



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

JENNIFER COHAN
SECRETARY

December 2, 2016

Mr. Christopher Duke
Becker Morgan Group, Inc.
250 South Main Street
Suite 109
Newark, DE 19711

Dear Mr. Duke:

The enclosed Traffic Impact Study (TIS) review letter for the **Brandywine Country Club** (Tax Parcel 06-040.00-004) development 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 Development Coordination Manual and other accepted practices and procedures for such studies. DelDOT 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. Michael Riemann, Becker Morgan Group, Inc.
Ms. Constance C. Holland, Office of State Planning Coordination
Mr. George Haggerty, New Castle County Department of Land Use
Mr. Owen Robatino, New Castle County Department of Land Use
Mr. Marco Boyce, New Castle County Department of Land Use
Mr. Andrew Parker, McCormick Taylor, Inc.
DelDOT Distribution

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Annie Cordo, Deputy Attorney General
Robert McCleary, 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
Peter Haag, Traffic Studies Manager, Traffic, DOTS
Kevin Canning, Canal District Engineer, North District
Matthew Lichtenstein, Canal District Public Works Engineer, Canal District
David Dooley, Service Development Planner, Delaware Transit Corporation
Jeffrey Van Horn, New Castle Subdivision Coordinator, Development Coordination
Pao Lin, New Castle Subdivision Manager, Development Coordination
Mark Galipo, Traffic Engineer, Traffic, DOTS
Anthony Aglio, Planning Supervisor, Statewide & Regional Planning
Claudy Joinville, Project Engineer, Development Coordination



November 30, 2016

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

RE: Agreement No. 1655
Traffic Impact Study Services
Task No. 1 Subtask 19A – Brandywine Country Club

Dear Mr. Brestel:

McCormick Taylor has completed its review of the Traffic Impact Study (TIS) for the Brandywine Country Club redevelopment project prepared by Becker Morgan Group, Inc. (BMG), dated August 2016. BMG prepared the report in a manner generally consistent with DelDOT's *Development Coordination Manual* [formerly *Standards and Regulations for Subdivision Streets*, incorporated by reference into the New Castle County Unified Development Code 40.11.130].

The TIS evaluates the impacts of the Brandywine Country Club redevelopment project located along Shipley Road (New Castle Road 214), approximately 0.8 miles south of the intersection with Naamans Road (DE Route 92 / New Castle Road 17) in New Castle County, Delaware. The proposed redevelopment converts the closed Brandywine Country Club into a residential development consisting of 408 apartments, 42 townhomes, 28 twin houses, and 87 single-family houses. While the TIS as submitted was based on 76 single-family houses instead of 87, the additional 11 units would have a negligible effect on the analysis and would not change the recommendations. Two access points are proposed: interconnection through the Concord Square Shopping Center to the existing signalized intersection of US Route 202 & Righter Parkway (Site Entrance A), and a full-access driveway on Shipley Road at the existing Shipley Road & Drexel Drive intersection (Site Entrance B). Construction is estimated to be complete by 2026.

The land is currently zoned S (Suburban) in New Castle County, and the developer proposes rezoning to ST (Suburban Transition).

DelDOT currently has no projects within the study area.

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

The proposed development would meet the New Castle County Level of Service (LOS) Standards as stated in Section 40.11.210 of the Unified Development Code (UDC).

However, as shown in the table below, based on the criteria listed in Chapter 2 of DelDOT's *Development Coordination Manual*, a stop-controlled minor street approach at the proposed Site Entrance B intersection on Shipley Road exhibits LOS deficiencies without the implementation

of physical roadway and/or traffic control improvements beyond those proposed in the TIS. Because this intersection is controlled only by stop signs on the minor street approaches, the deficiencies pertain to that approach only, and the intersection is not subject to New Castle County’s concurrency requirements.

<i>Intersection</i>	<i>Existing Traffic Control</i>	<i>Situations for which deficiencies occur</i>
Shipleigh Road & Summerset Road / Site Entrance B (Case 3B)	Unsignalized	2026 PM with development (Case 3B)
Shipleigh Road & Drexel Drive / Site Entrance B (Case 3A)	Unsignalized	2026 PM with development (Case 3A)

At the proposed Site Entrance B intersection on Shipleigh Road, the proposed Site Entrance approach would be deficient in either Case 3A (aligned with Drexel Drive) or Case 3B (aligned with Summerset Road). Case 3A was identified as the preferred alternative. Aligning the site entrance driveway opposite Drexel Drive would result in slightly lower delays and shorter queues compared to the Summerset Road location, and the Drexel Drive location allows for greater sight distance along Shipleigh Road. The proposed Site Entrance B intersection should include separate turn lanes as described below in Item No. 2. Even with the turn lanes, the analysis indicates that the proposed site entrance driveway approach would operate at LOS E during the weekday PM peak hour. However, given that the delay is less than one (1) second above LOS D and the queues would be less than three vehicles on all approaches, we do not recommend any further improvements be implemented by the developer at this intersection beyond those described below in Item No. 2.

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 improve Shipleigh Road along the site frontage in order to meet DelDOT’s major collector road standards. These standards include but are not limited to twelve-foot travel lanes and eight-foot shoulders. The developer should provide a bituminous concrete overlay to the existing travel lanes, at DelDOT’s discretion. DelDOT should analyze the existing lane’s pavement section and recommend an overlay thickness to the developer’s engineer if necessary.

2. The developer should improve the intersection of Shipley Road and Drexel Drive / Proposed Site Entrance B. The proposed configuration is shown in the table below.

Approach	Current Configuration	Proposed Configuration
Northbound Shipley Road	One shared through/right-turn lane	One left-turn lane and one shared through/right-turn lane
Southbound Shipley Road	One shared through/left-turn lane	One shared through/left-turn lane and one right-turn lane
Eastbound Proposed Site Entrance B	Does Not Exist	One left-turn lane and one shared through/right-turn lane
Westbound Drexel Drive	One shared left/right-turn lane	One shared left/through/right-turn lane

Initial recommended minimum turn-lane lengths (excluding tapers) of the separate turn lanes are listed below. The developer should coordinate with DelDOT's Development Coordination Section to determine final turn-lane lengths during the site plan review process.

Approach	Left-Turn Lane	Right-Turn Lane
Northbound Shipley Road	145 feet *	N/A
Southbound Shipley Road	N/A	190 feet *
Eastbound Proposed Site Entrance B	75 feet **	N/A
Westbound Drexel Drive	N/A	N/A

* initial turn-lane length based on DelDOT's *Auxiliary Lane Worksheet*.

** initial turn-lane length based on storage length per queuing analysis.

3. The developer should extend the existing right-turn lane on northbound US Route 202 at Righter Parkway / Concord Square Shopping Center (Site Entrance A). The recommended minimum length for the northbound US Route 202 right-turn lane (excluding taper) should be 350 feet. The developer should coordinate with DelDOT's Development Coordination Section to determine the final turn-lane length during the site plan review process.
4. The developer should extend the existing left-turn lane on westbound Naamans Road at Shipley Road / Brandywine Town Center Driveway. The recommended minimum length for the westbound Naamans Road left-turn lane (excluding taper) should be 375 feet. The developer should coordinate with DelDOT's Development Coordination Section to determine the final turn-lane length during the site plan review process.

5. The developer should coordinate with DelDOT regarding design of the interconnection boulevard through the Concord Square Shopping Center. The existing shopping center will need to be modified to accommodate the proposed interconnection boulevard between the Brandywine Country Club site and US Route 202. The developer should coordinate with DelDOT's Development Coordination Section to determine final design details of the interconnection during the site plan review process.
6. The following bicycle, pedestrian, and transit 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 on southbound Shipley Road at the proposed Site Entrance B intersection.
 - b. Adjacent to the right-turn lane on southbound Shipley Road at the proposed Site Entrance B intersection, 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. If a clubhouse or other community facility is constructed as shown on the conceptual site plan, bike parking should be provided near the building entrances. Where the building architecture provides for an awning or other overhang, the bike parking should be covered.
 - f. Along Shipley Road in any locations where the existing sidewalk is being disturbed, a minimum of a five-foot wide sidewalk that meets current AASHTO and ADA standards should be constructed along the site frontage. The sidewalk should have a minimum of a five-foot buffer from the roadway where possible. At the limits of new sidewalk construction, the sidewalk should connect to adjacent sections of existing sidewalk.
 - 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. In addition to the site frontage sidewalks described above, internal sidewalks and shared-use paths should be constructed within the development for pedestrian safety and to promote walking as a viable transportation alternative. These sidewalks and shared-use paths should meet current UDC, DelDOT, AASHTO and ADA standards. The network of internal sidewalks and shared-use paths should connect the building entrances to the sidewalks along Shipley Road and US Route 202. The developer should coordinate with DelDOT's Development Coordination Section to determine layout/alignment and other design details for all internal pedestrian facilities.
 - i. Where internal sidewalks are located alongside of parking spaces, a buffer should be added to eliminate vehicular overhang onto the sidewalk.
 - j. The developer should coordinate with the Delaware Transit Corporation (DTC) regarding transit facilities which could include modifications to existing bus stops



and/or the addition of one or more new bus stops. The developer should coordinate with the DTC regarding the details and implementation of the transit-related improvements.

