.0		0.0	8.7	8.7	0.0	0.0	
10th %ile Term Code	Min	Hold	Skip	4.000		Skip	Gap	Gap	Skip	Skip	Selection
Stops (vph)	149	95	107	4		23	217	25	Outp	Δ. Δ. Δ	
Fuel Used(gal)	3	2		i i		_0	4			0	4545414
CO Emissions (g/hr)	193	170	138	31		25	259	83	a sasana sa	32	
NOx Emissions (g/hr)	37	33	27	6		5		16	d Signatur	6	ansin i
VOC Emissions (g/hr)	45	39	32	7		6	60	19		7	
Dilemma Vehicles (#)	Ö	ŏ	o e e e e e e e e e e e e e e e e e e e	•		Ŏ	0	Ö		Ó	100011553
Queue Length 50th (ft)	62	27	45	0		8	91	0	* ** * * * * * * * * * * * * * * * * *	0	
Queue Length 95th (ft)	161	125	119	-		35	209	55		20	ppa (riva
Internal Link Dist (ft)	650	- 1,5-0	649	and an entity of			545		er territoria	659	*****
Turn Bay Length (ft)	200			300	Giralia Jati	300	300	300	bijahayan	009	1994,44,17
Base Capacity (vph)	579	969	606	587	* * * * * * * * * * * * * * * * * * *	575	1054	969	en, elenenera jedija	941	
Starvation Cap Reductn	Ĭ, Ŏ	Õ	000	0		0	0	0		0	
Spillback Cap Reductn	0	0	• • • • • • • • • • • • • • • • • • •	0	11 44 14 44 46 16 16 16 16 16 16 16 16 16 16 16 16 16	0		0	terioris e sterijijalise.	· · · · · · · · · · · · · · · · · · ·	4 4 15 5 1
Storage Cap Reductn	Ó	Ŏ	Ŏ	0		0	0	n	riciji e stabit	0	radian.
Reduced v/c Ratio	0.32	0.27	0.22	0.11		0.04	0.26	0.17			prose (relati
	0.02	0.21	V.22	0.11		0.04	U.ZU	U. 17		0.07	
Intersection Summary	011										
	Other		ANG UNING STATES A BEST MAGANESAN S		Spanianti tennahar	Signatura esta e	Charles Daniel Inno 1	galak galak saka saka sak		s Augustes en anvier en e	eda statue en en en
Cycle Length: 105.9								gariana.			

#### 1: Baldwin & University Avenue & Collins Ferry

Actuated Cycle Length: 56 . Ngg kanalistantan kanalana i manakan ngg taonakan na ngg taonakan na kang pagon da kanalan na kanalan na m

