

Cleveland Avenue Improvement Task Force SR 2 / SR 72 (Capitol Trail) Gap Study June 15, 2017

On March 6, 2017 at the E. Cleveland Avenue public workshop, a resident concern was repeatedly raised regarding egress delay and safety for motorists exiting driveways located along the southeast side of Capitol Trail north of E. Cleveland Avenue if a Florida T intersection were to be constructed at the Capitol Trail and E. Cleveland Avenue intersection. The specific concern was that the Florida T concept would allow for a relatively continuous “free” northbound movement through the intersection of E. Cleveland Avenue; therefore, the gaps in traffic that residents currently rely on to safely exit their driveways will be significantly reduced or eliminated. To analyze this issue, DeIDOT obtained a 24-hour video of traffic along Capitol Trail north of E. Cleveland Avenue to perform gap studies of the existing traffic conditions during various periods throughout the day. Next, a *SimTraffic* model for existing conditions was developed and calibrated, which then was adjusted to represent the proposed Florida T concept to analyze impacts under the proposed future conditions.

Site Description: Capitol Trail in Newark is a four-lane divided roadway with no shoulders. The speed limit is 35 miles per hour. Driveways for 22 properties are provided along the southeast side of Capitol Trail between E. Cleveland Avenue and the next closest signal to the northeast at Anna Way. Seven of these driveways are located in the first block northeast of E. Cleveland Avenue, although two of these properties have alternate access off of Woodlawn Avenue. Since May 2015, the existing signal at E. Cleveland Avenue provides split phasing for all four approaches, creating relatively predictable gaps in northbound traffic flow during the southbound Capitol Trail phase and the westbound Woodlawn Avenue phase.

Gap Study: The study primarily focused on two time periods: the morning peak hour, when residents are most likely to be exiting their driveways, but when conflicting traffic is lower; and the evening peak hour, a less common time for residents to be exiting their driveways, but when conflicting traffic is at its peak. The study was conducted from the video recorded on Capitol Trail on Wednesday, March 22, 2017. Figures 1 and 2 depict the cumulative vehicular arrivals during the AM and PM peak hours, respectively. The red points represent the end of an “acceptable gap,” defined in the *AASHTO Geometric Design of Highways and Streets* as 6.5 seconds or greater for cars turning right from a stop. Both the peak hours show the expected platooning caused by the E. Cleveland Avenue signal. The data from the studies was converted to an expected driveway delay by accounting for the number of acceptable gaps, the proportion of time “available” to enter the roadway, and the proportion of time the roadway is “blocked” by conflicting traffic. The expected delay was compared to a *SimTraffic* model and then calibrated to achieve a similar average delay. This data is presented in Table 1.

Table 1. Capitol Trail Existing Conditions – Gap and Average Delay Data

	Number of acceptable gaps	Avg. “blocked” duration (sec)	Field-measured avg. driveway delay (sec)	<i>SimTraffic</i> driveway delay (sec) – Existing	<i>SimTraffic</i> driveway delay (sec) – Florida T
AM Peak	77	22.4	5.4	10.3	12.8
PM Peak	45	47.7	14.2	13.1	19.3

A conservative assumption was made in both the field-measured gap data and the *SimTraffic* model that motorists will only exit their driveway if both the right and left lanes are clear of conflicting traffic for a sufficient amount of time. Thus, while conflicting vehicles can still arrive next to each other in two lanes, the motorist exiting the driveway will wait for any approaching conflicting vehicle to pass, regardless of lane.