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_mutcd/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.

A handwritten signature in black ink, appearing to read "Andrew J. Parker".

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

Enclosure

General Information

Report date: August 2016

Prepared by: Becker Morgan Group, Inc (BMG)

Prepared for: Shipley Road Investments, LLC

Tax parcels: 06-040.00-004

Generally consistent with DelDOT's *Development Coordination Manual*: Yes

Project Description and Background

Description: The existing site is a closed golf course/country club. The proposed redevelopment converts the closed Brandywine Country Club into a residential development consisting of 408 apartments, 42 townhomes, 28 twin houses, and 87 single-family houses.

Location: The proposed redevelopment is located along Shipley Road (New Castle Road 214), approximately 0.8 miles south of the intersection with Naamans Road (DE Route 92 / New Castle Road 17) in New Castle County, Delaware. A site location map is provided on Page 7.

Amount of land to be developed: approximately 112 acres

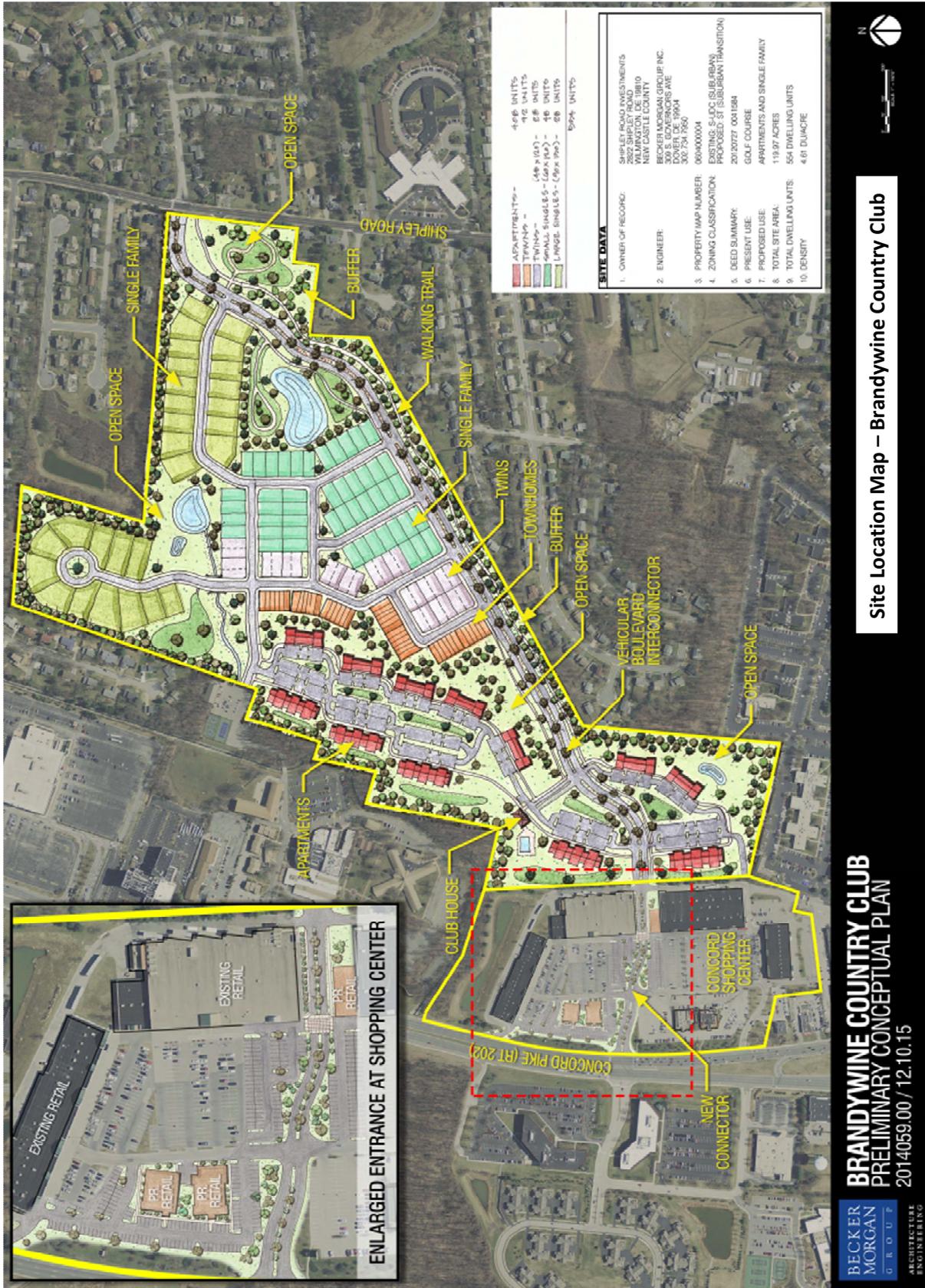
Land use approval(s) needed: Rezoning and Subdivision approval. The land is currently zoned S (Suburban) in New Castle County, and the developer proposes rezoning to ST (Suburban Transition).

Proposed completion date: 2026

Proposed access locations: Two access points are proposed: interconnection through the Concord Square Shopping Center to the existing signalized intersection of US Route 202 & Righter Parkway (Site Entrance A), and a full-access driveway on Shipley Road at the existing Shipley Road & Drexel Drive intersection (Site Entrance B). For Site Entrance B, a second location option was evaluated in which the entrance driveway would align opposite Summerset Drive instead of Drexel Drive.

Daily Traffic Volumes (per DelDOT Traffic Summary 2015):

- 2015 Average Daily Traffic on Shipley Road: 11,923 vpd
- 2015 Average Daily Traffic on US Route 202: 48,762 vpd



2015 Delaware Strategies for State Policies and Spending

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

The proposed Brandywine Country Club residential redevelopment is located within an Investment Level 2 area.

Investment Level 2

Investment Level 2 has many diverse characteristics. These areas can be composed of less developed areas within municipalities, rapidly growing areas in the counties that have or will have public water and wastewater services and utilities, areas that are generally adjacent to or near Investment Level 1 Areas, smaller towns and rural villages that should grow consistently with their historic character, and suburban areas with public water, wastewater, and utility services. These areas have been shown to be the most active portion of Delaware's developed landscape. They serve as transition areas between Level 1 and the state's more open, less populated areas. They generally contain a limited variety of housing types, predominantly detached single-family dwellings.

In Investment Level 2 Areas, like Investment Level 1 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.

Investments should encourage departure from the typical single-family-dwelling developments and promote a broader mix of housing types and commercial sites encouraging compact, mixed-use development where applicable. Overall, the State's intent is to use its spending and management tools to promote well-designed development in these areas. Such development provides for a variety of housing types, user-friendly transportation systems, and provides essential open spaces and recreational facilities, other public facilities, and services to promote a sense of community. Like the Level 1 Areas, Level 2 Areas would be a prime location for designating "pre-permitted areas."

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

The proposed Brandywine Country Club residential redevelopment is located within an Investment Level 2 area, to be rezoned and redeveloped with 408 apartments, 42 townhomes, 28 twin houses, and 76 single-family homes, which will replace the closed Brandywine Country Club. This type of development is generally consistent with the character of Investment Level 2 areas. It is proposed to have a mix of housing types and provides for open space and recreational facilities. The proposed development is surrounded by Investment Level 1 areas comprised of single family homes, commercial and retail developments. The proposed development appears to generally comply with the policies stated in the 2015 "Strategies for State Policies and Spending."

