VDOT Virginia Department of Transportation

ROAD SAFETY AUDITS

ROUTE 17 AND SUGAR HILL ROAD
CARROLLTON, VIRGINIA

July 2023

vhb

Field Review Documentation

1. Introduction

The study area consists of the intersection of Sugar Hill Road and Route 17 (Carrollton Boulevard). This intersection is situated in Carrollton, within the Isle of Wight County. Route 17 (Carrollton Boulevard) runs north/south and Sugar Hill Road runs east/west. The surrounding area primarily consists of some residential neighborhoods and some scattered commercial properties. Trip generators in the study area include the residential neighborhoods present off Sugar Hill Road, Finley's General Store, Oak Grove United Methodist Church, and Studio 17 Dance School on the northern part of the intersection and offices and small commercial businesses to the south. During the past few years, the Founders Pointe neighborhood was fully built out and a small multi-family development was constructed increasing traffic volumes on Sugar Hill Road.

1.1. RSA Details

The study team conducted the Road Safety Audit (RSA) on Wednesday, June 28, 2023, from 9:30 am to 11:30 am. The site conditions were sunny, hot, and humid.

1.2. RSA Attendees

- Tommy Catlett (VDOT)
- Jason Fowler (VDOT)
- Nathan Milaszewski (VDOT)
- Glenn Hott (VDOT)
- Paul Matticks (VDOT)
- Thomas Elswick (Isle of Wight County)
- Paul Kafer (Founders Pointe HOA representative)
- Clinton Jenkins (State Delegate)
- Taylor Bonner (VHB)
- Colby Schneider (VHB)
- Kirsten Tynch (VHB)

2. Existing Conditions

2.1. Study Area Characteristics

The study intersection is an unsignalized T-intersection with a stop-controlled approach on Sugar Hill Road and no traffic control on Route 17. There are no pedestrian or bicyclist facilities in the area. During the field review meeting it was noted that as properties are redeveloped in the area, sidewalks are required. The land use in the area is suburban and consists of low-density residential, medium-density residential, and commercial uses. The characteristics of the intersection are shown in Table 1.

Table 1. Intersection Characteristics by Approach

Characteristics	Route 17 (Carrollton Boulevard)	Sugar Hill Road
Orientation	North-South	East-West
Functional Classification	Principal Arterial	Local
Annual Average Daily Traffic (AADT) in 2021 (vehicles per day)	15,000	1,000
Speed Limit (miles per hour)	55	35
Number of Lanes	2 in each direction	1 in each direction
Lane Widths (feet)	10′ left turn lanes 11′ right turn lane 11′ through lanes	10′ left turn lane 12′ right turn lane 12′ receiving lane
Roadway Features	• Grass/Raised Concrete Median • Elevated northbound lanes • Horizontal curve on southbound approach	• Driveways to Finley's General Store and Studio Seventeen Dance within 100′ from the intersection
Distance from adjacent signalized intersections (feet)	Approx. 1900′ to the north Approx. 1400′ to the south	
Land Uses	Low-density residential, medium-density residential, commercial, institutional	

2.2. Crash History

Through the RSA, it is crucial to examine both motorized and non-motorized vehicle crashes to obtain a comprehensive understanding of how the intersection operates. Crash data was collected from March 2018 through March 2023 to obtain 5 full years of data for review. The most common crash type at the intersection was angle crashes involving a turning movement. Specifically, 9 of the 15 crashes involved a vehicle making a left turn from Sugar Hill Road. Figure 2 shows the crash diagram of the study area.