Figure 1. Cumulative Capitol Trail Vehicle Arrivals, AM Peak Hour

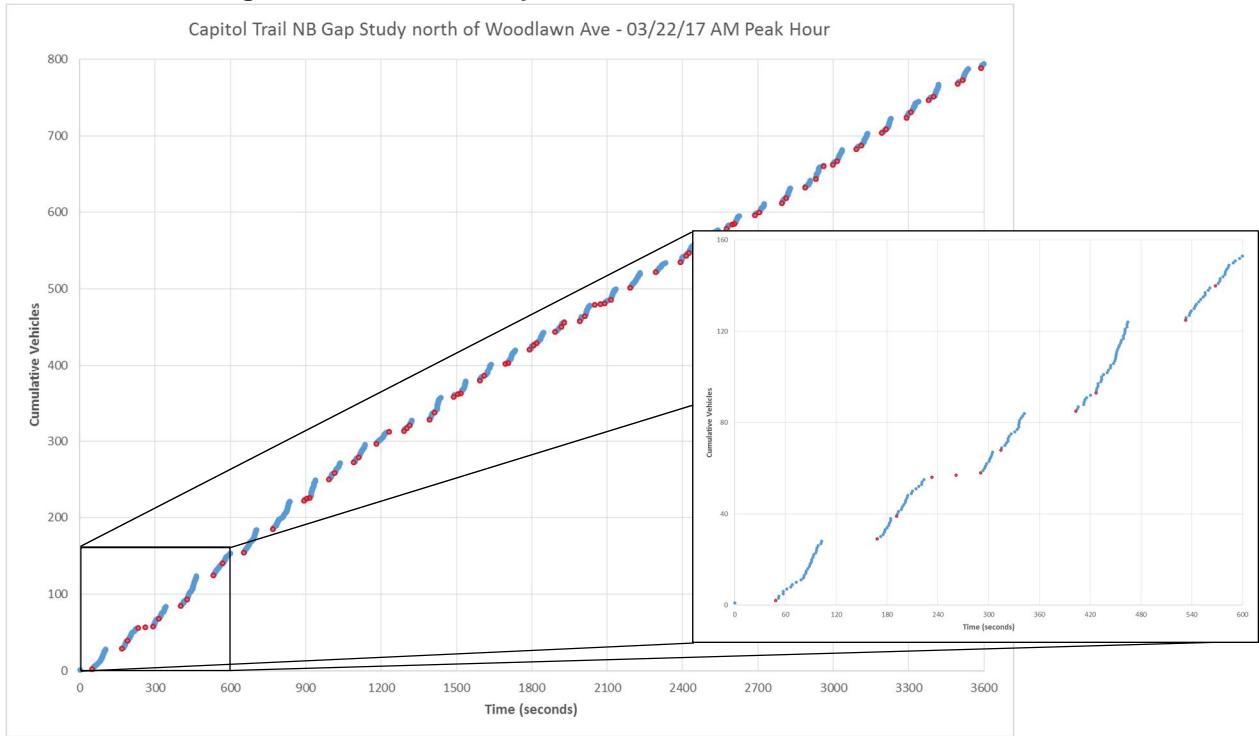
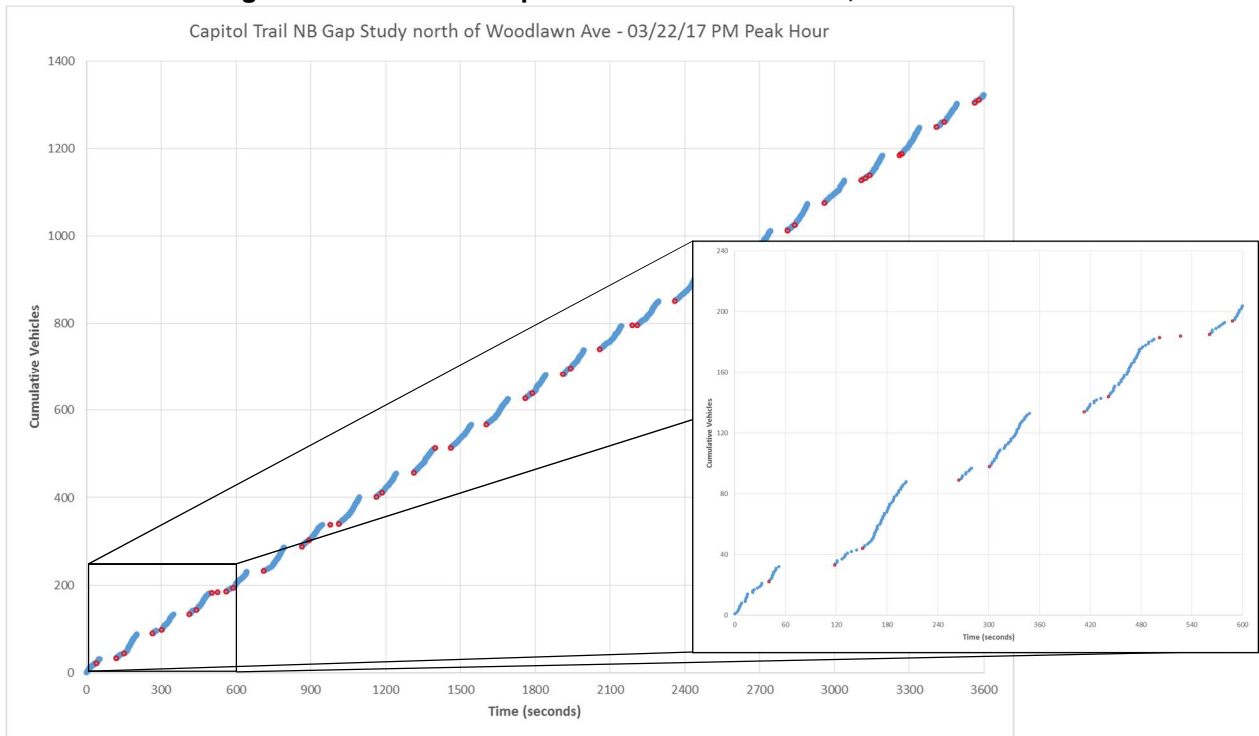


