



MEMORANDUM

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Date: April 22, 2019
To: Mark Luszcz, P.E., PTOE, Chief Traffic Engineer, DeIDOT
From: B.J. Song, RK&K
Jim Burnett, RK&K
CC: Peter Haag, DeIDOT
Subject: **Cooke Elementary School – School Zone Speed Review**

Introduction / Background

During the 149th General Assembly of the Delaware State Senate, which was introduced and passed on April 25, 2017, a Special Committee was established to study and make recommendations regarding truck traffic and freight movements along SR 41, SR 48 and SR 7, in New Castle County. Specifically, the Special Committee was directed to study and make recommendations regarding:

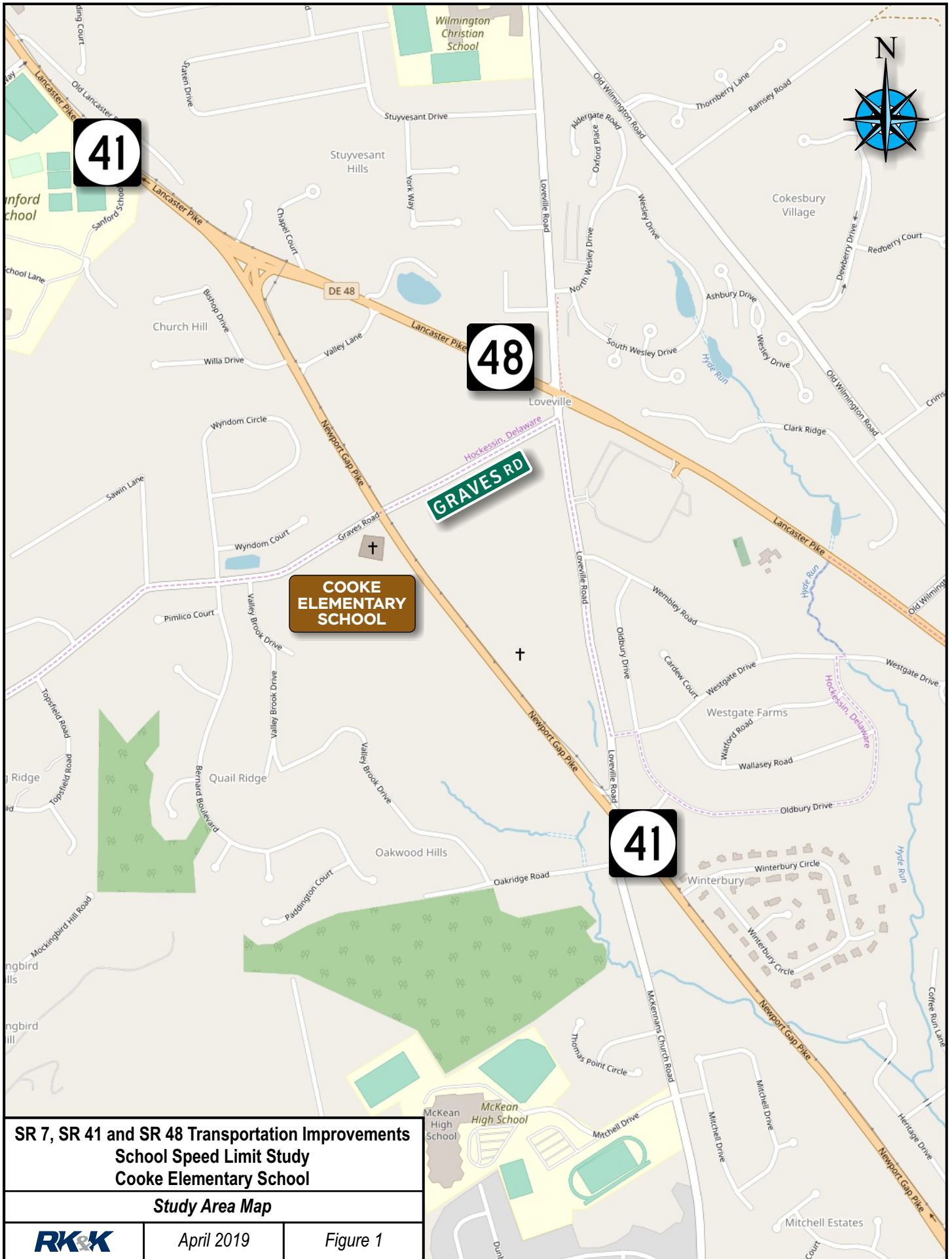
1. How to reduce the number of trucks traveling along these roadways; and
2. Any Improvements in engineering, infrastructure, education and enforcement that can improve the quality of life for those that live along these roadways.

