



STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
800 BAY ROAD
P.O. Box 778
DOVER, DELAWARE 19903

September 19, 2013

SHAILEN P. BHATT
SECRETARY

Mr. Carl Wilson
The Traffic Group, Inc.
9900 Franklin Square Drive
Suite H
Baltimore, MD 21236

Dear Mr. Wilson:

The enclosed Traffic Impact Study (TIS) review letter for the **Graves Road Elementary School** has been completed under the responsible charge of a registered professional engineer whose firm is authorized to work in the State of Delaware. They have found the TIS to conform to DelDOT's Standards and Regulations for Subdivision Streets and State Highway Access and other accepted practices and procedures for such studies. DelDOT accepts this review letter and concurs with the recommendations.

Please note that this review letter does not replace the previous review letter issued on July 23, 2013. (partial copy enclosed) The results of the review in that letter adhered to language that was contained in Section 124 of Senate Bill 145, which directed both the Department and the government of New Castle County to use the new method of developing the study area contained in the Department's Spring 2013 update to Chapter 2 of the Standards and Regulations for Subdivision Streets and State Highway Access.

New Castle County did not adhere to that directive; rather, they maintain that, under the New Castle County Unified Development Code (UDC), all signalized intersections within the area of study must achieve an acceptable level of service under future conditions. This review letter has been completed in that regard.

Should the County decide to adhere to the above-mentioned directive, this letter should be disregarded, and the July 23, 2013 letter should apply.



Mr. Carl Wilson
September 19, 2013
Page 2 of 2

If you have any questions concerning these letters, please contact me at (302) 760-2167.

Sincerely,



Troy Brestel
Project Engineer

TEB:km

Enclosures

cc with enclosures: Mr. Mark Parker, Becker Morgan Group, Inc.
Ms. Constance C. Holland, Office of State Planning Coordination
Mr. James Smith, Jr., New Castle County Department of Land Use
Mr. Andrew Parker, McCormick Taylor, Inc.
DelDOT Distribution

DelDOT Distribution

John Janowski, New Castle County Department of Land Use
Owen Robatino, New Castle County Department of Land Use
Frederick H. Schranck, Deputy Attorney General
Natalie Barnhart, Director, Transportation Solutions (DOTS)
Drew Boyce, Director, Planning
Mark Luszczyk, Chief Traffic Engineer, Traffic, DOTS
Mark Tudor, Assistant Director, Project Development North, DOTS
J. Marc Coté, Assistant Director, Development Coordination
T. William Brockenbrough, Jr., County Coordinator, Development Coordination
Thomas E. Meyer, Traffic Studies Manager, Traffic, DOTS
Donald Weber, North District Engineer, North District
Kevin Canning, Canal District Public Works Engineer, Canal District
Wayne Henderson, Service Development Planner, Delaware Transit Corporation
John Garcia, New Castle Subdivision Coordinator, Development Coordination
Joshua Schwartz, Subdivision Manager, Development Coordination
Ahmed Abdelmoteleb, New Castle Traffic Engineer, Traffic, DOTS
Marco Boyce, Planning Supervisor, Statewide & Regional Planning
Claudy Joinville, Project Engineer, Development Coordination



September 19, 2013

Mr. Troy E. Brestel
Project Engineer
DelDOT Division of Planning
P.O. Box 778
Dover, DE 19903

RE: Agreement No. 1529
Traffic Impact Study Services
Task No. 19A Subtask 5A – Graves Road Elementary School (Revised)

Dear Mr. Brestel,

McCormick Taylor has completed its review of the Revised Traffic Impact Study (TIS) for the Graves Road Elementary School prepared by The Traffic Group, Inc. (TTG), dated September 9, 2013. This review was assigned as Task Number 19A (Subtask 5A). This TIS is a revised version of the original TIS dated April 18, 2013, which we reviewed as Task Number 16A. The revisions reflect new information regarding the proposed school's hours of operation, which led to a shift in the morning peak hour for analysis *from* the local peak hour at each intersection *to* a system-wide morning peak hour of 8:00 AM to 9:00 AM. TTG prepared the report in a manner generally consistent with DelDOT's *Standards and Regulations for Subdivision Streets and State Highway Access*.

The TIS evaluates the impacts of Graves Road Elementary School, proposed to be located on the south side of Graves Road (New Castle Road 277) and on the west side of Delaware Route 41 (Newport Gap Pike / New Castle Road 21), within New Castle County, Delaware. The proposed elementary school would serve 600 students. The school is to be developed on approximately 17 acres of land. Two access points are proposed: one full access point along Graves Road (intended for cars only) and one rights-in/rights-out/lefts-in access point along Delaware Route 41 (intended for buses only). Construction is anticipated to be complete by 2015.

The land is currently zoned as S (Suburban) within New Castle County, and the developer does not propose to change the zoning.

DelDOT currently has one relevant project in the study area. It is the Corridor Capacity Preservation Program (CCPP), which is a statewide program intended to sustain the capacity of adopted highway corridors by various means such as limiting access points and using service roads for local vehicle trips. The general purpose of the program is to ensure that existing principal arterial roadways, including Delaware Route 48 (Lancaster Pike / New Castle Road 237) between Hercules Road (New Castle Road 282) and Delaware Route 41, are able to efficiently carry regional traffic without impedance from the effects of local development.

Based on our review, we have the following comments and recommendations:

The proposed development will not meet the New Castle County Level of Service (LOS) Standards as stated in Section 40.11.210 of the Unified Development Code (UDC) unless physical roadway and/or traffic control improvements are implemented at the following intersection:

<i>Intersection</i>	<i>Existing Traffic Control</i>	<i>Situations for which deficiencies occur</i>
Delaware Route 48 and Loveville Road (New Castle Road 276)	Signalized	2015 AM without and with Graves Road Elementary School

All other intersections included in the scope of this TIS meet the LOS concurrency requirements of Section 40.11.210 of the New Castle County UDC. Additionally, all of the remaining intersections meet DeIDOT's LOS criteria.

Should the County choose to approve the proposed development, the following items should be incorporated into the site design and reflected on the record plan by note or illustration. All applicable agreements (i.e. letter agreements for off-site improvements and traffic signal agreements) should be executed prior to entrance plan approval for the proposed development.

1. The developer should construct the site entrance on Delaware Route 41. The proposed configuration is shown in the table below.

Approach	Current Configuration	Proposed Configuration
Northbound Delaware Route 41	One through lane	One shared through/left-turn lane
Southbound Delaware Route 41	One through lane	One shared through/right-turn lane
Eastbound Site Entrance	Approach does not exist	One right-turn-only lane

At the site entrance on Delaware Route 41, the developer should add a concrete channelization island on the site driveway to separate entering and exiting traffic. The island should be designed to limit exiting traffic to right turns only. Eastbound lefts out would be prohibited. Besides eastbound rights out, other allowed movements at this intersection would be northbound lefts in and southbound rights in. The developer should coordinate with DeIDOT's Subdivision Section to determine an acceptable design of the channelization island.

School Zone Speed Reduction signs, along with signs indicating that this entrance is for bus traffic only, should be posted on the Delaware Route 41 approaches. The entrance driveway should be gated, with access controlled by school officials.

2. The developer should construct the site entrance on Graves Road. The proposed configuration is shown in the table below.

Approach	Current Configuration	Proposed Configuration
Northbound Site Entrance	Approach does not exist	One left-turn lane and one right-turn lane
Eastbound Graves Road	One through lane	One through lane and one right-turn lane
Westbound Graves Road	One through lane	One left-turn lane and one through lane

Initial recommended minimum turn-lane lengths (excluding tapers) of the separate turn lanes are listed below. The developer should coordinate with DelDOT's Subdivision Section to determine final turn-lane lengths.

Approach	Left-Turn Lane	Right-Turn Lane
Northbound Site Entrance	50 feet*	50 Feet*
Eastbound Graves Road	N/A	100 feet**
Westbound Graves Road	120 feet**	N/A

* turn-lane length based on storage length per queuing analysis, with 50-foot minimum

** turn-lane length based on deceleration + storage length per DelDOT's *Standards and Regulations for Subdivision Streets and State Highway Access*

3. The developer should enter into a traffic signal agreement with DelDOT for the intersection of Graves Road and the site entrance. The agreement should include pedestrian signals, crosswalks and interconnection at DelDOT's discretion, and the developer will be required to perform a signal warrant analysis.

4. The developer should improve the intersection of Delaware Route 48 and Loveville Road. The proposed configuration is shown in the table below.

Approach	Current Configuration	Proposed Configuration
Northbound Loveville Road	One left-turn lane and one shared through/right-turn lane	One left-turn lane, one through lane and one right-turn lane
Southbound Loveville Road	One left-turn lane and one shared through/right-turn lane	One left-turn lane and one shared through/right-turn lane
Eastbound Delaware Route 48	One left-turn lane and one shared through/right-turn lane	One left-turn lane and one shared through/right-turn lane
Westbound Delaware Route 48	One left-turn lane, one through lane and one right-turn lane	One left-turn lane, one through lane and one right-turn lane

Due to potential impacts and limitations of the proposed improvements, the developer should coordinate with DelDOT's Subdivision Section to determine an acceptable design for the improvements at this intersection.

