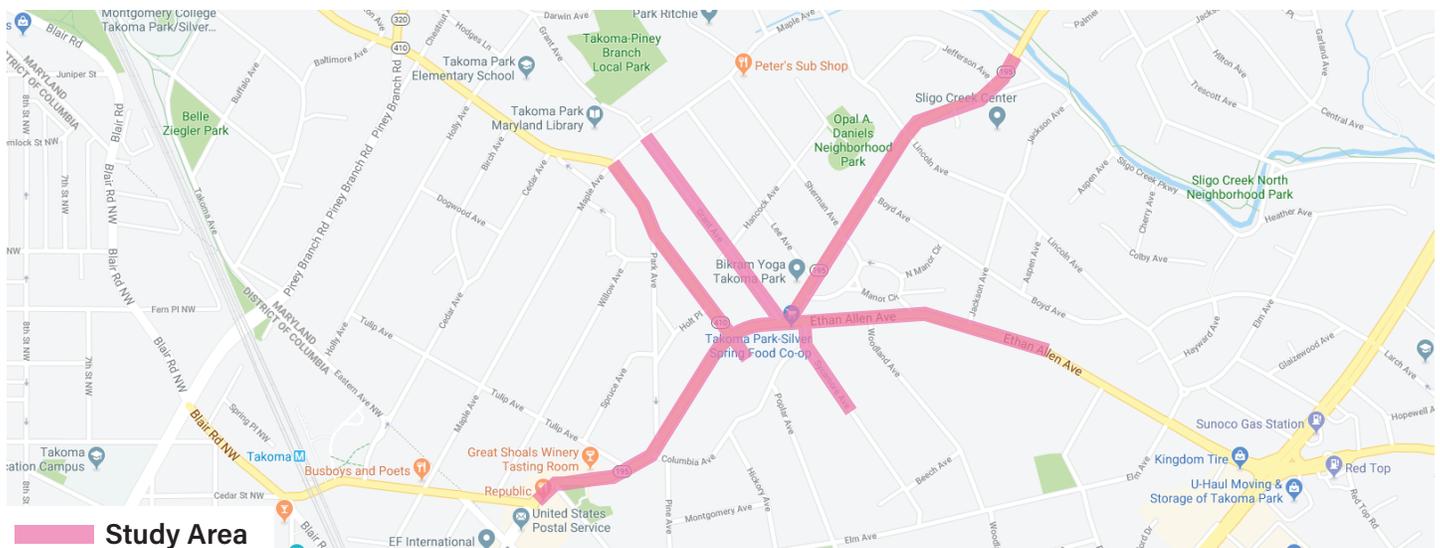


STUDY AREA

- The study area includes the intersections of Carroll Avenue (MD 195) at Philadelphia Avenue (MD 410), Ethan Allen Avenue (MD 410) at Carroll Avenue (MD 195) and Grant Avenue, and Ethan Allen Avenue (MD 410) at Sycamore Avenue
- The study area includes several bus stops serving Montgomery County Ride On Routes 12, 13, 16, and 18, and WMATA Route F4
- A large volume of pedestrians and bicyclists, including students from nearby schools (Takoma Park Elementary School, Piney Branch Elementary School, and Takoma Park Middle School) travel through the study area
- Bicycle markings within the study area include sharrows in both directions of Carroll Avenue north of Ethan Allen Avenue and a contraflow bicycle lane along Grant Avenue
- The posted speed limit is 25 mph throughout the study area
- The peak hours are 8:00 - 9:00 AM and 5:45 - 6:45 PM



ANALYSIS METHODOLOGY

- Observations are based on field observations performed by MDOT SHA in February 2019 during the AM and PM peak periods (7-9 AM and 4-6 PM)
- Modeling results are based on VISSIM modeling software, 2019 peak hour volumes (balanced), and the latest signal timings provided by MCDOT (implemented in Fall 2018 with all-pedestrian phases at each signal, except MD 410 at Sycamore Avenue)
- The intersections of MD 410 at Carroll Avenue/Grant Avenue and MD 410 at Sycamore Avenue operate on a single signal controller, and are grouped as a single intersection for the VISSIM analysis; this intersection is coordinated with the signal at MD 195/MD 410 at Philadelphia Avenue
- Crashes shown are police-reported crashes from 2015 to 2018; it should be noted that there were no police-reported pedestrian or bicycle crashes within that study period. Crash locations are approximate and based on available data. 2018 data is subject to change

