



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

NICOLE MAJESKI
SECRETARY

September 27, 2023
Revised: December 26, 2023

D.J. Hughes, P.E.
Davis Bowen & Friedel, Inc.
1 Park Avenue
Milford, DE 19963

Dear Mr. D.J. Hughes:

The enclosed Traffic Impact Study (TIS) review letter for the proposed **Brittingham** (Tax Parcel: 235-8.00-39.00) multi-use 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 letter and concurs with the recommendations. This letter has been revised to provide clarification in Items 2 and 4 of the recommendations. If you have any questions concerning this letter or the enclosed review letter, please contact me at Annamaria.Furmato@delaware.gov.

Sincerely,

Annamaria Furmato
TIS Group Project Engineer

AF:km

Enclosures

cc with enclosures: Joel Sens, Stafford Street Capital, LLC
Ring Lardner, Davis, Bowen & Friedel, Inc.
David L. Edgell, Office of State Planning Coordination
Jamie Whitehouse, Sussex County Planning & Zoning
Ms. Joanne Arellano, Johnson, Mirmiran & Thompson, Inc.
Mr. Mir Wahed, Johnson, Mirmiran & Thompson, Inc.
DelDOT Distribution

DelDOT Distribution

Brad Eaby, Deputy Attorney General
Shanté Hastings, Deputy Secretary / Director of Transportation Solutions (DOTS)
Mark Luszcz, Deputy Director, DelDOT Traffic, DOTS
Michael Simmons, Assistant Director, Project Development South, DOTS
Peter Haag, Chief Traffic Engineer, DelDOT Traffic, DOTS
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Derek Sapp, Sussex County Subdivision Reviewer, Development Coordination, Planning
Sireen Muhtaseb, TIS Group Manager, Development Coordination, Planning
Anthony Aglio, Planning Supervisor, Statewide & Regional Planning, Planning
Jennifer Cinelli, Transportation Planner, Statewide & Regional Planning



Revised December 21, 2023
September 19, 2023

Ms. Annamaria Furrato
Project Engineer
Delaware Department of Transportation
Development Coordination, Division of Planning
800 Bay Road
Dover, DE 19901

RE: Agreement No. 1945F
Project Number T202069012
Traffic Impact Study Services
Task 5-11A –Brittingham Property TIS

Dear Ms. Furrato:

Johnson, Mirmiran, and Thompson (JMT) has completed a review of the Traffic Impact Study (TIS) for the Brittingham Property development, which was prepared by Davis, Bowen & Friedel, Inc., dated May 2022 and the TIS Addendum which was prepared by Davis, Bowen & Friedel, Inc., dated December 2022. This review was assigned as Task Number 5-11A. The reports were prepared in a manner generally consistent with DelDOT's *Development Coordination Manual*. This letter has been revised to provide clarification on the maintenance of the proposed service road.

The TIS and the TIS Addendum evaluate the impacts of a proposed mixed-use development in Sussex County, Delaware. The site is located on the southwest corner of the intersection of Delaware Route 1 and Delaware Route 16. The proposed development would consist of a 265,000 square foot water park (indoor/outdoor with hotel and convention center), a 150,000 square foot shopping center, and a 5,600 square foot super convenience store with gas pumps.

The subject property is on an approximately 115.617-acre parcel that is currently zoned as AR-1 (Agricultural Residential). At the time of the DelDOT scoping meeting, the Developer was planning to rezone the entire parcel to C-4 (Planned Commercial). Subsequently, per a Preliminary Traffic Analysis (PTA) request to DelDOT, the developer requested to rezone a 64.855 acre portion of the parcel to C-3 (which includes the shopping center and convenience store with gas pumps). Construction for the development is anticipated to be completed in 2028.

Two full access points are proposed: one full access on Delaware Route 16 via a proposed roundabout off the future southbound Delaware Route 1 Ramps (Ramp C) and another access via the proposed Service Road intersection with the Delaware Route 1 directional ramps. Per the December 17, 2020 Scoping Meeting Memorandum by DelDOT, three future build scenarios were requested to be evaluated:

- Case 3a – Access on Delaware Route 16 via Delaware Route 1 Southbound Ramp C (proposed roundabout) and on Delaware Route 1 via Service Road directional ramps.



- Case 3b – Access on Delaware Route 16 via Delaware Route 1 Southbound Ramp C (proposed roundabout) and on Delaware Route 1 via Service Road diverge-only ramp (off-ramp from Delaware Route 1 to Service Road).
- Case 3c – Access only on Delaware Route 16 via Delaware Route 1 Southbound Ramp C (proposed roundabout).

The TIS Addendum was conducted to determine the appropriate lane configurations and control type for the intersection of the Delaware Route 1 directional ramps and the Service Road. The analysis was requested to consider a two-way stop-controlled intersection as well as a roundabout, and to evaluate if the queue along the off-ramp would impact operations along southbound Delaware Route 1.

DelDOT has several relevant and ongoing improvement projects within the study area including the *Corridor Capacity Preservation Program (CCPP)*, which aims to maintain the regional importance and preserve the intended function and capacity of existing designated transportation routes within the Program. The main objectives of the program are listed below:

- Prevent the need to build an entirely new road
- Minimize the transportation impacts of increased economic growth
- Maintain an existing road's ability to handle traffic efficiently and safely
- Preserve the ability to make future improvements
- Sort local and through traffic

Delaware Route 1 is one of the highways included in the CCPP. More information regarding the CCPP can be found at https://deldot.gov/Programs/corr_cap/index.shtml.

Through the *HEP SC, SR 1 and SR 16 Grade Separated Intersection* project (DelDOT Contract No. T201500301), the existing Delaware Route 1 and Delaware Route 16 signalized intersection will be replaced with a grade-separated intersection. The project was nominated by the 2013 Hazard Elimination Program (HEP) stating that the grade separation is necessary to improve safety and reduce the number of crashes at the intersection. The project impacts the proposed development directly as Delaware Route 1 and Delaware Route 16 are both access roads to the Brittingham Property. The project has been awarded to a contractor and is expected to be complete in the summer of 2025. More information about the project can be found at <https://deldot.gov/projects/index.shtml?dc=details&projectNumber=T201500301>.

The *SR 1 at S264 & S258 Intersection Improvements* project (DelDOT Contract No. T201904302) proposes to implement safety and operational improvements at the Delaware Route 1 intersections with Hudson Road/Steamboat Landing Road (Sussex Road 258) and Eagle Crest Road/Oyster Rocks Road (Sussex Road 264). Left turn and through movements from the Hudson Road and Steamboat Landing Road approaches would be eliminated. Through movements from Eagle Crest Road and Oyster Rocks Road would be eliminated, and the lengths of acceleration lanes for the left turn movements from Eagle Crest Road and Oyster Rocks Road onto Delaware Route 1 would be increased. The project is in the planning and design phase. Construction is currently planned to occur after the Grade Separated Intersection of Delaware Route 1 and Delaware Route 16 is open. More information about the project can be found at



<https://deldot.gov/projects/index.shtml?dc=details&projectNumber=T201904302>.

The *SRI and Cave Neck Road Grade Separated Intersection* project (DelDOT Contract No. T201912201) includes the construction of a grade separated intersection to separate through movements along Delaware Route 1 and turning movements to and from Cave Neck Road. In accordance with the CCPP, the project would preserve traffic capacity and safety along the Delaware Route 1 corridor. The project would improve safety at the unsignalized intersection of Delaware Route 1 and Cave Neck Road while simultaneously improving mobility and access for local traffic. The project is in the planning and design phase. The construction phase is expected to begin in 2025 and end in 2026. More information about the project can be found at <https://deldot.gov/projects/index.shtml?dc=details&projectNumber=T201912201>.

There is one pavement and rehabilitation project along Delaware Route 16 from US Route 113 to its terminus east of Delaware Route 1 (DelDOT Contract No. T202206301). Design is underway and construction is planned to start in the Fall of 2023.

Based on our review of the traffic impact study and the addendum, we have the following comments and recommendations:

The following intersections exhibit level of service (LOS) deficiencies without the implementation of physical roadway and/or traffic control improvements. Additionally, the table below does not include any signalized intersections that exhibit LOS deficiencies that can be mitigated with signal timing optimization as the development would not be recommended to implement any additional improvements at those intersections.

Intersection	LOS Deficiencies Occur			Case
	AM	PM	SAT	
Delaware Route 16/Delaware Route 1 Southbound Ramps C & D	X	X	X	Case 3a – 2028 with Development
	X	X	X	Case 3b – 2028 with Development
	X	X	X	Case 3c – 2028 with Development
Delaware Route 16/Delaware Route 1 Northbound Ramps A & B	X	X	X	Case 3 – 2028 with Development
Delaware Route 16/Zion Church Road (Sussex Road 235)			X	Case 2 – 2028 without Development
	X		X	Case 3 – 2028 with Development
Service Road/Delaware Route 1 Directional Ramps			X	Case 3 – 2028 with Development



Delaware Route 16 / Delaware Route 1 Southbound Ramps C & D

The Delaware Route 16 and Delaware Route 1 Southbound Ramps C & D intersection is proposed to be an unsignalized intersection constructed as part of the *HEP SC, SR 1 and SR 16 Grade Separated Intersection* project (DelDOT Contract No. T201500301). As part of the project, the intersection would be constructed to provide one through lane and one right turn lane along the eastbound Delaware Route 16 approach, one left turn lane and one through lane along the westbound Delaware Route 16 approach, and one shared left turn/through lane and one right turn lane along the southbound Delaware Route 1 Southbound Ramp D approach. The Delaware Route 1 Southbound Ramp C approach would provide one receiving lane that would merge with Southbound Delaware Route 1. The proposed unsignalized intersection would operate at acceptable LOS under future conditions without the proposed development (Case 2).

The proposed development would include a Service Road, to be constructed parallel to Delaware Route 1, primarily to provide access to the development and potentially to parcels between the site and the Broadkill River. The Service Road would intersect Delaware Route 16 at the location where the Delaware Route 1 Southbound Ramp C is proposed to intersect as part of the *HEP SC, SR 1 and SR 16 Grade Separated Intersection* project (DelDOT Contract No. T201500301). As such, the Delaware Route 1 Southbound Ramp C would be relocated to intersect the Service Road approximately 450 feet south of Delaware Route 16. The proposed northbound Service Road approach to Delaware Route 16 would provide one left turn lane and one right turn lane. With these modifications, the unsignalized intersection would exhibit LOS deficiencies under future conditions with the proposed development (Case 3a, 3b, and 3c). These deficiencies would occur along the northbound Service Road approach and the Southbound Delaware Route 1 Ramp D approach. Specifically, during the weekday AM peak hour under Case 3c conditions, the northbound Service Road approach would exhibit 418.5 seconds of delay per vehicle with a projected 95th percentile queue length of approximately 375 feet. Additionally, during the weekday PM and Summer Saturday peak hours under Case 3c conditions, the Southbound Delaware Route 1 Ramp D approach would exhibit over 1,000 seconds of delay per vehicle.

The deficiencies at the Delaware Route 16 and Delaware Route 1 Southbound Ramps C & D/Service Road intersection could be mitigated with the installation of a traffic signal or roundabout. Based on the results from the March 17, 2023 Signal Justification Study conducted by JMT, under Case 3A conditions the intersection would meet the Delaware Manual on Uniform Traffic Control Devices (DEMUTCD) warrants for the installation of a traffic signal. The warrants would be met with the construction of any component of the proposed development (water park, convenience store, or retail space). As such, it is recommended that the developer install a traffic signal at the Delaware Route 16 and Delaware Route 1 Southbound Ramps C & D /Service Road intersection.