5. The developer should enter into a traffic signal agreement with DelDOT for the intersection of Delaware Route 48 and Loveville Road. The agreement will cover potential future improvements as noted in Item No. 5. The agreement should include pedestrian signals, crosswalks and interconnection at DelDOT's discretion. One or more other developers may enter into a traffic signal agreement for this intersection as well. The developer should coordinate with DelDOT on the implementation and equitable cost sharing of the traffic signal.
6. The following bicycle and pedestrian improvements should be included:
- a. A right-turn yield to bikes sign (MUTCD R4-4) should be added at the start of the right-turn lane added to eastbound Graves Road at the site entrance.
 - b. Adjacent to the right-turn lane added to Graves Road at the site entrance, a minimum of a five-foot bicycle lane should be dedicated and striped with appropriate markings for bicyclists through the turn lane in order to facilitate safe and unimpeded bicycle travel.
 - c. Appropriate bicycle symbols, directional arrows, striping (including stop bars), and signing should be included along bicycle facilities and right-turn lanes within the project limits.
 - d. Utility covers should be made flush with the pavement
 - e. Bike parking should be provided near the school building entrance.
 - f. A minimum of a five-foot wide sidewalk (with a minimum of a three-foot buffer from the roadway) that meets current AASHTO and ADA standards should be constructed along the Graves Road site frontage and along the Delaware Route 41 site frontage.
 - g. ADA compliant curb ramps and crosswalks should be provided at all pedestrian crossings, including all site entrances. Type 3 curb ramps are discouraged.

- h. Internal sidewalks for pedestrian safety and to promote walking as a viable transportation alternative should be constructed within the property. These sidewalks should each be a minimum of five feet wide and should meet current AASHTO and ADA standards. These internal sidewalks should connect the school building entrances to the frontage sidewalks on Graves Road and Delaware Route 41.

Improvements in this TIS may be considered “significant” under DeIDOT’s *Work Zone Safety and Mobility Procedures and Guidelines*. These guidelines are available on DeIDOT’s website at http://www.deldot.gov/information/pubs_forms/manuals/de_mutcd/index.shtml. For any additional information regarding the work zone impact and mitigation procedures during construction please contact Mr. Adam Weiser of DeIDOT’s Traffic Section. Mr. Weiser can be reached at (302) 659-4073 or by email at Adam.Weiser@state.de.us.

Please note that this review generally focuses on capacity and level of service issues; additional safety and operational issues will be further addressed through DeIDOT’s subdivision review process.

Additional details on our review of this TIS are attached. Please contact me at (302) 738-0203 or through e-mail at ajparker@mtmail.biz if you have any questions concerning this review.

Sincerely,

McCormick Taylor, Inc.



Andrew J. Parker, P.E., PTOE
Project Manager

Enclosure

General Information

Report date: September 9, 2013

Prepared by: The Traffic Group, Inc. (TTG)

Prepared for: Red Clay Consolidated School District

Tax parcel: 08-019.00-067

Generally consistent with DelDOT's *Standards and Regulations for Subdivision Streets and State Highway Access*: Yes

Project Description and Background

Description: The proposed elementary school would serve 600 students.

Location: Graves Road Elementary School is proposed to be located on the south side of Graves Road (New Castle Road 277) and on the west side of Delaware Route 41 (Newport Gap Pike / New Castle Road 21), within New Castle County, Delaware. A site location map is included on Page 8.

Amount of land to be developed: approximately 17.1 acres of land

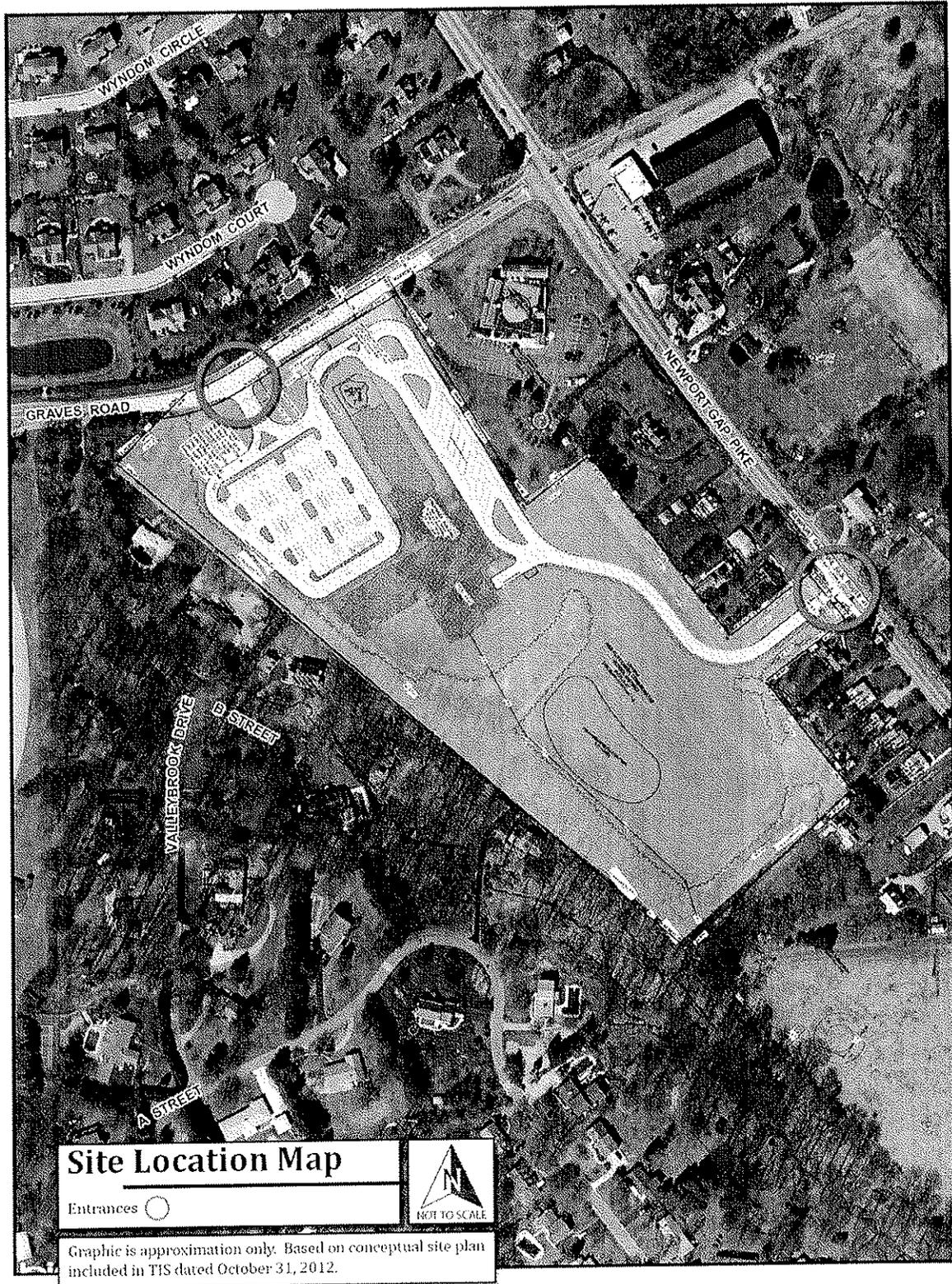
Land use approval(s) needed: Subdivision approval. The land is currently zoned as S (Suburban) within New Castle County, and will be developed under that zoning.

Proposed completion date: 2015

Proposed access locations: Two access points are proposed: one full-movement access point along Graves Road (intended for cars only) and one rights-in/rights-out/lefts-in access point along Delaware Route 41 (intended for buses only).

Daily Traffic Volumes (per DelDOT Traffic Summary 2012):

- 2012 Average Annual Daily Traffic on Graves Road: 4,910 vpd
- 2012 Average Annual Daily Traffic on Delaware Route 41: 13,171 vpd



Delaware Strategies for State Policies and Spending – 2010 Update

Location with respect to the Strategies for State Policies and Spending Map of Delaware:

The proposed Graves Road Elementary School is located within Investment Level 1 and Level 2 areas.

Investment Level 1

Investment Level 1 Areas are areas of the state that are most prepared for growth and where the state can make cost-effective infrastructure investments for schools, roads, and public safety. In these areas, state investments and policies should support and encourage a wide range of uses and densities, promote other transportation options, foster efficient use of existing public and private investments, and enhance community identity and integrity. Investment Level 1 Areas are often municipalities, towns, or urban/urbanizing places in counties. Density is generally higher than in the surrounding areas. Overall, it is the state's intent to use its spending and management tools to maintain and enhance community character, to promote well-designed and efficient new growth, and to facilitate redevelopment in Investment Level 1 Areas.