Natural Cycle: 85

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.54

Intersection Signal Delay: 17.0

Intersection Capacity Utilization 52.7% ICU Level of Service A

Analysis Period (min) 60

90th %ile Actuated Cycle: 76.5

70th %ile Actuated Cycle: 68.1

50th %ile Actuated Cycle: 61.3

30th %ile Actuated Cycle: 46.5

10th %ile Actuated Cycle: 27.7

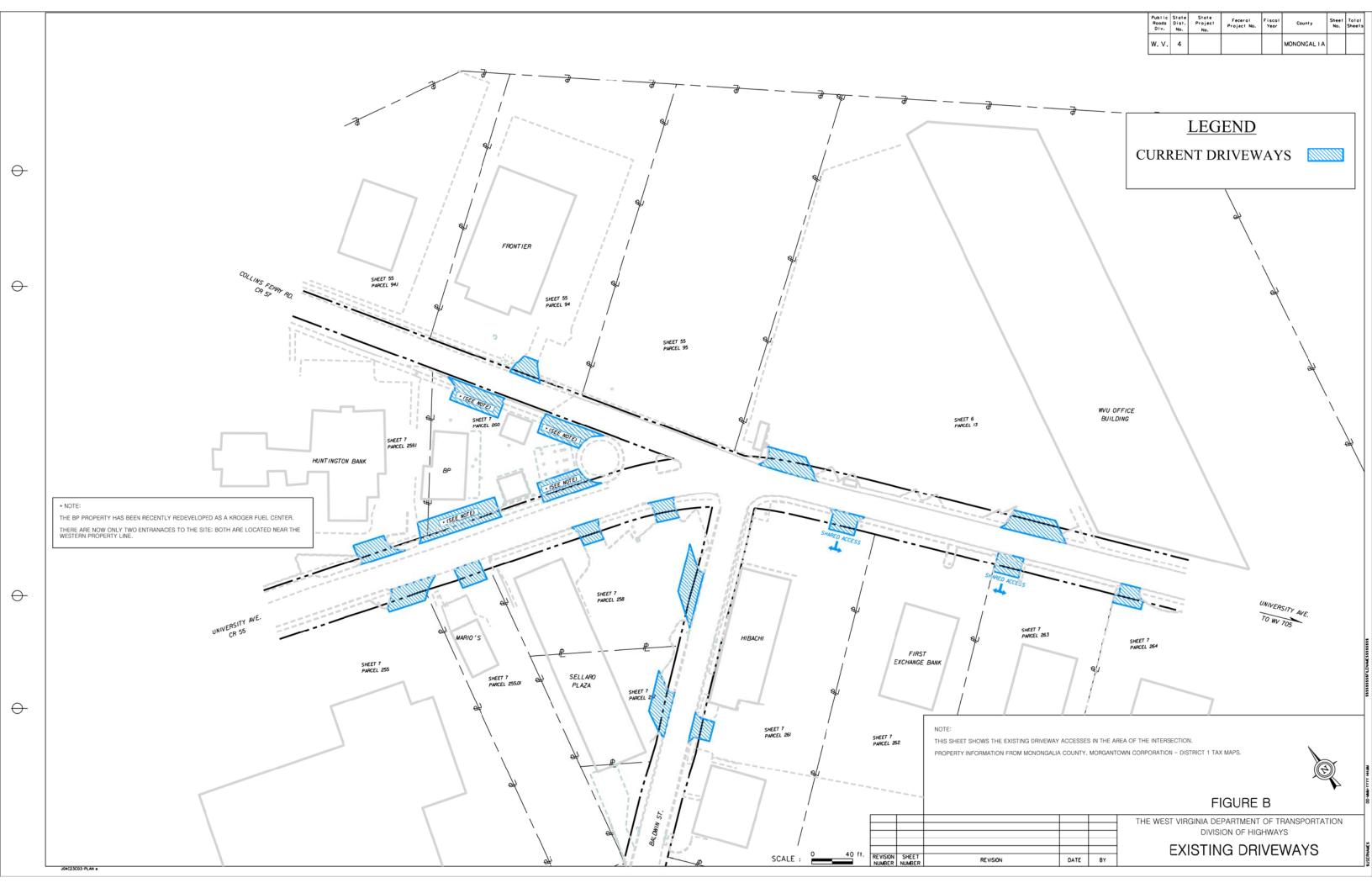
Splits and Phases: 1: Baldwin & University Avenue & Collins Ferry