Based on the Case 3a results during the Summer Saturday peak hour, the projected 95th percentile queue along the westbound Delaware Route 16 left turn onto Delaware Route 1 Southbound Ramps C & D/Service Road would be approximately 335 feet and the projected 95th percentile queue along the eastbound Delaware Route 16 left turn onto Delaware Route 1 Northbound Ramps A & B would be approximately 180 feet. As back-to-back left turn lanes are proposed as part of the *HEP SC, SR 1 and SR 16 Grade Separated Intersection* project, the projected 95th percentile



queue lengths for the left turn lanes would not be accommodated within the approximately 390 feet distance between the two intersections.

The design plans for the *HEP SC, SR 1 and SR 16 Grade Separated Intersection* project depicts approximately 60 feet of width along Delaware Route 16 under the overpass between the intersections with Ramps C & D and Ramps A & B. Within that area, the design plans depict a three-lane roadway. However, the approximately 60 feet of available width allows the provision of an additional lane. As such, it is recommended that the section of Delaware Route 16 between Ramps C & D and Ramps A & B be restriped to a four-lane roadway and provide one through lane and one left turn lane in the westbound direction towards Ramps C & D and one left turn lane and one through lane in the eastbound direction toward Ramps A & B. With this provision, the projected queue lengths under Case 3a conditions for the left turning movements from Delaware Route 16 onto Ramps C & D and A & B could be accommodated. The conceptual layout within attached Figure 1 on page 12 depicts the recommended layout.

The projected delays and queues could be further reduced along Delaware Route 16 at the Ramps C & D/Service Road intersection with the modification of the ramp approaches to provide separate left turn lanes and concurrent protected and permissive phasing. With split phase operation along the northbound Service Road and Delaware Route 1 Southbound Ramp D approaches, the projected 95th percentile queue length along the northbound Service Road approach would be approximately 500 feet during the Summer Saturday peak hour under Case 3a conditions and would spillback onto the proposed Service Road/Ramp C/Site Entrance roundabout. However, with protected and permitted phasing, the calculated 95th percentile queue length along the northbound Service Road approach would reduce to be approximately 220 feet under Case 3a Summer Saturday peak hour conditions and would not impact operations at the proposed roundabout. As such, it is recommended that the northbound and southbound approaches be modified to provide exclusive left turn lanes and provide protected and permitted left turn phasing.

Delaware Route 16 / Delaware Route 1 Northbound Ramps A & B

The Delaware Route 16 and Delaware Route 1 Northbound Ramps A & B intersection is proposed to be an unsignalized intersection constructed as part of the *HEP SC, SR 1 and SR 16 Grade Separated Intersection* project (DelDOT Contract No. T201500301). As part of the project, the intersection would be constructed to provide one left turn lane and one through lane along the eastbound Delaware Route 16 approach, one shared through/right turn lane along the westbound Delaware Route 16 approach, and one shared left turn/through lane and one right turn lane along the northbound Delaware Route 1 Northbound Ramp A approach. The Delaware Route 1 Northbound Ramp B approach would provide one receiving lane that would merge onto Northbound Delaware Route 1. The proposed unsignalized intersection would operate at acceptable LOS under future conditions without the proposed development (Case 2).

With the construction of the proposed development, the unsignalized intersection would exhibit LOS deficiencies under future conditions with the proposed development (Case 3). These deficiencies would occur along the northbound Delaware Route 1 Ramp A approach. Specifically, during the Summer Saturday peak hour under Case 3 conditions, the northbound Delaware Route 1 Ramp A approach would exhibit over 1,000 seconds of delay per vehicle.



The deficiencies at the Delaware Route 16 and Delaware Route 1 Northbound Ramps A & B intersection could be mitigated with the installation of a traffic signal or roundabout. Based on the results from the March 17, 2023 Signal Justification Study conducted by JMT, under Case 3A conditions the intersection would meet the DEMUTCD warrants for the installation of a traffic signal. The warrants would be met with the construction of any component of the proposed development (water park, convenience store, or retail space). As such, it is recommended that the developer install a traffic signal at the Delaware Route 16 and Delaware Route 1 Northbound Ramps A & B intersection.

Delaware Route 16 / Zion Church Road

The unsignalized Delaware Route 16 and Zion Church Road intersection exhibits LOS deficiencies along the southbound Zion Church Road approach during the Summer Saturday peak hour under future conditions without the proposed development (Case 2) and during weekday AM and Summer Saturday peak hours under future conditions with the proposed development (Case 3). During the Summer Saturday peak hour under Case 3 conditions, the southbound Zion Church Road approach would operate at LOS F with a delay of 632.0 seconds per vehicle and a calculated 95th percentile queue length of approximately 475 feet.

The deficiencies at the Delaware Route 16 and Zion Church Road intersection could be mitigated with the installation of a traffic signal or roundabout. Based on the results from the March 17, 2023 Signal Justification Study conducted by JMT, under Cases 2 and 3A conditions the installation of a traffic signal would meet the DEMUTCD warrants for the installation of a traffic signal. As the warrants for a traffic signal are met with and without the proposed development, it is not recommended that the developer be responsible to install the traffic signal. However, it is recommended that the developer contribute to the Traffic Signal Revolving Fund.

Delaware Route 1 Service Road Directional Ramps / Service Road

As part of the TIS Addendum dated December 2022, an analysis of the Delaware Route 1 Service Road directional ramps intersection with the Service Road was conducted to determine the appropriate lane configurations and control type. The TIS Addendum modeled the intersection as a two-way stop-controlled intersection and as an all-way stop-controlled intersection. The two-way stop-controlled scenario includes separate turn lanes along each approach with the westbound Delaware Route 1 Service Road directional ramp approach being stop-controlled and the northbound and southbound Service Road approaches being free-flowing. Under these conditions, the intersection would exhibit LOS deficiencies during the Summer Saturday peak hour. The deficiencies would occur along the westbound Delaware Route 1 Service Road directional ramp approach with a delay of 47.0 seconds per vehicle and a projected 95th percentile queue length of approximately 200 feet.

The LOS deficiencies at the intersection could be mitigated by the provision of an all-way stop-controlled intersection or a single lane roundabout. Based on the results from the March 17, 2023 All-Way Stop Control Study conducted by JMT, under Case 3A conditions the intersection would meet the DEMUTCD volume warrants for all-way stop control.

With the provision of an all-way stop-controlled intersection with one through lane and one right turn lane along the northbound Service Road approach, one left turn lane and one through lane



along the southbound Service Road approach, and one left turn lane and one right turn lane along the westbound Delaware Route 1 Service Road directional ramp approach, the intersection would operate at LOS C (16.8 seconds of delay per vehicle) and the projected 95th percentile queue length along the westbound Delaware Route 1 Service Road directional ramp approach would be reduced to approximately 85 feet. The projected queue is not anticipated to impact operations along Delaware Route 1. As such, it is recommended that the developer construct the Delaware Route 1 Service Road Directional Ramps and Service Road intersection to be all-way stop control.

Per the December 17, 2020 Scoping Meeting Memorandum, the Delaware Route 1 study intersections with Deep Branch Road (Sussex Road 234), Hudson Road/Steamboat Landing Road (Sussex Road 258), Hudson Road/Eagles Crest Road/Oyster Rocks Road (Sussex Road 264), and Cave Neck Road (Sussex Road 88) were not required to be analyzed due to the improvement projects planned in DelDOT's Capital Transportation Program. The proposed DelDOT projects that would impact the Delaware Route 1 intersections with Deep Branch Road (Sussex Road 234), Hudson Road/Steamboat Landing Road (Sussex Road 258), and Hudson Road/Eagles Crest Road/Oyster Rocks Road (Sussex Road 264) aim to improve safety and operations at the intersections but would not increase capacity. Additionally, the *SR1 and Cave Neck Road Grade Separated Intersection* project (DelDOT Contract No. T201912201) would convert the Delaware Route 1 and Cave Neck Road intersection to a grade-separated intersection and eliminate any capacity constraints at the existing intersection. However, per the scoping meeting memorandum, the developer would not be required to contribute towards the *SR 1 and Cave Neck Road Grade Separated Intersection* project since the improvements would primarily increase capacity along Delaware Route 1. As such, it is not recommended that the developer contribute to those projects.

Additionally, DelDOT requested three future build scenarios be evaluated as part of the TIS:

- Case 3a – Access on Delaware Route 16 via Delaware Route 1 Southbound Ramp C (proposed roundabout) and on Delaware Route 1 via Service Road directional ramps.
- Case 3b – Access on Delaware Route 16 via Delaware Route 1 Southbound Ramp C (proposed roundabout) and on Delaware Route 1 via Service Road diverge-only ramp (off-ramp from Delaware Route 1 to Service Road).
- Case 3c – Access only on Delaware Route 16 via Delaware Route 1 Southbound Ramp C (proposed roundabout).

For the three build scenarios, the Delaware Route 16 and Delaware Route 1 Southbound Ramps C & D/Service Road intersection as a roundabout would operate at acceptable LOS under Cases 3a and 3b but would exhibit LOS deficiencies under Case 3c conditions. Specifically, under Case 3c conditions, the roundabout would operate at LOS E (44.4 seconds of delay per vehicle).

Cases 3a and 3b would have different volumes at the proposed roundabout at the Delaware Route 1 Southbound Ramp (Ramp C) intersection with the Service Road. Between Cases 3a and 3b, the proposed roundabout would operate at acceptable LOS but there would be increases in delay and queue lengths under Case 3b.

Should Sussex County 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. The following items should be implemented at the same time as site construction once all agency approvals and permits are secured and completed in accordance with DeIDOT’s Standards and Specifications.

1. The developer shall improve Delaware Route 1 and Delaware Route 16 within the limits of their frontage to meet DeIDOT’s standards for their Functional Classification as found in Section 1.1 of the *Development Coordination Manual* and elsewhere therein. The improvements shall include both directions of travel, regardless of whether the developer’s lands are on one or both sides of the road. Frontage is defined in Section 1 of the *Development Coordination Manual*, which states “This length includes the length of roadway perpendicular to lines created by the projection of the outside parcel corners to the roadway.” The developer should coordinate with DeIDOT’s Development Coordination Section during the site plan review to determine the improvements.
2. The developer should construct a Service Road between Delaware Route 16 and the southerly limits of the proposed development. The exact location and design of the Service Road should be coordinated with DeIDOT for consistency with the proposed improvements as part of the *HEP SC, SR 1 and SR 16 Grade Separated Intersection* project (DeIDOT Contract No. T201500301). The Service Road is to be dedicated to public use and shall be State maintained; the appropriate right-of-way/permanent easements should be dedicated to DeIDOT and should be designed/constructed to State standards.
3. The developer should construct a full access for the proposed Brittingham Property development along the proposed Service Road, approximately 450 feet south of the intersection with Delaware Route 16. The intersection should be a dual-lane roundabout consistent with the lane configurations shown in the table below.

Approach	Current Configuration	Proposed Configuration
Eastbound Site Entrance	Approach does not exist	One shared left turn/through/right turn lane
Westbound Ramp C*	Approach does not exist	One receiving lane
Northbound Service Road	Approach does not exist	One through lane and one shared through/right turn lane
Southbound Service Road	Approach does not exist	One left turn lane and one through lane

*Westbound Ramp C is on the eastern leg of the intersection

The developer should submit a plan to DeIDOT’s Development Coordination and other pertinent sections depicting the roundabout design. The final design of the roundabout should be determined during the Entrance Plan review process.