Investment Level 2

Investment Level 2 Areas, like Investment Level 1 Areas, are areas prepared for growth and where the state can make cost-effective infrastructure investments for schools, roads, and public safety. In these areas, state investments and policies should support and encourage a wide range of uses and densities, promote other transportation options, foster efficient use of existing public and private investments, and enhance community identity and integrity. Investment Level 2 Areas serve as transition areas between Level 1 and the state's more open, less populated areas.

Proposed Development's Compatibility with Strategies for State Policies and Spending:

The proposed Graves Road Elementary School is located within Investment Level 1 and Level 2 areas, and is to be developed as 600-student elementary school. This type of development is consistent with the character of Investment Level 1 and Level 2 areas. It is therefore concluded that the proposed development generally complies with the policies stated in the 2010 update of the "Strategies for State Policies and Spending."

Comprehensive Plan

New Castle County Comprehensive Plan:

(Source: New Castle County Comprehensive Plan Update, April 2012)

The proposed Graves Road Elementary School is located in an area with future land use designated as Low Density Residential (1-3 dwelling units per acre).

The parcel is currently zoned S (Suburban), and the developer does not plan to rezone the parcel. According to Section 40.02.232 of the New Castle County Unified Development Code (UDC), characteristics of S zoning are as follows

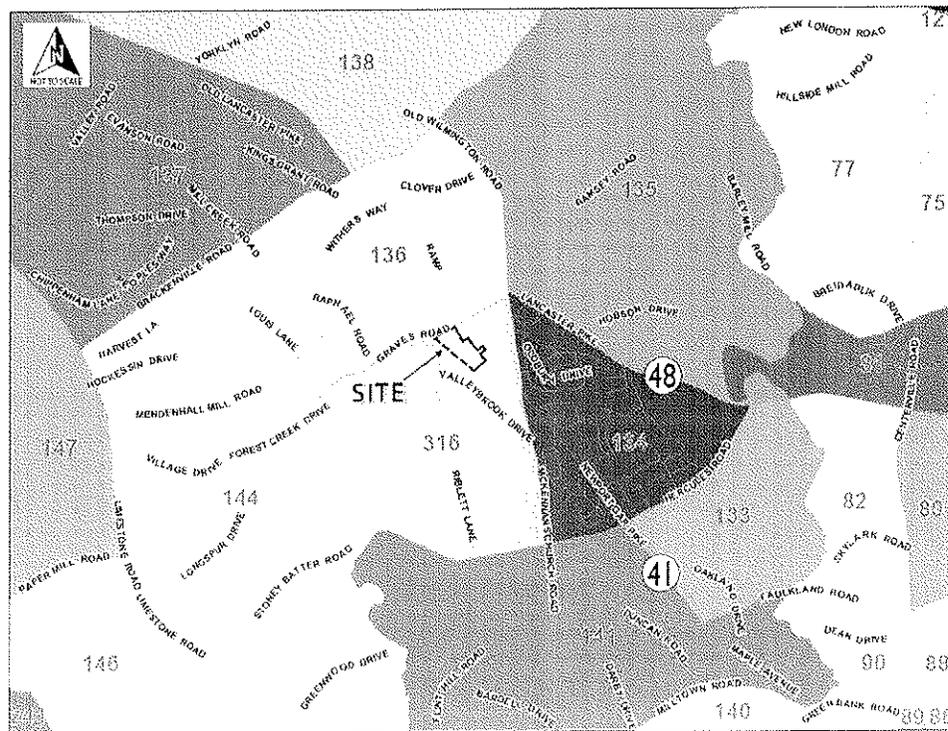
- This district permits a wide range of residential uses. This district includes all the newly developing areas designated as growth areas in the Comprehensive Development Plan.
- This district permits moderate to high density development and a full range of residential uses in a manner consistent with providing a high quality suburban character. Significant areas of open space and/or landscaping shall be provided to maintain the balance between green space and buildings that characterize suburban character. The highest densities are permitted in designed communities, hamlets and villages, through the use of Smart Code techniques.
- This district is not intended to be used for fully developed areas. Fully developed areas are zoned Neighborhood Conservation (NC). The Suburban District is used to in-fill tracts containing at least five (5) acres or where New Castle County seeks to redevelop the area to suburban character.

Proposed Development's Compatibility with Comprehensive Plan: The proposed Graves Road Elementary School is planned as a 600-student elementary school with some open space. Given that the site's future land use designation and S zoning are both residential in nature but the proposed land use (school) is non-residential, this development raises questions regarding consistency with the New Castle County Comprehensive Plan, and thus requires additional discussion.

Transportation Analysis Zones (TAZ)

Transportation Analysis Zones (TAZ) where development would be located: 316

TAZ Boundaries:



Current employment estimate for TAZ: 438 jobs in 2010
Future employment estimate for TAZ: 415 jobs in 2035
Current population estimate for TAZ: 1,138 people in 2010
Future population estimate for TAZ: 1,837 people in 2035
Current household estimate for TAZ: 478 houses in 2010
Future household estimate for TAZ: 835 houses in 2035
Relevant committed developments in TAZ: Marra Landing
Would the addition of committed developments to current estimates exceed future projections: No
Would the addition of committed developments and the proposed development to current estimates exceed future projections: Yes for employment, no for households and population

Relevant Projects in the DelDOT Capital Transportation Program (FY 2013 – FY 2018)

DelDOT currently has one relevant project in the study area. It is the Corridor Capacity Preservation Program (CCPP), which is a statewide program intended to sustain the capacity of adopted highway corridors by various means such as limiting access points and using service roads for local vehicle trips. The general purpose of the program is to ensure that existing principal arterial roadways, including Delaware Route 48 (Lancaster Pike / New Castle Road 237) between Hercules Road (New Castle Road 282) and Delaware Route 41, are able to efficiently carry regional traffic without impedance from the effects of local development.

Trip Generation

Trip generation for the proposed development was computed using comparable land uses and equations contained in Trip Generation, Eighth Edition, published by the Institute of Transportation Engineers (ITE). The following land uses were utilized to estimate the amount of new traffic generated for this development:

- 600-student elementary school (ITE Land Use Code 520)

Table 1
GRAVES ROAD ELEMENTARY SCHOOL PEAK HOUR TRIP GENERATION

Land Use	Vehicle Type	AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
600-student elementary school	Buses	12	12	24	12	12	24
	Cars	136	110	246	64	80	144
TOTAL TRIPS		148	122	270	76	92	168

Table 2
GRAVES ROAD ELEMENTARY SCHOOL DAILY TRIP GENERATION

Land Use	Weekday ADT		
	In	Out	Total
600-student elementary school	387	387	774
TOTAL TRIPS	387	387	774

Overview of TIS

Intersections examined:

- 1) Delaware Route 41 & Site Entrance
- 2) Graves Road & Site Entrance
- 3) Delaware Route 41 & Graves Road
- 4) Delaware Route 41 & Giada Drive
- 5) Delaware Route 41 & Loveville Road / McKennans Church Road (New Castle Road 276)
- 6) Delaware Route 41 & Winterbury Circle
- 7) Delaware Route 41 & Willa Drive
- 8) Delaware Route 41 & Daycare Access
- 9) Graves Road & Loveville Road
- 10) Graves Road & Valley Brook Drive
- 11) Graves Road & Bernard Boulevard / Wyndom Circle
- 12) Graves Road & Sawin Lane
- 13) Delaware Route 48 & Loveville Road
- 14) McKennans Church Road & Oakridge Road
- 15) Loveville Road & Westgate Drive
- 16) Loveville Road & Coffee Run

Conditions examined:

- 1) 2012 existing conditions (Case 1)
- 2) 2015 without Graves Road Elementary School (Case 2)
- 3) 2015 with Graves Road Elementary School (Case 3)

Peak hours evaluated:

Weekday morning and afternoon peak hours. As this TIS is for an elementary school, the afternoon peak period designated for traffic counts was 2:30 PM to 4:30 PM to reflect traffic conditions when afternoon school-related traffic is at its peak. This is earlier than the afternoon peak period designation of 4:00 PM to 6:00 PM for a typical (non-school) TIS, meant to capture afternoon commuter traffic. Additionally, while morning traffic counts were conducted from 7:00 AM to 9:00 AM, the time period used for analysis of morning conditions was set as 8:00 AM to 9:00 AM for all intersections to coincide with the morning peak hour of school-related traffic.

Committed developments considered:

- 1) Delaware National (158 single-family detached houses and 106 townhouses)
- 2) Little Falls Centre - Lot 4 (61,800 square feet of general office space)
- 3) Little Falls Centre - Lots 9 and 11 (203,500 square feet of general office space)
- 4) DuPont Chestnut Run Plaza (455,917 square feet of office space)
- 5) Barley Mill Plaza (1,146,000 square feet of medical office space, 54,000 square feet of general office space, 454,000 square feet of commercial space)
- 6) Greenville Overlook (160 single-family detached houses; 122 unbuilt)
- 7) Marra Landing (27 townhouses; 6 unbuilt)
- 8) Coffee Run (45 apartments)

Intersection Descriptions

1) Delaware Route 41 & Site Entrance

Type of Control: proposed two-way stop-controlled (rights-in/rights-out/lefts-in T-intersection)

Northbound approach: (Delaware Route 41) existing one through lane; proposed one shared through/left-turn lane

Southbound approach: (Delaware Route 41) existing one through lane; proposed one shared through/right-turn lane

Eastbound approach: (Proposed Site Entrance) proposed one right-turn-only lane, stop controlled

Note: The Delaware Route 41 site entrance will be limited to school bus traffic only.