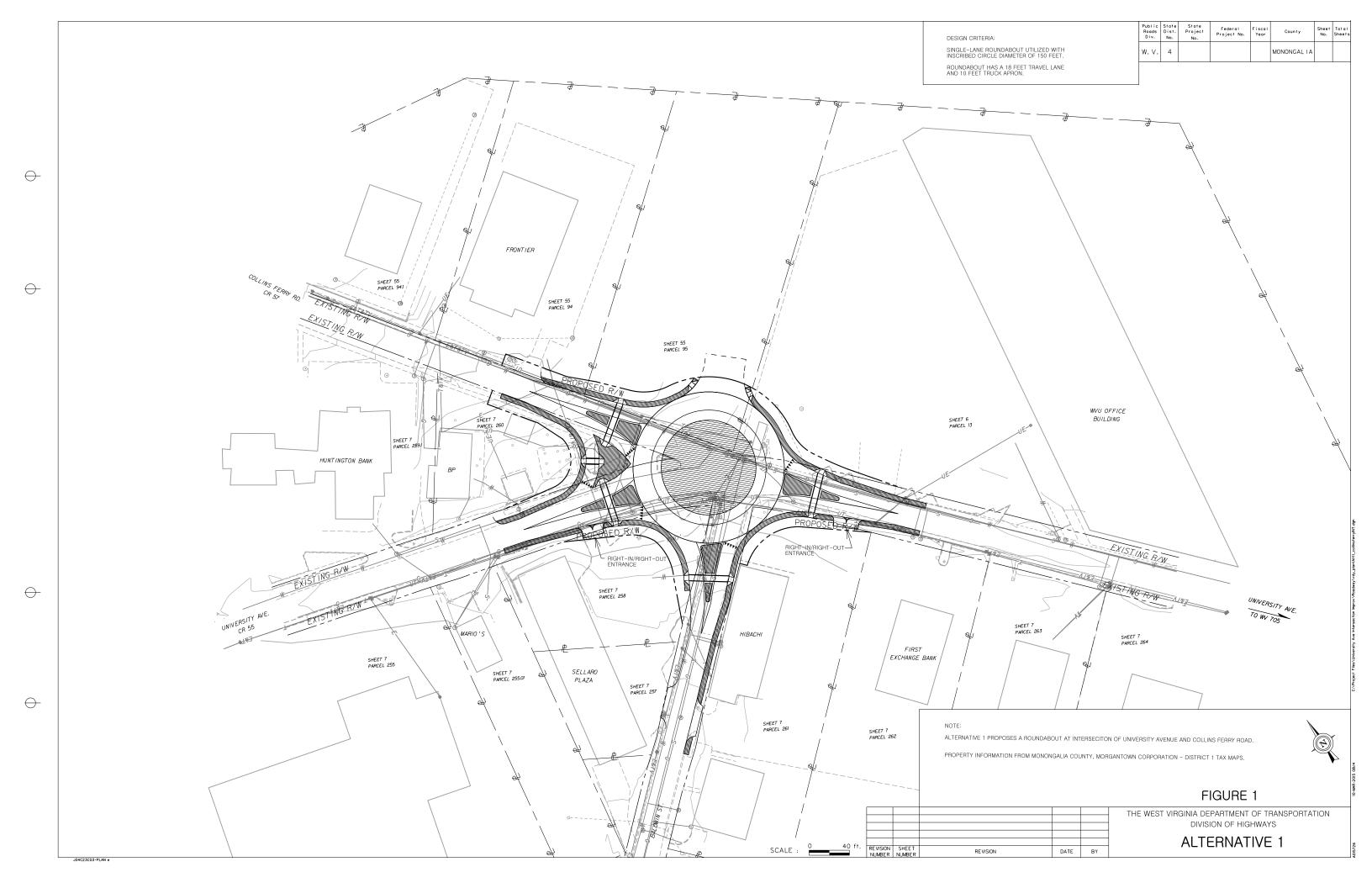
A 01	44 <b>62</b>	ø3	<b>7</b> 94
20 6 \$	32/4 \$	20.5 s	32.4 s
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20.5 s	32.4 s		