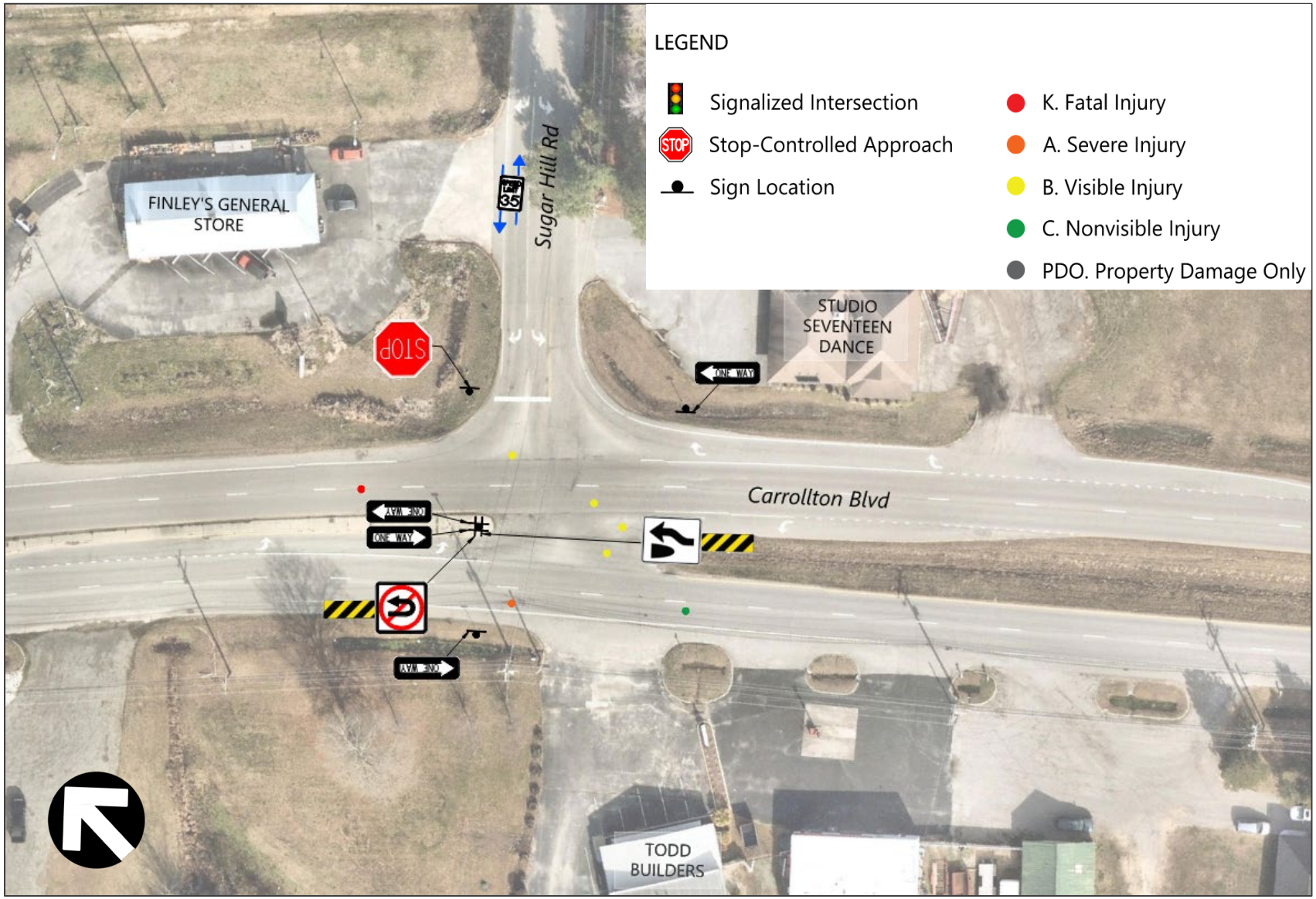


Figure 1. Existing Conditions Map

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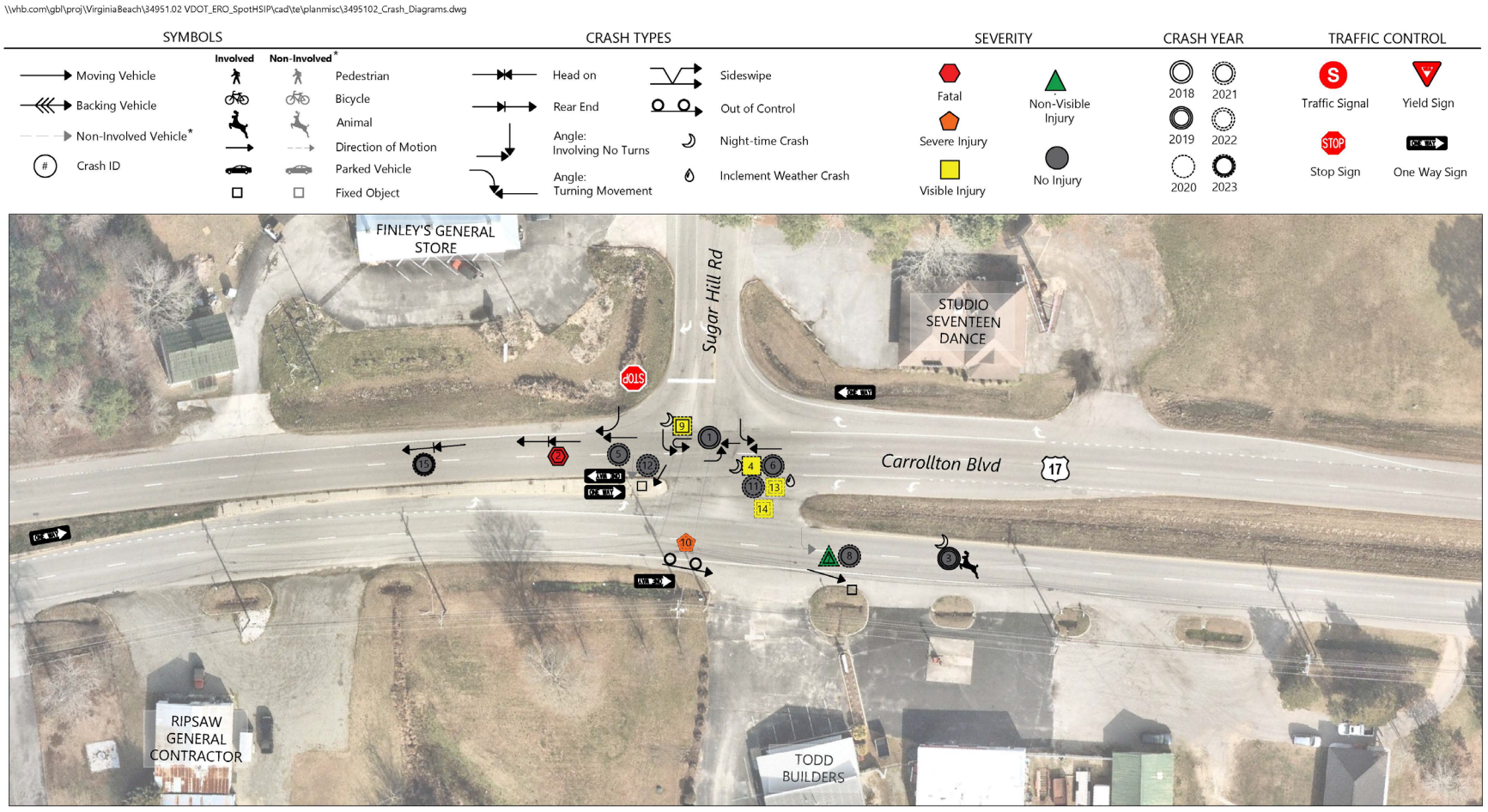


Figure 2. Crash Diagram for Route 17 and Sugar Hill Road

As shown in Figure 2, the intersection experienced a fatal crash in 2018 and multiple injury crashes in 2021 and 2022. Figure 3 breaks down the crash types by year, which reveals the uptick in angle crashes since 2021. The two fixed object crashes in 2021 also involved vehicles avoiding a collision when vehicles turning left from Sugar Hill Road entered their lane while traveling southbound on Route 17. Lighting and weather conditions at the time of the crash are shown in Figure 4, which reveals that most of the crashes occurred in the daylight (12/15) in dry conditions (14/15).