2) Graves Road & Site Entrance

Type of Control: proposed two-way stop-controlled (T-intersection)

Northbound approach: (Proposed Site Entrance) proposed one shared left/right-turn lane, stop controlled

Eastbound approach: (Graves Road) existing one through lane; proposed one shared through/right-turn lane

Westbound approach: (Graves Road) existing one through lane; proposed one shared through/left-turn lane

Note: The Graves Road site entrance will be for automobile traffic (no school buses).

3) Delaware Route 41 & Graves Road

Type of Control: signalized four-leg intersection

Northbound approach: (Delaware Route 41) one left-turn lane and one shared through/right-turn lane

Southbound approach: (Delaware Route 41) one left-turn lane and one shared through/right-turn lane

Eastbound approach: (Graves Road) one shared through/left-turn lane and one right-turn lane

Westbound approach: (Graves Road) one shared left/through/right lane

- 4) **Delaware Route 41 & Giada Drive**
Type of Control: two-way stop-controlled (T-intersection)
Northbound approach: (Delaware Route 41) one left-turn lane and one through lane
Southbound approach: (Delaware Route 41) one through lane and one right-turn lane
Eastbound approach: (Giada Drive) one shared left/right-turn lane, stop controlled

- 5) **Delaware Route 41 & Loveville Road / McKennans Church Road**
Type of Control: signalized four-leg intersection
Northbound approach: (Delaware Route 41) one left-turn lane, one through lane and one right-turn lane
Southbound approach: (Delaware Route 41) one left-turn lane, one through lane and one right-turn lane
Eastbound approach: (McKennans Church Road) one left-turn lane, one through lane and one right-turn lane
Westbound approach: (Loveville Road) one left-turn lane, one through lane and one right-turn lane

- 6) **Delaware Route 41 & Winterbury Circle**
Type of Control: two-way stop-controlled (T-intersection)
Northbound approach: (Delaware Route 41) one through lane and one right-turn lane
Southbound approach: (Delaware Route 41) one shared through/left-turn lane
Westbound approach: (Winterbury Circle) one shared left/right-turn lane, stop controlled

- 7) **Delaware Route 41 & Willa Drive**
Type of Control: two-way stop-controlled (T-intersection)
Northbound approach: (Delaware Route 41) one shared through/left-turn lane
Southbound approach: (Delaware Route 41) one shared through/right-turn lane
Eastbound approach: (Willa Drive) one shared left/right-turn lane, stop controlled

- 8) **Delaware Route 41 & Daycare Access**
Type of Control: two-way stop-controlled (right-in/right-out T-intersection)
Northbound approach: (Delaware Route 41) one through lane and one right-turn lane
Southbound approach: (Delaware Route 41) one through lane
Westbound approach: (Daycare Access) one right-turn-only lane, stop controlled

- 9) **Graves Road & Loveville Road**
Type of Control: two-way stop-controlled (T-intersection)
Northbound approach: (Loveville Road) one shared through/left-turn lane
Southbound approach: (Loveville Road) one shared through/right-turn lane
Eastbound approach: (Graves Road) one shared left/right-turn lane, stop controlled

- 10) **Graves Road & Valley Brook Drive**
Type of Control: two-way stop-controlled (T-intersection)
Northbound approach: (Valley Brook Drive) shared left/right-turn lane, stop controlled
Eastbound approach: (Graves Road) one shared through/right-turn lane
Westbound approach: (Graves Road) one shared through/left-turn lane
Note: Intersection operates as minor street stop-controlled despite lack of stop sign.

- 11) **Graves Road & Bernard Boulevard / Wyndom Circle**
Type of Control: two-way stop-controlled (four-leg intersection)
Northbound approach: (Bernard Boulevard) one shared through/left-turn lane and one right-turn lane, stop controlled
Southbound approach: (Wyndom Circle) one shared left/through/right-turn lane, stop controlled
Eastbound approach: (Graves Road) one shared left/through/right-turn lane
Westbound approach: (Graves Road) one shared through/left-turn lane and one right-turn lane

- 12) **Graves Road & Sawin Lane**
Type of Control: two-way stop-controlled (T-intersection)
Southbound approach: (Sawin Lane) one shared left/right-turn lane, stop controlled
Eastbound approach: (Graves Road) one shared through/left-turn lane
Westbound approach: (Graves Road) one shared through/right-turn lane
Note: Intersection operates as minor street stop-controlled despite lack of stop sign.

- 13) **Delaware Route 48 & Loveville Road**
Type of Control: signalized four-leg intersection
Northbound approach: (Loveville Road) one left-turn lane and one shared through/right-turn lane
Southbound approach: (Loveville Road) one left-turn lane and one shared through/right-turn lane
Eastbound approach: (Delaware Route 48) one left-turn lane and one shared through/right-turn lane
Westbound approach: (Delaware Route 48) one left-turn lane, one through lane and one right-turn lane

- 14) **McKennans Church Road & Oakridge Road**
Type of Control: two-way stop-controlled (T-intersection)
Northbound approach: (McKennans Church Road) one shared through/left-turn lane
Southbound approach: (McKennans Church Road) one shared through/right-turn lane
Eastbound approach: (Oakridge Road) one shared right/left-turn lane, stop controlled

- 15) **Loveville Road & Westgate Drive**
Type of Control: two-way stop-controlled (T-intersection)
Northbound approach: (Loveville Road) one shared through/right-turn lane
Southbound approach: (Loveville Road) one shared through/left-turn lane
Westbound approach: (Westgate Drive) one shared left/right-turn lane, stop controlled

16) Loveville Road & Coffee Run

Type of Control: two-way stop-controlled (T-intersection)

Northbound approach: (Loveville Road) one shared through/right-turn lane

Southbound approach: (Loveville Road) one shared through/left-turn lane

Westbound approach: (Coffee Run) one left-turn lane and one right-turn lane, stop controlled

Safety Evaluation

Crash Data: Crash data was obtained for January 2010 through January 2013 for the intersections and roadway segments within the study area. This included a total of 67 crashes, of which 58 occurred at or very near the three signalized intersections. As expected for signalized intersection crashes, the majority were either angle crashes or rear-end crashes. About 25% of the crashes resulted in injuries, but there were no fatal crashes reported in the study area during this three-year period. The crashes at or near each signalized intersection are as follows:

- Delaware Route 41 & Graves Road
 - 23 crashes reported
- Delaware Route 41 & Loveville Road / McKennans Church Road
 - 11 crashes reported
- Delaware Route 48 & Loveville Road
 - 24 crashes reported

Sight Distance: The proposed site entrance on Delaware Route 41 would be located on a straight and relatively flat section of roadway and would appear to have adequate sight distance. The proposed site entrance on Graves Road would be located on the outside of a horizontal curve and near the crest of a vertical curve, which presents potential sight distance and safety concerns especially for left-turning vehicles to and from the site. The proposed location of the Graves Road site entrance, as well as the lane configurations and allowed movements at that intersection, may require a closer evaluation from a safety perspective.

Other than the proposed site entrances, the existing roadways in the study area have some grades and other features that could present safety concerns. Generally, Delaware Route 41 goes downhill in the southbound direction, increasing stopping sight distance. Due to grades, embankment and trees, sight distance is limited on the eastbound and westbound Graves Road approaches at Delaware Route 41. Similarly, the Graves Road approach to Loveville Road is on an uphill grade and there is an embankment and trees on the north side of the road that block the driver's view to the left. The following intersections also have sight distance limitations or are hidden entrances, mostly due to being located in wooded areas where roadside trees are visual obstructions:

- Delaware Route 41 & Willa Drive
- Graves Road & Valley Brook Drive (also missing a stop sign on the Valley Brook Drive approach)
- Graves Road & Sawin Lane (also missing a stop sign on the Sawin Lane approach)
- Loveville Road & Westgate Drive

Transit, Pedestrian, and Bicycle Facilities

Existing transit service: The Delaware Transit Corporation (DTC) currently operates one transit route offering service near the proposed Graves Road Elementary School. DART Route 20, which offers weekday service connecting downtown Wilmington to Hockessin, travels along Delaware Route 48. The nearest bus stop to the proposed development is on Delaware Route 48 at Loveville Road. Route 20 makes 14 round trips each weekday, and none on weekends.

Planned transit service: Mr. Wayne Henderson, a Service Development Planner for the DTC, provided comments on February 4, 2013 and April 23, 2013 regarding DTC's future plans for transit services in this area. He stated that DART Route 20 is the only DTC transit service planned for this area at this time.