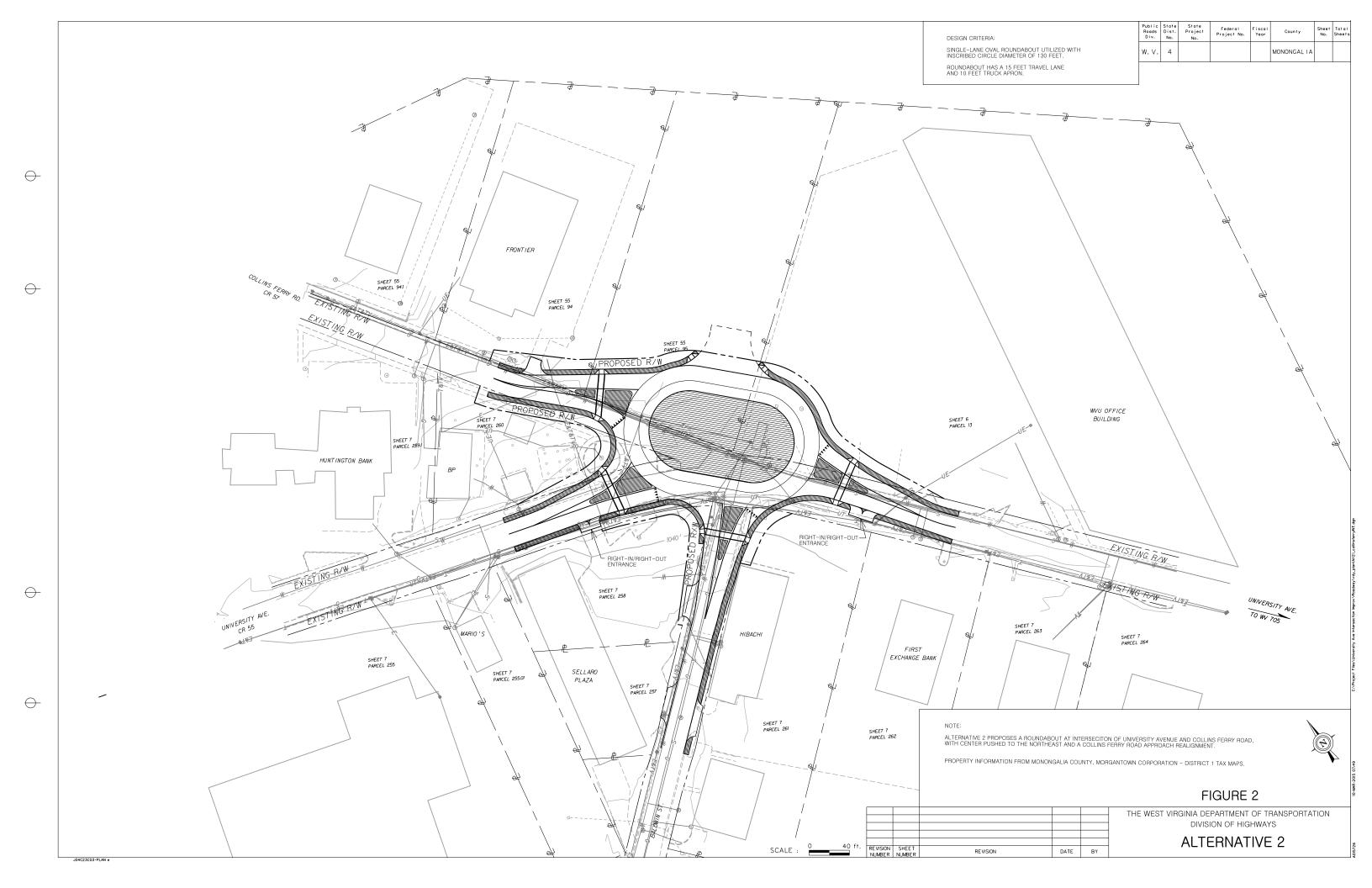
Intersection LOS: B

