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Date: May 15, 2025
To: Marilyn Smith, Executive Director, Dover/Kent County MPO
From: Marc Coté, Delaware Operations Manager, Rossi Group
CC: Robin Christiansen, Mayor, City of Dover
Lenita McIntyre, Principal, South Dover Elementary School
Stephen Bayer, Planning Supervisor, DelDOT

Re: South Dover Elementary School Traffic Circulation and Safety Assessment Technical Memorandum

The Dover/Kent County MPO contacted Rossi Group to conduct a traffic circulation and safety assessment of the South Dover Elementary School campus and South State Street approaches north and south of the campus entrance. The assessment is being funded by DelDOT's Division of Planning. The Capital School District and City of Dover are also stakeholders in the assessment.

During the process of the assessment, two meetings were held including representatives from the Dover/Kent County MPO, DelDOT, Capital School District, City of Dover, and the consulting team. Following a meeting in February where there was consensus on the recommendations, Rossi Group prepared the final draft memorandum and submitted it to DelDOT and the Dover/Kent County MPO. The assessment and associated recommendations were presented to the Dover/Kent County MPO Public Advisory Committee on April 10, 2025; Technical Advisory Committee on April 15, 2025; and the Council on May 7, 2025. Following the presentation on May 7, 2025, the Dover/Kent County MPO Council voted to approve the assessment and associated recommendations.

I. Project Description

The Capital School District has shared concerns regarding traffic patterns entering and exiting the school during morning drop-off and afternoon pick-up. Concerns relate to queuing of parents' vehicles onto South State Street, conflicting movements between vehicles and school buses, and the overall safety and efficiency related to traffic circulation on and around the school campus in the morning and afternoon. In addition to concerns about circulation on the South Dover Elementary School campus and South State Street, school officials expressed concerns about vehicles queuing in the alley between Pine Street and the campus, potentially blocking access to residential driveways and presenting a conflict for the City's trash collection. **Figure 1** shows the location of the school campus in the context of the surrounding area.

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Figure 1: Location of South Dover Elementary School

II. Existing Conditions

A. South State Street

South State Street is a two-lane roadway classified as a minor arterial with an AADT volume of 7,412 according to DelDOT's 2023 Traffic Summary. The speed limit of South State Street is 25 miles per hour, and 20 miles per hour when children are present. The roadway has 20-foot lanes in either direction with no striped shoulders; sidewalks are present on both sides of the road.

The intersection of South State Street and the South Dover Elementary School entrance is a signalized three-legged intersection, shown in **Figure 2**. Marked crosswalks with pedestrian signals and push buttons exist on the south and east legs, with the pedestrian signal on the south leg crossing having a separate phase.

At the intersection, the following lane configurations exist:

- School entrance/exit consists of one entrance lane and one exit lane; the exit lane has two separate turn lanes, one left and one right;
- South State Street northbound approach consists of one shared through-right lane;

- South State Street southbound approach has one shared through-left lane, respectively.

Figure 2: Intersection of South State Street and South Dover Elementary School entrance looking south

B. South Dover Elementary School Internal Circulation

The entrance to South Dover Elementary School, from South State Street, is a three-lane roadway with sidewalk along the south side. The roadway provides access to a parking lot in front of the school and then continues to the bus loop on the north side of the school. Angled bus parking is located in the center of the loop, providing line of sight from bus doors to the side entrance of the school. Designated vans drop off students along the curbline north of the building and often cut through empty bus parking spots to exit. Only school buses and designated vans are allowed to continue through to the bus loop which is signed as 'School Buses Only'.

All other incoming traffic must turn right into the school parking lot. The parking lot entrance is the south leg of the internal intersection with the school driveway, west of the bus loop. The main entrance of the school is off of the parking lot, and the drive aisle utilized for student drop-off and pick-up. Pavement marking arrows and 'Do Not Enter' signage indicate the direction of traffic flow within the parking lot as one-way counterclockwise. In the field, orange traffic barrels were observed being used to prevent vehicles from entering the wrong way in the parking lot and the bus loop (**Figure 3**). **Figure 4** shows the circulation pattern of vehicles arriving for student drop-off and pick-up.