- The developer should construct an off-ramp and on-ramp along Delaware Route 1, to State standards and for State maintenance, approximately 2,000 feet south of Delaware Route 16 connecting to the service road via an access road to be consistent with the lane configurations shown in the table below:

Approach	Current Configuration	Proposed Configuration
Eastbound Delaware Route 1 On Ramp	Approach does not exist	One on ramp
Southbound Delaware Route 1	Two through lanes	Two through lanes and one off ramp

The off-ramp and on-ramp should be designed per freeway standards for the radii, deceleration, and acceleration lengths. The developer should coordinate with DeIDOT on the location and design of the off-ramp and on-ramp.

- The developer should construct the Service Road intersection with the Delaware Route 1 Service Road directional ramps to be all-way stop-control and be consistent with the lane configurations shown in the table below:

Approach	Current Configuration	Proposed Configuration
Westbound Delaware Route 1 Service Road Directional Ramp	Approach does not exist	One left turn lane and one channelized right turn lane
Northbound Service Road	Approach does not exist	One through lane and one channelized right turn lane
Southbound Service Road	Approach does not exist	One left turn lane and one through lane

The developer should coordinate with DeIDOT on the design during the site plan review process.

- The developer should install a traffic signal at the Delaware Route 16 and Delaware Route 1 Northbound Ramps A & B intersection and extend the eastbound left turn lane. The intersection should be consistent with the lane configurations shown on the conceptual layout within attached Figure 1 on page 12. The recommended minimum storage length (excluding taper) for the eastbound Delaware Route 16 left turn lane is 180 feet. The projected queue lengths from the HCS analysis can be accommodated within the recommended storage length.
- The developer should enter into a traffic signal agreement with DeIDOT for the intersection of Delaware Route 16 and Delaware Route 1 Northbound Ramps A & B. The developer should coordinate with DeIDOT Subdivision Section to execute the traffic signal agreement.



8. The developer should install a traffic signal at the Delaware Route 16 and Delaware Route 1 Southbound Ramps C & D/Service Road intersection. The intersection should be consistent with the lane configurations shown on the conceptual layout within attached Figure 1 on page 12 and in the table below:

Approach	Current Configuration*	Proposed Configuration
Eastbound Delaware Route 16	One through lane and one right turn lane**	No change
Westbound Delaware Route 16	One left turn lane and one through lane	No change
Northbound Service Road	Approach does not exist	One left turn lane and one right turn lane
Southbound Delaware Route 1 Ramp D	One shared left turn/through/right turn lane	One left turn lane and one shared through/right turn lane

*The current lane configurations refer to the lane configurations proposed as part of the *HEP SC, SR 1 and SR 16 Grade Separated Intersection* project (DelDOT Contract No. T201500301).

**As part of the proposed configuration, the eastbound Delaware Route 16 right turn lane onto the Service Road should be constructed as a free-flow right turn lane with a lane add continued into the proposed site entrance roundabout

Based on the queue results from the HCS analysis, the recommended minimum storage length (excluding taper) for the westbound left turn lane is 310 feet. The storage length of the eastbound channelized right turn lane of approximately 350 feet proposed as part of the DelDOT project should be maintained. The signal design should incorporate protected and permissive concurrent phasing for the northbound Service Road and the Delaware Route 1 Southbound Ramp D left turning movements.

9. The developer should enter into a traffic signal agreement with DelDOT for the intersection of Delaware Route 16 and Delaware Route 1 Southbound Ramps C & D/Service Road. The developer should coordinate with DelDOT Subdivision Section to execute the traffic signal agreement.
10. The developer should enter into an agreement with DelDOT to contribute to the Traffic Signal Revolving Fund (TSRF) for a future traffic signal at the Delaware Route 16 and Zion Church Road intersection. The TSRF contribution is \$104,705.
11. Consistent with recommendations from the *Corridor Capacity Preservation Program (CCPP)*, the developer should close along Delaware Route 1 the third median south of the Delaware Route 16 intersection, which is at the southernmost site frontage limits. The developer should submit a plan to DelDOT Development Coordination Section depicting the design of the median closure.
12. The following bicycle, pedestrian, and transit improvements should be included:



- a. A minimum of fifteen-foot wide permanent easement from the edge of the right-of-way should be dedicated to DelDOT along the Delaware Route 1 and Delaware Route 16 site frontages. The developer should construct a ten-foot wide shared-use path (SUP) with an angled termination into the shoulder where the shoulder/bike lane is at least five feet wide. The SUP should be designed to meet current AASHTO and ADA standards. A minimum five-foot setback should be maintained from the edge of the pavement to the SUP. If feasible, the SUP should be placed behind utility poles and street trees should be provided within the buffer area. The developer should coordinate with DelDOT's Development Coordination Section during the plan review process to identify the exact location of the SUP.
- b. An internal connection should be provided from the proposed SUP to all parcels.
- c. Where internal sidewalks are located alongside of parking spaces, a buffer, physical barrier or signage should be added to eliminate vehicular overhand onto the sidewalk.
- d. Internal bicycle racks should be provided.
- e. Utility covers should be moved outside of any designated bicycle lanes and any proposed sidewalks/SUP or should be flush with the pavement.

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 Plan Review process.

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 https://www.deldot.gov/Publications/manuals/de_mutcd/index.shtml.

Additional details on our review of the TIS are attached. Please contact me at (302) 266-9600 if you have any questions concerning this review.

Sincerely,
Johnson, Mirmiran, and Thompson, Inc.

A handwritten signature in black ink, appearing to read 'Joanne M. Arellano'.

Joanne M. Arellano, P.E., PTOE

cc: Mir Wahed, P.E., PTOE
Janna Brown, P.E.

Enclosure

General Information

Report date: May 2022

Prepared by: Davis, Bowen & Friedel, Inc.

Prepared for: Stafford Street Capital, LLC

Tax Parcels: 235-8.00-39.00

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

Project Description and Background

Description: Stafford Street Capital, LLC seeks to develop a 265,000 square-foot water park (indoor / outdoor with hotel and convention center), a 150,000 square-foot shopping center, and a 5,600 square-foot super convenience store with gas pumps.

Location: The site is located on the southwest corner of Delaware Route 1 (Coastal Highway/Sussex Road 014) and Delaware Route 16 (Beach Highway/Sussex Road 016).

Amount of Land to be developed: An approximately 115.617-acre parcels.

Land Use approval(s) needed: Entrance Plan, Rezoning

Proposed completion date: 2028.

Proposed access locations: Two access points are proposed: one full access on Delaware Route 16 via the proposed roundabout off the future southbound Delaware Route 1 Ramps (Ramp C) and another access on Delaware Route 1 via the proposed Service Road directional ramps.

Daily Traffic Volumes:

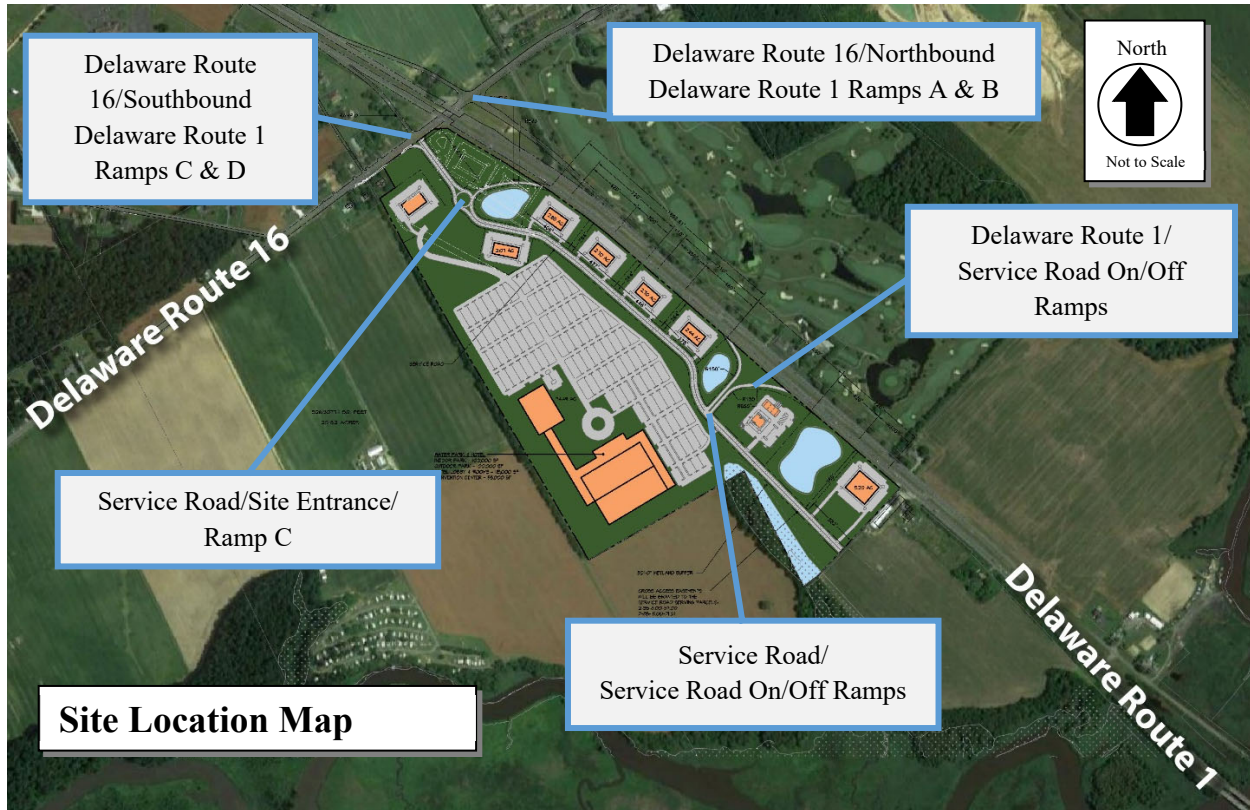
- 2019 Average Annual Daily Traffic on Southbound Delaware Route 1: 19,457

*AADT is sourced from ATR data provided by TIS Report. Data taken from seven full days starting 8/11/2019.

- 2019 Average Annual Daily Traffic on Delaware Route 16: 9662

*AADT is sourced from ATR data provided by TIS Report. Data taken from seven full days starting 8/16/2019.

Site Map



**Graphic is an approximation based on the MOU Exhibit A plan prepared by Davis, Bowen Friedel, Inc. dated March 16, 2021.*

Relevant and On-going Projects

DelDOT has several relevant and ongoing improvement projects within the study area including the *Corridor Capacity Preservation Program (CCPP)*, which aims to maintain the regional importance and preserve the intended function and capacity of existing designated transportation routes within the Program. The main objectives of the program are listed below:

- Prevent the need to build an entirely new road
- Minimize the transportation impacts of increased economic growth
- Maintain an existing road's ability to handle traffic efficiently and safely
- Preserve the ability to make future improvements
- Sort local and through traffic

Delaware Route 1 is one of the highways included in the CCPP. More information regarding the CCPP can be found at https://deldot.gov/Programs/corr_cap/index.shtml.

Through the *HEP SC, SR 1 and SR 16 Grade Separated Intersection* project (DelDOT Contract No. T201500301), the existing Delaware Route 1 and Delaware Route 16 signalized intersection will be replaced with a grade-separated intersection. The project was nominated by the 2013 Hazard Elimination Program (HEP) stating that the grade separation is necessary to improve safety

and reduce the number of crashes at the intersection. The project impacts the proposed development directly as Delaware Route 1 and Delaware Route 16 are both access roads to the Brittingham Property. The project has been awarded to a contractor and is expected to be complete in the summer of 2025. More information about the project can be found at <https://deldot.gov/projects/index.shtml?dc=details&projectNumber=T201500301>.