FIELD OBSERVATIONS - WEST INTERSECTION

PEDESTRIAN AND BICYCLE

- Pedestrian pushbuttons are used to activate the all-pedestrian phase nearly every signal cycle during both peak periods due to high demand; most pedestrians are compliant and only cross during this phase
- Most pedestrians use the crosswalks, but some cross diagonally
- Bicyclists often travel within the sidewalks as well as the roadways

SIGNAL TIMINGS AND OPERATIONS

- Westbound right-turning traffic has an overlap phase concurrent with southbound Philadelphia Avenue traffic
- When the fire department signal is activated on the south leg, the other approaches to the intersection experience delays of approximately two minutes
- Once the fire department signal is activated, it can take several signal cycles to clear the resulting queues along the other approaches
- Eastbound through vehicles bypass the left-turning vehicles using the fire station driveway

CONGESTED CONDITIONS

- Westbound queues at Philadelphia Avenue occasionally spillback through the eastern signal at Ethan Allen Avenue during both peak periods
- Eastbound and southbound vehicles are occasionally not able to clear the intersection in one signal cycle; these vehicles must wait through a second cycle during the PM peak period
- Eastbound queues exceeded 40 vehicles and southbound queues reached 33 vehicles during PM peak period field observations
- Eastbound and southbound queues sometimes block side street intersections
- On one occasion, an eastbound vehicle crossed the double-yellow centerline to bypass the eastbound queue and access the left-turn lane at the downstream signal at Ethan Allen Avenue; this nearly resulted in a crash with a westbound vehicle
- On several occasions, southbound vehicles that were 2nd or 3rd in queue crossed the center line to bypass the queue and completed their movement

SAFETY - WEST INTERSECTION

- There were multiple turn-related and fixed object crashes at this intersection
- Only one crash was noted as related to fire station operations; this crash did not involve fire vehicles
- There were no fatal or pedestrian/bicycle crashes during the four-year study period