Existing bicycle and pedestrian facilities: According to the bicycle level of service (BLOS) calculator developed by the *League of Illinois Bicyclists*, Graves Road operates at BLOS C and Delaware Route 41 operates at BLOS B. The only designated bicycle lanes in the study area are found along southbound Delaware Route 41 at Giada Drive for a short distance in both directions. The only sidewalks in the area are found along the east side of Loveville Road north of Delaware Route 48, along the east side of Wyndom Circle north of Graves Road, and along both sides of Giada Drive west of Delaware Route 41. There is also a crosswalk across the Giada Drive approach to Delaware Route 41. There are no pedestrian facilities at any of the signalized intersections.

Planned bicycle and pedestrian facilities: McCormick Taylor contacted Marco Boyce and Anthony Aglio with DelDOT's Bicycle and Pedestrian Facilities Team via email on May 7, 2013 regarding planned or requested bicycle and pedestrian facilities in the area of this proposed development. No response has been received to date. The site plan submitted with the PLUS application shows proposed sidewalks connecting the school building to the site entrances and along the property's site frontages on Graves Road and Delaware Route 41, along with crosswalks across both site entrances and a bike lane along eastbound Graves Road.

Previous Comments

All comments from DelDOT's Scoping Letter, Traffic Count Review, and Preliminary TIS (PTIS) Review were addressed in the Final TIS submission, with the following exception:

- The afternoon traffic counts for the intersection of Delaware Route 48 & Loveville Road covered the hours of 3:00 PM to 5:00 PM, with a peak hour of 4:00-5:00 PM. The Scoping Letter stated that the afternoon traffic counts should be conducted from 2:30 PM to 4:30 PM. While the TIS analyzed volumes for the 4:00-5:00 PM peak hour, which falls outside of the timeframe designated in the Scoping Letter, McCormick Taylor compared the 4:00-5:00 PM volumes to hourly volumes ending no later than 4:30 PM and did not find a significant difference for most movements, so the 4:00-5:00 PM volumes used in the TIS were also used in our analysis. Furthermore, the LOS deficiencies at this intersection occur only during the critical AM peak hour, and the improvements recommended in this letter are primarily based on AM peak hour conditions.

General HCS Analysis Comments

(see table footnotes on the following pages for specific comments)

- 1) For unsignalized intersections, the TIS and McCormick Taylor applied heavy vehicle (HV) percentages by movement. For signalized intersections, the TIS and McCormick Taylor applied HV percentages by lane group. For future conditions, the TIS and McCormick Taylor generally assumed future HV percentages to be the same as existing HV percentages.
- 2) For existing conditions, the TIS and McCormick Taylor determined and applied, for each intersection, the overall intersection peak hour factor (PHF). For future conditions, the TIS assumed future PHF to be the same as existing PHF, except at the intersection of Delaware Route 48 & Loveville Road where they assumed a future PHF of 0.92 (increase from existing PHF values of 0.90 for AM peak hour and 0.85 for PM peak hour). McCormick Taylor assumed future PHF to be the same as existing PHF for all intersections.
- 3) The HCS analyses included in the TIS did not always reflect the lane widths observed in the field by McCormick Taylor. McCormick Taylor's HCS analyses incorporated the field-measured lane widths.
- 4) The TIS and McCormick Taylor used different signal timings when analyzing the signalized intersections in some cases.
- 5) The TIS input Right-Turn-on-Red (RTOR) volumes for signalized intersection analyses. McCormick Taylor input no RTOR volumes, but did analyze right-turn movements from exclusive right-turn lanes as overlapping the protected left-turn phases.
- 6) Neither the TIS nor McCormick Taylor included percent grade in their analyses.

Table 3
PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for Graves Road Elementary School (Revised)
Report dated September 9, 2013
Prepared by The Traffic Group, Inc.

Unsignalized Intersection ¹ Two-Way Stop Control (T-intersection)	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM ²	Weekday PM	Weekday AM	Weekday PM
Delaware Route 41 & Site Entrance				
2015 with Graves Road Elementary (Case 3)				
Northbound Delaware Route 41 – Left	A (9.6)	A (8.5)	B (11.0)	B (10.4)
Eastbound Site Entrance – Right	C (15.4)	B (11.7)	C (16.2)	B (14.4)
2015 with Graves Road Elementary (Case 3) With Improvement Option 1 ³				
Northbound Delaware Route 41 – Left	N/A	N/A	B (11.0)	B (10.4)
Eastbound Site Entrance – Right	N/A	N/A	C (16.2)	B (14.4)
2015 with Graves Road Elementary (Case 3) With Improvement Option 2 ⁴				
Northbound Delaware Route 41 – Left	N/A	N/A	B (11.0)	B (10.4)
Eastbound Site Entrance – Right	N/A	N/A	C (16.2)	B (14.4)

¹ For both unsignalized and signalized intersection analyses, the numbers in parentheses following levels of service (LOS) are average delay per vehicle, measured in seconds. For signalized analyses, LOS analysis results are given for only the overall intersection delay.

² The TIS mistakenly analyzed the Case 3 AM peak hour for this proposed site entrance using volumes from their original TIS dated April 18, 2013 instead of from their revised TIS. McCormick Taylor analyzed this intersection using the updated volumes from the revised TIS.

³ Improvement Option 1 includes a separate left-turn lane on the northbound Delaware Route 41 approach, as warranted per DelDOT's Subdivision Manual.

⁴ Improvement Option 2 includes Improvement Option 1 plus a separate right-turn lane on the southbound approach of Delaware Route 41.

Table 4
PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for Graves Road Elementary School (Revised)
Report dated September 9, 2013
Prepared by The Traffic Group, Inc.

Unsignalized Intersection ⁵ Two-Way Stop Control (T-intersection)	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM ⁶	Weekday PM	Weekday AM	Weekday PM
Graves Road & Site Entrance				
2015 with Graves Road Elementary (Case 3)				
Northbound Site Entrance	C (23.3)	B (11.0)	B (14.5)	B (11.0)
Westbound Graves Road – Left	B (10.1)	A (7.7)	A (8.7)	A (7.8)
2015 with Graves Road Elementary (Case 3) With Improvement Option 1 ⁷				
Northbound Site Entrance	N/A	N/A	B (14.2)	B (11.0)
Westbound Graves Road – Left	N/A	N/A	A (8.7)	A (7.8)
2015 with Graves Road Elementary (Case 3) With Improvement Option 2 ⁸				
Northbound Site Entrance	N/A	N/A	B (13.1)	B (10.6)
Westbound Graves Road – Left	N/A	N/A	A (8.7)	A (7.8)

⁵ For both unsignalized and signalized intersection analyses, the numbers in parentheses following levels of service (LOS) are average delay per vehicle, measured in seconds. For signalized analyses, LOS analysis results are given for only the overall intersection delay.

⁶ The TIS mistakenly analyzed the Case 3 AM peak hour for this proposed site entrance using volumes from their original TIS dated April 18, 2013 instead of from their revised TIS. McCormick Taylor analyzed this intersection using the updated volumes from the revised TIS.

⁷ Improvement Option 1 includes a separate left-turn lane on the westbound Graves Road approach and a separate right-turn lane on the eastbound Graves Road approach, as warranted per DeIDOT's Subdivision Manual.

⁸ Improvement Option 2 includes Improvement Option 1 and changes the northbound approach exiting the site to a separate left-turn lane and a separate right-turn lane.

Table 5
PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for Graves Road Elementary School (Revised)
Report dated September 9, 2013
Prepared by The Traffic Group, Inc.

Signalized Intersection ⁹	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Delaware Route 41 & Graves Road				
2012 Existing (Case 1)	C (27.3)	C (23.5)	C (26.0)	C (23.7)
2015 without Graves Road Elementary (Case 2)	C (29.2)	C (25.2)	C (27.7)	C (25.2)
2015 with Graves Road Elementary (Case 3)	D (36.1)	C (27.2)	C (34.0)	C (27.6)

⁹ For both unsignalized and signalized intersection analyses, the numbers in parentheses following levels of service (LOS) are average delay per vehicle, measured in seconds. For signalized analyses, LOS analysis results are given for only the overall intersection delay.

Table 6
PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for Graves Road Elementary School (Revised)
Report dated September 9, 2013
Prepared by The Traffic Group, Inc.

Unsignalized Intersection ¹⁰ Two-Way Stop Control (T-intersection)	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Delaware Route 41 & Giada Drive ¹¹				
2012 Existing (Case 1)				
Northbound Delaware Route 41 – Left	A (8.5)	A (8.3)	A (8.5)	A (8.3)
Eastbound Giada Drive	B (12.4)	B (11.1)	B (12.4)	B (11.1)
2015 without Graves Road Elementary (Case 2)				
Northbound Delaware Route 41 – Left	A (8.6)	A (8.4)	A (8.6)	A (8.4)
Eastbound Giada Drive	B (13.1)	B (11.3)	B (13.1)	B (11.3)
2015 with Graves Road Elementary (Case 3)				
Northbound Delaware Route 41 – Left	A (8.7)	A (8.5)	A (8.7)	A (8.5)
Eastbound Giada Drive	B (13.8)	B (11.7)	B (13.8)	B (11.6)

¹⁰ For both unsignalized and signalized intersection analyses, the numbers in parentheses following levels of service (LOS) are average delay per vehicle, measured in seconds. For signalized analyses, LOS analysis results are given for only the overall intersection delay.