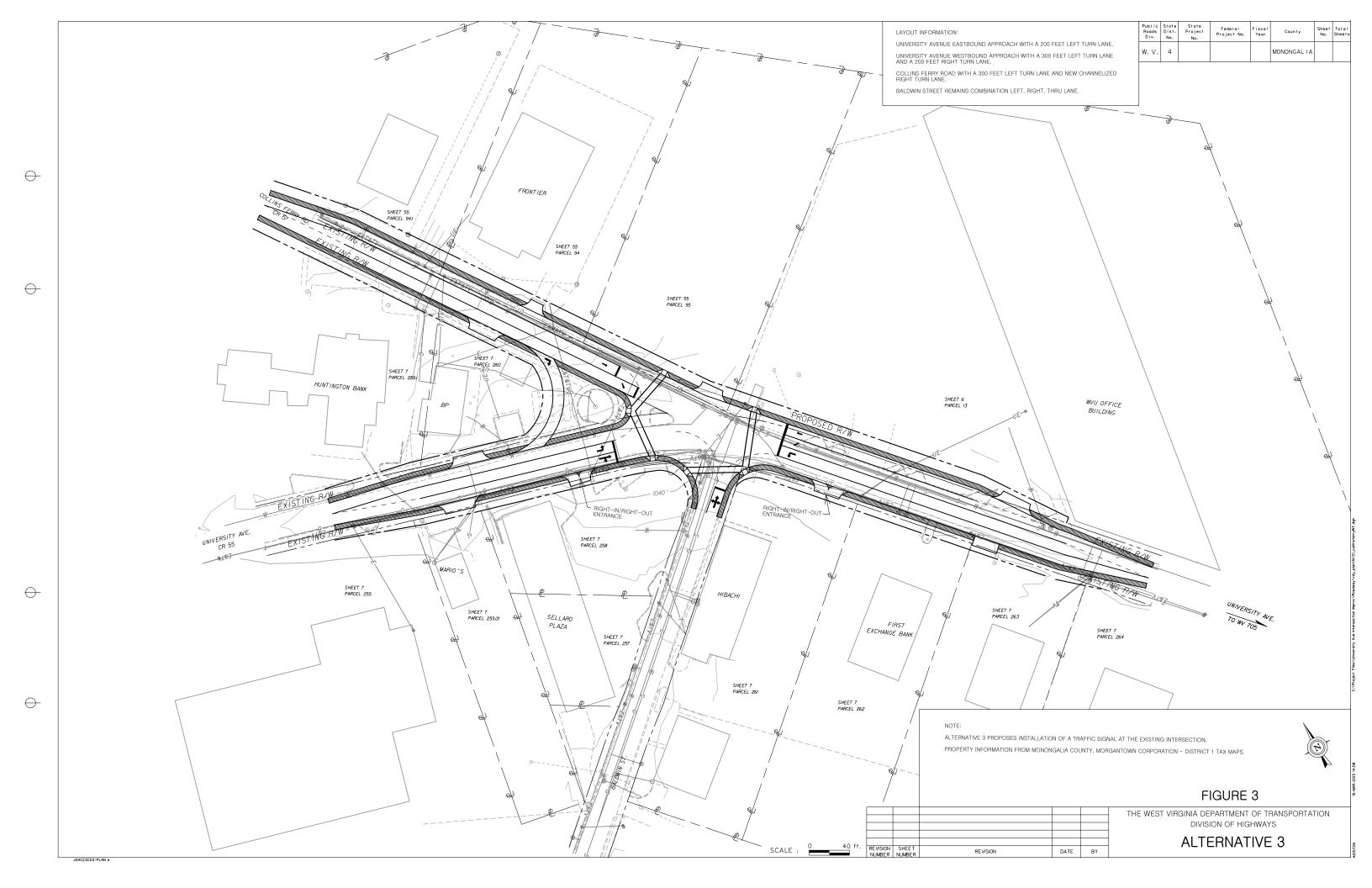
# APPENDIX "2"