Comprehensive Plan

New Castle County Comprehensive Plan:

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

The New Castle County Comprehensive Plan Future Land Use Map indicates that the proposed Brandywine Country Club residential redevelopment is located in an area with future land use designated as Low Density Residential (1-3 dwelling units per acre).

The land is currently zoned as S (Suburban) in New Castle County; the developer proposes rezoning to ST (Suburban Transition). According to Section 40.02.221 of the New Castle County unified Development Code (UDC), characteristics of ST zoning are as follows:

- The district provides for high quality, moderately high density development with a full range of residential uses and limited non-residential uses.
- The design requirements are intended to reflect a suburban transition character while encouraging pedestrian linkages in addition to automobile access.
- The intensity accommodates a range of housing types from small single-family to multi-family.
- The district shall only be located under the following circumstances:
 1. The project is located in the central core of the southern sewer service area as described more fully in Resolution 06-069 and adopted by County Council on March 28, 2006, or;
 2. The project proposes a gross density of less than five (5.0) dwelling units per acre, or;
 3. The project proposes a gross density of five (5.0) dwelling units per acre or greater and has access to transit services. Access to transit services shall mean:
 - a. Any proposed development or portion thereof within a one-quarter (1/4) mile walking distance to the nearest bus stop, or;
 - b. Any proposed development or portion thereof within a two (2) mile radius of an existing transit park and ride facility or one that is proposed and constructed prior to the issuance of the first Certificate of Occupancy.

Proposed Development's Compatibility with Comprehensive Plan: The proposed Brandywine Country Club residential redevelopment is planned to be redeveloped as 408 apartments, 42 townhomes, 28 twin houses, and 76 single-family homes, which will replace the closed Brandywine Country Club. The site's future land use designation is residential in nature, and the proposed development appears to be consistent with the characteristics of ST zoning. However, given that the proposed density of the site is greater than the 1-3 dwelling units per acre for Low Density Residential as designated in the Comprehensive Plan Future Land Use Map, this development may require additional discussion regarding consistency with the New Castle County Comprehensive Plan.

Relevant Projects in the DelDOT Capital Transportation Program

DelDOT currently has no active projects in the study area. DelDOT’s Hazard Elimination Program (HEP) 2011 Site CC was within the study area, along Naamans Road from US 202 to west of Paper Lane. Remedial improvements were identified in the Task 1 Report for the study area intersections of Naamans Road & Shipley Road, Naamans Road & Grubb Road (New Castle Road 209), and Naamans Road & Ebright Road (New Castle Road 204). The identified improvements were recently implemented along the Naamans Road corridor.

Trip Generation

Trip generation for the proposed development was computed using comparable land uses and equations contained in Trip Generation, Ninth 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:

- Single-Family Detached Homes (ITE Land Use Code 210)
- Apartments (ITE Land Use Code 220)
- Residential Condo/Townhouse (ITE Land Use Code 230)

Table 1
BRANDYWINE COUNTRY CLUB PEAK HOUR TRIP GENERATION

Land Use	Weekday AM Peak Hour			Weekday PM Peak Hour		
	In	Out	Total	In	Out	Total
76 Single-Family Detached Homes	16	47	63	52	30	82
408 Apartments	41	163	204	157	85	242
70 Residential Condo/Townhouse Units	7	32	39	30	15	45
TOTAL TRIPS	64	242	306	239	130	369

Table 2
BRANDYWINE COUNTRY CLUB DAILY TRIP GENERATION

Land Use	Weekday ADT		
	In	Out	Total
76 Single-Family Detached Homes	408	408	816
408 Apartments	1298	1298	2596
70 Residential Condo/Townhouse Units	236	236	472
TOTAL TRIPS	1942	1942	3884

Overview of TIS

Intersections Examined:

- 1) US 202 & Righter Parkway / Site Entrance A
- 2) Shipley Road & Summerset Road / Site Entrance B (Case 3B)
- 3) Shipley Road & Drexel Drive / Site Entrance B (Case 3A)
- 4) US 202 & Widener University Right-in/Right-Out (RIRO) Driveway
- 5) US 202 & Rocky Run Parkway (south)
- 6) Woodlawn Road (New Castle Road 223) & Rocky Run Parkway
- 7) US 202 & Woodlawn Road
- 8) US 202 & Passmore Road
- 9) SB US 202 & NB US 202 U-Turn Crossover
- 10) US 202 & Garden of Eden Road (New Castle Road 226) & Silverside Road WB Left-Turn
- 11) NB US 202 & Silverside Road (New Castle Road 212)
- 12) US 202 & Brandywine Boulevard
- 13) US 202 & Mount Lebanon Road (New Castle Road 227)
- 14) Shipley Road & Morningside Drive
- 15) Shipley Road & N. Rockfield Drive
- 16) Shipley Road & S. Rockfield Drive
- 17) Shipley Road & Pierson Drive
- 18) Shipley Road & Heathwood Drive
- 19) Shipley Road & Lori Lane
- 20) Naamans Road & Shipley Road
- 21) Naamans Road & Grubb Road (New Castle Road 209)
- 22) Naamans Road & Ebright Road (New Castle Road 204)
- 23) Silverside Road & Shipley Road

Conditions Examined:

- 1) 2016 existing conditions (Case 1)
- 2) 2026 without proposed development (Case 2)
- 3) 2026 with proposed development and Shipley Road entrance aligned with Drexel Drive (Case 3A)
- 4) 2026 with proposed development and Shipley Road entrance aligned with Summerset Road (Case 3B)

Peak hours evaluated: Weekday morning and evening peak hours

Committed developments considered:

- 1) Pilot School: 91,500 square-foot / 31-classroom school
- 2) Columbia Place: 149 active-adult townhouses/condominiums
- 3) Concord Mall: 343,000 square feet of additional retail
- 4) Seasons Pizza: 3,891 square-foot restaurant, 1,653 square feet of retail
- 5) AstraZeneca Fairfax: 1,147,859 square-foot office and research and development center

Intersection Descriptions:

1) US 202 & Righter Parkway / Site Entrance A

Type of Control: Signalized four-leg intersection

Northbound Approach: (US 202) three through lanes, one right-turn lane, and two left-turn lanes

Southbound Approach: (US 202) three through lanes, one right-turn lane, and two left-turn lanes

Eastbound Approach: (Righter Parkway) one shared through/left-turn lane, one left-turn lane, and one right-turn lane

Westbound Approach: (Concord Square Driveway/Site Entrance A) one shared through/left-turn lane, one exclusive left-turn lane, and one right-turn lane

2) Shipley Road & Summerset Road / Site Entrance B (Case 3B)

Type of Control: existing two-way stop-control (three-leg); proposed two-way stop-control (four-leg)

Northbound Approach: (Shipley Road) existing one shared through/right-turn lane; proposed (Case 3B) one shared left/through/right-turn lane

Southbound Approach: (Shipley Road) existing one through lane; proposed (Case 3B) shared through/left/right-turn lane

Eastbound Approach: (Proposed Site Entrance B) proposed one shared through/left/right-turn lane, stop-control

Westbound Approach: (Summerset Road) existing shared left/right-turn lane, stop-control; proposed (Case 3B) shared left/through/right-turn lane, stop-control

3) Shipley Road & Drexel Drive / Site Entrance B (Case 3A)

Type of Control: existing two-way stop-controlled (three-leg); proposed two-way stop-controlled (four-leg)

Northbound Approach: (Shipley Road) existing one shared through/right-turn lane; proposed (Case 3A) one left-turn lane and one shared through/right-turn lane

Southbound Approach: (Shipley Road) existing one shared through/left-turn lane; proposed (Case 3A) one shared through/left/-turn lane and one right-turn lane

Eastbound Approach: (Proposed Site Entrance B) proposed shared left/through/right-turn lane, stop-control

Westbound Approach: (Drexel Drive) existing shared left/right-turn lane, stop-control; proposed (Case 3A) shared through/left/right-turn lane, stop-control

4) US 202 & Widener University Right-in/Right-Out (RIRO) Driveway

Type of Control: two-way stop-control (three-leg)

Northbound Approach: (US 202) three through lanes and one right-turn lane

Southbound Approach: (US 202) three through lanes separated from northbound lanes by grass median

Westbound Approach: (Widener University RIRO Driveway) one right-turn lane, stop-controlled

5) US 202 & Rocky Run Parkway (south)