¹¹ The TIS analyzed this intersection with one shared lane on both the northbound and southbound approaches of Delaware Route 41. Based on our field view, McCormick Taylor analyzed the intersection with a separate left-turn lane on northbound Delaware Route 41 approach and a separate right-turn lane on the southbound Delaware Route 41 approach.

Table 7
PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for Graves Road Elementary School (Revised)
Report dated September 9, 2013
Prepared by The Traffic Group, Inc.

Signalized Intersection ¹²	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Delaware Route 41 & Loveville Road / McKennans Church Road				
2012 Existing (Case 1)	B (14.2)	B (15.3)	B (13.5)	B (14.5)
2015 without Graves Road Elementary (Case 2)	B (14.6)	B (16.0)	B (13.8)	B (15.1)
2015 with Graves Road Elementary (Case 3)	B (14.6)	B (16.1)	B (13.9)	B (15.0)

¹² For both unsignalized and signalized intersection analyses, the numbers in parentheses following levels of service (LOS) are average delay per vehicle, measured in seconds. For signalized analyses, LOS analysis results are given for only the overall intersection delay.

Table 8
PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for Graves Road Elementary School (Revised)
Report dated September 9, 2013
Prepared by The Traffic Group, Inc.

Unsignalized Intersection ¹³ Two-Way Stop Control (T-intersection)	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Delaware Route 41 & Winterbury Circle				
2012 Existing (Case 1)				
Southbound Delaware Route 41 – Left	A (7.8)	A (8.2)	A (7.8)	A (8.2)
Westbound Winterbury Circle	B (12.0)	B (14.0)	B (12.1)	B (14.1)
2015 without Graves Road Elementary (Case 2)				
Southbound Delaware Route 41 – Left	A (7.8)	A (8.3)	A (7.8)	A (8.3)
Westbound Winterbury Circle	B (12.5)	B (14.8)	B (12.6)	B (14.8)
2015 with Graves Road Elementary (Case 3)				
Southbound Delaware Route 41 – Left	A (7.9)	A (8.4)	A (7.9)	A (8.4)
Westbound Winterbury Circle	B (12.5)	B (14.7)	B (12.7)	B (14.7)

¹³ For both unsignalized and signalized intersection analyses, the numbers in parentheses following levels of service (LOS) are average delay per vehicle, measured in seconds. For signalized analyses, LOS analysis results are given for only the overall intersection delay.

Table 9
PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for Graves Road Elementary School (Revised)
Report dated September 9, 2013
Prepared by The Traffic Group, Inc.

Unsignalized Intersection ¹⁴ Two-Way Stop Control (T-intersection)	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Delaware Route 41 & Willa Drive				
2012 Existing (Case 1)				
Northbound Delaware Route 41 – Left	A (8.1)	A (8.2)	A (8.1)	A (8.2)
Eastbound Willa Drive	B (12.6)	B (13.0)	B (12.6)	B (13.0)
2015 without Graves Road Elementary (Case 2)				
Northbound Delaware Route 41 – Left	A (8.2)	A (8.3)	A (8.2)	A (8.3)
Eastbound Willa Drive	B (13.0)	B (13.5)	B (13.0)	B (13.5)
2015 with Graves Road Elementary (Case 3)				
Northbound Delaware Route 41 – Left	A (8.3)	A (8.4)	A (8.3)	A (8.4)
Eastbound Willa Drive	B (13.4)	B (13.4)	B (13.4)	B (13.4)

¹⁴ For both unsignalized and signalized intersection analyses, the numbers in parentheses following levels of service (LOS) are average delay per vehicle, measured in seconds. For signalized analyses, LOS analysis results are given for only the overall intersection delay.

Table 10
PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for Graves Road Elementary School (Revised)
Report dated September 9, 2013
Prepared by The Traffic Group, Inc.

Unsignalized Intersection ¹⁵ Two-Way Stop Control (T-intersection)	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Delaware Route 41 & Daycare Access				
2012 Existing (Case 1)				
Westbound Daycare Access – Right	B (10.5)	B (10.7)	B (10.5)	B (10.7)
2015 without Graves Road Elementary (Case 2)				
Westbound Daycare Access – Right	B (10.6)	B (10.9)	B (10.0+)	B (11.0)
2015 with Graves Road Elementary (Case 3)				
Westbound Daycare Access – Right	B (11.2)	B (11.2)	B (10.4)	B (11.2)

¹⁵ For both unsignalized and signalized intersection analyses, the numbers in parentheses following levels of service (LOS) are average delay per vehicle, measured in seconds. For signalized analyses, LOS analysis results are given for only the overall intersection delay.

Table 11
PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for Graves Road Elementary School (Revised)
Report dated September 9, 2013
Prepared by The Traffic Group, Inc.

Unsignalized Intersection ¹⁶ Two-Way Stop Control (T-intersection)	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Graves Road & Loveville Road ¹⁷				
2012 Existing (Case 1)				
Northbound Loveville Road – Left	A (7.5)	A (8.0)	A (7.5)	A (8.0)
Eastbound Graves Road	B (10.9)	B (12.4)	B (10.9)	B (12.5)
2015 without Graves Road Elementary (Case 2)				
Northbound Loveville Road – Left	A (7.6)	A (8.3)	A (7.6)	A (8.3)
Eastbound Graves Road	B (12.5)	B (14.5)	B (12.5)	B (14.6)
2015 with Graves Road Elementary (Case 3)				
Northbound Loveville Road – Left	A (7.6)	A (8.4)	A (7.6)	A (8.4)
Eastbound Graves Road	B (13.2)	C (15.4)	B (13.2)	C (15.5)

¹⁶ For both unsignalized and signalized intersection analyses, the numbers in parentheses following levels of service (LOS) are average delay per vehicle, measured in seconds. For signalized analyses, LOS analysis results are given for only the overall intersection delay.

¹⁷ Analysis results do not reflect the proximity of this intersection to the signalized intersection of Delaware Route 48 & Loveville Road, which is less than 150 feet to the north.

Table 12
PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for Graves Road Elementary School (Revised)
Report dated September 9, 2013
Prepared by The Traffic Group, Inc.

Unsignalized Intersection ¹⁸ Two-Way Stop Control (T-intersection)	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Graves Road & Valley Brook Road				
2012 Existing (Case 1)				
Northbound Valley Brook Road	B (11.5)	A (9.9)	B (11.3)	A (9.9)
Westbound Graves Road – Left	A (8.1)	A (7.5)	A (8.1)	A (7.5)
2015 without Graves Road Elementary (Case 2)				
Northbound Valley Brook Road	B (12.0)	B (10.2)	B (11.9)	B (10.2)
Westbound Graves Road – Left	A (8.2)	A (7.5)	A (8.2)	A (7.5)
2015 with Graves Road Elementary (Case 3)				
Northbound Valley Brook Road	B (12.5)	B (10.2)	B (12.3)	B (10.2)
Westbound Graves Road – Left	A (8.4)	A (7.6)	A (8.4)	A (7.6)

¹⁸ For both unsignalized and signalized intersection analyses, the numbers in parentheses following levels of service (LOS) are average delay per vehicle, measured in seconds. For signalized analyses, LOS analysis results are given for only the overall intersection delay.

Table 13
PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for Graves Road Elementary School (Revised)
Report dated September 9, 2013
Prepared by The Traffic Group, Inc.

Unsignalized Intersection ¹⁹ Two-Way Stop Control	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Graves Road & Bernard Boulevard / Wyndom Circle				
2012 Existing (Case 1)				
Northbound Bernard Boulevard	B (11.3)	A (9.8)	B (11.3)	A (9.8)
Southbound Wyndom Circle	B (12.4)	B (11.1)	B (12.4)	B (11.0)
Eastbound Graves Road – Left	A (7.4)	A (8.1)	A (7.4)	A (8.1)
Westbound Graves Road – Left	A (8.0)	A (7.6)	A (8.0)	A (7.5)
2015 without Graves Road Elementary (Case 2)				
Northbound Bernard Boulevard	B (11.9)	B (10.0+)	B (11.9)	B (10.0+)
Southbound Wyndom Circle	B (13.3)	B (11.6)	B (13.3)	B (11.6)
Eastbound Graves Road – Left	A (7.4)	A (8.2)	A (7.4)	A (8.2)
Westbound Graves Road – Left	A (8.2)	A (7.6)	A (8.2)	A (7.6)
2015 with Graves Road Elementary (Case 3)				
Northbound Bernard Boulevard	B (12.5)	B (10.1)	B (12.5)	B (10.1)
Southbound Wyndom Circle	B (14.5)	B (12.1)	B (14.5)	B (12.1)
Eastbound Graves Road – Left	A (7.5)	A (8.3)	A (7.5)	A (8.3)
Westbound Graves Road – Left	A (8.3)	A (7.6)	A (8.3)	A (7.6)

¹⁹ For both unsignalized and signalized intersection analyses, the numbers in parentheses following levels of service (LOS) are average delay per vehicle, measured in seconds. For signalized analyses, LOS analysis results are given for only the overall intersection delay.