Figure 3: Internal intersection from parking lot with traffic barrels

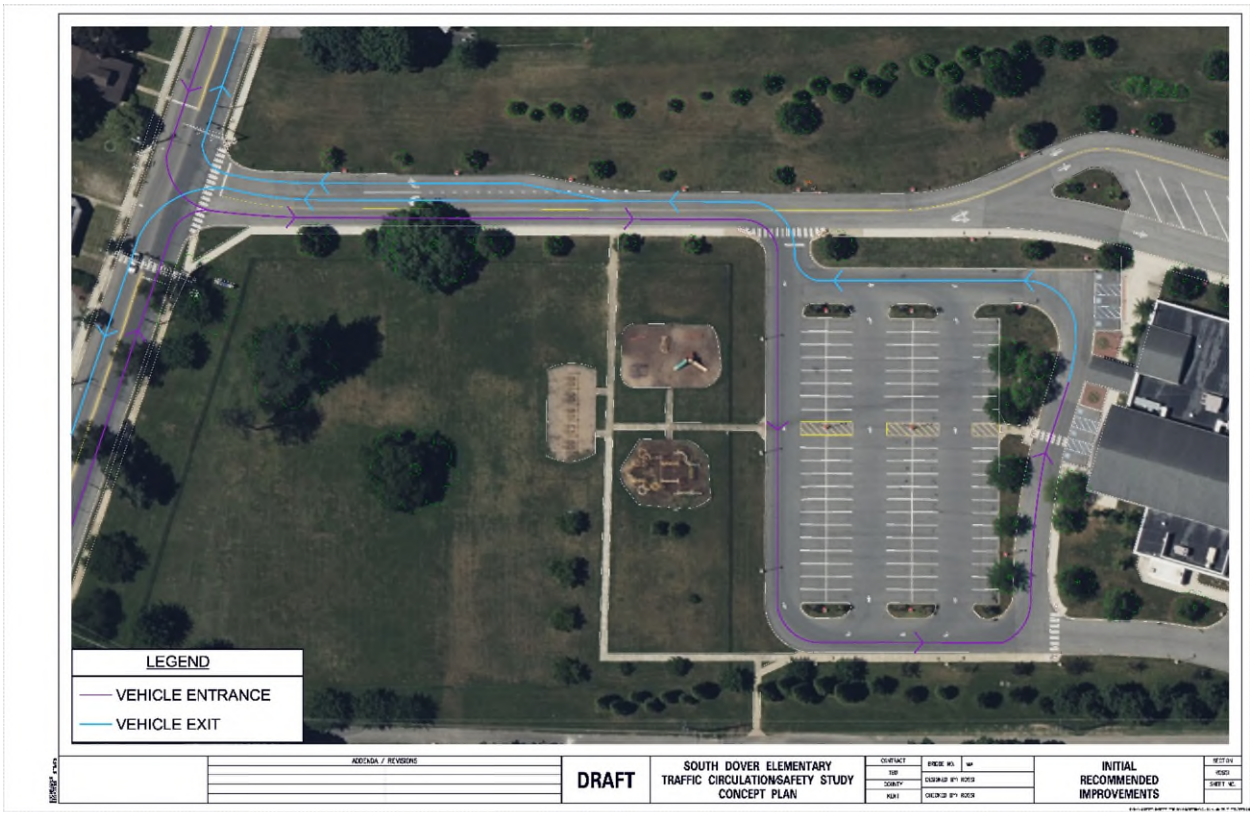

Figure 4: Internal circulation for student drop-off and pick-up

C. Drop-Off/Pick-Up Operations

The school doors open at 8:35 a.m., and school starts at 8:55 a.m. Students cannot be dropped off and let into the school prior to 8:35 a.m. There is an early care program that starts at 7:00 a.m. Students who arrive after 8:55 a.m. are considered late and must be signed in at the school office. School dismissal starts at 3:26 p.m. Following dismissal, buses leave in seven-minute intervals.

D. Field Observations

Rossi staff conducted field observations during morning drop-off and afternoon pick-up on two separate days, November 19, 2024, and December 17, 2024. On November 19, observations were performed at the State Street intersection, the school entrance, and the alley south of the school parallel to Pine Street. On December 17, 2024, observations were performed at the South State Street intersection, the internal school intersection, the school entrance, and the bus loop. The South Dover Elementary School campus and field observation locations are shown in **Figure 5**.

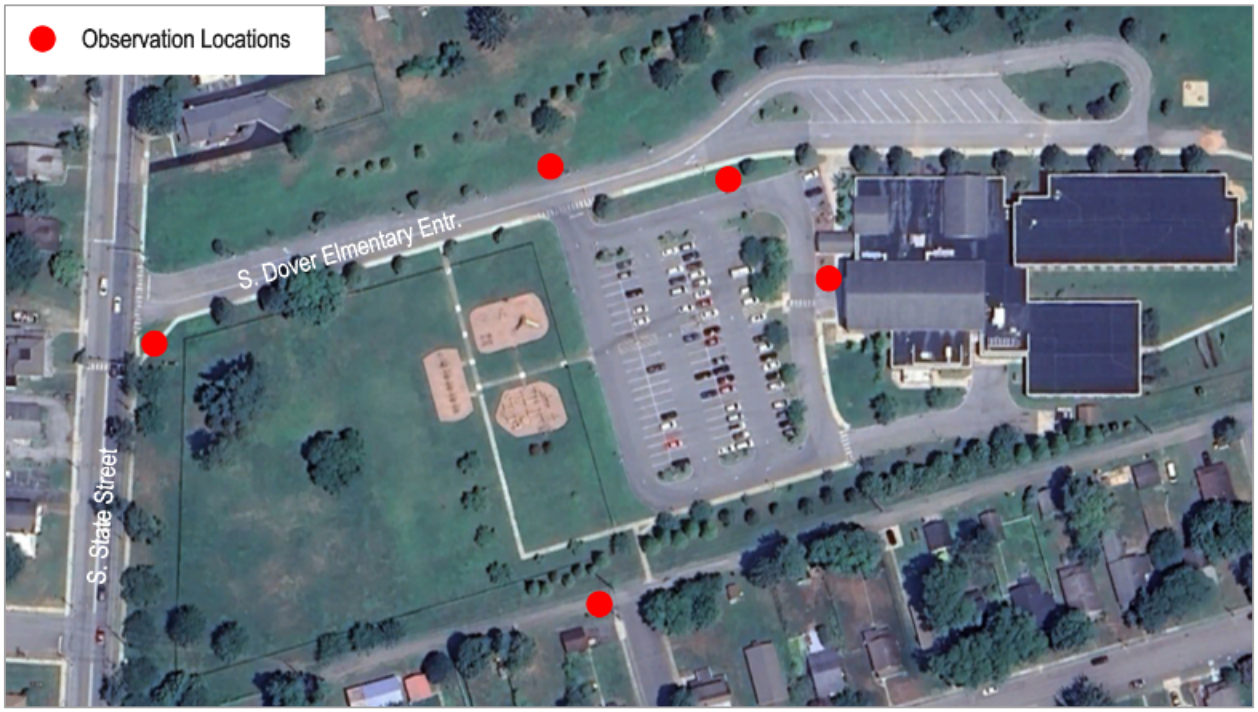

Figure 5: South Dover Elementary School Field Observation Locations

Drop-Off Period

The field observations for the morning drop-off and evening pick-up periods had differences in traffic movements and impacts. During the morning drop-off period, vehicles were observed queueing at the school's main entrance as early as 7:30 a.m. The constable was observed arriving at the State Street intersection between 8:25 and 8:32 p.m., with another person to assist in directing vehicles at the internal school intersection. Both had 'STOP' paddles to direct traffic.