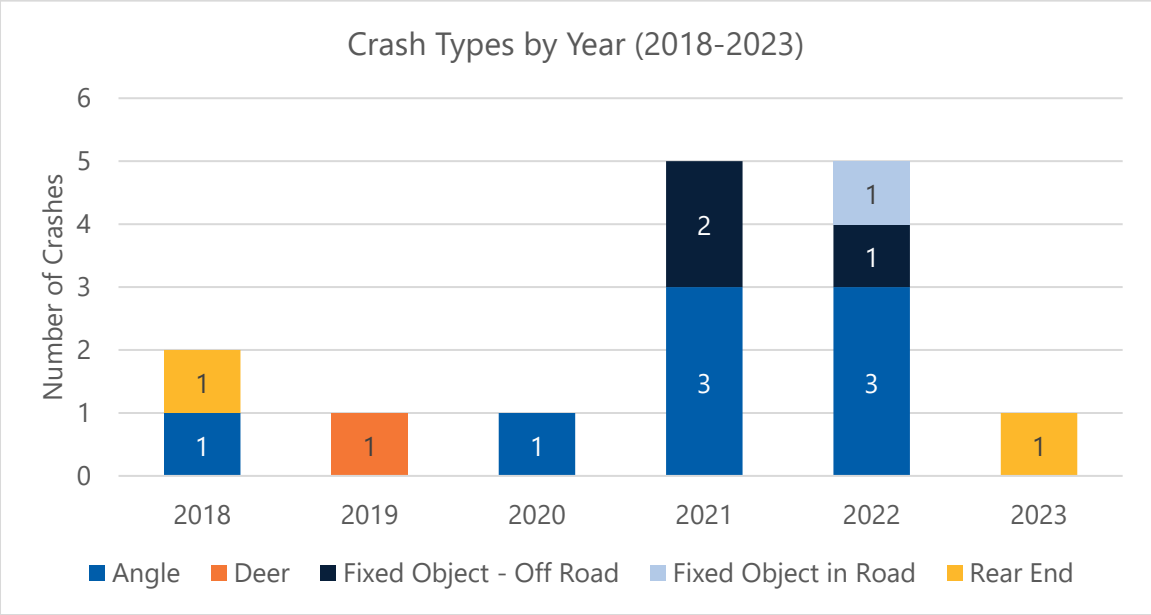


Figure 3. Crash Severity in the Study Zone (2018-2023)

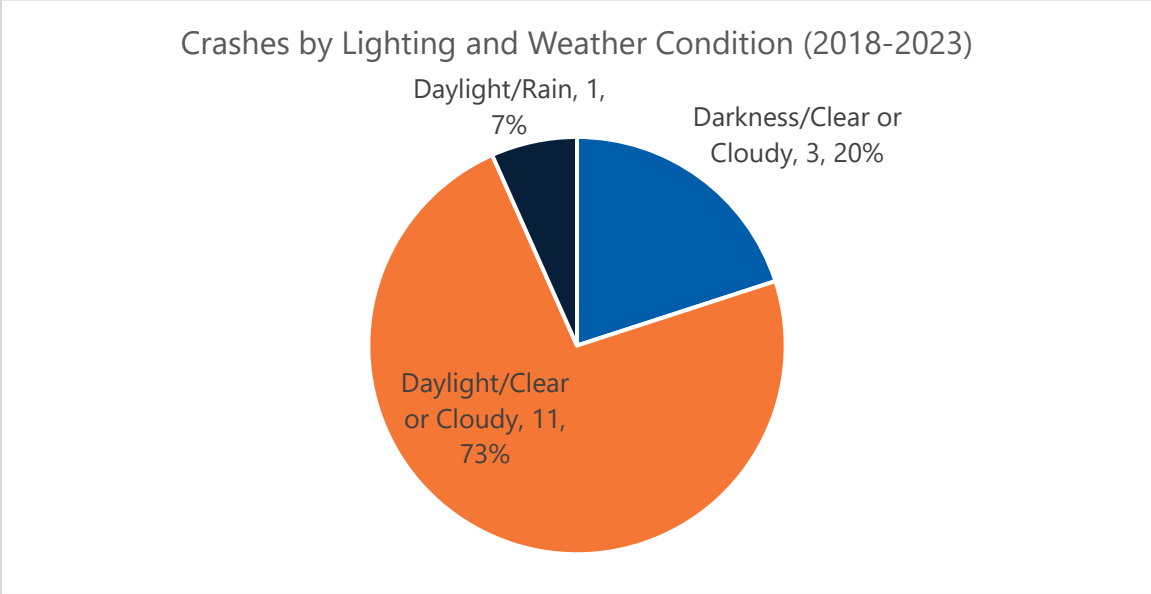


Figure 4. Lighting and Weather Condition During Crashes (2018-2023)

Additionally, 6 crashes (all involving left turns from Sugar Hill Road) occurred during the PM peak between 3:00 pm and 6:00 pm as shown in Figure 5. There was no significant difference to time of year for the crashes. However, January had the most crashes (3) as shown in Figure 6.