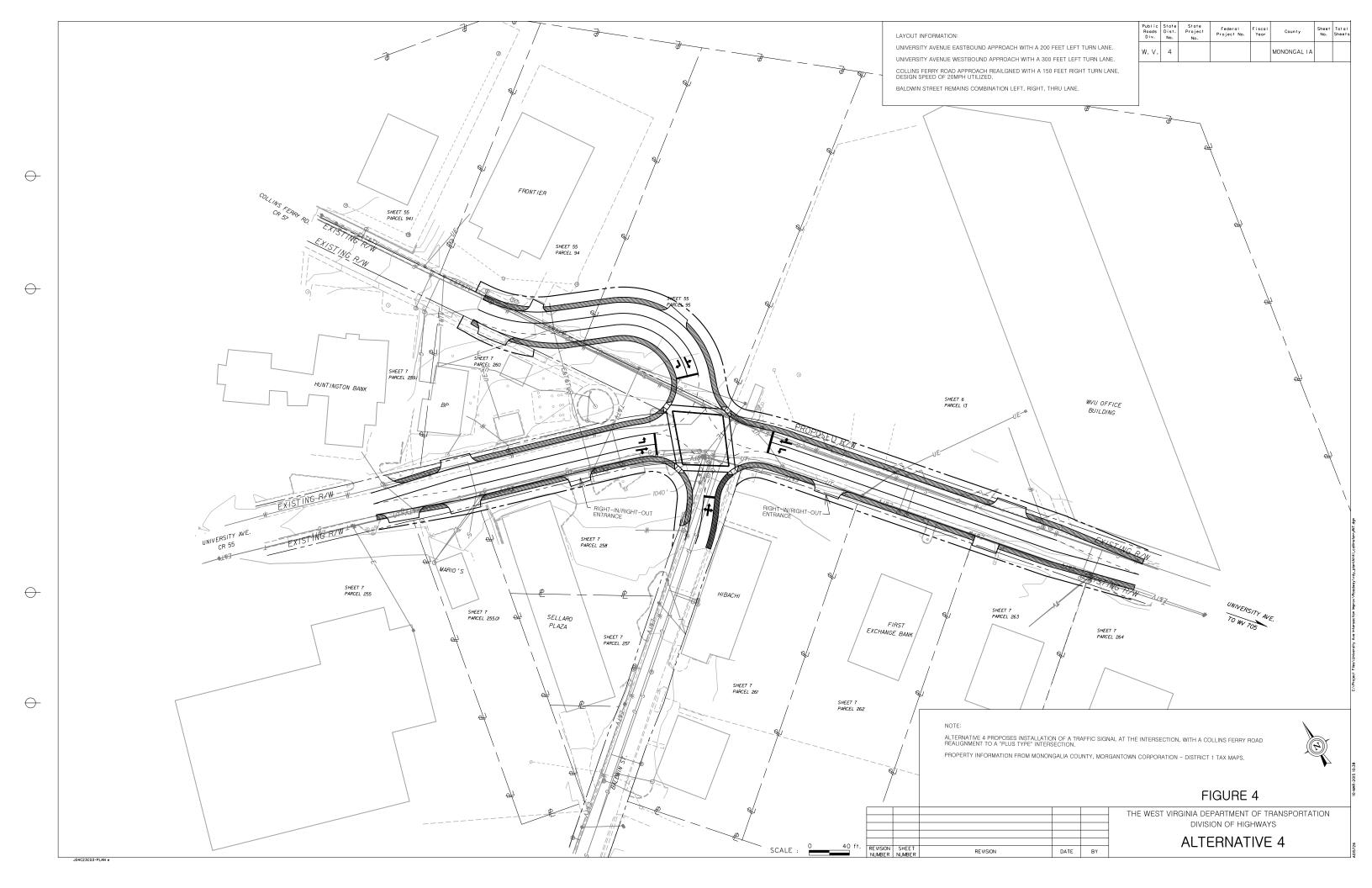
**Plan Sheets** 











# APPENDIX "3"

**Site Photos** 



Looking west along University Avenue toward intersection with Collins Ferry Road



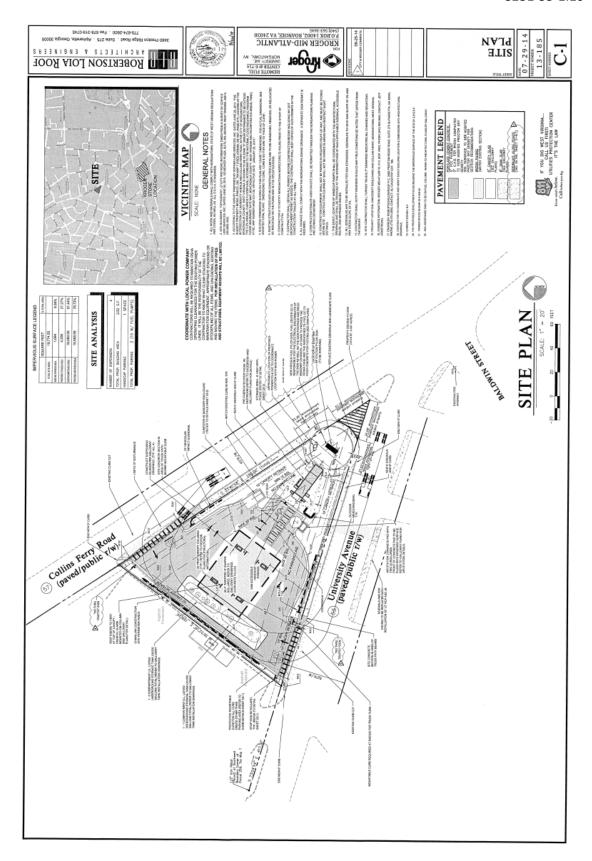
Looking south along Collins Ferry Road toward intersection with University Avenue



Looking east along University Avenue toward intersection with Collins Ferry Road



Looking across University Avenue toward Baldwin Street



Kroger Fuel Center – Site Plan (dated – 7/29/14, revision date - 8/24/14)

## **APPENDIX "4"**

**Field Review / Comments** 

A Field Review for the project was held on Thursday, September 18, 2014 at 11:00 am. The following personnel attended this review:

Steve Boggs	Technical Section	558-9662
Mark White	Technical Section	558-9625
Don Meadows	Traffic Engineering	558-9453
Deanna Deliere	Traffic Engineering	558-9455
Brian Carr	Planning	558-9580
Elwood Penn	Planning	558-9618
Chuck Bartley	Right-of-Way	558-9324
Hamilton Duncan	FHWA	357-5329
Joe Waterman	Utilities	558-9631
Chad Lowther	Review Section	558-9737