By 8:30 a.m. the queue was observed extending out of the parking lot and onto the school entrance drive. At 8:32 a.m. the queue was observed reaching South State Street, having queues for northbound right turns and southbound left turns. The longest queue observed in the field on South State Street was nine vehicles in the northbound right turn queue at 8:35 a.m. South State Street does not have turn lanes at the intersection, so when queueing began on South State Street to turn into the school, through movement vehicles were observed going around the queueing turn lanes in both the northbound and southbound lane, using the single lane in each direction as two lanes (**Figure 6**). After 8:35 a.m., when students are allowed to enter the school, the queue moved quickly as children exited the vehicles. Then vehicles began queuing westbound on the school entrance drive in the left and right turn lanes with the highest queues of seven and nine vehicles, respectively **(Figure 7).** By 8:50 a.m. the constable and other monitor were observed leaving the intersections.

Figure 6: Northbound South State Street queue during drop-off period

Figure 7: Queueing eastbound and westbound on school entrance drive after drop-off begins

Pick-Up Period

During the afternoon pick-up period, vehicles were observed queueing at the school's main entrance as early as 2:45 p.m. At 3:05 p.m. the queue was observed extending out of the parking lot and onto the school entrance drive. At 3:20 p.m. the constable arrived at the internal intersection and an additional person directed traffic at the State Street intersection, both with 'STOP' paddles. By 3:21 p.m. the queue was observed reaching South State Street. The longest queue observed in the field on South State Street was seven vehicles in the northbound right turn queue at 3:25 p.m., and four vehicles in the southbound left turn. School dismissal began at 3:26 p.m., and children began loading into vehicles, guided by staff. The queue was observed moving slower in the pick-up period, than the drop-off, with more dispersed queueing. No queues were observed on State Street after 3:30 p.m. Then vehicles began queueing westbound on the school entrance drive in the left- and right-turn lanes with the highest queue of seven vehicles, but an average of two to three vehicles from 3:25 to 3:45 p.m.

Buses and Vans

During the drop-off period, buses were first observed arriving at the school between 8:15 a.m. until 8:40 a.m. and departing from 8:40 a.m. until about 8:50 a.m. **(Figure 8)** Vans arrived during the drop-off period between 8:05 a.m. and 8:40 a.m. All vans left the campus by about 8:43 a.m. During the pick-up period, buses arrived between 3:07 p.m. and 3:40 p.m., and departed between 3:30 p.m. and 3:49 p.m.

Figure 8: Bus loop during evening pick-up

During both the morning and afternoon periods, some buses were observed driving eastbound in the westbound lane of the school entrance drive **(Figure 9)** before there was a queue in the eastbound lane of the school entrance drive. Others used the eastbound lane until the queue or the internal intersection, where they used the westbound lane to go around traffic barrels. Once the queue reached the school entrance drive, buses and vans arriving were observed using the westbound lane to go eastbound around the queue to their designated drop-off location in the bus loop. When the queue began on South State Street, northbound buses and vans were observed going to the left of vehicles queued to turn right, then directed by the constable/traffic monitor to turn onto the school entrance drive's westbound lane from the left side of the travel lane. The buses parked in the angled bus parking spaces, and the vans queued along the school's north wall. When leaving the school after drop-off, the vans did not follow the bus loop out, as the buses did; they used the westernmost bus parking spaces to turn around. The constable/traffic monitor at the internal intersection stopped traffic exiting the parking lot to let the vans and buses exit.

Figure 9: Bus going eastbound in the westbound lane of the school entrance drive

Alley

During meetings with the City and school officials, drop-off and pick-up traffic was noted as a concern in the alley adjacent to the school and parallel to Pine Street **(Figure 10)**. In the field, Rossi staff observed the alley and saw instances of vehicles parking on the neighborhood streets adjacent to the school, and in the alley, to walk their children to the school. Not many of these cases were observed in the field, and parking on streets to walk children to school is legal.

Figure 10: Vehicle parked on Park Avenue to drop-off children

E. Traffic Data

Traffic and pedestrian counts were performed on Tuesday, November 19, 2024, between 7:30 a.m. and 9:30 a.m. and between 2:30 p.m. and 4:30 p.m. The morning and afternoon peak hour counts representing the drop-off and pick-up periods, respectively, are between 7:45 a.m. and 8:45 a.m. and between 3:15 p.m. and 4:15 p.m. and shown in **Figure 11**. The morning drop-off had higher traffic volumes on northbound South State Street and turning into the school entrance than the afternoon pick-up. However, afternoon pick-up had higher traffic volumes on southbound State Street and westbound from the school entrance, exiting the school. Northbound South State Street had higher volumes turning into the school entrance than southbound South State Street in the morning and afternoon peak hours. There was very low pedestrian volume during the morning and evening peak hours, with pedestrian volume only present crossing the State Street.