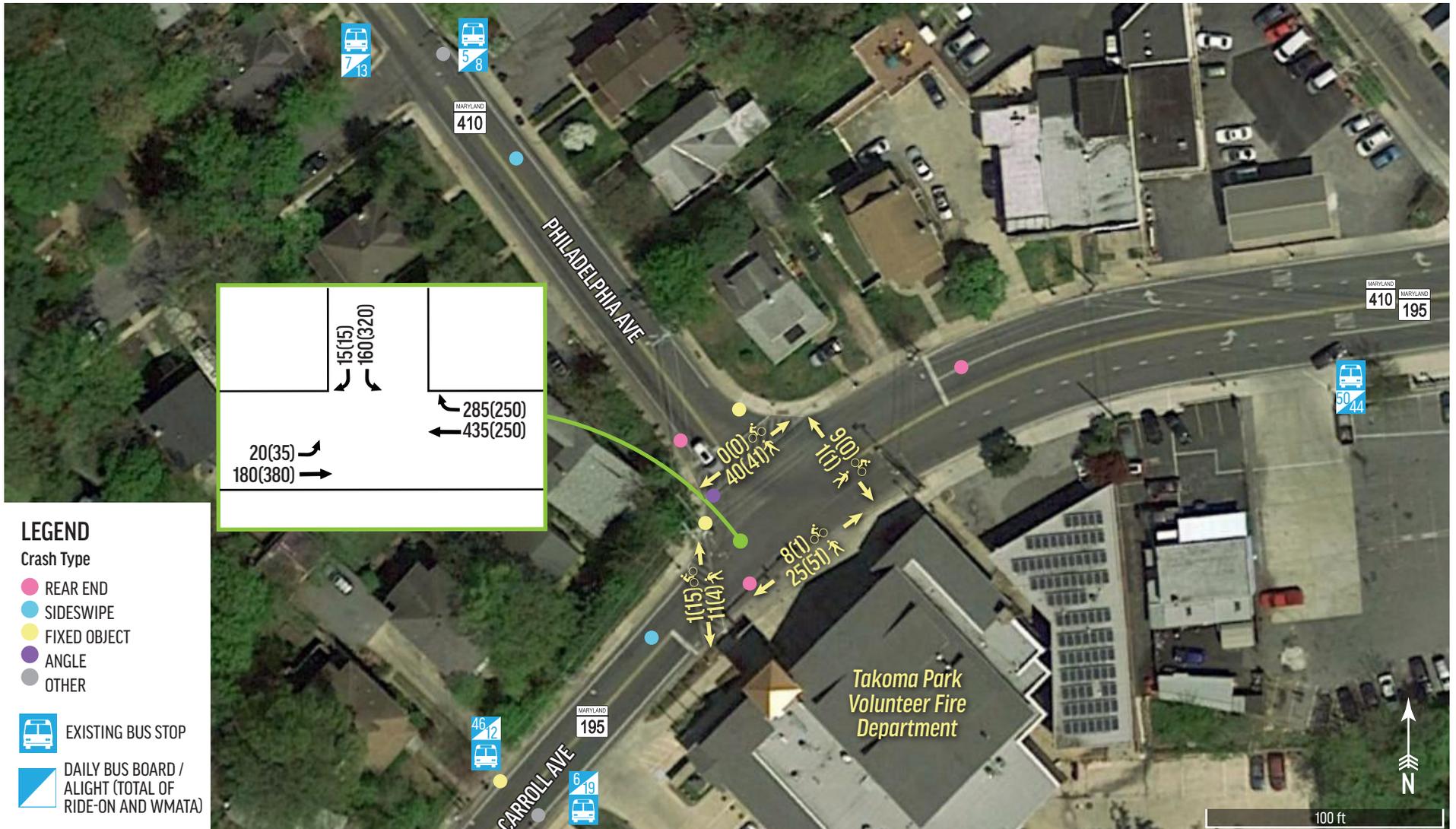


Pedestrians waiting to cross the intersection

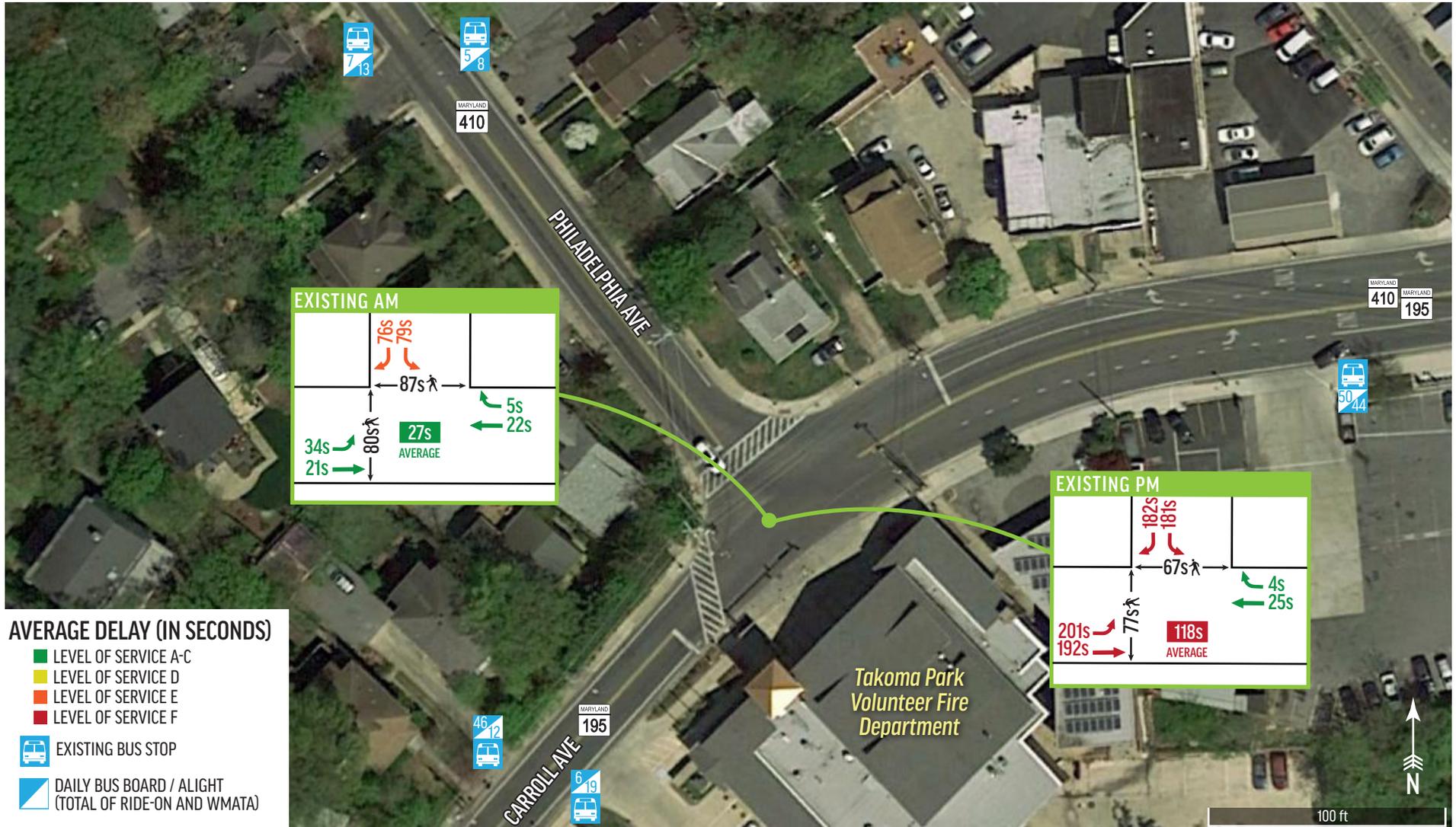


Fire Station along south leg of intersection

**EXISTING (2019) AM(PM) PEAK HOUR VOLUMES AND
 CRASH HISTORY (2015-2018) - WEST INTERSECTION**



EXISTING DELAYS (SECONDS) AND LEVEL OF SERVICE (LOS) - WEST INTERSECTION



FIELD OBSERVATIONS - EAST INTERSECTION

PEDESTRIAN AND BICYCLE

- Pedestrian pushbuttons are used to activate the all-pedestrian phase nearly every signal cycle during both peak periods due to high demand; most pedestrians are compliant and only cross during this phase
- Most pedestrians use the crosswalks, but some cross diagonally; crossing guards assist pedestrians during both peak periods
- Bicyclists often travel within the sidewalks as well as the roadways; eastbound left-turning bicyclists at onto Carroll Avenue use the left-turn lane and ride with vehicular traffic
- On one occasion during the PM peak, a crossing guard directed eastbound left-turning and southbound right-turning traffic to stop during their green phase to allow a pedestrian to cross the north leg



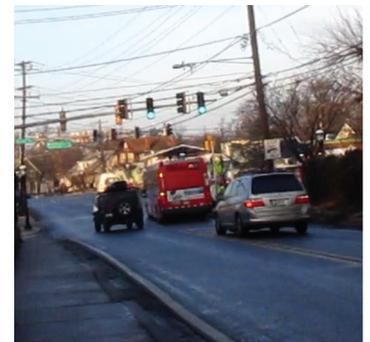
Crossing guard helping students cross the intersection

SIGNAL TIMINGS AND OPERATIONS

- Eastbound left-turning movements operate with exclusive/permissive (with and without green arrow) phasing
- Southbound right-turning traffic has an overlap phase concurrent with the eastbound left-turn phase
- The Sycamore Avenue phase is frequently skipped due to minimal traffic volumes
- Parallel parking along Grant Avenue and Carroll Avenue do not appear to significantly impact traffic operations
