Red Light Running Camera
(Photo Enforcement)
Engineering Safety Analysis

US29-Rio Road (Rte 631) Intersection

Albemarle County, Virginia

16 February 2010
Revised 13 July 2010

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US29-Rio Road (Rte 631)
Engineering Safety Analysis

February 16, 2010 (Revised July 13, 2010)

Local Jurisdiction: Albemarle County (County/City/Town) VDOT District: Culpeper

Intersection: Seminole Trail (US 29) at Rio Road (Route 631)
Street Name (Route #) at Street Name (Route #)

Proposed Enforcement: US-29 Southbound and Rio Road Eastbound approaches

This Study performed under the direction of John M. Kelsey, PE
(licensed professional engineer)

A. INTERSECTION & SIGNAL DATA

1. Signal Visibility

a. Minimum Sight Distance to Signal

Approach	Grade	Speed Limit (mph)	Measure (ft)	Required (ft)*
NB 29	3%	45	950	460
SB 29	4%	45	730	460
WB 631	0%	40	825	390
EB 631	-2%	35	340	325

*See attached table of minimum sight distance requirements from the MUTCD.

b. Are "SIGNAL AHEAD" signs present? ☒ Yes ☐ No

Are "SIGNAL AHEAD" signs needed? ☐ Yes ☒ No

Are other warning signs present in the vicinity of the intersection? ☒ Yes ☐ No

Explain: VDOT recently installed a "Signal Ahead" sign on the Rio Road Eastbound approach. Other typical signage includes: "Keep Right" and "Wrong Way" signs in the departure medians, one "U-Turns Must Yield to Right Turns" sign in the approach median of NB US29, and "Right Lane Must Turn Right" signs are provided at all approaches.

c. Information on Signal Heads

Approach	Lens Size	Lens Type (LED or Bulb)	Back Plates (Yes or No)
NB 29	12"	LED	Yes
SB 29	12"	LED	Yes
WB 631	12"	LED	Yes
EB 631	12"	LED	Yes

2. Pavement and Markings Data

a. Stop bars in "good" condition? ☒ Yes ☐ No

Explain: VDOT recently repainted

b. Lane lines "clearly" visible? ☒ Yes ☐ No

Explain: VDOT recently repainted

c. Crosswalks "clearly" marked? ☐ Yes ☒ No

Explain: Sidewalks and ADA Ramps are provided on the corners, but pedestrian crosswalks are not delineated.

d. Pavement conditions (ruts, potholes, cracking, etc.)?

☒ Good Explain: Pavement is in good condition on all approaches
☐ Fair Explain:
☐ Poor Explain:

e. Pavement surface treatments exist? (rumble strips, texturing, pavers, etc.)

☐ Yes Explain:
☒ No

3. Provide diagram of intersection including: pavement markings, width of lanes and medians, location of signal heads and signs, locations of loops/detectors, and grades.

Refer to Appendix A-1 diagrams (a) through (d)

B. SIGNAL TIMING & TRAFFIC DATA

1. Clearance Intervals

Direction	Posted Speed Limit (mph)	Existing Yellow	*TE Yellow Rounded*	Existing All Red	*TE All Red Rounded*	Width of Intersection (ft)
		(seconds)				
US-29 NBT	45	4.00	**4.00**	2.80	**4.50**	281
US-29 NBL	45	4.00	**4.00**	2.80	**4.50**	265
US-29 SBT	45	4.00	**4.00**	2.70	**4.50**	278
US-29 SBL	45	4.00	**4.00**	2.70	**4.50**	260
Rio Rd EBT	35	4.00	**4.00**	4.00	**4.50**	210
Rio Rd EBL	35	4.00	**4.00**	4.00	**4.50**	195
Rio Rd WBT	40	4.00	**4.00**	4.30	**4.00**	216
Rio Rd WBL	40	4.00	**4.00**	4.30	**3.50**	178
Refer to Appendix A-2 for the Clearance Interval narrative and computation table						

2. Include existing controller settings for each phase and each time-of-day. Information should include applicable settings such as minimum green, max 1 & 2, passage, minimum gap/ext, protected-permissive, lead-lag, yellow and all red, walk and ped clearance time, recall settings, offsets, cycle length, etc. Include analysis of peak hour conditions and a determination of whether signal timings are contributing to red-light running problem.

a. Does signal timing or phasing factor in as a possible contributor to RLR at this intersection?