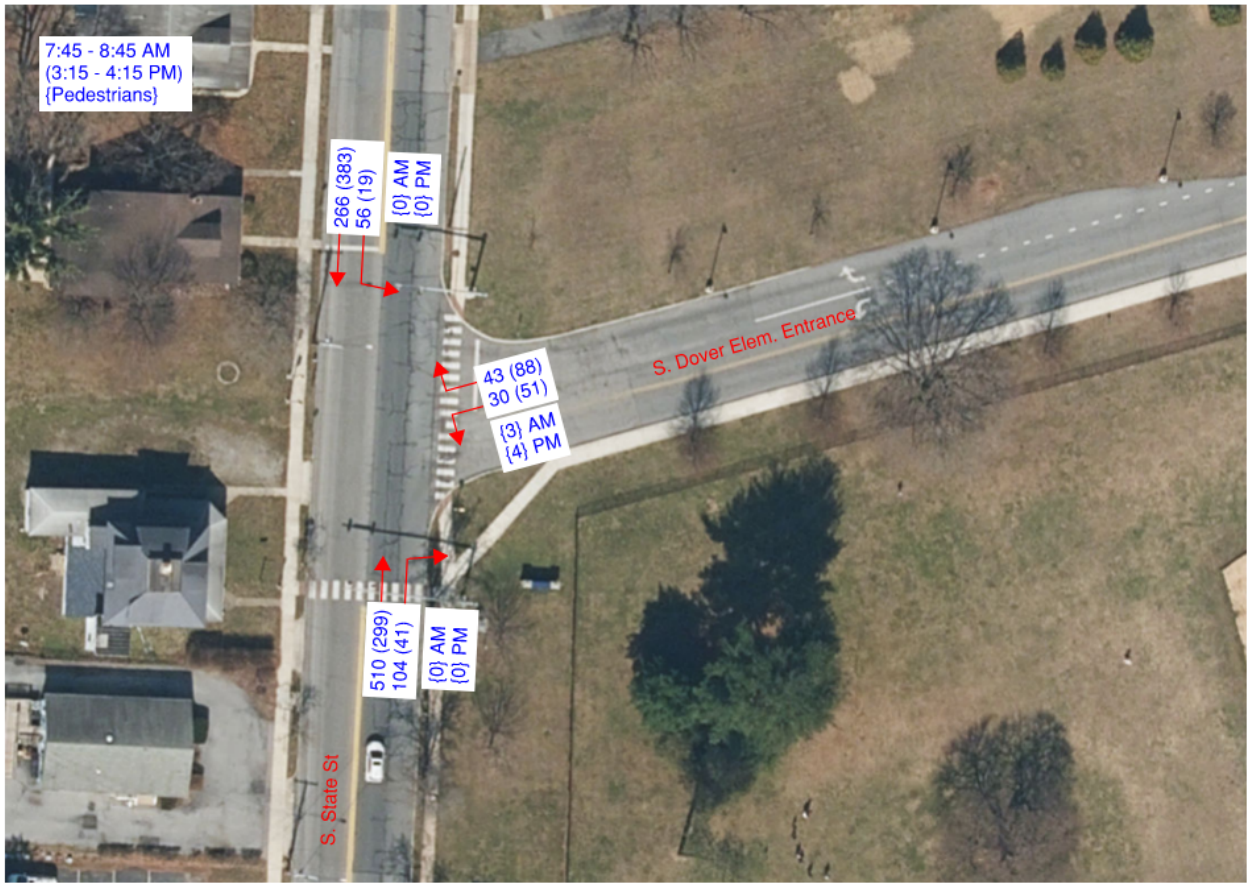

Figure 11: AM and PM Peak Hour Volumes at South State Street and South Dover Elementary School Intersection

Figure 12: Constable directing traffic at South State Street intersection

F. Crash Data

Crash data for a three-year period from December 5, 2021, through December 5, 2024, was provided by DelDOT for the intersection of South State Street and South Dover Elementary School. The crash data is summarized below.

During the three-year period, three crashes occurred within a 0.1-mile radius of the intersection of South State Street and South Dover Elementary School entrance. One crash occurred around the time of drop-off, and none around the time of pick-up. No crashes resulted in personal injury or fatality.

One crash occurred on Tuesday, January 11, 2022, at 8:41 a.m. The crash occurred under clear daylight and dry conditions. The crash was classified as Front to Rear with the primary contributing factor identified as following too close. A vehicle on southbound South State Street moved forward and then stopped at the study intersection light while attempting to turn left into the school and was rear ended by a vehicle following too close.

The second crash occurred on Friday, July 12, 2024, at 12:17 p.m. The crash occurred under cloudy and wet conditions. The crash was classified as Sideswipe, Same Direction with the primary contributing factor identified as improper passing. A vehicle was stopped on southbound South State Street at the light with their turn signal on, attempting to turn left into the school. Another vehicle attempted to pass this vehicle on the right when the collision occurred. This crash did not occur around drop-off or pick-up times.

Another crash occurred on Thursday, October 17, 2024, at 4:12 p.m. It occurred under clear daylight conditions. The crash was classified as Angle with the primary contributing factor identified as failed to yield right of way. A vehicle was traveling northbound on South State Street, north of the study intersection. While travelling northbound, another vehicle attempted to turn left onto South State Street southbound but failed to yield right of way and the two vehicles collided. Due to the location, crash details, and time of day, this crash does not need to be included when analyzing the functionality of the study intersection.

G. Surrounding Bicycle/Pedestrian Network

The South Dover Elementary School is located within a walkable area in south Dover, with no sidewalk gaps in the immediate area. South State Street has sidewalks on both sides of the street north and south of the school. Surrounding streets also have sidewalks. While the school is surrounded by a connected pedestrian network, very few students walk to school.

Bicycle Level of Traffic Stress (LTS) rates road segments on the amount of traffic stress imposed on bicyclists due to speed, volume, and separation of traffic. The LTS ranges from a level of one (1) with very low stress and suitable for all bicyclists, to four (4) with high stress and only suitable for very experienced bicyclists. South State Street, in front of the school and to the north, has an LTS of three. South of the school, beginning at Lotus Street, the bicycle LTS becomes a four. Surrounding neighborhood streets have LTS of one, which is conducive to cycling.

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III. Recommendations

The recommendations are presented in priority order. Recommendation A is a low-cost recommendation that, based upon traffic counts and field observations, should remove queuing from South State Street. If Recommendation A is implemented, and the school continues to see issues with queues extending to State Street, Recommendations B and/or C could be considered.

A. Snaked Queuing with Parking Lot Exit Lane

A snaked queuing configuration in the school parking lot, as shown in **Figure 13**, would provide more than 400 feet of additional queue length and likely eliminate queuing onto South State Street. The current parking lot queuing only utilizes the perimeter of the parking lot with one-way arrow markings. The snaked queuing would also utilize the two rows within the parking lot. The snaked configuration would require some of the existing arrow pavement markings to be removed and add new directional pavement arrows to be applied.