The *SR 1 at S264 & S258 Intersection Improvements* project (DelDOT Contract No. T201904302) proposes to implement safety and operational improvements at the Delaware Route 1 intersections with Hudson Road/Steamboat Landing Road (Sussex Road 258) and Eagle Crest Road/Oyster Rocks Road (Sussex Road 264). Left turn and through movements from the Hudson Road and Steamboat Landing Road approaches would be eliminated. Through movements from Eagle Crest Road and Oyster Rocks Road would be eliminated, and the lengths of acceleration lanes for the left turn movements from Eagle Crest Road and Oyster Rocks Road onto Delaware Route 1 would be increased. The project is in the planning and design phase. Construction is currently planned to occur after the Grade Separated Intersection of Delaware Route 1 and Delaware Route 16 is open. More information about the project can be found at <https://deldot.gov/projects/index.shtml?dc=details&projectNumber=T201904302>.

The *SRI and Cave Neck Road Grade Separated Intersection* project (DelDOT Contract No. T201912201) includes the construction of a grade separated intersection to separate through movements along Delaware Route 1 and turning movements to and from Cave Neck Road. In accordance with the CCPP, the project would preserve traffic capacity and safety along the Delaware Route 1 corridor. The project would improve safety at the unsignalized intersection of Delaware Route 1 and Cave Neck Road while simultaneously improving mobility and access for local traffic. The project is in the planning and design phase. The construction phase is expected to begin in 2025 and end in 2026. More information about the project can be found at <https://deldot.gov/projects/index.shtml?dc=details&projectNumber=T201912201>.

There is one pavement and rehabilitation project along Delaware Route 16 from US Route 113 to its terminus east of Delaware Route 1 (DelDOT Contract No. T202206301). Design is underway and construction is planned to start in the Fall of 2023.

Livable Delaware

(Source: Delaware Strategies for State Policies and Spending, 2020)

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

The proposed development is located within Investment Level 3.

Investment Level 3

Investment Level 3 Areas generally fall into two categories. The first category covers lands that are in the long-term growth plans of counties or municipalities where development is not necessary to accommodate expected population growth during a five-year planning period (or longer). In these instances, development in Investment Level 3 may be least appropriate for new growth and development in the near term. The second category includes lands that are adjacent to or

intermingled with fast-growing areas within counties or municipalities that are otherwise categorized as Investment Levels 1 or 2. Environmentally sensitive features, agricultural-preservation issues, or other infrastructure issues most often impact these lands. In these instances, development and growth may be appropriate in the near term, but the resources on the site and in the surrounding area should be carefully considered and accommodated by state agencies and local government with land-use authority. Investment Level 3 is further characterized by areas with new development separated from existing development by a substantial amount of vacant land that is not contiguous with existing infrastructure, areas that are experiencing some development pressure, areas with existing but disconnected development, and possible lack of adequate infrastructure.

The state will consider investing in infrastructure within Investment Level 3 Areas once the Investment Level 1 and 2 Areas are substantially built out, or when the infrastructure or facilities are logical extensions of existing systems and deemed appropriate to serve a particular area. The priorities in the Level 3 Areas are for DelDOT to focus on regional movements between towns and other population centers. DelDOT also supports the development and implementation of Transportation Improvement Districts in Investment Level 3 areas. Local roadway improvements will be made by developers and property owners as development occurs. Lower priority is given to transportation system–capacity improvements and transit-system enhancements.

Proposed Development’s Compatibility with Livable Delaware:

The proposed site is located in Investment Level 3. Investment 3 areas typically discourage new development in the near term for areas where it is not necessary to accommodate expected population growth. The second category of Investment 3, however, includes land that is adjacent to fast-growing areas within areas that are categorized at Investment Levels 1 or 2. Development in these areas may be appropriate if the resources on and near the site are carefully considered and accommodated. Furthermore, visitor-industry development may be appropriate in Investment Level 3 areas as it would provide employment opportunities and produce additional income. As the proposed use is a water park with a shopping center and convenience store, the proposed development is consistent with the 2020 update of the Livable Delaware “Strategies for State Policies and Spending.”

Comprehensive Plan

(Source: Sussex County 2019 Comprehensive Plan)

Sussex County Comprehensive Plan:

Per the *Sussex County Comprehensive Plan Existing Land Use Map*, the proposed development appears is zoned as Agricultural & Undeveloped Lands. Per the *Sussex County Comprehensive Plan 2045 Future Land Use Map*, the proposed development is in an area designated as a Developing Area Growth Area.

Proposed Development’s Compatibility with the Sussex County Comprehensive Plan:

The *Sussex County Comprehensive Plan* states that in selected areas and at appropriate intersections within the Developing Area Growth Areas, commercial uses should be allowed. Also, most of the proposed Developing Areas are adjacent to municipalities. The proposed land for this

project is located at an intersection that is southwest and southeast to two towns. Therefore, the proposed development is generally consistent with the *Sussex County Comprehensive Plan*.

Trip Generation

The trip generation for the proposed development was determined by using the comparable land use and rates/equations contained in the *Trip Generation, 10th Edition: An ITE Informational Report*, published by the Institute of Transportation Engineers (ITE) for ITE Land Use Codes 480 (Water Park), LUC 820 (Shopping Center), and LUC 960 (Super Convenience Market with Gas Pumps). Trip generation was reviewed by DelDOT as part of the Preliminary TIS (PTIS) submission.

Table 1a
Brittingham Property Trip Generation

	ADT	Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday Midday Peak Hour		
		In	Out	Total	In	Out	Total	In	Out	Total
Water Park	5,088	59	177	236	321	188	509	512	437	949
Shopping Center	7,921	141	86	227	352	382	734	444	409	853
Conv. Market	4,690	252	253	505	194	194	388	191	191	382
Total Trips	17,699	452	516	968	867	764	1,631	1,147	1,037	2,184
Int. Capture - Total	1,185	0	0	0	45	45	90	49	49	98
External Trips	16,514	452	516	968	822	719	1,541	1,098	988	2,086
Pass-by	3,385	192	192	384	261	261	522	246	246	492
New Trips	13,129	260	324	584	561	458	1,019	852	742	1,594

*Table 1a depicts the trip generation utilized for the TIS Report, which is what the analysis results and recommendations contained within this letter are based on.

Table 1b
Brittingham Property Trip Generation – C-3 Rezoning

	ADT	Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday Midday Peak Hour		
		In	Out	Total	In	Out	Total	In	Out	Total
Shopping Center	7,921	141	86	227	352	382	734	444	409	853
Conv. Market	4,690	252	253	505	194	194	388	191	191	382
Total Trips	12,611	393	339	732	546	576	1,122	635	600	1,235
Pass-by	3,622	192	192	384	272	272	544	256	256	512
New Trips	8,989	201	147	348	274	304	578	379	344	723

*Table 1b depicts the trip generation associated with the proposed C-3 Rezoning which takes into account the Shopping Center and Convenience Market with Gas Pumps uses. The water park is not included.

Overview of TIS

Intersections examined:

1. Delaware Route 16 / Delaware Route 1
 - a. Delaware Route 16 / Delaware Route 1 Southbound Ramps C & D
 - b. Delaware Route 1 Southbound Ramp (Ramp C) / Service Road
 - c. Delaware Route 16 / Delaware Route 1 Northbound Ramps A & B
 - d. Ramp B Merge onto Northbound Delaware Route 1
 - e. Ramp C Merge onto Southbound Delaware Route 1
2. Delaware Route 1 Weaving Segment
 - a. Ramp C Merge / Service Road off-ramp
3. Delaware Route 1 / Service Road Directional Ramps
4. Delaware Route 16 / Zion Church Road (Sussex Road 235)
5. Delaware Route 16 / Reynolds Road (Sussex Road 233)
6. Delaware Route 16 / Delaware Route 5 (Union Street)
7. Hudson Road (Sussex Road 258) / Eagle Crest Road (Sussex Road 264)

Conditions examined:

1. Case 1 – 2020 existing.
2. Case 2 – 2028 without development.

3. Case 3 – 2028 with development.
 - a. Access on Delaware Route 16 via Delaware Route 1 Southbound Ramp C (proposed roundabout) and on Delaware Route 1 via the Service Road directional ramps.
 - b. Access on Delaware Route 16 via Delaware Route 1 Southbound Ramp C (proposed roundabout) and on Delaware Route 1 via Service Road diverge-only ramp (off-ramp from Delaware Route 1 to Service Road).
 - c. Access only on Delaware Route 16 via Delaware Route 1 Southbound Ramp C (proposed roundabout).

Committed Developments considered:

1. Compass Point f.k.a. Sweetbriar Road Development (293 single-family detached houses)
2. Red Mill Pond South (177 single-family detached houses)
3. Woodfield Preserve f.k.a. Thompson Schell, LLC (256 single-family detached houses)
4. Woodfield Preserve Addition (36 single-family detached houses)
5. Sussex Consortium School (415-student elementary school)
6. Vincent Overlook (54 single-family detached houses)
7. Windstone (360 single-family detached houses)

Additional Developments considered:

1. Midway Auto Parts (15,000 square feet auto parts store)
2. Lockerman Property (255 single-family detached houses)

*The additional developments were not listed as committed developments in the December 17, 2020 DelDOT Scoping Meeting Memorandum, but the TIS has included these uses.

Intersection Descriptions

1. Delaware Route 16 / Delaware Route 1

Type of Control: Existing signalized intersection.

Eastbound Approach: (Delaware Route 16) Existing one shared left turn/ through lane and one channelized right turn lane.

Westbound Approach: (Delaware Route 16) Existing one shared left turn/ through lane and one channelized right turn lane.

Northbound Approach: (Delaware Route 1) Existing one left turn lane, two through lanes, and one channelized right turn lane.

Southbound Approach: (Delaware Route 1) Existing one left turn lane, two through lanes, and one channelized right turn lane.

1A. Delaware Route 16 / Delaware Route 1 Southbound Ramps C & D

Type of Control: Proposed two-way stop-controlled intersection.

Eastbound Approach: (Delaware Route 16) Proposed one shared through lane and one channelized right turn lane.

Westbound Approach: (Delaware Route 16) Proposed one left turn lane and one through lane.

Northbound Approach: (Delaware Route 1) Proposed one left turn lane and one right turn lane, stop-controlled

Southbound Approach: (Delaware Route 1) Proposed one shared left/through turn lane and one right turn lane, stop-controlled

*This intersection is being constructed as part of the *HEP SC, SR 1 and SR 16 Grade Separated Intersection* project (DelDOT Contract No. T201500301). Additionally, Brittingham Property is proposing to modify the Ramp C approach to be a Service Road that would provide access to the site and to southbound Delaware Route 1.

1B. Delaware Route 1 Southbound Ramp (Ramp C) / Service Road / Site Entrance

Type of Control: Proposed dual-lane roundabout.

Eastbound Approach: (Site Entrance) Proposed one shared left turn/through/right turn lane.

Northbound Approach: (Service Road) Proposed one through lane and one shared through/right turn lane.

Southbound Approach: (Service Road) Proposed one left turn lane and one shared through/right turn lane.

*This intersection is being constructed as part of the proposed Brittingham Property development.

**A receiving lane would be located on the easterly leg of the intersection to provide access onto southbound Delaware Route 1 (Ramp C).

1C. Delaware Route 16 / Delaware Route 1 Northbound Ramps A & B

Type of Control: Proposed two-way stop-controlled intersection.

Eastbound Approach: (Delaware Route 16) Proposed one left turn lane and one through lane.

Westbound Approach: (Delaware Route 16) Proposed one shared through/right turn lane.

Northbound Approach: (Delaware Route 1) Proposed one left turn lane and one channelized right turn lane, stop-controlled.

*This intersection is being constructed as part of the *HEP SC, SR 1 and SR 16 Grade Separated Intersection* project (DelDOT Contract No. T201500301).