Type of Control: Signalized four-leg intersection

Northbound Approach: (US 202) three through lanes, one left-turn lane, one right-turn lane

Southbound Approach: (US 202) three through lanes, one left-turn lane, one right-turn lane

Eastbound Approach: (Rocky Run Parkway) one shared through/left-turn lane, one channelized right-turn lane, yield-control

Westbound Approach: (Widener Driveway) one shared left/through/right-turn lane

6) Woodlawn Road & Rocky Run Parkway

Type of Control: Two-way stop-control (four-leg)

Northbound Approach: (Rocky Run Parkway) one shared left/through/right-turn lane, stop-controlled

Southbound Approach: (Rocky Run Parkway) one shared left/through/right-turn lane, stop-controlled

Eastbound Approach: (Woodlawn Road) one shared left/through/right-turn lane

Westbound Approach: (Woodlawn Road) one shared left/through/right-turn lane

7) US 202 & Woodlawn Road

Type of Control: Two-way stop-controlled (three-leg intersection)

Northbound Approach: (US 202) three through lanes separated from southbound lanes by concrete mountable curb median

Southbound Approach: (US 202) three through lanes and one right-turn lane

Eastbound Approach: (Woodlawn Road) one right-turn lane, stop-controlled

8) US 202 & Passmore Road

Type of Control: Two-way stop-controlled (three-leg intersection)

Northbound Approach: (US 202) three through lanes, separated from southbound lanes by grass median.

Southbound Approach: (US 202) three through lanes and one right-turn lane

Eastbound Approach: (Passmore Road) one right-turn lane, stop controlled

9) SB US 202 & NB US 202 U-Turn Crossover

Type of Control: signalized three-leg intersection

Southbound approach: (US Route 202) three through lanes

Westbound approach: (NB Crossover for U-turns from NB US 202 to SB US 202) one left-turn-only lane; left on flashing red arrow permitted after stop

10) US 202 & Garden of Eden Road & Silverside Road WB Left-Turn

Type of Control: signalized four-leg intersection

Southbound approach: (US Route 202) three through lanes and one right-turn lane

Eastbound approach: (Garden of Eden Road) one right-turn-only lane; right turn prohibited during right red arrow

Westbound approach: (WB Crossover from Silverside Road) two left-turn lanes

11) NB US 202 & Silverside Road

Type of Control: signalized five-leg intersection

Northbound approach: (US Route 202) three through lanes and one right-turn lane

Southbound approach: (SB Crossover from SB Route 202) one shared u-turn/left-turn lane and one exclusive left-turn lane to Silverside Road

Westbound approach: (Silverside Road) two left-turn lanes and one right-turn lane

12) US 202 & Brandywine Boulevard

Type of Control: signalized four-leg intersection

Northbound approach: (US Route 202) one shared through/left-turn lane, one exclusive through lane, and one shared through/right-turn lane

Southbound approach: (US Route 202) three through lanes and one right-turn lane

Westbound approach: (Brandywine Boulevard) one shared through/right-turn lane at NB 202; one shared through/left-turn lane at SB 202

13) US 202 & Mount Lebanon Road

Type of Control: Signalized, five-leg (US 202 SB) / four-leg (US 202 NB) intersection

Northbound approach: (US 202) three through lanes and one right-turn lane

Northbound Crossover approach: (NB Crossover from US 202) one shared through/left-turn lane

Southbound approach: (US 202) three through lanes, one left-turn lane, one right-turn lane

Eastbound approach: (Mount Lebanon Rd) one shared through/left-turn lane, one exclusive left-turn lane, one right-turn lane

Eastbound Crossover approach: (EB crossover from Mount Lebanon Rd and US 202 SB left-turns) one shared through/left-turn lane, one exclusive left turn lane

14) Shipley Road & Morningside Drive

Type of Control: Two-way stop-controlled (three-leg)

Northbound Approach: (Shipley Road) shared through/left-turn lane

Southbound approach: (Shipley Road) shared through/right-turn lane

Eastbound approach: (Morningside Drive) shared left/right-turn lane, stop-controlled

15) Shipley Road & N. Rockfield Drive

Type of Control: Two-way stop-control (three-leg)

Northbound Approach: (Shipley Road) shared through/left-turn lane

Southbound approach: (Shipley Road) shared through/right-turn lane

Eastbound approach: (N. Rockfield Drive) one left-turn lane and one right-turn lane, stop-controlled

16) Shipley Road & S. Rockfield Drive

Type of Control: Two-way stop-control (four-leg)

Northbound Approach: (Shipley Road) shared through/left/right-turn lane

Southbound approach: (Shipley Road) shared through/left/right-turn lane

Eastbound approach: (S. Rockfield Drive) one shared left/through/right-turn lane, stop-controlled

Westbound Approach: (Emsley Drive) one shared left/through/right-turn lane, stop-controlled

17) Shipley Road & Pierson Drive

Type of Control: Two-way stop-control (three-leg)

Northbound Approach: (Shipley Road) shared through/left-turn lane

Southbound approach: (Shipley Road) shared through/right-turn lane

Eastbound approach: (Pierson Drive) one shared left/right-turn lane, stop-controlled

18) Shipley Road & Heathwood Drive

Type of Control: Two-way stop-control (three-leg)

Northbound Approach: (Shipley Road) shared through/right-turn lane

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

Westbound approach: (Heathwood Drive) shared left/right-turn lane, stop-controlled

19) Shipley Road & Lori Lane

Type of Control: Two-way stop-control (four-leg)

Northbound Approach: (Shipley Road) shared through/left/right-turn lane

Southbound approach: (Shipley Road) shared through/left/right-turn lane

Eastbound Approach: (Pheasant Run Drive) one shared left/through/right-turn lane, stop-controlled

Westbound approach: (Lori Lane) one shared left/through/right-turn lane, stop-controlled

20) Naamans Road & Shipley Road

Type of control: Signalized four-leg intersection

Northbound approach: (Shipley Rd) two left-turn lanes and one channelized right-turn lane with yield-control

Southbound approach: (Brandywine Town Center driveway) two-left turn lanes and one channelized right-turn lane with yield-control

Eastbound approach: (Naamans Road) two through lanes, one U-turn lane and one right-turn lane

Westbound approach: (Naamans Road) two through lanes, one left-turn lane and one right-turn lane

21) Naamans Road & Grubb Road

Type of control: Signalized three-leg intersection

Northbound approach: (Grubb Road) one left-turn lane and one channelized right-turn lane with yield-control

Eastbound Approach: (Naamans Road) two through lanes and one right-turn lane

Westbound Approach: (Naamans Road) two through lanes and one left-turn lane

22) Naamans Road & Ebright Road

Type of Control: Signalized thee-leg intersection

Southbound approach: (Ebright Road) one left-turn lane and one channelized right-turn lane with yield-control

Eastbound approach: (Naamans Rd) two through lanes and two left-turn lanes

Westbound approach: (Naamans Rd) two through lanes, one left-turn lane and one right-turn lane

23) Silverside Road & Shipley Road

Type of Control: signalized four-leg intersection

Northbound approach: (Shipley Road) one left-turn lane, one through lane and one right-turn lane

Southbound approach: (Shipley Road) one left-turn lane, one through lane and one right-turn lane

Eastbound approach: (Silverside Road) one left-turn lane, one through lane and one right-turn lane

Westbound approach: (Silverside Road) one left-turn lane, one through lane and one right-turn lane

Safety Evaluation

Crash Data: Crash data from May 2013 to May 2016 was obtained for all studied intersections on the US 202 and Shipley Road corridors, and the Naamans Road & Shipley Road intersection. DelDOT's Hazard Elimination Program (HEP) for 2011 Site CC provides additional crash data for the Naamans Road intersections.

- A total of 204 crashes occurred at the US 202 corridor intersections during the study period. 61 of the 202 crashes occurred at the US 202, Garden of Eden Road & Silverside Road intersection.

Focusing on the proposed site access on US 202, a total of 25 crashes (12% of crashes on the corridor) occurred at the US 202 & Righter Parkway intersection. The data indicates that the most common types of crashes were rear-end crashes (64%). Most crashes at the intersection occurred during daylight (48%), and when surface conditions were dry (58%). Driver inattention (36%) is the leading cause of crashes at the intersection, followed by following to close (12%). Remaining crashes were caused by a variety of driver actions. Two crashes at the intersection lead to injury; no fatalities were recorded.