Creating an exit lane from the east side of the parking lot to the entrance drive, which is also shown in **Figure 13**, would reduce congestion at the current internal intersection. Under this scenario, the existing internal intersection would allow for entrance only to the parking lot. The new proposed exit lane would be extended from the drive aisle closest to the school building to connect with the entrance drive directly west of the bus parking area. This new exit would be stop-controlled with a stop sign and left-turn only sign at the exit. Dashed striping is proposed to guide drivers making the left turn in the correct path away from away from the bus loop.

The new parking lot exit would require the van drop-off and pick-up to be relocated. The three easternmost bus parking spaces, which are not currently used by buses, are proposed to be designated for vans. The parking spaces are proposed to be restriped to allow two vans per excess bus parking spot. This would also remove conflicts with the buses unloading students when leaving, as the vans were observed using westernmost bus parking space to exit the bus loop, rather than following the bus loop around to the exit.

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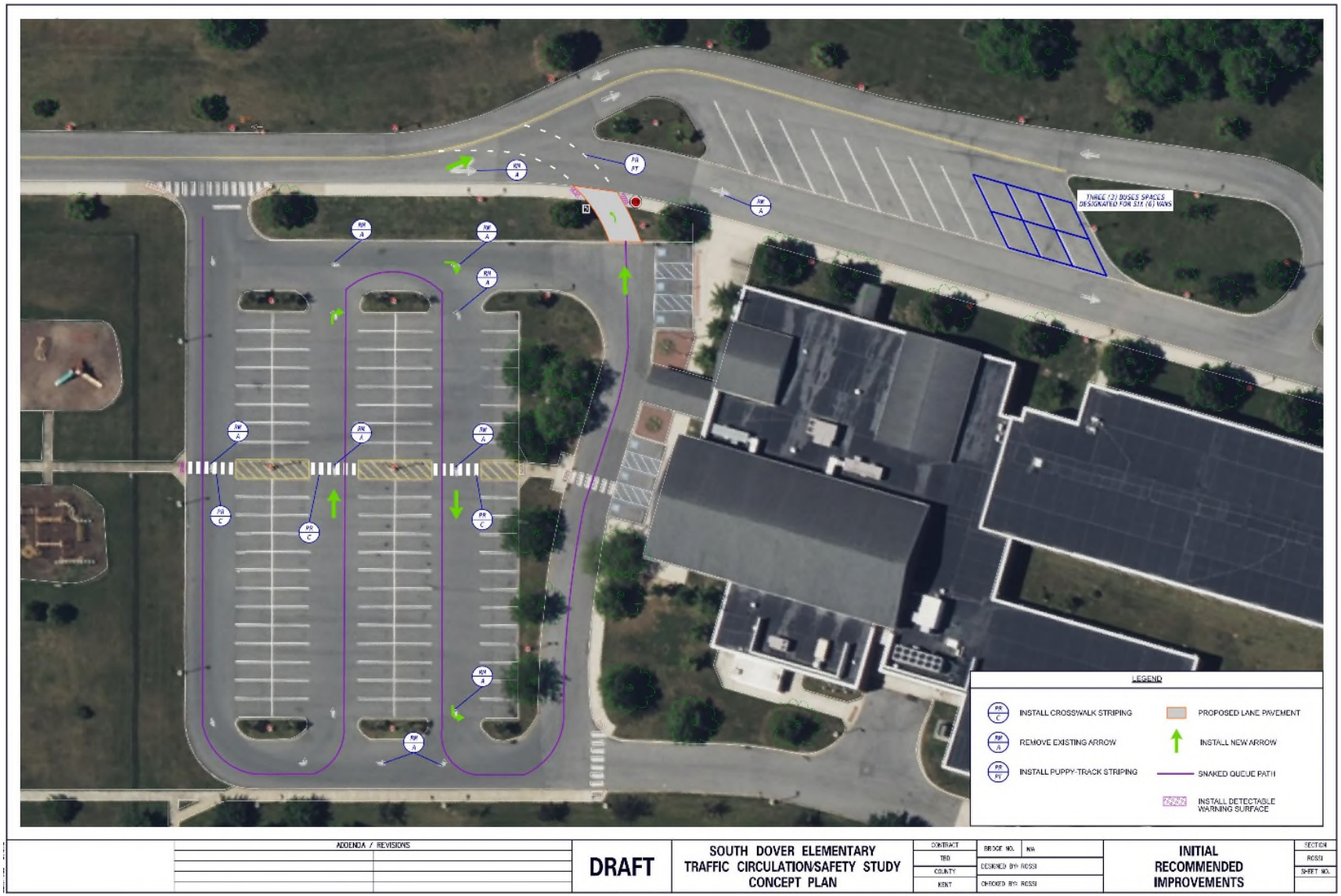

Figure 13: Recommendation A - Snaked Queuing with Parking Lot Exit Lane

B. Installation of Right-Turn Lane

If Recommendation A is implemented and queuing remains an issue on South State Street, the installation of a right-turn lane on the northbound approach of South State Street, as shown in **Figure 14**, is recommended to reduce lane confusion by separating the through traffic from those waiting to turn into the school. The queueing onto South State Street during school drop-off and pick-up periods blocks through traffic or causes vehicles to bypass the right-turn queue without a designated second lane and encroach over the centerline. The current northbound lane is 20 feet wide, which provides space for two 10-foot lanes. Due to the existing and proposed lane widths the centerline striping would not be impacted. The speed limit in the area is 25 mph and 20 mph when students are present in the school zone. Ten-foot lanes are appropriate with low speed limits located within city limits. The right-turn lane is proposed to be striped for 175-foot in length to provide capacity of seven vehicles with right-turn arrow markings.