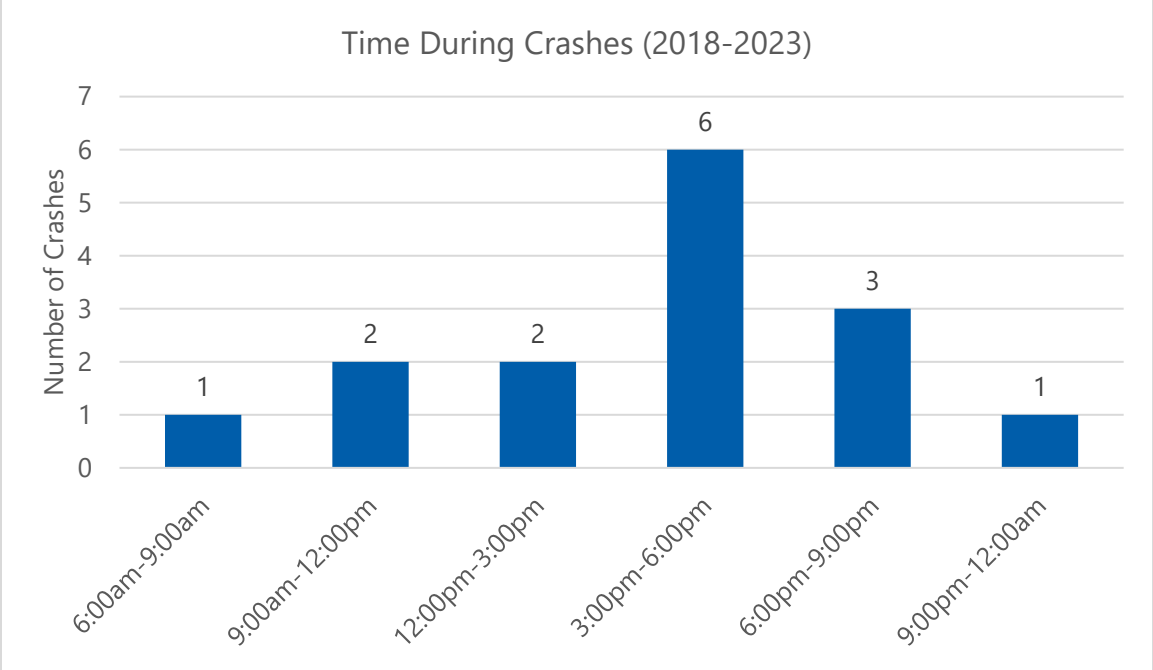


Figure 5. Crash Time in the Study Zone (2018-2023)

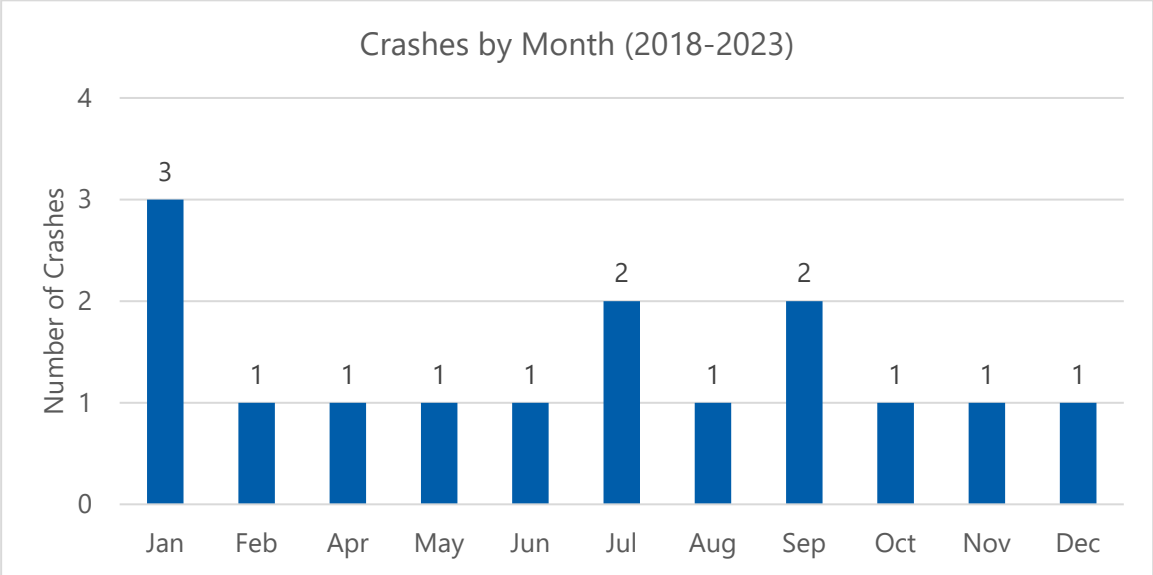


Figure 6. Crash Month in the Study Zone (2018-2023)

3. Prompt Questions

As part of the field review for the RSA, attendees were asked to consider prompt questions while observing traffic flow and intersection characteristics. The following table summarizes the conditions and characteristics observed by the RSA attendees.

Category	Prompt Question	Observation
General	What is working well at the intersection or on the corridor?	• The Route 17 corridor maintains a high level of service • Short wait time for turning traffic
	What are some positive design features?	• Turn lanes on most approaches
	What is the land use in the study area?	• Residential properties and a church to the north, varied commercial properties on the intersection quadrants
	Are there any challenges with access management?	• Wide commercial entrance on south side of intersection • Drivers using commercial parking area in the northeast quadrant to bypass traffic control at intersection • Several driveways are within the functional area of the intersection, and therefore do not meet current State access management standards
3.1. Intersection Sight Distance	3.1.1. Are there utility poles, signs or other objects blocking the view of traffic?	• Not for the Sugar Hill Road or Route 17 approaches, but the driveway on the south side of the intersection has some utility poles obstructing sight lines looking northbound
	3.1.2. Is sight distance sufficient for all turning movements?	• Sight distance appears to be adequate for most movements, but there are unique challenges at the intersection (see following section for more details)
	3.1.3. Is sight distance adequate for major road through movements? Can drivers see vehicles on side streets?	• If there is a northbound vehicle turning right into the dance studio or onto Sugar Hill, through vehicles on Route 17 may not see vehicles on Sugar Hill Road
	3.1.4. Do turning vehicles obstruct sight lines for other movements? Are there adequate gaps for turning movements?	• Northbound right turn traffic appears to block view of through movement • Southbound left turn lane traffic blocks sight distance for westbound left turn traffic • Westbound vehicles attempting to simultaneously turn left and right from Sugar Hill sometimes block sight for each other