☐ Yes Explain: Signal timing meets the TE Memo 306 guidelines. Refer to the "Program EPAC Data" dated 01/27/09 located in the Appendix.

☒ No

b. List comments or recommendations on potential signal timing or phasing changes:

None – Due to the sensitivity of this corridor to timing changes, VDOT has already done an extensive amount of planning, analysis and field adjustments to set the current signal timings.

3. Vehicle Detection Data

Approach	**Detection Type (loop, video, etc.)**	**Detector Location (measured from stop bar)**
NB 29	Loop	6x6 - 274'
SB 29	Loop	6x6 - 292'
WB 631	Loop	6x40's at stop bar
EB 631	Loop	6x40's at stop bar

4. Traffic Volume Data

Approach	Average Daily Volumes		Peak Hour Volumes	
	Total	Heavy Vehicles	Total	Heavy Vehicles
Rio Rd East	6596	172	650	16
Rio Rd West	12034	188	1036	13
Hwy 29 North	23589	487	2157	34
Hwy 29 South	29330	651	2213	34
Intersection Total	**71549**	**1498**	**6056**	**97**

The class and volume counts for all four of the US29-Rio Road intersection approaches were obtained using HI-STAR automatic traffic recorder units. Data was collected from each driving lane of each approach, including turn lanes, and the statistics were recorded in 15 minute time periods. The survey was conducted over a period of 48-hours beginning at 9PM (21:00) on 10/26/09 and ending at 9PM (21:00) on 10/28/09. Refer to the "Pedestrian and Vehicle Classification Counts and Violation Survey" included in the Appendix.

C. CRASH & ENFORCEMENT DATA

1. Three-Year Crash Data

This data was compiled from Police Department records of motor vehicle accidents at this intersection that met County criteria for preparation of an FR-300 accident report during the time period of January 1, 2006 to January 1, 2009.

Collision Type	3-year Total	Number of Injury Crashes	Number of Fatal Crashes	Crashes Associated With Red-Light-Running
Angle	24	19	0	19
Rear End	121	13	0	2
Head On	2	1	0	0
Sideswipe	29	2	0	1
Pedestrian	1	1	0	0
Bicyclist	0	0	0	0
TOTAL	177	36	0	22

Angle Crashes Caused by Red Light Violations (Reported 2006 – 2009)	
Approach Violation	**# of Angle Crashes**
Rio Road - EB	0
Rio Road - WB	4
US29 - NB	4
US29 - SB	11
TOTAL	19

Refer to the Angle Crash Analysis Diagram and Data Summary in Appendix A-1(e).

2. Crash Rate

a. Number of crashes per million entering vehicles: 2.26

$$\frac{71549 \text{ (total vol)} \times 365 \text{ (days)} \times 3 \text{ (years)}}{1{,}000{,}000} = 78.34 \qquad \frac{177 \text{ (3-yr total crashes)}}{78.34} = 2.26$$

b. Locality rate for comparison (if available): not available

The data above shows that this intersection has a high number of rear end crashes. The 121 rear end crashes out of the 177 total crashes reported over the three year period is approximately 68% of the crashes. We acknowledge VDOT's comment that accidents most commonly associated with red light running are angle crashes and as such traffic signal enforcement may not help to reduce the majority of the crashes at this particular intersection; however, this is only one of the factors to be considered in the evaluation.

As provided in the sections that follow, our assessment and conclusions also factor in the violation volumes and violation rates for each of the approaches and their impact to the safety of all users of this intersection, as well as the dangers to which motorists and police officers are subjected when using convention enforcement measures at this intersection.

3. Violation Rate

a. Number of red light running citations per year issued by law enforcement at the evaluated intersection, if available.
Number: 94 Year: 2008

b. Observed Violations
Date: 10/26/2009
Time Period: 6AM to 6PM (12 hours)

Approach	Left Turns		Through		Right Turns		Approach Totals	
	Violations	Volume	Violations	Volume	Violations	Volume	Violations	Volumes
EB	43	1606	21	2686	13	1122	77	5414
WB	19	2354	4	2490	10	4673	33	9517
NB	0	1717	19	12721	0	3086	19	17524
SB	28	4746	47	17199	0	840	75	22785
Intersection Totals	**90**	**10423**	**91**	**35096**	**23**	**9721**	**204**	**55240**