The Special Committee completed the study on January 12, 2018 and submitted twenty-four (24) recommendations to the Delaware Department of Transportation (DeIDOT) and the Delaware General Assembly. Recommendation #7 from the committee was for DeIDOT to complete a traffic engineering study to determine the feasibility of implementing school speed limit zones on SR 41 and Graves Road, near the Cooke Elementary School. Accordingly, DeIDOT requested that RK&K complete the school speed limit study and make recommendations regarding potential changes to the existing speed limits in the vicinity of the school. This memo presents the results of the study.

Existing Conditions

The intersection of SR 41 and Graves Road is located southeast of the Town of Hockessin in New Castle County, Delaware (see **Figure 1**). The study segment of SR 41 (Newport Gap Pike, N021) is classified as a Principal Arterial, according to DeIDOT's [2016 Classifications Map for New Castle County](#). According to DeIDOT's [Traffic Summary 2017](#), the study segment of SR 41 has 2017 Annual Average Daily Traffic (AADT) volume of 13,740 vehicles per day (vpd). SR 41 is a two-way road consisting of a one-lane in each northbound and southbound direction. At the intersection with Graves Road, both the northbound and the southbound SR 41 approaches consist of a separate left-turn lane and a shared through / right-turn lane. SR 41 connects to SR 48 (Lancaster Pike, N237) to the north and to SR 2 (Kirkwood Highway, N011) to the south. The study segment of SR 41 has a posted speed limit of 45 MPH. There is a shoulder present adjacent to the travel lane on both northbound and southbound SR 41; however, the northbound shoulder tapers off to provide a separate left-turn lane at the Graves Road intersection. There are no bike lanes or sidewalk present along SR 41. There is a school bus-only access for the Cooke Elementary School on SR 41, approximately 950 feet south of the Graves Road intersection.

The study segment of Graves Road (N277) is classified as a Major Collector, according to DeIDOT's [2016 Classifications Map for New Castle County](#). According to DeIDOT's [Traffic Summary 2017](#), the study



**SR 7, SR 41 and SR 48 Transportation Improvements
School Speed Limit Study
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Study Area Map



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Figure 1

segment of Graves Road has 2017 Annual Average Daily Traffic (AADT) volume of 4,130 vpd west of SR 41 and 3,590 vpd east of SR 41. Graves Road connects to McKennans Church Road (N276) to the east and to Mill Creek Road (N282) to the west. At the SR 41 intersection, the eastbound Graves Road approach consists of a shared left-turn / through / right-turn lane and the westbound Graves Road approach consists of a shared left-turn / through lane and a separate right-turn lane. The study segment of Graves Road has a posted speed limit of 35 MPH. There is no shoulder or sidewalk present adjacent to the travel lanes on Graves Road; however, there is a bike lane and a sidewalk present adjacent to eastbound Graves Road, within the Cooke Elementary School property. The main access to the Cooke Elementary School is on Graves Road approximately 700 feet west of the SR 41 intersection.

The intersection of SR 41 and Graves Road is controlled by a traffic signal and the minor street (Graves Road) approaches are split phased. The left-turns from the SR 41 approaches operate with protected / permissive phasing. There is no marked pedestrian crosswalk or pedestrian signal present at the intersection of SR 41 and Graves Road.