#### **COMMENTS**

**Joe Waterman, Engineering Division – Utilities** (comment via memorandum, 9/25/14)

Based on the plans, the following utility relocation cost should be included for the subject project:

```
Alternative 1 = $54,000 (Electric = $4,000, Telephone = $10,000, Water = $20,000, Sanitary S. = $20,000) Alternative 2 = $54,000 (Electric = $4,000, Telephone = $10,000, Water = $20,000, Sanitary S. = $20,000) Alternative 3 = $90,000 (Electric = $10,000, Telephone = $20,000, Water = $30,000, Sanitary S. = $30,000) Alternative 4 = $54,000 (Electric = $4,000, Telephone = $10,000, Water = $20,000, Sanitary S. = $20,000)
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#### Chuck Bartley, Right-of-Way Division (comment via memorandum, 9/26/14)

The following comments are based on a review of the Design Study and field observations. They are as follows:

- 1. Please show and label the existing bus stop. It should be in the narrative the relocation of the bus stop will be accommodated either in the design or as part of the construction process.
- 2. The temporary construction easement for Alternative 1 for Sellaro Plaza encompasses the entire parking area for the plaza. This TCE would effectively force closure of the plaza during construction and close all business operations within the plaza. The Right of Way Division feels this is unacceptable for this area.
- 3. Please show and label the commercial signs that would be impacted on the various alternatives. These items would be paid for as right of way impacts.
- 4. The access points for the commercial establishments could be configured to the driveway manual standards and become compliant as part of the design process. In addition, the possibility of right-in/right-out access could also maintain some of the multiple access to these parcels.

- 5. The purchase of the BP Station parcel by Kroger cannot be fully and accurately estimated until the new development is completed. The estimate submitted takes into account the area shown as proposed right of way and some potential damages to the property residue. If this parcel was to become landlocked or a total take, an additional \$1,000,000 could be added to the right of way cost.
- 6. The current vacant parcel between the Frontier & WVU parcels will be estimated based on the proposed right of way and assumed access to the property. Should this parcel not have access and become landlocked an additional \$1,000,000 or more could be added to the total right of way cost.
- 7. Please note the retaining wall for the parking to the doctor's office at the western end of Collins Ferry Road on Alternative 3. Any right of way take could be behind the retaining wall and have significant impact on the amount of parking for this parcel.
- 8. Sellaro Plaza has only 37 total parking spaces, including two handicap, for six businesses. Any loss of parking spaces would have a detrimental effect on this property and could possibly put it out of compliance with the city. This should be taken into consideration and verified.

The Right of Way cost estimates are as follows:

- 1) \$1,750,000
- 2) \$1,900,000
- 3) \$1,800,000
- 4) \$1,350,000

As noted in the report, the Kroger Fuel Center has subsequently been developed and completed since the project's field review. A copy of the proposed site plan is included with the site photos; by comparing it to the design alternates herein, the impacts to this development are:

Alt 1 – Impact to the kiosk building & pylon sign

Alt 2 – Impact to the pylon sign

Alt 3 – Impact to kiosk building, parking lot, and pylon sign

Alt 4 - none

The proposed alternates may be shifted, to avoid/minimize these impacts. This issue will need to be address during final design.

#### **Brian Carr, Planning Division** (comment via e-mail, 9/22/14)

I just want to repeat what I tried to convey at the field visit. Morgantown is a very bike/ped oriented area and the issue is very high on the MPO's list of priorities. I just want to make sure that all possible accommodations with regards to sidewalks and bike lanes are available and considered where reasonably possible. It does seem that the sidewalks are there but it would be nice to note it in the report. I did not notice any mention of it in the report although it seems to be shown in the diagrams. Furthermore, I realize that a dedicated bike lane is not prudent through this roundabout (or whatever solution is ultimately selected) but any note of why no additional bike accommodations

are considered would be helpful. The attached link is Morgantown's Bike Plan. <a href="http://plantogether.org/MMMPO%20Bicycle%20Plan%20Adopted.pdf">http://plantogether.org/MMMPO%20Bicycle%20Plan%20Adopted.pdf</a> They did not identify this corridor as part of their bike plan but did mention this intersection for improvement.

I also want to reiterate that if this project is taken before the PRC for review and it is decided to be "cancelled" due to severe increase in cost (which I understand may be necessary), the MPO will not take this lightly. As we have found with another project that was recently up for cancellation, the MPO refused to do so and the project is still required to be carried over in the STIP. The MPO and the City of Morgantown has recognized this intersection as a problem area and desire some kind of action as noted in their plan. I just wanted to keep you apprised of how Morgantown and the MPO react to these types of circumstances.

# **Deanna Deliere, Traffic Engineering Division - Operations** (hard copy plan sheets, 10/23/15)

Marked up plan sheets with information on access points for commercial business operations was given to DDC and will be placed in the project file. They recommend a driveway access for the undeveloped lot and that a right-in/right-out entrances be used at Sellaro Plaza and Hibachi locations. The study has incorporated these comments into the plan sheets.

# **Sajid Barlas, Material Division – Environmental & Coatings Group** (comment via email, 3/23/15)

I understand BP station has been removed & Kroger Fuel Center is in operation. However there is still a chance that some of the residual contamination may still be present and may become an issue during the construction. Based on this new information I would like to revise my estimate to \$100,000.00 for each alternate. This cost is to cover any environmental study may be necessary in future & to cover any surprises during the construction.

#### **Tim Currey, Engineering Division - Environmental** (comment via e-mail, 3/20/15)

This project will be processed as a Programmatic Categorical Exclusion for Environmental Section clearance of the National Environmental Policy Act (NEPA) and related requirements.

The following checklist represents the potential environmental concerns known at the time of completion of this design study report. As more information is obtained potential impacts or concerns may change.

<b>Environmental Concerns</b>	YES	NO	MAYBE
Historic Resource Concerns		$\boxtimes$	
Archaeology Concerns		$\boxtimes$	
Wetland Concerns		$\boxtimes$	
Residential/Business Concerns			$\boxtimes$
Mussel Survey Necessary		$\boxtimes$	
Endangered Species		$\boxtimes$	
Public Involvement	$\boxtimes$		
Section 4 (f) Issues			
FHWA Approval of CE			