1D. Ramp B Merge onto Northbound Delaware Route 1

Type of Control: Proposed freeway merge.

Westbound Approach: (Ramp B) Proposed one lane ramp.

Northbound Approach: Existing two through lanes.

*This intersection is being constructed as part of the *HEP SC, SR 1 and SR 16 Grade Separated Intersection* project (DelDOT Contract No. T201500301).

1E. Ramp C Merge onto Southbound Delaware Route 1

Type of Control: Proposed freeway merge.

Eastbound Approach: (Ramp C) Proposed one lane ramp.

Southbound Approach: Existing two through lanes.

*This intersection is being constructed as part of the *HEP SC, SR 1 and SR 16 Grade Separated Intersection* project (DelDOT Contract No. T201500301).

2. Delaware Route 1 Weaving Segment

Type of Control: Proposed freeway weaving segment.

Southbound Approach: (Delaware Route 1) Existing two through lanes and proposed off ramp.

* The off ramp would be constructed by Brittingham Property for the Service Road Directional Ramps.

3. Delaware Route 1/Service Road Directional Ramps

Type of Control: Proposed freeway merge/diverge.

Eastbound Approach: (Service Road Directional Ramps) Proposed one merge lane.

Southbound Approach: (Delaware Route 1) Existing two through lanes and proposed one diverge lane.

* The off ramp would be constructed by Brittingham Property for the Service Road Directional Ramps.

4. Delaware Route 16 / Zion Church Road (Sussex Road 235)

Type of Control: Existing Two-way stop-controlled intersection (T-intersection).

Eastbound Approach: (Delaware Route 16) Existing one shared left turn/ through lane.

Westbound Approach: (Delaware Route 16) Existing one shared right turn/through lane.

Southbound Approach: (Zion Church Road) Existing one shared left turn/ right turn lane, stop-controlled.

*A private entrance is located at the southerly leg of the intersection.

5. Delaware Route 16 / Reynolds Road (Sussex Road 233)

Type of Control: Existing Two-way stop-controlled intersection (T-intersection).

Eastbound Approach: (Delaware Route 16) Existing one shared left turn/ through lane.

Westbound Approach: (Delaware Route 16) Existing one shared right turn/through lane.

Southbound Approach: (Reynolds Road) Existing one shared left turn/right turn lane, stop-controlled.

6. Delaware Route 16 / Delaware Route 5

Type of Control: Existing signalized intersection.

Eastbound Approach: (Delaware Route 16) Existing one shared left turn/through/ right turn lane.

Westbound Approach: (Delaware Route 16) Existing one shared left turn/through/right turn lane.

Northbound Approach: (Delaware Route 5) Existing one shared left turn/through/right turn lane.

Southbound Approach: (Delaware Route 5) Existing one shared left turn/through/right turn lane.

7. Hudson Road (Sussex Road 258) / Eagle Crest Road (Sussex Road 264)

Type of Control: Existing Two-way stop-controlled intersection (T-intersection).

Westbound Approach: (Eagle Crest Road) Existing one shared left turn/right turn lane, stop-controlled.

Northbound Approach: (Hudson Road) Existing one shared through/right turn lane.

Southbound Approach: (Hudson Road) Existing one shared left turn/through lane.

Transit, Pedestrian, and Bicycle Facilities

Existing transit service: Per DelDOT Gateway, there are three DART Routes that run through the project area, 303, 305 and 307. DART Route 303 traverses along Delaware Route 16 through the study intersection of Delaware Route 5. Route 303 provides 8 round trips from 4:46 AM to 8:57 PM. DART Route 305 runs parallel to the study area along Delaware Route 1. Route 305 is a seasonal Bus Beach Service that provides 3 round trips from 8:00 AM to 10:01 PM on Saturdays, Sundays, and Holidays. DART Route 307 runs parallel to the study area along Delaware Route 1. Route 307 provides 5 round trips from 5:27 AM to 9:44 PM on weekdays.

Planned transit service: Per email correspondence on May 6, 2022, with Mr. Jared Kauffman, Planner for DART, the Delaware Transit Corporation does not have any transit specific comments for the project.

Existing bicycle and pedestrian facilities: According to DelDOT's Sussex County On-Road Bicycle Map, several study roadways are considered bicycle routes. Cave Neck Road is a statewide bicycle route. Delaware Route 16 and Delaware Route 5 south of Delaware Route 16 are regional bicycle routes. Hudson Road, Round Pole Bridge Road, and Delaware Route 5 north of Delaware Route 16 are connector bicycle routes. There is a signalized pedestrian crossing at the Delaware Route 16/Delaware Route 5 intersection.

Planned bicycle and pedestrian facilities: Per email correspondence dated June 15, 2022, from Mr. John Fiori, DelDOT's Bicycle Coordinator, and Ms. Linda Osiecki, DelDOT's Pedestrian Coordinator, the following improvements were recommended:

- Although it is unknown at this time if the Service Road will be state maintained or privately maintained, the comments below assume that the Service Road will be state maintained. Comments may need to be modified if determined otherwise.
- Per the DelDOT SUP/Sidewalk Policy a non-motorized facility is not required unless the total build-out site ADT is greater than 2,000-trips or is adjacent to an existing facility. The site would generate over 2,000 trips per day and so it is recommended to install a 10' wide shared-use path along the entire length of the Service Road.
- Due to the development along Delaware Route 16 as it approaches the Town of Milton, a 10' wide shared-use path is recommended to be installed along the south side of Delaware Route 16. This should be coordinated with any possible non-motorized facilities constructed by the *HEP SC, SR 1 and SR 16 Grade Separated Intersection* project (DelDOT Contract No. T201500301).
- If the SUP is installed, an internal connection from the SUP to all parcels will be required.
- Internal bicycle racks are requested on all parcels.
- At this time Local Systems Improvements has no bicycle/pedestrian improvement projects within the area of this project.
- The four (4) parcels along the east side of the Service Road have their own access, where it is highly recommended that cross-access be established between the parcels.
- There could be additional and/or revised comments once project is discussed at a pre-submittal meeting and/or plans are submitted for LONO/ENT review/approval.

Bicycle Level of Traffic Stress in Delaware: Researchers with the Mineta Transportation Institute developed a framework to measure low-stress connectivity, which can be used to evaluate and guide bicycle network planning. Bicycle LTS analysis uses factors such as the speed of traffic, volume of traffic, and the number of lanes to rate each roadway segment on a scale of 1 to 4, where 1 is a low-stress place to ride and 4 is a high-stress place to ride. It analyzes the total connectivity of a network to evaluate how many destinations can be accessed using low-stress routes. Developed by planners at the Delaware Department of Transportation (DelDOT), the bicycle Level of Traffic Stress (LTS) model will be applied to bicycle system planning and evaluation throughout the state. The Bicycle LTS for the roadways under existing conditions along the site frontage are summarized below. The Bicycle LTS was determined utilizing the Bicycle On-Road Network Level of Traffic Stress map from the April 2018 Blueprint for a Bicycle-Friendly Delaware

document which can be found on the following website:
<https://deldot.gov/Publications/plans/bikeandped/pdfs/DeIDOTBikePlan043018FINAL.pdf>

- Delaware Route 1 LTS: 4
- Delaware Route 16 LTS: 3

Crash Evaluation

Per the crash data included in the TIS from April 2019 to April 2022 provided by the Delaware Department of Transportation (DelDOT), 111 crashes were reported within the study area, 20 included injuries, and no reported crashes involved a fatality. A total of 87 crashes were reported at the intersection of Delaware Route 1 and Delaware Route 16 or along the Delaware Route 1 frontage, 13 at the intersection of Delaware Route 16 and Delaware Route 5, and 11 at the remaining three intersections reported and the Delaware Route 16 site frontage.

Previous Comments

All comments from the PTIS have been addressed in the Final TIS.

Sight Distance Evaluation

No sight distance constraints were noted at the future site entrance locations per a field visit conducted on May 25, 2022.

General HCS Analysis Comments

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

- 1) The TIS used version 7.9 of HCS7, whereas JMT used version 7.9.6 of HCS7 to complete the analysis.
- 2) Per DelDOT's *Development Coordination Manual*, JMT used a heavy vehicle percentage of 3% for each movement greater than 100 vph in the Case 2 and Case 3 future scenario analysis, unless the existing heavy vehicle percentage was greater than 3% and there was no significant increase of vehicles along that movement, in which case the existing heavy vehicle percentage was used for the analysis of future scenarios, whereas the TIS did not. JMT utilized the existing heavy vehicle percentage for each movement greater than 100 vph in the Case 3 Existing scenario.
- 3) Per DelDOT's *Development Coordination Manual* and coordination with DelDOT Planning, JMT used a heavy vehicle percentage of 5% for each movement less than 100 vph along roadways in the analyses, whereas the TIS did not.
- 4) Per DelDOT's *Development Coordination Manual*, JMT utilized the existing PHF for the Existing 2022 scenario and a future PHF for Case 2 and 3 scenarios of 0.80 for roadways with less than 500 vph, 0.88 for roadways between 500 and 1,000 vph, and 0.92 for roadways with more than 1,000 vph or the existing PHF, whichever was higher. The TIS utilized the higher of either the existing PHF or 0.92 for all cases.
- 5) JMT included bicycles and pedestrians counted during the traffic data collection in the analysis.
- 6) A TIS Addendum was conducted to determine the appropriate lane configurations and control type for the intersection of the Delaware Route 1 directional ramps and the Service Road. The analysis results for that intersection are depicted on Table 9.

Table 2
Peak Hour Levels Of Service (LOS)
Based on Final Traffic Impact Study for Brittingham Property
Report Dated: May 2022
Prepared by: Davis, Bowen & Friedel, Inc.

Signalized Intersection ¹	LOS per TIS			LOS per JMT		
	Weekday AM	Weekday PM	Saturday MIDDAY	Weekday AM	Weekday PM	Saturday MIDDAY
Delaware Route 16 / Delaware Route 1²						
2020 Existing (Case 1) with DelDOT timings ³	-	-	-	E (72.4)	E (79.2)	F (300.6)
2020 Existing (Case 1) with signal optimization ⁴	B (17.4)	C (20.9)	D (39.2)	C (28.3)	C (27.1)	D (43.3)

¹ For signalized and unsignalized analysis, the numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

² As part of the HEP SC, SR 1 and SR 16 Grade Separated Intersection project (DelDOT Contract No. T201500301), this intersection will be converted to a grade-separated interchange.

³ JMT analyzed a timing scenario utilizing green split times consistent with DelDOT MAX I green times.

⁴ The TIS modeled the intersection utilizing different cycle lengths, whereas JMT modeled the intersection utilizing a cycle length of 120 seconds during the AM and PM peak hours and 150 seconds during the Summer Saturday peak hour.

Table 2a
Peak Hour Levels Of Service (LOS)
Based on Final Traffic Impact Study for Brittingham Property
Report Dated: May 2022
Prepared by: Davis, Bowen & Friedel, Inc.