Speed Study

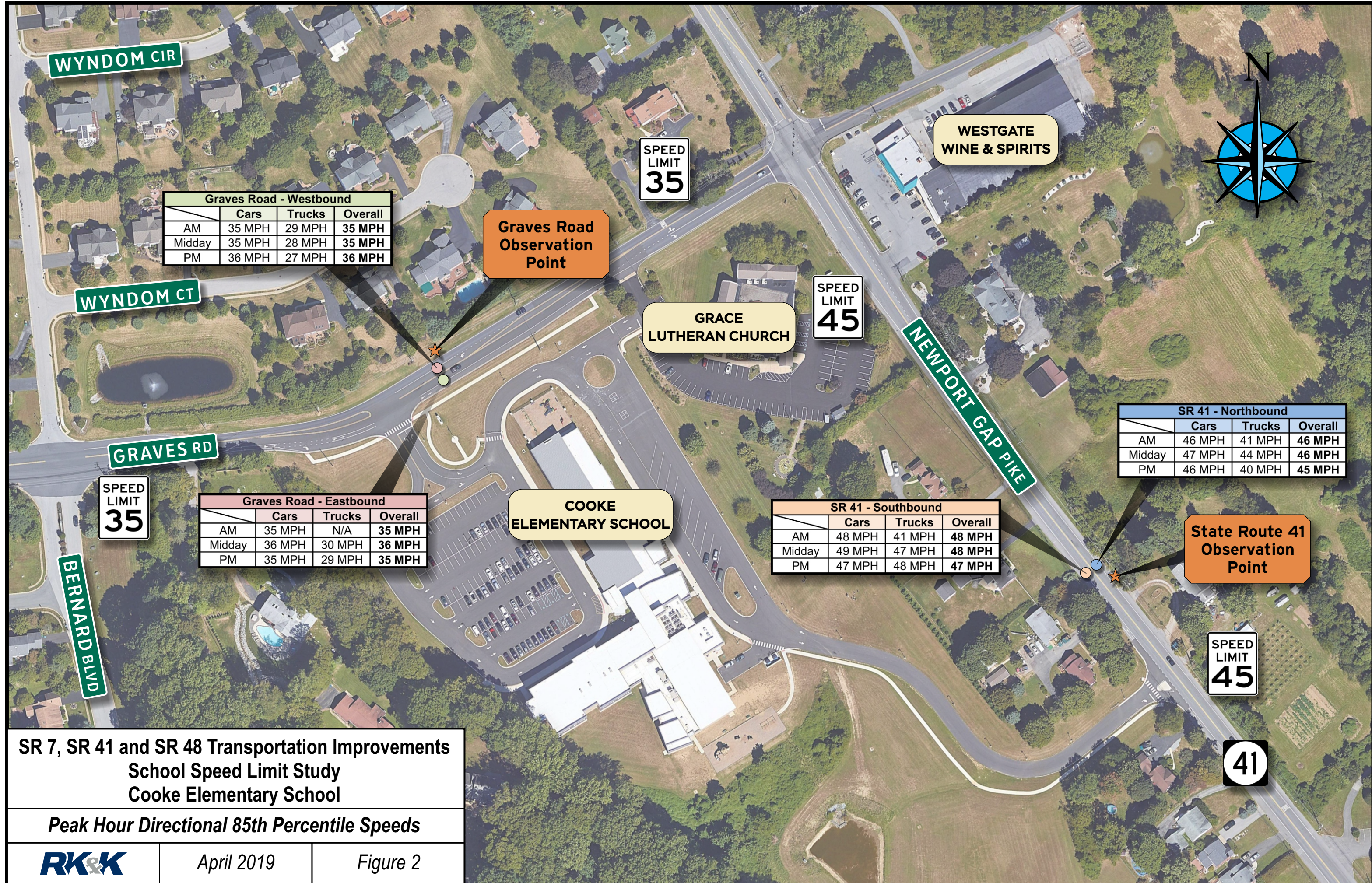
Many State jurisdictions, including the State of Delaware, set speed limits based primarily on the 85th percentile speed, with the posted speed limit set preferably within 5 MPH of the 85th percentile speed. The 85th percentile speed is the speed at which 85 percent of the vehicles recorded are traveling at or below. To determine the 85th percentile speeds for the study segment of SR 41 and Graves Road, RK&K completed spot speed studies at the following locations, which are also depicted in **Figure 2**:

- **Observation Point 1:** SR 41 approximately 700 feet south of Graves Road
- **Observation Point 2:** Graves Road approximately 600 feet west of SR 41

Since the purpose of this study was to determine the feasibility of implementing a school zone speed limit on SR 41 and Graves Road, spot speed studies were completed during the AM, Midday and PM peak periods, when school-related traffic is most likely expected. Vehicle speeds for each direction of travel were measured separately, and passenger vehicles and trucks were also recorded separately. **Table 1** shows the results collected from the Observation Point 1 (SR 41).