- Westbound vehicles traveling through the signal at Sycamore Avenue typically clear the signal at Carroll Avenue during the same signal phase (i.e., they do not become "trapped" within the intersection)
- Westbound vehicles turning left into the parking lot west of the Co-op are often blocked by eastbound queues, and must wait for these queues to clear before turning
- There are frequent turns into and out of the parking lot east of the Co-op; westbound left turns into the Co-op and onto Sycamore Avenue can cause significant delay for vehicles behind them

CONGESTED CONDITIONS

- Eastbound queues at Carroll Avenue occasionally spillback through the upstream signal at Philadelphia Avenue during both peak periods
- Westbound and southbound vehicles are occasionally unable to clear the intersection in one signal cycle and must wait through a second cycle during both peak periods
- Westbound through and southbound right-turn queues exceeded 40 vehicles during AM peak period field observations, which blocks access to other intersections; additionally, westbound through queues exceeded 40 vehicles during the PM peak period
- On one occasion, a southbound vehicle on Carroll Avenue turned right from the left-turn lane to avoid the queue, forcing the other right-turning vehicle to enter the rightmost lane west of the intersection (which becomes a lane drop onto Philadelphia Avenue)
- On one occasion a driver attempted to perform an illegal right-turn on red from southbound Carroll Avenue, but was directed to stop by a crossing guard
- While a westbound bus was stopped between Sycamore Avenue and Carroll Avenue to board/alight, several vehicles crossed the double-yellow center line to bypass the bus