Unsignalized Intersection Two-Way Stop Control ¹	LOS per TIS			LOS per JMT		
	Weekday AM	Weekday PM	Saturday Midday	Weekday AM	Weekday PM	Saturday Midday
Delaware Route 16/Delaware Route 1 Southbound Ramps C & D⁵						
2028 without Development (Case 2)						
Westbound Delaware Route 16 Left Turn	A (7.5)	A (7.7)	A (7.8)	A (7.5)	A (7.7)	A (7.7)
Southbound Delaware Route 1 Ramp D Approach	B (12.8)	C (20.2)	D (26.7)	B (12.4)	C (18.5)	C (23.5)
2028 with Development (Cases 3a and 3b)						
Westbound Delaware Route 16 Left Turn	A (7.9)	A (8.4)	A (9.0)	A (7.8)	A (8.4)	A (8.9)
Northbound Service Road Approach	F (55.8)	F (610.9)	F (*)	E (42.5)	F (455.8)	F (*)
Southbound Delaware Route 1 Ramp D Approach	C (22.0)	F (464.2)	F (*)	C (19.7)	F (339.0)	F (*)
2028 with Development (Case 3c)						
Westbound Delaware Route 16 Left Turn	A (7.9)	A (8.4)	A (9.0)	A (7.8)	A (8.4)	A (8.9)
Northbound Service Road Approach	F (810.8)	B (10.2)	B (11.6)	F (418.5)	B (10.2)	B (11.5)
Southbound Delaware Route 1 Ramp D Approach	F (112.7)	F (*)	F (*)	F (81.3)	F (*)	F (*)

*Indicates delay greater than 1,000 seconds per vehicle

⁵ The TIS utilized a heavy vehicle percentage of 5% for all movements whereas JMT assumed a heavy vehicle of 3%.

Table 2a (continued)
Peak Hour Levels Of Service (LOS)
Based on Final Traffic Impact Study for Brittingham Property
Report Dated: May 2022
Prepared by: Davis, Bowen & Friedel, Inc.

Roundabout ¹	LOS per TIS			LOS per JMT		
	Weekday AM	Weekday PM	Saturday MIDDAY	Weekday AM	Weekday PM	Saturday MIDDAY
Delaware Route 16/Delaware Route 1 Southbound Ramps C & D⁶						
2028 without Development (Case 2)						
Eastbound Delaware Route 16 Approach	-	-	-	A (0.7)	A (1.7)	A (1.0)
Westbound Delaware Route 16 Approach	-	-	-	A (5.5)	A (6.0)	A (5.9)
Southbound Delaware Route 1 Ramp D Approach	-	-	-	A (5.4)	A (5.6)	A (5.6)
Overall Intersection	-	-	-	A (3.4)	A (4.4)	A (3.2)
2028 with Development (Case 3a & 3b)						
Eastbound Delaware Route 16 Approach	-	-	-	A (0.6)	A (1.5)	A (1.2)
Westbound Delaware Route 16 Approach	-	-	-	A (8.5)	B (14.6)	D (27.2)
Northbound Service Road Approach	-	-	-	A (5.3)	A (7.5)	B (11.0)
Southbound Delaware Route 1 Ramp D Approach	-	-	-	A (8.0)	B (11.7)	C (16.5)
Overall Intersection	-	-	-	A (5.2)	A (9.0)	B (12.8)
2028 with Development (Case 3c)						
Eastbound Delaware Route 16 Approach	-	-	-	A (0.8)	A (2.2)	A (2.0)
Westbound Delaware Route 16 Approach	-	-	-	A (8.5)	B (14.7)	D (27.2)
Northbound Service Road Approach	-	-	-	A (5.3)	A (7.5)	B (11.0)
Southbound Delaware Route 1 Ramp D Approach	-	-	-	B (12.8)	F (51.1)	F (193.6)
Overall Intersection	-	-	-	A (6.4)	C (17.6)	E (44.4)

⁶ JMT conducted an additional analysis of the intersection as a single lane roundabout with a free-flow bypass lane along the eastbound Delaware Route 16 right turn.

Table 2a (continued)
Peak Hour Levels Of Service (LOS)
Based on Final Traffic Impact Study for Brittingham Property
Report Dated: May 2022
Prepared by: Davis, Bowen & Friedel, Inc.

Signalized Intersection ¹	LOS per TIS			LOS per JMT		
	Weekday AM	Weekday PM	Saturday MIDDAY	Weekday AM	Weekday PM	Saturday MIDDAY
Delaware Route 16/Delaware Route 1 Southbound Ramps C & D ^{7,8}						
2028 with Development (Cases 3a and 3b) ⁹	B (13.1)	B (17.9)	B (13.2)	B (18.0)	C (20.2)	C (28.4)
2028 with Development (Cases 3a and 3b) <i>Improvement Option 1</i> ¹⁰	-	-	-	B (17.4)	B (19.3)	C (32.7)
2028 with Development (Cases 3a and 3b) <i>with Improvement Option 2</i> ¹¹	-	B (12.8)	B (13.2)	B (13.3)	B (16.2)	B (17.0)
2028 with Development (Case 3c) ¹²	B (17.3)	C (34.8)	D (43.8)	C (23.1)	D (43.9)	D (54.5)
2028 with Development (Case 3c) <i>with Improvement Option 1</i> ¹⁰	-	-	-	C (22.7)	C (34.9)	D (44.6)
2028 with Development (Case 3c) <i>with Improvement Option 2</i> ¹¹	-	C (20.7)	C (27.1)	C (27.9)	C (28.0)	D (49.9)

⁷ Both the TIS and JMT modeled the intersection as a four-phase traffic signal with protected permissive left turn phasing along Delaware Route 16 and split phase operation along the Delaware Route 1 Ramps C & D approaches.

⁸ Both the TIS and JMT configured the eastbound Delaware Route 16 approach with a through lane and a channelized right turn lane, the westbound Delaware Route 16 approach with a left turn lane and a through lane, the northbound Delaware Route 1 Ramp C approach with a left turn lane and a right turn lane, and the southbound Delaware Route 1 Ramp D approach with a shared left turn/through lane and a right turn lane.

⁹ The TIS utilized various cycle lengths whereas JMT utilized a 80 second, 100 second, and 120 second cycle length for the AM, PM, and Saturday peak hour analyses, respectively.

¹⁰ JMT utilized a 80 second, 100 second, and 80 second cycle length for the AM, PM, and Saturday peak hour analyses, respectively. Improvement Option 1 involves the provision of two westbound Delaware Route 16 left turn lanes.

¹¹ JMT utilized a 70 second, 90 second, and 80 second cycle length for the AM, PM, and Saturday peak hour analyses, respectively. For Case 3c, a cycle length of 100 seconds was used during the Saturday peak hour. Improvement Option 2 involves the provision of the southbound approach with a separate left turn lane and shared through/right turn lane and protected/permissive left turn phasing along the northbound and southbound approaches.

¹² The TIS utilized various cycle lengths whereas JMT utilized a 80 second, 90 second, and 140 second cycle length for the AM, PM, and Saturday peak hour analyses, respectively.

Table 2b
Peak Hour Levels Of Service (LOS)
Based on Final Traffic Impact Study for Brittingham Property
Report Dated: May 2022
Prepared by: Davis, Bowen & Friedel, Inc.

Roundabout (3-legged) ¹	LOS per TIS			LOS per JMT		
	Weekday AM	Weekday PM	Saturday Midday	Weekday AM	Weekday PM	Saturday Midday
Delaware Route 1 Southbound Ramp (Ramp C) / Service Road¹³						
2028 with Development (Case 3a) ¹⁴						
Northbound Service Road Approach "	A (5.2)	A (5.2)	A (10.0)	A (7.4)	A (5.2)	A (9.9)
Southbound Service Road Approach "	A (4.8)	A (5.9)	A (8.3)	A (4.9)	A (5.9)	A (8.3)
Overall Intersection "	A (4.9)	A (5.6)	A (8.8)	A (5.7)	A (5.6)	A (8.8)
2028 with Development (Case 3b)						
Northbound Service Road Approach	A (7.7)	A (8.3)	E (46.4)	A (6.7)	A (7.0)	C (18.5)
Southbound Service Road Approach	A (4.8)	A (5.9)	A (8.3)	A (4.8)	A (5.9)	A (8.3)
Overall Intersection	A (6.1)	A (7.1)	C (24.6)	A (5.6)	A (6.4)	B (12.7)
2028 with Development (Case 3c)						
Northbound Service Road Approach	A (7.7)	A (8.3)	E (46.4)	A (6.7)	A (7.0)	C (18.5)
Southbound Service Road Approach	A (5.4)	A (9.1)	C (16.0)	A (5.4)	A (9.1)	C (16.0)
Overall Intersection	A (6.3)	A (8.8)	D (27.3)	A (5.9)	A (8.2)	C (16.9)

¹³ Both the TIS and JMT modeled the intersection as a two-lane roundabout. The northbound Service Road approach would provide one through lane and one shared through/right turn lane and the southbound Service Road approach would provide one left turn lane and one through lane.

¹⁴ During the AM peak hour, the TIS utilized a PHF of 0.92 whereas JMT utilized a PHF of 0.88 consistent with the *Development Coordination Manual*.

Table 2b (Continued)
Peak Hour Levels Of Service (LOS)
Based on Final Traffic Impact Study for Brittingham Property
Report Dated: May 2022
Prepared by: Davis, Bowen & Friedel, Inc.

Roundabout (4-legged) ¹	LOS per TIS			LOS per JMT		
	Weekday AM	Weekday PM	Saturday Midday	Weekday AM	Weekday PM	Saturday Midday
Delaware Route 1 Southbound Ramp (Ramp C) / Service Road¹⁵						
2028 with Development (Case 3a)						
Eastbound Entrance Approach	A (6.3)	A (6.8)	C (20.8)	A (6.3)	A (6.8)	C (20.8)
Northbound Service Road Approach "	A (5.4)	A (5.5)	B (10.9)	A (5.4)	A (5.5)	B (10.9)
Southbound Service Road Approach "	A (4.8)	A (5.9)	A (8.3)	A (4.8)	A (5.9)	A (8.3)
Overall Intersection "	A (5.1)	A (5.9)	B (10.5)	A (5.1)	A (5.9)	B (10.5)
2028 with Development (Case 3b)						
Eastbound Entrance Approach	A (6.3)	A (6.8)	C (20.8)	A (6.3)	A (6.8)	C (20.8)
Northbound Service Road Approach	A (7.2)	A (8.9)	F (57.1)	A (6.8)	A (7.4)	C (21.3)
Southbound Service Road Approach	A (4.8)	A (5.9)	A (8.3)	A (4.8)	A (5.9)	A (8.3)
Overall Intersection	A (5.8)	A (7.1)	C (24.9)	A (5.6)	A (6.6)	B (13.8)
2028 with Development (Case 3c)						
Eastbound Entrance Approach	A (7.4)	A (9.0)	E (38.4)	A (7.4)	A (9.0)	E (38.4)
Northbound Service Road Approach	A (6.8)	A (8.6)	F (57.6)	A (6.9)	A (7.4)	C (21.3)
Southbound Service Road Approach	A (5.4)	A (9.1)	C (16.0)	A (5.4)	A (9.1)	C (16.0)
Overall Intersection	A (6.0)	A (8.9)	D (29.6)	A (6.0)	A (8.5)	C (19.6)

¹⁵ Additional scenario with the roundabout as four-legged. The westerly leg would provide one shared left turn/through/right turn lane.

Table 2c
Peak Hour Levels Of Service (LOS)
Based on Final Traffic Impact Study for Brittingham Property
Report Dated: May 2022
Prepared by: Davis, Bowen & Friedel, Inc.

Unsignalized Intersection Two-Way Stop Control ¹	LOS per TIS			LOS per JMT		
	Weekday AM	Weekday PM	Saturday Midday	Weekday AM	Weekday PM	Saturday Midday
Delaware Route 16/Delaware Route 1 Northbound Ramps A & B						
2028 without Development (Case 2)						
Eastbound Delaware Route 16 Left Turn	A (7.8)	A (7.7)	A (8.0)	A (7.8)	A (7.7)	A (8.0)
Northbound Delaware Route 1 Ramp A Approach	B (14.9)	C (20.5)	C (21.7)	C (14.3)	C (19.0)	C (19.7)
2028 with Development (Case 3)						
Eastbound Delaware Route 16 Left Turn	A (8.3)	A (8.2)	A (9.2)	A (8.3)	A (8.2)	A (9.1)
Northbound Delaware Route 1 Ramp A Approach	F (172.5)	F (649.5)	F (*)	F (136.7)	F (559.3)	F (*)

*Indicates delay greater than 1,000 seconds per vehicle

Table 2c (continued)
Peak Hour Levels Of Service (LOS)
Based on Final Traffic Impact Study for Brittingham Property
Report Dated: May 2022
Prepared by: Davis, Bowen & Friedel, Inc.