Table 1						
SR 41 Peak Hour Directional 85th Percentile Speeds (45 MPH Speed Limit)						
	Northbound SR 41			Southbound SR 41		
	Cars	Trucks	Combined	Cars	Trucks	Combined
AM Peak	46 MPH	41 MPH	46 MPH	48 MPH	41 MPH	48 MPH
Midday Peak	47 MPH	44 MPH	46 MPH	49 MPH	47 MPH	48 MPH
PM Peak	46 MPH	40 MPH	45 MPH	47 MPH	48 MPH	47 MPH

The results show that the 85th percentile speed for northbound SR 41 is approximately 1 MPH higher than the posted speed limit (45 MPH) during the AM and the Midday peak hours and equaled the posted speed limit during the PM peak hour. The results also showed that the 85th percentile speed for southbound SR 41 is approximately 3 MPH higher than the posted speed limit (45 MPH) during the AM and the Midday peak hours and 2 MPH higher during the PM peak hour. Based on the results from the radar study, it appears there is very good motorist compliance for the existing speed limit on SR 41 between McKennans Church Road and Graves Road.



Graves Road - Westbound			
	Cars	Trucks	Overall
AM	35 MPH	29 MPH	35 MPH
Middy	35 MPH	28 MPH	35 MPH
PM	36 MPH	27 MPH	36 MPH

**Graves Road
Observation
Point**

Graves Road - Eastbound			
	Cars	Trucks	Overall
AM	35 MPH	N/A	35 MPH
Middy	36 MPH	30 MPH	36 MPH
PM	35 MPH	29 MPH	35 MPH

**COOKE
ELEMENTARY SCHOOL**

SR 41 - Northbound			
	Cars	Trucks	Overall
AM	46 MPH	41 MPH	46 MPH
Middy	47 MPH	44 MPH	46 MPH
PM	46 MPH	40 MPH	45 MPH

**State Route 41
Observation
Point**

SR 41 - Southbound			
	Cars	Trucks	Overall
AM	48 MPH	41 MPH	48 MPH
Middy	49 MPH	47 MPH	48 MPH
PM	47 MPH	48 MPH	47 MPH

**SR 7, SR 41 and SR 48 Transportation Improvements
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Peak Hour Directional 85th Percentile Speeds



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Figure 2

Table 2 shows the results collected from the Observation Point 2 (Graves Road).

Table 2 Graves Road Peak Hour Directional 85th Percentile Speeds (35 MPH Speed Limit)						
	Eastbound Graves Road			Westbound Graves Road		
	Cars	Trucks	Combined	Cars	Trucks	Combined
AM Peak	35 MPH	N/A	35 MPH	35 MPH	29 MPH	35 MPH
Midday Peak	36 MPH	30 MPH	36 MPH	35 MPH	28 MPH	35 MPH
PM Peak	35 MPH	29 MPH	35 MPH	36 MPH	27 MPH	36 MPH

The results show that the 85th percentile speed for eastbound Graves Road equaled the existing speed limit (35 MPH) during the AM and the PM peak hours and was approximately 1 MPH higher during the Midday peak hour. Similarly, the results also show that the 85th percentile speed for westbound Graves Road equaled the existing speed limit (35 MPH) during the AM and the Midday peak hours and was approximately 1 MPH higher during the PM peak hour. Based on the results from the radar study, it appears there is also very good motorist compliance for the existing speed limit on the section of Graves Road near the Cooke Elementary School.