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Figure 14: Recommendation B: Installation of Right-Turn Lane at South State Street Intersection

C. Extension of Westbound Right-Turn Lane

If congestion within the campus entrance drive continues to be an issue after implementation of Recommendation A, the westbound right-turn lane is proposed to be extended to the start of the bus loop, as shown in **Figure 15**, which would allow buses and vans to use this lane before coming into conflict with inbound traffic using the westbound left-turn lane. The westbound right-turn lane (exiting the school) has a current capacity of 218 feet and is proposed to be extended to 508 feet. Lane pavement is proposed to be added to extend to the 12-foot-wide right-turn lane with dashed striping proposed along its entire length. The proposed extension would require the relocation of three trees, four lights, a “School Buses Only” sign, and a junction well.

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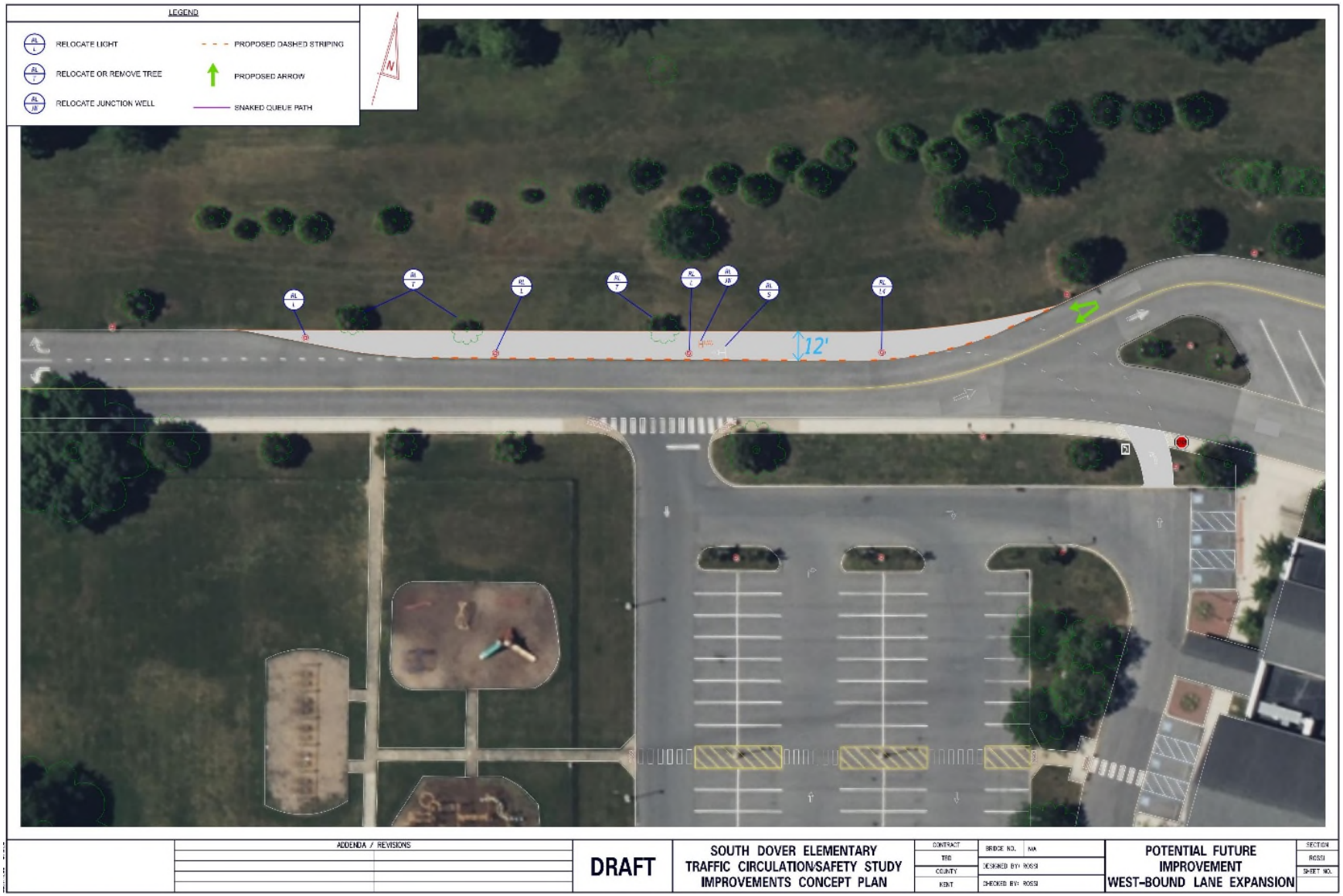

Figure 15: Recommendation C - Extension of Westbound Right-Turn Lane (pavement arrows are shown as existing or proposed assuming implementation of Recommendation A)

D. Other Recommendations

Additional recommendations could improve traffic function and safety for the school. These recommendations are in addition to the proposed improvements to the traffic circulation discussed previously.

Tree Removal

One tree on the corner of the South State Street and school entrance intersection (shown in **Figure 16**) is recommended to be removed to improve the line of sight. The tree is located in the grass buffer between the roadway and sidewalk, adjacent to the northbound stop bar at the school intersection, just in front of the ramp to the crosswalk on South State Street. For northbound vehicles, this tree is an obstruction to the line of sight of pedestrians waiting to cross South State Street. Removing and replanting a tree on site would improve the safety of the crossing at this intersection by improving the line of sight of pedestrians, which, due to the proximity to the elementary school, are likely to be small children. A new tree could be planted on the school grounds east of the existing tree.

Figure 16: Tree Recommended for Relocation on South State Street

Traffic Awareness for Students

Based on observation of students crossing South State Street, it is recommended that students be provided with education on pedestrian traffic signal operation. Education on how to safely cross the street and use a pedestrian push button could be provided to students to improve safety and awareness. Some students were observed not waiting for the pedestrian signal to actuate to cross the street at the South State Street intersection. DelDOT's Safe Routes to School Program and Pedestrian Section staff can provide assistance with this effort.