Roundabout ¹	LOS per TIS			LOS per JMT		
	Weekday AM	Weekday PM	Saturday MIDDAY	Weekday AM	Weekday PM	Saturday MIDDAY
Delaware Route 16/Delaware Route 1 Northbound Ramps A & B ¹⁶						
2028 without Development (Case 2)						
Eastbound Delaware Route 16 Approach	-	-	-	A (3.3)	A (3.9)	A (4.0)
Westbound Delaware Route 16 Approach	-	-	-	A (5.8)	A (6.0)	A (6.8)
Northbound Delaware Route 1 Ramp A Approach	-	-	-	A (5.0)	A (7.4)	A (6.9)
Overall Intersection	-	-	-	A (5.1)	A (6.2)	A (6.2)
2028 with Development (Case 3)						
Eastbound Delaware Route 16 Approach	-	-	-	A (4.3)	A (5.5)	A (6.6)
Westbound Delaware Route 16 Approach	-	-	-	A (8.8)	B (12.2)	D (25.6)
Northbound Delaware Route 1 Ramp A Approach	-	-	-	A (7.9)	C (22.0)	E (46.4)
Overall Intersection	-	-	-	A (7.1)	C (15.1)	D (28.4)

¹⁶ JMT conducted an additional analysis of the intersection as a single lane roundabout.

Table 2c (continued)
Peak Hour Levels Of Service (LOS)
Based on Final Traffic Impact Study for Brittingham Property
Report Dated: May 2022
Prepared by: Davis, Bowen & Friedel, Inc.

Signalized Intersection ¹	LOS per TIS			LOS per JMT		
	Weekday AM	Weekday PM	Saturday Midday	Weekday AM	Weekday PM	Saturday Midday
Delaware Route 16/Delaware Route 1 Northbound Ramps A & B						
2028 with Development (Case 3) ^{17,18}	B (17.8)	C (22.2)	C (29.9)	C (21.4)	C (27.5)	D (54.3)

¹⁷ The TIS utilized various cycle lengths whereas JMT utilized a 70 second cycle length for the AM and PM peak hours and a 80 second cycle length for the Saturday peak hour.

¹⁸ Both the TIS and JMT modeled the intersection as a three-phase traffic signal with the provision of a separate left turn lane and a through lane along the eastbound Delaware Route 16 approach, a shared through/right turn lane along the westbound Delaware Route 16 approach, and a shared left turn/through lane and a separate right turn lane along the northbound Delaware Route 1 Ramp approach.

Table 2d
Peak Hour Levels Of Service (LOS)
Based on Final Traffic Impact Study for Brittingham Property
Report Dated: May 2022
Prepared by: Davis, Bowen & Friedel, Inc.

Merge	LOS per TIS ¹⁹			LOS per JMT ²⁰		
	Weekday AM	Weekday PM	Saturday MIDDAY	Weekday AM	Weekday PM	Saturday MIDDAY
Ramp B Merge onto Northbound Delaware Route 1						
2028 without Development (Case 2)	B (1218)	B (990)	C (754)	B (10.4)	B (12.2)	C (22.3)
2028 with Development (Case 3)	B (1259)	B (1044)	C (804)	B (11.2)	B (13.3)	C (24.1)

¹⁹ The TIS calculated results based on the ramp service volumes which is shown in parenthesis as veh/hour.

²⁰ JMT calculated results based on density (pc/mi/ln) in the ramp influence area.

Table 2e
Peak Hour Levels Of Service (LOS)
Based on Final Traffic Impact Study for Brittingham Property
Report Dated: May 2022
Prepared by: Davis, Bowen & Friedel, Inc.

Merge	LOS per TIS ¹⁹			LOS per JMT ²⁰		
	Weekday AM	Weekday PM	Saturday Middy	Weekday AM	Weekday PM	Saturday Middy
Ramp C Merge onto Southbound Delaware Route 1						
2028 without Development (Case 2)	B (1164)	B (1081)	C (876)	B (13.2)	B (13.0)	C (25.2)
2028 with Development (Case 3a)	B (1103)	B (943)	C (677)	B (13.5)	B (14.0)	C (26.8)
2028 with Development (Cases 3b)	B (1103)	B (943)	D (1395)	B (15.4)	B (16.5)	D (30.1)
2028 with Development (Case 3c)	B (1267)	B (1236)	D (1395)	B (14.0)	B (14.1)	C (27.1)

Table 3
Peak Hour Levels Of Service (LOS)
Based on Final Traffic Impact Study for Brittingham Property
Report Dated: May 2022
Prepared by: Davis, Bowen & Friedel, Inc.

Weaving Segment ²¹	LOS per TIS			LOS per JMT		
	Weekday AM	Weekday PM	Saturday MIDDAY	Weekday AM	Weekday PM	Saturday MIDDAY
Delaware Route 1 Weaving Segment Ramp C Merge/Service Road Off-Ramp						
2028 with Development (Case 3a)	A (10.8)	A (11.9)	C (25.9)	A (10.3)	A (10.6)	B (23.5)
2028 with Development (Case 3b)	B (12.8)	B (14.8)	C (30.1)	B (12.4)	B (13.5)	C (28.7)

²¹ Weaving segment results are based on density (pc/mi/ln).

Table 4
Peak Hour Levels Of Service (LOS)
Based on Final Traffic Impact Study for Brittingham Property
Report Dated: May 2022
Prepared by: Davis, Bowen & Friedel, Inc.

Merge	LOS per TIS ¹⁹			LOS per JMT ²⁰		
	Weekday AM	Weekday PM	Saturday Midday	Weekday AM	Weekday PM	Saturday Midday
2028 with Development (Case 3)	B (911)	B (996)	C (406)	B (15.8)	B (15.6)	D (29.0)

Table 5
Peak Hour Levels Of Service (LOS)
Based on Final Traffic Impact Study for Brittingham Property
Report Dated: May 2022
Prepared by: Davis, Bowen & Friedel, Inc.

Unsignalized Intersection Two-Way Stop Control ¹	LOS per TIS			LOS per JMT		
	Weekday AM	Weekday PM	Saturday Midday	Weekday AM	Weekday PM	Saturday Midday
Delaware Route 16 / Zion Church Road (Sussex Road 235)						
2020 Existing (Case 1)						
Eastbound Delaware Route 16 Left Turn	A (8.1)	A (7.9)	A (8.1)	A (8.1)	A (7.9)	A (8.1)
Westbound Delaware Route 16 Left Turn	A (7.9)	A (7.6)	A (8.2)	A (7.9)	A (7.6)	A (8.2)
Northbound Zion Church Road Approach	-	B (11.3)	B (13.6)	A (10.0)	B (11.3)	B (13.6)
Southbound Zion Church Road Approach	D (26.2)	B (12.9)	D (34.7)	C (24.7)	B (12.7)	D (30.3)
2028 without Development (Case 2)						
Eastbound Delaware Route 16 Left Turn	A (8.3)	A (8.1)	A (8.4)	A (8.3)	A (8.1)	A (8.4)
Westbound Delaware Route 16 Left Turn	A (8.0)	A (7.8)	A (8.4)	A (8.0)	A (7.8)	A (8.4)
Northbound Zion Church Road Approach	-	B (12.9)	C (15.5)	B (10.1)	B (12.9)	C (15.5)
Southbound Zion Church Road Approach	E (37.6)	C (16.3)	F (90.9)	D (34.3)	C (15.5)	F (68.5)
2028 without Development (Case 2) <i>with turn lanes</i> ^{22, 23}						
Eastbound Delaware Route 16 Left Turn	-	-	A (8.4)	A (8.3)	A (8.1)	A (8.4)
Westbound Delaware Route 16 Left Turn	-	-	A (8.4)	A (8.0)	A (7.8)	A (8.4)
Northbound Zion Church Road Approach	-	-	C (15.5)	B (10.1)	B (12.9)	C (15.5)
Southbound Zion Church Road Approach	-	-	F (86.1)	C (21.1)	B (14.1)	F (65.2)

²² An additional scenario was analyzed including the provision of a separate right turn lane along the westbound and southbound approaches.

²³ The TIS did not conduct analysis for the AM and PM peak hour.

Table 5 (continued)
Peak Hour Levels Of Service (LOS)
Based on Final Traffic Impact Study for Brittingham Property
Report Dated: May 2022
Prepared by: Davis, Bowen & Friedel, Inc.

Unsignalized Intersection Two-Way Stop Control ¹	LOS per TIS			LOS per JMT		
	Weekday AM	Weekday PM	Saturday Midday	Weekday AM	Weekday PM	Saturday Midday
Delaware Route 16 / Zion Church Road (Sussex Road 235)						
2028 with Development (Case 3)						
Eastbound Delaware Route 16 Left Turn	A (8.6)	A (8.6)	A (9.2)	A (8.6)	A (8.6)	A (9.2)
Westbound Delaware Route 16 Left Turn	A (8.2)	A (8.3)	A (9.4)	A (8.2)	A (8.3)	A (9.4)
Northbound Zion Church Road Approach	-	C (18.0)	D (25.3)	B (10.6)	C (18.0)	D (25.3)
Southbound Zion Church Road Approach	F (82.0)	D (33.9)	F (807.6)	F (70.2)	D (29.2)	F (632.0)
2028 with Development (Case 3) <i>with turn lanes</i> ²²						
Eastbound Delaware Route 16 Left Turn	A (8.6)	A (8.6)	A (9.2)	A (8.6)	A (8.6)	A (9.2)
Westbound Delaware Route 16 Left Turn	A (8.2)	A (8.3)	A (9.4)	A (8.2)	A (8.3)	A (9.4)
Northbound Zion Church Road Approach	-	C (18.0)	D (25.3)	B (10.6)	C (18.0)	D (25.3)
Southbound Zion Church Road Approach	E (37.5)	D (27.6)	F (757.6)	D (33.8)	C (24.3)	F (591.7)

Table 5 (continued)
Peak Hour Levels Of Service (LOS)
Based on Final Traffic Impact Study for Brittingham Property
Report Dated: May 2022
Prepared by: Davis, Bowen & Friedel, Inc.

Roundabout ^{1, 24}	LOS per TIS			LOS per JMT		
	Weekday AM	Weekday PM	Saturday MIDDAY	Weekday AM	Weekday PM	Saturday MIDDAY
Delaware Route 16 / Zion Church Road (Sussex Road 235)						
2028 with Development (Case 3)						
Eastbound Delaware Route 16 Approach	--	--	--	A (6.8)	A (5.0)	A (8.3)
Westbound Delaware Route 16 Approach	--	--	--	A (5.8)	A (5.2)	A (5.9)
Northbound Zion Church Road Approach	--	--	--	A (5.0)	A (4.1)	A (5.7)
Southbound Zion Church Road Approach	--	--	--	A (5.8)	A (4.7)	A (6.9)
Overall	--	--	--	A (6.2)	A (5.1)	A (7.1)
2028 with Development (Case 3)						
Eastbound Delaware Route 16 Approach	--	--	--	A (7.7)	A (6.9)	C (15.3)
Westbound Delaware Route 16 Approach	--	--	--	A (6.7)	A (6.7)	A (8.7)
Northbound Zion Church Road Approach	--	--	--	A (5.4)	A (5.0)	A (7.8)
Southbound Zion Church Road Approach	--	--	--	A (6.6)	A (5.9)	B (10.3)
Overall	--	--	--	A (7.1)	A (6.7)	B (11.9)

²⁴JMT conducted an additional analysis of the intersection as a single lane roundabout.