Table 14
PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for Graves Road Elementary School (Revised)
Report dated September 9, 2013
Prepared by The Traffic Group, Inc.

Unsignalized Intersection ²⁰ Two-Way Stop Control (T-intersection)	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Graves Road & Sawin Lane				
2012 Existing (Case 1)				
Southbound Sawin Lane	B (11.0)	B (11.1)	B (11.0)	B (11.1)
Eastbound Graves Road – Left	A (7.4)	A (8.1)	A (7.4)	A (8.1)
2015 without Graves Road Elementary (Case 2)				
Southbound Sawin Lane	B (11.4)	B (11.6)	B (11.4)	B (11.6)
Eastbound Graves Road – Left	A (7.4)	A (8.2)	A (7.4)	A (8.2)
2015 with Graves Road Elementary (Case 3)				
Southbound Sawin Lane	B (12.5)	B (12.0)	B (12.5)	B (12.0)
Eastbound Graves Road – Left	A (7.5)	A (8.3)	A (7.5)	A (8.3)

²⁰ For both unsignalized and signalized intersection analyses, the numbers in parentheses following levels of service (LOS) are average delay per vehicle, measured in seconds. For signalized analyses, LOS analysis results are given for only the overall intersection delay.

Table 15
PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for Graves Road Elementary School (Revised)
Report dated September 9, 2013
Prepared by The Traffic Group, Inc.

Signalized Intersection ²¹	LOS per TIS ²²		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Delaware Route 48 & Loveville Road				
2012 Existing (Case 1)	D (35.0+)	C (21.2)	C (35.0-)	C (25.1)
2015 without Graves Road Elementary (Case 2)	F (109.0)	C (24.7)	F (89.6)	D (42.6)
2015 with Graves Road Elementary (Case 3)	F (112.8)	C (25.3)	F (98.4) ²³	D (43.6) ²⁴
2015 with Graves Road Elementary (Case 3) With Improvement Option 1 ²⁵	D (48.1)	C (23.9)	D (54.9) ²⁶	D (41.0) ²⁷

²¹ For unsignalized analyses, the numbers in parentheses following levels of service are average delay per vehicle, measured in seconds. For signalized analyses, those numbers are X-critical, a composite volume-to-capacity ratio.

²² The TIS applied a PHF of 0.92 for future conditions at this intersection, an increase from existing PHF (0.90 for the AM peak hour and 0.85 for the PM peak hour). McCormick Taylor applied existing PHF values to future conditions.

²³ The key 95th percentile queue lengths for the Case 3 AM peak hour are approximately 90 vehicles for the eastbound through/right-turn lane, 33 vehicles for the northbound through/right-turn lane, and 35 vehicles for the southbound left-turn lane.

²⁴ The key 95th percentile queue lengths for the Case 3 PM peak hour are approximately 11 vehicles for the westbound left-turn lane and 57 vehicles for the westbound through lane.

²⁵ Improvement Option 1 includes a separate right-turn lane on the northbound Loveville Road approach.

Table 16
PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for Graves Road Elementary School (Revised)
Report dated September 9, 2013
Prepared by The Traffic Group, Inc.

Unsignalized Intersection ²⁸ Two-Way Stop Control (T-intersection)	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
McKennans Church Road & Oakridge Road				
2012 Existing (Case 1)				
Northbound McKennans Church Road – Left	A (7.8)	A (7.8)	A (8.1)	A (7.8)
Eastbound Oakridge Road	B (10.7)	B (11.7)	B (10.7)	B (11.7)
2015 without Graves Road Elementary (Case 2)				
Northbound McKennans Church Road – Left	A (7.9)	A (7.8)	A (8.2)	A (7.8)
Eastbound Oakridge Road	B (10.9)	B (12.0)	B (10.9)	B (12.0)
2015 with Graves Road Elementary (Case 3)				
Northbound McKennans Church Road – Left	A (7.9)	A (7.8)	A (8.2)	A (7.8)
Eastbound Oakridge Road	B (11.3)	B (12.4)	B (11.3)	B (12.4)

²⁶ For both unsignalized and signalized intersection analyses, the numbers in parentheses following levels of service (LOS) are average delay per vehicle, measured in seconds. For signalized analyses, LOS analysis results are given for only the overall intersection delay.

Table 17
PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for Graves Road Elementary School (Revised)
Report dated September 9, 2013
Prepared by The Traffic Group, Inc.

Unsignalized Intersection ²⁹ Two-Way Stop Control (T-intersection)	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Loveville Road & Westgate Drive				
2012 Existing (Case 1)				
Southbound Loveville Road – Left	A (7.8)	A (7.6)	A (7.8)	A (7.7)
Westbound Westgate Drive	B (10.4)	B (11.2)	B (10.2)	B (11.1)
2015 without Graves Road Elementary (Case 2)				
Southbound Loveville Road – Left	A (7.8)	A (7.7)	A (7.8)	A (7.7)
Westbound Westgate Drive	B (10.6)	B (11.6)	B (10.4)	B (12.4)
2015 with Graves Road Elementary (Case 3)				
Southbound Loveville Road – Left	A (7.8)	A (7.7)	A (7.8)	A (7.7)
Westbound Westgate Drive	B (10.8)	B (11.7)	B (10.6)	B (11.5)

²⁷ For both unsignalized and signalized intersection analyses, the numbers in parentheses following levels of service (LOS) are average delay per vehicle, measured in seconds. For signalized analyses, LOS analysis results are given for only the overall intersection delay.

Table 18
PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for Graves Road Elementary School (Revised)
Report dated September 9, 2013
Prepared by The Traffic Group, Inc.

Unsignalized Intersection ³⁰ Two-Way Stop Control (T-intersection)	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Loveville Road & Coffee Run				
2012 Existing (Case 1)				
Southbound Loveville Road – Left	A (7.7)	A (7.6)	A (7.7)	A (7.7)
Westbound Coffee Run	A (9.9)	B (10.6)	A (9.9)	B (10.8)
2015 without Graves Road Elementary (Case 2)				
Southbound Loveville Road – Left	A (7.8)	A (7.7)	A (7.8)	A (7.7)
Westbound Coffee Run	B (10.5)	B (11.4)	B (10.5)	B (11.4)
2015 with Graves Road Elementary (Case 3)				
Southbound Loveville Road – Left	A (7.9)	A (7.8)	A (7.9)	A (7.8)
Westbound Coffee Run	B (10.6)	B (11.5)	B (10.6)	B (11.5)

²⁸ For both unsignalized and signalized intersection analyses, the numbers in parentheses following levels of service (LOS) are average delay per vehicle, measured in seconds. For signalized analyses, LOS analysis results are given for only the overall intersection delay.



STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
800 BAY ROAD
PO. BOX 778
DOVER, DELAWARE 19903

July 23, 2013

SHARLETT P. BEATT
SECRETARY

Mr. Carl Wilson
The Traffic Group, Inc.
9900 Franklin Square Drive
Suite H
Baltimore, MD 21236

Dear Mr. Wilson:

The enclosed Traffic Impact Study (TIS) review letter for the **Graves Road Elementary School** has been completed under the responsible charge of a registered professional engineer whose firm is authorized to work in the State of Delaware. They have found the TIS to conform to DeIDOT's Standards and Regulations for Subdivision Streets and State Highway Access and other accepted practices and procedures for such studies. DeIDOT accepts this review letter and concurs with the recommendations. If you have any questions concerning this letter or the enclosed review letter, please contact me at (302) 760-2167.

Sincerely,

Troy Brestel
Project Engineer

TEB:km

Enclosures

cc with enclosures: Mr. Mark Parker, Becker Morgan Group, Inc.
Ms. Constance C. Holland, Office of State Planning Coordination
Mr. James Smith, Jr., New Castle County Department of Land Use
Mr. Andrew Parker, McCormick Taylor, Inc.
DeIDOT Distribution



DelDOT Distribution

John Janowski, New Castle County Department of Land Use
Owen Robatino, New Castle County Department of Land Use
Frederick H. Schranck, Deputy Attorney General
Natalie Barnhart, Director, Transportation Solutions (DOTS)
Drew Boyce, Director, Planning
Mark Luszczyk, Chief Traffic Engineer, Traffic, DOTS
Mark Tudor, Assistant Director, Project Development North, DOTS
J. Marc Coté, Assistant Director, Development Coordination
T. William Brockenbrough, Jr., County Coordinator, Development Coordination
Thomas E. Meyer, Traffic Studies Manager, Traffic, DOTS
Donald Weber, North District Engineer, North District
Kevin Canning, Canal District Public Works Engineer, Canal District
Wayne Henderson, Service Development Planner, Delaware Transit Corporation
John Garcia, New Castle Subdivision Coordinator, Development Coordination
Joshua Schwartz, Subdivision Manager, Development Coordination
Ahmed Abdelmoteleb, New Castle Traffic Engineer, Traffic, DOTS
Marco Boyce, Planning Supervisor, Statewide & Regional Planning
Claudy Joinville, Project Engineer, Development Coordination



July 23, 2013

Mr. Troy E. Brestel
Project Engineer
DelDOT Division of Planning
P.O. Box 778
Dover, DE 19903

RE: Agreement No. 1529
Traffic Impact Study Services
Task No. 16A – Graves Road Elementary School

Dear Mr. Brestel,

McCormick Taylor has completed its review of the Traffic Impact Study (TIS) for the Graves Road Elementary School prepared by The Traffic Group, Inc. (TTG), dated April 18, 2013. This review was assigned as Task Number 16A. TTG prepared the report in a manner generally consistent with DelDOT's *Standards and Regulations for Subdivision Streets and State Highway Access*.