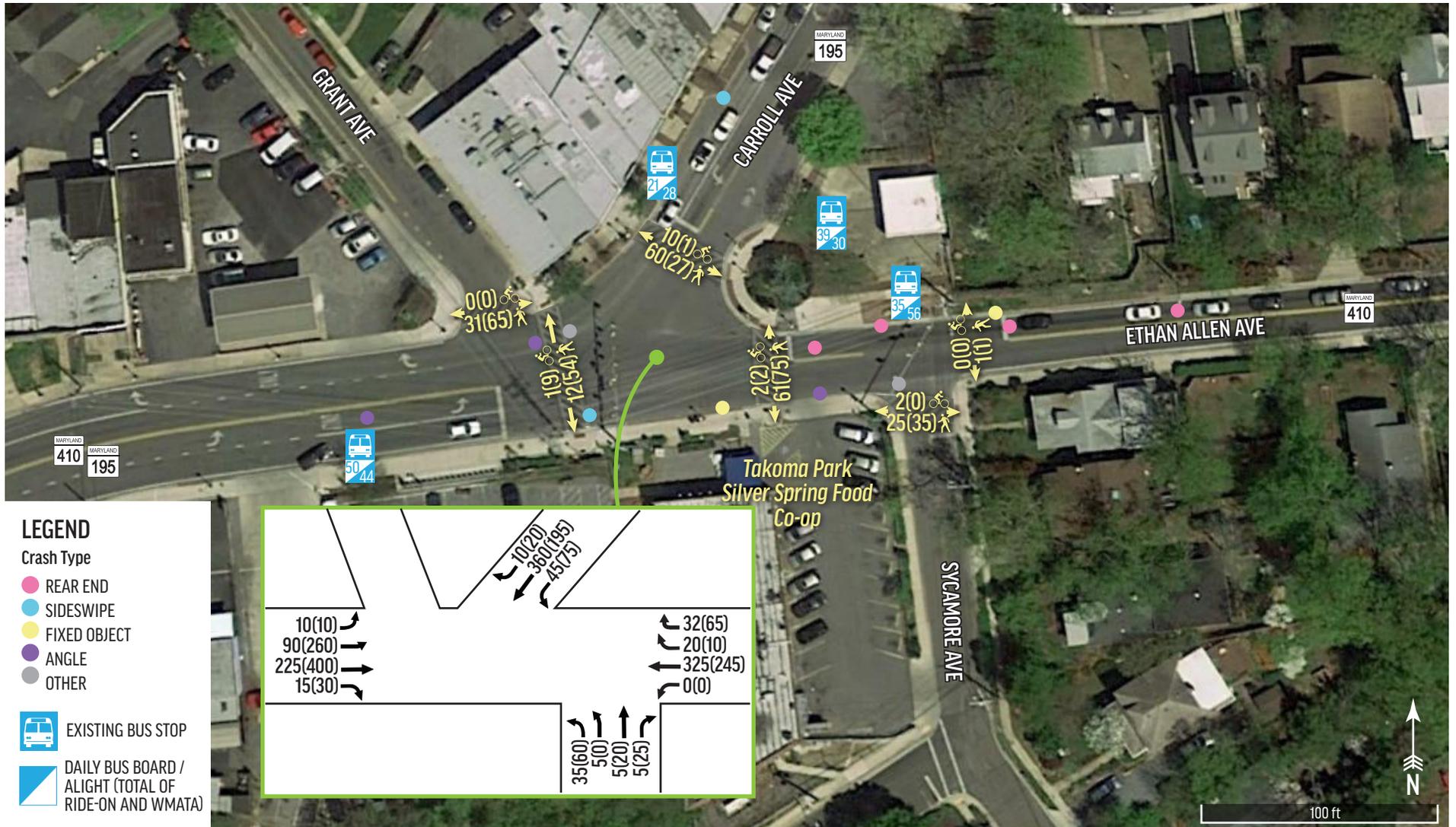


Vehicle illegally passing a bus stopped west of Sycamore Ave

SAFETY - EAST INTERSECTION

- Rear end and turn-related crashes comprise the majority of crashes on the east and west approaches, respectively
- Multiple crashes involved bus traffic and were typically the fault of the other driver
- There were no fatal or pedestrian/bicycle crashes during the four-year study period

**EXISTING (2019) AM(PM) PEAK HOUR VOLUMES AND
 CRASH HISTORY (2015-2018) - EAST INTERSECTION**



EXISTING DELAYS (SECONDS) AND LEVEL OF SERVICE (LOS) - EAST INTERSECTION