Table 5 (continued)
Peak Hour Levels Of Service (LOS)
Based on Final Traffic Impact Study for Brittingham Property
Report Dated: May 2022
Prepared by: Davis, Bowen & Friedel, Inc.

Signalized Intersection ¹	LOS per TIS			LOS per JMT		
	Weekday AM	Weekday PM	Saturday MIDDAY	Weekday AM	Weekday PM	Saturday MIDDAY
Delaware Route 16 / Zion Church Road (Sussex Road 235)						
2028 without Development (Case 2) <i>with turn lanes</i> ²⁵	-	-	-	B (12.4)	B (10.7)	B (13.3)
2028 with Development (Case 3) ²⁶	B (11.3)	A (7.1)	B (11.5)	-	-	-
2028 with Development (Case 3) <i>with turn lanes</i> ²⁵	-	-	-	B (12.5)	B (11.8)	C (25.1)

²⁵ JMT conducted an analysis of the intersection as an uncoordinated signalized intersection. One left turn lane and one through lane was provided along the eastbound approach, one through lane and one right turn lane was provided along the westbound approach, and one left turn lane and one right turn lane was provided along the southbound approach. A cycle length of 60 second was utilized during all peak hours.

²⁶ The TIS conducted the signalized analysis with one shared lane along each approach.

Table 6
Peak Hour Levels Of Service (LOS)
Based on Final Traffic Impact Study for Brittingham Property
Report Dated: May 2022
Prepared by: Davis, Bowen & Friedel, Inc.

Unsignalized Intersection Two-Way Stop Control ¹	LOS per TIS			LOS per JMT		
	Weekday AM	Weekday PM	Saturday Midday	Weekday AM	Weekday PM	Saturday Midday
Delaware Route 16 / Reynolds Road (Sussex Road 233) ²⁷						
2020 Existing (Case 1)						
Eastbound Delaware Route 16 Left Turn	A (7.7)	A (7.8)	A (8.2)	A (7.7)	A (7.8)	A (8.2)
Westbound Delaware Route 16 Left Turn	A (8.1)	A (7.7)	A (8.3)	-	-	-
Northbound Reynolds Road Approach	-	-	-	-	-	-
Southbound Reynolds Road Approach	B (12.5)	B (11.2)	C (15.4)	B (11.6)	B (10.8)	B (13.6)
2028 without Development (Case 2)						
Eastbound Delaware Route 16 Left Turn	A (8.0)	A (8.0)	A (8.4)	A (8.0)	A (8.0)	A (8.4)
Westbound Delaware Route 16 Left Turn	A (8.2)	A (7.9)	A (8.6)	-	-	-
Northbound Reynolds Road Approach	-	-	-	-	-	-
Southbound Reynolds Road Approach	B (14.8)	B (12.6)	C (18.9)	B (13.2)	B (11.8)	C (15.8)
2028 with Development (Case 3)						
Eastbound Delaware Route 16 Left Turn	A (8.3)	A (8.4)	A (9.3)	A (8.3)	A (8.4)	A (9.3)
Westbound Delaware Route 16 Left Turn	A (8.5)	A (8.3)	A (9.6)	-	-	-
Northbound Reynolds Road Approach	-	-	-	-	-	-
Southbound Reynolds Road Approach	C (19.4)	C (17.0)	E (41.1)	C (16.1)	B (14.8)	D (27.4)

²⁷ The TIS analyzed this location as a four-legged intersection, JMT analyzed this location as a t-intersection

Table 7
Peak Hour Levels Of Service (LOS)
Based on Final Traffic Impact Study for Brittingham Property
Report Dated: May 2022
Prepared by: Davis, Bowen & Friedel, Inc.

Signalized Intersection ¹	LOS per TIS			LOS per JMT		
	Weekday AM	Weekday PM	Saturday MIDDAY	Weekday AM	Weekday PM	Saturday MIDDAY
Delaware Route 16 / Delaware Route 5						
2020 Existing (Case 1) with DelDOT timings ²⁸	-	-	-	B (18.8)	C (21.9)	C (20.6)
2020 Existing (Case 1) with signal optimization ²⁹	B (11.0)	B (18.2)	B (16.8)	B (12.7)	B (14.1)	B (13.9)
2028 without Development (Case 2) with signal optimization ²⁹	B (13.5)	B (15.4)	B (13.1)	B (12.9)	B (15.1)	B (16.4)
2028 with Development (Case 3) with signal optimization ²⁹	B (14.5)	B (23.4)	C (33.8)	B (13.9)	C (22.7)	D (43.5)

²⁸ JMT analyzed a timing scenario utilizing green split times consistent with DelDOT MAX I green times. The TIS did not.

²⁹ The TIS modeled the intersection utilizing different cycle lengths, whereas JMT modeled the intersection utilizing a cycle length of 60 seconds.

Table 8
Peak Hour Levels Of Service (LOS)
Based on Final Traffic Impact Study for Brittingham Property
Report Dated: May 2022
Prepared by: Davis, Bowen & Friedel, Inc.

Unsignalized Intersection Two-Way Stop Control (T-Intersection) ¹	LOS per TIS			LOS per JMT		
	Weekday AM	Weekday PM	Saturday Midday	Weekday AM	Weekday PM	Saturday Midday
Hudson Road / Eagle Crest Road						
2020 Existing (Case 1)						
Westbound Eagle Crest Road Approach	B (10.6)	B (10.2)	B (10.4)	B (10.4)	B (10.1)	B (10.2)
Southbound Hudson Road Left Turn	A (7.7)	A (7.5)	A (7.5)	A (7.7)	A (7.5)	A (7.5)
2028 without Development (Case 2)						
Westbound Eagle Crest Road Approach	B (11.7)	B (11.5)	B (11.5)	B (11.4)	B (11.2)	B (11.2)
Southbound Hudson Road Left Turn	A (7.9)	A (7.6)	A (7.7)	A (7.9)	A (7.6)	A (7.7)
2028 with Development (Case 3)						
Westbound Eagle Crest Road Approach	B (12.1)	B (12.2)	B (12.6)	B (11.7)	B (11.8)	B (12.1)
Southbound Hudson Road Left Turn	A (7.9)	A (7.7)	A (7.8)	A (7.9)	A (7.7)	A (7.8)

Table 9
Peak Hour Levels Of Service (LOS)
Based on TIS Addendum for Brittingham Property
Report Dated: December 2022
Prepared by: Davis, Bowen & Friedel, Inc.

Unsignalized Intersection Two-Way Stop Control (T-Intersection) ¹	LOS per TIS			LOS per JMT		
	Weekday AM	Weekday PM	Saturday Midday	Weekday AM	Weekday PM	Saturday Midday
Service Road / Delaware Route 1 Directional Ramps						
2028 with Development (Case 3) ³⁰						
Westbound Delaware Route 1 Directional Ramps Approach	-	-	-	C (15.7)	E (49.6)	F (174.9)
Southbound Service Road Left Turn	-	-	-	A (8.2)	A (8.4)	A (8.8)
2028 with Development (Case 3) <i>with auxiliary lanes</i> ^{31, 32}						
Westbound Delaware Route 1 Directional Ramps Approach	B (11.9)	C (23.2)	E (47.0)	B (13.1)	C (23.2)	E (47.0)
Southbound Service Road Left Turn	A (8.2)	A (8.4)	A (8.8)	A (8.2)	A (8.4)	A (8.8)

³⁰ Intersection was modeled with shared lanes along all approaches.

³¹ Intersection was modeled with one through lane and one right turn lane along the northbound approach, one left turn lane and one through lane along the southbound approach, and one left turn lane and one right turn lane along the westbound approach.

³² During the AM peak hour, the TIS addendum utilized a volume of 100 along the southbound Service Road through movements, whereas JMT utilized a volume of 187 per the volume diagrams.

Table 9 (continued)
Peak Hour Levels Of Service (LOS)
Based on TIS Addendum for Brittingham Property
Report Dated: December 2022
Prepared by: Davis, Bowen & Friedel, Inc.

Unsignalized Intersection All-Way Stop Control (T-Intersection) ¹	LOS per TIS			LOS per JMT		
	Weekday AM	Weekday PM	Saturday Midday	Weekday AM	Weekday PM	Saturday Midday
Service Road / Delaware Route 1 Directional Ramps						
2028 with Development (Case 3) ³⁰						
Westbound Delaware Route 1 Directional Ramps Approach	-	-	-	B (10.5)	B (15.6)	C (23.9)
Northbound Service Road Approach	-	-	-	B (11.9)	B (15.5)	D (32.2)
Southbound Service Road Approach	-	-	-	B (10.3)	C (18.1)	D (34.8)
Overall LOS	-	-	-	B (11.1)	C (16.5)	D (30.8)
2028 with Development (Case 3) <i>with auxiliary lane along the Delaware Route 1 Directional Ramps</i> ³³						
Westbound Delaware Route 1 Directional Ramps Approach	B (11.2)	B (13.5)	C (17.6)	B (11.2)	B (13.5)	C (17.6)
Northbound Service Road Approach	B (12.1)	C (15.4)	D (29.6)	B (12.1)	C (15.4)	D (29.6)
Southbound Service Road Approach	B (10.5)	C (17.9)	D (32.0)	B (10.4)	C (17.9)	D (32.0)
Overall LOS	B (11.4)	C (15.8)	D (27.1)	B (11.4)	C (15.8)	D (27.1)
2028 with Development (Case 3) <i>with auxiliary lanes along all approaches</i> ³⁴						
Westbound Delaware Route 1 Directional Ramps Approach	B (11.1)	B (13.2)	C (16.7)	B (11.1)	B (13.2)	C (16.7)
Northbound Service Road Approach	A (9.7)	B (11.2)	B (13.8)	A (9.7)	B (11.3)	B (13.9)
Southbound Service Road Approach	B (10.8)	B (13.7)	C (19.8)	B (10.8)	B (13.8)	C (19.9)
Overall LOS	B (10.3)	B (12.7)	C (16.7)	B (10.3)	B (12.7)	C (16.8)

³³ Intersection was modeled with shared lanes along the northbound and southbound approaches, and a separate left turn lane and right turn lane along the westbound approach.

³⁴ Intersection was modeled with a separate through and right turn lane along the northbound approach, a separate through and left turn lane along the southbound approach, and a separate left turn and right turn lane along the westbound approach. TIS analysis results from a May 10, 2023 letter from Davis, Bowen & Friedel, Inc.

Table 9 (continued)
Peak Hour Levels Of Service (LOS)
Based on TIS Addendum for Brittingham Property
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Roundabout (T-Intersection) ¹	LOS per TIS			LOS per JMT		
	Weekday AM	Weekday PM	Saturday Midday	Weekday AM	Weekday PM	Saturday Midday
2028 with Development (Case 3) ³⁵						
Westbound Delaware Route 1 Directional Ramps Approach	-	-	-	A (4.8)	A (6.1)	A (7.1)
Northbound Service Road Approach	-	-	-	A (5.5)	A (6.2)	A (7.4)
Southbound Service Road Approach	-	-	-	A (5.0)	A (7.4)	A (9.1)
Overall LOS	-	-	-	A (5.2)	A (6.6)	A (7.9)

³⁵ The intersection was modeled as a single lane roundabout.