The TIS evaluates the impacts of Graves Road Elementary School, proposed to be located on the south side of Graves Road (New Castle Road 277) and on the west side of Delaware Route 41 (Newport Gap Pike / New Castle Road 21), within New Castle County, Delaware. The proposed elementary school would serve 600 students. The school is to be developed on approximately 17 acres of land. Two access points are proposed: one full access point along Graves Road (intended for cars only) and one rights-in/rights-out/lefts-in access point along Delaware Route 41 (intended for buses only). Construction is anticipated to be complete by 2015.

The land is currently zoned as S (Suburban) within New Castle County, and the developer does not propose to change the zoning.

This TIS was originally scoped to include 14 existing intersections plus two new site entrances, as documented in DelDOT's Scoping Meeting Minutes dated November 19, 2012. The TIS based on this scope was submitted by TTG on April 22, 2013 and we subsequently reviewed it. Since then, the 147th General Assembly has passed Senate Bill 145 (the Fiscal Year 2014 Bond Bill), which reads in part:

“Section 124: Red Clay Consolidated School District New Construction. In connection with the review of development plans for the Red Clay School District's new elementary school, proposed for construction at Graves Road and Newport Gap Pike, the Department of Transportation is directed to apply its new subdivision regulations, effective May 10, 2013 with respect to scoping the school's traffic impacts. The government of New Castle County is also directed to apply the Department's new scoping procedures in its subdivision approval process for this school.”

Pursuant to the language of the Bond Bill, DelDOT has applied its scoping procedures to the proposed Graves Road Elementary School and revised the list of intersections that should be evaluated for purposes of the TIS and subdivision approval process. DelDOT issued a memo dated July 19, 2013, identifying the revised list of intersections as follows:

1. Site Entrance / Graves Road
2. Site Entrance / Delaware Route 41
3. Graves Road / Delaware 41
4. Delaware Route 41 / Loveville Road (New Castle Road 276)

Our review of the TIS was completed prior to the number of study intersections being reduced. As such, the enclosures to this review letter document our full review of the submitted TIS. However, for the purpose of recommending improvements, we have only made recommendations that pertain to the four intersections listed above.

Based on our review, we have the following comments and recommendations:

All four intersections listed above meet the Level of Service (LOS) concurrency requirements of Section 40.11.210 of the New Castle County Unified Development Code (UDC). Additionally, all of the intersections meet DelDOT's LOS criteria.

At the intersection of Delaware Route 41 and Graves Road, there was some concern regarding queuing on the eastbound Graves Road approach potentially backing up far enough to affect the proposed school site entrance on Graves Road, to be located approximately 650 feet to the west of Delaware Route 41. This situation was closely evaluated to determine if the existing right-turn lane on eastbound Graves Road should be extended to provide additional storage that would help avoid potential queuing back to the site entrance. While the initial analysis indicated the future right-turn queues would extend beyond the existing right-turn lane during the weekday morning peak hour, it was determined that the intersection peak hour and the school peak hour would occur at different times, so adding the school peak hour traffic volumes to the intersection peak hour traffic volumes did not result in an accurate assessment. As such, DelDOT agreed to allow analysis of the intersection with school traffic added based on the school's peak hour of 8:00-9:00 AM instead of the intersection's peak hour of 7:00-8:00 AM, and that the Synchro / SimTraffic analysis program could be used in addition to HCS software to make an assessment of queue lengths in this instance. The resulting analysis indicated that eastbound right-turn queues would not reach beyond the existing right-turn lane often enough to warrant extending the length of the turn lane.

Should the County choose to approve the proposed development, the following items should be incorporated into the site design and reflected on the record plan. All applicable agreements (i.e. letter agreements for off-site improvements and traffic signal agreements) should be executed prior to entrance plan approval for the proposed development.

1. The developer should construct the site entrance on Delaware Route 41. The proposed configuration is shown in the table below.

Approach	Current Configuration	Proposed Configuration
Northbound Delaware Route 41	One through lane	One shared through/left-turn lane
Southbound Delaware Route 41	One through lane	One shared through/right-turn lane
Eastbound Site Entrance	Approach does not exist	One right-turn-only lane

At the site entrance on Delaware Route 41, the developer should add a concrete channelization island on the site driveway to separate entering and exiting traffic. The island should be designed to limit exiting traffic to right turns only. Eastbound lefts out would be prohibited. Besides eastbound rights out, other allowed movements at this intersection would be northbound lefts in and southbound rights in. The developer should coordinate with DelDOT's Subdivision Section to determine an acceptable design of the channelization island.

School Zone Speed Reduction signs, along with signs indicating that this entrance is for bus traffic only, should be posted on the Delaware Route 41 approaches. The entrance driveway should be gated, with access controlled by school officials.

2. The developer should construct the site entrance on Graves Road. The proposed configuration is shown in the table below.

Approach	Current Configuration	Proposed Configuration
Northbound Site Entrance	Approach does not exist	One left-turn lane and one right-turn lane
Eastbound Graves Road	One through lane	One through lane and one right-turn lane
Westbound Graves Road	One through lane	One left-turn lane and one through lane

Initial recommended minimum turn-lane lengths (excluding tapers) of the separate turn lanes are listed below. The developer should coordinate with DeIDOT's Subdivision Section to determine final turn-lane lengths.

Approach	Left-Turn Lane	Right-Turn Lane
Northbound Site Entrance	50 feet*	50 Feet*
Eastbound Graves Road	N/A	100 feet**
Westbound Graves Road	120 feet**	N/A

* turn-lane length based on storage length per queuing analysis, with 50-foot minimum

** turn-lane length based on deceleration + storage length per DeIDOT's *Standards and Regulations for Subdivision Streets and State Highway Access*

3. The developer should enter into a traffic signal agreement with DeIDOT for the intersection of Graves Road and the site entrance. The agreement should include pedestrian signals, crosswalks and interconnection at DeIDOT's discretion, and the developer will be required to perform a signal warrant analysis.
4. The following bicycle and pedestrian improvements should be included:
- a. A right-turn yield to bikes sign (MUTCD R4-4) should be added at the start of the right-turn lane added to eastbound Graves Road at the site entrance.
 - b. Adjacent to the right-turn lane added to Graves Road at the site entrance, a minimum of a five-foot bicycle lane should be dedicated and striped with appropriate markings for bicyclists through the turn lane in order to facilitate safe and unimpeded bicycle travel.
 - c. Appropriate bicycle symbols, directional arrows, striping (including stop bars), and signing should be included along bicycle facilities and right-turn lanes within the project limits.
 - d. Utility covers should be made flush with the pavement
 - e. Bike parking should be provided near the school building entrance.

- f. A minimum of a five-foot wide sidewalk (with a minimum of a three-foot buffer from the roadway) that meets current AASHTO and ADA standards should be constructed along the Graves Road site frontage and along the Delaware Route 41 site frontage.
- g. ADA compliant curb ramps and crosswalks should be provided at all pedestrian crossings, including all site entrances. Type 3 curb ramps are discouraged.
- h. Internal sidewalks for pedestrian safety and to promote walking as a viable transportation alternative should be constructed within the property. These sidewalks should each be a minimum of five feet wide and should meet current AASHTO and ADA standards. These internal sidewalks should connect the school building entrances to the frontage sidewalks on Graves Road and Delaware Route 41.

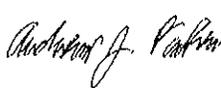
Improvements in this TIS may be considered "significant" under DelDOT's *Work Zone Safety and Mobility Procedures and Guidelines*. These guidelines are available on DelDOT's website at http://www.delDOT.gov/information/pubs_forms/manuals/de_muted/index.shtml. For any additional information regarding the work zone impact and mitigation procedures during construction please contact Mr. Adam Weiser of DelDOT's Traffic Section. Mr. Weiser can be reached at (302) 659-4073 or by email at Adam.Weiser@state.de.us.

Please note that this review generally focuses on capacity and level of service issues; additional safety and operational issues will be further addressed through DelDOT's subdivision review process.

Additional details on our review of this TIS are attached. Please contact me at (302) 738-0203 or through e-mail at ajparker@mtmail.biz if you have any questions concerning this review.

Sincerely,

McCormick Taylor, Inc.



Andrew J. Parker, P.E., PTOE
Project Manager

Enclosure