Figure 2. Cumulative Capitol Trail Vehicle Arrivals, PM Peak Hour



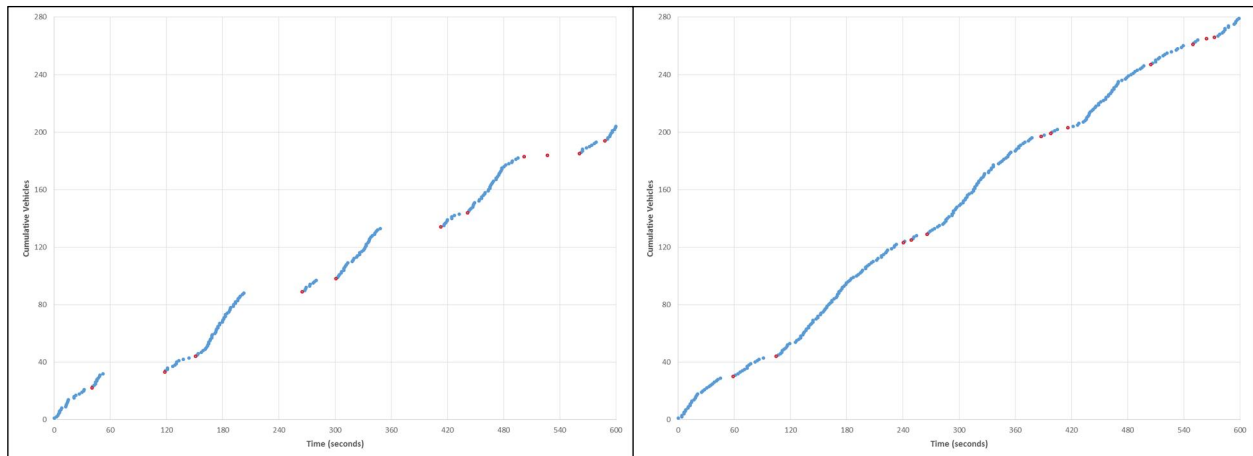
Florida T: The *SimTraffic* model was updated to reflect the proposed Florida T operation at the E. Cleveland Avenue intersection, with the delay recalculated for a driveway on Capitol Trail. With the Florida T, northbound traffic flows freely in one lane through the E. Cleveland Avenue intersection, with signalized eastbound lefts from E. Cleveland Avenue entering Capitol Trail in an adjoining lane. Under this intersection control scenario, **the projected driveway delay increases 2.5 seconds to 12.8 seconds during the AM peak hour and increases 6.2 seconds to 19.3 seconds during the PM peak hour.**