Crossing Supervision

The Manual on Uniform Traffic Control Devices (MUTCD) has standards on crossing guard uniform and operating procedures. The following guidance from the MUTCD should be followed for any staff directing traffic or assisting with street crossing:

- Law enforcement officers performing school crossing supervision and adult crossing guards shall wear high-visibility retroreflective safety apparel labeled as ANSI 107-2004 standard performance for Class 2.
- Adult crossing guards shall not direct traffic in the usual law enforcement regulatory sense. In the control of traffic, they shall pick opportune times to create a sufficient gap in the traffic flow. At these times, they shall stand in the roadway to indicate that pedestrians are about to use or are using the crosswalk, and that all vehicular traffic must stop.
- Adult crossing guards shall use a STOP paddle. The STOP paddle shall be the primary hand-signaling device.
- The STOP (R1-1) paddle shall be an octagonal shape. The background of the STOP face shall be red with at least 6-inch series upper-case white letters and border. The paddle shall be at least 18 inches in size and have the word message STOP on both sides. The paddle shall be retroreflectorized or illuminated when used during hours of darkness.

Signing and Marking Improvements

The MUTCD has standards on signing and marking required for school zones. Within proximity to Dover Elementary School there is existing school zone signing and marking along South State Street. However, some of these are not compliant with the current MUTCD. The signing and marking recommendations detail the improvements required to make the School Zone compliant with MUTCD standards. **Figures 17-20** are signing and marking recommendations provided by DelDOT.

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Figure 17: School Zone Marking Recommendations (1 of 2)

Figure 18: School Zone Marking Recommendations (2 of 2)

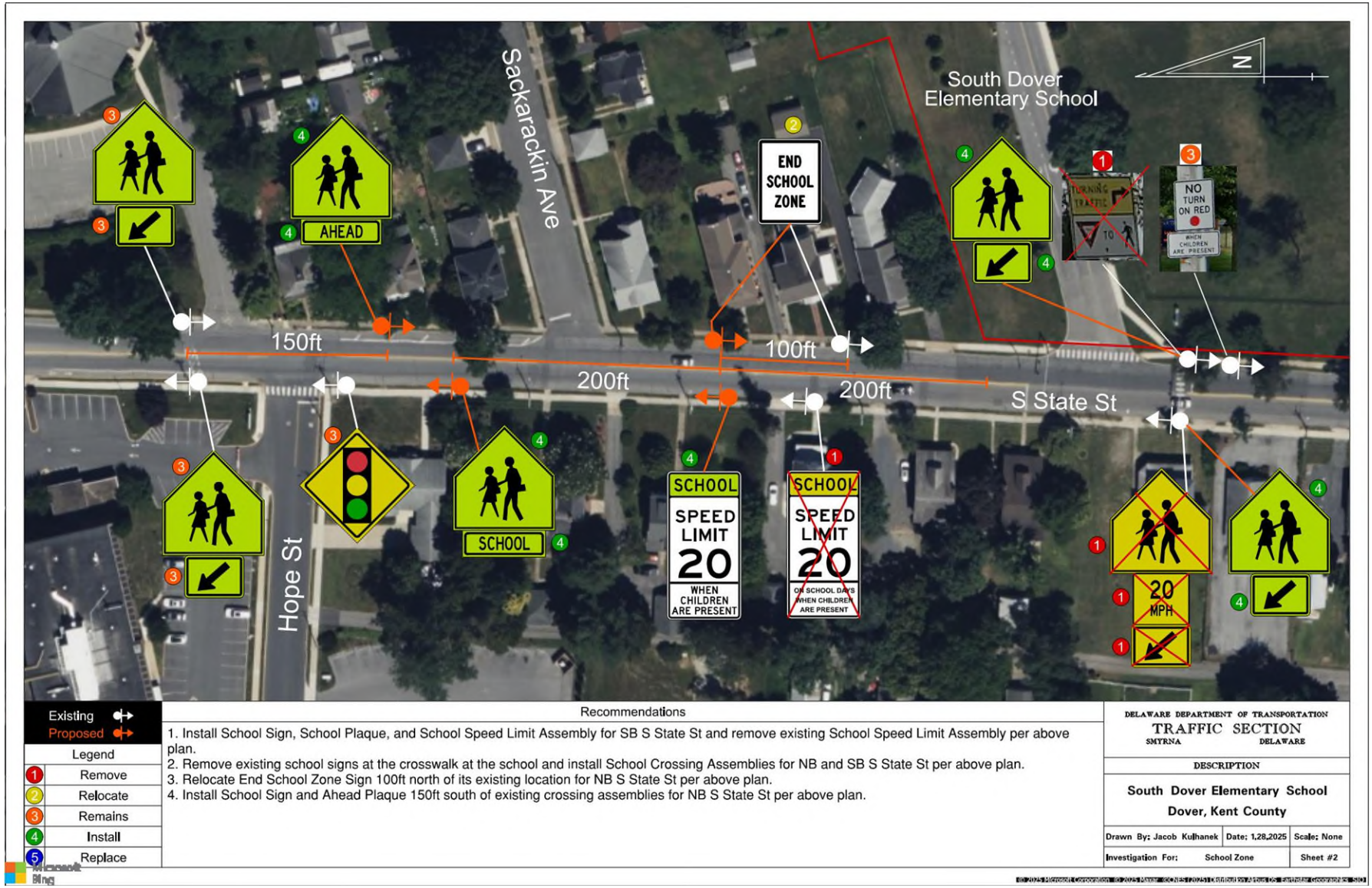

Figure 19: School Zone Signing Recommendations (1 of 2)