3.2. Intersection Features	3.2.1. Describe overall intersection operations.	• Northbound right turn traffic swings into westbound lane during turning movement • Numerous vehicles with trailers and large trucks turning on to and off of Sugar Hill • During off business hours, general store uses cones to block off parking lot to eliminate drivers from cutting through their lot to avoid the Sugar Hill intersection • Commercial access points are within intersection area of influence • Significant elevation differential between northbound and southbound lanes
	3.2.2. Is there sufficient time to clear queues for each movement?	• Wait timing for turning vehicles averaged less than 30 seconds
	3.2.3. Are adjacent signals pre-timed, actuated-coordinated, or actuated-free?	• Adjacent signals are actuated but not coordinated. Operating in free. Future plan to coordinate signals when Nike Park Extension signal comes online.
	3.2.4. Are all signals to the north and south visible?	• Yes
	3.2.5. Would sun glare be an issue for any approaches?	• Glare could be an issue for vehicles turning onto southbound Route 17 given typical sun position, though participants familiar with the intersection did not recall a time when is impacted visibility
3.3. Auxiliary Lanes	3.3.1. Is turn lane storage sufficient for visible queues?	• Southbound left turn storage approx. 100' (3 vehicles filled queue) • Residents expressed desire to extend the southbound left-turn storage because they feel uncomfortable decelerating into that lane given the speed of traffic on Route 17 • Eastbound left turn storage approx. 140' • Northbound left turn lane approx. 100' • Queues cleared in reasonable time frames and didn't extend into through lanes
	3.3.2. Are taper lengths appropriate for the turn lanes?	• Southbound left turn taper should be evaluated for adequacy
3.4. Signs, Markings, Lighting	3.4.1. Are signs visible, clear and appropriate? Are they legible for all drivers?	• Stop sign on Sugar Hill is in good condition • Stop bar is approximately 20' off Rt 17 – cars stop beyond the stop bar for improved visibility
	3.4.2. Are sign supports in good repair?	• Yes, though the sign on the median nose east of the intersection has recently been relocated

	3.4.3. What are the conditions of the pavement markings?	• Markings are worn • Sugar Hill will be repaved/remarked this year, but repaving will stop east of Rt 17
	3.4.4. Is lighting present? Is lighting sufficient for the intersection or corridor?	• No lighting in the area • Majority of crashes occurred in daytime (12/15)
	3.4.5. Are pavement markings compliant with the MUTCD and VDOT Road Design Manual?	• Southbound "No U-turn" sign in median is not visible to turning traffic. Need a "No U-turn" sign to median nose east of intersection
3.5. Pavement	3.5.1. Are there pavement defects?	• Some pavement cracks visible
	3.5.2. Is there loose stone or gravel present in the roadway?	• Some aligning with turning movements on and off Sugar Hill Road
	3.5.3. How does the pavement perform during wet conditions?	• Did not observe in wet conditions, however crash data did not indicate any crashes on wet roadway
3.6. Heavy Vehicles	3.6.1. Is the roadway on a truck route?	• On State Truck Route, not National Truck Route
	3.6.2. Are there many heavy vehicles present? If so, what vehicle types?	• Vehicles pulling trailers, commercial single unit trucks and some large trucks turning onto and off of Sugar Hill • Large trucks on Rt 17
	3.6.3. Are turning radii and stop line placement sufficient for heavy vehicle movements?	• Off-tracking visible in northeast and southeast quadrants • Vehicles were observed at turning into oncoming lane when turning right onto Sugar Hill from southbound Rt 17
3.7. Human Factors	3.7.1. Are drivers compliant to traffic control signage?	• Most comply • Some rolling stops
	3.7.2. How aggressive are drivers (in terms of passing, gap acceptance, risky maneuvers)?	• Drivers vary by determination of acceptable gaps – some are aggressive, and some are conservative
	3.7.3. Are drivers using turn signal indicators?	• Some use of turn indicators
	3.7.4. How close are drivers following together?	• Average
3.8. Speed Management	3.8.1. How fast are people driving?	• Per VDOT, 85th percentile speed is approx. 63 mph, new speed data has been requested
	3.8.2. Is there significant variation in the speed of vehicles?	• No
	3.8.3. Does the existing posted speed limit align with the "comfortable" driving speed of the roadway?	• Yes, but this is a segment of 55 mph between two 45 mph segments

	3.8.4. Are lane widths sufficient for traffic conditions?	• Turn lanes appear to be narrow for mix of traffic and speeds
	3.8.5. Is there a school zone present? If so, what is the posted speed?	• No
3.9. Vulnerable Road Users	3.9.1. Are pedestrians or bicyclists utilizing the intersection or corridor? If so, describe the activity present.	• None present during observations
	3.9.2. Are sidewalks present?	• No • Sidewalks added when properties are redeveloped
	3.9.3. Are bicyclist facilities present?	• No
	3.9.4. Are there marked crosswalks within or near the study area?	• No
	3.9.5. Are there trails or connecting facilities nearby?	• No • The Route 17 Master Plan features a multi-use path along the roadway to be installed in conjunction w/development
	3.9.6. What pedestrian generators are in the area?	• Residential properties in close proximity to general store and church
	3.9.7. Are there any schools, parks, or recreation centers nearby?	• Church on Sugar Hill Road
	3.9.8. Discuss surrounding neighborhood and characteristics (income, household vehicles, mode of transportation).	• New apartment building and single-family homes near intersection • No transit in the immediate area • HOA representative mentioned younger families with new drivers

4. Identified Concerns

4.1. Sight Distance Concerns

4.1.1. Right turn lane onto Sugar Hill Road obstructs sight lines for northbound vehicles.

A prominent concern of the intersection is the obstruction of sight lines between northbound vehicles on Route 17 and left turning vehicles from Sugar Hill Road. This sight line challenge occurs when a northbound vehicle enters the right turn lane to turn onto Sugar Hill Road and blocks the line of sight for vehicles continuing through on northbound Route 17. Due to this potential sight line blockage, the northbound through traffic on Route 17 may not see vehicles turning onto Route 17 from Sugar Hill Road, and correspondingly, vehicles turning off of Sugar Hill Road may not see the northbound through traffic on

Route 17. This concern was reflected in the narratives of the crash history as well as observations of visibility on site. A general overview of the sight line challenges at the intersection is demonstrated in Figure 7.