USLIMITS2 Analysis

In addition to the speed study, USLIMITS2 analyses were also completed for the section of SR 41 and Graves Road near the Cooke Elementary Schools to determine if the existing speed limits are appropriate. USLIMITS2 is a web-based tool designed by FHWA to help practitioners set reasonable, safe and consistent speed limits for specific segments of roads. USLIMITS2 is applicable to all types of roads ranging from rural local roads and residential streets to urban freeways; however, it is not directly applicable to school zones or construction zones.

USLIMITS2 uses input parameters such as roadway segment length, existing speed limit, roadway alignment and type, crash data, number of lanes, number of traffic signals and number of access points to calculate a recommended speed limit for the roadway segment being studied. Table 3 shows speed limits recommended from the USLIMIT2 analyses.

Table 3: USLIMITS2 Recommended Speed Limits For SR 41 and Graves Road Near Cooke Elementary School		
	Existing Speed Limit	USLIMIT2 Recommendation
SR 41	45 MPH	50 MPH*
Graves Road	35 MPH	30 MPH*

* USLIMITS2 analyses did not include crash data

Results from the USLIMITS2 analyses indicate that a speed limit of 50 MPH is recommended for the section of SR 41 between McKennans Church Road and Graves Road. This represents a 5 MPH *increase* of the existing speed limit of 45 MPH. The results also indicate that a speed limit of 30 MPH is recommended for the section of Graves Road between SR 41 and Wyndom Circle / Bernard Boulevard. This represents a 5 MPH *decrease* of the existing speed limit of 35 MPH.

It should be noted that USLIMITS2 analyses can incorporate crash data for the overall roadway segment as one of the input parameters. However, the only crash data available (see next page) was from the intersection of SR 41 and Graves Road and the school access intersection (e.g., not for the overall roadway corridor), crash data was not included in the USLIMITS2 analyses. Additionally, as noted previously, USLIMITS2 is not directly applicable to school zones.

Crash Analyses

Crash data covering the period between November 2015 and October 2018 was obtained from DeIDOT's Safety Section for the following intersections (0.05 Mile radius):

- SR 41 at Graves Road
- SR 41 at School Bus Access (Approximately 900 feet south of Grave Road)
- Graves Road at School Access (Approximately 700 feet west of Grave Road)

Table 4 summarizes the findings from the crash analysis for the intersection of SR 41 and Graves Road.