- A total of 45 crashes occurred at the Shipley Road corridor intersections during the study period. Almost all, 33 of the 45, occurred at the Shipley Road & Naamans Road

intersection (discussed with the Naamans Road corridor). The proposed site access intersection, Shipley Road & Drexel Drive, saw only one crash during the study period. This was a rear-end crash during daylight, on a dry roadway due to driver inattention, leading to an injury. The alternate site access intersection, Shipley Road & Summerset Drive, had zero crashes during the study period.

- A total of 33 crashes occurred on the Naamans Road corridor according to the TIS report crash analysis data. All crashes occurred at the intersection of Naamans Road & Shipley Road.
 - During the three year TIS crash study period the most common crash type is rear-end crashes (55%). Crashes typically occurred during daylight hours (48%). Road conditions were dry in 76% of crashes at the intersection. The leading cause of crashes at the intersection was driver inattention (21%), following too close contributed the second most (18%). Only 4 crashes (12%) resulted in injury, no fatalities were noted.
- Zero crashes were noted for the Naamans Road & Grubb Road or the Naamans Road & Ebright Road intersections in the TIS crash data analysis for the years 2013 to 2016. According to the data in the 2011 HEP Site CC Task I Report, a total of 106 crashes occurred on the Naamans Road corridor at the three TIS intersections (Naamans Road & Shipley Road, Naamans Road & Grubb Road, Naamans Road & Ebright Road). The study period for this report is the three years from January 2007 to December 2009
 - 33 crashes were recorded in the TIS analysis data for the intersection of Naamans Road & Shipley Road (2013 to 2016). Details are found in the proceeding Naamans Road corridor discussion. According to the 2011 HEP Site CC report, a total of 49 crashes occurred to the intersection during the 2007 to 2009 study period. The most common crash type was rear-end (65%). A total of 16 injury crashes occurred at the intersection, with no fatalities reported. Time of day and roadway conditions for the specific intersection were not noted in the report.
 - According to the 2011 HEP Site CC report, 29 crashes occurred at the Naamans Road & Grubb Road intersection during the three-year study period (2007 to 2009). The most common crash type was rear-end (72%). A total of 6 injury crashes occurred at the intersection, with no fatalities noted. Time of day and roadway conditions for the specific intersection were not noted in the report.
 - According to the 2011 HEP Site CC report, 28 crashes occurred at the Naamans Road & Ebright Road intersection during the three-year study period (2007 to 2009). The most common crash type was rear-end (75%). A total of 2 injury crashes occurred at the intersection, with no fatalities reported. Time of day and roadway conditions for the specific intersection were not noted in the report.

Sight Distance: For the proposed site driveway at the existing US 202 & Righter Parkway intersection all approaches are generally flat to slightly rolling terrain on US 202, and there are few potential visual obstructions. For the proposed site entrance of Shipley Road & Drexel Drive, all approaches are generally flat with few potential visual obstructions. Sight distance is largely adequate in the vicinity of the proposed site entrances and no major problems were observed during field observations in these areas. There are also a hill on US 202 near the

Rocky Run Parkway that limits sight distance to some extent, but it does not appear that mitigation is appropriate or feasible as part of this project.

Transit, Pedestrian, and Bicycle Facilities

Existing transit service: DART, a service of the Delaware Transit Corporation (DTC) operates three bus routes in the project area. DART Route 2 serves US 202, and has stops on northbound and southbound US 202 just south of Righter Parkway / proposed Site Entrance A. DART Route 35 serves US 202, Silverside Road and Shipley Road, and has stops on Shipley Road in the vicinity of proposed Site Entrance B. DART Route 61 serves US 202 and Naamans Road.

Planned transit service: DTC is considering changes for the US Route 202 corridor, including a more commuter-oriented transit service with limited stops and shorter travel times between certain employment centers and the City of Wilmington.

Existing bicycle and pedestrian facilities: According to DelDOT's New Castle County Bicycle Map (dated 2011), US 202, Naamans Road, Shipley Road, and Silverside Road are all high traffic roadways (over 10,000 vehicles daily). Naamans Road is designated as a Regional Bicycle Route, and Shipley Road and Silverside Road are Connector Bicycle Routes. Shipley Road has designated bicycle lanes in both the northbound and southbound sides of the road between Silverside Road and Naamans Road. Along US 202, there are shoulders but these are often interrupted by turn lanes and acceleration lanes with no bike lanes striped through them. According to the bicycle level of service (BLOS) calculator developed by the League of Illinois Bicyclists, the Shipley Road corridor operates at BLOS B.

Sidewalks are present on both sides of the road for the vast majority of the US 202, Shipley Road, and Naamans Street corridors within the study area. Marked pedestrian crossings exist at the vast majority of the signaled intersections in the study area, and there are also crosswalks at the unsignalized intersection of Shipley Road and Summerset Road.

Planned bicycle and pedestrian facilities: The TIS indicates that DelDOT was contacted but no response was received regarding planned or requested bicycle and pedestrian facilities in the area of this proposed development. The proposed development site plan shows a walking path running parallel to the boulevard connecting US 202 and Shipley Road through the site. The TIS anticipates that the interconnecting boulevard will serve as a low vehicle volume connection that will enhance the existing bicycle/pedestrian network.

Previous Comments

All comments from DelDOT's Scoping Letter, Traffic Count Review, Preliminary TIS (PTIS) Review, travel demand model analysis and other correspondence appear to have been addressed in the Final TIS submission.

General Analysis Comments

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

- 1) For all intersections, the TIS and McCormick Taylor applied heavy vehicle factors (HV) by movement using existing data. The TIS generally assumed future HV to be the same as existing HV or 3%, whichever was greater. McCormick Taylor generally assumed future HV to be the same as existing HV. Both the TIS and McCormick Taylor assumed 3% HV for future movements to and from the proposed site access point on Shipley Road.
- 2) For existing conditions, the TIS and McCormick Taylor determined, for each intersection, overall intersection peak hour factors (PHF) based on the provided traffic count data. For future conditions, the TIS and McCormick Taylor generally assumed existing PHF for all intersections.
- 3) For analyses of the signalized intersections, the TIS and McCormick Taylor used a base saturation flow rate of 1,900 pcphpl.
- 4) The 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 our field-measured lane widths.
- 5) The TIS and McCormick Taylor used different signal timings when analyzing the signalized intersections in some cases.
- 6) HCM analysis results used except where noted. Due to the complexity of some signalized intersections and the use of split phasing at some signalized intersections, HCM results could not always be generated.

Table 3
Peak Hour Levels of Service (LOS)
based on Traffic Impact Study for Brandywine Country Club Development
Report Dated August 2016
Prepared by Becker Morgan Group, Inc.

Signalized Intersection ¹	LOS per TIS ²		LOS per McCormick Taylor ²	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
US 202 & Rocky Run Parkway & Widener University Driveway				
<i>2016 Existing (Case 1)</i>	A (6.5)	C (26.4)	A (8.2)	B (10.4)
<i>2026 without Development (Case 2)</i>	B (17.2)	B (16.8)	B (16.0)	B (14.3)
<i>2026 with Development (Case 3)</i>	B (17.2)	B (16.3)	B (15.8)	B (11.8)

¹ The numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

² LOS results per Synchro methodology; HCM 2010 does not support split phasing.

Table 4
Peak Hour Levels of Service (LOS)
based on Traffic Impact Study for Brandywine Country Club Development
Report Dated August 2016
Prepared by Becker Morgan Group, Inc.

Signalized Intersection ³	LOS per TIS ⁴		LOS per McCormick Taylor ⁴	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
US 202 & Righter Parkway & Concord Square Driveway (Proposed Site Entrance A)				
<i>2016 Existing (Case 1)</i>	B (12.6)	C (29.8)	B (16.5)	C (30.0)
<i>2026 without Development (Case 2)</i>	A (6.0)	C (23.6)	A (7.4)	C (32.0)
<i>2026 with Development (Case 3)</i>	A (9.5)	C (24.7)	B (10.2)	D (53.6)

³ The numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

⁴ LOS results per Synchro methodology; HCM 2010 does not support split phasing.

Table 5
Peak Hour Levels of Service (LOS)
based on Traffic Impact Study for Brandywine Country Club Development
Report Dated August 2016
Prepared by Becker Morgan Group, Inc.