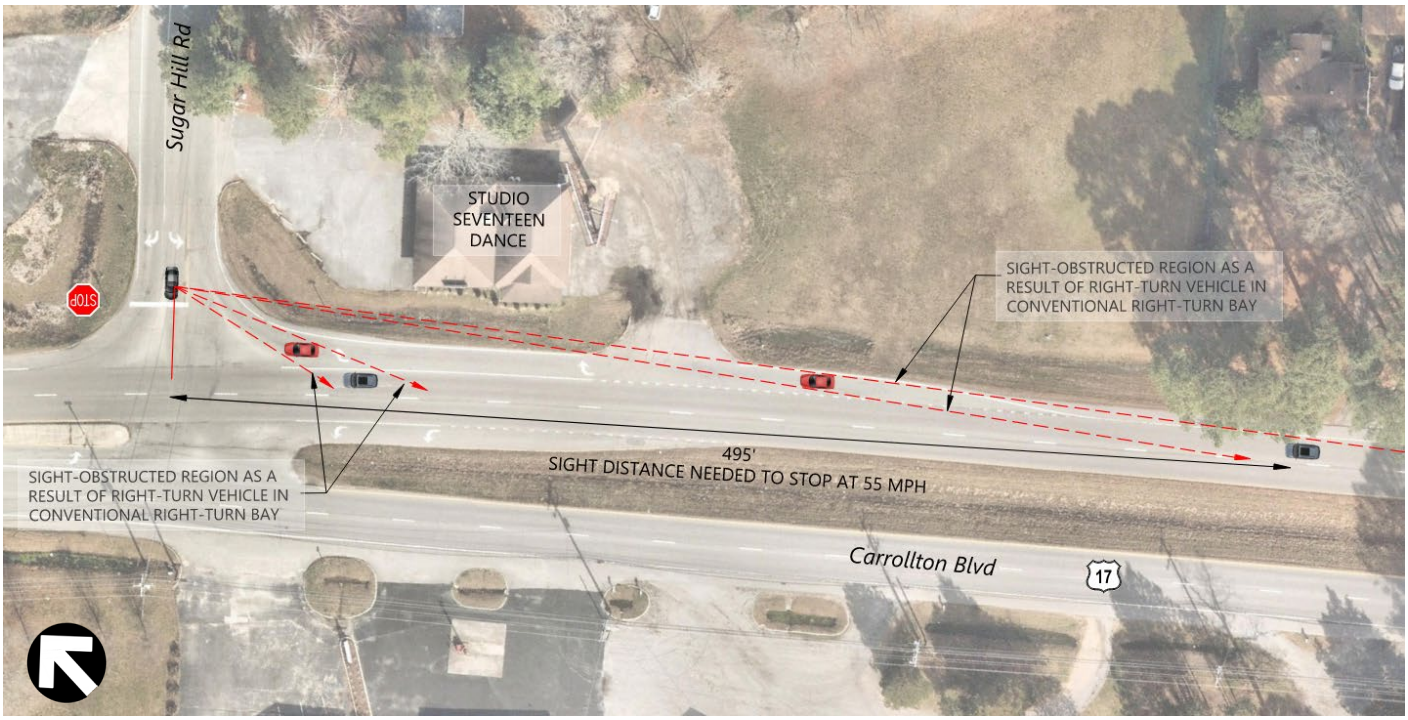


Figure 7. Right Turn Lane Obstructing Sight Lines between Through Vehicles on Route 17 and Sugar Hill Road Approach

The existing northbound right turn lane is currently 350', which is within VDOT Road Design Manual standards for urban roadways over 50 mph (100' minimum for turn lane storage length and 200' minimum for taper length). However, 505' is the design standard for a turn lane at 55 mph vehicular speed based on the 7th Edition American Association of State Highway and Transportation Officials (AASHTO) *Policy on Geometric Design of Highways and Streets* (also known as the "Green Book").

Further enhancing the sight distance challenges demonstrated in Figure 7, the required stopping sight distance for a vehicle traveling 55 mph is 495' on a level roadway. This makes the visibility challenges higher risk because sight lines may not be clear until roughly 250' prior to the intersection if a vehicle enters the right turn lane at the same time a vehicle traveling on northbound Route 17 is in the right through lane. This challenge is reflected in the crash history, which shows a series of collisions between northbound through vehicles and westbound left tuning vehicles on Route 17. The crash severities for such crashes range from property damage only to visible injuries, which may reflect the ability for northbound Route 17 drivers to slow slightly before the crashes, but not stop entirely before colliding with the left turning vehicle. Countermeasures are available to warn through traffic of the potential for turning traffic to provide more awareness and allow additional time to slow.

4.1.2. Vehicles turning left from Sugar Hill Road obstruct sight lines for vehicles turning right onto Route 17.

When both a left turning and right turning vehicle approach the intersection on Sugar Hill Road, they often block one another's visibility of traffic on Route 17. This occurs when a left turning vehicle pulls forward past the stop line to see northbound traffic, which then prevents right turning vehicles from seeing upstream. This becomes an issue when the left turning vehicle is waiting for a gap in the southbound traffic, but northbound traffic is clear. Based on the crash history, this may have been a contributing factor in the fatal rear end crash in 2018.