Table 4: Crash Data for Intersection of SR 41 / Graves Road (November 2015 - October 2018)									
	Date	Day	Time	Weather	Lighting	Surface	Crash Type	Severity	Contributing Causes
1	11/13/2015	Friday	5:24 PM	Clear	Dark/Lit	Dry	Sideswipe	PDO	Unknown
2	11/19/2015	Thursday	3:39 PM	Rain	Dusk	Wet	Angle	Injury	Disregarded Traffic Signal
3	11/26/2015	Thursday	8:40 PM	Clear	Dark/Lit	Dry	Rear-end	Injury	Careless driving
4	12/14/2015	Monday	7:45 AM	Fog	Daylight	Dry	Deer	PDO	Animal in Roadway
5	1/12/2016	Tuesday	2:59 PM	Clear	Daylight	Dry	Angle	Injury	Disregarded Traffic Signal
6	2/15/2016	Monday	2:18 PM	Snow	Daylight	Ice/Frost	Sideswipe	PDO	Ice on roadway
7	4/14/2016	Thursday	4:07 PM	Clear	Daylight	Dry	Rear-emd	PDO	Following too close
8	7/9/2016	Saturday	4:43 PM	Rain	Daylight	Wet	Angle	Injury	Disregarded Traffic Signal
9	7/21/2016	Thursday	4:45 PM	Clear	Daylight	Dry	Angle	PDO	Disregarded Traffic Signal
10	8/8/2016	Monday	1:43 PM	Clear	Daylight	Dry	Angle	Injury	Disregarded Traffic Signal
11	9/19/2016	Monday	3:58 PM	Cloudy	Daylight	Wet	Rear-end	Injury	Inattentive driving
12	10/14/2016	Friday	5:07 PM	Clear	Daylight	Dry	Angle ¹	PDO	Failed to remain stopped
13	11/8/2016	Tuesday	7:30 AM	Clear	Daylight	Dry	Rear-end	PDO	Careless driving
14	4/2/2017	Sunday	4:10 PM	Clear	Daylight	Dry	Rear-end	PDO	Inattentive driving
15	6/26/2017	Monday	10:53 AM	Clear	Daylight	Dry	Rear-end	PDO	Following too close
16	7/3/2017	Monday	6:49 PM	Clear	Daylight	Dry	Angle	PDO	Disregarded Traffic Signal
17	10/12/2017	Thursday	7:45 AM	Rain	Daylight	Wet	Angle ¹	PDO	Failed to remain stopped
18	10/21/2017	Saturday	2:27 PM	Clear	Daylight	Dry	Rear-end	Injury	Inattentive driving
19	10/26/2017	Thursday	6:30 AM	Clear	Dark/Lit	Dry	Deer	PDO	Animal in Roadway
20	11/10/2017	Friday	8:22 PM	Clear	Dark/Lit	Dry	Angle	PDO	Disregard Traffic Signal
21	12/4/2017	Monday	7:24 AM	Clear	Daylight	Dry	Angle	PDO	Disregard Traffic Signal
22	12/7/2017	Thursday	12:00 AM	Clear	Daylight	Dry	Rear-end	PDO	Inattentive driving
23	2/2/2018	Friday	4:48 PM	Cloudy	Dark/Lit	Dry	Rear-end	PDO	Careless driving
24	4/2/2018	Monday	5:58 PM	Cloudy	Daylight	Dry	Rear-end	PDO	Inattentive driving
25	7/15/2018	Sunday	3:21 PM	Clear	Daylight	Dry	Rear-end	PDO	Careless driving
26	8/25/2018	Saturday	2:20 PM	Clear	Daylight	Dry	Angle ¹	PDO	Failed to remain stopped
27	9/19/2018	Wednesday	12:12 PM	Clear	Daylight	Dry	Angle	Injury	Disregarded Traffic Signal

PDO: Property Damage Only
1: Angle crashes reported at the intersection of SR 41 and Westgate Shopping Center

The following trends were observed from the crash data for the intersection of SR 41 and Graves Road:

- There were total of twenty-seven (27) crashes, which included eight (8) personal injury crashes and nineteen (19) property-damage-only crashes.
- Nine (9) angle crashes were reported at the intersection of SR 41 and Graves Road. It should be noted that eight (8) of the nine reported crashes were attributable to motorists disregarding the traffic signal from the southbound SR 41 approach. There were also three (3) angle crashes involving vehicles from the Westgate Shopping Center Access, which is located south of Graves Road.

- There were eleven (11) reported rear-end crashes. Nine (9) of the eleven reported crashes involved vehicles approaching the intersection from the southbound SR 41 approach and were attributable to motorists driving in an inattentive manner or following too closely.
- There were two (2) opposite-direction sideswipe crashes reported. One crash was attributable to ice on roadway and the cause for the other crash was unknown.
- There were two (2) crashes involving a vehicle and a deer.

Table 5 summarizes the findings from the crash analysis for the intersection of SR 41 and the School Bus Access.

Table 5: Crash Data for Intersection of SR 41 / School Bus Access (November 2015 - October 2018)										
	Date	Day	Time	Weather	Lighting	Surface	Crash Type	Severity	Contributing Causes	
1	12/6/2015	Sunday	5:29 PM	Clear	Dark/Unlit	Dry	Angle	PDO	Inattentive Driving	
2	7/23/2017	Sunday	10:27 PM	Cloudy	Dark/Unlit	Wet	Front to rear	PDO	Unknown	
3	11/25/2017	Saturday	10:12 AM	Clear	Daylight	Dry	HFO / ROR	PDO	Inattentive Driving	
4	5/7/2018	Monday	1:53 PM	Clear	Daylight	Dry	Other	PDO	Animal in Roadway	

PDO: Property Damage Only
HFO: Hit-Fixed-Object Crash
ROR: Runoff-the-Road Crash

The following trends were observed from the crash data for the intersection of SR 41 and Graves Road:

- There were total of four (4) crashes, which resulted in property-damage-only.
- None of the four (4) crashes appear to have involved school related traffic. Two (2) crashes occurred on a Sunday and one (1) crash occurred on a Saturday. The remaining crash involved a motor vehicle and a deer on the roadway.