Signalized Intersection ⁵	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
SB US 202 & NB US 202 U-turn Crossover				
<i>2016 Existing (Case 1)</i>	B (17.5)	B (17.6)	B (16.5)	C (25.9)
<i>2026 without Development (Case 2)</i>	B (15.9)	B (19.8)	B (10.1)	C (34.8)
<i>2026 with Development (Case 3)</i>	B (15.2)	B (19.4)	B (10.4)	B (12.9)

⁵ The numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

Table 6
Peak Hour Levels of Service (LOS)
based on Traffic Impact Study for Brandywine Country Club Development
Report Dated August 2016
Prepared by Becker Morgan Group, Inc.

Signalized Intersection ⁶	LOS per TIS ⁷		LOS per McCormick Taylor ⁷	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
US 202 & Garden of Eden Road & Silverside Road WB Left-Turn ⁸				
<i>2016 Existing (Case 1)</i>	C (22.1)	B (16.3)	B (18.0)	C (30.2)
<i>2026 without Development (Case 2)</i>	B (14.7)	C (24.3)	B (19.7)	B (20.0)
<i>2026 with Development (Case 3)</i>	B (14.4)	C (24.4)	B (18.7)	B (14.7)

Signalized Intersection ⁶	LOS per TIS ⁷		LOS per McCormick Taylor ⁷	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
NB US 202 & Silverside Road ⁸				
<i>2016 Existing (Case 1)</i>	C (20.4)	C (27.7)	C (21.3)	C (28.2)
<i>2026 without Development (Case 2)</i>	C (20.7)	C (31.2)	C (24.9)	C (32.6)
<i>2026 with Development (Case 3)</i>	C (20.4)	C (31.6)	C (24.2)	C (34.0)

⁶ The numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

⁷ LOS results per Synchro methodology; HCM 2010 does not support clustered intersections.

⁸ Per DelDOT signal plan, intersection is operated by one controller. For analysis purposes the intersection was modeled as two clustered intersections in Synchro. Results shown for specified “sub”-intersections for information only.

Table 7
Peak Hour Levels of Service (LOS)
based on Traffic Impact Study for Brandywine Country Club Development
Report Dated August 2016
Prepared by Becker Morgan Group, Inc.

Signalized Intersection ⁹	LOS per TIS ¹⁰		LOS per McCormick Taylor ¹⁰	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
US 202, Garden of Eden Road & Silverside Road ¹¹				
<i>2016 Existing (Case 1)</i>	C (21.2)	B (18.1)	B (19.7)	C (29.0)
<i>2026 without Development (Case 2)</i>	B (17.7)	C (28.4)	C (22.3)	C (27.6)
<i>2026 with Development (Case 3)</i>	B (17.3)	C (28.7)	C (21.4)	C (23.9)

⁹ The numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

¹⁰ Averaged LOS results per Synchro methodology; HCM 2010 does not support clustered intersections.

¹¹ Averaged results for the clustered intersections; to be considered results for the US 202 & Garden of Eden Road & Silverside Road intersection proper.

Table 8
Peak Hour Levels of Service (LOS)
based on Traffic Impact Study for Brandywine Country Club Development
Report Dated August 2016
Prepared by Becker Morgan Group, Inc.

Signalized Intersection ¹²	LOS per TIS ¹³		LOS per McCormick Taylor ¹³	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
US 202 & Brandywine Boulevard ¹⁴				
<i>2016 Existing (Case 1)</i>	A (3.2)	A (6.3)	A (3.9)	A (5.1)
<i>2026 without Development (Case 2)</i>	A (2.9)	A (5.1)	A (2.4)	A (5.0)
<i>2026 with Development (Case 3)</i>	A (2.9)	A (5.0)	A (4.5)	A (5.0)

¹² The numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

¹³ Averaged LOS results per Synchro methodology, HCM 2010 does not support clustered intersections.

¹⁴ Averaged results for the clustered intersections, to be considered results for the US 202 & Brandywine Boulevard intersection. Per DelDOT signal plan intersection is operated by one controller with two points of intersection. For analysis purposes the intersection was modeled as two clustered intersections in Synchro.

Table 9
Peak Hour Levels of Service (LOS)
based on Traffic Impact Study for Brandywine Country Club Development
Report Dated August 2016
Prepared by Becker Morgan Group, Inc.

Signalized Intersection ¹⁵	LOS per TIS ¹⁶		LOS per McCormick Taylor ¹⁶	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
US 202 & Mount Lebanon Road ¹⁷				
<i>2016 Existing (Case 1)</i>	B (13.8)	B (15.2)	C (16.3)	C (21.7)
<i>2026 without Development (Case 2)</i>	B (14.1)	B (18.7)	B (14.2)	B (19.0)
<i>2026 with Development (Case 3)</i>	B (13.9)	B (20.0)	B (12.5)	B (19.2)

¹⁵ The numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

¹⁶ Averaged LOS results per Synchro methodology, HCM 2010 does not support clustered intersections.

¹⁷ Averaged results for the clustered intersections, to be considered results for the US 202 & Mt Lebanon Road intersection. Per DelDOT signal plan intersection is operated by one controller with two points of intersection. For analysis purposes the intersection was modeled as two clustered intersections in Synchro.

Table 10
Peak Hour Levels of Service (LOS)
based on Traffic Impact Study for Brandywine Country Club Development
Report Dated August 2016
Prepared by Becker Morgan Group, Inc.

Signalized Intersection ¹⁸	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Naamans Road & Shipley Road & Brandywine Town Center Driveway				
<i>2016 Existing (Case 1)</i>	C (22.9)	C (22.6)	B (10.9)	A (6.8)
<i>2026 without Development (Case 2)</i>	C (21.6)	C (25.9)	A (7.6)	A (8.7)
<i>2026 with Development (Case 3)</i>	C (22.5)	C (29.3)	B (14.8)	A (8.6)

¹⁸ The numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

Table 11
Peak Hour Levels of Service (LOS)
based on Traffic Impact Study for Brandywine Country Club Development
Report Dated August 2016
Prepared by Becker Morgan Group, Inc.

Signalized Intersection ¹⁹	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Naamans Road & Grubb Road				
<i>2016 Existing (Case 1)</i>	B (15.8)	A (8.6)	A (6.5)	B (17.5)
<i>2026 without Development (Case 2)</i>	B (17.8)	B (16.0)	B (16.0)	B (14.4)
<i>2026 with Development (Case 3)</i>	B (17.8)	B (16.1)	B (15.2)	C (21.2)

¹⁹ The numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

Table 12
Peak Hour Levels of Service (LOS)
based on Traffic Impact Study for Brandywine Country Club Development
Report Dated August 2016
Prepared by Becker Morgan Group, Inc.

Signalized Intersection ²⁰	LOS per TIS ²¹		LOS per McCormick Taylor ²¹	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Naamans Road & Ebright Road				
<i>2016 Existing (Case 1)</i>	C (28.9)	C (22.4)	C (20.9)	B (13.0)
<i>2026 without Development (Case 2)</i>	B (19.8)	C (23.4)	C (23.1)	B (14.1)
<i>2026 with Development (Case 3)</i>	C (20.2)	C (23.7)	C (24.0)	B (16.1)

²⁰ The numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

²¹ Results per Synchro methodology; HCM 2010 does not support pedestrian hold phases.

Table 13
Peak Hour Levels of Service (LOS)
based on Traffic Impact Study for Brandywine Country Club Development
Report Dated August 2016
Prepared by Becker Morgan Group, Inc.

Signalized Intersection ²²	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Shipley Road & Silverside Road				
<i>2016 Existing (Case 1)</i>	C (25.2)	C (23.0)	C (27.4)	C (28.1)
<i>2026 without Development (Case 2)</i>	C (26.3)	C (29.0)	C (28.3)	C (32.3)
<i>2026 with Development (Case 3)</i>	C (26.8)	C (29.7)	C (28.5)	C (31.0)

²² The numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

Table 14
Peak Hour Levels of Service (LOS)
based on Traffic Impact Study for Brandywine Country Club Development
Report Dated August 2016
Prepared by Becker Morgan Group, Inc.