Conversely, right turning vehicles that pull forward past the stop line may obstruct sight lines for left turning vehicles looking for a gap in the southbound direction. There were two crashes involving vehicles turning left from Sugar Hill Road that resulted in southbound vehicles swerving into off-road fixed objects to avoid a collision. From the existing stop line, left turning vehicles have adequate sight distance to see downstream in the southbound lanes unless their sight line is obstructed by adjacent westbound vehicles turning right on Route 17 or vehicles in the southbound left turn lane on Route 17 turning onto Sugar Hill Road. Such sight line obstructions could make it challenging for drivers attempting to turn left on southbound Route 17 to see a gap.

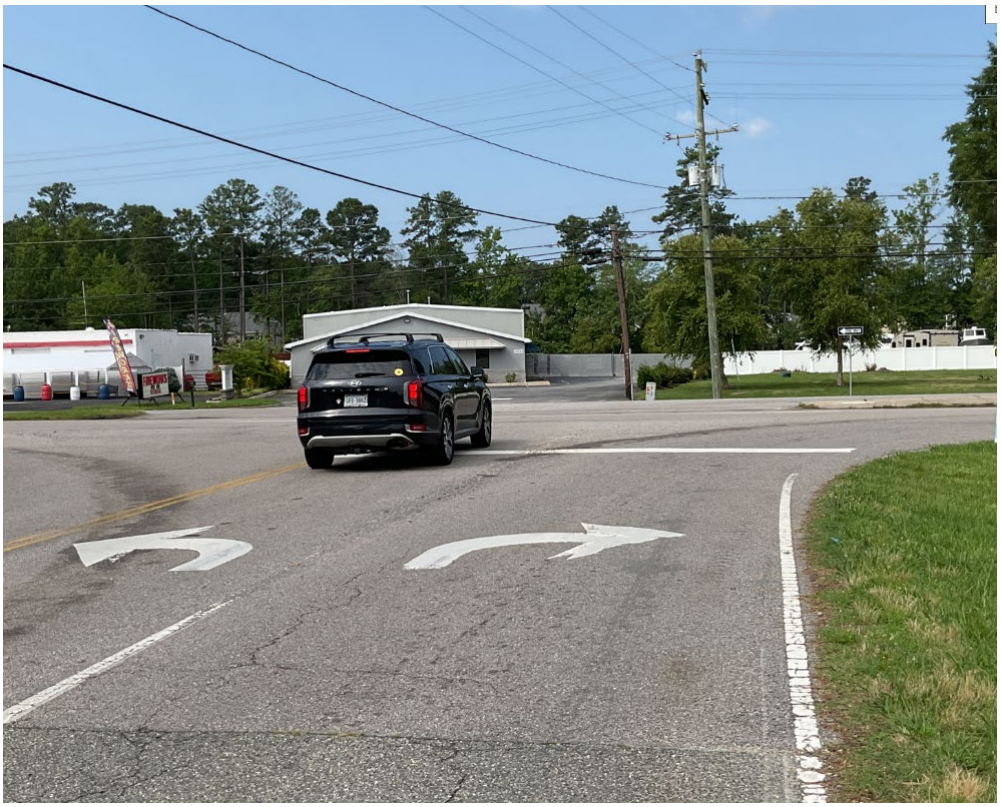


Figure 8. Sugar Hill Road Approach to Route 17

Some drivers turning right have recognized this sight distance challenge and have since begun cutting through the parking lot of the adjacent Finley's General Store to turn right from the driveway to the north. Alternatively, some right turning drivers were observed to encompass the middle of approach to Route 17, straddling both the left and right turn lane. Minor signs of this behavior can be seen on the pavement from the wear of the lane line and oil marks indicating the path of right turning vehicles (Figure 8).

4.2. Operational / Driver Behavior Concerns

4.2.1. Driver speeds are consistently higher than the 55 mph posted speed limit.

While the posted speed on this portion of the corridor is 55 mph, drivers frequently travel higher than the speed limit. This has been confirmed by past speed data indicating that the 85th percentile speed (speed that 85 percent of drivers are travelling at or below) is 63 mph. This part of the Route 17 is also located between two 45 mph posted speed segments and is a commuter route for people traveling into Suffolk and beyond (Norfolk, Virginia Beach).

High vehicle speeds can lead to severe crashes, especially when higher than the posted or design speed. The length of turn lanes, placement of warning signs, determination of yellow and red signal phases, and many other roadway elements rely on speed in the design. When operating speeds exceed the design speeds, it puts roadway users at higher risk of crashes. This is primarily because of the stopping sight distance required by drivers to react to a change in the roadway. The faster a driver is traveling, the more time and distance they need to slow down or stop. This can lead to an increase in rear end crashes for undersized turn lanes, turning vehicle crashes at intersections with insufficient sight distance to accommodate the operating speeds, or more frequent red light running crashes at signalized intersections.

4.2.2. Left turn lane for southbound Route 17 is not long enough for demand and speed.

Drivers on Route 17 frequently travel at speeds higher than the posted 55 mph speed, meaning that the design of roadway features such as turn lanes may feel uncomfortable for those higher speed vehicles. This discomfort can be enhanced when there is a queue of vehicles waiting to turn left, thus effectively shortening the deceleration distance in the turn lane. During the RSA, it was observed that three vehicles can be enough to fill the left turn lane for the southbound left from Route 17 onto Sugar Hill Road. This is dependent on a variety of factors, such as vehicle types, whether trailers are present, or spacing between the vehicles. However, this issue can pose a risk of rear end crashes when the effective deceleration distance is significantly shortened at higher vehicular speeds. Proposed improvements to the left turn lane must also consider impacts on sight lines for drivers looking for a gap on southbound Route 17 when turning left from Sugar Hill Road.