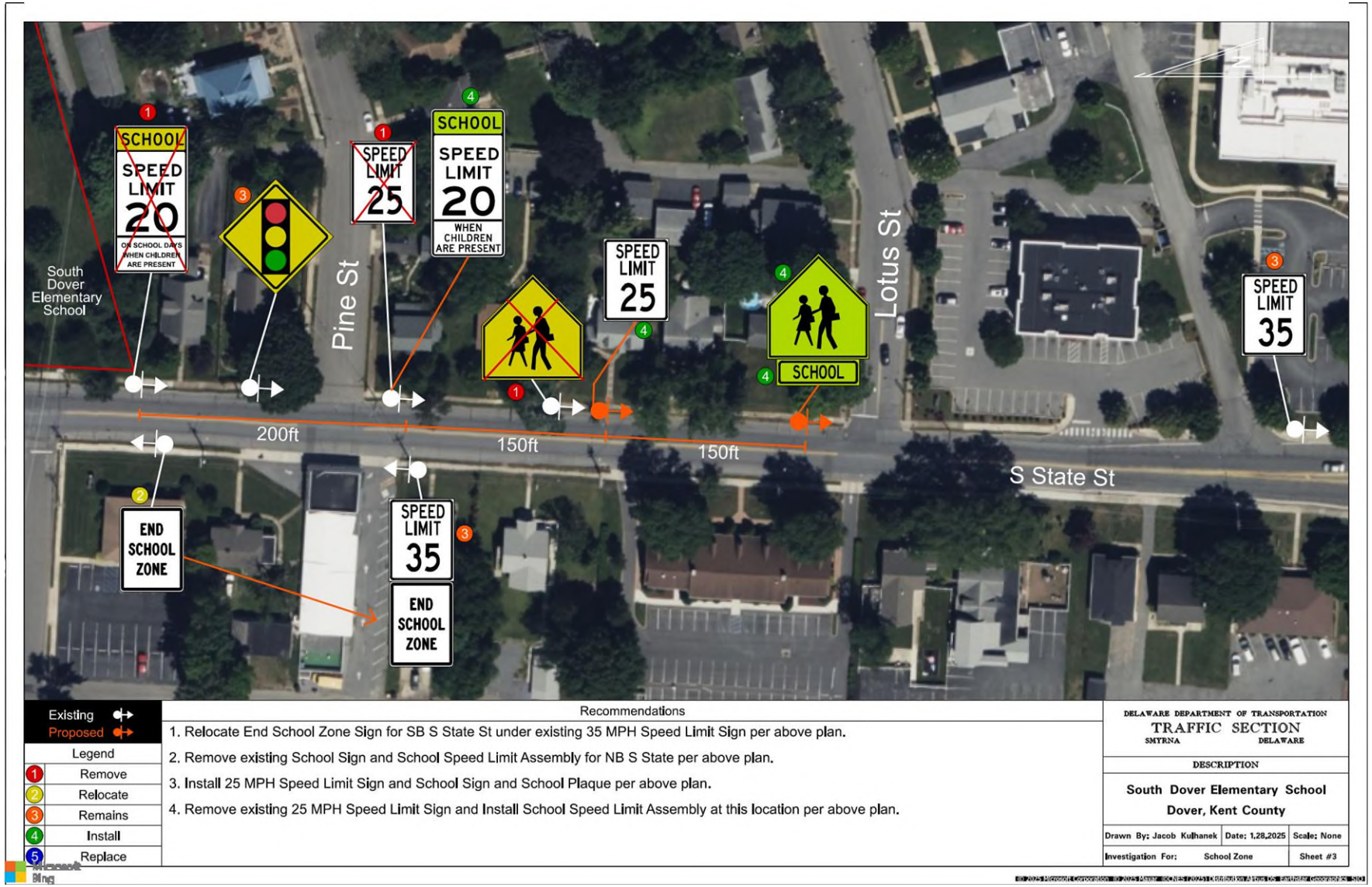

Figure 20: School Zone Signing Recommendations (2 of 2)

Relocation of "No Stopping, Standing, or Parking Begin" Sign

The existing "No Stopping, Standing, or Parking; Begin" sign, currently located on the west side of South State Street approximately at the center of the entrance to the school, allows vehicles to park too close to the intersection. Relocating this sign roughly 60 feet north to the current location of the existing "2 HR Parking" sign shown in **Figure 21** would be beneficial to traffic operations and safety at this intersection. The relocation of this sign would prevent vehicles from parking too close to the intersection, impeding southbound through traffic that could otherwise use the shoulder to go around vehicles turning left into the school. Restricting parking would also allow easier turning movements for the large buses entering and exiting the school.

Figure 21: Relocation of "No Stopping, Standing, or Parking Begin" Sign

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The following table is a compilation of the recommendations from the study with the responsible party and time frame for each recommendation identified.

Recommendation	**Responsible Party**	**Time Frame**
Implement Snaked Queuing with Parking Lot Exit Lane	Capital School District	Prior to 2025-2026 school year
Installation of Right-Turn Lane on South State Street	City of Dover, with approval from DelDOT	If the Snaked Queuing and Parking Lot Exit Lane do not address queuing, this will be considered in the future.
Extension of Westbound Right-Turn Lane Exiting School	Capital School District	If the Snaked Queuing and Parking Lot Exit Lane do not address queuing, this will be considered in the future.
Removal of Tree at the Southeast Corner of South State Street and School Entrance Drive	City of Dover	Prior to 2025-2026 school year
Planting of new replacement tree on school property	Capital School District	2025-2026 school year
Traffic Awareness for Students	Capital School District (with DelDOT support)	2025-2026 school year
Implementation of Crossing Supervision Standards	Capital School District	Immediate
Implementation of School Zone Signing and Marking Improvements	City of Dover, with approval from DelDOT	Prior to 2025-2026 school year
Relocation of “No Stopping, Standing, or Parking Begin” Sign	City of Dover	Prior to 2025-2026 school year