Unsignalized Intersection ²³ Two-Way Stop Control	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Woodlawn Road & Rocky Run Parkway				
<i>2016 Existing (Case 1)</i>				
Northbound Rocky Run Road	A (9.8)	A (9.3)	A (9.8)	A (9.3)
Southbound Rocky Run Road	A (9.6)	A (9.2)	A (9.6)	A (9.2)
Eastbound Woodlawn Road - Left	A (7.5)	A (7.2)	A (7.5)	A (7.2)
Westbound Woodlawn Road - Left	A (7.4)	A (7.3)	A (7.4)	A (7.3)
<i>2026 without Development (Case 2)</i>				
Northbound Rocky Run Road	B (10.8)	A (9.3)	B (12.6)	A (9.4)
Southbound Rocky Run Road	B (11.3)	A (9.3)	B (11.3)	A (9.4)
Eastbound Woodlawn Road - Left	A (7.8)	A (7.2)	A (7.8)	A (7.2)
Westbound Woodlawn Road - Left	A (7.7)	A (7.3)	A (7.7)	A (7.3)
<i>2026 with Development (Case 3)</i>				
Northbound Rocky Run Road	B (10.8)	A (9.3)	B (12.6)	A (9.4)
Southbound Rocky Run Road	B (11.3)	A (9.3)	B (11.3)	A (9.4)
Eastbound Woodlawn Road - Left	A (7.8)	A (7.2)	A (7.8)	A (97.2)
Westbound Woodlawn Road - Left	A (7.7)	A (7.3)	A (7.7)	A (7.3)

²³ The numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

Table 15
Peak Hour Levels of Service (LOS)
based on Traffic Impact Study for Brandywine Country Club Development
Report Dated August 2016
Prepared by Becker Morgan Group, Inc.

Unsignalized Intersection ²⁴ Two-Way Stop Control (T-intersection)	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
US 202 & Woodlawn Road				
<i>2016 Existing (Case 1)</i>				
Eastbound Woodlawn Road - Right	D (25.0)	C (23.4)	D (25.0)	C (24.1)
<i>2026 without Development (Case 2)</i>				
Eastbound Woodlawn Road - Right	D (33.6)	D (32.0)	E (35.1)	D (32.6)
<i>2026 with Development (Case 3)</i>				
Eastbound Woodlawn Road - Right	D (33.6)	D (32.2)	E (35.1)	D (32.8)

²⁴ The numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

Table 16
Peak Hour Levels of Service (LOS)
based on Traffic Impact Study for Brandywine Country Club Development
Report Dated August 2016
Prepared by Becker Morgan Group, Inc.

Unsignalized Intersection ²⁵ Two-Way Stop Control (T-intersection)	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM ²⁶	Weekday PM	Weekday AM ²⁶	Weekday PM
US 202 & Widener University RIRO Driveway				
<i>2016 Existing (Case 1)</i>				
Westbound Widener University RIRO - Right	A (0.0)	D (25.9)	A (0.0)	D (26.6)
<i>2026 without Development (Case 2)</i>				
Westbound Widener University RIRO - Right	A (0.0)	D (32.0)	A (0.0)	D (33.4)
<i>2026 with Development (Case 3)</i>				
Westbound Widener University RIRO - Right	A (0.0)	D (32.7)	A (0.0)	D (32.9)

²⁵ The numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

²⁶ This movement has zero delay in this scenario because there is zero volume on the westbound approach.

Table 17
Peak Hour Levels of Service (LOS)
based on Traffic Impact Study for Brandywine Country Club Development
Report Dated August 2016
Prepared by Becker Morgan Group, Inc.

Unsignalized Intersection ²⁷ Two-Way Stop Control (T-intersection)	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
US 202 & Passmore Road				
<i>2016 Existing (Case 1)</i>				
Eastbound Passmore Road - Right	D (26.3)	D (30.8)	D (26.4)	D (26.6)
<i>2026 without Development (Case 2)</i>				
Eastbound Passmore Road - Right	D (31.4)	E (46.4)	D (32.9)	E (45.1)
<i>2026 with Development (Case 3)</i>				
Eastbound Passmore Road - Right	D (33.0)	E (47.8)	D (34.8)	E (46.9)

²⁷ The numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

Table 18
Peak Hour Levels of Service (LOS)
based on Traffic Impact Study for Brandywine Country Club Development
Report Dated August 2016
Prepared by Becker Morgan 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
ShIPLEY Road & N. Rockfield Drive				
<i>2016 Existing (Case 1)</i>				
Northbound Shipley Road - Left	A (8.0)	A (8.4)	A (8.0)	A (8.4)
Eastbound N. Rockfield Drive	B (12.0)	C (16.2)	B (12.4)	C (17.4)
<i>2026 without Development (Case 2)</i>				
Northbound Shipley Road - Left	A (8.0)	A (8.5)	A (8.0)	A (8.4)
Eastbound N. Rockfield Drive	B (12.2)	C (17.2)	B (12.7)	C (18.4)
<i>2026 with Development (Case 3)</i>				
Northbound Shipley Road - Left	A (8.1)	A (8.7)	A (8.1)	A (8.7)
Eastbound N. Rockfield Drive	B (13.8)	C (17.5)	B (13.4)	C (18.7)

²⁸ The numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

Table 19
Peak Hour Levels of Service (LOS)
based on Traffic Impact Study for Brandywine Country Club Development
Report Dated August 2016
Prepared by Becker Morgan Group, Inc.

Unsignalized Intersection ²⁹ Two-Way Stop Control	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Shipleigh Road & S. Rockfield Drive & Emsley Drive				
<i>2016 Existing (Case 1)</i>				
Northbound Shipleigh Road - Left	A (7.9)	A (8.2)	A (7.9)	A (8.3)
Southbound Shipleigh Road - Left	A (0.0)	A (8.4)	A (0.0)	A (8.4)
Eastbound S. Rockfield Drive	B (13.0)	C (16.3)	B (13.5)	C (18.3)
Westbound Emsley Drive	B (14.3)	A (0.0)	B (13.6)	A (0.0)
<i>2026 without Development (Case 2)</i>				
Northbound Shipleigh Road - Left	A (8.0)	A (8.4)	A (7.9)	A (8.4)
Southbound Shipleigh Road - Left	A (0.0)	A (8.5)	A (0.0)	A (8.5)
Eastbound S. Rockfield Drive	B (13.5)	C (18.2)	B (13.9)	C (19.5)
Westbound Emsley Drive	B (14.9)	A (0.0)	B (14.1)	A (0.0)
<i>2026 with Development (Case 3)</i>				
Northbound Shipleigh Road - Left	A (8.0)	A (8.5)	A (8.0)	A (8.5)
Southbound Shipleigh Road - Left	A (0.0)	A (8.8)	A (0.0)	A (8.7)
Eastbound S. Rockfield Drive	B (13.9)	C (15.9)	B (14.5)	C (16.8)
Westbound Emsley Drive	C (16.4)	A (0.0)	C (15.3)	A (0.0)

²⁹ The numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

Table 20
Peak Hour Levels of Service (LOS)
based on Traffic Impact Study for Brandywine Country Club Development
Report Dated August 2016
Prepared by Becker Morgan 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
Shipley Road & Morningside Drive				
<i>2016 Existing (Case 1)</i>				
Northbound Shipley Road - Left	A (8.0)	A (8.2)	A (8.0)	A (8.2)
Eastbound Morningside Drive	B (10.4)	B (12.4)	B (10.4)	B (12.4)
<i>2026 without Development (Case 2)</i>				
Northbound Shipley Road - Left	A (8.1)	A (8.3)	A (8.0)	A (8.2)
Eastbound Morningside Drive	B (10.6)	B (12.7)	B (10.4)	B (12.7)
<i>2026 with Development (Case 3)</i>				
Northbound Shipley Road - Left	A (8.2)	A (8.6)	A (8.1)	A (8.5)
Eastbound Morningside Drive	B (10.9)	B (14.3)	B (10.8)	B (14.2)

³⁰ The numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

Table 21
Peak Hour Levels of Service (LOS)
based on Traffic Impact Study for Brandywine Country Club Development
Report Dated August 2016
Prepared by Becker Morgan Group, Inc.