4.2.3. Drivers do not comply with stop control for Sugar Hill Road.

During the RSA, the project team observed several instances of drivers approaching the stop control for Sugar Hill Road and performing a rolling stop. This is likely due to the driver observing a gap in traffic (both directions for left turns, northbound for right turns), and understanding that a stop may require them to wait for the next opportunity. While these occurrences at the time of observations did not result in any crashes or near misses, non-compliance with the stop control indicates the risk of future crashes.

Potential crashes that could occur as a result of this behavior include angle crashes with left turns onto Route 17 and rear end crashes involving vehicles turning right or left onto Route 17. In cases where drivers are not fully stopping in order to make a gap, they may be inadequately judging the amount of time required to make the turning maneuver. This can result in collisions with vehicles traveling on Route 17 that did not see or expect a vehicle to be turning in front of them.

4.2.4. Drivers do not comply with posted no U-turn sign for southbound Route 17.

There is a "No U-turn" sign posted in the median adjacent to the left turn lane on southbound Route 17. Despite the sign, the crash history and observations of local residents and the RSA team indicate that drivers do not always comply with the posted sign. This is a concern because of the time needed to make the U-turn given the geometry of the road, as well as the speeds along Route 17.

Significantly more time is needed to make a U-turn than what is needed for a left turning movement. Because of this, drivers need a much larger gap in traffic to make this maneuver, meaning a longer sight distance downstream is also needed. Additionally, a vehicle turning right from Sugar Hill Road onto Route 17 may not expect for a vehicle in the left turn lane to enter the northbound lanes. This can result in angle crashes with drivers believing they have the right-of-way when turning right and drivers making an illegal U-turn onto northbound Route 17.

4.2.5. There are multiple driveways within or near the intersection. Several access points are not compliant with VDOT Road Design Manual.

Access points closely spaced to the intersection introduce additional conflict points for drivers turning onto or off of the major roadway. At the study intersection, there are many driveways along the southbound direction of Route 17, as well as two driveways closely spaced to the intersection on Sugar Hill Road. In Figure 9, some of the driveways along southbound Route 17 are used to access the same business.



Figure 9. Driveways Southeast of the Intersection

4.3. Signing, Pavement Marking, and Lighting Concerns

4.3.1. Right turning vehicles frequently turn close to the edge of pavement, over the existing edge line.

The existing right turn radius from northbound Route 17 onto Sugar Hill Road is 40', which allows for roughly 20 mph turns per the AASHTO Green Book. Oil stains and tire paths on the roadway also indicate that vehicles are using the full radius to turn to maintain higher turning speeds. This can be seen in Figure 10, which shows the edge line for the right turn radius onto Sugar Hill Road very worn, as well as some pavement defects and sediment outlining the outer edge of the vehicle path.



Figure 10. Edge Line for Right Turn Radius onto Sugar Hill Road

The path of right turning vehicles as indicated by sediment, pavement defects, and worn markings also show that some vehicles are tracking over the double yellow centerline on Sugar Hill Road, as seen in Figure 11. Both the closeness of the turning vehicles and tracking over the centerline pose risks to right turning vehicles. Such risks include departing from the edge of pavement, as well as potentially side swiping opposing vehicles waiting to turn left from Sugar Hill Road. While the likelihood of a severe injury or fatal crash occurring as a result is low, there are still countermeasures that could be applied to mitigate these risks.



Figure 11. Worn Centerline on Sugar Hill Road Approach

4.3.2. Vehicles turning left from southbound Route 17 frequently cross over the centerline on Sugar Hill Road when no vehicles are waiting to turn left.

Observations on site revealed that many drivers turning left onto Sugar Hill Road crossing over the centerline and the left turn lane when no vehicles were present on the Sugar Hill Road approach. This common movement was also reflected with the slight wearing of the centerline pavement marking near the stop line for Sugar Hill Road left turns, as shown in Figure 11. The sweep of this movement may indicate opportunity for geometric improvements to better guide vehicle movements at the intersection.

4.3.3. No signage to indicate the presence of Sugar Hill Road prior to the intersection.

Drivers approaching the intersection may easily drive past Sugar Hill Road, as there is no traffic control on Route 17 or signage indicating the presence of an intersection. Vehicular speeds on Route 17 are also high with a 55 mph posted speed limit, which requires more time and distance for drivers to prepare for a turn. When the need for a turn is unexpected, drivers may brake harder in order to stop prior to the turn, thus increasing the risk of rear end crashes with unsuspecting drivers traveling behind the turning vehicle. There are currently no intersection warning signs on either approach of Route 17 to Sugar Hill Road.

4.3.4. Median object marker sign is frequently struck.

The signpost in the median featuring the object marker, one-way, and "No U-turn" signs is frequently struck and has been relocated 15 feet north (Figure 12). This common occurrence is indicative of turning movements that conflict with the placement of the median.



Figure 12. Relocated Signpost in Median on Route 17

An evaluation of intersection turning movements should be performed to determine if medians, signs, and pavement markings are adequately placed and designed.

4.4. Additional Concerns

4.4.1. A variety of roadside objects pose hazards for vehicles departing the roadway in the southbound direction of Route 17.

There were three crashes along the southbound Route 17 involving off road fixed objects. There are utility poles, signposts, and mailboxes all closely located near the curb that pose risks to vehicles departing the roadway. Two of the three crashes along southbound Route 17 were the result of left turning vehicles unexpectedly entering the lane in front of the through traveling vehicle. Figure 13 shows the roadside objects that also obstruct sight lines for vehicles existing the driveway opposite to Sugar Hill Road.



Figure 13. Utility Poles Obstructing Sight Lines from Driveway Looking North of Intersection

5. Next Steps

The study team has compiled the existing conditions, crash data, field observations, and identified concerns for the intersection of Route 17 and Sugar Hill Road. Next steps include determining potential treatments for the identified concerns at the intersection. Each potential recommendation will have an associated order of magnitude for implementation and design and installation cost. RSA recommendations will not include a comprehensive engineering assessment for each treatment but will propose potential improvements with initial considerations for feasibility.