Table 6 summarizes the findings from the crash analysis for the intersection of Graves Road and the main School Access.

Table 6: Crash Data for Intersection of Graves Road / School Access (November 2015 - October 2018)										
	Date	Day	Time	Weather	Lighting	Surface	Crash Type	Severity	Contributing Causes	
1	3/9/2018	Friday	8:50 AM	Clear	Daylight	Dry	Angle	Injury	Failed to remain stopped	

The following trends were observed from the crash data for the intersection of Graves Road and the main School Access:

- There was total of one (1) angle crash reported, which resulted in personal injury. The crash was attributable to a motorist failing to remain stopped from the main school access and coincided with the school's starting time.

Observations of Traffic Operations and Pedestrian Activities

Field observations were completed along the section of SR 41 and Graves Road in the vicinity of the Cooke Elementary School on Thursday, April 19, Monday, April 23 and Wednesday, October 3 in 2018. The following trends were observed while the school was in session:

- No students walking to / from the school were observed from 8:00 AM to 9:30 AM and 2:30 PM and 4:00 PM. The school confirmed that there are no 'walkers' to the school.
- Although there is a 'Buses Only' regulatory sign posted for the School Bus Access connection to SR 41, many other vehicles were observed using the school bus access. In particular, a few automobiles were observed making a left-turn from northbound SR 41 into the outbound right-turn lane to enter the school.

- The School Bus-Only access on SR 41 is designed to accommodate both left-turns and right-turns into the school from SR 41, but only right turns out of the school onto southbound SR 41; however, a few automobiles were observed making a left-turn from the School Bus Access on to northbound SR 41 (see Picture 1).



Picture 1: A Vehicle Making a Left-turn from the School Bus Only Access to Northbound SR 41

- All of the school buses exiting the school via the School Bus Only Access made right-turns onto southbound SR 41 (see Picture 2).



Picture 2: School Buses Turning Right from the School Bus-Only Access to Southbound SR 41

- Many school buses were observed making a left-turn into the school from northbound SR 41 via the School Bus-Only Access. School buses were frequently observed swinging wide to the right (e.g., encroaching onto the shoulder) before making the left-turn due to the tight turning radius (see Picture3). This maneuver frequently obstructed other northbound vehicles until the school bus completed the turn.



Picture 3: School Buses Making Wide Left-turns from Northbound SR 41, Obstructing Other Northbound Vehicles

Summary/Recommendations

Results from the speed study indicate that motorists – driving both cars and trucks - are currently doing a very good of complying with the existing posted speed limits on both Graves Road and on Newport Gap Pike (SR 41). In addition, there was only one (1) school related crash reported at the intersection of Graves Road and school's main access and no school related crashes were reported at the intersection of SR 41 and the School Bus Access. Furthermore, based on field observations and coordination with the Cooke Elementary School, it appears there are no students walking to or from the school.

However, results from the USLIMITS2 analyses suggested that a 5 MPH *increase* in the posted speed limit (45 MPH) on SR 41 near the Cooke Elementary School is appropriate, resulting in a 50 MPH posted speed limit. Due to the presence of the school, combined with the operation of the School Bus Access, where School Buses occasionally stop all northbound traffic to make left turns into the school, an increase in the posted speed limit on SR 41 is not recommended.

The USLIMITS2 analyses also suggested that a 5 MPH *decrease* in the posted speed limit (35 MPH) on Graves Road near the Cooke Elementary School is appropriate, resulting in a 30 MPH posted speed limit. Based on these findings, combined with the crash history that showed an injury collision involving a vehicle leaving the school, and considering the proximity of an outdoor school playground located between the school and Graves Road, a school zone speed limit of 20 MPH is recommended along Graves Road at / near the Cooke Elementary School.