The 12-hour red light running video survey was conducted concurrently with the 48-hour class and volume survey. One (1) camera was utilized at each approach. Refer to the "Pedestrian and Vehicle Classification Counts and Violation Survey" included in the Appendix.

c. Violations per 1000 Vehicles: (refer to data in the video survey table above)

Rio Road EB: $\frac{77 \text{ (violations)} \times 1000}{5414 \text{ (approach volume)}} = \mathbf{14.2}$

Rio Road WB: $\frac{33 \text{ (violations)} \times 1000}{9517 \text{ (approach volume)}} = 3.5$

US-29 NB: $\frac{19 \text{ (violations)} \times 1000}{17524 \text{ (approach volume)}} = 1.1$

US-29 SB: $\frac{75 \text{ (violations)} \times 1000}{22785 \text{ (approach volume)}} = \mathbf{3.3}$

4. Conclusions from Crash Data

Provide Photo Enforcement on the Rio Road Eastbound and the US-29 Southbound approaches. Although Rio Road Eastbound has the lowest reported angle crashes resulting from red-light violations, it has the highest number of left-turn violations (43), total violations (77), and the highest violation rate (14.2) of all four approaches. US-29 Southbound has the highest reported angle crashes resulting from red-light violations (12), the second highest left-turn violations (28), is in effect tied for the second highest violation rate (3.3), and nearly matches the highest total violations (75). Both of these approaches pose a threat to the safety of the motorists, bicyclists, and pedestrians who use this densely developed corridor now and in the future.

5. Enforcement and Operational Issues

a. Describe the difficulty experienced by law enforcement officers in patrol cars or on foot in apprehending violators.

Seminole Trail and Rio Road is one of the highest traffic volume intersections in Albemarle County. The high volume of traffic and limited availability of locations to stop violators makes the stopping of vehicles difficult and unsafe. Officers must coordinate enforcement efforts with one officer standing outside his/her police vehicle spotting violations and radioing to other officers in police vehicles to make the stop and issue a summons. This type of enforcement action is time consuming; man power intensive and dangerous to the motorists and law enforcement officers. There are simply more violators than officers available to enforce red light running at this intersection utilizing this type of enforcement procedure.

b. Describe the ability of law enforcement officers to apprehend violators safely within a reasonable distance from the violation.

The roadway, which is within the urban growth area, does not have sufficient space available to stop vehicles outside the roadway. Violators often pull into the entrance and parking lots of businesses which causes additional congestion with patrons entering and leaving the establishments. Additional obstructions in the traffic flow occur when violators, unable to find a place to pull over, simply stop in the middle of this multi-lane highway which creates additional hazards.

c. Are pedestrians at risk due to violations? ☒ Yes ☐ No

Explain: This is a very wide intersection (10 to 11 lanes) and takes a significant amount of time for a pedestrian to cross; the narrow median provides little refuge for crossing through two light cycles.

Number of pedestrians per hour? 13

(Refer to the "Pedestrian and Vehicle Classification Counts and Violation Survey" included in the Appendix)

Pedestrian crosswalk provided? ☐ Yes ☒ No

Due to the lack of pedestrian facilities at the intersection and the prevailing speed of traffic, VDOT does not encourage pedestrians crossing Rte US 29. However, the "US Route 29 Pedestrian Study", by VDOT and endorsed by Albemarle County, identified the potential to provide a better pedestrian environment along the US29 corridor and recommended improvements for the safety, convenience, and quality of pedestrian travel in the corridor. Specific projects to encourage pedestrian activity and to provide crossings in the vicinity of the US29-Rio Road intersection were identified in the study. The County Board of Supervisors identified similar improvements in their list of "priority pedestrian crossings". With the anticipation of increased pedestrian activity at and near this intersection, it is imperative we use every means at hand to improve our red-light running enforcement capability.

d. Have there been any changes to the operations of the intersection (signal timing, restriping, or increased enforcement) within the past three years? ☒ Yes ☐ No

Explain: Timing adjusted for Corridor Coordination improvements 8/2008.

Minimum Sight Distance

85th Percentile Speed (mph)	Minimum Sight Distance (ft)
20	175
25	215
30	270
35	325
40	390
45	460
50	540
55	625
60	715

Table 4D-1 *Manual on Uniform Traffic Control Devices,* (Revision 1, Nov 2004) Transportation Research Board (TRB), Washington, DC, 2003

Appendix

The Documents and Studies listed below are included Analysis for reference.