Unsignalized Intersection ³¹ Two-Way Stop Control (T-intersection)	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Shipleigh Road & Summerset Road & Site Entrance B (Case 3B)				
<i>2016 Existing (Case 1)</i>				
Southbound Shipleigh Road - Left	A (8.0)	A (8.7)	A (8.0)	A (8.7)
Westbound Summerset Road	B (14.4)	C (15.9)	C (16.2)	C (18.0)
<i>2026 without Development (Case 2)</i>				
Southbound Shipleigh Road - Left	A (8.1)	A (8.8)	A (8.1)	A (8.7)
Westbound Summerset Road	C (15.0)	C (18.7)	C (16.9)	C (19.1)
<i>2026 with Development (Case 3A)</i>				
Southbound Shipleigh Road - Left	A (8.3)	A (9.1)	A (8.3)	A (9.0)
Westbound Summerset Road	C (16.9)	C (19.6)	C (19.6)	C (23.1)
<i>2026 with Development (Case 3B)</i>				
Northbound Shipleigh Road – Left	A (8.3)	A (8.8)	A (8.3)	A (8.8)
Southbound Shipleigh Road – Left	A (8.1)	A (8.8)	A (8.0)	A (8.7)
Eastbound Site Entrance	C (23.1)	F (56.6)	C (22.9)	F (57.9) ³²
Westbound Summerset Road	C (20.6)	D (25.0)	C (24.1)	D (30.7)
<i>2026 with Development (Case 3B) With Improvement Option 1 ³³</i>				
Northbound Shipleigh Road – Left	N/A	N/A	A (8.2)	A (8.8)
Southbound Shipleigh Road – Left	N/A	N/A	A (8.0)	A (8.7)
Eastbound Site Entrance	N/A	N/A	C (19.0)	E (40.1) ³⁴
Westbound Summerset Road	N/A	N/A	C (23.4)	D (30.7)

³¹ The numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

³² The 95th percentile queue length for the eastbound approach is less than 4 vehicles during the Case 3B PM peak hour.

³³ Improvement Option 1 consists of adding a separate left-turn lane on the eastbound Site Entrance approach, a separate left-turn lane on the northbound approach and a separate right-turn lane on the southbound approach.

³⁴ The 95th percentile queue length for the eastbound approach is less than 3 vehicles during the Case 3B PM peak hour with Improvement Option 1.

Table 22
Peak Hour Levels of Service (LOS)
based on Traffic Impact Study for Brandywine Country Club Development
Report Dated August 2016
Prepared by Becker Morgan Group, Inc.

Unsignalized Intersection ³⁵ Two-Way Stop Control	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Shipley Road & Drexel Drive & Site Entrance B (Case 3A)				
<i>2016 Existing (Case 1)</i>				
Southbound Shipley Road - Left	A (8.0)	A (8.6)	A (8.0)	A (8.6)
Westbound Drexel Drive	B (12.5)	C (15.1)	B (11.9)	C (17.0)
<i>2026 without Development (Case 2)</i>				
Southbound Shipley Road - Left	A (8.1)	A (8.7)	A (8.0)	A (8.6)
Westbound Drexel Drive	B (12.9)	C (20.7)	B (12.2)	C (17.9)
<i>2026 with Development (Case 3A)</i>				
Northbound Shipley Road – Left	A (8.4)	A (8.8)	A (8.4)	A (8.8)
Southbound Shipley Road – Left	A (8.1)	A (8.7)	A (8.0)	A (8.7)
Eastbound Site Entrance B	C (23.9)	E (49.2)	C (23.3)	E (49.2) ³⁶
Westbound Drexel Drive	B (14.3)	D (26.7)	B (14.1)	D (28.7)
<i>2026 with Development (Case 3A) With Improvement Option 1³⁷</i>				
Northbound Shipley Road – Left	N/A	N/A	A (8.3)	A (8.5)
Southbound Shipley Road – Left	N/A	N/A	A (8.0)	A (8.7)
Eastbound Site Entrance B	N/A	N/A	C (19.2)	E (35.4) ³⁸
Westbound Drexel Drive	N/A	N/A	B (13.9)	D (26.3)
<i>2026 with Development (Case 3B)</i>				
Southbound Shipley Road - Left	A (8.1)	A (8.9)	A (8.1)	A (8.8)
Westbound Drexel Drive	B (12.8)	C (19.9)	B (12.7)	C (19.6)

³⁵ The numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

³⁶ The 95th percentile queue length for the eastbound approach is less than 4 vehicles during the Case 3A PM peak hour.

³⁷ Improvement Option 1 consists of adding a separate left-turn lane on the eastbound Site Entrance approach, a separate left-turn lane on the northbound approach and a separate right-turn lane on the southbound approach.

³⁸ The 95th percentile queue length for the eastbound approach is approximately 2 vehicles during the Case 3A PM peak hour with Improvement Option 1.

Table 23
Peak Hour Levels of Service (LOS)
based on Traffic Impact Study for Brandywine Country Club Development
Report Dated August 2016
Prepared by Becker Morgan Group, Inc.

Unsignalized Intersection ³⁹ Two-Way Stop Control (T-intersection)	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
ShIPLEY Road & PIERSON Drive				
<i>2016 Existing (Case 1)</i>				
Northbound Shipley Road - Left	A (8.4)	A (8.3)	A (8.4)	A (8.3)
Eastbound Pierson Drive	B (13.2)	B (14.6)	B (14.4)	C (16.4)
<i>2026 without Development (Case 2)</i>				
Northbound Shipley Road - Left	A (8.5)	A (8.4)	A (8.5)	A (8.4)
Eastbound Pierson Drive	B (13.7)	C (16.7)	B (14.9)	C (17.3)
<i>2026 with Development (Case 3)</i>				
Northbound Shipley Road - Left	A (8.7)	A (8.5)	A (8.7)	A (8.5)
Eastbound Pierson Drive	C (15.2)	C (18.4)	C (16.9)	C (21.8)

³⁹ The numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

Table 24
Peak Hour Levels of Service (LOS)
based on Traffic Impact Study for Brandywine Country Club Development
Report Dated August 2016
Prepared by Becker Morgan Group, Inc.

Unsignalized Intersection ⁴⁰ Two-Way Stop Control (T-intersection)	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Shipley Road & Heathwood Drive				
<i>2016 Existing (Case 1)</i>				
Southbound Shipley Road - Left	A (7.9)	A (8.7)	A (7.9)	A (8.7)
Westbound Heathwood Road	B (14.1)	C (17.0)	B (14.1)	C (17.0)
<i>2026 without Development (Case 2)</i>				
Southbound Shipley Road - Left	A (8.0)	A (8.8)	A (8.0)	A (8.8)
Westbound Heathwood Road	B (14.7)	C (18.1)	B (14.6)	C (17.9)
<i>2026 with Development (Case 3)</i>				
Southbound Shipley Road - Left	A (8.0)	A (9.0)	A (8.0)	A (8.9)
Westbound Heathwood Road	B (14.7)	C (17.4)	B (14.6)	C (17.2)

⁴⁰ The numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

Table 25
Peak Hour Levels of Service (LOS)
based on Traffic Impact Study for Brandywine Country Club Development
Report Dated August 2016
Prepared by Becker Morgan Group, Inc.

Unsignalized Intersection ⁴¹ Two-Way Stop Control	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Shipleigh Road & Lori Lane & Pheasant Run Drive				
<i>2016 Existing (Case 1)</i>				
Northbound Shipleigh Road - Left	A (8.3)	A (8.3)	A (8.3)	A (8.3)
Southbound Shipleigh Road - Left	A (7.9)	A (8.7)	A (7.9)	A (8.7)
Eastbound Pheasant Run Drive	B (13.1)	C (16.7)	B (13.1)	C (16.7)
Westbound Lori Lane	C (16.8)	C (21.2)	C (16.8)	C (21.2)
<i>2026 without Development (Case 2)</i>				
Northbound Shipleigh Road - Left	A (8.4)	A (8.4)	A (8.4)	A (8.4)
Southbound Shipleigh Road - Left	A (8.0)	A (8.9)	A (7.9)	A (8.8)
Eastbound Pheasant Run Drive	C (17.8)	C (17.8)	B (13.6)	C (17.6)
Westbound Lori Lane	B (13.6)	C (22.9)	C (17.6)	C (22.7)
<i>2026 with Development (Case 3)</i>				
Northbound Shipleigh Road - Left	A (8.6)	A (8.5)	A (8.5)	A (8.4)
Southbound Shipleigh Road - Left	A (8.0)	A (9.0)	A (8.0)	A (9.0)
Eastbound Pheasant Run Drive	B (14.3)	C (18.7)	B (14.1)	C (18.5)
Westbound Lori Lane	C (18.9)	C (24.5)	C (18.6)	C (24.3)

⁴¹ The numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.