While traffic patterns along Capitol Trail are expected to be noticeably different downstream of a Florida T intersection than the existing signalized intersection, the delay to enter the roadway remains reasonable due to an expected trade-off: acceptable gaps will occur more frequently, but they will typically be of a shorter duration. With the current operation, a vehicle exiting a driveway is more likely to arrive at Capitol Trail during an extended gap and have the ability to enter the roadway immediately; however, it is also more likely the vehicle will have to wait 60 seconds or longer for an extended platoon to pass (i.e., the range of potential delays is large). With a Florida T, vehicles passing Capitol Trail driveways will occur more randomly, so both extended gaps and extended platoons will be much less likely to occur. Other factors will also prevent Capitol Trail traffic from achieving truly random/"free" arrivals: the eastbound left turn off E. Cleveland Avenue will remain signalized, the Library Ave at E. Main Street signal will continue to create significant northbound gaps/platoons (although some of the gaps will be filled by westbound right turns from SR 273), and a significant proportion of the traffic on the northbound approach to E. Cleveland Avenue will enter the left-turn lanes, creating gaps in through traffic.

One caveat should be noted: because the gaps in a Florida T scenario will likely be of a shorter duration (though they will occur more often), the driveway delay is much more sensitive to a motorist's gap selection threshold. Elderly motorists, novice drivers, larger vehicles, and driveways with sight distance restrictions all may necessitate a longer gap to enter the roadway than the accepted *AASHTO* standard of 6.5 seconds. However, because gaps occur relatively frequently, it remains unlikely that significantly long delays would occur regularly, particularly in the morning, when Capitol Trail traffic is relatively light heading out of Newark.

Figure 3 depicts the difference between the existing operation (field videos) and the Florida T operation (*SimTraffic* animation) during PM peak traffic. There is clearly less total gap time in the Florida T scenario; however, shorter-duration gaps still occur fairly regularly. Consequently, delay does increase some, but not exponentially.

Figure 3. Cumulative Vehicle Arrivals PM Peak "Snapshot" – Existing (left) vs. Florida T (right)



Historical Operations: It is also important to note that prior to May 2015, the signal at Capitol Trail and E. Cleveland Avenue utilized concurrent phasing for northbound and southbound through traffic. Since southbound left-turn volume is very low, the westbound Woodlawn Avenue signal phase represented the predominant “gap creator” for departing Capitol Trail traffic. *SimTraffic* simulations were run for the historical phasing settings, and delays for the Capitol Trail driveways were determined. Table 2 summarizes the results of this analysis along with a comparison to the existing and Florida T operations. As shown, the Florida T gap results are also relatively consistent with the historical conditions along Capitol Trail prior to the May 2015 signal phasing modifications.

Table 2. Capitol Trail Driveways – Average Delays

	<i>SimTraffic</i> driveway delay (sec) – Historical	<i>SimTraffic</i> driveway delay (sec) – Existing	<i>SimTraffic</i> driveway delay (sec) – Florida T
AM Peak	6.7	10.3	12.8
PM Peak	20.2	13.1	19.3

Crash History: Five years (2012-2016) of crash data was reviewed between the signalized intersections at E. Cleveland Avenue and Anna Way. No crashes involved vehicles exiting driveways; two crashes involved vehicles slowing to enter driveways (one residential, one commercial). The following is a summary of the 17 reported crashes:

- 4 northbound lost control crashes (3 DUI)
- 4 northbound sideswipe crashes
- 3 southbound lost control crashes (1 DUI; 1 icy)
- 2 northbound rear end crashes (involved non-contact vehicles turning into driveways/side streets)
- 2 northbound crashes involving deer
- 1 southbound rear end (vehicle slowing to enter Capitol Plaza Professional Center)
- 1 southbound pedestrian crash (details vague/unclear)

DART Ridership Data and Mitigation: DART Bus Route 6, which connects Newark and Wilmington along Kirkwood Highway, has stops along Capitol Trail just north of E. Cleveland Avenue. Ridership data was obtained from DART – during weekdays, there are 9 boardings at the east side (outbound) stop and 11 alightings at the west side (inbound) stop. Currently, the east side bus stop is located upstream of where the northbound through and eastbound left-turn lanes merge in the Florida T concept. Regular bus stops in this section could cause delays and potential rear end crashes. To mitigate the potential issues, the concept design has been updated to include a bus pull-off area to serve the east side bus stop. Figure 4 depicts this updated design.

Figure 4. Florida T Conceptual Design with Bus Pull-off

